Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: xxx
Sequence Number: 001
Document number: K559-2254-XXXXXXNNNNN-xxx-001
Document description: Manufacturing Record Book

Revision	Date	Name	Description
001	12.11.2025	APR / ADI	First Version

MANUFACTURING RECORD BOOK INDEX

S.No	Document Number	Document Title	Total Pages
1	K559-2254-CWIWP4202201-A01-001	Supplier Document Register (SDR-3)	002
2	K559-2254-CWIWP4202201-A06-001	Catalogue Data	031
3	K559-2254-CWIWP4202201-B01-001	General Arrangements	026
4	K559-2254-CWIWP4202201-B04-001	Foundation Loading Diagram & Support Detail	012
5	K559-2254-CWIWP4202201-C04-001	Bill of Materials	088
6	K559-2254-CWIWP4202201-C06-001	Electrical Single Line Diagrams	502
7	K559-2254-CWIWP4202201-C08-001	Control Philosophy & Block Logic Diagrams	035
8	K559-2254-CWIWP4202201-C10-001	Electrical Schematics	502
9	K559-2254-CWIWP4202201-C11-001	OPERATIONAL MANUAL	203
10	K559-2254-CWIWP4202201-D03-001	Data Sheets (incl. Motor Data Sheets)	743
11	K559-2254-CWIWP4202201-D04-001	Noise Level Data Sheets	016
12	K559-2254-CWIWP4202201-D05-001	Material Safety Data Sheets	225
13	K559-2254-CWIWP4202201-E01-001	Interconnection Diagram	012
14	K559-2254-CWIWP4202201-E03-001	Panel Cabinet Layout	021
15	K559-2254-CWIWP4202201-E04-001	Terminal Block Diagrams	502
16	K559-2254-CWIWP4202201-E06-001	Computer System Documentation	1766
17	K559-2254-CWIWP4202201-E07-001	Control Diagrams	009
18	K559-2254-CWIWP4202201-E08-001	Electrical Termination & Hook Up Details	502
19	K559-2254-CWIWP4202201-E13-001	Cable Schedule	080
20	K559-2254-CWIWP4202201-E14-001	Load List	009
21	K559-2254-CWIWP4202201-E99-001	Electrical Equipment List-01	433
22	K559-2254-CWIWP4202201-E99-002	Hazardous Area Layout-02	020
23	K559-2254-CWIWP4202201-E99-003	Cable Transits Schedule-03	018
24	K559-2254-CWIWP4202201-E99-004	Earthing Layout-04	015
25	K559-2254-CWIWP4202201-E99-005	Harmonic Study Report-05	023
26	K559-2254-CWIWP4202201-E99-006	Overall Electrical Model-06	010
27	K559-2254-CWIWP4202201-F01-001	Detail Drawings (all equipment items)	025
28	K559-2254-CWIWP4202201-G01-001	Pressure Vessel / Tanks Mechanical Calculations - Calc. for lifting b	014
29	K559-2254-CWIWP4202201-G02-001	Process/Utility Calculations	011

30	K559-2254-CWIWP4202201-G11-001	Reliability and Availability	010
31	K559-2254-CWIWP4202201-H09-001	General performance curves (round trip efficiencies)	010
32	K559-2254-CWIWP4202201-H10-001	Assembly certificate Battery modules (zip folder including all test re	007
33	K559-2254-CWIWP4202201-H20-001	Stress test reports	009
34	K559-2254-CWIWP4202201-J04-001	Surface Preparation & Painting Specification	013
35	K559-2254-CWIWP4202201-J08-001	Acceptance Test Procedure (FAT)	075
36	K559-2254-CWIWP4202201-J09-001	Leak Testing Procedure	195
37	K559-2254-CWIWP4202201-J99-001 STATRO	Site Acceptance Test (SAT) Procedure	051
38	STATRON-DEN-BPH-CER-00005	Certificate for Safe Transport Goods - BESS Battery	007
39	STATRON-DEN-BPH-CER-00006	Material Saftey Data Sheet - BESS Battery	195
40	STATRON-DEN-BPH-DWG-00005	Drawing of LF280K plus holder	002
41	STATRON-INN-INP-TRT-00005	SAT Protocol	051
42	STATRON-INN-BPH-RPT-00009	Arc Flash Calculation	011
43		Transformer Data Sheets	002
44		Transformer Certificate of Compliance	002
45		FAT reports for PCS, BESS1, BESS2, BESS Converter Containers	075
46		Signed SAT report	051
47		Structural analysis of battery racks in containers	024
48		Battery Modules Sea Fastening Calculations	012

Supplier Document Register (SDR-3)

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Document No:	K559-2254-CWIWP4202201-A01-001	Revision:	6

BLPH Project - Supplier Document Register (SDR-3)

Review Code	Status	Date	Signature
Code 1	No Comments. Work May Proceed.		
Code 2	Comments As Noted. Incorporate Comments, Up-Rev. & Resubmit. Work May Proceed.		
Code 3	REJECTED. Incorporate Comments, Up-Rev. & Resubmit. Work May NOT Proceed.		
Code 4	For Information Only.		
Code 5	Document Required Cancelled.		

1-Supplier to complete and submit this form in accordance with specification SDR-1 and form SDR-2. Purchaser review and comments shall not be assumed to indicate either responsibility or liability for accuracy and completeness of this document or to alter any contractual terms and conditions.

2-Highlight all updates to this document in yellow.

3-In accordance to the SDR-2 form, submit native files against all revisions.

4-Submit all project controlled documentation to the specified mailbox.

Purchase Order Number:	CW-I-WP4-2022-01
Supplier Name:	Statron
Equipment Description:	Base Load Power Hub (BLPH), Battery Energy Storage System (BESS)
KBR Package Engr:	Ken Rose
Expeditor:	
Material Requisition No:	

Actual Submission Date	SDRL Code	Project Document number	Criticality (KBR use)	Revision Number (All Revisions)	Document / Drawing Description	Supplier Document Number / Revision	Planned Submission Date to Purchaser	Forecast Submission Date to Purchaser	Date Returned by Purchaser	Review code	Comments
9-Feb-2023	A01	K559-2254-CWIWP4202201-A01-001		001	Supplier Document Register (SDR-3)		3-Feb-2023				
9-Feb-2023	A02	K559-2254-CWIWP4202201-A02-001		001	Fabrication / Production Schedule incl. Sub-Orders		3-Feb-2023		22-Mar-23	2	
9-Feb-2023	A05	K559-2254-CWIWP4202201-A05-001		001	Monthly Progress Report		3-Feb-2023		15-May-23	1	
9-Feb-2023	A06	K559-2254-CWIWP4202201-A06-001		001	Catalogue Data		3-Feb-2023		15-May-23	2	
3-Mar-2023	B01	K559-2254-CWIWP4202201-B01-001		001	General Arrangements		3-Mar-2023		22-Mar-23	2	
3-Mar-2023	B04	K559-2254-CWIWP4202201-B04-001		001	Foundation Loading Diagram & Support Detail		3-Mar-2023		22-Mar-23	2	
31-Mar-2023	C04	K559-2254-CWIWP4202201-C04-001		001	Bill of Materials		31-Mar-2023		27-Apr-23	2	
3-Mar-2023	C06	K559-2254-CWIWP4202201-C06-001		001	Electrical Single Line Diagrams		3-Mar-2023		22-Mar-23	2	
	C07	K559-2254-CWIWP4202201-C07-001		001	Cause and Effects Charts		31-Jul-2023				
17-Mar-2023	C08	K559-2254-CWIWP4202201-C08-001		001	Control Philosophy & Block Logic Diagrams		3-Mar-2023	17-Mar-2023	27-Apr-23	2	
17-Mar-2023	C10	K559-2254-CWIWP4202201-C10-001		001	Electrical Schematics		17-Mar-2023		27-Apr-23	2	
31-Mar-2023	D03	K559-2254-CWIWP4202201-D03-001		001	Data Sheets (incl. Motor Data Sheets)		3-Mar-2023	31-Mar-2023	27-Apr-23	2	
3-Mar-2023	D04	K559-2254-CWIWP4202201-D04-001		001	Noise Level Data Sheets		3-Mar-2023		22-Mar-23	2	
3-Mar-2023	D05	K559-2254-CWIWP4202201-D05-001		001	Material Safety Data Sheets		3-Mar-2023		22-Mar-23	2	
3-Mar-2023	E01	K559-2254-CWIWP4202201-E01-001		001	Interconnection Diagram		3-Mar-2023		27-Apr-23	2	
3-Mar-2023	E03	K559-2254-CWIWP4202201-E03-001		001	Panel Cabinet Layout		3-Mar-2023		27-Apr-23	2	
17-Mar-2023	E04	K559-2254-CWIWP4202201-E04-001		001	Terminal Block Diagrams		17-Mar-2023		27-Apr-23	2	
17-Mar-2023	E06	K559-2254-CWIWP4202201-E06-001		001	Computer System Documentation		3-Mar-2023	17-Mar-2023	15-May-23	2	
17-Mar-2023	E07	K559-2254-CWIWP4202201-E07-001		001	Control Diagrams		17-Mar-2023		15-May-23	2	
17-Mar-2023	E08	K559-2254-CWIWP4202201-E08-001		001	Electrical Termination & Hook Up Details		17-Mar-2023		27-Apr-23	2	
31-Mar-2023	E13	K559-2254-CWIWP4202201-E13-001		001	Cable Schedule		31-Mar-2023		27-Apr-23	2	
3-Mar-2023	E14	K559-2254-CWIWP4202201-E14-001		001	Load List		3-Mar-2023		27-Apr-23	2	
31-Mar-2023	E99	K559-2254-CWIWP4202201-E99-001		001	Electrical Equipment List-01		31-Mar-2023		27-Apr-23	2	
31-Mar-2023	E99	K559-2254-CWIWP4202201-E99-002		001	Hazardous Area Layout-02		31-Mar-2023		27-Apr-23	2	
31-Mar-2023	E99	K559-2254-CWIWP4202201-E99-003		001	Cable Transits Schedule-03		31-Mar-2023		27-Apr-23	3	
31-Mar-2023	E99	K559-2254-CWIWP4202201-E99-004		001	Earthing Layout-04		31-Mar-2023		27-Apr-23	2	
17-Mar-2023	E99	K559-2254-CWIWP4202201-E99-005		001	Harmonic Study Report-05		17-Mar-2023		15-May-23	2	
17-Mar-2023	E99	K559-2254-CWIWP4202201-E99-006		001	Overall Electrical Model-06		17-Mar-2023		15-May-23	2	
31-Mar-2023	F01	K559-2254-CWIWP4202201-F01-001		001	Detail Drawings (all equipment items)		31-Mar-2023		27-Apr-23	2	
17-Mar-2023	G01	K559-2254-CWIWP4202201-G01-001		001	Pressure Vessel / Tanks Mechanical Calculations - Calc. for lifting brackets on containers		17-Mar-2023		15-May-23	2	
17-Mar-2023	G02	K559-2254-CWIWP4202201-G02-001		001	Process/Utility Calculations		17-Mar-2023		15-May-23	2	
17-Mar-2023	G11	K559-2254-CWIWP4202201-G11-001		001	Reliability and Availability		17-Mar-2023		27-Apr-23	2	
17-Mar-2023	H09	K559-2254-CWIWP4202201-H09-001		001	General performance curves (round trip efficiencies)		17-Mar-2023		27-Apr-23	2	
17-Mar-2023	J04	K559-2254-CWIWP4202201-J04-001		001	Surface Preparation & Painting Specification		17-Mar-2023		15-May-23	2	
	J08	K559-2254-CWIWP4202201-J08-001		001	Acceptance Test Procedure (FAT)		31-May-2023				
	J09	K559-2254-CWIWP4202201-J09-001		001	Leak Testing Procedure		31-May-2023				
	J99	K559-2254-CWIWP4202201-J99-001		001	Site Acceptance Test (SAT) Procedure		31-May-2023				

KBR DISTRIBUTION MATRIX (TO BE COMPLETED BY KBR RE)

Civil/Structural	Piping Design	Piping Engineering	Electrical	Instrumentation/Controls	Process Engineering	Machinery	Exchanger/Technology	Vessel Mechanical	Furnaces	OCE (Welding)	OCE (NDE)	OCE (Paint)	OCE (Noise/Vibration)	Inspection	Logistics	Engineering Management (FI only)	Expediting (FI Only)		

STATRON
NON STOP POWER

Catalogue Data

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: A06
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-A06-001
Document description: Catalogue Data

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

FREQCON
sustainable solutions

Technical Description

BESS FQ 1 MW / 5.5 MWh

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de

Software Development
FREQCON GmbH
Ringstr. 94
D-32427 Minden, Germany

Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
software@freqcon.de

Contact details
For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com/** to find more information about our products and solutions.

Content

1 About this Document 5

2 General Characteristics 5

2.1 FREQCON PCS 5

2.2 FREQCON Battery Storage 7

3 Offered BESS 1 MW / 5.5 MWh 9

3.1 PCS 9

3.2 Battery Storage 11

4 General Assembly and Onsite Installation 11

5 Availability and Modularity 12

5.1 Failure of battery rack(s) 12

5.2 Failure of DC IGBT Stack 13

6 Applications and EMS 13

7 Assembly and Dismantling 15

8 HVAC and Cooling 15

9 Fire Protection and Suppression 15

10 Norms and Standards 16

Identification

Name and Address of Manufacturer

Manufacturer of the product

FREQCON GmbH

Bürgerwiesenweg 5

D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.

The trademarks stated in this document are the property of their respective owner.

© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this Document

This document summarizes the characteristics of offered BESS system.

2 General Characteristics

Characteristics of the offered BESS system are briefly listed in this section. Please consult attached documents and annexes for further details.

2.1 FREQCON PCS

The FREQCON BESS is built to provide power and energy at the highest standards regarding safety, reliability and uptime available today. These benchmark characteristics are achieved by the combination of the safe and reliable battery storage and the FREQCON Power Conversion System (PCS): the Multi-Source Converter (MSC). FREQCON PCS is a bi-directional power inverter enabling the energy flow from and to the grid. The inverter is designed to provide 4-quadrant operation. Figure 1 shows the FREQCON PCS as a containerized solution along with a diagram showing the possibilities of connecting to different types of energy sources and loads in the same PCS.

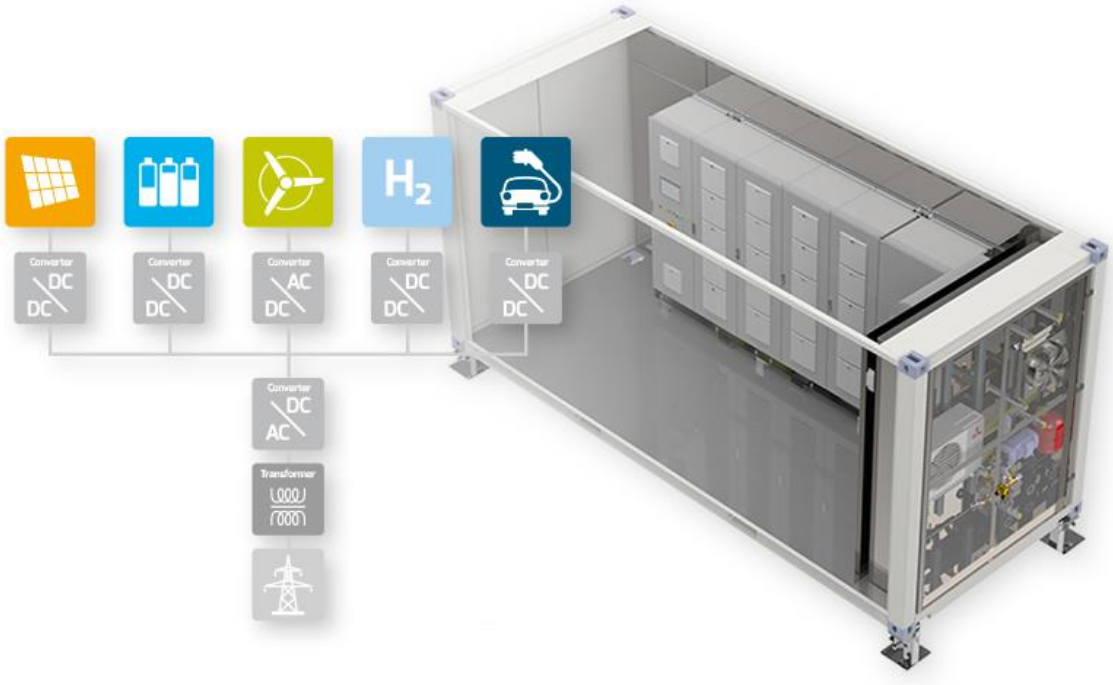


Figure 1: FREQCON PCS as a containerized solution.

The PCS is designed to be modular when it comes to connecting strings of batteries. This modularity means that at a later stage, new battery modules (FREQCON LFP8960 module or otherwise) can be connected while adapting to the new and old battery parameters simultaneously. The key to this flexibility is a central DC-bus connected with multiple DC/DC converters within the PCS.

If future extension of storage is accomplished via a different technology (or different specifications), these could be easily connected to the same PCS by installing the new IGBT powerstack(s). The IGBT powerstacks from FREQCON are modular in nature and can be installed with minimal effort.

The PCS also is flexible when it comes to connecting to the AC side (e.g. grid, factory, gensets) and it can also connect to other DC entities (e.g. PV modules, DC-grids, DC-car-charging) as seen in Figure 2.

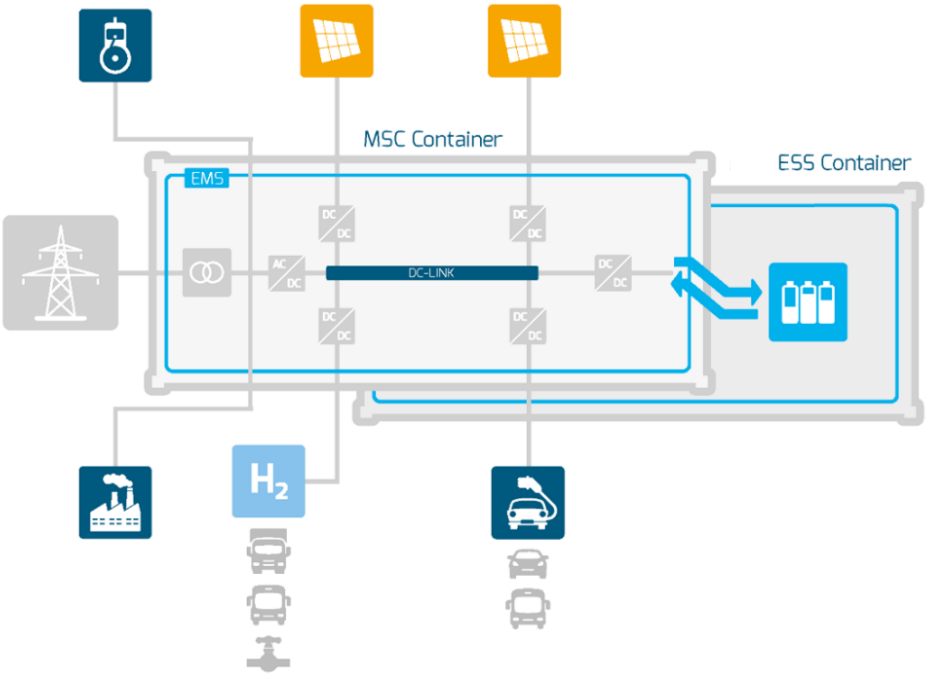


Figure 2: System diagram of integrated BESS solution by FREQCON.

Particularly important is the fact that energy hungry multiple AC/DC conversions can be avoided when charging the battery by PV, resulting in a higher overall round-trip-efficiency.

When compared with market available hybrid solutions, FREQCON PCS avoids energy losses of around 8% by avoiding the inefficient AC/DC conversions and transformer losses when the battery is charged by PV.

2.2 FREQCON Battery Storage

FREQCON relies on trusted and renowned manufacturers for battery cells. The battery storage for this offer is comprised of LFP LF280K battery cells from EVE. Table 1 shows the specifications of the battery cell.

Table 1: Parameters of LFP battery cell LF280K.

Parameter	Value
Nominal capacity	280 Ah
Nominal voltage	3.2 V
Maximum continuous charge/discharge	1C / 1C
Cut-off voltage charge	3.65 V
Cut-off voltage discharge	2.50 V
Self-discharge rate per month	≤ 3%

Using the LF280K battery cells, FREQCON constructs its LFP8960 battery modules for FREQCON battery storage solutions.



Figure 3: Freqcon battery module with 10 LF280K battery cells in series.

In each battery rack (1000mm x 1000mm x 2200mm) for this offer, 28 LFP8960 modules are connected in series to supply 700 VDC (at minimum cut-off voltage 2.5 VDC from each battery cell) from each battery rack. At maximum voltage of 3.65 VDC from each cell, the voltage supply from each rack would be 1,022 VDC.



Figure 4: Battery storage racks with 28 battery modules with total installed capacity of 250.88 kWh per rack.

3 Offered BESS 1 MW / 5.5 MWh

Characteristics of the offered BESS system are briefly listed in this section. Please consult attached documents for details.

3.1 PCS

The offered BESS is realized with a FREQCON PCS rated 1 MW at 620 VAC. Table 2 lists some specifications for the PCS.

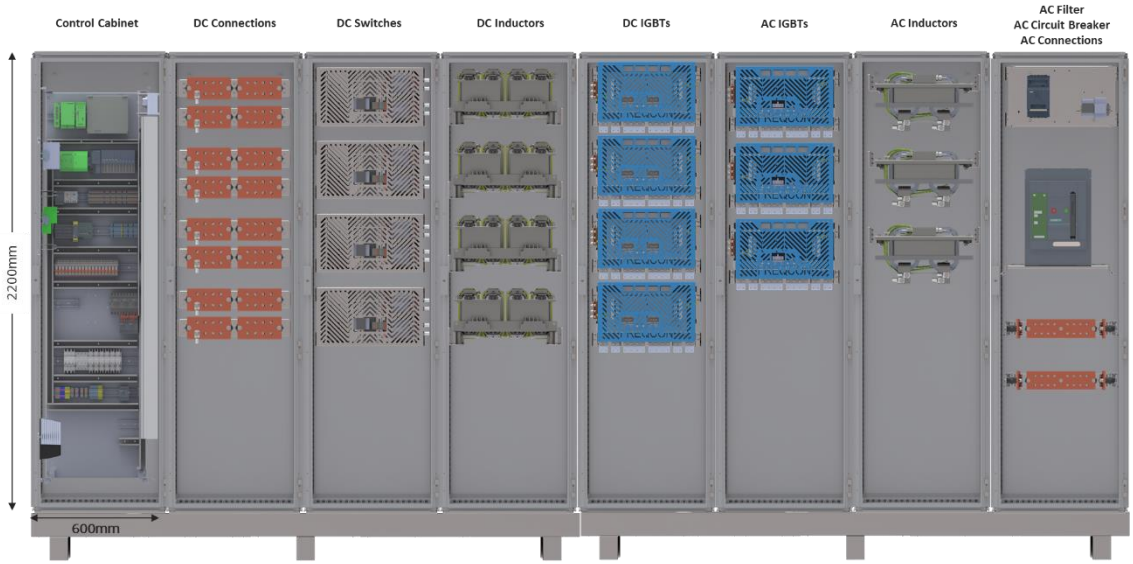
Table 2: Parameters for FREQCON PCS

Parameter	Value
Nominal power	1,000 kW
Nominal voltage	620 V_{AC}
Nominal current (continuous operation)	931 A_{AC}
Maximum current (continuous operation)	1,050 A_{AC}
DC link voltage	1,200 V_{DC}
Number of DC outputs	8
DC current per output	500 A_{DC}
DC current total	4,000 A_{DC}

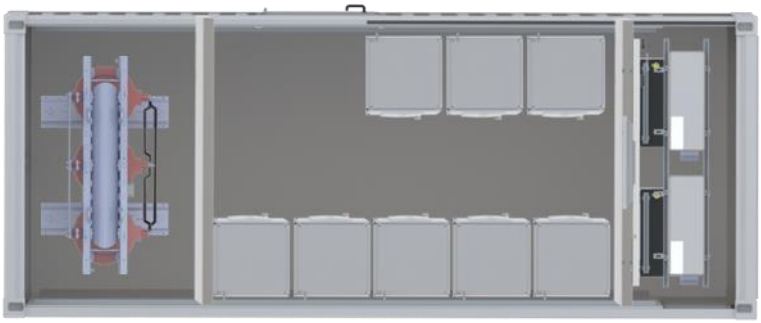
The PCS divides the battery storage into the eight IGBT powerstacks. This provides flexibility and modularity to the system. Even if the future extension of storage is accomplished via a different technology (or different specifications), these could be easily connected to the same PCS by connecting the new battery storage to one (or more) of the powerstacks and the old battery storage can be shifted to the remaining power stacks.

FREQCON PCS inherently also have the flexibility to extend the system by installing the new IGBT powerstacks to connect to the same DC link. The IGBT powerstacks are modular in nature and can be installed with minimal effort.

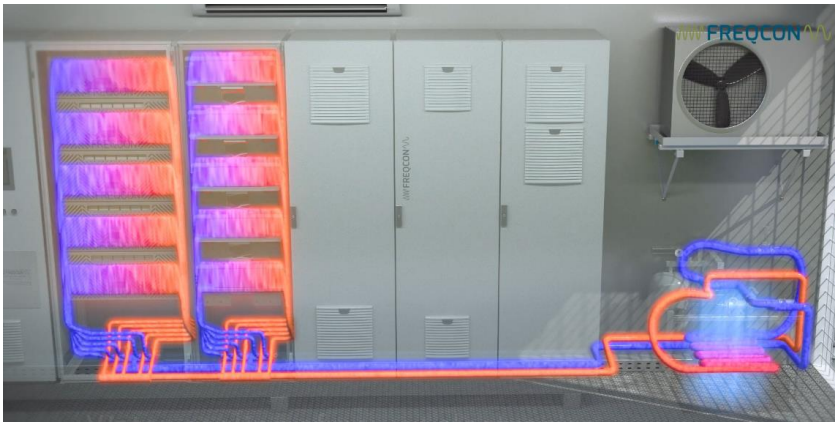
The PCS rated 1 MW at 620 V consists of eight cabinets (each of 600mm x 600 mm x 2200 mm). A possible overview of the PCS cabinets and the various components is shown below. Please note that this figure may not be accurate but is simply used to communicate a possible layout of components within the converter cabinets to be installed at site. The exact layout shall be communicated following the order and detailed engineering.



The PCS along with corresponding cooling units, heat exchangers, and 1 MVA 6.6 kV transformer is housed in a 20 ft. HC container as shown below:

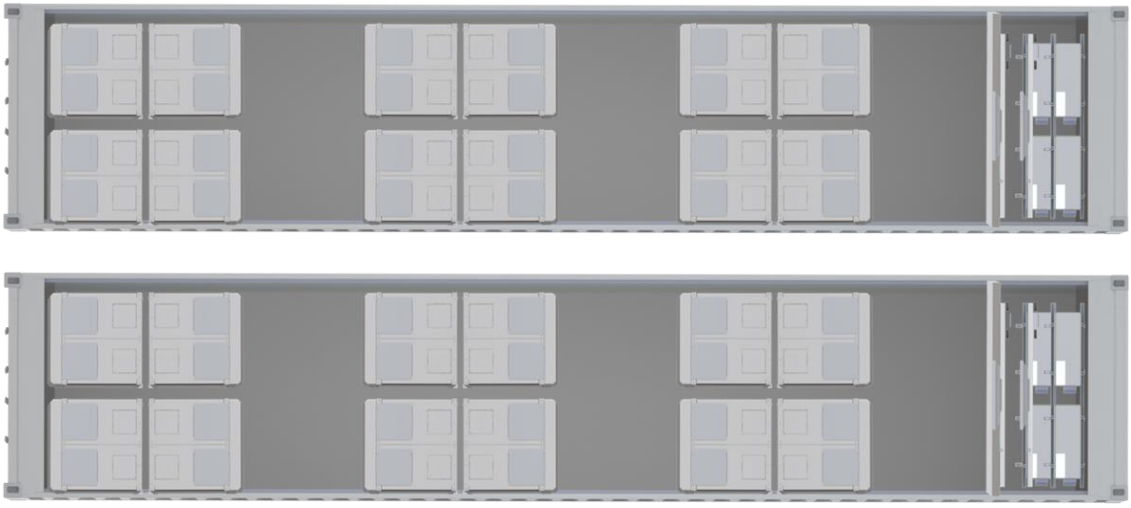


FREQCON PCS is water-cooled with a closed-circuit cooling system as shown in the figure below. The water-pumps and heat exchangers are part of the offer.



3.2 Battery Storage

The corresponding battery storage consists of two 40 ft. HC container with a total installed battery storage capacity of **5,519 kWh** with its standard battery rack (described in the previous sections). The usable capacity at 90% DoD is **5,000 kWh**. To realize the installed capacity at BoL, 22 battery racks are used.



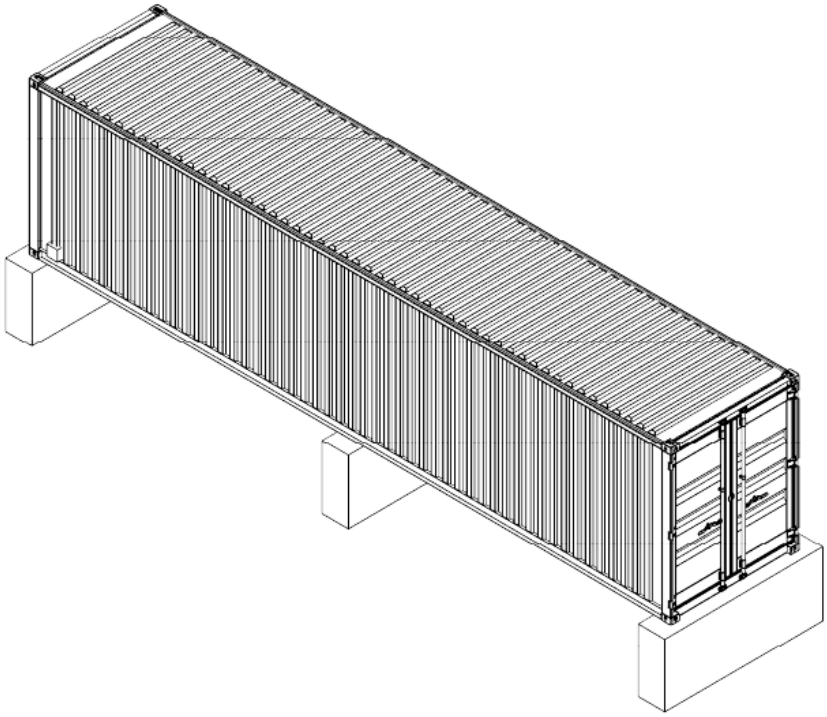
The battery racks can be easily transported and installed at target site. The battery racks are accessible for easy maintenance.

4 General Assembly and Onsite Installation

The offered containerized BESS can be delivered on site as a turnkey system with all the components i.e., inverter, and HVAC completely installed, along with empty battery cabinets. The battery modules would be transported at site separately and could be installed on site. However, it must be clarified where the installation is most optimal to be taken place.

This is because of the UN3480 regulation regarding batteries safe transport and the total allowable weight for road transport.

The containers are recommended to be placed on raised foundations. The following figures show the proposed foundations for a 40 ft. HC container. Please note that the following figures show a possible realization of the foundations. The exact design may vary depending on the project.





5 Availability and Modularity

The offered BESS is designed to be capable of remaining in operation during failures of one or more battery racks and even in case of failure of DC IGBT powerstack or inductor or switch & fuse.

5.1 Failure of battery rack(s)

In case there is failure in battery rack(s), the PCS shall disconnect these battery racks. This results in a maximum loss of available battery storage corresponding to number of battery racks disconnected. Each battery rack has 250 kWh installed capacity.

The failing battery rack(s) can be accessed without disrupting the functioning battery racks. This means any maintenance or repair can be performed without the system being significantly affected.

5.2 Failure of DC IGBT Stack

In case, the DC IGBT stacks encounter a failure event, the IGBT would be disconnected for repair and maintenance. The effect of the failure of DC IGBT stack would be disconnection of the battery racks connected to it.

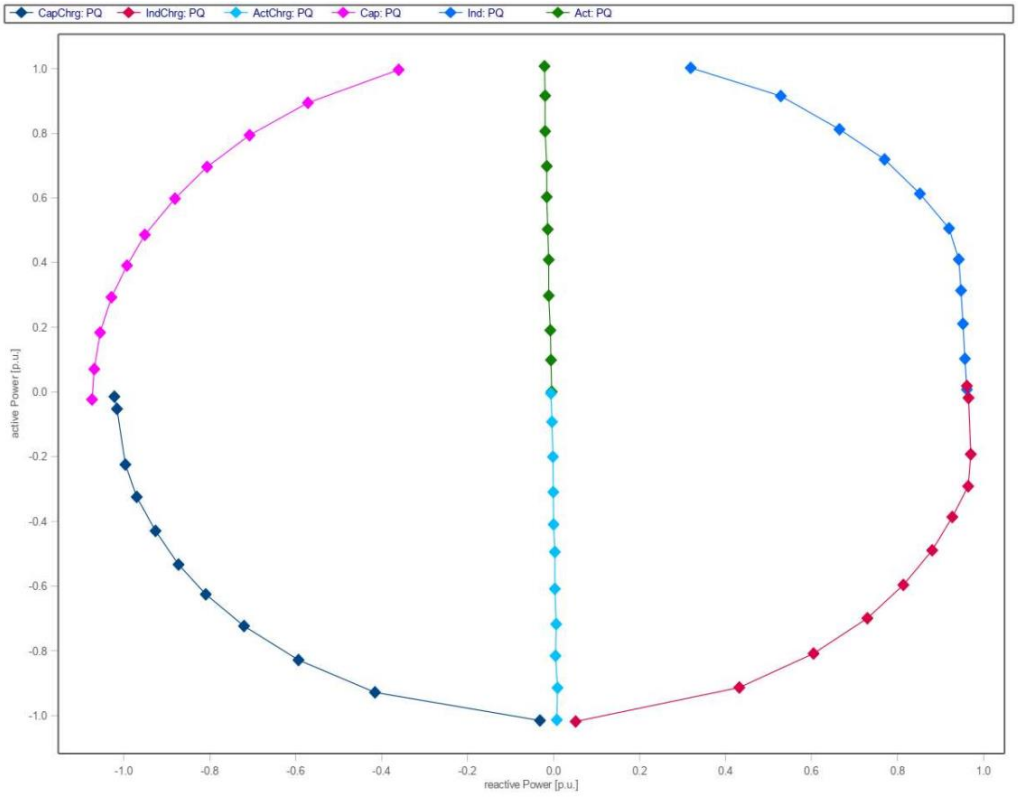
6 Applications and EMS

FREQCON BESS FQ is able to provide the following applications.

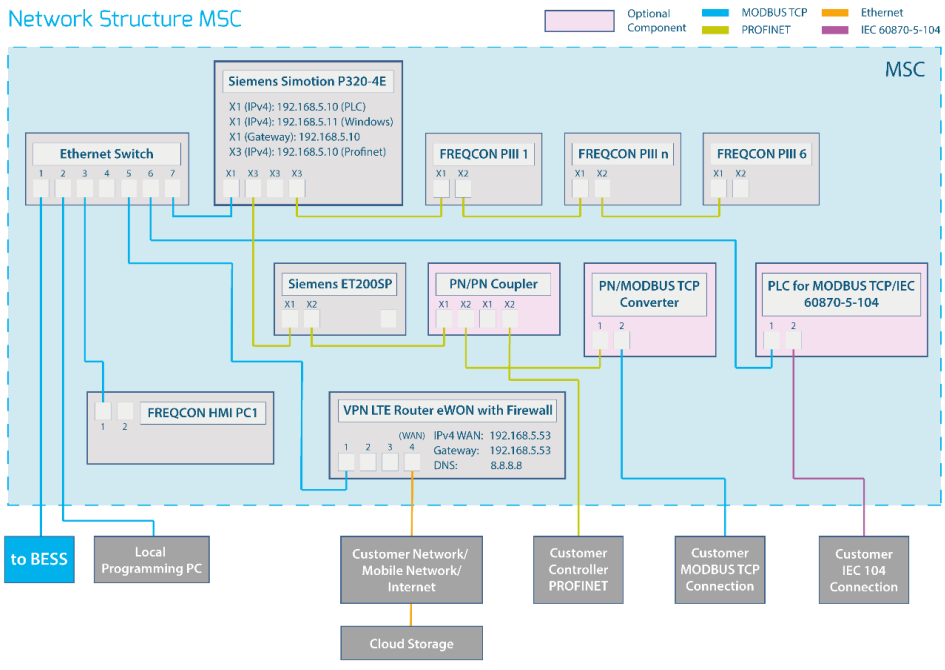


The addition of new applications requires only software update, which can also be performed remotely. In case, a new functionality is introduced which requires additional components, these will have to be procured and installed on site along with corresponding testing.

The FREQCON PCS is capable of providing reactive power compensation i.e. four quadrant operation. The following figure shows the results of the measurement in an active power/reactive power diagram (PQ diagram) with U = 100% Un.



The battery storage system is equipped with integrated Battery Management System (BMS). This monitors the batteries and provides all important information to the FREQCON EMS. Remote access to the system is also possible to the system for software updates as well as regular maintenance. The following figure shows the communication network of the PCS.

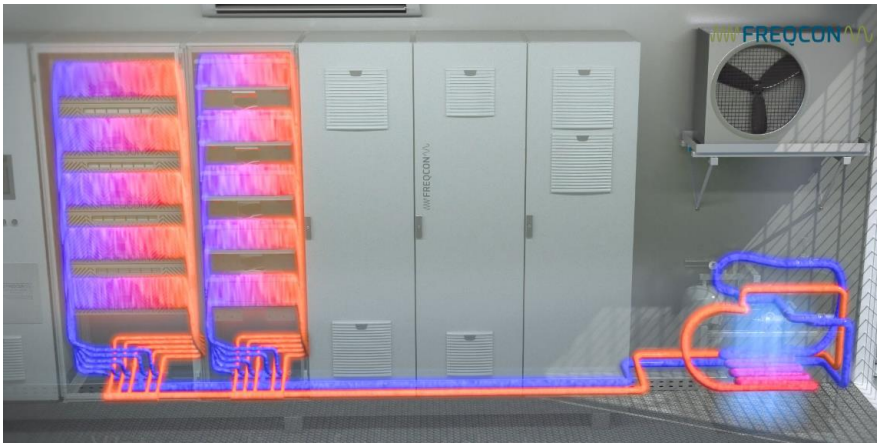


7 Assembly and Dismantling

The offered BESS is also flexible in assembly and eventual de-commissioning. LFP8960 battery modules are placed in individual cabinets and can easily be accessed/removed. The complete BESS is modular in nature and can be easily disassembled.

8 HVAC and Cooling

FREQCON PCS is water-cooled with a closed circuit cooling system as shown in the figure below. The water-pump and heat exchanger is part of the offer.



The HVAC signals shall be connected with Energy Management System from FREQCON PCS for optimum control.

9 Fire Protection and Suppression

The offered BESS is equipped with state-of-the-art fire protection and suppression system compliant with international standards. Each battery storage rack is equipped with active fire suppression capabilities such that other cabinets are not affected.

FREQCON's fire protection system aims to detect a malfunction as early as possible and suppress the problem before it results in a fire hazard. The converters, battery cabinets are equipped with several automatic detectors:

- Converter
  - Arc sensors
  - Temperature sensors
  - Smoke detectors
- Battery cabinet
  - CO sensors
  - Temperature sensors
  - Smoke detectors

- Transformer (if applicable)
  - Temperature sensors
  - Smoke detectors

10 Norms and Standards

The offered BESS is compliant with the norms and standards listed in the technical requirements for BESS. As per the requirements, if local norms are not met, FREQCON shall communicate equivalent IEC or acceptable standards.

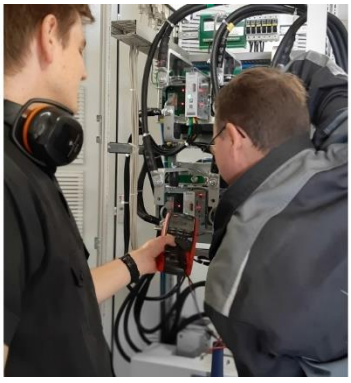
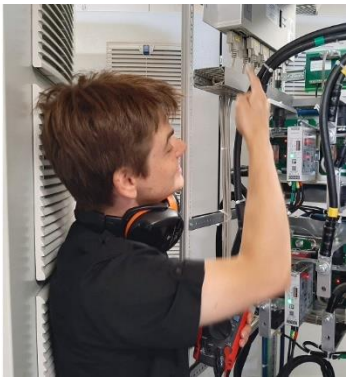
Furthermore, FREQCON has an in-house testing facility with a grid simulator. Grid converters up to 3 MW can be tested at this facility and the test bench consists of measuring instruments from accredited institutes. This enable fast, reliable, and certified managements to be carried out for FREQCON power converters.

Following is a list of applicable standards and guidelines including grid codes:

- ANSI C57. 12.28-2005
- ANSI Z535-1994
- ANSI/NEPA70 (2008)
- BDEW Mittelspannungsrichtlinie
- CEI (Italy)
- Chinese Grid Code
- DIN EN 55011 / EN 55011
- DIN EN 61000-4-2 / IEC 61000-4-2
- DIN EN 61000-6-4 / IEC 61000-6-4
- DIN EN 61427-1
- DIN EN 61427-2
- DIN EN 62109-1 / IEC 62109-1
- DIN EN 62109-2 / IEC 62109-2
- DIN EN 6247-1 / IEC 62477-1
- DIN VDE 0105-100
- EMC 2014/30/EU
- EN 50581
- EN 55011
- EN 60204-1
- EN 60721-3-3
- EN 61000-6-2
- EN 61000-6-4
- EN 62619
- EN EN 61936-1
- EN ISO 13849-1

- EN ISO 13849-2
- IEC 50541-1-2011-11
- IEC 60068-2-27
- IEC 60076-11
- IEC 61400-1
- IEC 61400-21
- IEC 62477-1:2012
- IEC 60068-2-6
- IEEE 1547
- IEEE 519-1992
- IEEE standard 154-2003
- Indian Grid Code
- Ireland DS3 Grid Services
- ISO 9001 9001:2015
- LVD 2014/35/EU
- SAE J2380
- SAE J2464
- TAB Hochspannung
- UL 1741
- UL 1973
- VDE 4105
- VDE 4110
- VDE 4120
- VDE 4130
- VDE-AR-N 4110
- VDE-AR-N 4120
- VDE-AR-N 4130

FREQCON has an in-house 3 MW full load test bench at the Rethem facility. It allows us to test our newly developed products under realistic conditions as well as carrying out certified measurements on behalf of our customers.

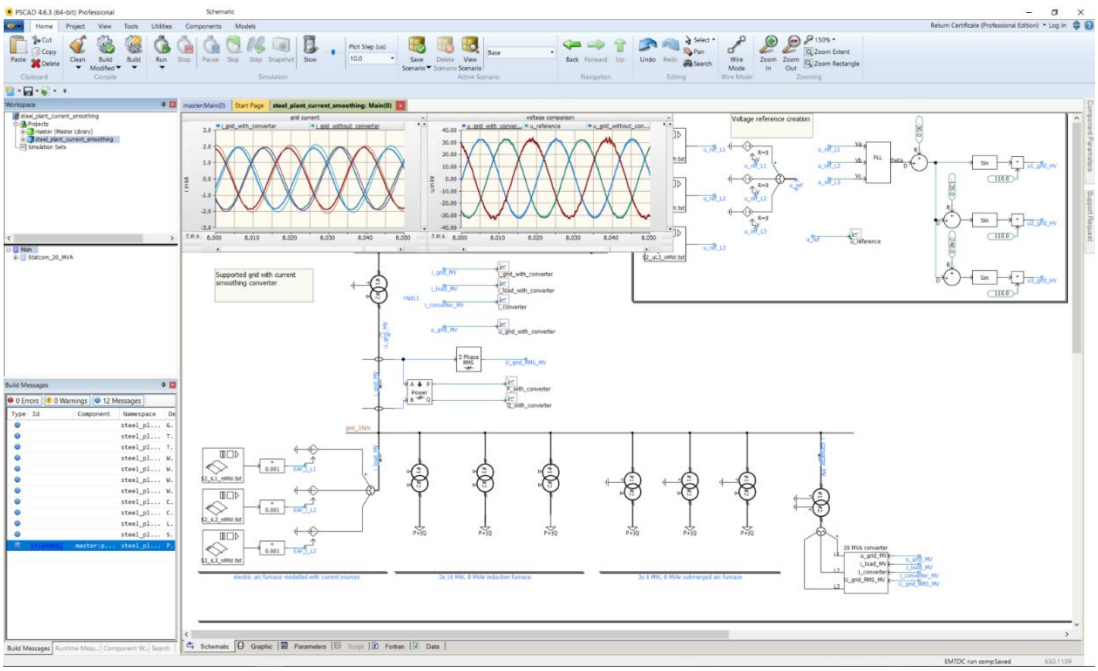




The test bench provides the following services:

- Set-up of an island grid with individual parameter specification
- Measurements of grid quality
- Acceptance tests
- Simulation of incidents or grid events
- Defined by grid codes
- Customer-specific (voltage, frequency, symmetrical, asymmetrical, LVRT, HVRT, FRT)
- Testing and modeling based on available grid data
- Customer project measurements for certifications (wind turbines)
- Verification of grid-code compliant operation
- Verifying software implementations of new algorithms

Electromagnetic transients (EMT) simulations are also performed to find any weak spots at an early stage. The behavior of the system is simulated and communicated with client until agreement is reached.

Therefore, all grid requirements are simulated and verified before delivery of product. Furthermore, test data, results and the FAT is documented is sent to client before delivery.



EVE Power Co., Ltd
Product Specification

File No	:	LF280K-72174
Version	:	B
Effective Date	:	Mar 23, 2021

Product name	:	LFP Power Battery
Model name	:	LF280K
Specification	:	3.2V 280Ah
Draft	:	Shuao He 2021.3.23
Checked	:	Yong zhang 2021.3.23
Approved	:	Dingding Yuan 2021.3.23
Customer Approved	:	

Mail : sales@evebattery.com

Address : No .68 Jingnan Avenue, Jiaodao District, Jingmen High-tech Zone, Jingmen City, Hubei Province.

History of specification

Date	Contents	Remarks
2020-09-23	First issue	Rf
2021-01-16	First issue	A
2021-03-23	Name change	B

Contents

1. Scope 1
2. Description and Model 1
3. General Technical Parameter 1
4. Test conditions 2
5. Main Performance 3
6. Transportation 4
7. Storage 4
8. Points for attention 5
Appendix Ⅰ: Two-dimensional graphs of Battery 6
Appendix Ⅱ: Battery coding rules 7
Appendix Ⅲ: Photos of battery appearance 7
Appendix IV: Battery packaging drawing 8
Appendix V: Electric performance curve 8

1. Scope

This specification is applied to Rechargeable LFP Power Battery with aluminum shell (3.2V 280Ah) manufactured by EVE Energy Co., Ltd., in which the description and model, main performance, test conditions and precautions of the product are included.

The product can be applied for Vehicle power supply, Storage system, etc.

2. Description and Model

2.1 Description: LFP Li-ion Power Battery with aluminum shell.

2.2 Model: LF280K

3. General Technical Parameter

#	Item		Parameter	Remark
1	Nominal Capacity		280.0 Ah	(25±2)℃, Standard charge and discharge
2	Typical Voltage		3.2 V	
3	AC Impedance Resistance(1KHz)		≤0.25 mΩ	
4	Standard charge and discharge	Charge / discharge current	0.5 C/0.5 C	
		Cut off voltage of charge / discharge	3.65 V/2.5 V	
5	Maximum charge / discharge current	Continuous charge / discharge	1 C/1 C	According to continuous / pulse charge and discharge ammeters
		Pulse charge / discharge (30s)	2 C/2 C	
6	Recommended scope of SOC		10%～90%	N.A.
7	Charging Temperature		0 ℃～55 ℃	According to continuous / pulse charge and discharge ammeters
8	Discharging Temperature		-20 ℃～55 ℃	

#	Item		Parameter	Remark
9	Storage temperature	Short term (within 1 month)	-20℃~45℃	N.A.
		Long term (within 1 year)	0℃~35℃	
10	Storage humidity range		<90%	
11	Self-discharge rate per month		≤3%/month	Temperature: (25±2)℃, Storage scope of SOC: 30%~50%SOC
12	Dimension	Width	173.7 ±0.5 mm	Refer to Appendix I
13		Thickness (under 300±20 kgf, 30%~40% SOC)	72.0 ±1.0 mm	
		Average thickness (200 pcs, under 300±20 kgf, 30%~40% SOC)	72.0 ±0.5 mm	
14		High (total)	207.5 ±0.5 mm	
15		High (subject)	204.6 ±0.5 mm	
16		Tabs Distance	123.0±0.3 mm	
17	Battery weight		5.42±0.3 kg	

4. Test conditions

4.1 Test environment conditions

Temperature: 25±2℃

Relative humidity (RH): 15%~85%

Atmospheric condition: 86KPa~106KPa

4.2 Standard Charge

The standard charge means charging the cell with charge current 0.5C(A) and constant voltage 3.65V at (25±2)℃, 0.05C cutoff.

4.3 Standard Discharge

The standard discharge means discharging the cell with discharge current 0.5C(A) and cutoff voltage 2.5V at (25±2) ℃.

4.4 Pole and Busbar welding requirements

No.	Item	Parameter	Remark
1	Penetration	≤ 2.5mm	
2	Pulling force	60-100kgf	
3	Temperature of pole plastic part	≤ 150℃	Related to power and time
4	The pressure on the pole	≤ 700N	

5. Main Performance

5.1 Electrical performance

No.	Item	Requirements	Measuring Procedure
1	Rate discharge performance at 25℃	Discharge capacity/nominal capacity×100% A) 0.5C (A) ≥100% B) 1.0C (A) ≥98%	After standard charge and 1h rest, discharge to 2.5V cutoff with the current of 0.5 C (A), 1.0C (A), respectively. If the discharge capacity fails to meet the technical requirements, this test is allowed to be repeated three times
2	Discharge performance at different temperature	Discharge capacity/nominal capacity×100% A)55℃≥95%(Cutoff 2.5V) B)-20℃≥70%(Cutoff 2.0V)	Measure the initial capacity and state of the battery: A) after standard charge and 5h rest at 55℃, discharge to 2.5V cutoff with the current of 0.5C(A); B) after standard charge at 25±2℃ and 24h rest at -20℃±2℃, discharge to 2.0V cutoff with the current of 0.5C(A).
3	The capacity retention and recovery at 25℃	Capacity Retention ≥ nominal capacity×95% Capacity Recovery ≥ nominal capacity×97%	Measure the initial capacity and state of the battery, after standard charge and stored for 28 days, discharge to 2.5V cutoff with the current of 0.5C (A), calculate the remaining capacity, the retention can be expressed as a percentage of nominal capacity. After standard charged and 30mins rest, calculate the discharging capacity (Ah), the recovery can be expressed as a percentage of nominal capacity. The recovery is measured with discharge current 0.5C (A) with 2.5V cut-off at (25±2) ℃.
4	cycle life at 25℃	≥6000 cycle @0.5C/0.5C	Under the 300kgf clamp, after standard charged and 30mins rest, discharge to 2.5V cutoff with the current of 0.5C(A) at (25±2) ℃, and then start the next cycle, end with the capacity decreasing to 80% of the

			initial capacity. The number of cycles is defined as the cycle life of the battery.
5	cycle life at 45℃	≥2500 cycle @0.5C/0.5C	Under the 300kgf clamp, after standard charged and 30mins rest, discharge to 2.5V cutoff with the current of 0.5C(A) at (45±2) ℃, and then start the next cycle, end with the capacity decreasing to 80% of the initial capacity. The number of cycles is defined as the cycle life of the battery.
6	End of life managem ent	capacity/nominal capacity <70%	During the use of the battery, the battery s hall be stopped when the end of life regul ations are exceeded.

5.2 Safety performance

No.	Item	Requirements	Measuring Procedure
1	Over Discharge	No fire、No explosion	Reference: GB/T 36276-2018 《Lithium ion battery for electrical energy storage》
2	Over Charging	No fire、No explosion	
3	Short-Circuit Test	No fire、No explosion	
4	Drop Test	No fire、No explosion	
5	Heating	No fire、No explosion	
6	Extrusion Test	No fire、No explosion	
7	Low pressure test	No fire、No explosion、No leakage	
8	Thermal runaway	No fire、No explosion	

6. Transportation

Battery for shipping should be packed in boxes with the State of charge (30%~50%SOC). The Violent vibration, impact extrusion, sun and rain should be prevented during shipping.

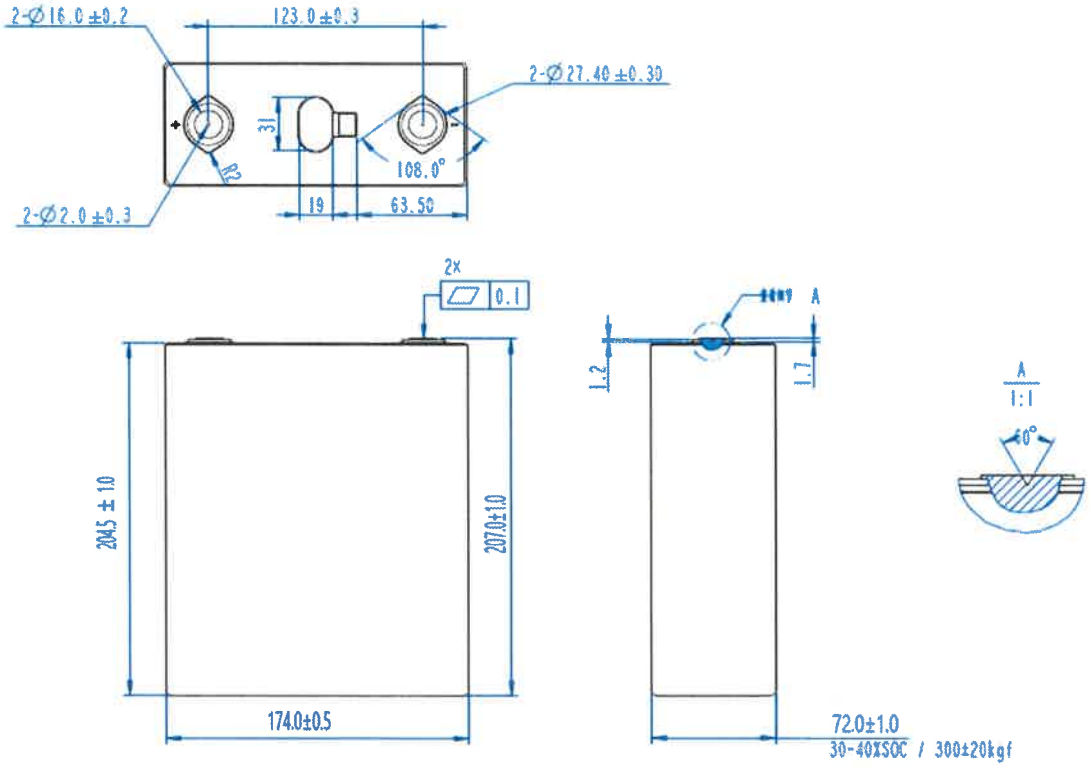
7. Storage

Batteries should be stored (more than 1 month) indoor with a dry and clean environment at 0 ℃~35 ℃. Avoiding contact with corrosive substances and staying away from fire and heat source. The battery should be charged and discharged every 6 months. The SOC for storage is between 30% ~ 50%.

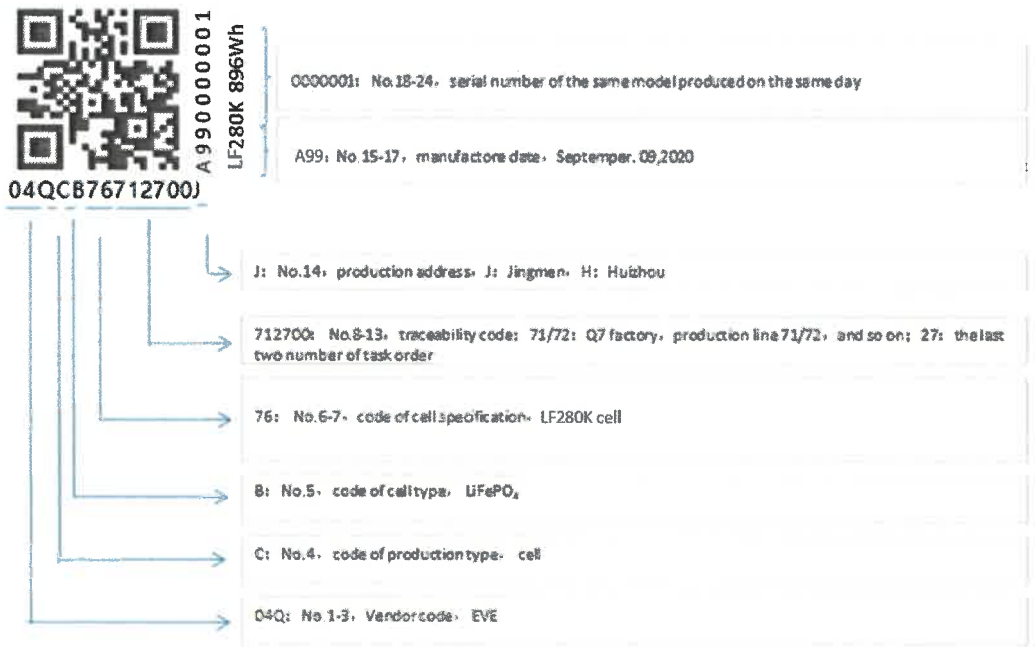
8. Points for attention

1. When the battery is charged and discharged, the conditions for monitoring and protecting the battery voltage, current and temperature shall be ensured.
2. Please keep the battery away from the heat source, fire source and other corrosive environments such as heating, strong acid and strong alkali.
3. Do not short circuit the battery or install it with incorrect polarity at any time，otherwise it can cause serious damage to the battery and cause danger.
4. Do not mix batteries of different models or manufacturers.
5. Do not use external force to make the battery fall, impact or puncture. Do not disassemble the battery or change the external structure.
6. When the battery is not used for a long time, please keep the battery in the state of 30%-50% SOC, and avoid the environment of strong direct sunlight or high temperature and humidity.
7. When operating the battery, it is necessary to wear rubber gloves and other protective devices.
8. In case of leakage, smoke or damage of battery, please stop using immediately and contact our company for handling.

Appendix Ⅰ: Two-dimensional graphs of Battery:



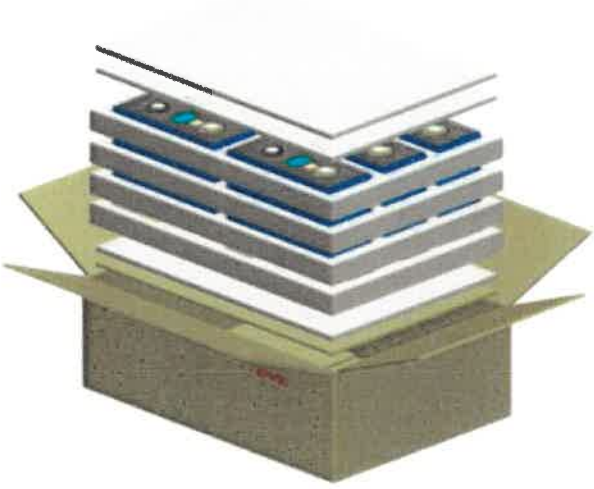
Appendix Ⅱ: Battery coding rules:



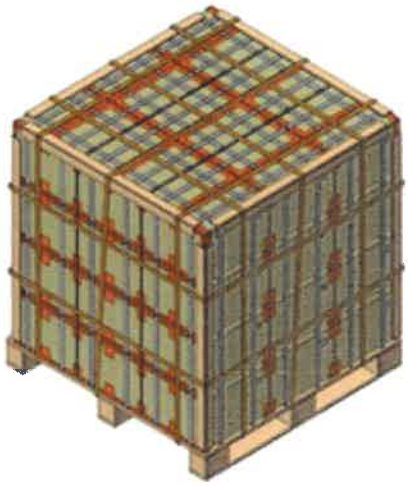
Appendix Ⅲ: photos of battery appearance:



Appendix IV: battery packaging drawing



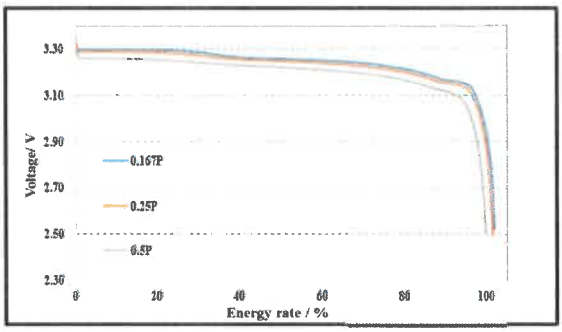
Length*width*height 426*302*245mm



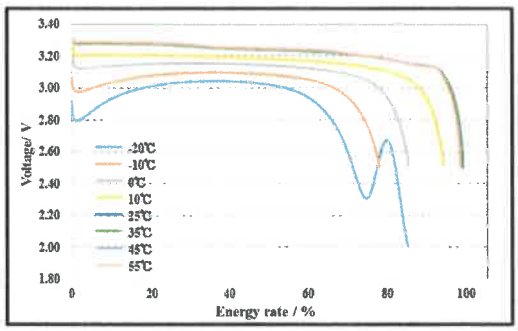
Length*width*height 1300*1100*1140mm

Appendix V: electric performance curve:

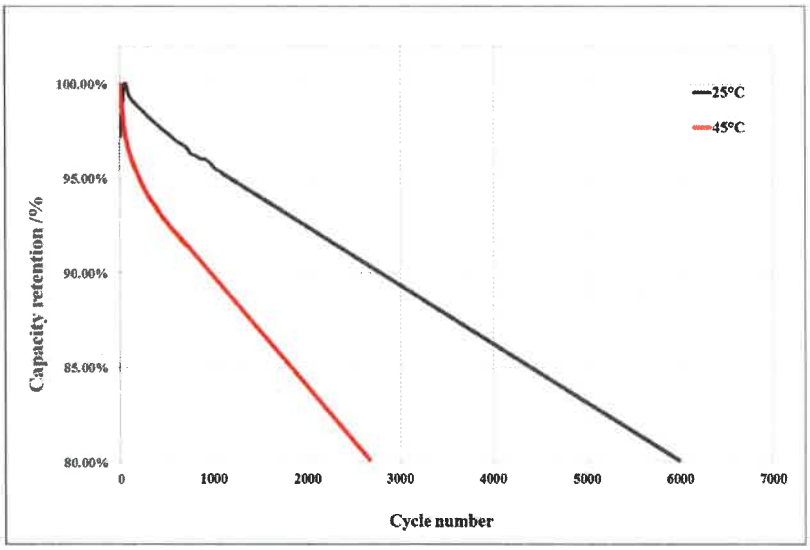
1、Rate discharge curve at 25°C



2、Discharge curve at different temperatures(0.5P)



3. Cycle curve (charge/discharge:0.5C/0.5C, 3.65V-2.5V)



STATRON
NON STOP POWER

General Arrangements

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: B01
Sequence Number: 001
Rev: 003
Document number: K559-2254-CWIWP4202201-B01-001
Document description: General Arrangements

Revision	Date	Name	Description
001	20.02.2023	CPA / ADI	First Version
002	12.04.2023	CPA / ADI	Updated according to KBR comments
003	21.01.2025	MMÜ	Second revision

General Arrangements
B01

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	B01
Document name	General Arrangements
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-01	C. Palenzuela	First version
2.0	2023-04-14	C. Palenzuela	Updated several pages according to KBR comments
3.0	2025-01-20	M. Müller	Second revision

Table 1: Version overview

	Date	Name
Editor	2023-04-14	C. Palenzuela
Checked by	2023-04-15	A. Fritz
Approved by	2023-04-15	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8

Identification

Product Version / Document Version

Product version
Prototype

Document release date
January 2025

Doc Code
K559-2254-CWIWP4202201-B01-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
General arrangement drawing – Compete system	508261 BESS 1 MW 5.5 MWh 6.6 kV
General arrangement drawing – PCS	53396 PCS Container
General arrangement drawing – BESS 1	53406 BESS Container 1
General arrangement drawing – BESS 2	53412 BESS Container 2

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

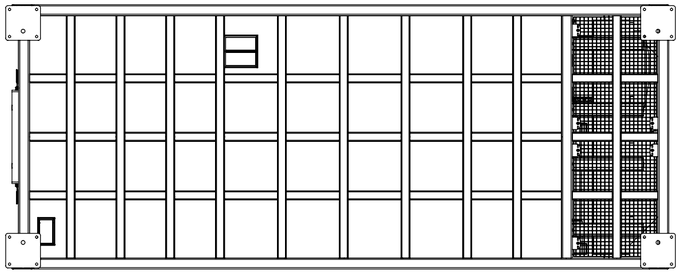
Table 3: Generic terms and abbreviations used

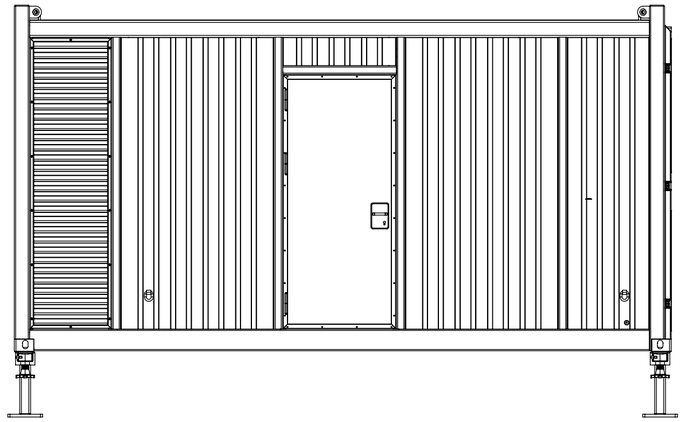
2 General

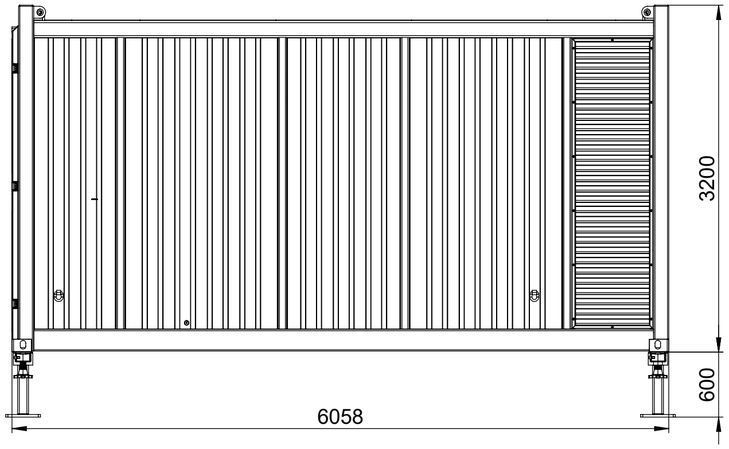
Drawings of the PCS and BESS general arrangements are attached to this document (*see section 1.3 "Other Applicable Documents"*).

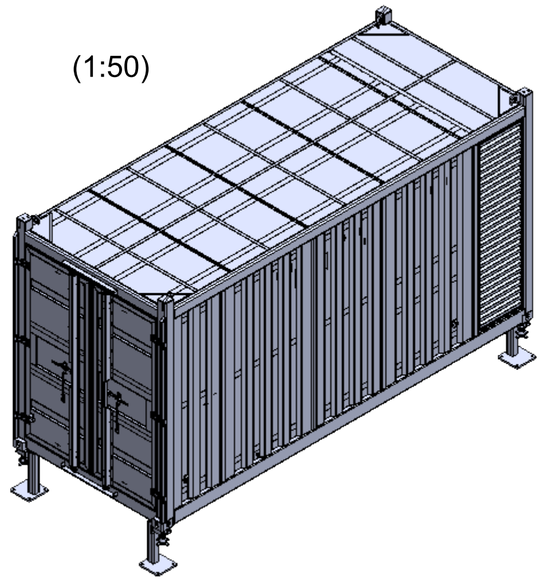
Component	Manufacturer	FRQ part no.	File Name
PCS	FREQCON	53396	53396 PCS Container.pdf
BESS 1		53406	53406 BESS Container 1.pdf
BESS 2		53412	53412 BESS Container 2.pdf
Complete System		508261	508261 BESS 1 MW 5.5 MWh 6.6 kV

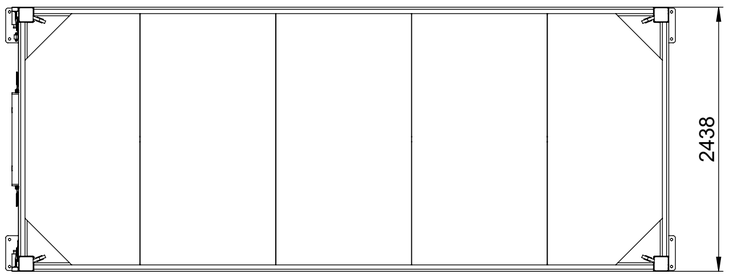
Table 4: Other applicable documents











Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	21.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: - (surface)

Werkstoff (material):

Gewicht (weight): 12199.00 kg

Bezeichnung (description):

Umrichtercontainer

PCS (Converter) Container

Scale: 1:40

Sheet: 1 (A2)

1 of: 4

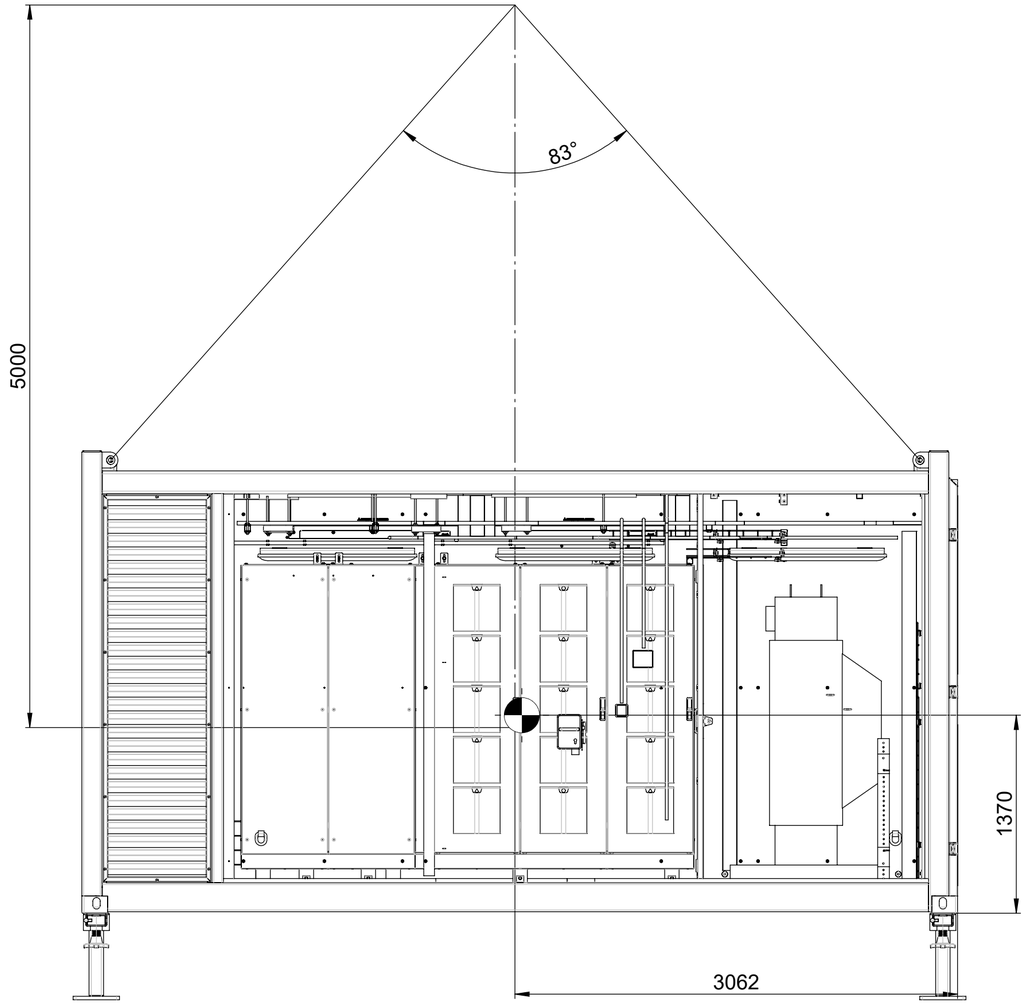
Artikel-Nr. (article number): 53396

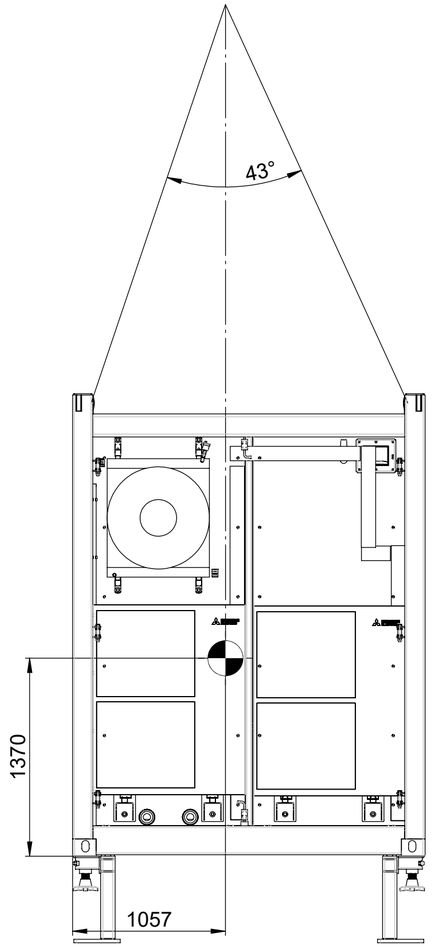
Revision:

alte Zeichnungs-Nr. (old drawing number):

CAD System SolidWorks

Status: Freigegeben





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Abmaße in mm für Nennmaßbereiche

Genauigkeitsgrad	0,5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	21.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.*

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 12199.00 kg

Bezeichnung (description):

Umrichtercontainer

PCS (Converter) Container

Scale: 1:30

Sheet: 2 (A2)

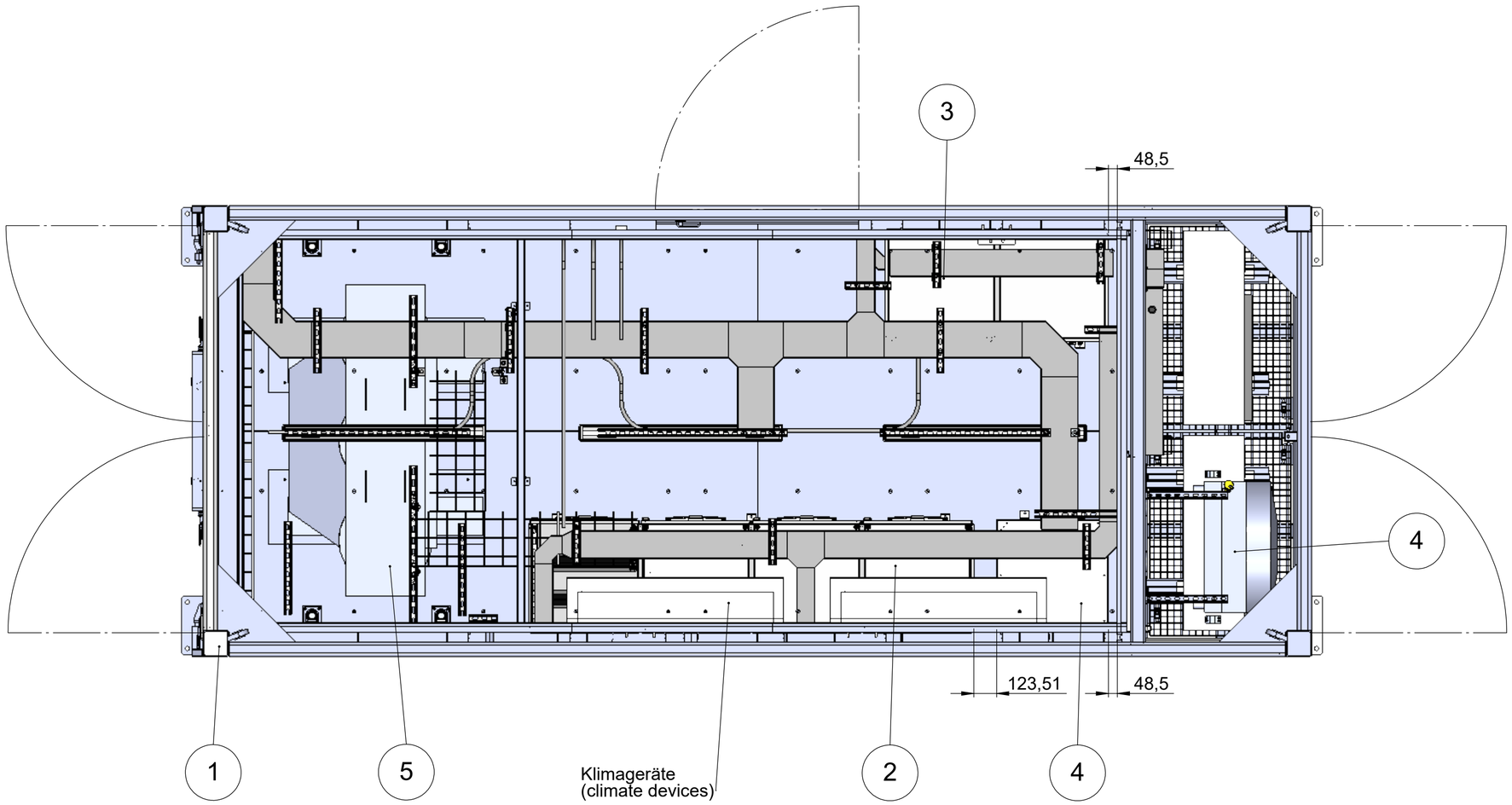
Artikel-Nr. (article number): 53396

2 of: 4

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Pos. Nr.	Menge	**Bezeichnung**	engl. Bezeichnung	Art.-Nr.	**Lieferant**	**Lieferanten Nr.**
1	1	Umrichtercontainer_20ft	PCS Container 20ft	508727	--	--
2	1	Umrichter	Converter System	53399	Freqcon	--
3	1	Steuerschrank1&2	Control Cabinets 1&2	53763	--	--
4	1	Kühlsystem	Cooling System	53405	--	--
5	1	Gießharztransformator 1250kVA	transformer 1250kVA	508464	Powerfullstop	

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Abmaße in mm für Nennmaßbereiche

Genauigkeitsgrad	0,5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 15899.18 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	21.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.*

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Umrichtercontainer

PCS (Converter) Container

Scale: 1:20

Sheet: 3 (A2)

Artikel-Nr. (article number): 53396

3 of: 4

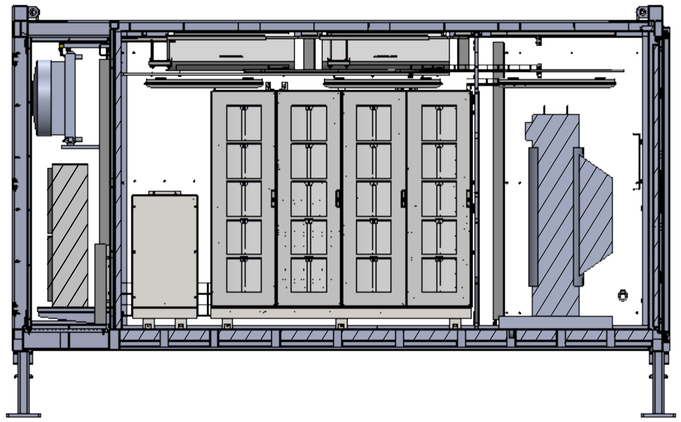
Revision:

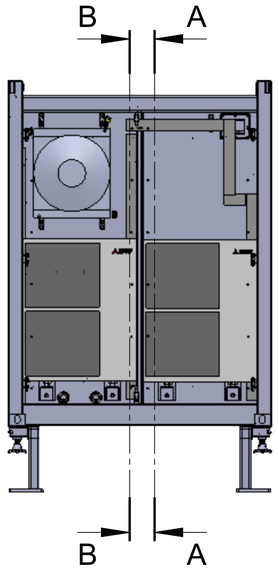
Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks

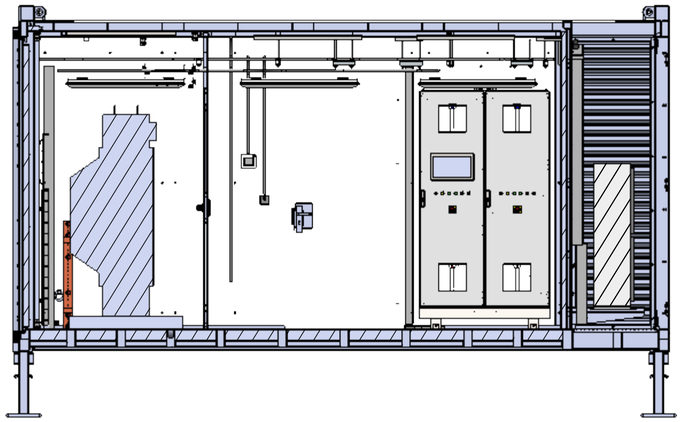
Status: Freigegeben

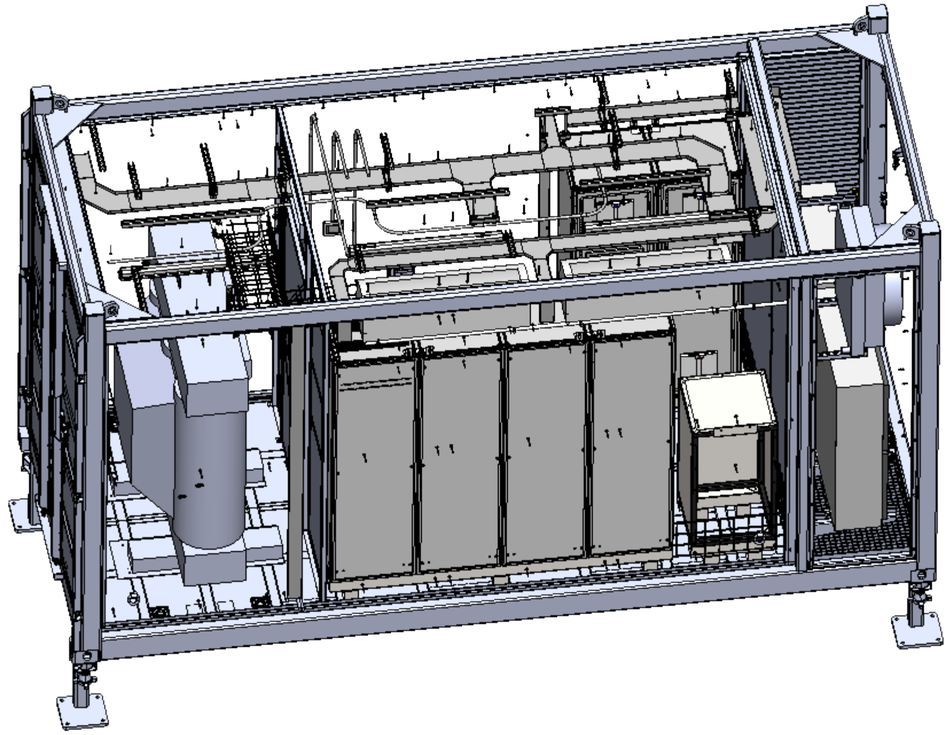
A-A





B-B





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 12199.00 kg

ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	21.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.“

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Umrichtercontainer

PCS (Converter) Container

Scale: 1:40

Sheet: 4 (A2)

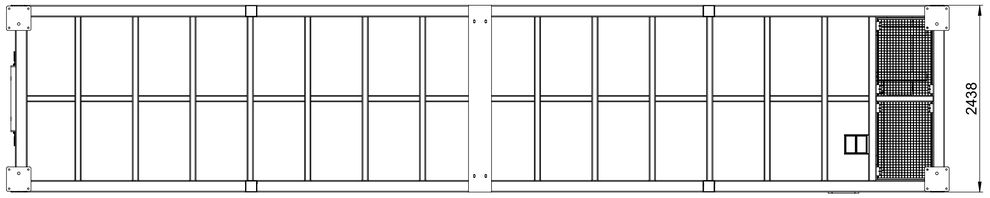
Artikel-Nr. (article number): 53396

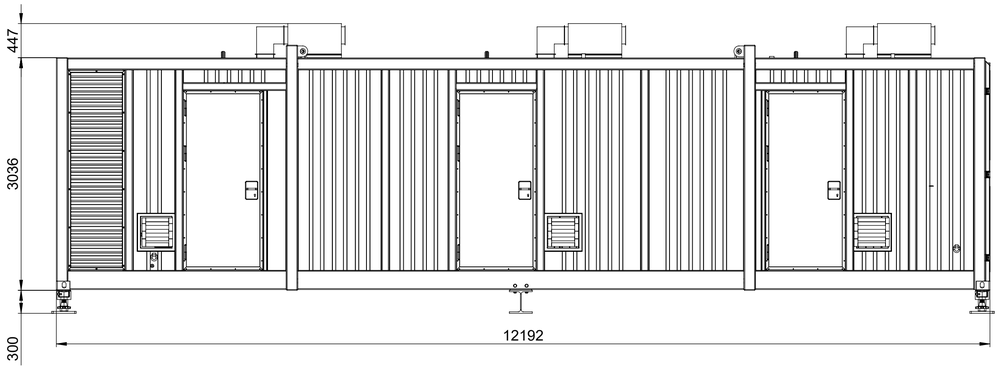
4 of: 4

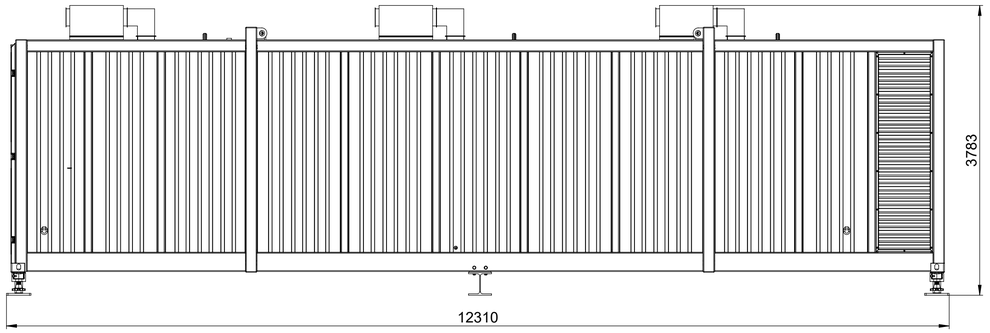
Revision:

Projekt-Nr. & Kunde (project number & customer):

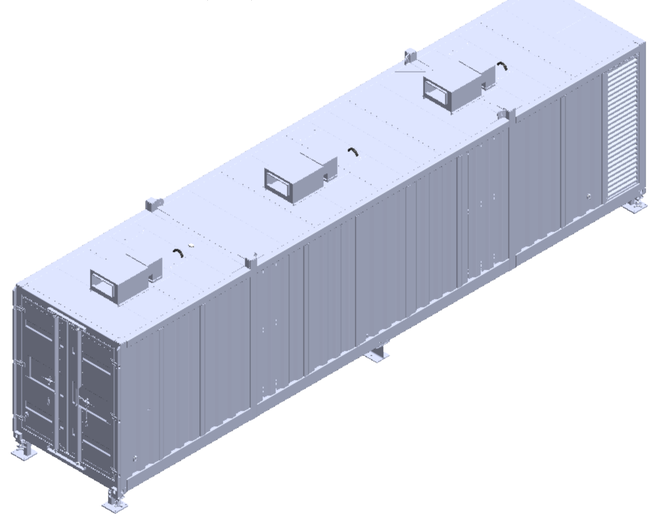
CAD System SolidWorks | Status: Freigegeben

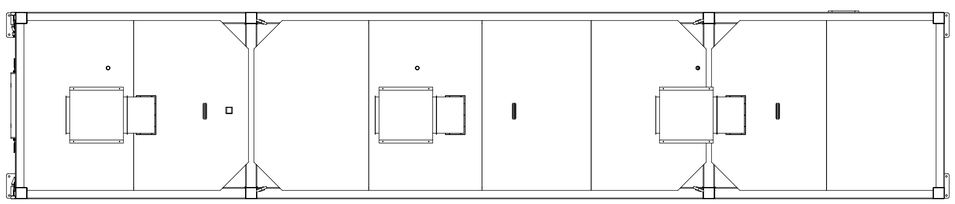




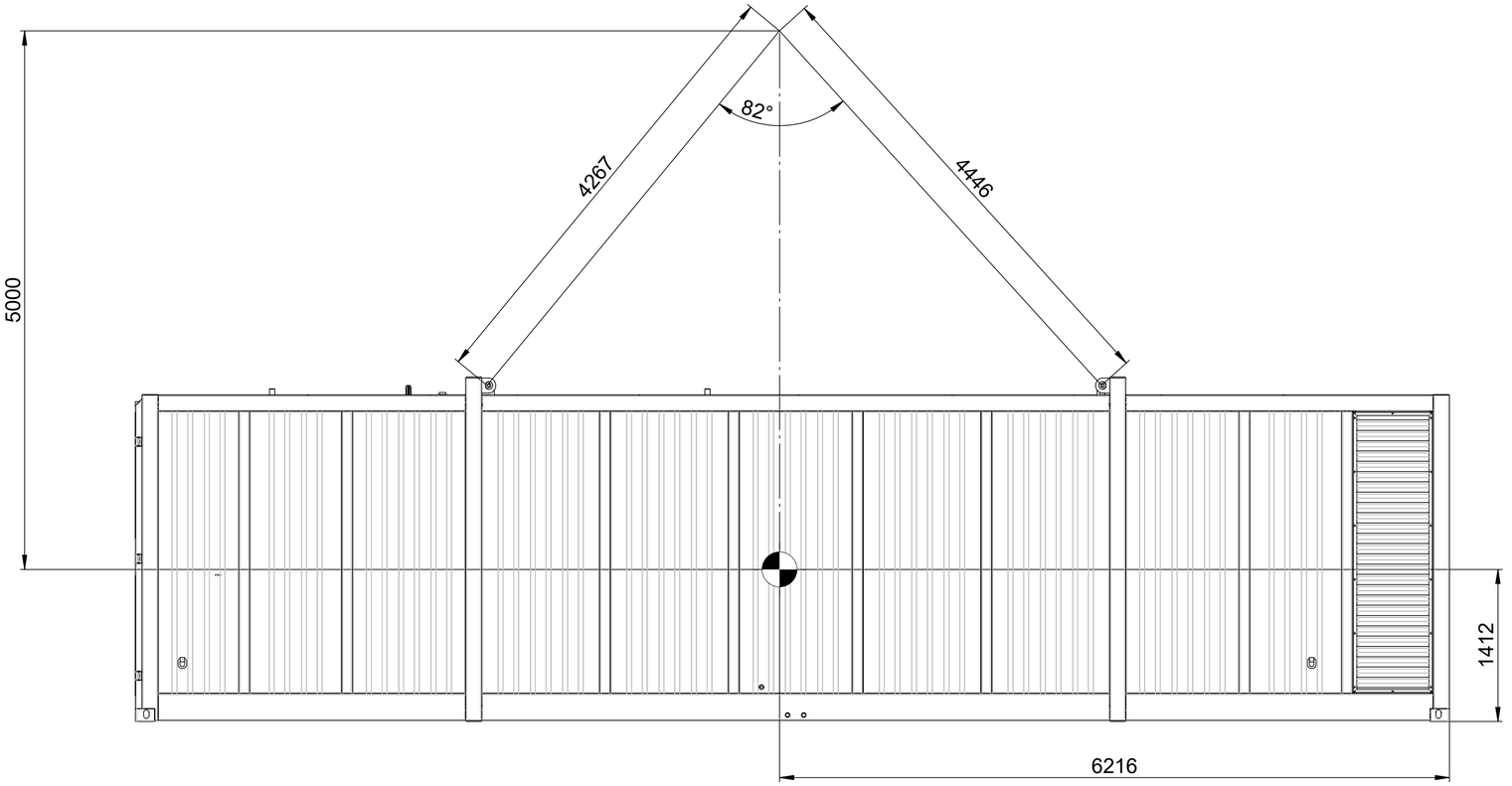


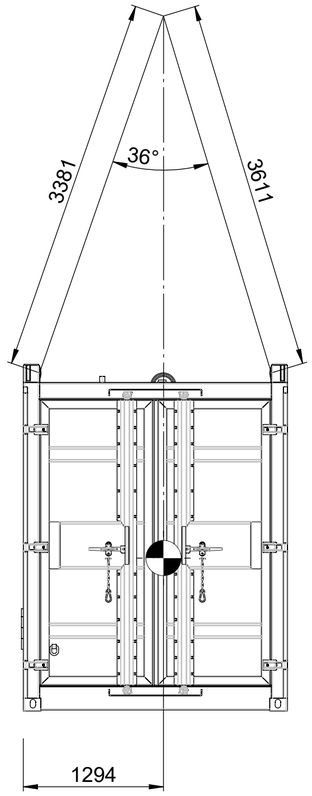
(1:50)





| | | |





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK							
Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	22.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: - (surface)

Werkstoff (material): Gewicht (weight): 14250.00 kg

Bezeichnung (description):

Batteriecontainer 1

Battery Container 1

Scale: 1:40

Sheet: 2 (A2)

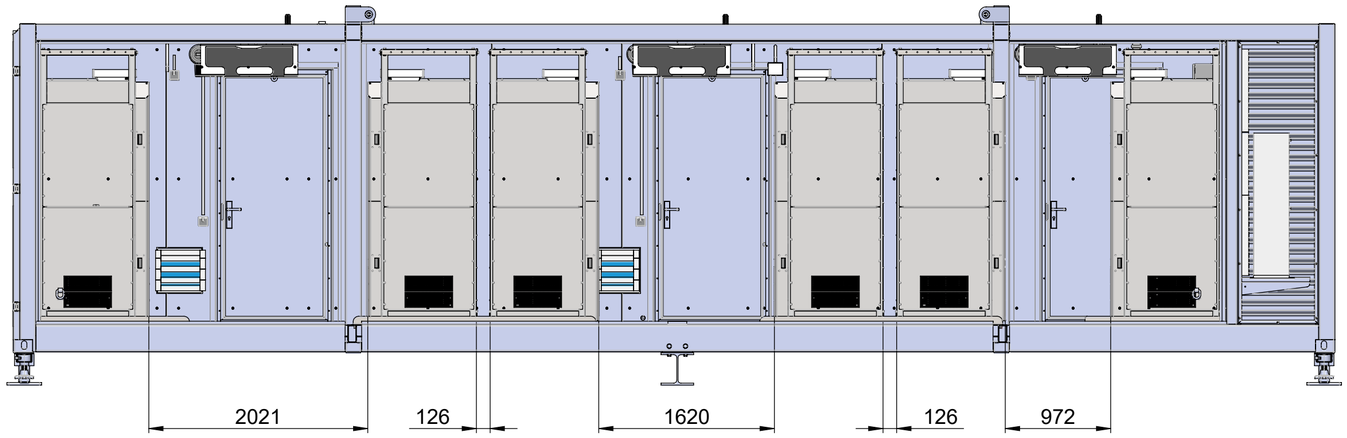
2 of: 4

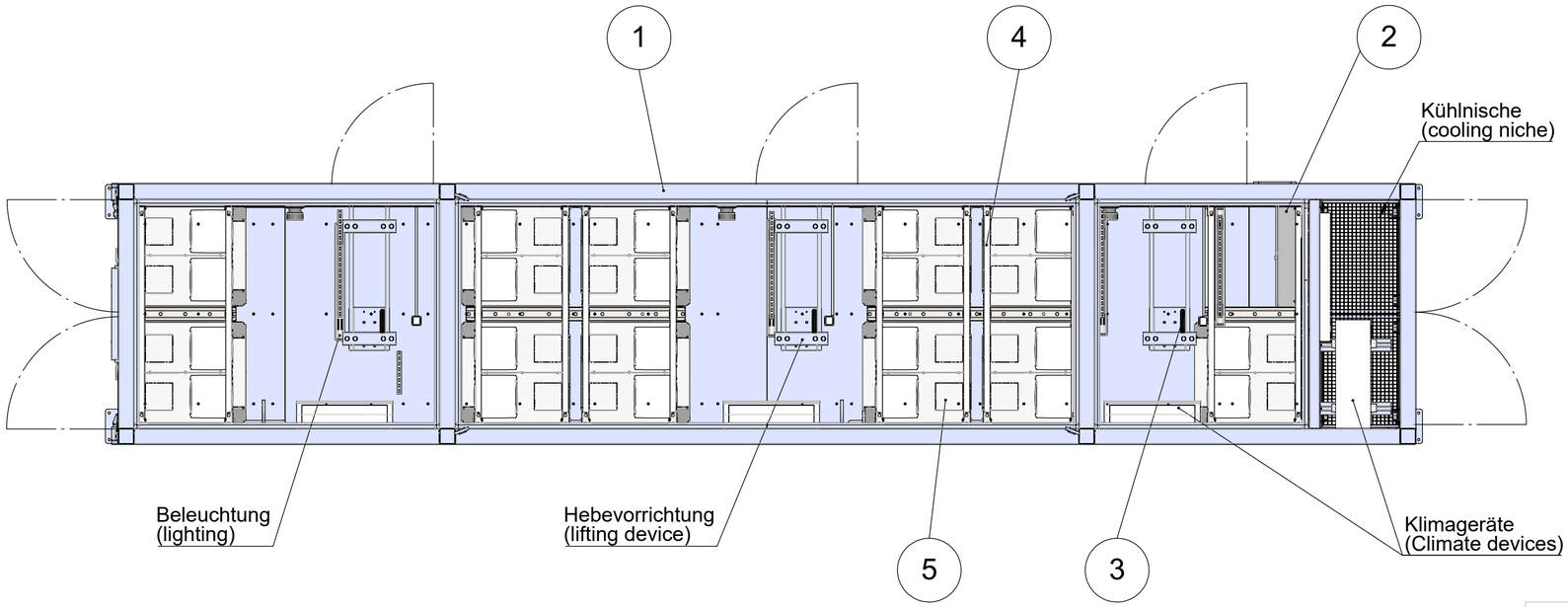
Artikel-Nr. (article number): 53406

Revision:

alte Zeichnungs-Nr. (old drawing number):

CAD System SolidWorks | Status: Freigegeben





Pos. Nr.	Menge	**Bezeichnung**	engl. Bezeichnung	Art.-Nr.	**Lieferant**	**Lieferanten Nr.**
1	1	BESS Container 1 RHS	BESS container 1 RHS	508728	--	--
2	1	Hilfsversorgungsschrank 1	Distribution Cabinet 1	53409	--	--
3	3	Netzanschlussleitung/Verlängerungskabel 3m, Schwar	Mains connection cable/extension cable	54615	Famo	2810377
4	1	Einbaurahmen Verstärkt	Reinforced mounting frame	509198		
5	11	Schrank_verstärkt_mit Einsch._LF280K_28	Reinforced cabinet with slide-in Units_28	54625	--	--

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0,5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 14791.35 kg

ISO 13715

	Datum (Date):	Name:
Drawn:	22.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.*

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Batteriecontainer 1

Battery Container 1

Scale: 1:40

Sheet: 3 (A2)

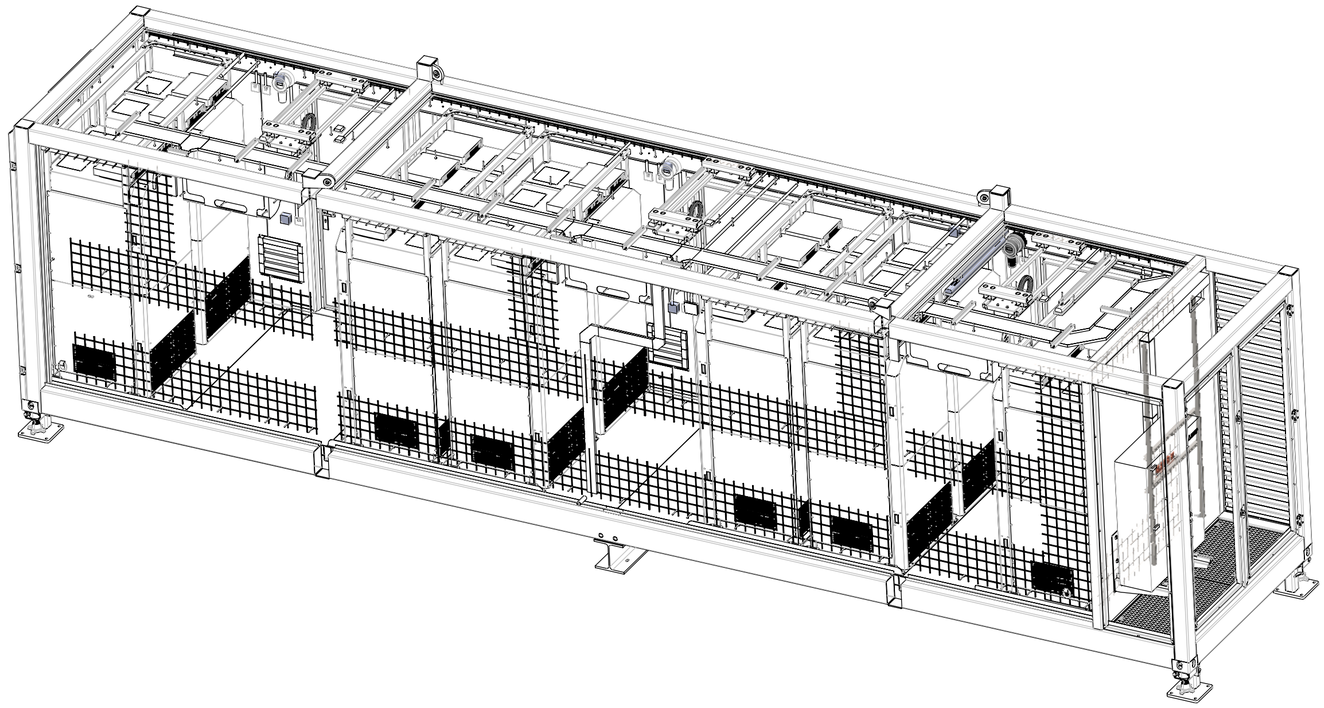
3 of: 4

Artikel-Nr. (article number): 53406

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 35853.00 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	22.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.'

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Batteriecontainer 1

Battery Container 1

Scale: 1:40

Sheet: 4 (A2)

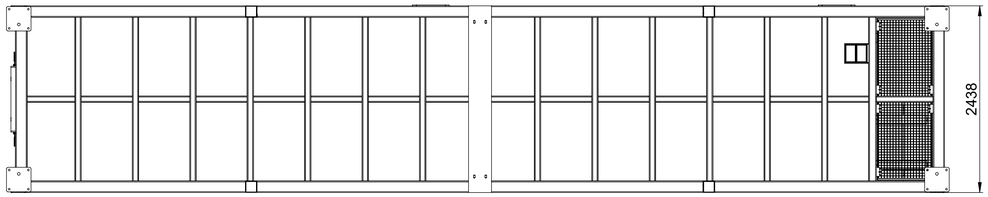
Artikel-Nr. (article number): 53406

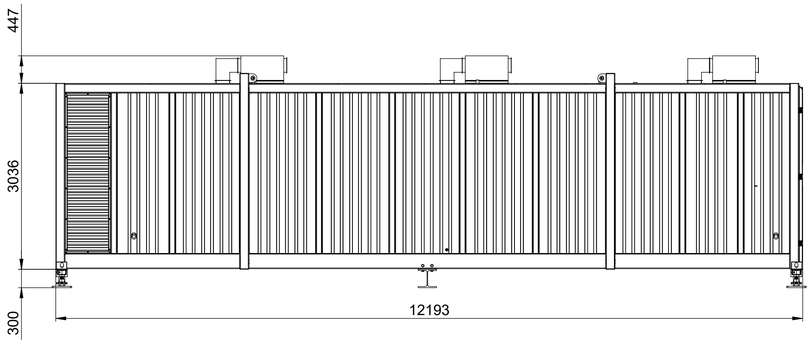
4 of: 4

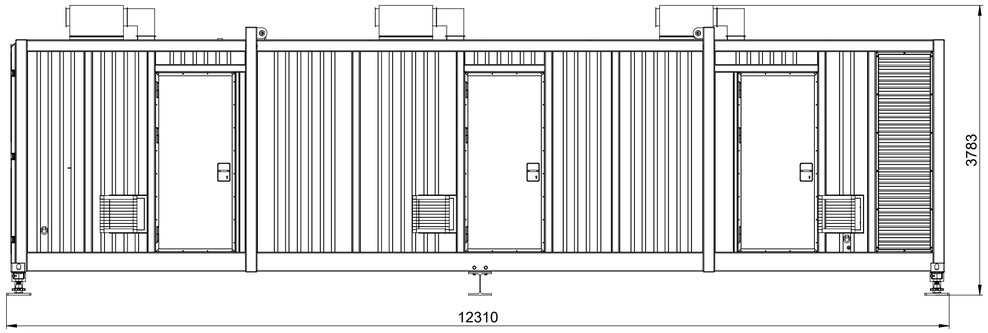
Revision:

Projekt-Nr. & Kunde (project number & customer):

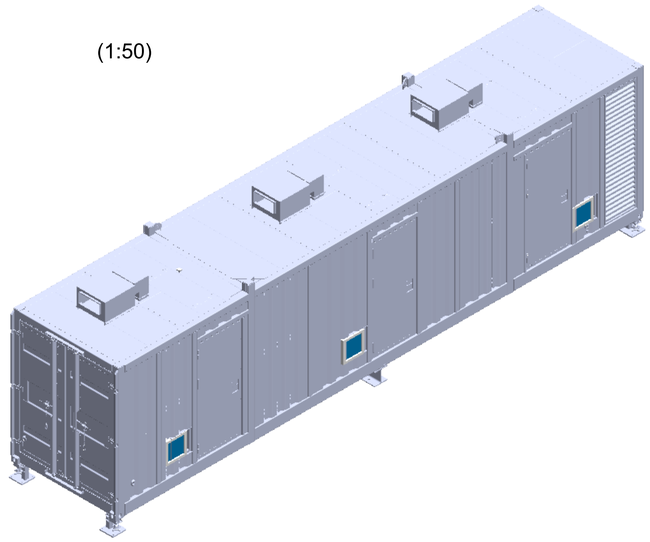
CAD System SolidWorks | Status: Freigegeben

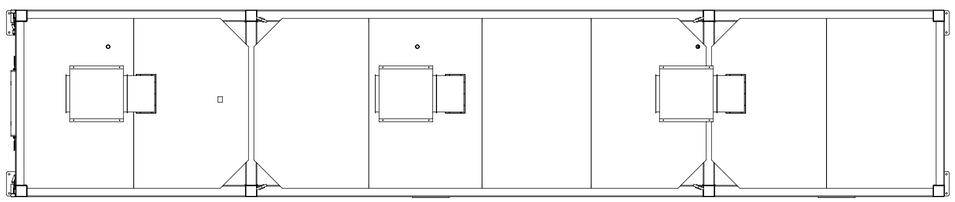




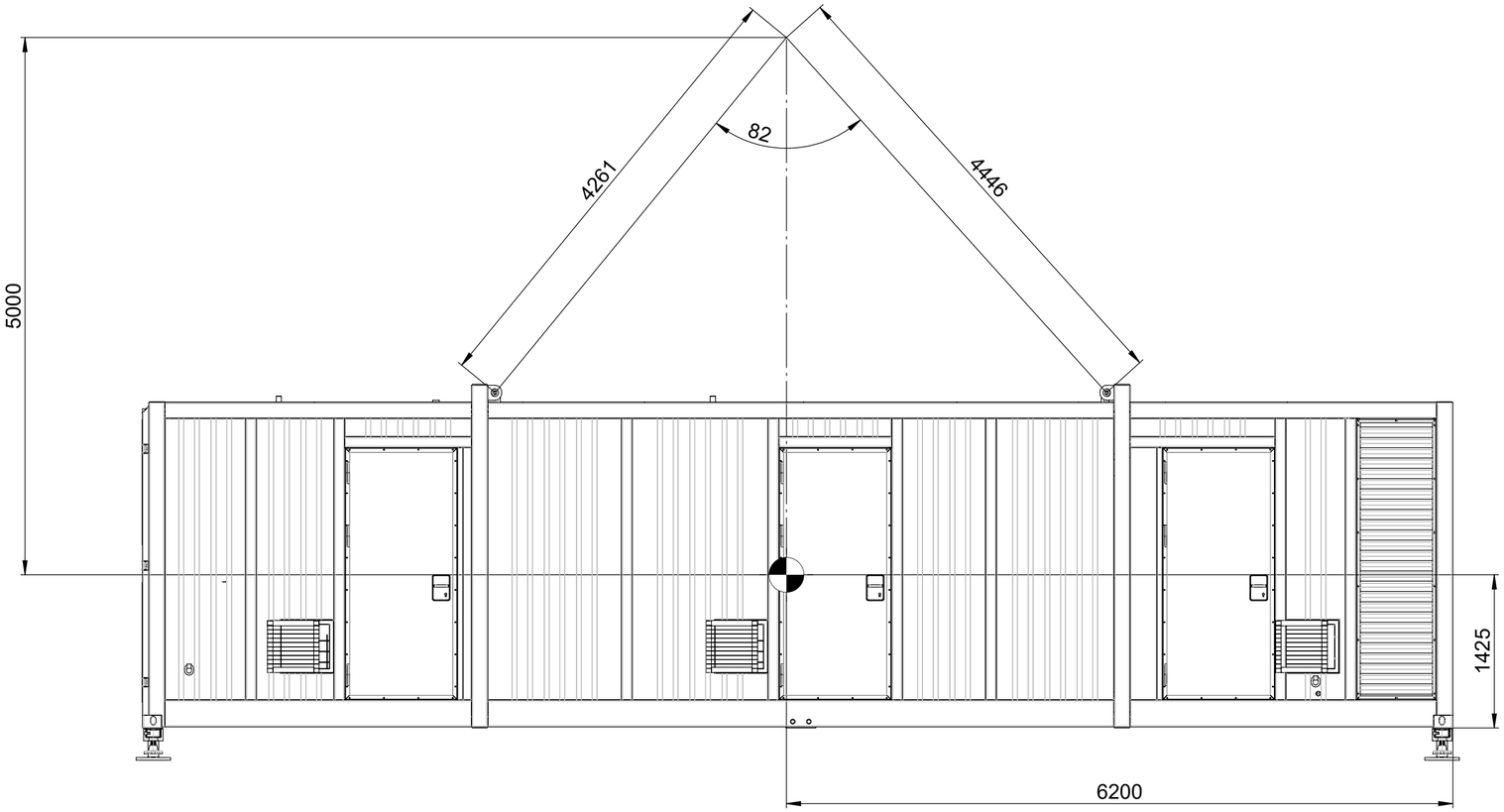


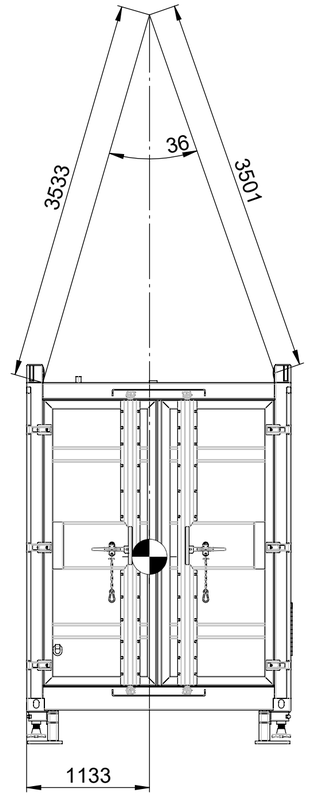
(1:50)





| | | |





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	17.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 14250.00 kg

Bezeichnung (description):

Batteriecontainer 2

Battery Container 2

Scale: 1:40

Sheet: 2 (A2)

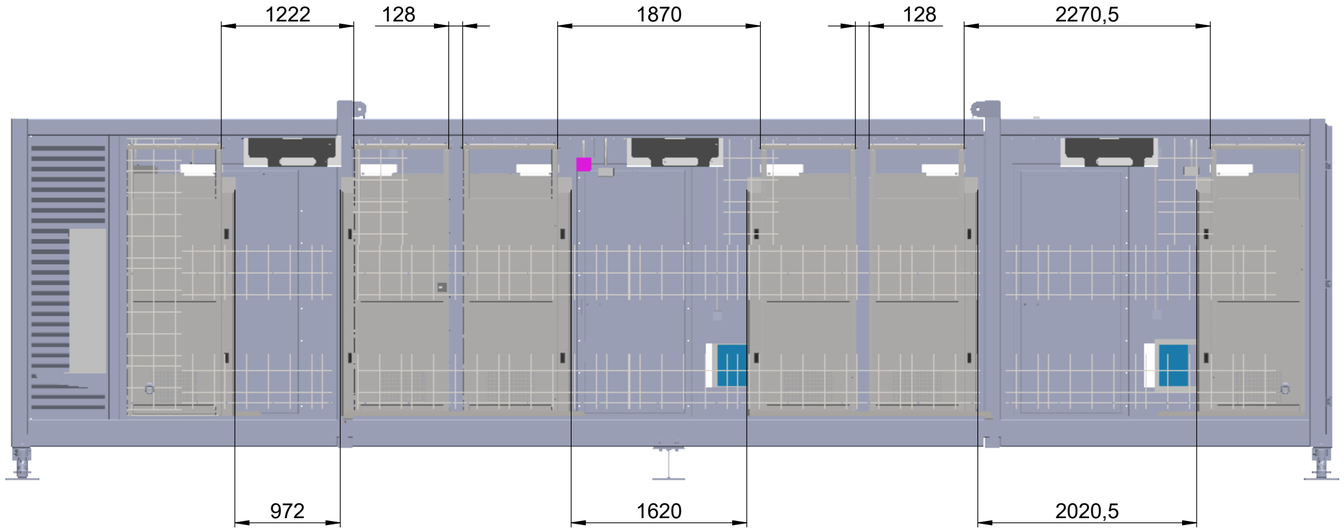
2 of: 4

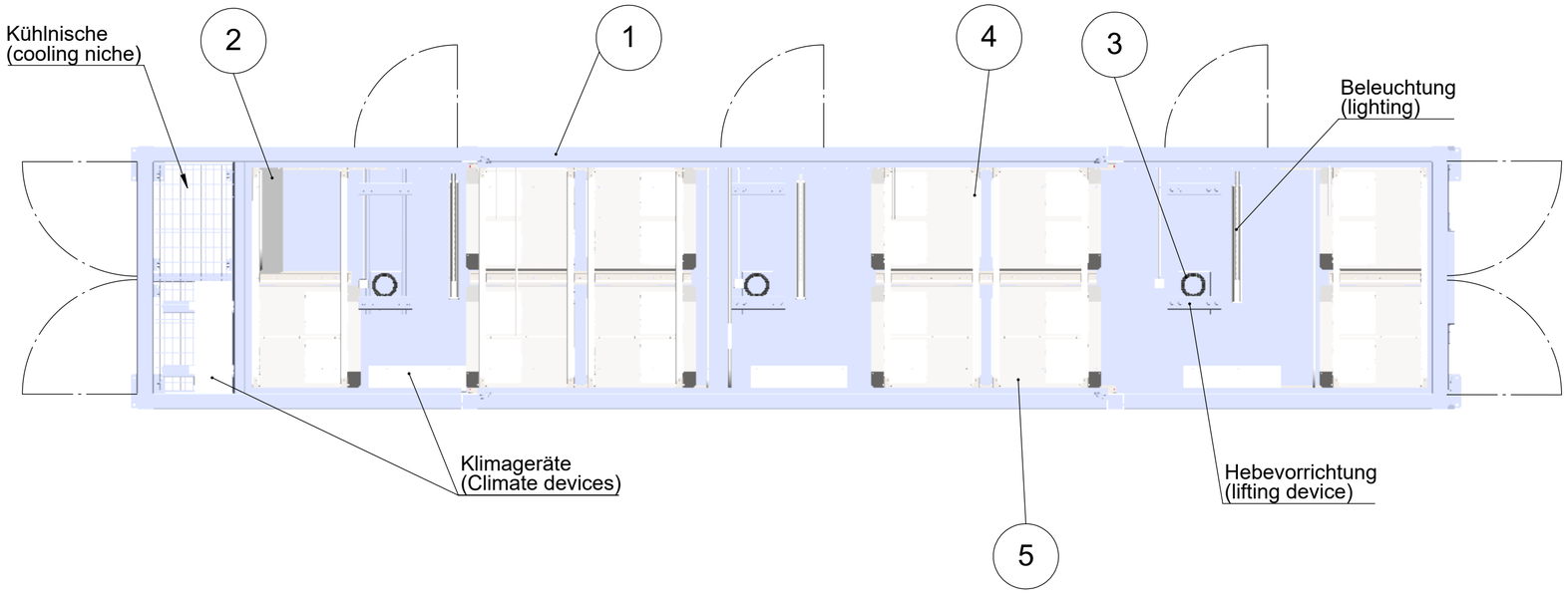
Artikel-Nr. (article number): 53412

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben





Pos. Nr.	Menge	**Bezeichnung**	engl. Bezeichnung	Art.-Nr.	**Lieferant**	**Lieferanten Nr.**
1	1	BESS Container 2 LHS	BESS container 2 LHS	507828	--	--
2	1	Hilfsversorgungsschrank 1	Distribution Cabinet 1	53409	--	--
3	3	Netzanschlussleitung/Verlängerungskabel 3m, Schwar	Mains connection cable/extension cable	54615	Famo	2810377
4	1	Einbaurahmen Verstärkt	Reinforced mounting frame	509198		
5	11	Schrank_verstärkt_mit Einsch._LF280K_28	Reinforced cabinet with slide in Units_28	54625	--	--

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	17.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 12085.48 kg

Bezeichnung (description):

Batteriecontainer 2

Battery Container 2

Scale: 1:40

Sheet: 3 (A2)

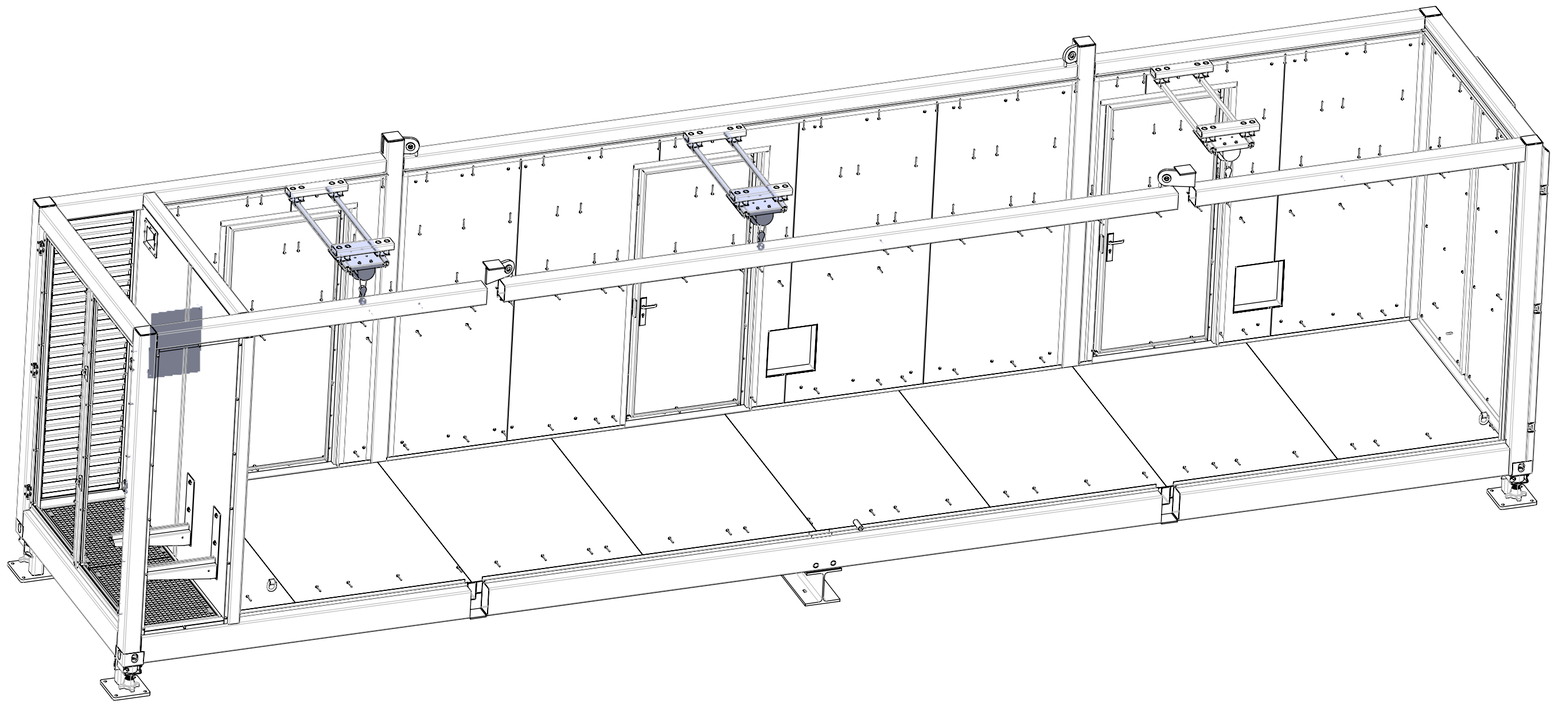
Artikel-Nr. (article number): 53412

3 of: 4

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche					
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	17.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016:
Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.'

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 7339.14 kg

Bezeichnung (description):

Batteriecontainer 2

Battery Container 2

Scale: 1:35

Sheet: 4 (A2)

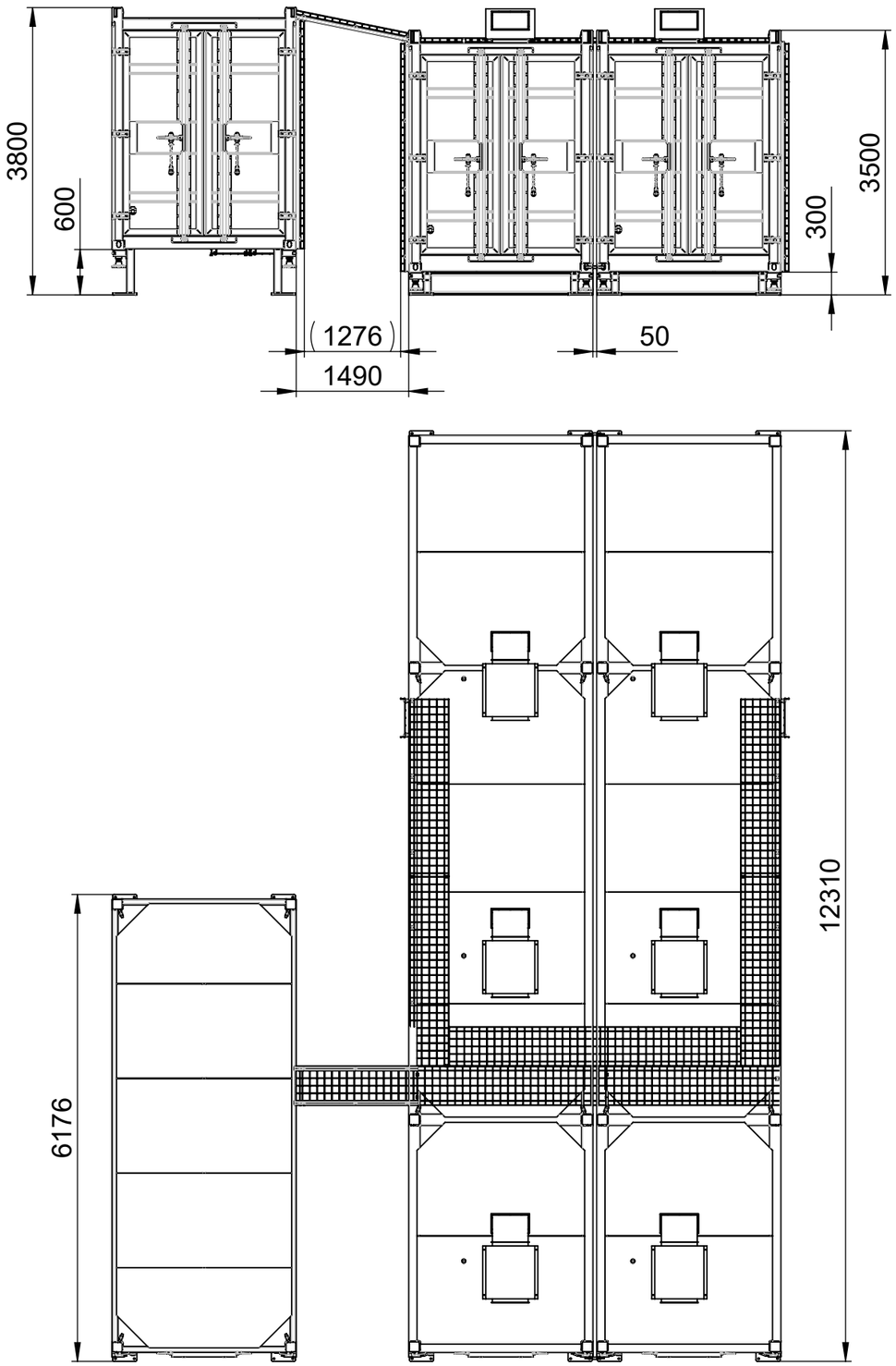
4 of: 4

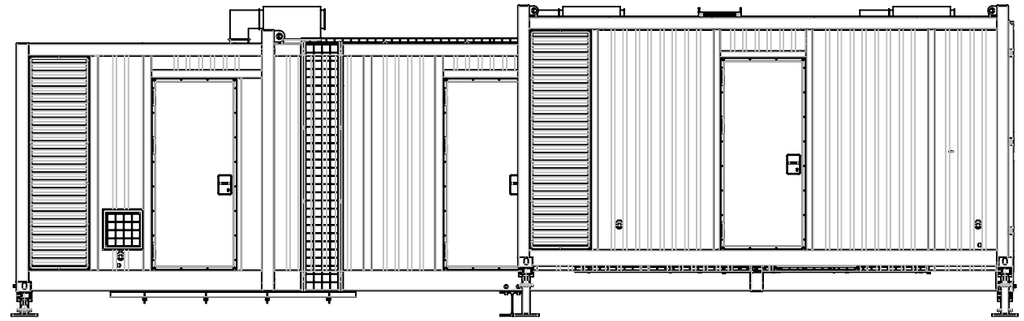
Artikel-Nr. (article number): 53412

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	27.06.2024	MvD
Checked:	23.01.2025	RK

Oberfläche: (surface) -

Werkstoff (material): 23553.52 kg

Bezeichnung (description): complet system

Scale: 1:75

Sheet: 1 (A3)

1 of: 1

Revision:

Artikel-Nr. (article number): 23A2007

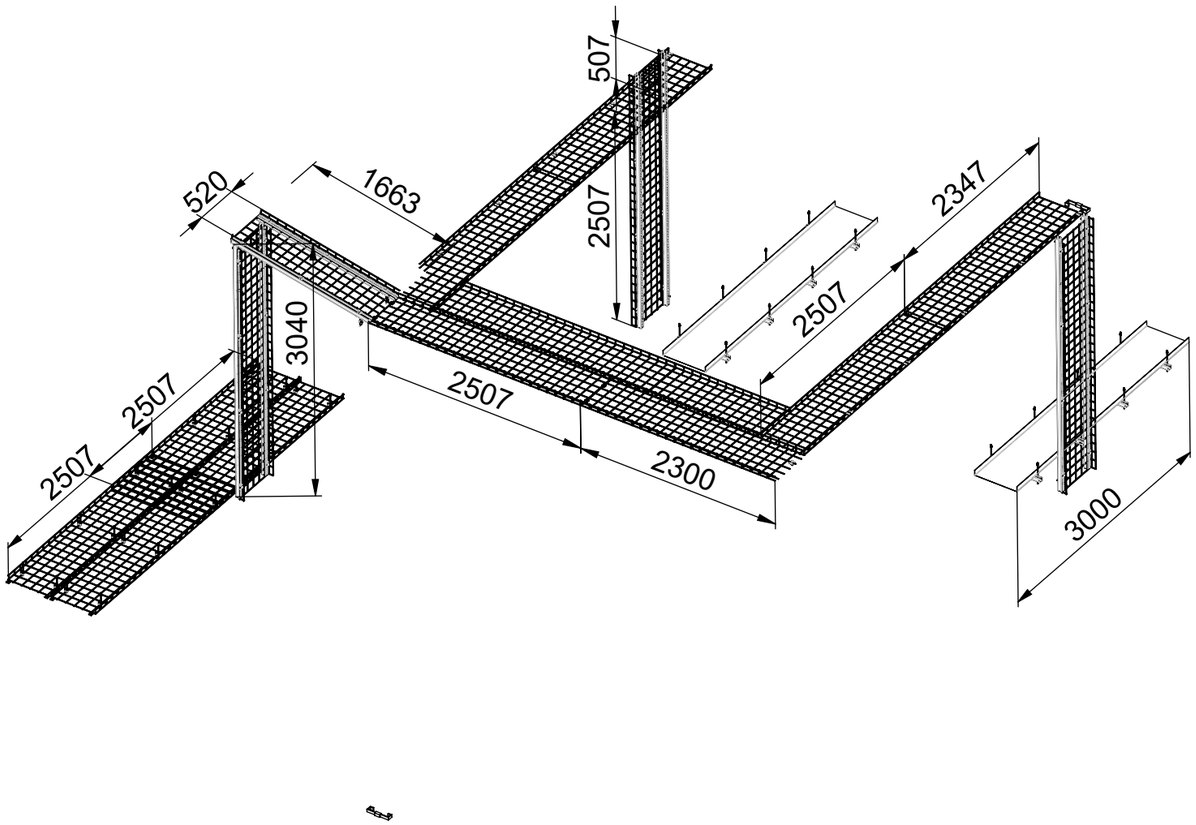
Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks

Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0



Pos. Nr.	Menge	**Bezeichnung**	Art.-Nr.	**Lieferant**	**Lieferanten Nr.**
1	25	V2A_ Gitterrinne GKX 520x60x2507	54848	Pflitsch	GKX 520x60 V2A
6	6	MS 41-41 VA	54532	Sikla	195796
8	80	Blindnietmutter M10 Flachkopf (0,7-3,5)	505856	Böllhoff	23307100235
9	60	Sperrkantscheibe - Form M - M10	503802	--	--
10	60	Zylinderschraube mit ISK ISO 4762 - M10 x 20 - 8.8 - St.	500865	--	--
11	15	Gewindeplatte VA NT CC41 M10	54544	Sikla	199312
12	6	Befestigungswinkel	54546		
13	50	Sechskantmutter ISO 4032 - M10 - 8	503711	--	--
14	20	Gewindehaken GH	54547	Sikla	101602
15	4	Befestigungswinkel	54549		
16	50	Gewindeplatte CC41-M8	54550	Sikla	195305
17	47	V4A Gitterkanal Verbindungslasche X1	52531	Pflitsch	GK L X1 V4A
18	47	Sperrkantscheibe - Form M - M8	503801	--	--
19	47	Zylinderschraube mit ISK ISO 4762 - M8 x 30 - 8.8 - St.	503670	--	--
20	30	Gitterkanal VerbindungslascheX2	52505	Pflitsch	GK L X2
21	2	Bridge Fitting CL1/50	53388	Plomben.de	TS20003-001
22	16	threaded rod / Gewindestange	---		
23	8	MS 41-41 VA-600	54717	Sikla	195796
24	2	Kabelrinne RKS Magic 60A4	509409	Obo	6047422
25	16	Sperrkantscheibe - Form B - M8	505744	--	--
26	16	Blindnietmutter M8 KSGRSO (e=3,0-4,5)	505060	Böllhoff	34367080045
27	1	V2A_ Gitterrinne GKX 520x60	54848	Pflitsch	GKX 520x60 V2A

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 491.43 kg

ISO 13715

	Datum (Date):	Name:
Drawn:	03.07.2024	MvD
Checked:	23.01.2025	RK

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.“

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Cable trays

Scale: 1:60

Sheet: 1 (A3)

1 of: 4

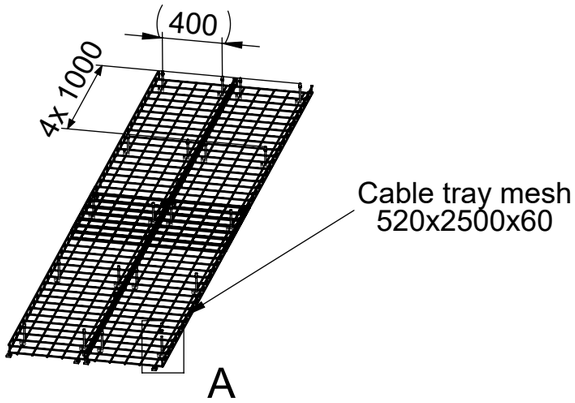
Revision:

Artikel-Nr. (article number): 54543

Projekt-Nr. & Kunde (project number & customer): 23A2007 Statron

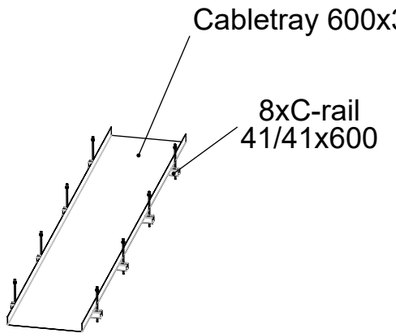
CAD System SolidWorks

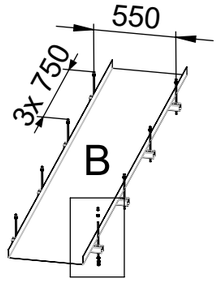
Status: Freigegeben



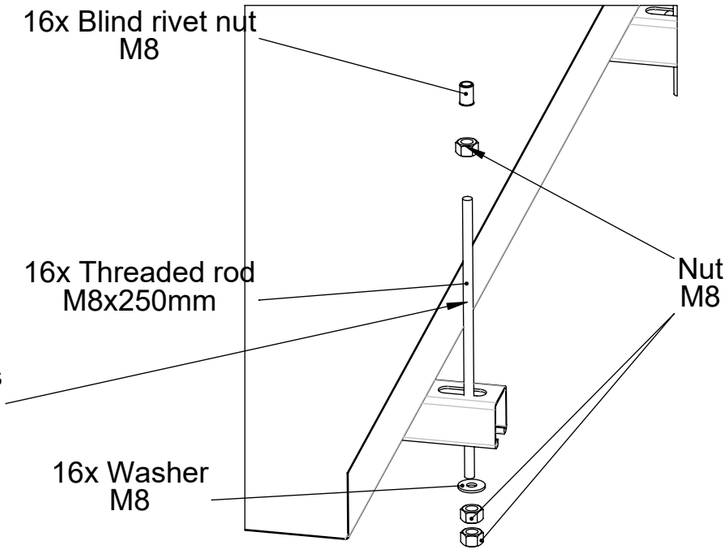
A

A (1:5)

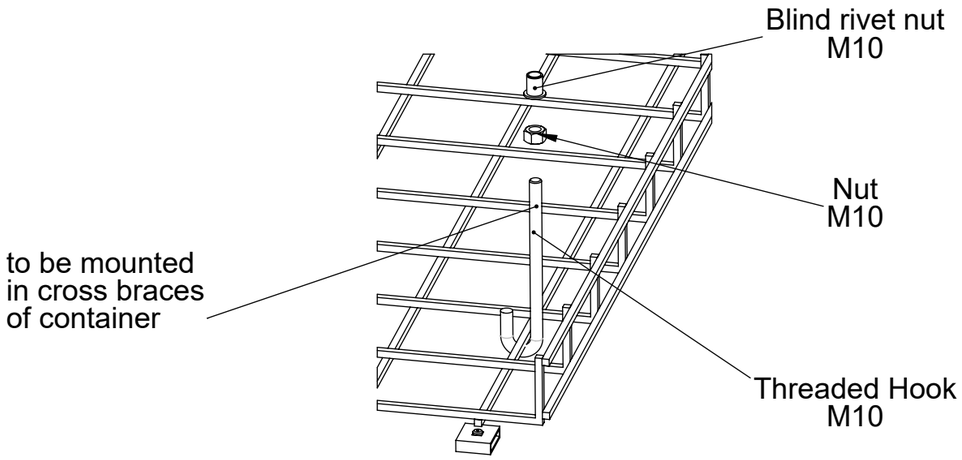




B (1:5)



Torque for all M8:
20Nm



Torque for all M10:
35Nm

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK							
Genauig-keitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 232.02 kg

+0,5 -0,5 ISO 13715

	Datum (Date):	Name:
Drawn:	03.07.2024	MvD
Checked:	23.01.2025	RK

Bezeichnung (description): Cable trays

Scale: 1:40

Sheet: 2 (A3)

2 of: 4

Revision:

Artikel-Nr. (article number): 54543

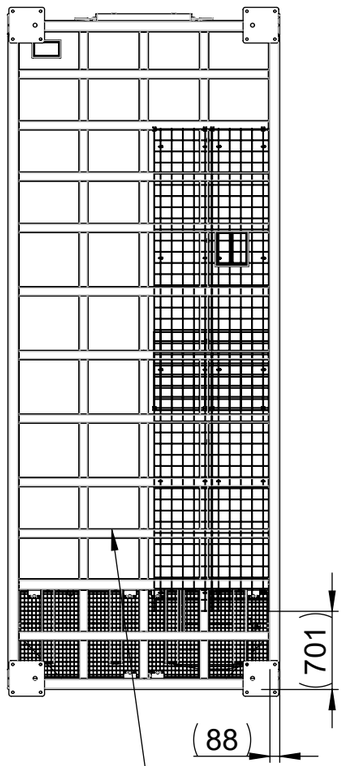
Projekt-Nr. & Kunde (project number & customer): 23A2007 Statron

CAD System SolidWorks

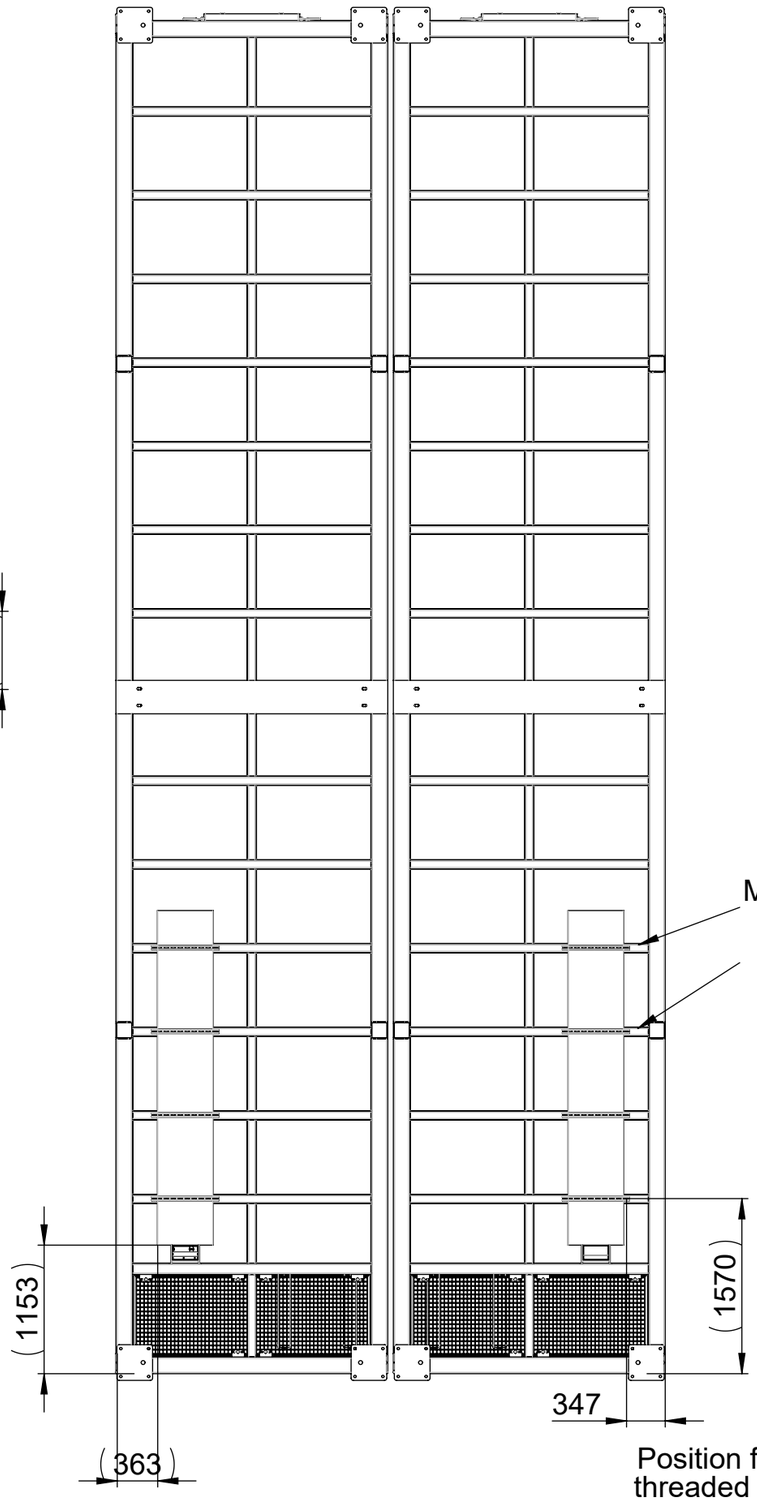
Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.“

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0



Drill holes for
M10 blind rivet nuts
in cross brace
Ø13mm



Drill holes for
M8 blind rivet nuts
in cross brace
Ø11mm

Position first
threaded rod

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	03.07.2024	MvD
Checked:	23.01.2025	RK

Oberfläche:
(surface) -

Werkstoff (material):

29931.12 kg

Bezeichnung (description):

complet system

Scale: 1:40

Sheet: 3 (A3)

3 of: 4

Revision:

Artikel-Nr. (article number):
23A2007

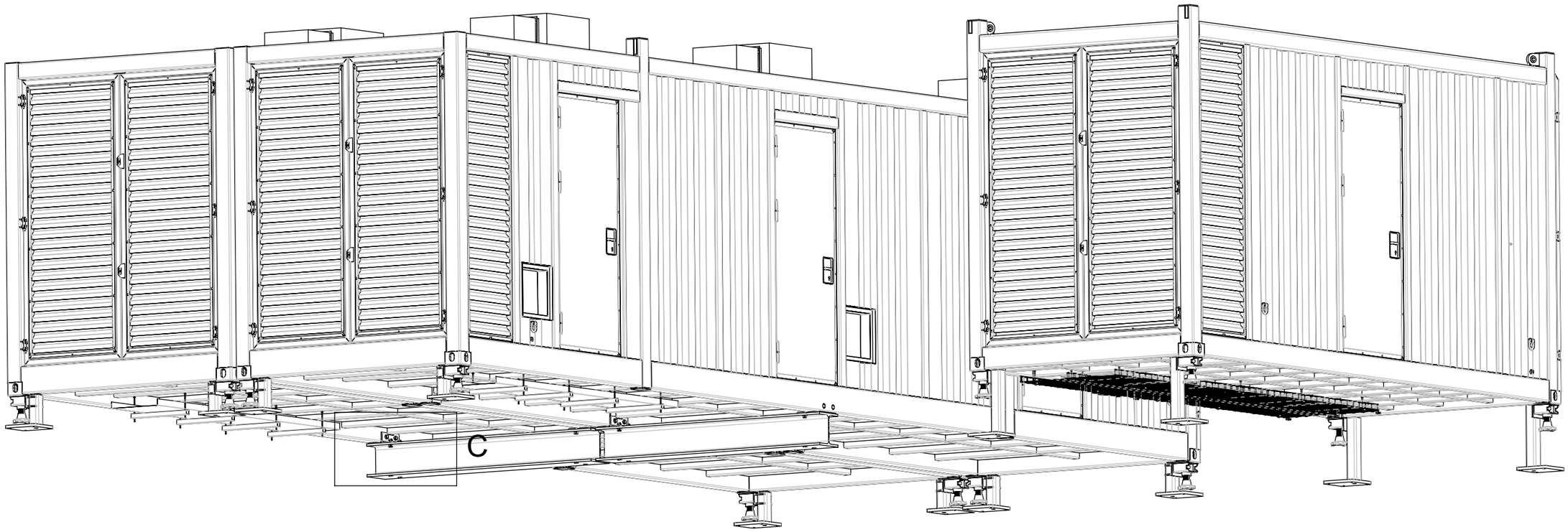
Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks

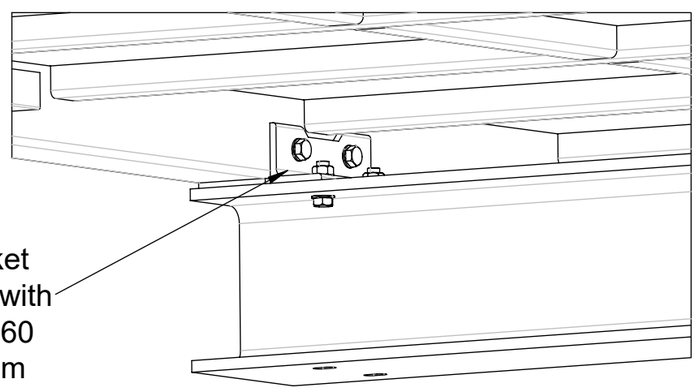
Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0



C (1:10)



Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	03.07.2024	MvD
Checked:	23.01.2025	RK

Oberfläche: (surface) -

Werkstoff (material): 29931.12 kg

Bezeichnung (description): complet system

Scale: 1:40

Sheet: 4 (A3)

4 of: 4

Revision:

Artikel-Nr. (article number): 23A2007

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks

Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

STATRON
NON STOP POWER

Foundation Loading Diagram & Support Detail

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: B04
Sequence Number: 001
Rev: 003
Document number: K559-2254-CWIWP4202201-B04-001
Document description: Foundation Loading Diagram & Support Detail

Revision	Date	Name	Description
001	01.03.2023	CPA / ADI	First Version
002	12.04.2023	CPA / ADI	Updated according to KBR comments
003	22.01.2025	MMÜ	Second revision

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Foundation Loading Diagram & Support Detail
B04

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	B04
Document name	Foundation Loading Diagram & Support Detail
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-01	C. Palenzuela	First version
2.0	2023-04-14	C. Palenzuela	Updated according to KBR comments
3.0	2025-01-22	C. Palenzuela	Second revision

Table 1: Version overview

	Date	Name
Editor	2023-04-14	C. Palenzuela
Checked by	2023-04-15	A. Fritz
Approved by	2023-04-15	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8

Identification

Product Version / Document Version

Product version
Prototype

Document release date
January 2025

Doc Code
K559-2254-CWIWP4202201-B04-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Foundation loading diagram and support detail	53396 PCS Container Foundation Load.pdf
Foundation loading diagram and support detail	53406 BESS Container 1 Foundation Load.pdf
Foundation loading diagram and support detail	53412 BESS Container 2 Foundation Load.pdf

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

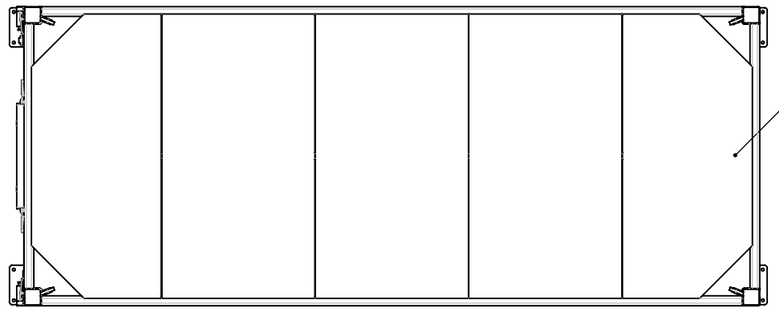
The foundation loading diagrams, and support details are attached to this document (*see section 1.3 "Other Applicable Documents"*).

Container	Manufacturer	FRQ part no.	File Name
PCS	FREQCON	53396	53396 PCS Container Foundation Load.pdf
BESS 1	FREQCON	53406	53406 BESS Container 1 Foundation Load.pdf
BESS 2	FREQCON	53412	53412 BESS Container 2 Foundation Load.pdf

Table 4: Other applicable documents

~23,1 kN

~17,4 kN



~31,8 kN

~20,9 kN

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 15899.18 kg

ISO 13715

	Datum (Date):	Name:
Drawn:	03.03.2023	Irina Hirsch
Checked:		

Bezeichnung (description):

Umrichtercontainer

PCS (Converter) Container

Scale: 1:50

Sheet: 1 (A3)

1 of: 1

Revision:

Artikel-Nr. (article number): 53396

alte Zeichnungs-Nr. (old drawing number):

CAD System SolidWorks

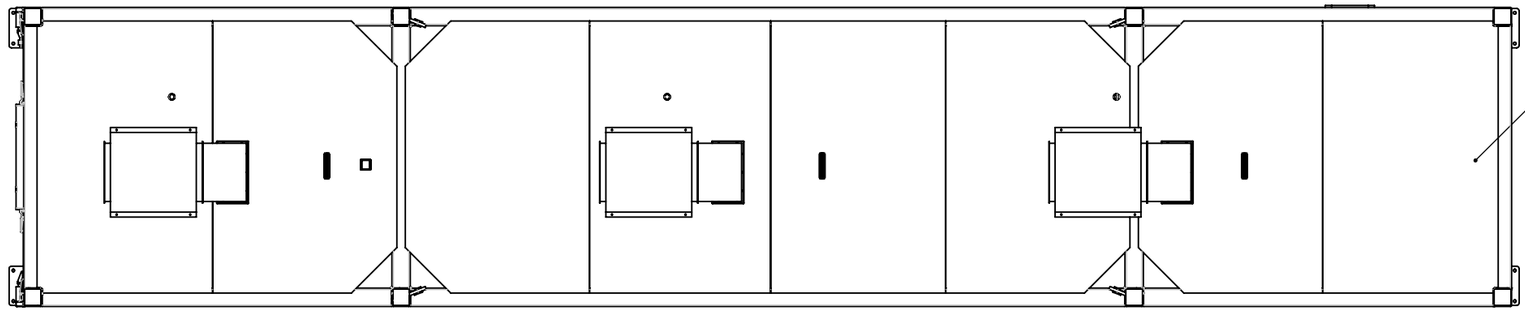
Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.“

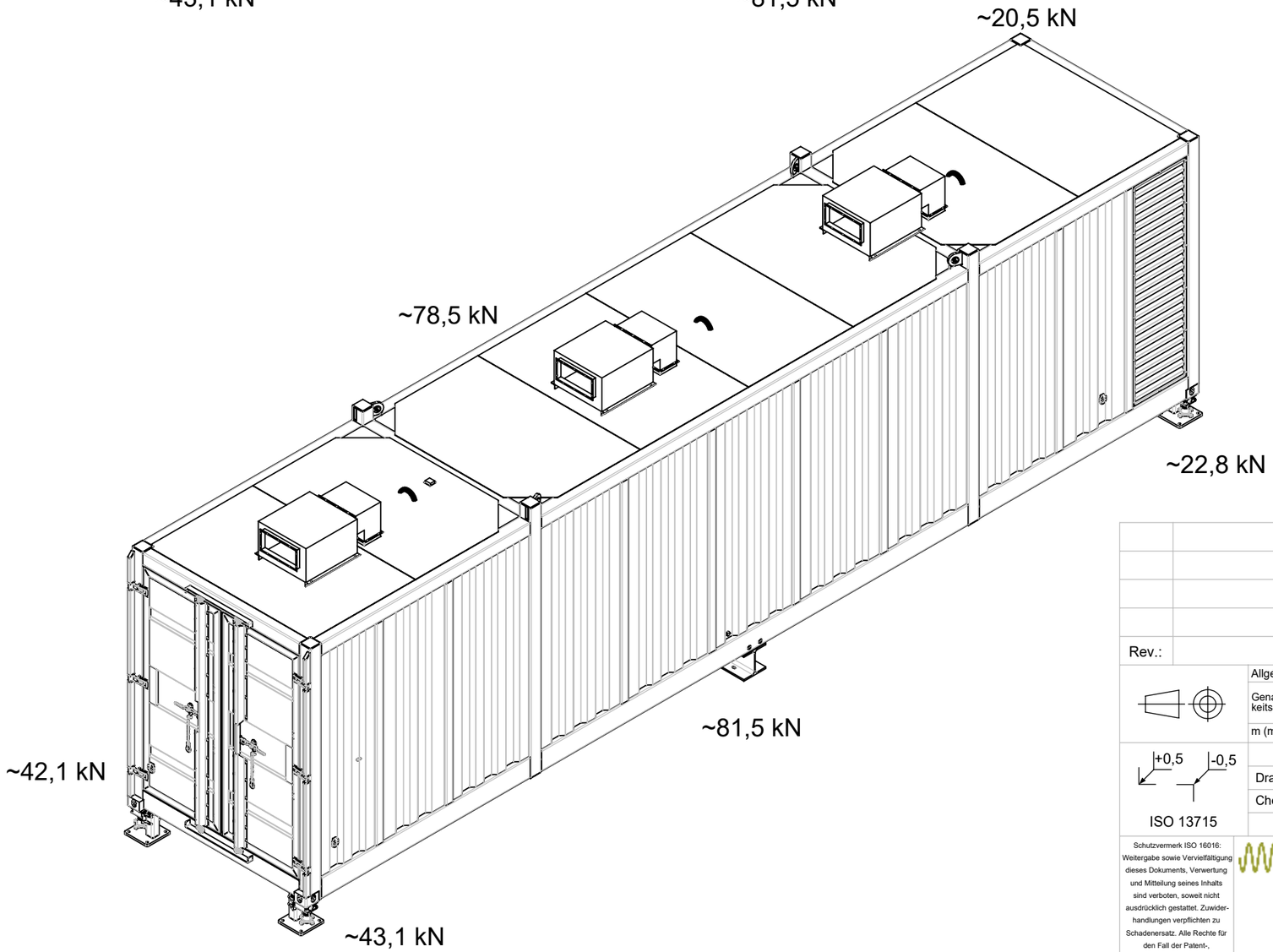
FREQCON

Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

~42,1 kN ~78,5 kN ~20,5 kN



~43,1 kN ~81,5 kN ~22,8 kN



Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 14791.35 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	03.03.2023	Irina Hirsch
Checked:		

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Batteriecontainer 1

Battery Container 1

Scale: 1:50

Sheet: 1 (A3)

1 of: 1

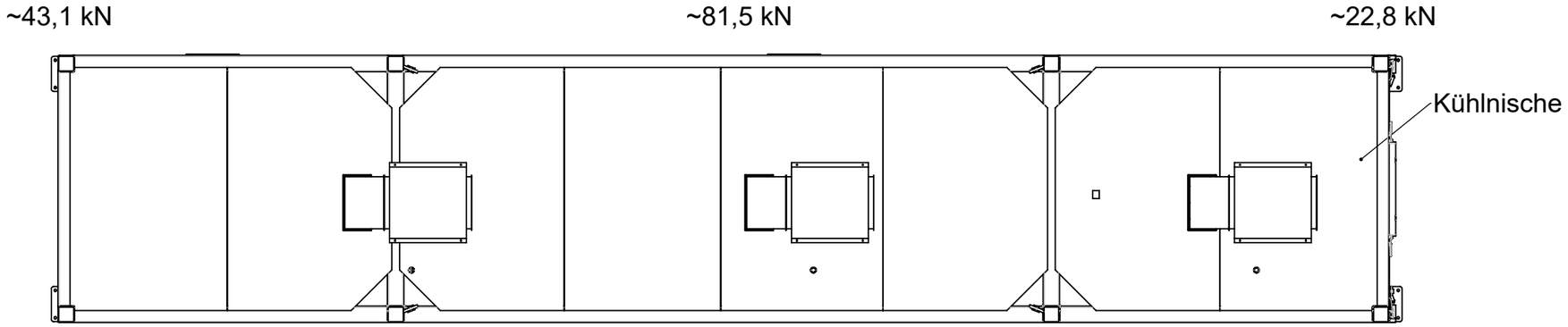
Artikel-Nr. (article number): 53406

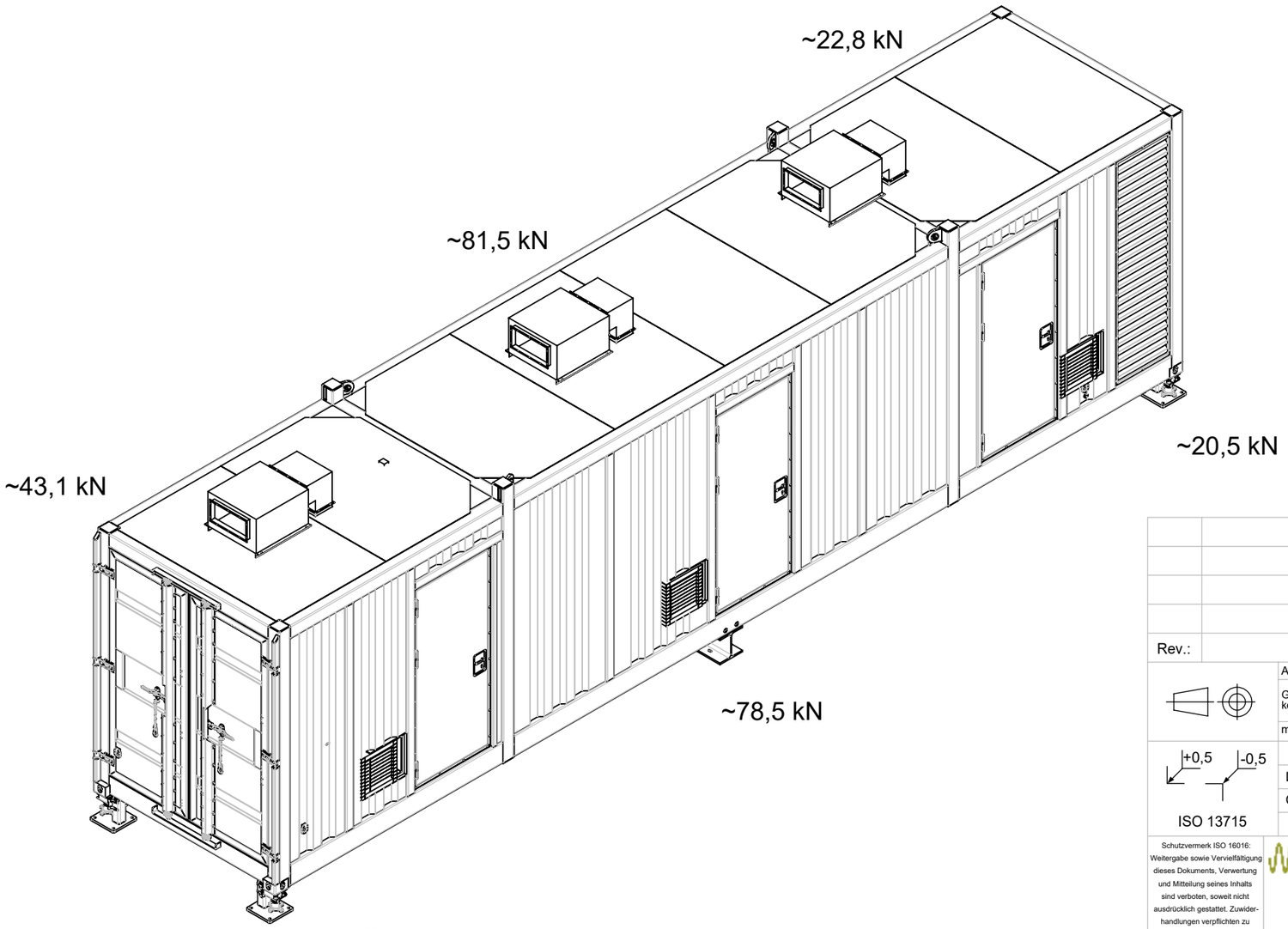
alte Zeichnungs-Nr. (old drawing number):

Revision:

CAD System SolidWorks

Status: Freigegeben





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK							
Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 12214.44 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	03.03.2023	Irina Hirsch
Checked:		

Bezeichnung (description):

Batteriecontainer 2

Battery Container 2

Scale: 1:50

Sheet: 1 (A3)

1 of: 1

Artikel-Nr. (article number): 53412

alte Zeichnungs-Nr. (old drawing number):

Revision:

CAD System SolidWorks

Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.“

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

STATRON
NON STOP POWER

Bill of Materials

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: C04
Sequence Number: 001
Rev: 003
Document number: K559-2254-CWIWP4202201-C04-001
Document description: Bill of Materials

Revision	Date	Name	Description
001	31.03.2023	CPA / ADI	First Version
002	20.11.2024	CPA/ADI	First Revision
003	21.01.2025	MMÜ	Second revision

Bill of Materials
C04

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	C04
Document name	Bill of Materials
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-30	C. Palenzuela	First version
2.0	2024-11-20	M. Müller	First revision
3.0	2025-01-21	M. Müller	Second revision

Table 1: Version overview

	Date	Name
Editor	2024-11-20	M. Müller
Checked by	2024-12-03	C. Palenzuela
Approved by	2024-12-03	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Other Applicable Documents 7
1.3 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
January 2025

Doc Code
K559-2254-CWIWP4202201-C04-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Bill of Materials	Bill_of_Materials.zip

Table 1: Other applicable documents

1.3 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
BoM	Bill of Materials
PCS	Power Conversion System

Table 2: Generic terms and abbreviations used

2 General

The bill of materials of the main system components are attached to this document (*see section 1.3 "Other Applicable Documents"*).

File name: Bill_of_Materials.zip

3 Appendix

1. Electrical Bill of Materials
   - Bill of Materials PCS:
     10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Bill of Materials PCS
   - Bill of Materials Battery Container 1:
     10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Bill of Materials Battery 1
   - Bill of Materials Battery Container 2:
     10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Bill of Materials Battery 2

2. Mechanical Bill of Materials
   - Bill of Materials PCS:
     Mechanical_BoM_PCS Container
   - Bill of Materials Battery Container 1:
     Mechanical_BoM_Battery_Container 1
   - Bill of Materials Battery Container 2:
     Mechanical_BoM_Battery_Container 2
   - Bill of Materials Overall System:
     Mechanical_BoM_Overall_System

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18T1 &EFS/18.2	1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555	
-18W5 &EFS/18.3	1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153	

previous page:
&EFS++Container/190

next page:
++CONV/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250123_V1.3	= UNIT_01 Converter Container 1
Date	05.11.2024							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer page: 1
Date								+ total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18Q1 &EFS++TRA/18.7	1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172	
-18Q1 &EFS++TRA/18.7	1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044	
-18Q1 &EFS++TRA/18.7	1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039	

previous page:
++TRA/1

next page:
+CON/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250123_V1.3	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B2 &EFS++CT+/147.7	1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648	
-201Q1 &EFS+/201.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-201Q1 &EFS+/201.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-201Q1 &EFS+/201.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-201Q1 &EFS+/201.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-201Q1 &EFS+/201.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-201Q1 &EFS+/201.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-201Q1-C &EFS+/201.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-201Q1-C &EFS+/201.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-202Q1 &EFS+/202.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-202Q1 &EFS+/202.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-202Q1 &EFS+/202.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-202Q1 &EFS+/202.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-202Q1 &EFS+/202.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-202Q1 &EFS+/202.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-202Q1-C &EFS+/202.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-202Q1-C &EFS+/202.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

previous page:
+/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-202Q1-C &EFS+/202.6;&EFS+/202.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-202Q1-C &EFS+/202.6;&EFS+/202.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-203Q1 &EFS+/203.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-203Q1 &EFS+/203.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-203Q1 &EFS+/203.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-203Q1 &EFS+/203.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-203Q1 &EFS+/203.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-203Q1 &EFS+/203.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-203Q1-C &EFS+/203.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-203Q1-C &EFS+/203.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1 &EFS+/207.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-207Q1 &EFS+/207.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-207Q1 &EFS+/207.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-207Q1 &EFS+/207.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-207Q1 &EFS+/207.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-207Q1-C &EFS+/207.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-207Q1-C &EFS+/207.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-207Q1-C &EFS+/207.6;&EFS+/207.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-207Q1-C &EFS+/207.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1-U1 &EFS+/207.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-211Q1 &EFS+/211.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-211Q1 &EFS+/211.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-211Q1 &EFS+/211.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-211Q1 &EFS+/211.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-211Q1 &EFS+/211.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-211Q1-C &EFS+/211.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-211Q1-C &EFS+/211.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-211Q1-C &EFS+/211.6;&EFS+/211.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-211Q1-C &EFS+/211.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-211Q1-U1 &EFS+/211.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-217Q1 &EFS+/217.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-217Q1 &EFS+/217.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-217Q1 &EFS+/217.3	1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524	
-217Q1 &EFS+/217.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-217Q1 &EFS+/217.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-217Q1 &EFS+/217.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-217Q1-C &EFS+/217.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-217Q1-C &EFS+/217.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-217Q1-C &EFS+/217.6;&EFS+/217.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-217Q1-C &EFS+/217.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-217Q1-U1 &EFS+/217.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-260B1 &EFS+/260.3	1	Optical smoke detector 12V, with alarm relais	130-60-457	ABUS Security-Center GmbH & Co. KG	500713	X
-279M1 &EFS+/279.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M2 &EFS+/279.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M3 &EFS+/279.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M4 &EFS+/279.5	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M5 &EFS+/279.6	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-N &EFS+/99.5	2	Busbar holder for busbars 12x 5 (10)-30x 5 (10) and 6x 6 mm	8US1923-1AA01	Siemens	501271	X

previous page:
3

next page:
+IND/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-201L1 &EFS+/201.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-201L1 &EFS+/201.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-201U1 &EFS+/201.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-202L1 &EFS+/202.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-202L1 &EFS+/202.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-202U1 &EFS+/202.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-203L1 &EFS+/203.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-203L1 &EFS+/203.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-203U1 &EFS+/203.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-207L1 &EFS+/207.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-207L1 &EFS+/207.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-211L1 &EFS+/211.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-211L1 &EFS+/211.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-217L1 &EFS+/217.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-217L1 &EFS+/217.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X

previous page:
+CON/4

next page:
+CIR/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-80Q1 &EFS+/80.0	1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955	
-80Q1 &EFS+/80.1	1	Circuit breaker 3WL1112, 1250A, 42kA 690V, size 1, 3-pole, IEC, ETU15B, withdrawable	3WL1112-2BB36-1BJ2-ZA08+K07+M06+M21+R10	Siemens	501430	X
-83U1 &EFS+/83.2	1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918	
-83U1-C1 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C2 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C3 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C4 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C7 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C8 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C9 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C10 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C13 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C14 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C15 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C16 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-148B3 &EFS++CT+/148.5	1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649	
-227U1 &EFS+/227.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-227U1-C1 &EFS+/227.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-C7 &EFS+/227.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

previous page:
+IND/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-C13 &EFS+/227.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-F0 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F1 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F1 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F1 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F2 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F2 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F2 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F3 &EFS+/227.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F3 &EFS+/227.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F3 &EFS+/227.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-F4 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F4 &EFS+/227.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F5 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F5 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F5 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F6 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F6 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F6 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-F7 &EFS+/227.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F7 &EFS+/227.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F8 &EFS+/227.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F8 &EFS+/227.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F9 &EFS+/227.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F9 &EFS+/227.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F9 &EFS+/227.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F10 &EFS+/227.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F10 &EFS+/227.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F10 &EFS+/227.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F11 &EFS+/227.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F11 &EFS+/227.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F12 &EFS+/227.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-K1 &EFS+/227.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K2 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K3 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K7 &EFS+/227.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-K8 &EFS+/227.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K9 &EFS+/227.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-U1 &EFS+/227.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-227U1-X3.1 &EFS+/227.a.0;&EFS+/227.a.9	0					
-227U1-X3.1 &EFS+/227.a.1...&EFS+/227.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-227U1-X3.1 &EFS+/227.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-227U1-X3.1 &EFS+/227.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-227U1-X3.1 &EFS+/227.a.2...&EFS+/227.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-227U1-X3.1 &EFS+/227.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-227U1-X3.2 &EFS+/227.a.0	0					
-227U1-X3.2 &EFS+/227.a.1...&EFS+/227.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-227U1-X3.2 &EFS+/227.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-231U1 &EFS+/231.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-231U1-C1 &EFS+/231.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-C7 &EFS+/231.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-C13 &EFS+/231.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-F0 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F1 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F1 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F1 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F2 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F2 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F2 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F3 &EFS+/231.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F3 &EFS+/231.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F3 &EFS+/231.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-F4 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F4 &EFS+/231.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F5 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F5 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F5 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F6 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F6 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F6 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-F7 &EFS+/231.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F7 &EFS+/231.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F8 &EFS+/231.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F8 &EFS+/231.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F9 &EFS+/231.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F9 &EFS+/231.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F9 &EFS+/231.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F10 &EFS+/231.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F10 &EFS+/231.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F10 &EFS+/231.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F11 &EFS+/231.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F11 &EFS+/231.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F12 &EFS+/231.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-K1 &EFS+/231.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K2 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K3 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K7 &EFS+/231.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

previous page: 5

next page: 7

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-K8 &EFS+/231.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K9 &EFS+/231.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-U1 &EFS+/231.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-231U1-X3.1 &EFS+/231.a.0;&EFS+/231.a.9	0					
-231U1-X3.1 &EFS+/231.a.1...&EFS+/231.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-231U1-X3.1 &EFS+/231.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-231U1-X3.1 &EFS+/231.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-231U1-X3.1 &EFS+/231.a.2...&EFS+/231.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-231U1-X3.1 &EFS+/231.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-231U1-X3.2 &EFS+/231.a.0	0					
-231U1-X3.2 &EFS+/231.a.1...&EFS+/231.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-231U1-X3.2 &EFS+/231.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-237U1 &EFS+/237.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-237U1-C1 &EFS+/237.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-C7 &EFS+/237.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-C13 &EFS+/237.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-F0 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F1 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F1 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F1 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F2 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F2 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F2 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F3 &EFS+/237.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F3 &EFS+/237.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F3 &EFS+/237.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-F4 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F4 &EFS+/237.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F5 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F5 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F5 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F6 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F6 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F6 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-F7 &EFS+/237.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F7 &EFS+/237.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F8 &EFS+/237.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F8 &EFS+/237.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F9 &EFS+/237.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F9 &EFS+/237.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F9 &EFS+/237.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F10 &EFS+/237.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F10 &EFS+/237.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F10 &EFS+/237.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F11 &EFS+/237.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F11 &EFS+/237.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F12 &EFS+/237.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-K1 &EFS+/237.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K2 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K3 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K7 &EFS+/237.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-K8 &EFS+/237.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K9 &EFS+/237.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-U1 &EFS+/237.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-237U1-X3.1 &EFS+/237.a.0;&EFS+/237.a.9	0					
-237U1-X3.1 &EFS+/237.a.1...&EFS+/237.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-237U1-X3.1 &EFS+/237.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-237U1-X3.1 &EFS+/237.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-237U1-X3.1 &EFS+/237.a.2...&EFS+/237.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-237U1-X3.1 &EFS+/237.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-237U1-X3.2 &EFS+/237.a.0	0					
-237U1-X3.2 &EFS+/237.a.1...&EFS+/237.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-237U1-X3.2 &EFS+/237.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-281M1 &EFS+/281.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M2 &EFS+/281.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M3 &EFS+/281.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-78F1 &EFS+/78.6	1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738	
-78F1 &EFS+/78.6	3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539	
-78F2 &EFS+/78.6	1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055	
-78F3 &EFS+/78.7;&EFS+/78.8	3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	
-78F3 &EFS+/78.7;&EFS+/78.8	3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545	
-78W1 &EFS+/78.3	1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W2 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W3 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W4 &EFS+/78.3	1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290	
-78W5 &EFS+/78.2	1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070	
-227W10 &EFS+/227.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W11 &EFS+/227.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W12 &EFS+/227.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W13 &EFS+/227.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W14 &EFS+/227.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W15 &EFS+/227.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-228F1 &EFS+/228.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F2 &EFS+/228.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F3 &EFS+/228.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231W10 &EFS+/231.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W11 &EFS+/231.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W12 &EFS+/231.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W13 &EFS+/231.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W14 &EFS+/231.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W15 &EFS+/231.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W10 &EFS+/237.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W11 &EFS+/237.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W12 &EFS+/237.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W13 &EFS+/237.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W14 &EFS+/237.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W15 &EFS+/237.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-238F1 &EFS+/238a.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F2 &EFS+/238a.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F3 &EFS+/238a.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F4 &EFS+/238b.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F5 &EFS+/238b.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F6 &EFS+/238b.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-X3.43	20	Multi-level terminal block	3208511	Phoenix Contact	500560	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113U5 &EFS/113c.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-XT1 &EFS/136.0...&EFS/136.8	20	Feed-through terminal block	3209510	Phoenix Contact	500583	
-XT1 &EFS/136.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT1 &EFS/136.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT1 &EFS/136.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
++CONV+AC_DC/2

next page:
+CTRL_1.1/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250123_V1.3	= UNIT_01 Converter Container 1	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84Q1 &EFS+/84.0	1	EMERGENCY STOP SWITCH	3LD2203-1TP53	Siemens	500810	X
-84Q1 &EFS+/84.0	1	Auxiliary switch	3LD9200-5B	Siemens	504922	X
-112A1 &EFS+/112.2	1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475	
-126S1 &EFS+/126.1	1	PUSHBUTTON, BLACK, 1 NO	3SU1100-0AB10-3BA0	Siemens	10026	X
-126S1 &EFS+/126.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H1 &EFS+/140.1	1	Complete device, round, indicator light RED	3SU1102-6AA20-3AA0	Siemens	10019	X
-140H1 &EFS+/140.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H2 &EFS+/140.2	1	Complete device, round, indicator light YELLOW	3SU1102-6AA30-3AA0	Siemens	10021	X
-140H2 &EFS+/140.2	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H3 &EFS+/140.3	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H3 &EFS+/140.3	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H4 &EFS+/140.4	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H4 &EFS+/140.4	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-278M1 &EFS+/278.1	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
+/1

next page:
+.2/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-110U1 &EFS+/110.2	1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789	
-110U1 &EFS+/110.2	1	Connector RJ45, 4 Pol., Profinet, VS-PN-RJ45-5-Q/IP20	1658435	Phoenix Contact	500806	X
-114A1 &EFS+/114.2	1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505	
-114A1 &EFS+/114.2	1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944	
-185R1 &EFS+/185.7	1	SK Enclosure heater, 800/870 W, 230 V, 1~, 50/60 Hz, WHD: 103x200x103 mm	3105400	Rittal	500621	X

previous page:
+.1/1

next page:
+.3/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250123_V1.3	= UNIT_01 Converter Container 1	
Date	23.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+ CTRL_1.2 Left side	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84F1 &EFS+/84.6	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-84F2 &EFS+/84.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	X
-84F2 &EFS+/84.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-84K1 &EFS+/84.5	1	CONT.RELAY,3NO+1NC,DC24V,DIODE	3RH2131-2FB40	Siemens	501288	X
-101Q1 &EFS+/101.2	1	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	X
-101Q1 &EFS+/101.2	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	X
-101Q1 &EFS+/101.2	1	3-PHASE BUSBAR W. INFEED	3RV2917-1A	Siemens	500799	X
-101Q1 &EFS+/101.2	1	3-phase busbar including extension connector for 3 circuit breakers Size S00 and S0	3RV2917-4B	Siemens	504254	X
-101T1 &EFS+/101.2	1	Power supply unit	2866404	Phoenix Contact	502745	X
-102G1 &EFS+/102.2	1	Uninterruptible power supply	2320241	Phoenix Contact	501836	X
-102G2 &EFS+/102.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	X
-103F1 &EFS+/103.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F2 &EFS+/103.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F3 &EFS+/103.6	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F4 &EFS+/103.8	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F5 &EFS+/103.9	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-111A1 &EFS+/111.0	1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287	
-113T1 &EFS+/113a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T1 &EFS+/113a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	

previous page:
+.2/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113T2 &EFS+/113b.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T2 &EFS+/113b.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-113U1 &EFS+/113a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U2 &EFS+/113a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-113U3 &EFS+/113b.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U4 &EFS+/113b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-115A1 &EFS+/115.3	1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt	
-120A1 &EFS+/120.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	X
-134K1 &EFS+/134.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-134K1 &EFS+/134.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K1 &EFS+/135.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K1 &EFS+/135.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K2 &EFS+/135.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K2 &EFS+/135.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K3 &EFS+/135.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K3 &EFS+/135.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K4 &EFS+/135.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K4 &EFS+/135.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K5 &EFS+/135.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-135K5 &EFS+/135.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-136K7 &EFS+/136.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K8 &EFS+/136.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K9 &EFS+/136.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-137K1 &EFS+/137.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K1 &EFS+/137.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K2 &EFS+/137.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K2 &EFS+/137.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K3 &EFS+/137.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K3 &EFS+/137.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K4 &EFS+/137.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K4 &EFS+/137.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-138K1 &EFS+/138.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K1 &EFS+/138.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K2 &EFS+/138.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K2 &EFS+/138.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K3 &EFS+/138.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K3 &EFS+/138.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K4 &EFS+/138.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-138K4 &EFS+/138.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K5 &EFS+/138.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K5 &EFS+/138.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K6 &EFS+/138.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K6 &EFS+/138.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K7 &EFS+/138.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K7 &EFS+/138.7	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-139K1 &EFS+/139.1	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K2 &EFS+/139.2	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K3 &EFS+/139.3	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-150K1 &EFS+/150.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K1 &EFS+/150.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150K2 &EFS+/150.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K2 &EFS+/150.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150X1 &EFS+/150.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-150X1 &EFS+/150.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-150X1 &EFS+/150.2;&EFS+/150.4;&EFS+/151.1;&EFS+/151.4;&EFS+/151.6	5	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-151K1 &EFS+/151.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K1 &EFS+/151.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X

previous page: 3

next page: 5

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-151K2 &EFS+/151.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K2 &EFS+/151.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K3 &EFS+/151.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K3 &EFS+/151.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K4 &EFS+/151.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K4 &EFS+/151.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-171K3 &EFS+/171.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-171K3 &EFS+/171.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-173K3 &EFS+/173.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-173K3 &EFS+/173.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-181Q1 &EFS+/181.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-181Q1 &EFS+/181.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q1 &EFS+/181.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-181Q2 &EFS+/181.3	1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671	
-181Q2 &EFS+/181.3	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q2 &EFS+/181.3	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-182Q1 &EFS+/182.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-182Q1 &EFS+/182.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-182Q1 &EFS+/182.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-183F1 &EFS+/183.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	X
-183F1 &EFS+/183.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-183F1 &EFS+/183.1	1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364	X
-183F1 &EFS+/183.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	X
-183F2 &EFS+/183.3	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-183F2 &EFS+/183.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185B1 &EFS+/185.6	1	Thermostat NC contact, -10 to 50 °C	8MR2170-1CA	Siemens	500816	X
-185F1 &EFS+/185.1	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-185F1 &EFS+/185.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185F2 &EFS+/185.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	X
-185F2 &EFS+/185.7	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-186B1 &EFS+/186.6	1	Thermostat NO contact, -10 to 50 °C	8MR2170-1CB	Siemens	501577	X
-186K1 &EFS+/186.6	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-187F1 &EFS+/187.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C13	5SY4113-7	Siemens	504323	X
-187F1 &EFS+/187.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-187F2 &EFS+/187.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-189K1 &EFS+/189.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-190F1 &EFS+/190.1	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F1 &EFS+/190.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-190F1 &EFS+/190.1	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F2 &EFS+/190.3	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F2 &EFS+/190.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F2 &EFS+/190.3	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F3 &EFS+/190.5	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F3 &EFS+/190.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F3 &EFS+/190.5	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190X10 &EFS+/190.9	1	5TE6 REG Socket Outlets, 16 A	5TE6800	Siemens	503215	X
-190XT1 &EFS+/190.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-190XT1 &EFS+/190.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-190XT1 &EFS+/190.1;&EFS+/190.5	3	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-191F1 &EFS+/191.1	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F1 &EFS+/191.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191F2 &EFS+/191.3	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F2 &EFS+/191.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191XT1 &EFS+/191.1;&EFS+/191.3	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X

previous page: 6

next page: 8

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-191XT1 &EFS+/191.1	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-191XT1 &EFS+/191.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-195K1 &EFS+/195.3	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K1 &EFS+/195.3	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K2 &EFS+/195.4	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K2 &EFS+/195.4	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K3 &EFS+/195.1	1	SIRIUS SAFETY RELAY STD RELAY 3NO+1NC	3SK1111-2AB30	Siemens	501260	X
-AI_01 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_01 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-AI_02 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_02 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_03 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_03 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_04 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_04 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_01 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_01 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X

previous page: 7

next page: 9

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-DI_02 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_02 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_03 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_03 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_04 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_04 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_05 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_05 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_06 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_06 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_01 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_01 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-DO_02 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_02 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_03 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_03 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_04 &EFS+/120.6	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_04 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-X1 &EFS+/181.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X1 &EFS+/181.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-X1 &EFS+/181.1;&EFS+/181.3;&EFS+/181.4;&EFS+/182.1;&EFS+/182.3;&EFS+/182.4	12	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-X1 &EFS+/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-X1 &EFS+/181.1;&EFS+/181.4;&EFS+/182.1;&EFS+/182.4	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-X3 &EFS+/127.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3 &EFS+/127.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.10 &EFS+/129.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0;&EFS+/129.2;&EFS+/129.4;&EFS+/129.6;&EFS+/129.8;&EFS+/129.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.10 &EFS+/129.0;&EFS+/129.4;&EFS+/129.6;&EFS+/129.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.11 &EFS+/130.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.11 &EFS+/130.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.11 &EFS+/130.0;&EFS+/130.2;&EFS+/130.4;&EFS+/130.6;&EFS+/130.8;&EFS+/130.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.11 &EFS+/130.0;&EFS+/130.4;&EFS+/130.6;&EFS+/130.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.12 &EFS+/131.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.12 &EFS+/131.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.12 &EFS+/131.0;&EFS+/131.2;&EFS+/131.4;&EFS+/131.6;&EFS+/131.8;&EFS+/131.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.12 &EFS+/131.0;&EFS+/131.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.13 &EFS+/132.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X

previous page: 9

next page: 11

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X3.13 &EFS+/132.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.13 &EFS+/132.0;&EFS+/132.2;&EFS+/132.4;&EFS+/132.6;&EFS+/132.8;&EFS+/132.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.13 &EFS+/132.0;&EFS+/132.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3	21	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3 &EFS+/127.1;&EFS+/127.5;&EFS+/128.3;&EFS+/188.1	5	Plug-in bridge FBS 2-3,5	3213014	Phoenix Contact	500802	X
-X5 &EFS+/145.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X5 &EFS+/145.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-X5.1 &EFS+/149.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0;&EFS+/149.2	2	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-X5.1 &EFS+/149.0	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-X5	15	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-XDC1 &EFS+/103.1	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC1 &EFS+/103.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC1 &EFS+/103.2;&EFS+/103.3	7	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC1 &EFS+/103.2	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	X
-XDC1 &EFS+/103.3	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	X
-XDC1 &EFS+/103.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XDC2 &EFS+/103.3	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC2 &EFS+/103.3	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC2 &EFS+/103.4;&EFS+/103.5	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC2 &EFS+/103.4;&EFS+/103.5	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC3 &EFS+/103.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC3 &EFS+/103.5	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC3 &EFS+/103.6;&EFS+/103.7	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC3 &EFS+/103.6;&EFS+/103.7	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC4 &EFS+/103.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC4 &EFS+/103.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC4 &EFS+/103.8;&EFS+/103.9	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC4 &EFS+/103.8;&EFS+/103.9	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC5.1 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.1 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.1 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC5.2 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.2 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.2 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XE &EFS+/84.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-XE &EFS+/84.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XE &EFS+/84.0;&EFS+/84.1	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XE &EFS+/84.0;&EFS+/84.1	3	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	X
-XE &EFS+/84.1;&EFS+/84.2	4	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-XE &EFS+/84.1	1	Plug-in bridge FBS 3-8	3030297	Phoenix Contact	501568	X
-XE &EFS+/84.2;&EFS+/84.3	3	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-XT &EFS+/183.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XT &EFS+/183.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XT &EFS+/183.1;&EFS+/183.2;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2;&EFS+/187.4;&EFS+/187.5	8	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-XT &EFS+/183.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XT &EFS+/187.4	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XT &EFS+/183.1;&EFS+/183.4;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2	6	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XV &EFS+/171.8	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-XV &EFS+/171.8	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Base terminal for component connector	3210185	Phoenix Contact	500828	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Component plug terminal block	3036796	Phoenix Contact	500533	X
-XV &EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	8	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	X
-XV &EFS+/171.8	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XV &EFS+/134.5	1	Diode ZY12 - zener diode, DO-41, plastic, 12V, 2W	17060488	Distrelec Schuricht GmbH	500556	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-85U1 &EFS+/85.0	1	Power Bridge Rectifiers SKD 30/16A1, Vrrm = 1600V, Id = 30A	07122150	Semikron	501556	X
-85U10 &EFS+/85.0	1	EMI Filter X2 Y1 Version 2	505722	Freqcon GmbH	505722	X
-85U11 &EFS+/85.1	1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702	
-149U1 &EFS+/149.5	1	Interface module	2959609	Phoenix Contact	501595	X
-171F1 &EFS+/171.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-171F1 &EFS+/171.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-171K1 &EFS+/171.7	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171K2 &EFS+/171.8	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171R1 &EFS+/171.1	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-171R2 &EFS+/171.2	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-173F2 &EFS+/173.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F2 &EFS+/173.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-173F3 &EFS+/173.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F3 &EFS+/173.4	2	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-173K1 &EFS+/173.8	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173K2 &EFS+/173.9	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173R1 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R2 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R3 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X

previous page:
+.3/13

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R4 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-189X1 &EFS+/189.4	9	Measuring transformer disconnect terminal	3035696	Phoenix Contact	54498	X
-189X1 &EFS+/189.4	9	Test adapter - PAIS-4-FIX GY	3032791	Phoenix Contact	501482	X
-189X1 &EFS+/189.4	1	End cover D-DTME 6	3034426	Phoenix Contact	505468	X
-189X1 &EFS+/189.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-306K1 &EFS+/306.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K1 &EFS+/306.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K2 &EFS+/306.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K2 &EFS+/306.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K3 &EFS+/306.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K3 &EFS+/306.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K4 &EFS+/306.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K4 &EFS+/306.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K5 &EFS+/306.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K5 &EFS+/306.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K6 &EFS+/306.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K6 &EFS+/306.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K1 &EFS+/307.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K1 &EFS+/307.1	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-307K2 &EFS+/307.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K2 &EFS+/307.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K3 &EFS+/307.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K3 &EFS+/307.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K4 &EFS+/307.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K4 &EFS+/307.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K5 &EFS+/307.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K5 &EFS+/307.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K6 &EFS+/307.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K6 &EFS+/307.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K1 &EFS+/308.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K1 &EFS+/308.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K2 &EFS+/308.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K2 &EFS+/308.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K3 &EFS+/308.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K3 &EFS+/308.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K4 &EFS+/308.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K4 &EFS+/308.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K5 &EFS+/308.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-308K5 &EFS+/308.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K6 &EFS+/308.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K6 &EFS+/308.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K1 &EFS+/350.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K1 &EFS+/350.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K2 &EFS+/350.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K2 &EFS+/350.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350X1.21 &EFS+/350.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	
-350X1.21 &EFS+/350.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-350X1.21 &EFS+/350.1 &EFS+/350.2 &EFS+/350.4 &EFS+/350.5 &EFS+/351.1 &EFS+/351.3 &EFS+/351.4 &EFS+/351.5 &EFS+/352.1 &EFS+/352.2 &EFS+/352.3 &EFS+/352.4 &EFS+/352.5 &EFS+/353.1 &EFS+/353.2 &EFS+/353.3 &EFS+/353.4 &EFS+/353.5 &EFS+/354.1 &EFS+/354.2 &EFS+/354.3 &EFS+/354.4 &EFS+/354.5	9	Multi-level terminal block	3208511	Phoenix Contact	500560	
-350X1.21 &EFS+/352.1	0					
-351K1 &EFS+/351.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K1 &EFS+/351.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K2 &EFS+/351.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K2 &EFS+/351.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K3 &EFS+/351.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K3 &EFS+/351.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-351K4 &EFS+/351.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K4 &EFS+/351.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

previous page: 3

next page: 5

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-352K1 &EFS+/352.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K1 &EFS+/352.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-352K2 &EFS+/352.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K2 &EFS+/352.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K1 &EFS+/353.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K1 &EFS+/353.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K2 &EFS+/353.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K2 &EFS+/353.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K3 &EFS+/353.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K3 &EFS+/353.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K4 &EFS+/353.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K4 &EFS+/353.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-XE2 &EFS+/173.1	0					
-XE2 &EFS+/173.2...&EFS+/173.5	11	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Base terminal for component connector	3210185	Phoenix Contact	500828	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Component plug terminal block	3036796	Phoenix Contact	500533	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B1 &EFS+/147.5	1	Temperature sensor PT100, cable 1.5m, PVC	1101-6030-1211-110	S+S Regeltechnik GmbH	501787	X
-190H1 &EFS+/190.5	1	LED system light, Without socket, Length: 337 mm, Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500110	Rittal	10007	X
-190H1 &EFS+/190.5	1	Infeed, 2-pole (with socket, without connector), Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500420	Rittal	10009	X
-190H1 &EFS+/190.5	1	Door-Operated Switch, Input voltage: 230 V AC, 24 V DC, - 240 V, 1~, 50 Hz/60 Hz,	2500460	Rittal	500736	X

previous page:
+.4/5

next page:
+CTRL_1/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250123_V1.3	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+ CTRL_1.5 above	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-20BG1 &EFS+/100.2	1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550	
-20BG1-X &EFS+/100.2	55	End bracket for terminal block	3022276	Phoenix Contact	500588	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-149X1 &EFS+/161.4...&EFS+/161.8	6	Feed-through terminal block Push-in PT 4	3211757	Phoenix Contact	500582	X
-149X1 &EFS+/161.4	1	End cover D-ST 4	3030420	Phoenix Contact	500502	
-149X1 &EFS+/161.4	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-149X1 &EFS+/161.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-160U1 &EFS+/160.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-161U1 &EFS+/161.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-162U1 &EFS+/162.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-163U1 &EFS+/163.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-164U1 &EFS+/164.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-240U1 &EFS+/440.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-240U1 &EFS+/440.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-240U1 &EFS+/440.1	1	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-241U1 &EFS+/441.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-241U1 &EFS+/441.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-241U1 &EFS+/441.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-242U1 &EFS+/442.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-242U1 &EFS+/442.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-242U1 &EFS+/442.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-243U1 &EFS+/443.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-243U1 &EFS+/443.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-243U1 &EFS+/443.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-278M2 &EFS+/278.3	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
1

next page:
+CTRL.4/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R5 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R6 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R7 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R8 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	

previous page:
+CTRL_2.1/2

next page:
++FAN+/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-52G1 &EFS++CT/181.0;&EFS++CT/181.7	0					
-52G1-148B1 &EFS++CT/148.1	1	Temperature sensor PT100, cable 3m, PVC	1101-6030-1231-110	S+S Regeltechnik GmbH	501575	X
-52G1-181M1 &EFS++CT/181.1	1	Pump CM10-2, 3x380V-415V, 50Hz, 1,27 kW, 2,85-2,9 A, 2.950 - 2.960 rpm / 440V-480V, 60Hz, 2,2 kW, 4,0-3,7A, 3.520-3.530 rpm	99080211	GRUNDFOS GmbH	501409	X
-52G1-181R1 &EFS++CT/181.3	1	Screw-in heater SEHK, 3kW, 400V	106066	Siekerkotte GmbH & Co. KG	500620	X
-52G1-181S1 &EFS++CT/181.7	0					
-52G1-181X1 &EFS++CT/181.0	0					
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.3;&EFS++CT/181.4;&EFS++CT/182.1	9	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-52G1-181X1 &EFS++CT/181.3	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-52G1-181X1 &EFS++CT/181.3	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X1 &EFS++CT/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.4;&EFS++CT/182.1	3	Ground terminal block	3209536	Phoenix Contact	500813	X
-52G1-181X3 &EFS++CT/148.1;&EFS++CT/181.7	2	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-52G1-181X3 &EFS++CT/181.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-52G1-181X3 &EFS++CT/181.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X3 &EFS++CT/181.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-52G1-182M1 &EFS++CT/182.1	1	Heat exchanger 40kW cooling capacity, alluminium, 1,72kW, 3,86A, 400V	FR6555950001	Bondioli & Pavesi S.p.A.	500850	X

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153
1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555

Editor	Freqcon_DG			Statron	FREQCON	SUMMARIZED PARTS LIST	20250123_V1.3	= UNIT_01	Converter Container 1
Date	05.11.2024							& EPA	Summarized part list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070
9	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604
1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524
3	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867
3	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872
3	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882
1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918
1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955
3	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046
3	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053
1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190
1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290
3	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157
3	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426
3	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449
1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648
1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649
3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055
1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044
1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039
1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172
9	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130
3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545
1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738
3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779

previous page:
1

next page:
++CT/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550
4	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890
1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702
5	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390
1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505
1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475
1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287
4	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805
2	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
2	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
38	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
41	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944
2	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
3	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845
2	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740
1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797
1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789
2	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
2	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
7	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804
1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt
4	Power Resistor 100W 1% 10K J	160141	Widap AG	501614

previous page: 1

next page: &EMB++TRA/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250123_V1.3	= UNIT_02 Battery Container 1
Date	05.11.2024							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 1
Date								+ total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U4 &EFS/613b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.3...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.3...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.1;&EFS/687.3;&EFS/687.4;&EFS/687.6...&EFS/687.8;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.9;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	

previous page: 5

next page: 7

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	

previous page:
6

next page:
&EPA++Container/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250123_V1.3	= UNIT_02 Battery Container 1
Date	21.01.2025							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet page: 7
Date								+ total: 492

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/7

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
6	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
3	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250123_V1.3	= UNIT_03 Battery Container 2
Date	05.11.2024							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 1
Date								+ total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-635K1 &EFS/635a.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K1 &EFS/635a.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-635K2 &EFS/635a.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K2 &EFS/635a.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K3 &EFS/635a.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K3 &EFS/635a.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K4 &EFS/635a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K4 &EFS/635a.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K5 &EFS/635a.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K5 &EFS/635a.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K6 &EFS/635a.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K6 &EFS/635a.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K7 &EFS/635b.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.2...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.2...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.1;&EFS/687.2;&EFS/687.4;&EFS/687.6...&EFS/687.8;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.8;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	
-XT &EFS/635b.1...&EFS/635b.5;&EFS/635b.7	14	Feed-through terminal block	3209510	Phoenix Contact	500583	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XT &EFS/635b.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT &EFS/635b.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT &EFS/635b.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
7

next page:
&EPA++Container/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250123_V1.3	= UNIT_03 Battery Container 2	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 8
Date								+	total: 492

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/8

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
2	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
13	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
9	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

Item no.	Quantity	Description	engl. Description	Art.-no.
1	1	Umrichtercontainer 20ft	PCS Container 20ft	508727
2	1	Umrichter	Converter System	53399
3	1	Steuerschrank 1&2	Control Cabinets 1&2	53763
4	1	Kühlsystem	Cooling System	53405
5	1	Gießharztransformator 1250kVA	transformer 1250kVA	508464

Item no.	Quantity	Description	engl. description	Art.-no.
1	1	BESS Container 2 LHS	BESS container 2 LHS	507828
2	1	Hilfsversorgungsschrank 1	Distribution Cabinet 1	53409
3	3	Netzanschlussleitung/Verlängerungskabel 3m, schwarz	Mains connection cable/extension cable	54615
4	1	Einbaurahmen verstärkt	Reinforced mounting frame	509198
5	11	Schrank_verstärkt_mit Einsch._LF280K_28	Reinforced cabinet with slide-in Units_28	54625

Item no.	Quantity	Description	engl. description	Art.-no.
1	1	BESS Container 2 LHS	BESS container 2 LHS	507828
2	1	Hilfsversorgungsschrank 1	Distribution Cabinet 1	53409
3	3	Netzanschlussleitung/Verlängerungskabel 3m, schwarz	Mains connection cable/extension cable	54615
4	1	Einbaurahmen verstärkt	Reinforced mounting frame	509198
5	11	Schrank_verstärkt_mit Einsch._LF280K_28	Reinforced cabinet with slide-in Units_28	54625

Item no.	Quantity	Description	Art.-no.	Supplier	Supplier number
1	1	Battery container 2	53412	Freqcon	
2	1	Battery container 1	53406	Freqcon	
3	1	PCS (Converter) container	53396	Freqcon	

STATRON
NON STOP POWER

Electrical Single Line Diagrams

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: C06
Sequence Number: 001
Rev: 002
Document number: K559-2254-CWIWP4202201-C06-001
Document description: Electrical Single Line Diagrams

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Electrical Single Line Diagrams
C06

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	C06
Document name	Electrical Single Line Diagrams
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-02-20	C. Palenzuela	First version
2.0	2024-11-21	M. Müller	First revision

Table 1: Version overview

	Date	Name
Editor	2024-11-21	M. Müller
Checked by	2024-11-27	C. Palenzuela
Approved by	2024-11-27	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
November 2024

Doc Code
K559-2254-CWIWP4202201-C06-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Single Line Diagram – FREQCON BESS and PCS	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Single Line Diagram

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The electrical single line diagram of the proposed BESS and PCS system is attached to this document (*see section 1.3 "Other Applicable Documents"*).

3 Appendix

1. FREQCON Single Line Diagram:
   10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Single Line Diagram

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	CONVERTER CONTAINER	
Circuit diagram No:	10354_23A2007	20250805_V2.0

Producer (company):	Freqcon GmbH	53396
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	CT_Ausbau_1 53457 CT_Ausbau_2 53765
Type:	BESS MSC-1000-620-8	CONV 53399
Project manager:	Freqcon_CP	

created on:	17.09.2019			
edited on:	05.08.2025	edited by:	Freqcon_DG	total pages: 492

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	05.11.2024	Freqcon_DG
	3	INDEX	23.01.2025	Freqcon_DG
	4	INDEX	23.01.2025	Freqcon_DG
	5	INDEX	23.01.2025	Freqcon_DG
	6	INDEX	05.11.2024	Freqcon_DG
	7	INDEX	23.01.2025	Freqcon_DG
	8	INDEX	21.01.2025	Freqcon_DG
	9	INDEX	23.01.2025	Freqcon_DG
	10	INDEX	21.01.2025	Freqcon_DG
	11	INDEX	21.01.2025	Freqcon_DG
	12	INDEX	21.01.2025	Freqcon_DG
	13	INDEX	23.01.2025	Freqcon_DG
	14	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&ELU		Cabinet Overview		
	5a	CABINETS OVERVIEW	05.11.2024	Freqcon_DG
&EFS ++TRA		Circuit diagram medium voltage transformer		
	18	MV-TRANSFORMER UNIT_01+02	05.11.2024	Freqcon_DG
	18a	TEMPERATURE TRANSFORMER UNIT_01+02	05.11.2024	Freqcon_DG
&EFS ++CONV		Circuit diagram Converter		
	78	GRID CONNECTION	18.06.2024	Freqcon_JD
	80	BG CIRCUIT BREAKER 1000A AC GRID	18.06.2024	Freqcon_JD
	82	PI INDUCTORS GRID SIDE	18.06.2024	Freqcon_JD
	83	GRID AC FILTER 3* 600 µF + OVERVOLTAGE PROTECTOR	18.06.2024	Freqcon_JD
	99	BUSBARS N, PE	18.06.2024	Freqcon_JD
	200	POWER CIRCUITS COVER PAGE	14.06.2024	Freqcon_JD
	201	IGBT & INDUCTOR FOR GRID PHASE 1	18.06.2024	Freqcon_JD
	202	IGBT & INDUCTOR FOR GRID PHASE 2	18.06.2024	Freqcon_JD
	203	IGBT & INDUCTOR FOR GRID PHASE 3	18.06.2024	Freqcon_JD
	207	IGBT & INDUCTOR SUB 3_1 - 3_3	18.06.2024	Freqcon_JD
	211	IGBT & INDUCTOR SUB 2_1 -2_3	18.06.2024	Freqcon_JD
	217	IGBT & INDUCTOR SUB 4_1 -4_3	18.06.2024	Freqcon_JD
	227	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	18.06.2024	Freqcon_JD
	227.a	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	18.06.2024	Freqcon_JD
	228	DC SURGE ARRESTER 3_1 - 3_3	18.06.2024	Freqcon_JD
	231	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	231.a	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	237	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	237.a	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	29.07.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CONV		Circuit diagram Converter		
	238a	DC SURGE ARRESTER 2_1 - 2_3	18.06.2024	Freqcon_JD
	238b	DC SURGE ARRESTER 4_1 - 4_3	18.06.2024	Freqcon_JD
	260	SMOKE DETECTOR	18.06.2024	Freqcon_JD
	279	CONVERTER CABINET CLIMATE	18.06.2024	Freqcon_JD
	281	CIRCUIT BREAKER CABINET CLIMATE	18.06.2024	Freqcon_JD
&EFS ++CT		Circuit diagram Control cabinets		
	84	FEEDING CONTROL CABINET (CTRL)	29.07.2024	Freqcon_DG
	85	SUPPLY UDC	29.07.2024	Freqcon_DG
	100	CONTROL CABINET COVER PAGE	18.06.2024	Freqcon_JD
	101	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	102	CONTROL VOLTAGE UPS	18.06.2024	Freqcon_JD
	103	CONTROL VOLTAGE FUSE	29.07.2024	Freqcon_DG
	110	MAIN PLC	20.06.2024	Freqcon_JD
	111	ETHERNET SWITCH	23.01.2025	Freqcon_DG
	112	PANEL PC HMI	18.06.2024	Freqcon_JD
	113a	ETHERNET / PROFINET ISOLATOR	18.06.2024	Freqcon_JD
	113b	ETHERNET / PROFINET ISOLATOR	18.06.2024	Freqcon_JD
	113c	PROFINET	25.11.2024	Freqcon_DG
	114	HELMHOLZ	23.01.2025	Freqcon_DG
	115	UMTS ROUTER	18.06.2024	Freqcon_JD
	120	ET200 24V DC	25.11.2024	Freqcon_DG
	121	ET200SP DIGITAL INPUTS DI_01 - DI_03	14.06.2024	Freqcon_JD
	122	ET200SP DIGITAL INPUTS DI_04 + DI_05	14.06.2024	Freqcon_JD
	123	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	14.06.2024	Freqcon_JD
	123.a	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	18.06.2024	Freqcon_JD
	124	ET200SP ANALOG INPUTS AI_01 - AI_03	14.06.2024	Freqcon_JD

previous page: 2

next page: 4

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram Control cabinets		
	125	ET200SP ANALOG INPUTS AI_04	14.06.2024	Freqcon_JD
	126	INPUTS CONTROL ELEMENTS	02.07.2024	Freqcon_JD
	127	DIGITAL INPUTS CB 1	18.06.2024	Freqcon_JD
	128	DIGITAL INPUTS CB 2	18.06.2024	Freqcon_JD
	129	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	18.06.2024	Freqcon_JD
	130	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	18.06.2024	Freqcon_JD
	131	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	29.07.2024	Freqcon_DG
	132	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	29.07.2024	Freqcon_DG
	133	DIGITAL INPUTS SPARE	05.11.2024	Freqcon_DG
	134	DIGITAL INPUTS SMOKE DETECTORS	18.06.2024	Freqcon_JD
	135	OUTPUTS FAN	19.06.2024	Freqcon_JD
	136	OUTPUTS COMMUNICATION	12.09.2024	Freqcon_DG
	137	OUTPUTS CIRCUIT BREAKER	18.06.2024	Freqcon_JD
	138	OUTPUTS CONTROL ELEMENTS	03.07.2024	Freqcon_JD
	139	OUTPUTS COOLING	14.06.2024	Freqcon_JD
	140	OUTPUTS CONTROL ELEMENTS	14.06.2024	Freqcon_JD
	145	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	14.06.2024	Freqcon_JD
	146	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	18.06.2024	Freqcon_JD
	147	ANALOG INPUTS CABINET TEMPERATURE	18.06.2024	Freqcon_JD
	148	ANALOG INPUTS COOLING WATER TEMPERATURE	18.06.2024	Freqcon_JD
	149	ANALOG INPUTS MEASURING VOLTAGE	18.06.2024	Freqcon_JD
	150	OUTPUTS DC CONTACTORS 2_1	18.06.2024	Freqcon_JD
	151	OUTPUTS DC CONTACTORS 2_2, 2_3	18.06.2024	Freqcon_JD
	160	INTERFACE HVIO 1	29.07.2024	Freqcon_DG
	161	INTERFACE HVIO 2	05.11.2024	Freqcon_DG
	162	INTERFACE HVIO 2 ANALOG	18.06.2024	Freqcon_JD
	163	INTERFACE HVIO 3	18.06.2024	Freqcon_JD

previous page: 3

next page: 5

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram Control cabinets		
	164	INTERFACE HVIO 4	18.06.2024	Freqcon_JD
	171	PRE-CHARGING UDC	18.06.2024	Freqcon_JD
	173	DISCHARGE UDC	18.06.2024	Freqcon_JD
	181	WATER SYSTEM	29.07.2024	Freqcon_DG
	182	HEAT EXCHANGER	18.06.2024	Freqcon_JD
	183	Supply for cabinet fan	29.07.2024	Freqcon_DG
	185	FAN / HEATING CONTROL CABINET	18.06.2024	Freqcon_JD
	186	THERMOSTAT	18.06.2024	Freqcon_JD
	187	24V DC SUPPLY CB	18.06.2024	Freqcon_JD
	188	24V DC SUPPLY CON / CB GRID	18.06.2024	Freqcon_JD
	189	TEST TERMINAL BLOCK	18.06.2024	Freqcon_JD
	190	CONTAINER COOLING, LIGHT 230V SUPPLY	29.07.2024	Freqcon_DG
	191	CONTAINER COOLING	29.07.2024	Freqcon_DG
	195	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	29.07.2024	Freqcon_DG
	278	CONTROL CABINET CLIMATE	29.07.2024	Freqcon_DG
	306	Feedback DC contactors 1_4 - 1_6	18.06.2024	Freqcon_JD
	307	Feedback DC contactors 2_1 - 2_3	18.06.2024	Freqcon_JD
	308	Feedback DC contactors 2_4 - 2_6	29.07.2024	Freqcon_DG
	350	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	18.06.2024	Freqcon_JD
	351	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	29.07.2024	Freqcon_DG
	352	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	29.07.2024	Freqcon_DG
	353	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	29.07.2024	Freqcon_DG
	440	PIII PROFINET IGBT IRT INTERFACE 1	18.06.2024	Freqcon_JD
	441	PIII PROFINET IGBT IRT INTERFACE 2	18.06.2024	Freqcon_JD
	442	PIII PROFINET IGBT IRT INTERFACE 3	18.06.2024	Freqcon_JD
	443	PIII PROFINET IGBT IRT INTERFACE 4	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
&EPC ++TRA		Parts List medium voltage transformer		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV		Parts List Converter		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +CON		Parts List Converter Converter cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +IND		Parts List Converter Inductor cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +CIR		Parts List Converter Circuit Breaker cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
	6	PARTS LIST	05.11.2024	Freqcon_DG
	7	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CONV +CIR		Parts List Converter Circuit Breaker cabinet		
	8	PARTS LIST	05.11.2024	Freqcon_DG
	9	PARTS LIST	05.11.2024	Freqcon_DG
	10	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +AC_DC		Parts List Converter AC and DC connection cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT		Parts List Control cabinets		
	1	PARTS LIST	21.01.2025	Freqcon_DG
&EPC ++CT +CTRL_1.1		Parts List Control cabinets Control cabinet 1 Cabinet door		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.2		Parts List Control cabinets Control cabinet 1 Left side		
	1	PARTS LIST	23.01.2025	Freqcon_DG
&EPC ++CT +CTRL_1.3		Parts List Control cabinets Control cabinet 1 Main mounting plate		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
	6	PARTS LIST	05.11.2024	Freqcon_DG
	7	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL_1.3		Parts List Control cabinets Control cabinet 1 Main mounting plate		
	8	PARTS LIST	21.01.2025	Freqcon_DG
	9	PARTS LIST	21.01.2025	Freqcon_DG
	10	PARTS LIST	05.11.2024	Freqcon_DG
	11	PARTS LIST	05.11.2024	Freqcon_DG
	12	PARTS LIST	21.01.2025	Freqcon_DG
	13	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.4		Parts List Control cabinets Control cabinet 1 Right side		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.5		Parts List Control cabinets Control cabinet 1 above		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1		Parts List Control cabinets Control cabinet 1		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_2.1		Parts List Control cabinets Control cabinet 2 Cabinet door		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL.4		Parts List Control cabinets		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++FAN		Parts List FAN		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++TRA		Summarized part list medium voltage transformer		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++CONV		Summarized part list Converter		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
	2	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++CT		Summarized part list Control cabinets		
	1	SUMMARIZED PARTS LIST	23.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	23.01.2025	Freqcon_DG
&EMB ++TRA		Cable list medium voltage transformer		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CONV		Cable list Converter		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG

previous page: 8

next page: 10

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CONV		Cable list Converter		
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	05.11.2024	Freqcon_DG
	11	CABEL LIST	05.11.2024	Freqcon_DG
	12	CABEL LIST	05.11.2024	Freqcon_DG
	13	CABEL LIST	05.11.2024	Freqcon_DG
	14	CABEL LIST	05.11.2024	Freqcon_DG
	15	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CONV +CIR		Cable list Converter Circuit Breaker cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CT		Cable list Control cabinets		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	21.01.2025	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CT		Cable list Control cabinets		
	10	CABEL LIST	05.11.2024	Freqcon_DG
	11	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++FAN		Cable list FAN		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++EXTERN		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMZ ++CONV +IND		Terminals Converter Inductor cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+IND-207L1.1 - =UNIT_01++CONV+IND-217L1.3	05.11.2024	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+IND-207L1.1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+IND-207L1.2	05.11.2024	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+IND-207L1.3	05.11.2024	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+IND-211L1.1	05.11.2024	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+IND-211L1.2	05.11.2024	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+IND-211L1.3	05.11.2024	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CONV+IND-217L1.1	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_01++CONV+IND-217L1.2	05.11.2024	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CONV+IND-217L1.3	05.11.2024	Freqcon_DG
&EMZ ++CONV +CIR		Terminals Converter Circuit Breaker cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+CIR-227U1-X3.1 - =UNIT_01++CONV+CIR-237U1-X3.2	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.1	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CONV +CIR		Terminals Converter Circuit Breaker cabinet		
	2003	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.2	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.2	21.01.2025	Freqcon_DG
&EMZ ++CONV +AC_DC		Terminals Converter AC and DC connection cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+AC_DC-X3.43 - =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
&EMZ ++CT		Terminals Control cabinets		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+-XT1 - =UNIT_01++CT+-XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+-XT1	21.01.2025	Freqcon_DG
&EMZ ++CT +CTRL_1.3		Terminals Control cabinets Control cabinet 1 Main mounting plate		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.3-X1 - =UNIT_01++CT+CTRL_1.3-XV	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.11	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.12	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.13	21.01.2025	Freqcon_DG
	2007	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CT +CTRL_1.3		Terminals Control cabinets Control cabinet 1 Main mounting plate		
	2009	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5.1	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC3	23.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC4	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.1	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.2	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_01++CT+CTRL_1.3-XE	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_01++CT+CTRL_1.3-190XT1	21.01.2025	Freqcon_DG
	2024	Klemmenplan =UNIT_01++CT+CTRL_1.3-191XT1	21.01.2025	Freqcon_DG
	2025	Klemmenplan =UNIT_01++CT+CTRL_1.3-XV	21.01.2025	Freqcon_DG
&EMZ ++CT +CTRL_1.4		Terminals Control cabinets Control cabinet 1 Right side		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.4-350X1.21 - =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.4-XE2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CT +CTRL_2.1		Terminals Control cabinets Control cabinet 2 Cabinet door		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_2.1-149X1 - =UNIT_01++CT+CTRL_2.1-149X1	05.11.2024	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_2.1-149X1	05.11.2024	Freqcon_DG
&EMZ ++FAN		Terminals FAN		
	1000	Klemmenleistenübersicht : =UNIT_01++FAN+-52G1-181X1 - =UNIT_01++FAN+-52G1-181X3	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++FAN+-52G1-181X1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++FAN+-52G1-181X3	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/14

next page: 6a

SPECIFICATION of grounding

	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Editor	Freqcon_JD			Statron	FREQCON	Specification Earthing	20250805_V2.0	= UNIT_01	Converter Container 1
Date	14.06.2024	Norm						& EAC	Explanatory documents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 6a
Date								+	total: 492

Single line diagram

=UNIT_01++TRA

=UNIT_01++CONV

+AC_DC

+CIR

+IND

+CON

+IND

+CIR

+AC_DC

medium voltage transformer
-18T1
&EFS++TRA/18.2
1,25MVA
6,6kV/0,62 kV AC

Gehäuse Erdung

V1_L1 V1_L2 V1_L3

-78W1 - 78W3
GRID L1 -L3
&EFS++CONV/78.1

NSGAFöu 3x4x50mm²

3WL1112-2BB36-1BJ2-Z
A08+H07+M06+M21+R10

-80Q1
max.
1250 A
&EFS++CONV/80.0

-83U1
Filter Caps 3*600µF
Overvoltage protect
&EFS++CONV/83.2

PT100
201L1 - 203L1
Inductor
1*1000A
0,2mH
&EFS++CONV/201.1

PIII 1_1
-
PIII_1_3
201Q1 - 203Q1
1000A Stack x 3
AC
DC

V1_DC+ V1_DC-
UDC +
UDC N
UDC -

PIII 2_1
-
PIII_2_3
-211Q1
3X250A Stack
DC DC DC DC DC

PT100
-211L1
&EFS++CONV/211.1
0,6mH
3*250A

V3_L2 V3_L3 -231U1 VA_182
&EFS++CONV/231.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V3_L1 VA_186 VA_184

NSGAFöu 6x1x50mm²

-224W10 DC 1.4 + Pos.
-224W11 DC 1.4 - Pos.
-224W12 DC 1.5 + Pos.
-224W13 DC 1.5 - Pos.
-224W14 DC 1.6 + Pos.
-224W15 DC 1.6 - Pos.

HELUTHERM 2x1x70mm²

=UNIT_02++
BAT 1-3
BAT 4-5
BAT 6-8
LFP Battery Modul

V3_DC- V3_Ub -227U1 VA_188
&EFS++CONV/227.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V3_DC+ VA_192 VA_190

-231W10 DC 2.1 + Pos.
-231W11 DC 2.1 - Pos.
-231W12 DC 2.2 + Pos.
-231W13 DC 2.2 - Pos.
-231W14 DC 2.3 + Pos.
-231W15 DC 2.3 - Pos.

BAT 9-11
BAT 1-3

V4_L1 V4_L3 -237U1 V4_L2
&EFS++CONV/237.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V4_DC+ V4_DC- V4_Ub

-237W10 DC 2.4 + Pos.
-237W11 DC 2.4 - Pos.
-237W12 DC 2.5 + Pos.
-237W13 DC 2.5 - Pos.
-237W14 DC 2.6 + Pos.
-237W15 DC 2.6 - Pos.

BAT 4-6
BAT 7-8
BAT 9-11

PIII 3_1
-
PIII_3_3
-207Q1
3X250A Stack

PT100
-207L1
&EFS++CONV/207.1
0,6mH
3*250A

PIII 4_1
-
PIII_4_3
-217Q1
3X250A Stack

PT100
-217L1
&EFS++CONV/217.1
0,6mH
3*250A

N
78W4:N
&EFS++CONV/78.3
PEN
78W5:PE
&EFS++CONV/78.2

UDC_LINK_+ 2a.2 /
UDC_LINK_N 2a.5 /
UDC_LINK_- 2a.2 /

previous page: &EAC/6a

next page: 2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0
Date	18.06.2024	Norm		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Proved by							
Date							

=	UNIT_01	Converter Container 1	
&	EFA	Single line diagram	
++			page: 1a
+			total: 492

Single line diagram

Control circuit

++CONV

++CT
+CTRL_1

CTRL

UDC_LINK_+ / 1a.4

UDC_LINK_- / 1a.4

UDC_LINK_N / 1a.4

+4

-173F2 &EFS++CT/173.2 10A

-173F3 &EFS++CT/173.4 1A

-173K2 1500V 30A DC

-173R3 500 Ohm 150 W

-173R4 500 Ohm 150 W

-173K1 1500V 30A DC

-173R1 500 Ohm 150 W

-173R2 500 Ohm 150 W

V1_DC-

V1_DC+

+4

V1_L1 V1_L2 V1_L3

-85U1 &EFS++CT/85.6 L1 L2 L3 DC+ DC-

-171F1 &EFS++CT/171.2 10A

-171K1 &EFS++CT/171.7 1500V 50A DC

-171K2 &EFS++CT/171.8 1500V 50A DC

-171R1 &EFS++CT/171.1 15 Ohm 300W

-171R2 &EFS++CT/171.2 15 Ohm 300W

Precharge Resistors

Grid 400V
inc. overvotage fuse
& Fuse ??A(20A)

+3
Main mounting plate

1-6
-XE
1

-84F2

>+
CTRL_1.1
-84Q1

AC L1,L2,L3

101T1 &EFS++CT/101.2

24V DC supply unit

102G1 &EFS++CT/102.2
24V DC UPS

+24VDC
GND

+ 24V DC
24V GND

-102G2 &EFS++CT/102.6 Battery

-103F1 - 103F4 &EFS++CT/103.2 F2, 10A 60VDC

-103F5 &EFS++CT/103.9 F2, 10A 60VDC

-186K1 &EFS++CT/186.6

-186B1 &EFS++CT/186.6

24V Supply
Main PLC
ET200SP

+24V DC
for Control Cabinet

24V GND

400V AC
Control Cabinet

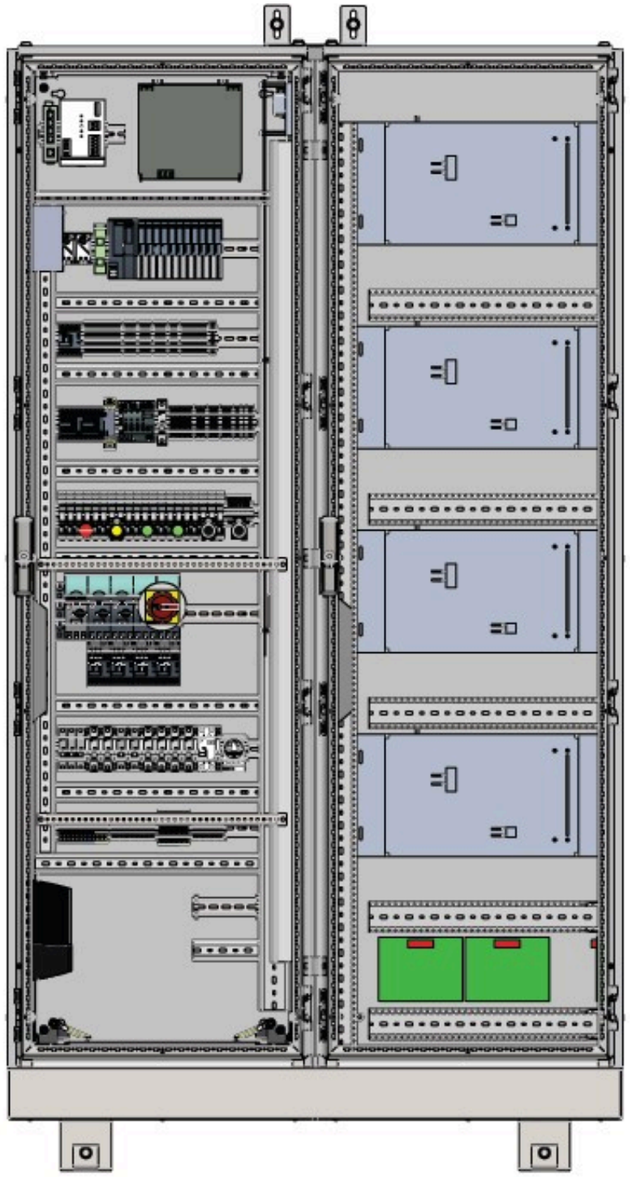
Thermostat
for start PLC

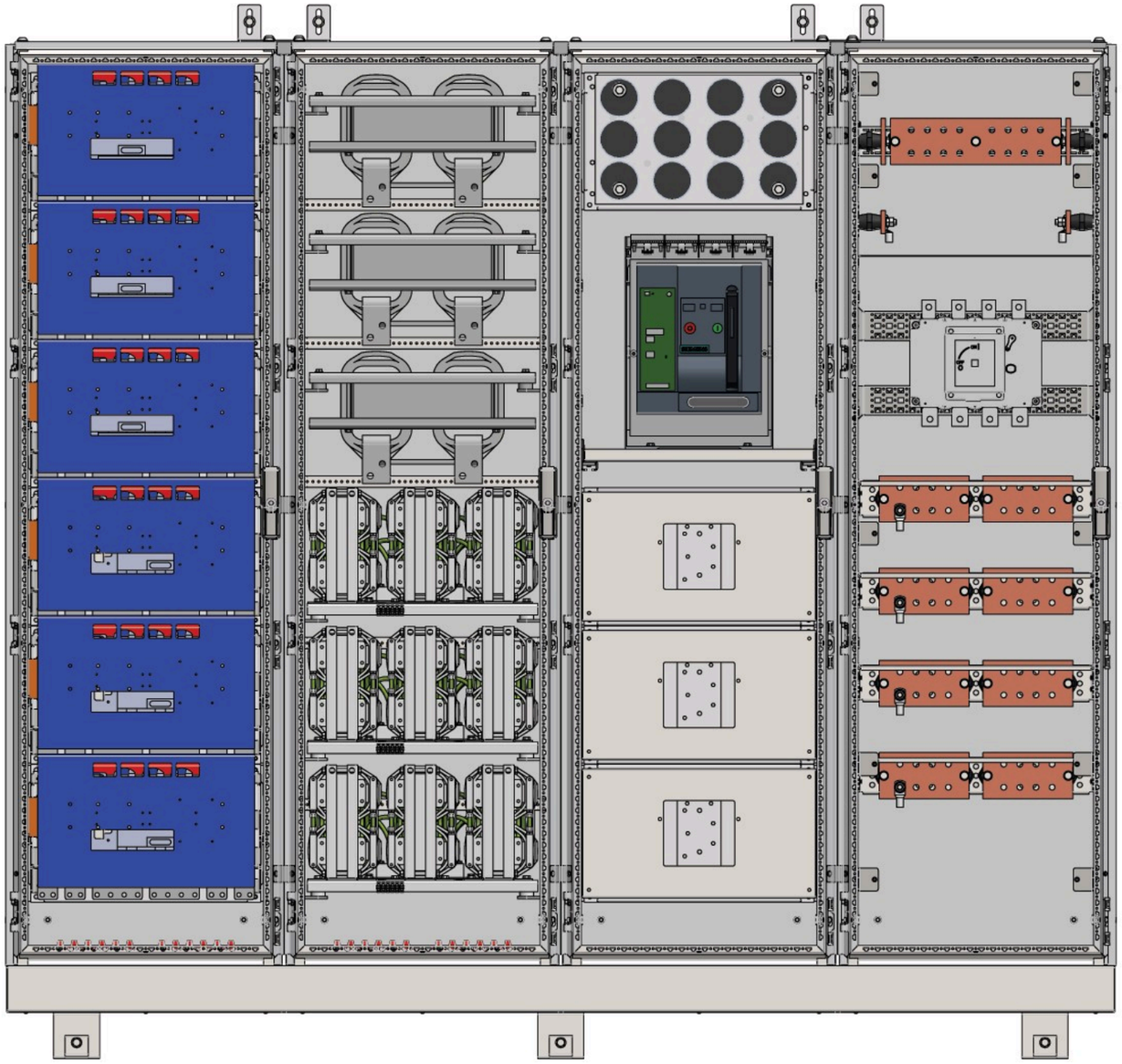
previous page: 1a

next page: &ELU/5a

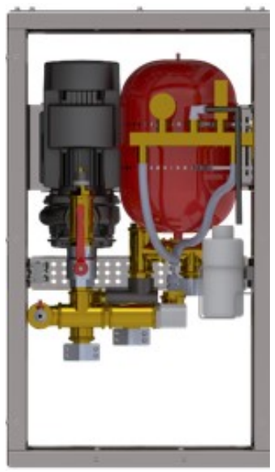
Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 2a
Date								+	total: 492

0	1	2	3	4	5	6	7	8	9









+CTRL_1
Control cabinet 1

+CTRL_2
Control cabinet 2

++CT Control cabinets

+CON
Converter cabinet

+IND
Inductor cabinet

+CIR
Circuit Breaker cabinet

+AC_DC
AC and DC connection cabinet

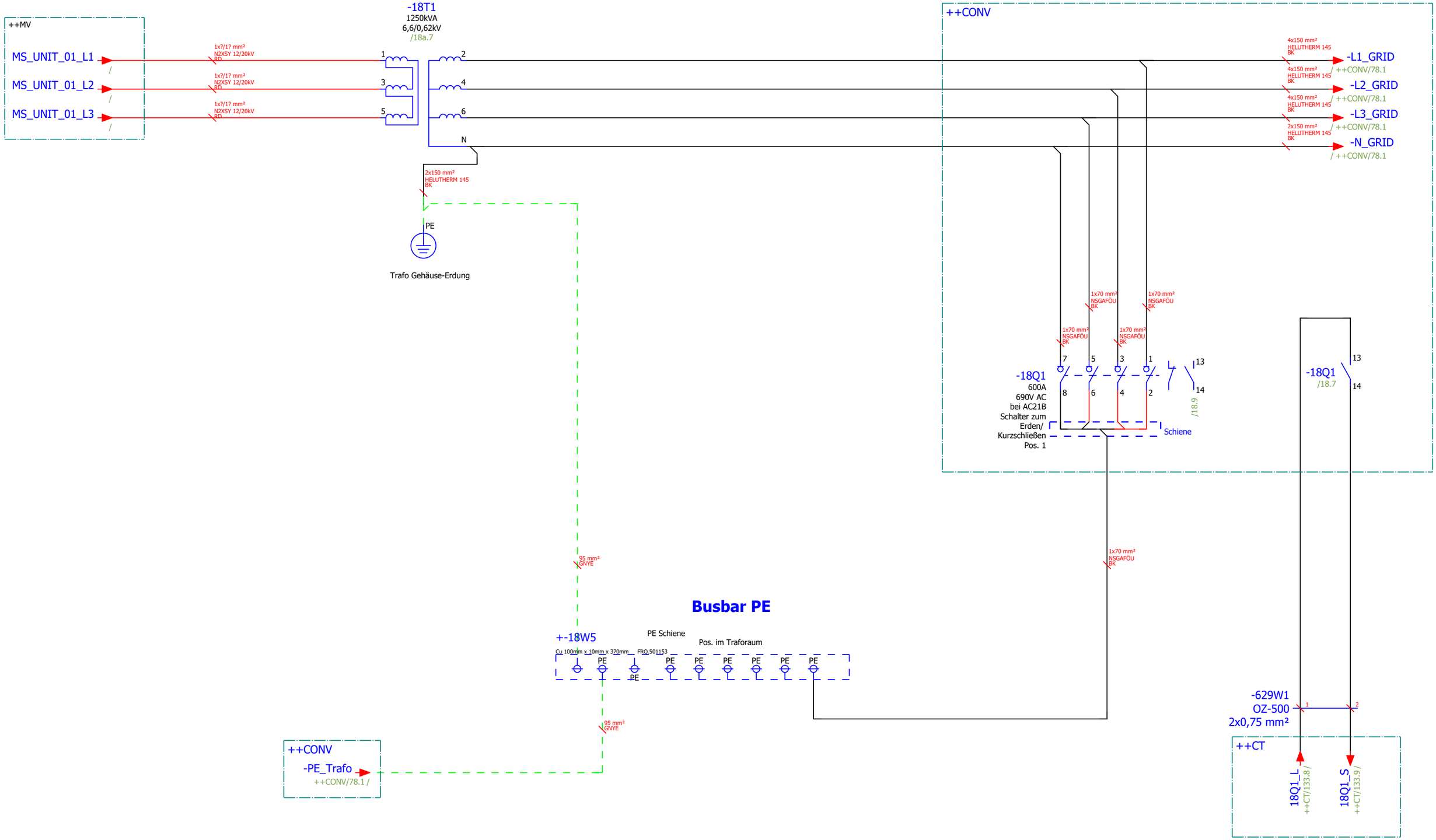
++CONV Converter

++FAN
FAN

previous page:
&EFA/2a

next page:
&EFS++TRA/18

Editor	Freqcon_DG			Statron	FREQCON	CABINETS OVERVIEW	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024	Norm						& ELU	Cabinet Overview
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



Earthing switch in On
Transformer 620V side

previous page: &ELU++/5a

next page: 18a

Editor	Freqcon_DG			Statron	FREQCON	MV-TRANSFORMER UNIT_01+02	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer page: 18
Date								+ total: 492

++CT
+CTRL_1.2
-18B1
PWR07
Trafo-
Temperaturüberwachung
Pos: in Tür +ASC

SUPPLY
24-240V AC DC

ALARM

FAULT

FAN

PT100 SENSORS

CH 1

CH 2

CH 3

CH 4

40 41 42 4 5 6 7 8 9 1 2 3 4 5 6 13 14 15 16 17 18 19 20 21 22 23 24

0,75 mm² RT

-18W2
JZ-500
8G1,5 mm²

1 GNYE 2 3 4 5 6

-18W1
F-CY-OZ (LiY-CY)
10x1,5 mm²
500V
geschirmt

1 2 3 4 5 6 7 8 9

-18T1
/18.2

3x PT100 Fühler in NS-Wicklung Trafo

CH 3 CH 2 CH 1

3 2 1 3 2 1 3 2 1

++CT

-1L+3 ++CT/103.2/
-1PE5 ++CT/103.4/
-1M6 ++CT/103.3/
-PreAlarm ++CT/133.0/
-Trip ++CT/133.0/
-Fault ++CT/133.0/
-Fan ++CT/133.0/

previous page:
18

next page:
++CONV/78

Editor	Freqcon_DG			Statron	FREQCON	TEMPERATURE TRANSFORMER UNIT_01+02	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer	page: 18a
Date								+		total: 492

Grid Busbars L1, L2, L3

++TRA

-L1_GRID ++TRA/18.9 /
-L2_GRID ++TRA/18.9 /
-L3_GRID ++TRA/18.9 /

+AC_DC-78W1 GRID L1 Pos. 1/ Links
Cu 100mm x 10mm x 370mm FRQ.52163 &EFA++/1a.0
+AC_DC-78W2 GRID L2 Pos. 1/ Mitte
Cu 100mm x 10mm x 370mm FRQ.52163
+AC_DC-78W3 GRID L3 Pos. 1/ Rechts
Cu 100mm x 10mm x 370mm FRQ.52163

4x50 mm² NSGAFöu BK → -L1CON1 / 80.0
4x50 mm² NSGAFöu BK → -L2CON1 / 80.0
4x50 mm² NSGAFöu BK → -L3CON1 / 80.0

25 mm² NSGAFöu BK
+AC_DC -78F1 690Vac 100A gL/gG NH00 /78.8
1 3 5 13 21 / 2 4 6 14 22

-1F2 / ++CT/127.4
F3 / 238b.9

-238W7 OZ-500 2x0,75 mm² /238a.2
0,75 mm² BU
+AC_DC -X3.43 20 19

-78W7 OZ-500 2x0,75 mm²
1 2 / 13 14

25 mm² BK
+AC_DC -78F2 Typ 1 + Typ 2 400/690 V~
L1 L2 L3 / PE PE

+AC_DC -78F3 20A, aR
1 3 5 / 2 4 6

-78W6 OZ-600 3x2,5 mm² 0,6kV/1kV
1 2 3

+AC_DC -78F1 /78.6

-CHA_L1 ++CT/85.1 /
-CHA_L2 ++CT/85.1 /
-CHA_L3 ++CT/85.1 /

35 mm² GNYE

Busbars N

-N_GRID ++TRA/18.9 /

+AC_DC-78W4 GRID N &EFA++/1a.1 Pos. unten Links
Cu 50mm x 10mm x 370mm FRQ.50622
16 mm² NSGA Föu BK
-AC_F_N.1 83.3 /
-AC_F_N.2 83.3 /
-AC_F_N.3 83.3 /
2x50 mm² NSGAFöu BK → GRID_N / 99.5

Busbars PE

Einspeisung_IEC_Seite 78
Einbauort_Sicherung in Connection cabinet

-PE_Trafo ++TRA/18.2 /

+AC_DC-78W5 GRID PE &EFA++/1a.1 Pos. unten rechts
Cu 100mm x 10mm x 370mm FRQ.50070

95 mm² GNYE
35 mm² GNYE

PE_2_1 238a.1 /
PE_2_2 238a.4 /
PE_2_3 238a.8 /
PE_3_1 228.1 /
PE_3_2 228.4 /
PE_3_3 228.8 /
PE_4_1 238b.1 /
PE_4_2 238b.4 /
PE_4_3 238b.8 /

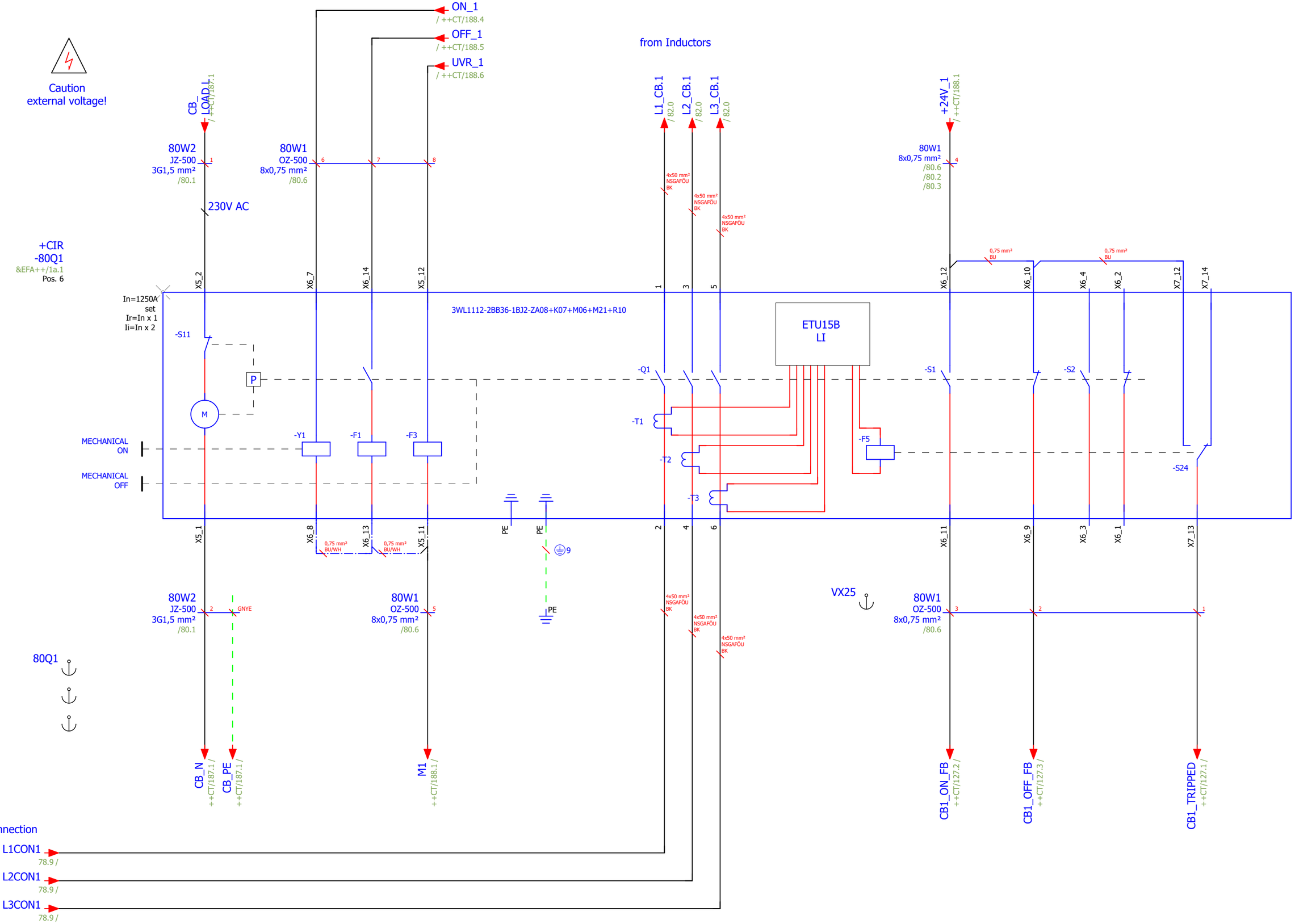
=UNIT_02 PE_BAT_CONV_1 =UNIT_02++Container/278.5 /
=UNIT_03 PE_BAT_CONV_2 =UNIT_03++Container/278.5 /

PE Container
PE Cabinet base frame front side
PE Cabinet base frame back side

400V TYP 1

previous page: ++TRA/18a
next page: 80

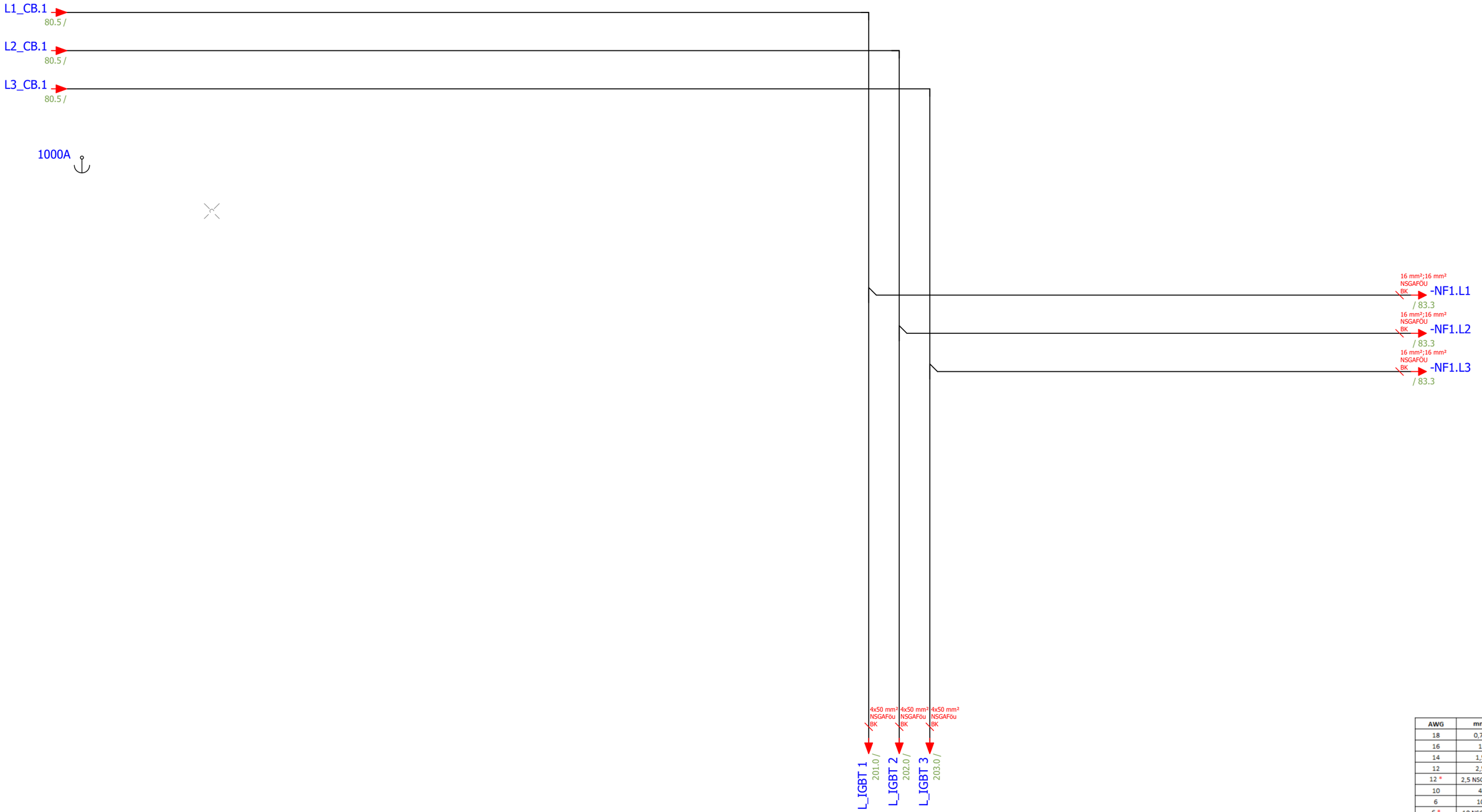
Editor	Freqcon_JD			Statron	FREQCON	GRID CONNECTION	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	



previous page: 78

next page: 82

Editor	Freqcon_JD			Statron		BG CIRCUIT BREAKER 1000A AC GRID	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024				FREQCON			& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 80
Date								+	total: 492



AWG	mm²
18	0,75
16	1
14	1,5
12	2,5
12 *	2,5 NSGAFÖu
10	4
6	10
6 *	10 NSGAFÖu
4	16
2	25
2 *	16 NSGAFÖu
1	35
250 kcmil	95 ALU
2x2	1x70 NSGAFÖu
2x4	2x70 NSGAFÖu
4x250 kcmil	4x70 NSGAFÖu
6x250 kcmil	6x70 NSGAFÖu

*cable into seperate UL protective tube

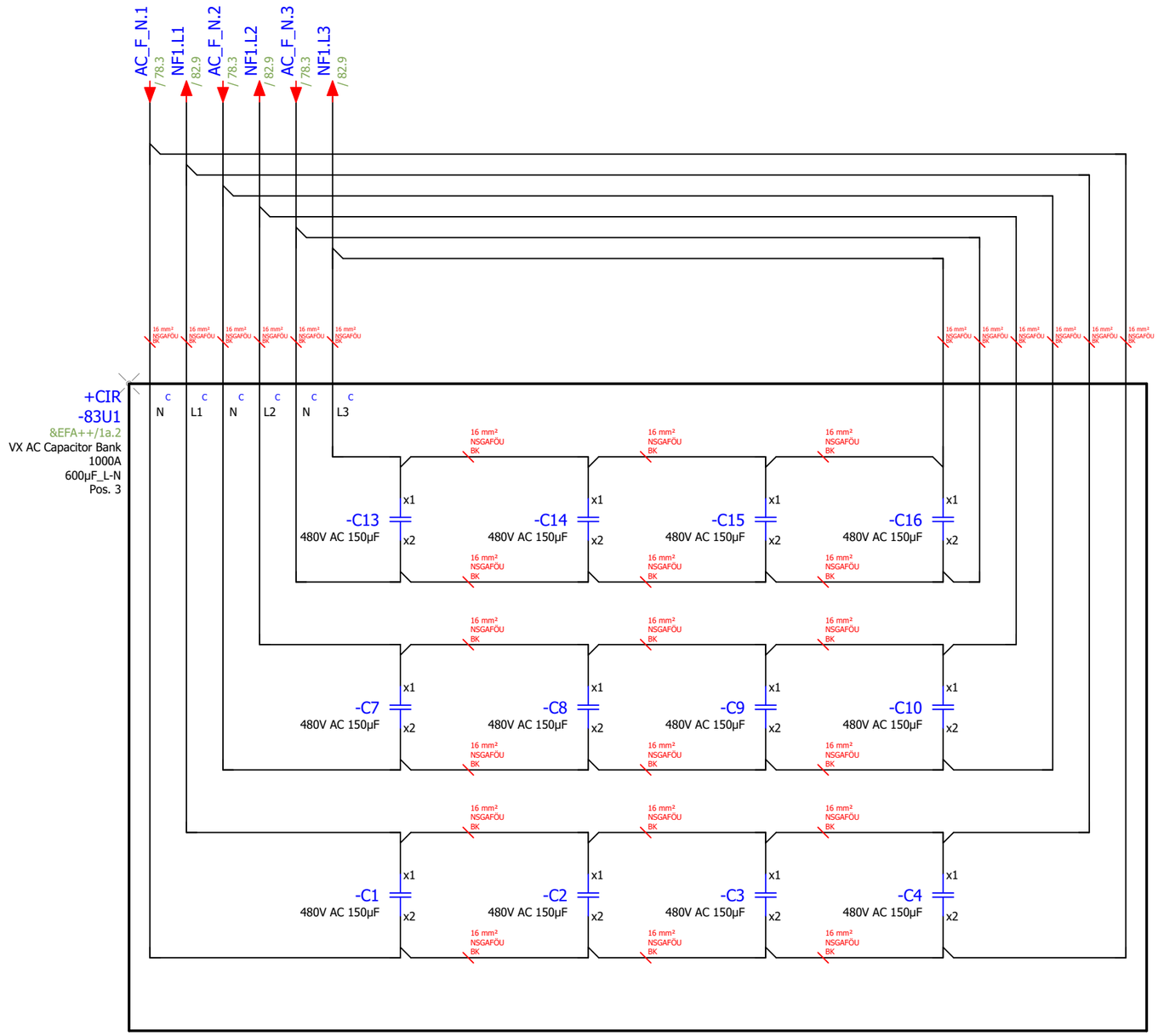
previous page:
80

next page:
83

Editor	Freqcon_JD			Statron	FREQCON	PI INDUCTORS GRID SIDE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 82
Date								+		total: 492

to polarity bar

behind main breaker



AWG	mm²	
18	0,75	
16	1	
14	1,5	
12	2,5	
12 *	2,5 NSGAFöu	
10	4	
6	10	
6 *	10 NSGAFöu	
4	16	
2	25	
2 *	16 NSGAFöu	
1	35	
250 kcmil	95 ALU	
2x2	1x70 NSGAFöu	
2x4	2x70 NSGAFöu	
4x250 kcmil	4x70 NSGAFöu	
6x250 kcmil	6x70 NSGAFöu	

*cable into seperate UL protective tube

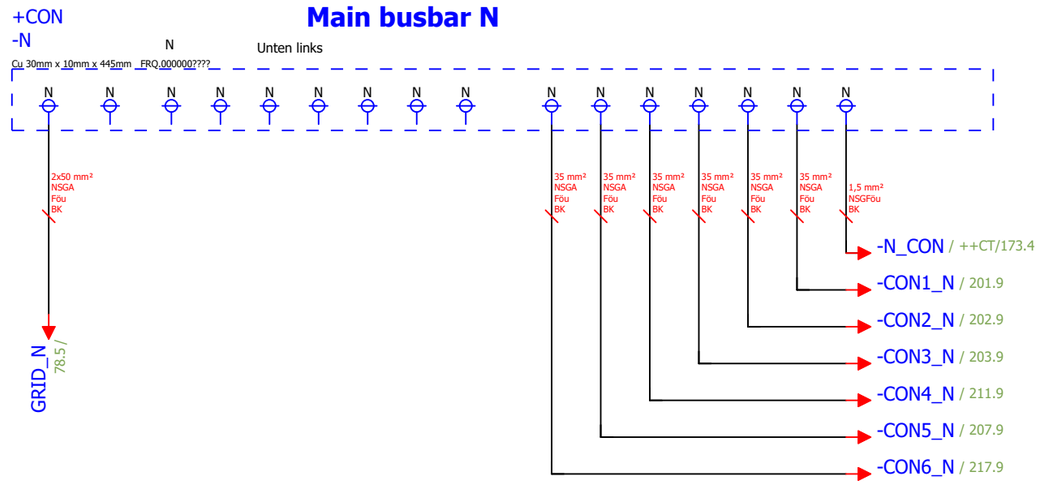
83U1

previous page: 82

next page: 99

Editor	Freqcon_JD			Statron	FREQCON	GRID AC FILTER 3* 600 µF + OVERVOLTAGE PROTECTOR	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 83
Date								+		total: 492

in converter cabinet



1000A

previous page: 83

next page: 200

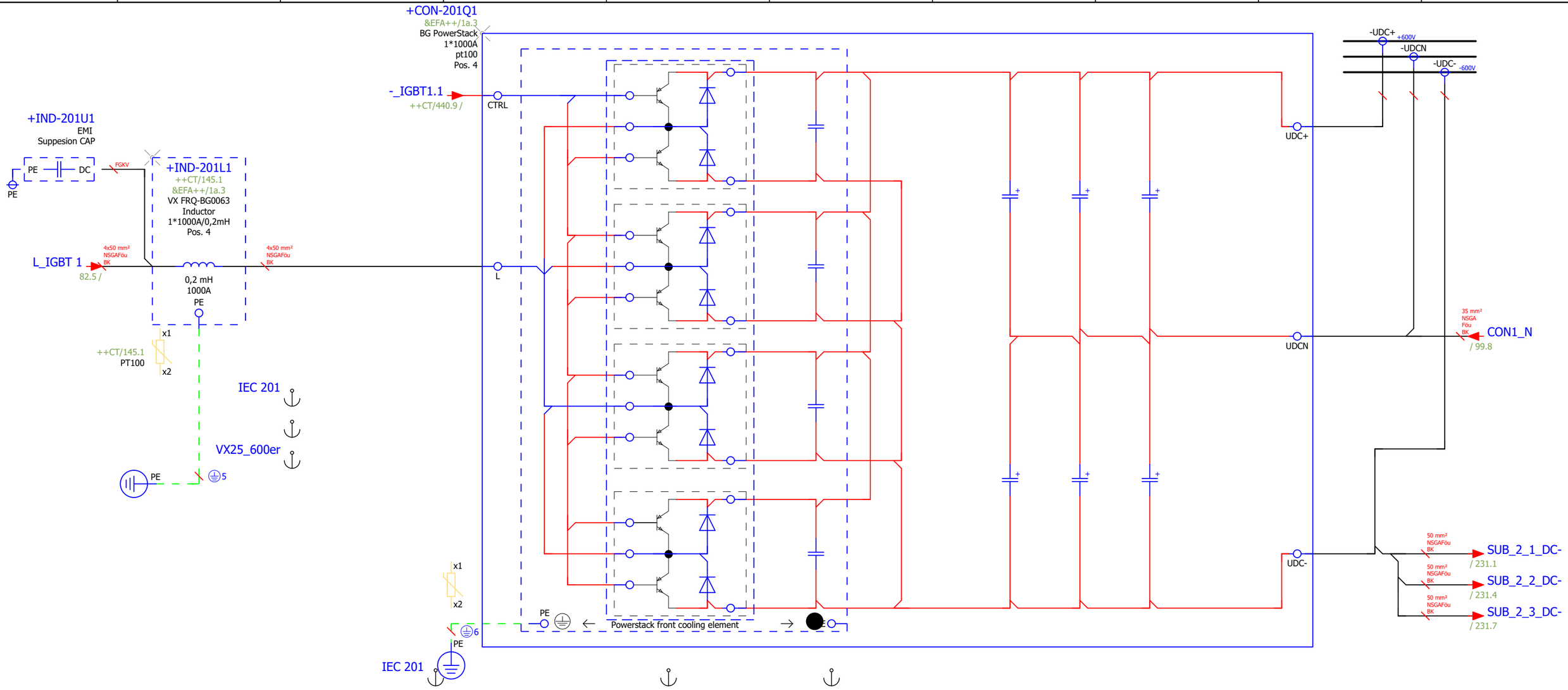
Editor	Freqcon_JD			Statron	FREQCON	BUSBARS N, PE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 99
Date								+	total: 492

Power Circuits

Pages 200 - 299

- Converter cabinet
- Inductor cabinet
- Circuit Breaker cabinet

Editor	Freqcon_JD			Statron	FREQCON	POWER CIRCUITS COVER PAGE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 200
Date								+	total: 492



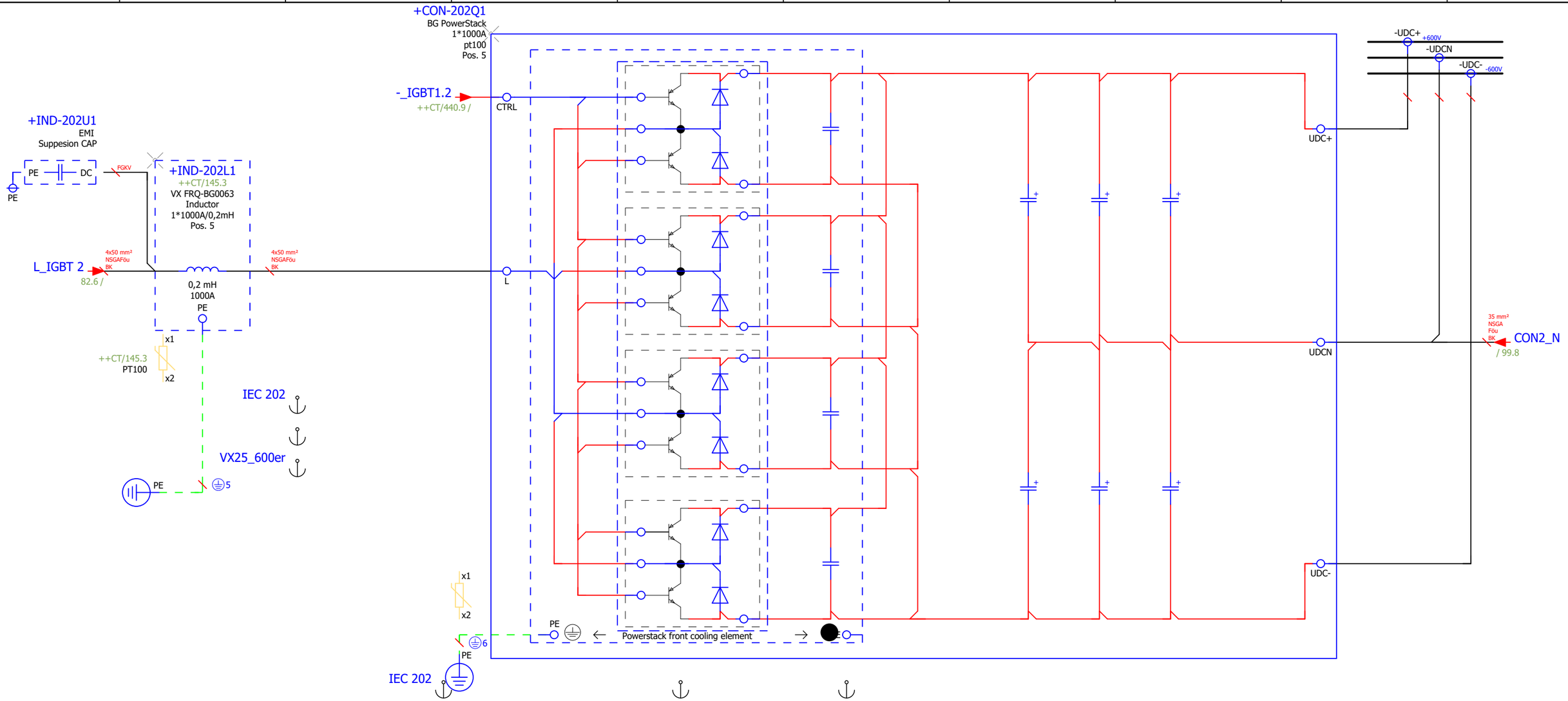
previous page: 200

next page: 202

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR FOR GRID PHASE 1	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 201

total: 492

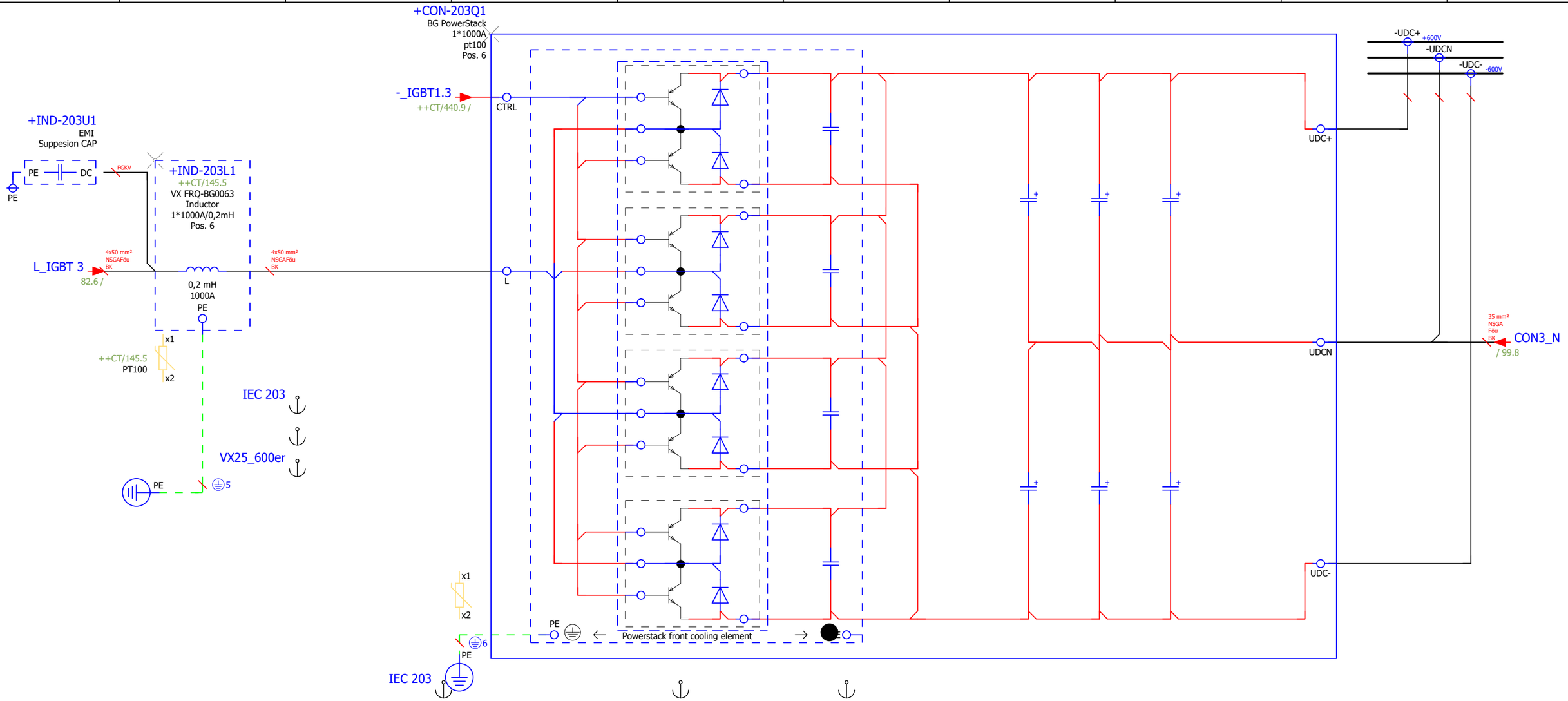


previous page:
201

next page:
203

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR FOR GRID PHASE 2	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 202
total: 492



previous page:
202

next page:
207

Editor	Freqcon_JD			Statron		IGBT & INDUCTOR FOR GRID PHASE 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 203
Date								+	total: 492

+CON-207Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 1

-_IGBT3.1_2
207.9 /
CTRL

+IND-207L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 1

L_IGBT 3_1
227.0 /
50 mm² NSGAFöu BK
0,6mH
L:1

L_IGBT 3_2
227.3 /
50 mm² NSGAFöu BK
0,6mH
L:2

L_IGBT 3_3
227.6 /
50 mm² NSGAFöu BK
0,6mH
L:3

PE.1 PE.2 PE.3

IEC 204 DC

++CT/146.5
PT100
x1 x2
++CT/146.7
x1 x2
++CT/147.1
x1 x2

VX25

PE
5

PE
5

PE
5

x1
x2
6
PE

IEC 204

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON5_N
/ 99.8

+CON-207Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT3.1
++CT/442.9 /
X1
25-POL SUB-D SOCKET

-_IGBT3.2
++CT/442.9 /
X2
25-POL SUB-D SOCKET

-_IGBT3.3
++CT/442.9 /
X3
25-POL SUB-D SOCKET

SKiiP 3 Adapter

FRQ-M00080
FREQCON

Shield connect by a ring cable lug
SH

X4
26-POL Stiftleiste (für Flachband) SOCKET
-_IGBT3.1_2
/ 207.3

previous page: 203
next page: 211

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 3_1 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 207
Date								+ total: 492

+CON-211Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 2

-_IGBT2.1_2
211.9 /

CTRL

+IND-211L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 2

L_IGBT 2_1
231.0 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:1

L_IGBT 2_2
231.3 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:2

L_IGBT 2_3
231.6 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:3

PE.1 PE.2 PE.3

IEC 211 DC

++CT/145.7
PT100
x1 x2
++CT/146.1
x1 x2
++CT/146.3
x1 x2

VX25

PE 5

PE 5

PE 5

x1 x2

6 PE

IEC 211

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON4_N
/ 99.8

+CON-211Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT2.1
++CT/441.9 /
X1
25-POL SUB-D SOCKET

-_IGBT2.2
++CT/441.9 /
X2
25-POL SUB-D SOCKET

-_IGBT2.3
++CT/441.9 /
X3
25-POL SUB-D SOCKET

Shield connect by a ring cable lug
SH

SKiiP 3 Adapter

FRQ-M00080
FREQCON

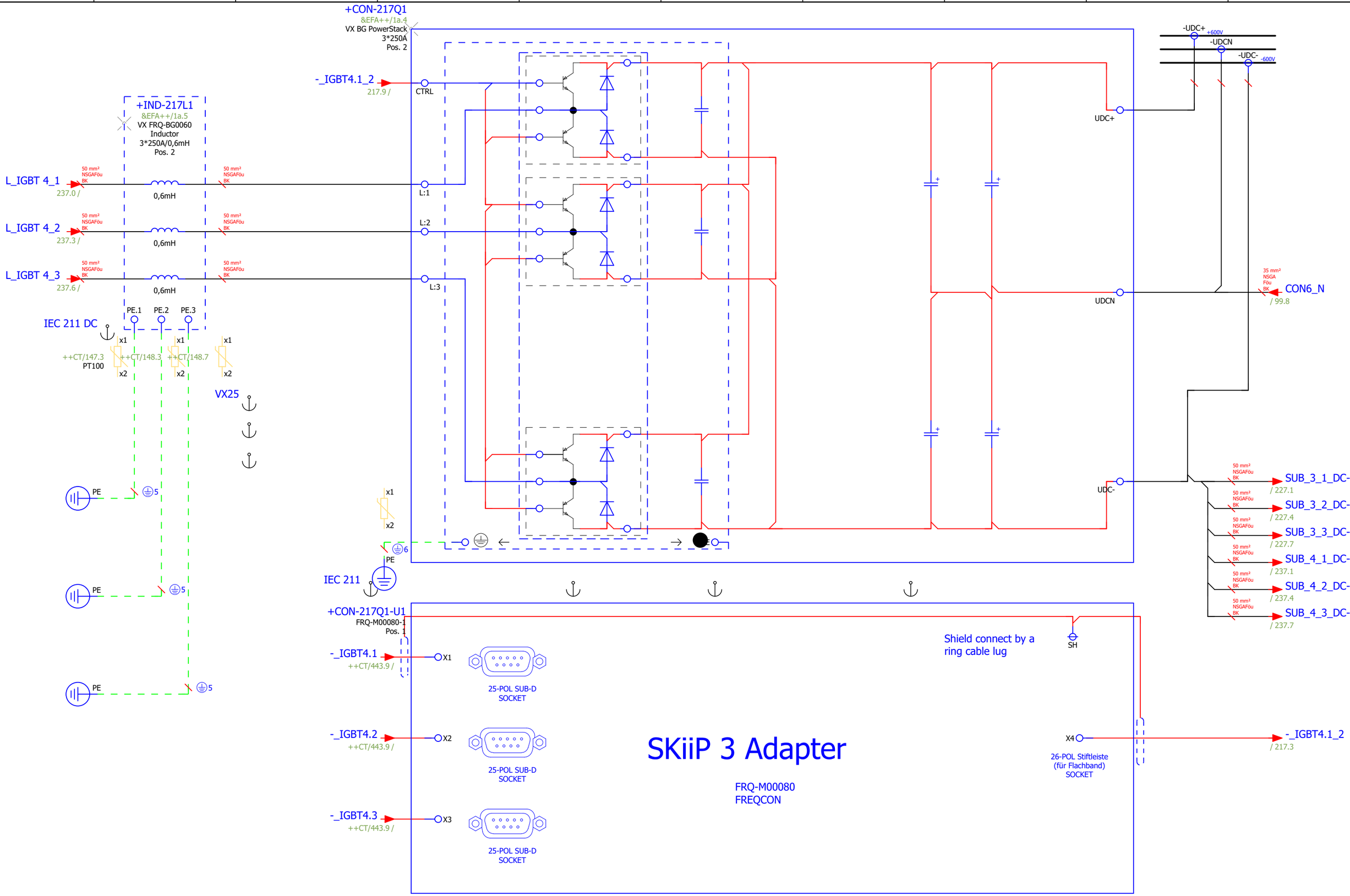
X4
26-POL Stiftleiste (für Flachband) SOCKET

-_IGBT2.1_2
/ 211.3

previous page: 207

next page: 217

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 2_1 -2_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	



previous page: 211

next page: 227

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 4_1 -4_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 217

total: 492

VX25

224

Spare connections, if the BSU will be from here 20A supplied.

* cable intro seperate UL protrctive tube

L_IGBT 3_1 / 207.0 — SUB_3_1_V / ++CT/163.9 — SUB_3_1_DC- / 217.9 — SUB_3_1_V.1 / ++CT/162.9

L_IGBT 3_2 / 207.0 — SUB_3_2_V / ++CT/163.9 — SUB_3_2_DC- / 217.9 — SUB_3_2_V.1 / ++CT/162.9

L_IGBT 3_3 / 207.0 — SUB_3_3_V / ++CT/163.9 — SUB_3_3_DC- / 217.9 — SUB_3_3_V.1 / ++CT/162.9

227W1 OZ-600 2x0,75 mm² (1 / 2)

227W2 OZ-600 2x0,75 mm² (1 / 2)

227W3 OZ-600 2x0,75 mm² (1 / 2)

+CIR
-227U1
/227.a.0
&EFA++/1a.6
VX DC switch and Fuse
3*250A
1000V
Pos. 1

50 mm² NSGAFöu BK

PE

7

PE

Rear mounting plate

IGBT1 1+ — V_IGBT1 1+ — V_DC1 1+ — V_DC 1-

UDC [1]-

IGBT2 2+ — V_IGBT2 2+ — V_DC2 2+

UDC [2]-

IGBT3 3+ — V_IGBT3 3+ — V_DC3 3+

UDC [3]-

F3 1A — -C1 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F4 1A [20A, aR (BSU)] — F0 [20A, aR (BSU)]

F7 1A — -C7 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F8 1A

F11 1A — -C13 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F12 1A

16 mm² NSGAFöu BK

AWG	mm²	*cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

Front mounting plate — PE — -U1 EMI Suppesion CAP — PE — Front mounting plate — PE

16 mm² FGKV

PE

1 2 3 4 5 6

16 mm² in Shrin-kable Tube FGKV

-K1 /227.a.1 1500V 300A — -K7 /227.a.3 1500V 300A

-K2 /227.a.2 1500V 300A — -K8 /227.a.4 1500V 300A

-K3 /227.a.2 1500V 300A — -K9 /227.a.5 1500V 300A

A1 A2

70 mm² NSGAFöu BK

-F1 /227.a.7 1250V 400A 1KN/110 HLS Datenblatt

-F2 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F5 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F6 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F9 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F10 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

IEC

DC1 + — DC1 -

DC2 + — DC2 -

DC3 + — DC3 -

*2

The single conductor must be placed in the protective tube

EEC

DC+ and DC- Busbars in Connection cabinet

+AC_DC-227W10 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_1 + Pos. =UNIT_02 — DC+3_1_BAT / =UNIT_02++ASC/678.7

+AC_DC-227W11 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_1 - Pos. — DC-3_1_BAT / =UNIT_02++ASC/678.7

DC+3_1 / 228.1

DC-3_1 / 228.1

+AC_DC-227W12 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_2 + Pos.

+AC_DC-227W13 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_2 - Pos.

DC+3_2 / 228.4

DC-3_2 / 228.4

+AC_DC-227W14 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_3 + Pos. =UNIT_03 — DC+3_3_BAT / =UNIT_03++ASC/678.0

+AC_DC-227W15 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_3 - Pos. — DC-3_3_BAT / =UNIT_03++ASC/678.0

DC+3_3 / 228.7

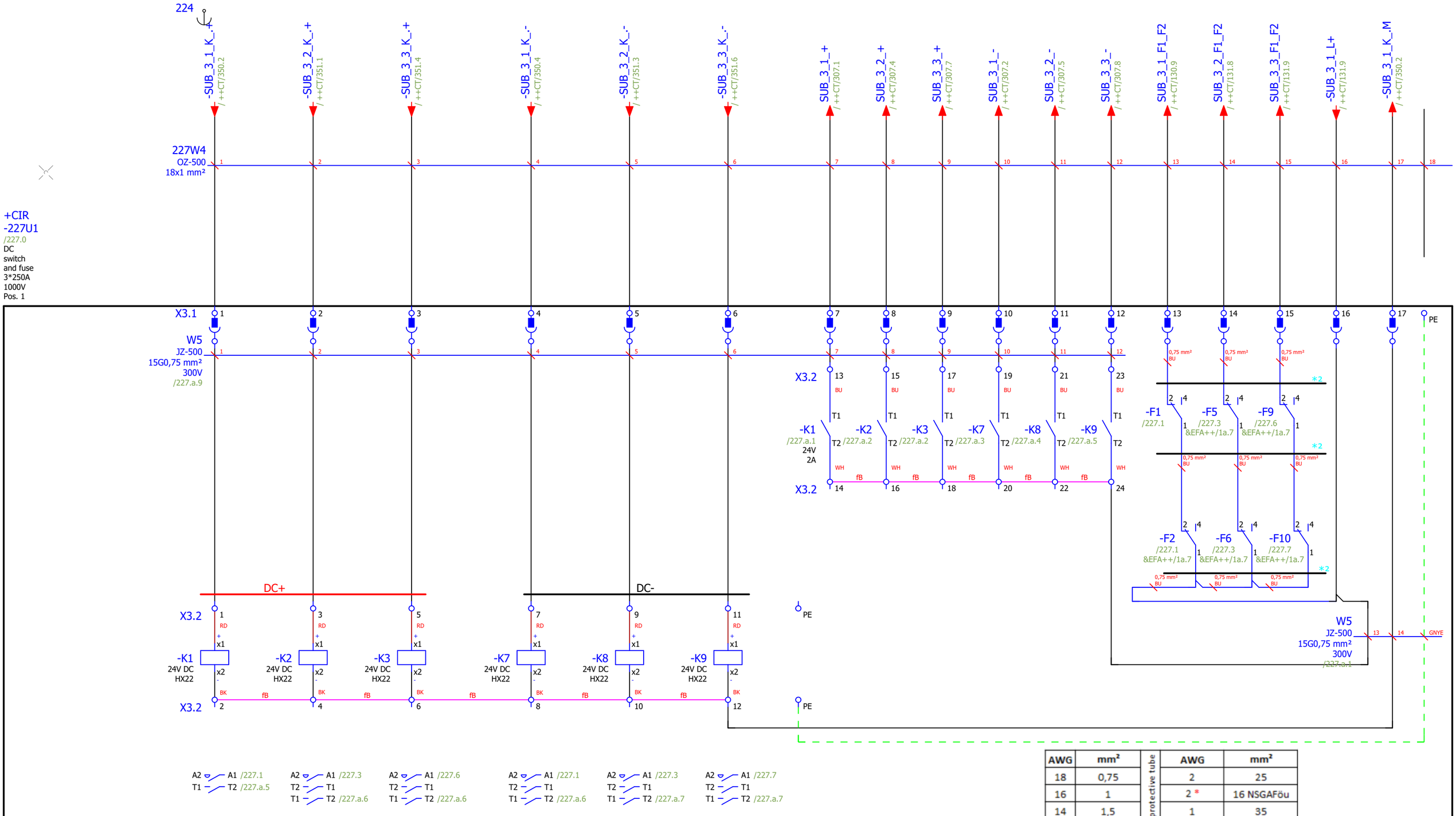
DC-3_3 / 228.8

previous page: 217

next page: 227.a

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 227
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 227

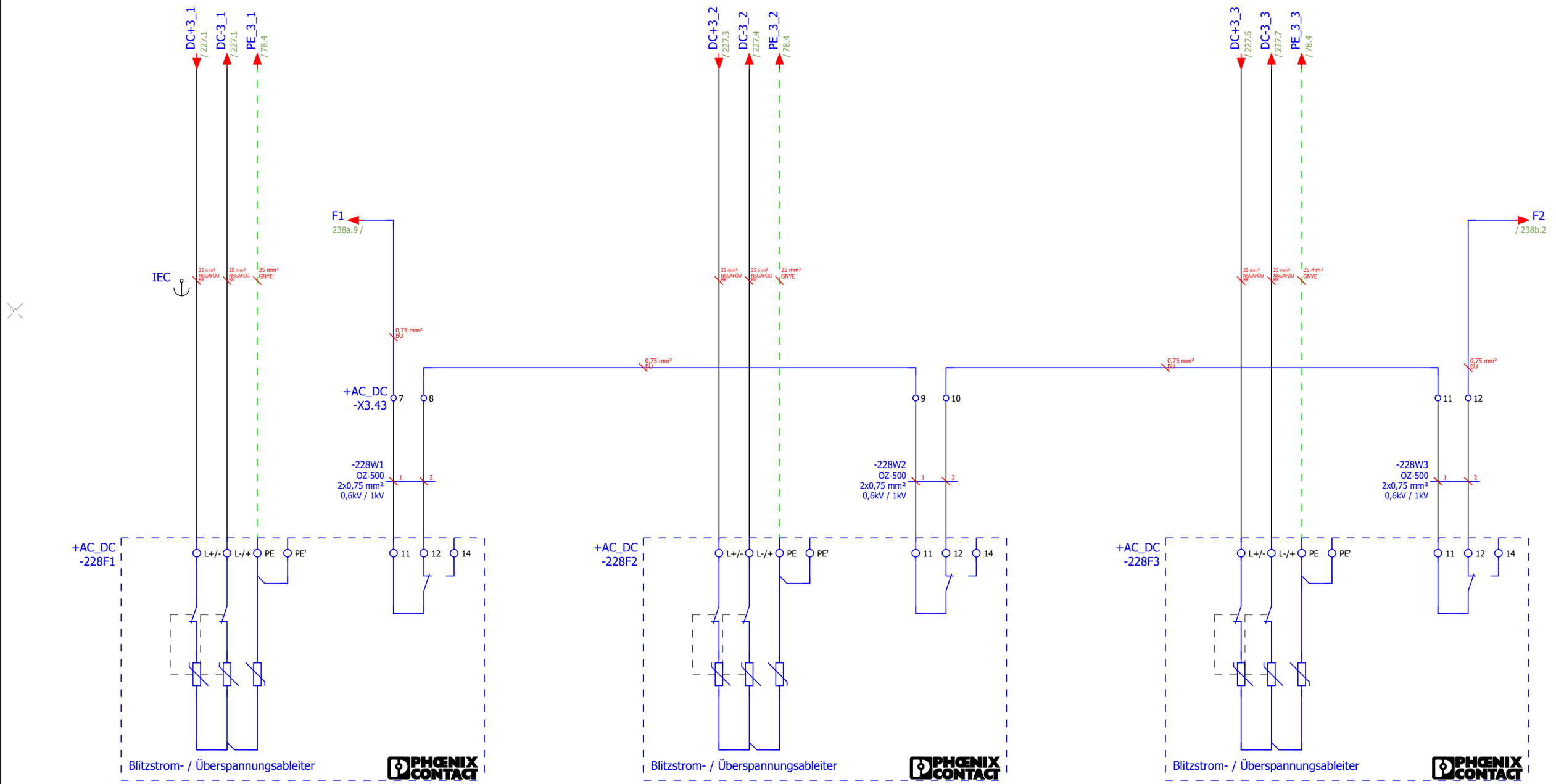
next page: 228

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 227.a
							+ total: 492

DC+ and DC- Busbars

DC+ and DC- Busbars

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 3_1

SURGE ARRESTER
DC SUBSYSTEM 3_2

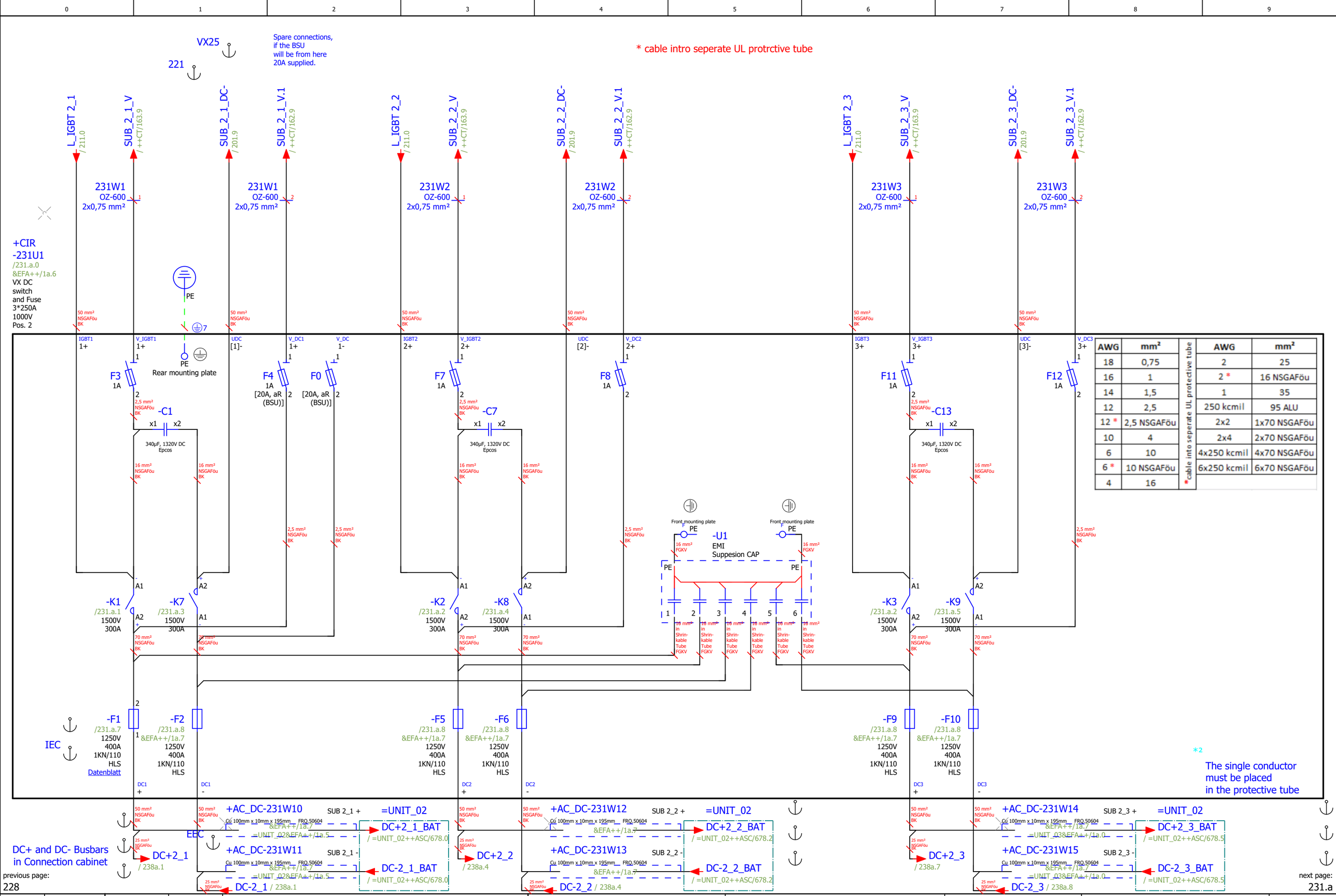
SURGE ARRESTER
DC SUBSYSTEM 3_3

in Connection cabinet

previous page:
227.a

next page:
231

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 3_1 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 228
Date								+	total: 492

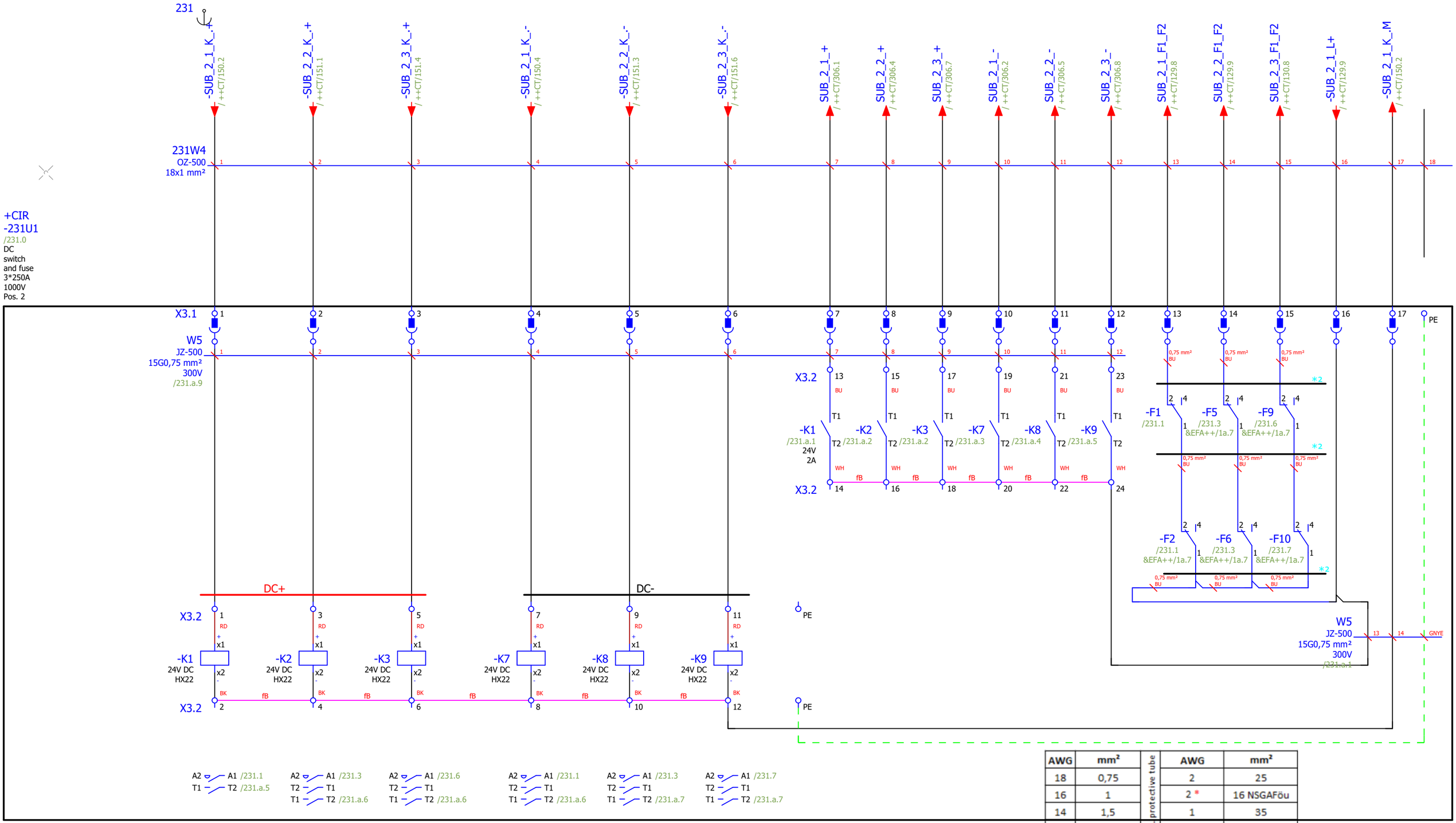


AWG	mm²	AWG	mm²
18	0,75	2	25
16	1	2 *	16 NSGAFöu
14	1,5	1	35
12	2,5	250 kcmil	95 ALU
12 *	2,5 NSGAFöu	2x2	1x70 NSGAFöu
10	4	2x4	2x70 NSGAFöu
6	10	4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu	6x250 kcmil	6x70 NSGAFöu
4	16		

*cable into seperate UL protective tube

Editor	Freqcon_JD			Statron		SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024			Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Proved by							
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 231
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 231

next page: 237

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 231.a
							+ total: 492

VX25
224

Spare connections,
if the BSU
will be from here
20A supplied.

* cable intro seperate UL protrctive tube

+CIR
-237U1
/237.a.0
&EFA++/1a.6
VX DC
switch
and Fuse
3*250A
1000V
Pos. 3

L_IGBT 4_1 / 217.0
SUB_4_1_V / ++CT/164.9
SUB_4_1_DC- / 217.9
SUB_4_1_V.1 / ++CT/164.9
L_IGBT 4_2 / 217.0
SUB_4_2_V / ++CT/164.9
SUB_4_2_DC- / 217.9
SUB_4_2_V.1 / ++CT/164.9
L_IGBT 4_3 / 217.0
SUB_4_3_V / ++CT/164.9
SUB_4_3_DC- / 217.9
SUB_4_3_V.1 / ++CT/164.9

237W1 OZ-600 2x0,75 mm²
237W1 OZ-600 2x0,75 mm²
237W2 OZ-600 2x0,75 mm²
237W2 OZ-600 2x0,75 mm²
237W3 OZ-600 2x0,75 mm²
237W3 OZ-600 2x0,75 mm²

50 mm² NSGAFöu BK

PE
PE
Rear mounting plate
7

IGBT1 1+ | V_IGBT1 1+ | V_DC1 1+ | V_DC 1-
UDC [1]-
IGBT2 2+ | V_IGBT2 2+ | V_DC2 2+
UDC [2]-
IGBT3 3+ | V_IGBT3 3+ | V_DC3 3+
UDC [3]-

F3 1A
F4 1A [20A, aR (BSU)]
F0 [20A, aR (BSU)]
F7 1A
F8 1A
F11 1A
F12 1A

2,5 mm² NSGAFöu BK

-C1
-C7
-C13
x1 x2
340µF, 1320V DC Epcos
16 mm² NSGAFöu BK

Front mounting plate
PE
-U1
EMI
Suppesion CAP
16 mm² FGKV
1 2 3 4 5 6
16 mm² in Shrin-kable Tube FGKV

-K1 /237.a.1 1500V 300A
-K7 /237.a.3 1500V 300A
-K2 /237.a.2 1500V 300A
-K8 /237.a.4 1500V 300A
-K3 /237.a.2 1500V 300A
-K9 /237.a.5 1500V 300A
A1 A2

70 mm² NSGAFöu BK

-F1 /237.a.7 1250V 400A 1KN/110 HLS Datenblatt
-F2 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F5 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F6 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F9 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F10 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
IEC

DC1 + / DC1 -
DC2 + / DC2 -
DC3 + / DC3 -

*2
The single conductor
must be placed
in the protective tube

AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

EEC

+AC_DC-237W10 SUB 4_1 + Pos. =UNIT_03 → DC+4_1_BAT / =UNIT_03++ASC/678.2
+AC_DC-237W11 SUB 4_1 - Pos. → DC-4_1_BAT / =UNIT_03++ASC/678.2
+AC_DC-237W12 SUB 4_2 + Pos. =UNIT_03 → DC+4_2_BAT / =UNIT_03++ASC/678.5
+AC_DC-237W13 SUB 4_2 - Pos. → DC-4_2_BAT / =UNIT_03++ASC/678.5
+AC_DC-237W14 SUB 4_3 + Pos. =UNIT_03 → DC+4_3_BAT / =UNIT_03++ASC/678.7
+AC_DC-237W15 SUB 4_3 - Pos. → DC-4_3_BAT / =UNIT_03++ASC/678.7

Cu 100mm x 10mm x 195mm FRQ.50604 &EFA++/1a.7 =UNIT_03&EFA++/1a.0
Cu 100mm x 10mm x 195mm FRQ.50604 &EFA++/1a.7 =UNIT_03&EFA++/1a.5

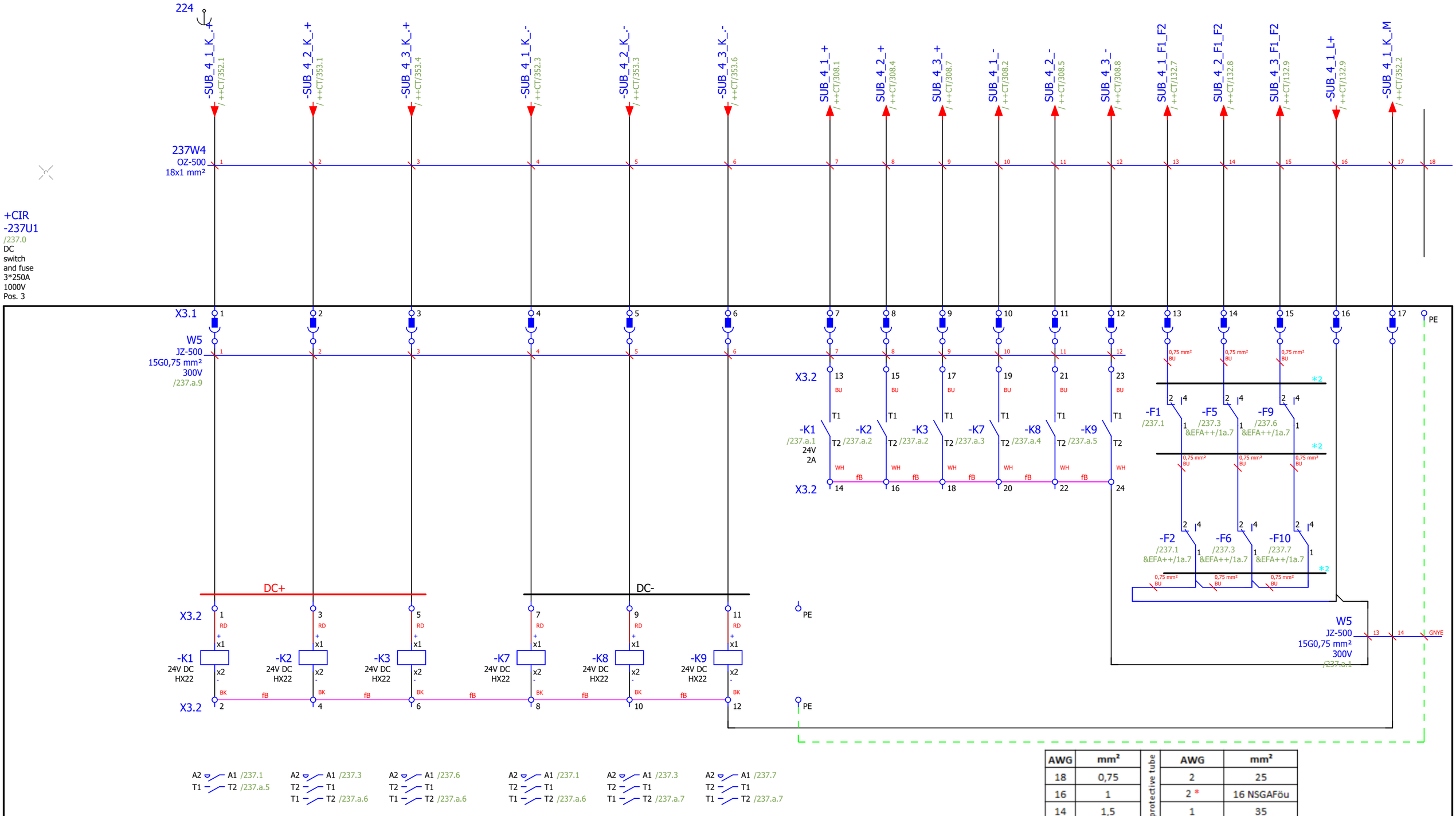
DC+4_1 / 238b.1
DC-4_1 / 238b.1
DC+4_2 / 238b.4
DC-4_2 / 238b.4
DC+4_3 / 238b.7
DC-4_3 / 238b.8

DC+ and DC- Busbars
in Connection cabinet

previous page: 231.a
next page: 237.a

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						10354_23A2007
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 237
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 237

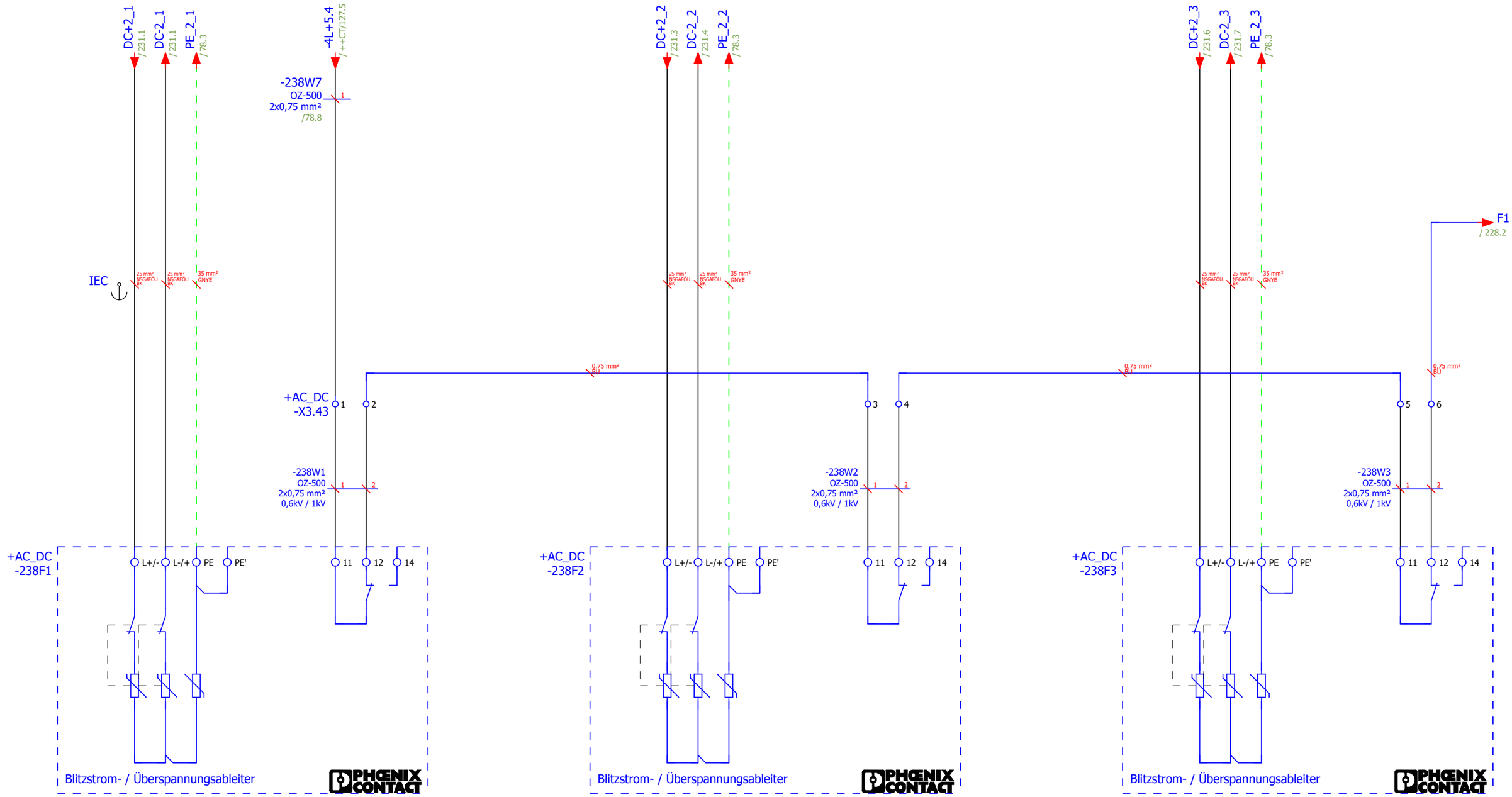
next page: 238a

Editor	Freqcon_DG			Statron	FREQCON	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	20250805_V2.0
Date	29.07.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 237.a
							+ total: 492

DC+ and DC- Busbars

DC+ and DC- Busbars

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 2_1

SURGE ARRESTER
DC SUBSYSTEM 2_2

SURGE ARRESTER
DC SUBSYSTEM 2_3

in Connection cabinet

previous page:
237.a

next page:
238b

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 2_1 - 2_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 238a
Date								+ total: 492

DC+ and DC- Busbars

DC+4_1 / 237.1
DC-4_1 / 237.1
PE_4_1 / 78.4

IEC

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F2
228.9 /

0,75 mm² BU

+AC_DC
-X3.43
13 14

-238W4
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F4
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_1

DC+ and DC- Busbars

DC+4_2 / 237.3
DC-4_2 / 237.4
PE_4_2 / 78.4

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

0,75 mm² BU

15 16

-238W5
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F5
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_2

DC+ and DC- Busbars

DC+4_3 / 237.6
DC-4_3 / 237.7
PE_4_3 / 78.5

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F3
/ 78.9

0,75 mm² BU

17 18

-238W6
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F6
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

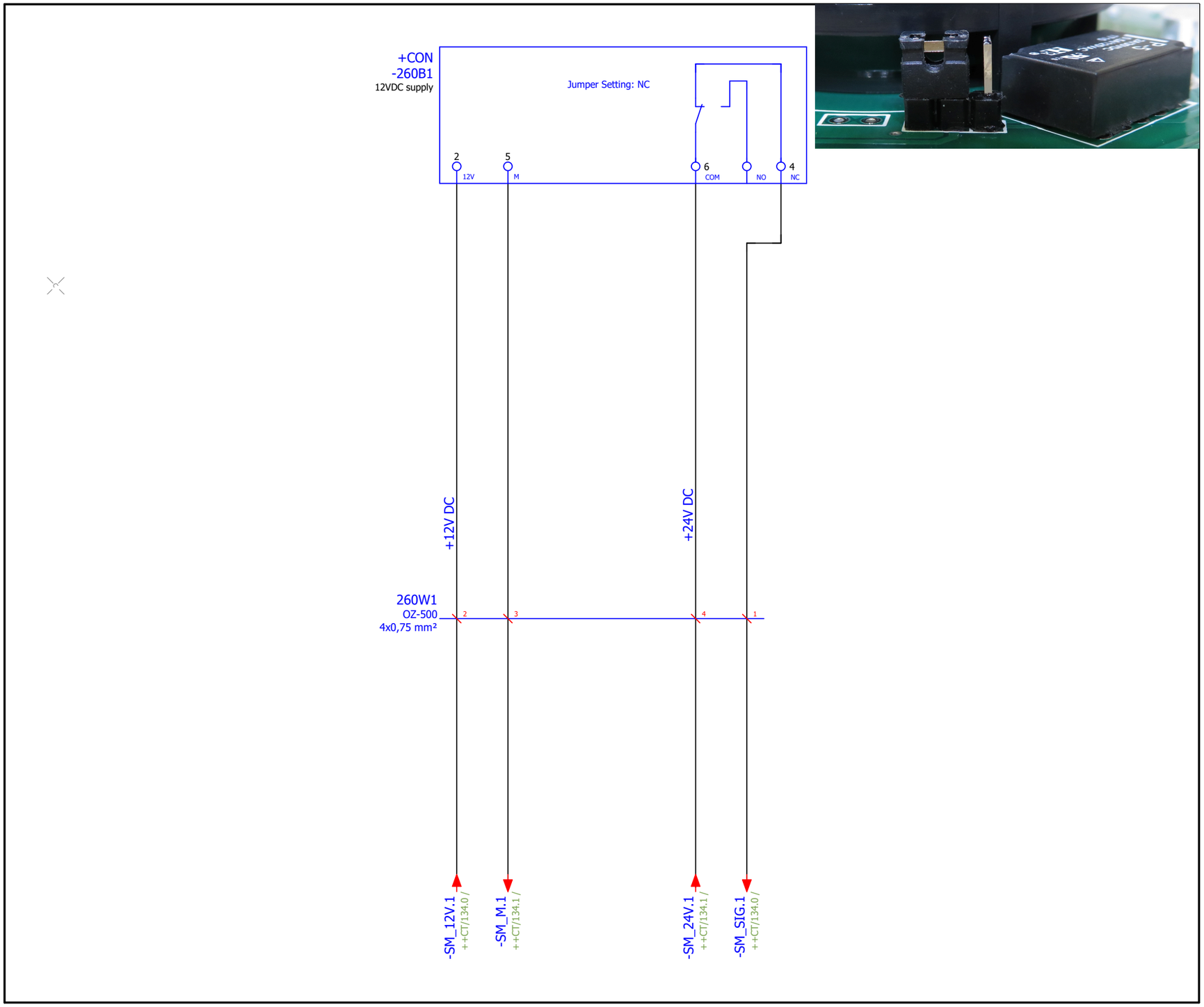
SURGE ARRESTER
DC SUBSYSTEM 4_3

in Connection cabinet

previous page: 238a

next page: 260

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 4_1 - 4_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 238b
Date								+	total: 492

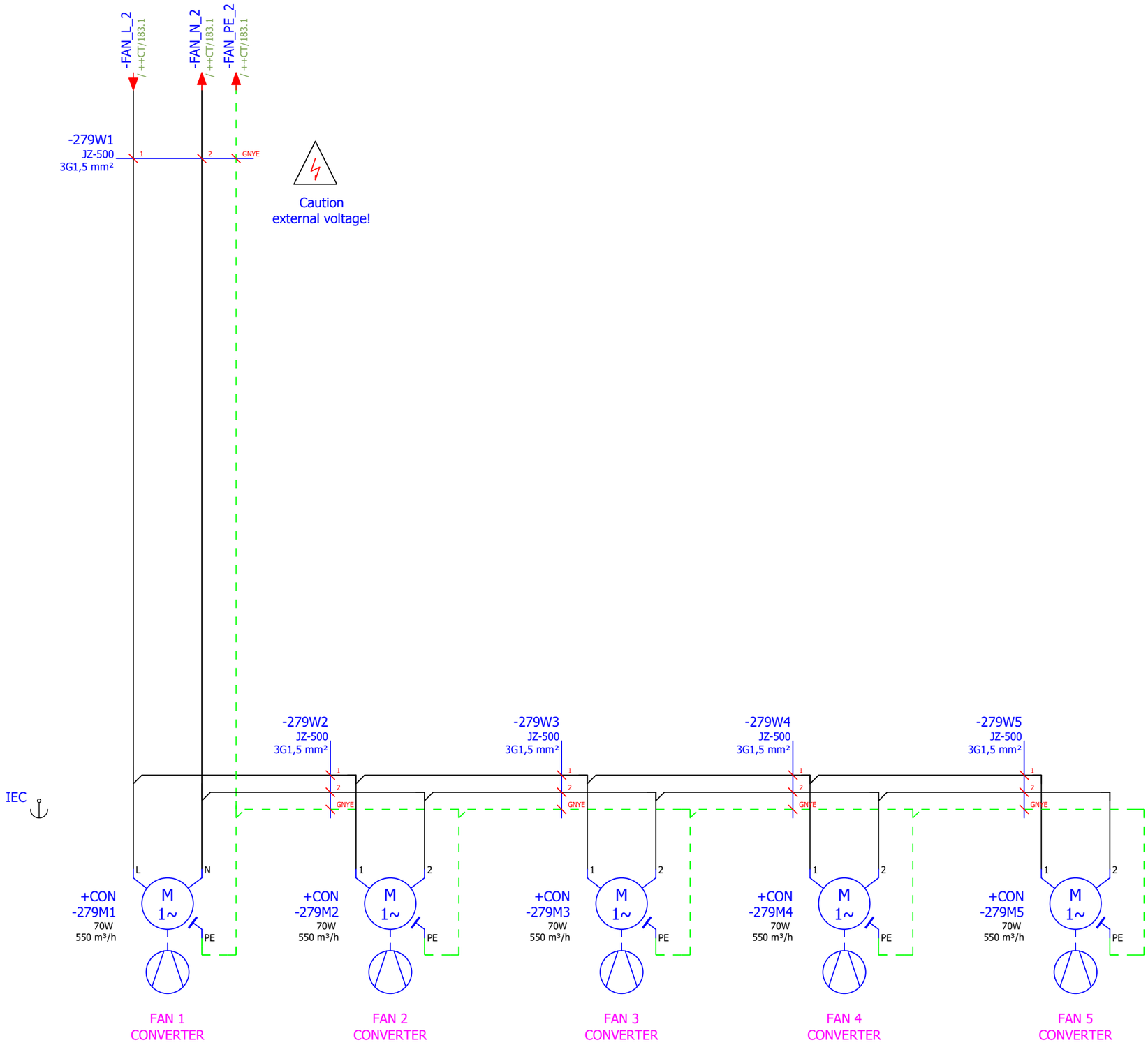


SMOKE DETECTOR
+CON CABINET

previous page:
238b

next page:
279

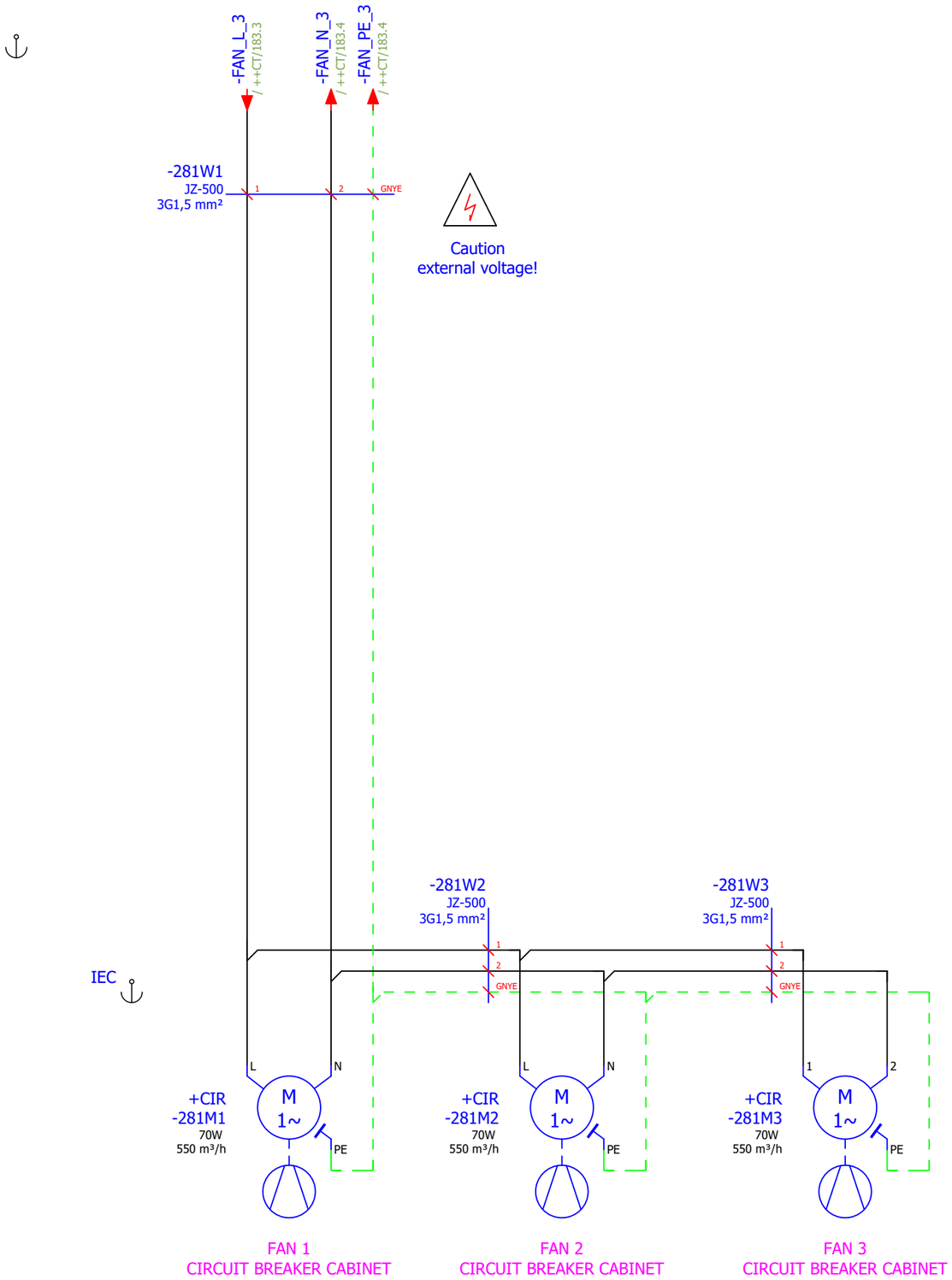
Editor	Freqcon_JD			Statron	FREQCON	SMOKE DETECTOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 260
Date								+	total: 492



previous page:
260

next page:
281

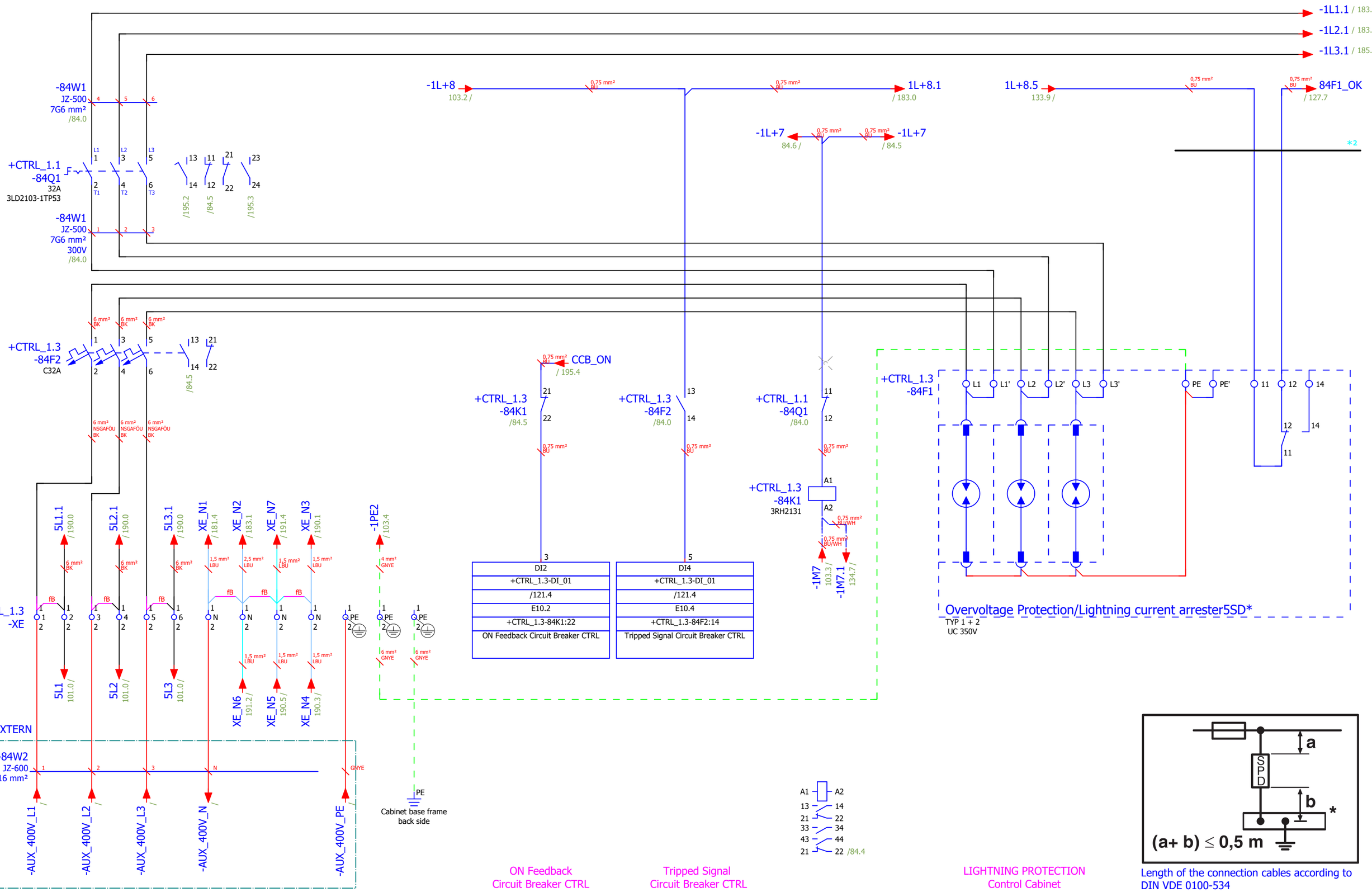
Editor	Freqcon_JD			Statron	FREQCON	CONVERTER CABINET CLIMATE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 279
Date								+	total: 492



previous page:
279

next page:
++CT/84

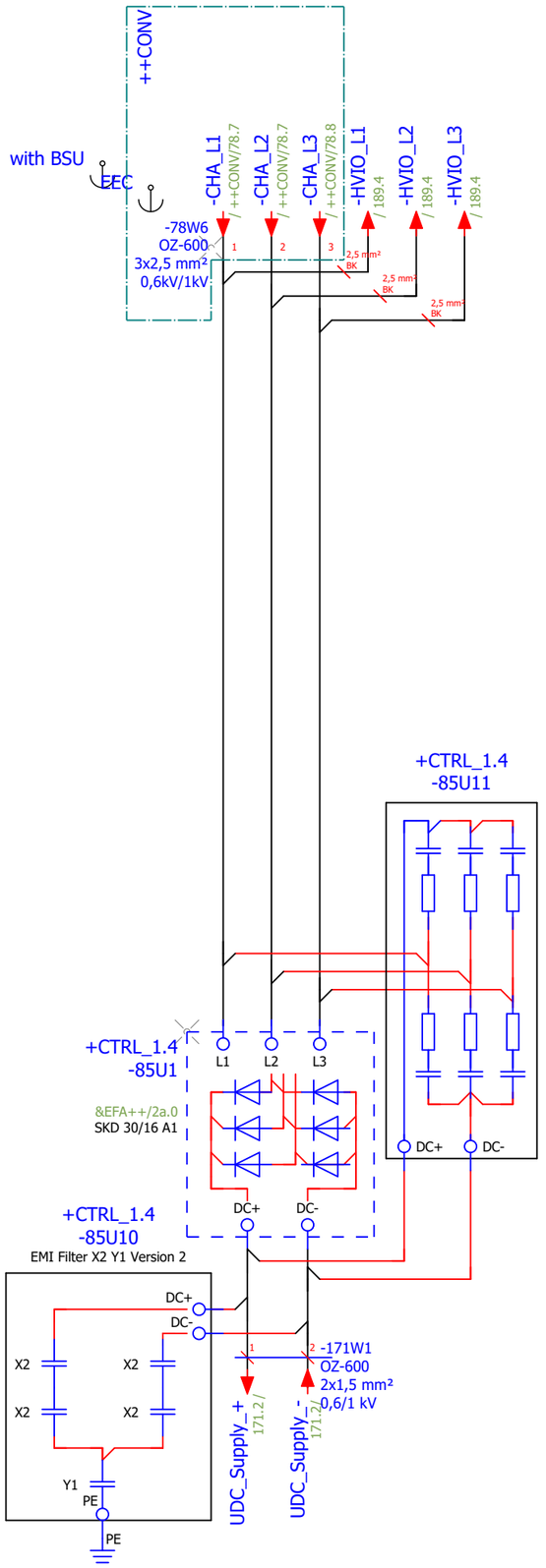
Editor	Freqcon_JD			Statron	FREQCON	CIRCUIT BREAKER CABINET CLIMATE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 281
Date								+	total: 492



previous page:
++CONV/281

next page:
85

Editor	Freqcon_DG			Statron	FREQCON	FEEDING CONTROL CABINET (CTRL)	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	



previous page: 84

earthing via cooling element

next page: 100

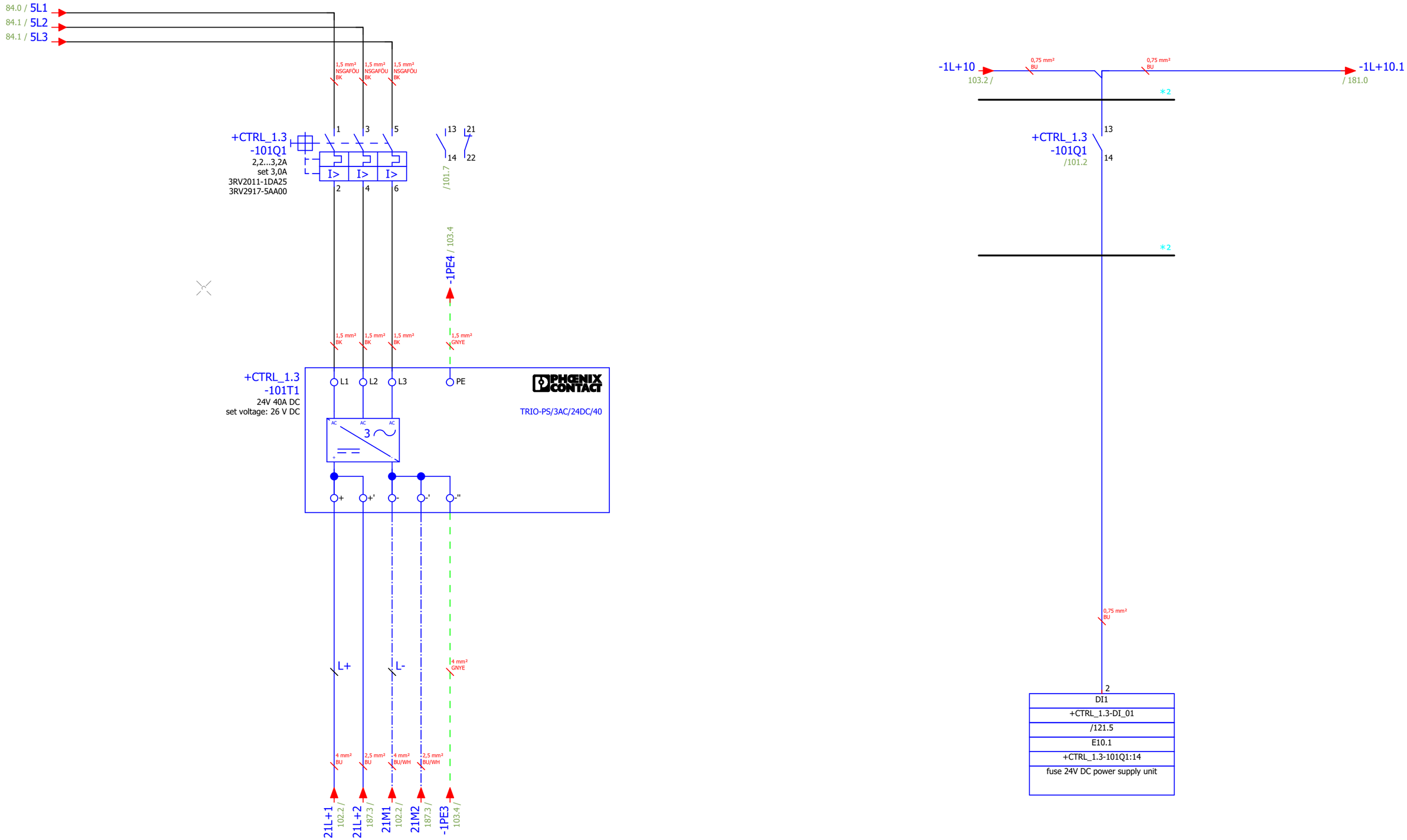
Editor	Freqcon_DG			Statron		SUPPLY UDC	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	29.07.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 85
Date								+		total: 492

Control Cabinet

Pages 100 - 199

previous page: 85

next page: 101

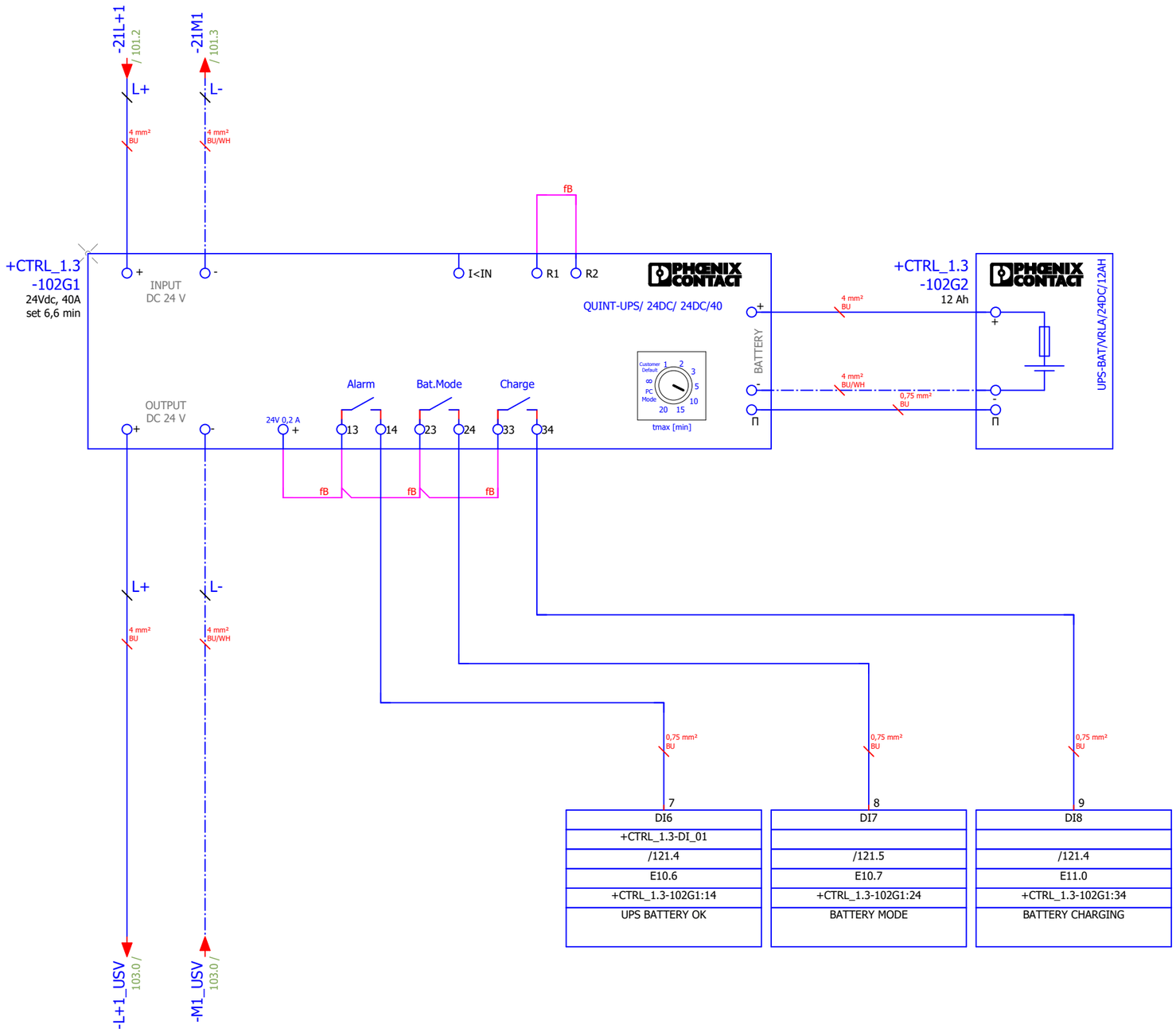


previous page: 100

Power supply unit from 400V AC

next page: 102

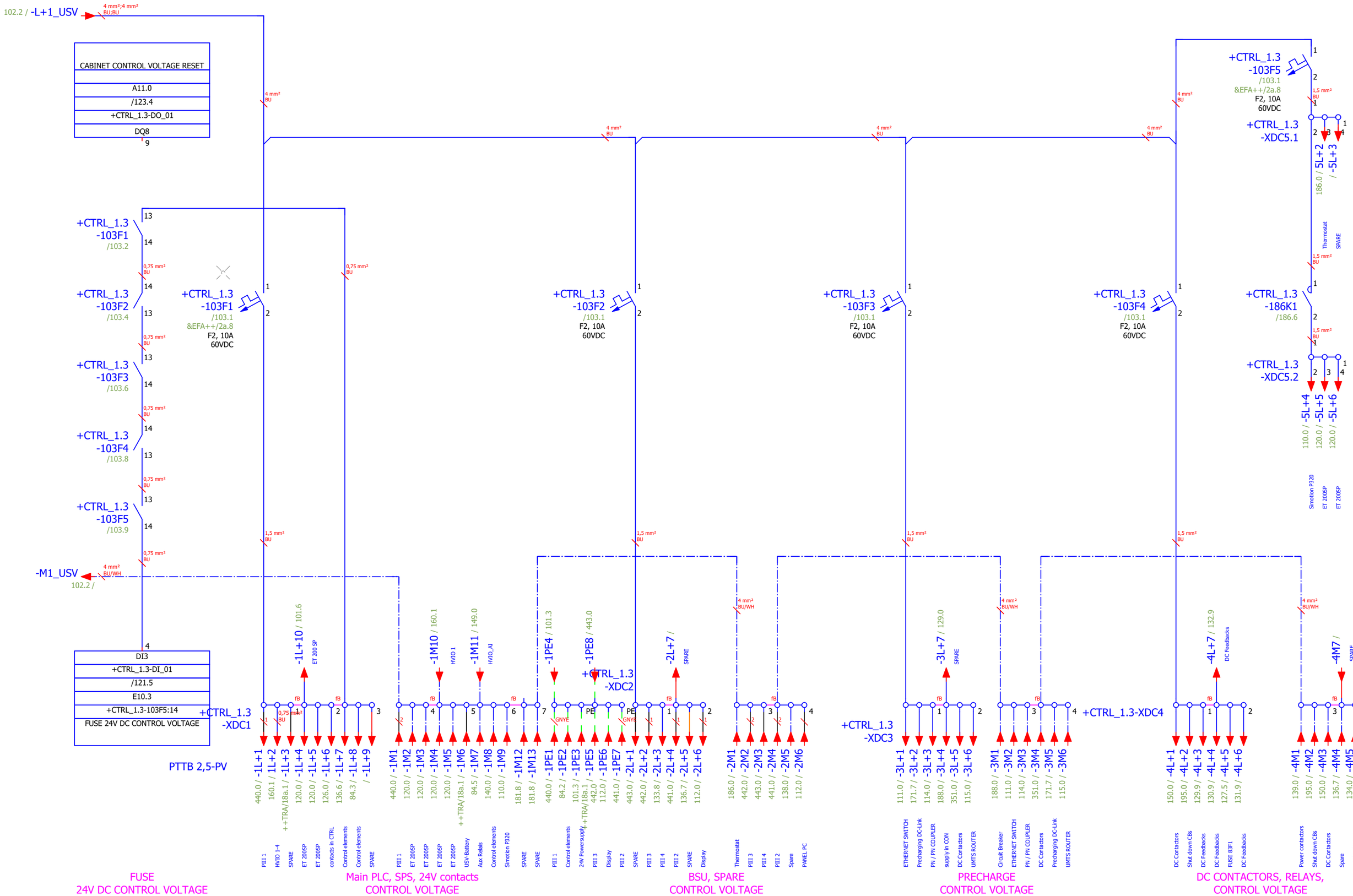
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 101
Date								+	total: 492



previous page:
101

next page:
103

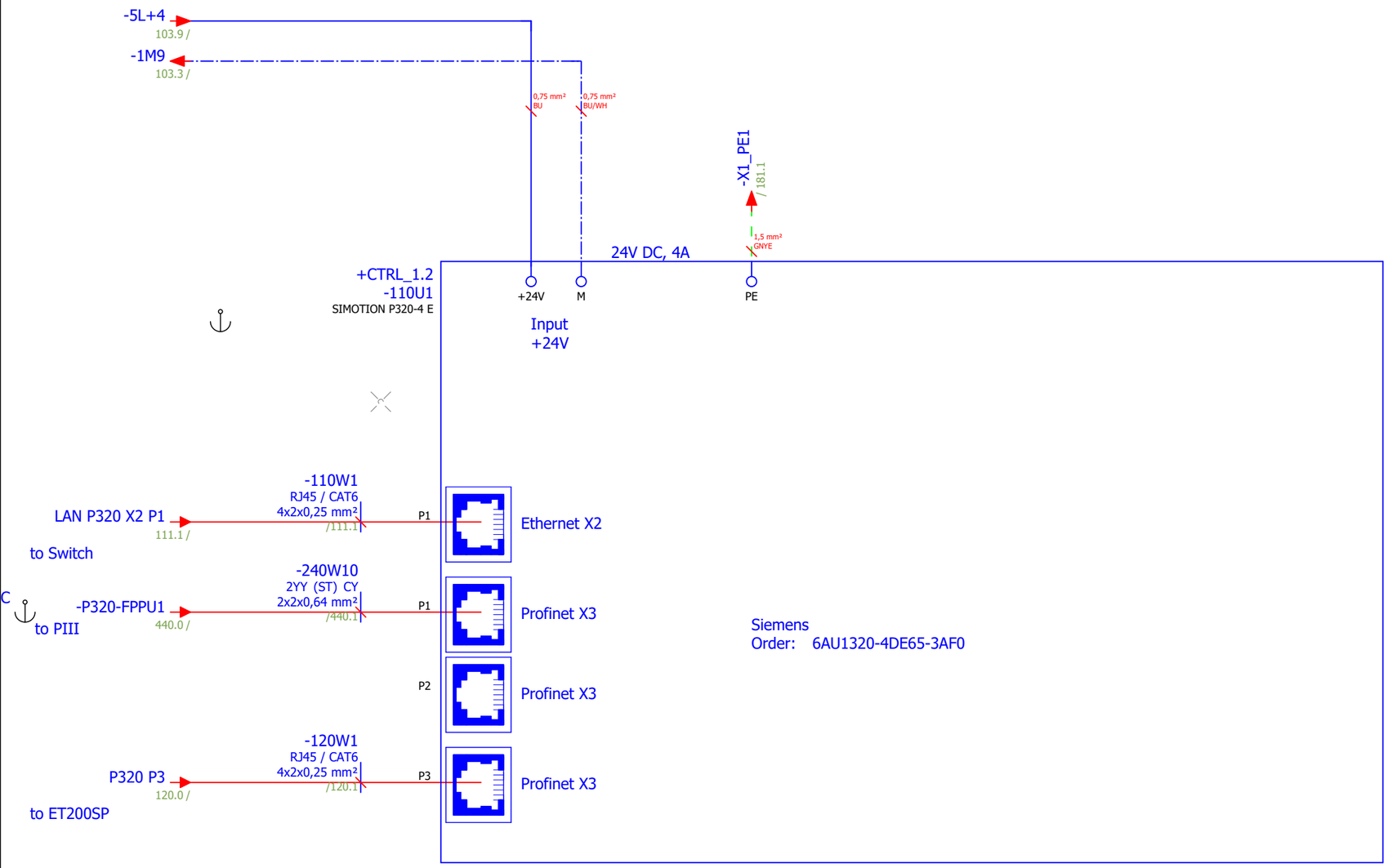
Editor	Freqcon_JD			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 102
Date								+ total: 492



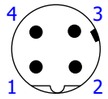
previous page: 102

next page: 110

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 103
Date								+	total: 492



Plug with D-coded



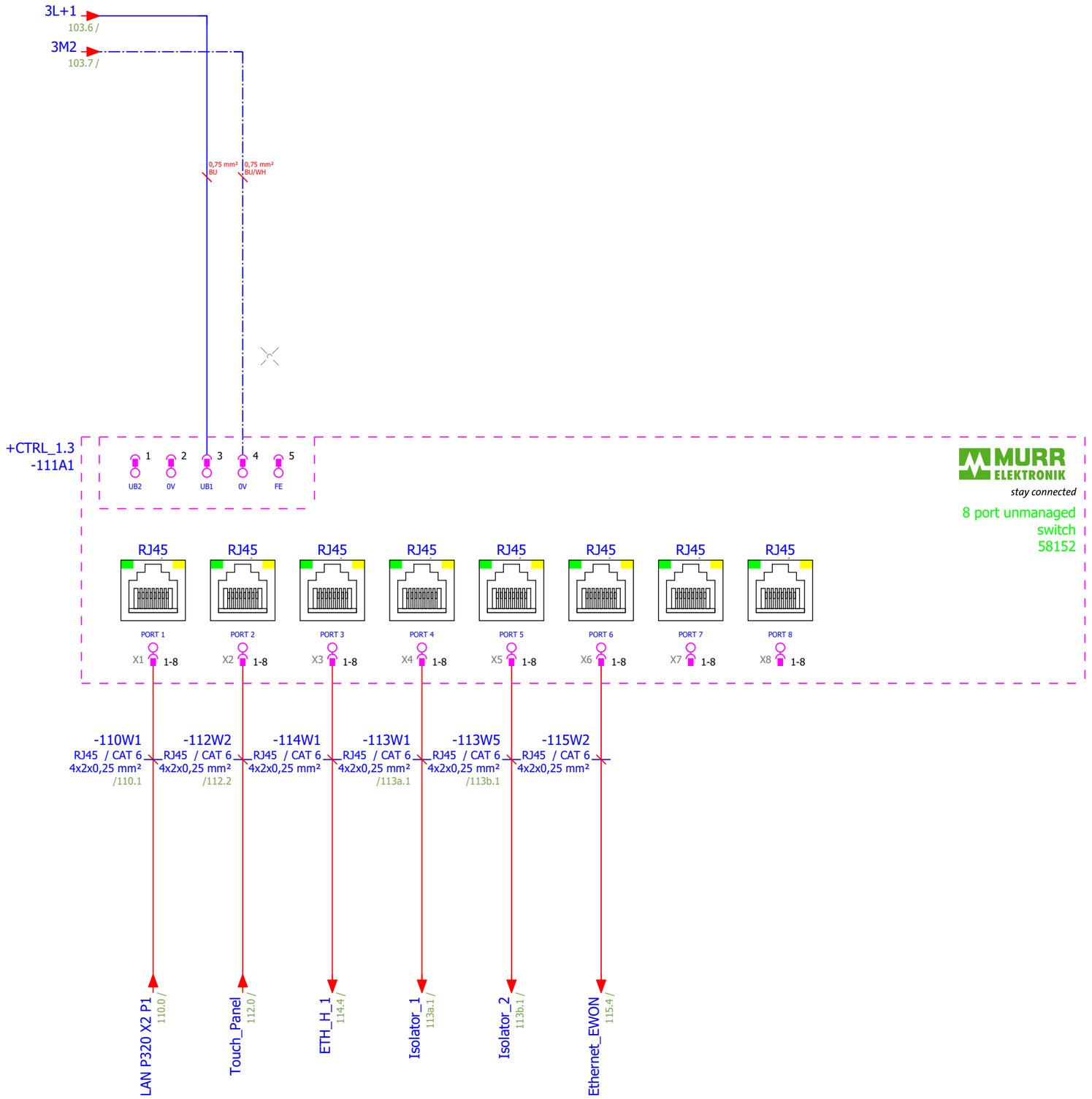
Top view of the pinheader

Signal	Colour	RJ45	M12 plug
TD+	yellow	1	1
TD-	orange	2	3
RD+	white	3	2
RD-	blue	6	4

Connection P320 -- PIII

previous page: 103

next page: 111

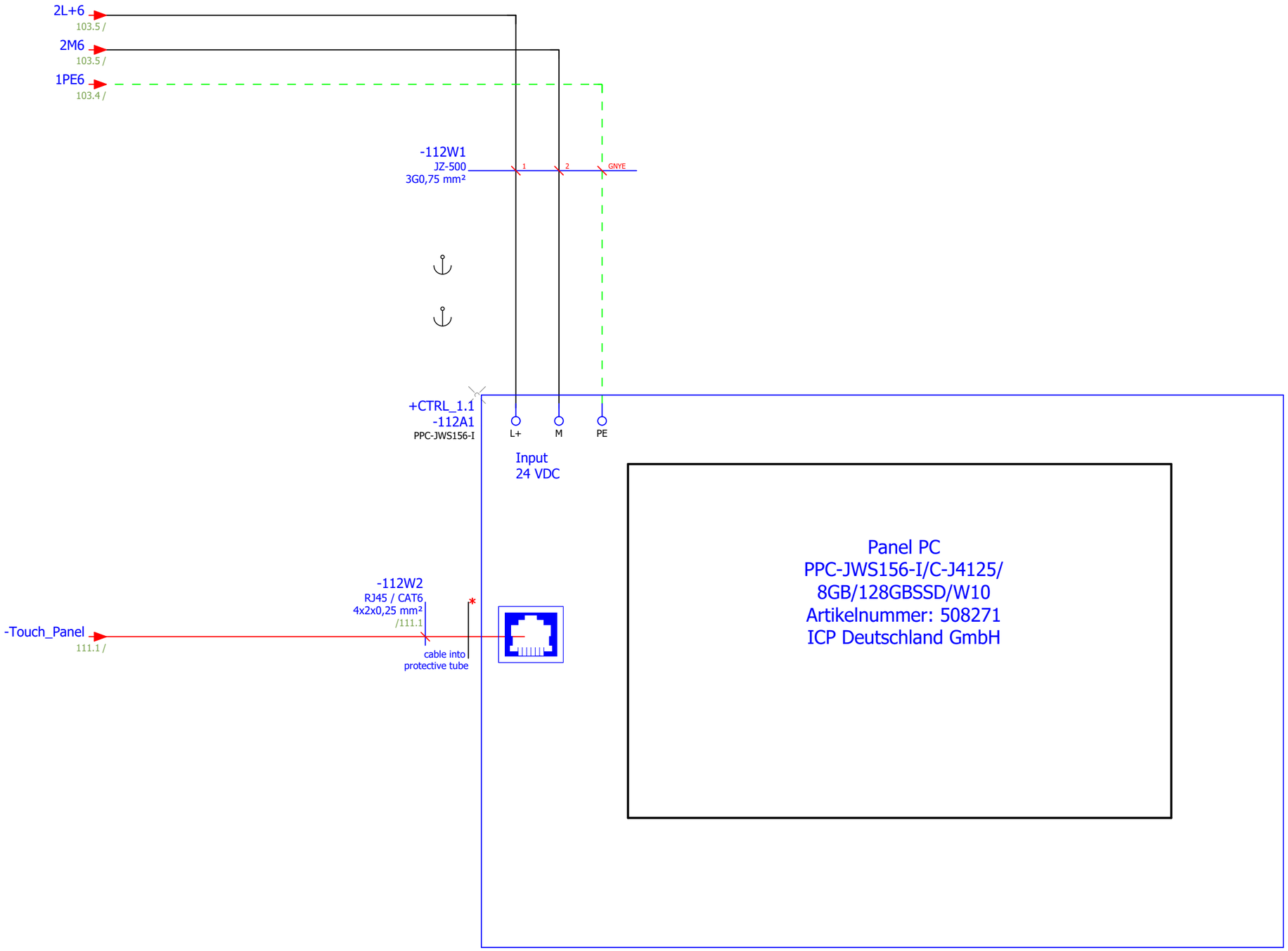


previous page:
110

next page:
112

Editor	Freqcon_DG			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_01	Converter Container 1
Date	23.01.2025							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

page: 111
total: 492



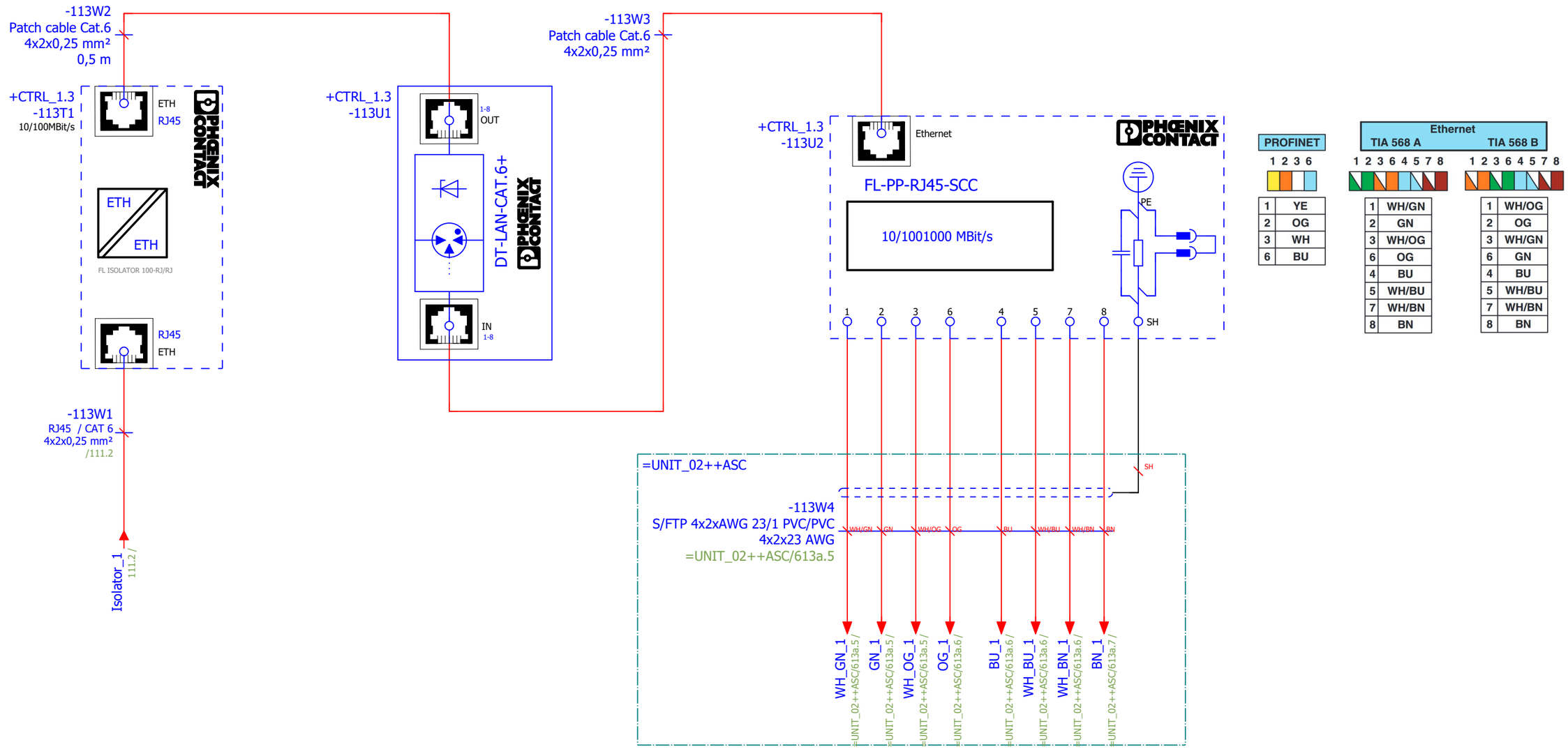
PANEL PC

previous page:
111

next page:
113a

Editor	Freqcon_JD			Statron	FREQCON	PANEL PC HMI	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

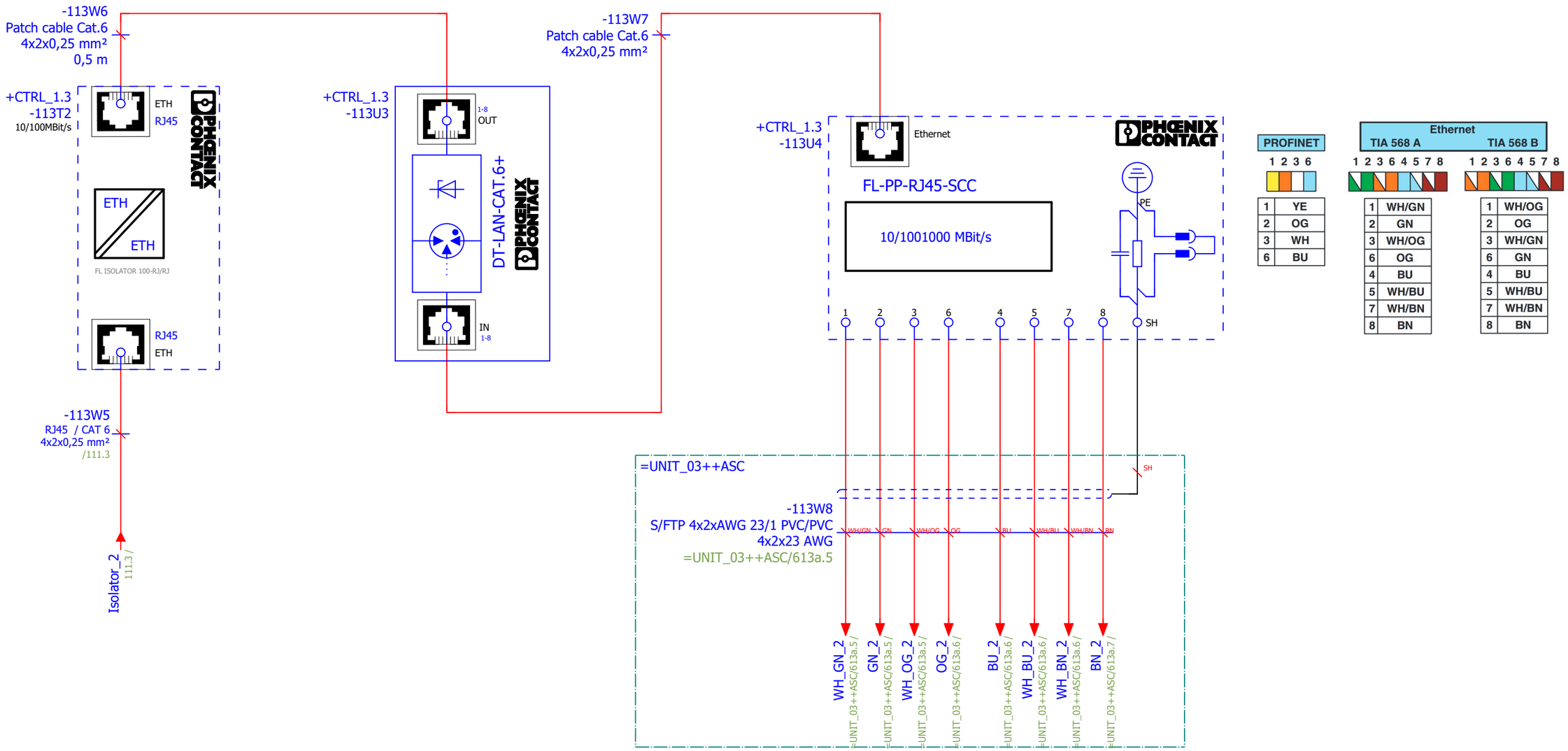
page: 112
total: 492



previous page:
112

next page:
113b

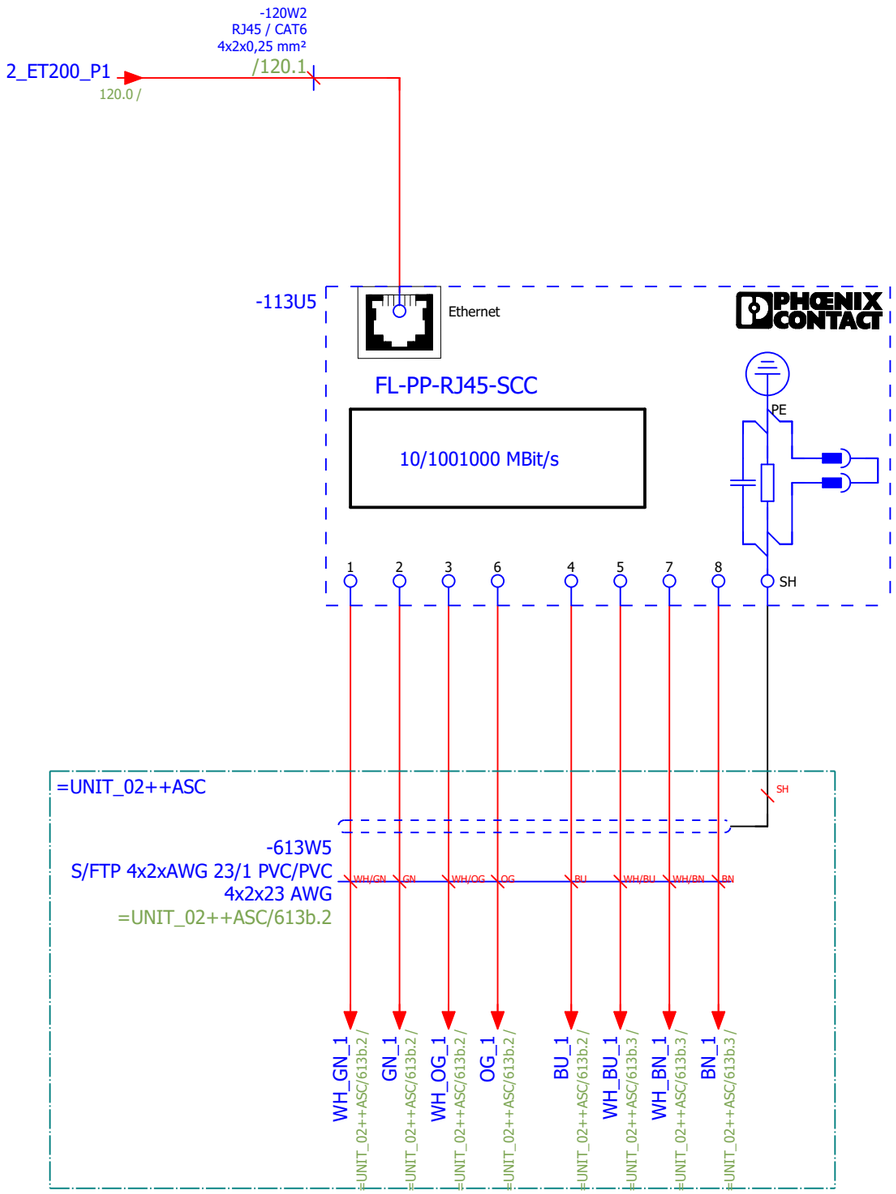
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 113a
Date								+	total: 492



previous page:
113a

next page:
113c

Editor	Freqcon_JD			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 113b
Date								+	total: 492



PROFINET

1 2 3 6

1	YE
2	OG
3	WH
6	BU

Ethernet

TIA 568 A

1 2 3 6 4 5 7 8

1	WH/GN
2	GN
3	WH/OG
6	OG
4	BU
5	WH/BU
7	WH/BN
8	BN

TIA 568 B

1 2 3 6 4 5 7 8

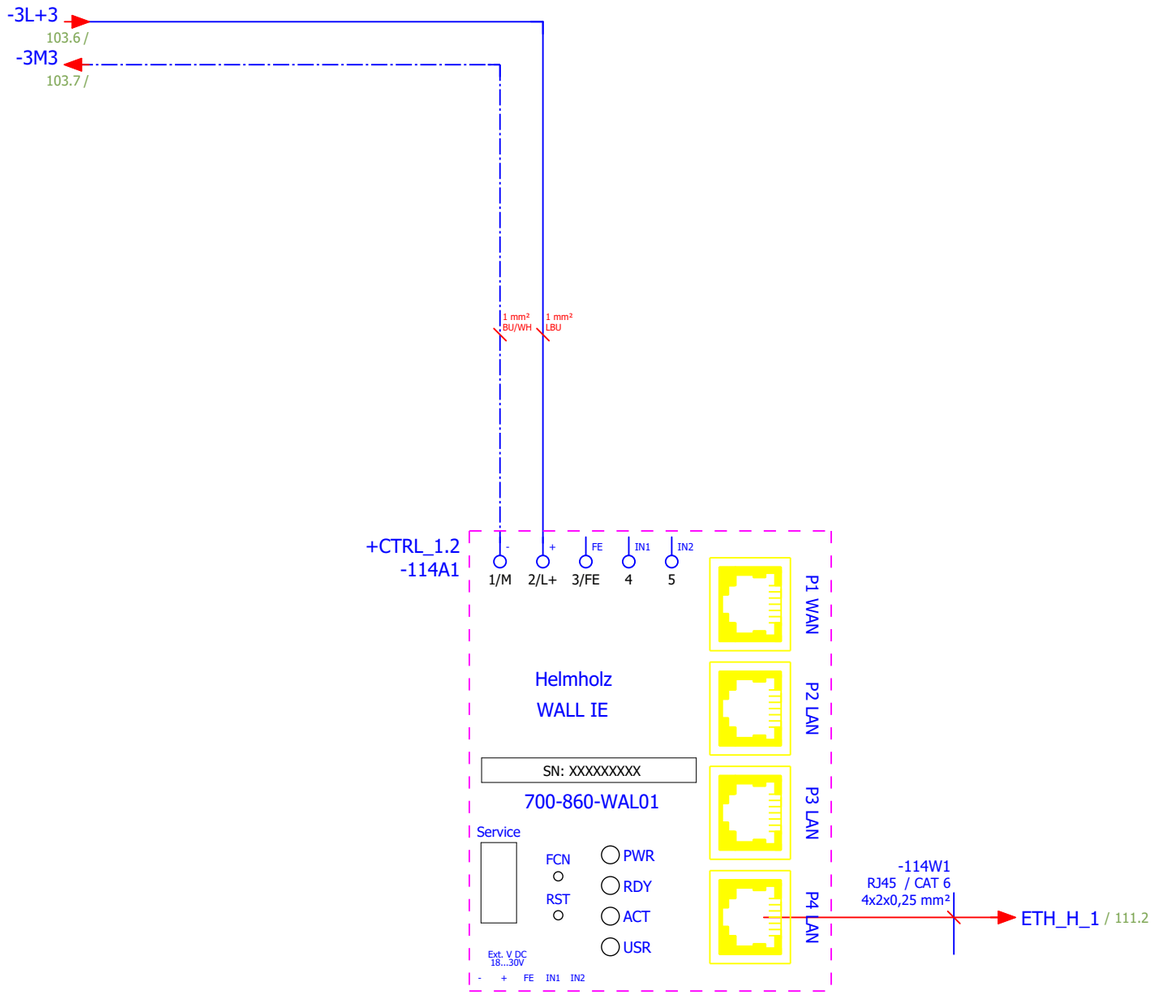
1	WH/OG
2	OG
3	WH/GN
6	GN
4	BU
5	WH/BU
7	WH/BN
8	BN

previous page: 113b

next page: 114

Editor	Freqcon_DG			Statron		PROFINET	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 113c
Date								+		total: 492

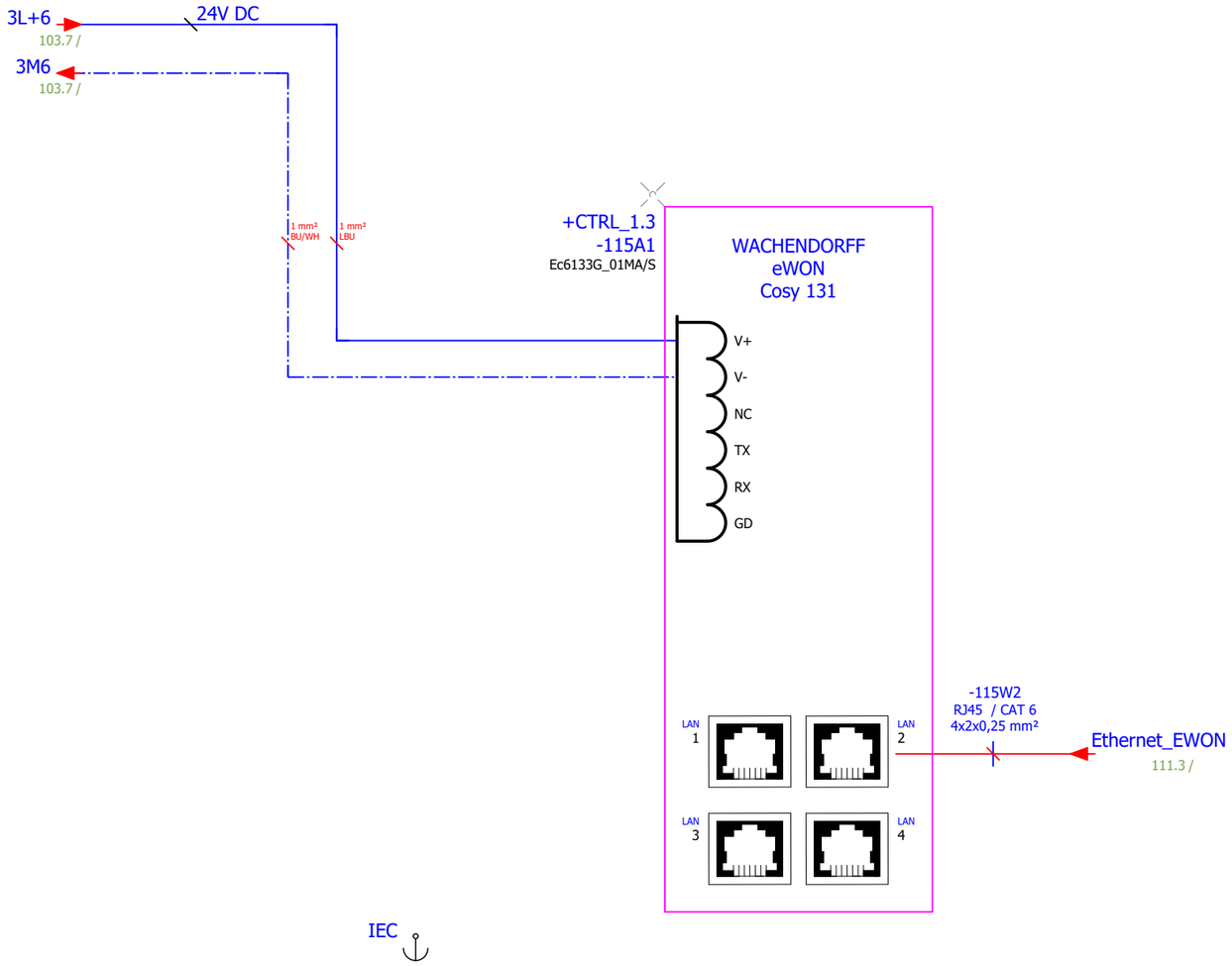
0	1	2	3	4	5	6	7	8	9



previous page:
113c

next page:
115

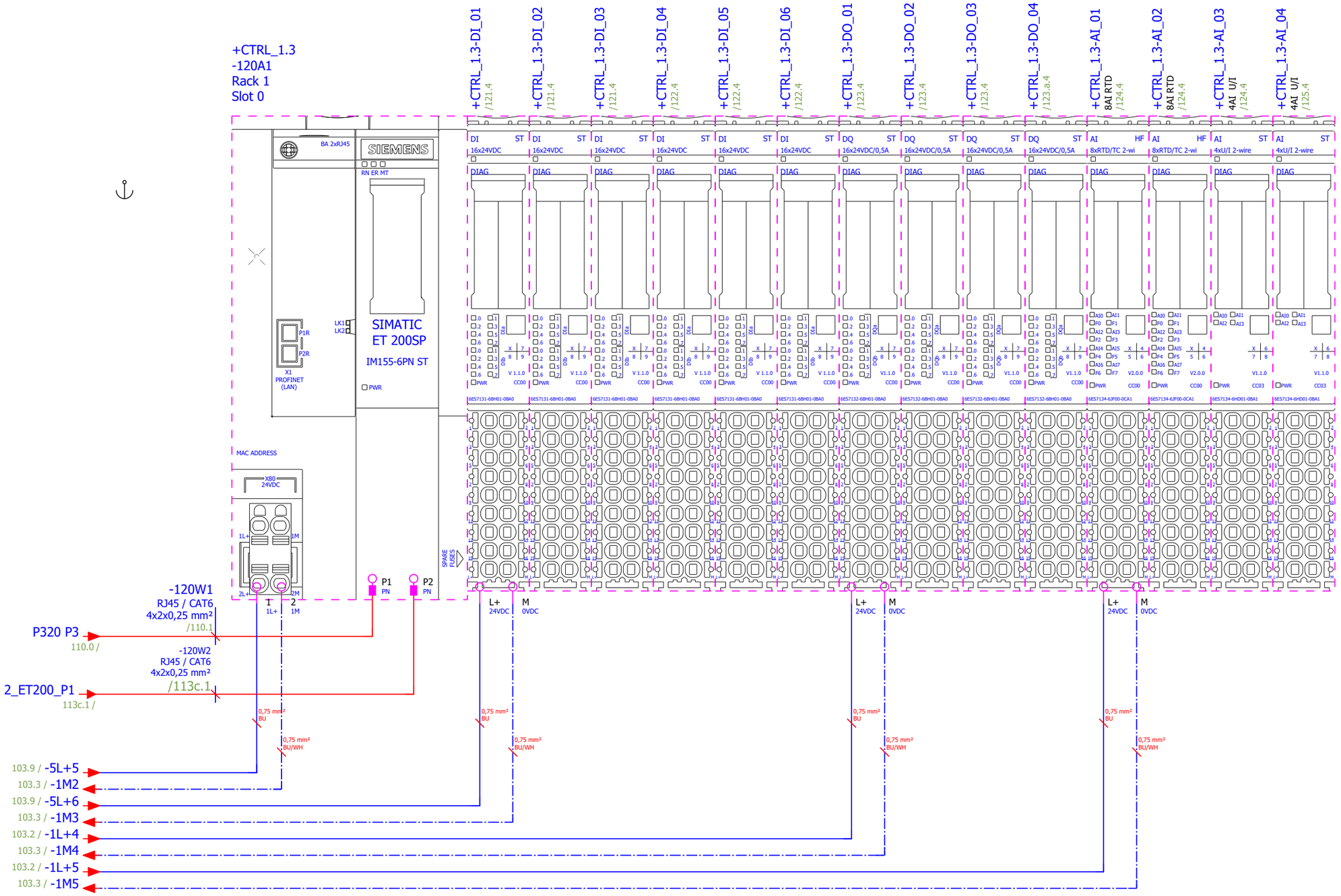
Editor	Freqcon_DG			Statron	FREQCON	HELMHOLZ	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	23.01.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 114
Date								+	total: 492



previous page:
114

next page:
120

Editor	Freqcon_JD			Statron	FREQCON	UMTS ROUTER	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 115
Date								+	total: 492



previous page: 115

next page: 121

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 120
Date								+		total: 492

+CTRL_1.3-DI_01

/120.3

		DI0 1	E10.0	E10.1 2 DI1	/101.7	fuse 24V DC power supply unit
ON Feedback Circuit Breaker CTRL	/84.4	DI2 3	E10.2	E10.3 4 DI3	/103.1	FUSE 24V DC CONTROL VOLTAGE
Tripped Signal Circuit Breaker CTRL	/84.5	DI4 5	E10.4	E10.5 6 DI5	/127.7	LIGHTNING PROTECTION in Control Cabinet OPTIONAL
UPS BATTERY OK	/102.5	DI6 7	E10.6	E10.7 8 DI7	/102.6	BATTERY MODE
BATTERY CHARGING	/102.7	DI8 9	E11.0	E11.1 10 DI9	/126.1	RESET -126S1
FUSE FOR PUMP	/181.2	DI10 11	E11.2	E11.3 12 DI11	/182.2	FAN 1 HEAT EXCHANGER
FUSE FOR HEATER	/181.5	DI12 13	E11.4	E11.5 14 DI13		
Fuse Fans CON, IND Cabinets	/183.6	DI14 15	E11.6	E11.7 16 DI15	/185.9	supply light, fan, heater, power unit in cabinet
	/120.3	24VDC L+		M 0VDC	/120.3	

+CTRL_1.3-DI_02

/120.3

FAULT SIGNAL SAFETY RELAY	/195.4	DI0 1	E12.0	E12.1 2 DI1	/187.6	FUSES SUPPLY FOR CIRCUIT BREAKER 1+2
CB 1 ON GRID	/127.2	DI2 3	E12.2	E12.3 4 DI3	/127.3	CB 1 OFF GRID
CB 1 Tripped GRID	/127.1	DI4 5	E12.4	E12.5 6 DI5	/127.4	FUSE AND LIGHTNING PROTECTION
Smoke detector CON	/134.0	DI6 7	E12.6	E12.7 8 DI7	/129.0	SUBSYSTEM 2_1_DC + Contactor K1 is on
SUBSYSTEM 2_1_DC -Contactor K7 is on	/129.1	DI8 9	E13.0	E13.1 10 DI9	/129.2	SUBSYSTEM 2_2_DC + Contactor K2 is on
SUBSYSTEM 2_2_DC -Contactor K8 is on	/129.3	DI10 11	E13.2	E13.3 12 DI11	/129.4	SUBSYSTEM 2_3_DC + Contactor K3 is on
SUBSYSTEM 2_3_DC -Contactor K9 is on	/129.5	DI12 13	E13.4	E13.5 14 DI13	/129.6	SUBSYSTEM 2_3_DC + SPARE
SUBSYSTEM 2_DC -SPARE	/129.7	DI14 15	E13.6	E13.7 16 DI15	/129.8	SUBSYSTEM 2_1_DC FUSE OK
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_03

/120.3

SUBSYSTEM 2_2_DC FUSE OK	/129.9	DI0 1	E14.0	E14.1 2 DI1	/130.0	SUBSYSTEM 3_1_DC + Contactor K1 is on
SUBSYSTEM 3_1_DC -Contactor K7 is on	/130.1	DI2 3	E14.2	E14.3 4 DI3	/130.2	SUBSYSTEM 3_2_DC + Contactor K2 is on
SUBSYSTEM 3_2_DC -Contactor K8 is on	/130.3	DI4 5	E14.4	E14.5 6 DI5	/130.4	SUBSYSTEM 3_3_DC + Contactor K3 is on
SUBSYSTEM 3_3_DC -Contactor K9 is on	/130.5	DI6 7	E14.6	E14.7 8 DI7	/130.6	SUBSYSTEM 3_DC + SPARE
SUBSYSTEM 3_DC -SPARE	/130.7	DI8 9	E15.0	E15.1 10 DI9	/130.8	SUBSYSTEM 2_DC FUSE OK
SUBSYSTEM 3_1_DC FUSE OK	/130.9	DI10 11	E15.2	E15.3 12 DI11	/131.0	SUBSYSTEM 4_1_DC + Contactor K1 is on
SUBSYSTEM 4_1_DC -Contactor K7 is on	/131.1	DI12 13	E15.4	E15.5 14 DI13	/131.2	SUBSYSTEM 4_2_DC + Contactor K2 is on
SUBSYSTEM 4_2_DC -Contactor K8 is on	/131.3	DI14 15	E15.6	E15.7 16 DI15	/131.4	SUBSYSTEM 4_3_DC + Contactor K3 is on
		24VDC L+		M 0VDC		

previous page: 120

next page: 122

+CTRL_1.3-DI_04

/120.4

SPARE	/133.1	DI0 1	E16.0	E16.1 2 DI1	/133.2	SPARE
SPARE	/133.3	DI2 3	E16.2	E16.3 4 DI3	/133.4	TRIP
Earthing switch in On Transformer 620V side	/133.9	DI4 5	E16.4	E16.5 6 DI5		
		DI6 7	E16.6	E16.7 8 DI7		
		DI8 9	E17.0	E17.1 10 DI9		
Fuse 230V AC for Container Air Conditioning	/133.6	DI10 11	E17.2	E17.3 12 DI11	/128.1	CB 2 Tripped ISLAND GRID
CB 2 ON ISLAND GRID	/128.2	DI12 13	E17.4	E17.5 14 DI13	/128.3	CB 2 OFF ISLAND GRID
FUSE AND LIGHTNING PROTECTION 2	/128.4	DI14 15	E17.6	E17.7 16 DI15	/182.5	FAN 2 HEAT EXCHANGER (OPTIONAL)
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_05

/120.4

SUBSYSTEM 4_3_DC -Contactor K9 is on	/131.5	DI0 1	E18.0	E18.1 2 DI1	/131.6	SUBSYSTEM 4_DC + SPARE
SUBSYSTEM 4_DC -SPARE	/131.7	DI2 3	E18.2	E18.3 4 DI3	/131.8	SUBSYSTEM 3_2_DC FUSE OK
SUBSYSTEM 3_3_DC FUSE OK	/131.9	DI4 5	E18.4	E18.5 6 DI5	/132.0	
	/132.1	DI6 7	E18.6	E18.7 8 DI7	/132.2	
	/132.3	DI8 9	E19.0	E19.1 10 DI9	/132.4	
	/132.5	DI10 11	E19.2	E19.3 12 DI11	/132.6	
SUBSYSTEM 4_1_DC FUSE OK	/132.7	DI12 13	E19.4	E19.5 14 DI13	/132.8	SUBSYSTEM 4_2_DC FUSE OK
SUBSYSTEM 4_3_DC FUSE OK	/132.9	DI14 15	E19.6	E19.7 16 DI15		
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_06

/120.4

Shut-down to BESS	/136.6	DI0 1	E20.0	E20.1 2 DI1		
		DI2 3	E20.2	E20.3 4 DI3		
		DI4 5	E20.4	E20.5 6 DI5		
		DI6 7	E20.6	E20.7 8 DI7		
incoming CB is open	/136.8	DI8 9	E21.0	E21.1 10 DI9	/136.9	cmd island mode
		DI10 11	E21.2	E21.3 12 DI11		
		DI12 13	E21.4	E21.5 14 DI13		
		DI14 15	E21.6	E21.7 16 DI15		
		24VDC L+		M 0VDC		

previous page: 121

next page: 123

+CTRL_1.3-DO_01

/120.5

CON Fans 1-5 in door	/135.1	DQ0 1	A10.0	A10.1 2 DQ1	/135.2	FAN 1 Control cabinet
CIR Fans 1-3 in door	/135.3	DQ2 3	A10.2	A10.3 4 DQ3	/135.4	SPARE 230V
CB2 ON ISLAND GRID OPTIONAL	/137.3	DQ4 5	A10.4	A10.5 6 DQ5	/137.4	CB 2 OFF ISLAND GRID OPTIONAL
Precharging DC-Link Capacitors	/171.5	DQ6 7	A10.6	A10.7 8 DQ7	/173.6	Discharge CON
CABINET CONTROL VOLTAGE RESET	/103.1	DQ8 9	A11.0	A11.1 10 DQ9	/137.1	CB1 ON GRID
CB 1 OFF GRID	/137.2	DQ10 11	A11.2	A11.3 12 DQ11	/189.1	GRID FAULT
FAULT 140H1	/140.1	DQ12 13	A11.4	A11.5 14 DQ13	/140.2	PREHEATING 140H2
READY FOR OPERATION 140H3	/140.3	DQ14 15	A11.6	A11.7 16 DQ15	/140.4	OPERATING 140H4
	/120.5	24VDC L+		M 0VDC	/120.5	

+CTRL_1.3-DO_02

/120.5

SUBSYSTEM 2_1 CONTACTOR DC+ ON	/150.1	DQ0 1	A12.0	A12.1 2 DQ1	/150.3	SUBSYSTEM 2_1 CONTACTOR DC-ON
SUBSYSTEM 2_2 CONTACTOR DC+ ON	/151.0	DQ2 3	A12.2	A12.3 4 DQ3	/151.2	SUBSYSTEM 2_2 CONTACTOR DC-ON
SUBSYSTEM 2_3 CONTACTOR DC+ ON	/151.3	DQ4 5	A12.4	A12.5 6 DQ5	/151.5	SUBSYSTEM 2_3 CONTACTOR DC-ON
		DQ6 7	A12.6	A12.7 8 DQ7	/135.5	SPARE
		DQ8 9	A13.0	A13.1 10 DQ9		
		DQ10 11	A13.2	A13.3 12 DQ11	/139.4	Fan 2 Heat exchanger optional
Heater On converter coolingsystem	/139.1	DQ12 13	A13.4	A13.5 14 DQ13	/139.2	Pump converter coolingsystem
Fan 1 Heat exchanger	/139.3	DQ14 15	A13.6	A13.7 16 DQ15	/134.8	Reset the smoke detectors
		24VDC L+		M 0VDC		

+CTRL_1.3-DO_03

/120.5

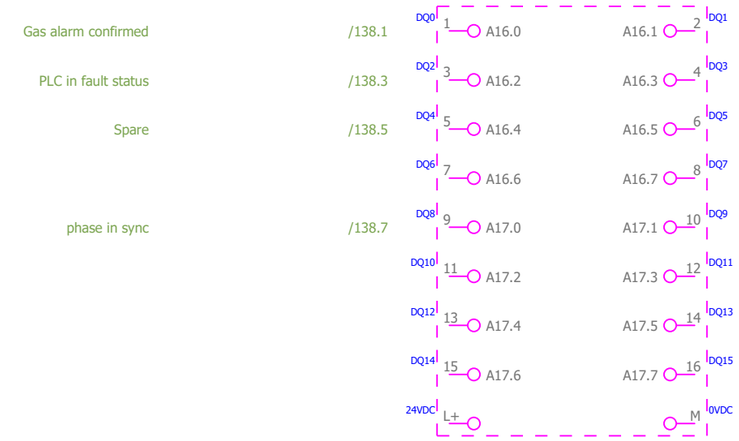
SUBSYSTEM 3_1 CONTACTOR DC+ ON	/350.1	DQ0 1	A14.0	A14.1 2 DQ1	/350.3	SUBSYSTEM 3_1 CONTACTOR DC-ON
		DQ2 3	A14.2	A14.3 4 DQ3		
SUBSYSTEM 3_3 CONTACTOR DC+ ON	/351.4	DQ4 5	A14.4	A14.5 6 DQ5	/351.5	SUBSYSTEM 3_3 CONTACTOR DC-ON
SUBSYSTEM 4_1 CONTACTOR DC+ ON	/352.0	DQ6 7	A14.6	A14.7 8 DQ7	/352.2	SUBSYSTEM 4_1 CONTACTOR DC-ON
SUBSYSTEM 4_2 CONTACTOR DC+ ON	/353.0	DQ8 9	A15.0	A15.1 10 DQ9	/353.2	SUBSYSTEM 4_2 CONTACTOR DC-ON
SUBSYSTEM 4_3 CONTACTOR DC+ ON	/353.3	DQ10 11	A15.2	A15.3 12 DQ11	/353.5	SUBSYSTEM 4_3 CONTACTOR DC-ON
		DQ12 13	A15.4	A15.5 14 DQ13		
		DQ14 15	A15.6	A15.7 16 DQ15		
		24VDC L+		M 0VDC		

previous page: 122

next page: 123.a

+CTRL_1.3-DO_04

/120.6



previous page: 123

next page: 124

Editor	Freqcon_JD			Statron	FREQCON	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 123.a
Date								+	total: 492

+CTRL_1.3-AI_01

/120.6

INDUCTOR GRID PHASE L1 TEMPERATURE 1_1	/145.1	M0+	1	PIW150	PIW152	2	M1+	/145.3	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3	/145.5	M2+	3	PIW154	PIW156	4	M3+	/145.7	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2	/146.1	M4+	5	PIW158	PIW160	6	M5+	/146.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1	/146.5	M6+	7	PIW162	PIW164	8	M7+	/146.7	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2
INDUCTOR GRID PHASE L1 TEMPERATURE 1_1	/145.1	M0-	9	PIW150	PIW152	10	M1-	/145.3	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3	/145.5	M2-	11	PIW154	PIW156	12	M3-	/145.7	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2	/146.1	M4-	13	PIW158	PIW160	14	M5-	/146.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1	/146.5	M6-	15	PIW162	PIW164	16	M7-	/146.7	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2
	/120.6	24VDC	L+		M	0VDC		/120.6	

+CTRL_1.3-AI_02

/120.6

INDUCTOR DC SUB 3_3 TEMPERATURE 3_3	/147.1	M0+	1	PIW166	PIW168	2	M1+	/147.3	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1
CONTROL CABINET TEMPERATURE	/147.5	M2+	3	PIW170	PIW172	4	M3+	/147.7	CONVERTER CABINET TEMPERATURE
COOLING WATER TEMPERATURE	/148.1	M4+	5	PIW174	PIW176	6	M5+	/148.3	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2
CIR CABINET TEMPERATURE	/148.5	M6+	7	PIW178	PIW180	8	M7+	/148.7	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3	/147.1	M0-	9	PIW166	PIW168	10	M1-	/147.3	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1
CONTROL CABINET TEMPERATURE	/147.5	M2-	11	PIW170	PIW172	12	M3-	/147.7	CONVERTER CABINET TEMPERATURE
COOLING WATER TEMPERATURE	/148.1	M4-	13	PIW174	PIW176	14	M5-	/148.3	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2
CIR CABINET TEMPERATURE	/148.5	M6-	15	PIW178	PIW180	16	M7-	/148.7	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3
		24VDC	L+		M	0VDC			

+CTRL_1.3-AI_03

/120.7

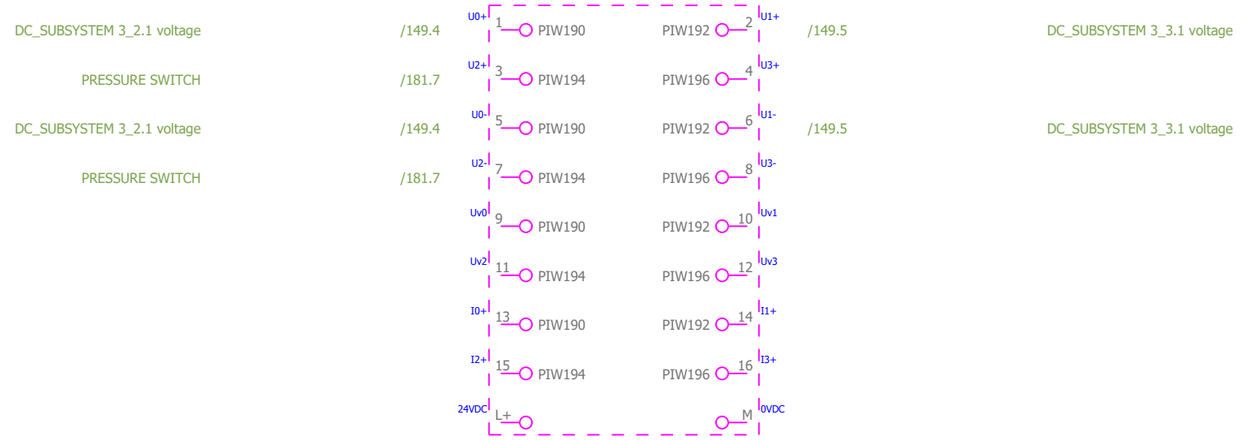
DC_SUBSYSTEM 2_1.1 voltage	/149.0	U0+	1	PIW182	PIW184	2	U1+	/149.1	DC_SUBSYSTEM 2_2.1 voltage
DC_SUBSYSTEM 2_3.1 voltage	/149.2	U2+	3	PIW186	PIW188	4	U3+	/149.3	DC_SUBSYSTEM 3_1.1 voltage
DC_SUBSYSTEM 2_1.1 voltage	/149.0	U0-	5	PIW182	PIW184	6	U1-	/149.1	DC_SUBSYSTEM 2_2.1 voltage
DC_SUBSYSTEM 2_3.1 voltage	/149.2	U2-	7	PIW186	PIW188	8	U3-	/149.3	DC_SUBSYSTEM 3_1.1 voltage
		Uv0	9	PIW182	PIW184	10	Uv1		
		Uv2	11	PIW186	PIW188	12	Uv3		
		I0+	13	PIW182	PIW184	14	I1+		
		I2+	15	PIW186	PIW188	16	I3+		
		24VDC	L+		M	0VDC			

previous page: 123.a

next page: 125

+CTRL_1.3-AI_04

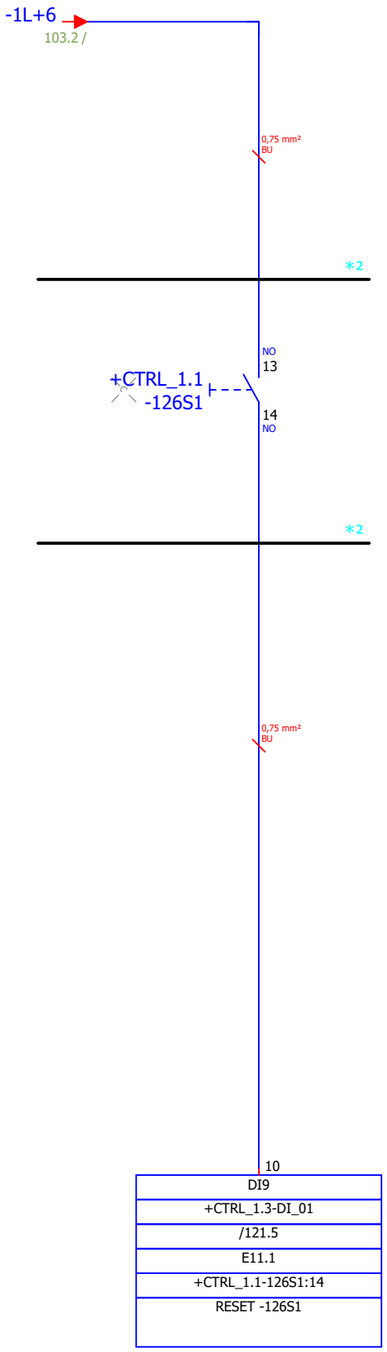
/120.7



previous page: 124

next page: 126

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_04	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 125
Date								+	total: 492



RESET
-126S1

*2
The single conductor
must be placed
in the protective tube

previous page:
125

next page:
127

Editor	Freqcon_JD			Statron	FREQCON	INPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	02.07.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 126
Date								+		total: 492

EC

3WL

++CONV

-CB1_TRIPPED / ++CONV/80.8

-CB1_ON_FB / ++CONV/80.7

-CB1_OFF_FB / ++CONV/80.7

-1F2 / ++CONV/78.9

-4L+5.4 / ++CONV/238a.2

-80W1
OZ-500
8x0,75 mm²

-238W7
OZ-500
2x0,75 mm²

-24V_Signal / 189.5

-4L+5.3 / 134.0

84F1_OK / 84.9

+CTRL_1.3
-X3

fB

bridge

0,75 mm² BU

-4L+5 / 103.8

-4L+5.1 / 128.5

DI14	DI2	DI3	DI5
+CTRL_1.3-DI_02	+CTRL_1.3-DI_02		
/121.4	/121.4	/121.5	/121.5
E12.4	E12.2	E12.3	E12.5
++CONV+CIR-80Q1:X7_13	++CONV+CIR-80Q1:X6_11	++CONV+CIR-80Q1:X6_9	++CONV+AC_DC-78F1:13
CB 1 Tripped GRID	CB 1 ON GRID	CB 1 OFF GRID	FUSE AND LIGHTNING PROTECTION

DI5
+CTRL_1.3-DI_01
/121.5
E10.5
+CTRL_1.3-84F1:12
LIGHTNING PROTECTION in Control Cabinet OPTIONAL

Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 1 Tripped GRID

CB 1 ON GRID

CB 1 OFF GRID

FUSE AND LIGHTNING PROTECTION

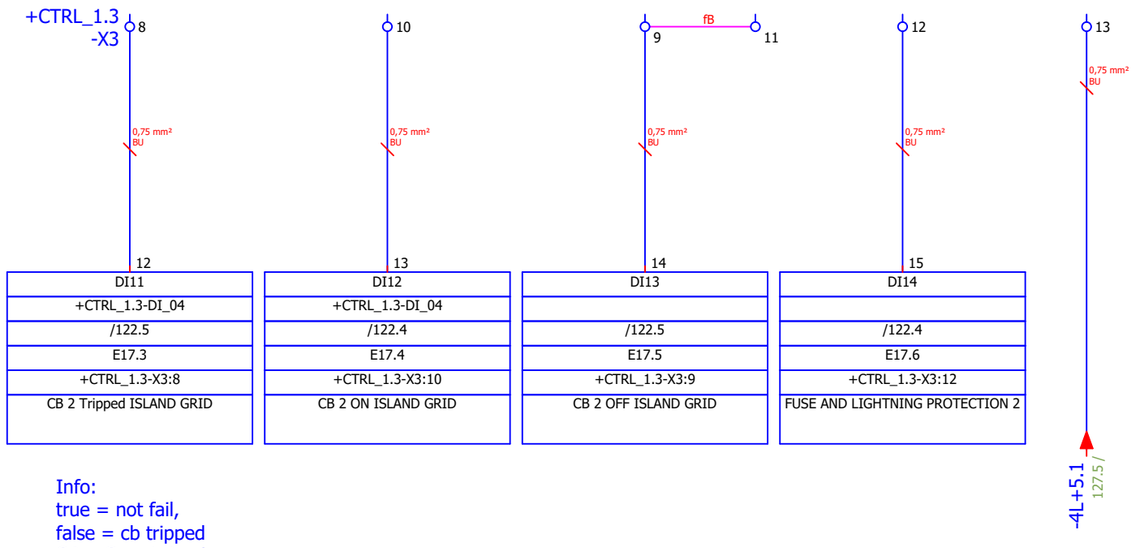
LIGHTNING PROTECTION in Control Cabinet OPTIONAL

previous page: 126

next page: 128

Editor	Freqcon_JD			Statron		DIGITAL INPUTS CB 1	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

0	1	2	3	4	5	6	7	8	9



Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 2 Tripped ISLAND GRID

CB 2 ON ISLAND GRID

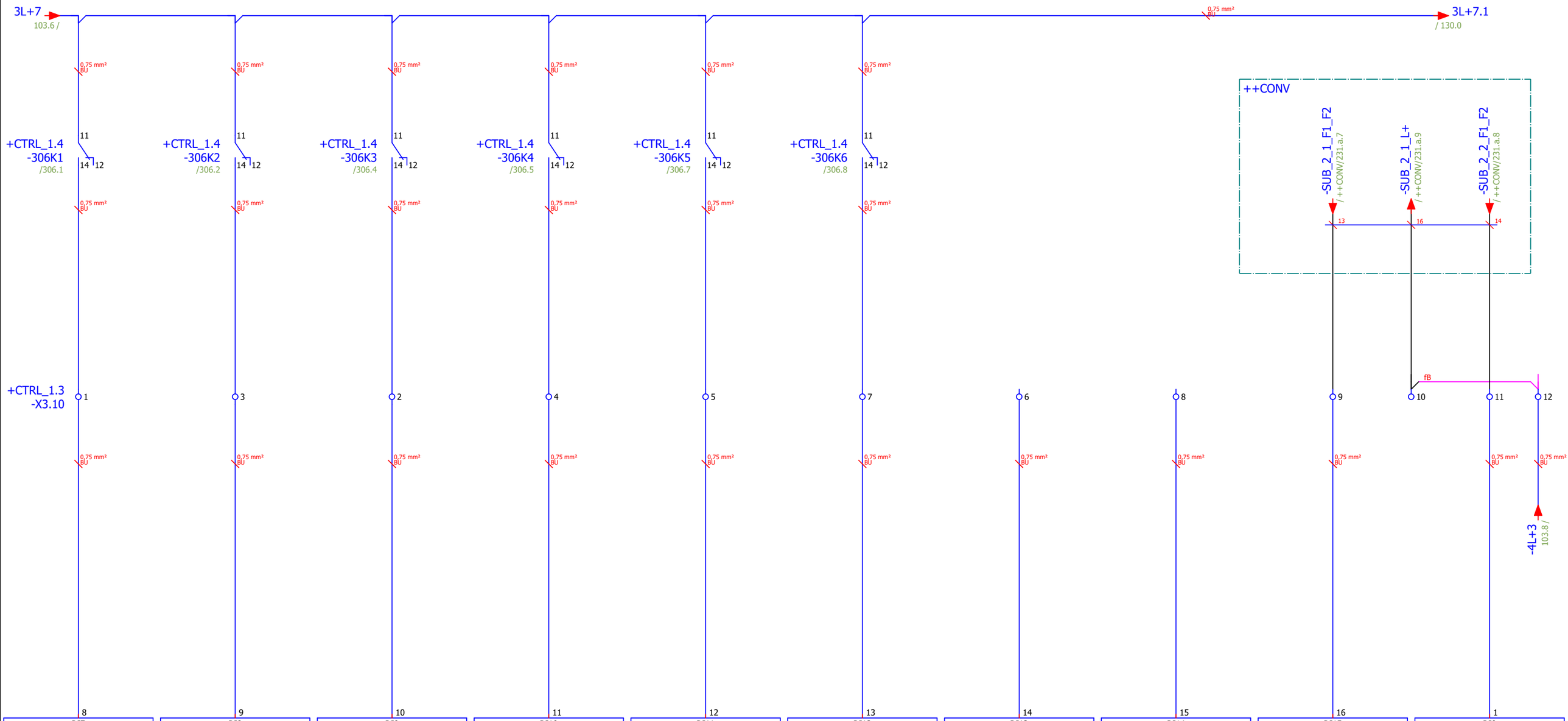
CB 2 OFF ISLAND GRID

FUSE AND LIGHTNING PROTECTION 2

previous page: 127

next page: 129

Editor	Freqcon_JD			Statron		DIGITAL INPUTS CB 2	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 128
Date								+	total: 492



8	9	10	11	12	13	14	15	16	1
DI7	DI8	DI9	DI10	DI11	DI12	DI13	DI14	DI15	DI0
+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_03
/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4
E12.7	E13.0	E13.1	E13.2	E13.3	E13.4	E13.5	E13.6	E13.7	E14.0
+CTRL_1.4-306K1:14	+CTRL_1.4-306K2:14	+CTRL_1.4-306K3:14	+CTRL_1.4-306K4:14	+CTRL_1.4-306K5:14	+CTRL_1.4-306K6:14	+CTRL_1.3-X3.10:6	+CTRL_1.3-X3.10:8	++CONV+CIR-231U1-F1:2	++CONV+CIR-231U1-F5:2
SUBSYSTEM 2_1_DC + Contactor K1 is on	SUBSYSTEM 2_1_DC -Contactor K7 is on	SUBSYSTEM 2_2_DC + Contactor K2 is on	SUBSYSTEM 2_2_DC -Contactor K8 is on	SUBSYSTEM 2_3_DC + Contactor K3 is on	SUBSYSTEM 2_3_DC -Contactor K9 is on	SUBSYSTEM 2_3_DC + SPARE	SUBSYSTEM 2_DC -SPARE	SUBSYSTEM 2_1_DC FUSE OK	SUBSYSTEM 2_2_DC FUSE OK

Feedback of DC Contactors

SUBSYSTEM 2_1_DC + Contactor K1 is on

SUBSYSTEM 2_1_DC - Contactor K7 is on

SUBSYSTEM 2_2_DC + Contactor K2 is on

SUBSYSTEM 2_2_DC - Contactor K8 is on

SUBSYSTEM 2_3_DC + Contactor K3 is on

SUBSYSTEM 2_3_DC - Contactor K9 is on

SUBSYSTEM 2_3_DC + SPARE

SUBSYSTEM 2_DC - SPARE

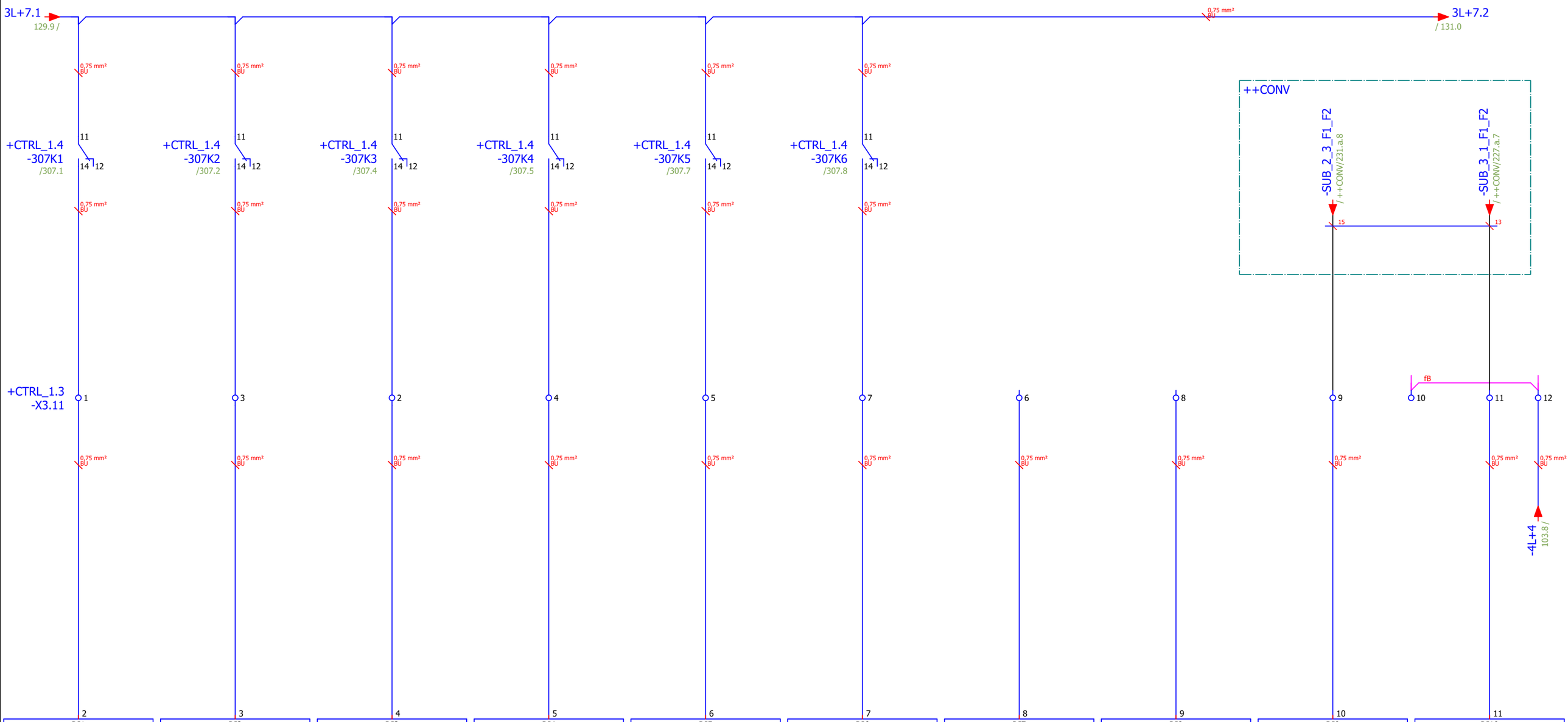
SUBSYSTEM 2_1_DC FUSE OK

SUBSYSTEM 2_2_DC FUSE OK

previous page: 128

next page: 130

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 129
Date								+ total: 492



2	3	4	5	6	7	8	9	10	11
DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	DI9	DI10
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03
/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4
E14.1	E14.2	E14.3	E14.4	E14.5	E14.6	E14.7	E15.0	E15.1	E15.2
+CTRL_1.4-307K1:14	+CTRL_1.4-307K2:14	+CTRL_1.4-307K3:14	+CTRL_1.4-307K4:14	+CTRL_1.4-307K5:14	+CTRL_1.4-307K6:14	+CTRL_1.3-X3.11:6	+CTRL_1.3-X3.11:8	++CONV+CIR-231U1-F9:2	++CONV+CIR-227U1-F1:2
SUBSYSTEM 3_1_DC + Contactor K1 is on	SUBSYSTEM 3_1_DC -Contactor K7 is on	SUBSYSTEM 3_2_DC + Contactor K2 is on	SUBSYSTEM 3_2_DC -Contactor K8 is on	SUBSYSTEM 3_3_DC + Contactor K3 is on	SUBSYSTEM 3_3_DC -Contactor K9 is on	SUBSYSTEM 3_DC + SPARE	SUBSYSTEM 3_DC -SPARE	SUBSYSTEM 2_DC FUSE OK	SUBSYSTEM 3_1_DC FUSE OK

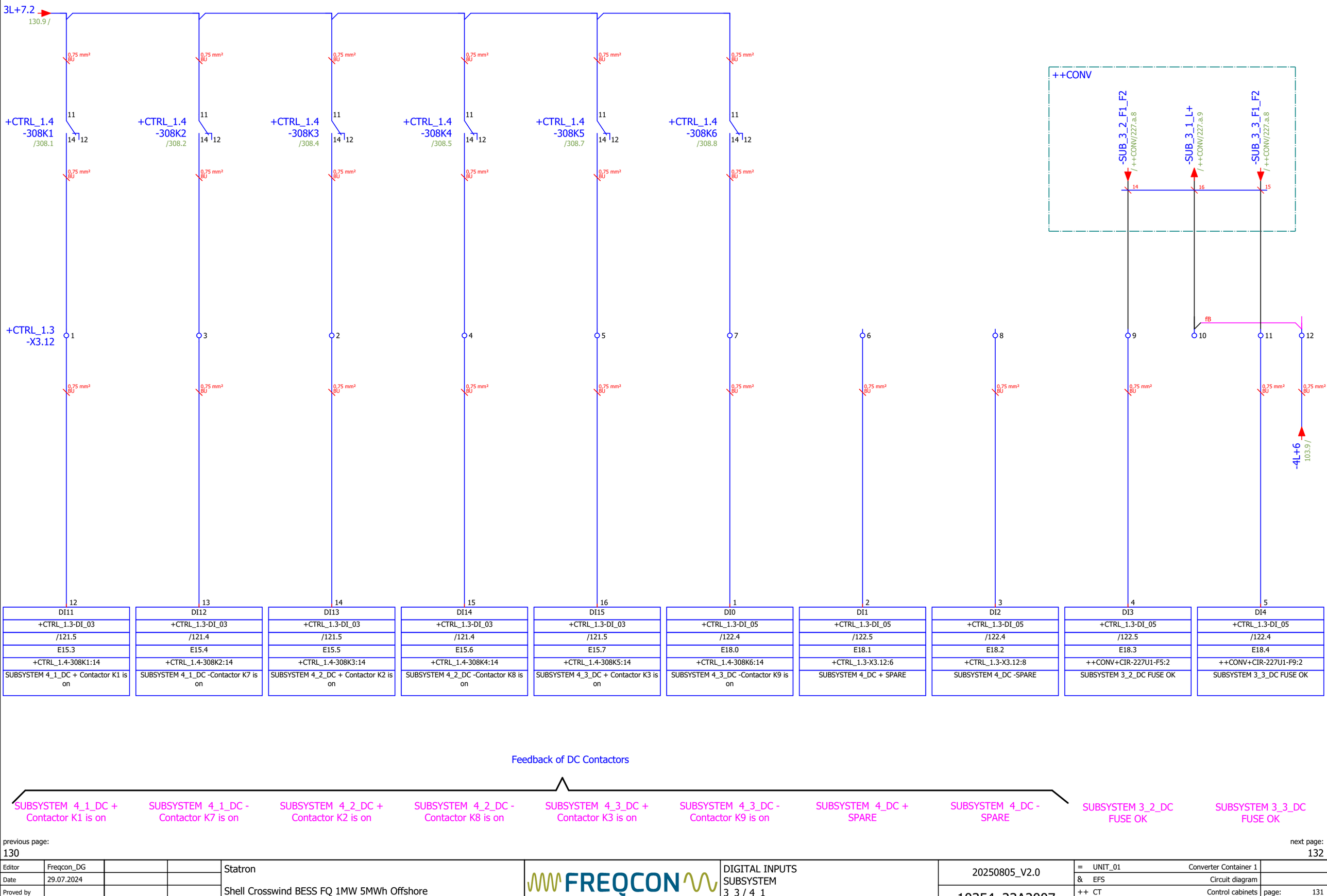
Feedback of DC Contactors

SUBSYSTEM 3_1_DC + Contactor K1 is on | SUBSYSTEM 3_1_DC - Contactor K7 is on | SUBSYSTEM 3_2_DC + Contactor K2 is on | SUBSYSTEM 3_2_DC - Contactor K8 is on | SUBSYSTEM 3_3_DC + Contactor K3 is on | SUBSYSTEM 3_3_DC - Contactor K9 is on | SUBSYSTEM 3_DC + SPARE | SUBSYSTEM 3_DC - SPARE | SUBSYSTEM 2_DC FUSE OK | SUBSYSTEM 3_1_DC FUSE OK

previous page: 129

next page: 131

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 130
Date								+ total: 492



12	13	14	15	16	1	2	3	4	5
DI11	DI12	DI13	DI14	DI15	DI0	DI1	DI2	DI3	DI4
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05
/121.5	/121.4	/121.5	/121.4	/121.5	/122.4	/122.5	/122.4	/122.5	/122.4
E15.3	E15.4	E15.5	E15.6	E15.7	E18.0	E18.1	E18.2	E18.3	E18.4
+CTRL_1.4-308K1:14	+CTRL_1.4-308K2:14	+CTRL_1.4-308K3:14	+CTRL_1.4-308K4:14	+CTRL_1.4-308K5:14	+CTRL_1.4-308K6:14	+CTRL_1.3-X3.12:6	+CTRL_1.3-X3.12:8	++CONV+CIR-227U1-F5:2	++CONV+CIR-227U1-F9:2
SUBSYSTEM 4_1_DC + Contactor K1 is on	SUBSYSTEM 4_1_DC -Contactor K7 is on	SUBSYSTEM 4_2_DC + Contactor K2 is on	SUBSYSTEM 4_2_DC -Contactor K8 is on	SUBSYSTEM 4_3_DC + Contactor K3 is on	SUBSYSTEM 4_3_DC -Contactor K9 is on	SUBSYSTEM 4_DC + SPARE	SUBSYSTEM 4_DC -SPARE	SUBSYSTEM 3_2_DC FUSE OK	SUBSYSTEM 3_3_DC FUSE OK

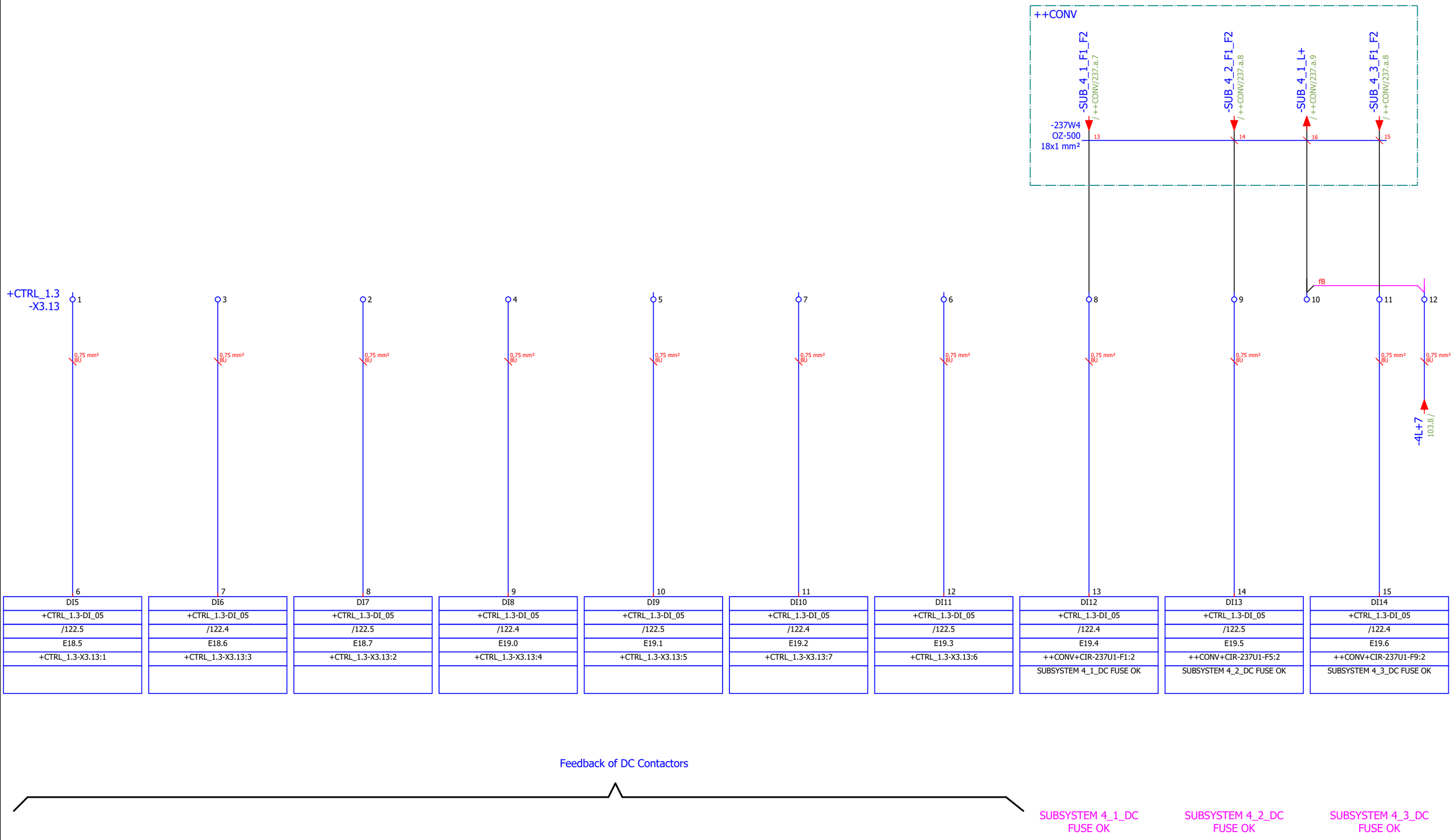
Feedback of DC Contactors

SUBSYSTEM 4_1_DC + Contactor K1 is on | SUBSYSTEM 4_1_DC - Contactor K7 is on | SUBSYSTEM 4_2_DC + Contactor K2 is on | SUBSYSTEM 4_2_DC - Contactor K8 is on | SUBSYSTEM 4_3_DC + Contactor K3 is on | SUBSYSTEM 4_3_DC - Contactor K9 is on | SUBSYSTEM 4_DC + SPARE | SUBSYSTEM 4_DC - SPARE | SUBSYSTEM 3_2_DC FUSE OK | SUBSYSTEM 3_3_DC FUSE OK

previous page: 130

next page: 132

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 131
Date								+ total: 492



Feedback of DC Contactors

SUBSYSTEM 4_1_DC FUSE OK

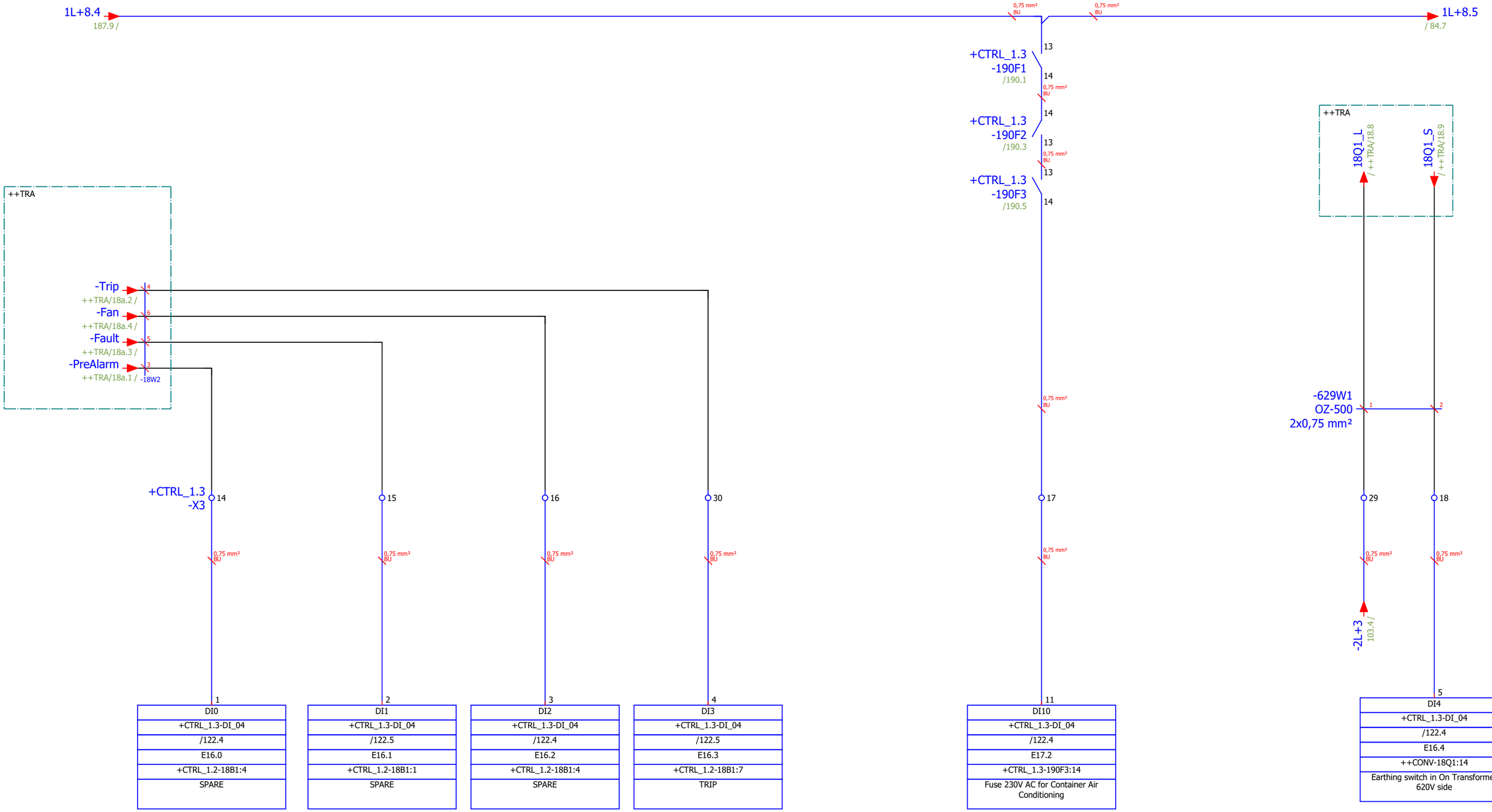
SUBSYSTEM 4_2_DC FUSE OK

SUBSYSTEM 4_3_DC FUSE OK

previous page: 131

next page: 133

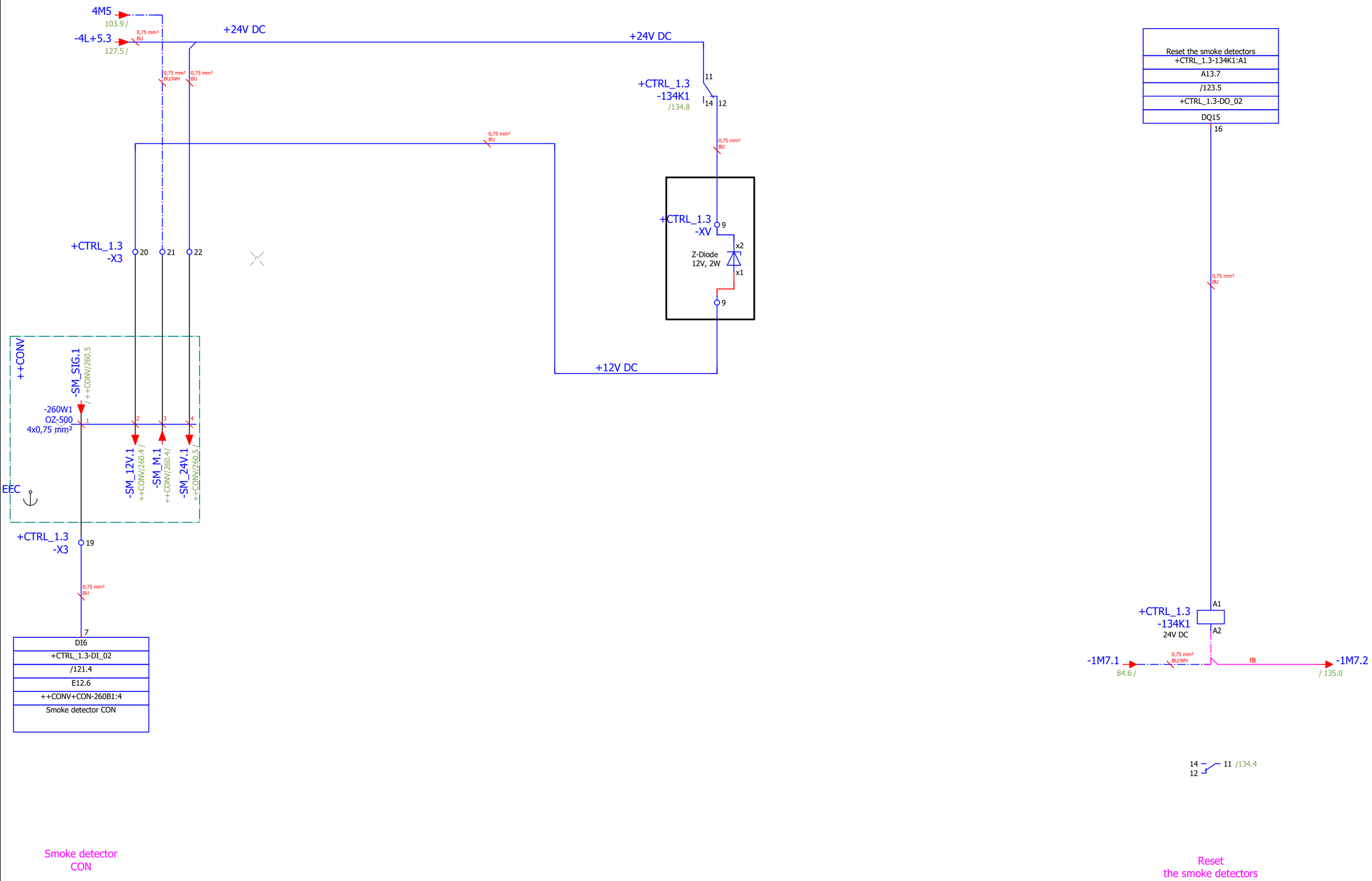
Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 132
Date								+	total: 492



previous page: 132

next page: 134

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SPARE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 133
Date								+	total: 492



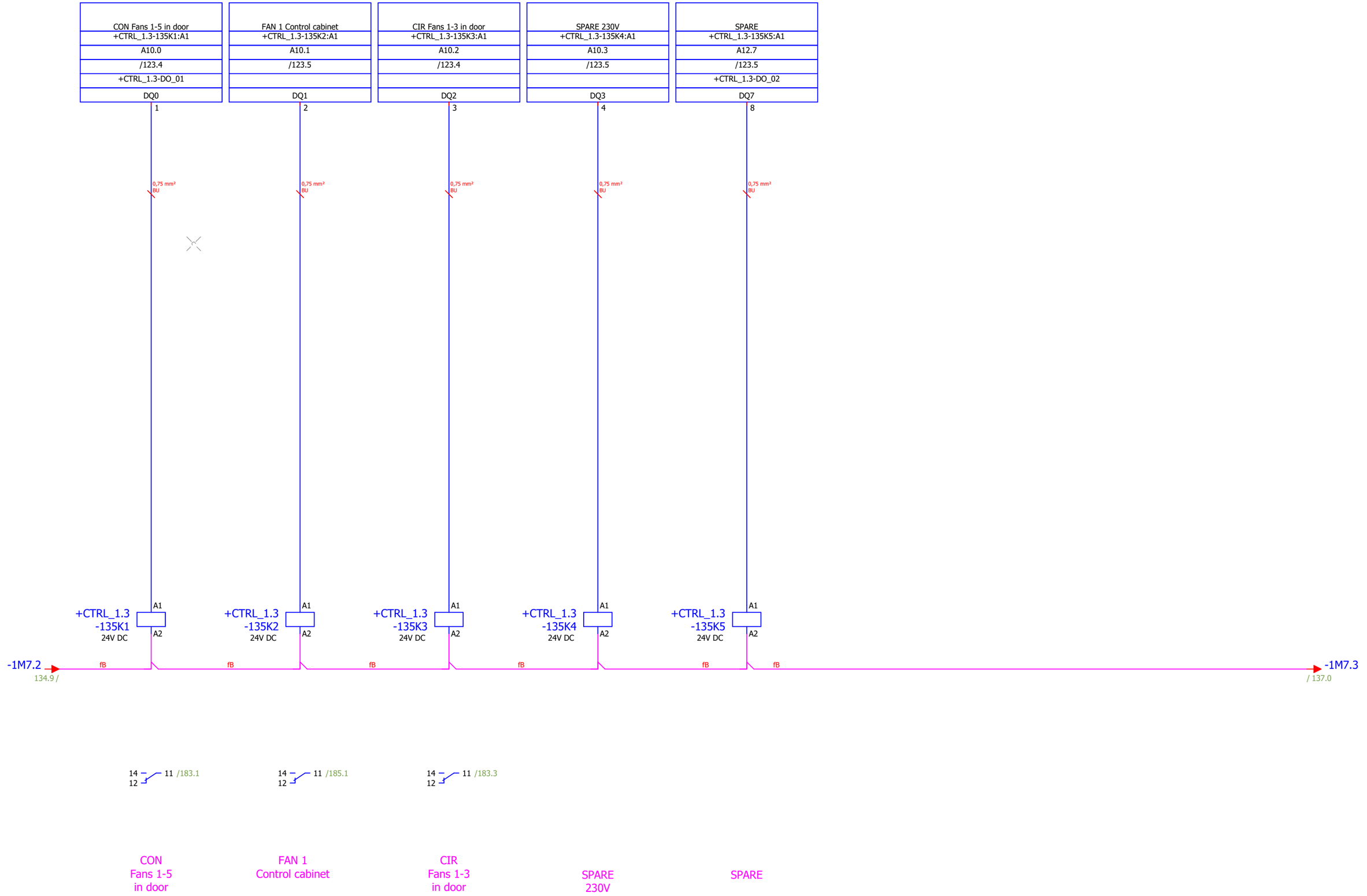
previous page:
133

next page:
135

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SMOKE DETECTORS	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

page: 134
total: 492

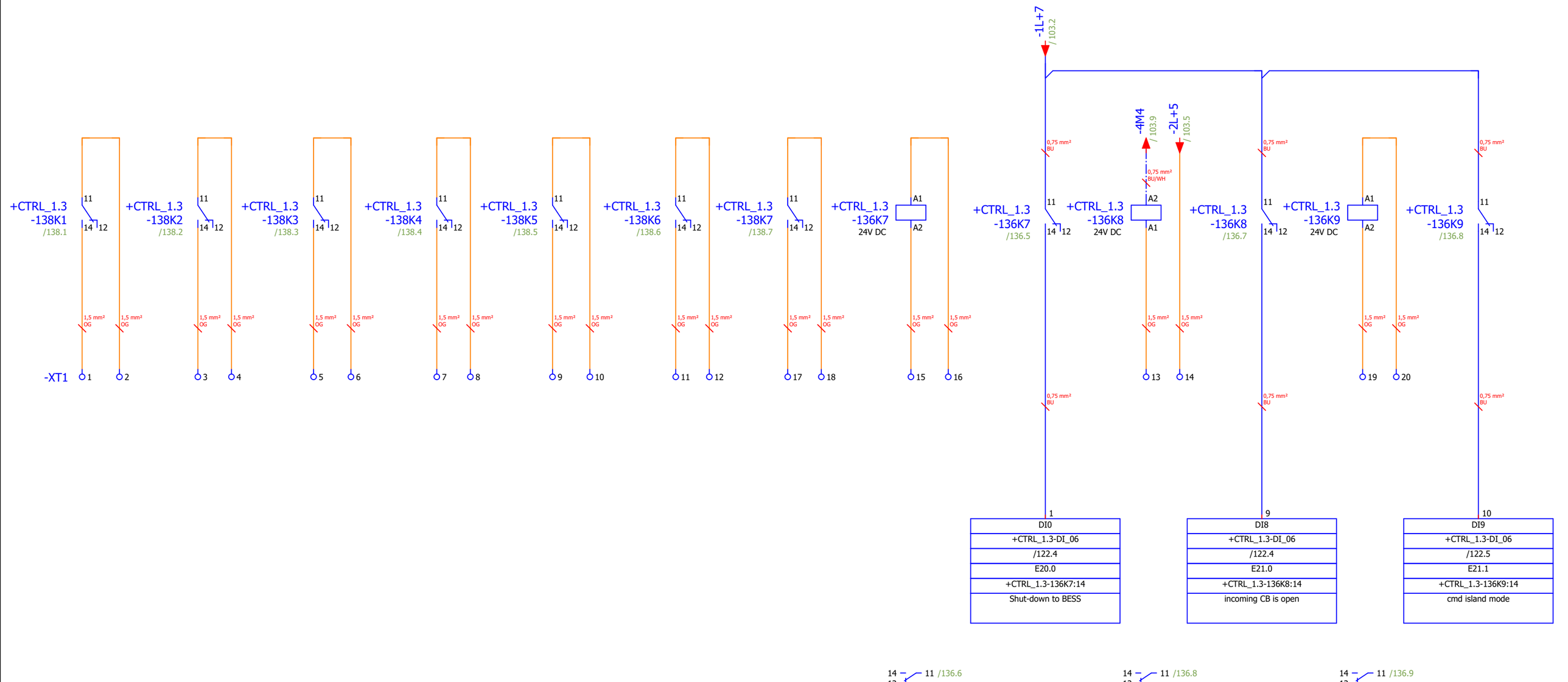
0	1	2	3	4	5	6	7	8	9



previous page: 134

next page: 136

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FAN	20250805_V2.0	= UNIT_01	Converter Container 1
Date	19.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 135
Date								+	total: 492

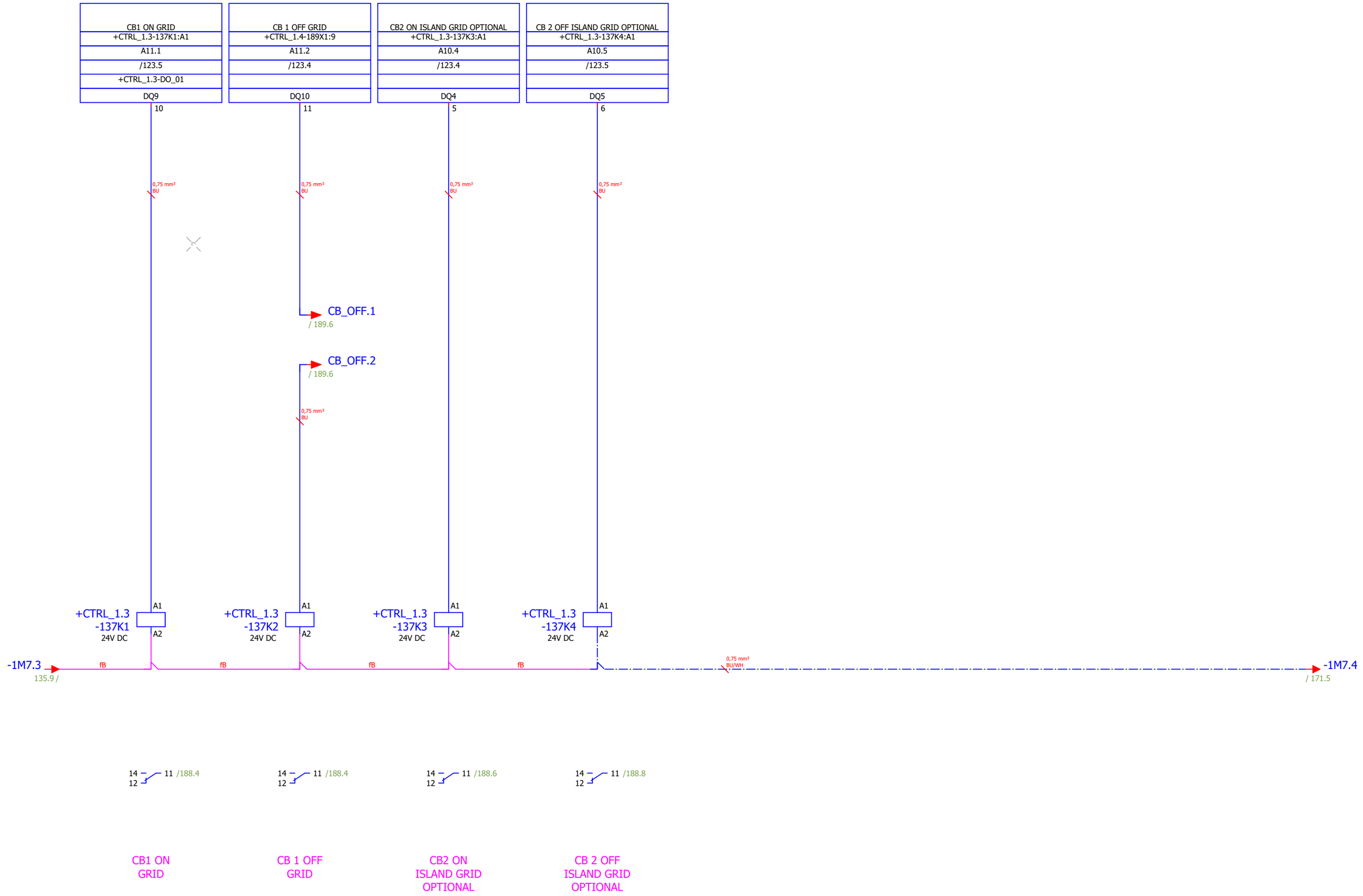


Gas confirmed FGS	Smoke confirmed FGS	PLC fault status SIS	Thermal runaway SIS	Spare	Spare	phase in sync	Shut-down to BESS	Shut-down to BESS	incoming CB is open	incoming CB is open	cmd island mode	cmd island mode

previous page: 135

next page: 137

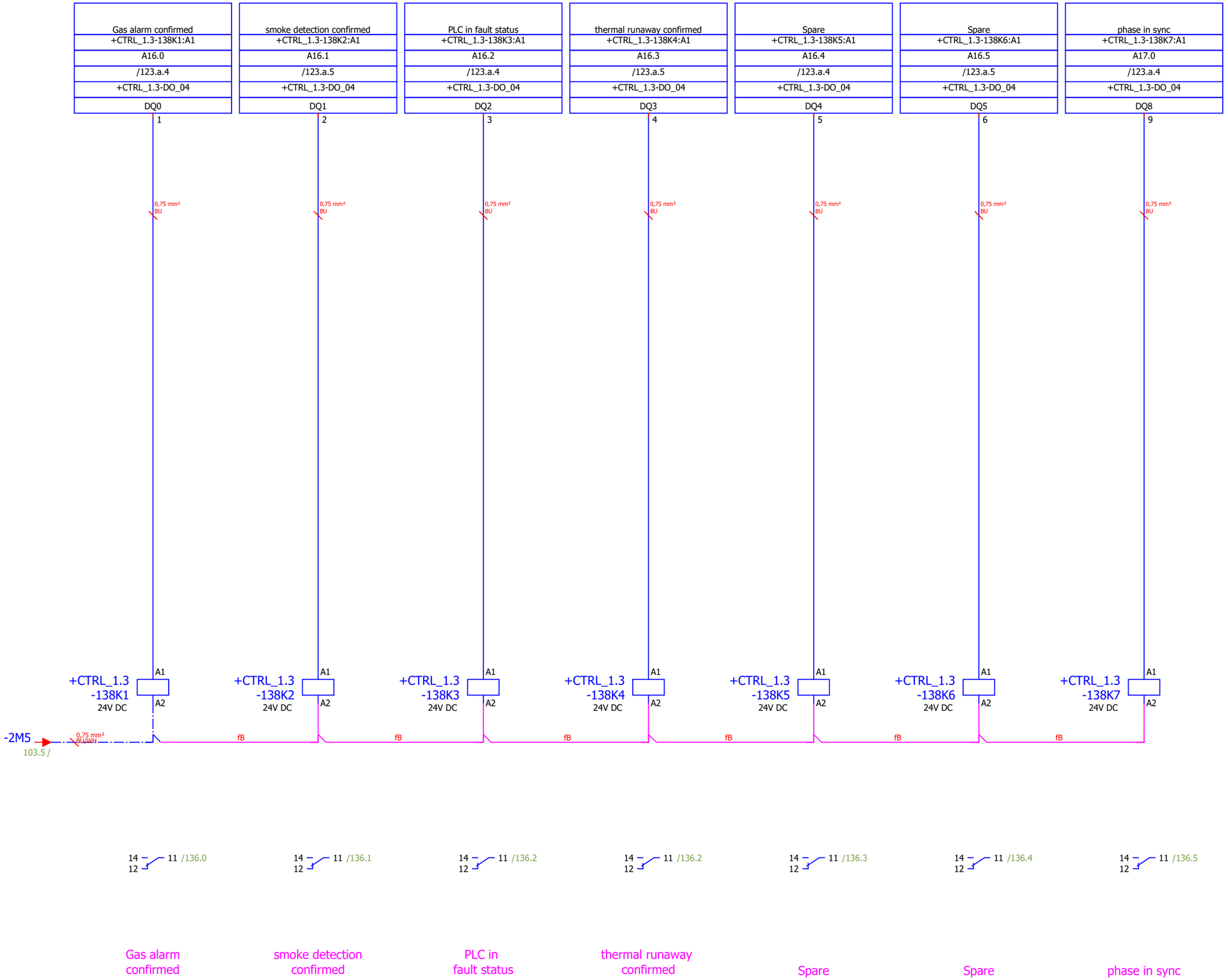
Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 136
Date								+	total: 492



previous page: 136

next page: 138

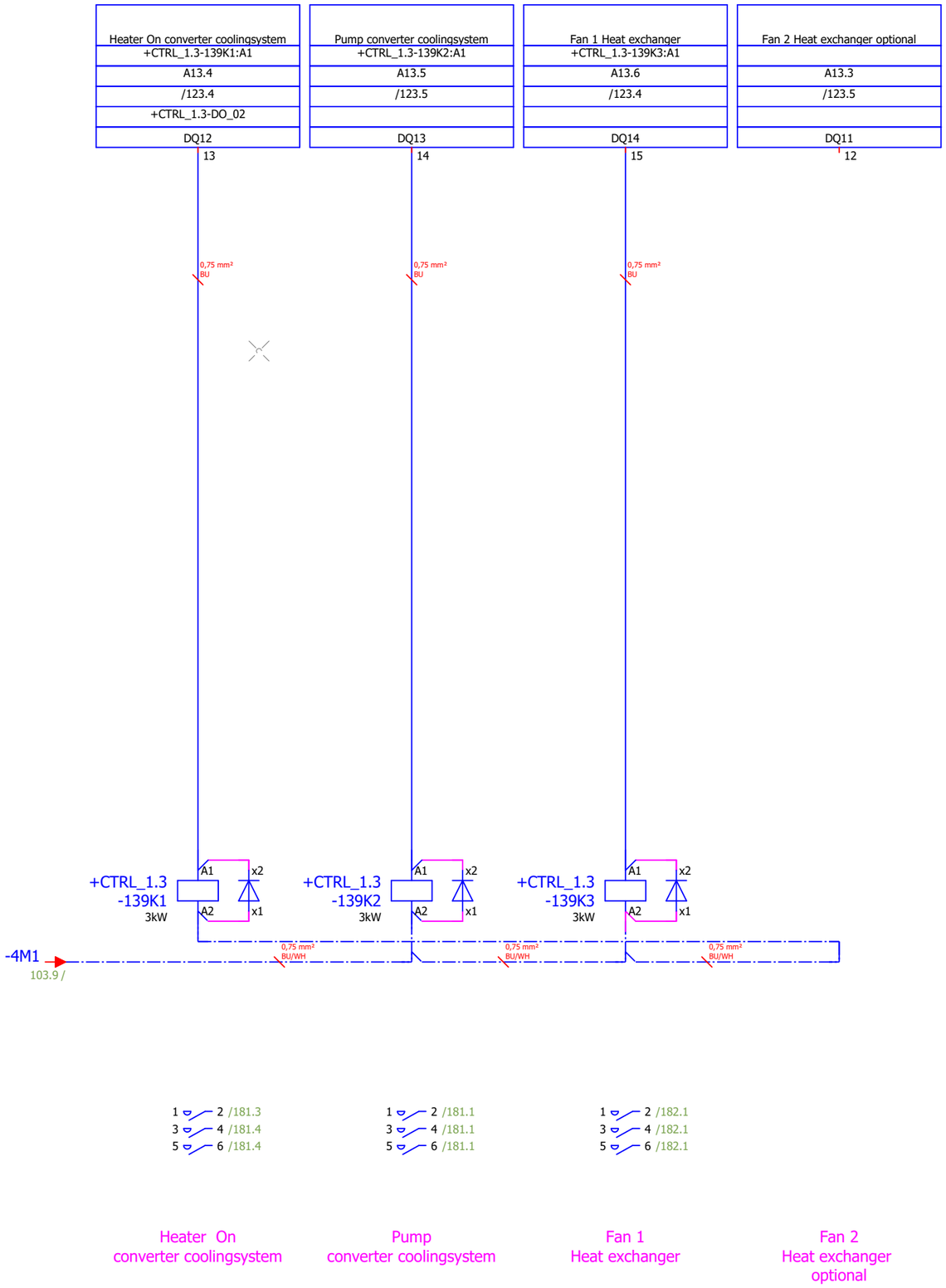
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CIRCUIT BREAKER	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 137
Date								+	total: 492



previous page: 137

next page: 139

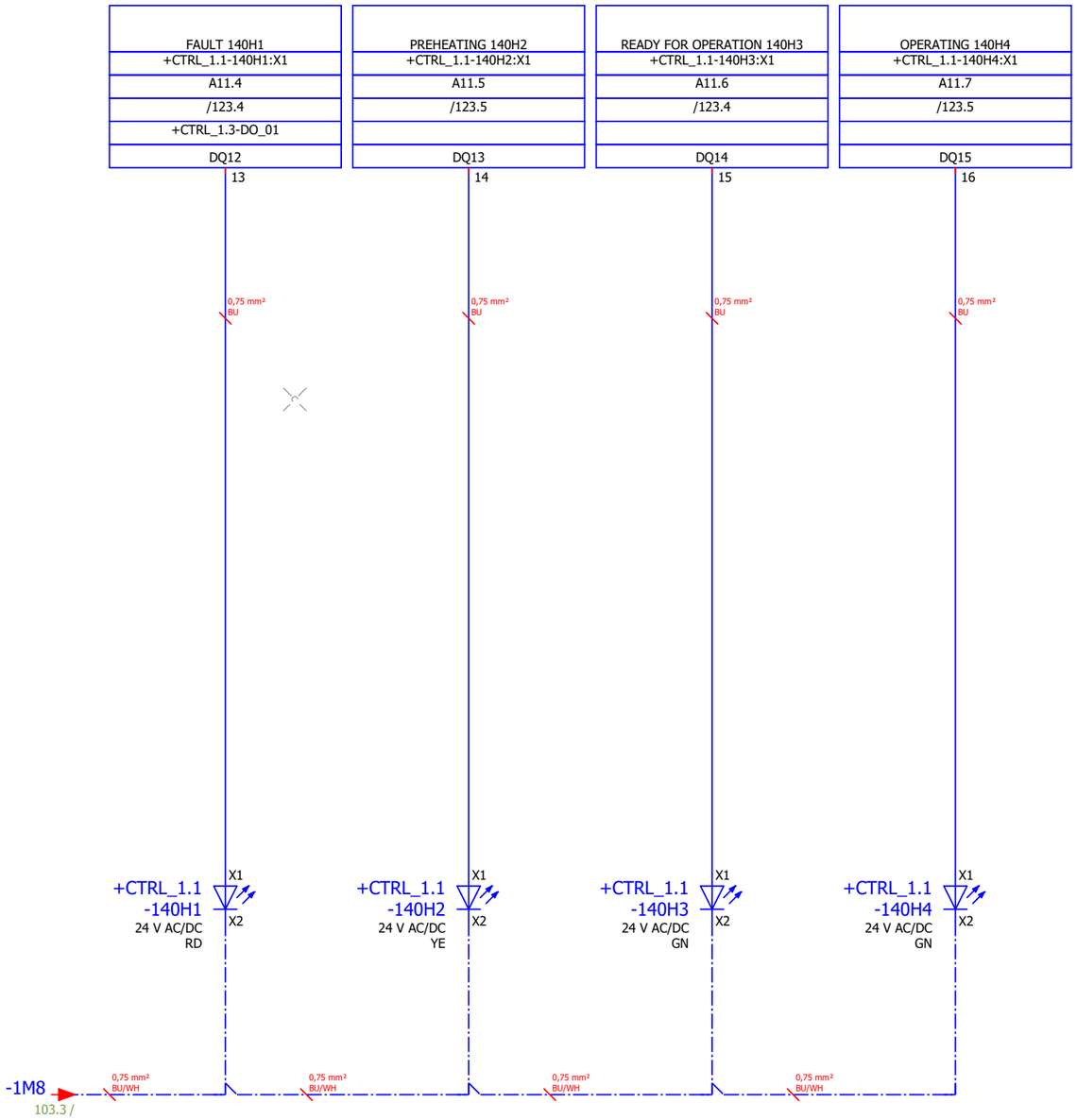
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	03.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 138
Date								+	total: 492



previous page:
138

next page:
140

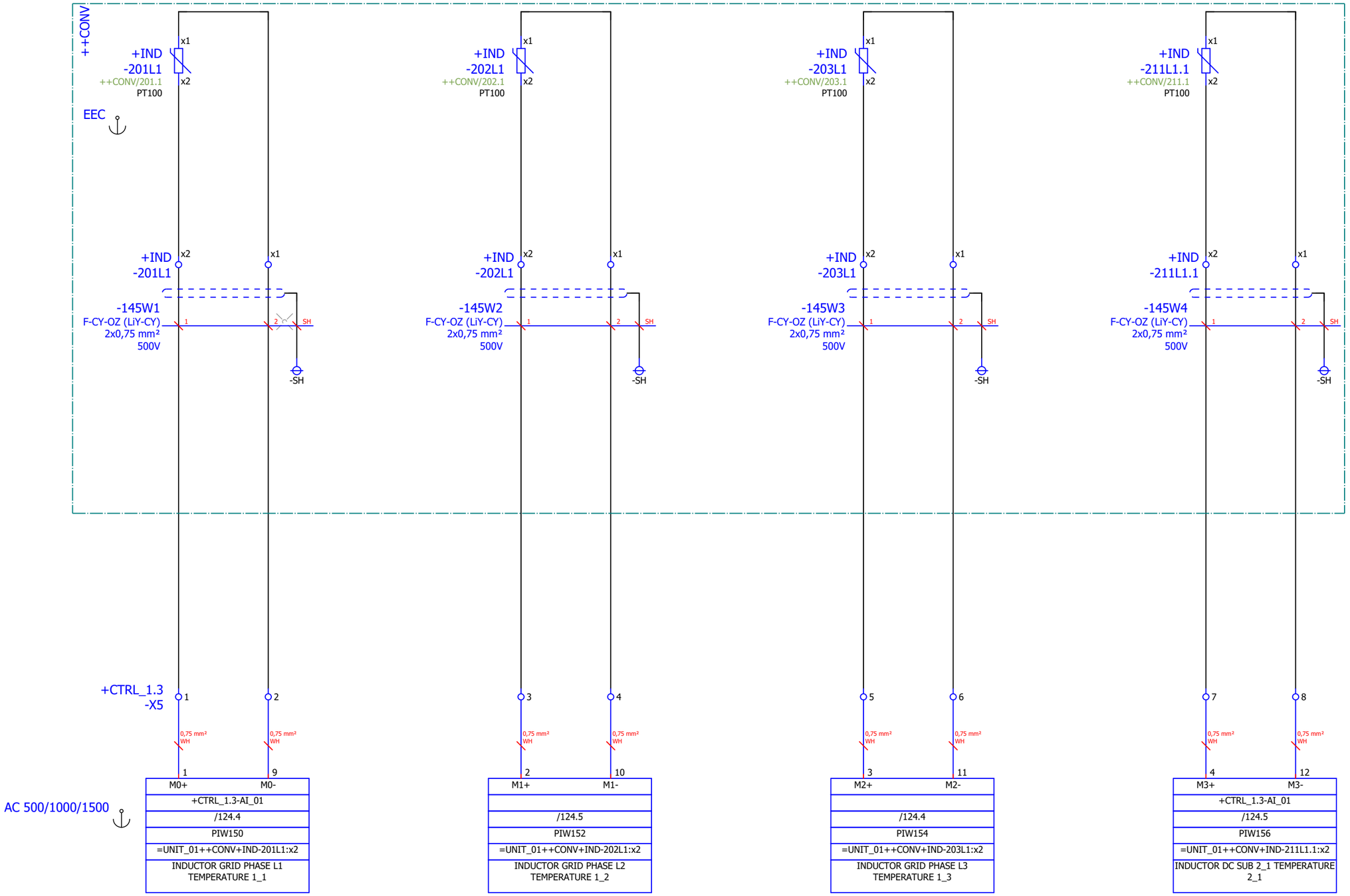
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COOLING	20250805_V2.0	= UNIT_01	Converter Container 1
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 139
Date								+	total: 492



previous page: 139

next page: 145

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	14.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 140
Date								+		total: 492



INDUCTOR
GRID PHASE L1
TEMPERATURE 1_1

INDUCTOR
GRID PHASE L2
TEMPERATURE 1_2

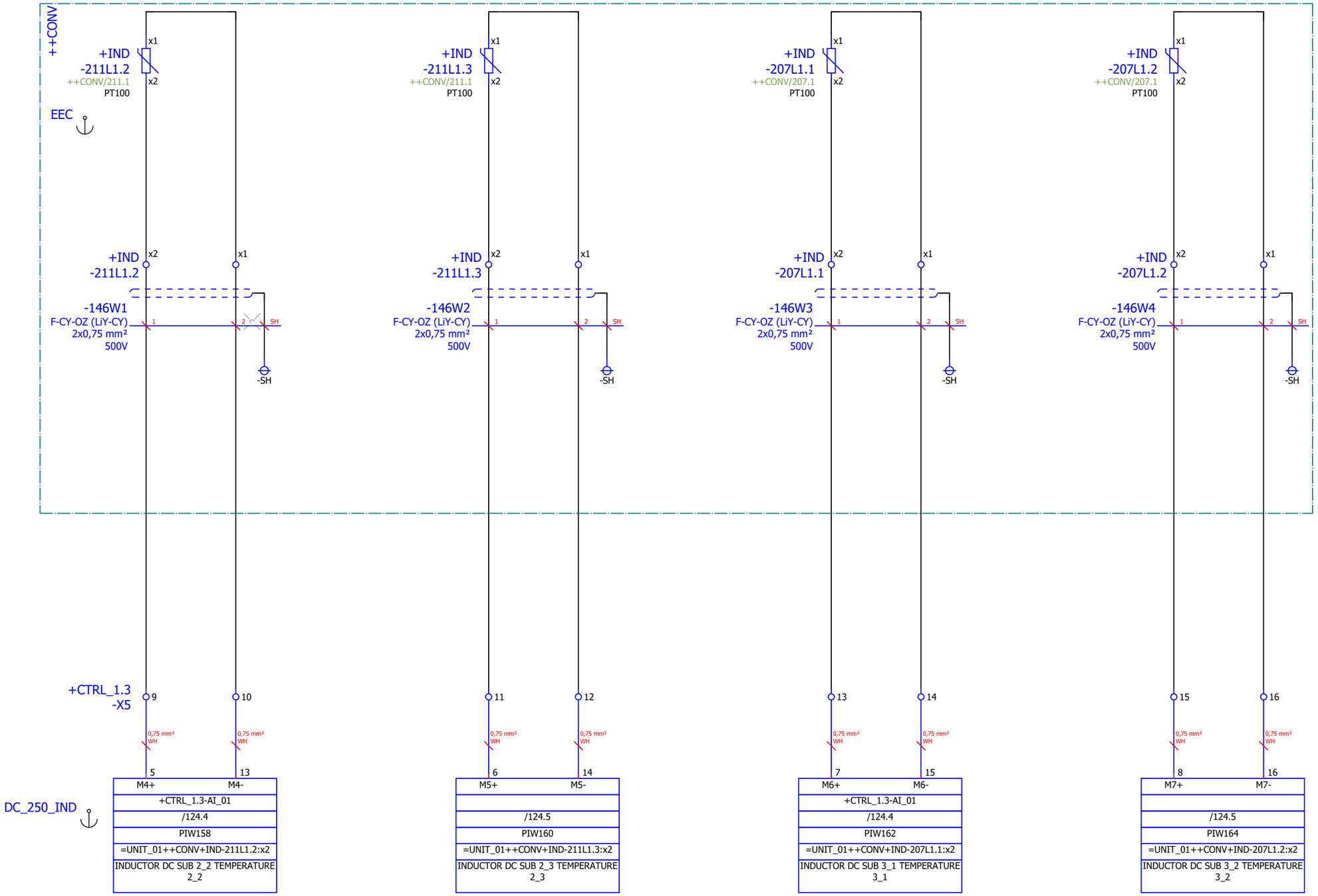
INDUCTOR
GRID PHASE L3
TEMPERATURE 1_3

INDUCTOR
DC SUB 2_1
TEMPERATURE 2_1

previous page:
140

next page:
146

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	14.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 145
Date								+		total: 492



INDUCTOR
DC SUB 2_2
TEMPERATURE 2_2

INDUCTOR
DC SUB 2_3
TEMPERATURE 2_3

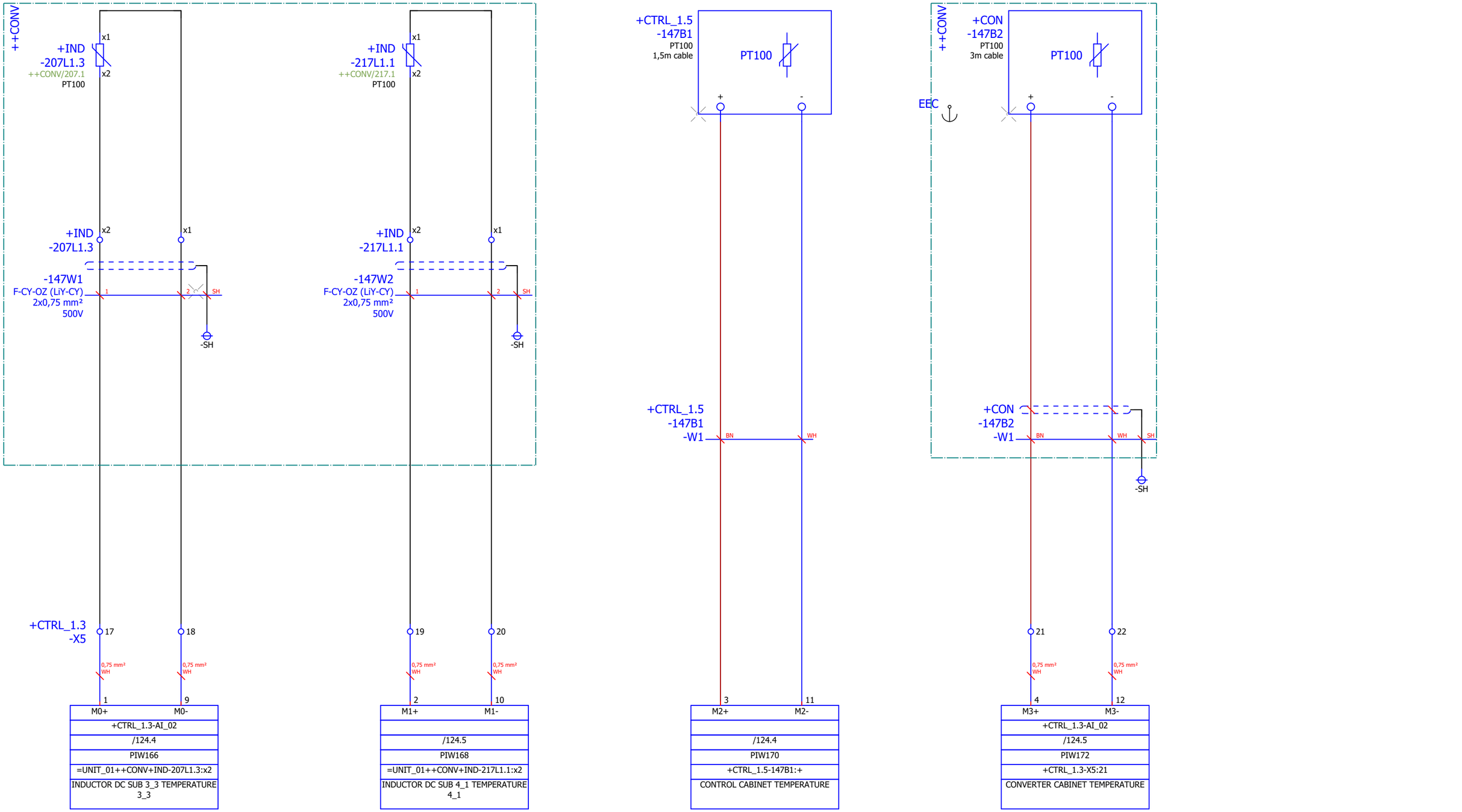
INDUCTOR
DC SUB 3_1
TEMPERATURE 3_1

INDUCTOR
DC SUB 3_2
TEMPERATURE 3_2

previous page: 145

next page: 147

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 146
Date								+		total: 492



INDUCTOR DC SUB 3_3 TEMPERATURE 3_3

INDUCTOR DC SUB 4_1 TEMPERATURE 4_1

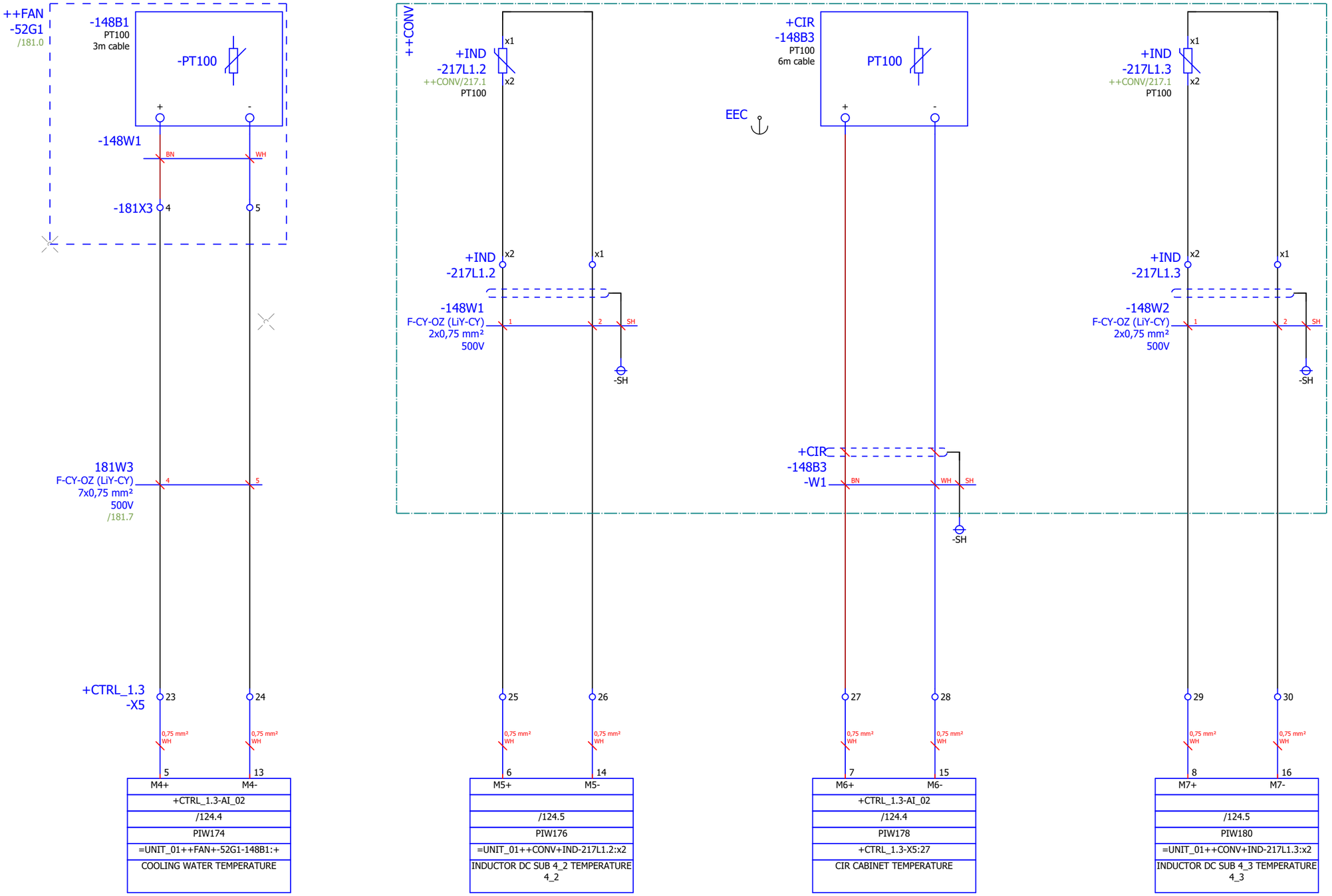
CONTROL CABINET TEMPERATURE

CONVERTER CABINET TEMPERATURE

previous page: 146

next page: 148

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS CABINET TEMPERATURE	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 147
Date								+	total: 492



COOLING WATER TEMPERATURE

INDUCTOR DC SUB 4_2 TEMPERATURE 4_2

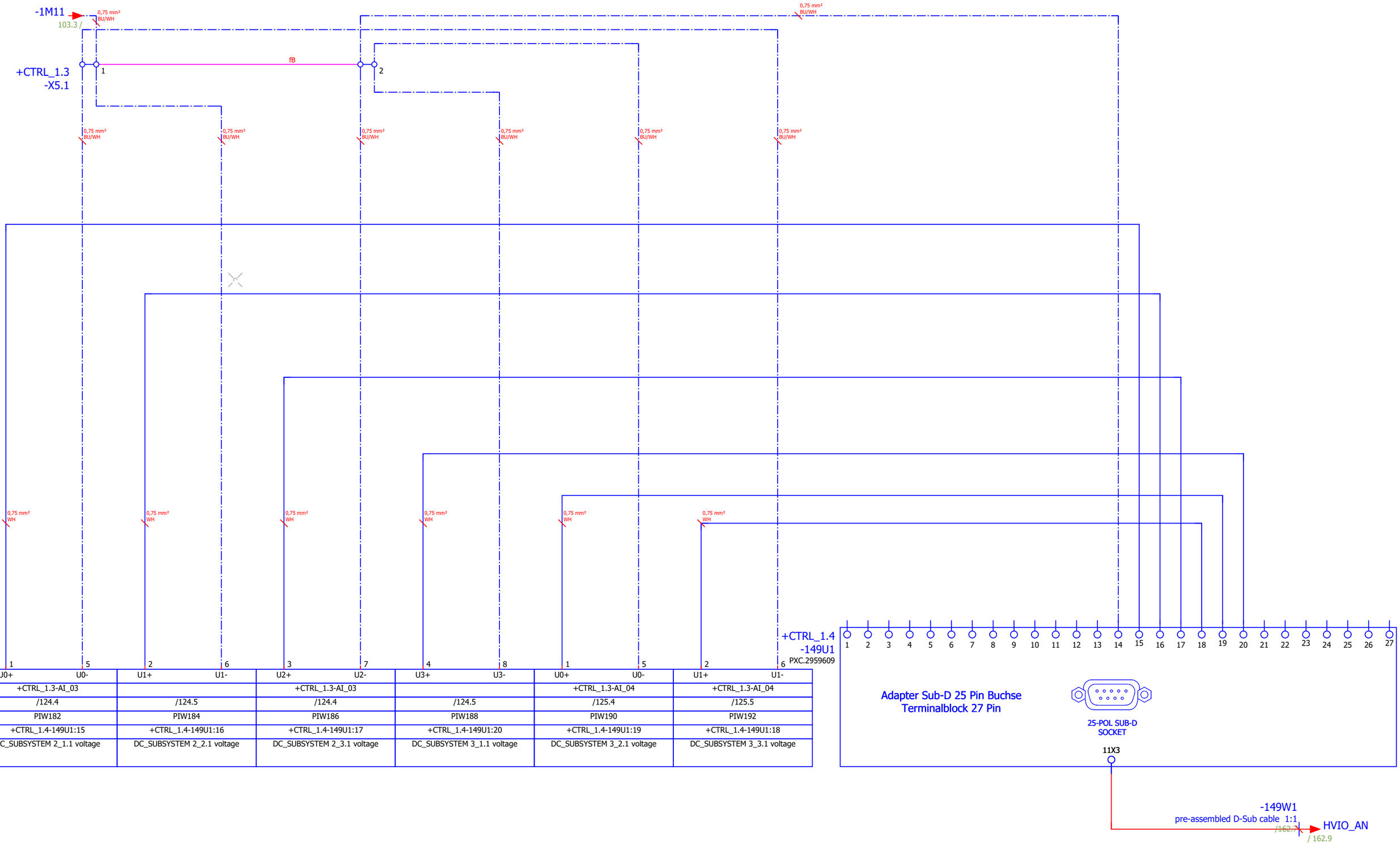
CIR CABINET TEMPERATURE

INDUCTOR DC SUB 4_3 TEMPERATURE 4_3

previous page: 147

next page: 149

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS COOLING WATER TEMPERATURE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 148
Date								+		total: 492

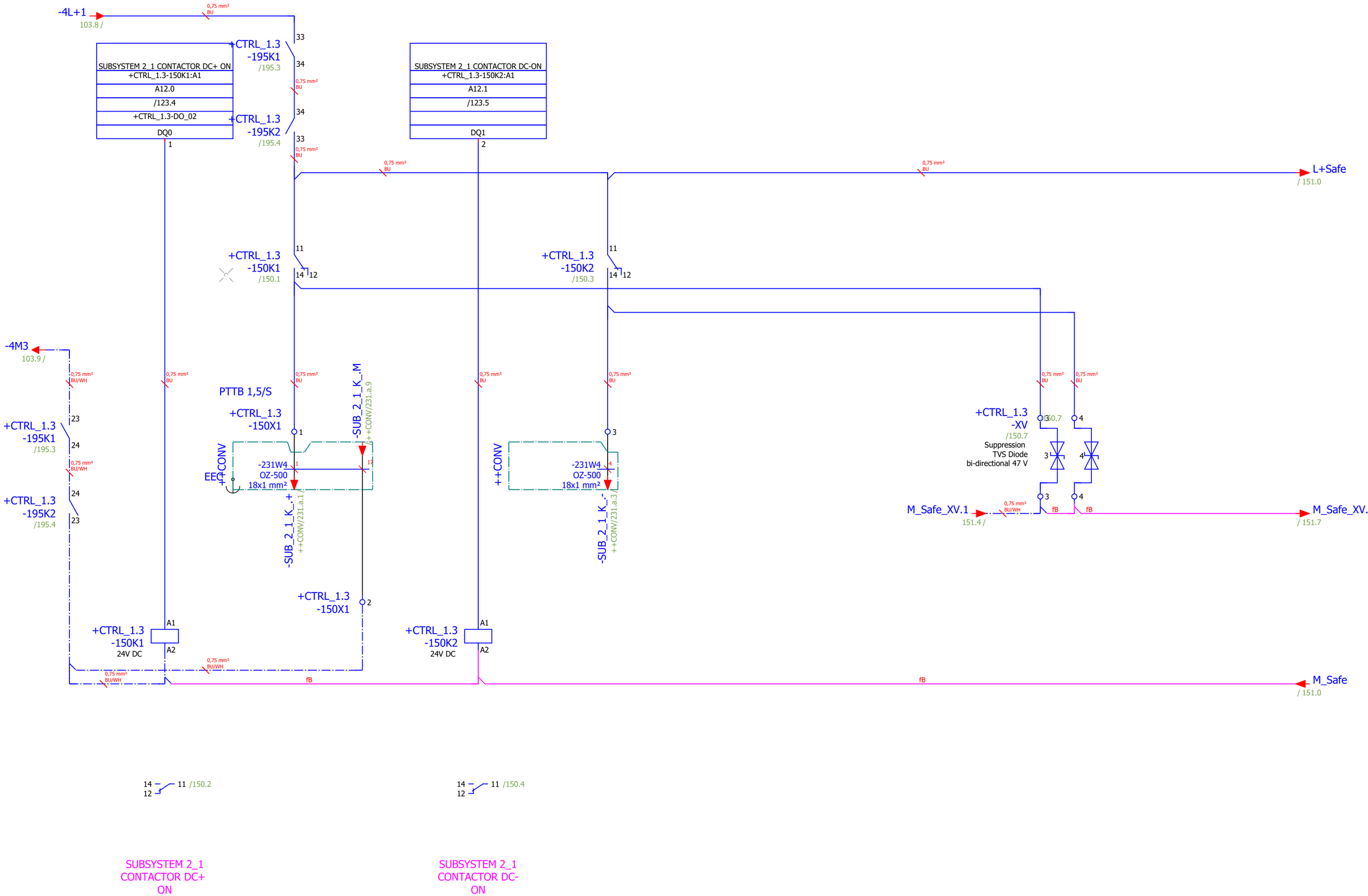


Voltage measurement

previous page: 148

next page: 150

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS MEASURING VOLTAGE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 149
Date							10354_23A2007	+		total: 492



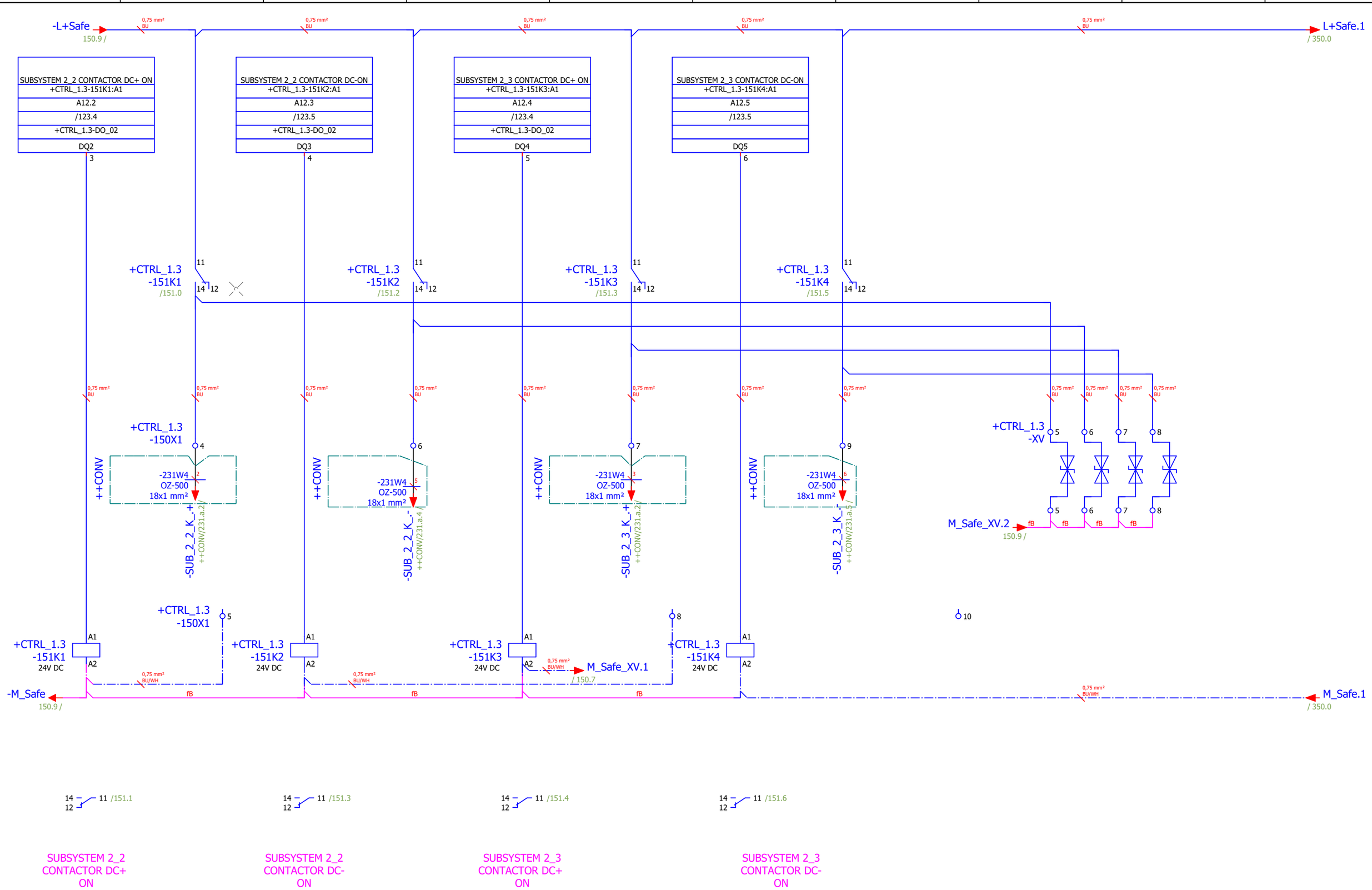
14 12 11 /150.2

14 12 11 /150.4

SUBSYSTEM 2_1 CONTACTOR DC+ ON

SUBSYSTEM 2_1 CONTACTOR DC- ON

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 150
Date								+	total: 492



14 12 11 /151.1

14 12 11 /151.3

14 12 11 /151.4

14 12 11 /151.6

SUBSYSTEM 2_2 CONTACTOR DC+ ON

SUBSYSTEM 2_2 CONTACTOR DC- ON

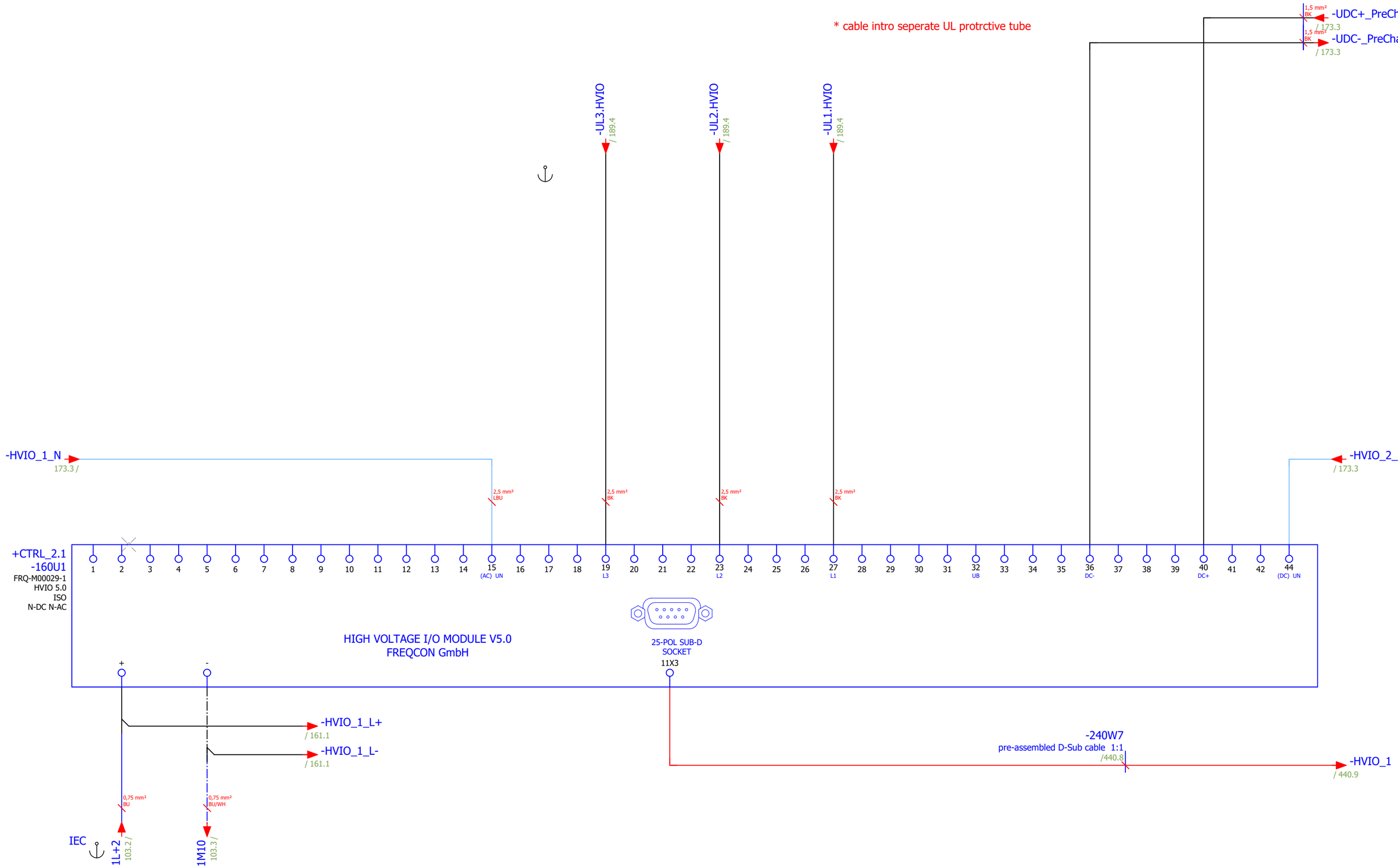
SUBSYSTEM 2_3 CONTACTOR DC+ ON

SUBSYSTEM 2_3 CONTACTOR DC- ON

previous page: 150

next page: 160

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_2, 2_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 151
Date								+	total: 492

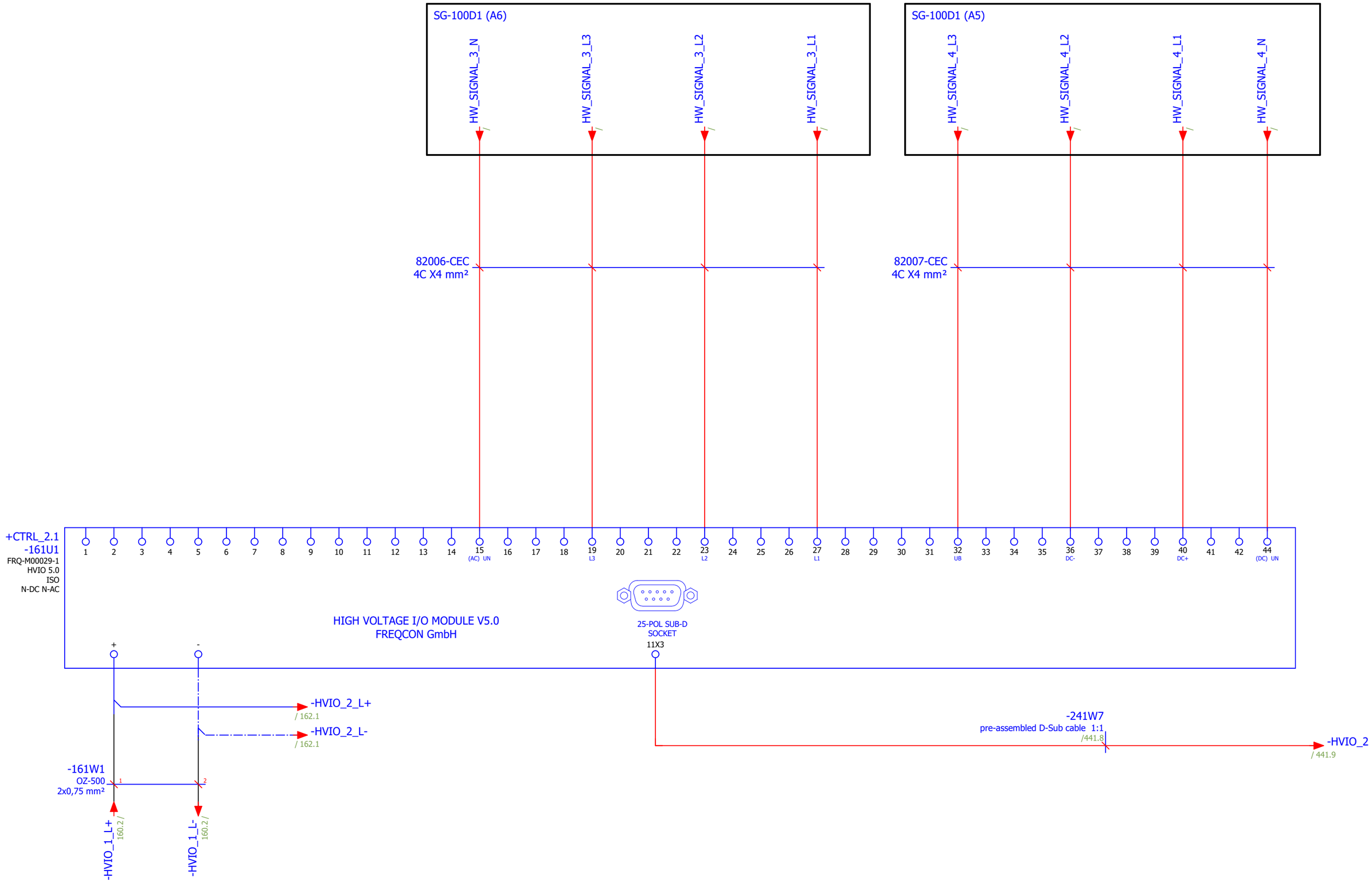


previous page: 151

Measuring: Grid side voltage / DC-Link

next page: 161

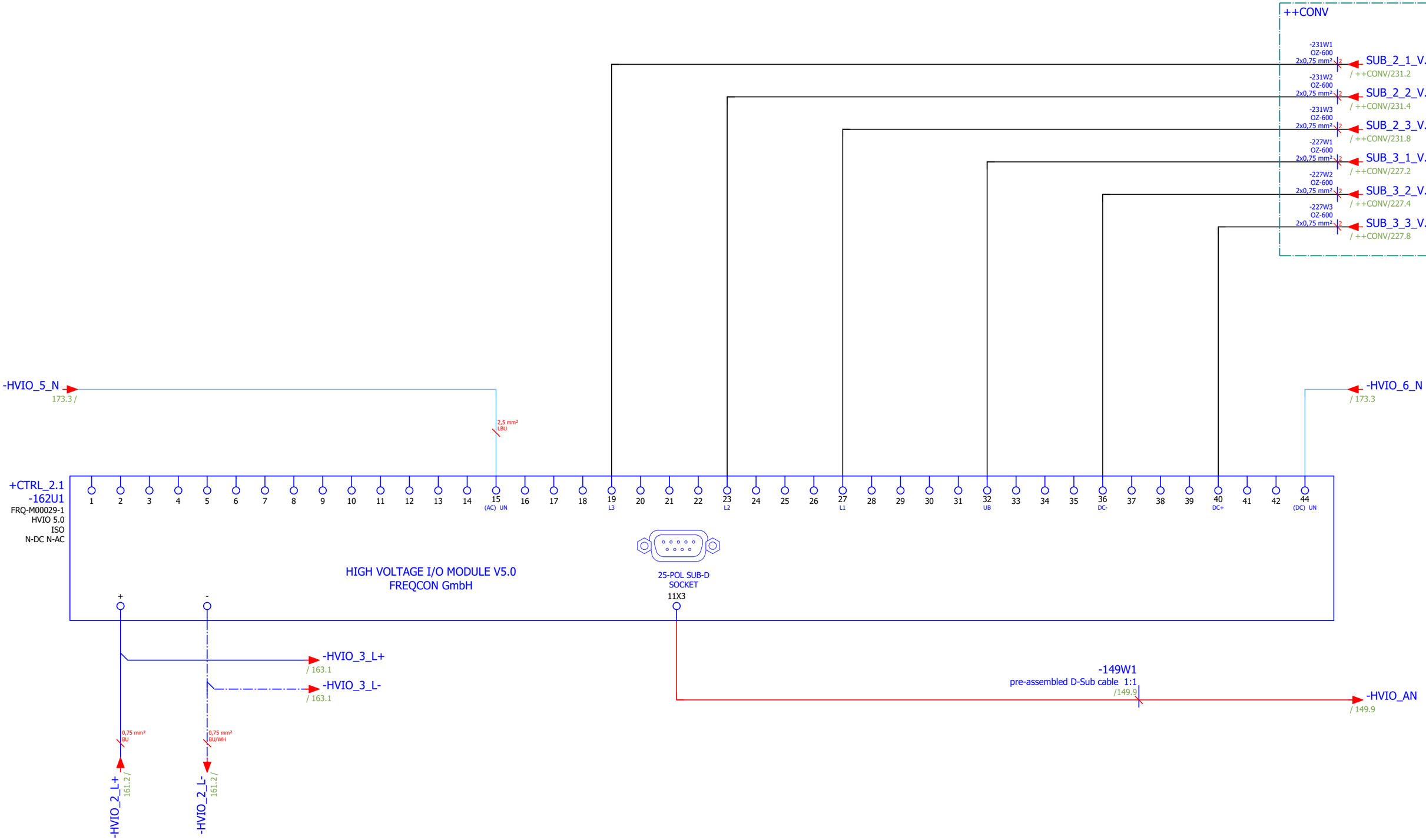
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 160
Date								+	total: 492



previous page:
160

next page:
162

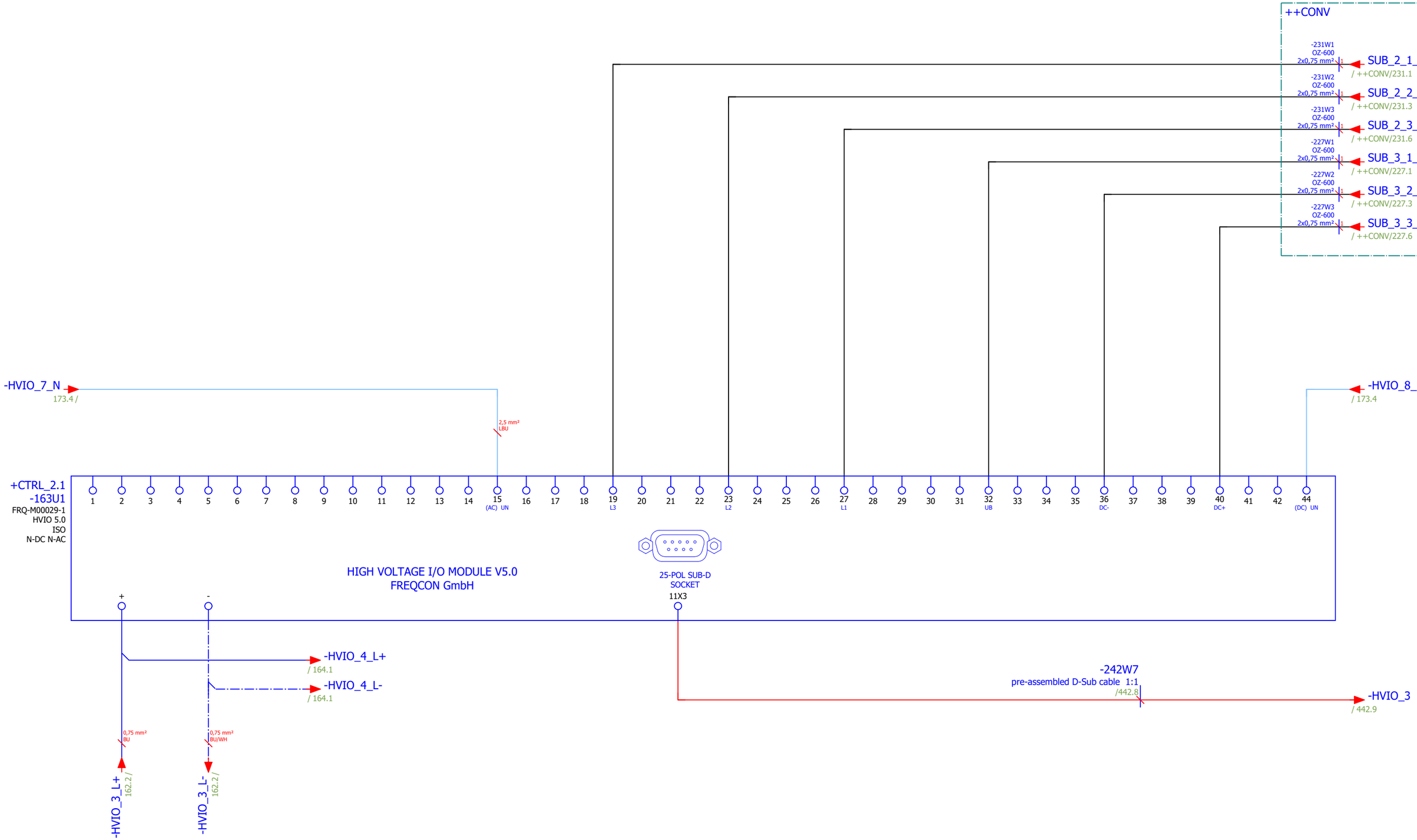
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 2	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.08.2025							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 161
Date								+		total: 492



previous page:
161

next page:
163

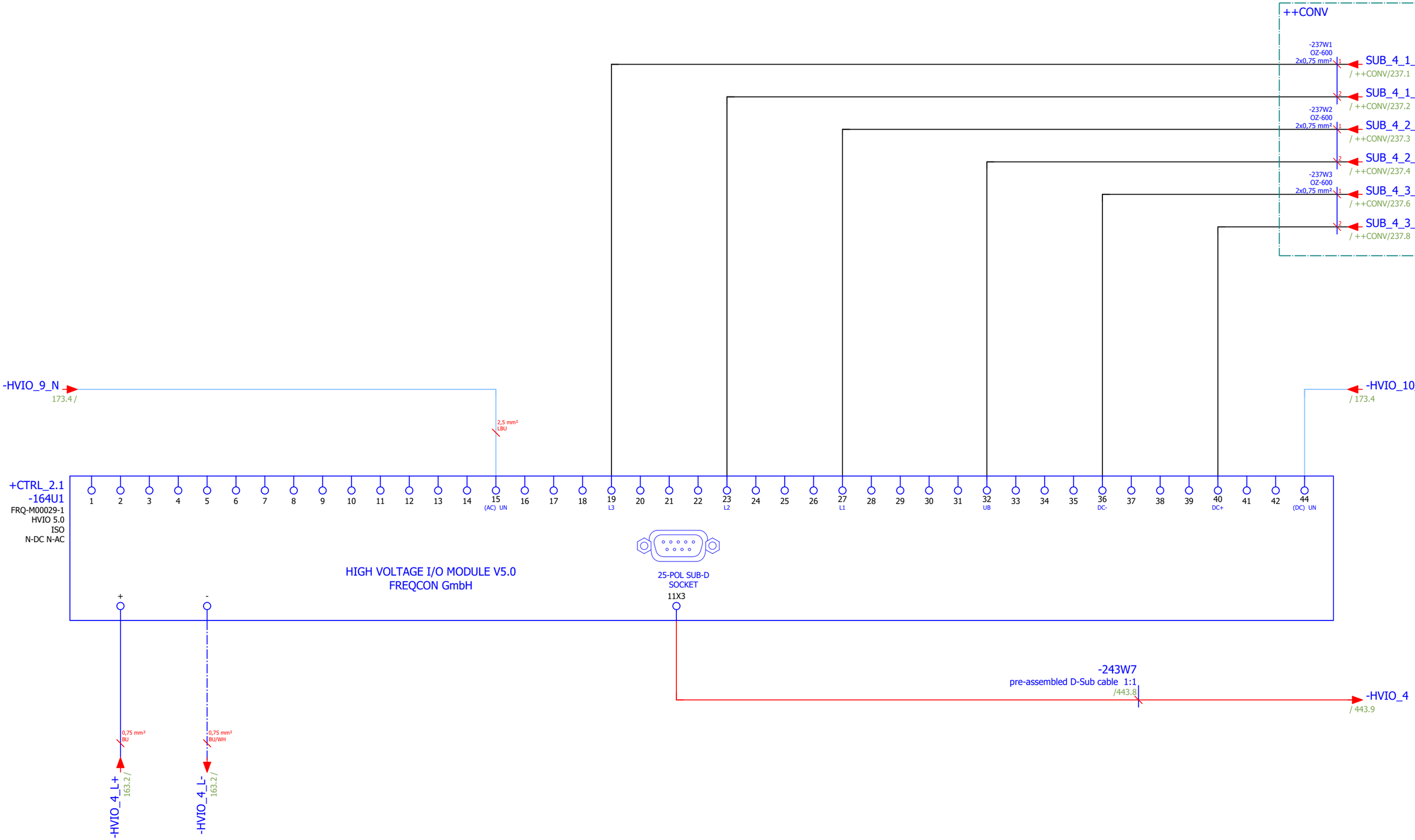
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 2 ANALOG	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 162
Date								+	total: 492



previous page:
162

next page:
164

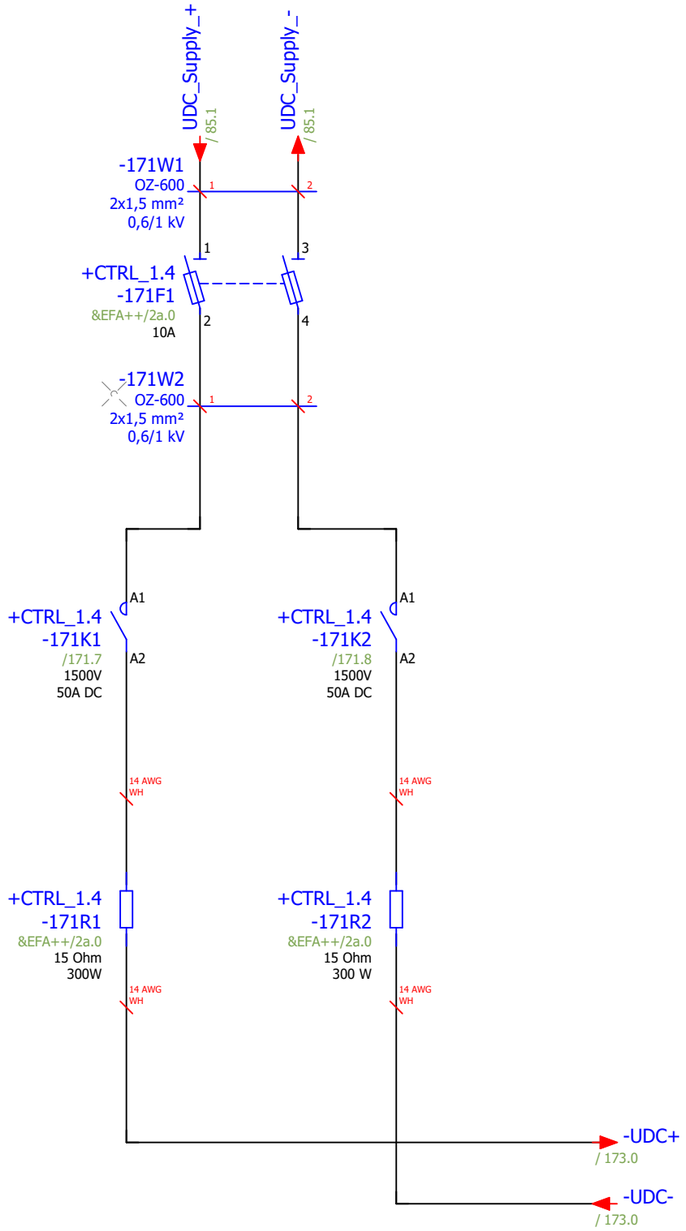
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 163
Date								+	total: 492



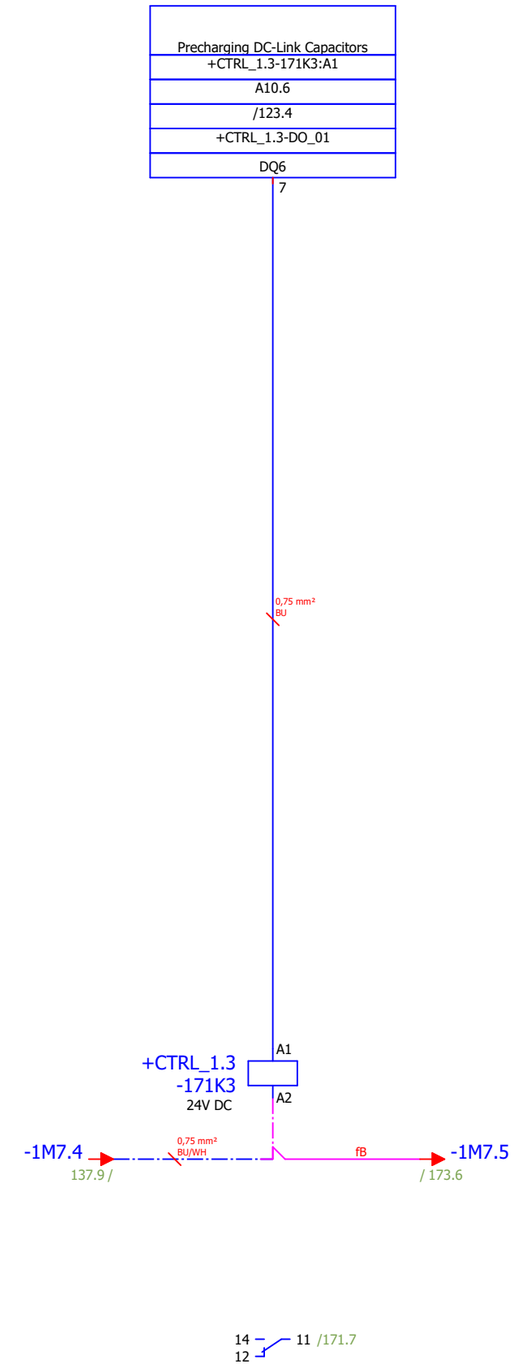
previous page:
163

next page:
171

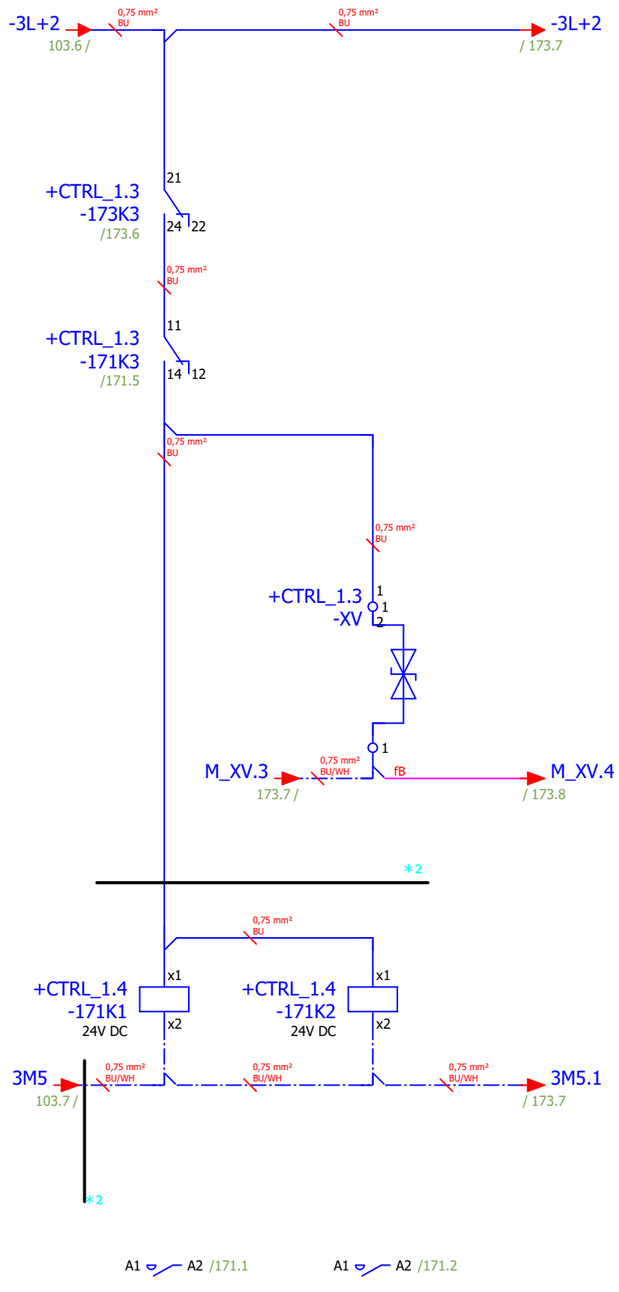
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 4	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 164
Date								+	total: 492



RESISTORS
FOR PRECHARGING
from Grid or Battery or DC-Link



Precharging
DC-Link Capacitors

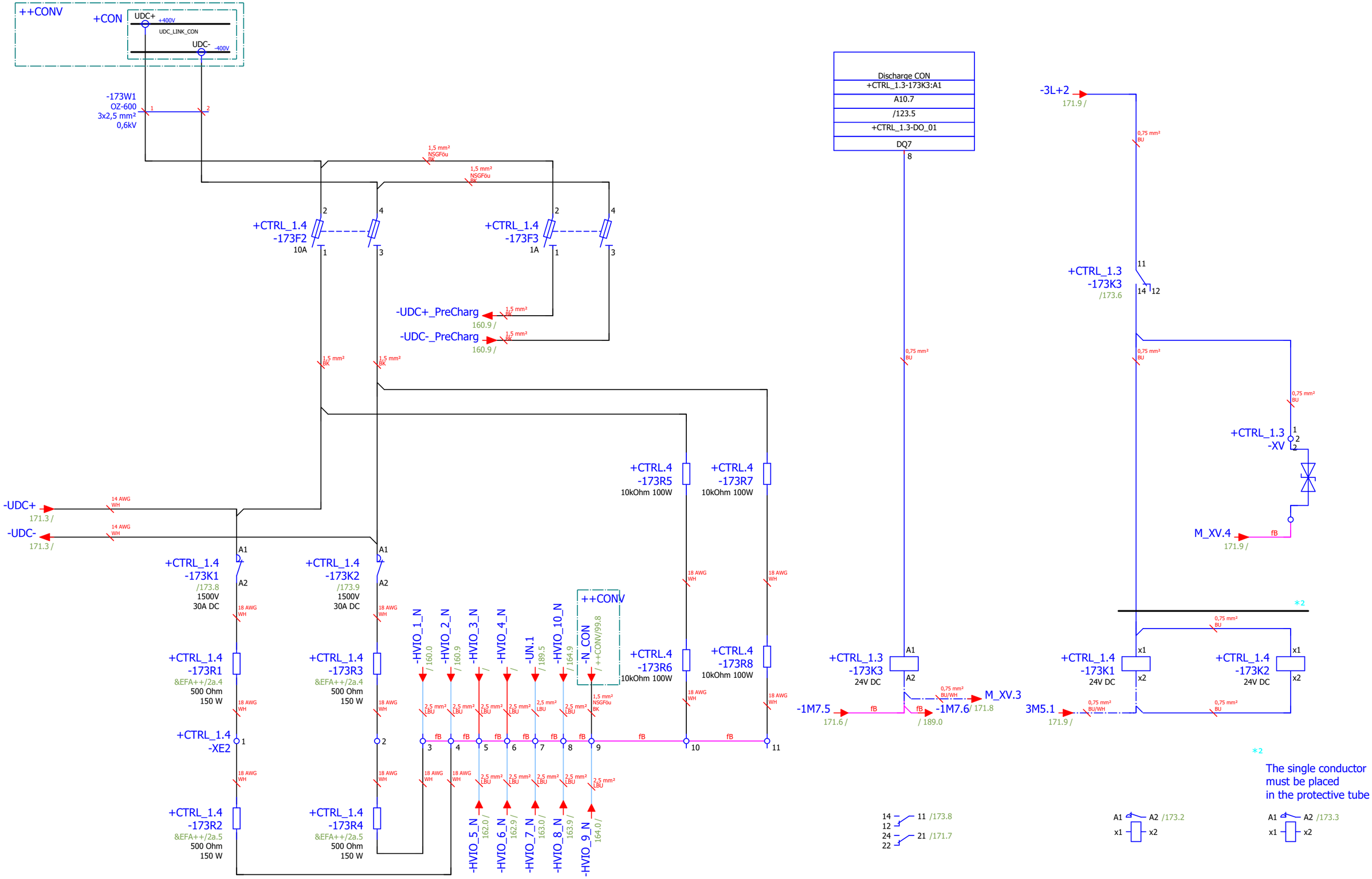


*2 The single conductor must be placed in the protective tube

previous page: 164

next page: 173

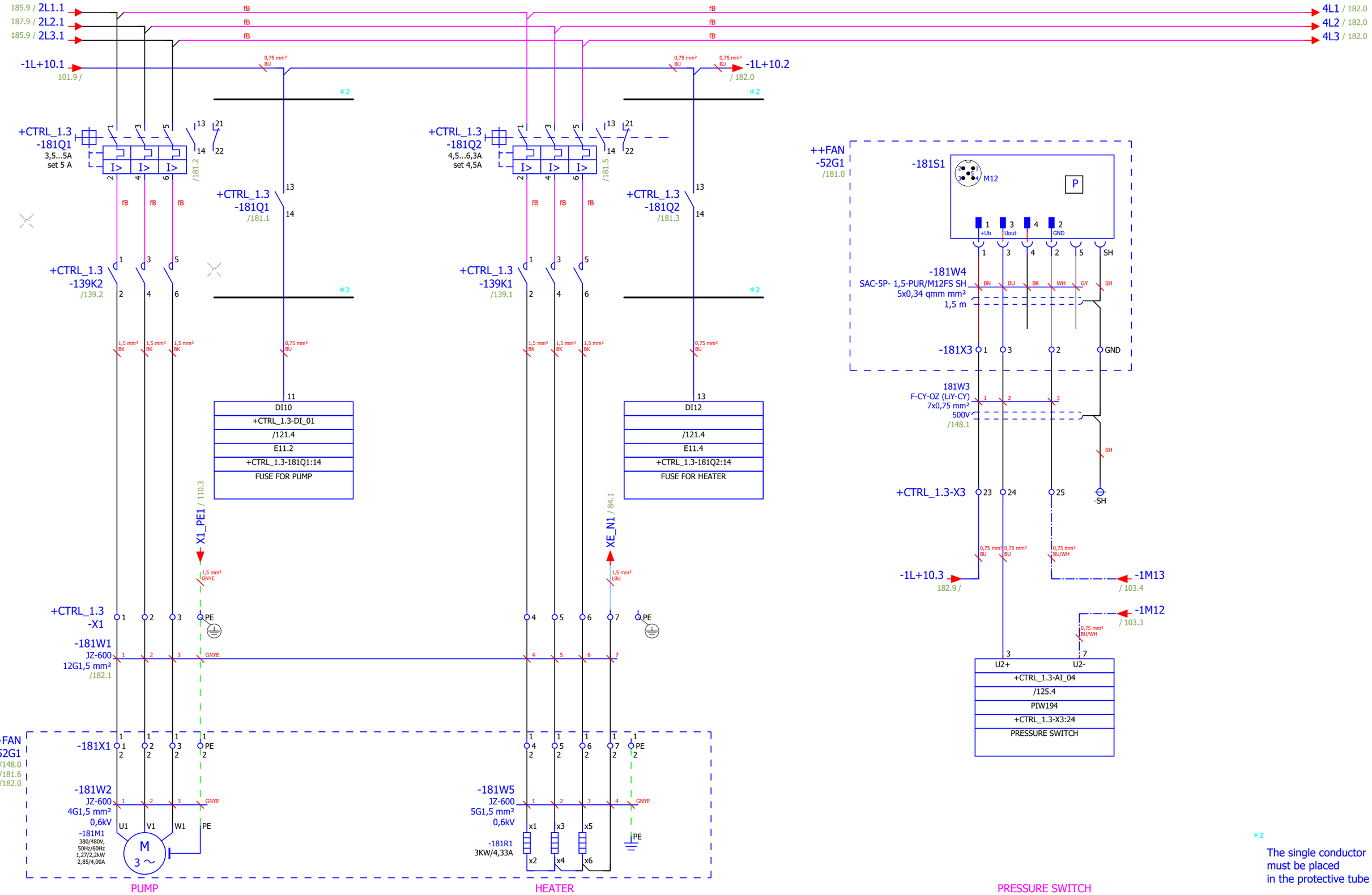
Editor	Freqcon_JD			Statron	FREQCON	PRE-CHARGING UDC	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 171
Date								+	total: 492



previous page: 171

next page: 181

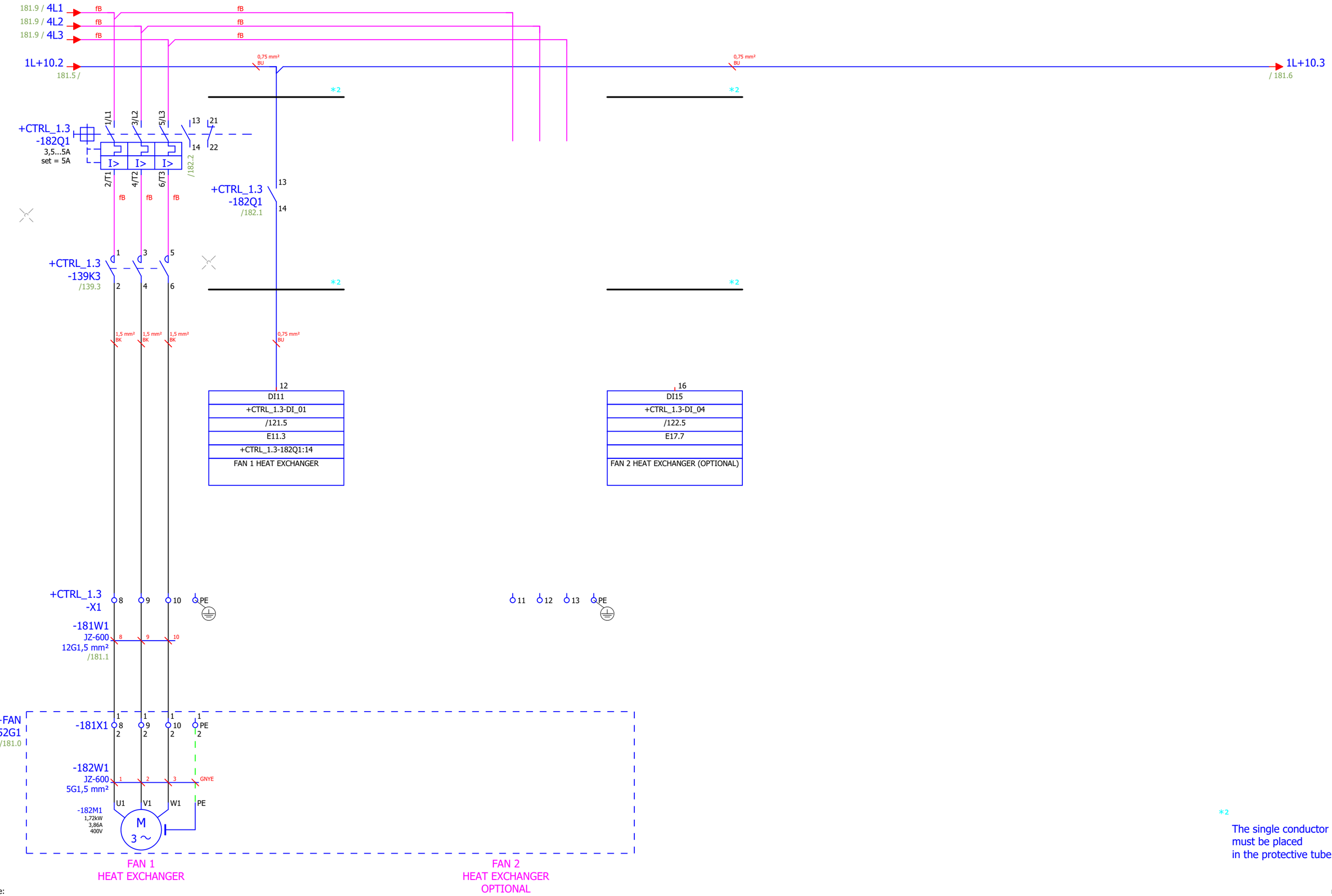
Editor	Freqcon_DG			Statron	FREQCON	DISCHARGE UDC	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 173
Date								+	total: 492



previous page: 173

next page: 182

Editor	Freqcon_DG			Statron	FREQCON	WATER SYSTEM	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 181
Date								+	total: 492



*2 The single conductor must be placed in the protective tube

previous page: 181

next page: 183

Editor	Freqcon_JD			Statron	FREQCON	HEAT EXCHANGER	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 182
Date								+	total: 492

84.9 / 1L1.1
84.9 / 1L2.1
fB
1L1.2 / 185.0
1L2.2 / 187.0

-1L+8.1
84.6 /
0,75 mm² BU
-1L+8.2
/ 185.8

+CTRL_1.3
-183F1
C16A
/183.6
+CTRL_1.3
-183F2
C10A
/183.6

*2
+CTRL_1.3
-183F1
/183.1
0,75 mm² BU
*2
+CTRL_1.3
-183F2
/183.3
0,75 mm² BU
*2

1,5 mm² BK
1,5 mm² BK

+CTRL_1.3
-135K1
/135.1
XE_N2 / 84.1
+CTRL_1.3
-135K3
/135.3

1,5 mm² BK
2,5 mm² LBU
1,5 mm² BK

fB
fB
FB_XT.4-6
/ 185.1

PT 2,5 +CTRL_1.3
-XT
PE
PE

15
DI14
+CTRL_1.3-DI_01
/121.4
E11.6
+CTRL_1.3-183F2:13
Fuse Fans CON, IND Cabinets

++CONV
-279W1
JZ-500
3G1,5 mm²
GNYE
-FAN_L_2 ++CONV/279.1/
-FAN_N_2 ++CONV/279.1/
-FAN_PE_2 ++CONV/279.1/
EEC

++CONV
-281W1
JZ-500
3G1,5 mm²
GNYE
-FAN_L_3 ++CONV/281.1/
-FAN_N_3 ++CONV/281.1/
-FAN_PE_3 ++CONV/281.1/
EEC

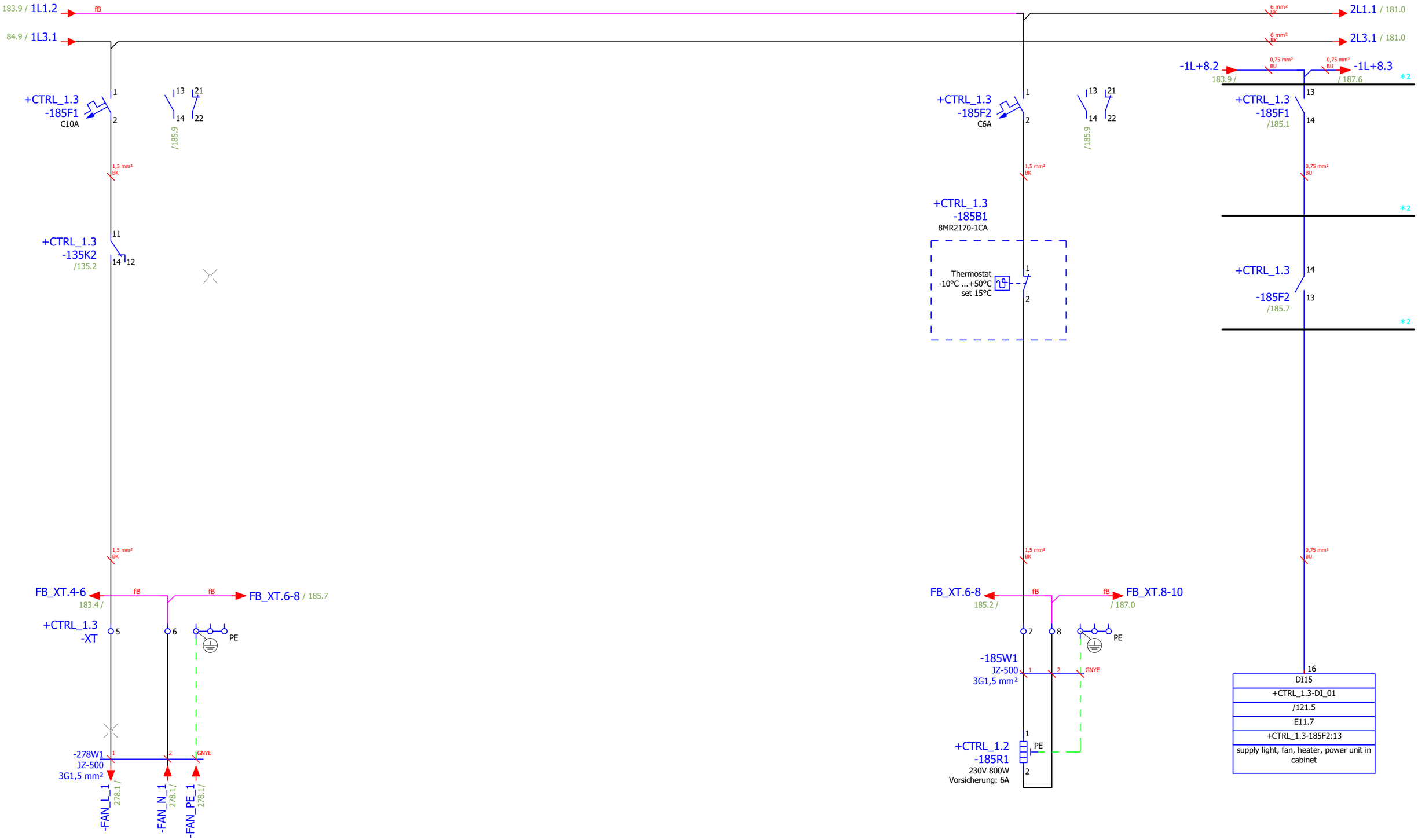
CON
Fans 1-5
in door

CIR
Fans 1-3
in door

*2
The single conductor
must be placed
in the protective tube

previous page: 182
next page: 185

Editor	Freqcon_DG			Statron	FREQCON	Supply for cabinet fan	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 183
Date								+	total: 492



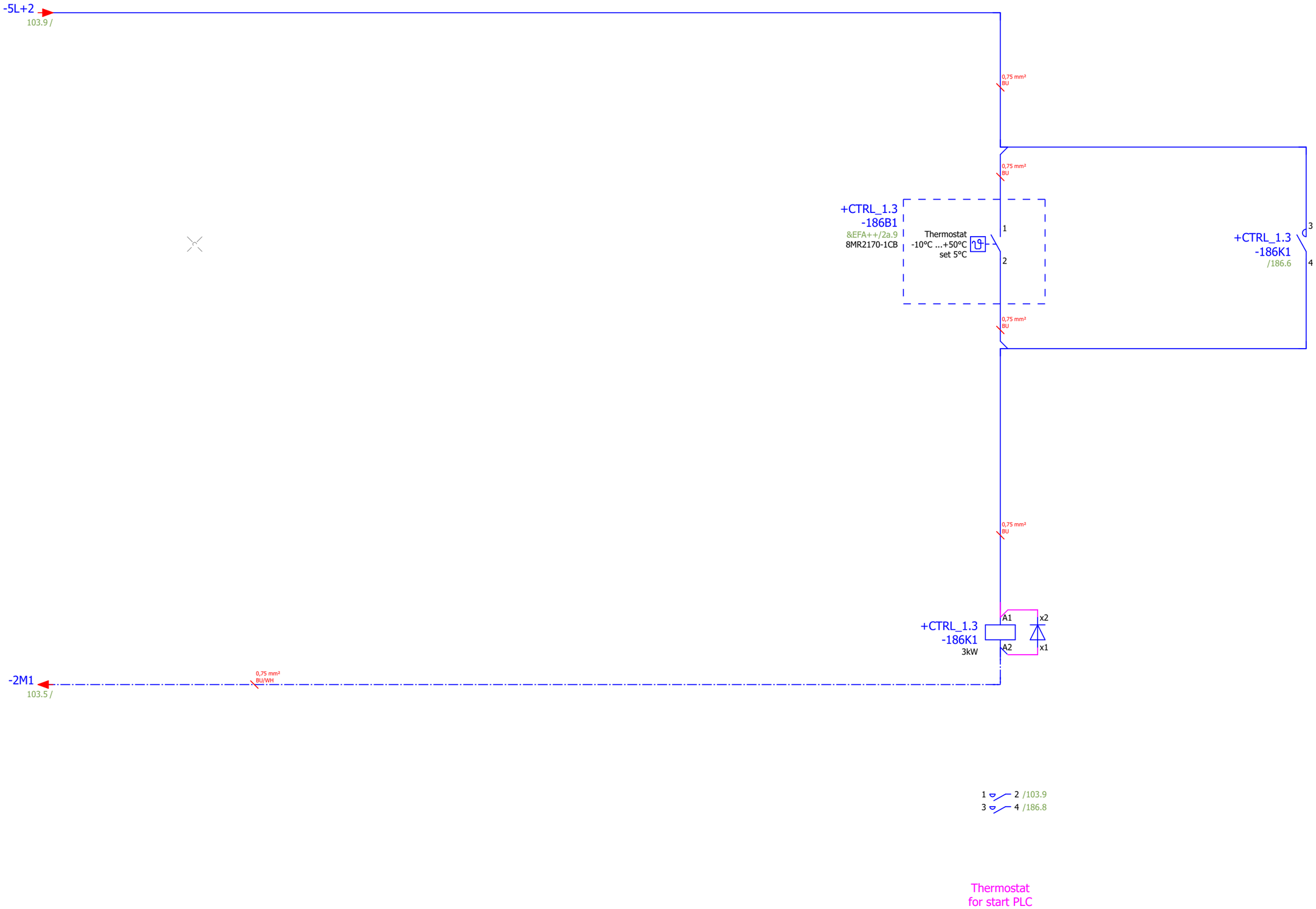
FAN 1
CONTROL CABINET

HEATING
CONTROL CABINET

previous page: 183

next page: 186

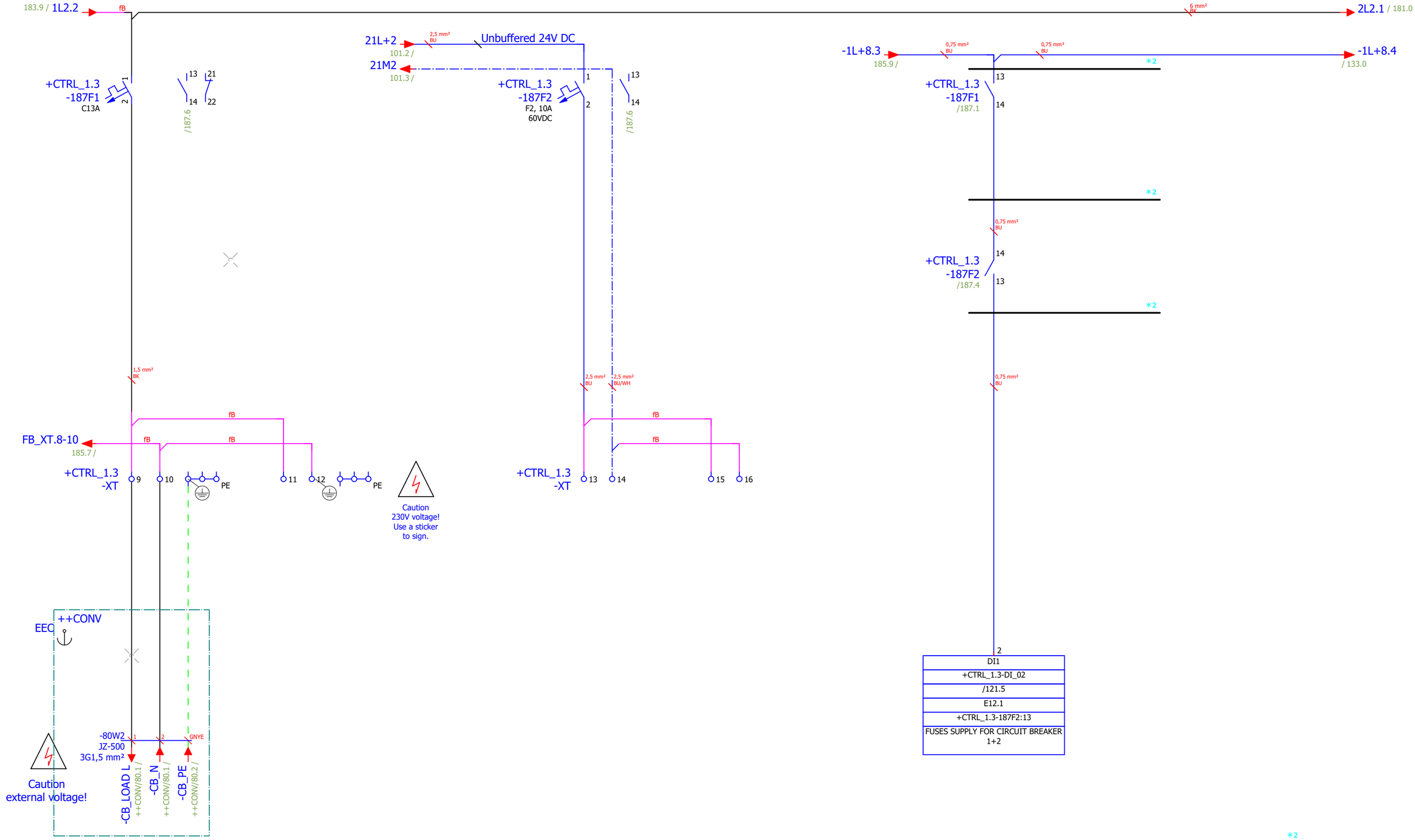
Editor	Freqcon_JD			Statron	FREQCON	FAN / HEATING CONTROL CABINET	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 185
Date								+	total: 492



previous page: 185

next page: 187

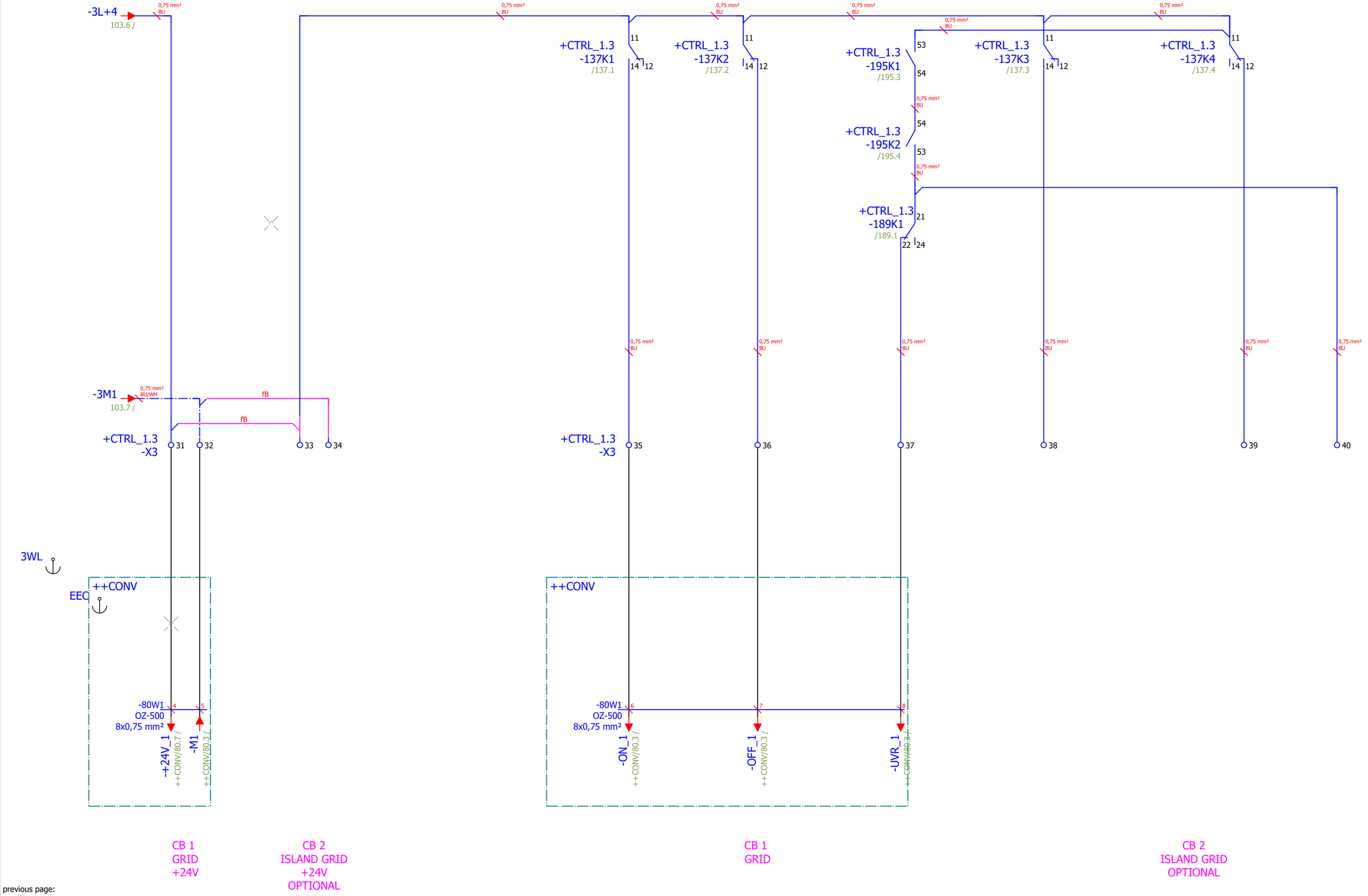
Editor	Freqcon_JD			Statron	FREQCON	THERMOSTAT	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 186
Date								+	total: 492



previous page: 186

next page: 188

Editor	Freqcon_JD			Statron	FREQCON	24V DC SUPPLY CB	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 187
Date								+	total: 492



previous page: 187

next page: 189

Editor	Freqcon_JD			Statron	FREQCON	24V DC SUPPLY CON / CB GRID	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 188
Date								+	total: 492

GRID FAULT
+CTRL_1.3-189K1:A1
A11.3
/123.5
+CTRL_1.3-DO_01
DQ11
12

0,75 mm² BU

+CTRL_1.3
-189K1
24V DC
A1
A2

-1M7.6 fB 0,75 mm² BU/WH -M_(GND)
173.6 / / 189.5

14 11 /189.6
12
24 21 /188.6
22

Voltage inputs
3 phases 620V AC

Grid Circuit Breaker:
if OFF then 24V;
if ON then 0V

Grid OK

-UL1.HVIO / 160.5 — 2,5 mm² BK
-UL2.HVIO / 160.5 — 2,5 mm² BK
-UL3.HVIO / 160.4 — 2,5 mm² BK
-UN.1 / 173.4 — 2,5 mm² LBU
-24V_Signal / 127.4 — 0,75 mm² BU
-M_(GND) / 189.1 — 0,75 mm² BU/WH
+CTRL_1.3 -189K1 /189.1 — 0,75 mm² BU (11 / 12 / 14)
CB_OFF.1 / 137.2 — 0,75 mm² BU

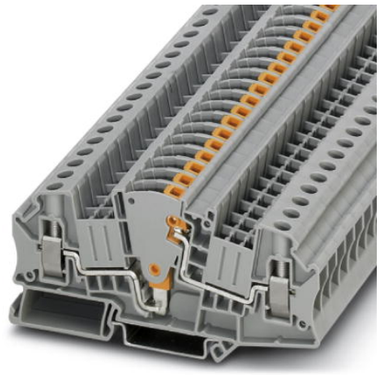
+CTRL_1.4
-189X1
Test disconnect
terminal block
Phoenix Contact
PTME 6

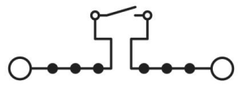
1 2 3 4 5 6 7 8 9

2,5 mm² BK
2,5 mm² BK
2,5 mm² BK
0,75 mm² BU

-HVIO_L1 / 85.1 /
-HVIO_L2 / 85.1 /
-HVIO_L3 / 85.2 /
CB_OFF.2 / 137.2 /

Relais
Circuit Breaker
OFF



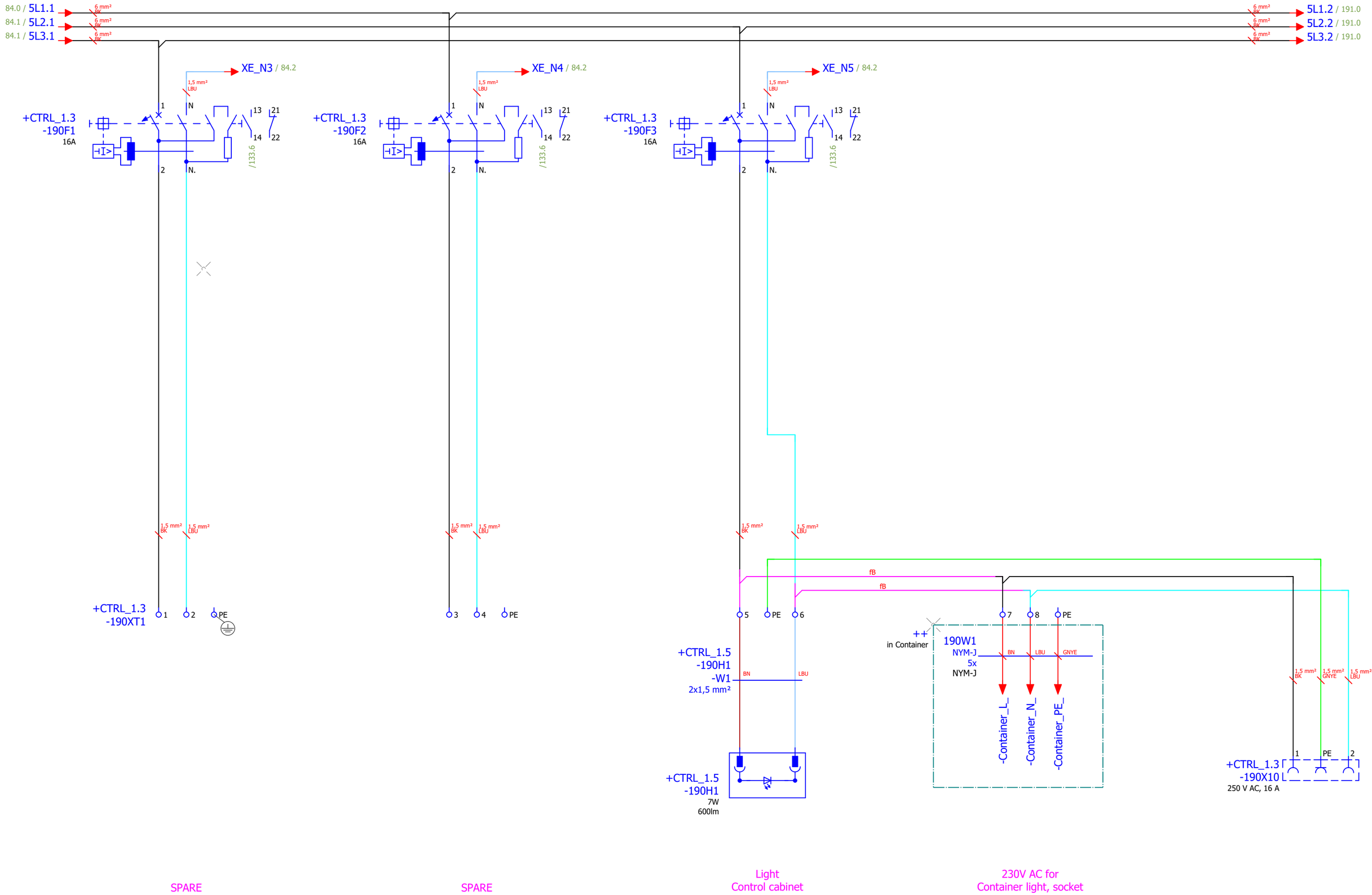


GRID FAULT

Test terminal block for protection tests

previous page: 188
next page: 190

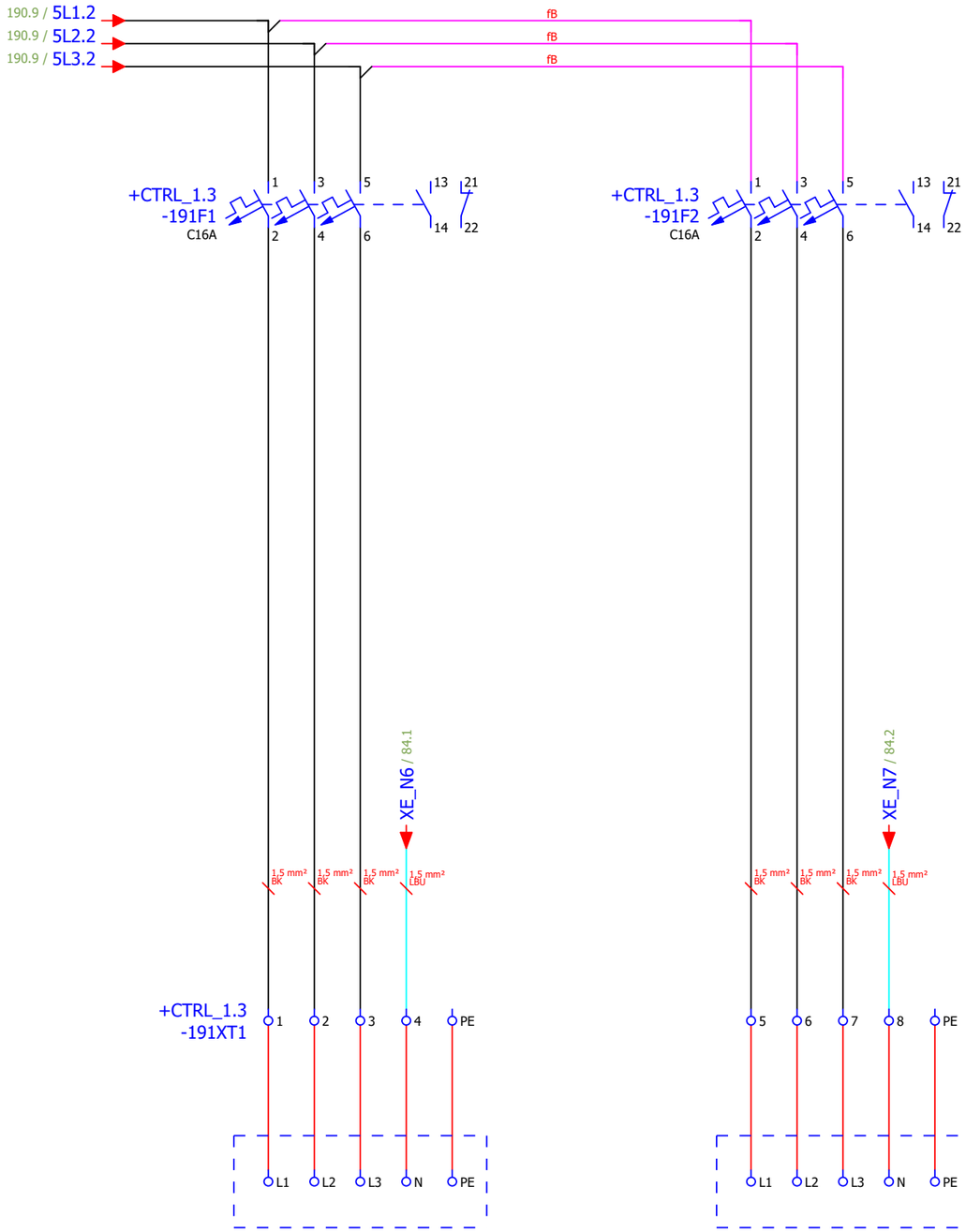
Editor	Freqcon_JD			Statron	FREQCON	TEST TERMINAL BLOCK	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 189
Date								+ total: 492



previous page: 189

next page: 191

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING, LIGHT 230V SUPPLY	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 190
Date								+	total: 492

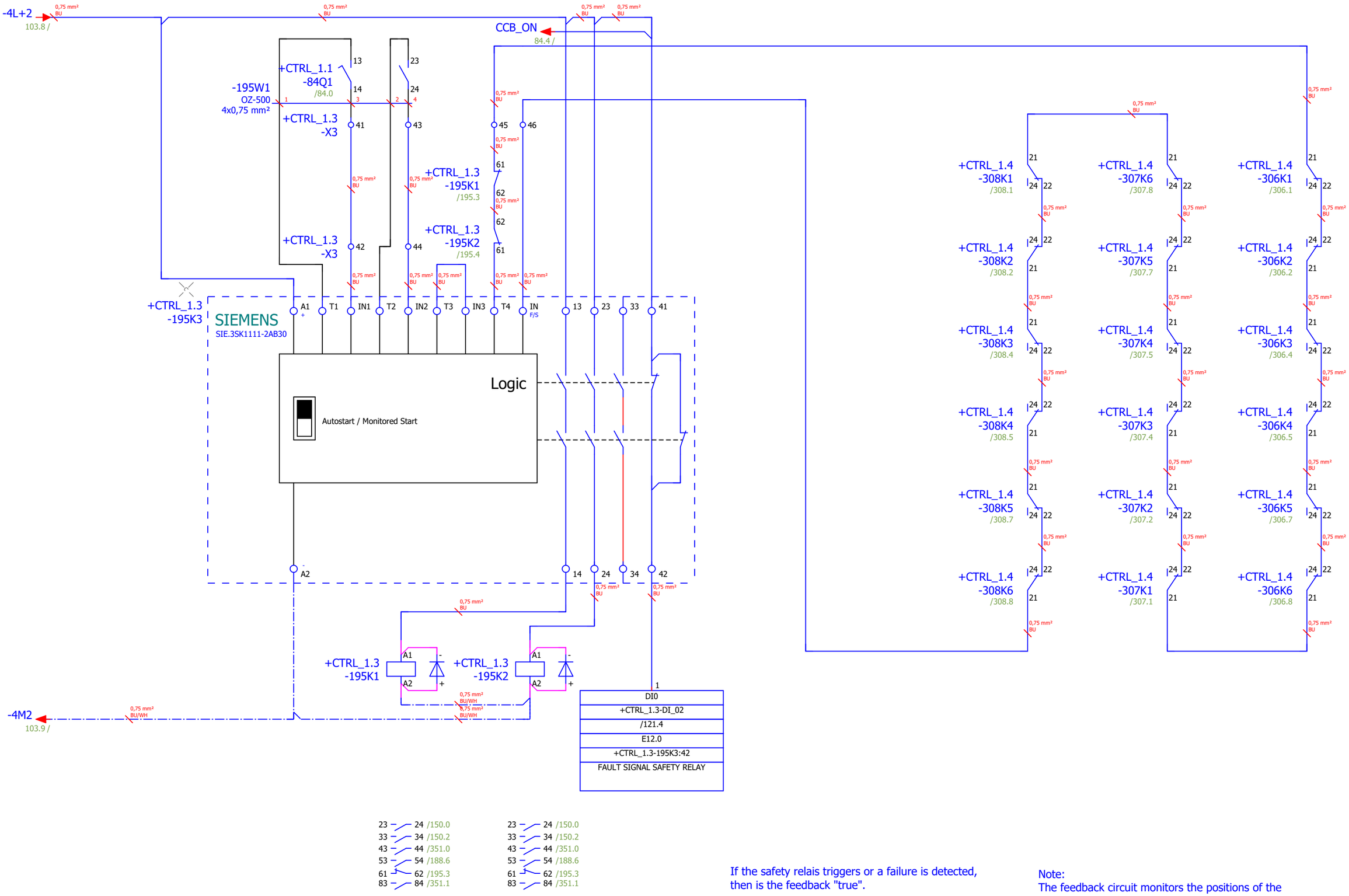


400V AC for
Container Air Conditioning 1

400V AC for
Container Air Conditioning 2

previous page: 190

next page: 195



23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
83 — 84 /351.1

23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
83 — 84 /351.1

SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS

FAULT SIGNAL SAFETY RELAY

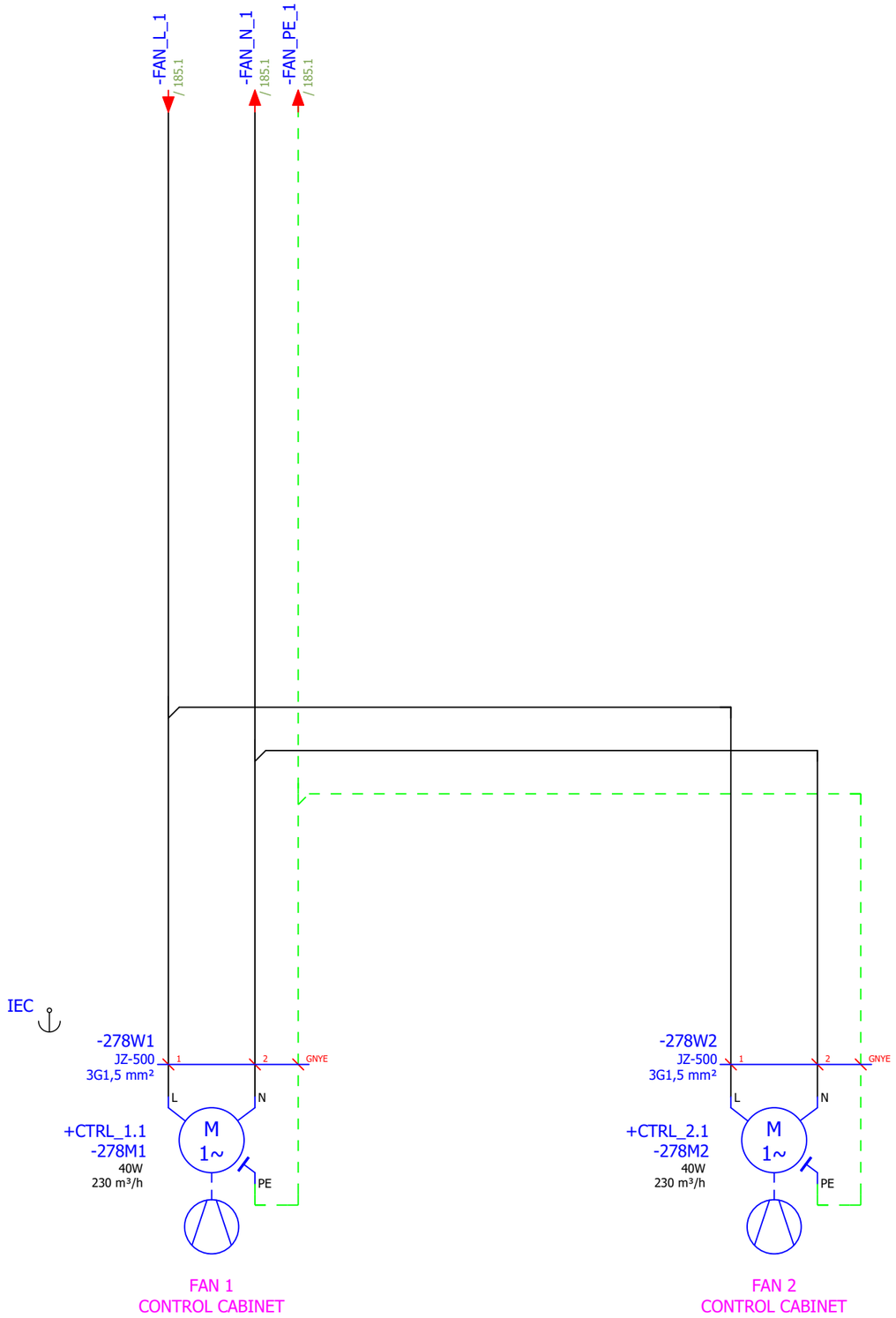
If the safety relais triggers or a failure is detected, then is the feedback "true".

Note:
The feedback circuit monitors the positions of the positive-guided NC contacts on the contactors 195K1 and 195K2. If one of their contacts latsches, then it is not possible to switch the contactors back on.

previous page: 191

next page: 278

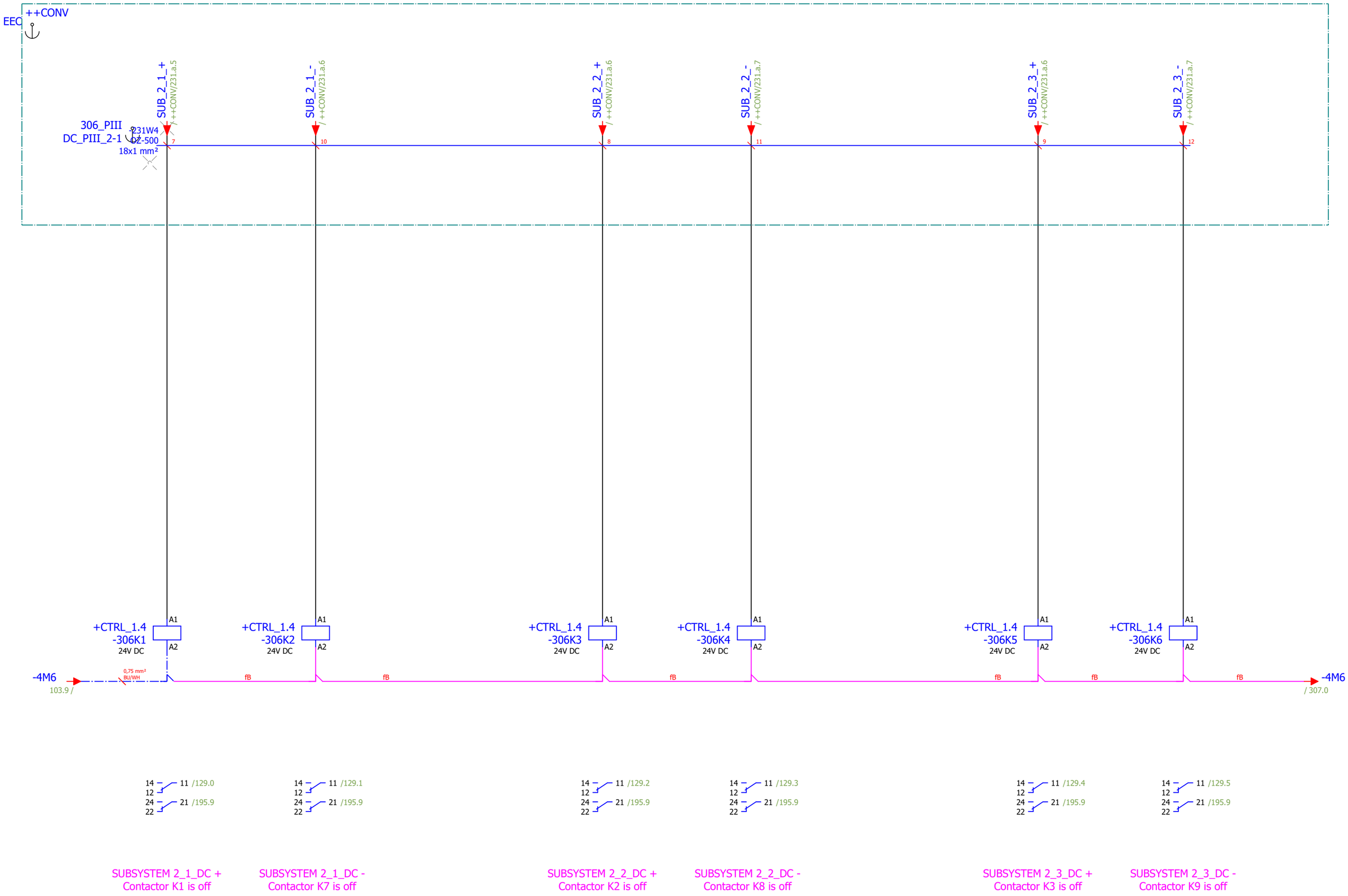
Editor	Freqcon_DG			Statron	FREQCON	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 195
Date								+ total: 492



previous page:
195

next page:
306

Editor	Freqcon_DG			Statron	FREQCON	CONTROL CABINET CLIMATE	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 278
Date								+	total: 492



previous page: 278

next page: 307

Editor	Freqcon_JD			Statron	FREQCON	Feedback DC contactors 1_4 - 1_6	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 306
Date								+	total: 492

EEC ++CONV

306_PIII
DC_PIII_3-1
227W4
D2-500
18x1 mm²

SUB_3_1_+ /++CONV/227.a.5 — 7
SUB_3_1_- /++CONV/227.a.6 — 10
SUB_3_2_+ /++CONV/227.a.6 — 8
SUB_3_2_- /++CONV/227.a.7 — 11
SUB_3_3_+ /++CONV/227.a.6 — 9
SUB_3_3_- /++CONV/227.a.7 — 12

+CTRL_1.4 -307K1 24V DC A1 A2
+CTRL_1.4 -307K2 24V DC A1 A2
+CTRL_1.4 -307K3 24V DC A1 A2
+CTRL_1.4 -307K4 24V DC A1 A2
+CTRL_1.4 -307K5 24V DC A1 A2
+CTRL_1.4 -307K6 24V DC A1 A2

-4M6 306.9 / — fB — fB — fB — fB — fB — fB — -4M6 / 308.0

14 12 11 /130.0 21 /195.8 22 24
14 12 11 /130.1 21 /195.8 22 24
14 12 11 /130.2 21 /195.8 22 24
14 12 11 /130.3 21 /195.8 22 24
14 12 11 /130.4 21 /195.8 22 24
14 12 11 /130.5 21 /195.8 22 24

SUBSYSTEM 3_1_DC +
Contactor K1 is off

SUBSYSTEM 3_1_DC -
Contactor K7 is off

SUBSYSTEM 3_2_DC +
Contactor K2 is off

SUBSYSTEM 3_2_DC -
Contactor K8 is off

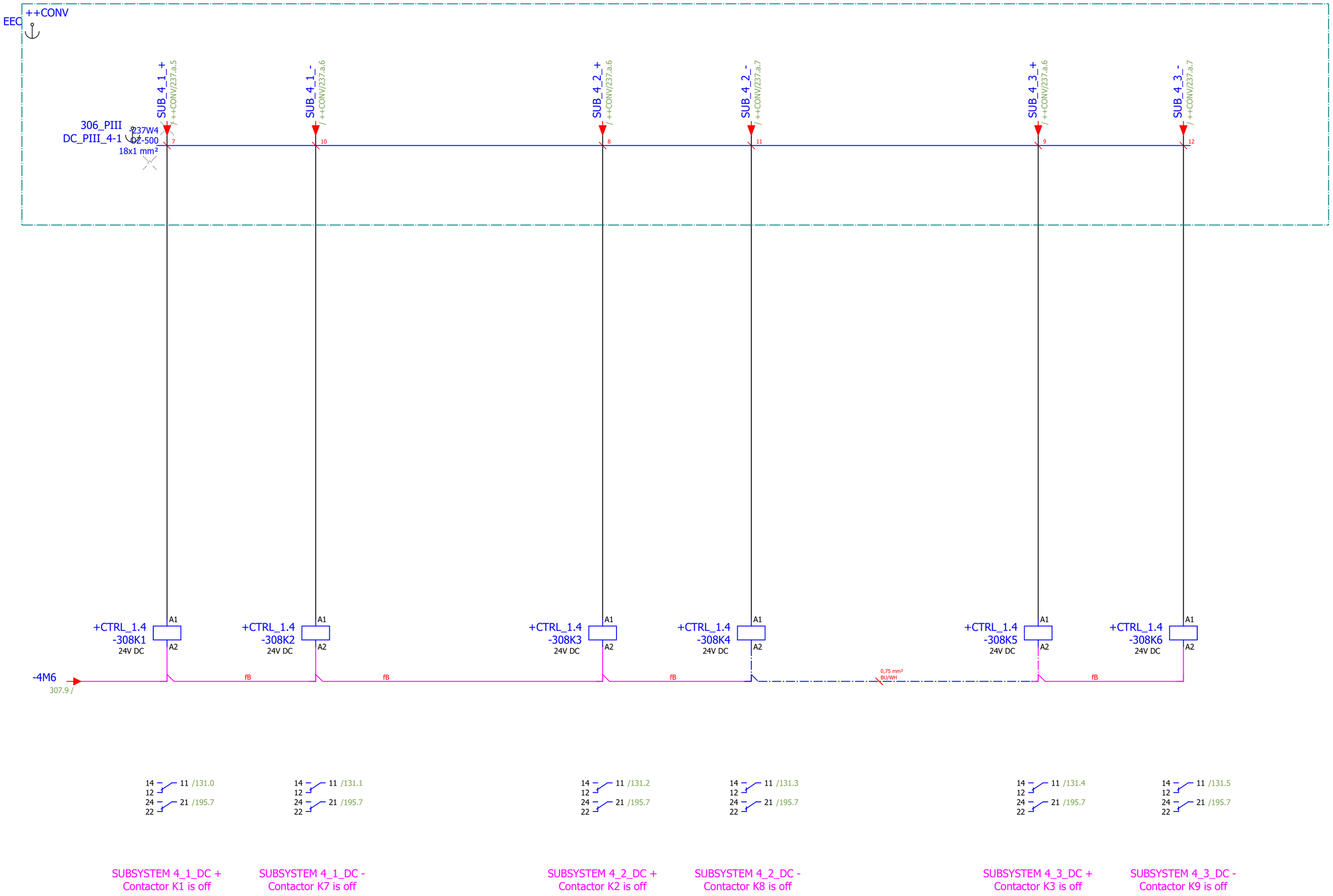
SUBSYSTEM 3_3_DC +
Contactor K3 is off

SUBSYSTEM 3_3_DC -
Contactor K9 is off

previous page: 306

next page: 308

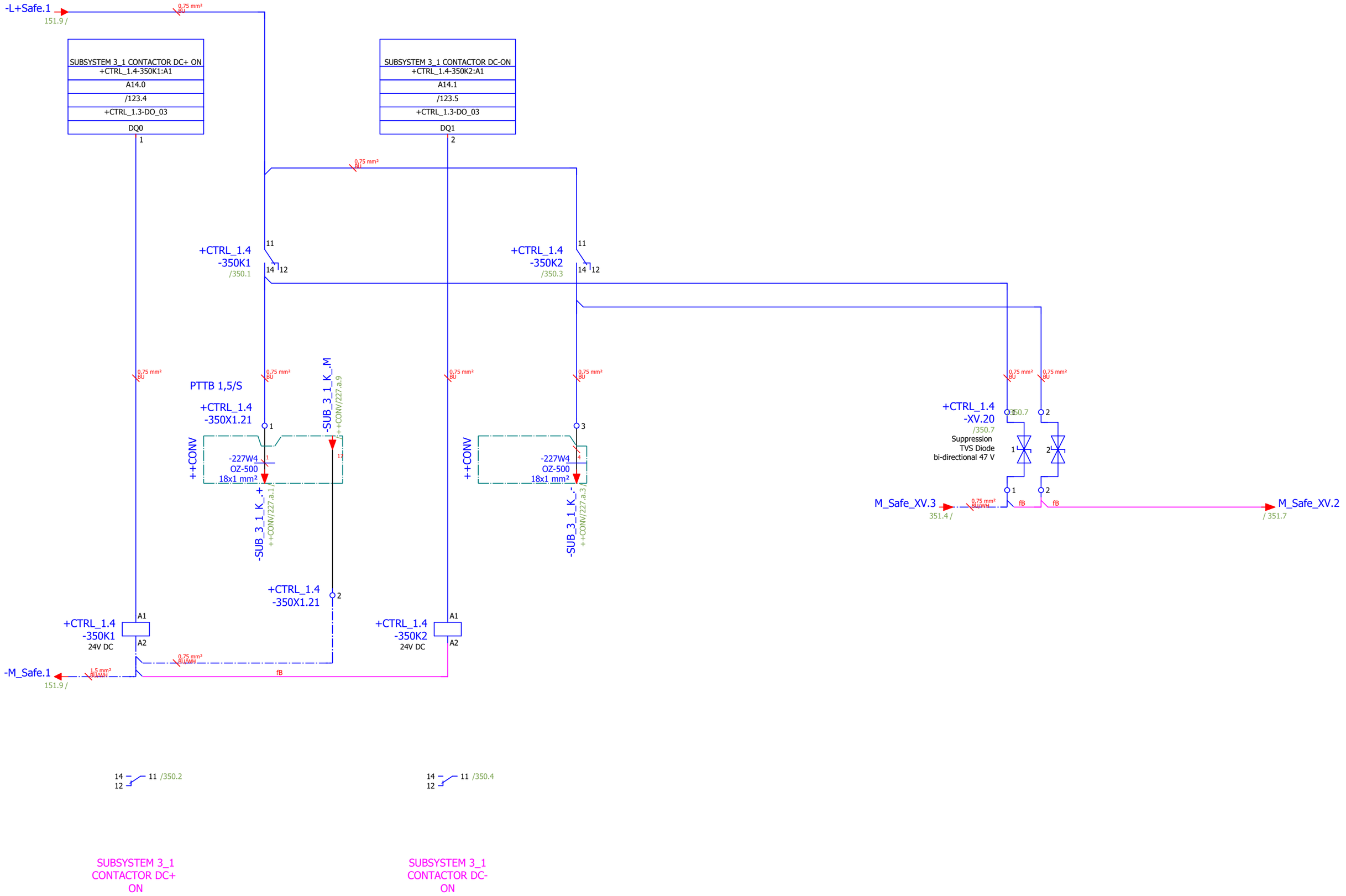
Editor	Freqcon_JD			Statron	FREQCON	Feedback DC contactors 2_1 - 2_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 307
Date								+	total: 492



previous page: 307

next page: 350

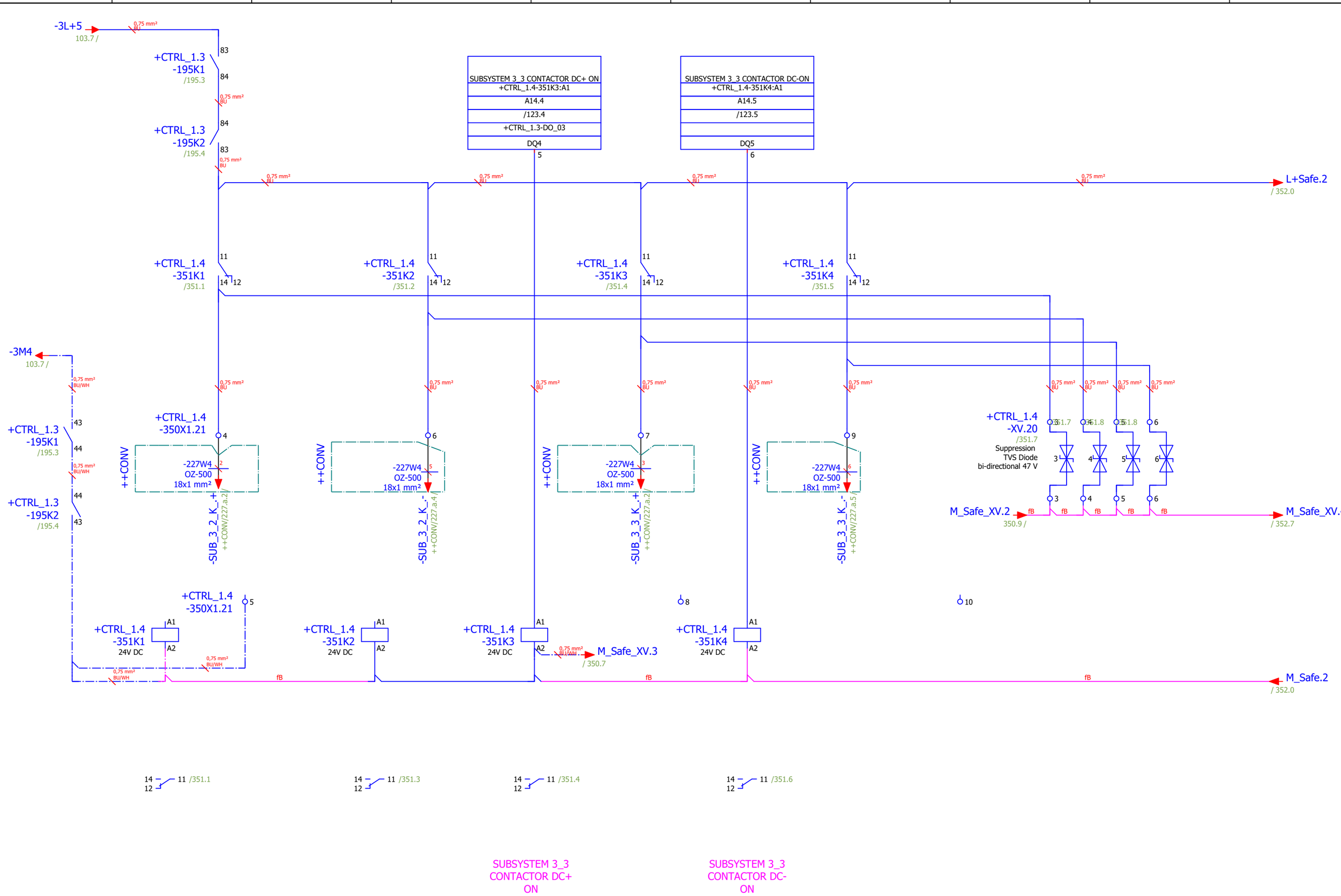
Editor	Freqcon_DG			Statron	FREQCON	Feedback DC contactors 2_4 - 2_6	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 308
Date								+	total: 492



previous page: 308

next page: 351

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 350
Date								+	total: 492



previous page: 350

next page: 352

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 351
Date								+	total: 492

-L+Safe.2
351.9 /

SUBSYSTEM 4_1 CONTACTOR DC+ ON
+CTRL_1.4-352K1:A1
A14.6
/123.4
+CTRL_1.3-DO_03
DQ6
7

SUBSYSTEM 4_1 CONTACTOR DC-ON
+CTRL_1.4-352K2:A1
A14.7
/123.5
DQ7
8

L+Safe.3
/ 353.0

0,75 mm² BU

+CTRL_1.4
-352K1
/352.0
11 14 12

+CTRL_1.4
-352K2
/352.2
11 14 12

+CTRL_1.4
-350X1.21
11

-SUB_4_1_K_M
/++CONV/237.a.9

++CONV
-237W4
OZ-500
18x1 mm²
1 17

-SUB_4_1_K_+
/++CONV/237.a.1

13

++CONV
-237W4
OZ-500
18x1 mm²
4

-SUB_4_1_K_-
/++CONV/237.a.3

+CTRL_1.4
-XV.20
/352.7
Suppression
TVS Diode
bi-directional 47 V
7 8

M_Safe_XV.4
351.9 /
fB

M_Safe_XV.5
/ 353.7

+CTRL_1.4
-350X1.21
12

+CTRL_1.4
-352K1
24V DC
A1 A2

+CTRL_1.4
-352K2
24V DC
A1 A2

-M_Safe.2
351.9 /

M_Safe.3
/ 353.0

14 12 11 /352.1

14 12 11 /352.3

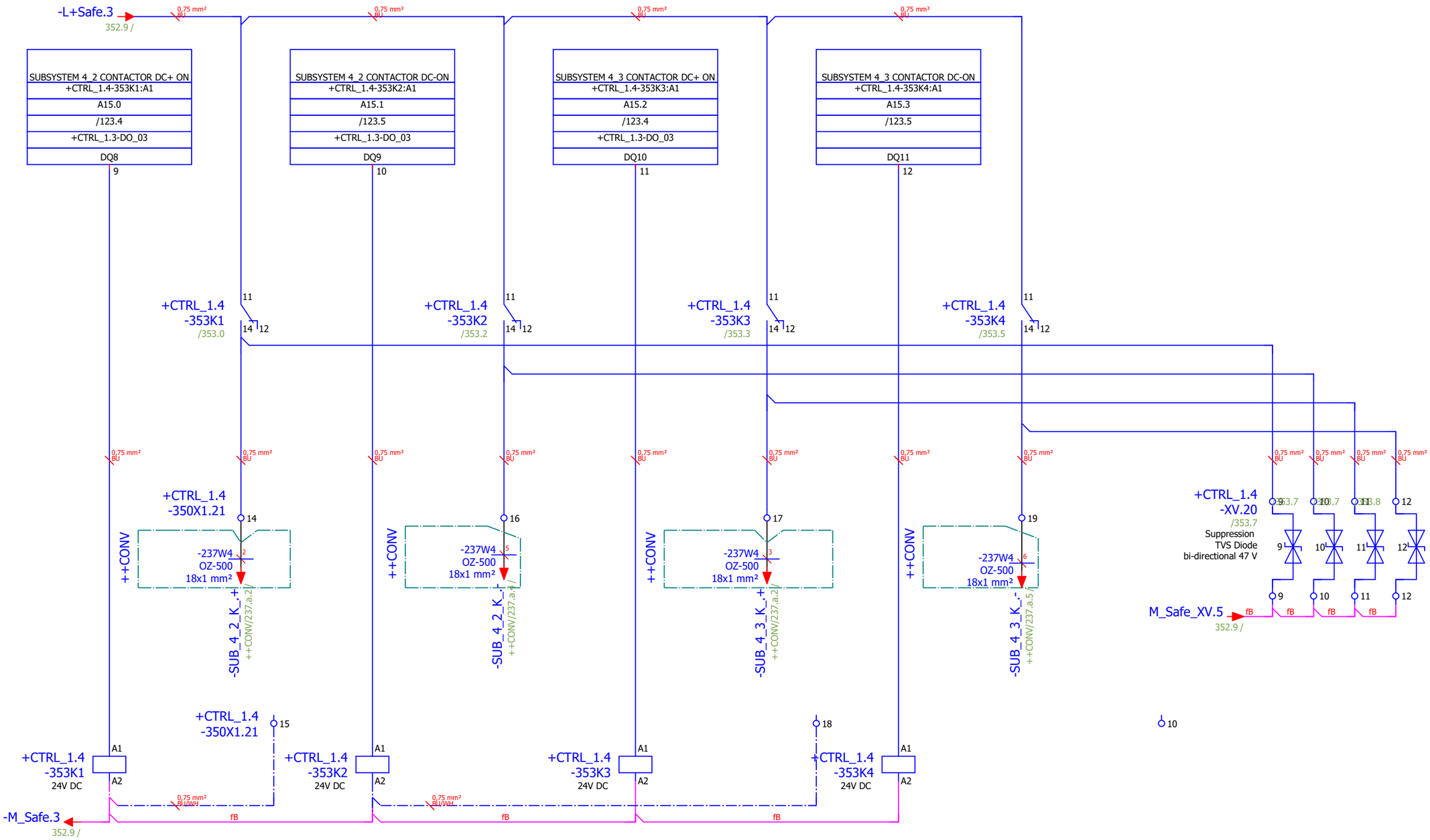
SUBSYSTEM 4_1
CONTACTOR DC+
ON

SUBSYSTEM 4_1
CONTACTOR DC-
ON

previous page:
351

next page:
353

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 352
Date								+	total: 492



14 12 — 11 /353.1

14 12 — 11 /353.3

14 12 — 11 /353.4

14 12 — 11 /353.6

SUBSYSTEM 4_2 CONTACTOR DC+ ON

SUBSYSTEM 4_2 CONTACTOR DC- ON

SUBSYSTEM 4_3 CONTACTOR DC+ ON

SUBSYSTEM 4_3 CONTACTOR DC- ON

previous page: 352

next page: 440

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 353
Date								+ total: 492

-1L+1
103.2 /
-1M1
103.3 /
-1PE1
103.4 /
240W9
JZ-500
3G0,75 mm²
1 2 GNYE

4 3
1 2
Stecker A-Codiert

PIII_1

+CTRL_2.1
-240U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
4 3
1 2
Ansicht
Stiftleiste
24 VDC
M12 System-
steckverbinder

Ansicht
Buchsenleiste
240W10
2YY (ST) CY
2x2x0,64 mm²
/110.1
-P320-FPPU1
110.0 /
P1
3 4
(IN)
2 1
M12 System-
steckverbinder

240W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU1-FPPU2
441.0 /
P2
3 4
(OUT)
2 1

Arc Detect
3 4
2 1

M6 Bolzen
-PE

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_1
CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1 X1
IGBT2 X2
IGBT3 X3
IGBT4 X4
25-POL SUB-D SOCKET

++CONV
240W1
pre-assembled D-Sub cable 1:1
-_IGBT1.1
/ ++CONV/201.3
240W2
pre-assembled D-Sub cable 1:1
-_IGBT1.2
/ ++CONV/202.3
240W3
pre-assembled D-Sub cable 1:1
-_IGBT1.3
/ ++CONV/203.3

IEC
PE
19

PIII_1
-240W7
pre-assembled D-Sub cable 1:1
/160.7
-HVIO_1
/ 160.9

PIII_Version
2_6_V_4

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

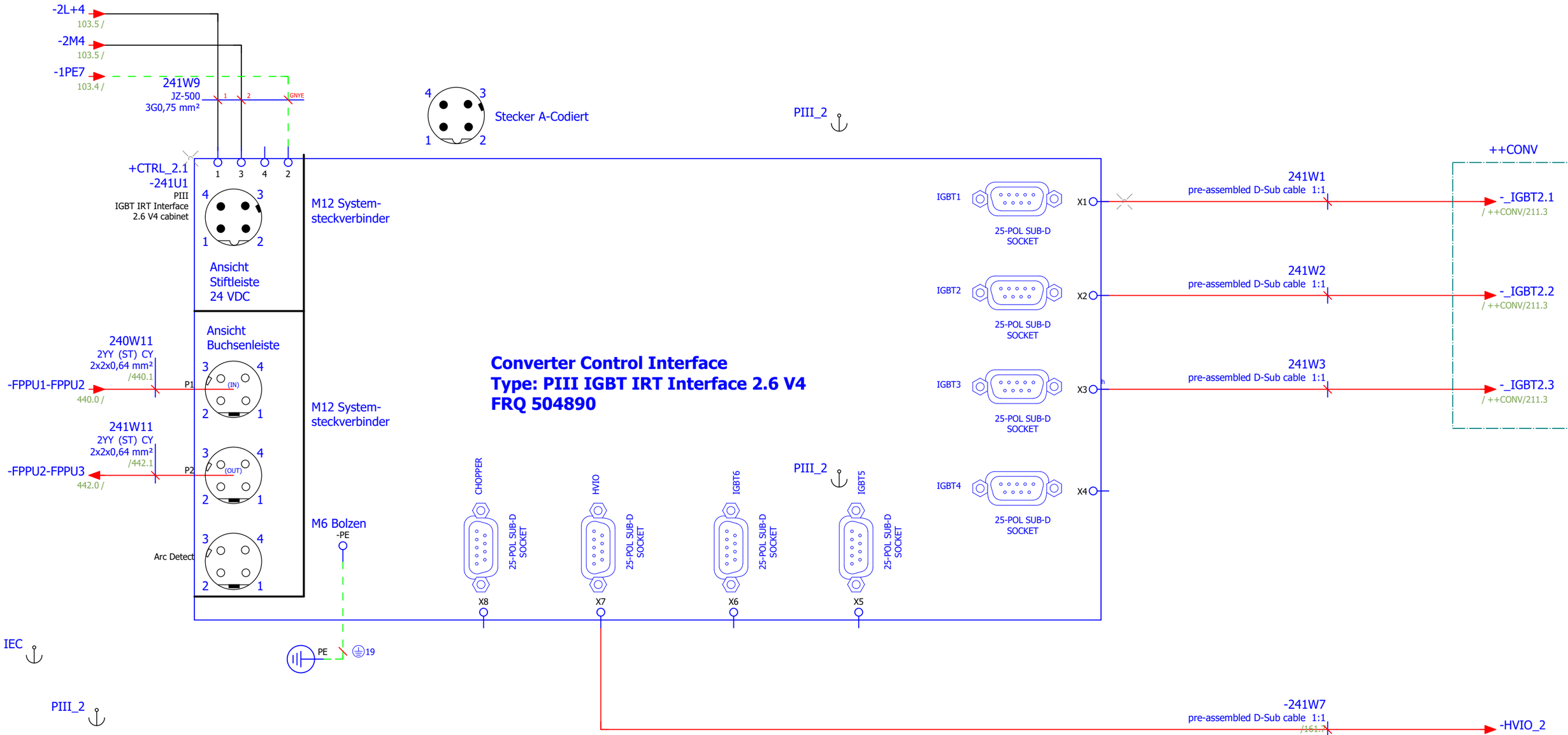
3 4
2 1
Plug D-coded

P2 LAN OUT
P1 LAN IN
Supply 24 V DC
Arc Detect
Fuse 6A F
IGBT6 IGBT4 IGBT2 HVIO
IGBT5 IGBT3 IGBT1 CHOPPER
25-POL SUB-D

connector view PIII

previous page: 353
next page: 441

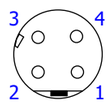
Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 440
Date								+	total: 492

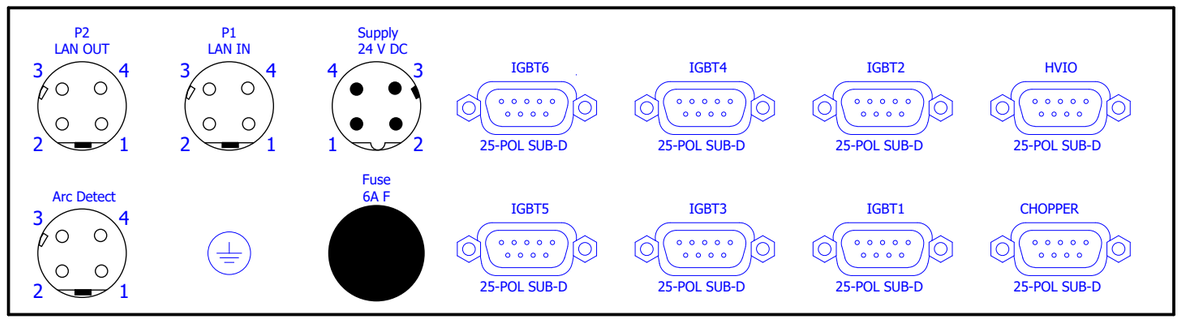


Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320





connector view PIII

previous page: 440
next page: 442

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 441
Date								+ total: 492

-2L+2
103.4 /
-2M2
103.5 /
-1PE5
103.4 /
242W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-242U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

241W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU2-FPPU3
441.0 /
P1 (IN)

242W11
2YY (ST) CY
2x2x0,64 mm²
/443.1
-FPPU3-FPPU4
443.0 /
P2 (OUT)

Arc Detect

M12 System-
steckverbinder

M6 Bolzen
-PE

PE
19

IEC

PIII_3

PIII_Version
2_6_V_4

Stecker A-Codiert

PIII_3

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1 X1
IGBT2 X2
IGBT3 X3
IGBT4 X4
25-POL SUB-D SOCKET

242W1
pre-assembled D-Sub cable 1:1
-_IGBT3.1
/ ++CONV/207.3

242W2
pre-assembled D-Sub cable 1:1
-_IGBT3.2
/ ++CONV/207.3

242W3
pre-assembled D-Sub cable 1:1
-_IGBT3.3
/ ++CONV/207.3

++CONV

-242W7
pre-assembled D-Sub cable 1:1
/163.7
-HVIO_3
/ 163.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

P2 LAN OUT
P1 LAN IN
Supply 24 V DC
Arc Detect
Fuse 6A F
IGBT6 IGBT4 IGBT2 HVIO
IGBT5 IGBT3 IGBT1 CHOPPER
25-POL SUB-D

connector view PIII

previous page: 441
next page: 443

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 442
Date								+	total: 492

-2L+1
103.4 /
-2M3
103.5 /
-1PE8
103.4 /
243W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-243U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

242W11
2YY (ST) CY
2x2x0,64 mm²
/442.1
-FPPU3-FPPU4
442.0 /
P1 (IN)
P2 (OUT)
Arc Detect

M12 System-
steckverbinder

M6 Bolzen
-PE
PE
19

Stecker A-Codiert

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_2

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1
IGBT2
IGBT3
IGBT4
25-POL SUB-D SOCKET
X1 X2 X3 X4

243W1
pre-assembled D-Sub cable 1:1
-_IGBT4.1
/ ++CONV/217.3

243W2
pre-assembled D-Sub cable 1:1
-_IGBT4.2
/ ++CONV/217.3

243W3
pre-assembled D-Sub cable 1:1
-_IGBT4.3
/ ++CONV/217.3

++CONV

IEC

PIII_4

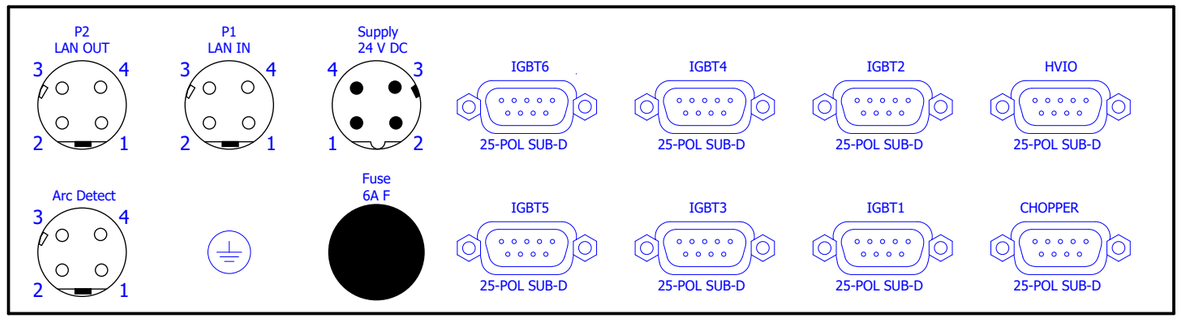
PIII_Version
2_6_V_4

-243W7
pre-assembled D-Sub cable 1:1
/164.7
-HVIO_4
/ 164.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

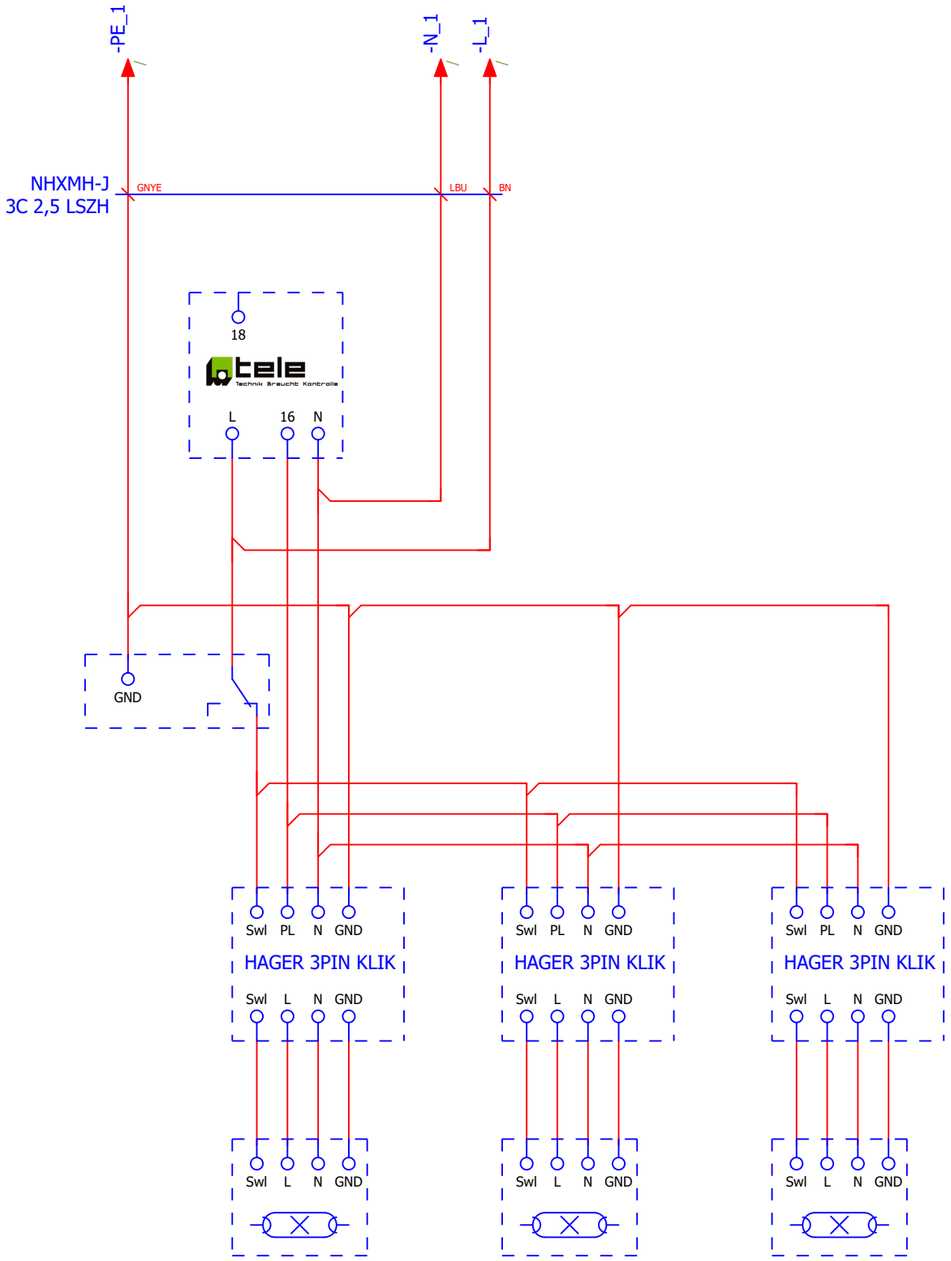


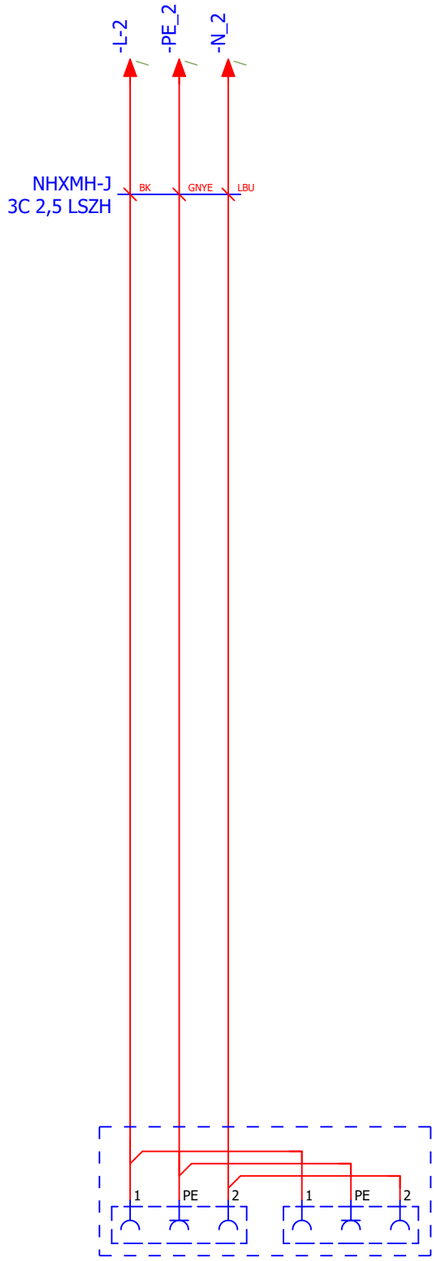
connector view PIII

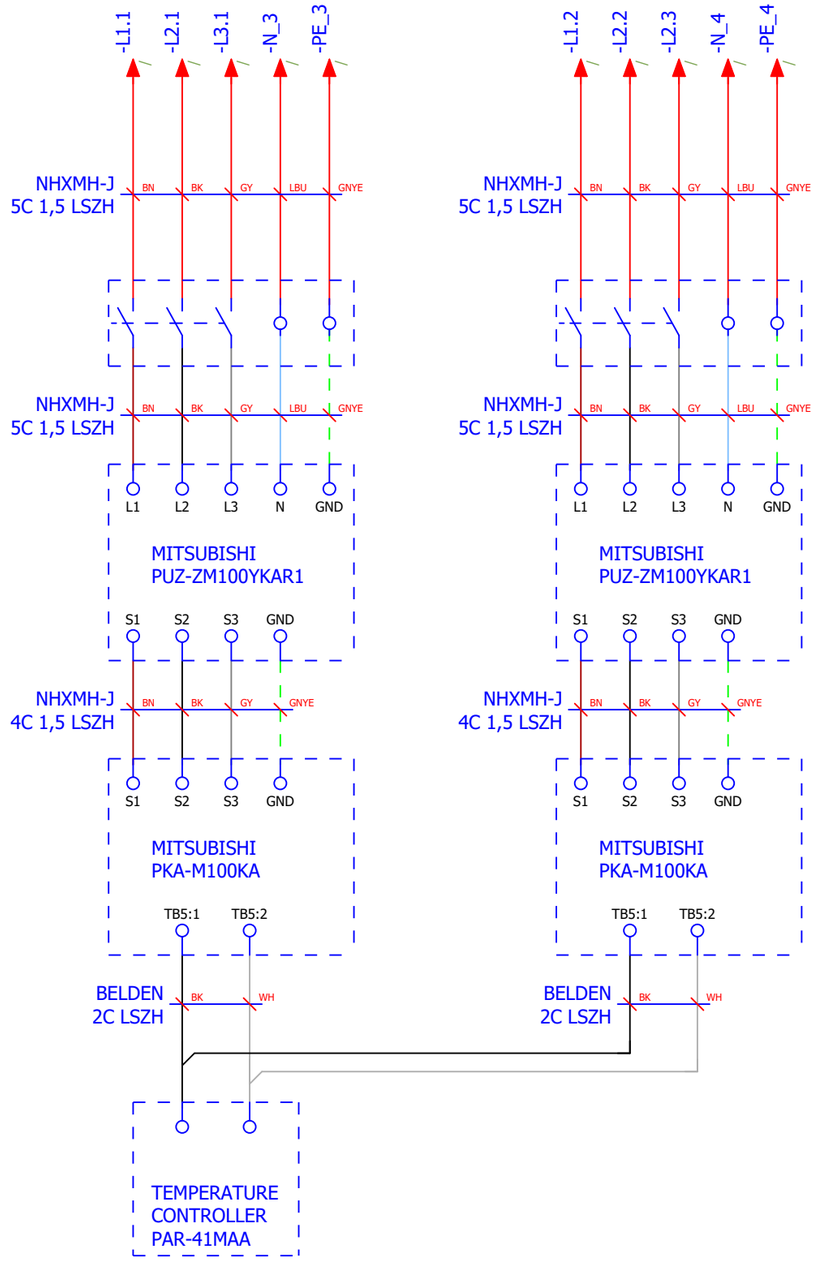
previous page: 442

next page: ++Container/190

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 4	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 443
Date								+		total: 492







previous page:
++CT/443

next page:
&EPC++TRA/1

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18T1 &EFS/18.2	1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555	
-18W5 &EFS/18.3	1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153	

previous page:
&EFS++Container/190

next page:
++CONV/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18Q1 &EFS++TRA/18.7	1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172	
-18Q1 &EFS++TRA/18.7	1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044	
-18Q1 &EFS++TRA/18.7	1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039	

previous page:
++TRA/1

next page:
+CON/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B2 &EFS++CT+/147.7	1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648	
-201Q1 &EFS+/201.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-201Q1 &EFS+/201.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-201Q1 &EFS+/201.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-201Q1 &EFS+/201.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-201Q1 &EFS+/201.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-201Q1 &EFS+/201.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-201Q1-C &EFS+/201.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-201Q1-C &EFS+/201.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-202Q1 &EFS+/202.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-202Q1 &EFS+/202.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-202Q1 &EFS+/202.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-202Q1 &EFS+/202.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-202Q1 &EFS+/202.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-202Q1 &EFS+/202.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-202Q1-C &EFS+/202.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-202Q1-C &EFS+/202.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

previous page:
+/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-202Q1-C &EFS+/202.6;&EFS+/202.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-202Q1-C &EFS+/202.6;&EFS+/202.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-203Q1 &EFS+/203.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-203Q1 &EFS+/203.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-203Q1 &EFS+/203.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-203Q1 &EFS+/203.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-203Q1 &EFS+/203.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-203Q1 &EFS+/203.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-203Q1-C &EFS+/203.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-203Q1-C &EFS+/203.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1 &EFS+/207.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-207Q1 &EFS+/207.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-207Q1 &EFS+/207.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-207Q1 &EFS+/207.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-207Q1 &EFS+/207.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-207Q1-C &EFS+/207.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-207Q1-C &EFS+/207.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-207Q1-C &EFS+/207.6;&EFS+/207.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-207Q1-C &EFS+/207.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1-U1 &EFS+/207.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-211Q1 &EFS+/211.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-211Q1 &EFS+/211.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-211Q1 &EFS+/211.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-211Q1 &EFS+/211.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-211Q1 &EFS+/211.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-211Q1-C &EFS+/211.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-211Q1-C &EFS+/211.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-211Q1-C &EFS+/211.6;&EFS+/211.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-211Q1-C &EFS+/211.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-211Q1-U1 &EFS+/211.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-217Q1 &EFS+/217.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-217Q1 &EFS+/217.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-217Q1 &EFS+/217.3	1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524	
-217Q1 &EFS+/217.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-217Q1 &EFS+/217.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-217Q1 &EFS+/217.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-217Q1-C &EFS+/217.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-217Q1-C &EFS+/217.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-217Q1-C &EFS+/217.6;&EFS+/217.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-217Q1-C &EFS+/217.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-217Q1-U1 &EFS+/217.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-260B1 &EFS+/260.3	1	Optical smoke detector 12V, with alarm relais	130-60-457	ABUS Security-Center GmbH & Co. KG	500713	X
-279M1 &EFS+/279.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M2 &EFS+/279.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M3 &EFS+/279.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M4 &EFS+/279.5	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M5 &EFS+/279.6	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-N &EFS+/99.5	2	Busbar holder for busbars 12x 5 (10)-30x 5 (10) and 6x 6 mm	8US1923-1AA01	Siemens	501271	X

previous page:
3

next page:
+IND/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-201L1 &EFS+/201.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-201L1 &EFS+/201.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-201U1 &EFS+/201.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-202L1 &EFS+/202.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-202L1 &EFS+/202.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-202U1 &EFS+/202.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-203L1 &EFS+/203.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-203L1 &EFS+/203.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-203U1 &EFS+/203.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-207L1 &EFS+/207.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-207L1 &EFS+/207.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-211L1 &EFS+/211.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-211L1 &EFS+/211.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-217L1 &EFS+/217.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-217L1 &EFS+/217.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X

previous page: +CON/4

next page: +CIR/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-80Q1 &EFS+/80.0	1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955	
-80Q1 &EFS+/80.1	1	Circuit breaker 3WL1112, 1250A, 42kA 690V, size 1, 3-pole, IEC, ETU15B, withdrawable	3WL1112-2BB36-1BJ2-ZA08+K07+M06+M21+R10	Siemens	501430	X
-83U1 &EFS+/83.2	1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918	
-83U1-C1 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C2 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C3 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C4 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C7 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C8 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C9 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C10 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C13 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C14 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C15 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C16 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-148B3 &EFS++CT+/148.5	1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649	
-227U1 &EFS+/227.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-227U1-C1 &EFS+/227.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-C7 &EFS+/227.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

previous page:
+IND/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-C13 &EFS+/227.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-F0 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F1 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F1 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F1 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F2 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F2 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F2 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F3 &EFS+/227.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F3 &EFS+/227.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F3 &EFS+/227.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-F4 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F4 &EFS+/227.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F5 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F5 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F5 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F6 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F6 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F6 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-F7 &EFS+/227.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F7 &EFS+/227.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F8 &EFS+/227.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F8 &EFS+/227.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F9 &EFS+/227.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F9 &EFS+/227.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F9 &EFS+/227.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F10 &EFS+/227.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F10 &EFS+/227.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F10 &EFS+/227.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F11 &EFS+/227.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F11 &EFS+/227.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F12 &EFS+/227.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-K1 &EFS+/227.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K2 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K3 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K7 &EFS+/227.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-K8 &EFS+/227.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K9 &EFS+/227.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-U1 &EFS+/227.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-227U1-X3.1 &EFS+/227.a.0;&EFS+/227.a.9	0					
-227U1-X3.1 &EFS+/227.a.1...&EFS+/227.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-227U1-X3.1 &EFS+/227.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-227U1-X3.1 &EFS+/227.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-227U1-X3.1 &EFS+/227.a.2...&EFS+/227.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-227U1-X3.1 &EFS+/227.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-227U1-X3.2 &EFS+/227.a.0	0					
-227U1-X3.2 &EFS+/227.a.1...&EFS+/227.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-227U1-X3.2 &EFS+/227.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-231U1 &EFS+/231.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-231U1-C1 &EFS+/231.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-C7 &EFS+/231.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-C13 &EFS+/231.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-F0 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F1 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F1 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F1 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F2 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F2 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F2 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F3 &EFS+/231.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F3 &EFS+/231.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F3 &EFS+/231.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-F4 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F4 &EFS+/231.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F5 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F5 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F5 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F6 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F6 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F6 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-F7 &EFS+/231.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F7 &EFS+/231.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F8 &EFS+/231.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F8 &EFS+/231.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F9 &EFS+/231.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F9 &EFS+/231.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F9 &EFS+/231.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F10 &EFS+/231.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F10 &EFS+/231.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F10 &EFS+/231.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F11 &EFS+/231.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F11 &EFS+/231.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F12 &EFS+/231.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-K1 &EFS+/231.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K2 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K3 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K7 &EFS+/231.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

previous page: 5

next page: 7

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-K8 &EFS+/231.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K9 &EFS+/231.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-U1 &EFS+/231.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-231U1-X3.1 &EFS+/231.a.0;&EFS+/231.a.9	0					
-231U1-X3.1 &EFS+/231.a.1...&EFS+/231.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-231U1-X3.1 &EFS+/231.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-231U1-X3.1 &EFS+/231.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-231U1-X3.1 &EFS+/231.a.2...&EFS+/231.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-231U1-X3.1 &EFS+/231.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-231U1-X3.2 &EFS+/231.a.0	0					
-231U1-X3.2 &EFS+/231.a.1...&EFS+/231.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-231U1-X3.2 &EFS+/231.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-237U1 &EFS+/237.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-237U1-C1 &EFS+/237.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-C7 &EFS+/237.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-C13 &EFS+/237.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-F0 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F1 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F1 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F1 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F2 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F2 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F2 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F3 &EFS+/237.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F3 &EFS+/237.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F3 &EFS+/237.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-F4 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F4 &EFS+/237.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F5 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F5 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F5 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F6 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F6 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F6 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-F7 &EFS+/237.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F7 &EFS+/237.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F8 &EFS+/237.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F8 &EFS+/237.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F9 &EFS+/237.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F9 &EFS+/237.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F9 &EFS+/237.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F10 &EFS+/237.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F10 &EFS+/237.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F10 &EFS+/237.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F11 &EFS+/237.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F11 &EFS+/237.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F12 &EFS+/237.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-K1 &EFS+/237.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K2 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K3 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K7 &EFS+/237.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-K8 &EFS+/237.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K9 &EFS+/237.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-U1 &EFS+/237.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-237U1-X3.1 &EFS+/237.a.0;&EFS+/237.a.9	0					
-237U1-X3.1 &EFS+/237.a.1...&EFS+/237.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-237U1-X3.1 &EFS+/237.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-237U1-X3.1 &EFS+/237.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-237U1-X3.1 &EFS+/237.a.2...&EFS+/237.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-237U1-X3.1 &EFS+/237.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-237U1-X3.2 &EFS+/237.a.0	0					
-237U1-X3.2 &EFS+/237.a.1...&EFS+/237.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-237U1-X3.2 &EFS+/237.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-281M1 &EFS+/281.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M2 &EFS+/281.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M3 &EFS+/281.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-78F1 &EFS+/78.6	1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738	
-78F1 &EFS+/78.6	3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539	
-78F2 &EFS+/78.6	1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055	
-78F3 &EFS+/78.7;&EFS+/78.8	3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	
-78F3 &EFS+/78.7;&EFS+/78.8	3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545	
-78W1 &EFS+/78.3	1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W2 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W3 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W4 &EFS+/78.3	1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290	
-78W5 &EFS+/78.2	1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070	
-227W10 &EFS+/227.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W11 &EFS+/227.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W12 &EFS+/227.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W13 &EFS+/227.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W14 &EFS+/227.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W15 &EFS+/227.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-228F1 &EFS+/228.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F2 &EFS+/228.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F3 &EFS+/228.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231W10 &EFS+/231.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W11 &EFS+/231.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W12 &EFS+/231.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W13 &EFS+/231.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W14 &EFS+/231.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W15 &EFS+/231.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W10 &EFS+/237.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W11 &EFS+/237.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W12 &EFS+/237.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W13 &EFS+/237.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W14 &EFS+/237.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W15 &EFS+/237.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-238F1 &EFS+/238a.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F2 &EFS+/238a.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F3 &EFS+/238a.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F4 &EFS+/238b.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F5 &EFS+/238b.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F6 &EFS+/238b.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-X3.43	20	Multi-level terminal block	3208511	Phoenix Contact	500560	X

previous page:
1

next page:
++CT+/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113U5 &EFS/113c.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-XT1 &EFS/136.0...&EFS/136.8	20	Feed-through terminal block	3209510	Phoenix Contact	500583	
-XT1 &EFS/136.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT1 &EFS/136.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT1 &EFS/136.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
++CONV+AC_DC/2

next page:
+CTRL_1.1/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84Q1 &EFS+/84.0	1	EMERGENCY STOP SWITCH	3LD2203-1TP53	Siemens	500810	X
-84Q1 &EFS+/84.0	1	Auxiliary switch	3LD9200-5B	Siemens	504922	X
-112A1 &EFS+/112.2	1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475	
-126S1 &EFS+/126.1	1	PUSHBUTTON, BLACK, 1 NO	3SU1100-0AB10-3BA0	Siemens	10026	X
-126S1 &EFS+/126.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H1 &EFS+/140.1	1	Complete device, round, indicator light RED	3SU1102-6AA20-3AA0	Siemens	10019	X
-140H1 &EFS+/140.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H2 &EFS+/140.2	1	Complete device, round, indicator light YELLOW	3SU1102-6AA30-3AA0	Siemens	10021	X
-140H2 &EFS+/140.2	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H3 &EFS+/140.3	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H3 &EFS+/140.3	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H4 &EFS+/140.4	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H4 &EFS+/140.4	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-278M1 &EFS+/278.1	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
+/1

next page:
+.2/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-110U1 &EFS+/110.2	1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789	
-110U1 &EFS+/110.2	1	Connector RJ45, 4 Pol., Profinet, VS-PN-RJ45-5-Q/IP20	1658435	Phoenix Contact	500806	X
-114A1 &EFS+/114.2	1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505	
-114A1 &EFS+/114.2	1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944	
-185R1 &EFS+/185.7	1	SK Enclosure heater, 800/870 W, 230 V, 1~, 50/60 Hz, WHD: 103x200x103 mm	3105400	Rittal	500621	X

previous page:
+.1/1

next page:
+.3/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	23.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+ CTRL_1.2 Left side	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84F1 &EFS+/84.6	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-84F2 &EFS+/84.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	X
-84F2 &EFS+/84.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-84K1 &EFS+/84.5	1	CONT.RELAY,3NO+1NC,DC24V,DIODE	3RH2131-2FB40	Siemens	501288	X
-101Q1 &EFS+/101.2	1	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	X
-101Q1 &EFS+/101.2	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	X
-101Q1 &EFS+/101.2	1	3-PHASE BUSBAR W. INFEED	3RV2917-1A	Siemens	500799	X
-101Q1 &EFS+/101.2	1	3-phase busbar including extension connector for 3 circuit breakers Size S00 and S0	3RV2917-4B	Siemens	504254	X
-101T1 &EFS+/101.2	1	Power supply unit	2866404	Phoenix Contact	502745	X
-102G1 &EFS+/102.2	1	Uninterruptible power supply	2320241	Phoenix Contact	501836	X
-102G2 &EFS+/102.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	X
-103F1 &EFS+/103.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F2 &EFS+/103.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F3 &EFS+/103.6	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F4 &EFS+/103.8	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F5 &EFS+/103.9	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-111A1 &EFS+/111.0	1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287	
-113T1 &EFS+/113a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T1 &EFS+/113a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	

previous page:
+.2/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113T2 &EFS+/113b.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T2 &EFS+/113b.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-113U1 &EFS+/113a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U2 &EFS+/113a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-113U3 &EFS+/113b.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U4 &EFS+/113b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-115A1 &EFS+/115.3	1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt	
-120A1 &EFS+/120.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	X
-134K1 &EFS+/134.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-134K1 &EFS+/134.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K1 &EFS+/135.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K1 &EFS+/135.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K2 &EFS+/135.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K2 &EFS+/135.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K3 &EFS+/135.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K3 &EFS+/135.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K4 &EFS+/135.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K4 &EFS+/135.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K5 &EFS+/135.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-135K5 &EFS+/135.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-136K7 &EFS+/136.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K8 &EFS+/136.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K9 &EFS+/136.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-137K1 &EFS+/137.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K1 &EFS+/137.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K2 &EFS+/137.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K2 &EFS+/137.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K3 &EFS+/137.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K3 &EFS+/137.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K4 &EFS+/137.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K4 &EFS+/137.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-138K1 &EFS+/138.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K1 &EFS+/138.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K2 &EFS+/138.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K2 &EFS+/138.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K3 &EFS+/138.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K3 &EFS+/138.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K4 &EFS+/138.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-138K4 &EFS+/138.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K5 &EFS+/138.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K5 &EFS+/138.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K6 &EFS+/138.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K6 &EFS+/138.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K7 &EFS+/138.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K7 &EFS+/138.7	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-139K1 &EFS+/139.1	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K2 &EFS+/139.2	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K3 &EFS+/139.3	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-150K1 &EFS+/150.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K1 &EFS+/150.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150K2 &EFS+/150.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K2 &EFS+/150.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150X1 &EFS+/150.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-150X1 &EFS+/150.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-150X1 &EFS+/150.2;&EFS+/150.4;&EFS+/151.1;&EFS+/151.4;&EFS+/151.6	5	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-151K1 &EFS+/151.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K1 &EFS+/151.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-151K2 &EFS+/151.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K2 &EFS+/151.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K3 &EFS+/151.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K3 &EFS+/151.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K4 &EFS+/151.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K4 &EFS+/151.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-171K3 &EFS+/171.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-171K3 &EFS+/171.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-173K3 &EFS+/173.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-173K3 &EFS+/173.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-181Q1 &EFS+/181.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-181Q1 &EFS+/181.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q1 &EFS+/181.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-181Q2 &EFS+/181.3	1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671	
-181Q2 &EFS+/181.3	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q2 &EFS+/181.3	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-182Q1 &EFS+/182.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-182Q1 &EFS+/182.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-182Q1 &EFS+/182.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-183F1 &EFS+/183.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	X
-183F1 &EFS+/183.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-183F1 &EFS+/183.1	1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364	X
-183F1 &EFS+/183.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	X
-183F2 &EFS+/183.3	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-183F2 &EFS+/183.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185B1 &EFS+/185.6	1	Thermostat NC contact, -10 to 50 °C	8MR2170-1CA	Siemens	500816	X
-185F1 &EFS+/185.1	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-185F1 &EFS+/185.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185F2 &EFS+/185.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	X
-185F2 &EFS+/185.7	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-186B1 &EFS+/186.6	1	Thermostat NO contact, -10 to 50 °C	8MR2170-1CB	Siemens	501577	X
-186K1 &EFS+/186.6	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-187F1 &EFS+/187.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C13	5SY4113-7	Siemens	504323	X
-187F1 &EFS+/187.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-187F2 &EFS+/187.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-189K1 &EFS+/189.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-190F1 &EFS+/190.1	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F1 &EFS+/190.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-190F1 &EFS+/190.1	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F2 &EFS+/190.3	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F2 &EFS+/190.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F2 &EFS+/190.3	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F3 &EFS+/190.5	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F3 &EFS+/190.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F3 &EFS+/190.5	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190X10 &EFS+/190.9	1	5TE6 REG Socket Outlets, 16 A	5TE6800	Siemens	503215	X
-190XT1 &EFS+/190.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-190XT1 &EFS+/190.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-190XT1 &EFS+/190.1;&EFS+/190.5	3	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-191F1 &EFS+/191.1	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F1 &EFS+/191.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191F2 &EFS+/191.3	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F2 &EFS+/191.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191XT1 &EFS+/191.1;&EFS+/191.3	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-191XT1 &EFS+/191.1	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-191XT1 &EFS+/191.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-195K1 &EFS+/195.3	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K1 &EFS+/195.3	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K2 &EFS+/195.4	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K2 &EFS+/195.4	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K3 &EFS+/195.1	1	SIRIUS SAFETY RELAY STD RELAY 3NO+1NC	3SK1111-2AB30	Siemens	501260	X
-AI_01 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_01 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-AI_02 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_02 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_03 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_03 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_04 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_04 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_01 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_01 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X

previous page: 7

next page: 9

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-DI_02 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_02 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_03 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_03 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_04 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_04 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_05 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_05 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_06 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_06 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_01 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_01 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-DO_02 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_02 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_03 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_03 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_04 &EFS+/120.6	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_04 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-X1 &EFS+/181.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X1 &EFS+/181.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-X1 &EFS+/181.1;&EFS+/181.3;&EFS+/181.4;&EFS+/182.1;&EFS+/182.3;&EFS+/182.4	12	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-X1 &EFS+/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-X1 &EFS+/181.1;&EFS+/181.4;&EFS+/182.1;&EFS+/182.4	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-X3 &EFS+/127.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3 &EFS+/127.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.10 &EFS+/129.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0;&EFS+/129.2;&EFS+/129.4;&EFS+/129.6;&EFS+/129.8;&EFS+/129.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.10 &EFS+/129.0;&EFS+/129.4;&EFS+/129.6;&EFS+/129.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.11 &EFS+/130.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.11 &EFS+/130.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.11 &EFS+/130.0;&EFS+/130.2;&EFS+/130.4;&EFS+/130.6;&EFS+/130.8;&EFS+/130.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.11 &EFS+/130.0;&EFS+/130.4;&EFS+/130.6;&EFS+/130.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.12 &EFS+/131.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.12 &EFS+/131.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.12 &EFS+/131.0;&EFS+/131.2;&EFS+/131.4;&EFS+/131.6;&EFS+/131.8;&EFS+/131.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.12 &EFS+/131.0;&EFS+/131.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.13 &EFS+/132.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X3.13 &EFS+/132.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.13 &EFS+/132.0;&EFS+/132.2;&EFS+/132.4;&EFS+/132.6;&EFS+/132.8;&EFS+/132.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.13 &EFS+/132.0;&EFS+/132.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3	21	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3 &EFS+/127.1;&EFS+/127.5;&EFS+/128.3;&EFS+/188.1	5	Plug-in bridge FBS 2-3,5	3213014	Phoenix Contact	500802	X
-X5 &EFS+/145.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X5 &EFS+/145.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-X5.1 &EFS+/149.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0;&EFS+/149.2	2	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-X5.1 &EFS+/149.0	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-X5	15	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-XDC1 &EFS+/103.1	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC1 &EFS+/103.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC1 &EFS+/103.2;&EFS+/103.3	7	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC1 &EFS+/103.2	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	X
-XDC1 &EFS+/103.3	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	X
-XDC1 &EFS+/103.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XDC2 &EFS+/103.3	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X

previous page: 10

next page: 12

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC2 &EFS+/103.3	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC2 &EFS+/103.4;&EFS+/103.5	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC2 &EFS+/103.4;&EFS+/103.5	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC3 &EFS+/103.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC3 &EFS+/103.5	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC3 &EFS+/103.6;&EFS+/103.7	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC3 &EFS+/103.6;&EFS+/103.7	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC4 &EFS+/103.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC4 &EFS+/103.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC4 &EFS+/103.8;&EFS+/103.9	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC4 &EFS+/103.8;&EFS+/103.9	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC5.1 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.1 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.1 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC5.2 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.2 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.2 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XE &EFS+/84.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-XE &EFS+/84.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XE &EFS+/84.0;&EFS+/84.1	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XE &EFS+/84.0;&EFS+/84.1	3	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	X
-XE &EFS+/84.1;&EFS+/84.2	4	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-XE &EFS+/84.1	1	Plug-in bridge FBS 3-8	3030297	Phoenix Contact	501568	X
-XE &EFS+/84.2;&EFS+/84.3	3	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-XT &EFS+/183.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XT &EFS+/183.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XT &EFS+/183.1;&EFS+/183.2;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2;&EFS+/187.4;&EFS+/187.5	8	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-XT &EFS+/183.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XT &EFS+/187.4	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XT &EFS+/183.1;&EFS+/183.4;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2	6	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XV &EFS+/171.8	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-XV &EFS+/171.8	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Base terminal for component connector	3210185	Phoenix Contact	500828	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Component plug terminal block	3036796	Phoenix Contact	500533	X
-XV &EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	8	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	X
-XV &EFS+/171.8	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XV &EFS+/134.5	1	Diode ZY12 - zener diode, DO-41, plastic, 12V, 2W	17060488	Distrelec Schuricht GmbH	500556	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-85U1 &EFS+/85.0	1	Power Bridge Rectifiers SKD 30/16A1, Vrrm = 1600V, Id = 30A	07122150	Semikron	501556	X
-85U10 &EFS+/85.0	1	EMI Filter X2 Y1 Version 2	505722	Freqcon GmbH	505722	X
-85U11 &EFS+/85.1	1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702	
-149U1 &EFS+/149.5	1	Interface module	2959609	Phoenix Contact	501595	X
-171F1 &EFS+/171.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-171F1 &EFS+/171.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-171K1 &EFS+/171.7	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171K2 &EFS+/171.8	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171R1 &EFS+/171.1	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-171R2 &EFS+/171.2	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-173F2 &EFS+/173.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F2 &EFS+/173.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-173F3 &EFS+/173.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F3 &EFS+/173.4	2	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-173K1 &EFS+/173.8	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173K2 &EFS+/173.9	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173R1 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R2 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R3 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X

previous page:
+.3/13

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R4 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-189X1 &EFS+/189.4	9	Measuring transformer disconnect terminal	3035696	Phoenix Contact	54498	X
-189X1 &EFS+/189.4	9	Test adapter - PAIS-4-FIX GY	3032791	Phoenix Contact	501482	X
-189X1 &EFS+/189.4	1	End cover D-DTME 6	3034426	Phoenix Contact	505468	X
-189X1 &EFS+/189.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-306K1 &EFS+/306.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K1 &EFS+/306.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K2 &EFS+/306.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K2 &EFS+/306.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K3 &EFS+/306.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K3 &EFS+/306.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K4 &EFS+/306.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K4 &EFS+/306.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K5 &EFS+/306.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K5 &EFS+/306.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K6 &EFS+/306.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K6 &EFS+/306.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K1 &EFS+/307.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K1 &EFS+/307.1	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-307K2 &EFS+/307.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K2 &EFS+/307.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K3 &EFS+/307.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K3 &EFS+/307.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K4 &EFS+/307.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K4 &EFS+/307.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K5 &EFS+/307.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K5 &EFS+/307.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K6 &EFS+/307.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K6 &EFS+/307.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K1 &EFS+/308.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K1 &EFS+/308.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K2 &EFS+/308.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K2 &EFS+/308.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K3 &EFS+/308.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K3 &EFS+/308.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K4 &EFS+/308.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K4 &EFS+/308.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K5 &EFS+/308.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-308K5 &EFS+/308.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K6 &EFS+/308.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K6 &EFS+/308.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K1 &EFS+/350.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K1 &EFS+/350.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K2 &EFS+/350.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K2 &EFS+/350.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350X1.21 &EFS+/350.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	
-350X1.21 &EFS+/350.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-350X1.21 &EFS+/350.1&EFS+/350.2&EFS+/350.4&EFS+/351.1&EFS+/351.3&EFS+/351.4&EFS+/352.1&EFS+/352.3&EFS+/353.1&EFS+/353.4&EFS+/352.4	9	Multi-level terminal block	3208511	Phoenix Contact	500560	
-350X1.21 &EFS+/352.1	0					
-351K1 &EFS+/351.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K1 &EFS+/351.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K2 &EFS+/351.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K2 &EFS+/351.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K3 &EFS+/351.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K3 &EFS+/351.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-351K4 &EFS+/351.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K4 &EFS+/351.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

previous page: 3

next page: 5

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-352K1 &EFS+/352.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K1 &EFS+/352.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-352K2 &EFS+/352.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K2 &EFS+/352.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K1 &EFS+/353.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K1 &EFS+/353.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K2 &EFS+/353.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K2 &EFS+/353.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K3 &EFS+/353.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K3 &EFS+/353.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K4 &EFS+/353.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K4 &EFS+/353.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-XE2 &EFS+/173.1	0					
-XE2 &EFS+/173.2...&EFS+/173.5	11	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Base terminal for component connector	3210185	Phoenix Contact	500828	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Component plug terminal block	3036796	Phoenix Contact	500533	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B1 &EFS+/147.5	1	Temperature sensor PT100, cable 1.5m, PVC	1101-6030-1211-110	S+S Regeltechnik GmbH	501787	X
-190H1 &EFS+/190.5	1	LED system light, Without socket, Length: 337 mm, Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500110	Rittal	10007	X
-190H1 &EFS+/190.5	1	Infeed, 2-pole (with socket, without connector), Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500420	Rittal	10009	X
-190H1 &EFS+/190.5	1	Door-Operated Switch, Input voltage: 230 V AC, 24 V DC, - 240 V, 1~, 50 Hz/60 Hz,	2500460	Rittal	500736	X

previous page:
+.4/5

next page:
+CTRL_1/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-20BG1 &EFS+/100.2	1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550	
-20BG1-X &EFS+/100.2	55	End bracket for terminal block	3022276	Phoenix Contact	500588	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-149X1 &EFS+/161.4...&EFS+/161.8	6	Feed-through terminal block Push-in PT 4	3211757	Phoenix Contact	500582	X
-149X1 &EFS+/161.4	1	End cover D-ST 4	3030420	Phoenix Contact	500502	
-149X1 &EFS+/161.4	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-149X1 &EFS+/161.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-160U1 &EFS+/160.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-161U1 &EFS+/161.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-162U1 &EFS+/162.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-163U1 &EFS+/163.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-164U1 &EFS+/164.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-240U1 &EFS+/440.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-240U1 &EFS+/440.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-240U1 &EFS+/440.1	1	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-241U1 &EFS+/441.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-241U1 &EFS+/441.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-241U1 &EFS+/441.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-242U1 &EFS+/442.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-242U1 &EFS+/442.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-242U1 &EFS+/442.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-243U1 &EFS+/443.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-243U1 &EFS+/443.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-243U1 &EFS+/443.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-278M2 &EFS+/278.3	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
1

next page:
+CTRL.4/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R5 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R6 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R7 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R8 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	

previous page:
+CTRL_2.1/2

next page:
++FAN+/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-52G1 &EFS++CT/181.0;&EFS++CT/181.7	0					
-52G1-148B1 &EFS++CT/148.1	1	Temperature sensor PT100, cable 3m, PVC	1101-6030-1231-110	S+S Regeltechnik GmbH	501575	X
-52G1-181M1 &EFS++CT/181.1	1	Pump CM10-2, 3x380V-415V, 50Hz, 1,27 kW, 2,85-2,9 A, 2.950 - 2.960 rpm / 440V-480V, 60Hz, 2,2 kW, 4,0-3,7A, 3.520-3.530 rpm	99080211	GRUNDFOS GmbH	501409	X
-52G1-181R1 &EFS++CT/181.3	1	Screw-in heater SEHK, 3kW, 400V	106066	Siekerkotte GmbH & Co. KG	500620	X
-52G1-181S1 &EFS++CT/181.7	0					
-52G1-181X1 &EFS++CT/181.0	0					
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.3;&EFS++CT/181.4;&EFS++CT/182.1	9	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-52G1-181X1 &EFS++CT/181.3	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-52G1-181X1 &EFS++CT/181.3	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X1 &EFS++CT/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.4;&EFS++CT/182.1	3	Ground terminal block	3209536	Phoenix Contact	500813	X
-52G1-181X3 &EFS++CT/148.1;&EFS++CT/181.7	2	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-52G1-181X3 &EFS++CT/181.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-52G1-181X3 &EFS++CT/181.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X3 &EFS++CT/181.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-52G1-182M1 &EFS++CT/182.1	1	Heat exchanger 40kW cooling capacity, alluminium, 1,72kW, 3,86A, 400V	FR6555950001	Bondioli & Pavesi S.p.A.	500850	X

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153
1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555

Editor	Freqcon_DG			Statron	FREQCON	SUMMARIZED PARTS LIST	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EPA	Summarized part list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070
9	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604
1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524
3	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867
3	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872
3	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882
1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918
1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955
3	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046
3	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053
1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190
1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290
3	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157
3	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426
3	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449
1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648
1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649
3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055
1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044
1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039
1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172
9	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130
3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545
1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738
3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779

previous page:
1

next page:
++CT/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550
4	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890
1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702
5	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390
1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505
1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475
1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287
4	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805
2	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
2	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
38	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
41	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944
2	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
3	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845
2	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740
1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671

Summarized parts list

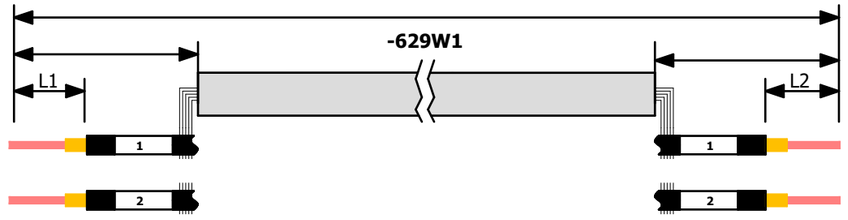
Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797
1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789
2	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
2	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
7	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804
1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt
4	Power Resistor 100W 1% 10K J	160141	Widap AG	501614

0	1	2	3	4	5	6	7	8	9

Cable name =UNIT_01++TRA+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:29	Fuse 230V AC for Container Air Conditioning		
Control cabinet 1	++CT+CTRL_1.3-X3:18	Earthing switch in On Transformer 620V side		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Fuse 230V AC for Container Air Conditioning	++CONV-18Q1:13	
		Earthing switch in On Transformer 620V side	++CONV-18Q1:14	

FRQ_Kabelplan_04_groß_de_en

previous page:
&EPA++CT/2

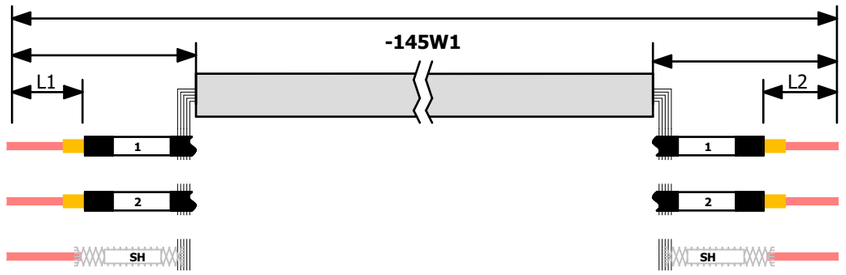
next page:
++CONV/1

Editor	Freqcon_DG			Statron		CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

page: 1
total: 492

Cable name =UNIT_01++CONV+-145W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

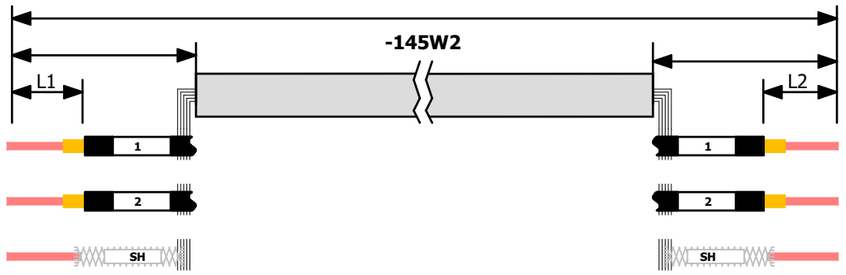


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-201L1:	INDUCTOR GRID PHASE L1 TEMPERATURE 1_1		
Inductor cabinet	+IND-201L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L1	++CT+CTRL_1.3-X5:1	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:2	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

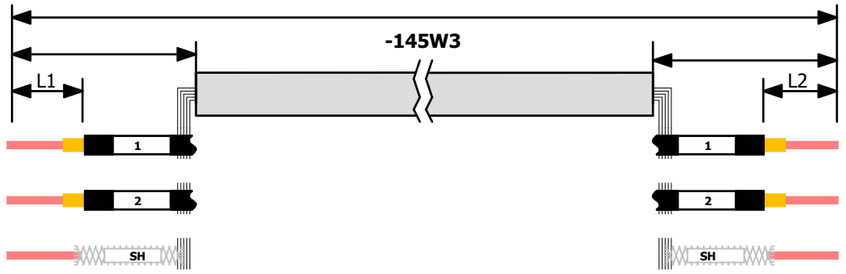


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-202L1:	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2		
Inductor cabinet	+IND-202L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L2	++CT+CTRL_1.3-X5:3	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:4	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

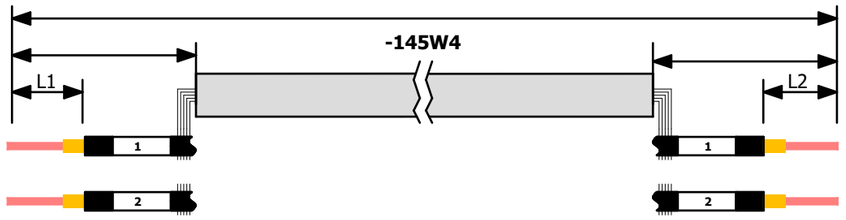


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-203L1:	INDUCTOR GRID PHASE L3 TEMPERATURE 1_3		
Inductor cabinet	+IND-203L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L3	++CT+CTRL_1.3-X5:5	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:6	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.1:	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		
Inductor cabinet	+IND-211L1.1	=		

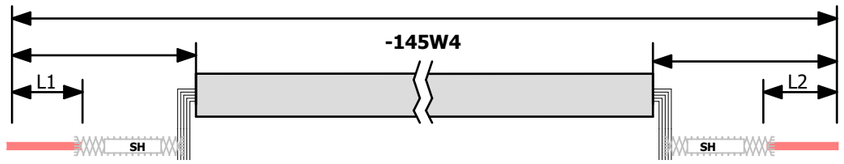
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1	++CT+CTRL_1.3-X5:7	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:8	*Control cabinet 1*

previous page: ++TRA/1
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

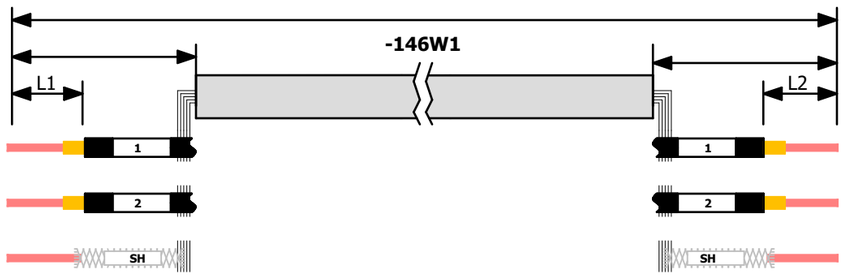


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1		

Cable name =UNIT_01++CONV+-146W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

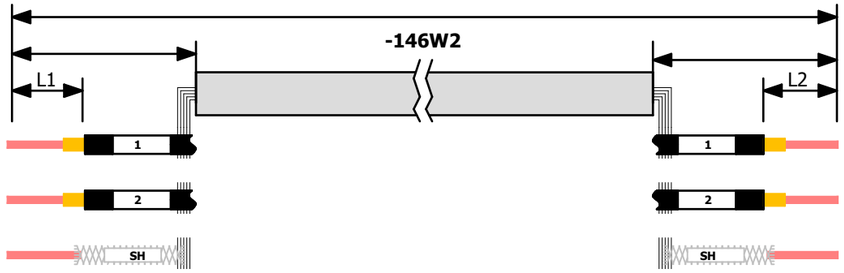


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.2	INDUCTOR DC SUB 2_2 TEMPERATURE 2_2		
Inductor cabinet	+IND-211L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_2	++CT+CTRL_1.3-X5:9	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:10	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3		
Inductor cabinet	+IND-211L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_3	++CT+CTRL_1.3-X5:11	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:12	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.1	INDUCTOR DC SUB 3_1 TEMPERATURE 3_1		
Inductor cabinet	+IND-207L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_1	++CT+CTRL_1.3-X5:13	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:14	***Control cabinet 1***
		=		

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-146W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

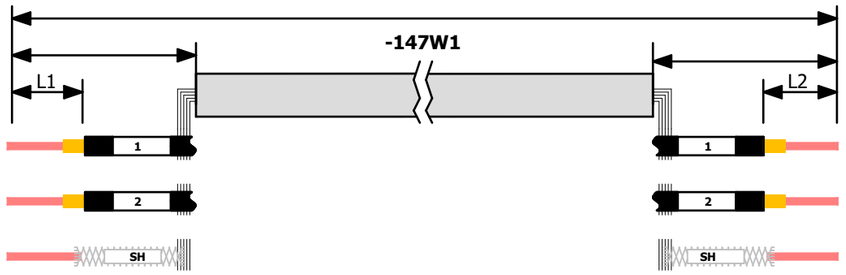


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.2	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2		
Inductor cabinet	+IND-207L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_2	++CT+CTRL_1.3-X5:15	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:16	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-147W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

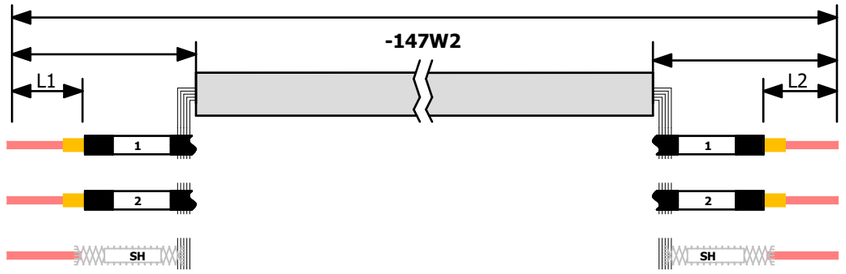


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.3:	INDUCTOR DC SUB 3_3 TEMPERATURE 3_3		
Inductor cabinet	+IND-207L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_3	++CT+CTRL_1.3-X5:17	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:18	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-147W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

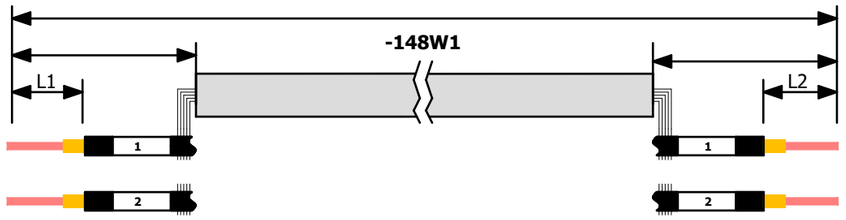


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.1:	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1		
Inductor cabinet	+IND-217L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_1	++CT+CTRL_1.3-X5:19	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:20	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.2:	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		
Inductor cabinet	+IND-217L1.2	=		

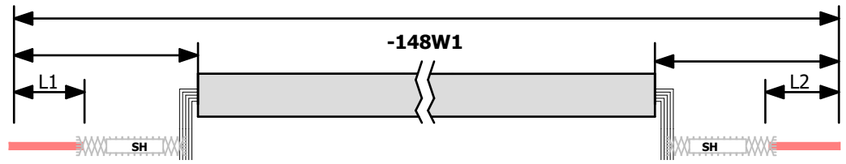
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2	++CT+CTRL_1.3-X5:25	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:26	*Control cabinet 1*

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2		

Cable name =UNIT_01++CONV+-148W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

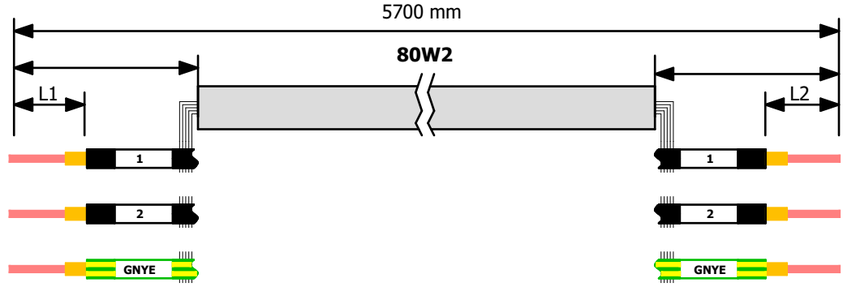


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.3:	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3		
Inductor cabinet	+IND-217L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_3	++CT+CTRL_1.3-X5:29	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:30	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-80W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

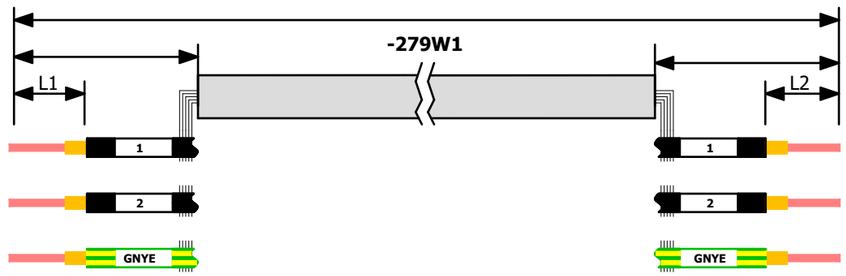


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:9	230V AC for Circuit Breaker 1	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:10	=	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	230V AC for Circuit Breaker 1	+CIR-80Q1:X5_2	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-80Q1:X5_1	***Circuit Breaker cabinet***
		=		

Cable name =UNIT_01++CONV+-279W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:1	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:2	=	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CON-279M1:L	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:N	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:PE	***Converter cabinet***

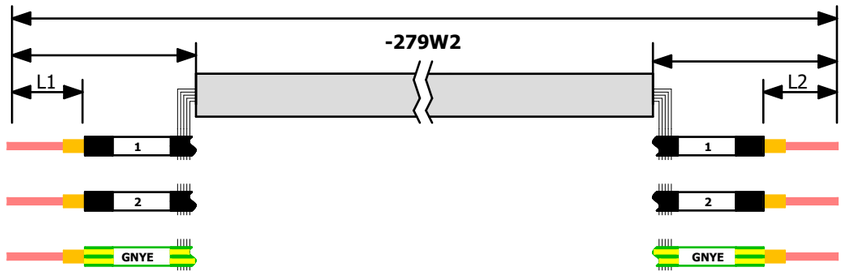
previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M1:L	FAN 1 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M1:N	=	stripped	8 mm
Converter cabinet	+CON-279M1:PE	=	stripped	8 mm

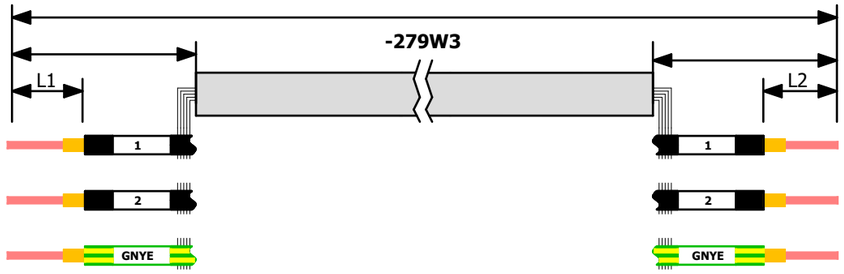


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CONVERTER	+CON-279M2:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M2:1	FAN 2 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M2:2	=	stripped	8 mm
Converter cabinet	+CON-279M2:PE	=	stripped	8 mm

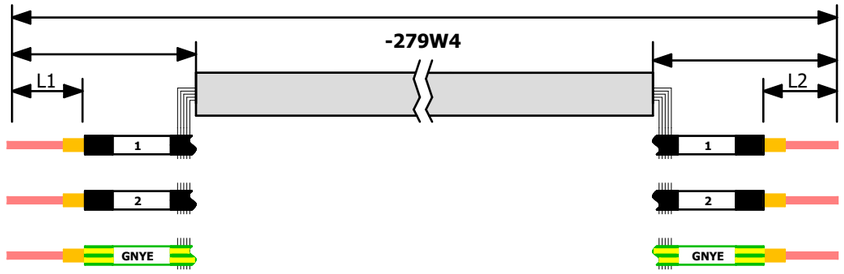


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CONVERTER	+CON-279M3:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W4
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M3:1	FAN 3 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M3:2	=	stripped	8 mm
Converter cabinet	+CON-279M3:PE	=	stripped	8 mm

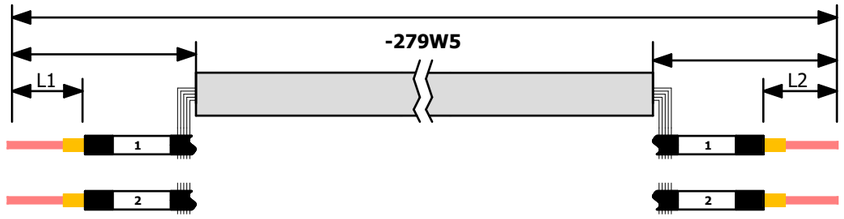


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 3 CONVERTER	+CON-279M4:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:1	FAN 4 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M4:2	=	stripped	8 mm



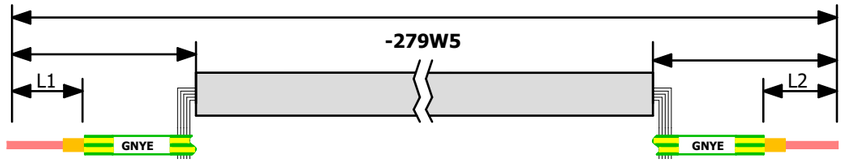
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M5:2	***Converter cabinet***

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

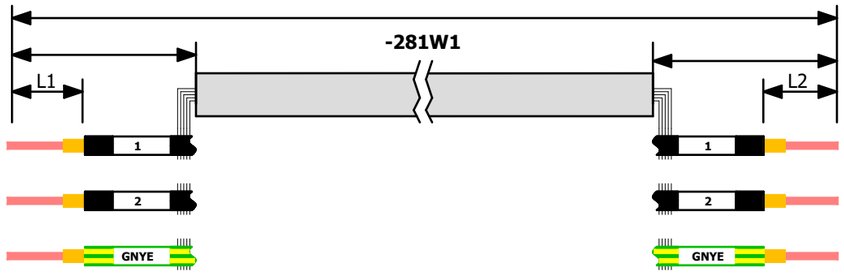


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:PE	FAN 4 CONVERTER	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:PE	*Converter cabinet*

Cable name =UNIT_01++CONV+-281W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:3	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:4	CIR Fans 1-3 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CIR-281M1:L	*Circuit Breaker cabinet*
8 mm	stripped	CIR Fans 1-3	+CIR-281M1:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M1:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

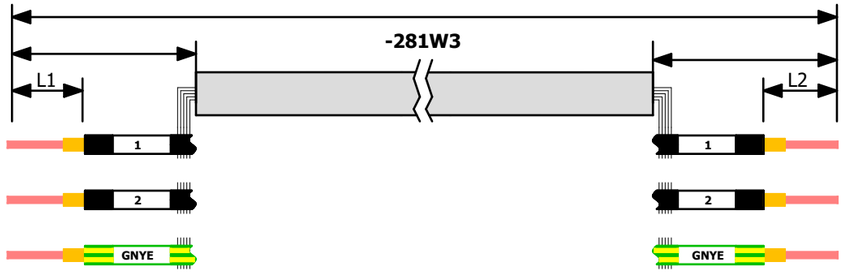


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M1:L	FAN 1 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CIRCUIT BREAKER CABINET	+CIR-281M2:L	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M2:L	FAN 2 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:PE	=	stripped	8 mm

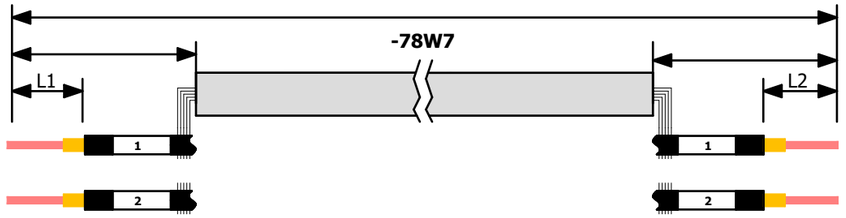
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CIRCUIT BREAKER CABINET	+CIR-281M3:1	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:2	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:PE	*Circuit Breaker cabinet*

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-78W7
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

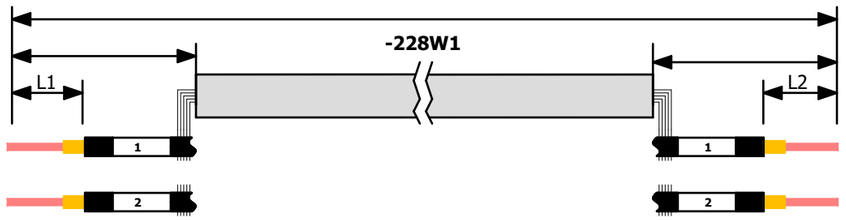


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:20			
AC and DC connection cabinet	+AC_DC-X3.43:19			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+AC_DC-78F1:13	AC and DC connection cabinet
			+AC_DC-78F1:14	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:7	SURGE ARRESTER DC SUBSYSTEM 3_1		
AC and DC connection cabinet	+AC_DC-X3.43:8	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_1	+AC_DC-228F1:11	AC and DC connection cabinet
		=	+AC_DC-228F1:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

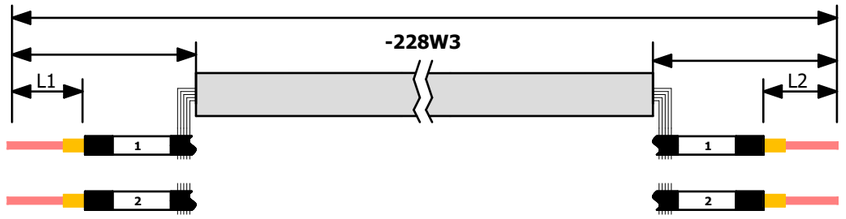


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:9	SURGE ARRESTER DC SUBSYSTEM 3_2		
AC and DC connection cabinet	+AC_DC-X3.43:10	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_2	+AC_DC-228F2:11	AC and DC connection cabinet
		=	+AC_DC-228F2:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:11	SURGE ARRESTER DC SUBSYSTEM 3_3		
AC and DC connection cabinet	+AC_DC-X3.43:12	=		

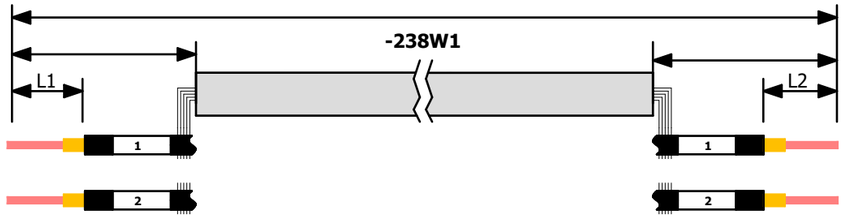
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_3	+AC_DC-228F3:11	AC and DC connection cabinet
		=	+AC_DC-228F3:12	AC and DC connection cabinet

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

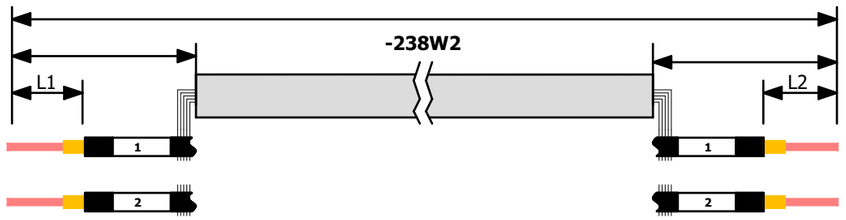


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1		
AC and DC connection cabinet	+AC_DC-X3.43:2	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_1	+AC_DC-238F1:11	***AC and DC connection cabinet***
		=	+AC_DC-238F1:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

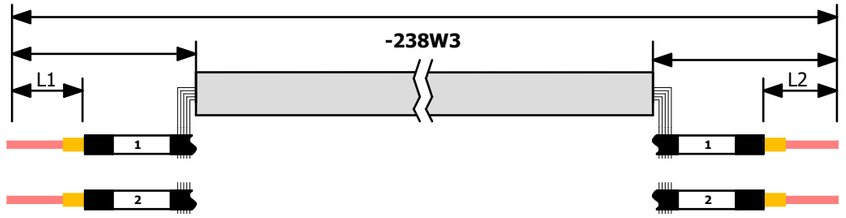


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:3	SURGE ARRESTER DC SUBSYSTEM 2_2		
AC and DC connection cabinet	+AC_DC-X3.43:4	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_2	+AC_DC-238F2:11	***AC and DC connection cabinet***
		=	+AC_DC-238F2:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

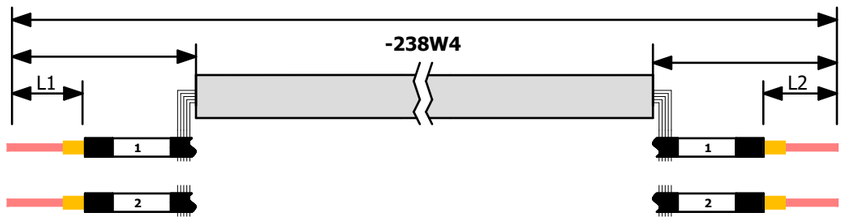


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:5	SURGE ARRESTER DC SUBSYSTEM 2_3		
AC and DC connection cabinet	+AC_DC-X3.43:6	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_3	+AC_DC-238F3:11	***AC and DC connection cabinet***
		=	+AC_DC-238F3:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W4
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:13	SURGE ARRESTER DC SUBSYSTEM 4_1		
AC and DC connection cabinet	+AC_DC-X3.43:14	=		

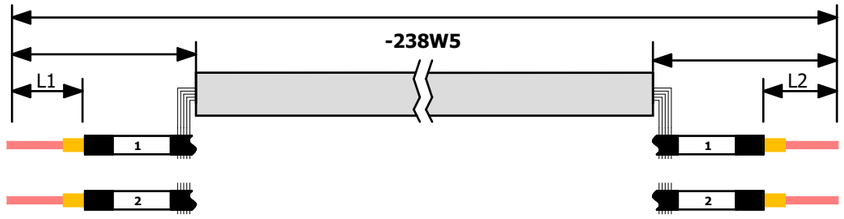
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_1	+AC_DC-238F4:11	***AC and DC connection cabinet***
		=	+AC_DC-238F4:12	***AC and DC connection cabinet***

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W5
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

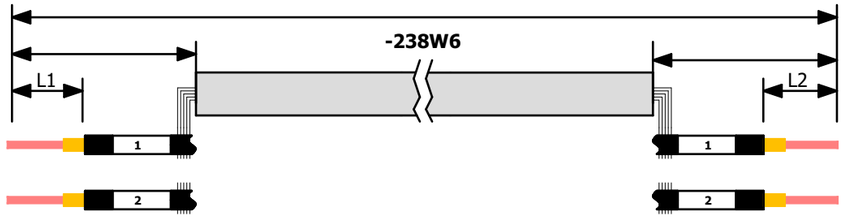


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:15	SURGE ARRESTER DC SUBSYSTEM 4_2		
AC and DC connection cabinet	+AC_DC-X3.43:16	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_2	+AC_DC-238F5:11	***AC and DC connection cabinet***
		=	+AC_DC-238F5:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W6
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

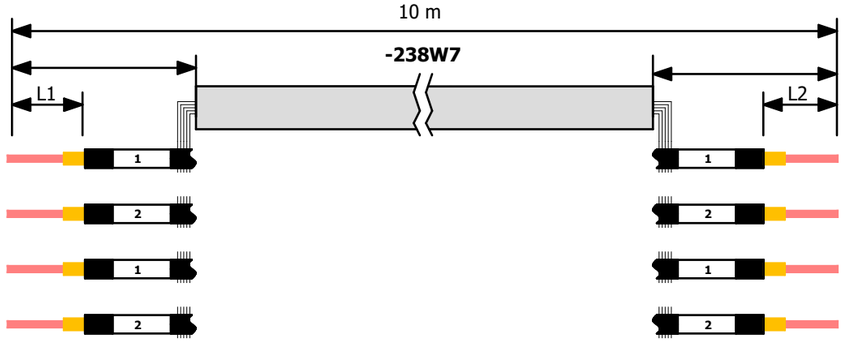


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:17	SURGE ARRESTER DC SUBSYSTEM 4_3		
AC and DC connection cabinet	+AC_DC-X3.43:18	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_3	+AC_DC-238F6:11	***AC and DC connection cabinet***
		=	+AC_DC-238F6:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W7
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030;10030

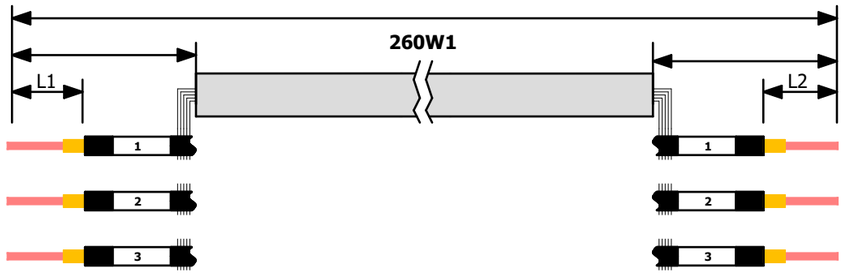


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1	stripped	7mm
AC and DC connection cabinet	+AC_DC-X3.43:20		stripped	7mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8mm	stripped	SURGE ARRESTER DC SUBSYSTEM 2_1	++CT+CTRL_1.3-X3:5	***Control cabinet 1***
8mm	stripped		++CT+CTRL_1.3-X3:6	***Control cabinet 1***

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors 3

Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:19	Smoke detector CON		
Control cabinet 1	++CT+CTRL_1.3-X3:20	=		
Control cabinet 1	++CT+CTRL_1.3-X3:21	=		

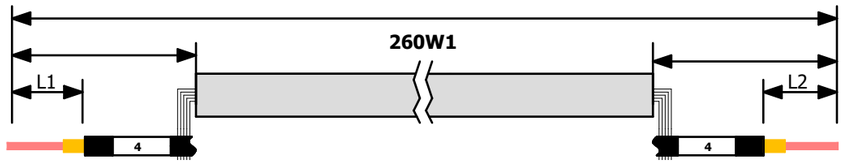
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Smoke detector CON	+CON-260B1:4	***Converter cabinet***
		=	+CON-260B1:2	***Converter cabinet***
		=	+CON-260B1:5	***Converter cabinet***

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors

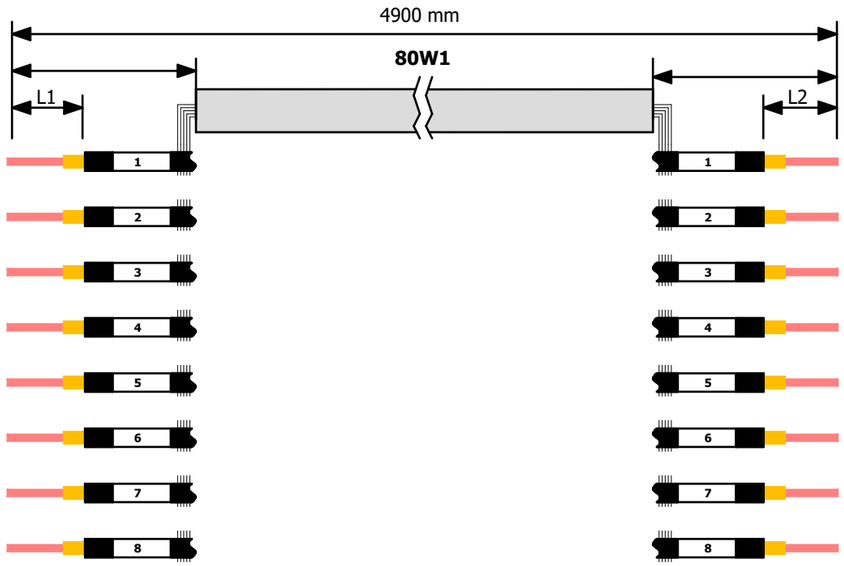
Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:22	Smoke detector CON					Smoke detector CON	+CON-260B1:6	*Converter cabinet*

Cable name =UNIT_01++CONV+-80W1
Cable type OZ-500 8x0,75 mm²
Free conductors

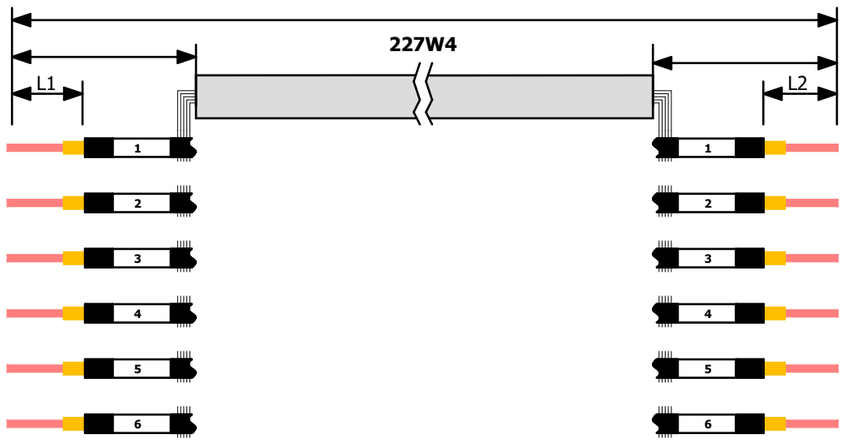
Cable parts HELU.10173
Order number 10173



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:1	CB 1 Tripped GRID	stripped	8 mm	8 mm	stripped	CB 1 Tripped GRID	+CIR-80Q1:X7_13	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:2	CB 1 OFF GRID	stripped	8 mm	8 mm	stripped	CB 1 OFF GRID	+CIR-80Q1:X6_9	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:3	CB 1 ON GRID	stripped	8 mm	8 mm	stripped	CB 1 ON GRID	+CIR-80Q1:X6_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:31	CB 1 GRID +24V	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_12	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:32	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:35	CB 2 ISLAND GRID +24V OPTIONAL	stripped	8 mm	8 mm	stripped	CB 2 ISLAND GRID	+CIR-80Q1:X6_7	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:36	CB 1 GRID	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_14	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:37	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_12	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



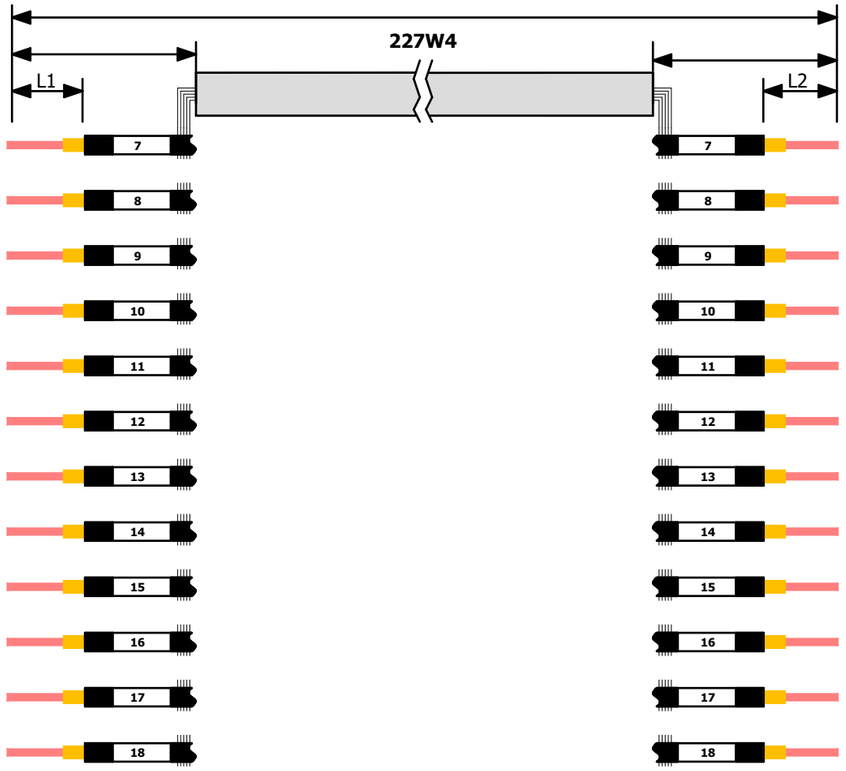
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:1	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:4	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:7	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:3	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:6	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:9	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EMB Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 10
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

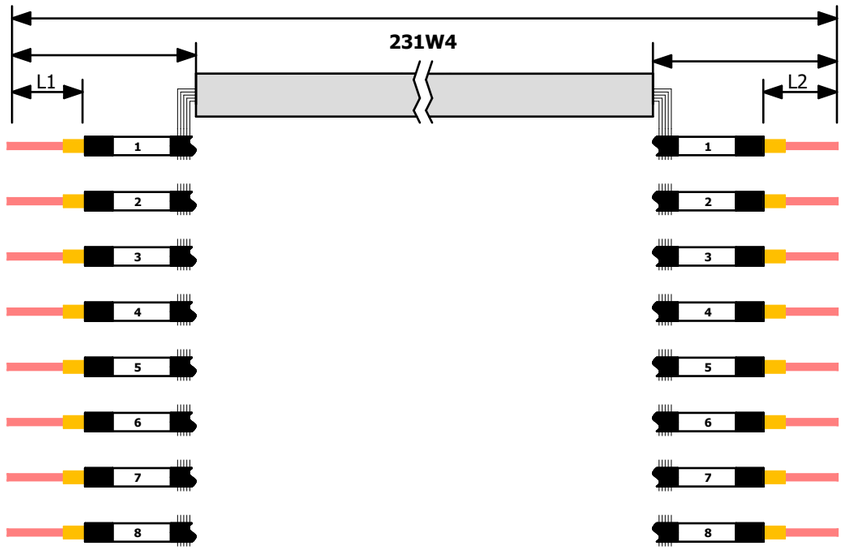
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K3:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

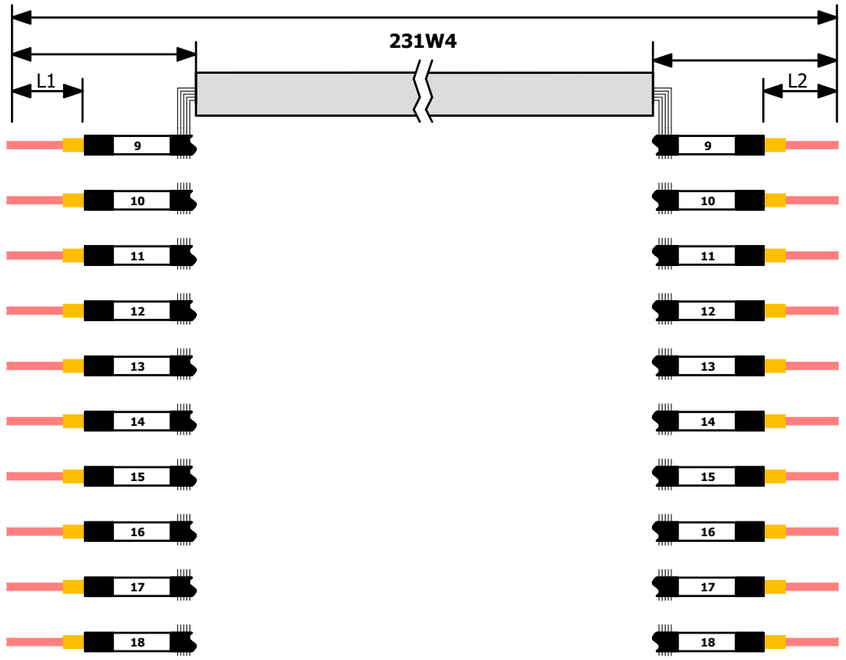


Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:4	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:7	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:3	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:6	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K3:A1	***Control cabinet 1***

previous page: 10
next page: 12

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

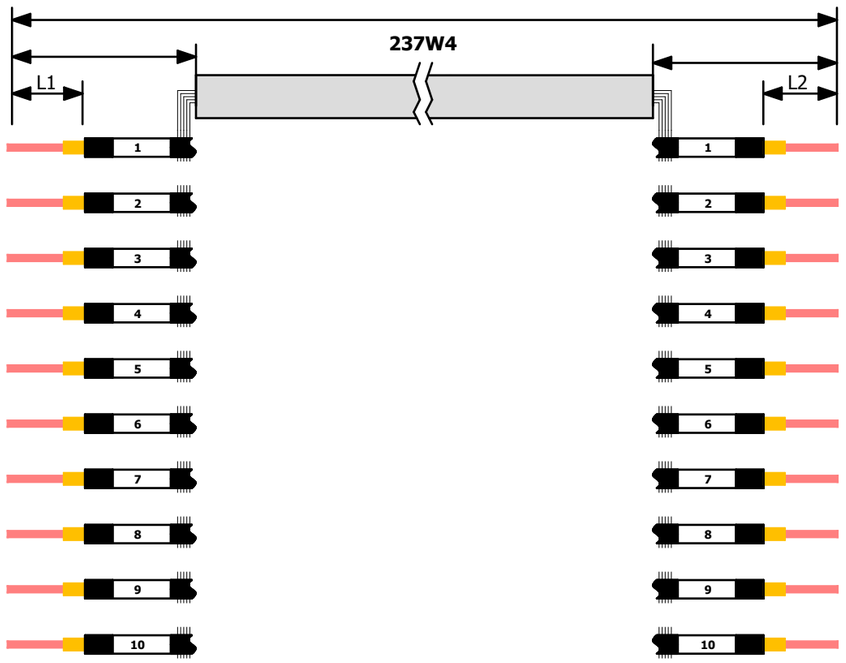
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



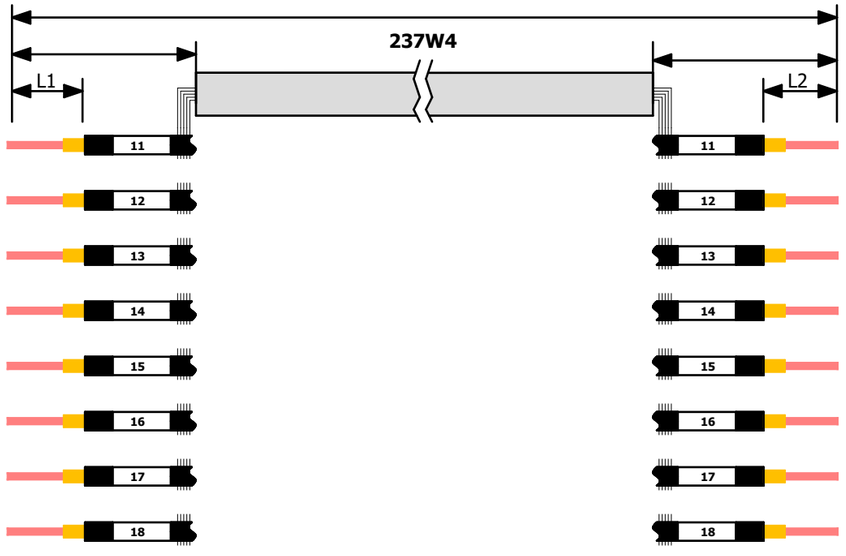
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-237U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:14	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:17	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:13	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:16	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:19	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K3:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K2:A1	***Control cabinet 1***

previous page: 11
next page: 13

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-X3.1:11		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:12		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:13		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:14		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:15		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:16		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:17		stripped	8 mm
			stripped	8 mm

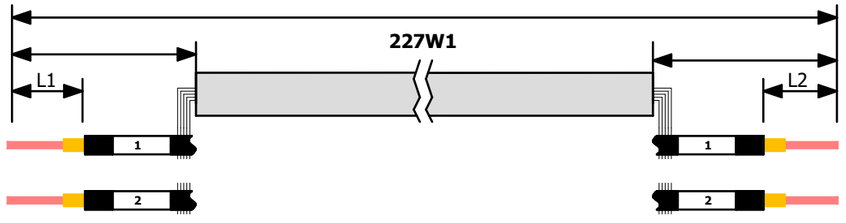


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped		++CT+CTRL_1.4-308K4:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-308K6:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:8	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:9	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:11	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:10	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-350X1.21:12	*Control cabinet 1*
8 mm	stripped			

Cable name =UNIT_01++CONV+-227W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F3:1			
Circuit Breaker cabinet	+CIR-227U1-F4:1			

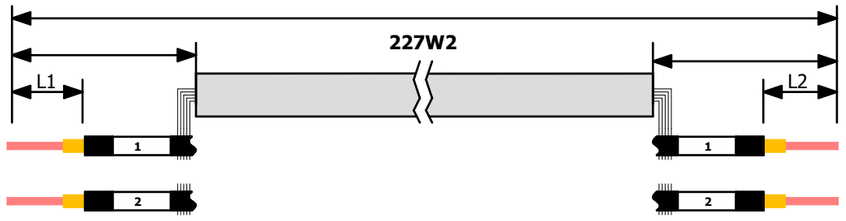


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:32	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-227W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F7:1			
Circuit Breaker cabinet	+CIR-227U1-F8:1			



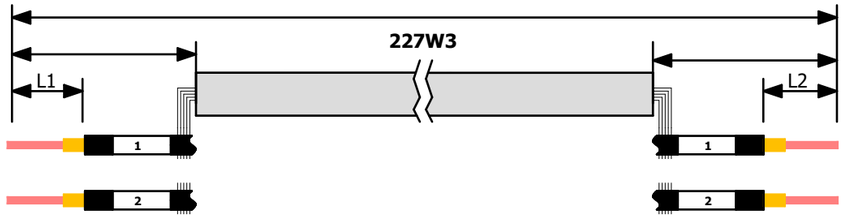
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:36	*Control cabinet 2*

previous page: 12
next page: 14

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-227W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

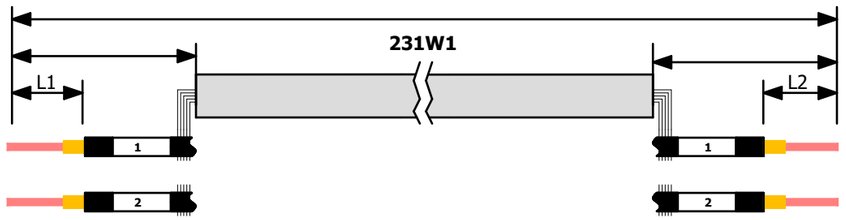


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F11:1			
Circuit Breaker cabinet	+CIR-227U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:40	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

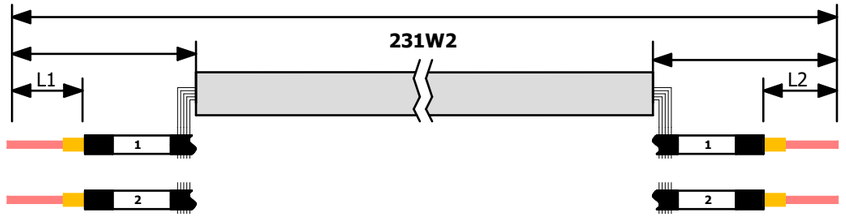


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F3:1			
Circuit Breaker cabinet	+CIR-231U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:19	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

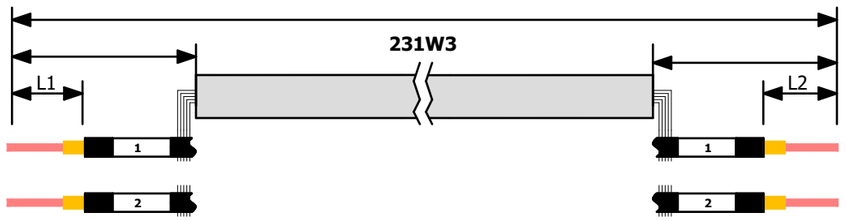


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F7:1			
Circuit Breaker cabinet	+CIR-231U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:23	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F11:1			
Circuit Breaker cabinet	+CIR-231U1-F12:1			

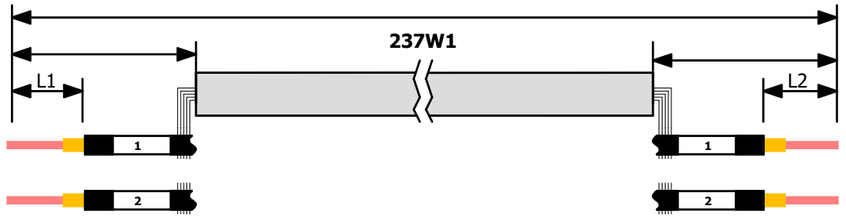
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:27	*Control cabinet 2*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 14
Date								+		total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-237W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

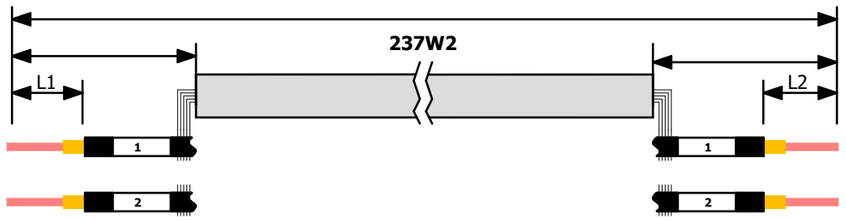


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F3:1			
Circuit Breaker cabinet	+CIR-237U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

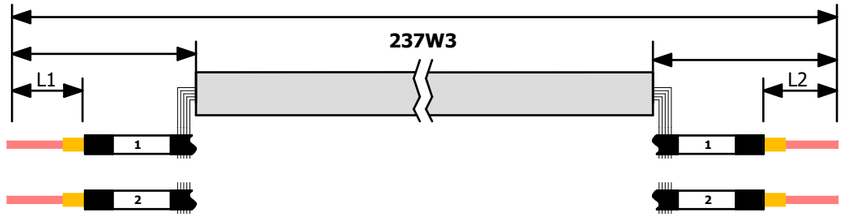


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F7:1			
Circuit Breaker cabinet	+CIR-237U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

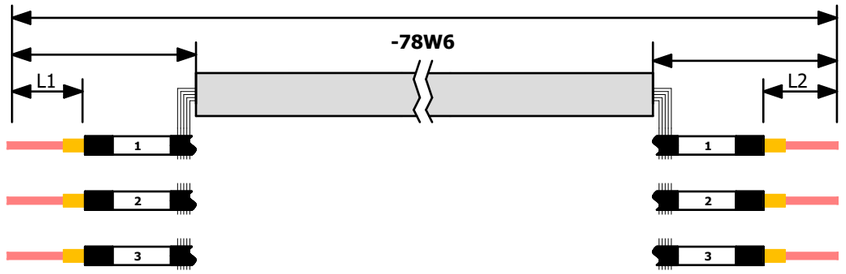


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F11:1			
Circuit Breaker cabinet	+CIR-237U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-78W6
Cable type OZ-600 3x2,5 mm²
Free conductors

Cable parts HELU.10691
Order number 10691



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-78F3:2			
AC and DC connection cabinet	+AC_DC-78F3:4			
AC and DC connection cabinet	+AC_DC-78F3:6			

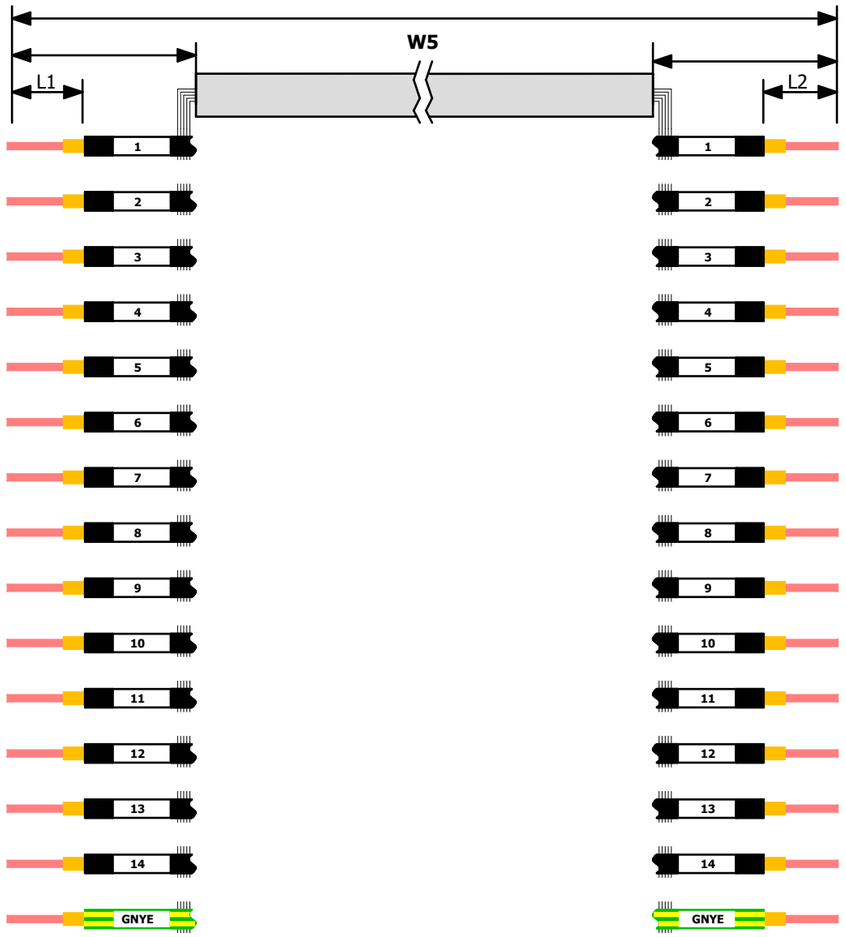
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_1.4-85U1:L1	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L2	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L3	*Control cabinet 1*

previous page: 14
next page: +CIR/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-227U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

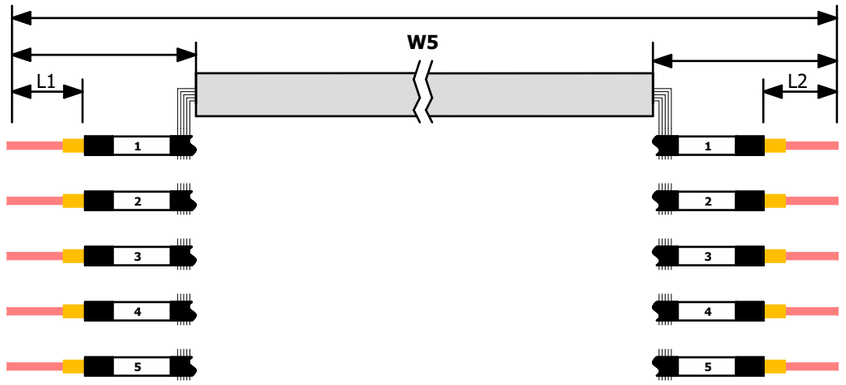
Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-227U1-X3.1:1							-227U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:2							-227U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:3							-227U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:4							-227U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:5							-227U1-X3.2:9	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:6							-227U1-X3.2:11	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:7							-227U1-X3.2:13	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:8							-227U1-X3.2:15	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:9							-227U1-X3.2:17	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:10							-227U1-X3.2:19	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:11							-227U1-X3.2:21	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:12							-227U1-X3.2:23	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:16							-227U1-X3.2:24	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:17							-227U1-X3.2:12	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:PE							-227U1-X3.2:PE	Circuit Breaker cabinet

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-231U1-X3.1:1							-231U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:2							-231U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:3							-231U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:4							-231U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:5							-231U1-X3.2:9	Circuit Breaker cabinet

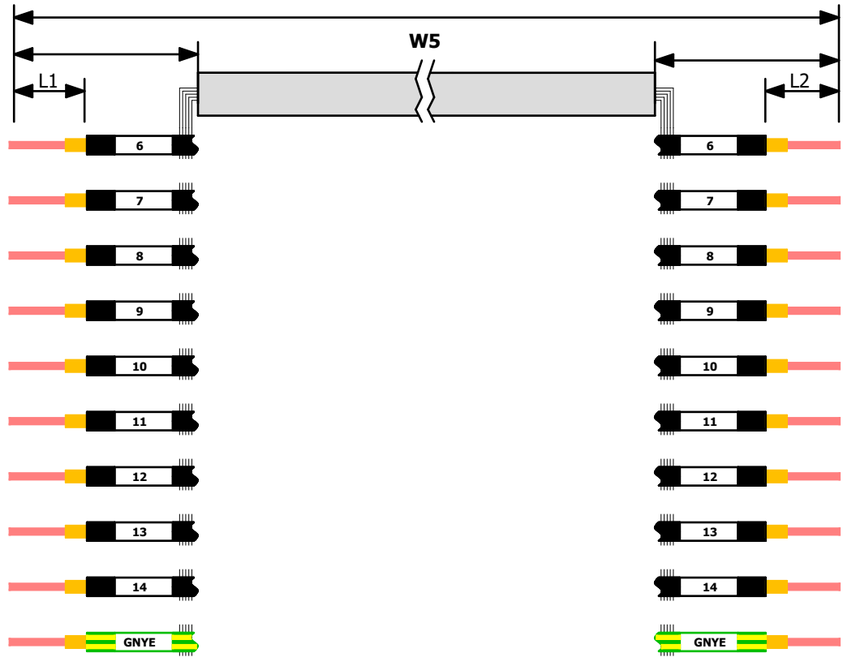
previous page: +/15
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-231U1-X3.1:6			
Circuit Breaker cabinet	-231U1-X3.1:7			
Circuit Breaker cabinet	-231U1-X3.1:8			
Circuit Breaker cabinet	-231U1-X3.1:9			
Circuit Breaker cabinet	-231U1-X3.1:10			
Circuit Breaker cabinet	-231U1-X3.1:11			
Circuit Breaker cabinet	-231U1-X3.1:12			
Circuit Breaker cabinet	-231U1-X3.1:16			
Circuit Breaker cabinet	-231U1-X3.1:17			
Circuit Breaker cabinet	-231U1-X3.1:PE			

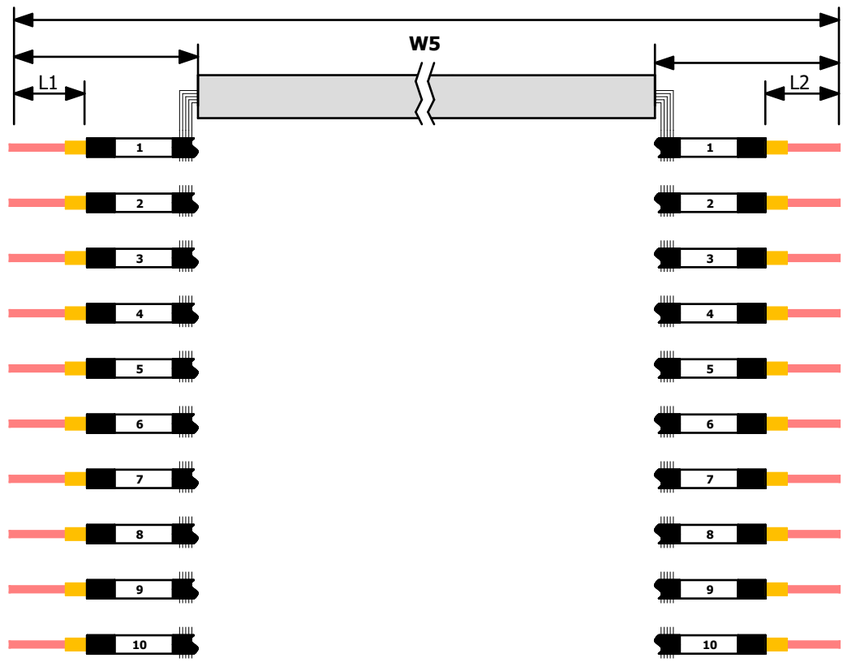


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-231U1-X3.2:11	*Circuit Breaker cabinet*
			-231U1-X3.2:13	*Circuit Breaker cabinet*
			-231U1-X3.2:15	*Circuit Breaker cabinet*
			-231U1-X3.2:17	*Circuit Breaker cabinet*
			-231U1-X3.2:19	*Circuit Breaker cabinet*
			-231U1-X3.2:21	*Circuit Breaker cabinet*
			-231U1-X3.2:23	*Circuit Breaker cabinet*
			-231U1-X3.2:24	*Circuit Breaker cabinet*
			-231U1-X3.2:12	*Circuit Breaker cabinet*
			-231U1-X3.2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:1			
Circuit Breaker cabinet	-237U1-X3.1:2			
Circuit Breaker cabinet	-237U1-X3.1:3			
Circuit Breaker cabinet	-237U1-X3.1:4			
Circuit Breaker cabinet	-237U1-X3.1:5			
Circuit Breaker cabinet	-237U1-X3.1:6			
Circuit Breaker cabinet	-237U1-X3.1:7			
Circuit Breaker cabinet	-237U1-X3.1:8			
Circuit Breaker cabinet	-237U1-X3.1:9			
Circuit Breaker cabinet	-237U1-X3.1:10			



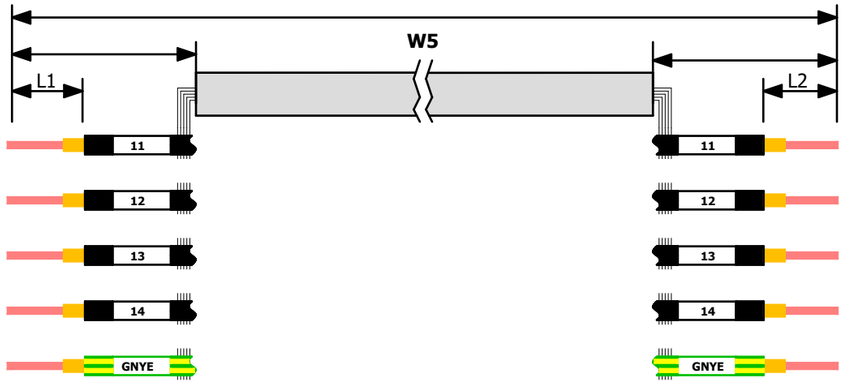
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:1	*Circuit Breaker cabinet*
			-237U1-X3.2:3	*Circuit Breaker cabinet*
			-237U1-X3.2:5	*Circuit Breaker cabinet*
			-237U1-X3.2:7	*Circuit Breaker cabinet*
			-237U1-X3.2:9	*Circuit Breaker cabinet*
			-237U1-X3.2:11	*Circuit Breaker cabinet*
			-237U1-X3.2:13	*Circuit Breaker cabinet*
			-237U1-X3.2:15	*Circuit Breaker cabinet*
			-237U1-X3.2:17	*Circuit Breaker cabinet*
			-237U1-X3.2:19	*Circuit Breaker cabinet*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



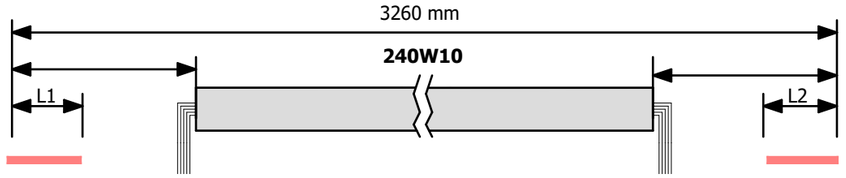
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:11			
Circuit Breaker cabinet	-237U1-X3.1:12			
Circuit Breaker cabinet	-237U1-X3.1:16			
Circuit Breaker cabinet	-237U1-X3.1:17			
Circuit Breaker cabinet	-237U1-X3.1:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:21	*Circuit Breaker cabinet*
			-237U1-X3.2:23	*Circuit Breaker cabinet*
			-237U1-X3.2:24	*Circuit Breaker cabinet*
			-237U1-X3.2:12	*Circuit Breaker cabinet*
			-237U1-X3.2:PE	*Circuit Breaker cabinet*

FRQ_Kabelplan_04_gro8_de_en

previous page: 2
next page: ++CT+/1

Cable name =UNIT_01++CT+-240W10
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

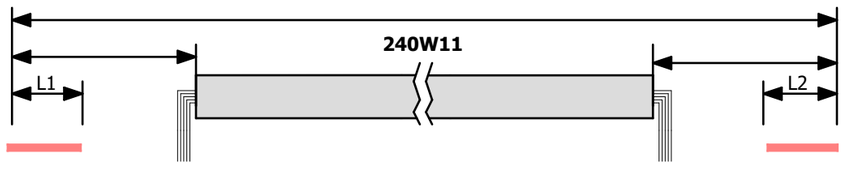


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

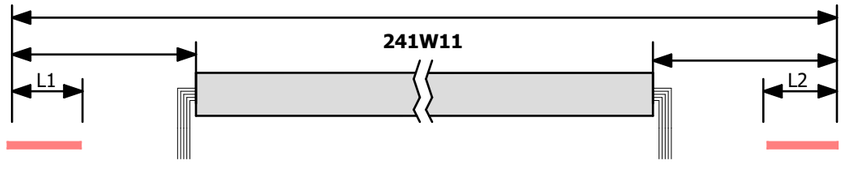


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-240U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

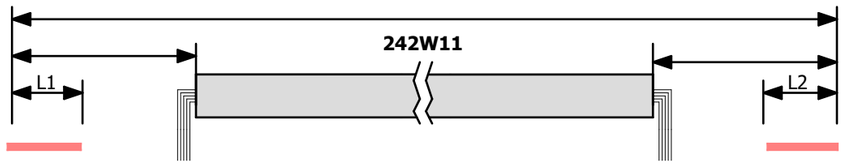


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-241U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

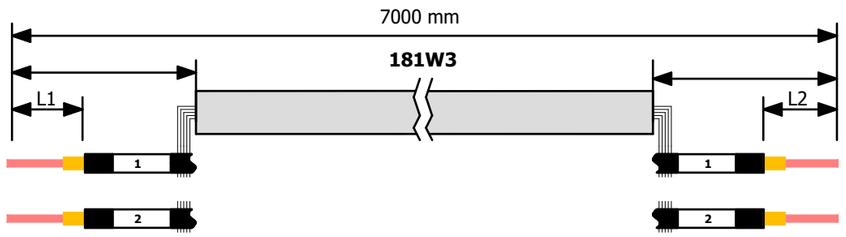


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-242U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2



Cable parts HELU.16563
Order number 16563

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:23	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X3:24	=	stripped	8 mm

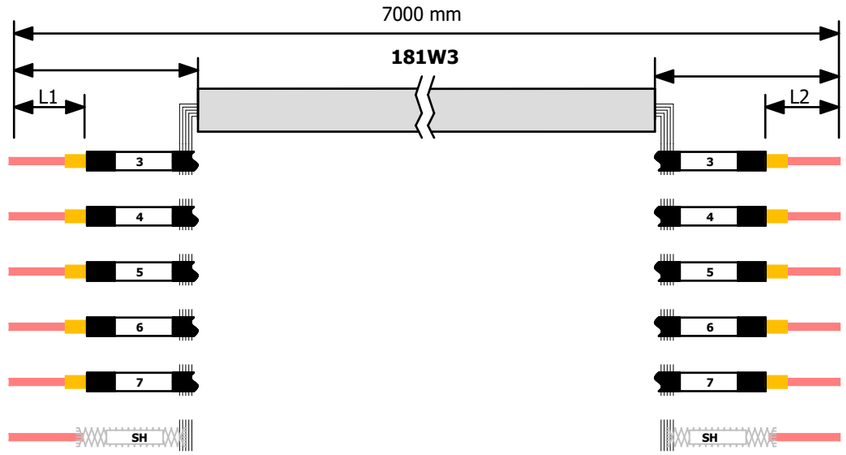
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:1	
	Flat connector	=	++FAN-52G1-181X3:3	

previous page: ++CONV+CIR/3
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2

Cable parts HELU.16563
Order number 16563

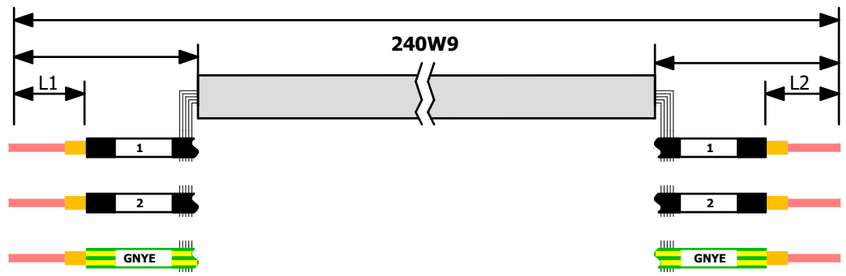


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:25	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X5:23	COOLING WATER TEMPERATURE	End splice	8 mm
Control cabinet 1	+CTRL_1.3-X5:24	=	End splice	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:2	
8 mm	stripped	COOLING WATER TEMPERATURE	++FAN-52G1-181X3:4	
8 mm	stripped	=	++FAN-52G1-181X3:5	

Cable name =UNIT_01++CT+-240W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031

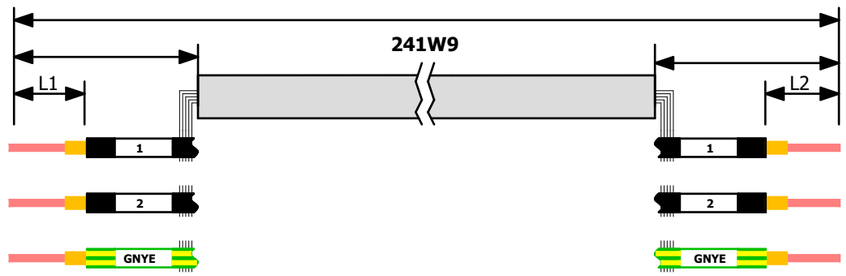


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC1:1	FUSE 24V DC CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:4	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	FUSE 24V DC CONTROL VOLTAGE	+CTRL_2.1-240U1:1	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-240U1:3	*Control cabinet 2*
	Connector	=	+CTRL_2.1-240U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:4	=	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

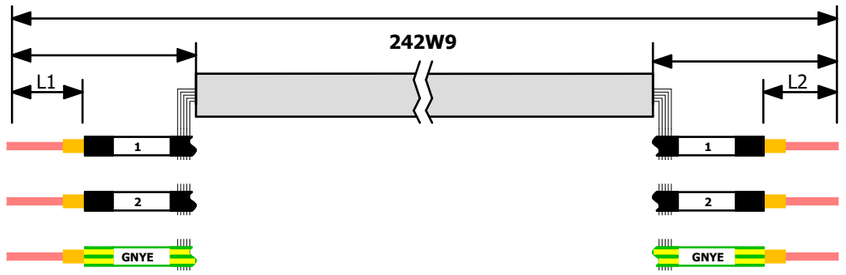
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-241U1:1	*Control cabinet 2*
	Connector	=	+CTRL_2.1-241U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-241U1:2	*Control cabinet 2*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

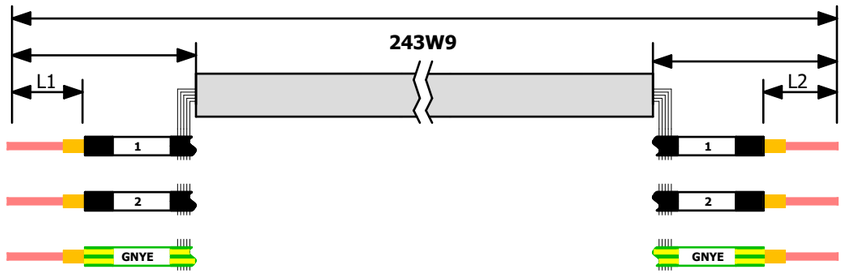


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-242U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

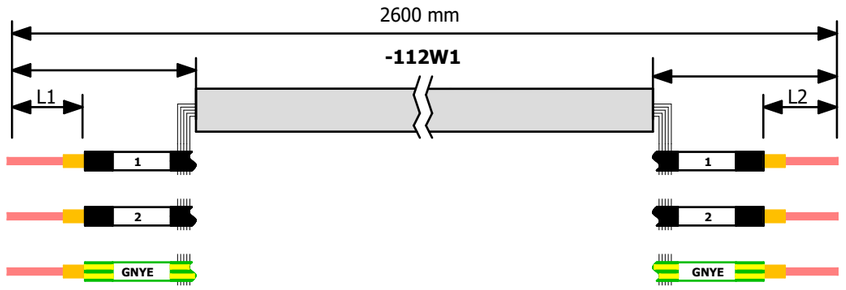


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-243U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-112W1
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

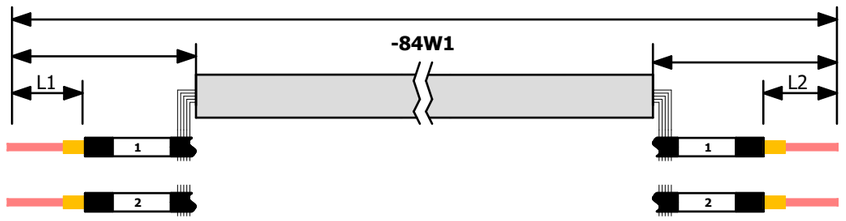


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE		
Control cabinet 1	+CTRL_1.3-XDC2:4	=		
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		BSU, SPARE CONTROL VOLTAGE	+CTRL_1.1-112A1:L+	*Control cabinet 1*
		=	+CTRL_1.1-112A1:M	*Control cabinet 1*
		Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_1.1-112A1:PE	*Control cabinet 1*

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors 1

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:2		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:4		stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	End splice		+CTRL_1.3-84F1:L1'	*Control cabinet 1*
8 mm	End splice		+CTRL_1.3-84F1:L2'	*Control cabinet 1*

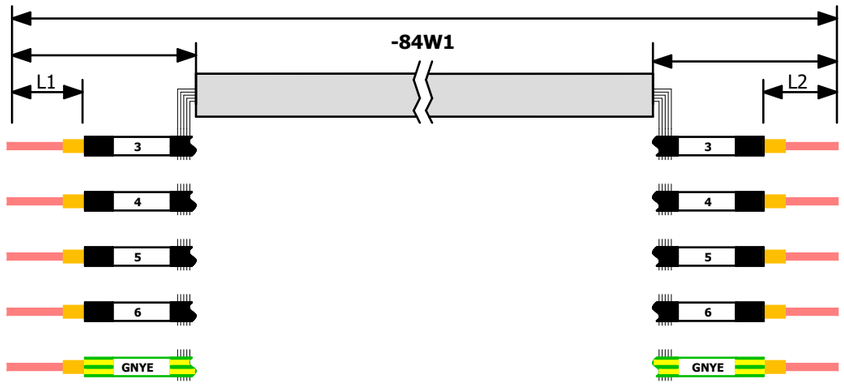
previous page: 2

next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors

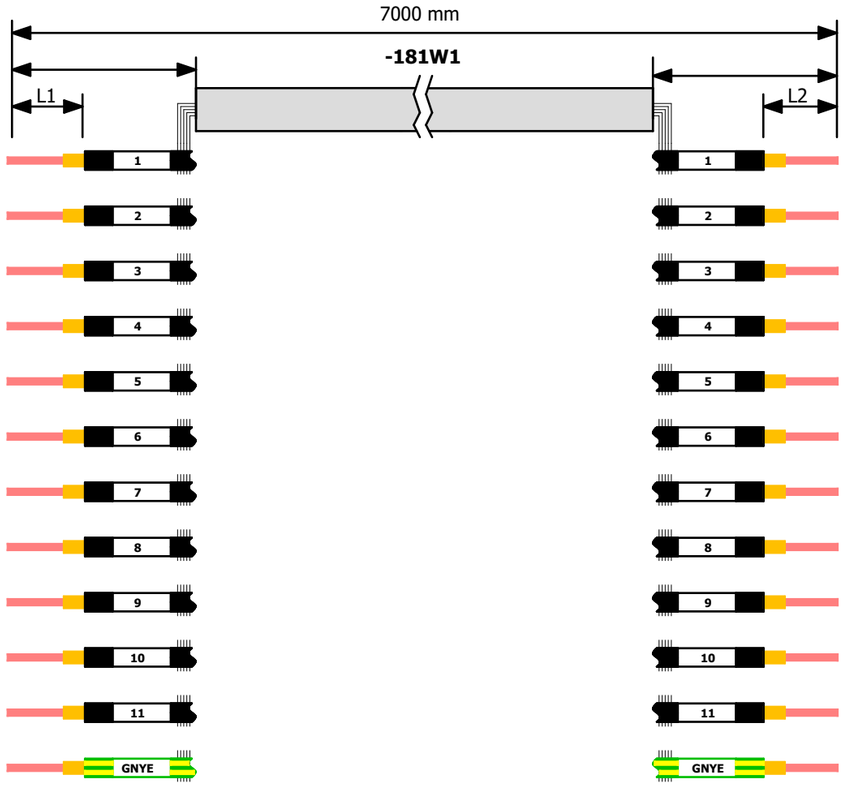
Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.1-84Q1:6		stripped	8 mm	8 mm	End splice		+CTRL_1.3-84F1:L3'	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:1		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F1:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:3		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F2:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:5		stripped	8 mm	8 mm	End splice		+CTRL_1.3-185F1:1	Control cabinet 1

Cable name =UNIT_01++CT+-181W1
Cable type JZ-600 12G1,5 mm²
Free conductors

Cable parts HELU.10670
Order number 10670



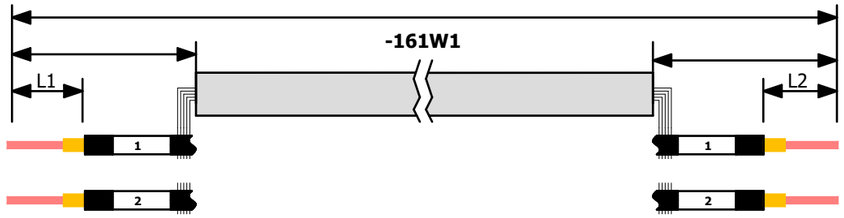
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.3-X1:1	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:1:1	
Control cabinet 1	+CTRL_1.3-X1:2	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:2:1	
Control cabinet 1	+CTRL_1.3-X1:3	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:3:1	
Control cabinet 1	+CTRL_1.3-X1:4	FUSE FOR PUMP	stripped	8 mm	8 mm	stripped	FUSE FOR PUMP	++FAN-52G1-181X1:4:1	
Control cabinet 1	+CTRL_1.3-X1:5	HEATER	stripped	8 mm	8 mm	stripped	HEATER	++FAN-52G1-181X1:5:1	
Control cabinet 1	+CTRL_1.3-X1:6	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:6:1	
Control cabinet 1	+CTRL_1.3-X1:7	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:7:1	
Control cabinet 1	+CTRL_1.3-X1:8	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	++FAN-52G1-181X1:8:1	
Control cabinet 1	+CTRL_1.3-X1:9	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:9:1	
Control cabinet 1	+CTRL_1.3-X1:10	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:10:1	
Control cabinet 1	+CTRL_1.3-X1:PE	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:PE:1	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-161W1
Cable type OZ-500 2x0,75 mm²
Free conductors 0

Cable parts HELU.10030
Order number 10030

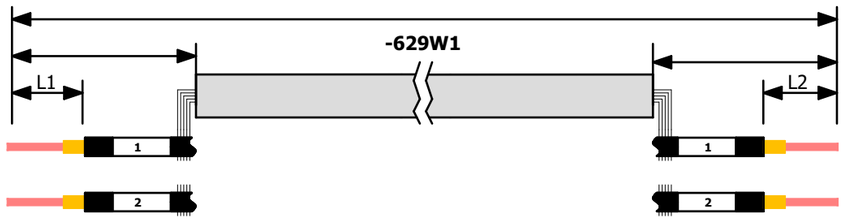


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:+			
Control cabinet 2	+CTRL_2.1-160U1:-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_2.1-161U1:+	Control cabinet 2
			+CTRL_2.1-161U1:-	Control cabinet 2

Cable name =UNIT_01++CT+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_01++CT+-195W1
Cable type OZ-500 4x0,75 mm²
Free conductors 0

Cable parts HELU.10034
Order number 10034

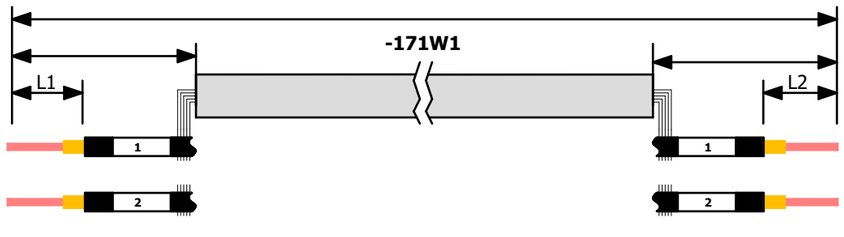


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:13	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:23			
Control cabinet 1	+CTRL_1.1-84Q1:14	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:24			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-195K3:T1	Control cabinet 1
			+CTRL_1.3-195K3:T2	Control cabinet 1
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-X3:41	Control cabinet 1
			+CTRL_1.3-X3:43	Control cabinet 1

Cable name =UNIT_01++CT+-171W1
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:1			
Control cabinet 1	+CTRL_1.4-171F1:3			

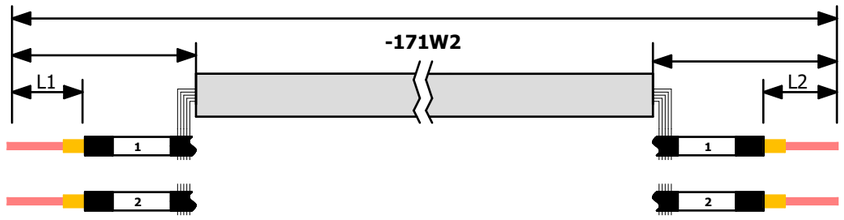
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-85U1:DC+	Control cabinet 1
			+CTRL_1.4-85U1:DC-	Control cabinet 1

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-171W2
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656

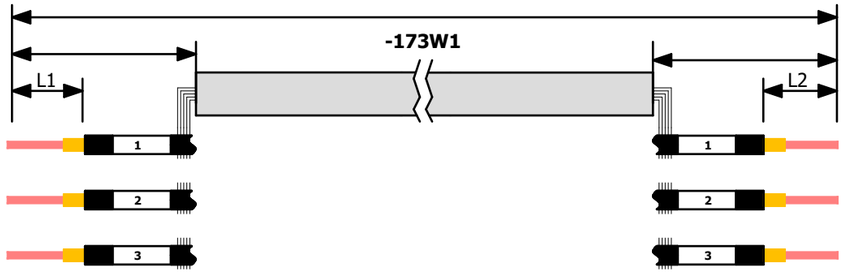


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:2			
Control cabinet 1	+CTRL_1.4-171F1:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-171K1:A1	*Control cabinet 1*
			+CTRL_1.4-171K2:A1	*Control cabinet 1*

Cable name =UNIT_01++CT+-173W1
Cable type OZ-600 3x2,5 mm²
Free conductors 3

Cable parts HELU.10691
Order number 10691

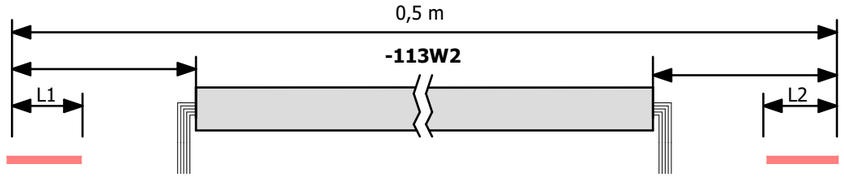


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-UDC+			
Converter cabinet	++CONV+CON-UDC-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-173F2:2	*Control cabinet 1*
			+CTRL_1.4-173F2:4	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

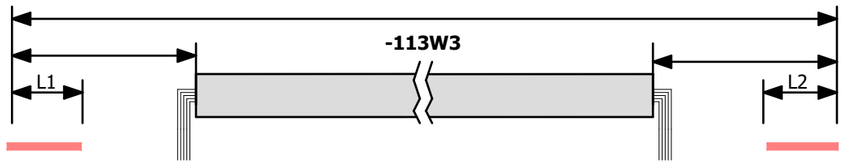


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U1:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U1:IN			

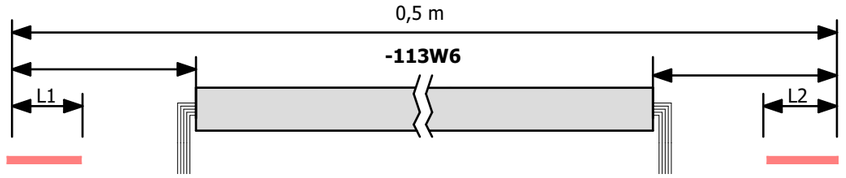
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U2:8	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 6
Date								+ total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-113W6
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

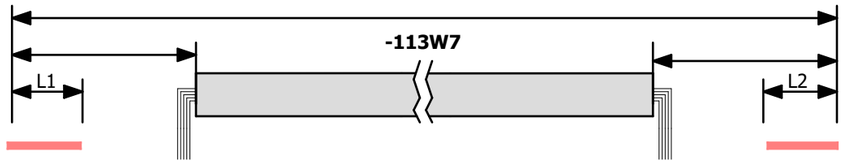


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T2:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U3:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W7
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

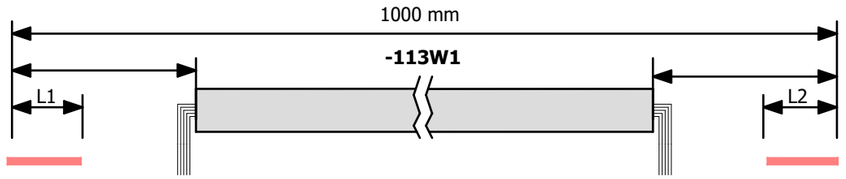


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U3:IN			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U4:8	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W1
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

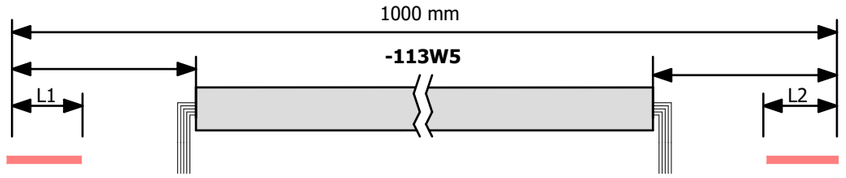


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X4:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T1:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W5
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

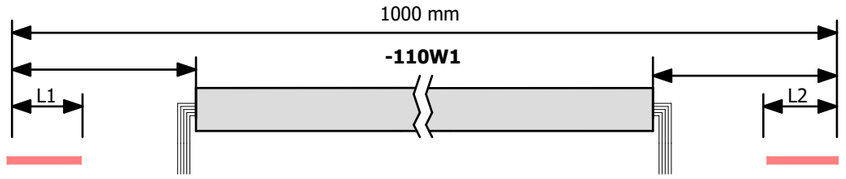


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X5:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T2:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-110W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



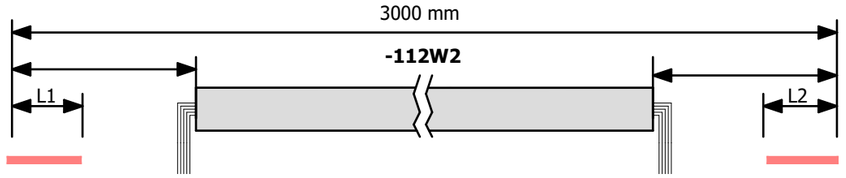
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X1:1-8	*Control cabinet 1*

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-112W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

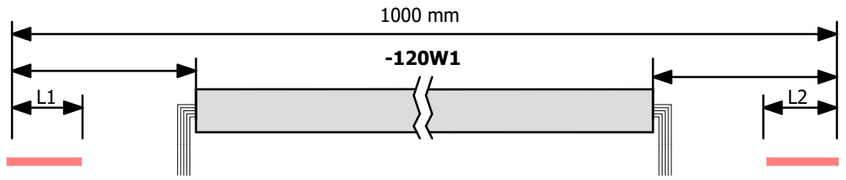


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-112A1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X2:1-8	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

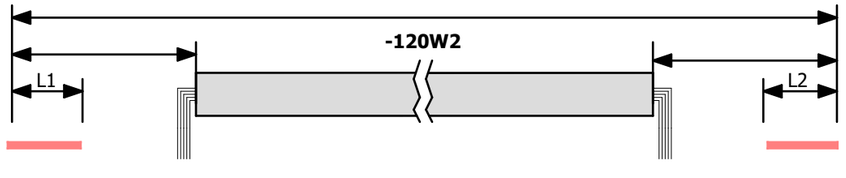


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P3		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-120A1:-X1:P1	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

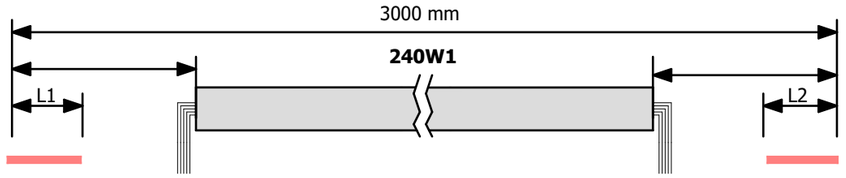


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-113U5:8			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-120A1:-X1:P2	*Control cabinet 1*

Cable name =UNIT_01++CT+-240W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

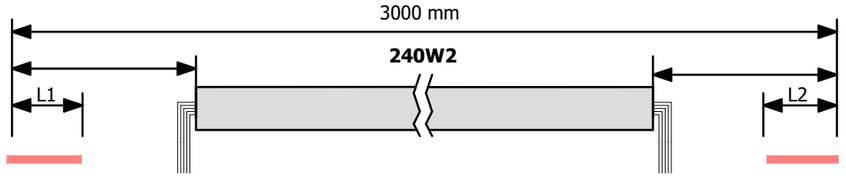


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-201Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

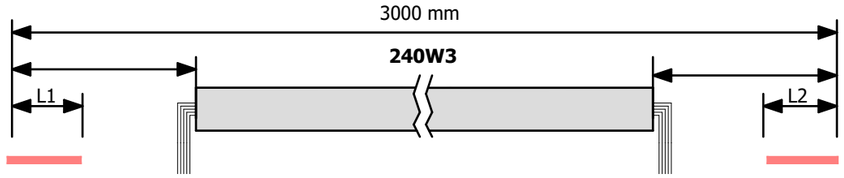
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-202Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X2	*Control cabinet 2*

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-240W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

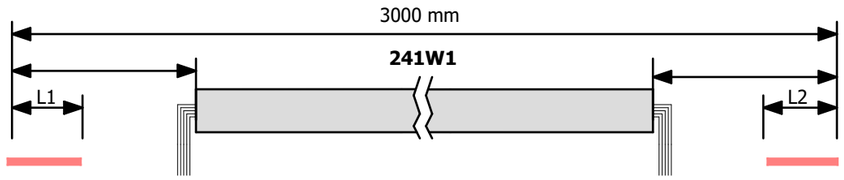


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-203Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

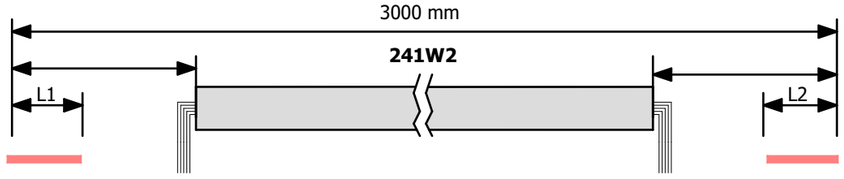


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

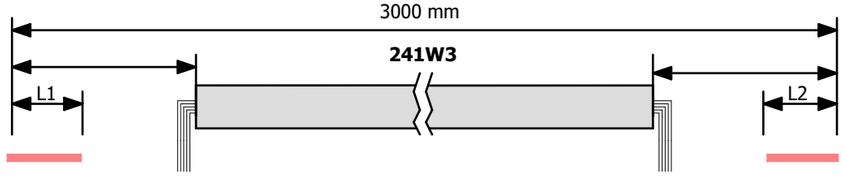


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

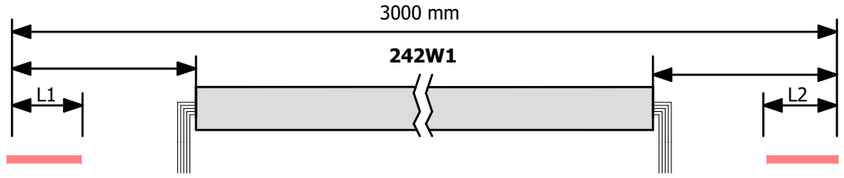


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X1		Connector	

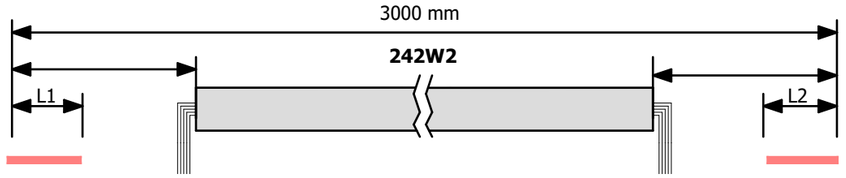
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X1	***Control cabinet 2***

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

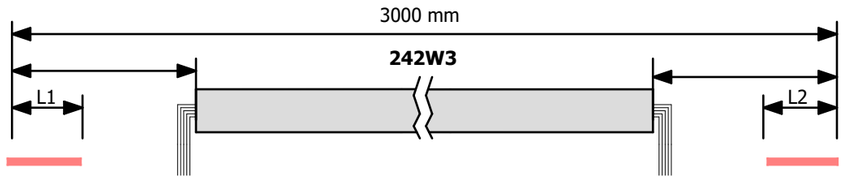


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

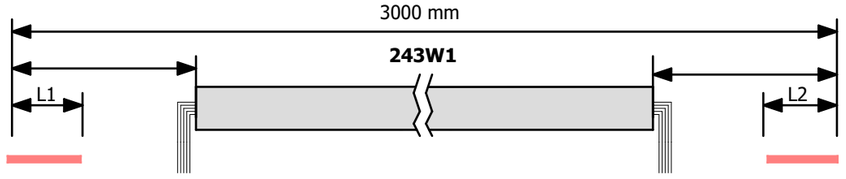


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

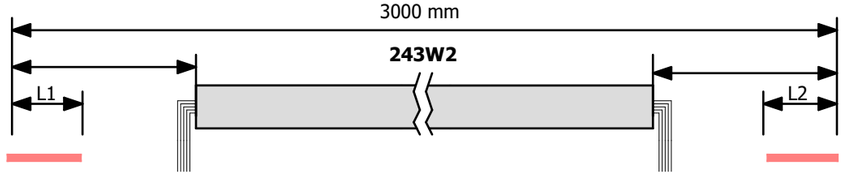


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

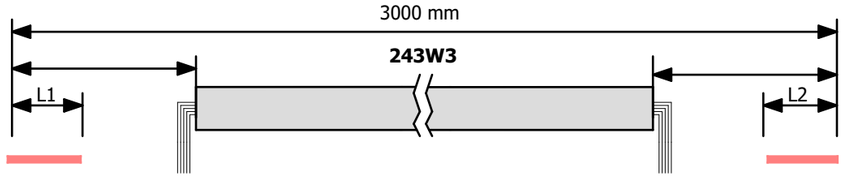


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X3		Connector	

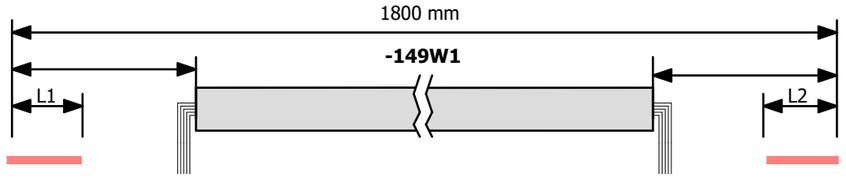
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X3	***Control cabinet 2***

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 10
Date							10354_23A2007	+		total: 492

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_01++CT+-149W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.671476
Order number

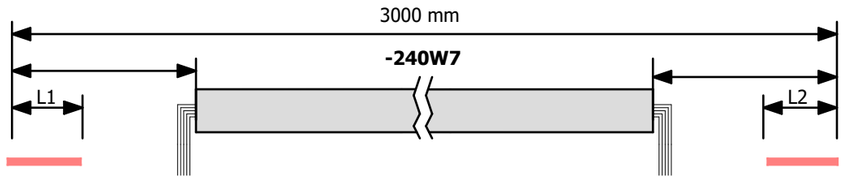


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-149U1:11X3		Connecor	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-162U1:11X3	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

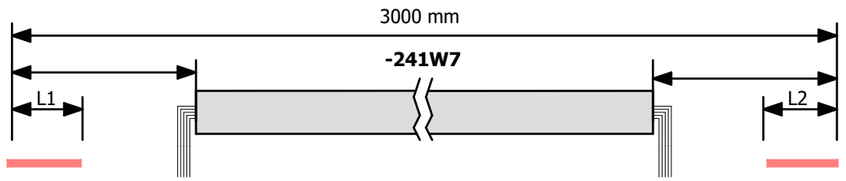


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

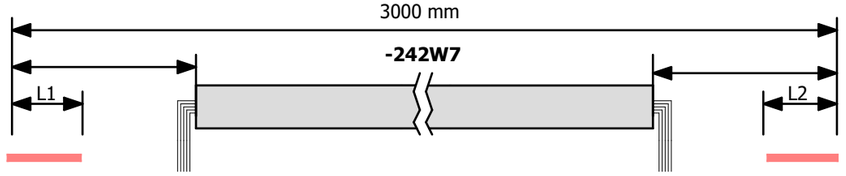


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-161U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

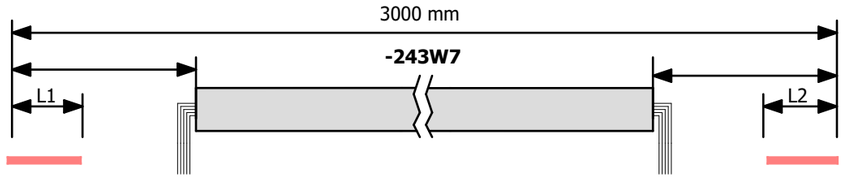


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-163U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-164U1:11X3		Connector	

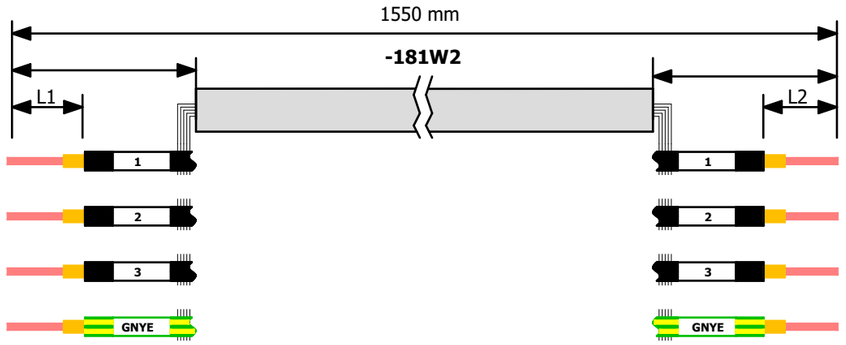
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:X7	*Control cabinet 2*

previous page: 10
next page: ++FAN/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++FAN+-52G1-181W2
Cable type JZ-600 4G1,5 mm²
Free conductors

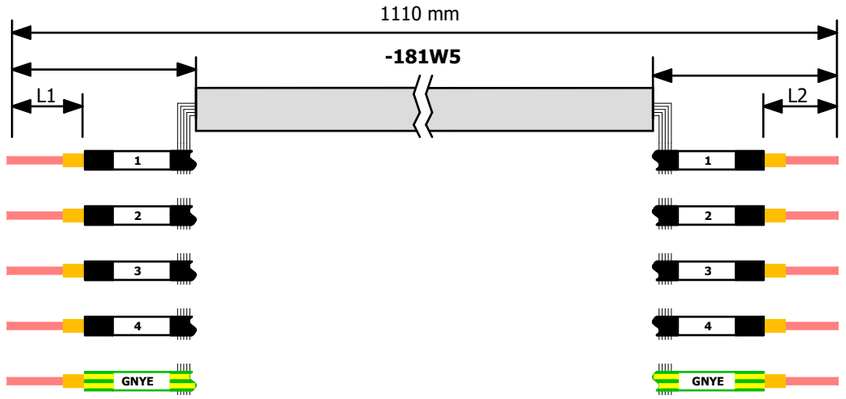
Cable parts HELU.10659
Order number 10659



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:1:2	PUMP	stripped	8 mm	5 mm	Ring cable lug M4	PUMP	-52G1-181M1:U1	
	-52G1-181X1:2:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:V1	
	-52G1-181X1:3:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:PE	

Cable name =UNIT_01++FAN+-52G1-181W5
Cable type JZ-600 5G1,5 mm²
Free conductors

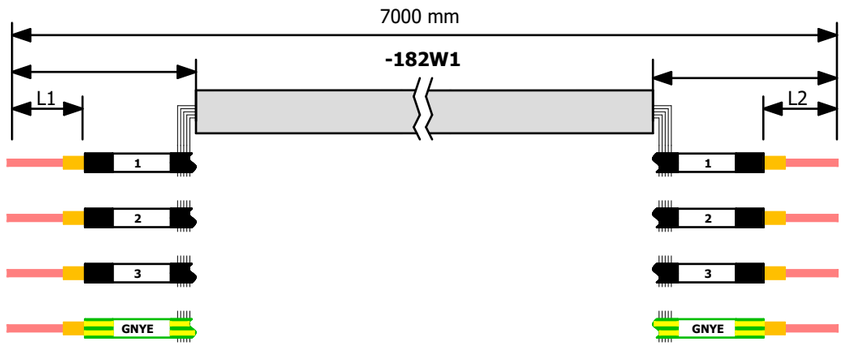
Cable parts HELU.10661
Order number 10661



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:4:2	FUSE FOR PUMP	stripped	8 mm	5 mm	Ring cable lug M4	FUSE FOR PUMP	-52G1-181R1:x1	
	-52G1-181X1:5:2	HEATER	stripped	8 mm	5 mm	Ring cable lug M4	HEATER	-52G1-181R1:x3	
	-52G1-181X1:6:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x5	
	-52G1-181X1:7:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x6	
	-52G1-181X1:PE:2	=					=	-52G1-181R1:PE	

Cable name =UNIT_01++FAN+-52G1-182W1
Cable type JZ-600 5G1,5 mm²
Free conductors

Cable parts HELU.10659
Order number 10659



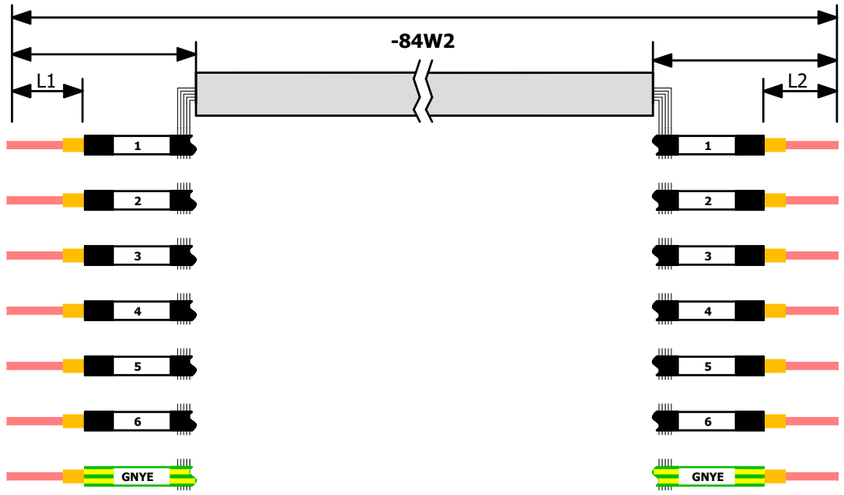
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:8:2	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	-52G1-182M1:U1	
	-52G1-181X1:9:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:V1	
	-52G1-181X1:10:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:PE	

previous page: ++CT/11
next page: ++EXTERN/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++EXTERN+-84W2
Cable type JZ-600 5G16 mm²
Free conductors 7

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page:
++FAN/1

next page:
&EMZ++CONV+IND/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-207L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2000
-207L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2001
-207L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2002
-211L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2003
-211L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2004
-211L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2005
-217L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2006
-217L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2007
-217L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2008

previous page:
&EMB++EXTERN+/1

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text			-146W3	Cable name	Strip =UNIT_01++CONV+IND-207L1.1						Cable name												Page / column
			F-CY-0Z (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1			1		++CT+CTRL_1.3-X5	13		,	-207L1.1	x2													&EFS++CT+/146.5
=			2		++CT+CTRL_1.3-X5	14		,	-207L1.1	x1													&EFS++CT+/146.5

Terminal diagram

Freqcon_F13_001_02

Function text			-146W4	Cable name	Strip =UNIT_01++CONV+IND-207L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2			1		++CT+CTRL_1.3-X5	15		,	-207L1.2	x2													&EFS++CT+/146.7
=			2		++CT+CTRL_1.3-X5	16		,	-207L1.2	x1													&EFS++CT+/146.7

Terminal diagram

Freqcon_F13_001_02

Function text			-147W1	Cable name	Strip =UNIT_01++CONV+IND-207L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3			1		++CT+CTRL_1.3-X5	17		,	-207L1.3	x2													&EFS++CT+/147.1
=			2		++CT+CTRL_1.3-X5	18		,	-207L1.3	x1													&EFS++CT+/147.1

Terminal diagram

Freqcon_F13_001_02

Function text			-145W4	Cable name	Strip =UNIT_01++CONV+IND-211L1.1						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1			1		++CT+CTRL_1.3-X5	7		,	-211L1.1	x2													&EFS++CT+/145.7
=			2		++CT+CTRL_1.3-X5	8		,	-211L1.1	x1													&EFS++CT+/145.7

Terminal diagram

Freqcon_F13_001_02

Function text			-146W1	Cable name	Strip =UNIT_01++CONV+IND-211L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2			1		++CT+CTRL_1.3-X5	9		,	-211L1.2	x2													&EFS++CT+/146.1
=			2		++CT+CTRL_1.3-X5	10		,	-211L1.2	x1													&EFS++CT+/146.1

Terminal diagram

Freqcon_F13_001_02

Function text			-146W2	Cable name	Strip =UNIT_01++CONV+IND-211L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3			1		++CT+CTRL_1.3-X5	11		,	-211L1.3	x2													&EFS++CT+/146.3
=			2		++CT+CTRL_1.3-X5	12		,	-211L1.3	x1													&EFS++CT+/146.3

Terminal diagram

Freqcon_F13_001_02

Function text			-147W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.1						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1			1		++CT+CTRL_1.3-X5	19		,	-217L1.1	x2													&EFS++CT+/147.3
=			2		++CT+CTRL_1.3-X5	20		,	-217L1.1	x1													&EFS++CT+/147.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W1	Cable name	Strip =UNIT_01++CONV+IND-217L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2			1		++CT+CTRL_1.3-X5	25		,	-217L1.2	x2													&EFS++CT+/148.3
=			2		++CT+CTRL_1.3-X5	26		,	-217L1.2	x1													&EFS++CT+/148.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3			1		++CT+CTRL_1.3-X5	29		,	-217L1.3	x2													&EFS++CT+/148.7
=			2		++CT+CTRL_1.3-X5	30		,	-217L1.3	x1													&EFS++CT+/148.7

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-227U1-X3.1	DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2000
-227U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2001
-231U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2002
-231U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2003
-237U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2004
-237U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2005

previous page: +IND/2008

next page: 2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-227U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-227W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-227U1-W5	Page / column
			0Z-500	Cable type							Cable type	1Z-500	
			1		++CT+CTRL_1.4-350X1.21	1	1	,	-227U1-X3.2	1		1	&EFS+/227.a.1
			2		++CT+CTRL_1.4-350X1.21	4	2	,	-227U1-X3.2	3		2	&EFS+/227.a.2
			3		++CT+CTRL_1.4-350X1.21	7	3	,	-227U1-X3.2	5		3	&EFS+/227.a.2
			4		++CT+CTRL_1.4-350X1.21	3	4	,	-227U1-X3.2	7		4	&EFS+/227.a.3
			5		++CT+CTRL_1.4-350X1.21	6	5	,	-227U1-X3.2	9		5	&EFS+/227.a.4
			6		++CT+CTRL_1.4-350X1.21	9	6	,	-227U1-X3.2	11		6	&EFS+/227.a.5
			7		++CT+CTRL_1.4-307K1	A1	7	,	-227U1-X3.2	13		7	&EFS+/227.a.5
			8		++CT+CTRL_1.4-307K3	A1	8	,	-227U1-X3.2	15		8	&EFS+/227.a.6
			9		++CT+CTRL_1.4-307K5	A1	9	,	-227U1-X3.2	17		9	&EFS+/227.a.6
			10		++CT+CTRL_1.4-307K2	A1	10	,	-227U1-X3.2	19		10	&EFS+/227.a.6
			11		++CT+CTRL_1.4-307K4	A1	11	,	-227U1-X3.2	21		11	&EFS+/227.a.7
			12		++CT+CTRL_1.4-307K6	A1	12	,	-227U1-X3.2	23		12	&EFS+/227.a.7
			13		++CT+CTRL_1.3-X3.11	11	13	,	-227U1-F1	2			&EFS+/227.a.7
			14		++CT+CTRL_1.3-X3.12	9	14	,	-227U1-F5	2			&EFS+/227.a.8
			15		++CT+CTRL_1.3-X3.12	11	15	,	-227U1-F9	2			&EFS+/227.a.8
			16		++CT+CTRL_1.3-X3.12	10	16	,	-227U1-F2	1			&EFS+/227.a.9
									-227U1-X3.2	24		13	
			17		++CT+CTRL_1.4-350X1.21	2	17	,	-227U1-X3.2	12		14	&EFS+/227.a.9
							PE	,	-227U1-X3.2	PE		GNYE	&EFS+/227.a.9

previous page: 1000

next page: 2001

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-227U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-227U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-227U1-X3.1	1		1										&EFS+/227.a.1
							2															&EFS+/227.a.1
							3		-227U1-X3.1	2		2										&EFS+/227.a.2
							4															&EFS+/227.a.2
							5		-227U1-X3.1	3		3										&EFS+/227.a.2
							6															&EFS+/227.a.2
							7		-227U1-X3.1	4		4										&EFS+/227.a.3
							8															&EFS+/227.a.3
							9		-227U1-X3.1	5		5										&EFS+/227.a.4
							10															&EFS+/227.a.4
							11		-227U1-X3.1	6		6										&EFS+/227.a.5
							12		-227U1-X3.1	17		14										&EFS+/227.a.5
							13		-227U1-X3.1	7		7										&EFS+/227.a.5
							14															&EFS+/227.a.5
							15		-227U1-X3.1	8		8										&EFS+/227.a.6
							16															&EFS+/227.a.6
							17		-227U1-X3.1	9		9										&EFS+/227.a.6
							18															&EFS+/227.a.6
							19		-227U1-X3.1	10		10										&EFS+/227.a.6
							20															&EFS+/227.a.6
							21		-227U1-X3.1	11		11										&EFS+/227.a.7
							22															&EFS+/227.a.7
							23		-227U1-X3.1	12		12										&EFS+/227.a.7
							24		-227U1-X3.1	16		13										&EFS+/227.a.7
							PE															&EFS+/227.a.5
							PE		-227U1-X3.1	PE		GNYE										&EFS+/227.a.5

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2001
+	CIR	Circuit Breaker cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-231U1-W5	Page / column
			0Z-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.3-150X1	1	1	,	-231U1-X3.2	1		1	&EFS+/231.a.1
			2		++CT+CTRL_1.3-150X1	4	2	,	-231U1-X3.2	3		2	&EFS+/231.a.2
			3		++CT+CTRL_1.3-150X1	7	3	,	-231U1-X3.2	5		3	&EFS+/231.a.2
			4		++CT+CTRL_1.3-150X1	3	4	,	-231U1-X3.2	7		4	&EFS+/231.a.3
			5		++CT+CTRL_1.3-150X1	6	5	,	-231U1-X3.2	9		5	&EFS+/231.a.4
			6		++CT+CTRL_1.3-150X1	9	6	,	-231U1-X3.2	11		6	&EFS+/231.a.5
			7		++CT+CTRL_1.4-306K1	A1	7	,	-231U1-X3.2	13		7	&EFS+/231.a.5
			8		++CT+CTRL_1.4-306K3	A1	8	,	-231U1-X3.2	15		8	&EFS+/231.a.6
			9		++CT+CTRL_1.4-306K5	A1	9	,	-231U1-X3.2	17		9	&EFS+/231.a.6
			10		++CT+CTRL_1.4-306K2	A1	10	,	-231U1-X3.2	19		10	&EFS+/231.a.6
			11		++CT+CTRL_1.4-306K4	A1	11	,	-231U1-X3.2	21		11	&EFS+/231.a.7
			12		++CT+CTRL_1.4-306K6	A1	12	,	-231U1-X3.2	23		12	&EFS+/231.a.7
			13		++CT+CTRL_1.3-X3.10	9	13	,	-231U1-F1	2			&EFS+/231.a.7
			14		++CT+CTRL_1.3-X3.10	11	14	,	-231U1-F5	2			&EFS+/231.a.8
			15		++CT+CTRL_1.3-X3.11	9	15	,	-231U1-F9	2			&EFS+/231.a.8
			16		++CT+CTRL_1.3-X3.10	10	16	,	-231U1-F2	1			&EFS+/231.a.9
									-231U1-X3.2	24		13	
			17		++CT+CTRL_1.3-150X1	2	17	,	-231U1-X3.2	12		14	&EFS+/231.a.9
							PE	,	-231U1-X3.2	PE		GNYE	&EFS+/231.a.9

previous page: 2001

next page: 2003

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-231U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-231U1-X3.1	1		1										&EFS+/231.a.1
							2															&EFS+/231.a.1
							3		-231U1-X3.1	2		2										&EFS+/231.a.2
							4															&EFS+/231.a.2
							5		-231U1-X3.1	3		3										&EFS+/231.a.2
							6															&EFS+/231.a.2
							7		-231U1-X3.1	4		4										&EFS+/231.a.3
							8															&EFS+/231.a.3
							9		-231U1-X3.1	5		5										&EFS+/231.a.4
							10															&EFS+/231.a.4
							11		-231U1-X3.1	6		6										&EFS+/231.a.5
							12		-231U1-X3.1	17		14										&EFS+/231.a.5
							13		-231U1-X3.1	7		7										&EFS+/231.a.5
							14															&EFS+/231.a.5
							15		-231U1-X3.1	8		8										&EFS+/231.a.6
							16															&EFS+/231.a.6
							17		-231U1-X3.1	9		9										&EFS+/231.a.6
							18															&EFS+/231.a.6
							19		-231U1-X3.1	10		10										&EFS+/231.a.6
							20															&EFS+/231.a.6
							21		-231U1-X3.1	11		11										&EFS+/231.a.7
							22															&EFS+/231.a.7
							23		-231U1-X3.1	12		12										&EFS+/231.a.7
							24		-231U1-X3.1	16		13										&EFS+/231.a.7
							PE															&EFS+/231.a.5
							PE		-231U1-X3.1	PE		GNYE										&EFS+/231.a.5

previous page: 2002

next page: 2004

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-237W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-237U1-W5	Page / column
			QZ-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.4-350X1.21	11	1	,	-237U1-X3.2	1		1	&EFS+/237.a.1
			2		++CT+CTRL_1.4-350X1.21	14	2	,	-237U1-X3.2	3		2	&EFS+/237.a.2
			3		++CT+CTRL_1.4-350X1.21	17	3	,	-237U1-X3.2	5		3	&EFS+/237.a.2
			4		++CT+CTRL_1.4-350X1.21	13	4	,	-237U1-X3.2	7		4	&EFS+/237.a.3
			5		++CT+CTRL_1.4-350X1.21	16	5	,	-237U1-X3.2	9		5	&EFS+/237.a.4
			6		++CT+CTRL_1.4-350X1.21	19	6	,	-237U1-X3.2	11		6	&EFS+/237.a.5
			7		++CT+CTRL_1.4-308K1	A1	7	,	-237U1-X3.2	13		7	&EFS+/237.a.5
			8		++CT+CTRL_1.4-308K3	A1	8	,	-237U1-X3.2	15		8	&EFS+/237.a.6
			9		++CT+CTRL_1.4-308K5	A1	9	,	-237U1-X3.2	17		9	&EFS+/237.a.6
			10		++CT+CTRL_1.4-308K2	A1	10	,	-237U1-X3.2	19		10	&EFS+/237.a.6
			11		++CT+CTRL_1.4-308K4	A1	11	,	-237U1-X3.2	21		11	&EFS+/237.a.7
			12		++CT+CTRL_1.4-308K6	A1	12	,	-237U1-X3.2	23		12	&EFS+/237.a.7
			13		++CT+CTRL_1.3-X3.13	8	13	,	-237U1-F1	2			&EFS+/237.a.7
			14		++CT+CTRL_1.3-X3.13	9	14	,	-237U1-F5	2			&EFS+/237.a.8
			15		++CT+CTRL_1.3-X3.13	11	15	,	-237U1-F9	2			&EFS+/237.a.8
			16		++CT+CTRL_1.3-X3.13	10	16	,	-237U1-F2	1			&EFS+/237.a.9
									-237U1-X3.2	24		13	
			17		++CT+CTRL_1.4-350X1.21	12	17	,	-237U1-X3.2	12		14	&EFS+/237.a.9
							PE	,	-237U1-X3.2	PE		GNYE	&EFS+/237.a.9

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 2004
Date								+ CIR Circuit Breaker cabinet total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-237U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-237U1-X3.1	1		1										&EFS+/237.a.1
							2															&EFS+/237.a.1
							3		-237U1-X3.1	2		2										&EFS+/237.a.2
							4															&EFS+/237.a.2
							5		-237U1-X3.1	3		3										&EFS+/237.a.2
							6															&EFS+/237.a.2
							7		-237U1-X3.1	4		4										&EFS+/237.a.3
							8															&EFS+/237.a.3
							9		-237U1-X3.1	5		5										&EFS+/237.a.4
							10															&EFS+/237.a.4
							11		-237U1-X3.1	6		6										&EFS+/237.a.5
							12		-237U1-X3.1	17		14										&EFS+/237.a.5
							13		-237U1-X3.1	7		7										&EFS+/237.a.5
							14															&EFS+/237.a.5
							15		-237U1-X3.1	8		8										&EFS+/237.a.6
							16															&EFS+/237.a.6
							17		-237U1-X3.1	9		9										&EFS+/237.a.6
							18															&EFS+/237.a.6
							19		-237U1-X3.1	10		10										&EFS+/237.a.6
							20															&EFS+/237.a.6
							21		-237U1-X3.1	11		11										&EFS+/237.a.7
							22															&EFS+/237.a.7
							23		-237U1-X3.1	12		12										&EFS+/237.a.7
							24		-237U1-X3.1	16		13										&EFS+/237.a.7
							PE															&EFS+/237.a.5
							PE		-237U1-X3.1	PE		GNYE										&EFS+/237.a.5

previous page:
2004

next page:
+AC_DC/1000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.2	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 2005
Date								+ CIR	Circuit Breaker cabinet	total: 492

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X3.43		1	20	0	0	40	=UNIT_01&EMZ++CONV+AC_DC/2000

previous page:
+CIR/2005

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text	-238W3 OZ-500	-238W2 OZ-500	-238W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-238W7 OZ-500	Page / column
SURGE ARRESTER DC SUBSYSTEM 2_1			1		-238F1	11	1	,	++CT+CTRL_1.3-X3	5		1	&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_1			2		-238F1	12	2	,	-X3.43	3			&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		1			-238F2	11	3	,	-X3.43	2			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		2			-238F2	12	4	,	-X3.43	5			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	1				-238F3	11	5	,	-X3.43	4			&EFS+/238a.9
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	2				-238F3	12	6	,	-X3.43	7			&EFS+/238a.9
SURGE ARRESTER DC SUBSYSTEM 2_3	2				-238F3	12	6	,	-X3.43	7			&EFS+/238a.9
								,					

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	20250805_V2.0
Date	21.01.2025					
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007
Date						

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2000
+	AC_DC	AC and DC connection cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	-228W3 OZ-500	-228W2 OZ-500	-228W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 3_1			1		-228F1	11	7	,	-X3.43	6		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_1			2		-228F1	12	8	,	-X3.43	9		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		1			-228F2	11	9	,	-X3.43	8		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		2			-228F2	12	10	,	-X3.43	11		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	1				-228F3	11	11	,	-X3.43	10		&EFS+/228.9
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	2				-228F3	12	12	,	-X3.43	13		&EFS+/228.9
								,				

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Function text	-238W6 OZ-500	-238W5 OZ-500	-238W4 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 4_1			1		-238F4	11	13	,	-X3.43	12		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_1			2		-238F4	12	14	,	-X3.43	15		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		1			-238F5	11	15	,	-X3.43	14		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		2			-238F5	12	16	,	-X3.43	17		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	1				-238F6	11	17	,	-X3.43	16		&EFS+/238b.9
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	2				-238F6	12	18	,	-X3.43	19		&EFS+/238b.9
								,				

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2002
+	AC_DC	AC and DC connection cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text			-78W7	Cable name	Strip =UNIT_01++CONV+AC_DC-X3.43						Cable name	-238W7										Page / column
			0Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	0Z-500										
			2		-78F1	14	19	,	-X3.43	18												&EFS+/78.8
								,														
			1		-78F1	13	20	,	++CT+CTRL_1.3-X3	6		2										&EFS+/78.8
								,														

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-XT1		1	20	0	0	20	=UNIT_01&EMZ++CT/2000

previous page:
++CONV+AC_DC/2003

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+-XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
Gas confirmed FGS							1	,	+CTRL_1.3-138K1	14			&EFS/136.0
=							2	,	+CTRL_1.3-138K1	11			&EFS/136.0
Smoke confirmed FGS							3	,	+CTRL_1.3-138K2	14			&EFS/136.1
=							4	,	+CTRL_1.3-138K2	11			&EFS/136.1
PLC fault status SIS							5	,	+CTRL_1.3-138K3	14			&EFS/136.2
=							6	,	+CTRL_1.3-138K3	11			&EFS/136.2
=							7	,	+CTRL_1.3-138K4	14			&EFS/136.2
Spare							8	,	+CTRL_1.3-138K4	11			&EFS/136.3
=							9	,	+CTRL_1.3-138K5	14			&EFS/136.3
=							10	,	+CTRL_1.3-138K5	11			&EFS/136.3
=							11	,	+CTRL_1.3-138K6	14			&EFS/136.4
=							12	,	+CTRL_1.3-138K6	11			&EFS/136.4
phase in sync							13	,	+CTRL_1.3-138K7	14			&EFS/136.5
=							14	,	+CTRL_1.3-138K7	11			&EFS/136.5
=							15	,	+CTRL_1.3-136K7	A2			&EFS/136.5
Shut-down to BESS							16	,	+CTRL_1.3-136K7	A1			&EFS/136.6
incoming CB is open							17	,	+CTRL_1.3-136K8	A2			&EFS/136.7
=							18	,	+CTRL_1.3-136K8	A1			&EFS/136.7
=							19	,	+CTRL_1.3-136K9	A2			&EFS/136.8
=							20	,	+CTRL_1.3-136K9	A1			&EFS/136.8

previous page: 1000

next page: +CTRL_1.3/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X1	Hauptsteuerstromkreis 400V/230V AC	1	PE	4	1	18	=UNIT_01&EMZ++CT+CTRL_1.3/2000
-X3	CONTROL VOLTAGE 24V DC	1	46	0	0	45	=UNIT_01&EMZ++CT+CTRL_1.3/2001
-X3.10	Rückmeldung DC Schütze Subsystem 1_4	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2003
-X3.11	=	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2004
-X3.12	=	1	12	0	0	14	=UNIT_01&EMZ++CT+CTRL_1.3/2005
-X3.13	Rückmeldung DC Schütze Subsystem 1_6	1	12	0	0	14	=UNIT_01&EMZ++CT+CTRL_1.3/2006
-X5	Kleinspannungssignale	1	30	0	0	30	=UNIT_01&EMZ++CT+CTRL_1.3/2007
-X5.1	DC Subsystem Spannungsmessung	1	2	0	0	4	=UNIT_01&EMZ++CT+CTRL_1.3/2009
-150X1	Subsysteme DC Schütz EIN	1	10	0	0	10	=UNIT_01&EMZ++CT+CTRL_1.3/2010
-XDC1	Steuerspannung 24VDC (USV) DC1	1	PE	2	0	16	=UNIT_01&EMZ++CT+CTRL_1.3/2011
-XDC2	Steuerspannung 24VDC (USV) DC2	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2013
-XDC3	Steuerspannung 24VDC (USV) DC3	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2016
-XDC4	Steuerspannung 24VDC (USV) DC4	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2017
-XDC5.1	Steuerspannung 24VDC (USV) DC5.1	1	1	0	0	2	=UNIT_01&EMZ++CT+CTRL_1.3/2018
-XDC5.2	Steuerspannung 24VDC (USV) DC5.2	1	1	0	0	2	=UNIT_01&EMZ++CT+CTRL_1.3/2019
-XE	Hauptstromversorgung 400V AC	1	6	3	4	14	=UNIT_01&EMZ++CT+CTRL_1.3/2020
-XT	Transfer Klemmenblock 24VDC/230VAC	1	16	6	0	22	=UNIT_01&EMZ++CT+CTRL_1.3/2021
-190XT1	230VAC Beleuchtung/Klimaanlage Container/Schrank	1	PE	4	4	16	=UNIT_01&EMZ++CT+CTRL_1.3/2023
-191XT1		1	PE	2	2	10	=UNIT_01&EMZ++CT+CTRL_1.3/2024
-XV	Suppression TVS Diode	1	4	0	0	27	=UNIT_01&EMZ++CT+CTRL_1.3/2025

previous page: +/2000

next page: 2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X1

Hauptsteuerstromkreis 400V/230V AC

Function text			-181W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
			1Z-600	Cable type							Cable type	
PUMP			1		++FAN-52G1-181X1	1:1	1	,	-139K2	2		&EFS+/181.1
=			2		++FAN-52G1-181X1	2:1	2	,	-139K2	4		&EFS+/181.1
=			3		++FAN-52G1-181X1	3:1	3	,	-139K2	6		&EFS+/181.1
=			GNYE		++FAN-52G1-181X1	PE:1	PE	,	+.2-110U1-PE			&EFS+/181.1
FUSE FOR PUMP			4		++FAN-52G1-181X1	4:1	4	,	-139K1	2		&EFS+/181.3
HEATER			5		++FAN-52G1-181X1	5:1	5	,	-139K1	4		&EFS+/181.4
=			6		++FAN-52G1-181X1	6:1	6	,	-139K1	6		&EFS+/181.4
=			7		++FAN-52G1-181X1	7:1	7	,	-XE	N:1		&EFS+/181.4
								,				
HEATER							PE	,				&EFS+/181.4
FAN 1 HEAT EXCHANGER			8		++FAN-52G1-181X1	8:1	8	,	-139K3	2		&EFS+/182.1
=			9		++FAN-52G1-181X1	9:1	9	,	-139K3	4		&EFS+/182.1
=			10		++FAN-52G1-181X1	10:1	10	,	-139K3	6		&EFS+/182.1
=							PE	,				&EFS+/182.1
FAN 2 HEAT EXCHANGER OPTIONAL							11	,				&EFS+/182.3
=							12	,				&EFS+/182.4
=							13	,				&EFS+/182.4
=							PE	,				&EFS+/182.4

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2000
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++CONV-80W1 OZ-500	-181W3 F-CY-OZ (LIY-CY)	++CONV-260W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CT+CTRL_1.3-X3 CONTROL VOLTAGE 24V DC — Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-80W1 OZ-500	++CONV-238W7 OZ-500	++TRA-629W1 OZ-500	++CONV-260W1 OZ-500	-181W3 F-CY-OZ (LIY-CY)	Page / column
CB 1 Tripped GRID					-DI_02	5	1		++CONV+CIR-80Q1	X7_13		1					&EFS+/127.1
CB 1 OFF GRID					-DI_02	4	2		++CONV+CIR-80Q1	X6_9		2					&EFS+/127.3
CB 1 ON GRID					-DI_02	3	3		++CONV+CIR-80Q1	X6_11		3					&EFS+/127.2
FUSE AND LIGHTNING PROTECTION							4		+.4-189X1	5							&EFS+/127.4
=					-XDC4	2	5		++CONV+AC_DC-X3.43	1			1				&EFS+/127.5
=					-DI_02	6	6		++CONV+AC_DC-X3.43	20			2				&EFS+/127.4
=					-X3	13	7		-134K1	11							&EFS+/127.5
CB 2 Tripped ISLAND GRID					-DI_04	12	8										&EFS+/128.1
CB 2 OFF ISLAND GRID					-DI_04	14	9										&EFS+/128.3
CB 2 ON ISLAND GRID					-DI_04	13	10										&EFS+/128.2
FUSE AND LIGHTNING PROTECTION 2							11										&EFS+/128.4
=					-DI_04	15	12										&EFS+/128.4
=					-X3	7	13										&EFS+/128.5
SPARE					-DI_04	1	14		+.2-18B1	4							&EFS+/133.1
SPARE					-DI_04	2	15		+.2-18B1	1							&EFS+/133.2
SPARE					-DI_04	3	16		+.2-18B1	4							&EFS+/133.3
Fuse 230V AC for Container Air Conditioning					-DI_04	11	17		-190F3	14							&EFS+/133.6
Earthing switch in On Transformer 620V side					-DI_04	5	18		++CONV-18Q1	14				2			&EFS+/133.9
Smoke detector CON					-DI_02	7	19		++CONV+CON-260B1	4					1		&EFS+/134.0
=			2		++CONV+CON-260B1	2	20		-XV	9							&EFS+/134.0
=			3		++CONV+CON-260B1	5	21		-XDC4	4							&EFS+/134.1
=			4		++CONV+CON-260B1	6	22		-134K1	11							&EFS+/134.1
PRESSURE SWITCH					-182Q1	13	23		++FAN-52G1-181X3	1						1	&EFS+/181.7
=		2			++FAN-52G1-181X3	3	24		-AI_04	3							&EFS+/181.7
=		3			++FAN-52G1-181X3	2	25		-XDC1	7							&EFS+/181.7
Fuse 230V AC for Container Air Conditioning					-XDC2	1	29		++CONV-18Q1	13				1			&EFS+/133.8
TRIP					-DI_04	4	30		+.2-18B1	7							&EFS+/133.4
CB 1 GRID +24V	4				++CONV+CIR-80Q1	X6_12	31		-XDC3	2							&EFS+/188.1
=	5				++CONV+CIR-80Q1	X5_11	32		-XDC3	3							&EFS+/188.1
CB 2 ISLAND GRID +24V OPTIONAL							33		-137K1	11							&EFS+/188.2
=							34										&EFS+/188.2
=	6				++CONV+CIR-80Q1	X6_7	35		-137K1	14							&EFS+/188.4
CB 1 GRID	7				++CONV+CIR-80Q1	X6_14	36		-137K2	12							&EFS+/188.5

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3

CONTROL VOLTAGE 24V DC

Function text			++CONV-80W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-195W1											Page / column
			OZ-500	Cable type							Cable type	OZ-500											
CB 1 GRID			8		++CONV+CIR-80Q1	X5_12	37	,	-189K1	22													&EFS+/188.6
=							38	,	-137K3	14													&EFS+/188.6
CB 2 ISLAND GRID OPTIONAL							39	,	-137K4	12													&EFS+/188.8
=							40	,	-189K1	21													&EFS+/188.8
SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS					-X3	42	41	,	+.1-84Q1	14		3											&EFS+/195.2
=					-195K3	IN1	42	,	-X3	41													&EFS+/195.2
=					-X3	44	43	,	+.1-84Q1	24		4											&EFS+/195.3
=					-195K3	IN2	44	,	-X3	43													&EFS+/195.3
=					-195K1	61	45	,	+.4-306K1	21													&EFS+/195.3
FAULT SIGNAL SAFETY RELAY					-195K3	IN	46	,	+.4-308K6	21													&EFS+/195.4
FAULT SIGNAL SAFETY RELAY					-195K3	IN	46	,	+.4-308K6	21													&EFS+/195.4

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 2002
Date							10354_23A2007	+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.10

Rückmeldung DC Schütze Subsystem 1_4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	OZ-500	++CONV-231W4	Page / column
SUBSYSTEM 2_1_DC + Contactor K1 is on			-DI_02	8	1		+.4-306K1	14					&EFS+/129.0
SUBSYSTEM 2_2_DC + Contactor K2 is on			+.4-306K3	14	2		-DI_02	10					&EFS+/129.2
SUBSYSTEM 2_1_DC -Contactor K7 is on			+.4-306K2	14	3		-DI_02	9					&EFS+/129.1
SUBSYSTEM 2_2_DC -Contactor K8 is on			+.4-306K4	14	4		-DI_02	11					&EFS+/129.3
SUBSYSTEM 2_3_DC + Contactor K3 is on			-DI_02	12	5		+.4-306K5	14					&EFS+/129.4
SUBSYSTEM 2_3_DC + SPARE			-DI_02	14	6								&EFS+/129.6
SUBSYSTEM 2_3_DC -Contactor K9 is on			-DI_02	13	7		+.4-306K6	14					&EFS+/129.5
SUBSYSTEM 2_DC -SPARE			-DI_02	15	8								&EFS+/129.7
SUBSYSTEM 2_1_DC FUSE OK			-DI_02	16	9		++CONV+CIR-231U1-X3.1	13		13			&EFS+/129.8
SUBSYSTEM 2_2_DC FUSE OK					10		++CONV+CIR-231U1-X3.1	16		16			&EFS+/129.9
=			-DI_03	1	11		++CONV+CIR-231U1-X3.1	14		14			&EFS+/129.9
=			-XDC4	1	12								&EFS+/129.9

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 2003
Date							10354_23A2007	+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.3-X3.11 Rückmeldung DC Schütze Subsystem 1_4					Cable name	++CONV-231W4	++CONV-227W4									Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	OZ-500	OZ-500									
SUBSYSTEM 3_1_DC + Contactor K1 is on					-DI_03	2	1		+.4-307K1	14												&EFS+/130.0
SUBSYSTEM 3_2_DC + Contactor K2 is on					+.4-307K3	14	2		-DI_03	4												&EFS+/130.2
SUBSYSTEM 3_1_DC -Contactor K7 is on					+.4-307K2	14	3		-DI_03	3												&EFS+/130.1
SUBSYSTEM 3_2_DC -Contactor K8 is on					+.4-307K4	14	4		-DI_03	5												&EFS+/130.3
SUBSYSTEM 3_3_DC + Contactor K3 is on					-DI_03	6	5		+.4-307K5	14												&EFS+/130.4
SUBSYSTEM 3_DC + SPARE					-DI_03	8	6															&EFS+/130.6
SUBSYSTEM 3_3_DC -Contactor K9 is on					-DI_03	7	7		+.4-307K6	14												&EFS+/130.5
SUBSYSTEM 3_DC -SPARE					-DI_03	9	8															&EFS+/130.7
SUBSYSTEM 2_DC FUSE OK					-DI_03	10	9		++CONV+CIR-231U1-X3.1	15		15										&EFS+/130.8
SUBSYSTEM 3_1_DC FUSE OK							10															&EFS+/130.9
=					-DI_03	11	11		++CONV+CIR-227U1-X3.1	13			13									&EFS+/130.9
=					-XDC4	2	12															&EFS+/130.9

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.12

Rückmeldung DC Schütze Subsystem 1_4

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-227W4										Page / column
				Cable type							Cable type	OZ-500										
SUBSYSTEM 4_1_DC + Contactor K1 is on					-DI_03	12	1		+.4-308K1	14												&EFS+/131.0
SUBSYSTEM 4_2_DC + Contactor K2 is on					+.4-308K3	14	2		-DI_03	14												&EFS+/131.2
SUBSYSTEM 4_1_DC -Contactor K7 is on					+.4-308K2	14	3		-DI_03	13												&EFS+/131.1
SUBSYSTEM 4_2_DC -Contactor K8 is on					+.4-308K4	14	4		-DI_03	15												&EFS+/131.3
SUBSYSTEM 4_3_DC + Contactor K3 is on					-DI_03	16	5		+.4-308K5	14												&EFS+/131.4
SUBSYSTEM 4_DC + SPARE					-DI_05	2	6															&EFS+/131.6
SUBSYSTEM 4_3_DC -Contactor K9 is on					-DI_05	1	7		+.4-308K6	14												&EFS+/131.5
SUBSYSTEM 4_DC -SPARE					-DI_05	3	8															&EFS+/131.7
SUBSYSTEM 3_2_DC FUSE OK					-DI_05	4	9		++CONV+CIR-227U1-X3.1	14		14										&EFS+/131.8
SUBSYSTEM 3_3_DC FUSE OK							10		++CONV+CIR-227U1-X3.1	16		16										&EFS+/131.9
=					-DI_05	5	11		++CONV+CIR-227U1-X3.1	15		15										&EFS+/131.9
=					-XDC4	2	12															&EFS+/131.9

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.13

Rückmeldung DC Schütze Subsystem 1_6

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	++CONV-237W4	OZ-500	Page / column
			-DI_05	6	1								&EFS+/132.0
					2		-DI_05	8					&EFS+/132.2
					3		-DI_05	7					&EFS+/132.1
					4		-DI_05	9					&EFS+/132.3
			-DI_05	10	5								&EFS+/132.4
			-DI_05	12	6								&EFS+/132.6
			-DI_05	11	7								&EFS+/132.5
SUBSYSTEM 4_1_DC FUSE OK			-DI_05	13	8		++CONV+CIR-237U1-X3.1	13			13		&EFS+/132.7
SUBSYSTEM 4_2_DC FUSE OK			-DI_05	14	9		++CONV+CIR-237U1-X3.1	14			14		&EFS+/132.8
SUBSYSTEM 4_3_DC FUSE OK					10		++CONV+CIR-237U1-X3.1	16			16		&EFS+/132.9
=			-DI_05	15	11		++CONV+CIR-237U1-X3.1	15			15		&EFS+/132.9
=			-XDC4	2	12								&EFS+/132.9

previous page: 2005

next page: 2007

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.13	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2006
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-145W1	++CONV-145W2	++CONV-145W3	++CONV-145W4	++CONV-146W1	++CONV-146W2	++CONV-146W3	++CONV-146W4	++CONV-147W1	++CONV-147W2	-181W3	Page / column
				Cable type							Cable type	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	
INDUCTOR GRID PHASE L1 TEMPERATURE 1_1					-AI_01	1	1	,	++CONV+IND-201L1			1											&EFS+/145.1
=					-AI_01	9	2	,	++CONV+IND-201L1			2											&EFS+/145.1
INDUCTOR GRID PHASE L2 TEMPERATURE 1_2					-AI_01	2	3	,	++CONV+IND-202L1				1										&EFS+/145.3
=					-AI_01	10	4	,	++CONV+IND-202L1				2										&EFS+/145.3
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3					-AI_01	3	5	,	++CONV+IND-203L1					1									&EFS+/145.5
=					-AI_01	11	6	,	++CONV+IND-203L1					2									&EFS+/145.5
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1					-AI_01	4	7	,	++CONV+IND-211L1.1						1								&EFS+/145.7
=					-AI_01	12	8	,	++CONV+IND-211L1.1						2								&EFS+/145.7
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2					-AI_01	5	9	,	++CONV+IND-211L1.2							1							&EFS+/146.1
=					-AI_01	13	10	,	++CONV+IND-211L1.2							2							&EFS+/146.1
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3					-AI_01	6	11	,	++CONV+IND-211L1.3								1						&EFS+/146.3
=					-AI_01	14	12	,	++CONV+IND-211L1.3								2						&EFS+/146.3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1					-AI_01	7	13	,	++CONV+IND-207L1.1									1					&EFS+/146.5
=					-AI_01	15	14	,	++CONV+IND-207L1.1									2					&EFS+/146.5
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2					-AI_01	8	15	,	++CONV+IND-207L1.2										1				&EFS+/146.7
=					-AI_01	16	16	,	++CONV+IND-207L1.2										2				&EFS+/146.7
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3					-AI_02	1	17	,	++CONV+IND-207L1.3											1			&EFS+/147.1
=					-AI_02	9	18	,	++CONV+IND-207L1.3											2			&EFS+/147.1
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1					-AI_02	2	19	,	++CONV+IND-217L1.1												1		&EFS+/147.3
=					-AI_02	10	20	,	++CONV+IND-217L1.1												2		&EFS+/147.3
CONVERTER CABINET TEMPERATURE					-AI_02	4	21	,	++CONV+CON-147B2	+													&EFS+/147.7
=					-AI_02	12	22	,	++CONV+CON-147B2	-													&EFS+/147.7
COOLING WATER TEMPERATURE					-AI_02	5	23	,	++FAN-52G1-181X3	4												4	&EFS+/148.1
=					-AI_02	13	24	,	++FAN-52G1-181X3	5												5	&EFS+/148.1

previous page: 2006

next page: 2008

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-148W1	++CONV-148W2										Page / column
				Cable type							Cable type	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)										
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2					-AI_02	6	25	,	++CONV+IND-217L1.2			1											&EFS+/148.3
=					-AI_02	14	26	,	++CONV+IND-217L1.2			2											&EFS+/148.3
CIR CABINET TEMPERATURE					-AI_02	7	27	,	++CONV+CIR-148B3	+													&EFS+/148.5
=					-AI_02	15	28	,	++CONV+CIR-148B3	-													&EFS+/148.5
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3					-AI_02	8	29	,	++CONV+IND-217L1.3				1										&EFS+/148.7
=					-AI_02	16	30	,	++CONV+IND-217L1.3				2										&EFS+/148.7

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5.1

DC Subsystem Spannungsmessung

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC_SUBSYSTEM 2_1.1 voltage			-AI_03	5	1		-AI_04	6			&EFS+/149.0
			-XDC1	6							
			-AI_03	6							
DC_SUBSYSTEM 2_3.1 voltage			-AI_03	7	2		+.4-149U1	14			&EFS+/149.2
			-AI_04	5							
			-AI_03	8							

previous page: 2008

next page: 2010

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_01++CT+CTRL_1.3-X5.1	20250805_V2.0	=	UNIT_01	Converter Container 1	
Date	21.01.2025							&	EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++	CT	Control cabinets	page: 2009
Date							10354_23A2007	+	CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-150X1

Subsysteme DC Schütz EIN

Function text			++CONV-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-231W4	Page / column
			OZ-500	Cable type							Cable type	OZ-500	
SUBSYSTEM 2_1 CONTACTOR DC+ ON			1		++CONV+CIR-231U1-X3.1	1	1	,	-150K1	14			&EFS+/150.2
=					-195K2	23	2	,	++CONV+CIR-231U1-X3.1	17		17	&EFS+/150.2
SUBSYSTEM 2_1 CONTACTOR DC-ON			4		++CONV+CIR-231U1-X3.1	4	3	,	-150K2	14			&EFS+/150.4
SUBSYSTEM 2_2 CONTACTOR DC+ ON			2		++CONV+CIR-231U1-X3.1	2	4	,	-151K1	14			&EFS+/151.1
=					-151K1	A2	5	,					&EFS+/151.1
SUBSYSTEM 2_3 CONTACTOR DC+ ON			5		++CONV+CIR-231U1-X3.1	5	6	,	-151K2	14			&EFS+/151.3
=			3		++CONV+CIR-231U1-X3.1	3	7	,	-151K3	14			&EFS+/151.4
=					-151K2	A2	8	,					&EFS+/151.4
SUBSYSTEM 2_3 CONTACTOR DC-ON			6		++CONV+CIR-231U1-X3.1	6	9	,	-151K4	14			&EFS+/151.6
=							10	,					&EFS+/151.6

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2010
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text	-112W1 / JZ-500	-242W9 / JZ-500	-240W9 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-243W9 / JZ-500	Page / column
FUSE 24V DC CONTROL VOLTAGE			1		+CTRL_2.1-240U1	1	1		-103F1	2			&EFS+/103.2
					+CTRL_2.1-160U1	+							
					+.2-18B1	40							
FUSE 24V DC CONTROL VOLTAGE					-DO_01	L+	2		-101Q1	13			&EFS+/103.2
					-AI_01	L+							
					+.1-126S1	13							
FUSE 24V DC CONTROL VOLTAGE					-136K7	11	3		-103F1	13			&EFS+/103.2
					-84F2	13							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			2		+CTRL_2.1-240U1	3	4		-102G1	OUTPUT DC 24 V:-			&EFS+/103.3
					-120A1	-X80:2							
					-DI_01	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-DO_01	M	5		+CTRL_2.1-160U1	-			&EFS+/103.3
					-AI_01	M							
					+.2-18B1	42							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-84K1	A2	6		-X5.1	1			&EFS+/103.3
					+.1-140H1	X2							
					+.2-110U1	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-AI_04	7	7						&EFS+/103.3
					-XDC2	3							
					-X3	25							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			GNYE		+CTRL_2.1-240U1	2	PE		-101T1	PE			&EFS+/103.4
					-XE	PE:1							
					-101T1	-"							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					+.2-18B1	41	PE		+CTRL_2.1-243U1	2		GNYE	&EFS+/103.4
		GNYE			+CTRL_2.1-242U1	2							
	GNYE				+.1-112A1	PE							

previous page: 2010

next page: 2012

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text			-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
			1Z-500	Cable type							Cable type	
			GNYE		+CTRL_2.1-241U1	2						

previous page: 2011

next page: 2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1
Date	21.01.2025					
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Date						

20250805_V2.0

10354_23A2007

=	UNIT_01	Converter Container 1		
&	EMZ	Terminals		
++	CT	Control cabinets	page:	2012
+	CTRL_1.3	Main mounting plate	total:	492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text	-241W9 / JZ-500	-242W9 / JZ-500	-243W9 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			1		+CTRL_2.1-243U1	1	1		-103F2	2		&EFS+/103.4
		1			+CTRL_2.1-242U1	1						
					-X3	29						
BSU, SPARE CONTROL VOLTAGE	1				+CTRL_2.1-241U1	1	2					&EFS+/103.5

previous page: 2012

next page: 2014

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2013
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text	-243W9 / JZ-500	-242W9 / JZ-500	-112W1 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
			1		+.1-112A1	L+						
BSU, SPARE CONTROL VOLTAGE					-186K1	A2	3		-XDC1	7		&EFS+/103.5
		2			+CTRL_2.1-242U1	3						
	2				+CTRL_2.1-243U1	3						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1		
&	EMZ	Terminals		
++	CT	Control cabinets	page:	2014
+	CTRL_1.3	Main mounting plate	total:	492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text		-112W1	-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
		1Z-500	1Z-500	Cable type							Cable type	
BSU, SPARE CONTROL VOLTAGE			2		+CTRL_2.1-241U1	3	4	⌟	-XDC3	3		&EFS+/103.5
					-138K1	A2						
		2			+.1-112A1	M						
								'				

previous page: 2014

next page: 2016

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2015
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC3

Steuerspannung 24VDC (USV) DC3

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
BSU, SPARE CONTROL VOLTAGE			-111A1	3	1		-103F3	2			&EFS+/103.6
			-173K3	21							
			+.2-114A1	2/L+							
BSU, SPARE CONTROL VOLTAGE			-X3	31	2		+.4-306K1	11			&EFS+/103.6
			-195K1	83							
			-115A1	V+							
PRECHARGE CONTROL VOLTAGE			-X3	32	3		-XDC2	4			&EFS+/103.7
			-111A1	4							
			+.2-114A1	1/M							
PRECHARGE CONTROL VOLTAGE			-195K1	43	4		-XDC4	3			&EFS+/103.7
			+.4-171K1	x2							
			-115A1	V-							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC4

Steuerspannung 24VDC (USV) DC4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
PRECHARGE CONTROL VOLTAGE			-195K1	33	1		-103F4	2			&EFS+/103.8
			-195K3	A1							
			-X3.10	12							
PRECHARGE CONTROL VOLTAGE			-X3.11	12	2		-X3.13	12			&EFS+/103.8
			-X3	5							
			-X3.12	12							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-139K2	A2	3		-XDC3	4			&EFS+/103.9
			-195K3	A2							
			-195K1	23							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-X3	21	4						&EFS+/103.9
			+.4-306K1	A2							
			+.4-306K1	A2							

previous page: 2016

next page: 2018

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.1

Steuerspannung 24VDC (USV) DC5.1

Function text				Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE						-186K1	1	1	,	-103F5	2			&EFS+/103.9
						-186K1	3							
									,					

previous page:
2017

next page:
2019

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2018
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.2

Steuerspannung 24VDC (USV) DC5.2

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			+.2-110U1	+24V	1	,	-186K1	2			&EFS+/103.9
			-120A1	-X80:1							
			-DI_01	L+							
						,					

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XE

Hauptstromversorgung 400V AC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
					1		-84F2	2			&EFS+/84.0
1-6					1						&EFA+++/2a.4
Supply Control Cabinet 3-phase 400V AC					N		-X1	7			&EFS+/84.1
=			-191XT1	4	N		-XT	2			&EFS+/84.1
=			-190F3	N	N		-191XT1	8			&EFS+/84.2
=			-190F2	N	N		-190F1	N			&EFS+/84.2
=					PE						&EFS+/84.2
=			-84F1	PE	PE		-XDC1	PE			&EFS+/84.2
=				PE	PE						&EFS+/84.3
			-101Q1	1	2		-190F2	1			&EFS+/84.0
					3		-84F2	4			&EFS+/84.0
Supply Control Cabinet 3-phase 400V AC			-101Q1	3	4		-190F3	1			&EFS+/84.1
=					5		-84F2	6			&EFS+/84.1
=			-101Q1	5	6		-190F1	1			&EFS+/84.1

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_01++CT+CTRL_1.3-XE	20250805_V2.0	=	UNIT_01	Converter Container 1	
Date	21.01.2025							&	EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++	CT	Control cabinets	page: 2020
Date							10354_23A2007	+	CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text	-278W1	++CONV-281W1	++CONV-279W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-279W1	++CONV-281W1	-278W1	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	1Z-500	1Z-500	1Z-500	
CON Fans 1-5 in door			1		++CONV+CON-279M1	L	1		-135K1	14					&EFS+/183.1
=			2		++CONV+CON-279M1	N	2		-XE	N:1					&EFS+/183.1
=							PE		++CONV+CON-279M1	PE		GNYE			&EFS+/183.1
=		1			++CONV+CIR-281M1	L	3		-135K3	14					&EFS+/183.3
CIR Fans 1-3 in door		2			++CONV+CIR-281M1	N	4								&EFS+/183.4
=							PE		++CONV+CIR-281M1	PE			GNYE		&EFS+/183.4
FAN 1 CONTROL CABINET	1				+.1-278M1	L	5		-135K2	14					&EFS+/185.1
=	2				+.1-278M1	N	6								&EFS+/185.1
=							PE		+.1-278M1	PE				GNYE	&EFS+/185.1

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2021
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text		++CONV-80W2	-185W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-185W1	++CONV-80W2										Page / column
		1Z-500	1Z-500	Cable type							Cable type	1Z-500	1Z-500										
HEATING CONTROL CABINET			1		+.2-185R1	1	7		-185B1	2													&EFS+/185.7
=			2		+.2-185R1	2	8																&EFS+/185.7
=							PE		+.2-185R1	PE		GNYE											&EFS+/185.7
230V AC for Circuit Breaker 1		1			++CONV+CIR-80Q1	X5_2	9		-187F1	2													&EFS+/187.1
=		2			++CONV+CIR-80Q1	X5_1	10																&EFS+/187.1
=							PE						GNYE										&EFS+/187.1
230V AC for Circuit Breaker Optional							11																&EFS+/187.2
=							12																&EFS+/187.2
=							PE																&EFS+/187.2
24V DC for Circuit Breaker 2 Optional							13		-187F2	2													&EFS+/187.4
=							14		-101T1	-													&EFS+/187.4
24V DC for Circuit Breaker Optional							15																&EFS+/187.5
=							16																&EFS+/187.5

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 2022
Date								+ CTRL_1.3 Main mounting plate total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-190XT1

230VAC Beleuchtung/Klimaanlage Container/Schrank

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
SPARE					1		-190F1	2			&EFS+/190.1
=					2		-190F1	N.			&EFS+/190.1
SPARE					PE						&EFS+/190.1
=					3		-190F2	2			&EFS+/190.3
=					4		-190F2	N.			&EFS+/190.3
SPARE					PE						&EFS+/190.3
Light Control cabinet		BN	+.5-190H1		5		-190F3	2			&EFS+/190.5
=					PE		-190X10	PE			&EFS+/190.5
=		LBU	+.5-190H1		6		-190F3	N.			&EFS+/190.5
230V AC for Container light, socket					7		-190X10	1			&EFS+/190.7
=					8		-190X10	2			&EFS+/190.7
230V AC for Container light, socket					PE						&EFS+/190.7

previous page: 2022

next page: 2024

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-190XT1	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 2023
Date								+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.3-191XT1					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
400V AC for Container Air Conditioning 1							1	,	-191F1	2												&EFS+/191.1
=							2	,	-191F1	4												&EFS+/191.1
=							3	,	-191F1	6												&EFS+/191.1
=							4	,	-XE	N:2												&EFS+/191.2
=							PE	,														&EFS+/191.2
400V AC for Container Air Conditioning 2							5	,	-191F2	2												&EFS+/191.3
=							6	,	-191F2	4												&EFS+/191.3
=							7	,	-191F2	6												&EFS+/191.3
=							8	,	-XE	N:1												&EFS+/191.4
=							PE	,														&EFS+/191.4

previous page: 2023

next page: 2025

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XV

Suppression TVS Diode

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
Suppression TVS Diode bi-directional 47 V					1		-171K3	14			&EFS+/171.8
Suppression TVS Diode bi-directional 47 V					5						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					6						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					7						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					8						&EFS+/151.8
Suppression TVS Diode bi-directional 47 V					9						&EFS+/134.5
Suppression TVS Diode bi-directional 47 V					2		-173K3	14			&EFS+/173.9
Suppression TVS Diode bi-directional 47 V					3						&EFS+/150.7
Suppression TVS Diode bi-directional 47 V					4						&EFS+/150.7

previous page: 2024

next page: +.4/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-350X1.21	Subsysteme DC Schütz EIN	1	19	0	0	21	=UNIT_01&EMZ++CT+CTRL_1.4/2000
-XE2	Gleichstromversorgung 1000VDC	1	11	0	0	11	=UNIT_01&EMZ++CT+CTRL_1.4/2001
-XV.20		1	12	0	0	36	=UNIT_01&EMZ++CT+CTRL_1.4/2002

previous page:
+.3/2025

next page:
2000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.4-350X1.21 - =UNIT_01++CT+CTRL_1.4-XV.20	20250805_V2.0	= UNIT_01	Converter Container 1
Date	21.01.2025							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+ CTRL_1.4	Right side

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-350X1.21

Subsysteme DC Schütz EIN

Function text		++CONV-237W4 OZ-500	++CONV-227W4 OZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-227W4 OZ-500	++CONV-237W4 OZ-500	Page / column
SUBSYSTEM 3_1 CONTACTOR DC+ ON			1		++CONV+CIR-227U1-X3.1	1	1	,	-350K1	14				&EFS+/350.2
=					-350K1	A2	2	,	++CONV+CIR-227U1-X3.1	17		17		&EFS+/350.2
SUBSYSTEM 3_1 CONTACTOR DC-ON			4		++CONV+CIR-227U1-X3.1	4	3	,	-350K2	14				&EFS+/350.4
			2		++CONV+CIR-227U1-X3.1	2	4	,	-351K1	14				&EFS+/351.1
					+.3-195K2	43	5	,						&EFS+/351.1
SUBSYSTEM 3_3 CONTACTOR DC+ ON			5		++CONV+CIR-227U1-X3.1	5	6	,	-351K2	14				&EFS+/351.3
=			3		++CONV+CIR-227U1-X3.1	3	7	,	-351K3	14				&EFS+/351.4
SUBSYSTEM 3_3 CONTACTOR DC-ON							8	,						&EFS+/351.5
=			6		++CONV+CIR-227U1-X3.1	6	9	,	-351K4	14				&EFS+/351.6
=							10	,						&EFS+/351.7
SUBSYSTEM 4_3 CONTACTOR DC-ON							10	,						&EFS+/353.6
SUBSYSTEM 4_1 CONTACTOR DC+ ON		1			++CONV+CIR-237U1-X3.1	1	11	,	-352K1	14				&EFS+/352.1
SUBSYSTEM 4_1 CONTACTOR DC-ON					-352K1	A2	12	,	++CONV+CIR-237U1-X3.1	17		17		&EFS+/352.2
=		4			++CONV+CIR-237U1-X3.1	4	13	,	-352K2	14				&EFS+/352.3
SUBSYSTEM 4_2 CONTACTOR DC+ ON		2			++CONV+CIR-237U1-X3.1	2	14	,	-353K1	14				&EFS+/353.1
=					-353K1	A2	15	,						&EFS+/353.1
SUBSYSTEM 4_3 CONTACTOR DC+ ON		5			++CONV+CIR-237U1-X3.1	5	16	,	-353K2	14				&EFS+/353.3
=		3			++CONV+CIR-237U1-X3.1	3	17	,	-353K3	14				&EFS+/353.4
=					-353K2	A2	18	,						&EFS+/353.4
SUBSYSTEM 4_3 CONTACTOR DC-ON		6			++CONV+CIR-237U1-X3.1	6	19	,	-353K4	14				&EFS+/353.6

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2000
Date								+ CTRL_1.4 Right side — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-XE2

Gleichstromversorgung 1000VDC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
RESISTORS FOR DISCHARGING UDC+			-173R2		1		-173R1				&EFS+/173.2
RESISTORS FOR DISCHARGING UDC-			-173R4		2		-173R3				&EFS+/173.3
=			-173R4		3		+CTRL_2.1-160U1	15			&EFS+/173.3
=			-173R2		4		+CTRL_2.1-160U1	44			&EFS+/173.3
=			+CTRL_2.1-162U1	15	5		+CTRL_2.1-161U1	15			&EFS+/173.3
=			+CTRL_2.1-162U1	44	6		+CTRL_2.1-161U1	44			&EFS+/173.3
=			+CTRL_2.1-163U1	15	7		-189X1	4			&EFS+/173.4
=			+CTRL_2.1-163U1	44	8		+CTRL_2.1-164U1	44			&EFS+/173.4
=			+CTRL_2.1-164U1	15	9		++CONV+CON-N	N			&EFS+/173.4
=					10		+CTRL.4-173R6				&EFS+/173.5
=					11		+CTRL.4-173R8				&EFS+/173.5

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.4-XV.20					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Suppression TVS Diode bi-directional 47 V							1															&EFS+/350.7
Suppression TVS Diode bi-directional 47 V							2															&EFS+/350.7
Suppression TVS Diode bi-directional 47 V							3															&EFS+/351.7
Suppression TVS Diode bi-directional 47 V							4															&EFS+/351.7
Suppression TVS Diode bi-directional 47 V							5															&EFS+/351.8
Suppression TVS Diode bi-directional 47 V							6															&EFS+/351.8
Suppression TVS Diode bi-directional 47 V							7															&EFS+/352.7
Suppression TVS Diode bi-directional 47 V							8															&EFS+/352.7
Suppression TVS Diode bi-directional 47 V							9															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							10															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							11															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							12															&EFS+/353.8

previous page: 2001

next page: 2003

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.4-XV.20						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-149X1		1	6	0	0	6	=UNIT_01&EMZ++CT+CTRL_2.1/2000

previous page:
+CTRL_1.4/2003

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_2.1-149X1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
					-161U1	19	1	,															&EFS+/161.4
					-161U1	23	2	,															&EFS+/161.5
					-161U1	27	3	,															&EFS+/161.5
					-161U1	32	4	,															&EFS+/161.6
					-161U1	36	5	,															&EFS+/161.7
					-161U1	40	6	,															&EFS+/161.8

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-52G1-181X1	400VAC Wassersystem	1	PE	3	1	14	=UNIT_01&EMZ++FAN/2000
-52G1-181X3		1	GND	0	0	6	=UNIT_01&EMZ++FAN/2001

previous page:
++CT+CTRL_2.1/2000

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++FAN+-52G1-181X1

400VAC Wassersystem

Function text	-52G1-182W1	-52G1-181W5	-52G1-181W2	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CT-181W1	Page / column
	1Z-600	1Z-600	1Z-600	Cable type							Cable type	1Z-600	
PUMP			1		-52G1-181M1	U1	1	,	++CT+CTRL_1.3-X1	1		1	&EFS++CT/181.1
=			2		-52G1-181M1	V1	2	,	++CT+CTRL_1.3-X1	2		2	&EFS++CT/181.1
=			3		-52G1-181M1	W1	3	,	++CT+CTRL_1.3-X1	3		3	&EFS++CT/181.1
FUSE FOR PUMP		1			-52G1-181R1	x1	4	,	++CT+CTRL_1.3-X1	4		4	&EFS++CT/181.3
HEATER		2			-52G1-181R1	x3	5	,	++CT+CTRL_1.3-X1	5		5	&EFS++CT/181.4
=		3			-52G1-181R1	x5	6	,	++CT+CTRL_1.3-X1	6		6	&EFS++CT/181.4
=		4			-52G1-181R1	x6	7	,	++CT+CTRL_1.3-X1	7		7	&EFS++CT/181.4
								,					
FAN 1 HEAT EXCHANGER	1				-52G1-182M1	U1	8	,	++CT+CTRL_1.3-X1	8		8	&EFS++CT/182.1
=	2				-52G1-182M1	V1	9	,	++CT+CTRL_1.3-X1	9		9	&EFS++CT/182.1
=	3				-52G1-182M1	W1	10	,	++CT+CTRL_1.3-X1	10		10	&EFS++CT/182.1
PUMP			GNYE		-52G1-181M1	PE	PE	,	++CT+CTRL_1.3-X1	PE		GNYE	&EFS++CT/181.1
HEATER		GNYE			-52G1-181R1	PE	PE	,					&EFS++CT/181.4
FAN 1 HEAT EXCHANGER	GNYE				-52G1-182M1	PE	PE	,					&EFS++CT/182.1

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++FAN+-52G1-181X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN FAN page: 2000
Date								+ total: 492

Terminal diagram

Freqcon_F13_001_02

Function text			++CT-181W3	Cable name	Strip =UNIT_01++FAN+-52G1-181X3					Cable name	++CT-181W3										Page / column
			F-CY-0Z (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-0Z (LiY-CY)										
PRESSURE SWITCH			1		++CT+CTRL_1.3-X3	23	1	,	-52G1	1												&EFS++CT/181.7
=					-52G1	2	2	,	++CT+CTRL_1.3-X3	25		3										&EFS++CT/181.7
=					-52G1	3	3	,	++CT+CTRL_1.3-X3	24		2										&EFS++CT/181.7
COOLING WATER TEMPERATURE			4		++CT+CTRL_1.3-X5	23	4	,	-52G1-148B1	+												&EFS++CT/148.1
=			5		++CT+CTRL_1.3-X5	24	5	,	-52G1-148B1	-												&EFS++CT/148.1
PRESSURE SWITCH					-52G1	SH	GND	,														&EFS++CT/181.7

previous page: 2000

next page: =UNIT_02&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++FAN+-52G1-181X3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN FAN page: 2001
Date								+ total: 492

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

FREQCON

Customer:	Statron		
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Type:	BESS MSC-1000-620-8		
Product	BATTERY CONTAINER 1		
Circuit diagram No:	10354_23A2007	20250805_V2.0	
Producer (company):	Freqcon GmbH	53406 ASC	53409
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Type:	BESS MSC-1000-620-8		
Project manager:	Freqcon_CP		

created on: 17.09.2019
edited on: 05.08.2025 edited by: Freqcon_DG total pages: 492

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	21.01.2025	Freqcon_DG
	3	INDEX	21.01.2025	Freqcon_DG
	4	INDEX	21.01.2025	Freqcon_DG
	5	INDEX	21.01.2025	Freqcon_DG
	6	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	05.11.2024	Freqcon_DG
	3a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
&ELU		Cabinet Overview		
	5a	Container overview	14.06.2024	Freqcon_JD
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	191	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	192	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	193	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	278	EARTHING CONTAINER	08.10.2024	Freqcon_DG
	290	BATTERY CABINETS 1-3	18.06.2024	Freqcon_JD
	291	BATTERY CABINETS 4+5	18.06.2024	Freqcon_JD
	292	BATTERY CABINETS 6-8	18.06.2024	Freqcon_JD
	293	BATTERY CABINETS 9-11	18.06.2024	Freqcon_JD
&EFS ++ASC		Circuit diagram auxillary cabinet		
	601	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	602	CONTROL VOLTAGE UPS	05.11.2024	Freqcon_DG
	603	CONTROL VOLTAGE FUSE	21.01.2025	Freqcon_DG
	611	ETHERNET SWITCH	18.06.2024	Freqcon_JD
	613a	ETHERNET / PROFINET ISOLATOR	25.11.2024	Freqcon_DG
	613b	PROFINET	25.11.2024	Freqcon_DG
	620	ET200 24V DC ASC	03.12.2024	Freqcon_DG
	621	ET200SP DIGITAL INPUTS DI_21 + DI_22	03.12.2024	Freqcon_DG
	623	ET200SP DIGITAL OUTPUTS DO_21	14.06.2024	Freqcon_JD
	624	ET200SP ANALOG INPUTS AI_21	14.06.2024	Freqcon_JD
	625	ET200SP ANALOG OUTPUTS AO_21	14.06.2024	Freqcon_JD
	636	OUTPUTS FIRE DAMPER	18.06.2024	Freqcon_JD
	669	SMOKE POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	670	GAS POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	678	DC BATTERY CABINETS	18.06.2024	Freqcon_JD
	680a	STATIONARY GAS DETECTOR BAT 1-4	14.06.2024	Freqcon_JD
	680b	STATIONARY GAS DETECTOR BAT 5-8	18.06.2024	Freqcon_JD
	680c	STATIONARY GAS DETECTOR BAT 9-11	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++ASC		Circuit diagram auxillary cabinet		
	681	EXTRACT FAN FIRE DAMPER	14.06.2024	Freqcon_JD
	684	AUXILIARY SUPPLY 400V AC	22.11.2024	Freqcon_DG
	685	AUXILIARY SUPPLY 400V AC	05.11.2024	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	29.10.2024	Freqcon_DG
	691	CONTAINER COOLING / LIGHTNING	05.11.2024	Freqcon_DG
&EPC ++Container		Parts List		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	21.01.2025	Freqcon_DG
	4	PARTS LIST	21.01.2025	Freqcon_DG
	5	PARTS LIST	21.01.2025	Freqcon_DG
	6	PARTS LIST	21.01.2025	Freqcon_DG
	7	PARTS LIST	21.01.2025	Freqcon_DG
&EPA ++Container		Summarized part list		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG

previous page: 2

next page: 4

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++Container		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	21.01.2025	Freqcon_DG
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_02++ASC+-X5.1 - =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_02++ASC+-X5.1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_02++ASC+-X5.2	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2002	Klemmenplan =UNIT_02++ASC+-X5.3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_02++ASC+-X6	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_02++ASC+-XDC1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_02++ASC+-XDC2	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_02++ASC+-XES	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2009	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2024	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2025	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2026	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2027	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2028	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG

previous page: 4

next page: 6

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2029	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2030	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2031	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2032	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2033	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/6

next page: 6a

SPECIFICATION of grounding

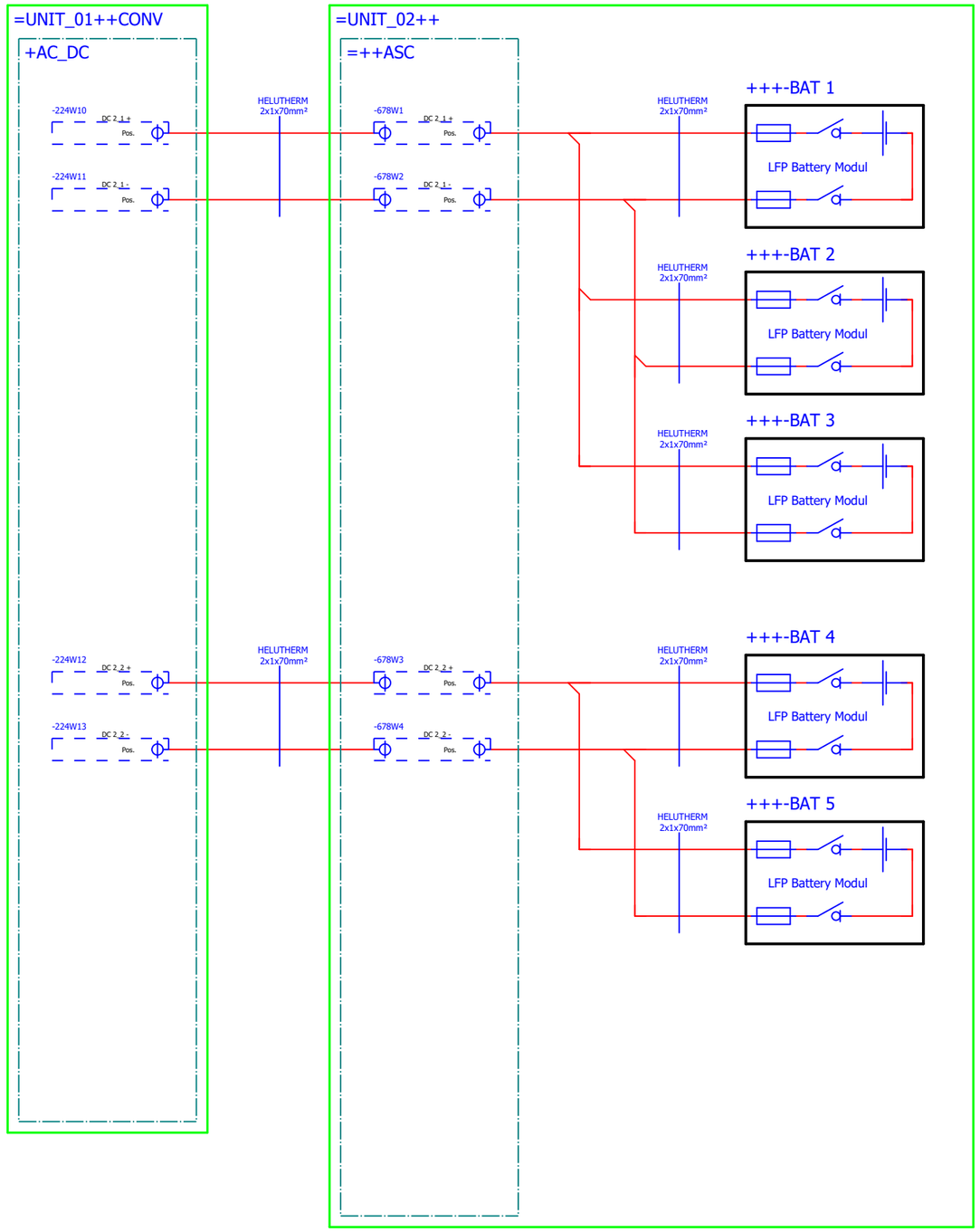
	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

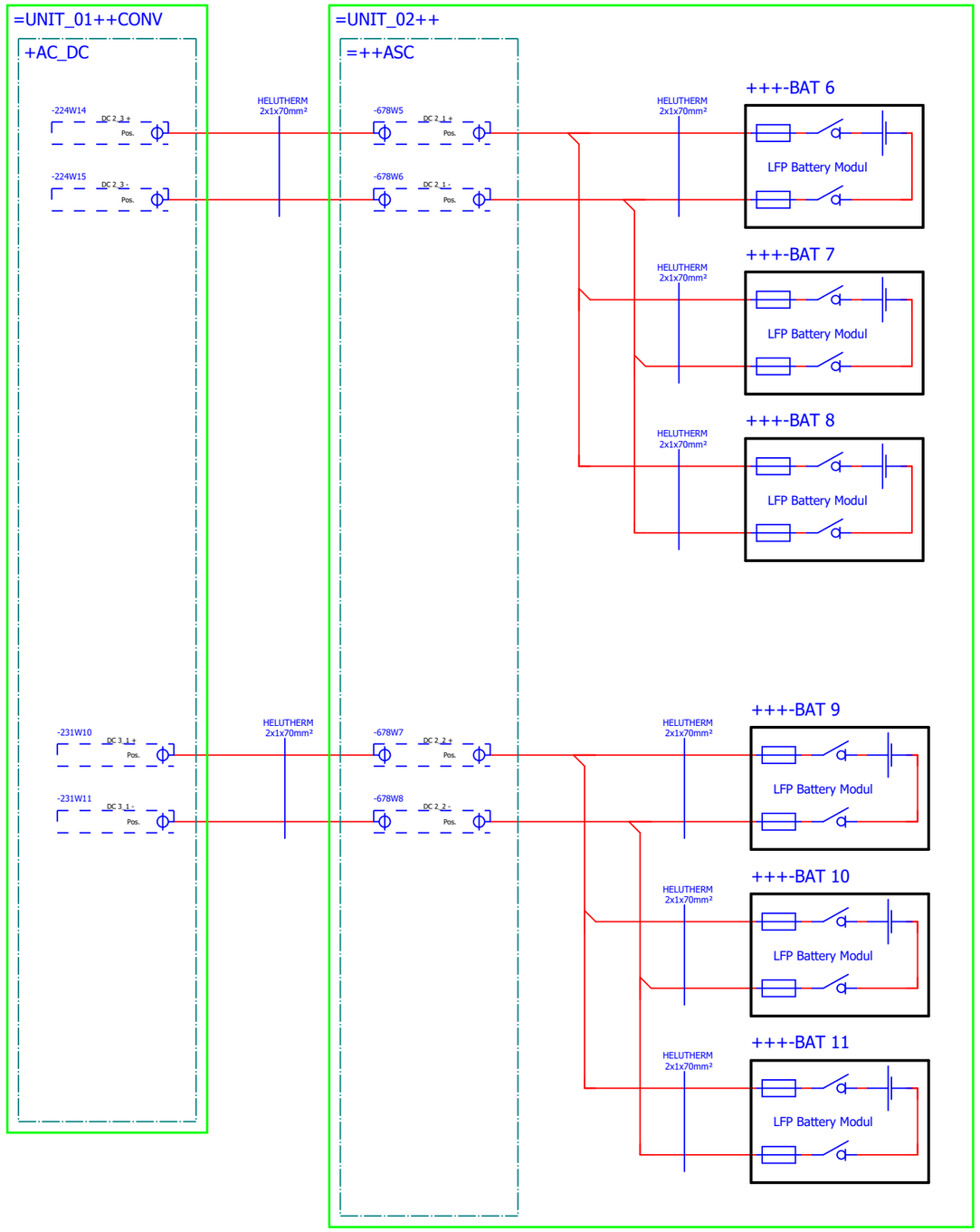
previous page: 1a

next page: &EFA/1a

Editor	Freqcon_JD			Statron	FREQCON	Specification Earthing	20250805_V2.0	= UNIT_02	Battery Container 1
Date	14.06.2024	Norm						& EAC	Explanatory documents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 6a
Date								+	total: 492

Single line diagram





previous page:
&EAC/6a

next page:
2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 1a
Date								+	total: 492

Single line diagram

Control circuit

++ASC

400V

-XES

-684F3 &EFS++ASC/684.2 C32A

-684F1 &EFS++ASC/684.0 C32A

-684F2 &EFS++ASC/684.5 TYP 1 + 2 SPD

-601F1 &EFS++ASC/601.1 TYP 1 + 2 SPD

-684F4 &EFS++ASC/685.0 C32A

-684F5 &EFS++ASC/685.5 TYP 1 + 2 SPD

-691F1 &EFS++ASC/691.1 C6A

-691F2 &EFS++ASC/691.3 C6A

-691F3 &EFS++ASC/691.4 C6A

-636K1 &EFS++ASC/636.1

-636K2 &EFS++ASC/636.2

-636K3 &EFS++ASC/636.4

M 1~

Exhaust Unit / shut-off flap Bat 1-4

Exhaust Unit / shut-off flap Bat 5-8

Exhaust Unit / shut-off flap Bat 9-11

Container Internal Lighting

-690F1 &EFS++ASC/690.1 16A

-690F3 &EFS++ASC/690.5 C6A

-690F4 &EFS++ASC/690.7 C6A

-690F5 &EFS++ASC/690.8 C6A

1/N/PE

crane 1

crane 2

crane 3

-691F4 &EFS++ASC/691.5 C16A

Cooling Units

-690F2 &EFS++ASC/690.3 16A

1/N/PE 1/N/PE

Container Sockets

-101Q1

20 A

Power Supply

-687F1 &EFS++ASC/687.1 C16A

-687F2 &EFS++ASC/687.3 C16A

-687F3 &EFS++ASC/687.4 C16A

-687F4 &EFS++ASC/687.5 C16A

-687F5 &EFS++ASC/687.7 C16A

Battery cabinet 1

Battery cabinet 2

Battery cabinet 3

Battery cabinet 4

Battery cabinet 5

-687F6 &EFS++ASC/687.8 C16A

-688F1 &EFS++ASC/688.1 C16A

-688F2 &EFS++ASC/688.2 C16A

-688F3 &EFS++ASC/688.4 C16A

-688F4 &EFS++ASC/688.5 C16A

-688F5 &EFS++ASC/688.7 C16A

Battery cabinet 6

Battery cabinet 7

Battery cabinet 8

Battery cabinet 9

Battery cabinet 10

Battery cabinet 11

previous page: 1a

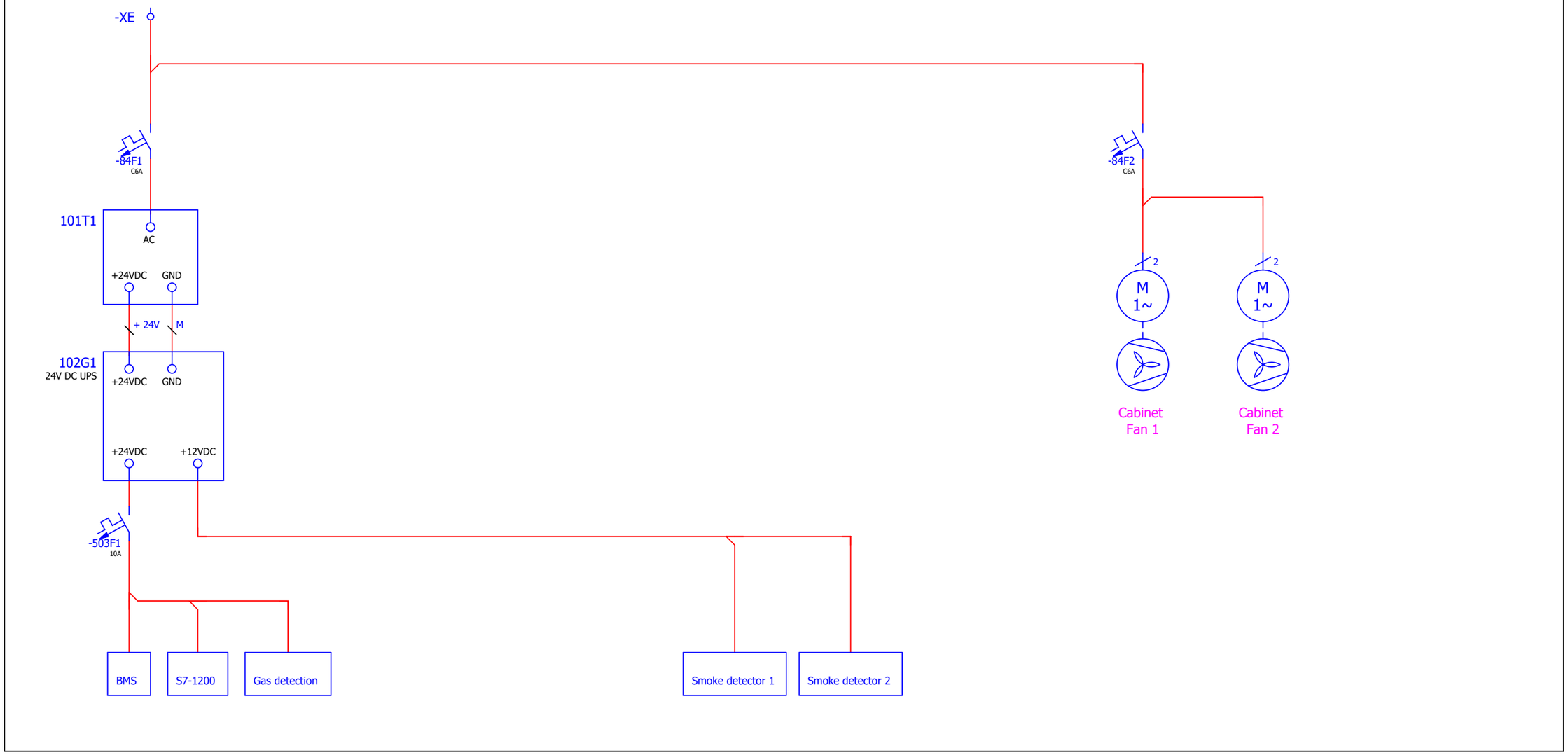
next page: 3a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2a
Date								+ total: 492

Single line diagram

Control circuit

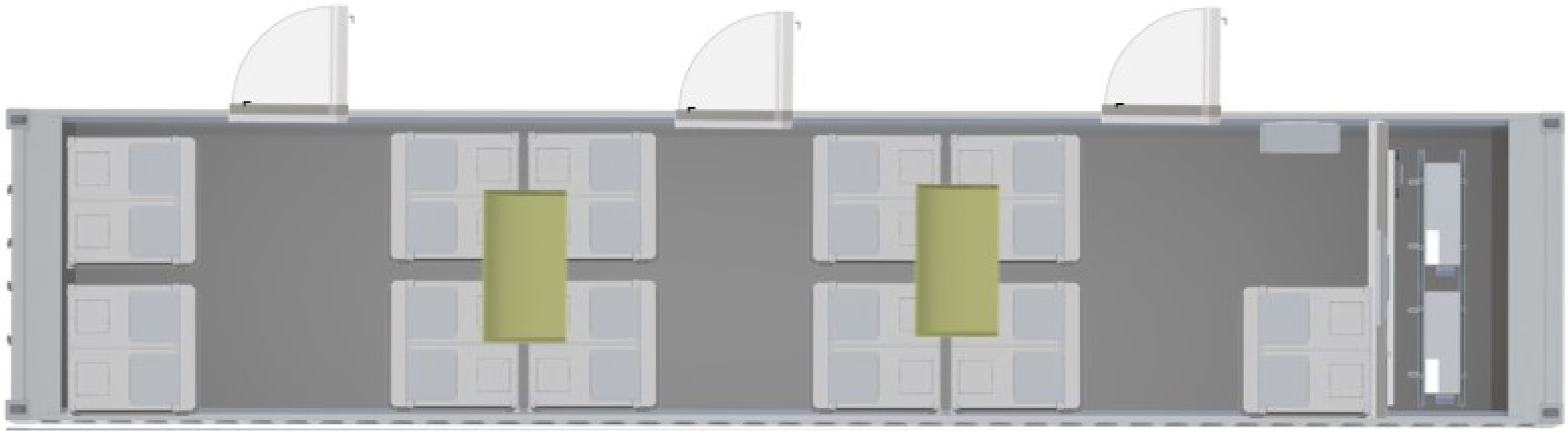
Battery Cabinet



previous page:
2a

next page:
&ELU/5a

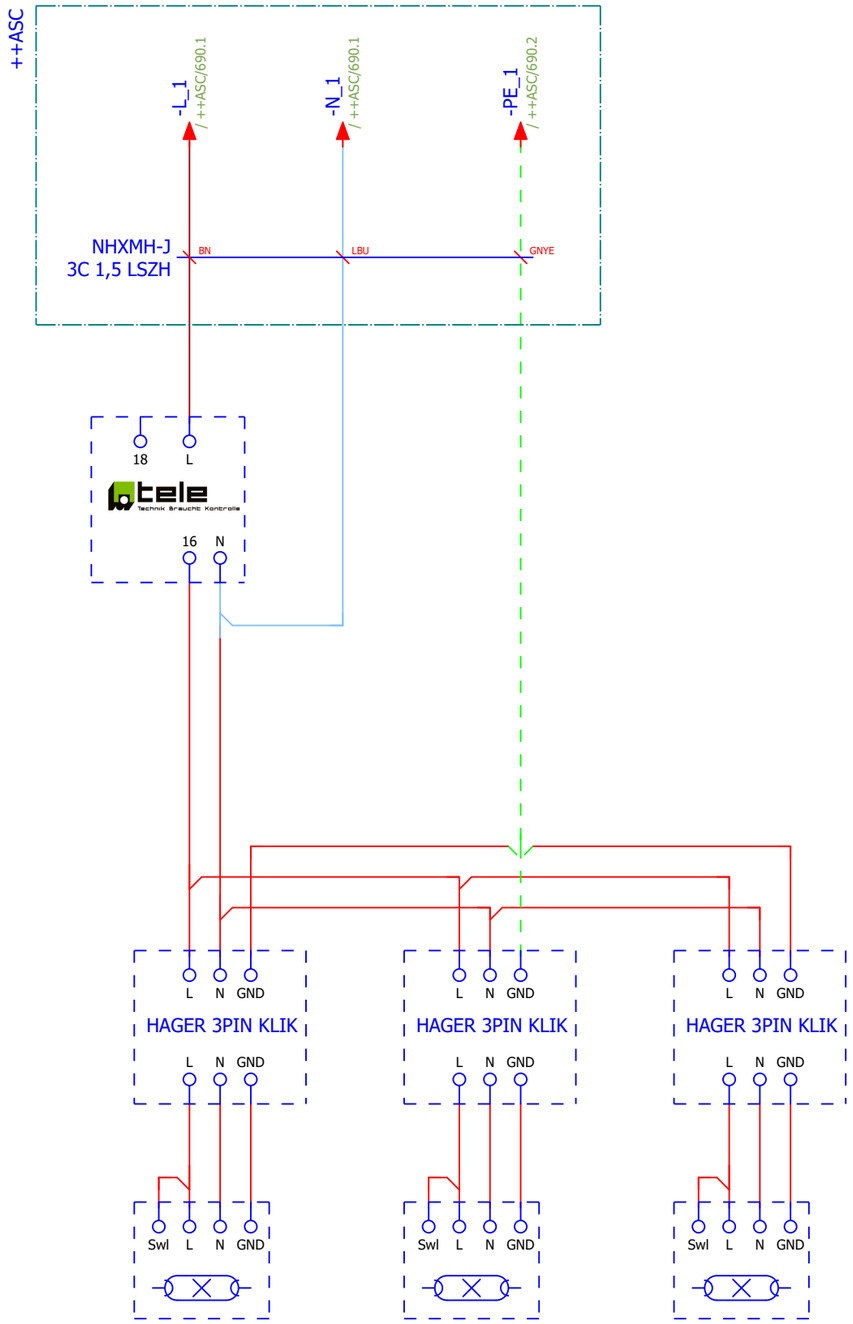
0	1	2	3	4	5	6	7	8	9



previous page:
&EFA/3a

next page:
&EFS++Container/190

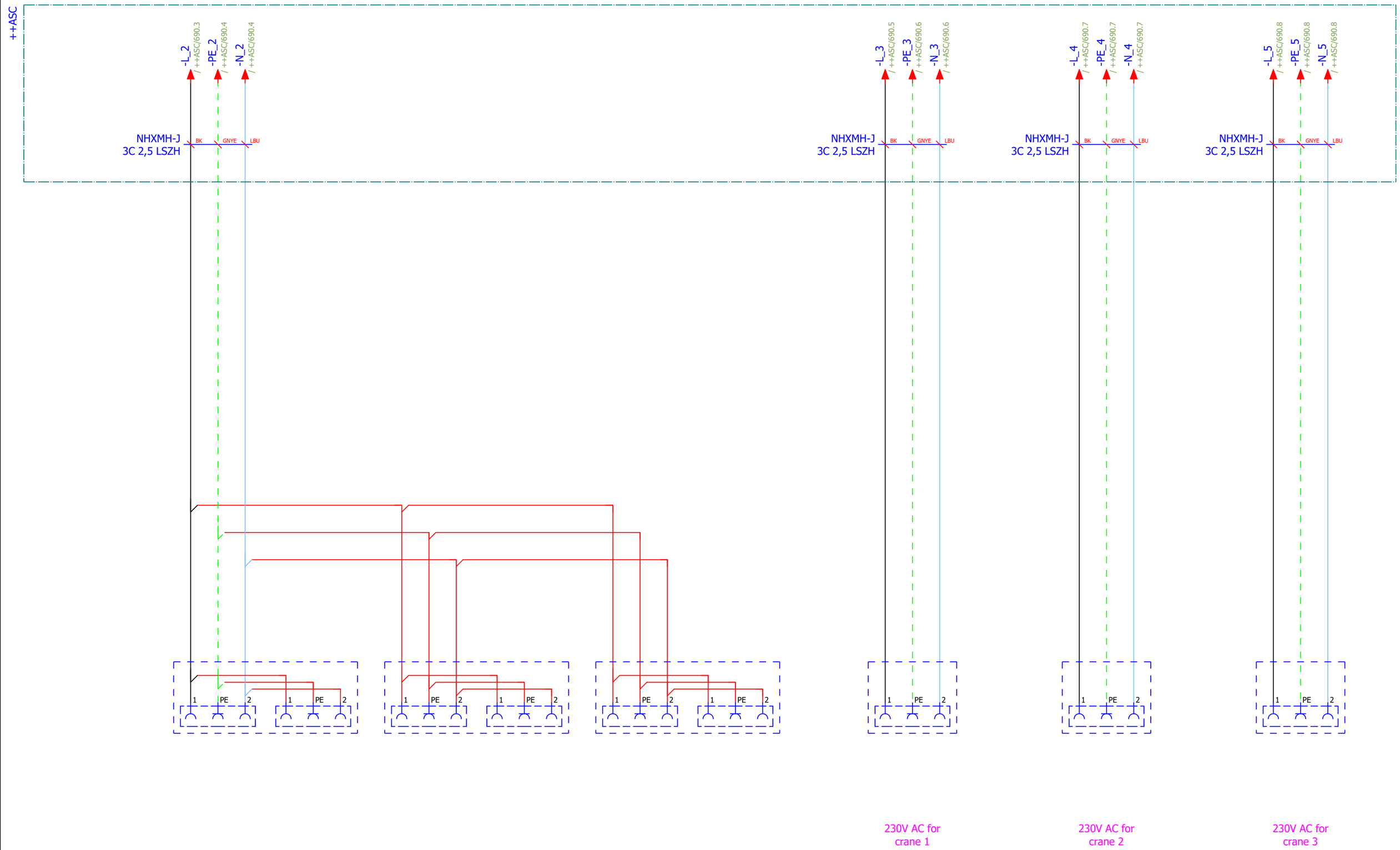
Editor	Freqcon_JD			Statron	FREQCON	Container overview	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024	Norm						& ELU Cabinet Overview	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
191

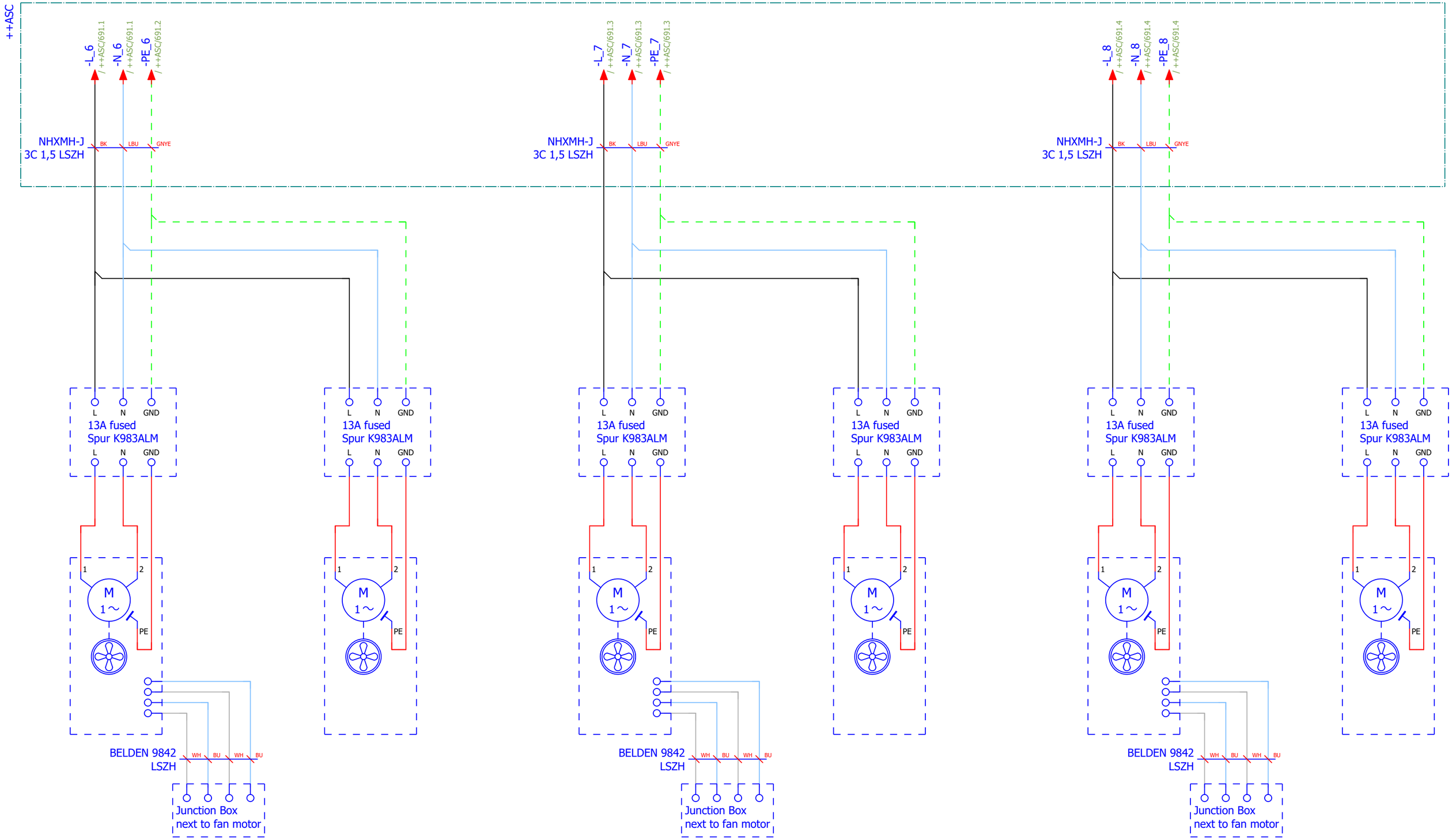
Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492



previous page: 190

next page: 192

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 191
Date								+	total: 492



230V AC for
Exhaust Unit
Battery cabinets 1-4

230V AC for
shut-off flap
Battery cabinets 1-4

230V AC for
Exhaust Unit
Battery cabinets 5-8

230V AC for
shut-off flap
Battery cabinets 5-8

230V AC for
Exhaust Unit
Battery cabinets 9-11

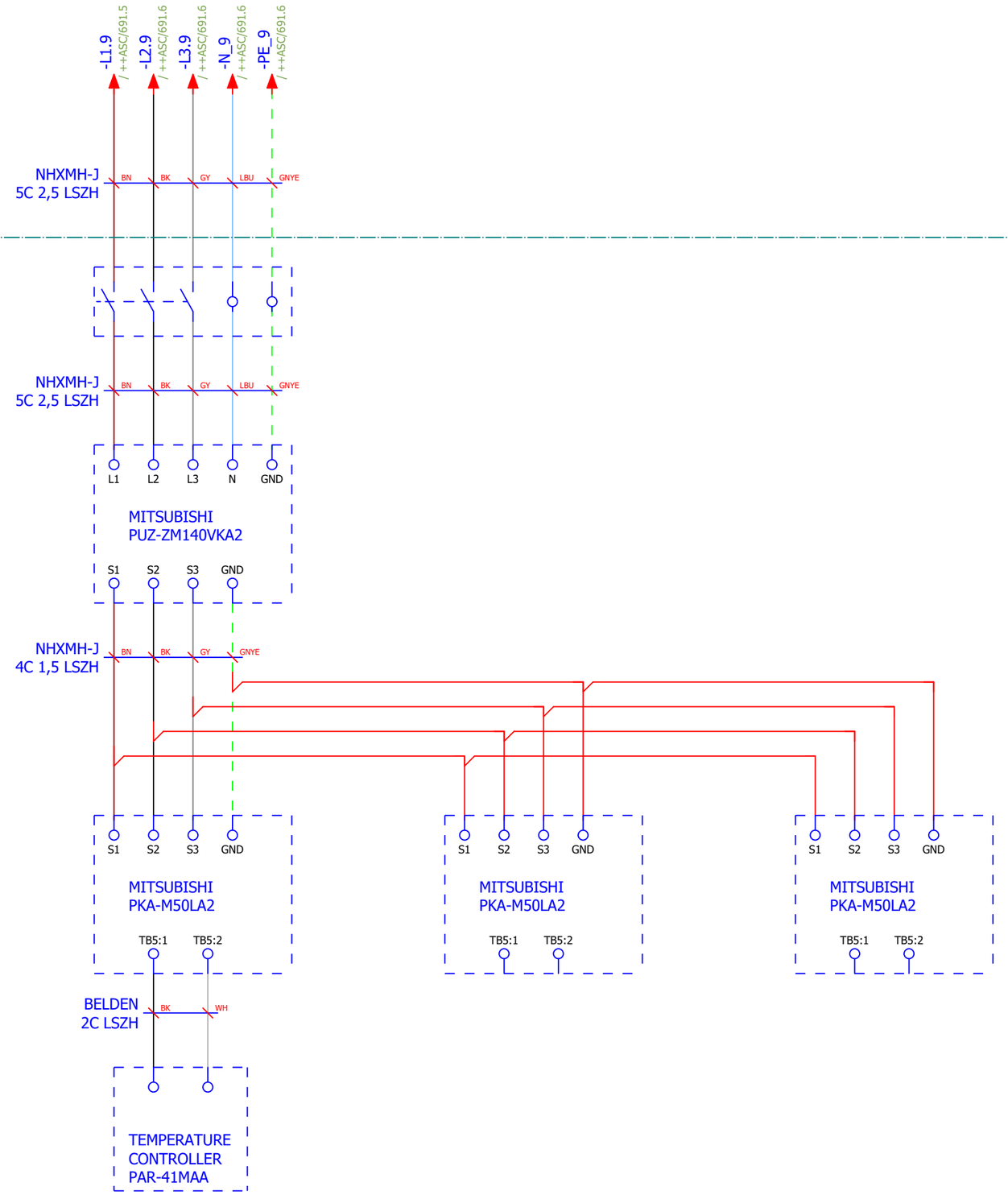
230V AC for
shut-off flap
Battery cabinets 9-11

previous page:
191

next page:
193

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 192
Date								+ total: 492

++ASC

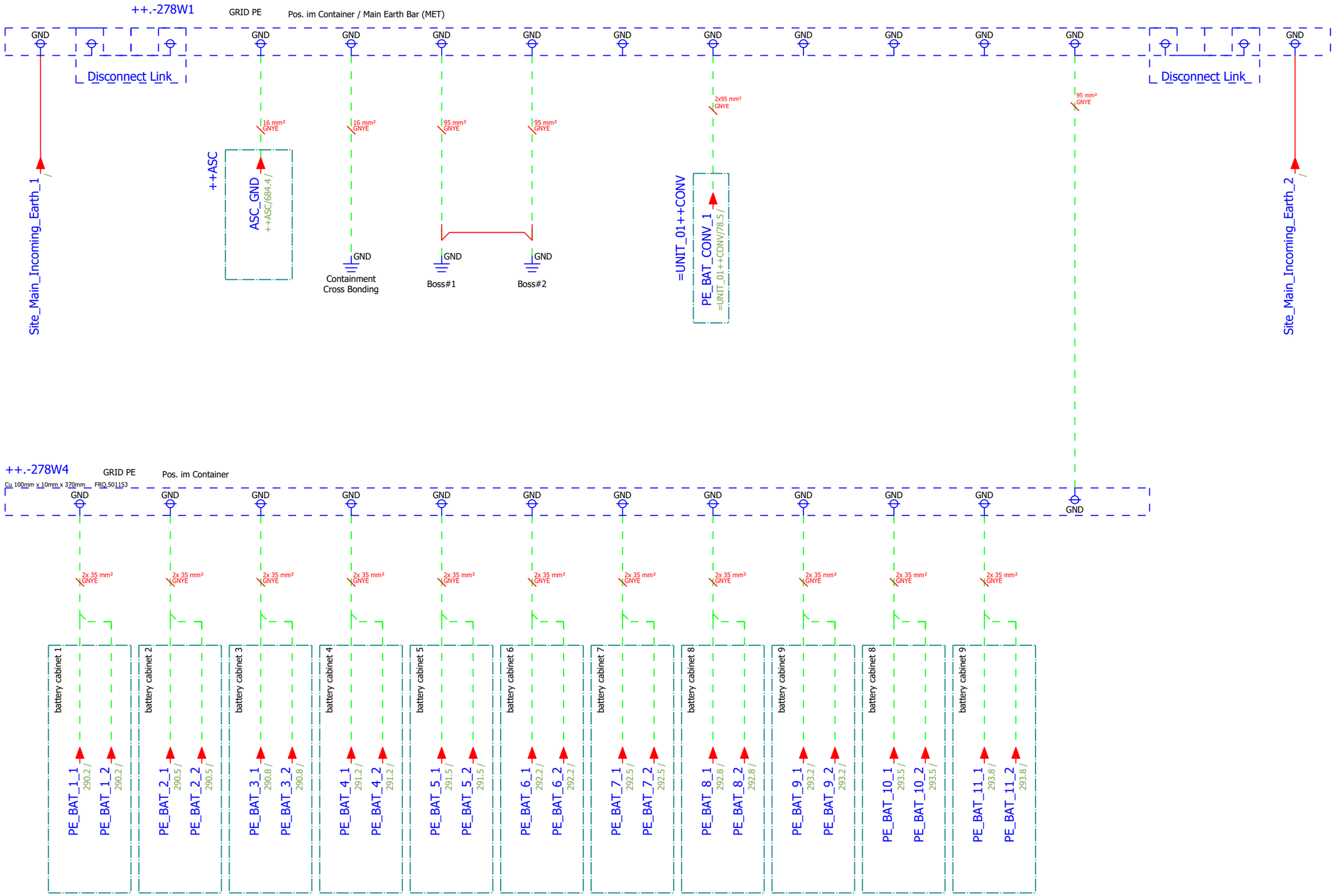


previous page:
192

next page:
278

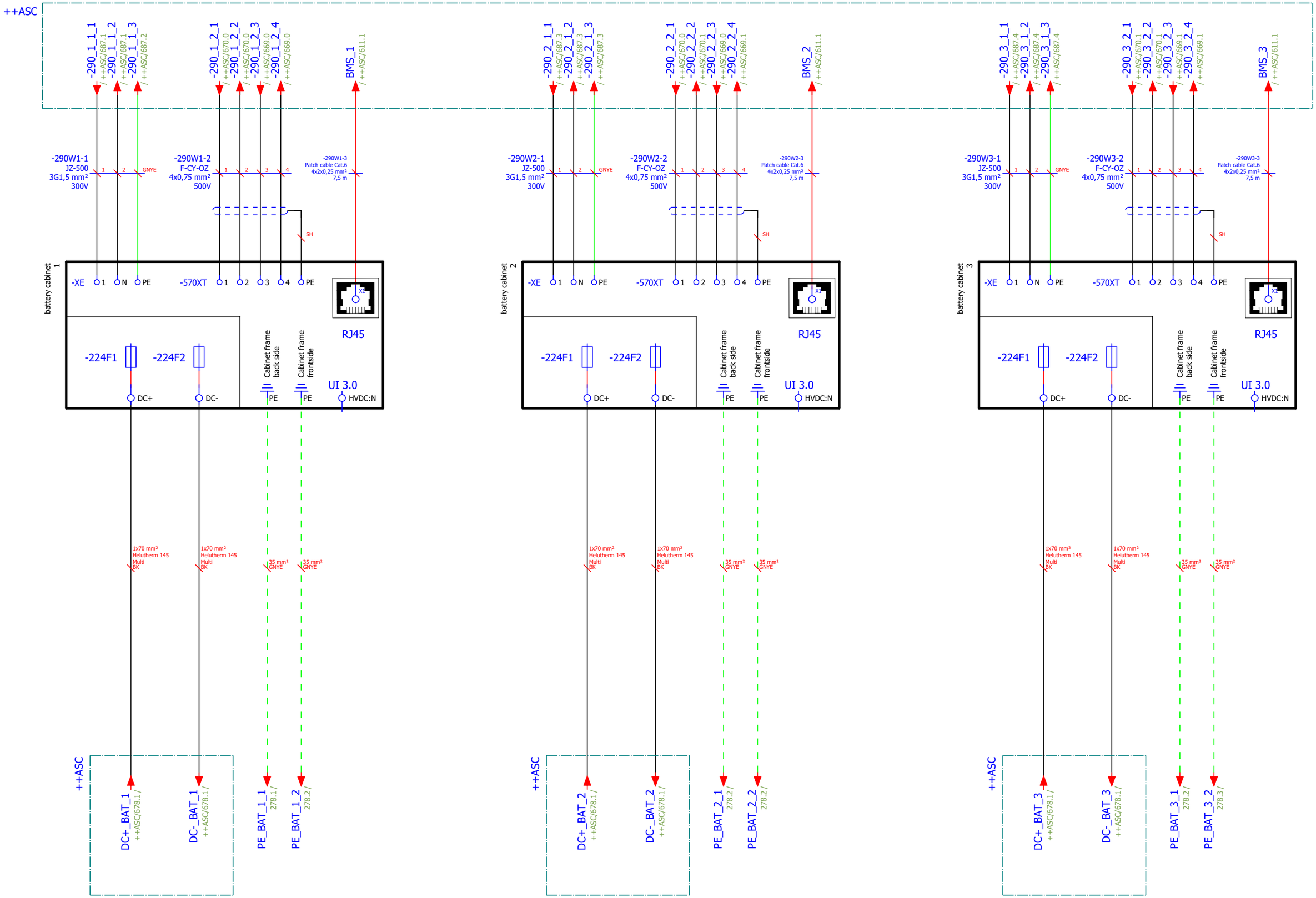
Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 193
Date								+	total: 492

Busbars PE



previous page: 193

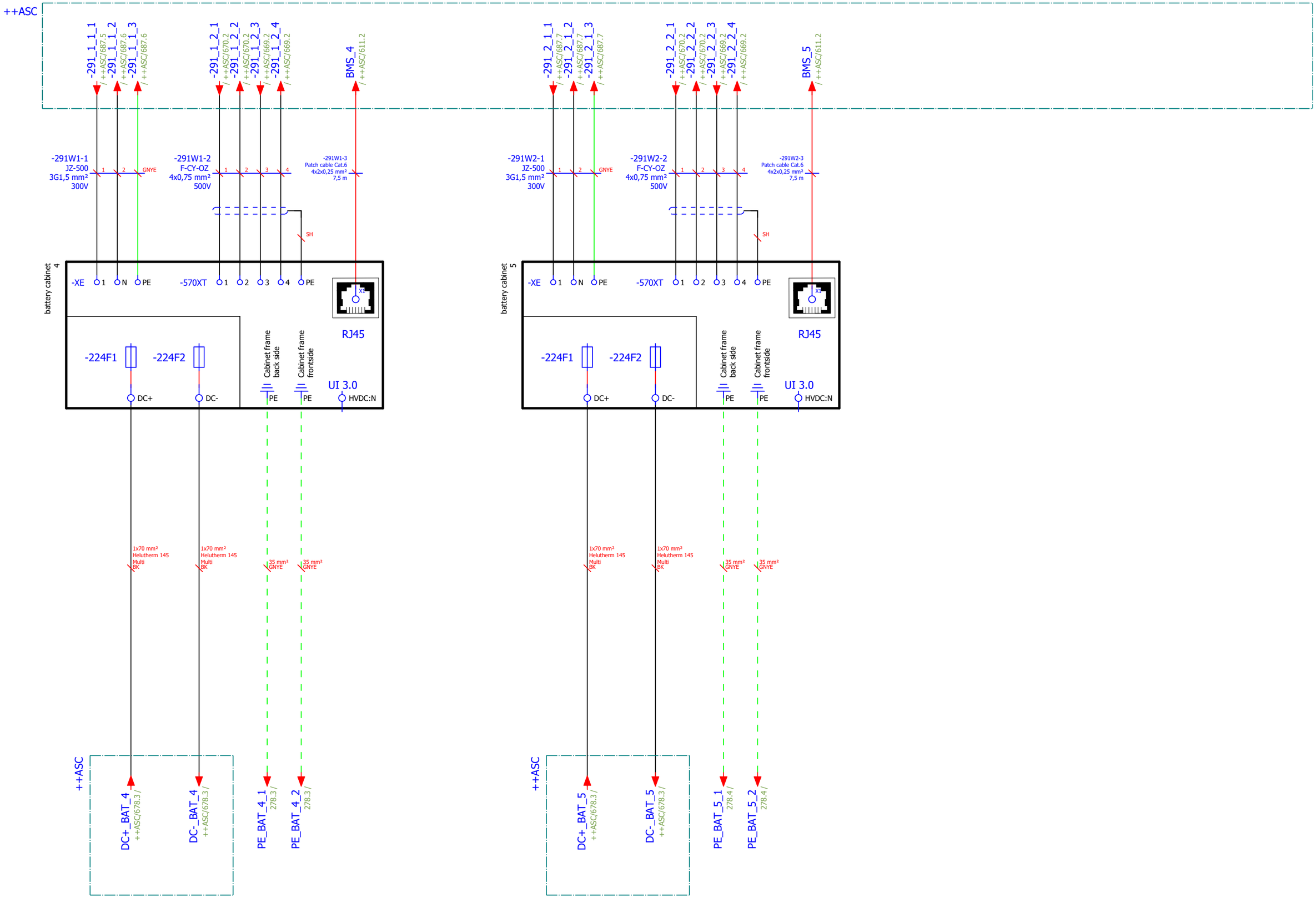
next page: 290



previous page: 278

next page: 291

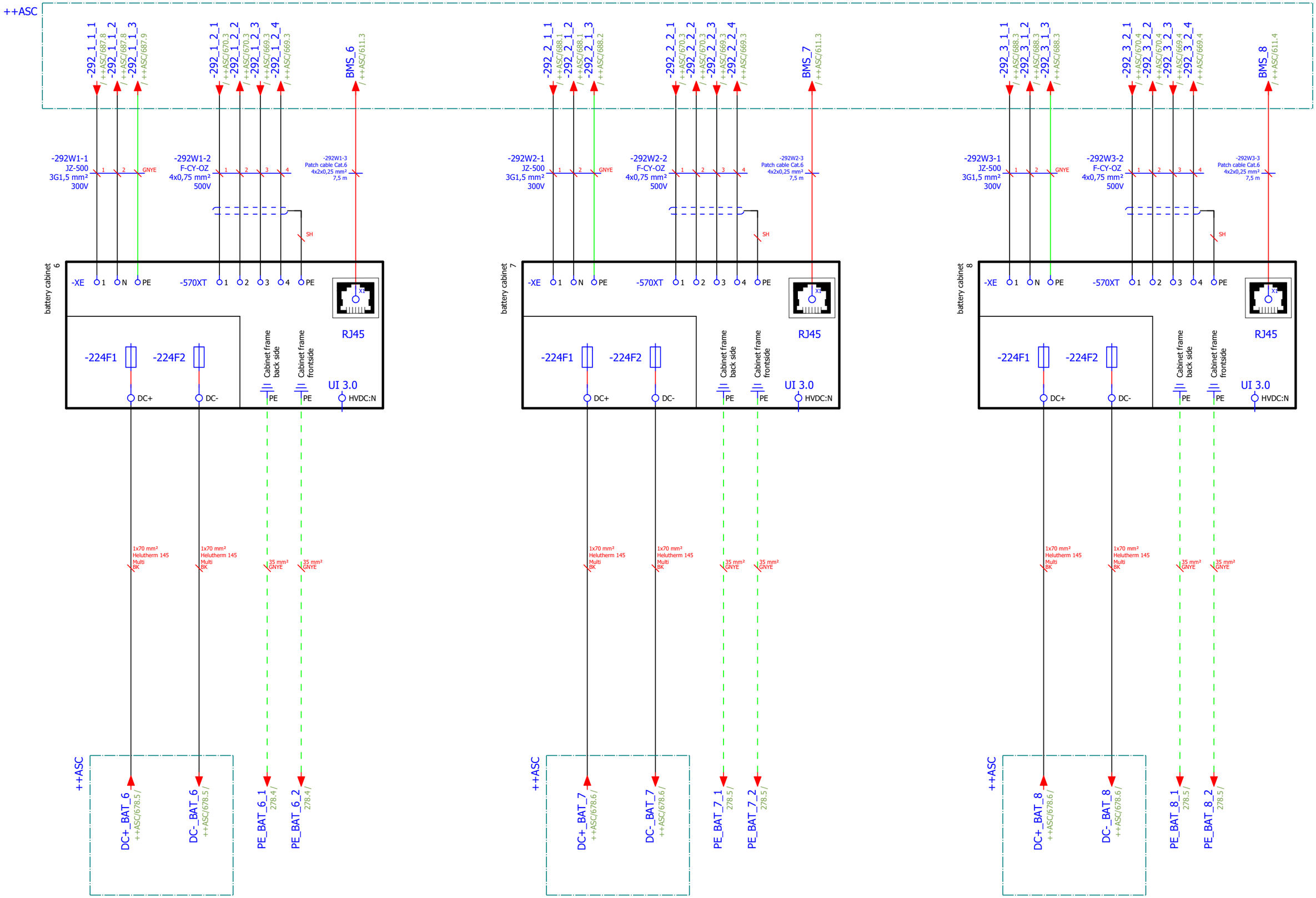
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 1-3	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 290
Date								+	total: 492



previous page: 290

next page: 292

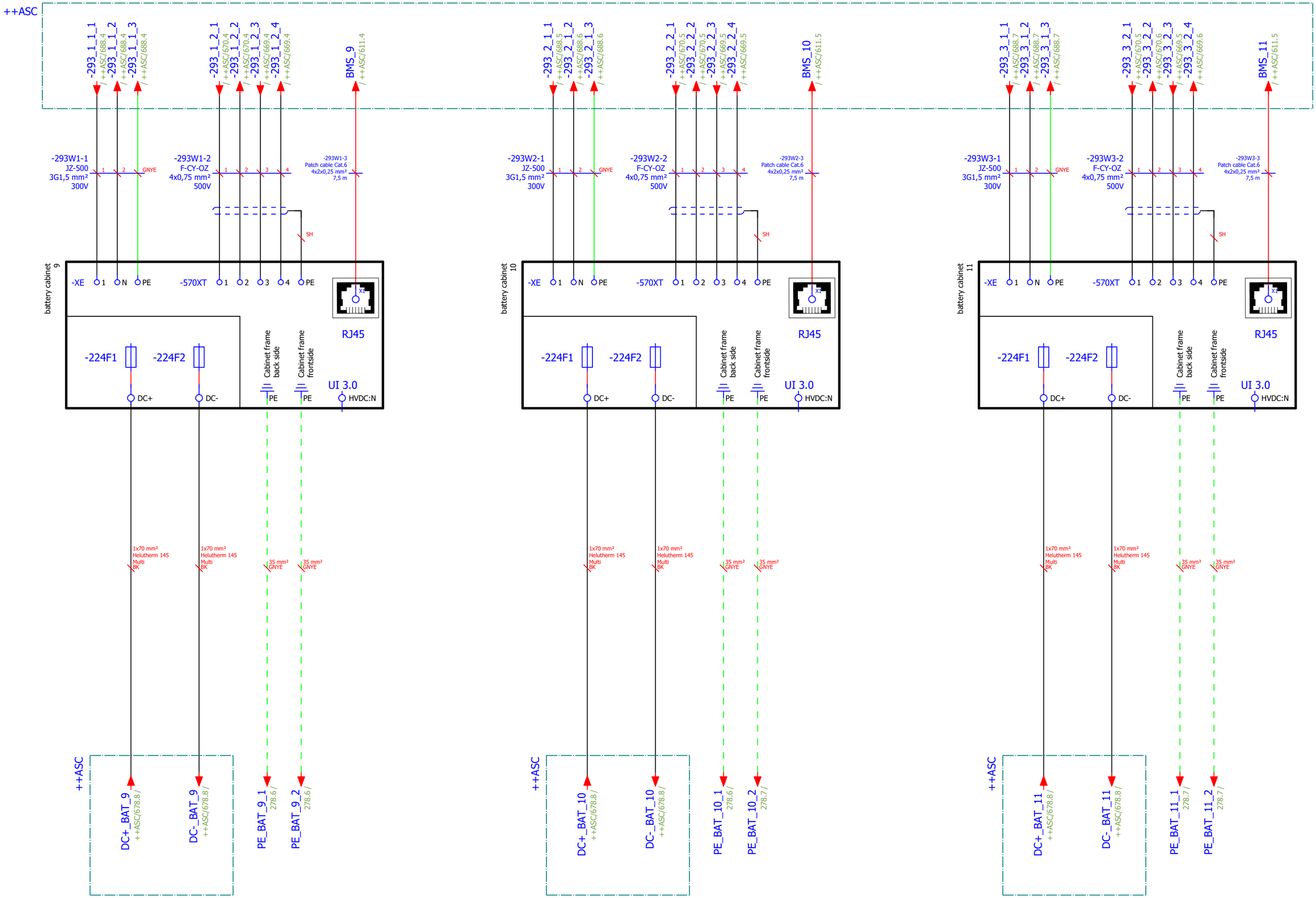
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 4+5	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 291
Date								+	total: 492



previous page: 291

next page: 293

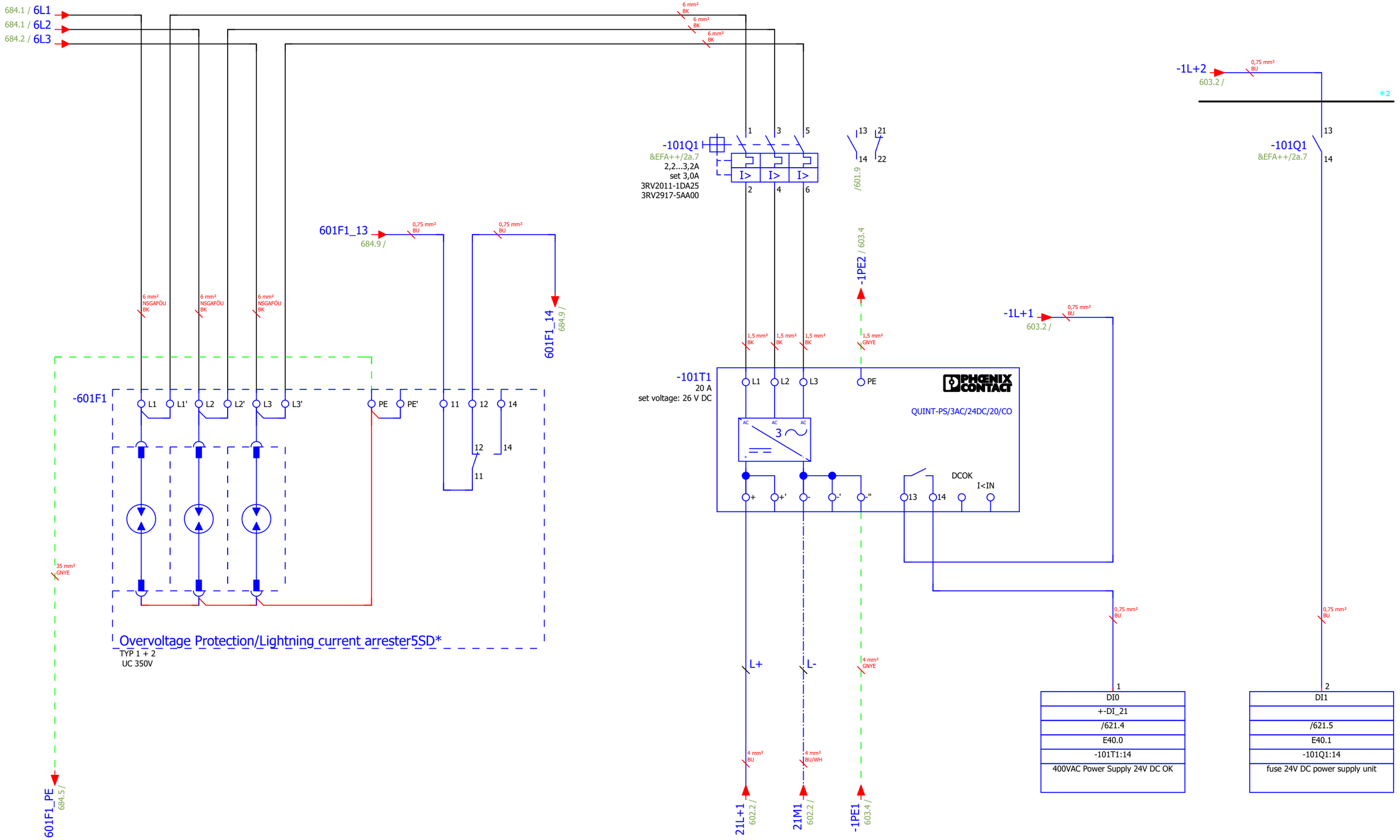
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 6-8	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 292
Date								+	total: 492



previous page: 292

next page: ++ASC/601

Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 9-11	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 293
Date								+	total: 492



previous page:
++Container/293

Power supply unit from 400V AC

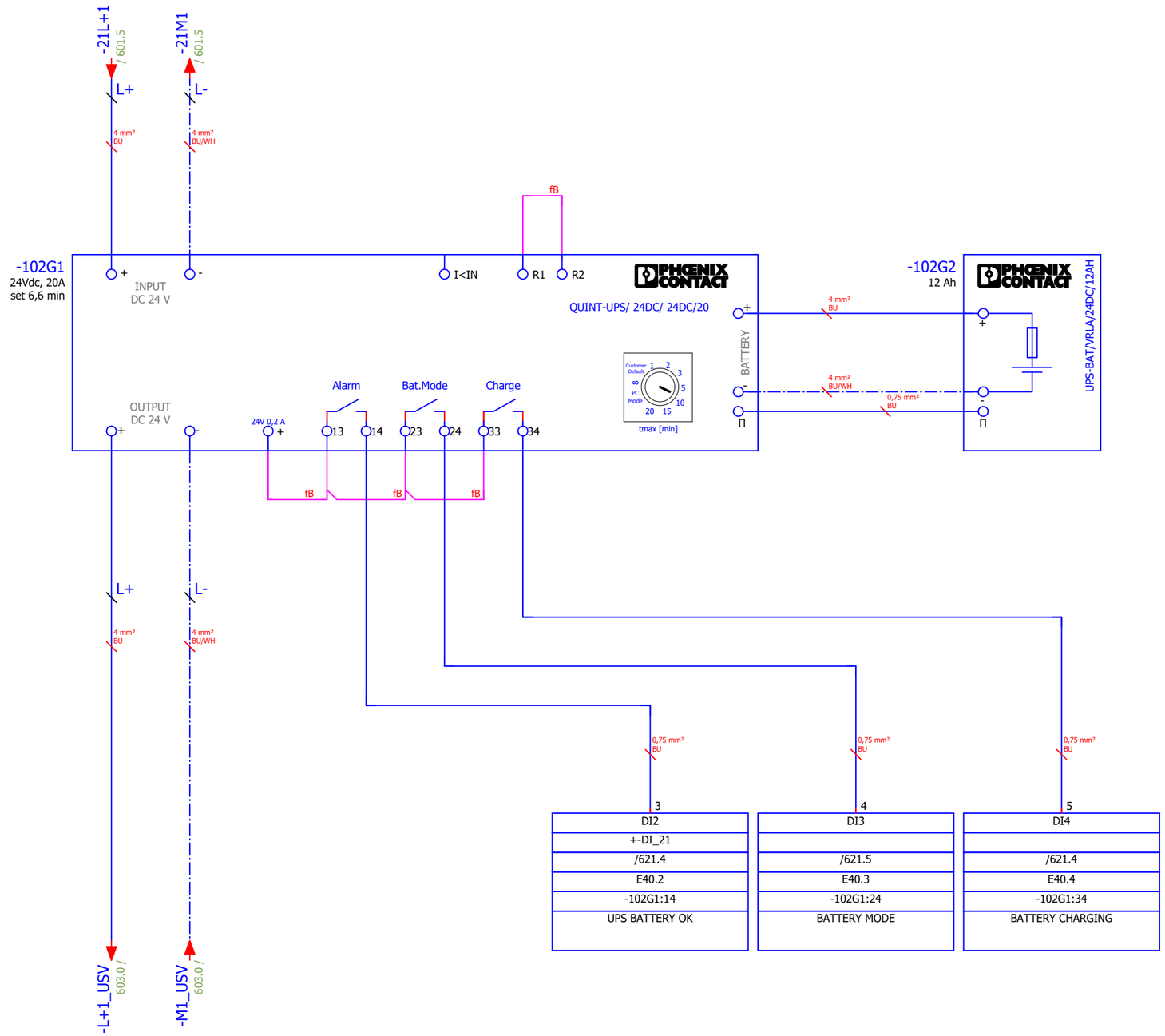
400VAC
Power Supply
24V DC OK

fuse
24V DC power supply unit

next page:
602

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

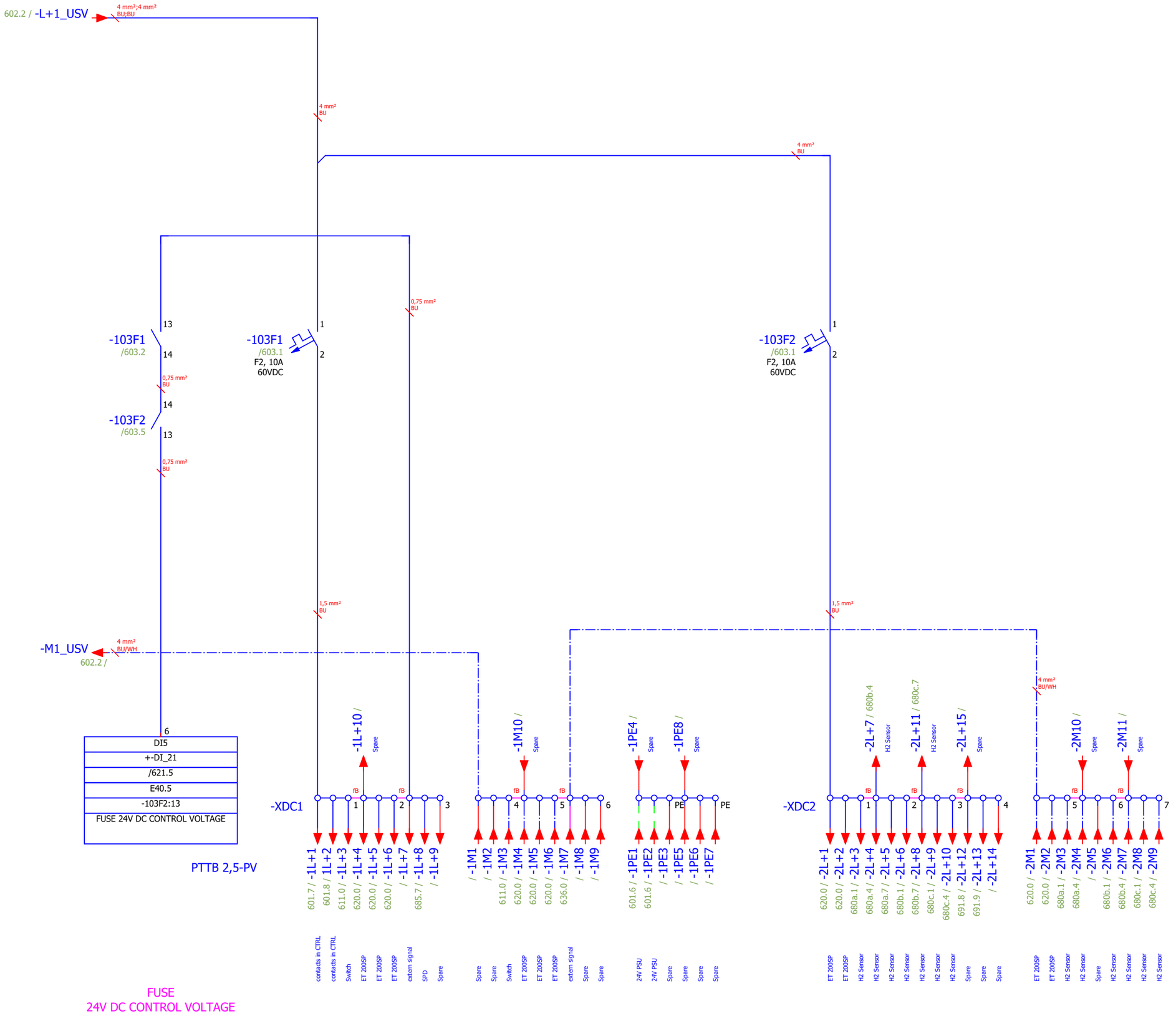
page: 601
total: 492



previous page:
601

next page:
603

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 602
Date								+ — total: 492

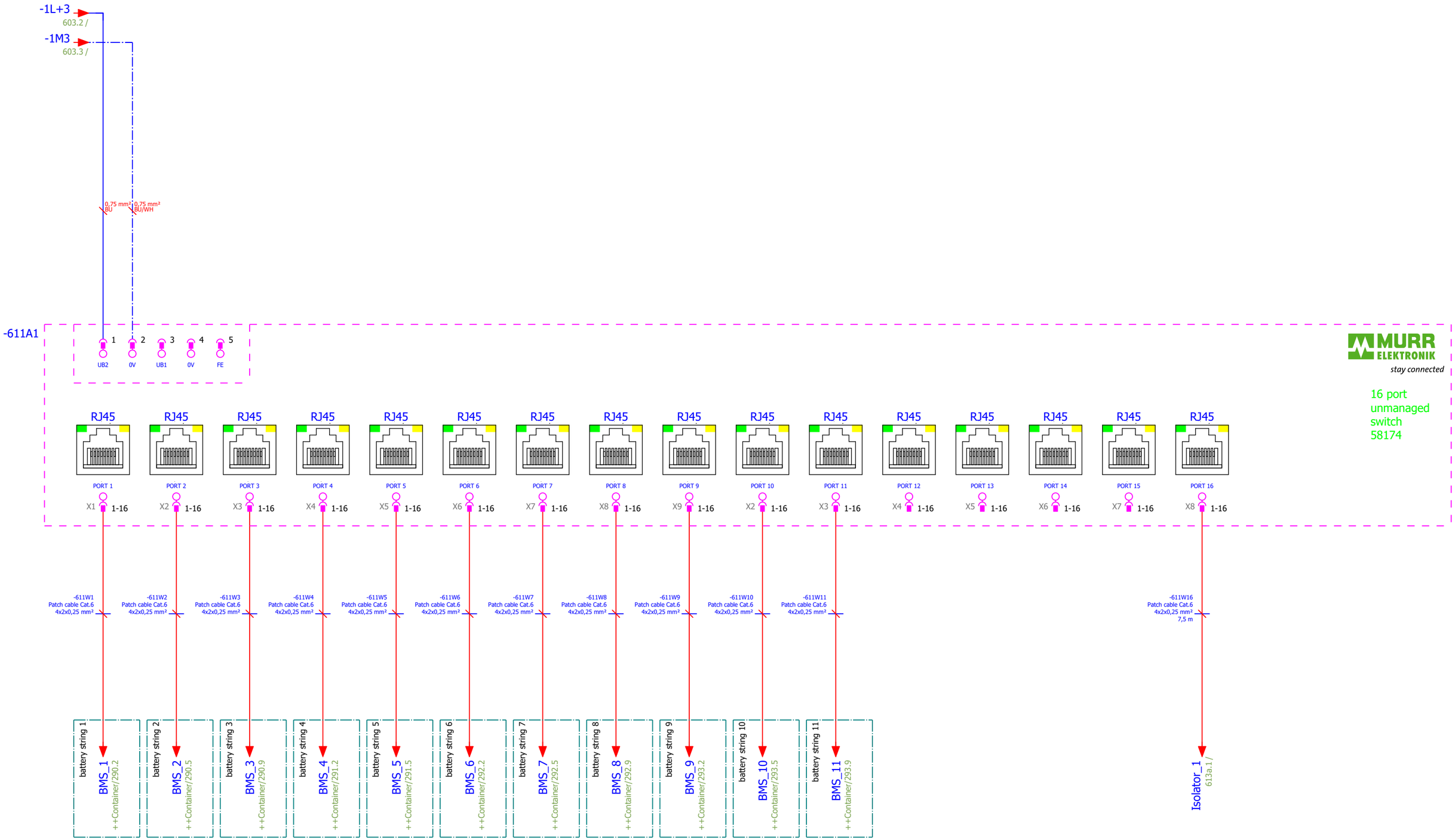


previous page:
602

next page:
611

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_02	Battery Container 1
Date	21.01.2025							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxiliary cabinet
Date								+	

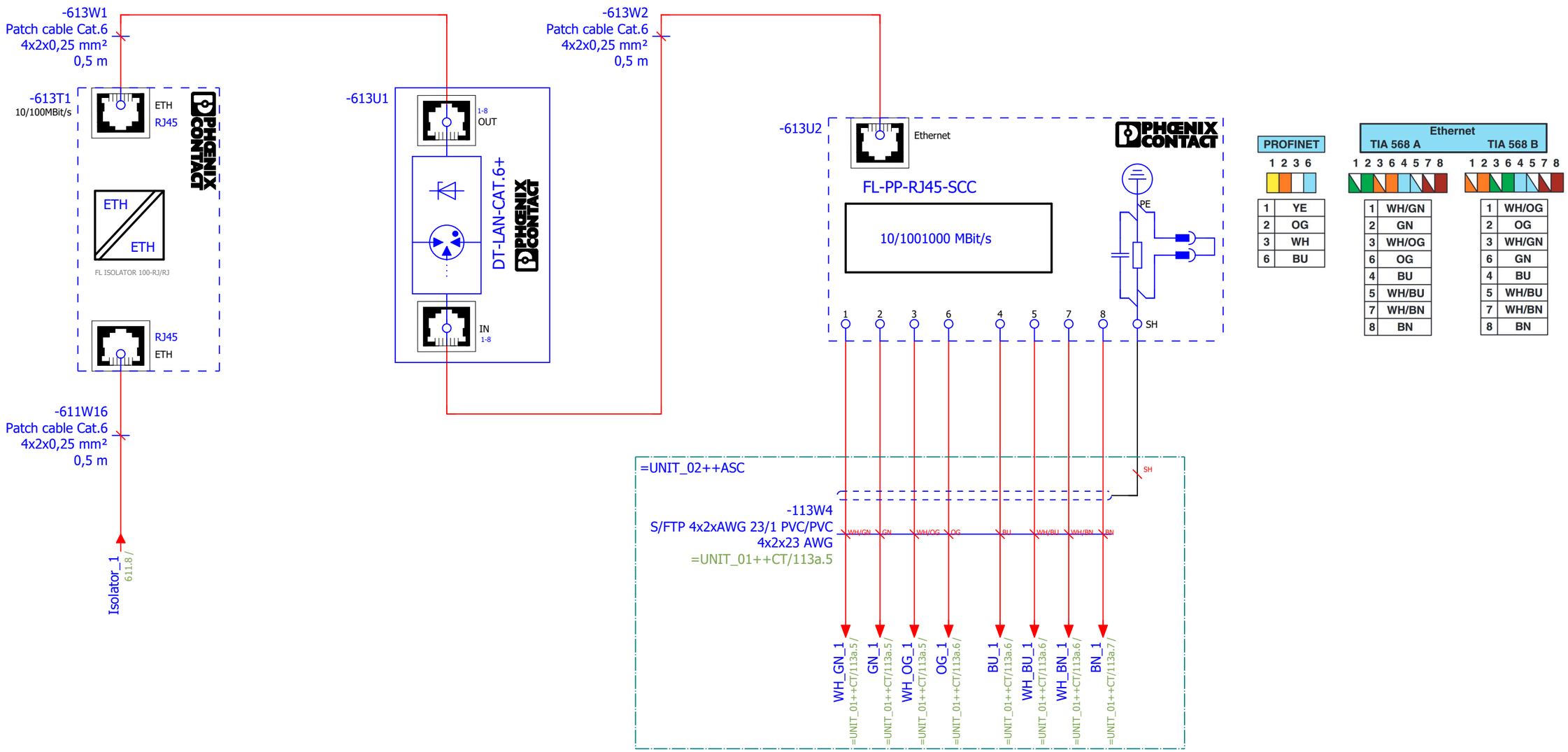
page: 603
total: 492



previous page: 603

next page: 613a

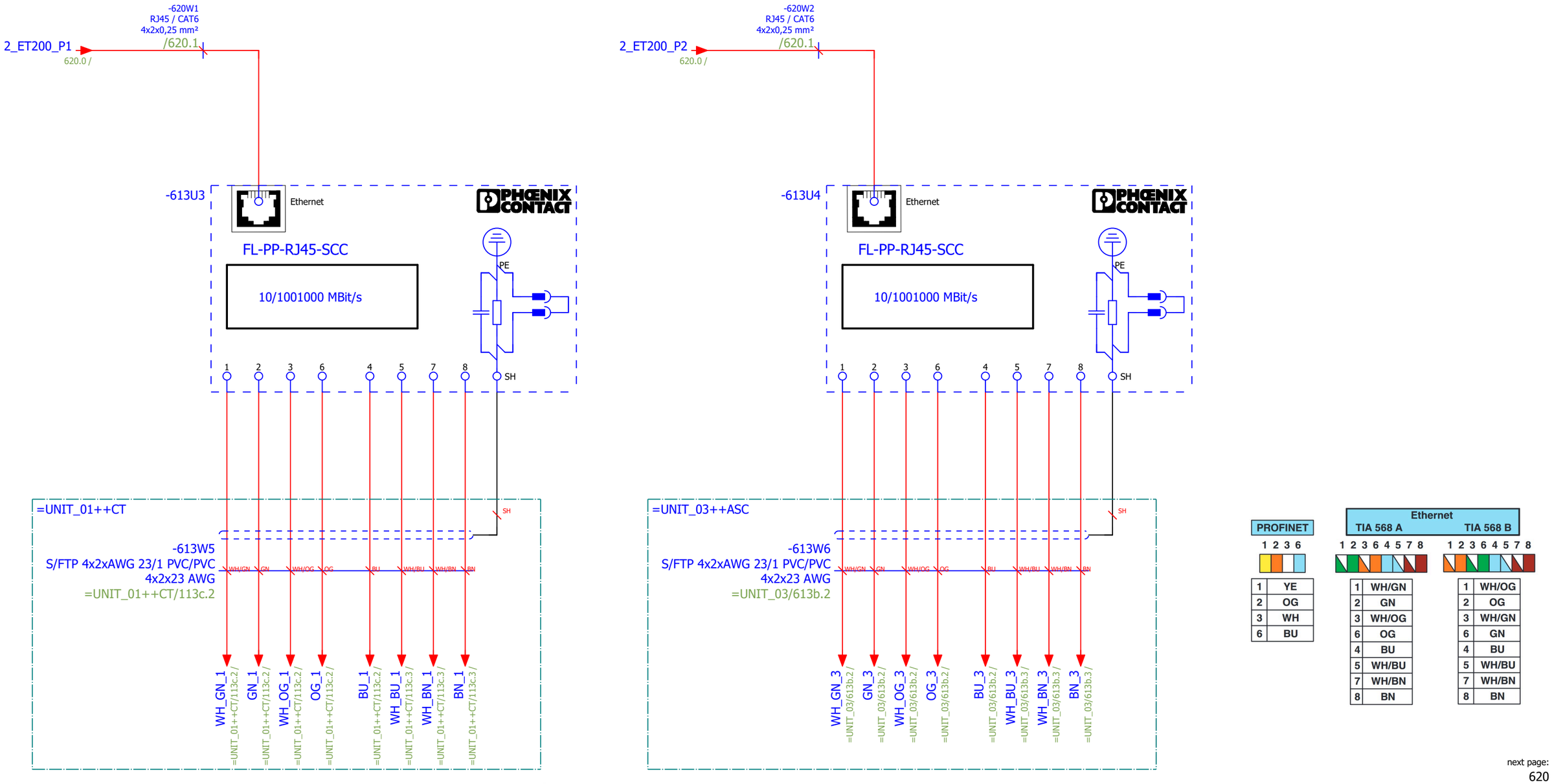
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 492



previous page:
611

next page:
613b

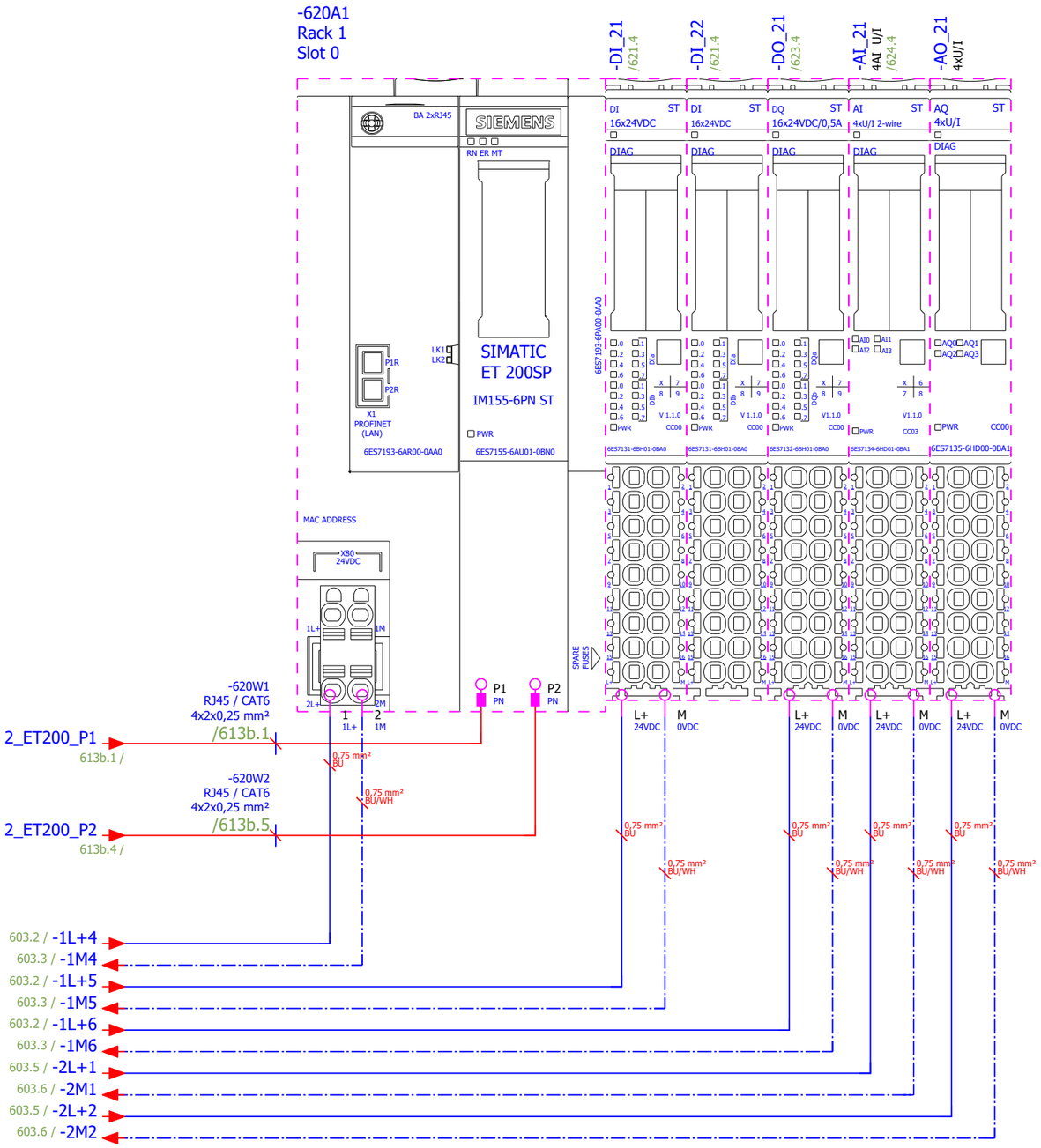
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	25.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 613a
Date								+	total: 492



previous page:
613a

next page:
620

Editor	Freqcon_DG			Statron	FREQCON	PROFINET	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613b
Date								+		total: 492



previous page:
613b

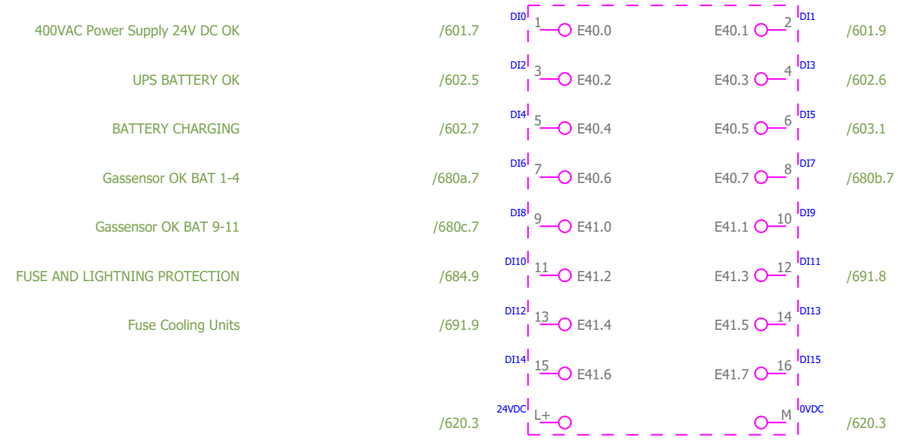
next page:
621

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC ASC	20250805_V2.0	= UNIT_02	Battery Container 1
Date	03.12.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 620
total: 492

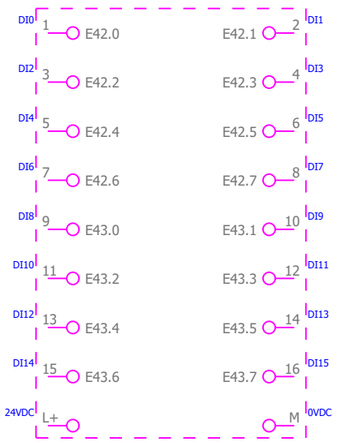
-DI_21

/620.3



-DI_22

/620.3



previous page: 620

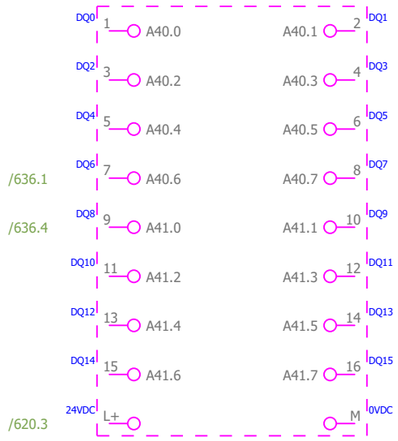
next page: 623

Editor	Freqcon_DG			Statron	FREQCON	ET200SP DIGITAL INPUTS DI_21 + DI_22	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	03.12.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 621
Date								+	total: 492

0	1	2	3	4	5	6	7	8	9

-DO_21

/620.3



230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4 /636.1

230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11 /636.4

/620.3

/636.2 230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8

/620.4

previous page: 621

next page: 624

Editor	Freqcon_JD			Statron	FREQCON	ET200SP DIGITAL OUTPUTS DO_21	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 623
Date								+	total: 492

-AI_21

/620.4



gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

/620.4

/680b.2 gas concentration BAT 5-8

/680b.2 gas concentration BAT 5-8

/620.4

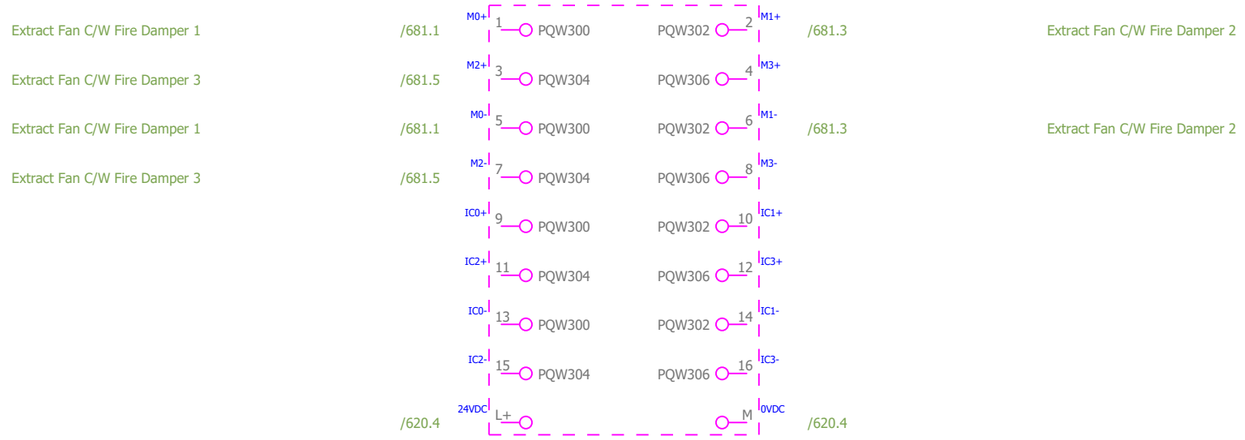
previous page: 623

next page: 625

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_21	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 624
Date								+	total: 492

-AO_21

/620.4



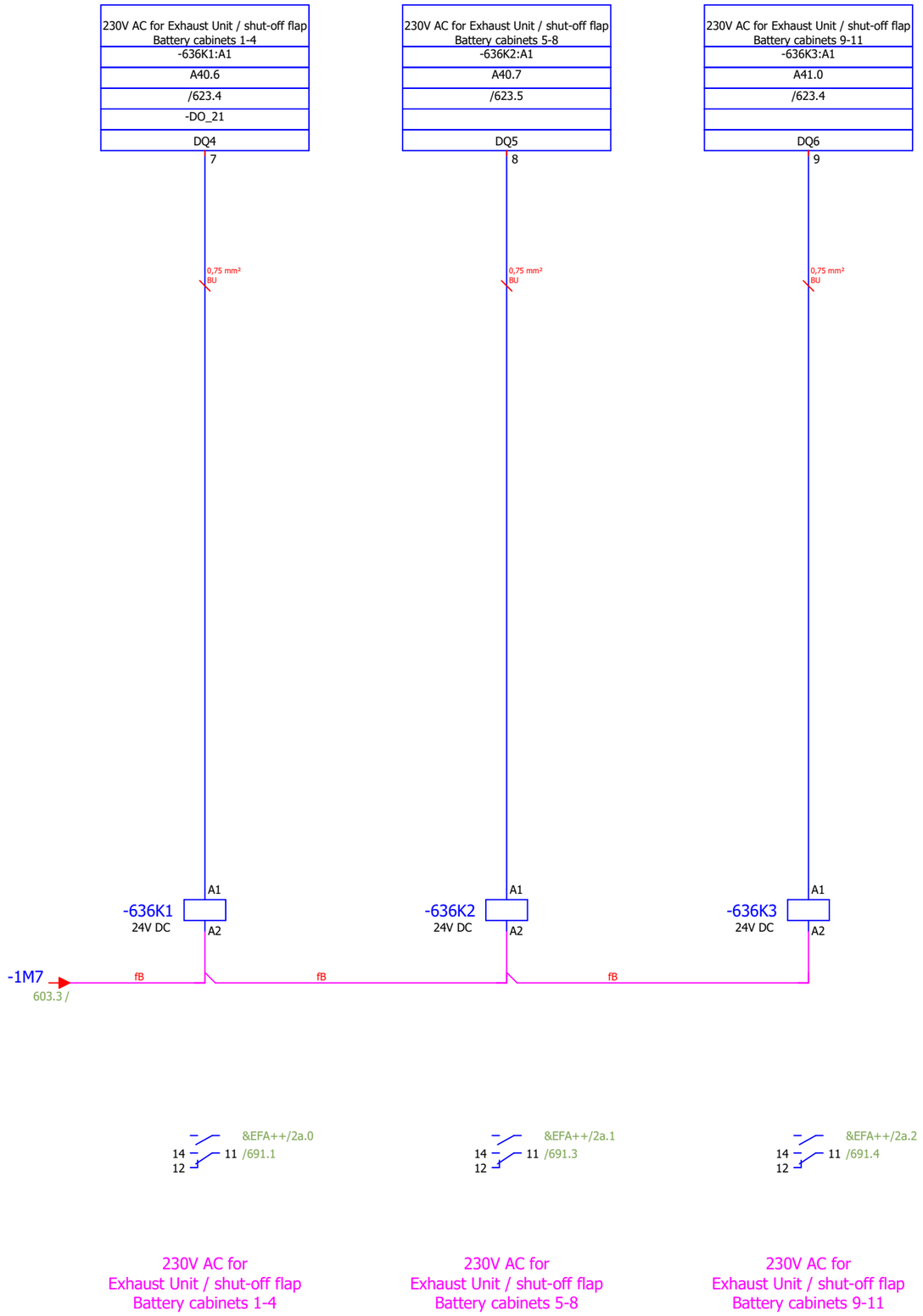
previous page: 624

next page: 636

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG OUTPUTS AO_21	20250805_V2.0	= UNIT_02	Battery Container 1
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 625

total: 492

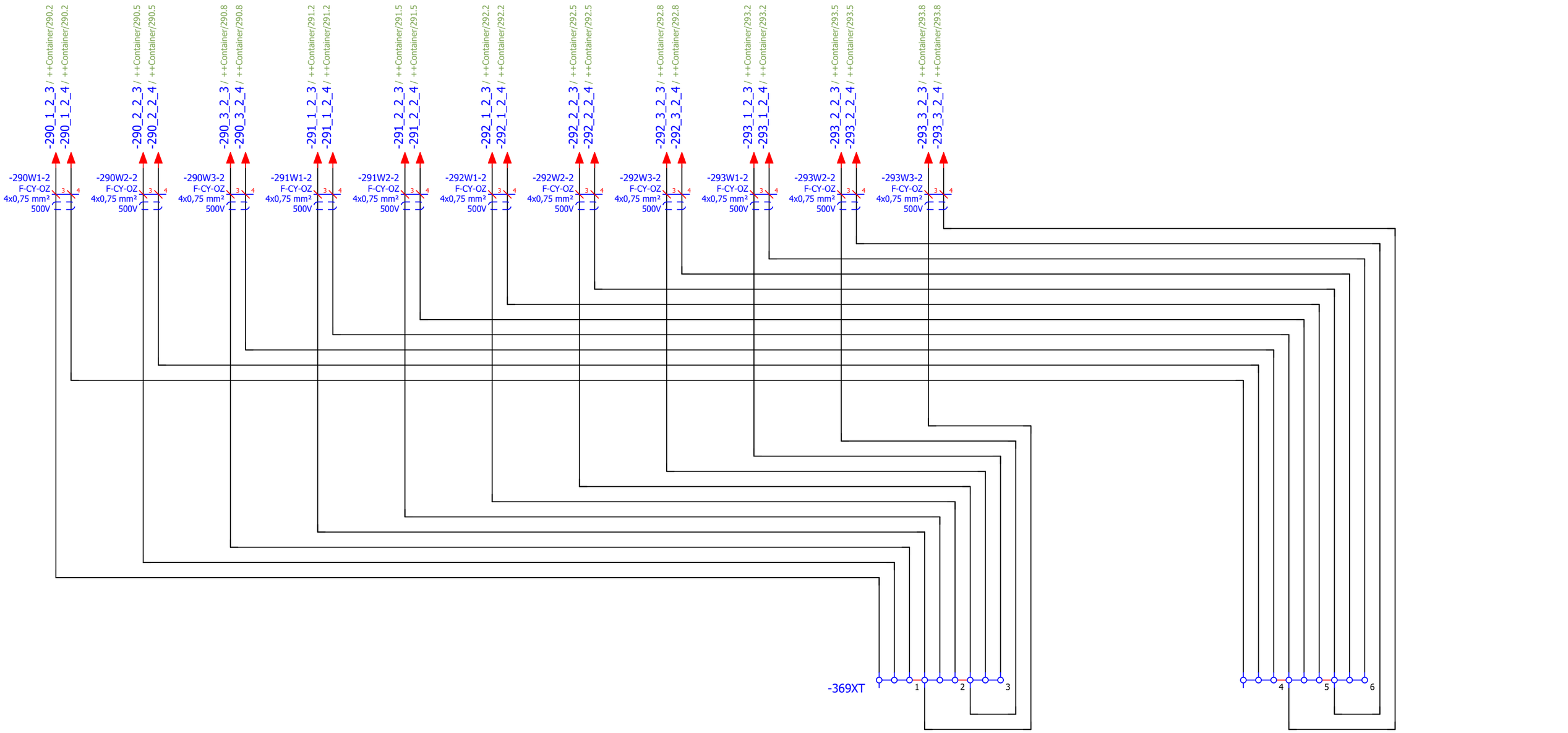


previous page: 625

next page: 669

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FIRE DAMPER	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 636
total: 492



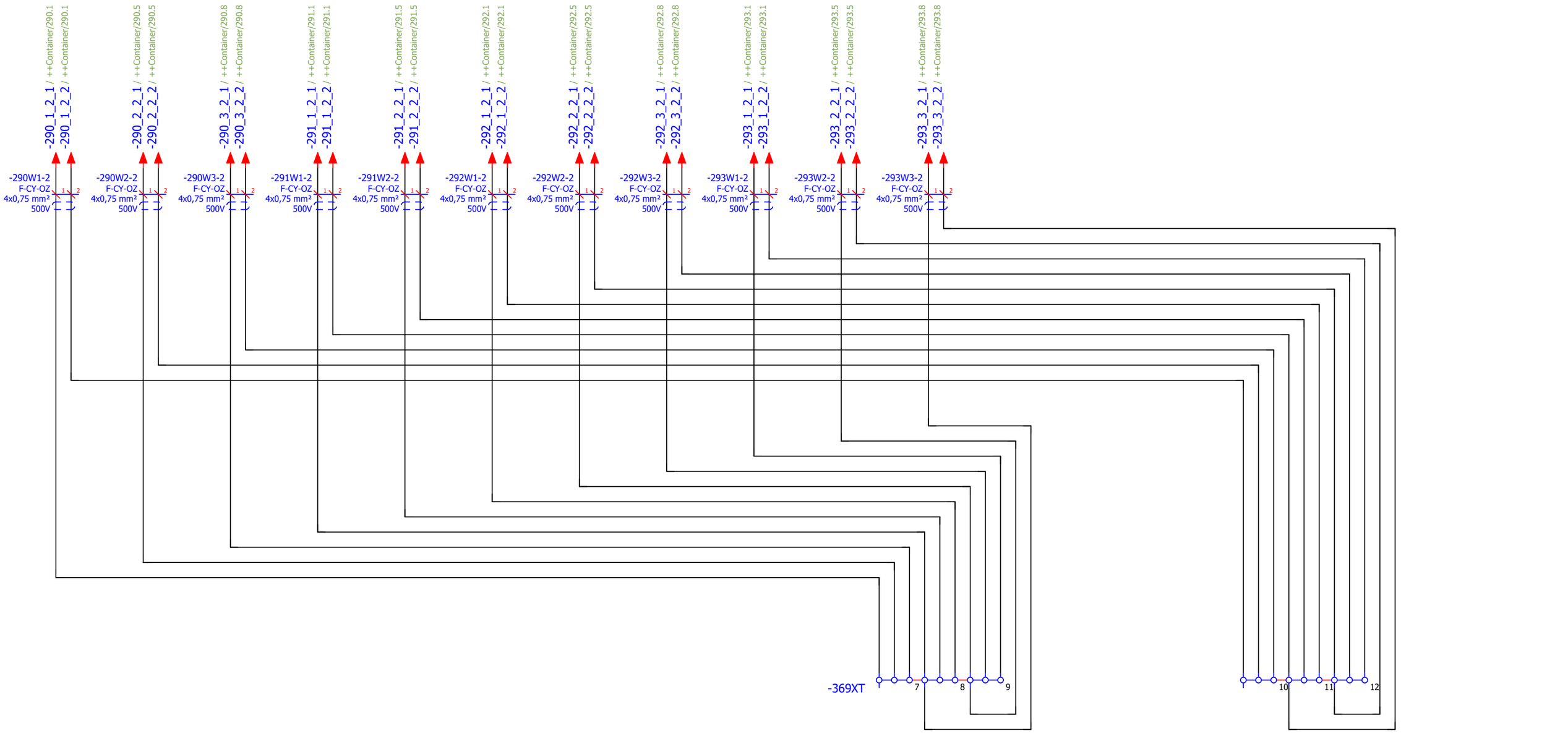
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page: 636

next page: 670

Editor	Freqcon_JD			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 492



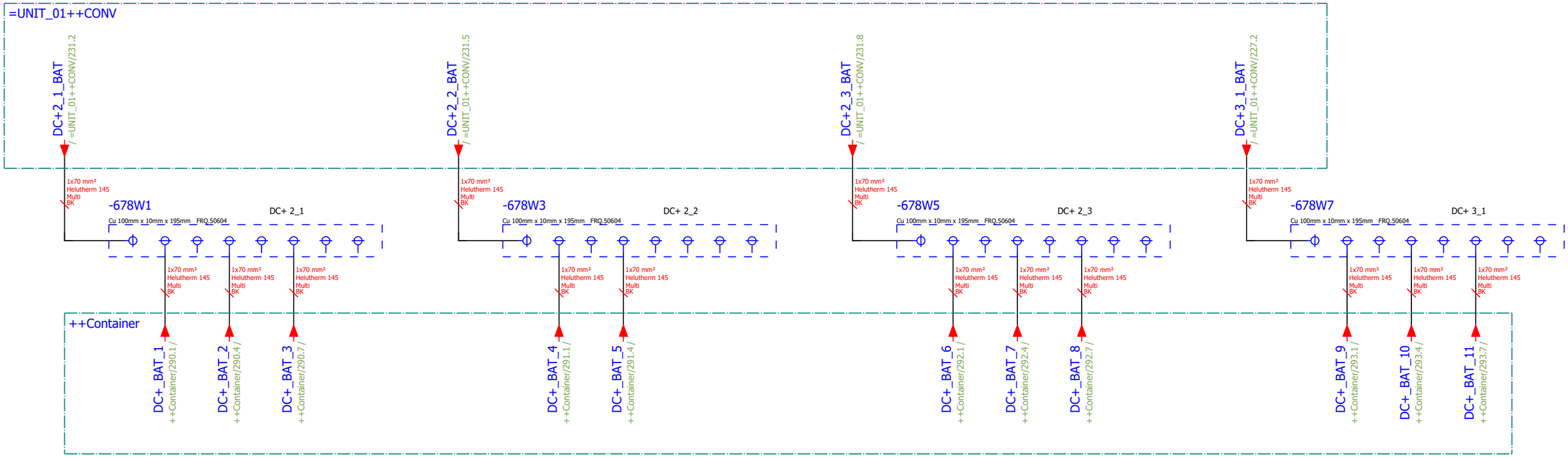
battery cabinet gas
potential-free contacts
customer

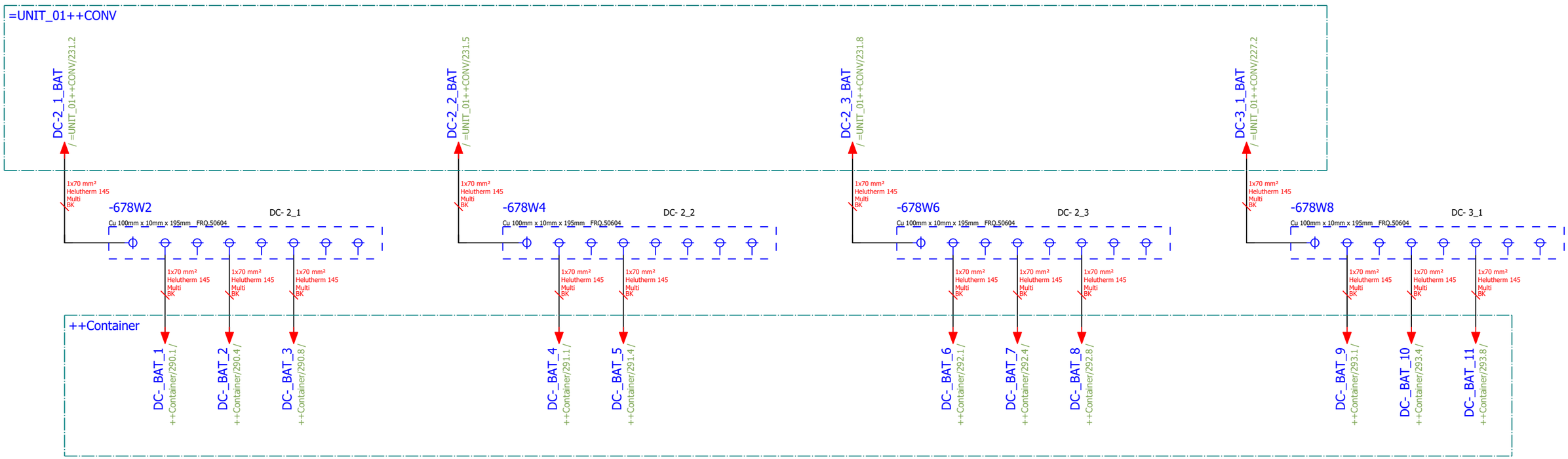
battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
678

Editor	Freqcon_JD			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 492





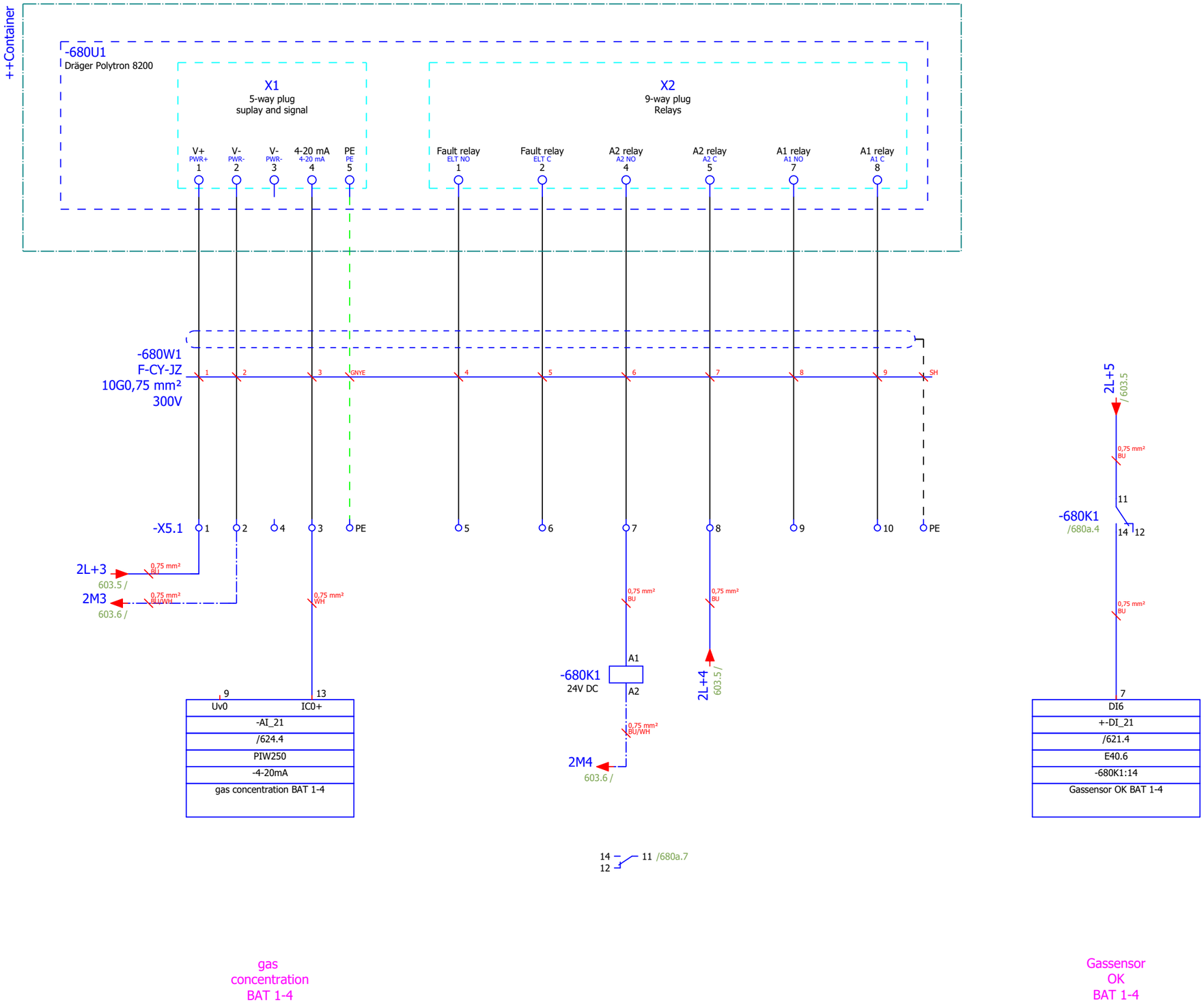
previous page: 670

next page: 680a

Editor	Freqcon_JD			Statron	FREQCON	DC BATTERY CABINETS	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 678

total: 492



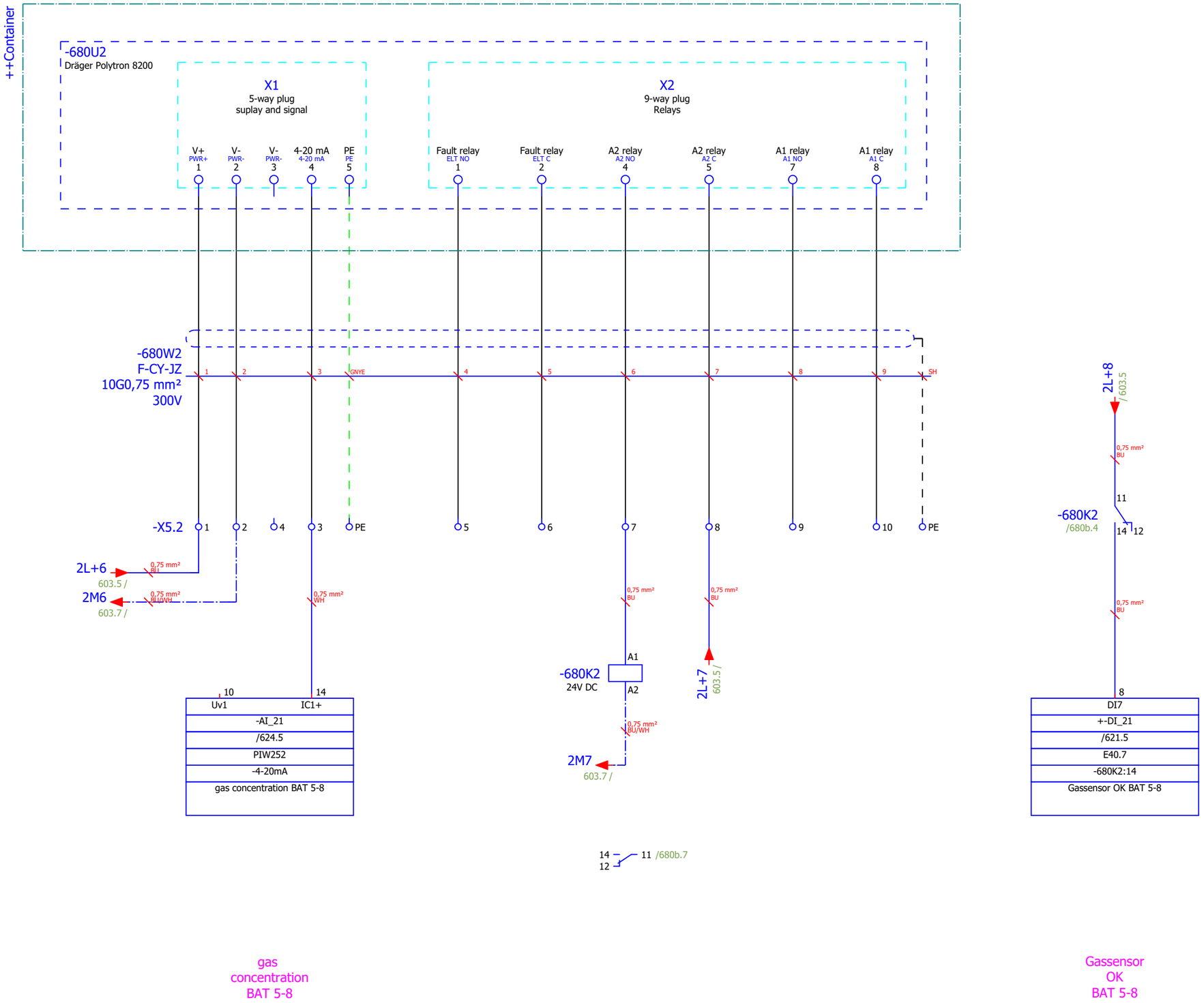
gas concentration BAT 1-4

Gassensor OK BAT 1-4

previous page: 678

next page: 680b

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 1-4	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680a
Date								+	total: 492



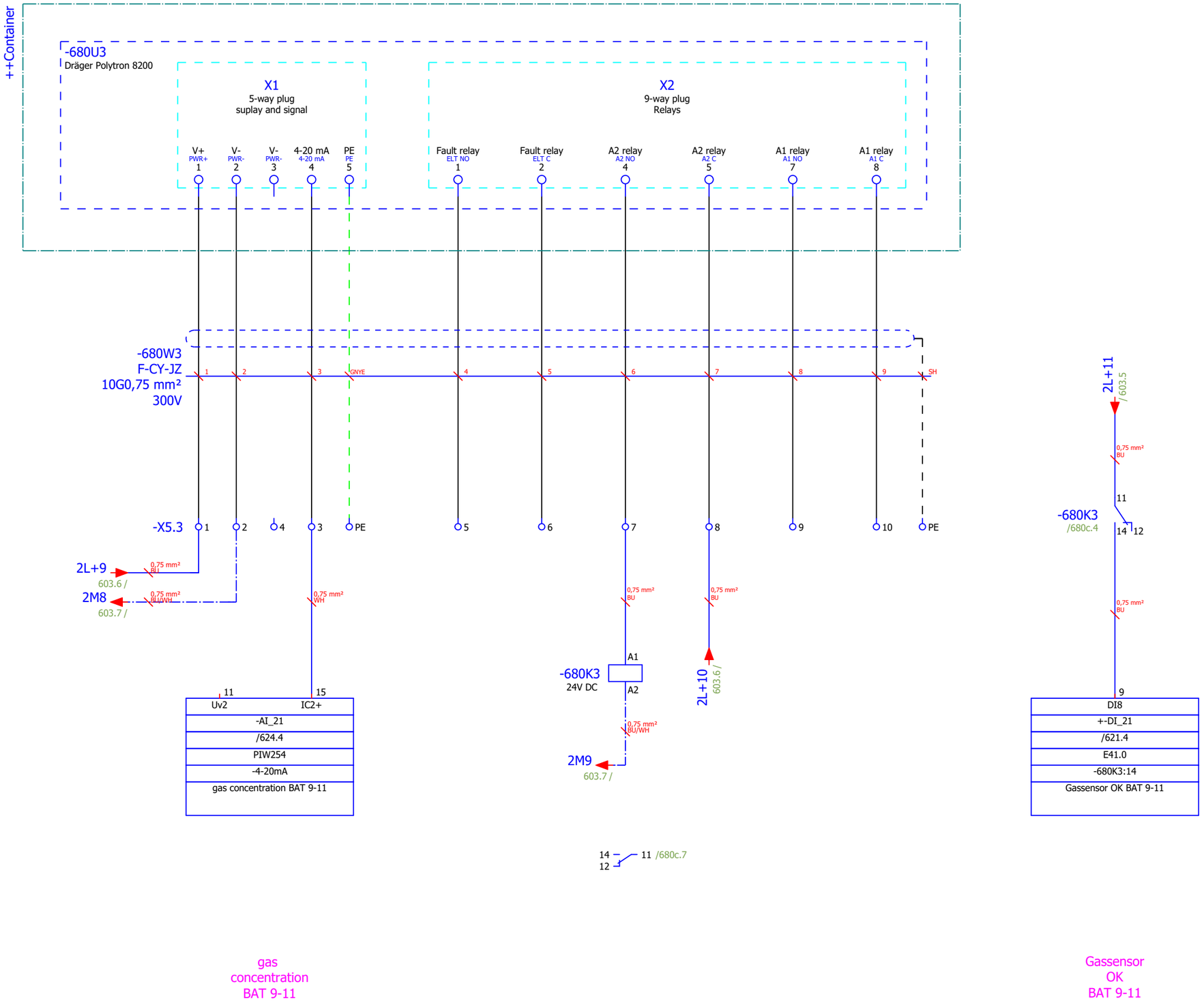
gas concentration BAT 5-8

Gassensor OK BAT 5-8

previous page: 680a

next page: 680c

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 5-8	20250805_V2.0	= UNIT_02 Battery Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 680b
Date								+ — total: 492



gas concentration BAT 9-11

Gassensor OK BAT 9-11

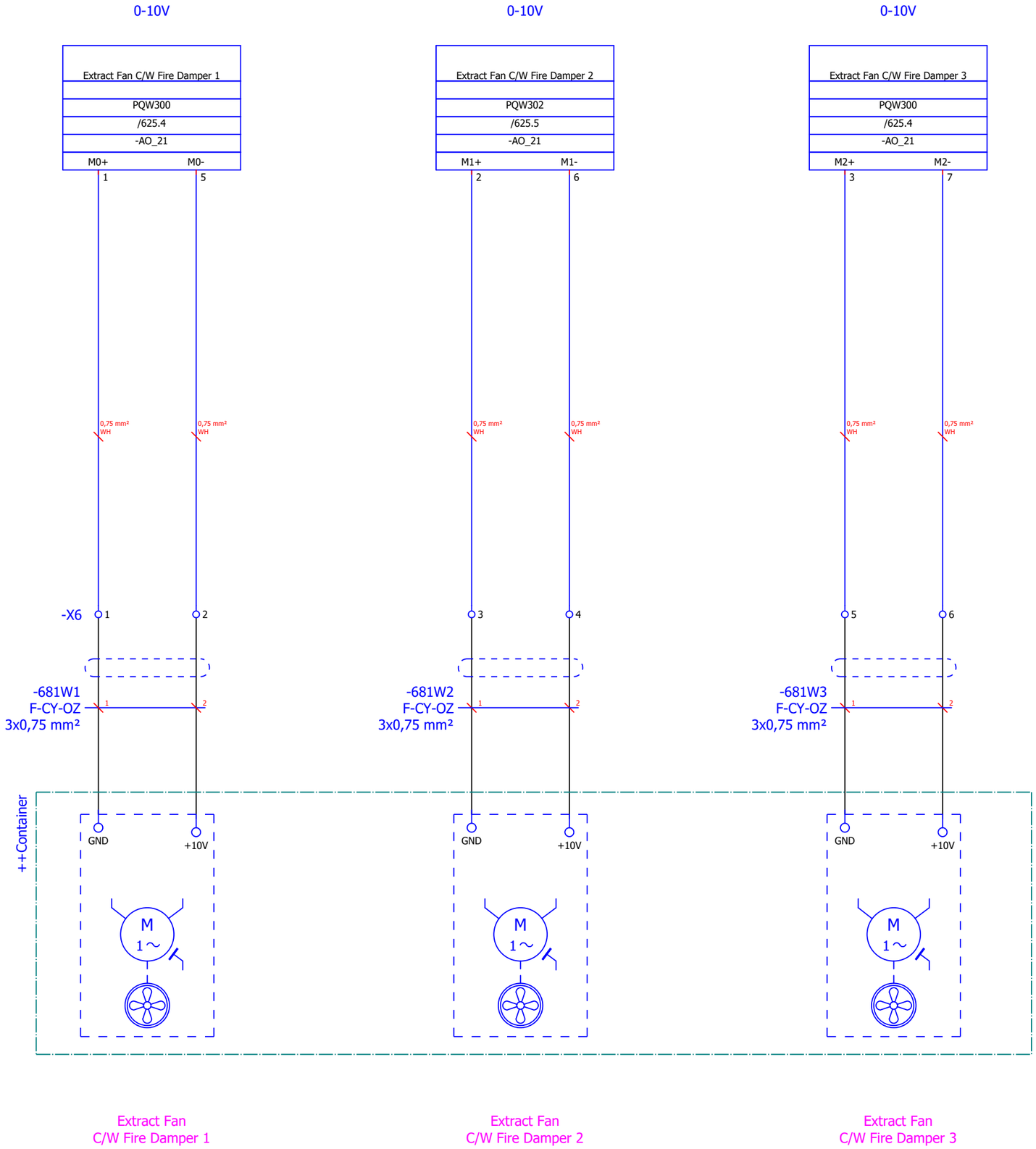
previous page: 680b

next page: 681

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 9-11	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 680c

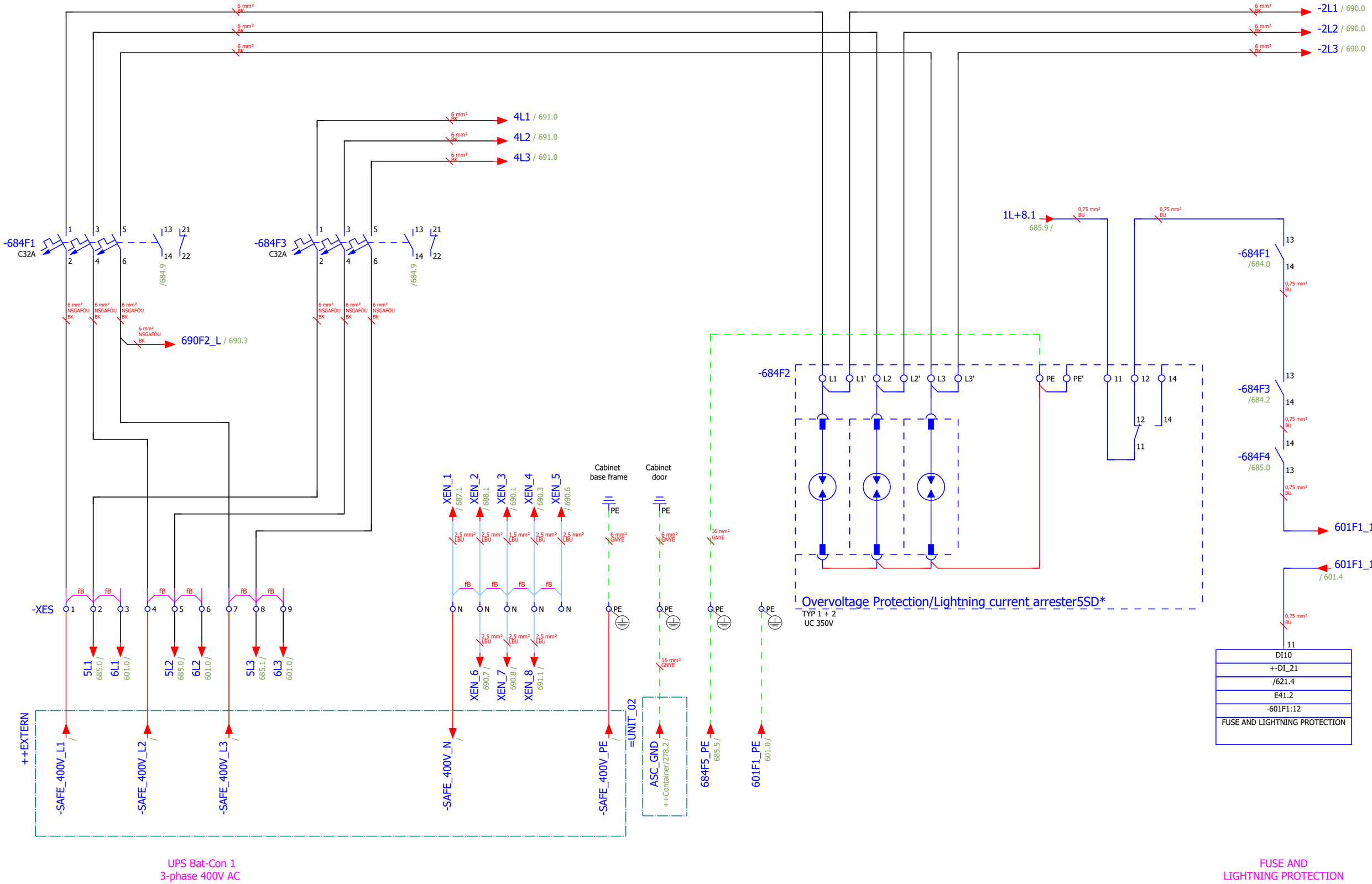
total: 492



previous page: 680c

next page: 684

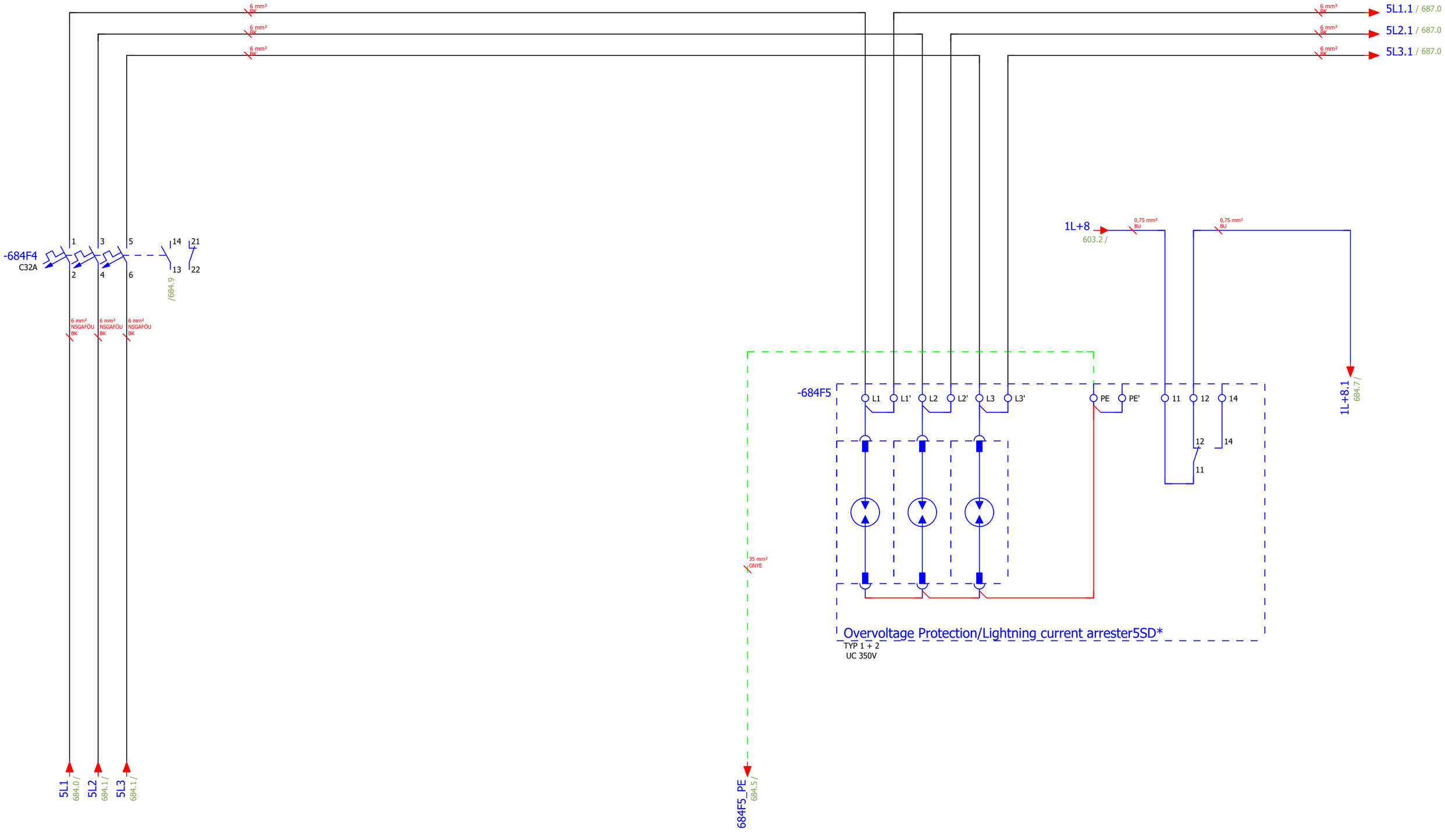
Editor	Freqcon_JD			Statron	FREQCON	EXTRACT FAN FIRE DAMPER	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 681
Date								+	total: 492



previous page: 681

next page: 685

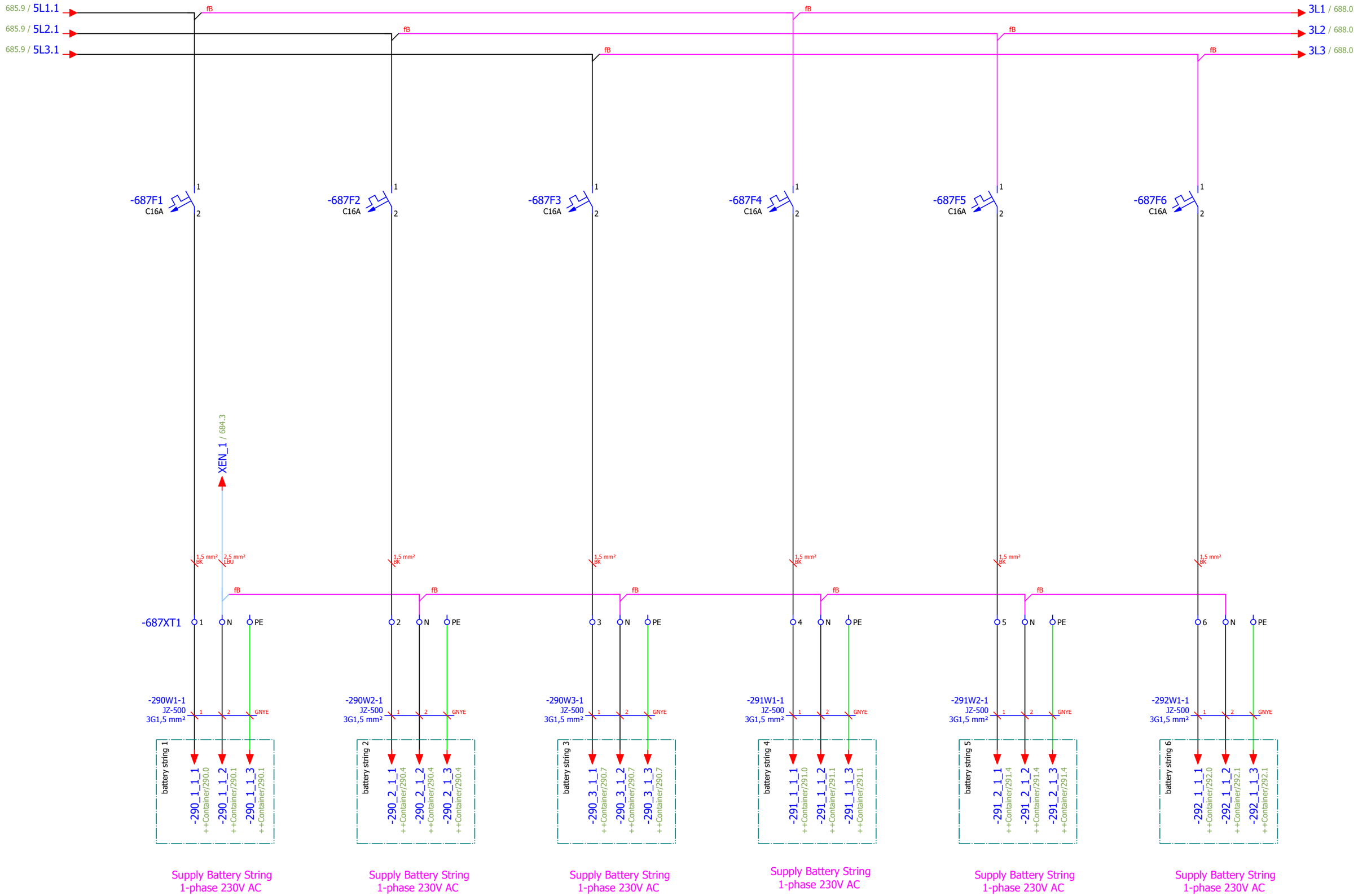
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	22.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 684
Date								+		total: 492



FUSE AND
LIGHTNING PROTECTION

previous page: 684
next page: 687

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	05.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 685
Date								+	total: 492



previous page: 685

next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 492

687.9 / 3L1
687.9 / 3L2
687.9 / 3L3

fB

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

XEN_2 / 684.3

1,5 mm² BK
2,5 mm² LBU

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

GNYE

battery string 7
-292_2_1_1 ++Container/292.4
-292_2_1_2 ++Container/292.4
-292_2_1_3 ++Container/292.4

battery string 8
-292_3_1_1 ++Container/292.7
-292_3_1_2 ++Container/292.7
-292_3_1_3 ++Container/292.7

battery string 9
-293_1_1_1 ++Container/293.0
-293_1_1_2 ++Container/293.1
-293_1_1_3 ++Container/293.1

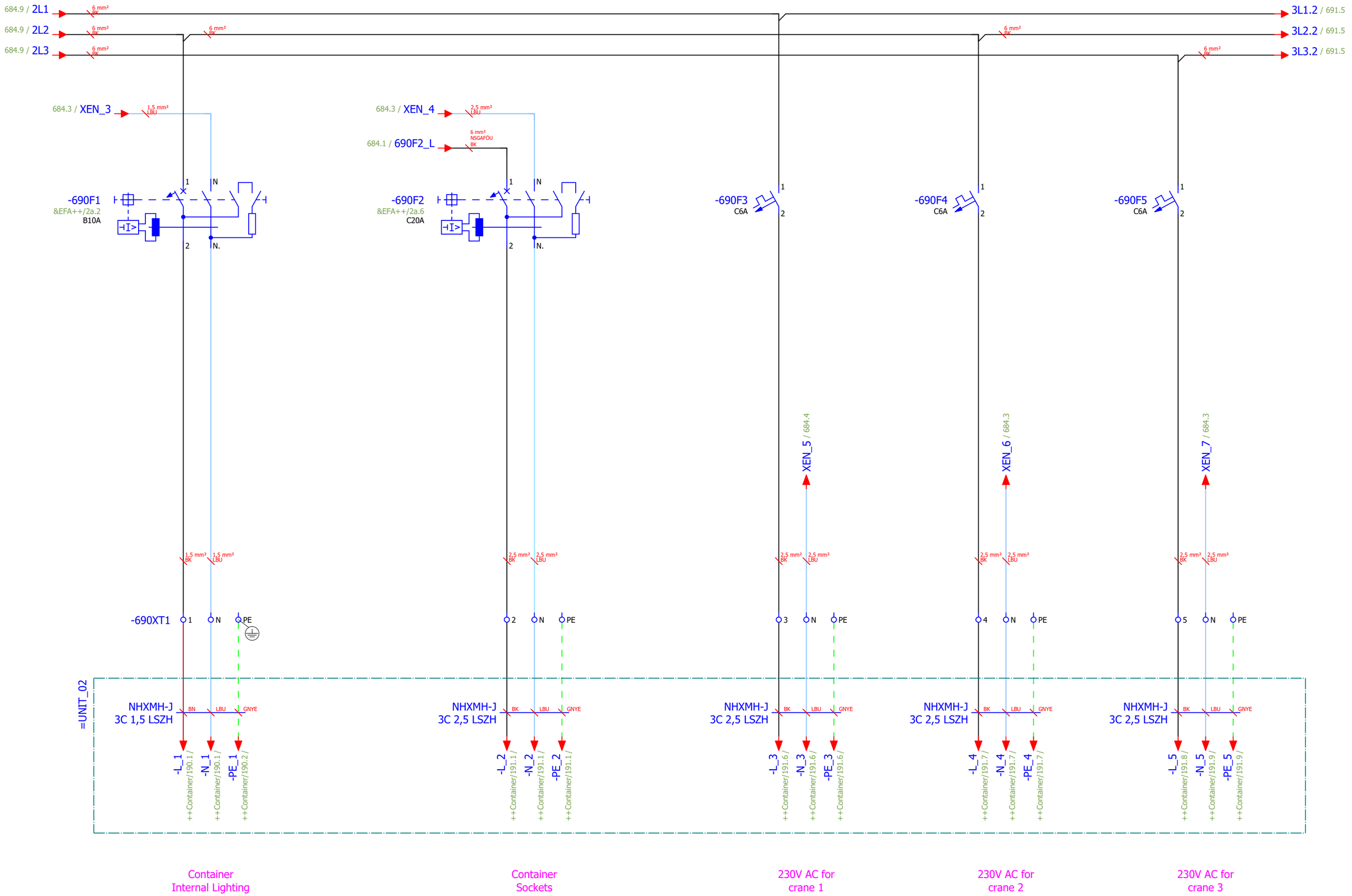
battery string 10
-293_2_1_1 ++Container/293.4
-293_2_1_2 ++Container/293.4
-293_2_1_3 ++Container/293.4

battery string 11
-293_3_1_1 ++Container/293.7
-293_3_1_2 ++Container/293.7
-293_3_1_3 ++Container/293.7

Supply Battery String 1-phase 230V AC

previous page: 687
next page: 690

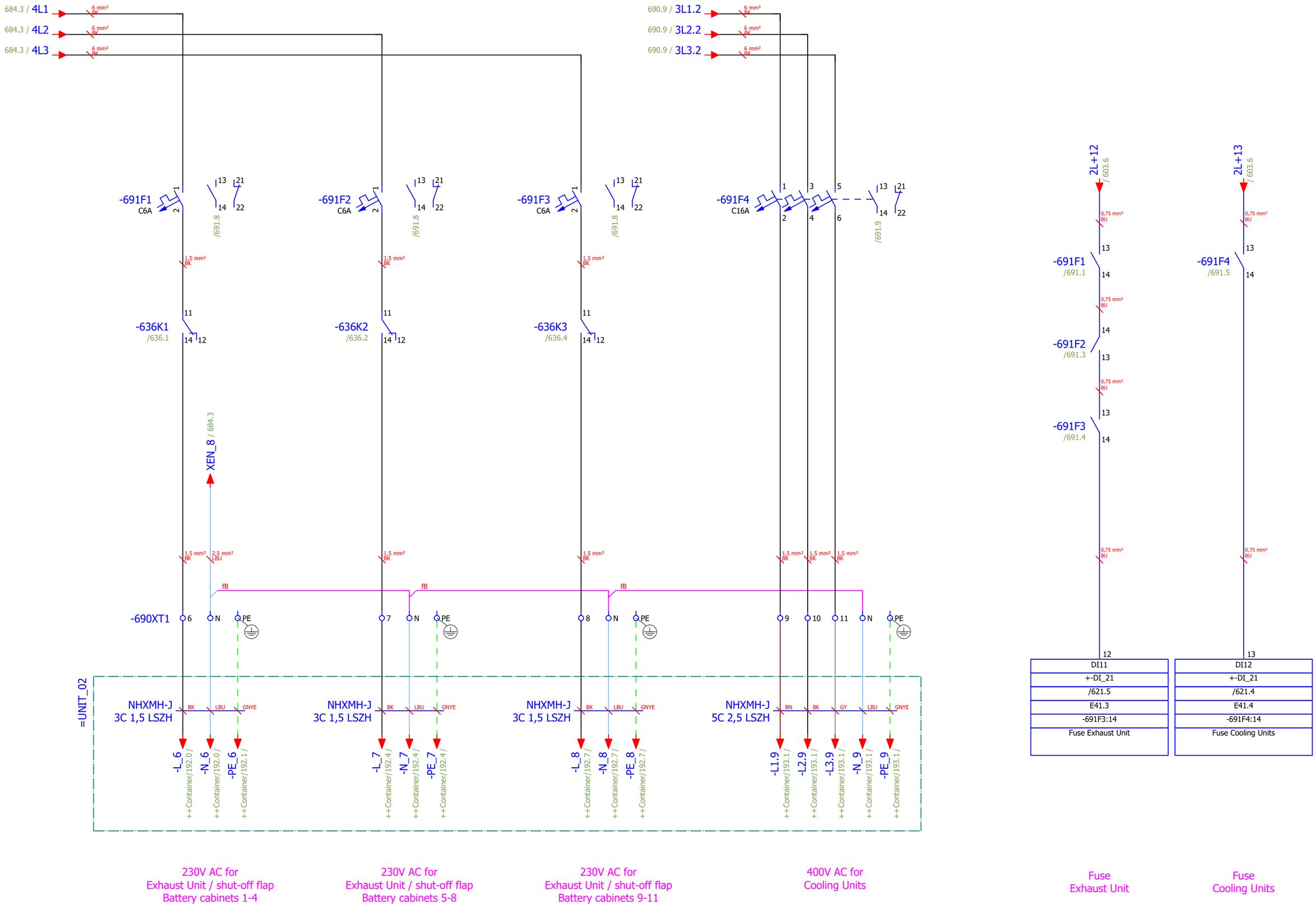
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 492



previous page: 688

next page: 691

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	29.10.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 690
Date								+		total: 492



previous page:
690

next page:
&EPC++Container/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 691
Date								+		total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U4 &EFS/613b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.3...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.3...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.1;&EFS/687.3;&EFS/687.4;&EFS/687.6...&EFS/687.8;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.9;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	

previous page:
6

next page:
&EPA++Container/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/7

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
6	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
3	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

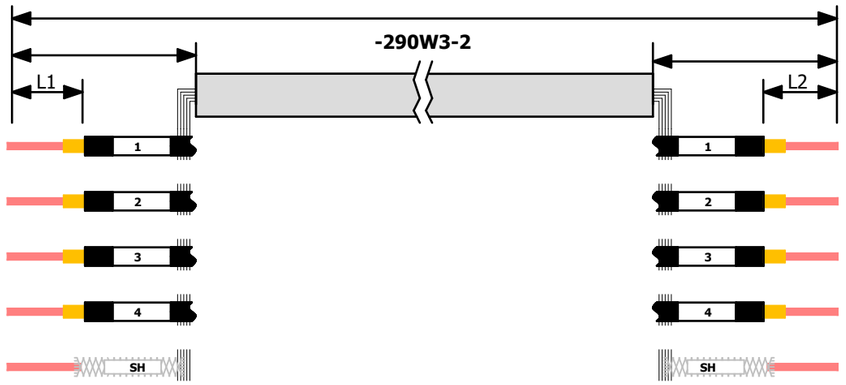
Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

Cable name =UNIT_02++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

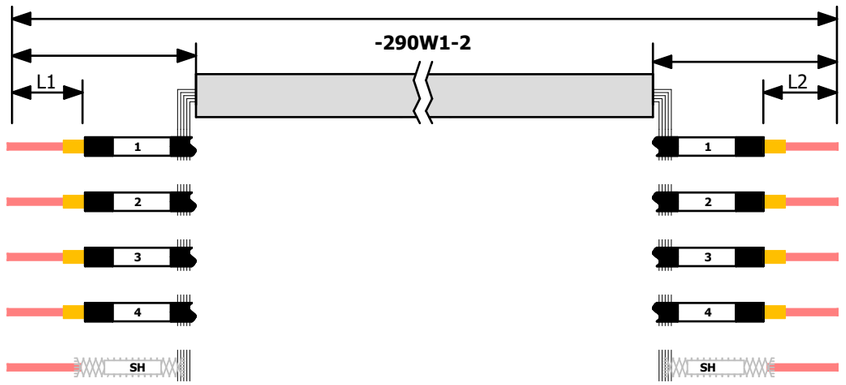


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

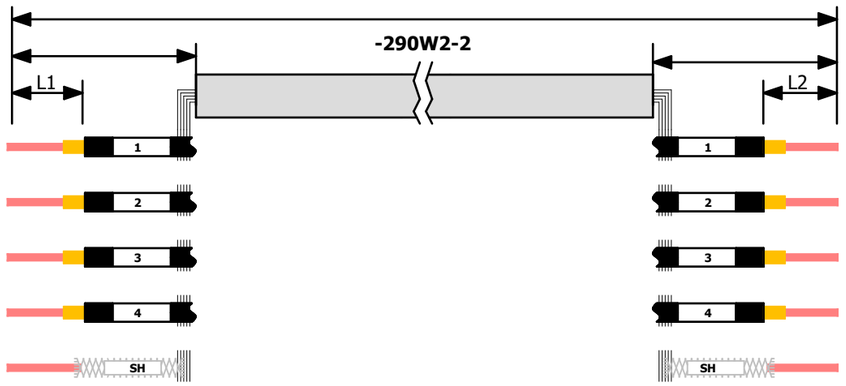


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

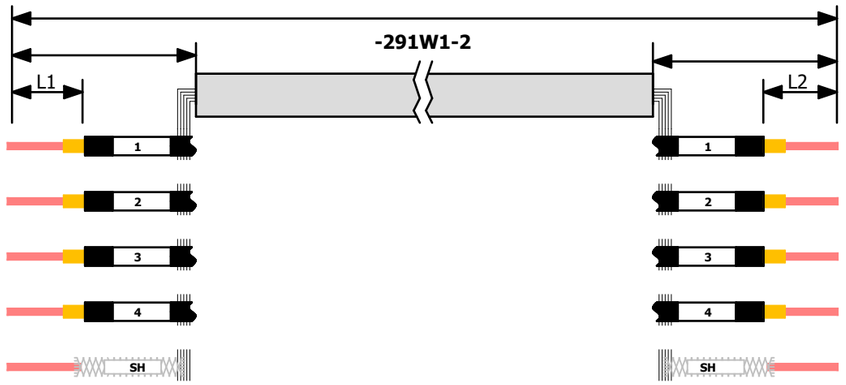
previous page:
&EPA++ASC/2

next page:
2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

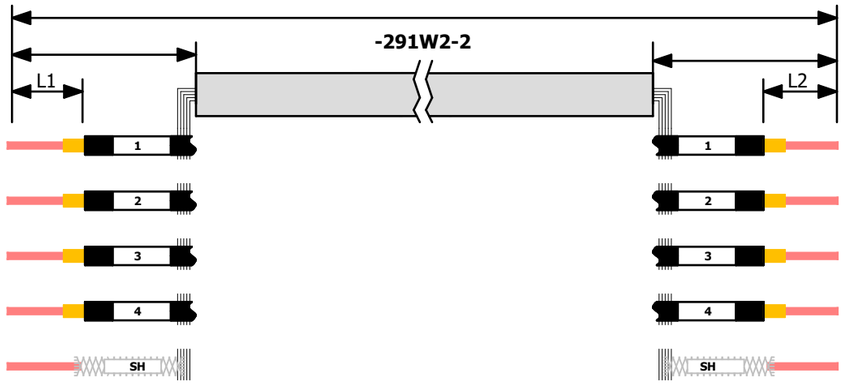


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

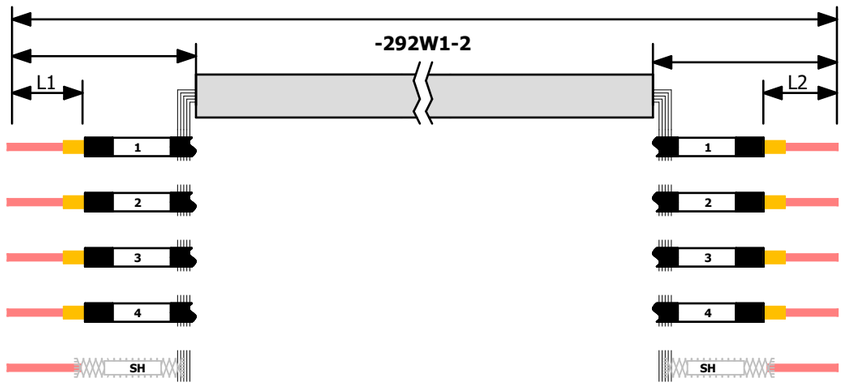


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

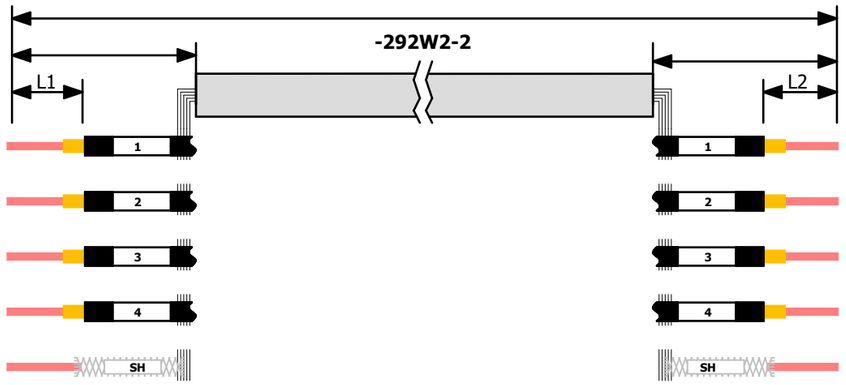
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

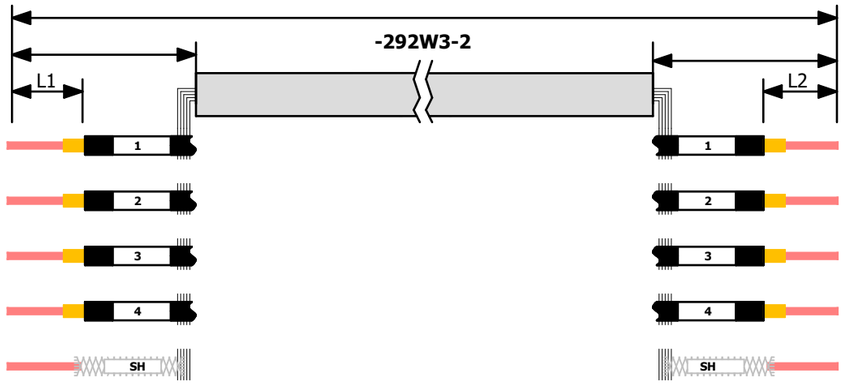


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

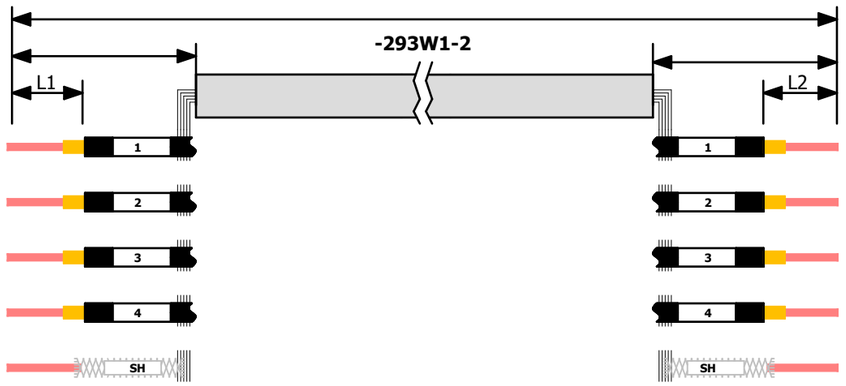


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

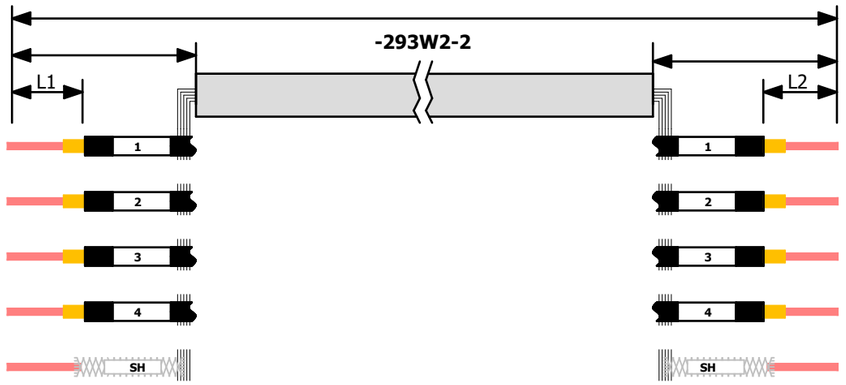
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

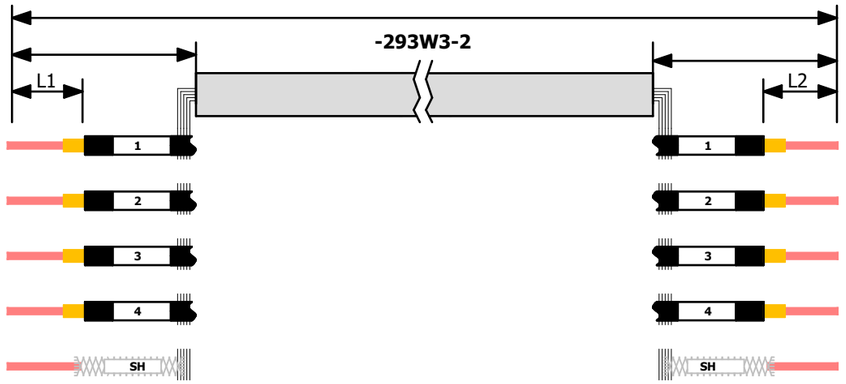


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

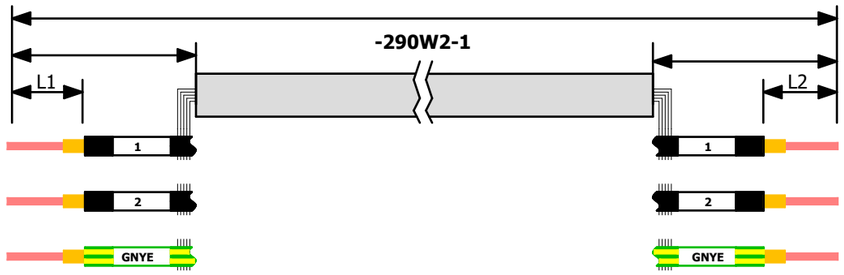
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

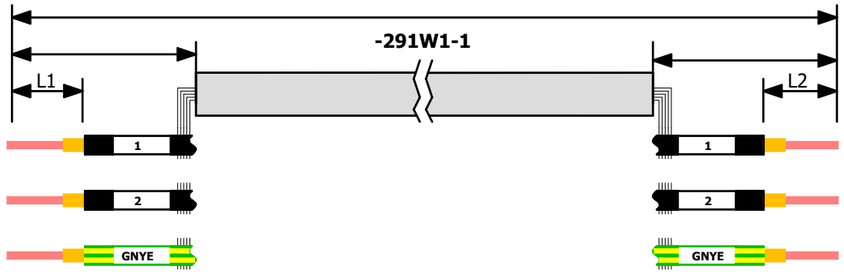


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

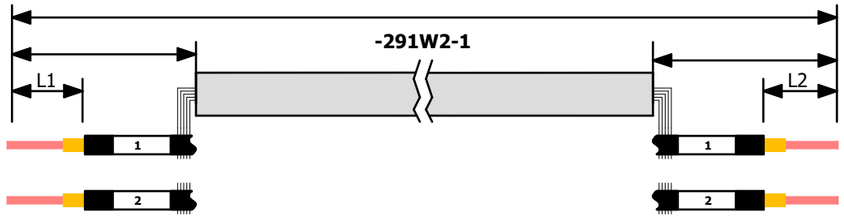


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

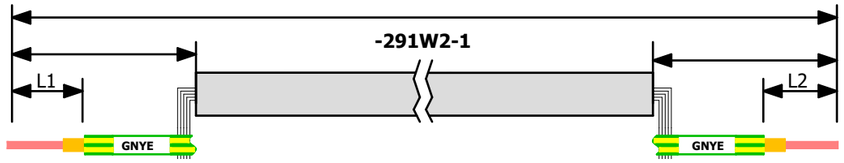
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

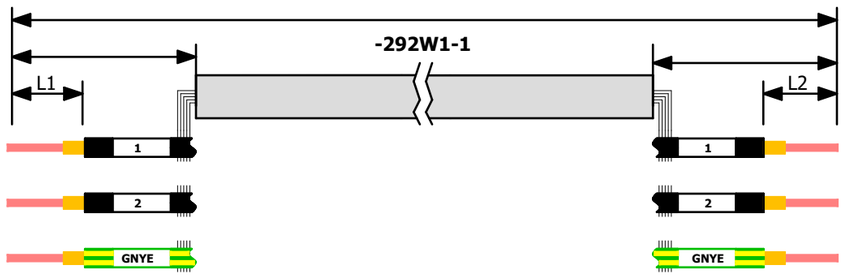


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

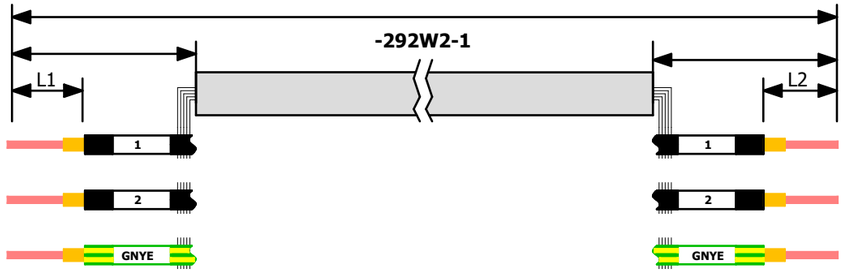


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

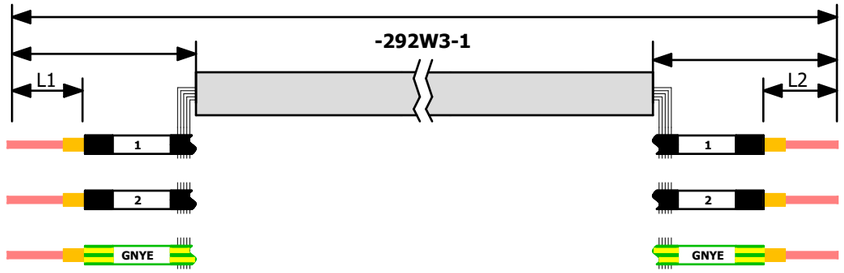


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

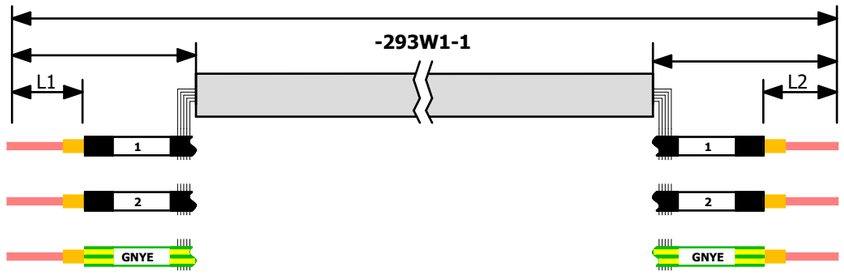
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

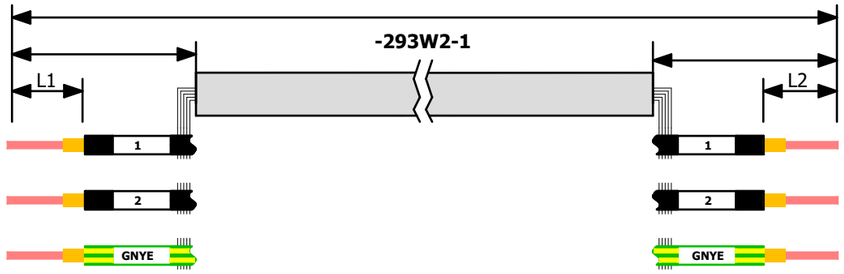


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

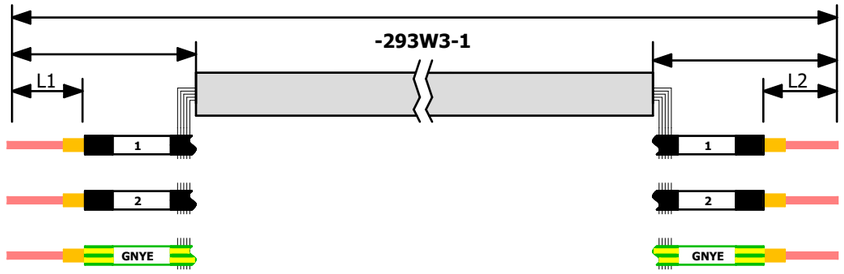


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

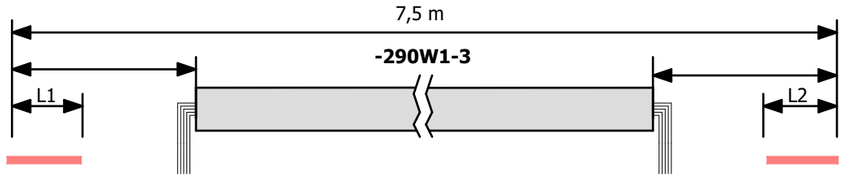


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

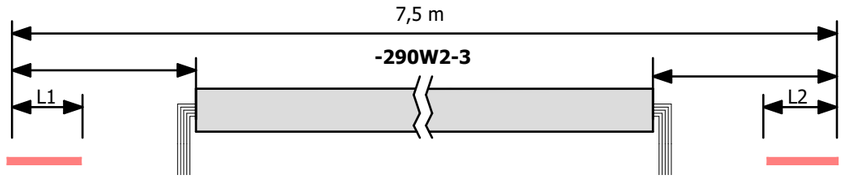
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 7
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

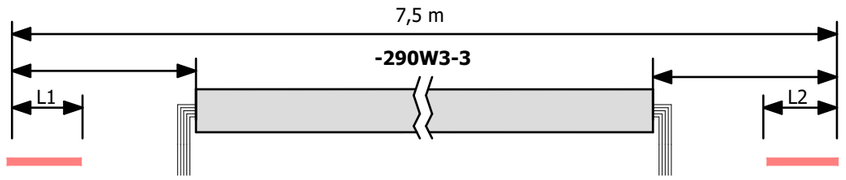


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

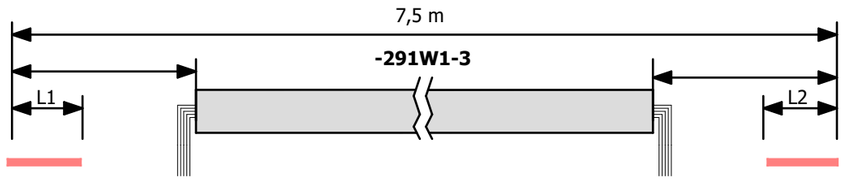


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_02++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

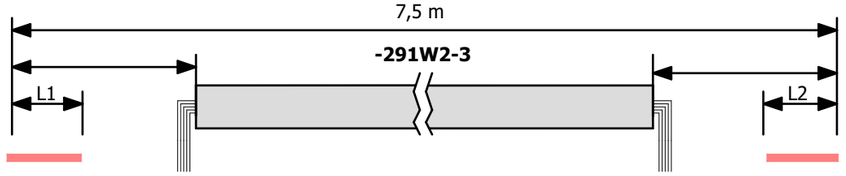


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

Cable name =UNIT_02++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

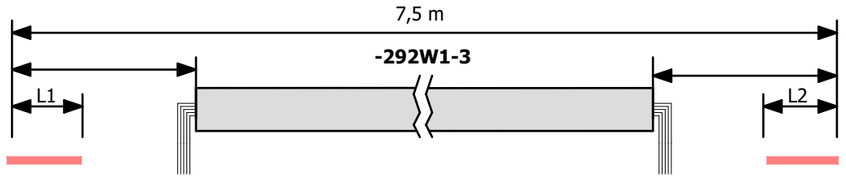


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_02++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



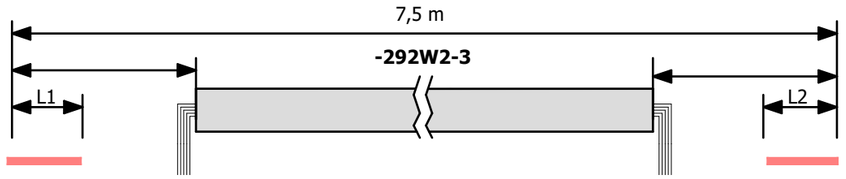
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

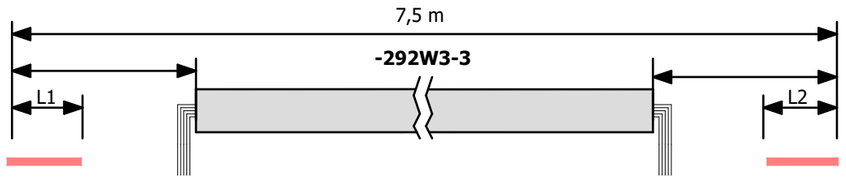


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X7:1-16	

Cable name =UNIT_02++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

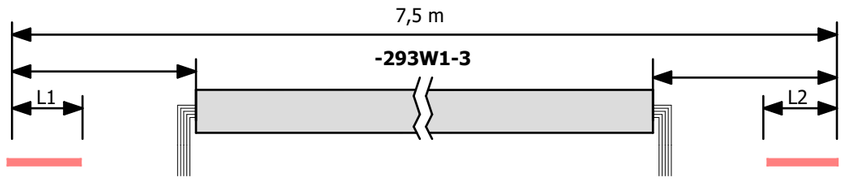


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X8:1-16	

Cable name =UNIT_02++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

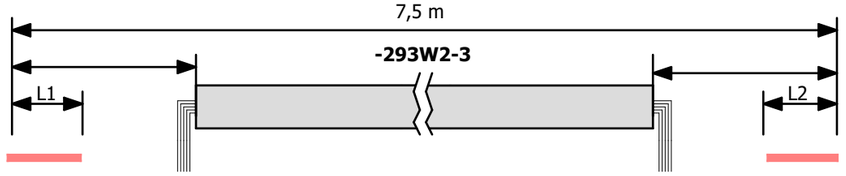


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X9:1-16	

Cable name =UNIT_02++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

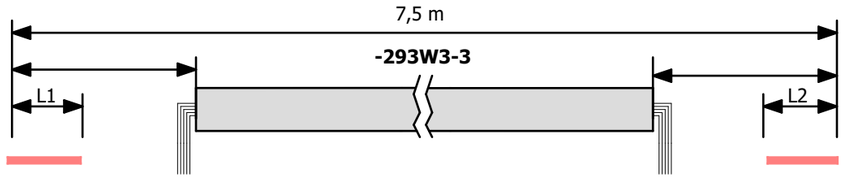


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

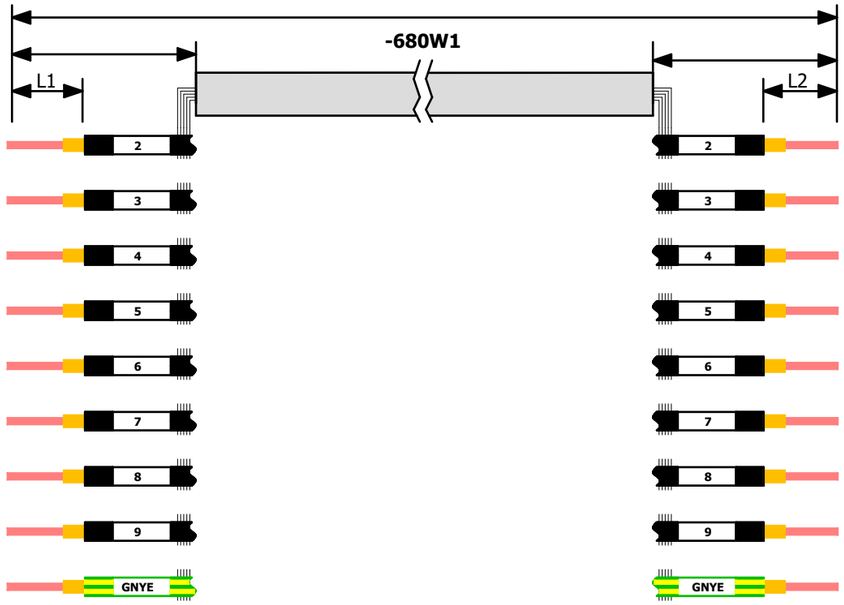
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

FRQ_Kabelplan_04_gro8_de_en

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 9
Date								+	total: 492

Cable name =UNIT_02++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

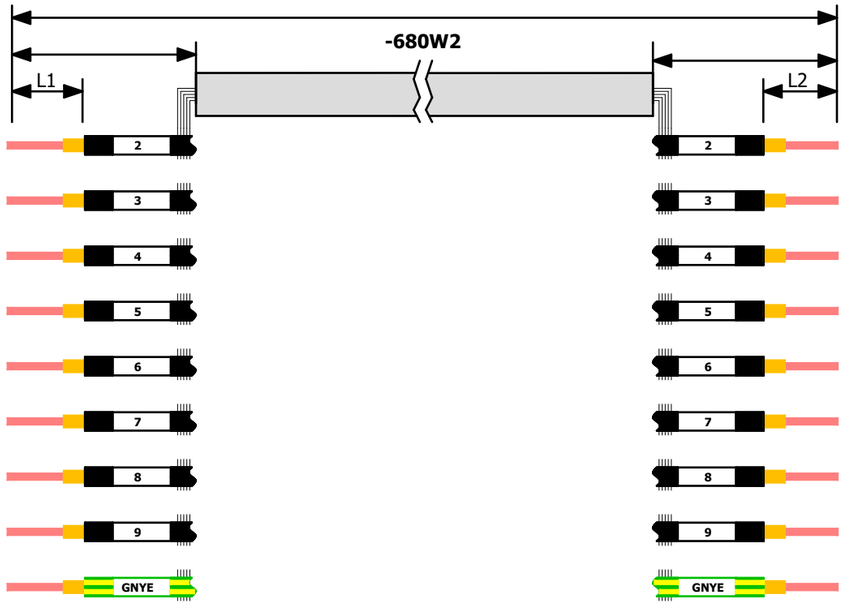


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_02++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

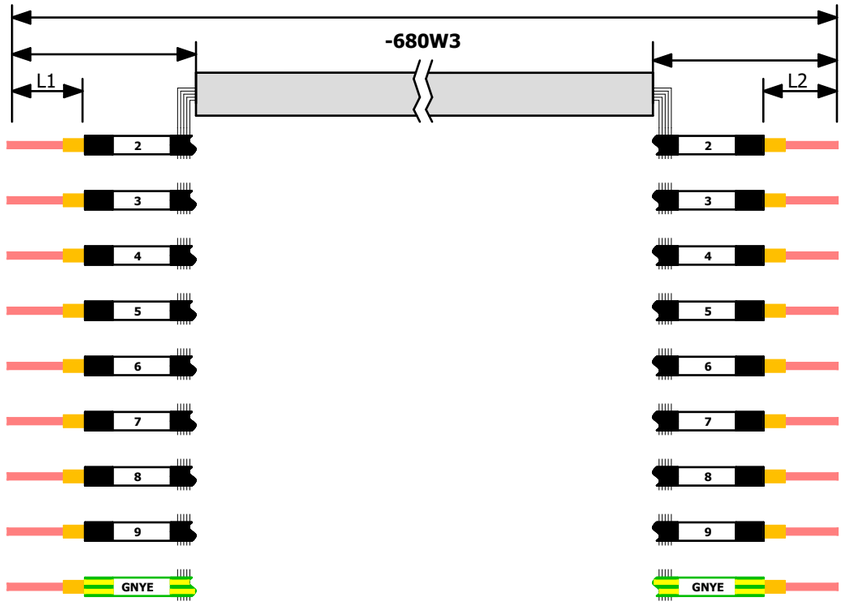
FRQ_Kabelplan_04_gro8_de_en

previous page: ++Container/9
next page: 2

Cable name =UNIT_02++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 9

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

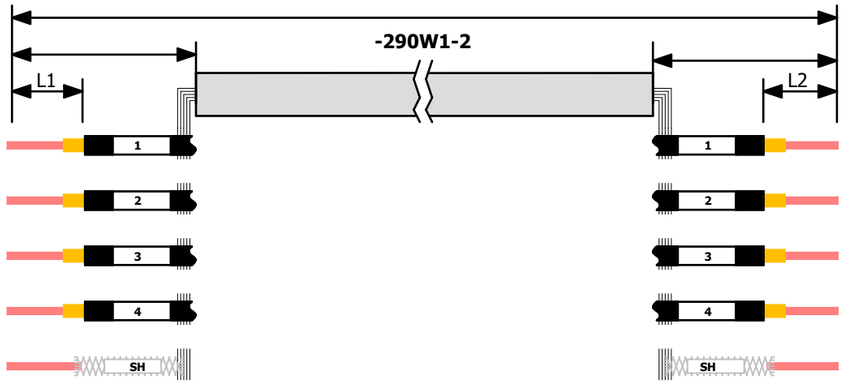


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_02++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

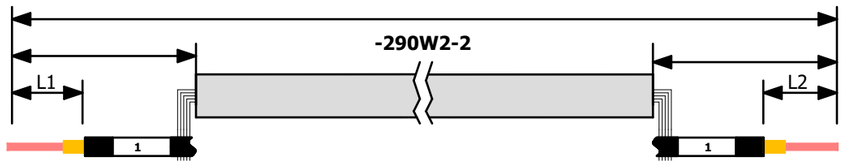


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

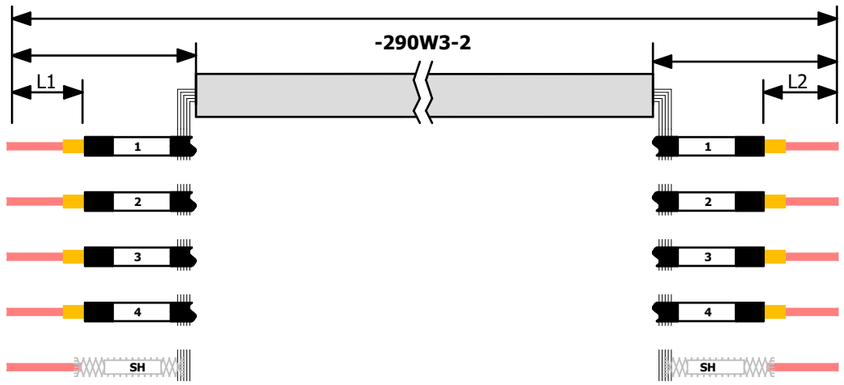


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

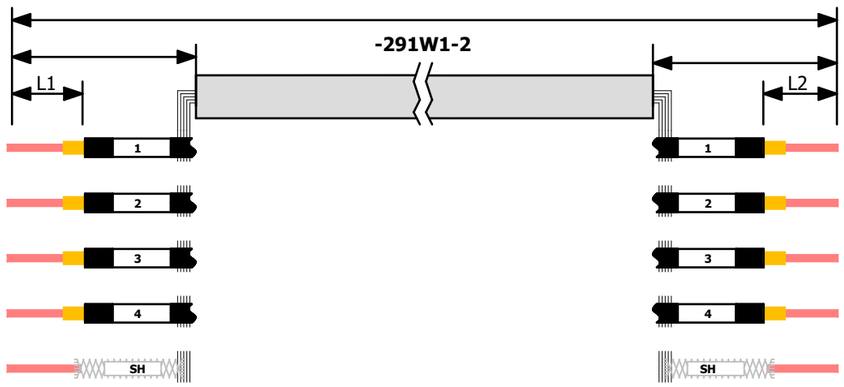


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

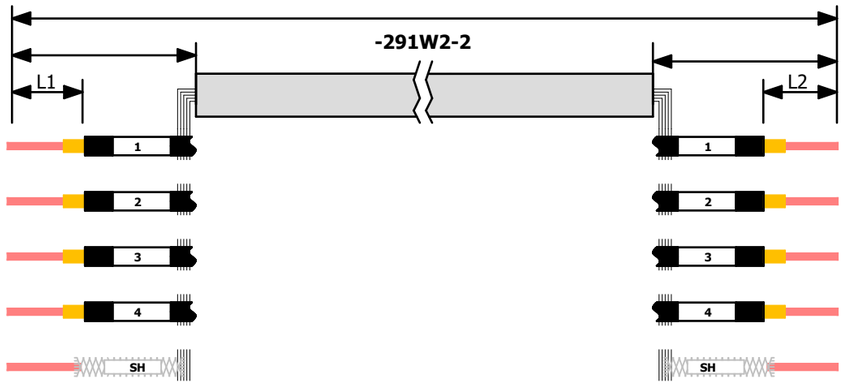
previous page: 2

next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

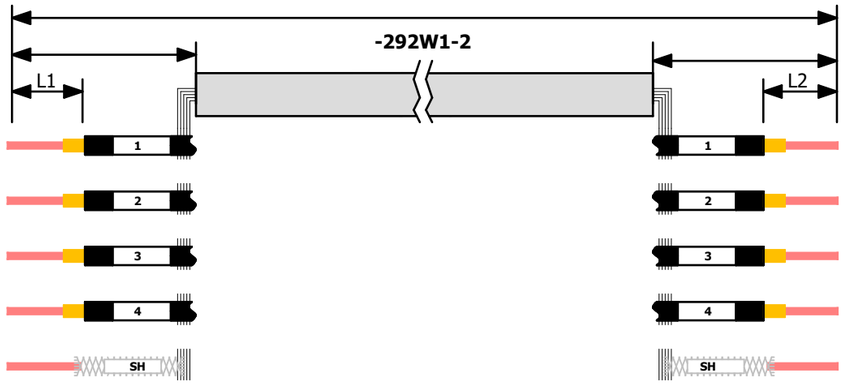


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

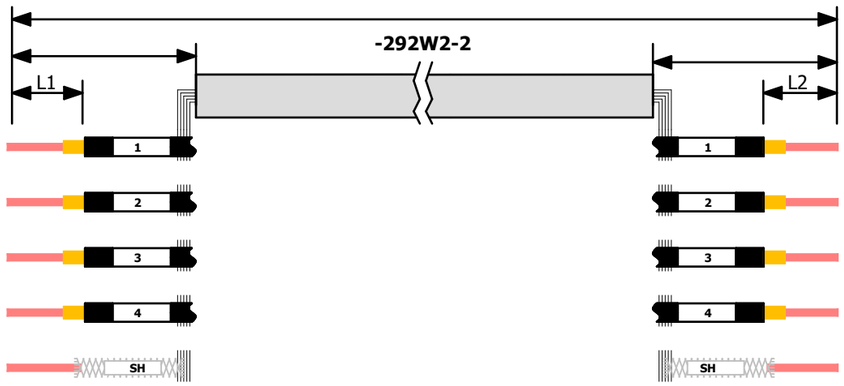


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

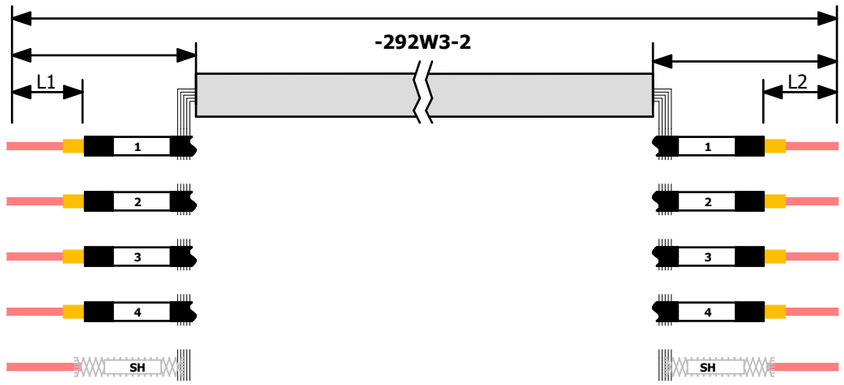
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

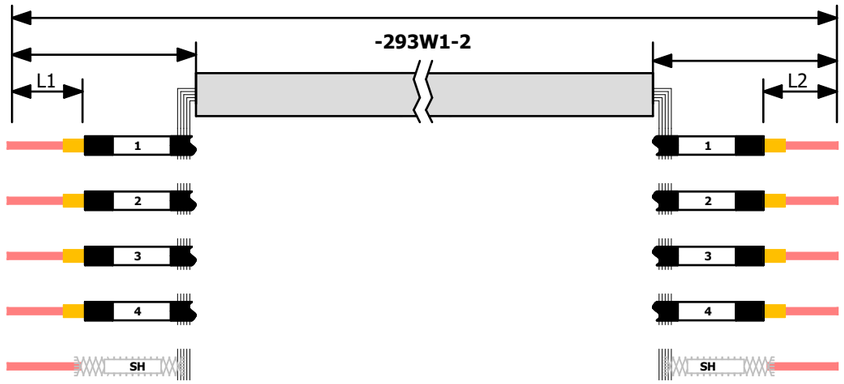


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

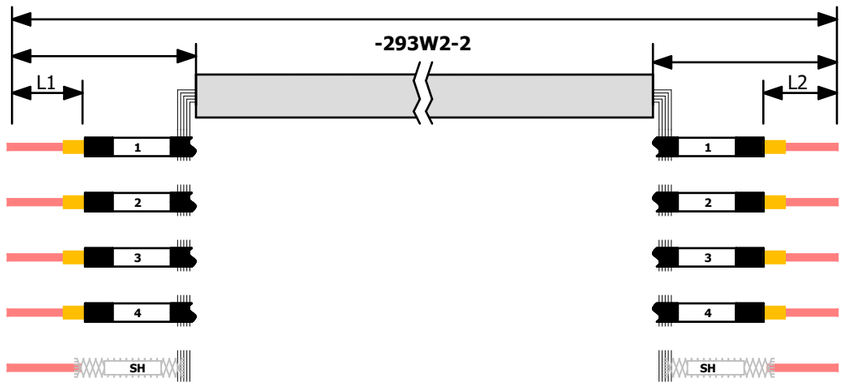


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

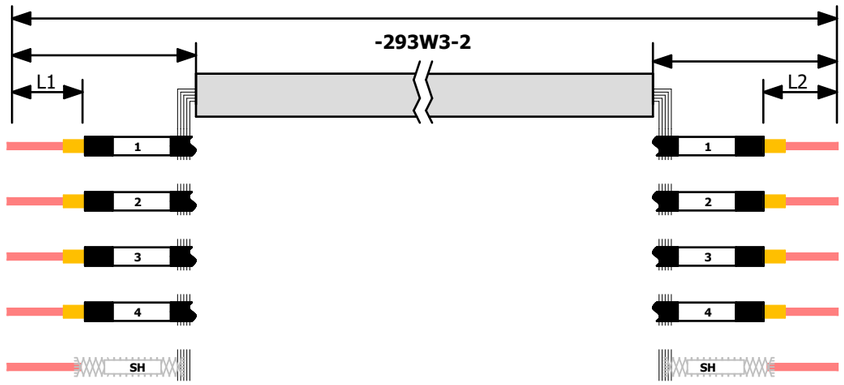
previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

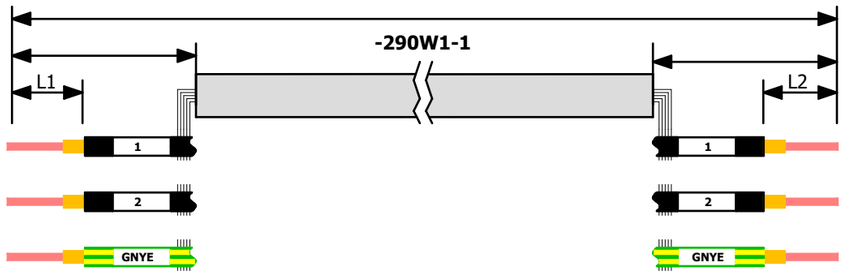


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

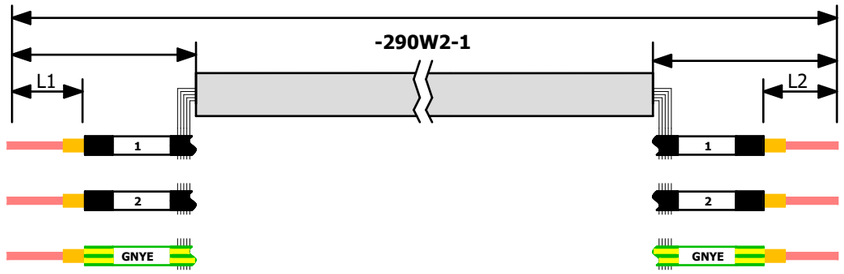


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

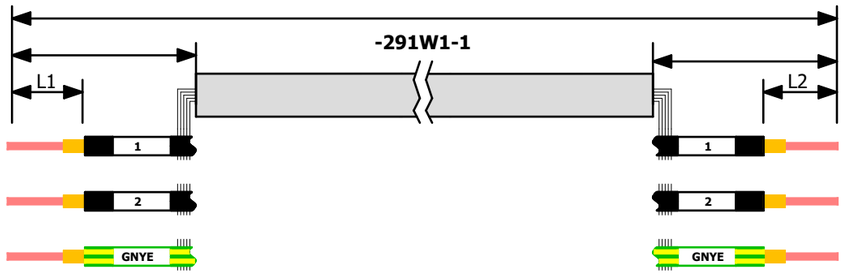


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

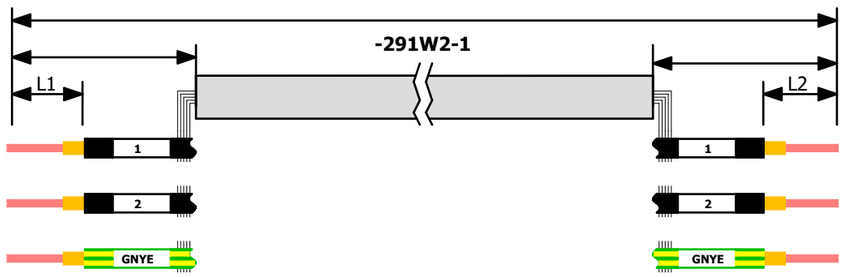


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

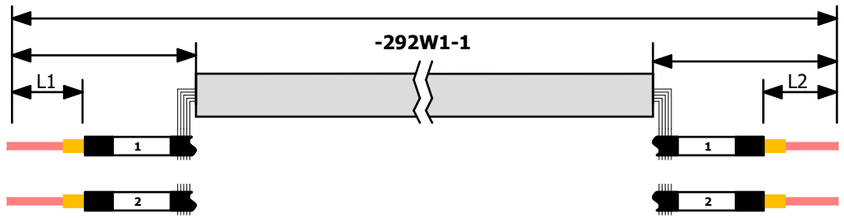


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

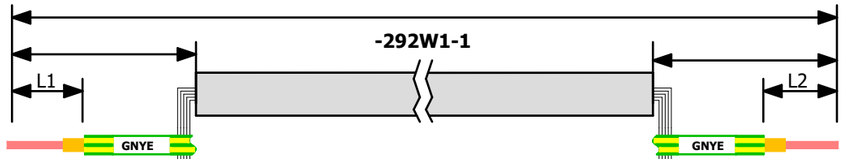
previous page: 6

next page: 8

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

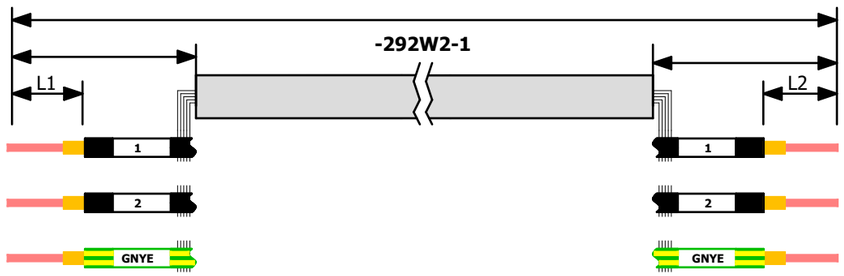


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

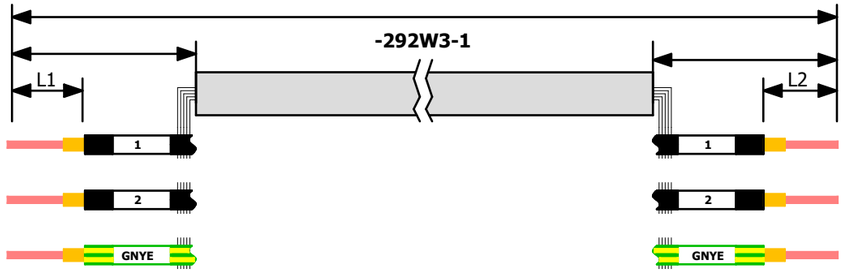


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

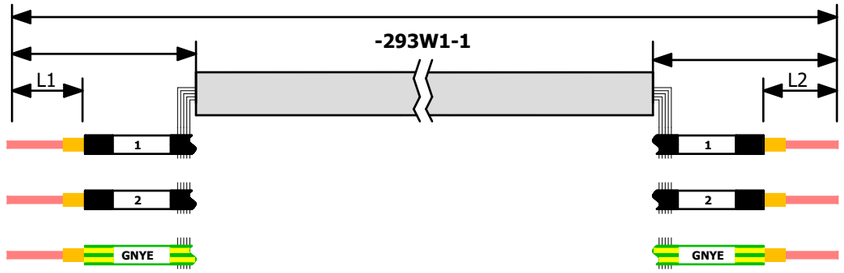


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

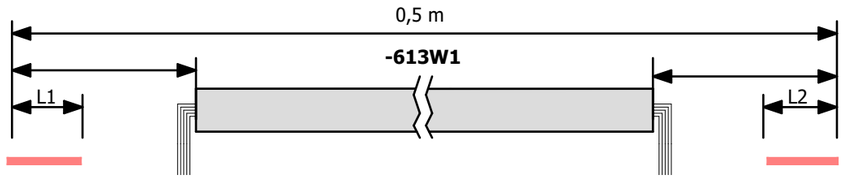


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

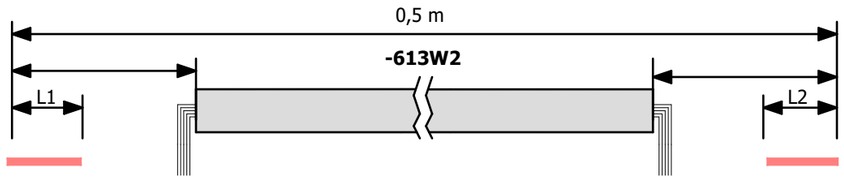


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_02++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			

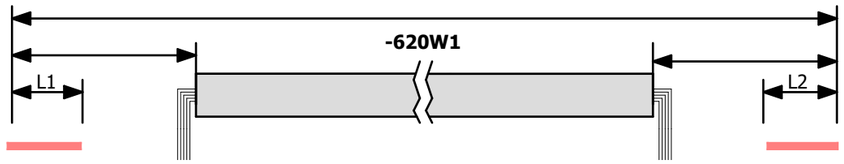
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 9
Date								+		total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_02++ASC+-620W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

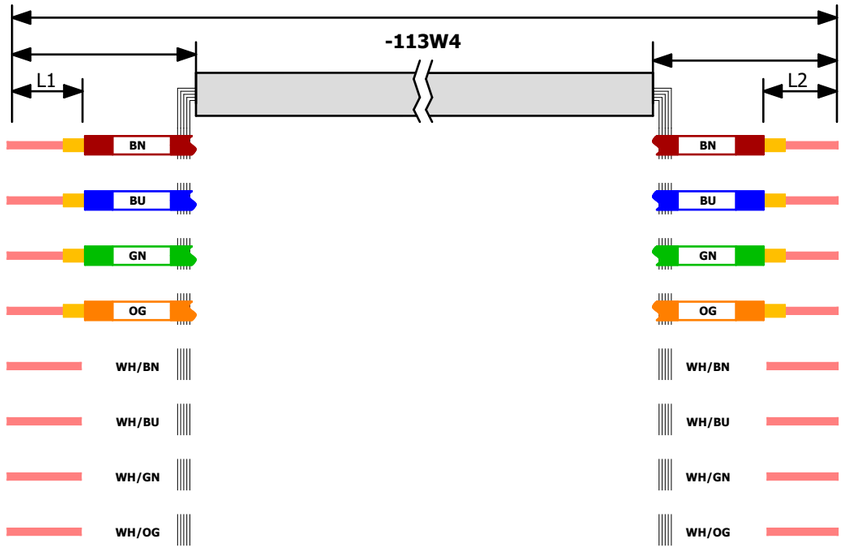
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U4:8							-620A1:-X1:P2	

Cable name =UNIT_02++ASC+-113W4
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:3							-613U2:3	

previous page: 9
next page: &EMZ/1000

FRQ_Kabelplan_04_groß_de_en

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X5.1		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2000
-X5.2		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2001
-X5.3		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2002
-X6		1	6	0	0	6	=UNIT_02&EMZ++ASC/2003
-XDC1		1	PE	2	0	14	=UNIT_02&EMZ++ASC/2004
-XDC2		1	7	0	0	14	=UNIT_02&EMZ++ASC/2005
-XES		1	9	4	5	18	=UNIT_02&EMZ++ASC/2006
-369XT		1	12	0	0	24	=UNIT_02&EMZ++ASC/2007
-687XT1		1	PE	11	11	44	=UNIT_02&EMZ++ASC/2019
-690XT1		1	PE	40	4	119	=UNIT_02&EMZ++ASC/2030

previous page:
&EMB/10

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-X5.1

Function text				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-JZ	-680W1	Page / column
gas concentration BAT 1-4					-XDC2	1	1	,	++Container-680U1-X1	1				&EFS/680a.2
=					-XDC2	5	2	,	++Container-680U1-X1	2		2		&EFS/680a.2
=					-AI_21	13	3	,	++Container-680U1-X1	4		3		&EFS/680a.2
=							4	,						&EFS/680a.2
=							5	,	++Container-680U1-X2	1		4		&EFS/680a.3
=							6	,	++Container-680U1-X2	2		5		&EFS/680a.3
=					-680K1	A1	7	,	++Container-680U1-X2	4		6		&EFS/680a.4
=					-XDC2	2	8	,	++Container-680U1-X2	5		7		&EFS/680a.4
=							9	,	++Container-680U1-X2	7		8		&EFS/680a.5
=							10	,	++Container-680U1-X2	8		9		&EFS/680a.5
=							PE	,	++Container-680U1-X1	5		GNYE		&EFS/680a.2
=							PE	,	-480W1					&EFS/680a.6

previous page:
1000

next page:
2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X5.1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2000
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X5.2						Cable name	-680W2										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-JZ											
gas concentration BAT 5-8					-XDC2	2	1	,	++Container-680U2-X1	1													&EFS/680b.2
=					-XDC2	6	2	,	++Container-680U2-X1	2		2											&EFS/680b.2
=					-AI_21	14	3	,	++Container-680U2-X1	4		3											&EFS/680b.2
=							4	,															&EFS/680b.2
=							5	,	++Container-680U2-X2	1		4											&EFS/680b.3
=							6	,	++Container-680U2-X2	2		5											&EFS/680b.3
=					-680K2	A1	7	,	++Container-680U2-X2	4		6											&EFS/680b.4
=					-XDC2	2	8	,	++Container-680U2-X2	5		7											&EFS/680b.4
=							9	,	++Container-680U2-X2	7		8											&EFS/680b.5
=							10	,	++Container-680U2-X2	8		9											&EFS/680b.5
=							PE	,	++Container-680U2-X1	5		GNYE											&EFS/680b.2
=							PE	,	-480W1														&EFS/680b.6

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X5.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1
&	EMZ	Terminals
++	ASC	auxillary cabinet
+		

page: 2001
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X5.3					Cable name	-680W3										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z										
gas concentration BAT 9-11					-XDC2	3	1	,	++Container-680U3-X1	1												&EFS/680c.2
=					-XDC2	7	2	,	++Container-680U3-X1	2		2										&EFS/680c.2
=					-AI_21	15	3	,	++Container-680U3-X1	4		3										&EFS/680c.2
=							4	,														&EFS/680c.2
=							5	,	++Container-680U3-X2	1		4										&EFS/680c.3
=							6	,	++Container-680U3-X2	2		5										&EFS/680c.3
=					-680K3	A1	7	,	++Container-680U3-X2	4		6										&EFS/680c.4
=					-XDC2	3	8	,	++Container-680U3-X2	5		7										&EFS/680c.4
=							9	,	++Container-680U3-X2	7		8										&EFS/680c.5
=							10	,	++Container-680U3-X2	8		9										&EFS/680c.5
=							PE	,	++Container-680U3-X1	5		GNYE										&EFS/680c.2
=							PE	,	-480W1													&EFS/680c.6

previous page:
2001

next page:
2003

Editor	Freqcon_DG			Statron		FREQCON	Klemmenplan =UNIT_02++ASC+-X5.3	20250805_V2.0	=	UNIT_02	Battery Container 1		
Date	21.01.2025								&	EMZ	Terminals		
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				10354_23A2007	++	ASC	auxillary cabinet	page:	2002
Date									+			total:	492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X6					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Extract Fan C/W Fire Damper 1						GND	1	,	-AO_21	1													&EFS/681.1
=						+10V	2	,	-AO_21	5													&EFS/681.1
Extract Fan C/W Fire Damper 2						GND	3	,	-AO_21	2													&EFS/681.3
=						+10V	4	,	-AO_21	6													&EFS/681.3
Extract Fan C/W Fire Damper 3						GND	5	,	-AO_21	3													&EFS/681.5
=						+10V	6	,	-AO_21	7													&EFS/681.5

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X6	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2003

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-XDC1

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FUSE 24V DC CONTROL VOLTAGE			-101T1	13	1		-103F1	2			&EFS/603.2
			-101Q1	13							
			-611A1	1							
FUSE 24V DC CONTROL VOLTAGE			-620A1	-X80:1	2						&EFS/603.2
			-DI_21	L+							
			-DO_21	L+							
FUSE 24V DC CONTROL VOLTAGE			-684F5	11	3		-103F1	13			&EFS/603.2
FUSE 24V DC CONTROL VOLTAGE			-611A1	2	4		-102G1	OUTPUT DC 24 V:-			&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE			-620A1	-X80:2	5						&EFS/603.3
			-DI_21	M							
			-DO_21	M							
FUSE 24V DC CONTROL VOLTAGE			-636K1	A2	6		-XDC2	5			&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE			-101T1	-"	PE						&EFS/603.4
			-101T1	PE							
FUSE 24V DC CONTROL VOLTAGE					PE						&EFS/603.4

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XDC1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2004

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-XDC2						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
FUSE 24V DC CONTROL VOLTAGE					-AI_21	L+	1		-103F2	2													&EFS/603.5
					-AO_21	L+																	
					-X5.1	1																	
FUSE 24V DC CONTROL VOLTAGE					-X5.1	8	2		-X5.2	8													&EFS/603.5
					-680K1	11																	
					-X5.2	1																	
FUSE 24V DC CONTROL VOLTAGE					-680K2	11	3		-680K3	11													&EFS/603.5
					-X5.3	1																	
					-X5.3	8																	
FUSE 24V DC CONTROL VOLTAGE					-691F1	13	4																&EFS/603.6
					-691F4	13																	
					-691F4	13																	
FUSE 24V DC CONTROL VOLTAGE					-AI_21	M	5		-XDC1	6													&EFS/603.6
					-AO_21	M																	
					-X5.1	2																	
FUSE 24V DC CONTROL VOLTAGE					-680K1	A2	6																&EFS/603.6
					-X5.2	2																	
FUSE 24V DC CONTROL VOLTAGE					-680K2	A2	7																&EFS/603.7
					-X5.3	2																	
					-680K3	A2																	

previous page: 2004

next page: 2006

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XDC2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2005
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-XES					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
							1		-684F1	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC							N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-690F1	N													&EFS/684.3
=					-690XT1	N	N		-690F2	N													&EFS/684.3
=							N		-690XT1	N													&EFS/684.4
=							PE			PE													&EFS/684.4
=					++Container-278W1	GND	PE			PE													&EFS/684.4
=					-684F5	PE	PE		-684F2	PE													&EFS/684.5
=					-601F1	PE	PE																&EFS/684.5
					-684F4	2	2		-684F3	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC					-601F1	L1	3																&EFS/684.1
=							4		-684F1	4													&EFS/684.1
=					-684F4	4	5		-684F3	4													&EFS/684.1
=					-601F1	L2	6																&EFS/684.1
=							7		-684F1	6													&EFS/684.1
=					-684F4	6	8		-684F3	6													&EFS/684.1
=					-601F1	L3	9																&EFS/684.2

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-OZ	++Container-290W2-2 F-CY-OZ	++Container-290W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	1					&EFS/669.5
		3			++Container-570XT	3						
	3				++Container-570XT	3						

previous page: 2006

next page: 2008

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2007

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	2		++Container-570XT	3		3	&EFS/669.5
		3			++Container-570XT	3							
	3				++Container-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	3		++Container-570XT	3		3	&EFS/669.6
		3			++Container-570XT	3							
	3				++Container-570XT	3							

previous page: 2008

next page: 2010

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 2009
Date								+ — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	4					&EFS/669.7
		4			++Container-570XT	4						
	4				++Container-570XT	4						

previous page:
2009

next page:
2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2010
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	5		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

previous page:
2010

next page:
2012

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2011
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	6		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

previous page: 2011

next page: 2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2012

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	7					&EFS/670.5
		1			++Container-570XT	1						
	1				++Container-570XT	1						

previous page: 2012

next page: 2014

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	8		++Container-570XT	1		1	&EFS/670.5
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	9		++Container-570XT	1		1	&EFS/670.6
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	10					&EFS/670.7
		2			++Container-570XT	2						
	2				++Container-570XT	2						

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	11		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	12		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

previous page: 2017

next page: 2019

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2018

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			++Container-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				++Container-XE	1	3	,	-687F3	2		&EFS/687.4

previous page:
2018

next page:
2020

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2019
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-1 JZ-500	++Container-291W2-1 JZ-500	++Container-291W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	4	,	-687F4	2		&EFS/687.5
=		1			++Container-XE	1	5	,	-687F5	2		&EFS/687.7
=	1				++Container-XE	1	6	,	-687F6	2		&EFS/687.8

previous page: 2019

next page: 2021

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025					& EMZ Terminals
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date						+

page: 2020

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-1	++Container-292W3-1	++Container-292W2-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	7	,	-688F1	2													&EFS/688.1
=		1			++Container-XE	1	8	,	-688F2	2													&EFS/688.3
=	1				++Container-XE	1	9	,	-688F3	2													&EFS/688.4

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W1-1 JZ-500	++Container-293W3-1 JZ-500	++Container-293W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	10	,	-688F4	2		&EFS/688.5
=		1			++Container-XE	1	11	,	-688F5	2		&EFS/688.7
=	2				++Container-XE	N	N	,	-XES	N		&EFS/687.1

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2022

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W1-1 JZ-500	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/687.6

previous page: 2022

next page: 2024

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2023

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W2-1 -XZ-500	++Container-292W1-1 -XZ-500	++Container-291W2-1 -XZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.7
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.8
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N		-XES	N		&EFS/688.1

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2024 of total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W2-1 -1Z-500	++Container-293W1-1 -1Z-500	++Container-292W3-1 -1Z-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/688.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/688.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/688.6

previous page: 2024

next page: 2026

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W2-1	++Container-290W1-1	++Container-293W3-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N																&EFS/688.7
Supply Battery String 1-phase 230V AC		GNYE			++Container-XE	PE	PE																&EFS/687.2
=	GNYE				++Container-XE	PE	PE																&EFS/687.3

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W2-1 -XZ-500	++Container-291W1-1 -XZ-500	++Container-290W3-1 -XZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,				&EFS/687.4
=		GNYE			++Container-XE	PE	PE	,				&EFS/687.6
=	GNYE				++Container-XE	PE	PE	,				&EFS/687.7

previous page: 2026

next page: 2028

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W3-1 / JZ-500	++Container-292W2-1 / JZ-500	++Container-292W1-1 / JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,				&EFS/687.9
=		GNYE			++Container-XE	PE	PE	,				&EFS/688.2
=	GNYE				++Container-XE	PE	PE	,				&EFS/688.3

previous page: 2027

next page: 2029

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02	Battery Container 1
Date	21.01.2025					& EMZ	Terminals
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date						+	

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W3-1	++Container-293W2-1	++Container-293W1-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/688.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Container Internal Lighting						L	1	,	-690F1	2													&EFS/690.1
=						1	2	,	-690F2	2													&EFS/690.3
Container Sockets						1	3	,	-690F3	2													&EFS/690.5
230V AC for crane 2						1	4	,	-690F4	2													&EFS/690.7
230V AC for crane 3						1	5	,	-690F5	2													&EFS/690.8
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						L	6	,	-636K1	14													&EFS/691.1
						L																	
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						L	7	,	-636K2	14													&EFS/691.3
						L																	
								,															
								,															

previous page: 2029

next page: 2031

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,		

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
400V AC for Cooling Units							10	,	-691F4	4													&EFS/691.6
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,														

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
												Cable type	
230V AC for crane 2						PE	PE						&EFS/690.7
230V AC for crane 3						PE	PE						&EFS/690.8
Container Sockets						2	N		-690F2	N.			&EFS/690.4
230V AC for crane 1						2	N		-XES	N			&EFS/690.6
230V AC for crane 2						2	N		-XES	N			&EFS/690.7
230V AC for crane 3						2	N		-XES	N			&EFS/690.8
Container Internal Lighting						N	N		-690F1	N.			&EFS/690.1
=						GND	PE						&EFS/690.2
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						N	N		-XES	N			&EFS/691.1
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						GND	PE						&EFS/691.2
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						N	N						&EFS/691.3
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						GND	PE						&EFS/691.3
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						N	N						&EFS/691.4
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						GND	PE						&EFS/691.4
						GND							
400V AC for Cooling Units							N						&EFS/691.6
=							PE						&EFS/691.6

previous page: 2032

next page: =UNIT_03&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-690XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet page: 2033
Date								+ total: 492

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	BATTERY CONTAINER 2	
Circuit diagram No:	10354_23A2007	20250805_V2.0

Producer (company):	Freqcon GmbH	53412 ASC 53409
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Project manager:	Freqcon_CP	

created on: 17.09.2019
edited on: 05.08.2025 edited by: Freqcon_DG total pages: 492

previous page:
=UNIT_02&EMZ++ASC/2033

next page:
&EAB/1

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	21.01.2025	Freqcon_DG
	3	INDEX	21.01.2025	Freqcon_DG
	4	INDEX	21.01.2025	Freqcon_DG
	5	INDEX	21.01.2025	Freqcon_DG
	6	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	05.11.2024	Freqcon_DG
	3a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
&ELU		Cabinet Overview		
	5a	Container overview	14.06.2024	Freqcon_JD
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	191	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	192	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	193	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	278	EARTHING CONTAINER	18.06.2024	Freqcon_JD
	290	BATTERY CABINETS 1-3	18.06.2024	Freqcon_JD
	291	BATTERY CABINETS 4+5	18.06.2024	Freqcon_JD
	292	BATTERY CABINETS 6-8	18.06.2024	Freqcon_JD
	293	BATTERY CABINETS 9-11	18.06.2024	Freqcon_JD
&EFS ++ASC		Circuit diagram auxillary cabinet		
	601	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	602	CONTROL VOLTAGE UPS	18.06.2024	Freqcon_JD
	603	CONTROL VOLTAGE FUSE	10.10.2024	Freqcon_DG
	611	ETHERNET SWITCH	18.06.2024	Freqcon_JD
	613a	ETHERNET / PROFINET ISOLATOR	25.11.2024	Freqcon_DG
	613b	PROFINET	25.11.2024	Freqcon_DG
	620	ET200 24V DC ASC	25.11.2024	Freqcon_DG
	621	ET200SP DIGITAL INPUTS DI_21 + DI_22	03.12.2024	Freqcon_DG
	623	ET200SP DIGITAL OUTPUTS DO_21	14.06.2024	Freqcon_JD
	624	ET200SP ANALOG INPUTS AI_21	14.06.2024	Freqcon_JD
	625	ET200SP ANALOG OUTPUTS AO_21	14.06.2024	Freqcon_JD
	635a	OUTPUTS COMMUNICATION	18.06.2024	Freqcon_JD
	635b	OUTPUTS COMMUNICATION	18.06.2024	Freqcon_JD
	636	OUTPUTS FIRE DAMPER	18.06.2024	Freqcon_JD
	669	SMOKE POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	670	GAS POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	678	DC BATTERY CABINETS	18.06.2024	Freqcon_JD
	680a	STATIONARY GAS DETECTOR BAT 1-4	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++ASC		Circuit diagram auxillary cabinet		
	680b	STATIONARY GAS DETECTOR BAT 5-8	18.06.2024	Freqcon_JD
	680c	STATIONARY GAS DETECTOR BAT 9-11	18.06.2024	Freqcon_JD
	681	EXTRACT FAN FIRE DAMPER	18.06.2024	Freqcon_JD
	684	AUXILIARY SUPPLY 400V AC	22.11.2024	Freqcon_DG
	685	AUXILIARY SUPPLY 400V AC	08.10.2024	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	29.10.2024	Freqcon_DG
	691	CONTAINER COOLING / LIGHTNING	05.11.2024	Freqcon_DG
&EPC ++Container		Parts List		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	21.01.2025	Freqcon_DG
	4	PARTS LIST	21.01.2025	Freqcon_DG
	5	PARTS LIST	21.01.2025	Freqcon_DG
	6	PARTS LIST	21.01.2025	Freqcon_DG
	7	PARTS LIST	21.01.2025	Freqcon_DG
	8	PARTS LIST	21.01.2025	Freqcon_DG
&EPA ++Container		Summarized part list		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
&EMB ++Container		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	21.01.2025	Freqcon_DG

previous page: 3

next page: 5

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_03++ASC+-X5.1 - =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_03++ASC+-X5.1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_03++ASC+-X5.2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_03++ASC+-X5.3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_03++ASC+-X6	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_03++ASC+-XDC1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_03++ASC+-XDC2	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_03++ASC+-XES	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_03++ASC+-XT	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2009	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2024	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG
	2025	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2026	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG
	2027	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2028	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2029	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2030	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2031	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2032	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2033	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2034	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/6

next page: 6a

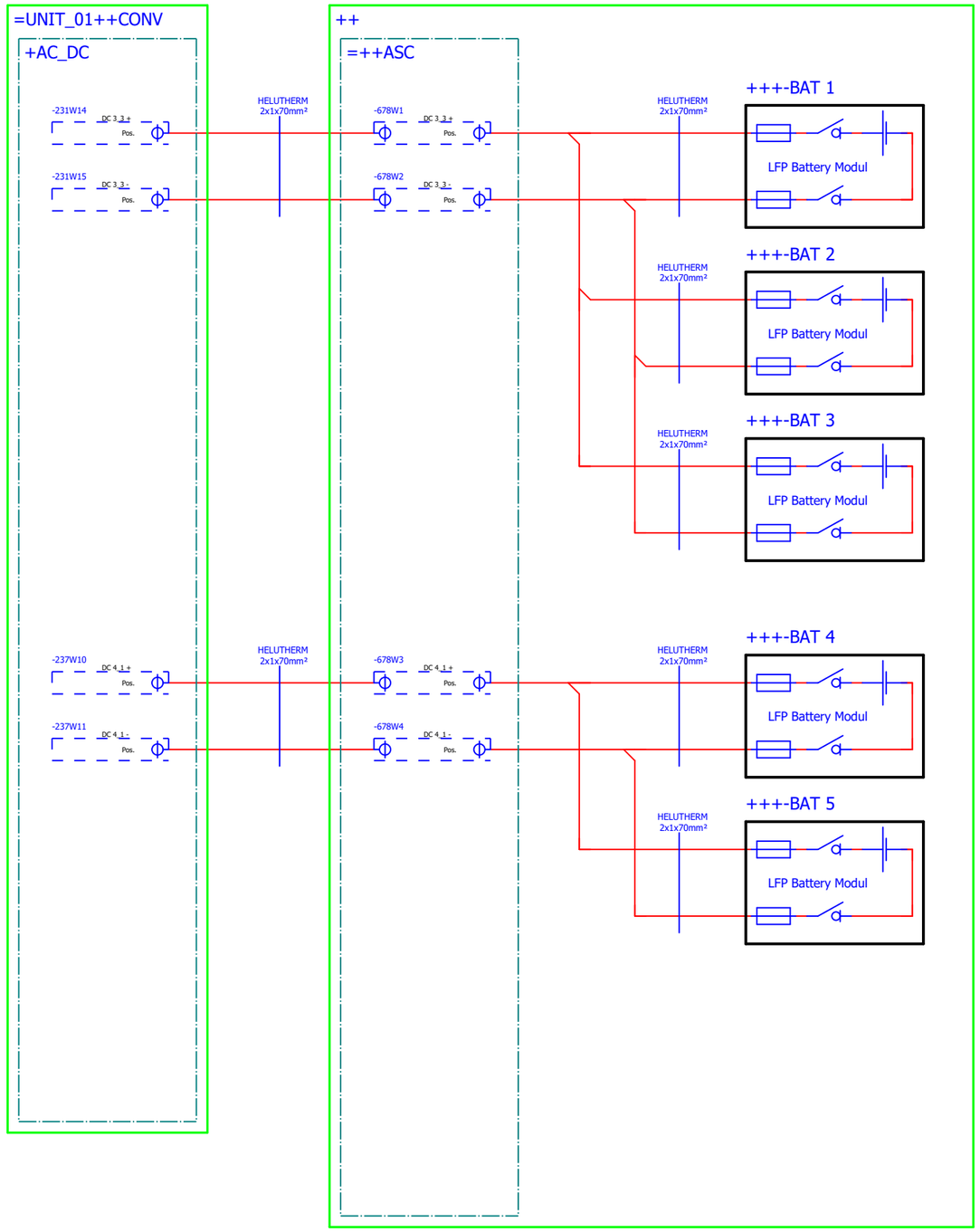
SPECIFICATION of grounding

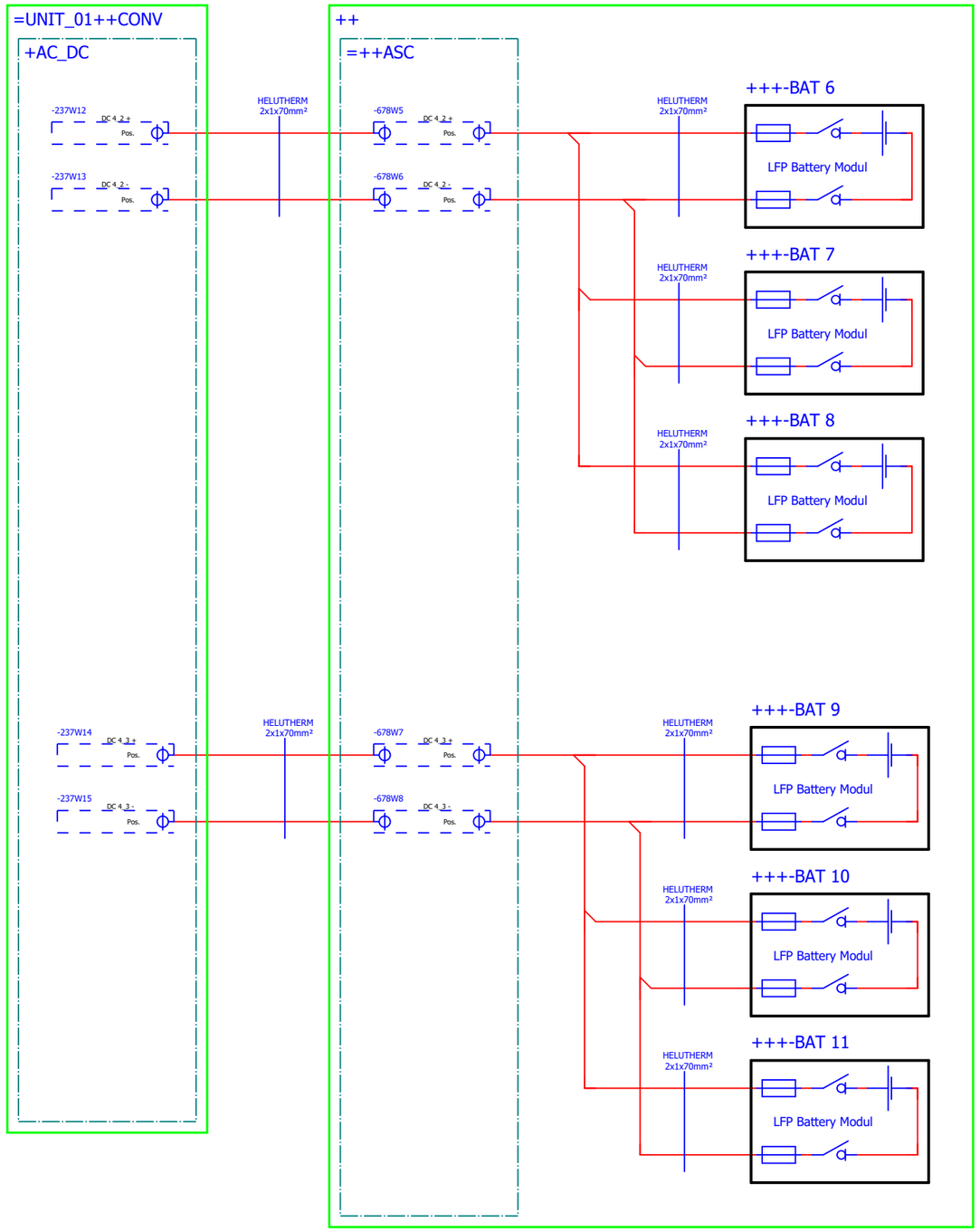
	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Single line diagram





previous page:
&EAC/6a

next page:
2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 1a
Date								+ total: 492

Single line diagram

Control circuit

++ASC

400V

-XES

-684F3 &EFS++ASC/684.2 C32A

-684F1 &EFS++ASC/684.0 C32A

-684F2 &EFS++ASC/684.5 TYP 1 + 2 SPD

-601F1 &EFS++ASC/601.1 TYP 1 + 2 SPD

-684F4 &EFS++ASC/685.0 C32A

-684F5 &EFS++ASC/685.5 TYP 1 + 2 SPD

-691F1 &EFS++ASC/691.1 C6A

-691F2 &EFS++ASC/691.3 C6A

-691F3 &EFS++ASC/691.4 C6A

-690F1 &EFS++ASC/690.1 16A

-690F3 &EFS++ASC/690.5 C6A

-690F4 &EFS++ASC/690.7 C6A

-690F5 &EFS++ASC/690.8 C6A

-691F4 &EFS++ASC/691.5 C16A

-690F2 &EFS++ASC/690.3 16A

-101Q1

-687F1 &EFS++ASC/687.1 C16A

-687F2 &EFS++ASC/687.3 C16A

-687F3 &EFS++ASC/687.4 C16A

-687F4 &EFS++ASC/687.5 C16A

-687F5 &EFS++ASC/687.7 C16A

-636K1 &EFS++ASC/636.1

-636K2 &EFS++ASC/636.2

-636K3 &EFS++ASC/636.4

M 1~

1/N/PE

1/N/PE

1/N/PE

1/N/PE 1/N/PE

20 A

Battery cabinet 1

Battery cabinet 2

Battery cabinet 3

Battery cabinet 4

Battery cabinet 5

-687F6 &EFS++ASC/687.8 C16A

-688F1 &EFS++ASC/688.1 C16A

-688F2 &EFS++ASC/688.2 C16A

-688F3 &EFS++ASC/688.4 C16A

-688F4 &EFS++ASC/688.5 C16A

-688F5 &EFS++ASC/688.7 C16A

Battery cabinet 6

Battery cabinet 7

Battery cabinet 8

Battery cabinet 9

Battery cabinet 10

Battery cabinet 11

Exhaust Unit / shut-off flap Bat 1-4

Exhaust Unit / shut-off flap Bat 5-8

Exhaust Unit / shut-off flap Bat 9-11

Container Internal Lighting

crane 1

crane 2

crane 3

Cooling Units

Container Sockets

Power Supply

previous page: 1a

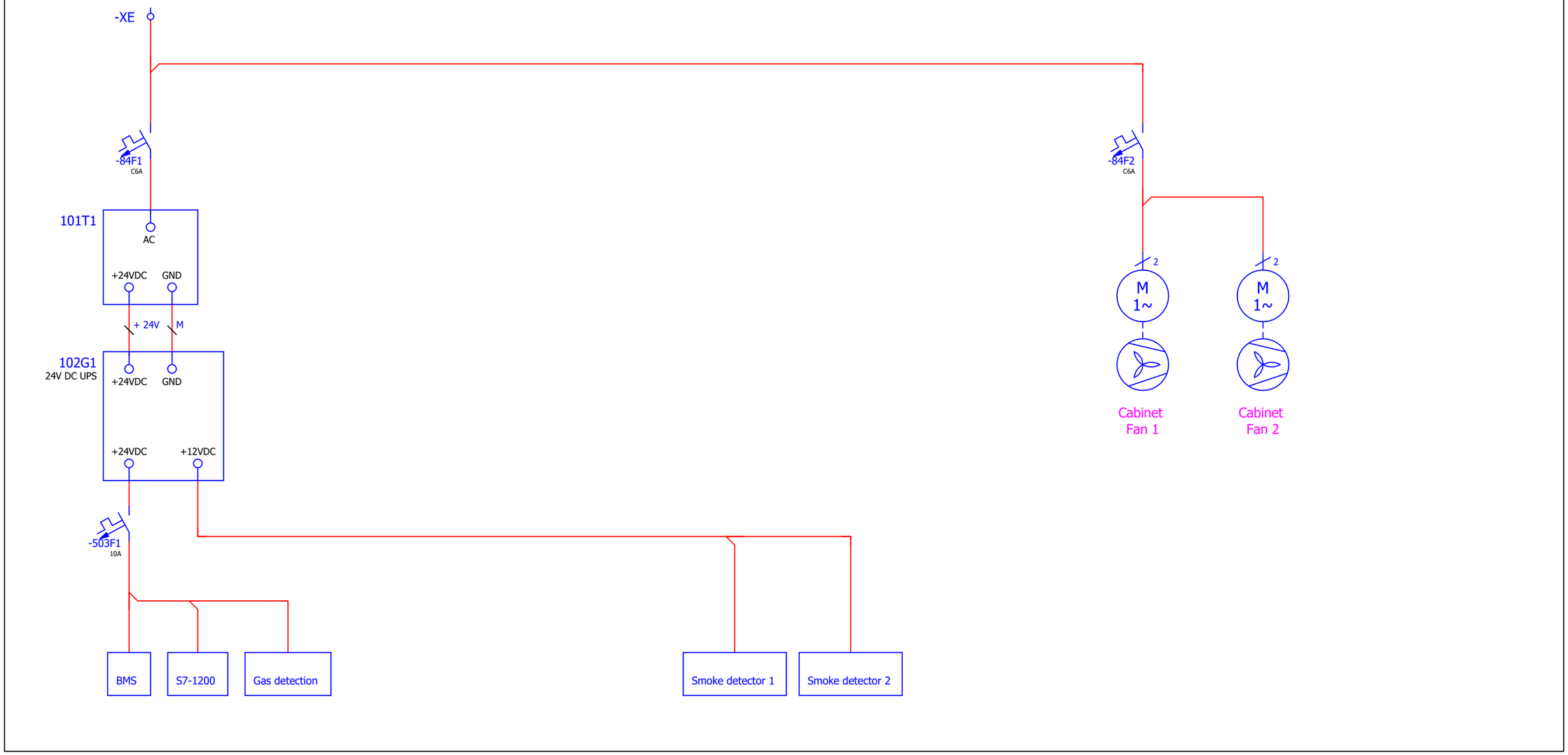
next page: 3a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2a
Date								+ total: 492

Single line diagram

Control circuit

Battery Cabinet

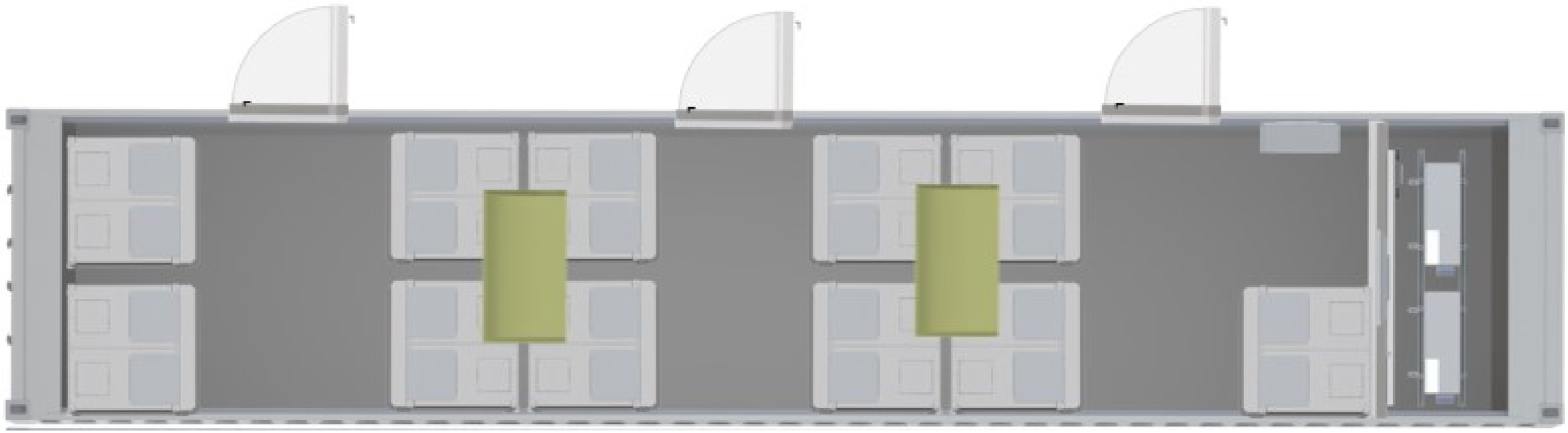


previous page:
2a

next page:
&ELU/5a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 3a
Date								+	total: 492

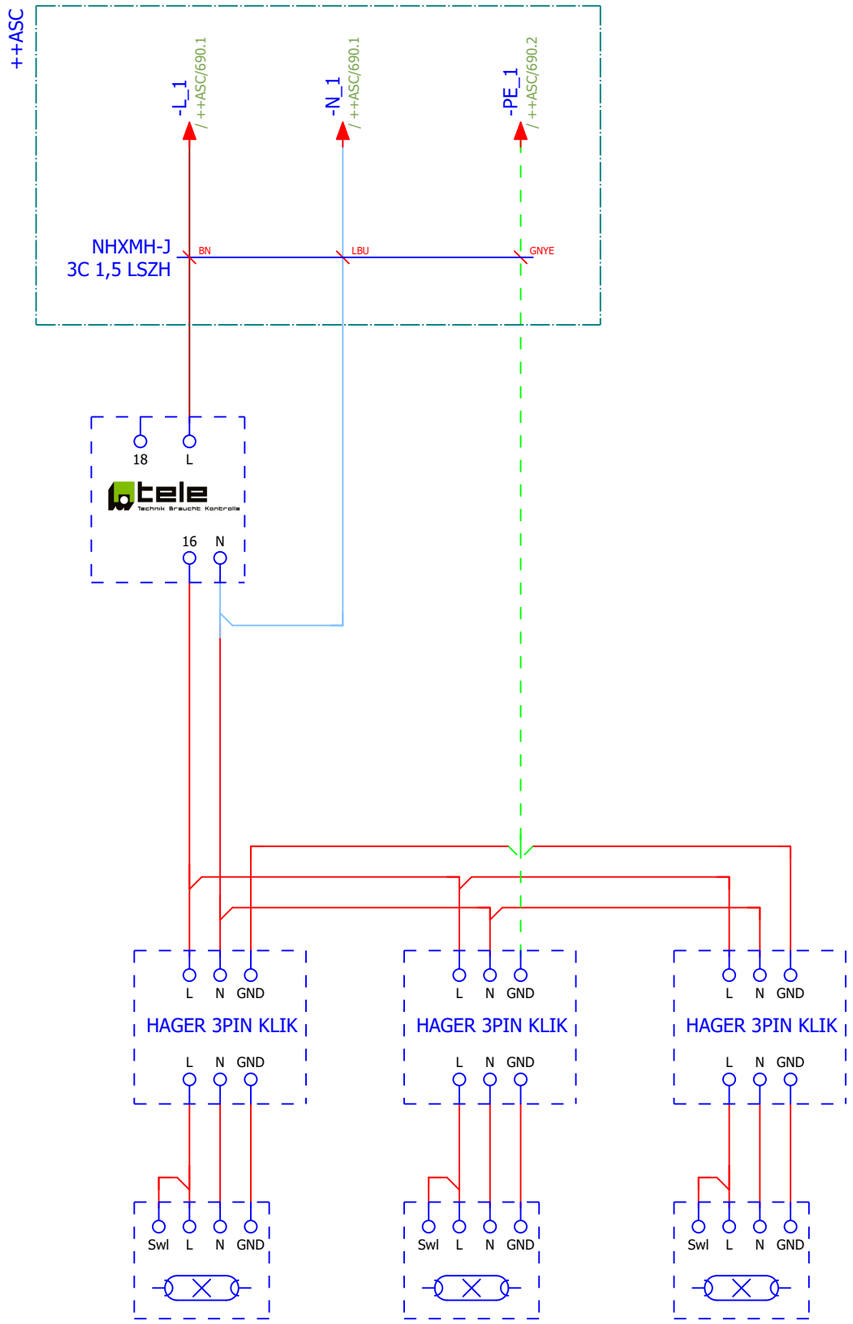
0	1	2	3	4	5	6	7	8	9



previous page:
&EFA/3a

next page:
&EFS++Container/190

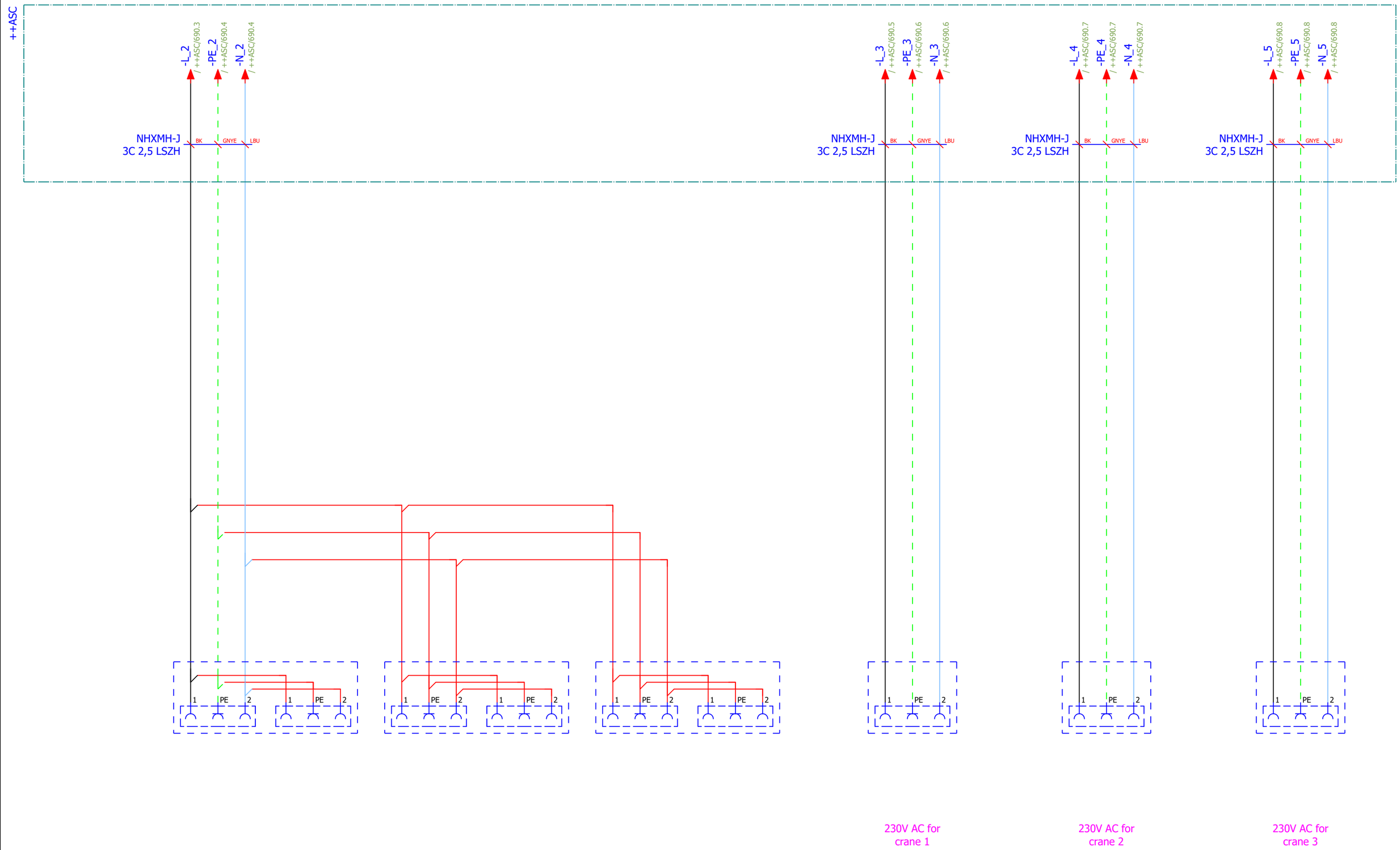
Editor	Freqcon_JD			Statron	FREQCON	Container overview	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	14.06.2024	Norm						& ELU Cabinet Overview	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
191

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492



previous page: 190

next page: 192

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 191
Date								+	total: 492

++ASC

-L_6 / ++ASC/691.1
-N_6 / ++ASC/691.1
-PE_6 / ++ASC/691.2

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 1-4

-L_6 / ++ASC/691.1
-N_6 / ++ASC/691.1
-PE_6 / ++ASC/691.2

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

230V AC for
shut-off flap
Battery cabinets 1-4

-L_7 / ++ASC/691.3
-N_7 / ++ASC/691.3
-PE_7 / ++ASC/691.3

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 5-8

-L_7 / ++ASC/691.3
-N_7 / ++ASC/691.3
-PE_7 / ++ASC/691.3

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

230V AC for
shut-off flap
Battery cabinets 5-8

-L_8 / ++ASC/691.4
-N_8 / ++ASC/691.4
-PE_8 / ++ASC/691.4

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 9-11

-L_8 / ++ASC/691.4
-N_8 / ++ASC/691.4
-PE_8 / ++ASC/691.4

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

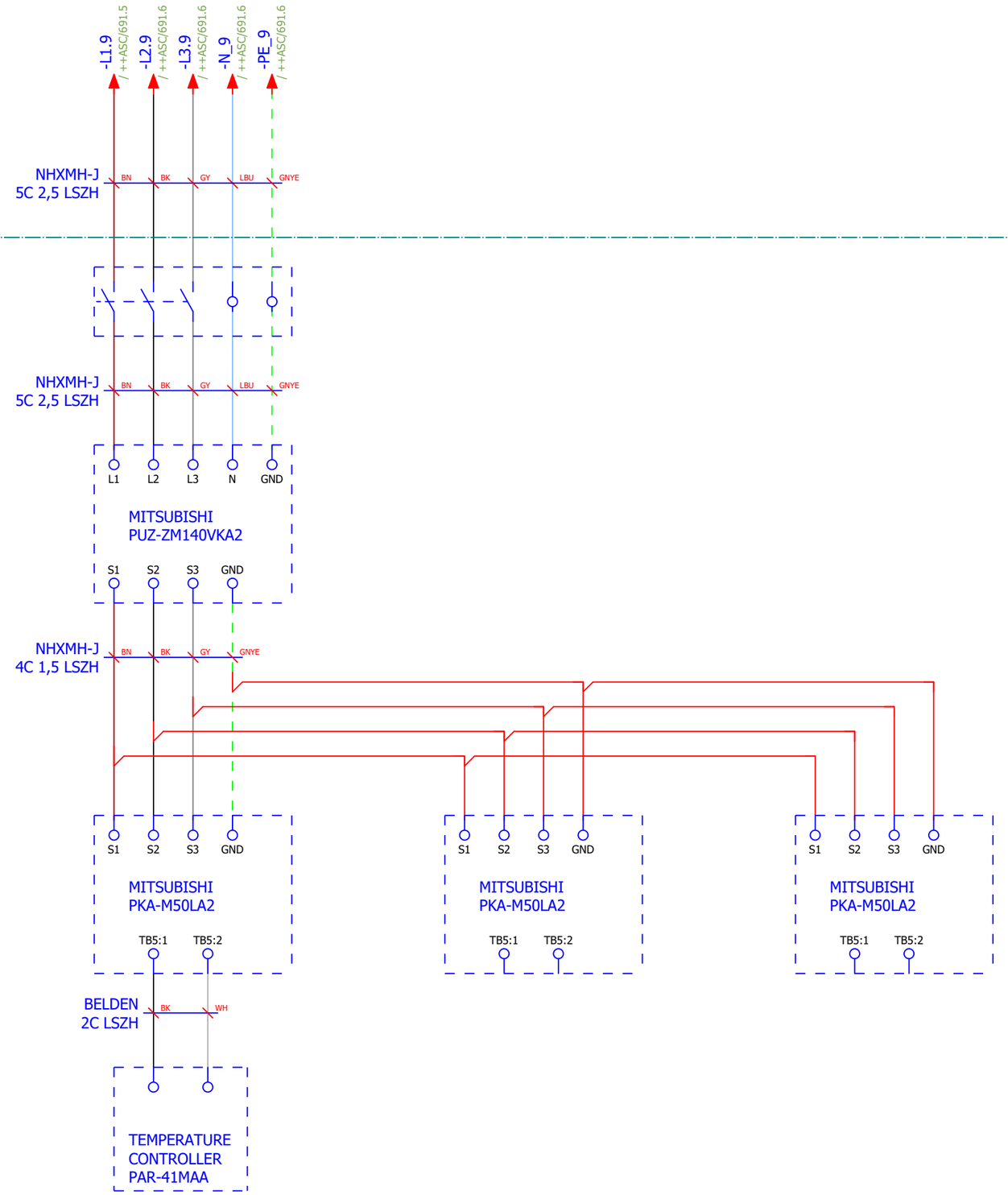
230V AC for
shut-off flap
Battery cabinets 9-11

previous page:
191

next page:
193

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 192
Date								+	total: 492

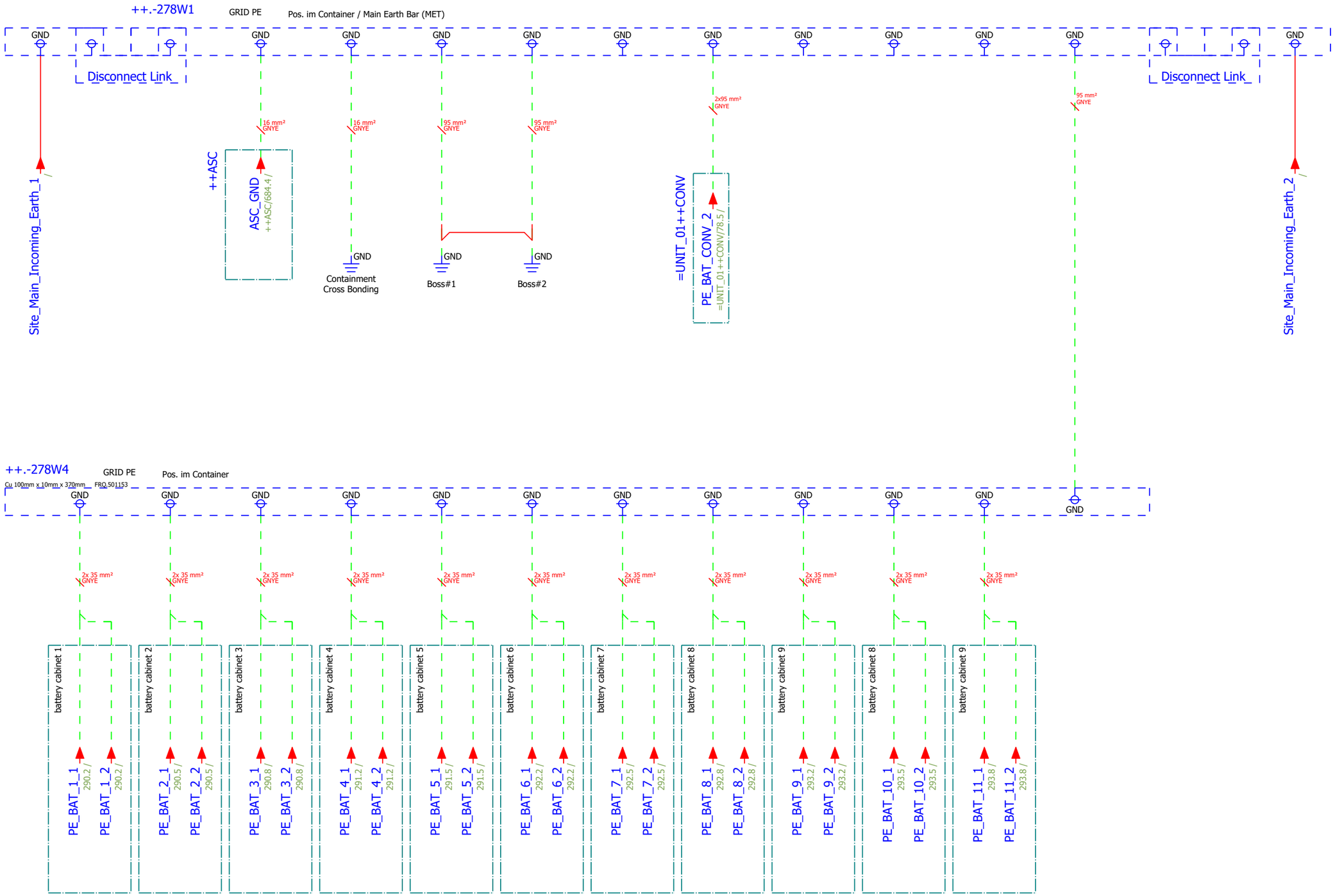
++ASC



previous page: 192

next page: 278

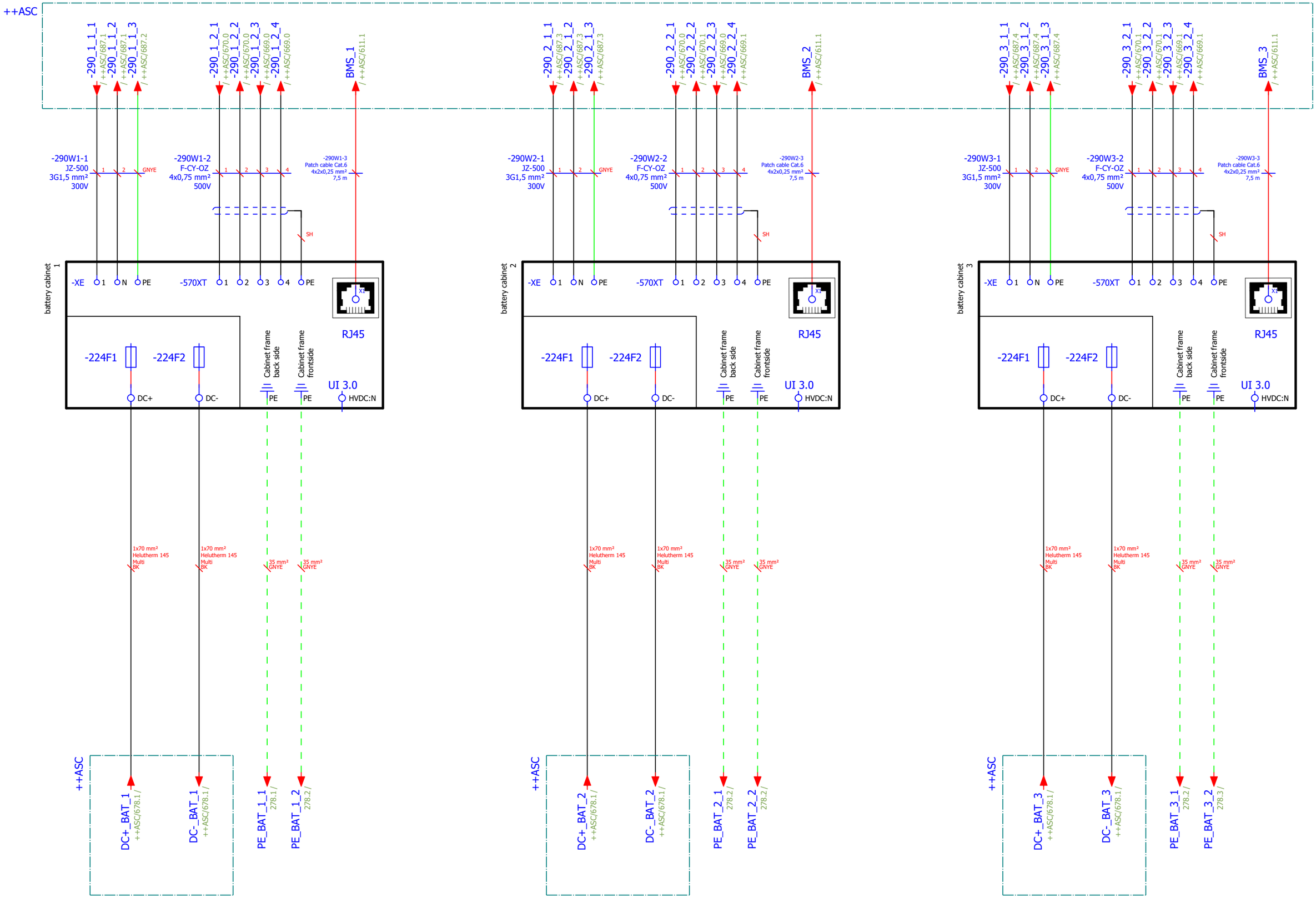
Busbars PE



previous page: 193

next page: 290

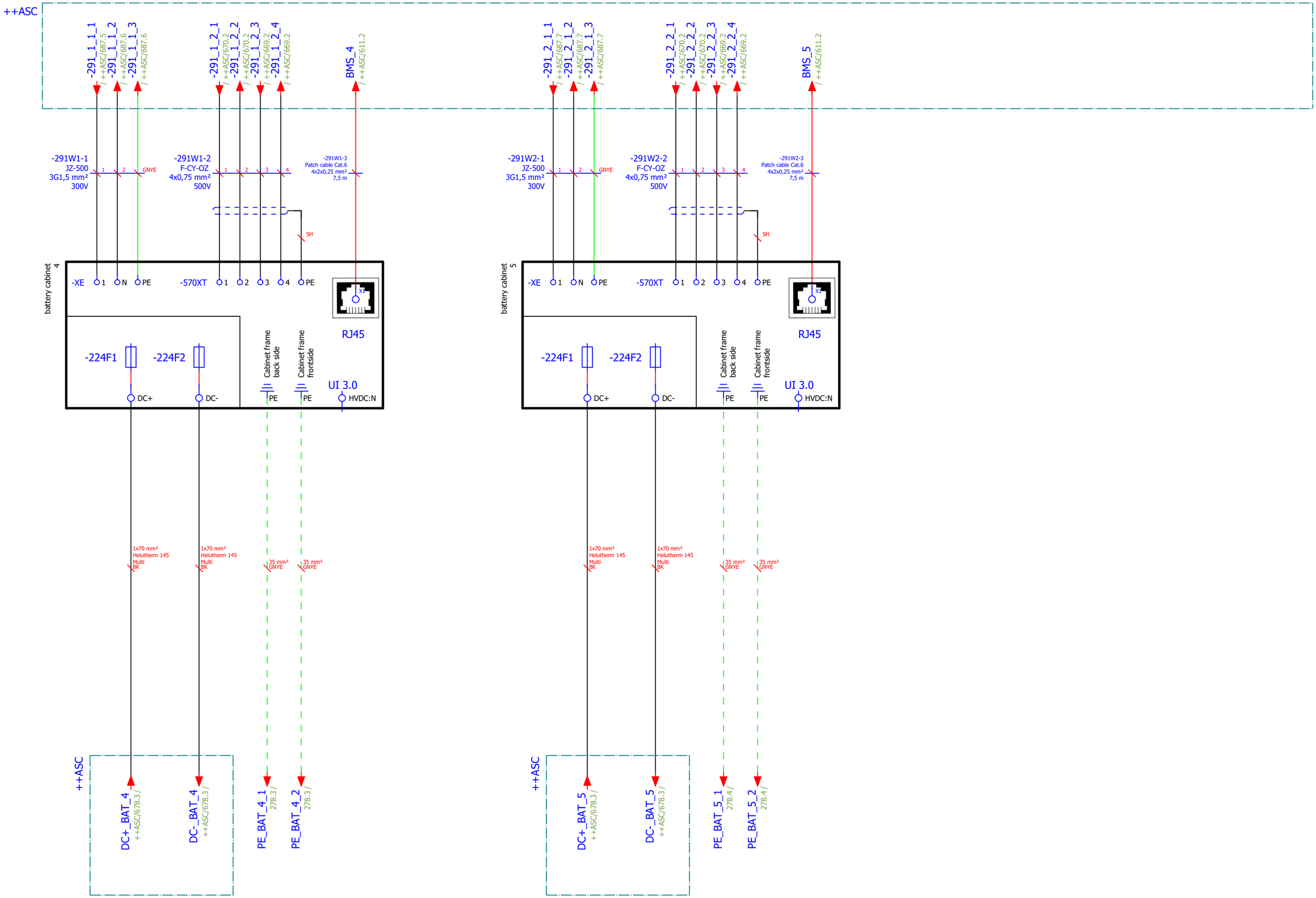
Editor	Freqcon_JD			Statron	FREQCON	EARTHING CONTAINER	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 278
Date								+	total: 492



previous page: 278

next page: 291

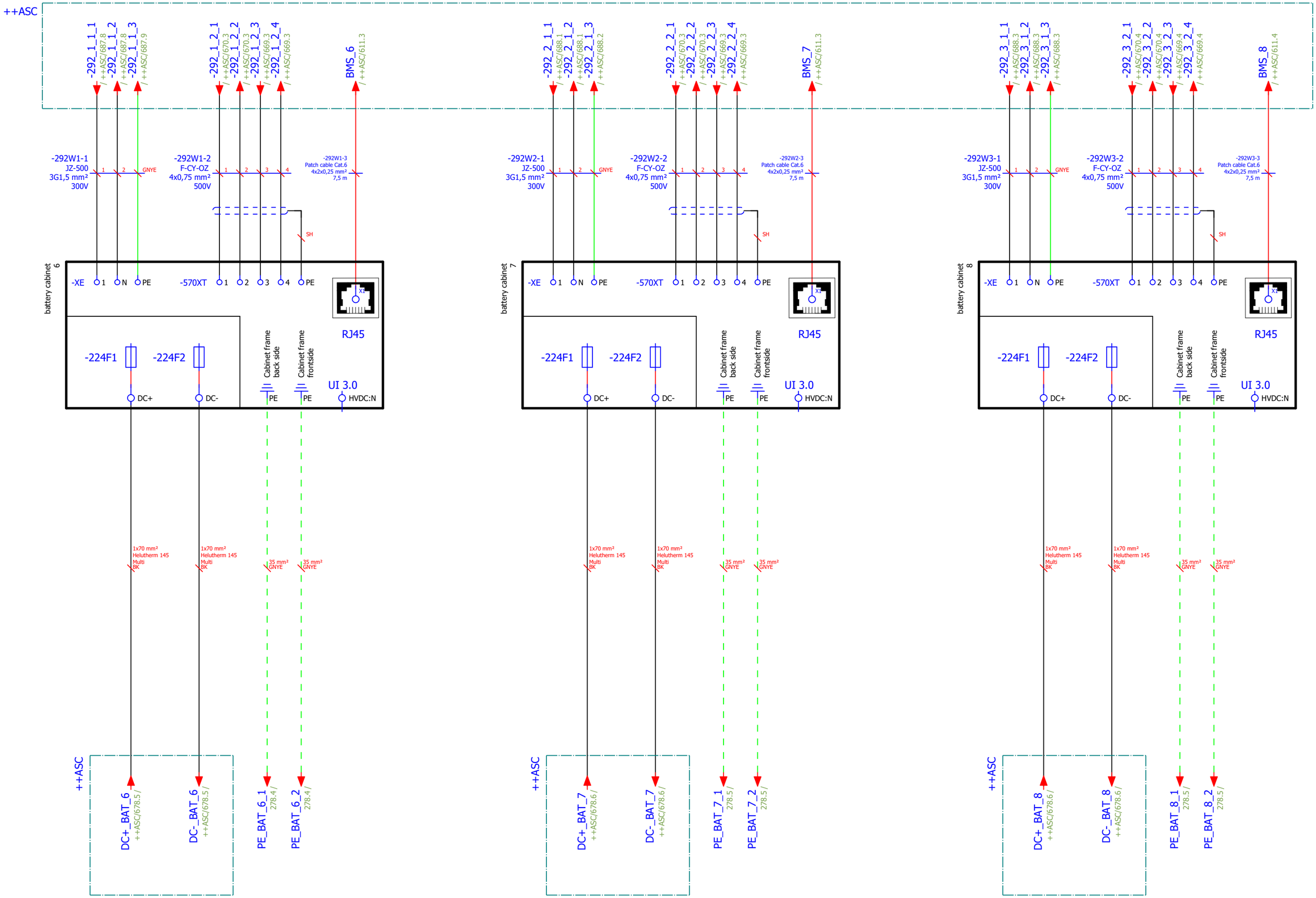
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 1-3	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 290
Date								+	total: 492



previous page: 290

next page: 292

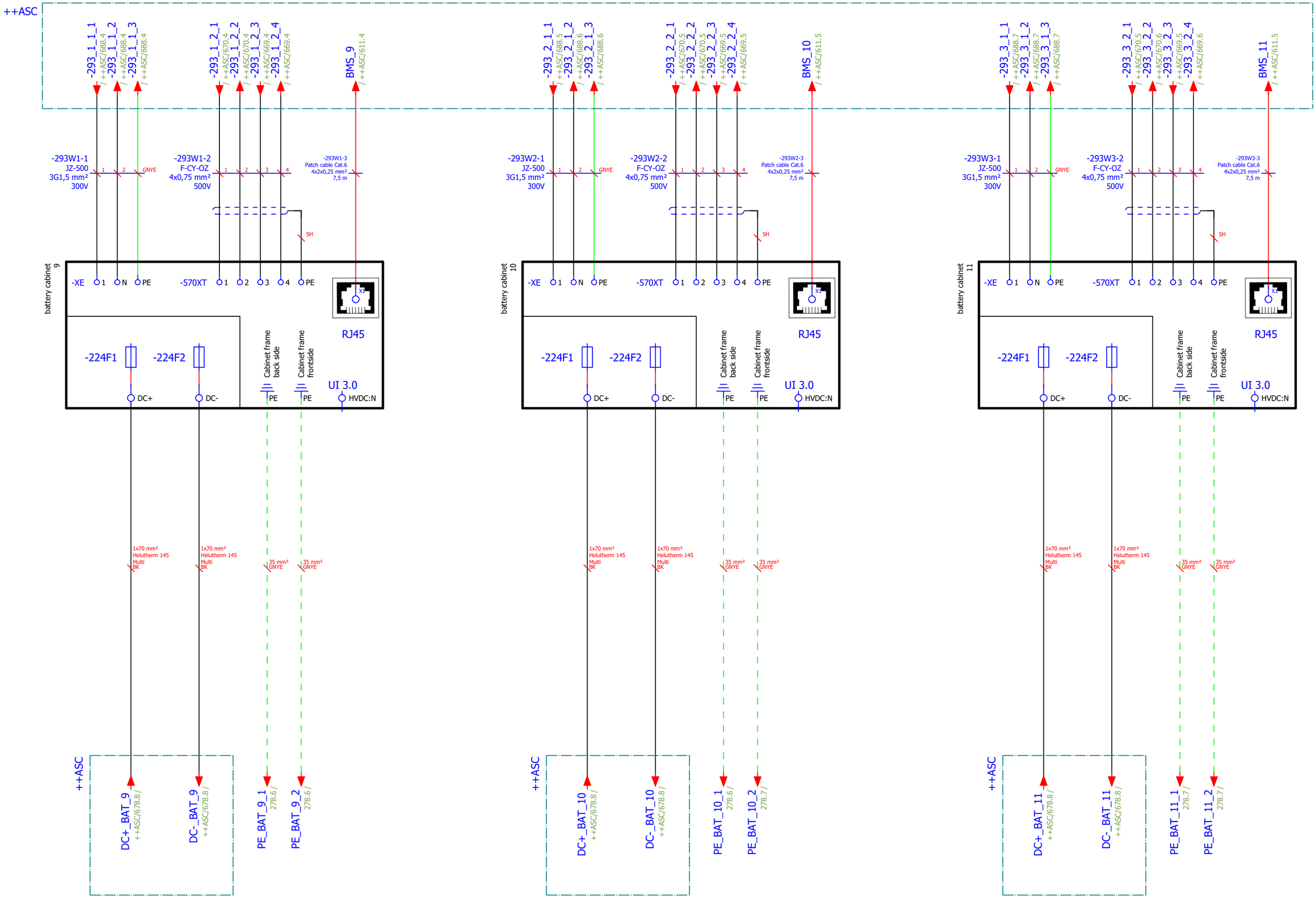
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 4+5	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 291
Date								+	total: 492



previous page: 291

next page: 293

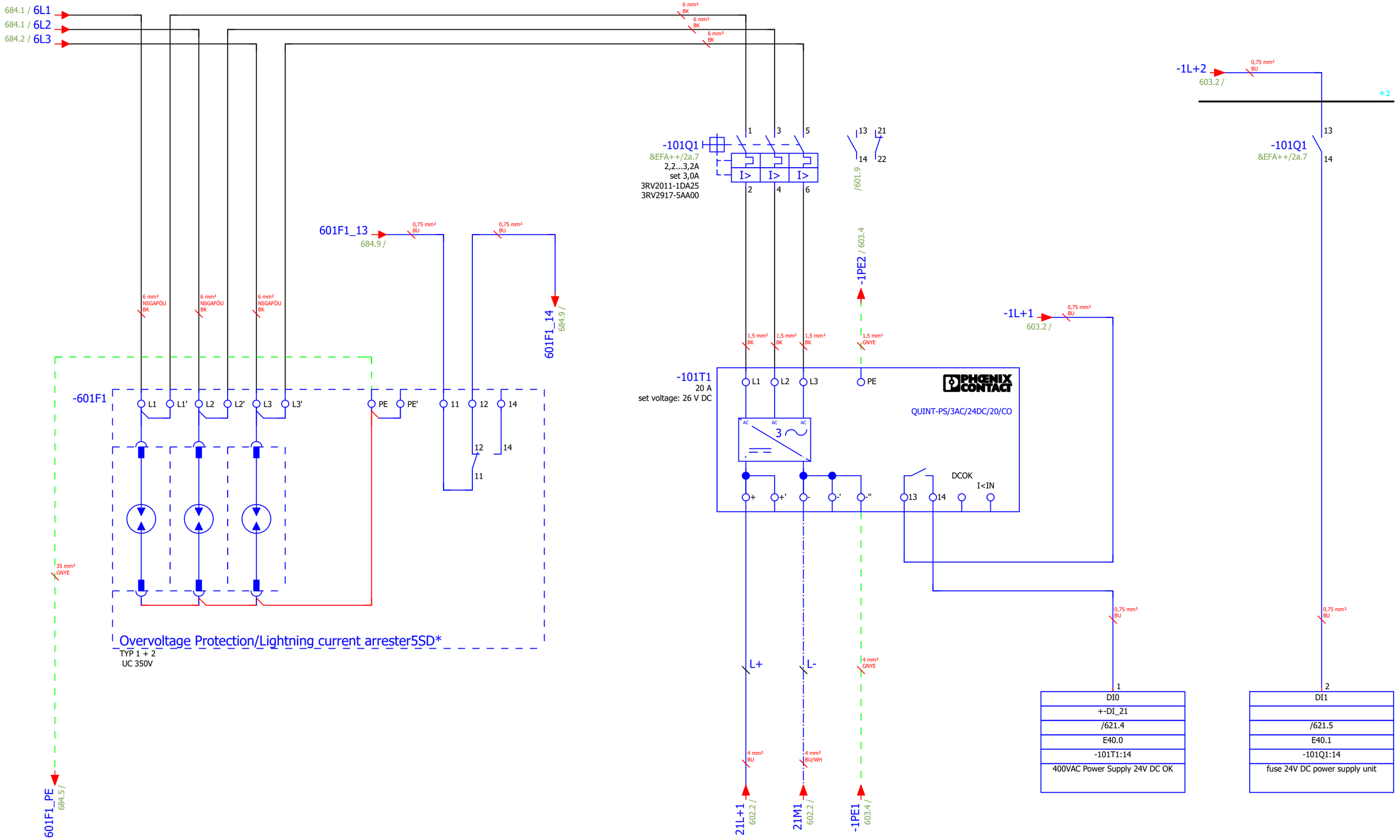
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 6-8	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 292
Date								+ total: 492



previous page: 292

next page: ++ASC/601

Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 9-11	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 293
Date								+ total: 492



previous page:
++Container/293

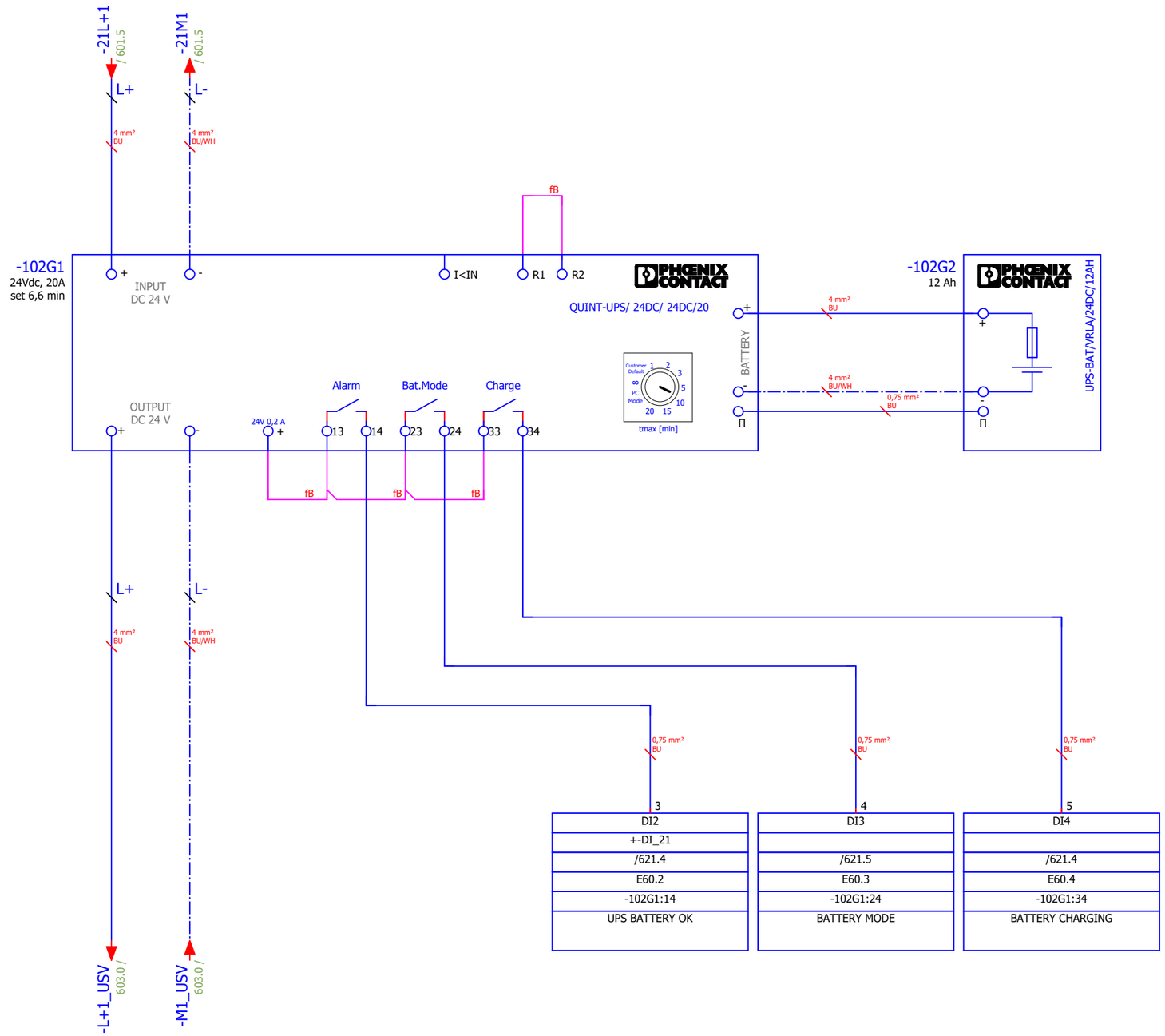
Power supply unit from 400V AC

400VAC
Power Supply
24V DC OK

fuse
24V DC power supply unit

next page:
602

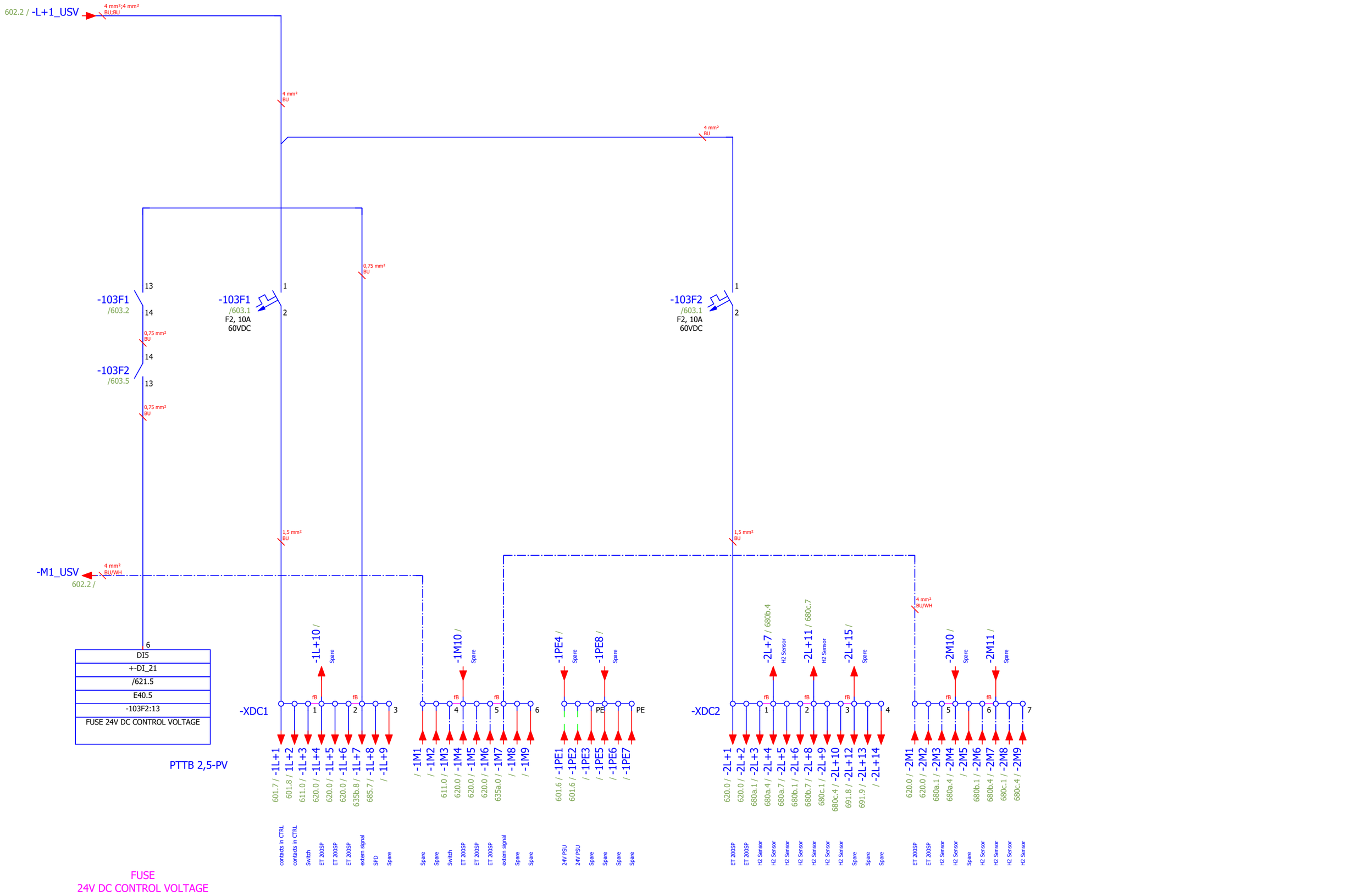
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_03	Battery Container 2
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	page: 601 / total: 492



previous page:
601

next page:
603

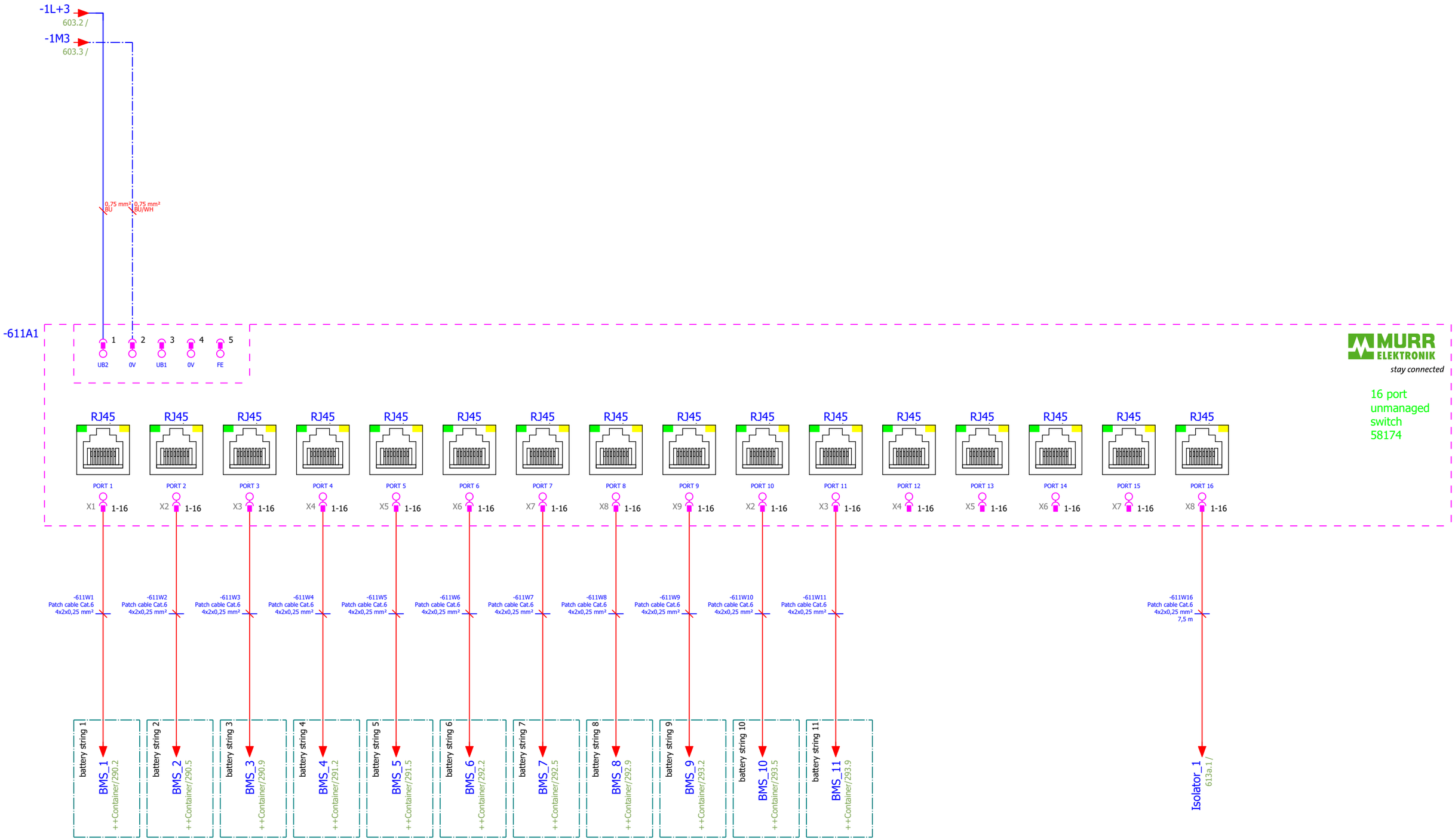
Editor	Freqcon_JD			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 602
Date								+	total: 492



previous page:
602

next page:
611

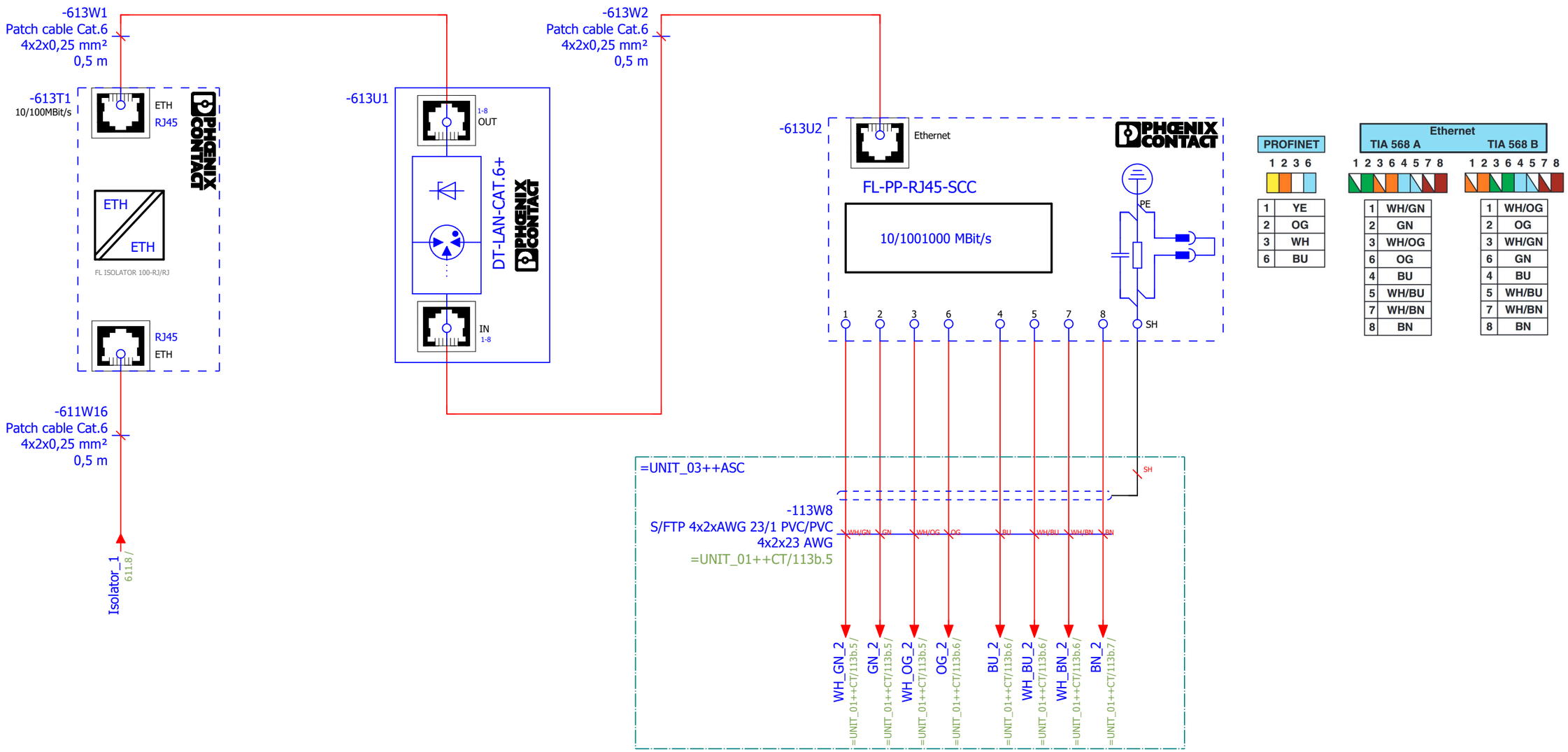
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	10.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxiliary cabinet	page: 603
Date								+	total: 492



previous page: 603

next page: 613a

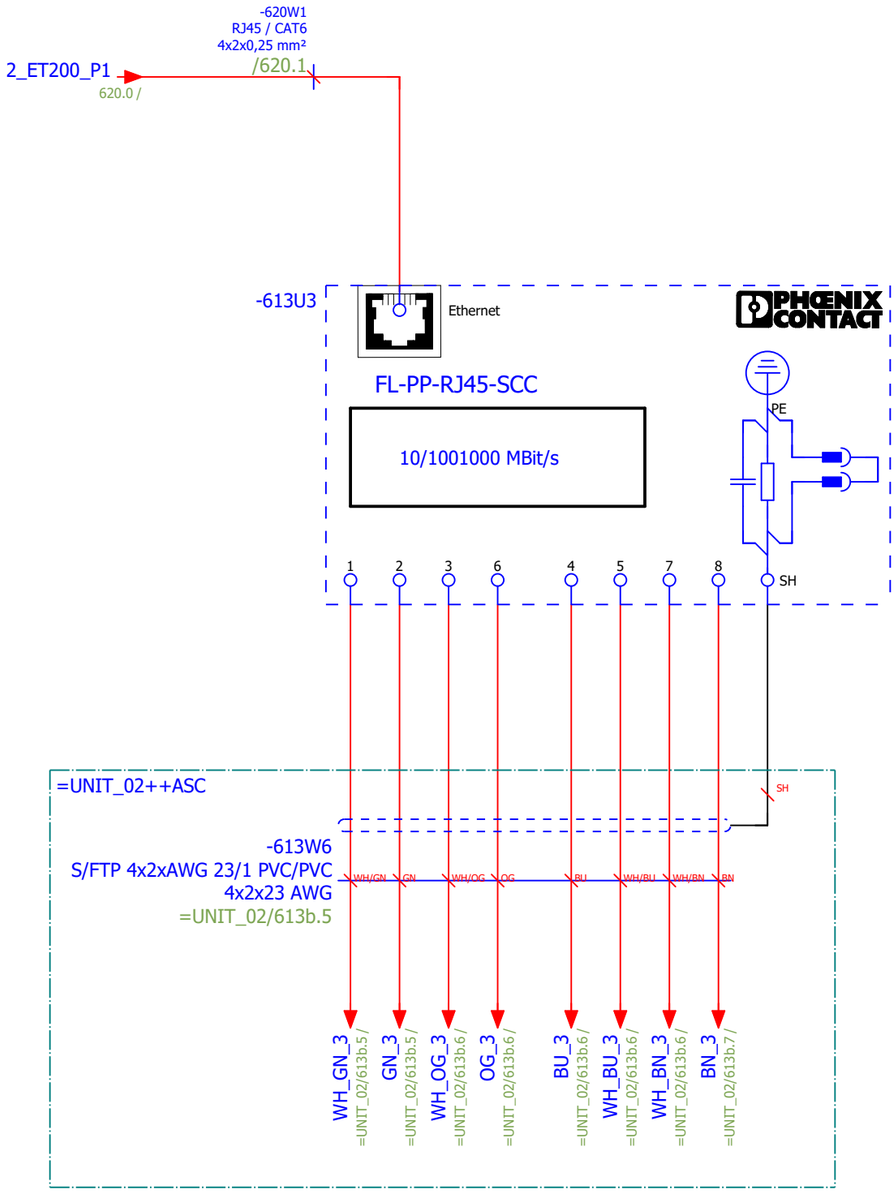
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 492



previous page:
611

next page:
613b

Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	25.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 613a
Date								+	total: 492



PROFINET

1 2 3 6

1	YE
2	OG
3	WH
6	BU

Ethernet

TIA 568 A

1 2 3 6 4 5 7 8

1	WH/GN
2	GN
3	WH/OG
6	OG
4	BU
5	WH/BU
7	WH/BN
8	BN

TIA 568 B

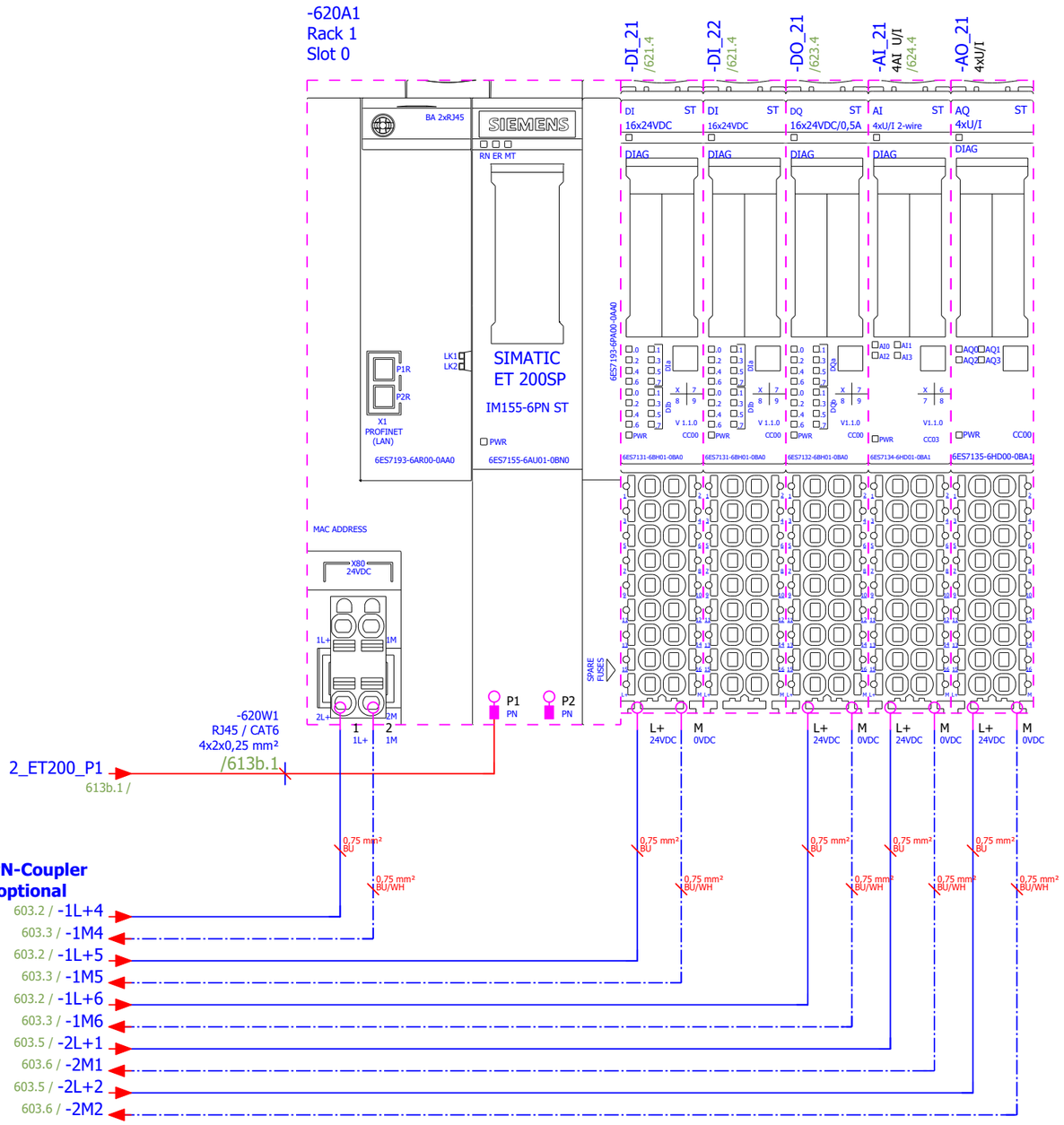
1 2 3 6 4 5 7 8

1	WH/OG
2	OG
3	WH/GN
6	GN
4	BU
5	WH/BU
7	WH/BN
8	BN

previous page:
613a

next page:
620

Editor	Freqcon_DG			Statron	FREQCON	PROFINET	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613b
Date								+		total: 492



previous page:
613b

next page:
621

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC ASC	20250805_V2.0	= UNIT_03	Battery Container 2
Date	25.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 620
total: 492

-DI_21

/620.3

400VAC Power Supply 24V DC OK	/601.7	DI0	1	E60.0	E60.1	2	DI1	/601.9	fuse 24V DC power supply unit
UPS BATTERY OK	/602.5	DI2	3	E60.2	E60.3	4	DI3	/602.6	BATTERY MODE
BATTERY CHARGING	/602.7	DI4	5	E60.4	E60.5	6	DI5	/603.1	FUSE 24V DC CONTROL VOLTAGE
Gassensor OK BAT 1-4	/680a.7	DI6	7	E60.6	E60.7	8	DI7	/680b.7	Gassensor OK BAT 5-8
Gassensor OK BAT 9-11	/680c.7	DI8	9	E61.0	E61.1	10	DI9	/635b.8	Shut-down to BESS
FUSE AND LIGHTNING PROTECTION	/684.9	DI10	11	E61.2	E61.3	12	DI11	/691.8	Fuse Exhaust Unit
Fuse Cooling Units	/691.9	DI12	13	E61.4	E61.5	14	DI13		
		DI14	15	E61.6	E61.7	16	DI15		
	/620.3	24VDC	L+			M	0VDC	/620.3	

-DI_22

/620.3

DI0	1	E62.0	E62.1	2	DI1
DI2	3	E62.2	E62.3	4	DI3
DI4	5	E62.4	E62.5	6	DI5
DI6	7	E62.6	E62.7	8	DI7
DI8	9	E63.0	E63.1	10	DI9
DI10	11	E63.2	E63.3	12	DI11
DI12	13	E63.4	E63.5	14	DI13
DI14	15	E63.6	E63.7	16	DI15
24VDC	L+			M	0VDC

previous page: 620

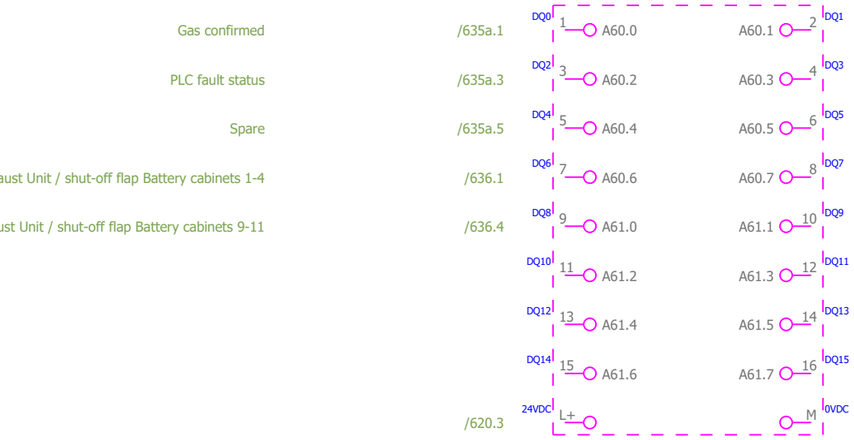
next page: 623

Editor	Freqcon_DG			Statron		ET200SP DIGITAL INPUTS DI_21 + DI_22	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	03.12.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 621
Date								+		total: 492

0	1	2	3	4	5	6	7	8	9

-DO_21

/620.3



Gas confirmed	/635a.1				/635a.2	Smoke confirmed
PLC fault status	/635a.3				/635a.4	Thermal runaway
Spare	/635a.5				/635a.6	Spare
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4	/636.1				/636.2	230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11	/636.4					
	/620.3				/620.4	

previous page: 621

next page: 624

Editor	Freqcon_JD			Statron		ET200SP DIGITAL OUTPUTS DO_21	20250805_V2.0	= UNIT_03	Battery Container 2
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

-AI_21

/620.4



gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

/620.4

/680b.2 gas concentration BAT 5-8

/680b.2 gas concentration BAT 5-8

/620.4

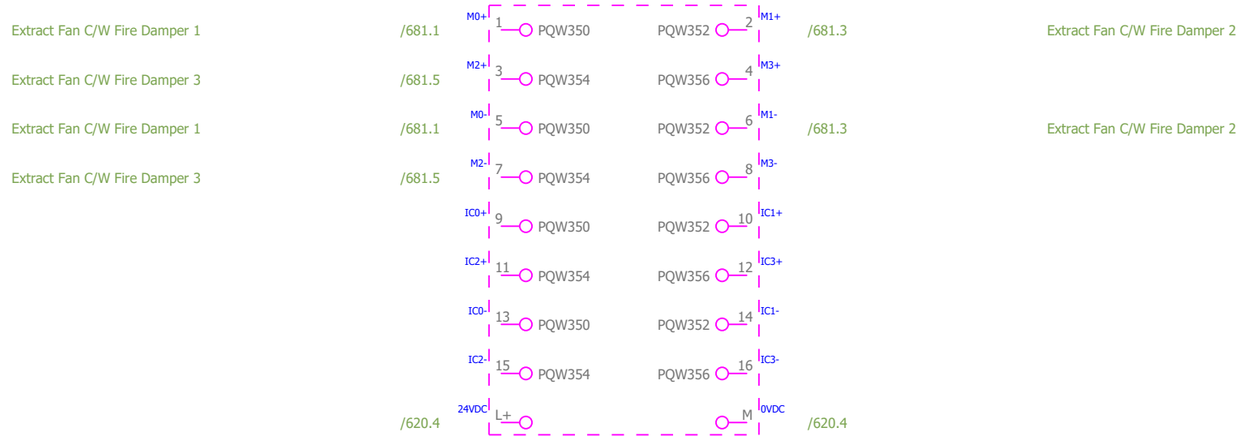
previous page: 623

next page: 625

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_21	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 624
Date								+	total: 492

-AO_21

/620.4



previous page: 624

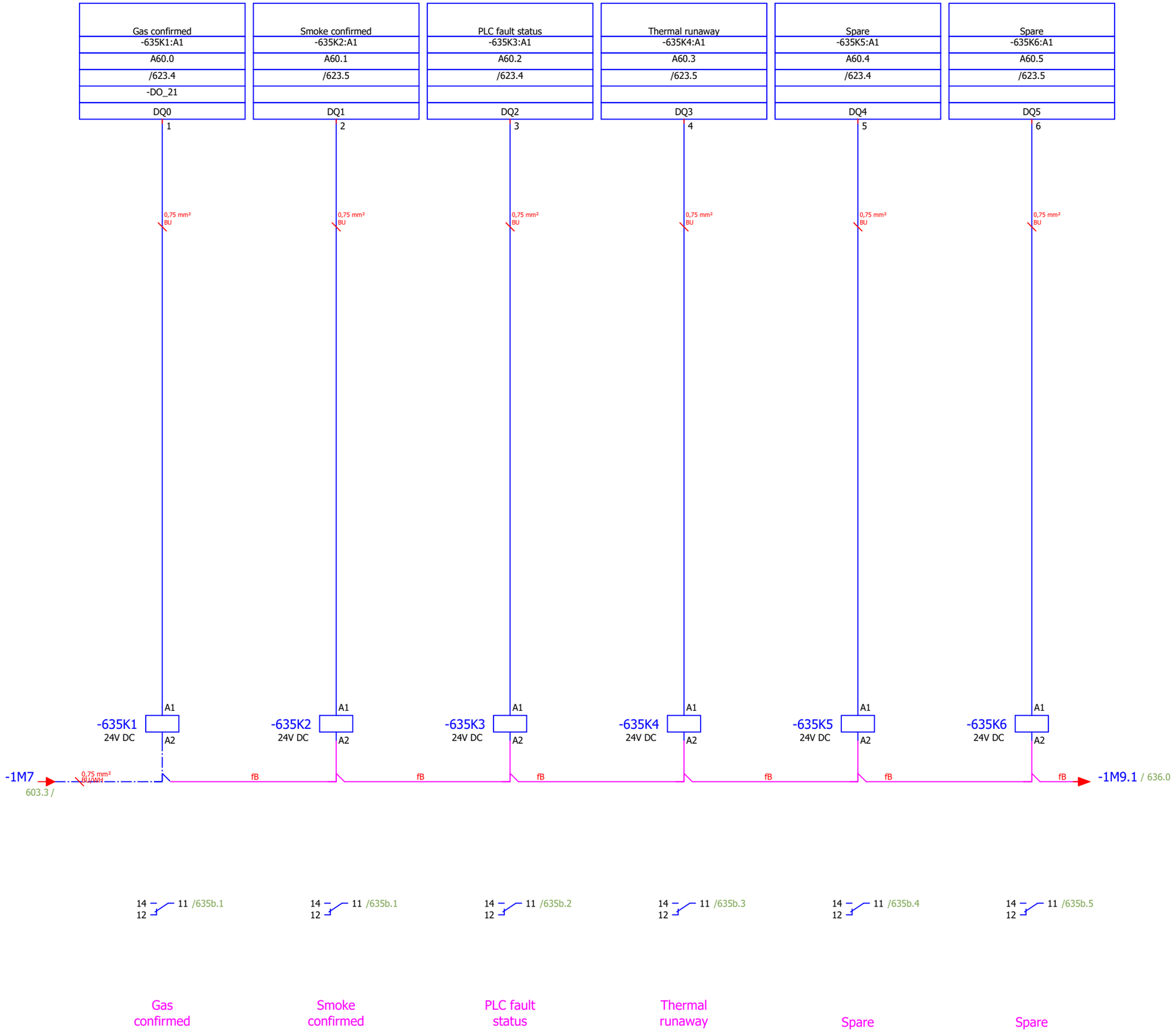
next page: 635a

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG OUTPUTS AO_21	20250805_V2.0	= UNIT_03	Battery Container 2
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 625

total: 492

0	1	2	3	4	5	6	7	8	9



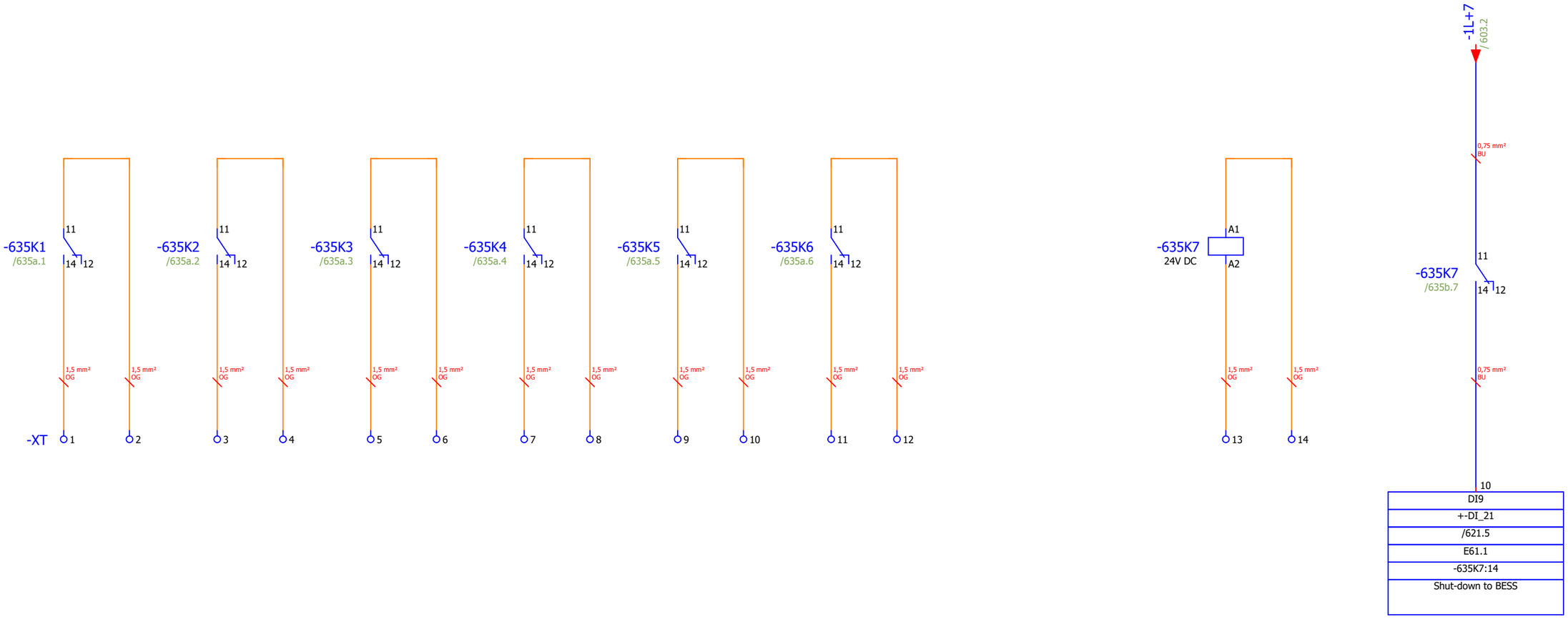
previous page: 625

next page: 635b

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 635a

total: 492



Gas confirmed FGS

Smoke confirmed FGS

PLC fault status SIS

Thermal runaway SIS

Spare

Spare

Shut-down to BESS

Shut-down to BESS

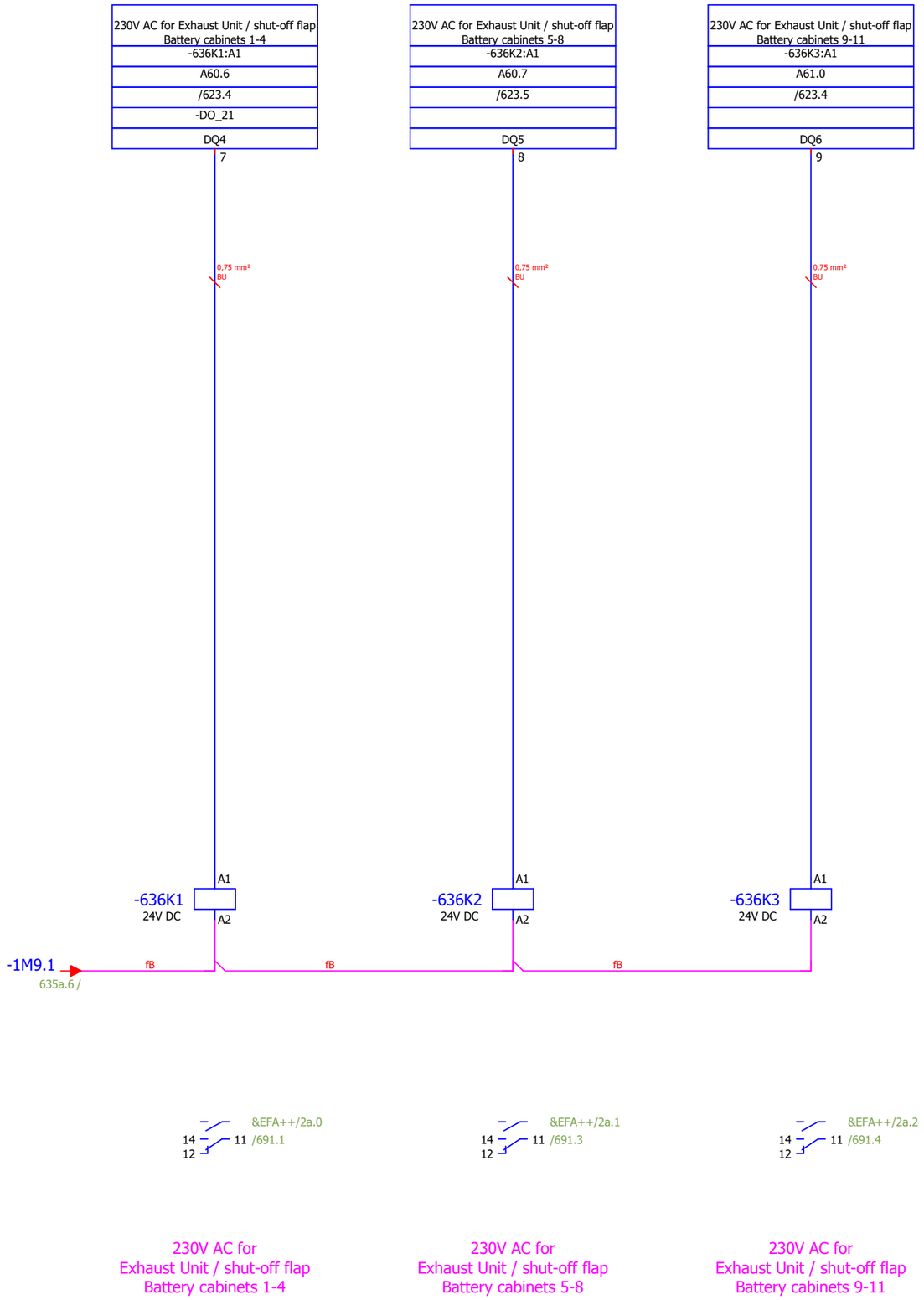
previous page: 635a

next page: 636

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 635b

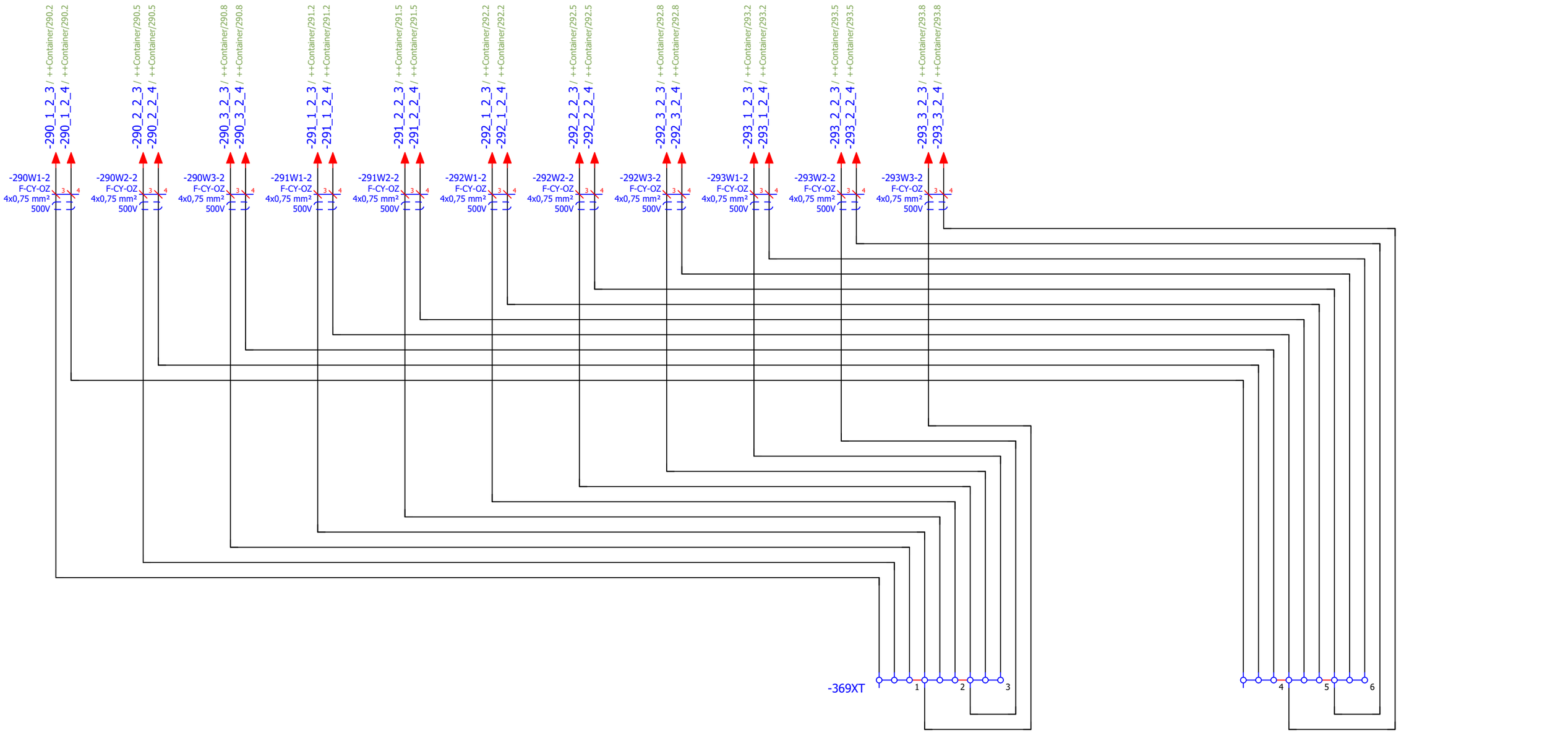
total: 492



previous page:
635b

next page:
669

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FIRE DAMPER	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 636
Date								+	total: 492



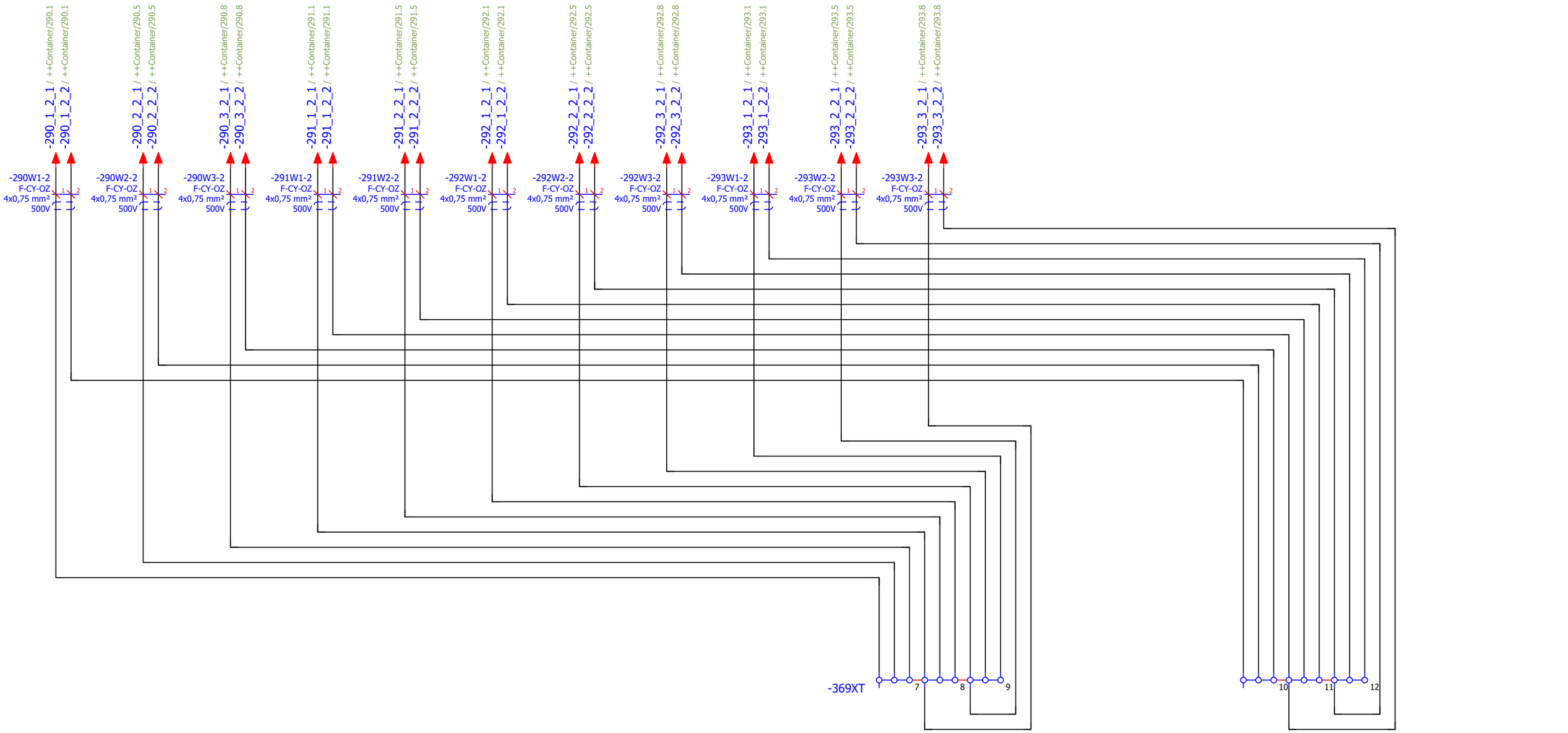
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page: 636

next page: 670

Editor	Freqcon_JD			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 492



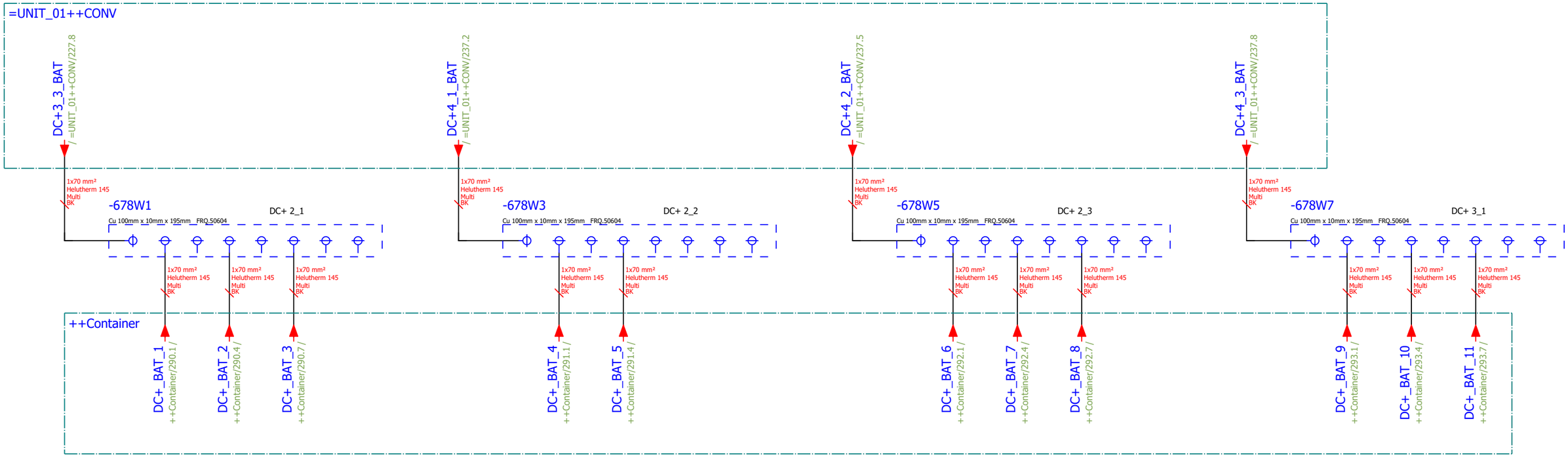
battery cabinet gas
potential-free contacts
customer

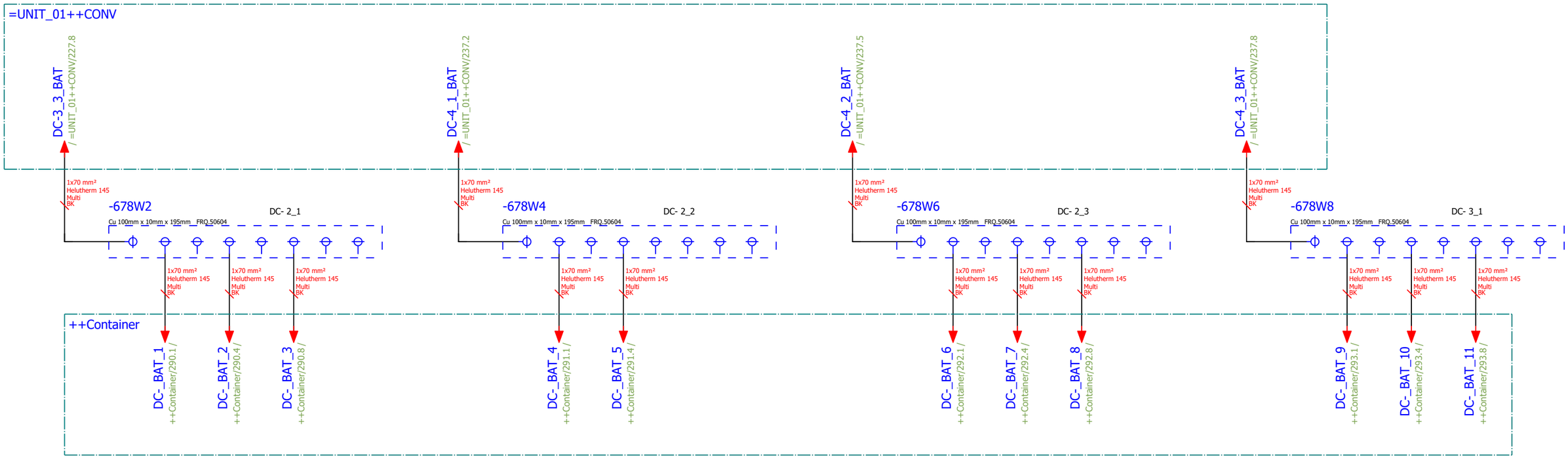
battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
678

Editor	Freqcon_JD			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 492





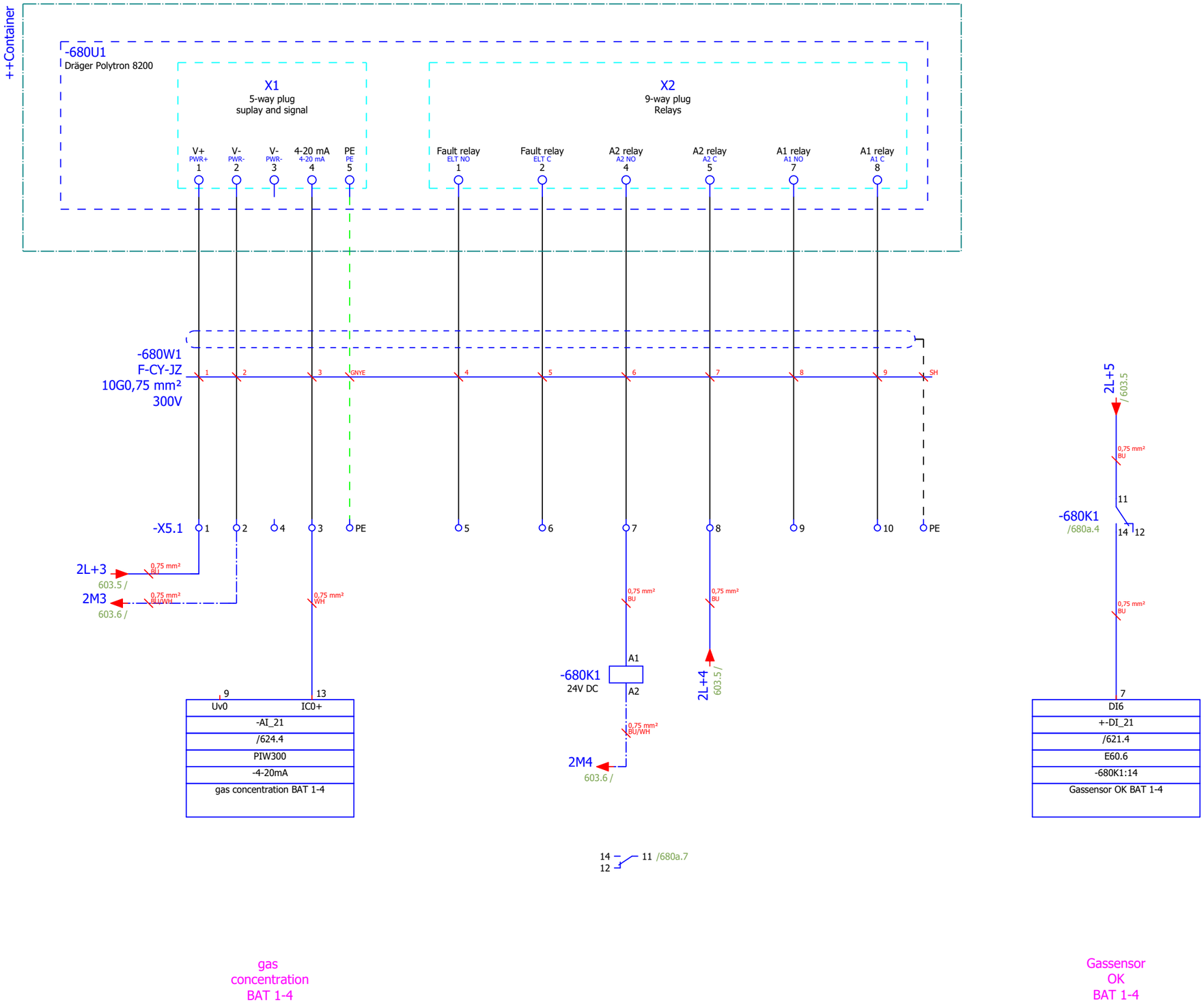
previous page: 670

next page: 680a

Editor	Freqcon_JD			Statron	FREQCON	DC BATTERY CABINETS	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 678

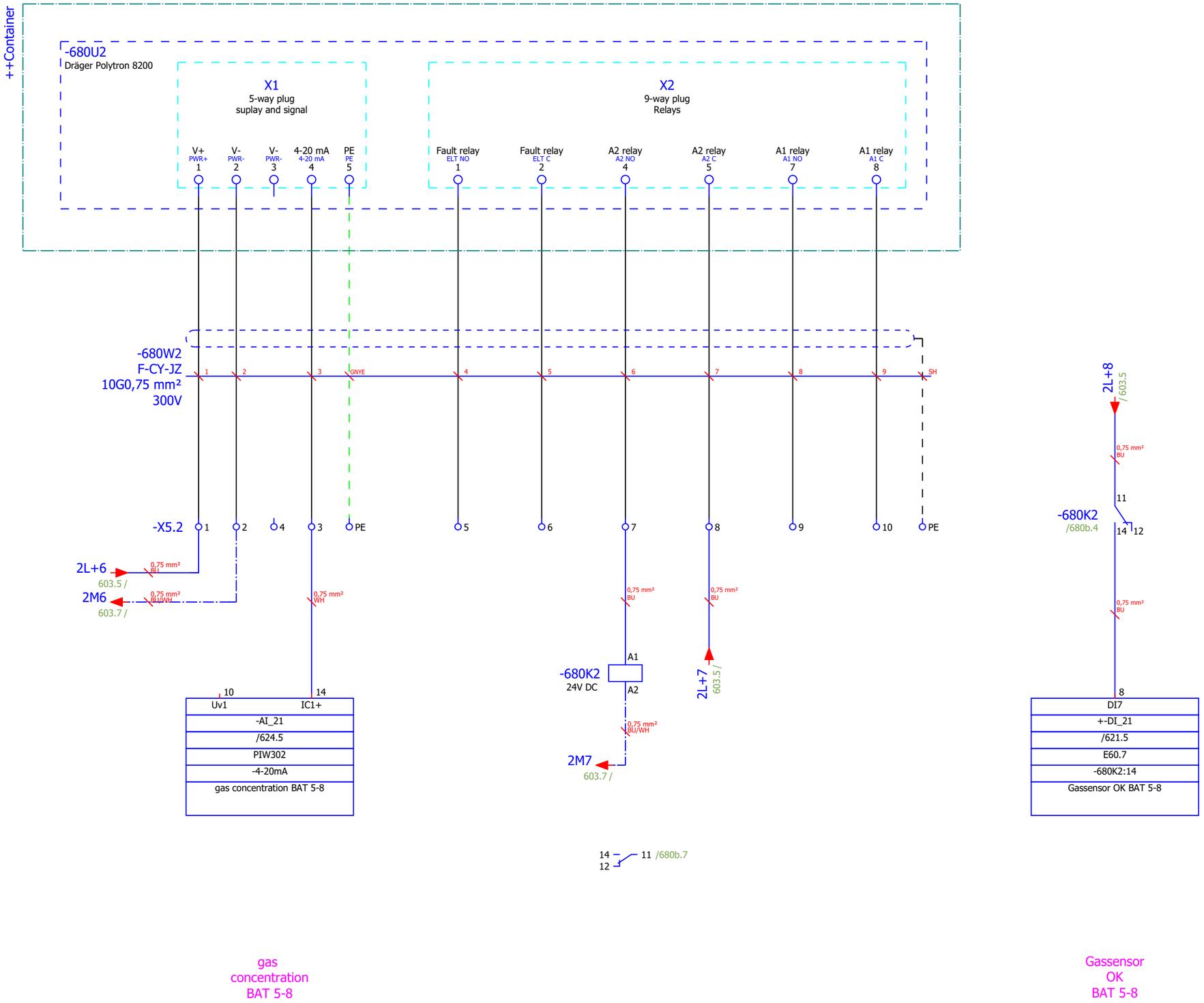
total: 492



previous page: 678

next page: 680b

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 1-4	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680a
Date								+	total: 492



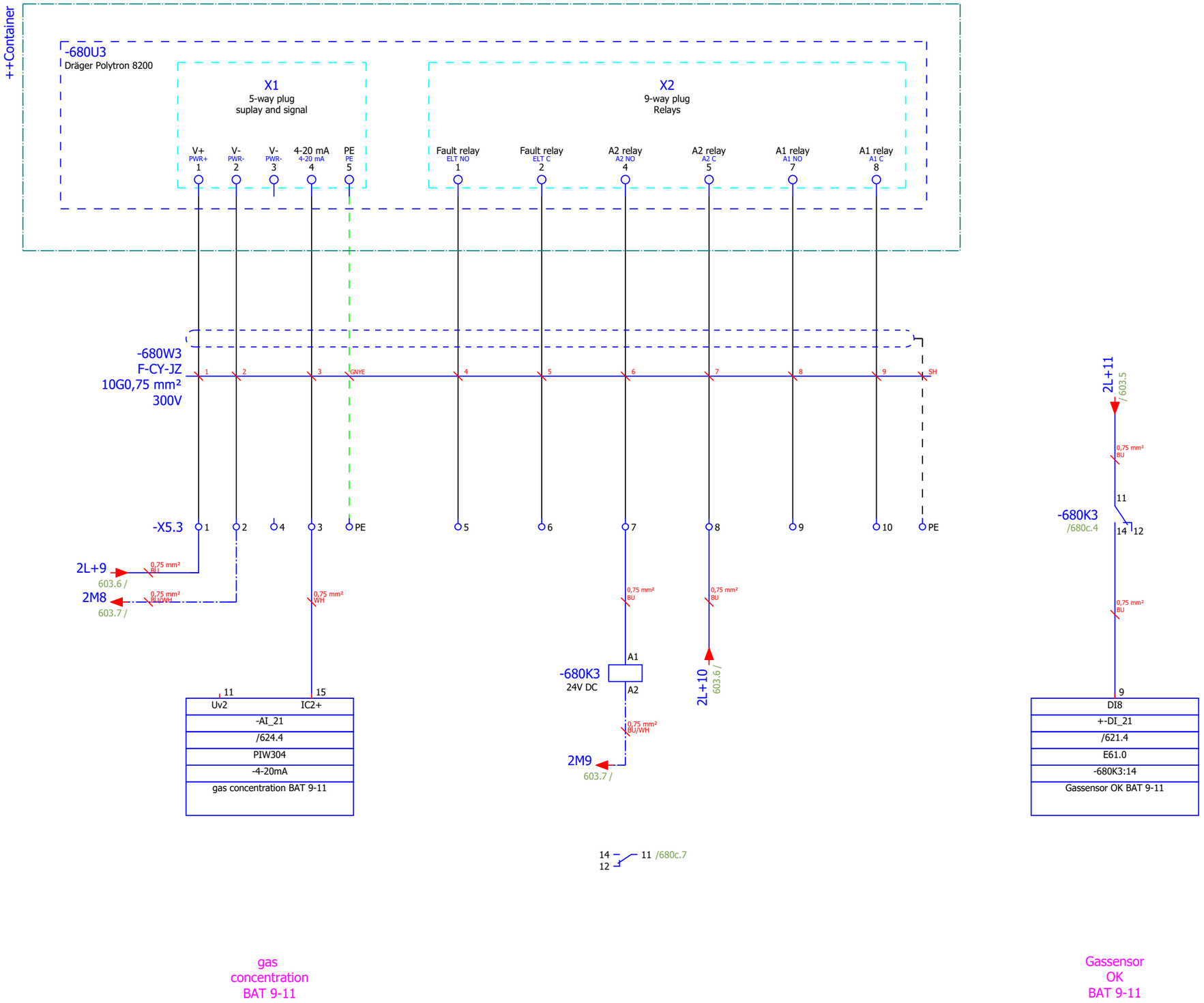
gas concentration BAT 5-8

Gassensor OK BAT 5-8

previous page: 680a

next page: 680c

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 5-8	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 680b
Date								+ — total: 492



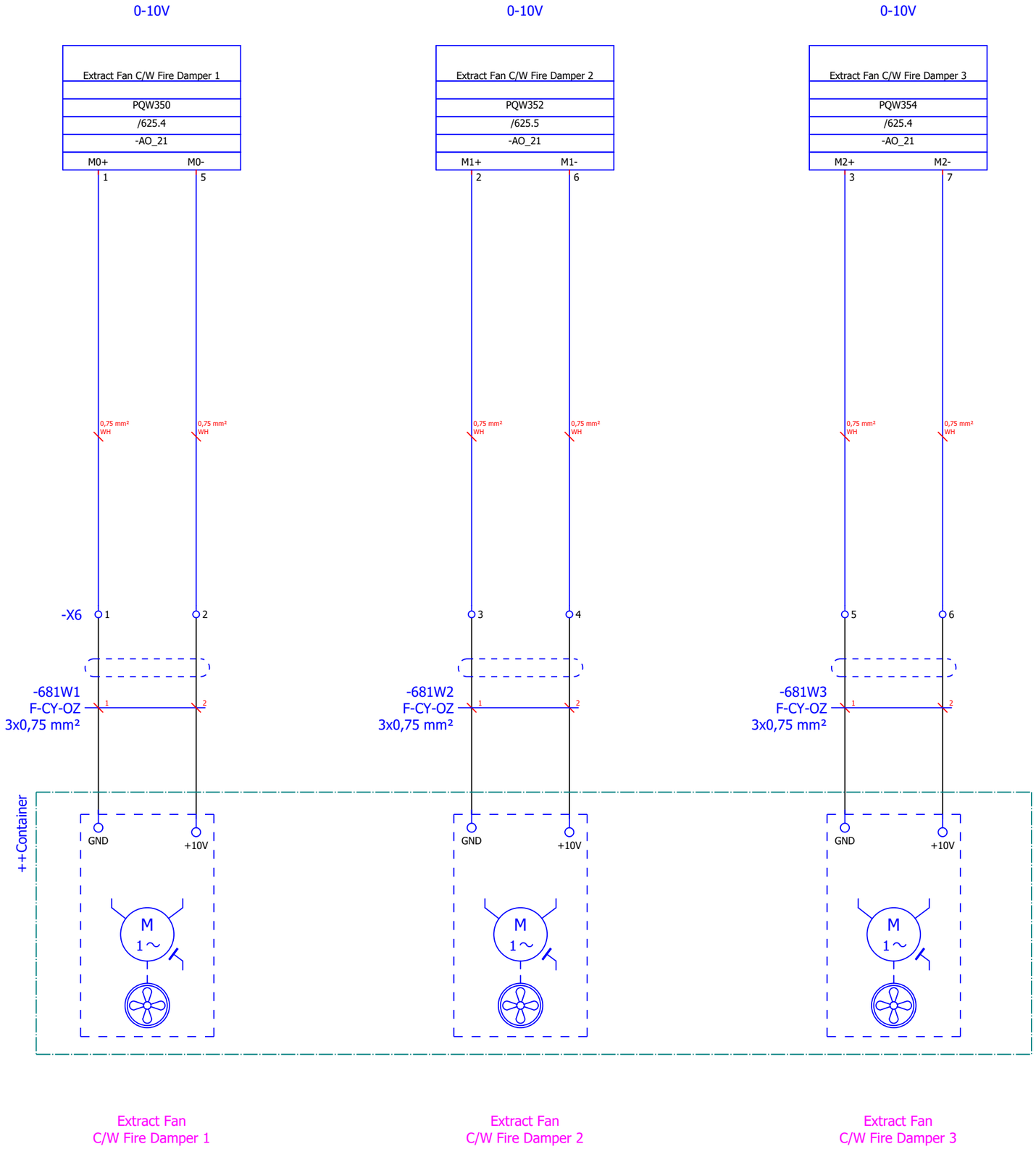
gas concentration BAT 9-11

Gassensor OK BAT 9-11

previous page: 680b

next page: 681

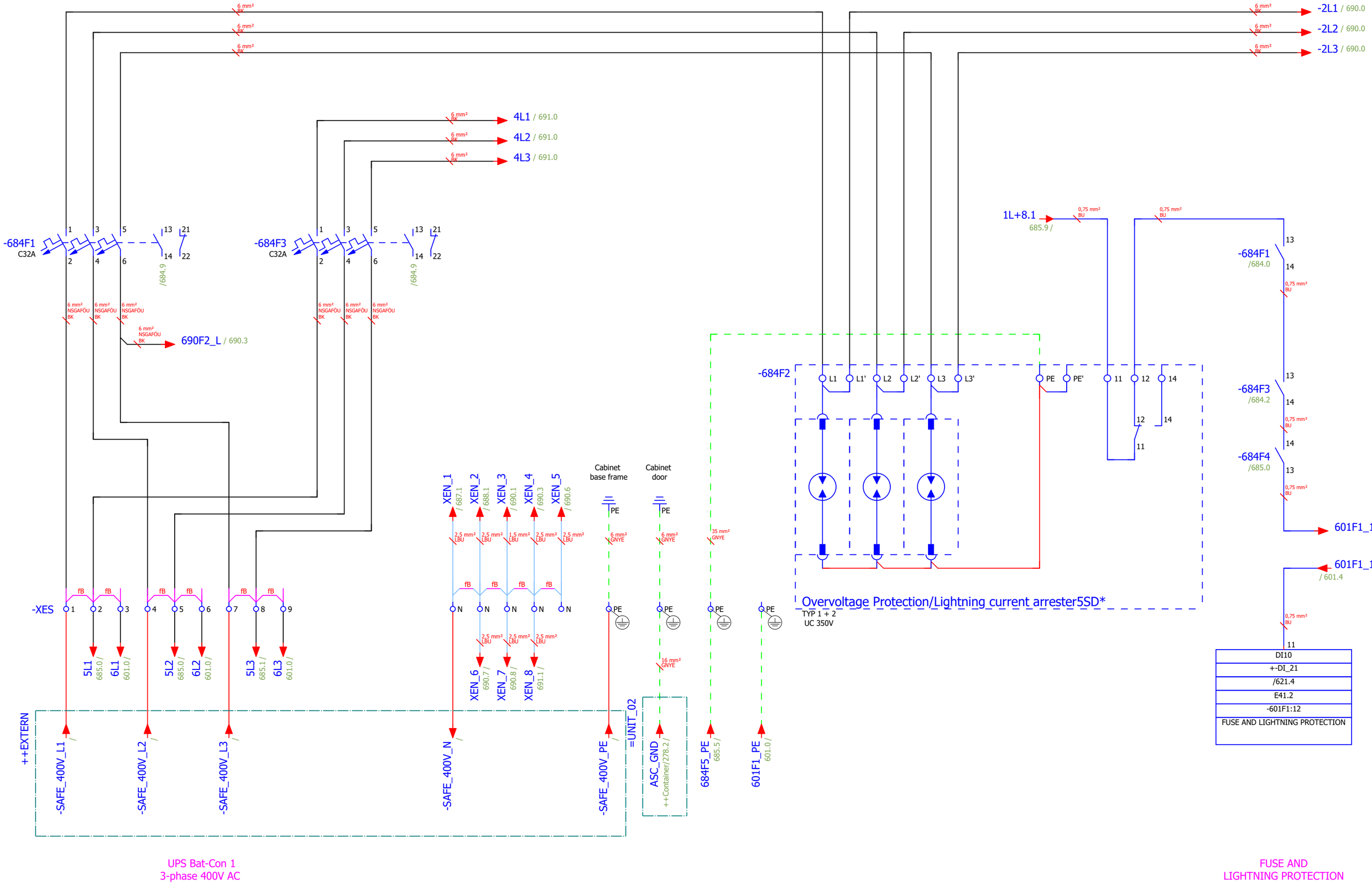
Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 9-11	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680c
Date								+	total: 492



previous page: 680c

next page: 684

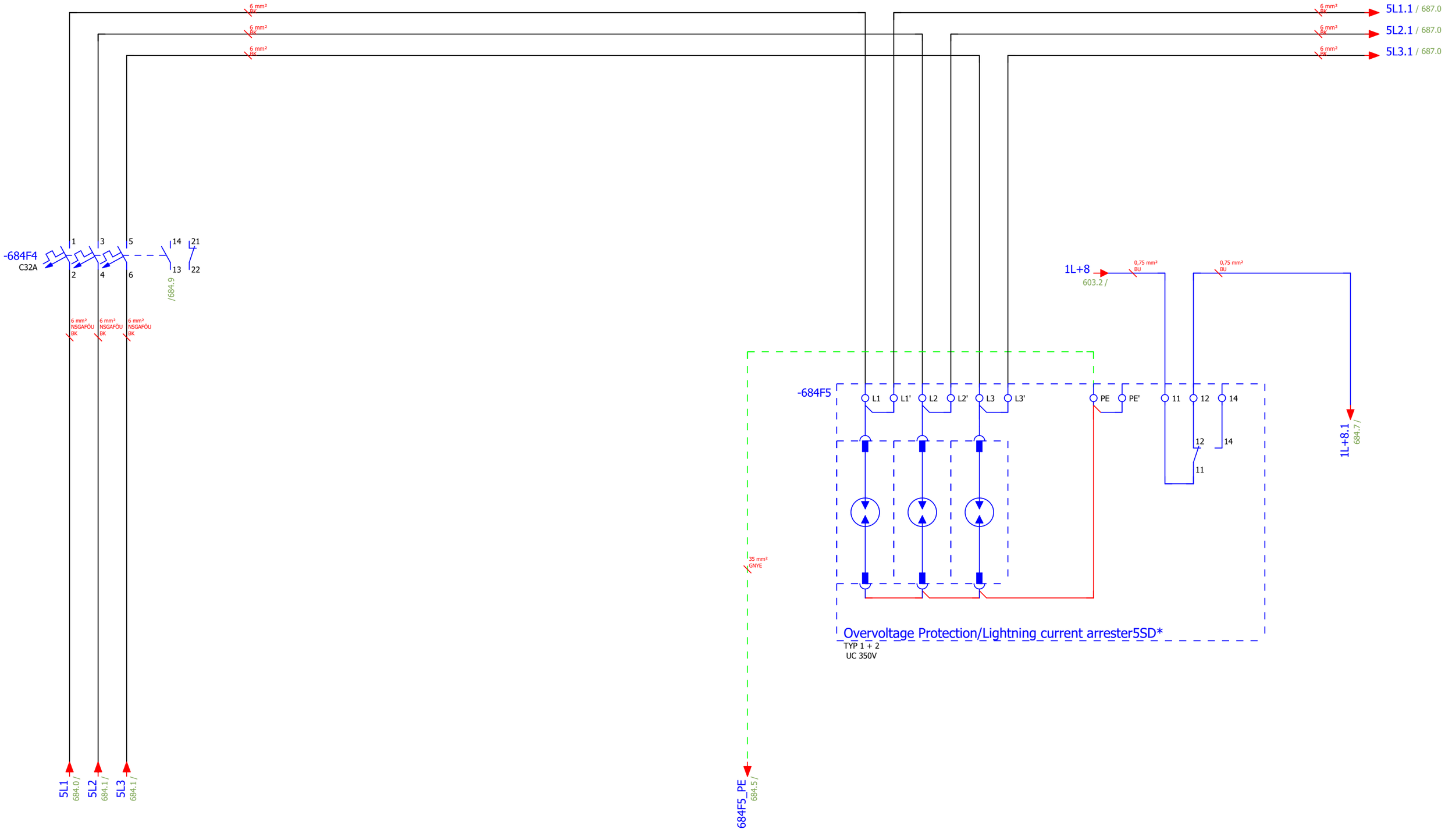
Editor	Freqcon_JD			Statron	FREQCON	EXTRACT FAN FIRE DAMPER	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 681
Date								+	total: 492



previous page: 681

next page: 685

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	22.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 684
Date								+	total: 492

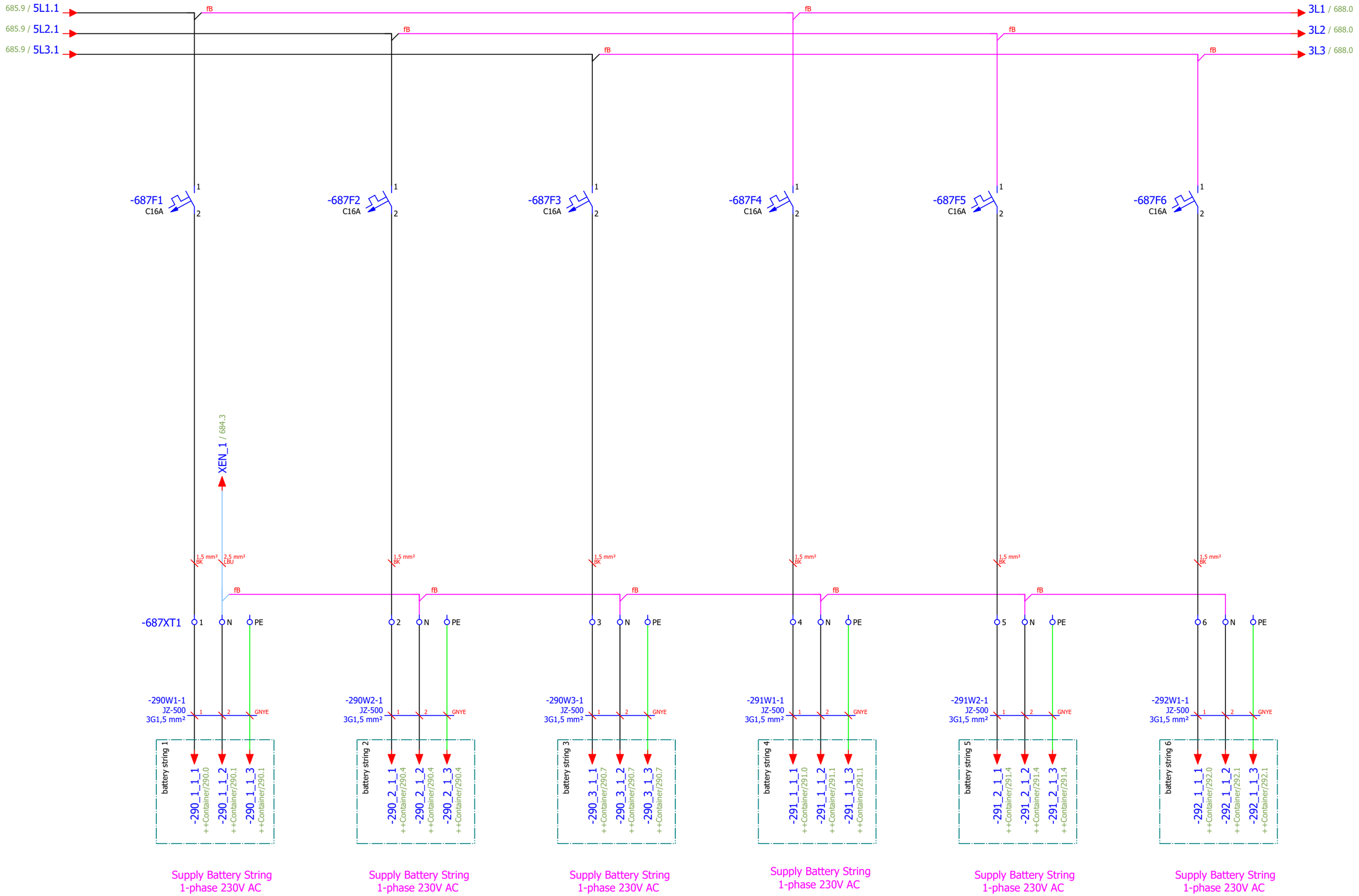


FUSE AND
LIGHTNING PROTECTION

previous page: 684

next page: 687

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 685
Date								+	total: 492



previous page: 685

next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 492

687.9 / 3L1
687.9 / 3L2
687.9 / 3L3

fB

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

XEN_2 / 684.3

1,5 mm² BK
2,5 mm² LBU

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

GNYE

battery string 7
-292_2_1_1 ++Container/292.4
-292_2_1_2 ++Container/292.4
-292_2_1_3 ++Container/292.4

battery string 8
-292_3_1_1 ++Container/292.7
-292_3_1_2 ++Container/292.7
-292_3_1_3 ++Container/292.7

battery string 9
-293_1_1_1 ++Container/293.0
-293_1_1_2 ++Container/293.1
-293_1_1_3 ++Container/293.1

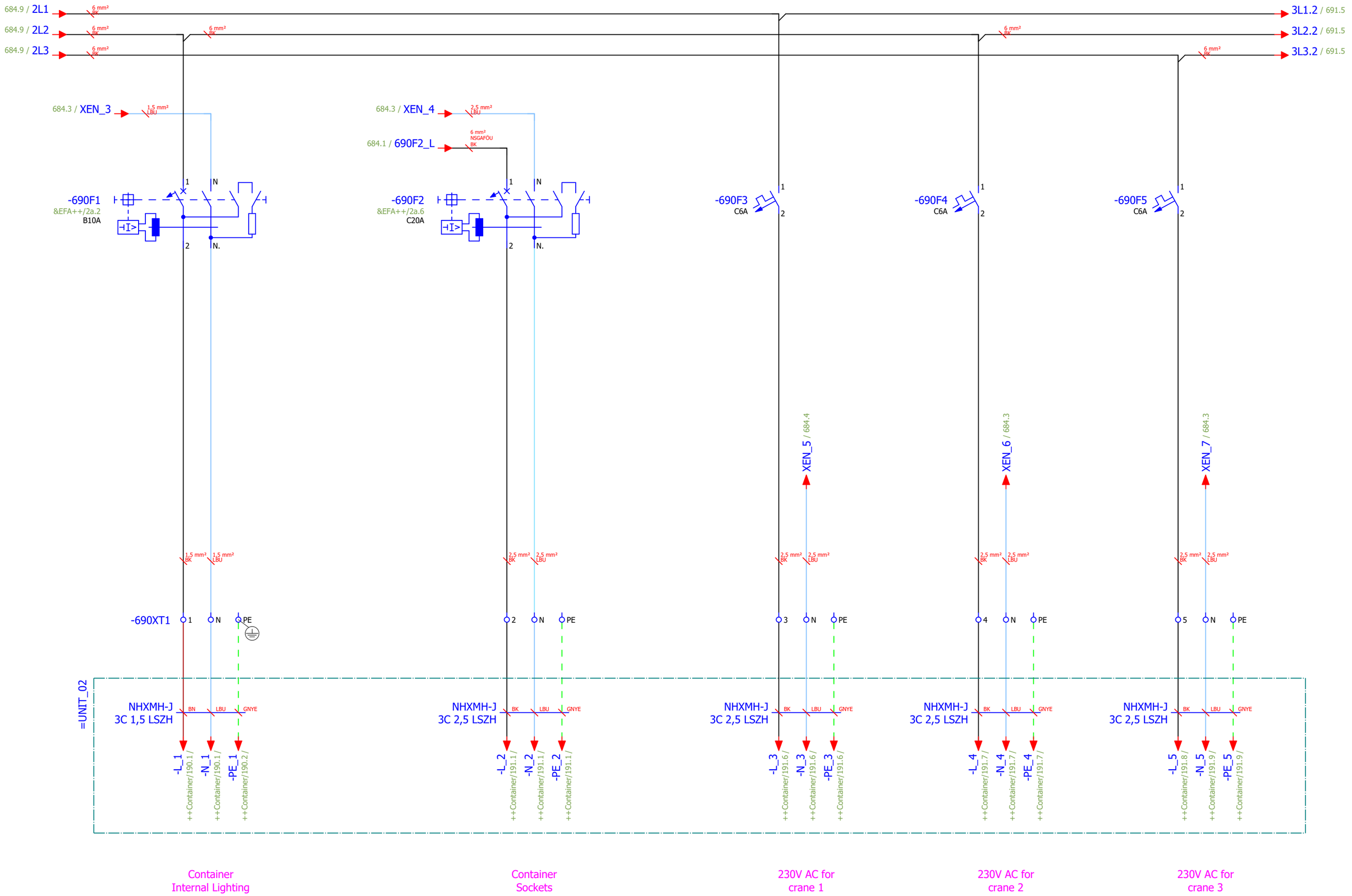
battery string 10
-293_2_1_1 ++Container/293.4
-293_2_1_2 ++Container/293.4
-293_2_1_3 ++Container/293.4

battery string 11
-293_3_1_1 ++Container/293.7
-293_3_1_2 ++Container/293.7
-293_3_1_3 ++Container/293.7

Supply Battery String 1-phase 230V AC

previous page: 687
next page: 690

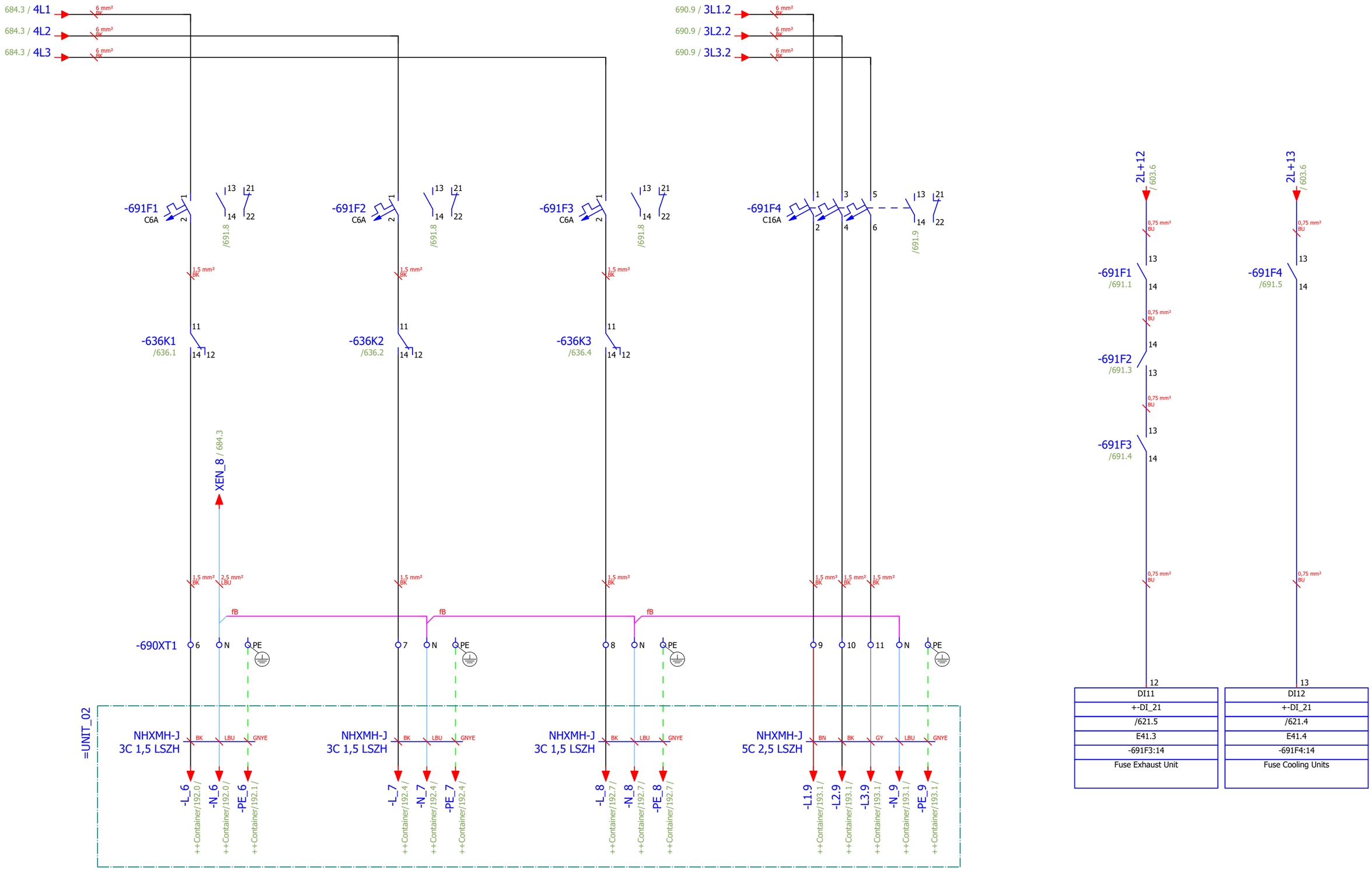
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 492



previous page: 688

next page: 691

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	29.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 690
Date								+	total: 492



previous page: 690

next page: &EPC++Container/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 691
Date								+		total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-635K1 &EFS/635a.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K1 &EFS/635a.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-635K2 &EFS/635a.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K2 &EFS/635a.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K3 &EFS/635a.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K3 &EFS/635a.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K4 &EFS/635a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K4 &EFS/635a.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K5 &EFS/635a.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K5 &EFS/635a.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K6 &EFS/635a.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K6 &EFS/635a.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K7 &EFS/635b.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.2...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.2...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	

previous page: 2

next page: 4

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.2;&EFS/687.3;&EFS/687.4;&EFS/687.5...&EFS/687.8;&EFS/688;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.8;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	
-XT &EFS/635b.1...&EFS/635b.5;&EFS/635b.7	14	Feed-through terminal block	3209510	Phoenix Contact	500583	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XT &EFS/635b.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT &EFS/635b.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT &EFS/635b.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
7

next page:
&EPA++Container/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 8
Date								+	total: 492

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/8

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
2	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
13	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
9	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

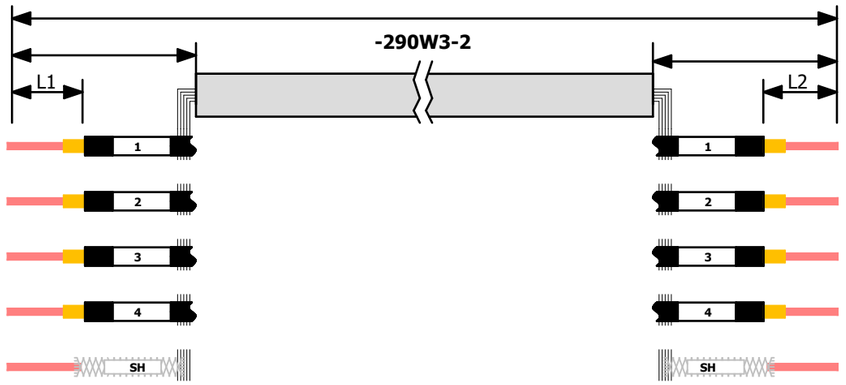
Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

Cable name =UNIT_03++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

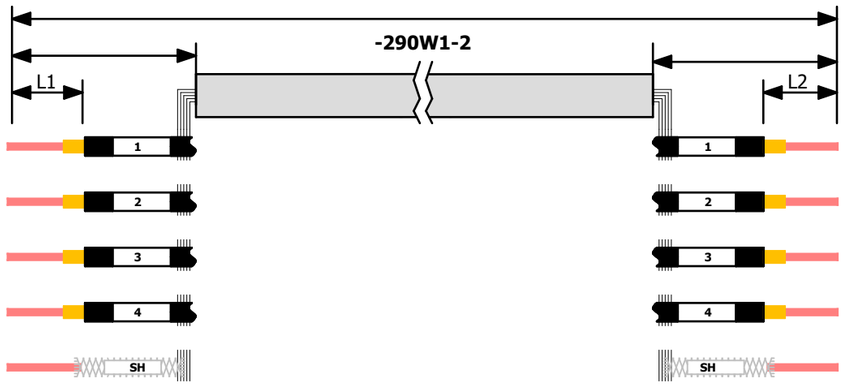


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

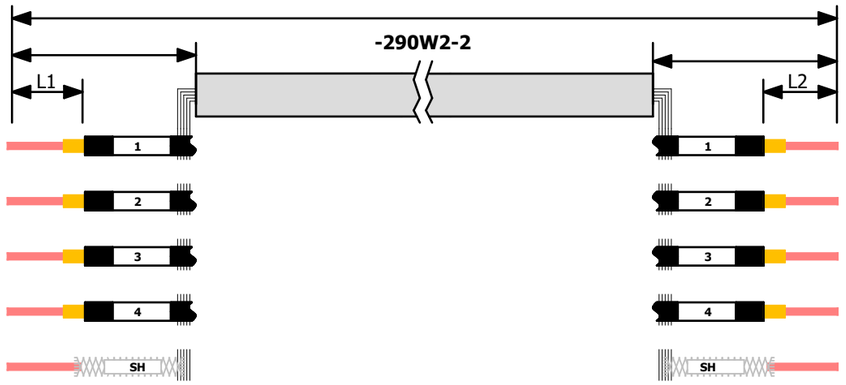


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

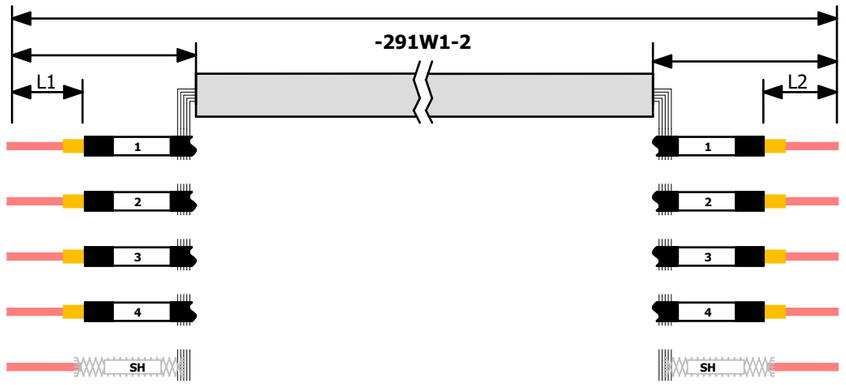
previous page:
&EPA++ASC/2

next page:
2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

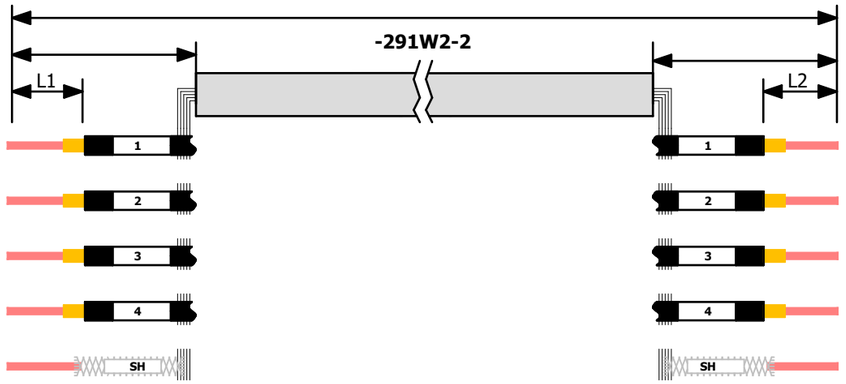


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

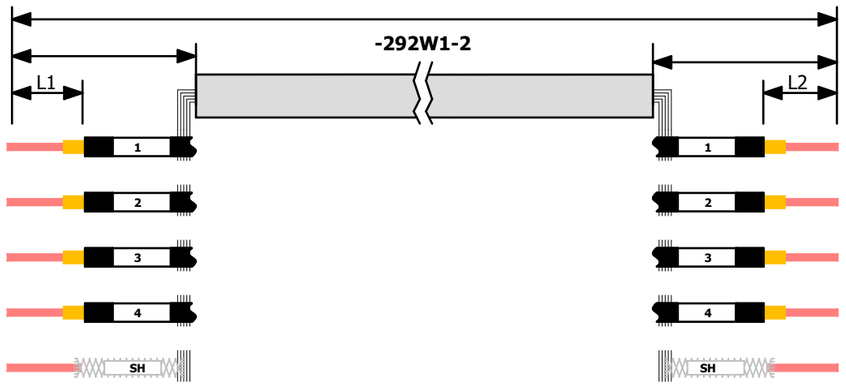


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

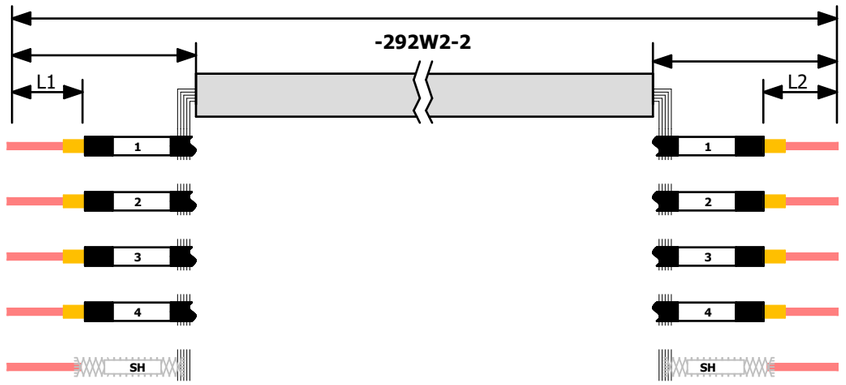
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

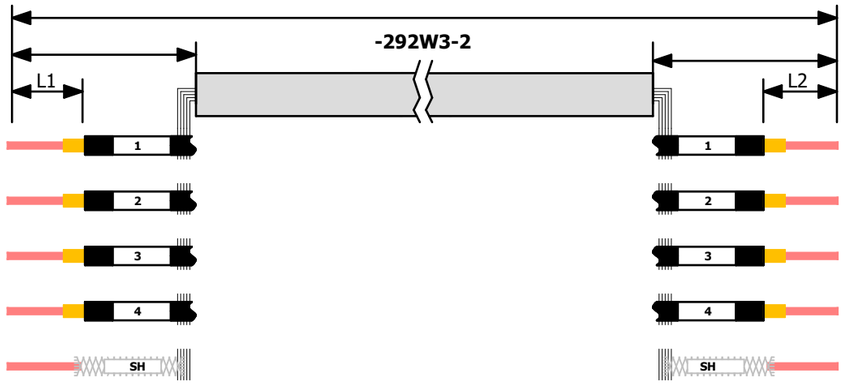


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

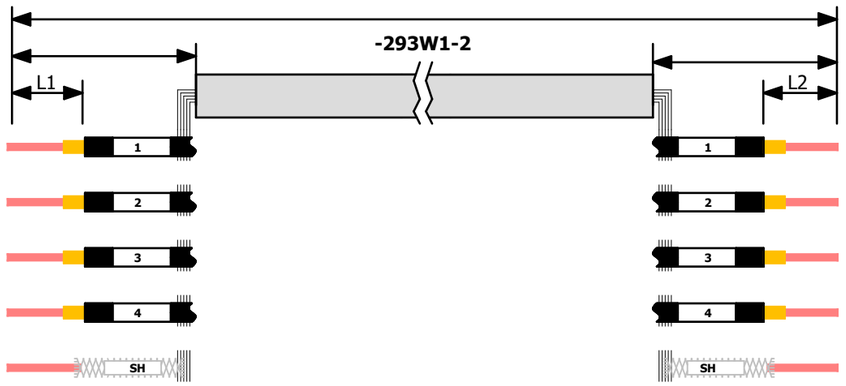


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

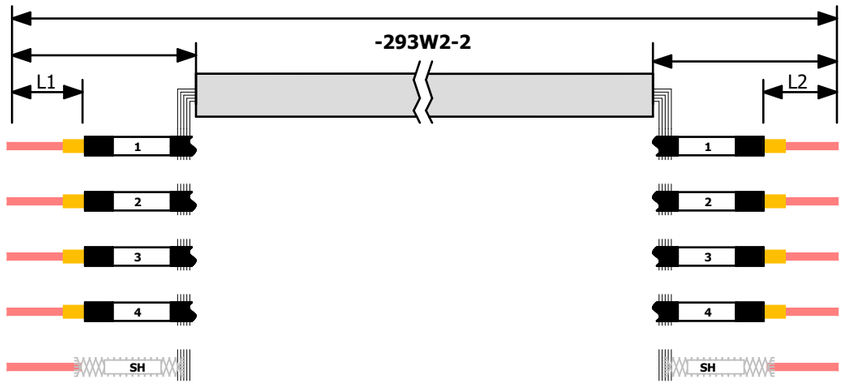
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

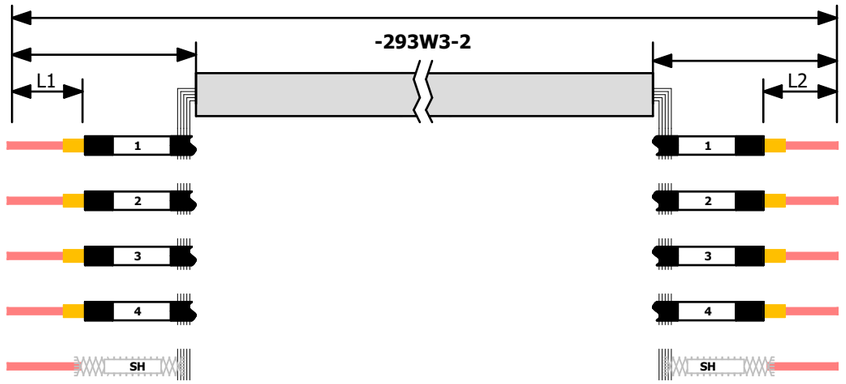


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_03	Battery Container 2
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 4
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

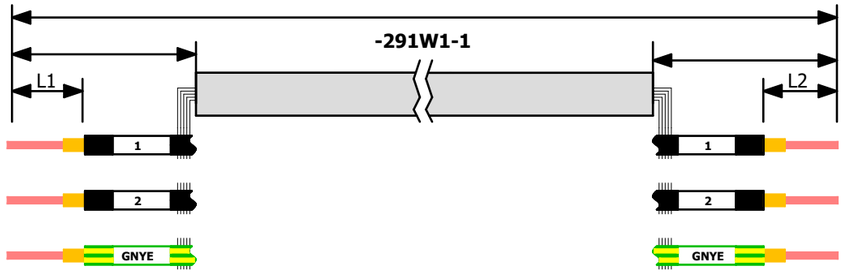


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

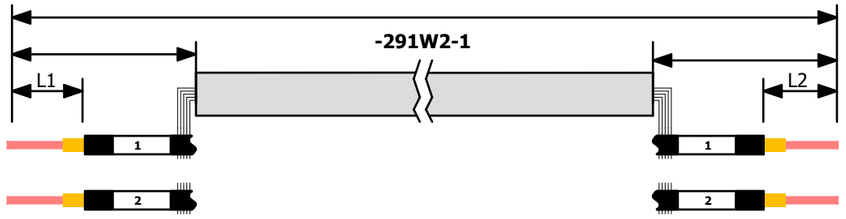


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

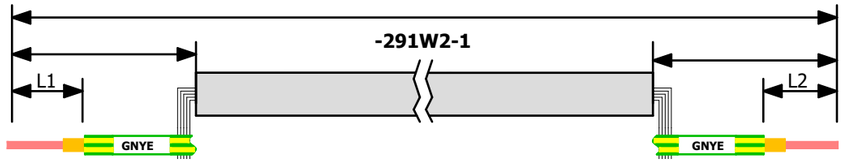
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

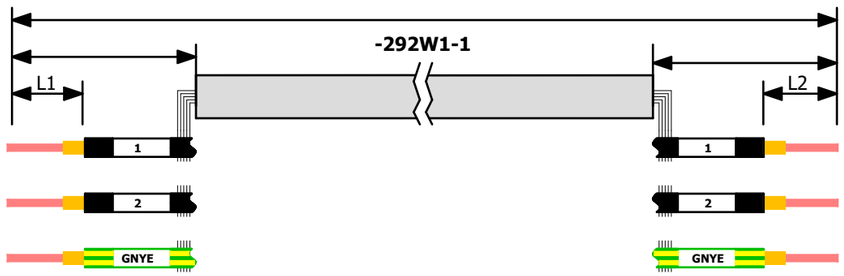


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

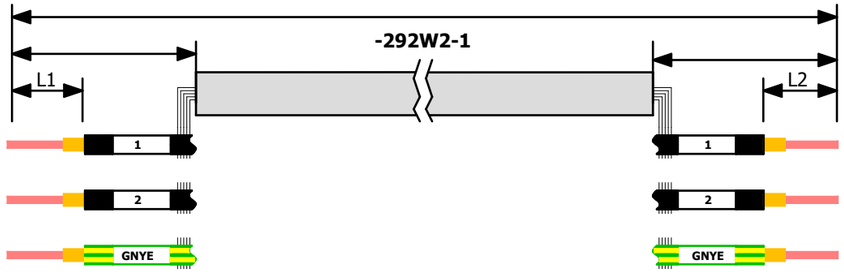


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

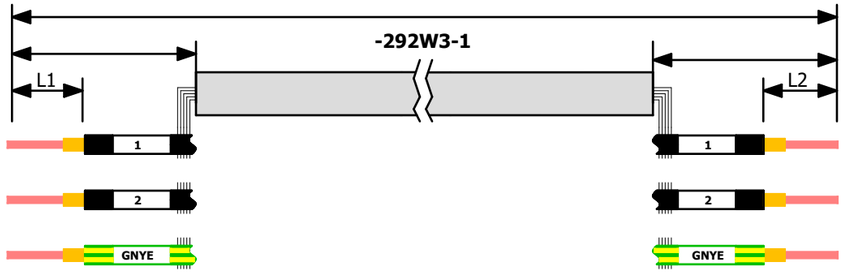


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

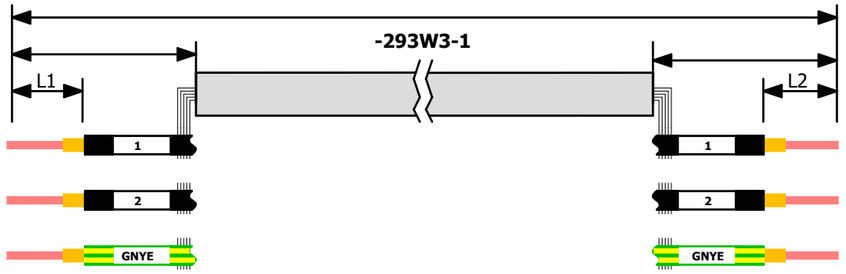


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

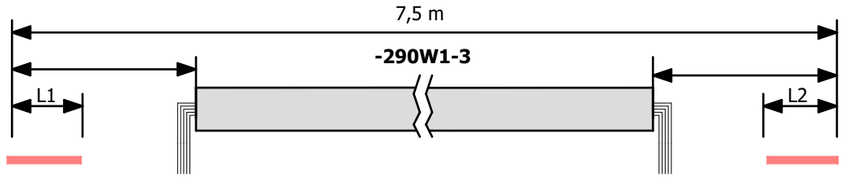


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

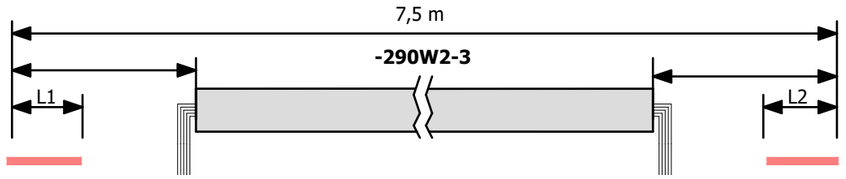


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Cable name =UNIT_03++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

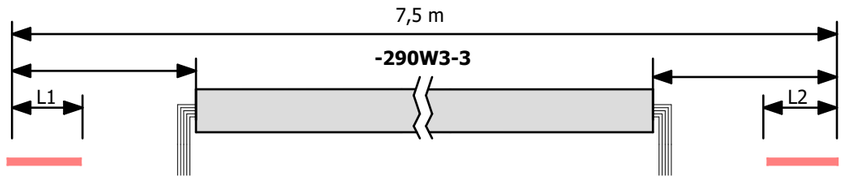


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

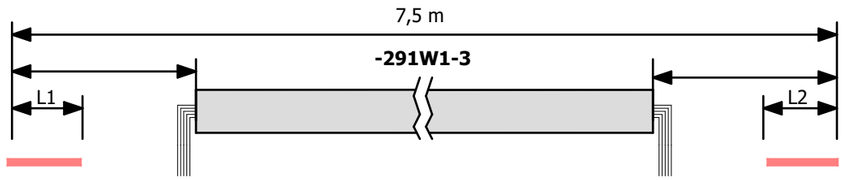


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_03++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

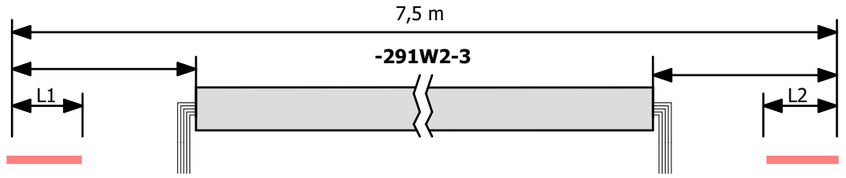


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

Cable name =UNIT_03++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

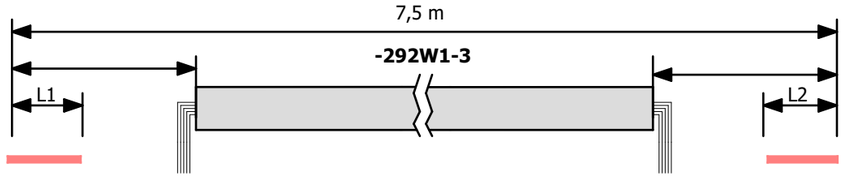


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_03++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



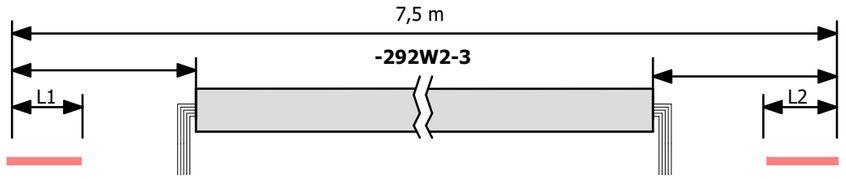
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

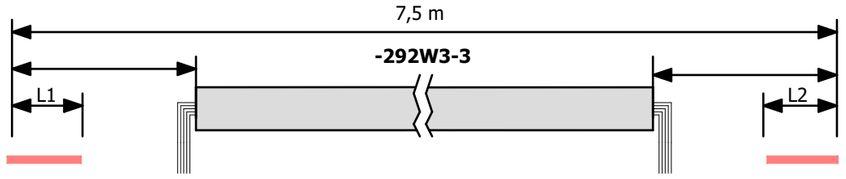
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X7:1-16	

Cable name =UNIT_03++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

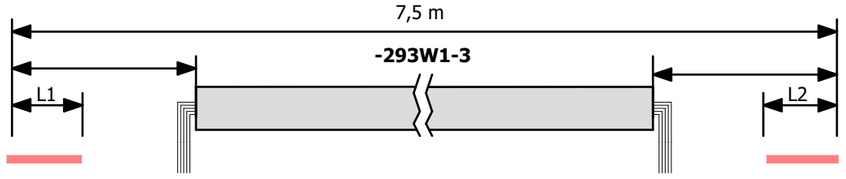
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X8:1-16	

Cable name =UNIT_03++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

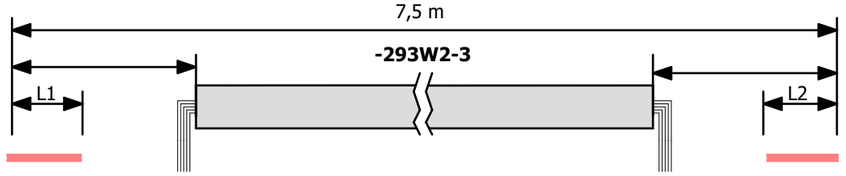
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X9:1-16	

Cable name =UNIT_03++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

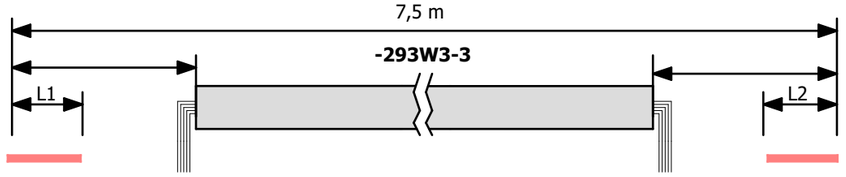
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



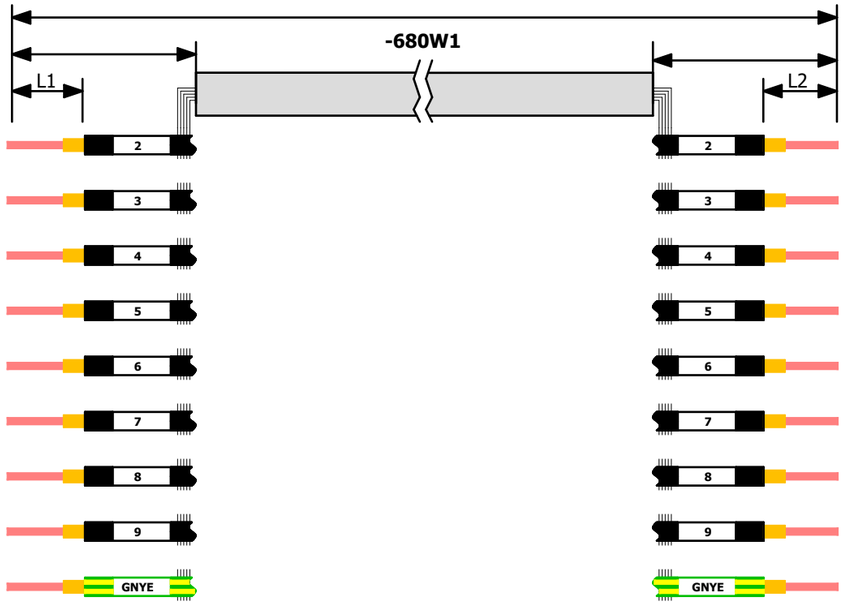
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X3:1-16	

previous page: 8
next page: ++ASC/1

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

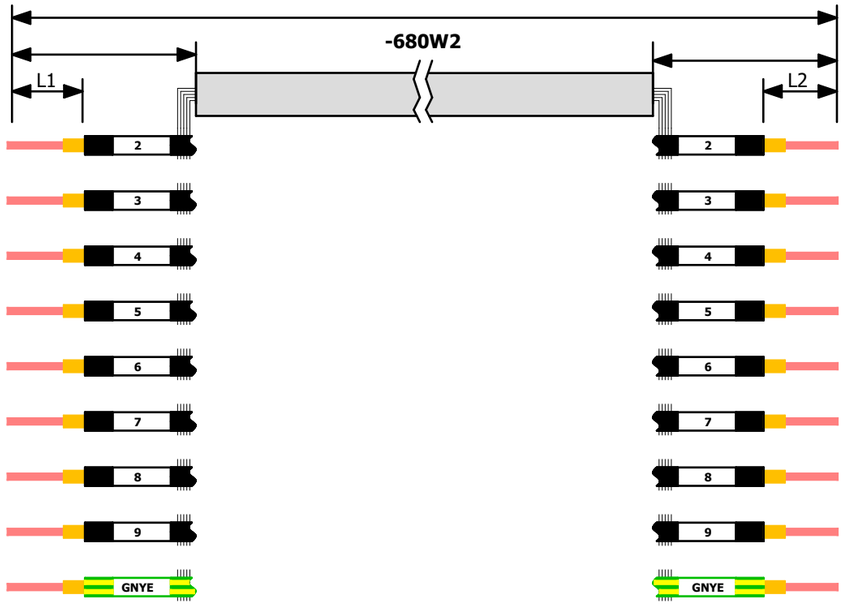


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_03++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

previous page:
++Container/9

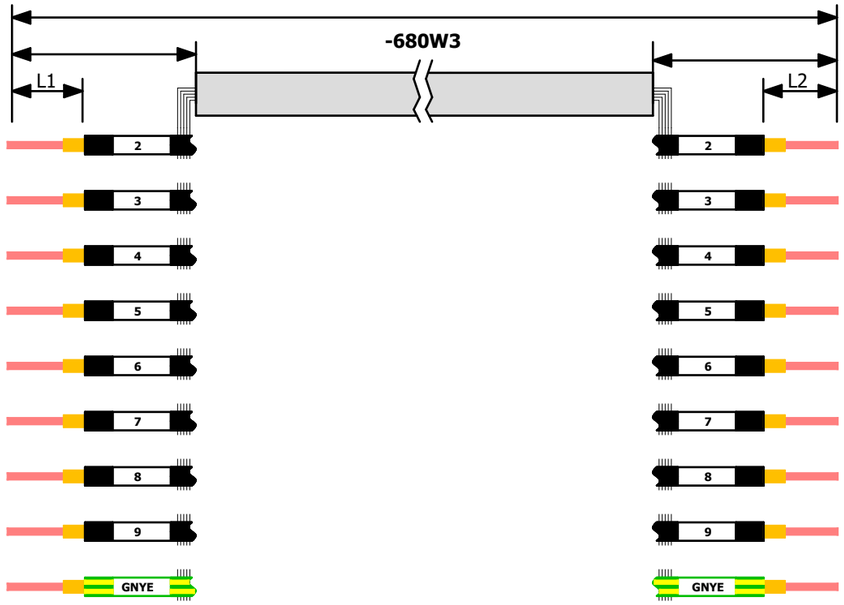
next page:
2

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 9

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

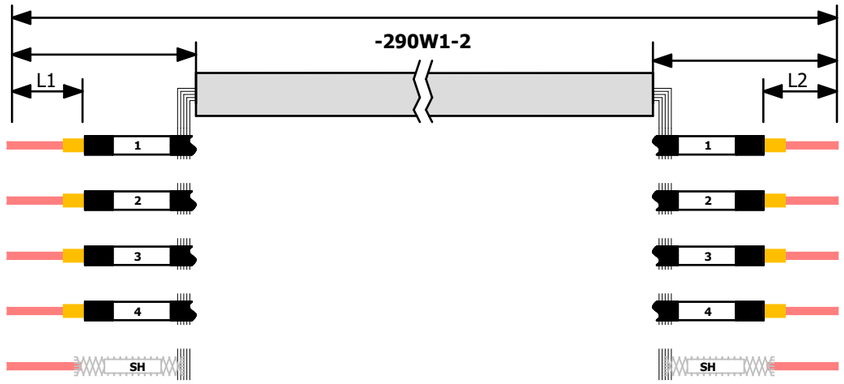


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_03++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

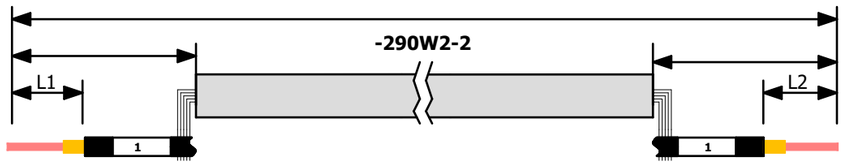


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

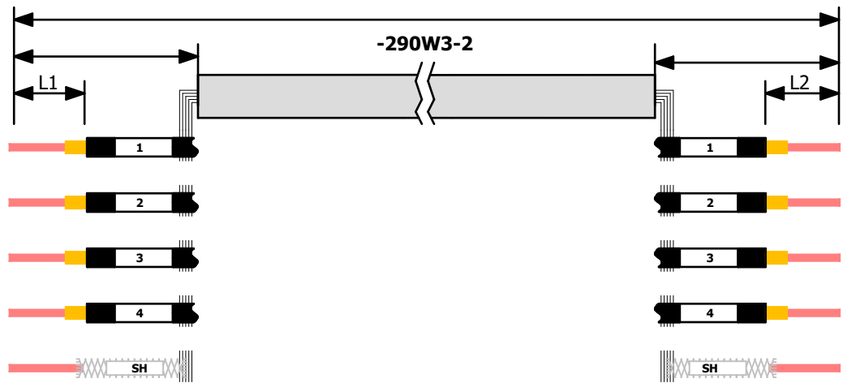


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

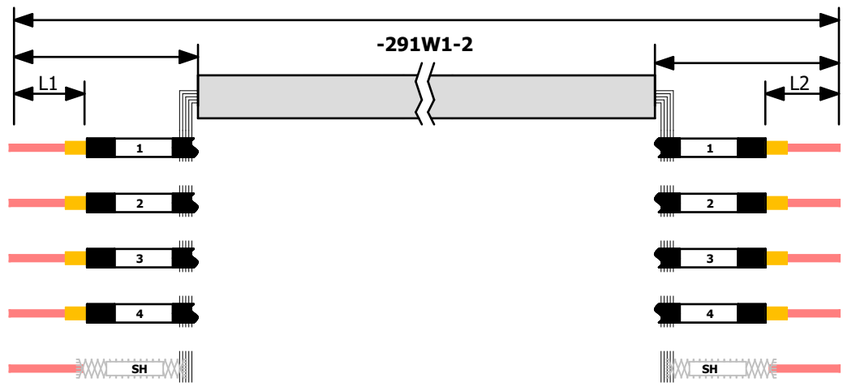


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 2

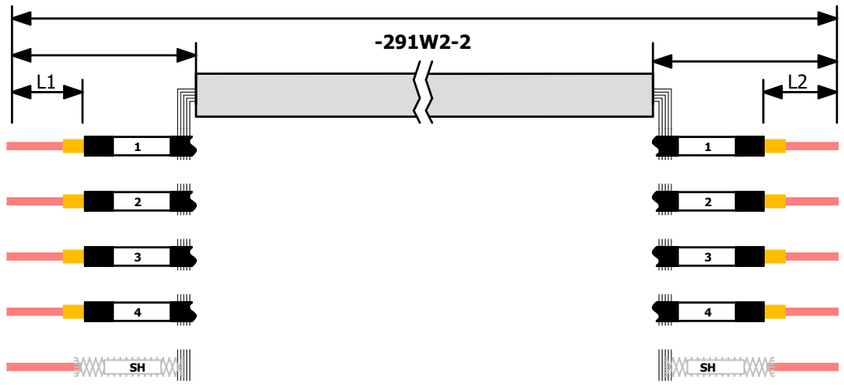
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

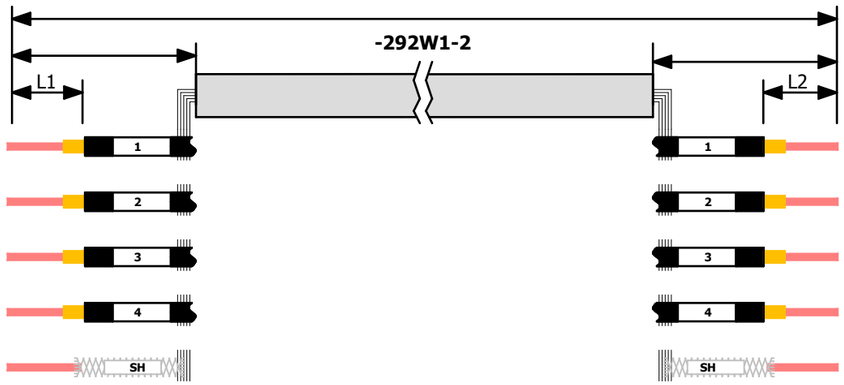


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

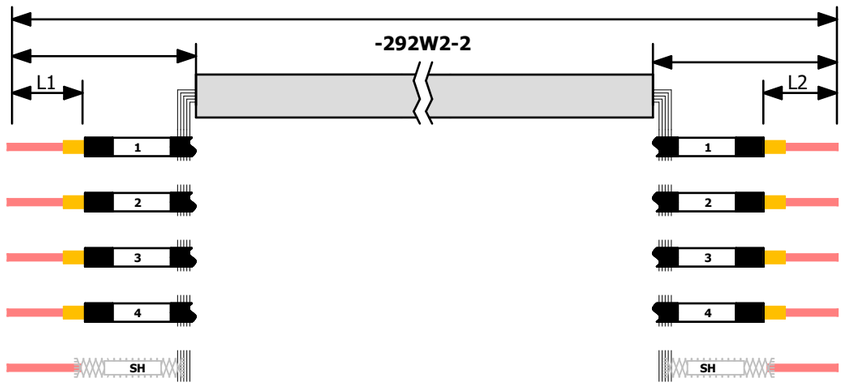


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



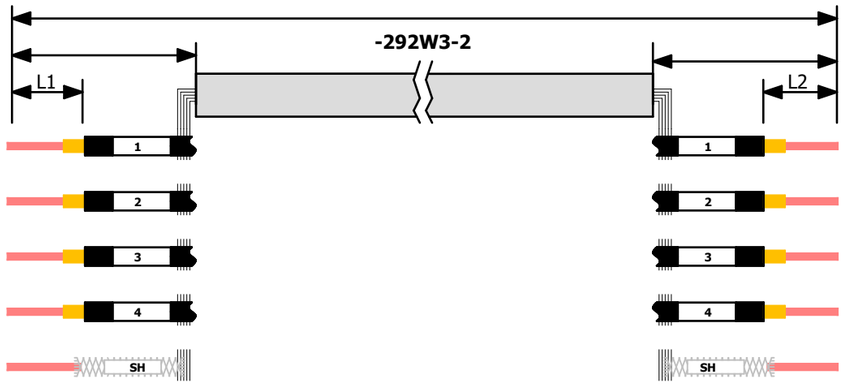
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

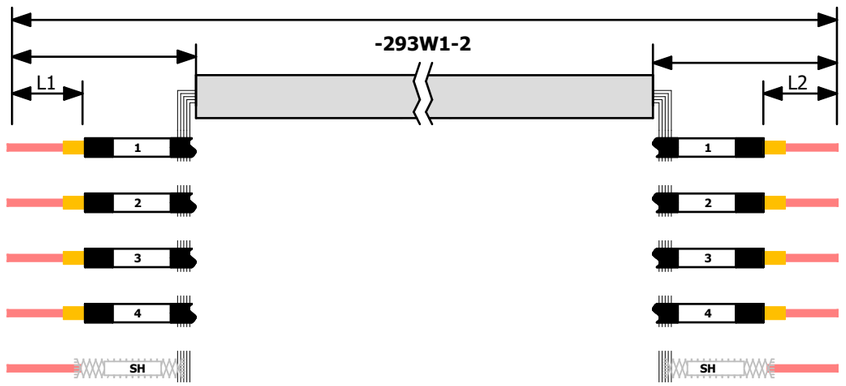
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

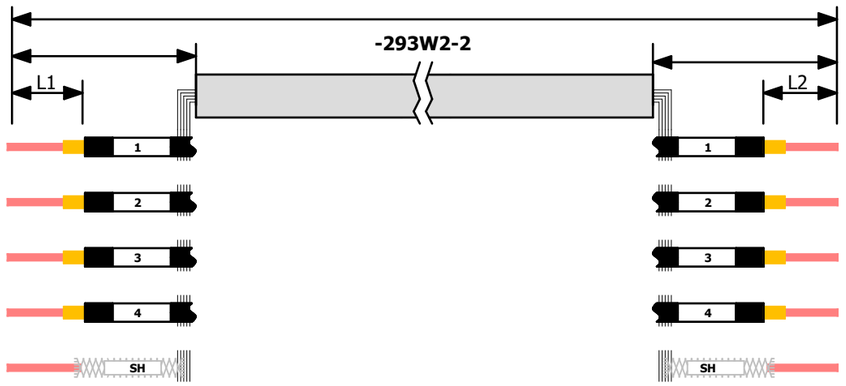
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



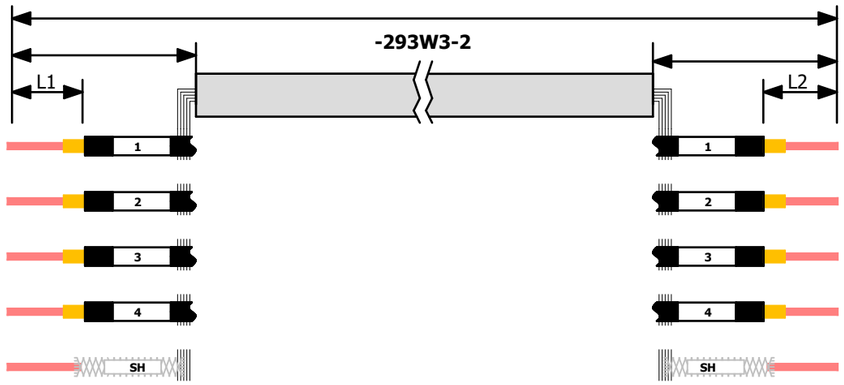
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

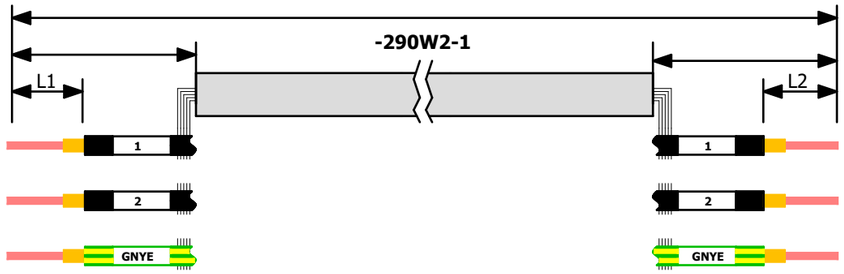


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

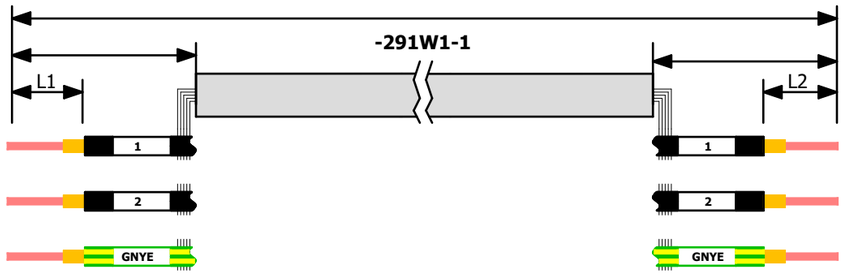


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

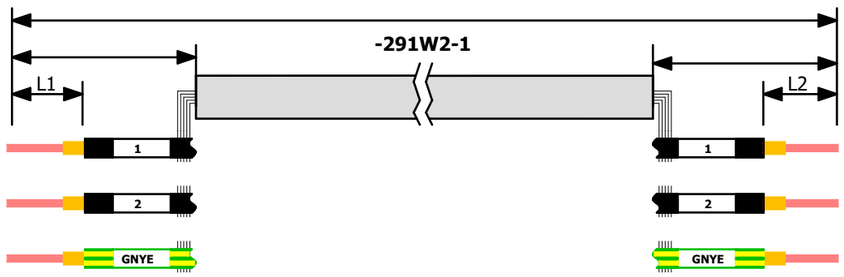


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

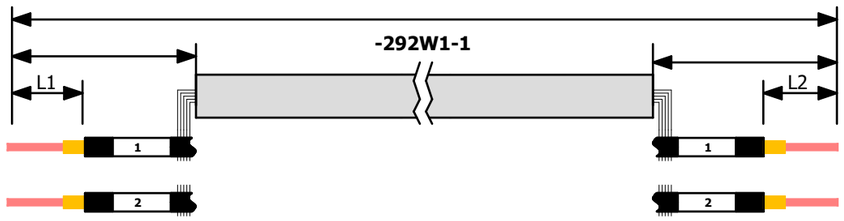


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

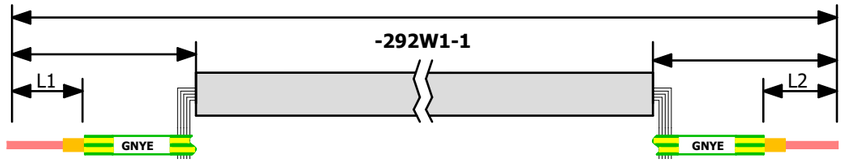
previous page: 6

next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

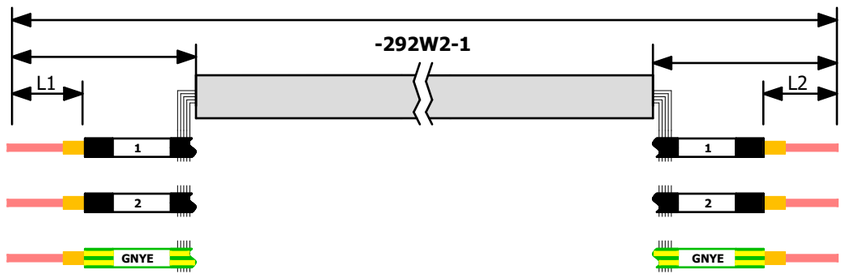


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

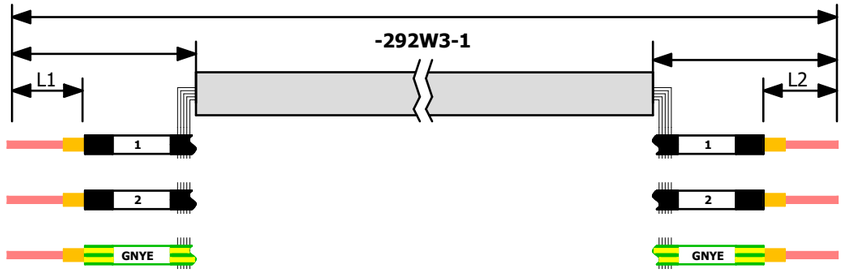


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

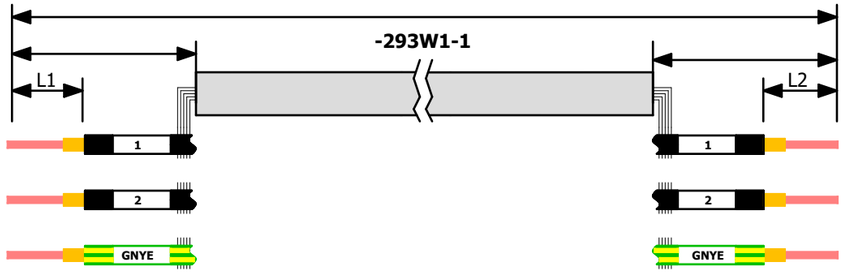


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

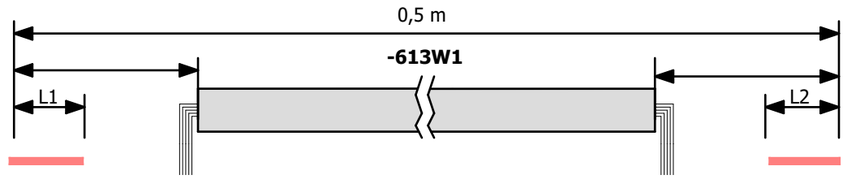


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

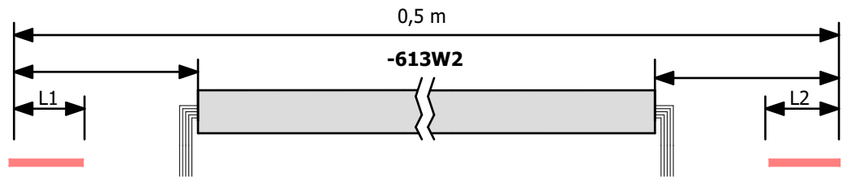


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_03++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			



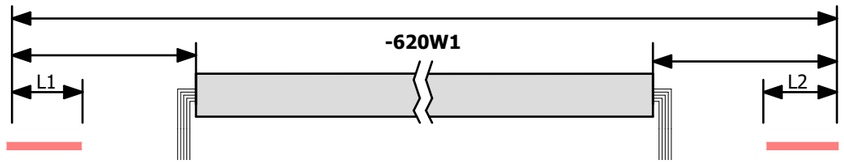
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

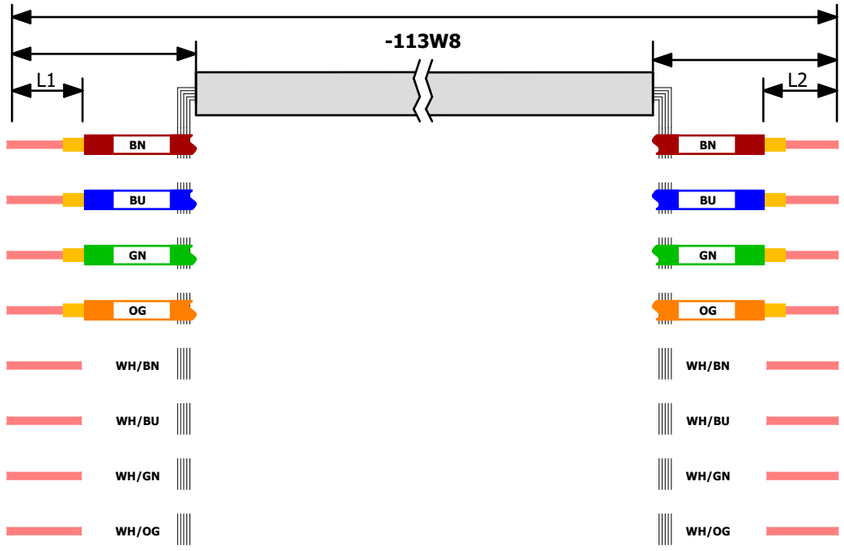
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_03++ASC+-113W8
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:3							-613U2:3	

previous page: 9

next page: &EMZ/1000

FRQ_Kabelplan_04_groß_de_en

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X5.1		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2000
-X5.2		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2001
-X5.3		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2002
-X6		1	6	0	0	6	=UNIT_03&EMZ++ASC/2003
-XDC1		1	PE	2	0	14	=UNIT_03&EMZ++ASC/2004
-XDC2		1	7	0	0	14	=UNIT_03&EMZ++ASC/2005
-XES		1	9	4	5	18	=UNIT_03&EMZ++ASC/2006
-XT		1	14	0	0	14	=UNIT_03&EMZ++ASC/2007
-369XT		1	12	0	0	24	=UNIT_03&EMZ++ASC/2008
-687XT1		1	PE	11	11	44	=UNIT_03&EMZ++ASC/2020
-690XT1		1	PE	40	4	119	=UNIT_03&EMZ++ASC/2031

previous page:
&EMB/10

next page:
2000

Editor	Freqcon_DG			Statron		Klemmenleistenübersicht : =UNIT_03++ASC+-X5.1 - =UNIT_03++ASC+-690XT1	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 1000
Date								+		total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.1						Cable name	-680W1										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 1-4					-XDC2	1	1	,	++Container-680U1-X1	1													&EFS/680a.2
=					-XDC2	5	2	,	++Container-680U1-X1	2		2											&EFS/680a.2
=					-AI_21	13	3	,	++Container-680U1-X1	4		3											&EFS/680a.2
=							4	,															&EFS/680a.2
=							5	,	++Container-680U1-X2	1		4											&EFS/680a.3
=							6	,	++Container-680U1-X2	2		5											&EFS/680a.3
=					-680K1	A1	7	,	++Container-680U1-X2	4		6											&EFS/680a.4
=					-XDC2	2	8	,	++Container-680U1-X2	5		7											&EFS/680a.4
=							9	,	++Container-680U1-X2	7		8											&EFS/680a.5
=							10	,	++Container-680U1-X2	8		9											&EFS/680a.5
=							PE	,	++Container-680U1-X1	5		GNYE											&EFS/680a.2
=							PE	,	-480W1														&EFS/680a.6

previous page:
1000

next page:
2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-X5.1	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2000
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.2						Cable name	-680W2										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 5-8					-XDC2	2	1	,	++Container-680U2-X1	1													&EFS/680b.2
=					-XDC2	6	2	,	++Container-680U2-X1	2		2											&EFS/680b.2
=					-AI_21	14	3	,	++Container-680U2-X1	4		3											&EFS/680b.2
=							4	,															&EFS/680b.2
=							5	,	++Container-680U2-X2	1		4											&EFS/680b.3
=							6	,	++Container-680U2-X2	2		5											&EFS/680b.3
=					-680K2	A1	7	,	++Container-680U2-X2	4		6											&EFS/680b.4
=					-XDC2	2	8	,	++Container-680U2-X2	5		7											&EFS/680b.4
=							9	,	++Container-680U2-X2	7		8											&EFS/680b.5
=							10	,	++Container-680U2-X2	8		9											&EFS/680b.5
=							PE	,	++Container-680U2-X1	5		GNYE											&EFS/680b.2
=							PE	,	-480W1														&EFS/680b.6

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-X5.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2001
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.3						Cable name	-680W3										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 9-11					-XDC2	3	1	,	++Container-680U3-X1	1													&EFS/680c.2
=					-XDC2	7	2	,	++Container-680U3-X1	2		2											&EFS/680c.2
=					-AI_21	15	3	,	++Container-680U3-X1	4		3											&EFS/680c.2
=							4	,															&EFS/680c.2
=							5	,	++Container-680U3-X2	1		4											&EFS/680c.3
=							6	,	++Container-680U3-X2	2		5											&EFS/680c.3
=					-680K3	A1	7	,	++Container-680U3-X2	4		6											&EFS/680c.4
=					-XDC2	3	8	,	++Container-680U3-X2	5		7											&EFS/680c.4
=							9	,	++Container-680U3-X2	7		8											&EFS/680c.5
=							10	,	++Container-680U3-X2	8		9											&EFS/680c.5
=							PE	,	++Container-680U3-X1	5		GNYE											&EFS/680c.2
=							PE	,	-480W1														&EFS/680c.6

previous page:
2001

next page:
2003

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_03++ASC+-X5.3	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2002
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X6					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Extract Fan C/W Fire Damper 1						GND	1	,	-AO_21	1													&EFS/681.1
=						+10V	2	,	-AO_21	5													&EFS/681.1
Extract Fan C/W Fire Damper 2						GND	3	,	-AO_21	2													&EFS/681.3
=						+10V	4	,	-AO_21	6													&EFS/681.3
Extract Fan C/W Fire Damper 3						GND	5	,	-AO_21	3													&EFS/681.5
=						+10V	6	,	-AO_21	7													&EFS/681.5

previous page: 2002

next page: 2004

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XDC1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
FUSE 24V DC CONTROL VOLTAGE					-101T1	13	1		-103F1	2													&EFS/603.2
					-101Q1	13																	
					-611A1	1																	
FUSE 24V DC CONTROL VOLTAGE					-620A1	-X80:1	2																&EFS/603.2
					-DI_21	L+																	
					-DO_21	L+																	
FUSE 24V DC CONTROL VOLTAGE					-635K7	11	3		-103F1	13													&EFS/603.2
					-684F5	11																	
FUSE 24V DC CONTROL VOLTAGE					-611A1	2	4		-102G1	OUTPUT DC 24 V:-													&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE					-620A1	-X80:2	5																&EFS/603.3
					-DI_21	M																	
					-DO_21	M																	
FUSE 24V DC CONTROL VOLTAGE					-635K1	A2	6		-XDC2	5													&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE					-101T1	-"	PE																&EFS/603.4
					-101T1	PE																	
FUSE 24V DC CONTROL VOLTAGE							PE																&EFS/603.4

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_03++ASC+-XDC1	20250805_V2.0	= UNIT_03	Battery Container 2
Date	21.01.2025							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 2004

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-XDC2

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FUSE 24V DC CONTROL VOLTAGE			-AI_21	L+	1		-103F2	2			&EFS/603.5
			-AO_21	L+							
			-X5.1	1							
FUSE 24V DC CONTROL VOLTAGE			-X5.1	8	2		-X5.2	8			&EFS/603.5
			-680K1	11							
			-X5.2	1							
FUSE 24V DC CONTROL VOLTAGE			-680K2	11	3		-680K3	11			&EFS/603.5
			-X5.3	1							
			-X5.3	8							
FUSE 24V DC CONTROL VOLTAGE			-691F1	13	4						&EFS/603.6
			-691F4	13							
			-691F4	13							
FUSE 24V DC CONTROL VOLTAGE			-AI_21	M	5		-XDC1	6			&EFS/603.6
			-AO_21	M							
			-X5.1	2							
FUSE 24V DC CONTROL VOLTAGE			-680K1	A2	6						&EFS/603.6
			-X5.2	2							
FUSE 24V DC CONTROL VOLTAGE			-680K2	A2	7						&EFS/603.7
			-X5.3	2							
			-680K3	A2							

previous page: 2004

next page: 2006

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XES						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
							1		-684F1	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC							N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-690F1	N													&EFS/684.3
=					-690XT1	N	N		-690F2	N													&EFS/684.3
=							N		-690XT1	N													&EFS/684.4
=							PE			PE													&EFS/684.4
=					++Container-278W1	GND	PE			PE													&EFS/684.4
=					-684F5	PE	PE		-684F2	PE													&EFS/684.5
=					-601F1	PE	PE																&EFS/684.5
					-684F4	2	2		-684F3	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC					-601F1	L1	3																&EFS/684.1
=							4		-684F1	4													&EFS/684.1
=					-684F4	4	5		-684F3	4													&EFS/684.1
=					-601F1	L2	6																&EFS/684.1
=							7		-684F1	6													&EFS/684.1
=					-684F4	6	8		-684F3	6													&EFS/684.1
=					-601F1	L3	9																&EFS/684.2

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
Gas confirmed FGS							1	,	-635K1	14			&EFS/635b.1
=							2	,	-635K1	11			&EFS/635b.1
=							3	,	-635K2	14			&EFS/635b.1
Smoke confirmed FGS							4	,	-635K2	11			&EFS/635b.2
=							5	,	-635K3	14			&EFS/635b.2
Thermal runaway SIS							6	,	-635K3	11			&EFS/635b.3
=							7	,	-635K4	14			&EFS/635b.3
=							8	,	-635K4	11			&EFS/635b.3
Spare							9	,	-635K5	14			&EFS/635b.4
=							10	,	-635K5	11			&EFS/635b.4
=							11	,	-635K6	14			&EFS/635b.5
=							12	,	-635K6	11			&EFS/635b.5
Shut-down to BESS							13	,	-635K7	A2			&EFS/635b.7
=							14	,	-635K7	A1			&EFS/635b.7

previous page: 2006

next page: 2008

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-OZ	++Container-290W2-2 F-CY-OZ	++Container-290W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	1					&EFS/669.5
		3			++Container-570XT	3						
	3				++Container-570XT	3						

previous page: 2007

next page: 2009

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2008

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	2		++Container-570XT	3		3	&EFS/669.5
		3			++Container-570XT	3							
	3				++Container-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	3		++Container-570XT	3		3	&EFS/669.6
		3			++Container-570XT	3							
	3				++Container-570XT	3							

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2010

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	4					&EFS/669.7
		4			++Container-570XT	4						
	4				++Container-570XT	4						

previous page:
2010

next page:
2012

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2011
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	5		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	6		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	7					&EFS/670.5
		1			++Container-570XT	1						
	1				++Container-570XT	1						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	8		++Container-570XT	1		1	&EFS/670.5
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	9		++Container-570XT	1		1	&EFS/670.6
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	10					&EFS/670.7
		2			++Container-570XT	2						
	2				++Container-570XT	2						

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	11		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	12		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

previous page: 2018

next page: 2020

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2019

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			++Container-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				++Container-XE	1	3	,	-687F3	2		&EFS/687.4

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2020 of total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-1 JZ-500	++Container-291W2-1 JZ-500	++Container-291W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	4	,	-687F4	2		&EFS/687.5
=		1			++Container-XE	1	5	,	-687F5	2		&EFS/687.7
=	1				++Container-XE	1	6	,	-687F6	2		&EFS/687.8

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-687XT1

Function text	++Container-293W1-1 JZ-500	++Container-292W3-1 JZ-500	++Container-292W2-1 JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	7	,	-688F1	2		&EFS/688.1
=		1			++Container-XE	1	8	,	-688F2	2		&EFS/688.3
=	1				++Container-XE	1	9	,	-688F3	2		&EFS/688.4

previous page: 2021

next page: 2023

Editor	Freqcon_DG	Statron	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	21.01.2025				& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007	++ ASC auxillary cabinet	page: 2022
Date					+	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W1-1	++Container-293W3-1	++Container-293W2-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	10	,	-688F4	2													&EFS/688.5
=		1			++Container-XE	1	11	,	-688F5	2													&EFS/688.7
=	2				++Container-XE	N	N	,	-XES	N													&EFS/687.1
								,															

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W1-1 JZ-500	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/687.6

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2024

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W2-1 -XZ-500	++Container-292W1-1 -XZ-500	++Container-291W2-1 -XZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.7
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.8
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N		-XES	N		&EFS/688.1

previous page: 2024

next page: 2026

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W2-1 -1Z-500	++Container-293W1-1 -1Z-500	++Container-292W3-1 -1Z-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/688.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/688.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/688.6

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	++Container-293W3-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N	⌟				&EFS/688.7
								,				
Supply Battery String 1-phase 230V AC		GNYE			++Container-XE	PE	PE	,				&EFS/687.2
=	GNYE				++Container-XE	PE	PE	,				&EFS/687.3

previous page: 2026

next page: 2028

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W2-1	++Container-291W1-1	++Container-290W3-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/687.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/687.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/687.7

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W3-1	++Container-292W2-1	++Container-292W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/687.9
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.2
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.3

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W3-1	++Container-293W2-1	++Container-293W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/688.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
				Cable type							Cable type	
Container Internal Lighting						L	1	,	-690F1	2		&EFS/690.1
=						1	2	,	-690F2	2		&EFS/690.3
Container Sockets						1	3	,	-690F3	2		&EFS/690.5
230V AC for crane 2						1	4	,	-690F4	2		&EFS/690.7
230V AC for crane 3						1	5	,	-690F5	2		&EFS/690.8
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						L	6	,	-636K1	14		&EFS/691.1
						L						
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						L	7	,	-636K2	14		&EFS/691.3
						L						
								,				
								,				

previous page: 2030

next page: 2032

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,		

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
400V AC for Cooling Units							10	,	-691F4	4													&EFS/691.6
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,														

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
				Cable type							Cable type		
230V AC for crane 2						PE	PE						&EFS/690.7
230V AC for crane 3						PE	PE						&EFS/690.8
Container Sockets						2	N		-690F2	N.			&EFS/690.4
230V AC for crane 1						2	N		-XES	N			&EFS/690.6
230V AC for crane 2						2	N		-XES	N			&EFS/690.7
230V AC for crane 3						2	N		-XES	N			&EFS/690.8
Container Internal Lighting						N	N		-690F1	N.			&EFS/690.1
=						GND	PE						&EFS/690.2
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						N	N		-XES	N			&EFS/691.1
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						GND	PE						&EFS/691.2
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						N	N						&EFS/691.3
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						GND	PE						&EFS/691.3
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						N	N						&EFS/691.4
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						GND	PE						&EFS/691.4
						GND							
400V AC for Cooling Units							N						&EFS/691.6
=							PE						&EFS/691.6

previous page: 2033

next page:

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-690XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

STATRON
NON STOP POWER

Control Philosophy & Block Logic Diagrams

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: C08
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-C08-001
Document description: Control Philosophy & Block Logic Diagrams

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version

Control Philosophy & Block Logic Diagrams
C08

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	C08
Document name	Control Philosophy & Block Logic Diagrams
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-14	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-14	C. Palenzuela
Checked by	2023-03-15	A. Fritz
Approved by	2023-03-15	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 Main Control System 8
2.1 Network Structure PCS 10
2.2 Converter Main States 11
2.2.1 Error Levels 11
2.2.2 Main States Description 11
3 BESS Control System 14
3.1 Battery Cabinet Control System 14
3.2 Network Structure BESS Control 15
3.3 BESS Main States 16
3.3.1 Main States Description 16
4 Operating Interfaces 18
5 Data Interfaces 20
5.1 Profinet 20
5.2 Ethernet 21
6 Network Devices 21
6.1 Siemens Simotion P320 21
6.2 Switch 21
6.3 VPN Router (optional) 21
6.4 HMI/WebVisu 22
6.4.1 Overview 23
6.4.2 Cooling 25
6.4.3 DC Port Page 26
6.5 Buffer Files 27
7 Appendix 30

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-C08-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 Main Control System

The complete BESS is controlled and monitored by a main control system installed on the P320 PLC inside the control cabinet (CTRL). Both, the converter control system as well as the BESS control system are installed on the same PLC.

Data exchange between the individual cabinet control systems and BESS main control system is performed via MODBUS TCP protocol.

BESS Main Control System Overview

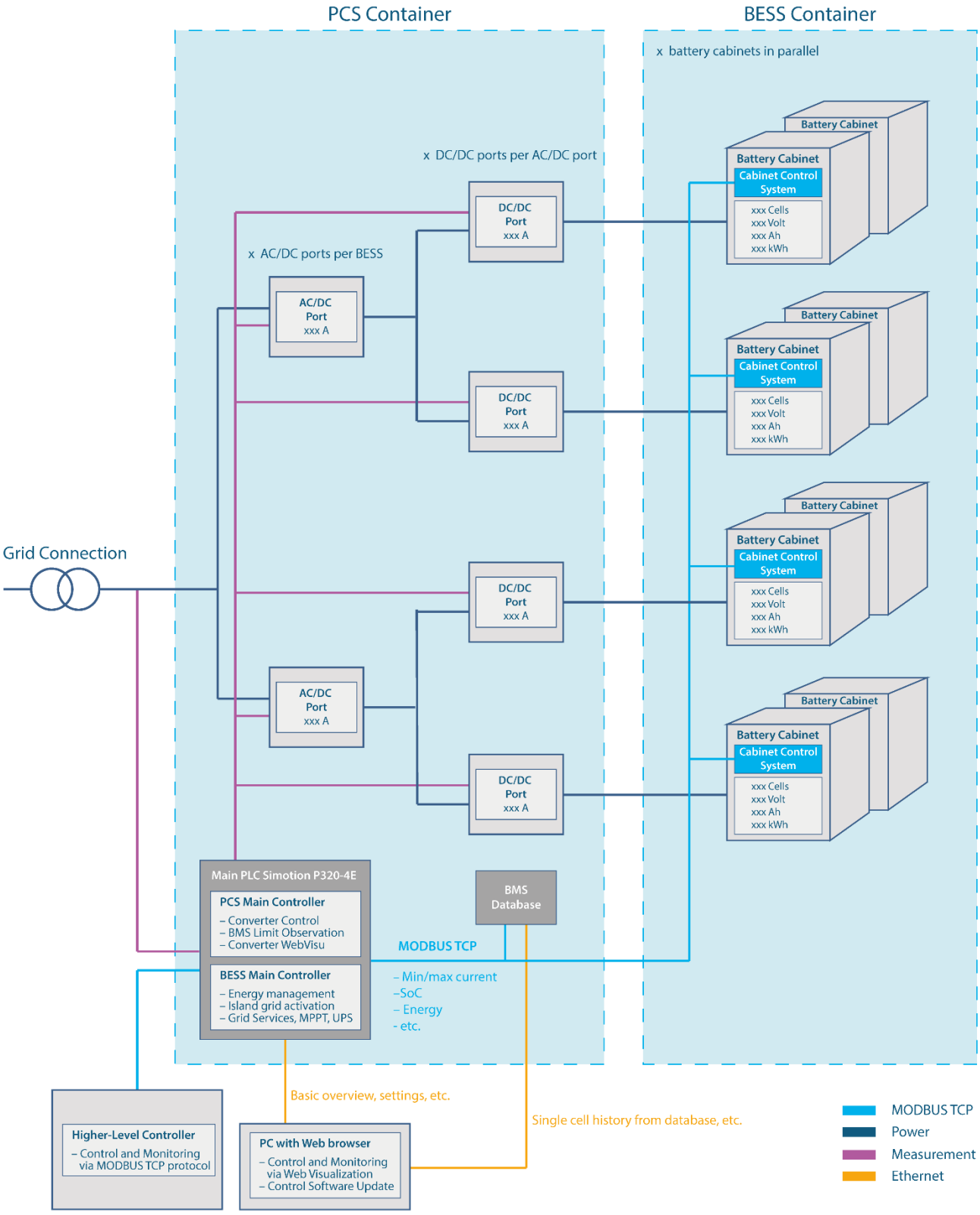


Figure 1: BESS main control system overview

2.1 Network Structure PCS

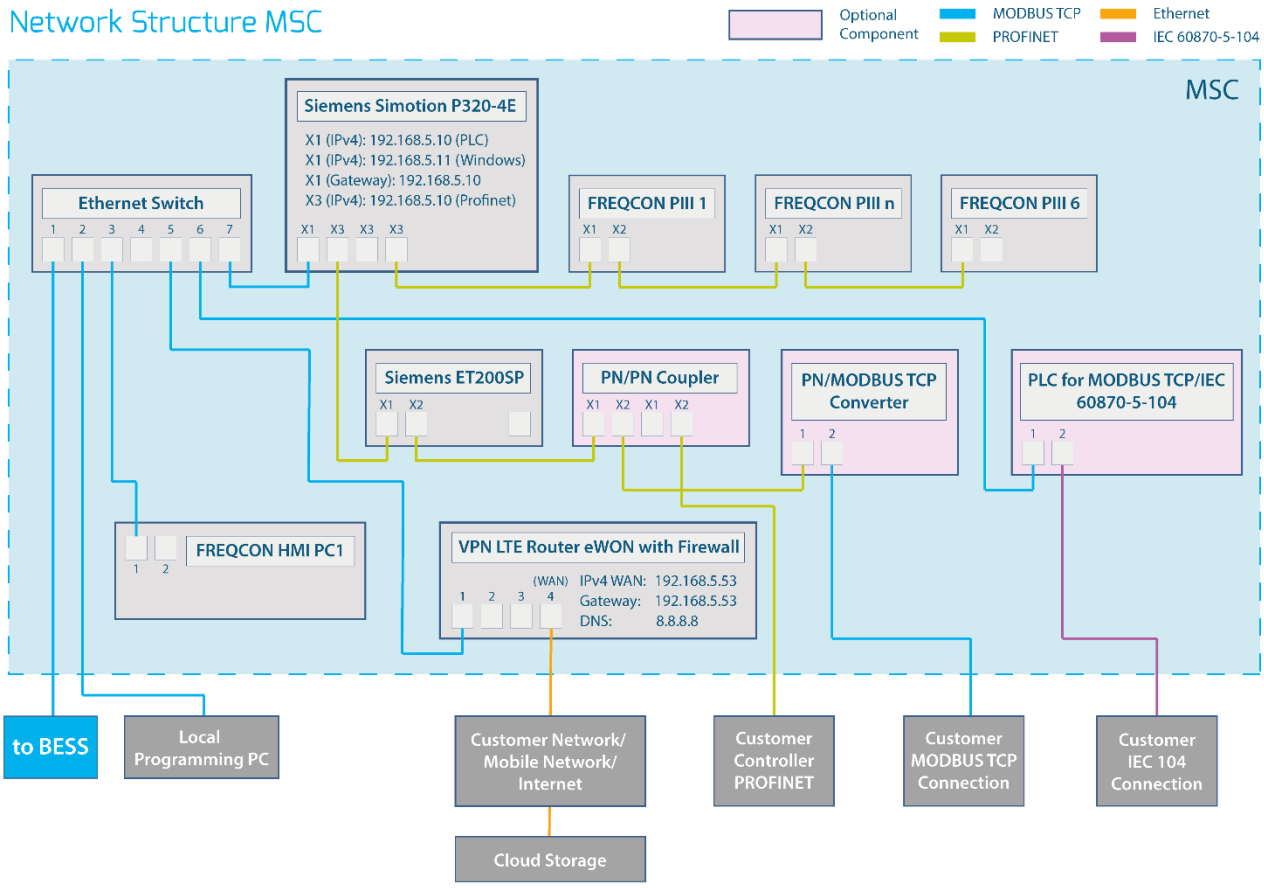


Figure 2: PCS (MSC 1000) Network Structure

2.2 Converter Main States

The individual converter main states are depicted in the flow diagram below and described in section 2.2.2.

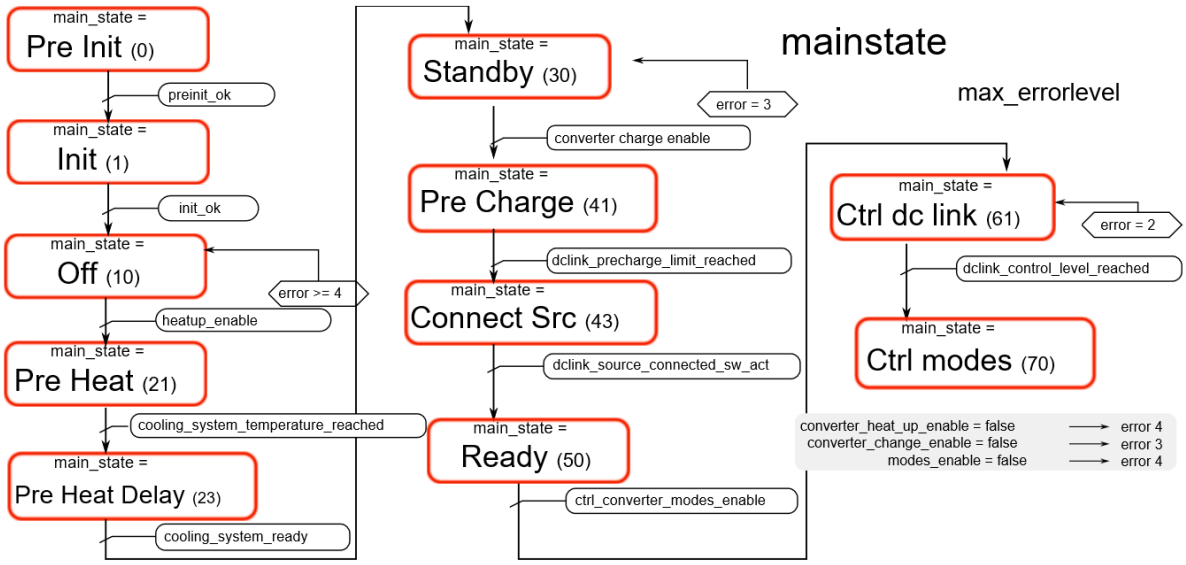


Figure 1: Converter main states

2.2.1 Error Levels

Error Level	Description
0	No error, logging information
1	Warning category, a warning limit is reached
2	Error category, stop subsystems
3	Error category, stop system and discharge DC-link, cooling system enable
4	Error category, stop system and also the cooling system

2.2.2 Main States Description

INIT

The system was turned on and the stored initialization parameters are read. Cooling and converter system are stopped.

OFF

The DC link is discharged. The converter and cooling system are not in operation.

Pre-Heat

The converter is switched-off and is preparing for operation. The cooling system regulates to the optimum temperature of the cooling water, IGBT, capacitors and inductors.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Heat-Delay

The converter is preparing for operation. The operation temperatures of the components are reached and maintained for a defined time span.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

STANDBY

Standby mode – converter is off, but the cooling system is in operation.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Pre-Charge

The converter´s main DC-link is pre-charged to a defined voltage level.

An error level 3, such as detection of wrong grid conditions, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Connect SW

Source contactor is closed.

An error level 3, such as switching error of the source contactor, is leading to a change to main state "STANDBY" (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

READY

Converter is ready for operation. Cooling system is operating, the DC link is charged and source is connected.

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

DC link Ctrl

The converter power module that is set to "DC link control" mode is activated.

An error level 2, such as derating, DC link errors or over temperature, are leading to a change to main state READY (converter is off, cooling system is in operation).

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Ctrl Mode

The remaining converter power modules that are enabled are activated. The converter is operating.

An error level 1, such as power module over temperature, over-current or over-voltage, is leading to a stop of the respective power module.

An error level 2, such as derating, DC link errors or over temperature, are leading to a change to main state READY (converter is off, cooling system is in operation).

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

3 BESS Control System

The aim of the ESS energy storage system is to store and release electrical energy.
energy. LiFePo4 (LFP) batteries are predominantly used for energy storage in the FREQCON system. The control system described in this document has the following functions and tasks.

- Monitoring of the battery cells
- Communication interface to consumers (converters) and chargers
- Communication interface to databases
- WebVisualisation for service purposes

Components of the system

- Battery cabinet control system
- Battery modules
- BMS
- Sensors (current, voltage, temperature, etc.)
- DC switches and line protection

3.1 Battery Cabinet Control System

Each battery cabinet is equipped with its own control system (Siemens S7) collecting the relevant data from the individual battery modules and providing these to the BESS and PCS main control system.

The tasks and features of the battery cabinet control system are the following:

- Monitoring of battery cell voltages and temperatures
- Monitoring of the battery charging and discharging current
- Control of DC switches
- Monitoring of line protection and smoke detectors
- MODBUS RTU Master for communication with BMS system (battery monitoring system)
- MODBUS TCP Server provides the communication interface to other systems

Cabinet Control System Overview

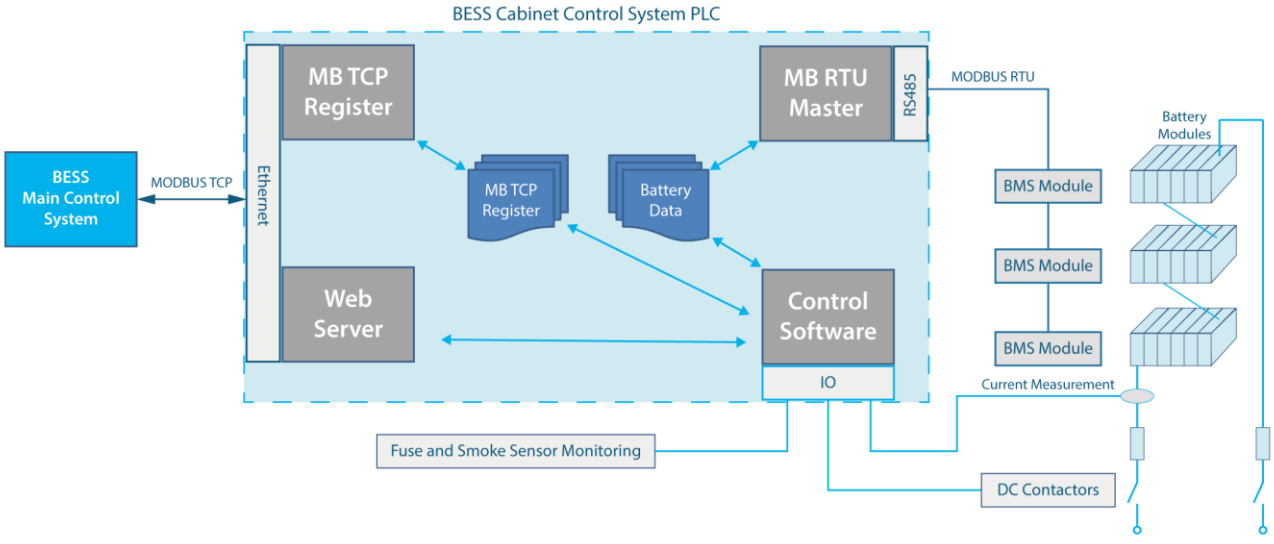


Figure 3: BESS cabinet control system overview

Data exchange between the cabinet control system and the individual battery modules is performed via MODBUS RTU protocol. Therefore, each battery cabinet is provided with several MODBUS RTU interfaces for Modbus connection of the battery modules.

3.2 Network Structure BESS Control

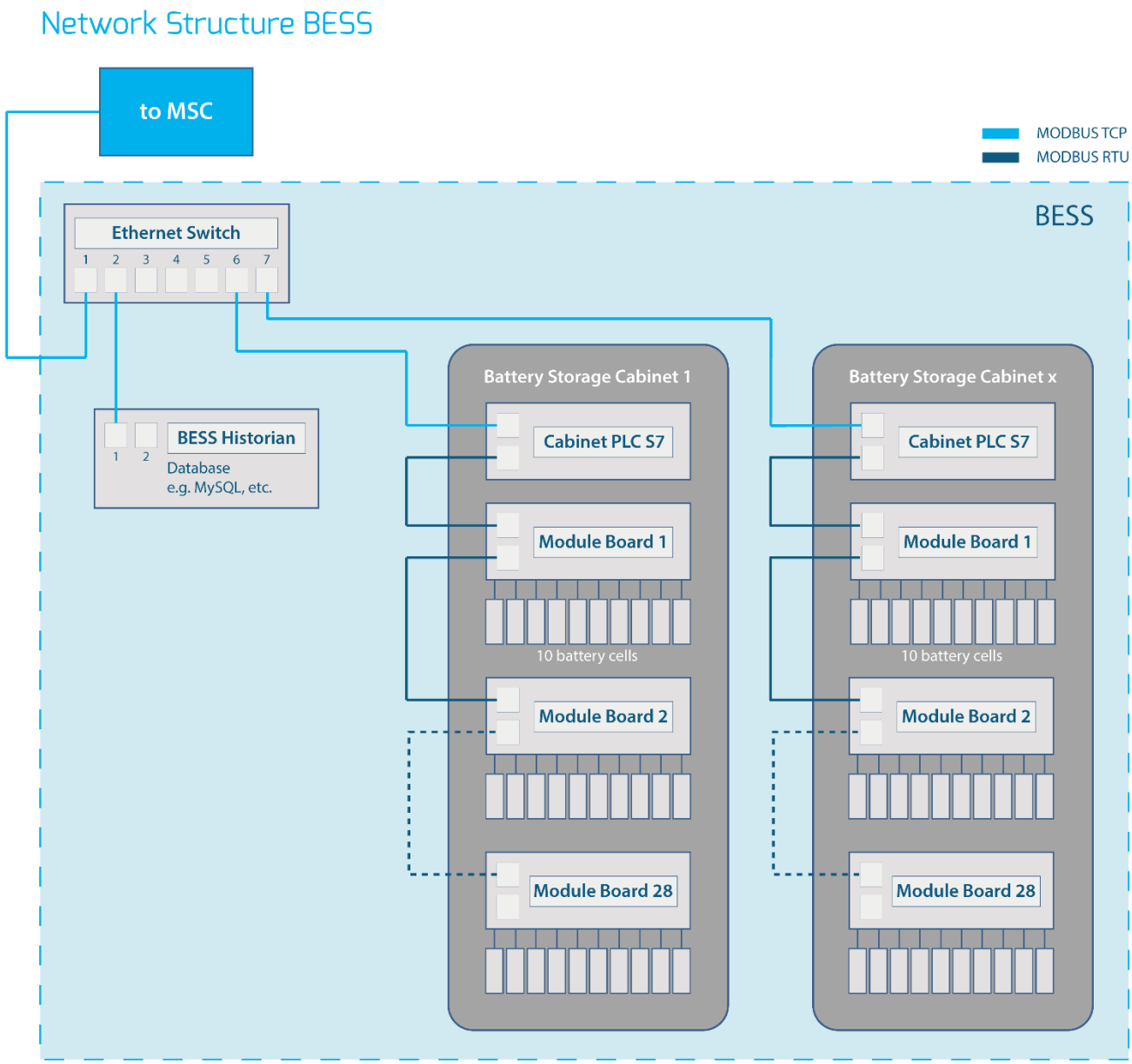
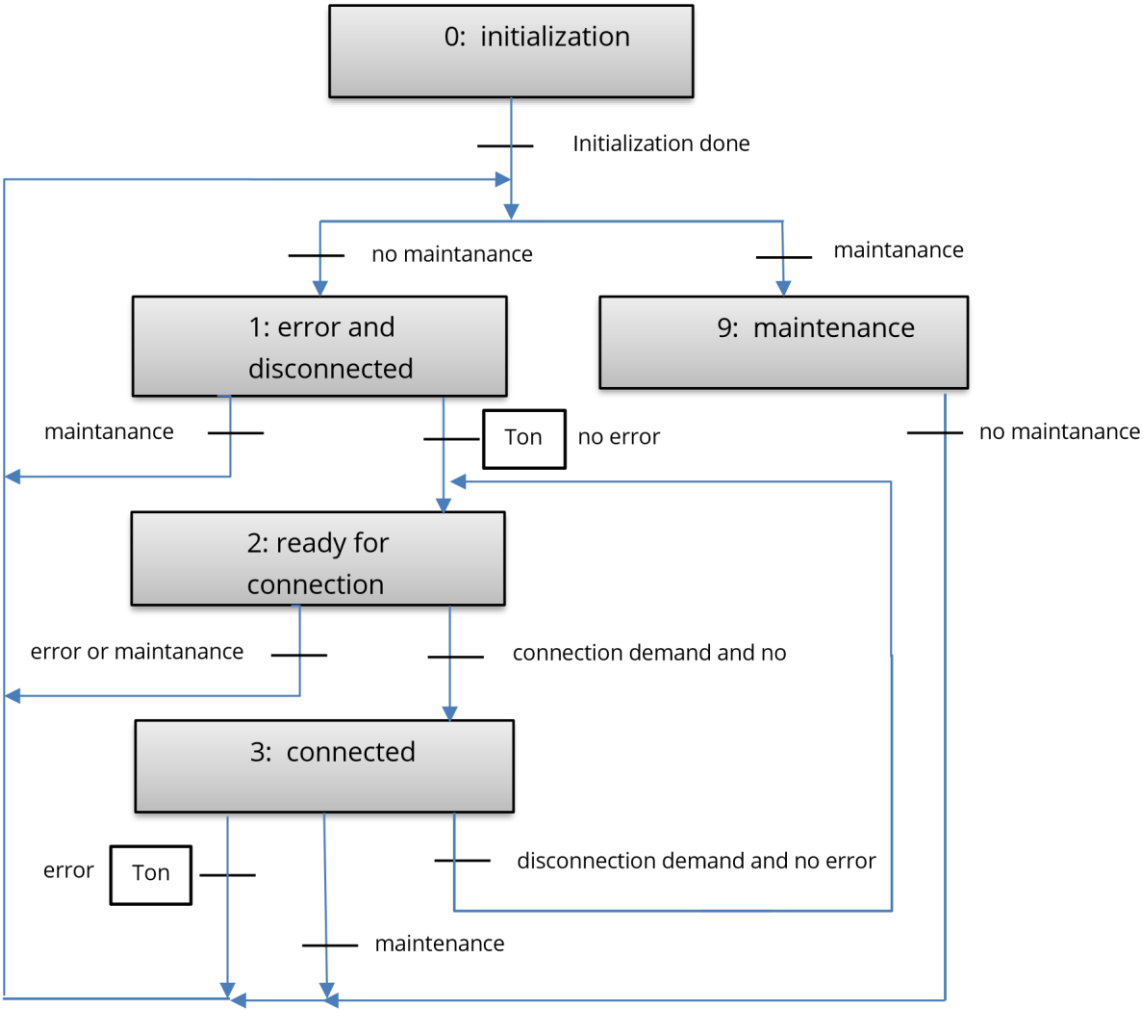


Figure 4: BESS Network Structure

3.3 BESS Main States

The individual BESS main states are depicted in the flow diagram below and described in the following section.



3.3.1 Main States Description

Initialization

The system parameters are set and stored operating data is read back. After successful initialization the status changes to the state “Error and disconnected”.

Error and Disconnected

The energy storage system (ESS) has an error and the system is disconnected from consumers/generators. If there is no error message, the system changes to the ready for connection state.

Ready for Connection

The BESS is error-free and ready to connect the consumers/generators. An external control signal (MODBUS TCP connection to the inverter/consumer) triggers the change to the connected state.

Connected

The BESS is connected to the loads/generators. If the external release for the connected state, the system switches to the disconnected state. If an error message is present, the system switches to the error and disconnected state after a time delay (init parameter). The time delay (TON) provides the external inverter/consumer with the required time period for battery current reduction to 0 A.

Maintenance

The ESS is disconnected from the load/generator. In this operating state the following functions are enabled:

- Modification of MODBUS RTU slave addresses (battery modules)

4 Operating Interfaces

The BESS/PCS is operated and controlled either via

- The control panel on the control cabinet CTRL of the converter system (*see figure below,* ②)
  - Push-buttons
    - RESET (restart emergency stop circuit)
  - Indication lights:
    - Fault (red; controller error is active)
    - Preheating (yellow; preheating of coolant)
    - Ready for Operation (green; converter is ready for operation)
    - Operating (green; converter is active)
  - Other control elements:
    - Main switch
    - Emergency-stop push button (optional)

- interface to the customer's higher-level control system(s)
- HMI (TFT panel) on control cabinet door (*see figure below,* ①)
- FREQON WebVisualization (*see figure below,* ②)



4.1 Control Panel

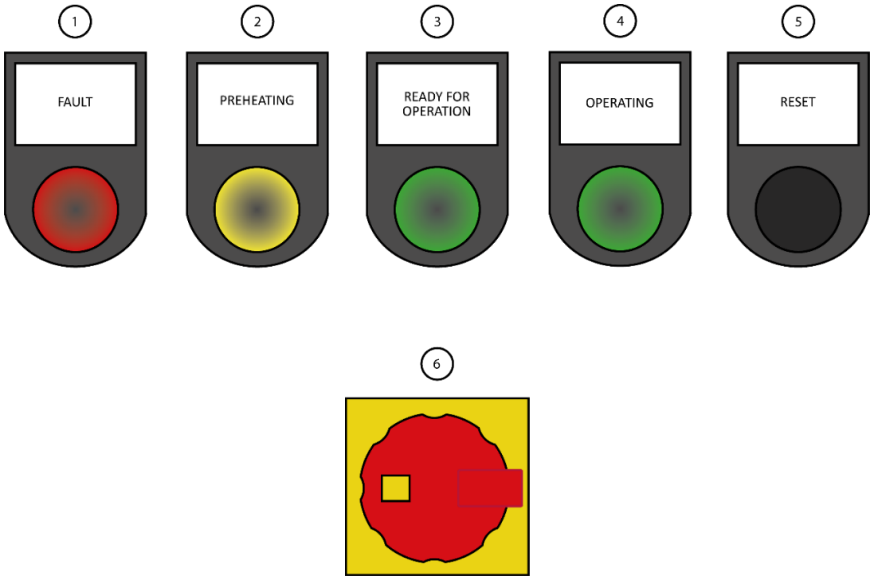


Figure 5: Control panel

4.2 Indicator Lights

Pos.	Indicator Light	Description
①	**Fault**	**Flashing light:** A warning of the converter main controller is present. The converter remains in operation. **Constantly glowing:** A fault has been detected by the converter main controller. Converter stops operating.
②	**Preheating**	**Flashing light:** The cooling system is preheating until the set cooling temperature value has been reached. **Constantly glowing:** The coolant temperature has reached the set temperature and is maintained for a set time span (defined in controller). **Light off:** The coolant temperature was maintained to the set cooling temperature for the time span defined in the controller. The preheating process is finished.
③	**Ready for Operation**	**Flashing light:** The DC-link of the converter is pre-charging until the set voltage has been reached. **Constantly glowing:** The DC-link is precharged to the set voltage and the power switches are closed.
④	**Operating**	The converter ´s IGBT´s are enabled and the converter is operating.

Table 4: Indicator Lights

4.3 Control Elements

Pos.	Control Element	Description
⑤	**Reset** *Push button*	Resets an existing converter fault.
⑥	**Main switch** *Selector switch*	**ON**: To enable the converter, set the selector switch to ON-position. **OFF**: To power-off the B2G Converter, set the selector switch to OFF-position.

Table 5: Control Elements

5 Data Interfaces

The BESS/PCS system can be connected to a higher-level control unit (control room) via MODBUS TCP interface (PROFINET as option). The required parameters (current, voltages, frequency, power) are provided by the BESS/PCS main control system and transmitted via MODBUS TCP protocol.

The higher-level controller is connected to the BESS/PCS main control system via a network isolator (113T1) inside the CTRL control cabinet of the PCS system.

For external control and monitoring of the converter, it is necessary that the customer has access to selected control and status variables stored in the BESS/PCS main control system, which can be read and overwritten by the customer's higher-level control. For this purpose, predefined control profiles with the relevant control variables and status profiles with all relevant status variables are stored for the data transfer between the customer's higher-level controller and the converter system.

5.1 Profinet

Profinet connections for the following components:

- Siemens Simotion P320 (Profinetport X3)
- ET200 IO modules
- PIII IGBT interface

The Profinet network cannot be reached from outside. A communication to a superior control is possible by a Profinet coupler. No other network traffic can be transmitted through this coupler. And thus a manipulation from the outside is excluded.

5.2 Ethernet

Ethernet connections for the following components:

- Siemens Simotion P320 (Ethernetport X1)
- HMI
- VPN Gateway
- Programming PC
- Battery Monitoring System
- Telecontrol coupler according to IEC101/104

The Ethernet network can be accessed from outside by a locally connected programming PC or by means of a secure VPN connection through a router.

6 Network Devices

6.1 Main PLC - SIMOTION P320-4 E

The control system consists of an industrial PC with Windows as operating system. A soft PLC is executed there and a web browser is provided for diagnostic purposes.
The device is protected against external access and manipulation by a router etc.

Updates of the control software can be imported in different ways:

- By removing the memory card and recording it in a CF drive.
- By uploading a compiled software via the web interface
- By uploading a software via an engineering PC

6.2 Battery Cabinet PLC - SIMATIC S7

Each battery cabinet of the BESS is equipped with a Siemens PLC with the following functions and tasks.

- Monitoring of the battery cells
- Communication interface to consumers (converters) and chargers
- Communication interface to databases
- WebVisualisation for service purposes

6.3 Switch

Industrial switch, freely configurable and updateable.

6.4 VPN Router (optional)

Industrial VPN router which separates the internal network from all external networks. A secure and protected access via a VPN connection can be configured.

6.5 HMI/WebVisu

A HMI touch panel is installed at the outside of the control cabinet (CTRL) door. The HMI offers the user granular control, real-time monitoring and visualization of the systems main controller functions. It is also possible, to connect to the HMI via remote connection by a PC or laptop, the so called FREQCON WebVisu.

The HMI/WebVisu provide the following pages:

- Overview
- Cooling
- DC/DC
- Event List
- Error List
- Buffer List
- Initialization

The individual pages can be selected by using the corresponding navigation buttons on the left side of every page.

Note:

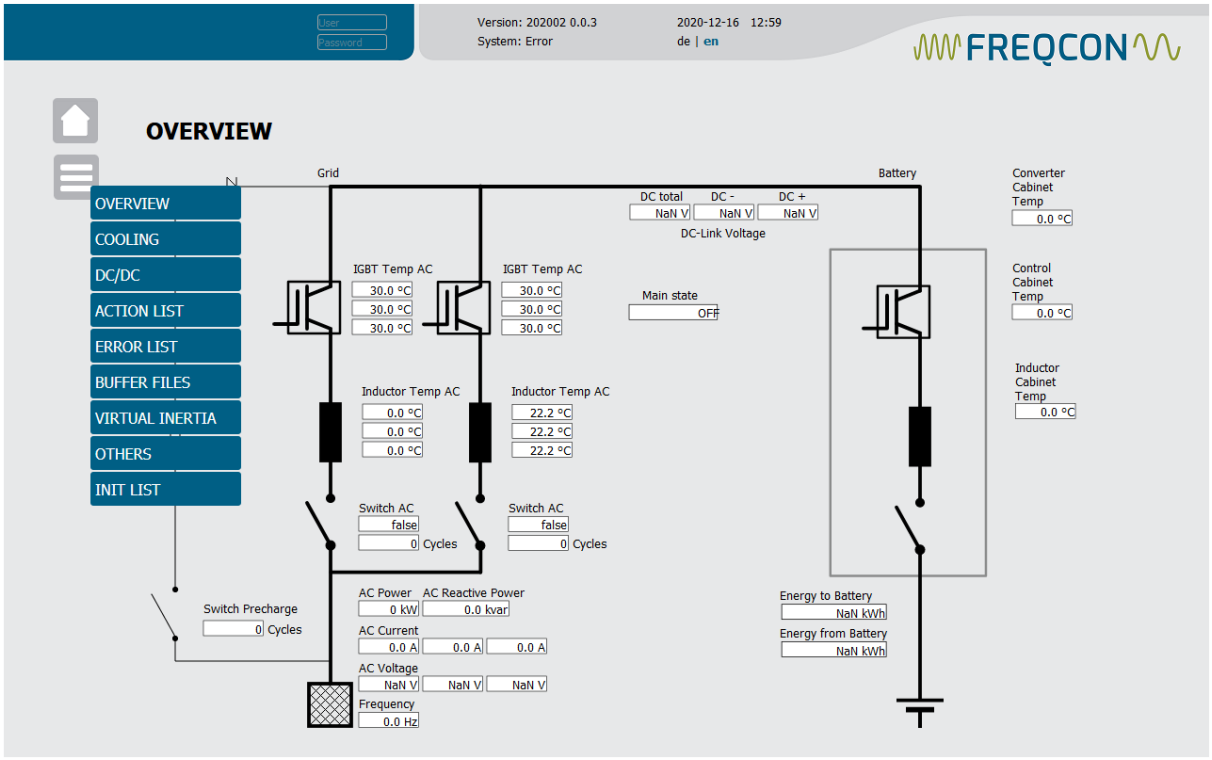
- Fields highlighted in grey are command fields for setpoint values. The set values can be adjusted by entering values inside the fields and are acknowledged by pressing “Enter” on the virtual keyboard of the WebVisu.
- White fields are displaying actual values.
- Values must be entered to the fields without any unit.
- The selection of the individual WebVisu pages is dependent of the user rights of the currently logged in user profile.
- When setting the power demand for charging and discharging the batteries “Grid: P demand”:
  Negative sign (-) = batteries are charged / positive sign (+) = batteries are discharged

The following subsections provide example pages of the FREQCON WebVisualisation, providing the possibility of remote monitoring and control of the PCS and BESS system via web browser.

6.5.1 Overview

The “Overview” page provides the user with a graphical overview of the systems main components and visibility to important operating data while the system is in operation.

The converter system is represented using a graphical overview of the system including the AC grid and power port control components. The cooling system and key temperature data will also be shown.



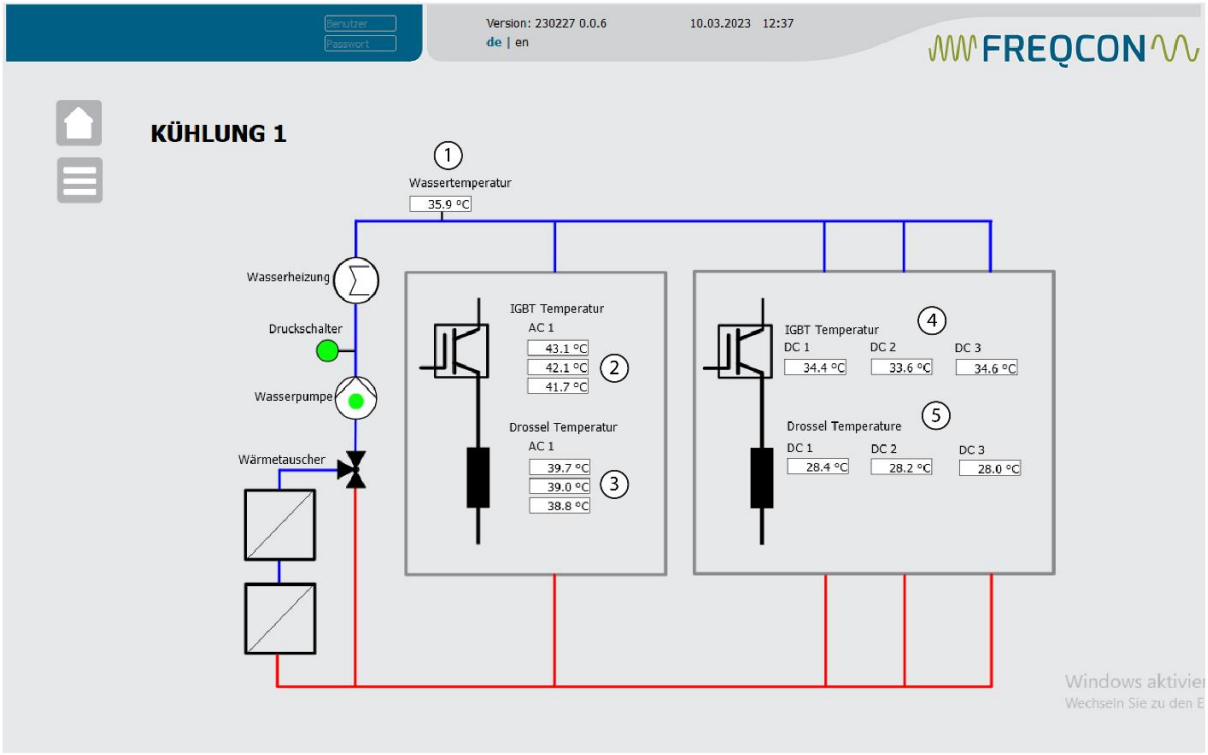
	Description	Value
1	Switching cycles of the precharge switch	Cycle number
2	Mains frequency	Hz
3	AC voltage mains phases L1/L2/L3 against N (from left to right)	V
4	AC current mains phases L1/L2/L3 against N (from left to right)	A
5	AC power (left) / AC reactive power (right)	kW/kvar
6	AC switch switching cycles	Zyklen
7	AC switch switching state	Open / closed
8	Temperatures of the AC chokes 1/2/3	°C
9	Temperatures of the AC IGBTs 1/2/3	°C
10	Temperatures of the AC-IGBTs 4/5/6	°C

11	Temperatures of the AC chokes 4/5/6	°C
12	AC switch switching state	Open / closed
13	AC switch Switching cycles	Cycles
14	Current main state of the converter	
15	Total DC link voltage	V
16	Negative DC link voltag	V
17	Positive DC link voltage	V
18	Temperature inside the converter cabinet (CON)	°C
19	Temperature inside the control cabinet (CTRL)	°C
20	Temperature inside the reactor cabinet (IND_AC)	°C

6.5.2 Cooling

The WebVisu page "Cooling " provide the user with a graphical overview of the main components of the converter cooling system:

- Cooling water heating element (water heater)
- pressure switch
- Cooling water pump
- Heat exchanger

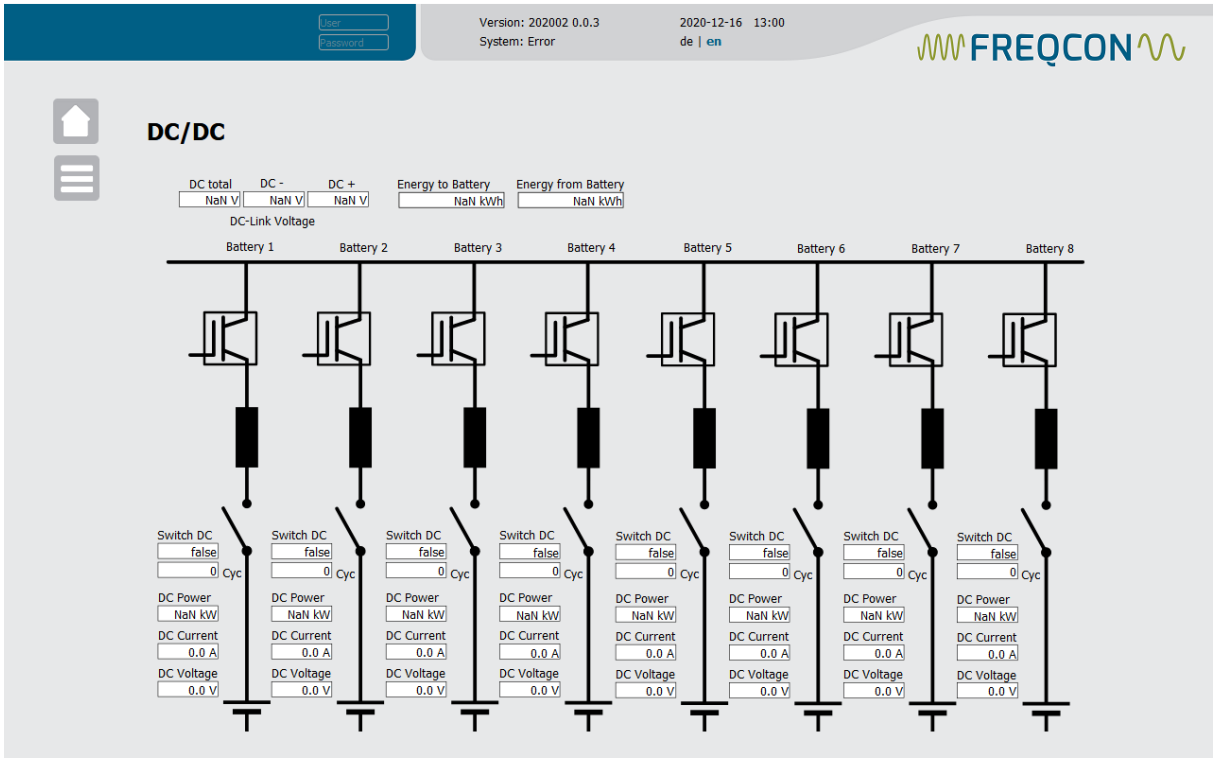


On the WebVisu page "Cooling" the following actual values are displayed:

	Description	Value
1	Cooling water temperature inside the cooling system	°C
2	Temperatures of the AC IGBTs 1/2/3	°C
3	Temperatures of the AC chokes 1/2/3	°C
4	IGBT temperatures of the DC ports 1/2/3	°C
7	Choke temperatures of the DC ports 1/2/3	°C

6.5.3 DC Port Page

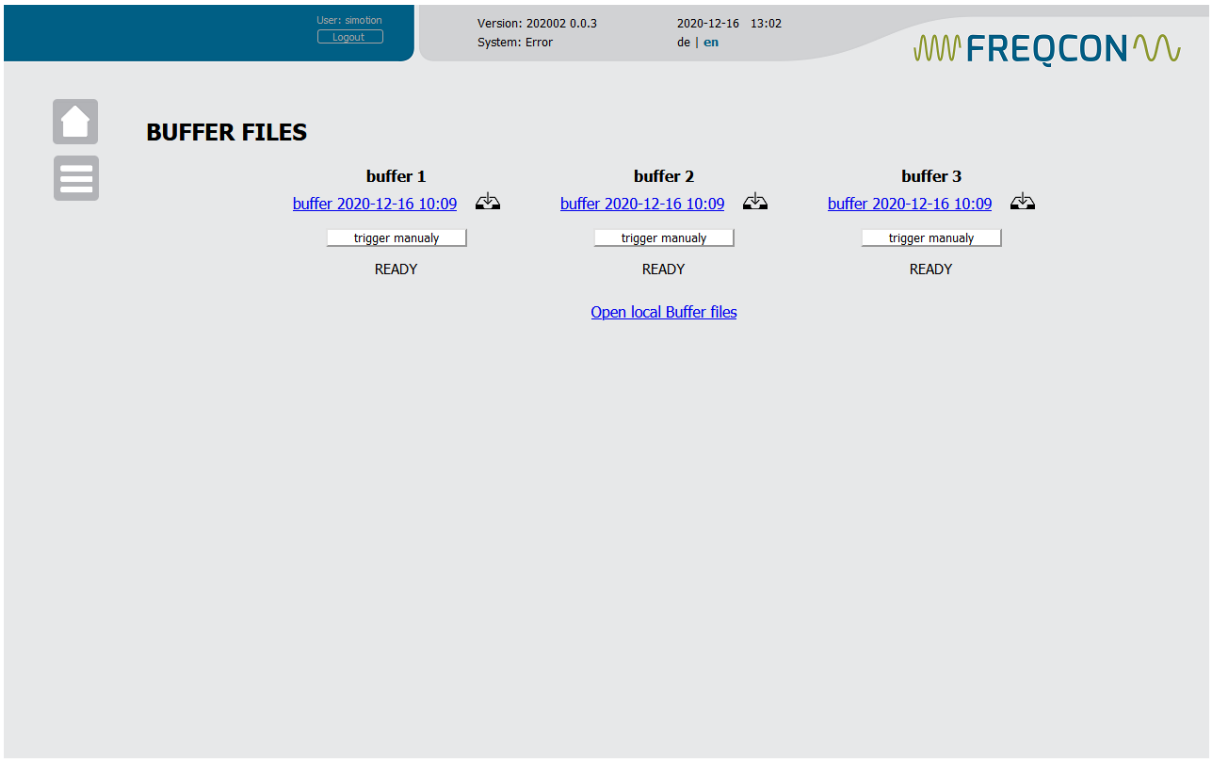
The WebVisu page "DC/DC" (see figure) provides the user with a graphical overview of the individual DC battery ports of the inverter system and offers information on both the individual DC ports.



The "DC/DC" WebVisu page displays the following actual values:

	Beschreibung	Wert
1	Total DC link voltage	V
2	Negative DC-Zwischenkreisspannung	V
3	Negative DC link voltage	V
4	Positive DC link voltage	
5	Display of the switching position of the DC switch	Open / closed
6	DC switch switching cycle	Number of cycles
7	Current DC power of the respective battery output	kWh
8	Actual DC current of the respective battery feeder	A
9	Actual DC voltage of the respective battery feeder	V

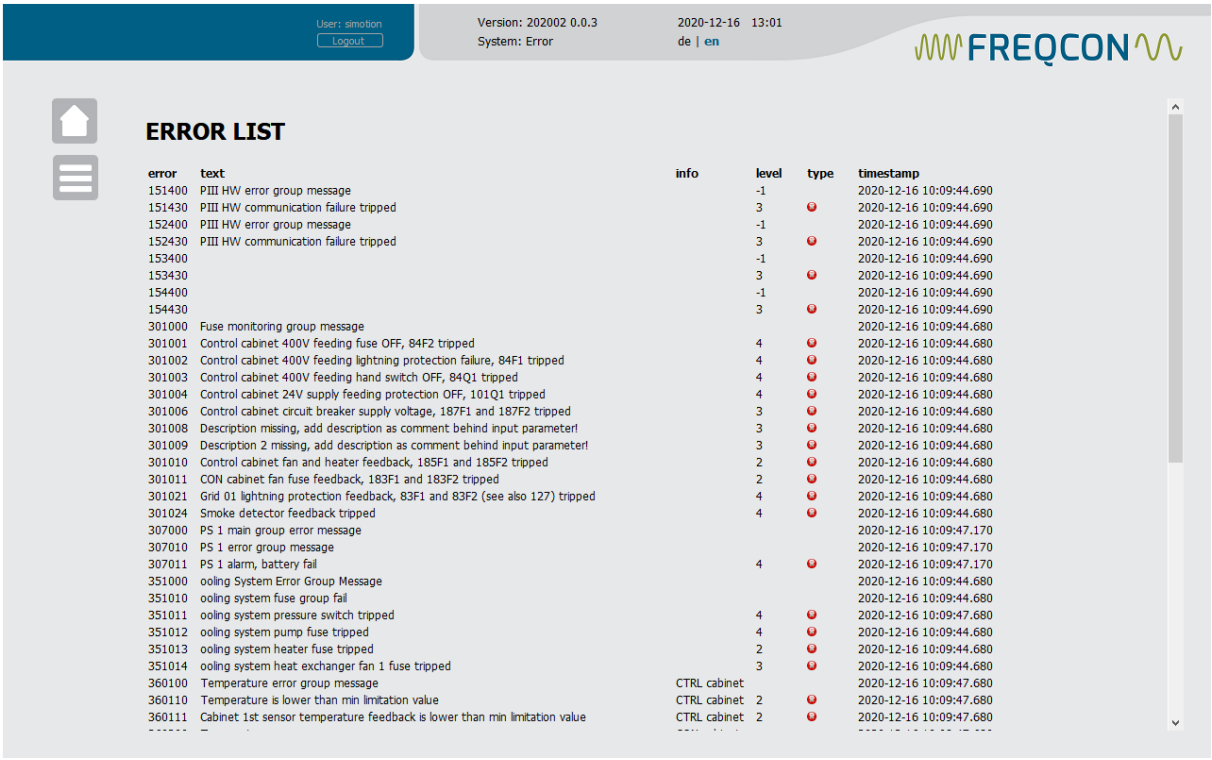
6.6 Buffer Files



The WebVisu page "Buffer Files" provides the user with downloadable buffer files with performance values from the time when an error occurred. The power values were recorded during a period of 0.75 s before and 0.75 s after the error.

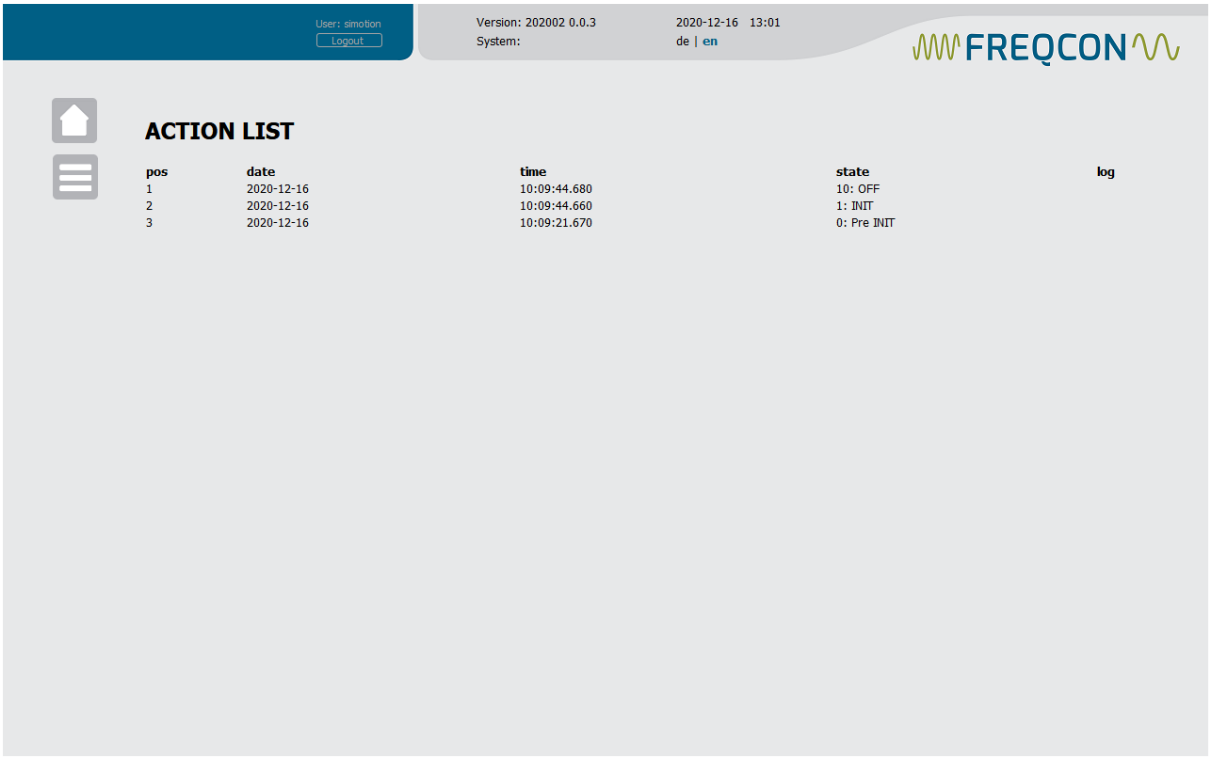
The buffer files are downloadable in .BUF format and can be viewed using the "FREQCON Buffer Analysis" tool. This allows performance values of previous faults to be analyzed.

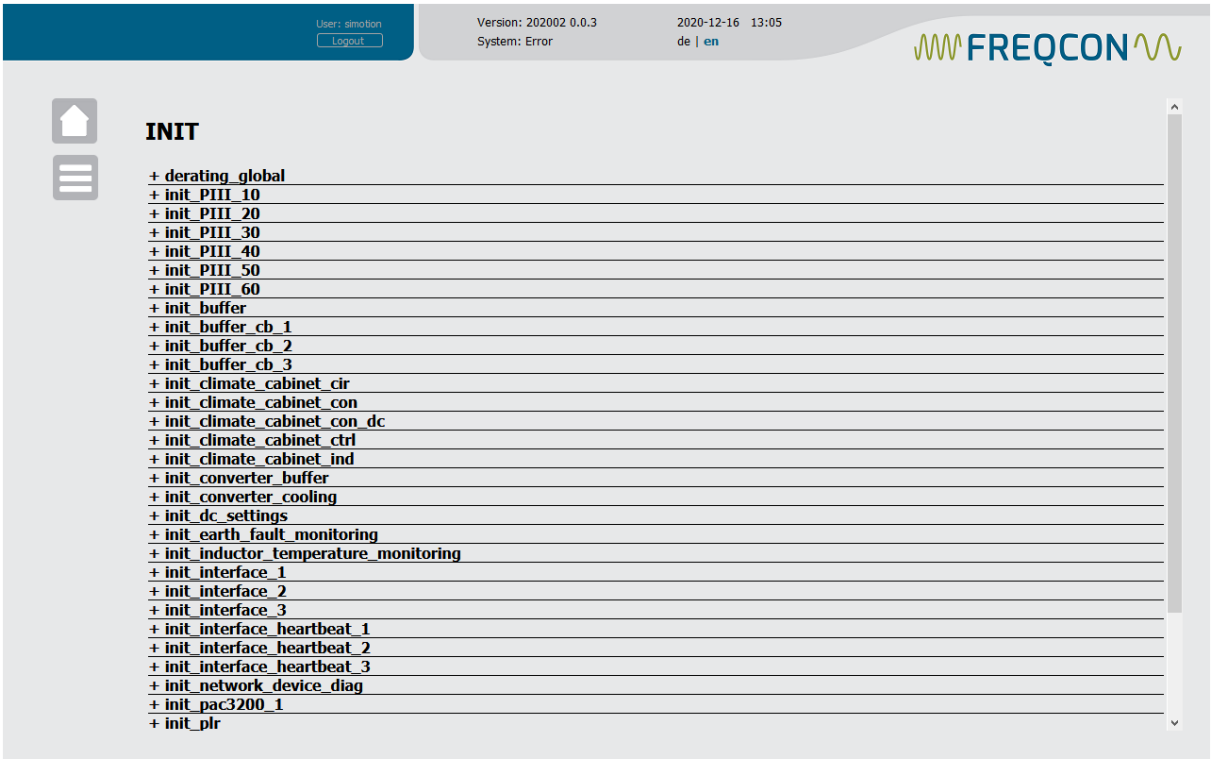
30 buffer files are stored on the PLC in a loop. If this threshold is exceeded, the oldest buffer is always overwritten with a newer file.



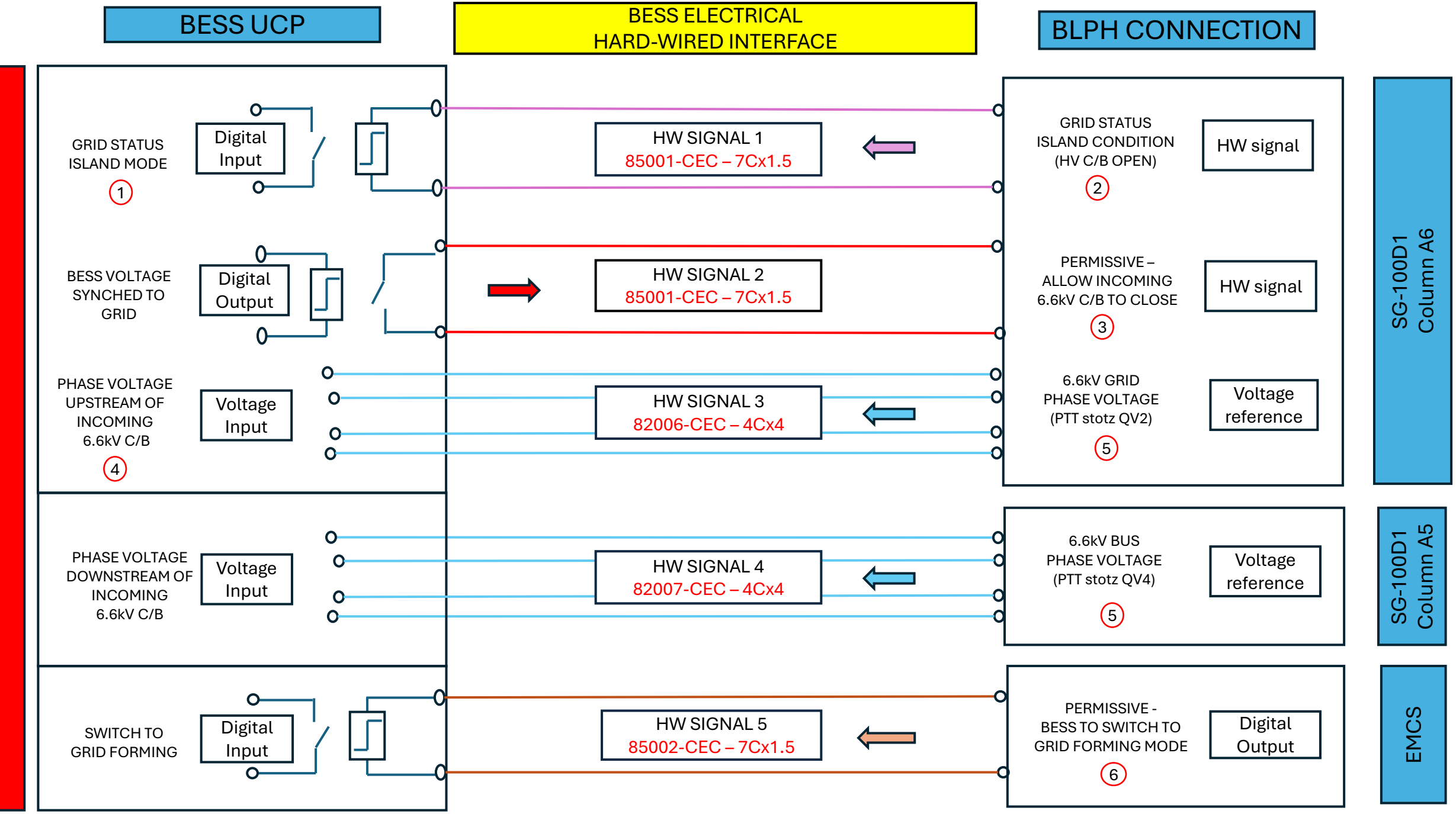
ERROR LIST

error	text	info	level	type	timestamp
151400	PIII HW error group message		-1		2020-12-16 10:09:44.690
151430	PIII HW communication failure tripped		3		2020-12-16 10:09:44.690
152400	PIII HW error group message		-1		2020-12-16 10:09:44.690
152430	PIII HW communication failure tripped		3		2020-12-16 10:09:44.690
153400			-1		2020-12-16 10:09:44.690
153430			3		2020-12-16 10:09:44.690
154400			-1		2020-12-16 10:09:44.690
154430			3		2020-12-16 10:09:44.690
301000	Fuse monitoring group message				2020-12-16 10:09:44.680
301001	Control cabinet 400V feeding fuse OFF, 84F2 tripped		4		2020-12-16 10:09:44.680
301002	Control cabinet 400V feeding lightning protection failure, 84F1 tripped		4		2020-12-16 10:09:44.680
301003	Control cabinet 400V feeding hand switch OFF, 84Q1 tripped		4		2020-12-16 10:09:44.680
301004	Control cabinet 24V supply feeding protection OFF, 101Q1 tripped		4		2020-12-16 10:09:44.680
301006	Control cabinet circuit breaker supply voltage, 187F1 and 187F2 tripped		3		2020-12-16 10:09:44.680
301008	Description missing, add description as comment behind input parameter!		3		2020-12-16 10:09:44.680
301009	Description 2 missing, add description as comment behind input parameter!		3		2020-12-16 10:09:44.680
301010	Control cabinet fan and heater feedback, 185F1 and 185F2 tripped		2		2020-12-16 10:09:44.680
301011	CON cabinet fan fuse feedback, 183F1 and 183F2 tripped		2		2020-12-16 10:09:44.680
301021	Grid 01 lightning protection feedback, 83F1 and 83F2 (see also 127) tripped		4		2020-12-16 10:09:44.680
301024	Smoke detector feedback tripped		4		2020-12-16 10:09:44.680
307000	PS 1 main group error message				2020-12-16 10:09:47.170
307010	PS 1 error group message				2020-12-16 10:09:47.170
307011	PS 1 alarm, battery fail		4		2020-12-16 10:09:47.170
351000	ooling System Error Group Message				2020-12-16 10:09:44.680
351010	ooling system fuse group fail				2020-12-16 10:09:44.680
351011	ooling system pressure switch tripped		4		2020-12-16 10:09:47.680
351012	ooling system pump fuse tripped		4		2020-12-16 10:09:44.680
351013	ooling system heater fuse tripped		2		2020-12-16 10:09:44.680
351014	ooling system heat exchanger fan 1 fuse tripped		3		2020-12-16 10:09:44.680
360100	Temperature error group message	CTRL cabinet			2020-12-16 10:09:47.680
360110	Temperature is lower than min limitation value	CTRL cabinet	2		2020-12-16 10:09:47.680
360111	Cabinet 1st sensor temperature feedback is lower than min limitation value	CTRL cabinet	2		2020-12-16 10:09:47.680


User: simotion
Logout
Version: 202002 0.0.3
System:
2020-12-16 13:01
de | en
FREQCON
ACTION LIST
pos date time state log
1 2020-12-16 10:09:44.680 10: OFF
2 2020-12-16 10:09:44.660 1: INIT
3 2020-12-16 10:09:21.670 0: Pre INIT


User: simotion
Logout
Version: 202002 0.0.3
System: Error
2020-12-16 13:05
de | en
FREQCON
INIT
+ derating_global
+ init_PIII_10
+ init_PIII_20
+ init_PIII_30
+ init_PIII_40
+ init_PIII_50
+ init_PIII_60
+ init_buffer
+ init_buffer_cb_1
+ init_buffer_cb_2
+ init_buffer_cb_3
+ init_climate_cabinet_cir
+ init_climate_cabinet_con
+ init_climate_cabinet_con_dc
+ init_climate_cabinet_ctrl
+ init_climate_cabinet_ind
+ init_converter_buffer
+ init_converter_cooling
+ init_dc_settings
+ init_earth_fault_monitoring
+ init_inductor_temperature_monitoring
+ init_interface_1
+ init_interface_2
+ init_interface_3
+ init_interface_heartbeat_1
+ init_interface_heartbeat_2
+ init_interface_heartbeat_3
+ init_network_device_diag
+ init_pac3200_1
+ init_plr

7 Appendix


BESS UCP
BESS ELECTRICAL
HARD-WIRED INTERFACE
BLPH CONNECTION
GRID STATUS
ISLAND MODE
1
Digital
Input
HW SIGNAL 1
85001-CEC – 7Cx1.5
GRID STATUS
ISLAND CONDITION
(HV C/B OPEN)
2
HW signal
BESS VOLTAGE
SYNCHED TO
GRID
Digital
Output
HW SIGNAL 2
85001-CEC – 7Cx1.5
PERMISSIVE –
ALLOW INCOMING
6.6kV C/B TO CLOSE
3
HW signal
PHASE VOLTAGE
UPSTREAM OF
INCOMING
6.6kV C/B
4
Voltage
Input
HW SIGNAL 3
82006-CEC – 4Cx4
6.6kV GRID
PHASE VOLTAGE
(PTT stotz QV2)
5
Voltage
reference
SG-100D1
Column A6
PHASE VOLTAGE
DOWNSTREAM OF
INCOMING
6.6kV C/B
Voltage
Input
HW SIGNAL 4
82007-CEC – 4Cx4
6.6kV BUS
PHASE VOLTAGE
(PTT stotz QV4)
5
Voltage
reference
SG-100D1
Column A5
SWITCH TO
GRID FORMING
Digital
Input
HW SIGNAL 5
85002-CEC – 7Cx1.5
PERMISSIVE -
BESS TO SWITCH TO
GRID FORMING MODE
6
Digital
Output
EMCS

Reference document - 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_2024XXXX_V0.7

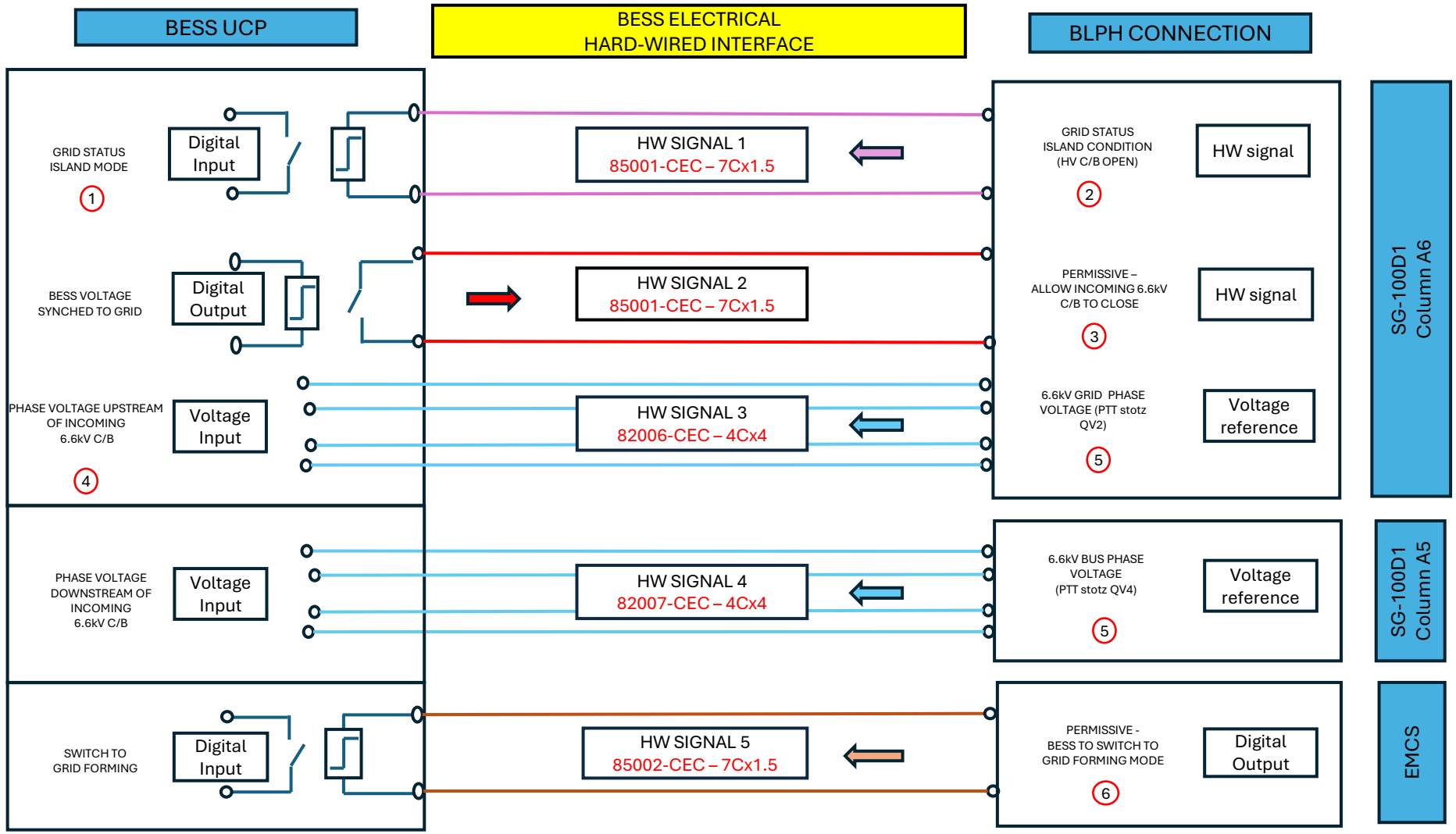
PCS container – Ctrl1 – terminal –xt1 – page 136

PCS container – Ctrl1 – terminal –xt1 – page 136

PCS container – Ctrl1 – high votlage I/O module (-161U1) – page 161

PCS container – Ctrl1 – high votlage I/O module (-161U1) – page 161

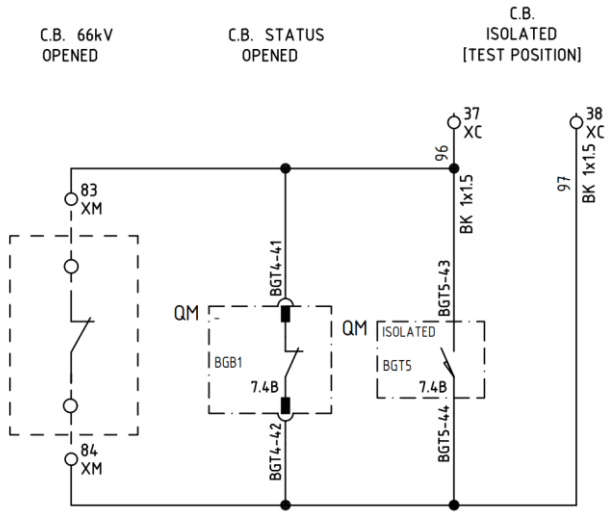
PCS container – Ctrl1 – terminal –xt1 – page 136



NOTES

1 GRID STATUS ISLAND MODE: 0 = 6.6 kV System is synchronized with the grid and BESS has to operate in grid following
1 = 6.6 kV System is islanded from the grid and BESS has to operate in grid forming IF the permissive is received

2 GRID STATUS ISLAND MODE: the signal is generated as OR of the 66 kV CB open status and the 6.6 kV incoming CB open status as per following scheme

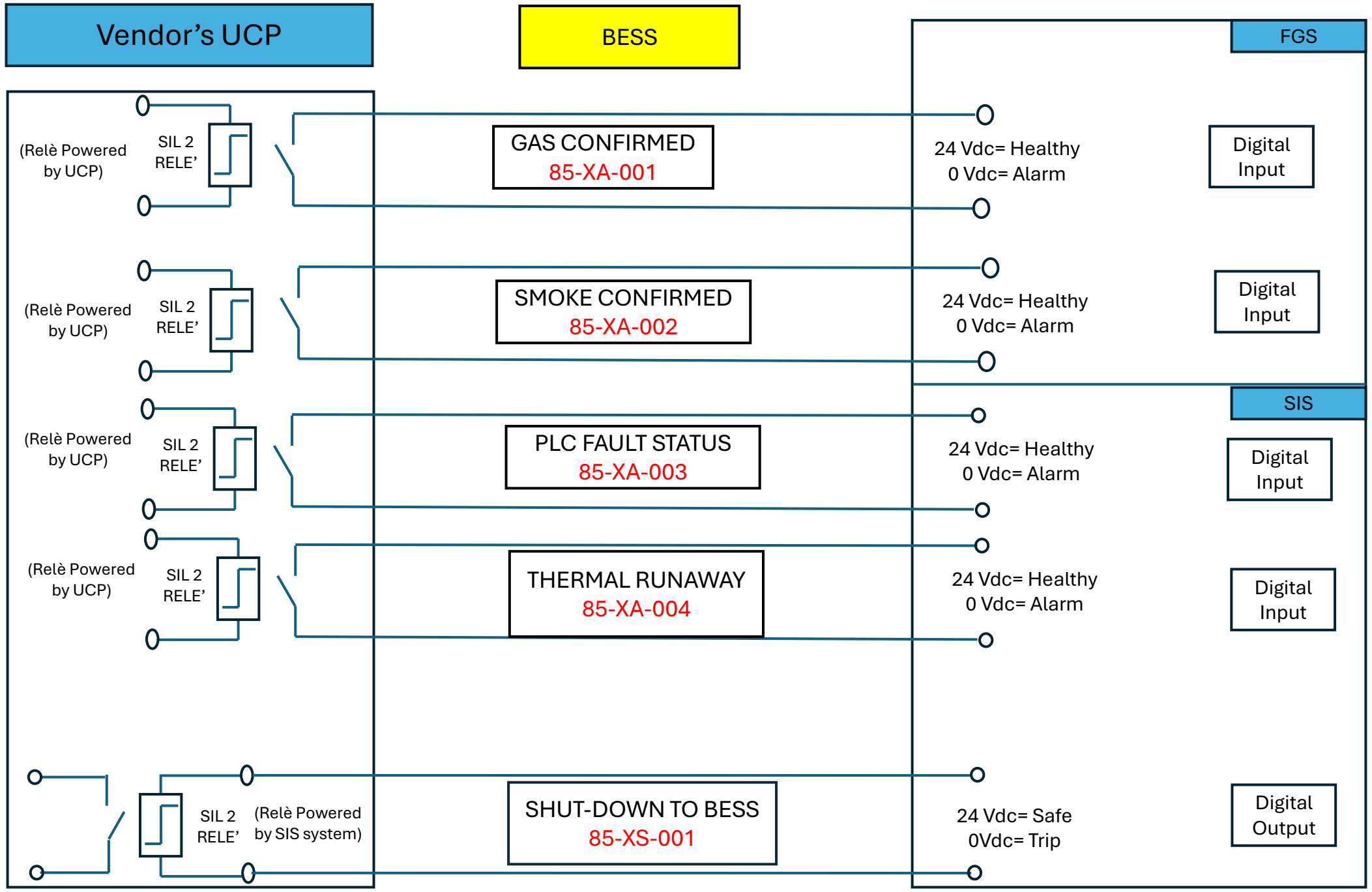


3 PERMISSIVE – ALLOW INCOMING 6.6kV C/B TO CLOSE: This signal is connected as input to the REX 640 protection relay on the 6.6 kV incoming CB in order to close the breaker, provided that the synchrocheck function gives the permissive.
The input BI6 on card D will be used.

4 PHASE VOLTAGE UPSTREAM OF INCOMING 6.6 kV CB: Once BESS read a voltage 110 V on this signal it has automatically to start the synchronization to the grid in order to reach the synchronization and send the permissive to close signal to the incoming CB.

5 VOLTAGES FROM 6.6 kV SWITCHGEAR: These signals are voltage references from secondary side of voltage transformers, so they are at 110 V 50 Hz, with 4 wires.

6 PERMISSIVE - BESS TO SWITCH TO GRID FORMING MODE: This signal will be maintained at 1 until the operator will not reset it manually, in order to prevent the islanding or the automatic return from the island (as per note 4)


Vendor's UCP
BESS
FGS
(Relè Powered by UCP)
SIL 2 RELE'
GAS CONFIRMED
85-XA-001
24 Vdc= Healthy
0 Vdc= Alarm
Digital Input
(Relè Powered by UCP)
SIL 2 RELE'
SMOKE CONFIRMED
85-XA-002
24 Vdc= Healthy
0 Vdc= Alarm
Digital Input
SIS
(Relè Powered by UCP)
SIL 2 RELE'
PLC FAULT STATUS
85-XA-003
24 Vdc= Healthy
0 Vdc= Alarm
Digital Input
(Relè Powered by UCP)
SIL 2 RELE'
THERMAL RUNAWAY
85-XA-004
24 Vdc= Healthy
0 Vdc= Alarm
Digital Input
SIL 2 RELE'
(Relè Powered by SIS system)
SHUT-DOWN TO BESS
85-XS-001
24 Vdc= Safe
0Vdc= Trip
Digital Output

STATRON
NON STOP POWER

Electrical Schematics

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: C10
Sequence Number: 001
Rev: 002
Document number: K559-2254-CWIWP4202201-C10-001
Document description: Electrical Schematics

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Electrical Schematics
C10

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	C10
Document name	Electrical Schematics
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	C. Palenzuela	First version
2.0	2024-12-18	M. Müller	First revised version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	C. Palenzuela
Checked by	2023-03-14	A. Fritz
Approved by	2023-03-14	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
December 2024

Doc Code
K559-2254-CWIWP4202201-C10-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
BESS and PCS circuit diagram	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The electrical schematics are attached to this document (*see section 1.3 "Other Applicable Documents"*).

3 Appendix

1. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	CONVERTER CONTAINER	
Circuit diagram No:	10354_23A2007	20250805_V2.0

Producer (company):	Freqcon GmbH	53396
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	CT_Ausbau_1 53457 CT_Ausbau_2 53765
Type:	BESS MSC-1000-620-8	CONV 53399
Project manager:	Freqcon_CP	

created on:	17.09.2019			
edited on:	05.08.2025	edited by:	Freqcon_DG	total pages: 492

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	05.11.2024	Freqcon_DG
	3	INDEX	23.01.2025	Freqcon_DG
	4	INDEX	23.01.2025	Freqcon_DG
	5	INDEX	23.01.2025	Freqcon_DG
	6	INDEX	05.11.2024	Freqcon_DG
	7	INDEX	23.01.2025	Freqcon_DG
	8	INDEX	21.01.2025	Freqcon_DG
	9	INDEX	23.01.2025	Freqcon_DG
	10	INDEX	21.01.2025	Freqcon_DG
	11	INDEX	21.01.2025	Freqcon_DG
	12	INDEX	21.01.2025	Freqcon_DG
	13	INDEX	23.01.2025	Freqcon_DG
	14	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&ELU		Cabinet Overview		
	5a	CABINETS OVERVIEW	05.11.2024	Freqcon_DG
&EFS ++TRA		Circuit diagram medium voltage transformer		
	18	MV-TRANSFORMER UNIT_01+02	05.11.2024	Freqcon_DG
	18a	TEMPERATURE TRANSFORMER UNIT_01+02	05.11.2024	Freqcon_DG
&EFS ++CONV		Circuit diagram Converter		
	78	GRID CONNECTION	18.06.2024	Freqcon_JD
	80	BG CIRCUIT BREAKER 1000A AC GRID	18.06.2024	Freqcon_JD
	82	PI INDUCTORS GRID SIDE	18.06.2024	Freqcon_JD
	83	GRID AC FILTER 3* 600 µF + OVERVOLTAGE PROTECTOR	18.06.2024	Freqcon_JD
	99	BUSBARS N, PE	18.06.2024	Freqcon_JD
	200	POWER CIRCUITS COVER PAGE	14.06.2024	Freqcon_JD
	201	IGBT & INDUCTOR FOR GRID PHASE 1	18.06.2024	Freqcon_JD
	202	IGBT & INDUCTOR FOR GRID PHASE 2	18.06.2024	Freqcon_JD
	203	IGBT & INDUCTOR FOR GRID PHASE 3	18.06.2024	Freqcon_JD
	207	IGBT & INDUCTOR SUB 3_1 - 3_3	18.06.2024	Freqcon_JD
	211	IGBT & INDUCTOR SUB 2_1 -2_3	18.06.2024	Freqcon_JD
	217	IGBT & INDUCTOR SUB 4_1 -4_3	18.06.2024	Freqcon_JD
	227	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	18.06.2024	Freqcon_JD
	227.a	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	18.06.2024	Freqcon_JD
	228	DC SURGE ARRESTER 3_1 - 3_3	18.06.2024	Freqcon_JD
	231	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	231.a	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	237	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	237.a	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	29.07.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CONV		Circuit diagram Converter		
	238a	DC SURGE ARRESTER 2_1 - 2_3	18.06.2024	Freqcon_JD
	238b	DC SURGE ARRESTER 4_1 - 4_3	18.06.2024	Freqcon_JD
	260	SMOKE DETECTOR	18.06.2024	Freqcon_JD
	279	CONVERTER CABINET CLIMATE	18.06.2024	Freqcon_JD
	281	CIRCUIT BREAKER CABINET CLIMATE	18.06.2024	Freqcon_JD
&EFS ++CT		Circuit diagram Control cabinets		
	84	FEEDING CONTROL CABINET (CTRL)	29.07.2024	Freqcon_DG
	85	SUPPLY UDC	29.07.2024	Freqcon_DG
	100	CONTROL CABINET COVER PAGE	18.06.2024	Freqcon_JD
	101	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	102	CONTROL VOLTAGE UPS	18.06.2024	Freqcon_JD
	103	CONTROL VOLTAGE FUSE	29.07.2024	Freqcon_DG
	110	MAIN PLC	20.06.2024	Freqcon_JD
	111	ETHERNET SWITCH	23.01.2025	Freqcon_DG
	112	PANEL PC HMI	18.06.2024	Freqcon_JD
	113a	ETHERNET / PROFINET ISOLATOR	18.06.2024	Freqcon_JD
	113b	ETHERNET / PROFINET ISOLATOR	18.06.2024	Freqcon_JD
	113c	PROFINET	25.11.2024	Freqcon_DG
	114	HELMHOLZ	23.01.2025	Freqcon_DG
	115	UMTS ROUTER	18.06.2024	Freqcon_JD
	120	ET200 24V DC	25.11.2024	Freqcon_DG
	121	ET200SP DIGITAL INPUTS DI_01 - DI_03	14.06.2024	Freqcon_JD
	122	ET200SP DIGITAL INPUTS DI_04 + DI_05	14.06.2024	Freqcon_JD
	123	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	14.06.2024	Freqcon_JD
	123.a	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	18.06.2024	Freqcon_JD
	124	ET200SP ANALOG INPUTS AI_01 - AI_03	14.06.2024	Freqcon_JD

previous page: 2

next page: 4

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram Control cabinets		
	125	ET200SP ANALOG INPUTS AI_04	14.06.2024	Freqcon_JD
	126	INPUTS CONTROL ELEMENTS	02.07.2024	Freqcon_JD
	127	DIGITAL INPUTS CB 1	18.06.2024	Freqcon_JD
	128	DIGITAL INPUTS CB 2	18.06.2024	Freqcon_JD
	129	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	18.06.2024	Freqcon_JD
	130	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	18.06.2024	Freqcon_JD
	131	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	29.07.2024	Freqcon_DG
	132	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	29.07.2024	Freqcon_DG
	133	DIGITAL INPUTS SPARE	05.11.2024	Freqcon_DG
	134	DIGITAL INPUTS SMOKE DETECTORS	18.06.2024	Freqcon_JD
	135	OUTPUTS FAN	19.06.2024	Freqcon_JD
	136	OUTPUTS COMMUNICATION	12.09.2024	Freqcon_DG
	137	OUTPUTS CIRCUIT BREAKER	18.06.2024	Freqcon_JD
	138	OUTPUTS CONTROL ELEMENTS	03.07.2024	Freqcon_JD
	139	OUTPUTS COOLING	14.06.2024	Freqcon_JD
	140	OUTPUTS CONTROL ELEMENTS	14.06.2024	Freqcon_JD
	145	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	14.06.2024	Freqcon_JD
	146	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	18.06.2024	Freqcon_JD
	147	ANALOG INPUTS CABINET TEMPERATURE	18.06.2024	Freqcon_JD
	148	ANALOG INPUTS COOLING WATER TEMPERATURE	18.06.2024	Freqcon_JD
	149	ANALOG INPUTS MEASURING VOLTAGE	18.06.2024	Freqcon_JD
	150	OUTPUTS DC CONTACTORS 2_1	18.06.2024	Freqcon_JD
	151	OUTPUTS DC CONTACTORS 2_2, 2_3	18.06.2024	Freqcon_JD
	160	INTERFACE HVIO 1	29.07.2024	Freqcon_DG
	161	INTERFACE HVIO 2	05.11.2024	Freqcon_DG
	162	INTERFACE HVIO 2 ANALOG	18.06.2024	Freqcon_JD
	163	INTERFACE HVIO 3	18.06.2024	Freqcon_JD

previous page: 3

next page: 5

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram Control cabinets		
	164	INTERFACE HVIO 4	18.06.2024	Freqcon_JD
	171	PRE-CHARGING UDC	18.06.2024	Freqcon_JD
	173	DISCHARGE UDC	18.06.2024	Freqcon_JD
	181	WATER SYSTEM	29.07.2024	Freqcon_DG
	182	HEAT EXCHANGER	18.06.2024	Freqcon_JD
	183	Supply for cabinet fan	29.07.2024	Freqcon_DG
	185	FAN / HEATING CONTROL CABINET	18.06.2024	Freqcon_JD
	186	THERMOSTAT	18.06.2024	Freqcon_JD
	187	24V DC SUPPLY CB	18.06.2024	Freqcon_JD
	188	24V DC SUPPLY CON / CB GRID	18.06.2024	Freqcon_JD
	189	TEST TERMINAL BLOCK	18.06.2024	Freqcon_JD
	190	CONTAINER COOLING, LIGHT 230V SUPPLY	29.07.2024	Freqcon_DG
	191	CONTAINER COOLING	29.07.2024	Freqcon_DG
	195	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	29.07.2024	Freqcon_DG
	278	CONTROL CABINET CLIMATE	29.07.2024	Freqcon_DG
	306	Feedback DC contactors 1_4 - 1_6	18.06.2024	Freqcon_JD
	307	Feedback DC contactors 2_1 - 2_3	18.06.2024	Freqcon_JD
	308	Feedback DC contactors 2_4 - 2_6	29.07.2024	Freqcon_DG
	350	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	18.06.2024	Freqcon_JD
	351	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	29.07.2024	Freqcon_DG
	352	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	29.07.2024	Freqcon_DG
	353	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	29.07.2024	Freqcon_DG
	440	PIII PROFINET IGBT IRT INTERFACE 1	18.06.2024	Freqcon_JD
	441	PIII PROFINET IGBT IRT INTERFACE 2	18.06.2024	Freqcon_JD
	442	PIII PROFINET IGBT IRT INTERFACE 3	18.06.2024	Freqcon_JD
	443	PIII PROFINET IGBT IRT INTERFACE 4	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
&EPC ++TRA		Parts List medium voltage transformer		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV		Parts List Converter		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +CON		Parts List Converter Converter cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +IND		Parts List Converter Inductor cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +CIR		Parts List Converter Circuit Breaker cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
	6	PARTS LIST	05.11.2024	Freqcon_DG
	7	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CONV +CIR		Parts List Converter Circuit Breaker cabinet		
	8	PARTS LIST	05.11.2024	Freqcon_DG
	9	PARTS LIST	05.11.2024	Freqcon_DG
	10	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +AC_DC		Parts List Converter AC and DC connection cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT		Parts List Control cabinets		
	1	PARTS LIST	21.01.2025	Freqcon_DG
&EPC ++CT +CTRL_1.1		Parts List Control cabinets Control cabinet 1 Cabinet door		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.2		Parts List Control cabinets Control cabinet 1 Left side		
	1	PARTS LIST	23.01.2025	Freqcon_DG
&EPC ++CT +CTRL_1.3		Parts List Control cabinets Control cabinet 1 Main mounting plate		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
	6	PARTS LIST	05.11.2024	Freqcon_DG
	7	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL_1.3		Parts List Control cabinets Control cabinet 1 Main mounting plate		
	8	PARTS LIST	21.01.2025	Freqcon_DG
	9	PARTS LIST	21.01.2025	Freqcon_DG
	10	PARTS LIST	05.11.2024	Freqcon_DG
	11	PARTS LIST	05.11.2024	Freqcon_DG
	12	PARTS LIST	21.01.2025	Freqcon_DG
	13	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.4		Parts List Control cabinets Control cabinet 1 Right side		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.5		Parts List Control cabinets Control cabinet 1 above		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1		Parts List Control cabinets Control cabinet 1		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_2.1		Parts List Control cabinets Control cabinet 2 Cabinet door		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL.4		Parts List Control cabinets		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++FAN		Parts List FAN		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++TRA		Summarized part list medium voltage transformer		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++CONV		Summarized part list Converter		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
	2	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++CT		Summarized part list Control cabinets		
	1	SUMMARIZED PARTS LIST	23.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	23.01.2025	Freqcon_DG
&EMB ++TRA		Cable list medium voltage transformer		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CONV		Cable list Converter		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG

previous page: 8

next page: 10

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CONV		Cable list Converter		
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	05.11.2024	Freqcon_DG
	11	CABEL LIST	05.11.2024	Freqcon_DG
	12	CABEL LIST	05.11.2024	Freqcon_DG
	13	CABEL LIST	05.11.2024	Freqcon_DG
	14	CABEL LIST	05.11.2024	Freqcon_DG
	15	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CONV +CIR		Cable list Converter Circuit Breaker cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CT		Cable list Control cabinets		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	21.01.2025	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CT		Cable list Control cabinets		
	10	CABEL LIST	05.11.2024	Freqcon_DG
	11	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++FAN		Cable list FAN		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++EXTERN		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMZ ++CONV +IND		Terminals Converter Inductor cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+IND-207L1.1 - =UNIT_01++CONV+IND-217L1.3	05.11.2024	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+IND-207L1.1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+IND-207L1.2	05.11.2024	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+IND-207L1.3	05.11.2024	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+IND-211L1.1	05.11.2024	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+IND-211L1.2	05.11.2024	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+IND-211L1.3	05.11.2024	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CONV+IND-217L1.1	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_01++CONV+IND-217L1.2	05.11.2024	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CONV+IND-217L1.3	05.11.2024	Freqcon_DG
&EMZ ++CONV +CIR		Terminals Converter Circuit Breaker cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+CIR-227U1-X3.1 - =UNIT_01++CONV+CIR-237U1-X3.2	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.1	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CONV +CIR		Terminals Converter Circuit Breaker cabinet		
	2003	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.2	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.2	21.01.2025	Freqcon_DG
&EMZ ++CONV +AC_DC		Terminals Converter AC and DC connection cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+AC_DC-X3.43 - =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
&EMZ ++CT		Terminals Control cabinets		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+-XT1 - =UNIT_01++CT+-XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+-XT1	21.01.2025	Freqcon_DG
&EMZ ++CT +CTRL_1.3		Terminals Control cabinets Control cabinet 1 Main mounting plate		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.3-X1 - =UNIT_01++CT+CTRL_1.3-XV	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.11	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.12	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.13	21.01.2025	Freqcon_DG
	2007	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CT +CTRL_1.3		Terminals Control cabinets Control cabinet 1 Main mounting plate		
	2009	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5.1	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC3	23.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC4	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.1	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.2	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_01++CT+CTRL_1.3-XE	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_01++CT+CTRL_1.3-190XT1	21.01.2025	Freqcon_DG
	2024	Klemmenplan =UNIT_01++CT+CTRL_1.3-191XT1	21.01.2025	Freqcon_DG
	2025	Klemmenplan =UNIT_01++CT+CTRL_1.3-XV	21.01.2025	Freqcon_DG
&EMZ ++CT +CTRL_1.4		Terminals Control cabinets Control cabinet 1 Right side		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.4-350X1.21 - =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.4-XE2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CT +CTRL_2.1		Terminals Control cabinets Control cabinet 2 Cabinet door		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_2.1-149X1 - =UNIT_01++CT+CTRL_2.1-149X1	05.11.2024	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_2.1-149X1	05.11.2024	Freqcon_DG
&EMZ ++FAN		Terminals FAN		
	1000	Klemmenleistenübersicht : =UNIT_01++FAN+-52G1-181X1 - =UNIT_01++FAN+-52G1-181X3	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++FAN+-52G1-181X1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++FAN+-52G1-181X3	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/14

next page: 6a

SPECIFICATION of grounding

	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Editor	Freqcon_JD			Statron	FREQCON	Specification Earthing	20250805_V2.0	= UNIT_01	Converter Container 1
Date	14.06.2024	Norm						& EAC	Explanatory documents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 6a
Date								+	total: 492

Single line diagram

=UNIT_01++TRA

=UNIT_01++CONV

+AC_DC

+CIR

+IND

+CON

+IND

+CIR

+AC_DC

medium voltage transformer
-18T1
&EFS++TRA/18.2
1,25MVA
6,6kV/0,62 kV AC

Gehäuse Erdung

V1_L1 V1_L2 V1_L3

-78W1 - 78W3
GRID L1 -L3
&EFS++CONV/78.1

NSGAFöu 3x4x50mm²

3WL1112-2BB36-1BJ2-Z
A08+H07+M06+M21+R10

-80Q1
max.
1250 A
&EFS++CONV/80.0

-83U1
Filter Caps 3*600µF
Overvoltage protect
&EFS++CONV/83.2

PT100
201L1 - 203L1
Inductor
1*1000A
0,2mH
&EFS++CONV/201.1

PIII 1_1
-
PIII_1_3
201Q1 - 203Q1
1000A Stack x 3
AC
DC

V1_DC+ V1_DC-
UDC +
UDC N
UDC -

PIII 2_1
-
PIII_2_3
-211Q1
3X250A Stack
DC DC DC DC DC

PT100
-211L1
&EFS++CONV/211.1
0,6mH
3*250A

V3_L2 V3_L3 -231U1 VA_182
&EFS++CONV/231.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V3_L1 VA_186 VA_184

NSGAFöu 6x1x50mm²

-224W10 DC 1.4 + Pos.
-224W11 DC 1.4 - Pos.
-224W12 DC 1.5 + Pos.
-224W13 DC 1.5 - Pos.
-224W14 DC 1.6 + Pos.
-224W15 DC 1.6 - Pos.

HELUTHERM 2x1x70mm²

=UNIT_02++
BAT 1-3
BAT 4-5
BAT 6-8
LFP Battery Modul

V3_DC- V3_Ub -227U1 VA_188
&EFS++CONV/227.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V3_DC+ VA_192 VA_190

-231W10 DC 2.1 + Pos.
-231W11 DC 2.1 - Pos.
-231W12 DC 2.2 + Pos.
-231W13 DC 2.2 - Pos.
-231W14 DC 2.3 + Pos.
-231W15 DC 2.3 - Pos.

BAT 9-11
BAT 1-3

V4_L1 V4_L3 -237U1 V4_L2
&EFS++CONV/237.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V4_DC+ V4_DC- V4_Ub

-237W10 DC 2.4 + Pos.
-237W11 DC 2.4 - Pos.
-237W12 DC 2.5 + Pos.
-237W13 DC 2.5 - Pos.
-237W14 DC 2.6 + Pos.
-237W15 DC 2.6 - Pos.

BAT 4-6
BAT 7-8
BAT 9-11

PIII 3_1
-
PIII_3_3
-207Q1
3X250A Stack

PT100
-207L1
&EFS++CONV/207.1
0,6mH
3*250A

PIII 4_1
-
PIII_4_3
-217Q1
3X250A Stack

PT100
-217L1
&EFS++CONV/217.1
0,6mH
3*250A

N
78W4:N
&EFS++CONV/78.3
PEN
78W5:PE
&EFS++CONV/78.2

UDC_LINK_+ 2a.2 /
UDC_LINK_N 2a.5 /
UDC_LINK_- 2a.2 /

previous page: &EAC/6a

next page: 2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0
Date	18.06.2024	Norm		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Proved by							
Date							

=	UNIT_01	Converter Container 1	
&	EFA	Single line diagram	
++			page: 1a
+			total: 492

Single line diagram

Control circuit

++CONV

++CT
+CTRL_1

CTRL

UDC_LINK_+ / 1a.4

UDC_LINK_- / 1a.4

UDC_LINK_N / 1a.4

+4

-173F2 &EFS++CT/173.2 10A

-173F3 &EFS++CT/173.4 1A

-173K2 1500V 30A DC

-173R3 500 Ohm 150 W

-173R4 500 Ohm 150 W

-173K1 1500V 30A DC

-173R1 500 Ohm 150 W

-173R2 500 Ohm 150 W

V1_DC-

V1_DC+

+4

V1_L1 V1_L2 V1_L3

-85U1 &EFS++CT/85.6 L1 L2 L3 DC+ DC-

-171F1 &EFS++CT/171.2 10A

-171K1 &EFS++CT/171.7 1500V 50A DC

-171K2 &EFS++CT/171.8 1500V 50A DC

-171R1 &EFS++CT/171.1 15 Ohm 300W

-171R2 &EFS++CT/171.2 15 Ohm 300W

Precharge Resistors

Grid 400V
inc. overvotage fuse
& Fuse ??A(20A)

+3
Main mounting plate

1-6
-XE
1

-84F2

>+
CTRL_1.1
-84Q1

AC L1,L2,L3

101T1 &EFS++CT/101.2

24V DC supply unit

102G1 &EFS++CT/102.2
24V DC UPS

+24VDC
GND

+ 24V DC
24V GND

-102G2 &EFS++CT/102.6 Battery

-103F1 - 103F4 &EFS++CT/103.2 F2, 10A 60VDC

-103F5 &EFS++CT/103.9 F2, 10A 60VDC

-186K1 &EFS++CT/186.6

-186B1 &EFS++CT/186.6

24V Supply
Main PLC
ET200SP

+24V DC
for Control Cabinet

24V GND

400V AC
Control Cabinet

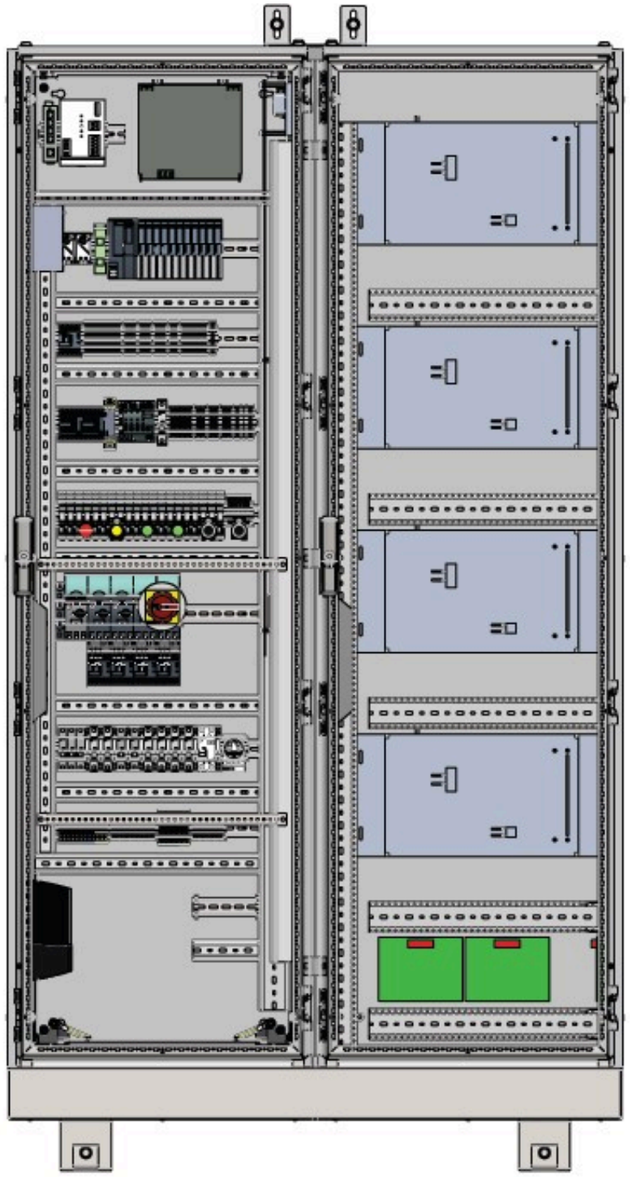
Thermostat
for start PLC

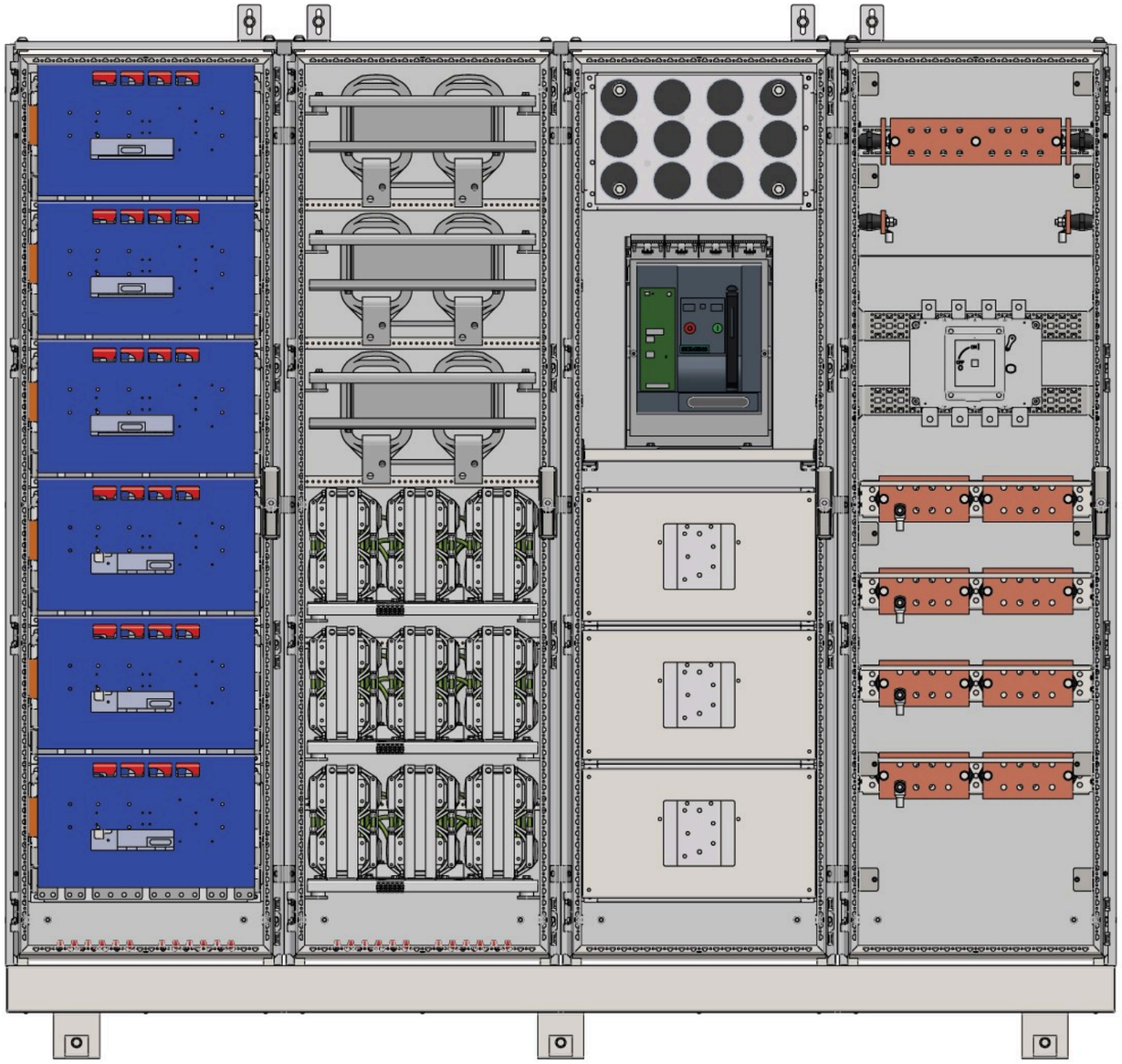
previous page: 1a

next page: &ELU/5a

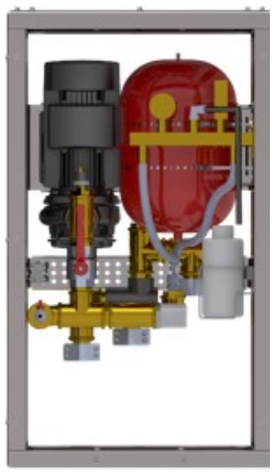
Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 2a
Date								+	total: 492

0	1	2	3	4	5	6	7	8	9









+CTRL_1
Control cabinet 1

+CTRL_2
Control cabinet 2

++CT Control cabinets

+CON
Converter cabinet

+IND
Inductor cabinet

+CIR
Circuit Breaker cabinet

+AC_DC
AC and DC connection cabinet

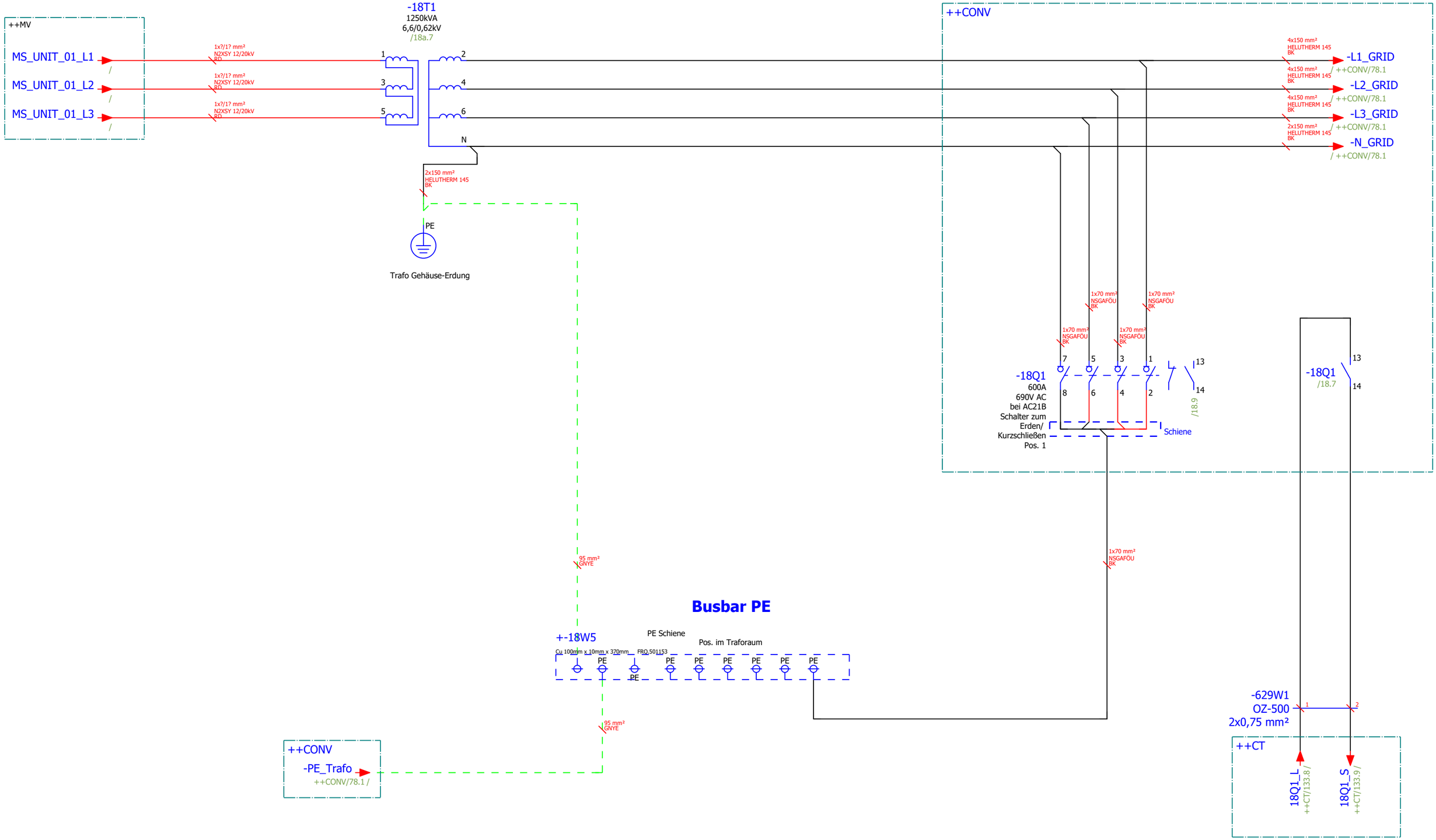
++CONV Converter

++FAN
FAN

previous page:
&EFA/2a

next page:
&EFS++TRA/18

Editor	Freqcon_DG			Statron	FREQCON	CABINETS OVERVIEW	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024	Norm						& ELU	Cabinet Overview
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
18a

Editor	Freqcon_DG			Statron	FREQCON	MV-TRANSFORMER UNIT_01+02	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer page: 18
Date								+ total: 492

++CT
+CTRL_1.2
-18B1
PWR07
Trafo-
Temperaturüberwachung
Pos: in Tür +ASC

SUPPLY
24-240V AC DC

ALARM

FAULT

FAN

PT100 SENSORS

CH 1

CH 2

CH 3

CH 4

40 41 42 4 5 6 7 8 9 1 2 3 4 5 6 13 14 15 16 17 18 19 20 21 22 23 24

0,75 mm² RT

-18W2
JZ-500
8G1,5 mm²

1 GNYE 2 3 4 5 6

-18W1
F-CY-OZ (LiY-CY)
10x1,5 mm²
500V
geschirmt

1 2 3 4 5 6 7 8 9

-18T1
/18.2

3x PT100 Fühler in NS-Wicklung Trafo

CH 3 CH 2 CH 1

3 2 1 3 2 1 3 2 1

++CT

-1L+3 ++CT/103.2/
-1PE5 ++CT/103.4/
-1M6 ++CT/103.3/
-PreAlarm ++CT/133.0/
-Trip ++CT/133.0/
-Fault ++CT/133.0/
-Fan ++CT/133.0/

previous page:
18

next page:
++CONV/78

Editor	Freqcon_DG			Statron	FREQCON	TEMPERATURE TRANSFORMER UNIT_01+02	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer	page: 18a
Date								+		total: 492

Grid Busbars L1, L2, L3

++TRA

-L1_GRID ++TRA/18.9 /
-L2_GRID ++TRA/18.9 /
-L3_GRID ++TRA/18.9 /

+AC_DC-78W1 GRID L1 Pos. 1/ Links
Cu 100mm x 10mm x 370mm FRQ.52163 &EFA++/1a.0
+AC_DC-78W2 GRID L2 Pos. 1/ Mitte
Cu 100mm x 10mm x 370mm FRQ.52163
+AC_DC-78W3 GRID L3 Pos. 1/ Rechts
Cu 100mm x 10mm x 370mm FRQ.52163

4x50 mm² NSGAFöu BK → -L1CON1 / 80.0
4x50 mm² NSGAFöu BK → -L2CON1 / 80.0
4x50 mm² NSGAFöu BK → -L3CON1 / 80.0

25 mm² NSGAFöu BK
+AC_DC -78F1 690Vac 100A gL/gG NH00 /78.8
1 3 5 13 21 / 2 4 6 14 22

-1F2 / ++CT/127.4
F3 / 238b.9

-238W7 OZ-500 2x0,75 mm² /238a.2
0,75 mm² BU
+AC_DC -X3.43 20 19

-78W7 OZ-500 2x0,75 mm²
1 2 / 13 14

25 mm² BK
+AC_DC -78F2 Typ 1 + Typ 2 400/690 V~
L1 L2 L3 / PE PE

+AC_DC -78F3 20A, aR
1 3 5 / 2 4 6

-78W6 OZ-600 3x2,5 mm² 0,6kV/1kV
1 2 3

+AC_DC -78F1 /78.6

-CHA_L1 ++CT/85.1 /
-CHA_L2 ++CT/85.1 /
-CHA_L3 ++CT/85.1 /

35 mm² GNYE

Busbars N

-N_GRID ++TRA/18.9 /

+AC_DC-78W4 GRID N &EFA++/1a.1 Pos. unten Links
Cu 50mm x 10mm x 370mm FRQ.50622
16 mm² NSGA Föu BK
-AC_F_N.1 83.3 /
-AC_F_N.2 83.3 /
-AC_F_N.3 83.3 /
2x50 mm² NSGAFöu BK → GRID_N / 99.5

Busbars PE

Einspeisung_IEC_Seite 78
Einbauort_Sicherung in Connection cabinet

-PE_Trafo ++TRA/18.2 /

+AC_DC-78W5 GRID PE &EFA++/1a.1 Pos. unten rechts
Cu 100mm x 10mm x 370mm FRQ.50070

95 mm² GNYE
35 mm² GNYE

PE_2_1 238a.1 /
PE_2_2 238a.4 /
PE_2_3 238a.8 /
PE_3_1 228.1 /
PE_3_2 228.4 /
PE_3_3 228.8 /
PE_4_1 238b.1 /
PE_4_2 238b.4 /
PE_4_3 238b.8 /

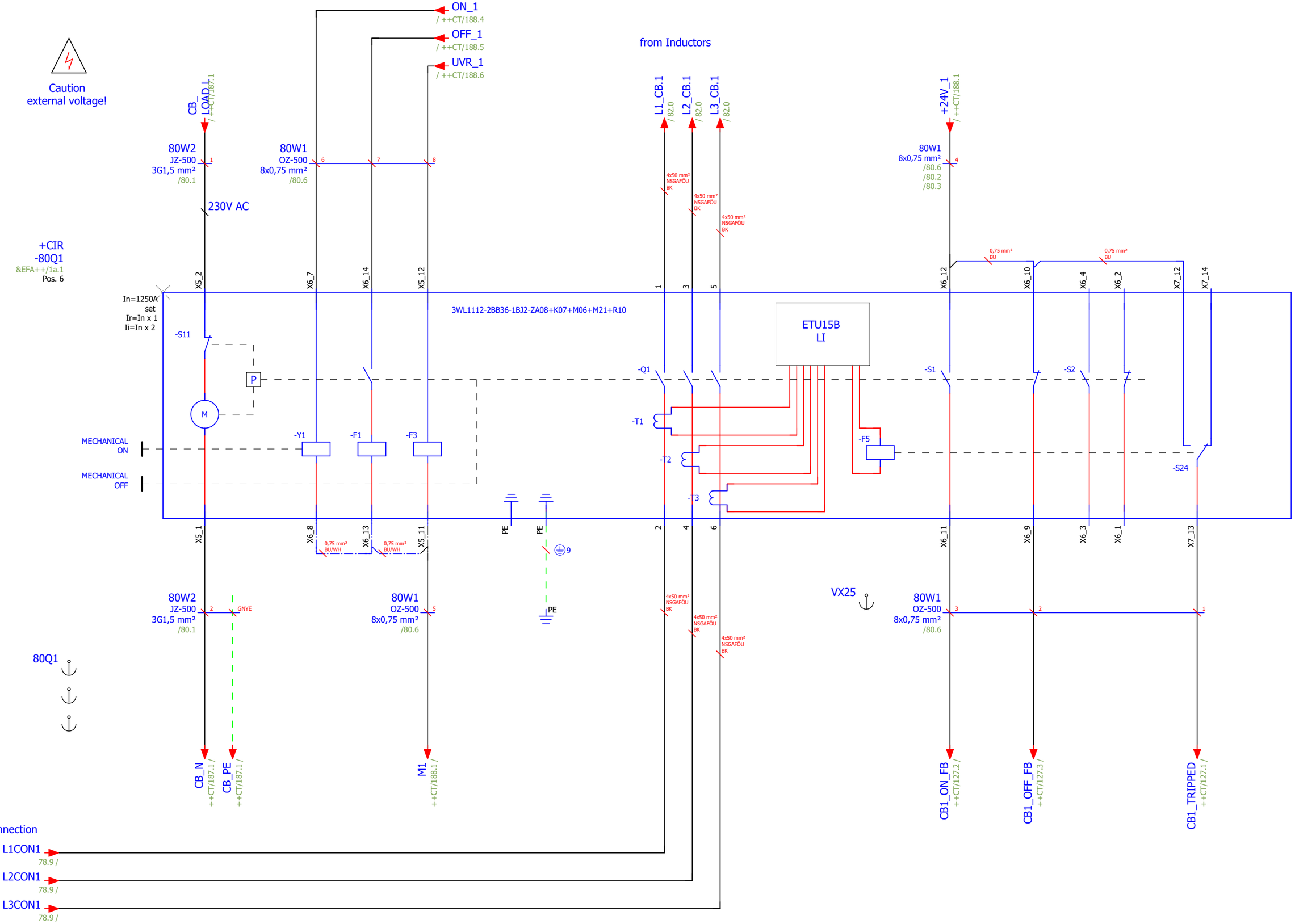
=UNIT_02 PE_BAT_CONV_1 =UNIT_02++Container/278.5 /
=UNIT_03 PE_BAT_CONV_2 =UNIT_03++Container/278.5 /

PE Container
PE Cabinet base frame front side
PE Cabinet base frame back side

400V TYP 1

previous page: ++TRA/18a
next page: 80

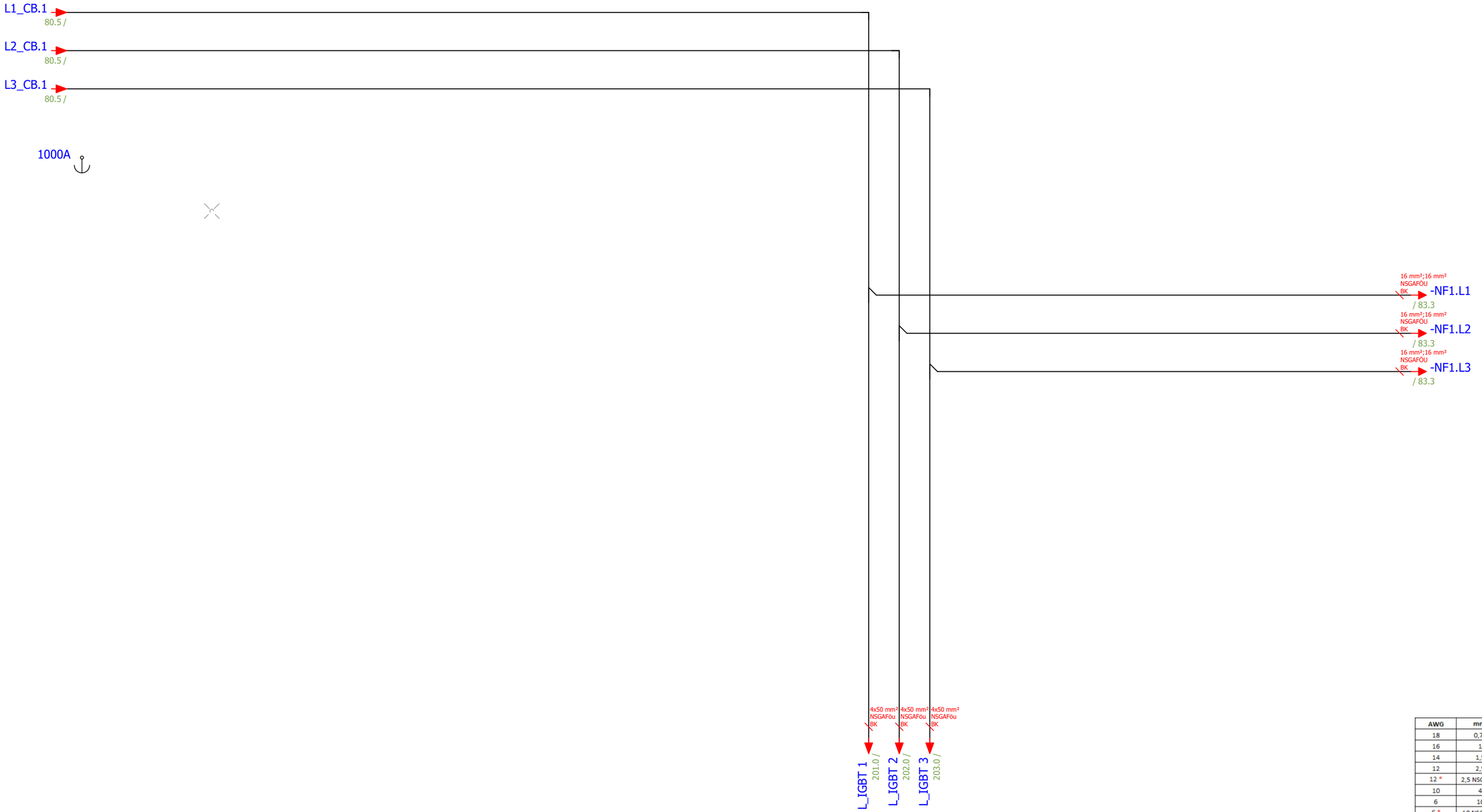
Editor	Freqcon_JD			Statron	FREQCON	GRID CONNECTION	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	



previous page: 78

next page: 82

Editor	Freqcon_JD			Statron		BG CIRCUIT BREAKER 1000A AC GRID	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024				FREQCON			& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 80
Date								+	total: 492



AWG	mm²
18	0,75
16	1
14	1,5
12	2,5
12 *	2,5 NSGAFÖu
10	4
6	10
6 *	10 NSGAFÖu
4	16
2	25
2 *	16 NSGAFÖu
1	35
250 kcmil	95 ALU
2x2	1x70 NSGAFÖu
2x4	2x70 NSGAFÖu
4x250 kcmil	4x70 NSGAFÖu
6x250 kcmil	6x70 NSGAFÖu

*cable into seperate UL protective tube

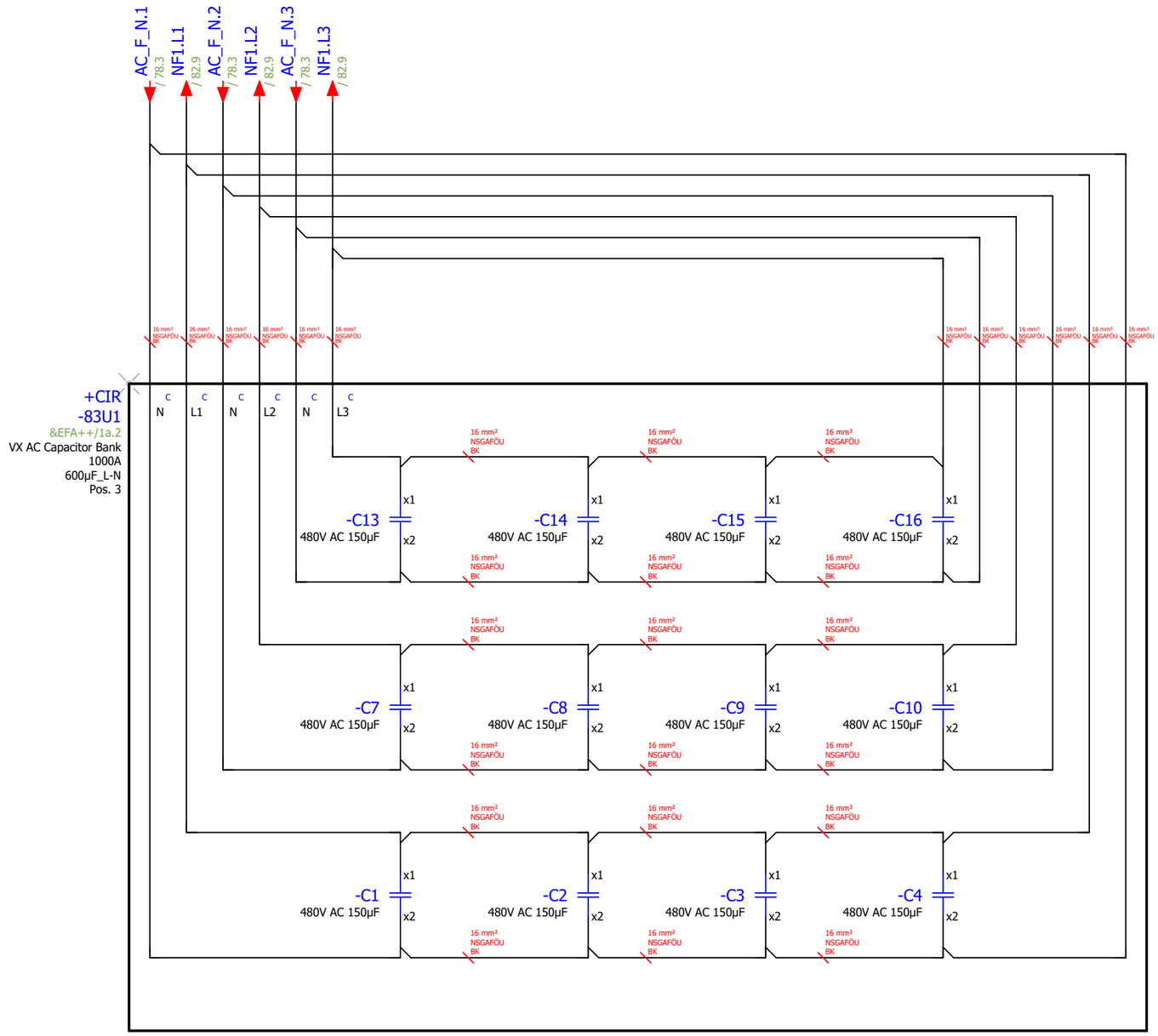
previous page:
80

next page:
83

Editor	Freqcon_JD			Statron	FREQCON	PI INDUCTORS GRID SIDE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 82
Date								+		total: 492

to polarity bar

behind main breaker



AWG	mm²	
18	0,75	
16	1	
14	1,5	
12	2,5	
12 *	2,5 NSGAFöu	
10	4	
6	10	
6 *	10 NSGAFöu	
4	16	
2	25	
2 *	16 NSGAFöu	
1	35	
250 kcmil	95 ALU	
2x2	1x70 NSGAFöu	
2x4	2x70 NSGAFöu	
4x250 kcmil	4x70 NSGAFöu	
6x250 kcmil	6x70 NSGAFöu	

*cable into seperate UL protective tube

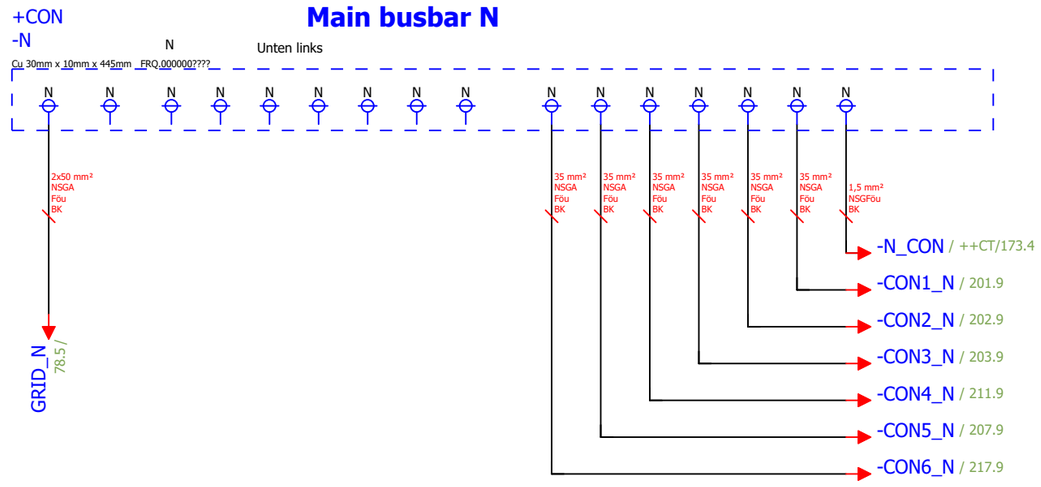
83U1

previous page: 82

next page: 99

Editor	Freqcon_JD			Statron	FREQCON	GRID AC FILTER 3* 600 µF + OVERVOLTAGE PROTECTOR	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 83
Date								+		total: 492

in converter cabinet



1000A

previous page: 83

next page: 200

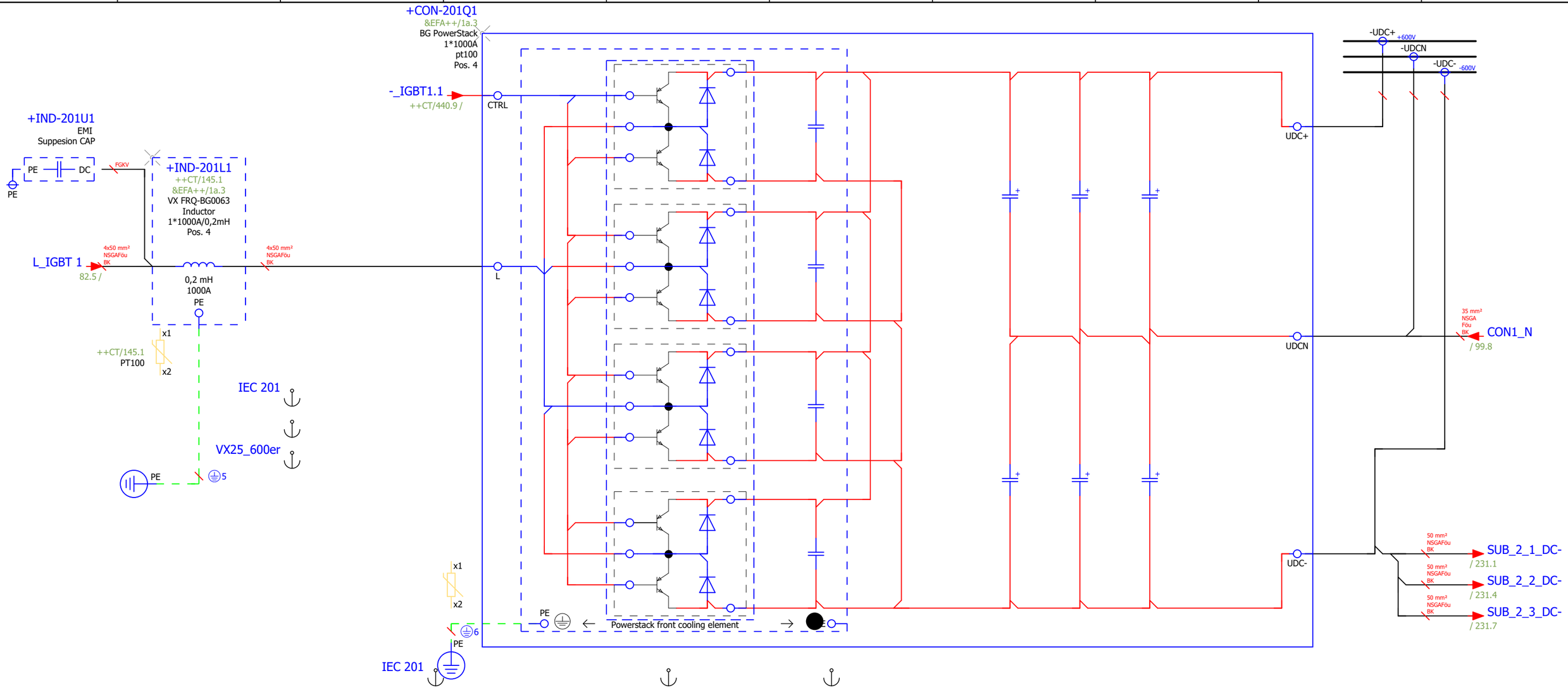
Editor	Freqcon_JD			Statron	FREQCON	BUSBARS N, PE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 99
Date								+	total: 492

Power Circuits

Pages 200 - 299

- Converter cabinet
- Inductor cabinet
- Circuit Breaker cabinet

Editor	Freqcon_JD			Statron	FREQCON	POWER CIRCUITS COVER PAGE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 200
Date								+	total: 492



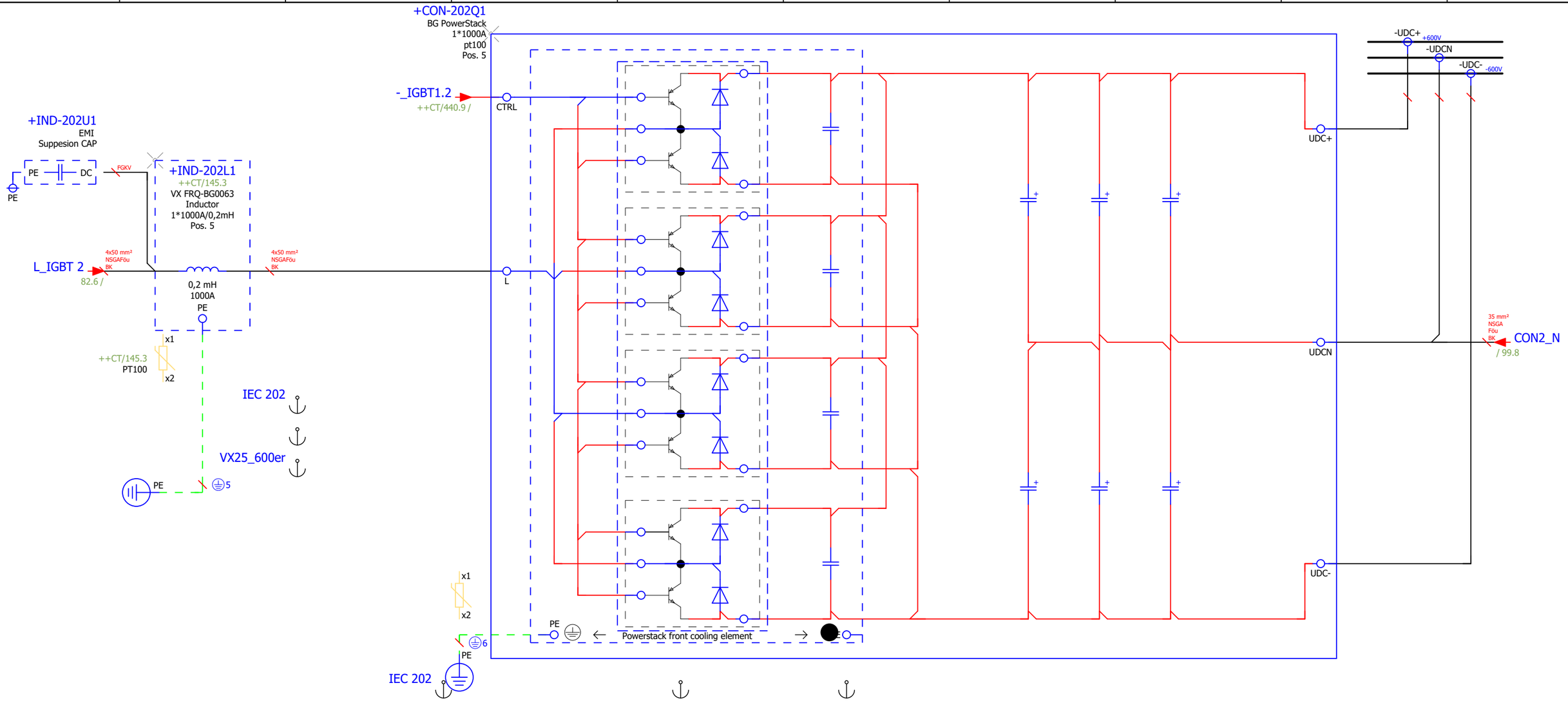
previous page: 200

next page: 202

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR FOR GRID PHASE 1	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 201

total: 492

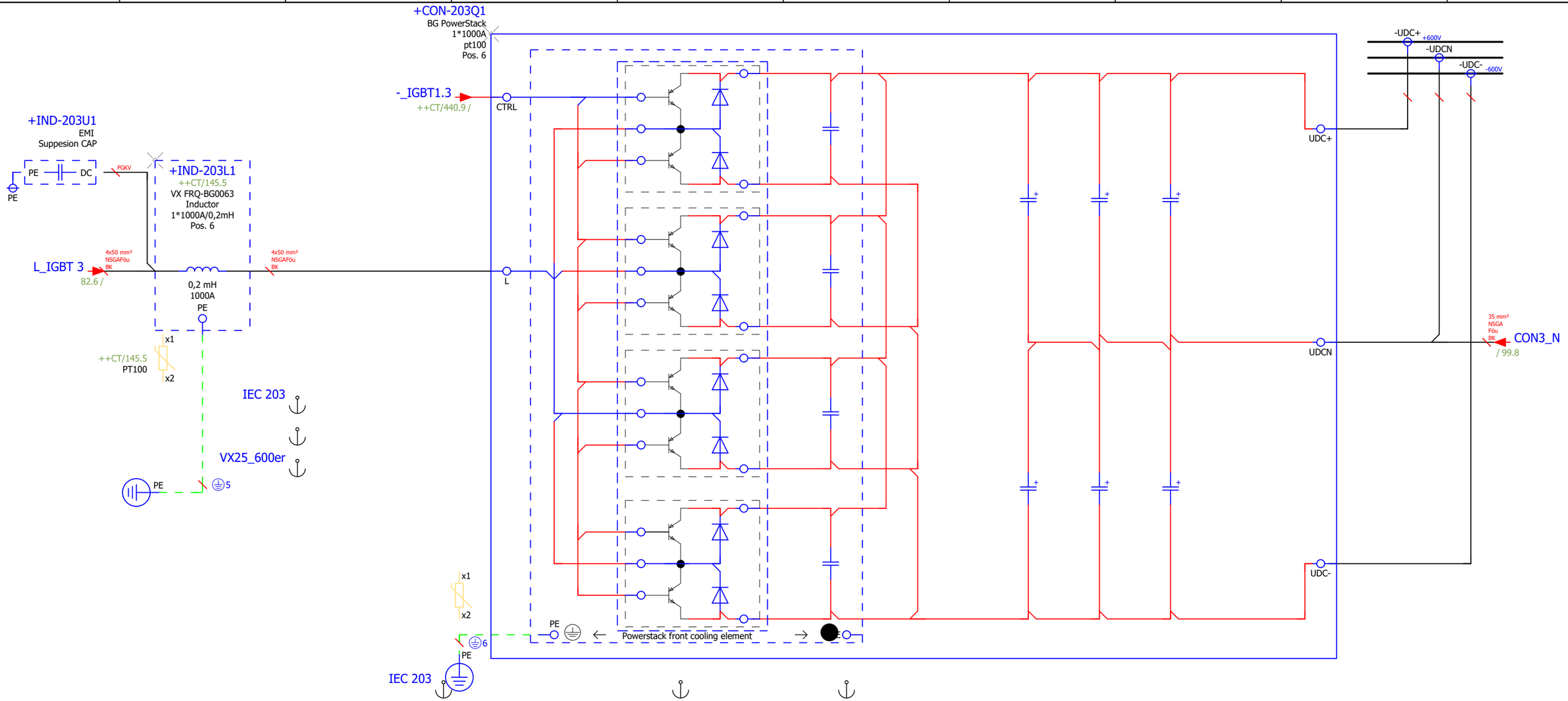


previous page:
201

next page:
203

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR FOR GRID PHASE 2	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 202
total: 492



previous page:
202

next page:
207

Editor	Freqcon_JD			Statron		IGBT & INDUCTOR FOR GRID PHASE 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 203
Date								+	total: 492

+CON-207Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 1

-_IGBT3.1_2
207.9 /
CTRL

+IND-207L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 1

L_IGBT 3_1
227.0 /
50 mm² NSGAFöu BK
0,6mH
L:1

L_IGBT 3_2
227.3 /
50 mm² NSGAFöu BK
0,6mH
L:2

L_IGBT 3_3
227.6 /
50 mm² NSGAFöu BK
0,6mH
L:3

PE.1 PE.2 PE.3

IEC 204 DC

++CT/146.5
PT100
x1 x2
++CT/146.7
x1 x2
++CT/147.1
x1 x2

VX25

PE
5

PE
5

PE
5

x1
x2
6
PE

IEC 204

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON5_N
/ 99.8

+CON-207Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT3.1
++CT/442.9 /
X1
25-POL SUB-D SOCKET

-_IGBT3.2
++CT/442.9 /
X2
25-POL SUB-D SOCKET

-_IGBT3.3
++CT/442.9 /
X3
25-POL SUB-D SOCKET

SKiiP 3 Adapter

FRQ-M00080
FREQCON

Shield connect by a ring cable lug
SH

X4
26-POL Stiftleiste (für Flachband) SOCKET
-_IGBT3.1_2
/ 207.3

previous page: 203
next page: 211

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 3_1 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 207
Date								+ total: 492

+CON-211Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 2

-_IGBT2.1_2
211.9 /

CTRL

+IND-211L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 2

L_IGBT 2_1
231.0 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:1

L_IGBT 2_2
231.3 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:2

L_IGBT 2_3
231.6 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:3

PE.1 PE.2 PE.3

IEC 211 DC

++CT/145.7
PT100
x1 x2
++CT/146.1
x1 x2
++CT/146.3
x1 x2

VX25

PE 5

PE 5

PE 5

x1 x2

6 PE

IEC 211

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON4_N
/ 99.8

+CON-211Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT2.1
++CT/441.9 /
X1
25-POL SUB-D SOCKET

-_IGBT2.2
++CT/441.9 /
X2
25-POL SUB-D SOCKET

-_IGBT2.3
++CT/441.9 /
X3
25-POL SUB-D SOCKET

Shield connect by a ring cable lug
SH

SKiiP 3 Adapter

FRQ-M00080
FREQCON

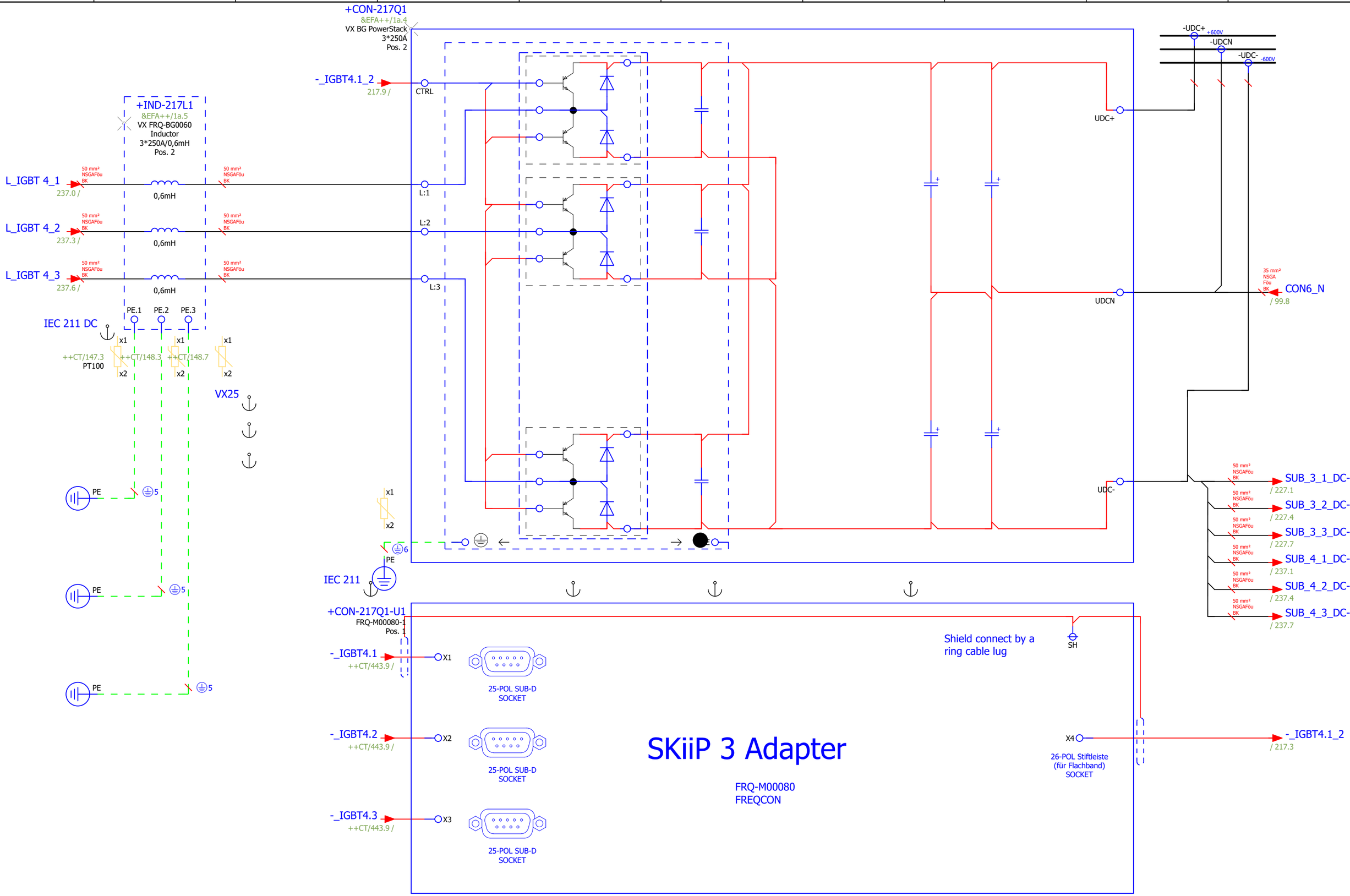
X4
26-POL Stiftleiste (für Flachband) SOCKET

-_IGBT2.1_2
/ 211.3

previous page: 207

next page: 217

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 2_1 -2_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	



previous page: 211

next page: 227

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 4_1 -4_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 217

total: 492

VX25

224

Spare connections, if the BSU will be from here 20A supplied.

* cable intro seperate UL protrctive tube

L_IGBT 3_1 / 207.0 — SUB_3_1_V / ++CT/163.9 — SUB_3_1_DC- / 217.9 — SUB_3_1_V.1 / ++CT/162.9

L_IGBT 3_2 / 207.0 — SUB_3_2_V / ++CT/163.9 — SUB_3_2_DC- / 217.9 — SUB_3_2_V.1 / ++CT/162.9

L_IGBT 3_3 / 207.0 — SUB_3_3_V / ++CT/163.9 — SUB_3_3_DC- / 217.9 — SUB_3_3_V.1 / ++CT/162.9

227W1 OZ-600 2x0,75 mm² (1 / 2)

227W2 OZ-600 2x0,75 mm² (1 / 2)

227W3 OZ-600 2x0,75 mm² (1 / 2)

+CIR
-227U1
/227.a.0
&EFA++/1a.6
VX DC switch and Fuse
3*250A
1000V
Pos. 1

50 mm² NSGAFöu BK

PE

7

PE

Rear mounting plate

IGBT1 1+ — V_IGBT1 1+ — V_DC1 1+ — V_DC 1-

UDC [1]-

IGBT2 2+ — V_IGBT2 2+ — V_DC2 2+

UDC [2]-

IGBT3 3+ — V_IGBT3 3+ — V_DC3 3+

UDC [3]-

F3 1A — -C1 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F4 1A [20A, aR (BSU)] — F0 [20A, aR (BSU)]

F7 1A — -C7 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F8 1A

F11 1A — -C13 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F12 1A

16 mm² NSGAFöu BK

AWG	mm²	*cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

Front mounting plate — PE — -U1 EMI Suppesion CAP — PE — Front mounting plate — PE

16 mm² FGKV

1 2 3 4 5 6

16 mm² in Shrin-kable Tube FGKV

-K1 /227.a.1 1500V 300A — -K7 /227.a.3 1500V 300A

-K2 /227.a.2 1500V 300A — -K8 /227.a.4 1500V 300A

-K3 /227.a.2 1500V 300A — -K9 /227.a.5 1500V 300A

A1 A2

70 mm² NSGAFöu BK

-F1 /227.a.7 1250V 400A 1KN/110 HLS Datenblatt

-F2 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F5 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F6 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F9 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F10 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

IEC

DC1 + — DC1 -

DC2 + — DC2 -

DC3 + — DC3 -

*2

The single conductor must be placed in the protective tube

DC+ and DC- Busbars in Connection cabinet

EEC

+AC_DC-227W10 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_1 + Pos. =UNIT_02 — DC+3_1_BAT / =UNIT_02++ASC/678.7

+AC_DC-227W11 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_1 - Pos. — DC-3_1_BAT / =UNIT_02++ASC/678.7

DC+3_1 / 228.1 — DC-3_1 / 228.1

+AC_DC-227W12 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_2 + Pos.

+AC_DC-227W13 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_2 - Pos.

DC+3_2 / 228.4 — DC-3_2 / 228.4

+AC_DC-227W14 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_3 + Pos. =UNIT_03 — DC+3_3_BAT / =UNIT_03++ASC/678.0

+AC_DC-227W15 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_3 - Pos. — DC-3_3_BAT / =UNIT_03++ASC/678.0

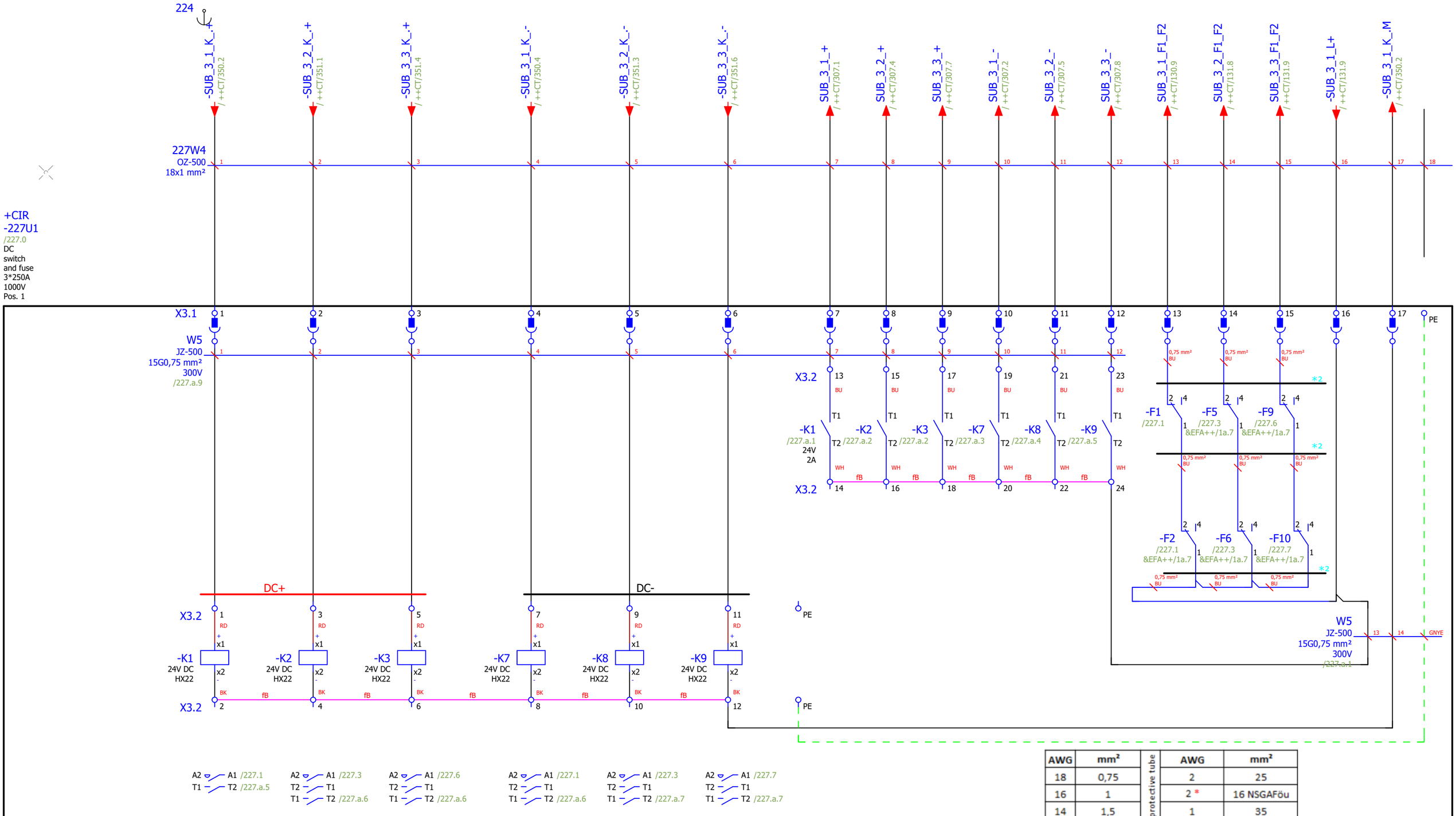
DC+3_3 / 228.7 — DC-3_3 / 228.8

previous page: 217

next page: 227.a

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 227
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 227

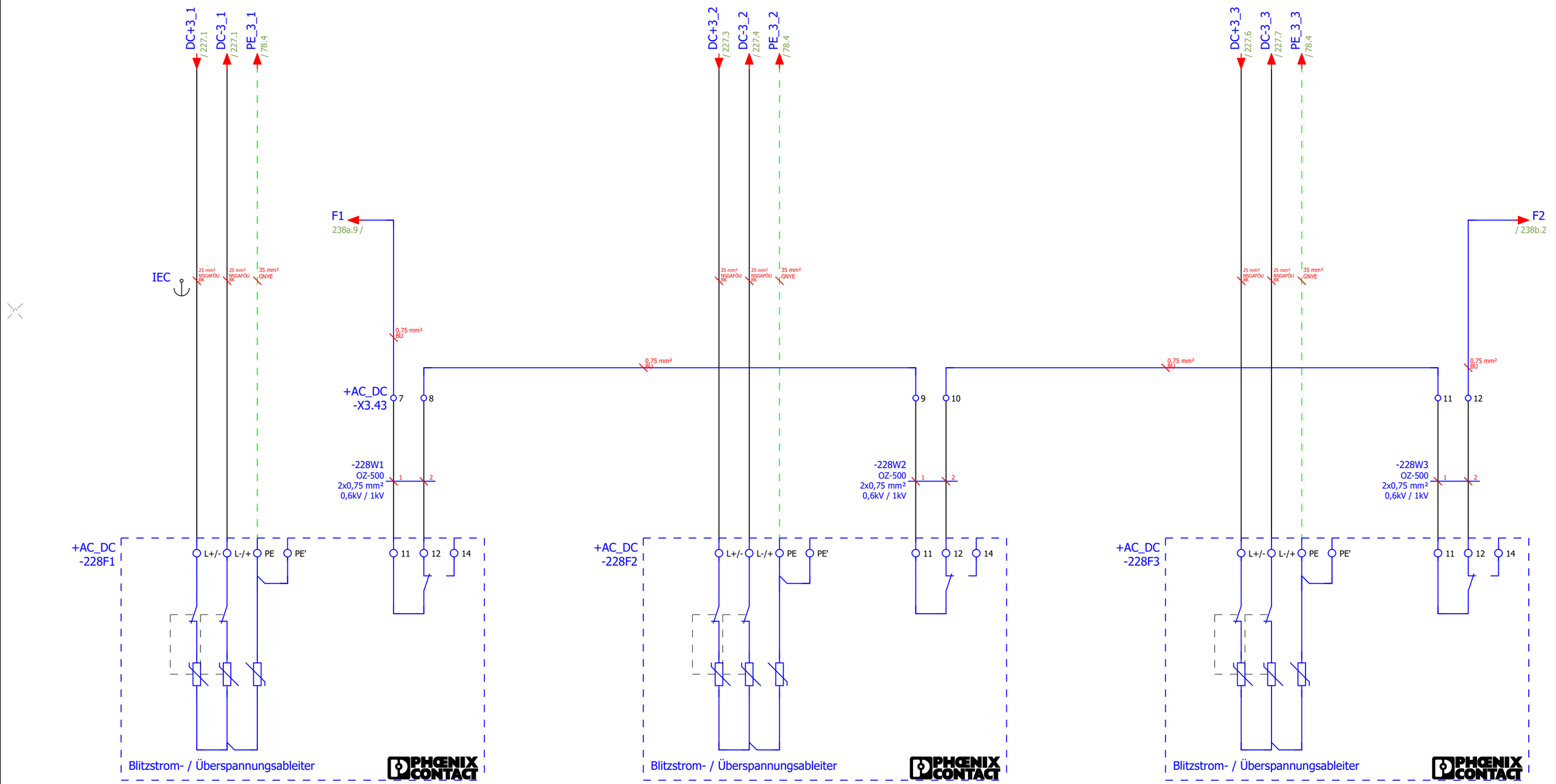
next page: 228

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 227.a
							+ total: 492

DC+ and DC- Busbars

DC+ and DC- Busbars

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 3_1

SURGE ARRESTER
DC SUBSYSTEM 3_2

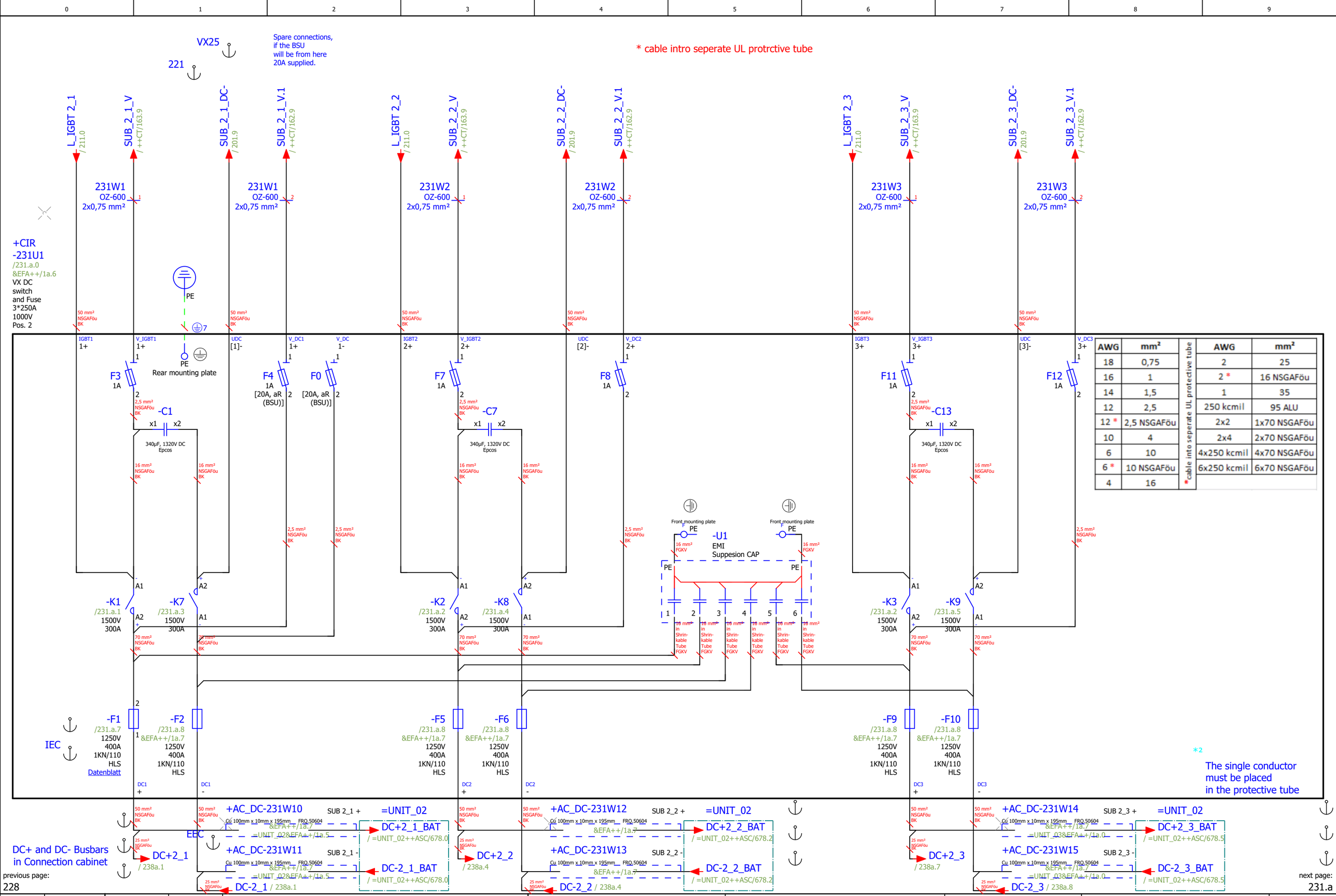
SURGE ARRESTER
DC SUBSYSTEM 3_3

in Connection cabinet

previous page:
227.a

next page:
231

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 3_1 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 228
Date								+	total: 492

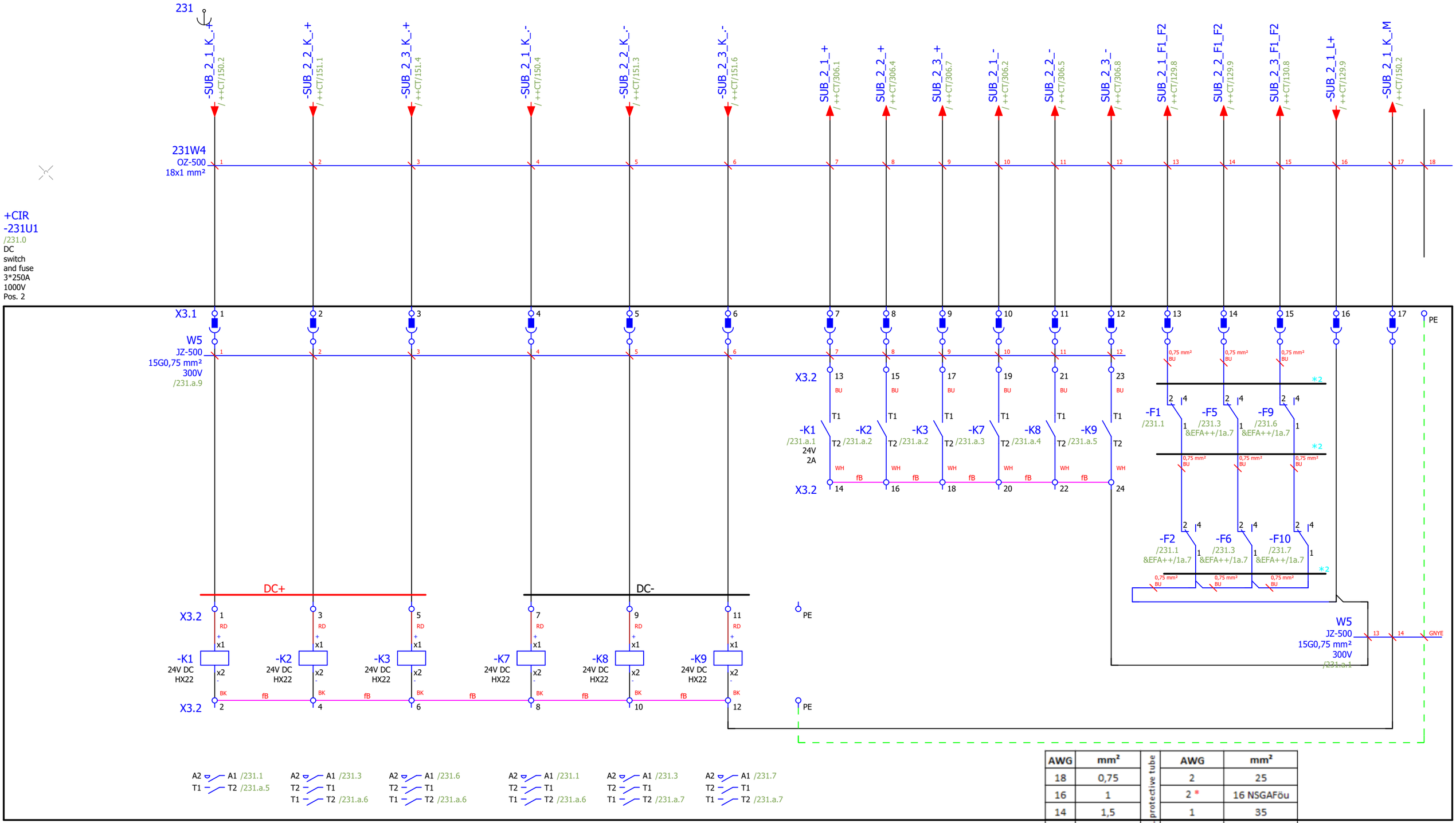


AWG	mm²	AWG	mm²
18	0,75	2	25
16	1	2 *	16 NSGAFöu
14	1,5	1	35
12	2,5	250 kcmil	95 ALU
12 *	2,5 NSGAFöu	2x2	1x70 NSGAFöu
10	4	2x4	2x70 NSGAFöu
6	10	4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu	6x250 kcmil	6x70 NSGAFöu
4	16		

*cable into seperate UL protective tube

Editor	Freqcon_JD			Statron		SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024			Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Proved by							
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 231
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 231

next page: 237

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 231.a
							+ total: 492

VX25
224

Spare connections,
if the BSU
will be from here
20A supplied.

* cable intro seperate UL protrctive tube

+CIR
-237U1
/237.a.0
&EFA++/1a.6
VX DC
switch
and Fuse
3*250A
1000V
Pos. 3

L_IGBT 4_1 / 217.0
SUB_4_1_V / ++CT/164.9
SUB_4_1_DC- / 217.9
SUB_4_1_V.1 / ++CT/164.9
L_IGBT 4_2 / 217.0
SUB_4_2_V / ++CT/164.9
SUB_4_2_DC- / 217.9
SUB_4_2_V.1 / ++CT/164.9
L_IGBT 4_3 / 217.0
SUB_4_3_V / ++CT/164.9
SUB_4_3_DC- / 217.9
SUB_4_3_V.1 / ++CT/164.9

237W1 OZ-600 2x0,75 mm²
237W1 OZ-600 2x0,75 mm²
237W2 OZ-600 2x0,75 mm²
237W2 OZ-600 2x0,75 mm²
237W3 OZ-600 2x0,75 mm²
237W3 OZ-600 2x0,75 mm²

50 mm² NSGAFöu BK

PE
PE
Rear mounting plate
7

IGBT1 1+ | V_IGBT1 1+ | V_DC1 1+ | V_DC 1-
UDC [1]-
IGBT2 2+ | V_IGBT2 2+ | V_DC2 2+
UDC [2]-
IGBT3 3+ | V_IGBT3 3+ | V_DC3 3+
UDC [3]-

F3 1A
F4 1A [20A, aR (BSU)]
F0 [20A, aR (BSU)]
F7 1A
F8 1A
F11 1A
F12 1A

2,5 mm² NSGAFöu BK

-C1
-C7
-C13
x1 x2
340µF, 1320V DC Epcos
16 mm² NSGAFöu BK

Front mounting plate
PE
-U1
EMI
Suppesion CAP
16 mm² FGKV
1 2 3 4 5 6
16 mm² in Shrin-kable Tube FGKV

-K1 /237.a.1 1500V 300A
-K7 /237.a.3 1500V 300A
-K2 /237.a.2 1500V 300A
-K8 /237.a.4 1500V 300A
-K3 /237.a.2 1500V 300A
-K9 /237.a.5 1500V 300A
A1 A2

70 mm² NSGAFöu BK

-F1 /237.a.7 1250V 400A 1KN/110 HLS Datenblatt
-F2 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F5 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F6 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F9 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F10 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
IEC

DC1 + / DC1 -
DC2 + / DC2 -
DC3 + / DC3 -

*2
The single conductor
must be placed
in the protective tube

AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

EEC

+AC_DC-237W10 SUB 4_1 + Pos. =UNIT_03 → DC+4_1_BAT / =UNIT_03++ASC/678.2
+AC_DC-237W11 SUB 4_1 - Pos. → DC-4_1_BAT / =UNIT_03++ASC/678.2
+AC_DC-237W12 SUB 4_2 + Pos. =UNIT_03 → DC+4_2_BAT / =UNIT_03++ASC/678.5
+AC_DC-237W13 SUB 4_2 - Pos. → DC-4_2_BAT / =UNIT_03++ASC/678.5
+AC_DC-237W14 SUB 4_3 + Pos. =UNIT_03 → DC+4_3_BAT / =UNIT_03++ASC/678.7
+AC_DC-237W15 SUB 4_3 - Pos. → DC-4_3_BAT / =UNIT_03++ASC/678.7

Cu 100mm x 10mm x 195mm FRQ.50604 &EFA++/1a.7 =UNIT_03&EFA++/1a.0
Cu 100mm x 10mm x 195mm FRQ.50604 &EFA++/1a.7 =UNIT_03&EFA++/1a.5

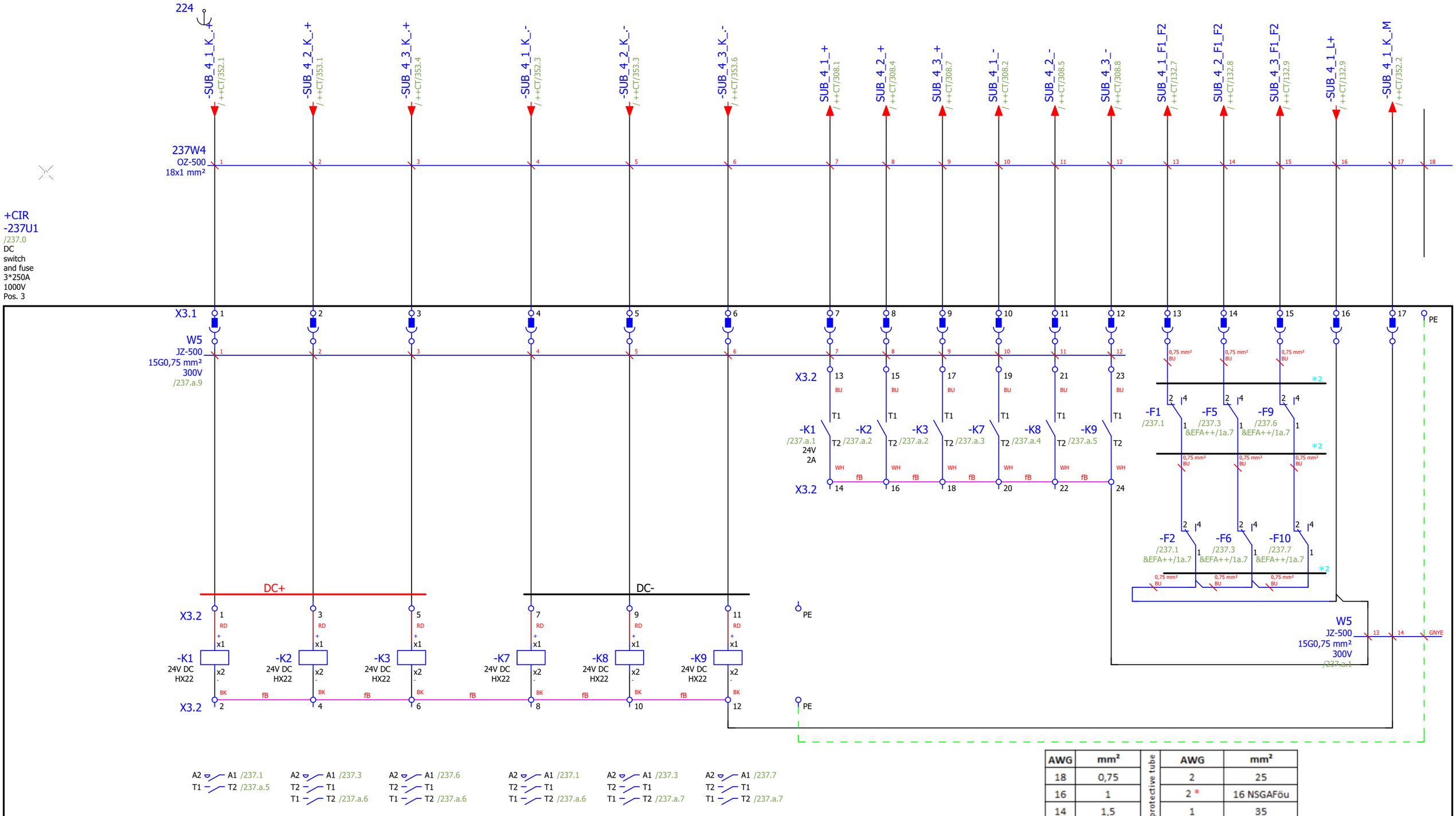
DC+4_1 / 238b.1
DC-4_1 / 238b.1
DC+4_2 / 238b.4
DC-4_2 / 238b.4
DC+4_3 / 238b.7
DC-4_3 / 238b.8

DC+ and DC- Busbars
in Connection cabinet

previous page: 231.a
next page: 237.a

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						10354_23A2007
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 237
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 237

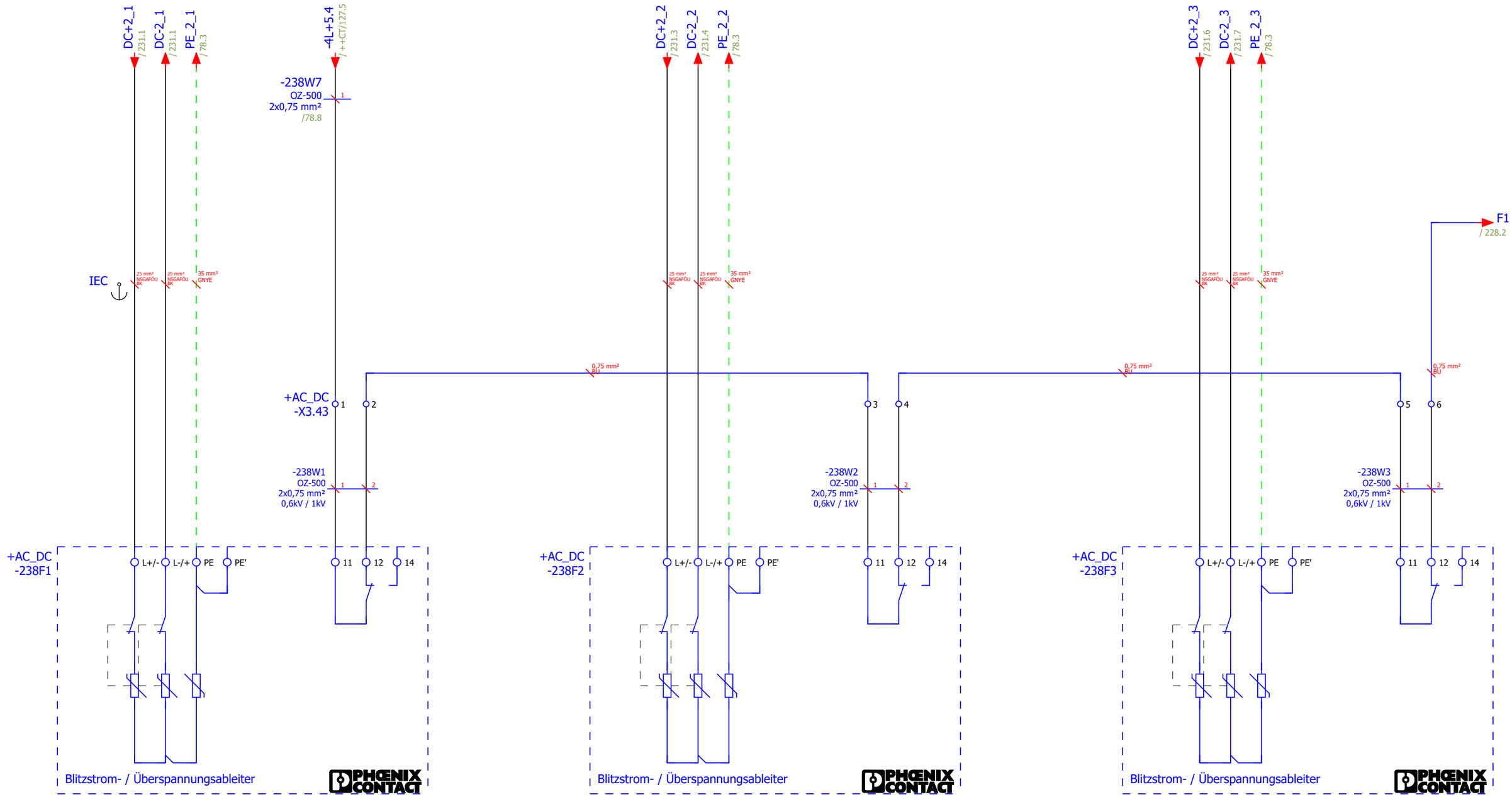
next page: 238a

Editor	Freqcon_DG			Statron	FREQCON	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	20250805_V2.0
Date	29.07.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 237.a
							+ total: 492

DC+ and DC- Busbars

DC+ and DC- Busbars

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 2_1

SURGE ARRESTER
DC SUBSYSTEM 2_2

SURGE ARRESTER
DC SUBSYSTEM 2_3

in Connection cabinet

previous page:
237.a

next page:
238b

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 2_1 - 2_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 238a
Date								+ total: 492

DC+ and DC- Busbars

DC+4_1 / 237.1
DC-4_1 / 237.1
PE_4_1 / 78.4

IEC

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F2
228.9 /

0,75 mm² BU

+AC_DC
-X3.43
13 14

-238W4
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F4
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_1

DC+ and DC- Busbars

DC+4_2 / 237.3
DC-4_2 / 237.4
PE_4_2 / 78.4

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

0,75 mm² BU

15 16

-238W5
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F5
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_2

DC+ and DC- Busbars

DC+4_3 / 237.6
DC-4_3 / 237.7
PE_4_3 / 78.5

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F3
/ 78.9

0,75 mm² BU

17 18

-238W6
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F6
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

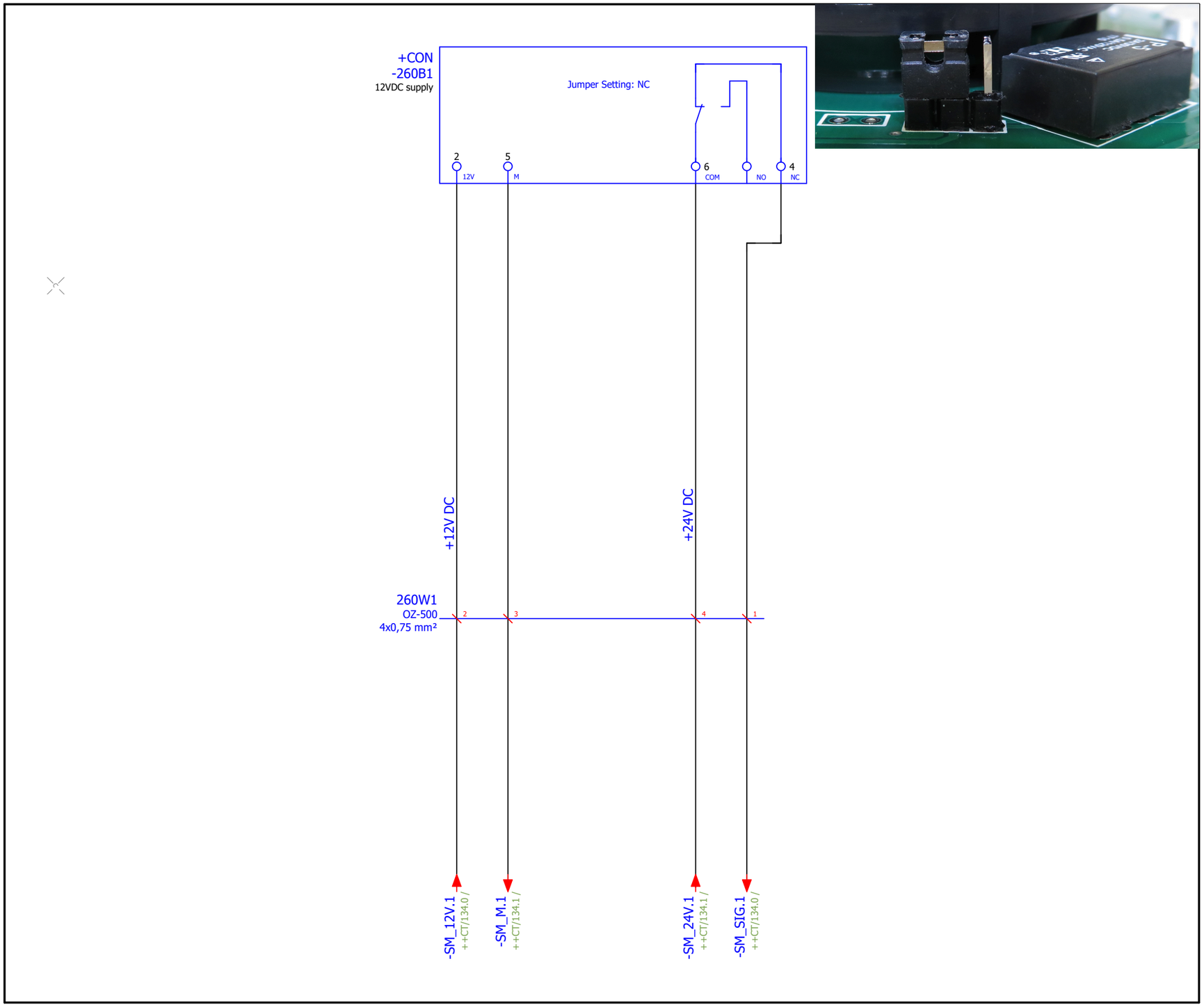
SURGE ARRESTER
DC SUBSYSTEM 4_3

in Connection cabinet

previous page: 238a

next page: 260

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 4_1 - 4_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 238b
Date								+	total: 492

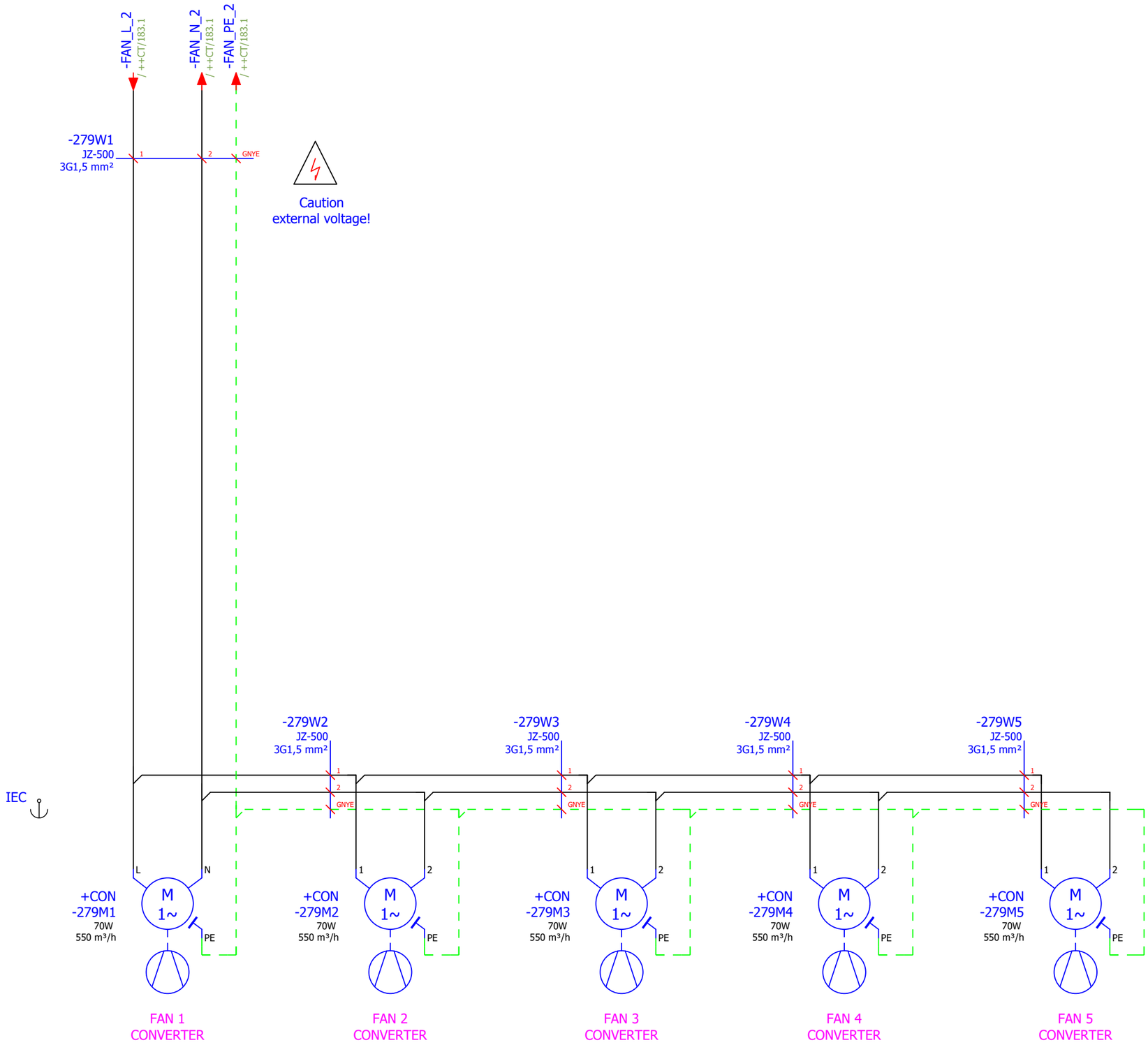


SMOKE DETECTOR
+CON CABINET

previous page:
238b

next page:
279

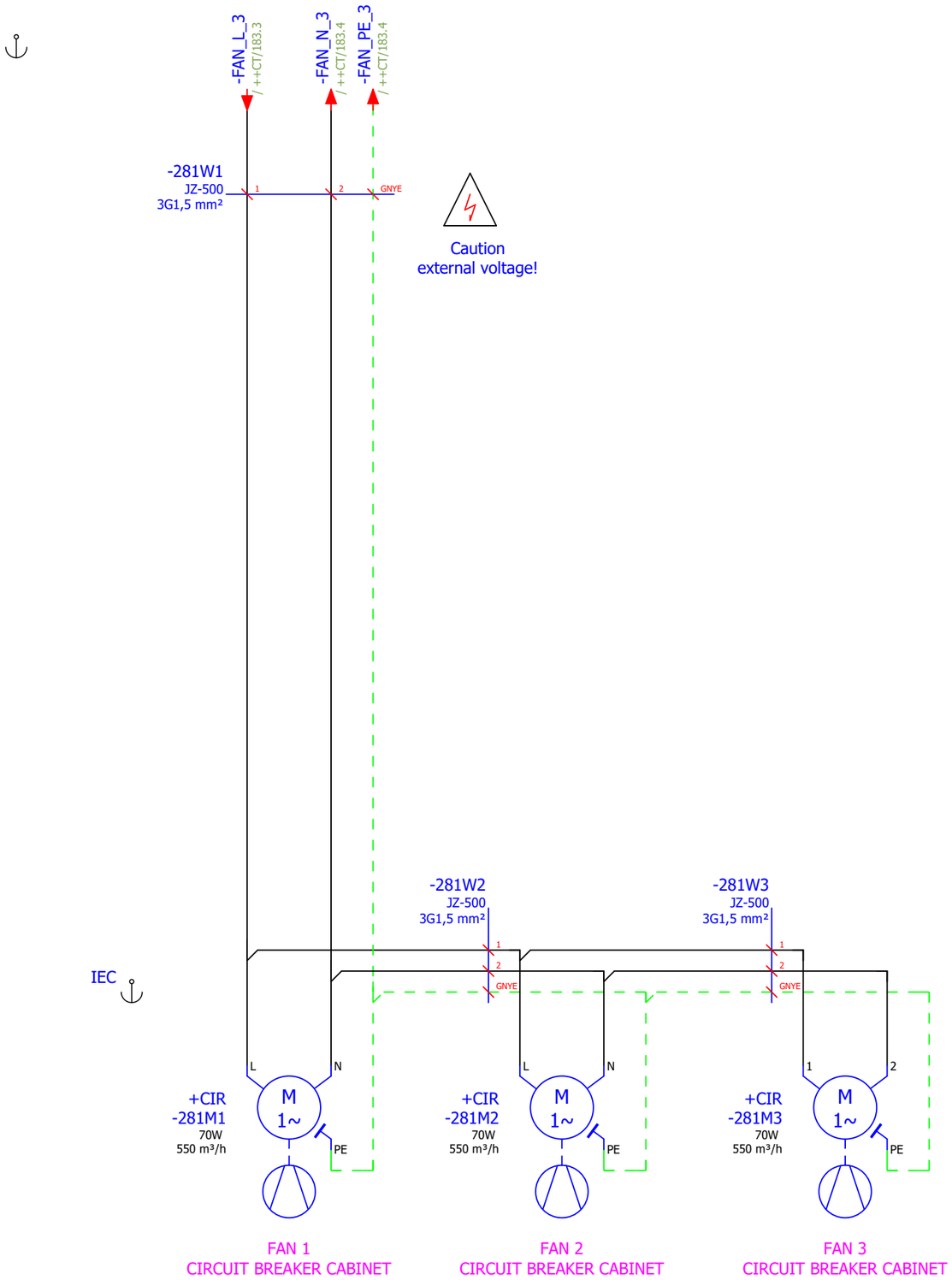
Editor	Freqcon_JD			Statron	FREQCON	SMOKE DETECTOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 260
Date								+	total: 492



previous page:
260

next page:
281

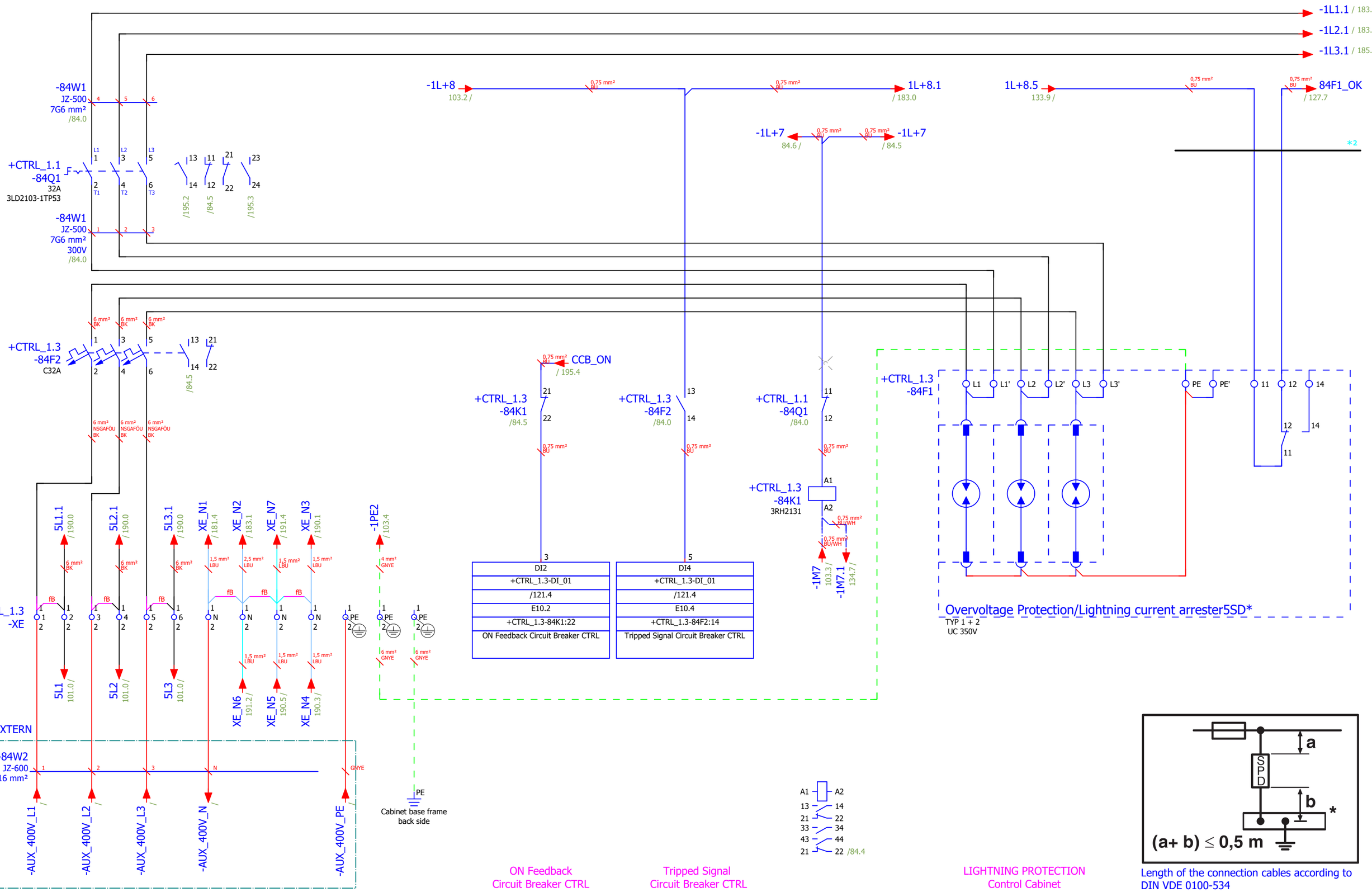
Editor	Freqcon_JD			Statron	FREQCON	CONVERTER CABINET CLIMATE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 279
Date								+	total: 492



previous page:
279

next page:
++CT/84

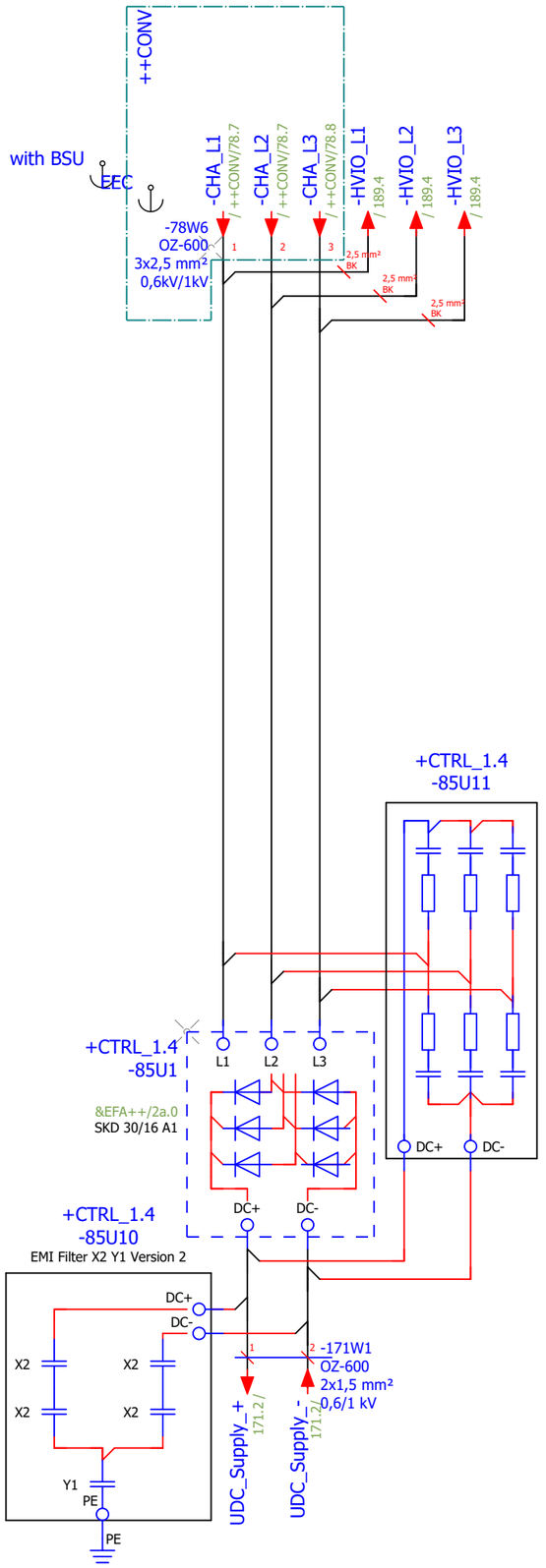
Editor	Freqcon_JD			Statron	FREQCON	CIRCUIT BREAKER CABINET CLIMATE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 281
Date								+	total: 492



previous page:
++CONV/281

next page:
85

Editor	Freqcon_DG			Statron	FREQCON	FEEDING CONTROL CABINET (CTRL)	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	



previous page: 84

earthing via cooling element

next page: 100

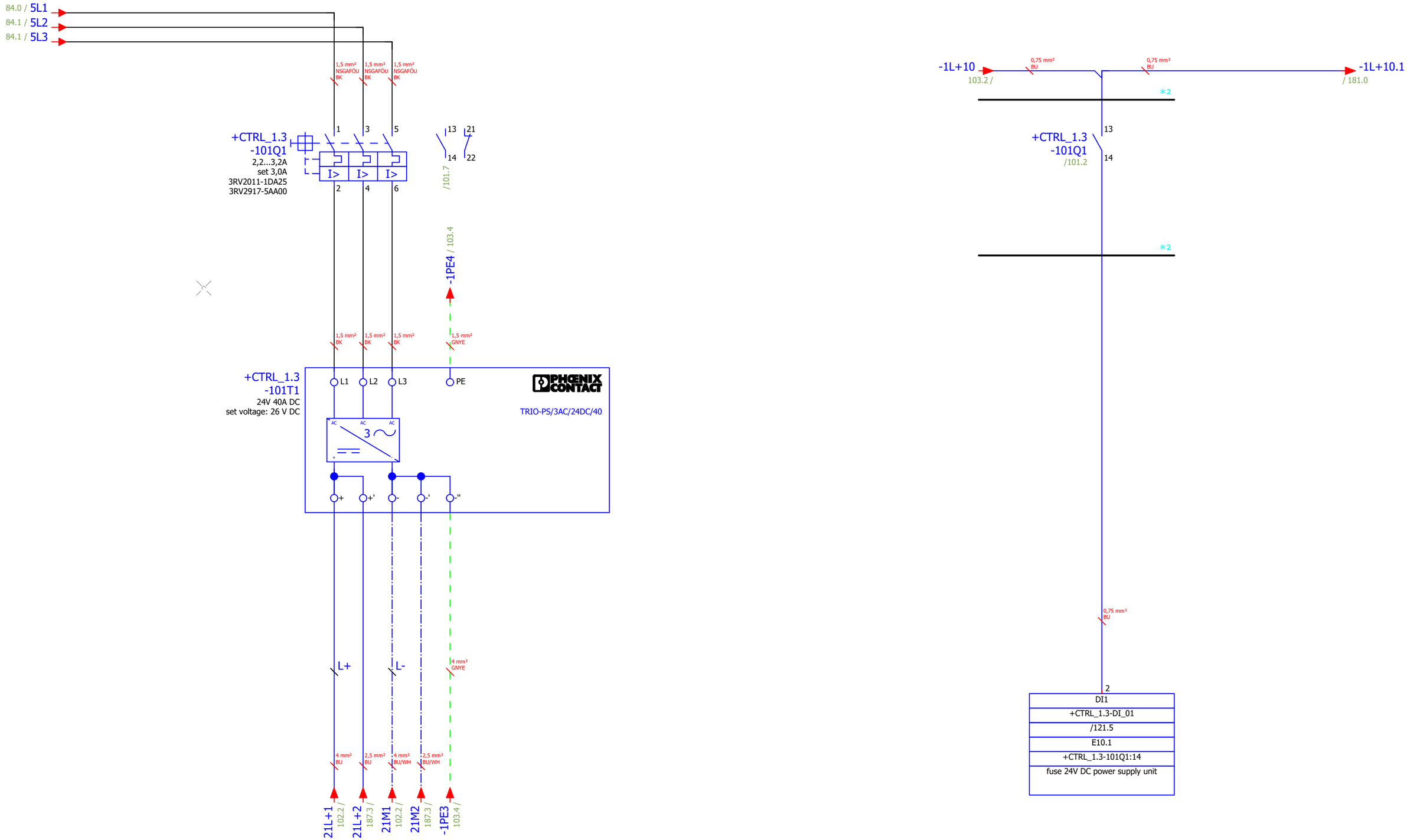
Editor	Freqcon_DG			Statron		SUPPLY UDC	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	29.07.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 85
Date								+		total: 492

Control Cabinet

Pages 100 - 199

previous page: 85

next page: 101

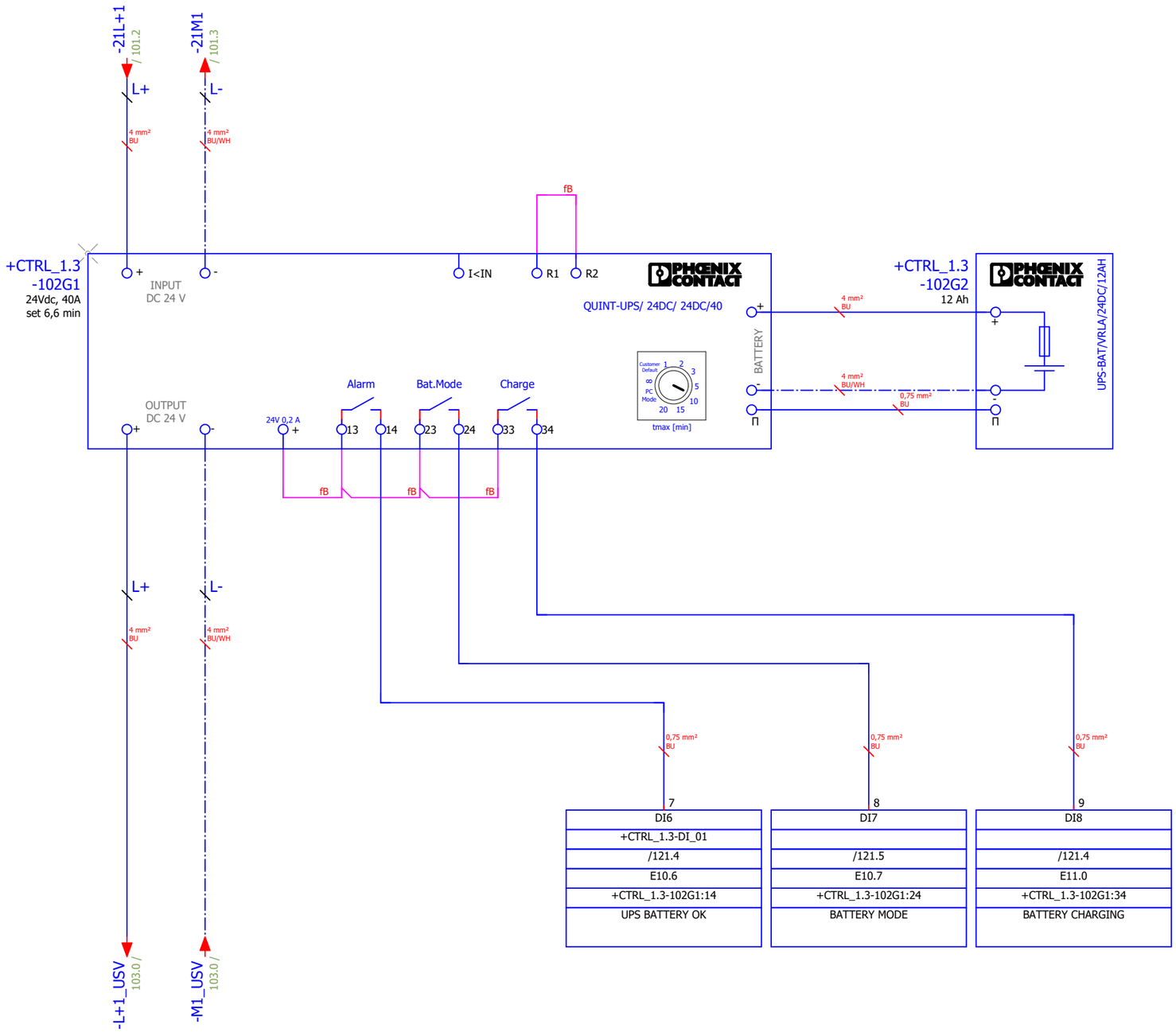


previous page: 100

Power supply unit from 400V AC

next page: 102

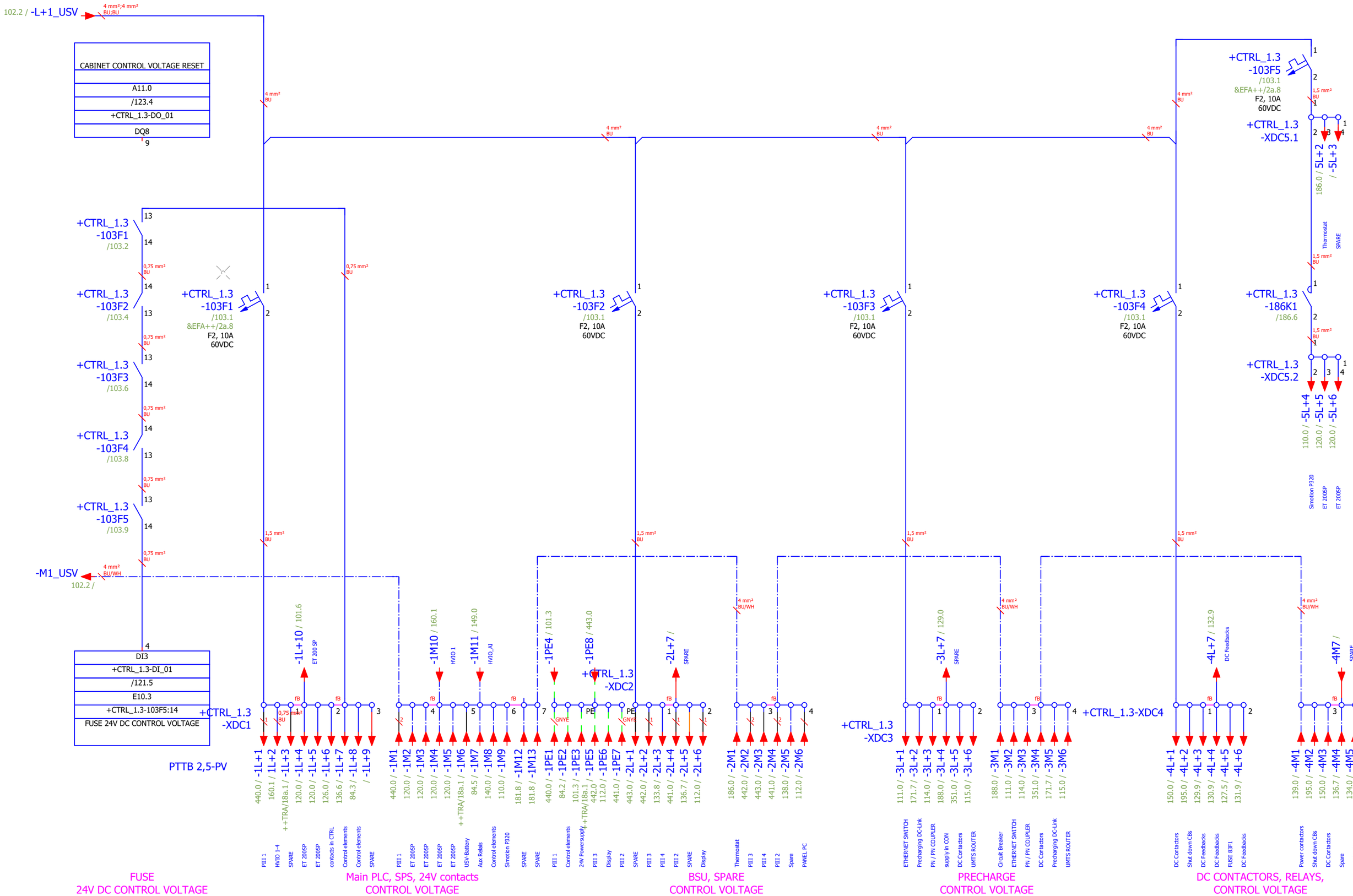
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 101
Date								+	total: 492



previous page:
101

next page:
103

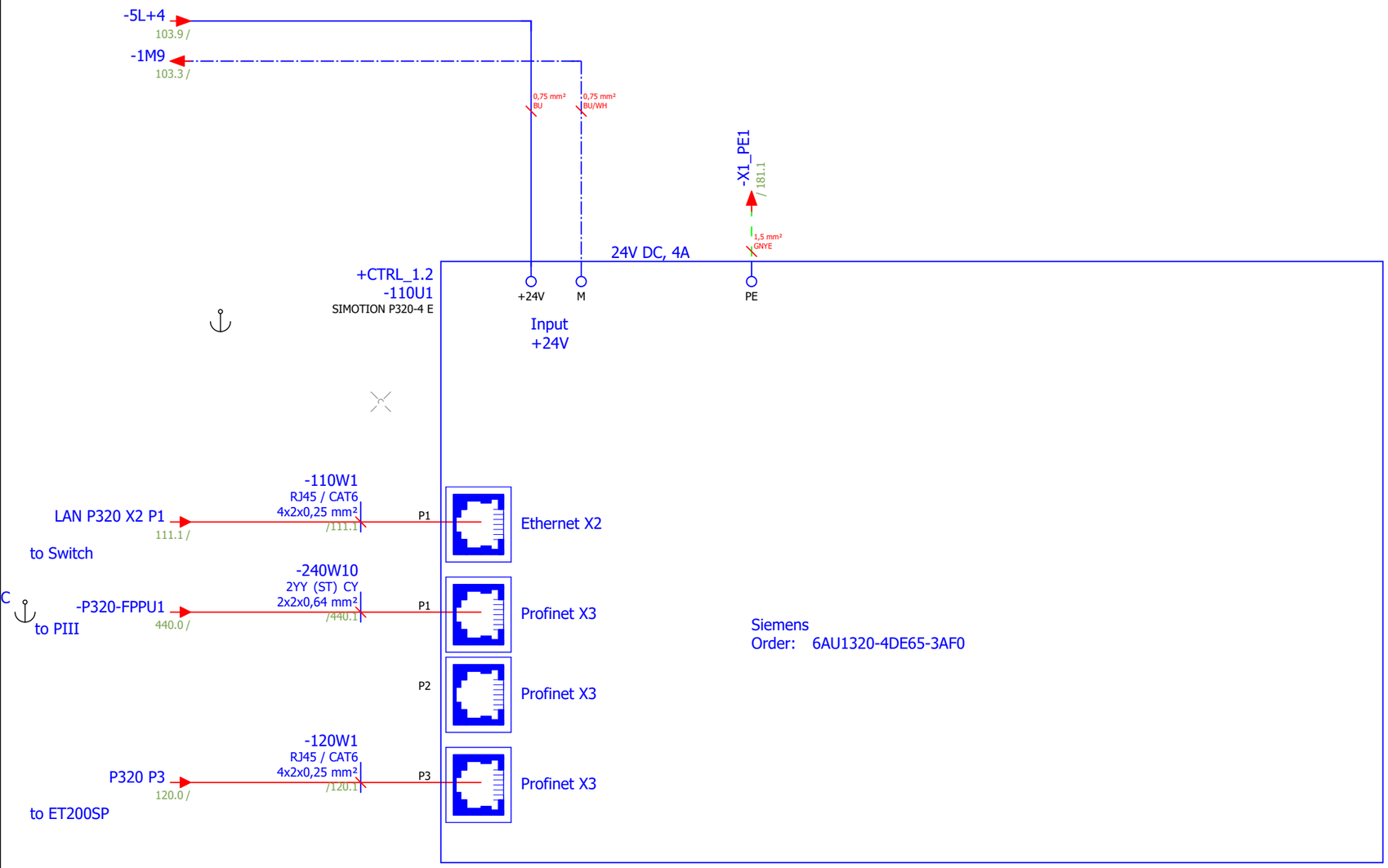
Editor	Freqcon_JD			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 102
Date								+ total: 492



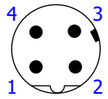
previous page: 102

next page: 110

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 103
Date								+	total: 492



Plug with D-coded



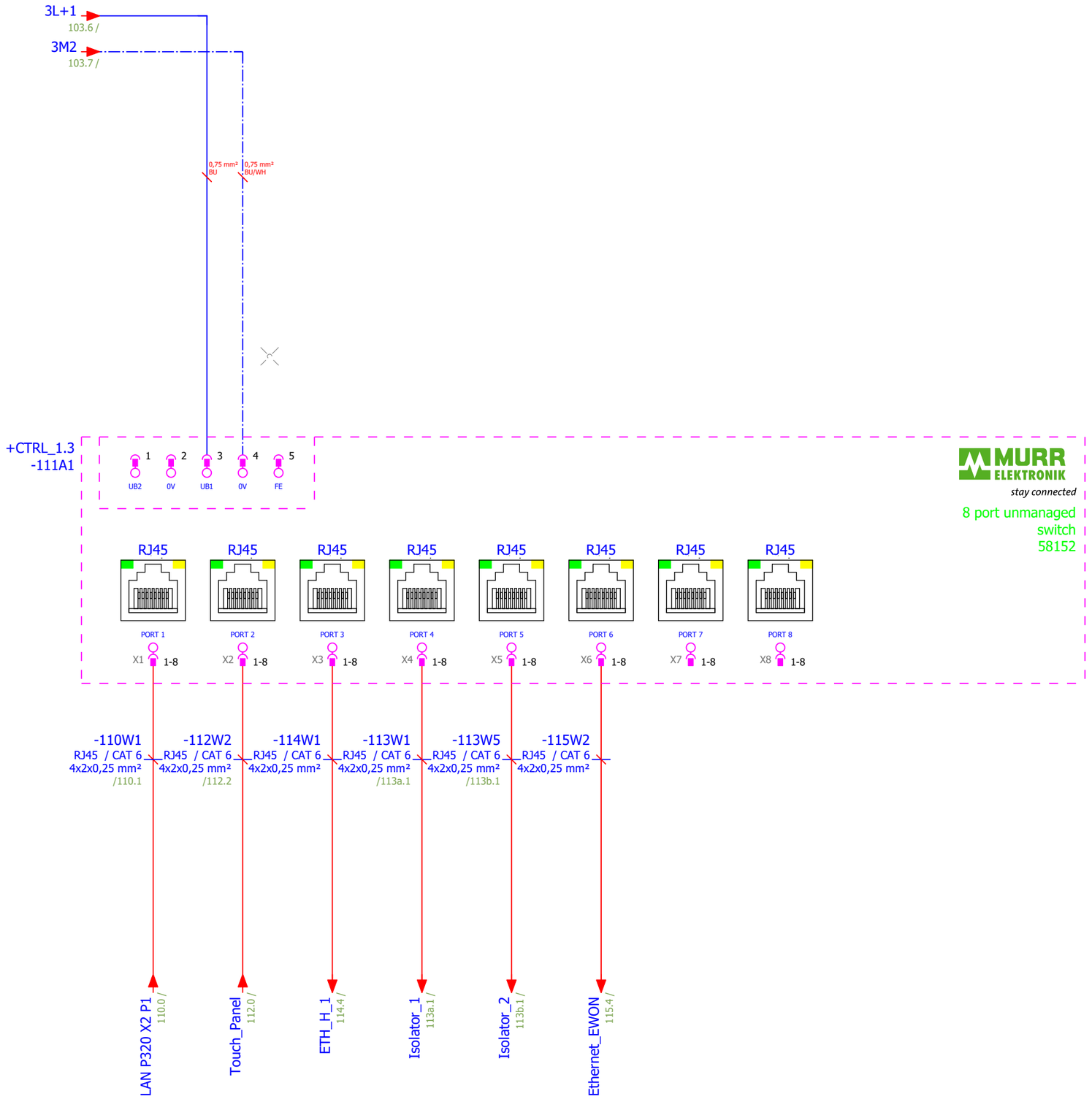
Top view of the pinheader

Signal	Colour	RJ45	M12 plug
TD+	yellow	1	1
TD-	orange	2	3
RD+	white	3	2
RD-	blue	6	4

Connection P320 -- PIII

previous page: 103

next page: 111

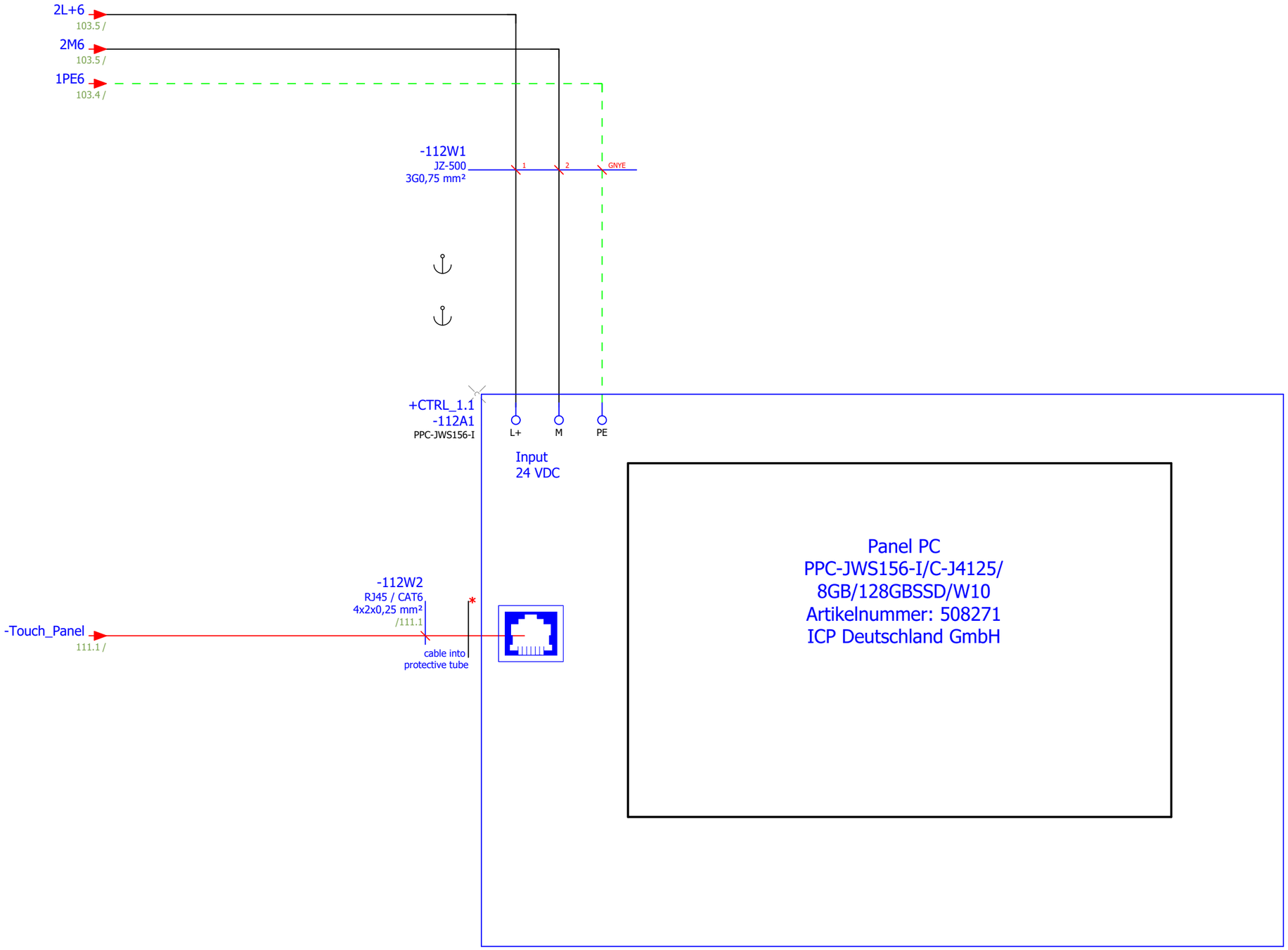


previous page:
110

next page:
112

Editor	Freqcon_DG			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_01	Converter Container 1
Date	23.01.2025							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

page: 111
total: 492



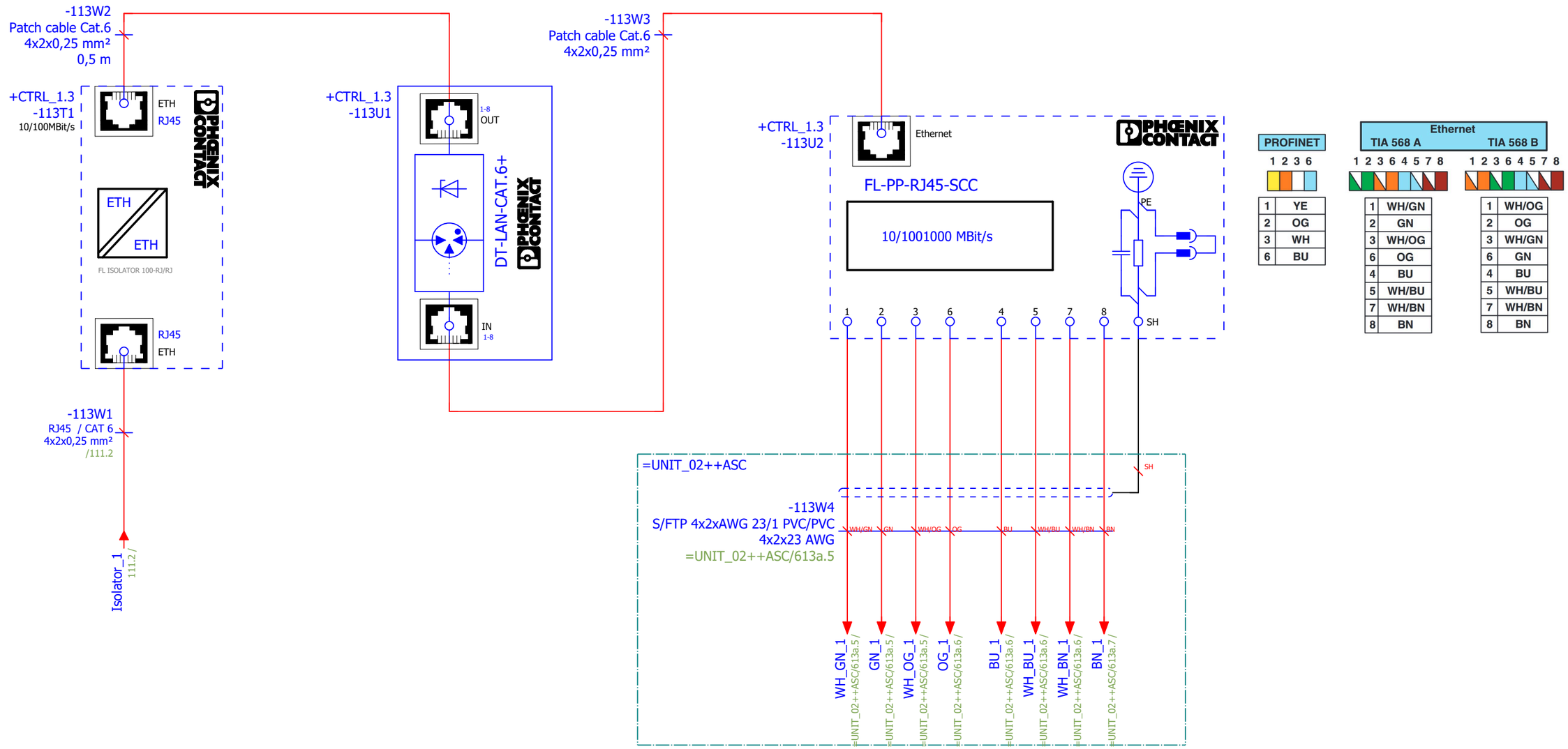
PANEL PC

previous page:
111

next page:
113a

Editor	Freqcon_JD			Statron	FREQCON	PANEL PC HMI	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

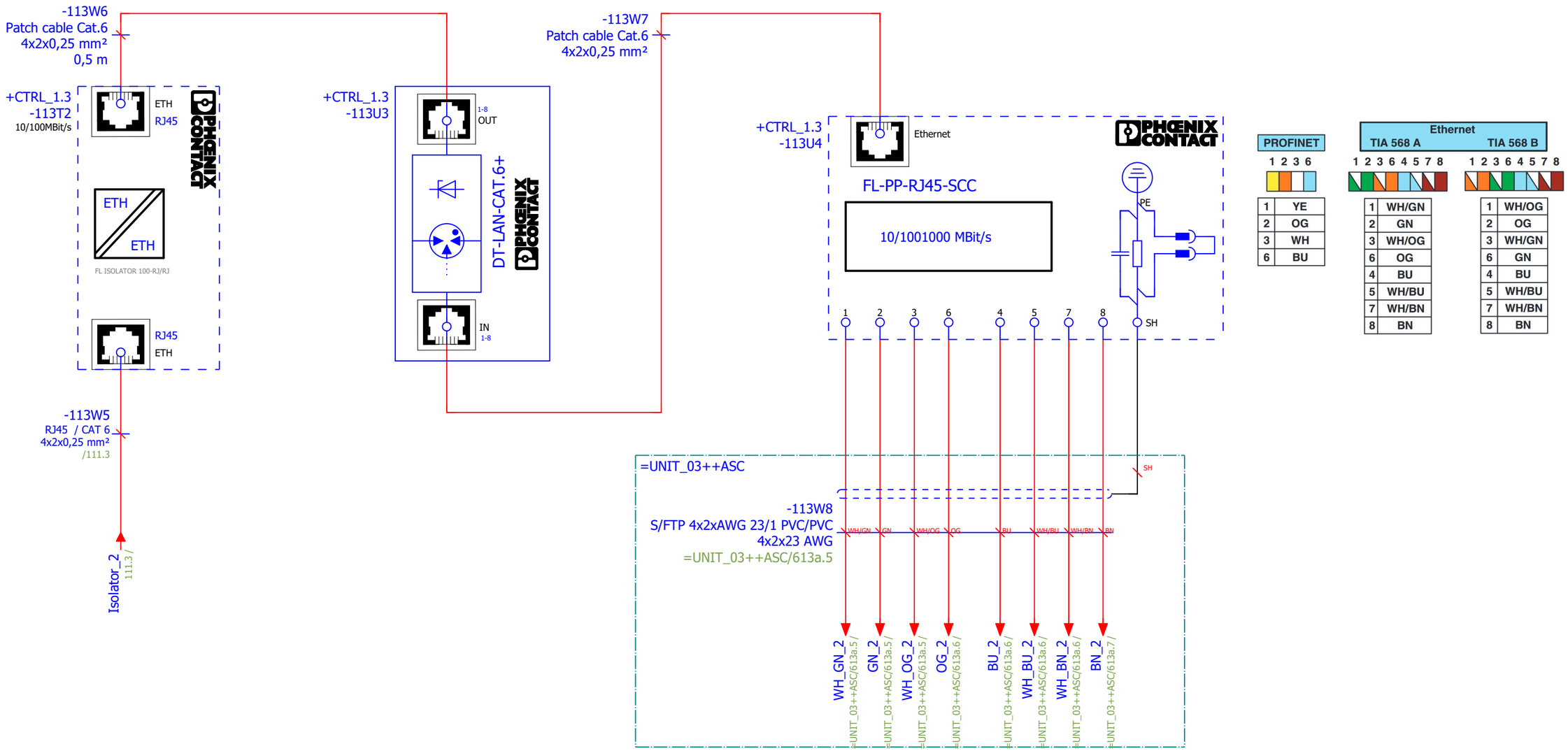
page: 112
total: 492



previous page:
112

next page:
113b

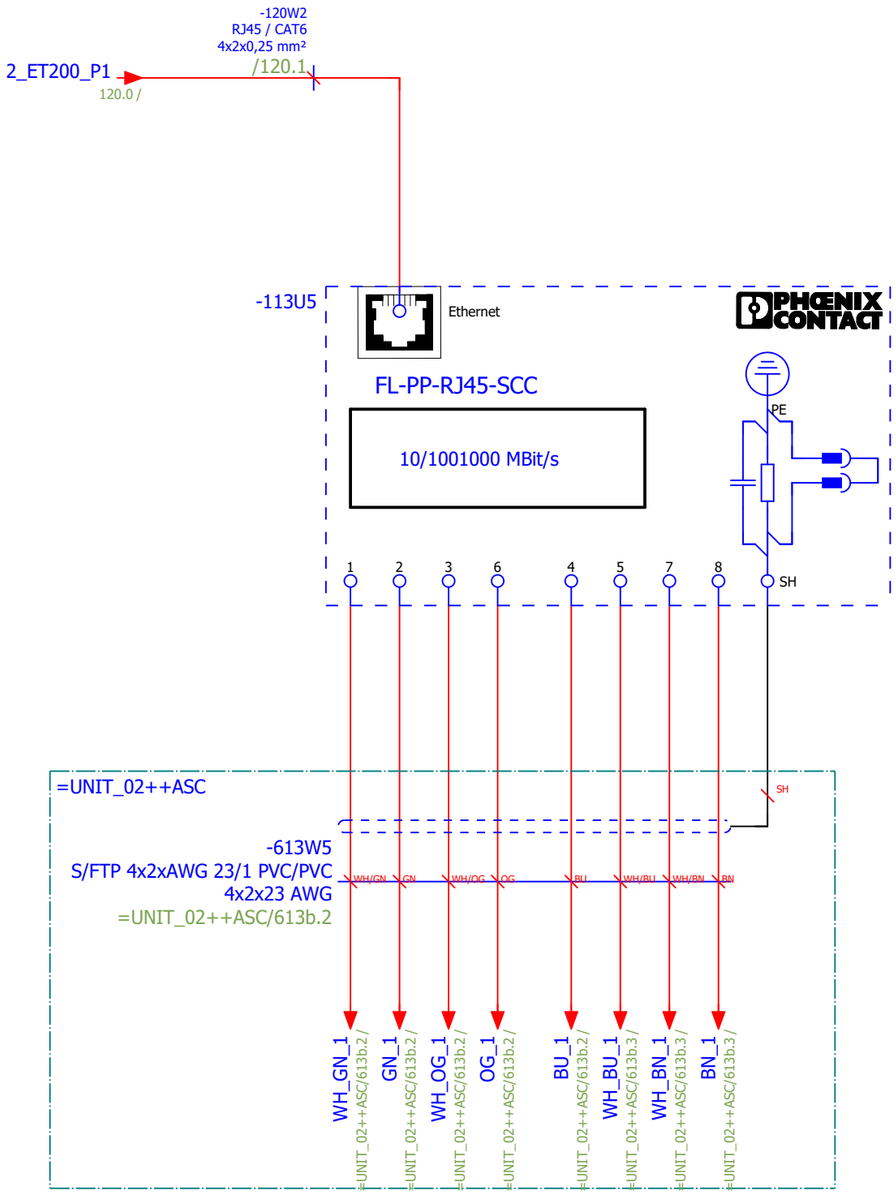
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 113a
Date								+	total: 492



previous page:
113a

next page:
113c

Editor	Freqcon_JD			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 113b
Date								+	total: 492



PROFINET

1 2 3 6

1	YE
2	OG
3	WH
6	BU

Ethernet

TIA 568 A

1 2 3 6 4 5 7 8

1	WH/GN
2	GN
3	WH/OG
6	OG
4	BU
5	WH/BU
7	WH/BN
8	BN

TIA 568 B

1 2 3 6 4 5 7 8

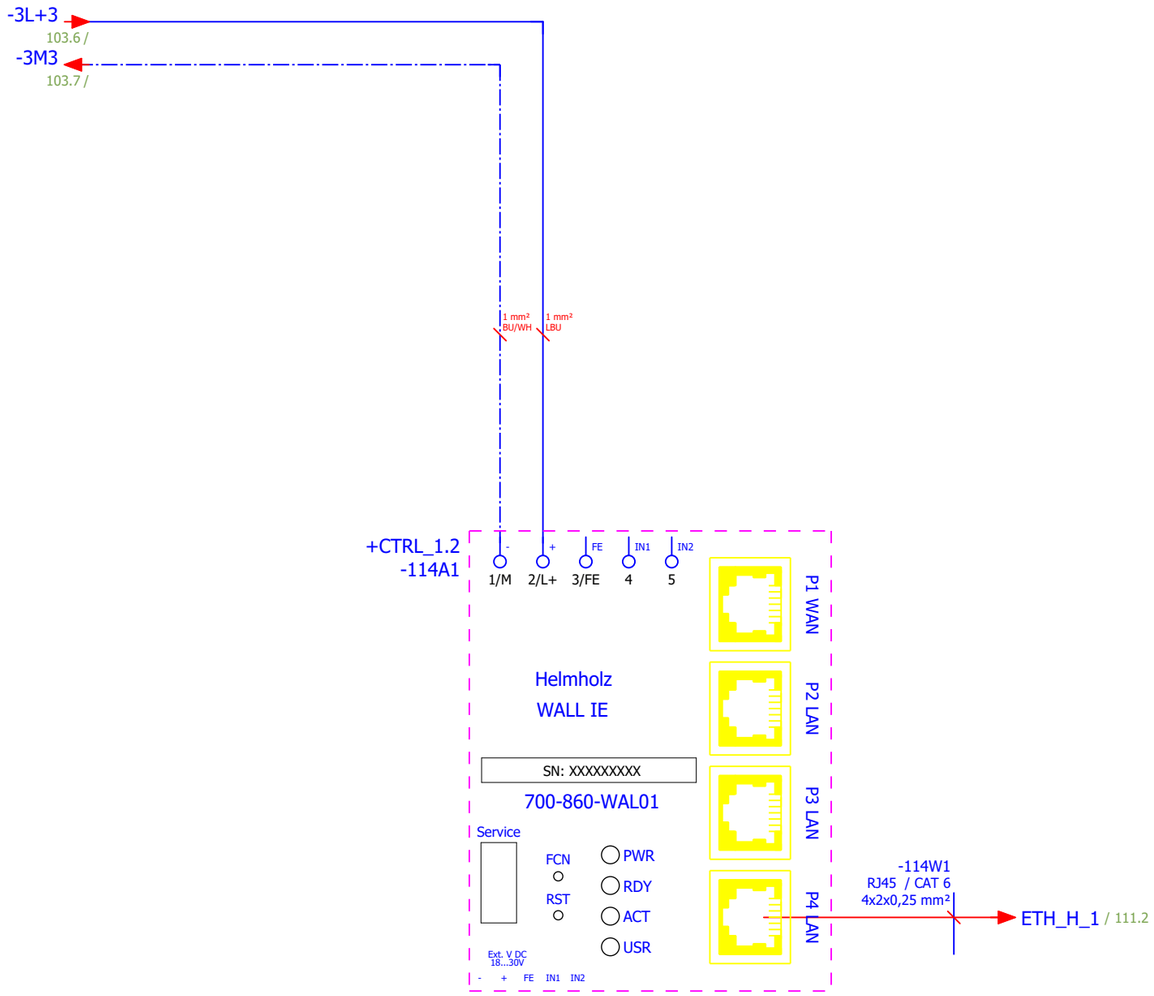
1	WH/OG
2	OG
3	WH/GN
6	GN
4	BU
5	WH/BU
7	WH/BN
8	BN

previous page: 113b

next page: 114

Editor	Freqcon_DG			Statron		PROFINET	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 113c
Date								+		total: 492

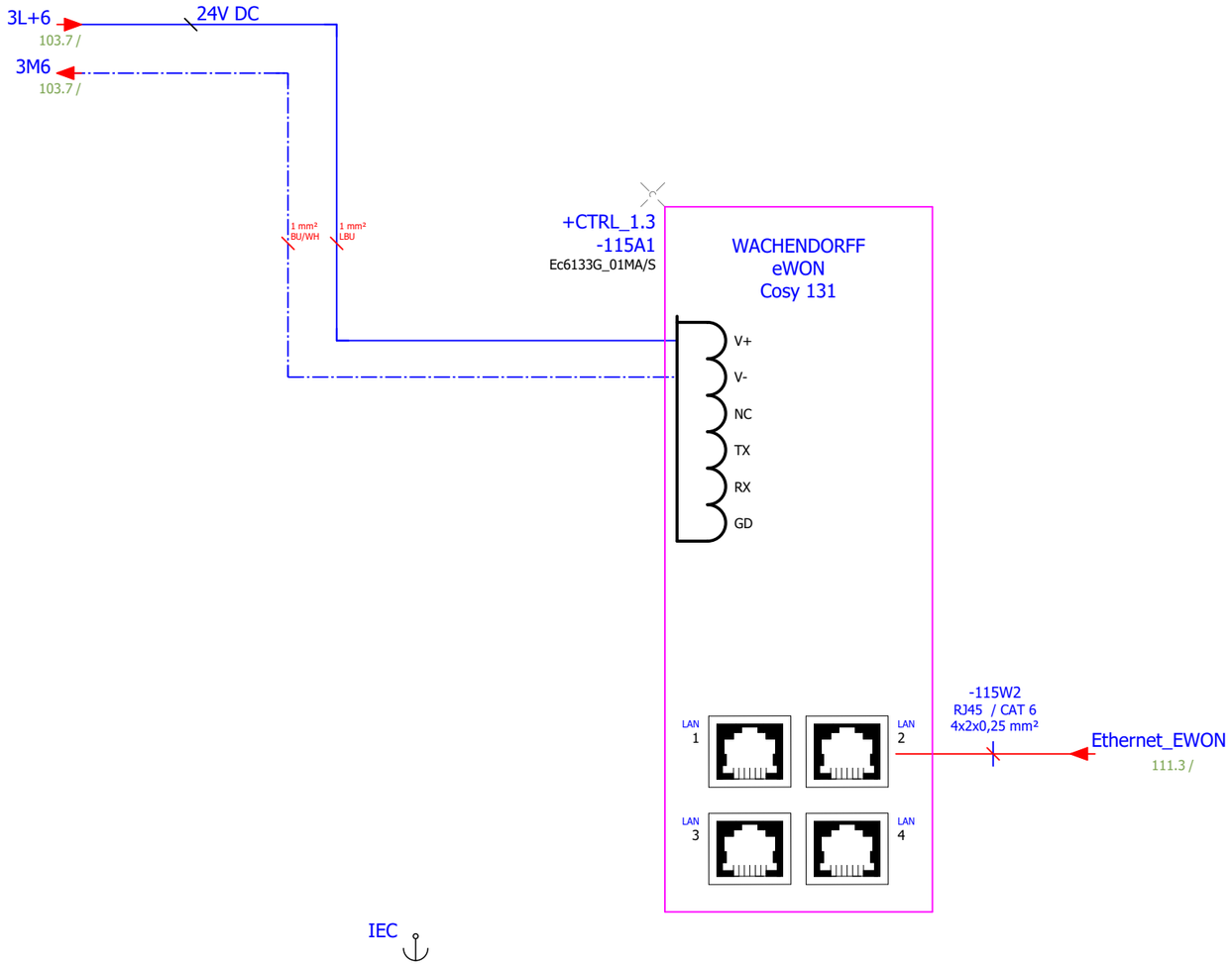
0	1	2	3	4	5	6	7	8	9



previous page:
113c

next page:
115

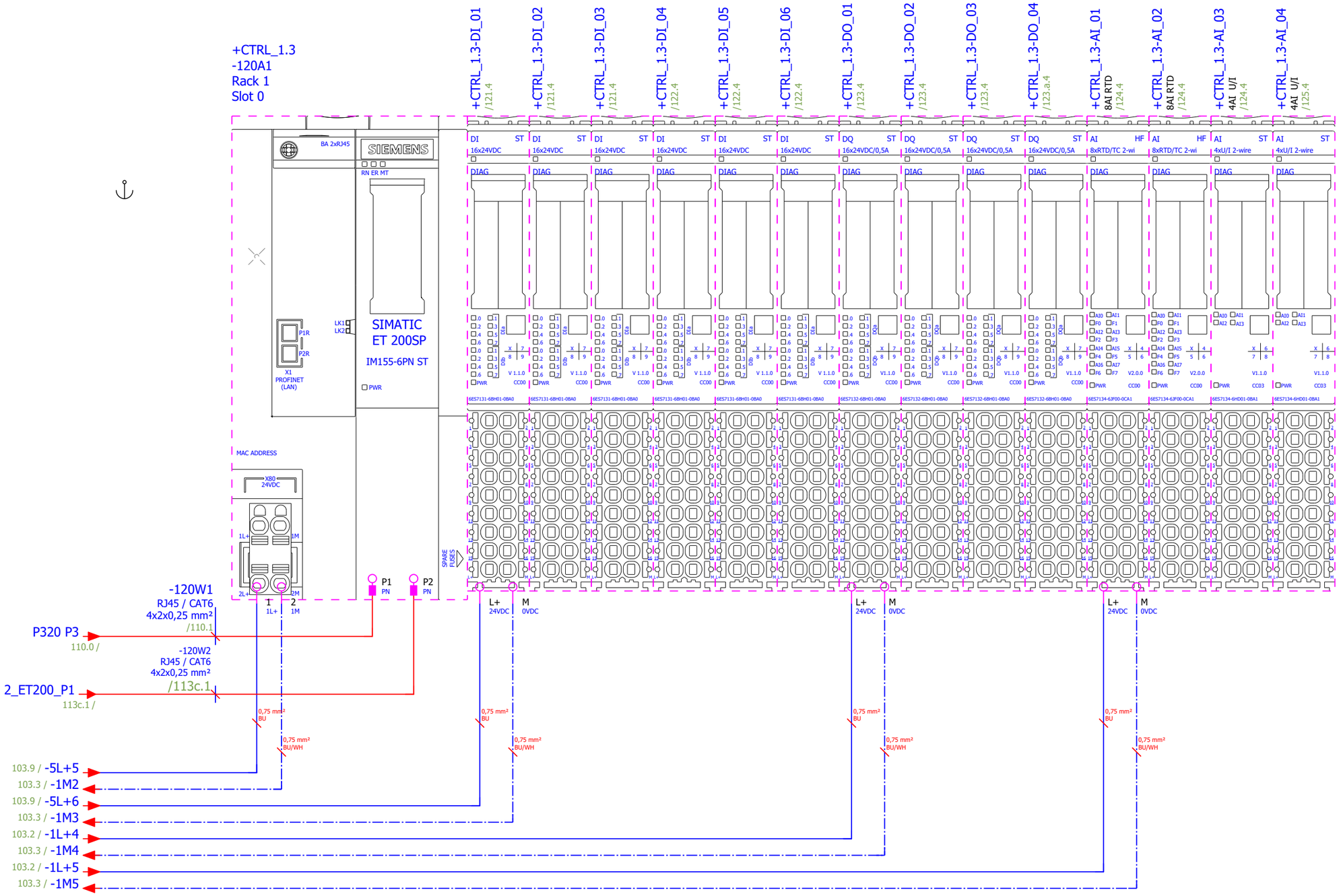
Editor	Freqcon_DG			Statron	FREQCON	HELMHOLZ	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	23.01.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 114
Date								+	total: 492



previous page:
114

next page:
120

Editor	Freqcon_JD			Statron	FREQCON	UMTS ROUTER	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 115
Date								+	total: 492



previous page: 115

next page: 121

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 120
Date								+		total: 492

+CTRL_1.3-DI_01

/120.3

		DI0 1	E10.0	E10.1 2 DI1	/101.7	fuse 24V DC power supply unit
ON Feedback Circuit Breaker CTRL	/84.4	DI2 3	E10.2	E10.3 4 DI3	/103.1	FUSE 24V DC CONTROL VOLTAGE
Tripped Signal Circuit Breaker CTRL	/84.5	DI4 5	E10.4	E10.5 6 DI5	/127.7	LIGHTNING PROTECTION in Control Cabinet OPTIONAL
UPS BATTERY OK	/102.5	DI6 7	E10.6	E10.7 8 DI7	/102.6	BATTERY MODE
BATTERY CHARGING	/102.7	DI8 9	E11.0	E11.1 10 DI9	/126.1	RESET -126S1
FUSE FOR PUMP	/181.2	DI10 11	E11.2	E11.3 12 DI11	/182.2	FAN 1 HEAT EXCHANGER
FUSE FOR HEATER	/181.5	DI12 13	E11.4	E11.5 14 DI13		
Fuse Fans CON, IND Cabinets	/183.6	DI14 15	E11.6	E11.7 16 DI15	/185.9	supply light, fan, heater, power unit in cabinet
	/120.3	24VDC L+		M 0VDC	/120.3	

+CTRL_1.3-DI_02

/120.3

FAULT SIGNAL SAFETY RELAY	/195.4	DI0 1	E12.0	E12.1 2 DI1	/187.6	FUSES SUPPLY FOR CIRCUIT BREAKER 1+2
CB 1 ON GRID	/127.2	DI2 3	E12.2	E12.3 4 DI3	/127.3	CB 1 OFF GRID
CB 1 Tripped GRID	/127.1	DI4 5	E12.4	E12.5 6 DI5	/127.4	FUSE AND LIGHTNING PROTECTION
Smoke detector CON	/134.0	DI6 7	E12.6	E12.7 8 DI7	/129.0	SUBSYSTEM 2_1_DC + Contactor K1 is on
SUBSYSTEM 2_1_DC -Contactor K7 is on	/129.1	DI8 9	E13.0	E13.1 10 DI9	/129.2	SUBSYSTEM 2_2_DC + Contactor K2 is on
SUBSYSTEM 2_2_DC -Contactor K8 is on	/129.3	DI10 11	E13.2	E13.3 12 DI11	/129.4	SUBSYSTEM 2_3_DC + Contactor K3 is on
SUBSYSTEM 2_3_DC -Contactor K9 is on	/129.5	DI12 13	E13.4	E13.5 14 DI13	/129.6	SUBSYSTEM 2_3_DC + SPARE
SUBSYSTEM 2_DC -SPARE	/129.7	DI14 15	E13.6	E13.7 16 DI15	/129.8	SUBSYSTEM 2_1_DC FUSE OK
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_03

/120.3

SUBSYSTEM 2_2_DC FUSE OK	/129.9	DI0 1	E14.0	E14.1 2 DI1	/130.0	SUBSYSTEM 3_1_DC + Contactor K1 is on
SUBSYSTEM 3_1_DC -Contactor K7 is on	/130.1	DI2 3	E14.2	E14.3 4 DI3	/130.2	SUBSYSTEM 3_2_DC + Contactor K2 is on
SUBSYSTEM 3_2_DC -Contactor K8 is on	/130.3	DI4 5	E14.4	E14.5 6 DI5	/130.4	SUBSYSTEM 3_3_DC + Contactor K3 is on
SUBSYSTEM 3_3_DC -Contactor K9 is on	/130.5	DI6 7	E14.6	E14.7 8 DI7	/130.6	SUBSYSTEM 3_DC + SPARE
SUBSYSTEM 3_DC -SPARE	/130.7	DI8 9	E15.0	E15.1 10 DI9	/130.8	SUBSYSTEM 2_DC FUSE OK
SUBSYSTEM 3_1_DC FUSE OK	/130.9	DI10 11	E15.2	E15.3 12 DI11	/131.0	SUBSYSTEM 4_1_DC + Contactor K1 is on
SUBSYSTEM 4_1_DC -Contactor K7 is on	/131.1	DI12 13	E15.4	E15.5 14 DI13	/131.2	SUBSYSTEM 4_2_DC + Contactor K2 is on
SUBSYSTEM 4_2_DC -Contactor K8 is on	/131.3	DI14 15	E15.6	E15.7 16 DI15	/131.4	SUBSYSTEM 4_3_DC + Contactor K3 is on
		24VDC L+		M 0VDC		

previous page: 120

next page: 122

+CTRL_1.3-DI_04

/120.4

SPARE	/133.1	DI0 1	E16.0	E16.1 2 DI1	/133.2	SPARE
SPARE	/133.3	DI2 3	E16.2	E16.3 4 DI3	/133.4	TRIP
Earthing switch in On Transformer 620V side	/133.9	DI4 5	E16.4	E16.5 6 DI5		
		DI6 7	E16.6	E16.7 8 DI7		
		DI8 9	E17.0	E17.1 10 DI9		
Fuse 230V AC for Container Air Conditioning	/133.6	DI10 11	E17.2	E17.3 12 DI11	/128.1	CB 2 Tripped ISLAND GRID
CB 2 ON ISLAND GRID	/128.2	DI12 13	E17.4	E17.5 14 DI13	/128.3	CB 2 OFF ISLAND GRID
FUSE AND LIGHTNING PROTECTION 2	/128.4	DI14 15	E17.6	E17.7 16 DI15	/182.5	FAN 2 HEAT EXCHANGER (OPTIONAL)
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_05

/120.4

SUBSYSTEM 4_3_DC -Contactor K9 is on	/131.5	DI0 1	E18.0	E18.1 2 DI1	/131.6	SUBSYSTEM 4_DC + SPARE
SUBSYSTEM 4_DC -SPARE	/131.7	DI2 3	E18.2	E18.3 4 DI3	/131.8	SUBSYSTEM 3_2_DC FUSE OK
SUBSYSTEM 3_3_DC FUSE OK	/131.9	DI4 5	E18.4	E18.5 6 DI5	/132.0	
	/132.1	DI6 7	E18.6	E18.7 8 DI7	/132.2	
	/132.3	DI8 9	E19.0	E19.1 10 DI9	/132.4	
	/132.5	DI10 11	E19.2	E19.3 12 DI11	/132.6	
SUBSYSTEM 4_1_DC FUSE OK	/132.7	DI12 13	E19.4	E19.5 14 DI13	/132.8	SUBSYSTEM 4_2_DC FUSE OK
SUBSYSTEM 4_3_DC FUSE OK	/132.9	DI14 15	E19.6	E19.7 16 DI15		
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_06

/120.4

Shut-down to BESS	/136.6	DI0 1	E20.0	E20.1 2 DI1		
		DI2 3	E20.2	E20.3 4 DI3		
		DI4 5	E20.4	E20.5 6 DI5		
		DI6 7	E20.6	E20.7 8 DI7		
incoming CB is open	/136.8	DI8 9	E21.0	E21.1 10 DI9	/136.9	cmd island mode
		DI10 11	E21.2	E21.3 12 DI11		
		DI12 13	E21.4	E21.5 14 DI13		
		DI14 15	E21.6	E21.7 16 DI15		
		24VDC L+		M 0VDC		

previous page: 121

next page: 123

+CTRL_1.3-DO_01

/120.5

CON Fans 1-5 in door	/135.1	DQ0 1	A10.0	A10.1 2 DQ1	/135.2	FAN 1 Control cabinet
CIR Fans 1-3 in door	/135.3	DQ2 3	A10.2	A10.3 4 DQ3	/135.4	SPARE 230V
CB2 ON ISLAND GRID OPTIONAL	/137.3	DQ4 5	A10.4	A10.5 6 DQ5	/137.4	CB 2 OFF ISLAND GRID OPTIONAL
Precharging DC-Link Capacitors	/171.5	DQ6 7	A10.6	A10.7 8 DQ7	/173.6	Discharge CON
CABINET CONTROL VOLTAGE RESET	/103.1	DQ8 9	A11.0	A11.1 10 DQ9	/137.1	CB1 ON GRID
CB 1 OFF GRID	/137.2	DQ10 11	A11.2	A11.3 12 DQ11	/189.1	GRID FAULT
FAULT 140H1	/140.1	DQ12 13	A11.4	A11.5 14 DQ13	/140.2	PREHEATING 140H2
READY FOR OPERATION 140H3	/140.3	DQ14 15	A11.6	A11.7 16 DQ15	/140.4	OPERATING 140H4
	/120.5	24VDC L+		M 0VDC	/120.5	

+CTRL_1.3-DO_02

/120.5

SUBSYSTEM 2_1 CONTACTOR DC+ ON	/150.1	DQ0 1	A12.0	A12.1 2 DQ1	/150.3	SUBSYSTEM 2_1 CONTACTOR DC-ON
SUBSYSTEM 2_2 CONTACTOR DC+ ON	/151.0	DQ2 3	A12.2	A12.3 4 DQ3	/151.2	SUBSYSTEM 2_2 CONTACTOR DC-ON
SUBSYSTEM 2_3 CONTACTOR DC+ ON	/151.3	DQ4 5	A12.4	A12.5 6 DQ5	/151.5	SUBSYSTEM 2_3 CONTACTOR DC-ON
		DQ6 7	A12.6	A12.7 8 DQ7	/135.5	SPARE
		DQ8 9	A13.0	A13.1 10 DQ9		
		DQ10 11	A13.2	A13.3 12 DQ11	/139.4	Fan 2 Heat exchanger optional
Heater On converter coolingsystem	/139.1	DQ12 13	A13.4	A13.5 14 DQ13	/139.2	Pump converter coolingsystem
Fan 1 Heat exchanger	/139.3	DQ14 15	A13.6	A13.7 16 DQ15	/134.8	Reset the smoke detectors
		24VDC L+		M 0VDC		

+CTRL_1.3-DO_03

/120.5

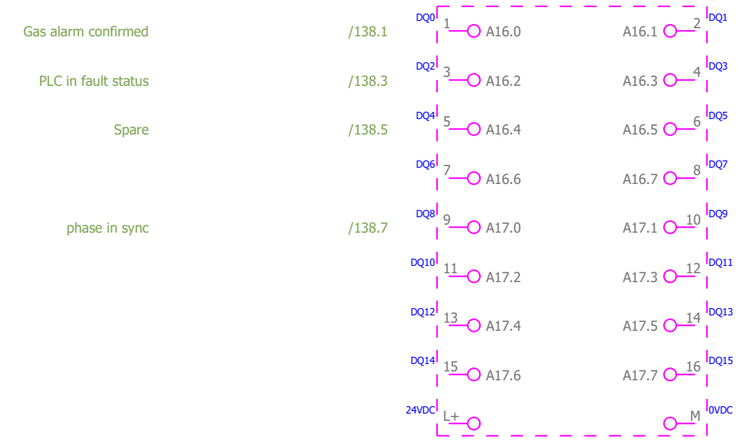
SUBSYSTEM 3_1 CONTACTOR DC+ ON	/350.1	DQ0 1	A14.0	A14.1 2 DQ1	/350.3	SUBSYSTEM 3_1 CONTACTOR DC-ON
		DQ2 3	A14.2	A14.3 4 DQ3		
SUBSYSTEM 3_3 CONTACTOR DC+ ON	/351.4	DQ4 5	A14.4	A14.5 6 DQ5	/351.5	SUBSYSTEM 3_3 CONTACTOR DC-ON
SUBSYSTEM 4_1 CONTACTOR DC+ ON	/352.0	DQ6 7	A14.6	A14.7 8 DQ7	/352.2	SUBSYSTEM 4_1 CONTACTOR DC-ON
SUBSYSTEM 4_2 CONTACTOR DC+ ON	/353.0	DQ8 9	A15.0	A15.1 10 DQ9	/353.2	SUBSYSTEM 4_2 CONTACTOR DC-ON
SUBSYSTEM 4_3 CONTACTOR DC+ ON	/353.3	DQ10 11	A15.2	A15.3 12 DQ11	/353.5	SUBSYSTEM 4_3 CONTACTOR DC-ON
		DQ12 13	A15.4	A15.5 14 DQ13		
		DQ14 15	A15.6	A15.7 16 DQ15		
		24VDC L+		M 0VDC		

previous page: 122

next page: 123.a

+CTRL_1.3-DO_04

/120.6



previous page: 123

next page: 124

Editor	Freqcon_JD			Statron	FREQCON	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 123.a
Date								+	total: 492

+CTRL_1.3-AI_01

/120.6

INDUCTOR GRID PHASE L1 TEMPERATURE 1_1	/145.1	M0+	1	PIW150	PIW152	2	M1+	/145.3	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3	/145.5	M2+	3	PIW154	PIW156	4	M3+	/145.7	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2	/146.1	M4+	5	PIW158	PIW160	6	M5+	/146.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1	/146.5	M6+	7	PIW162	PIW164	8	M7+	/146.7	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2
INDUCTOR GRID PHASE L1 TEMPERATURE 1_1	/145.1	M0-	9	PIW150	PIW152	10	M1-	/145.3	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3	/145.5	M2-	11	PIW154	PIW156	12	M3-	/145.7	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2	/146.1	M4-	13	PIW158	PIW160	14	M5-	/146.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1	/146.5	M6-	15	PIW162	PIW164	16	M7-	/146.7	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2
	/120.6	24VDC	L+		M	0VDC		/120.6	

+CTRL_1.3-AI_02

/120.6

INDUCTOR DC SUB 3_3 TEMPERATURE 3_3	/147.1	M0+	1	PIW166	PIW168	2	M1+	/147.3	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1
CONTROL CABINET TEMPERATURE	/147.5	M2+	3	PIW170	PIW172	4	M3+	/147.7	CONVERTER CABINET TEMPERATURE
COOLING WATER TEMPERATURE	/148.1	M4+	5	PIW174	PIW176	6	M5+	/148.3	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2
CIR CABINET TEMPERATURE	/148.5	M6+	7	PIW178	PIW180	8	M7+	/148.7	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3	/147.1	M0-	9	PIW166	PIW168	10	M1-	/147.3	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1
CONTROL CABINET TEMPERATURE	/147.5	M2-	11	PIW170	PIW172	12	M3-	/147.7	CONVERTER CABINET TEMPERATURE
COOLING WATER TEMPERATURE	/148.1	M4-	13	PIW174	PIW176	14	M5-	/148.3	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2
CIR CABINET TEMPERATURE	/148.5	M6-	15	PIW178	PIW180	16	M7-	/148.7	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3
		24VDC	L+		M	0VDC			

+CTRL_1.3-AI_03

/120.7

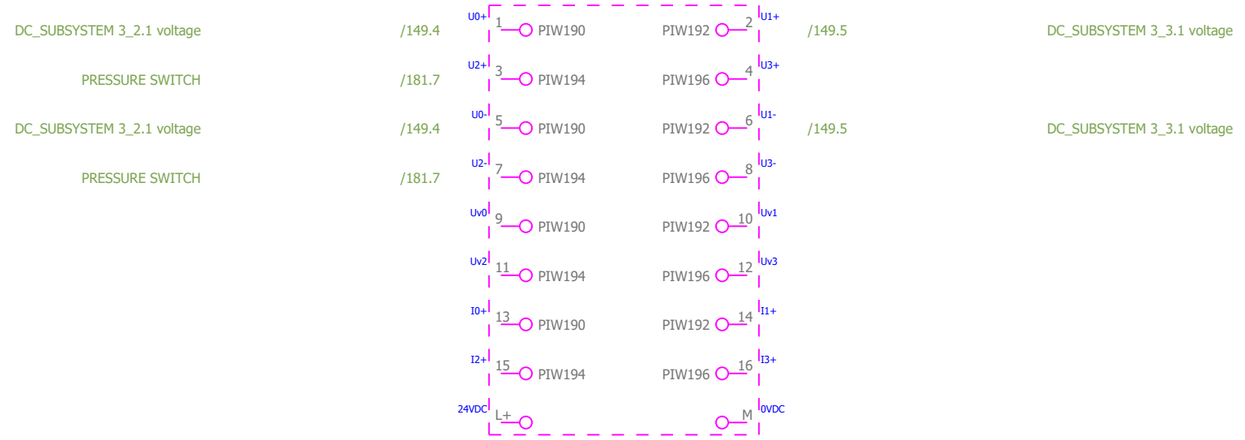
DC_SUBSYSTEM 2_1.1 voltage	/149.0	U0+	1	PIW182	PIW184	2	U1+	/149.1	DC_SUBSYSTEM 2_2.1 voltage
DC_SUBSYSTEM 2_3.1 voltage	/149.2	U2+	3	PIW186	PIW188	4	U3+	/149.3	DC_SUBSYSTEM 3_1.1 voltage
DC_SUBSYSTEM 2_1.1 voltage	/149.0	U0-	5	PIW182	PIW184	6	U1-	/149.1	DC_SUBSYSTEM 2_2.1 voltage
DC_SUBSYSTEM 2_3.1 voltage	/149.2	U2-	7	PIW186	PIW188	8	U3-	/149.3	DC_SUBSYSTEM 3_1.1 voltage
		Uv0	9	PIW182	PIW184	10	Uv1		
		Uv2	11	PIW186	PIW188	12	Uv3		
		I0+	13	PIW182	PIW184	14	I1+		
		I2+	15	PIW186	PIW188	16	I3+		
		24VDC	L+		M	0VDC			

previous page: 123.a

next page: 125

+CTRL_1.3-AI_04

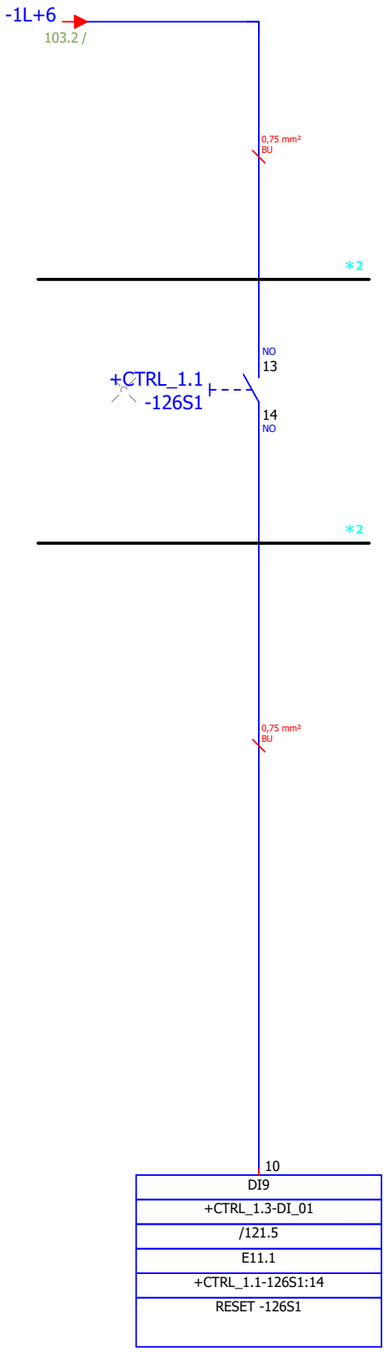
/120.7



previous page: 124

next page: 126

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_04	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 125
Date								+	total: 492



RESET
-126S1

*2
The single conductor
must be placed
in the protective tube

previous page:
125

next page:
127

Editor	Freqcon_JD			Statron	FREQCON	INPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	02.07.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 126
Date								+		total: 492

EC

3WL

++CONV

-CB1_TRIPPED / ++CONV/80.8

-CB1_ON_FB / ++CONV/80.7

-CB1_OFF_FB / ++CONV/80.7

-1F2 / ++CONV/78.9

-4L+5.4 / ++CONV/238a.2

-80W1
OZ-500
8x0,75 mm²

-238W7
OZ-500
2x0,75 mm²

-24V_Signal / 189.5

-4L+5.3 / 134.0

84F1_OK / 84.9

+CTRL_1.3
-X3

fB

bridge

0,75 mm² BU

-4L+5 / 103.8

-4L+5.1 / 128.5

DI14	DI2	DI3	DI5
+CTRL_1.3-DI_02	+CTRL_1.3-DI_02		
/121.4	/121.4	/121.5	/121.5
E12.4	E12.2	E12.3	E12.5
++CONV+CIR-80Q1:X7_13	++CONV+CIR-80Q1:X6_11	++CONV+CIR-80Q1:X6_9	++CONV+AC_DC-78F1:13
CB 1 Tripped GRID	CB 1 ON GRID	CB 1 OFF GRID	FUSE AND LIGHTNING PROTECTION

DI5
+CTRL_1.3-DI_01
/121.5
E10.5
+CTRL_1.3-84F1:12
LIGHTNING PROTECTION in Control Cabinet OPTIONAL

Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 1 Tripped GRID

CB 1 ON GRID

CB 1 OFF GRID

FUSE AND LIGHTNING PROTECTION

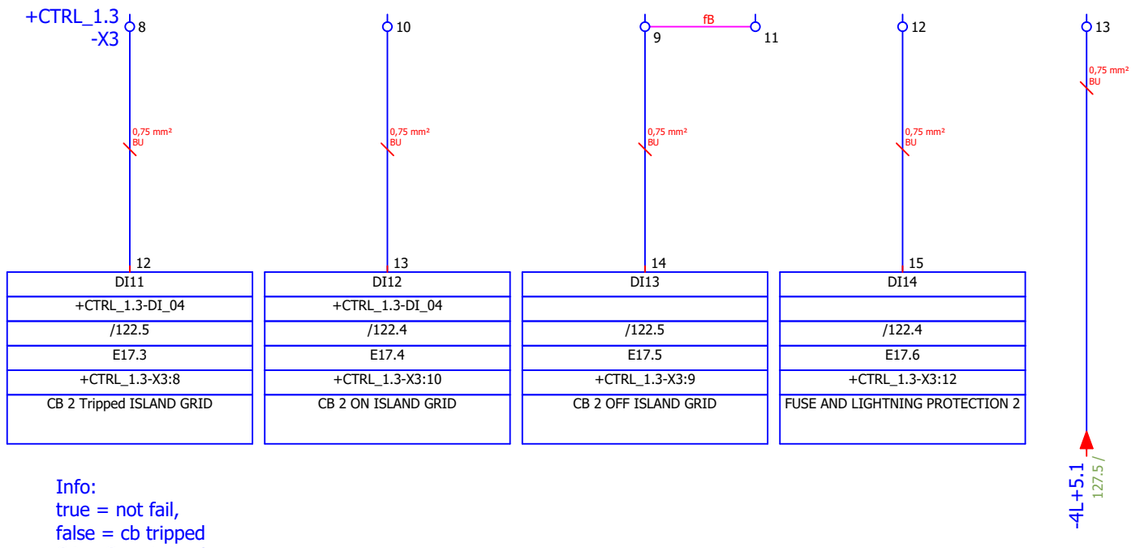
LIGHTNING PROTECTION in Control Cabinet OPTIONAL

previous page: 126

next page: 128

Editor	Freqcon_JD			Statron		DIGITAL INPUTS CB 1	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

0	1	2	3	4	5	6	7	8	9



Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 2 Tripped ISLAND GRID

CB 2 ON ISLAND GRID

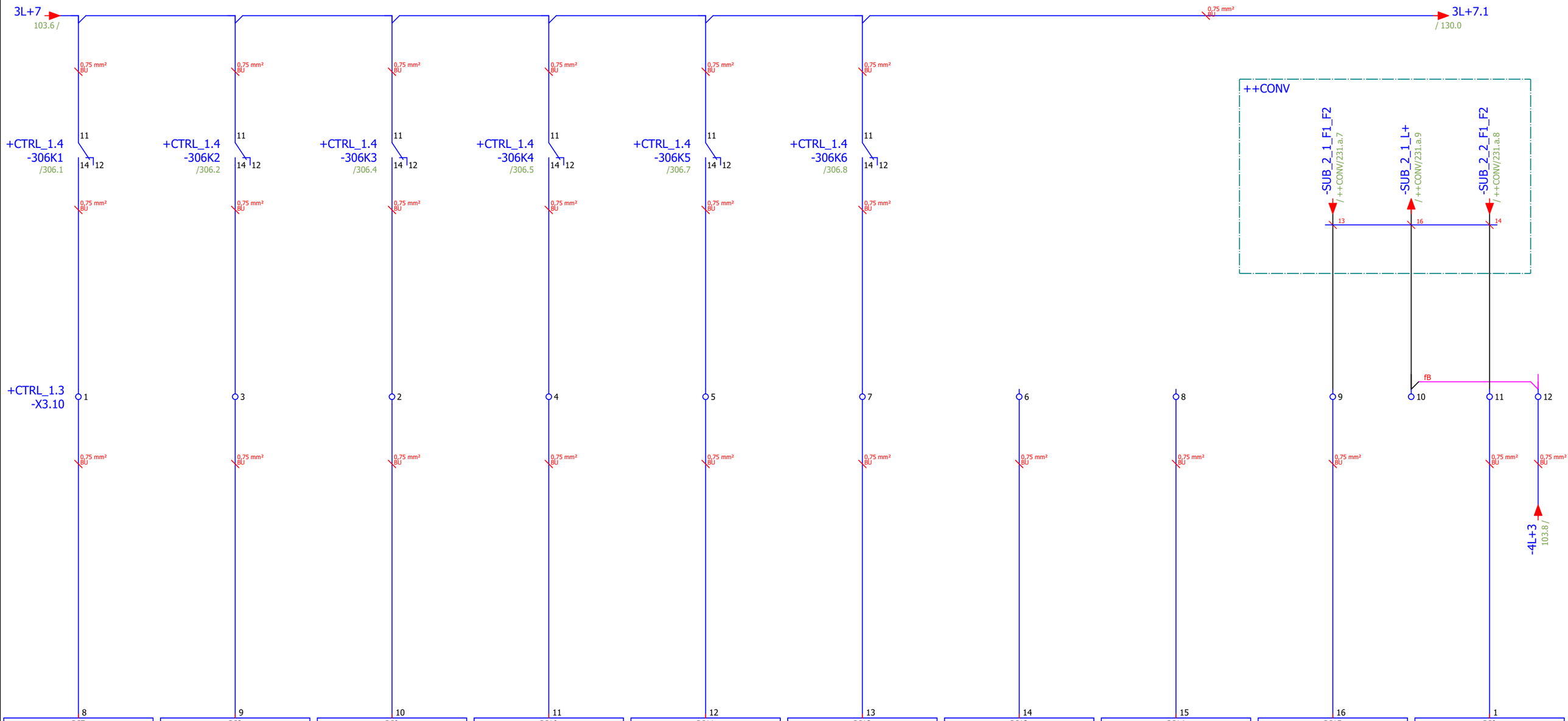
CB 2 OFF ISLAND GRID

FUSE AND LIGHTNING PROTECTION 2

previous page: 127

next page: 129

Editor	Freqcon_JD			Statron		DIGITAL INPUTS CB 2	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 128
Date								+	total: 492



8	9	10	11	12	13	14	15	16	1
DI7	DI8	DI9	DI10	DI11	DI12	DI13	DI14	DI15	DI0
+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_03
/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4
E12.7	E13.0	E13.1	E13.2	E13.3	E13.4	E13.5	E13.6	E13.7	E14.0
+CTRL_1.4-306K1:14	+CTRL_1.4-306K2:14	+CTRL_1.4-306K3:14	+CTRL_1.4-306K4:14	+CTRL_1.4-306K5:14	+CTRL_1.4-306K6:14	+CTRL_1.3-X3.10:6	+CTRL_1.3-X3.10:8	++CONV+CIR-231U1-F1:2	++CONV+CIR-231U1-F5:2
SUBSYSTEM 2_1_DC + Contactor K1 is on	SUBSYSTEM 2_1_DC -Contactor K7 is on	SUBSYSTEM 2_2_DC + Contactor K2 is on	SUBSYSTEM 2_2_DC -Contactor K8 is on	SUBSYSTEM 2_3_DC + Contactor K3 is on	SUBSYSTEM 2_3_DC -Contactor K9 is on	SUBSYSTEM 2_3_DC + SPARE	SUBSYSTEM 2_DC -SPARE	SUBSYSTEM 2_1_DC FUSE OK	SUBSYSTEM 2_2_DC FUSE OK

Feedback of DC Contactors

SUBSYSTEM 2_1_DC + Contactor K1 is on

SUBSYSTEM 2_1_DC - Contactor K7 is on

SUBSYSTEM 2_2_DC + Contactor K2 is on

SUBSYSTEM 2_2_DC - Contactor K8 is on

SUBSYSTEM 2_3_DC + Contactor K3 is on

SUBSYSTEM 2_3_DC - Contactor K9 is on

SUBSYSTEM 2_3_DC + SPARE

SUBSYSTEM 2_DC - SPARE

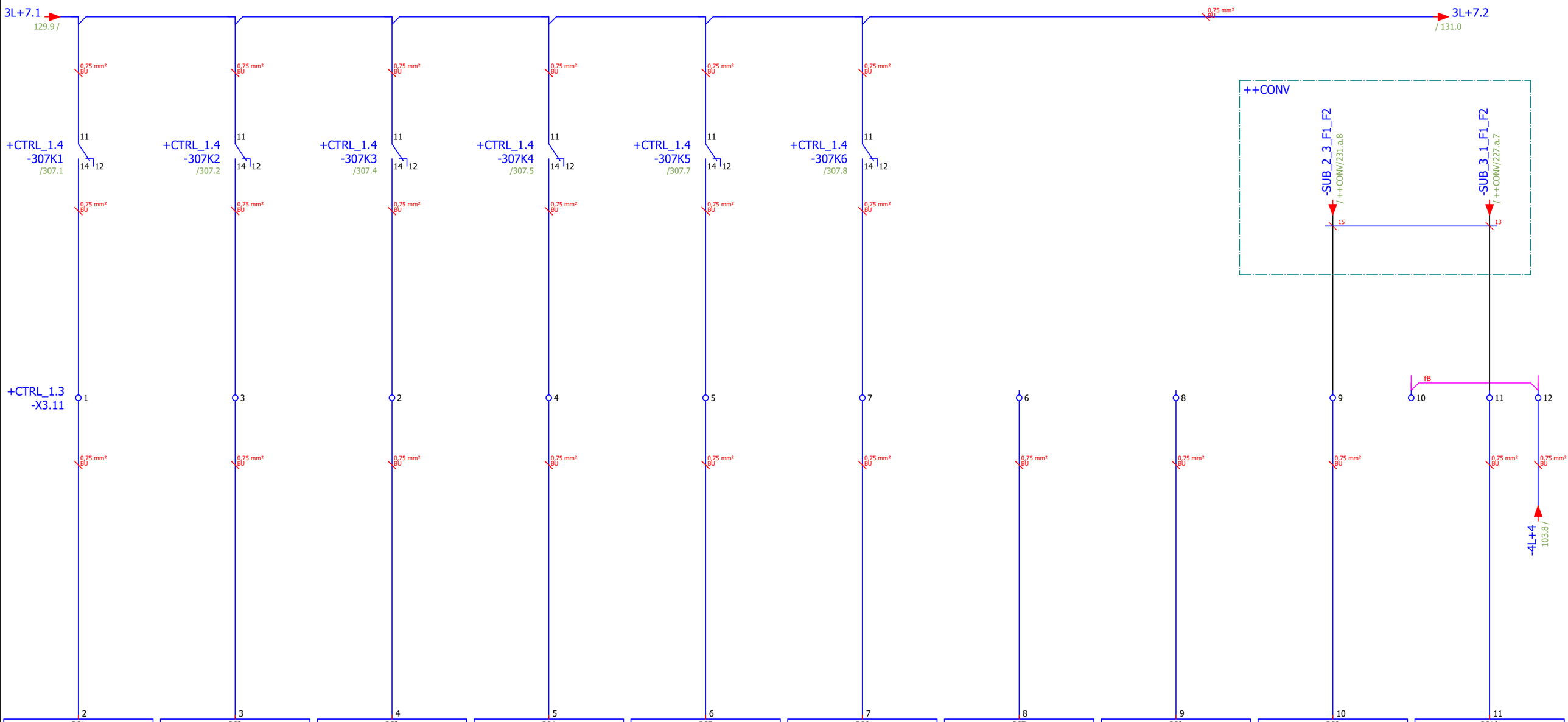
SUBSYSTEM 2_1_DC FUSE OK

SUBSYSTEM 2_2_DC FUSE OK

previous page: 128

next page: 130

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 129
Date								+ total: 492



2	3	4	5	6	7	8	9	10	11
DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	DI9	DI10
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03
/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4
E14.1	E14.2	E14.3	E14.4	E14.5	E14.6	E14.7	E15.0	E15.1	E15.2
+CTRL_1.4-307K1:14	+CTRL_1.4-307K2:14	+CTRL_1.4-307K3:14	+CTRL_1.4-307K4:14	+CTRL_1.4-307K5:14	+CTRL_1.4-307K6:14	+CTRL_1.3-X3.11:6	+CTRL_1.3-X3.11:8	++CONV+CIR-231U1-F9:2	++CONV+CIR-227U1-F1:2
SUBSYSTEM 3_1_DC + Contactor K1 is on	SUBSYSTEM 3_1_DC -Contactor K7 is on	SUBSYSTEM 3_2_DC + Contactor K2 is on	SUBSYSTEM 3_2_DC -Contactor K8 is on	SUBSYSTEM 3_3_DC + Contactor K3 is on	SUBSYSTEM 3_3_DC -Contactor K9 is on	SUBSYSTEM 3_DC + SPARE	SUBSYSTEM 3_DC -SPARE	SUBSYSTEM 2_DC FUSE OK	SUBSYSTEM 3_1_DC FUSE OK

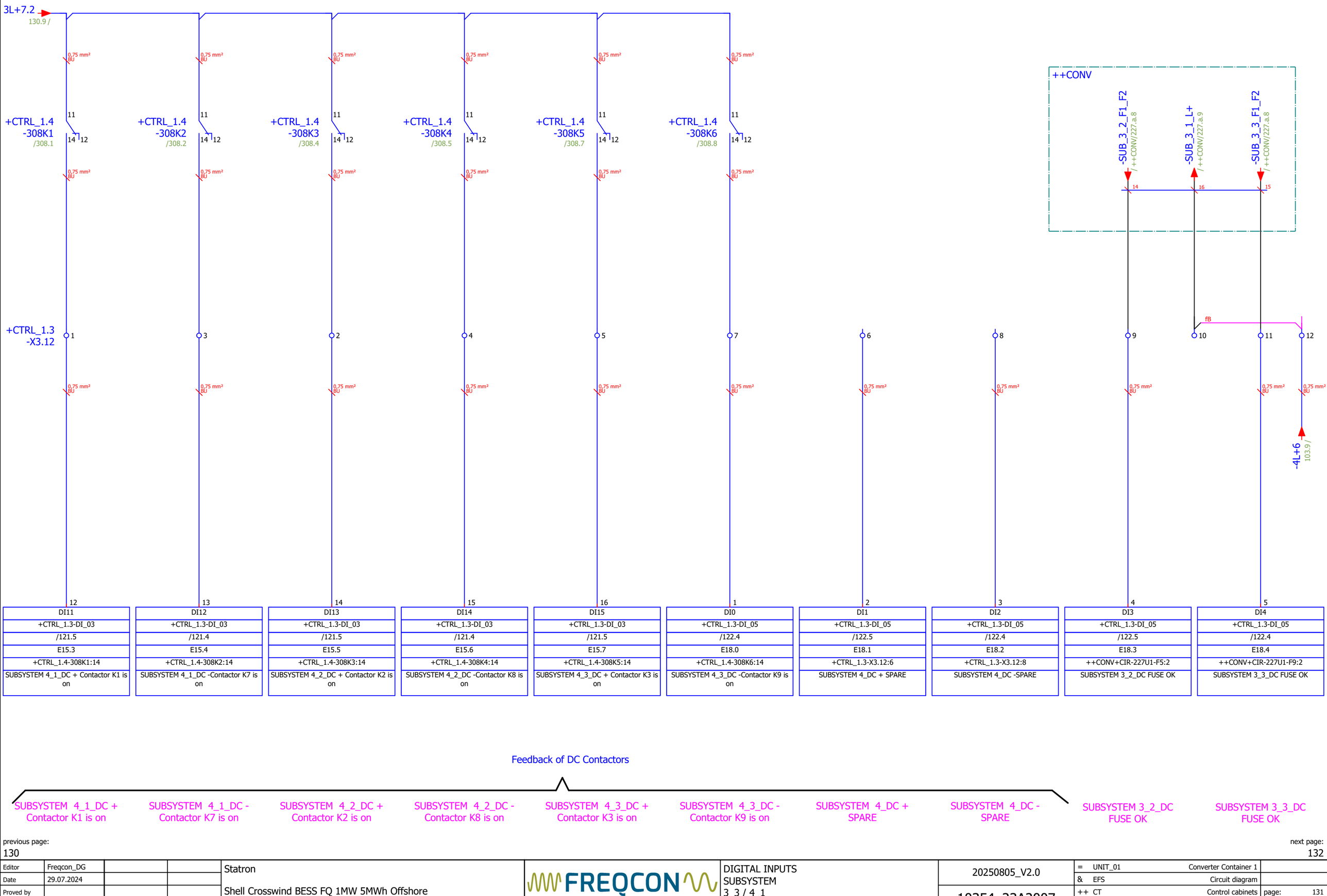
Feedback of DC Contactors

SUBSYSTEM 3_1_DC + Contactor K1 is on | SUBSYSTEM 3_1_DC - Contactor K7 is on | SUBSYSTEM 3_2_DC + Contactor K2 is on | SUBSYSTEM 3_2_DC - Contactor K8 is on | SUBSYSTEM 3_3_DC + Contactor K3 is on | SUBSYSTEM 3_3_DC - Contactor K9 is on | SUBSYSTEM 3_DC + SPARE | SUBSYSTEM 3_DC - SPARE | SUBSYSTEM 2_DC FUSE OK | SUBSYSTEM 3_1_DC FUSE OK

previous page: 129

next page: 131

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 130
Date								+ total: 492



12	13	14	15	16	1	2	3	4	5
DI11	DI12	DI13	DI14	DI15	DI0	DI1	DI2	DI3	DI4
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05
/121.5	/121.4	/121.5	/121.4	/121.5	/122.4	/122.5	/122.4	/122.5	/122.4
E15.3	E15.4	E15.5	E15.6	E15.7	E18.0	E18.1	E18.2	E18.3	E18.4
+CTRL_1.4-308K1:14	+CTRL_1.4-308K2:14	+CTRL_1.4-308K3:14	+CTRL_1.4-308K4:14	+CTRL_1.4-308K5:14	+CTRL_1.4-308K6:14	+CTRL_1.3-X3.12:6	+CTRL_1.3-X3.12:8	++CONV+CIR-227U1-F5:2	++CONV+CIR-227U1-F9:2
SUBSYSTEM 4_1_DC + Contactor K1 is on	SUBSYSTEM 4_1_DC -Contactor K7 is on	SUBSYSTEM 4_2_DC + Contactor K2 is on	SUBSYSTEM 4_2_DC -Contactor K8 is on	SUBSYSTEM 4_3_DC + Contactor K3 is on	SUBSYSTEM 4_3_DC -Contactor K9 is on	SUBSYSTEM 4_DC + SPARE	SUBSYSTEM 4_DC -SPARE	SUBSYSTEM 3_2_DC FUSE OK	SUBSYSTEM 3_3_DC FUSE OK

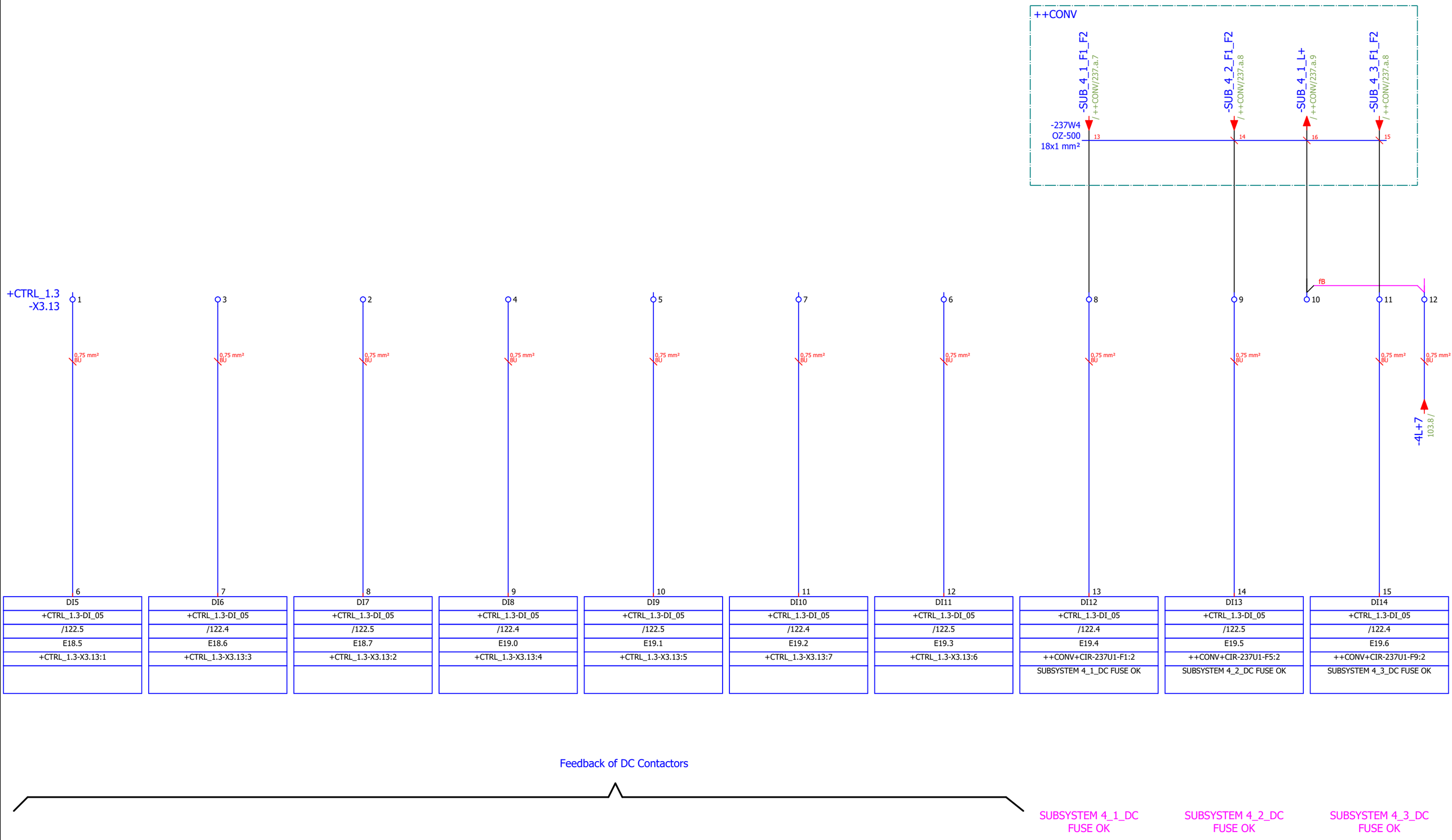
Feedback of DC Contactors

SUBSYSTEM 4_1_DC + Contactor K1 is on | SUBSYSTEM 4_1_DC - Contactor K7 is on | SUBSYSTEM 4_2_DC + Contactor K2 is on | SUBSYSTEM 4_2_DC - Contactor K8 is on | SUBSYSTEM 4_3_DC + Contactor K3 is on | SUBSYSTEM 4_3_DC - Contactor K9 is on | SUBSYSTEM 4_DC + SPARE | SUBSYSTEM 4_DC - SPARE | SUBSYSTEM 3_2_DC FUSE OK | SUBSYSTEM 3_3_DC FUSE OK

previous page: 130

next page: 132

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 131
Date								+ total: 492



Feedback of DC Contactors

SUBSYSTEM 4_1_DC FUSE OK

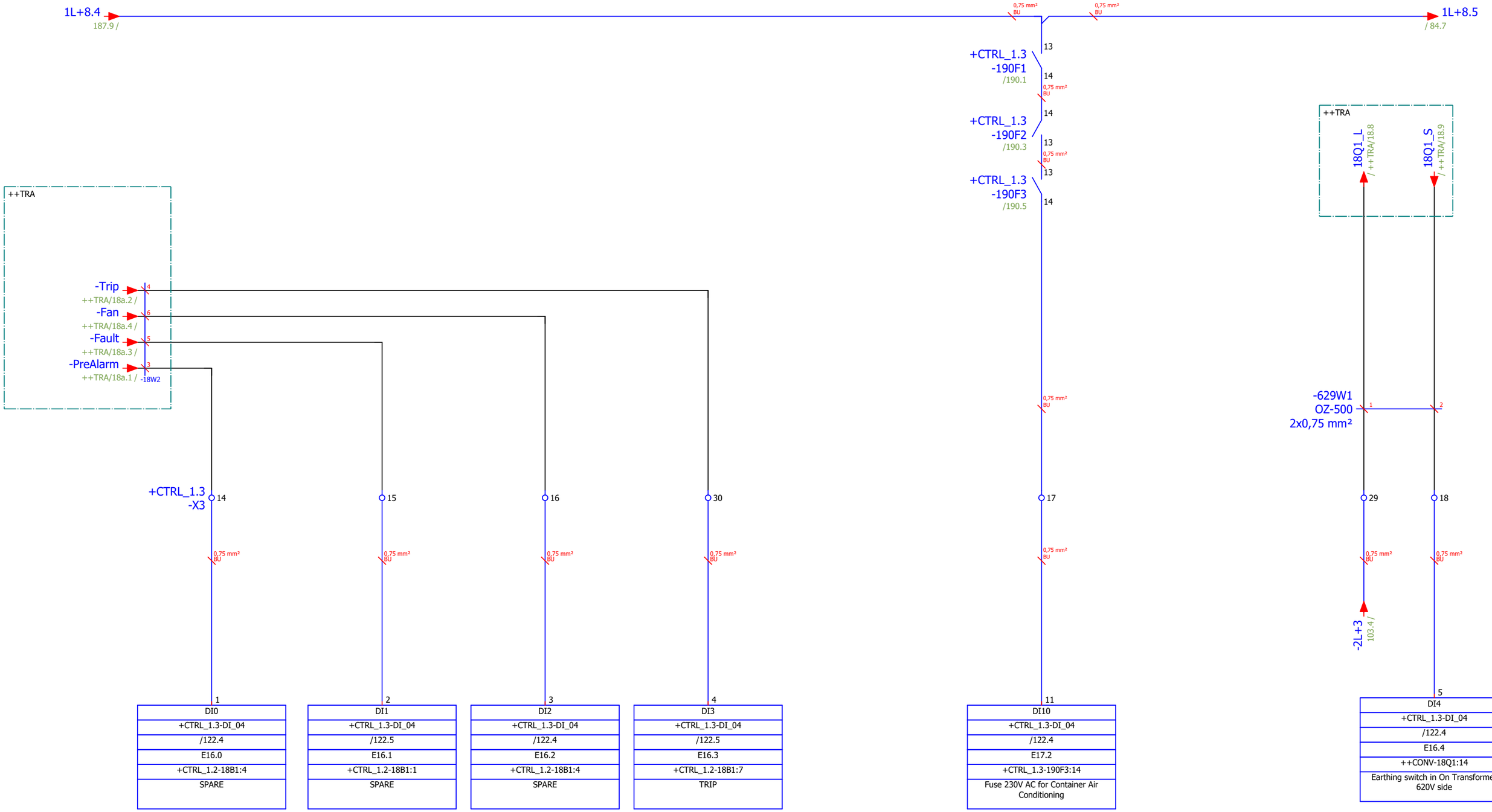
SUBSYSTEM 4_2_DC FUSE OK

SUBSYSTEM 4_3_DC FUSE OK

previous page: 131

next page: 133

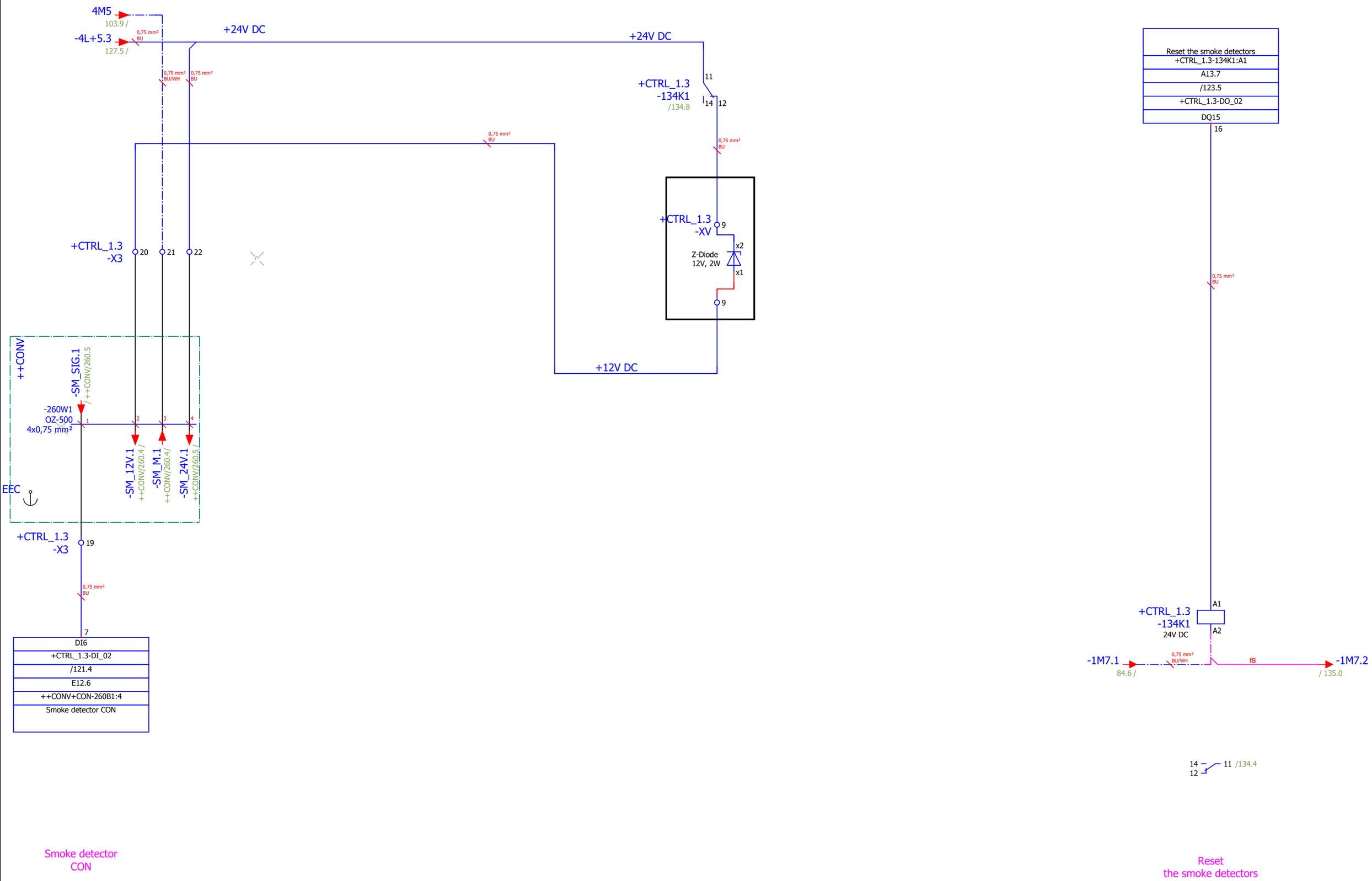
Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 132
Date								+	total: 492



previous page: 132

next page: 134

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SPARE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 133
Date								+	total: 492



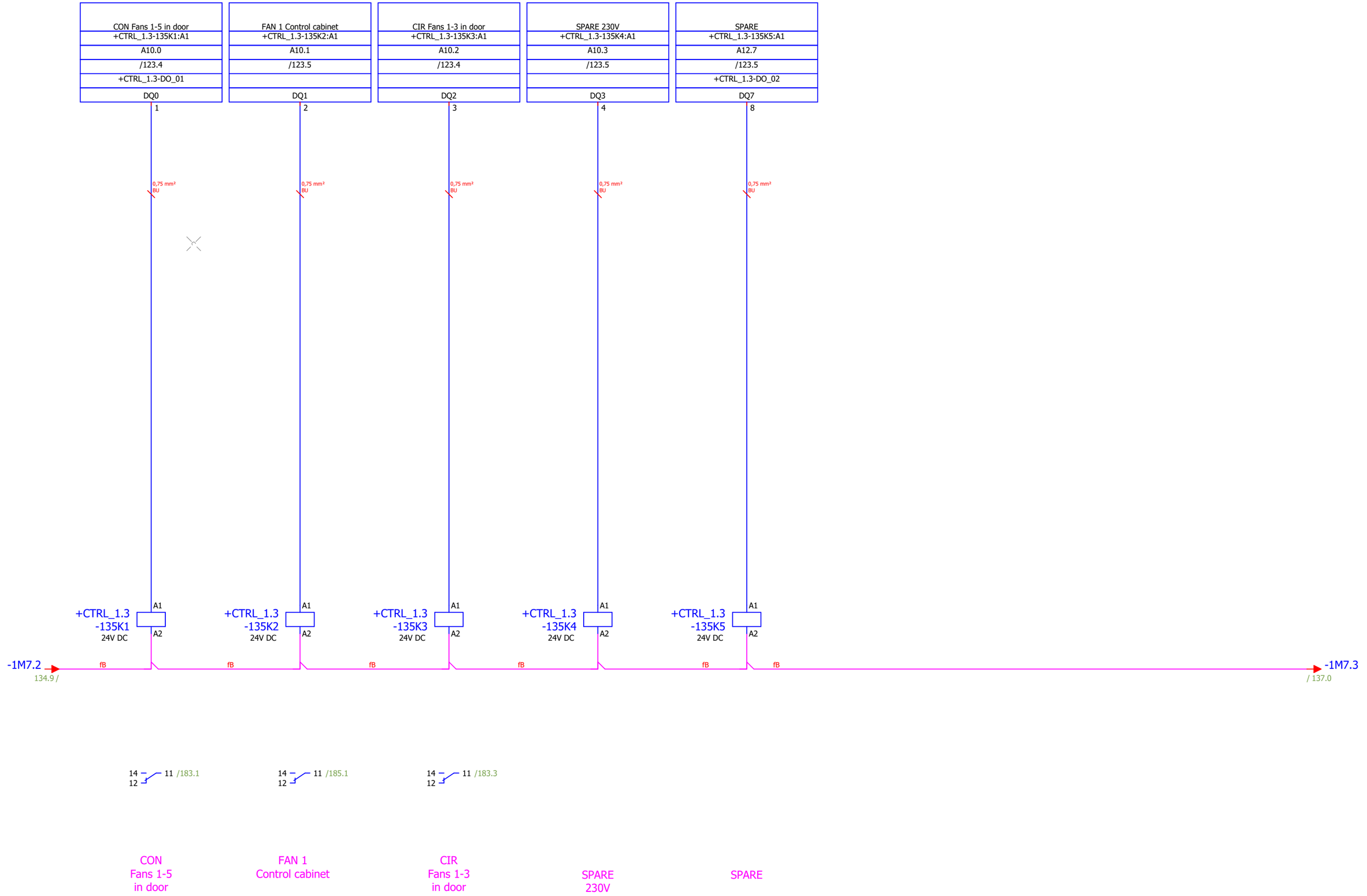
previous page:
133

next page:
135

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SMOKE DETECTORS	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

page: 134
total: 492

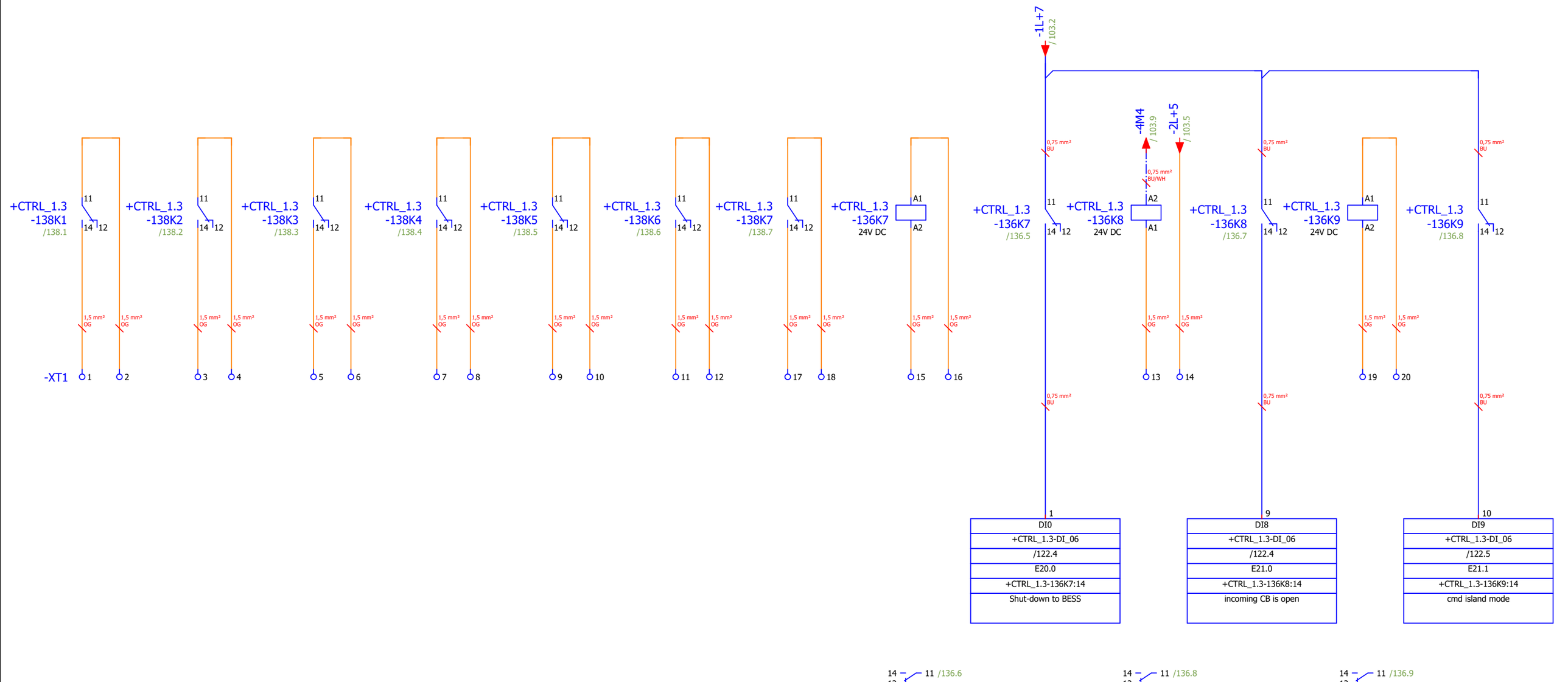
0	1	2	3	4	5	6	7	8	9



previous page: 134

next page: 136

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FAN	20250805_V2.0	= UNIT_01	Converter Container 1
Date	19.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 135
Date								+	total: 492

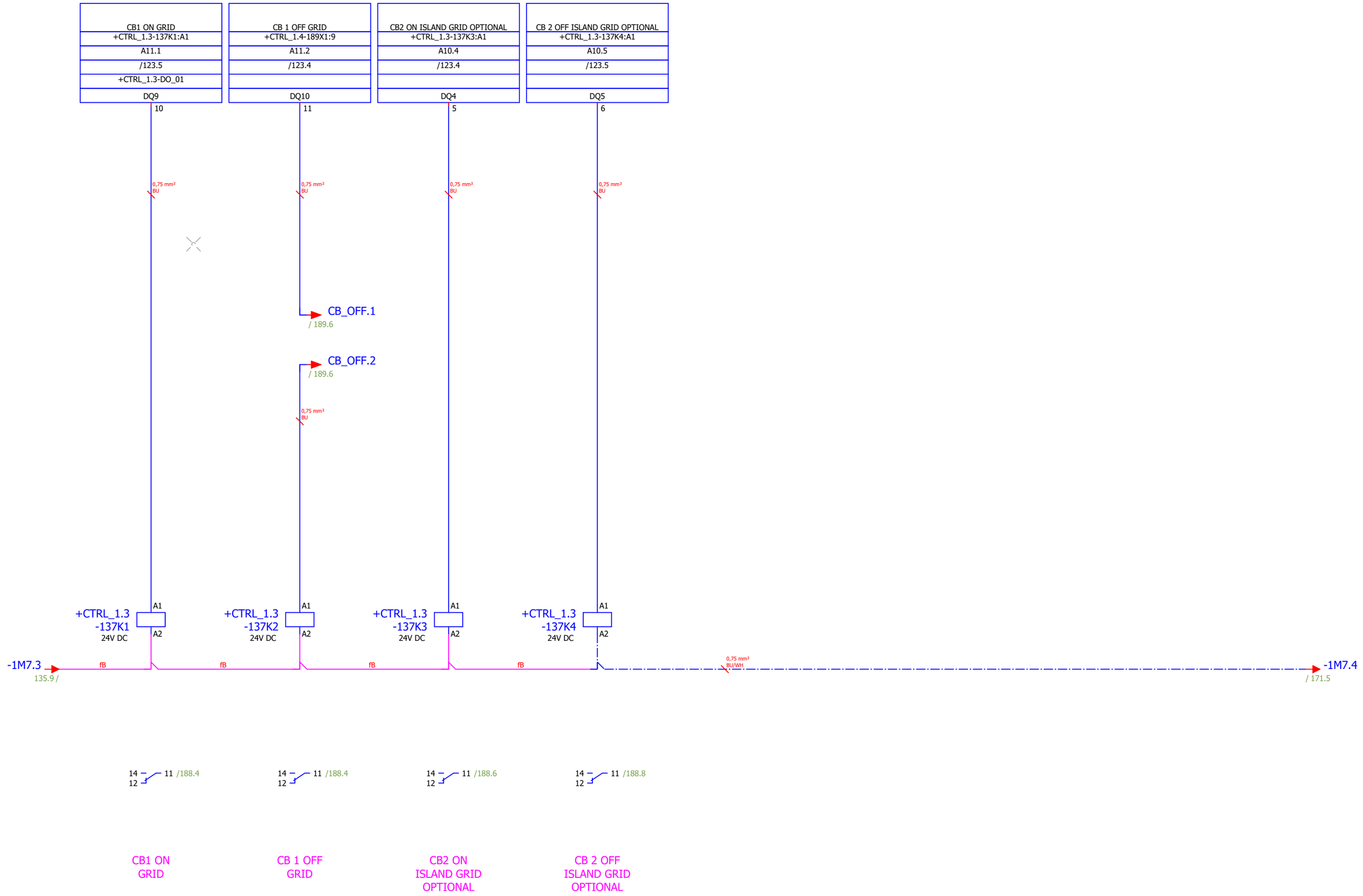


Gas confirmed FGS	Smoke confirmed FGS	PLC fault status SIS	Thermal runaway SIS	Spare	Spare	phase in sync	Shut-down to BESS	Shut-down to BESS	incoming CB is open	incoming CB is open	cmd island mode	cmd island mode

previous page: 135

next page: 137

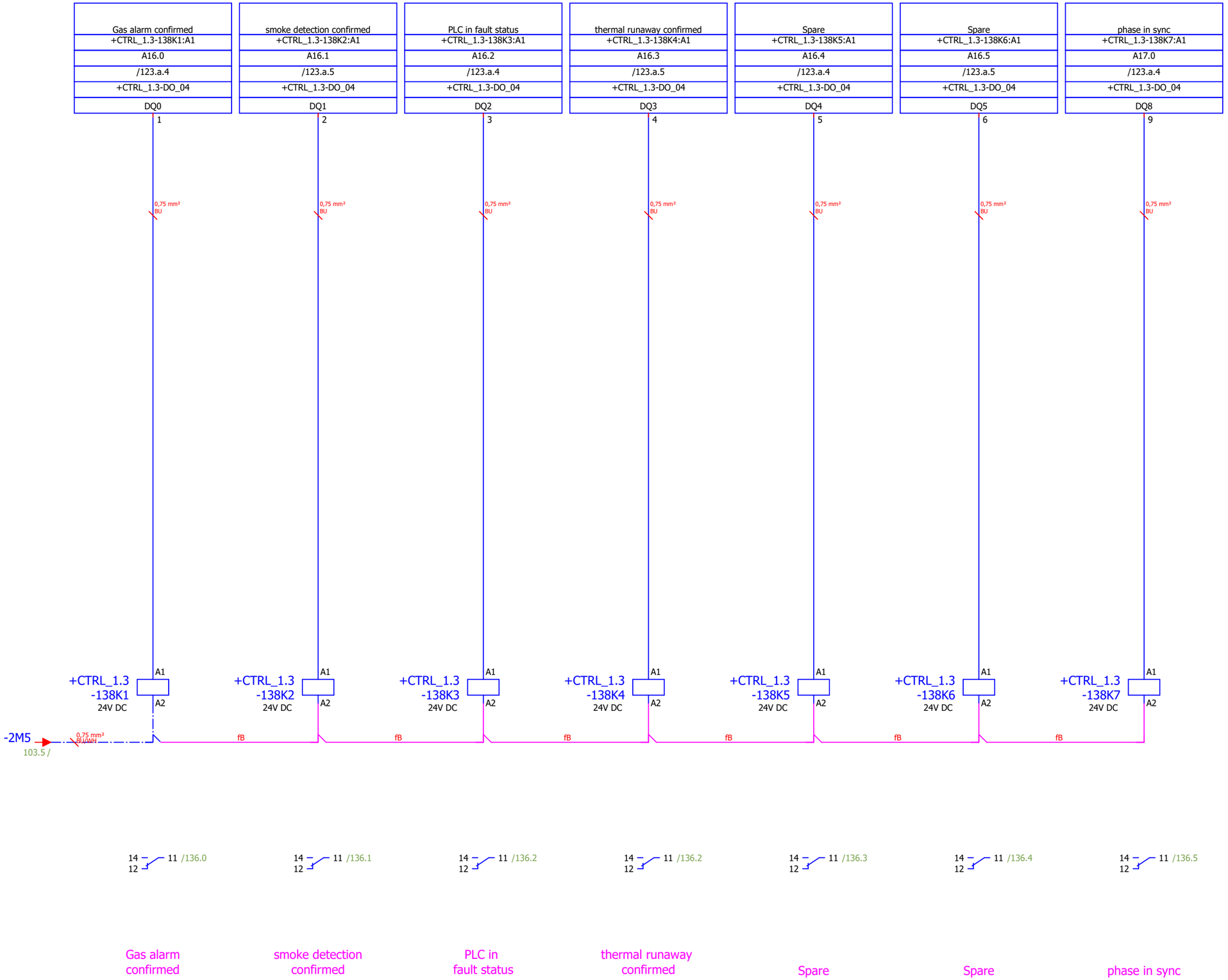
Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 136
Date								+	total: 492



previous page: 136

next page: 138

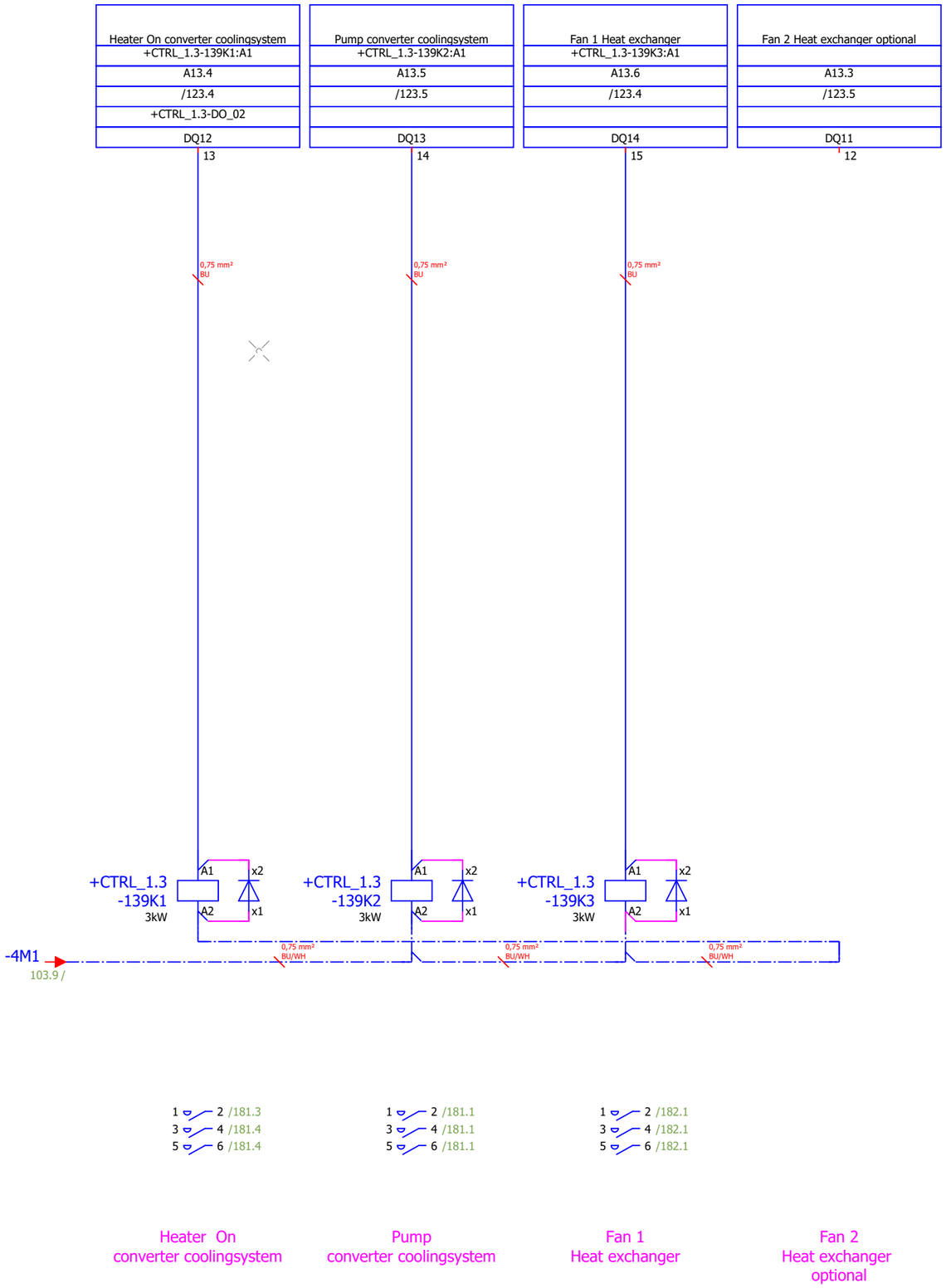
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CIRCUIT BREAKER	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 137
Date								+	total: 492



previous page: 137

next page: 139

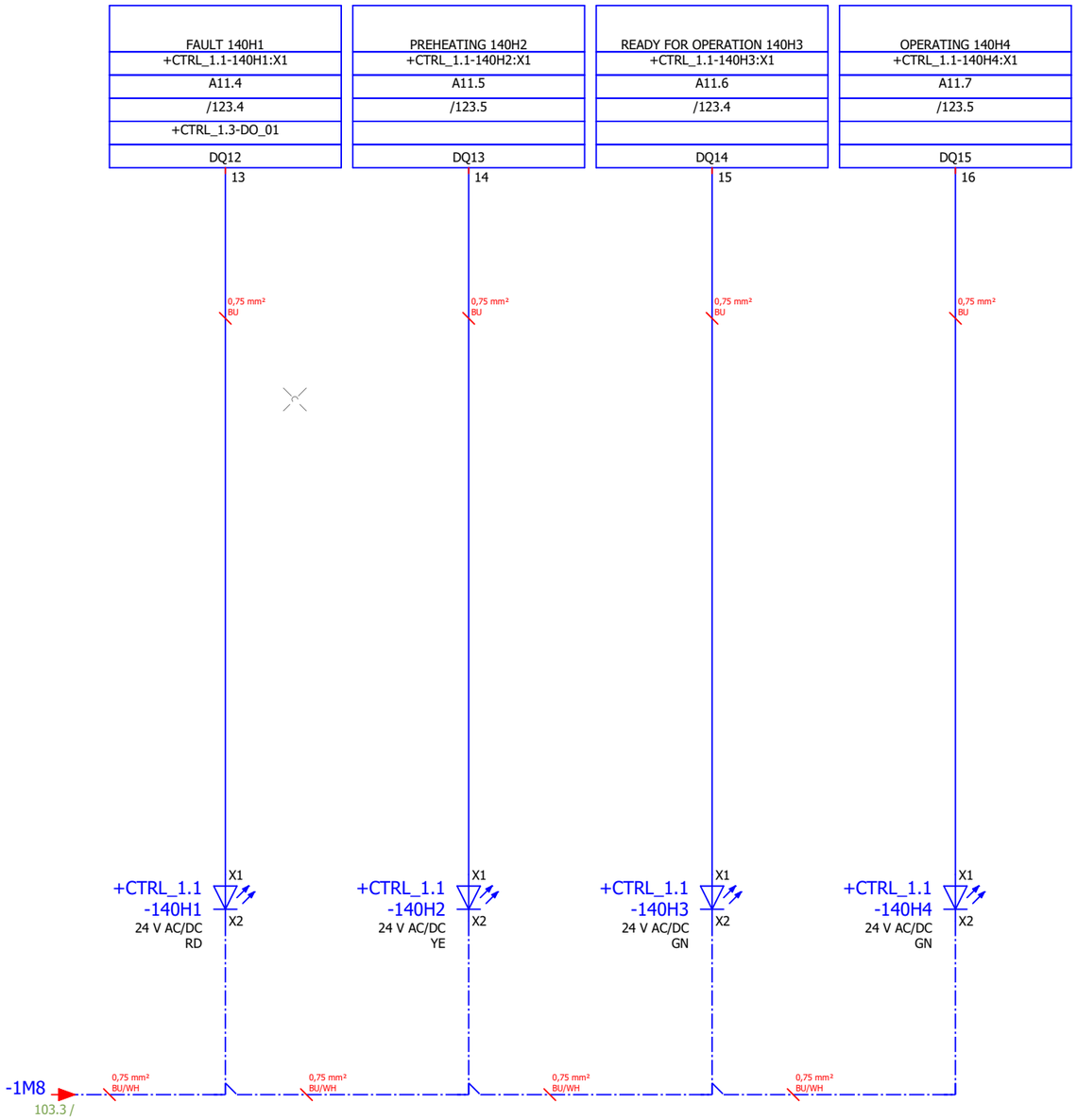
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	03.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 138
Date								+	total: 492



previous page:
138

next page:
140

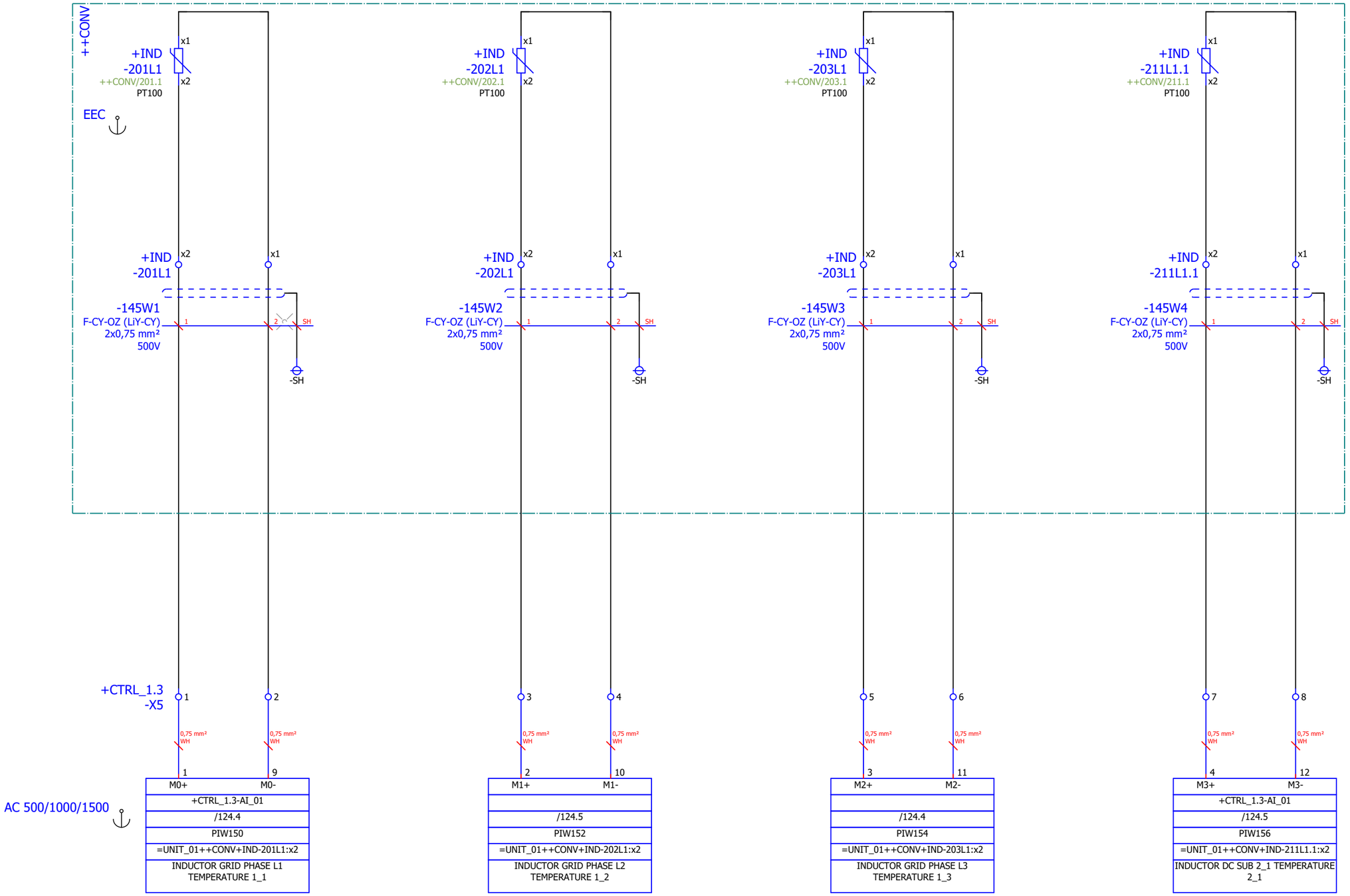
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COOLING	20250805_V2.0	= UNIT_01	Converter Container 1
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 139
Date								+	total: 492



previous page: 139

next page: 145

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	14.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 140
Date								+		total: 492



INDUCTOR
GRID PHASE L1
TEMPERATURE 1_1

INDUCTOR
GRID PHASE L2
TEMPERATURE 1_2

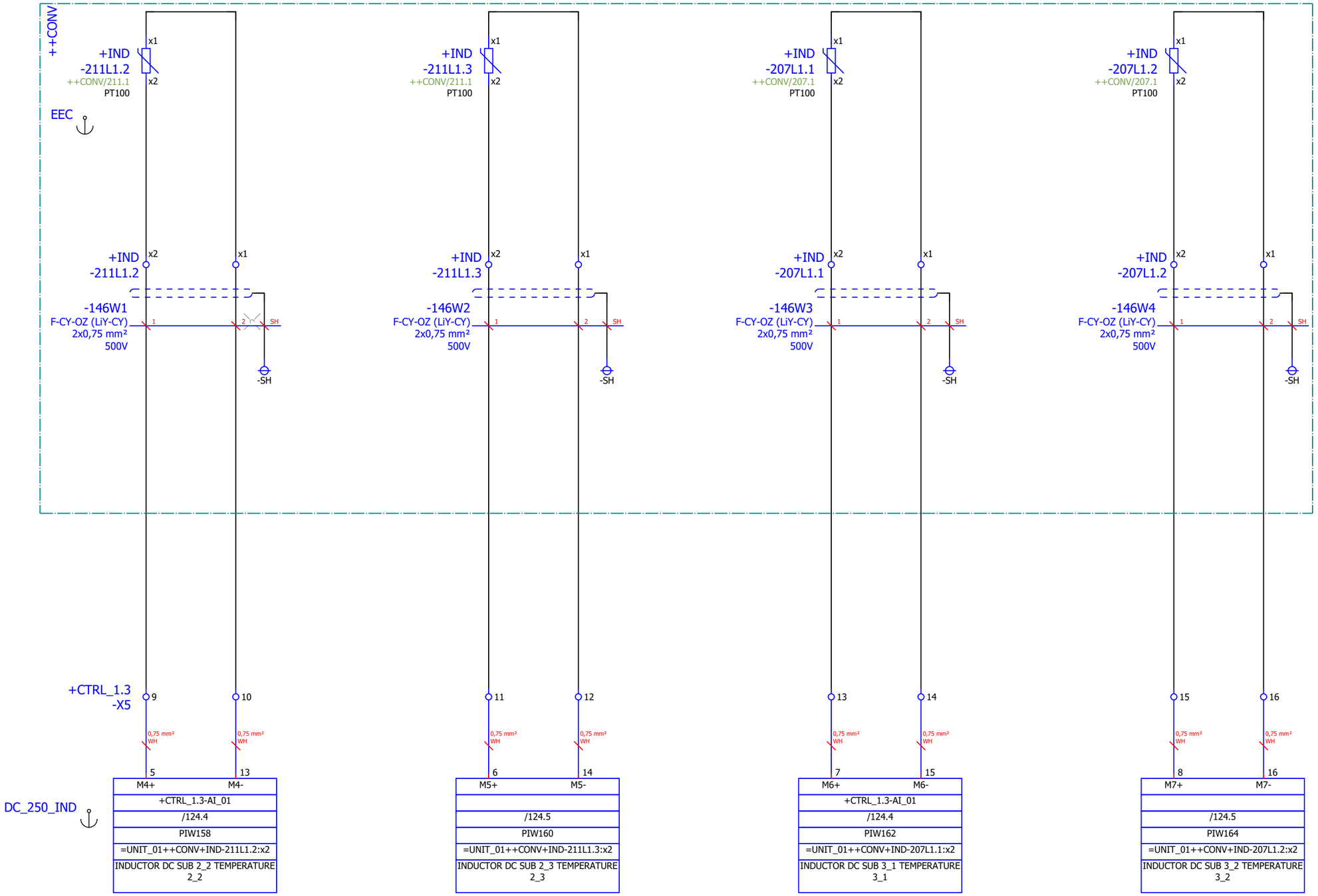
INDUCTOR
GRID PHASE L3
TEMPERATURE 1_3

INDUCTOR
DC SUB 2_1
TEMPERATURE 2_1

previous page:
140

next page:
146

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	14.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 145
Date								+		total: 492



INDUCTOR
DC SUB 2_2
TEMPERATURE 2_2

INDUCTOR
DC SUB 2_3
TEMPERATURE 2_3

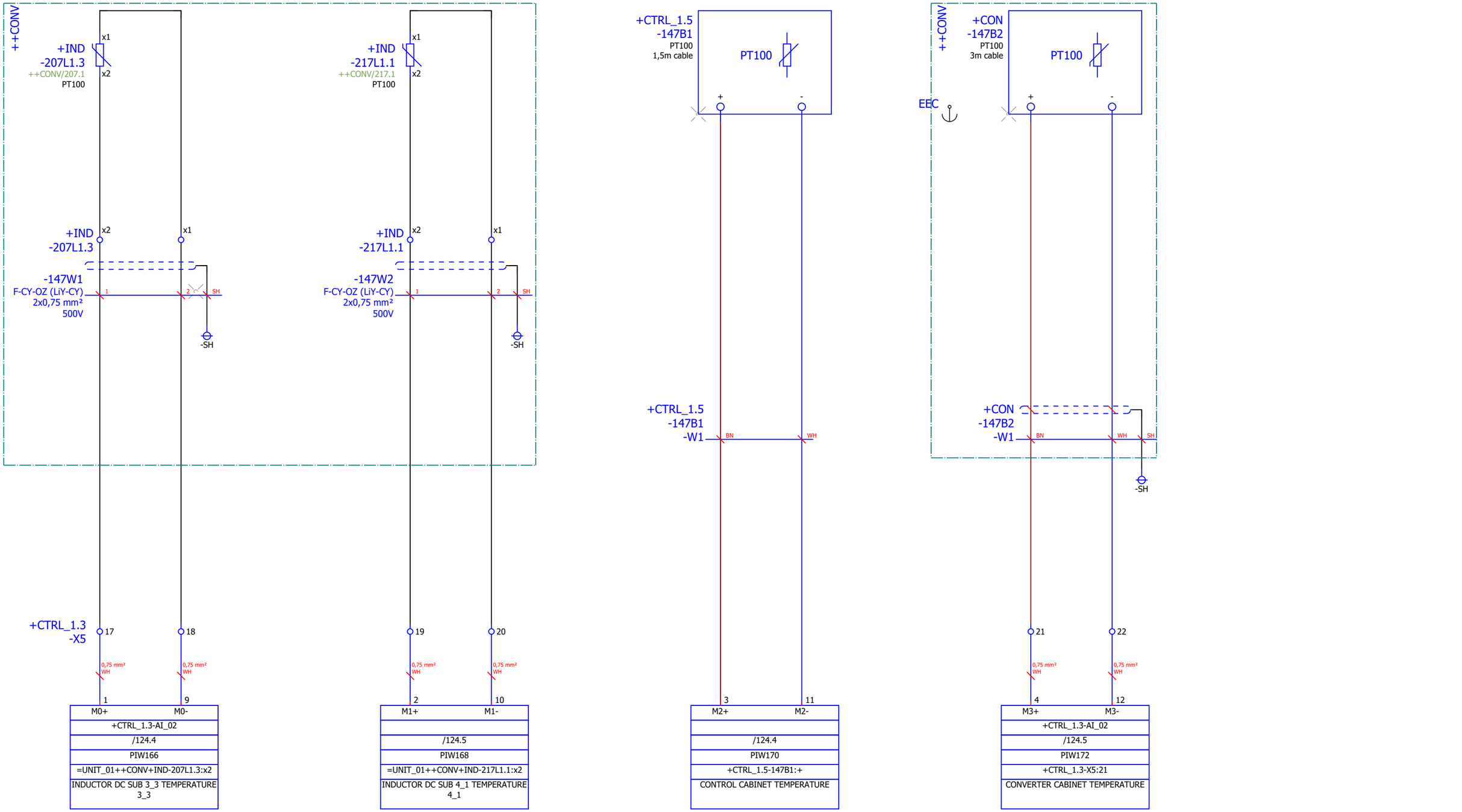
INDUCTOR
DC SUB 3_1
TEMPERATURE 3_1

INDUCTOR
DC SUB 3_2
TEMPERATURE 3_2

previous page: 145

next page: 147

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 146
Date								+		total: 492



INDUCTOR DC SUB 3_3 TEMPERATURE 3_3

INDUCTOR DC SUB 4_1 TEMPERATURE 4_1

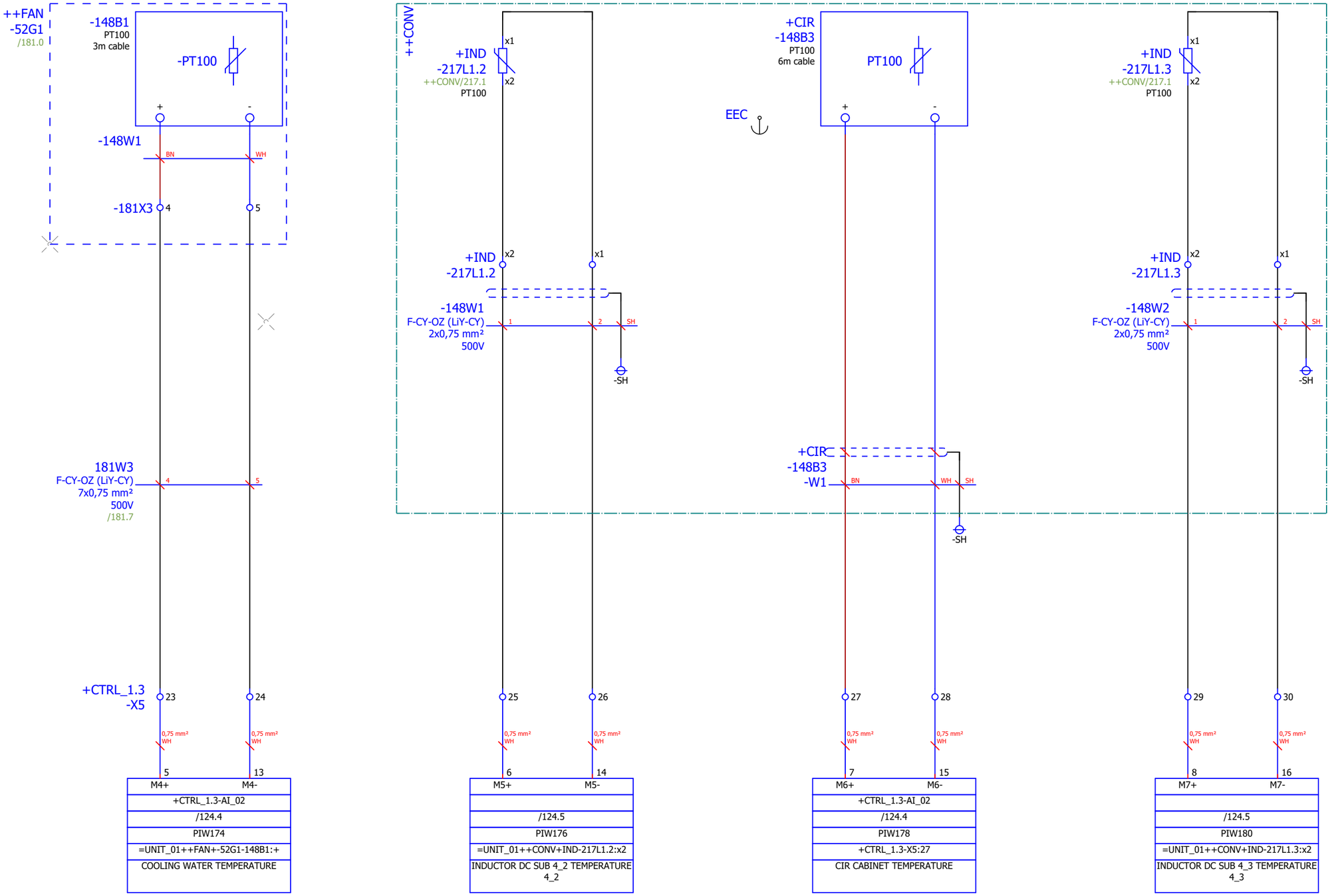
CONTROL CABINET TEMPERATURE

CONVERTER CABINET TEMPERATURE

previous page: 146

next page: 148

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS CABINET TEMPERATURE	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 147
Date								+	total: 492



COOLING WATER TEMPERATURE

INDUCTOR DC SUB 4_2 TEMPERATURE 4_2

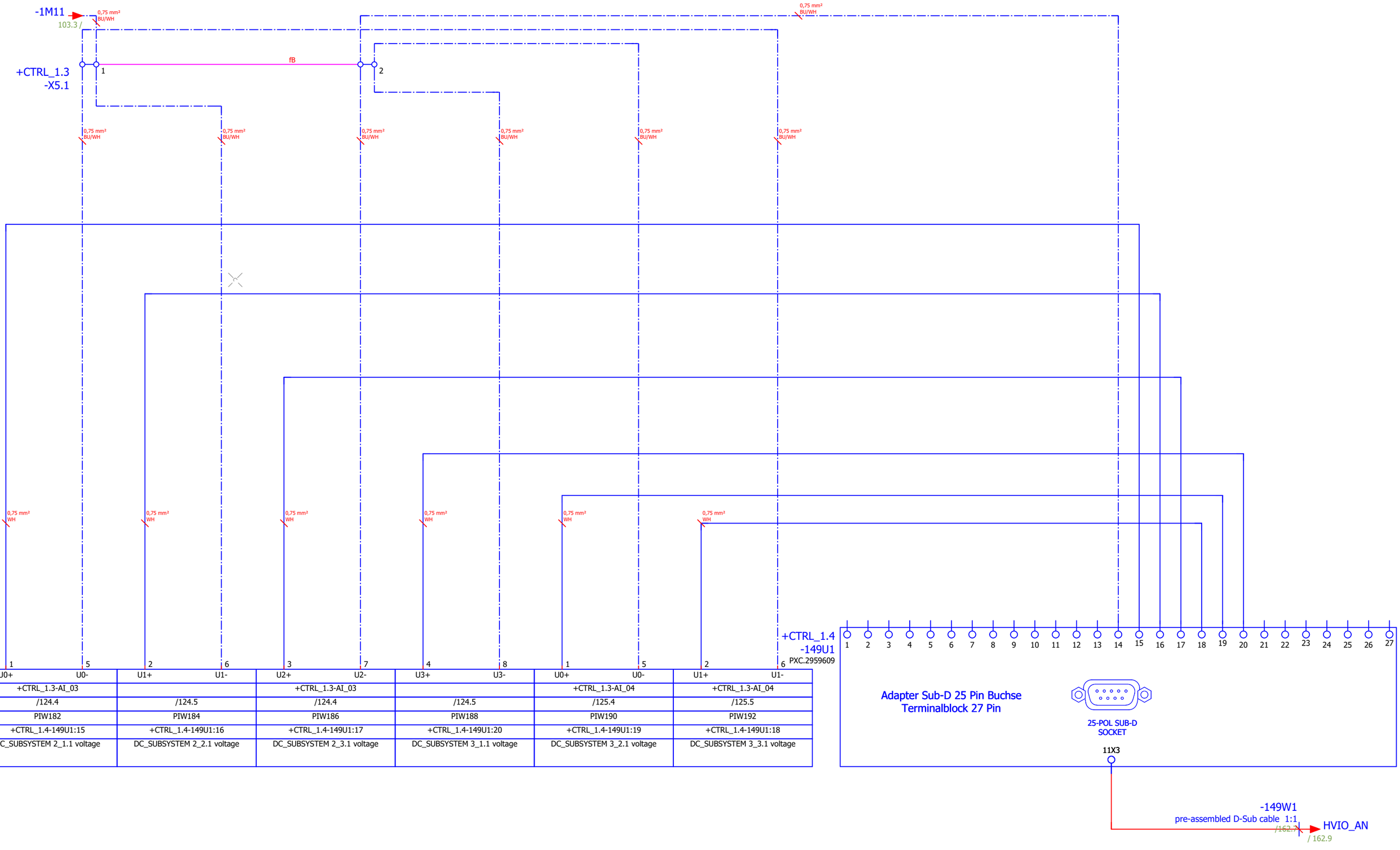
CIR CABINET TEMPERATURE

INDUCTOR DC SUB 4_3 TEMPERATURE 4_3

previous page: 147

next page: 149

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS COOLING WATER TEMPERATURE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 148
Date								+		total: 492

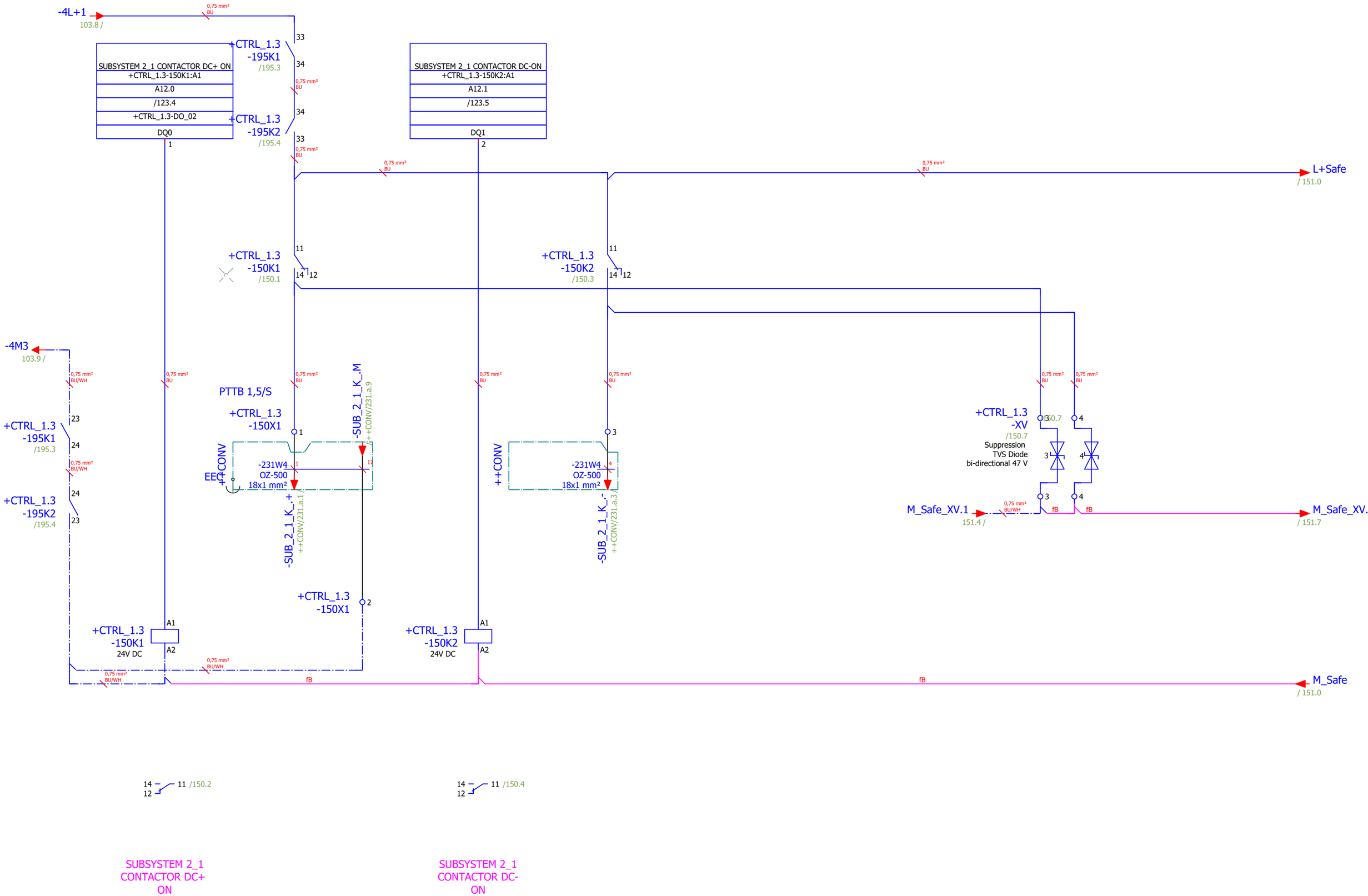


Voltage measurement

previous page: 148

next page: 150

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS MEASURING VOLTAGE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 149
Date							10354_23A2007	+		total: 492



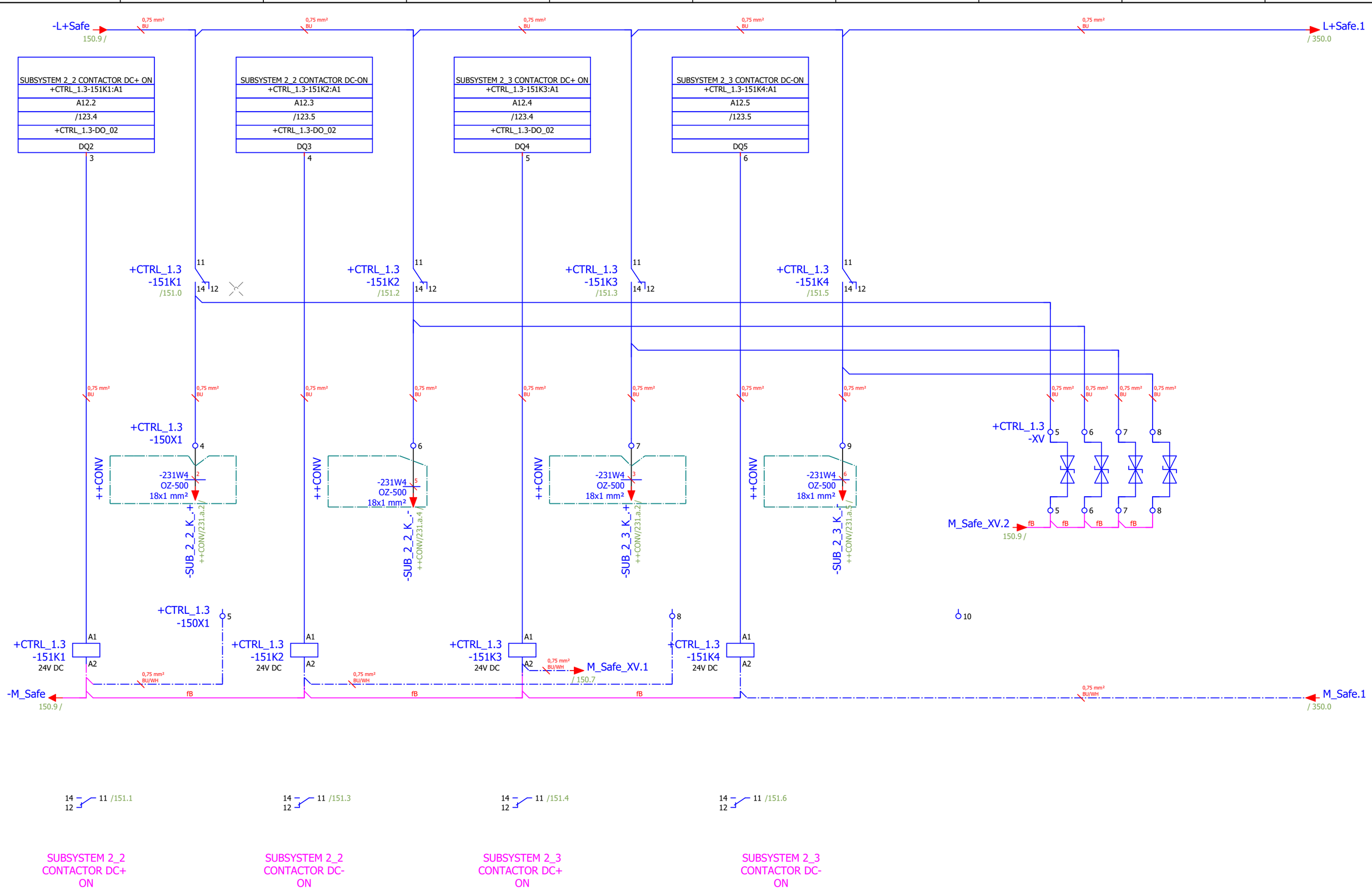
14 12 11 /150.2

14 12 11 /150.4

SUBSYSTEM 2_1 CONTACTOR DC+ ON

SUBSYSTEM 2_1 CONTACTOR DC- ON

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 150
Date								+	total: 492



14 12 11 /151.1

14 12 11 /151.3

14 12 11 /151.4

14 12 11 /151.6

SUBSYSTEM 2_2 CONTACTOR DC+ ON

SUBSYSTEM 2_2 CONTACTOR DC- ON

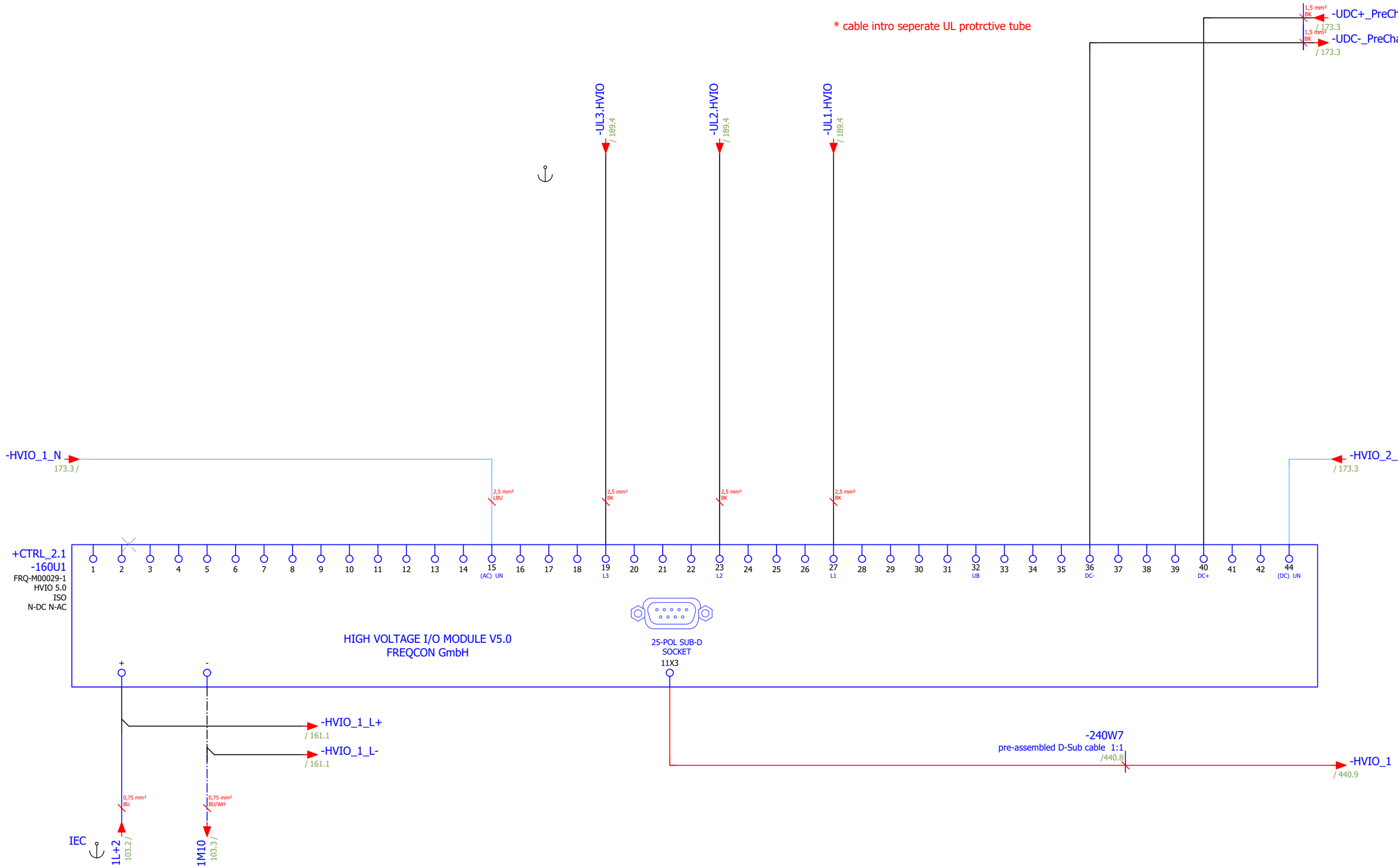
SUBSYSTEM 2_3 CONTACTOR DC+ ON

SUBSYSTEM 2_3 CONTACTOR DC- ON

previous page: 150

next page: 160

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_2, 2_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 151
Date								+	total: 492

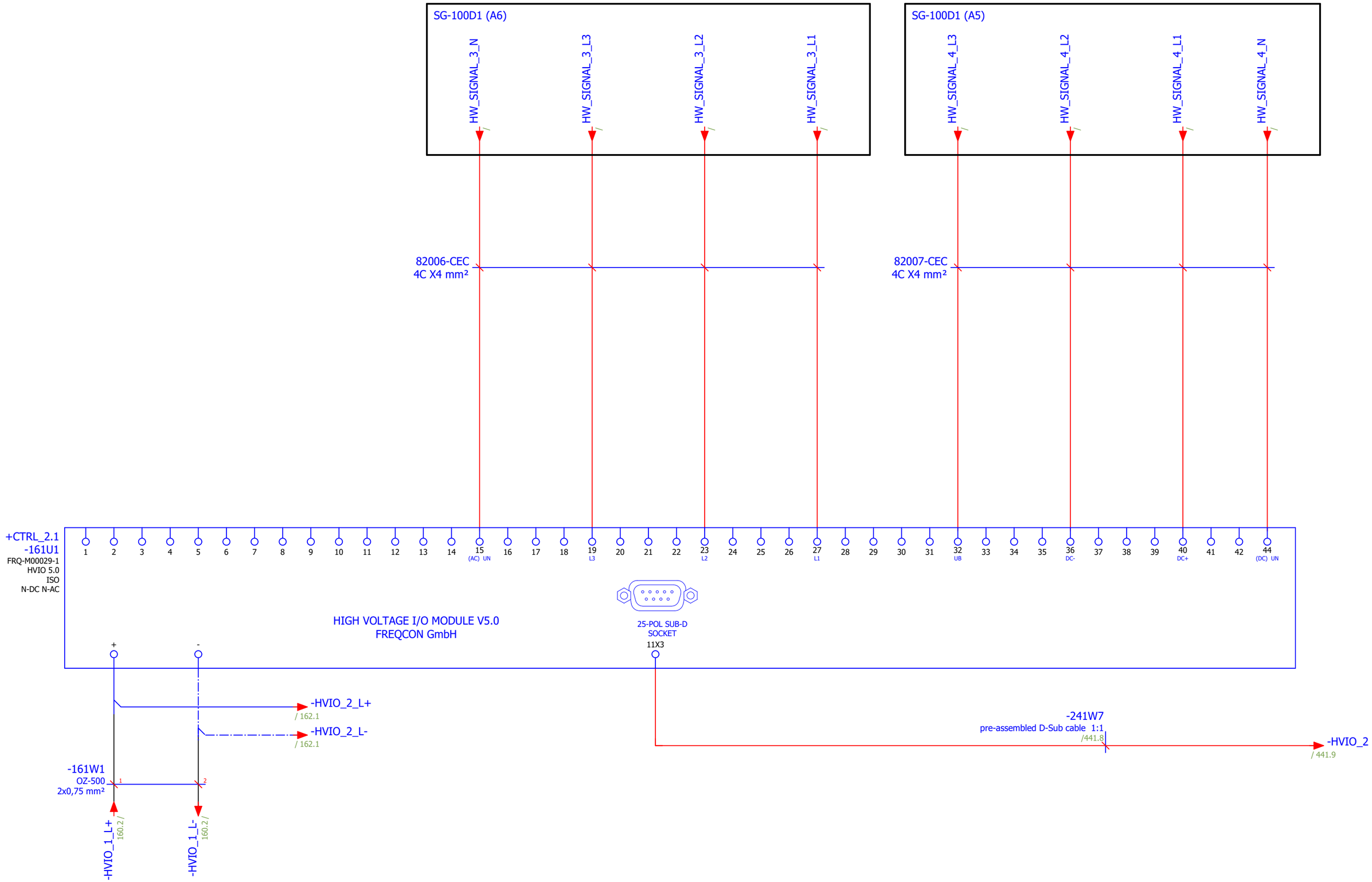


previous page: 151

Measuring: Grid side voltage / DC-Link

next page: 161

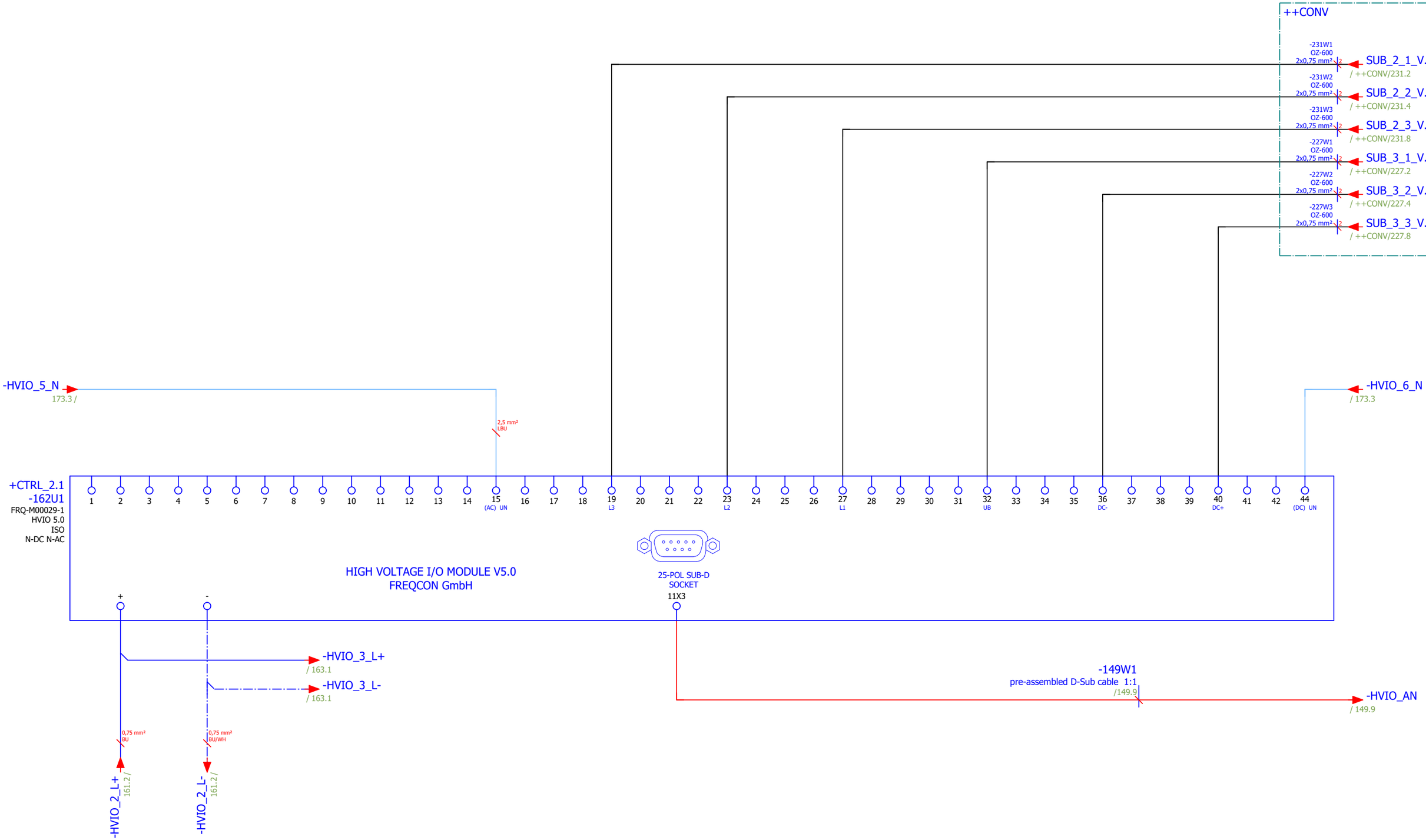
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 160
Date								+	total: 492



previous page:
160

next page:
162

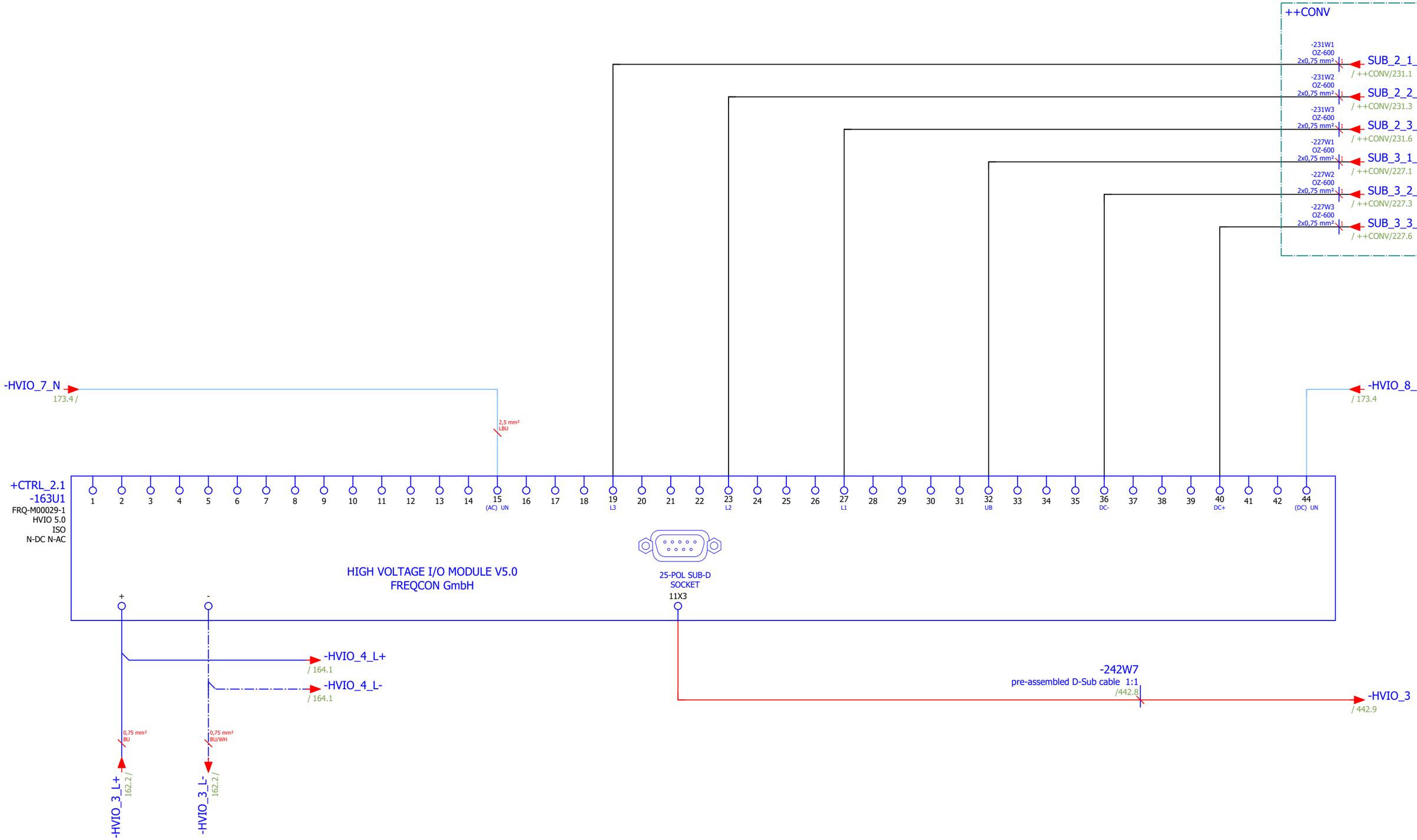
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 2	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.08.2025							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 161
Date								+		total: 492



previous page:
161

next page:
163

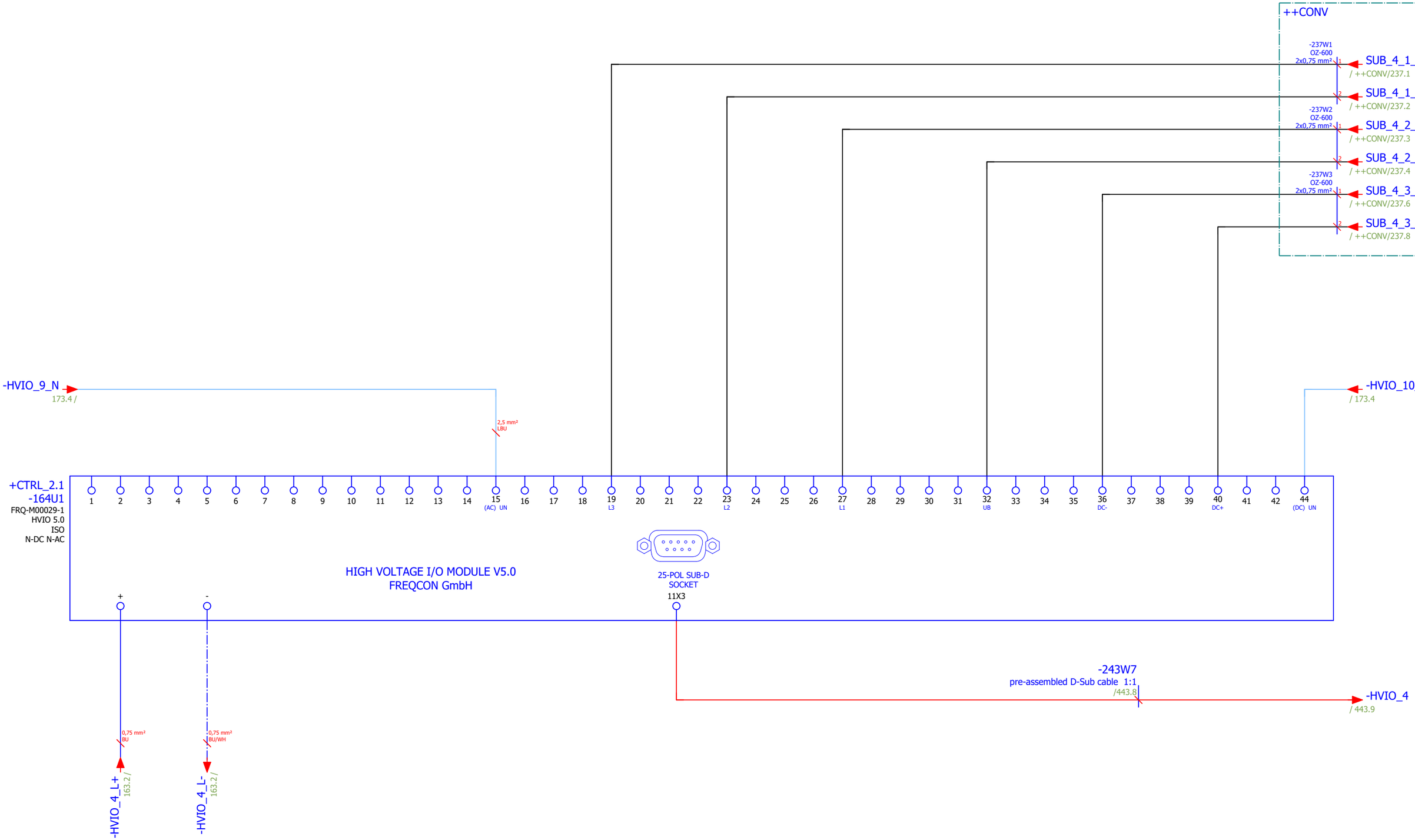
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 2 ANALOG	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 162
Date								+	total: 492



previous page:
162

next page:
164

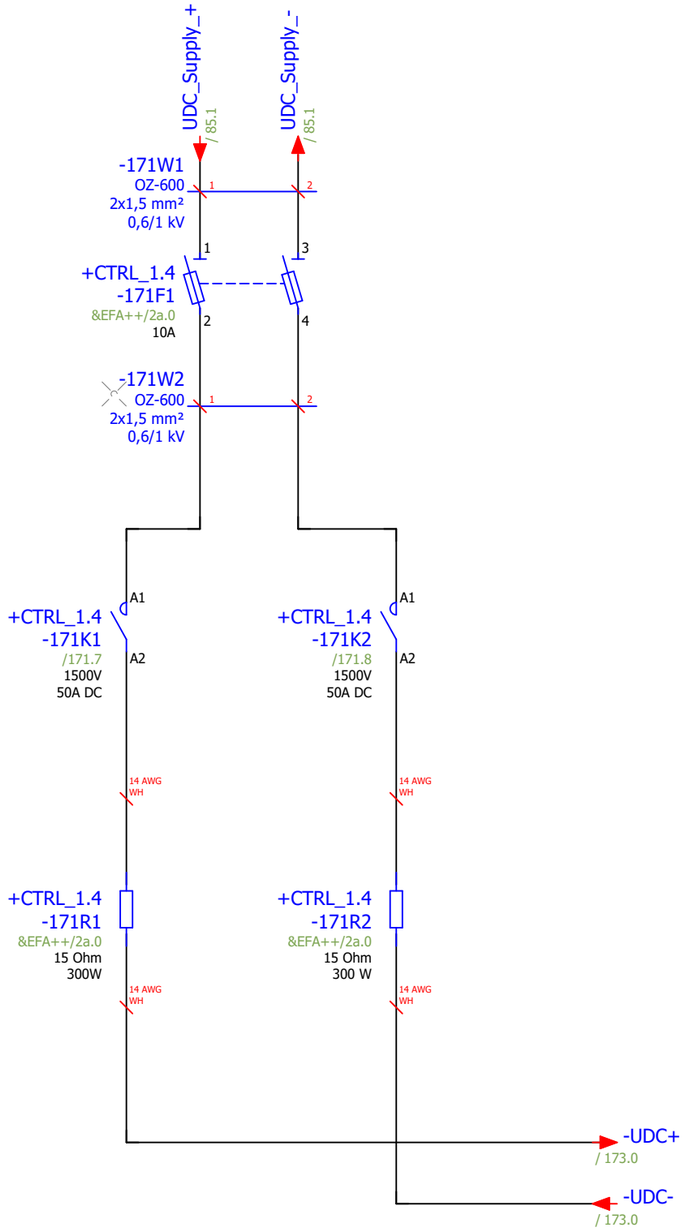
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 163
Date								+	total: 492



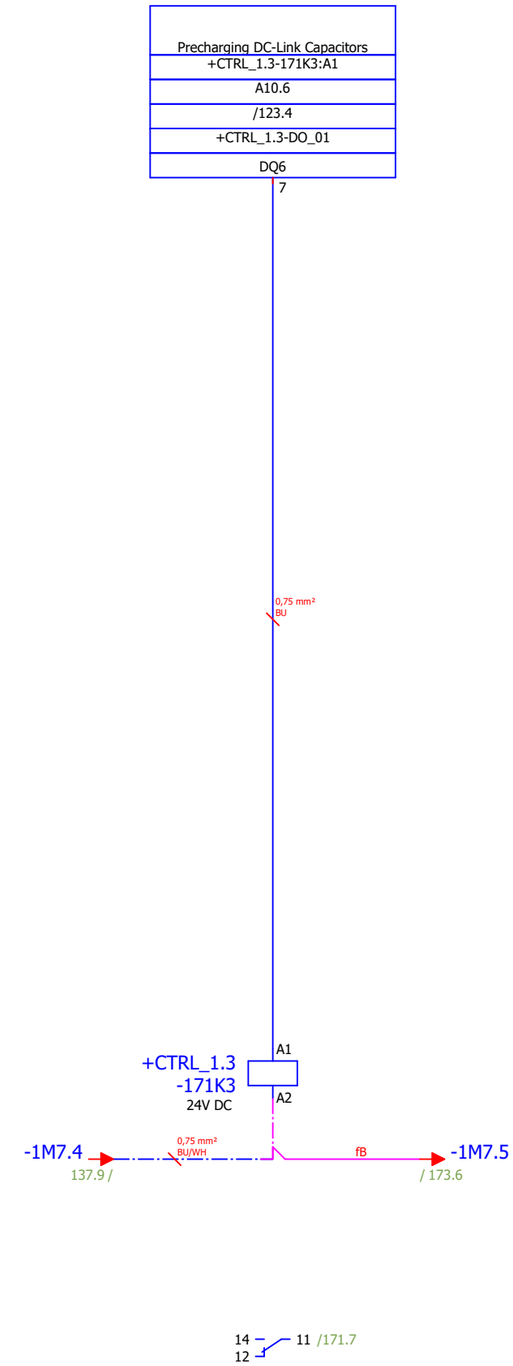
previous page:
163

next page:
171

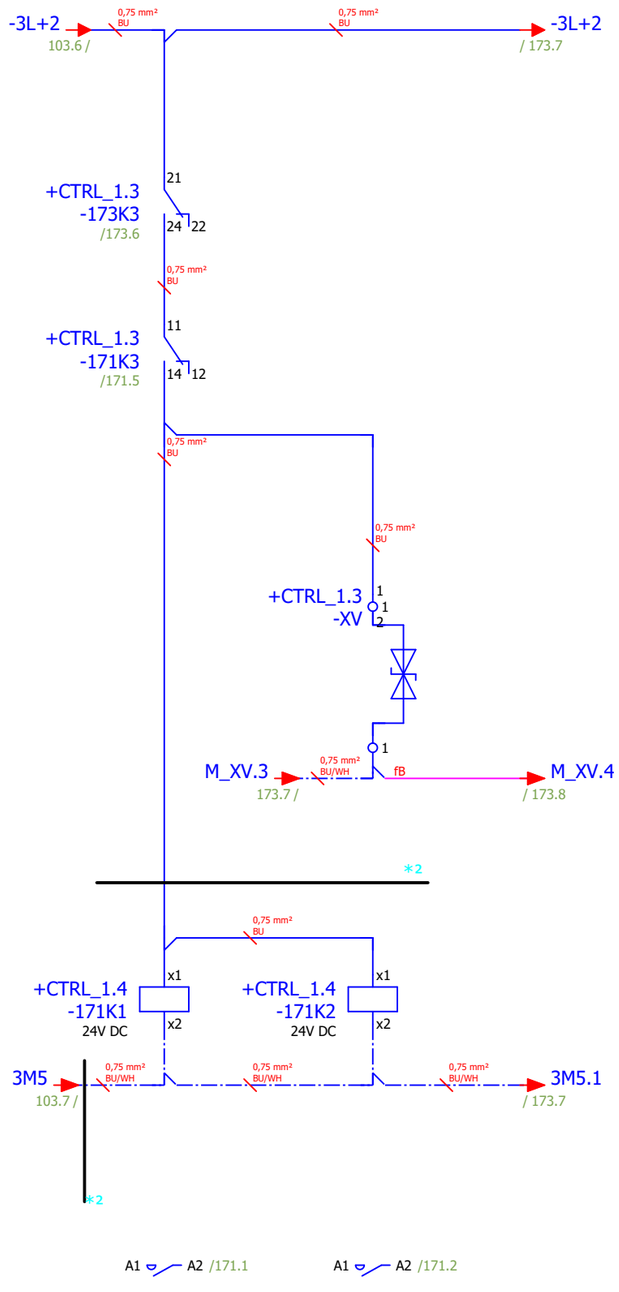
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 4	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 164
Date								+	total: 492



RESISTORS
FOR PRECHARGING
from Grid or Battery or DC-Link



Precharging
DC-Link Capacitors

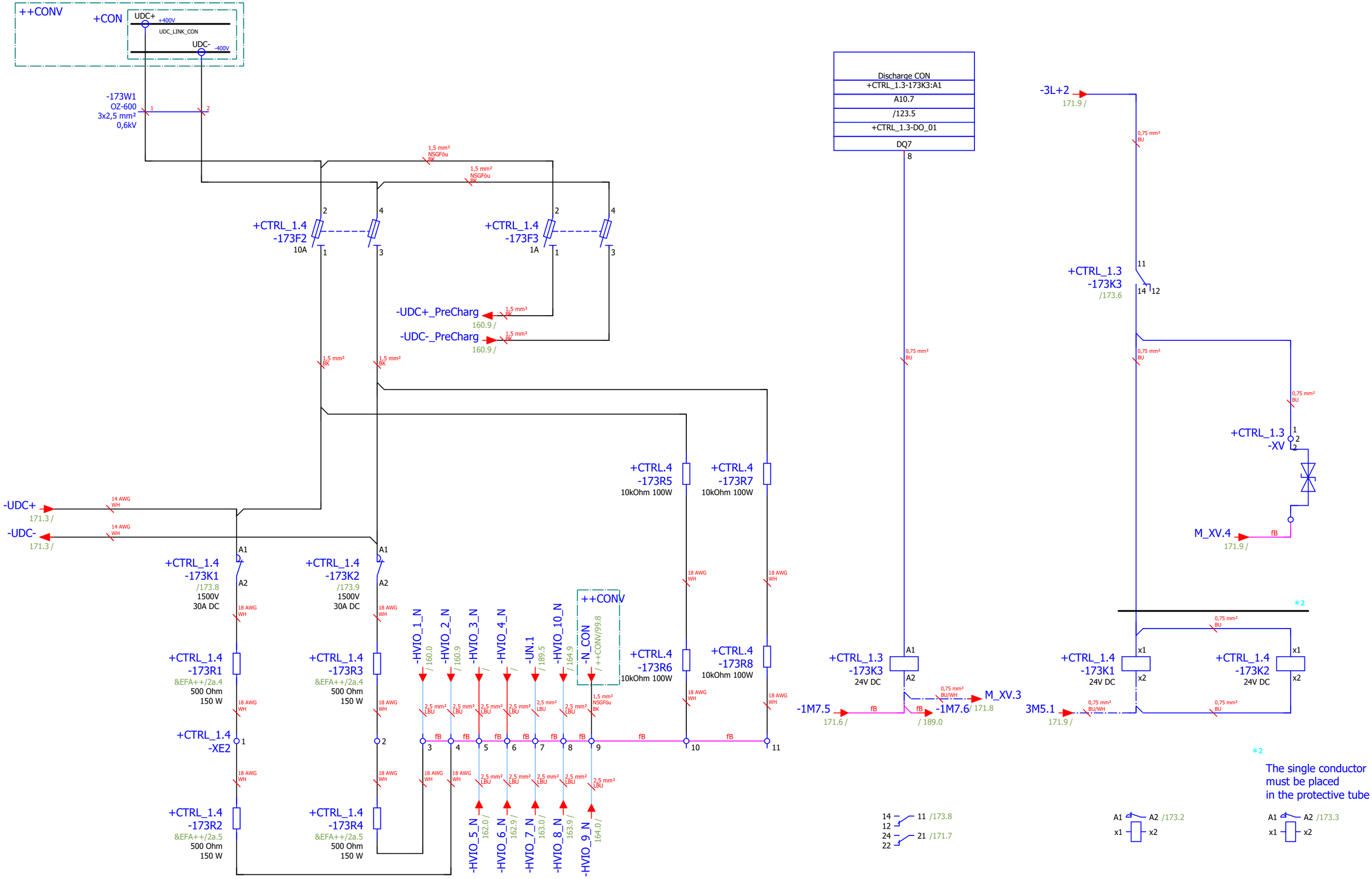


*2 The single conductor must be placed in the protective tube

previous page: 164

next page: 173

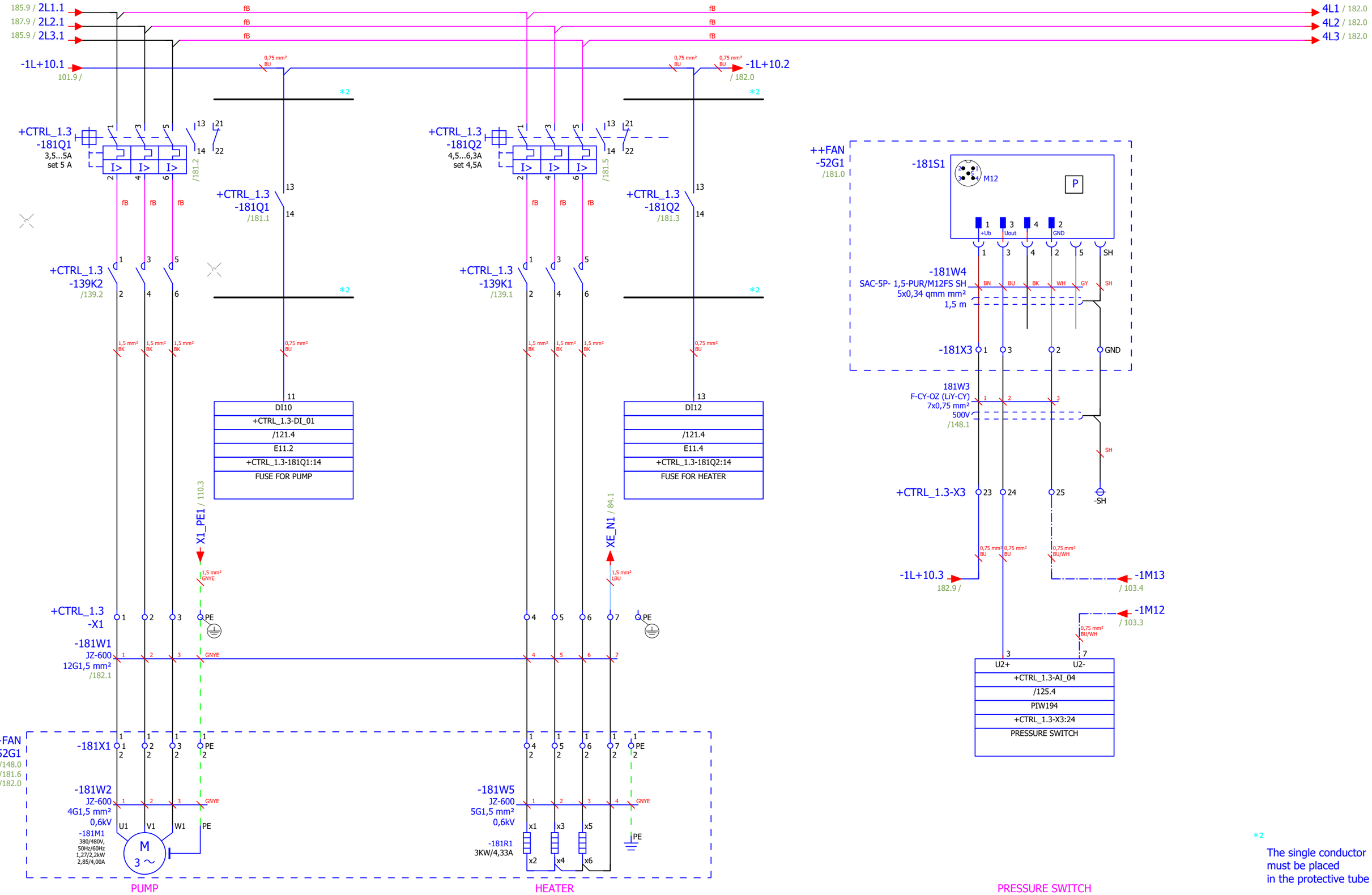
Editor	Freqcon_JD			Statron	FREQCON	PRE-CHARGING UDC	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 171
Date								+	total: 492



previous page: 171

next page: 181

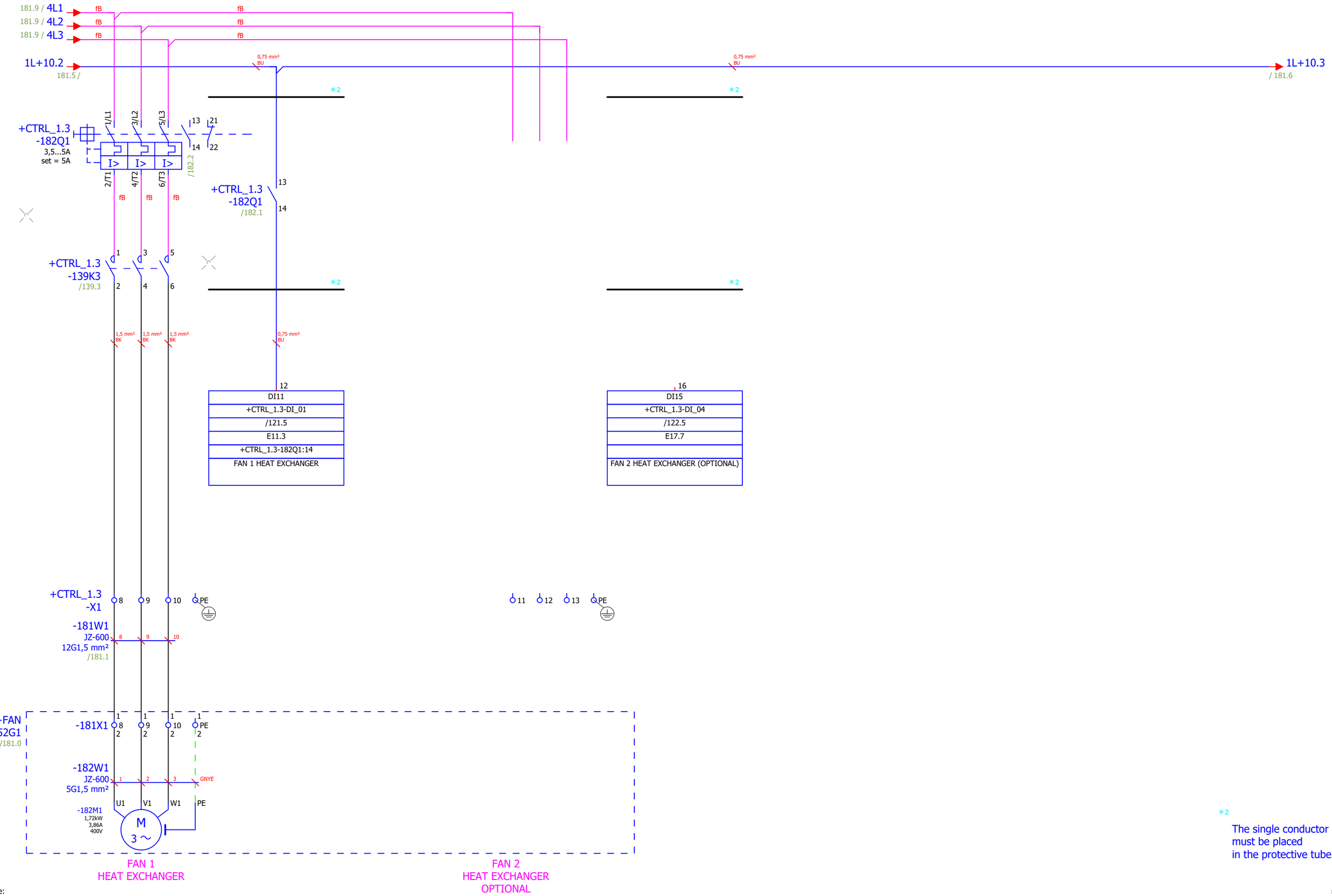
Editor	Freqcon_DG			Statron	FREQCON	DISCHARGE UDC	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 173
Date								+	total: 492



previous page: 173

next page: 182

Editor	Freqcon_DG			Statron	FREQCON	WATER SYSTEM	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 181
Date								+	total: 492



*2 The single conductor must be placed in the protective tube

previous page: 181

next page: 183

Editor	Freqcon_JD			Statron	FREQCON	HEAT EXCHANGER	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 182
Date								+	total: 492

84.9 / 1L1.1
84.9 / 1L2.1
fB
1L1.2 / 185.0
1L2.2 / 187.0

-1L+8.1
84.6 /
0,75 mm² BU
-1L+8.2
/ 185.8

+CTRL_1.3
-183F1
C16A
/183.6
+CTRL_1.3
-183F2
C10A
/183.6

*2
+CTRL_1.3
-183F1
/183.1
0,75 mm² BU
*2
+CTRL_1.3
-183F2
/183.3
0,75 mm² BU
*2

1,5 mm² BK
1,5 mm² BK

+CTRL_1.3
-135K1
/135.1
XE_N2 / 84.1
+CTRL_1.3
-135K3
/135.3

1,5 mm² BK
2,5 mm² LBU
1,5 mm² BK

fB
fB
FB_XT.4-6
/ 185.1

PT 2,5 +CTRL_1.3
-XT
PE
PE

15
DI14
+CTRL_1.3-DI_01
/121.4
E11.6
+CTRL_1.3-183F2:13
Fuse Fans CON, IND Cabinets

++CONV
-279W1
JZ-500
3G1,5 mm²
GNYE
-FAN_L_2 ++CONV/279.1/
-FAN_N_2 ++CONV/279.1/
-FAN_PE_2 ++CONV/279.1/
EEC

++CONV
-281W1
JZ-500
3G1,5 mm²
GNYE
-FAN_L_3 ++CONV/281.1/
-FAN_N_3 ++CONV/281.1/
-FAN_PE_3 ++CONV/281.1/
EEC

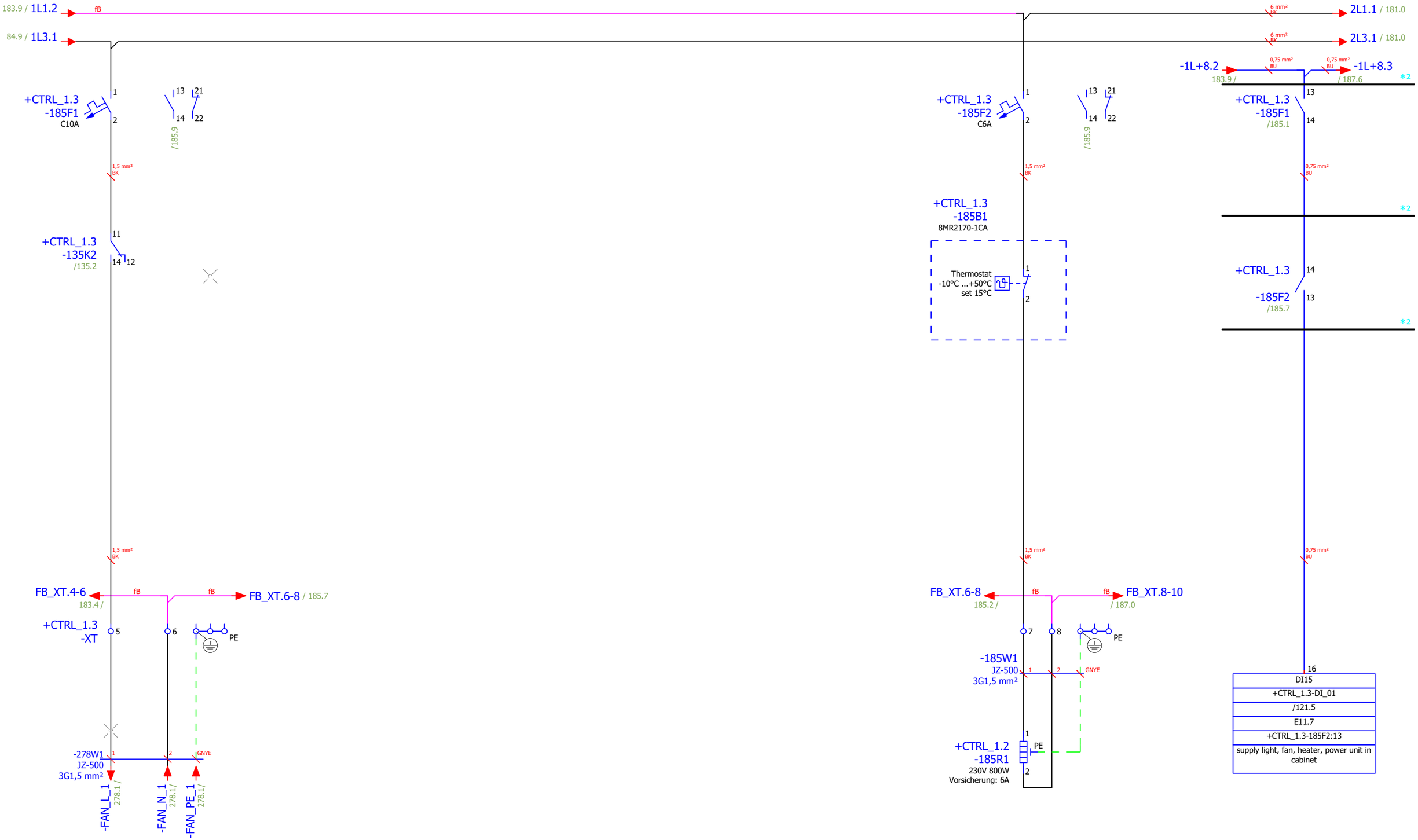
CON
Fans 1-5
in door

CIR
Fans 1-3
in door

*2
The single conductor
must be placed
in the protective tube

previous page: 182
next page: 185

Editor	Freqcon_DG			Statron	FREQCON	Supply for cabinet fan	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 183
Date								+	total: 492



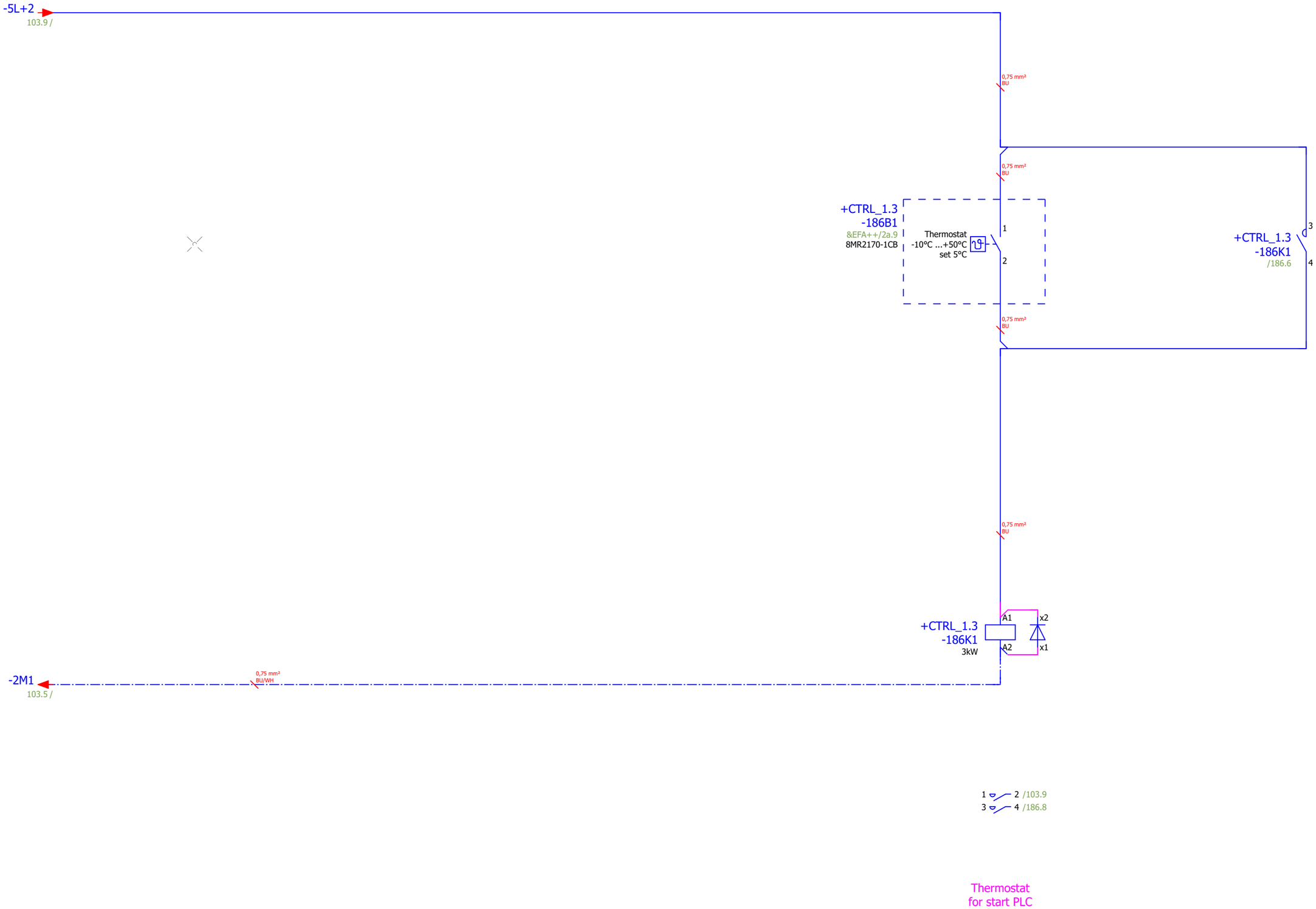
FAN 1
CONTROL CABINET

HEATING
CONTROL CABINET

previous page: 183

next page: 186

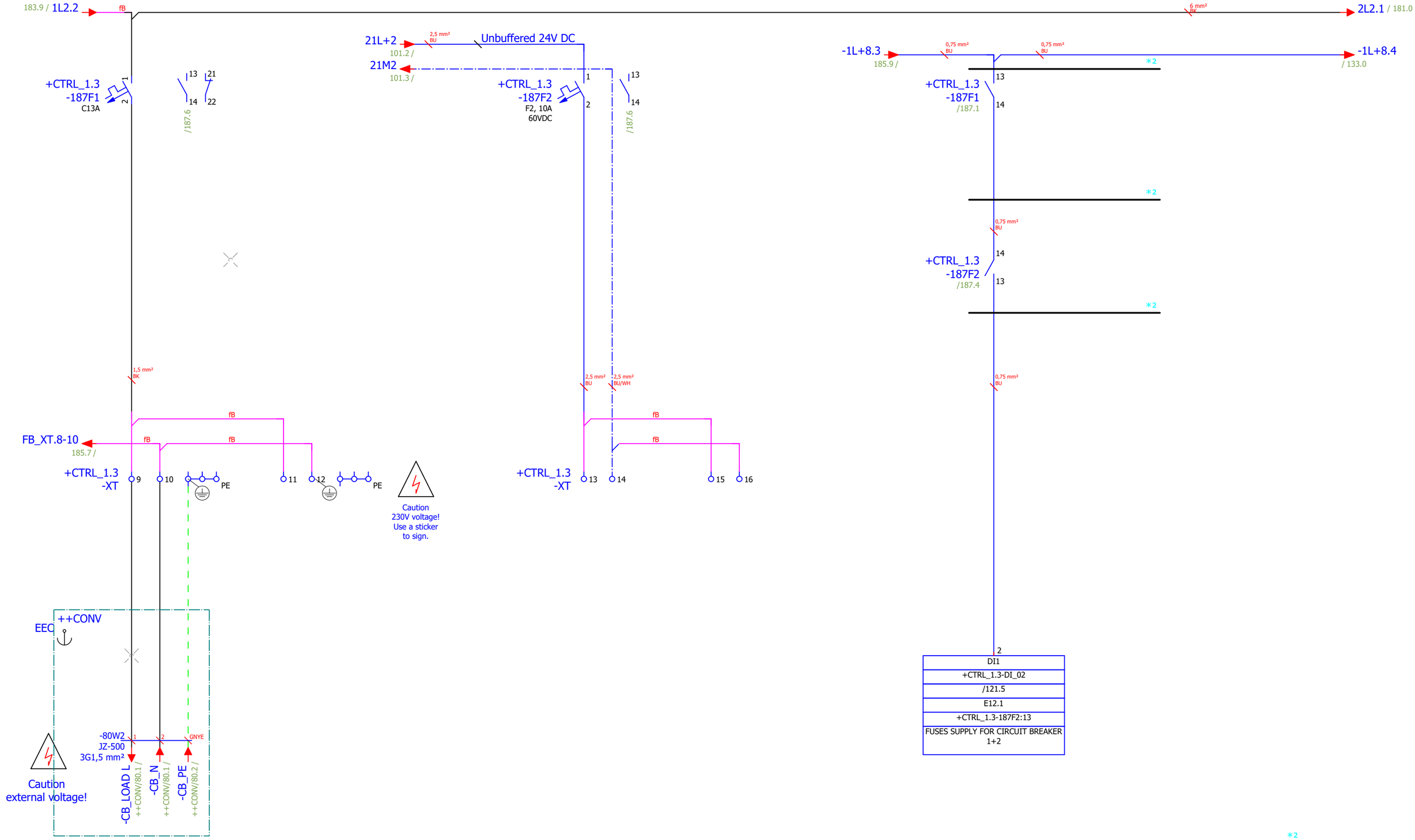
Editor	Freqcon_JD			Statron	FREQCON	FAN / HEATING CONTROL CABINET	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 185
Date								+	total: 492



previous page: 185

next page: 187

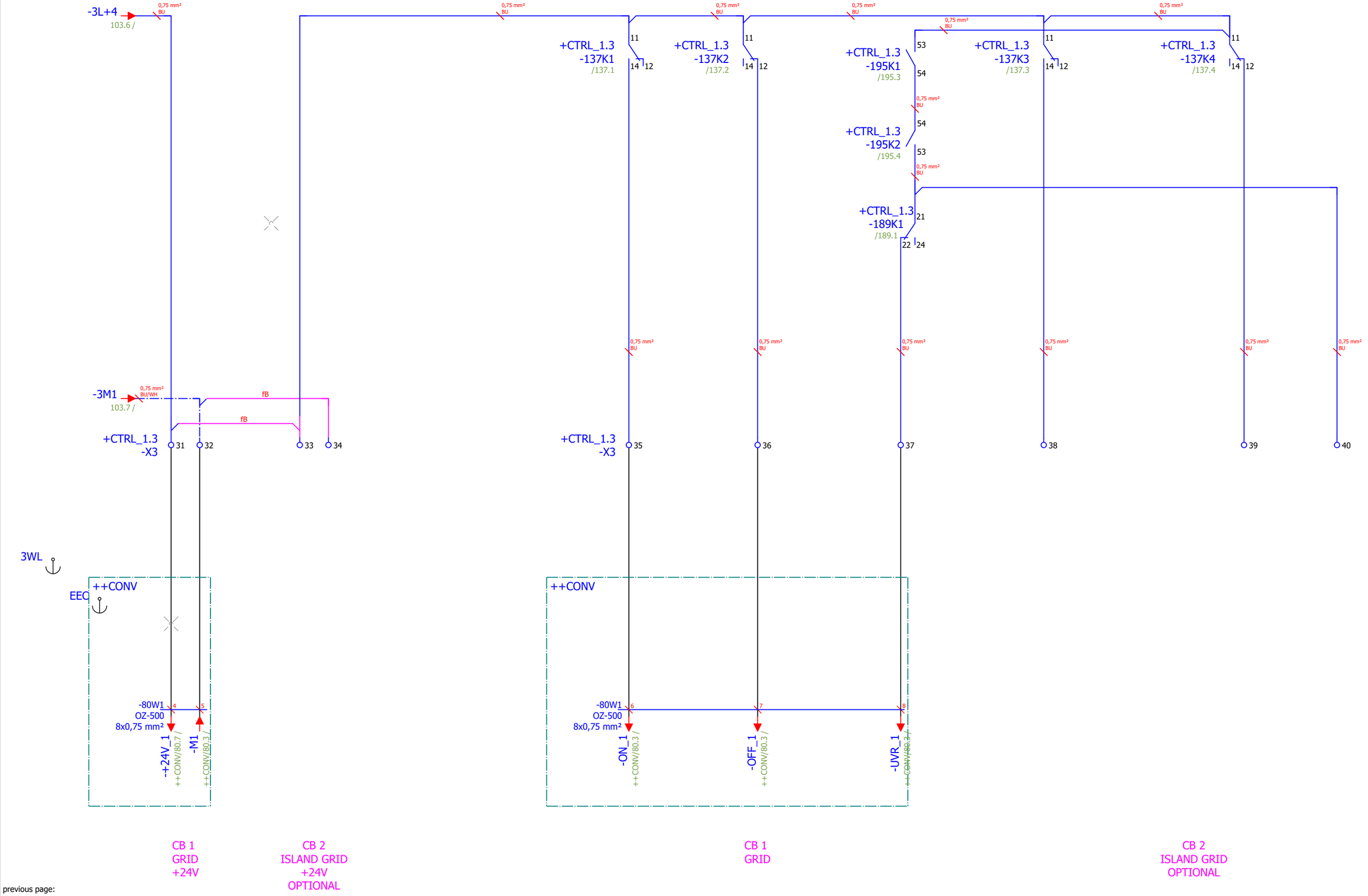
Editor	Freqcon_JD			Statron	FREQCON	THERMOSTAT	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 186
Date								+	total: 492



previous page: 186

next page: 188

Editor	Freqcon_JD			Statron	FREQCON	24V DC SUPPLY CB	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 187
Date								+	total: 492



previous page: 187

next page: 189

Editor	Freqcon_JD			Statron	FREQCON	24V DC SUPPLY CON / CB GRID	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 188
Date								+	total: 492

GRID FAULT
+CTRL_1.3-189K1:A1
A11.3
/123.5
+CTRL_1.3-DO_01
DQ11
12

0,75 mm² BU

+CTRL_1.3
-189K1
24V DC
A1
A2

-1M7.6 fB 0,75 mm² BU/WH -M_(GND)
173.6 / / 189.5

14 11 /189.6
12
24 21 /188.6
22

Voltage inputs
3 phases 620V AC

Grid Circuit Breaker:
if OFF then 24V;
if ON then 0V

Grid OK

-UL1.HVIO / 160.5 — 2,5 mm² BK
-UL2.HVIO / 160.5 — 2,5 mm² BK
-UL3.HVIO / 160.4 — 2,5 mm² BK
-UN.1 / 173.4 — 2,5 mm² LBU
-24V_Signal / 127.4 — 0,75 mm² BU
-M_(GND) / 189.1 — 0,75 mm² BU/WH
+CTRL_1.3 -189K1 /189.1 — 0,75 mm² BU (11 / 12 / 14)
CB_OFF.1 / 137.2 — 0,75 mm² BU

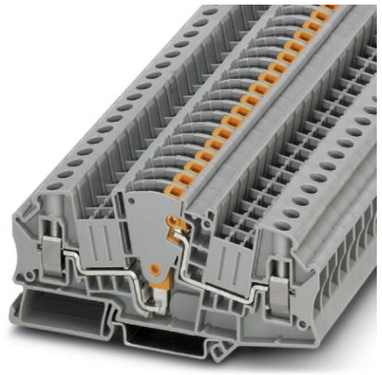
+CTRL_1.4
-189X1
Test disconnect
terminal block
Phoenix Contact
PTME 6

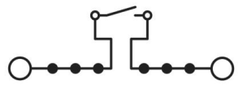
1 2 3 4 5 6 7 8 9

2,5 mm² BK
2,5 mm² BK
2,5 mm² BK
0,75 mm² BU

-HVIO_L1 / 85.1 /
-HVIO_L2 / 85.1 /
-HVIO_L3 / 85.2 /
CB_OFF.2 / 137.2 /

Relais
Circuit Breaker
OFF



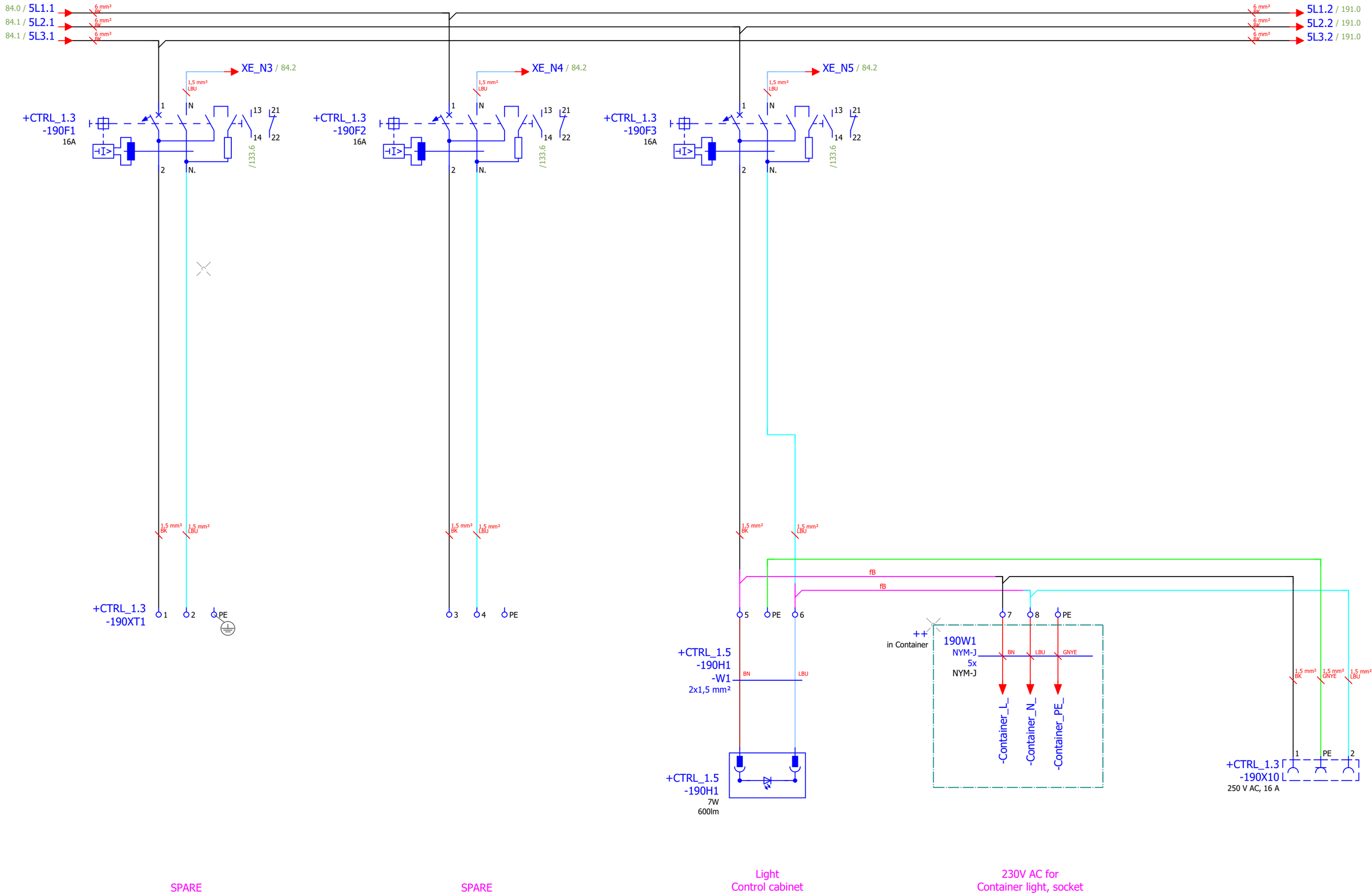


GRID FAULT

Test terminal block for protection tests

previous page: 188
next page: 190

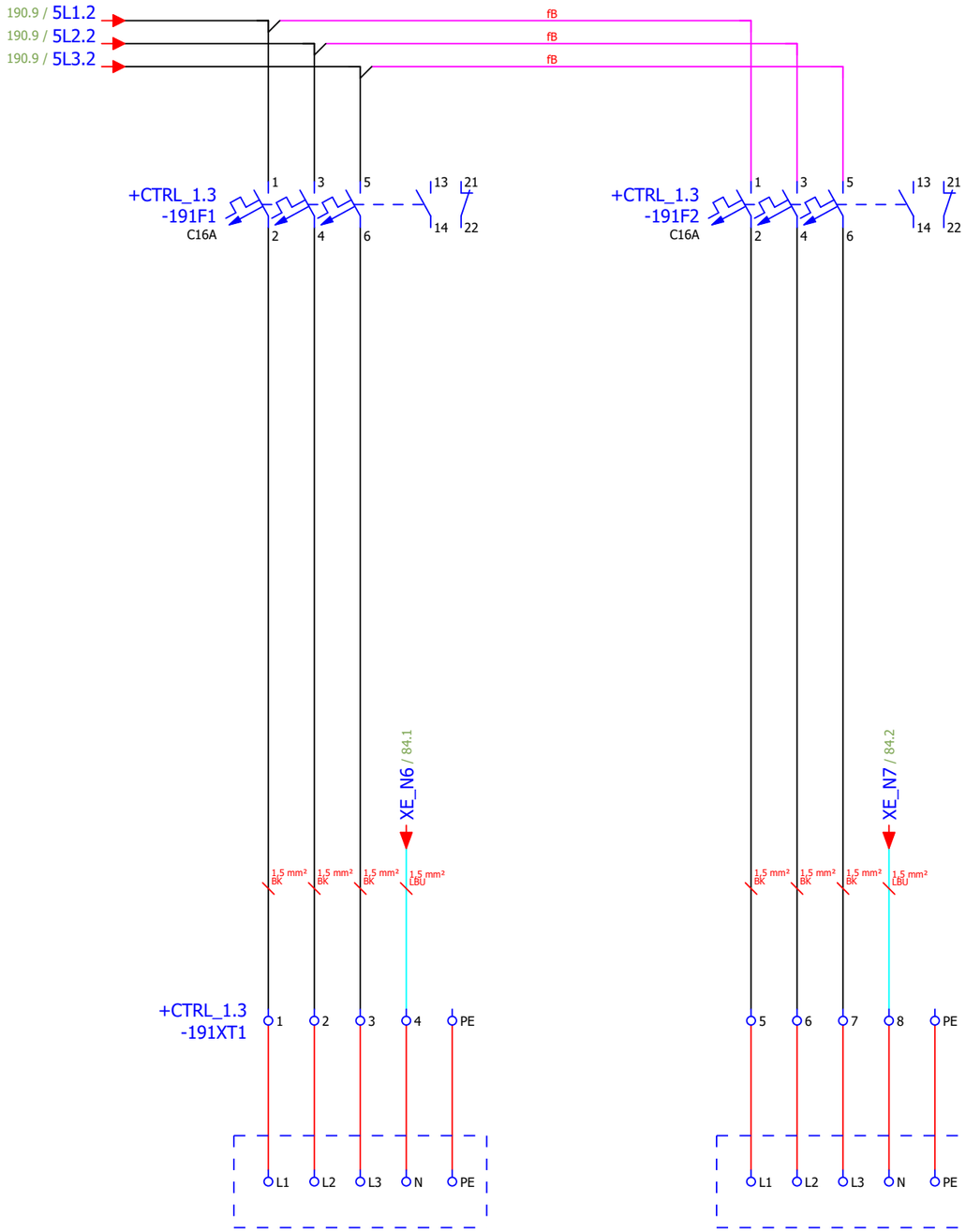
Editor	Freqcon_JD			Statron	FREQCON	TEST TERMINAL BLOCK	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 189
Date								+ total: 492



previous page: 189

next page: 191

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING, LIGHT 230V SUPPLY	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 190
Date								+	total: 492

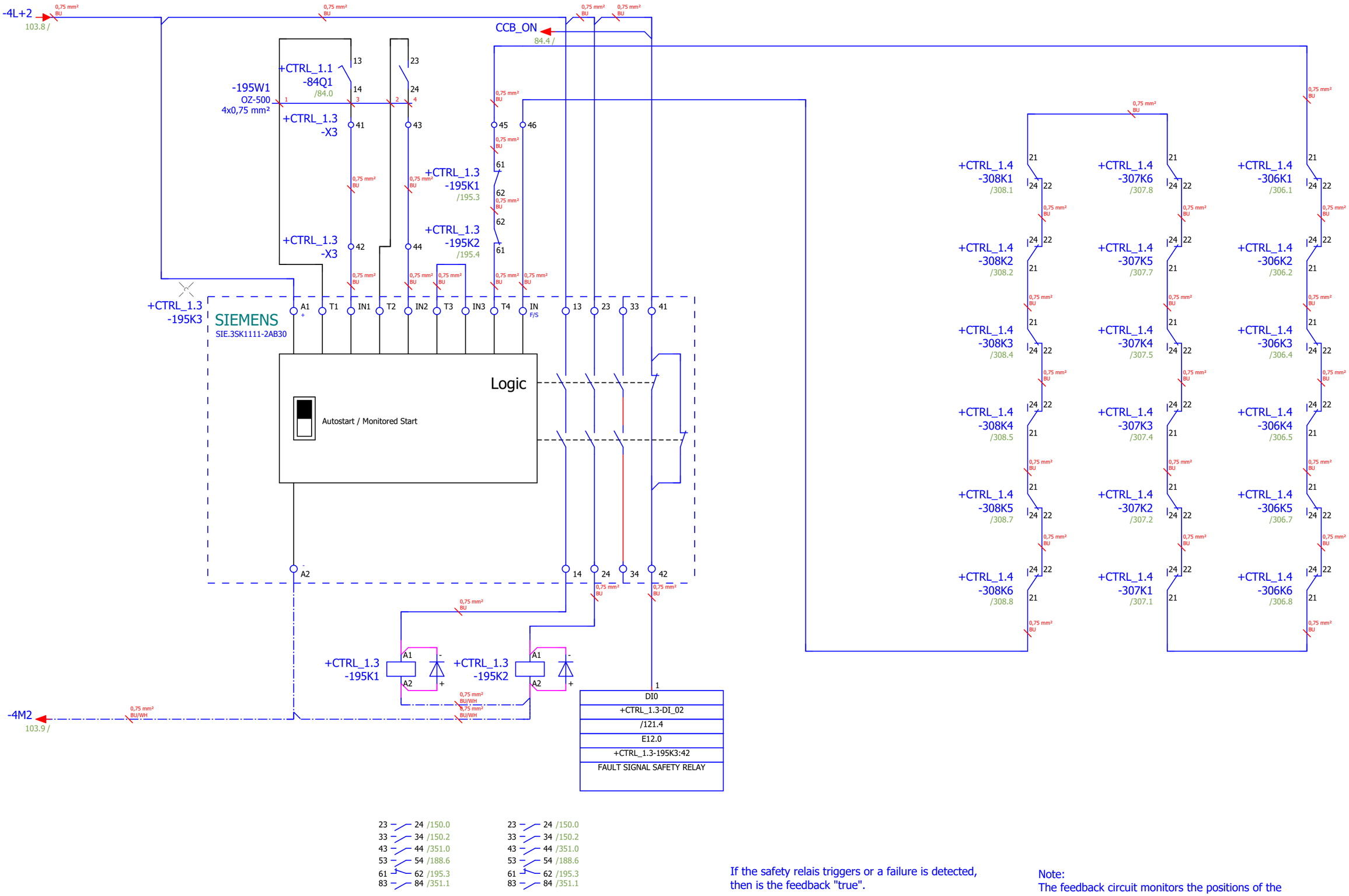


400V AC for
Container Air Conditioning 1

400V AC for
Container Air Conditioning 2

previous page: 190

next page: 195



23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
83 — 84 /351.1

23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
83 — 84 /351.1

SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS

FAULT SIGNAL SAFETY RELAY

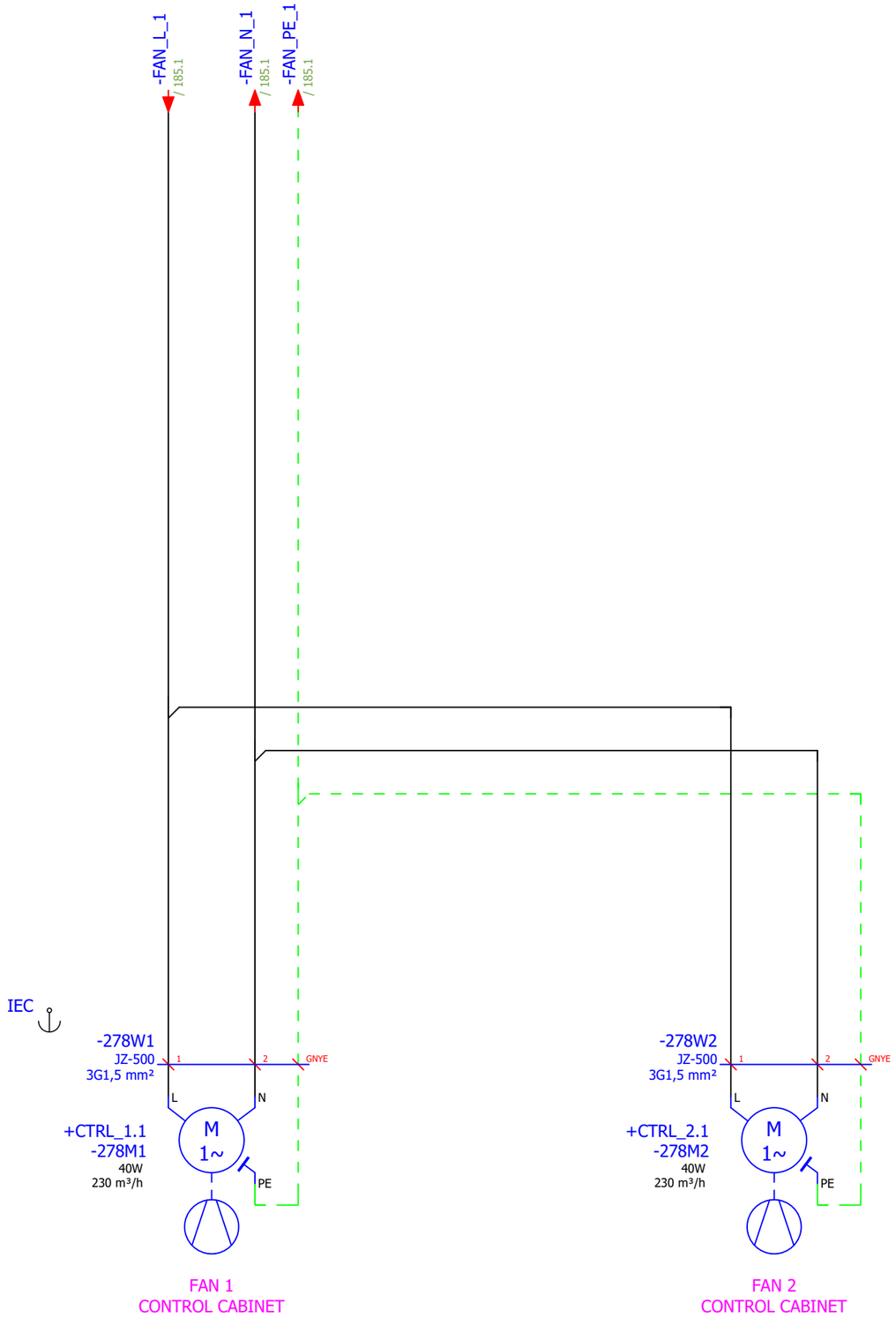
If the safety relais triggers or a failure is detected, then is the feedback "true".

Note:
The feedback circuit monitors the positions of the positive-guided NC contacts on the contactors 195K1 and 195K2. If one of their contacts latsches, then it is not possible to switch the contactors back on.

previous page: 191

next page: 278

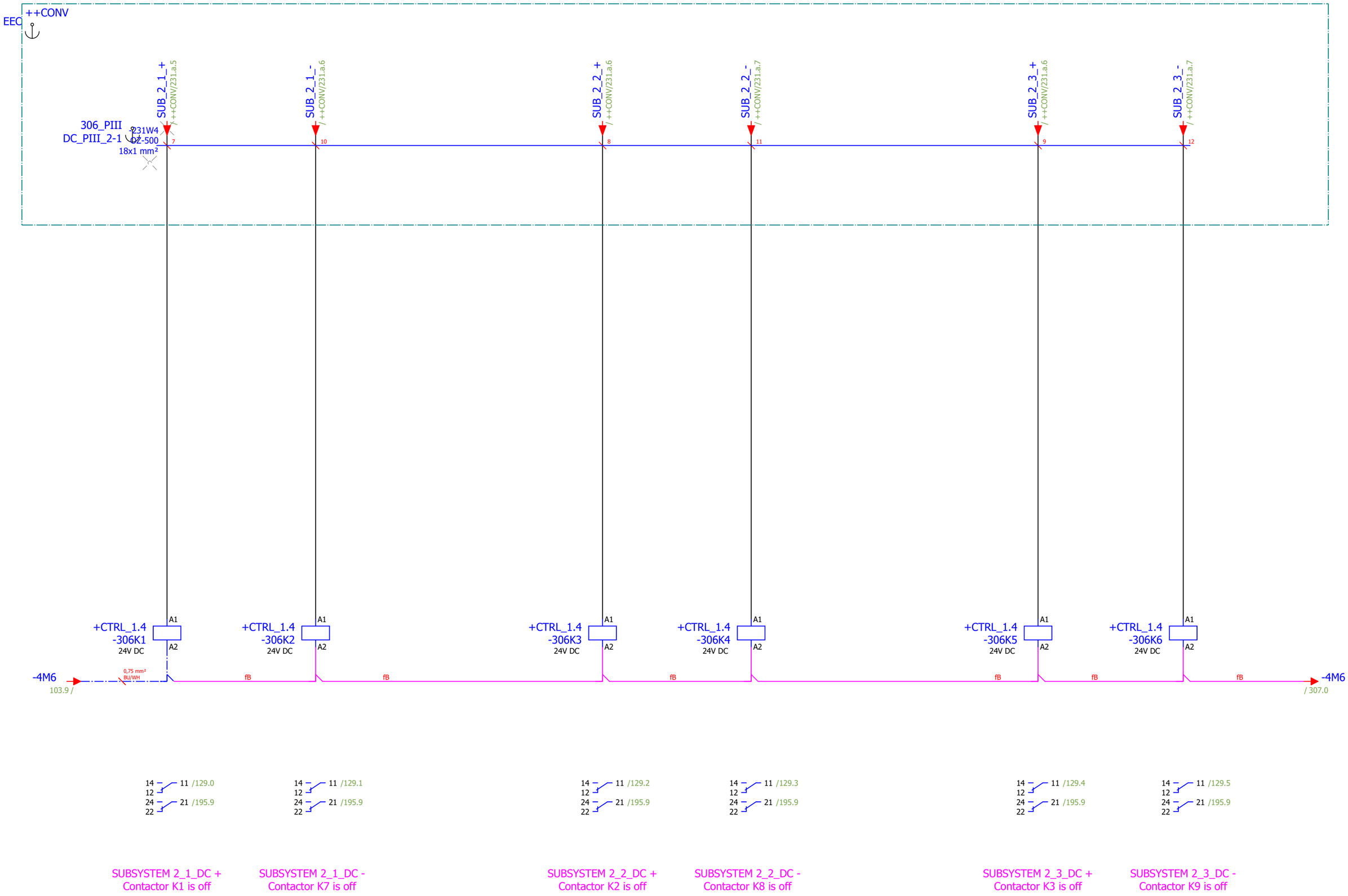
Editor	Freqcon_DG			Statron	FREQCON	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 195
Date								+ total: 492



previous page:
195

next page:
306

Editor	Freqcon_DG			Statron	FREQCON	CONTROL CABINET CLIMATE	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 278
Date								+	total: 492



previous page: 278

next page: 307

Editor	Freqcon_JD			Statron	FREQCON	Feedback DC contactors 1_4 - 1_6	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 306
Date								+	total: 492

EEC ++CONV

306_PIII
DC_PIII_3-1
227W4
D2-500
18x1 mm²

SUB_3_1_+ /++CONV/227.a.5 — 7
SUB_3_1_- /++CONV/227.a.6 — 10
SUB_3_2_+ /++CONV/227.a.6 — 8
SUB_3_2_- /++CONV/227.a.7 — 11
SUB_3_3_+ /++CONV/227.a.6 — 9
SUB_3_3_- /++CONV/227.a.7 — 12

+CTRL_1.4 -307K1 24V DC A1 A2
+CTRL_1.4 -307K2 24V DC A1 A2
+CTRL_1.4 -307K3 24V DC A1 A2
+CTRL_1.4 -307K4 24V DC A1 A2
+CTRL_1.4 -307K5 24V DC A1 A2
+CTRL_1.4 -307K6 24V DC A1 A2

-4M6 306.9 / — fB — fB — fB — fB — fB — fB — -4M6 / 308.0

14 12 11 /130.0 21 /195.8 22 24
14 12 11 /130.1 21 /195.8 22 24
14 12 11 /130.2 21 /195.8 22 24
14 12 11 /130.3 21 /195.8 22 24
14 12 11 /130.4 21 /195.8 22 24
14 12 11 /130.5 21 /195.8 22 24

SUBSYSTEM 3_1_DC +
Contactor K1 is off

SUBSYSTEM 3_1_DC -
Contactor K7 is off

SUBSYSTEM 3_2_DC +
Contactor K2 is off

SUBSYSTEM 3_2_DC -
Contactor K8 is off

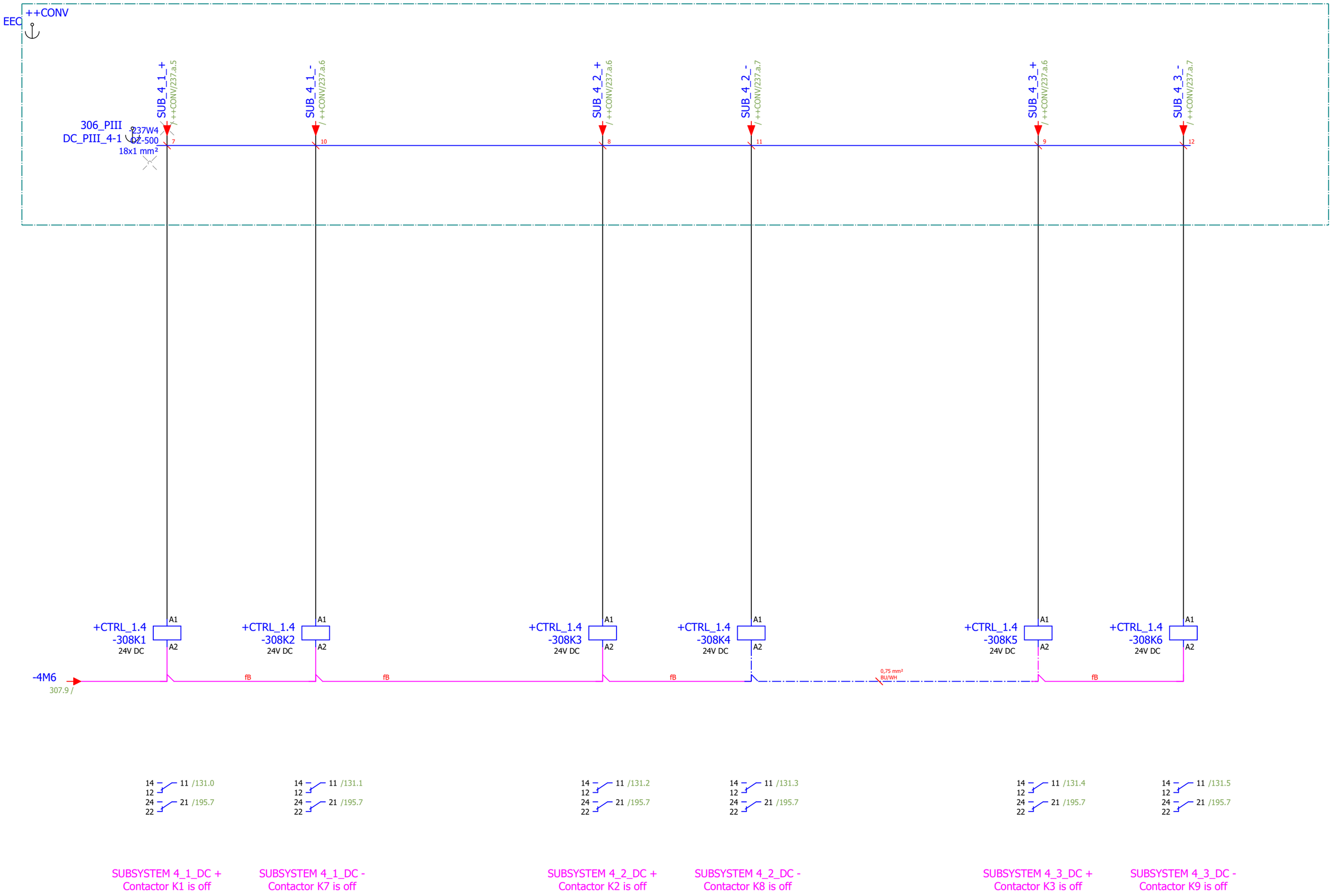
SUBSYSTEM 3_3_DC +
Contactor K3 is off

SUBSYSTEM 3_3_DC -
Contactor K9 is off

previous page: 306

next page: 308

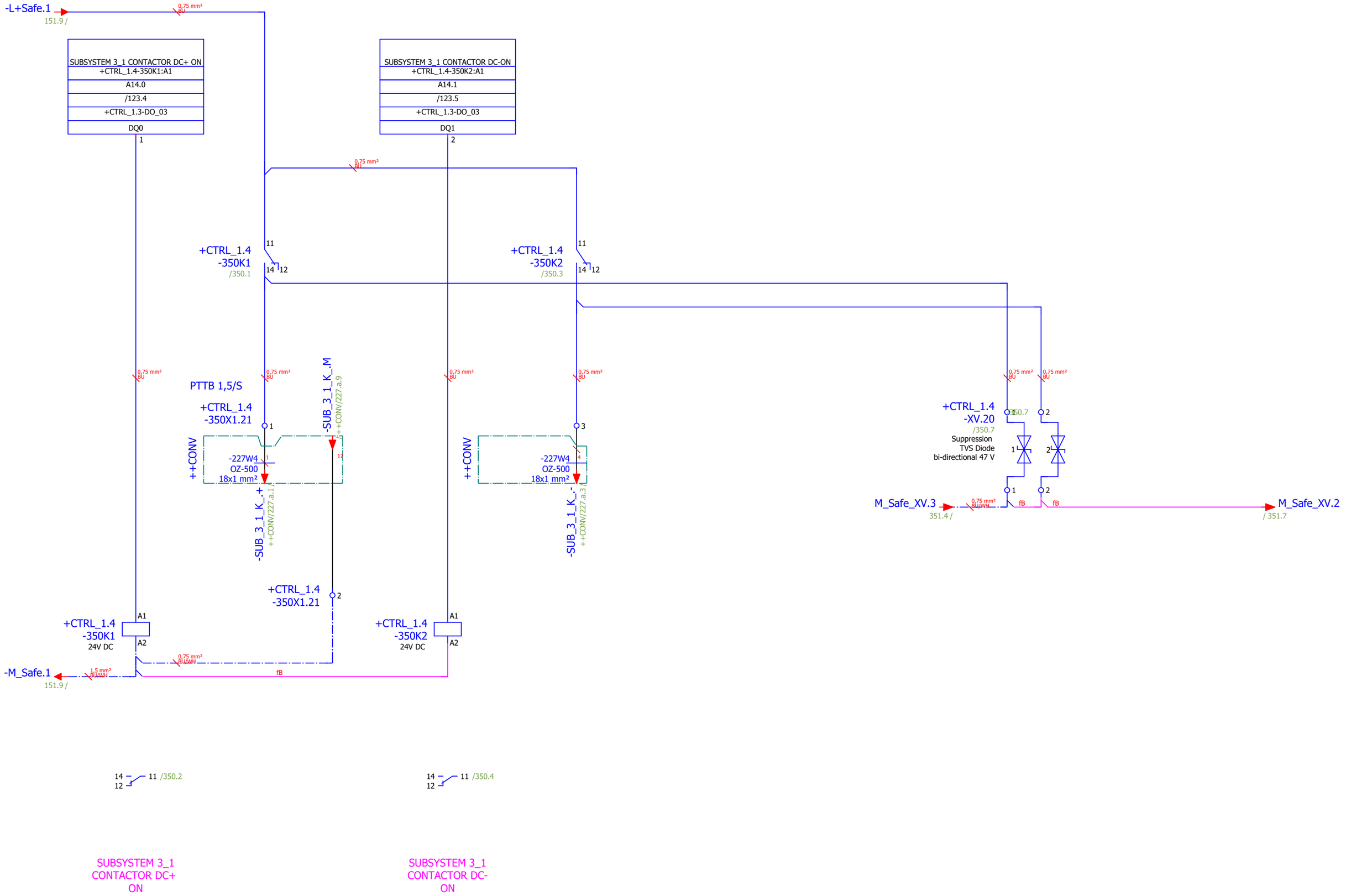
Editor	Freqcon_JD			Statron	FREQCON	Feedback DC contactors 2_1 - 2_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 307
Date								+	total: 492



previous page: 307

next page: 350

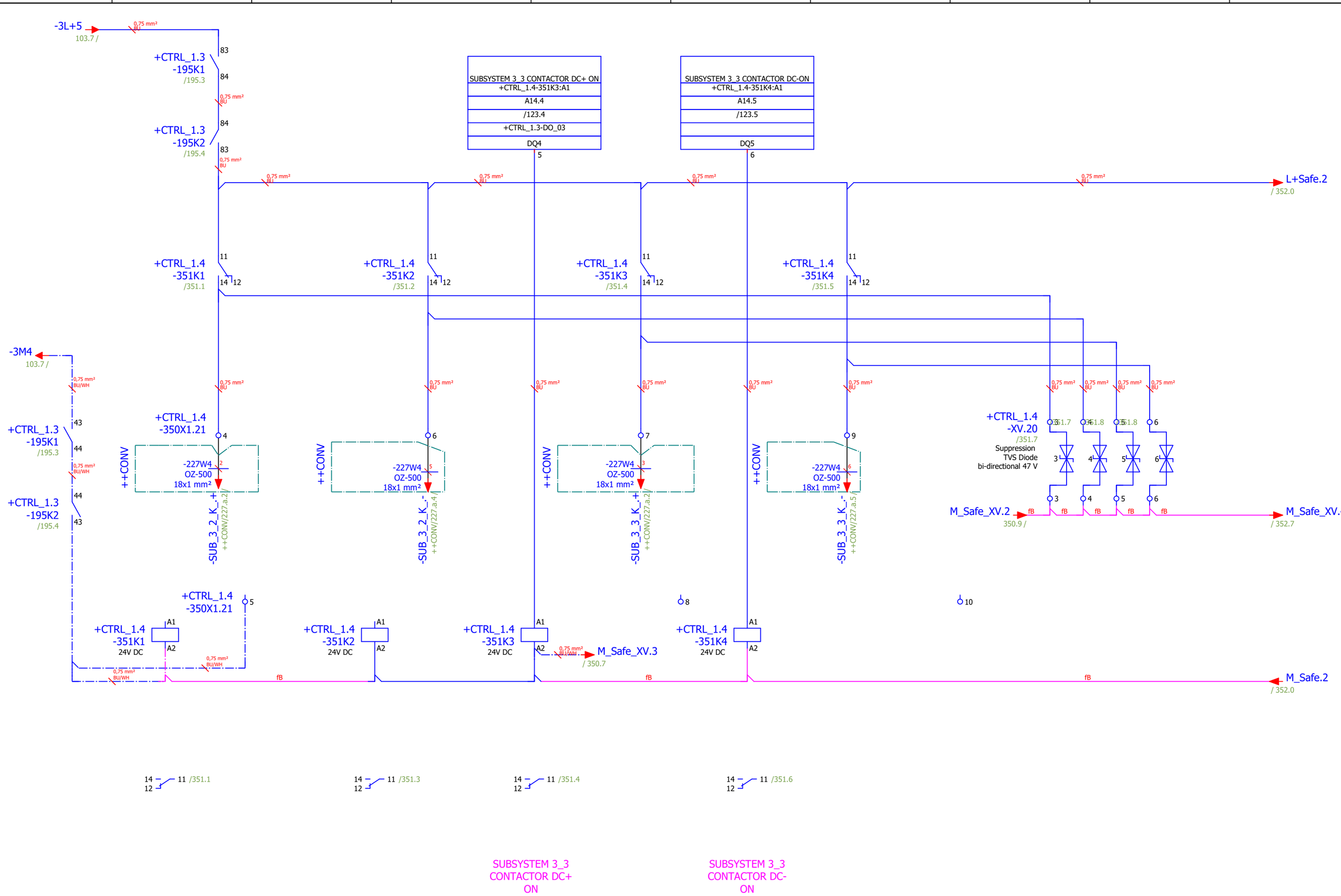
Editor	Freqcon_DG			Statron	FREQCON	Feedback DC contactors 2_4 - 2_6	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 308
Date								+	total: 492



previous page: 308

next page: 351

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 350
Date								+	total: 492



previous page: 350

next page: 352

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 351
Date								+	total: 492

-L+Safe.2
351.9 /

SUBSYSTEM 4_1 CONTACTOR DC+ ON
+CTRL_1.4-352K1:A1
A14.6
/123.4
+CTRL_1.3-DO_03
DQ6
7

SUBSYSTEM 4_1 CONTACTOR DC-ON
+CTRL_1.4-352K2:A1
A14.7
/123.5
DQ7
8

L+Safe.3
/ 353.0

0,75 mm² BU

+CTRL_1.4
-352K1
/352.0
11 14 12

+CTRL_1.4
-352K2
/352.2
11 14 12

+CTRL_1.4
-350X1.21
11

-SUB_4_1_K_M
/++CONV/237.a.9

++CONV
-237W4
OZ-500
18x1 mm²
1 17

-SUB_4_1_K_+
/++CONV/237.a.1

13

++CONV
-237W4
OZ-500
18x1 mm²
4

-SUB_4_1_K_-
/++CONV/237.a.3

+CTRL_1.4
-XV.20
/352.7
Suppression
TVS Diode
bi-directional 47 V
7 8

M_Safe_XV.4
351.9 /
fB

M_Safe_XV.5
/ 353.7

+CTRL_1.4
-350X1.21
12

+CTRL_1.4
-352K1
24V DC
A1 A2

+CTRL_1.4
-352K2
24V DC
A1 A2

-M_Safe.2
351.9 /

M_Safe.3
/ 353.0

14 12 11 /352.1

14 12 11 /352.3

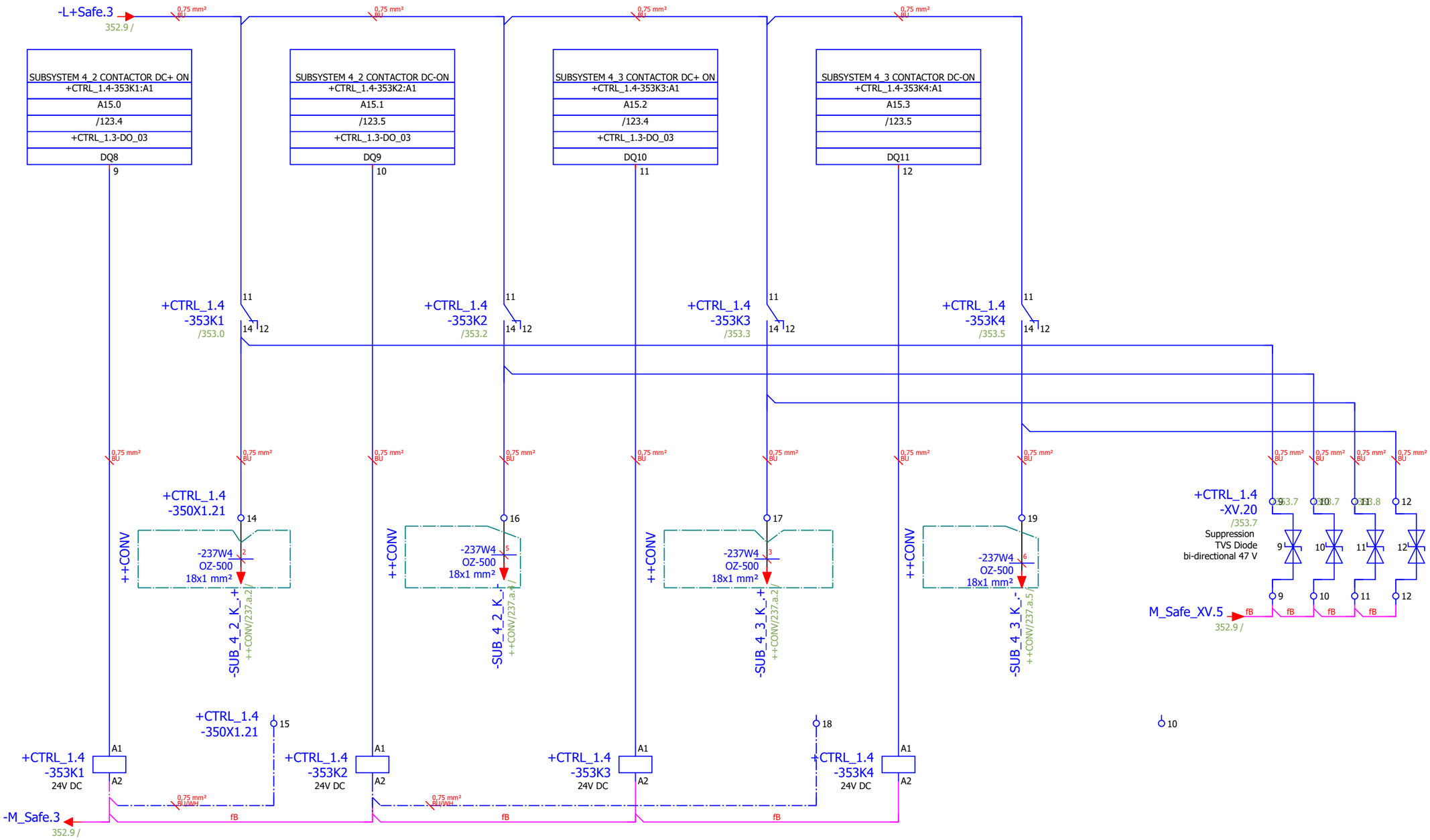
SUBSYSTEM 4_1
CONTACTOR DC+
ON

SUBSYSTEM 4_1
CONTACTOR DC-
ON

previous page:
351

next page:
353

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 352
Date								+	total: 492



14 12 — 11 /353.1

14 12 — 11 /353.3

14 12 — 11 /353.4

14 12 — 11 /353.6

SUBSYSTEM 4_2 CONTACTOR DC+ ON

SUBSYSTEM 4_2 CONTACTOR DC- ON

SUBSYSTEM 4_3 CONTACTOR DC+ ON

SUBSYSTEM 4_3 CONTACTOR DC- ON

previous page: 352

next page: 440

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 353
Date								+ total: 492

-1L+1
103.2 /
-1M1
103.3 /
-1PE1
103.4 /
240W9
JZ-500
3G0,75 mm²
1 2 GNYE

4 3
1 2
Stecker A-Codiert

PIII_1

+CTRL_2.1
-240U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
4 3
1 2
Ansicht
Stiftleiste
24 VDC
M12 System-
steckverbinder

Ansicht
Buchsenleiste
240W10
2YY (ST) CY
2x2x0,64 mm²
/110.1
-P320-FPPU1
110.0 /
P1
3 4
(IN)
2 1
M12 System-
steckverbinder

240W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU1-FPPU2
441.0 /
P2
3 4
(OUT)
2 1

Arc Detect
3 4
2 1

M6 Bolzen
-PE

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_1
CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1 X1
IGBT2 X2
IGBT3 X3
IGBT4 X4
25-POL SUB-D SOCKET

++CONV
240W1
pre-assembled D-Sub cable 1:1
-_IGBT1.1
/ ++CONV/201.3
240W2
pre-assembled D-Sub cable 1:1
-_IGBT1.2
/ ++CONV/202.3
240W3
pre-assembled D-Sub cable 1:1
-_IGBT1.3
/ ++CONV/203.3

IEC
PE
19

PIII_1
-240W7
pre-assembled D-Sub cable 1:1
/160.7
-HVIO_1
/ 160.9

PIII_Version
2_6_V_4

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

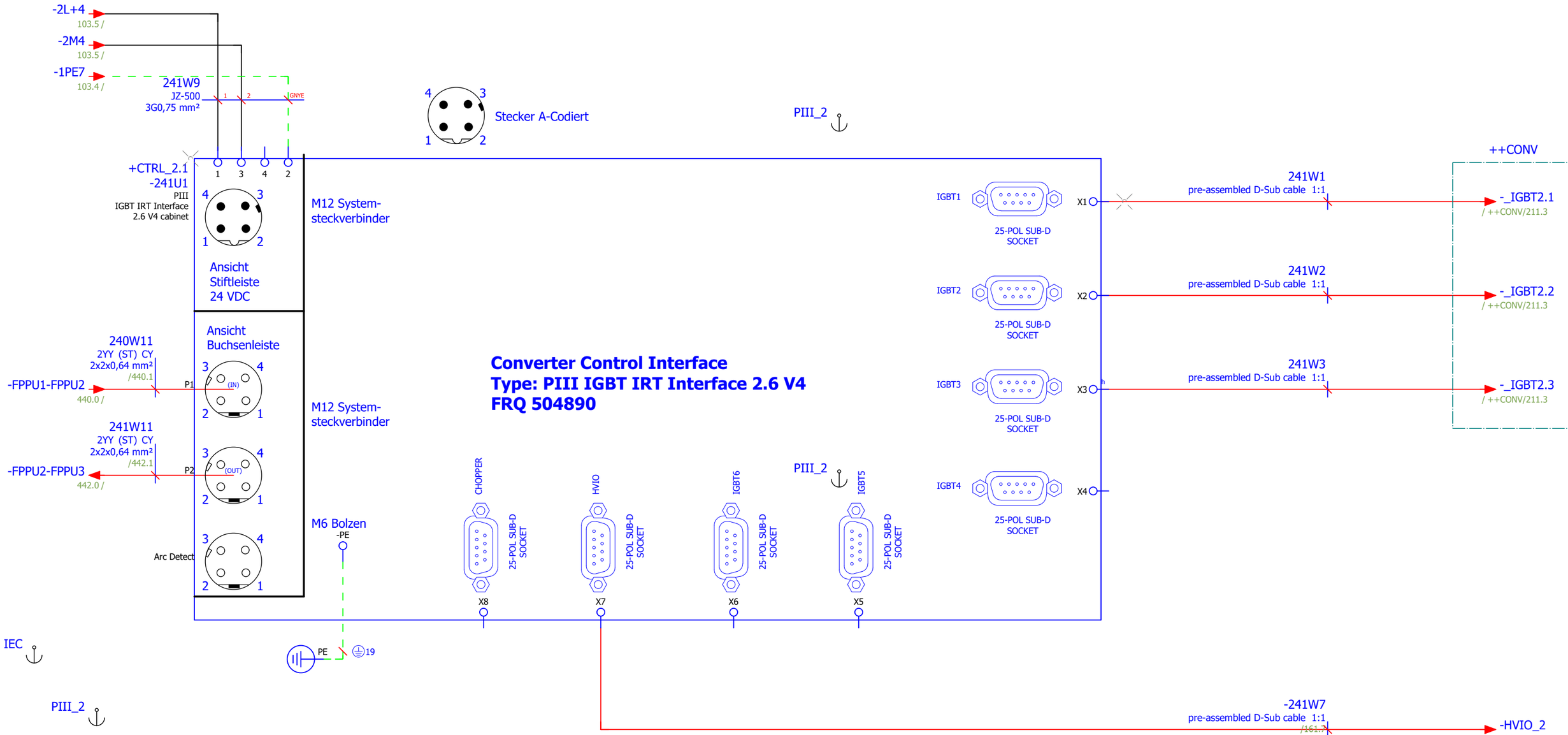
3 4
2 1
Plug D-coded

P2 LAN OUT
P1 LAN IN
Supply 24 V DC
Arc Detect
Fuse 6A F
IGBT6 IGBT4 IGBT2 HVIO
IGBT5 IGBT3 IGBT1 CHOPPER
25-POL SUB-D

connector view PIII

previous page: 353
next page: 441

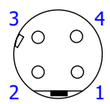
Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 440
Date								+	total: 492

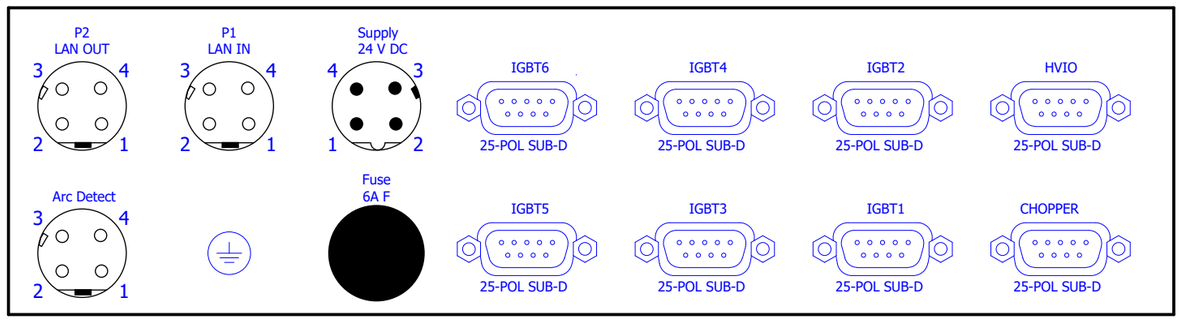


Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320





connector view PIII

previous page: 440
next page: 442

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 441
Date								+ total: 492

-2L+2
103.4 /
-2M2
103.5 /
-1PE5
103.4 /
242W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-242U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

241W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU2-FPPU3
441.0 /
P1 (IN)

242W11
2YY (ST) CY
2x2x0,64 mm²
/443.1
-FPPU3-FPPU4
443.0 /
P2 (OUT)

Arc Detect

M12 System-
steckverbinder

M6 Bolzen
-PE

PE
19

IEC

PIII_3

PIII_Version
2_6_V_4

Stecker A-Codiert

PIII_3

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1 X1
IGBT2 X2
IGBT3 X3
IGBT4 X4
25-POL SUB-D SOCKET

242W1
pre-assembled D-Sub cable 1:1
-_IGBT3.1
/ ++CONV/207.3

242W2
pre-assembled D-Sub cable 1:1
-_IGBT3.2
/ ++CONV/207.3

242W3
pre-assembled D-Sub cable 1:1
-_IGBT3.3
/ ++CONV/207.3

++CONV

-242W7
pre-assembled D-Sub cable 1:1
/163.7
-HVIO_3
/ 163.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

P2 LAN OUT
P1 LAN IN
Supply 24 V DC
Arc Detect
Fuse 6A F
IGBT6 IGBT4 IGBT2 HVIO
IGBT5 IGBT3 IGBT1 CHOPPER
25-POL SUB-D

connector view PIII

previous page: 441
next page: 443

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 442
Date								+	total: 492

-2L+1
103.4 /
-2M3
103.5 /
-1PE8
103.4 /
243W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-243U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

242W11
2YY (ST) CY
2x2x0,64 mm²
/442.1
-FPPU3-FPPU4
442.0 /
P1 (IN)
P2 (OUT)
Arc Detect

M12 System-
steckverbinder

M6 Bolzen
-PE
PE
19

Stecker A-Codiert

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_2

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1
IGBT2
IGBT3
IGBT4
25-POL SUB-D SOCKET
X1 X2 X3 X4

243W1
pre-assembled D-Sub cable 1:1
-_IGBT4.1
/ ++CONV/217.3

243W2
pre-assembled D-Sub cable 1:1
-_IGBT4.2
/ ++CONV/217.3

243W3
pre-assembled D-Sub cable 1:1
-_IGBT4.3
/ ++CONV/217.3

++CONV

IEC

PIII_4

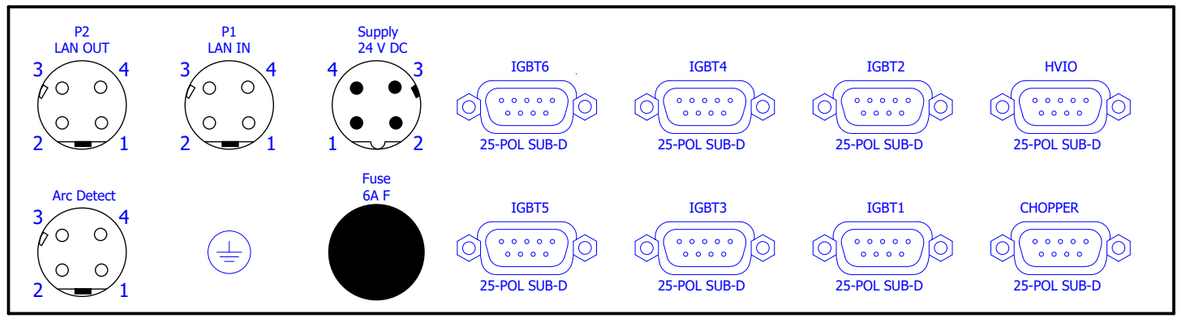
PIII_Version
2_6_V_4

-243W7
pre-assembled D-Sub cable 1:1
/164.7
-HVIO_4
/ 164.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

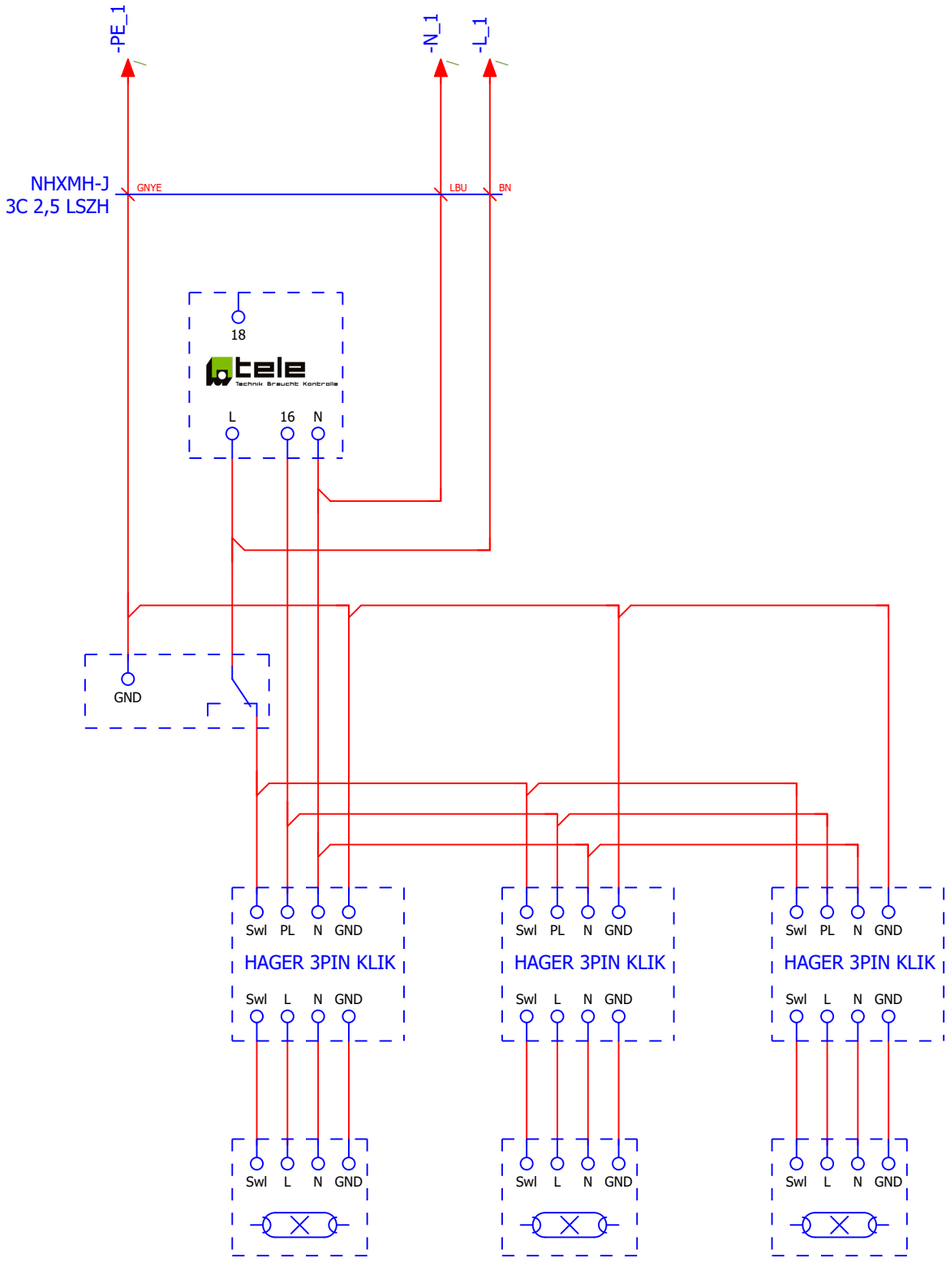


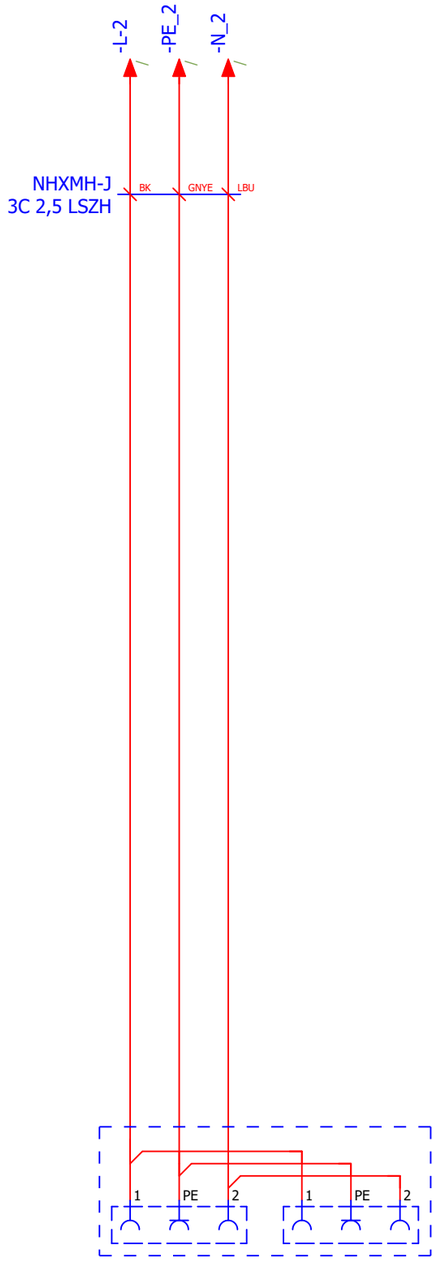
connector view PIII

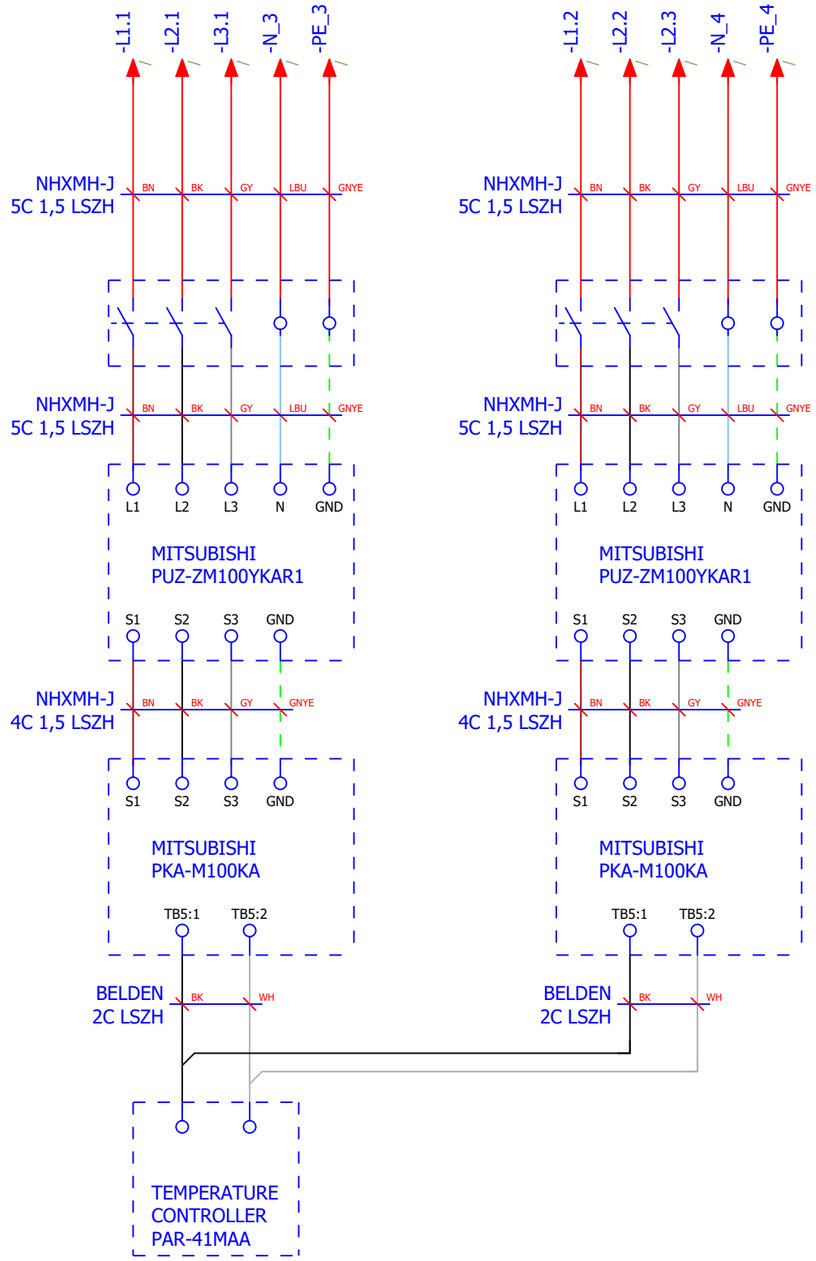
previous page: 442

next page: ++Container/190

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 4	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 443
Date								+		total: 492







previous page:
++CT/443

next page:
&EPC++TRA/1

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18T1 &EFS/18.2	1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555	
-18W5 &EFS/18.3	1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153	

previous page:
&EFS++Container/190

next page:
++CONV/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18Q1 &EFS++TRA/18.7	1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172	
-18Q1 &EFS++TRA/18.7	1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044	
-18Q1 &EFS++TRA/18.7	1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039	

previous page:
++TRA/1

next page:
+CON/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B2 &EFS++CT+/147.7	1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648	
-201Q1 &EFS+/201.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-201Q1 &EFS+/201.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-201Q1 &EFS+/201.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-201Q1 &EFS+/201.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-201Q1 &EFS+/201.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-201Q1 &EFS+/201.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-201Q1-C &EFS+/201.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-201Q1-C &EFS+/201.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-202Q1 &EFS+/202.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-202Q1 &EFS+/202.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-202Q1 &EFS+/202.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-202Q1 &EFS+/202.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-202Q1 &EFS+/202.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-202Q1 &EFS+/202.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-202Q1-C &EFS+/202.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-202Q1-C &EFS+/202.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

previous page:
+/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-202Q1-C &EFS+/202.6;&EFS+/202.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-202Q1-C &EFS+/202.6;&EFS+/202.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-203Q1 &EFS+/203.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-203Q1 &EFS+/203.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-203Q1 &EFS+/203.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-203Q1 &EFS+/203.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-203Q1 &EFS+/203.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-203Q1 &EFS+/203.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-203Q1-C &EFS+/203.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-203Q1-C &EFS+/203.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1 &EFS+/207.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-207Q1 &EFS+/207.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-207Q1 &EFS+/207.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-207Q1 &EFS+/207.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-207Q1 &EFS+/207.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-207Q1-C &EFS+/207.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-207Q1-C &EFS+/207.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-207Q1-C &EFS+/207.6;&EFS+/207.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-207Q1-C &EFS+/207.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1-U1 &EFS+/207.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-211Q1 &EFS+/211.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-211Q1 &EFS+/211.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-211Q1 &EFS+/211.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-211Q1 &EFS+/211.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-211Q1 &EFS+/211.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-211Q1-C &EFS+/211.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-211Q1-C &EFS+/211.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-211Q1-C &EFS+/211.6;&EFS+/211.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-211Q1-C &EFS+/211.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-211Q1-U1 &EFS+/211.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-217Q1 &EFS+/217.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-217Q1 &EFS+/217.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-217Q1 &EFS+/217.3	1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524	
-217Q1 &EFS+/217.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-217Q1 &EFS+/217.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-217Q1 &EFS+/217.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-217Q1-C &EFS+/217.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-217Q1-C &EFS+/217.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-217Q1-C &EFS+/217.6;&EFS+/217.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-217Q1-C &EFS+/217.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-217Q1-U1 &EFS+/217.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-260B1 &EFS+/260.3	1	Optical smoke detector 12V, with alarm relais	130-60-457	ABUS Security-Center GmbH & Co. KG	500713	X
-279M1 &EFS+/279.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M2 &EFS+/279.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M3 &EFS+/279.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M4 &EFS+/279.5	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M5 &EFS+/279.6	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-N &EFS+/99.5	2	Busbar holder for busbars 12x 5 (10)-30x 5 (10) and 6x 6 mm	8US1923-1AA01	Siemens	501271	X

previous page:
3

next page:
+IND/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-201L1 &EFS+/201.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-201L1 &EFS+/201.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-201U1 &EFS+/201.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-202L1 &EFS+/202.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-202L1 &EFS+/202.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-202U1 &EFS+/202.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-203L1 &EFS+/203.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-203L1 &EFS+/203.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-203U1 &EFS+/203.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-207L1 &EFS+/207.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-207L1 &EFS+/207.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-211L1 &EFS+/211.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-211L1 &EFS+/211.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-217L1 &EFS+/217.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-217L1 &EFS+/217.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X

previous page: +CON/4

next page: +CIR/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-80Q1 &EFS+/80.0	1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955	
-80Q1 &EFS+/80.1	1	Circuit breaker 3WL1112, 1250A, 42kA 690V, size 1, 3-pole, IEC, ETU15B, withdrawable	3WL1112-2BB36-1BJ2-ZA08+K07+M06+M21+R10	Siemens	501430	X
-83U1 &EFS+/83.2	1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918	
-83U1-C1 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C2 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C3 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C4 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C7 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C8 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C9 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C10 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C13 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C14 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C15 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C16 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-148B3 &EFS++CT+/148.5	1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649	
-227U1 &EFS+/227.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-227U1-C1 &EFS+/227.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-C7 &EFS+/227.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

previous page:
+IND/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-C13 &EFS+/227.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-F0 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F1 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F1 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F1 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F2 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F2 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F2 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F3 &EFS+/227.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F3 &EFS+/227.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F3 &EFS+/227.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-F4 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F4 &EFS+/227.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F5 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F5 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F5 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F6 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F6 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F6 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-F7 &EFS+/227.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F7 &EFS+/227.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F8 &EFS+/227.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F8 &EFS+/227.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F9 &EFS+/227.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F9 &EFS+/227.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F9 &EFS+/227.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F10 &EFS+/227.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F10 &EFS+/227.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F10 &EFS+/227.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F11 &EFS+/227.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F11 &EFS+/227.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F12 &EFS+/227.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-K1 &EFS+/227.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K2 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K3 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K7 &EFS+/227.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-K8 &EFS+/227.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K9 &EFS+/227.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-U1 &EFS+/227.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-227U1-X3.1 &EFS+/227.a.0;&EFS+/227.a.9	0					
-227U1-X3.1 &EFS+/227.a.1...&EFS+/227.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-227U1-X3.1 &EFS+/227.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-227U1-X3.1 &EFS+/227.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-227U1-X3.1 &EFS+/227.a.2...&EFS+/227.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-227U1-X3.1 &EFS+/227.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-227U1-X3.2 &EFS+/227.a.0	0					
-227U1-X3.2 &EFS+/227.a.1...&EFS+/227.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-227U1-X3.2 &EFS+/227.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-231U1 &EFS+/231.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-231U1-C1 &EFS+/231.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-C7 &EFS+/231.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-C13 &EFS+/231.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-F0 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F1 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F1 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F1 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F2 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F2 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F2 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F3 &EFS+/231.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F3 &EFS+/231.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F3 &EFS+/231.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-F4 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F4 &EFS+/231.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F5 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F5 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F5 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F6 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F6 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F6 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-F7 &EFS+/231.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F7 &EFS+/231.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F8 &EFS+/231.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F8 &EFS+/231.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F9 &EFS+/231.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F9 &EFS+/231.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F9 &EFS+/231.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F10 &EFS+/231.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F10 &EFS+/231.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F10 &EFS+/231.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F11 &EFS+/231.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F11 &EFS+/231.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F12 &EFS+/231.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-K1 &EFS+/231.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K2 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K3 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K7 &EFS+/231.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

previous page: 5

next page: 7

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-K8 &EFS+/231.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K9 &EFS+/231.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-U1 &EFS+/231.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-231U1-X3.1 &EFS+/231.a.0;&EFS+/231.a.9	0					
-231U1-X3.1 &EFS+/231.a.1...&EFS+/231.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-231U1-X3.1 &EFS+/231.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-231U1-X3.1 &EFS+/231.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-231U1-X3.1 &EFS+/231.a.2...&EFS+/231.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-231U1-X3.1 &EFS+/231.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-231U1-X3.2 &EFS+/231.a.0	0					
-231U1-X3.2 &EFS+/231.a.1...&EFS+/231.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-231U1-X3.2 &EFS+/231.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-237U1 &EFS+/237.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-237U1-C1 &EFS+/237.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-C7 &EFS+/237.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-C13 &EFS+/237.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-F0 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F1 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F1 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F1 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F2 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F2 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F2 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F3 &EFS+/237.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F3 &EFS+/237.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F3 &EFS+/237.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-F4 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F4 &EFS+/237.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F5 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F5 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F5 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F6 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F6 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F6 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-F7 &EFS+/237.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F7 &EFS+/237.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F8 &EFS+/237.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F8 &EFS+/237.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F9 &EFS+/237.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F9 &EFS+/237.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F9 &EFS+/237.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F10 &EFS+/237.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F10 &EFS+/237.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F10 &EFS+/237.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F11 &EFS+/237.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F11 &EFS+/237.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F12 &EFS+/237.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-K1 &EFS+/237.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K2 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K3 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K7 &EFS+/237.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-K8 &EFS+/237.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K9 &EFS+/237.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-U1 &EFS+/237.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-237U1-X3.1 &EFS+/237.a.0;&EFS+/237.a.9	0					
-237U1-X3.1 &EFS+/237.a.1...&EFS+/237.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-237U1-X3.1 &EFS+/237.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-237U1-X3.1 &EFS+/237.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-237U1-X3.1 &EFS+/237.a.2...&EFS+/237.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-237U1-X3.1 &EFS+/237.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-237U1-X3.2 &EFS+/237.a.0	0					
-237U1-X3.2 &EFS+/237.a.1...&EFS+/237.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-237U1-X3.2 &EFS+/237.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-281M1 &EFS+/281.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M2 &EFS+/281.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M3 &EFS+/281.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-78F1 &EFS+/78.6	1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738	
-78F1 &EFS+/78.6	3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539	
-78F2 &EFS+/78.6	1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055	
-78F3 &EFS+/78.7;&EFS+/78.8	3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	
-78F3 &EFS+/78.7;&EFS+/78.8	3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545	
-78W1 &EFS+/78.3	1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W2 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W3 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W4 &EFS+/78.3	1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290	
-78W5 &EFS+/78.2	1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070	
-227W10 &EFS+/227.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W11 &EFS+/227.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W12 &EFS+/227.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W13 &EFS+/227.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W14 &EFS+/227.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W15 &EFS+/227.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-228F1 &EFS+/228.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F2 &EFS+/228.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F3 &EFS+/228.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231W10 &EFS+/231.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W11 &EFS+/231.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W12 &EFS+/231.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W13 &EFS+/231.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W14 &EFS+/231.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W15 &EFS+/231.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W10 &EFS+/237.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W11 &EFS+/237.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W12 &EFS+/237.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W13 &EFS+/237.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W14 &EFS+/237.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W15 &EFS+/237.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-238F1 &EFS+/238a.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F2 &EFS+/238a.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F3 &EFS+/238a.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F4 &EFS+/238b.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F5 &EFS+/238b.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F6 &EFS+/238b.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-X3.43	20	Multi-level terminal block	3208511	Phoenix Contact	500560	X

previous page:
1

next page:
++CT+/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113U5 &EFS/113c.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-XT1 &EFS/136.0...&EFS/136.8	20	Feed-through terminal block	3209510	Phoenix Contact	500583	
-XT1 &EFS/136.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT1 &EFS/136.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT1 &EFS/136.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
++CONV+AC_DC/2

next page:
+CTRL_1.1/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84Q1 &EFS+/84.0	1	EMERGENCY STOP SWITCH	3LD2203-1TP53	Siemens	500810	X
-84Q1 &EFS+/84.0	1	Auxiliary switch	3LD9200-5B	Siemens	504922	X
-112A1 &EFS+/112.2	1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475	
-126S1 &EFS+/126.1	1	PUSHBUTTON, BLACK, 1 NO	3SU1100-0AB10-3BA0	Siemens	10026	X
-126S1 &EFS+/126.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H1 &EFS+/140.1	1	Complete device, round, indicator light RED	3SU1102-6AA20-3AA0	Siemens	10019	X
-140H1 &EFS+/140.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H2 &EFS+/140.2	1	Complete device, round, indicator light YELLOW	3SU1102-6AA30-3AA0	Siemens	10021	X
-140H2 &EFS+/140.2	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H3 &EFS+/140.3	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H3 &EFS+/140.3	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H4 &EFS+/140.4	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H4 &EFS+/140.4	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-278M1 &EFS+/278.1	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
+/1

next page:
+.2/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-110U1 &EFS+/110.2	1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789	
-110U1 &EFS+/110.2	1	Connector RJ45, 4 Pol., Profinet, VS-PN-RJ45-5-Q/IP20	1658435	Phoenix Contact	500806	X
-114A1 &EFS+/114.2	1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505	
-114A1 &EFS+/114.2	1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944	
-185R1 &EFS+/185.7	1	SK Enclosure heater, 800/870 W, 230 V, 1~, 50/60 Hz, WHD: 103x200x103 mm	3105400	Rittal	500621	X

previous page:
+.1/1

next page:
+.3/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	23.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+ CTRL_1.2 Left side	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84F1 &EFS+/84.6	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-84F2 &EFS+/84.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	X
-84F2 &EFS+/84.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-84K1 &EFS+/84.5	1	CONT.RELAY,3NO+1NC,DC24V,DIODE	3RH2131-2FB40	Siemens	501288	X
-101Q1 &EFS+/101.2	1	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	X
-101Q1 &EFS+/101.2	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	X
-101Q1 &EFS+/101.2	1	3-PHASE BUSBAR W. INFEED	3RV2917-1A	Siemens	500799	X
-101Q1 &EFS+/101.2	1	3-phase busbar including extension connector for 3 circuit breakers Size S00 and S0	3RV2917-4B	Siemens	504254	X
-101T1 &EFS+/101.2	1	Power supply unit	2866404	Phoenix Contact	502745	X
-102G1 &EFS+/102.2	1	Uninterruptible power supply	2320241	Phoenix Contact	501836	X
-102G2 &EFS+/102.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	X
-103F1 &EFS+/103.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F2 &EFS+/103.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F3 &EFS+/103.6	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F4 &EFS+/103.8	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F5 &EFS+/103.9	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-111A1 &EFS+/111.0	1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287	
-113T1 &EFS+/113a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T1 &EFS+/113a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	

previous page:
+.2/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113T2 &EFS+/113b.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T2 &EFS+/113b.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-113U1 &EFS+/113a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U2 &EFS+/113a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-113U3 &EFS+/113b.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U4 &EFS+/113b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-115A1 &EFS+/115.3	1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt	
-120A1 &EFS+/120.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	X
-134K1 &EFS+/134.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-134K1 &EFS+/134.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K1 &EFS+/135.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K1 &EFS+/135.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K2 &EFS+/135.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K2 &EFS+/135.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K3 &EFS+/135.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K3 &EFS+/135.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K4 &EFS+/135.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K4 &EFS+/135.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K5 &EFS+/135.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-135K5 &EFS+/135.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-136K7 &EFS+/136.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K8 &EFS+/136.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K9 &EFS+/136.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-137K1 &EFS+/137.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K1 &EFS+/137.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K2 &EFS+/137.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K2 &EFS+/137.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K3 &EFS+/137.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K3 &EFS+/137.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K4 &EFS+/137.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K4 &EFS+/137.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-138K1 &EFS+/138.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K1 &EFS+/138.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K2 &EFS+/138.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K2 &EFS+/138.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K3 &EFS+/138.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K3 &EFS+/138.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K4 &EFS+/138.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-138K4 &EFS+/138.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K5 &EFS+/138.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K5 &EFS+/138.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K6 &EFS+/138.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K6 &EFS+/138.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K7 &EFS+/138.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K7 &EFS+/138.7	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-139K1 &EFS+/139.1	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K2 &EFS+/139.2	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K3 &EFS+/139.3	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-150K1 &EFS+/150.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K1 &EFS+/150.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150K2 &EFS+/150.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K2 &EFS+/150.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150X1 &EFS+/150.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-150X1 &EFS+/150.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-150X1 &EFS+/150.2;&EFS+/150.4;&EFS+/151.1;&EFS+/151.4;&EFS+/151.6	5	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-151K1 &EFS+/151.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K1 &EFS+/151.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-151K2 &EFS+/151.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K2 &EFS+/151.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K3 &EFS+/151.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K3 &EFS+/151.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K4 &EFS+/151.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K4 &EFS+/151.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-171K3 &EFS+/171.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-171K3 &EFS+/171.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-173K3 &EFS+/173.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-173K3 &EFS+/173.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-181Q1 &EFS+/181.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-181Q1 &EFS+/181.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q1 &EFS+/181.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-181Q2 &EFS+/181.3	1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671	
-181Q2 &EFS+/181.3	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q2 &EFS+/181.3	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-182Q1 &EFS+/182.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-182Q1 &EFS+/182.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-182Q1 &EFS+/182.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-183F1 &EFS+/183.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	X
-183F1 &EFS+/183.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-183F1 &EFS+/183.1	1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364	X
-183F1 &EFS+/183.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	X
-183F2 &EFS+/183.3	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-183F2 &EFS+/183.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185B1 &EFS+/185.6	1	Thermostat NC contact, -10 to 50 °C	8MR2170-1CA	Siemens	500816	X
-185F1 &EFS+/185.1	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-185F1 &EFS+/185.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185F2 &EFS+/185.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	X
-185F2 &EFS+/185.7	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-186B1 &EFS+/186.6	1	Thermostat NO contact, -10 to 50 °C	8MR2170-1CB	Siemens	501577	X
-186K1 &EFS+/186.6	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-187F1 &EFS+/187.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C13	5SY4113-7	Siemens	504323	X
-187F1 &EFS+/187.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-187F2 &EFS+/187.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-189K1 &EFS+/189.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-190F1 &EFS+/190.1	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F1 &EFS+/190.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-190F1 &EFS+/190.1	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F2 &EFS+/190.3	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F2 &EFS+/190.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F2 &EFS+/190.3	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F3 &EFS+/190.5	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F3 &EFS+/190.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F3 &EFS+/190.5	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190X10 &EFS+/190.9	1	5TE6 REG Socket Outlets, 16 A	5TE6800	Siemens	503215	X
-190XT1 &EFS+/190.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-190XT1 &EFS+/190.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-190XT1 &EFS+/190.1;&EFS+/190.5	3	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-191F1 &EFS+/191.1	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F1 &EFS+/191.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191F2 &EFS+/191.3	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F2 &EFS+/191.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191XT1 &EFS+/191.1;&EFS+/191.3	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-191XT1 &EFS+/191.1	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-191XT1 &EFS+/191.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-195K1 &EFS+/195.3	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K1 &EFS+/195.3	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K2 &EFS+/195.4	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K2 &EFS+/195.4	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K3 &EFS+/195.1	1	SIRIUS SAFETY RELAY STD RELAY 3NO+1NC	3SK1111-2AB30	Siemens	501260	X
-AI_01 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_01 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-AI_02 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_02 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_03 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_03 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_04 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_04 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_01 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_01 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X

previous page: 7

next page: 9

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-DI_02 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_02 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_03 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_03 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_04 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_04 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_05 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_05 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_06 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_06 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_01 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_01 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-DO_02 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_02 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_03 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_03 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_04 &EFS+/120.6	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_04 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-X1 &EFS+/181.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X1 &EFS+/181.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-X1 &EFS+/181.1;&EFS+/181.3;&EFS+/181.4;&EFS+/182.1;&EFS+/182.3;&EFS+/182.4	12	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-X1 &EFS+/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-X1 &EFS+/181.1;&EFS+/181.4;&EFS+/182.1;&EFS+/182.4	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-X3 &EFS+/127.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3 &EFS+/127.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.10 &EFS+/129.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0;&EFS+/129.2;&EFS+/129.4;&EFS+/129.6;&EFS+/129.8;&EFS+/129.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.10 &EFS+/129.0;&EFS+/129.4;&EFS+/129.6;&EFS+/129.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.11 &EFS+/130.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.11 &EFS+/130.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.11 &EFS+/130.0;&EFS+/130.2;&EFS+/130.4;&EFS+/130.6;&EFS+/130.8;&EFS+/130.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.11 &EFS+/130.0;&EFS+/130.4;&EFS+/130.6;&EFS+/130.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.12 &EFS+/131.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.12 &EFS+/131.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.12 &EFS+/131.0;&EFS+/131.2;&EFS+/131.4;&EFS+/131.6;&EFS+/131.8;&EFS+/131.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.12 &EFS+/131.0;&EFS+/131.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.13 &EFS+/132.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X3.13 &EFS+/132.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.13 &EFS+/132.0;&EFS+/132.2;&EFS+/132.4;&EFS+/132.6;&EFS+/132.8;&EFS+/132.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.13 &EFS+/132.0;&EFS+/132.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3	21	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3 &EFS+/127.1;&EFS+/127.5;&EFS+/128.3;&EFS+/188.1	5	Plug-in bridge FBS 2-3,5	3213014	Phoenix Contact	500802	X
-X5 &EFS+/145.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X5 &EFS+/145.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-X5.1 &EFS+/149.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0;&EFS+/149.2	2	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-X5.1 &EFS+/149.0	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-X5	15	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-XDC1 &EFS+/103.1	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC1 &EFS+/103.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC1 &EFS+/103.2;&EFS+/103.3	7	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC1 &EFS+/103.2	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	X
-XDC1 &EFS+/103.3	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	X
-XDC1 &EFS+/103.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XDC2 &EFS+/103.3	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X

previous page: 10

next page: 12

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC2 &EFS+/103.3	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC2 &EFS+/103.4;&EFS+/103.5	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC2 &EFS+/103.4;&EFS+/103.5	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC3 &EFS+/103.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC3 &EFS+/103.5	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC3 &EFS+/103.6;&EFS+/103.7	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC3 &EFS+/103.6;&EFS+/103.7	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC4 &EFS+/103.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC4 &EFS+/103.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC4 &EFS+/103.8;&EFS+/103.9	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC4 &EFS+/103.8;&EFS+/103.9	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC5.1 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.1 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.1 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC5.2 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.2 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.2 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XE &EFS+/84.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-XE &EFS+/84.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XE &EFS+/84.0;&EFS+/84.1	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XE &EFS+/84.0;&EFS+/84.1	3	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	X
-XE &EFS+/84.1;&EFS+/84.2	4	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-XE &EFS+/84.1	1	Plug-in bridge FBS 3-8	3030297	Phoenix Contact	501568	X
-XE &EFS+/84.2;&EFS+/84.3	3	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-XT &EFS+/183.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XT &EFS+/183.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XT &EFS+/183.1;&EFS+/183.2;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2;&EFS+/187.4;&EFS+/187.5	8	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-XT &EFS+/183.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XT &EFS+/187.4	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XT &EFS+/183.1;&EFS+/183.4;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2	6	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XV &EFS+/171.8	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-XV &EFS+/171.8	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Base terminal for component connector	3210185	Phoenix Contact	500828	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Component plug terminal block	3036796	Phoenix Contact	500533	X
-XV &EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	8	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	X
-XV &EFS+/171.8	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XV &EFS+/134.5	1	Diode ZY12 - zener diode, DO-41, plastic, 12V, 2W	17060488	Distrelec Schuricht GmbH	500556	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-85U1 &EFS+/85.0	1	Power Bridge Rectifiers SKD 30/16A1, Vrrm = 1600V, Id = 30A	07122150	Semikron	501556	X
-85U10 &EFS+/85.0	1	EMI Filter X2 Y1 Version 2	505722	Freqcon GmbH	505722	X
-85U11 &EFS+/85.1	1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702	
-149U1 &EFS+/149.5	1	Interface module	2959609	Phoenix Contact	501595	X
-171F1 &EFS+/171.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-171F1 &EFS+/171.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-171K1 &EFS+/171.7	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171K2 &EFS+/171.8	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171R1 &EFS+/171.1	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-171R2 &EFS+/171.2	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-173F2 &EFS+/173.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F2 &EFS+/173.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-173F3 &EFS+/173.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F3 &EFS+/173.4	2	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-173K1 &EFS+/173.8	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173K2 &EFS+/173.9	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173R1 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R2 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R3 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X

previous page:
+.3/13

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R4 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-189X1 &EFS+/189.4	9	Measuring transformer disconnect terminal	3035696	Phoenix Contact	54498	X
-189X1 &EFS+/189.4	9	Test adapter - PAIS-4-FIX GY	3032791	Phoenix Contact	501482	X
-189X1 &EFS+/189.4	1	End cover D-DTME 6	3034426	Phoenix Contact	505468	X
-189X1 &EFS+/189.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-306K1 &EFS+/306.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K1 &EFS+/306.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K2 &EFS+/306.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K2 &EFS+/306.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K3 &EFS+/306.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K3 &EFS+/306.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K4 &EFS+/306.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K4 &EFS+/306.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K5 &EFS+/306.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K5 &EFS+/306.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K6 &EFS+/306.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K6 &EFS+/306.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K1 &EFS+/307.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K1 &EFS+/307.1	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-307K2 &EFS+/307.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K2 &EFS+/307.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K3 &EFS+/307.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K3 &EFS+/307.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K4 &EFS+/307.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K4 &EFS+/307.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K5 &EFS+/307.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K5 &EFS+/307.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K6 &EFS+/307.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K6 &EFS+/307.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K1 &EFS+/308.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K1 &EFS+/308.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K2 &EFS+/308.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K2 &EFS+/308.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K3 &EFS+/308.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K3 &EFS+/308.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K4 &EFS+/308.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K4 &EFS+/308.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K5 &EFS+/308.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-308K5 &EFS+/308.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K6 &EFS+/308.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K6 &EFS+/308.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K1 &EFS+/350.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K1 &EFS+/350.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K2 &EFS+/350.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K2 &EFS+/350.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350X1.21 &EFS+/350.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	
-350X1.21 &EFS+/350.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-350X1.21 &EFS+/350.1&EFS+/350.2&EFS+/350.4&EFS+/351.1&EFS+/351.3&EFS+/351.4&EFS+/352.1&EFS+/352.3&EFS+/353.1&EFS+/353.4&EFS+/352.4	9	Multi-level terminal block	3208511	Phoenix Contact	500560	
-350X1.21 &EFS+/352.1	0					
-351K1 &EFS+/351.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K1 &EFS+/351.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K2 &EFS+/351.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K2 &EFS+/351.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K3 &EFS+/351.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K3 &EFS+/351.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-351K4 &EFS+/351.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K4 &EFS+/351.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

previous page: 3

next page: 5

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-352K1 &EFS+/352.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K1 &EFS+/352.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-352K2 &EFS+/352.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K2 &EFS+/352.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K1 &EFS+/353.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K1 &EFS+/353.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K2 &EFS+/353.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K2 &EFS+/353.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K3 &EFS+/353.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K3 &EFS+/353.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K4 &EFS+/353.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K4 &EFS+/353.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-XE2 &EFS+/173.1	0					
-XE2 &EFS+/173.2...&EFS+/173.5	11	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Base terminal for component connector	3210185	Phoenix Contact	500828	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Component plug terminal block	3036796	Phoenix Contact	500533	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B1 &EFS+/147.5	1	Temperature sensor PT100, cable 1.5m, PVC	1101-6030-1211-110	S+S Regeltechnik GmbH	501787	X
-190H1 &EFS+/190.5	1	LED system light, Without socket, Length: 337 mm, Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500110	Rittal	10007	X
-190H1 &EFS+/190.5	1	Infeed, 2-pole (with socket, without connector), Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500420	Rittal	10009	X
-190H1 &EFS+/190.5	1	Door-Operated Switch, Input voltage: 230 V AC, 24 V DC, - 240 V, 1~, 50 Hz/60 Hz,	2500460	Rittal	500736	X

previous page:
+.4/5

next page:
+CTRL_1/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-20BG1 &EFS+/100.2	1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550	
-20BG1-X &EFS+/100.2	55	End bracket for terminal block	3022276	Phoenix Contact	500588	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-149X1 &EFS+/161.4...&EFS+/161.8	6	Feed-through terminal block Push-in PT 4	3211757	Phoenix Contact	500582	X
-149X1 &EFS+/161.4	1	End cover D-ST 4	3030420	Phoenix Contact	500502	
-149X1 &EFS+/161.4	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-149X1 &EFS+/161.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-160U1 &EFS+/160.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-161U1 &EFS+/161.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-162U1 &EFS+/162.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-163U1 &EFS+/163.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-164U1 &EFS+/164.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-240U1 &EFS+/440.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-240U1 &EFS+/440.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-240U1 &EFS+/440.1	1	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-241U1 &EFS+/441.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-241U1 &EFS+/441.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-241U1 &EFS+/441.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-242U1 &EFS+/442.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-242U1 &EFS+/442.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-242U1 &EFS+/442.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-243U1 &EFS+/443.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-243U1 &EFS+/443.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-243U1 &EFS+/443.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-278M2 &EFS+/278.3	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
1

next page:
+CTRL.4/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R5 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R6 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R7 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R8 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	

previous page:
+CTRL_2.1/2

next page:
++FAN+/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-52G1 &EFS++CT/181.0;&EFS++CT/181.7	0					
-52G1-148B1 &EFS++CT/148.1	1	Temperature sensor PT100, cable 3m, PVC	1101-6030-1231-110	S+S Regeltechnik GmbH	501575	X
-52G1-181M1 &EFS++CT/181.1	1	Pump CM10-2, 3x380V-415V, 50Hz, 1,27 kW, 2,85-2,9 A, 2.950 - 2.960 rpm / 440V-480V, 60Hz, 2,2 kW, 4,0-3,7A, 3.520-3.530 rpm	99080211	GRUNDFOS GmbH	501409	X
-52G1-181R1 &EFS++CT/181.3	1	Screw-in heater SEHK, 3kW, 400V	106066	Siekerkotte GmbH & Co. KG	500620	X
-52G1-181S1 &EFS++CT/181.7	0					
-52G1-181X1 &EFS++CT/181.0	0					
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.3;&EFS++CT/181.4;&EFS++CT/182.1	9	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-52G1-181X1 &EFS++CT/181.3	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-52G1-181X1 &EFS++CT/181.3	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X1 &EFS++CT/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.4;&EFS++CT/182.1	3	Ground terminal block	3209536	Phoenix Contact	500813	X
-52G1-181X3 &EFS++CT/148.1;&EFS++CT/181.7	2	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-52G1-181X3 &EFS++CT/181.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-52G1-181X3 &EFS++CT/181.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X3 &EFS++CT/181.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-52G1-182M1 &EFS++CT/182.1	1	Heat exchanger 40kW cooling capacity, alluminium, 1,72kW, 3,86A, 400V	FR6555950001	Bondioli & Pavesi S.p.A.	500850	X

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153
1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555

Editor	Freqcon_DG			Statron	FREQCON	SUMMARIZED PARTS LIST	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EPA	Summarized part list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070
9	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604
1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524
3	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867
3	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872
3	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882
1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918
1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955
3	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046
3	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053
1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190
1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290
3	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157
3	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426
3	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449
1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648
1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649
3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055
1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044
1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039
1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172
9	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130
3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545
1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738
3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779

previous page:
1

next page:
++CT/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550
4	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890
1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702
5	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390
1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505
1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475
1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287
4	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805
2	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
2	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
38	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
41	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944
2	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
3	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845
2	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740
1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671

Summarized parts list

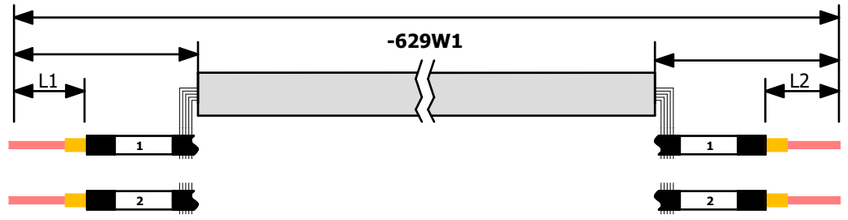
Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797
1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789
2	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
2	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
7	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804
1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt
4	Power Resistor 100W 1% 10K J	160141	Widap AG	501614

0	1	2	3	4	5	6	7	8	9

Cable name =UNIT_01++TRA+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:29	Fuse 230V AC for Container Air Conditioning		
Control cabinet 1	++CT+CTRL_1.3-X3:18	Earthing switch in On Transformer 620V side		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Fuse 230V AC for Container Air Conditioning	++CONV-18Q1:13	
		Earthing switch in On Transformer 620V side	++CONV-18Q1:14	

FRQ_Kabelplan_04_groß_de_en

previous page:
&EPA++CT/2

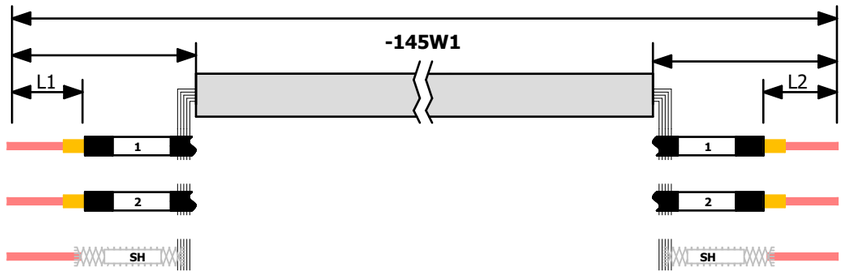
next page:
++CONV/1

Editor	Freqcon_DG			Statron		CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

page: 1
total: 492

Cable name =UNIT_01++CONV+-145W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

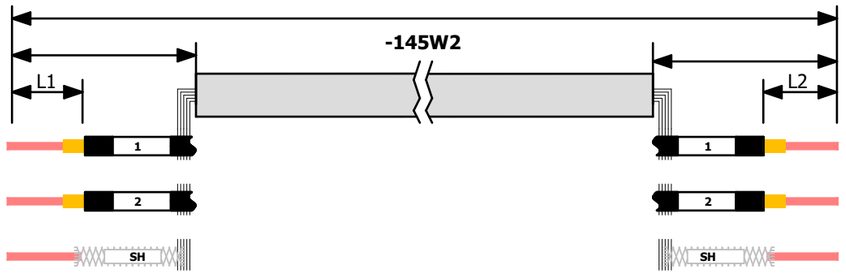


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-201L1:	INDUCTOR GRID PHASE L1 TEMPERATURE 1_1		
Inductor cabinet	+IND-201L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L1	++CT+CTRL_1.3-X5:1	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:2	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

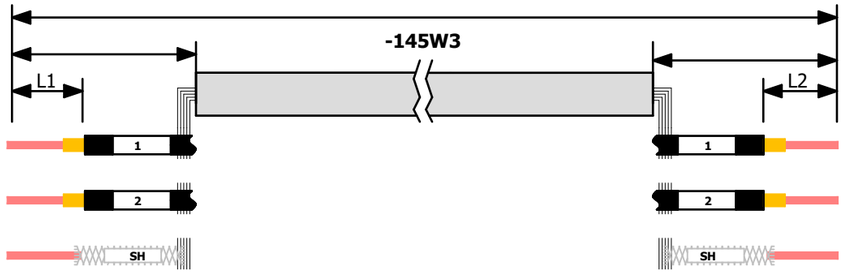


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-202L1:	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2		
Inductor cabinet	+IND-202L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L2	++CT+CTRL_1.3-X5:3	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:4	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

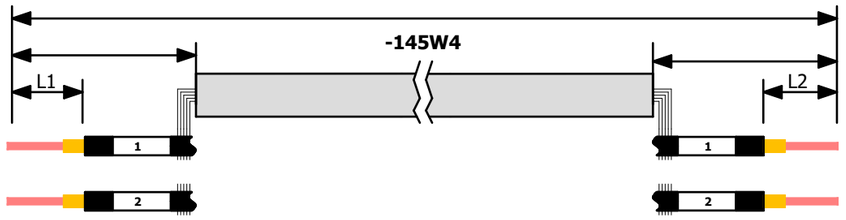


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-203L1:	INDUCTOR GRID PHASE L3 TEMPERATURE 1_3		
Inductor cabinet	+IND-203L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L3	++CT+CTRL_1.3-X5:5	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:6	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.1:	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		
Inductor cabinet	+IND-211L1.1	=		

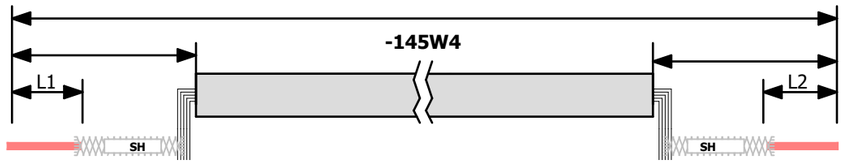
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1	++CT+CTRL_1.3-X5:7	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:8	*Control cabinet 1*

previous page: ++TRA/1
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

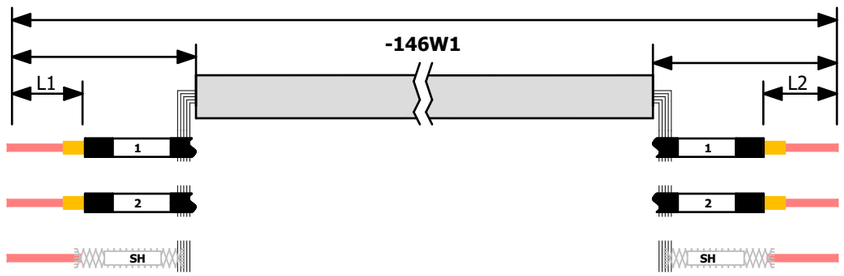


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1		

Cable name =UNIT_01++CONV+-146W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

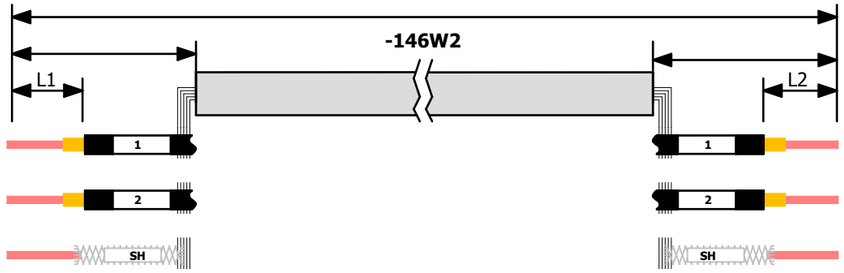


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.2	INDUCTOR DC SUB 2_2 TEMPERATURE 2_2		
Inductor cabinet	+IND-211L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_2	++CT+CTRL_1.3-X5:9	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:10	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3		
Inductor cabinet	+IND-211L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_3	++CT+CTRL_1.3-X5:11	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:12	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.1	INDUCTOR DC SUB 3_1 TEMPERATURE 3_1		
Inductor cabinet	+IND-207L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_1	++CT+CTRL_1.3-X5:13	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:14	***Control cabinet 1***
		=		

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-146W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

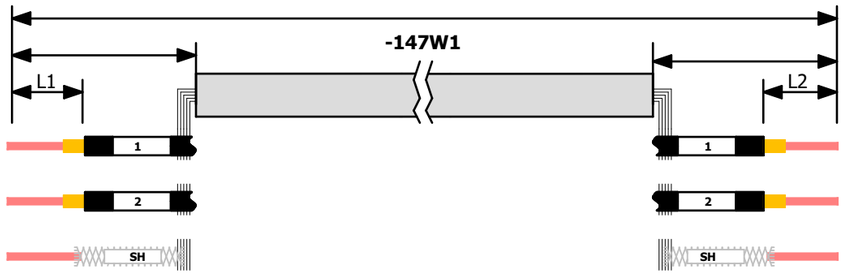


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.2	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2		
Inductor cabinet	+IND-207L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_2	++CT+CTRL_1.3-X5:15	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:16	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-147W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

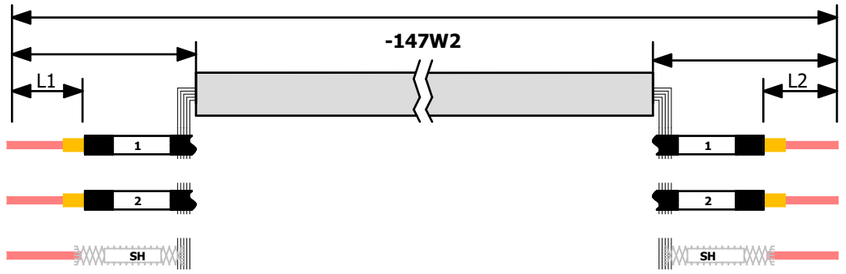


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.3:	INDUCTOR DC SUB 3_3 TEMPERATURE 3_3		
Inductor cabinet	+IND-207L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_3	++CT+CTRL_1.3-X5:17	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:18	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-147W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

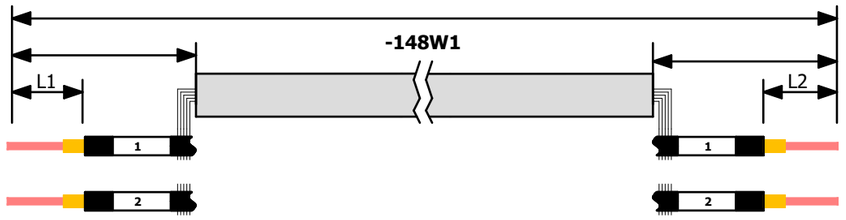


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.1:	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1		
Inductor cabinet	+IND-217L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_1	++CT+CTRL_1.3-X5:19	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:20	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.2:	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		
Inductor cabinet	+IND-217L1.2	=		

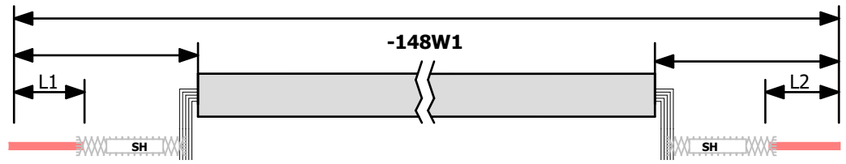
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2	++CT+CTRL_1.3-X5:25	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:26	*Control cabinet 1*

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2		

Cable name =UNIT_01++CONV+-148W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

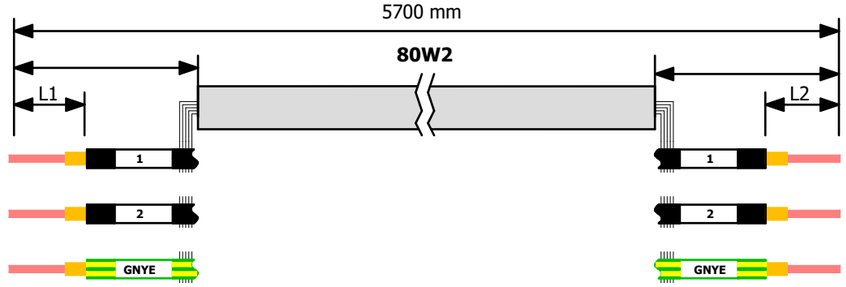


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.3:	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3		
Inductor cabinet	+IND-217L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_3	++CT+CTRL_1.3-X5:29	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:30	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-80W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

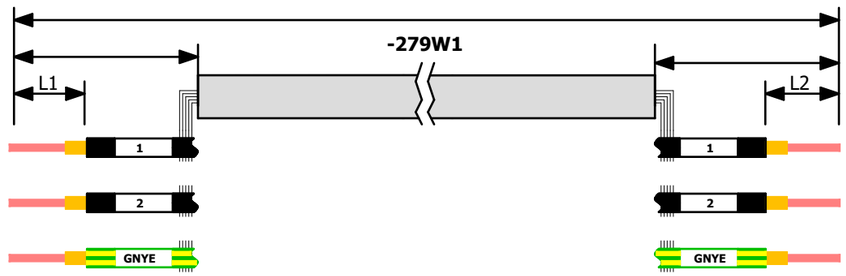


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:9	230V AC for Circuit Breaker 1	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:10	=	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	230V AC for Circuit Breaker 1	+CIR-80Q1:X5_2	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-80Q1:X5_1	***Circuit Breaker cabinet***
		=		

Cable name =UNIT_01++CONV+-279W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:1	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:2	=	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CON-279M1:L	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:N	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:PE	***Converter cabinet***

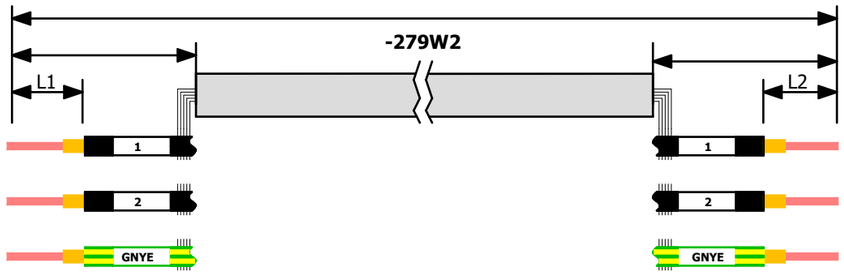
previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M1:L	FAN 1 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M1:N	=	stripped	8 mm
Converter cabinet	+CON-279M1:PE	=	stripped	8 mm

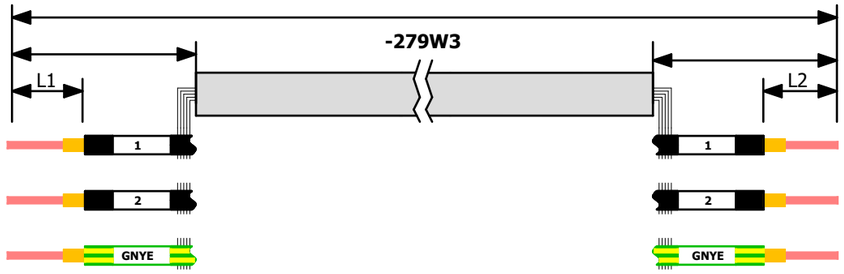


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CONVERTER	+CON-279M2:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M2:1	FAN 2 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M2:2	=	stripped	8 mm
Converter cabinet	+CON-279M2:PE	=	stripped	8 mm

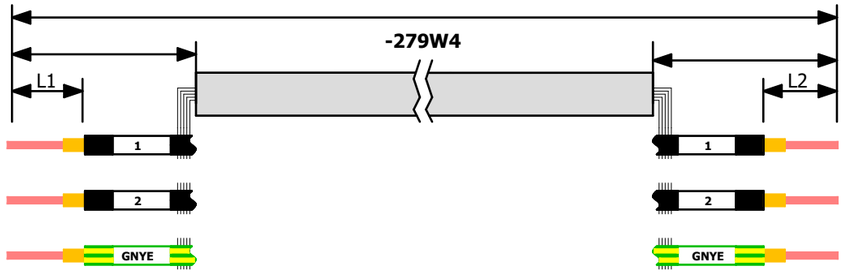


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CONVERTER	+CON-279M3:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W4
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M3:1	FAN 3 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M3:2	=	stripped	8 mm
Converter cabinet	+CON-279M3:PE	=	stripped	8 mm

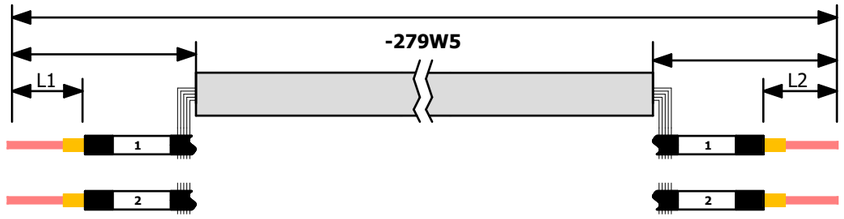


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 3 CONVERTER	+CON-279M4:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:1	FAN 4 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M4:2	=	stripped	8 mm



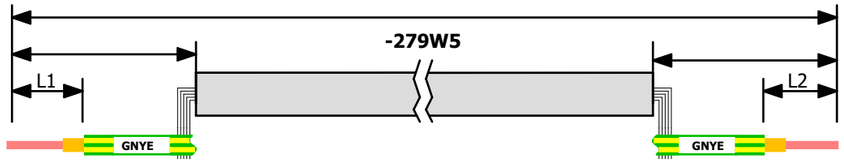
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M5:2	***Converter cabinet***

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

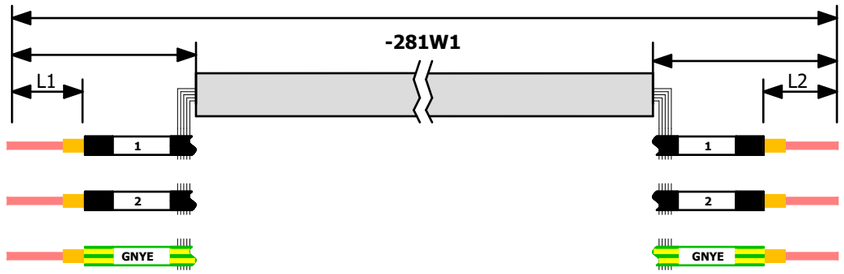


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:PE	FAN 4 CONVERTER	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:PE	*Converter cabinet*

Cable name =UNIT_01++CONV+-281W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:3	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:4	CIR Fans 1-3 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CIR-281M1:L	*Circuit Breaker cabinet*
8 mm	stripped	CIR Fans 1-3	+CIR-281M1:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M1:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

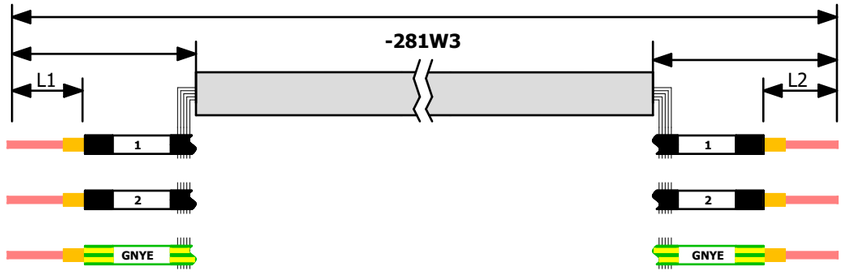


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M1:L	FAN 1 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CIRCUIT BREAKER CABINET	+CIR-281M2:L	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M2:L	FAN 2 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:PE	=	stripped	8 mm

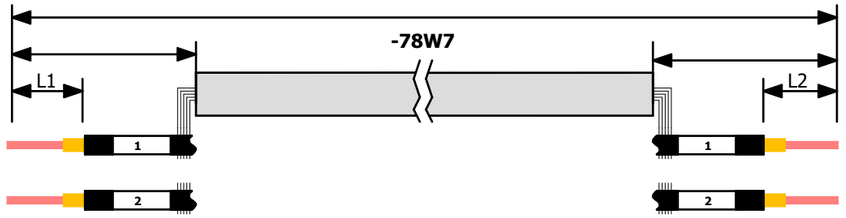
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CIRCUIT BREAKER CABINET	+CIR-281M3:1	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:2	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:PE	*Circuit Breaker cabinet*

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-78W7
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

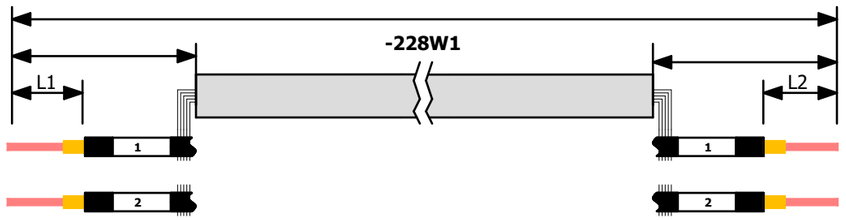


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:20			
AC and DC connection cabinet	+AC_DC-X3.43:19			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+AC_DC-78F1:13	AC and DC connection cabinet
			+AC_DC-78F1:14	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:7	SURGE ARRESTER DC SUBSYSTEM 3_1		
AC and DC connection cabinet	+AC_DC-X3.43:8	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_1	+AC_DC-228F1:11	AC and DC connection cabinet
		=	+AC_DC-228F1:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

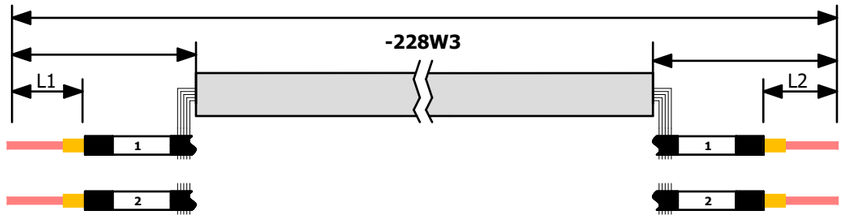


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:9	SURGE ARRESTER DC SUBSYSTEM 3_2		
AC and DC connection cabinet	+AC_DC-X3.43:10	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_2	+AC_DC-228F2:11	AC and DC connection cabinet
		=	+AC_DC-228F2:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:11	SURGE ARRESTER DC SUBSYSTEM 3_3		
AC and DC connection cabinet	+AC_DC-X3.43:12	=		

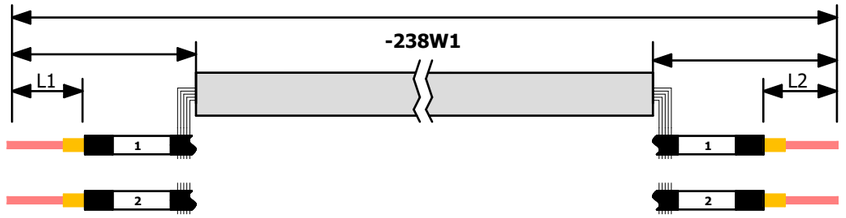
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_3	+AC_DC-228F3:11	AC and DC connection cabinet
		=	+AC_DC-228F3:12	AC and DC connection cabinet

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

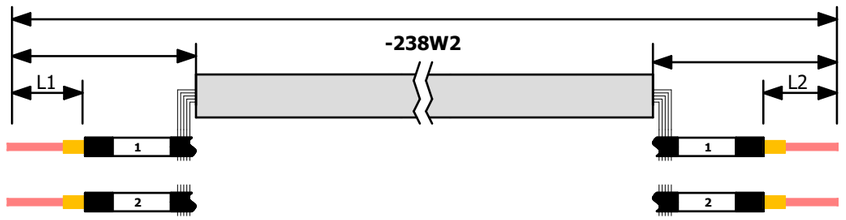


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1		
AC and DC connection cabinet	+AC_DC-X3.43:2	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_1	+AC_DC-238F1:11	***AC and DC connection cabinet***
		=	+AC_DC-238F1:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

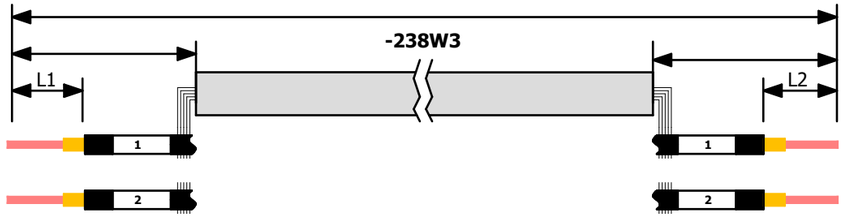


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:3	SURGE ARRESTER DC SUBSYSTEM 2_2		
AC and DC connection cabinet	+AC_DC-X3.43:4	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_2	+AC_DC-238F2:11	***AC and DC connection cabinet***
		=	+AC_DC-238F2:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

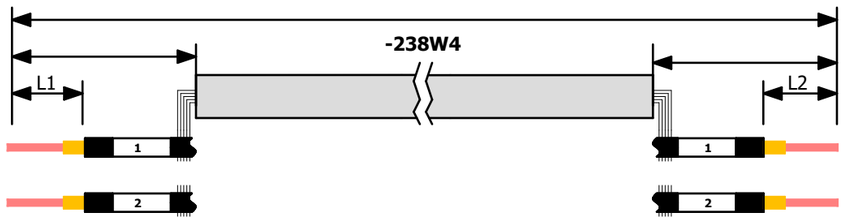


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:5	SURGE ARRESTER DC SUBSYSTEM 2_3		
AC and DC connection cabinet	+AC_DC-X3.43:6	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_3	+AC_DC-238F3:11	***AC and DC connection cabinet***
		=	+AC_DC-238F3:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W4
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:13	SURGE ARRESTER DC SUBSYSTEM 4_1		
AC and DC connection cabinet	+AC_DC-X3.43:14	=		

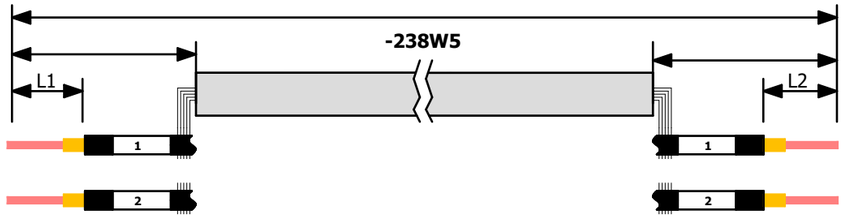
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_1	+AC_DC-238F4:11	***AC and DC connection cabinet***
		=	+AC_DC-238F4:12	***AC and DC connection cabinet***

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W5
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

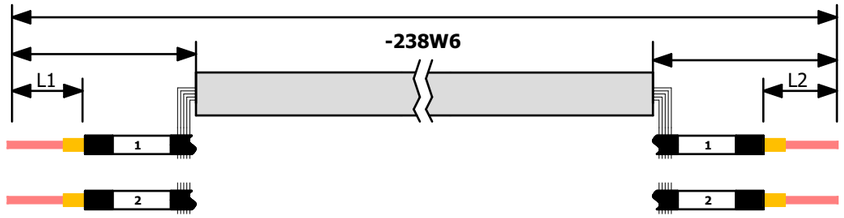


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:15	SURGE ARRESTER DC SUBSYSTEM 4_2		
AC and DC connection cabinet	+AC_DC-X3.43:16	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_2	+AC_DC-238F5:11	***AC and DC connection cabinet***
		=	+AC_DC-238F5:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W6
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

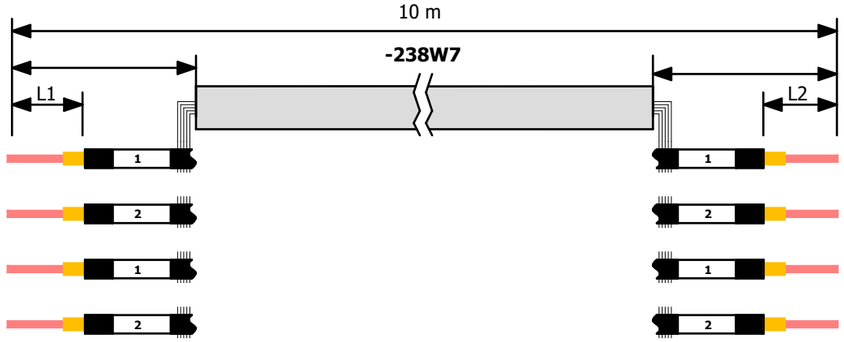


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:17	SURGE ARRESTER DC SUBSYSTEM 4_3		
AC and DC connection cabinet	+AC_DC-X3.43:18	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_3	+AC_DC-238F6:11	***AC and DC connection cabinet***
		=	+AC_DC-238F6:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W7
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030;10030

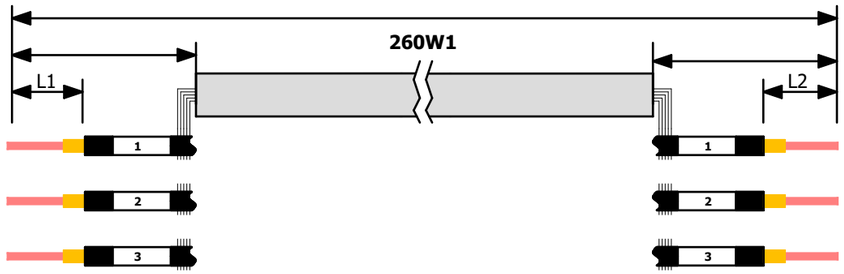


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1	stripped	7mm
AC and DC connection cabinet	+AC_DC-X3.43:20		stripped	7mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8mm	stripped	SURGE ARRESTER DC SUBSYSTEM 2_1	++CT+CTRL_1.3-X3:5	***Control cabinet 1***
8mm	stripped		++CT+CTRL_1.3-X3:6	***Control cabinet 1***

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors 3

Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:19	Smoke detector CON		
Control cabinet 1	++CT+CTRL_1.3-X3:20	=		
Control cabinet 1	++CT+CTRL_1.3-X3:21	=		

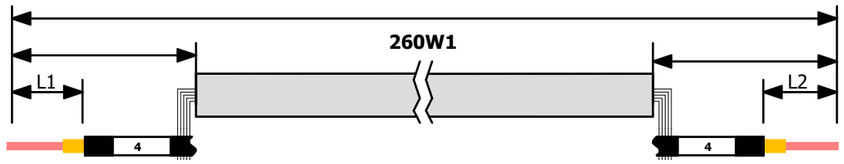
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Smoke detector CON	+CON-260B1:4	***Converter cabinet***
		=	+CON-260B1:2	***Converter cabinet***
		=	+CON-260B1:5	***Converter cabinet***

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors

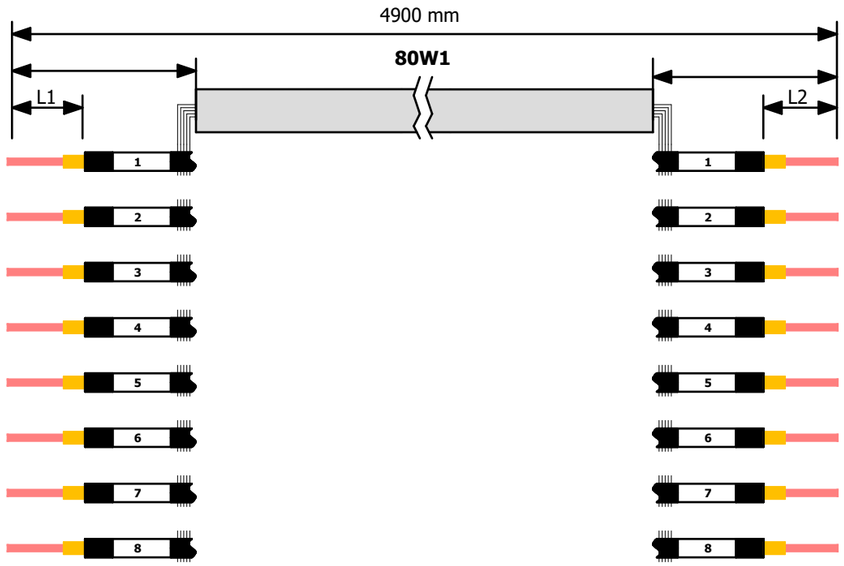
Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:22	Smoke detector CON					Smoke detector CON	+CON-260B1:6	*Converter cabinet*

Cable name =UNIT_01++CONV+-80W1
Cable type OZ-500 8x0,75 mm²
Free conductors

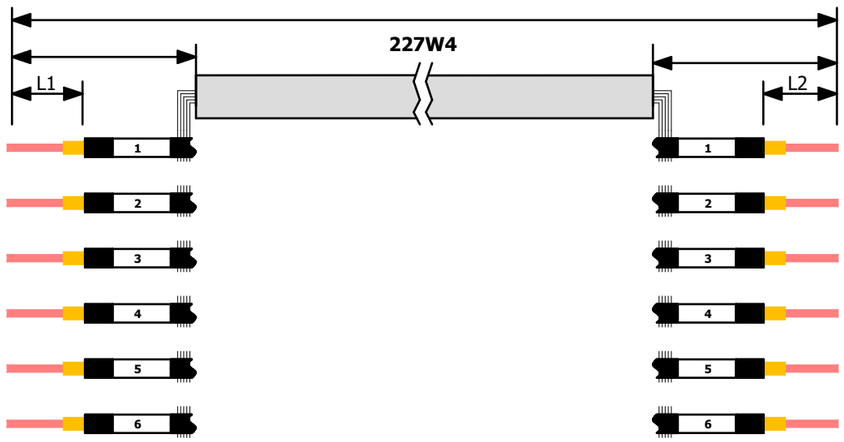
Cable parts HELU.10173
Order number 10173



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:1	CB 1 Tripped GRID	stripped	8 mm	8 mm	stripped	CB 1 Tripped GRID	+CIR-80Q1:X7_13	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:2	CB 1 OFF GRID	stripped	8 mm	8 mm	stripped	CB 1 OFF GRID	+CIR-80Q1:X6_9	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:3	CB 1 ON GRID	stripped	8 mm	8 mm	stripped	CB 1 ON GRID	+CIR-80Q1:X6_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:31	CB 1 GRID +24V	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_12	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:32	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:35	CB 2 ISLAND GRID +24V OPTIONAL	stripped	8 mm	8 mm	stripped	CB 2 ISLAND GRID	+CIR-80Q1:X6_7	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:36	CB 1 GRID	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_14	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:37	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_12	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



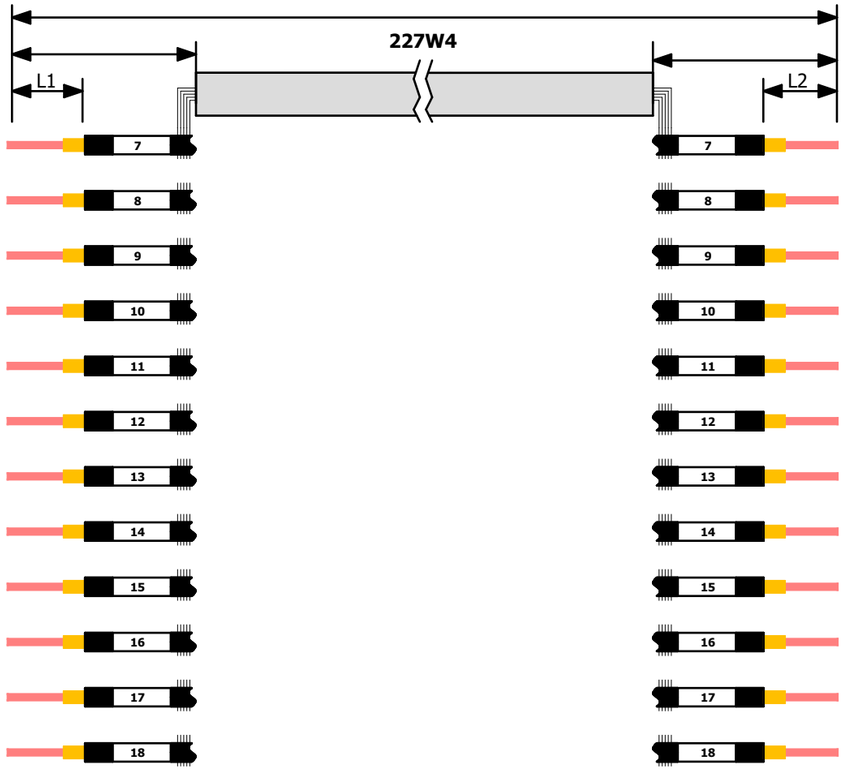
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:1	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:4	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:7	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:3	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:6	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:9	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EMB Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 10
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

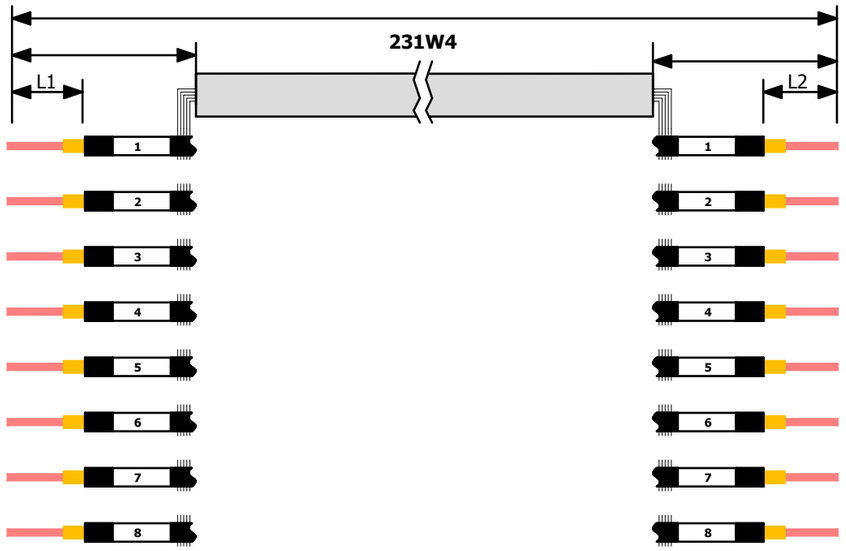
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K3:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

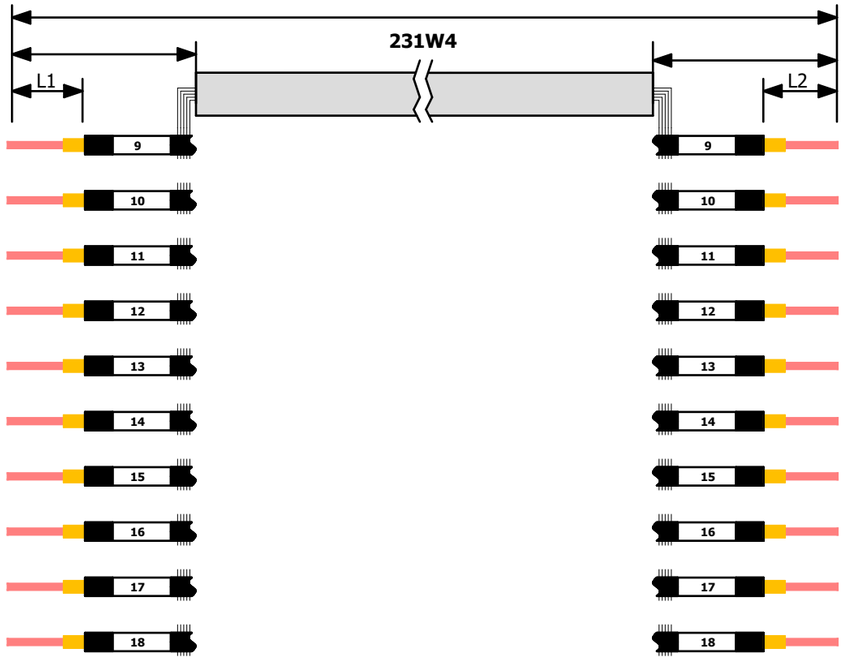


Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:4	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:7	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:3	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:6	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K3:A1	***Control cabinet 1***

previous page: 10
next page: 12

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

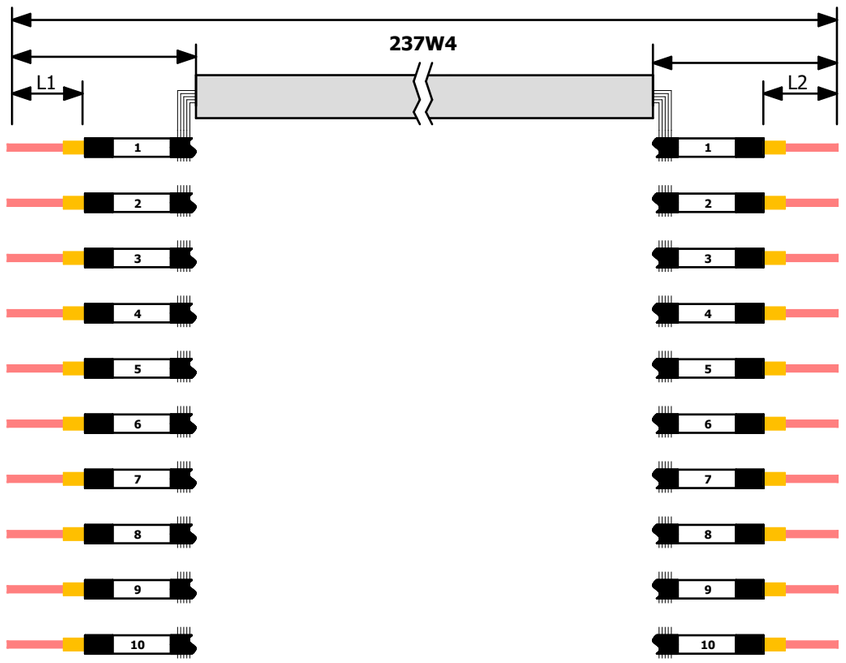
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



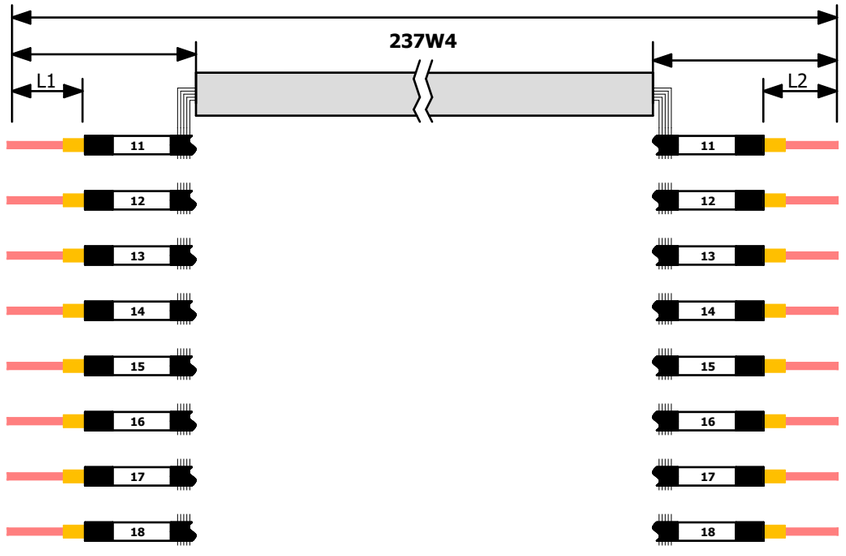
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-237U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:14	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:17	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:13	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:16	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:19	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K3:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K2:A1	***Control cabinet 1***

previous page: 11
next page: 13

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-X3.1:11		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:12		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:13		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:14		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:15		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:16		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:17		stripped	8 mm
			stripped	8 mm

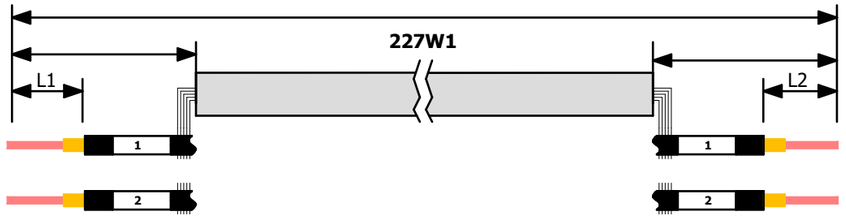


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped		++CT+CTRL_1.4-308K4:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-308K6:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:8	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:9	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:11	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:10	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-350X1.21:12	*Control cabinet 1*
8 mm	stripped			

Cable name =UNIT_01++CONV+-227W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F3:1			
Circuit Breaker cabinet	+CIR-227U1-F4:1			

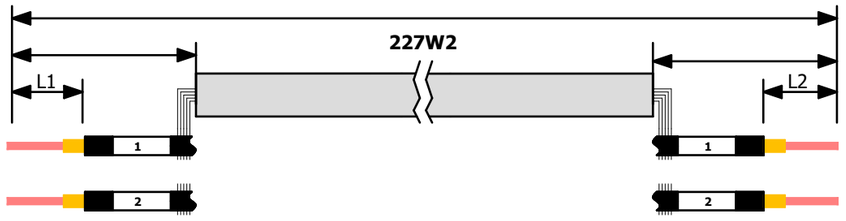


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:32	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-227W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F7:1			
Circuit Breaker cabinet	+CIR-227U1-F8:1			



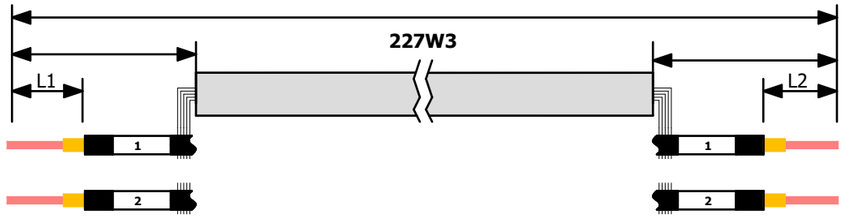
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:36	*Control cabinet 2*

previous page: 12
next page: 14

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-227W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

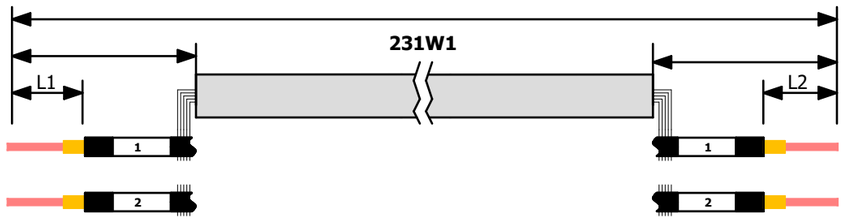


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F11:1			
Circuit Breaker cabinet	+CIR-227U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:40	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

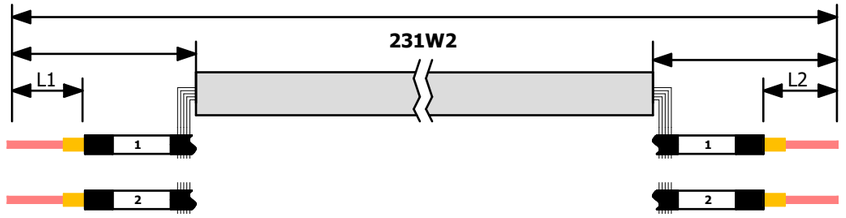


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F3:1			
Circuit Breaker cabinet	+CIR-231U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:19	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

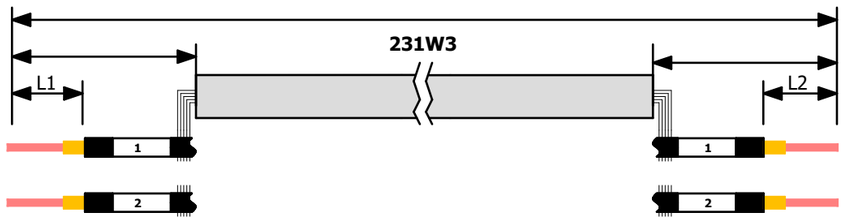


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F7:1			
Circuit Breaker cabinet	+CIR-231U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:23	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F11:1			
Circuit Breaker cabinet	+CIR-231U1-F12:1			

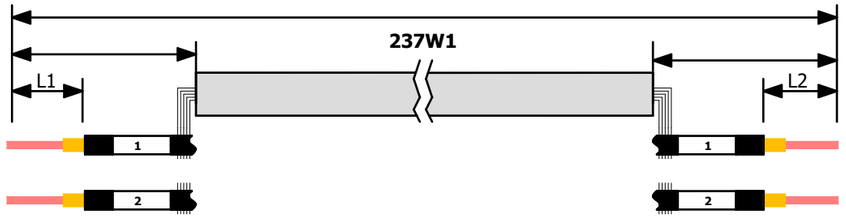
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:27	*Control cabinet 2*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 14
Date								+		total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-237W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

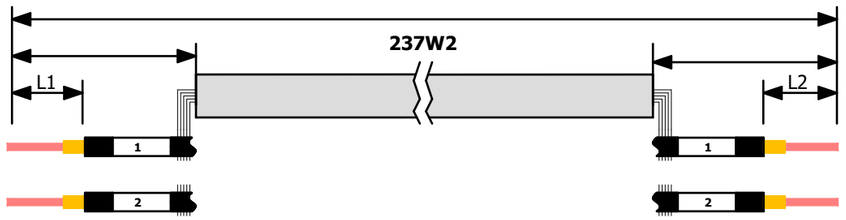


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F3:1			
Circuit Breaker cabinet	+CIR-237U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

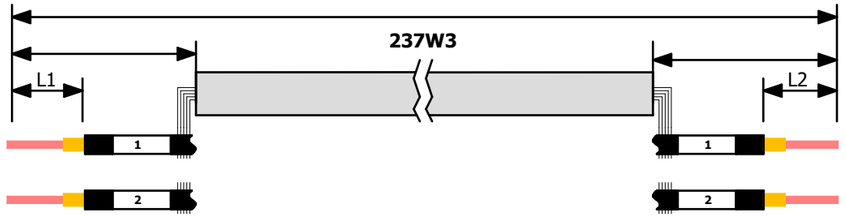


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F7:1			
Circuit Breaker cabinet	+CIR-237U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

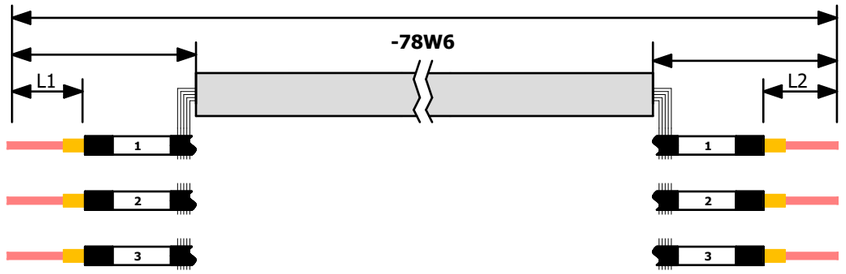


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F11:1			
Circuit Breaker cabinet	+CIR-237U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-78W6
Cable type OZ-600 3x2,5 mm²
Free conductors

Cable parts HELU.10691
Order number 10691



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-78F3:2			
AC and DC connection cabinet	+AC_DC-78F3:4			
AC and DC connection cabinet	+AC_DC-78F3:6			

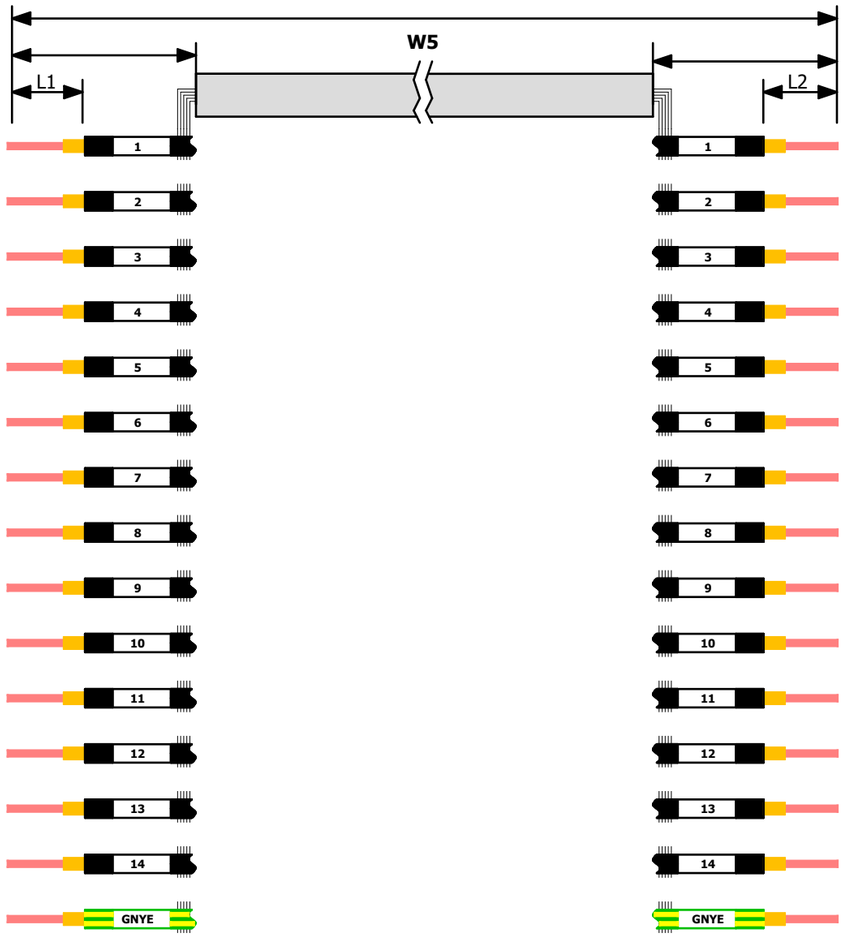
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_1.4-85U1:L1	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L2	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L3	*Control cabinet 1*

previous page: 14
next page: +CIR/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-227U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

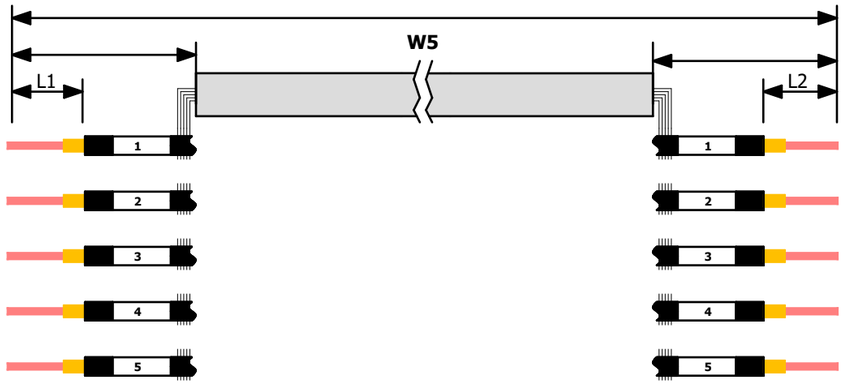
Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-227U1-X3.1:1							-227U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:2							-227U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:3							-227U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:4							-227U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:5							-227U1-X3.2:9	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:6							-227U1-X3.2:11	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:7							-227U1-X3.2:13	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:8							-227U1-X3.2:15	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:9							-227U1-X3.2:17	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:10							-227U1-X3.2:19	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:11							-227U1-X3.2:21	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:12							-227U1-X3.2:23	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:16							-227U1-X3.2:24	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:17							-227U1-X3.2:12	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:PE							-227U1-X3.2:PE	Circuit Breaker cabinet

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-231U1-X3.1:1							-231U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:2							-231U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:3							-231U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:4							-231U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:5							-231U1-X3.2:9	Circuit Breaker cabinet

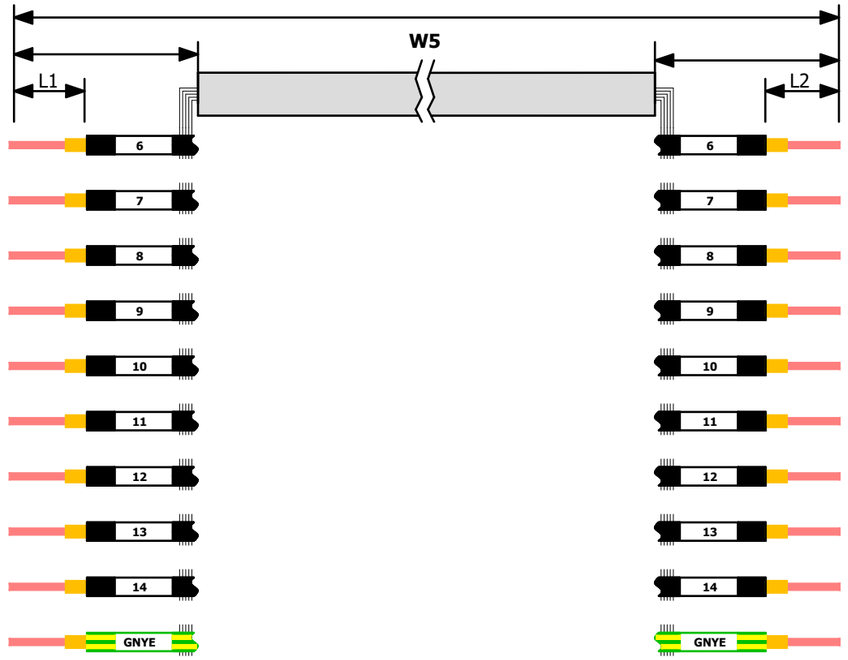
previous page: +/15
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-231U1-X3.1:6			
Circuit Breaker cabinet	-231U1-X3.1:7			
Circuit Breaker cabinet	-231U1-X3.1:8			
Circuit Breaker cabinet	-231U1-X3.1:9			
Circuit Breaker cabinet	-231U1-X3.1:10			
Circuit Breaker cabinet	-231U1-X3.1:11			
Circuit Breaker cabinet	-231U1-X3.1:12			
Circuit Breaker cabinet	-231U1-X3.1:16			
Circuit Breaker cabinet	-231U1-X3.1:17			
Circuit Breaker cabinet	-231U1-X3.1:PE			

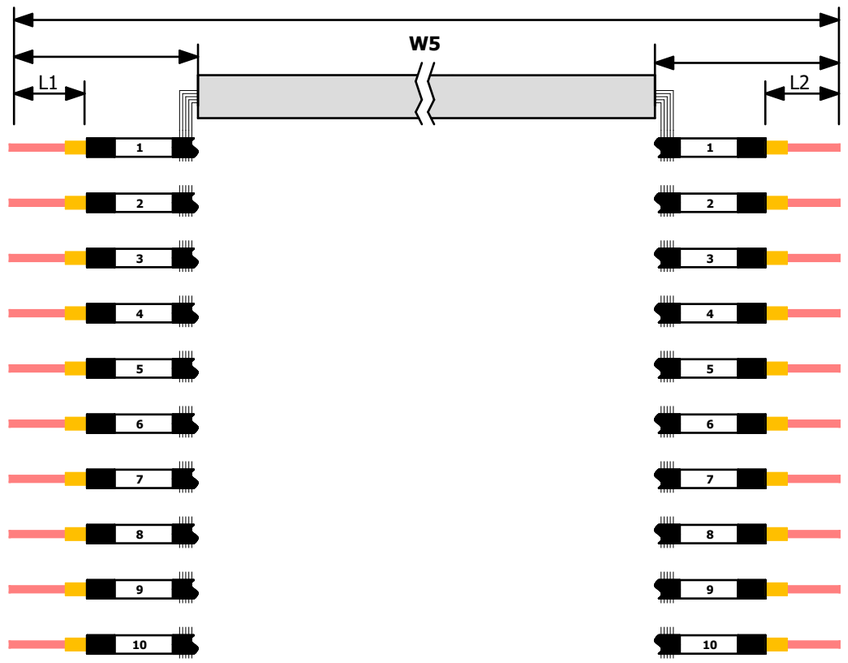


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-231U1-X3.2:11	*Circuit Breaker cabinet*
			-231U1-X3.2:13	*Circuit Breaker cabinet*
			-231U1-X3.2:15	*Circuit Breaker cabinet*
			-231U1-X3.2:17	*Circuit Breaker cabinet*
			-231U1-X3.2:19	*Circuit Breaker cabinet*
			-231U1-X3.2:21	*Circuit Breaker cabinet*
			-231U1-X3.2:23	*Circuit Breaker cabinet*
			-231U1-X3.2:24	*Circuit Breaker cabinet*
			-231U1-X3.2:12	*Circuit Breaker cabinet*
			-231U1-X3.2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:1			
Circuit Breaker cabinet	-237U1-X3.1:2			
Circuit Breaker cabinet	-237U1-X3.1:3			
Circuit Breaker cabinet	-237U1-X3.1:4			
Circuit Breaker cabinet	-237U1-X3.1:5			
Circuit Breaker cabinet	-237U1-X3.1:6			
Circuit Breaker cabinet	-237U1-X3.1:7			
Circuit Breaker cabinet	-237U1-X3.1:8			
Circuit Breaker cabinet	-237U1-X3.1:9			
Circuit Breaker cabinet	-237U1-X3.1:10			



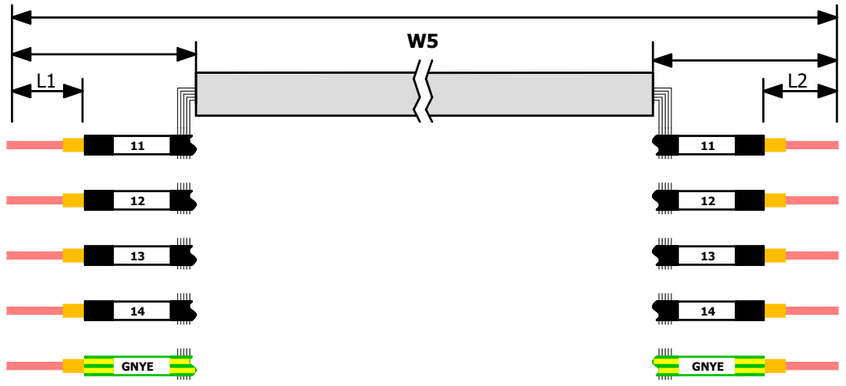
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:1	*Circuit Breaker cabinet*
			-237U1-X3.2:3	*Circuit Breaker cabinet*
			-237U1-X3.2:5	*Circuit Breaker cabinet*
			-237U1-X3.2:7	*Circuit Breaker cabinet*
			-237U1-X3.2:9	*Circuit Breaker cabinet*
			-237U1-X3.2:11	*Circuit Breaker cabinet*
			-237U1-X3.2:13	*Circuit Breaker cabinet*
			-237U1-X3.2:15	*Circuit Breaker cabinet*
			-237U1-X3.2:17	*Circuit Breaker cabinet*
			-237U1-X3.2:19	*Circuit Breaker cabinet*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



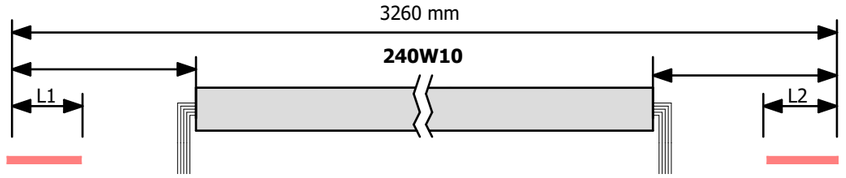
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:11			
Circuit Breaker cabinet	-237U1-X3.1:12			
Circuit Breaker cabinet	-237U1-X3.1:16			
Circuit Breaker cabinet	-237U1-X3.1:17			
Circuit Breaker cabinet	-237U1-X3.1:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:21	*Circuit Breaker cabinet*
			-237U1-X3.2:23	*Circuit Breaker cabinet*
			-237U1-X3.2:24	*Circuit Breaker cabinet*
			-237U1-X3.2:12	*Circuit Breaker cabinet*
			-237U1-X3.2:PE	*Circuit Breaker cabinet*

FRQ_Kabelplan_04_gro8_de_en

previous page: 2
next page: ++CT+/1

Cable name =UNIT_01++CT+-240W10
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

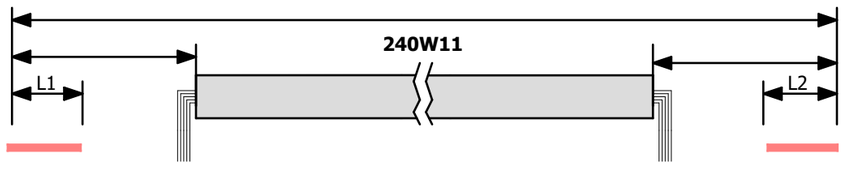


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

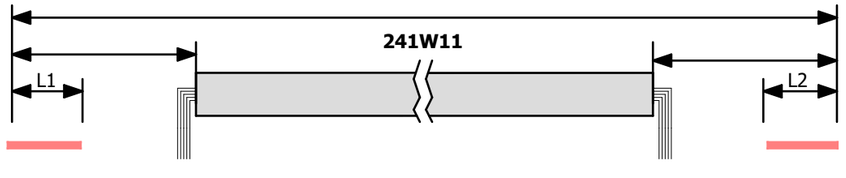


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-240U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

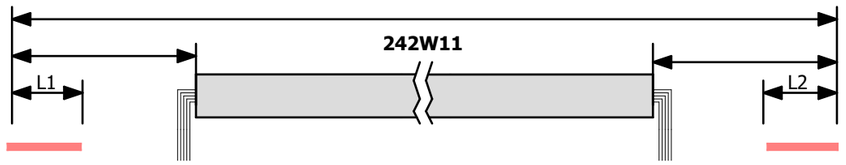


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-241U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

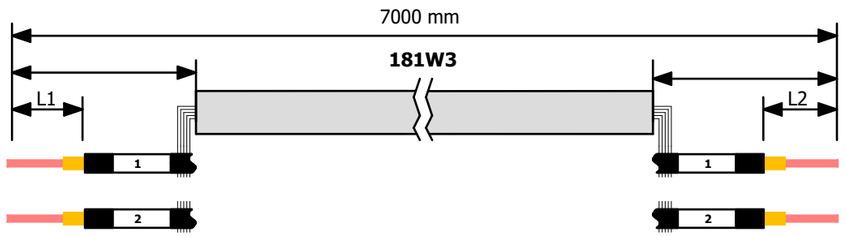


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-242U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2



Cable parts HELU.16563
Order number 16563

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:23	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X3:24	=	stripped	8 mm

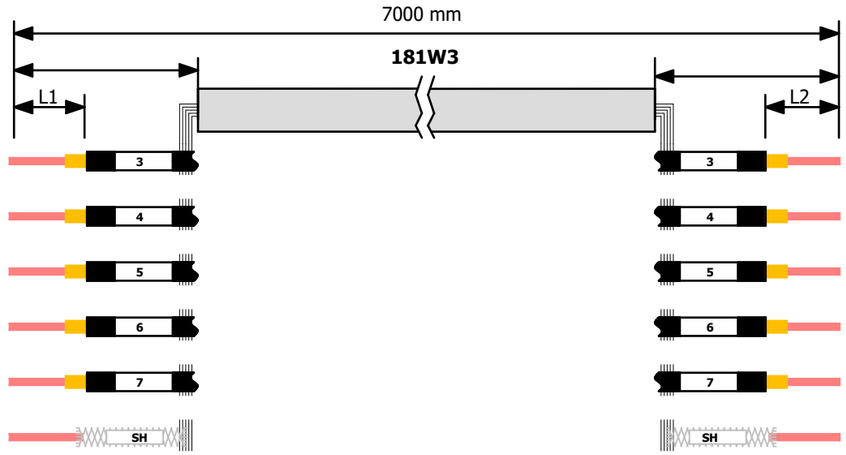
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:1	
	Flat connector	=	++FAN-52G1-181X3:3	

previous page: ++CONV+CIR/3
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2

Cable parts HELU.16563
Order number 16563

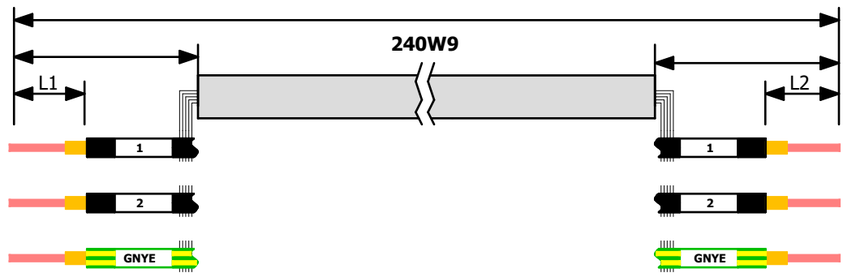


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:25	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X5:23	COOLING WATER TEMPERATURE	End splice	8 mm
Control cabinet 1	+CTRL_1.3-X5:24	=	End splice	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:2	
8 mm	stripped	COOLING WATER TEMPERATURE	++FAN-52G1-181X3:4	
8 mm	stripped	=	++FAN-52G1-181X3:5	

Cable name =UNIT_01++CT+-240W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031

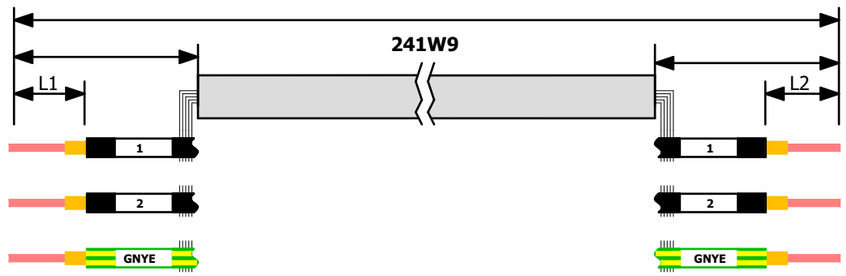


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC1:1	FUSE 24V DC CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:4	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	FUSE 24V DC CONTROL VOLTAGE	+CTRL_2.1-240U1:1	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-240U1:3	*Control cabinet 2*
	Connector	=	+CTRL_2.1-240U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:4	=	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

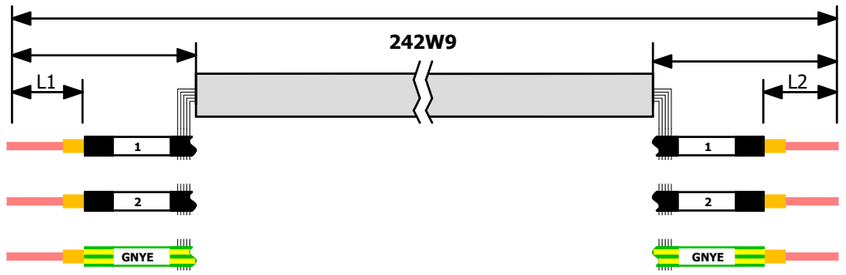
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-241U1:1	*Control cabinet 2*
	Connector	=	+CTRL_2.1-241U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-241U1:2	*Control cabinet 2*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

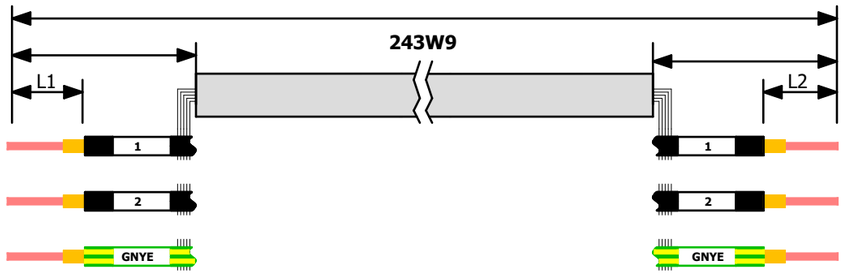


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-242U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

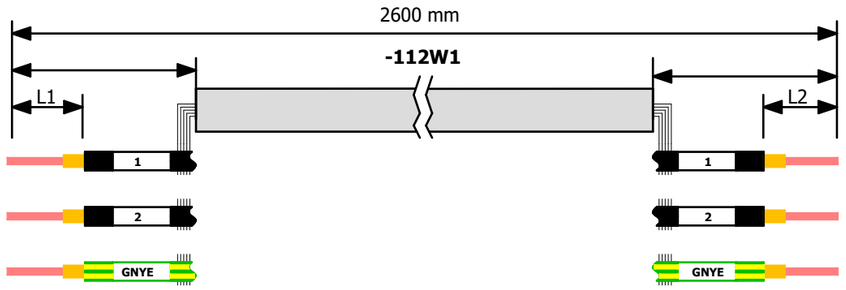


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-243U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-112W1
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

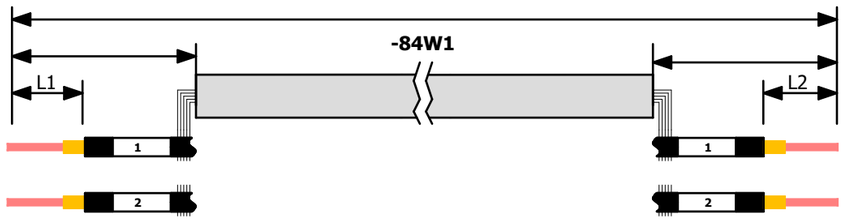


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE		
Control cabinet 1	+CTRL_1.3-XDC2:4	=		
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		BSU, SPARE CONTROL VOLTAGE	+CTRL_1.1-112A1:L+	*Control cabinet 1*
		=	+CTRL_1.1-112A1:M	*Control cabinet 1*
		Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_1.1-112A1:PE	*Control cabinet 1*

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors 1

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:2		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:4		stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	End splice		+CTRL_1.3-84F1:L1'	*Control cabinet 1*
8 mm	End splice		+CTRL_1.3-84F1:L2'	*Control cabinet 1*

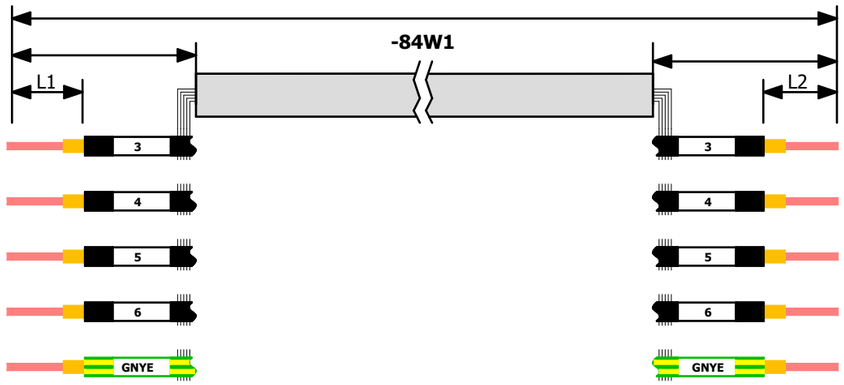
previous page: 2

next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors

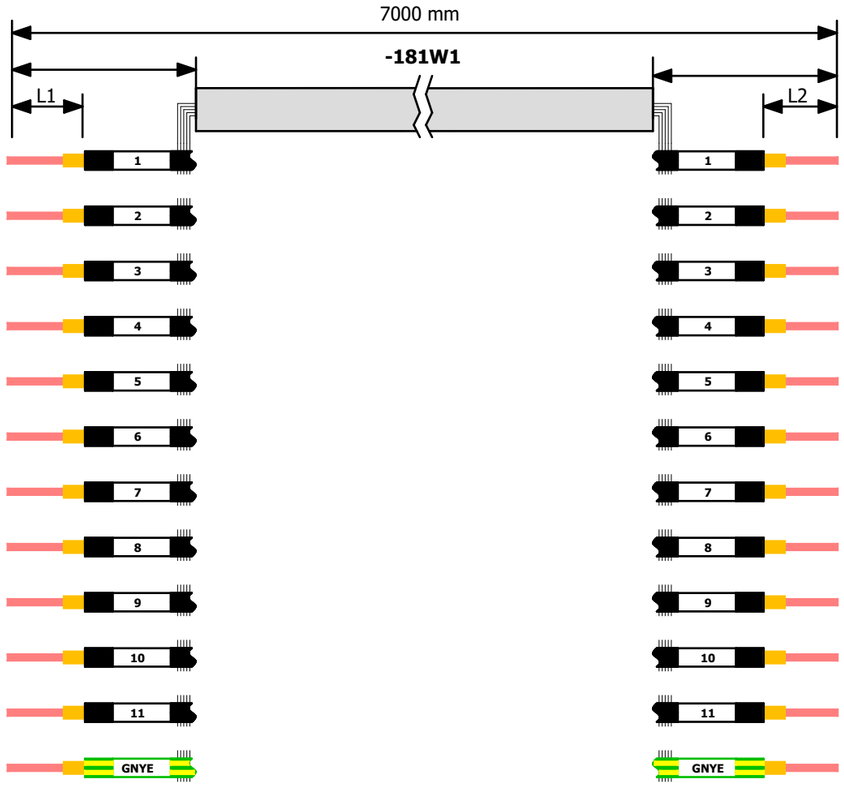
Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.1-84Q1:6		stripped	8 mm	8 mm	End splice		+CTRL_1.3-84F1:L3'	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:1		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F1:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:3		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F2:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:5		stripped	8 mm	8 mm	End splice		+CTRL_1.3-185F1:1	Control cabinet 1

Cable name =UNIT_01++CT+-181W1
Cable type JZ-600 12G1,5 mm²
Free conductors

Cable parts HELU.10670
Order number 10670



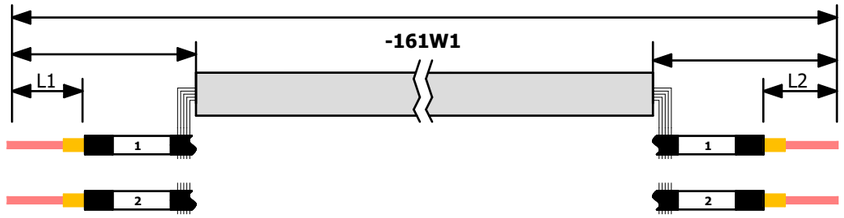
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.3-X1:1	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:1:1	
Control cabinet 1	+CTRL_1.3-X1:2	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:2:1	
Control cabinet 1	+CTRL_1.3-X1:3	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:3:1	
Control cabinet 1	+CTRL_1.3-X1:4	FUSE FOR PUMP	stripped	8 mm	8 mm	stripped	FUSE FOR PUMP	++FAN-52G1-181X1:4:1	
Control cabinet 1	+CTRL_1.3-X1:5	HEATER	stripped	8 mm	8 mm	stripped	HEATER	++FAN-52G1-181X1:5:1	
Control cabinet 1	+CTRL_1.3-X1:6	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:6:1	
Control cabinet 1	+CTRL_1.3-X1:7	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:7:1	
Control cabinet 1	+CTRL_1.3-X1:8	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	++FAN-52G1-181X1:8:1	
Control cabinet 1	+CTRL_1.3-X1:9	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:9:1	
Control cabinet 1	+CTRL_1.3-X1:10	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:10:1	
Control cabinet 1	+CTRL_1.3-X1:PE	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:PE:1	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-161W1
Cable type OZ-500 2x0,75 mm²
Free conductors 0

Cable parts HELU.10030
Order number 10030

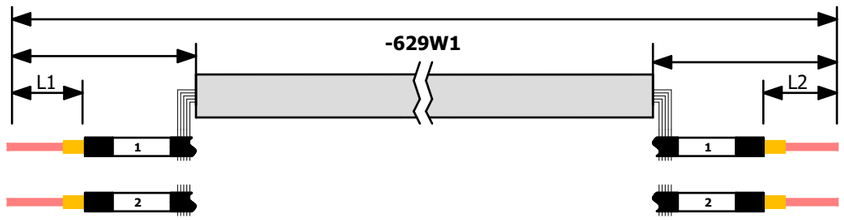


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:+			
Control cabinet 2	+CTRL_2.1-160U1:-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_2.1-161U1:+	Control cabinet 2
			+CTRL_2.1-161U1:-	Control cabinet 2

Cable name =UNIT_01++CT+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_01++CT+-195W1
Cable type OZ-500 4x0,75 mm²
Free conductors 0

Cable parts HELU.10034
Order number 10034

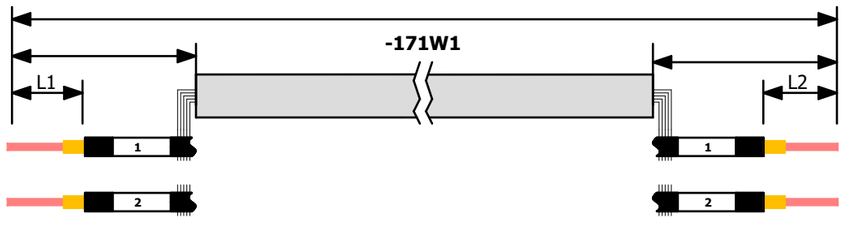


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:13	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:23			
Control cabinet 1	+CTRL_1.1-84Q1:14	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:24			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-195K3:T1	Control cabinet 1
			+CTRL_1.3-195K3:T2	Control cabinet 1
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-X3:41	Control cabinet 1
			+CTRL_1.3-X3:43	Control cabinet 1

Cable name =UNIT_01++CT+-171W1
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:1			
Control cabinet 1	+CTRL_1.4-171F1:3			

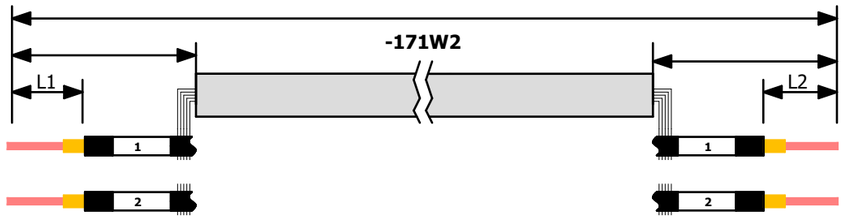
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-85U1:DC+	Control cabinet 1
			+CTRL_1.4-85U1:DC-	Control cabinet 1

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-171W2
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656

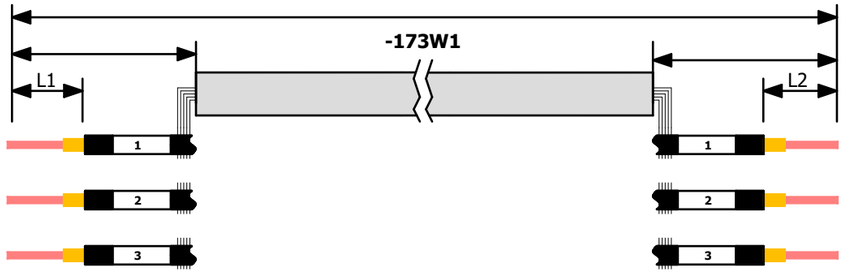


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:2			
Control cabinet 1	+CTRL_1.4-171F1:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-171K1:A1	*Control cabinet 1*
			+CTRL_1.4-171K2:A1	*Control cabinet 1*

Cable name =UNIT_01++CT+-173W1
Cable type OZ-600 3x2,5 mm²
Free conductors 3

Cable parts HELU.10691
Order number 10691

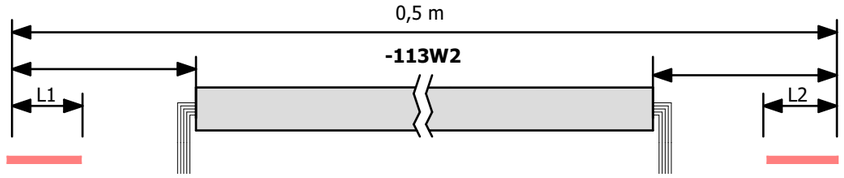


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-UDC+			
Converter cabinet	++CONV+CON-UDC-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-173F2:2	*Control cabinet 1*
			+CTRL_1.4-173F2:4	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

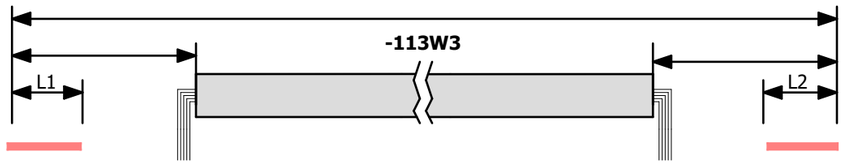


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U1:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U1:IN			

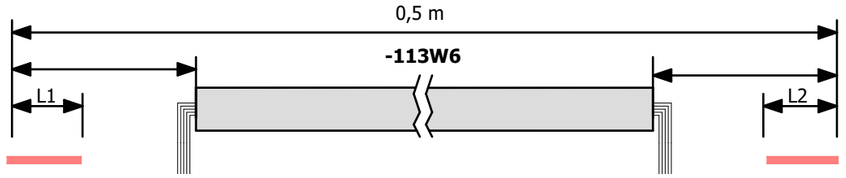
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U2:8	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 6
Date								+ total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-113W6
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

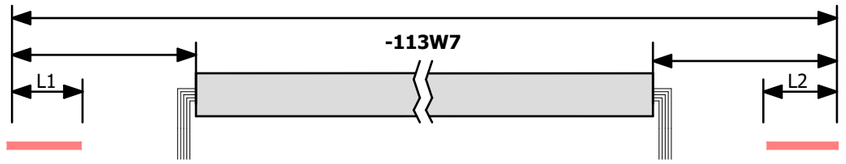


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T2:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U3:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W7
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

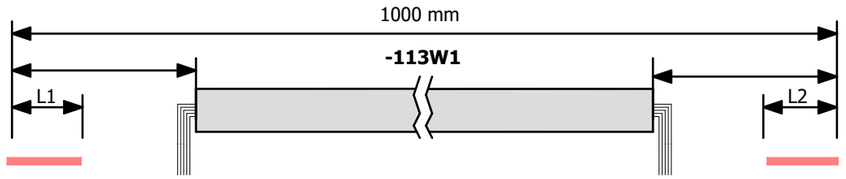


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U3:IN			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U4:8	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W1
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

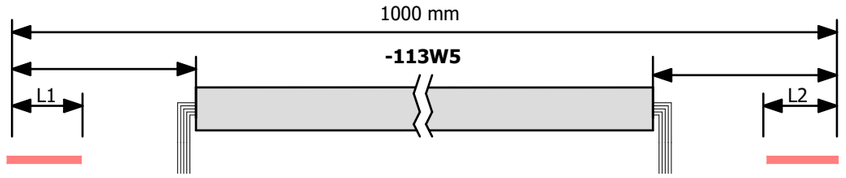


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X4:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T1:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W5
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

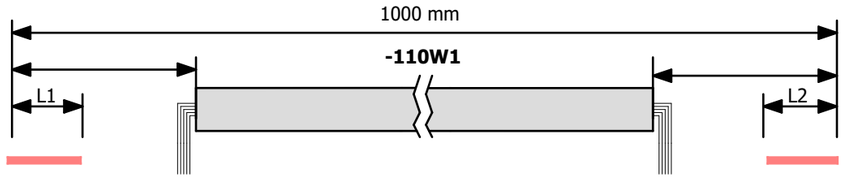


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X5:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T2:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-110W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



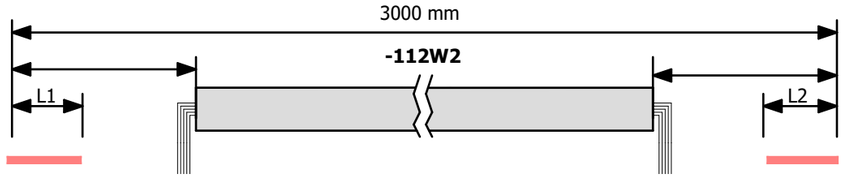
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X1:1-8	*Control cabinet 1*

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-112W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

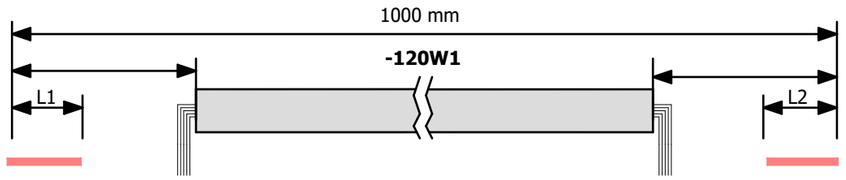


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-112A1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X2:1-8	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

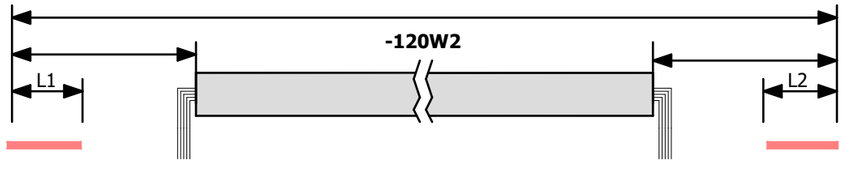


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P3		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-120A1:-X1:P1	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

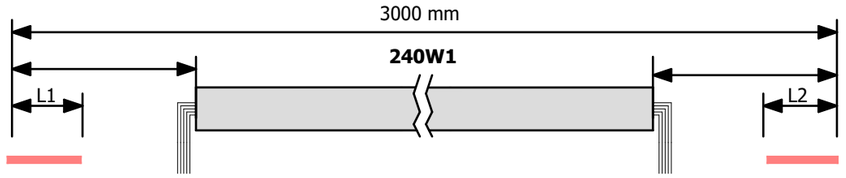


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-113U5:8			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-120A1:-X1:P2	*Control cabinet 1*

Cable name =UNIT_01++CT+-240W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

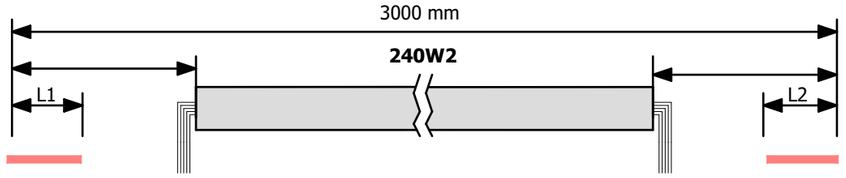


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-201Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

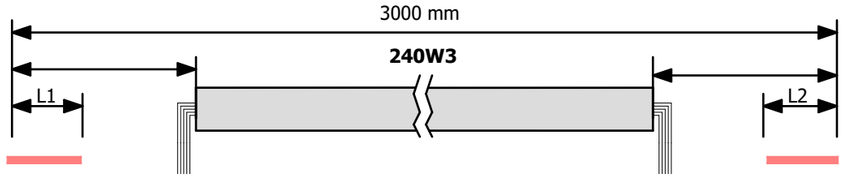
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-202Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X2	*Control cabinet 2*

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-240W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

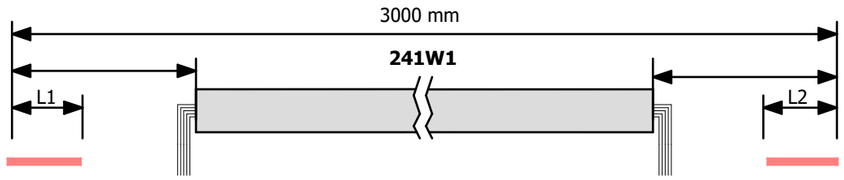


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-203Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

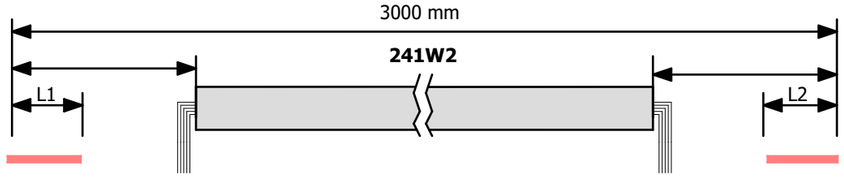


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

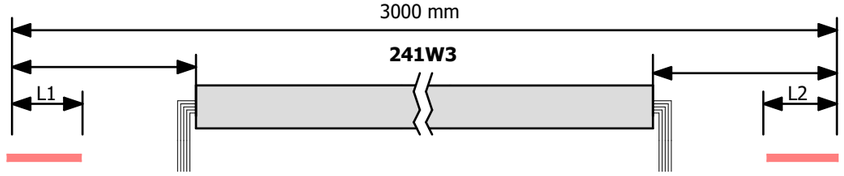


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

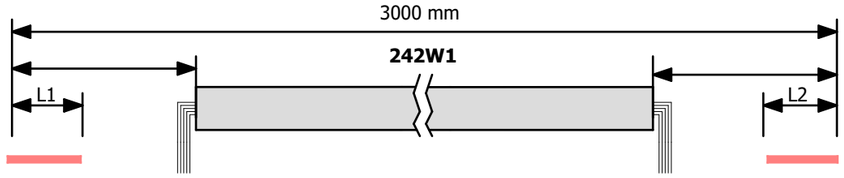


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X1		Connector	

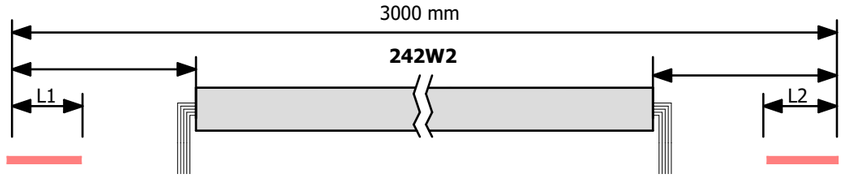
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X1	***Control cabinet 2***

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

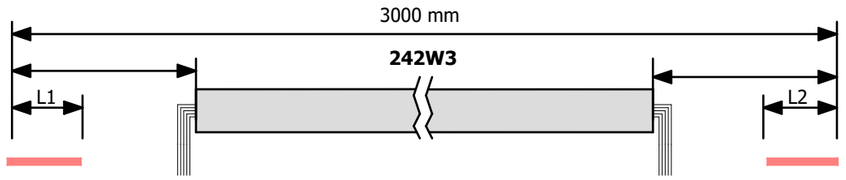


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

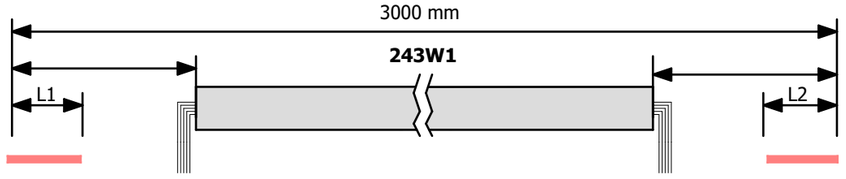


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

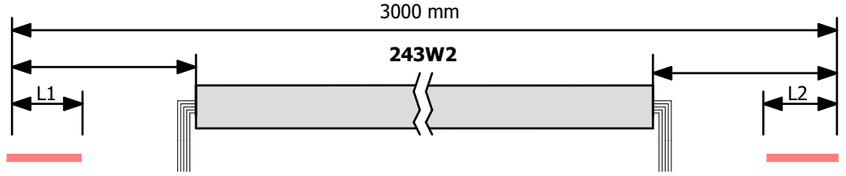


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

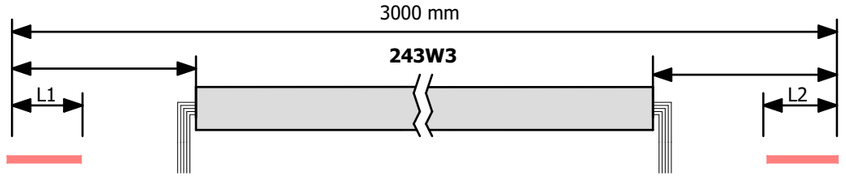


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X3		Connector	

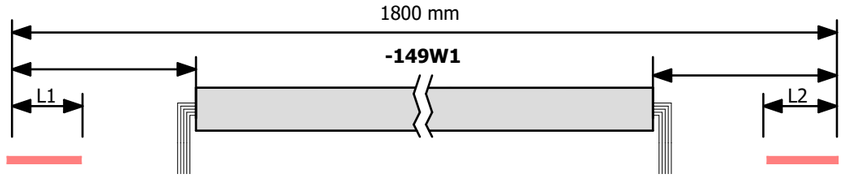
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X3	***Control cabinet 2***

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 10
Date							10354_23A2007	+		total: 492

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_01++CT+-149W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.671476
Order number

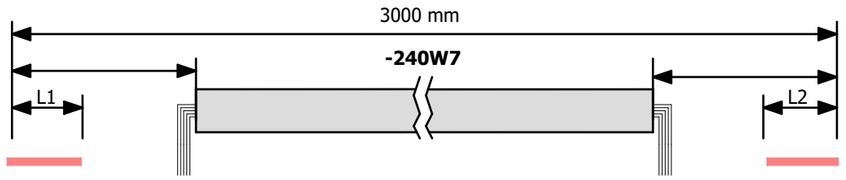


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-149U1:11X3		Connecor	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-162U1:11X3	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

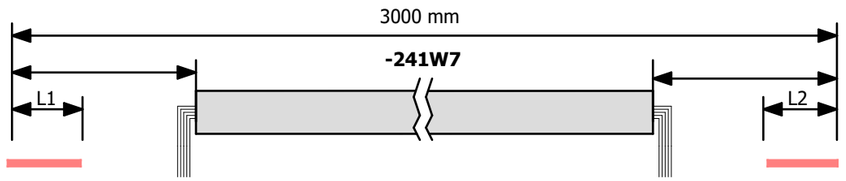


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

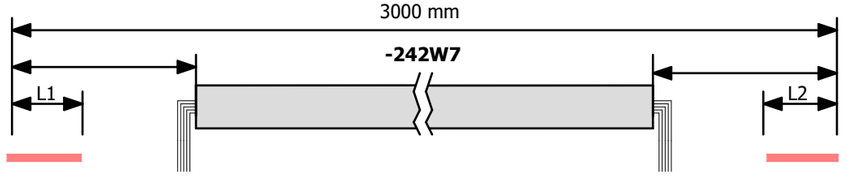


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-161U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

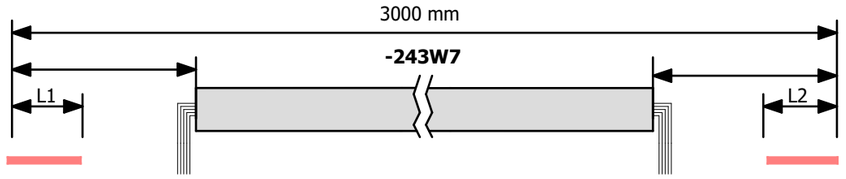


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-163U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-164U1:11X3		Connector	

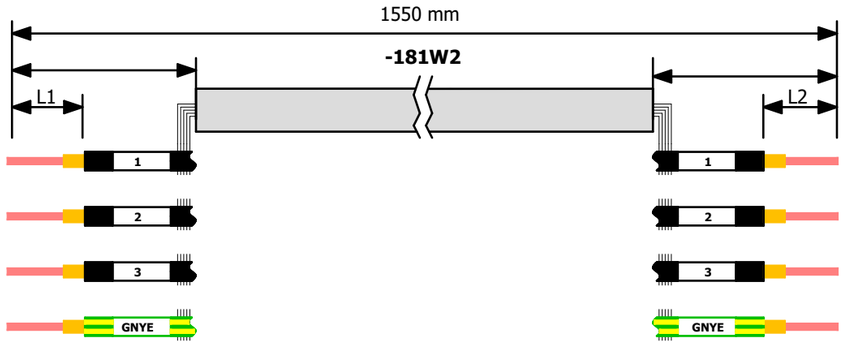
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:X7	*Control cabinet 2*

previous page: 10
next page: ++FAN/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++FAN+-52G1-181W2
Cable type JZ-600 4G1,5 mm²
Free conductors

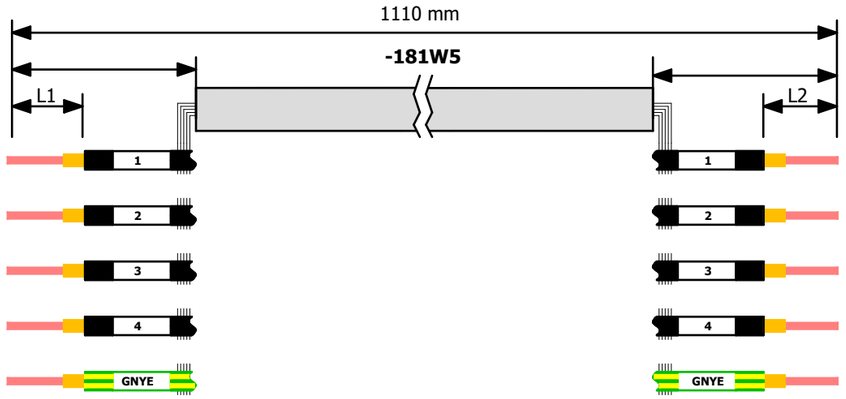
Cable parts HELU.10659
Order number 10659



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:1:2	PUMP	stripped	8 mm	5 mm	Ring cable lug M4	PUMP	-52G1-181M1:U1	
	-52G1-181X1:2:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:V1	
	-52G1-181X1:3:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:PE	

Cable name =UNIT_01++FAN+-52G1-181W5
Cable type JZ-600 5G1,5 mm²
Free conductors

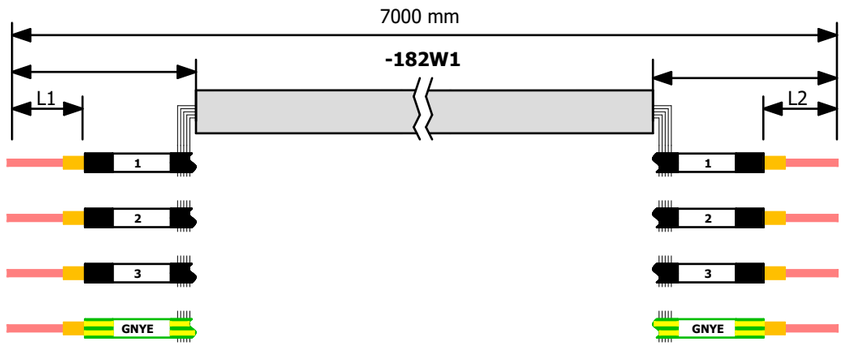
Cable parts HELU.10661
Order number 10661



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:4:2	FUSE FOR PUMP	stripped	8 mm	5 mm	Ring cable lug M4	FUSE FOR PUMP	-52G1-181R1:x1	
	-52G1-181X1:5:2	HEATER	stripped	8 mm	5 mm	Ring cable lug M4	HEATER	-52G1-181R1:x3	
	-52G1-181X1:6:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x5	
	-52G1-181X1:7:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x6	
	-52G1-181X1:PE:2	=					=	-52G1-181R1:PE	

Cable name =UNIT_01++FAN+-52G1-182W1
Cable type JZ-600 5G1,5 mm²
Free conductors

Cable parts HELU.10659
Order number 10659



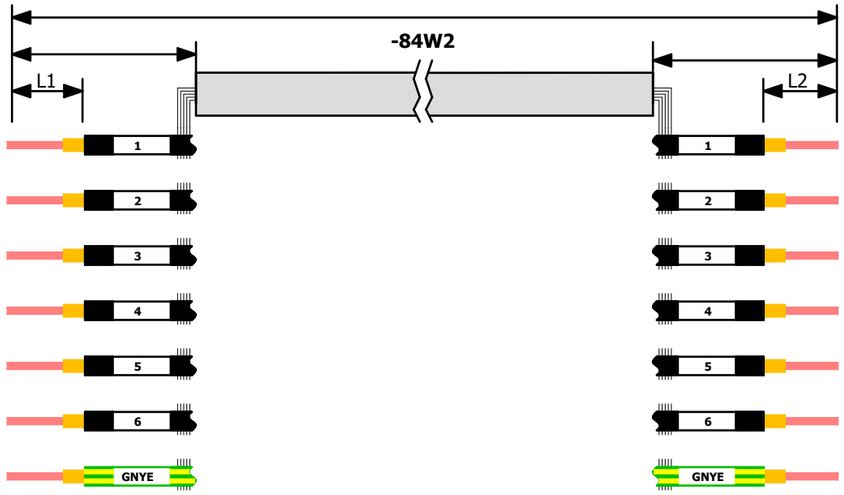
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:8:2	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	-52G1-182M1:U1	
	-52G1-181X1:9:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:V1	
	-52G1-181X1:10:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:PE	

previous page: ++CT/11
next page: ++EXTERN/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++EXTERN+-84W2
Cable type JZ-600 5G16 mm²
Free conductors 7

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page:
++FAN/1

next page:
&EMZ++CONV+IND/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-207L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2000
-207L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2001
-207L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2002
-211L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2003
-211L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2004
-211L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2005
-217L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2006
-217L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2007
-217L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2008

previous page:
&EMB++EXTERN+/1

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text			-146W3	Cable name	Strip =UNIT_01++CONV+IND-207L1.1						Cable name												Page / column
			F-CY-0Z (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1			1		++CT+CTRL_1.3-X5	13		,	-207L1.1	x2													&EFS++CT+/146.5
=			2		++CT+CTRL_1.3-X5	14		,	-207L1.1	x1													&EFS++CT+/146.5

Terminal diagram

Freqcon_F13_001_02

Function text			-146W4	Cable name	Strip =UNIT_01++CONV+IND-207L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2			1		++CT+CTRL_1.3-X5	15		,	-207L1.2	x2													&EFS++CT+/146.7
=			2		++CT+CTRL_1.3-X5	16		,	-207L1.2	x1													&EFS++CT+/146.7

Terminal diagram

Freqcon_F13_001_02

Function text			-147W1	Cable name	Strip =UNIT_01++CONV+IND-207L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3			1		++CT+CTRL_1.3-X5	17		,	-207L1.3	x2													&EFS++CT+/147.1
=			2		++CT+CTRL_1.3-X5	18		,	-207L1.3	x1													&EFS++CT+/147.1

Terminal diagram

Freqcon_F13_001_02

Function text			-145W4	Cable name	Strip =UNIT_01++CONV+IND-211L1.1						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1			1		++CT+CTRL_1.3-X5	7		,	-211L1.1	x2													&EFS++CT+/145.7
=			2		++CT+CTRL_1.3-X5	8		,	-211L1.1	x1													&EFS++CT+/145.7

Terminal diagram

Freqcon_F13_001_02

Function text			-146W1	Cable name	Strip =UNIT_01++CONV+IND-211L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2			1		++CT+CTRL_1.3-X5	9		,	-211L1.2	x2													&EFS++CT+/146.1
=			2		++CT+CTRL_1.3-X5	10		,	-211L1.2	x1													&EFS++CT+/146.1

Terminal diagram

Freqcon_F13_001_02

Function text			-146W2	Cable name	Strip =UNIT_01++CONV+IND-211L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3			1		++CT+CTRL_1.3-X5	11		,	-211L1.3	x2													&EFS++CT+/146.3
=			2		++CT+CTRL_1.3-X5	12		,	-211L1.3	x1													&EFS++CT+/146.3

Terminal diagram

Freqcon_F13_001_02

Function text			-147W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.1						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1			1		++CT+CTRL_1.3-X5	19		,	-217L1.1	x2													&EFS++CT+/147.3
=			2		++CT+CTRL_1.3-X5	20		,	-217L1.1	x1													&EFS++CT+/147.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W1	Cable name	Strip =UNIT_01++CONV+IND-217L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2			1		++CT+CTRL_1.3-X5	25		,	-217L1.2	x2													&EFS++CT+/148.3
=			2		++CT+CTRL_1.3-X5	26		,	-217L1.2	x1													&EFS++CT+/148.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3			1		++CT+CTRL_1.3-X5	29		,	-217L1.3	x2													&EFS++CT+/148.7
=			2		++CT+CTRL_1.3-X5	30		,	-217L1.3	x1													&EFS++CT+/148.7

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-227U1-X3.1	DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2000
-227U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2001
-231U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2002
-231U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2003
-237U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2004
-237U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2005

previous page: +IND/2008

next page: 2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-227U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-227W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-227U1-W5	Page / column
			0Z-500	Cable type							Cable type	1Z-500	
			1		++CT+CTRL_1.4-350X1.21	1	1	,	-227U1-X3.2	1		1	&EFS+/227.a.1
			2		++CT+CTRL_1.4-350X1.21	4	2	,	-227U1-X3.2	3		2	&EFS+/227.a.2
			3		++CT+CTRL_1.4-350X1.21	7	3	,	-227U1-X3.2	5		3	&EFS+/227.a.2
			4		++CT+CTRL_1.4-350X1.21	3	4	,	-227U1-X3.2	7		4	&EFS+/227.a.3
			5		++CT+CTRL_1.4-350X1.21	6	5	,	-227U1-X3.2	9		5	&EFS+/227.a.4
			6		++CT+CTRL_1.4-350X1.21	9	6	,	-227U1-X3.2	11		6	&EFS+/227.a.5
			7		++CT+CTRL_1.4-307K1	A1	7	,	-227U1-X3.2	13		7	&EFS+/227.a.5
			8		++CT+CTRL_1.4-307K3	A1	8	,	-227U1-X3.2	15		8	&EFS+/227.a.6
			9		++CT+CTRL_1.4-307K5	A1	9	,	-227U1-X3.2	17		9	&EFS+/227.a.6
			10		++CT+CTRL_1.4-307K2	A1	10	,	-227U1-X3.2	19		10	&EFS+/227.a.6
			11		++CT+CTRL_1.4-307K4	A1	11	,	-227U1-X3.2	21		11	&EFS+/227.a.7
			12		++CT+CTRL_1.4-307K6	A1	12	,	-227U1-X3.2	23		12	&EFS+/227.a.7
			13		++CT+CTRL_1.3-X3.11	11	13	,	-227U1-F1	2			&EFS+/227.a.7
			14		++CT+CTRL_1.3-X3.12	9	14	,	-227U1-F5	2			&EFS+/227.a.8
			15		++CT+CTRL_1.3-X3.12	11	15	,	-227U1-F9	2			&EFS+/227.a.8
			16		++CT+CTRL_1.3-X3.12	10	16	,	-227U1-F2	1			&EFS+/227.a.9
									-227U1-X3.2	24		13	
			17		++CT+CTRL_1.4-350X1.21	2	17	,	-227U1-X3.2	12		14	&EFS+/227.a.9
							PE	,	-227U1-X3.2	PE		GNYE	&EFS+/227.a.9

previous page: 1000

next page: 2001

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-227U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-227U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-227U1-X3.1	1		1										&EFS+/227.a.1
							2															&EFS+/227.a.1
							3		-227U1-X3.1	2		2										&EFS+/227.a.2
							4															&EFS+/227.a.2
							5		-227U1-X3.1	3		3										&EFS+/227.a.2
							6															&EFS+/227.a.2
							7		-227U1-X3.1	4		4										&EFS+/227.a.3
							8															&EFS+/227.a.3
							9		-227U1-X3.1	5		5										&EFS+/227.a.4
							10															&EFS+/227.a.4
							11		-227U1-X3.1	6		6										&EFS+/227.a.5
							12		-227U1-X3.1	17		14										&EFS+/227.a.5
							13		-227U1-X3.1	7		7										&EFS+/227.a.5
							14															&EFS+/227.a.5
							15		-227U1-X3.1	8		8										&EFS+/227.a.6
							16															&EFS+/227.a.6
							17		-227U1-X3.1	9		9										&EFS+/227.a.6
							18															&EFS+/227.a.6
							19		-227U1-X3.1	10		10										&EFS+/227.a.6
							20															&EFS+/227.a.6
							21		-227U1-X3.1	11		11										&EFS+/227.a.7
							22															&EFS+/227.a.7
							23		-227U1-X3.1	12		12										&EFS+/227.a.7
							24		-227U1-X3.1	16		13										&EFS+/227.a.7
							PE															&EFS+/227.a.5
							PE		-227U1-X3.1	PE		GNYE										&EFS+/227.a.5

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2001
+	CIR	Circuit Breaker cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-231U1-W5	Page / column
			0Z-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.3-150X1	1	1	,	-231U1-X3.2	1		1	&EFS+/231.a.1
			2		++CT+CTRL_1.3-150X1	4	2	,	-231U1-X3.2	3		2	&EFS+/231.a.2
			3		++CT+CTRL_1.3-150X1	7	3	,	-231U1-X3.2	5		3	&EFS+/231.a.2
			4		++CT+CTRL_1.3-150X1	3	4	,	-231U1-X3.2	7		4	&EFS+/231.a.3
			5		++CT+CTRL_1.3-150X1	6	5	,	-231U1-X3.2	9		5	&EFS+/231.a.4
			6		++CT+CTRL_1.3-150X1	9	6	,	-231U1-X3.2	11		6	&EFS+/231.a.5
			7		++CT+CTRL_1.4-306K1	A1	7	,	-231U1-X3.2	13		7	&EFS+/231.a.5
			8		++CT+CTRL_1.4-306K3	A1	8	,	-231U1-X3.2	15		8	&EFS+/231.a.6
			9		++CT+CTRL_1.4-306K5	A1	9	,	-231U1-X3.2	17		9	&EFS+/231.a.6
			10		++CT+CTRL_1.4-306K2	A1	10	,	-231U1-X3.2	19		10	&EFS+/231.a.6
			11		++CT+CTRL_1.4-306K4	A1	11	,	-231U1-X3.2	21		11	&EFS+/231.a.7
			12		++CT+CTRL_1.4-306K6	A1	12	,	-231U1-X3.2	23		12	&EFS+/231.a.7
			13		++CT+CTRL_1.3-X3.10	9	13	,	-231U1-F1	2			&EFS+/231.a.7
			14		++CT+CTRL_1.3-X3.10	11	14	,	-231U1-F5	2			&EFS+/231.a.8
			15		++CT+CTRL_1.3-X3.11	9	15	,	-231U1-F9	2			&EFS+/231.a.8
			16		++CT+CTRL_1.3-X3.10	10	16	,	-231U1-F2	1			&EFS+/231.a.9
									-231U1-X3.2	24		13	
			17		++CT+CTRL_1.3-150X1	2	17	,	-231U1-X3.2	12		14	&EFS+/231.a.9
							PE	,	-231U1-X3.2	PE		GNYE	&EFS+/231.a.9

previous page: 2001

next page: 2003

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-231U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-231U1-X3.1	1		1										&EFS+/231.a.1
							2															&EFS+/231.a.1
							3		-231U1-X3.1	2		2										&EFS+/231.a.2
							4															&EFS+/231.a.2
							5		-231U1-X3.1	3		3										&EFS+/231.a.2
							6															&EFS+/231.a.2
							7		-231U1-X3.1	4		4										&EFS+/231.a.3
							8															&EFS+/231.a.3
							9		-231U1-X3.1	5		5										&EFS+/231.a.4
							10															&EFS+/231.a.4
							11		-231U1-X3.1	6		6										&EFS+/231.a.5
							12		-231U1-X3.1	17		14										&EFS+/231.a.5
							13		-231U1-X3.1	7		7										&EFS+/231.a.5
							14															&EFS+/231.a.5
							15		-231U1-X3.1	8		8										&EFS+/231.a.6
							16															&EFS+/231.a.6
							17		-231U1-X3.1	9		9										&EFS+/231.a.6
							18															&EFS+/231.a.6
							19		-231U1-X3.1	10		10										&EFS+/231.a.6
							20															&EFS+/231.a.6
							21		-231U1-X3.1	11		11										&EFS+/231.a.7
							22															&EFS+/231.a.7
							23		-231U1-X3.1	12		12										&EFS+/231.a.7
							24		-231U1-X3.1	16		13										&EFS+/231.a.7
							PE															&EFS+/231.a.5
							PE		-231U1-X3.1	PE		GNYE										&EFS+/231.a.5

previous page: 2002

next page: 2004

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-237W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-237U1-W5	Page / column
			QZ-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.4-350X1.21	11	1	,	-237U1-X3.2	1		1	&EFS+/237.a.1
			2		++CT+CTRL_1.4-350X1.21	14	2	,	-237U1-X3.2	3		2	&EFS+/237.a.2
			3		++CT+CTRL_1.4-350X1.21	17	3	,	-237U1-X3.2	5		3	&EFS+/237.a.2
			4		++CT+CTRL_1.4-350X1.21	13	4	,	-237U1-X3.2	7		4	&EFS+/237.a.3
			5		++CT+CTRL_1.4-350X1.21	16	5	,	-237U1-X3.2	9		5	&EFS+/237.a.4
			6		++CT+CTRL_1.4-350X1.21	19	6	,	-237U1-X3.2	11		6	&EFS+/237.a.5
			7		++CT+CTRL_1.4-308K1	A1	7	,	-237U1-X3.2	13		7	&EFS+/237.a.5
			8		++CT+CTRL_1.4-308K3	A1	8	,	-237U1-X3.2	15		8	&EFS+/237.a.6
			9		++CT+CTRL_1.4-308K5	A1	9	,	-237U1-X3.2	17		9	&EFS+/237.a.6
			10		++CT+CTRL_1.4-308K2	A1	10	,	-237U1-X3.2	19		10	&EFS+/237.a.6
			11		++CT+CTRL_1.4-308K4	A1	11	,	-237U1-X3.2	21		11	&EFS+/237.a.7
			12		++CT+CTRL_1.4-308K6	A1	12	,	-237U1-X3.2	23		12	&EFS+/237.a.7
			13		++CT+CTRL_1.3-X3.13	8	13	,	-237U1-F1	2			&EFS+/237.a.7
			14		++CT+CTRL_1.3-X3.13	9	14	,	-237U1-F5	2			&EFS+/237.a.8
			15		++CT+CTRL_1.3-X3.13	11	15	,	-237U1-F9	2			&EFS+/237.a.8
			16		++CT+CTRL_1.3-X3.13	10	16	,	-237U1-F2	1			&EFS+/237.a.9
									-237U1-X3.2	24		13	
			17		++CT+CTRL_1.4-350X1.21	12	17	,	-237U1-X3.2	12		14	&EFS+/237.a.9
							PE	,	-237U1-X3.2	PE		GNYE	&EFS+/237.a.9

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 2004
Date								+ CIR Circuit Breaker cabinet total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-237U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-237U1-X3.1	1		1										&EFS+/237.a.1
							2															&EFS+/237.a.1
							3		-237U1-X3.1	2		2										&EFS+/237.a.2
							4															&EFS+/237.a.2
							5		-237U1-X3.1	3		3										&EFS+/237.a.2
							6															&EFS+/237.a.2
							7		-237U1-X3.1	4		4										&EFS+/237.a.3
							8															&EFS+/237.a.3
							9		-237U1-X3.1	5		5										&EFS+/237.a.4
							10															&EFS+/237.a.4
							11		-237U1-X3.1	6		6										&EFS+/237.a.5
							12		-237U1-X3.1	17		14										&EFS+/237.a.5
							13		-237U1-X3.1	7		7										&EFS+/237.a.5
							14															&EFS+/237.a.5
							15		-237U1-X3.1	8		8										&EFS+/237.a.6
							16															&EFS+/237.a.6
							17		-237U1-X3.1	9		9										&EFS+/237.a.6
							18															&EFS+/237.a.6
							19		-237U1-X3.1	10		10										&EFS+/237.a.6
							20															&EFS+/237.a.6
							21		-237U1-X3.1	11		11										&EFS+/237.a.7
							22															&EFS+/237.a.7
							23		-237U1-X3.1	12		12										&EFS+/237.a.7
							24		-237U1-X3.1	16		13										&EFS+/237.a.7
							PE															&EFS+/237.a.5
							PE		-237U1-X3.1	PE		GNYE										&EFS+/237.a.5

previous page:
2004

next page:
+AC_DC/1000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.2	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 2005
Date								+ CIR	Circuit Breaker cabinet	total: 492

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X3.43		1	20	0	0	40	=UNIT_01&EMZ++CONV+AC_DC/2000

previous page:
+CIR/2005

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text	-238W3 OZ-500	-238W2 OZ-500	-238W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-238W7 OZ-500	Page / column
SURGE ARRESTER DC SUBSYSTEM 2_1			1		-238F1	11	1	,	++CT+CTRL_1.3-X3	5		1	&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_1			2		-238F1	12	2	,	-X3.43	3			&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		1			-238F2	11	3	,	-X3.43	2			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		2			-238F2	12	4	,	-X3.43	5			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	1				-238F3	11	5	,	-X3.43	4			&EFS+/238a.9
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	2				-238F3	12	6	,	-X3.43	7			&EFS+/238a.9
SURGE ARRESTER DC SUBSYSTEM 2_3	2				-238F3	12	6	,	-X3.43	7			&EFS+/238a.9
								,					

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	20250805_V2.0
Date	21.01.2025					
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007
Date						

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2000
+	AC_DC	AC and DC connection cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	-228W3 OZ-500	-228W2 OZ-500	-228W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 3_1			1		-228F1	11	7	,	-X3.43	6		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_1			2		-228F1	12	8	,	-X3.43	9		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		1			-228F2	11	9	,	-X3.43	8		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		2			-228F2	12	10	,	-X3.43	11		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	1				-228F3	11	11	,	-X3.43	10		&EFS+/228.9
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	2				-228F3	12	12	,	-X3.43	13		&EFS+/228.9
								,				

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Function text	-238W6 OZ-500	-238W5 OZ-500	-238W4 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 4_1			1		-238F4	11	13	,	-X3.43	12		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_1			2		-238F4	12	14	,	-X3.43	15		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		1			-238F5	11	15	,	-X3.43	14		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		2			-238F5	12	16	,	-X3.43	17		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	1				-238F6	11	17	,	-X3.43	16		&EFS+/238b.9
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	2				-238F6	12	18	,	-X3.43	19		&EFS+/238b.9
								,				

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2002
+	AC_DC	AC and DC connection cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text			-78W7	Cable name	Strip =UNIT_01++CONV+AC_DC-X3.43						Cable name	-238W7										Page / column
			0Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	0Z-500										
			2		-78F1	14	19	,	-X3.43	18												&EFS+/78.8
								,														
			1		-78F1	13	20	,	++CT+CTRL_1.3-X3	6		2										&EFS+/78.8
								,														

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-XT1		1	20	0	0	20	=UNIT_01&EMZ++CT/2000

previous page:
++CONV+AC_DC/2003

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+-XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
Gas confirmed FGS							1	,	+CTRL_1.3-138K1	14			&EFS/136.0
=							2	,	+CTRL_1.3-138K1	11			&EFS/136.0
Smoke confirmed FGS							3	,	+CTRL_1.3-138K2	14			&EFS/136.1
=							4	,	+CTRL_1.3-138K2	11			&EFS/136.1
PLC fault status SIS							5	,	+CTRL_1.3-138K3	14			&EFS/136.2
=							6	,	+CTRL_1.3-138K3	11			&EFS/136.2
=							7	,	+CTRL_1.3-138K4	14			&EFS/136.2
Spare							8	,	+CTRL_1.3-138K4	11			&EFS/136.3
=							9	,	+CTRL_1.3-138K5	14			&EFS/136.3
=							10	,	+CTRL_1.3-138K5	11			&EFS/136.3
=							11	,	+CTRL_1.3-138K6	14			&EFS/136.4
=							12	,	+CTRL_1.3-138K6	11			&EFS/136.4
phase in sync							13	,	+CTRL_1.3-138K7	14			&EFS/136.5
=							14	,	+CTRL_1.3-138K7	11			&EFS/136.5
=							15	,	+CTRL_1.3-136K7	A2			&EFS/136.5
Shut-down to BESS							16	,	+CTRL_1.3-136K7	A1			&EFS/136.6
incoming CB is open							17	,	+CTRL_1.3-136K8	A2			&EFS/136.7
=							18	,	+CTRL_1.3-136K8	A1			&EFS/136.7
=							19	,	+CTRL_1.3-136K9	A2			&EFS/136.8
=							20	,	+CTRL_1.3-136K9	A1			&EFS/136.8

previous page: 1000

next page: +CTRL_1.3/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X1	Hauptsteuerstromkreis 400V/230V AC	1	PE	4	1	18	=UNIT_01&EMZ++CT+CTRL_1.3/2000
-X3	CONTROL VOLTAGE 24V DC	1	46	0	0	45	=UNIT_01&EMZ++CT+CTRL_1.3/2001
-X3.10	Rückmeldung DC Schütze Subsystem 1_4	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2003
-X3.11	=	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2004
-X3.12	=	1	12	0	0	14	=UNIT_01&EMZ++CT+CTRL_1.3/2005
-X3.13	Rückmeldung DC Schütze Subsystem 1_6	1	12	0	0	14	=UNIT_01&EMZ++CT+CTRL_1.3/2006
-X5	Kleinspannungssignale	1	30	0	0	30	=UNIT_01&EMZ++CT+CTRL_1.3/2007
-X5.1	DC Subsystem Spannungsmessung	1	2	0	0	4	=UNIT_01&EMZ++CT+CTRL_1.3/2009
-150X1	Subsysteme DC Schütz EIN	1	10	0	0	10	=UNIT_01&EMZ++CT+CTRL_1.3/2010
-XDC1	Steuerspannung 24VDC (USV) DC1	1	PE	2	0	16	=UNIT_01&EMZ++CT+CTRL_1.3/2011
-XDC2	Steuerspannung 24VDC (USV) DC2	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2013
-XDC3	Steuerspannung 24VDC (USV) DC3	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2016
-XDC4	Steuerspannung 24VDC (USV) DC4	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2017
-XDC5.1	Steuerspannung 24VDC (USV) DC5.1	1	1	0	0	2	=UNIT_01&EMZ++CT+CTRL_1.3/2018
-XDC5.2	Steuerspannung 24VDC (USV) DC5.2	1	1	0	0	2	=UNIT_01&EMZ++CT+CTRL_1.3/2019
-XE	Hauptstromversorgung 400V AC	1	6	3	4	14	=UNIT_01&EMZ++CT+CTRL_1.3/2020
-XT	Transfer Klemmenblock 24VDC/230VAC	1	16	6	0	22	=UNIT_01&EMZ++CT+CTRL_1.3/2021
-190XT1	230VAC Beleuchtung/Klimaanlage Container/Schrank	1	PE	4	4	16	=UNIT_01&EMZ++CT+CTRL_1.3/2023
-191XT1		1	PE	2	2	10	=UNIT_01&EMZ++CT+CTRL_1.3/2024
-XV	Suppression TVS Diode	1	4	0	0	27	=UNIT_01&EMZ++CT+CTRL_1.3/2025

previous page: +/2000

next page: 2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X1

Hauptsteuerstromkreis 400V/230V AC

Function text			-181W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
			1Z-600	Cable type							Cable type	
PUMP			1		++FAN-52G1-181X1	1:1	1	,	-139K2	2		&EFS+/181.1
=			2		++FAN-52G1-181X1	2:1	2	,	-139K2	4		&EFS+/181.1
=			3		++FAN-52G1-181X1	3:1	3	,	-139K2	6		&EFS+/181.1
=			GNYE		++FAN-52G1-181X1	PE:1	PE	,	+.2-110U1-PE			&EFS+/181.1
FUSE FOR PUMP			4		++FAN-52G1-181X1	4:1	4	,	-139K1	2		&EFS+/181.3
HEATER			5		++FAN-52G1-181X1	5:1	5	,	-139K1	4		&EFS+/181.4
=			6		++FAN-52G1-181X1	6:1	6	,	-139K1	6		&EFS+/181.4
=			7		++FAN-52G1-181X1	7:1	7	,	-XE	N:1		&EFS+/181.4
								,				
HEATER							PE	,				&EFS+/181.4
FAN 1 HEAT EXCHANGER			8		++FAN-52G1-181X1	8:1	8	,	-139K3	2		&EFS+/182.1
=			9		++FAN-52G1-181X1	9:1	9	,	-139K3	4		&EFS+/182.1
=			10		++FAN-52G1-181X1	10:1	10	,	-139K3	6		&EFS+/182.1
=							PE	,				&EFS+/182.1
FAN 2 HEAT EXCHANGER OPTIONAL							11	,				&EFS+/182.3
=							12	,				&EFS+/182.4
=							13	,				&EFS+/182.4
=							PE	,				&EFS+/182.4

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2000
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++CONV-80W1 OZ-500	-181W3 F-CY-OZ (LIY-CY)	++CONV-260W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CT+CTRL_1.3-X3 CONTROL VOLTAGE 24V DC — Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-80W1 OZ-500	++CONV-238W7 OZ-500	++TRA-629W1 OZ-500	++CONV-260W1 OZ-500	-181W3 F-CY-OZ (LIY-CY)	Page / column
CB 1 Tripped GRID					-DI_02	5	1		++CONV+CIR-80Q1	X7_13		1					&EFS+/127.1
CB 1 OFF GRID					-DI_02	4	2		++CONV+CIR-80Q1	X6_9		2					&EFS+/127.3
CB 1 ON GRID					-DI_02	3	3		++CONV+CIR-80Q1	X6_11		3					&EFS+/127.2
FUSE AND LIGHTNING PROTECTION							4		+.4-189X1	5							&EFS+/127.4
=					-XDC4	2	5		++CONV+AC_DC-X3.43	1			1				&EFS+/127.5
=					-DI_02	6	6		++CONV+AC_DC-X3.43	20			2				&EFS+/127.4
=					-X3	13	7		-134K1	11							&EFS+/127.5
CB 2 Tripped ISLAND GRID					-DI_04	12	8										&EFS+/128.1
CB 2 OFF ISLAND GRID					-DI_04	14	9										&EFS+/128.3
CB 2 ON ISLAND GRID					-DI_04	13	10										&EFS+/128.2
FUSE AND LIGHTNING PROTECTION 2							11										&EFS+/128.4
=					-DI_04	15	12										&EFS+/128.4
=					-X3	7	13										&EFS+/128.5
SPARE					-DI_04	1	14		+.2-18B1	4							&EFS+/133.1
SPARE					-DI_04	2	15		+.2-18B1	1							&EFS+/133.2
SPARE					-DI_04	3	16		+.2-18B1	4							&EFS+/133.3
Fuse 230V AC for Container Air Conditioning					-DI_04	11	17		-190F3	14							&EFS+/133.6
Earthing switch in On Transformer 620V side					-DI_04	5	18		++CONV-18Q1	14				2			&EFS+/133.9
Smoke detector CON					-DI_02	7	19		++CONV+CON-260B1	4					1		&EFS+/134.0
=			2		++CONV+CON-260B1	2	20		-XV	9							&EFS+/134.0
=			3		++CONV+CON-260B1	5	21		-XDC4	4							&EFS+/134.1
=			4		++CONV+CON-260B1	6	22		-134K1	11							&EFS+/134.1
PRESSURE SWITCH					-182Q1	13	23		++FAN-52G1-181X3	1						1	&EFS+/181.7
=		2			++FAN-52G1-181X3	3	24		-AI_04	3							&EFS+/181.7
=		3			++FAN-52G1-181X3	2	25		-XDC1	7							&EFS+/181.7
Fuse 230V AC for Container Air Conditioning					-XDC2	1	29		++CONV-18Q1	13				1			&EFS+/133.8
TRIP					-DI_04	4	30		+.2-18B1	7							&EFS+/133.4
CB 1 GRID +24V	4				++CONV+CIR-80Q1	X6_12	31		-XDC3	2							&EFS+/188.1
=	5				++CONV+CIR-80Q1	X5_11	32		-XDC3	3							&EFS+/188.1
CB 2 ISLAND GRID +24V OPTIONAL							33		-137K1	11							&EFS+/188.2
=							34										&EFS+/188.2
=	6				++CONV+CIR-80Q1	X6_7	35		-137K1	14							&EFS+/188.4
CB 1 GRID	7				++CONV+CIR-80Q1	X6_14	36		-137K2	12							&EFS+/188.5

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3

CONTROL VOLTAGE 24V DC

Function text			++CONV-80W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-195W1											Page / column
			OZ-500	Cable type							Cable type	OZ-500											
CB 1 GRID			8		++CONV+CIR-80Q1	X5_12	37	,	-189K1	22													&EFS+/188.6
=							38	,	-137K3	14													&EFS+/188.6
CB 2 ISLAND GRID OPTIONAL							39	,	-137K4	12													&EFS+/188.8
=							40	,	-189K1	21													&EFS+/188.8
SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS					-X3	42	41	,	+.1-84Q1	14		3											&EFS+/195.2
=					-195K3	IN1	42	,	-X3	41													&EFS+/195.2
=					-X3	44	43	,	+.1-84Q1	24		4											&EFS+/195.3
=					-195K3	IN2	44	,	-X3	43													&EFS+/195.3
=					-195K1	61	45	,	+.4-306K1	21													&EFS+/195.3
FAULT SIGNAL SAFETY RELAY					-195K3	IN	46	,	+.4-308K6	21													&EFS+/195.4
FAULT SIGNAL SAFETY RELAY					-195K3	IN	46	,	+.4-308K6	21													&EFS+/195.4

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 2002
Date							10354_23A2007	+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.10

Rückmeldung DC Schütze Subsystem 1_4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	OZ-500	++CONV-231W4	Page / column
SUBSYSTEM 2_1_DC + Contactor K1 is on			-DI_02	8	1		+.4-306K1	14					&EFS+/129.0
SUBSYSTEM 2_2_DC + Contactor K2 is on			+.4-306K3	14	2		-DI_02	10					&EFS+/129.2
SUBSYSTEM 2_1_DC -Contactor K7 is on			+.4-306K2	14	3		-DI_02	9					&EFS+/129.1
SUBSYSTEM 2_2_DC -Contactor K8 is on			+.4-306K4	14	4		-DI_02	11					&EFS+/129.3
SUBSYSTEM 2_3_DC + Contactor K3 is on			-DI_02	12	5		+.4-306K5	14					&EFS+/129.4
SUBSYSTEM 2_3_DC + SPARE			-DI_02	14	6								&EFS+/129.6
SUBSYSTEM 2_3_DC -Contactor K9 is on			-DI_02	13	7		+.4-306K6	14					&EFS+/129.5
SUBSYSTEM 2_DC -SPARE			-DI_02	15	8								&EFS+/129.7
SUBSYSTEM 2_1_DC FUSE OK			-DI_02	16	9		++CONV+CIR-231U1-X3.1	13		13			&EFS+/129.8
SUBSYSTEM 2_2_DC FUSE OK					10		++CONV+CIR-231U1-X3.1	16		16			&EFS+/129.9
=			-DI_03	1	11		++CONV+CIR-231U1-X3.1	14		14			&EFS+/129.9
=			-XDC4	1	12								&EFS+/129.9

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 2003
Date							10354_23A2007	+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.3-X3.11 Rückmeldung DC Schütze Subsystem 1_4					Cable name	++CONV-231W4	++CONV-227W4									Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	OZ-500	OZ-500									
SUBSYSTEM 3_1_DC + Contactor K1 is on					-DI_03	2	1		+.4-307K1	14												&EFS+/130.0
SUBSYSTEM 3_2_DC + Contactor K2 is on					+.4-307K3	14	2		-DI_03	4												&EFS+/130.2
SUBSYSTEM 3_1_DC -Contactor K7 is on					+.4-307K2	14	3		-DI_03	3												&EFS+/130.1
SUBSYSTEM 3_2_DC -Contactor K8 is on					+.4-307K4	14	4		-DI_03	5												&EFS+/130.3
SUBSYSTEM 3_3_DC + Contactor K3 is on					-DI_03	6	5		+.4-307K5	14												&EFS+/130.4
SUBSYSTEM 3_DC + SPARE					-DI_03	8	6															&EFS+/130.6
SUBSYSTEM 3_3_DC -Contactor K9 is on					-DI_03	7	7		+.4-307K6	14												&EFS+/130.5
SUBSYSTEM 3_DC -SPARE					-DI_03	9	8															&EFS+/130.7
SUBSYSTEM 2_DC FUSE OK					-DI_03	10	9		++CONV+CIR-231U1-X3.1	15		15										&EFS+/130.8
SUBSYSTEM 3_1_DC FUSE OK							10															&EFS+/130.9
=					-DI_03	11	11		++CONV+CIR-227U1-X3.1	13			13									&EFS+/130.9
=					-XDC4	2	12															&EFS+/130.9

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.12

Rückmeldung DC Schütze Subsystem 1_4

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-227W4										Page / column
				Cable type							Cable type	OZ-500										
SUBSYSTEM 4_1_DC + Contactor K1 is on					-DI_03	12	1		+.4-308K1	14												&EFS+/131.0
SUBSYSTEM 4_2_DC + Contactor K2 is on					+.4-308K3	14	2		-DI_03	14												&EFS+/131.2
SUBSYSTEM 4_1_DC -Contactor K7 is on					+.4-308K2	14	3		-DI_03	13												&EFS+/131.1
SUBSYSTEM 4_2_DC -Contactor K8 is on					+.4-308K4	14	4		-DI_03	15												&EFS+/131.3
SUBSYSTEM 4_3_DC + Contactor K3 is on					-DI_03	16	5		+.4-308K5	14												&EFS+/131.4
SUBSYSTEM 4_DC + SPARE					-DI_05	2	6															&EFS+/131.6
SUBSYSTEM 4_3_DC -Contactor K9 is on					-DI_05	1	7		+.4-308K6	14												&EFS+/131.5
SUBSYSTEM 4_DC -SPARE					-DI_05	3	8															&EFS+/131.7
SUBSYSTEM 3_2_DC FUSE OK					-DI_05	4	9		++CONV+CIR-227U1-X3.1	14		14										&EFS+/131.8
SUBSYSTEM 3_3_DC FUSE OK							10		++CONV+CIR-227U1-X3.1	16		16										&EFS+/131.9
=					-DI_05	5	11		++CONV+CIR-227U1-X3.1	15		15										&EFS+/131.9
=					-XDC4	2	12															&EFS+/131.9

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.13

Rückmeldung DC Schütze Subsystem 1_6

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	++CONV-237W4	OZ-500	Page / column
			-DI_05	6	1								&EFS+/132.0
					2		-DI_05	8					&EFS+/132.2
					3		-DI_05	7					&EFS+/132.1
					4		-DI_05	9					&EFS+/132.3
			-DI_05	10	5								&EFS+/132.4
			-DI_05	12	6								&EFS+/132.6
			-DI_05	11	7								&EFS+/132.5
SUBSYSTEM 4_1_DC FUSE OK			-DI_05	13	8		++CONV+CIR-237U1-X3.1	13			13		&EFS+/132.7
SUBSYSTEM 4_2_DC FUSE OK			-DI_05	14	9		++CONV+CIR-237U1-X3.1	14			14		&EFS+/132.8
SUBSYSTEM 4_3_DC FUSE OK					10		++CONV+CIR-237U1-X3.1	16			16		&EFS+/132.9
=			-DI_05	15	11		++CONV+CIR-237U1-X3.1	15			15		&EFS+/132.9
=			-XDC4	2	12								&EFS+/132.9

previous page: 2005

next page: 2007

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.13	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2006
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-145W1	++CONV-145W2	++CONV-145W3	++CONV-145W4	++CONV-146W1	++CONV-146W2	++CONV-146W3	++CONV-146W4	++CONV-147W1	++CONV-147W2	-181W3	Page / column
				Cable type							Cable type	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	
INDUCTOR GRID PHASE L1 TEMPERATURE 1_1					-AI_01	1	1	,	++CONV+IND-201L1			1											&EFS+/145.1
=					-AI_01	9	2	,	++CONV+IND-201L1			2											&EFS+/145.1
INDUCTOR GRID PHASE L2 TEMPERATURE 1_2					-AI_01	2	3	,	++CONV+IND-202L1				1										&EFS+/145.3
=					-AI_01	10	4	,	++CONV+IND-202L1				2										&EFS+/145.3
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3					-AI_01	3	5	,	++CONV+IND-203L1					1									&EFS+/145.5
=					-AI_01	11	6	,	++CONV+IND-203L1					2									&EFS+/145.5
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1					-AI_01	4	7	,	++CONV+IND-211L1.1						1								&EFS+/145.7
=					-AI_01	12	8	,	++CONV+IND-211L1.1						2								&EFS+/145.7
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2					-AI_01	5	9	,	++CONV+IND-211L1.2							1							&EFS+/146.1
=					-AI_01	13	10	,	++CONV+IND-211L1.2							2							&EFS+/146.1
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3					-AI_01	6	11	,	++CONV+IND-211L1.3								1						&EFS+/146.3
=					-AI_01	14	12	,	++CONV+IND-211L1.3								2						&EFS+/146.3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1					-AI_01	7	13	,	++CONV+IND-207L1.1									1					&EFS+/146.5
=					-AI_01	15	14	,	++CONV+IND-207L1.1									2					&EFS+/146.5
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2					-AI_01	8	15	,	++CONV+IND-207L1.2										1				&EFS+/146.7
=					-AI_01	16	16	,	++CONV+IND-207L1.2										2				&EFS+/146.7
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3					-AI_02	1	17	,	++CONV+IND-207L1.3											1			&EFS+/147.1
=					-AI_02	9	18	,	++CONV+IND-207L1.3											2			&EFS+/147.1
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1					-AI_02	2	19	,	++CONV+IND-217L1.1												1		&EFS+/147.3
=					-AI_02	10	20	,	++CONV+IND-217L1.1												2		&EFS+/147.3
CONVERTER CABINET TEMPERATURE					-AI_02	4	21	,	++CONV+CON-147B2	+													&EFS+/147.7
=					-AI_02	12	22	,	++CONV+CON-147B2	-													&EFS+/147.7
COOLING WATER TEMPERATURE					-AI_02	5	23	,	++FAN-52G1-181X3	4												4	&EFS+/148.1
=					-AI_02	13	24	,	++FAN-52G1-181X3	5												5	&EFS+/148.1

previous page: 2006

next page: 2008

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-148W1	++CONV-148W2										Page / column
				Cable type							Cable type	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)										
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2					-AI_02	6	25	,	++CONV+IND-217L1.2			1											&EFS+/148.3
=					-AI_02	14	26	,	++CONV+IND-217L1.2			2											&EFS+/148.3
CIR CABINET TEMPERATURE					-AI_02	7	27	,	++CONV+CIR-148B3	+													&EFS+/148.5
=					-AI_02	15	28	,	++CONV+CIR-148B3	-													&EFS+/148.5
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3					-AI_02	8	29	,	++CONV+IND-217L1.3				1										&EFS+/148.7
=					-AI_02	16	30	,	++CONV+IND-217L1.3				2										&EFS+/148.7

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5.1

DC Subsystem Spannungsmessung

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC_SUBSYSTEM 2_1.1 voltage			-AI_03	5	1		-AI_04	6			&EFS+/149.0
			-XDC1	6							
			-AI_03	6							
DC_SUBSYSTEM 2_3.1 voltage			-AI_03	7	2		+.4-149U1	14			&EFS+/149.2
			-AI_04	5							
			-AI_03	8							

previous page: 2008

next page: 2010

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_01++CT+CTRL_1.3-X5.1	20250805_V2.0	=	UNIT_01	Converter Container 1	
Date	21.01.2025							&	EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++	CT	Control cabinets	page: 2009
Date							10354_23A2007	+	CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-150X1

Subsysteme DC Schütz EIN

Function text			++CONV-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-231W4	Page / column
			OZ-500	Cable type							Cable type	OZ-500	
SUBSYSTEM 2_1 CONTACTOR DC+ ON			1		++CONV+CIR-231U1-X3.1	1	1	,	-150K1	14			&EFS+/150.2
=					-195K2	23	2	,	++CONV+CIR-231U1-X3.1	17		17	&EFS+/150.2
SUBSYSTEM 2_1 CONTACTOR DC-ON			4		++CONV+CIR-231U1-X3.1	4	3	,	-150K2	14			&EFS+/150.4
SUBSYSTEM 2_2 CONTACTOR DC+ ON			2		++CONV+CIR-231U1-X3.1	2	4	,	-151K1	14			&EFS+/151.1
=					-151K1	A2	5	,					&EFS+/151.1
SUBSYSTEM 2_3 CONTACTOR DC+ ON			5		++CONV+CIR-231U1-X3.1	5	6	,	-151K2	14			&EFS+/151.3
=			3		++CONV+CIR-231U1-X3.1	3	7	,	-151K3	14			&EFS+/151.4
=					-151K2	A2	8	,					&EFS+/151.4
SUBSYSTEM 2_3 CONTACTOR DC-ON			6		++CONV+CIR-231U1-X3.1	6	9	,	-151K4	14			&EFS+/151.6
=							10	,					&EFS+/151.6

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2010
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text	-112W1 / JZ-500	-242W9 / JZ-500	-240W9 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-243W9 / JZ-500	Page / column
FUSE 24V DC CONTROL VOLTAGE			1		+CTRL_2.1-240U1	1	1		-103F1	2			&EFS+/103.2
					+CTRL_2.1-160U1	+							
					+.2-18B1	40							
FUSE 24V DC CONTROL VOLTAGE					-DO_01	L+	2		-101Q1	13			&EFS+/103.2
					-AI_01	L+							
					+.1-126S1	13							
FUSE 24V DC CONTROL VOLTAGE					-136K7	11	3		-103F1	13			&EFS+/103.2
					-84F2	13							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			2		+CTRL_2.1-240U1	3	4		-102G1	OUTPUT DC 24 V:-			&EFS+/103.3
					-120A1	-X80:2							
					-DI_01	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-DO_01	M	5		+CTRL_2.1-160U1	-			&EFS+/103.3
					-AI_01	M							
					+.2-18B1	42							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-84K1	A2	6		-X5.1	1			&EFS+/103.3
					+.1-140H1	X2							
					+.2-110U1	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-AI_04	7	7						&EFS+/103.3
					-XDC2	3							
					-X3	25							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			GNYE		+CTRL_2.1-240U1	2	PE		-101T1	PE			&EFS+/103.4
					-XE	PE:1							
					-101T1	-"							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					+.2-18B1	41	PE		+CTRL_2.1-243U1	2		GNYE	&EFS+/103.4
		GNYE			+CTRL_2.1-242U1	2							
	GNYE				+.1-112A1	PE							

previous page: 2010

next page: 2012

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text			-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
			1Z-500	Cable type							Cable type	
			GNYE		+CTRL_2.1-241U1	2						

previous page: 2011

next page: 2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1
Date	21.01.2025					
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Date						

20250805_V2.0

10354_23A2007

=	UNIT_01	Converter Container 1		
&	EMZ	Terminals		
++	CT	Control cabinets	page:	2012
+	CTRL_1.3	Main mounting plate	total:	492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text	-241W9 / JZ-500	-242W9 / JZ-500	-243W9 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			1		+CTRL_2.1-243U1	1	1		-103F2	2		&EFS+/103.4
		1			+CTRL_2.1-242U1	1						
					-X3	29						
BSU, SPARE CONTROL VOLTAGE	1				+CTRL_2.1-241U1	1	2					&EFS+/103.5

previous page: 2012

next page: 2014

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2013
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text	-243W9 / JZ-500	-242W9 / JZ-500	-112W1 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
			1		+.1-112A1	L+						
BSU, SPARE CONTROL VOLTAGE					-186K1	A2	3		-XDC1	7		&EFS+/103.5
		2			+CTRL_2.1-242U1	3						
	2				+CTRL_2.1-243U1	3						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1		
&	EMZ	Terminals		
++	CT	Control cabinets	page:	2014
+	CTRL_1.3	Main mounting plate	total:	492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text		-112W1	-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
		1Z-500	1Z-500	Cable type							Cable type	
BSU, SPARE CONTROL VOLTAGE			2		+CTRL_2.1-241U1	3	4	⌟	-XDC3	3		&EFS+/103.5
					-138K1	A2						
		2			+.1-112A1	M						
								'				

previous page: 2014

next page: 2016

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2015
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC3

Steuerspannung 24VDC (USV) DC3

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
BSU, SPARE CONTROL VOLTAGE			-111A1	3	1		-103F3	2			&EFS+/103.6
			-173K3	21							
			+.2-114A1	2/L+							
BSU, SPARE CONTROL VOLTAGE			-X3	31	2		+.4-306K1	11			&EFS+/103.6
			-195K1	83							
			-115A1	V+							
PRECHARGE CONTROL VOLTAGE			-X3	32	3		-XDC2	4			&EFS+/103.7
			-111A1	4							
			+.2-114A1	1/M							
PRECHARGE CONTROL VOLTAGE			-195K1	43	4		-XDC4	3			&EFS+/103.7
			+.4-171K1	x2							
			-115A1	V-							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC4

Steuerspannung 24VDC (USV) DC4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
PRECHARGE CONTROL VOLTAGE			-195K1	33	1		-103F4	2			&EFS+/103.8
			-195K3	A1							
			-X3.10	12							
PRECHARGE CONTROL VOLTAGE			-X3.11	12	2		-X3.13	12			&EFS+/103.8
			-X3	5							
			-X3.12	12							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-139K2	A2	3		-XDC3	4			&EFS+/103.9
			-195K3	A2							
			-195K1	23							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-X3	21	4						&EFS+/103.9
			+.4-306K1	A2							
			+.4-306K1	A2							

previous page: 2016

next page: 2018

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.1

Steuerspannung 24VDC (USV) DC5.1

Function text				Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE						-186K1	1	1	,	-103F5	2			&EFS+/103.9
						-186K1	3							
									,					

previous page:
2017

next page:
2019

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2018
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.2

Steuerspannung 24VDC (USV) DC5.2

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			+.2-110U1	+24V	1	,	-186K1	2			&EFS+/103.9
			-120A1	-X80:1							
			-DI_01	L+							
						,					

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XE

Hauptstromversorgung 400V AC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
					1		-84F2	2			&EFS+/84.0
1-6					1						&EFA+++/2a.4
Supply Control Cabinet 3-phase 400V AC					N		-X1	7			&EFS+/84.1
=			-191XT1	4	N		-XT	2			&EFS+/84.1
=			-190F3	N	N		-191XT1	8			&EFS+/84.2
=			-190F2	N	N		-190F1	N			&EFS+/84.2
=					PE						&EFS+/84.2
=			-84F1	PE	PE		-XDC1	PE			&EFS+/84.2
=				PE	PE						&EFS+/84.3
			-101Q1	1	2		-190F2	1			&EFS+/84.0
					3		-84F2	4			&EFS+/84.0
Supply Control Cabinet 3-phase 400V AC			-101Q1	3	4		-190F3	1			&EFS+/84.1
=					5		-84F2	6			&EFS+/84.1
=			-101Q1	5	6		-190F1	1			&EFS+/84.1

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_01++CT+CTRL_1.3-XE	20250805_V2.0	=	UNIT_01	Converter Container 1	
Date	21.01.2025							&	EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++	CT	Control cabinets	page: 2020
Date							10354_23A2007	+	CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text	-278W1	++CONV-281W1	++CONV-279W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-279W1	++CONV-281W1	-278W1	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	1Z-500	1Z-500	1Z-500	
CON Fans 1-5 in door			1		++CONV+CON-279M1	L	1		-135K1	14					&EFS+/183.1
=			2		++CONV+CON-279M1	N	2		-XE	N:1					&EFS+/183.1
=							PE		++CONV+CON-279M1	PE		GNYE			&EFS+/183.1
=		1			++CONV+CIR-281M1	L	3		-135K3	14					&EFS+/183.3
CIR Fans 1-3 in door		2			++CONV+CIR-281M1	N	4								&EFS+/183.4
=							PE		++CONV+CIR-281M1	PE			GNYE		&EFS+/183.4
FAN 1 CONTROL CABINET	1				+.1-278M1	L	5		-135K2	14					&EFS+/185.1
=	2				+.1-278M1	N	6								&EFS+/185.1
=							PE		+.1-278M1	PE				GNYE	&EFS+/185.1

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2021
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text		++CONV-80W2	-185W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-185W1	++CONV-80W2										Page / column
		1Z-500	1Z-500	Cable type							Cable type	1Z-500	1Z-500										
HEATING CONTROL CABINET			1		+.2-185R1	1	7		-185B1	2													&EFS+/185.7
=			2		+.2-185R1	2	8																&EFS+/185.7
=							PE		+.2-185R1	PE		GNYE											&EFS+/185.7
230V AC for Circuit Breaker 1		1			++CONV+CIR-80Q1	X5_2	9		-187F1	2													&EFS+/187.1
=		2			++CONV+CIR-80Q1	X5_1	10																&EFS+/187.1
=							PE						GNYE										&EFS+/187.1
230V AC for Circuit Breaker Optional							11																&EFS+/187.2
=							12																&EFS+/187.2
=							PE																&EFS+/187.2
24V DC for Circuit Breaker 2 Optional							13		-187F2	2													&EFS+/187.4
=							14		-101T1	-													&EFS+/187.4
24V DC for Circuit Breaker Optional							15																&EFS+/187.5
=							16																&EFS+/187.5

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 2022
Date								+ CTRL_1.3 Main mounting plate total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-190XT1

230VAC Beleuchtung/Klimaanlage Container/Schrank

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
SPARE					1		-190F1	2			&EFS+/190.1
=					2		-190F1	N.			&EFS+/190.1
SPARE					PE						&EFS+/190.1
=					3		-190F2	2			&EFS+/190.3
=					4		-190F2	N.			&EFS+/190.3
SPARE					PE						&EFS+/190.3
Light Control cabinet		BN	+.5-190H1		5		-190F3	2			&EFS+/190.5
=					PE		-190X10	PE			&EFS+/190.5
=		LBU	+.5-190H1		6		-190F3	N.			&EFS+/190.5
230V AC for Container light, socket					7		-190X10	1			&EFS+/190.7
=					8		-190X10	2			&EFS+/190.7
230V AC for Container light, socket					PE						&EFS+/190.7

previous page: 2022

next page: 2024

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-190XT1	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 2023
Date								+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.3-191XT1					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
400V AC for Container Air Conditioning 1							1	,	-191F1	2												&EFS+/191.1
=							2	,	-191F1	4												&EFS+/191.1
=							3	,	-191F1	6												&EFS+/191.1
=							4	,	-XE	N:2												&EFS+/191.2
=							PE	,														&EFS+/191.2
400V AC for Container Air Conditioning 2							5	,	-191F2	2												&EFS+/191.3
=							6	,	-191F2	4												&EFS+/191.3
=							7	,	-191F2	6												&EFS+/191.3
=							8	,	-XE	N:1												&EFS+/191.4
=							PE	,														&EFS+/191.4

previous page: 2023

next page: 2025

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XV

Suppression TVS Diode

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
Suppression TVS Diode bi-directional 47 V					1		-171K3	14			&EFS+/171.8
Suppression TVS Diode bi-directional 47 V					5						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					6						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					7						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					8						&EFS+/151.8
Suppression TVS Diode bi-directional 47 V					9						&EFS+/134.5
Suppression TVS Diode bi-directional 47 V					2		-173K3	14			&EFS+/173.9
Suppression TVS Diode bi-directional 47 V					3						&EFS+/150.7
Suppression TVS Diode bi-directional 47 V					4						&EFS+/150.7

previous page: 2024

next page: +.4/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-350X1.21	Subsysteme DC Schütz EIN	1	19	0	0	21	=UNIT_01&EMZ++CT+CTRL_1.4/2000
-XE2	Gleichstromversorgung 1000VDC	1	11	0	0	11	=UNIT_01&EMZ++CT+CTRL_1.4/2001
-XV.20		1	12	0	0	36	=UNIT_01&EMZ++CT+CTRL_1.4/2002

previous page:
+.3/2025

next page:
2000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.4-350X1.21 - =UNIT_01++CT+CTRL_1.4-XV.20	20250805_V2.0	= UNIT_01	Converter Container 1
Date	21.01.2025							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+ CTRL_1.4	Right side

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-350X1.21

Subsysteme DC Schütz EIN

Function text		++CONV-237W4 OZ-500	++CONV-227W4 OZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-227W4 OZ-500	++CONV-237W4 OZ-500	Page / column
SUBSYSTEM 3_1 CONTACTOR DC+ ON			1		++CONV+CIR-227U1-X3.1	1	1	,	-350K1	14				&EFS+/350.2
=					-350K1	A2	2	,	++CONV+CIR-227U1-X3.1	17		17		&EFS+/350.2
SUBSYSTEM 3_1 CONTACTOR DC-ON			4		++CONV+CIR-227U1-X3.1	4	3	,	-350K2	14				&EFS+/350.4
			2		++CONV+CIR-227U1-X3.1	2	4	,	-351K1	14				&EFS+/351.1
					+.3-195K2	43	5	,						&EFS+/351.1
SUBSYSTEM 3_3 CONTACTOR DC+ ON			5		++CONV+CIR-227U1-X3.1	5	6	,	-351K2	14				&EFS+/351.3
=			3		++CONV+CIR-227U1-X3.1	3	7	,	-351K3	14				&EFS+/351.4
SUBSYSTEM 3_3 CONTACTOR DC-ON							8	,						&EFS+/351.5
=			6		++CONV+CIR-227U1-X3.1	6	9	,	-351K4	14				&EFS+/351.6
=							10	,						&EFS+/351.7
SUBSYSTEM 4_3 CONTACTOR DC-ON							10	,						&EFS+/353.6
SUBSYSTEM 4_1 CONTACTOR DC+ ON		1			++CONV+CIR-237U1-X3.1	1	11	,	-352K1	14				&EFS+/352.1
SUBSYSTEM 4_1 CONTACTOR DC-ON					-352K1	A2	12	,	++CONV+CIR-237U1-X3.1	17		17		&EFS+/352.2
=		4			++CONV+CIR-237U1-X3.1	4	13	,	-352K2	14				&EFS+/352.3
SUBSYSTEM 4_2 CONTACTOR DC+ ON		2			++CONV+CIR-237U1-X3.1	2	14	,	-353K1	14				&EFS+/353.1
=					-353K1	A2	15	,						&EFS+/353.1
SUBSYSTEM 4_3 CONTACTOR DC+ ON		5			++CONV+CIR-237U1-X3.1	5	16	,	-353K2	14				&EFS+/353.3
=		3			++CONV+CIR-237U1-X3.1	3	17	,	-353K3	14				&EFS+/353.4
=					-353K2	A2	18	,						&EFS+/353.4
SUBSYSTEM 4_3 CONTACTOR DC-ON		6			++CONV+CIR-237U1-X3.1	6	19	,	-353K4	14				&EFS+/353.6

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2000
Date								+ CTRL_1.4 Right side — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-XE2

Gleichstromversorgung 1000VDC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
RESISTORS FOR DISCHARGING UDC+			-173R2		1		-173R1				&EFS+/173.2
RESISTORS FOR DISCHARGING UDC-			-173R4		2		-173R3				&EFS+/173.3
=			-173R4		3		+CTRL_2.1-160U1	15			&EFS+/173.3
=			-173R2		4		+CTRL_2.1-160U1	44			&EFS+/173.3
=			+CTRL_2.1-162U1	15	5		+CTRL_2.1-161U1	15			&EFS+/173.3
=			+CTRL_2.1-162U1	44	6		+CTRL_2.1-161U1	44			&EFS+/173.3
=			+CTRL_2.1-163U1	15	7		-189X1	4			&EFS+/173.4
=			+CTRL_2.1-163U1	44	8		+CTRL_2.1-164U1	44			&EFS+/173.4
=			+CTRL_2.1-164U1	15	9		++CONV+CON-N	N			&EFS+/173.4
=					10		+CTRL.4-173R6				&EFS+/173.5
=					11		+CTRL.4-173R8				&EFS+/173.5

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.4-XV.20					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Suppression TVS Diode bi-directional 47 V							1															&EFS+/350.7
Suppression TVS Diode bi-directional 47 V							2															&EFS+/350.7
Suppression TVS Diode bi-directional 47 V							3															&EFS+/351.7
Suppression TVS Diode bi-directional 47 V							4															&EFS+/351.7
Suppression TVS Diode bi-directional 47 V							5															&EFS+/351.8
Suppression TVS Diode bi-directional 47 V							6															&EFS+/351.8
Suppression TVS Diode bi-directional 47 V							7															&EFS+/352.7
Suppression TVS Diode bi-directional 47 V							8															&EFS+/352.7
Suppression TVS Diode bi-directional 47 V							9															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							10															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							11															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							12															&EFS+/353.8

previous page: 2001

next page: 2003

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.4-XV.20						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-149X1		1	6	0	0	6	=UNIT_01&EMZ++CT+CTRL_2.1/2000

previous page:
+CTRL_1.4/2003

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_2.1-149X1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
					-161U1	19	1	,															&EFS+/161.4
					-161U1	23	2	,															&EFS+/161.5
					-161U1	27	3	,															&EFS+/161.5
					-161U1	32	4	,															&EFS+/161.6
					-161U1	36	5	,															&EFS+/161.7
					-161U1	40	6	,															&EFS+/161.8

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-52G1-181X1	400VAC Wassersystem	1	PE	3	1	14	=UNIT_01&EMZ++FAN/2000
-52G1-181X3		1	GND	0	0	6	=UNIT_01&EMZ++FAN/2001

previous page:
++CT+CTRL_2.1/2000

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++FAN+-52G1-181X1

400VAC Wassersystem

Function text	-52G1-182W1	-52G1-181W5	-52G1-181W2	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CT-181W1	Page / column
	1Z-600	1Z-600	1Z-600	Cable type							Cable type	1Z-600	
PUMP			1		-52G1-181M1	U1	1	,	++CT+CTRL_1.3-X1	1		1	&EFS++CT/181.1
=			2		-52G1-181M1	V1	2	,	++CT+CTRL_1.3-X1	2		2	&EFS++CT/181.1
=			3		-52G1-181M1	W1	3	,	++CT+CTRL_1.3-X1	3		3	&EFS++CT/181.1
FUSE FOR PUMP		1			-52G1-181R1	x1	4	,	++CT+CTRL_1.3-X1	4		4	&EFS++CT/181.3
HEATER		2			-52G1-181R1	x3	5	,	++CT+CTRL_1.3-X1	5		5	&EFS++CT/181.4
=		3			-52G1-181R1	x5	6	,	++CT+CTRL_1.3-X1	6		6	&EFS++CT/181.4
=		4			-52G1-181R1	x6	7	,	++CT+CTRL_1.3-X1	7		7	&EFS++CT/181.4
								,					
FAN 1 HEAT EXCHANGER	1				-52G1-182M1	U1	8	,	++CT+CTRL_1.3-X1	8		8	&EFS++CT/182.1
=	2				-52G1-182M1	V1	9	,	++CT+CTRL_1.3-X1	9		9	&EFS++CT/182.1
=	3				-52G1-182M1	W1	10	,	++CT+CTRL_1.3-X1	10		10	&EFS++CT/182.1
PUMP			GNYE		-52G1-181M1	PE	PE	,	++CT+CTRL_1.3-X1	PE		GNYE	&EFS++CT/181.1
HEATER		GNYE			-52G1-181R1	PE	PE	,					&EFS++CT/181.4
FAN 1 HEAT EXCHANGER	GNYE				-52G1-182M1	PE	PE	,					&EFS++CT/182.1

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++FAN+-52G1-181X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN FAN page: 2000
Date								+ total: 492

Terminal diagram

Freqcon_F13_001_02

Function text			++CT-181W3	Cable name	Strip =UNIT_01++FAN+-52G1-181X3					Cable name	++CT-181W3										Page / column
			F-CY-0Z (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-0Z (LiY-CY)										
PRESSURE SWITCH			1		++CT+CTRL_1.3-X3	23	1	,	-52G1	1												&EFS++CT/181.7
=					-52G1	2	2	,	++CT+CTRL_1.3-X3	25		3										&EFS++CT/181.7
=					-52G1	3	3	,	++CT+CTRL_1.3-X3	24		2										&EFS++CT/181.7
COOLING WATER TEMPERATURE			4		++CT+CTRL_1.3-X5	23	4	,	-52G1-148B1	+												&EFS++CT/148.1
=			5		++CT+CTRL_1.3-X5	24	5	,	-52G1-148B1	-												&EFS++CT/148.1
PRESSURE SWITCH					-52G1	SH	GND	,														&EFS++CT/181.7

previous page: 2000

next page: =UNIT_02&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++FAN+-52G1-181X3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN FAN page: 2001
Date								+ total: 492

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

FREQCON

Customer:	Statron		
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Type:	BESS MSC-1000-620-8		
Product	BATTERY CONTAINER 1		
Circuit diagram No:	10354_23A2007	20250805_V2.0	
Producer (company):	Freqcon GmbH	53406 ASC	53409
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Type:	BESS MSC-1000-620-8		
Project manager:	Freqcon_CP		

created on: 17.09.2019
edited on: 05.08.2025 edited by: Freqcon_DG total pages: 492

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	21.01.2025	Freqcon_DG
	3	INDEX	21.01.2025	Freqcon_DG
	4	INDEX	21.01.2025	Freqcon_DG
	5	INDEX	21.01.2025	Freqcon_DG
	6	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	05.11.2024	Freqcon_DG
	3a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
&ELU		Cabinet Overview		
	5a	Container overview	14.06.2024	Freqcon_JD
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	191	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	192	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	193	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	278	EARTHING CONTAINER	08.10.2024	Freqcon_DG
	290	BATTERY CABINETS 1-3	18.06.2024	Freqcon_JD
	291	BATTERY CABINETS 4+5	18.06.2024	Freqcon_JD
	292	BATTERY CABINETS 6-8	18.06.2024	Freqcon_JD
	293	BATTERY CABINETS 9-11	18.06.2024	Freqcon_JD
&EFS ++ASC		Circuit diagram auxillary cabinet		
	601	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	602	CONTROL VOLTAGE UPS	05.11.2024	Freqcon_DG
	603	CONTROL VOLTAGE FUSE	21.01.2025	Freqcon_DG
	611	ETHERNET SWITCH	18.06.2024	Freqcon_JD
	613a	ETHERNET / PROFINET ISOLATOR	25.11.2024	Freqcon_DG
	613b	PROFINET	25.11.2024	Freqcon_DG
	620	ET200 24V DC ASC	03.12.2024	Freqcon_DG
	621	ET200SP DIGITAL INPUTS DI_21 + DI_22	03.12.2024	Freqcon_DG
	623	ET200SP DIGITAL OUTPUTS DO_21	14.06.2024	Freqcon_JD
	624	ET200SP ANALOG INPUTS AI_21	14.06.2024	Freqcon_JD
	625	ET200SP ANALOG OUTPUTS AO_21	14.06.2024	Freqcon_JD
	636	OUTPUTS FIRE DAMPER	18.06.2024	Freqcon_JD
	669	SMOKE POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	670	GAS POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	678	DC BATTERY CABINETS	18.06.2024	Freqcon_JD
	680a	STATIONARY GAS DETECTOR BAT 1-4	14.06.2024	Freqcon_JD
	680b	STATIONARY GAS DETECTOR BAT 5-8	18.06.2024	Freqcon_JD
	680c	STATIONARY GAS DETECTOR BAT 9-11	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++ASC		Circuit diagram auxillary cabinet		
	681	EXTRACT FAN FIRE DAMPER	14.06.2024	Freqcon_JD
	684	AUXILIARY SUPPLY 400V AC	22.11.2024	Freqcon_DG
	685	AUXILIARY SUPPLY 400V AC	05.11.2024	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	29.10.2024	Freqcon_DG
	691	CONTAINER COOLING / LIGHTNING	05.11.2024	Freqcon_DG
&EPC ++Container		Parts List		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	21.01.2025	Freqcon_DG
	4	PARTS LIST	21.01.2025	Freqcon_DG
	5	PARTS LIST	21.01.2025	Freqcon_DG
	6	PARTS LIST	21.01.2025	Freqcon_DG
	7	PARTS LIST	21.01.2025	Freqcon_DG
&EPA ++Container		Summarized part list		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG

previous page: 2

next page: 4

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++Container		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	21.01.2025	Freqcon_DG
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_02++ASC+-X5.1 - =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_02++ASC+-X5.1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_02++ASC+-X5.2	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2002	Klemmenplan =UNIT_02++ASC+-X5.3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_02++ASC+-X6	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_02++ASC+-XDC1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_02++ASC+-XDC2	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_02++ASC+-XES	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2009	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2024	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2025	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2026	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2027	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2028	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG

previous page: 4

next page: 6

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2029	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2030	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2031	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2032	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2033	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/6

next page: 6a

SPECIFICATION of grounding

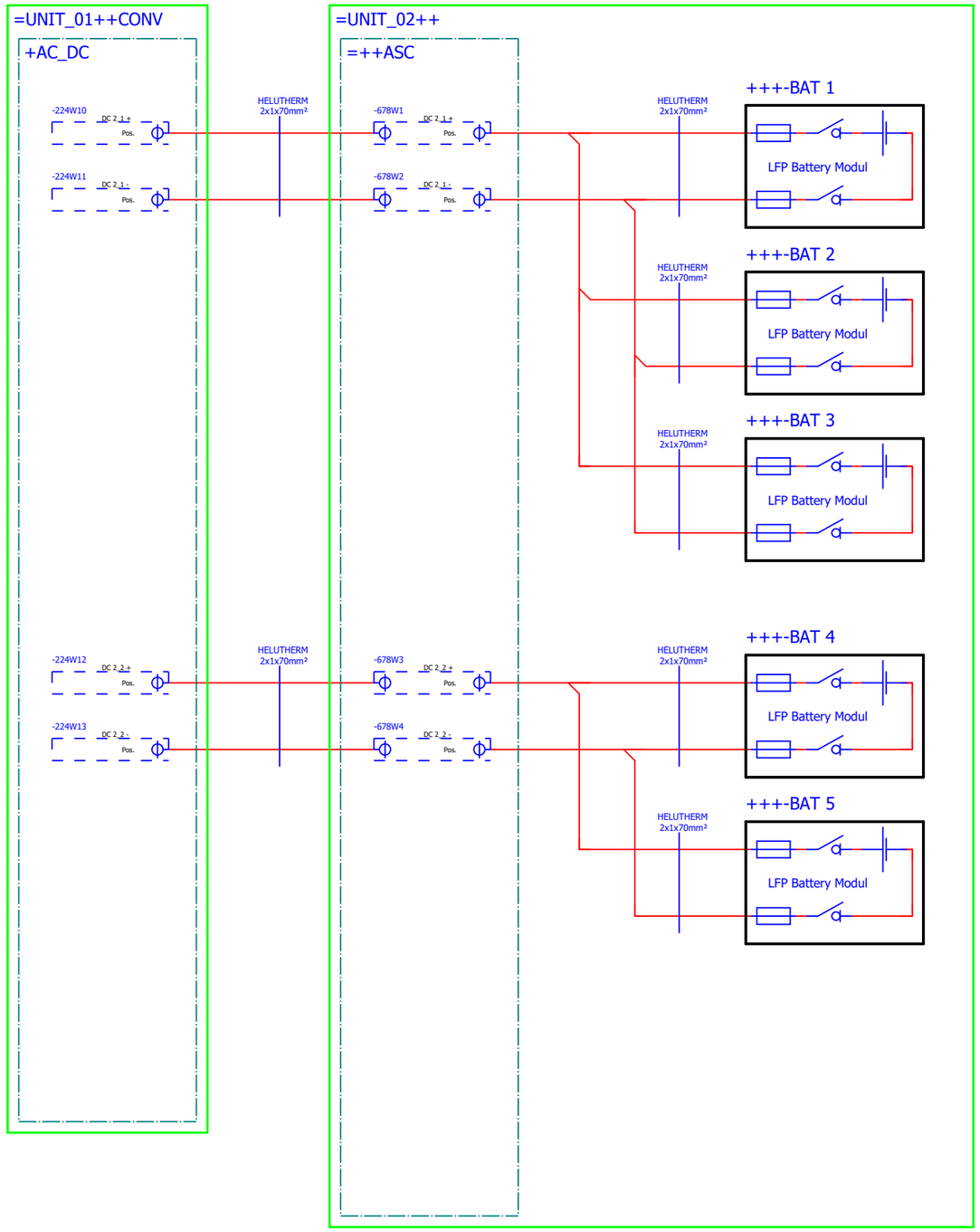
	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

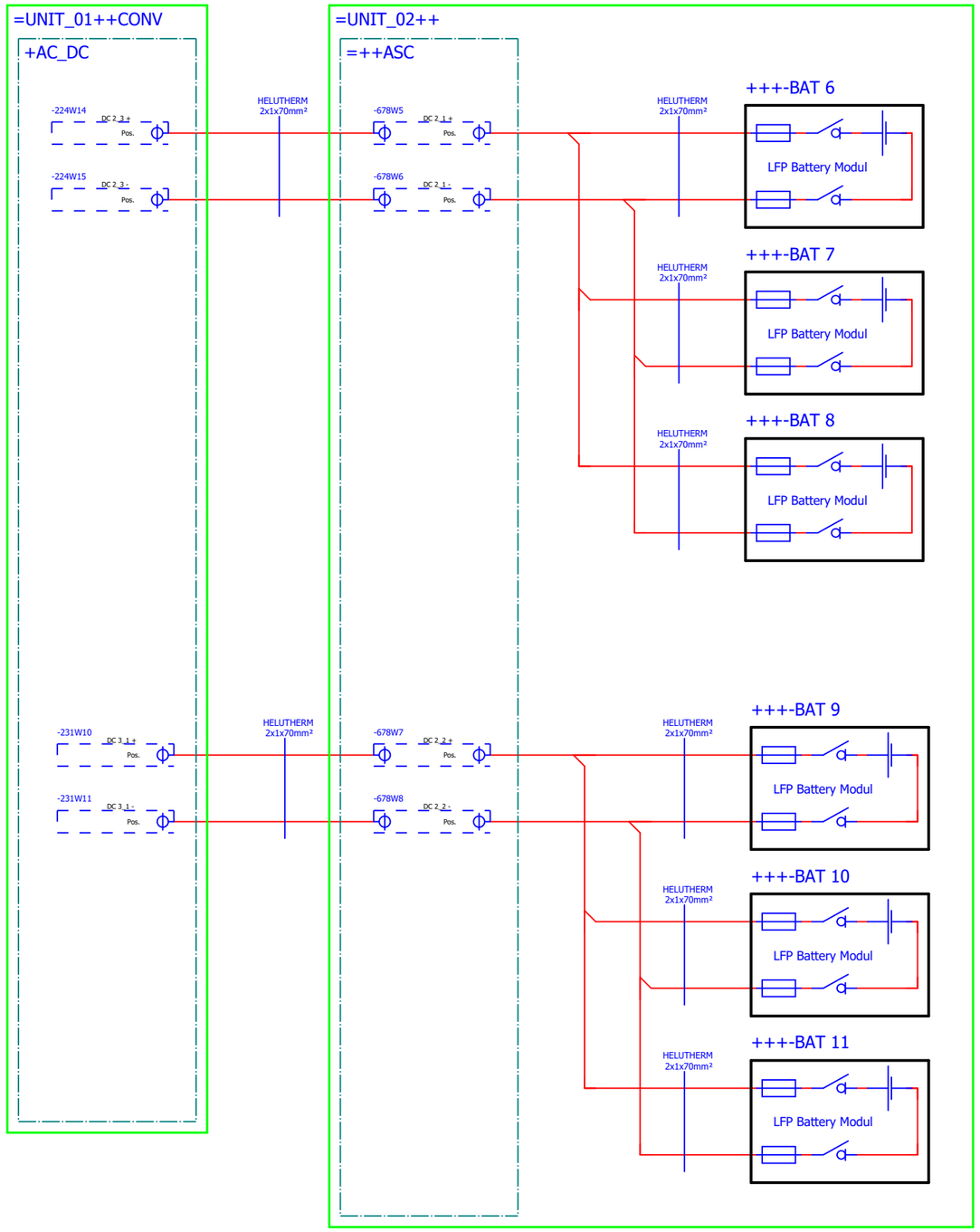
previous page: 1a

next page: &EFA/1a

Editor	Freqcon_JD			Statron	FREQCON	Specification Earthing	20250805_V2.0	= UNIT_02	Battery Container 1
Date	14.06.2024	Norm						& EAC	Explanatory documents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 6a
Date								+	total: 492

Single line diagram





previous page:
&EAC/6a

next page:
2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 1a
Date								+	total: 492

Single line diagram

Control circuit

++ASC

400V

-XES

-684F3 &EFS++ASC/684.2 C32A

-684F1 &EFS++ASC/684.0 C32A

-684F2 &EFS++ASC/684.5 TYP 1 + 2 SPD

-601F1 &EFS++ASC/601.1 TYP 1 + 2 SPD

-684F4 &EFS++ASC/685.0 C32A

-684F5 &EFS++ASC/685.5 TYP 1 + 2 SPD

-691F1 &EFS++ASC/691.1 C6A

-691F2 &EFS++ASC/691.3 C6A

-691F3 &EFS++ASC/691.4 C6A

-636K1 &EFS++ASC/636.1

-636K2 &EFS++ASC/636.2

-636K3 &EFS++ASC/636.4

M 1~

Exhaust Unit / shut-off flap Bat 1-4

Exhaust Unit / shut-off flap Bat 5-8

Exhaust Unit / shut-off flap Bat 9-11

Container Internal Lighting

-690F1 &EFS++ASC/690.1 16A

-690F3 &EFS++ASC/690.5 C6A

-690F4 &EFS++ASC/690.7 C6A

-690F5 &EFS++ASC/690.8 C6A

1/N/PE

crane 1

crane 2

crane 3

-691F4 &EFS++ASC/691.5 C16A

Cooling Units

-690F2 &EFS++ASC/690.3 16A

1/N/PE 1/N/PE

Container Sockets

-101Q1

20 A

Power Supply

-687F1 &EFS++ASC/687.1 C16A

-687F2 &EFS++ASC/687.3 C16A

-687F3 &EFS++ASC/687.4 C16A

-687F4 &EFS++ASC/687.5 C16A

-687F5 &EFS++ASC/687.7 C16A

Battery cabinet 1

Battery cabinet 2

Battery cabinet 3

Battery cabinet 4

Battery cabinet 5

-687F6 &EFS++ASC/687.8 C16A

-688F1 &EFS++ASC/688.1 C16A

-688F2 &EFS++ASC/688.2 C16A

-688F3 &EFS++ASC/688.4 C16A

-688F4 &EFS++ASC/688.5 C16A

-688F5 &EFS++ASC/688.7 C16A

Battery cabinet 6

Battery cabinet 7

Battery cabinet 8

Battery cabinet 9

Battery cabinet 10

Battery cabinet 11

previous page: 1a

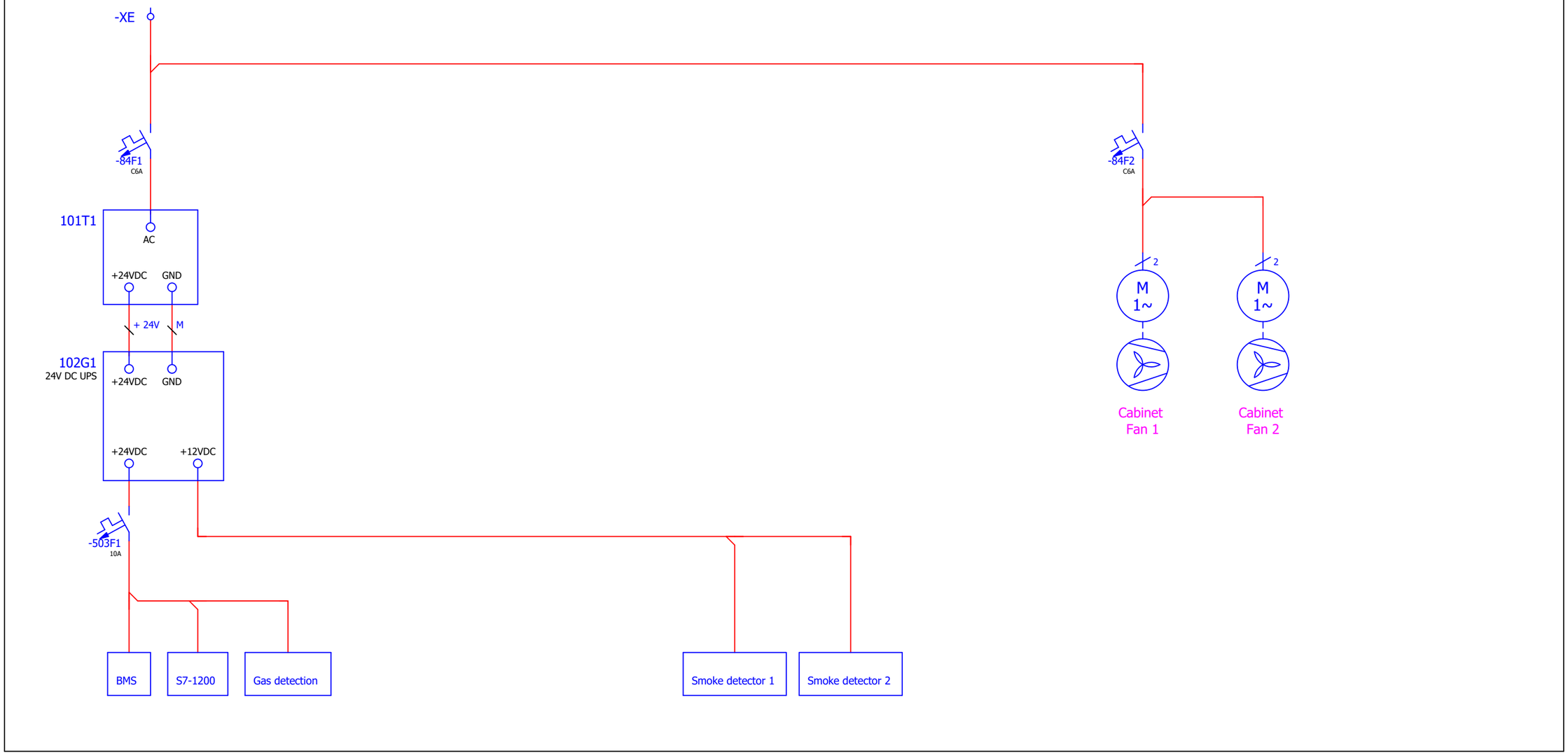
next page: 3a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2a
Date								+ total: 492

Single line diagram

Control circuit

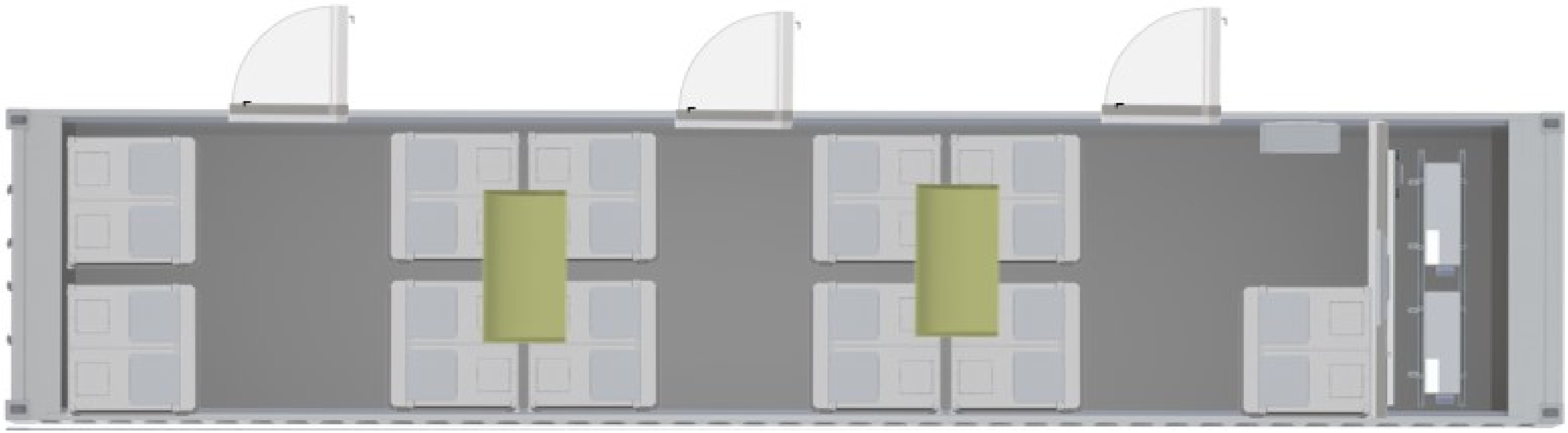
Battery Cabinet



previous page:
2a

next page:
&ELU/5a

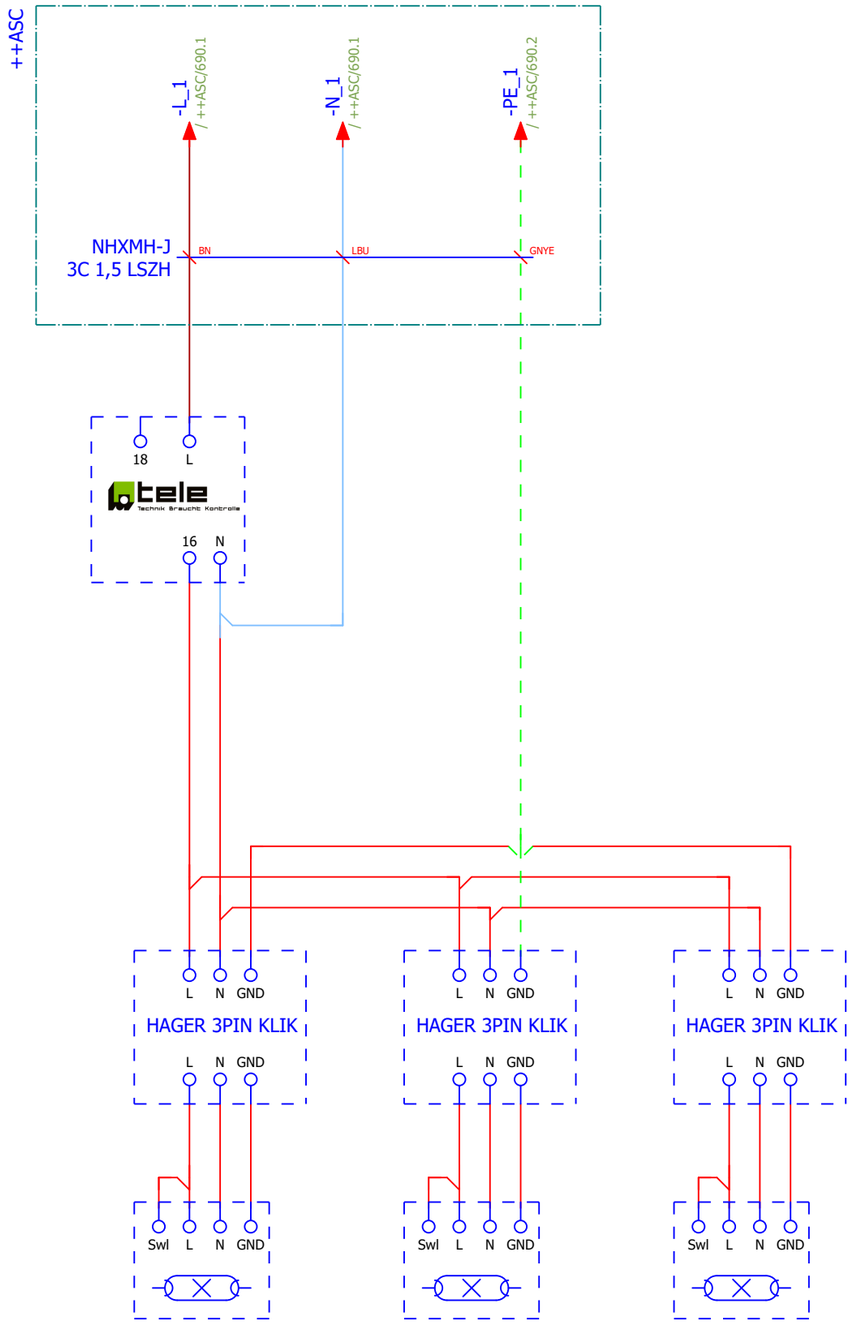
0	1	2	3	4	5	6	7	8	9



previous page:
&EFA/3a

next page:
&EFS++Container/190

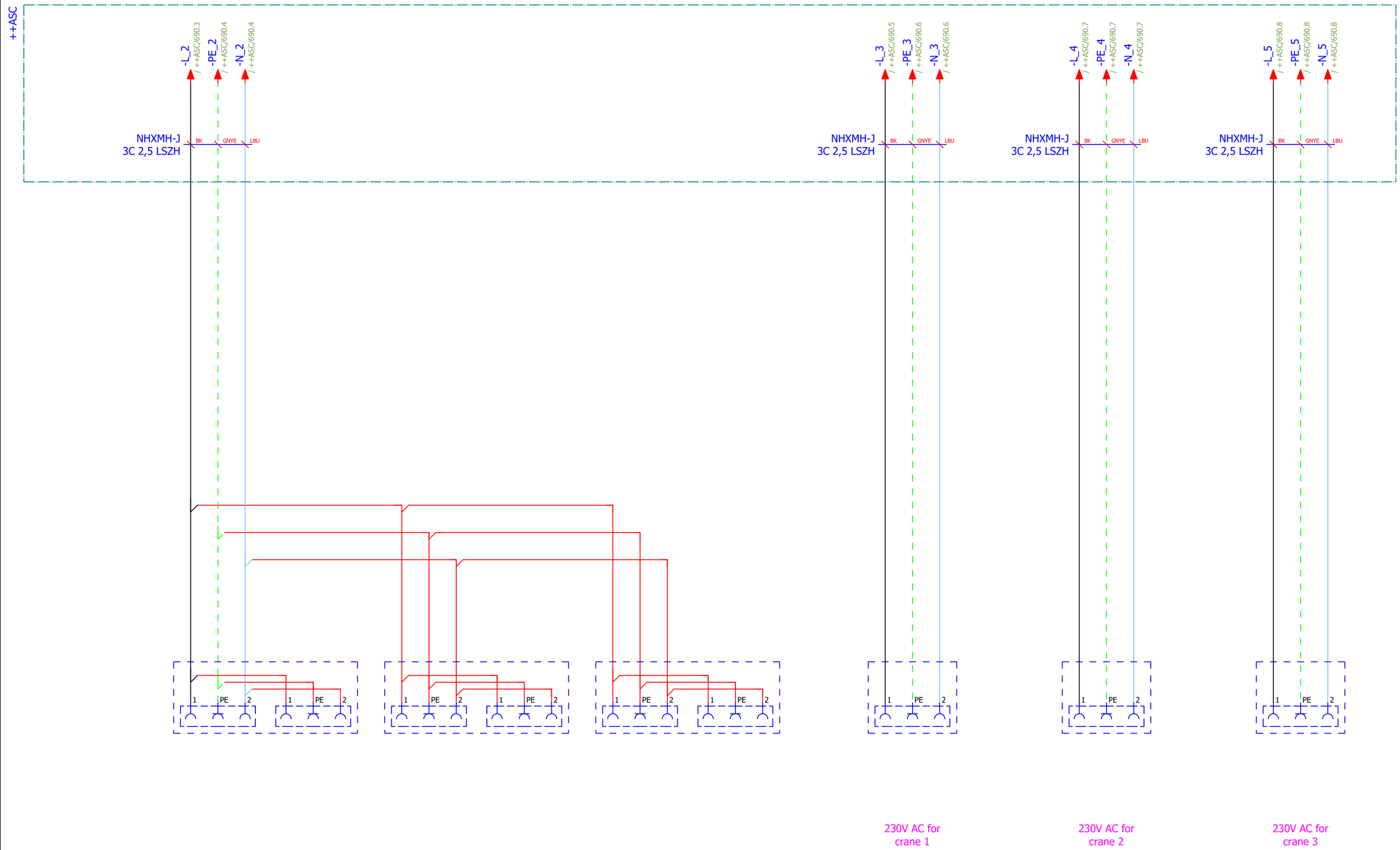
Editor	Freqcon_JD			Statron	FREQCON	Container overview	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024	Norm						& ELU Cabinet Overview	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
191

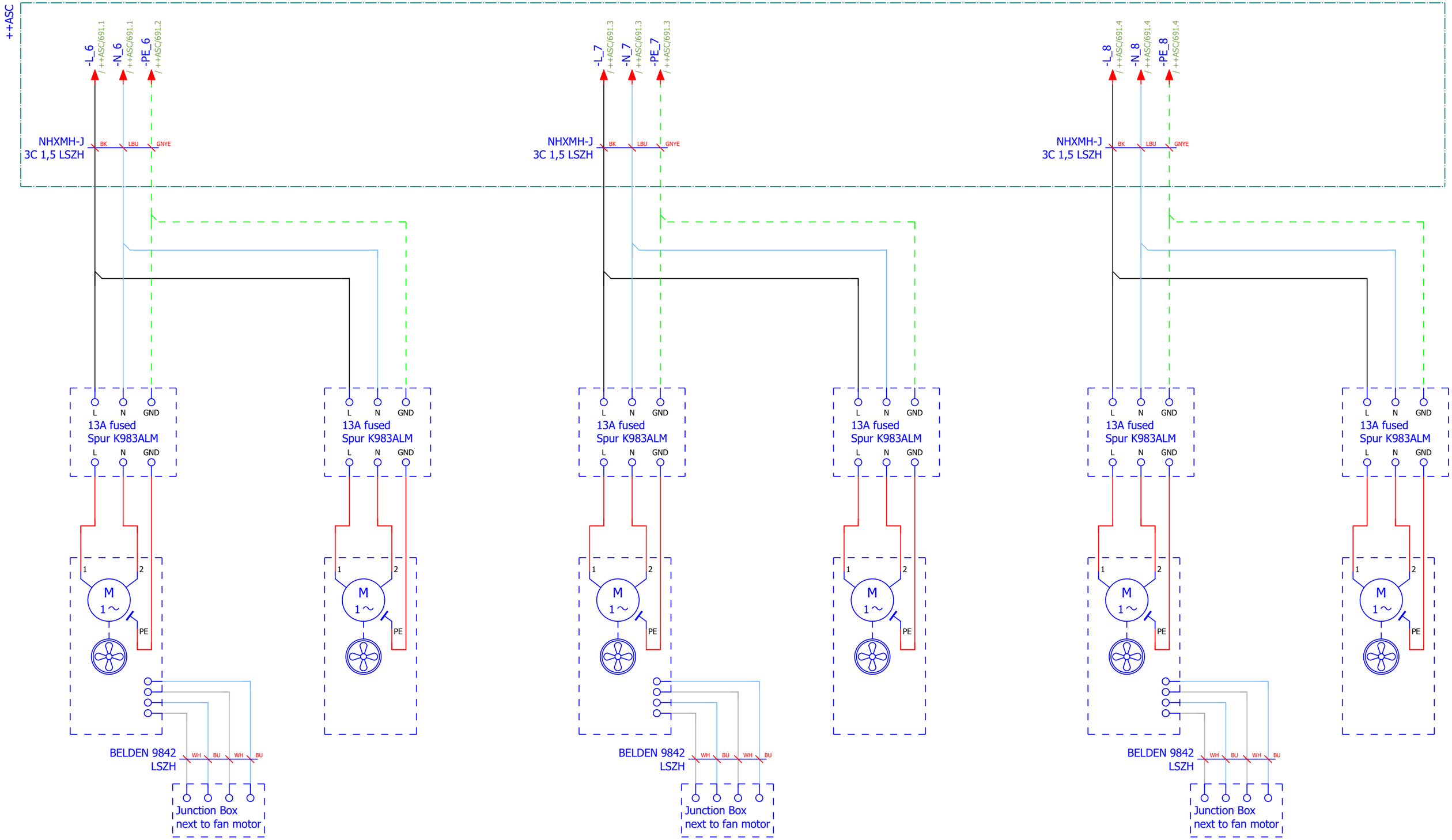
Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492



previous page: 190

next page: 192

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 191
Date								+	total: 492



230V AC for
Exhaust Unit
Battery cabinets 1-4

230V AC for
shut-off flap
Battery cabinets 1-4

230V AC for
Exhaust Unit
Battery cabinets 5-8

230V AC for
shut-off flap
Battery cabinets 5-8

230V AC for
Exhaust Unit
Battery cabinets 9-11

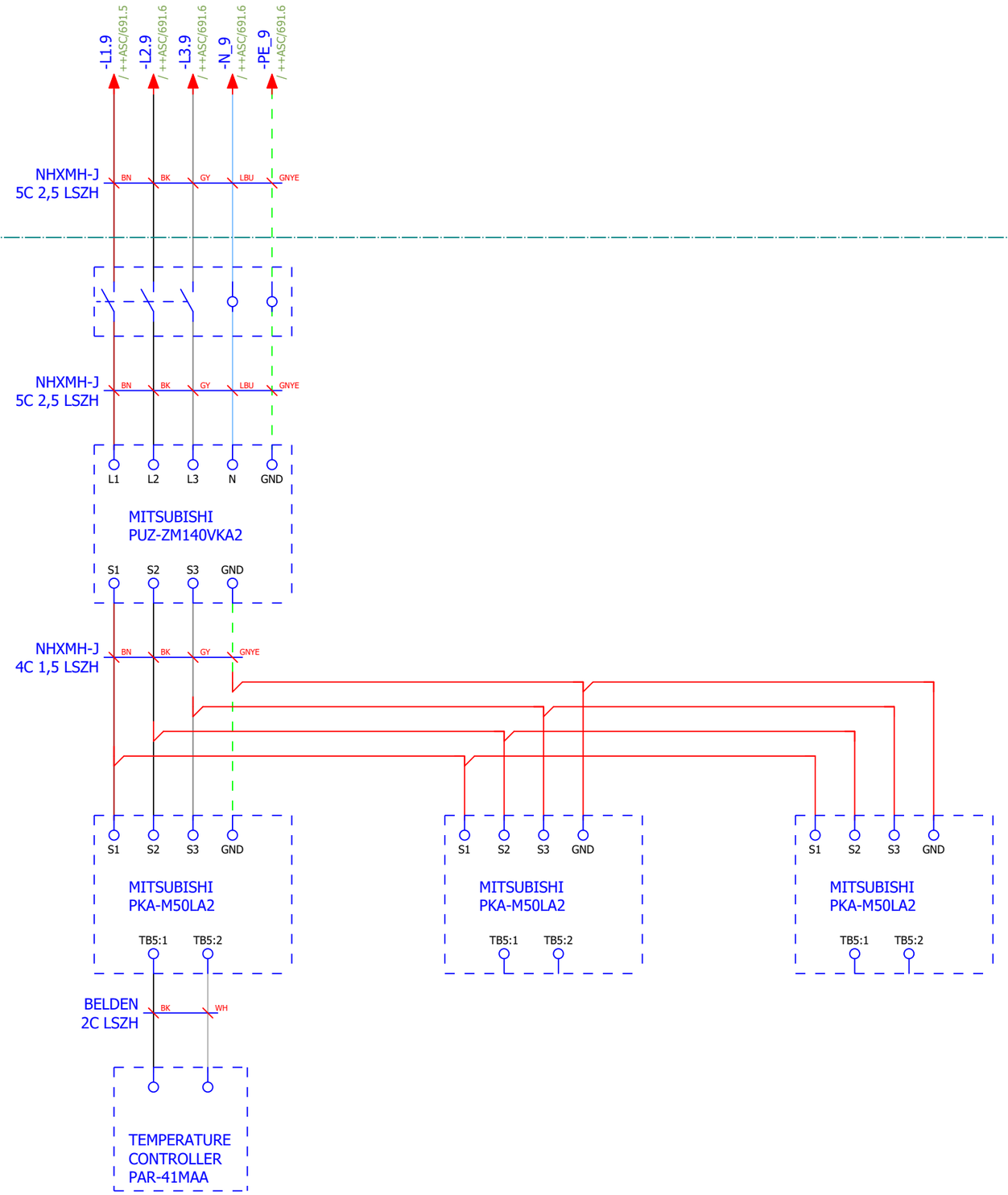
230V AC for
shut-off flap
Battery cabinets 9-11

previous page:
191

next page:
193

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 192
Date								+ total: 492

++ASC

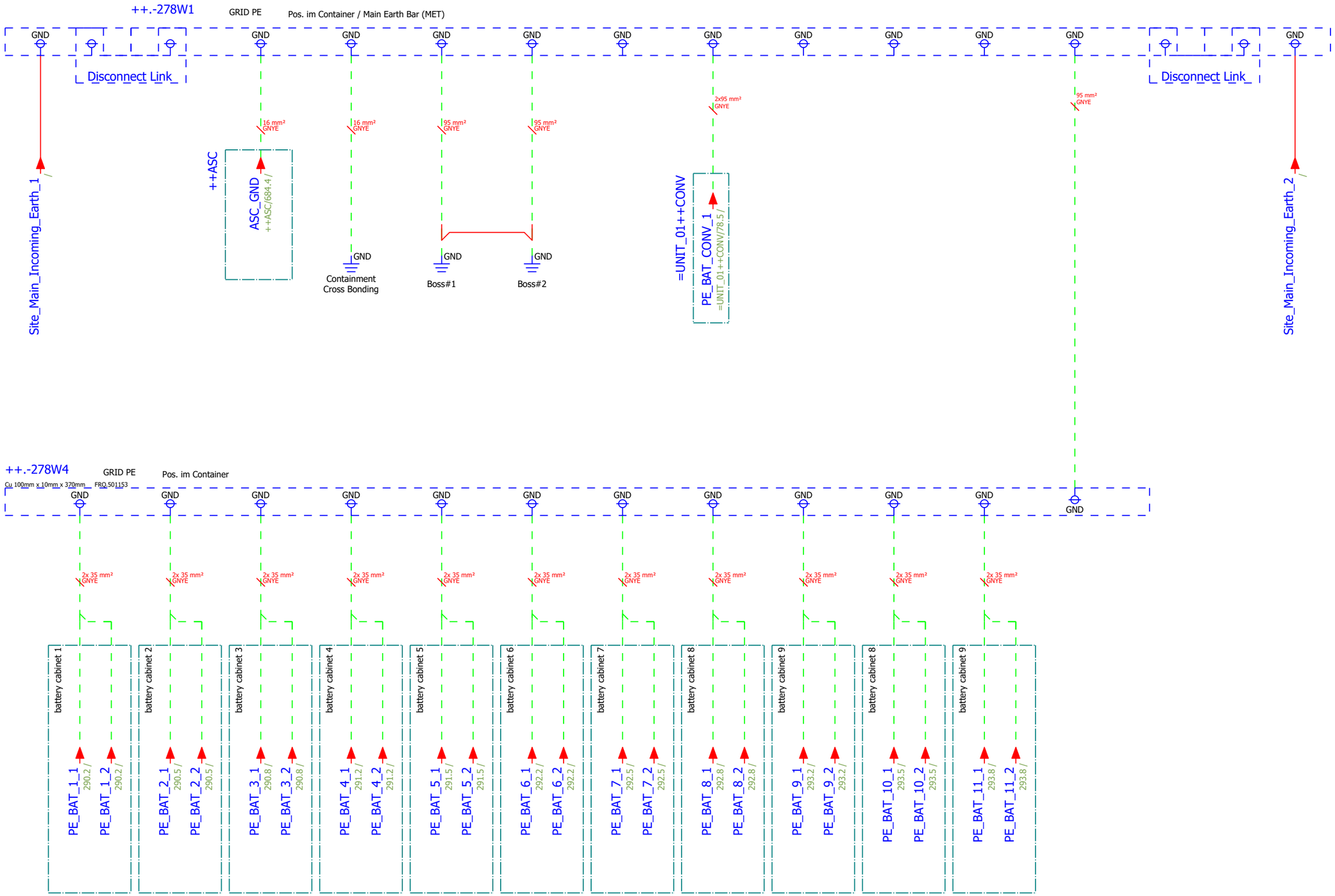


previous page:
192

next page:
278

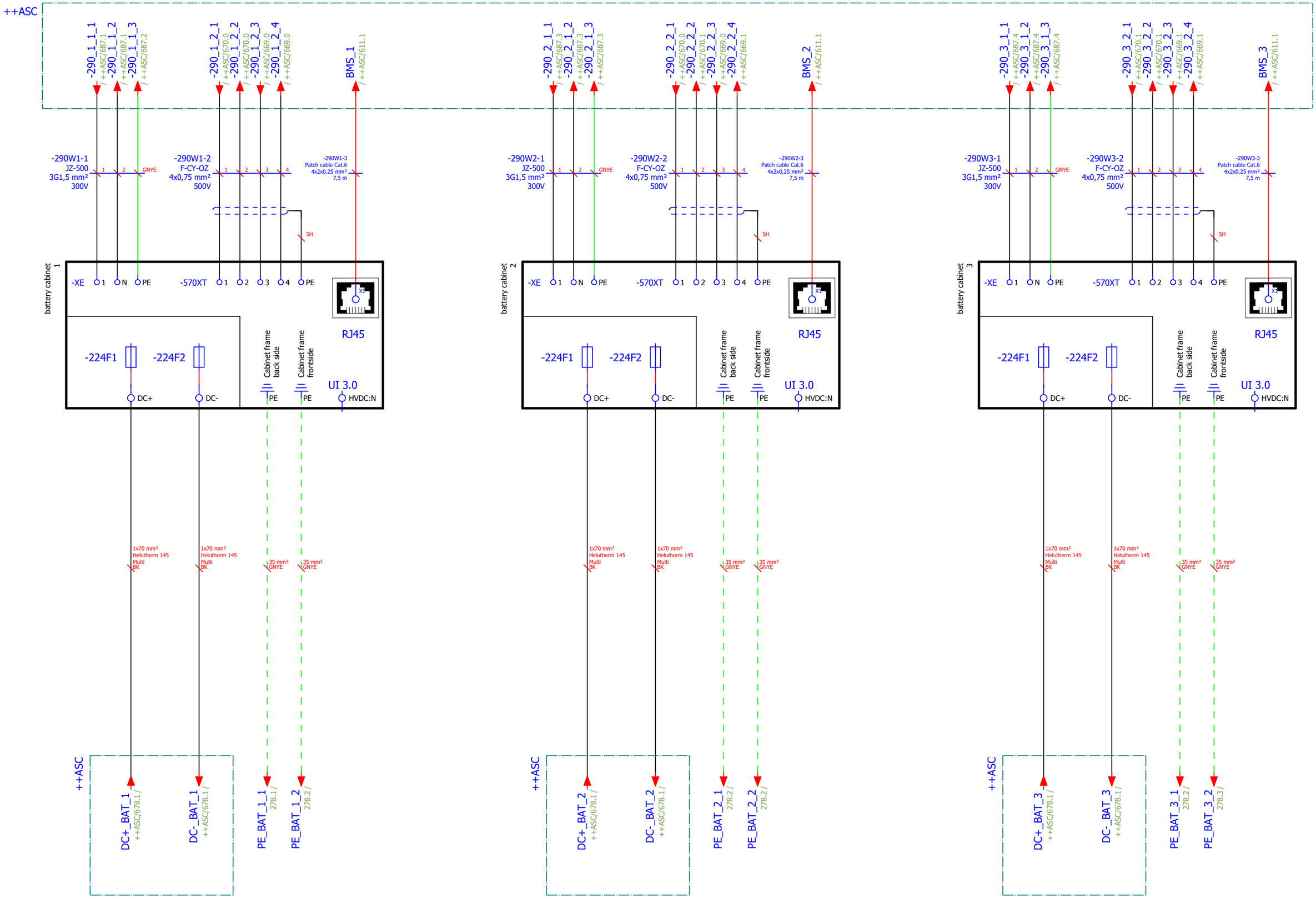
Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 193
Date								+	total: 492

Busbars PE



previous page: 193

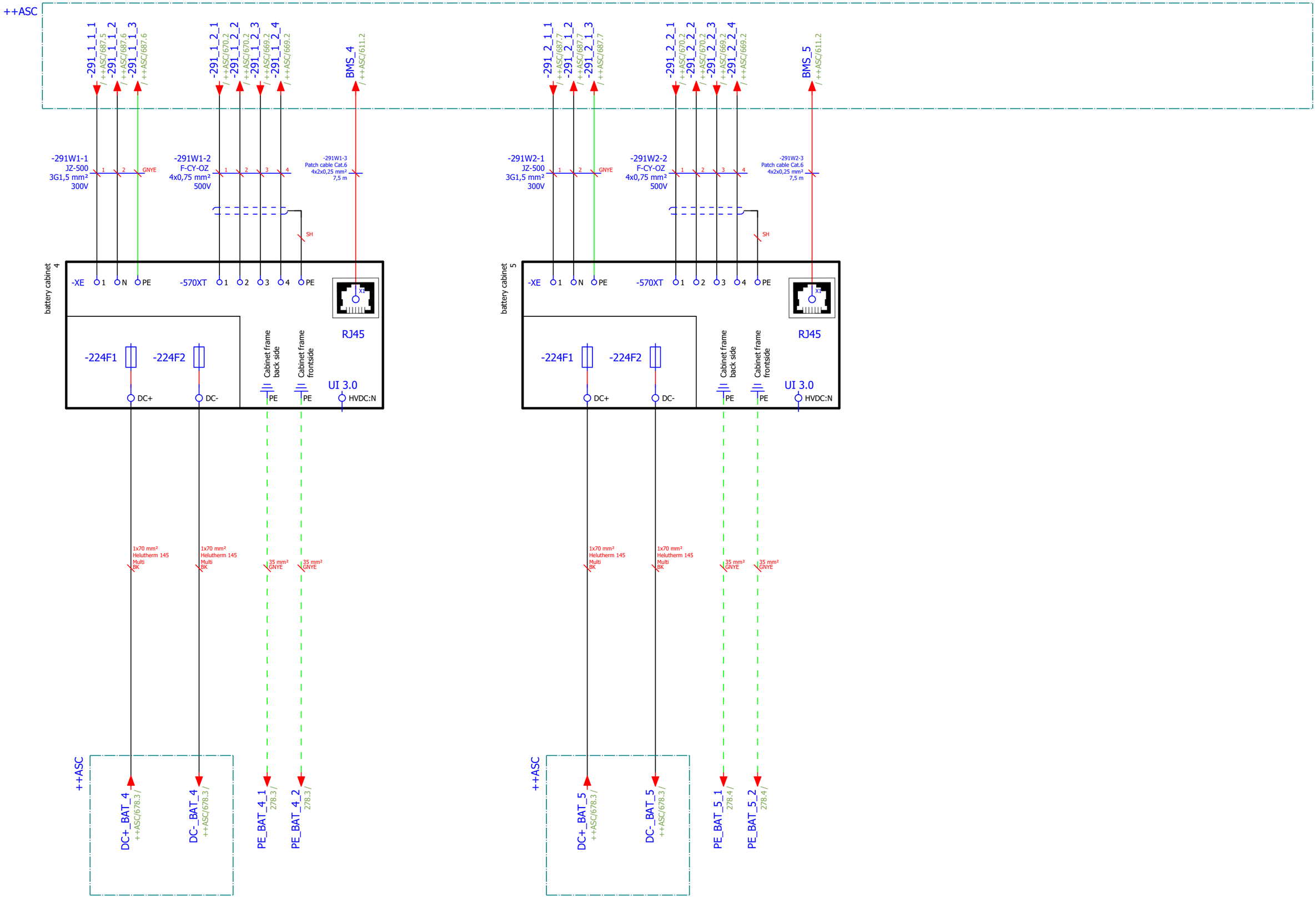
next page: 290



previous page: 278

next page: 291

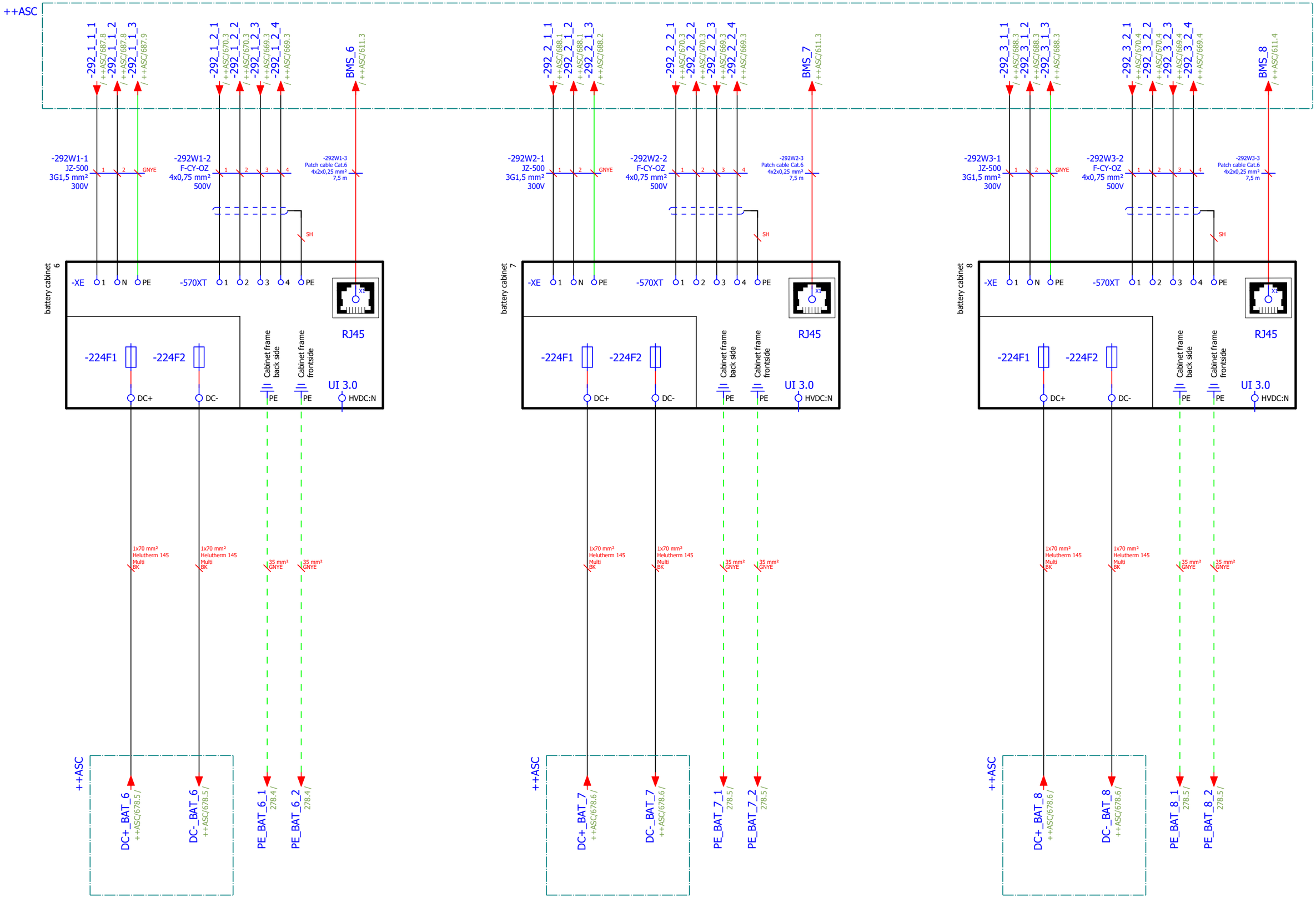
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 1-3	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 290
Date								+	total: 492



previous page: 290

next page: 292

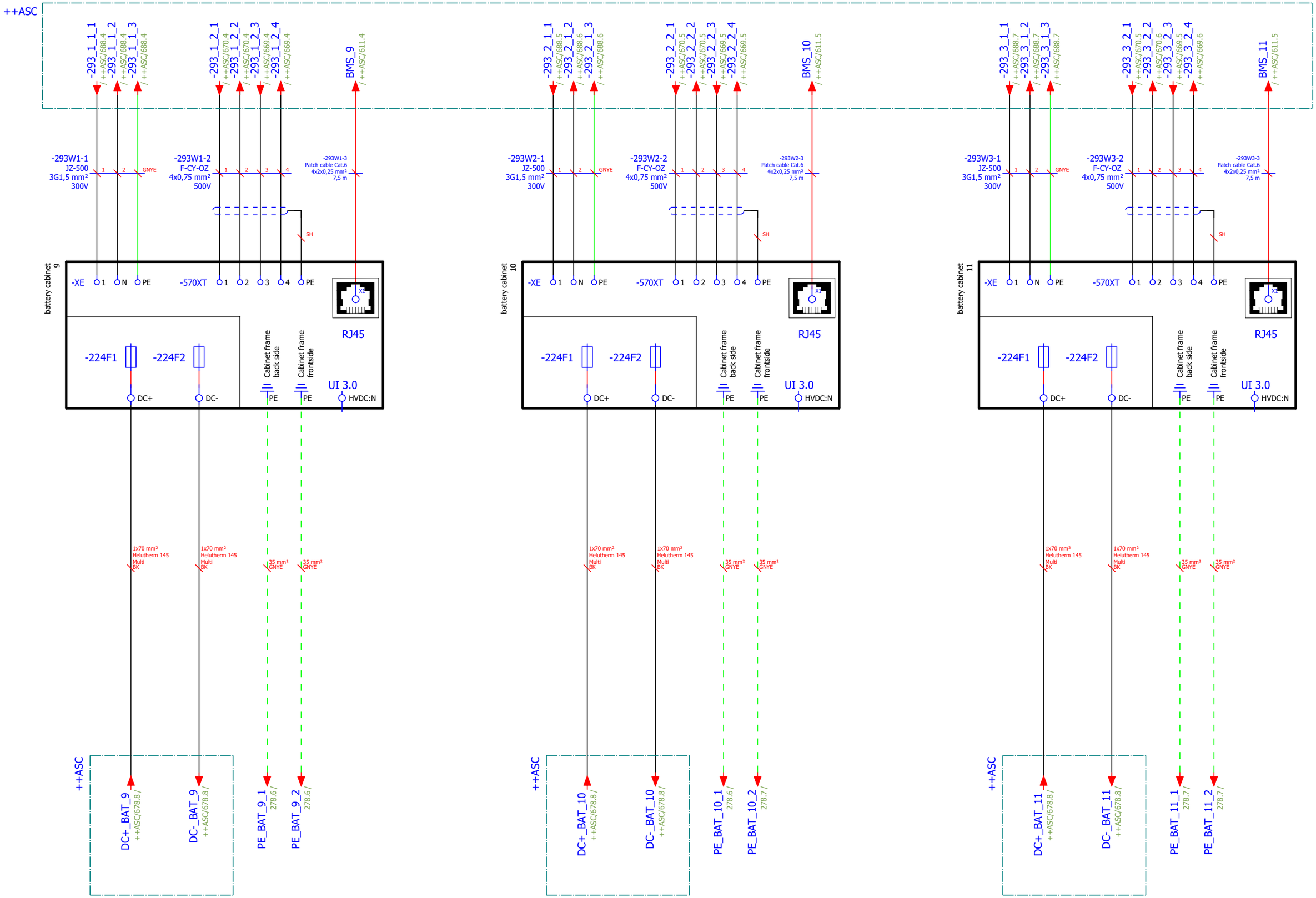
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 4+5	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 291
Date								+	total: 492



previous page: 291

next page: 293

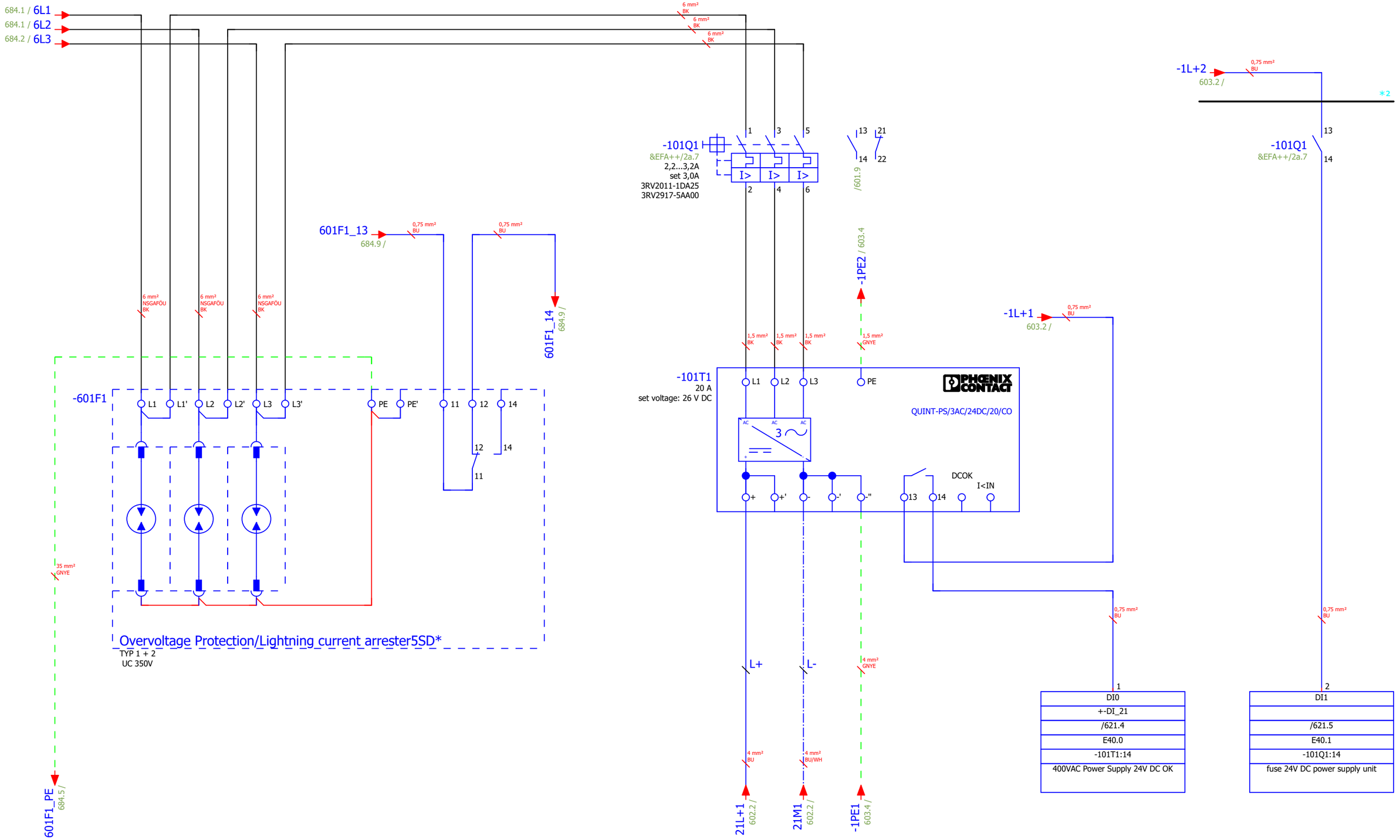
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 6-8	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 292
Date								+	total: 492



previous page: 292

next page: ++ASC/601

Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 9-11	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 293
Date								+	total: 492



previous page:
++Container/293

Power supply unit from 400V AC

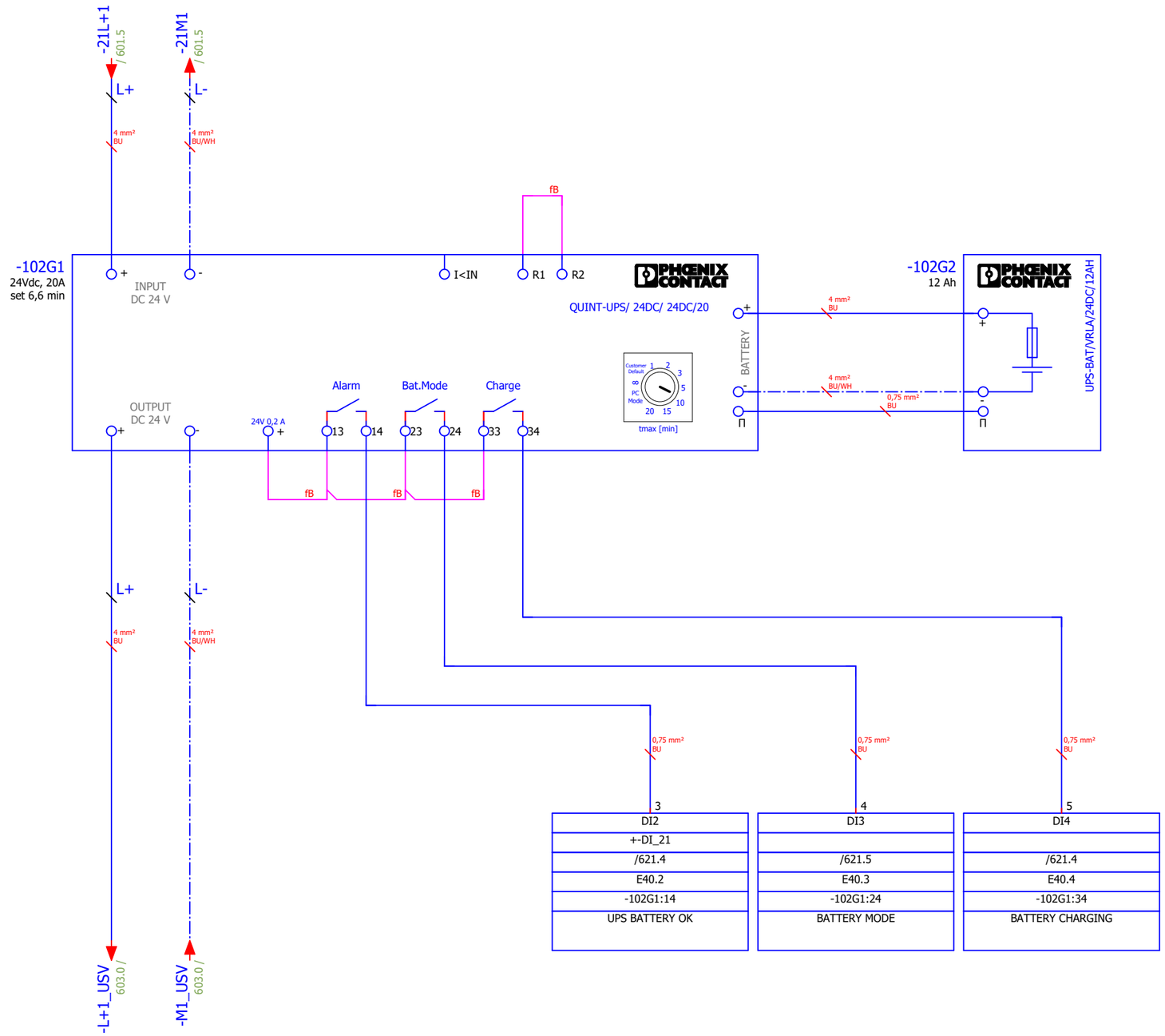
400VAC
Power Supply
24V DC OK

fuse
24V DC power supply unit

next page:
602

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

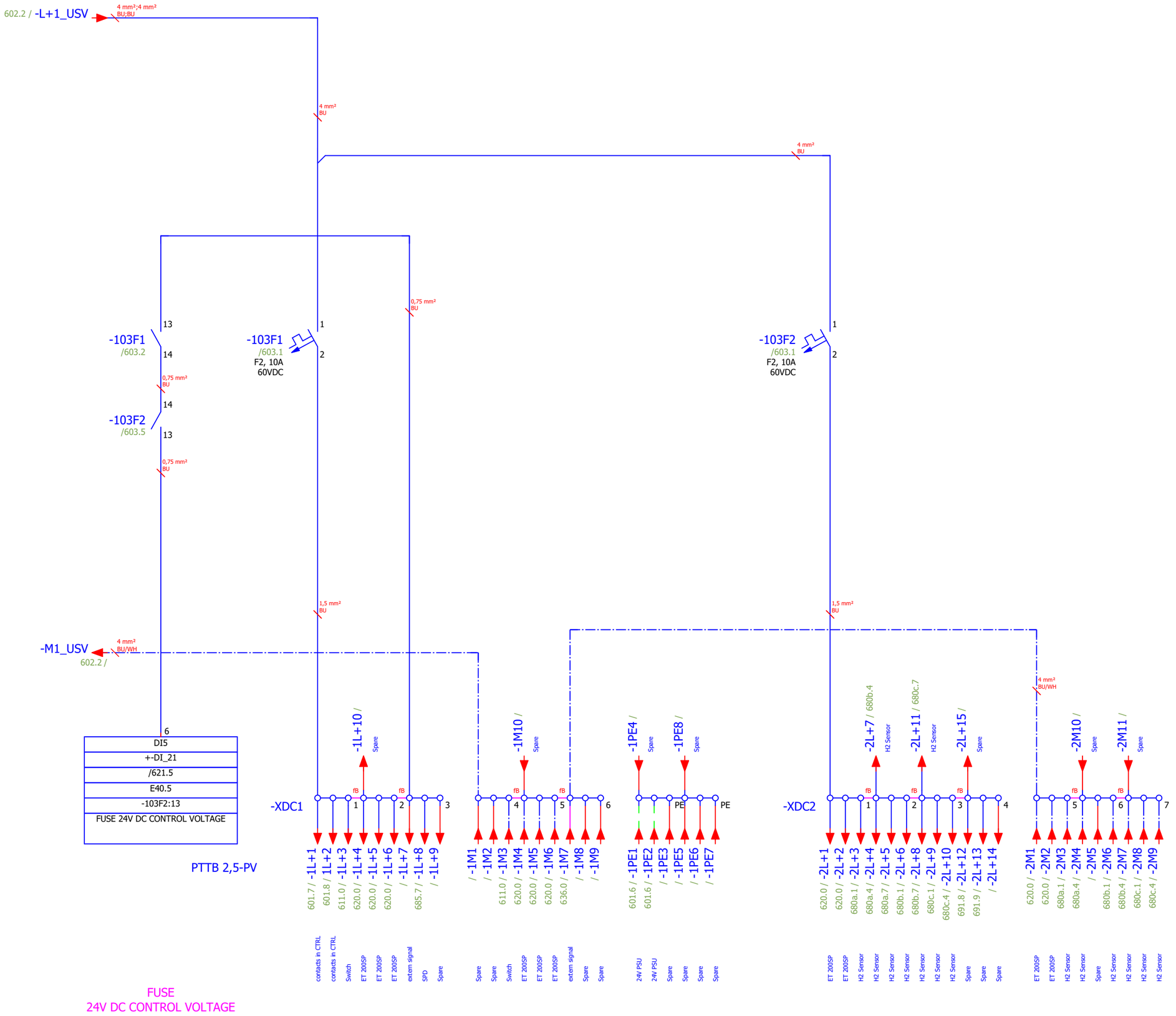
page: 601
total: 492



previous page:
601

next page:
603

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 602
Date								+ — total: 492

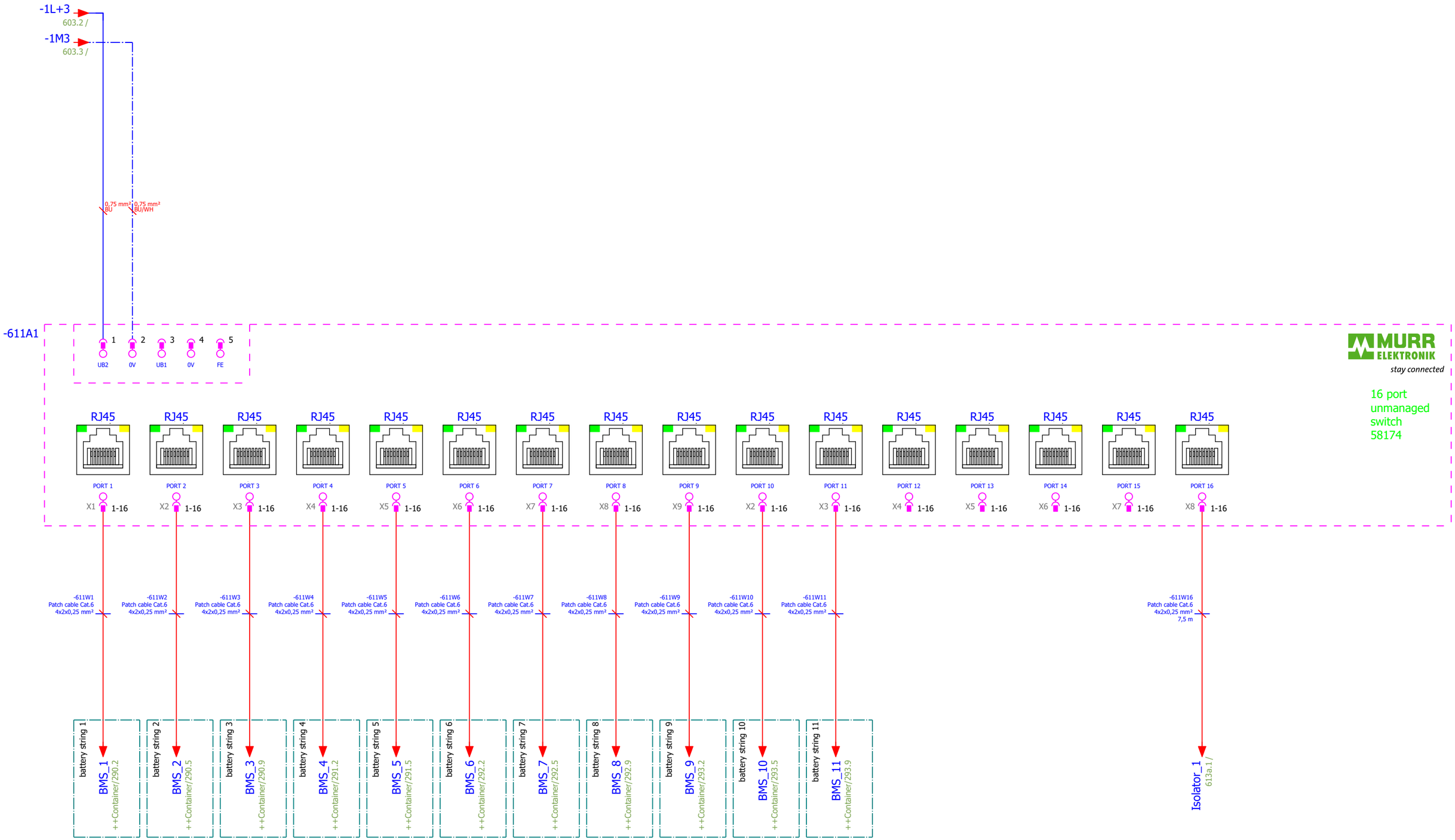


previous page:
602

next page:
611

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_02	Battery Container 1
Date	21.01.2025							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxiliary cabinet
Date								+	

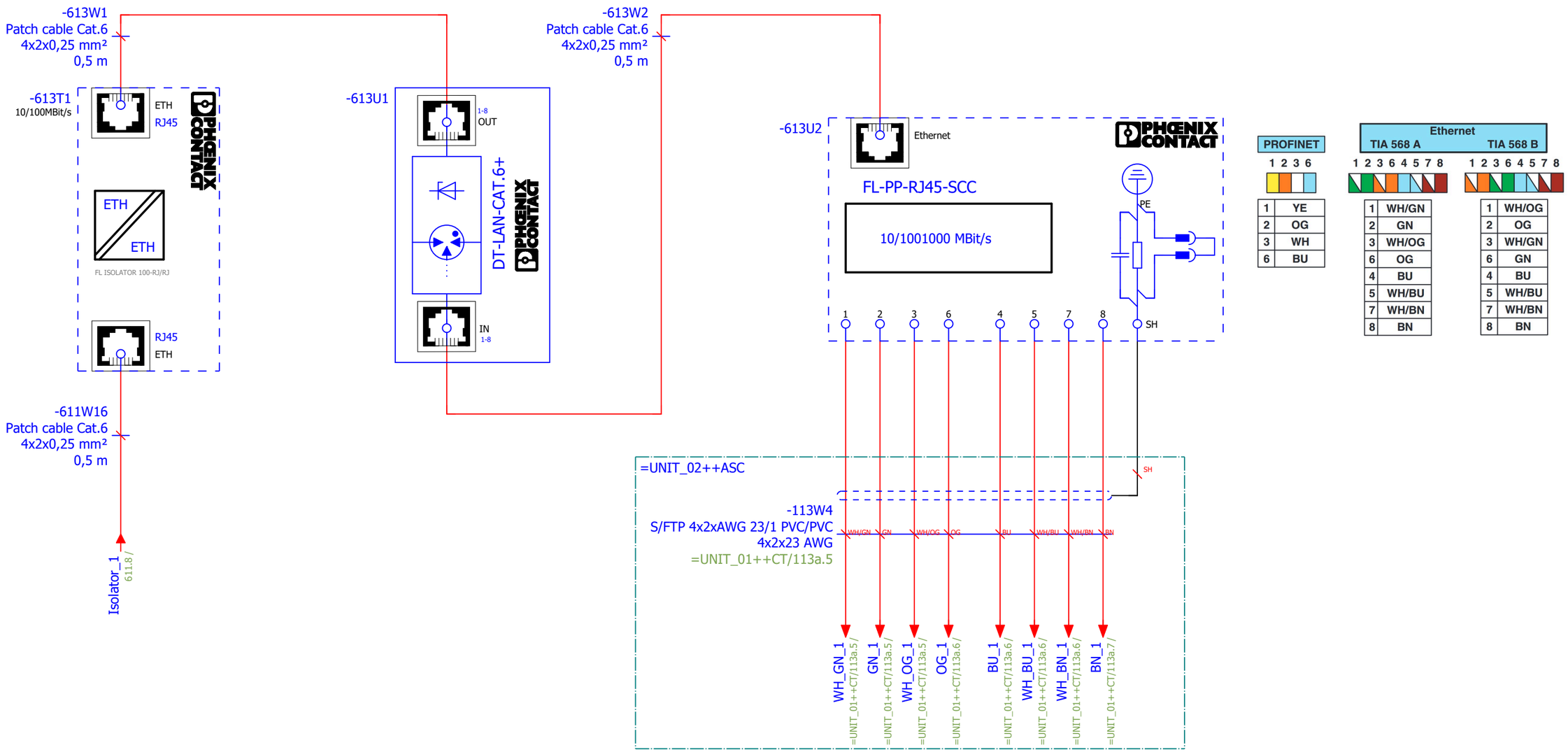
page: 603
total: 492



previous page: 603

next page: 613a

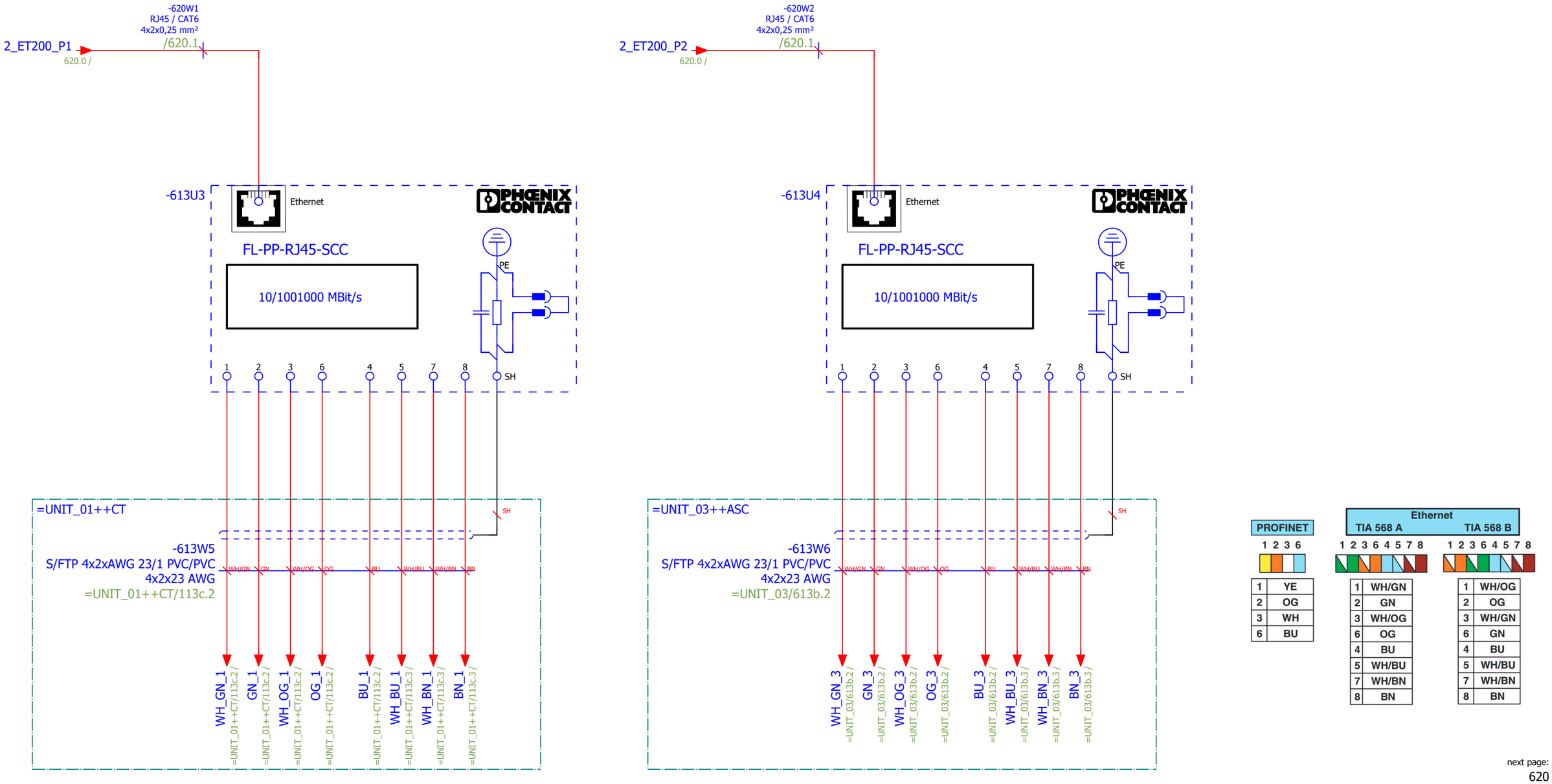
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 492



previous page:
611

next page:
613b

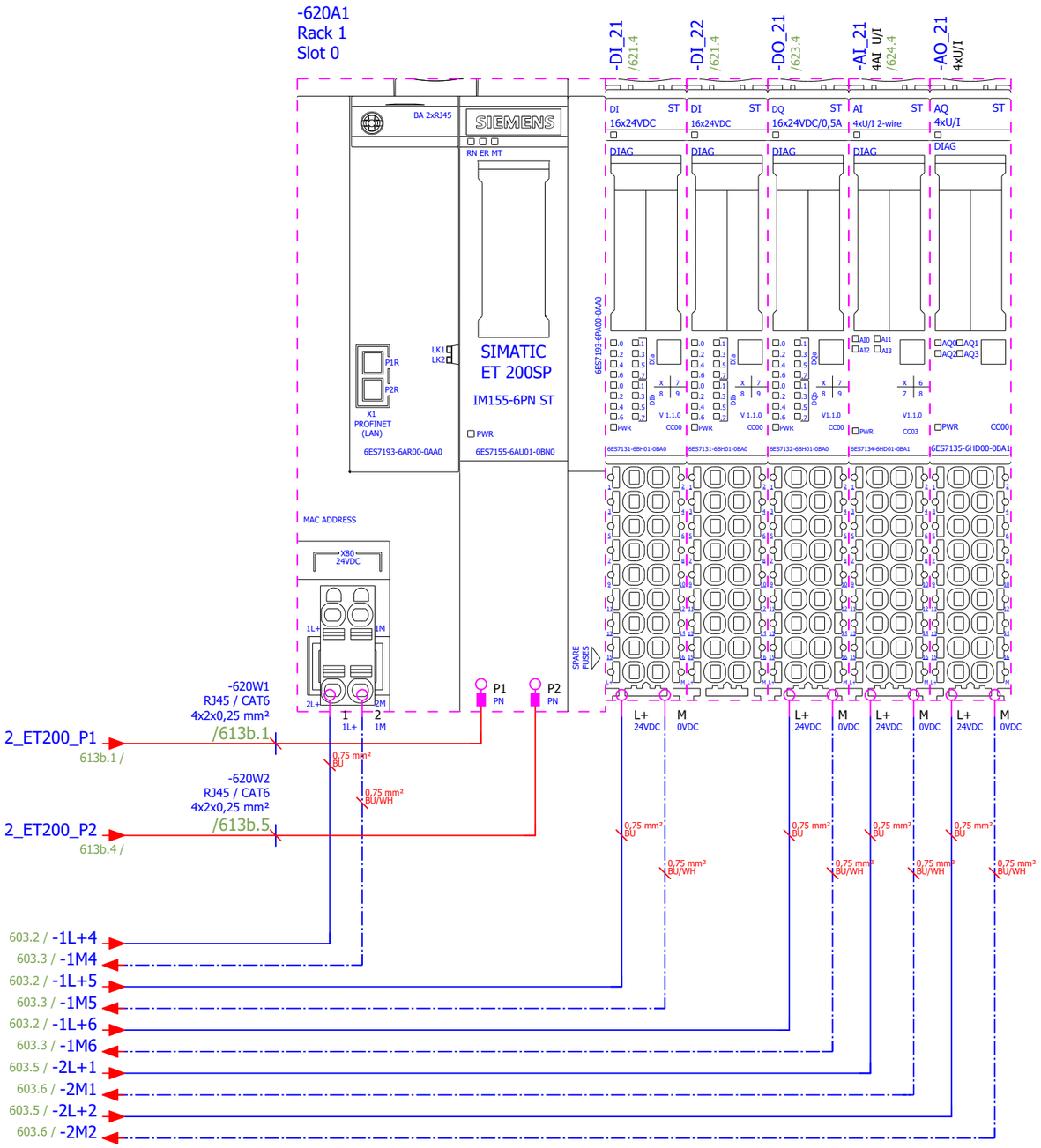
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	25.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 613a
Date								+	total: 492



previous page:
613a

next page:
620

Editor	Freqcon_DG			Statron	FREQCON	PROFINET	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613b
Date								+		total: 492



previous page:
613b

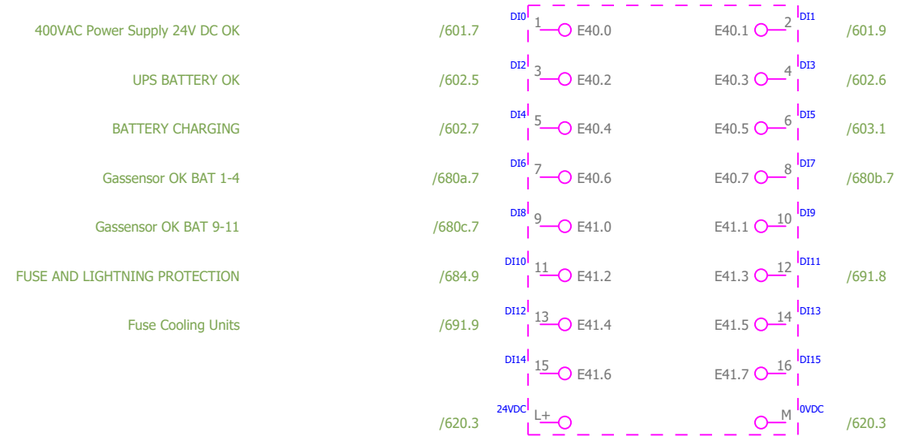
next page:
621

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC ASC	20250805_V2.0	= UNIT_02	Battery Container 1
Date	03.12.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 620
total: 492

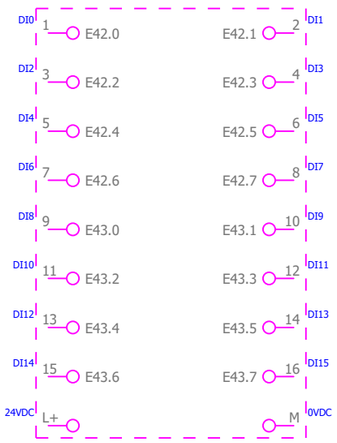
-DI_21

/620.3



-DI_22

/620.3



previous page: 620

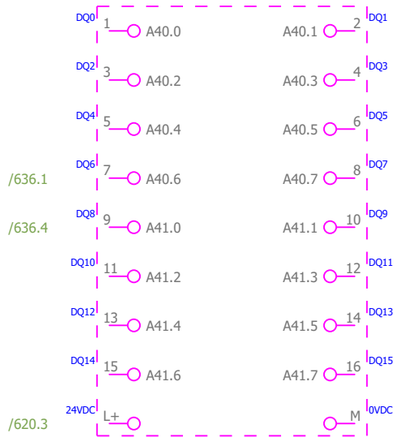
next page: 623

Editor	Freqcon_DG			Statron	FREQCON	ET200SP DIGITAL INPUTS DI_21 + DI_22	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	03.12.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 621
Date								+	total: 492

0	1	2	3	4	5	6	7	8	9

-DO_21

/620.3



230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4 /636.1

230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11 /636.4

/620.3

/636.2 230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8

/620.4

previous page: 621

next page: 624

Editor	Freqcon_JD			Statron	FREQCON	ET200SP DIGITAL OUTPUTS DO_21	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 623
Date								+	total: 492

-AI_21

/620.4



gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

/620.4

/680b.2 gas concentration BAT 5-8

/680b.2 gas concentration BAT 5-8

/620.4

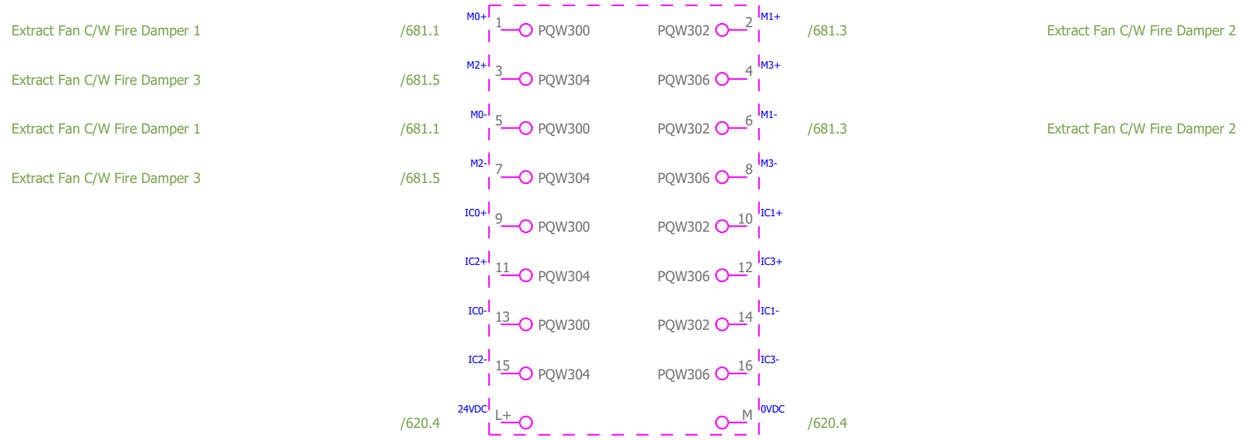
previous page: 623

next page: 625

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_21	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 624
Date								+	total: 492

-AO_21

/620.4



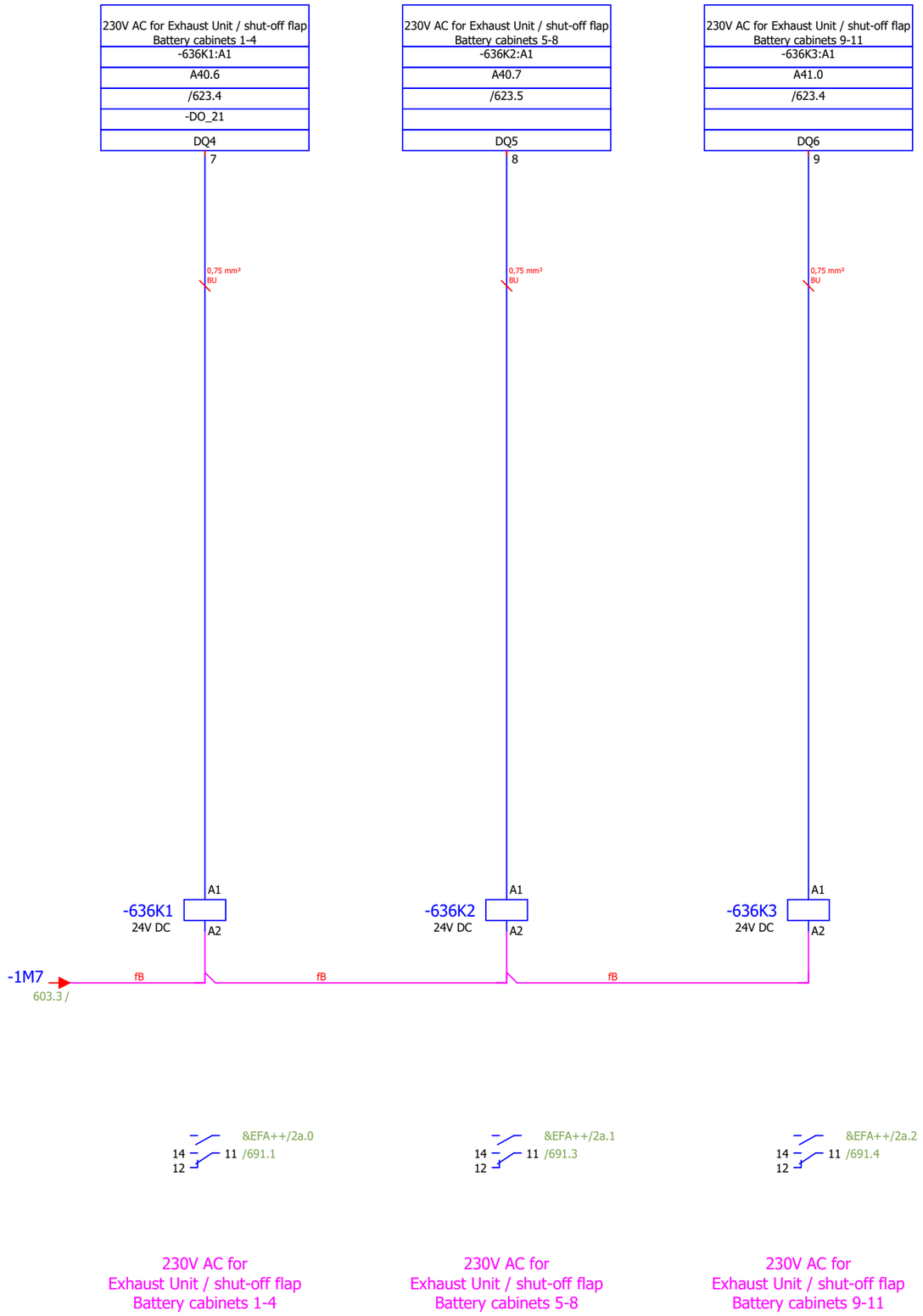
previous page: 624

next page: 636

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG OUTPUTS AO_21	20250805_V2.0	= UNIT_02	Battery Container 1
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 625

total: 492

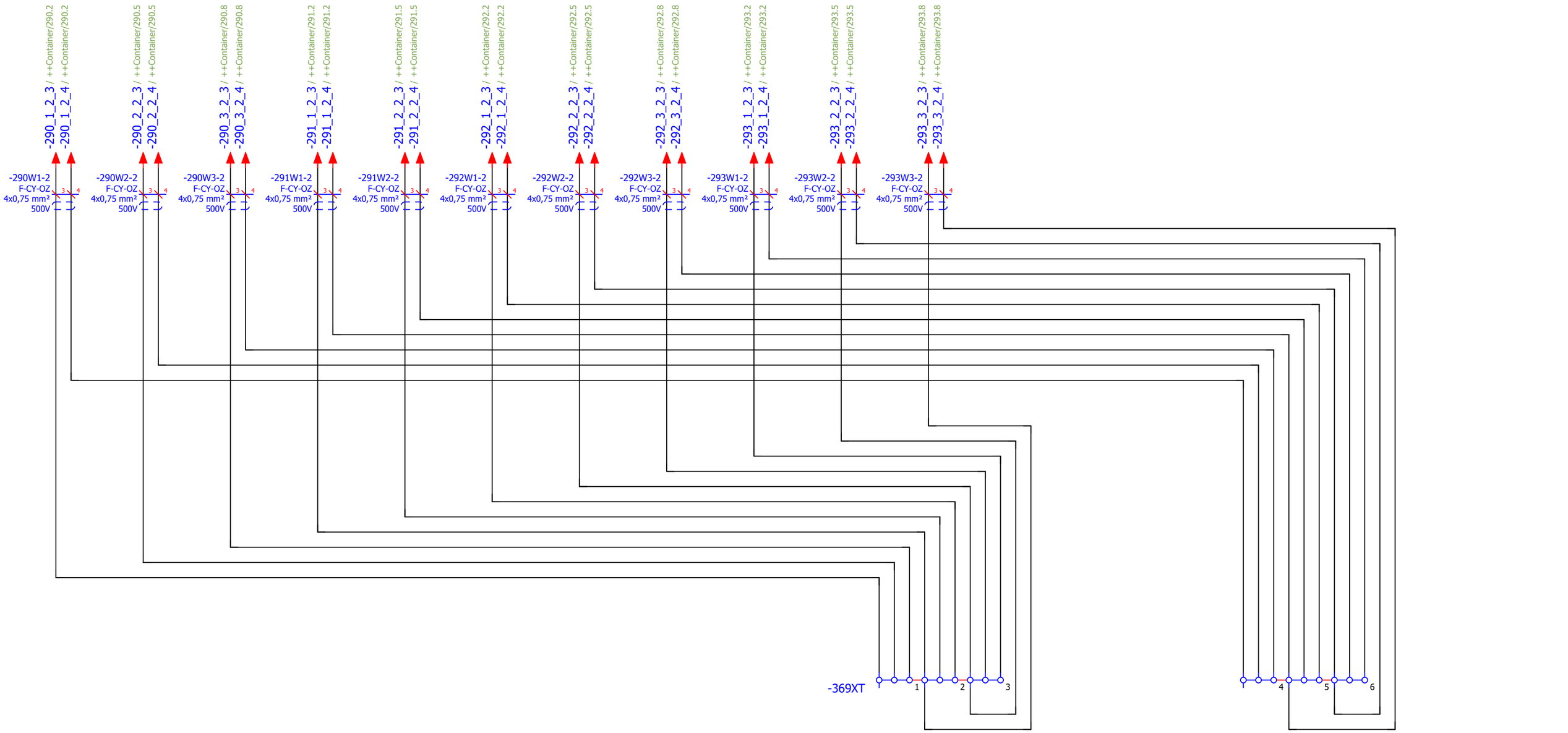


previous page: 625

next page: 669

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FIRE DAMPER	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 636
total: 492



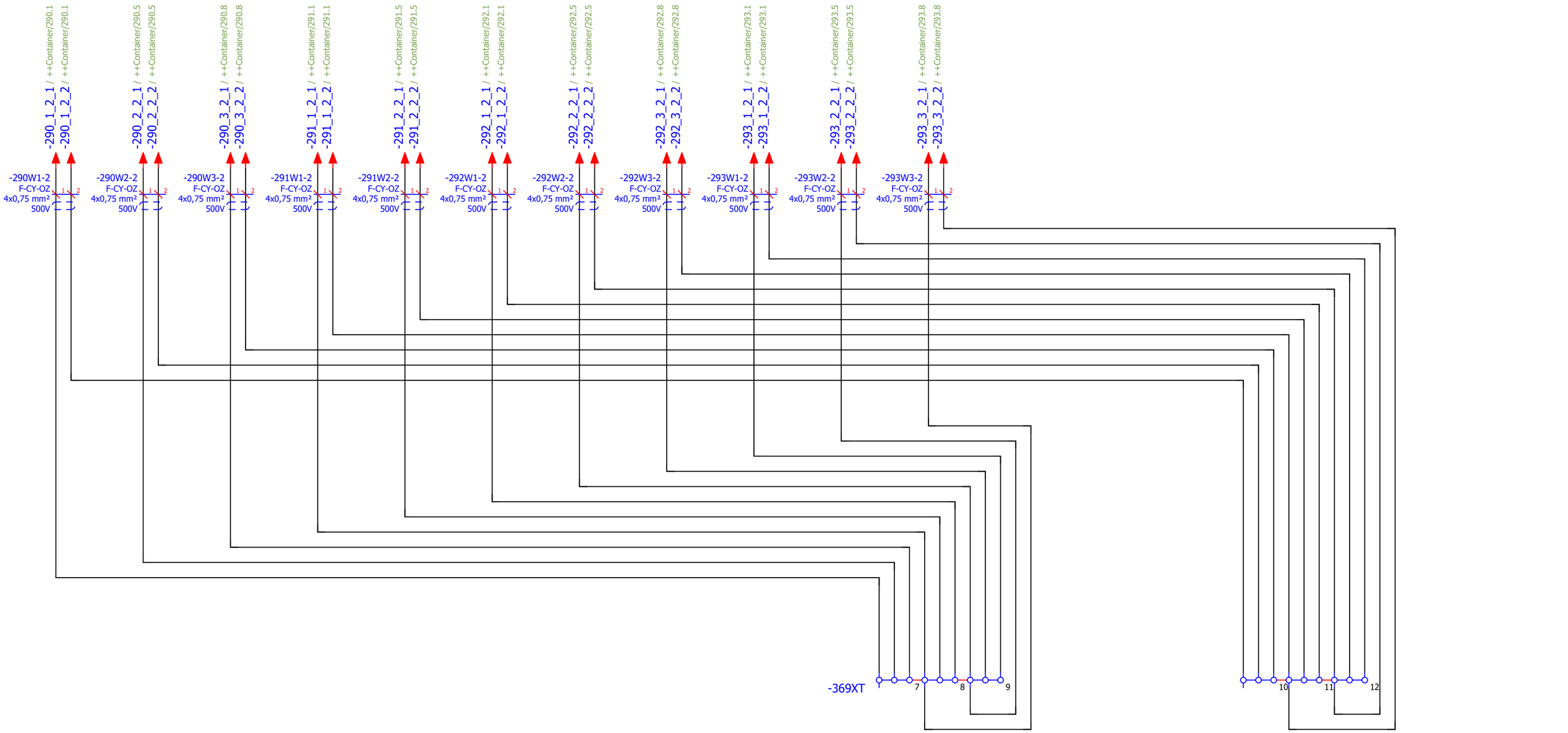
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page: 636

next page: 670

Editor	Freqcon_JD			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 492



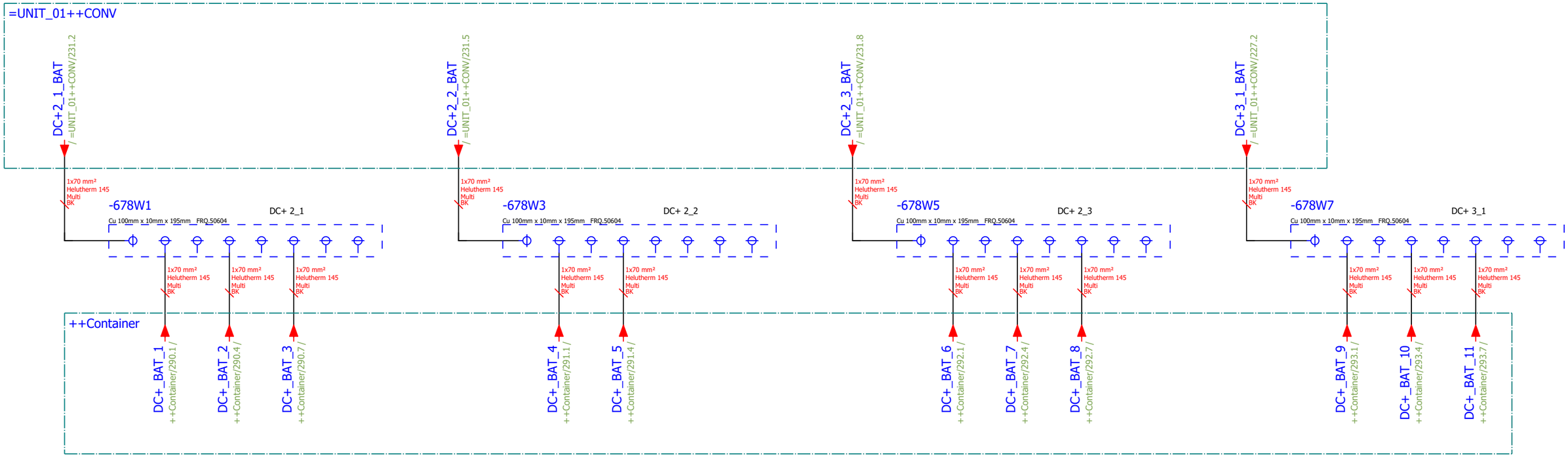
battery cabinet gas
potential-free contacts
customer

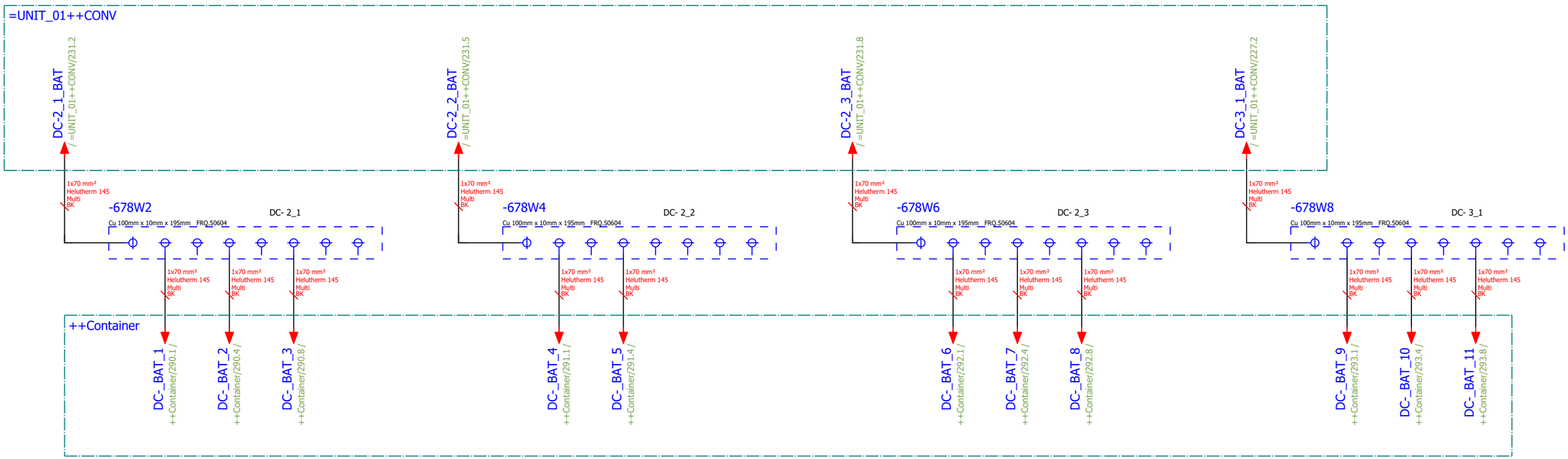
battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
678

Editor	Freqcon_JD			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 492





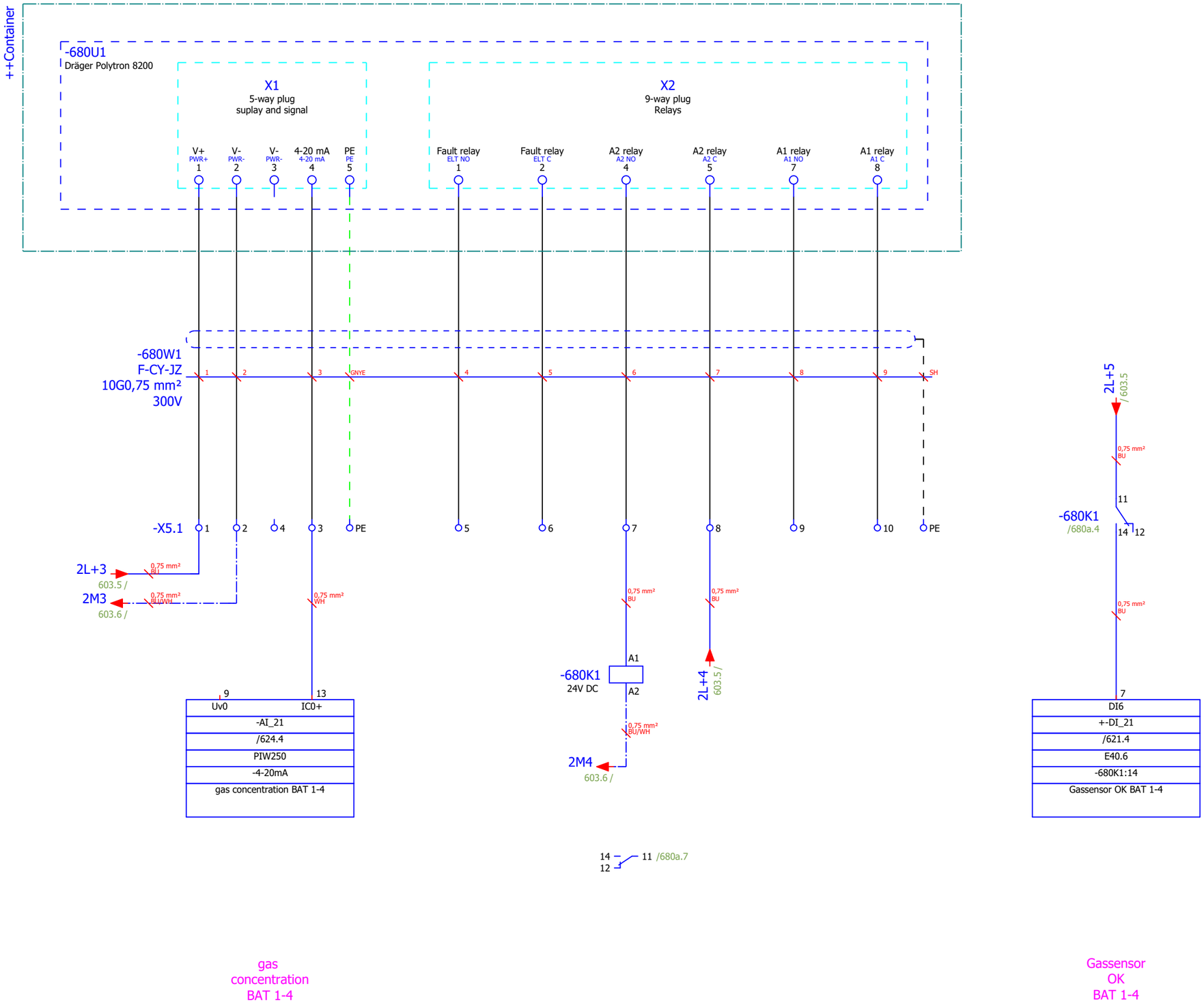
previous page: 670

next page: 680a

Editor	Freqcon_JD			Statron	FREQCON	DC BATTERY CABINETS	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 678

total: 492



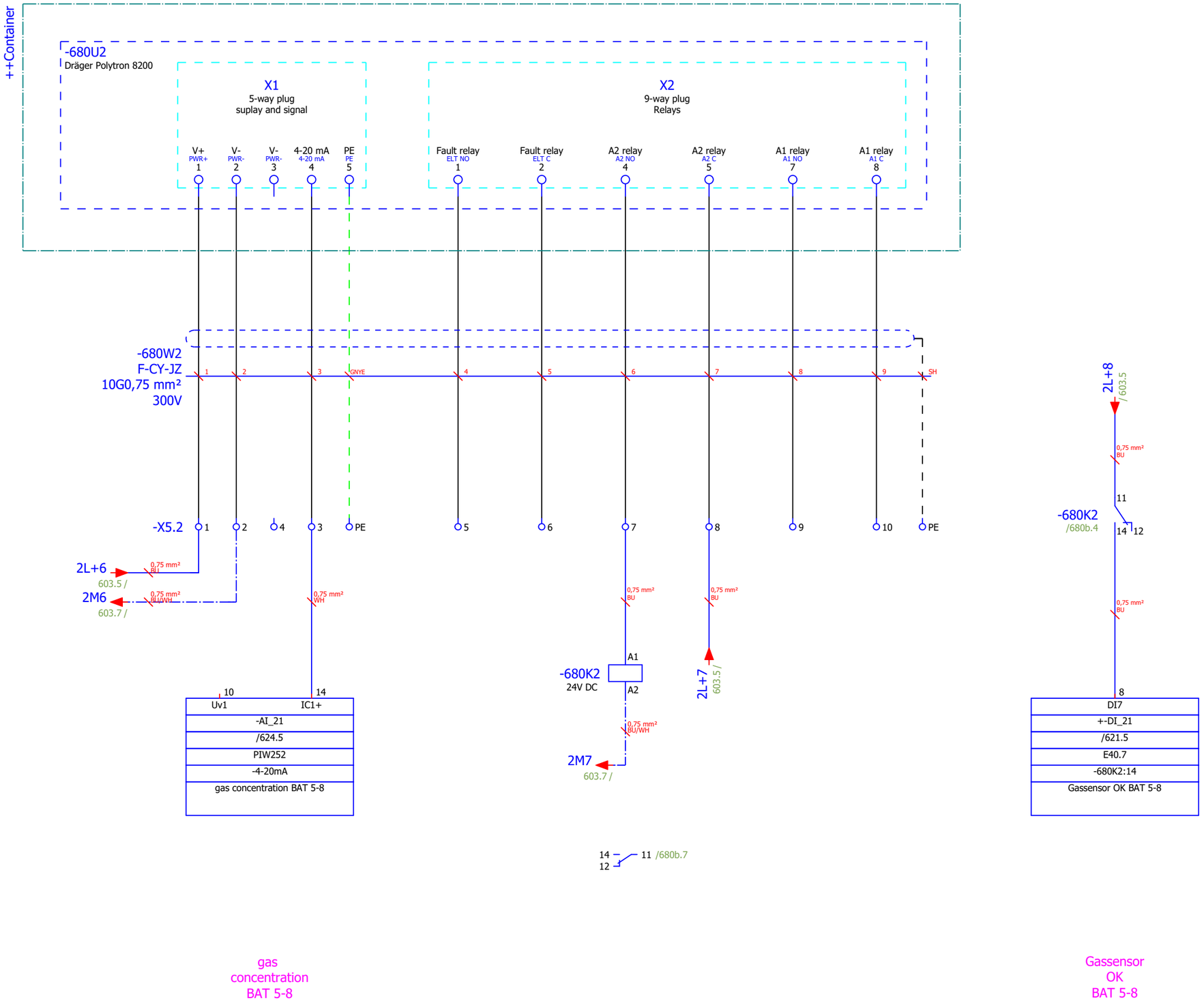
gas concentration BAT 1-4

Gassensor OK BAT 1-4

previous page: 678

next page: 680b

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 1-4	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680a
Date								+	total: 492



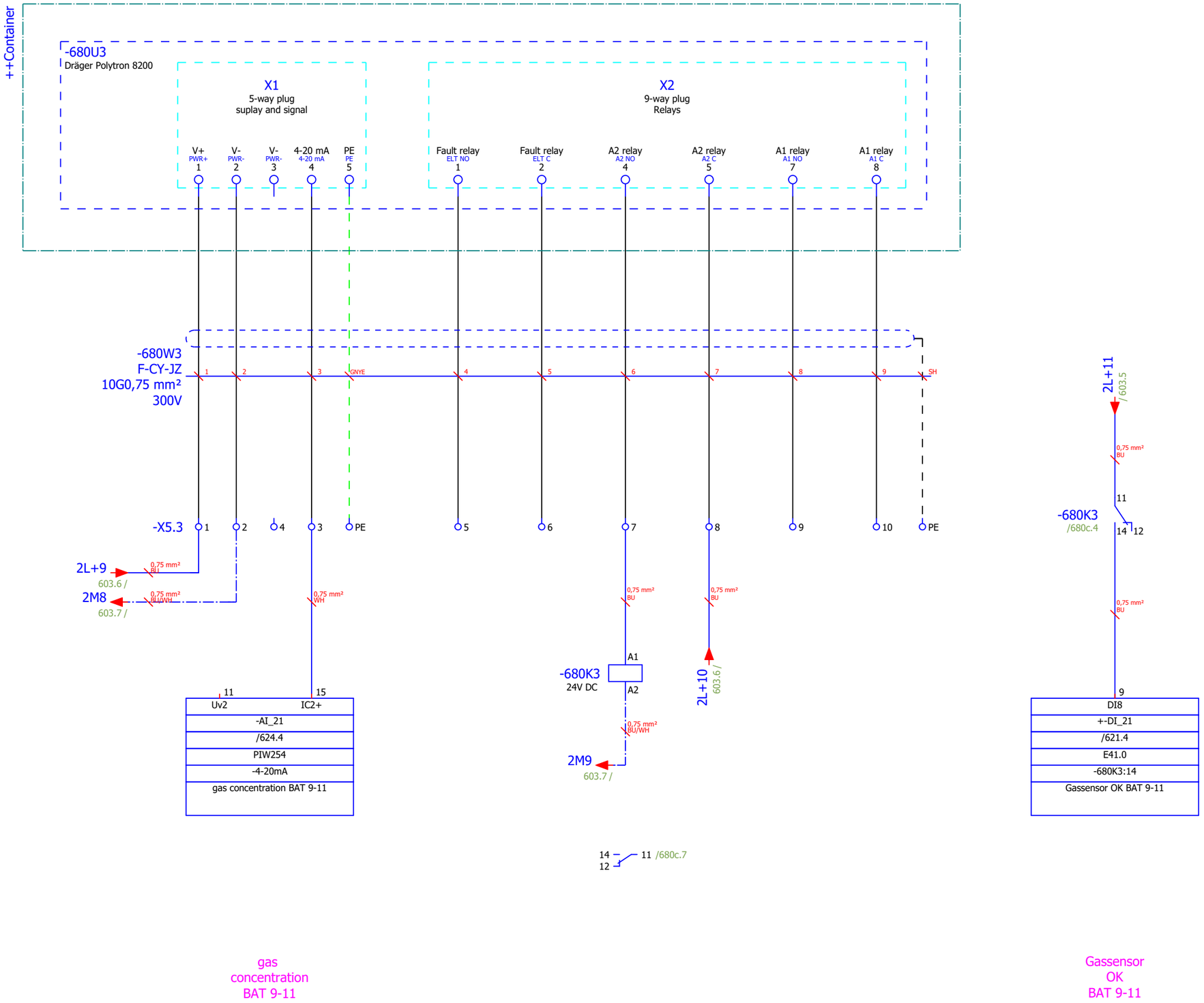
gas concentration BAT 5-8

Gassensor OK BAT 5-8

previous page: 680a

next page: 680c

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 5-8	20250805_V2.0	= UNIT_02 Battery Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 680b
Date								+ — total: 492



gas concentration BAT 9-11

Gassensor OK BAT 9-11

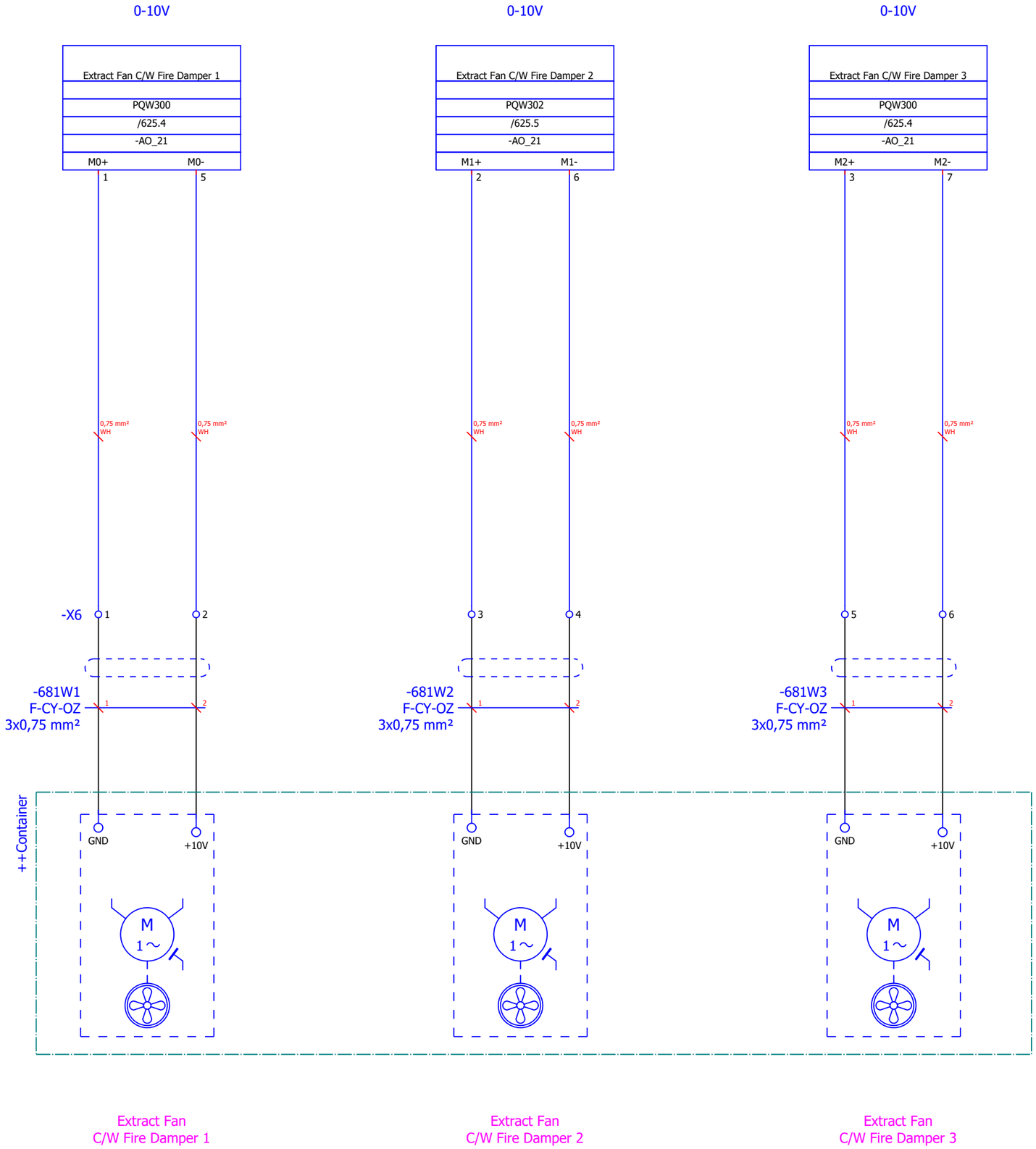
previous page: 680b

next page: 681

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 9-11	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 680c

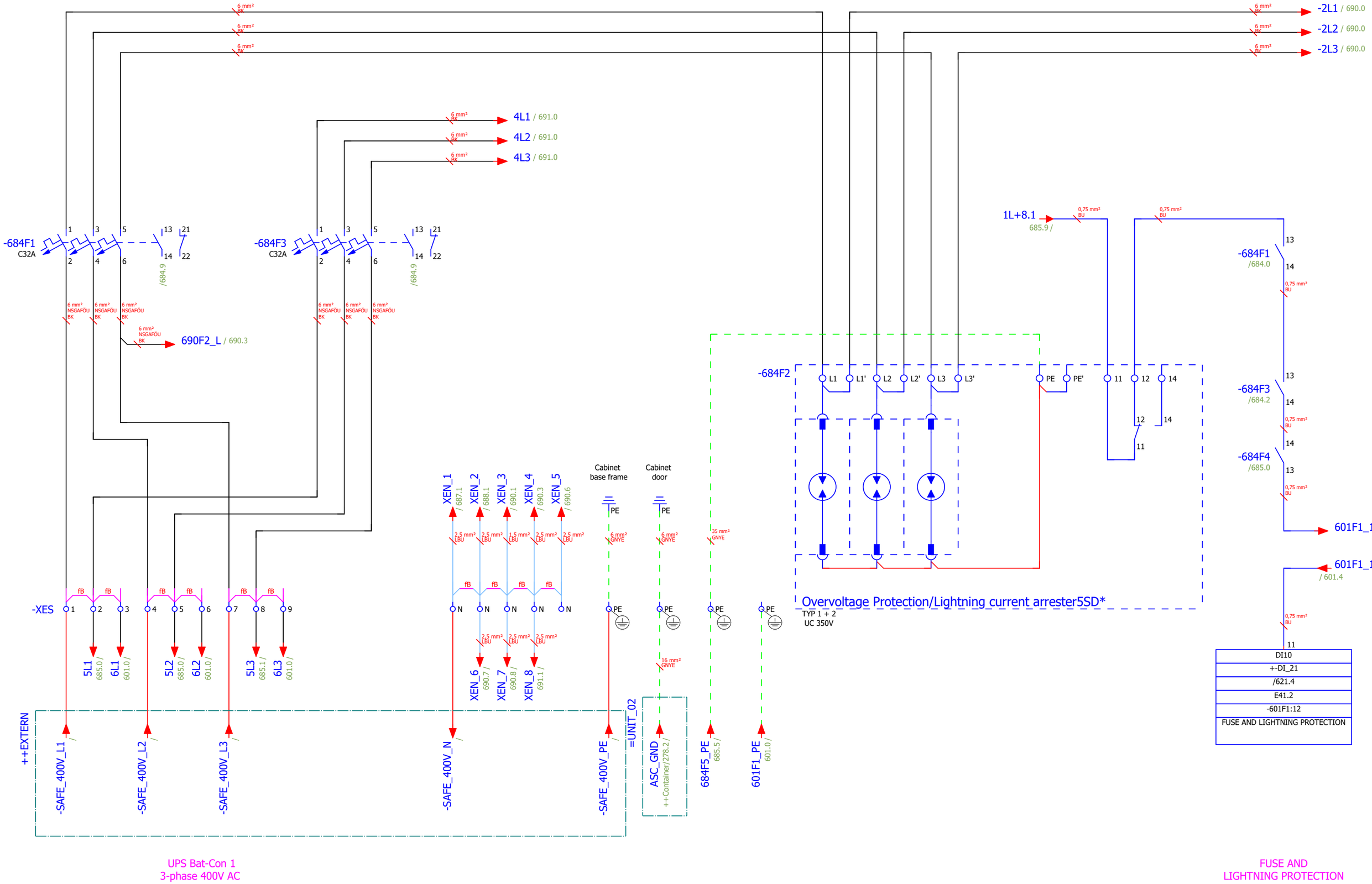
total: 492



previous page: 680c

next page: 684

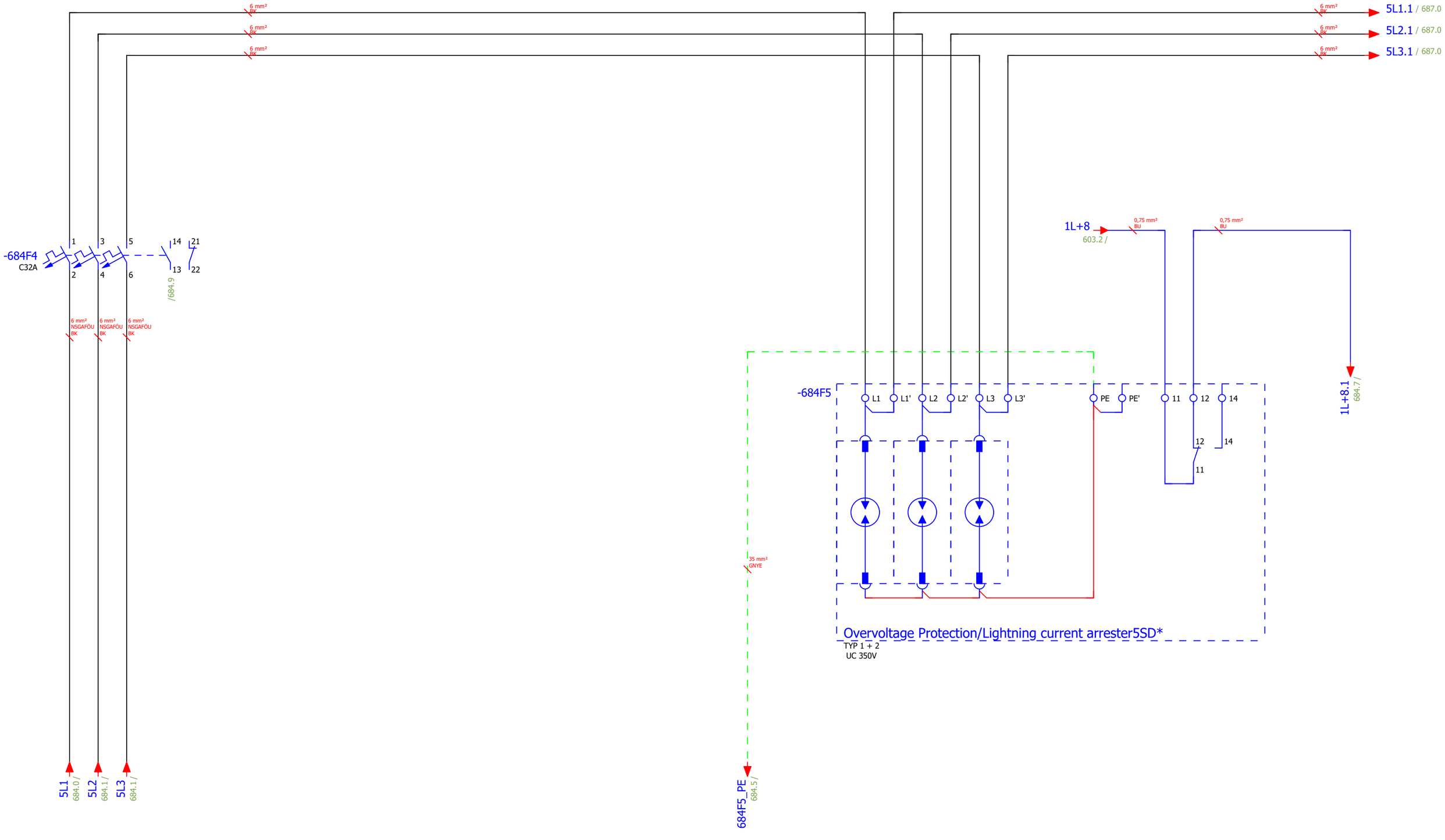
Editor	Freqcon_JD			Statron	FREQCON	EXTRACT FAN FIRE DAMPER	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 681
Date								+	total: 492



previous page: 681

next page: 685

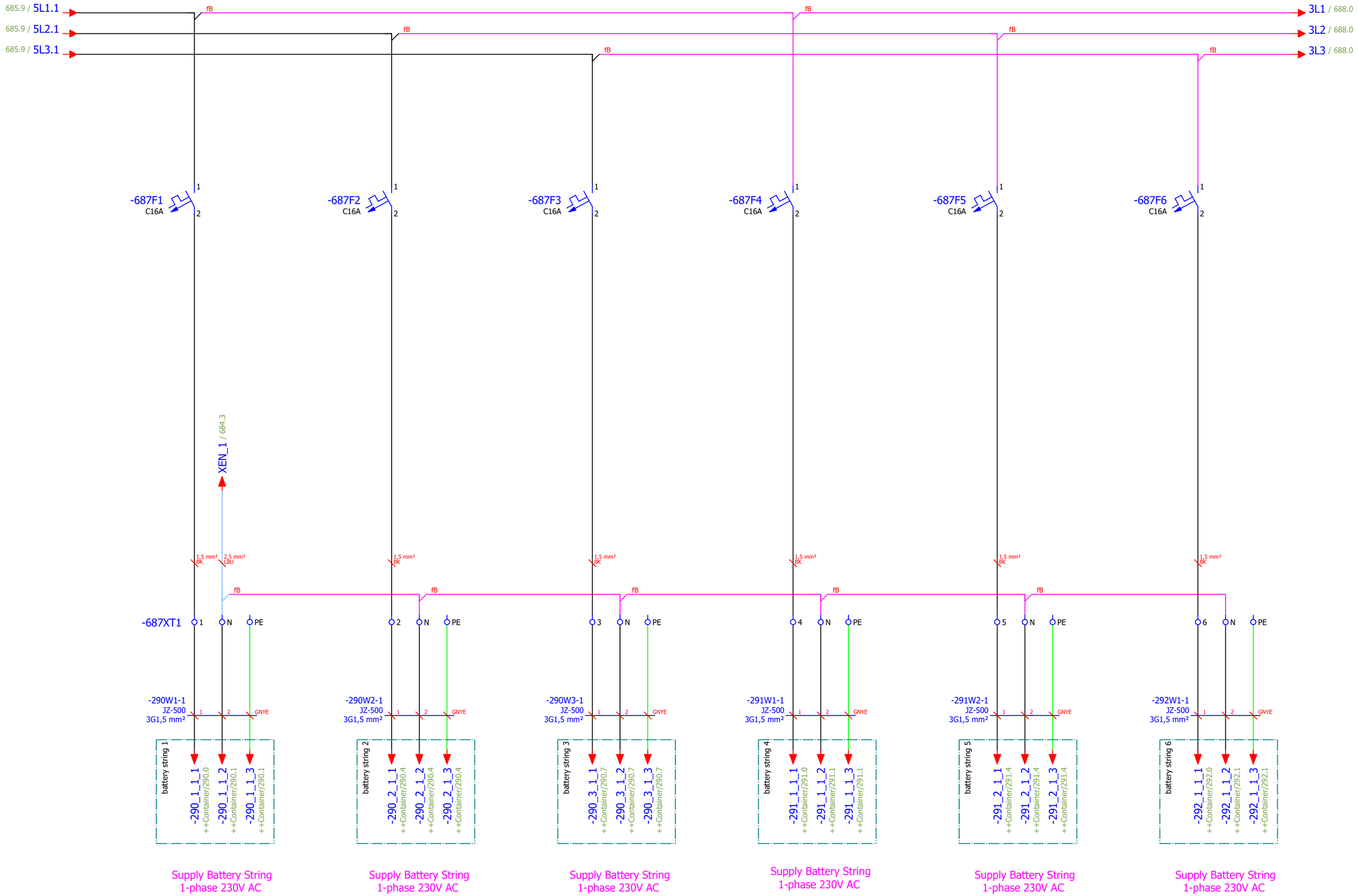
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	22.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 684
Date								+		total: 492



FUSE AND
LIGHTNING PROTECTION

previous page: 684
next page: 687

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	05.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 685
Date								+	total: 492



previous page: 685

next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 492

687.9 / 3L1
687.9 / 3L2
687.9 / 3L3

fB

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

XEN_2 / 684.3

1,5 mm² BK
2,5 mm² LBU

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

GNYE

battery string 7
-292_2_1_1 ++Container/292.4
-292_2_1_2 ++Container/292.4
-292_2_1_3 ++Container/292.4

battery string 8
-292_3_1_1 ++Container/292.7
-292_3_1_2 ++Container/292.7
-292_3_1_3 ++Container/292.7

battery string 9
-293_1_1_1 ++Container/293.0
-293_1_1_2 ++Container/293.1
-293_1_1_3 ++Container/293.1

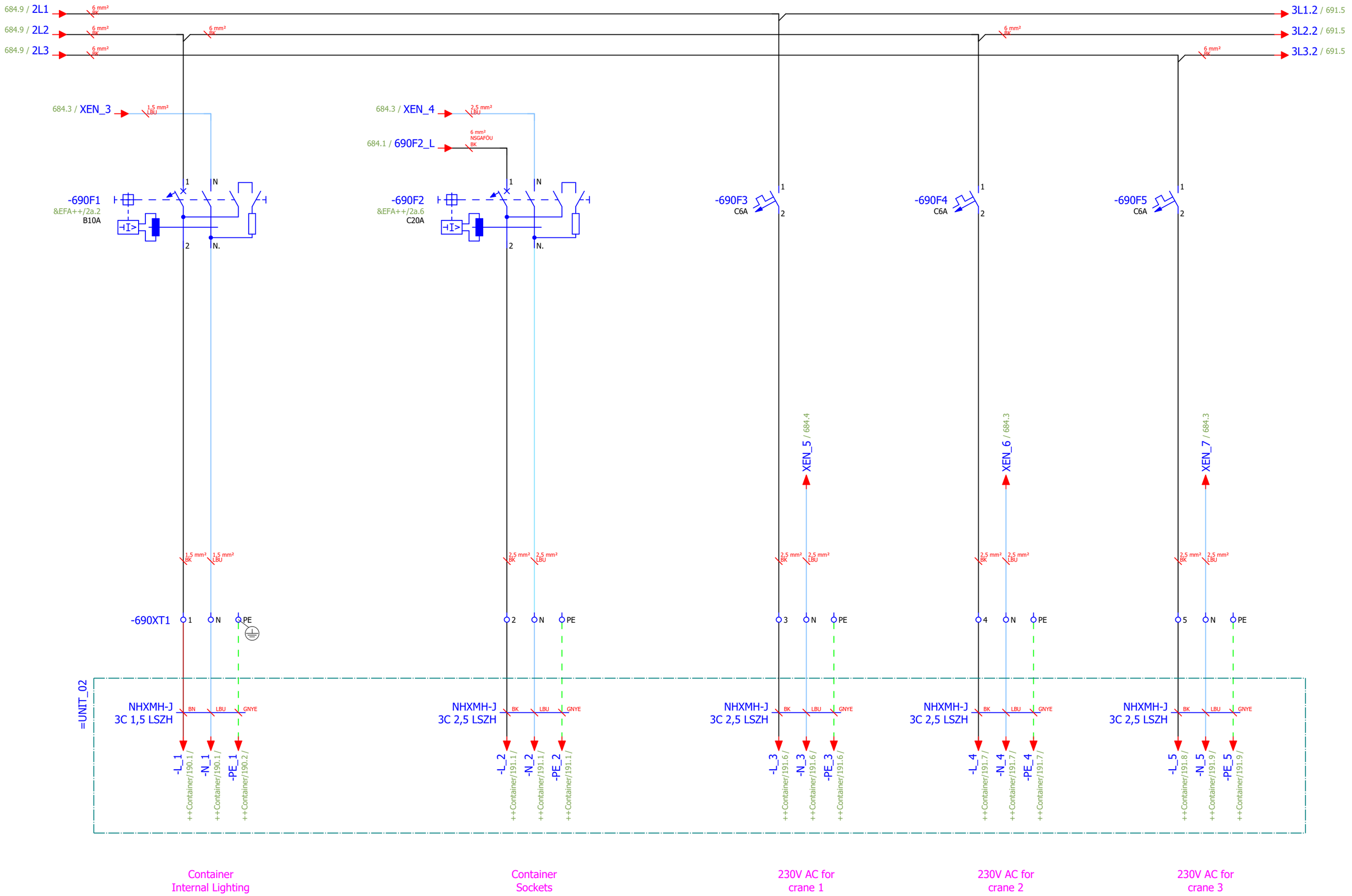
battery string 10
-293_2_1_1 ++Container/293.4
-293_2_1_2 ++Container/293.4
-293_2_1_3 ++Container/293.4

battery string 11
-293_3_1_1 ++Container/293.7
-293_3_1_2 ++Container/293.7
-293_3_1_3 ++Container/293.7

Supply Battery String 1-phase 230V AC

previous page: 687
next page: 690

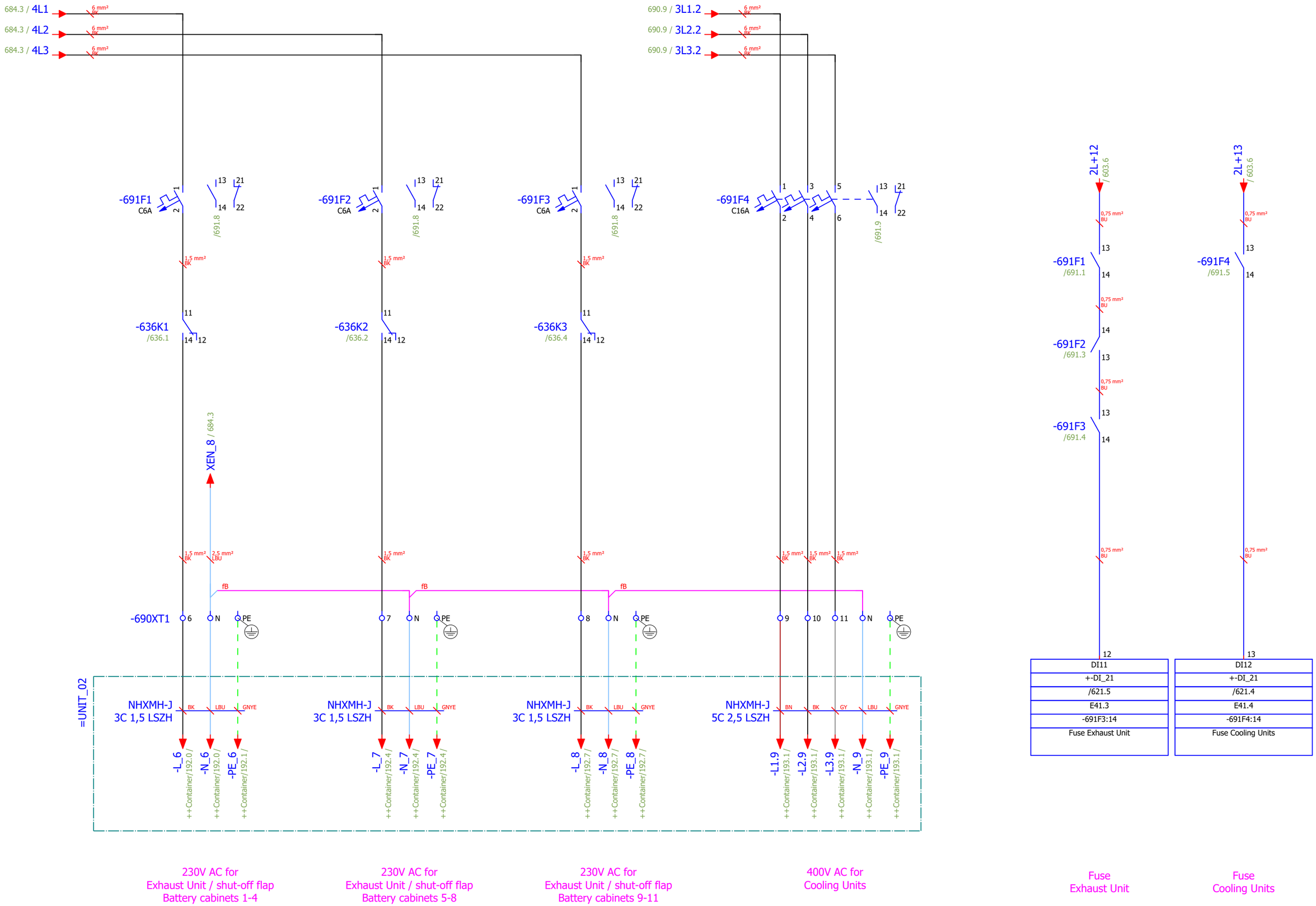
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 492



previous page: 688

next page: 691

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	29.10.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 690
Date								+		total: 492



previous page:
690

next page:
&EPC++Container/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 691
Date								+		total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U4 &EFS/613b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.3...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.3...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.1;&EFS/687.3;&EFS/687.4;&EFS/687.6...&EFS/687.8;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.9;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	

previous page:
6

next page:
&EPA++Container/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/7

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
6	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
3	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

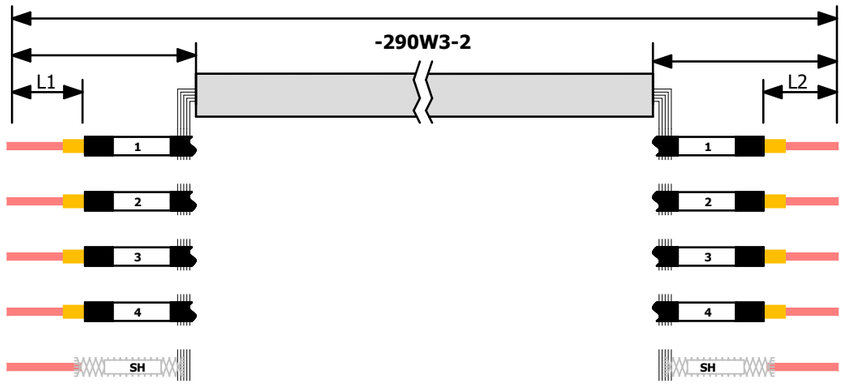
Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

Cable name =UNIT_02++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

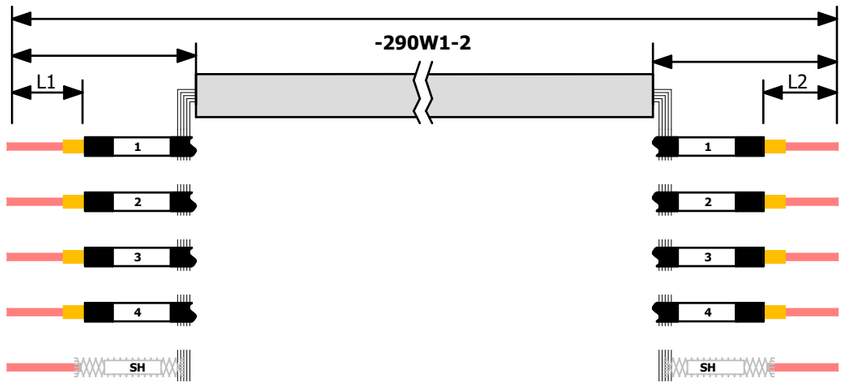


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

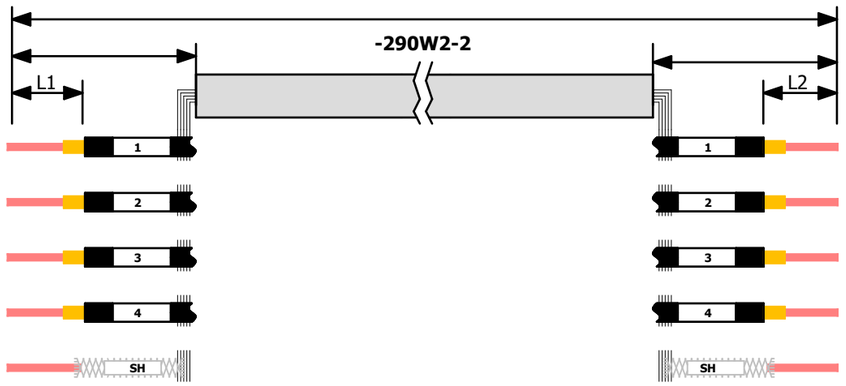


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

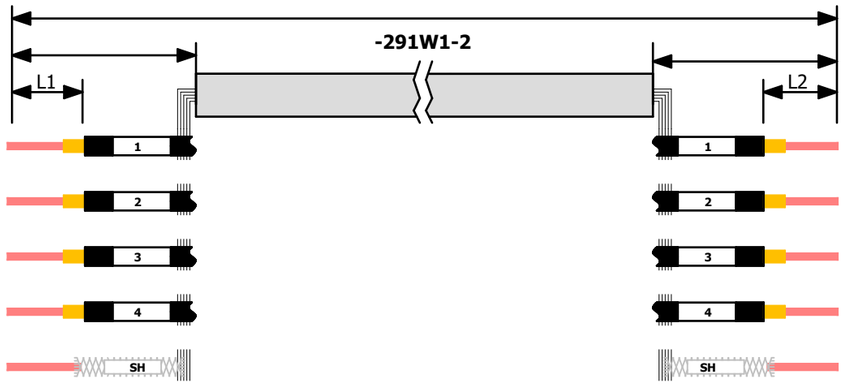
previous page:
&EPA++ASC/2

next page:
2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

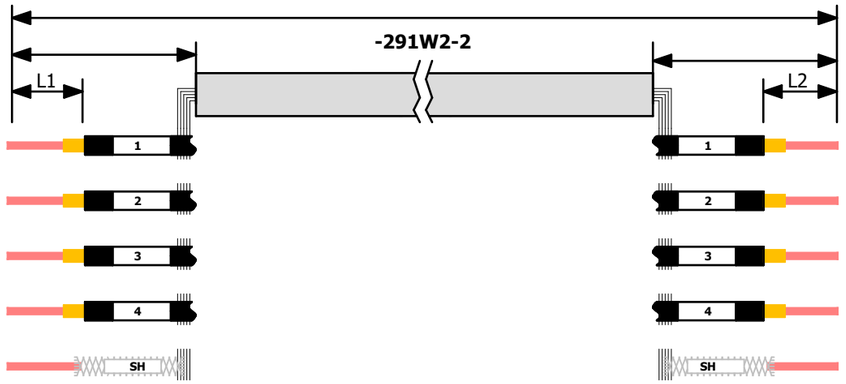


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

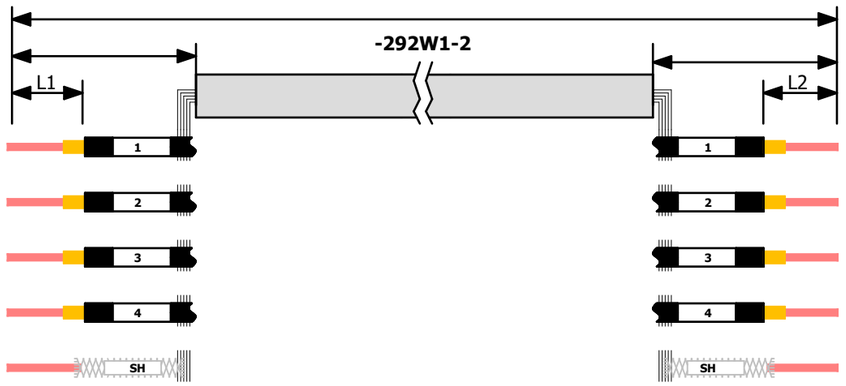


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

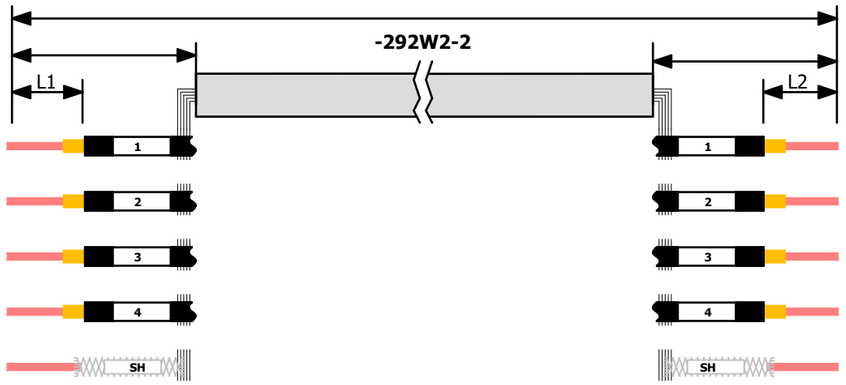
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

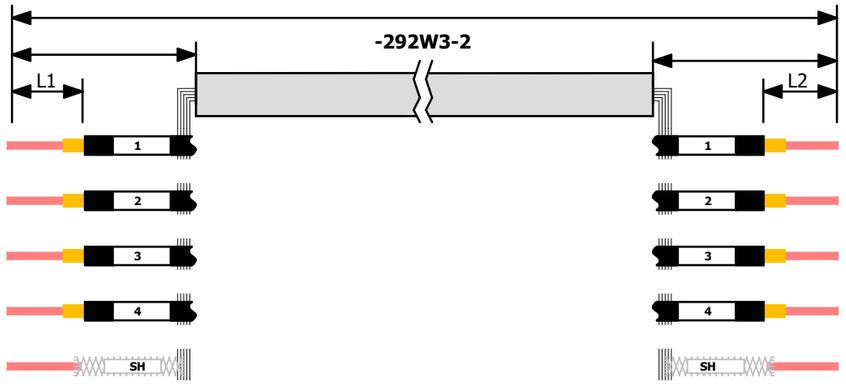


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

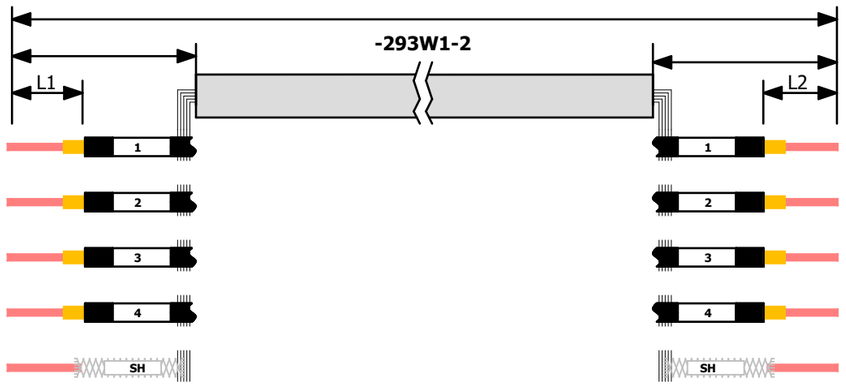


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

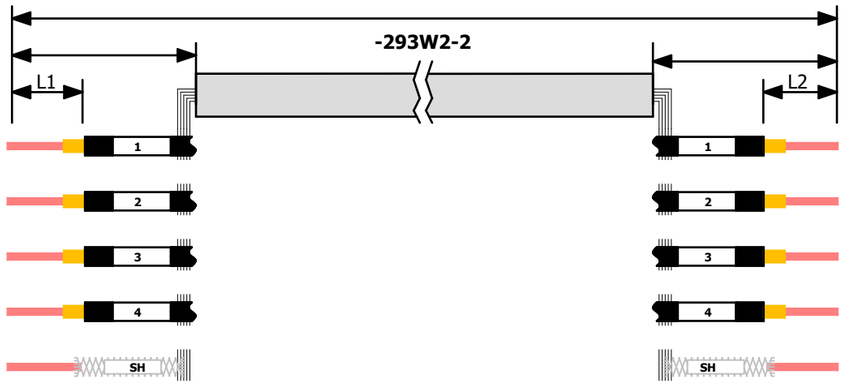
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

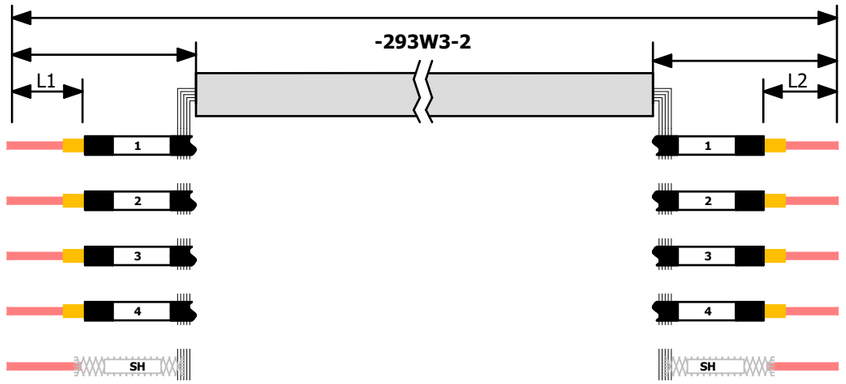


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

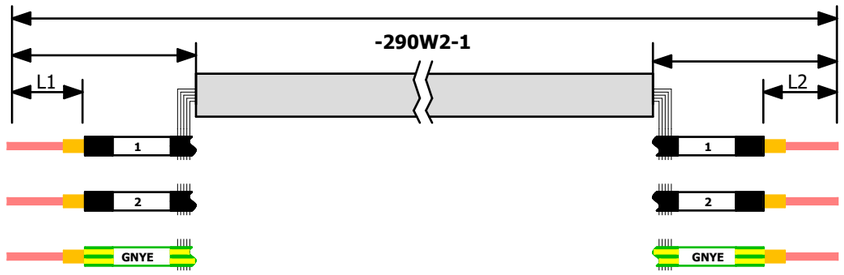
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

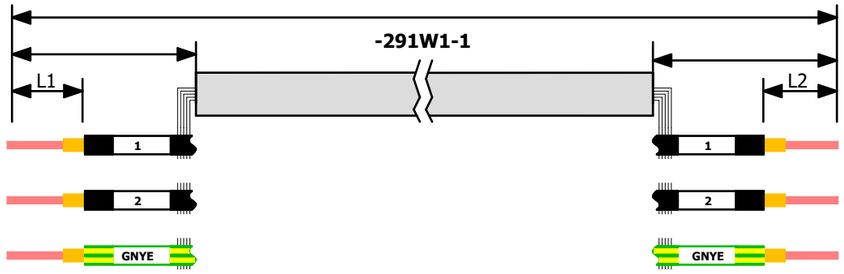


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

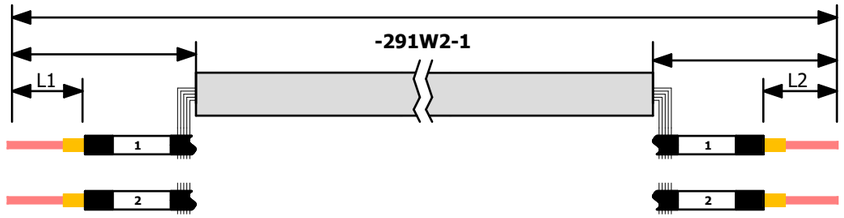


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

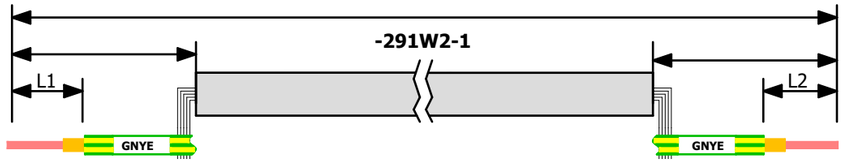
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

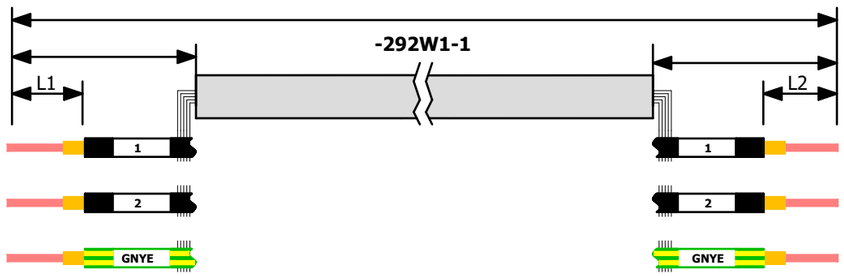


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

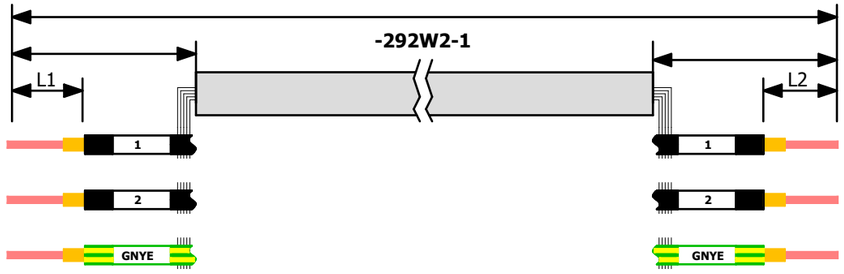


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

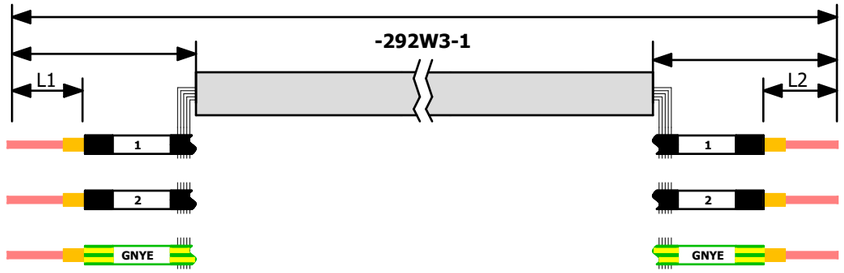


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

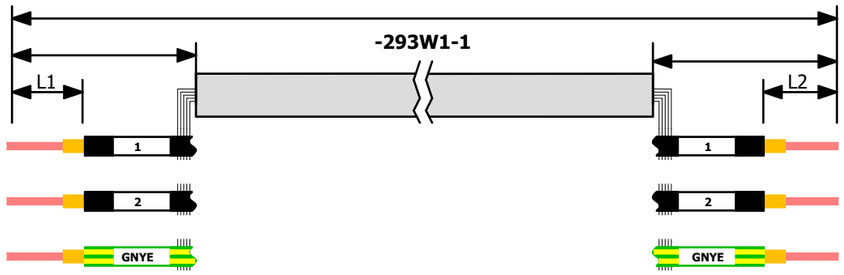
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

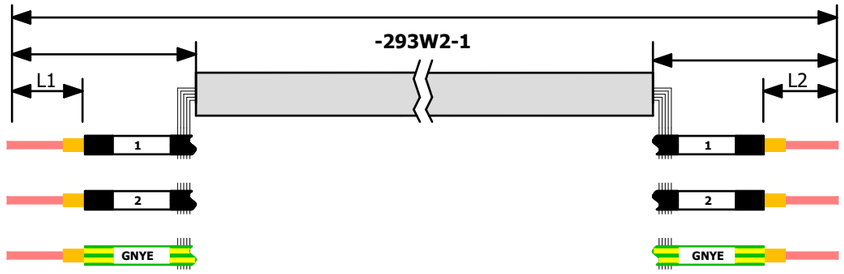


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

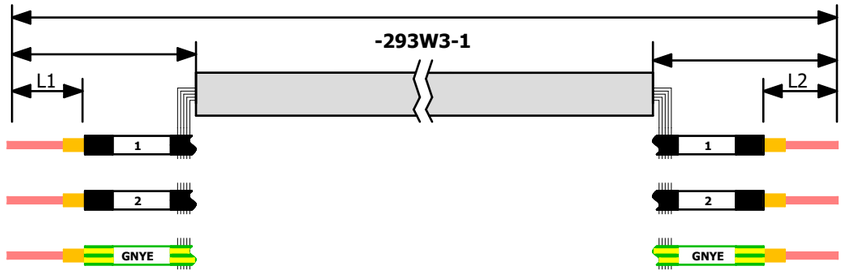


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

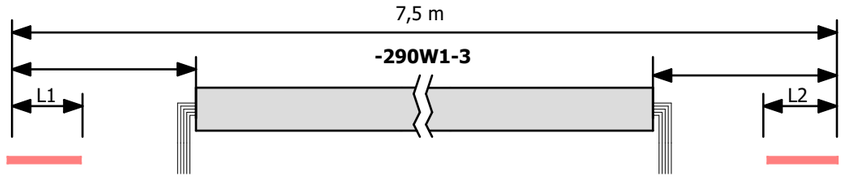


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

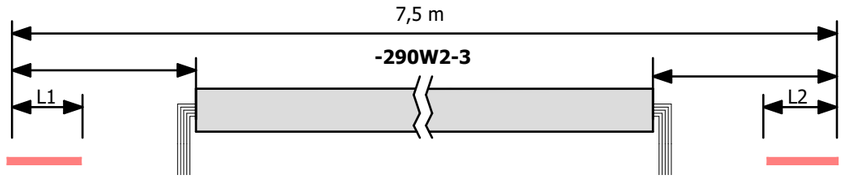
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 7
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

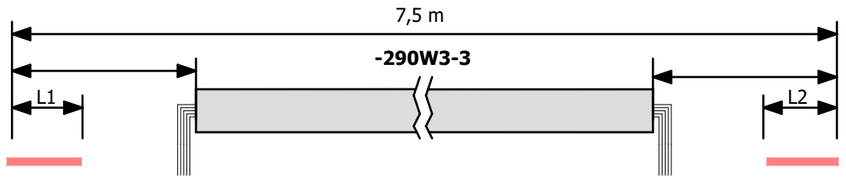


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

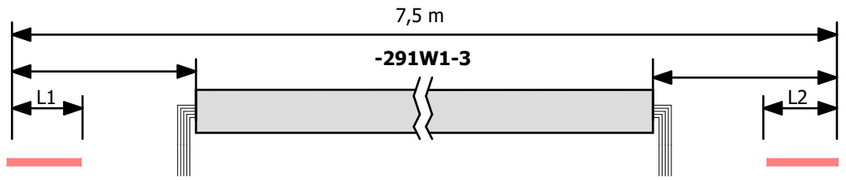


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_02++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

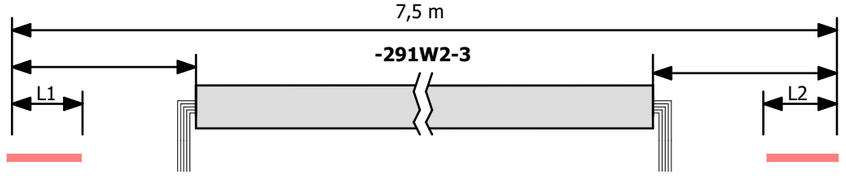


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

Cable name =UNIT_02++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

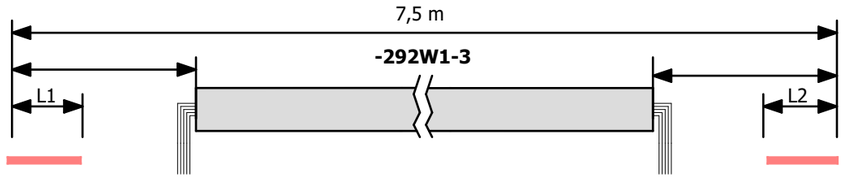


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_02++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



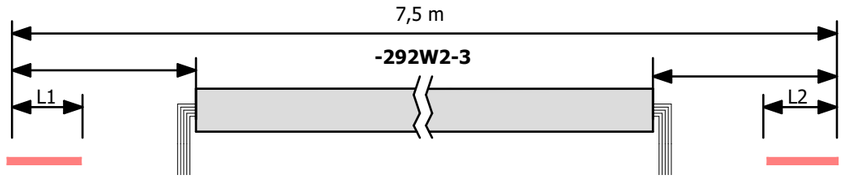
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

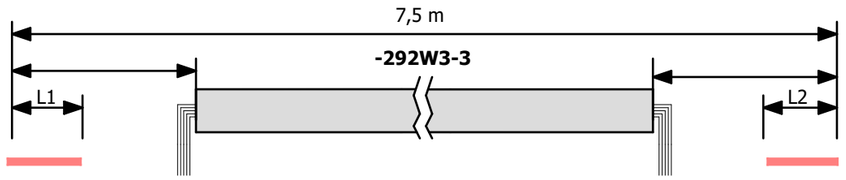


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X7:1-16	

Cable name =UNIT_02++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

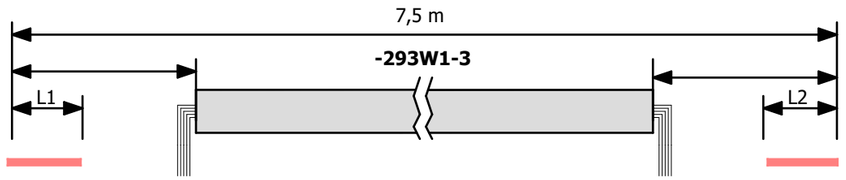


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X8:1-16	

Cable name =UNIT_02++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

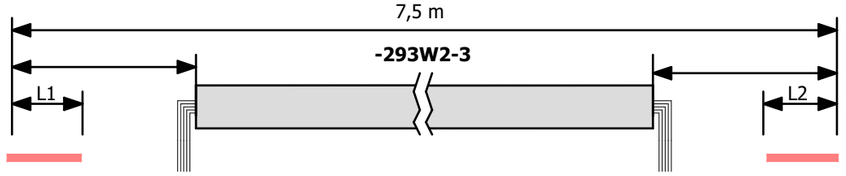


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X9:1-16	

Cable name =UNIT_02++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

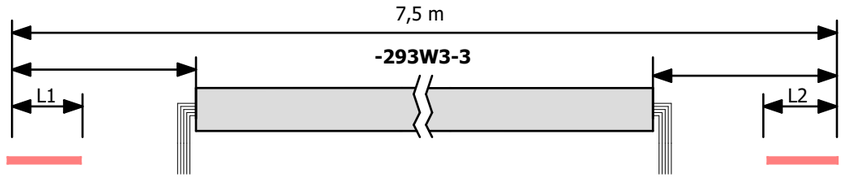


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

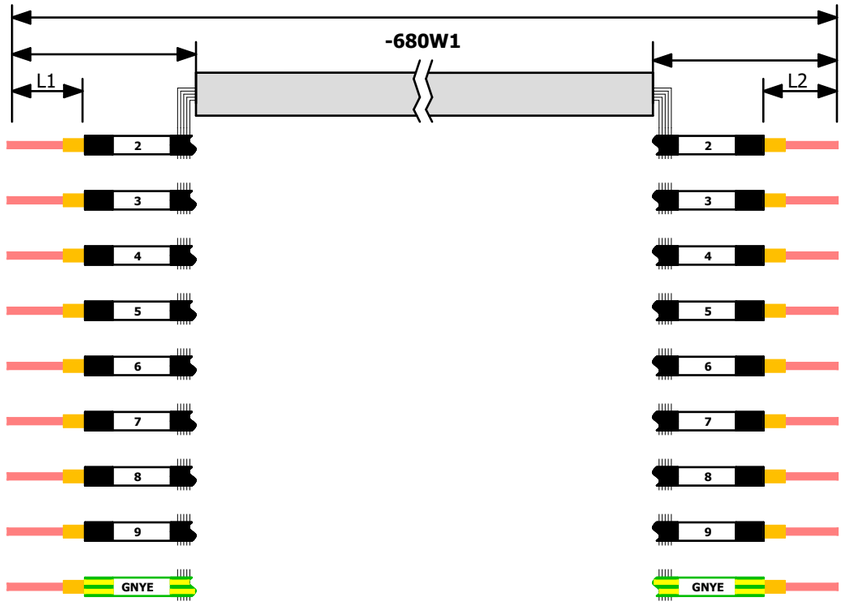
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

FRQ_Kabelplan_04_gro8_de_en

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 9
Date								+	total: 492

Cable name =UNIT_02++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

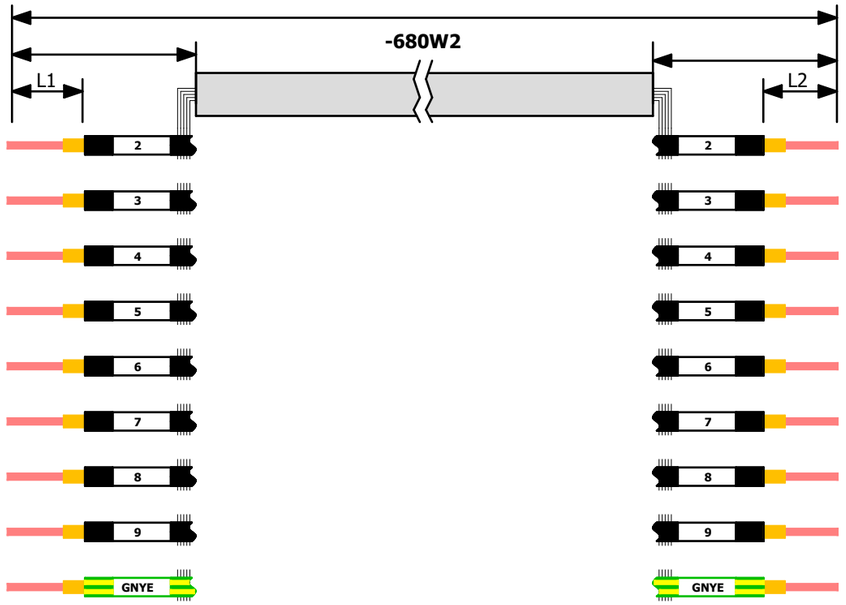


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_02++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

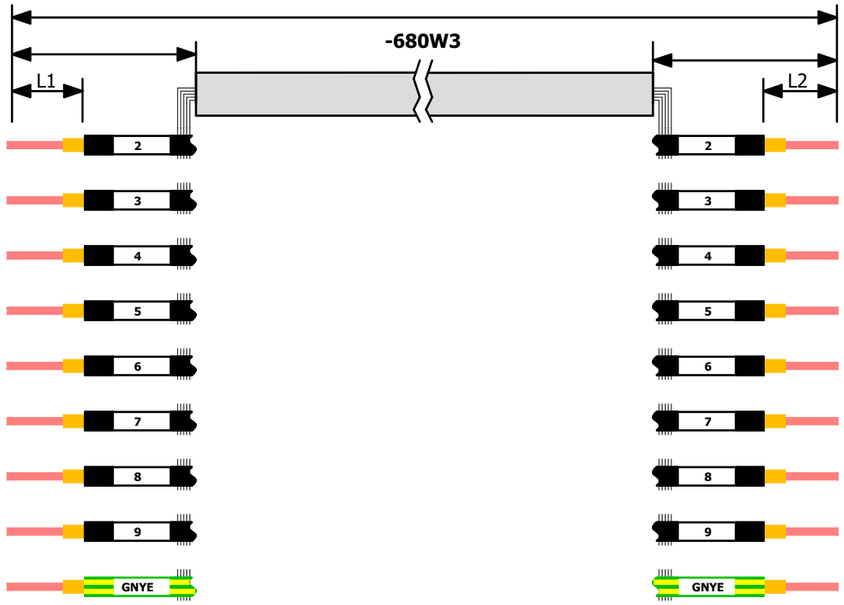
FRQ_Kabelplan_04_gro8_de_en

previous page: ++Container/9
next page: 2

Cable name =UNIT_02++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 9

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

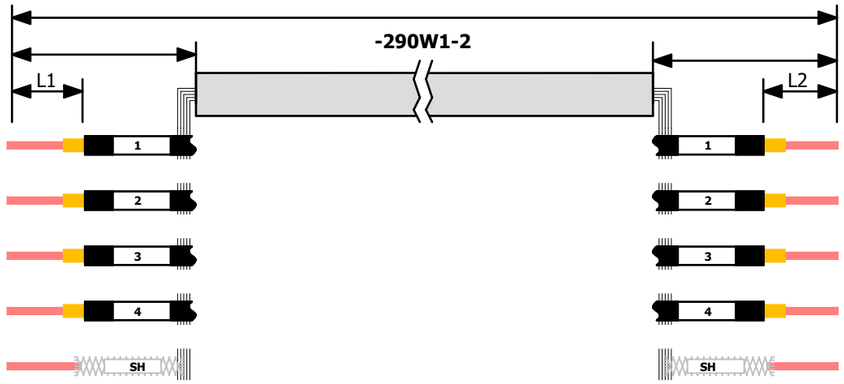


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_02++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

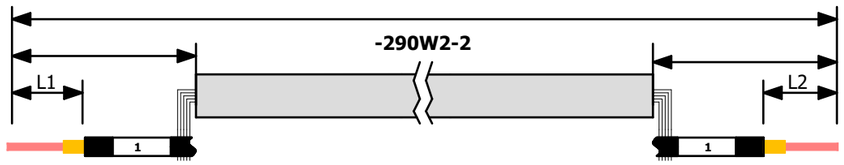


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

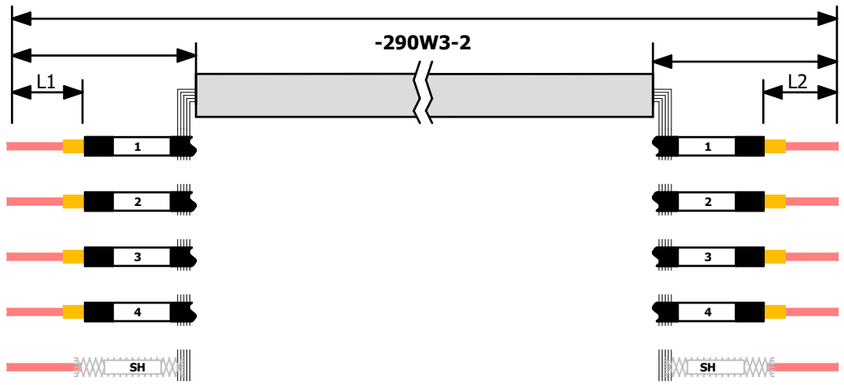


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

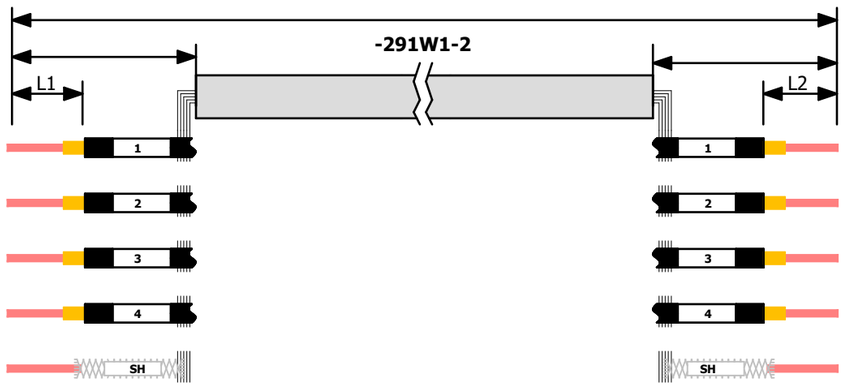


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

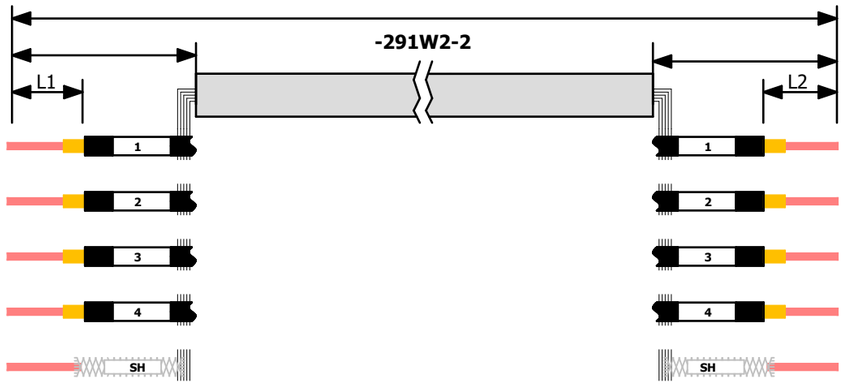
previous page: 2

next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

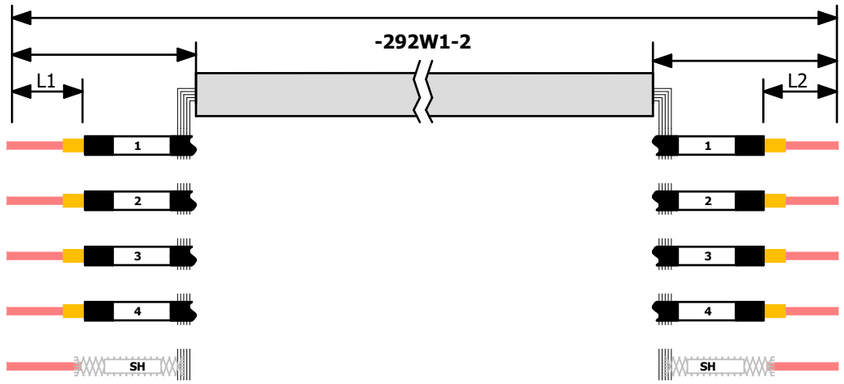


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

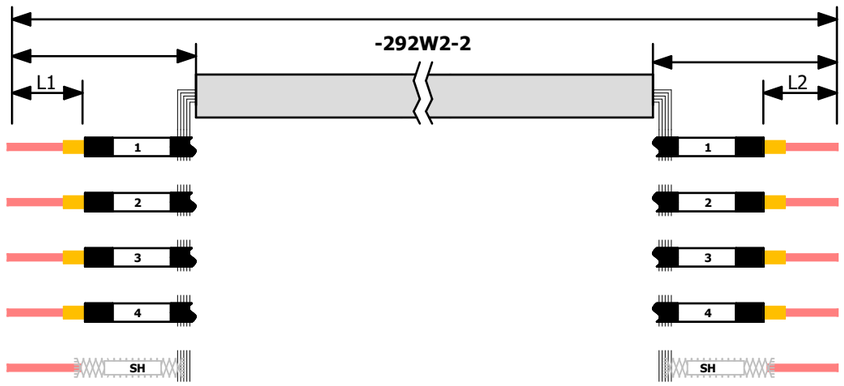


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

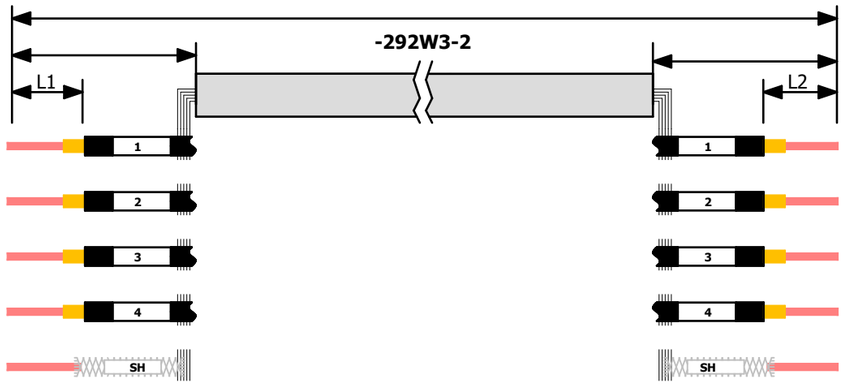
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

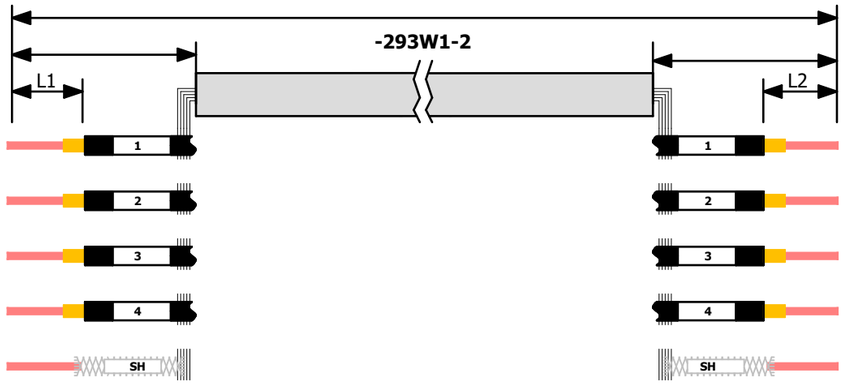


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

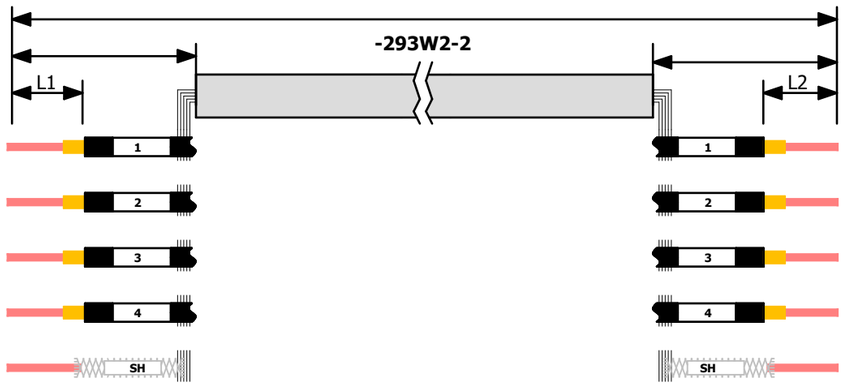


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

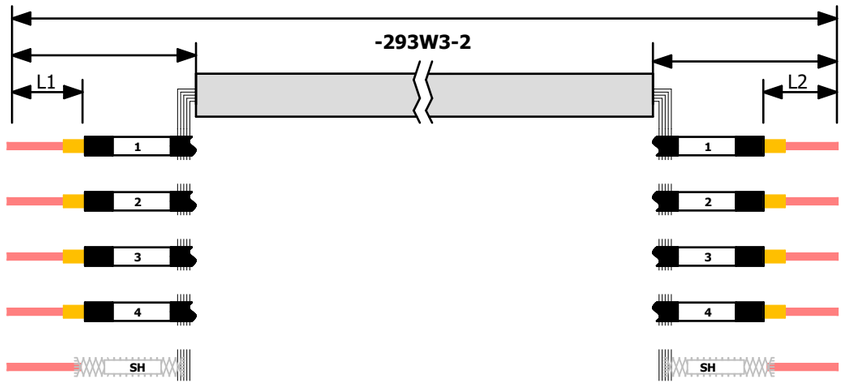
previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

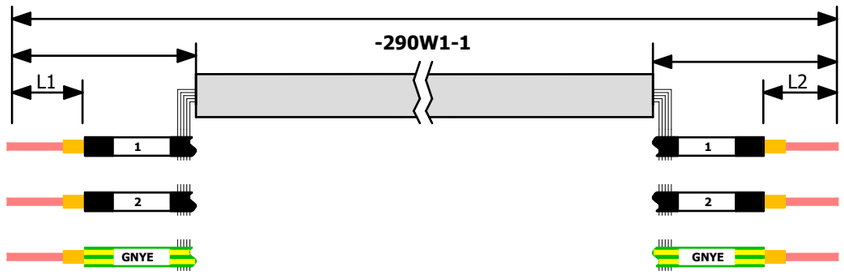


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

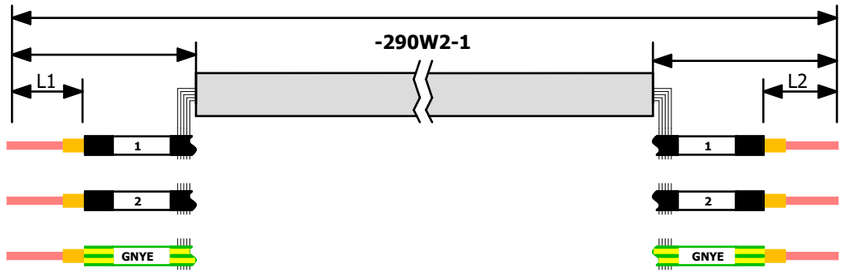


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

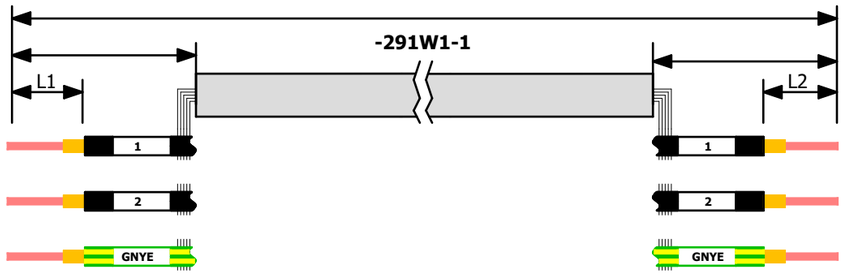


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

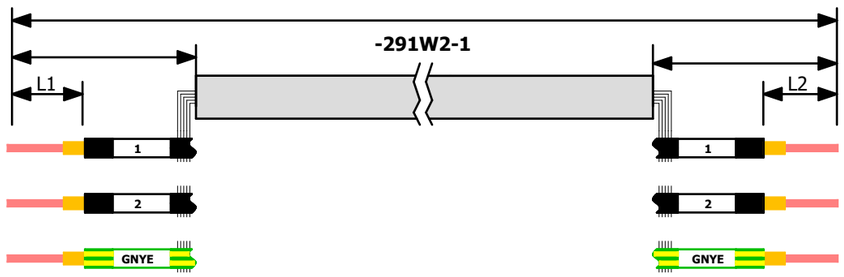


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

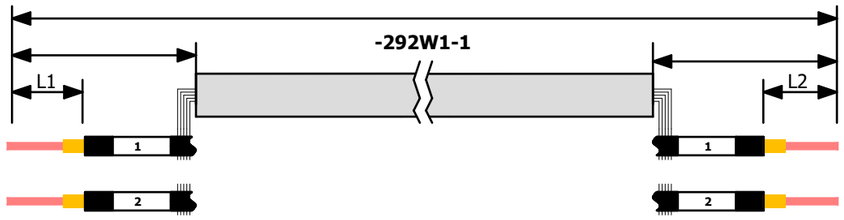


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

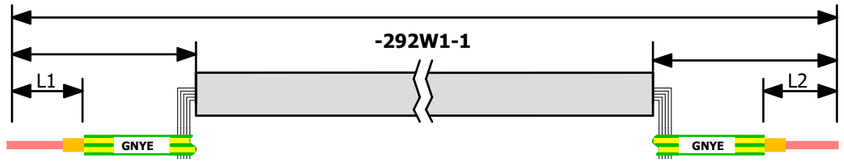
previous page: 6

next page: 8

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

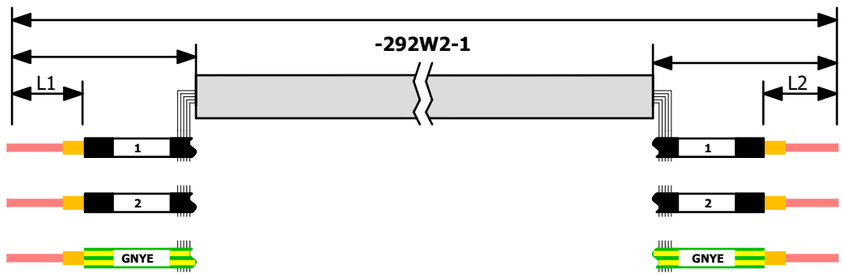


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

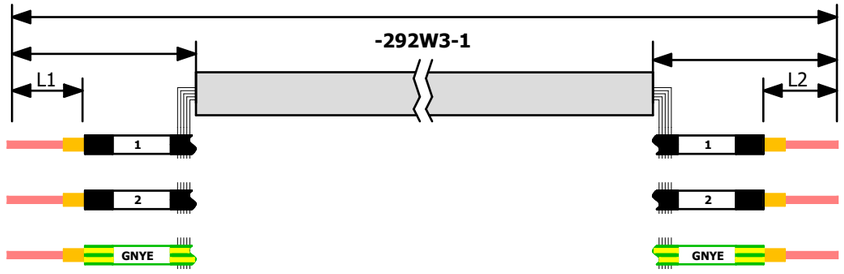


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

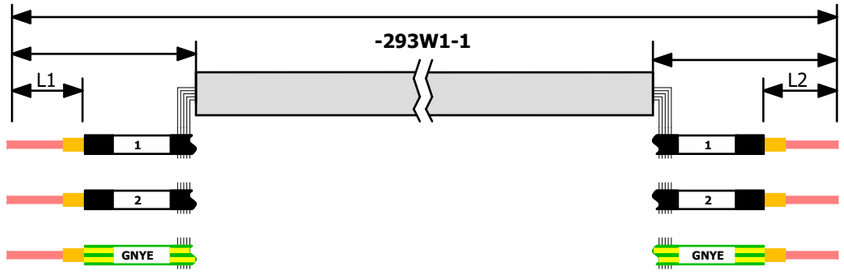


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

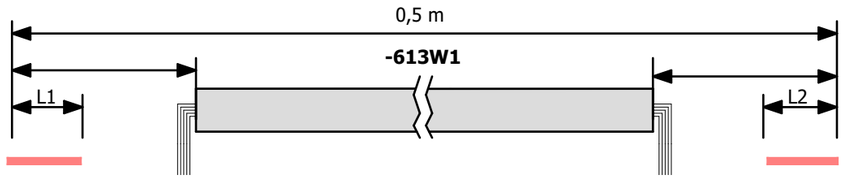


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

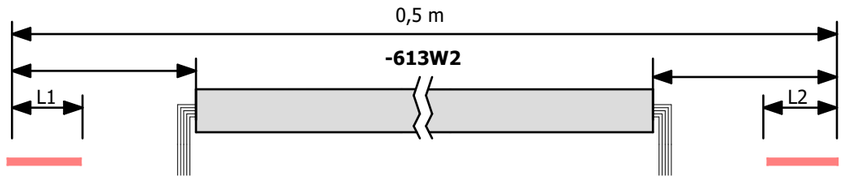


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_02++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			

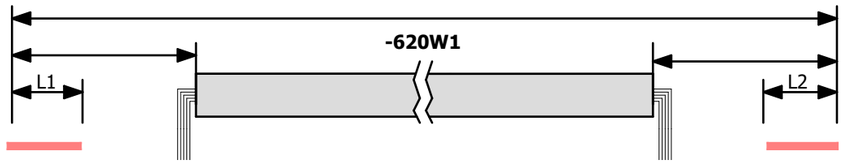
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 9
Date								+		total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_02++ASC+-620W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

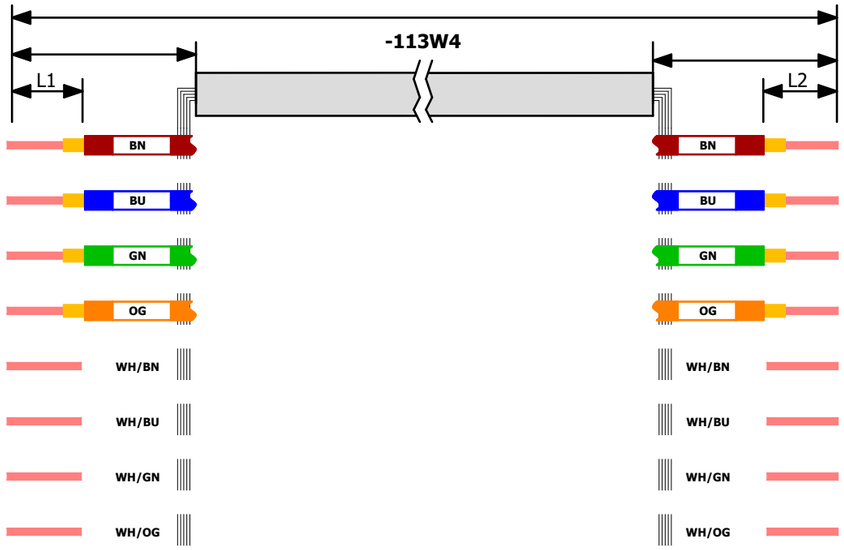
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U4:8							-620A1:-X1:P2	

Cable name =UNIT_02++ASC+-113W4
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:3							-613U2:3	

previous page: 9
next page: &EMZ/1000

FRQ_Kabelplan_04_groß_de_en

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X5.1		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2000
-X5.2		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2001
-X5.3		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2002
-X6		1	6	0	0	6	=UNIT_02&EMZ++ASC/2003
-XDC1		1	PE	2	0	14	=UNIT_02&EMZ++ASC/2004
-XDC2		1	7	0	0	14	=UNIT_02&EMZ++ASC/2005
-XES		1	9	4	5	18	=UNIT_02&EMZ++ASC/2006
-369XT		1	12	0	0	24	=UNIT_02&EMZ++ASC/2007
-687XT1		1	PE	11	11	44	=UNIT_02&EMZ++ASC/2019
-690XT1		1	PE	40	4	119	=UNIT_02&EMZ++ASC/2030

previous page:
&EMB/10

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-X5.1

Function text				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-JZ	-680W1	Page / column
gas concentration BAT 1-4					-XDC2	1	1	,	++Container-680U1-X1	1				&EFS/680a.2
=					-XDC2	5	2	,	++Container-680U1-X1	2		2		&EFS/680a.2
=					-AI_21	13	3	,	++Container-680U1-X1	4		3		&EFS/680a.2
=							4	,						&EFS/680a.2
=							5	,	++Container-680U1-X2	1		4		&EFS/680a.3
=							6	,	++Container-680U1-X2	2		5		&EFS/680a.3
=					-680K1	A1	7	,	++Container-680U1-X2	4		6		&EFS/680a.4
=					-XDC2	2	8	,	++Container-680U1-X2	5		7		&EFS/680a.4
=							9	,	++Container-680U1-X2	7		8		&EFS/680a.5
=							10	,	++Container-680U1-X2	8		9		&EFS/680a.5
=							PE	,	++Container-680U1-X1	5		GNYE		&EFS/680a.2
=							PE	,	-480W1					&EFS/680a.6

previous page:
1000

next page:
2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X5.1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2000
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X5.2						Cable name	-680W2										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-JZ											
gas concentration BAT 5-8					-XDC2	2	1	,	++Container-680U2-X1	1													&EFS/680b.2
=					-XDC2	6	2	,	++Container-680U2-X1	2		2											&EFS/680b.2
=					-AI_21	14	3	,	++Container-680U2-X1	4		3											&EFS/680b.2
=							4	,															&EFS/680b.2
=							5	,	++Container-680U2-X2	1		4											&EFS/680b.3
=							6	,	++Container-680U2-X2	2		5											&EFS/680b.3
=					-680K2	A1	7	,	++Container-680U2-X2	4		6											&EFS/680b.4
=					-XDC2	2	8	,	++Container-680U2-X2	5		7											&EFS/680b.4
=							9	,	++Container-680U2-X2	7		8											&EFS/680b.5
=							10	,	++Container-680U2-X2	8		9											&EFS/680b.5
=							PE	,	++Container-680U2-X1	5		GNYE											&EFS/680b.2
=							PE	,	-480W1														&EFS/680b.6

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X5.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1
&	EMZ	Terminals
++	ASC	auxillary cabinet
+		

page: 2001
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X5.3					Cable name	-680W3										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z										
gas concentration BAT 9-11					-XDC2	3	1	,	++Container-680U3-X1	1												&EFS/680c.2
=					-XDC2	7	2	,	++Container-680U3-X1	2		2										&EFS/680c.2
=					-AI_21	15	3	,	++Container-680U3-X1	4		3										&EFS/680c.2
=							4	,														&EFS/680c.2
=							5	,	++Container-680U3-X2	1		4										&EFS/680c.3
=							6	,	++Container-680U3-X2	2		5										&EFS/680c.3
=					-680K3	A1	7	,	++Container-680U3-X2	4		6										&EFS/680c.4
=					-XDC2	3	8	,	++Container-680U3-X2	5		7										&EFS/680c.4
=							9	,	++Container-680U3-X2	7		8										&EFS/680c.5
=							10	,	++Container-680U3-X2	8		9										&EFS/680c.5
=							PE	,	++Container-680U3-X1	5		GNYE										&EFS/680c.2
=							PE	,	-480W1													&EFS/680c.6

previous page:
2001

next page:
2003

Editor	Freqcon_DG			Statron		FREQCON	Klemmenplan =UNIT_02++ASC+-X5.3	20250805_V2.0	=	UNIT_02	Battery Container 1		
Date	21.01.2025								&	EMZ	Terminals		
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				10354_23A2007	++	ASC	auxillary cabinet	page:	2002
Date									+			total:	492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X6					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Extract Fan C/W Fire Damper 1						GND	1	,	-AO_21	1													&EFS/681.1
=						+10V	2	,	-AO_21	5													&EFS/681.1
Extract Fan C/W Fire Damper 2						GND	3	,	-AO_21	2													&EFS/681.3
=						+10V	4	,	-AO_21	6													&EFS/681.3
Extract Fan C/W Fire Damper 3						GND	5	,	-AO_21	3													&EFS/681.5
=						+10V	6	,	-AO_21	7													&EFS/681.5

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X6	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2003

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-XDC1

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FUSE 24V DC CONTROL VOLTAGE			-101T1	13	1		-103F1	2			&EFS/603.2
			-101Q1	13							
			-611A1	1							
FUSE 24V DC CONTROL VOLTAGE			-620A1	-X80:1	2						&EFS/603.2
			-DI_21	L+							
			-DO_21	L+							
FUSE 24V DC CONTROL VOLTAGE			-684F5	11	3		-103F1	13			&EFS/603.2
FUSE 24V DC CONTROL VOLTAGE			-611A1	2	4		-102G1	OUTPUT DC 24 V:-			&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE			-620A1	-X80:2	5						&EFS/603.3
			-DI_21	M							
			-DO_21	M							
FUSE 24V DC CONTROL VOLTAGE			-636K1	A2	6		-XDC2	5			&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE			-101T1	-"	PE						&EFS/603.4
			-101T1	PE							
FUSE 24V DC CONTROL VOLTAGE					PE						&EFS/603.4

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XDC1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2004

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-XDC2						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
FUSE 24V DC CONTROL VOLTAGE					-AI_21	L+	1		-103F2	2													&EFS/603.5
					-AO_21	L+																	
					-X5.1	1																	
FUSE 24V DC CONTROL VOLTAGE					-X5.1	8	2		-X5.2	8													&EFS/603.5
					-680K1	11																	
					-X5.2	1																	
FUSE 24V DC CONTROL VOLTAGE					-680K2	11	3		-680K3	11													&EFS/603.5
					-X5.3	1																	
					-X5.3	8																	
FUSE 24V DC CONTROL VOLTAGE					-691F1	13	4																&EFS/603.6
					-691F4	13																	
					-691F4	13																	
FUSE 24V DC CONTROL VOLTAGE					-AI_21	M	5		-XDC1	6													&EFS/603.6
					-AO_21	M																	
					-X5.1	2																	
FUSE 24V DC CONTROL VOLTAGE					-680K1	A2	6																&EFS/603.6
					-X5.2	2																	
FUSE 24V DC CONTROL VOLTAGE					-680K2	A2	7																&EFS/603.7
					-X5.3	2																	
					-680K3	A2																	

previous page: 2004

next page: 2006

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XDC2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2005
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-XES					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
							1		-684F1	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC							N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-690F1	N													&EFS/684.3
=					-690XT1	N	N		-690F2	N													&EFS/684.3
=							N		-690XT1	N													&EFS/684.4
=							PE			PE													&EFS/684.4
=					++Container-278W1	GND	PE			PE													&EFS/684.4
=					-684F5	PE	PE		-684F2	PE													&EFS/684.5
=					-601F1	PE	PE																&EFS/684.5
					-684F4	2	2		-684F3	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC					-601F1	L1	3																&EFS/684.1
=							4		-684F1	4													&EFS/684.1
=					-684F4	4	5		-684F3	4													&EFS/684.1
=					-601F1	L2	6																&EFS/684.1
=							7		-684F1	6													&EFS/684.1
=					-684F4	6	8		-684F3	6													&EFS/684.1
=					-601F1	L3	9																&EFS/684.2

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-OZ	++Container-290W2-2 F-CY-OZ	++Container-290W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	1					&EFS/669.5
		3			++Container-570XT	3						
	3				++Container-570XT	3						

previous page: 2006

next page: 2008

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2007

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	2		++Container-570XT	3		3	&EFS/669.5
		3			++Container-570XT	3							
	3				++Container-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	3		++Container-570XT	3		3	&EFS/669.6
		3			++Container-570XT	3							
	3				++Container-570XT	3							

previous page: 2008

next page: 2010

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 2009
Date								+ — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	4					&EFS/669.7
		4			++Container-570XT	4						
	4				++Container-570XT	4						

previous page:
2009

next page:
2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2010
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	5		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

previous page:
2010

next page:
2012

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2011
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	6		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

previous page: 2011

next page: 2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2012

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	7					&EFS/670.5
		1			++Container-570XT	1						
	1				++Container-570XT	1						

previous page: 2012

next page: 2014

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	8		++Container-570XT	1		1	&EFS/670.5
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	9		++Container-570XT	1		1	&EFS/670.6
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	10					&EFS/670.7
		2			++Container-570XT	2						
	2				++Container-570XT	2						

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	11		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	12		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

previous page: 2017

next page: 2019

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2018

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			++Container-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				++Container-XE	1	3	,	-687F3	2		&EFS/687.4

previous page:
2018

next page:
2020

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2019
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-1 JZ-500	++Container-291W2-1 JZ-500	++Container-291W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	4	,	-687F4	2		&EFS/687.5
=		1			++Container-XE	1	5	,	-687F5	2		&EFS/687.7
=	1				++Container-XE	1	6	,	-687F6	2		&EFS/687.8

previous page: 2019

next page: 2021

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025					& EMZ Terminals
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date						+

page: 2020

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-1	++Container-292W3-1	++Container-292W2-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	7	,	-688F1	2													&EFS/688.1
=		1			++Container-XE	1	8	,	-688F2	2													&EFS/688.3
=	1				++Container-XE	1	9	,	-688F3	2													&EFS/688.4

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W1-1 JZ-500	++Container-293W3-1 JZ-500	++Container-293W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	10	,	-688F4	2		&EFS/688.5
=		1			++Container-XE	1	11	,	-688F5	2		&EFS/688.7
=	2				++Container-XE	N	N	,	-XES	N		&EFS/687.1

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2022

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W1-1 JZ-500	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/687.6

previous page: 2022

next page: 2024

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2023

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W2-1 -XZ-500	++Container-292W1-1 -XZ-500	++Container-291W2-1 -XZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.7
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.8
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N		-XES	N		&EFS/688.1

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2024 of total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W2-1 -1Z-500	++Container-293W1-1 -1Z-500	++Container-292W3-1 -1Z-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/688.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/688.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/688.6

previous page: 2024

next page: 2026

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W2-1	++Container-290W1-1	++Container-293W3-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N																&EFS/688.7
Supply Battery String 1-phase 230V AC		GNYE			++Container-XE	PE	PE																&EFS/687.2
=	GNYE				++Container-XE	PE	PE																&EFS/687.3

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W2-1 -XZ-500	++Container-291W1-1 -XZ-500	++Container-290W3-1 -XZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,				&EFS/687.4
=		GNYE			++Container-XE	PE	PE	,				&EFS/687.6
=	GNYE				++Container-XE	PE	PE	,				&EFS/687.7

previous page: 2026

next page: 2028

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W3-1 / JZ-500	++Container-292W2-1 / JZ-500	++Container-292W1-1 / JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,				&EFS/687.9
=		GNYE			++Container-XE	PE	PE	,				&EFS/688.2
=	GNYE				++Container-XE	PE	PE	,				&EFS/688.3

previous page: 2027

next page: 2029

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02	Battery Container 1
Date	21.01.2025					& EMZ	Terminals
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date						+	

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W3-1	++Container-293W2-1	++Container-293W1-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/688.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Container Internal Lighting						L	1	,	-690F1	2													&EFS/690.1
=						1	2	,	-690F2	2													&EFS/690.3
Container Sockets						1	3	,	-690F3	2													&EFS/690.5
230V AC for crane 2						1	4	,	-690F4	2													&EFS/690.7
230V AC for crane 3						1	5	,	-690F5	2													&EFS/690.8
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						L	6	,	-636K1	14													&EFS/691.1
						L																	
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						L	7	,	-636K2	14													&EFS/691.3
						L																	
								,															
								,															

previous page: 2029

next page: 2031

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,		

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
400V AC for Cooling Units							10	,	-691F4	4													&EFS/691.6
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,														

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
												Cable type	
230V AC for crane 2						PE	PE						&EFS/690.7
230V AC for crane 3						PE	PE						&EFS/690.8
Container Sockets						2	N		-690F2	N.			&EFS/690.4
230V AC for crane 1						2	N		-XES	N			&EFS/690.6
230V AC for crane 2						2	N		-XES	N			&EFS/690.7
230V AC for crane 3						2	N		-XES	N			&EFS/690.8
Container Internal Lighting						N	N		-690F1	N.			&EFS/690.1
=						GND	PE						&EFS/690.2
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						N	N		-XES	N			&EFS/691.1
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						GND	PE						&EFS/691.2
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						N	N						&EFS/691.3
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						GND	PE						&EFS/691.3
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						N	N						&EFS/691.4
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						GND	PE						&EFS/691.4
						GND							
400V AC for Cooling Units							N						&EFS/691.6
=							PE						&EFS/691.6

previous page: 2032

next page: =UNIT_03&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-690XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet page: 2033
Date								+ total: 492

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	BATTERY CONTAINER 2	
Circuit diagram No:	10354_23A2007	20250805_V2.0

Producer (company):	Freqcon GmbH	53412 ASC 53409
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Project manager:	Freqcon_CP	

created on: 17.09.2019
edited on: 05.08.2025 edited by: Freqcon_DG total pages: 492

previous page:
=UNIT_02&EMZ++ASC/2033

next page:
&EAB/1

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	21.01.2025	Freqcon_DG
	3	INDEX	21.01.2025	Freqcon_DG
	4	INDEX	21.01.2025	Freqcon_DG
	5	INDEX	21.01.2025	Freqcon_DG
	6	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	05.11.2024	Freqcon_DG
	3a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
&ELU		Cabinet Overview		
	5a	Container overview	14.06.2024	Freqcon_JD
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	191	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	192	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	193	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	278	EARTHING CONTAINER	18.06.2024	Freqcon_JD
	290	BATTERY CABINETS 1-3	18.06.2024	Freqcon_JD
	291	BATTERY CABINETS 4+5	18.06.2024	Freqcon_JD
	292	BATTERY CABINETS 6-8	18.06.2024	Freqcon_JD
	293	BATTERY CABINETS 9-11	18.06.2024	Freqcon_JD
&EFS ++ASC		Circuit diagram auxillary cabinet		
	601	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	602	CONTROL VOLTAGE UPS	18.06.2024	Freqcon_JD
	603	CONTROL VOLTAGE FUSE	10.10.2024	Freqcon_DG
	611	ETHERNET SWITCH	18.06.2024	Freqcon_JD
	613a	ETHERNET / PROFINET ISOLATOR	25.11.2024	Freqcon_DG
	613b	PROFINET	25.11.2024	Freqcon_DG
	620	ET200 24V DC ASC	25.11.2024	Freqcon_DG
	621	ET200SP DIGITAL INPUTS DI_21 + DI_22	03.12.2024	Freqcon_DG
	623	ET200SP DIGITAL OUTPUTS DO_21	14.06.2024	Freqcon_JD
	624	ET200SP ANALOG INPUTS AI_21	14.06.2024	Freqcon_JD
	625	ET200SP ANALOG OUTPUTS AO_21	14.06.2024	Freqcon_JD
	635a	OUTPUTS COMMUNICATION	18.06.2024	Freqcon_JD
	635b	OUTPUTS COMMUNICATION	18.06.2024	Freqcon_JD
	636	OUTPUTS FIRE DAMPER	18.06.2024	Freqcon_JD
	669	SMOKE POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	670	GAS POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	678	DC BATTERY CABINETS	18.06.2024	Freqcon_JD
	680a	STATIONARY GAS DETECTOR BAT 1-4	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++ASC		Circuit diagram auxillary cabinet		
	680b	STATIONARY GAS DETECTOR BAT 5-8	18.06.2024	Freqcon_JD
	680c	STATIONARY GAS DETECTOR BAT 9-11	18.06.2024	Freqcon_JD
	681	EXTRACT FAN FIRE DAMPER	18.06.2024	Freqcon_JD
	684	AUXILIARY SUPPLY 400V AC	22.11.2024	Freqcon_DG
	685	AUXILIARY SUPPLY 400V AC	08.10.2024	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	29.10.2024	Freqcon_DG
	691	CONTAINER COOLING / LIGHTNING	05.11.2024	Freqcon_DG
&EPC ++Container		Parts List		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	21.01.2025	Freqcon_DG
	4	PARTS LIST	21.01.2025	Freqcon_DG
	5	PARTS LIST	21.01.2025	Freqcon_DG
	6	PARTS LIST	21.01.2025	Freqcon_DG
	7	PARTS LIST	21.01.2025	Freqcon_DG
	8	PARTS LIST	21.01.2025	Freqcon_DG
&EPA ++Container		Summarized part list		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
&EMB ++Container		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	21.01.2025	Freqcon_DG

previous page: 3

next page: 5

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_03++ASC+-X5.1 - =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_03++ASC+-X5.1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_03++ASC+-X5.2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_03++ASC+-X5.3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_03++ASC+-X6	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_03++ASC+-XDC1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_03++ASC+-XDC2	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_03++ASC+-XES	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_03++ASC+-XT	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2009	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2024	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG
	2025	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2026	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG
	2027	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2028	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2029	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2030	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2031	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2032	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2033	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2034	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/6

next page: 6a

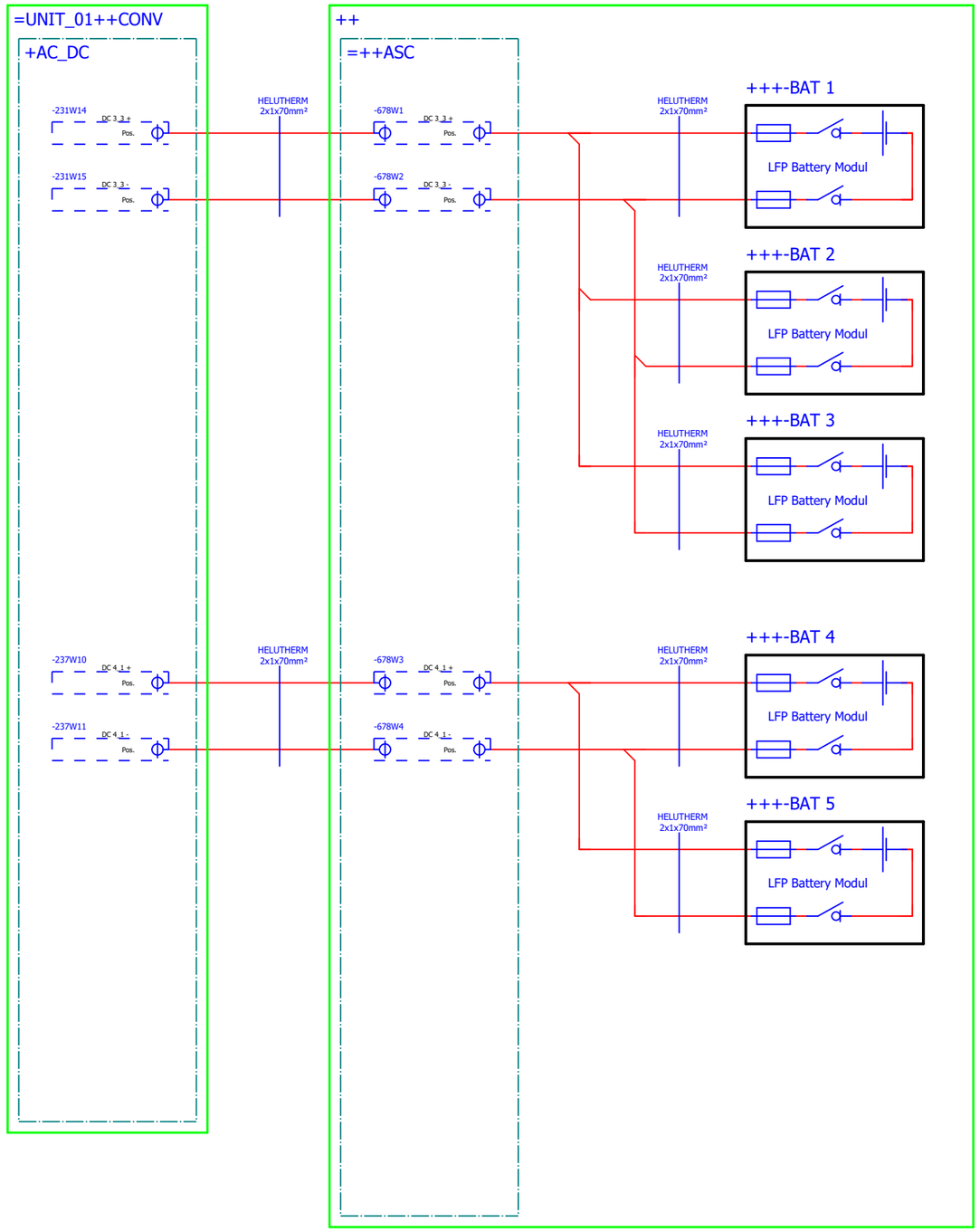
SPECIFICATION of grounding

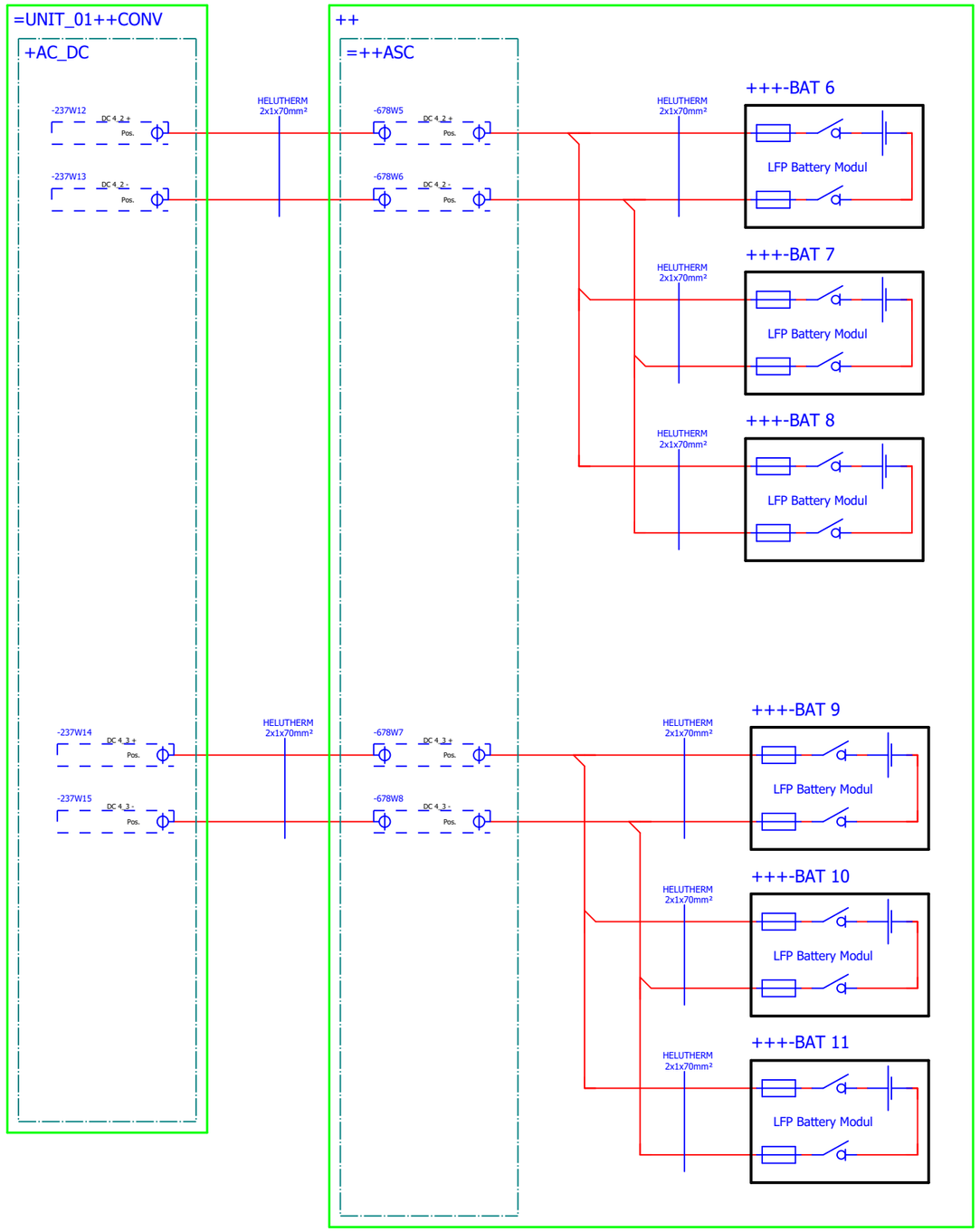
	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Single line diagram





previous page:
&EAC/6a

next page:
2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 1a
Date								+ total: 492

Single line diagram

Control circuit

++ASC

400V

-XES

-684F3 &EFS++ASC/684.2 C32A

-684F1 &EFS++ASC/684.0 C32A

-684F2 &EFS++ASC/684.5 TYP 1 + 2 SPD

-601F1 &EFS++ASC/601.1 TYP 1 + 2 SPD

-684F4 &EFS++ASC/685.0 C32A

-684F5 &EFS++ASC/685.5 TYP 1 + 2 SPD

-691F1 &EFS++ASC/691.1 C6A

-691F2 &EFS++ASC/691.3 C6A

-691F3 &EFS++ASC/691.4 C6A

-690F1 &EFS++ASC/690.1 16A

-690F3 &EFS++ASC/690.5 C6A

-690F4 &EFS++ASC/690.7 C6A

-690F5 &EFS++ASC/690.8 C6A

-691F4 &EFS++ASC/691.5 C16A

-690F2 &EFS++ASC/690.3 16A

-101Q1

-687F1 &EFS++ASC/687.1 C16A

-687F2 &EFS++ASC/687.3 C16A

-687F3 &EFS++ASC/687.4 C16A

-687F4 &EFS++ASC/687.5 C16A

-687F5 &EFS++ASC/687.7 C16A

-636K1 &EFS++ASC/636.1

-636K2 &EFS++ASC/636.2

-636K3 &EFS++ASC/636.4

M 1~

1/N/PE

1/N/PE

1/N/PE

1/N/PE 1/N/PE

20 A

Battery cabinet 1

Battery cabinet 2

Battery cabinet 3

Battery cabinet 4

Battery cabinet 5

-687F6 &EFS++ASC/687.8 C16A

-688F1 &EFS++ASC/688.1 C16A

-688F2 &EFS++ASC/688.2 C16A

-688F3 &EFS++ASC/688.4 C16A

-688F4 &EFS++ASC/688.5 C16A

-688F5 &EFS++ASC/688.7 C16A

Battery cabinet 6

Battery cabinet 7

Battery cabinet 8

Battery cabinet 9

Battery cabinet 10

Battery cabinet 11

Exhaust Unit / shut-off flap Bat 1-4

Exhaust Unit / shut-off flap Bat 5-8

Exhaust Unit / shut-off flap Bat 9-11

Container Internal Lighting

crane 1

crane 2

crane 3

Cooling Units

Container Sockets

Power Supply

previous page: 1a

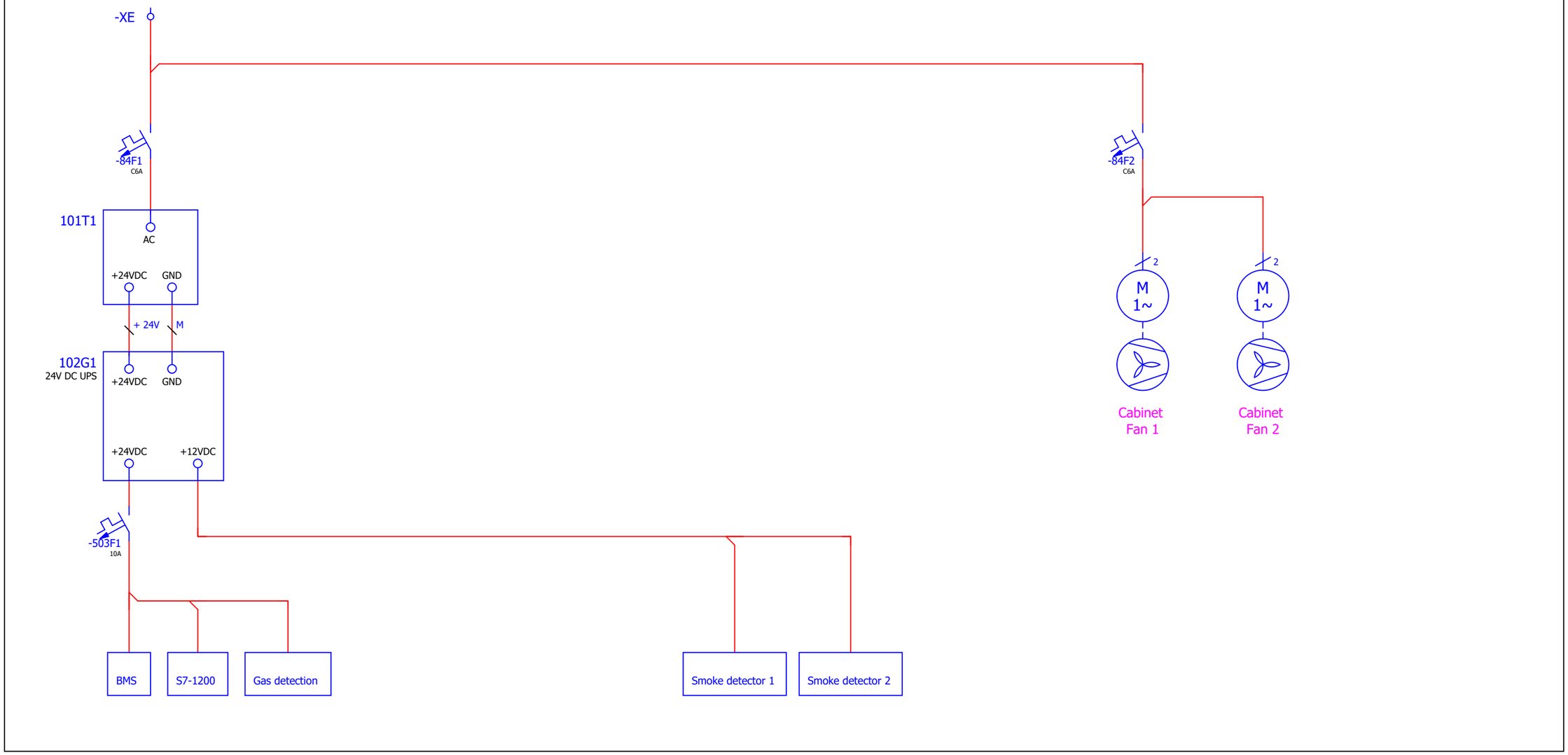
next page: 3a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2a
Date								+ total: 492

Single line diagram

Control circuit

Battery Cabinet

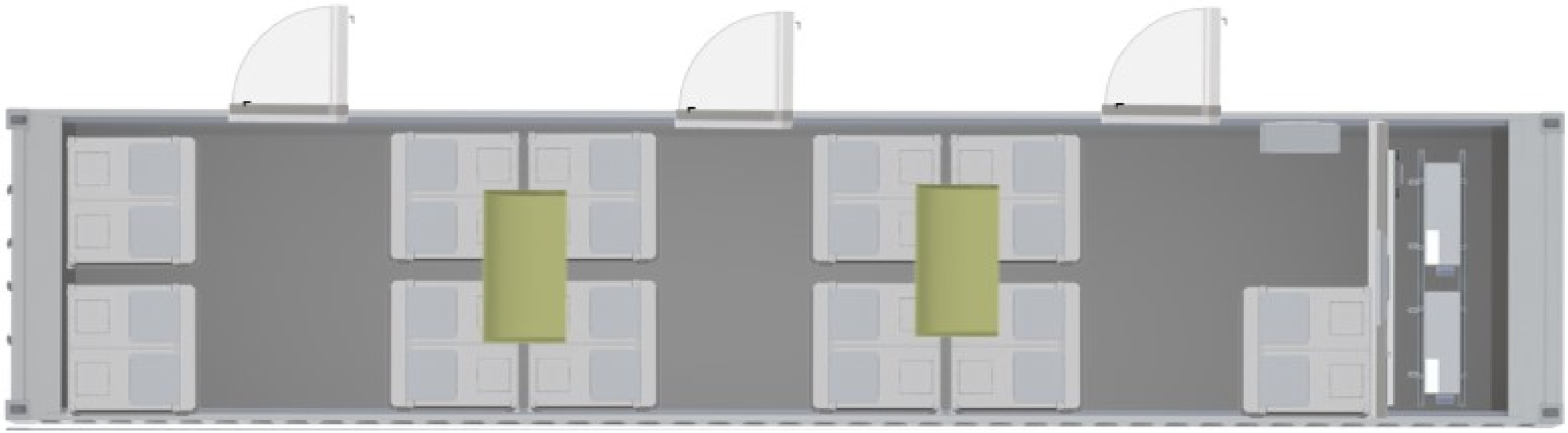


previous page:
2a

next page:
&ELU/5a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 3a
Date								+	total: 492

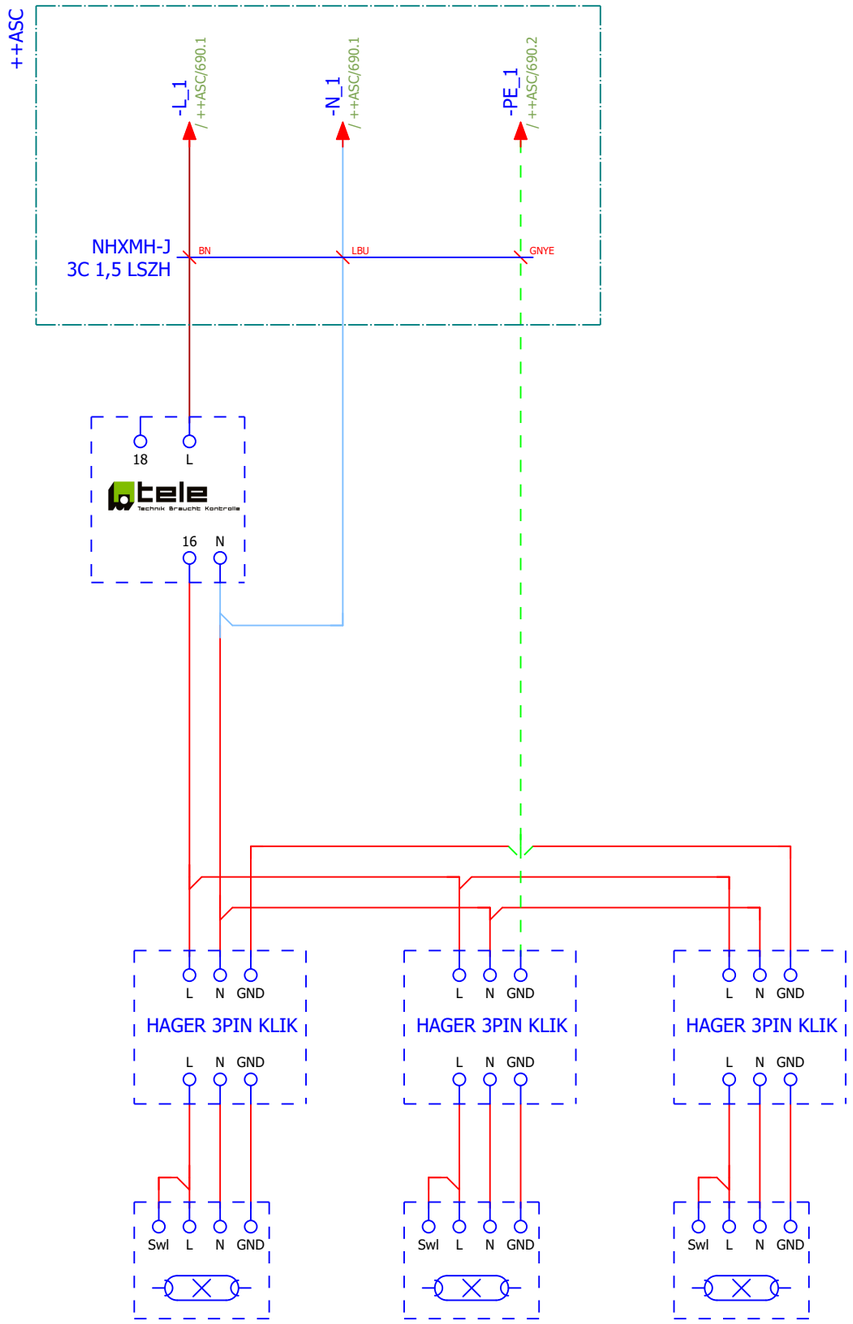
0	1	2	3	4	5	6	7	8	9



previous page:
&EFA/3a

next page:
&EFS++Container/190

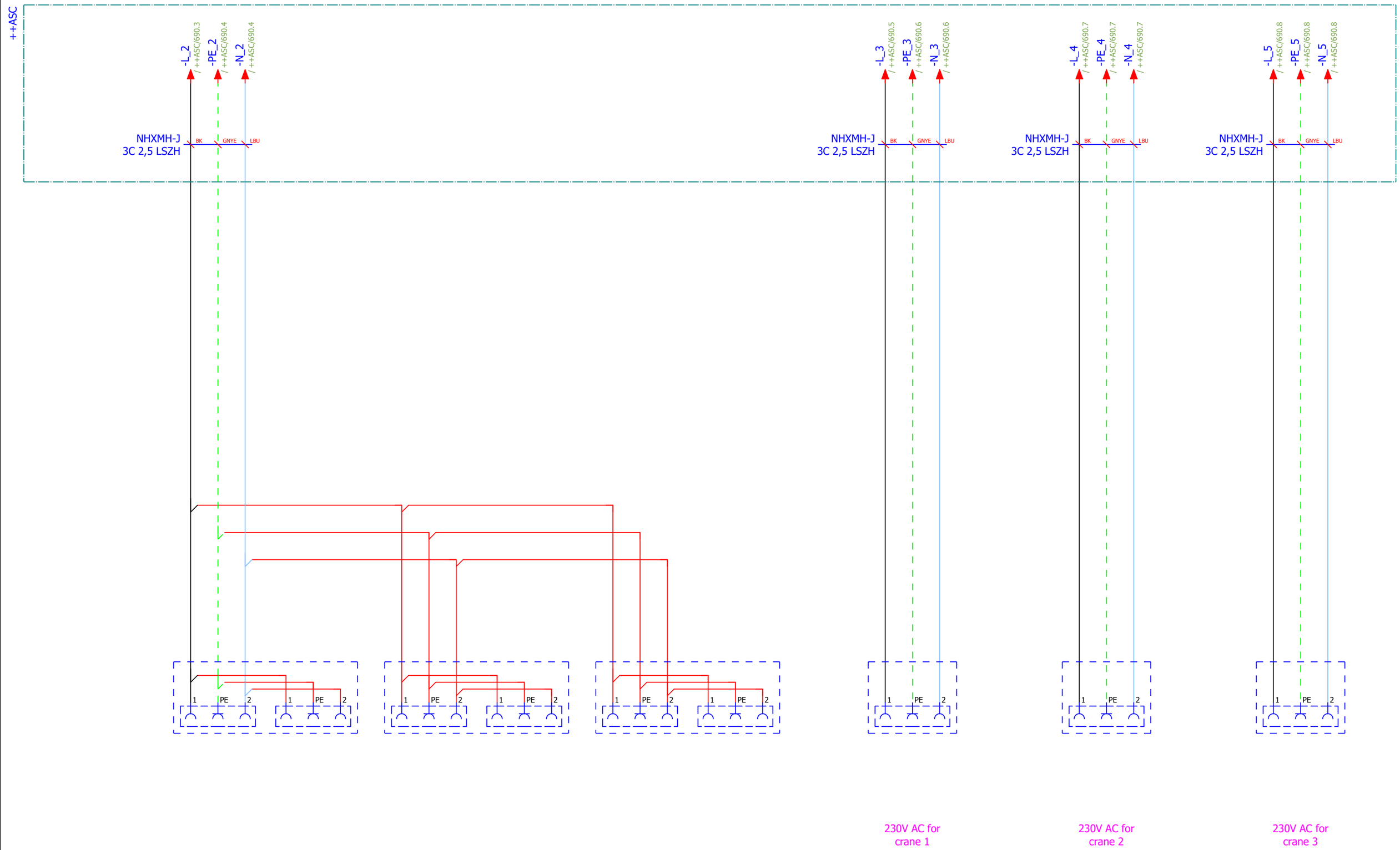
Editor	Freqcon_JD			Statron	FREQCON	Container overview	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	14.06.2024	Norm						& ELU Cabinet Overview	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
191

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492



previous page: 190

next page: 192

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 191
Date								+	total: 492

++ASC

-L_6 / ++ASC/691.1
-N_6 / ++ASC/691.1
-PE_6 / ++ASC/691.2

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 1-4

-L_6 / ++ASC/691.1
-N_6 / ++ASC/691.1
-PE_6 / ++ASC/691.2

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

230V AC for
shut-off flap
Battery cabinets 1-4

-L_7 / ++ASC/691.3
-N_7 / ++ASC/691.3
-PE_7 / ++ASC/691.3

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 5-8

-L_7 / ++ASC/691.3
-N_7 / ++ASC/691.3
-PE_7 / ++ASC/691.3

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

230V AC for
shut-off flap
Battery cabinets 5-8

-L_8 / ++ASC/691.4
-N_8 / ++ASC/691.4
-PE_8 / ++ASC/691.4

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 9-11

-L_8 / ++ASC/691.4
-N_8 / ++ASC/691.4
-PE_8 / ++ASC/691.4

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

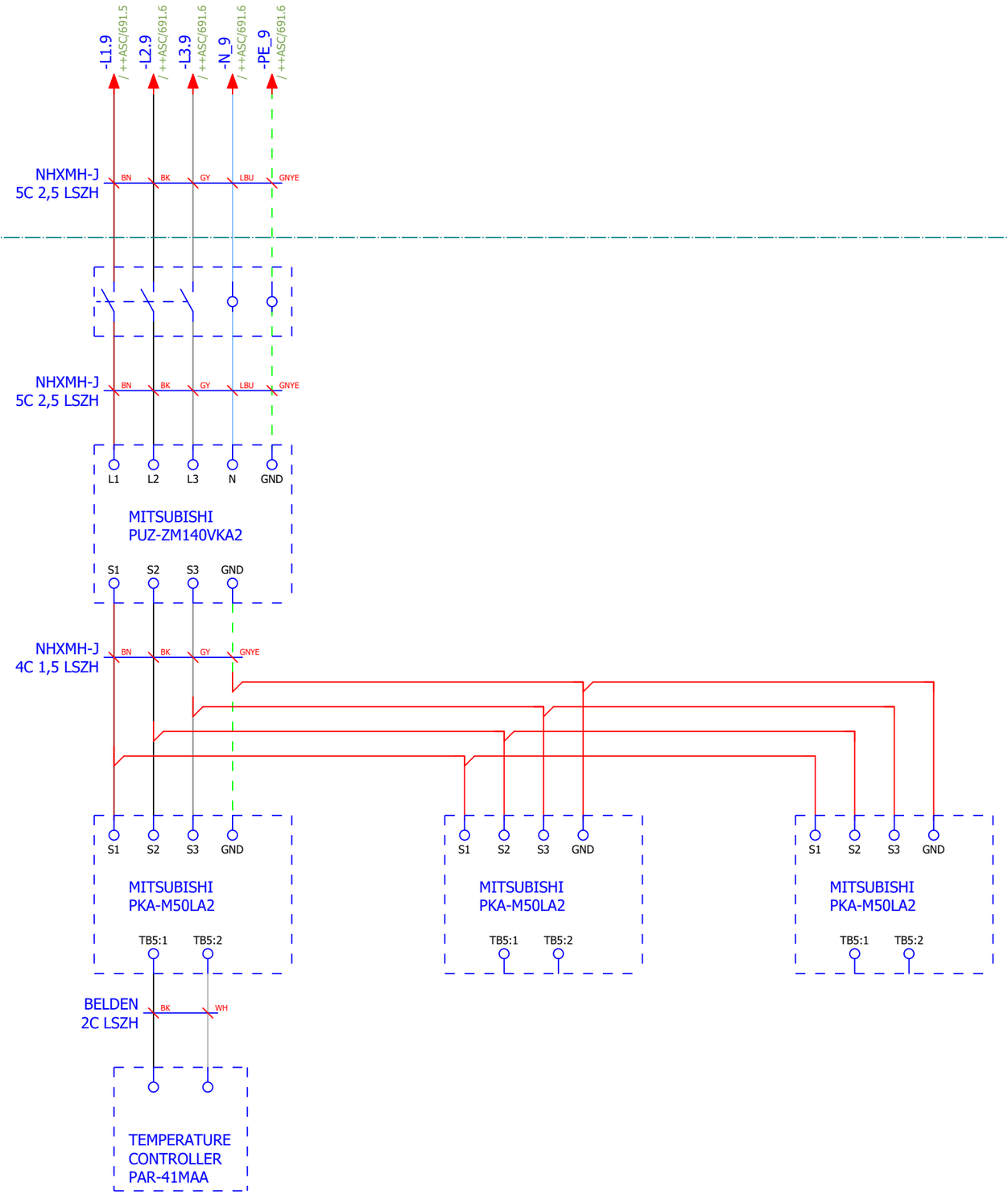
230V AC for
shut-off flap
Battery cabinets 9-11

previous page:
191

next page:
193

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 192
Date								+	total: 492

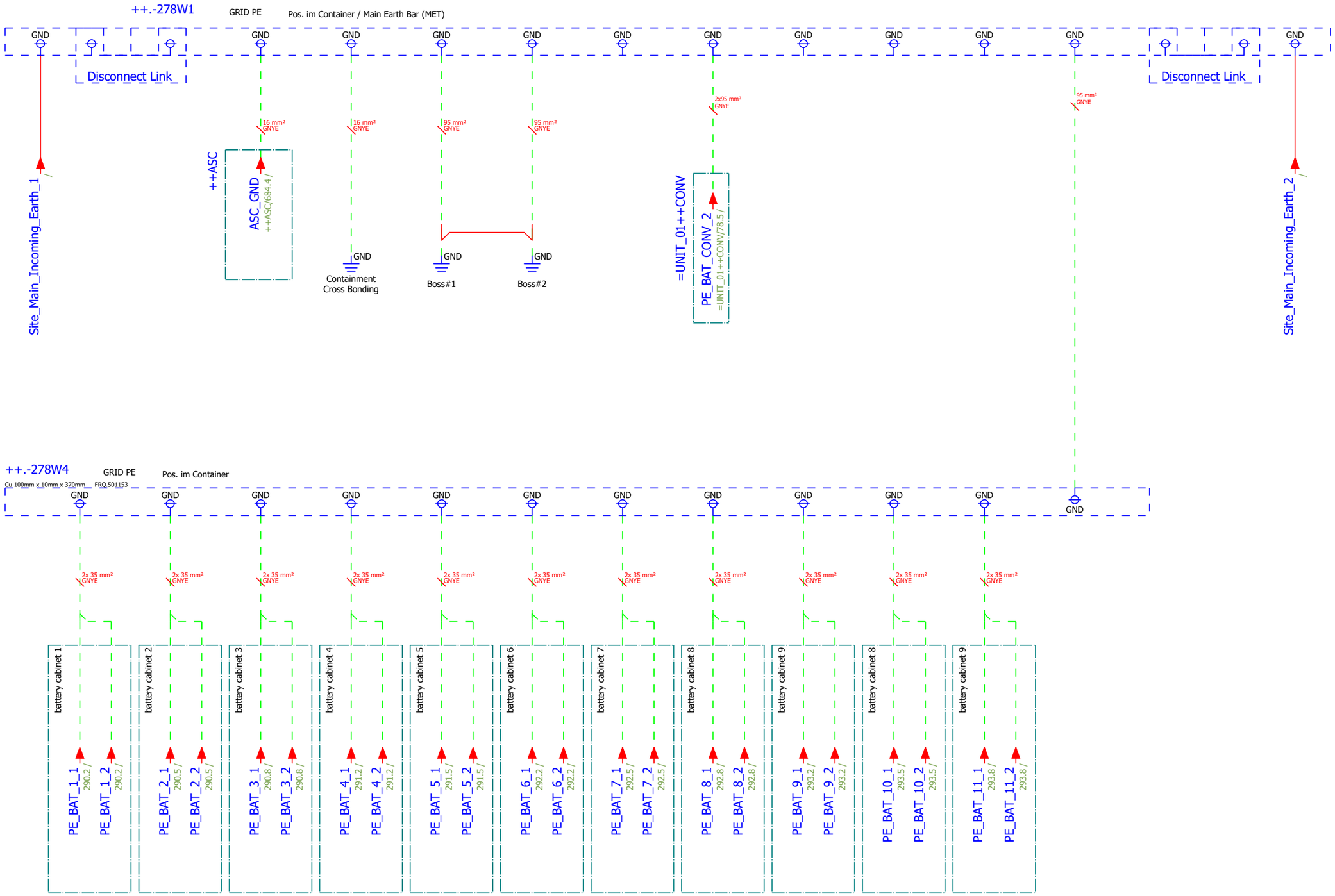
++ASC



previous page: 192

next page: 278

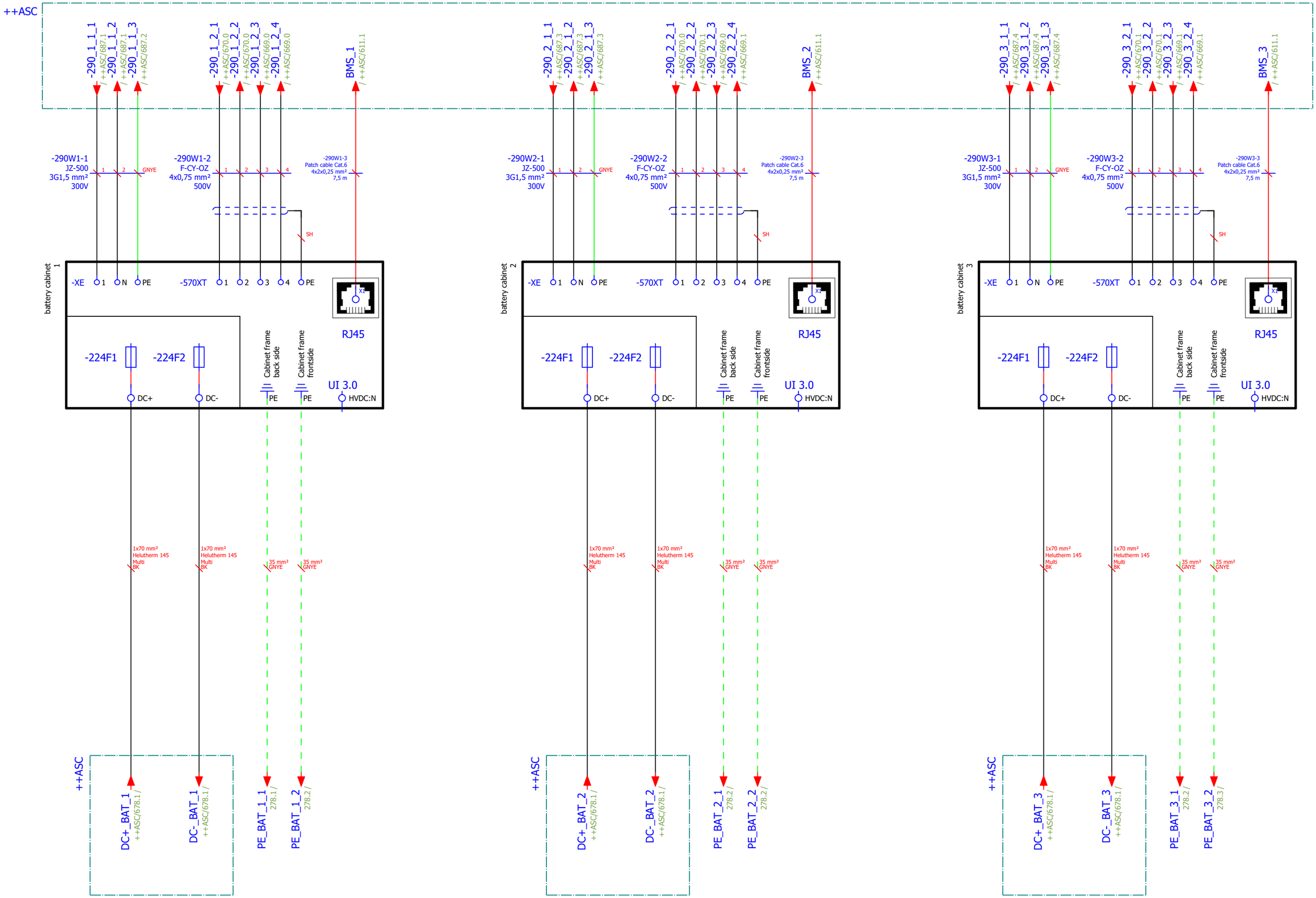
Busbars PE



previous page: 193

next page: 290

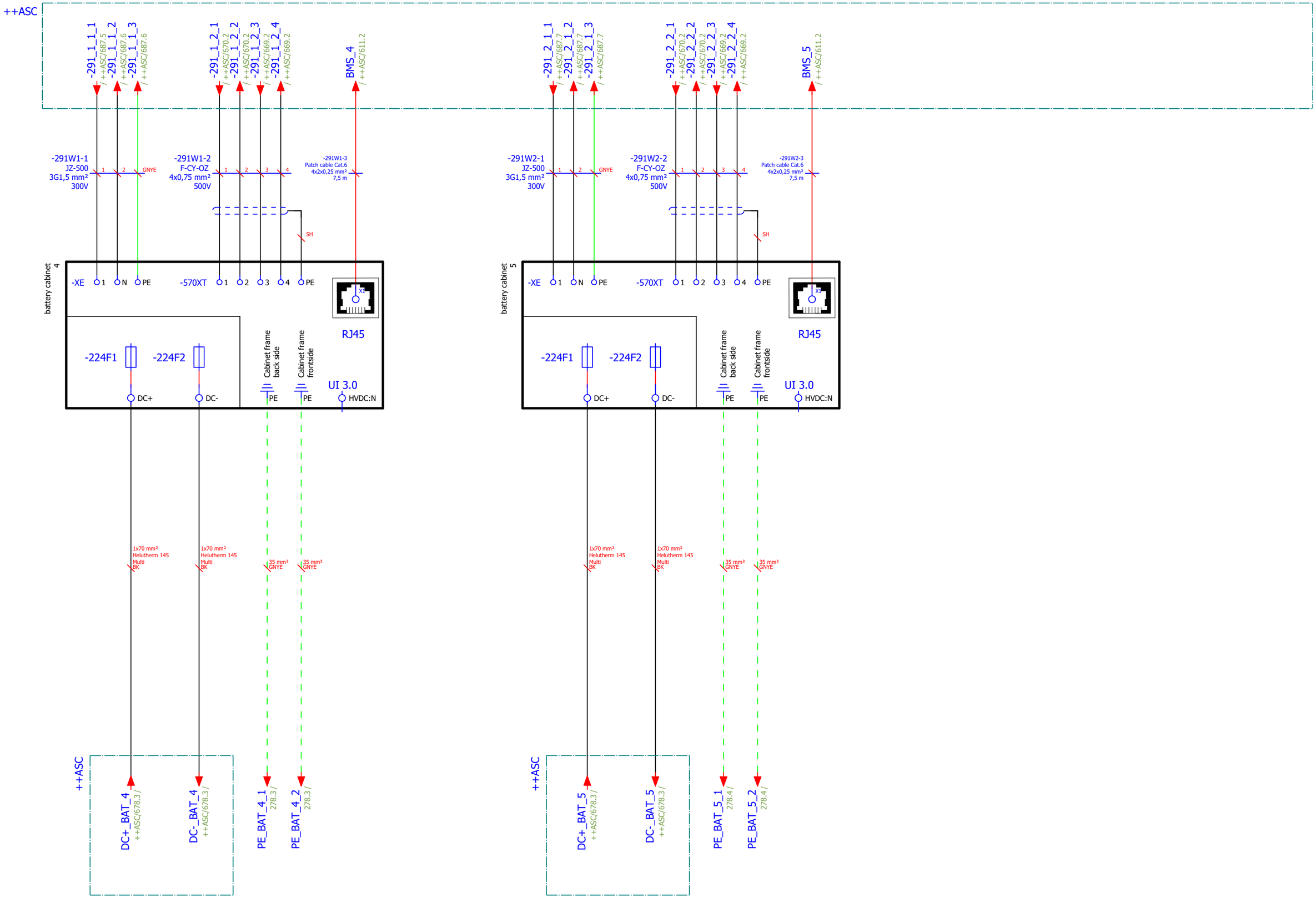
Editor	Freqcon_JD			Statron	FREQCON	EARTHING CONTAINER	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 278
Date								+	total: 492



previous page: 278

next page: 291

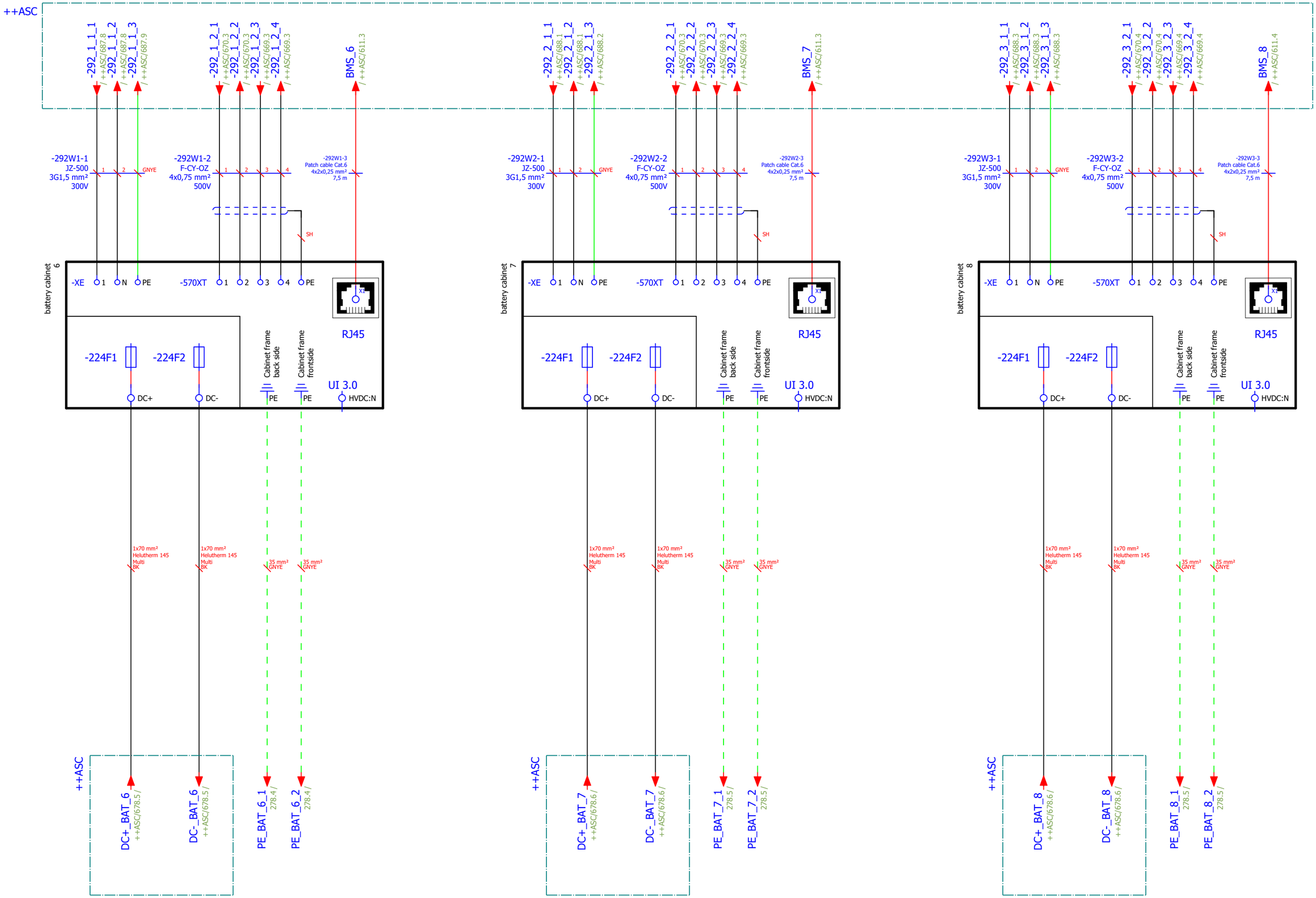
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 1-3	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 290
Date								+	total: 492



previous page: 290

next page: 292

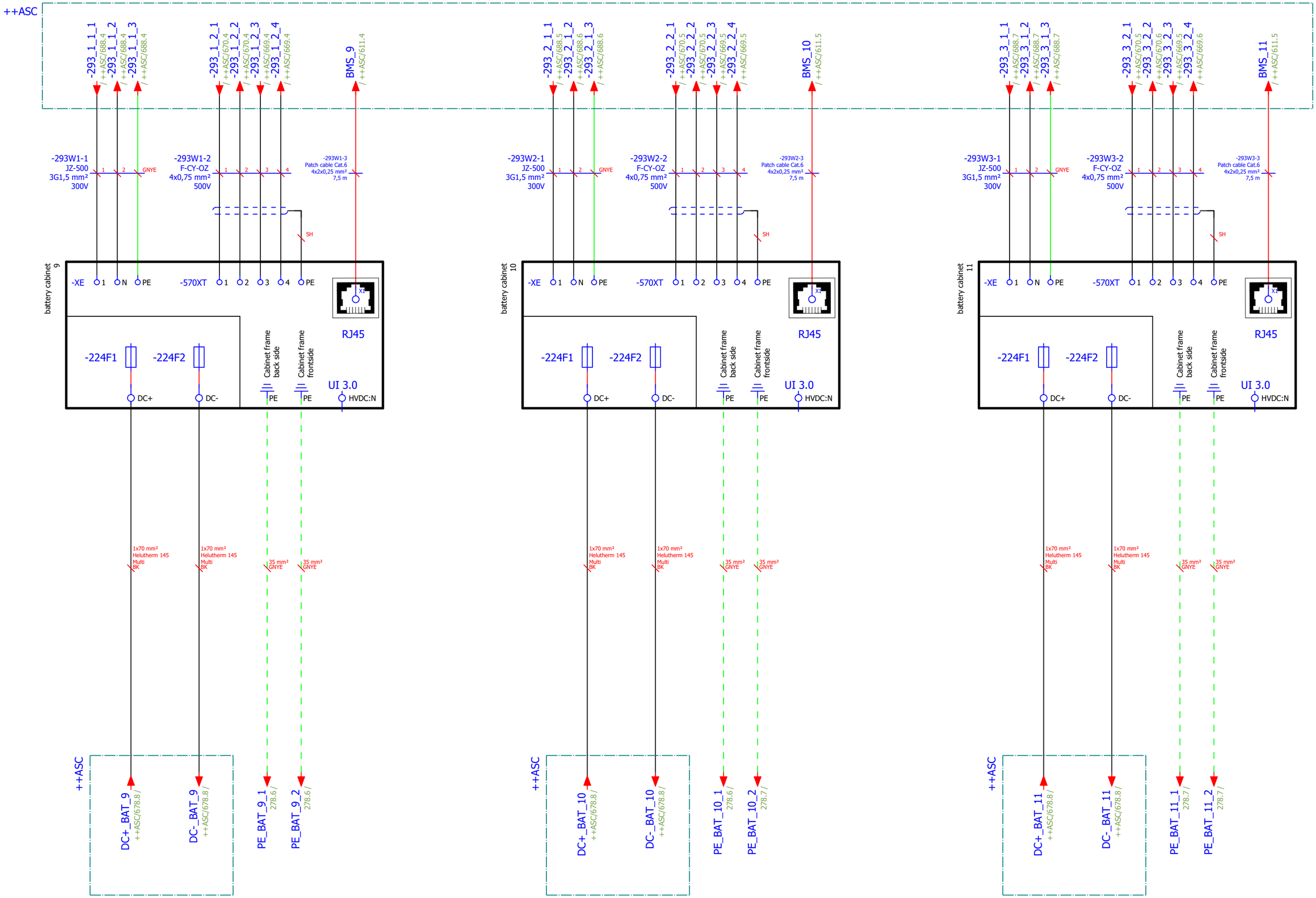
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 4+5	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 291
Date								+	total: 492



previous page: 291

next page: 293

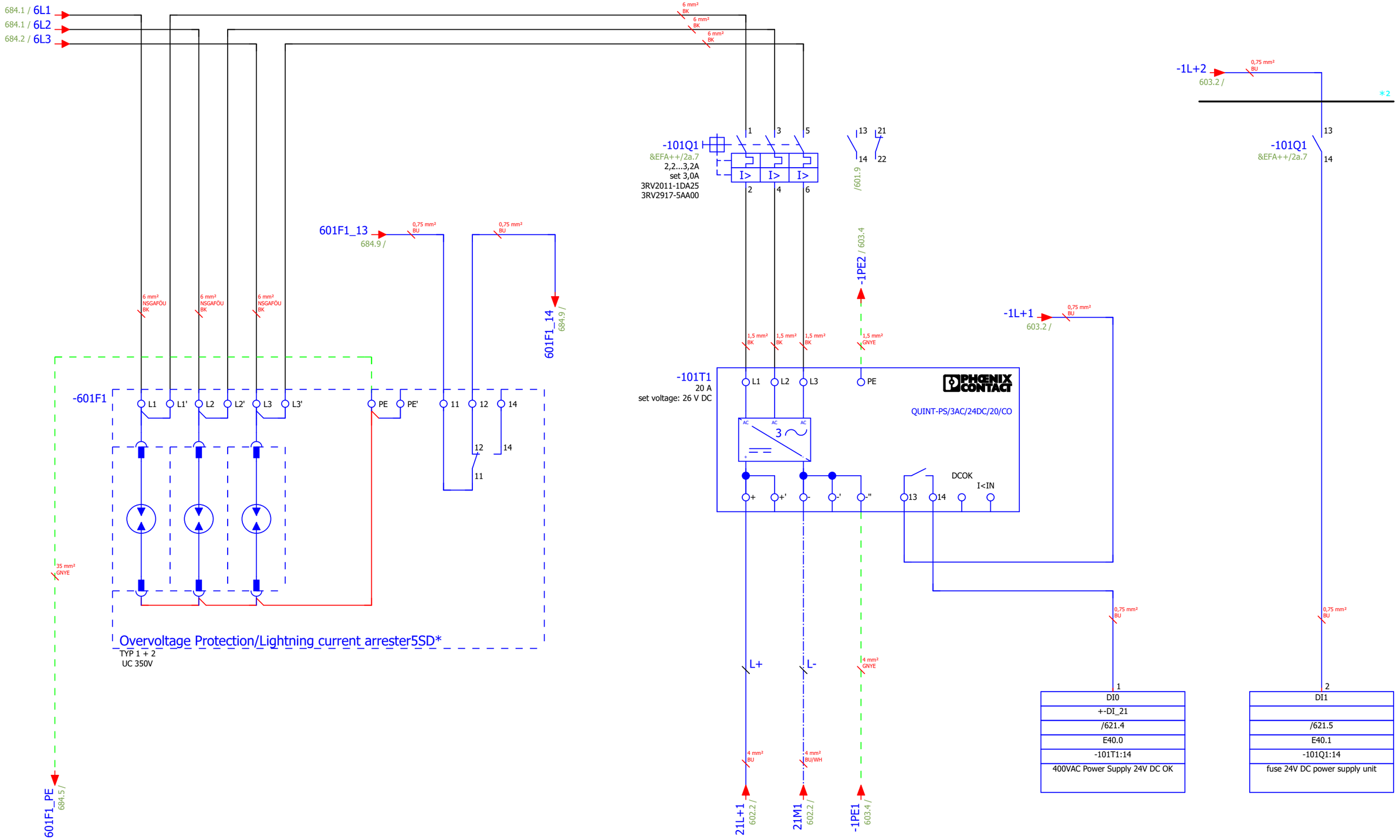
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 6-8	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 292
Date								+ total: 492



previous page: 292

next page: ++ASC/601

Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 9-11	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 293
Date								+ total: 492



previous page:
++Container/293

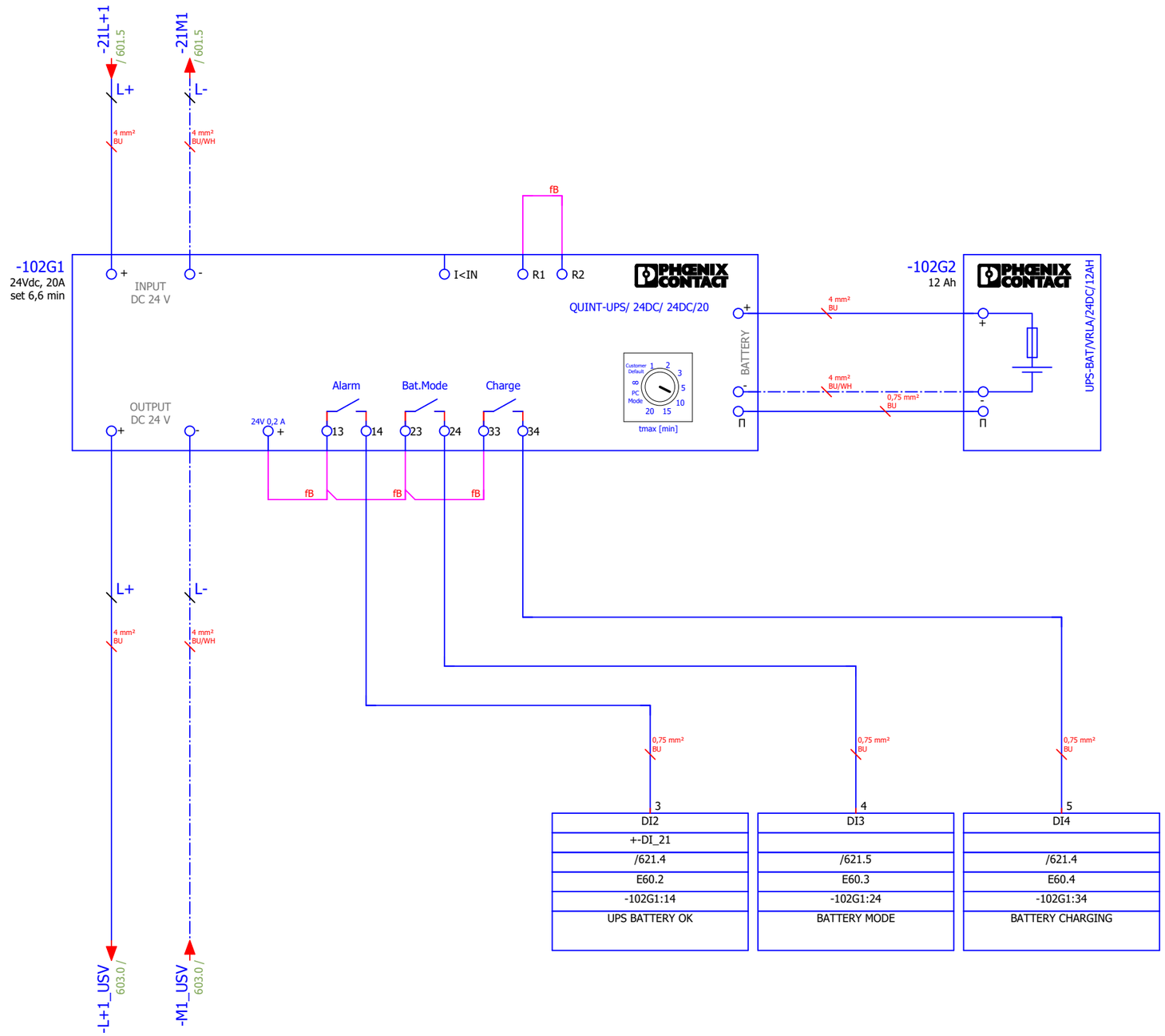
Power supply unit from 400V AC

400VAC
Power Supply
24V DC OK

fuse
24V DC power supply unit

next page:
602

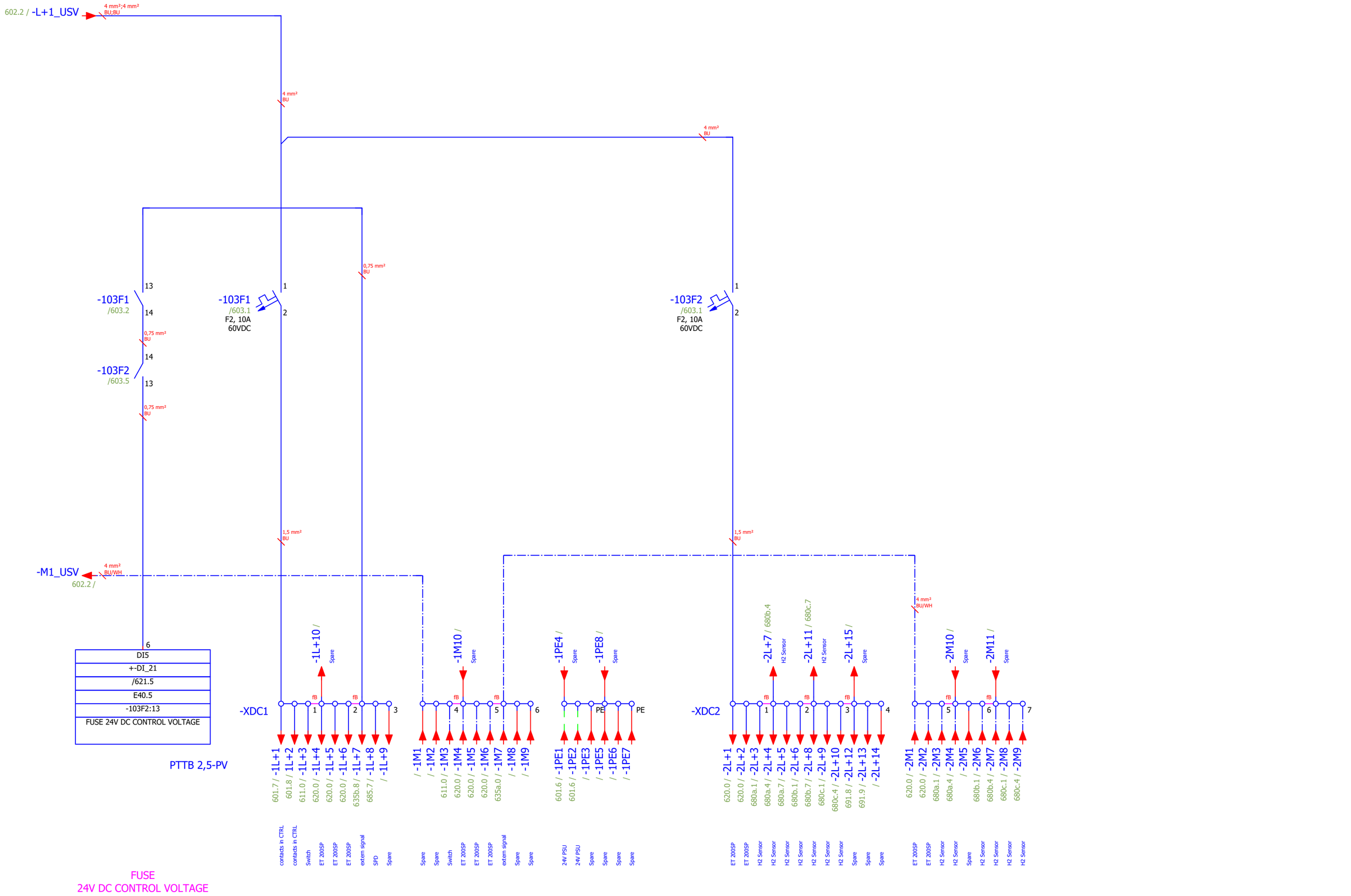
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_03	Battery Container 2
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	page: 601 / total: 492



previous page:
601

next page:
603

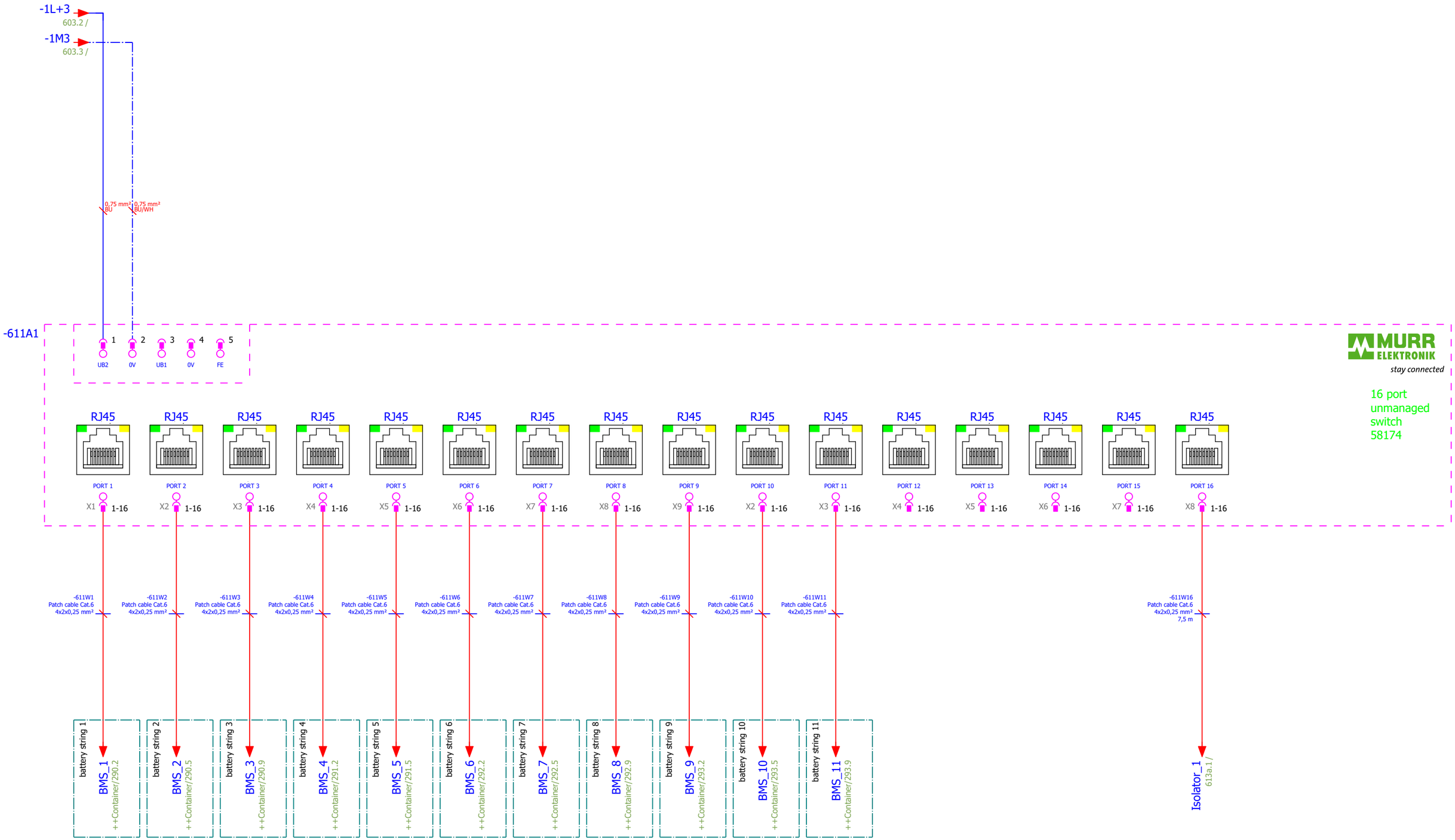
Editor	Freqcon_JD			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 602
Date								+	total: 492



previous page:
602

next page:
611

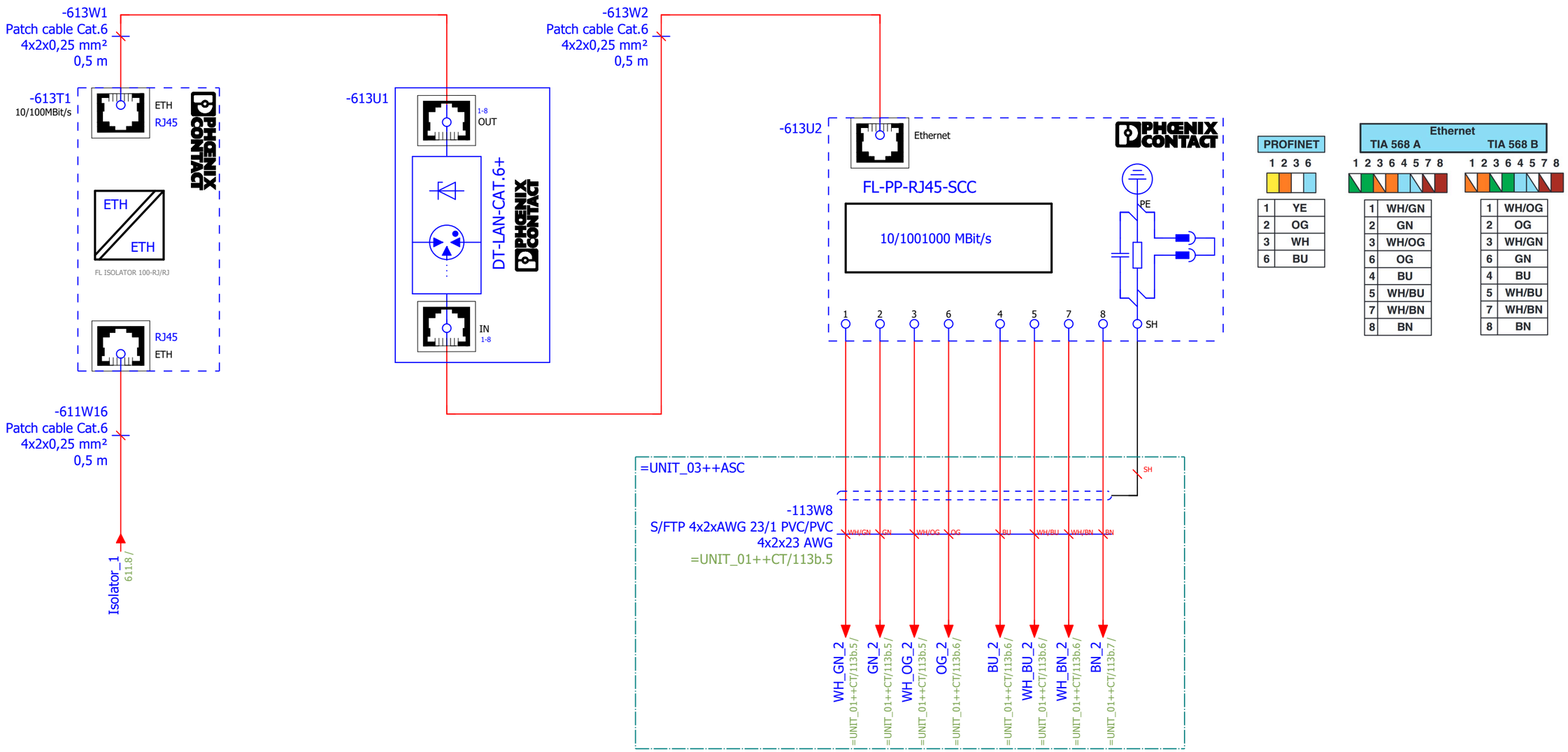
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	10.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxiliary cabinet	page: 603
Date								+	total: 492



previous page: 603

next page: 613a

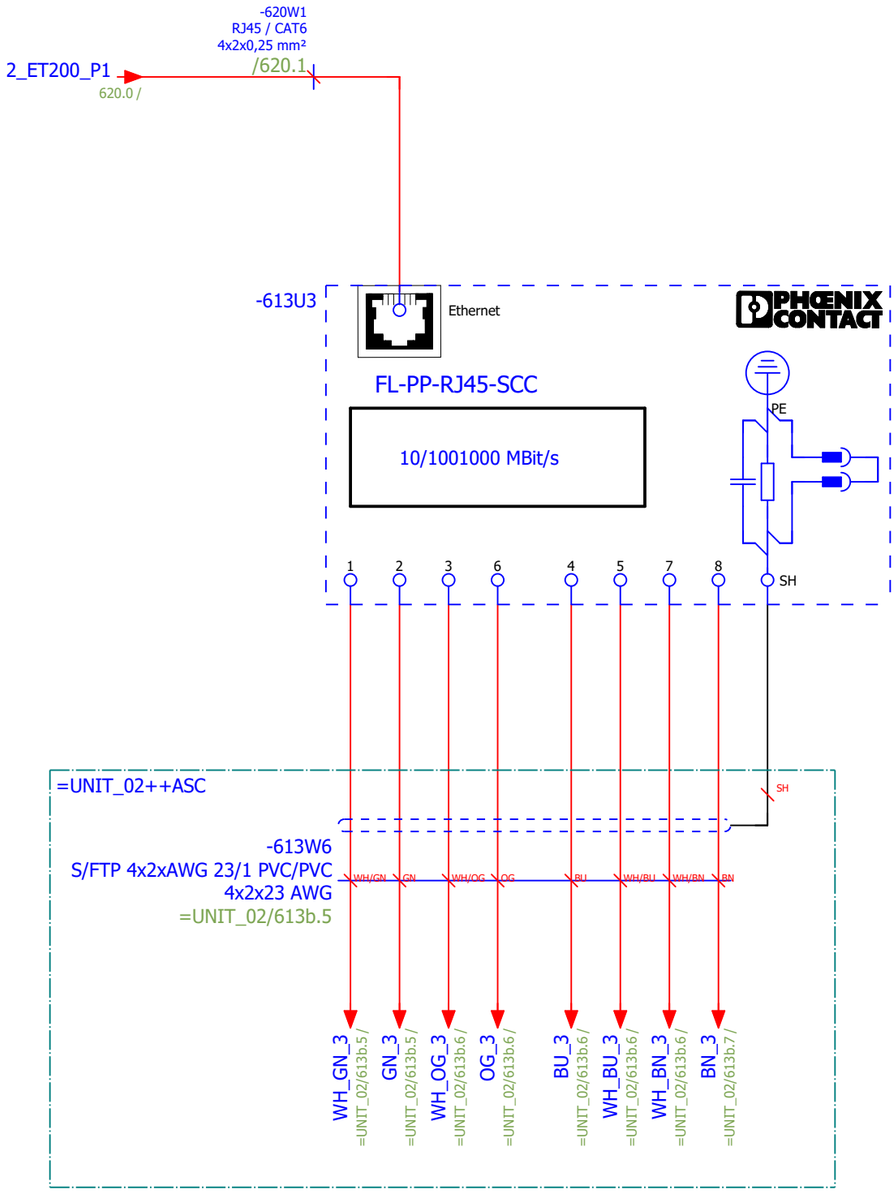
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 492



previous page:
611

next page:
613b

Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	25.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 613a
Date								+	total: 492



PROFINET

1 2 3 6

1	YE
2	OG
3	WH
6	BU

Ethernet

TIA 568 A

1 2 3 6 4 5 7 8

1	WH/GN
2	GN
3	WH/OG
6	OG
4	BU
5	WH/BU
7	WH/BN
8	BN

TIA 568 B

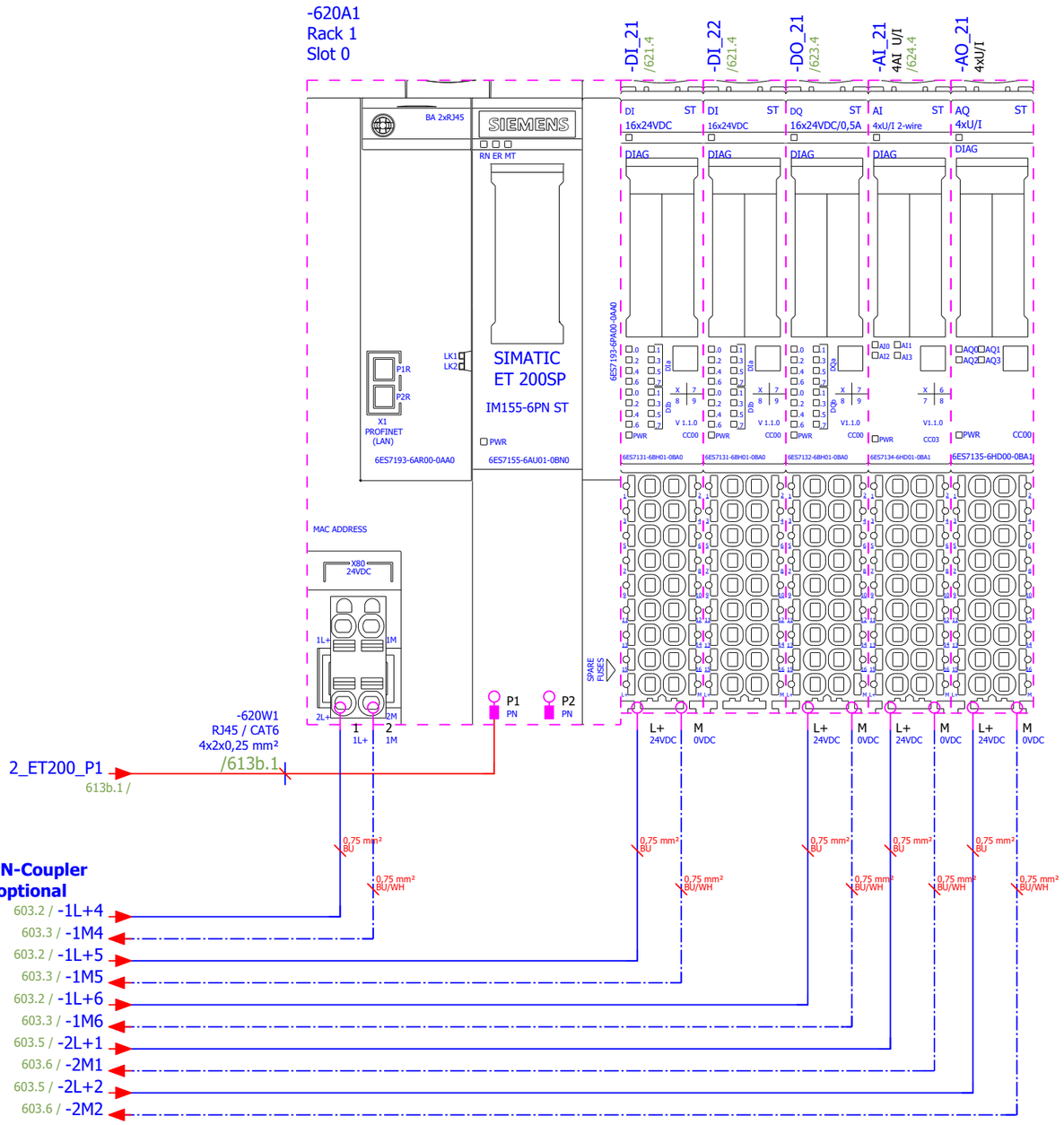
1 2 3 6 4 5 7 8

1	WH/OG
2	OG
3	WH/GN
6	GN
4	BU
5	WH/BU
7	WH/BN
8	BN

previous page:
613a

next page:
620

Editor	Freqcon_DG			Statron	FREQCON	PROFINET	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613b
Date								+		total: 492



previous page:
613b

next page:
621

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC ASC	20250805_V2.0	= UNIT_03	Battery Container 2
Date	25.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 620
total: 492

-DI_21

/620.3

400VAC Power Supply 24V DC OK	/601.7	DI0	1	E60.0	E60.1	2	DI1	/601.9	fuse 24V DC power supply unit
UPS BATTERY OK	/602.5	DI2	3	E60.2	E60.3	4	DI3	/602.6	BATTERY MODE
BATTERY CHARGING	/602.7	DI4	5	E60.4	E60.5	6	DI5	/603.1	FUSE 24V DC CONTROL VOLTAGE
Gassensor OK BAT 1-4	/680a.7	DI6	7	E60.6	E60.7	8	DI7	/680b.7	Gassensor OK BAT 5-8
Gassensor OK BAT 9-11	/680c.7	DI8	9	E61.0	E61.1	10	DI9	/635b.8	Shut-down to BESS
FUSE AND LIGHTNING PROTECTION	/684.9	DI10	11	E61.2	E61.3	12	DI11	/691.8	Fuse Exhaust Unit
Fuse Cooling Units	/691.9	DI12	13	E61.4	E61.5	14	DI13		
		DI14	15	E61.6	E61.7	16	DI15		
	/620.3	24VDC	L+			M	0VDC	/620.3	

-DI_22

/620.3

DI0	1	E62.0	E62.1	2	DI1
DI2	3	E62.2	E62.3	4	DI3
DI4	5	E62.4	E62.5	6	DI5
DI6	7	E62.6	E62.7	8	DI7
DI8	9	E63.0	E63.1	10	DI9
DI10	11	E63.2	E63.3	12	DI11
DI12	13	E63.4	E63.5	14	DI13
DI14	15	E63.6	E63.7	16	DI15
24VDC	L+			M	0VDC

previous page: 620

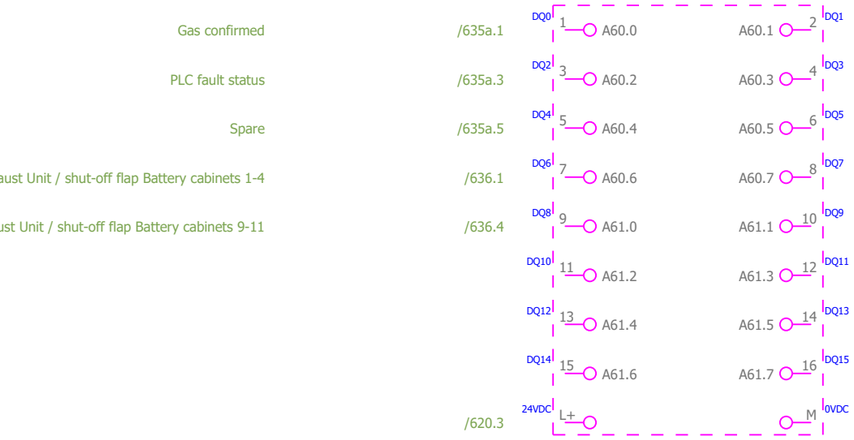
next page: 623

Editor	Freqcon_DG			Statron		ET200SP DIGITAL INPUTS DI_21 + DI_22	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	03.12.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 621
Date								+		total: 492

0	1	2	3	4	5	6	7	8	9

-DO_21

/620.3



Gas confirmed	/635a.1				/635a.2	Smoke confirmed
PLC fault status	/635a.3				/635a.4	Thermal runaway
Spare	/635a.5				/635a.6	Spare
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4	/636.1				/636.2	230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11	/636.4					
	/620.3				/620.4	

previous page: 621

next page: 624

Editor	Freqcon_JD			Statron		ET200SP DIGITAL OUTPUTS DO_21	20250805_V2.0	= UNIT_03	Battery Container 2
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

-AI_21

/620.4



gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

/620.4

/680b.2 gas concentration BAT 5-8

/680b.2 gas concentration BAT 5-8

/620.4

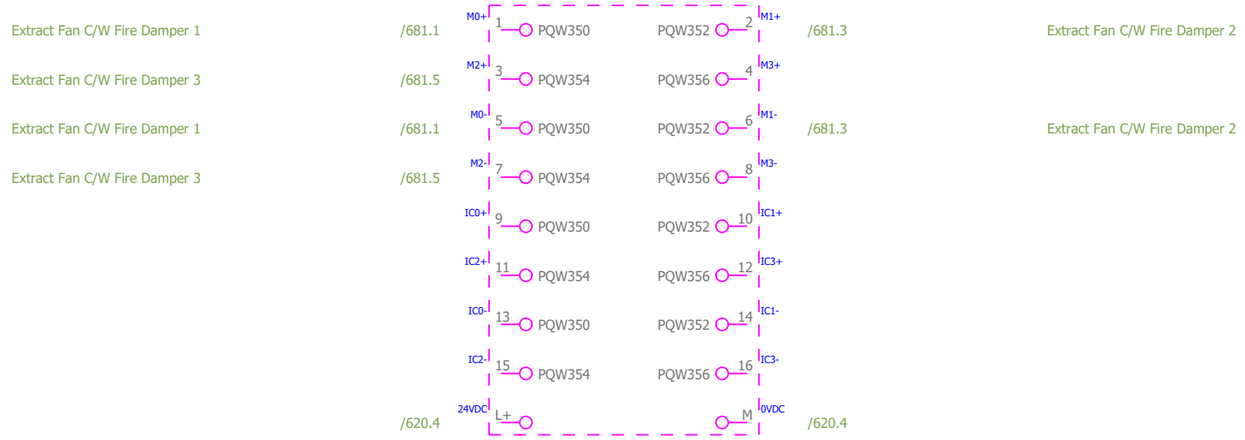
previous page: 623

next page: 625

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_21	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 624
Date								+	total: 492

-AO_21

/620.4



previous page: 624

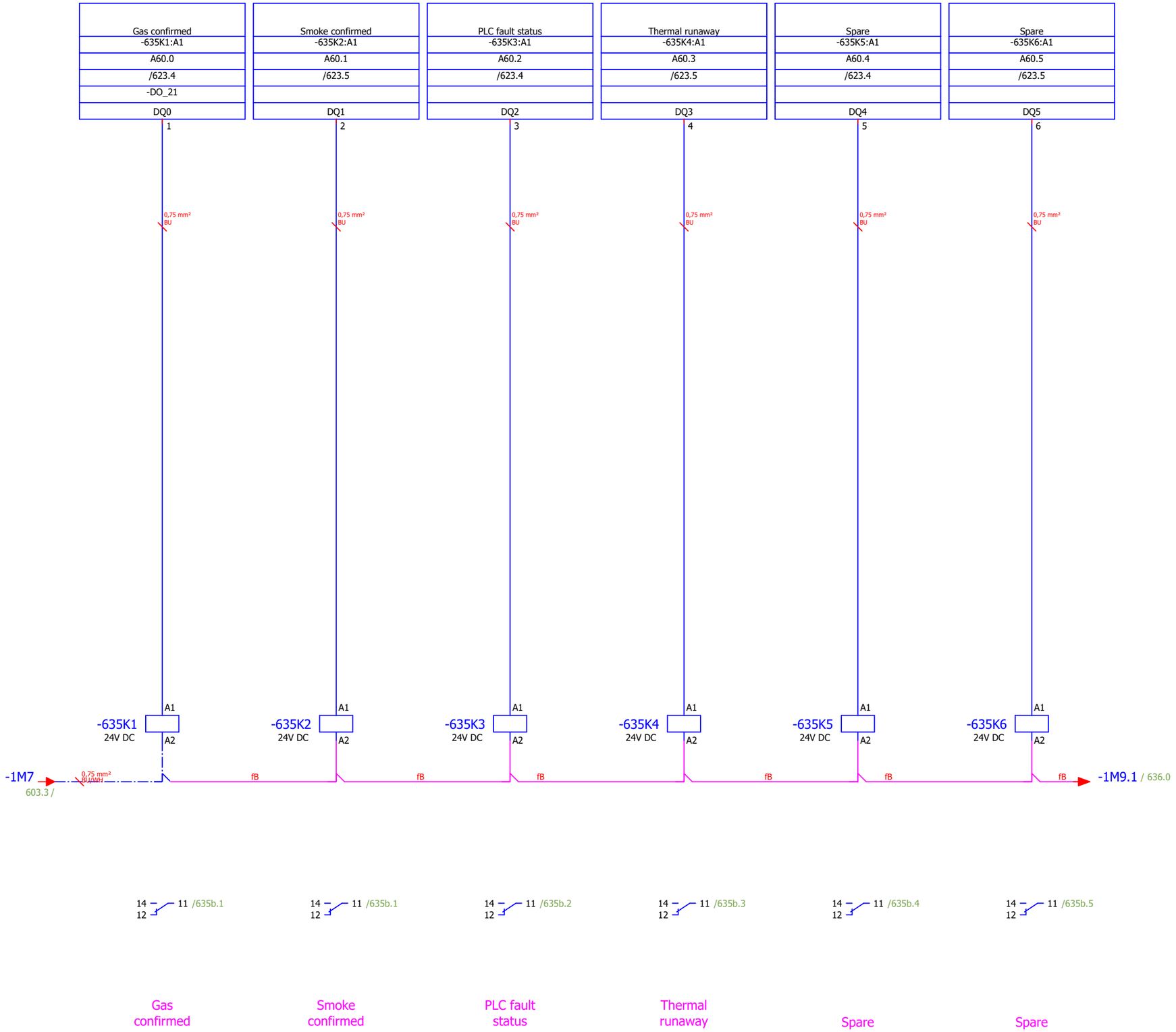
next page: 635a

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG OUTPUTS AO_21	20250805_V2.0	= UNIT_03	Battery Container 2
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 625

total: 492

0	1	2	3	4	5	6	7	8	9



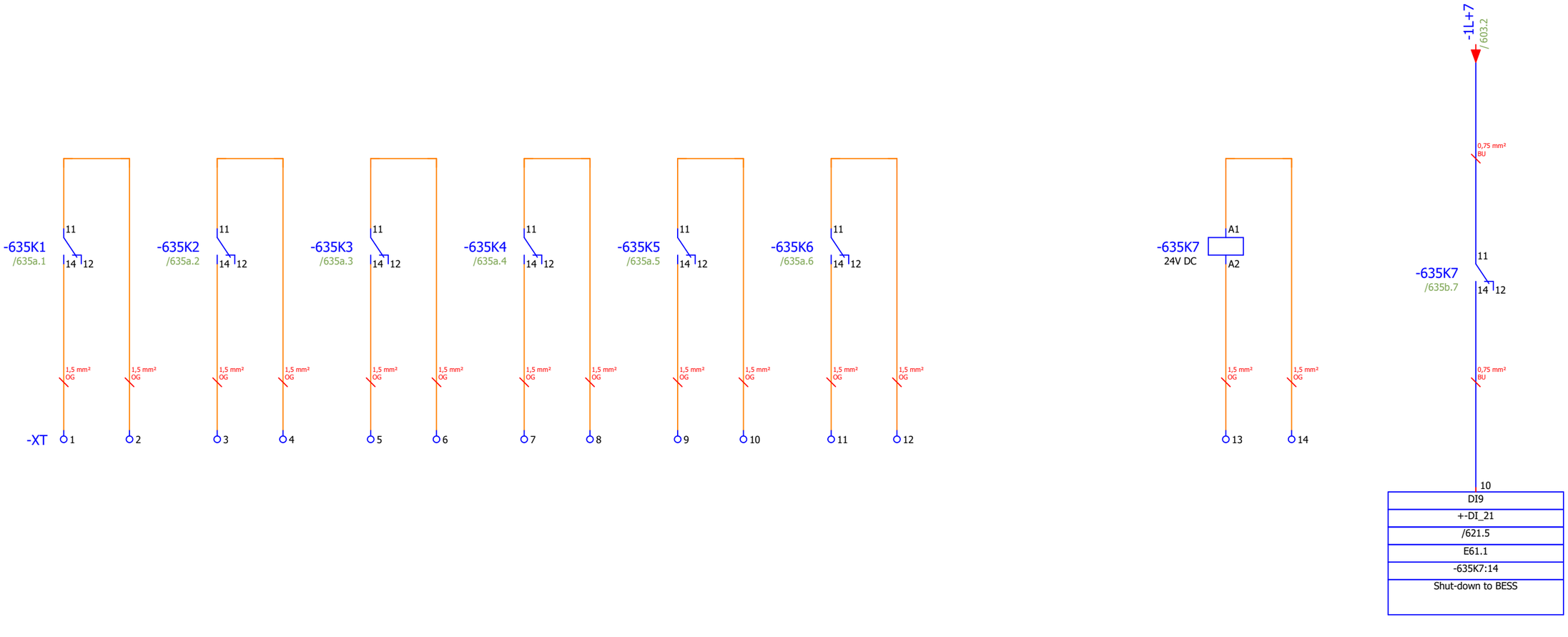
previous page: 625

next page: 635b

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 635a

total: 492



Gas confirmed FGS

Smoke confirmed FGS

PLC fault status SIS

Thermal runaway SIS

Spare

Spare

Shut-down to BESS

Shut-down to BESS

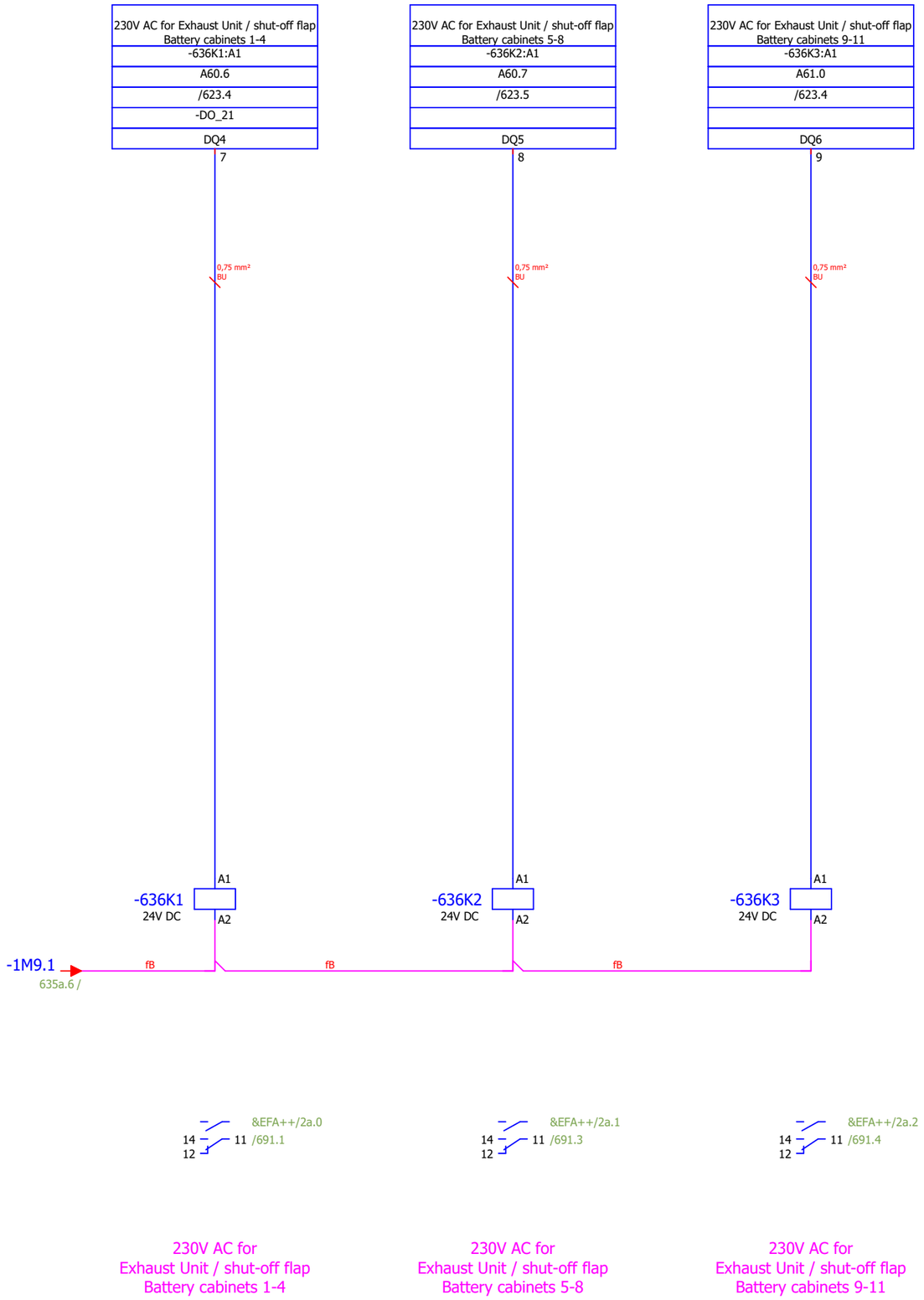
previous page: 635a

next page: 636

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 635b

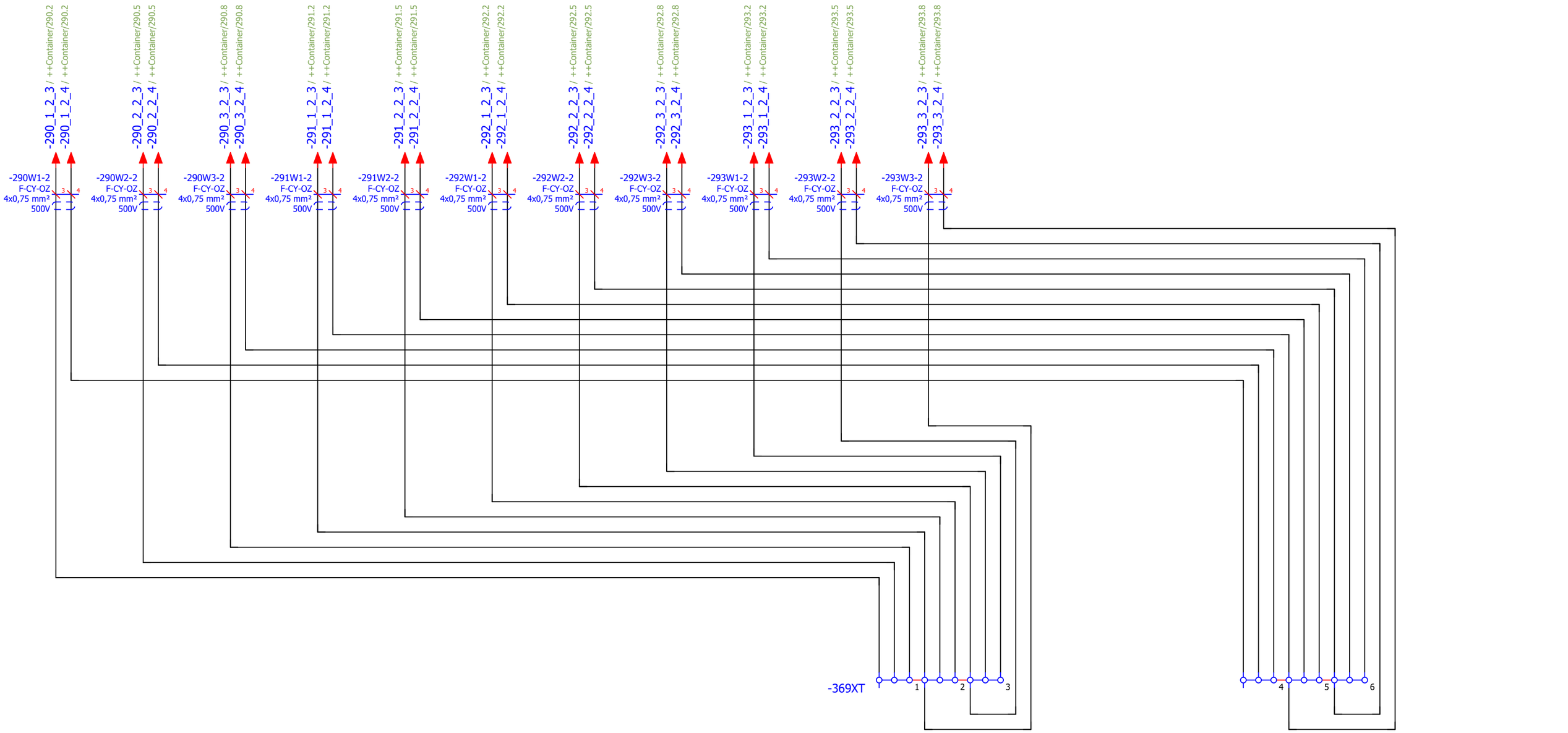
total: 492



previous page:
635b

next page:
669

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FIRE DAMPER	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 636
Date								+	total: 492



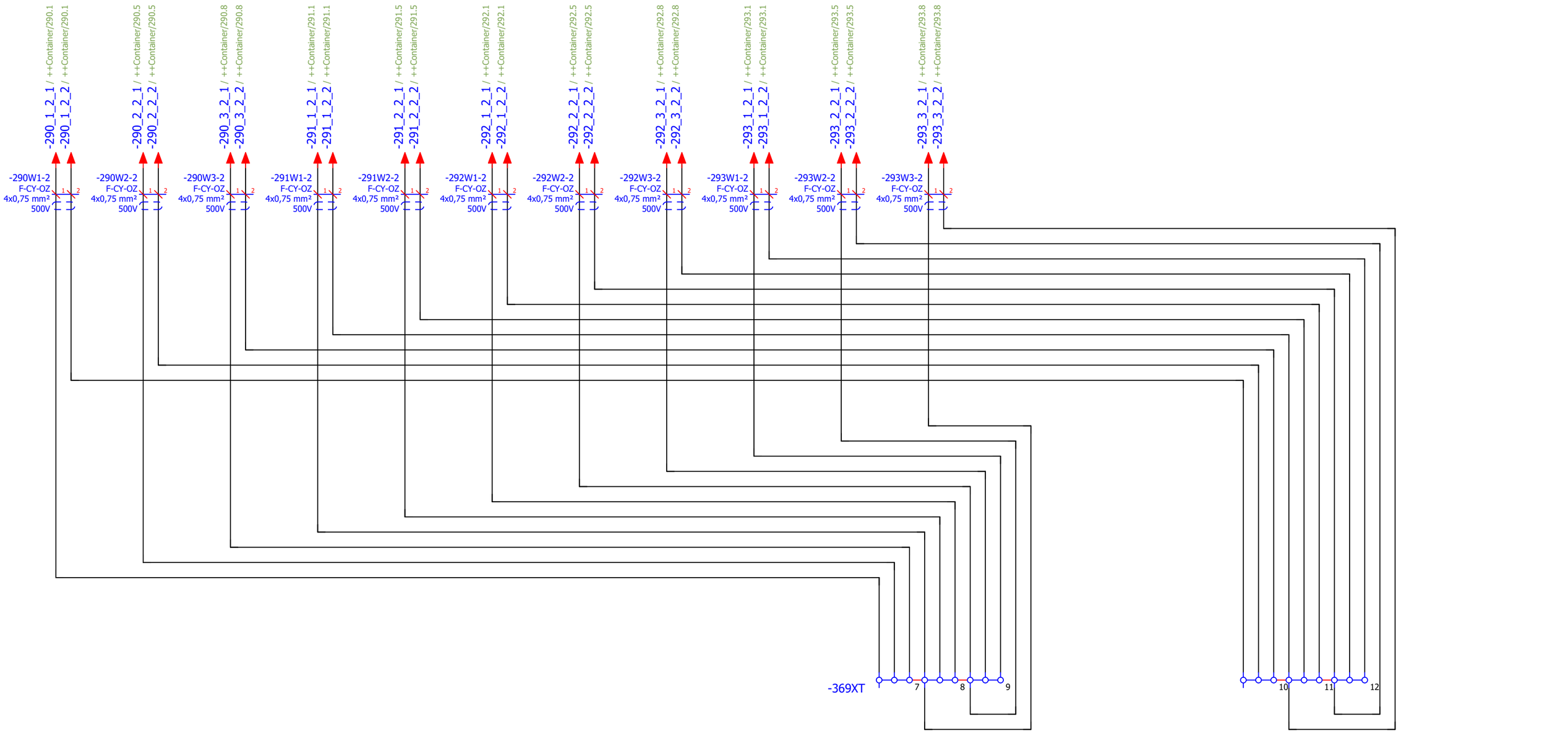
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page: 636

next page: 670

Editor	Freqcon_JD			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 492



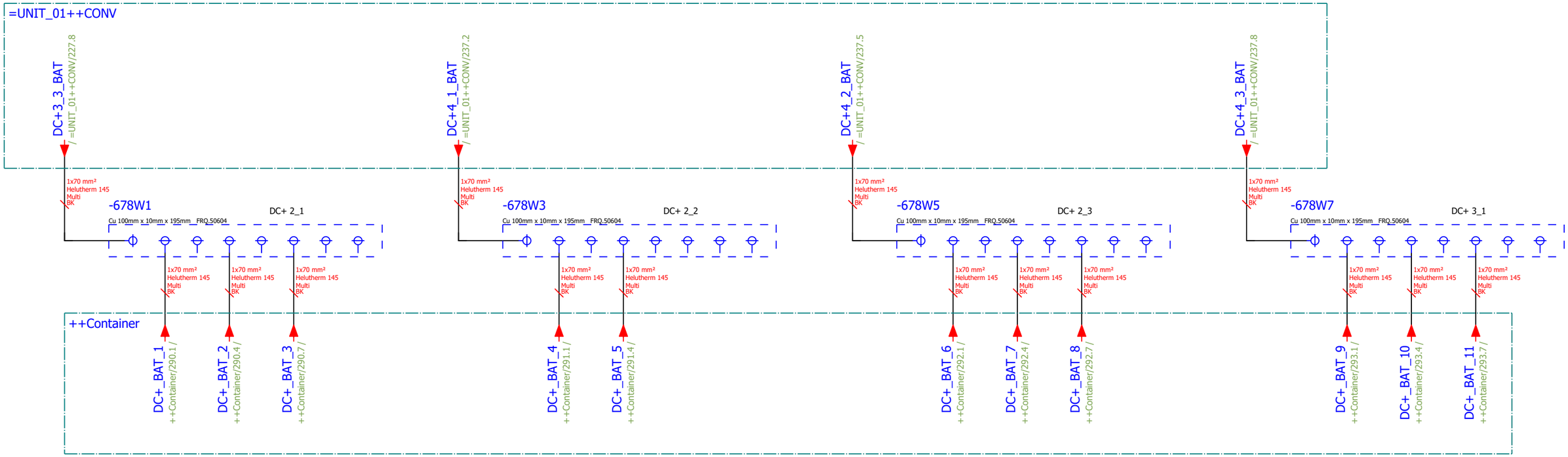
battery cabinet gas
potential-free contacts
customer

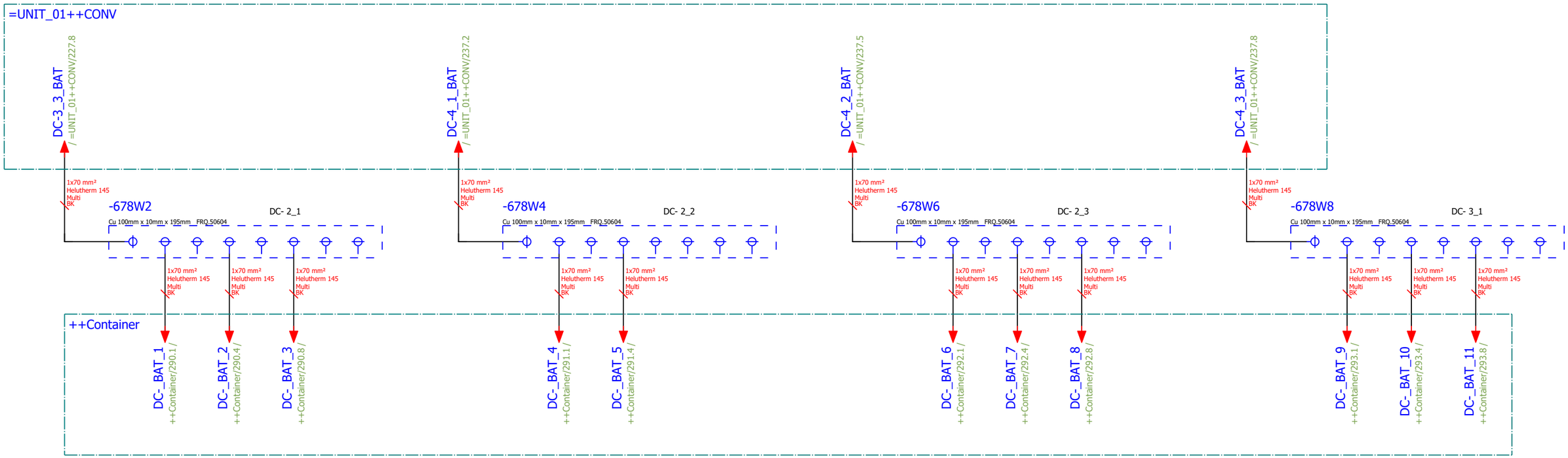
battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
678

Editor	Freqcon_JD			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 492





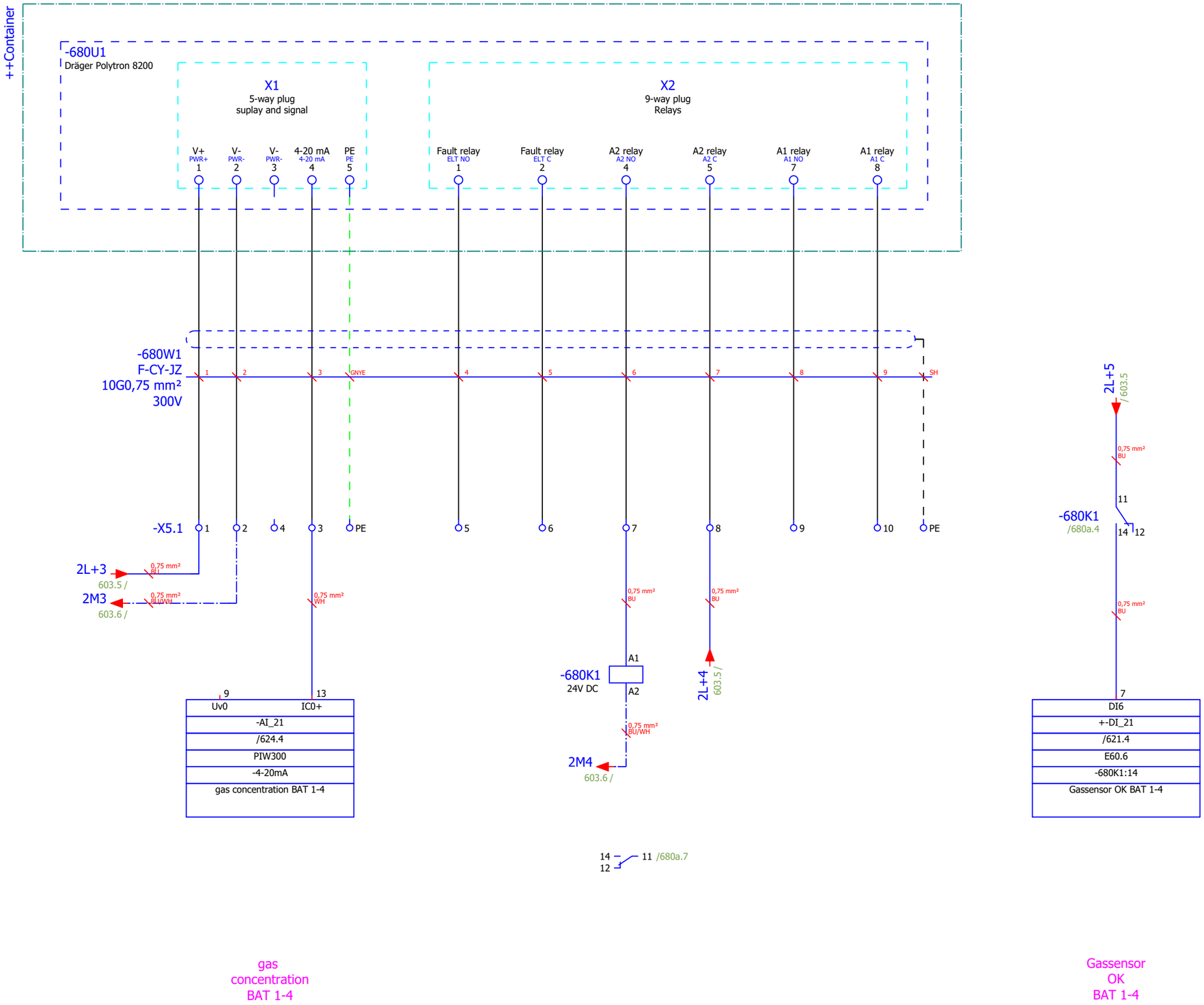
previous page: 670

next page: 680a

Editor	Freqcon_JD			Statron	FREQCON	DC BATTERY CABINETS	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 678

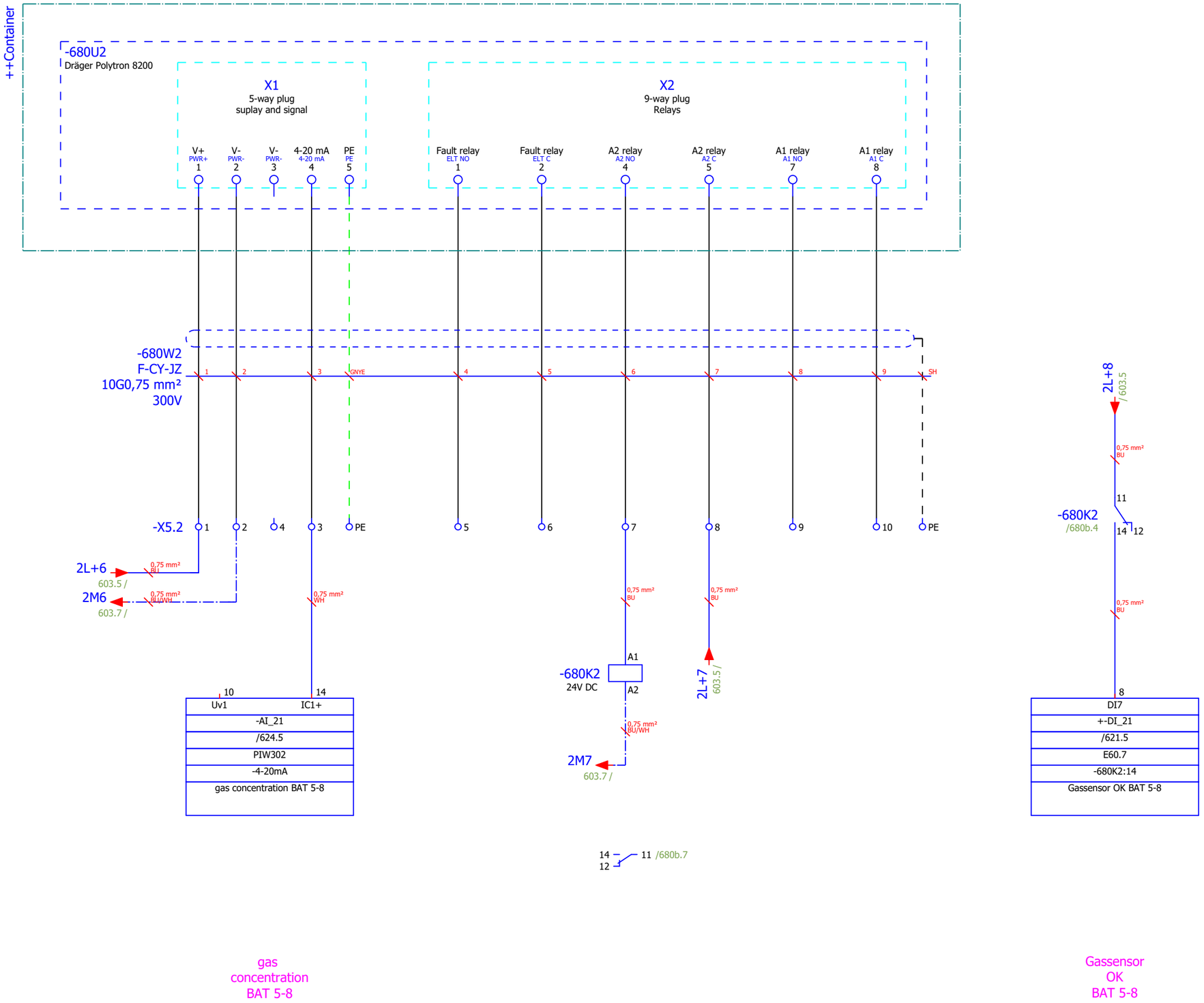
total: 492



previous page: 678

next page: 680b

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 1-4	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680a
Date								+	total: 492



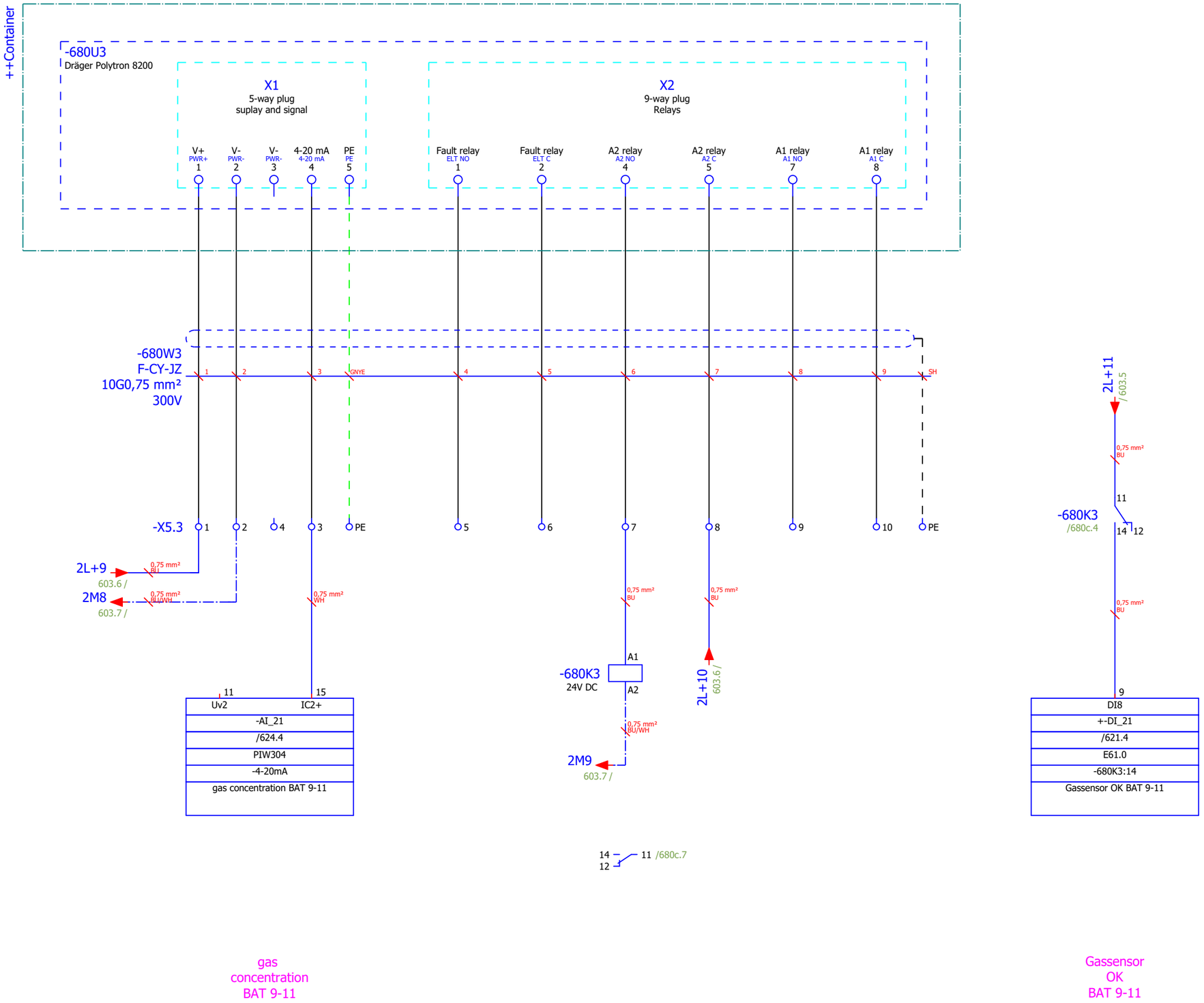
gas concentration BAT 5-8

Gassensor OK BAT 5-8

previous page: 680a

next page: 680c

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 5-8	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 680b
Date								+ — total: 492



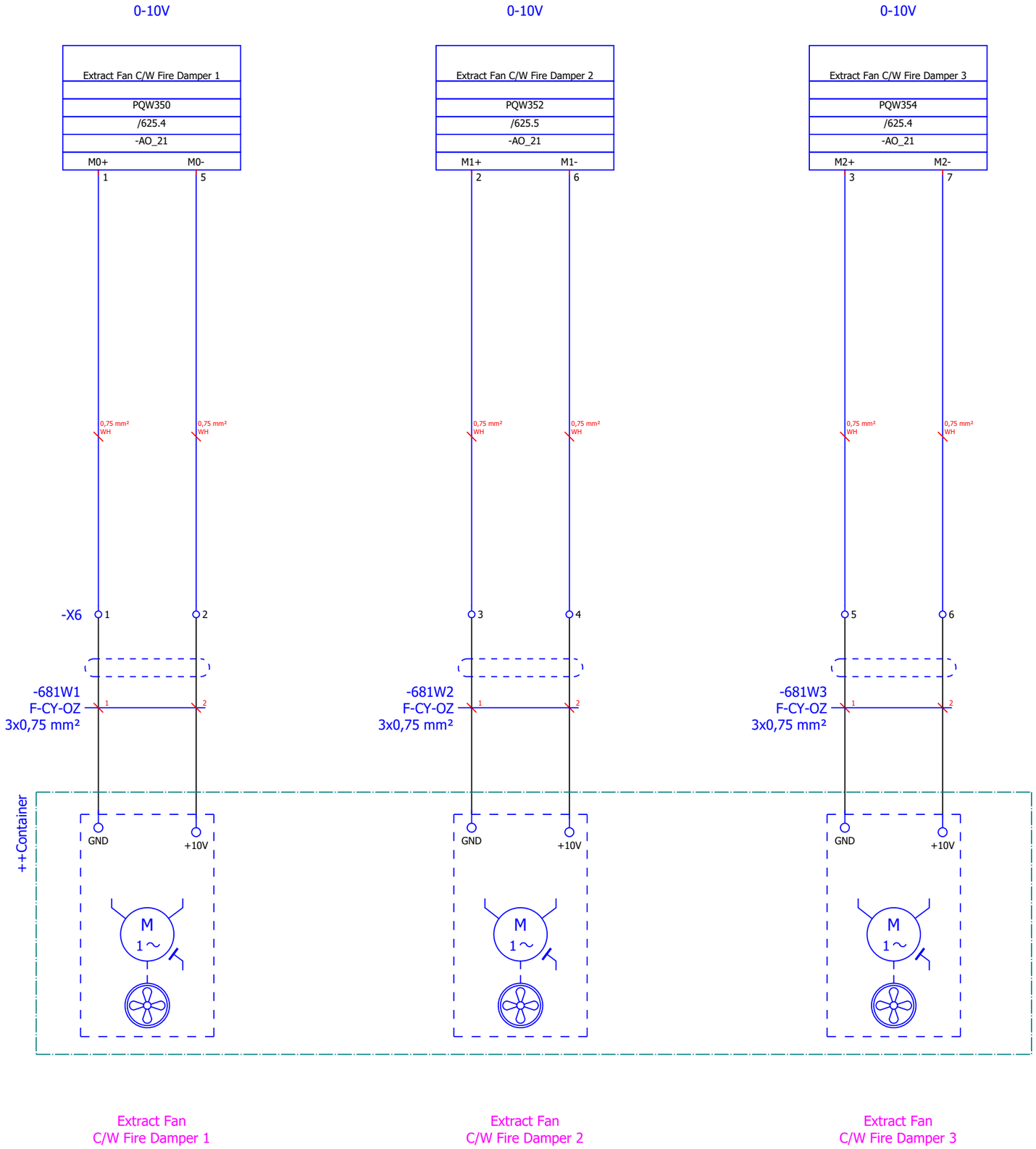
gas concentration BAT 9-11

Gassensor OK BAT 9-11

previous page: 680b

next page: 681

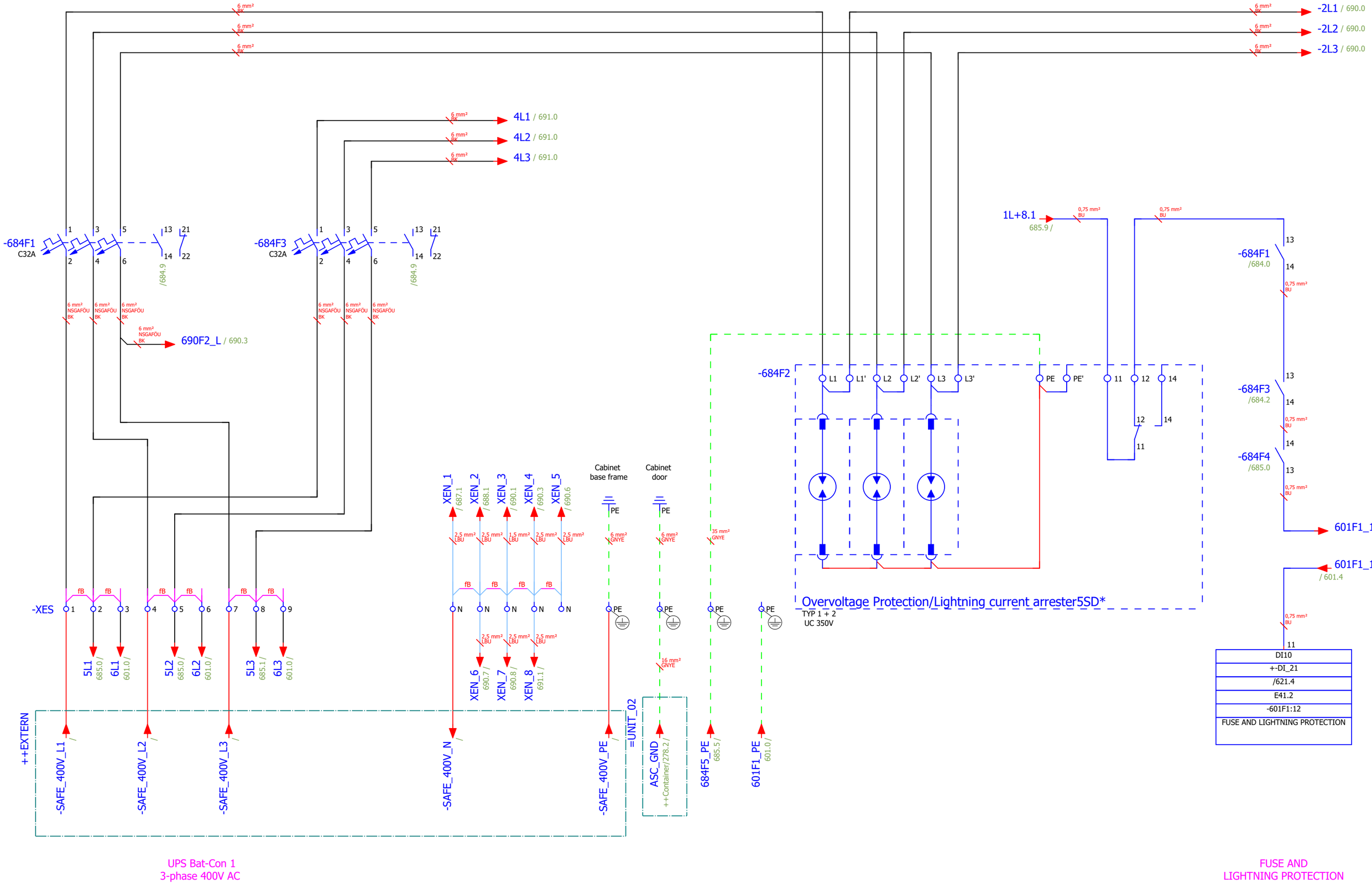
Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 9-11	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680c
Date								+	total: 492



previous page: 680c

next page: 684

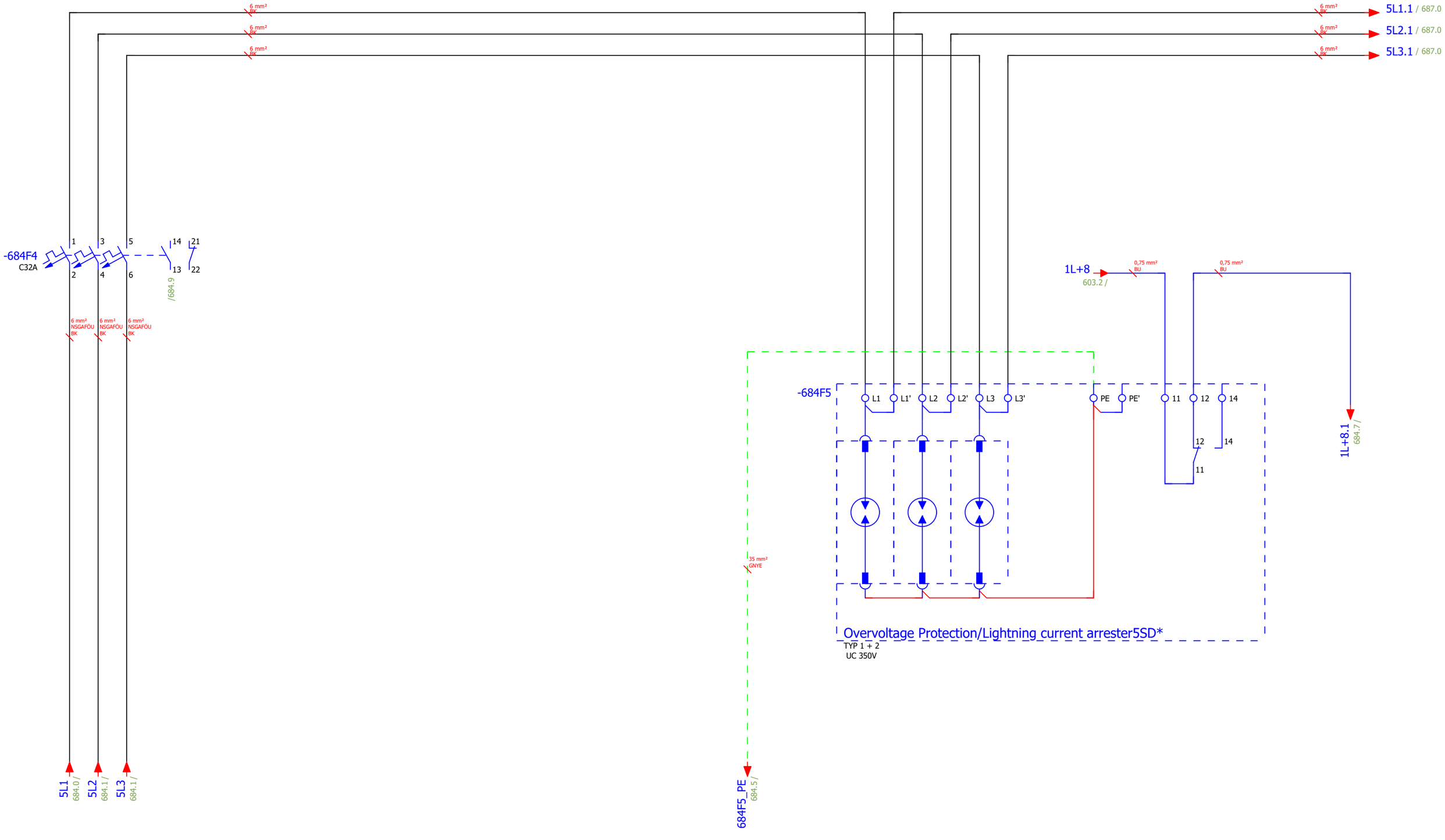
Editor	Freqcon_JD			Statron	FREQCON	EXTRACT FAN FIRE DAMPER	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 681
Date								+	total: 492



previous page: 681

next page: 685

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	22.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 684
Date								+	total: 492

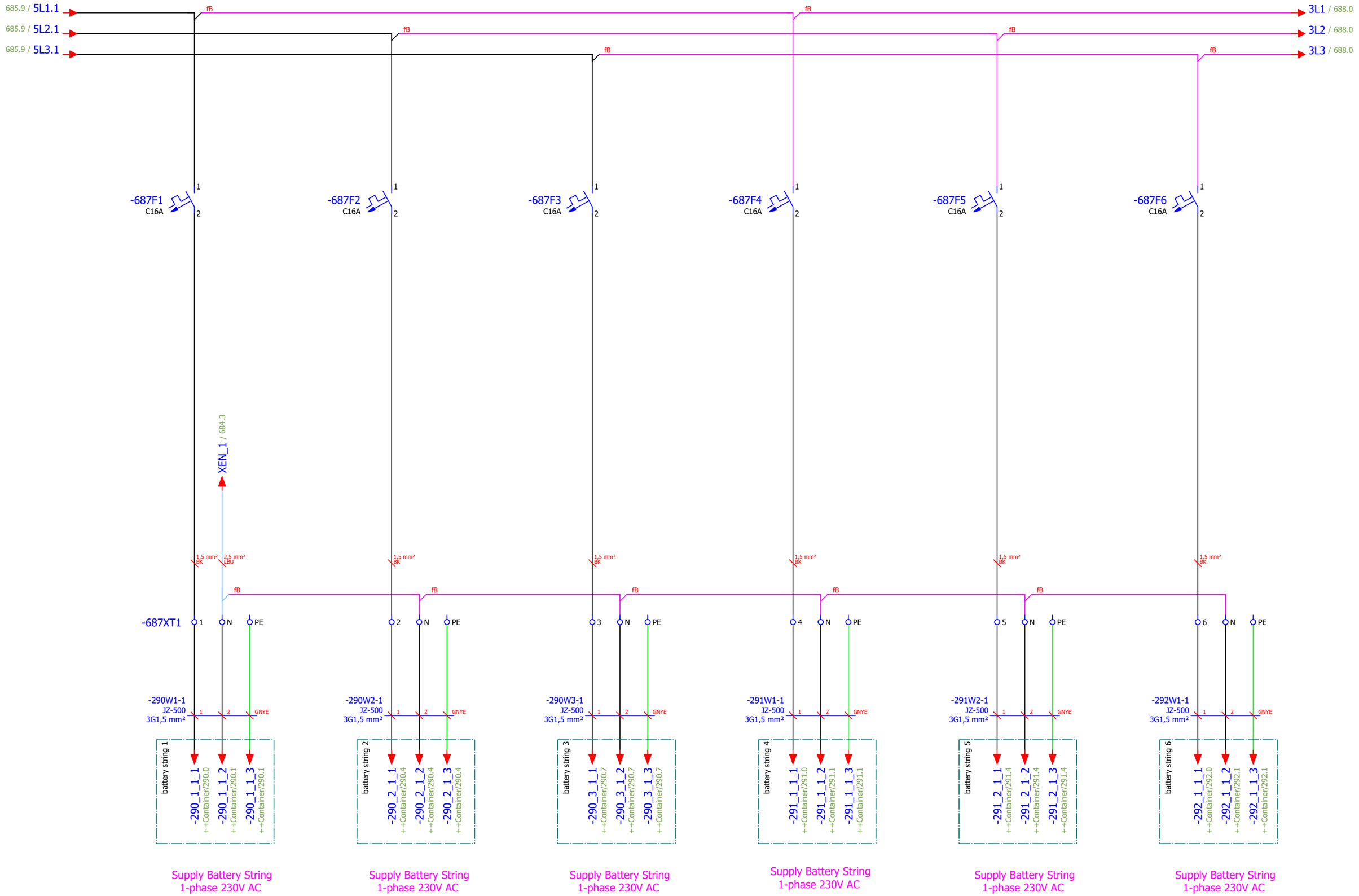


FUSE AND
LIGHTNING PROTECTION

previous page: 684

next page: 687

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 685
Date								+	total: 492



previous page: 685

next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 492

687.9 / 3L1
687.9 / 3L2
687.9 / 3L3

fB

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

XEN_2 / 684.3

1,5 mm² BK
2,5 mm² LBU

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

GNYE

battery string 7
-292_2_1_1 ++Container/292.4
-292_2_1_2 ++Container/292.4
-292_2_1_3 ++Container/292.4

battery string 8
-292_3_1_1 ++Container/292.7
-292_3_1_2 ++Container/292.7
-292_3_1_3 ++Container/292.7

battery string 9
-293_1_1_1 ++Container/293.0
-293_1_1_2 ++Container/293.1
-293_1_1_3 ++Container/293.1

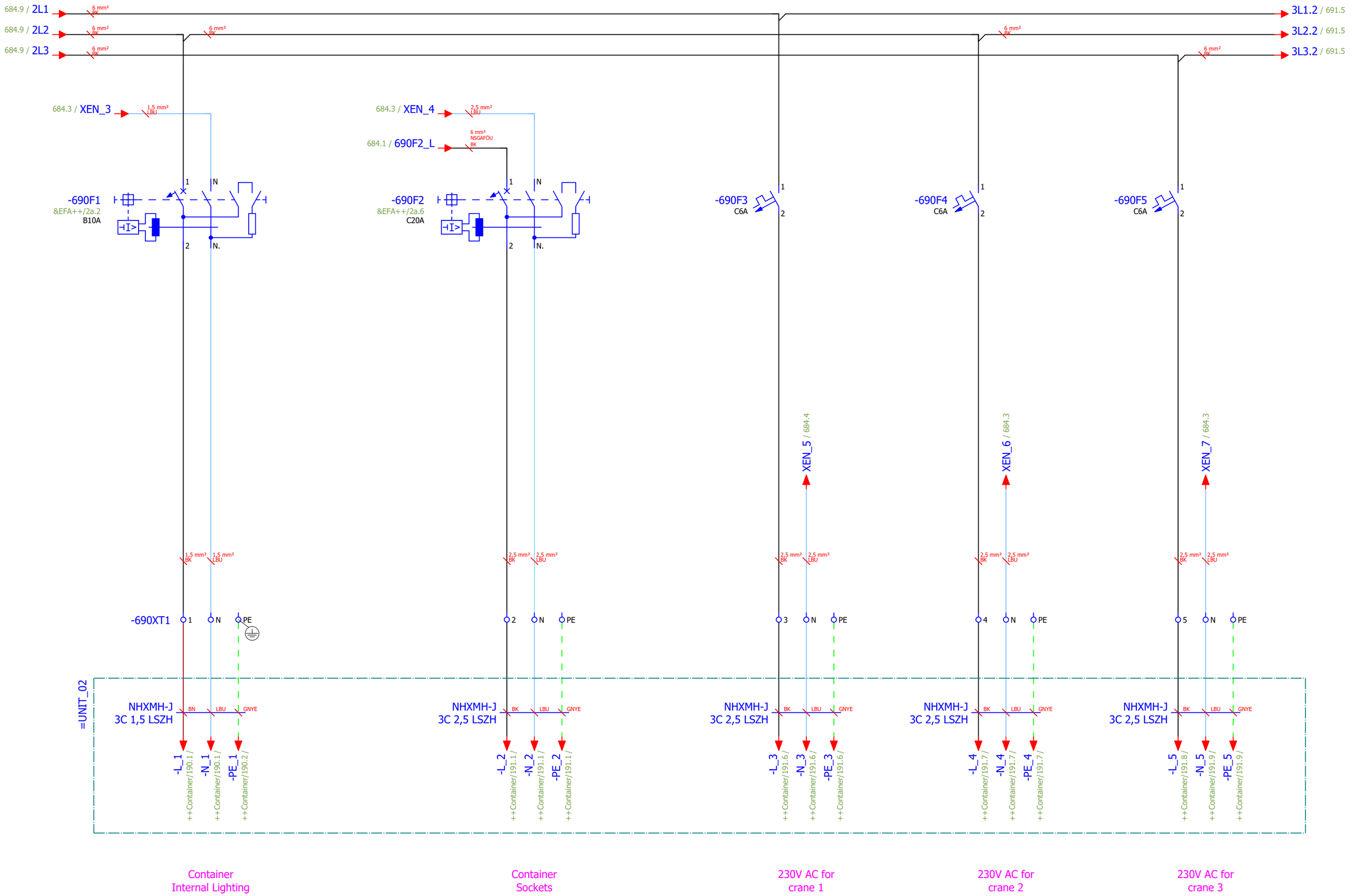
battery string 10
-293_2_1_1 ++Container/293.4
-293_2_1_2 ++Container/293.4
-293_2_1_3 ++Container/293.4

battery string 11
-293_3_1_1 ++Container/293.7
-293_3_1_2 ++Container/293.7
-293_3_1_3 ++Container/293.7

Supply Battery String 1-phase 230V AC

previous page: 687
next page: 690

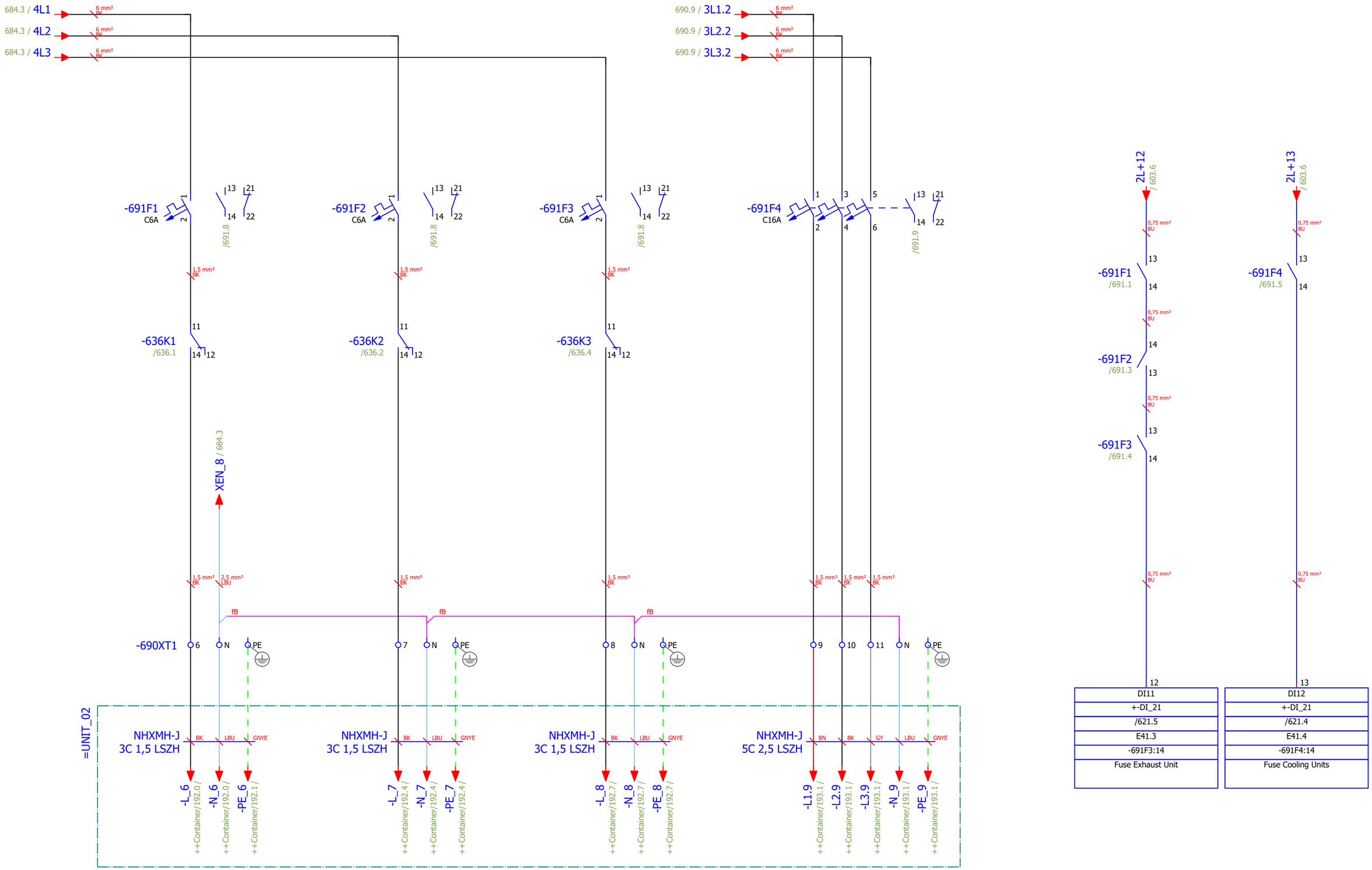
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 492



previous page: 688

next page: 691

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	29.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 690
Date								+	total: 492



previous page:
690

next page:
&EPC++Container/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 691
Date								+		total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-635K1 &EFS/635a.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K1 &EFS/635a.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-635K2 &EFS/635a.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K2 &EFS/635a.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K3 &EFS/635a.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K3 &EFS/635a.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K4 &EFS/635a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K4 &EFS/635a.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K5 &EFS/635a.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K5 &EFS/635a.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K6 &EFS/635a.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K6 &EFS/635a.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K7 &EFS/635b.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.2...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.2...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	

previous page: 2

next page: 4

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.2;&EFS/687.3;&EFS/687.4;&EFS/687.5...&EFS/687.8;&EFS/688;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.8;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	
-XT &EFS/635b.1...&EFS/635b.5;&EFS/635b.7	14	Feed-through terminal block	3209510	Phoenix Contact	500583	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XT &EFS/635b.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT &EFS/635b.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT &EFS/635b.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
7

next page:
&EPA++Container/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 8
Date								+	total: 492

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/8

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
2	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
13	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
9	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

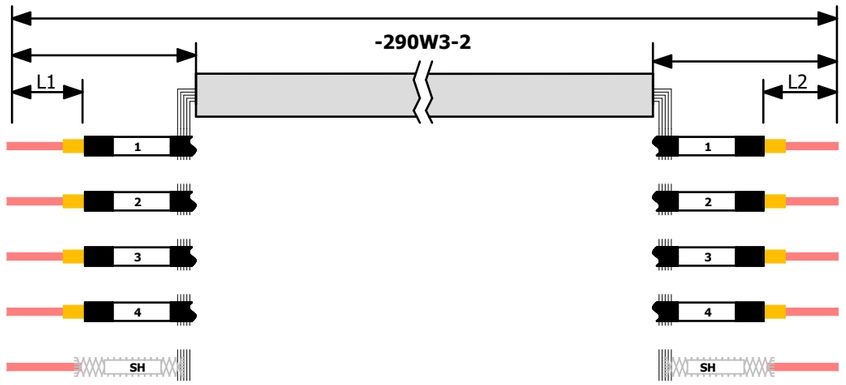
Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

Cable name =UNIT_03++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

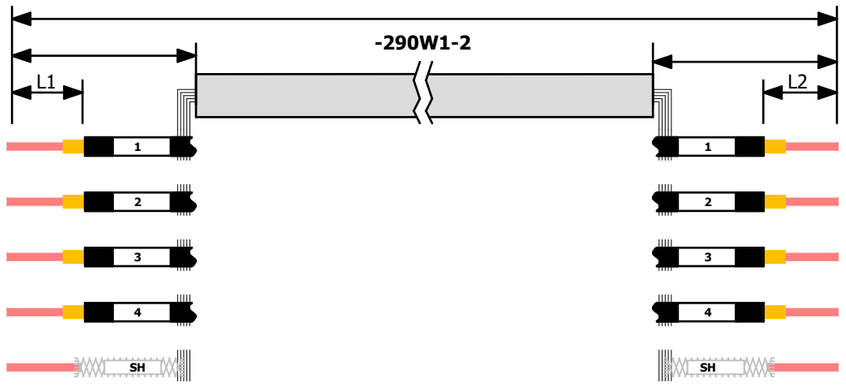


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

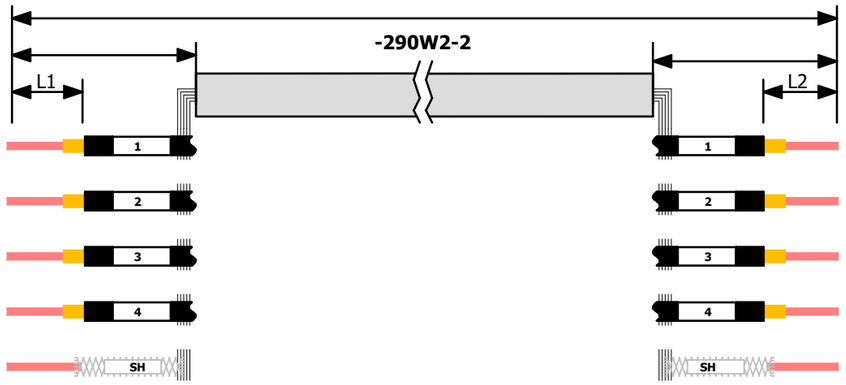


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

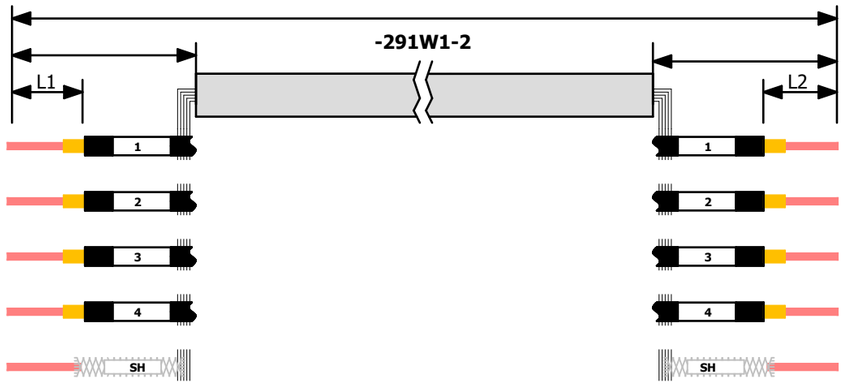
previous page:
&EPA++ASC/2

next page:
2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

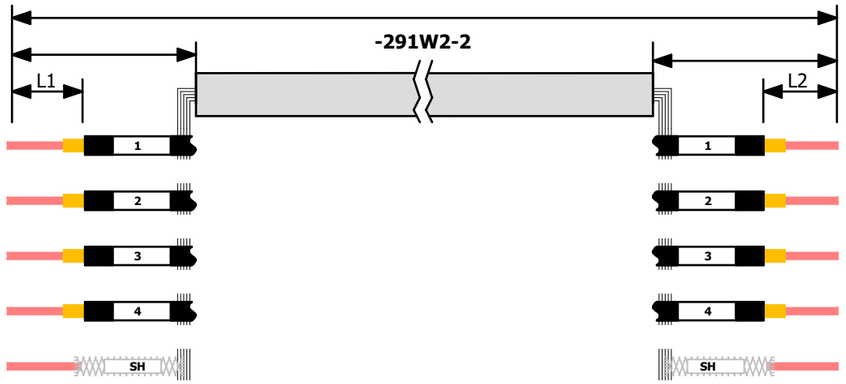


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

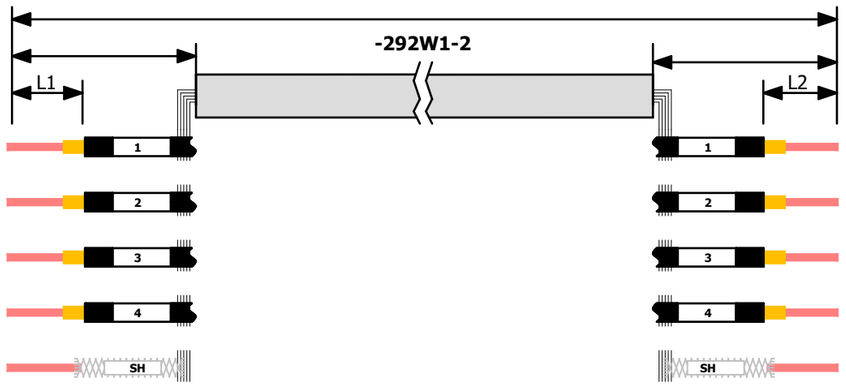


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

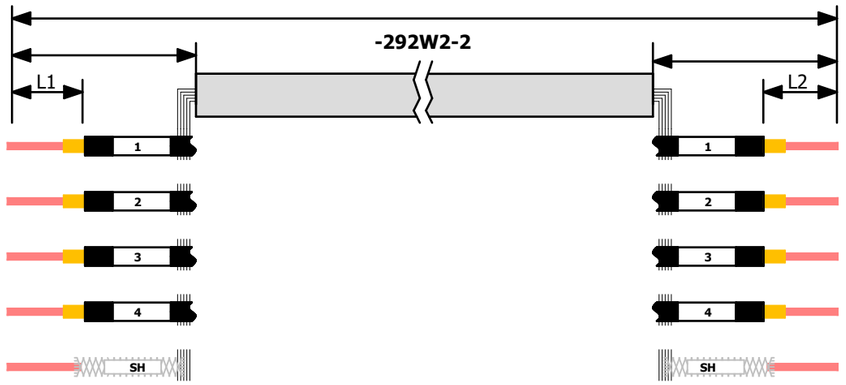
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

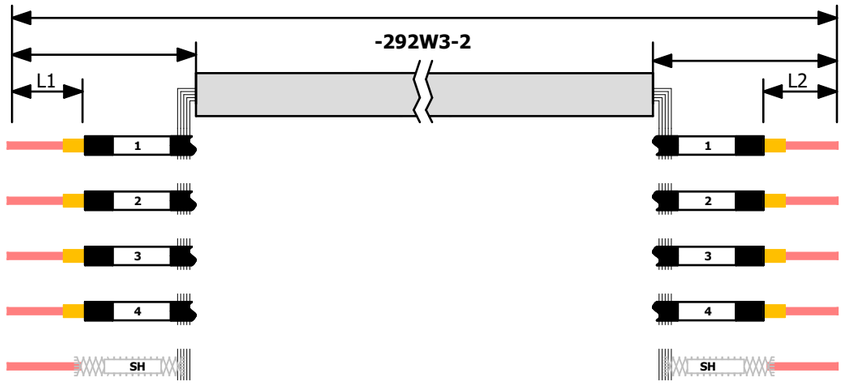


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

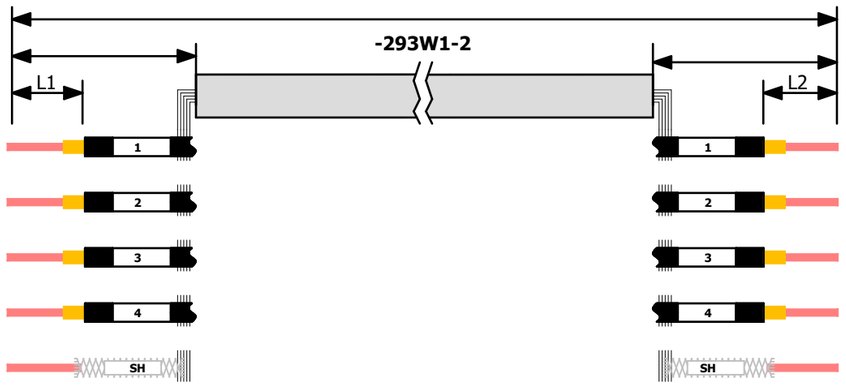


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

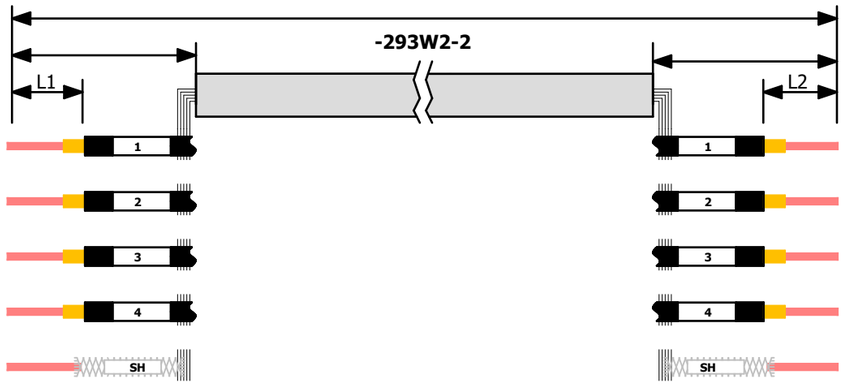
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

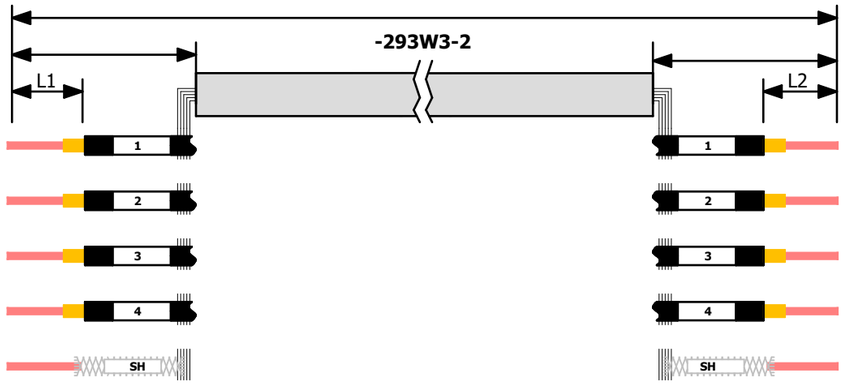


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_03	Battery Container 2
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 4
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

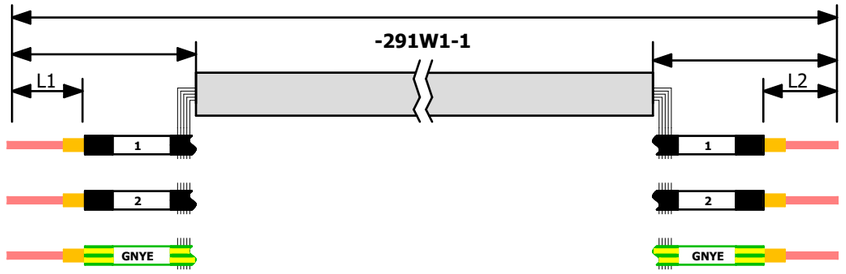


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

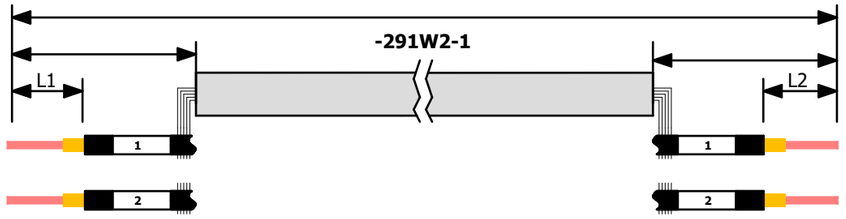


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

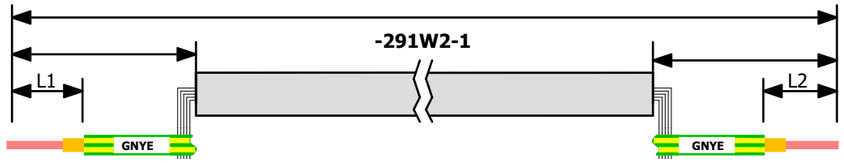
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

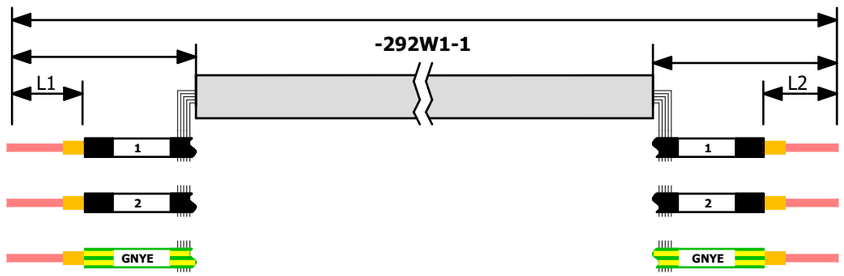


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

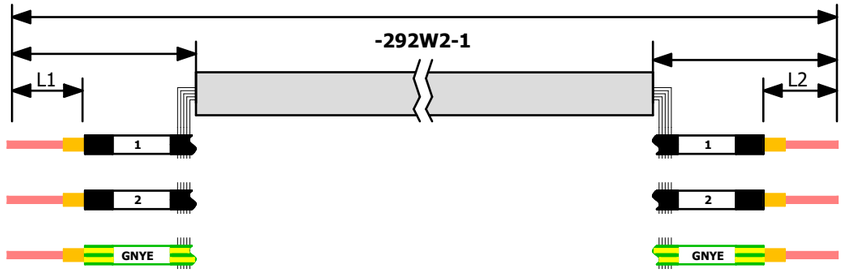


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

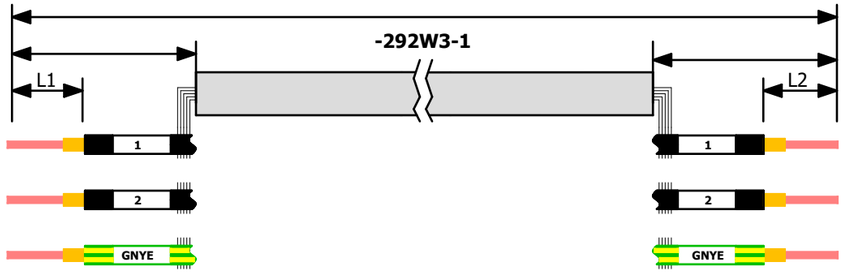


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

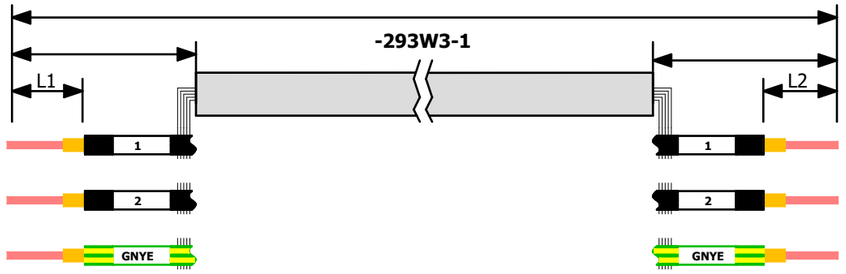


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

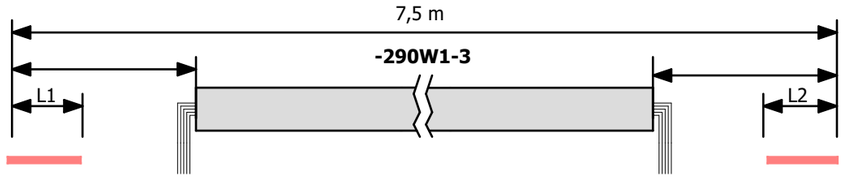


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

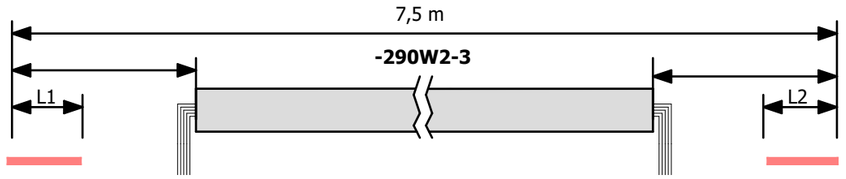


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Cable name =UNIT_03++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

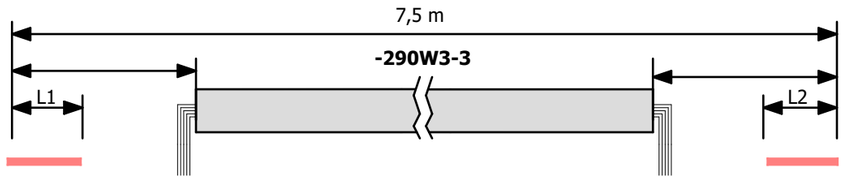


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

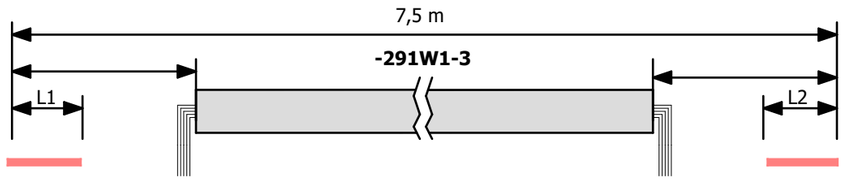


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_03++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

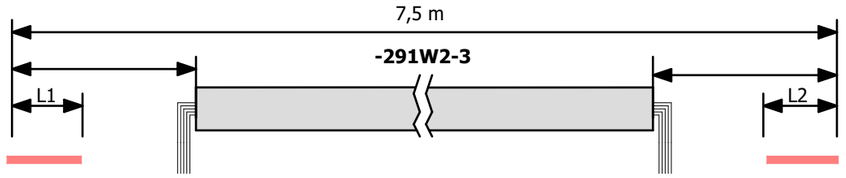


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

Cable name =UNIT_03++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

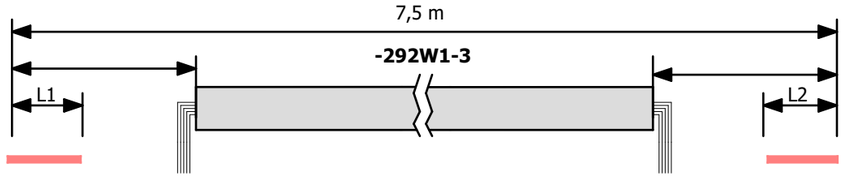


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_03++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



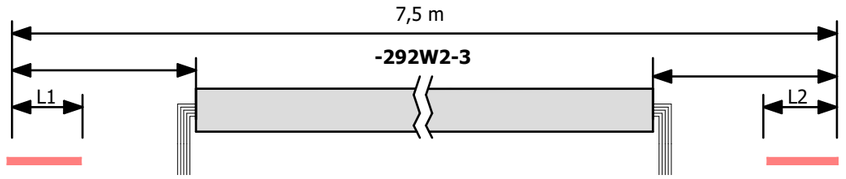
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

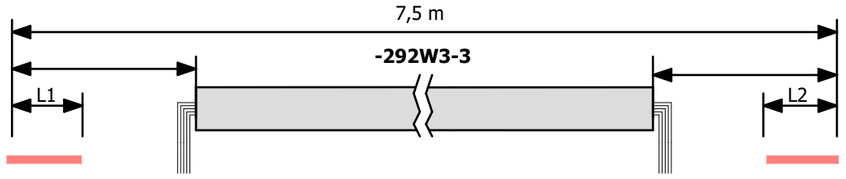
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X7:1-16	

Cable name =UNIT_03++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

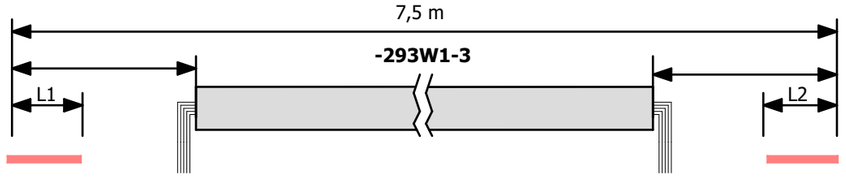
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X8:1-16	

Cable name =UNIT_03++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

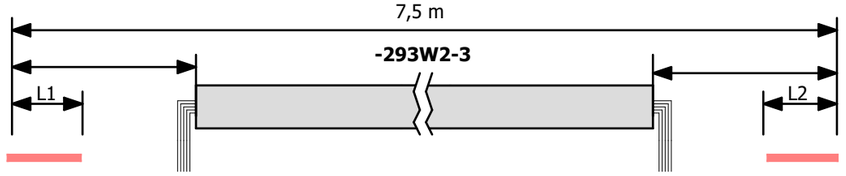
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X9:1-16	

Cable name =UNIT_03++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

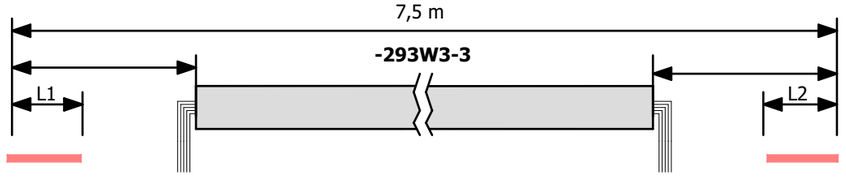
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



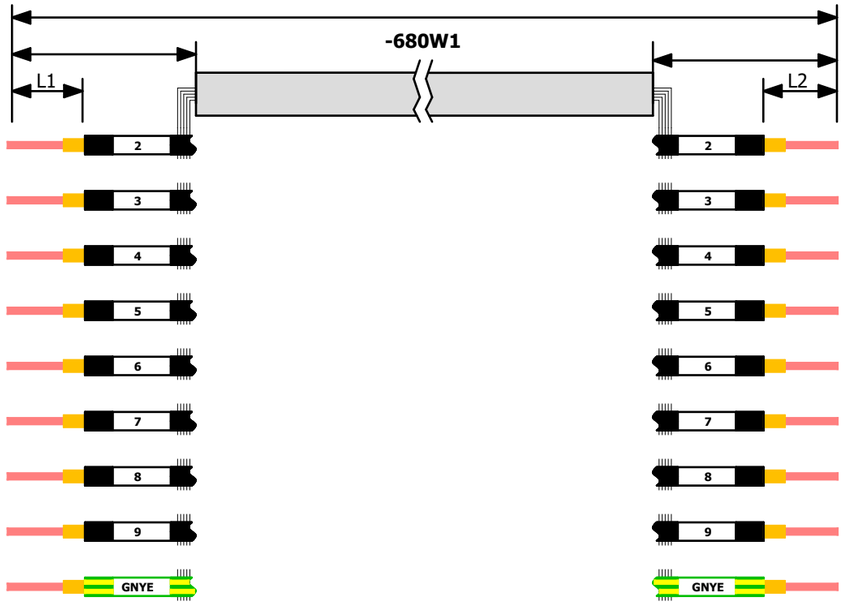
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X3:1-16	

previous page: 8
next page: ++ASC/1

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

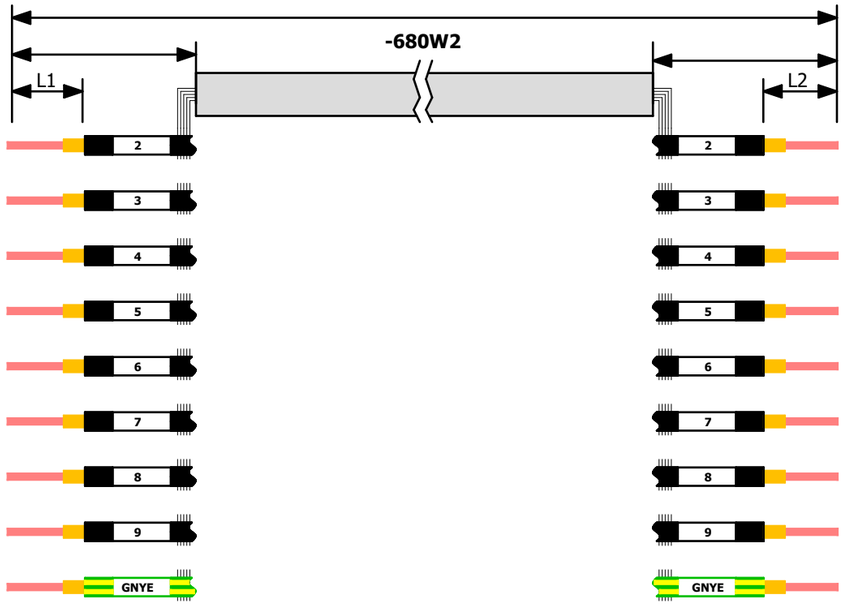


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_03++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

previous page:
++Container/9

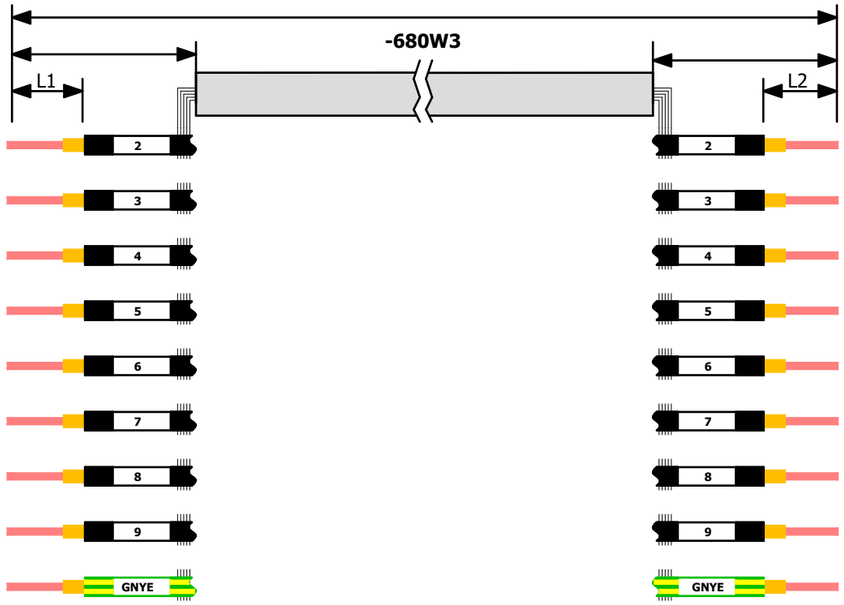
next page:
2

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 9

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

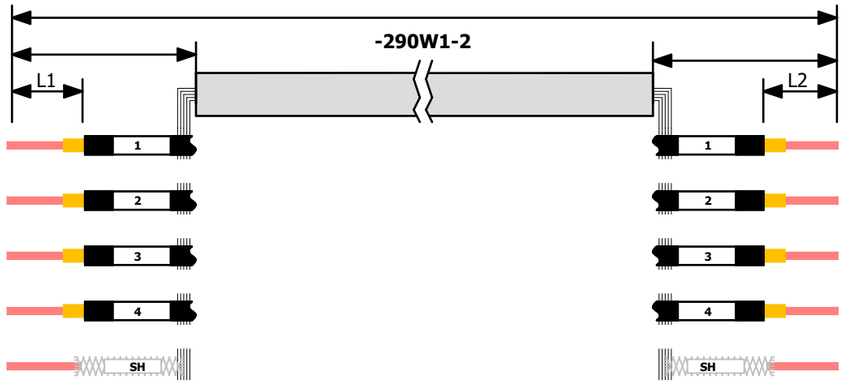


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_03++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

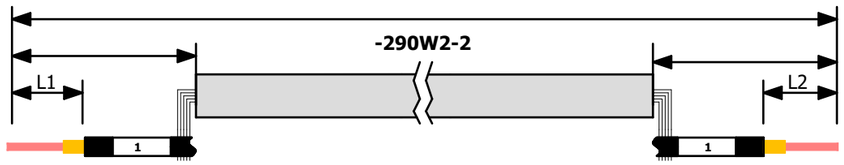


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

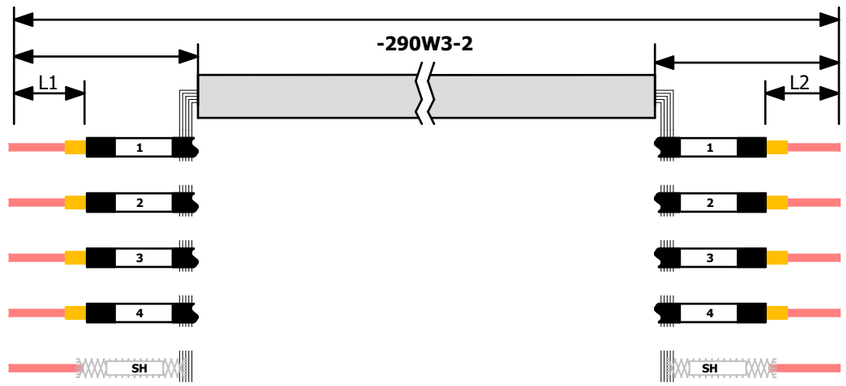


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

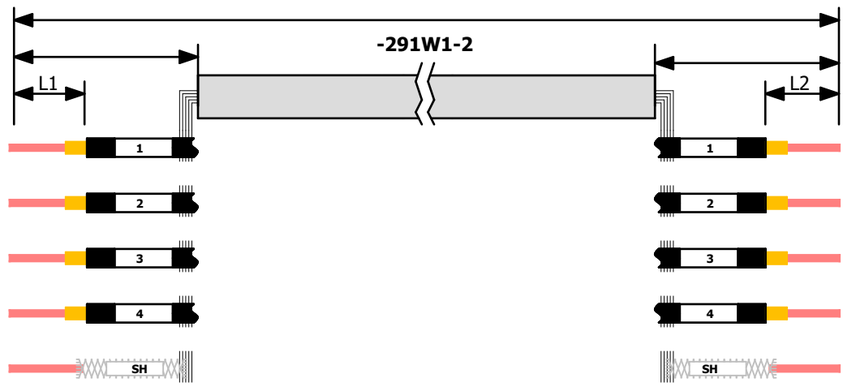


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 2

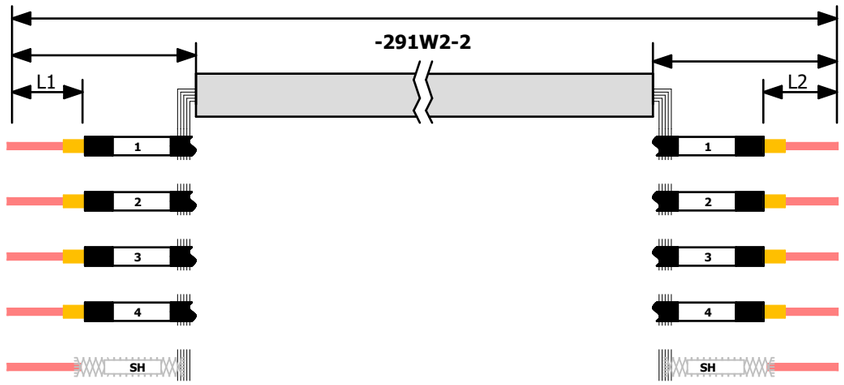
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

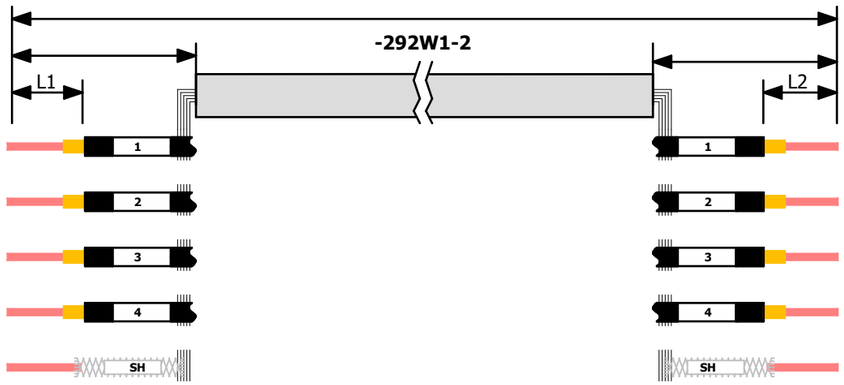


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

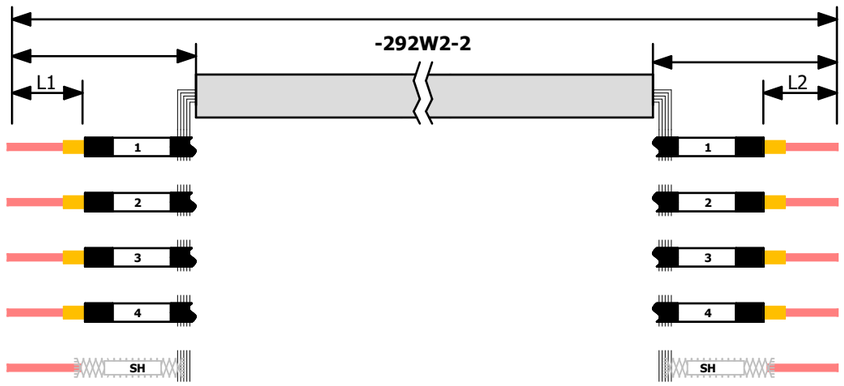


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



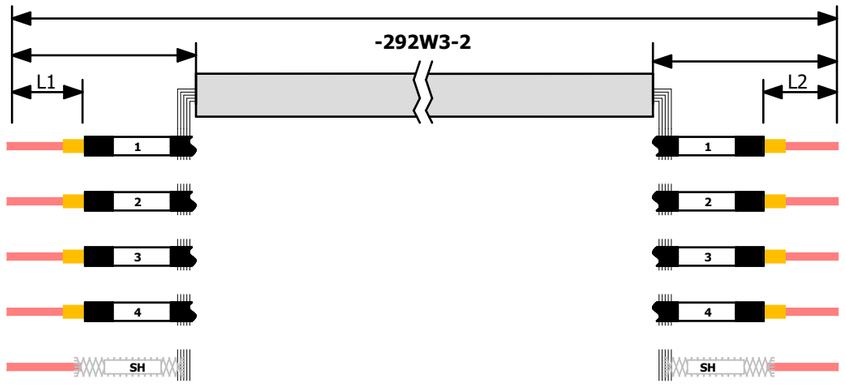
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

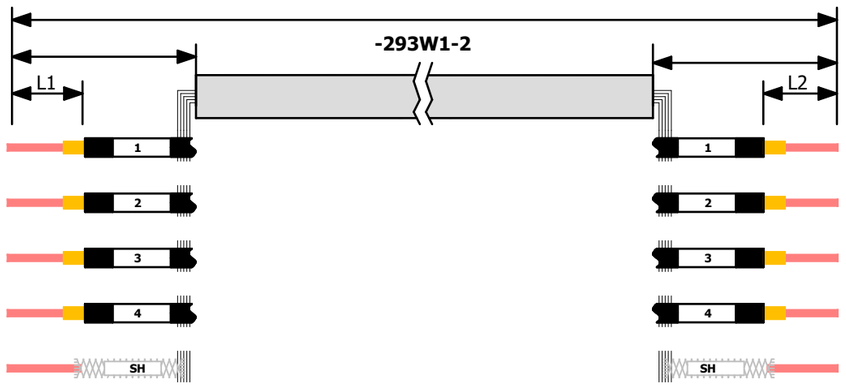
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

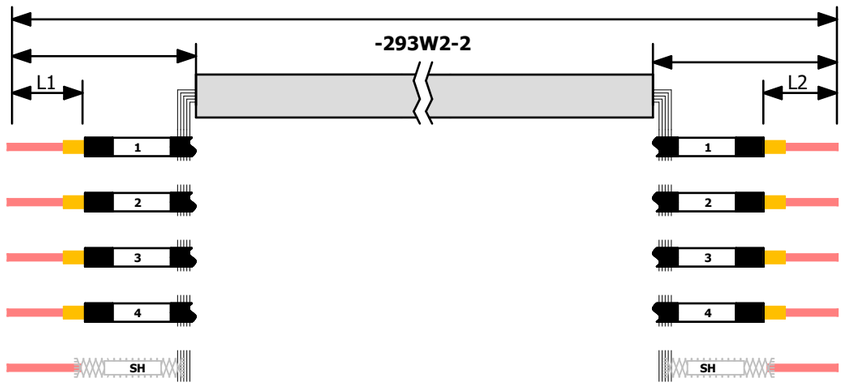
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



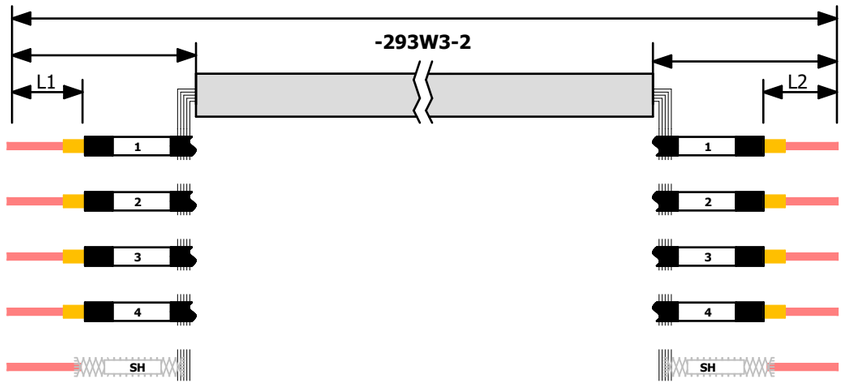
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

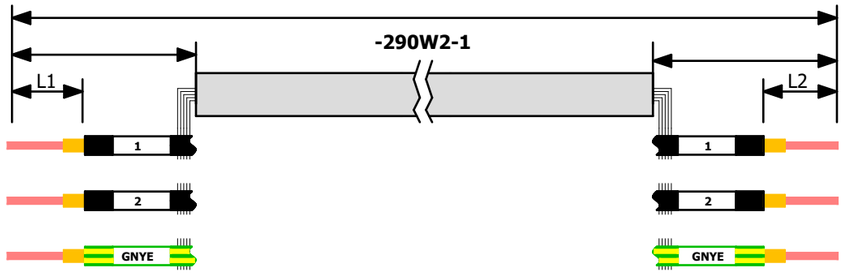


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

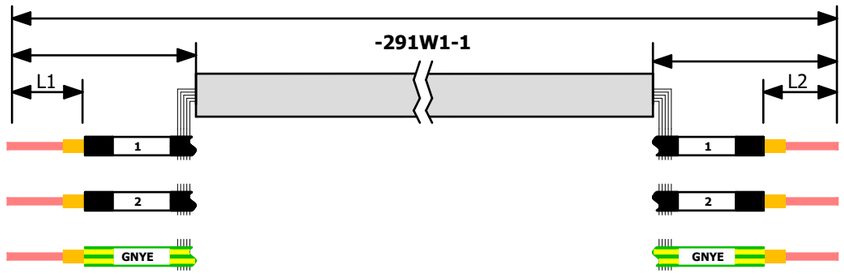


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

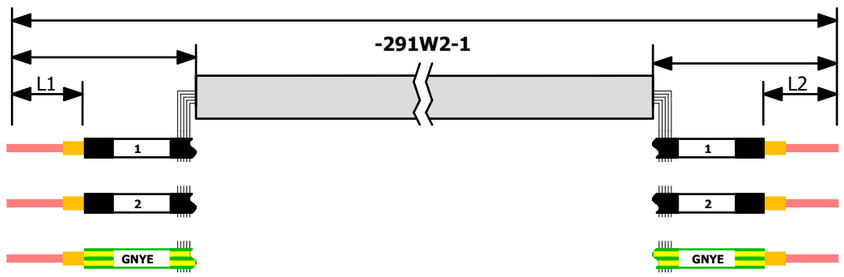


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

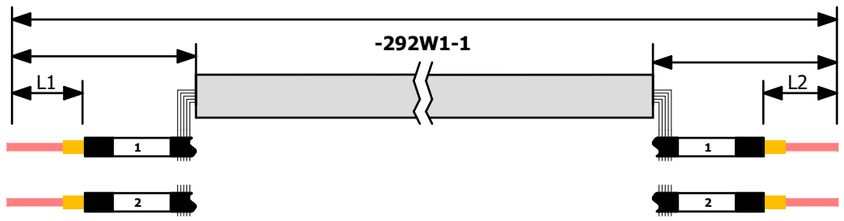


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

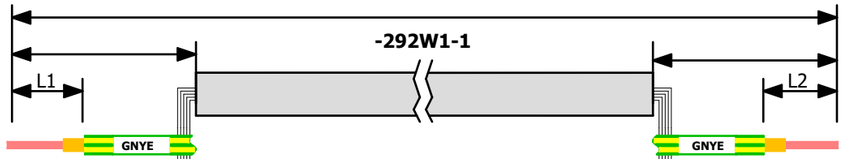
previous page: 6

next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

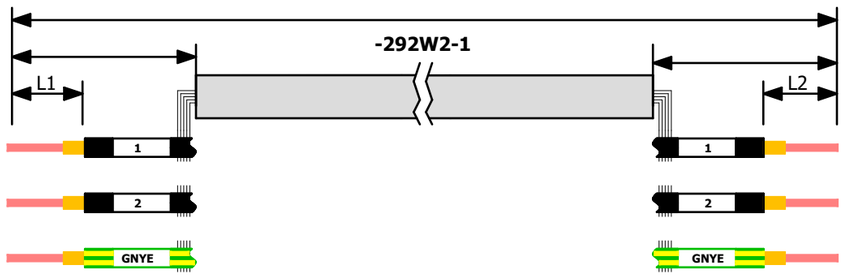


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

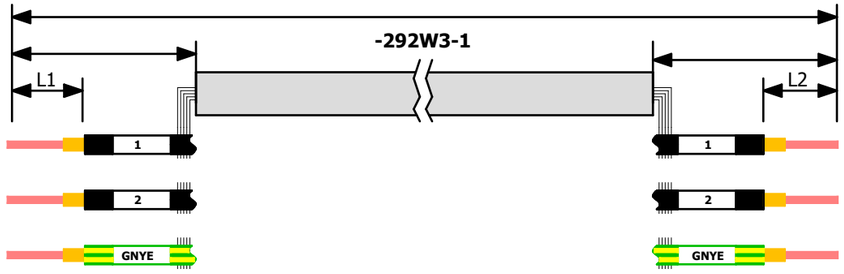


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

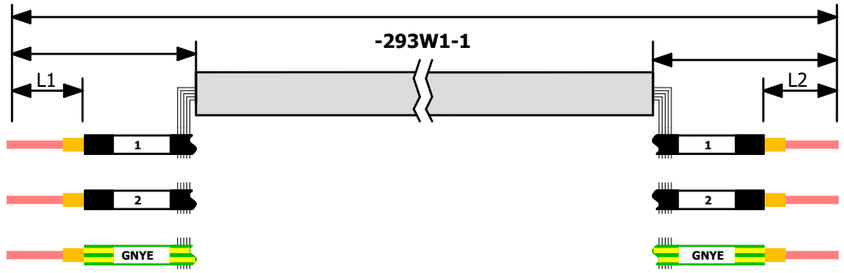


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

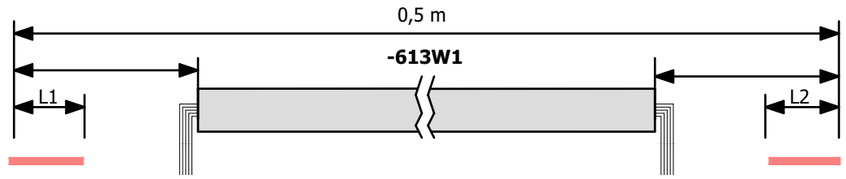


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

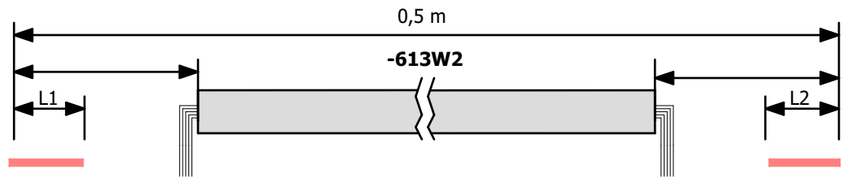


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_03++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			



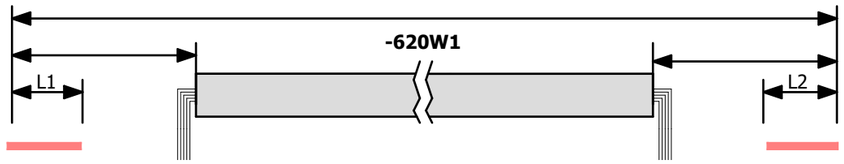
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

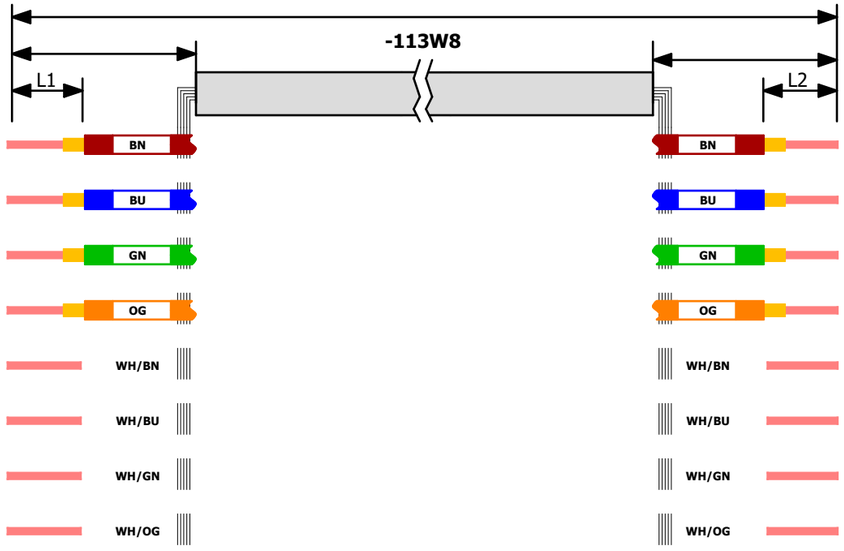
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_03++ASC+-113W8
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:3							-613U2:3	

previous page: 9

next page: &EMZ/1000

FRQ_Kabelplan_04_groß_de_en

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X5.1		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2000
-X5.2		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2001
-X5.3		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2002
-X6		1	6	0	0	6	=UNIT_03&EMZ++ASC/2003
-XDC1		1	PE	2	0	14	=UNIT_03&EMZ++ASC/2004
-XDC2		1	7	0	0	14	=UNIT_03&EMZ++ASC/2005
-XES		1	9	4	5	18	=UNIT_03&EMZ++ASC/2006
-XT		1	14	0	0	14	=UNIT_03&EMZ++ASC/2007
-369XT		1	12	0	0	24	=UNIT_03&EMZ++ASC/2008
-687XT1		1	PE	11	11	44	=UNIT_03&EMZ++ASC/2020
-690XT1		1	PE	40	4	119	=UNIT_03&EMZ++ASC/2031

previous page:
&EMB/10

next page:
2000

Editor	Freqcon_DG			Statron		Klemmenleistenübersicht : =UNIT_03++ASC+-X5.1 - =UNIT_03++ASC+-690XT1	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 1000
Date								+		total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.1						Cable name	-680W1										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 1-4					-XDC2	1	1	,	++Container-680U1-X1	1													&EFS/680a.2
=					-XDC2	5	2	,	++Container-680U1-X1	2		2											&EFS/680a.2
=					-AI_21	13	3	,	++Container-680U1-X1	4		3											&EFS/680a.2
=							4	,															&EFS/680a.2
=							5	,	++Container-680U1-X2	1		4											&EFS/680a.3
=							6	,	++Container-680U1-X2	2		5											&EFS/680a.3
=					-680K1	A1	7	,	++Container-680U1-X2	4		6											&EFS/680a.4
=					-XDC2	2	8	,	++Container-680U1-X2	5		7											&EFS/680a.4
=							9	,	++Container-680U1-X2	7		8											&EFS/680a.5
=							10	,	++Container-680U1-X2	8		9											&EFS/680a.5
=							PE	,	++Container-680U1-X1	5		GNYE											&EFS/680a.2
=							PE	,	-480W1														&EFS/680a.6

previous page:
1000

next page:
2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-X5.1	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2000
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.2						Cable name	-680W2										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 5-8					-XDC2	2	1	,	++Container-680U2-X1	1													&EFS/680b.2
=					-XDC2	6	2	,	++Container-680U2-X1	2		2											&EFS/680b.2
=					-AI_21	14	3	,	++Container-680U2-X1	4		3											&EFS/680b.2
=							4	,															&EFS/680b.2
=							5	,	++Container-680U2-X2	1		4											&EFS/680b.3
=							6	,	++Container-680U2-X2	2		5											&EFS/680b.3
=					-680K2	A1	7	,	++Container-680U2-X2	4		6											&EFS/680b.4
=					-XDC2	2	8	,	++Container-680U2-X2	5		7											&EFS/680b.4
=							9	,	++Container-680U2-X2	7		8											&EFS/680b.5
=							10	,	++Container-680U2-X2	8		9											&EFS/680b.5
=							PE	,	++Container-680U2-X1	5		GNYE											&EFS/680b.2
=							PE	,	-480W1														&EFS/680b.6

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-X5.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2001
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.3						Cable name	-680W3										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 9-11					-XDC2	3	1	,	++Container-680U3-X1	1													&EFS/680c.2
=					-XDC2	7	2	,	++Container-680U3-X1	2		2											&EFS/680c.2
=					-AI_21	15	3	,	++Container-680U3-X1	4		3											&EFS/680c.2
=							4	,															&EFS/680c.2
=							5	,	++Container-680U3-X2	1		4											&EFS/680c.3
=							6	,	++Container-680U3-X2	2		5											&EFS/680c.3
=					-680K3	A1	7	,	++Container-680U3-X2	4		6											&EFS/680c.4
=					-XDC2	3	8	,	++Container-680U3-X2	5		7											&EFS/680c.4
=							9	,	++Container-680U3-X2	7		8											&EFS/680c.5
=							10	,	++Container-680U3-X2	8		9											&EFS/680c.5
=							PE	,	++Container-680U3-X1	5		GNYE											&EFS/680c.2
=							PE	,	-480W1														&EFS/680c.6

previous page:
2001

next page:
2003

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_03++ASC+-X5.3	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2002
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X6					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Extract Fan C/W Fire Damper 1						GND	1	,	-AO_21	1													&EFS/681.1
=						+10V	2	,	-AO_21	5													&EFS/681.1
Extract Fan C/W Fire Damper 2						GND	3	,	-AO_21	2													&EFS/681.3
=						+10V	4	,	-AO_21	6													&EFS/681.3
Extract Fan C/W Fire Damper 3						GND	5	,	-AO_21	3													&EFS/681.5
=						+10V	6	,	-AO_21	7													&EFS/681.5

previous page: 2002

next page: 2004

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XDC1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
FUSE 24V DC CONTROL VOLTAGE					-101T1	13	1		-103F1	2													&EFS/603.2
					-101Q1	13																	
					-611A1	1																	
FUSE 24V DC CONTROL VOLTAGE					-620A1	-X80:1	2																&EFS/603.2
					-DI_21	L+																	
					-DO_21	L+																	
FUSE 24V DC CONTROL VOLTAGE					-635K7	11	3		-103F1	13													&EFS/603.2
					-684F5	11																	
FUSE 24V DC CONTROL VOLTAGE					-611A1	2	4		-102G1	OUTPUT DC 24 V:-													&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE					-620A1	-X80:2	5																&EFS/603.3
					-DI_21	M																	
					-DO_21	M																	
FUSE 24V DC CONTROL VOLTAGE					-635K1	A2	6		-XDC2	5													&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE					-101T1	-"	PE																&EFS/603.4
					-101T1	PE																	
FUSE 24V DC CONTROL VOLTAGE							PE																&EFS/603.4

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_03++ASC+-XDC1	20250805_V2.0	= UNIT_03	Battery Container 2
Date	21.01.2025							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 2004

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-XDC2

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FUSE 24V DC CONTROL VOLTAGE			-AI_21	L+	1		-103F2	2			&EFS/603.5
			-AO_21	L+							
			-X5.1	1							
FUSE 24V DC CONTROL VOLTAGE			-X5.1	8	2		-X5.2	8			&EFS/603.5
			-680K1	11							
			-X5.2	1							
FUSE 24V DC CONTROL VOLTAGE			-680K2	11	3		-680K3	11			&EFS/603.5
			-X5.3	1							
			-X5.3	8							
FUSE 24V DC CONTROL VOLTAGE			-691F1	13	4						&EFS/603.6
			-691F4	13							
			-691F4	13							
FUSE 24V DC CONTROL VOLTAGE			-AI_21	M	5		-XDC1	6			&EFS/603.6
			-AO_21	M							
			-X5.1	2							
FUSE 24V DC CONTROL VOLTAGE			-680K1	A2	6						&EFS/603.6
			-X5.2	2							
FUSE 24V DC CONTROL VOLTAGE			-680K2	A2	7						&EFS/603.7
			-X5.3	2							
			-680K3	A2							

previous page: 2004

next page: 2006

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XES						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
							1		-684F1	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC							N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-690F1	N													&EFS/684.3
=					-690XT1	N	N		-690F2	N													&EFS/684.3
=							N		-690XT1	N													&EFS/684.4
=							PE			PE													&EFS/684.4
=					++Container-278W1	GND	PE			PE													&EFS/684.4
=					-684F5	PE	PE		-684F2	PE													&EFS/684.5
=					-601F1	PE	PE																&EFS/684.5
					-684F4	2	2		-684F3	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC					-601F1	L1	3																&EFS/684.1
=							4		-684F1	4													&EFS/684.1
=					-684F4	4	5		-684F3	4													&EFS/684.1
=					-601F1	L2	6																&EFS/684.1
=							7		-684F1	6													&EFS/684.1
=					-684F4	6	8		-684F3	6													&EFS/684.1
=					-601F1	L3	9																&EFS/684.2

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
Gas confirmed FGS							1	,	-635K1	14			&EFS/635b.1
=							2	,	-635K1	11			&EFS/635b.1
=							3	,	-635K2	14			&EFS/635b.1
Smoke confirmed FGS							4	,	-635K2	11			&EFS/635b.2
=							5	,	-635K3	14			&EFS/635b.2
Thermal runaway SIS							6	,	-635K3	11			&EFS/635b.3
=							7	,	-635K4	14			&EFS/635b.3
=							8	,	-635K4	11			&EFS/635b.3
Spare							9	,	-635K5	14			&EFS/635b.4
=							10	,	-635K5	11			&EFS/635b.4
=							11	,	-635K6	14			&EFS/635b.5
=							12	,	-635K6	11			&EFS/635b.5
Shut-down to BESS							13	,	-635K7	A2			&EFS/635b.7
=							14	,	-635K7	A1			&EFS/635b.7

previous page: 2006

next page: 2008

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-OZ	++Container-290W2-2 F-CY-OZ	++Container-290W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	1					&EFS/669.5
		3			++Container-570XT	3						
	3				++Container-570XT	3						

previous page: 2007

next page: 2009

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2008

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	2		++Container-570XT	3		3	&EFS/669.5
		3			++Container-570XT	3							
	3				++Container-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	3		++Container-570XT	3		3	&EFS/669.6
		3			++Container-570XT	3							
	3				++Container-570XT	3							

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2010

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	4					&EFS/669.7
		4			++Container-570XT	4						
	4				++Container-570XT	4						

previous page:
2010

next page:
2012

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2011
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	5		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	6		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	7					&EFS/670.5
		1			++Container-570XT	1						
	1				++Container-570XT	1						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	8		++Container-570XT	1		1	&EFS/670.5
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	9		++Container-570XT	1		1	&EFS/670.6
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	10					&EFS/670.7
		2			++Container-570XT	2						
	2				++Container-570XT	2						

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	11		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	12		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

previous page: 2018

next page: 2020

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2019

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			++Container-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				++Container-XE	1	3	,	-687F3	2		&EFS/687.4

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2020 of total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-1 JZ-500	++Container-291W2-1 JZ-500	++Container-291W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	4	,	-687F4	2		&EFS/687.5
=		1			++Container-XE	1	5	,	-687F5	2		&EFS/687.7
=	1				++Container-XE	1	6	,	-687F6	2		&EFS/687.8

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-687XT1

Function text	++Container-293W1-1 JZ-500	++Container-292W3-1 JZ-500	++Container-292W2-1 JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	7	,	-688F1	2		&EFS/688.1
=		1			++Container-XE	1	8	,	-688F2	2		&EFS/688.3
=	1				++Container-XE	1	9	,	-688F3	2		&EFS/688.4

previous page: 2021

next page: 2023

Editor	Freqcon_DG	Statron	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	21.01.2025				& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007	++ ASC auxillary cabinet	page: 2022
Date					+	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W1-1	++Container-293W3-1	++Container-293W2-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	10	,	-688F4	2													&EFS/688.5
=		1			++Container-XE	1	11	,	-688F5	2													&EFS/688.7
=	2				++Container-XE	N	N	,	-XES	N													&EFS/687.1
								,															

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W1-1 JZ-500	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/687.6

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2024

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W2-1 -XZ-500	++Container-292W1-1 -XZ-500	++Container-291W2-1 -XZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.7
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.8
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N		-XES	N		&EFS/688.1

previous page: 2024

next page: 2026

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W2-1 -1Z-500	++Container-293W1-1 -1Z-500	++Container-292W3-1 -1Z-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/688.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/688.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/688.6

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	++Container-293W3-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N	⌟				&EFS/688.7
								,				
Supply Battery String 1-phase 230V AC		GNYE			++Container-XE	PE	PE	,				&EFS/687.2
=	GNYE				++Container-XE	PE	PE	,				&EFS/687.3

previous page: 2026

next page: 2028

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W2-1	++Container-291W1-1	++Container-290W3-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/687.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/687.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/687.7

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W3-1	++Container-292W2-1	++Container-292W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/687.9
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.2
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.3

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W3-1	++Container-293W2-1	++Container-293W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/688.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
				Cable type							Cable type	
Container Internal Lighting						L	1	,	-690F1	2		&EFS/690.1
=						1	2	,	-690F2	2		&EFS/690.3
Container Sockets						1	3	,	-690F3	2		&EFS/690.5
230V AC for crane 2						1	4	,	-690F4	2		&EFS/690.7
230V AC for crane 3						1	5	,	-690F5	2		&EFS/690.8
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						L	6	,	-636K1	14		&EFS/691.1
						L						
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						L	7	,	-636K2	14		&EFS/691.3
						L						
								,				
								,				

previous page: 2030

next page: 2032

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,		

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
400V AC for Cooling Units							10	,	-691F4	4													&EFS/691.6
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,														

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
				Cable type							Cable type		
230V AC for crane 2						PE	PE						&EFS/690.7
230V AC for crane 3						PE	PE						&EFS/690.8
Container Sockets						2	N		-690F2	N.			&EFS/690.4
230V AC for crane 1						2	N		-XES	N			&EFS/690.6
230V AC for crane 2						2	N		-XES	N			&EFS/690.7
230V AC for crane 3						2	N		-XES	N			&EFS/690.8
Container Internal Lighting						N	N		-690F1	N.			&EFS/690.1
=						GND	PE						&EFS/690.2
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						N	N		-XES	N			&EFS/691.1
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						GND	PE						&EFS/691.2
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						N	N						&EFS/691.3
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						GND	PE						&EFS/691.3
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						N	N						&EFS/691.4
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						GND	PE						&EFS/691.4
						GND							
400V AC for Cooling Units							N						&EFS/691.6
=							PE						&EFS/691.6

previous page: 2033

next page:

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-690XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

STATRON
NON STOP POWER

Operational Manual

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: C11
Sequence Number: 001
Rev: 003
Document number: K559-2254-CWIWP4202201-C11-001
Document description: Operation Manual

Operation Manual
C11

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	C11
Document name	Operation Manual
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2025-01-21	M. Müller	First version
2.0	2025-01-30	M. Müller	Updated version
3,0	2025-02-04	M. Müller	Updated version

Table 1: Version overview

	Date	Name
Editor	2025-01-20	M. Müller
Checked by	2025-01-21	C. Palenzuela
Approved by	2025-01-21	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8

Identification

Product Version / Document Version

Product version
Prototype

Document release date
February 2025

Doc Code
K559-2254-CWIWP4202201-C11-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Operation Manual	10354_23A2007_250205_Operating_Manual_BESS_1MW_5MWh_6.6kV_EN_v1.2

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

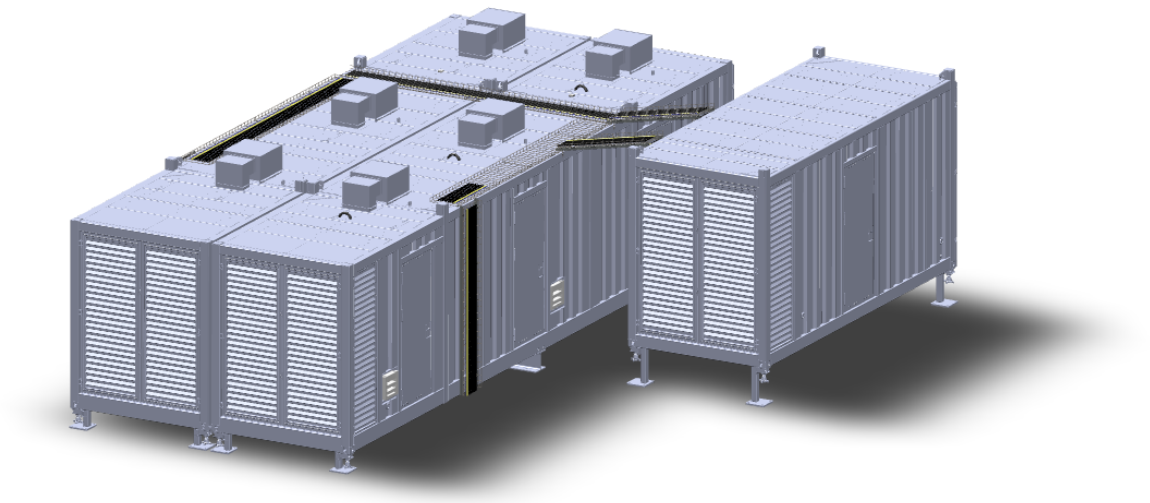
The BESS operation manual is attached to this document (*see section 1.3 "Other Applicable Documents"*).

FREQCON

Operating and Maintenance Manual
BESS PRO

1 MW/ 5 MWh
6.6 kV AC

Stationary Battery Energy Storage System (BESS)



Version	Date	Name	Description
v0.4	2024-08-22	M. Müller C. Palenzuela	First draft version
v1.0	2025-01-22	M. Müller C. Palenzuela	Final version
v1.1	2025-01-31	M. Müller	Updated version
v1.2	2025-02-05	C. Palenzuela	Updated section 11.2.3.1

Table 1: Version overview

	Date	Name
Editor:	2024-08-22	M. Müller C. Palenzuela
Checked by:	2024-08-24	M. Müller
Approved by:	2024-08-24	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware/Software Development and Production Centre

FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Deutschland

Phone: +49 (0) 5165 - 291 760 - 0

E-Mail:
info@freqcon.com

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.com**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Service

Service hotline for repair, complaints and maintenance from Monday to Thursday from 9:00 am - 4:00 pm and Friday from 9:00 am - 2:00 pm:

Phone: +49 (0) 5165 – 291 760 – 50

E-Mail:
service@freqcon.com

Content

1 About these Instructions 11
1.1 Disclaimer of Liability 12
1.2 Applicable Documents 12
1.3 Abbreviations 12
1.4 Warning Symbols 13
1.5 Information Symbols 14
1.6 Warning Levels / Signal Words 14
1.7 Target Groups 15
2 Safety Instructions 16
2.1 The Five Safety Rules 16
2.2 Basic Safety Information 16
2.3 Safety Instructions Battery Storage Unit 25
2.3.1 Safety Data Sheet 26
2.3.2 Personal Protection 26
2.3.3 Fire Fighting Measures 28
2.3.4 Disposal Considerations 31
2.3.5 Transport Information 31
2.4 Handling Electrostatic Sensitive Devices (ESD) 31
2.5 Warnings and Symbols on the Device 32
2.6 Qualification of Personnel 33
2.7 Personal Protection Equipment (PPE) 33
2.8 Changes of the Product 34
2.9 Proper Use 34
2.10 Misuse 35
2.11 Duties of the Operating Company 35
2.12 Duties of the User 36
3 Product Description 37
3.1 Working Principle 38
3.2 Control 38
3.3 PCS 38
3.4 Decoupling Protection 39
3.5 Auxiliary Power Supply of Protective Devices 39
3.6 Behavior in the event of a supply voltage failure 40
4 Design 41

4.1 AC Grid Connection 42
4.2 Data Interface 42
4.3 Safety Design 43
4.3.1 Safety Chain Battery Cell 43
4.3.2 Safety BMS Rack (S7) 43
4.3.3 Safety Converter Control 44
4.3.4 Overview of the Safety Concept 45
4.3.5 Fire Protection System and Suppression System 46
4.4 PCS Container 50
4.4.1 Container Overview 50
4.4.2 Cabinet Overview- Converter Cabinets 54
4.4.3 Internal Components – Converter Cabinets 55
4.4.4 Cabinet Overview - Control Cabinets 57
4.4.5 Internal Components – Control Cabinets (CTRL_1 and CTRL_2) 58
4.4.6 External Components – Control Cabinet 59
4.5 BESS 1 Container 60
4.5.1 Container Overview 60
4.5.2 Cabinet Overview- BESS 1 Battery Cabinets 64
4.5.3 Internal Components – Battery Cabinets 65
4.6 BESS 2 Container 66
4.6.1 Container Overview 66
4.6.2 Cabinet Overview- BESS 2 Battery Cabinets 70
4.6.3 Internal Components – Battery Cabinets 71
4.7 Battery Modules 72
4.7.1 Design 72
4.7.2 Technical Data 73
4.7.3 Connection Elements 74
4.7.4 Communication Scheme 74
4.7.5 Lifting Device and Mounting Table 75
4.7.6 Mobile Lifting Device 77
4.7.7 MV Transformer 78
4.8 Cooling System 79
4.8.1 BESS 1 / BESS 2 Container 79
4.8.2 PCS Container 80
5 Operating Interfaces 84

6 Control System 84
6.1 Main Control System 84
6.2 Battery Cabinet Control System 86
6.3 Network Structure 87
7 Converter Main States 90
7.1 Error Levels 90
7.2 Main States 91
8 Technical Data 93
9 Environmental Conditions 94
10 Transport, Storage and Commissioning 95
10.1 Unpacking 95
10.2 Transport 96
10.2.1 Container Lifting 98
10.2.2 Dimensions and Center of Gravity 101
10.3 Storage 102
10.3.1 Storage Condition 102
10.4 Assembly and Initial Commissioning 104
11 Mounting 105
11.1 General 105
11.1.1 Cable Routing 106
11.1.2 Coding 106
11.2 Installation location 107
11.2.1 Distances Between Containers 108
11.2.2 Cable Outlets 109
11.2.3 Cable Gland Description 112
11.2.4 AC Connection 119
11.2.5 Higher-Level Controller Connection 121
12 Pre-Commissioning 122
12.1 Activate Motor Contactors and Fuses 122
12.2 Check Power Cables 122
12.3 Check Communication Cables 123
12.4 Cooling System Preparations 123
13 Commissioning 123
14 Operation 123
14.1 Operating Panel 124

14.2 Indicator Lights ... 124
14.3 Control Elements ... 125
14.4 Switching on the BESS ... 126
14.5 Switching off the BESS ... 128
14.6 De-Energizing ... 130
14.7 Check Voltage-Free Status of DC Link ... 131
14.8 AC Circuit Breaker ... 132
14.8.1 Circuit Breaker Components ... 133
14.8.2 Positions of CB in the Guide Frame ... 134
14.8.3 Protect the CB Against Unintentional Reclosing ... 135
14.9 DC Fuse Switch Disconnectors ... 137
14.9.1 Fuse Disconnector Components ... 138
14.9.2 Locking Device ... 139
14.9.3 Protect the DC Disconnector Against Unintentional Reclosing ... 140
15 Monitoring ... 141
16 Data transfer with higher-level controller ... 142
17 Maintenance ... 142
17.1 Preparations Prior Maintenance ... 144
17.2 Maintenance Schedule ... 145
17.3 UPS ... 146
17.3.1 UPS Functionality Check ... 146
17.3.2 Removing the UPS battery ... 147
17.4 Changing the Intake Fan Filters ... 150
17.5 Visual Inspection ... 151
17.6 AC Circuit Breaker(s) ... 152
17.6.1 Inspection work ... 152
17.7 Replace PLC Buffer Battery ... 153
17.7.1 Preventive maintenance ... 153
17.7.2 Replacing Backup Battery ... 153
17.8 Exchanging the Cooling Liquid ... 154
17.8.2 Filling the Cooling System ... 157
17.9 Check pressure of expansion tank ... 160
17.10 Pump ... 162
17.11 Exhaust Units ... 163
17.12 Fire Dampers ... 163

17.13 H2 Sensors 163
18 Container Repair 164
18.1 Process Instructions (New Application) 164
18.2 Process instructions (Repair - damage down to the steel) 165
18.3 Process instructions (Repair - damage only within the topcoat) 167
19 Settable Devices 168
20 IP Addresses 168
21 PLC 169
21.1 Indicator Lights 169
21.2 Connection Elements 171
21.3 PLC Connection 172
21.4 Compiled Project Update 173
22 WebVisu 176
22.1 WebVisu remote connection 177
22.2 Navigation 178
22.2.1 Home Button 178
22.2.2 Page Menu Button 179
22.3 WebVisu User Interface 179
22.4 WebVisu Pages 180
22.4.1 Overview 180
22.4.2 Overview DC-DC 181
22.4.3 AC-DC Converter 182
22.4.4 DC Link 183
22.4.5 DC-DC Converter 184
22.4.6 Converter Control 185
22.4.7 Cooling 186
22.4.8 Battery Overview 187
22.4.9 Grid Protection Settings 188
22.4.10 Init List 189
22.4.11 Error List 190
22.4.12 Action List 191
23 Troubleshooting 192
24 Dismantling and Disposal 192
24.1 Safety 192
24.2 Dismantling 192

24.3 Disposal of Packaging Material 192
24.4 BESS Disposal 193

Identification

Product and Type Designation

Type
BESS 1 MW / 5 MWh / 6.6 kV / 620 V AC

Serial number

PCS	FRQ-53396000001
BESS 1	FRQ-53406000001
BESS 2	FRQ-53412000001

Product family
BESS Energy Storage System

Product Version / Document Version

Product version
Prototype

Document release date
February 2025

Doc Code
10354_23A2007_250205_Operating_Manual_BESS_1MW_5MWh_6.6kV_EN_v1.2

Name and Address of Manufacturer and Supplier

FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Deutschland

Legal Information

This work is protected by copyright. This work is protected by copyright. This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About these Instructions

This manual is part of the product and applies exclusively to the system described in this document.

This operating manual contains the necessary information for the proper use of the described system. The operating manual is supplied together with the product and is considered as an important part of the product.

Please read this manual carefully, as it contains important information on the installation and operation of the product.
Please pay particular attention to the notes regarding the safe use of the system.
The manufacturer accepts no liability for any damage caused by failure to observe these instructions.

Keep this manual and provide it to the new owner in case of a change of the operating company.
All personnel who have any relation of handling or operating the product must always have direct access to this manual.

All personnel who have any relation of operating the unit are obligated to read all related manuals regarding the system described in this document. The employed personnel must declare that they have fully read and understood all contents of the manuals and agree to follow all instructions, especially issues regarding safety and accident prevention.

Additional Documents

The instructions of this operating manual must be supplemented with the necessary, customary local and current accident prevention regulations, environmental protection rules and laws.

Location of the Manual

Always keep this manual within direct reach when operating or handling the unit. The operator must have direct access to the manual. The operator must have direct access to the manual.

Display Elements

Symbol	Significance
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

1.1 Disclaimer of Liability

The contents of this publication have been reviewed to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, any necessary corrections are included in subsequent editions.

1.2 Applicable Documents

The delivery scope of the product includes the following documents:

Document	Document Name
Circuit diagram BESS 1 MW / 5 MWh (FREQCON)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20250123_V1.3
Data interface description (FREQCON)	23A2007_250116_Modbus_Register BESS_V1_0_0_1
Maintenance schedule – BESS (FREQCON)	EED_0000_20_Maintenance_Schedule_BESS_LFP_v1.3_EN
Operating and Maintenance Manual -AC circuit breaker 3WL (Siemens)	3ZX1812-0WL00-0AN4_online_201806140915326928
Operating Manual -DC circuit breaker 3NP1 (Siemens)	System_Manual_3NP1_3ZX1012-0NP10-1AC1_en-US
Operating, commissioning and maintenance instructions PLC Simotion P320-4 (Siemens)	P320_4_commissioning_en-US P320_4_operating_en-US
MSDS Battery Cells LF280 (EVE)	LF280K MSDS
Aerosol Safety Data Sheet (Stat-X)	Stat-X Aerosol Safety Sheet 19010.3_SDSR_Stat-X_1
Stat-X operating instructions (Stat-X)	19001 1.2.5 Owners Manual Electric DE
Operating and Maintenance Manual – exhaust units (Puma)	TFE_Direct_Driven_Unit_Run_&_Standby_O_&_M_1030
Operating and Maintenance Manual – fire dampers (Puma)	Air_Make_Up_Dampers_O&M_1032
Operating and Maintenance Manual – H2 sensors (Dräger)	Dräger Polytron 8200 manual 9033302_01_2011_enus
Operating Instructions – cable hoist	manual_2255140

Table 3: Applicable documents

1.3 Abbreviations

The following list provides descriptions about the generic terms and abbreviations used in this document:

Generic Term and Abbreviation	Significance
AC	Alternating current
Identifier	Equipment labeling
BESS	Battery Energy Storage System
BMS	Battery management system
BSU	Blackstart unit
DC	Direct current
DC-link	Direct current link
EMC	Electromagnetic compatibility
EMF	Electromagnetic fields
EMS	Energy management system
FRQ	FRFEQCON GmbH
HMI	Human-Machine Interface
HV	High voltage

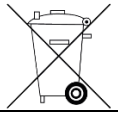
HVIO	High Voltage I/O Module
MB	Modbus
RTU	Remote Terminal Unit
TCP	Transmission control protocol
MSC	Multi-Source Converter
MV	Medium voltage
LFP	Lithium iron phosphate
LV	Low voltage
PCS	Power conversion system
PLC	Programmable Logic Controller
PPE	Personal safety equipment
IGBT	Insulated-Gate Bipolar Transistor
IEC	International Electrotechnical Commission
I/O	Input/output
IP	Internet protocol
SoC	State of charge
TR	Thermal runway
UPS	Uninterruptable power supply

Table 4: List of Abbreviations

1.4 Warning Symbols

Observe the warning symbols in this document and those attached on the device. The warning symbols have the following meaning:

Symbols	Significance
	Hazard (general)
	Hazard by voltage
	Hazard by high temperature
	Hazard by batteries
	Hazard by fire
	Maintenance lockout tagout, do not switch!
	Acute toxicity (oral, dermal, inhalation) (hazard. category 4)
	Respiratory sensitization (hazard category 1, 1A and 1B)
	Prohibition for people with pacemakers

	Hazard by heavy load
	Do not dispose in household waste. (See section 24 “Dismantling and Disposal”)

1.5 Information Symbols

Symbol	Significance
	Important technical information for this product

1.6 Warning Levels / Signal Words

DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE	Indicates that property damage can result, if proper precautions are not taken.

1.7 Target Groups

⚠ DANGER	
	**Danger from and for unauthorized persons** Unauthorized persons are not aware of the dangers in the work area and may endanger themselves and third parties. ➜ Keep unauthorized persons away from the work area. ➜ If in doubt, speak to persons and direct them away from the work area. ➜ Interrupt the work as long as unauthorized persons are in the work area. ➜ Always keep the entrance door(s) locked when not performing work on the system to prevent unauthorized persons from entering the container.

Group	Significance
Operator	• Uses the product himself for commercial or economic purposes or lets a third-party use/apply it. • During operation, bears legal product responsibility for the protection of the user, personnel and third parties. • May not open control cabinets and/or perform maintenance.
Trained person	• Has been demonstrably trained and instructed by the operator about the assigned tasks and possible dangers in case of improper behavior. • Is authorized to operate the plant. • May not open control cabinets and/or perform maintenance.
Service Personnel	• FREQCON GmbH service personnel • Personnel trained and authorized by FREQCON and authorized specialist personnel. • Carries out all other work on the plant, e. g. commissioning, maintenance work, transport, and troubleshooting.
Manufacturer	• Person who was/is involved in the development of the energy storage system and has detailed knowledge of the structure and function of the modules or the entire system - in accordance with the relevant specialist area.

Table 5: Target groups

2 Safety Instructions

2.1 The Five Safety Rules

For your own personal safety and to prevent material damage when carrying out any work, always observe the safety-relevant instructions and the following five safety rules according to EN 50110-1 "Working in a voltage-free state".



2.2 Basic Safety Information

Do not operate!	**Lock and tag power switches and controller devices**
	Follow national laws regarding occupational safety and health. ➜ Identify the energy source(s). ➜ Isolate the energy source(s). ➜ Determine voltage-free status. ➜ Ground device or equipment to protect from short circuiting and from shocks. ➜ Lock and Tag the energy source(s). ➜ Prove that the equipment isolation is effective. ➜ When required, apply lock-out device or clamp and secure with padlock(s).

Important!	
	➜ Read the instructions of this manual thoroughly before use! ➜ Keep manual within reach. ➜ All personnel who have to perform any task on the BESS (on-site or remotely) with respect to operation of the unit are obligated to read all related manuals regarding the BESS. By proceeding with work on the BESS, the personnel declare that they have fully read and understood all contents of the manuals and agree to follow all instructions, especially issues regarding safety and accident prevention.

⚠ DANGER	
	**Hazard by voltage** Always respect all the safety instructions and, in particular: ➜ Always use protective devices suitable and approved for each type of activity. ➜ The instructions in this manual must be strictly followed. ➜ Use of the equipment must comply with all national and local regulations. ➜ Access to internal components is only allowed after the converter has been de-energized and disconnected from all power supplies.

⚠ DANGER	
	**Hazard by voltage** ➜ Electric shock hazard. ➜ Only electricians may perform work on electrical components. ➜ Do not touch live components! ➜ Disconnect the device from all power supplies, before performing work on the device. ➜ Do not short circuit any conductive parts that are not de-energized before. (Take care with jewellery, tools, instruments, etc. which can cause short circuits accidentally.)

⚠ DANGER	
	**Hazard by voltage** ➜ Before opening the cabinet doors de-energize the converter. ➜ Even if the main circuit breaker is switched off, the cabinets are not completely voltage-free.

⚠ DANGER	
	**Risk of burns on hot surfaces** ➜ Avoid contact with hot surfaces or wear protective clothing (e.g. protective gloves).

⚠ DANGER	
	**General risk of injury due to improper handling** ➜ Only perform work on the device if you have expert knowledge of the respective activity. ➜ Follow the operating instructions and warnings stated in this manual.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 “Protect the CB Against Unintentional Reclosing”. ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

⚠ DANGER	
	**Danger to life through electric arcs** Danger by electric arcs could occur by: • Exceedance of the maximum input current • Faulty design of circuit breakers or transformers • Faulty or not connected cables • Excessive contamination Electric arcs may lead to death, severe injuries or material damage. ➜ Make sure the system is properly designed and all power cables are connected correctly. The maximum permissible input current is provided in the table "Technical Data". ➜ Excessive contamination must be removed.

⚠ DANGER	
	**General risk of injury due to improper handling.** Always respect all the safety instructions and, in particular: ➜ Always use protective devices suitable and approved for each type of activity. ➜ The instructions in this manual must be strictly followed. ➜ Use of the equipment must comply with all national and local regulations. ➜ Access to internal components is only allowed after the converter has been de-energized and disconnected from all power supplies. ➜ It is not allowed to perform work on a live converter. ➜ The converter and all connected systems/components must be electrical grounded properly. ➜ All installation work and maintenance on the BESS must be carried out by qualified personnel. ➜ Improper use or handling of the BESS during transportation, installation or during operation may result in damage to the equipment or cause severe, even fatal injury. ➜ Maintenance work on the converter unit must be performed with reasonable care. ➜ Non-compliance with the present instructions may cause damage to the product and could lead to serious injuries of the personnel.

⚠ DANGER	
	**Danger to life when live parts are touched on damaged devices** Improper handling of devices can cause damage. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components. If touched, this can result in death or severe injury. ➜ Ensure compliance with the limit values specified in the technical data during transport, storage and operation. ➜ Do not use any damaged devices.

⚠ DANGER	
	**Danger to life through electric shock due to unconnected cable shields** Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields. ➜ As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.

⚠ DANGER	
	**Danger to life due to electric shock when not grounded** If the protective conductor connection is missing or incorrect, high voltages can occur at open, exposed parts when using devices of protection class I. Touching these parts can result in death or serious injury. ➜ Ground the device in compliance with the applicable regulations.

⚠ DANGER	
	**Danger to life due to electric shock when opening plug connections in operation** When opening plug connections in operation, arcs can result in death or severe injuries. ➜ Only open plug connections when the equipment is de-energized, unless it has been explicitly stated that they can be opened in operation.

⚠ DANGER	
	**Danger to life through electric shock due to the residual charge of the power component capacitors** Due to the use of capacitors, a dangerous voltage is present even up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury. ➜ Wait for 5 minutes and then check the de-energized state of the system. Only then should you start working on the device.

⚠ DANGER	
	**Danger to life from electromagnetic fields** Electromagnetic fields (EMF) are generated by the operation of electrical power equipment, such as transformers, converters, or motors. People with pacemakers or implants are at particular risk in the immediate vicinity of this equipment. ➜ If you have a heart pacemaker or implant, maintain a minimum distance of 2 m from electrical power equipment.

⚠ DANGER	
	**Danger to life when safety functions are inactive** Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death. ➜ Observe the information in the appropriate product documentation before commissioning. ➜ Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components. ➜ Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing. ➜ Perform a function test. ➜ Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

⚠ DANGER	
	**Danger to life due to fire if overheating occurs because of insufficient ventilation clearances** Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems. ➜ Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

⚠ DANGER	
	**Danger of an accident occurring due to missing or illegible warning labels** Missing or illegible warning labels can result in accidents involving death or serious injury. Check that the warning labels are complete based on the documentation. ➜ Attach any missing warning labels to the components, in the national language if necessary. ➜ Replace illegible warning labels.

⚠ WARNING	
	**Hazard by hot surfaces of components** During operation, some components may heat up significantly, e.g. heat sinks and inductors. These components can still be very hot for some time after operation. In case of contact, severe bodily injuries, such as skin burns, may result. ➜ Do not touch hot surfaces even after shutdown of the converter system.

⚠ WARNING	
	**Danger to life or malfunctions of the BESS as a result of incorrect or changed parameterization** As a result of incorrect or changed parameterization, the system can malfunction, which in turn can lead to injuries or death. ➜ Protect the parameterization (parameter assignments) against unauthorized access. ➜ Respond to possible malfunctions by applying suitable measures (e.g. EMERGENCY STOP or EMERGENCY OFF).

⚠ WARNING	
 	**Hazard by cooling liquid** The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed. ➜ Avoid oral ingestion of the coolant since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention. ➜ Avoid skin contact with the coolant. ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

⚠ CAUTION	
	**Hazard by sharp edges on packaging** Improper handling during unpacking can cause injuries. ➜ Use appropriate safety gloves to protect your hands from possible cuts.

NOTICE	
	**Material damage due to loose power connections** Insufficient tightening torques or vibrations can result in loose electrical connections. This can result in damage due to fire, device defects or malfunctions. ➜ Tighten all power connections with the specified tightening torques, e.g. grid supply connection. ➜ Check all power connections at regular intervals. This applies in particular after transport.

NOTICE	
	**Device damage caused by incorrect voltage/insulation tests** Incorrect voltage/insulation tests can damage the device. ➜ Before performing voltage/insulation tests on the equipment, disconnect all equipment as high voltage tests have been performed on inverters and motors by their manufacturers. Therefore, it is not necessary to perform a retest on the system.

NOTICE

Material damage due to overloading of DC devices and connecting cables

The DC paths and the connection cables are not protected against overload by the BESS.

Select external components according to the specified nominal and maximum currents of the BESS.

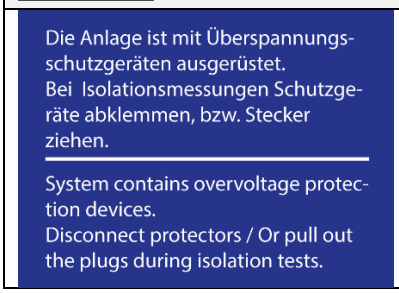
➜ If necessary, use appropriate protective equipment for the external components.

NOTICE

Material damage due to improper use of the transformer

For your safety, carefully read the delivered operating instructions of the transformer and observe the instructions. Technical specifications of the transformer which are provided on its´ type plate like rated current, rated power etc. must be strictly observed when commissioning and feeding power to the grid. All electrical connection work must be carried out onsite and by trained, qualified personnel, provided with the required safety devices in accordance with the national occupational safety regulations. Please pay attention to the proper protection of the transformer during unloading, installation at the place of operation, feeding and operation The transgression of the voltage or power and the presence of external factors (such as condensation, solar radiation, plants and animals) can affect the proper functioning of the transformer).

NOTICE



General risk of damage

During isolation tests disconnect overvoltage protection devices or pull out the plugs otherwise they will be activated or destroyed.

2.3 Safety Instructions Battery Storage Unit

⚠ DANGER	
	**Hazard by electrolyte** Work on the battery storage system is only allowed to be performed by FREQCON service personnel or qualified personnel trained and authorized by FREQCON. It is not allowed to modify or manipulate the battery storage unit and its components. ➜ Do not open, disassemble or puncture the battery storage cabinets or battery modules. ➜ Do not short circuit the battery storage unit. ➜ Do not expose the battery storage system to vibrations or shock. ➜ Do not a use defective or damaged battery storage system or battery modules. ➜ Do not touch defective or damaged batteries with bare hands. Defective or damaged batteries must only be handled by FREQCON personnel.

⚠ DANGER	
	**Hazard by electrolyte** The material/media required for intended operation of the battery storage system are procured and provided by the manufacturer. ➜ The proper handling of these materials/media and the associated risks underly the sole responsibility of the manufacturer. ➜ Hazard and disposal information must be provided by the manufacturer. ➜ The safety data sheets of the material and media manufacturers are to be observed.

⚠ WARNING	
	**Health hazards due to negligent use of personal protective equipment** Serious injuries can occur when working without personal protective equipment. ➜ Wear personal protective equipment (PPE) when working on the BESS. Refer to section 2.7 "Personal Protection Equipment (PPE)" for information regarding the required PPE.

⚠ WARNING	
	**Possible danger to life due to electric shock when extinguishing fire or due to flooding!** If the following instructions are not observed, this can lead to damage to property and personal injury, for which FREQCON GmbH accepts no liability whatsoever. ➜ In the event of a fire, switch off the battery storage system if safe to do so. ➜ Immediately alert the fire department. ➜ Immediately remove yourself and other persons from the danger zone. ➜ Inform the fire department about the presence of lithium iron phosphate batteries.

⚠ CAUTION	
	**Danger due to fire breaking out** During operation, fire may break out, e.g. due to sparks or heated surfaces. ➜ Observe the relevant safety regulations (5 safety rules). ➜ Note the risk of arcing when operating the NH isolators installed inside the battery storage cabinets. ➜ Never install or operate a potentially defective or obviously defective battery storage unit.

⚠ CAUTION	
	**Hazard by burns (electric arcs)** When working on the electrical equipment, you may come into direct contact with faulty or overloaded parts which can cause burns. ➜ Always observe the relevant country-specific safety regulations. ➜ Note the risk of arcing when operating the NH isolators installed inside the battery storage cabinets. ➜ Note the risk of arcing when operating the NH isolators installed inside the battery storage cabinets.

2.3.1 Safety Data Sheet

Observe the information provided in the Material Safety Data Sheet (MSDS) of the battery cells (*see section 1.2 "Applicable Documents"*).

2.3.2 Personal Protection

This chapter describes the personal protection for FREQCON battery converter systems in the event of fire or the occurrence of a toxic gas concentration.

Basic safety measures

- No person may remain inside the container or in the safety area of the container while the system is in operation.
- All container doors must be locked while the system is in operation.
- Maintenance and repair work may only be carried out when the system is switched off and all energy sources are disconnected from the system.

Critical situation regarding personal safety

A person enters the container for maintenance/repair work in which there is a fire (risk of deflagration when opening the container door) or a toxic concentration of carbon monoxide due to outgassing batteries.

Definition of the protection objective

Under all circumstances, a person must be prevented from entering the container if the critical situation mentioned before exists.

Technical measures to achieve the protection objective

- Reliable detection of a fire or toxic gas concentration using suitable sensors (smoke detectors, CO sensors, temperature sensors).
- The sensors are redundant. Smoke detectors, CO sensors and temperature sensors are installed in each battery room.
- One H2 sensor is installed inside each battery room of the BESS containers.
- If the system is shut down by emergency shutdown, no person may enter the container.
- If a hazardous situation exists, an infrared thermometer must first be used to check whether there is a fire in the container. A temperature above 60 °C is a sure sign of a fire inside the container. If this is the case, the container doors must not be opened (risk of deflagration) and the fire brigade must be alerted.
- If a fire can be ruled out as the cause of the emergency shutdown, a toxic gas concentration could be present. Entering the container is not permitted in this situation. Active ventilation (exhaust units in the BESS container roof) reduces the gas concentration in the container.

2.3.3 Fire Fighting Measures

1) Fire protection / early fire detection
   a. Spatial conditions:
      Primarily through the structural measure; Space between modules, air conditioning and ventilation reduces the risk of thermal stress to a minimum
   b. It must be ensured that there is no additional fire load in the battery rooms. Unauthorized access must be strictly prevented.
   c. Sensors for detecting smoke, heat and CO gas are redundantly built into the alarm system.
   d. At 300 °C automatic fire suppression using an aerosol mist triggers itself.

Important: Extinguishing an internal cell fire is not possible. Due to the chemical release of bound oxygen in the cathodes, the fire inside the cell sustains itself. The aerosol extinguishing system is intended to prevent the flames from spreading to the outer surroundings of the battery module!

2) Behavior in case of fire
   a. Upon detecting a fire in the battery room, the battery container is immediately and automatically disconnected from the grid. The circuit breaker opens its contacts to prevent any further external energy supply.
   b. Toxic and hazardous substances are released by the battery in the event of a fire.
      Harmful gases include:
      Hydrogen (H_2) 48%
      Carbon dioxide (CO_2) 27%
      Carbon monoxide (CO) 11%
   c. Remove all persons from the danger area.
   d. Clear affected area and secure from entry.
   e. Disconnect all supply voltages of the BESS at the disconnection points of the external voltage sources.
   f. Only start active measures in the event of visible flame development outside the energy storage unit.
   g. Do not enter any electrolyte cloud that may form in the external area (near the floor).
   h. Wait at least 48 hours before starting firefighting measures inside the container. First open the access door and wait another 2 h.

⚠ DANGER	
	**Poisoning and chemical burns hazard** Escaping electrolyte gases contain chemicals which are harmful to humans. ➜ Keep away from electrolyte mist clouds. ➜ Approach electrolyte mist clouds only under full protection. ➜ Observe the instructions in the Material Safety Data Sheet of the battery cells *(see applicable documents)*. ➜ Follow the following instructions

3) Recommendation for rescue units

   Firefighting should be conducted according to regional standards and guidelines.
   (EN 15182-1:2019-11).
   The distance for the fire hose nozzle must be maintained.

Ensure full protective gear according to DGUV Information 205-014 (e.g. DIN EN 469 ; Protective clothing for the fire brigade - performance requirements for protective clothing for fire brigade activities) and recirculating air independent respirator is worn.
For firefighting protective equipment, thermal risk is given more priority than chemical hazard.

4) Instructions after fire extinction

Once the fire brigade has cleared the fire site and the fire has been extinguished, an electrically trained specialist must immediately ensure and verify the absence of voltage (measure all poles) and secure against re-energization.
5 safety rules!
Attention: Batteries continue to maintain voltage even after disconnection!
In addition, ventilate the rooms adequately to eliminate any remaining hazardous fire gases.
According to the technical data sheet, the battery modules must be stored/disposed.

Rules of Conduct for the Fire Brigade

The following notice board must be kept outside the container or handed over to the local fire department. A laminated copy is included in the scope of delivery.

Rules of conduct for the fire brigade



Attention electrical voltage!

Batteries are still live after disconnection!!!

Batteries can outgas when heated

CO = carbon monoxide
H2 = Hydrogen







Unauthorized access is strictly prohibited.

Keep doors closed in case of fire

The use of respiratory protection is strongly recommended





Battery fire cannot be extinguished!

Container cooling from outside

Extinguishing agents: water

2.3.4 Disposal Considerations

Lithium-ion cell batteries are labeled in compliance with the EU Battery Directive 2006/66/EC.

For instructions regarding the disposal of the battery storage system and its battery storage modules, refer to section 24 ”Dismantling and Disposal”.

2.3.5 Transport Information

For information regarding the transport of the battery storage system and its battery storage modules, refer to section 10.2 "Transport”.

2.4 Handling Electrostatic Sensitive Devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE



Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- ➜ Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g. conductive foam rubber of aluminum foil.
- ➜ Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- ➜ Place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam. ESD packaging, ESD transport container).

⚠ DANGER



Danger to life as a result of unsafe operating states resulting from software manipulation

Software manipulations (e.g. viruses, trojans, malware or worms) can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- ➜ Keep the software up to date.
- ➜ Incorporate all installed products, especially the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation.
- ➜ Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

2.5 Warnings and Symbols on the Device



2.6 Qualification of Personnel

Installation, service and operating personnel must be sufficiently trained before installing, operating and handling the equipment.

2.7 Personal Protection Equipment (PPE)

Always wear safety equipment when working on the product.

When carrying out maintenance and service work, secure controllers, devices and units of designated area against accidental activation.

Symbol	Meaning and Application
	Gloves made of nitrile rubber against chemicals and microorganisms (at least protection index 2 according to EN 374-1) • for removal of electrolyte or hydrofluoric acid (only by FREQCON service) • Gloves according to EN 60903 - up to 1000 V AC for live working activities
	Safety shoes (toe protection, non-slip, ESD) • Operation • Cleaning Safety shoes (acid resistant) or rubber boots • for removal of electrolyte or hydrofluoric acid (only by FREQCON service)
	Tightly fitting safety goggles/basket goggles/face shield • for removal of electrolyte and hydrofluoric acid (only by FREQCON service)
	Chemical protective suit • for removal of electrolyte and hydrofluoric acid (only by FREQCON service) • for fire fighting
	Ambient air-independent breathing apparatus • for firefighting in case of smoke formation inside or outside the building (by rescue forces)

Table 6: Personal Protection Equipment (PPE)

2.8 Changes of the Product

Modifications to the product and/or mounting of parts from other manufacturers can endanger the operating safety of the product. This especially applies to tampering with safety-relevant parts.

Any modification carried out without prior written approval by the manufacturer will result in the manufacturer's declaration of conformity becoming void. The responsibility for damage and accidents caused by modifications of this kind shall be borne solely by the user.

2.9 Proper Use

The Battery Energy Storage System (BESS) described in this document is intended to feed into or draw power out of a connected electric grid by means of a power conversion system connected between both. The system specifications are listed in section 3 of this document.

The system is properly constructed, installed and commissioned by FREQCON service personnel according to manufacturer specifications. The operator ensures that the required environmental conditions are met (*see section 8 and 9*).

Modification of the device by the operator or integrator is not permitted. Only use the device in accordance with the specifications in this manual and the locally applicable standards and directives. Use contrary to the specifications and specified operating limits as well as any modification of the energy storage unit by the user is not permitted and will void the warranty!

Deviations from this manual are not permitted or require the separate written approval of FREQCON GmbH.

The system is intended for stationary use as a fixed installation. Any other or additional use is considered improper and increases the risk of personal injury and property damage when handling the energy storage system. The manufacturer rejects any liability and warranty claims for damage caused by improper use.

Access to the container is only permitted for instructed personnel. The access doors of the container must be locked if no instructed personnel are on site. The access doors of the container must be locked if no instructed personnel is on site.

Proper use also includes the following measures:

- ➜ Observe the operating manual.
- ➜ Comply with technical data.
- ➜ Comply with maintenance conditions.
- ➜ Immediately eliminate faults which hamper safety.
- ➜ Operate the unit only when it is in technically flawless condition.

2.10 Misuse

Any use which goes beyond the proper use is considered to be misuse. It can result in serious injuries or damage and is therefore prohibited.

The responsibility for damage resulting from misuse shall be borne solely by the operating company of the product.

2.11 Duties of the Operating Company

To ensure safe, smooth operation of the unit, you as the operator must comply with the following:

Personnel

- ➜ Only allow personnel with corresponding knowledge to operate and clean the product.
- ➜ Only allow a trained electrician or person with electro technical instruction to work on the electrical system. The regulations given in section 1.7 “Target Groups” must be observed.
- ➜ Clearly and bindingly specify the responsibilities for operation, service and maintenance work.

Operating Manual

- ➜ Always keep this operating manual available near the device.
- ➜ Make sure that the personnel have read and understood this operating manual before working on the device.

Safety

- ➜ Monitor the compliance with the generally valid legal and other binding safety and accident prevention regulations.
- ➜ Make sure that the users of the product wear the necessary, personal safety equipment in accordance with their job.
- ➜ Ensure that all safety and danger warnings on the product and in the installation room are kept complete and in legible condition.

Inspection and Maintenance

- ➜ Observe the adherence of the inspection and maintenance intervals in section 16 „Maintenance“.
- ➜ Operate the product only if it is flawless.

2.12 Duties of the User

The following are referred to as users:

- Persons, who install and configure the product.
- Persons, who operate the product and eliminate errors during the process.
- Persons, who carry out checking, maintenance and inspection activities.

Follow the instructions below in the interest of your own safety and for fault-free operation of the product:

➜ Read this operating manual before using the product. If you have questions, contact your superior or the safety officer.
➜ Always carry out activities based on the complete operating manual. Missing information due to an incomplete operating manual can result in serious or fatal injuries and in damage.
➜ Familiarize yourself with the safety devices of the product. Do not make any modifications to it.
➜ Do not operate the product until you have received a complete user training course for this product from an authorized person.
➜ Report any fault in the product to your superior if you cannot and may not eliminate it yourself.

3 Product Description

The battery energy storage system described in this document (BESS) is designed as a battery-to-grid system.

The BESS system is generally capable to provide the following functions, but the specific functions depend on the contractually agreed specifications:



Figure 1: BESS Functions Overview

The BESS consisting of a battery storage system with battery modules, battery control system and air conditioning systems are integrated in two (2) 40" HC containers with an active fire suppression system (*see section 4, "Design"*).

The PCS hardware and software control system as well as the converter technology incl. water cooling system with heat exchangers and air conditioning systems for the interior temperature are integrated in one (1) separate 20" container with a passive fire suppression system. The BESS is connected to the AC grid via busbars at the HV side of a 6.6 kV /620 V AC MV transformer inside the PCS container. The cable entries into the containers are located in the container floors.

It is not permitted to use the BESS system for purposes other than those specified in this manual.

Only sufficiently trained personnel are permitted to run, handle, and operate the unit (*see section 1.7* "*Target* Groups").

3.1 Working Principle

The BESS consists of a converter system with a total output of 1 MW and a battery storage system with a usable storage capacity of 5 MWh (5.5 MWh installed).

The BESS is passively charged by the energy taken from the AC grid via contactors and resistors from the DC link of the PCS as soon as the voltage level of the battery storage system falls below a value predefined in the PCS controller.

3.2 Control

A Programmable Logic Controller (PLC) is used as system controller. After commissioning and parameterization, the BESS operates automatically. The control system provides remote monitoring and access to the converter functions and set point adjustment via IT network. For detailed information regarding the control system, refer to section 6 “Control System”.

3.3 PCS

The BESS system is equipped with an integrated power conversion system (PCS), the FREQCON MSC converter system.

The key component of the converter system is a DC link converter with a control unit, generating a controlled DC voltage from the AC infeed, the so-called DC link voltage. The DC link voltage is kept to a constant level independently from the grid voltage (also in case of power feedback into the grid). It is required that the specified DC voltage setpoint is within a defined operational range.

3.4 Decoupling Protection

The decoupling protection of the converter system consists of the main controller, which evaluates the signals and controls the coupling switch (circuit breaker). In addition, peripherals for measuring the grid voltage are installed. The periphery consists of a HVIO that divides the grid voltage to a lower voltage and a PIII converter interface that digitizes the measured voltage and provides it to the main controller.

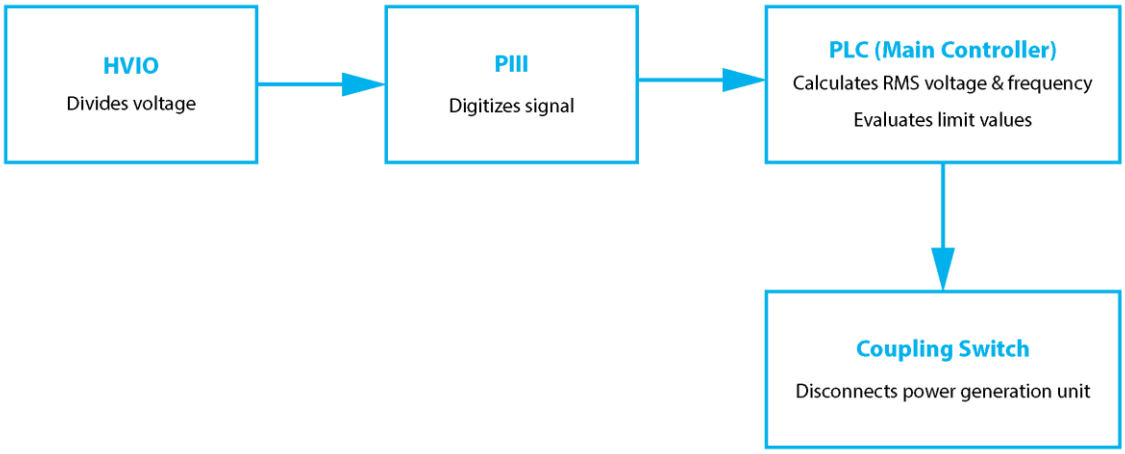


Figure 2: Decoupling protection scheme

The grid phases are measured by an HVIO board that is connected to a PIII. The voltages evaluated are phase-neutral voltages.

The measured instantaneous voltages are used to determine the RMS value, the phase angle and the frequency in the main controller. The currents are recorded directly at IGBT half bridges and also digitized via the PIII. RMS currents are calculated in the main controller.

RMS voltages, RMS currents and frequency are monitored for limit values in the main controller and the coupling switch is switched off if these are exceeded.

3.5 Auxiliary Power Supply of Protective Devices

The entire control system is buffered via a UPS. This is set so that the control and protection system is supplied with energy for at least 15 minutes.

In the event of a faulty UPS and a grid failure, the main controller fails, the grid switch opens, and the converter disconnects from the grid.

3.6 Behavior in the event of a supply voltage failure

If the supply voltage of the converter system fails, the following steps are carried out:

1. The failure of the supply voltage is immediately detected by the main controller.
2. A level 4 error is triggered. This means:
   a. All IGBTs (both DC and AC side) are switched off (500 µs after the fault occurs).
   b. The switches to the energy sources are opened (30 ms after the fault occurs), which disconnects the converter system from all AC and DC networks.
   c. The DC link of the converter system is discharged.
   d. The cooling system of the converter system is switched off (30 ms after the error occurs). This is possible because there are no more heat losses.
3. The UPS supplies the converter control system for another 15 minutes. A backup copy of the init files and parameters is created in the non-volatile memory.
   a. When the power supply is restored, this data is automatically reloaded. It is neither possible nor necessary for the customer to access the data.
   b. Important operating data of the converter system at the time of the power failure (voltages, currents, temperatures, etc.) are logged in a buffer file as long as the UPS is running. Which data is logged in detail depends on the converter type.
   c. The buffer file can be displayed via the FREQCON buffer analysis tool (subject to license) as soon as the supply voltage is available again.
4. If a battery storage system is present, the battery control is switched off immediately so that the battery storage is transferred to a safe state. No operating data of the battery system is saved.
5. Before the switch cabinet doors are opened for a visual inspection after the supply voltage has failed, it is essential to wait for the DC link to discharge.

⚠ DANGER	
	**Risk of injury due to electric shock** Discharging the DC link takes several minutes. The "Ready for Operation" signal light is not an indicator of a fully discharged DC link. Do not carry out any work on the converter before the DC link has been completely discharged. ➜ Wait until the DC link is completely discharged and check that it is de-energized as described in section 14.7 "Check Voltage-Free Status of DC Link ".

4 Design

For better handling and to increase system flexibility, all components of the BESS system are housed in containers.

BESS main components:

- BESS with installed battery modules, control systems and integrated fire protection and suppression system
- Integrated climate control system
- Integrated emergency fan system
- Several sensor systems (H2, CO; temperature and smoke)

PCS main components

- Converter system consisting of AC/DC battery converter, control system and converter cooling system
- Integrated water-air cooling system
- Integrated climate control system
- Several sensor systems (temperature and smoke)

Both the PCS and the BESS are controlled and monitored by the same main control system, which is installed in the control cabinet (CTRL) of the PCS container.

The waste heat in the interior of the containers is conducted via internal air conditioning (AC) units from the interior to external AC units at the front side of the container (*see section 4.8 "Cooling System"*).

The BESS containers are equipped with recesses on its underside for the passage of cables (*see section 11.2.2 "Cable Outlets"*). Furthermore, the PCS container is also provided with cutouts on the bottom side to connect the external AC and DC line cables to the converter system.

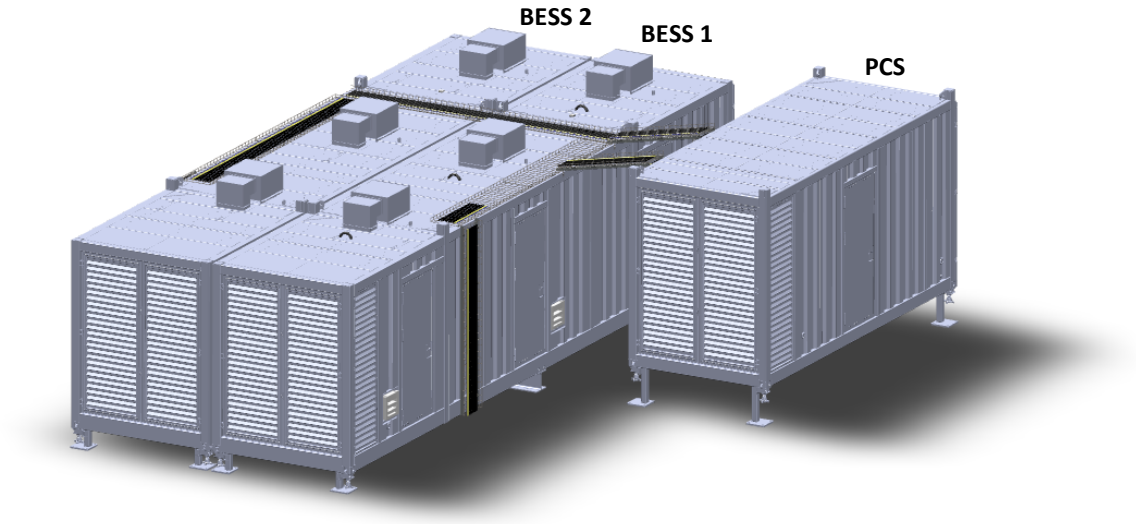


Figure 3: Design

4.1 AC Grid Connection

The BESS is equipped with AC busbars for connection of a 620 V AC grid. The AC busbars are located inside the AC_DC cabinet (*see section 4.4.3*) of the converter system.

Cutouts for inserting the AC power cables into the container are located in the container floor (*see section 11.2.2 "Cable Outlets"*). Through these cutouts, the AC power cables can be fed directly from below into the converter cabinets and connected to the corresponding AC connection busbars inside the cabinets of the converter system.

Further information and a description of the connection of the AC mains supply cables to the converter system are provided in section 11.2.4 "AC Connection".

Note:
The electrical connection must only be performed by personnel trained by FREQCON or by FREQCON service personnel.

4.2 Data Interface

The BESS system can be connected to an electronic higher-level control unit (control room) via a PROFINET interface. The required parameters (current, voltages, frequency, power) are provided by the BESS main control system and transmitted via PROFINET protocol.

The higher-level control unit is connected to the main control unit via a network isolator (114A1) in the CTRL_1 control cabinet (*see section 11.2.5 "Higher-Level Controller Connection"*).

For external control and monitoring of the converter, it is necessary that the customer has access to selected control and status variables stored in the BESS main control system, which can be read and overwritten by the customer's higher-level control. For this purpose, predefined control profiles with the relevant control variables and status profiles with all relevant status variables are stored for the data transfer between the customer's higher-level controller and the converter system.

For a detailed description of the individual data profiles, see the applicable document "23A2007_250116_Modbus_Register BESS_Vx_x_x_x".

4.3 Safety Design

4.3.1 Safety Chain Battery Cell

The battery monitoring system, BMS interface UI and BMS interface RS485, signal error messages via potential-free contacts. See also the documentation for the "BMS interface UI" and "BMS inter-face RS485" hardware modules.

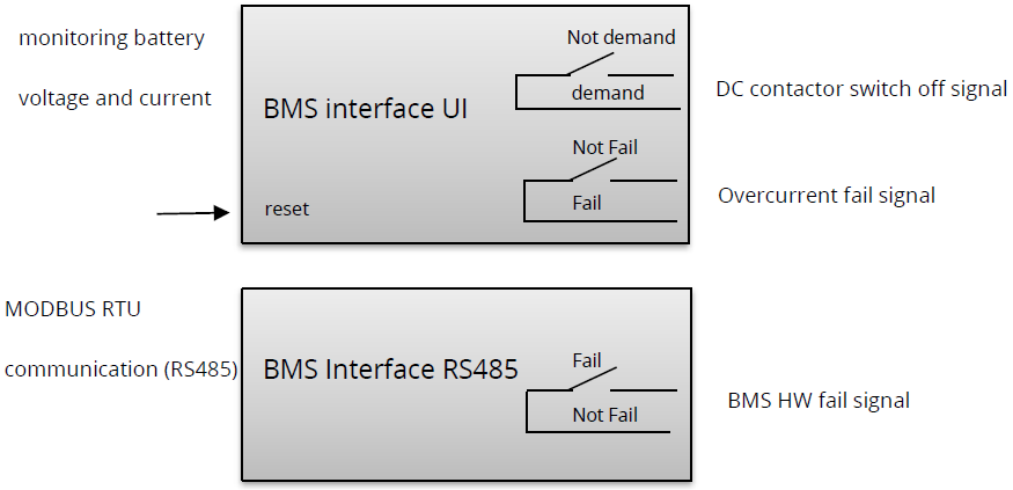


Figure 4: Safety chain battery cell

4.3.1.1 BMS Interface UI

The BMS interface UI monitors the total voltage of a battery rack and the current of the rack.
The BMS interface UI independently monitors the global battery voltage and the battery current. There is a potential-free contact for both errors which opens the contact in the event of an error.
The BMS interface UI has its own digital input for resetting an error message. If an error has been signaled and acknowledged manually via the visualization or MODBUS TCP, this digital input is set briefly.

4.3.1.2 BMS Module

The signals of the BMS interface are monitored in FB_battery_monitoring.
BMS interface RS485 HW error signal. The BMS monitors the battery cells for overvoltage, undervoltage and overtemperature.
If an error is detected locally by a BMS board, the safety chain is opened and an error is signaled.

4.3.2 Safety BMS Rack (S7)

The BMS rack monitors the following states:

- Modbus RTU communication error: The MODBUS RTU master cyclically queries the data of all BMS battery modules (MODBUS RTU slaves).
  If a MODBUS RTU slave [nmodule] is not reached or supplies faulty data, this is evaluated as a communication error. There is a communication error counter for each battery module. While a communication error increments the counter reading, successful communication re-sets the counter to 0.

- Battery voltage monitoring (cmp): The measured battery voltage is cyclically compared with the sum of the individual battery module voltages. If the absolute value of the difference be-tween the two voltages exceeds the 16 V limit value for more than 30 s, an error signal is is-sued.
- Battery monitoring cell voltage: Monitoring of all cell voltages to the maximum value of the measured voltages.
- Battery monitoring current: Monitoring of the battery current.
- Battery monitoring cell temperature: The maximum battery cell temperature is determined cyclically, approximately every 2.5 s, from all battery module cell temperatures recorded. A peak filter suppresses temperature jumps greater than 5 °C for a maximum of 8 cycles. If the average cell temperature is already close to the switch-off limit, incorrect measurements (jump) would result in a warning or error signal.
- Battery monitoring Balancer Temperature and ambient temperature Balancer
- Monitoring the battery pack connections + and - for overtemperature
- Smoke detector
- Gas sensor
- Line protection (fuses) of the auxiliary systems
- Main fuse (battery current)
- Modbus-TCP communication error: An error is triggered in the event of a communication timeout with the charging system (inverter control).
- Contactor feedback: Monitoring whether the status of the contactors matches the target status

If a fault is detected, the DC contactors open after 0.5 seconds.
In addition to errors, warnings can also be generated for cell voltages and cell currents.

4.3.3 Safety Converter Control

The converter system constantly communicates with the connected battery racks and continuously checks the following statuses:

- Modbus-TCP communication: In the event of a communication timeout with the battery racks, a corresponding rack is switched off or an error is triggered at converter level.
- Fault conditions: All faults at BMS rack level are signaled to the converter and the current is briefly set to zero to enable the DC contactors in the racks to be switched without current. Every fault reported by a rack prompts the converter system to disconnect the corresponding rack. Some error states also trigger a switch-off of the converter. The following error messages trigger a switch-off of the converter:
  - Error with the DC contactors in a rack
  - Tripping of a DC fuse in a rack
  - Triggering a smoke detector in a rack
  - Triggering a gas alarm in a rack
- Overvoltage (cell voltage): In the event of a cell overvoltage, the current setpoint value is also set to zero independently of the lookup tables.
- Undervoltage (cell voltage): If a cell is undervoltage, the batteries are charged with a low current to prevent deep discharge. If the cell voltage drops further, the corresponding rack is dis-connected.
- Warning messages: If a warning message is generated by a rack, the charging system re-quests a disconnection of the corresponding rack. As soon as the warning is no longer pre-sent, an attempt is made to reconnect the rack.

- Charge control system: To protect the cells from fault conditions, the following limits are available for charging and discharging the system. The respective limit values can be stored via lookup tables and thus set graduated limit values for the charging and discharging current. All limits are analyzed separately and the lowest limit is selected for the current limit. The limits are parameterized so that the charging or discharging current can be reduced to 0 A.
  - Maximum cell voltage
  - Maximum cell temperature
  - Maximum balance temperature
  - SOC (real)
  - Customer SOC (adjusted to capacity sold)

4.3.4 Overview of the Safety Concept

The safety aspects described in chapters 4.3.1 to 4.3.3 result in a three-stage safety concept:

1. Module level:
   - Detection of cell voltages and temperatures and opening of the safety chain in the event of a limit value violation.
2. Rack level:
   - Evaluation the safety chain and open the DC contactors if necessary.
   - In-house evaluation of cell voltages, cell currents, cell temperatures, smoke sensors, gas sensors and communication with the modules and the charging system. If required, fault generation and opening of the DC contactors.
   - Option to disconnect the rack independently if the safety chain is triggered or a self-detected fault condition occurs.
3. Converter level:
   - Evaluation of the cell voltages, currents and temperatures as well as the error states of a rack. Triggering of a converter error for selected error states of individual racks.
   - Reduction of the charging and discharging currents according to lookup tables depending on the cell voltage and temperatures.
   - Request to switch off the rack or the inverter in the event of a rack fault.

4.3.5 Fire Protection System and Suppression System

FREQCON uses highly safe lithium-ion battery cell technology: Lithium iron phosphate (LiFePO4) cells are, among other things, highly temperature resistant and significantly safer compared to cells based on other lithium-ion technologies. The use of these technologies significantly reduces the probability of a thermal runaway, as they do not catch fire even in the event of a short circuit or overcharging.

Furthermore, in addition to controlling and monitoring the state of charge at cell and system level, the FREQCON BMS (Battery Management System) also handles temperature management during charging and discharging. Every second, the temperature, state of charge and all other important operating parameters of each individual battery cell, as well as of the battery modules, are collected and analyzed by the FREQCON BMS.

This means that a potential problem of the cells is already detected at approx. 60 °C, and thus much earlier than the actual fire development the battery storage is brought back into a safe operating condition by segmental or complete shutdown.

In addition to CO sensors and smoke detectors, there are a total of 339 temperature sensors in one battery cabinet alone. This ensures that the cells are always kept within the defined and safe operating range and that, in addition to achieving high efficiency and low degradation, the probability of overloading is also excluded.

The fire protection system meets the thermal runaway propagation containment requirements of IEC 62619 as well as requirements of the EN 54 Fire detection and fire alarm systems standard.

4.3.5.1 Detection and Response

The fire protection system aims to detect malfunction as early as possible and suppress the problem before it results in a fire hazard. The system is divided into two parts. One part is primarily designed for plant protection and the other part has the aim of personal safety. For both purposes the BESS containers are equipped with several automatic detectors:

Personal safety:

- 3x H2 sensor per BESS container
- 3x emergency exhaust unit per BESS container

Plant protection:

- 1x CO sensor per battery cabinet
- 2x smoke detectors per battery cabinet
- Temperature sensors (in cells)

The carbon monoxide (CO) sensors for the battery cabinets are an extra measure to detect malfunctioning even before smoke detection (VESDA). Its primary objective is to detect outgassing from battery cells. With the cell chemistry known, the specific reactions that occur during outgassing are well understood. The relative proportions of these gases can be predicted based on the known reactions. For the used battery cells up to 169.7 liters of gas mixture of a single battery cell are released in the unlikely event of outgassing. The main components of this gas mixture being approximately:

- Carbon monoxide (CO): 11 %
- Carbon dioxide (CO2): 27 %
- Hydrogen (H2): 48 %

The CO sensors trigger an alarm based on the measured CO concentration as specified in DIN EN 50291-1:

Co concentration	No alarm within	Alarm not later than
30 ppm	120 min	-
50 ppm	60 min	90 min
100 ppm	10 min	40 min
300 ppm	-	3 min

As the complete outgassing of a single battery cell results in about 500 ppm CO in the battery room the CO sensor will be triggered in such an event based on the thresholds in table given above. The CO sensor alarm will reset when the CO concentration falls below approximately 50 ppm.

The alarm level of the analog CO sensor is set to 1000 ppm which is equivalent to a H_2 concentration of about 10 % LEL (lower explosive limit).

The smoke detector has an optical work principle and is getting triggered by (smoke) particles. It is getting also triggered from the aerosol which is released during the outgassing of a battery cell, being thereby independent of the gas concentration.

Personal safety - If an incident should occur and one sensor of the security chain for personal safety is triggered the system responds as follows:

- The complete system (BESS and PCS) is switched off and disconnected from the mains via a control system. The AC connection of the converter is disconnected, the DC connection to the battery storage system is cut off, and if existing, the MV switchgear with the transformer and low voltage distribution are disconnected from the mains.
- H2 concentration > 4000 ppm of analog H2 sensor (equivalent to about 4 % LEL H_2):
  - Battery cabinets are switched off
  - Stop charging/discharging
  - Ventilation starting (Exhaust units)
  - Error message (Error level 4)

Plant protection - Depending on which sensors are triggered the system responds as follows:

- Temperature >55 °C:
  - Battery cabinet is switched off
  - Stop charging/discharging
  - Warning message
- Temperature >56 °C:
  - Same as temperature >55 °C
  - Error message
- 1x CO sensor in the battery cabinets is triggered:
  - Battery cabinet is switched off

  - Stop charging/discharging
  - Warning message
- 2x smoke detectors are triggered:
  - Disconnects battery DC connection (contactors)
  - Deactivate converter IGBTs
  - Disconnect converter from AC connection
  - Error message
- Temperature > 300 °C:
  - StatX fire suppression triggers itself
- CO concentration > 300 ppm of analog CO sensor:
  - Battery cabinet is switched off
  - Stop charging/discharging
  - Error message

The active emergency exhaust system of the container ensures the gas concentration decreases over time. Based on the assumption of a slight overpressure of 1 Pa which is reasonable in the event of an outgassing battery cell, the estimated time for a complete air exchange in the battery room is less than an hour.

4.3.5.2 Active Fire Suppression inside Battery Cabinets

The fire protection system actively fights the fire only in the affected area (battery cabinet). This is achieved by using condensed aerosol, a compact and effective solution compared to CO2 or halocarbons. The aerosol is contained in Stat-X 60 E cartridges, which are triggered by a 12 VDC signal from the control system or self-triggered due to rupture of a temperature sensitive seal, releasing ultrafine cloud of condensed aerosol to chemically extinguish the fire. These cartridges are non-pressurized, leave minimal residue after discharge, and approved for halon and hydrofluorocarbons (HFCs). The cartridges meet the standards dictated by NFPA 2010 and UL 2775.

Each battery cabinet contains two (2) Stat-X aerosol cartridges and two (2) smoke detectors *(see figure below*). Furthermore, the battery cabinets are also equipped with temperature sensors and CO detectors. As soon as a temperature of >300°C has been reached inside the affected cabinet, the aerosol fire suppression cartridges are self-activated and the affected battery cabinet is filled with an aerosol cloud, extinguishing the fire. Aerosol is not released in other cabinets where the sensors have not been triggered, thereby eliminating the fault at the source, and preventing it from spreading to other parts of the system. The aerosol remaining in the air provides additional extended protection for a finite time against re-flash of any fire in case of lithium-ion batteries. The aerosol remains in the cabinet until it is certain that the fire hazard has been eliminated.



① Aerosol cartridge
② Smoke detector

For safety reasons, the container may not be entered for 48 hours after the extinguishing system has been triggered. The defective battery module must then be replaced by the manufacturer and the entire system is put back into operation.

The Stat-X aerosol cartridges are easily replaceable and are connected to the fire protection system again for future events.

Fire detectors will have to be cleaned and tested after a Stat-X discharge event.

After discharge there may be some minimal residue in the immediate vicinity of the generator or underneath it. This should clean up easily with water or detergent as any residue is water soluble. The Stat-X agent does not require hazmat procedures after discharge for cleanup and there are no hazardous materials in the generators themselves

Figure 5: Battery cabinet (1000 mm wide) with Stat-X fire extinguishing cartridges (front view)

4.4 PCS Container

4.4.1 Container Overview

Side view

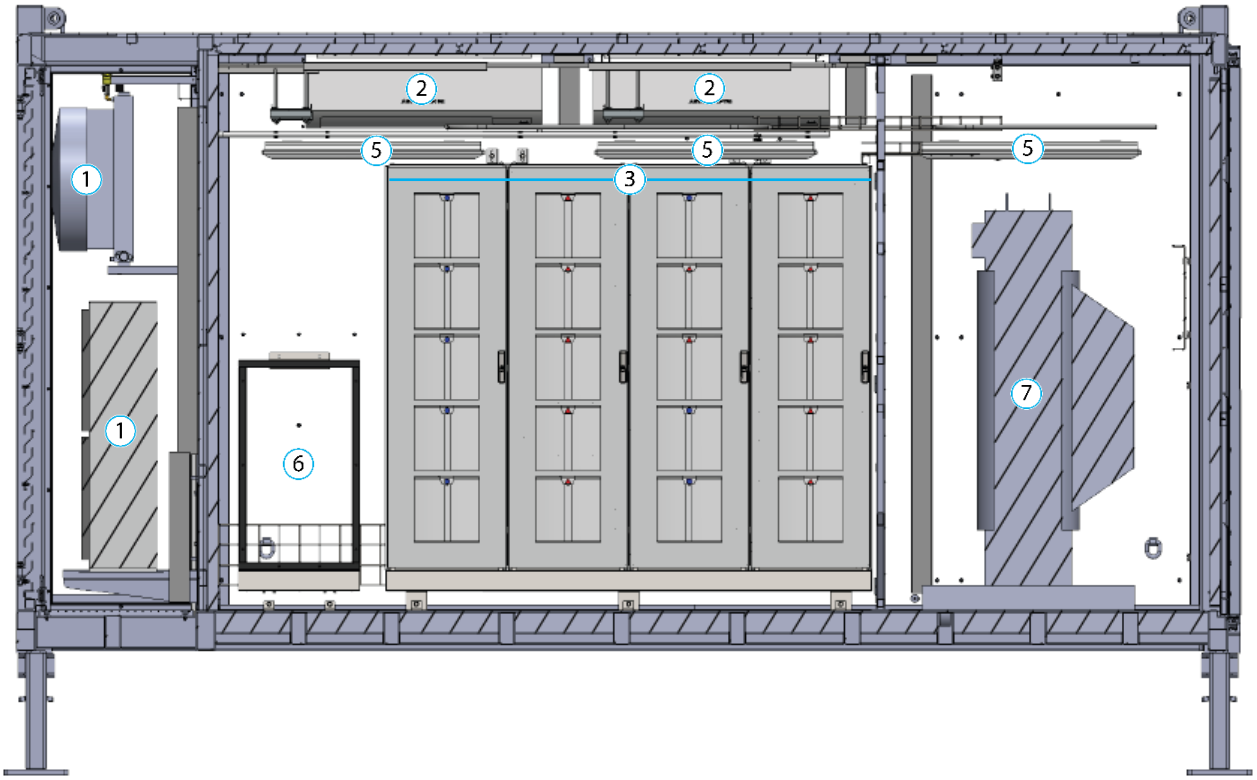


Figure 6: Container overview – side view

Position	Component
①	External cooling system components (*for details see section 4.8 "Cooling System"*)
②	Internal cooling system components (*for details see section 4.8 "Cooling System"*)
③	Converter cabinets (CONV)
④	Control cabinets (CTRL_1 & CTRL_2)
⑤	Container lights
⑥	Cooling system cabinet (COSY)
⑦	MV Transformer

Table 7: Container overview – components

Top View

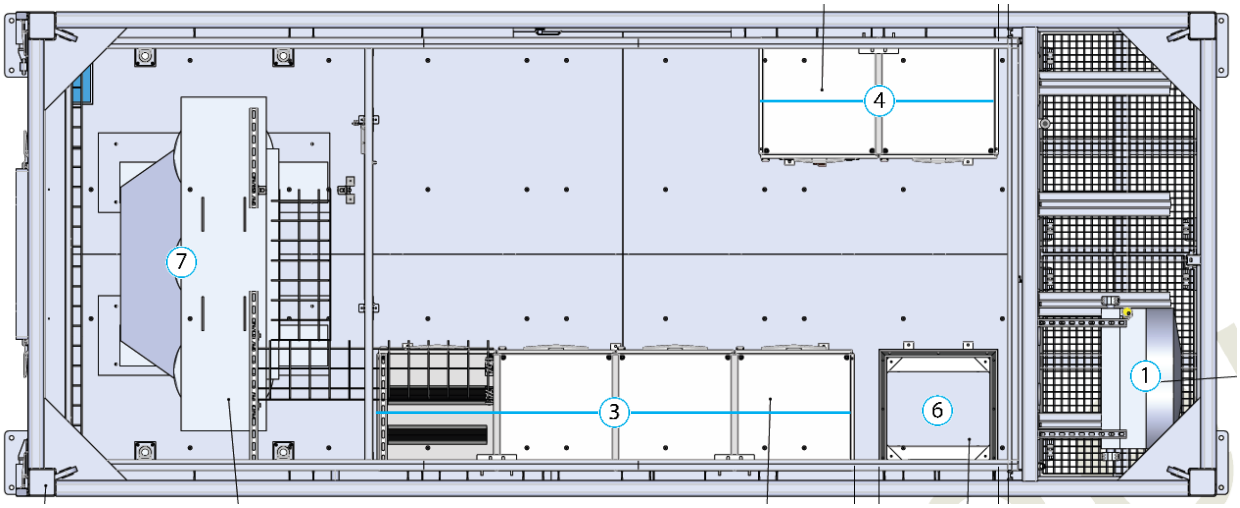


Figure 7: Container overview – side view

Perspective view

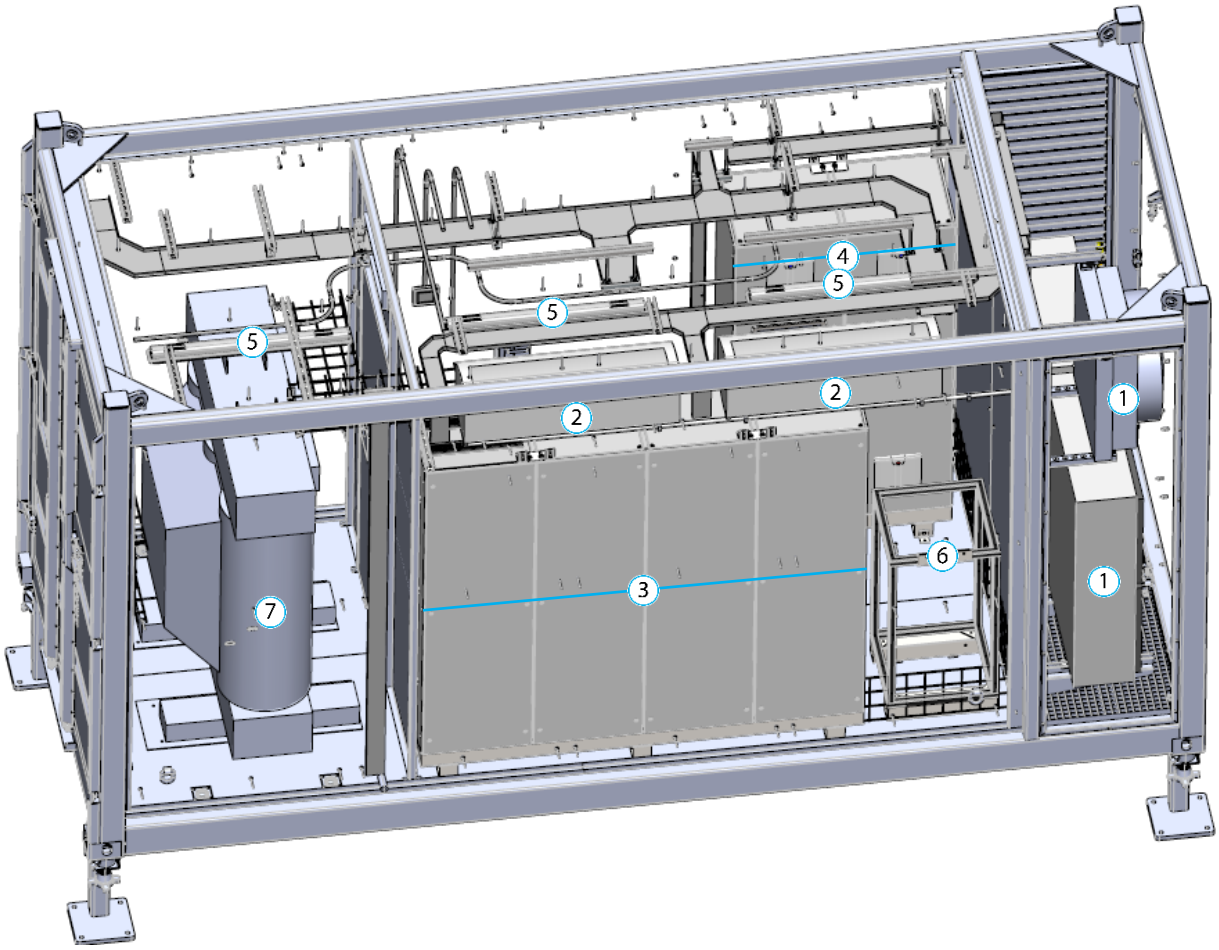


Figure 8: Container overview- perspective view

Side View Left

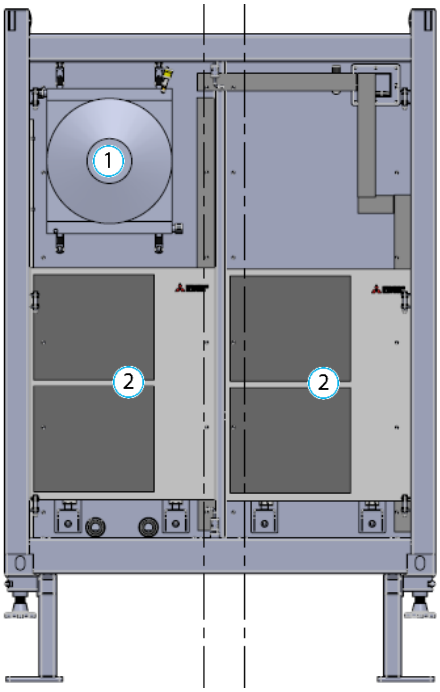


Figure 9: Container overview – side view left

Position	Component
①	Heat exchanger
②	External AC unit

Side View Right

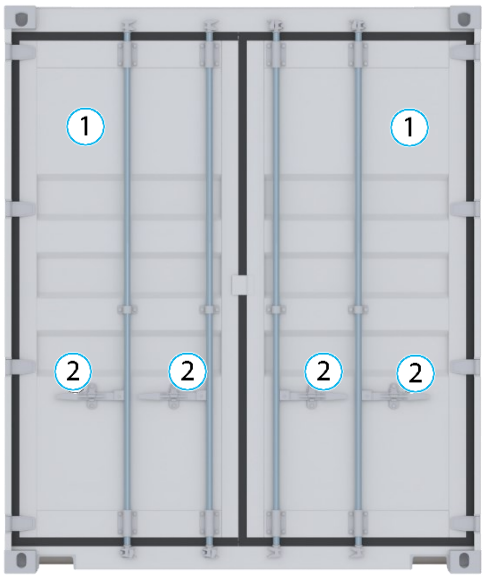


Figure 10: Container overview – side view right

Position	Component
①	Container doors
②	Door lock

Table 8: Container overview – side view left

4.4.2 Cabinet Overview- Converter Cabinets



Figure 11: Cabinet overview – converter unit

Position	Cabinet Designation	Abbreviation
①	Converter cabinet	CON
②	Inductor cabinet	IND
③	Circuit breaker cabinet	CIR
④	AC and DC connection cabinet	AC_DC

Table 9: Cabinet Overview – converter unit

4.4.3 Internal Components – Converter Cabinets

The following internal components are installed in the control cabinets of the AC/DC converter unit:

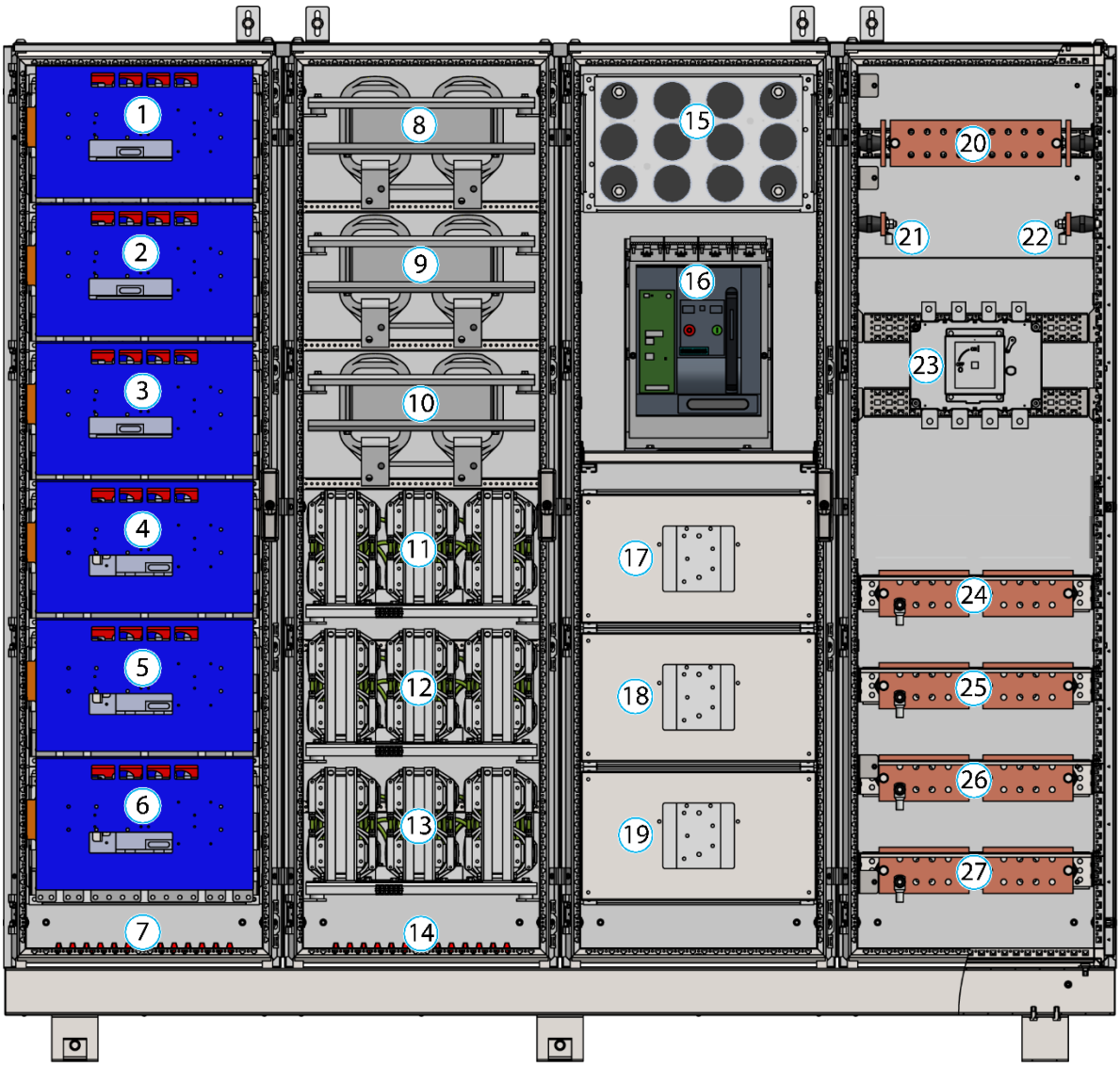


Figure 12: Internal components – converter unit

Pos.	Component	Part number	Identifier
1	AC IGBT Power Stack 1* 1000 A	52872	201Q1
2	AC IGBT Power Stack 1* 1000 A	52872	202Q1
3	AC IGBT Power Stack 1* 1000 A	52872	203Q1
4	DC IGBT Power Stack 3* 250 A	52867	207Q1
5	DC IGBT Power Stack 3* 250 A	52867	211Q1

6	DC IGBT Power Stack 3* 250 A	52867	217Q1
7	Coolant dispenser	--	--
8	AC Single phase line inductor 1000 A / 0.2 mH	53053	201L1
9	AC Single phase line inductor 1000 A / 0.2 mH	53053	202L1
10	AC Single phase line inductor 1000 A / 0.2 mH	53053	203L1
11	DC Single phase line inductor 3x 250 A / 0.6 mH	53046	207L1
12	DC Single phase line inductor 3x 250 A / 0.6 mH	53046	211L1
13	DC Single phase line inductor 3x 250 A / 0.6 mH	53046	217L1
14	Coolant dispenser	--	--
15	AC Filter 1000 A / 3*600 µF	52918	83U1
16	AC Main circuit breaker IEC 1000 A	52955	80Q1
17	DC Switch & Fuse 3* 250 A / 1000 V	52882	227U1
18	DC Switch & Fuse 3* 250 A / 1000 V	52882	231U1
19	DC Switch & Fuse 3* 250 A / 1000 V	52882	237U1
20	AC Grid connection busbars L1/L2/L3	--	78W1 - 78W3
21	N - Connection busbar	--	78W4
22	PE - Connection busbar	--	78W5
23	Switch for earthing and short-circuiting 600 A / 690 V	10172	18Q1
24	DC connection busbars + / - BESS 1 string 1 - 8	--	227W10 – 227W15
25	DC connection busbars + / - BESS 1 string 9 - 11	--	231W10 – 231W11
26	DC connection busbars + / - BESS 2 string 1 – 3 DC connection busbars + / - BESS 2 string 4 - 6	--	231W14 / 231W15 237W10 / 237W11
27	DC connection busbars + / - BESS 2 string 7 - 11	--	237W12 – 237W15

Table 10: Internal components – converter unit

4.4.4 Cabinet Overview - Control Cabinets

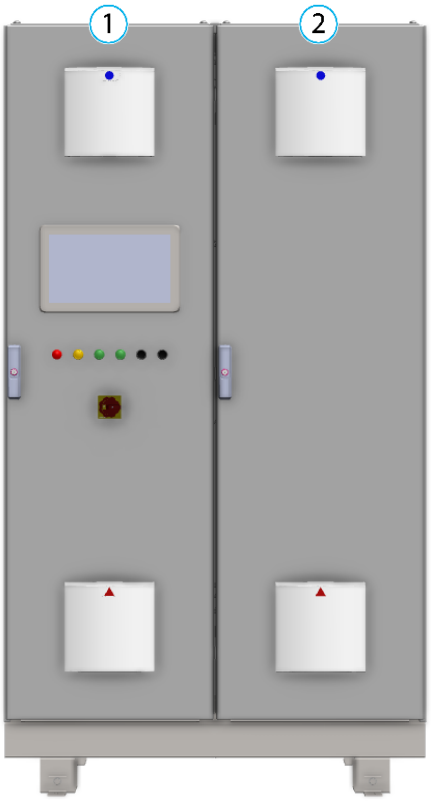


Figure 13: Cabinet overview – control cabinets

Position	Cabinet Designation	Abbreviation
①	Control cabinet 1	CTRL_1
②	Control cabinet 2	CTRL_2

Table 11: Cabinet Overview – control cabinets

4.4.5 Internal Components – Control Cabinets (CTRL_1 and CTRL_2)

The following internal components are contained within the control cabinets (CTRL_1 and CTRL_2).

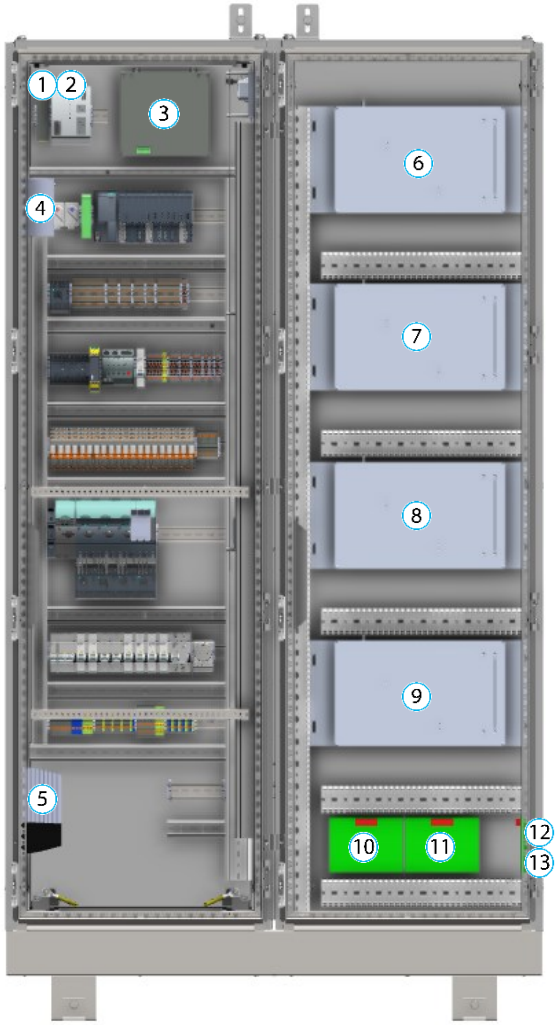


Figure 14: Internal components – control cabinets (CTRL_1 and CTRL_2)

Pos.	Component	Part number	Identifier
1	UPS unit 24 V DC	501836	102G1
2	24 V DC power supply for UPS unit	502745	101T1
3	Energy storage 24 V DC / 12 Ah for UPS unit	501229	102G2
4	Main controller PLC SIMOTION P320-4	500789	110U1
5	Cabinet heater 800 W	500621	185R1
6	PIII IGBT IRT Interface 2.6 V4	504890	240U1
7	PIII IGBT IRT Interface 2.6 V4	504890	241U1
8	PIII IGBT IRT Interface 2.6 V4	504890	242U1
9	PIII IGBT IRT Interface 2.6 V4	504890	243U1

10	HVIO Modul V5.0	500390	161U1
11	HVIO Modul V5.0	500390	162U1
12	HVIO Modul V5.0	500390	163U1
13	HVIO Modul V5.0	500390	164U1

4.4.6 External Components – Control Cabinet

The following internal components are contained within the control cabinet 1 (CTRL_1).

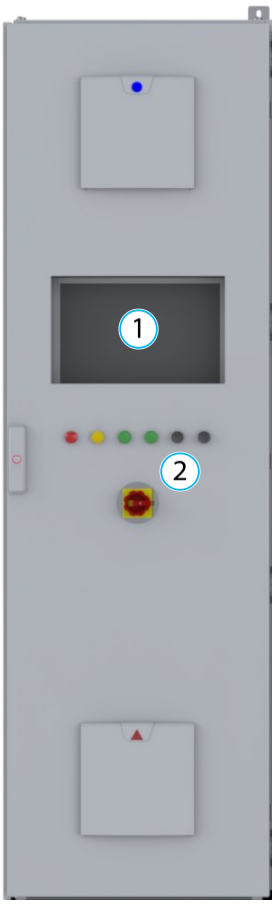


Figure 15: Internal components - control cabinet 1

Pos.	Component
1	HMI panel
2	Operating panel *(see 14.1 "Operating* Panel*")*

Table 12: Internal components - control cabinet

4.5 BESS 1 Container

4.5.1 Container Overview

Side view

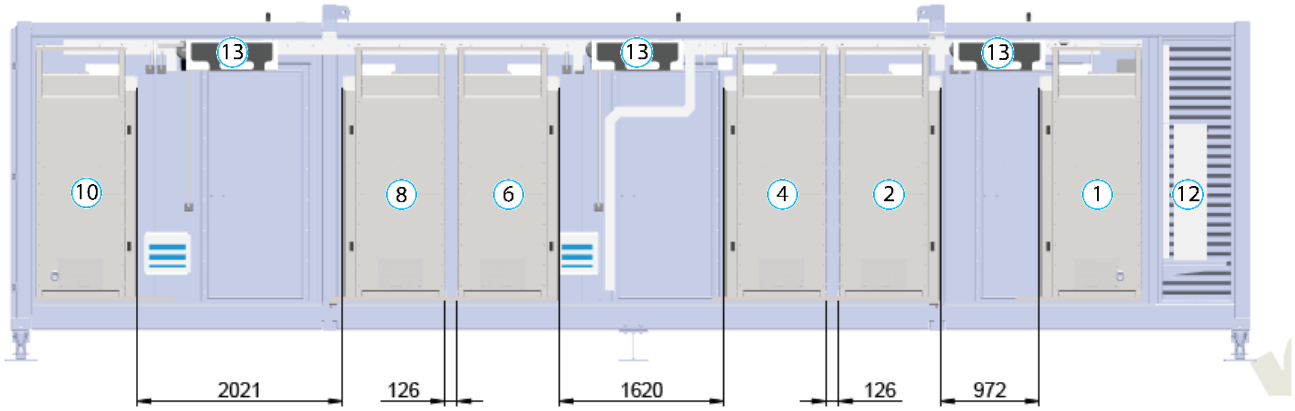


Figure 16: Container overview – side view

Position	Component
①	Battery storage cabinet (BESS 1 string 1)
②	Battery storage cabinet (BESS 1 string 2)
③	Battery storage cabinet (BESS 1 string 3)
④	Battery storage cabinet (BESS 1 string 4)
⑤	Battery storage cabinet (BESS 1 string 5)
⑥	Battery storage cabinet (BESS 1 string 6)
⑦	Battery storage cabinet (BESS 1 string 7)
⑧	Battery storage cabinet (BESS 1 string 8)
⑨	Battery storage cabinet (BESS 1 string 9)
⑩	Battery storage cabinet (BESS 1 string 10)
⑪	Battery storage cabinet (BESS 1 string 11)
⑫	External cooling system component (*for details see section 4.8 "Cooling System"*)
⑬	Internal cooling system component (*for details see section 4.8 "Cooling System"*)
⑭	Container lights
⑮	Lifting device (*for details see section 4.7.5 "Lifting Device"*)

Table 13: Container overview – components

Top View

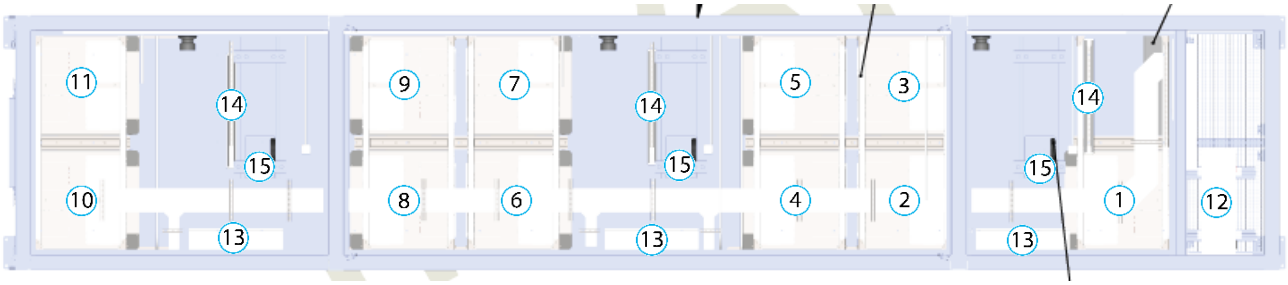


Figure 17: Container overview – top view

Perspective view

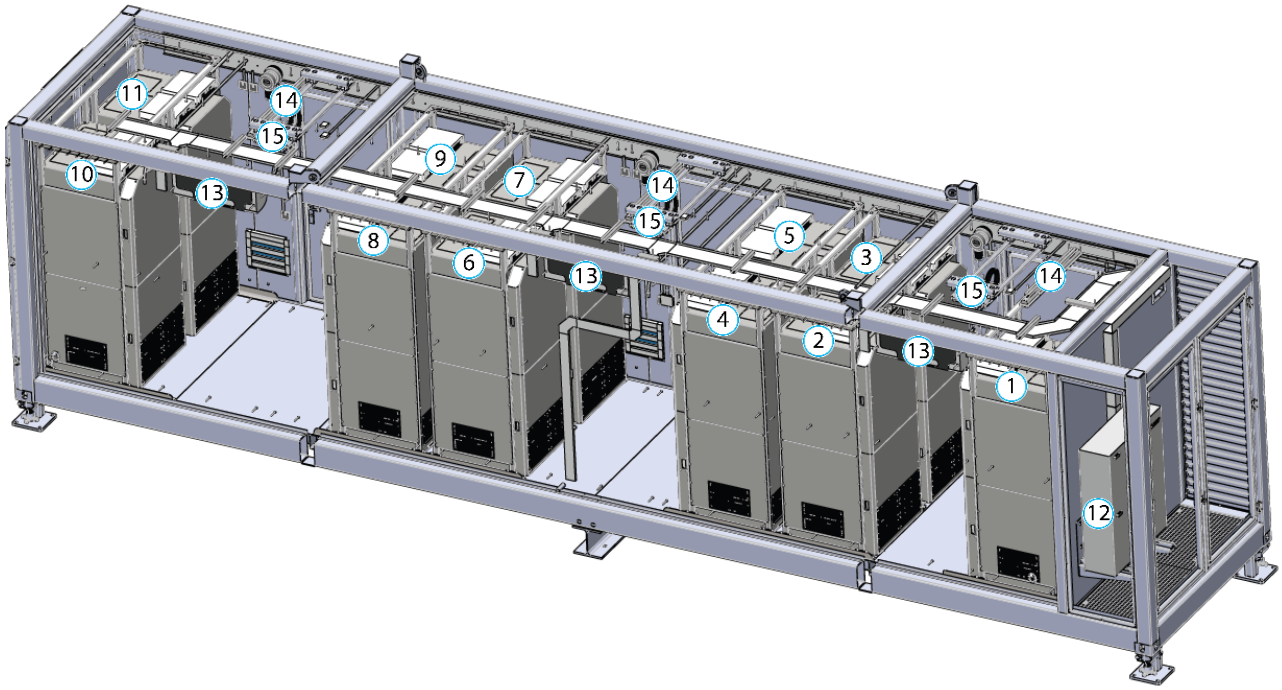


Figure 18: Container overview- perspective view

Side View Left

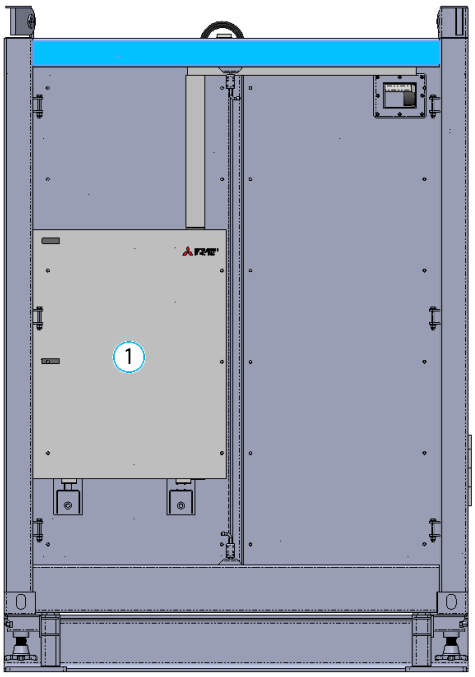


Figure 19: Container overview – side view left

Position	Component
①	External AC unit

Table 14: Container overview – side view left

Side View Right

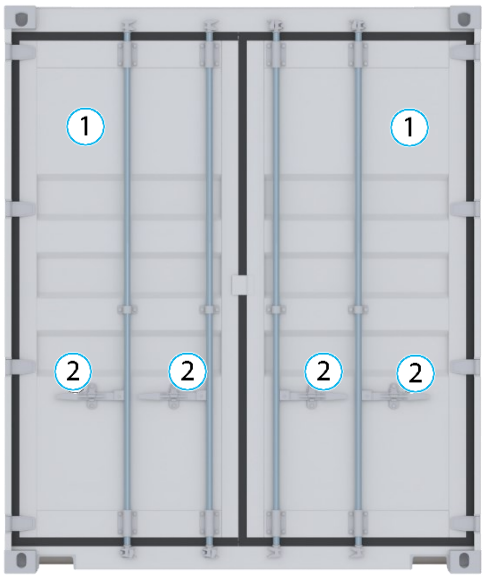


Figure 20: Container overview – side view right

Position	Component
①	Container doors
②	Door lock

Table 15: Container overview – side view left

4.5.2 Cabinet Overview- BESS 1 Battery Cabinets

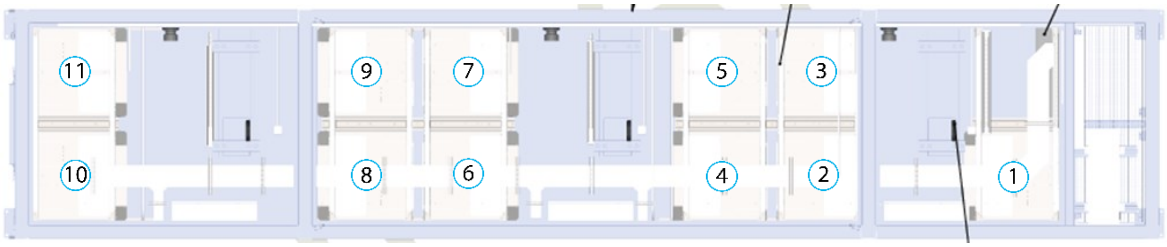


Figure 21: Cabinet overview – BESS 1 battery cabinets (Container top view)

Position	Cabinet Designation	Abbreviation
①	Battery cabinet 1	BESS.STR_1
②	Battery cabinet 2	BESS.STR_2
③	Battery cabinet 3	BESS.STR_3
④	Battery cabinet 4	BESS.STR_4
⑤	Battery cabinet 5	BESS.STR_5
⑥	Battery cabinet 6	BESS.STR_6
⑦	Battery cabinet 7	BESS.STR_7
⑧	Battery cabinet 8	BESS.STR_8
⑨	Battery cabinet 9	BESS.STR_9
⑩	Battery cabinet 10	BESS.STR_10
⑪	Battery cabinet 11	BESS.STR_11

Table 16: Cabinet Overview – BESS 1 battery cabinets

4.5.3 Internal Components – Battery Cabinets

The following internal components are contained within the battery cabinets:



Figure 22: Internal components – battery storage cabinets

Pos.	Component	Part number
①	Cabinet fan	505587
②	Battery module LF 280	508972
③	Aerosol cartridge of fire extinguishing unit Aero-X Stat-X 60E	506501
④	Optical smoke detector 12 V	500713
⑤	DC fuse switch disconnector 3NP1, 3-pole, NH2, 400 A	10226
⑥	Mounting plate with cabinet control system, DC, contactors etc.	52422

Table 17: Internal components – battery storage cabinets

4.6 BESS 2 Container

4.6.1 Container Overview

Side view

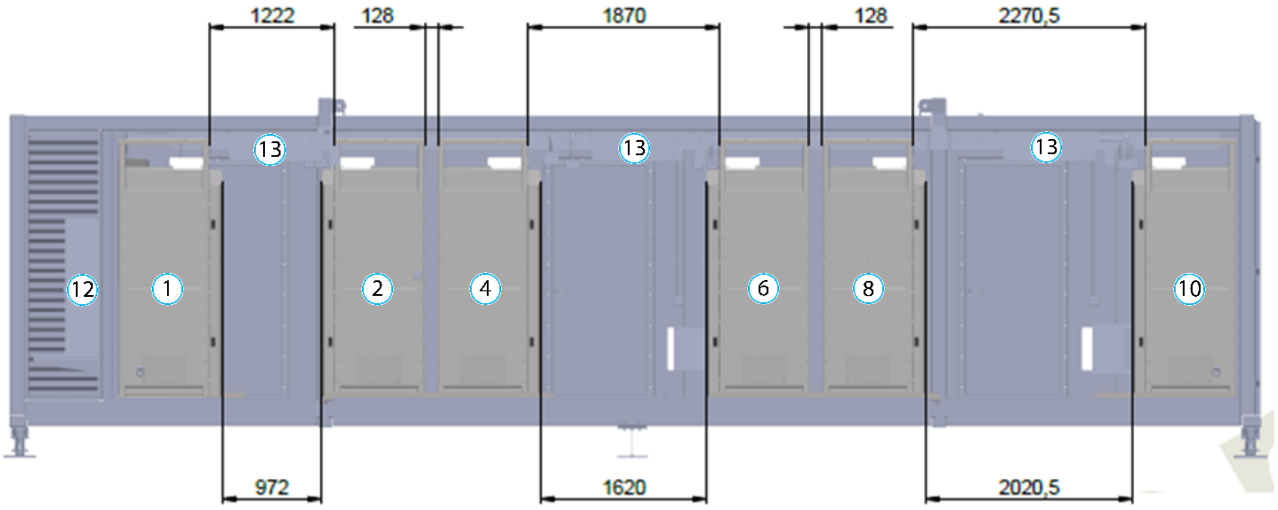


Figure 23: Container overview – side view

Position	Component
①	Battery storage cabinet (BESS 2 string 1)
②	Battery storage cabinet (BESS 2 string 2)
③	Battery storage cabinet (BESS 2 string 3)
④	Battery storage cabinet (BESS 2 string 4)
⑤	Battery storage cabinet (BESS 2 string 5)
⑥	Battery storage cabinet (BESS 2 string 6)
⑦	Battery storage cabinet (BESS 2 string 7)
⑧	Battery storage cabinet (BESS 2 string 8)
⑨	Battery storage cabinet (BESS 2 string 9)
⑩	Battery storage cabinet (BESS 2 string 10)
⑪	Battery storage cabinet (BESS 2 string 11)
⑫	External cooling system component (*for details see section 4.8 "Cooling System"*)
⑬	Internal cooling system component (*for details see section 4.8 "Cooling System"*)
⑭	Container lights
⑮	Lifting device (*for details see section 4.7.5 "Lifting Device"*)

Table 18: Container overview – components

Top View

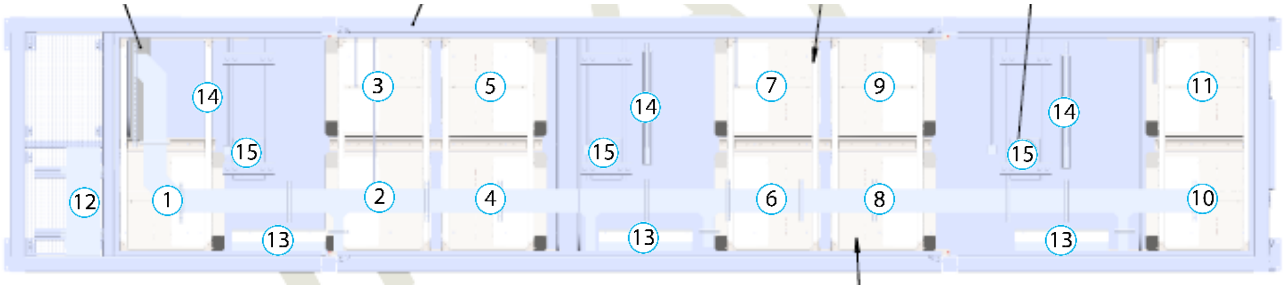


Figure 24: Container overview – top view

Perspective view

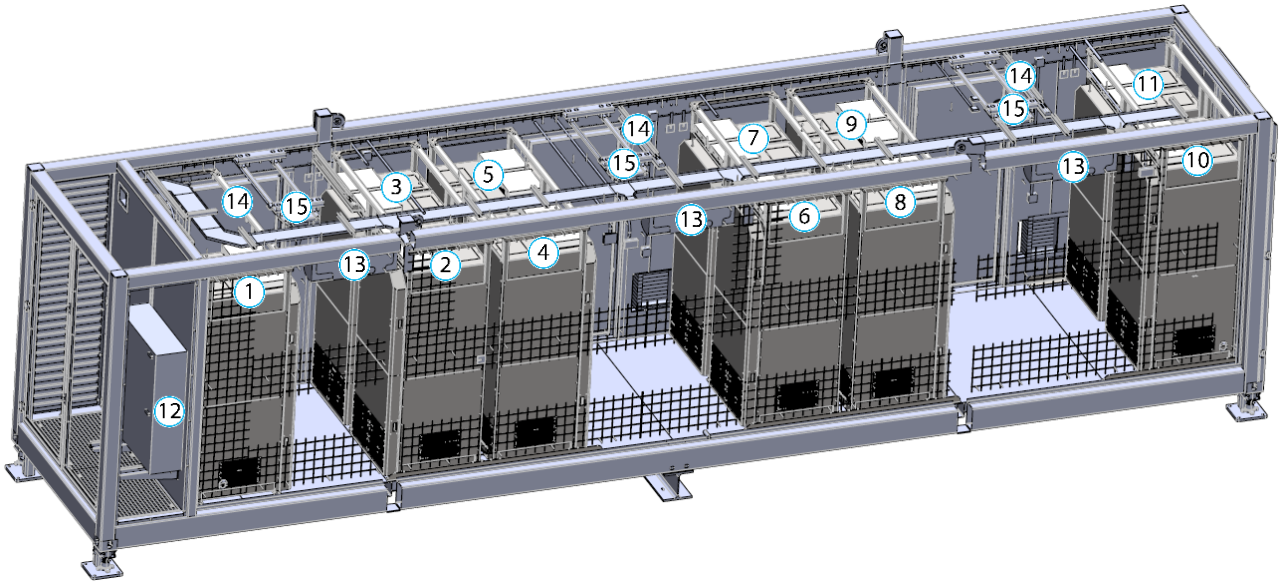


Figure 25: Container overview- perspective view

Side View Left

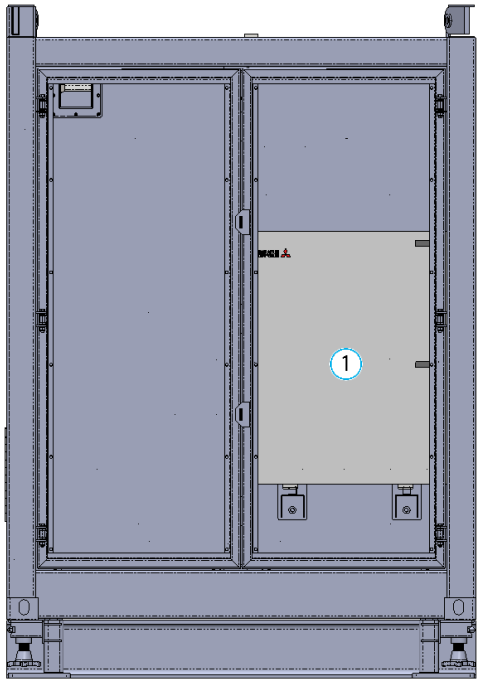


Figure 26: Container overview – side view left

Position	Component
①	External AC unit

Table 19: Container overview – side view left

Side View Right

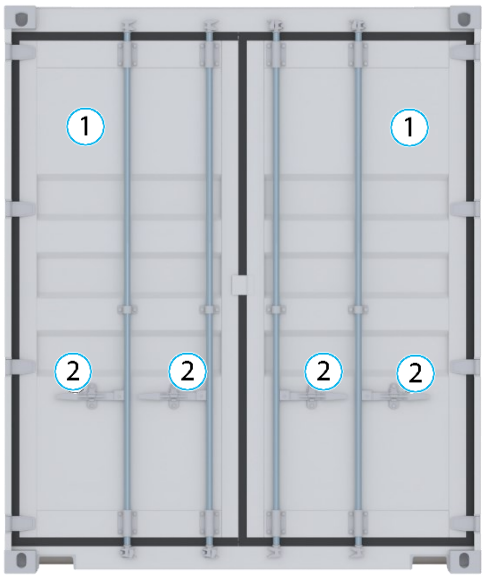


Figure 27: Container overview – side view right

Position	Component
①	Container doors
②	Door lock

Table 20: Container overview – side view left

4.6.2 Cabinet Overview- BESS 2 Battery Cabinets

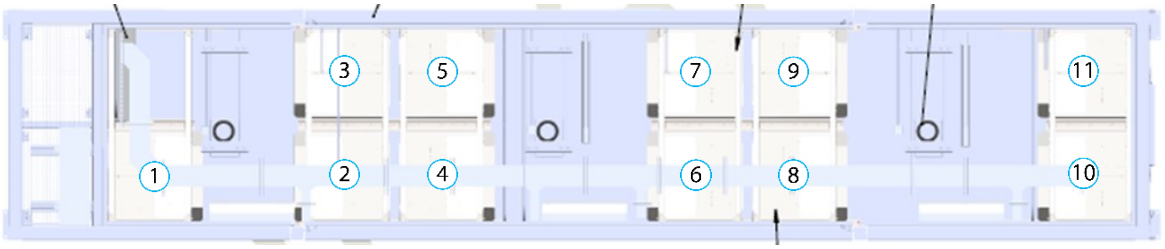


Figure 28: Cabinet overview – BESS 2 battery cabinets (Container top view)

Position	Cabinet Designation	Abbreviation
①	Battery cabinet 1	BESS.STR_1
②	Battery cabinet 2	BESS.STR_2
③	Battery cabinet 3	BESS.STR_3
④	Battery cabinet 4	BESS.STR_4
⑤	Battery cabinet 5	BESS.STR_5
⑥	Battery cabinet 6	BESS.STR_6
⑦	Battery cabinet 7	BESS.STR_7
⑧	Battery cabinet 8	BESS.STR_8
⑨	Battery cabinet 9	BESS.STR_9
⑩	Battery cabinet 10	BESS.STR_10
⑪	Battery cabinet 11	BESS.STR_11

Table 21: Cabinet Overview – BESS 2 battery cabinets

4.6.3 Internal Components – Battery Cabinets

The following internal components are contained within the battery cabinets:



Figure 29: Internal components – battery storage cabinets

Pos.	Component	Part number
①	Cabinet fan	505587
②	Battery module LF 280	508972
③	Aerosol cartridge of fire extinguishing unit Aero-X Stat-X 60E	506501
④	Optical smoke detector 12 V	500713
⑤	DC fuse switch disconnector 3NP1, 3-pole, NH2, 400 A	10226
⑥	Mounting plate with cabinet control system, DC, contactors etc.	52422

Table 22: Internal components – battery storage cabinets

4.7 Battery Modules



Figure 30: Battery module LF 280

4.7.1 Design

The lithium iron phosphate cells (LiFePO4) inside the LF 280 battery modules are connected in series and provide a total energy content of 8.96 kWh per module.

Each module is equipped with a monitoring PCB, providing the following functions:

- Voltage monitoring of single cells for charging and discharging
- Battery temperature monitoring
- Selective cell balancing
- Data exchange with central BESS controller
- Local insulation measurement
- Robust industrial design for transport, assembly und operation



Figure 31: Battery module design

No.	Component
①	Battery module LF280
②	Boreholes for lifting device (M6)
③	DC positive (+) socket
④	DC negative (-) socket
⑤	COM-Connection RJ45 and 24 V DC power supply
⑥	Boreholes for transport handle mounting
⑦	Label with safety and warning instructions

Table 23: Battery module design

4.7.2 Technical Data

Technical Data Battery Module LF 280	
Part number	508972
Rated Voltage	32 V DC
Total capacity	280 Ah
Number of cells per battery module	10
Stored Energy	8960 Wh
Maximum voltage	36 V DC
Max. current	280 A
Max. charge and discharge rate	1 C
Temperature range storage	-20 °C … +45 °C (long-term storage at 0…35°C)
Temperature range operation	0 °C … +55 °C
Connections for DC+ / DC-	Surlock Plus
Communication connections	RJ 45
Protection class	IP 20
Weight	65.3 kg
Dimensions (WxHxD)	188 mm x 239 mm x 908 mm
Cell Data (Single Cell)	
Type	Prismatic cells
Capacity (typ.)	280 Ah
Voltage (typ.)	3.2 V
Voltage (max.)	3.65 V
Voltage (min.)	2.5 V
Battery life	>3500 cycles (80% remaining capacity)
Impedance (AC)	<0.25 mΩ
BMS Pack Universal	
Power supply (external)	24 V DC (rated), <0.5 W
Power supply (internal)	36 V DC (max.), < 0.2 W
Communication	EIA-485, Modbus RTU
Baud rate (max.)	19200 Bit/s
Bus participants (max.)	32
Balancer design	Load resistor
Balancer current @3.5 V	1.06 A
Voltage measurement	10 measurements per 14-bit resolution
Temperature measurements	8x NTC 10 kΩ (up to 14 bit analogue/digital converter) 1x PT100 (12 bit analogue/digital converter)
Isolation measurement	Earth fault monitoring

Table 24: Technical data - Battery module LF280

4.7.3 Connection Elements



Figure 32:Connection elements

Pos.	Terminal	Description	Connection type	Cable
①	X1	DC + Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
②	X2	DC – Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
④	X3	Communication (input)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7
⑤	X4	Communication (Output)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7
⑤	X5	24 V DC power supply	2-pole male terminal	Pay attention to cable routing in cabinet

Table 25: Connection elements

4.7.4 Communication Scheme

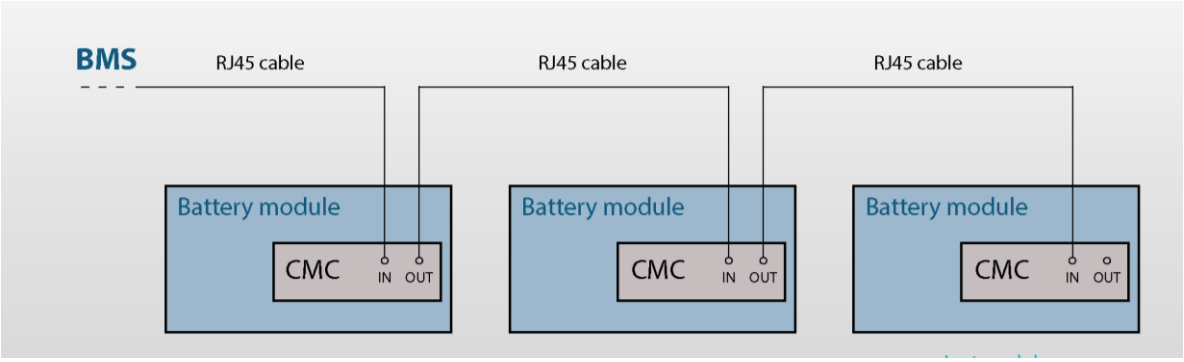


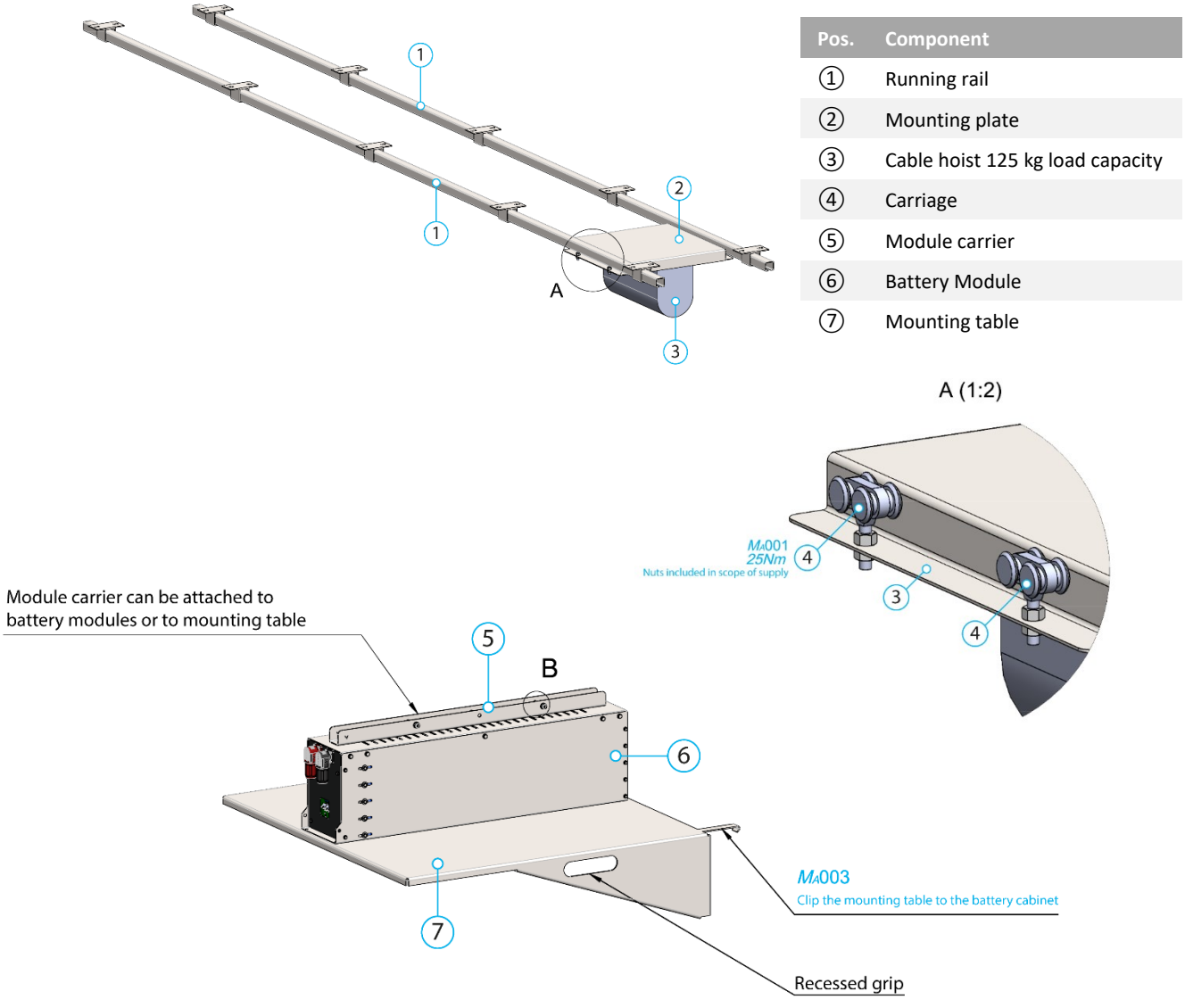
Figure 33: BMS communication scheme

4.7.5 Lifting Device and Mounting Table

For the lifting of battery modules, a lifting device is installed at the container ceiling, allowing safe handling and installation of the battery modules.

The lifting device mainly consist of a cable hoist which is mounted to a mounting plate with carriers, allowing to move the cable hoist through running rails to each end of the container. The cable hoist is operated via cable remote control.
For better handling of the battery modules when inserting them to the battery storage cabinet, a mounting table is provided, that can be attached to the battery storage cabinets.

For detailed information and operating instructions regarding the cable hoist, please refer to the original cable hoist manufacturer's original operating manual (*see section 1.2 "Applicable Documents"*).



Pos.	Component
①	Running rail
②	Mounting plate
③	Cable hoist 125 kg load capacity
④	Carriage
⑤	Module carrier
⑥	Battery Module
⑦	Mounting table

Figure 34: Lifting device and mounting table

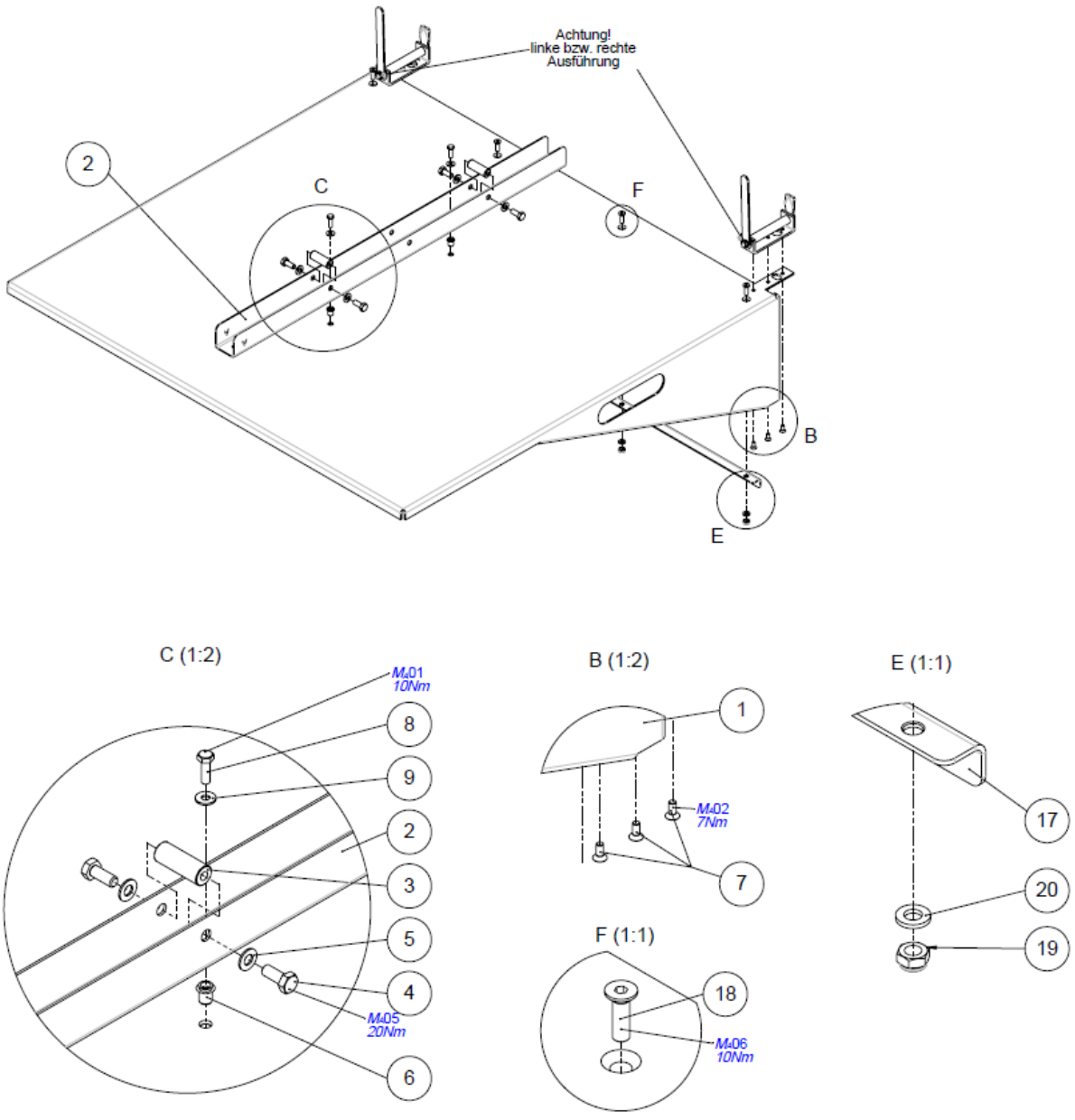


Figure 35: Mounting table

4.7.6 Mobile Lifting Device

A mobile lifting device for moving battery modules inside the BESS containers can be used. The mobile lifting device “Material-Lift GUIL ELC-725” or other models are suitable to lift and mount battery modules inside FREQCON BESS containers.

One (1) battery module can be placed onto the table of the mobile lifting device at once. The module needs to be pushed from the pallet of the forklift truck in front of the BESS container door onto the table of the mobile lifting device.

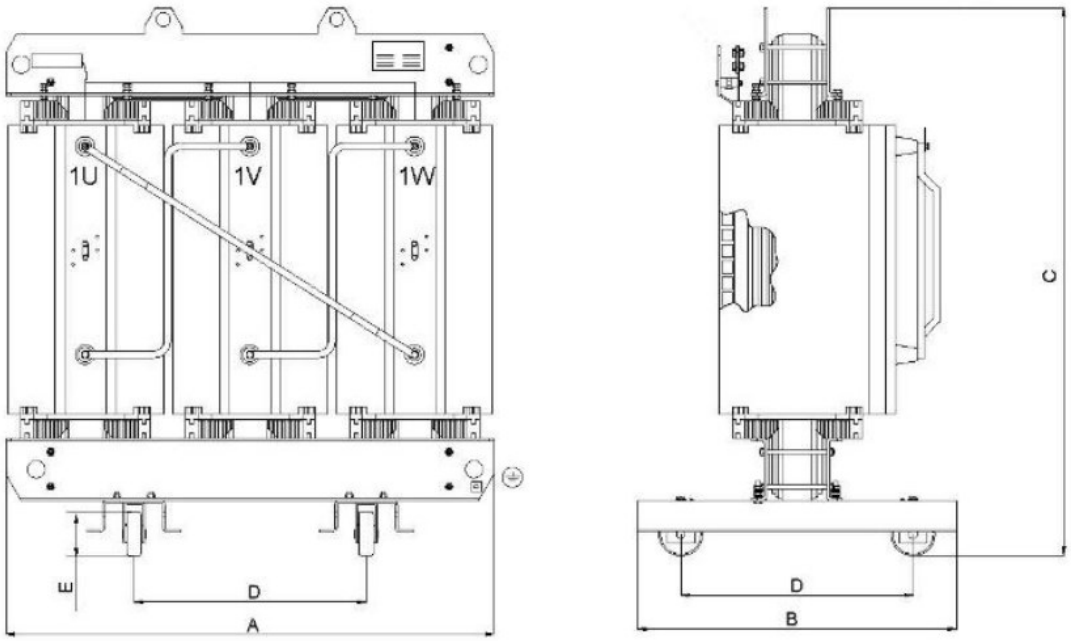
The mobile lifting device can then be moved to the battery cabinet where the battery module needs to be installed.



Figure 36: Mobile lifting device “Material-Lift GUIL ELC-725”

Technical details	
Dimensions L x W x H	400 mm x 550 mm x 1320 mm
Type of construction	Material lift
Overall height	1320 mm
Dead weight	51 kg
Lifting function	Cable winch
Lifting height	4000 mm
Platform dimensions L x W	550 x 500 mm
Table height max.	3940 mm
Table height min.	1320 mm
Load capacity:	125 kg

4.7.7 MV Transformer



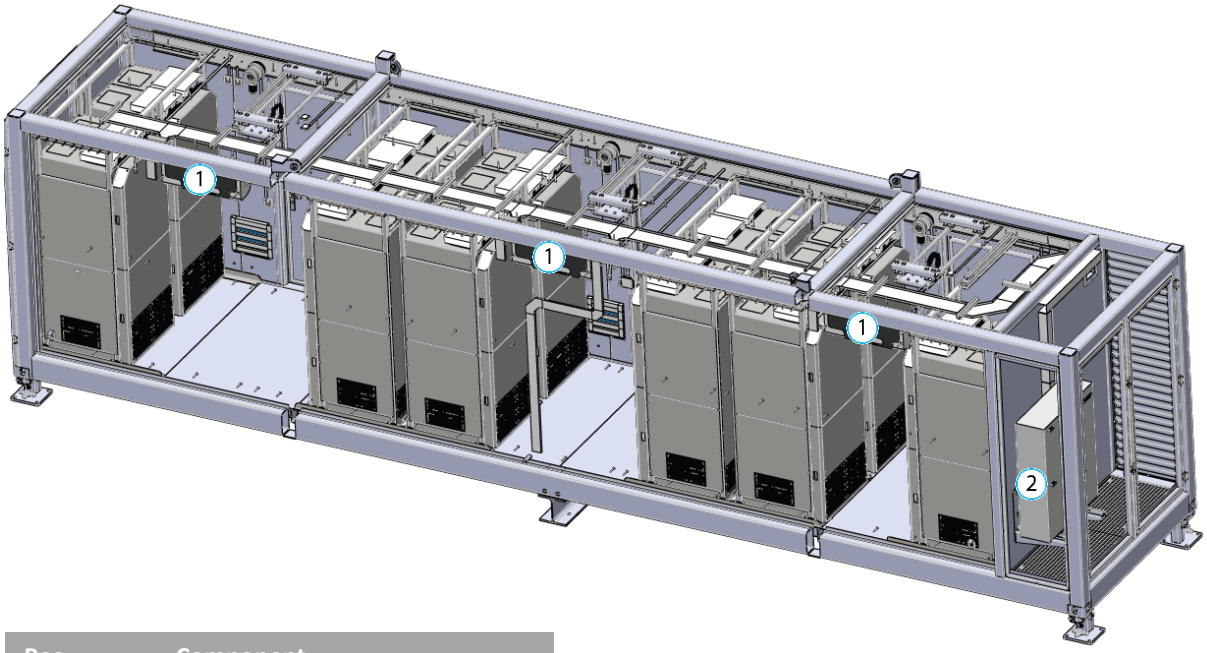
Position	1			
Reference Standards	IEC 60076-1,IEC 60076-11, EU 548/2014,EN 50588-1			
Type	TPZ3K7.2.1250	**Application**	Converter	6 Pulse
Rated Power – AN	1250 kVA	**Duty Class**	I	
Type of Cooling	AN	**Frequency**	50 Hz	
Degree of Protection	IP00			

CHARACTERISTICS

	HV	**LV**
Voltage	7 kV	0,62 kV
Insulation Class	7.2/20/60 kV	1,1/3/- kV
Tapping	±2x2,5%	-
Material	Aluminium	Aluminium
Insulation class	F	F
Temperature rise	100 K	100 K
Connections location	Top	Top
Vector Group	Dyn5	
Level of losses	EcoDesign TIER II	
No-Load Losses (Po)	1620 W	
On-Load Losses 120°C (Pcc)	11000 W	
Tolerance on the losses	0%	
Impedance 120°C (Uk%)	6%	
Power Noise (Lwa)	≤ 66 dB(A)	
Pressure Noise (Lpa)	≤ 52 dB(A)	
Ambient Temperature	-25°C ; + 40°C	
Installation	≤ 1.000 m	
Fire (F), Environmental (E), Climatic (C) Classes	F1/E2/C2	
HV/LV earth screen	YES	
Dimensions IP00 (AxBxC)	1680x1050x1990 mm	**Wheel Base (D)** 820 mm
Wheels Dimensions (E)	160 mm	**Total Weight IP00** 3600 Kg

4.8 Cooling System

4.8.1 BESS 1 / BESS 2 Container



Pos	Component
①	Internal AC unit
②	External AC unit

Table 26: BESS 1 / BESS 2: Cooling system components

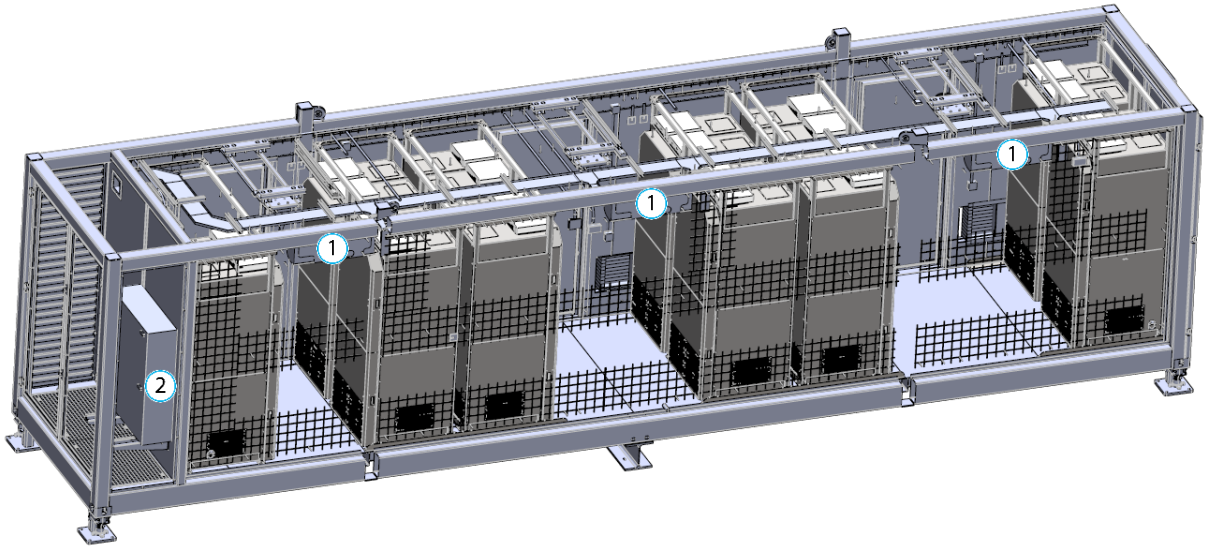


Figure 37: BESS 1 (above) / BESS 2 (below): Cooling system components

4.8.1.1 Battery Cabinets Cooling

The waste heat inside the battery cabinets is actively dissipated by two fans in the roof of each battery cabinet. The heated air is pushed out of the cabinet to the inside of the BESS container.

4.8.1.2 Container Cooling

The waste heat in the interior of the container is conducted via the three internal air conditioning (AC) units (*see Figure 37*) from the interior to the external air conditioning units of the container.

The container is equipped with several temperature sensors for monitoring the internal container temperature.

4.8.2 PCS Container

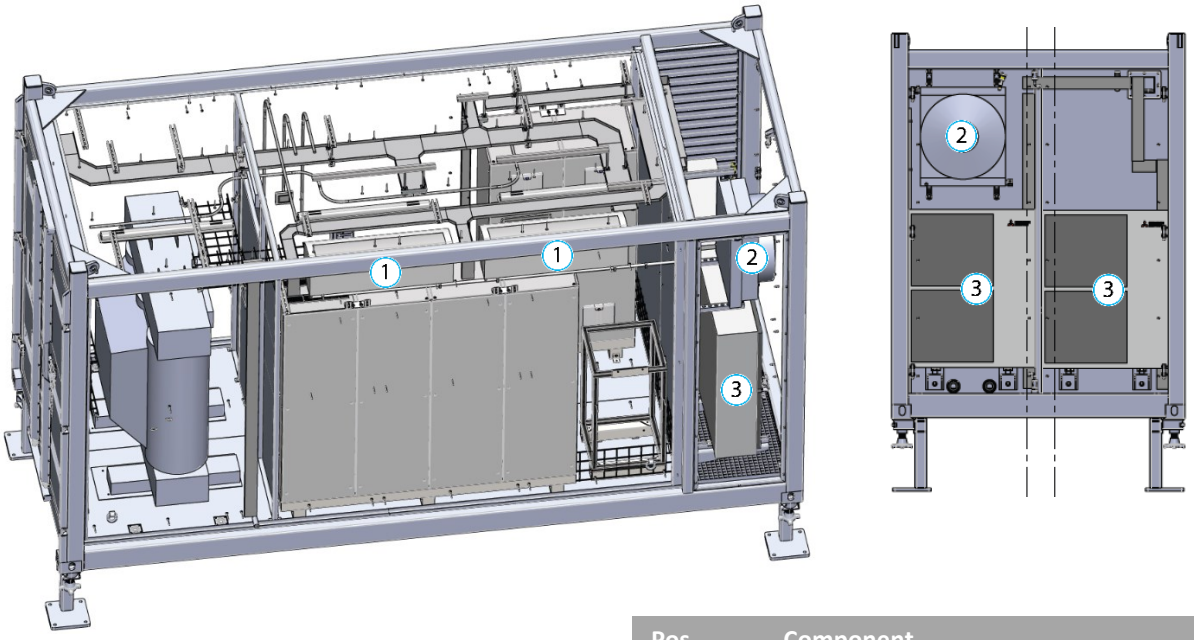


Figure 38: PCS: Cooling system components

Pos	Component
①	Internal AC unit
②	Heat exchanger
③	External AC unit

Table 27: PCS: Cooling system components

4.8.2.1 Container Cooling

The waste heat in the interior of the container is conducted via the three internal air conditioning (AC) units (*see Figure 38*) from the interior to the external air conditioning units of the container.

The container is equipped with several temperature sensors for monitoring the internal container temperature.

4.8.2.2 Converter Cooling System

To dissipate the waste heat from the IGBT power modules and inductors installed in the converter, these components are cooled down to the required operating temperature by an internal cooling system consisting of cooling hoses, coolant pumps, water distributors and four air/water heat exchangers.

The water-glycol-circulation (WGC) is designed as a closed cooling circuit. A water-glycol mix flows through the cooling modules of the converter and dissipates the heat produced by the IGBT modules. Additionally, the IGBT modules need a minimum temperature to operate properly. To heat up the IGBT modules from a cold start, the water-cooling system is pre-heated by an electrical heating element which is flange-mounted to the coolant manifold. The pre-heating process is performed to achieve an operational temperature of 25 °C, which takes about 20 minutes. After the IGBT modules have reached the temperature of about 25 °C, the converter is permitted to begin its normal operation.

The electrical pre-heater will be switched off automatically by a control unit at a temperature of > 28 °C of the coolant temperature sensor. The heating element is switched off at least 2 minutes before the pump is switched off. This procedure avoids overheating of the heating element since there must be a permanent flow around the heating element during heating.

A 3/2 directional mixing valve at the WGC unit controls the inlet temperature to the converter by mixing the water-glycol mixture of the heat exchanger and a bypass circuit. The 3/2 directional mixing valve opens at 36°C (mechanically set at mixing valve) and leads the cooling water to the heat exchanger.

Pre-heater on-off temperature hysteresis (sensor measures the inlet temperature to the converter)	
Coolant temperature > 28 °C	Heaters will be turned off
Coolant temperature < 25 °C	Heater will be turned back on

Table 28: Pre-heater on-off temperature hysteresis

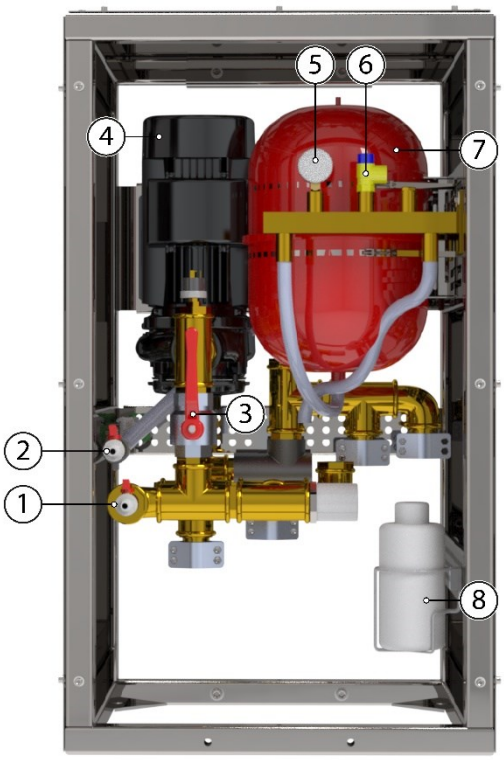


Figure 39: Cooling system cabinet (COSY) components

Position	Component
①	¾“ inlet flow connection with valve
②	"¾“ return flow connection with valve
③	Stop cock
④	Coolant pump
⑤	Manometer
⑥	Overpressure valve
⑦	Expansion vessel
⑧	Overflow vessel

Table 29: Cooling system enclosure (COSY) components

4.8.2.3 IGBT modules cooling

The cooling system dissipates the heat generated during normal operation of the converter.
The IGBT modules are mounted on heat sinks through which coolant flows. Tubing connectors provide the connection to the inlet and outlet of coolant.

4.8.2.4 Coolant Specifications

Coolant		
	Manufacturer	**Description**
Allowed Coolants	NALCO AG	Varidos FSK
	BASF AG	Glysantin G30
	Clariant	Antifrogen N
	Clariant	Antifrogen L
	DOW	Dowcal 20
Coolant concentration mixed with water	> 40 % to 60 % (depending on manufacturer recommendation)	
Coolant change interval	Every 5 years	

Table 30: Coolant specifications

5 Operating Interfaces

The BESS is operated and controlled either via

- The control panel on the control cabinet CTRL of the converter (*see section 14.1)*
  - Push-buttons
    - RESET (restart emergency stop circuit)
  - Indication lights:
    - Fault (red; controller error is active)
    - Preheating (yellow; preheating of coolant)
    - Ready for Operation (green; converter is ready for operation)
    - Operating (green; converter is active)
  - Other control elements:
    - Main switch
    - Emergency-stop push button
- interface to the customer's higher-level control system (*see section 6*).

6 Control System

6.1 Main Control System

The system is controlled and monitored by a main control system installed on the P320 PLC inside the control cabinet (CTRL). Both the converter and the BESS control system are installed on the same PLC.

Data exchange between the individual cabinet control systems and BESS main control system is performed via MODBUS TCP protocol.

BESS Main Control System Overview

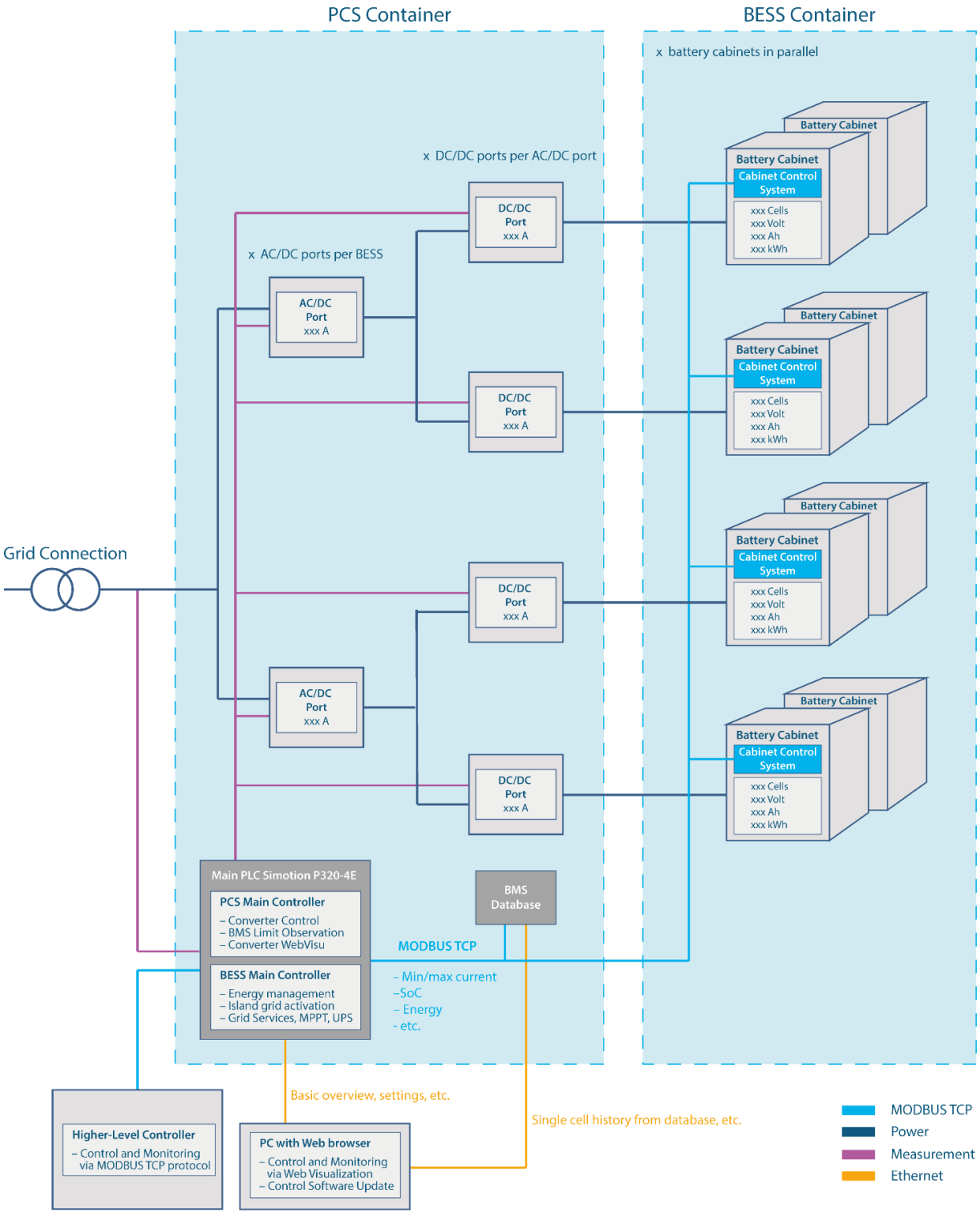


Figure 40: Main control system overview

6.2 Battery Cabinet Control System

Each battery cabinet is equipped with its own control system (Siemens S7) collecting the relevant data from the individual battery modules and providing these to the main control system (*see section 6.1*).

The tasks and features of the cabinet control system are the following:

- Monitoring of battery cell voltages and temperatures
- Monitoring of the battery charging and discharging current
- Control of DC switches
- Monitoring of line protection and smoke detectors
- MODBUS RTU Master for communication with BMS system (battery monitoring system)
- MODBUS TCP Server provides the communication interface to other systems. For example, for the external charger or the consumers

Cabinet Control System Overview

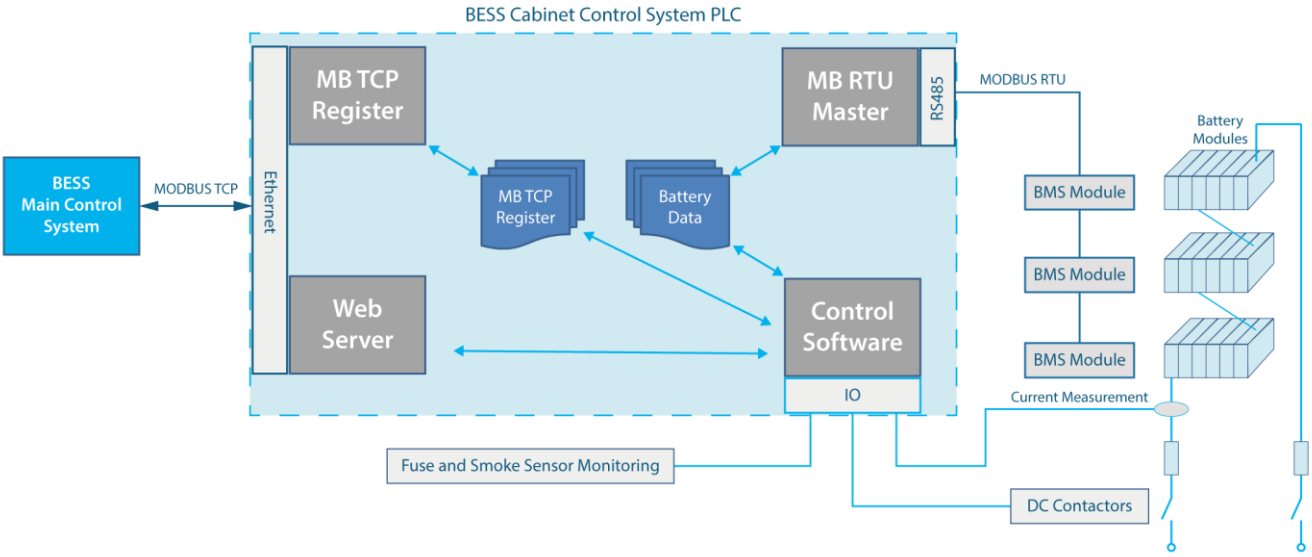


Figure 41: BESS cabinet control system overview

Data exchange between the cabinet control system and the individual battery modules is performed via MODBUS RTU protocol. Therefore, each battery cabinet is provided with several MODBUS RTU interfaces for Modbus connection of the battery modules.

6.3 Network Structure

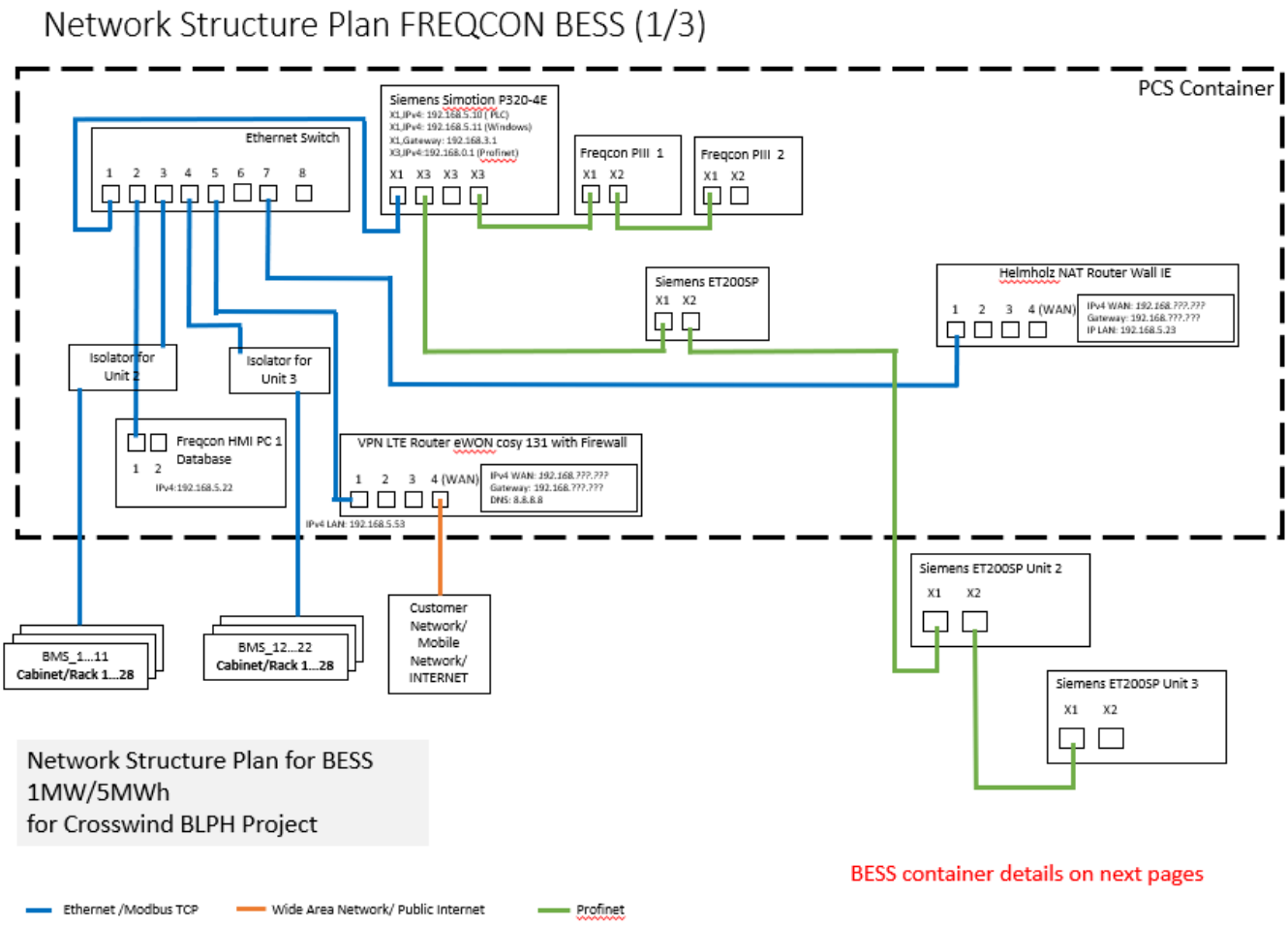


Figure 42: MSC network structure (1/3)

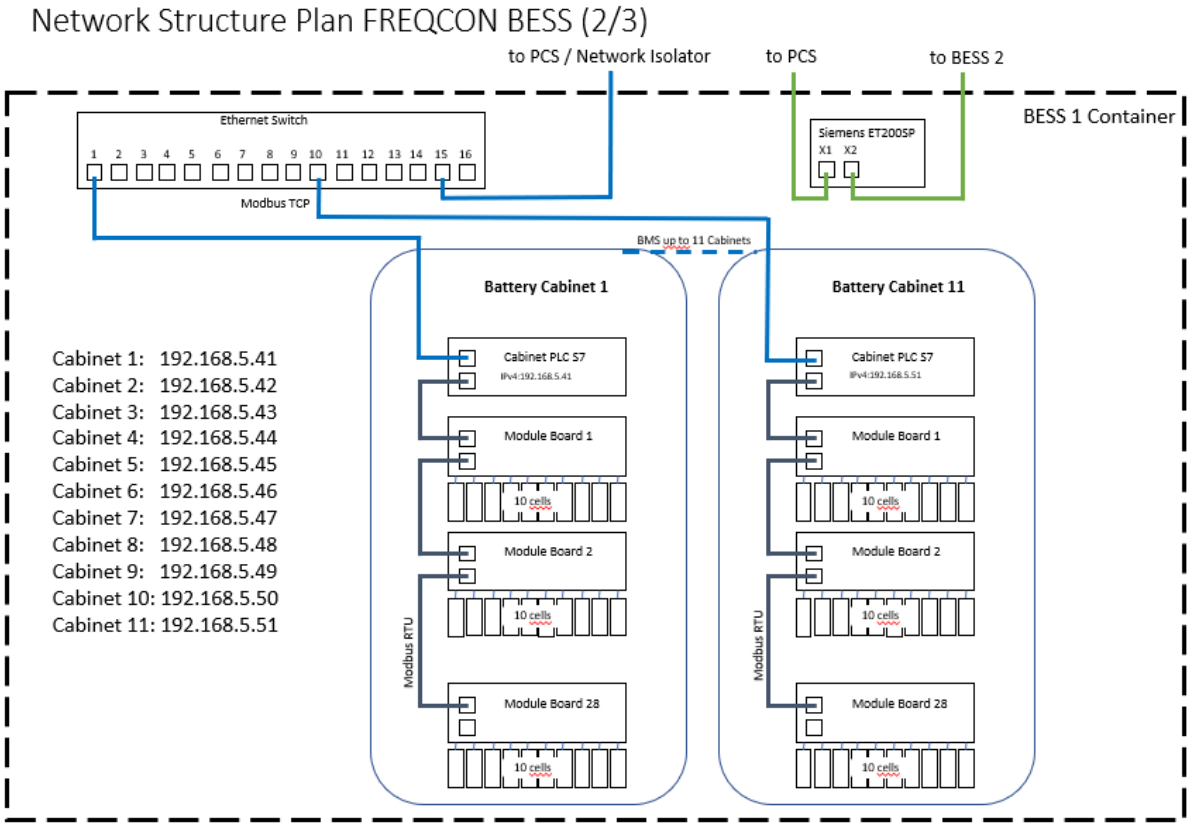


Figure 43: BESS network structure (2/3)

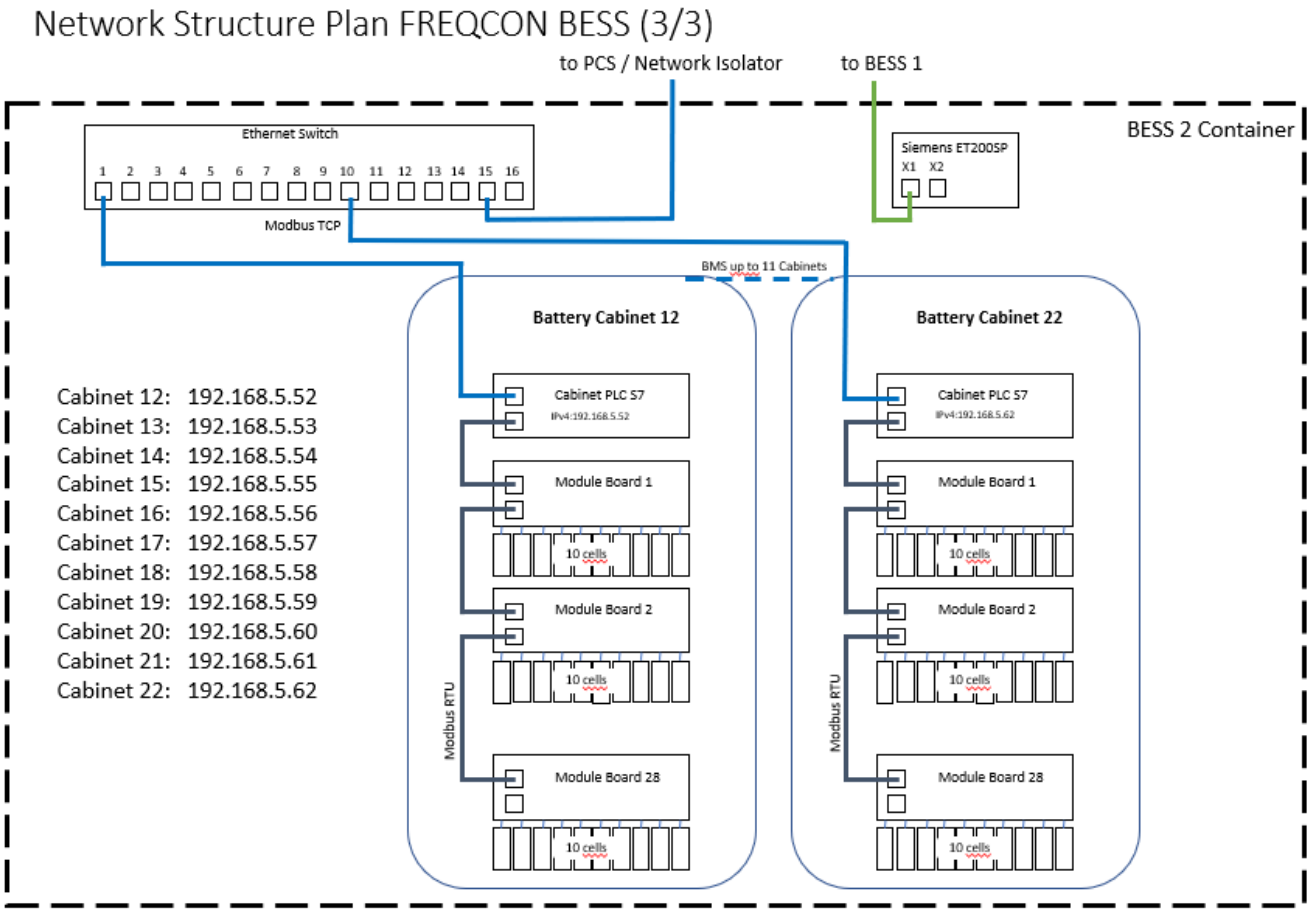


Figure 44: BESS network structure (3/3)

7 Converter Main States

The individual converter main states are depicted in the flow diagram below and described in section 7.2.

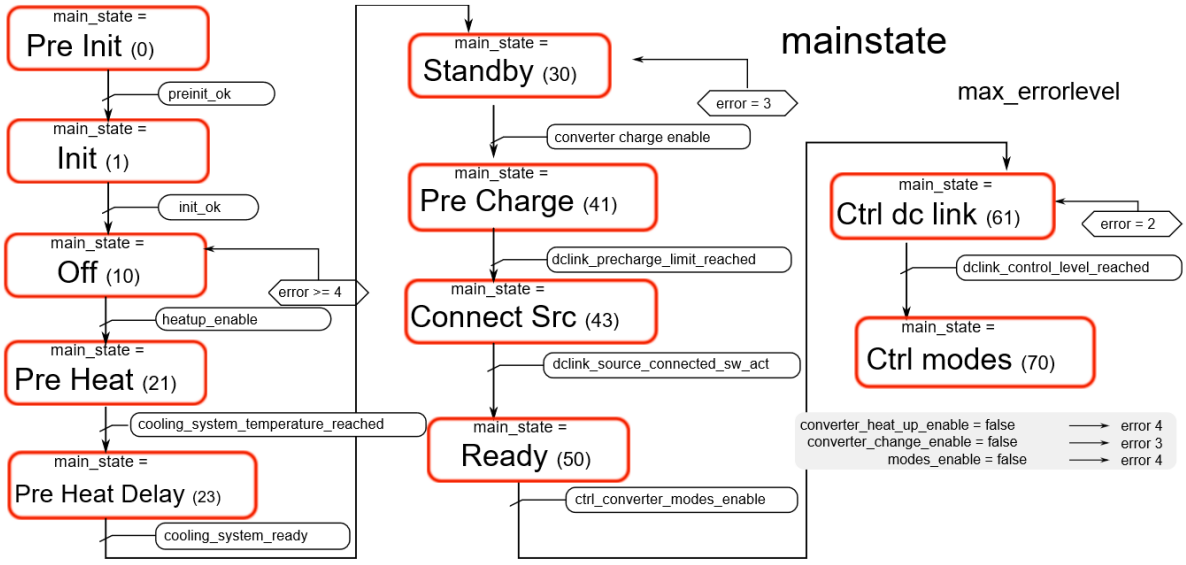


Figure 45: Converter main states

7.1 Error Levels

Error Level	Description
0	No error, logging information
1	Warning category, a warning limit is reached
2	Error category, stop subsystems
3	Error category, stop system and discharge DC-link, cooling system enable
4	Error category, stop system and also the cooling system

Table 31: Error levels

7.2 Main States

INIT

The system was turned on and the stored initialization parameters are read. Cooling and converter system are stopped.

OFF

DC link is discharged. The converter and cooling system are not in operation.

Pre-Heat

The converter is switched-off and is preparing for operation. The cooling system regulates to the optimum temperature of the cooling water, IGBT, capacitors and inductors.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Heat-Delay

The converter is preparing for operation. The operation temperatures of the components are reached and maintained for a defined time span.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

STANDBY

Standby mode – converter is off, but the cooling system is in operation.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Pre-Charge

The converter´s main DC-link is pre-charged to a defined voltage level.

An error level 3, such as detection of wrong grid conditions, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Connect SW

Source contactor is closed.

An error level 3, such as switching error of the source contactor, is leading to a change to main state "STANDBY" (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

READY

Converter is ready for operation. Cooling system is operating, the DC link is charged and source is connected.

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

DC link Ctrl

The converter power module that is set to "DC link control" mode is activated.

An error level 2, such as derating, DC link errors or over temperature, are leading to a change to main state READY (converter is off, cooling system is in operation).

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Ctrl Mode

The remaining converter power modules that are enabled are activated. The converter is operating.

An error level 1, such as power module over temperature, over-current or over-voltage, is leading to a stop of the respective power module.

An error level 2, such as derating, DC link errors or over temperature, are leading to a change to main state READY (converter is off, cooling system is in operation).

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

8 Technical Data

Container	
Container type	PCS: Customer-specific container BESS: Customer-specific container
Transport weight	PCS: approx. 13.7 t BESS: approx. 15 t (Batteries not installed)
Total weight	BESS: approx. 35 t (Batteries installed)
Container dimensions (L x W x H)	PCS: 6058 mm x 2438 mm x 3200 mm BESS: 12310 mm x 2438 mm x 3783 mm

PCS	
Type	MSC-1000-620-8
Manufacturer	FREQCON GmbH
Nominal AC voltage	620 VAC + 10% - 20%
AC power frequency (nominal)	50 Hz ± 5 Hz
Nominal apparent power	1000 kVA
Nominal active power	1000 kW
Nominal AC current	931 A
Maximum AC current	1050 A
Power factor at rated power / adjustable	1 / 0.03 overexcited to 0.0 underexcited
IGBT switching frequency	2 to 4 kHz
DC link voltage	1175 VDC
Number of DC outputs	8
Current per DC output	250 ADC
DC voltage range	700 VDC to 1022 VDC
HVAC system	included

BESS	
Battery Module	1C LFP Battery 280Ah
Cell manufacturer	EVE
Battery cells per cabinet	28
Battery capacity per cabinet	250.88 kWh
Number of battery cabinets	22
BESS capacity (installed)	5500 kWh
BESS capacity (usable at 0.2 C operation)	5000 kWh
Storage temperature range battery storage (> 1 month)	0 °C to 35 °C (30% to 50% SoC)
Ambient temperature range	-20 °C to +40 °C
Battery management system	FREQCON BMS

Controller	
Main control system	Siemens Simotion P320-4
Control software	FREQCON Framework
Internal communication	Profinet IRT
External communication interfaces	Ethernet, RS485, RS232, MODBUS TCP, Profibus, Profinet
Maximum total harmonic distortion	< 3% at nominal power

Converter Cooling System	
Cooling principle	Liquid and air cooled, air heat exchanger
Maximum cooling water inlet temperature	65°C
Operating pressure range cooling system	2.5 … 3.5 bar
Nominal cooling system pressure	3 bar
Coolant capacity (without hoses)	Approx. 80 l
Heat exchanger weight (without cooling liquid)	Approx. 75 kg

Protective Devices and Standards	
Battery (DC)	Fuse and DC load break switch
AC side disconnection point	Air circuit breaker
DC overvoltage protection	Surge arrester, type I
AC overvoltage protection	Surge arrester, class I
Ground fault monitoring	Yes
Insulation monitoring	Yes
Fire protection (converter)	Smoke and arc detection
Fire protection (batteries)	Active Fire Protection System
Maximum permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month/year) / 0% to 95%
Inverter Life (rated conditions)	20 years

Table 32: Technical data

9 Environmental Conditions

	Stationary Operation	Storage packaging with protected layers	Transportation packaging with protected layers
Relative Humidity	Max. 95% No condensation; Relative Humidity <60% under corrosive atmosphere	Max. 95%	Max. 95%
Pollution level IEC60721-3-3 IEC60721-3-2 IEC60721-3-1	No conductive dust		
	3S2 coated PCB: Chemical Air: 3C2 Solid Particulate: 3S2	1S3 coated PCB: Chemical Air: 1C2 Solid Particulate: 1S3	2S2 coated PCB: Chemical Air: 2C2 Solid Particulate: 2S2
Atmospheric pressure	70 … 106 kPa	70 … 106 kPa	70 … 106 kPa
Vibration amplitude	Max 1 mm (5 … 13.2 Hz)	Max 1 mm (5 … 13.2 Hz)	Max. 3.5 mm (5 … 13.2 Hz)
IEC60068-2	Max. 7 m/s^2 (13.2 … 100 Hz) sinusoidal	Max. 7m/s^2 (13.2 … 100 Hz) sinusoidal	Max. 15 m/s^2 (9 … 200 Hz) sinusoidal
Impact IEC60068-2-29	Impermissible	Max. 100 m/s^2, 11 ms	Max. 100 m/s2, 11 ms
Free-fall	Impermissible	Impermissible	Impermissible

Table 33: Environmental conditions

10 Transport, Storage and Commissioning



Please observe the instructions for transport in section 10.2 and for storage and professional handling in section 10.3.

10.1 Unpacking

⚠ CAUTION



Hazard by sharp edges on packaging
Improper handling during unpacking can cause injuries.
➜ Use appropriate safety gloves to protect your hands from possible cuts.

The packaging of the system consists of cardboard, plastic and corrugated board. After usage the packaging must be disposed according to the local regulations for the disposal of paper products (e.g. recycling). After delivery, the delivered units and components must be checked for completeness and damage. If any damage on the delivered units and components have been found, contact the delivery service or FREQCON GmbH immediately.

10.2 Transport

Regarding the transport of the battery modules, refer to the battery module manual.

⚠ DANGER	
	**Hazard by electrolyte release due to mechanical damage to battery modules** Severe burns, long-term physical damage, and environmental damage due to electrolyte. ➜ The device must be disconnected before maintenance work. Work under voltage is not permitted. ➜ Observe the safety data sheet of the battery module and keep it accessible at all times. ➜ Never open battery modules by force. ➜ Avoid contact with escaping electrolyte at all costs, leave the danger area immediately. ➜ In case of ingestion, immediately alert the emergency services! ➜ In case of eye contact: Rinse cautiously with water for several minutes. Remove any contact lenses and continue rinsing. Call poison information center or doctor! ➜ In case of skin contact: Remove contaminated clothing immediately. Wash/shower skin with plenty of water. Call poison control center or doctor! ➜ Prevent release of electrolyte into the environment at all costs. ➜ Wear suitable protective equipment when disposing of electrolyte *(see section* 2.7 "Personal Protection Equipment (PPE)").

⚠ DANGER	
	**Fire due to short circuits in the event of mechanical damage to the battery modules.** Severe burns or death due to short circuits that may result in fire. The electrolyte used is highly flammable as a liquid or vapor. ➜ Avoid mechanical damage. ➜ Never open battery modules by force. ➜ Protect the system against vandalism. ➜ Fire loads or sources of fire near the installation site are not permitted. ➜ In the event of damage, press the emergency OFF button immediately. ➜ In case of fire, leave the danger area immediately and alert the fire department!

NOTICE
Inadequate transportation of the device and all of its components may cause damage to the installed components. ➜ Vibrations and jolts must be avoided during transportation. ➜ The container must be transported in a horizontal position (lying down). ➜ Make sure to observe the specific national safety precautions for transport by truck, train or ship´.

NOTICE
Do not transport the containers with installed batteries ➜ Lifting or Moving of the Container is not allowed if battery modules are inside the container ➜ Remove every battery module from the container before lifting or mowing the container

The container must be transported to the installation site by instructed personnel.

The container weight is specified in section 8, "Technical Data" on page 93. Make sure that the components can be placed at ground level.

For information regarding the dimensions and center of gravity of the container, see section 10.2.2. The container weight is specified in section 8, "Technical Data". Make sure that the components can be placed at ground level.
Vibrations and jolts must be avoided during transportation. If the system was damaged during transport, you must immediately inform the responsible transport company.

The cabinet must be transported in a horizontal position (lying down). It is not permitted to tip over the container during transportation or in any other scenario.
Applied assemblies (if existing) must be protected against damage by external influences during transportation and storage.



All persons involved in the transport of lithium batteries must be trained and certified according to regulations.

The information provided below is for informational purposes only.

10.2.1 Container Lifting

⚠ DANGER	
	**Heavy load** **Improper lifting can result in death, serious injury or property damage.** Never lift the container above people. Use only lifting and personal protective equipment approved by OSHA or other national institutions.

NOTICE
Only use an appropriate crane to lift the container, capable to withstand the loads specified as follows: Total weight of cabinet combination *see section 8, „Technical Data“ page 93.*

NOTICE
Observe the container´s center of gravity during lifting: Observe the container´s center of gravity during lifting with crane, shown in section 10.2.2.

To lift the containers with a crane, use the four transport lugs on the top corners of the container (*see following illustration*).

PCS

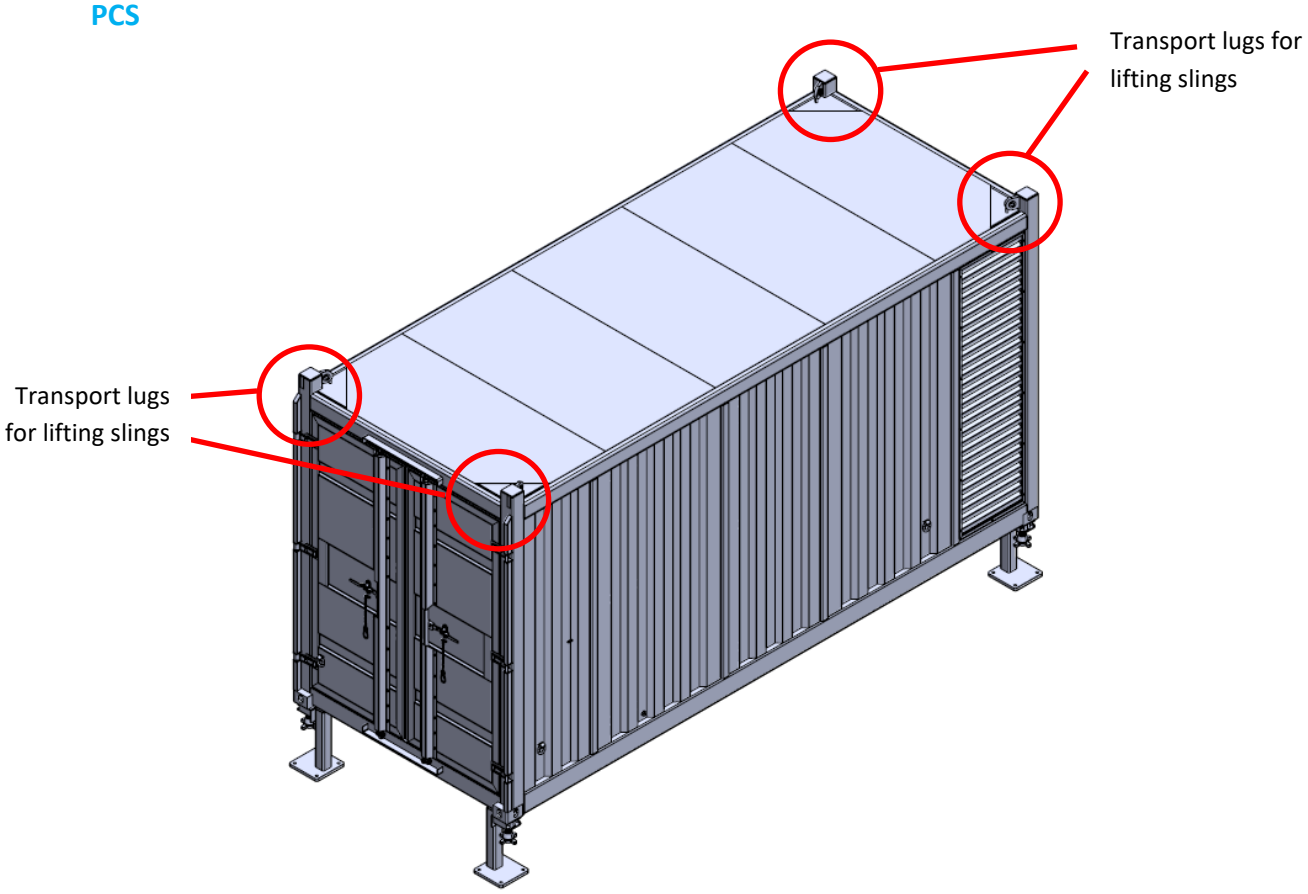


Figure 46: PCS container transport lugs

BESS 1

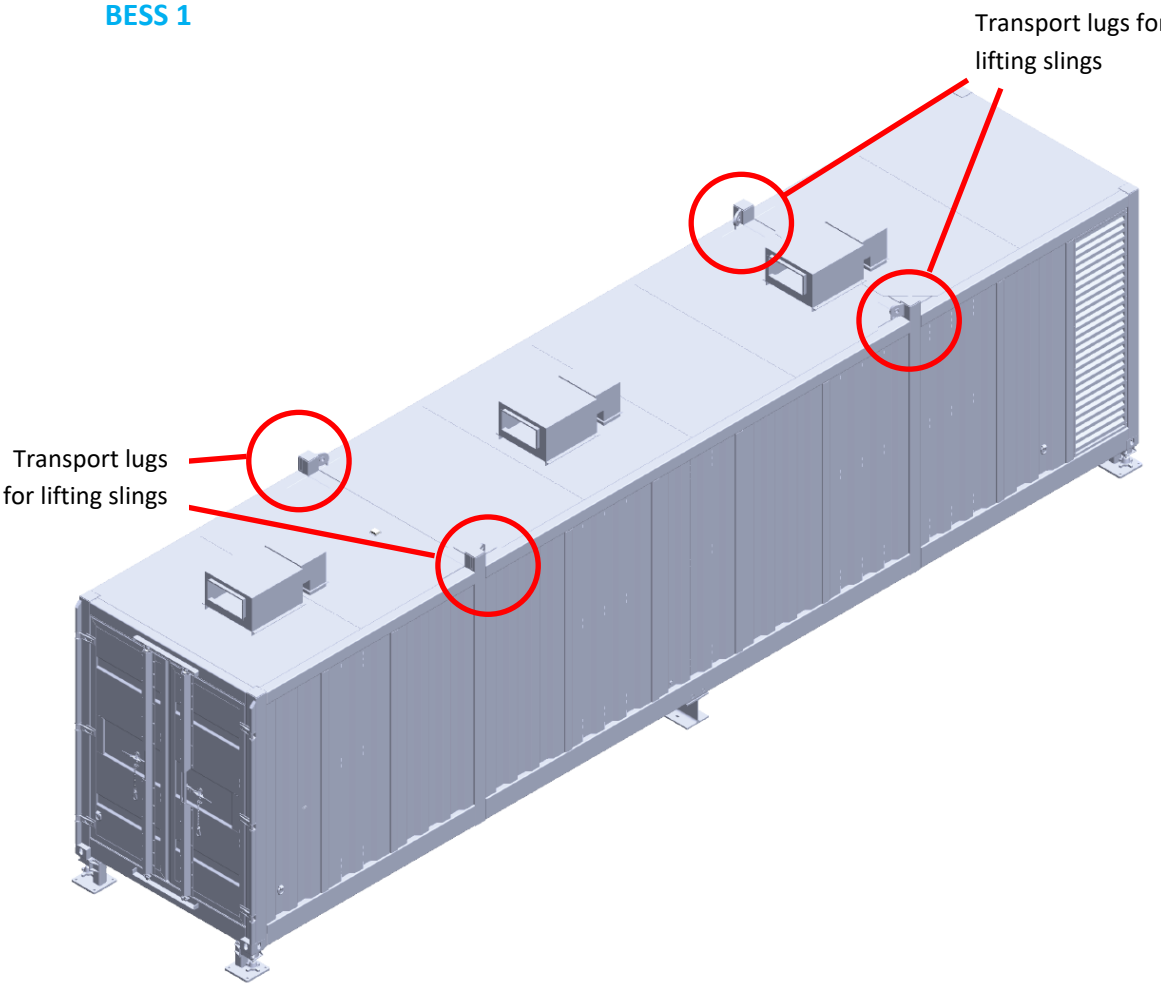


Figure 47: BESS 1 container transport lugs

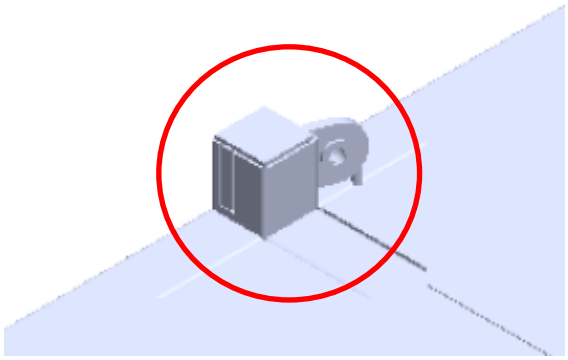


Figure 48: Transport lug

BESS 2

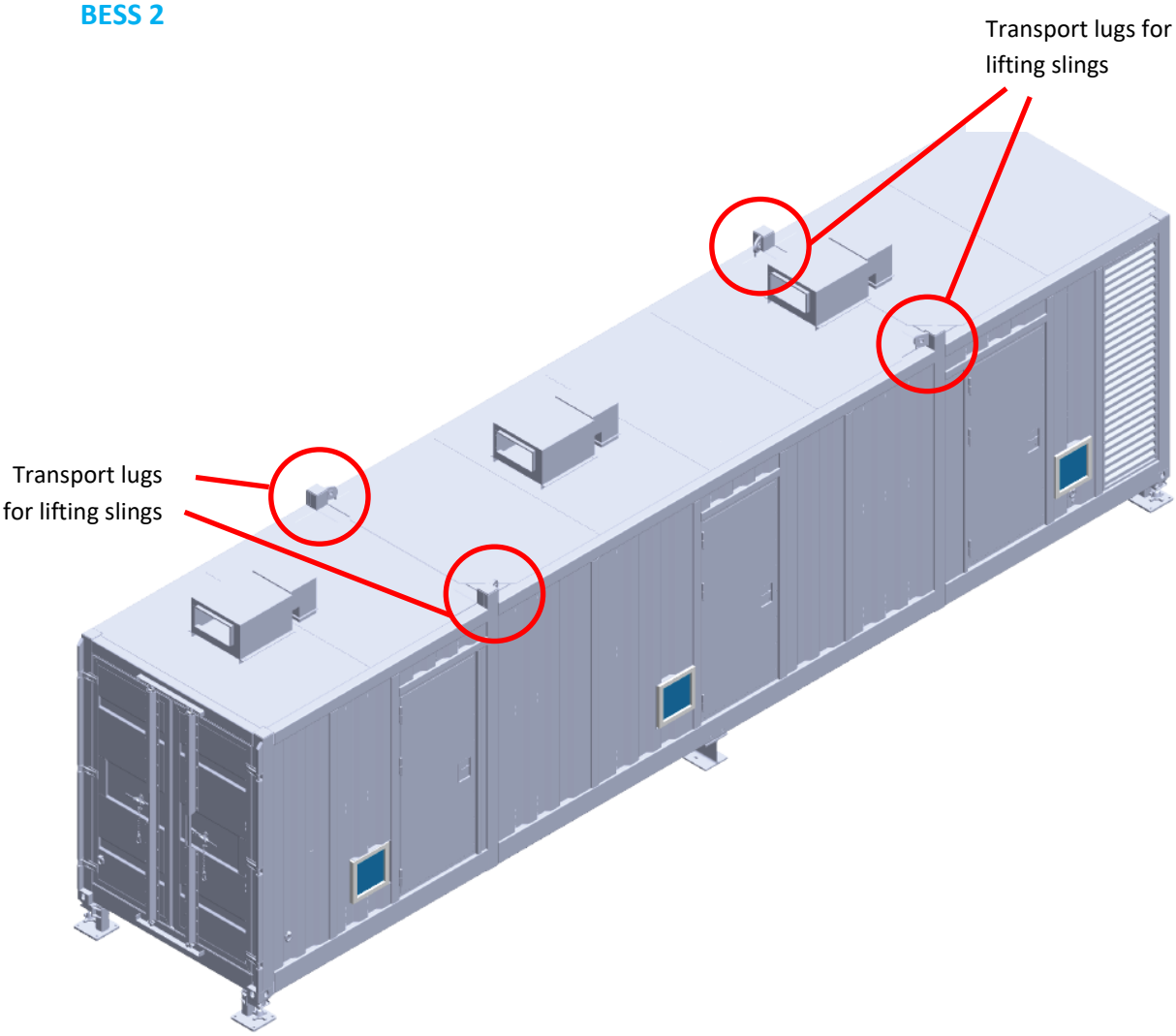


Figure 49: BESS 2 container transport lugs

10.2.2 Dimensions and Center of Gravity

10.2.2.1 PCS Container

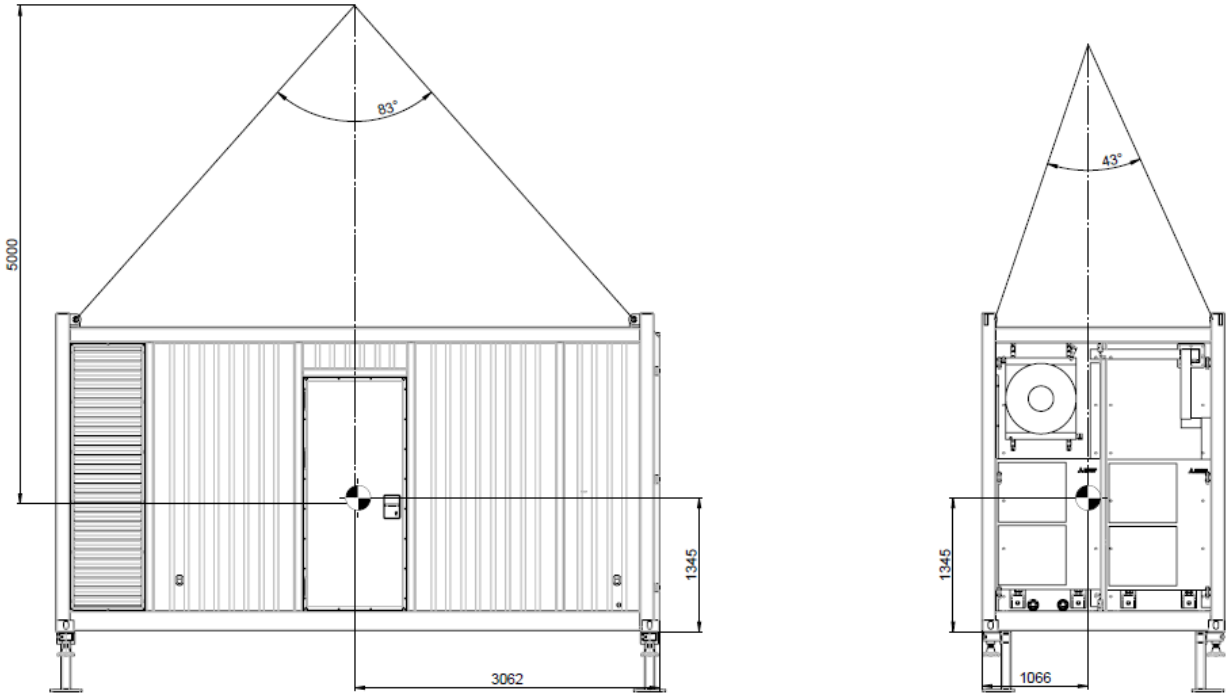
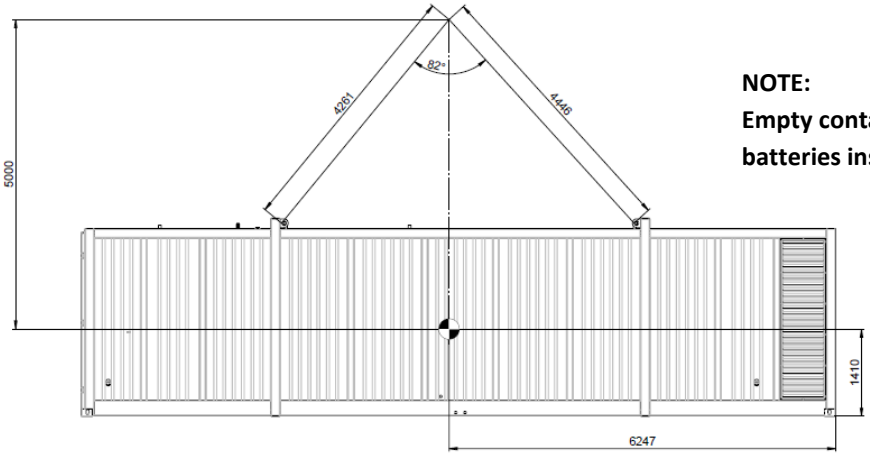


Figure 50: PCS Container – dimensions and center of gravity

10.2.2.2 BESS 1 Container



NOTE:
Empty container, no batteries installed

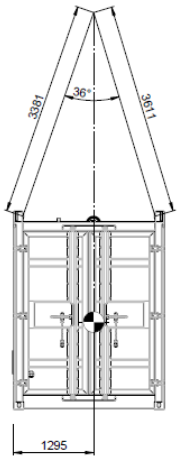
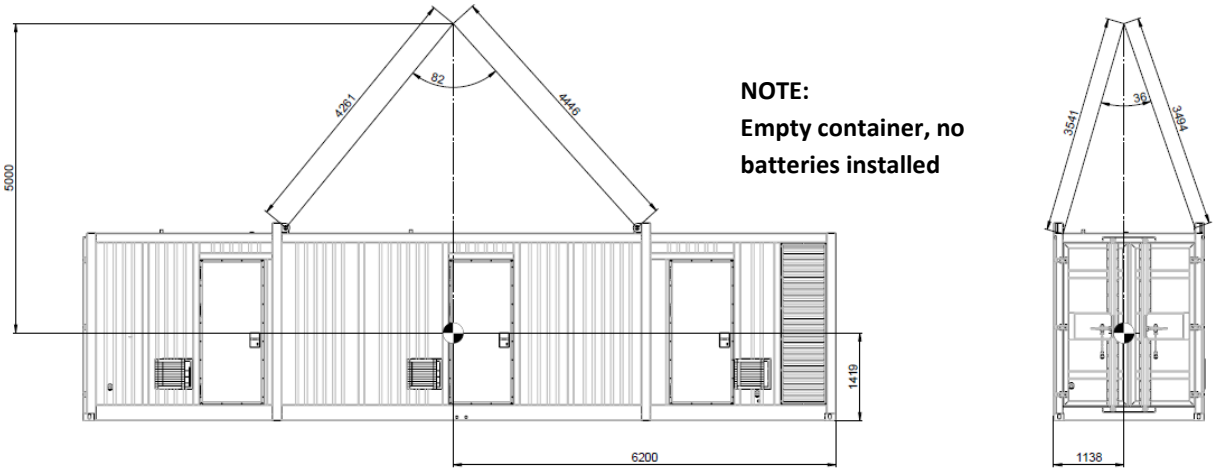


Figure 51: BESS 1 Container – dimensions and center of gravity

10.2.2.3 BESS 2 Container



NOTE:
Empty container, no batteries installed

Figure 52: BESS 2 Container – dimensions and center of gravity

10.3 Storage

10.3.1 Storage Condition

NOTICE	
	Damage to components in the event of improper storage. The storage conditions of the energy storage device are only maintained when the climate control of the container is active. ➜ Keep air conditioning activated/enabled even in case of storage. ➜ Supply energy storage with power even if it is out of operation. ➜ Only deactivate air conditioning if storage conditions are maintained by other measures. ➜ Condensing must be avoided.

NOTICE
The cooling liquid inside the cooling system must be removed at least once every five years. ➜ Check the pressure on the expansion tank every time the cooling liquid is exchanged. The cooling system must be completely drained during a pressure test of the expansion vessel *(see section 17.8.1.3 "Draining the cooling* system*")*.

NOTICE
➜ The BESS container must not be exposed to strong vibrations. ➜ Condensing must be avoided.

NOTICE
The battery of the UPS unit of the converter system must be removed from the battery module at storage temperatures of <0°C. ➜ The removal of the UPS battery is described at 17.3.2.

Store the components of the energy storage system under the following conditions:

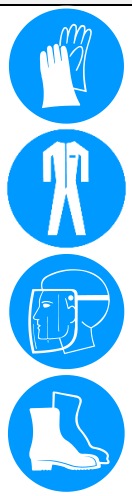
➜ Store the components of the energy storage device according to pollution degree 2 (no conductive pollution).
➜ Do not expose components of the energy storage device to aggressive media.

Storage Condition	Value
Storage temperature	*see technical data in section 8*
Max. relative humidity	*see technical data in section 8*
Positioning of the product during storage	laying down, horizontal

Table 34: Storage conditions

10.4 Assembly and Initial Commissioning

⚠ DANGER	
	**Electric shock due to low voltage and arcing on loose wires.** Severe irreparable damage to the nervous system, burns and death. ➜ Access to control cabinets and string cabinets only by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel. ➜ Plant control units may also be opened by instructed persons with the qualification of a qualified electrician. ➜ Work on electrical and electronic components as well as cables of the battery system may only be carried out by FREQCON service personnel!

⚠ DANGER	
	**Electric shock due to low voltage and arcing on loose wires.** Severe irreparable damage to the nervous system, burns and death. ➜ Access to control cabinets and string cabinets only by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel. ➜ Work on electrical and electronic components as well as cables of the battery system may only be carried out by FREQCON service personnel! ➜ Wear personal protection equipment (Electrician's gloves, protective visor, safety shoes, hearing protection)

The energy storage system may only be installed and commissioned by trained service personnel or by FREQCON instructed and authorized maintenance personnel.

11 Mounting

11.1 General

The BESS container must be set up and positioned safely at the installation site and may only be installed by instructed FREQCON service personnel.

Service personnel must at least have the following tools in reach before starting the installation:

Pos.	Installation Tools	Amount
	Basic Tools	
1.	Flashlight	1
2.	Pliers set	1
3.	Ratchet set	1
4.	Torque wrench (1 - 100 Nm)	1
5.	Socket wrench set (with sockets 7 – 19 mm)	1
6.	Wrench set	1
7.	Cross-section screw drivers set	1
8.	Flat-section screw drivers set	1
9.	Allen key / Hex socket key set	1
10.	Cutter	1
11.	First-aid kit	1
12.	Multi-meter instrument	1
13.	Two-pole voltage tester	

Table 35: Installation tools

⚠ DANGER	
	**Electric shock due to low voltage and arcing on loose wires.** Severe irreparable damage to the nervous system, burns and death. ➜ Access to control cabinets and string cabinets only by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel. ➜ Plant control units may also be opened by instructed persons with the qualification of a qualified electrician. ➜ Work on electrical and electronic components as well as cables of the battery system may only be carried out by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel.

⚠ DANGER
Make sure that the energy source is locked and tagged and ensure that the isolation is effective before conducting work on the system. After switching-off the voltage supply, some components might still carry a charge. Check all poles using a suitable device.

⚠ WARNING
The electrical connection must be carried out in accordance with the local regulations of the utility company and /or VDE (in Germany).

Do not operate!	Lock and tag power switches and controller devices
	Observe national laws regarding Occupational Safety and Health, as well as Industrial Standards. ➢ DIN VDE 0105-100; VDE 0105-100:2009-10 Operation of electrical installations - General requirements.

11.1.1 Cable Routing

It is recommended that the power cables and the control cables are installed in separate trays. Avoid long parallel runs of power cables with other cables in order to decrease electromagnetic interference.
Where control cables must cross power cables, make sure they are arranged at an angle as near to 90 degrees as possible.
The cable trays must have good electrical connection to each other and to the grounding/earthing.

11.1.2 Coding

11.1.2.1 Coding Terminal Strip

Terminal designation	Description
-XE1	Main power supply 600 V AC
-XE2	DC power supply 1000 V DC
-XE	Main power supply 400 V AC
-X1	Main power 400 V / 230 VAC
-X2	Light cabinet 230 V AC
-X3	Control voltage 24 V DC
-14X1	Control voltage 24 V DC (to DC contactors)
-X5	Low-voltage signals
-XDC0	24 V DC power supply
-XDC1-4	Control voltage 24 VDC (UPS)
-XT	Transfer terminal block 24 V DC / 230 V AC

11.1.2.2 Coding Wiring colors

Cable	Color
L1/L2/L3	Black
N	Light blue
PE	Yellow-green
External voltage	Orange
Control voltage 24 VDC	Dark blue
Analog signals	White

11.1.2.3 Coding Power Supply

Terminal	Phase
U1	L1
V1	L2
W1	L3

11.2 Installation location

⚠ DANGER

Danger to life due to electric shock!
The DC paths and the connection cables are not protected against overload by the BESS.
Select external components according to the specified nominal and maximum currents of the BESS.
➜ If necessary, use appropriate protective equipment for the external components.

⚠ DANGER

Danger from and for unauthorized persons
Unauthorized persons are not aware of the dangers in the work area and may endanger themselves and third parties danger.
➜ Keep unauthorized persons away from the work area.
➜ If in doubt, speak to persons and direct them away from the work area.
➜ Interrupt the work as long as unauthorized persons are in the work area.
➜ Always keep the entrance door(s) locked when not performing work on the system to prevent unauthorized persons from entering the container.

⚠ WARNING

Danger to life due to unsuitable lifting material
While lifting the battery modules use only suitable lifting equipment and lifting tackle
➜ Make sure that all the material and equipment is designed for the weight and all required inspections have been done.
➜ Make sure that no person is under the battery module during lifting.

⚠ CAUTION

Danger to life due to unsuitable lifting material
While lifting the container and/or battery modules use only suitable lifting equipment and lifting tackle
➜ Make sure that all the material and equipment is designed for the weight and all required inspections have been done.
➜ Make sure that no person is under the container or battery module during lifting.

NOTICE

Equipment damage due to intruding animals
Prevent animals from entering the interior of the container from below through the cable glands or recesses.
➜ Secure the container from the outside with suitable protection against the entry of animals.

The BESS containers are designed for outdoor installation, on a flat and ground level surface. Make sure that the environmental conditions meet the values of section 8 „Technical Data“ and section 9 “Environmental Conditions”.

The entrances to the containers must be accessible from every side to allow for visual inspections or maintenance and repair work, if necessary

Air inlets and outlets of the containers, as well as on the cabinets inside the container, must always be kept free and cleaned of dirt in order to ensure the required air flow of the installed fans.

11.2.1 Distances Between Containers

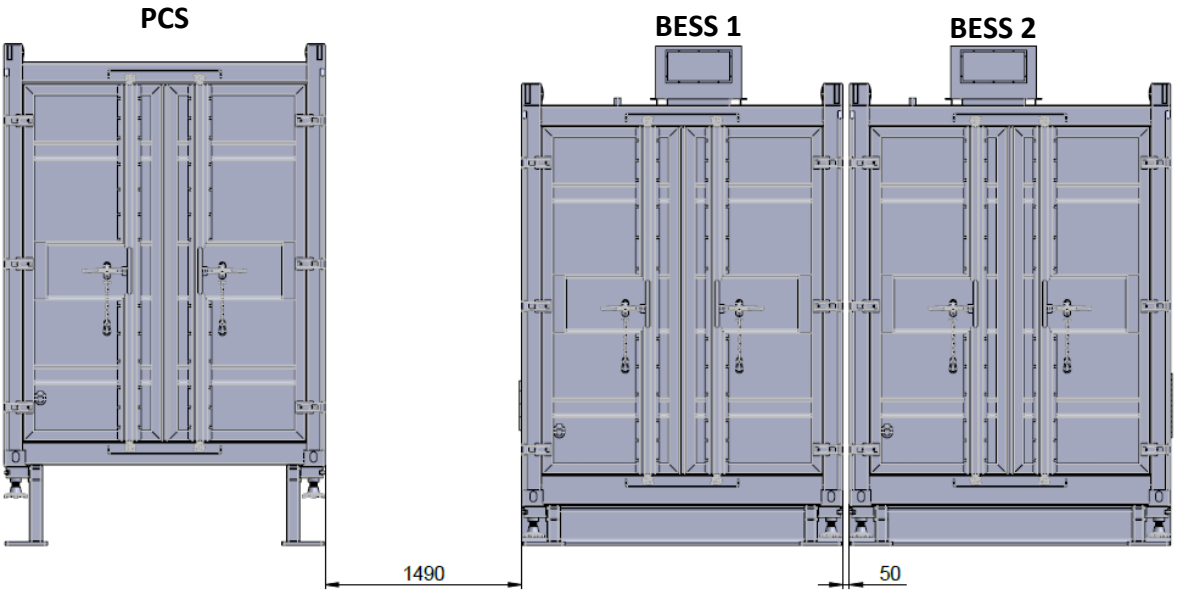


Figure 53: Distances between containers

11.2.2 Cable Outlets

Overall System

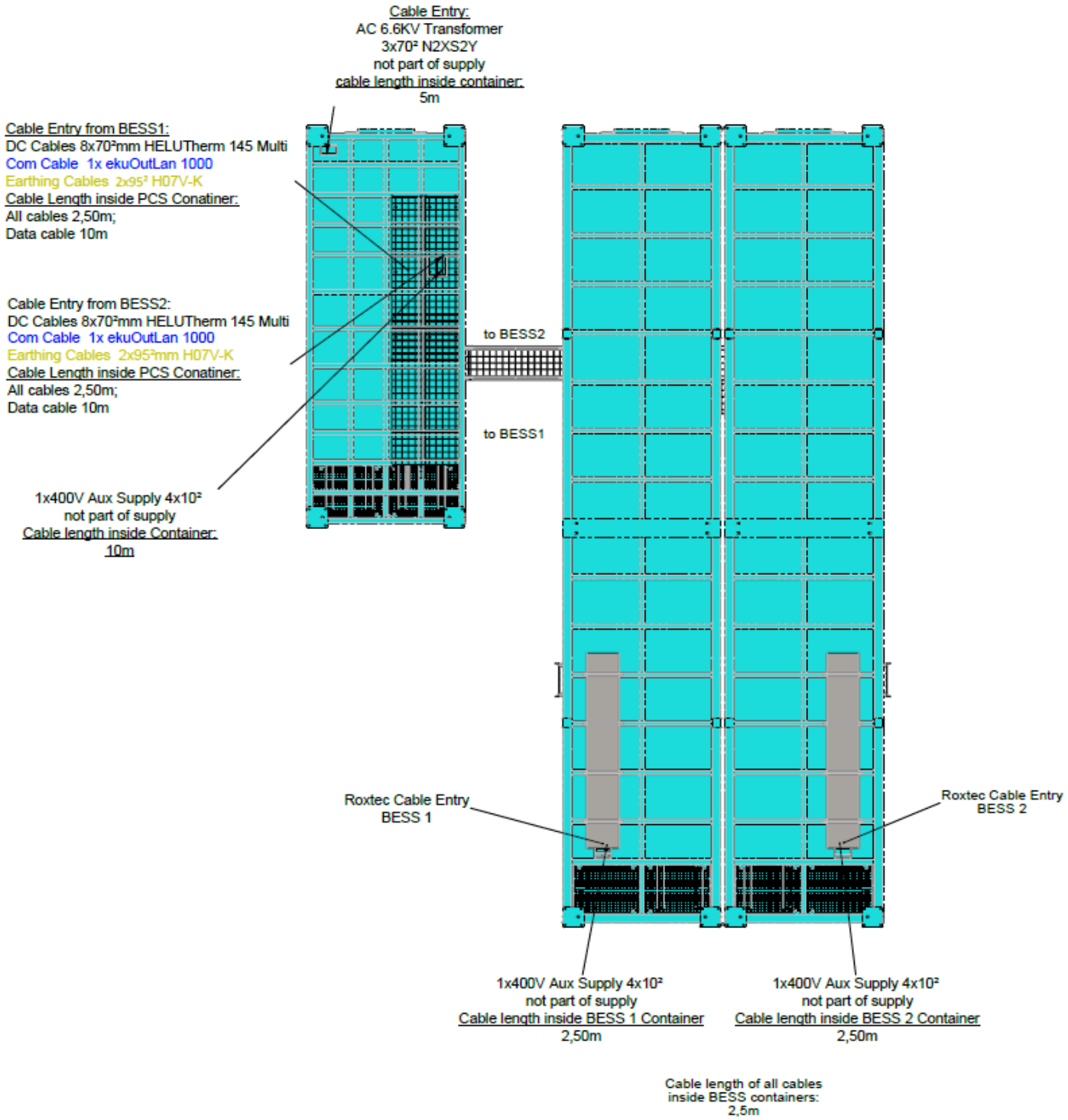


Figure 54: Cable outlets – Overall system (Bottom view)

11.2.2.1 PCS Container

Cable interface 1 (Roxtec cable gland)
- DC power cables
- Communication cables
- 400 V AC aux. cables

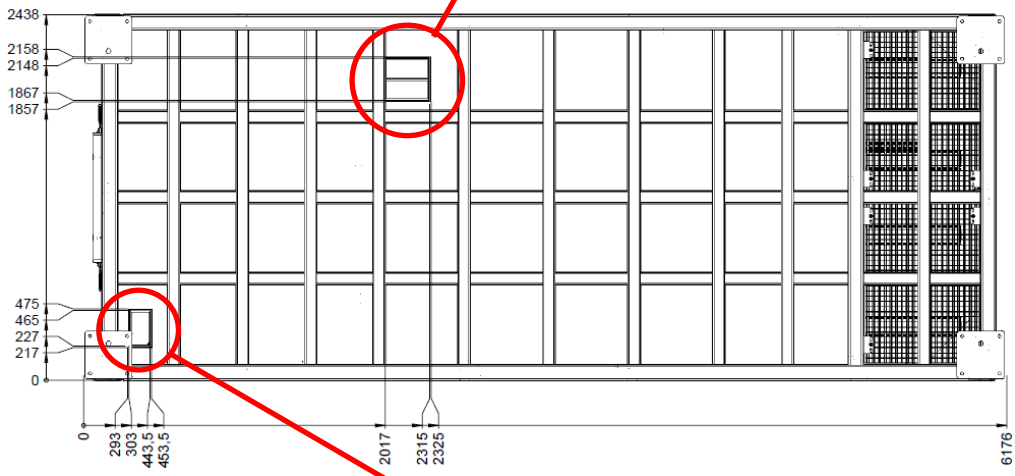


Figure 55: Cable outlets – PCS (Bottom view)

Cable interface 2 (Roxtec cable gland)
- 6.6 kV MV cables

11.2.2.2 BESS 1 Container

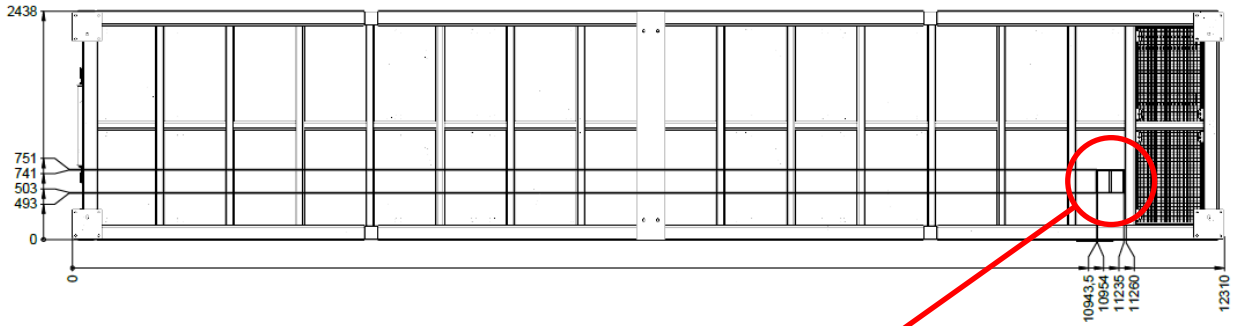


Figure 56: Cable outlets – BESS 1 (Bottom view)

Cable interface (Roxtec cable gland)
- DC power cables
- Communication cables
- 400 V AC aux. cables

11.2.2.3 BESS 2 Container

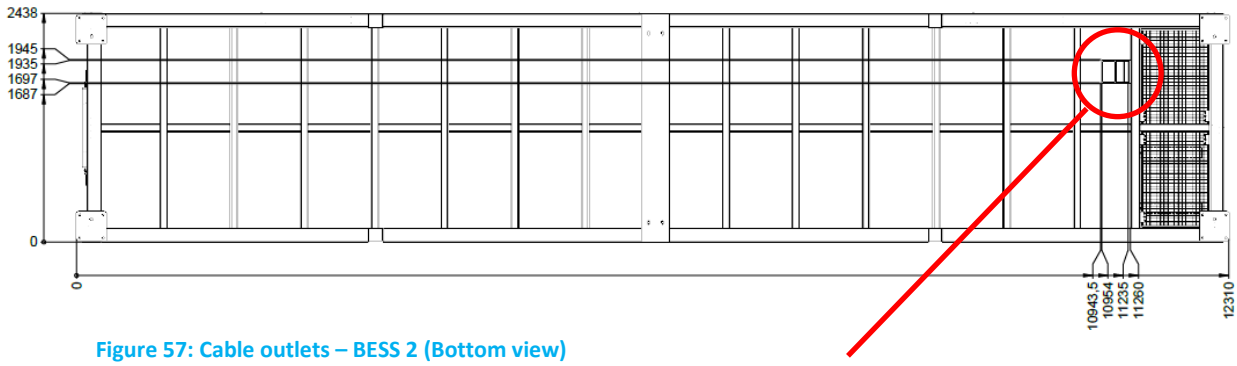


Figure 57: Cable outlets – BESS 2 (Bottom view)

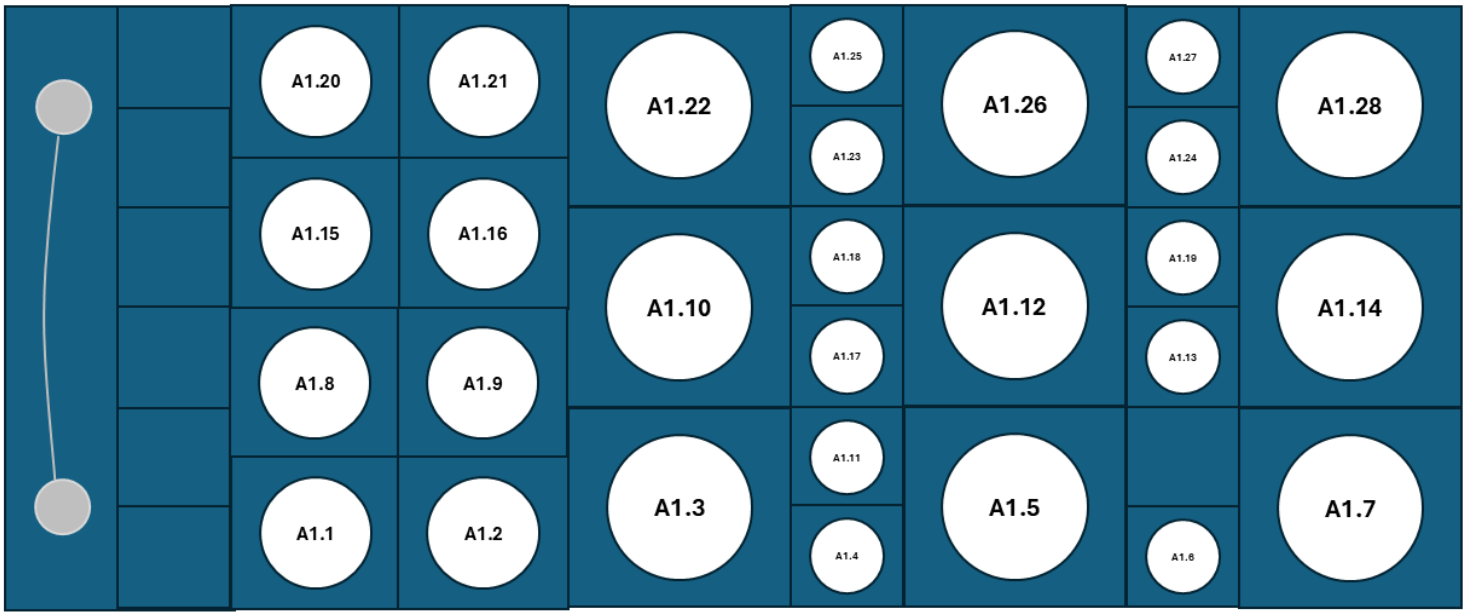
Cable interface (Roxtec cable gland)

- DC power cables
- Communication cables
- 400 V AC aux. cables

11.2.3 Cable Gland Description

11.2.3.1 PCS Container

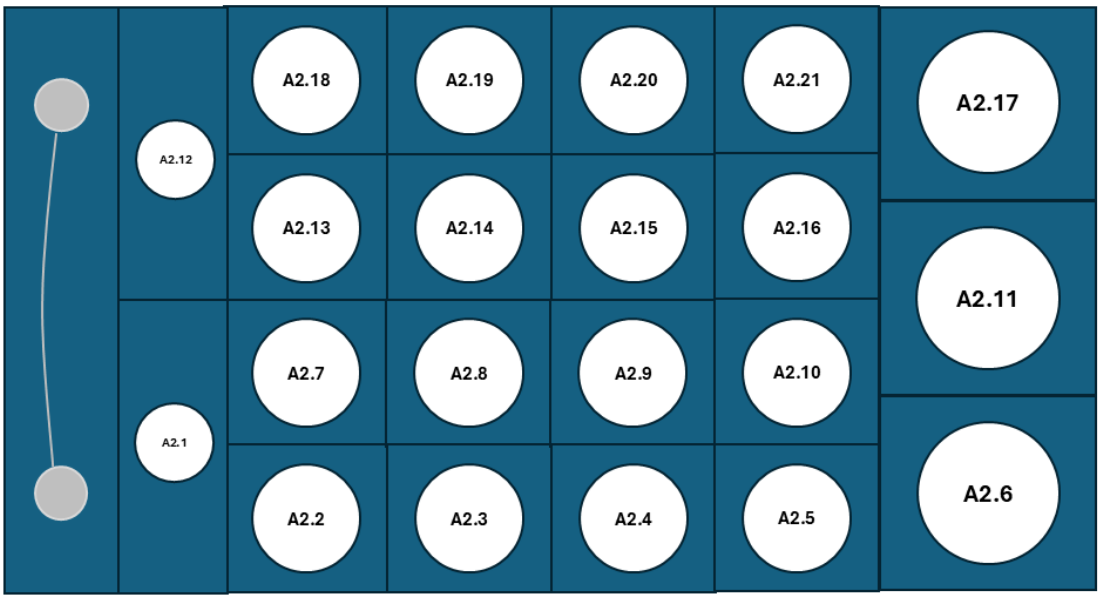
Cable interface – PCS – Comm and Aux 1



PCS – Comm and Aux 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:2		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:4	*	P320 PLC / B400-NET-001.01	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5		85002CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:9		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:11	*	P320 PLC / B400-NET-001.02	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		85001-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:15		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:16	**	P320 PLC / B400-FGS-002	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:18		C-85-XS-001 / B400-SIS-001	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:19	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:20		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:21	**	P320 PLC / B400-SIS-001	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:23	***	82006-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:24	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:25	***	82007-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:26		83011-CEL / 84W2	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:27	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

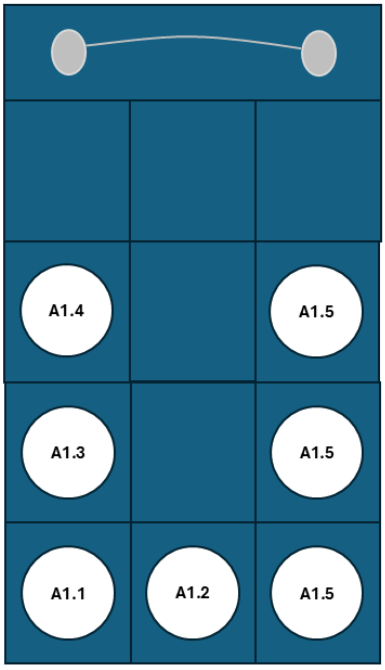
Cable interface – PCS – Comm and Aux 2



PCS – Comm and Aux 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:2	Solarflex-X 1x 70	DC Cable - DC+4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:3	Solarflex-X 1x 70	DC Cable - DC-4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:4	Solarflex-X 1x 70	DC Cable - DC+3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC-3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:7	Solarflex-X 1x 70	DC Cable - DC+4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:8	Solarflex-X 1x 70	DC Cable - DC-4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:9	Solarflex-X 1x 70	DC Cable - DC+2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:13	Solarflex-X 1x 70	DC Cable - DC+4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:14	Solarflex-X 1x 70	DC Cable - DC-4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC+2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC-2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:18	Solarflex-X 1x 70	DC Cable - DC+3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:19	Solarflex-X 1x 70	DC Cable - DC-3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:20	Solarflex-X 1x 70	DC Cable - DC+2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:21	Solarflex-X 1x 70	DC Cable - DC-2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 (MV Transformer)

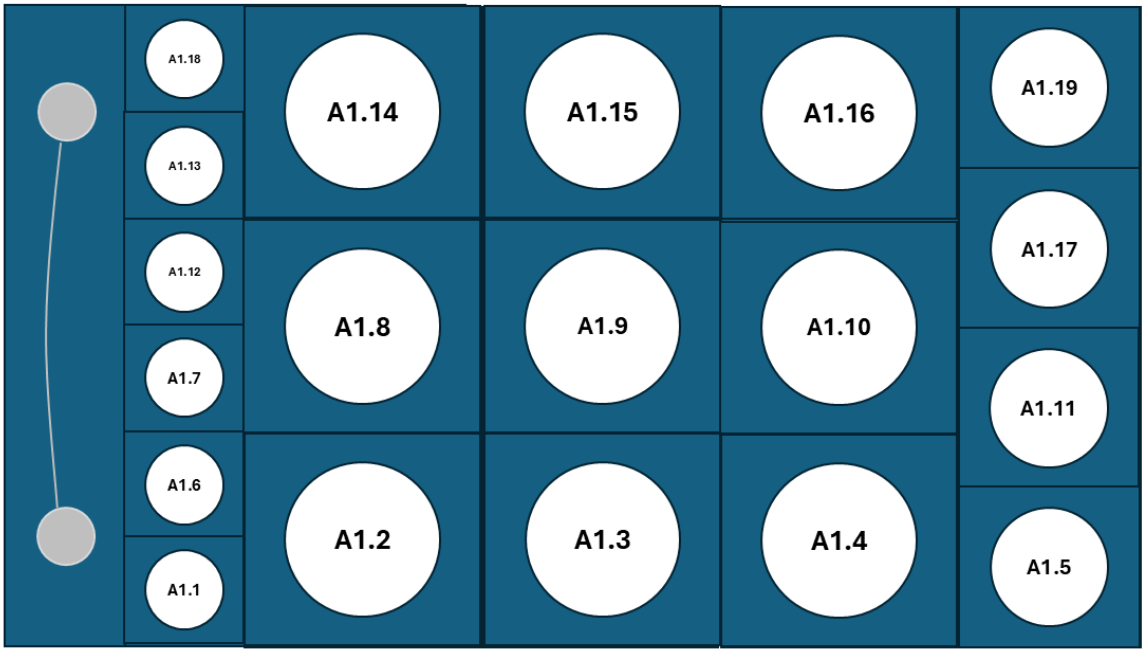


PCS – MV Transformer

Pos.	Cable ID	Name	Cable Category	OD (mm / [“])	Module Type
A1:1	1	82005 – L2	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:2	4	82005 – L3	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:3	5	82005 – L1	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

11.2.3.2 BESS 1

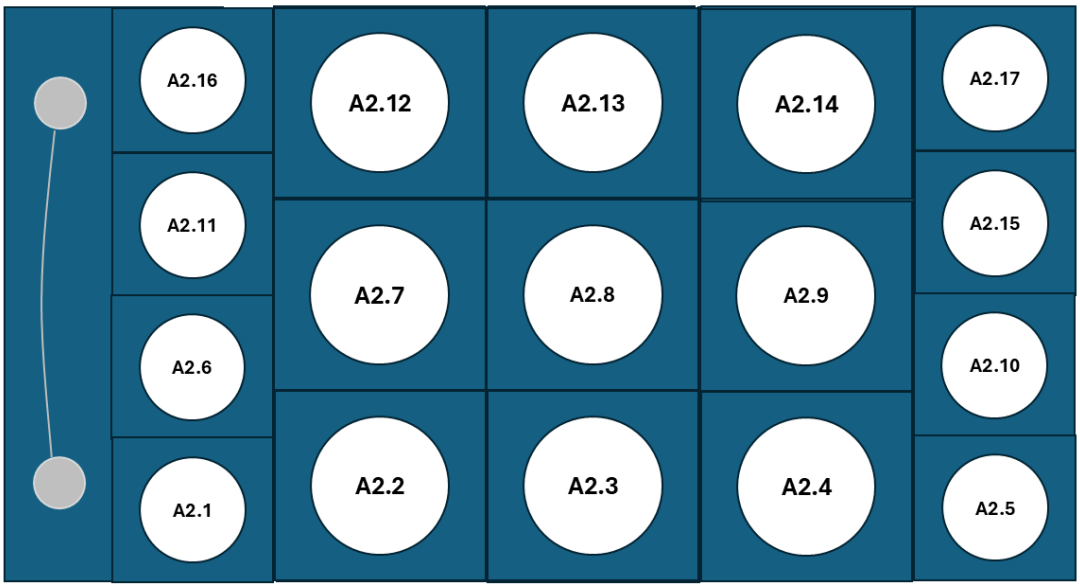
Cable interface 1 - BESS 1



BESS 1 - 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:1	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5	4x 10 mm²	400 V Aux Supply – 83015-CEL	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:6	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:7		COM Cable - ETH	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		COM Cable - UNIT_1 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13		COM Cable - UNIT_3 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 - BESS 1

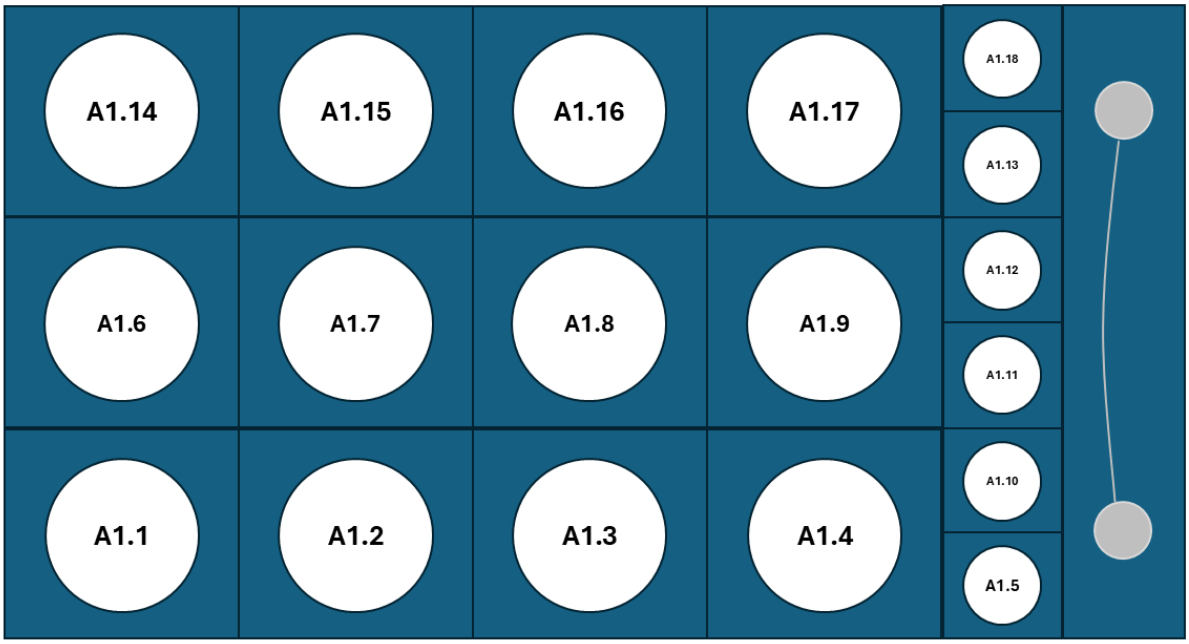


BESS 1 - 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:1	Solarflex-X 1x 70	DC Cable - DC-2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC+2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:6	Solarflex-X 1x 70	DC Cable - DC+2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:11	Solarflex-X 1x 70	DC Cable - DC-2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC-3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC+2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:17	Solarflex-X 1x 70	DC Cable - DC+3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

11.2.3.3 BESS 2

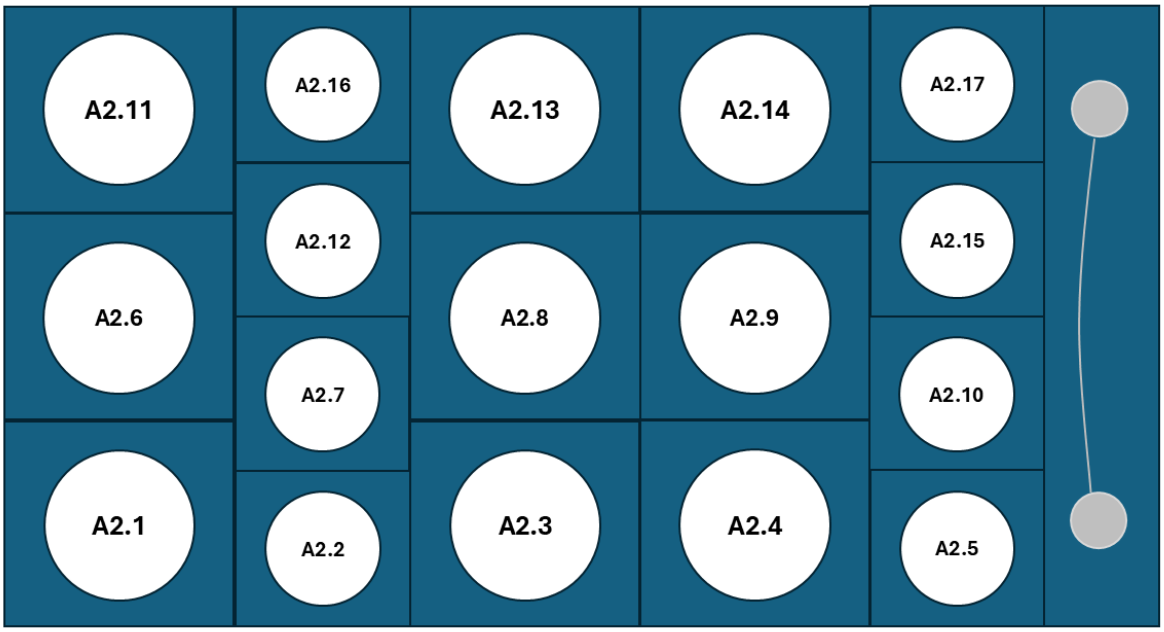
Cable interface 1 - BESS 2



BESS 2 - 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:1	4x 10 mm²	400 V Aux Supply – 83014-CEL	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:10	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		COM Cable - ETH	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13		COM Cable - UNIT_2 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:18		COM Cable – ET200 Unit_1 (not connected)	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 - BESS 2



BESS 2 - 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:2	Solarflex-X 1x 70	DC Cable - DC+4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC+3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:7	Solarflex-X 1x 70	DC Cable - DC-4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:12	Solarflex-X 1x 70	DC Cable - DC-4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC+4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC+4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:17	Solarflex-X 1x 70	DC Cable - DC-4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

11.2.4 AC Connection

⚠ DANGER

Before performing work on the BESS, make sure the system is disconnected from all power supplies, the feed-in disconnectors are open and secured against unintentional reclosing.

NOTICE

- ➜ Comply with the minimum cable cross-sections indicated in the wiring diagram provided.
- ➜ Always secure AC power cables with adequate strain relief in order to prevent the removal of the power cables from the AC connections after installation.

To connect the 620 V AC network, the system provides AC, PE and N connection busbars within the **AC_DC cabinet** *(see circuit diagram and following figure, ① to ⑤)*.

Also refer to the provided circuit diagram (*see section 1.2 "Applicable Documents"*) when connecting the BESS to the AC grid.

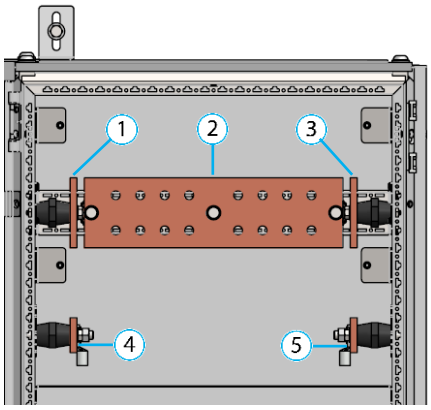


Figure 58: AC grid connection busbars inside AC_DC cabinet

Pos.	Description	Identifier
①	AC grid connection busbar L1	78W1
②	AC grid connection busbar L2	78W2
③	AC grid connection busbar L3	78W3
④	AC grid connection busbar N	78W5
⑤	AC grid connection busbar PE	78W4

Table 36: AC grid connection busbars inside AC_DC cabinet

Task 1: **Connect the AC grid supply cables to the designated AC grid connection busbars inside the AC_DC cabinet *(see wiring diagram and illustration below)*.**

Step 1 : Lead the customer-side AC grid supply cables through the recess provided in the container floor from below into the container interior.

Step 2 : Lead AC grid supply cables through the recess provided in the cabinet floor of the AC_DC cabinet from below to the inside of the cabinet.

Step 3 : Locate the 78W1, 78W2 and 78W3 AC connection and the PE and N busbars inside the AC_DC cabinet (*see illustration above,* ① - ⑤).

Step 4 : Screw the three grid phase cables L1, L2, L3 and the PE and N cable to the corresponding connection busbars inside the AC_DC cabinet (*see illustration and table above,* ① - ⑤) using appropriate cable lugs, screws, nuts and washers.

Step 5 : Apply the torque specified by the screw connection manufacturer to the connection.

Step 6 : Check connections for tightness.

✓ **The AC grid supply cables were successfully connected to the corresponding AC grid connection busbars in the AC_DC cabinet.**

11.2.5 Higher-Level Controller Connection

⚠ DANGER

Before performing work on the BESS, make sure the system is disconnected from all power supplies, the feed-in disconnectors are open and secured against unintentional reclosing.

The converter system is mainly controlled and monitored via the customers´ higher-level controller. The higher-level controller is connected to the BESS main controller via a PROFINET interface. Therefore, a network isolator (114A1) is provided inside the control cabinet 1 (CTRL_1) of the converter system, to which the higher-level controller can be connected via an Ethernet line.

To connect the higher-level controller to the converter controller via Ethernet line, proceed as follows:

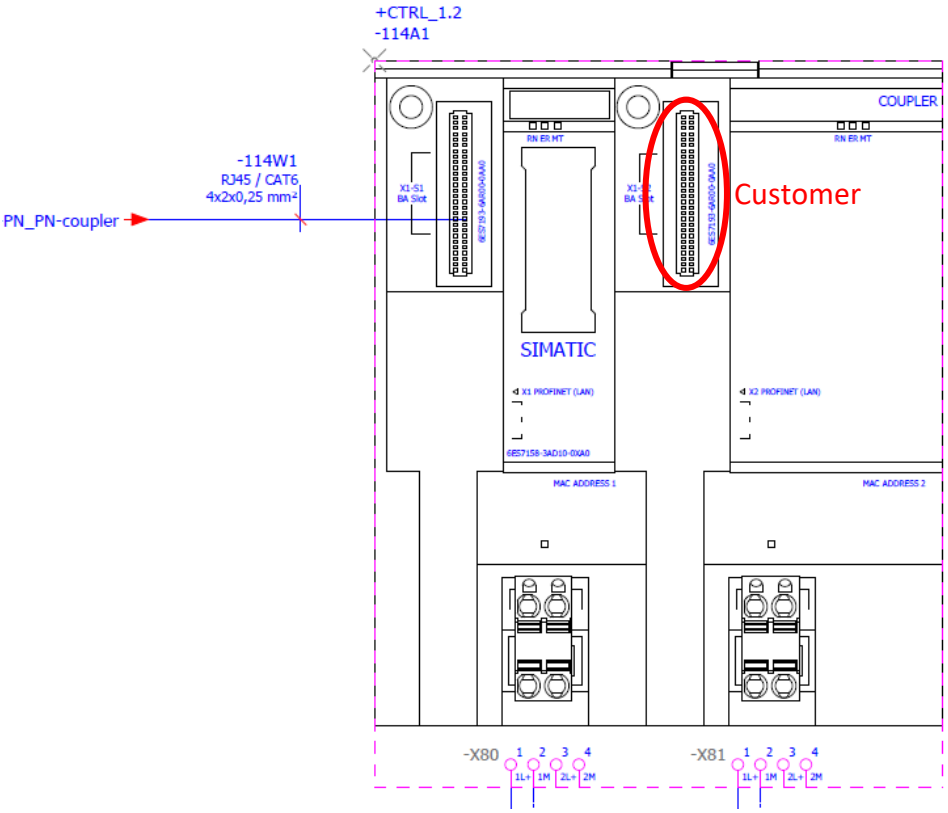


Figure 59: Network isolator 114A1 inside CTRL_1 cabinet

Task 1: **Connect the customer-side higher-level controller to the BESS main controller cabinet (*see circuit diagram and illustration above*).**

Step 1 : Lead the Ethernet cable coming from the external, higher-level controller through the recess in the bottom of the control cabinet 1 (CTRL_1) into the cabinet interior.

Step 2 : Locate the network isolator (114A1) inside the control cabinet.

Step 3 : Connect the external Ethernet cable to the free port of the network isolator.

✓ **The higher-level controller has been successfully connected to the BESS main controller via Ethernet cable.**

12 Pre-Commissioning

Follow the steps below for preparations prior to commissioning of the converter:

Do not operate!	Lock and tag power switches and controller devices
⚠ DANGER 	Disconnect power and block operation controller devices. Follow national laws regarding Occupational Safety and Health. 1. Identify the energy source(s). 2. Isolate the energy source(s). 3. Determine voltage-free status. 4. Ground device or equipment to protect from short circuiting and from shocks. 5. Lock and Tag the energy source(s). 6. Prove that the equipment isolation is effective. 7. When required, apply lock-out device or clamp and secure with padlock(s).

12.1 Activate Motor Contactors and Fuses

Task 1: Activate motor contactors and test auxiliary voltages

Set the main switch on the control cabinet door to ON position. ☐

Activate the motor contactors inside the converters system cabinets. ☐

Check the 400 V AC power supply using the corresponding terminals inside CTRL cabinet. ☐

Task 2: Switch on fuses

Switch on all 24/230/400V AC/DC fuses inside the cabinets. ☐

Install the fuses for the UPS supply. ☐

Check, whether the 24 V DC voltage has the correct polarity and magnitude. ☐

Switch on all the 24 V DC fuses (130F1) if not already activated (green indicator lights indicate activated fuse). ☐

After this action all the control devices indicator lights in the control cabinet including the main PLC Siemens SIMOTION P320 should glow green, indicating that these parts are activated and working.

12.2 Check Power Cables

Inspect wiring for proper installation and connection. See wiring diagram for detailed information about the wiring. ☐

12.3 Check Communication Cables

Inspect wiring for proper installation and connection. See wiring diagram for detailed information about the wiring. ☐

Communication between main PLC and converter is established. ☐

12.4 Cooling System Preparations

The cooling system is set under 3 bar air pressure for at least 1 hour. The system pressure must not decrease within that time. ☐

The system is filled with coolant under working pressure of 3 bar and checked for leakage for at least an hour. ☐

13 Commissioning

Follow the steps below for commissioning of the BESS:

Task 1: **Converter Commissioning**

Step 1 : Make sure that the customer-side mains is switched off and decoupled from the converter system.

Step 2 : Make sure that all the work and action instructions listed in section 11 "Mounting" have been carried out.

Step 3 : Follow all instructions listed in section 14.4.

✓ **The BESS is now ready for operation.**

14 Operation

⚠ DANGER	
	Do not enter the container if the warning light is on (red light) ➜ It is only allowed to enter the container if the warning light indicated that it is safe to enter the container (green light) ➜ If the warning light is completely off (no green or red light) consider that it is not safe to enter the container. Before entering the container, make sure that there is no fire inside and no harmful atmosphere

NOTICE	
	• Staying in the container during operation is not permitted, except to turn-off the system in case of emergency • Use the remote interface to start the converter • Do always switch off the converter if you go inside the container

14.1 Operating Panel

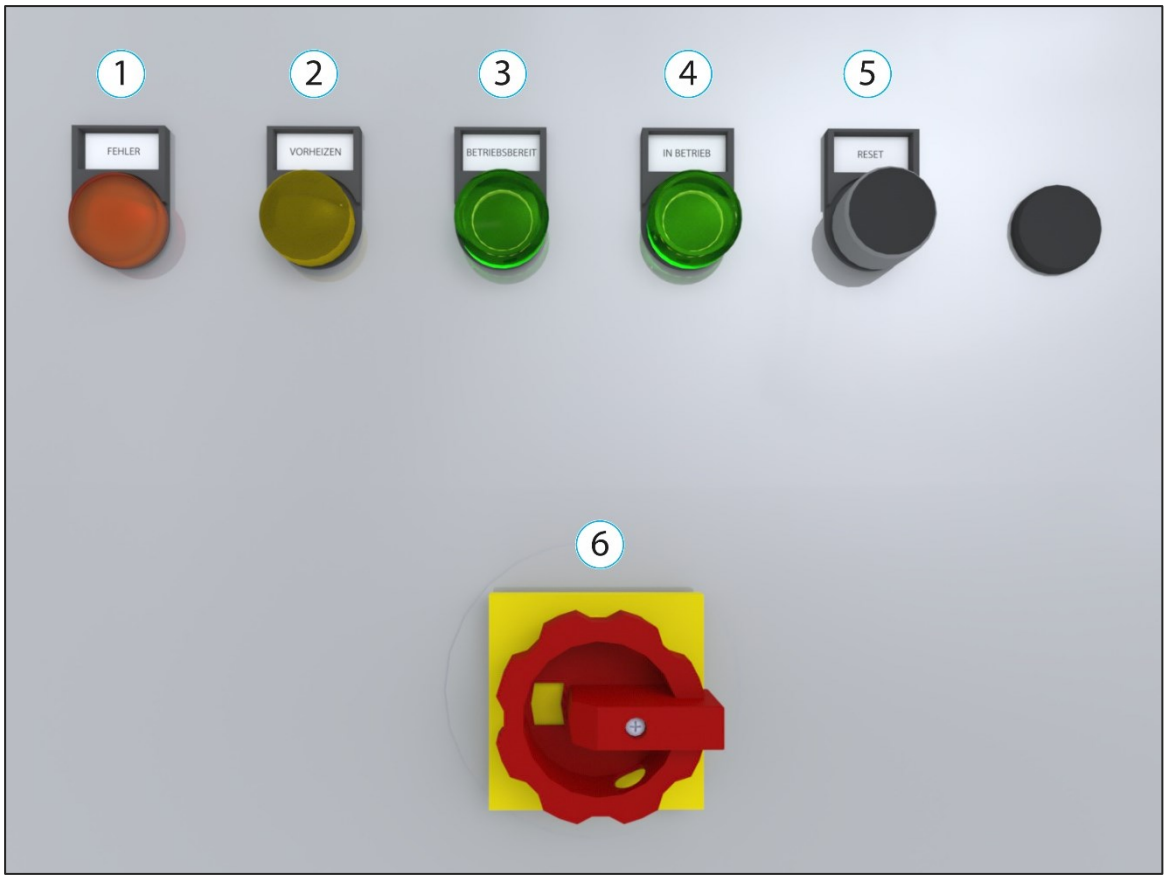


Figure 60: Operating panel

14.2 Indicator Lights

Pos.	Indicator Light	Description
①	**Fault**	**Flashing light** A warning of the converter main controller is present. The converter remains in operation. Constantly glowing: A fault has been detected by the converter main controller. The BESS does not function correctly.
②	**Preheating**	**Flashing light** The cooling liquid is preheated until the set cooling liquid temperature has been reached. Constantly glowing: The coolant temperature has reached the set temperature and is maintained for a set time span (defined in controller). **Light off:** The cooling liquid temperature was maintained for the time span defined in the controller. The preheating process is finished.
③	**Ready for Operation**	**Flashing light** The DC-link of the converter is pre-charging until the set voltage has been reached. **Constantly glowing:**

		The DC-link is precharged to the set voltage and the power switches are closed.
④	**Operating**	**Constantly glowing:** The converter´s IGBTs are enabled. The converter is operating.

Table 37: Indicator lights

14.3 Control Elements

Pos.	Control Element	Description
⑤	**Reset** *Push button*	Resets an existing fault of the main controller and the emergency stop relay.
⑥	**Main switch** *Rotary Switch*	Main switch 480 V power supply for converter control electronics.

Table 38: Control Elements

14.4 Switching on the BESS

Carry out the following steps to switch on the BESS:

Task 1: **Switch on the BESS**
Step 1 : Make sure that the external emergency stop button (customer side, if present) is not activated.
Step 2 : Switch the main switch (*see figure 60,* ⑥) to the "ON" position.

Note 1: If the temperature inside the control cabinet falls below 15°C, the internal control cabinet heating is automatically switched on. The main control is only enabled after the temperature limit value of >5°C has been reached.
Note 2: Once the BESS control system has started up, the function commands transmitted by the higher-level control system are executed.
Note 3: If the BESS control unit detects an error, the red "Fault" indicator (①) lights up.

Step 3 : Check the BESS control system for error messages via the higher-level control system (customer side using WebVisu or communication interface).
Step 4 : Resolve the error(s) if possible.
Step 5 : After successful troubleshooting, acknowledge the error by sending a "Reset" command via the higher-level control system (customer side via WebVisu or communication interface) or the reset button on the CTRL cabinet (⑤*)*.

	For detailed information on the control commands, such as the reset command, which are transmitted to the BESS control system via the customer's higher-level control system, please refer to the document "Description of data profiles" (*see section 1.2 "Applicable Documents"*).

	The control bits described below can be set simultaneously and are automatically processed by the control system in the correct sequence.

Step 6 : Set the **converter_heatup_enable** bit to **TRUE** via the communication interface of the external control room or via the WebVisu. The signal initiates the preheating process of the cooling system. This process normally takes 20 minutes. The "Preheating" indication light illuminates (*see figure 60,* ②).
Step 7 : As soon as all temperatures are within the permissible range, the "Preheating" indication light goes off.
Step 8 : Set the **converter_charge_enable** bit to **TRUE** via the communication interface of the external control room or via the WebVisu. The signal initiates precharging of the DC link and the "Ready for operation" indication light (③) starts to flash. As soon as the DC link is pre-charged, the main switch responsible for the DC link control is switched on and the "Ready for operation" indication light (③) starts to light up constantly.
Step 9 : Set the **converter_modes_enable** bit to **TRUE** via the communication interface of the external control room or via the WebVisu. The signal activates the pulse enable of the grid IGBT´s.
Step 10 : If no errors have occurred, the BESS starts normal operation and the "Operation" indication light (④) lights up constantly.

Step 11 : The detailed procedure for switching on the converter system must be carried out in accordance with the document "Description of data profiles" (*see section 1.2 "Applicable Documents")*. The sequence of the individual steps is shown on the "Flow Chart" tab.

✓ **The BESS is now switched on and in operation.**

14.5 Switching off the BESS

Follow the steps below in order to switch-off the converter:

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 “Protect the CB Against Unintentional Reclosing”. ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

Task 1: **Switch off the BESS.**

Step 1 : To switch off the converter, carry out the steps in reverse order according to the document "Description of the data profiles" in the "Flow chart" tab (*see section 1.2 “Applicable Documents”*).

Step 2 : Set the **converter_modes_enable** bit to **FALSE** via the communication interface of the external control room or via the WebVisu. The signal deactivates the pulse enable of the grid IGBT´s.

Step 3 : Set the **converter_charge_enable** bit to **FALSE** via the communication interface of the external control room or via the WebVisu. The signal opens the main switch and initiates the discharge of the DC link. As soon as the main switch is open, the "Ready for operation" indication light goes off (*see figure 60,* ③).

⚠ DANGER	
	**Risk of injury due to electric shock!** **Discharging the DC link takes several minutes. The "Ready for operation" indication light is not an indicator of a fully discharged DC link. Do not carry out any work on BESS before the DC link has been completely discharged.** ➜ Wait until the DC link is completely discharged and check that it is de-energized as described in section 14.7 "Check Voltage-Free Status of DC Link ".

Step 4 : Set the **converter_heatup_enable** bit to **FALSE** via the communication interface of the external control room or via the WebVisu. The signal switches off the water cooling of the converter after a run-on time of 2 minutes.

Step 5 : Switch the main switch on the converter control cabinet (*see figure 60,* ⑥) to the "OFF" position.

✓ **The BESS is now switched off.**



The UPS can be switched off by pulling the blade type fuse of the UPS unit.

14.6 De-Energizing

Carry out the following steps to de-energize the BESS system:

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 "Protect the CB Against Unintentional Reclosing". ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

Task 1: **De-energize the BESS**

Step 1 : Switch-off the converter system like explained in section 14.4.

Step 2 : Secure the AC circuit breaker(s) from unintentional reclosure, like explained in section 14.9.3.

Step 3 : Decouple the customer AC connection from the converter system using a suitable disconnection device.

Step 4 : Wait for 30 minutes until the converters´ DC link is discharged and check the voltage-free status of the DC-link by using a suitable 2-pole voltage tester.

✓ **The BESS is now switched off and de-energized.**

14.7 Check Voltage-Free Status of DC Link



The DC link voltage can be up to 1300 VDC. Make sure that the measuring device for testing the absence of voltage in the DC link is suitable for this voltage range.



For converter systems with more than one DC link, the following steps must be carried out to check the absence of DC link voltage on each DC link.

The following steps must be followed to check that the DC link is de-energized:

Step 1 : After switching off the system, check the DC link voltage on the WebVisu or via the communication interface of the external control room.

Step 2 : Check that the DC link is de-energized at the HVIO measuring fuse 173F2 between connections 2 and 4 in the CTRL cabinet.

Step 3 : In addition, check that the DC link is de-energized at the HVIO measuring fuse 173F2 by measuring between connection 2 and N (or PE) in the CTRL cabinet.

Step 4 : In addition, check that the DC link is de-energized at the HVIO measuring fuse 173F2 by measuring between connection 4 and N (or PE) in the CTRL cabinet.

Step 5 : Check that there is no voltage on the DC link between a DC- connection (*see figure below*, ①) and DC+ connection (②) of the PowerStack.

➜ For switch cabinets with more than one installed PowerStack, access to the DC link connections is at the bottom stack.
➜ The DC+ connections are positioned slightly to the rear compared to the DC connections.

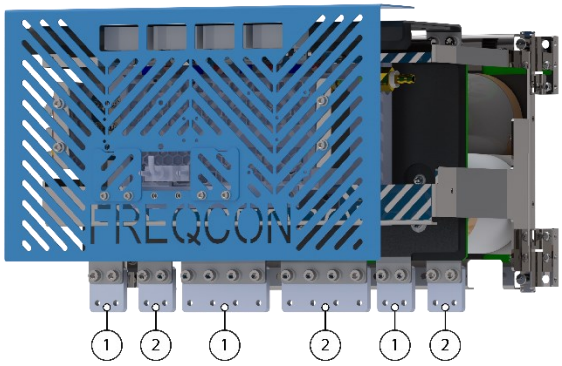


Figure 61: DC- connections ① and DC+ connections ② on the PowerStack (figure may differ from the actual design)

14.8 AC Circuit Breaker

NOTICE

The AC main circuit breaker(s) must not be switched manually!
Do not switch the AC main circuit breaker manually under any circumstances, as this could damage the breaker and the equipment.

The converter system is equipped with an individual 3WL circuit breaker, in order to disconnect the connected grid from the BESS systems electric circuit.

The main circuit-breaker(s) is/are located in the CIR cabinet (*see section 4.4.3 "Internal Components"*).

To protect the circuit breaker against unauthorized switching and to protect the maintenance and operator personnel, the circuit breakers contain a number of locking devices.

For instructions on how to secure the circuit-breaker(s) against reclosing, see section 14.8.3.

Detailed information can be found in the manufacturer's documentation for the circuit-breaker (*see also section 1.2 "Applicable documents"*):

Document type	Document Name	File Name
Operating instructions AC circuit breaker	3ZX1812-0WL00-0AN4	3ZX1812-0WL00-0AN4_online_201806140915326928

14.8.1 Circuit Breaker Components

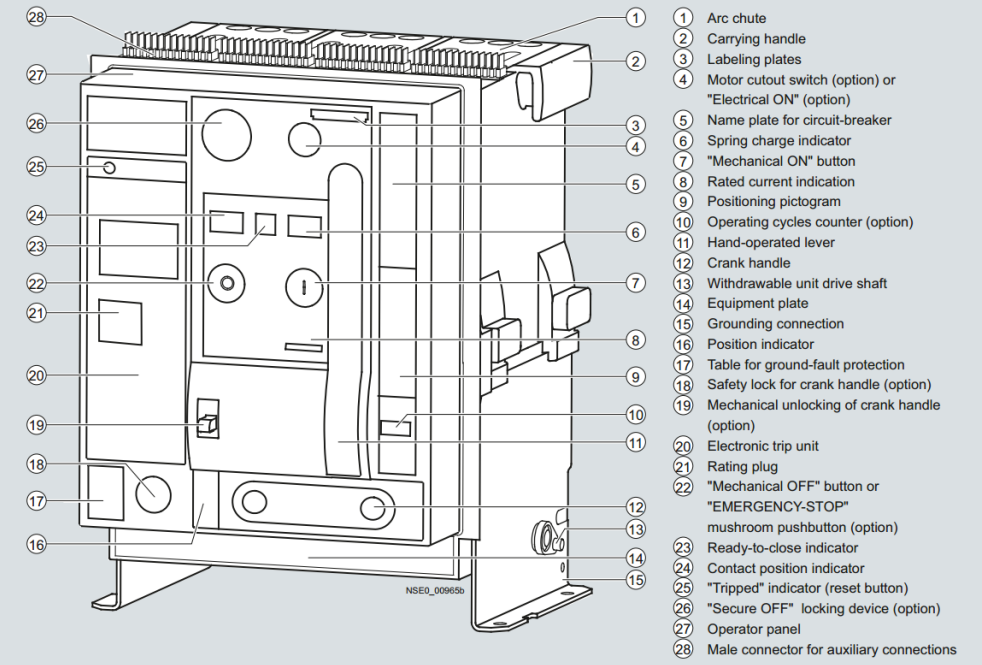
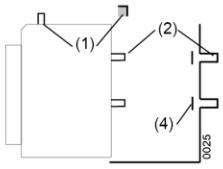
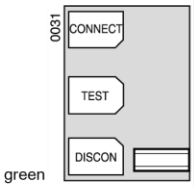
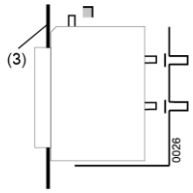
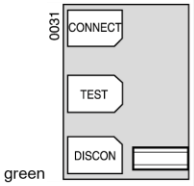
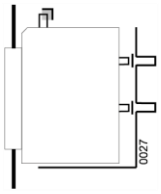
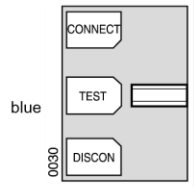
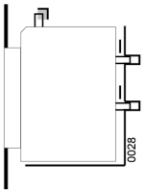
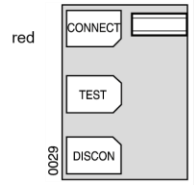


Figure 62: Circuit breaker components

14.8.2 Positions of CB in the Guide Frame

	Diagram	Positon indicator	Power circuit	Auxiliary circuit	Cubicle door	Shutter
Maintenance position			disconnected	disconnected	open	closed
Disconnected position			disconnected	disconnected	closed	closed
Test position			disconnected	connected	closed	closed
Connected position			connected	connected	closed	open

(1) Auxiliary circuit
(2) Primary circuit
(3) Cubicle door
(4) Shutter

Figure 63: Circuit breaker positions

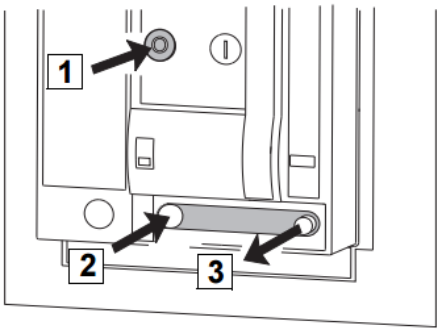
14.8.3 Protect the CB Against Unintentional Reclosing

Drawing out of the racking handle can be prevented by fitting a maximum of three padlocks. The circuit breaker is then locked against moving.

Task 1: **Unlocking the racking handle/ Withdrawing racking handle.**

Step 1 : OPEN circuit breaker.

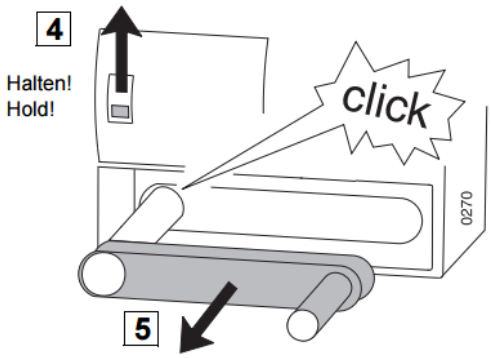
Step 2 : Push the crank.



Step 3 : Pull out handle.

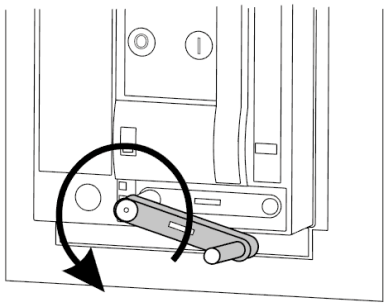
Step 4 : Lift and hold the control lever.

Step 5 : Pull out the crank.

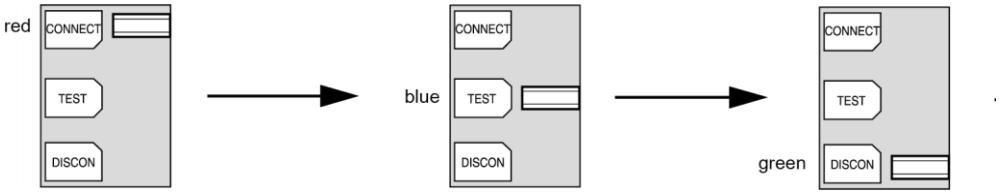


Task 2: Racking circuit breaker into the disconnected position.

Step 1 : Rack the handle until the disconnected position is indicated by the position indicator (green).



Position indicatior

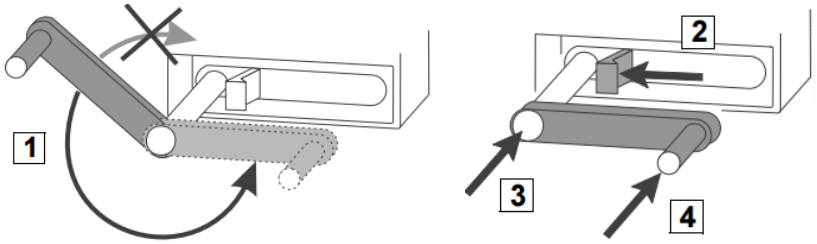


Task 3: Push in the racking handle.

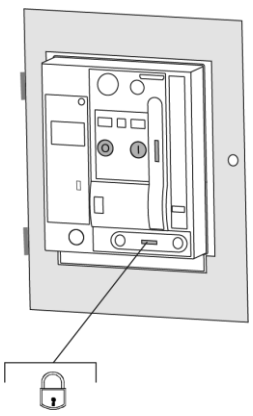
Step 1 : Bring the racking handle to the position indicated in the illustration below.

Step 2 : Push in the crank.

Step 3 : Push in the handle.



Task 4: Lock the racking handle with one or more padlocks.



14.9 DC Fuse Switch Disconnectors

NOTICE	
	**The DC fuse switch disconnectors must not be switched manually!** Do not switch the DC fuse switch disconnectors manually under any circumstances, as this could damage the breaker and the equipment.

Each of the battery storage cabinets is equipped with a DC fuse switch disconnector, in order to disconnect the corresponding battery cabinet from the electric circuit of the BESS.

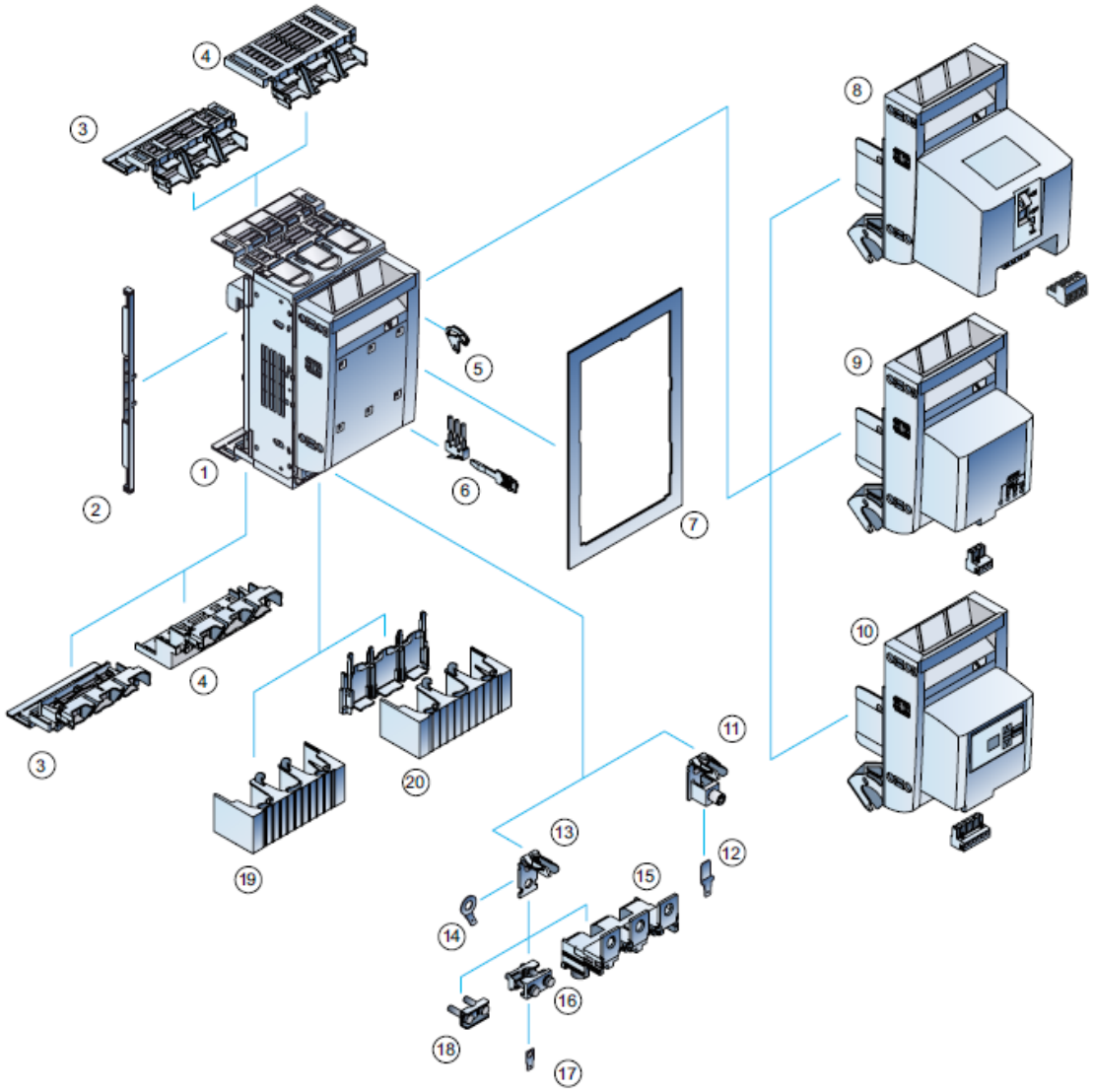
A DC fuse switch-disconnector is located on the mounting plate at the bottom of each battery cabinet.

To protect the DC fuse switch disconnector against unauthorized switching and to protect the maintenance personnel, the disconnector is provided with locking devices.

For instructions on how to prevent unintentional reclosing of the DC fuse switch disconnector, *see section 14.9.3, "Protect the DC Disconnector Against Unintentional Reclosing"*.

For detailed information regarding the DC fuse switch disconnector, refer to the original manufacturer manual (*see section 1.2 "Applicable Documents"*).

14.9.1 Fuse Disconnector Components



① SENTRON 3NP1 fuse switch disconnector
② Cover support
③ Reach-round protection for mounting onto Siemens busbar system
④ Reach-round protection for mounting onto Rittal busbar system
⑤ Locking device
⑥ Auxiliary switch with actuator
⑦ Molded plastic cover
⑧ Handle unit with mechanical fuse monitoring (MFM)
⑨ Handle unit with electronic fuse monitoring (EFM 10)
⑩ Handle unit with electronic fuse monitoring (EFM 20/25)
⑪ Box terminal
⑫ Auxiliary conductor terminal for box terminal
⑬ Blade terminal
⑭ Auxiliary conductor terminal for blade terminal
⑮ Deep-drawn terminal module
⑯ Prism terminal
⑰ Auxiliary conductor terminal for prism terminal
⑱ Saddle terminal
⑲ Terminal cover
⑳ Terminal cover with reach-round protection on the back

Figure 64: Circuit breaker components

14.9.2 Locking Device

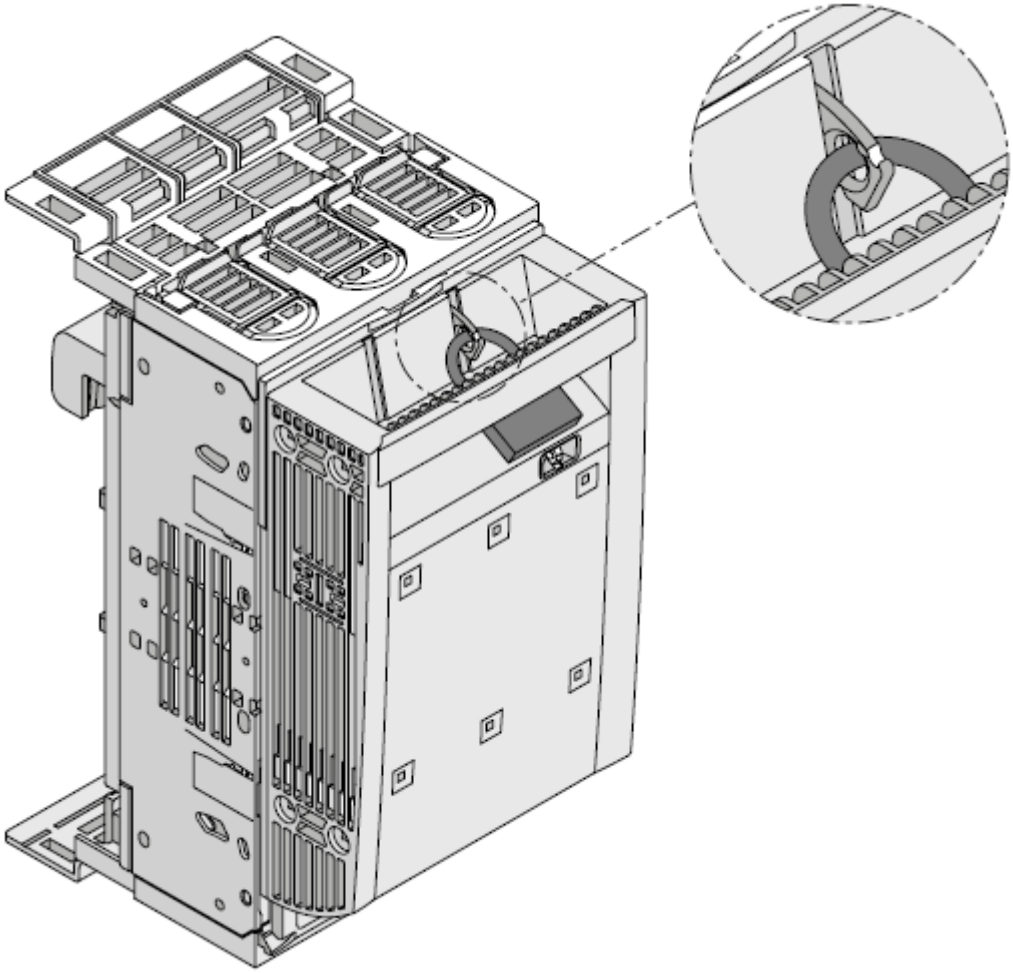


Figure 65: Locking device

14.9.3 Protect the DC Disconnector Against Unintentional Reclosing

You can lock the 3NP1 fuse switch disconnector to protect it against unauthorized actuation.
Either an eye (optional accessory, see below) and a padlock (shackle diameter: 6 mm) or two padlocks (shackle diameter: 2x 3 mm) are required for this purpose. The padlocks are not supplied with the fuse switch disconnector.

NOTICE
You can open the handle unit of a fuse switch disconnector that has been locked with an eye and one padlock by force in order to trip an emergency stop (rupture point on the eye).

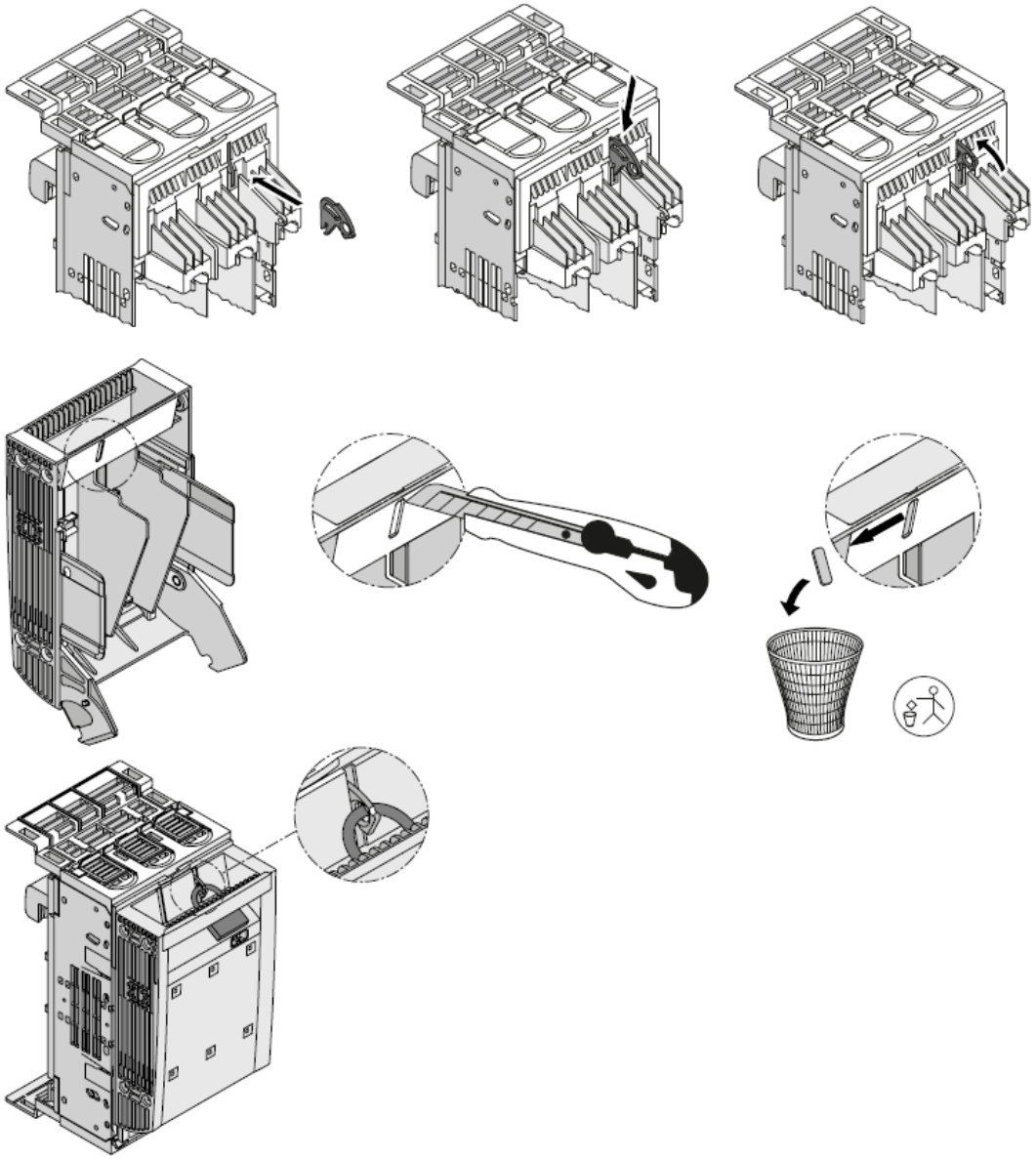


Figure 66: Secure fuse switch-disconnector against unintentional reclosing

15 Monitoring

PIII Converter Control Module

The converter system is equipped with two converter control interfaces.

PIII Indicator Lights

LED	Color	Label	Description
1	red	**UDC max**	DC-link voltage exceeded maximum value
2	red	**Imod max**	Current of one or more IGBT´s exceeded maximum value
3	red	**Error IGBT 1**	Error detected on IGBT 1
4	red	**Error IGBT 2**	Error detected on IGBT 2
5	red	**Error IGBT 3**	Error detected on IGBT 3
6	red	**Error IGBT 4**	Error detected on IGBT 4
7	red	**Error IGBT 5**	Error detected on IGBT 5
8	red	**Error IGBT 6**	Error detected on IGBT 6
9	red	**Error IGBT 7**	Error detected on IGBT 7
10	green	**PWM Mode**	IGBT 1, IGBT 2 and IGBT 3 are working in PWM mode
11	green	**Enable**	IGBT 1 - 6 ready for operation
12	green	**Top 1**	Top 1 active
13	green	**Bot 1**	Bot 1 active
14	green	**Top 2**	Top 2 active
15	green	**Bot 2**	Bot 2 active
16	green	**Top 3**	Top 3 active
17	green	**Bot 3**	Bot 3 active
18	green	**Top 4**	Top 4 active
19	green	**Bot 4**	Bot 4 active
20	green	**Top 5**	Top 5 active
21	green	**Bot 5**	Bot 5 active
22	green	**Top 6**	Top 6 active
23	green	**Bot 6**	Bot 6 active
24	green	**Chopper Active**	Brake chopper is active
25	green	**Blinki**	Profinet communication between main PLC and PIII is established
26	green	**24 V Supply**	24V supply connected
27	green	**UL 1**	L1 voltage apparent
28	green	**UL 2**	L2 voltage apparent
29	green	**UL 3**	L3 voltage apparent
30	green	**Urec**	Booster voltage is apparent on rectifier
31	green	**UDC +**	DC link voltage is apparent
32	green	**Arc Detect**	Arc detection has tripped

Table 39: PIII indicator lights

16 Data transfer with higher-level controller

As described in section 4.2 "Data Interface", the BESS is controlled and monitored via the transfer of data with the customer's higher-level control system. Data transfer between BESS and the higher-level control system is performed via PROFINET protocol.

For external control and monitoring of the converter, it is necessary for the customer to have access to selected control and status variables stored in the converter controller, which can be read and overwritten by the customer's higher-level controller. For this purpose, predefined control profiles with the relevant control variables and status profiles with all relevant status variables are stored for the data transfer from BESS to the customer's higher-level controller.

For a detailed description of the individual data profiles, see Description of data profiles (*see section 1.2 "Applicable Documents"*).

17 Maintenance

The following describes the maintenance work that is necessary for trouble-free operation of the converter system (PCS) and Battery Energy Storage System (BESS). Maintenance intervals must be observed (*see section 17.2 "Maintenance* Schedule*"*).

If increased wear of individual components or functional groups is determined during regular inspections, the operator has to reduce the required maintenance intervals on the basis of the actual signs of wear. Changes compared to the normal operation (increased power consumption, temperatures, vibrations, noises, etc. or respond of monitoring systems) might indicate the functionality of the device is impaired. These then have to be subjected to an inspection by qualified personnel.

For information regarding maintenance of the BESS battery cabinets refer to document „20_Maintenance_Schedule“ (*see section 1.2 "Applicable Documents"*). Maintenance intervals provided in the maintenance schedule must be adhered.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 “Protect the CB Against Unintentional Reclosing”. ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

⚠ WARNING	
 	**Hazard by cooling liquid** The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed. ➜ Avoid oral ingestion of the coolant, since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention. ➜ Avoid skin contact with the coolant. ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

NOTICE
Service and maintenance work on the BESS and cooling system must only be carried out by qualified and authorized personnel.

17.1 Preparations Prior Maintenance

The following safety precautions must be carried out before commencing service and maintenance work.

Non-observation of these safety instructions can cause injury to persons, damage to objects or malfunction or damage to the device itself.

Do not operate!	**Lock and tag power switches and controller devices**
⚠ DANGER 	Disconnect power and block operation controller devices. Follow national laws regarding Occupational Safety and Health. 1. Identify the energy source(s). 2. Isolate the energy source(s). 3. Determine voltage-free status. 4. Ground device or equipment to protect from short circuiting and from shocks. 5. Lock and Tag the energy source(s). 6. Prove that the equipment isolation is effective. 7. When required, apply lock-out device or clamp and secure with padlock(s).

17.2 Maintenance Schedule

Location	Component	Maintenance Work	Maintenance Interval	Description in
PCS Container CTRL cabinet	UPS battery	Functionality check	Once every 6 months	Section 17.3.1
PCS Container CTRL cabinet	UPS battery	Remove battery from battery unit	At storage temperatures below 0°C	Section 17.3.2
PCS Container All switch cabinets	Intake fan filters	Check the fan filters for contamination and replace if necessary	Once every 6 months	Section 17.4
All containers	Complete BESS system	Visual inspection	Once every 6 months / in case of a fault	Section 17.5
PCS Container CIR cabinet	Circuit breaker 3WL	Inspection	Once every 12 months	Section 17.6.1
		Replace arc-chute covers	After no more than three short-circuit interruptions	
		Replace arc chutes and contact system	Depending upon their condition	
		Replace operating system	Depending upon their condition	
PCS Container CTRL cabinet	PLC	Replace backup battery of Simotion PLC	Once every 4 years	Section 17.7
PCS Container COSY	Coolant	Exchange cooling liquid	Once every 5 years	Section 17.6
PCS Container COSY	Expansion vessel	Check pressure	Once every 5 years / When exchanging the cooling liquid / When error "pressure low" is apparent	Section 17.9
BESS Containers	Exhaust units	Inspection	Once every 6 months / in accordance with existing maintenance schedule	Section 17.11
BESS Containers	Fire dampers	Inspection	Once every 6 months / in accordance with existing maintenance schedule	Section 17.12
BESS Containers	H2 Sensors	Inspection	Once every 6 months	Section 17.13

Table 40: PCS Maintenance Schedule

17.3 UPS

17.3.1 UPS Functionality Check

(once every 6 months)

In order to check the functionality of the UPS device, the following steps must be performed:

Task 1: **Perform functionality check of the UPS device**

Step 1 : Set the main switch on the door of the control cabinet (*see figure 60,* ⑥) to the "OFF" position.

Step 2 : Locate the UPS module 102G1 inside the control cabinet (*see section 4.4.3*).
The yellow LED (*see figure below,* ④) on the front of the UPS module should glow, indicating that battery mode is active and the battery is discharging because the power supply is not available.

Step 3 : Wait for the buffer time set on the potentiometer on the front of the UPS module (②, default value: 6.6 min.).
During this time, check if the SoC bar graph (①) is displaying the current state of charge (SoC).

Note 4: During and after the test, the red LED (③) displaying an UPS alarm should not start glowing, since this would indicate an faulty or almost empty battery. In this case, the UPS battery must be replaced as described in the original manufacturer documentation.

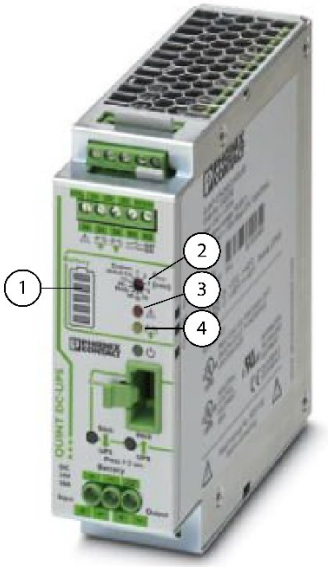


Figure 67: UPS module

Pos.	Description
①	Bar graph for displaying the current charging state of the power storage device
②	Buffer time setting: default: 6.6 min.
③	Red LED: alarm
④	Yellow LED: battery mode

Icon	Meaning of LEDs
⚠	Red LED on: UPS alarm due to one of the reasons: • battery almost empty • battery not detected • battery replacement required LED off: No UPS alarm, power supply available, normal operation.
🔋	Yellow LED on: Battery mode is ON, battery is discharging because power supply failed. LED off: Battery mode is OFF, i.e. mains available.
⏻	Green LED on: Mains is ON. LED off: Mains is OFF.

17.3.2 Removing the UPS battery

(At storage temperatures below 0°C)

NOTICE
The battery of the UPS unit must be removed at temperatures below 0°C.

In order to remove the battery from the energy storage device UPS-BAT/VRLA/24DC/12AH, the service mode of the UPS device must be activated.

Task 1: Activate service mode

The corresponding activation rights have to be granted for service mode activation and deactivation.

The service mode cannot be activated, while the QUINT-UPS runs in battery mode. The power supply must be available.

Step 1 : Depending on the granted activation rights, the service mode can be activated in three different ways:

1. By holding down both push buttons on the QUINT-UPS named "Stick -> UPS" and "UPS -> Stick" for at least 6 seconds.

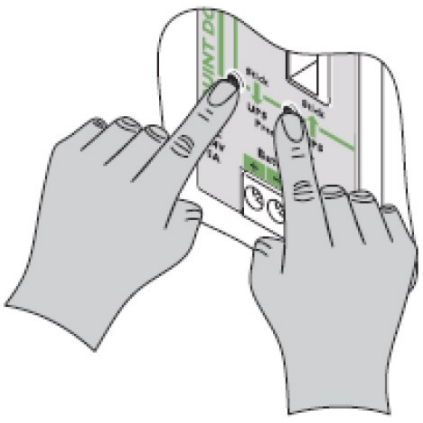


Figure 68: UPS control elements

2. By connecting a service stick (*see manufacturer manual*) to the Data port of the UPS.
3. By using the UPS-CONF (*see manufacturer manual*) software as follows:
   In the "Settings" group, select the "Service" item, and click the "On / Off" button near the "Activate service mode" text.

While the service mode is active

- the alarm status is activated,
- the charging current is interrupted,
- the status LED "Service mode active" in the UPS-CONF software ("Settings" group /"Service" item) is green

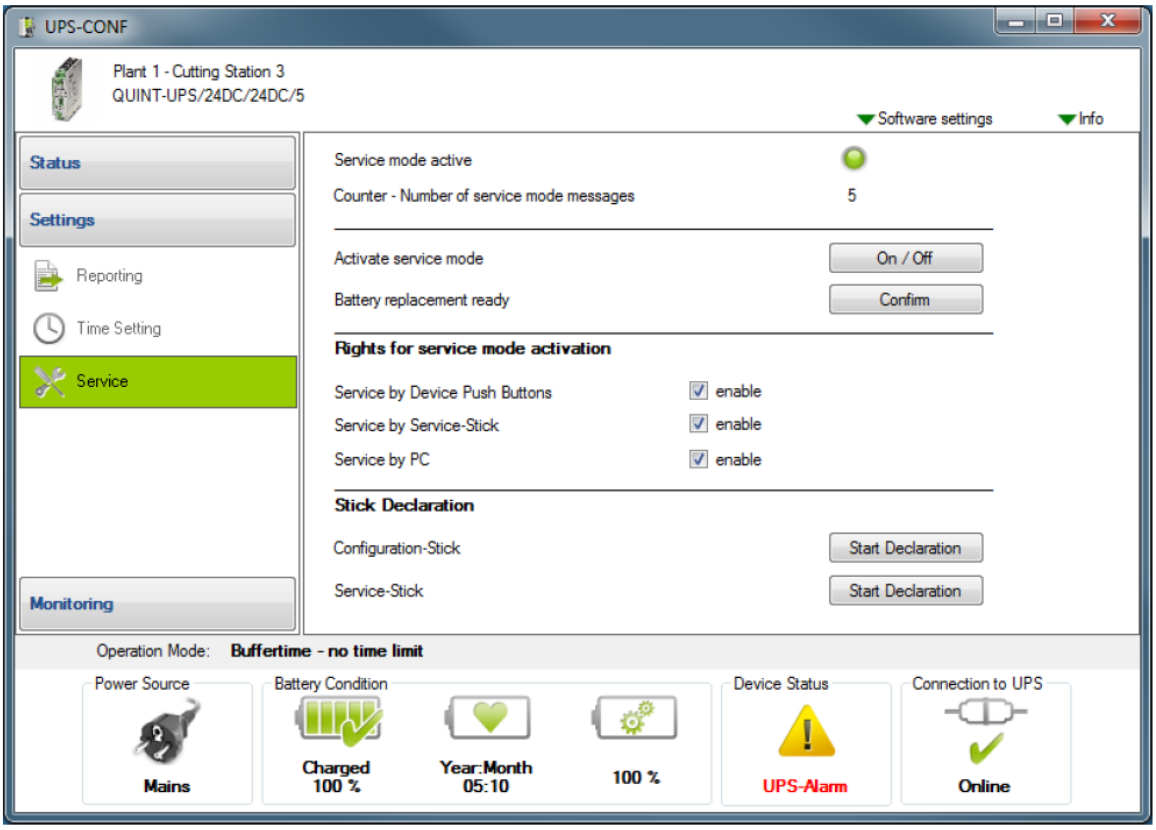


Figure 69: UPS CONF software

Task 2: Remove battery

⚠ DANGER
Before activating the service mode, read and obey carefully the safety instructions in the topic “Important safety notes” of the manufacturer manual.

⚠ DANGER
Watch polarity when connecting cables!

Step 1 : Activate the service mode by one of the ways described in Task 1.
Step 2 : Open battery module housing.
Step 3 : Remove fuses *(see illustration below)*.

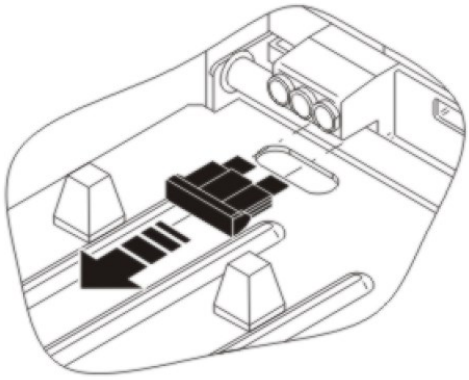


Figure 70: Remove UPS battery fuses

Step 4 : Remove cabling.
Step 5 : Remove battery.
Step 6 : Fix cabling inside housing.
Step 7 : Store the battery module together with the fuses.
Step 8 : Close battery module housing.

NOTICE
The battery and the fuses of the UPS unit must be reassembled before commissioning, recommissioning and operation of the MSC converter unit.

17.4 Changing the Intake Fan Filters

Check every 6 months, replace depending on degree of soiling)

The fan-and-filter unit and outlet filter are supplied as standard with a standard filter mat for the pre-filtering of dry, coarse dust and lint. In order to increase the protection category, and in the case of dust with a grain size of < 10 µm, we recommend the use of fine filter mats (optionally available).
The filter must be checked in regular intervals in accordance to the level of dust exposure and replaced as necessary.

⚠ DANGER

➜ Only change the filter mat while the fan rotor is stationary.
➜ Never insert your fingers into the fan rotor.

⚠ DANGER

The unit is live. Switch off the power supply before opening, and take suitable precautions against it being accidently switched back on.

NOTICE

Use only original Rittal filters which bear the Rittal logo in order to safeguard the designated protection category, air throughout and operating approvals.

To insert or replace the filter, proceed as follows (direction of airflow: drawing from outside and blowing into the enclosure):

Task 1: **Replace intake filter**
Step 1 : First press the catch of the louvred grill (Rittal logo) up slightly with one finger.
Step 2 : Once it is released, the louvred grill can be dropped open by approx. 70° or 90°.
Step 3 : If necessary, first place the fine filter mat into the housing.
Step 4 : Ensure that the open (roughened) side faces towards the louvred grill.
Step 5 : Insert the enclosed standard filter mat.
Step 6 : Ensure that the open side (without Rittal logo) faces towards the louvred grill.
Step 7 : Push the louvred grill back onto the enclosure until it snaps audibly into position.

17.5 Visual Inspection

(once every 12 months/in case of a fault)

Check the fan filters for contamination. Replace filters if necessary (*see section 17.4*).

Visually inspect the BESS cabinets for:

- Corrosion
- Damage
- Contamination

Electrical connections
Electrical connections must be checked for proper connection in order to ensure safe operation of the system and to prevent personnel from injuries due to electrical shock.

Corrosion
Corroded electrical connections must be replaced in order to maintain safe operation of the system and to prevent personnel from injuries due to electrical shock.

Damage
Damaged wires and clamps must be replaced immediately in order to maintain safe operation of the converter system and to prevent personnel from injuries due to electrical shock.

Contamination
Check the interior of the converter unit for contamination and dirt in order to prevent the internal components from short-circuiting and damage.

NOTICE
Do not use solvents for cleaning – especially on polycarbonate plastics. Use a vacuum cleaner to remove dirt or dust.

17.6 AC Circuit Breaker(s)

17.6.1 Inspection work

(once every 12 months)

The arc chutes and contact system of the circuit breaker(s) must be inspected according to these operation instructions. If a fault condition opens the circuit breaker(s), the circuit breaker(s) should be inspected before it is put back into service. Contact assemblies need to be changed according to their condition.

The switchgear operator has to determine inspection intervals depending on the breaker application conditions:

- min. 1 x per annum
- after interruption of heavy loads

During the inspection the following items must be examined:

- arc chutes and contact systems
- electrical and mechanical functionality of the breaker
- mechanical on- / off-functionality
- main and auxiliary circuits, function and connecting quality
- plausibility control of trip unit settings and correction, if necessary

Draw-Out guide frames with arc-chute covers installed, have to be replaced after no more than three short-circuit interruptions of the circuit breaker. If the breaker endurance is exhausted, then the breaker and old spare parts need to be disposed off, according to the effective legal regulations.
The arc chutes and the contact system must be replaced depending upon their condition.

Depending on the circuit breaker stress it may also be necessary to replace the operating system.

For detailed regarding the maintenance of the circuit breaker, refer to original manufacturers´ documentation (*see section 1.2 "Applicable Documents"*):

Document type	Document Name	File Name
Operating instructions	3ZX1812-0WL00-0AN4	3ZX1812-0WL00-0AN4_online_201806140915326928

17.7 Replace PLC Buffer Battery

17.7.1 Preventive maintenance

(every 4 years)

To maintain the high system availability, the manufacturer recommends the preventive replacement of the CMOS buffer battery, which is installed in the system PLC.

Component	Replacement interval
CMOS buffer battery	4 years

17.7.2 Replacing Backup Battery

NOTICE

The service life of the backup battery is approx. 5 - 8 years, depending on the ambient conditions.

Detailed information on maintenance can be found in the manufacturer's documentation for the Simotion P320-4 PLC *(see also section "Other applicable documents")*:

Document type	Document Name	File Name
Operating instructions	P320- 4 Commissioning and installation manual	P320_4_commissioning_en-EN

17.8 Exchanging the Cooling Liquid

(Every 5 years)

The cooling liquid inside the converter cooling system is to be exchanged as described in the following sections.

Like described in section 0, the converter cooling system is split up into two independent cooling systems for each converter system, allowing Converter System 1 and 2 independently from one another.

Therefore, each of the following steps must be performed for each cooling system separately.

NOTICE

- The cooling liquid inside the cooling system must be removed at least once every five years.
- Check the pressure on the expansion tank every time the cooling liquid is exchanged. The cooling system must be completely drained in order to perform a pressure check of the expansion tank (*see section17.9*).

NOTICE

The pump must not run dry as it might damage the pump.

17.8.1.1 Required Tools

The following table provides you with information regarding the tools required to perform maintenance work on the cooling system:

Amount	Tool	Description	Preferred Type	Manufacturer
3	Hose ½"	Length: 2 m, max. 50 bar	Variolux Silverline	Gardena
1	Filling pump	For glycol use, min. 2 bar pressure	Unistar 2000 A	ZUWA
1	Cooling liquid vessel	Min. 55 l capacity		
1	Inlet pressure gauge	For expansion tanks, digital	Art. No.: 512240122	OEG
1	Tank filler 400 ml	For increasing and testing the pressure in expansion tanks	Art. No.: 311779100	OEG
1	Adapter for tank filler	Adapter for screwing on the tank filler can	Art. No.: 512240126	OEG

Table 41: Required tools for cooling system maintenance

17.8.1.2 Allowed Coolants

The following table lists the suitable coolants for using in the cooling system. When exchanging the cooling liquid of the cooling system, only use a coolant listed in the table.

Please observe the manufacture's information regarding the cooling range of the designated cooling liquid.

Manufacturer	Type
NALCO AG	Varidos FSK
BASF AG	Glysantin G30
Clariant	Antifrogen N
Clariant	Antifrogen L
DOW	Dowcal 20
Zitrec	M-25 C

Table 42: Allowed coolants

17.8.1.3 Draining the cooling system

NOTICE

Check the pressure on the expansion tank every time the cooling liquid is exchanged. The cooling system must be empty in order to perform a pressure check of the expansion tank (*see section 17.9*).

⚠ WARNING



Hazard by cooling liquid

The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed.

- ➜ Avoid oral ingestion of the coolant, since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention.
- ➜ Avoid skin contact with the coolant.
- ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

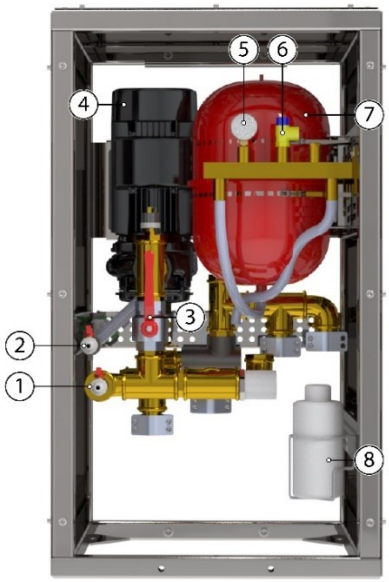


Figure 71: Cooling system components inside cooling system cabinet (COSY)

Pos.	Cooling system components
①	¾“ inlet flow connection with valve
②	"¾“ return flow connection with valve
③	Stop cock
④	Coolant pump
⑤	Manometer
⑥	Overpressure valve
⑦	Expansion vessel
⑧	Overflow vessel

Table 43: Cooling system components

Task 1: **Draining the cooling system**

Step 1 : Connect a pressure hose to the return flow connection of the cooling system inside the COSY cabinet (*see figure 71,* ②) and lead the end of the hose inside a suitable vessel.

Step 2 : Open the return flow valve (②).

Step 3 : The cooling liquid drains through the hose inside the vessel.

Step 4 : Wait until the cooling system is completely drained and then check it for any liquid remaining in the system.

17.8.2 Filling the Cooling System

⚠ WARNING	
	**Hazard by cooling liquid** The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed. ➜ Avoid oral ingestion of the coolant, since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention. ➜ Avoid skin contact with the coolant. ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

Task 1: **Prepare Coolant**

Step 1 : The expansion tank must be pre-charged to 1 bar at approx. 20 °C on the gas side.

Step 2 : Use a suitable container to prepare approx. 55 liters of coolant with a ratio of 60% water and 40% glycol (with Antifrogen N). The actual amount needed depends on the length of the hoses used to connect the heat exchanger.

Step 3 : Open the cooling liquid container (e.g. Antifrogen N) and place it in close proximity to the converter cooling system.

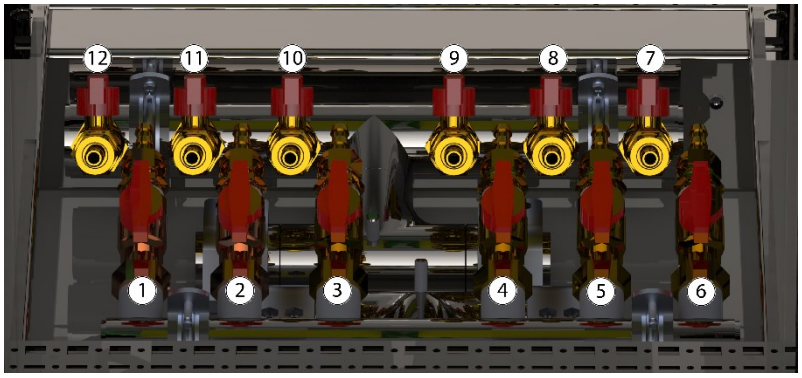


Figure 72: Water distributor, connections and valves in CON Cabinet

Pos.	Cooling System Component
①	Sub circuit with valve 1 - inlet flow
②	Sub circuit with valve 2 - inlet flow
③	Sub circuit with valve 3 - inlet flow
④	Sub circuit with valve 4 - inlet flow
⑤	Sub circuit with valve 5 - inlet flow

⑥	Sub circuit with valve 6 - inlet flow
⑦	Sub circuit with valve 6 - return flow
⑧	Sub circuit with valve 5 - return flow
⑨	Sub circuit with valve 4 - return flow
⑩	Sub circuit with valve 3 - return flow
⑪	Sub circuit with valve 2 - return flow
⑫	Sub circuit with valve 1 - return flow

Table 44: Cooling system – Coolant dispenser connections and valves inside CON cabinet

Task 2: Fill cooling system

NOTICE

Make sure that the pressure and suction hoses are completely immersed in the cooling liquid inside the cooling liquid container throughout the whole filling process, to avoid suction of air into the cooling circuit.

Step 1 : Connect the external filling pump and the cooling liquid canister using a suction hose.

Step 2 : Connect the external filling pump to the inlet flow connection *(see figure 71, ①)* with a pressure hose.

Step 3 : Open the valve on the top of the heat exchanger - if there are several heat exchangers, the valve of each heat exchanger must be opened *(see illustration below)*.

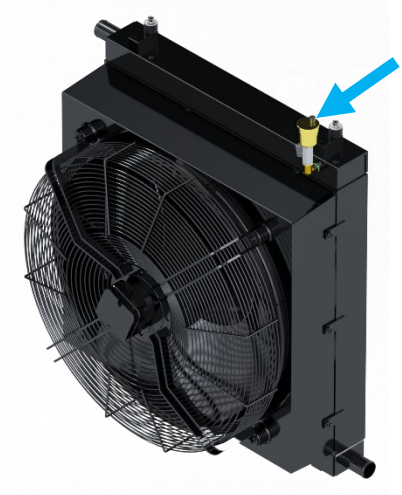


Figure 73: Valve on heat exchanger

Step 4 : Connect the return flow connection (*see figure 71,* ②) and the coolant canister with a pressure hose.

Step 5 : Close ALL valves of the sub-circuits on the water distributor of the CON cabinet (*see figure 72* ① - ⑥, ⑦ - ⑫).

Step 6 : Open the stop cock of the converter cooling system (*see figure 71,* ③).

Step 7 : Open the valves on the inlet flow connection and on the return flow connection.

Step 8 : Switch on the external filling pump and make sure that the intake hose is completely immersed in the cooling liquid inside the cooling liquid canister, so no air is sucked into the cooling circuit.

Step 9 : The main cooling circuit will be filled with coolant and the air will be removed from the circuit during this time. Wait until no more air bubbles are inside the cooling liquid canister.

Step 10 : Open the inlet flow and return flow valves of sub-circuit 1 (*see figure 72,* ① *and* ⑫).

Step 11 : Wait for 3 minutes. The sub cooling circuit will be filled with coolant and the air will be removed from the circuit during this time.

Step 12 : Shut off the inlet and return flow valve of sub circuit 1.

Step 13 : Proceed the same way for the remaining IGBT cooling circuits inside the CON cabinet.

Step 14 : Proceed the same way for the cooling circuits inside the IND cabinet.

Step 15 : Close the stopcock (*see figure 71,*③).

Step 16 : Open the valves of all connected sub-circuits.

Step 17 : Close the valve of the return flow connection (*see figure 71,* ②).

Step 18 : Wait until a pressure of 3 bar is indicated by the cooling systems´ manometer (*see figure 71,* ⑤). As soon as 3 bar have been reached, immediately shut off the inlet flow valve (*see figure 71,* ①).

Step 19 : Shut-off the external filling pump, but make sure the suction and pressure hose are still immersed in the cooling liquid inside the cooling liquid container.

Step 20 : Activate the coolant pump of the cooling system by switching on the motor protection circuit breaker 181Q1 inside the control cabinet and activate the contactor 139K2 inside the control cabinet using a suitable insulated tool.

Step 21 : Let the coolant pump run for 120 min.

Step 22 : Close the valve on the top of the heat exchanger(s) (*see figure 73*).

Step 23 : Deactivate the coolant pump of the cooling system by removing the insulated tool.

Step 24 : Check if the pressure on the cooling system manometer is indicated with 3 bar.

Step 25 : If the pressure indicated by the manometer is below 3 bar, switch the external filling pump back on an open the inlet flow valve.

Step 26 : As soon as a pressure of 3 bar has been reached, immediately shut-off the inlet flow valve and switch off the external filling pump.

Task 3: Perform a visual check of the entire cooling circuit for leaks.

17.9 Check pressure of expansion tank

Once every 5 years / When exchanging the cooling liquid / When error "pressure low" is apparent

NOTICE

The cooling system must be empty in order to perform a pressure check of the expansion tank (*see section 17.9*).

➜ Check the pressure on the expansion tank every time the cooling liquid is exchanged.

⚠ WARNING

Before performing maintenance work, make sure the system is off, cooled and not pressurized, all the electric parts are not energized, and the vessel is completely empty.

Maintenance of the expansion tank is to be performed according to the manual of the manufacturer.
ZILMET: manual_expansion_tank_537L_zilmet

Perform a pressure check of the expansion, checking that the pre-charge is at 1.5 bar.

- At least once every 5 years
- whenever the coolant of the water-cooling system is exchanged
- when converter controller reports the error message “pressure low”

The cooling system must be reduced to 0 bar in order to perform a pressure check of the expansion tank. **The necessary gas pressure is 1.5 bar**. If necessary, refill gas to 1.5 bar with compressed nitrogen. Exceptionally, the expansion tank can be filled up with compressed air. At the next maintenance the gas pre-charge pressure must be corrected with nitrogen.
The filling valve is similar to a filling valve of a car tire. Check the pressure with a tire gauge. Avoid unnecessary gas losses during testing.
See instructions below on how to perform a pressure check of the expansion tank and how to refill gas if necessary.

Task 1: **Check pressure of expansion tank**
In order to check the pressure of the expansion tank, the coolant inside the cooling systems´ circuits must be drained, until the manometer of the water-cooling system indicates a pressure of **0 bar**.

Step 1 : Drain the converter´s water cooling system like explained in section 17.8.1.3 until the manometer of the cooling system indicates a system pressure of 0 bar.

Step 2 : Connect the supplied tank filler with manometer and adapter (*see figure 75*) to the filling valve connection of the expansion vessel (*see figure 74*) and check if the nominal pressure of 1.5 bar is apparent.



Figure 74: Filling valve connection on expansion tank



Figure 75: Tank filler with manometer and adapter

NOTE: If the pressure indicated by the pressure gauge is below 1.5 bar, refill the expansion tank with gas, as described in the following:

Task 2: **Refill gas of expansion tank to 1.5 bar**

Step 1 : Connect the supplied tank filler with manometer and adapter to the filling valve connection of the expansion tank.

> **⚠ WARNING**
>
> Hold the tank filler bottle in upright position during the filling process. Don´t hold the bottle horizontally or tip the bottle during the filling process, since it could lead to injuries due to bursting material.

Step 2 : Refill gas until the connected pressure gauge is indicating a pressure of 1.5 bar.

Task 3: **Refill converter cooling system with coolant**

Step 1 : Refill the converter water-cooling system with cooling liquid like described in section 17.8.2 until the manometer of the water-cooling system indicates a pressure of 3 bar.

Step 2 : Let the coolant pump run for at least 1 hour.

Step 3 : Turn off- the internal coolant pump and check if the pressure indicated by the cooling system manometer is 3 bar.

Note: If the pressure is below 3 bar, refill cooling liquid until a pressure of 3 bar is indicated by the manometer of the water-cooling system.

17.10 Pump

⚠ WARNING

Make sure that escaping cooling water does not cause injury to persons or damage to the equipment.

- The internal pump parts are maintenance-free.
- It is important to keep the motor clean in order to ensure adequate cooling of the motor.
- If the pump is installed in dusty environments, it must be cleaned and checked regularly.
- Take the enclosure class of the motor into account when cleaning.
- The motor has maintenance-free, greased-for-life bearings.
- Pump bearings and shaft seal are maintenance free.

Maintenance of the pump is to be performed according to the manual of the manufacturer

Manufacturer:	Grundfos
Type:	CM10-2 A-R-A-E-AQQE
Manufacturer article no.:	99080211

Frost Protection

NOTICE

Before start-up after a period of inactivity, the pump and the suction pipe should be completely filled with liquid.

Pumps which are not being used during periods of frost should be drained to avoid damage.
Remove the filling and drain plugs from the pump (*see illustration below).*

Do not refit the plugs until the pump is taken into operation again.

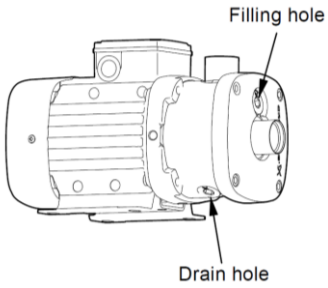


Figure 76: Position of filling hole and drain hole

17.11 Exhaust Units

Once every 6 months / fit in with existing service and maintenance plan

Periodically the extract unit must be electrically tested to ensure that the supply to the unit is continuous and that mechanically the FSD and motor open and close effectively.

It is recommended that this test be carried out twice yearly or to fit in with existing service and maintenance contracts.

The air flow failure switch should be checked for free movement and electrical conductance.

Refer to Puma technical sales leaflet for further information regarding dimensions, weights and unit performance and fan curves.

17.12 Fire Dampers

Once every 6 months / fit in with existing service and maintenance plan

The damper and motor require no service as such, but a periodic mechanical and electrical test of the working mechanisms should be carried out at least twice yearly, or to coincide with existing service and maintenance contracts.

See appropriate certified drawing of units for further information re: sizes etc.

17.13 H2 Sensors

Once every 6 months

The inspection must be carried out by trained service personnel.

The inspection intervals must be established in each individual case and shortened if necessary, depending on technical safety considerations, engineering conditions and the technical requirements of the equipment.

Contact Dräger service if you wish to take out a service contract and have any repairs carried out.

18 Container Repair

In case the container surface is damaged, repair the damaged surface as described in the following, to maintain the surface protection of the container.

18.1 Process Instructions (New Application)

Surface preparation according to DIN EN ISO 12944-4 sandblasting to surface preparation standard SA 2.5 (40 µm minimum roughness depth, medium roughness grade (G), angular blasting grit).

Primer:
REESA 2K-HS-Filling-Primer ZP
Material Nr.: 3D061
Color: ca. RAL 7035
Dry film thickness (DFT): 80 - 100 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

- Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

Topcoat:
REESA 2K-HS-PUR-OneCoat-Paint
Material Nr.: 6D062
Color: n. a.
Dry film thickness: 60 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

- Furthermore, a forced drying period of 60 minutes at a temperature of +60 °C is possible. Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C. The complete reaction period of the topcoat is 7 days.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

18.2 Process instructions (Repair - damage down to the steel)

Surface preparation according to DIN EN ISO 12944-4 surface preparation standard PSt2:

- Removal of loose and labile coating particles.
- Removal of rust using a wire brush or sandpaper (grain size 180).
- Surface grinding of the damaged and uneven areas, as well as edge areas, using sandpaper (grain size 180) until even.
- Removal of all foreign and separating substances.

Primer:
REESA 2K-HS-Filling-Primer ZP
Material nr.: 30061
Color: ca. RAL 7035
Dry film thickness: 80 - 100 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

Application process: brush application
Up to 3 coats may be required to achieve the DFT.
Intermediate drying time of the individual coats: 30 min.
Drying time between primer and topcoat: 2 hours.

- Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

Topcoat:
REESA 2K-HS-PUR-One-Coat-Paint
Material Nr.: 60062
Color: n. a.
Dry film thickness: 60 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

Application process: brush application
Up to two coats may be required to achieve the DFT.
Intermediate drying time of the individual coats: 30 min.

- Furthermore, a forced drying period of 60 minutes at a temperature of +60 °C is possible. Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C. The complete reaction period of the topcoat is 7 days.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

18.3 Process instructions (Repair - damage only within the topcoat)

Surface preparation according to DIN EN ISO 12944-4 surface preparation standard PSt2:

- Removal of loose and labile coating particles.
- Surface grinding of the damaged and uneven areas, as well as edge areas, using sandpaper (grain size 180) until even.
- Removal of all foreign and separating substances.

Topcoat:
REESA 2K-HS-PUR-One-Coat-Paint
Material Nr.: 60062
Color: n. a.
Dry film thickness: 60 - 80 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

- Furthermore, a forced drying period of 60 minutes at a temperature of 60 °C is possible. Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C. The complete reaction period of the topcoat is 7 days.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

19 Settable Devices

The following table provides the manufacturer settings of the components listed in the table.

Location	Identifier	Settable Device	Setting
CIR	80Q1	AC circuit breaker 3WL I_N=1250 A / 690 V	$I_R = I_N \times 1.0$ $I_i = I_N \times 2.0$
CTRL_1	101Q1	Circuit-breaker for motor protection, 2.2 ... 3.2 A	3 A
CTRL_1	181Q1	Circuit-breaker for motor protection, 3.5 ... 5 A	5 A
CTRL_1	181Q2	Circuit-breaker for motor protection, 4.5 ... 6.3 A	4.5 A
CTRL_1	182Q1	Circuit-breaker for motor protection, 3.5 ... 5 A	5 A
CTRL_1	185B1	Thermostat -10°C … +50°C	15°C
CTRL_1	186B1	Thermostat -10°C … +50°C	5°C
CTRL_1	102G1	USV QUINT 24 V DC / 20 A	6.6 min
CTRL_1	101T1	TRIO-PS/3AC/24DC/40	26 V DC
BESS_1	101T1	TRIO-PS/3AC/24DC/40	26 V DC
BESS_1	101Q1	Circuit-breaker for motor protection, 2.2 ... 3.2 A	3 A
BESS_1	102G1	USV QUINT 24 V DC / 20 A	6.6 min
BESS_2	101T1	TRIO-PS/3AC/24DC/40	26 V DC
BESS_2	101Q1	Circuit-breaker for motor protection, 2.2 ... 3.2 A	3 A
BESS_2	102G1	USV QUINT 24 V DC / 20 A	6.6 min

Table 45: Settable devices

20 IP Addresses

The following table provides the IP-addresses set at delivery state of the listed components.

Component	IP Address
Main controller P320	192.168.5.10

Table 46: IP addresses of components

21 PLC

The following sections provide you with a description of the connection elements and the indicator lights of the PLC and gives you information regarding the handling of the unit.

For further information regarding the PLC, see device manual SIMOTION_P320-4 of the manufacturer.

21.1 Indicator Lights

The following table describes the indicator lights at the front panel of the P320 PLC.

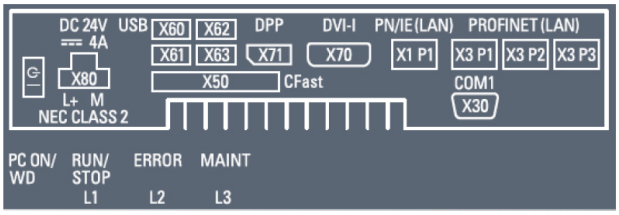


Figure 77: P320 PLC indicator lights

LED	Significance	State	Description
PC ON/ WD	Power supply	Green	BIOS ready to boot. Indicates the correct supply voltage of 3.3 V, 5 V and 12 V from the integrated power unit.
		OFF	Not relevant.
		Green/yellow flashing (1 Hz)	BIOS in POST, power switch on.
		Yellow	Idle state
RUN/STOP or L1	RUN STOP	Off	SIMOTION P Runtime is not running.
		Green	SIMOTION P320-4 in RUN.
		Yellow	SIMOTION P320-4 in STOP.
		Green/yellow: Flashes quickly (2 Hz)	DCP flashing
		Yellow: Flashes quickly (5 Hz)	FAULT state (only in combination with L2 and L3)
ERROR or L2 (SF PROFINET LED)	-	Off	SIMOTION P320-4 is working error-free.
	Error	Red: Continuous light	Bus error at the PROFINET interface.
		Red: Flashes quickly (2 Hz)	Erroneous configuration.

		Red: Flashes quickly (5 Hz)	FAULT state (only in combination with L1 and L3)
	INIT	Red: Flashes slowly (0.5 Hz)	During the INIT process, the SF PROFINET LED is con- trolled by the boot loader. The precise flashing behavior therefore cannot be determined and displayed. In the INIT state, 0.5 Hz flashing is displayed in the SI- MOTION P State. If no project has yet been loaded, 0.5 Hz flashing is also displayed for the INIT, which, in this case, is also retained in the Running state.
MAINT or L3 (SF LED)	-	Off	SIMOTION P320-4 is working error-free.
	Error	Red	An event has occurred which needs to be acknowledged (alarm, message, notification). (See Diagnostics Guide)
		Red: Flashes slowly (0.5 Hz)	License missing for licensed technology objects. Carry out the licensing to correct the error. Further information on the licensing can be found in the SIMOTION P320-4 E / SIMOTION P320-4 S Commissioning and Hardware Installation Manual.
		Red: Flashes quickly (5 Hz)	FAULT state (only in combination with L1 and L2) A fault has occurred to which the user program cannot respond. The following actions may be required to rectify the fault: ● Power OFF/ON ● Recommissioning

Table 47: P320 Indicator lights

21.2 Connection Elements

The following table describes the connection elements at the back side of the P320 PLC.

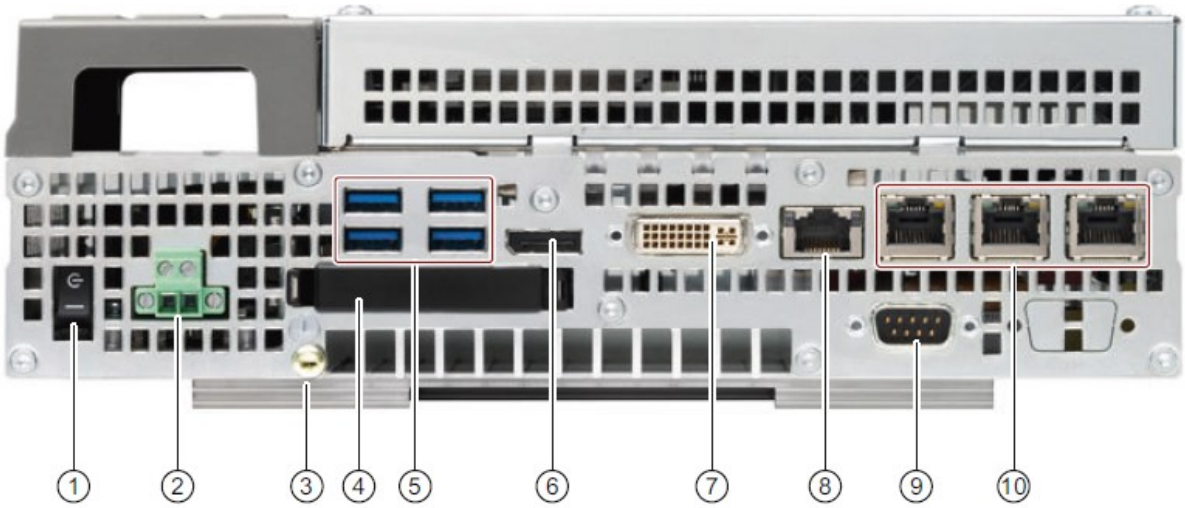


Figure 78: PLC connection elements

Pos.	Description	Description
①	On/off switch	Position OFF is the delivery state. The on/off switch does not isolate the device from the power supply.
②	24 VDC	24 VDC power supply connection
③	Protective conductor	Protective conductor terminal
④	Memory card slot	Cover for the CFast card
⑤	4 × USB 3.0	USB 3.0 high current, backward compatible with USB 2.0/1.1
⑥	Display port	Display port connection for digital monitor
⑦	DVI-I	DVI connector for CRT or LCD monitor with DVI interface
⑧	Ethernet	RJ45 Ethernet connection for 10/100/1000 Mbps
⑨	COM1	Serial interface
⑩	3 × PROFINET	PROFINET ports with three RJ45 sockets

Table 48: Table 38: PLC connection elements

21.3 PLC Connection

Follow the following steps to connect to the main PLC via PC or laptop.

Task 1: **Establish a connection to the PLC via PC or Laptop.**

Step 1 : Connect a PC or laptop via Ethernet cable to port X5 of Ethernet Switch 111A1 inside the CTRL cabinet (*see illustration below*).

Note 1: The connected PC or laptop and the converter PLC must be set to the same IP range.

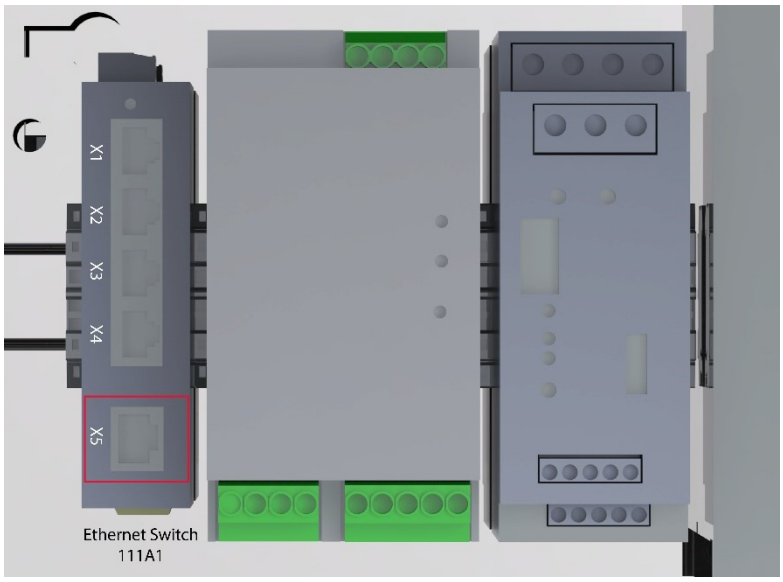


Figure 79: Ethernet Switch 111A1 - Port X5

21.4 Compiled Project Update

In case the PLC control software is not up to date at the time of commissioning, the control software must be updated.

Follow the following steps to perform a compiled project update of the main PLC.

Task 1: **Access the PLC user interface**
Step 1 : Connect to the PLC like described in section 21.3 “PLC“.
Step 2 : Open a web browser of your choice on the connected PLC or laptop
Step 3 : Type in the IP address of the PLC in the address field of your PC´s or laptop´s browser, followed by **/index.mwsl**.

Beispiel 1: 192.168.5.10/index.mwsl

The main controllers´ IP address set at delivery state is provided in Table 46.

Step 4 : The Simotion page “Home” will be displayed in the web browser of the connected PC or laptop.
✓ **The PLC user interface has been successfully accessed.**

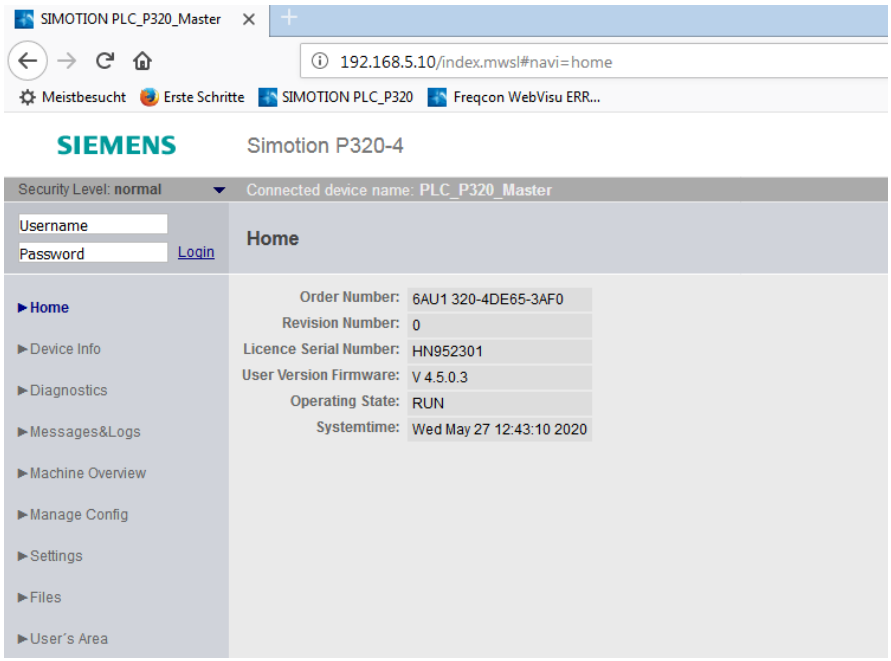


Figure 80: Connecting to the PLC user interface

Task 2: **Stop SIMOTION P320 operation.**

Step 1 : Connect to the PLC like described in section 21.3 “PLC“.

Step 2 : Select the "Settings" tab on the left-hand side of the visualization page (*see figure below,* ①).

Step 3 : In the new window, enter the following user data in the fields provided (case-sensitive):

Username: simotion

Password: simotion

Step 4 : Stop the PLC from running by clicking on the "STOP" button (②).

✓ **The PLC has been successfully stopped from operation.**

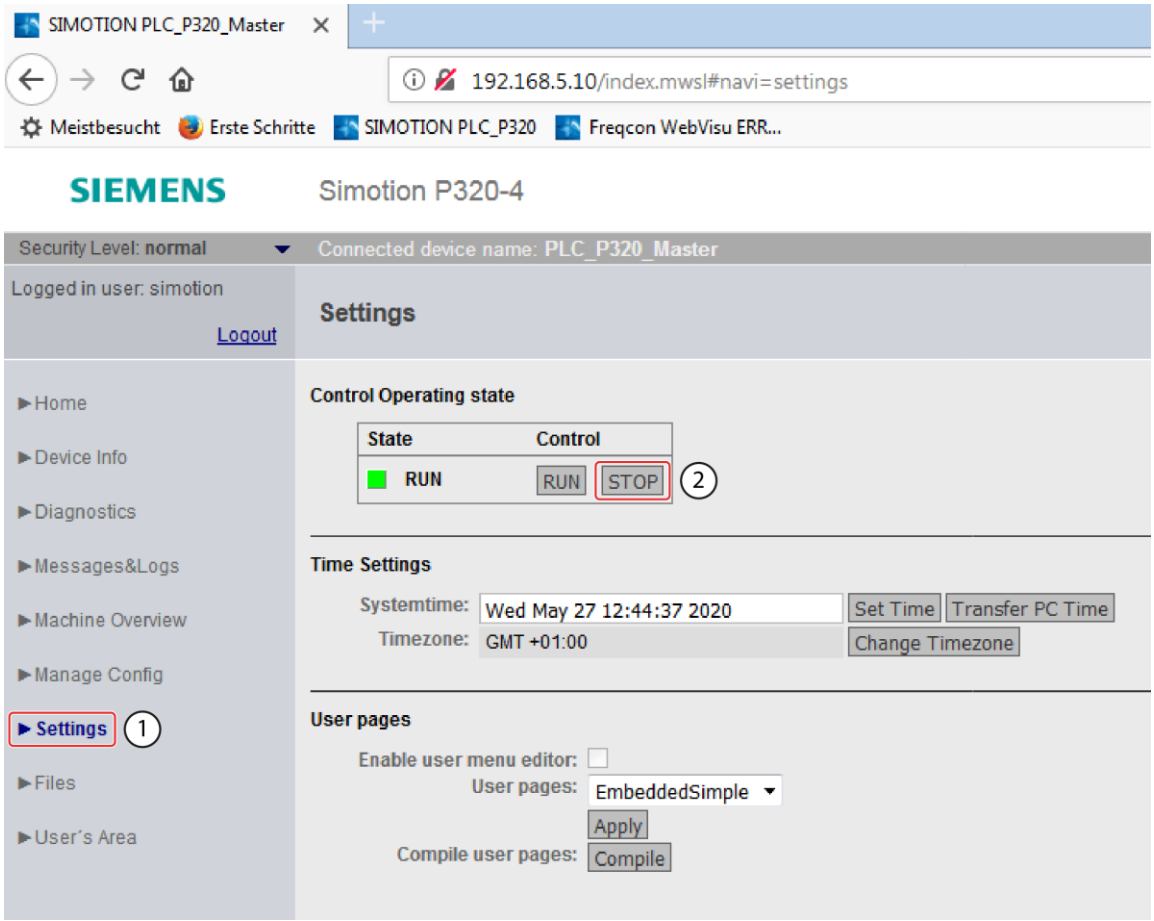


Figure 81: „Settings“ page

Task 3: **Load the compiled project ZIP archive to the SIMOTION P320 PLC**

Step 1 : Select “Manage Config” on the left site of the page (see *figure* below , ③).

Step 2 : Load the compiled project to the system by selecting the folder symbol (④).

Step 3 : Transfer the compiled project to the PLC by selecting the "Send update data" button (⑤).

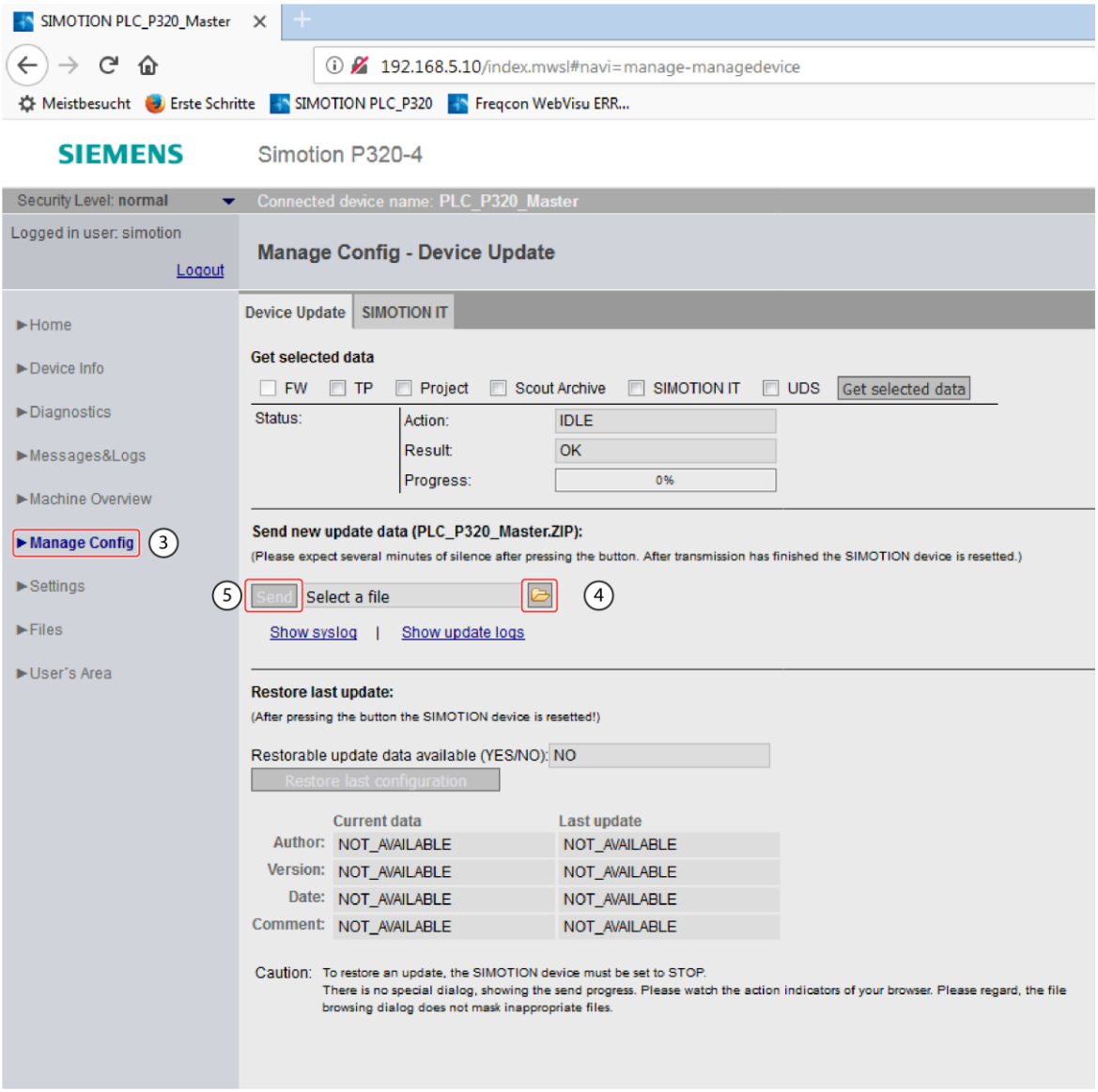


Figure 82: "Manage Config" page

Step 4 : Wait until the confirmation screen appears. The PLC reboots.

Step 5 : Wait for 5-7 minutes until the PLC has completed the reboot process.

Step 6 : Select the "Settings" tab.

Step 7 : Start the PLC by selecting the "RUN" button.

✓ **The PLC software has been successfully updated.**

22 WebVisu

FREQCON Web Visualization (WebVisu) provides granular control, real-time monitoring and visualization of key BESS functions. The WebVisu can be accessed either via the HMI touch panel on the control cabinet of the BESS or via a remote connection using a PC or laptop *(see section 22.1 "WebVisu remote connection")*.

The following sections provide you with information on handling and functionality and offer information on the individual WebVisu pages:

- Overview
- Overview DC-DC
- AC-DC Converter
- DC Link
- DC-DC Converter
- Converter Control
- Cooling
- Battery Overview
- Grid Protection Settings
- Init List
- Error List
- Action List

The individual pages can be selected by using the corresponding navigation buttons on the left side of every WebVisu page.

Note:

- Fields highlighted in grey can be adjusted by entering values inside the fields. Adjusted values are accepted by pressing the "Enter" key.
- Values must be entered in the fields without a unit.
- Fields with a white background indicate actual values.
- The selection of individual WebVisu pages depends on the user rights of the currently logged in user profile.

22.1 WebVisu remote connection

To connect to the WebVisu of the BESS via remote connection, carry out the following steps:

Task 1: **Establish a remote connection to the WebVisu of BESS**

Step 1 : Establish a connection to the PLC (main controller) in the control cabinet of the BESS by connecting a PC or laptop to the RJ45 socket of the network isolator (113T1) using an Ethernet cable.

Note 1: The connected PC or laptop and the PLC must be in the same IP range.

Step 2 : Open a web browser of your choice on the connected PLC or laptop.

Step 3 : Enter the IP address of the PLC in the address field of your PC´s or laptop´s browser.

Example: http://192.168.5.30

Note 2: The IP address of the main controller set at delivery is specified in Table 46.

Step 4 : The WebVisu page "Overview" is displayed in the web browser of the connected PC or laptop.

✓ **The remote connection to the WebVisu of BESS has been successfully established.**

22.2 Navigation

22.2.1 Home Button

The WebVisu "Overview" page can be displayed by selecting the "Home" button that appears on the left side of each WebVisu page *(see figure below)*.

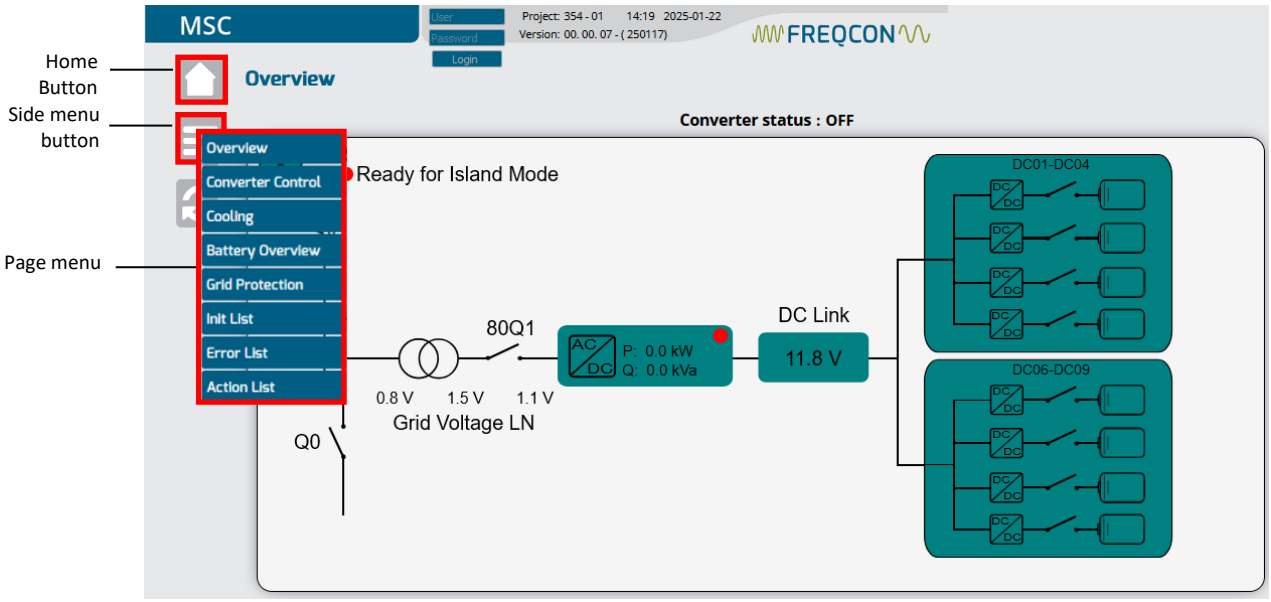


Figure 83: Navigation

22.2.2 Page Menu Button

The Page Menu is displayed via the Page Menu button that appears on every WebVisu page (*see figure 83*).

After selecting the Page Menu button, the Page Menu appears, where all WebVisu pages that can be selected with the respective user profile.

22.3 WebVisu User Interface

At the top of each WebVisu page, a user interface appears for each user (*see figure below*):

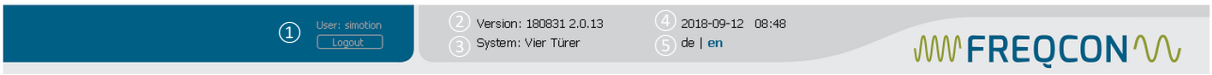


Figure 84: WebVisu user interface

The user interface provides the following information:

	Notification/Function	Description
①	User login	Type in the user profile name and password here. Press "Enter" to log in with a user profile. If a user profile is logged in, the current user profile is displayed here.
②	Version	Software version currently installed in the main control of the BESS
③	System	BESS-Identification number
④	Time/Date	Current time and date
⑤	Language selection	Choice between German and English display language

22.4 WebVisu Pages

22.4.1 Overview

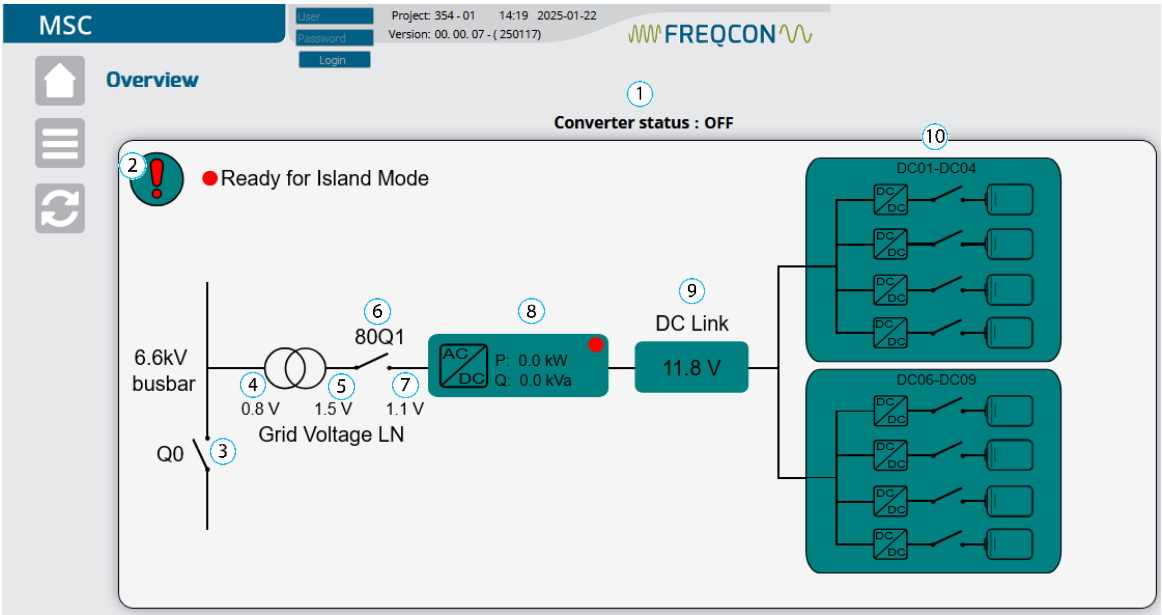


Figure 85: WebVisu page "Overview"

The "Overview" WebVisu page (*see figure above*) provides the user with a graphical overview of the main components of the BESS system and displays the following actual values:

	Description	Value
1	Converter status; for more detailed description see page “Converter control”	--
2	Green: no errors, red: errors; Clicking on the symbol takes you to the page "Error list"	--
3	MV Switch status	Open / closed
4	Voltage at the high-voltage side of the MV transformer	V
5	Voltage at the low-voltage side of the MV transformer	V
6	AC Circuit breaker 80Q1 (Switching state)	Open / closed
7	Voltage at the AC output of the converter	V
8	AC/DC Converter: active power and reactive power; Red: off, green: operation; Clicking on the symbol takes you to the page "AC-DC converter"	kW / kVA
9	DC Link voltage; Clicking on the symbol takes you to the page “DC Link”	V
10	DC/DC Converter; Clicking on the symbol takes you to the page "Overview DC-DC" of the DC Subsystems DC01-DC04 respectively DC06-DC09	--

22.4.2 Overview DC-DC

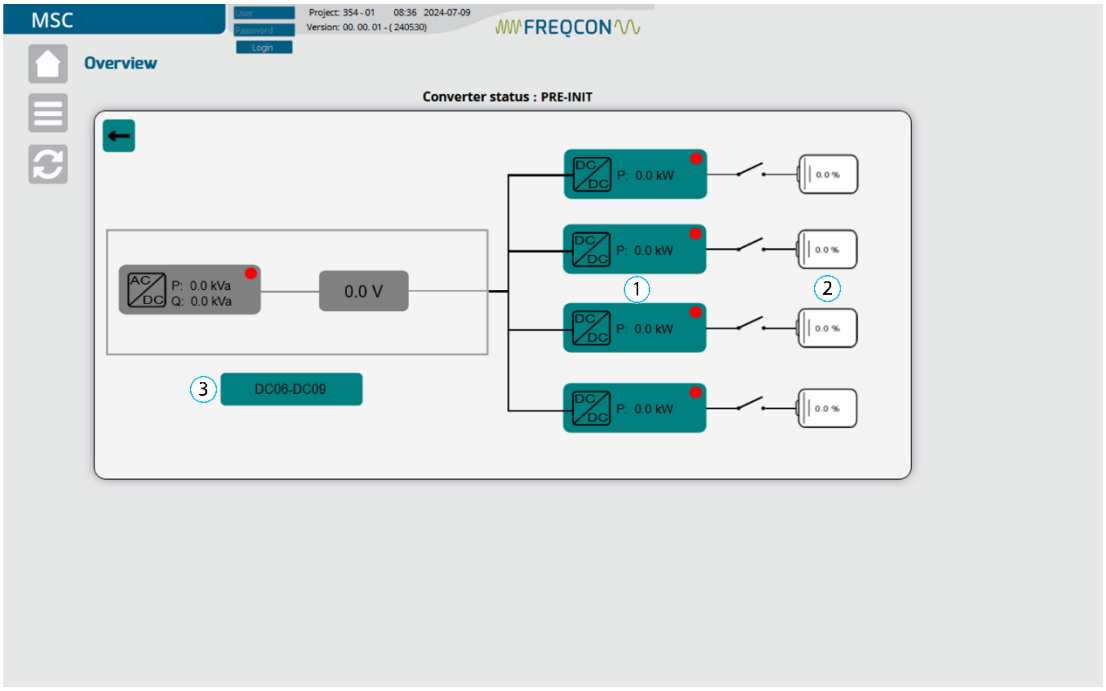


Figure 86: WebVisu page "Overview DC-DC"

The "Overview DC-DC" WebVisu page (*see figure above*) provides the user with a graphical overview of the main components of the BESS system and displays the following actual values:

	Description	Value
1	DC/DC Converter: active power (positive value: battery is charging, negative value: battery is discharging) Red: off; green: operation; Clicking on the symbol takes you to the page "DC-DC Converter" of the respective battery string	kW
2	State of charge	%
3	Switch to the page “Overview DC-DC” of the other DC Subsystem	--

22.4.3 AC-DC Converter

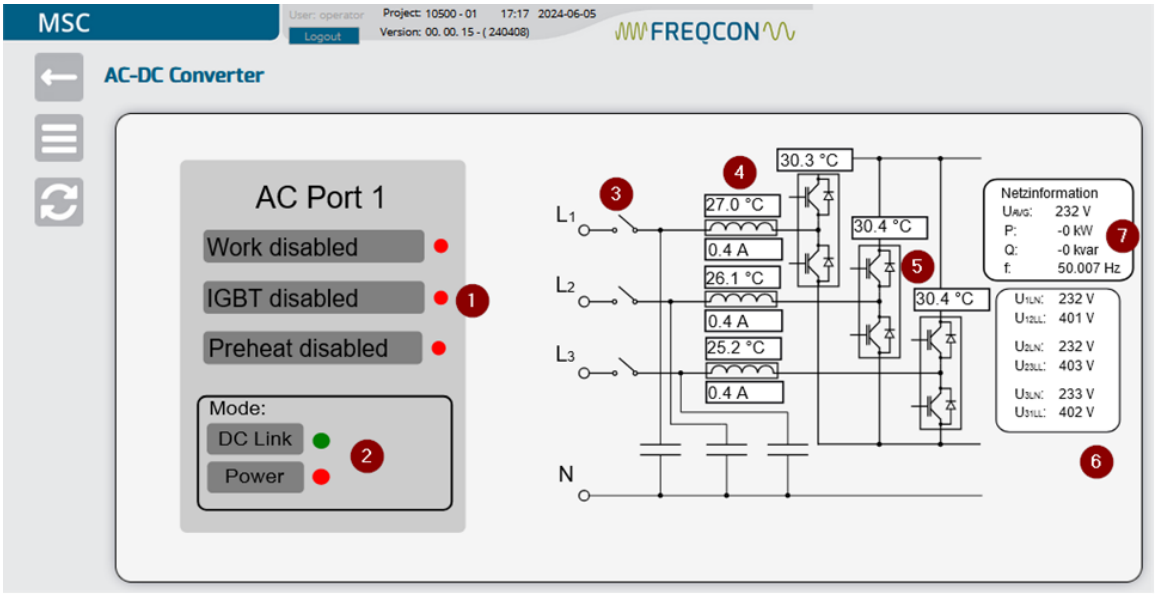


Figure 87: WebVisu page “AC-DC Converter"

	Description	Value
1	Working mode, not changeable	--
2	Control mode, not changeable	--
3	AC Circuit breaker	Open / closed
4	Inductor temperatures and phase currents through the IGBT and inductors	°C / A
5	IGBT temperatures	°C
6	String voltages and phase voltages at grid connection point	V
7	Grid information: Average voltage, active power, reactive power, grid frequency	V / kW / kvar / Hz

22.4.4 DC Link

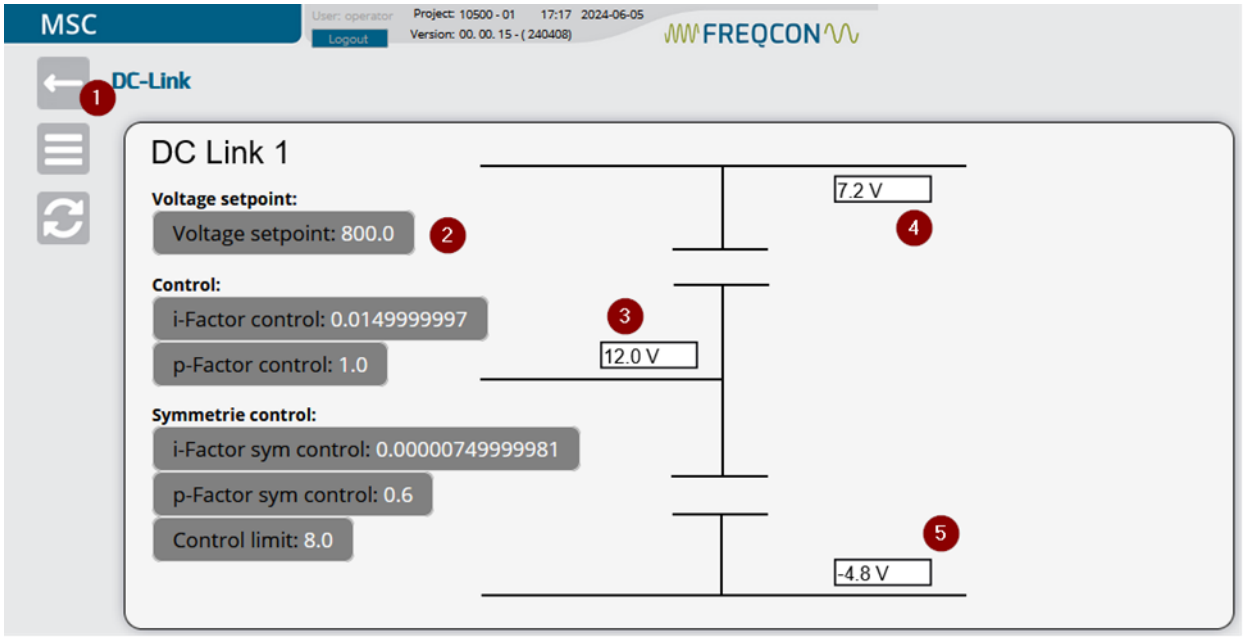


Figure 88: WebVisu page “DC Link"

	Description	Value
1	Back to “Overview”	--
2	DC link voltage setpoint, fixed value	V
3	Total DC link voltage	V
4	Positive DC link voltage	V
5	Negative DC link voltage	V

22.4.5 DC-DC Converter

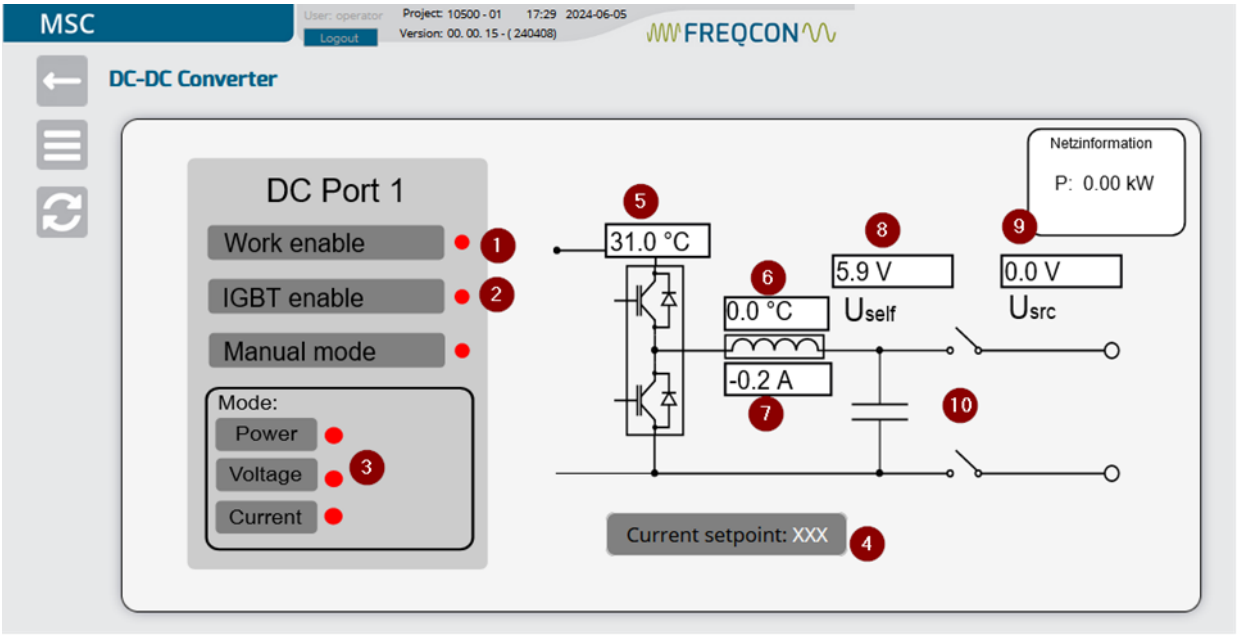


Figure 89: WebVisu page “DC-DC Converter"

	Description	Value
1	Status, not manually changeable	--
2	IGBT enabled	--
3	Control mode, not manually changeable	--
4	Manual setpoint, not available here	--
5	IGBT temperature	°C
6	Inductor temperature	°C
7	Current, filtered	A
8	Voltage at the filter capacitor	V
9	Voltage at the source	V
10	DC contactor (positive and negative)	Open / closed

22.4.6 Converter Control

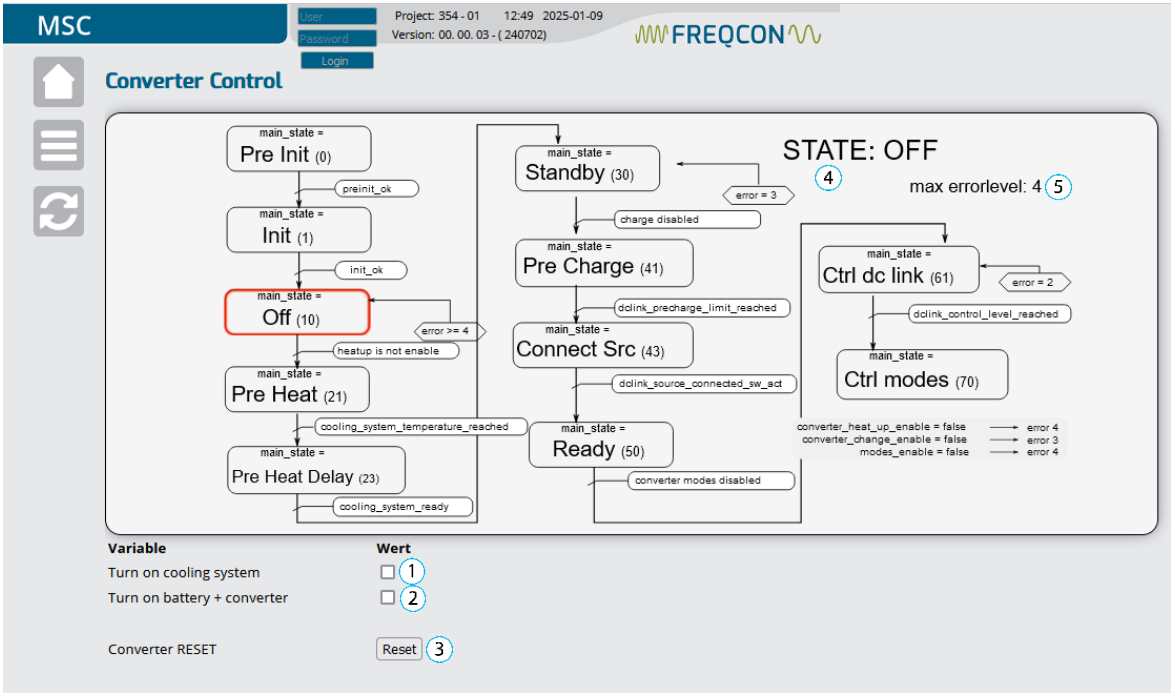


Figure 90: WebVisu page "Converter Control"

	Description	Value
1	Switch on cooling system, converter starts up to standby	--
2	Switch on converter and connect battery system	--
3	Reset converter error	--
4	The converter follows a step chain when it is switched on: Preinit: After switching on the PLC Init: Loading the initialization parameters from the memory card OFF: Converter is off Preheat: Coolant is heated to minimum temperature Preheat Delay: Temperature is held for a few minutes to reduce humidity caused by condensation on the components Standby: Cooling system is ready for use PreCharge: Charging of the DC link via resistors Connect Source: Switching on the mains switch S1 Ready: DC link is pre-charged and converter is connected to the mains, but IGBT is still off Ctrl DC Link: Switch on IGBT and regulate DC link voltage to nominal value Ctrl Modes: Normal operation	--
5	Error level 0 ... 1: Messages, warnings Error level 2: Shutdown of subsystems, e.g. a DC port Error level 3: Shutdown to standby, e.g. in the event of current or voltage overshoots, overtemperatures, etc.	--

22.4.7 Cooling

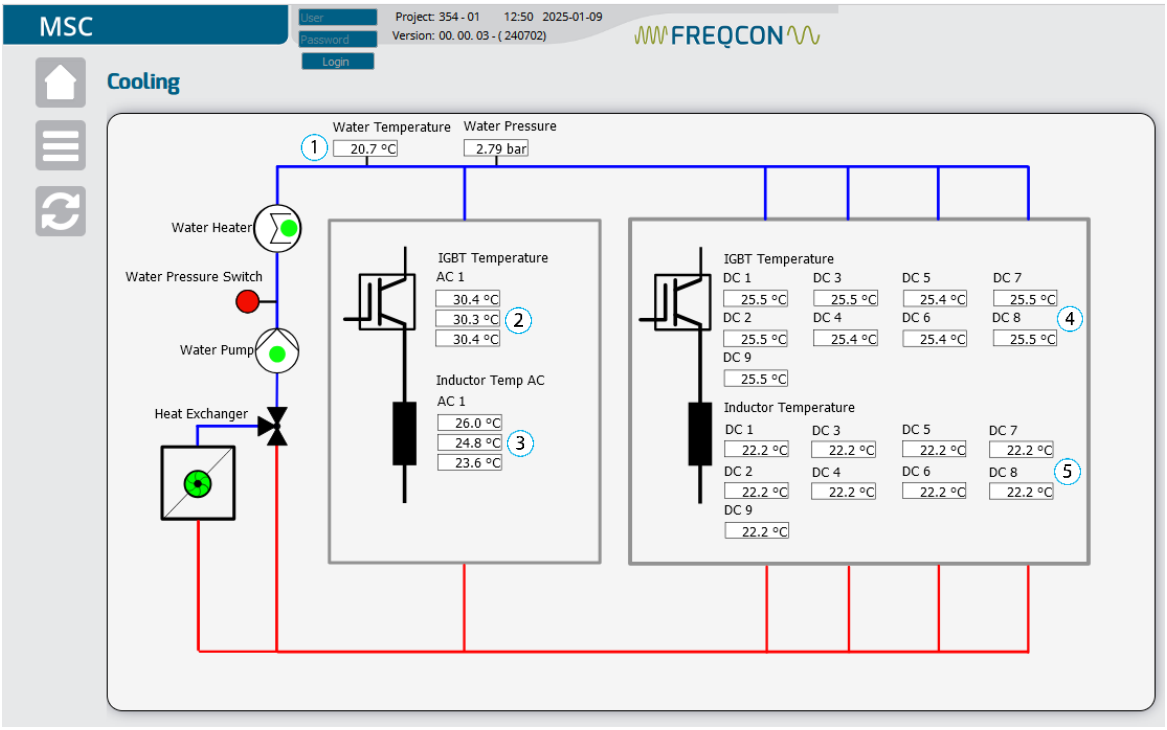


Figure 91: WebVisu page "Cooling"

The "Cooling" WebVisu pages provide the user with a graphical overview of the main components of the BESS cooling system:

- Cooling water heating element (water heater)
- Pressure switch
- Cooling water pump (water pump)
- Heat exchanger

The following actual values are displayed on the "Cooling" WebVisu page:

	Description	Value
1	Cooling water temperature inside the cooling system	°C
2	Temperatures of the AC IGBTs 1/2/3	°C
3	Temperatures of AC inductors 1/2/3	°C
4	IGBT temperatures of DC ports 1 - 8	°C
5	Inductor temperatures of DC ports 1 - 8	°C

22.4.8 Battery Overview

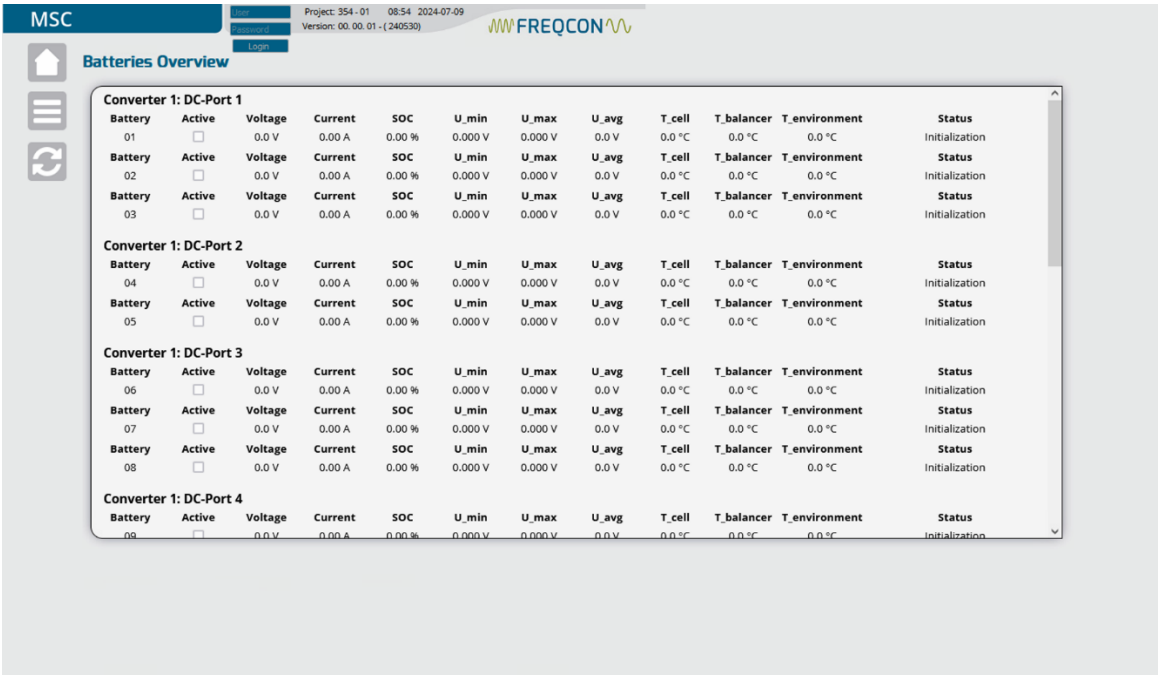


Figure 92: WebVisu page “Battery Overview"

The data is transmitted by the BMS as soon as the respective battery string is connected. If the string is disconnected from the converter system, the value "0" is displayed for current, voltage and SOC.

22.4.9 Grid Protection Settings

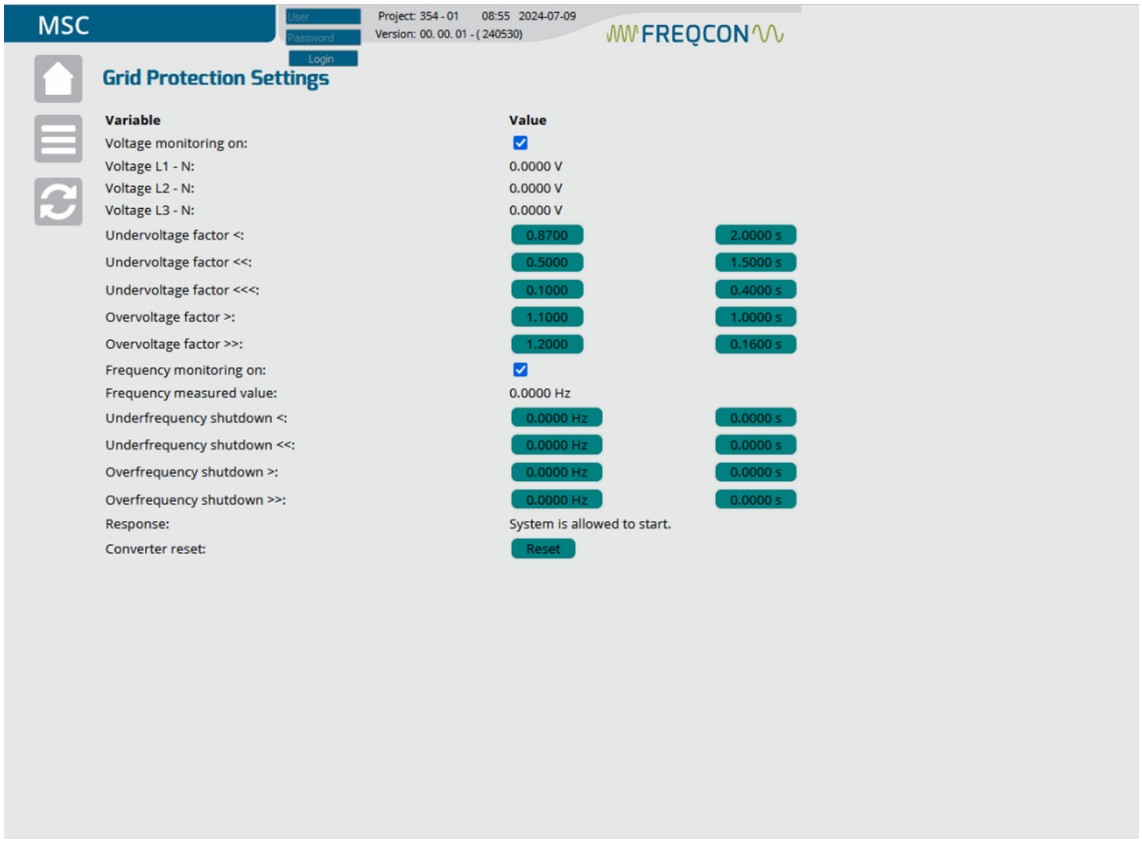


Figure 93: WebVisu page "Grid Protection Settings"

Changing the settings requires a logged in user "operator".

22.4.10 Init List

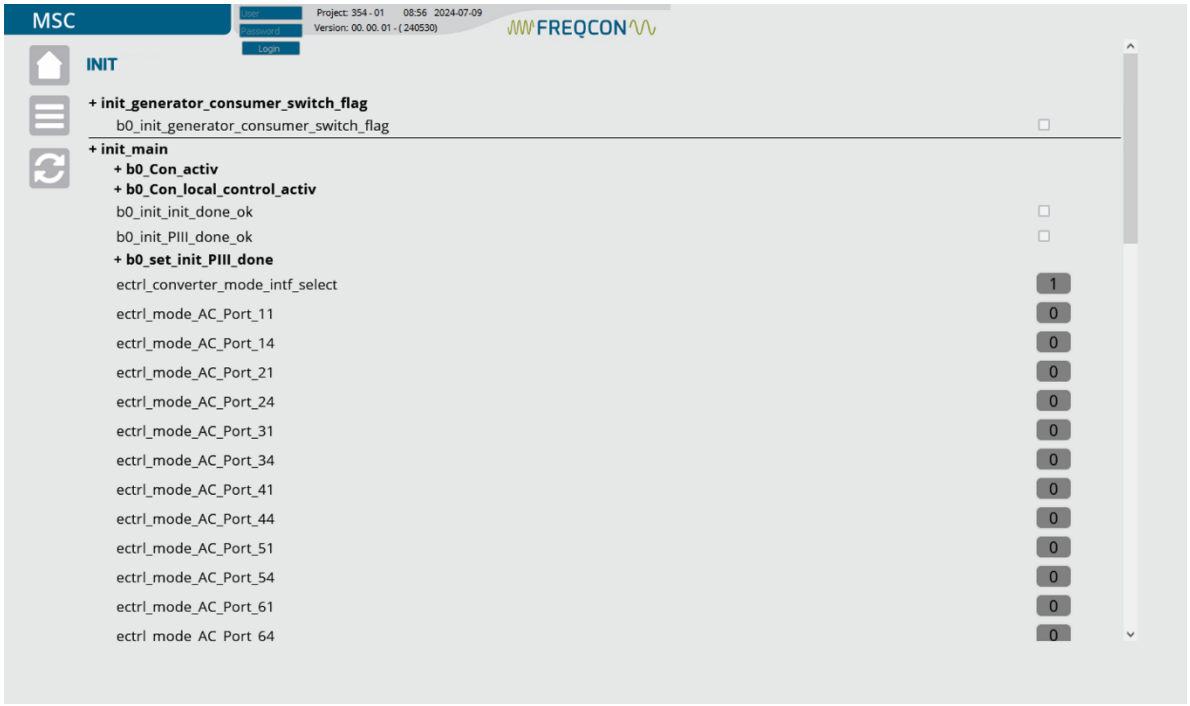


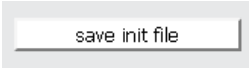
Figure 94: WebVisu page "Init List"

The WebVisu page "Init List" provides the user with an overview of all initialization values (Init values) stored in the BESS main controller.

The "Operator" user profile, as well as users who are not logged in with a profile, can only **check** the set Init values.
Only the **"Service"** and **"Factory"** user profiles can **adjust init values by** changing the value of the corresponding variable in the value field.

- ➜ To expand the parameter overview, click on the "+" sign in front of the corresponding init value.
- ➜ Fixed Init values are displayed on the right side of the corresponding Init parameter.
- ➜ To change the value, change the value inside the box and press „Enter“ on the keyboard of your PC or Laptop.
- ➜ The new value is set, but will be reset after a reboot of the controller.

Note:
To **permanently** adjust the init value, press "Enter" on your PC or laptop keyboard and then select the "Save init file" button at the bottom of the "Init" page. The selected value now remains saved even if the controller is restarted



22.4.11 Error List

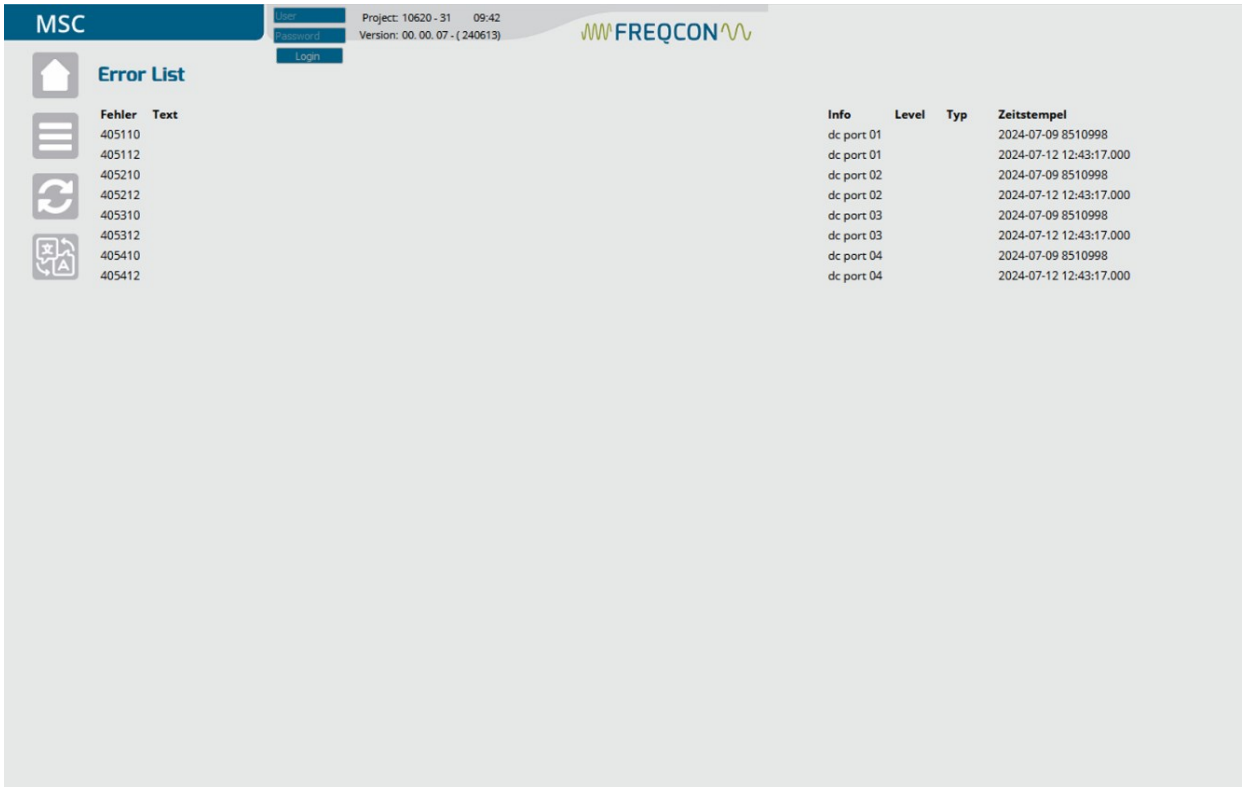


Figure 95: WebVisu page "Error list"

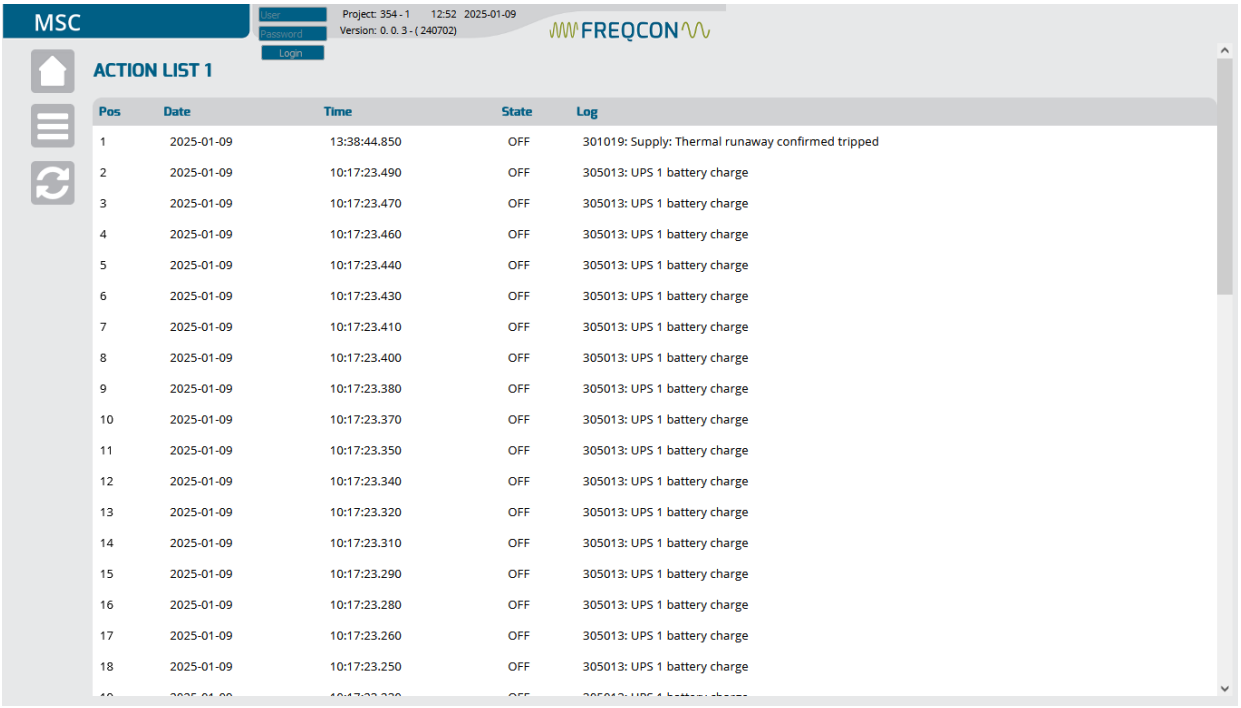
The WebVisu "Error List" page provides the user with a list of current system messages, warnings and errors.

The Error List shows only **current** system messages, warnings and errors. After a reset of a warning or error, these warning and error messages will not be any more displayed in the error list, if the warning or error is not anymore apparent.

The following information are provided inside the error list.

Name	Description
Error	Code of the individual message, warning or error.
Text	Description text for the individual message, warning or error.
Info	Additional information regarding the individual message, warning or error.
Level	Level of message, warning or error. **Note:** Level 1 to 4 are error levels and lead to a stop of the BESS system. For additional information regarding individual error messages, *see section 7.1* "Error Levels": Levels 0 and below are reporting and warning levels and do not cause the BESS system to stop.
Type	Indicates the message type of the individual message. Possible message types are: message, warning or error.
Time stamp	Indicates the time, at when the message, warning or error was detected by the controller.

22.4.12 Action List



Pos	Date	Time	State	Log
1	2025-01-09	13:38:44.850	OFF	301019: Supply: Thermal runaway confirmed tripped
2	2025-01-09	10:17:23.490	OFF	305013: UPS 1 battery charge
3	2025-01-09	10:17:23.470	OFF	305013: UPS 1 battery charge
4	2025-01-09	10:17:23.460	OFF	305013: UPS 1 battery charge
5	2025-01-09	10:17:23.440	OFF	305013: UPS 1 battery charge
6	2025-01-09	10:17:23.430	OFF	305013: UPS 1 battery charge
7	2025-01-09	10:17:23.410	OFF	305013: UPS 1 battery charge
8	2025-01-09	10:17:23.400	OFF	305013: UPS 1 battery charge
9	2025-01-09	10:17:23.380	OFF	305013: UPS 1 battery charge
10	2025-01-09	10:17:23.370	OFF	305013: UPS 1 battery charge
11	2025-01-09	10:17:23.350	OFF	305013: UPS 1 battery charge
12	2025-01-09	10:17:23.340	OFF	305013: UPS 1 battery charge
13	2025-01-09	10:17:23.320	OFF	305013: UPS 1 battery charge
14	2025-01-09	10:17:23.310	OFF	305013: UPS 1 battery charge
15	2025-01-09	10:17:23.290	OFF	305013: UPS 1 battery charge
16	2025-01-09	10:17:23.280	OFF	305013: UPS 1 battery charge
17	2025-01-09	10:17:23.260	OFF	305013: UPS 1 battery charge
18	2025-01-09	10:17:23.250	OFF	305013: UPS 1 battery charge

Figure 96: WebVisu page "Action list"

The WebVisu page "Action list" provides the user with an overview of the system events stored by the BESS controller.

The event list records the most important events and information of the BESS system, such as

- Plant operation
- Error messages
- Event messages
- Status messages

23 Troubleshooting

⚠ DANGER	
	**Electric shock due to low voltage** Severe irreparable damage to the nervous system, severe burns and death. ➜ In the event of faults, contact customer support. ➜ Have work on the energy storage device performed by service personnel only.

24 Dismantling and Disposal

24.1 Safety

For all work on the BESS observe the „Safety Instructions“ in section 2.

24.2 Dismantling

The end user is responsible for dismantling the energy storage device.

24.3 Disposal of Packaging Material

The proper disposal of packing materials is subject to national regulations and laws. If there are any doubts regarding the proper disposal of the packaging materials, ask a local disposal specialist or consult the local authorities.

The packaging my consist of the following materials:

- wooden frames
- pallets
- polyethylene foil
- plywood
- plastics
- silica gel

24.4 BESS Disposal

Always adhere the national regulations and laws regarding disposal or recycling.

⚠ WARNING	
	**Danger to life due to improper dismantling** In the case of improper dismantling, materials can slip, tip or shift, which can result in death, severe personal injury or material damage. ➜ Only qualified personal is allowed to dismantle and dispose, wearing suitable protective clothing. ➜ Before starting to dismantle, deenergize and ground the device. ➜ Also refer to section 10.1 "Unpacking" and section 10.2 “Transport”.

⚠ WARNING	
	Do not dispose the refrigerant of the external cooling unit in the atmosphere. It should be disposed of by companies dealing with special waste collection and recovery.

The batteries installed in the FREQCON BESS Container are subject to EU Directive 2006/66/EC on batteries and accumulators as well as spent batteries and accumulators.
They must be disposed of separately.
For this purpose, the batteries categorized as industrial batteries are not to be returned to the common take-back system but directly to the manufacturer FREQCON GmbH or a third-party company, qualified for this service.

Please note that the existing regulations for the transport of hazardous materials must be observed. The transport is the responsibility of the end user.

The end user is responsible for the following when disposing of batteries:

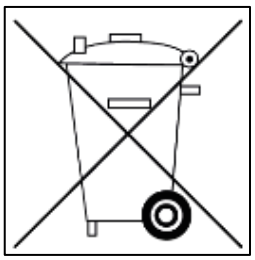
- Packaging
- Labeling
- Return transport to the manufacturer

After transport, the battery storage system must be disposed according to local regulations.
The energy storage device also contains electrical and electronic components that must be disposed of separately from other waste in accordance with local regulations and laws.

Pay particular care for the disposal or recycling of the following components:

- Batteries
- Circuit boards
- Electrical components
- Refrigerants

NOTE:
The transport of the battery modules installed inside the battery storage system underly strict regulations (UN 3480) and are only allowed to be transported by companies, qualified for this purpose.



The energy storage device also contains electrical and electronic components that must be disposed of separately from other waste in accordance with local regulations and laws.

STATRON
NON STOP POWER

Data Sheets (incl. Motor Data Sheets)

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: D03
Sequence Number: 001
Rev: 002
Document number: K559-2254-CWIWP4202201-D03-001
Document description: Data Sheets

Revision	Date	Name	Description
001	31.03.2023	CPA / ADI	First Version
002	15.06.2023	CPA / ADI	Second Version

Data Sheets
D03

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	D03
Document name	Data Sheets
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-30	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-31	C. Palenzuela
Checked by	2023-03-31	A. Fritz
Approved by	2023-03-31	M. Maaz

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-D03-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Archive with PCS and BESS main components data sheets	Data Sheets PCS & BESS.zip

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The data sheets of the main system components are attached to this document (*see section 1.3 "Other Applicable Documents"*).

File name: Data Sheets PCS & BESS.zip

3 Appendix

1. Data Sheets PCS & BESS.zip

Rittal – The System.

Faster – better – everywhere.

Performance diagrams – Climate control



ENCLOSURES | POWER DISTRIBUTION | CLIMATE CONTROL | IT INFRASTRUCTURE | SOFTWARE & SERVICES

FRIEDHELM LOH GROUP

Rittal – The System.

Faster – better – everywhere.



ENCLOSURES | POWER DISTRIBUTION | CLIMATE CONTROL

FRIEDHELM LOH GROUP

Performance diagrams

Cooling with ambient air

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units
Air throughput 20/25 – 900 m^3/h ..... 4 – 7
TopTherm fan-and-filter units, with EC technology
Air throughput 55 – 900 m^3/h ..... 8 – 9
Roof-mounted fans
Air throughput 500 – 1069 m^3/h ..... 10 – 12
Rack-mounted fans for 482.6 mm (19˝)
Air throughput 320/480 m^3/h 12
Tangential fans for 482.6 mm (19˝)
Air throughput 320 m^3/h 12
Selection diagram for fans 13
TopTherm air/air heat exchangers
Specific thermal output 17.5 – 90 W/K 13
Selection diagram for air/air heat exchangers 13

Cooling units

VX25 Blue e+ integration solution
Output class 1300 W
(110 – 240 V, 1 ~, 50 – 60 Hz / 380 – 480 V, 3 ~, 50 – 60 Hz) 14
Thermoelectric coolers
Total cooling output 100 W 15
TopTherm wall-mounted cooling units Blue e
Output class 300 – 2500 W (115/230 V, 1~, 400 V, 2~) ..... 15 – 18
TopTherm wall-mounted cooling units Blue e, slimline
Output category 1500 W (230 V, 1~, 400/460 V, 3~) 19
TopTherm wall-mounted cooling units Blue e
Output class 1000 – 4000 W (400/460 V, 3~) ..... 20 – 22
Wall-mounted cooling units Blue e+
Output class 1600 – 5800 W 23
TopTherm roof-mounted cooling units Blue e
Output class 500 – 2000 W (115/230 V, 1~, 400 V, 2~) ..... 25 – 27
TopTherm roof-mounted cooling units Blue e
Output class 3000 – 4000 W (400/460 V, 3~) 28
Roof-mounted cooling unit Blue e+
Output class 1300 W
(110 – 240 V, 1 ~, 50 – 60 Hz / 380 – 480 V, 3 ~, 50 – 60 Hz) 29
Modular climate control concept – Cooling module Blue e
Output class 1500 – 2500 W (230 V, 1~, 400/460 V, 3~) ..... 30 – 31

Cooling with water

Wall-mounted air/water heat exchangers
Output class 300 – 7000 W ..... 32 – 42
Roof-mounted air/water heat exchangers
Output class 1875 – 4000 W ..... 43 – 46
Liquid Cooling Package
Output class 10 kW 47
TopTherm chillers
Output class 1 – 40 kW ..... 48 – 49
Blue e+ chillers
Output class 2.5 – 5.5 kW 50

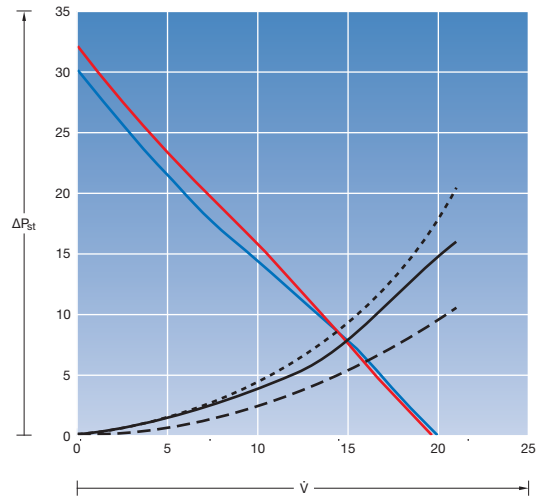
Enclosure heaters

Enclosure heaters without fan
Heating output 8 – 150 W 52
Enclosure heaters with fan
Heating output 250 – 800 W 53

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units

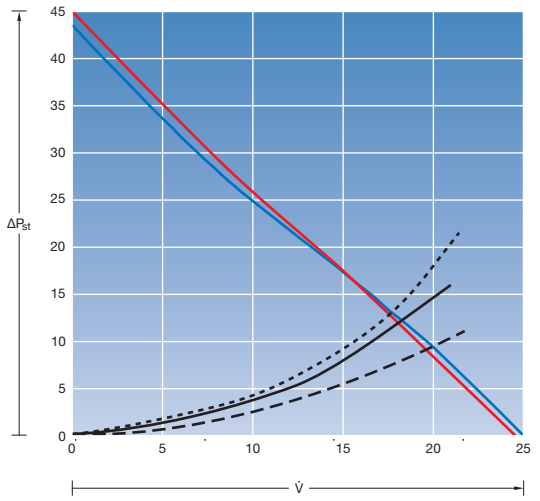
Air throughput 20/25 m³/h

50 Hz
SK 3237.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

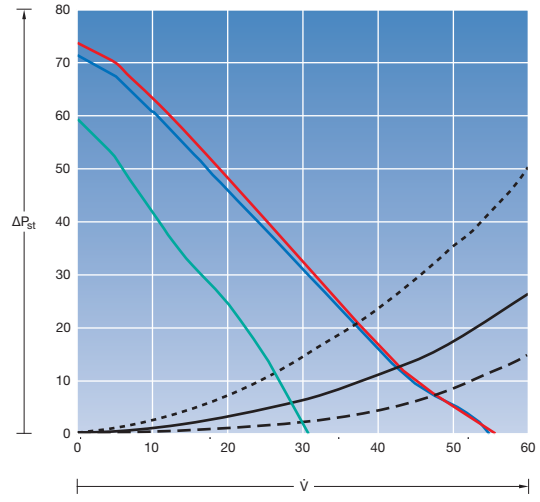
60 Hz
SK 3237.100, .110, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

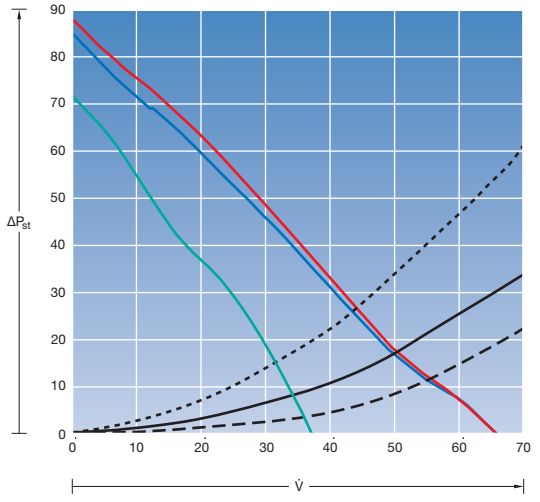
Air throughput 55/66 m³/h

50 Hz
SK 3238.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

60 Hz
SK 3238.100, .110, .600

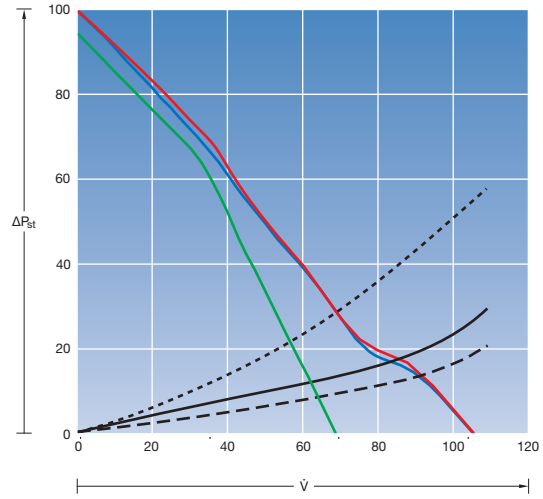


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units

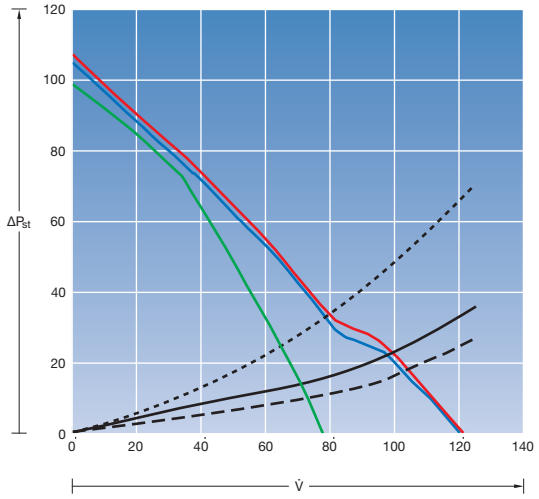
Air throughput 105/120 m³/h

50 Hz
SK 3239.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

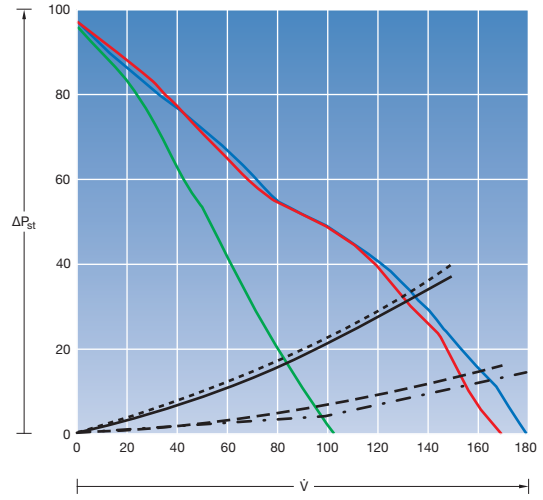
60 Hz
SK 3239.100, .110, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

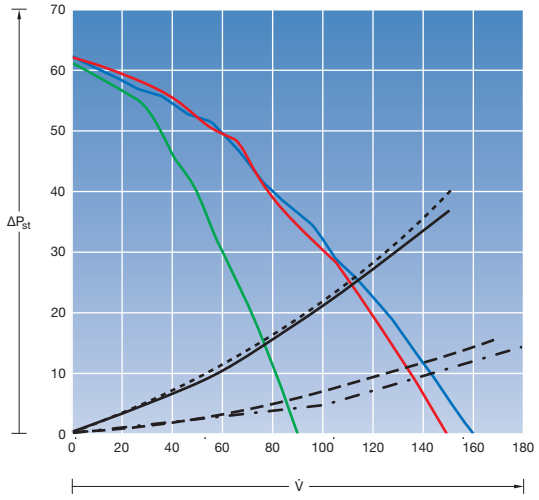
Air throughput 180/160 m³/h

50 Hz
SK 3240.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

60 Hz
SK 3240.100, .110, .600

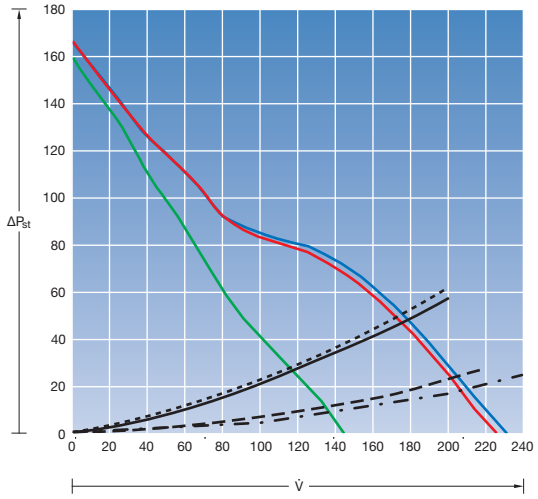


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units

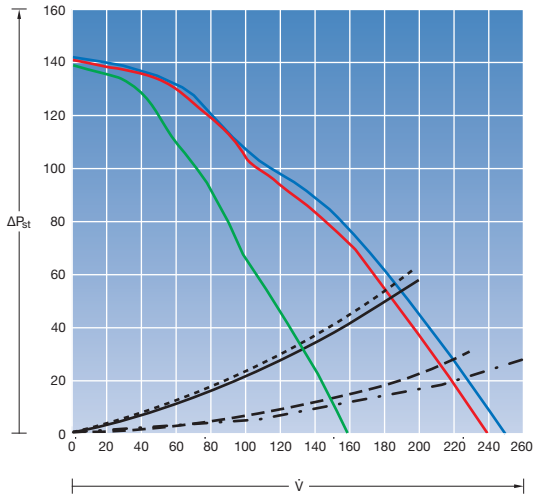
Air throughput 230/250 m³/h

50 Hz
SK 3241.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

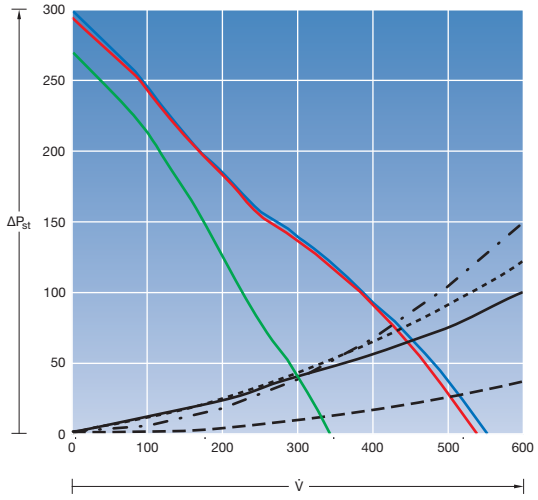
60 Hz
SK 3241.100, .110, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

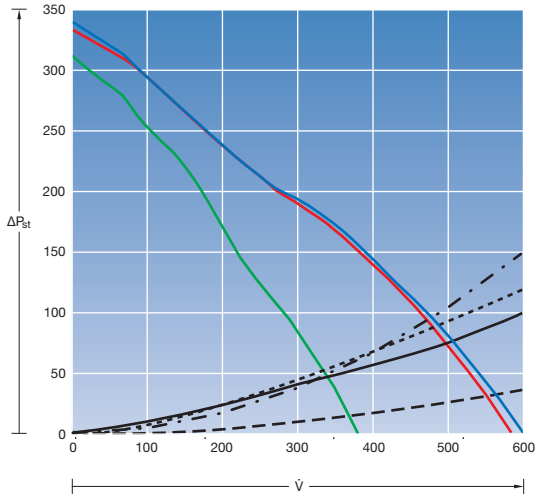
Air throughput 550/600 m³/h

50 Hz
SK 3243.100, .110, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

60 Hz
SK 3243.100, .110, .600

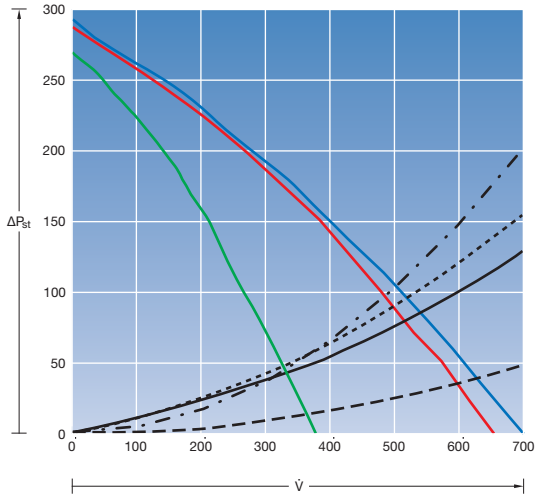


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units

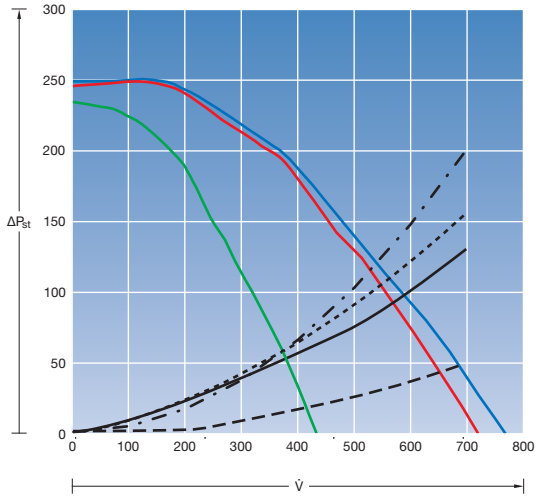
Air throughput 700/770 m³/h

50 Hz
SK 3244.100, .110, .140, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

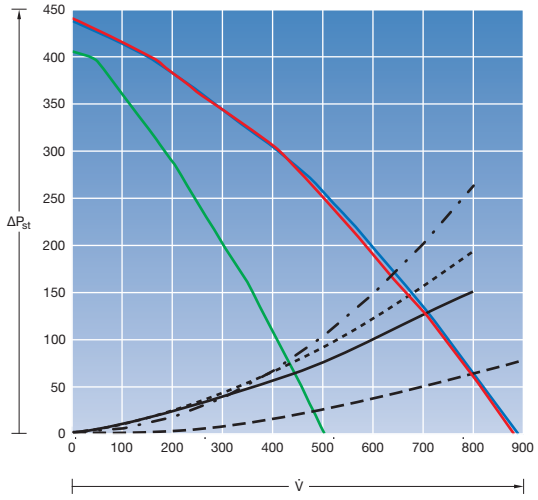
60 Hz
SK 3244.100, .110, .140, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Air throughput 900 m³/h

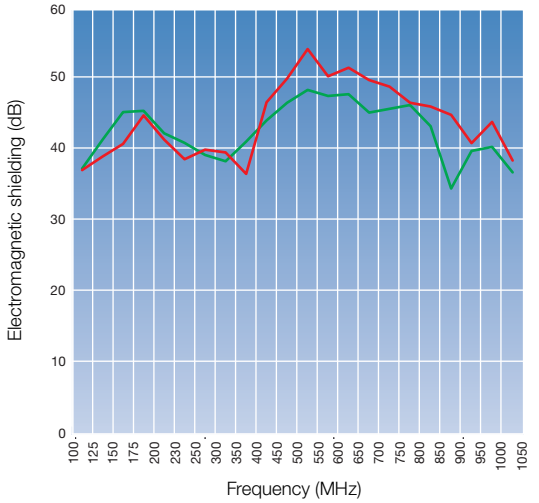
50/60 Hz
SK 3245.600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Shielding/attenuation diagram
Testing to EN 61587-3: 2006 – Electromagnetic shielding performance tests for cabinets, racks and sub-racks

TopTherm EMC fan-and-filter units/outlet filters
SK 3237.XXX – SK 3245.XXX

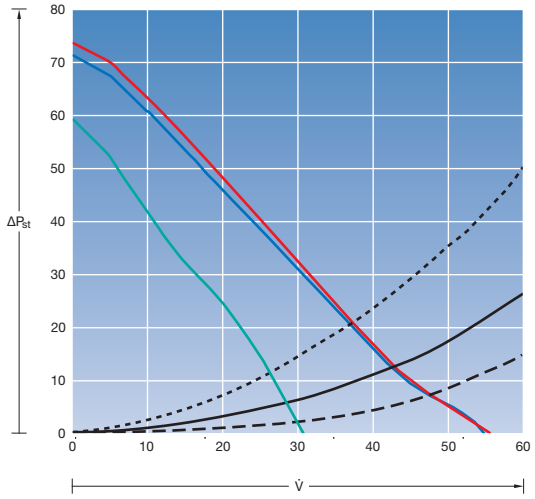


= vertical attenuation
= horizontal attenuation

TopTherm fan-and-filter units with EC technology

Air throughput 55 m³/h

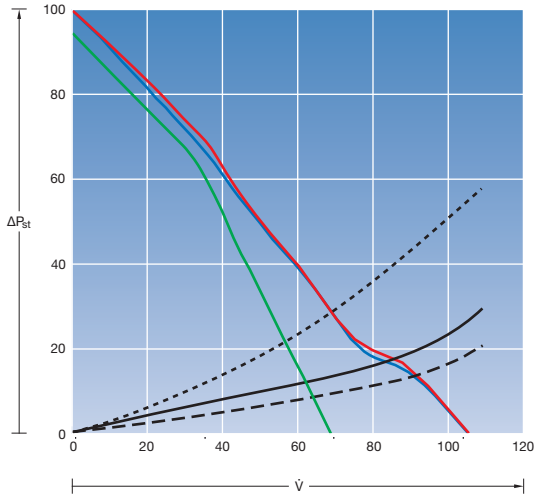
50/60 Hz
SK 3238.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

Air throughput 105 m³/h

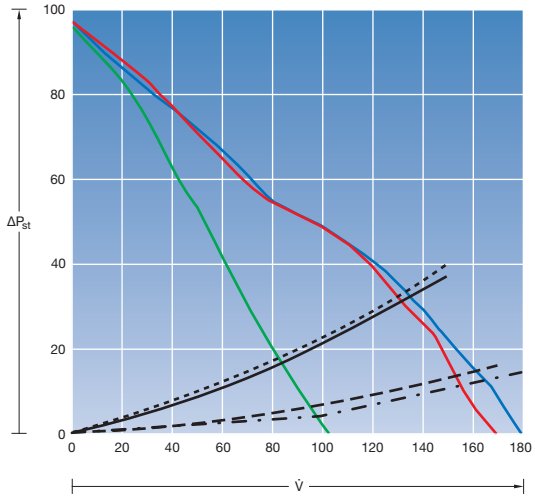
50/60 Hz
SK 3239.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

Air throughput 180 m³/h

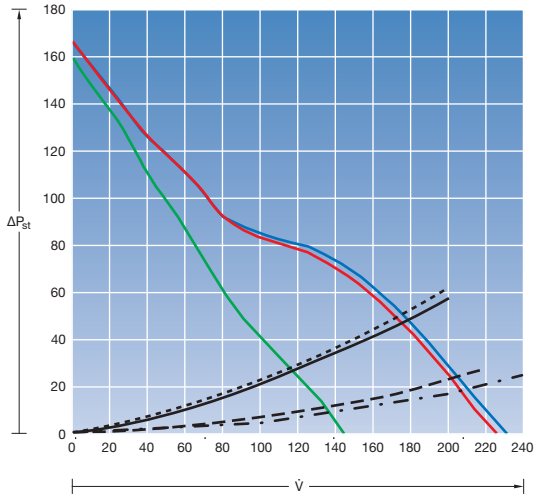
50/60 Hz
SK 3240.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Air throughput 230 m³/h

50/60 Hz
SK 3241.500

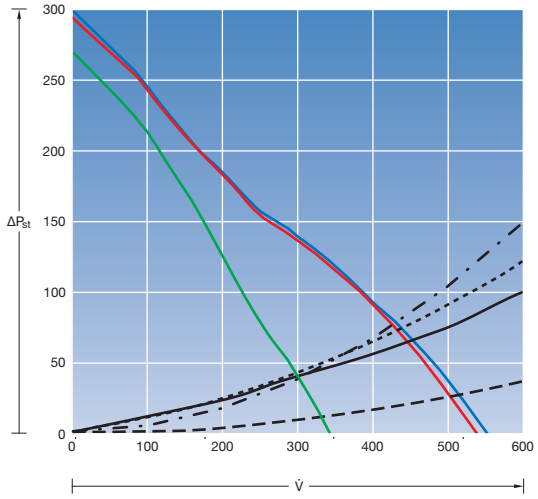


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

TopTherm fan-and-filter units with EC technology

Air throughput 550 m³/h

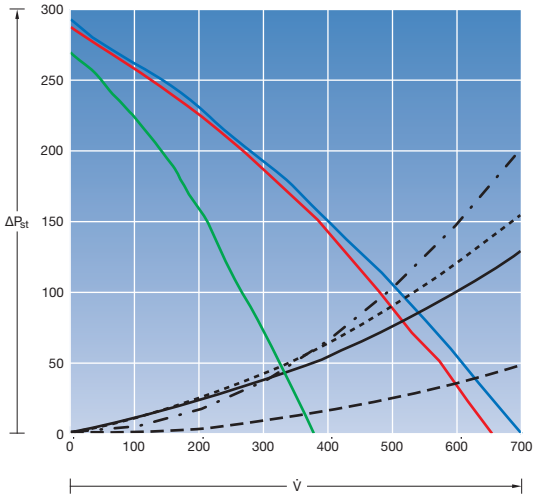
50/60 Hz
SK 3243.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Air throughput 700 m³/h

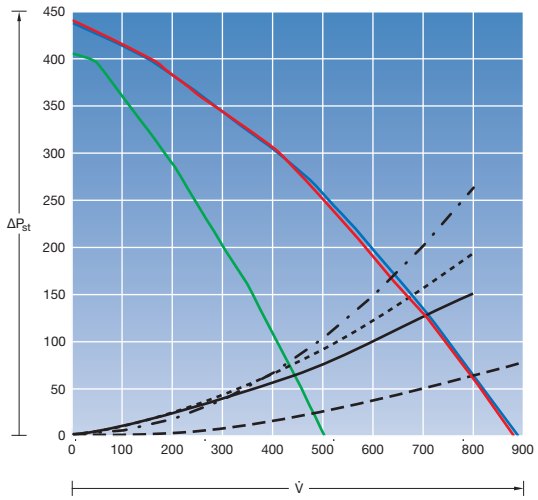
50/60 Hz
SK 3244.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Air throughput 900 m³/h

50/60 Hz
SK 3245.500, .510



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Roof-mounted fans

Using the base/plinth:

If the vented base/plinth is used as an air inlet instead of the outlet filter 3243.200, the resistance curves as indicated in the performance diagrams will apply as follows:

----- 1 x vented base/plinth with filter

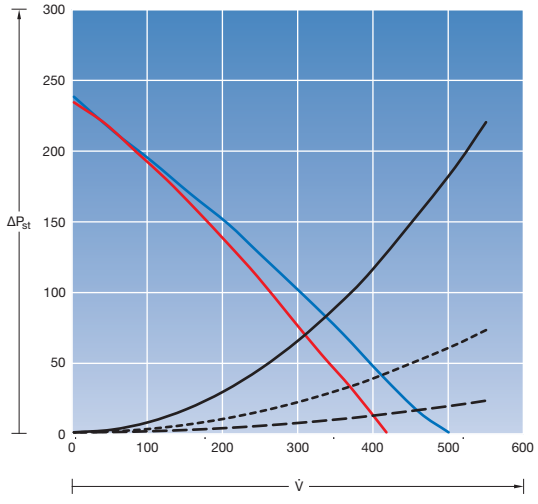
– – – 2 x vented base/plinth with filter

– – – 1 x vented base/plinth without filter

Roof-mounted fans

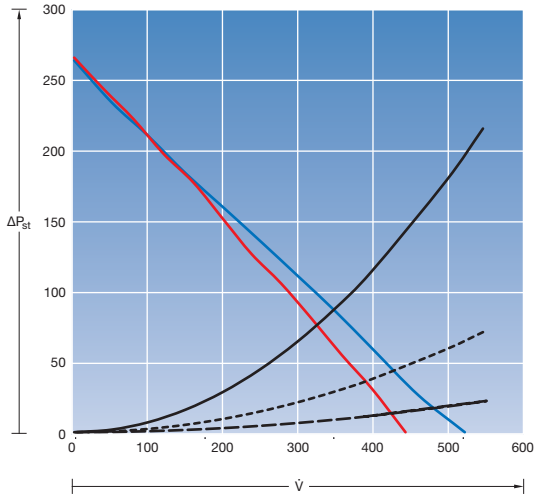
Air throughput 500/525 m³/h

50 Hz
SK 3139.100/.110



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= without filter mat (IP 22)
= with filter mat (IP 55)
= 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
----- = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
– – – = 2 x outlet filter 3243.200 with standard filter (IP 54)

60 Hz
SK 3139.100/.110

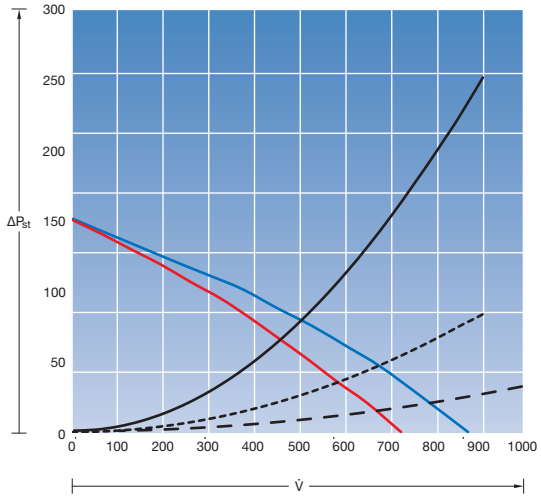


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= without filter mat (IP 22)
= with filter mat (IP 55)
= 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
----- = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
– – – = 2 x outlet filter 3243.200 with standard filter (IP 54)

Roof-mounted fans

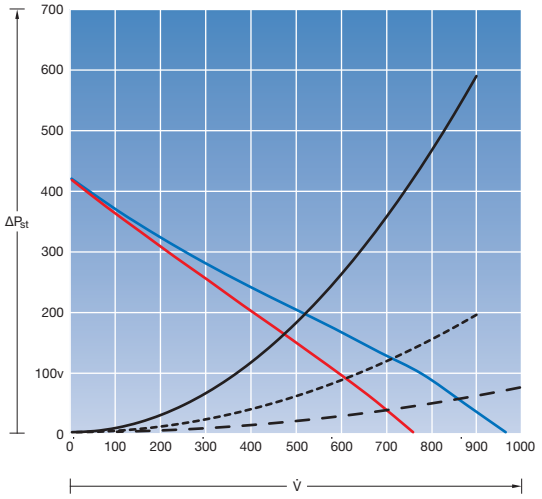
Air throughput 873/965 m³/h

50 Hz
SK 3140.100/.110



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
— = without filter mat (IP 22)
— = with filter mat (IP 55)
— = 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 2 x outlet filter 3243.200 with standard filter (IP 54)

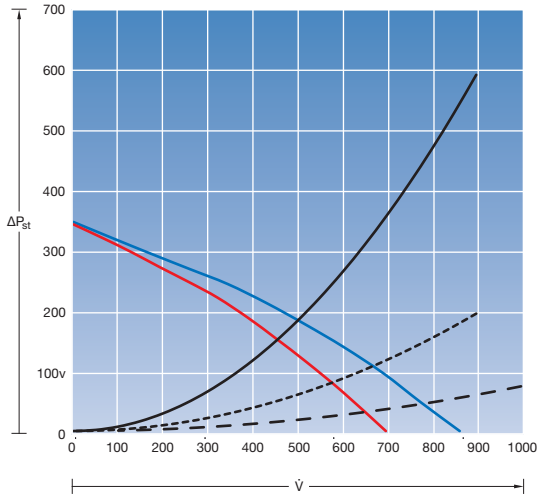
60 Hz
SK 3140.100/.110



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
— = without filter mat (IP 22)
— = with filter mat (IP 55)
— = 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 2 x outlet filter 3243.200 with standard filter (IP 54)

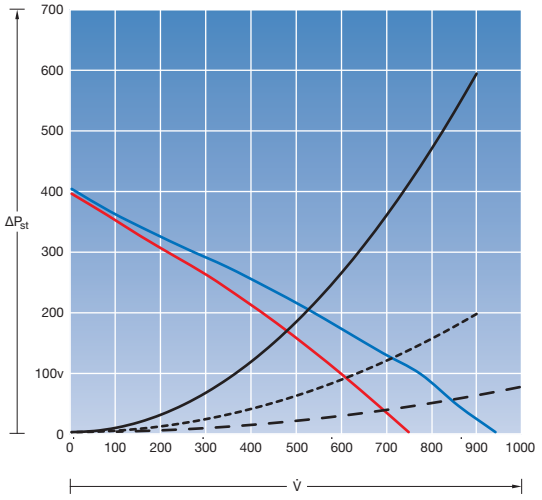
Air throughput 863/942 m³/h

400 V, 50 Hz
SK 3140.140



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
— = without filter mat (IP 22)
— = with filter mat (IP 55)
— = 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 2 x outlet filter 3243.200 with standard filter (IP 54)

400 V, 60 Hz
SK 3140.140

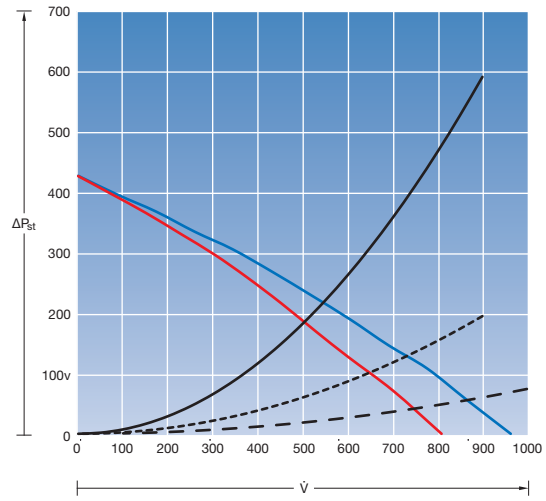


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
— = without filter mat (IP 22)
— = with filter mat (IP 55)
— = 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 2 x outlet filter 3243.200 with standard filter (IP 54)

Roof-mounted fans

Air throughput 963 m³/h

460 V, 60 Hz
SK 3140.140

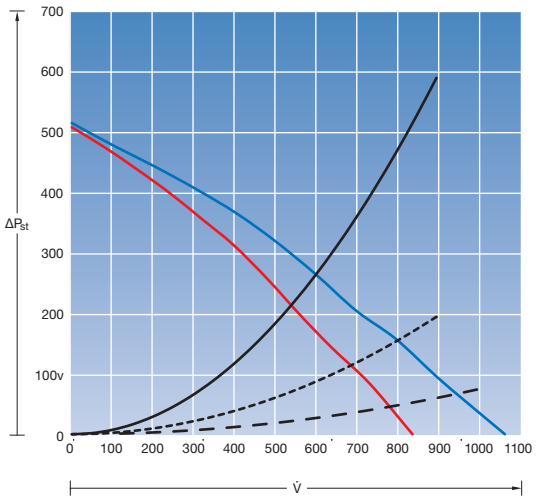


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= without filter mat (IP 22)
= with filter mat (IP 55)
= 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
= 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
= 2 x outlet filter 3243.200 with standard filter (IP 54)

Roof-mounted fans with EC technology

Air throughput 1069 m³/h

50/60 Hz
SK 3140.500/.510

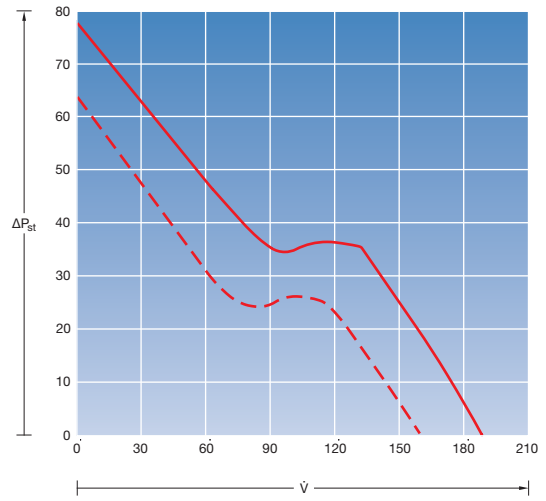


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= without filter mat (IP 22)
= with filter mat (IP 55)
= 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
= 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
= 2 x outlet filter 3243.200 with standard filter (IP 54)

Rack-mounted fans for 482.6 mm (19˝)

Air throughput 320/480 m³/h

50/60 Hz
SK 3340.230, 3341.024, .115, .230, 3342.024, .230, .500, 3350.115, .230, 3351.230, 3352.230, .500

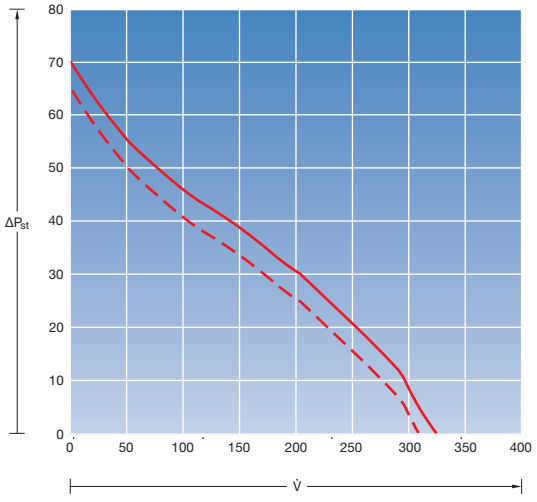


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= 50 Hz
= 60 Hz

Tangential fans for 482.6 mm (19˝)

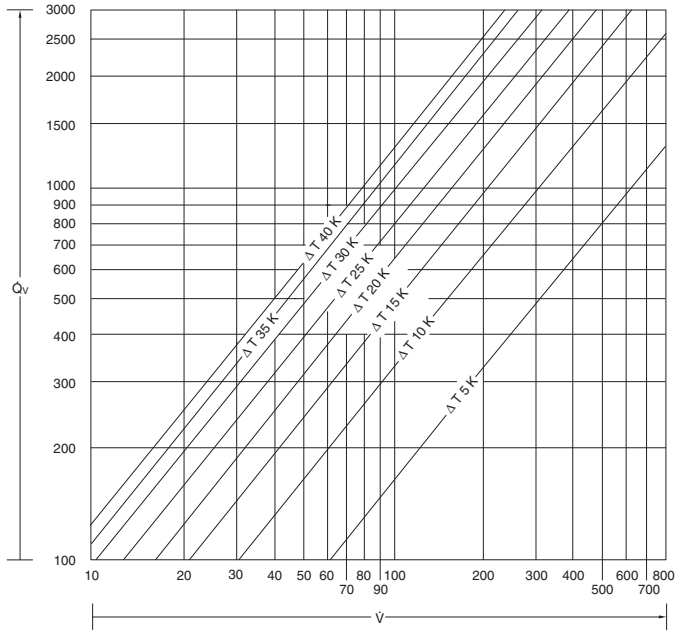
Air throughput 320 m³/h

50/60 Hz
SK 3144.000, 3145.000



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= 50 Hz
= 60 Hz

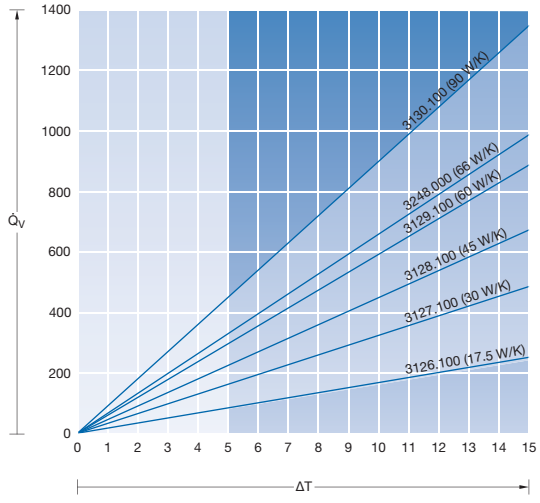
Selection diagram
for fans



$\dot{V}$ = Volumetric flow (m^3/h)
$\dot{Q}_V$ = Heat loss (W)

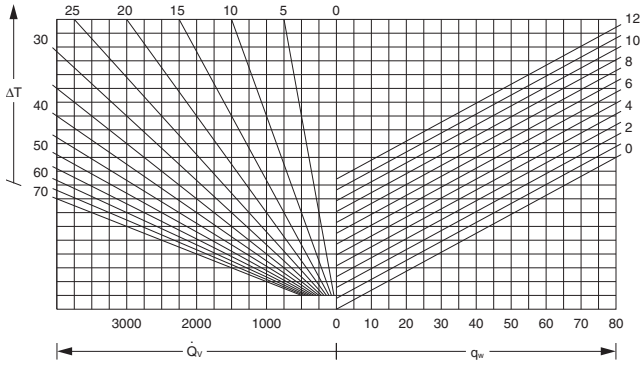
TopTherm air/air heat exchangers
Specific thermal output 17.5 – 90 W/K, wall-mounted with controller

50/60 Hz
SK 3126.100, 3127.100, 3128.100, 3129.100, 3130.100, 3248.000



$\dot{Q}_V$ = Heat loss (W)
ΔT = Temperature difference (K)

Selection diagram
for air/air heat exchangers

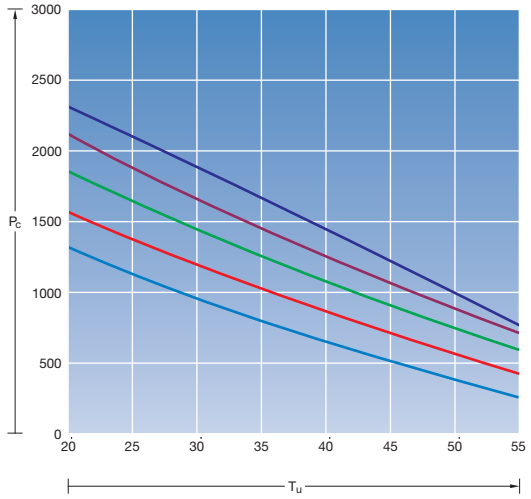


ΔT	=	Temperature difference (K)
$\dot{Q}_V$	=	Heat loss (W)
q_W	=	Specific thermal output (W/K)
A	=	Enclosure surface area to IEC 890 (m^2)
k	=	Heat transfer coefficient (W/m^2 K) for sheet steel k = 5.5 W/m^2 K

VX25 Blue e+ integration solution

Output class 1300 W (110 – 240 V, 1 ~, 50 – 60 Hz / 380 – 480 V, 3 ~, 50 – 60 Hz)

1.30 kW
SK 3185.030



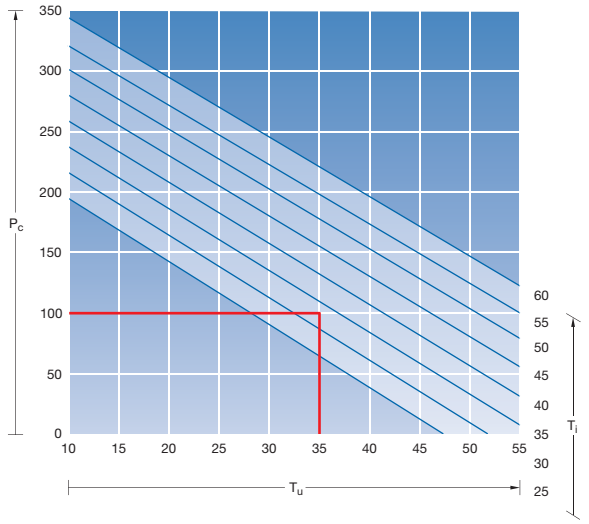
Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Thermoelectric coolers

Cooling output

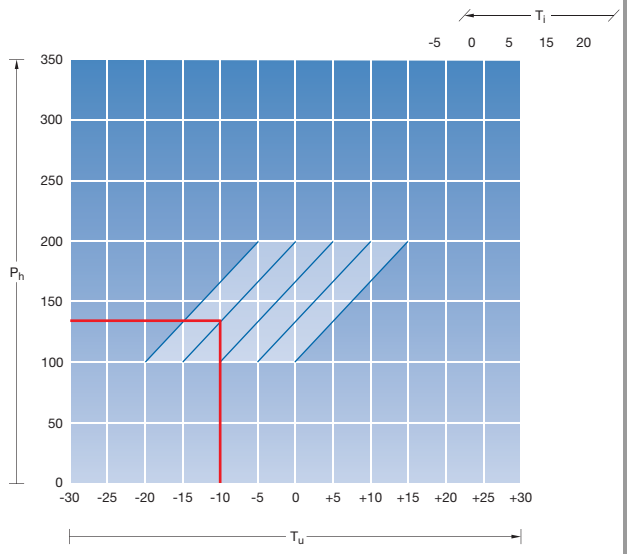
50/60 Hz
SK 3201.200, .300



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Heating output

50/60 Hz
SK 3201.200, .300

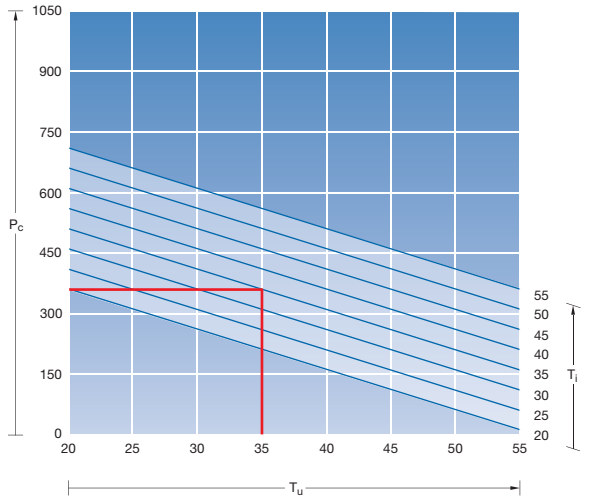


T_u = Ambient temperature (°C)
P_h = Heating output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units

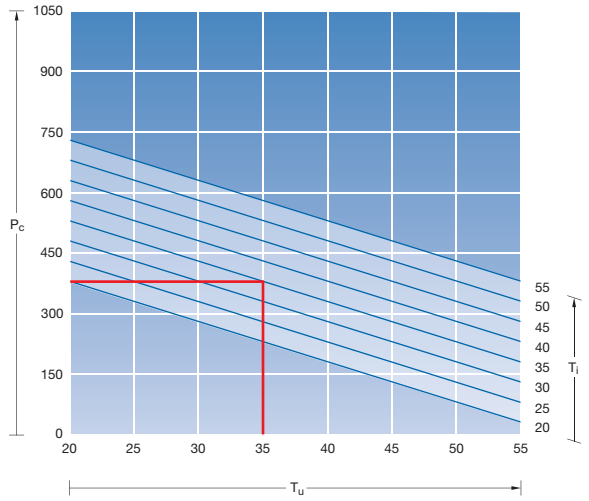
Output class 300 W (115/230 V, 1~)

50 Hz
SK 3302.300, .310, .100, .110, .200



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3302.300, .310, .100, .110, .200

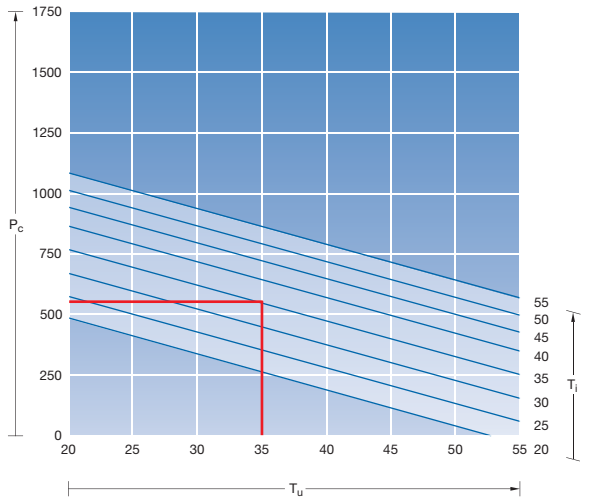


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

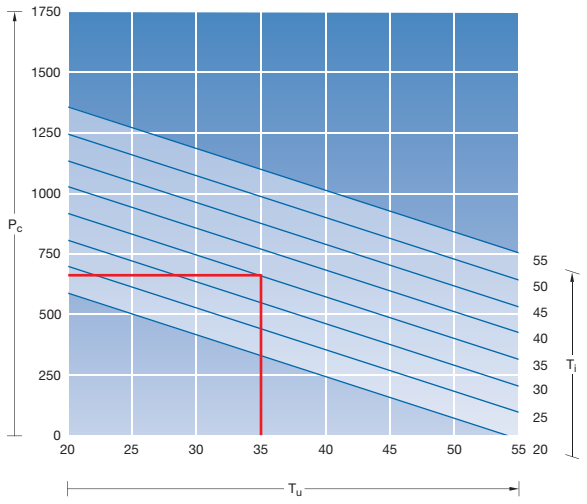
Output class 500 W (115/230 V, 1~)

50 Hz
SK 3303.500, .510, .600, .504, .514



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

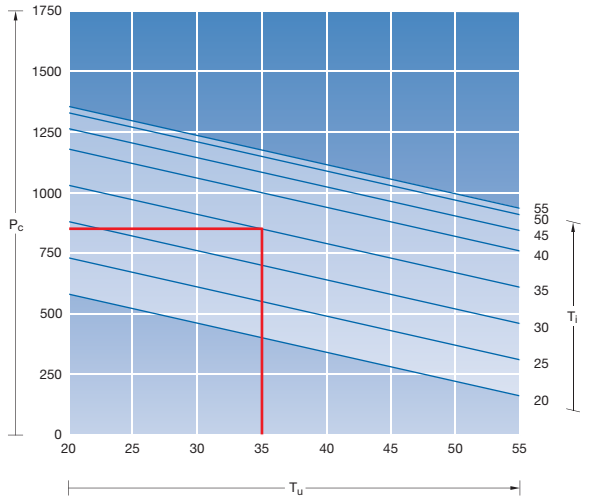
60 Hz
SK 3303.500, .510, .600, .504, .514



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

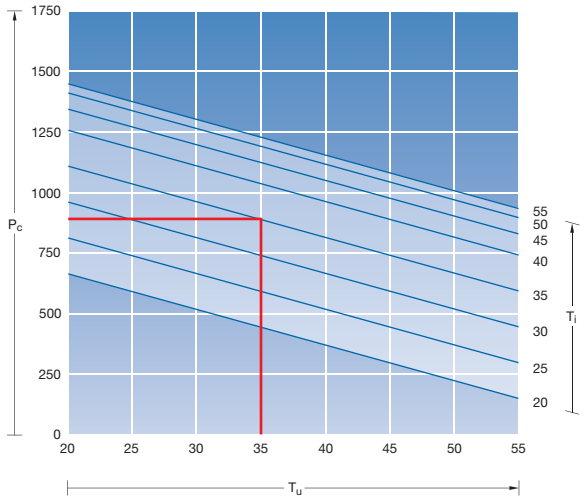
Output class 750 W (115/230 V, 1~, 400 V, 2~)

50 Hz
SK 3361.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3361.500, .510, .540, .600

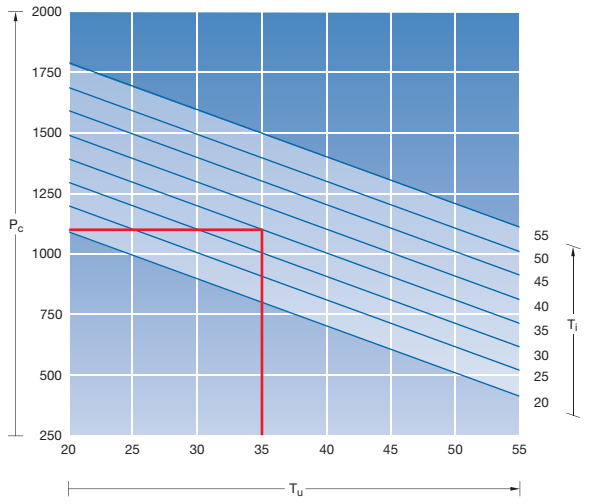


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

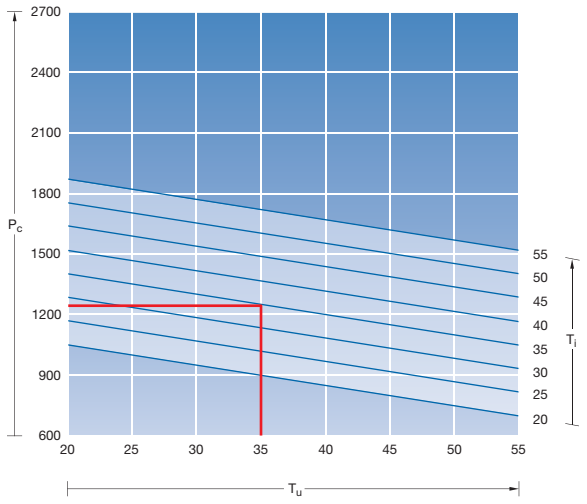
Output class 1000 W (115/230 V, 1~)

50 Hz
SK 3304.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

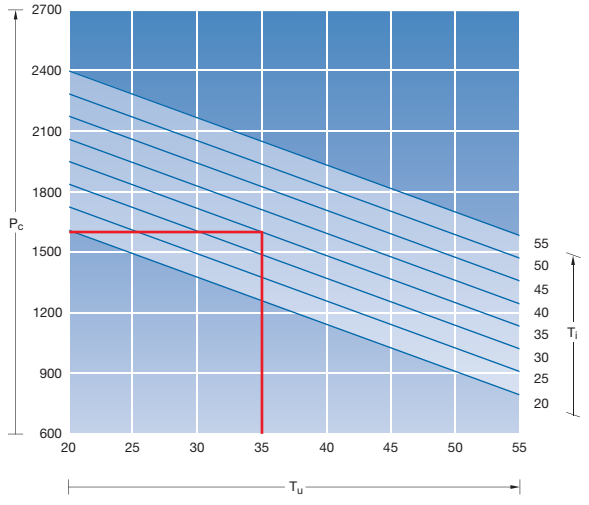
60 Hz
SK 3304.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

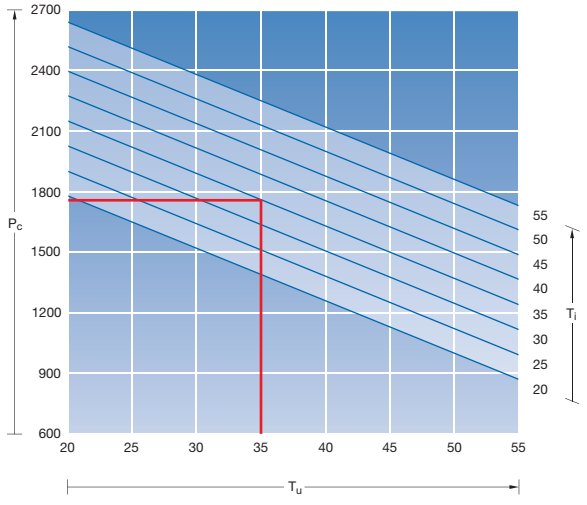
Output class 1500 W (115/230 V, 1~)

50 Hz
SK 3305.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3305.500, .510, .600, .504

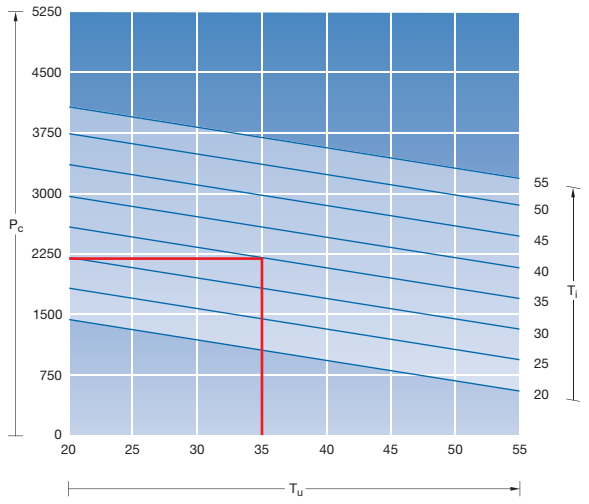


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

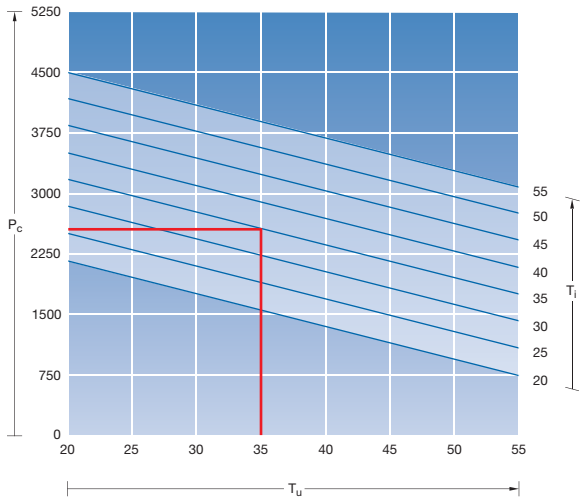
Output class 2000 W (115/230 V, 1~)

50 Hz
SK 3328.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

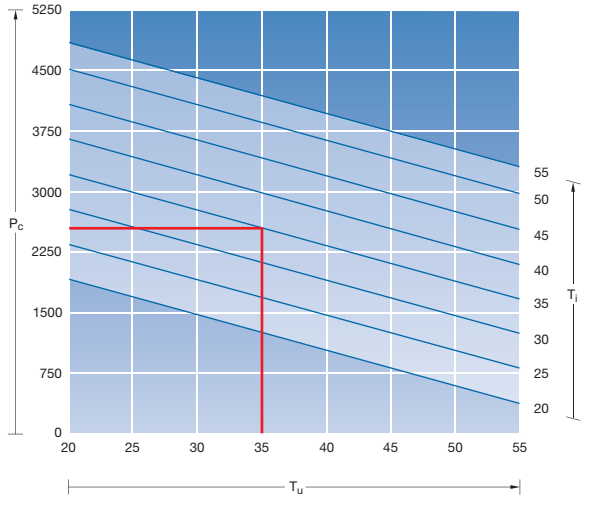
60 Hz
SK 3328.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

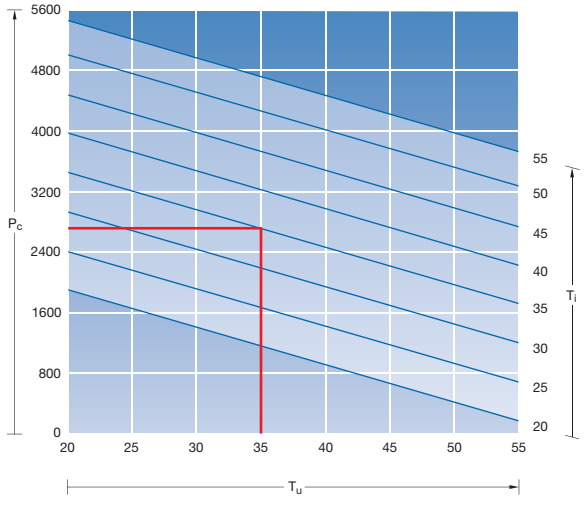
Output class 2500 W (115/230 V, 1~)

50 Hz
SK 3329.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3329.500, .510, .600, .504

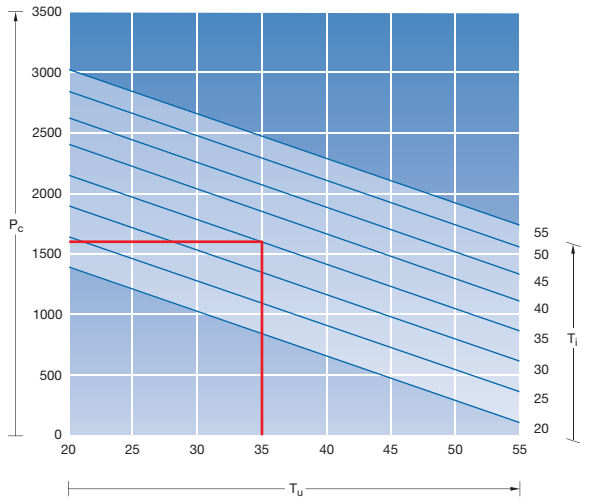


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e, slimline

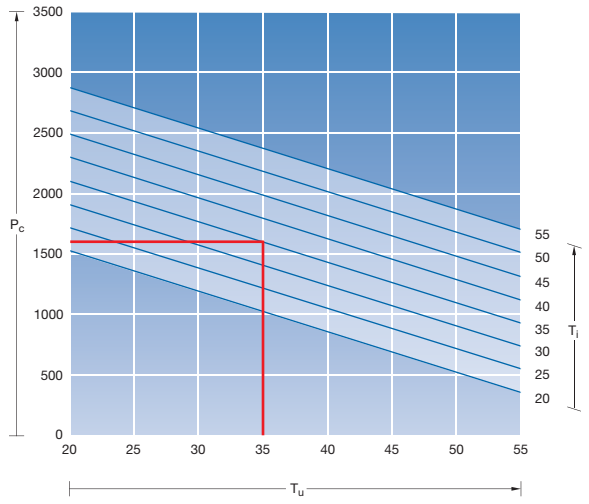
Output class 1500 W (230 V, 1~)

50 Hz
SK 3366.500



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

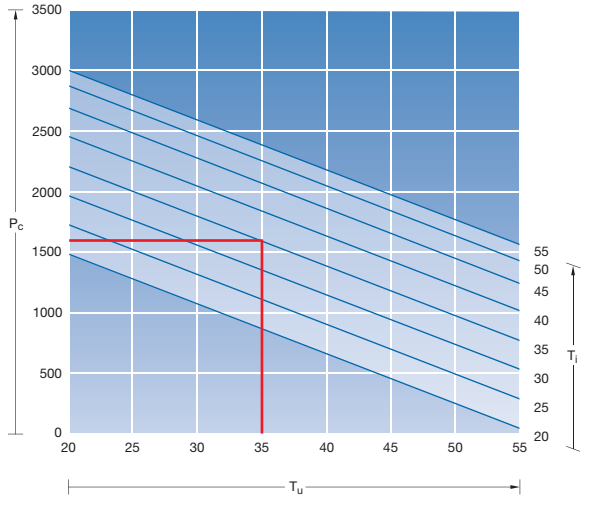
60 Hz
SK 3366.500



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

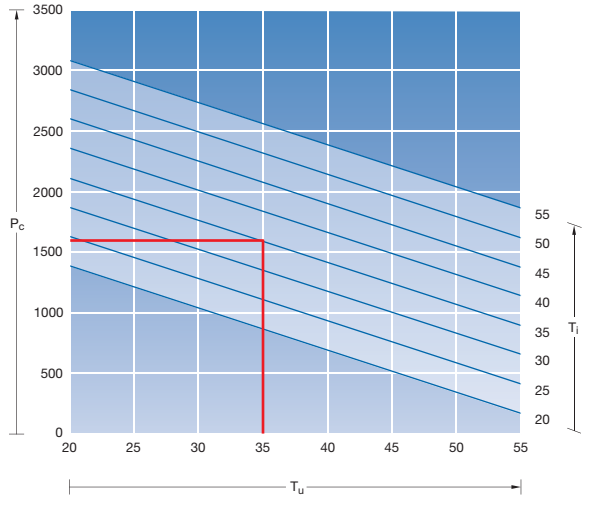
Output class 1500 W (400/460 V, 3~)

50 Hz
SK 3366.540



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3366.540

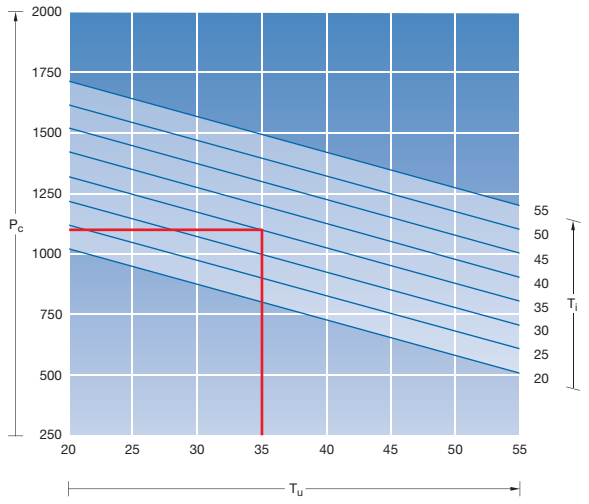


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

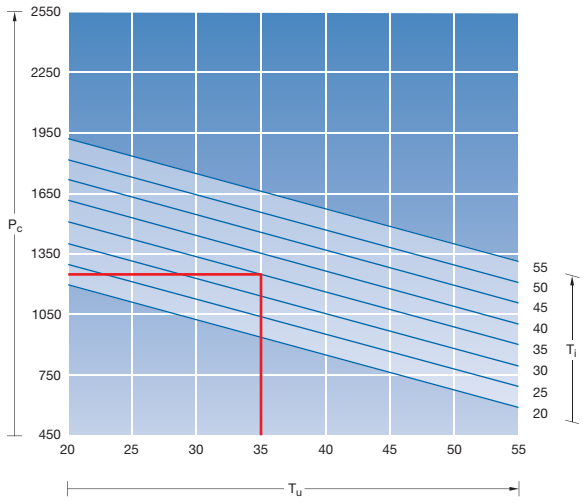
Output class 1000 W (400/460 V, 3~)

50 Hz
SK 3304.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

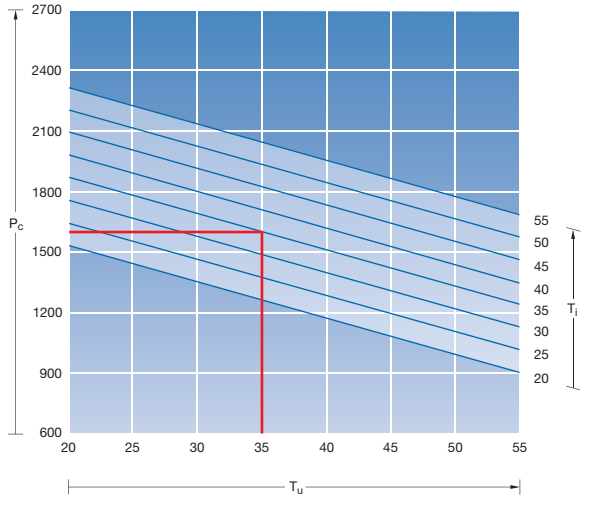
60 Hz
SK 3304.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

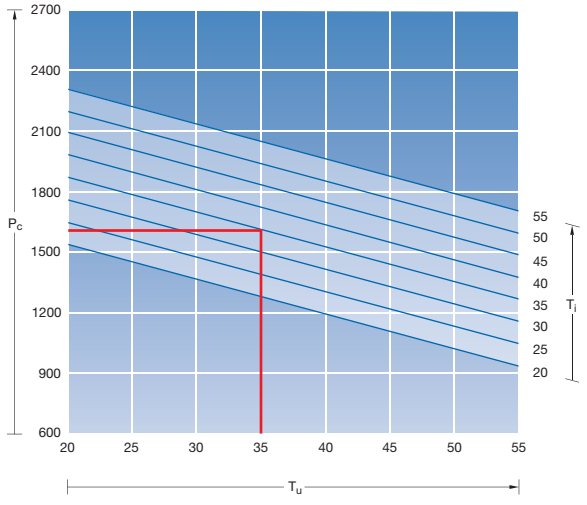
Output class 1500 W (400/460 V, 3~)

50 Hz
SK 3305.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3305.540, .640, .544

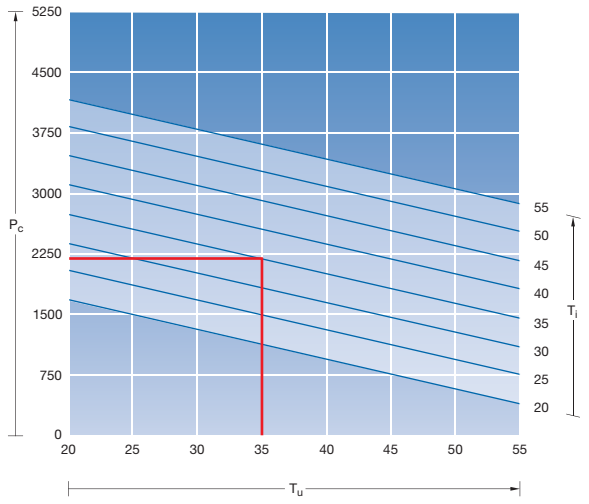


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

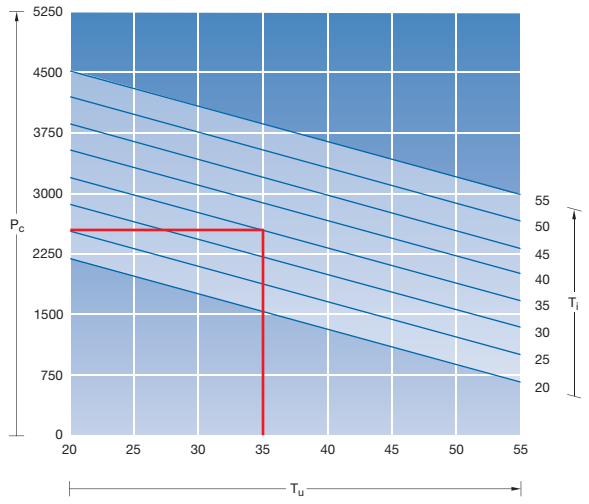
Output class 2000 W (400/460 V, 3~)

50 Hz
SK 3328.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

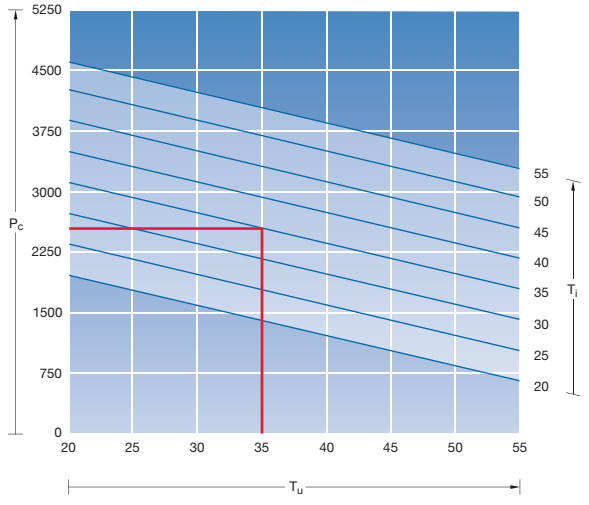
60 Hz
SK 3328.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

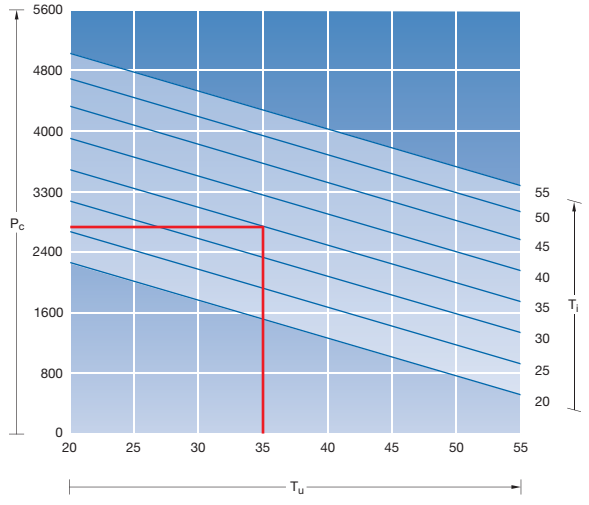
Output class 2500 W (400/460 V, 3~)

50 Hz
SK 3329.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3329.540, .640, .544

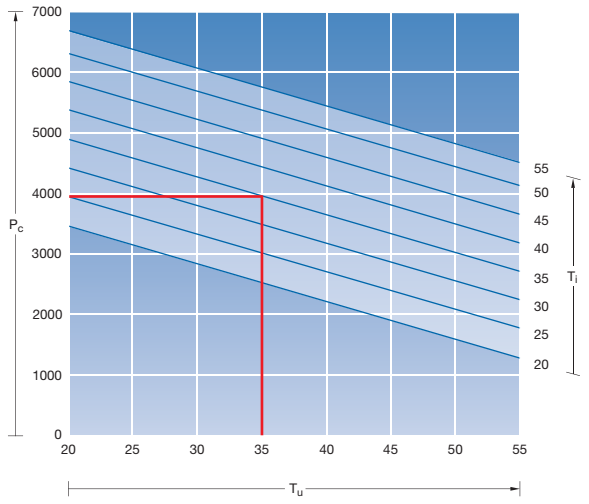


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

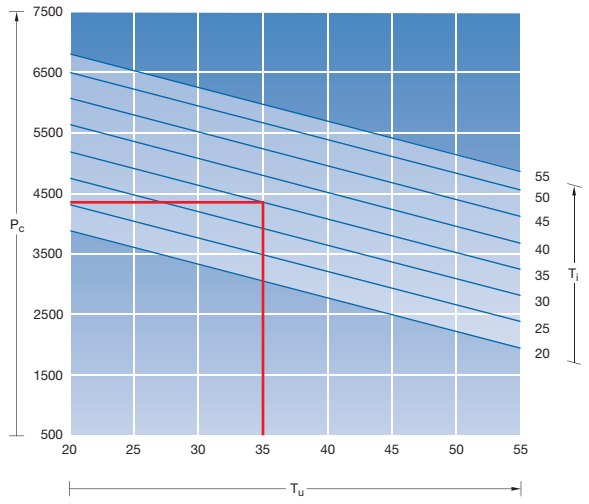
Output class 4000 W (400/460 V, 3~)

50 Hz
SK 3332.540, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3332.540, .640

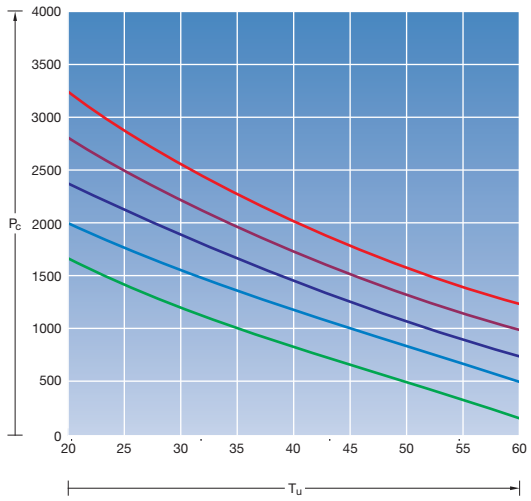


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Wall-mounted cooling units Blue e+

Output class 1600/2000 W (110 – 240 V, 1~, 50 – 60 Hz / 380 – 480 V, 3~, 50 – 60 Hz)

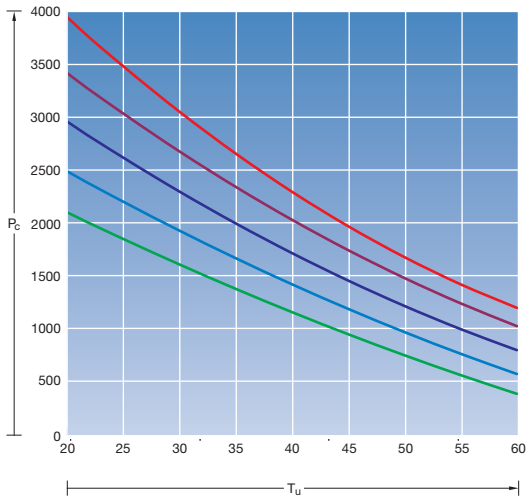
1.6 kW
SK 3185.530, .830



Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

2 kW
SK 3186.630, .930

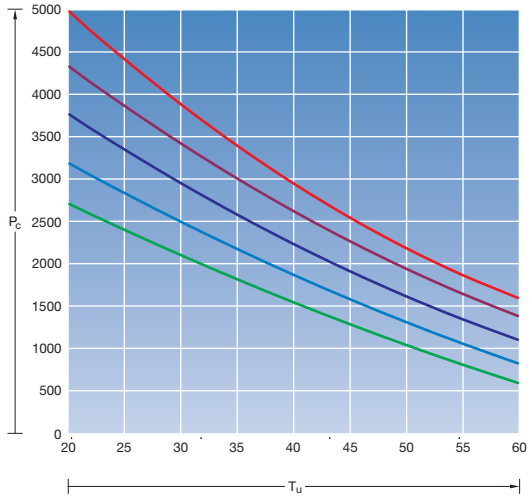


Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Output class 2600/4200 W (110 – 240 V, 1~, 50 – 60 Hz / 380 – 480 V, 3~, 50 – 60 Hz)

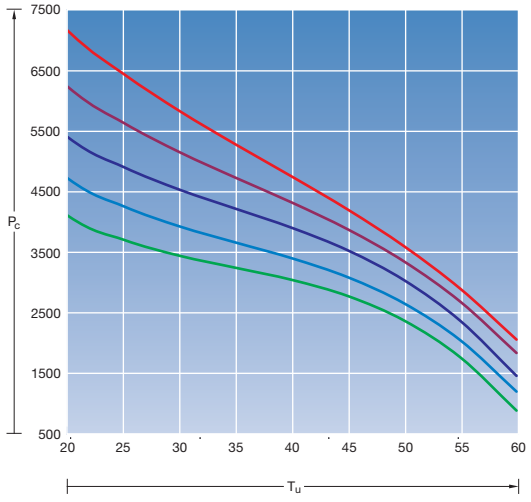
2.6 kW
SK 3187.630, .930



Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

4.2 kW
SK 3188.640, .940



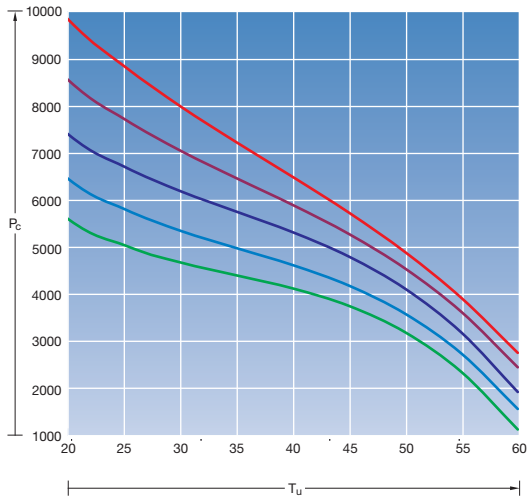
Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Wall-mounted cooling units Blue e+

Output class 5800 W (380 – 480 V, 3~, 50 – 60 Hz)

5.8 kW
SK 3189.640, .940



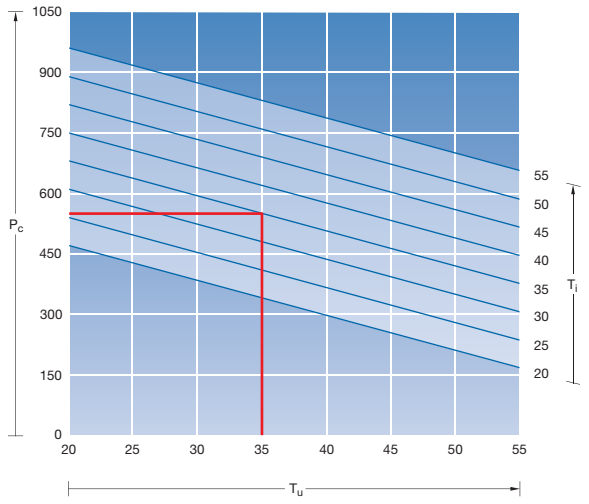
Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

TopTherm roof-mounted cooling units Blue e

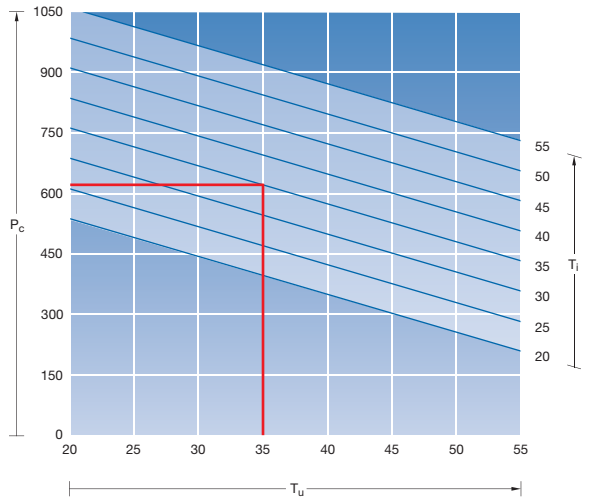
Output class 500 W (115/230 V, 1~)

50 Hz
SK 3382.500, .510, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

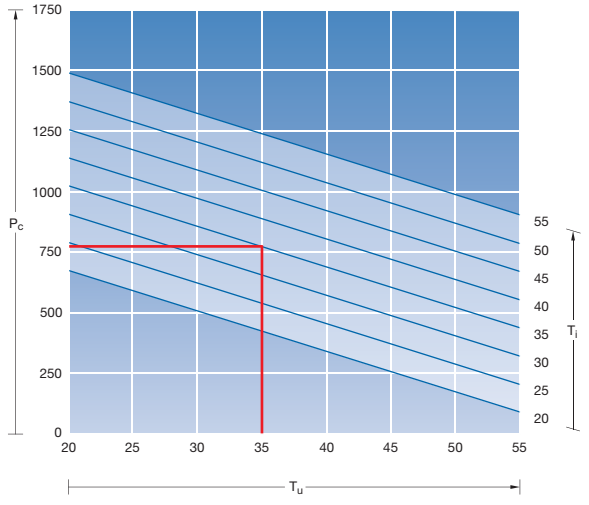
60 Hz
SK 3382.500, .510, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

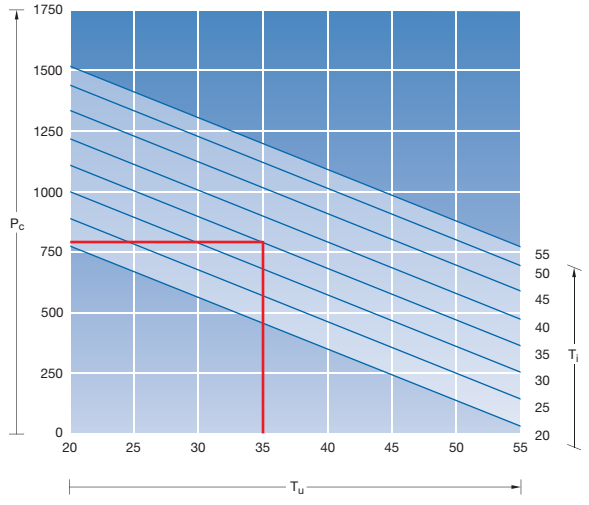
Output class 750 W (115/230 V, 1~, 400 V, 2~)

50 Hz
SK 3359.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3359.500, .510, .540, .600

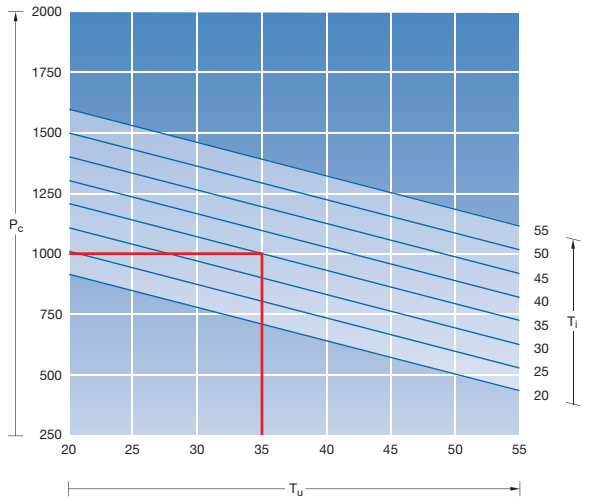


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm roof-mounted cooling units Blue e

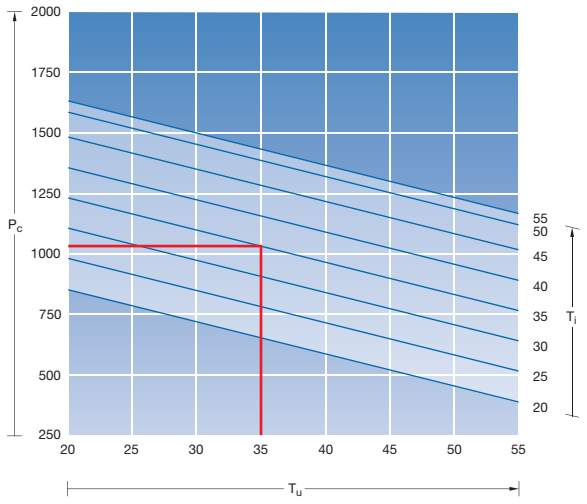
Output class 1000 W (115/230 V, 1~, 400 V, 2~)

50 Hz
3383.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

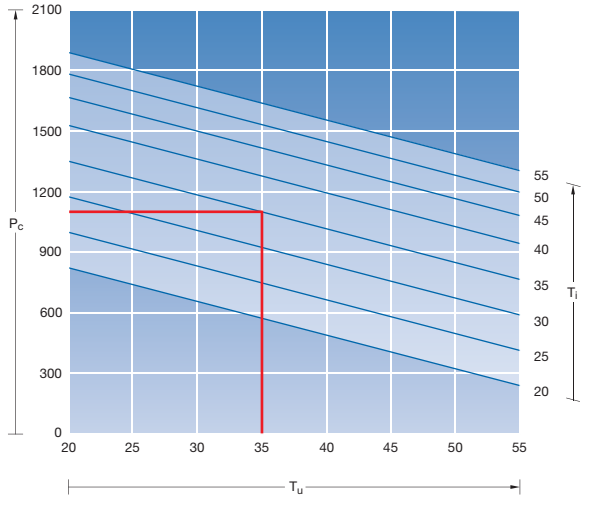
60 Hz
3383.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

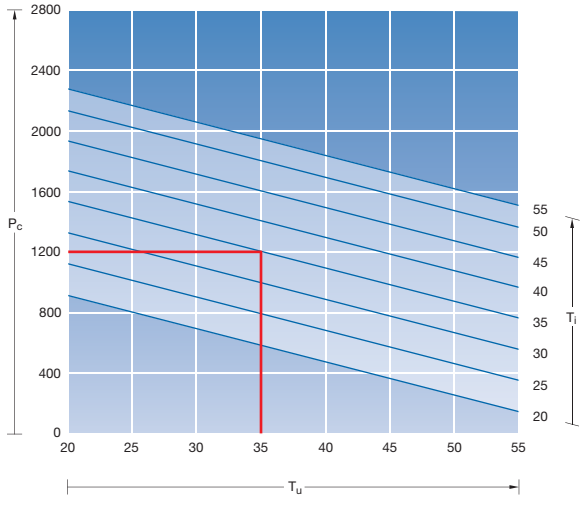
Output class 1100 W (115/230 V, 1~)

50 Hz
SK 3273.500, .515



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3273.500, .515

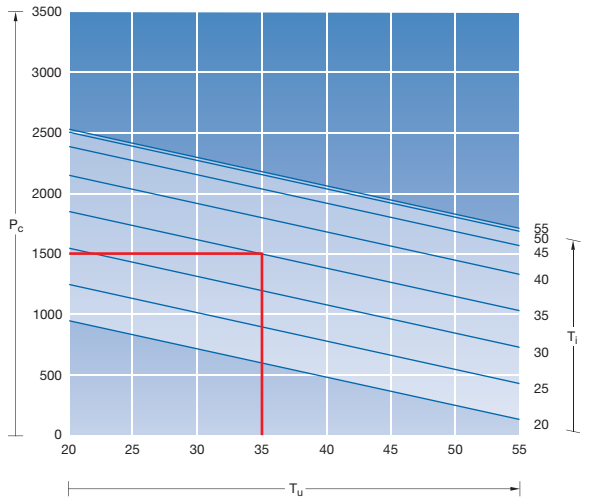


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm roof-mounted cooling units Blue e

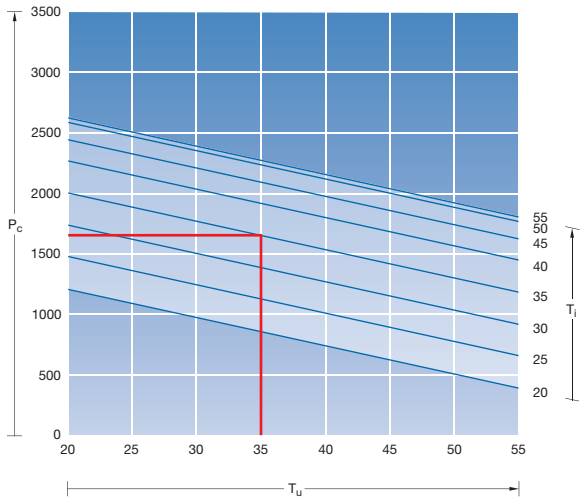
Output class 1500 W (115/230 V, 1~, 400 V, 2~)

50 Hz
3384.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

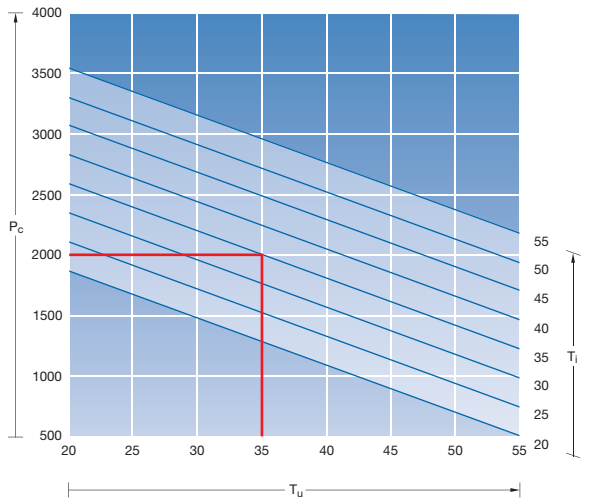
60 Hz
3384.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

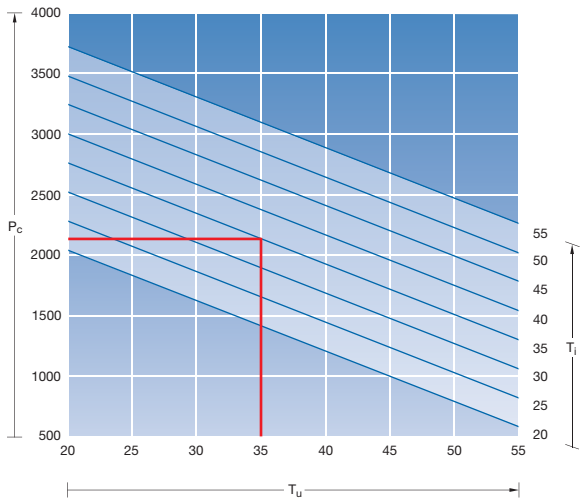
Output class 2000 W (115/230 V, 1~, 400 V, 2~)

50 Hz
SK 3385.500, .510, .540, .600, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3385.500, .510, .540, .600, .640

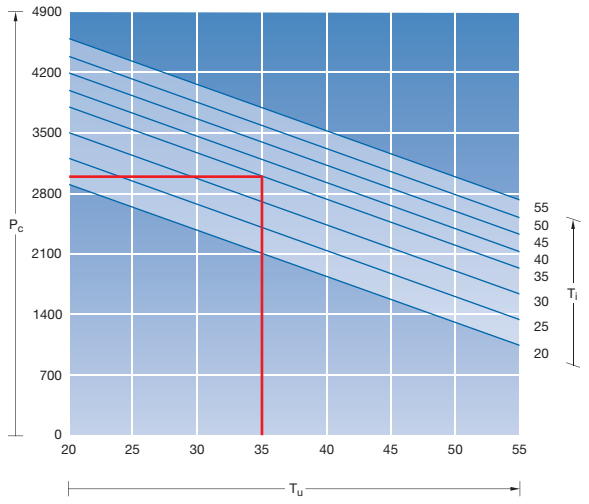


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm roof-mounted cooling units Blue e

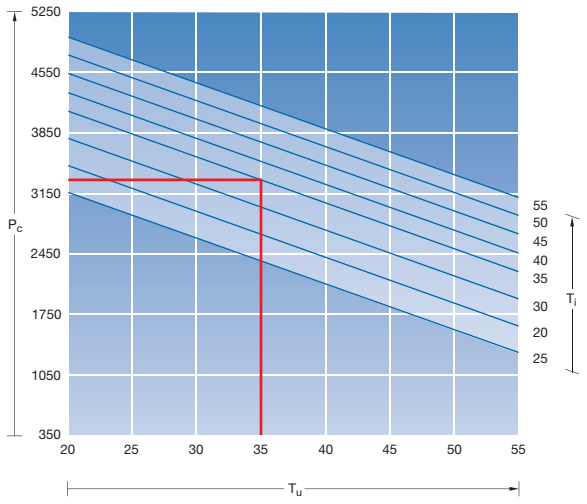
Output class 3000 W (400/460 V, 3~)

50 Hz
3386.540, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

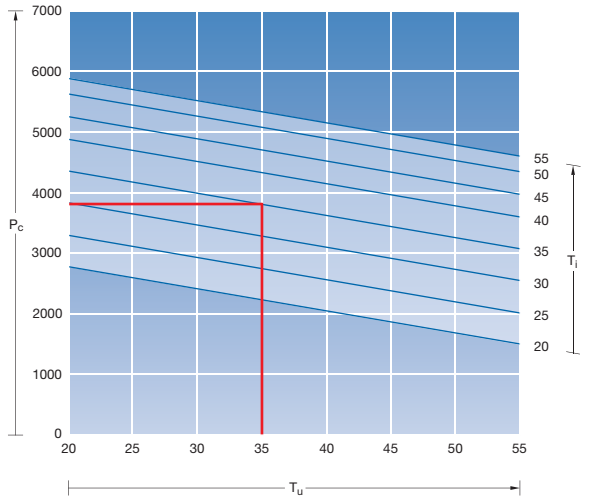
60 Hz
3386.540, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

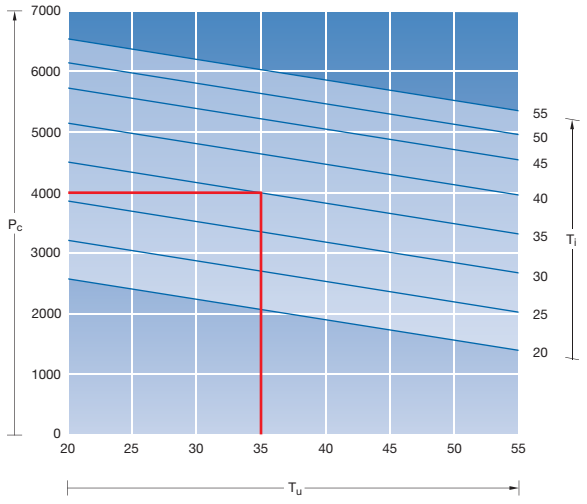
Output class 4000 W (400/460 V, 3~)

50 Hz
3387.540, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
3387.540, .640

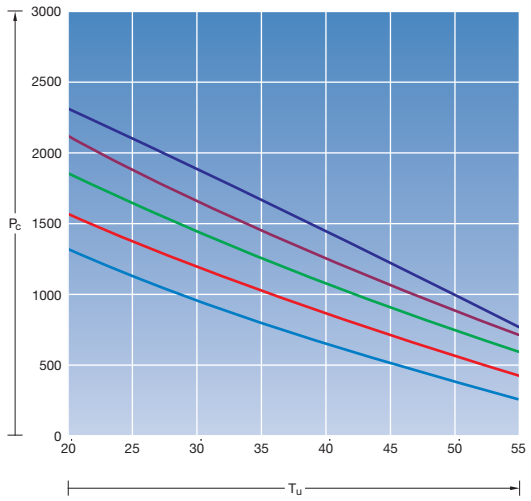


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Roof-mounted cooling unit Blue e+

Output class 1300 W (110 – 240 V, 1 ~, 50 – 60 Hz / 380 – 480 V, 3 ~, 50 – 60 Hz)

1.30 kW
SK 3185.730



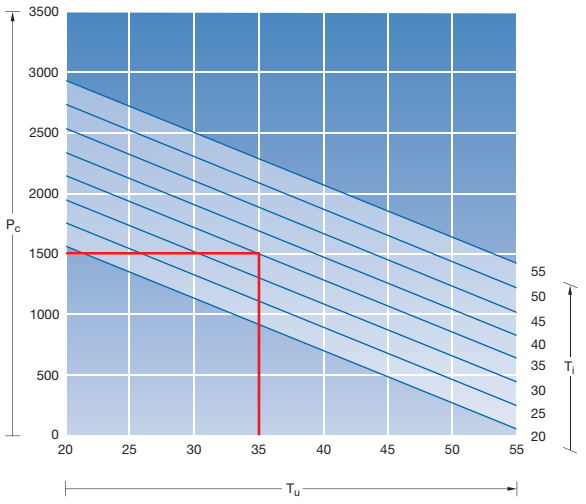
Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Modular climate control concept – Cooling module Blue e

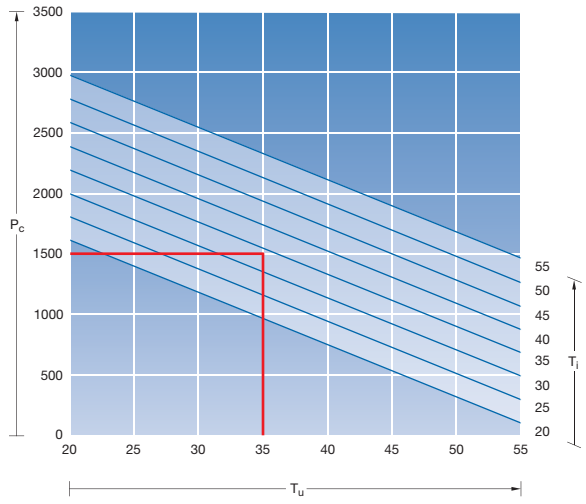
Output class 1500 W (230 V, 1~)

50 Hz
SK 3307.700



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

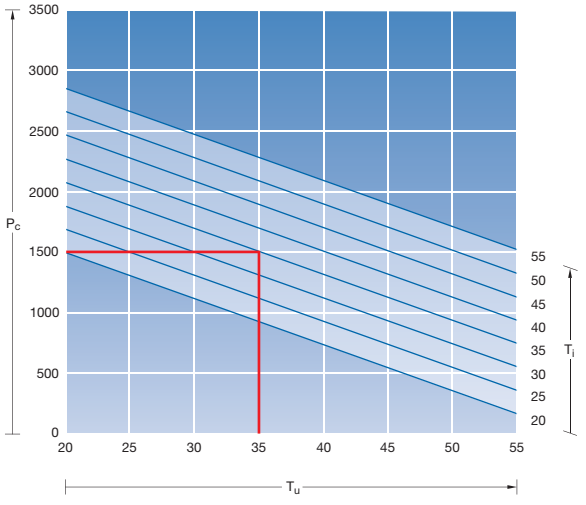
60 Hz
SK 3307.700



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

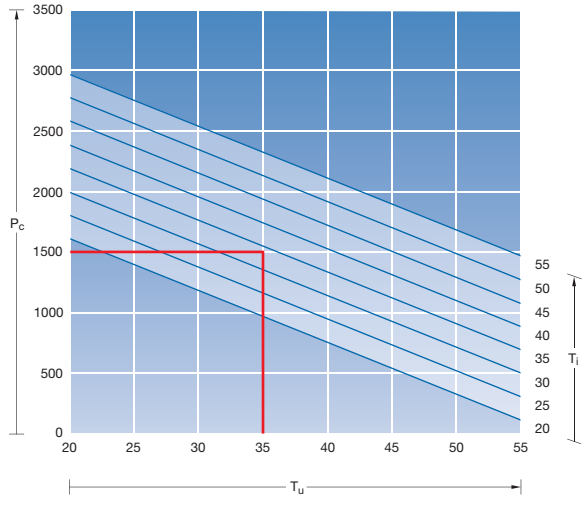
Output class 1500 W (400/460 V, 3~)

50 Hz
SK 3307.740



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3307.740

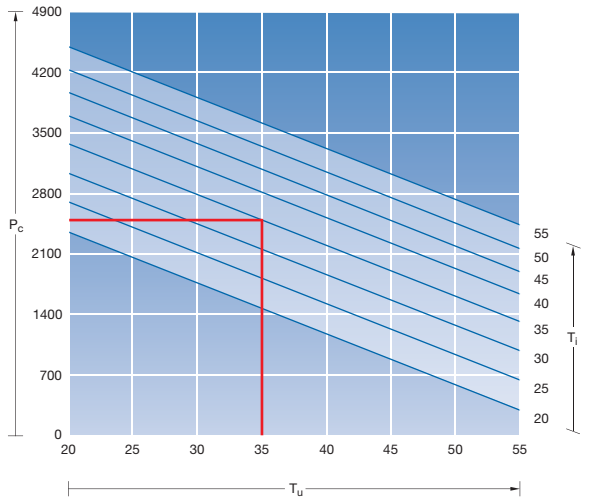


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Modular climate control concept – Cooling module Blue e

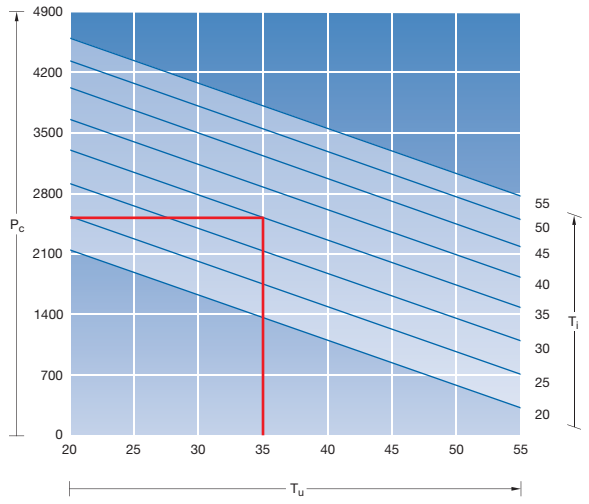
Output class 2500 W (230 V, 1~)

50 Hz
SK 3310.700



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

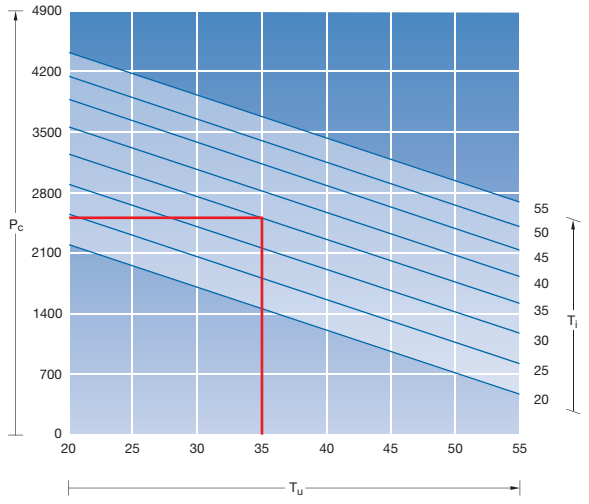
60 Hz
SK 3310.700



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

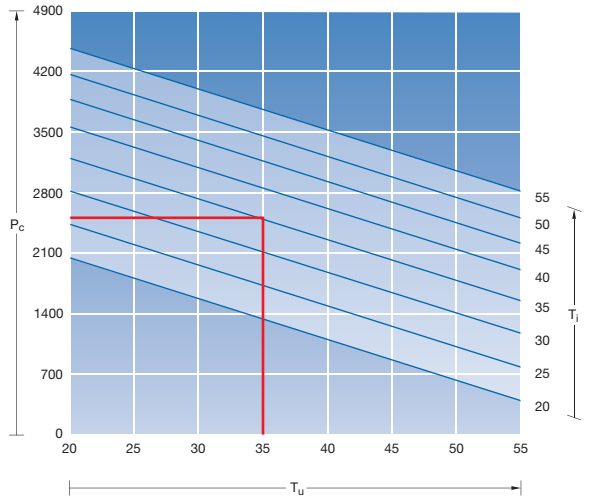
Output class 2500 W (400/460 V, 3~)

50 Hz
SK 3310.740



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3310.740

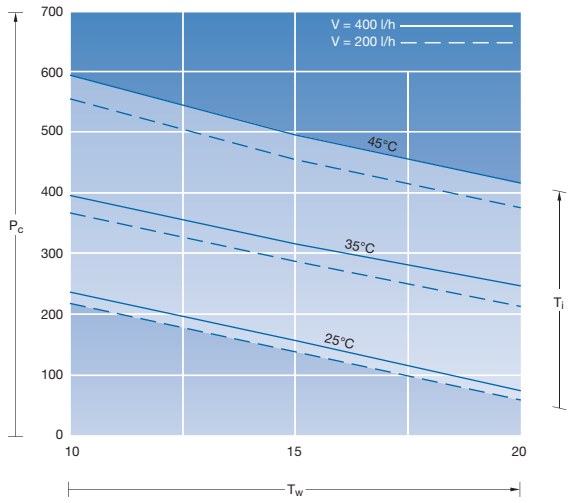


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Wall-mounted air/water heat exchangers

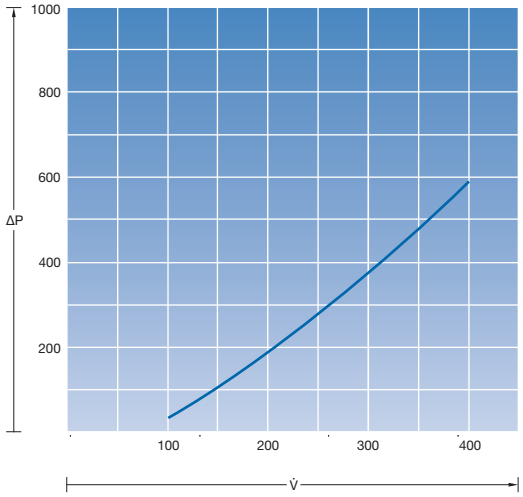
Output class 300 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3212.024, .115, .230



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

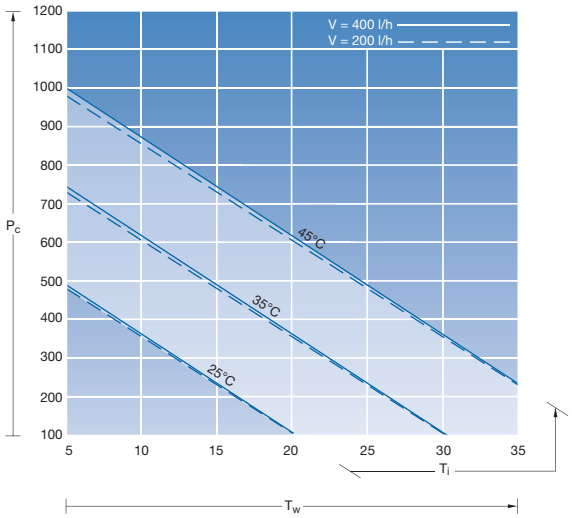
Water resistance diagram
SK 3212.024, .115, .230



$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

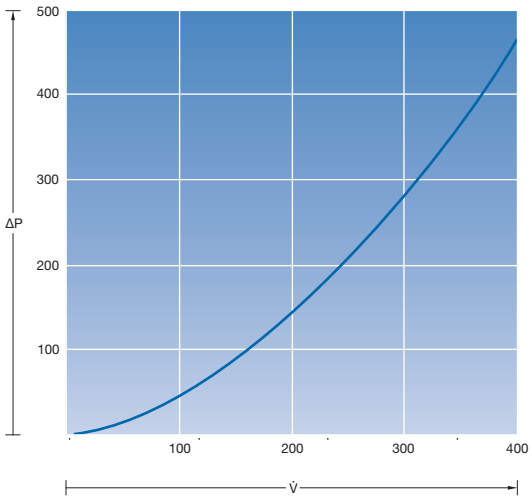
Output class 600 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3214.100



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3214.100

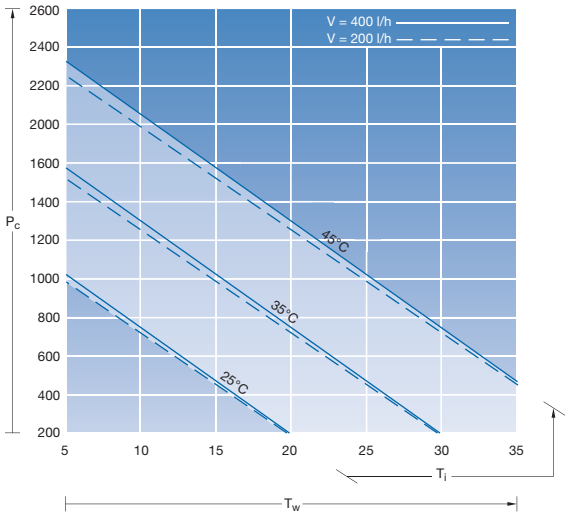


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

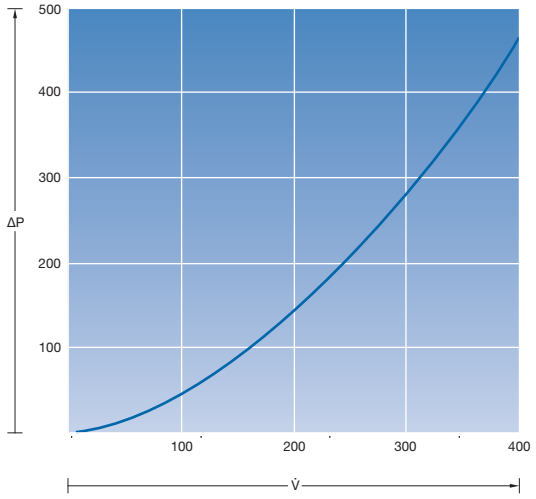
Output class 1250 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3215.100



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

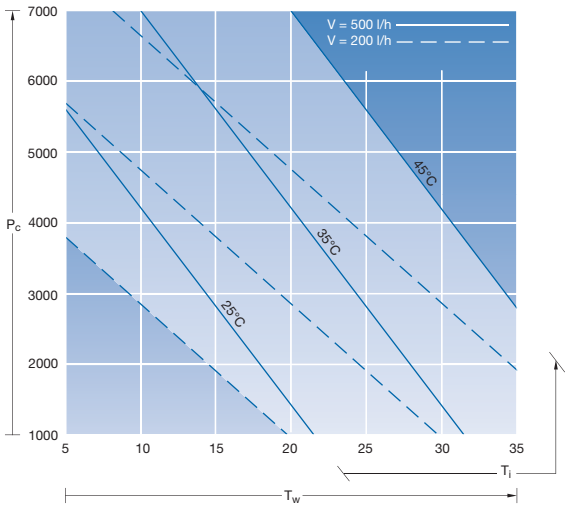
Water resistance diagram
SK 3215.100



$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

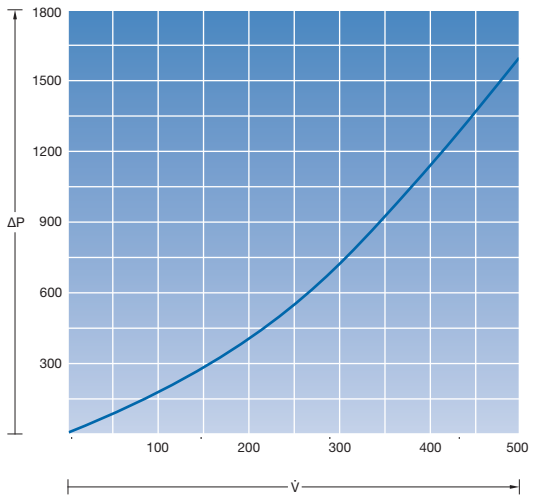
Output class 7000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3216.480



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3216.480

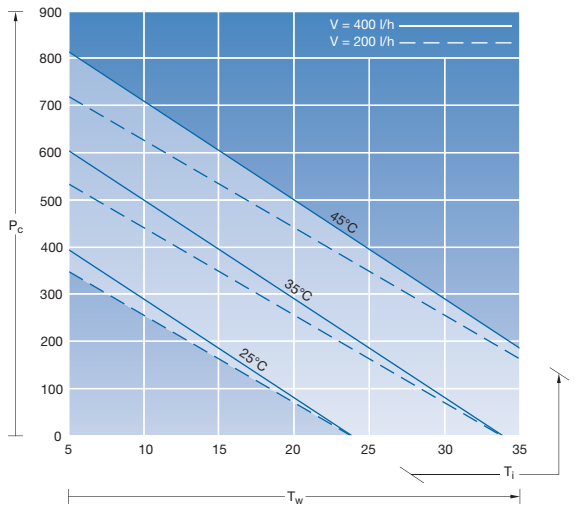


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

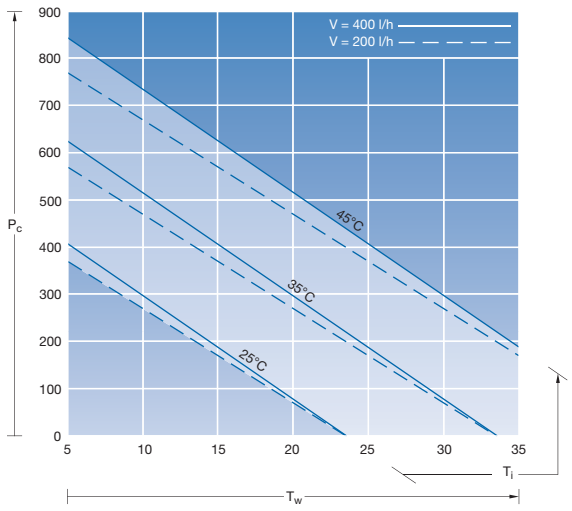
Output class 500 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3363.100, .500



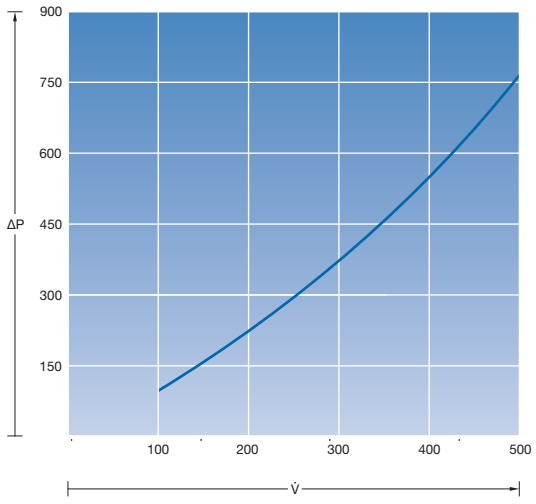
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3363.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3363.100, .500

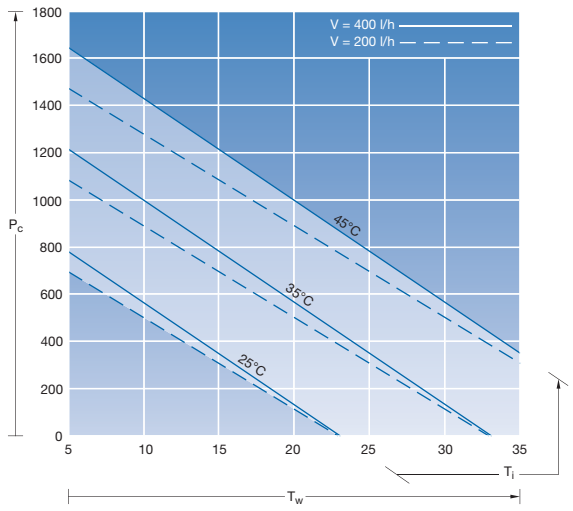


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

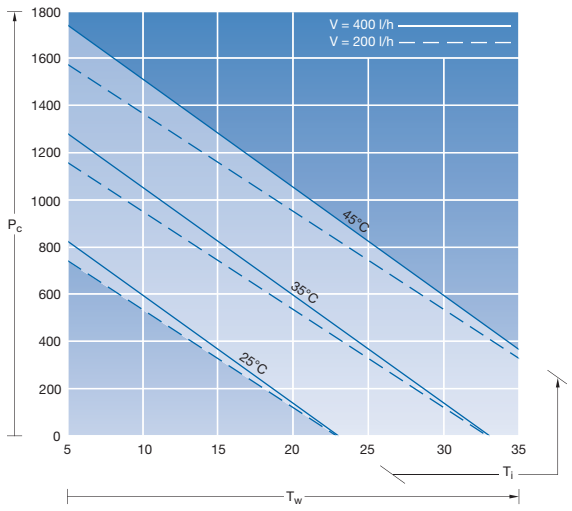
Output class 1000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3364.100, .500



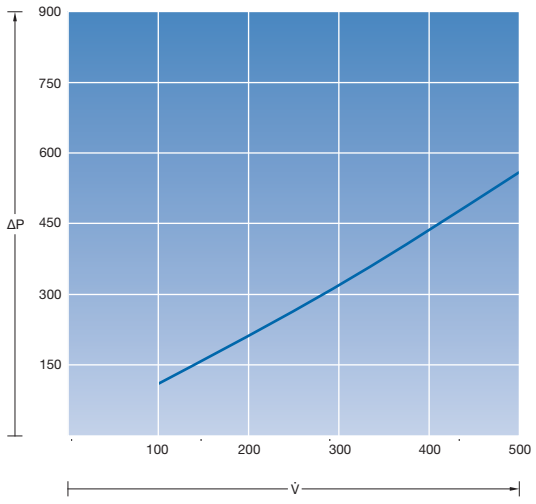
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3364.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3364.100, .500

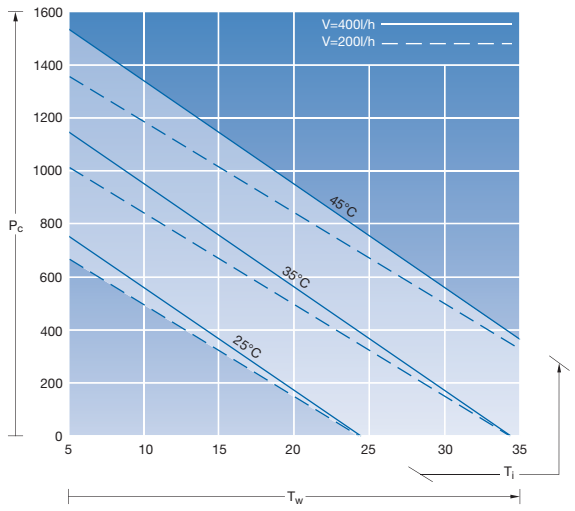


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

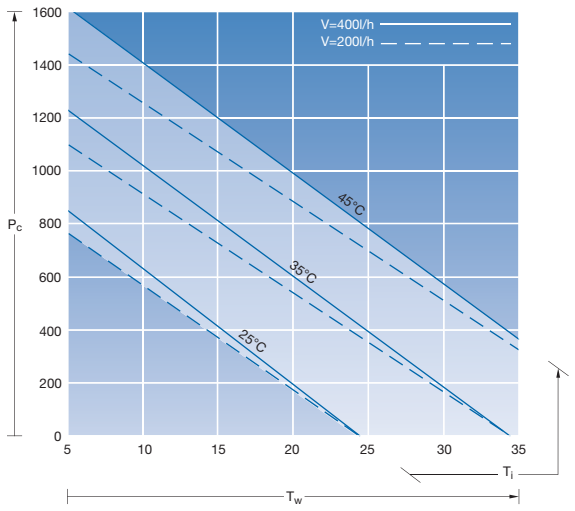
Output class 1000 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3364.504



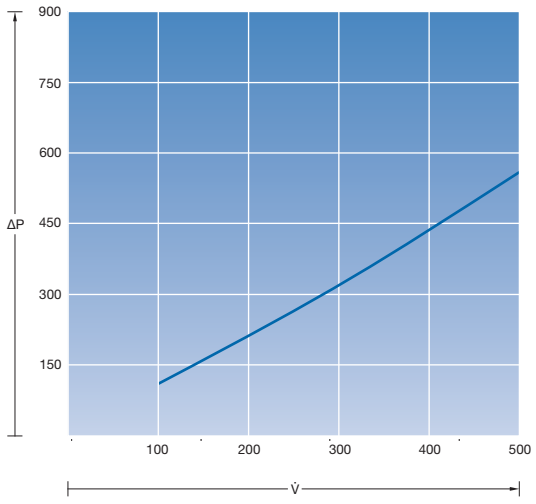
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3364.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3364.504

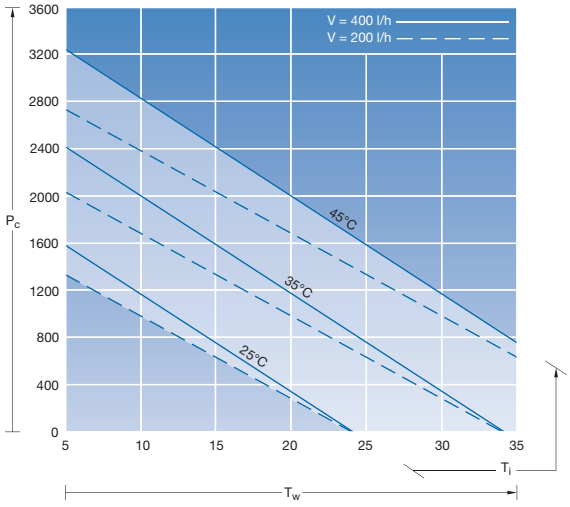


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

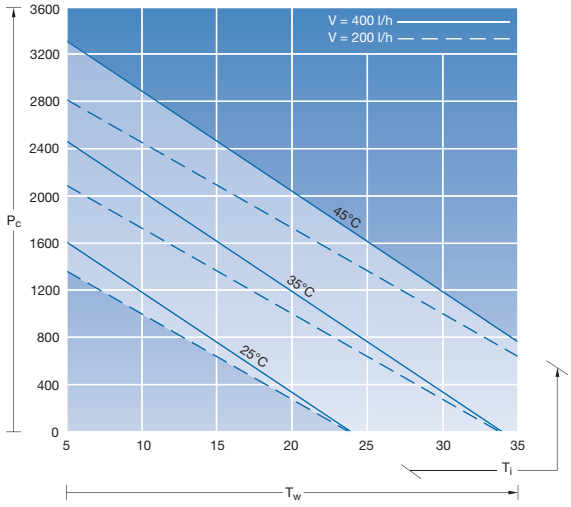
Output class 2000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3373.100, .500



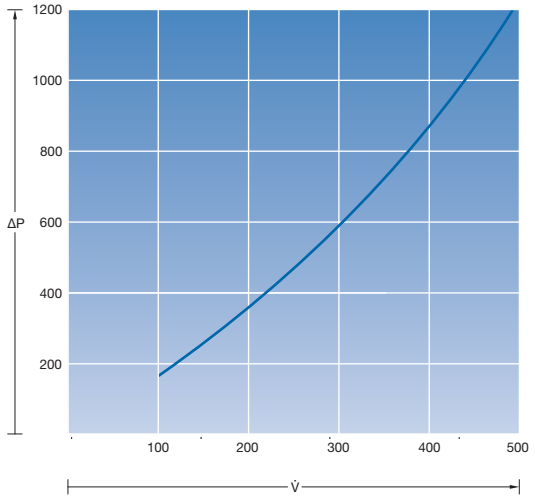
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3373.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3373.100, .500

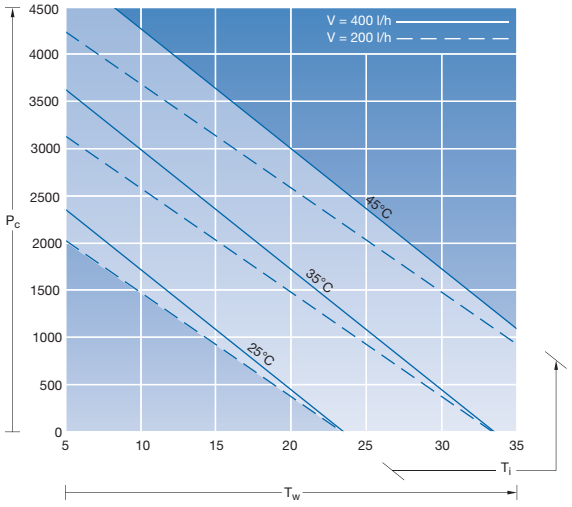


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

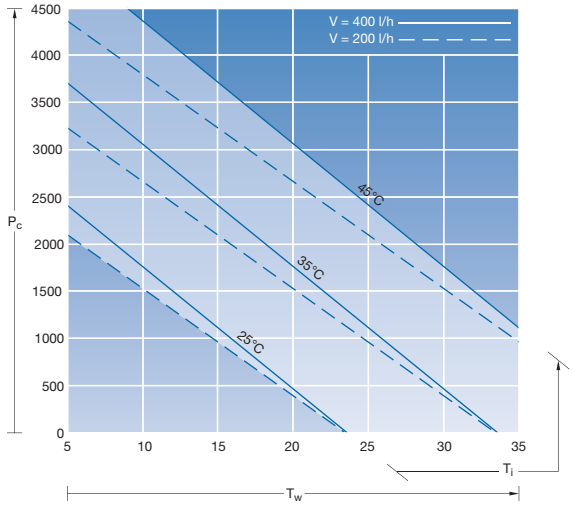
Output class 3000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3374.100, .500



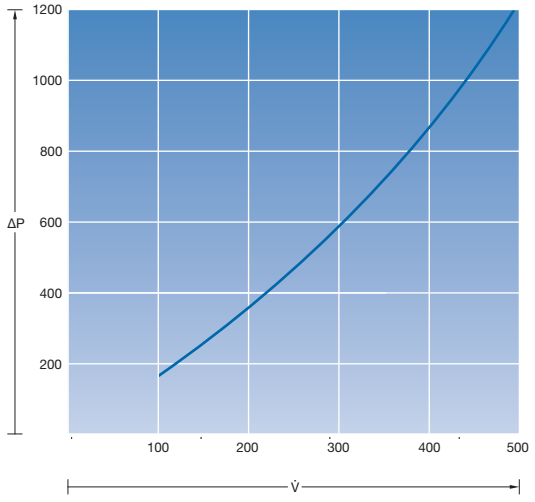
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3374.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3374.100, .500

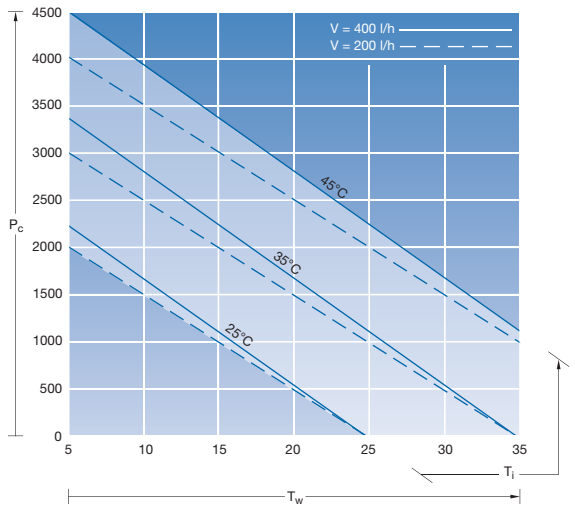


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

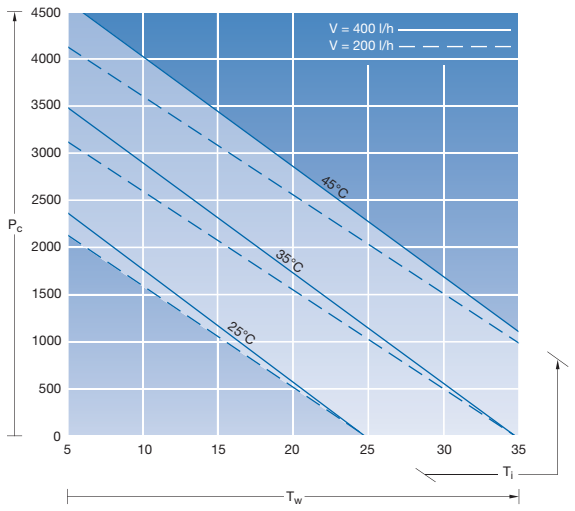
Output class 2500 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3374.504



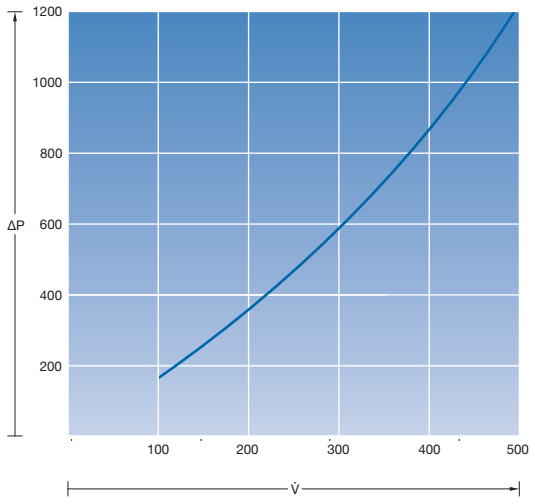
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3374.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3374.504

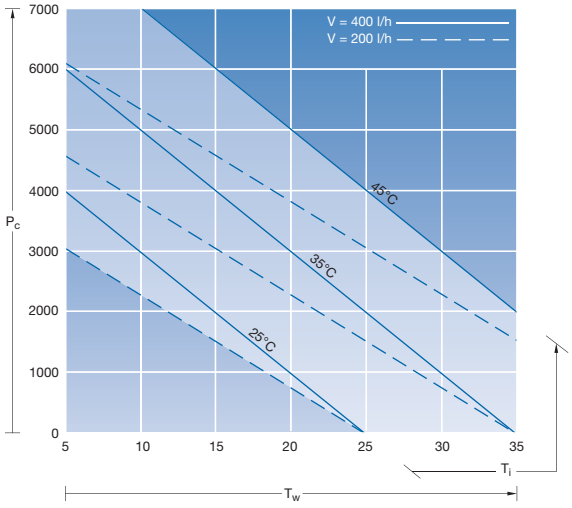


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

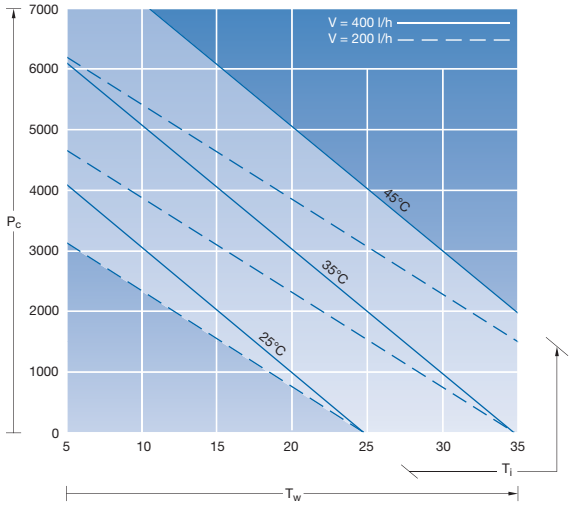
Output class 5000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3375.100, .500



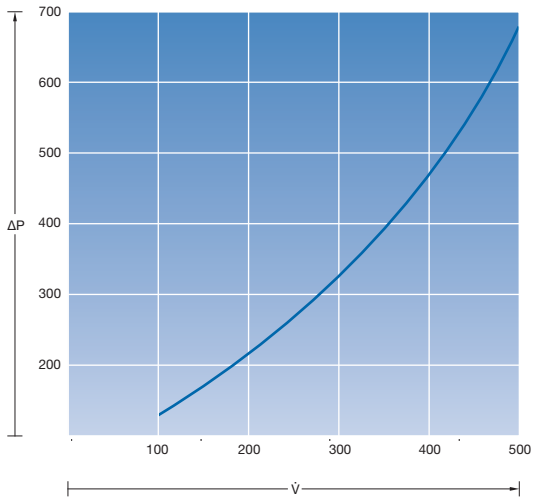
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3375.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3375.100, .500

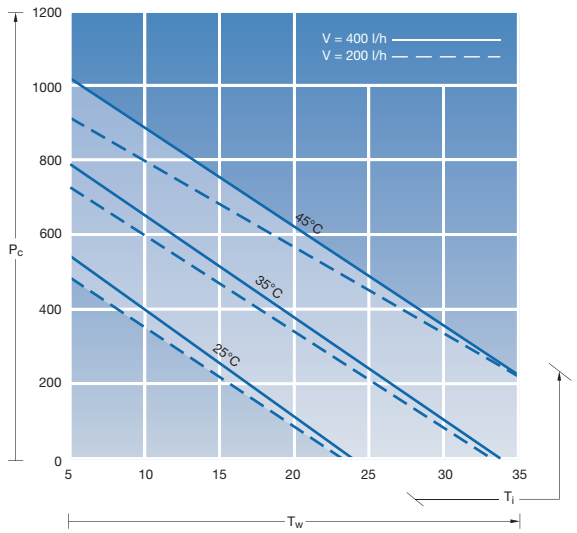


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers HD

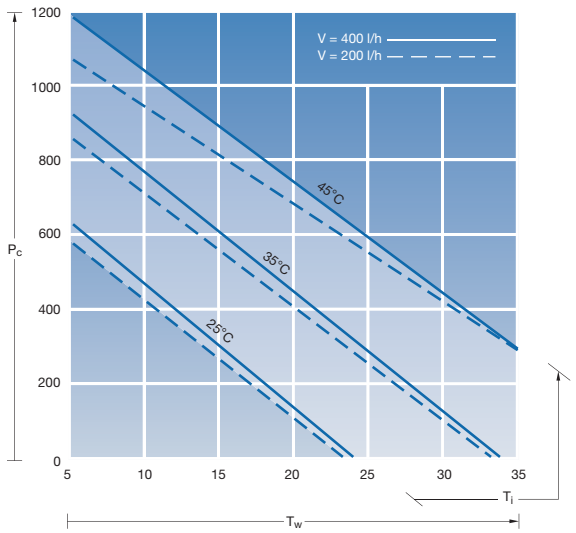
Output class 600/1200 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3214.700



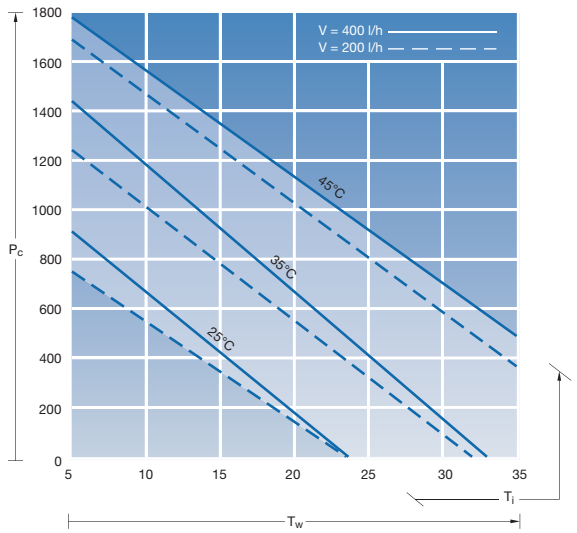
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3274.600



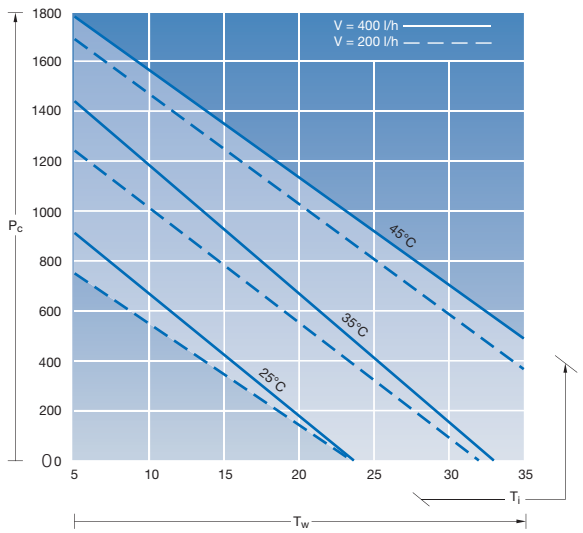
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

50 Hz
SK 3217.500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3217.600

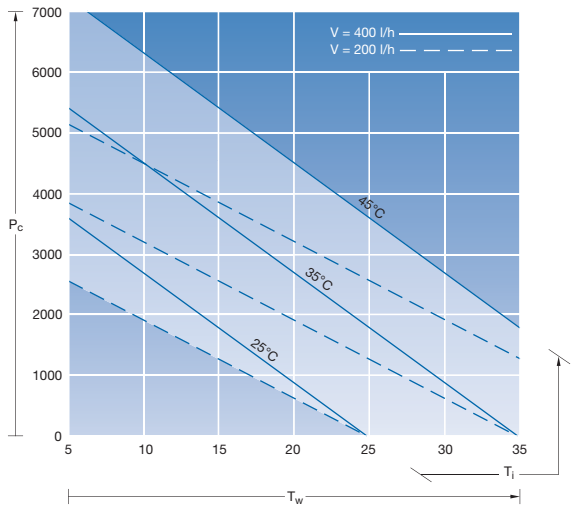


T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Wall-mounted air/water heat exchangers

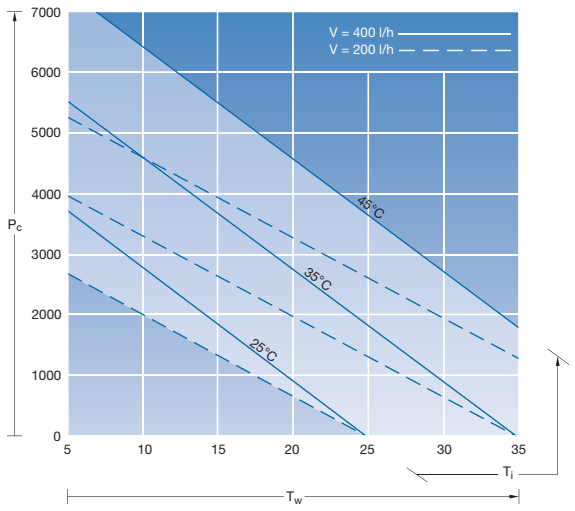
Output class 4000 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3375.504



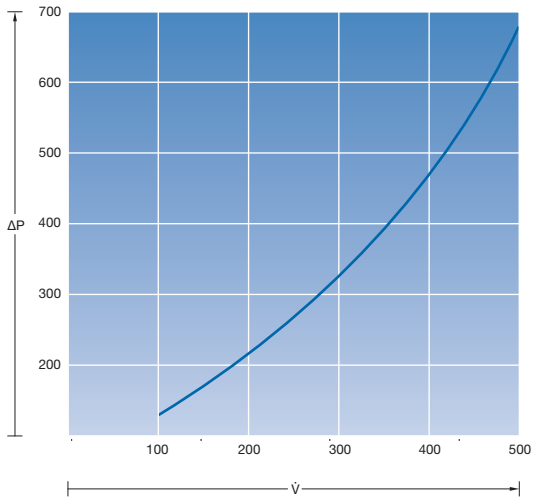
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3375.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3375.504

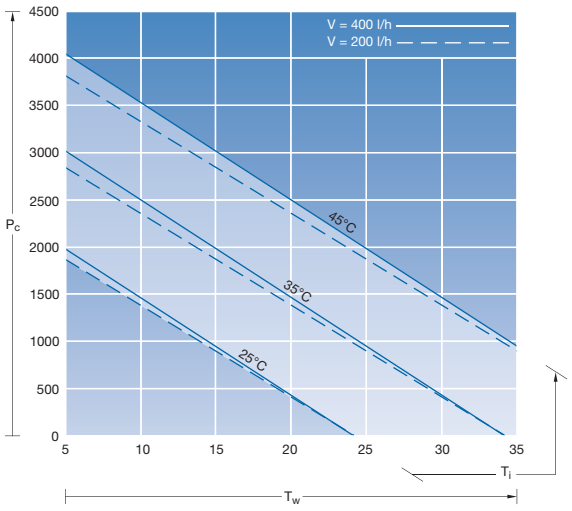


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Roof-mounted air/water heat exchangers

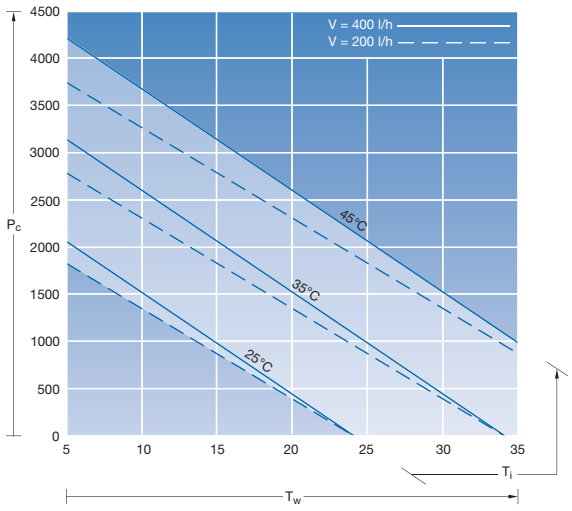
Output class 2500 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3209.100, .500



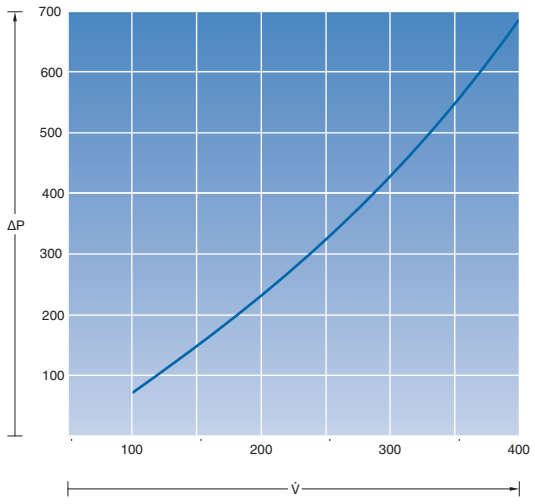
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3209.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3209.100, .500

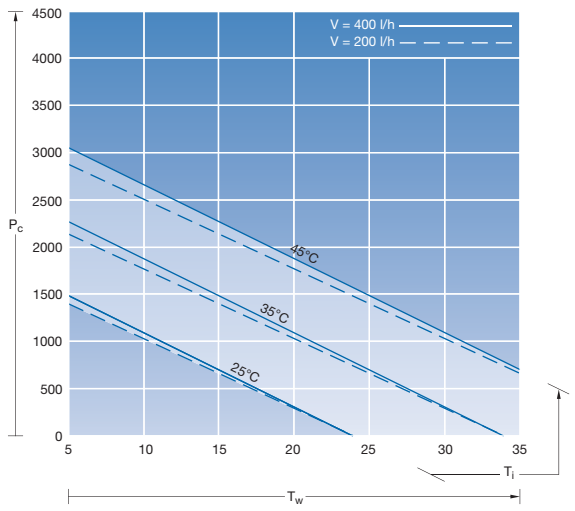


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Roof-mounted air/water heat exchangers

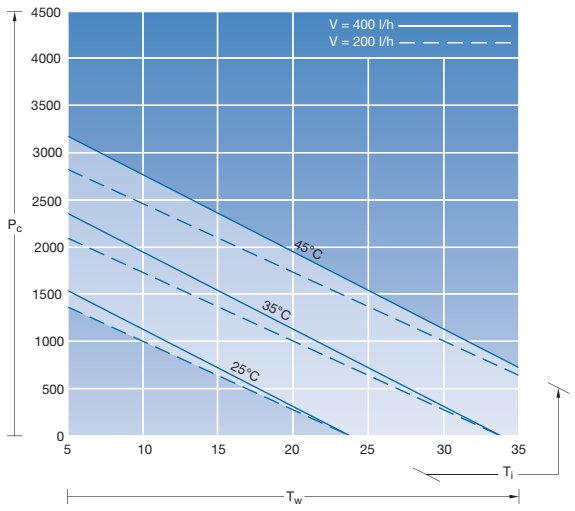
Output class 1875 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3209.504



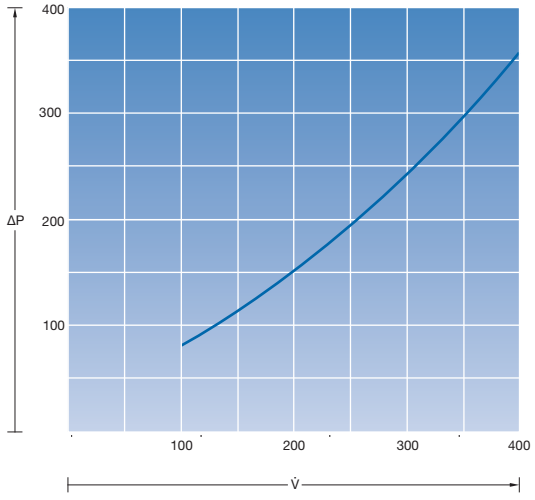
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3209.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3209.504

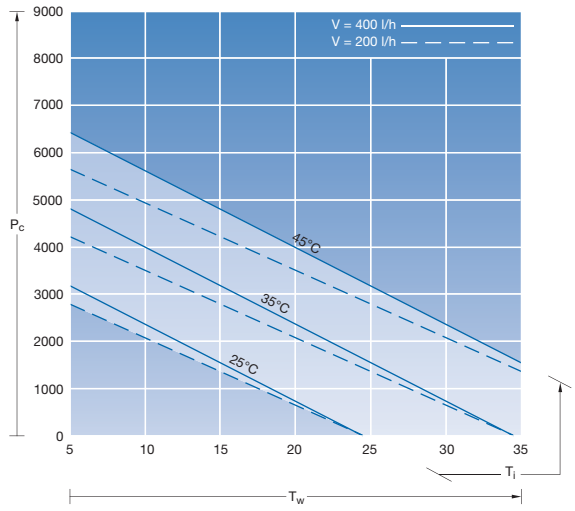


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Roof-mounted air/water heat exchangers

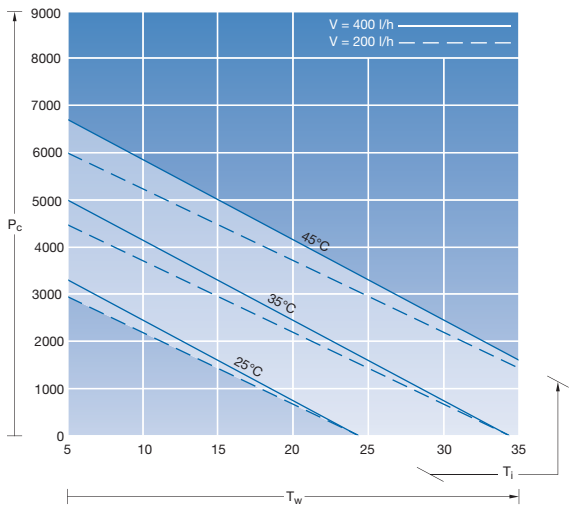
Output class 4000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3210.100, .500



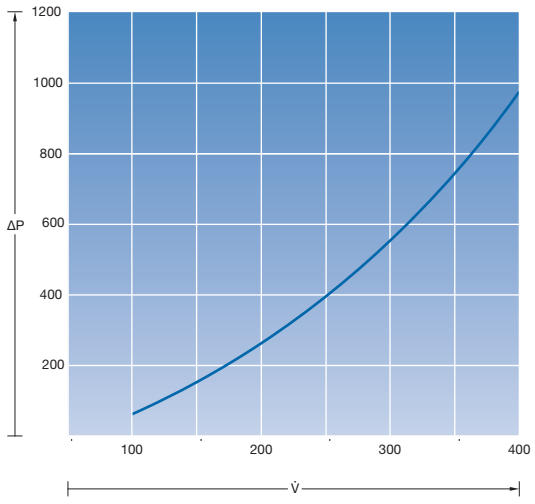
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3210.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3210.100, .500

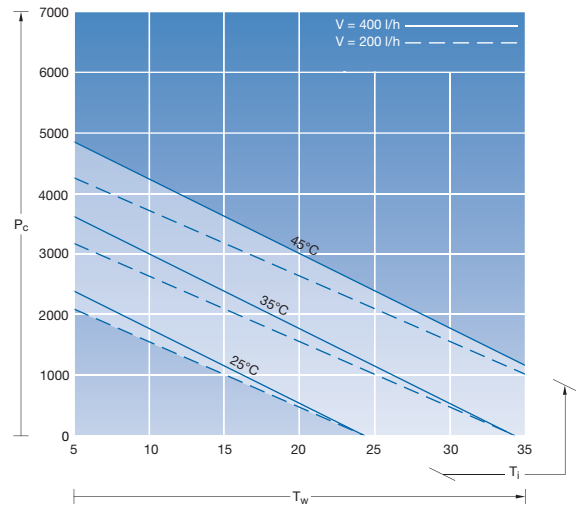


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Roof-mounted air/water heat exchangers

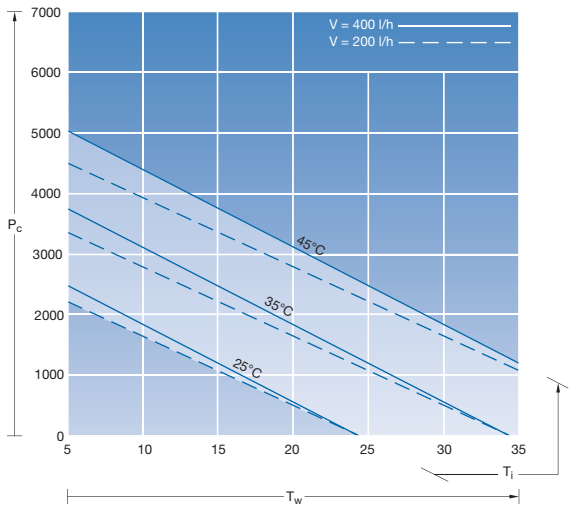
Output class 3000 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3210.504



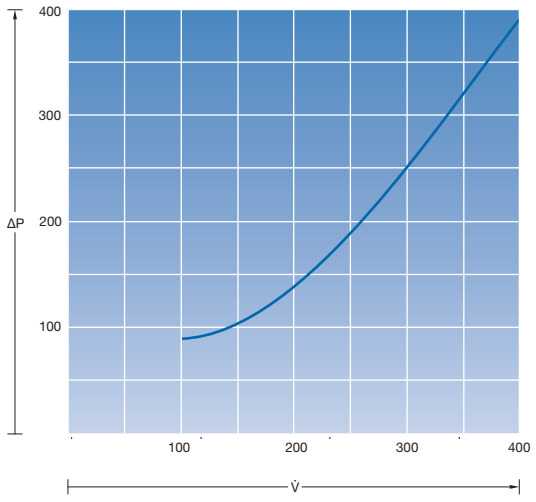
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3210.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3210.504

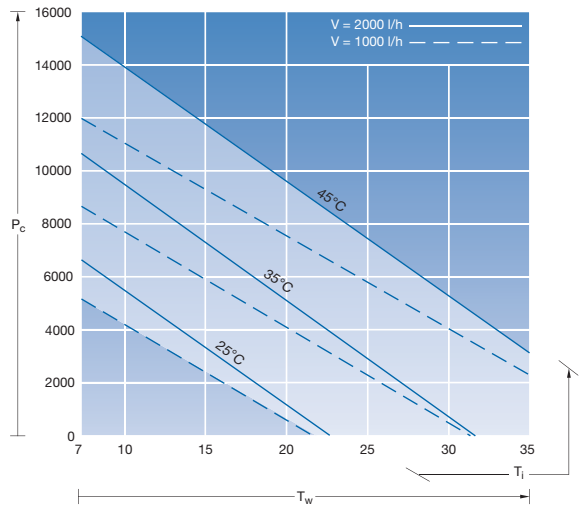


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Liquid Cooling Package

Output class 10 kW, LCP Rack Industry
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3378.200, .280

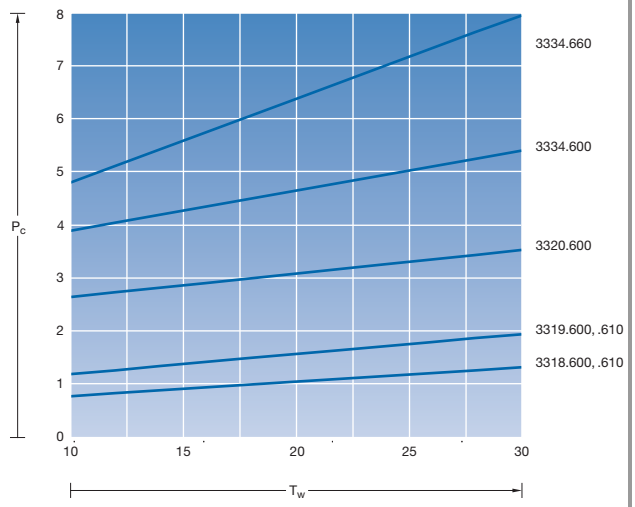


T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm chillers

Output class 1 – 6 kW

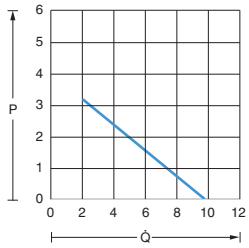
50 Hz at T_u = 32 °C
SK 3318.600, .610, 3319.600, .610, 3320.600, 3334.600, .660



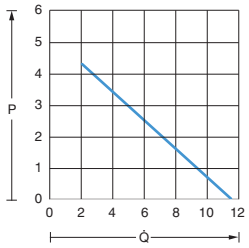
T_w = Water inlet temperature (°C)
T_u = Ambient temperature (°C)
P_c = Total cooling output (kW)

Characteristic curves of pump
SK 3318.600/SK 3318.610/SK 3319.600/SK 3319.610

50 Hz

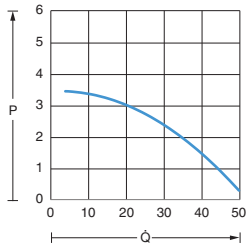


60 Hz

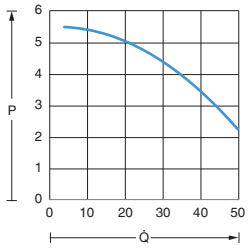


SK 3320.600/SK 3334.600/SK 3334.660

50 Hz



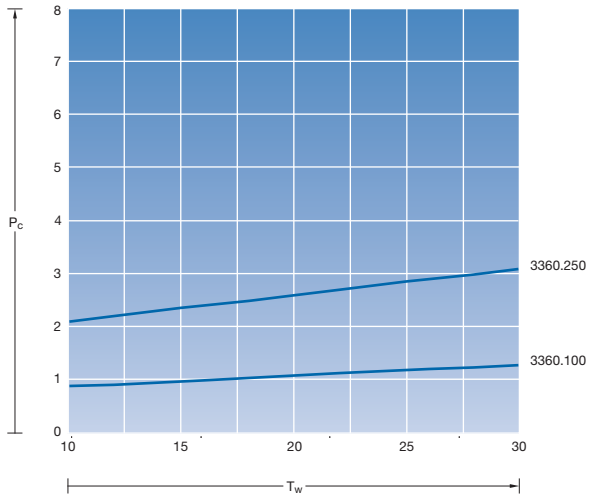
60 Hz



P = External static pressure [bar]
Q̇ = Delivery flow Q [l/min]

Output class 1 – 2.5 kW, wall-mounted

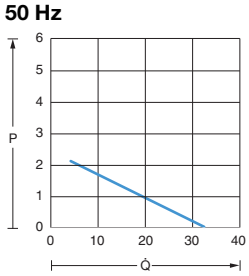
50 Hz at T_u = 32 °C
SK 3360.100, .250



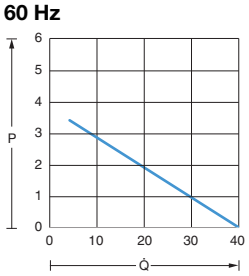
T_w = Water inlet temperature (°C)
T_u = Ambient temperature (°C)
P_c = Total cooling output (kW)

Characteristic curves of pump
SK 3360.100/SK 3360.250

50 Hz



60 Hz

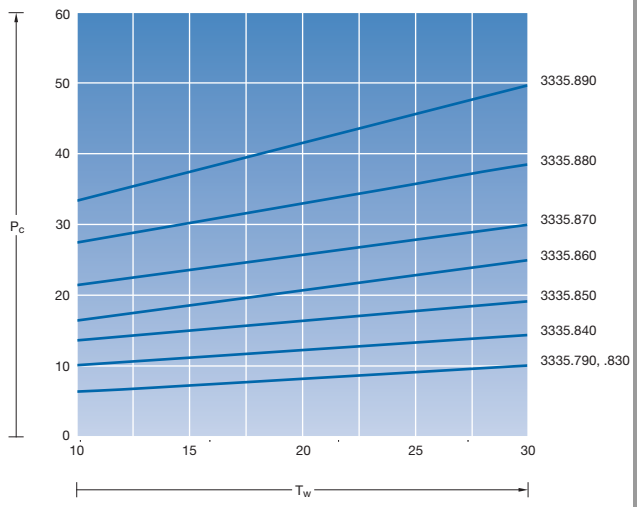


P = External static pressure [bar]
Q̇ = Delivery flow Q [l/min]

TopTherm chillers

Output class 8 – 40 kW

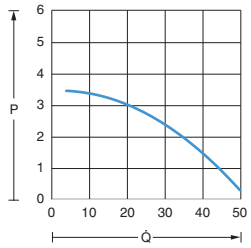
50 Hz at T_u = 32 °C
SK 3335.790, .830, .840, .850, .860, .870, .880, .890



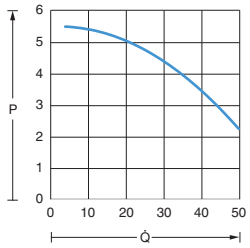
T_w = Water inlet temperature (°C)
T_u = Ambient temperature (°C)
P_c = Total cooling output (kW)

Characteristic curves of pump
SK 3335.790/SK 3335.830

50 Hz

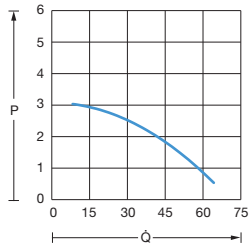


60 Hz

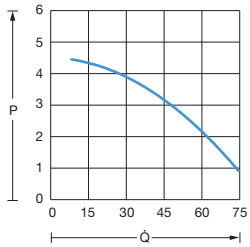


SK 3335.840

50 Hz

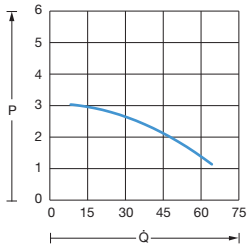


60 Hz

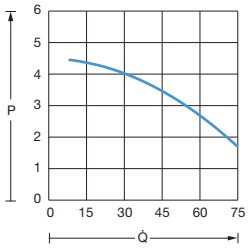


Characteristic curves of pump
SK 3335.850

50 Hz

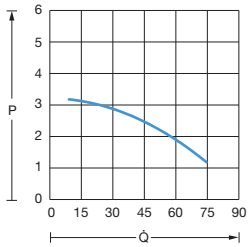


60 Hz

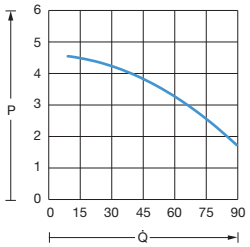


SK 3335.860

50 Hz

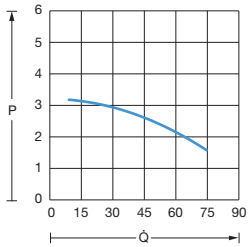


60 Hz

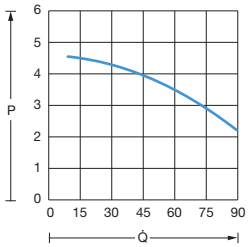


SK 3335.870

50 Hz

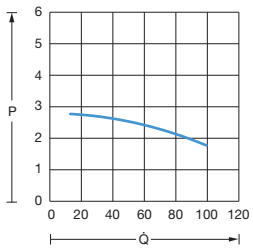


60 Hz

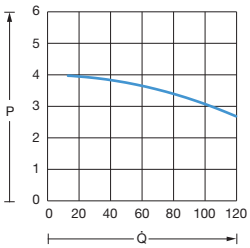


SK 3335.880

50 Hz

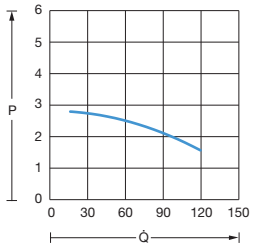


60 Hz

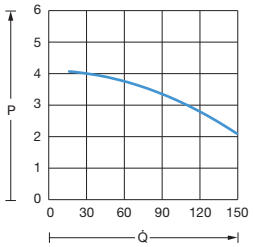


SK 3335.890

50 Hz



60 Hz

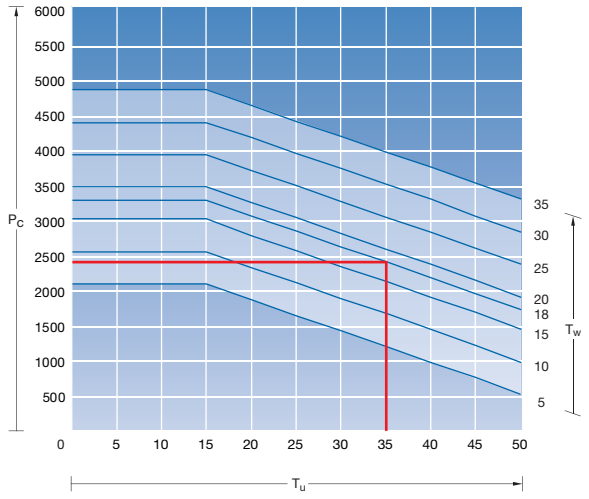


P = External static pressure [bar]
Q̇ = Delivery flow Q [l/min]

Blue e+ chillers

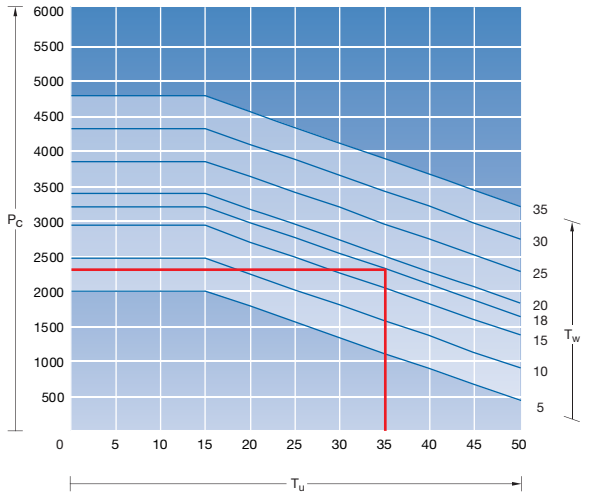
Output class 2.5 kW

50 Hz
SK 3320.200



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

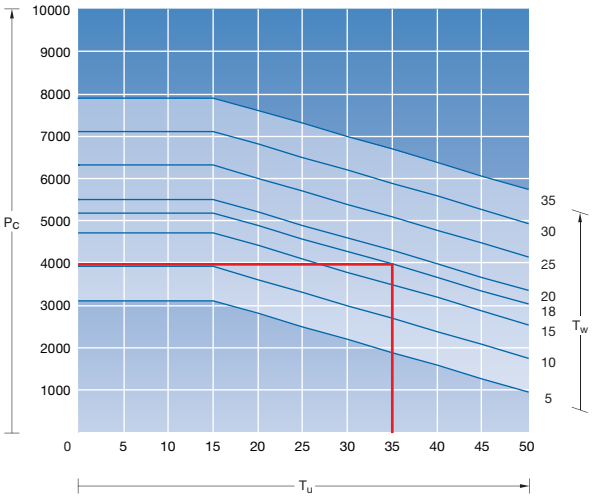
60 Hz
SK 3320.200



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

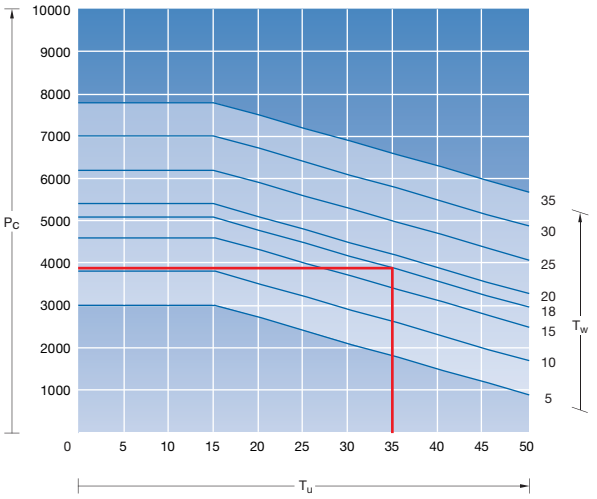
Output class 4.0 kW

50 Hz
SK 3334.300



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

60 Hz
SK 3334.300

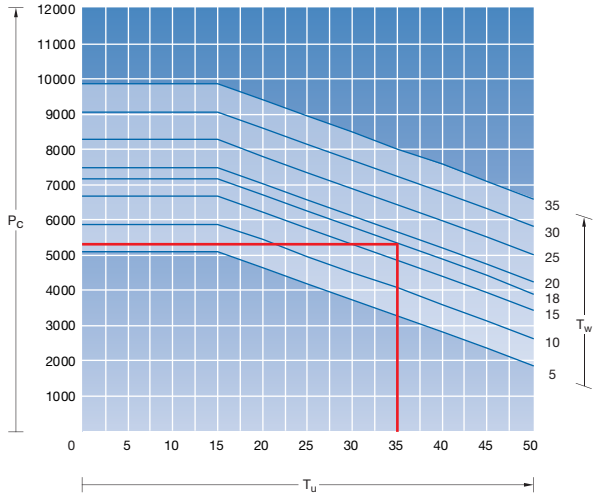


T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Blue e+ chillers

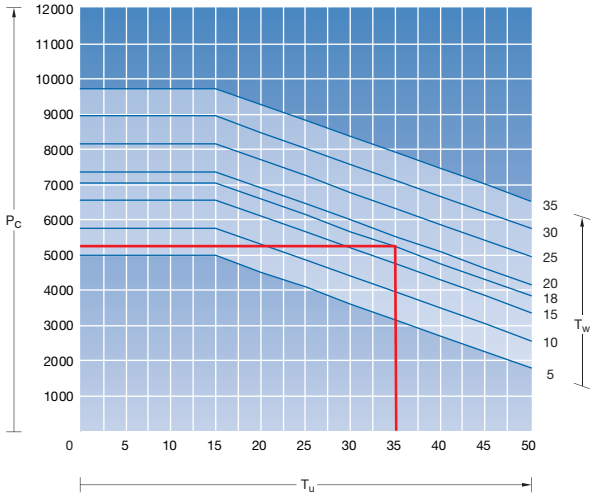
Output class 5.5 kW

50 Hz
SK 3334.400



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

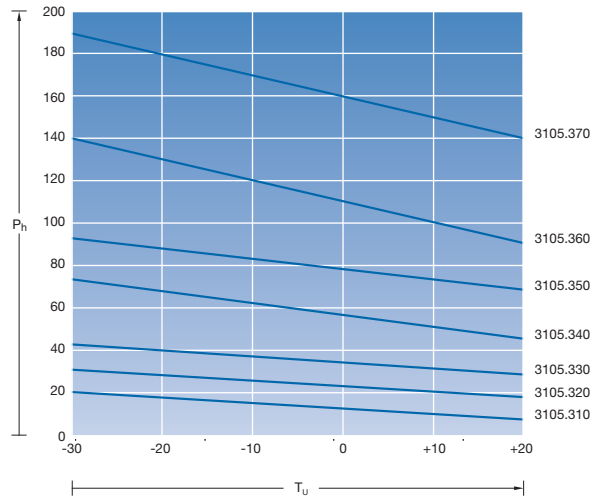
60 Hz
SK 3334.400



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

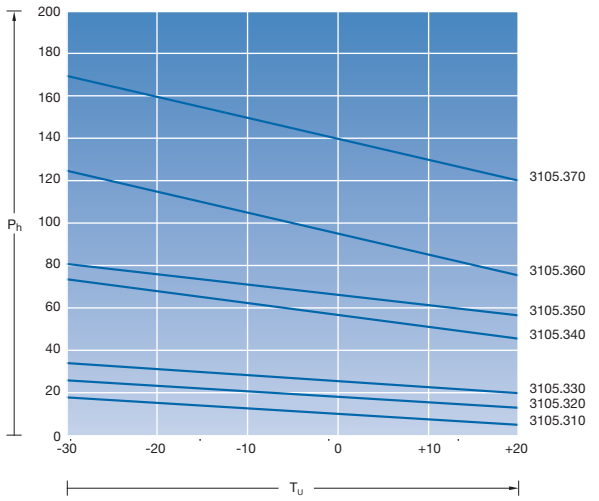
Enclosure heaters without fan

Heating output 230 V



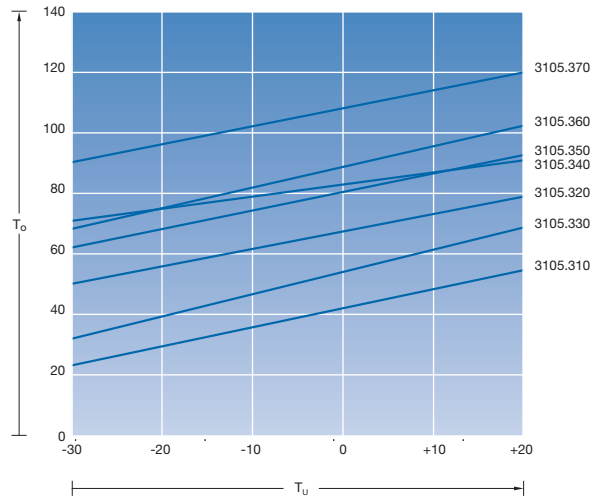
T_u = Ambient temperature (°C)
P_h = Heating output (W)

Heating output 110 V



T_u = Ambient temperature (°C)
P_h = Heating output (W)

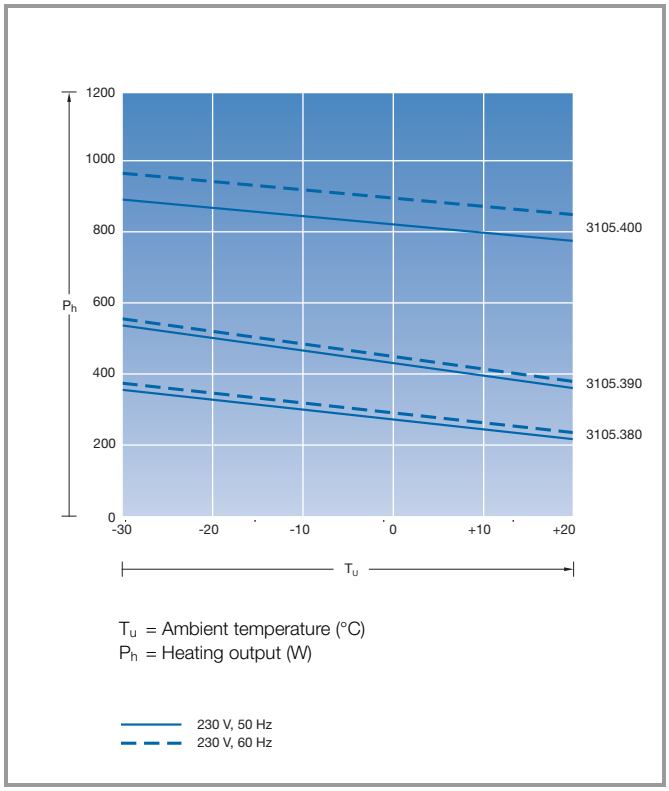
Maximum surface temperature



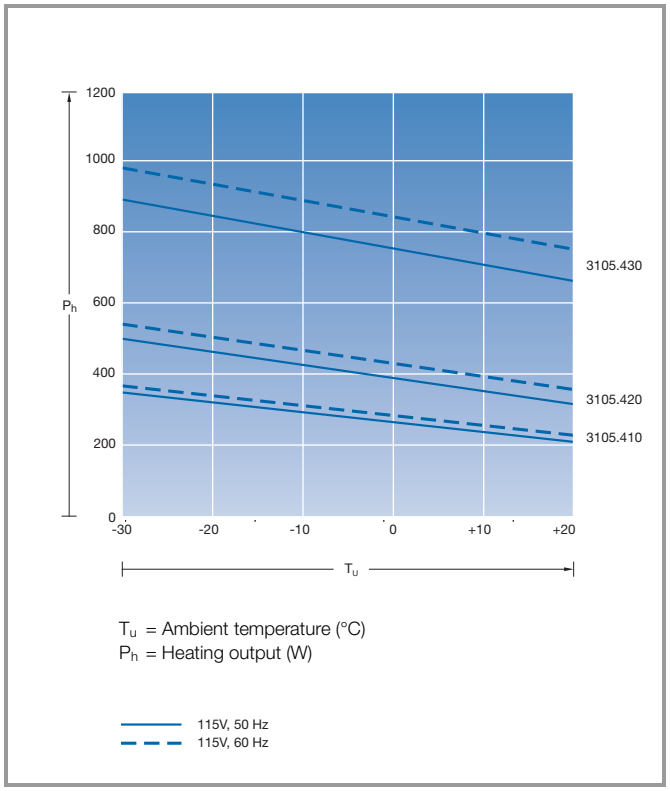
T_u = Ambient temperature (°C)
T_o = Surface temperature (°C)

Enclosure heaters with fan

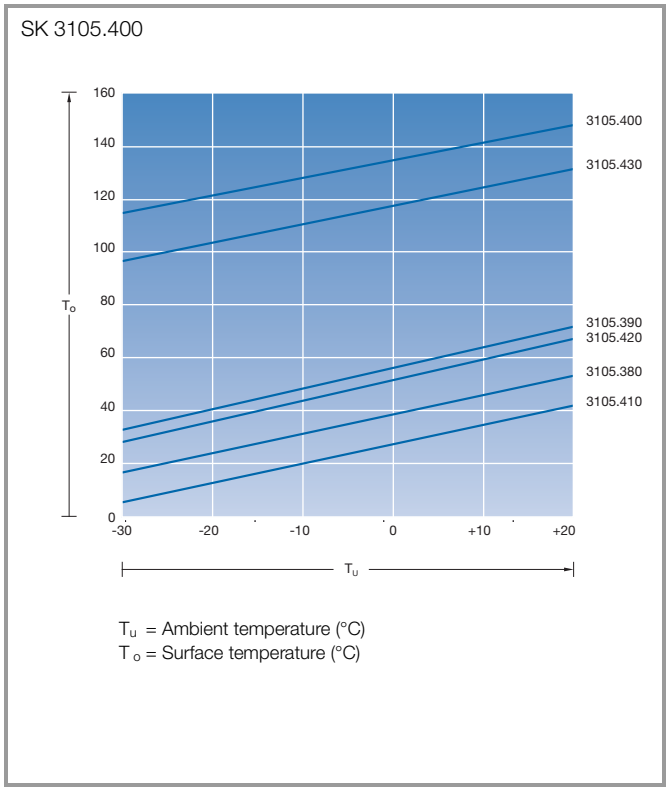
Heating output 230 V, 50/60 Hz



Heating output 115 V, 50/60 Hz



Maximum surface temperature



Rittal – The System.

Faster – better – everywhere.

- Enclosures
- Power Distribution
- Climate Control
- IT Infrastructure
- Software & Services

You can find the contact details of all
Rittal companies throughout the world here.

www.rittal.com/contact

XWW000079EN1901

Rittal – The System.

Faster – better – everywhere.

TopTherm fan-and-filter units – SK 3241.100

Date : May 10, 2019

ENCLOSURES POWER DISTRIBUTION CLIMATE CONTROL IT INFRASTRUCTURE SOFTWARE & SERVICES

FRIEDHELM LOH GROUP

TopTherm fan-and-filter units – SK 3241.100

created: 10.05.2019 build on www.rittal.com/uk-en



Product description

Colour:	RAL 7035
Protection category IP to IEC 60 529:	IP 54 with standard filter and additional fine filter mat: IP 55 with standard filter and hose-proof hood: IP 56
Protection category NEMA:	with standard filter: Type 12 with standard filter and additional fine filter mat: Type 12 with standard filter and hose-proof hood: Type 3, 3R, 4, 4X
Supply includes:	Complete unit ready to install, including filter mat
Note:	With the fan-and-filter unit 3237.XXX, electrical connection is made via two single wires on the unit; for all other fan-and-filter units, a screwless spring terminal is used.

Product features

Air throughput (unimpeded air flow):	At 50 Hz: 230 m³/h At 60 Hz: 250 m³/h
Air throughput with outlet filter including standard filter mat (quantity x order number, output 50/60 Hz):	1 x 3240200: 183/205 m³/h 2 x 3240200: 203/220 m³/h 1 x 3243200: 203/230 m³/h
Rated operating voltage:	230 V, 1~, 50 Hz/60 Hz
Dimensions:	Width: 255 mm Height: 255 mm

© Rittal 2019

Required mounting cut-out:	Width: 224 mm Height: 224 mm
Build depth:	25 mm
Installation depth:	107 mm
Temperature range:	Bearing: -30°C…+70°C Operation (environment): -30°C...+55°C
Power consumption P---sub---el---subcl---:	At 50 Hz: 40 W At 60 Hz: 42 W
Rated current (max.):	At 50 Hz: 0.26 A At 60 Hz: 0.24 A
Miniature circuit-breaker/fuse:	4 A
Noise level:	At 50 Hz: 54 dB(A) At 60 Hz: 56 dB(A)
Diagonal fan:	Diagonal, self-starting shaded pole motor
Packs of:	1 pc(s).
Weight/pack:	2.24 kg
EAN:	4028177651982
Customs tariff number:	84145915
ETIM 6.0:	EC000320
ETIM 5.0:	EC000320
eCl@ss 8.0/8.1:	27180716
eCl@ss 7.0/7.1:	27180716
eCl@ss 6.0/6.1:	27180716
eCl@ss 5.1/5.1.4:	27180705
Product description:	SK fan and filter units TopTherm, 230/250 m³/h, 230 V, 1~, 50/60 Hz, WHD: 255 x 255 x 25 mm

Approvals

© Rittal 2019

Approvals:	Approval overview CSA UL + C-UL - FTTA UR + C-UR
Certificates:	EAC
Declarations:	Declaration of conformity

© Rittal 2019

Rittal – The System.

Faster – better – everywhere.

Performance diagrams – Climate control



ENCLOSURES | POWER DISTRIBUTION | CLIMATE CONTROL | IT INFRASTRUCTURE | SOFTWARE & SERVICES

FRIEDHELM LOH GROUP

Rittal – The System.

Faster – better – everywhere.



ENCLOSURES | POWER DISTRIBUTION | CLIMATE CONTROL

FRIEDHELM LOH GROUP

Performance diagrams

Cooling with ambient air

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units
Air throughput 20/25 – 900 m^3/h ..... 4 – 7
TopTherm fan-and-filter units, with EC technology
Air throughput 55 – 900 m^3/h ..... 8 – 9
Roof-mounted fans
Air throughput 500 – 1069 m^3/h ..... 10 – 12
Rack-mounted fans for 482.6 mm (19˝)
Air throughput 320/480 m^3/h 12
Tangential fans for 482.6 mm (19˝)
Air throughput 320 m^3/h 12
Selection diagram for fans 13
TopTherm air/air heat exchangers
Specific thermal output 17.5 – 90 W/K 13
Selection diagram for air/air heat exchangers 13

Cooling units

VX25 Blue e+ integration solution
Output class 1300 W
(110 – 240 V, 1 ~, 50 – 60 Hz / 380 – 480 V, 3 ~, 50 – 60 Hz) 14
Thermoelectric coolers
Total cooling output 100 W 15
TopTherm wall-mounted cooling units Blue e
Output class 300 – 2500 W (115/230 V, 1~, 400 V, 2~) ..... 15 – 18
TopTherm wall-mounted cooling units Blue e, slimline
Output category 1500 W (230 V, 1~, 400/460 V, 3~) 19
TopTherm wall-mounted cooling units Blue e
Output class 1000 – 4000 W (400/460 V, 3~) ..... 20 – 22
Wall-mounted cooling units Blue e+
Output class 1600 – 5800 W 23
TopTherm roof-mounted cooling units Blue e
Output class 500 – 2000 W (115/230 V, 1~, 400 V, 2~) ..... 25 – 27
TopTherm roof-mounted cooling units Blue e
Output class 3000 – 4000 W (400/460 V, 3~) 28
Roof-mounted cooling unit Blue e+
Output class 1300 W
(110 – 240 V, 1 ~, 50 – 60 Hz / 380 – 480 V, 3 ~, 50 – 60 Hz) 29
Modular climate control concept – Cooling module Blue e
Output class 1500 – 2500 W (230 V, 1~, 400/460 V, 3~) ..... 30 – 31

Cooling with water

Wall-mounted air/water heat exchangers
Output class 300 – 7000 W ..... 32 – 42
Roof-mounted air/water heat exchangers
Output class 1875 – 4000 W ..... 43 – 46
Liquid Cooling Package
Output class 10 kW 47
TopTherm chillers
Output class 1 – 40 kW ..... 48 – 49
Blue e+ chillers
Output class 2.5 – 5.5 kW 50

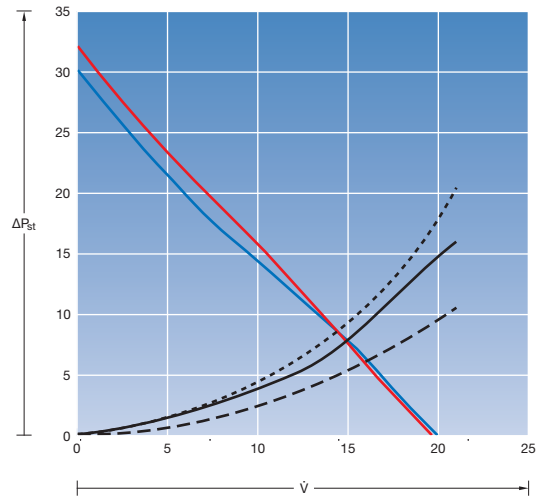
Enclosure heaters

Enclosure heaters without fan
Heating output 8 – 150 W 52
Enclosure heaters with fan
Heating output 250 – 800 W 53

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units

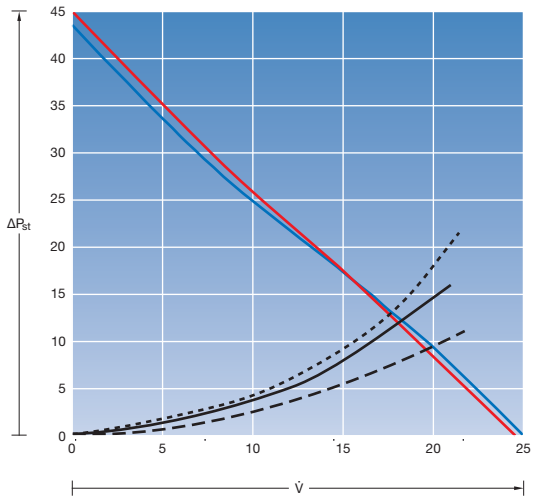
Air throughput 20/25 m³/h

50 Hz
SK 3237.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

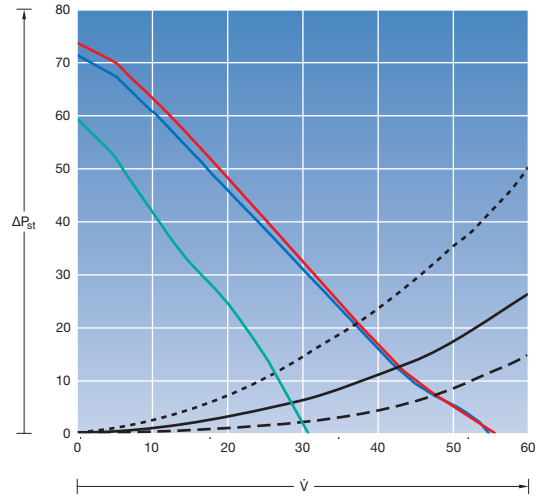
60 Hz
SK 3237.100, .110, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

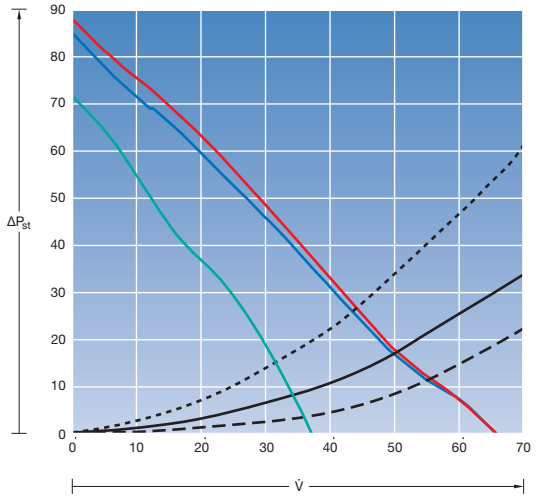
Air throughput 55/66 m³/h

50 Hz
SK 3238.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

60 Hz
SK 3238.100, .110, .600

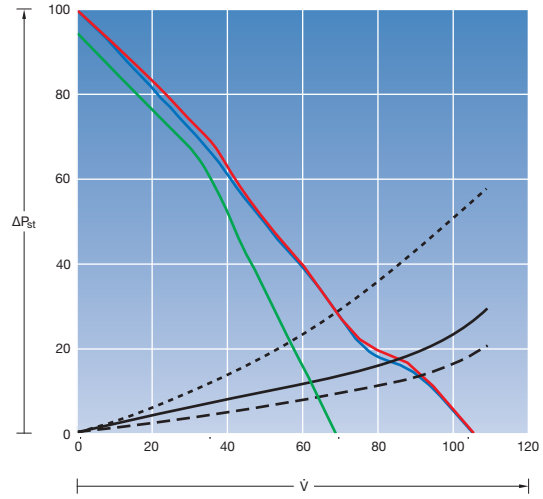


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units

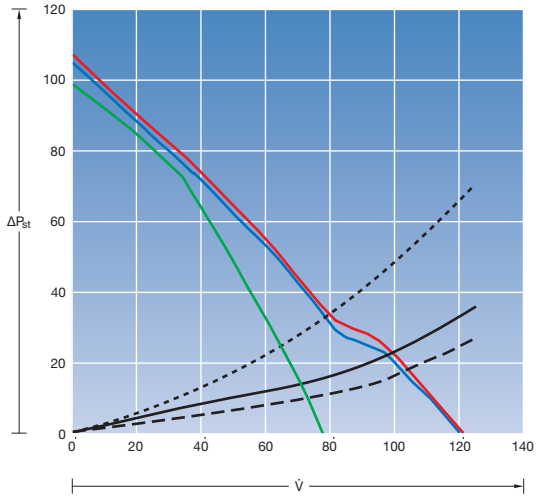
Air throughput 105/120 m³/h

50 Hz
SK 3239.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

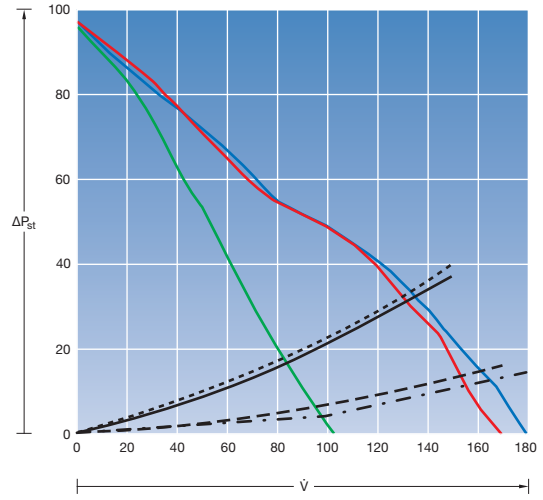
60 Hz
SK 3239.100, .110, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

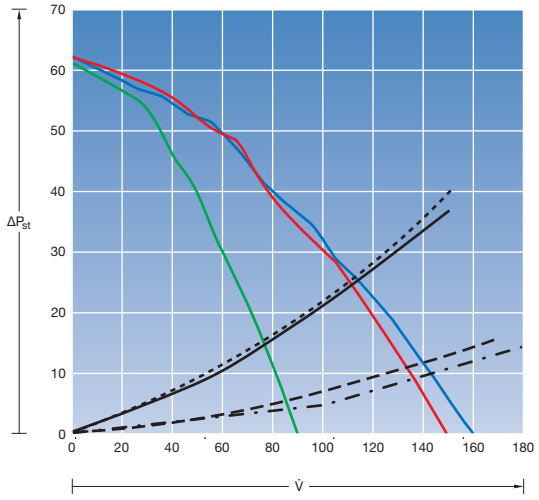
Air throughput 180/160 m³/h

50 Hz
SK 3240.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

60 Hz
SK 3240.100, .110, .600

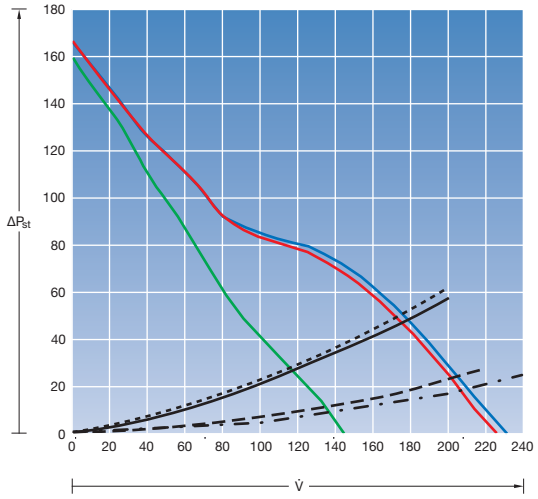


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units

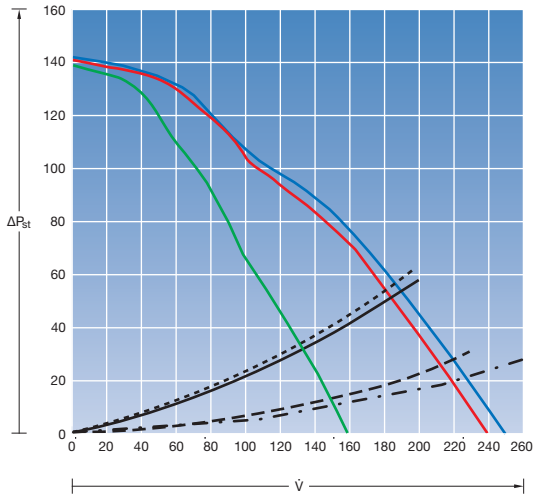
Air throughput 230/250 m³/h

50 Hz
SK 3241.100, .110, .124, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

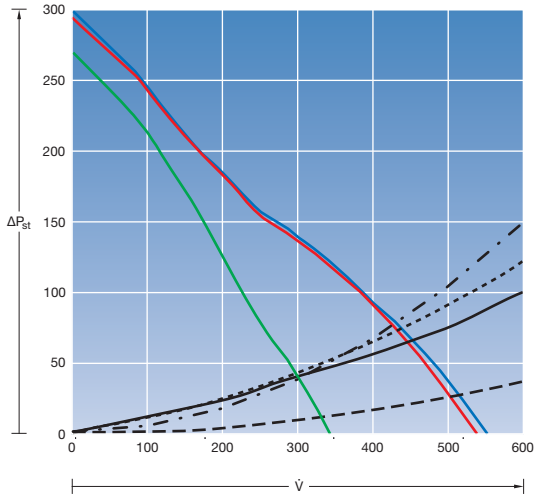
60 Hz
SK 3241.100, .110, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

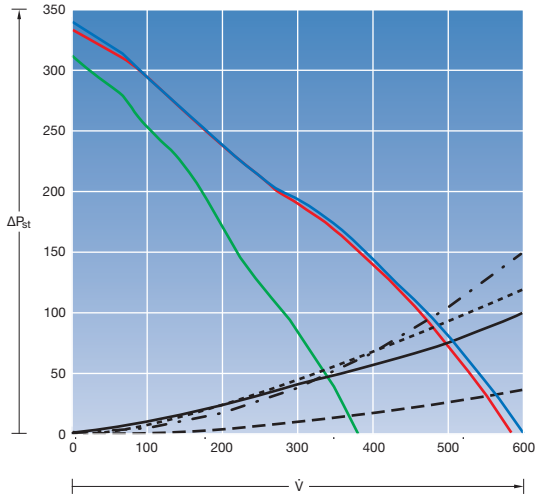
Air throughput 550/600 m³/h

50 Hz
SK 3243.100, .110, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

60 Hz
SK 3243.100, .110, .600

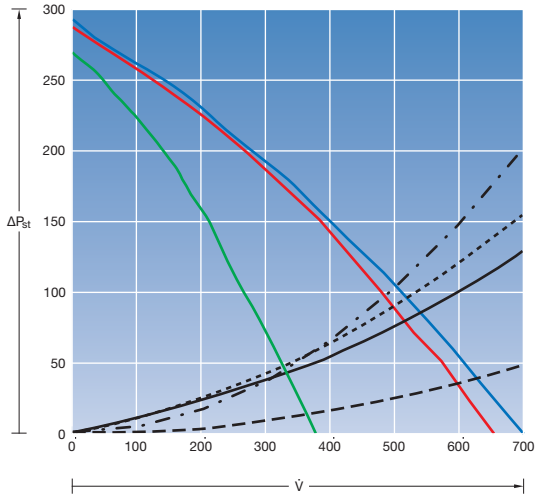


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

TopTherm fan-and-filter units and EMC TopTherm fan-and-filter units

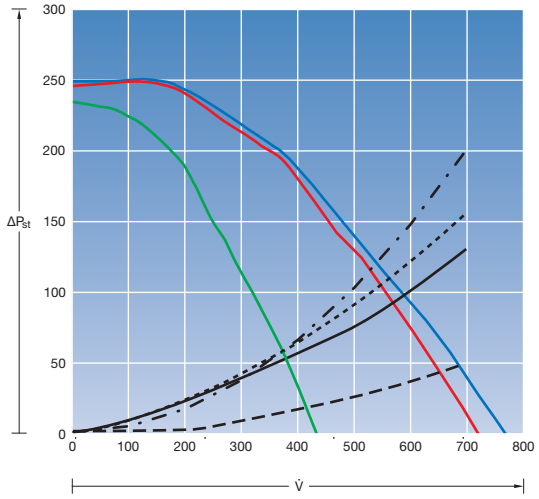
Air throughput 700/770 m³/h

50 Hz
SK 3244.100, .110, .140, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

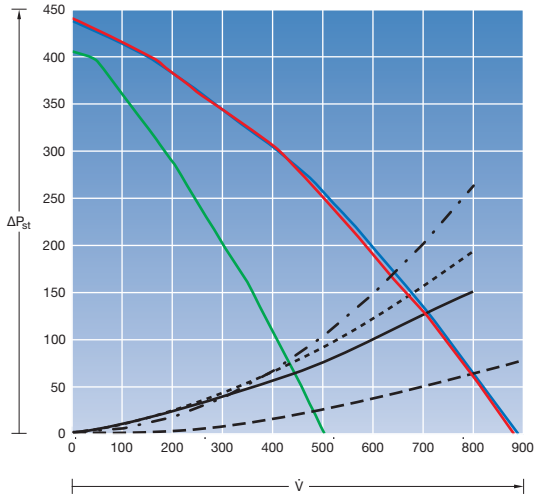
60 Hz
SK 3244.100, .110, .140, .600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Air throughput 900 m³/h

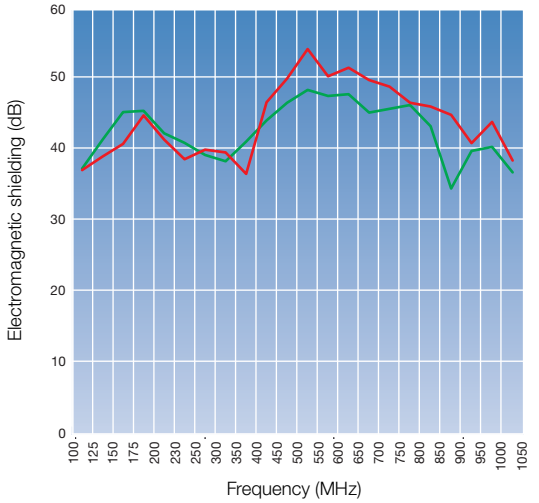
50/60 Hz
SK 3245.600



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Shielding/attenuation diagram
Testing to EN 61587-3: 2006 – Electromagnetic shielding performance tests for cabinets, racks and sub-racks

TopTherm EMC fan-and-filter units/outlet filters
SK 3237.XXX – SK 3245.XXX

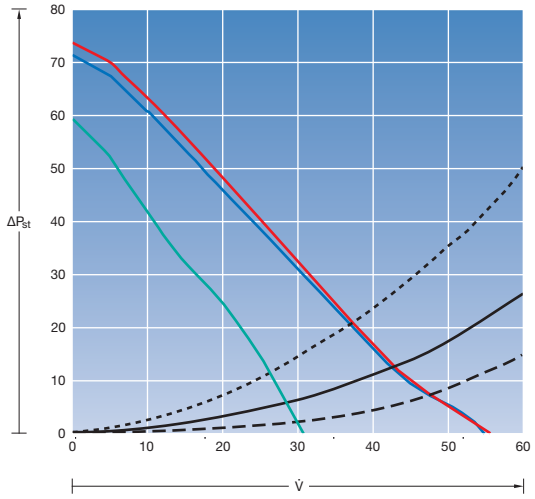


= vertical attenuation
= horizontal attenuation

TopTherm fan-and-filter units with EC technology

Air throughput 55 m³/h

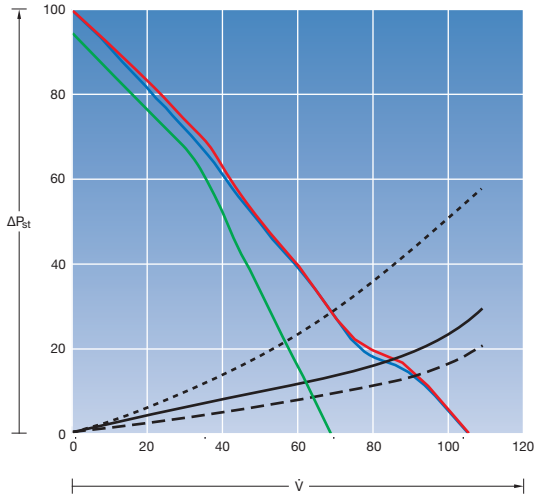
50/60 Hz
SK 3238.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

Air throughput 105 m³/h

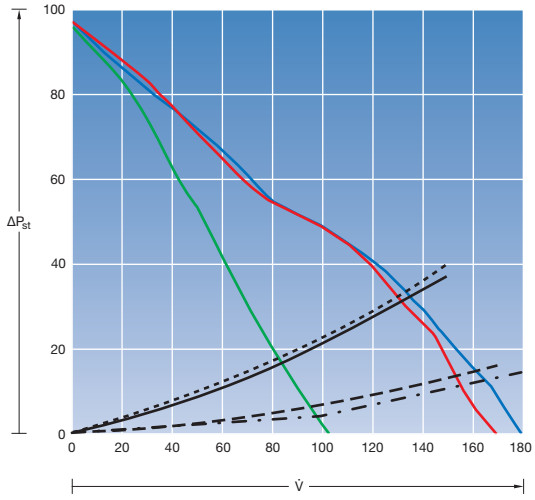
50/60 Hz
SK 3239.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter

Air throughput 180 m³/h

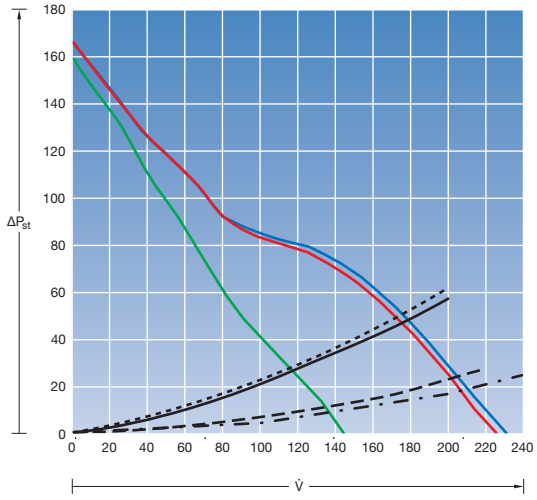
50/60 Hz
SK 3240.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Air throughput 230 m³/h

50/60 Hz
SK 3241.500

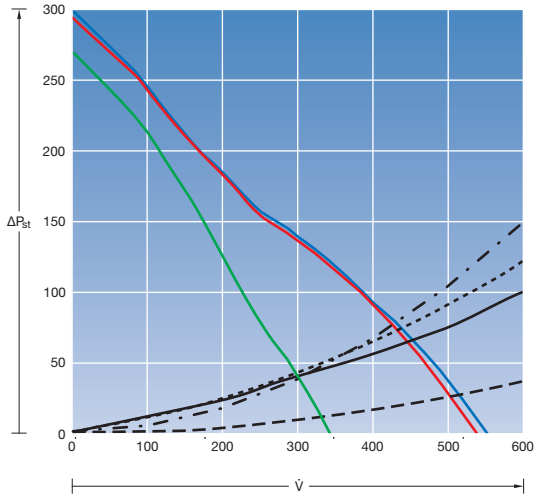


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

TopTherm fan-and-filter units with EC technology

Air throughput 550 m³/h

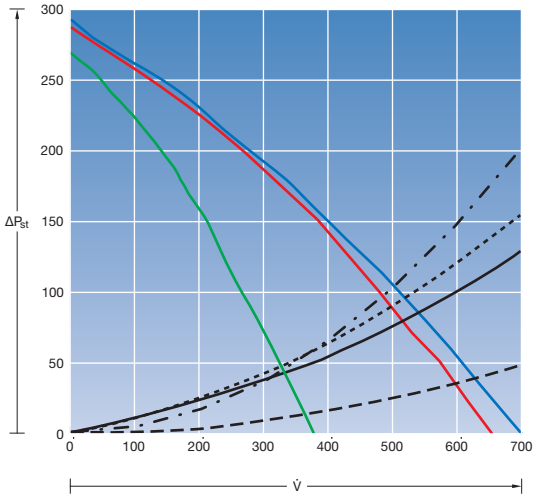
50/60 Hz
SK 3243.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Air throughput 700 m³/h

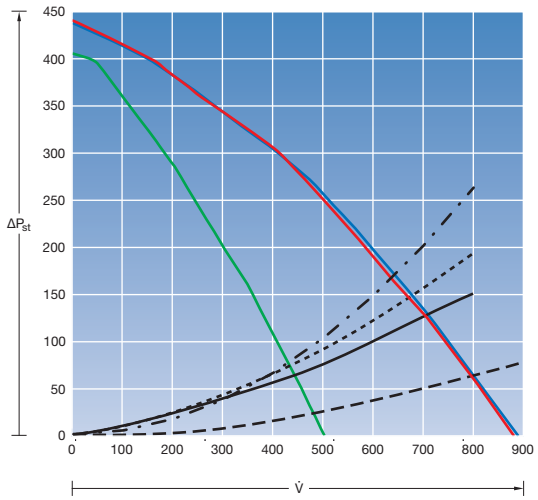
50/60 Hz
SK 3244.500



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Air throughput 900 m³/h

50/60 Hz
SK 3245.500, .510



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= with standard filter
= with hose-proof hood
= with standard and fine filter
= 1 x outlet filter with hose-proof hood
= 1 x outlet filter
= 2 x outlet filter
= 1 x roof vent 3138.000 with filter

Roof-mounted fans

Using the base/plinth:

If the vented base/plinth is used as an air inlet instead of the outlet filter 3243.200, the resistance curves as indicated in the performance diagrams will apply as follows:

----- 1 x vented base/plinth with filter

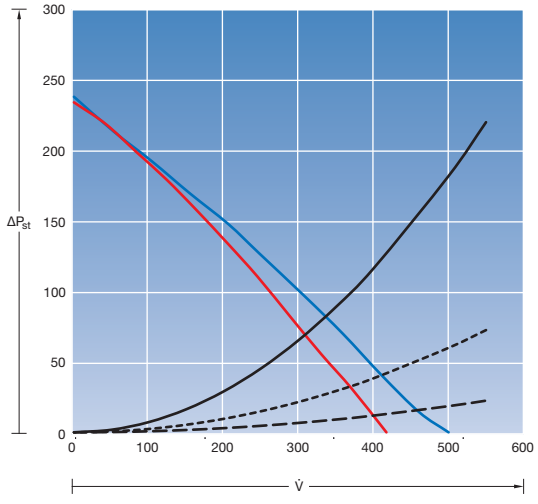
– – – 2 x vented base/plinth with filter

– – – 1 x vented base/plinth without filter

Roof-mounted fans

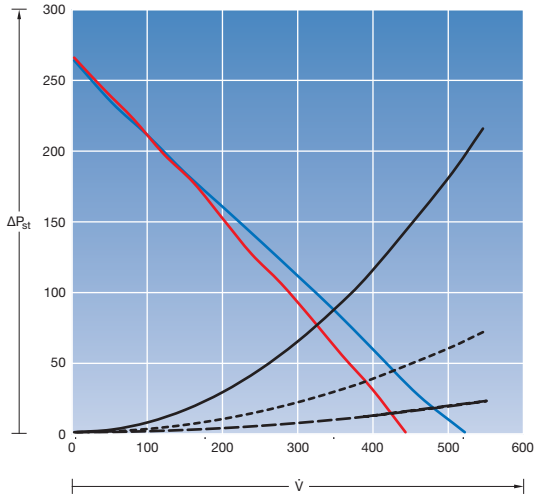
Air throughput 500/525 m³/h

50 Hz
SK 3139.100/.110



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= without filter mat (IP 22)
= with filter mat (IP 55)
= 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
----- = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
– – – = 2 x outlet filter 3243.200 with standard filter (IP 54)

60 Hz
SK 3139.100/.110

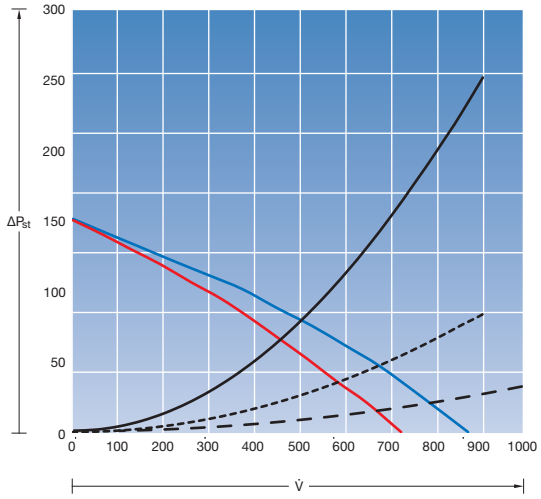


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= without filter mat (IP 22)
= with filter mat (IP 55)
= 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
----- = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
– – – = 2 x outlet filter 3243.200 with standard filter (IP 54)

Roof-mounted fans

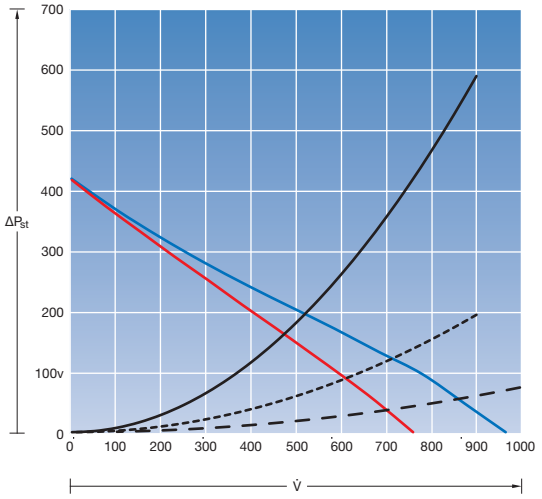
Air throughput 873/965 m³/h

50 Hz
SK 3140.100/.110



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
— = without filter mat (IP 22)
— = with filter mat (IP 55)
— = 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 2 x outlet filter 3243.200 with standard filter (IP 54)

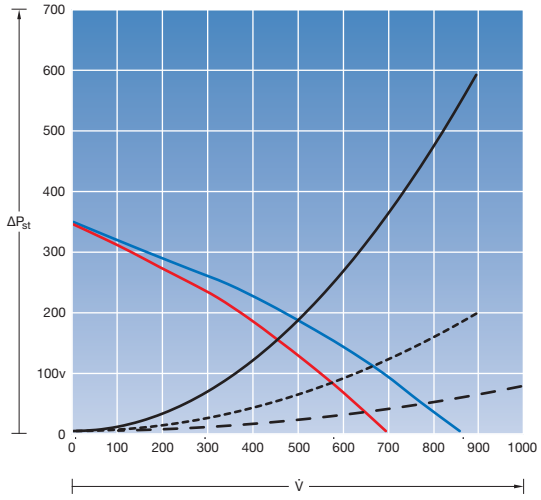
60 Hz
SK 3140.100/.110



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
— = without filter mat (IP 22)
— = with filter mat (IP 55)
— = 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 2 x outlet filter 3243.200 with standard filter (IP 54)

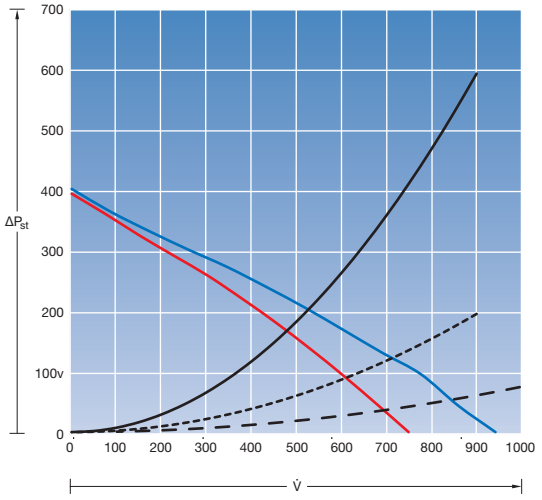
Air throughput 863/942 m³/h

400 V, 50 Hz
SK 3140.140



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
— = without filter mat (IP 22)
— = with filter mat (IP 55)
— = 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 2 x outlet filter 3243.200 with standard filter (IP 54)

400 V, 60 Hz
SK 3140.140

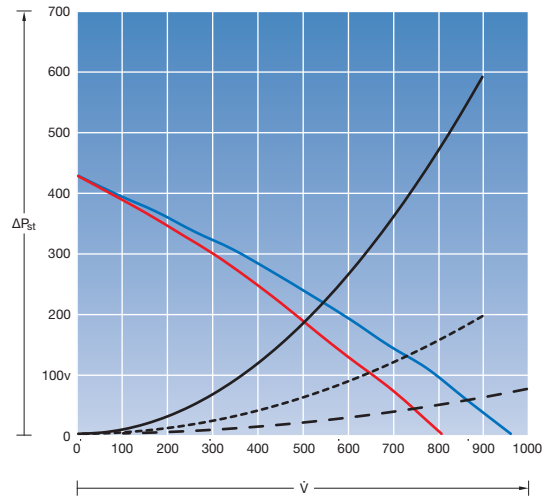


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
— = without filter mat (IP 22)
— = with filter mat (IP 55)
— = 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
- - - = 2 x outlet filter 3243.200 with standard filter (IP 54)

Roof-mounted fans

Air throughput 963 m³/h

460 V, 60 Hz
SK 3140.140

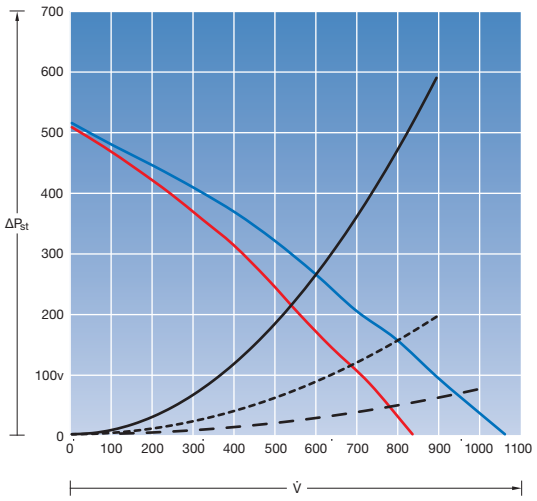


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= without filter mat (IP 22)
= with filter mat (IP 55)
= 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
= 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
= 2 x outlet filter 3243.200 with standard filter (IP 54)

Roof-mounted fans with EC technology

Air throughput 1069 m³/h

50/60 Hz
SK 3140.500/.510

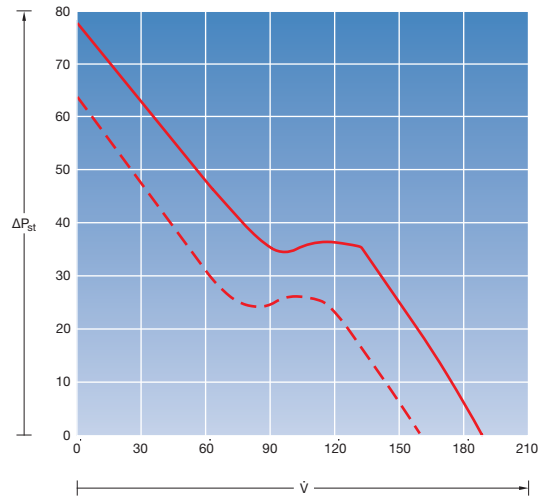


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= without filter mat (IP 22)
= with filter mat (IP 55)
= 1 x outlet filter 3243.200 with standard and fine filter (IP 55)
= 1 x outlet filter 3243.200 with standard filter (IP 54) or 2 x outlet filter 3243.200 with standard and fine filter (IP 55)
= 2 x outlet filter 3243.200 with standard filter (IP 54)

Rack-mounted fans for 482.6 mm (19˝)

Air throughput 320/480 m³/h

50/60 Hz
SK 3340.230, 3341.024, .115, .230, 3342.024, .230, .500, 3350.115, .230, 3351.230, 3352.230, .500

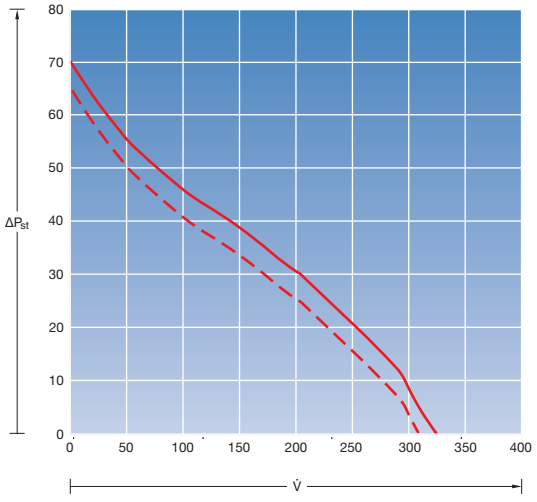


V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= 50 Hz
= 60 Hz

Tangential fans for 482.6 mm (19˝)

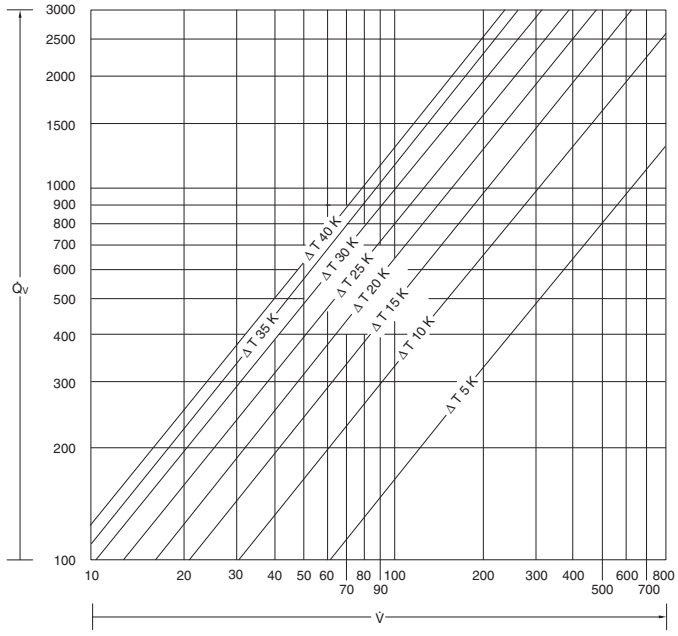
Air throughput 320 m³/h

50/60 Hz
SK 3144.000, 3145.000



V̇ = Volumetric flow (m³/h)
ΔPst = Stat. pressure difference (Pa)
= 50 Hz
= 60 Hz

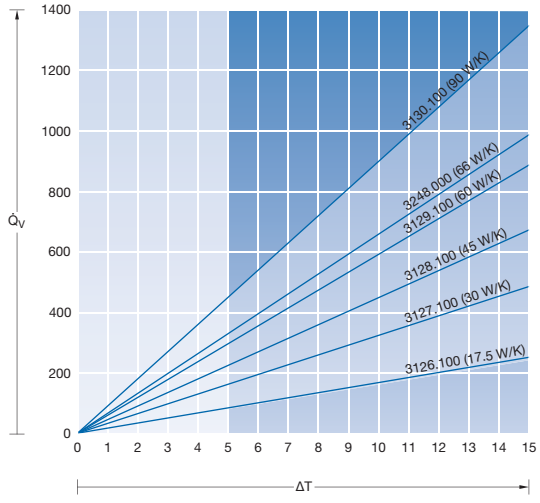
Selection diagram
for fans



$\dot{V}$ = Volumetric flow (m^3/h)
$\dot{Q}_V$ = Heat loss (W)

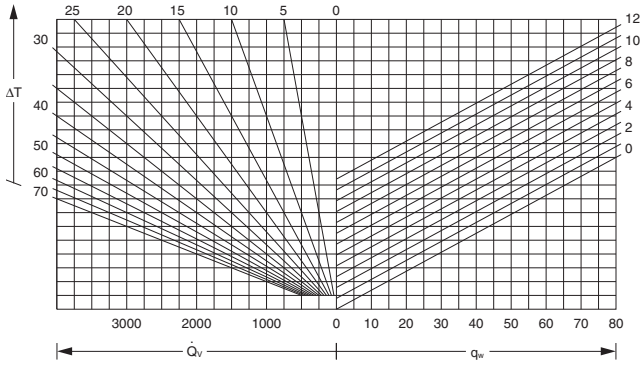
TopTherm air/air heat exchangers
Specific thermal output 17.5 – 90 W/K, wall-mounted with controller

50/60 Hz
SK 3126.100, 3127.100, 3128.100, 3129.100, 3130.100, 3248.000



$\dot{Q}_V$ = Heat loss (W)
ΔT = Temperature difference (K)

Selection diagram
for air/air heat exchangers

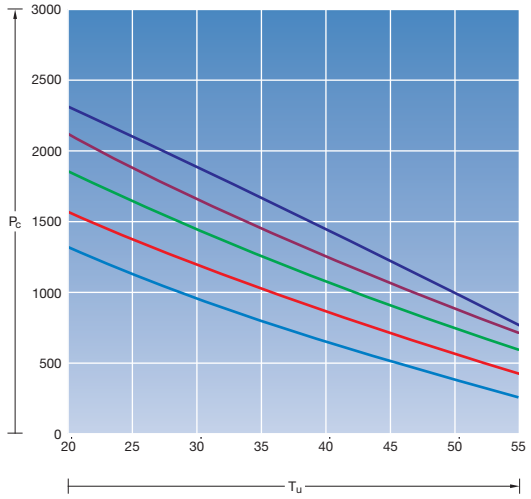


ΔT	=	Temperature difference (K)
$\dot{Q}_V$	=	Heat loss (W)
q_W	=	Specific thermal output (W/K)
A	=	Enclosure surface area to IEC 890 (m^2)
k	=	Heat transfer coefficient (W/m^2 K) for sheet steel k = 5.5 W/m^2 K

VX25 Blue e+ integration solution

Output class 1300 W (110 – 240 V, 1 ~, 50 – 60 Hz / 380 – 480 V, 3 ~, 50 – 60 Hz)

1.30 kW
SK 3185.030



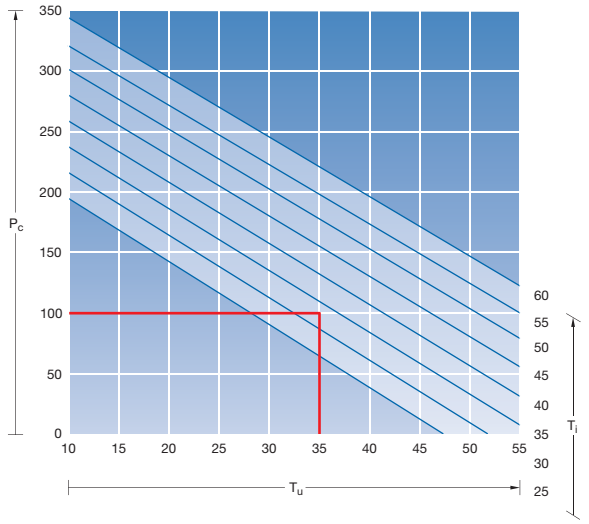
Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Thermoelectric coolers

Cooling output

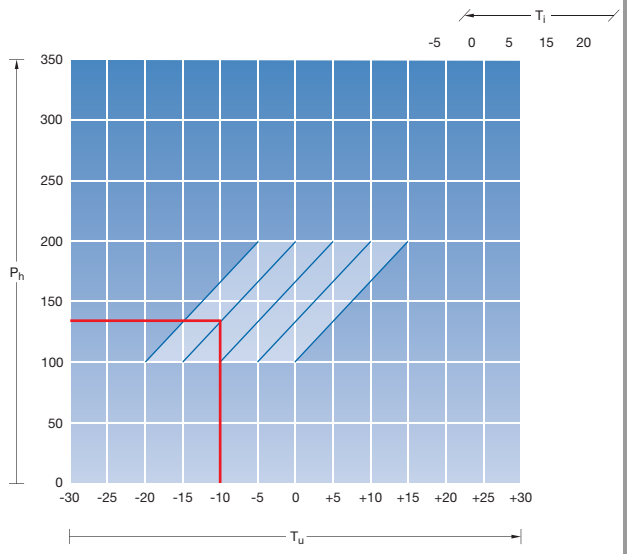
50/60 Hz
SK 3201.200, .300



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Heating output

50/60 Hz
SK 3201.200, .300

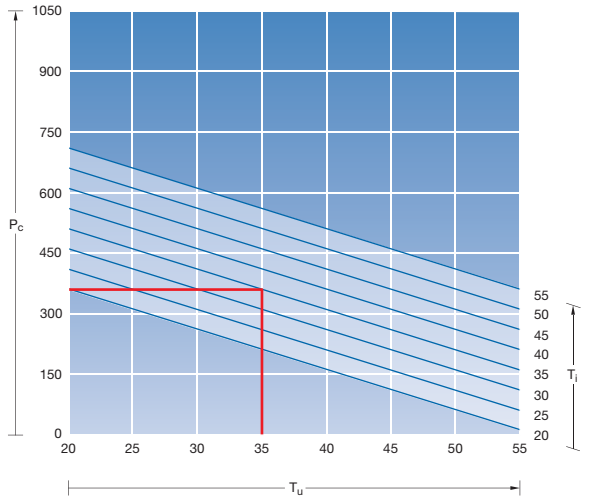


T_u = Ambient temperature (°C)
P_h = Heating output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units

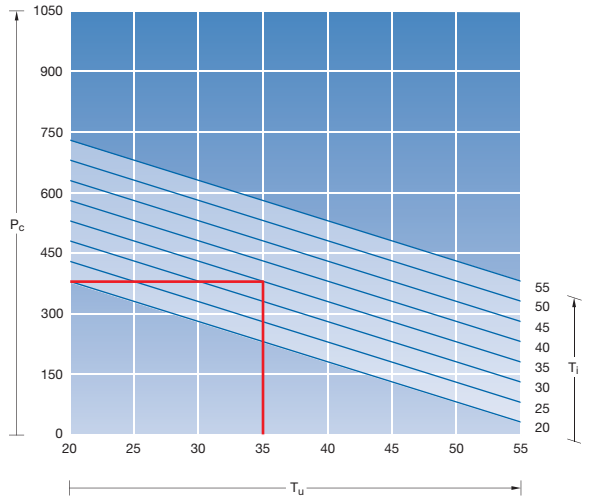
Output class 300 W (115/230 V, 1~)

50 Hz
SK 3302.300, .310, .100, .110, .200



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3302.300, .310, .100, .110, .200

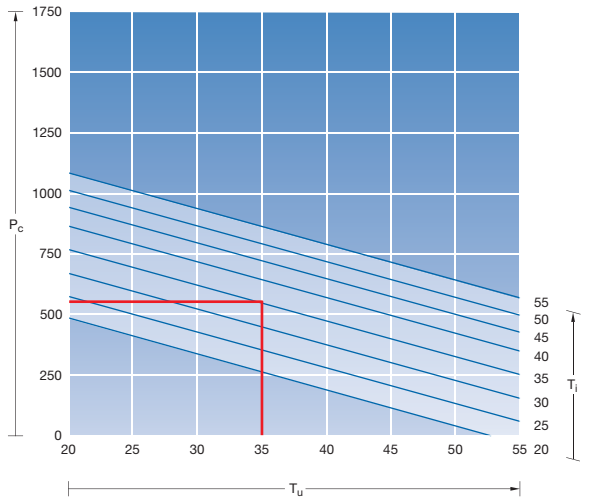


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

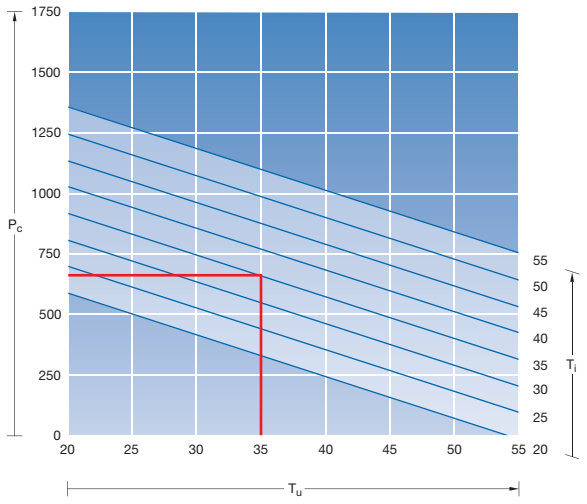
Output class 500 W (115/230 V, 1~)

50 Hz
SK 3303.500, .510, .600, .504, .514



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

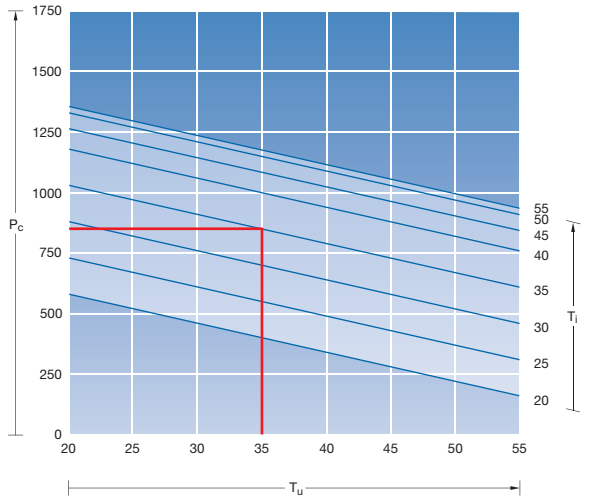
60 Hz
SK 3303.500, .510, .600, .504, .514



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

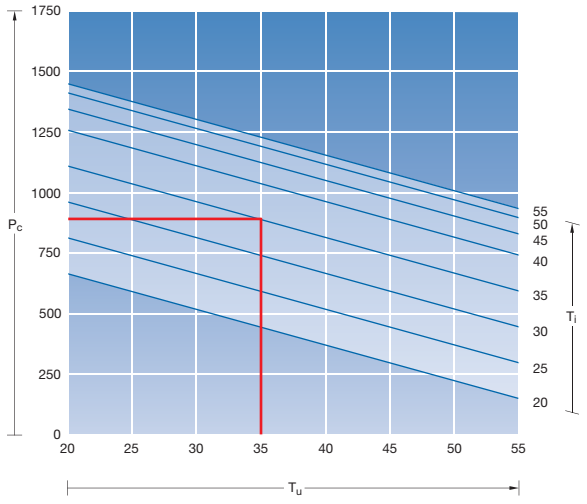
Output class 750 W (115/230 V, 1~, 400 V, 2~)

50 Hz
SK 3361.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3361.500, .510, .540, .600

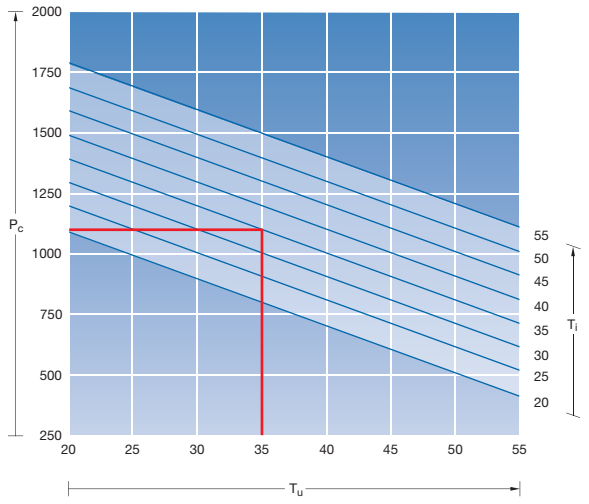


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

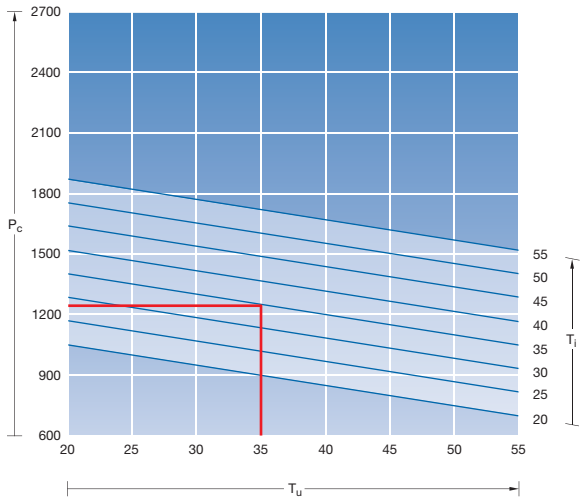
Output class 1000 W (115/230 V, 1~)

50 Hz
SK 3304.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

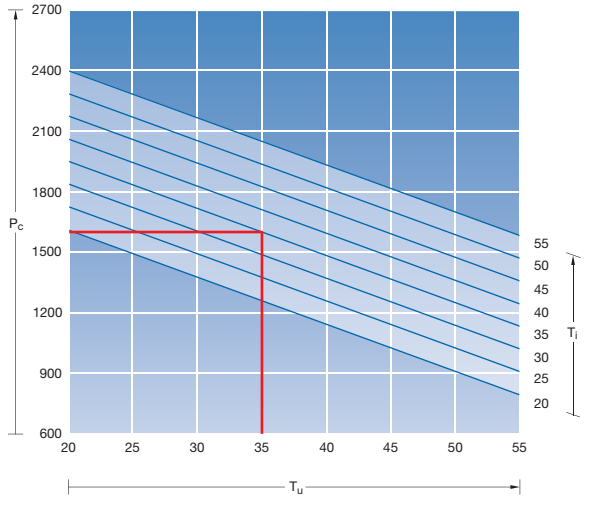
60 Hz
SK 3304.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

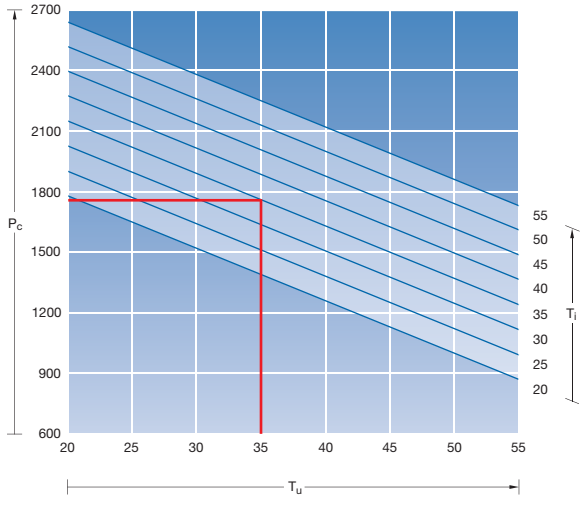
Output class 1500 W (115/230 V, 1~)

50 Hz
SK 3305.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3305.500, .510, .600, .504

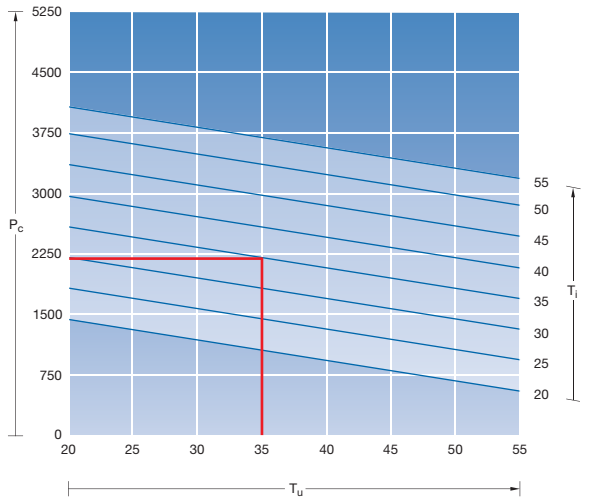


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

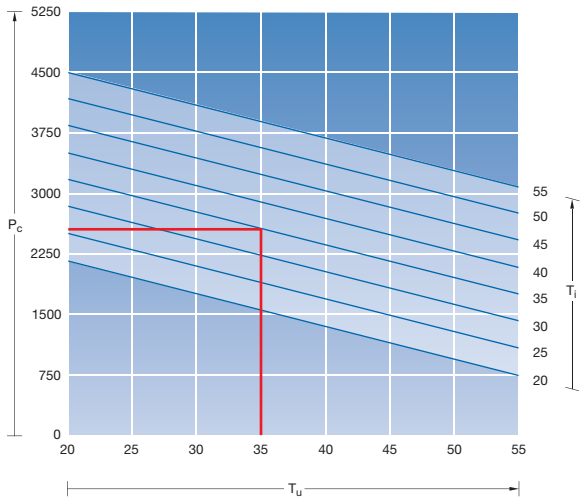
Output class 2000 W (115/230 V, 1~)

50 Hz
SK 3328.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

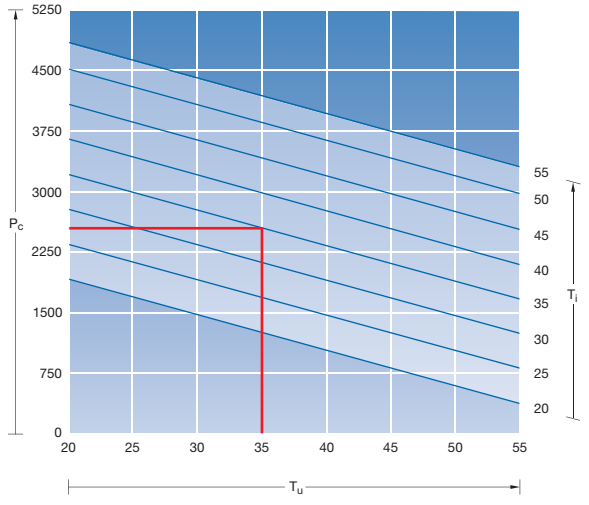
60 Hz
SK 3328.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

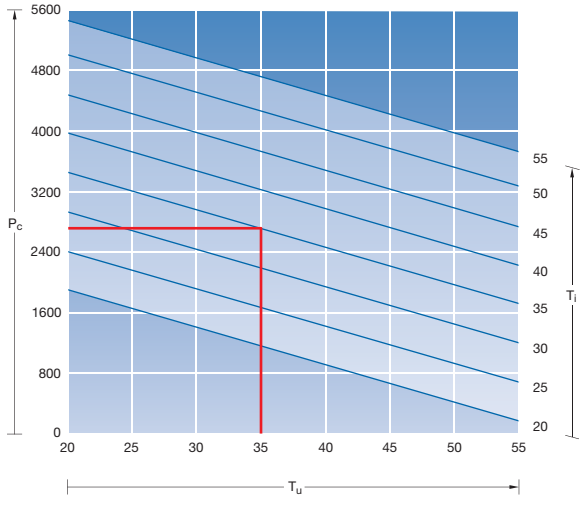
Output class 2500 W (115/230 V, 1~)

50 Hz
SK 3329.500, .510, .600, .504



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3329.500, .510, .600, .504

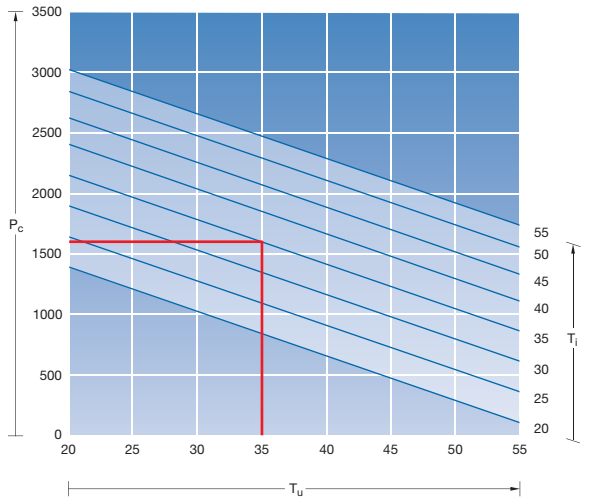


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e, slimline

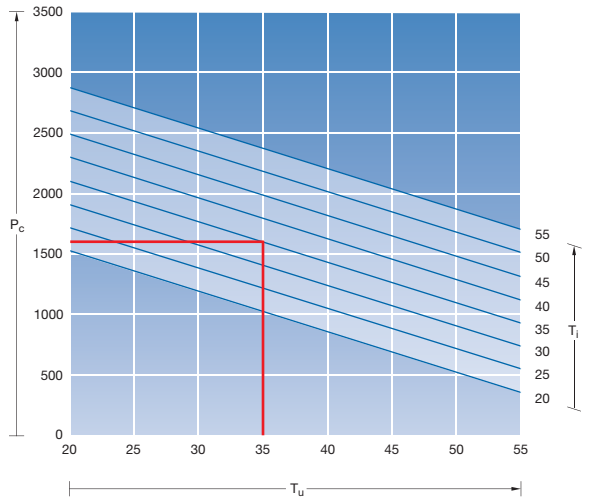
Output class 1500 W (230 V, 1~)

50 Hz
SK 3366.500



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

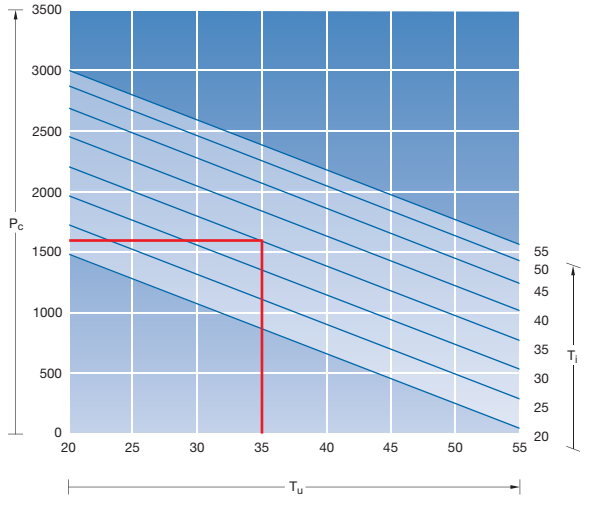
60 Hz
SK 3366.500



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

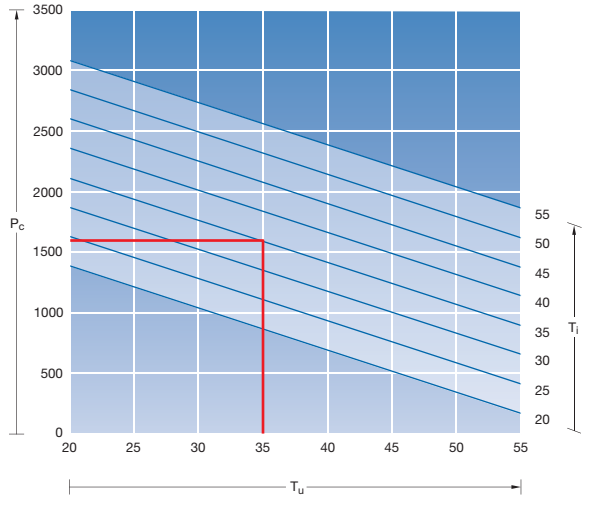
Output class 1500 W (400/460 V, 3~)

50 Hz
SK 3366.540



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3366.540

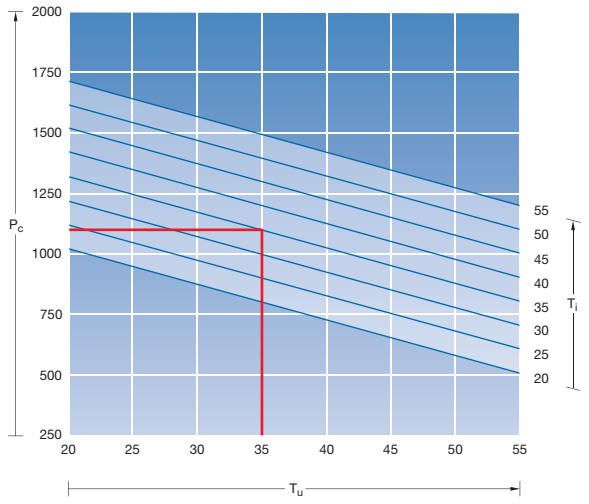


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

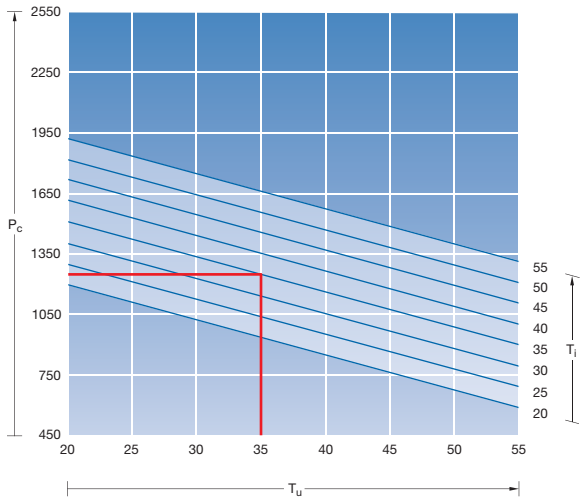
Output class 1000 W (400/460 V, 3~)

50 Hz
SK 3304.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

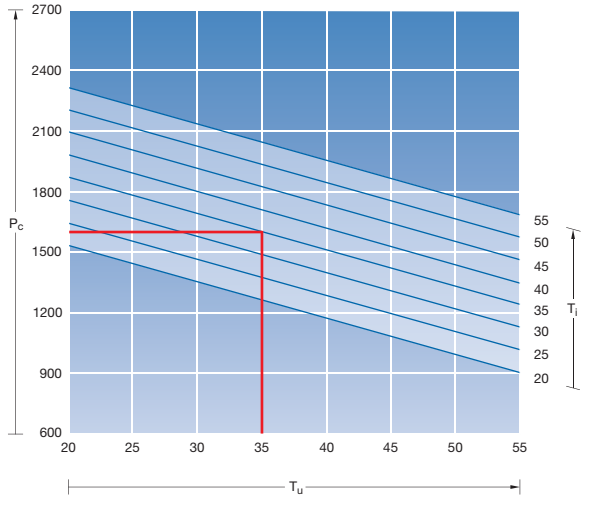
60 Hz
SK 3304.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

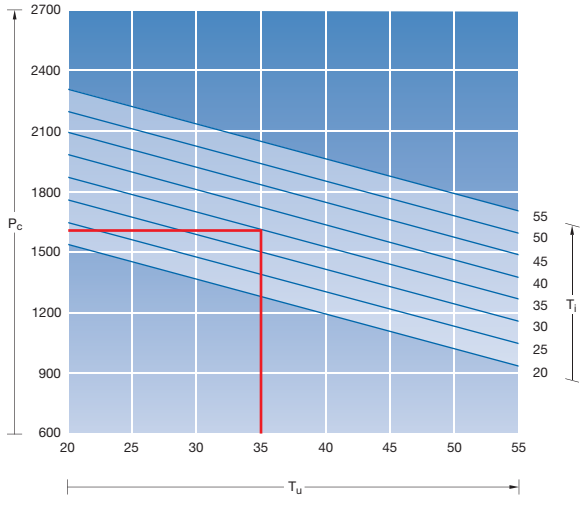
Output class 1500 W (400/460 V, 3~)

50 Hz
SK 3305.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3305.540, .640, .544

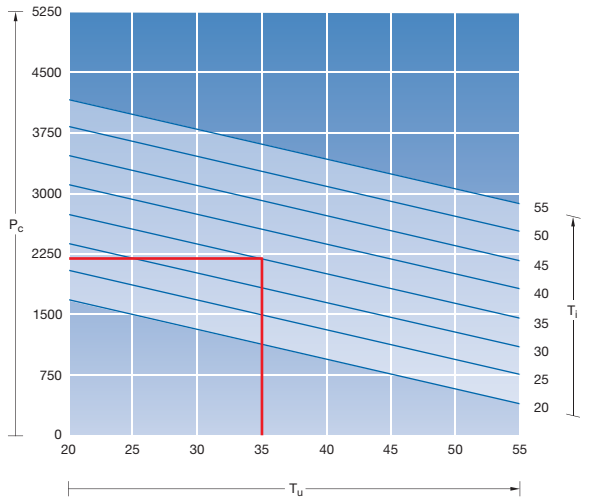


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

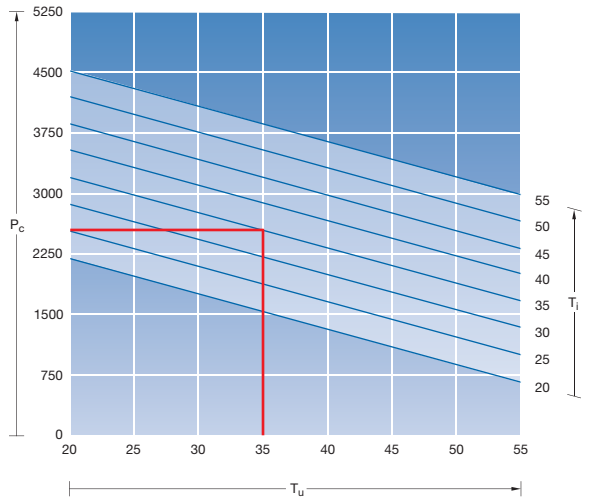
Output class 2000 W (400/460 V, 3~)

50 Hz
SK 3328.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

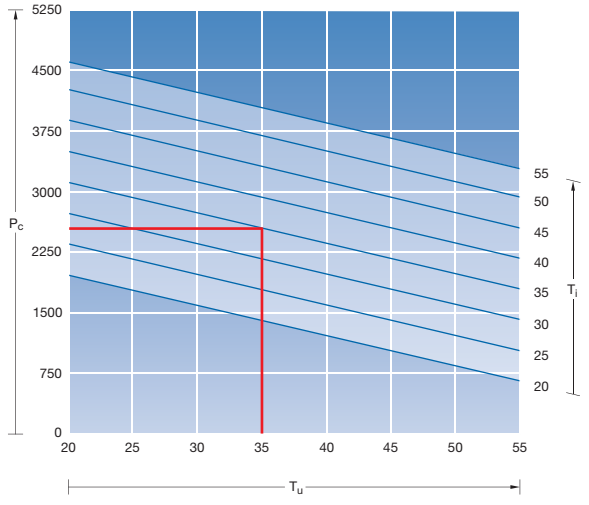
60 Hz
SK 3328.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

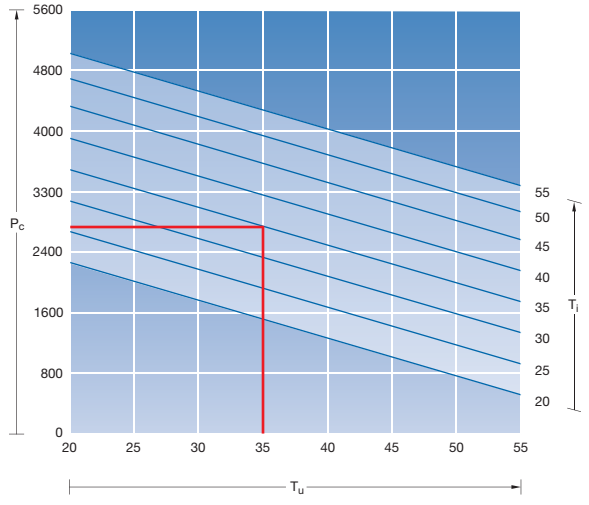
Output class 2500 W (400/460 V, 3~)

50 Hz
SK 3329.540, .640, .544



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3329.540, .640, .544

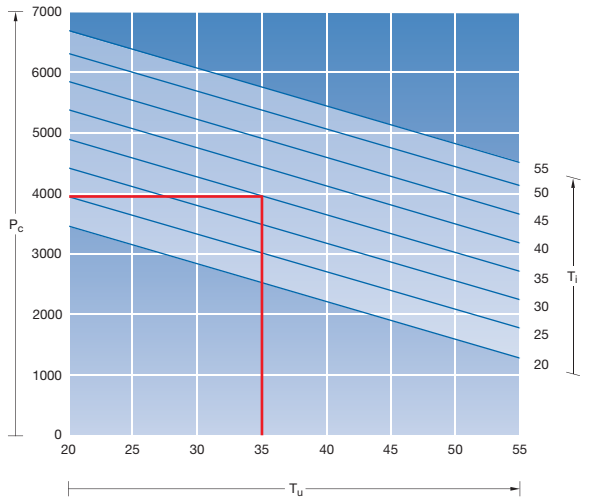


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm wall-mounted cooling units Blue e

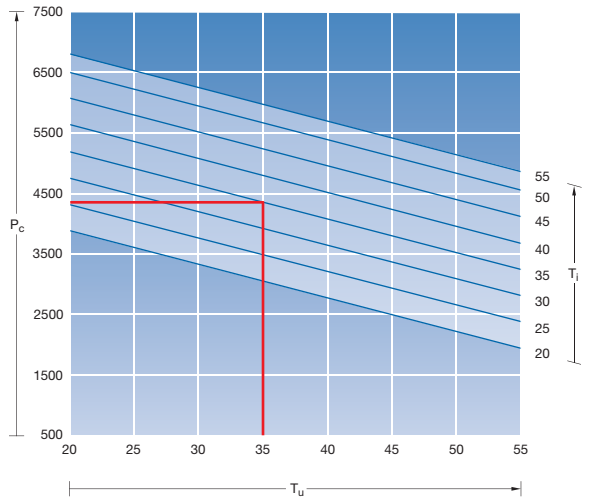
Output class 4000 W (400/460 V, 3~)

50 Hz
SK 3332.540, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3332.540, .640

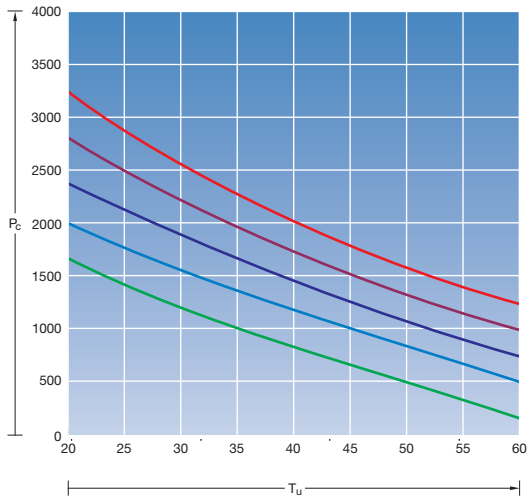


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Wall-mounted cooling units Blue e+

Output class 1600/2000 W (110 – 240 V, 1~, 50 – 60 Hz / 380 – 480 V, 3~, 50 – 60 Hz)

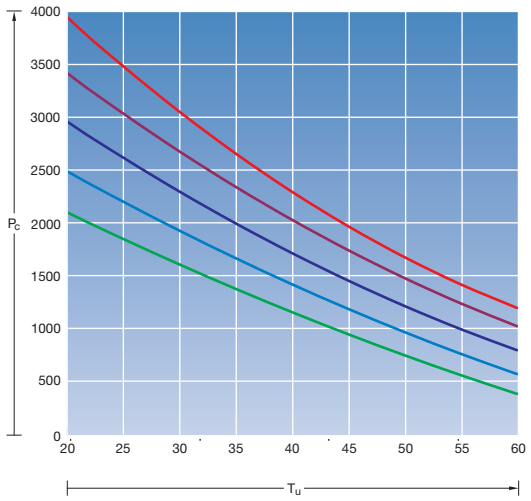
1.6 kW
SK 3185.530, .830



Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

2 kW
SK 3186.630, .930

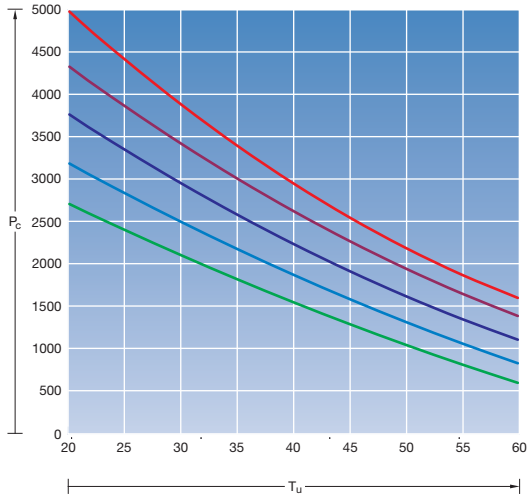


Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Output class 2600/4200 W (110 – 240 V, 1~, 50 – 60 Hz / 380 – 480 V, 3~, 50 – 60 Hz)

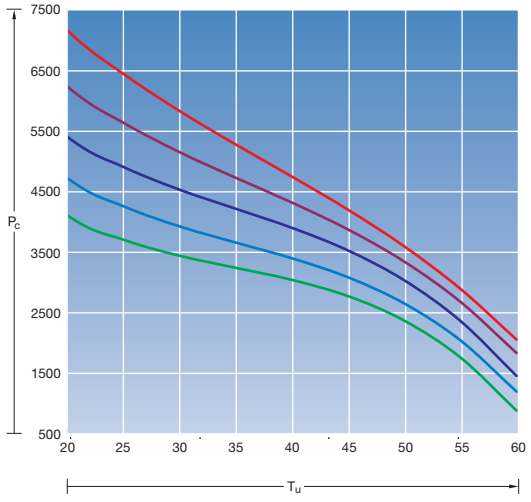
2.6 kW
SK 3187.630, .930



Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

4.2 kW
SK 3188.640, .940



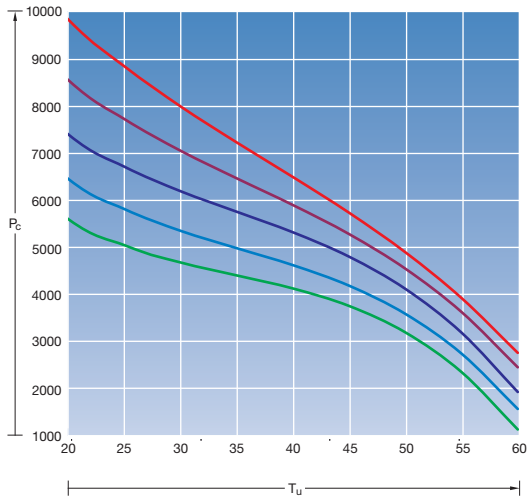
Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Wall-mounted cooling units Blue e+

Output class 5800 W (380 – 480 V, 3~, 50 – 60 Hz)

5.8 kW
SK 3189.640, .940



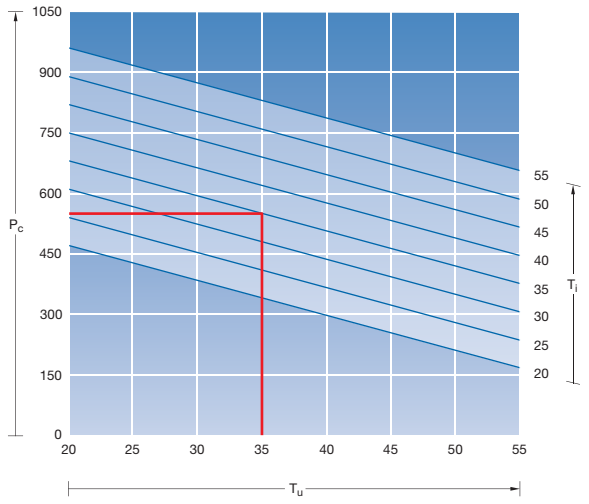
Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

TopTherm roof-mounted cooling units Blue e

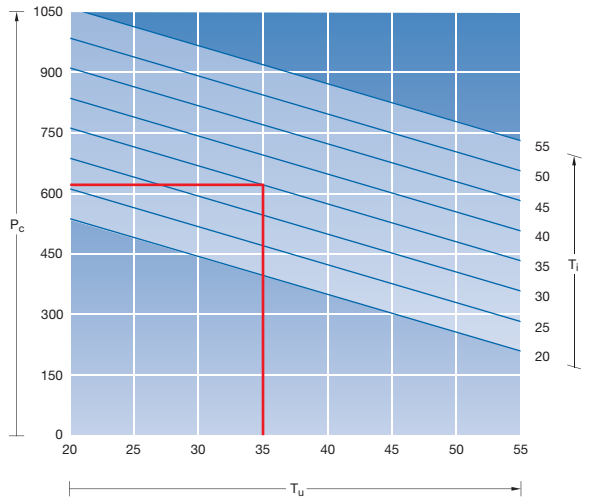
Output class 500 W (115/230 V, 1~)

50 Hz
SK 3382.500, .510, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

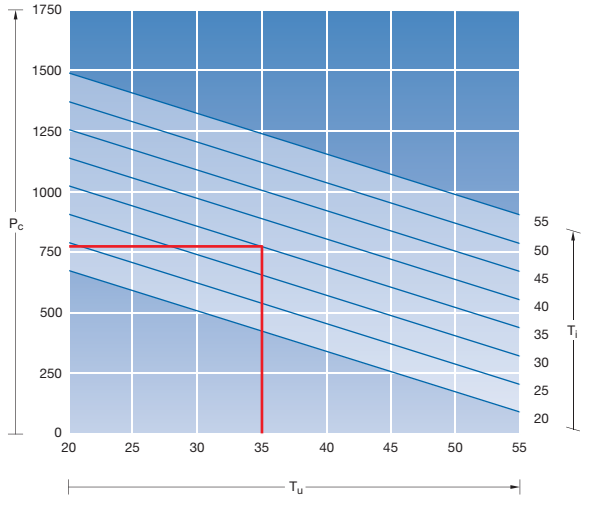
60 Hz
SK 3382.500, .510, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

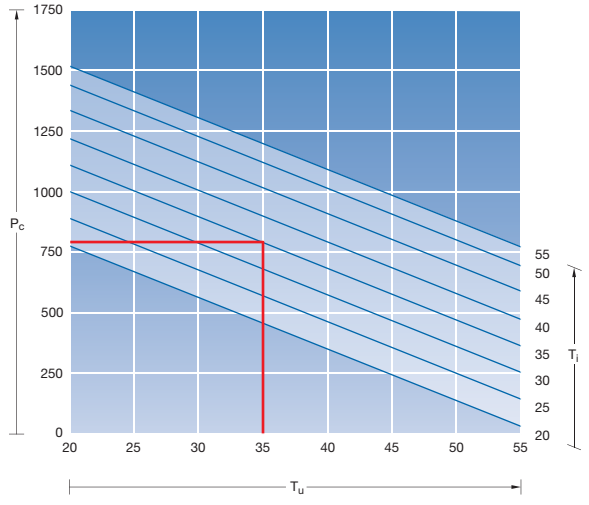
Output class 750 W (115/230 V, 1~, 400 V, 2~)

50 Hz
SK 3359.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3359.500, .510, .540, .600

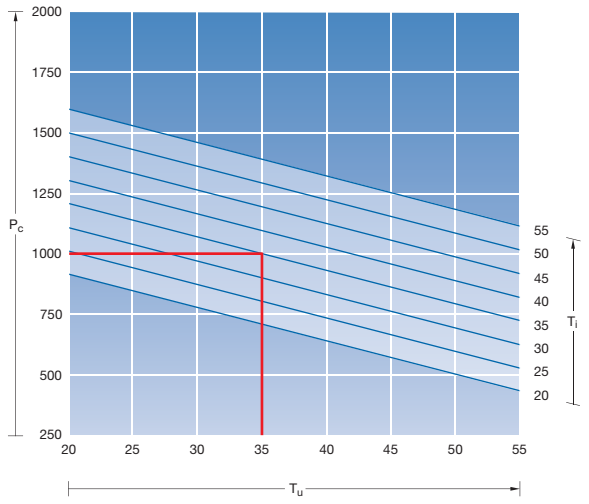


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm roof-mounted cooling units Blue e

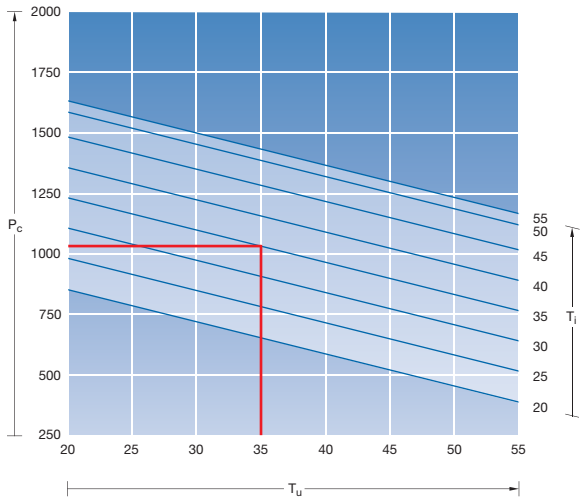
Output class 1000 W (115/230 V, 1~, 400 V, 2~)

50 Hz
3383.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

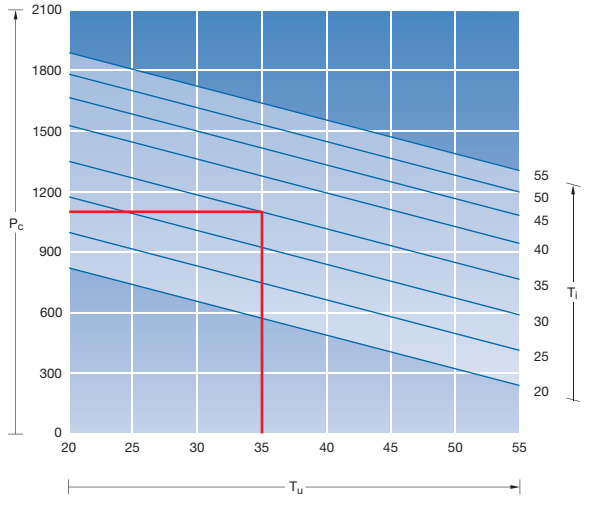
60 Hz
3383.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

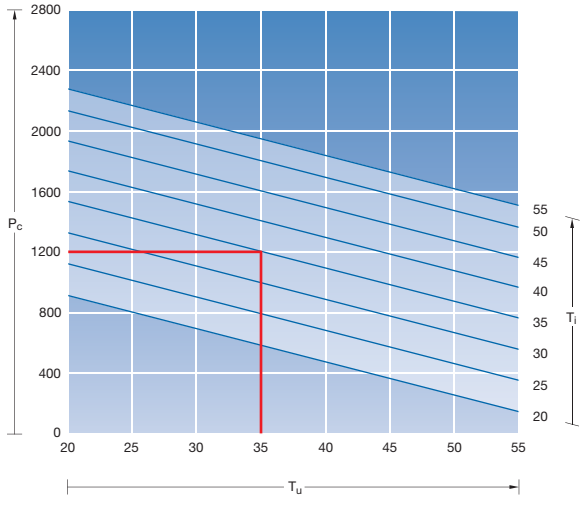
Output class 1100 W (115/230 V, 1~)

50 Hz
SK 3273.500, .515



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3273.500, .515

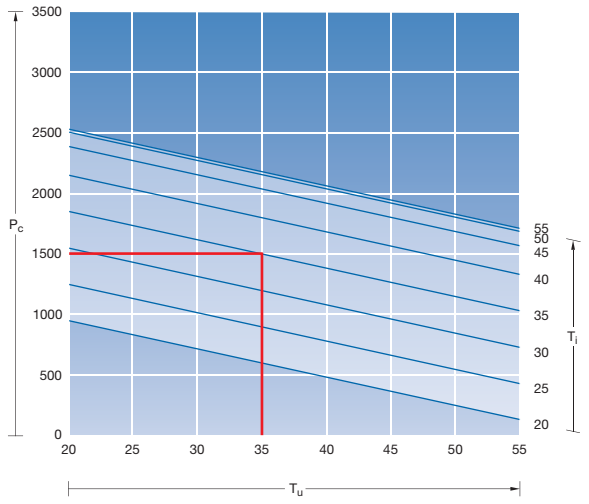


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm roof-mounted cooling units Blue e

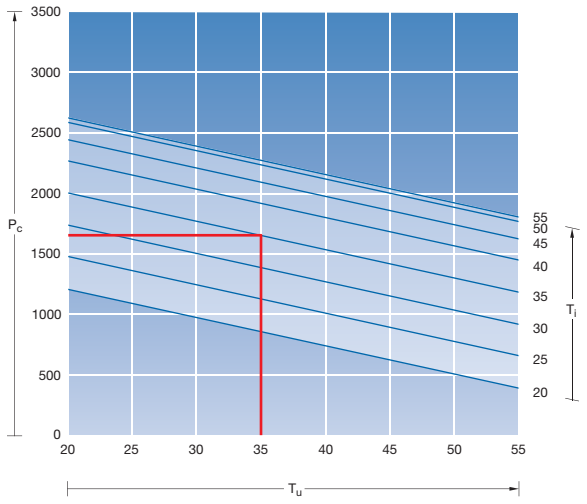
Output class 1500 W (115/230 V, 1~, 400 V, 2~)

50 Hz
3384.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

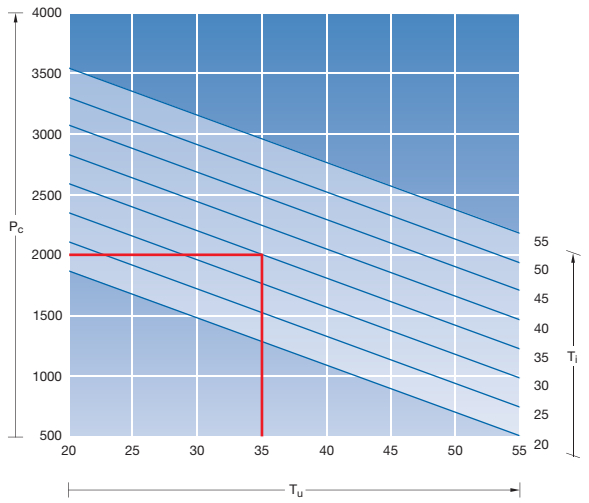
60 Hz
3384.500, .510, .540, .600



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

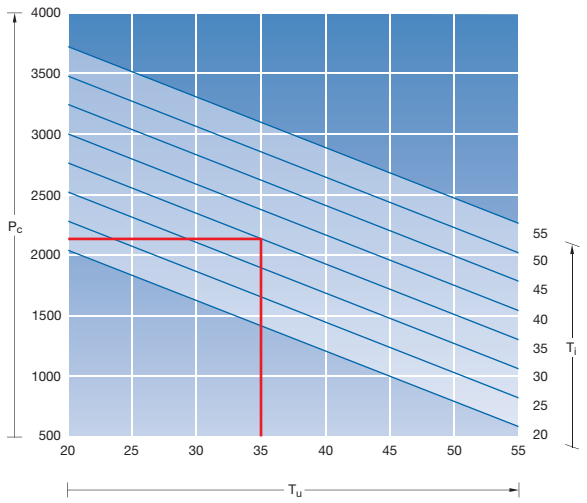
Output class 2000 W (115/230 V, 1~, 400 V, 2~)

50 Hz
SK 3385.500, .510, .540, .600, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3385.500, .510, .540, .600, .640

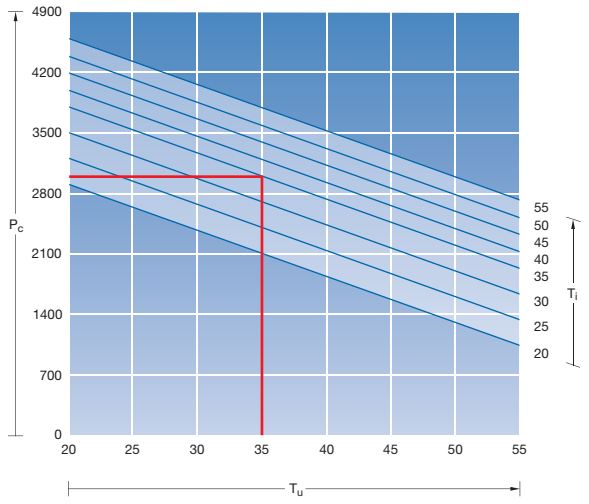


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm roof-mounted cooling units Blue e

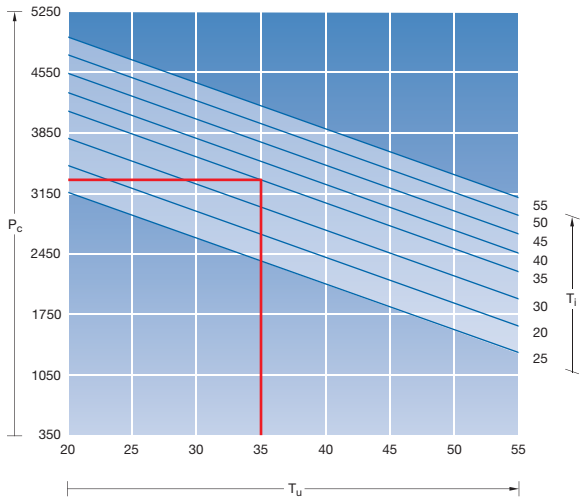
Output class 3000 W (400/460 V, 3~)

50 Hz
3386.540, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

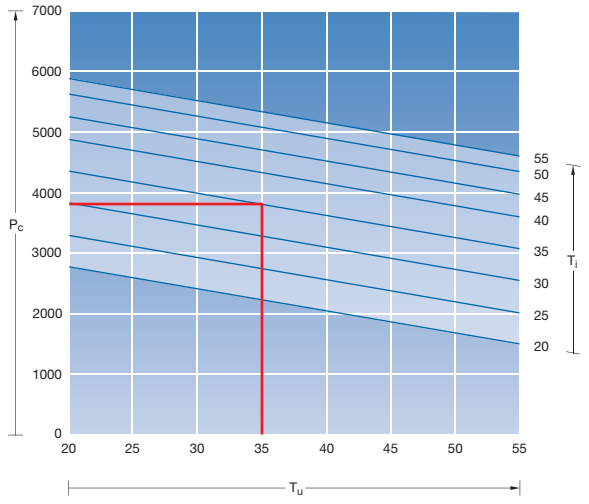
60 Hz
3386.540, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

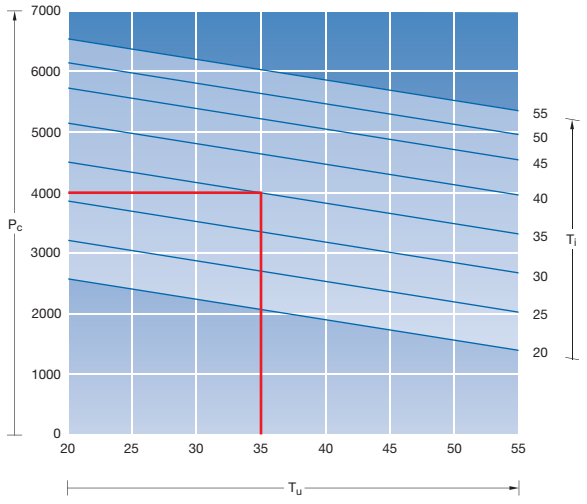
Output class 4000 W (400/460 V, 3~)

50 Hz
3387.540, .640



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
3387.540, .640

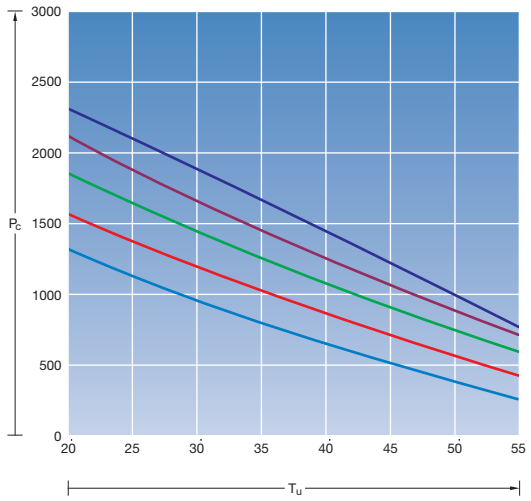


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Roof-mounted cooling unit Blue e+

Output class 1300 W (110 – 240 V, 1 ~, 50 – 60 Hz / 380 – 480 V, 3 ~, 50 – 60 Hz)

1.30 kW
SK 3185.730



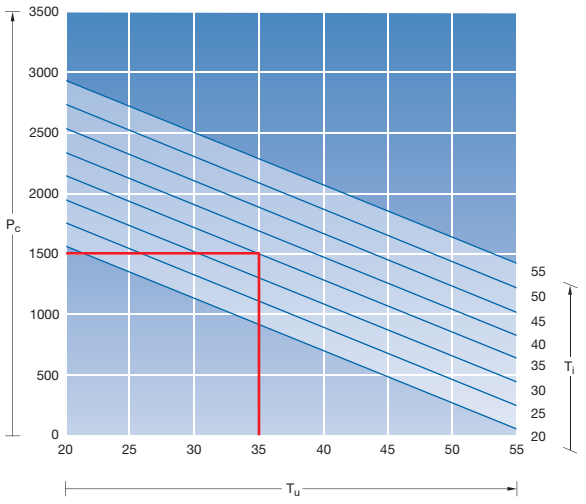
Enclosure internal temperature T_i
- 45 °C
- 40 °C
- 35 °C
- 30 °C
- 25 °C

P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Modular climate control concept – Cooling module Blue e

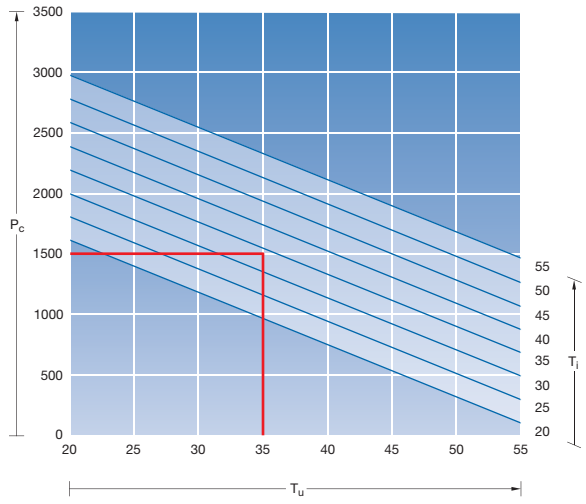
Output class 1500 W (230 V, 1~)

50 Hz
SK 3307.700



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

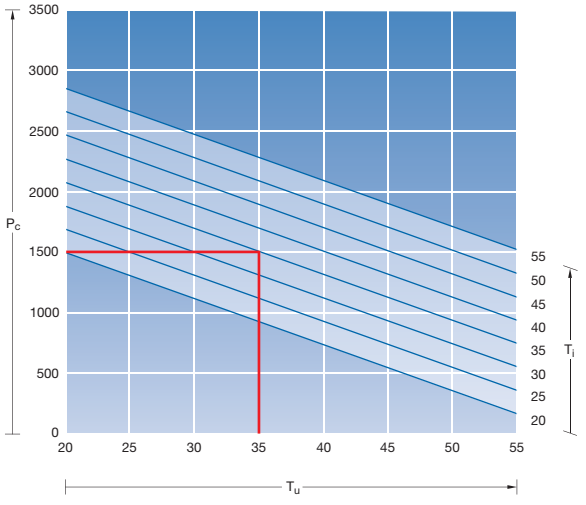
60 Hz
SK 3307.700



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

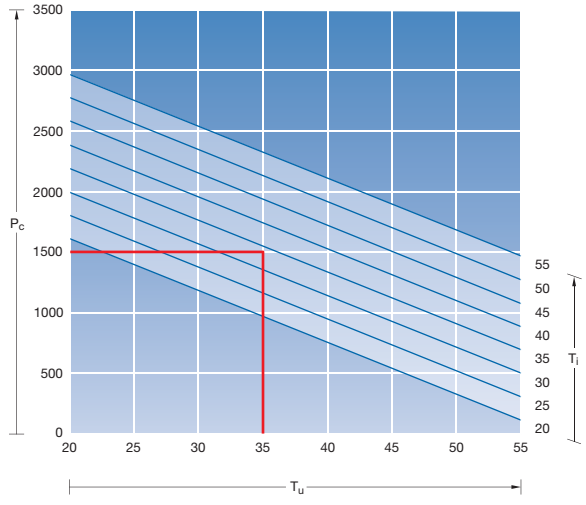
Output class 1500 W (400/460 V, 3~)

50 Hz
SK 3307.740



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3307.740

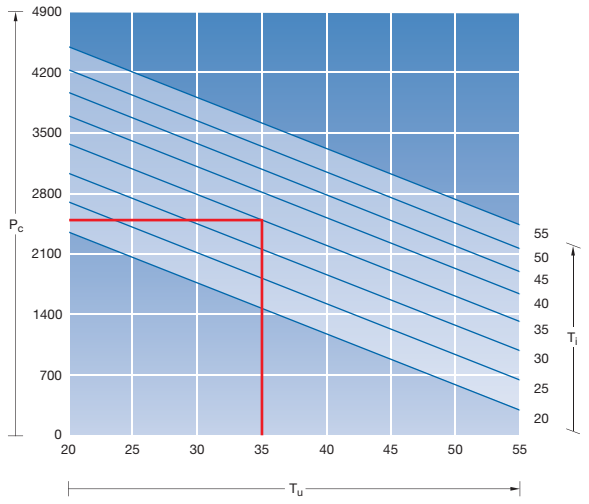


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Modular climate control concept – Cooling module Blue e

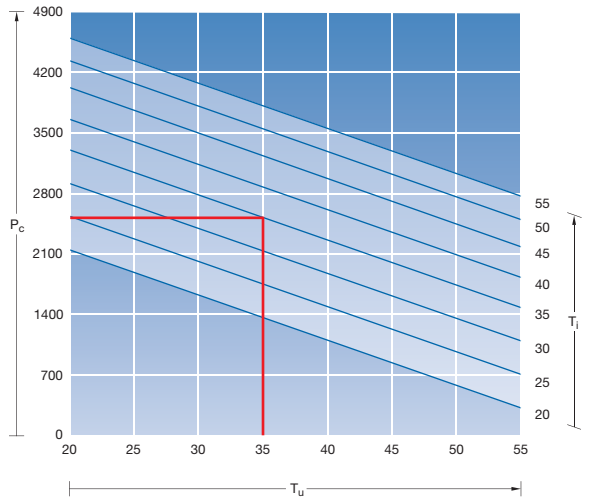
Output class 2500 W (230 V, 1~)

50 Hz
SK 3310.700



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

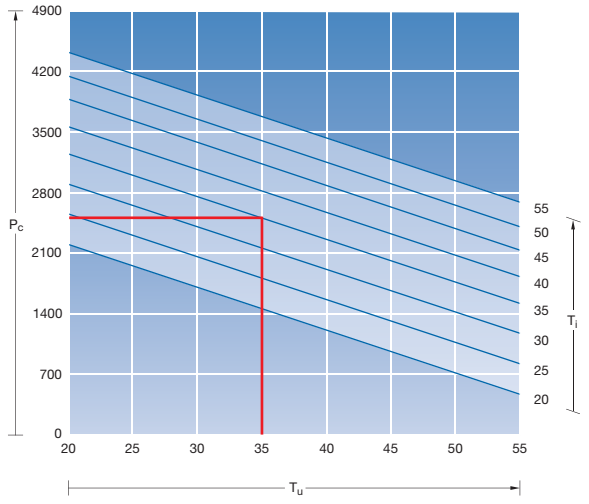
60 Hz
SK 3310.700



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

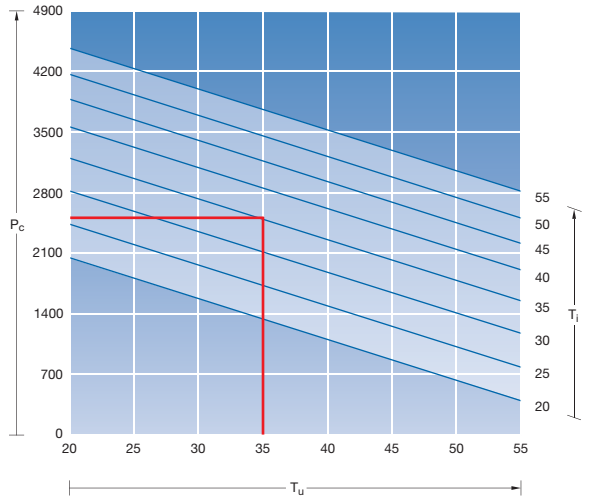
Output class 2500 W (400/460 V, 3~)

50 Hz
SK 3310.740



T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3310.740

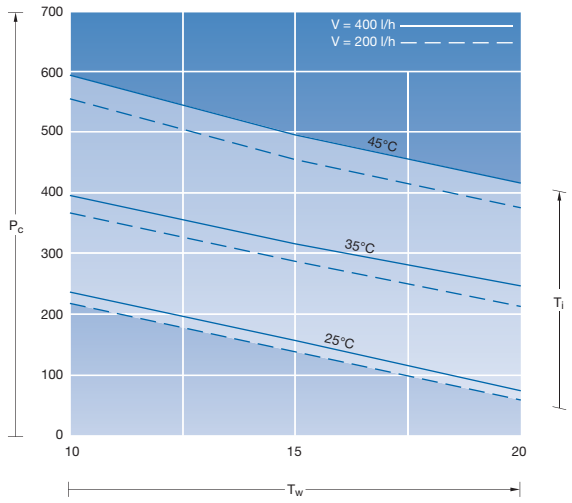


T_u = Ambient temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Wall-mounted air/water heat exchangers

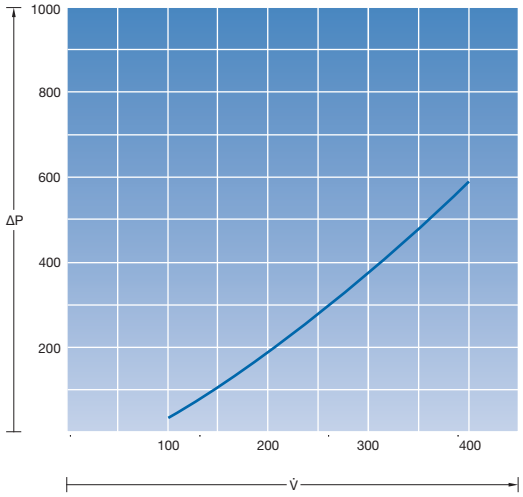
Output class 300 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3212.024, .115, .230



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

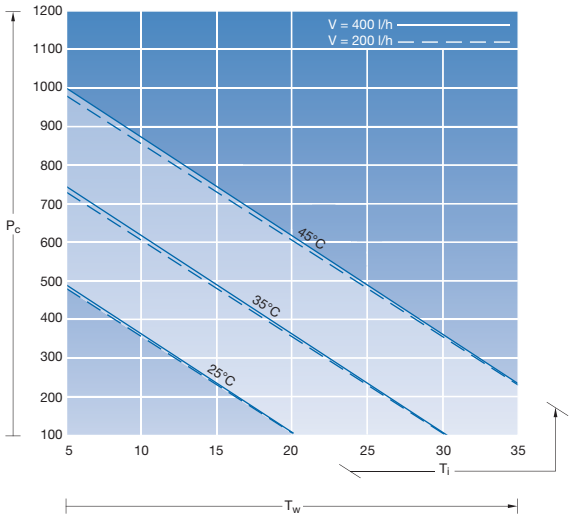
Water resistance diagram
SK 3212.024, .115, .230



$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

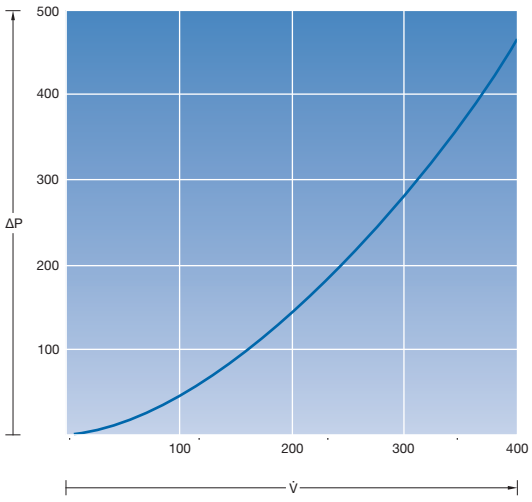
Output class 600 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3214.100



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3214.100

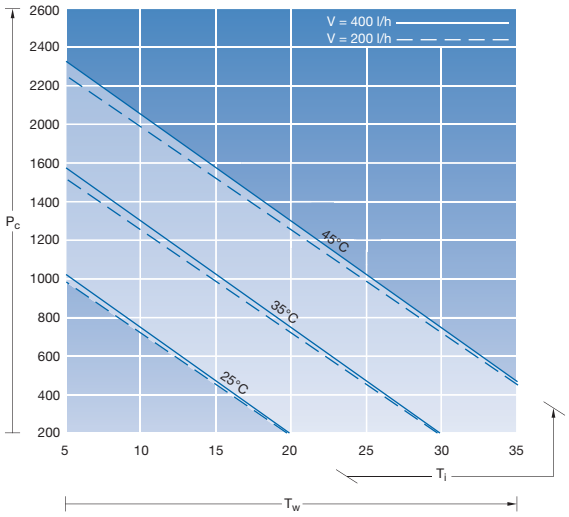


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

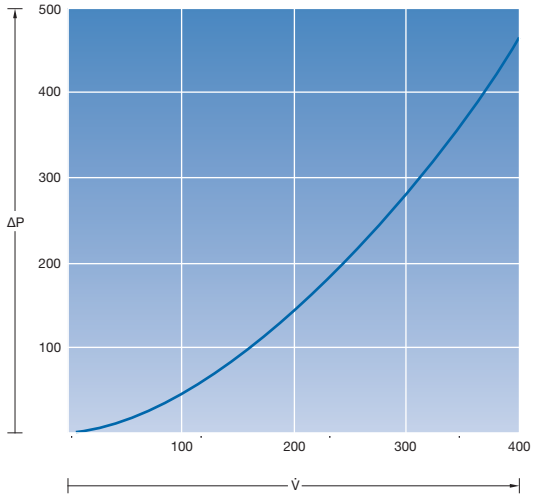
Output class 1250 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3215.100



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

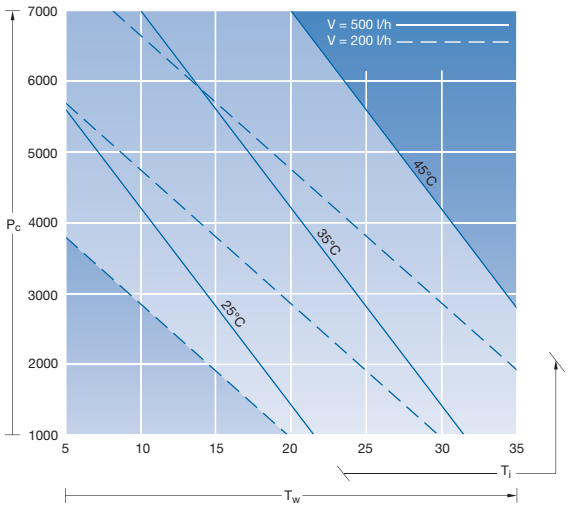
Water resistance diagram
SK 3215.100



$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

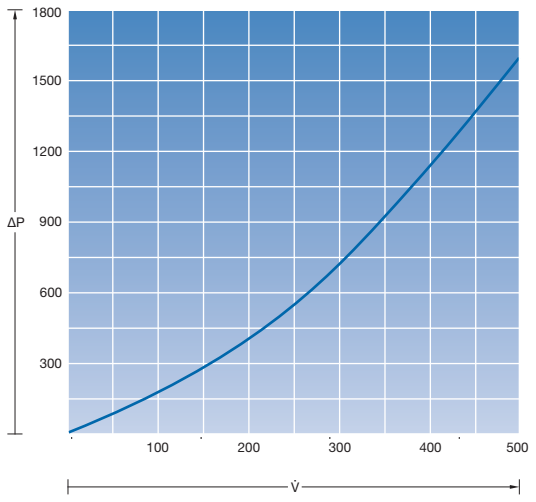
Output class 7000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3216.480



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3216.480

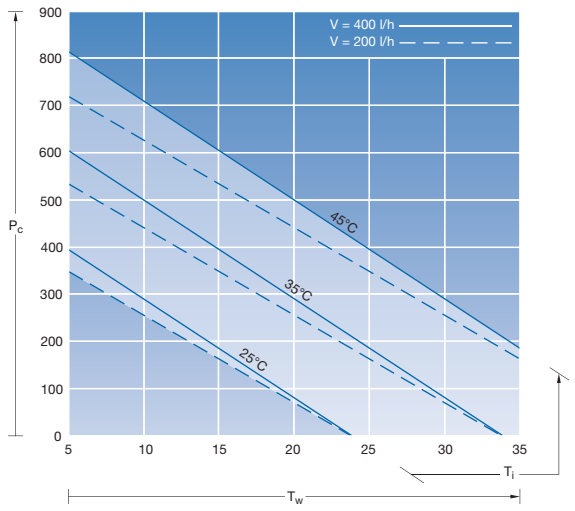


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

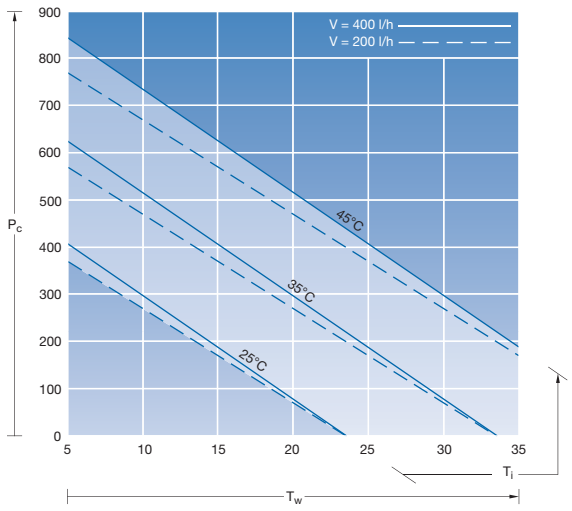
Output class 500 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3363.100, .500



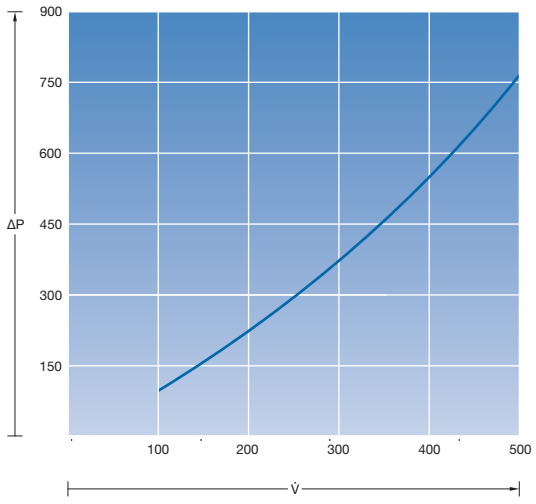
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3363.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3363.100, .500

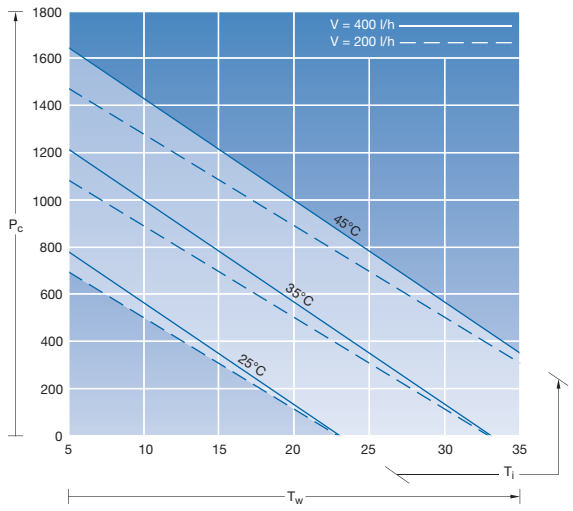


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

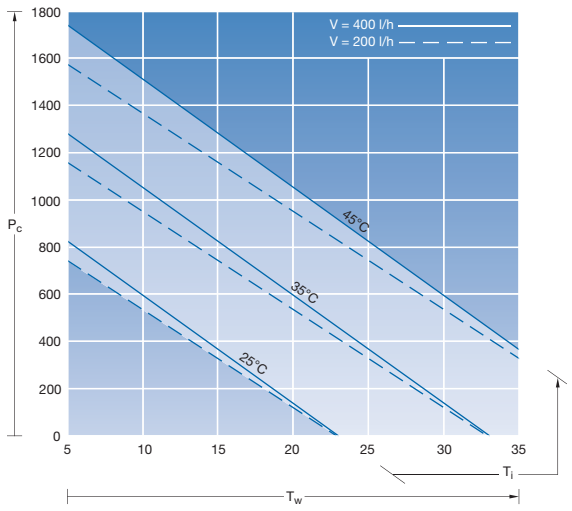
Output class 1000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3364.100, .500



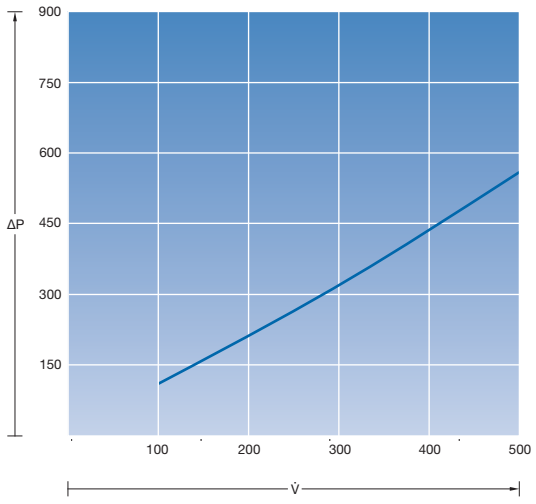
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3364.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3364.100, .500

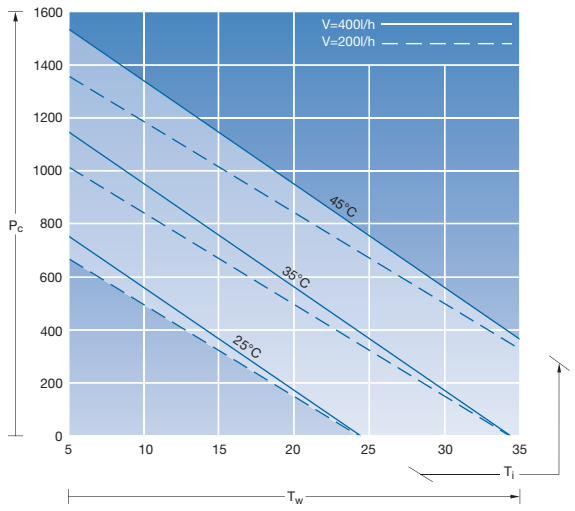


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

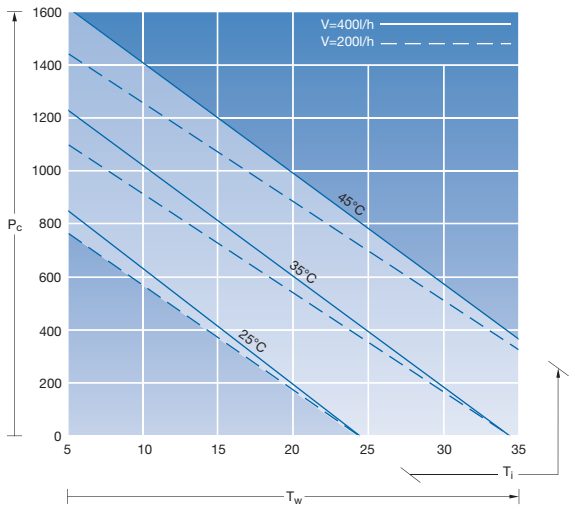
Output class 1000 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3364.504



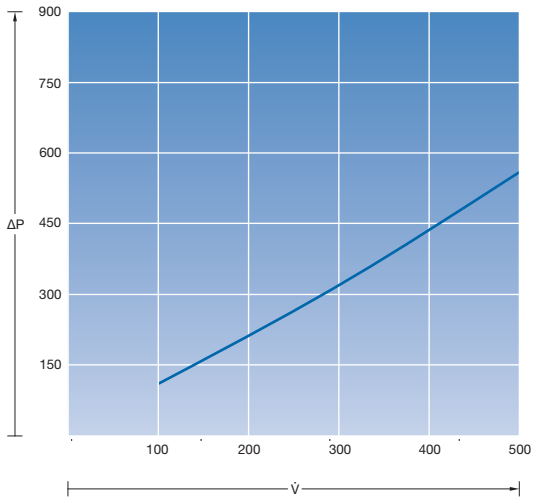
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3364.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3364.504

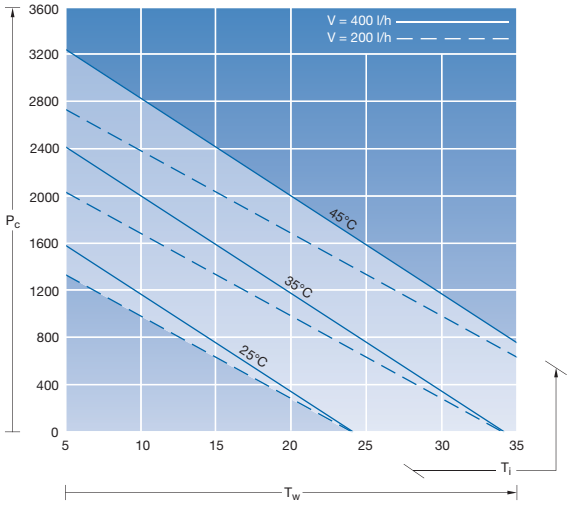


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

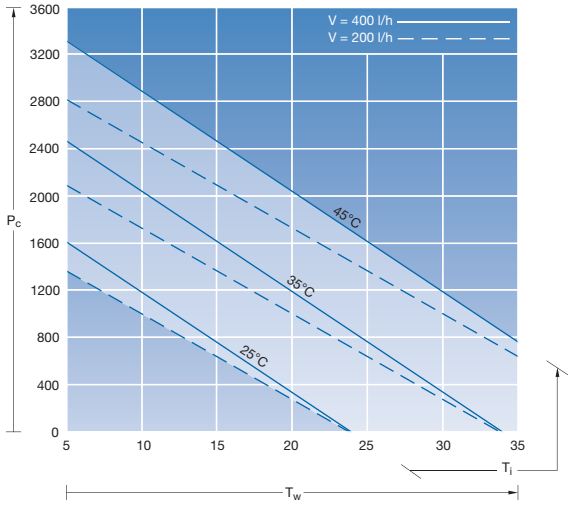
Output class 2000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3373.100, .500



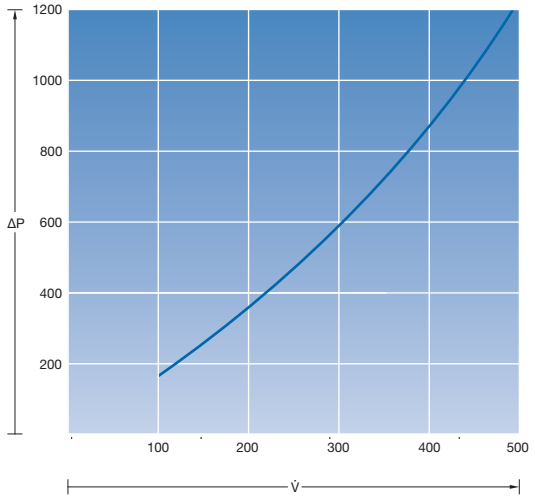
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3373.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3373.100, .500

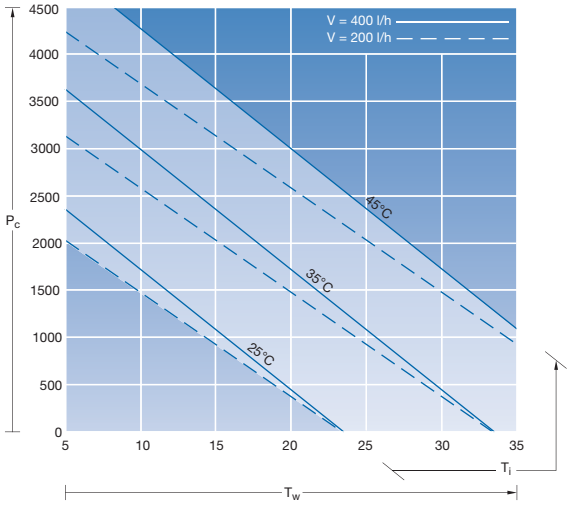


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

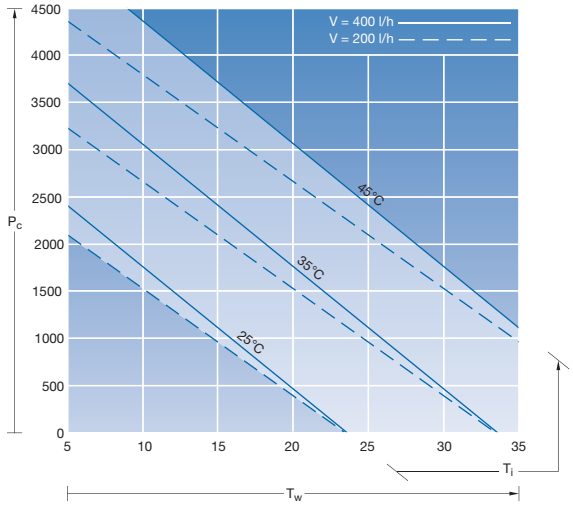
Output class 3000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3374.100, .500



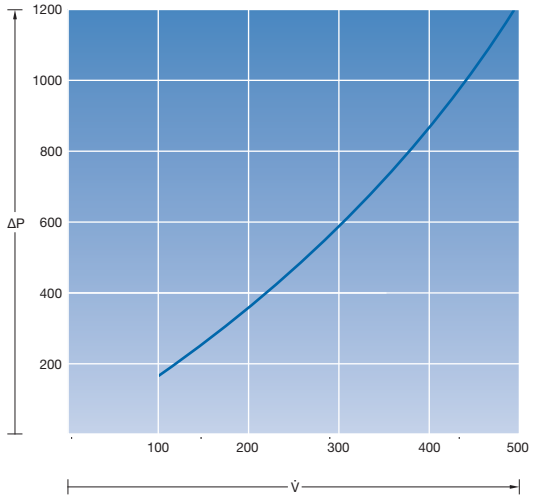
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3374.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3374.100, .500

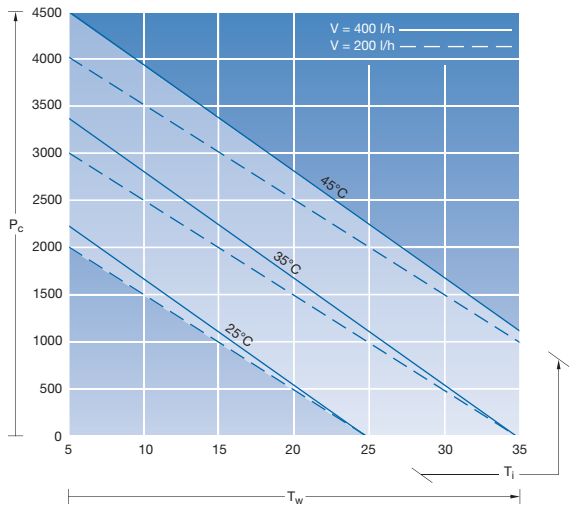


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

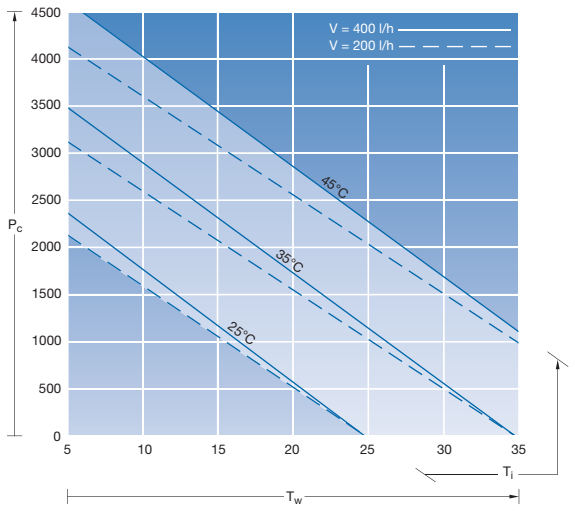
Output class 2500 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3374.504



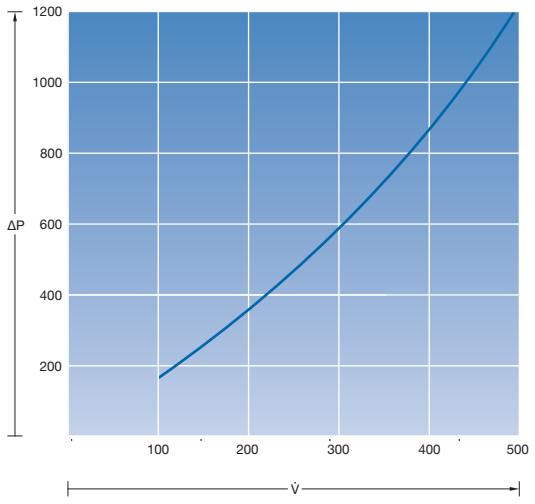
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3374.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3374.504

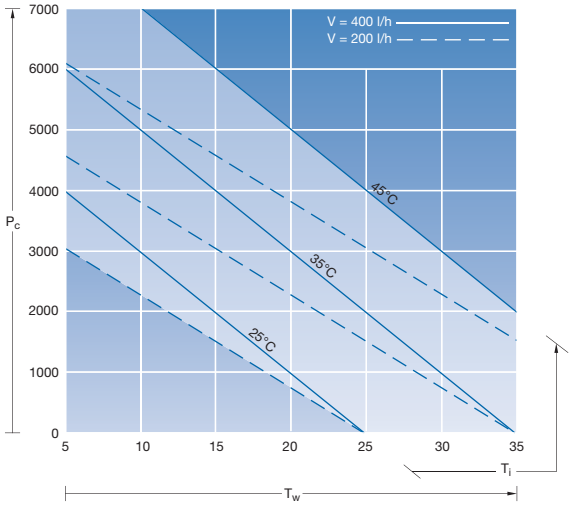


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers

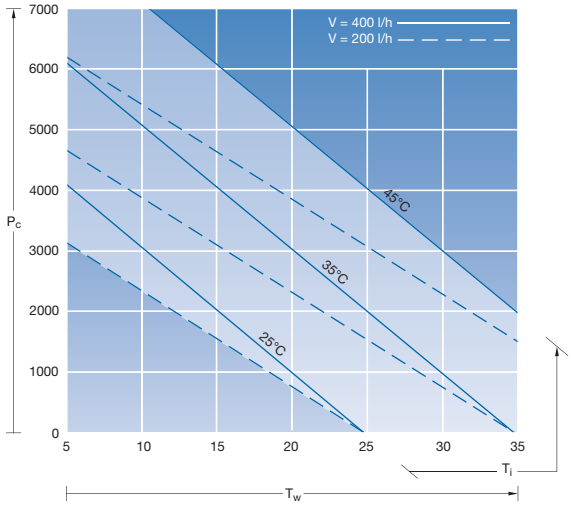
Output class 5000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3375.100, .500



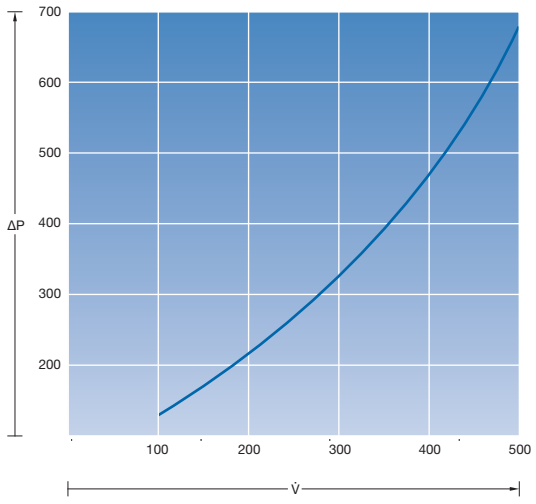
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3375.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3375.100, .500

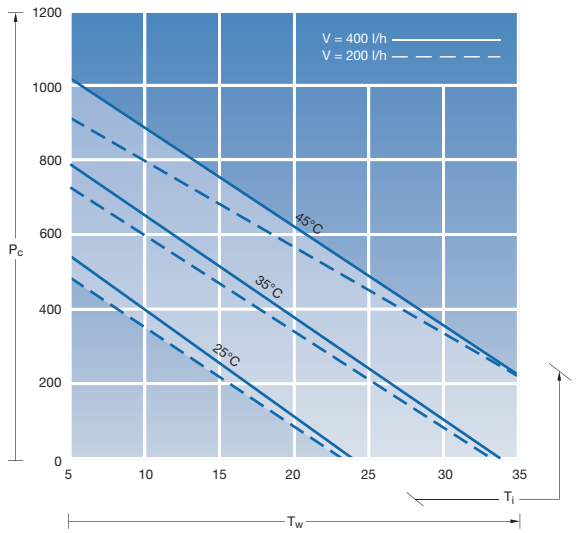


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Wall-mounted air/water heat exchangers HD

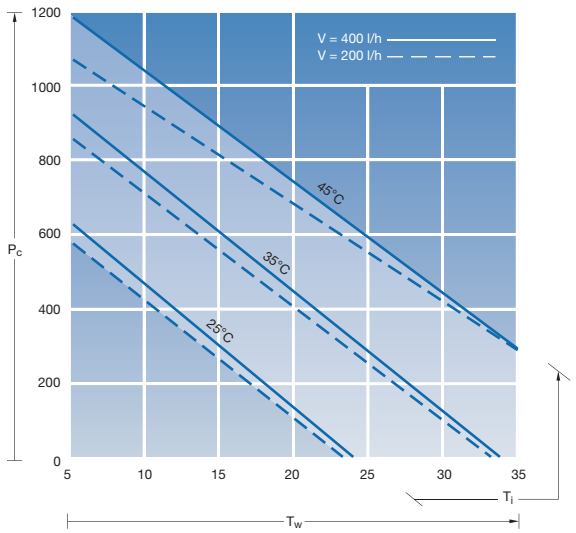
Output class 600/1200 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3214.700



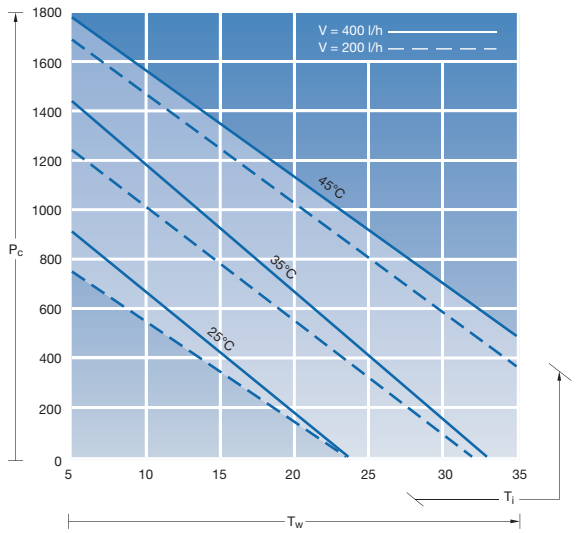
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3274.600



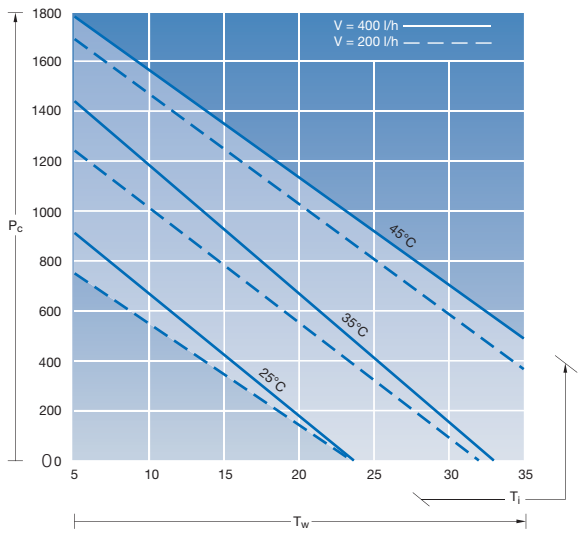
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

50 Hz
SK 3217.500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3217.600

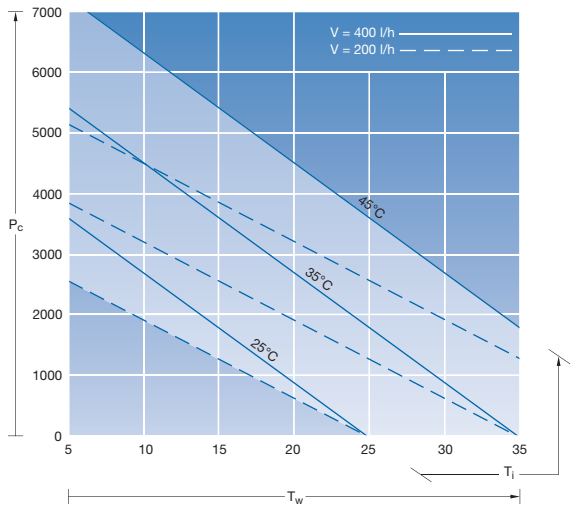


T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Wall-mounted air/water heat exchangers

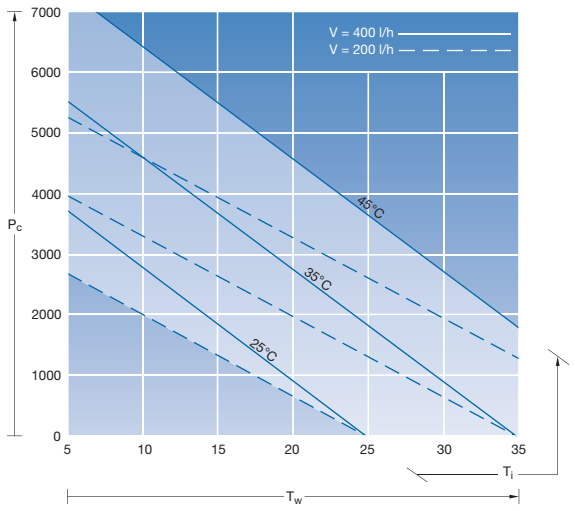
Output class 4000 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3375.504



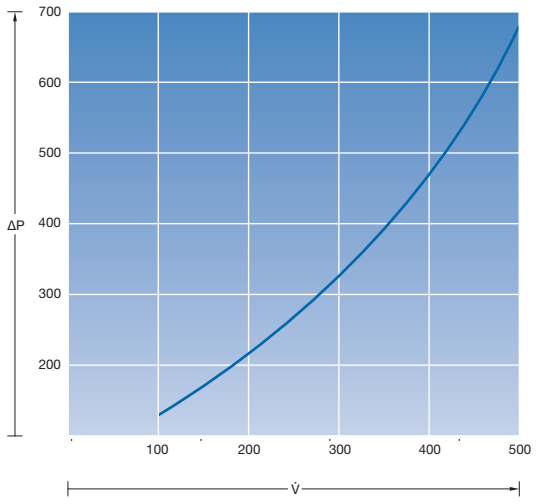
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3375.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3375.504

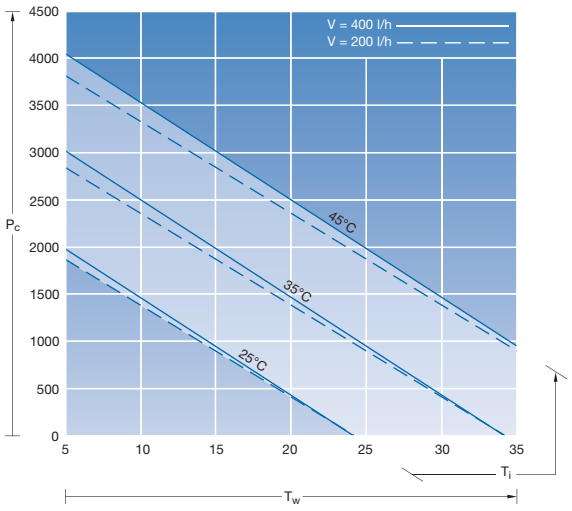


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Roof-mounted air/water heat exchangers

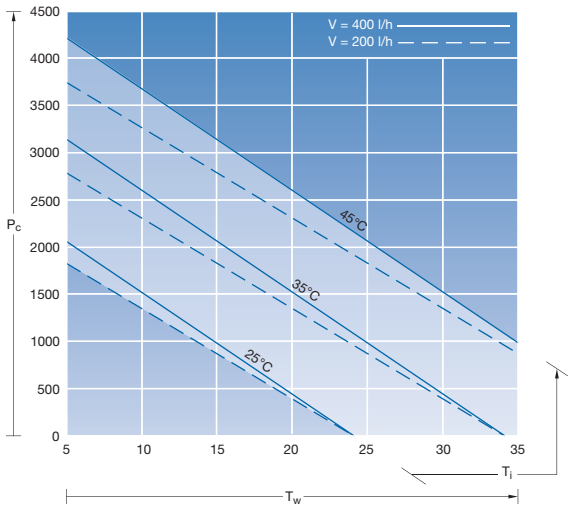
Output class 2500 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3209.100, .500



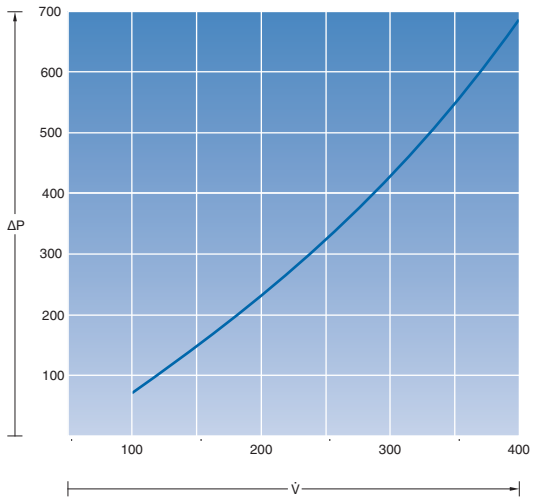
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3209.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3209.100, .500

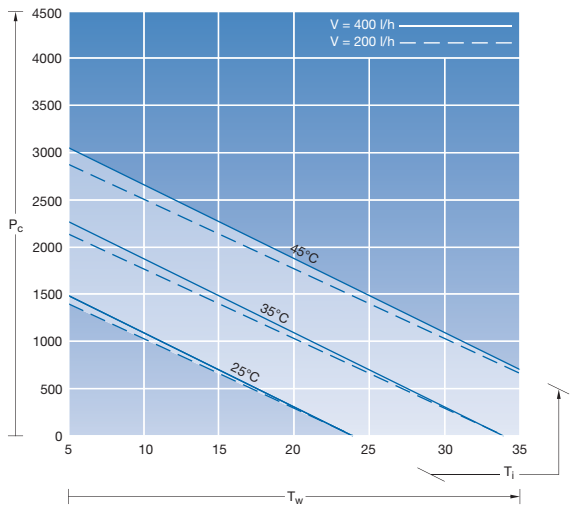


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Roof-mounted air/water heat exchangers

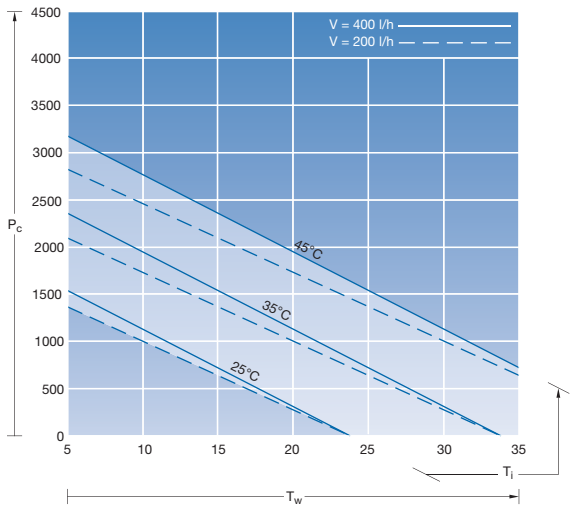
Output class 1875 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3209.504



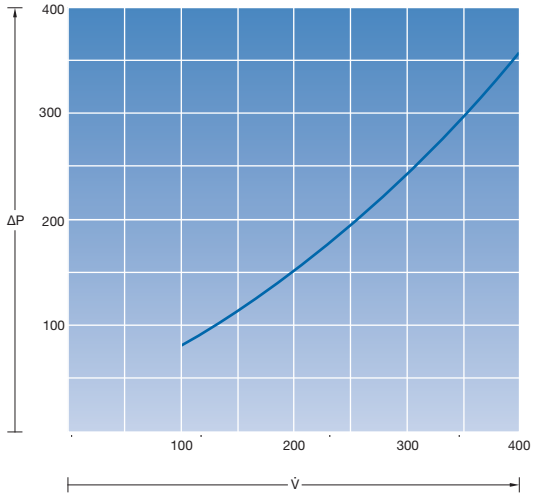
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3209.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3209.504

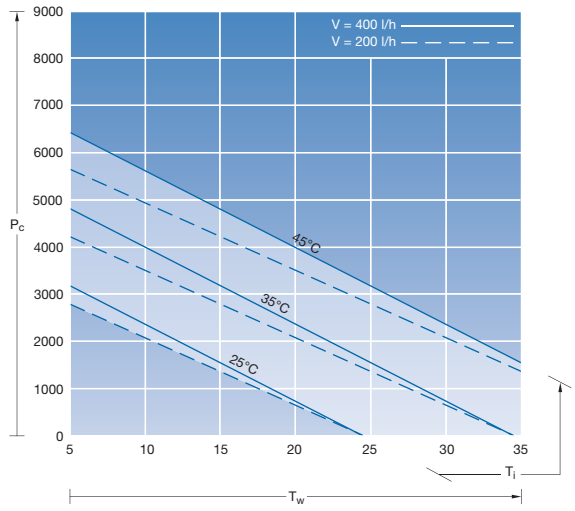


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Roof-mounted air/water heat exchangers

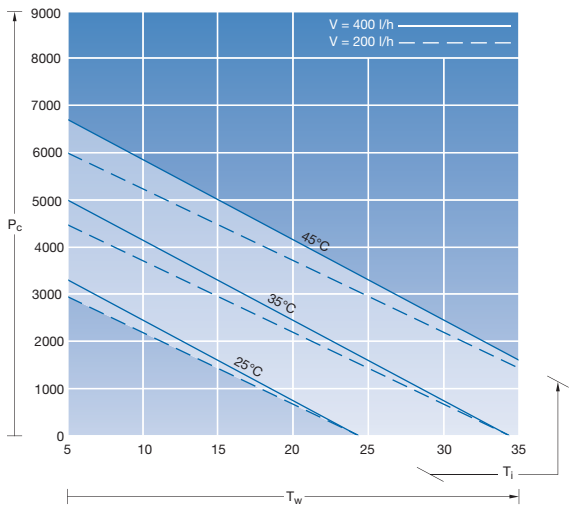
Output class 4000 W
Water-carrying parts: Copper/brass (Cu/CuZn)

50 Hz
SK 3210.100, .500



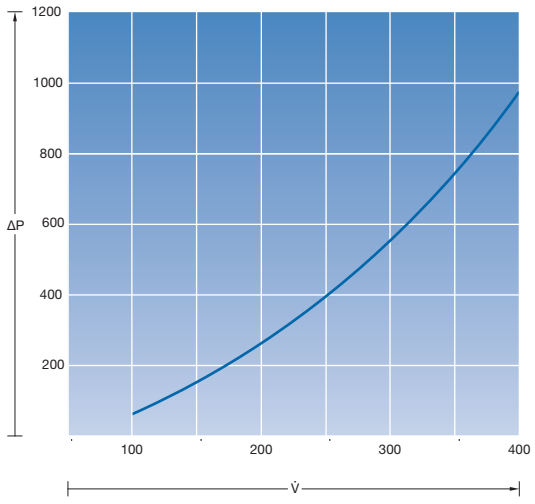
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3210.100, .500



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3210.100, .500

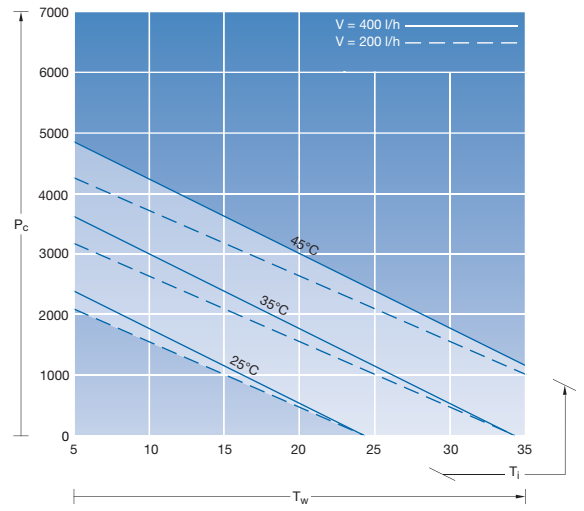


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Roof-mounted air/water heat exchangers

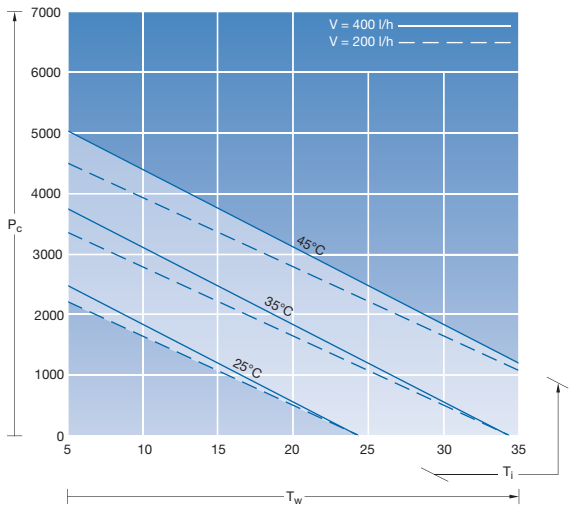
Output class 3000 W
Water-carrying parts: Stainless steel (1.4571)

50 Hz
SK 3210.504



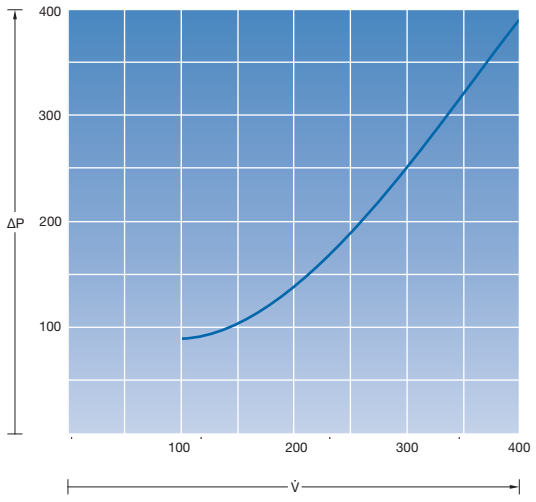
T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

60 Hz
SK 3210.504



T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

Water resistance diagram
SK 3210.504

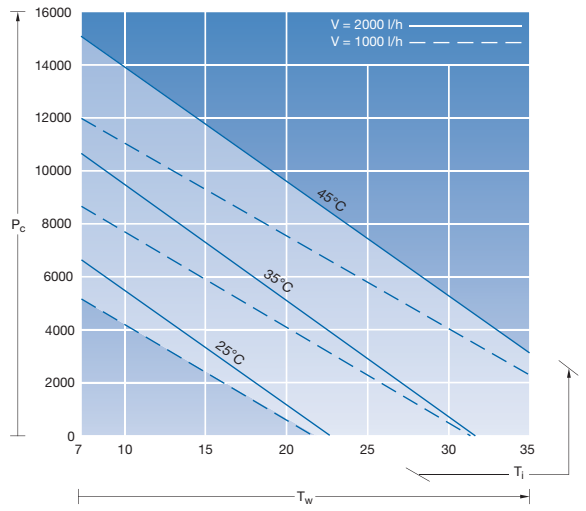


$\dot{V}$ = Volumetric flow (l/h)
ΔP = Water resistance (mbar)

Liquid Cooling Package

Output class 10 kW, LCP Rack Industry
Water-carrying parts: Copper/brass (Cu/CuZn)

50/60 Hz
SK 3378.200, .280

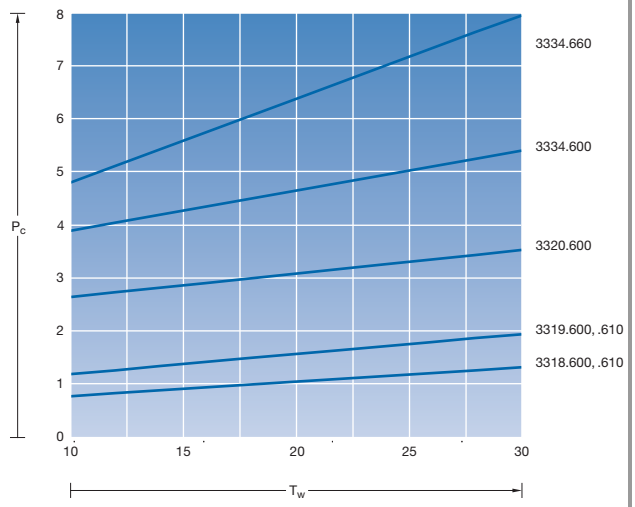


T_w = Water inlet temperature (°C)
P_c = Total cooling output (W)
T_i = Enclosure internal temperature (°C)

TopTherm chillers

Output class 1 – 6 kW

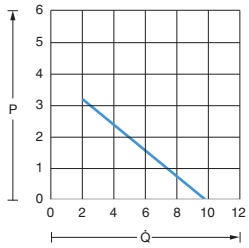
50 Hz at T_u = 32 °C
SK 3318.600, .610, 3319.600, .610, 3320.600, 3334.600, .660



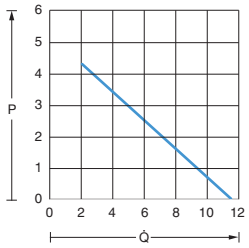
T_w = Water inlet temperature (°C)
T_u = Ambient temperature (°C)
P_c = Total cooling output (kW)

Characteristic curves of pump
SK 3318.600/SK 3318.610/SK 3319.600/SK 3319.610

50 Hz

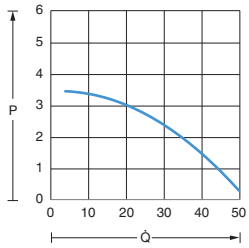


60 Hz

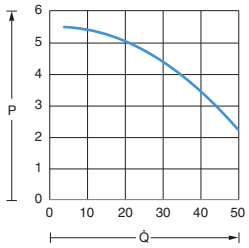


SK 3320.600/SK 3334.600/SK 3334.660

50 Hz



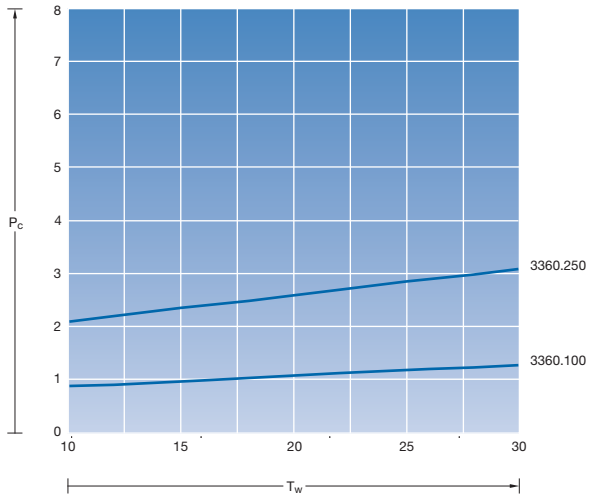
60 Hz



P = External static pressure [bar]
Q̇ = Delivery flow Q [l/min]

Output class 1 – 2.5 kW, wall-mounted

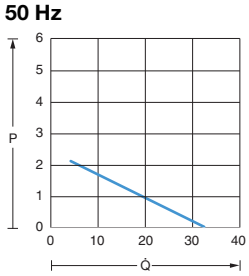
50 Hz at T_u = 32 °C
SK 3360.100, .250



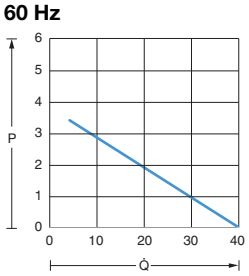
T_w = Water inlet temperature (°C)
T_u = Ambient temperature (°C)
P_c = Total cooling output (kW)

Characteristic curves of pump
SK 3360.100/SK 3360.250

50 Hz



60 Hz

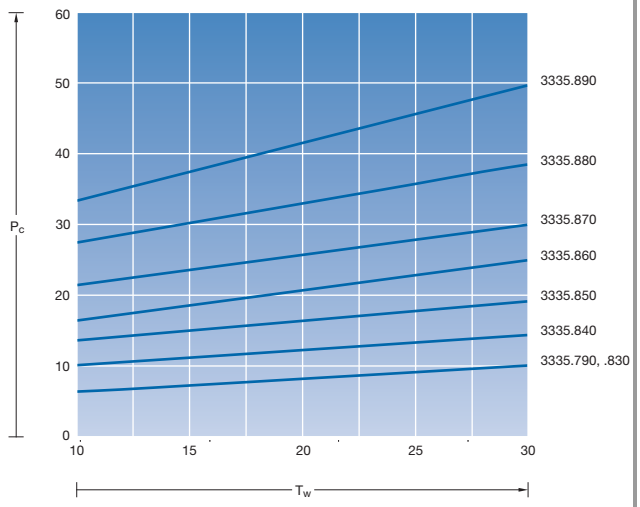


P = External static pressure [bar]
Q̇ = Delivery flow Q [l/min]

TopTherm chillers

Output class 8 – 40 kW

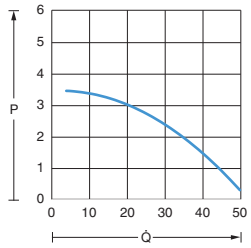
50 Hz at T_u = 32 °C
SK 3335.790, .830, .840, .850, .860, .870, .880, .890



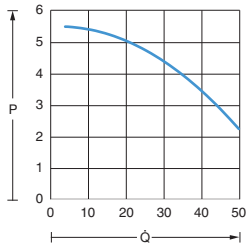
T_w = Water inlet temperature (°C)
T_u = Ambient temperature (°C)
P_c = Total cooling output (kW)

Characteristic curves of pump
SK 3335.790/SK 3335.830

50 Hz

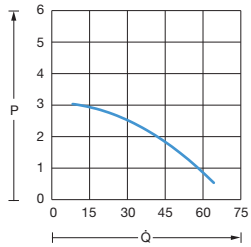


60 Hz

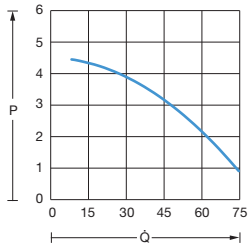


SK 3335.840

50 Hz

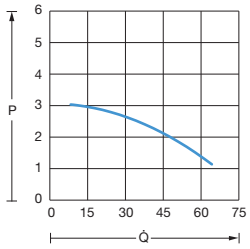


60 Hz

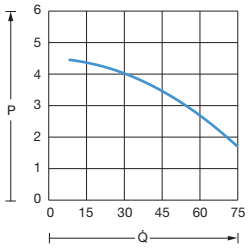


Characteristic curves of pump
SK 3335.850

50 Hz

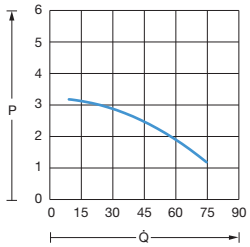


60 Hz

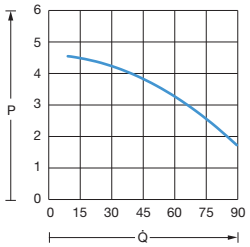


SK 3335.860

50 Hz

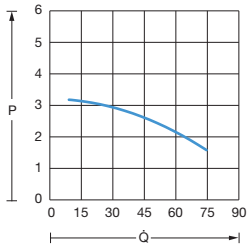


60 Hz

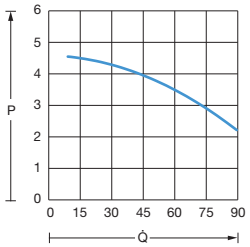


SK 3335.870

50 Hz

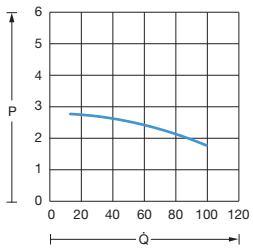


60 Hz

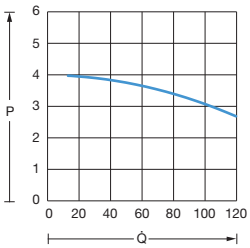


SK 3335.880

50 Hz

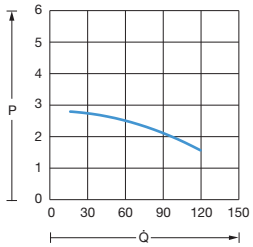


60 Hz

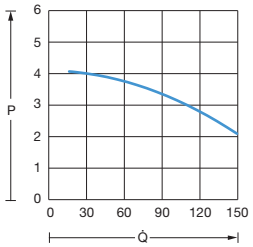


SK 3335.890

50 Hz



60 Hz

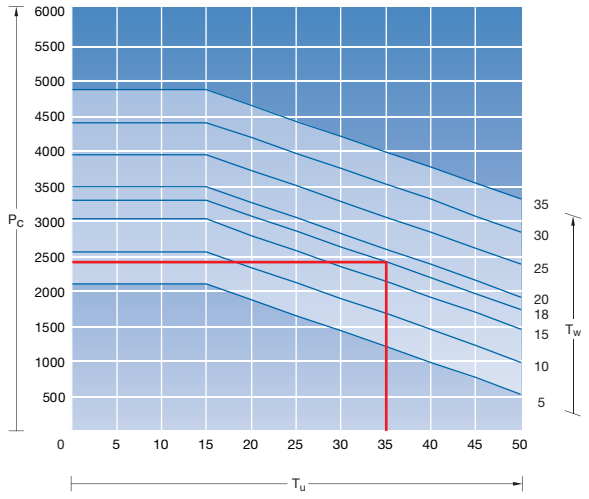


P = External static pressure [bar]
Q̇ = Delivery flow Q [l/min]

Blue e+ chillers

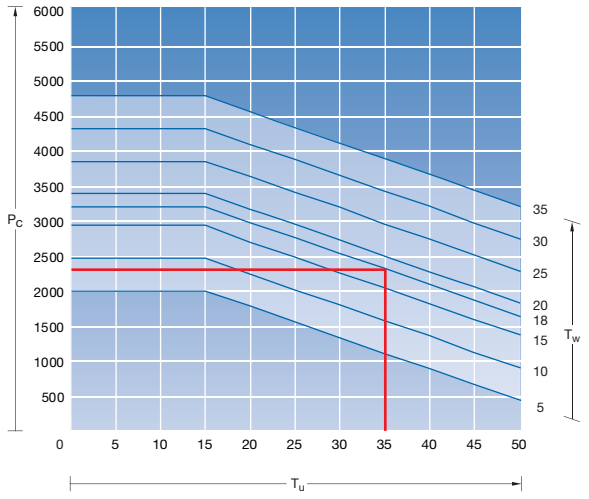
Output class 2.5 kW

50 Hz
SK 3320.200



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

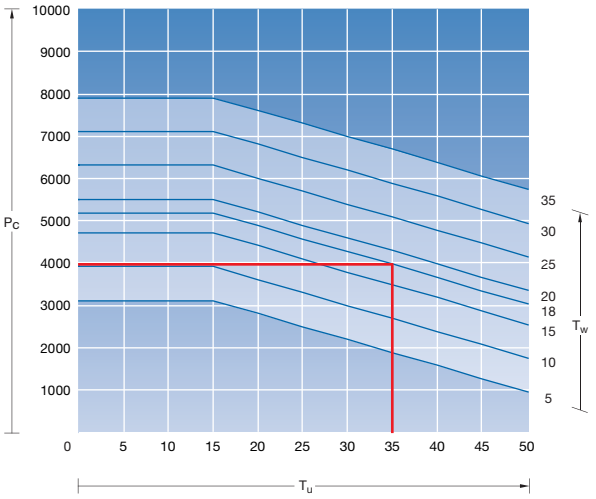
60 Hz
SK 3320.200



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

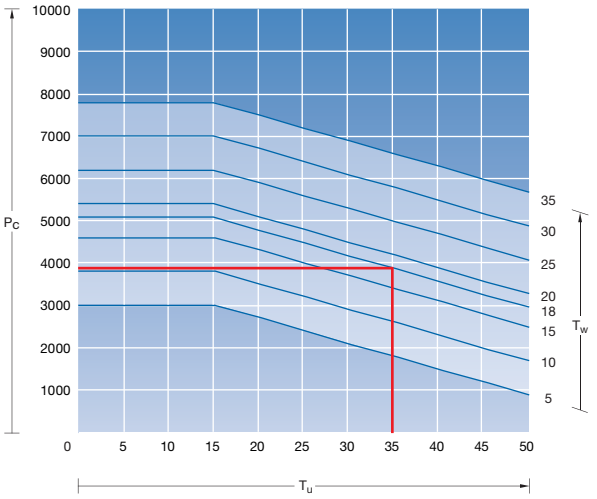
Output class 4.0 kW

50 Hz
SK 3334.300



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

60 Hz
SK 3334.300

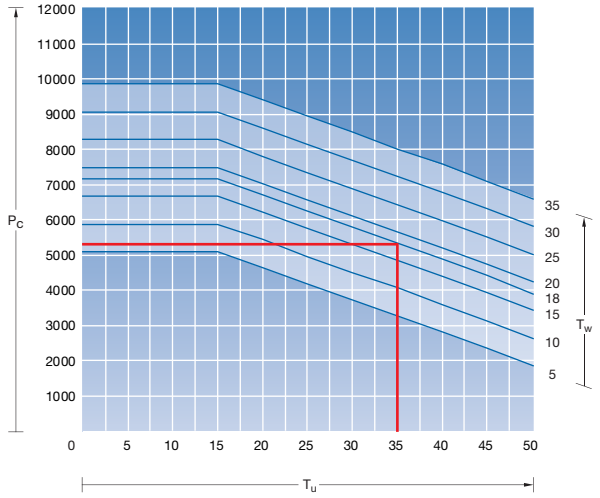


T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

Blue e+ chillers

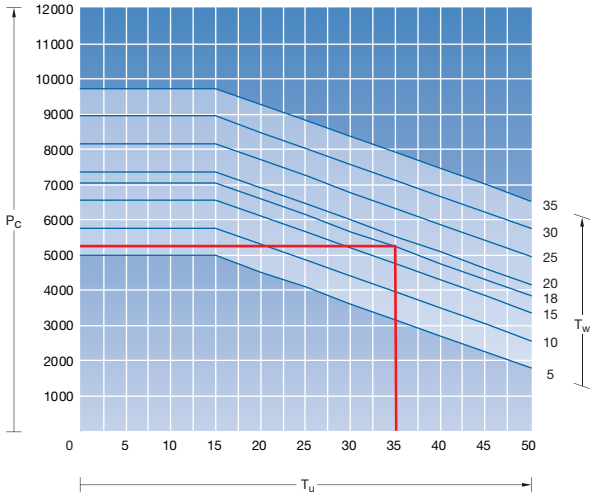
Output class 5.5 kW

50 Hz
SK 3334.400



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

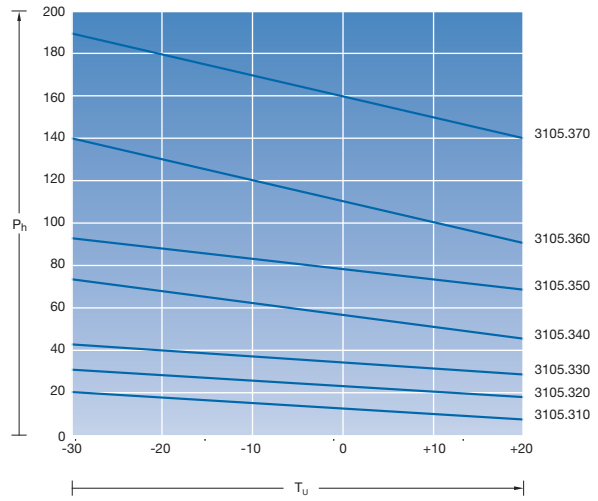
60 Hz
SK 3334.400



T_w = Water inlet temperature [°C]
P_c = Total cooling output [W]
T_u = Ambient temperature [°C]

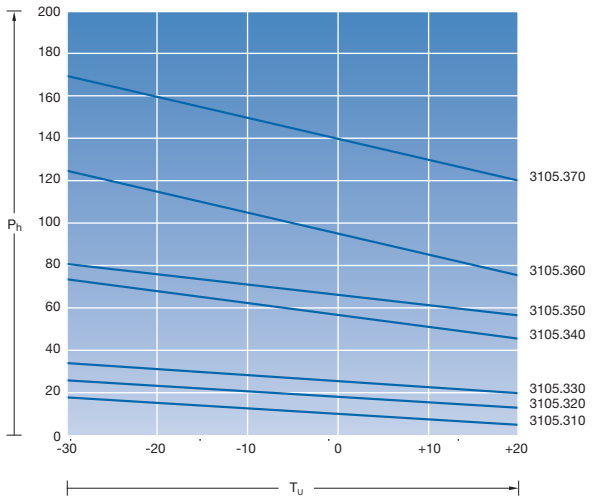
Enclosure heaters without fan

Heating output 230 V



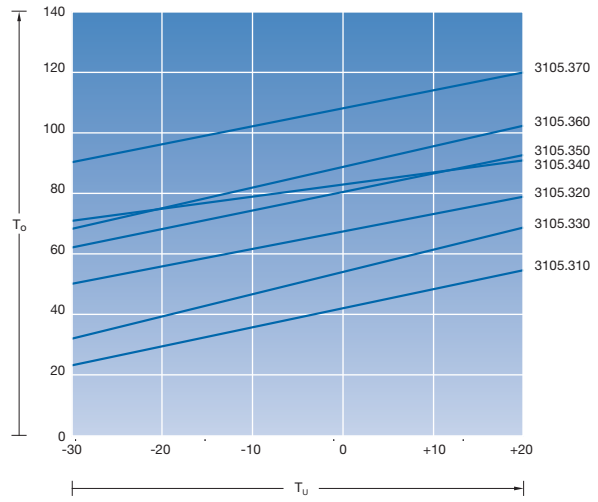
T_u = Ambient temperature (°C)
P_h = Heating output (W)

Heating output 110 V



T_u = Ambient temperature (°C)
P_h = Heating output (W)

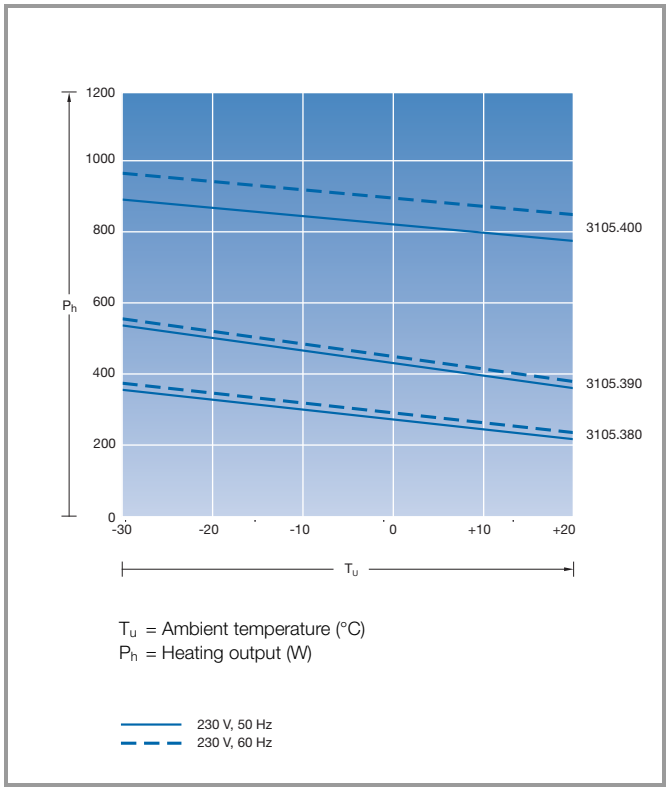
Maximum surface temperature



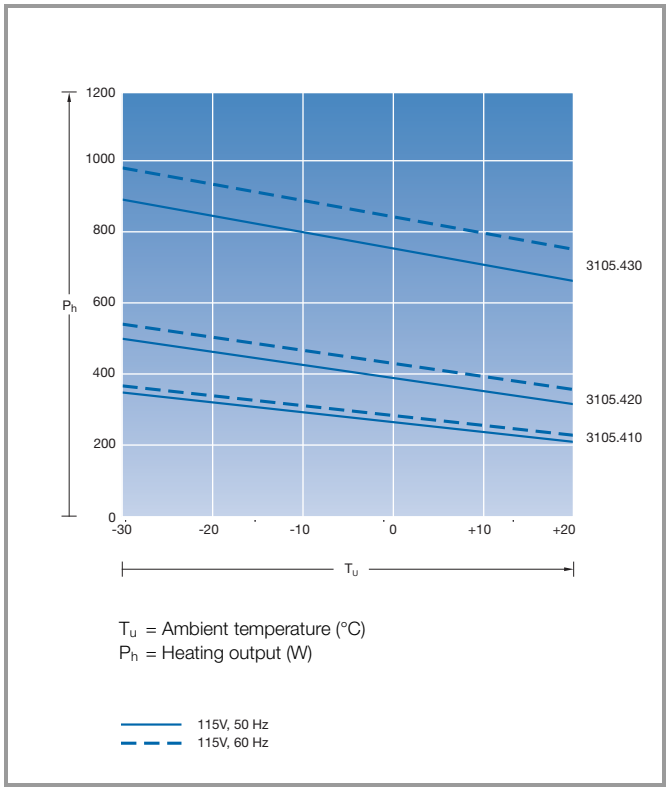
T_u = Ambient temperature (°C)
T_o = Surface temperature (°C)

Enclosure heaters with fan

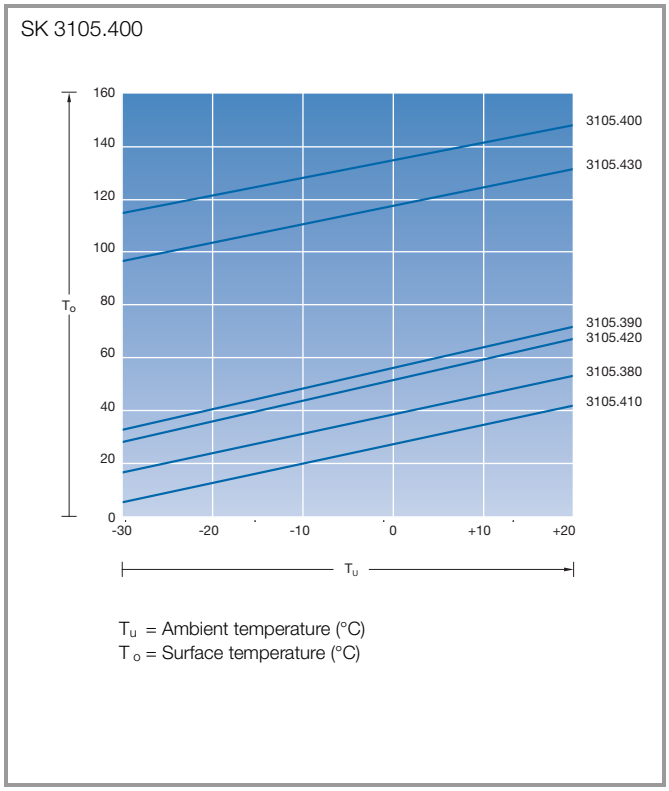
Heating output 230 V, 50/60 Hz



Heating output 115 V, 50/60 Hz



Maximum surface temperature



Rittal – The System.

Faster – better – everywhere.

- Enclosures
- Power Distribution
- Climate Control
- IT Infrastructure
- Software & Services

You can find the contact details of all
Rittal companies throughout the world here.

www.rittal.com/contact

XWW000079EN1901

Rittal – The System.

Faster – better – everywhere.

Enclosure heater with fan – SK 3105.400

Date : Jun 3, 2019

ENCLOSURES POWER DISTRIBUTION CLIMATE CONTROL IT INFRASTRUCTURE SOFTWARE & SERVICES

FRIEDHELM LOH GROUP

Enclosure heater with fan – SK 3105.400

created: 03.06.2019 build on www.rittal.com/uk-en



Product description

Supply includes:	PTC heater with fan Quick-connection terminal Assembly parts
Note:	For precise temperature control inside the enclosure, we recommend the enclosure internal thermostat or the digital enclosure internal temperature display and thermostat. In order to prevent condensation on assemblies, a hygrostat is recommended to regulate heating. In larger enclosures, even heat distribution is best achieved by installing several low-output heaters. The installation of heaters is generally advisable, in order to prevent condensation.

Product features

Continuous thermal output at 10 °C:	800 W - 870 W Note: Continuous thermal output with fan
Rated operating voltage:	230 V, 1~, 50 Hz/60 Hz
Dimensions:	Width: 103 mm Height: 200 mm Depth: 103 mm
Miniature circuit-breaker/fuse:	6 A
Fans pre-integrated:	yes
Packs of:	1 pc(s).
Weight/pack:	1.22 kg

© Rittal 2019

EAN:	4028177662889
Customs tariff number:	85162999
ETIM 6.0:	EC000737
ETIM 5.0:	EC000737
eCl@ss 8.0/8.1:	27180710
eCl@ss 7.0/7.1:	27180710
eCl@ss 6.0/6.1:	27180710
eCl@ss 5.1/5.1.4:	27180710
Product description:	SK enclosure heater, with fan, 800/870 W, 230 V, 1~, 50/60 Hz, WHD: 103 x 200 x 103 mm

Approvals

Approvals:	Approval overview CSA UR + C-UR VDE
Certificates:	EAC
Declarations:	Declaration of conformity

© Rittal 2019

PROFINET IRT IGBT Interface

Part No. 504890

Version 2.6 v4



Application

The FREQCON PROFINET IRT IGBT Interface (PIII) introduces the smartest way to control IGBT modules used in MW frequency converters for battery or solar applications. The PIII interface is able to control high power IGBTs directly via a standard industrial PLC.

For additional information, see circuit diagram and parts list of PROFINET IRT IGBT Interface PIII.

Communication

The PIII can communicate with the PROFINET IRT+ protocol, DDP (dynamic data packaging) allowing data trans-mission with a cycle time of 250 µs and down to 32.5 µs. One PIII device is able to control up to seven IGBT modules (seventh IGBT as break chopper).

Interface

The PIII housing is equipped with eight 25 Pin DSUB connectors (7x IGBT, 1x HVIO) on the bottom side of the housing.

Housing

The FREQCON PIII module is housed in a 420 mm x 240 mm x 56 mm aluminum case.

Technical Data

Technical Data PIII 2.6 v4	
Input Voltage	24 V DC (±10%)
Operation current (without IGBT connected)	300 mA
Max. current	6 A
Operating temperature range	0 °C … +50 °C
Storage and transport temperature range	-30 °C … +50 °C
IGBT Interfaces	8 x 25-pole DSUB female
Protection class	IP50
Weight	3 kg
Dimensions (W x H x D)	500 x 240 x 65 mm

FREQCON GmbH
Bürgerwiesenweg 5
27336 Rethem
Tel: +49 (0) 5165 – 291 760 – 0
www.freqcon.com

Topology

The following scheme depicts the topology of a system with several interconnected PIII modules.

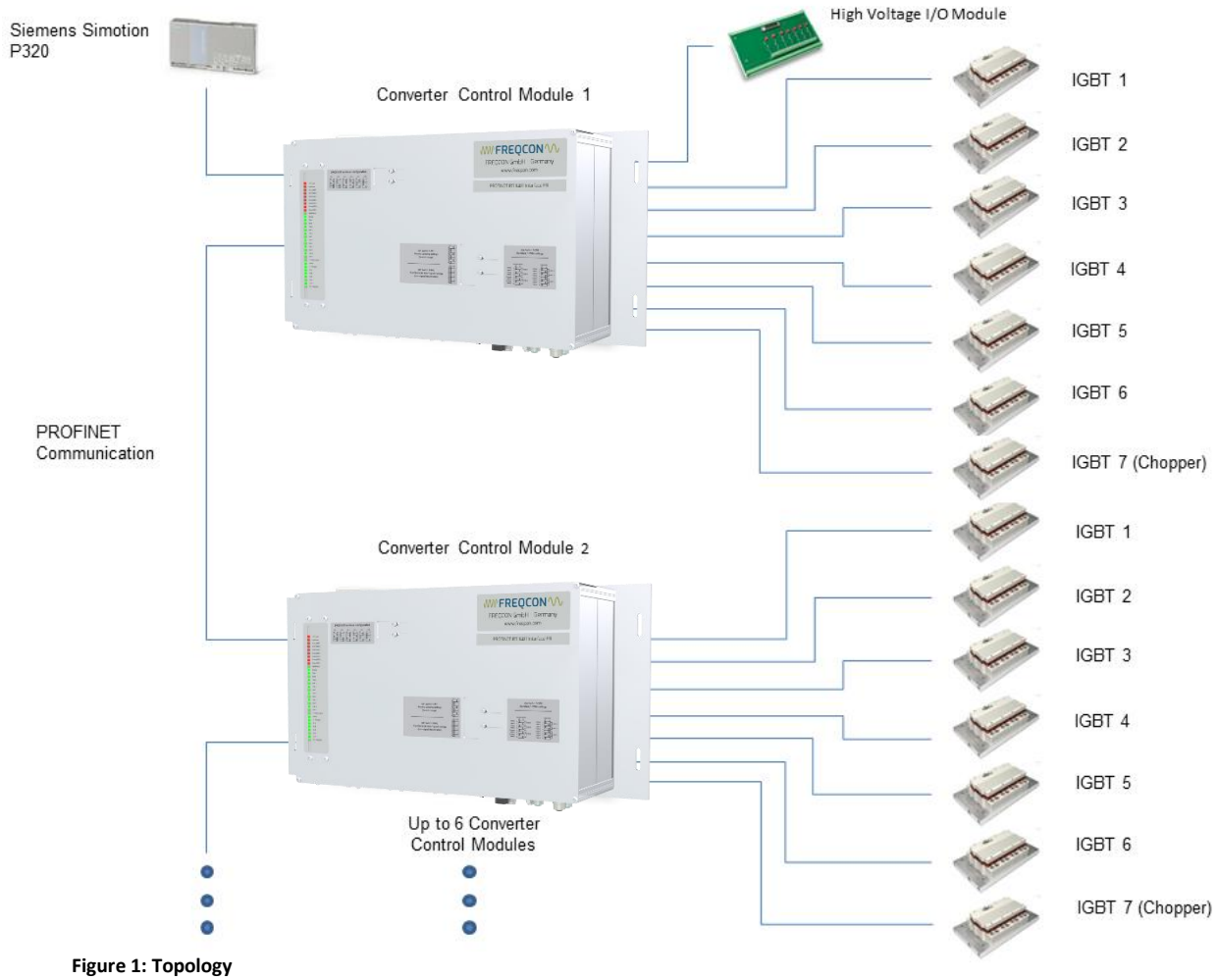


Figure 1: Topology

System Design

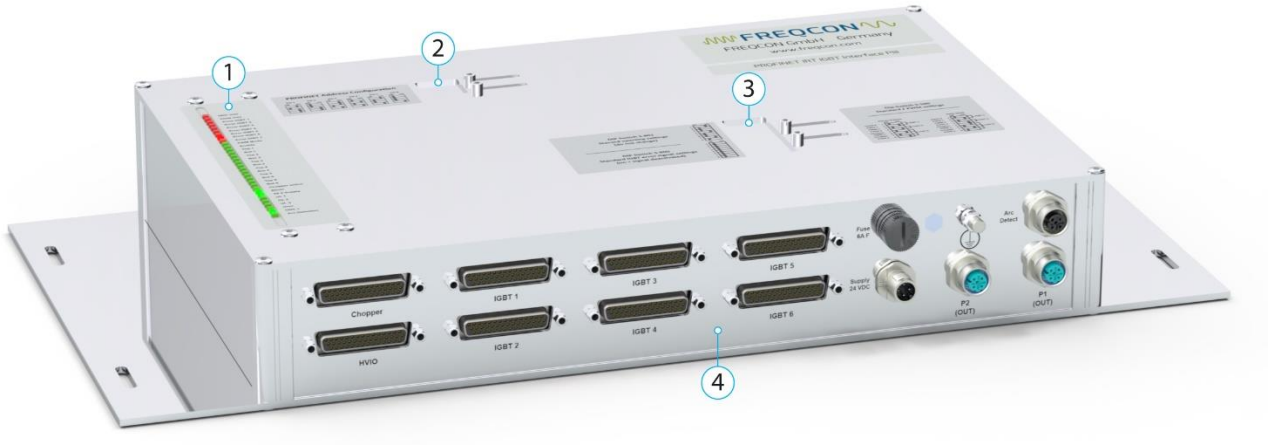


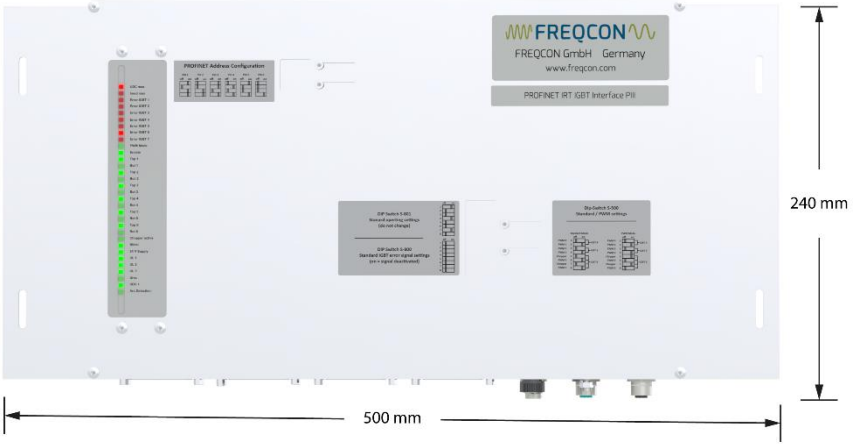
Figure 2: System design

Pos.	Component(s)
①	LED indication lights
②	Housing window - Dip switches for PROFINET setting configuration
③	Housing window – Dip switches for operating/error signal settings configuration
④	Connectors (IGBT/24 VDC supply/COM In/ COM Out/Arc detection)

Dimensions

(in mm)

Front View



Side View



Figure 3: Dimensions

Interfaces

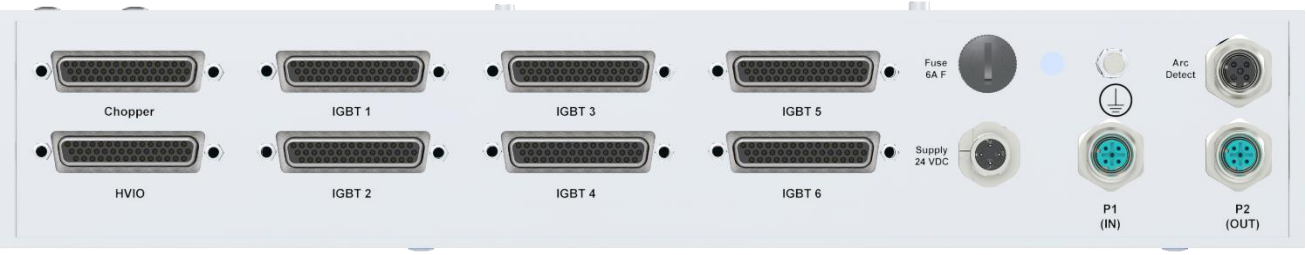


Figure 4: Interfaces 2mql out

Chopper-IGBT Connector: 25-Pole DSUB female

DSUB No.	Description
1	+24 V IGBT
2	+24 V IGBT
3	+24 V IGBT
4	
5	
6	
7	
8	Top 7
9	
10	
11	
12	
13	
14	GND 24V IGBT
15	GND 24V IGBT
16	GND 24V IGBT
17	
18	Error 7
19	
20	
21	Bot 7
22	GND (Top / Bot)
23	
24	
25	Shield

HVIO Connector: 25-Pole DSUB female

DSUB No.	Description
1	PEN
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	GND
15	Phase L3
16	Phase L2
17	Phase L1
18	DC Link+
19	DC Link-
20	REC+ Voltage
21	
22	
23	
24	
25	

IGBT 1 Connector: 25-Pole DSUB female

DSUB No.	Description
1	+24 V IGBT
2	+24 V IGBT
3	+24 V IGBT
4	
5	
6	Temperature analogue 1
7	
8	Top 1
9	
10	Current actual value 1
11	
12	
13	
14	GND 24V IGBT
15	GND 24V IGBT
16	GND 24V IGBT
17	
18	Error 1
19	GND (temperature analogue)
20	
21	Bot 1
22	GND (Top / Bot)
23	GND (current actual value)
24	
25	Shield

IGBT 2 Connector: 25-Pole DSUB female

DSUB No.	Description
1	+24 V IGBT
2	+24 V IGBT
3	+24 V IGBT
4	
5	
6	Temperature analogue2
7	
8	Top 2
9	
10	Current actual value 2
11	
12	
13	
14	GND 24V IGBT
15	GND 24V IGBT
16	GND 24V IGBT
17	
18	Error 2
19	GND (temperature analogue)
20	
21	Bot 2
22	GND (Top / Bot)
23	GND (current actual value)
24	
25	Shield

IGBT 3 Connector: 25-Pole DSUB female

DSUB No.	Description
1	+24 V IGBT
2	+24 V IGBT
3	+24 V IGBT
4	
5	
6	Temperature analogue 3
7	
8	Top 3
9	
10	Current actual value 3
11	
12	
13	
14	GND 24V IGBT
15	GND 24V IGBT
16	GND 24V IGBT
17	
18	Error 3
19	GND (temperature analogue)
20	
21	Bot 3
22	GND (Top / Bot)
23	GND (current actual value)
24	
25	Shield

IGBT 4 Connector: 25-Pole DSUB female

DSUB No.	Description
1	+24 V IGBT
2	+24 V IGBT
3	+24 V IGBT
4	
5	
6	Temperature analogue 4
7	
8	Top 4
9	
10	Current actual value 4
11	
12	
13	
14	GND 24V IGBT
15	GND 24V IGBT
16	GND 24V IGBT
17	
18	Error 4
19	GND (temperature analogue)
20	
21	Bot 4
22	GND (Top / Bot)
23	GND (current actual value)
24	
25	Shield

IGBT 5 Connector: 25-Pole DSUB female

DSUB No.	Description
1	+24 V IGBT
2	+24 V IGBT
3	+24 V IGBT
4	
5	
6	Temperature analogue 5
7	
8	Top 5
9	
10	Current actual value 5
11	
12	
13	
14	GND 24V IGBT
15	GND 24V IGBT
16	GND 24V IGBT
17	
18	Error 5
19	GND (temperature analogue)
20	
21	Bot 5
22	GND (Top / Bot)
23	GND (current actual value)
24	
25	Shield

IGBT 6 Connector: 25-Pole DSUB female

DSUB No.	Description
1	+24 V IGBT
2	+24 V IGBT
3	+24 V IGBT
4	
5	
6	Temperature analogue 6
7	
8	Top 6
9	
10	Current actual value 6
11	
12	
13	
14	GND 24V IGBT
15	GND 24V IGBT
16	GND 24V IGBT
17	
18	Error 6
19	GND (temperature analogue)
20	
21	Bot 6
22	GND (Top / Bot)
23	GND (current actual value)
24	
25	Shield

PROFINET Input Connector (P1 IN)

Connector M12, 4-pos., female, D-coded, for rear mounting, with Ethernet cable AWG 26 stranded Phoenix Contact Type: VS-DSIV-M12FSD/0.5-RJ45.

Pin No.	Signal	Description
1	TD+	Transmission data +
2	TD-	Transmission data -
3	RD+	Receiver data +
4	RD-	Receiver data -

PROFINET Output Connector (P2 OUT)

Connector M12, 4-pos., female, D-coded, for rear mounting, with Ethernet cable AWG 26 stranded Phoenix Contact Type: VS-DSIV-M12FSD/0.5-RJ45.

Pin No.	Signal	Description
1	TD+	Transmission data +
2	TD-	Transmission data -
3	RD+	Receiver data +
4	RD-	Receiver data -

Power Supply 24VDC Connector

Connector M12, 4-pole, female, A-coded.
Phoenix Contact Type: SACC-ES-MS-4CON-M16/0.5 SCO.

Pin No.	Description
1	+24 V
2	PE
3	GND
4	Not connected

Arc Detection Connector

Connector M12, 5-pole, female, A-coded.
CONEC Type: SAL-12-FKH5-0,5-9

Pin No.	Description
1	GND
2	5 V
3	Input arc detect signal
4	Shield
5	Not connected

LED Indication Lights

Label	Description
UDC max	DC Link Voltage too high
Imod max	Current of one or more IGBT´s too high
Error IGBT 1	Error detected on IGBT 1
Error IGBT 2	Error detected on IGBT 2
Error IGBT 3	Error detected on IGBT 3
Error IGBT 4	Error detected on IGBT 4
Error IGBT 5	Error detected on IGBT 5
Error IGBT 6	Error detected on IGBT 6
Error IGBT 7	Error detected on IGBT 7 (chopper)
PWM Mode	IGBT 1 to 3 in PWM Mode
Enable	IGBT 1 to 6 ready for operation
Top 1	Top 1 activated
Bot 1	Bot 1 activated
Top 2	Top 2 activated
Bot 2	Bot 2 activated
Top 3	Top 3 activated
Bot 3	Bot 3 activated
Top 4	Top 4 activated
Bot 4	Bot 4 activated
Top 5	Top 5 activated
Bot 5	Bot 5 activated
Top 6	Top 6 activated
Bot 6	Bot 6 activated
Chopper active	Chopper is active
Blinki	Profinet communication between PLC and PIII is established
24 V Supply	24 V input supply is connected
UL 1	L1 voltage is present
UL 2	L2 voltage is present
UL 3	L3 voltage is present
Urec	Booster voltage on rectifier is present
UDC +	DC Link voltage is present
Arc Detection	Arc detection triggered

If an error occurs (indicated by the LED´s 1 to 7) the IGBT´s 1 to 6 are deactivated by the PIII, until a reset is performed by the simotion controller.

Dip Switch Description

Three DIP switches are located on the interface board and are accessible via protection windows on the casing (*see figure 2*). The standard DIP switch settings are described on page 15.

Dip Switch -801

Standard operating setting - do not change:

Dip Switch No.	Description
1 on	Phase L3 measurement activated
1 off	Phase L3 measurement deactivated
2 on	For factory testing only
2 off	Normal operation setting
3 on	For factory testing only
3 off	Normal operation setting
4 on	Phase L2 measurement activated
4 off	Phase L2 measurement deactivated
5 on	For factory testing only
5 off	Normal operation setting
6 on	For factory testing only
6 off	Normal operation setting
7 on	Phase L1 measurement activated
7 off	Phase L1 measurement deactivated
8 on	For factory testing only
8 off	Normal operation setting

Dip Switch -800

Standard IGBT error signal settings:

Dip Switch No.	Description
1 on	Error1 disabled
1 off	Error1 enabled
2 on	Error2 disabled
2 off	Error2 enabled
3 on	Error3 disabled
3 off	Error3 enabled
4 on	Error4 disabled
4 off	Error4 enabled
5 on	Error5 disabled
5 off	Error5 enabled
6 on	Error6 disabled
6 off	Error6 enabled
7 on	Error7 disabled
7 off	Error7 enabled
8 on	No function
8 off	No function

Standard Operating Settings

The DIP switches S-801 and S-800 are located on the interface board and are accessible by a small protection window (*see figure 5*).

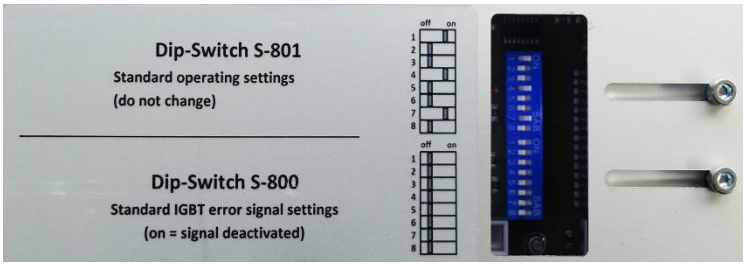


Figure 5: DIP switches in housing

In order to set the DIP switches, the screws of the protection window are to be untightened and the protection plate must be slide to the side.

After access to the S-801 and S-800 DIP switches is provided, the switches must be set as follows:

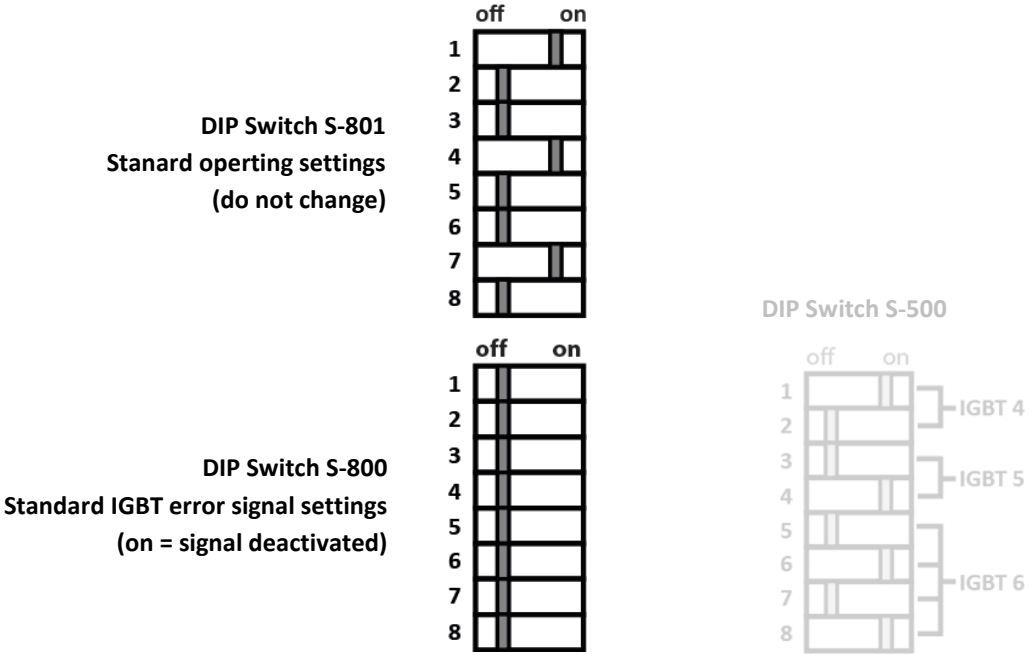


Figure 6: Depiction of dip switches S-801 and S-800

Operating Mode Settings

The DIP switch S-500 is located on the interface board to the right of the S-800 and S-801 DIP and is accessible by a small protection window. The S-500 DIP switch is used to connect the IGBTs 4, 5, 6 to different PWM signal generation sources.

In order to set the DIP switches, the screws of the protection window are to be untightened and the protection plate must be slide to the side.

After access to the S-500 DIP switch is provided, the switch must be set as follows for universal mode:

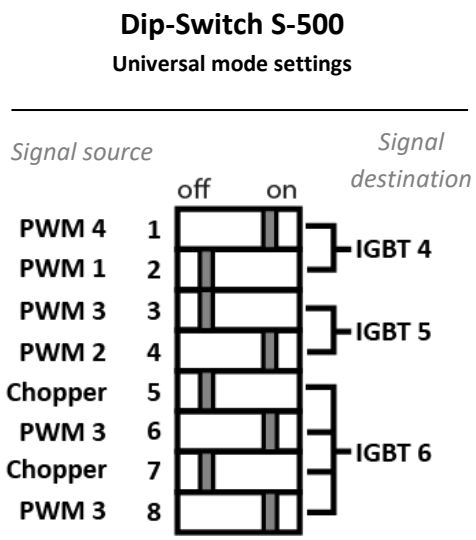


Figure 7: Depiction of DIP switch S-500

Detailed explanation of the switches:

If switch 1 is on and switch 2 off, the signal source for IGBT 4 is data word “PWM 4”,
If switch 1 is off and switch 2 is on, the signal source for IGBT 4 is data word “PWM 1”.

If switch 3 is on and switch 4 off, the signal source for IGBT 5 is data word “PWM 3”,
If switch 3 is off and switch 4 is on, the signal source for IGBT 5 is data word “PWM 2”.

If switch 5 and 7 is on and switch 5 and 8 is off, IGBT 6 is controlled by the chopper hardware logic.
If switch 7 and 7 is off and switch 5 and 8 is on, IGBT 6 is controlled by the data word “PWM 3”.

PROFINET Standard Configuration

It is possible to connect up to six PIII devices to a single main PLC. Therefore, each PIII that is connected to the main PLC must be assigned with an individual PROFINET address (see Figure 9: PROFINET address topology).

A DIP switch for PROFINET address configuration is located on the interface board and is accessible by a small protection window (*see figure 2*).

In order to set the DIP switch, the screws of the protection window are to be untightened and the protection plate must be slide to the side.

After access to the PROFINET configuration DIP switch is provided, the PROFINET configuration switches must be set as follows:

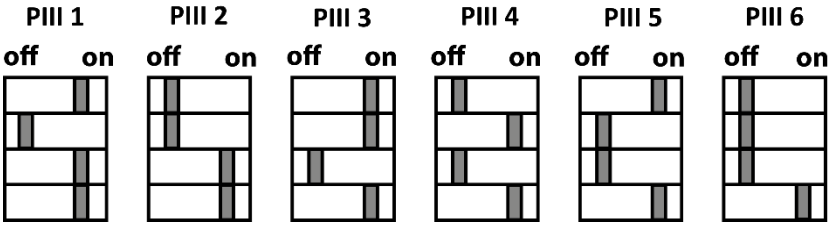


Figure 8: PROFINET address configuration

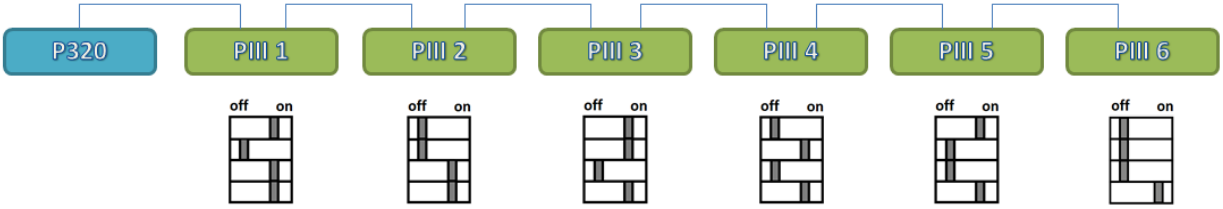


Figure 9: PROFINET address topology

Arc Detection

The FREQCON PIII is able to detect electric arcs inside its installation site. The detection is ensured by a light sensor cable (③) that can be connected to the PIII device via female M12 5-pole connector (②). The sensor (①) constantly measures the light intensity of the PIII installation environment.



Figure 10: Arc detection sensor cable

Pos.	Component
1	Light sensor socket
2	Connector 5-pole M12
3	Sensor cable 4*0.14 mm² shielded / 4.5mm outer diameter
4	Clamp-on ferrite bead

Note: The external arc detection sensor with cable is not part of the scope of supply and must be ordered separately.

The following external arc detection sensors with cable can be ordered:

Order No.	Component	Cable length
500402	External arc sensor with cable	3.5 m
500403	External arc sensor with cable	4.5 m
500404	External arc sensor with cable	5.5 m

Arc Detection Cable Installation

- ➜ Install the arc detection sensor inside the switch cabinet where the IGBT PowerStacks are installed, since potentially occurring arcs will be created in this cabinet.
- ➜ The arc detection sensor head must be installed on the front side of the cabinet frame inside the switch cabinet.
- ➜ If there is only one IGBT PowerStack installed inside the switch cabinet, install the sensor head at the height of the IGBT PowerStacks´ center.
- ➜ If more than one IGBT PowerStack is installed inside the switch cabinet, install the sensor head at the height of the center of all installed PowerStacks.
- ➜ **Do not cover the external arc detection sensor window! Covering the arc detection window leads to measurement errors of the light sensor!**

Observe the following instruction for the installation of the external arc detection sensor cable.

Task 1: **Install mounting bracket to the switch cabinet frame**

Step 1: Install the delivered mounting bracket to the frame of the switch cabinet where the power modules are located by using suitable connection material. Use the two drill holes (①) for installation to the switch cabinet frame.

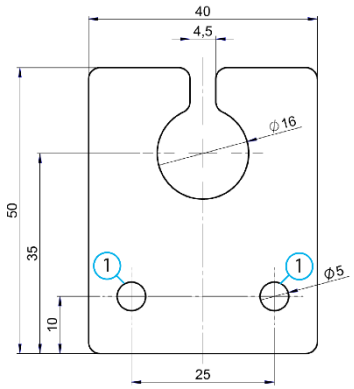


Figure 11: Mounting bracket with drill holes

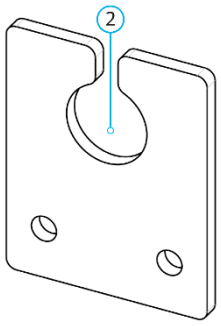


Figure 12: Mounting bracket recess

Step 2: Lead the sensor head of the delivered arc detection sensor cable through the recess of the mounting bracket (②) and finally slide it down the recess until the catches snap into place.

Step 3: Lead the other end of the arc detection sensor cable to the cabinet where the PIII converter interface is installed. Lay and fix the cable properly.

Step 4: Loop the cable once and lay the cable loop inside the delivered clamp-on ferrite bead.

Step 5: Close the clamp-on ferrite bead.

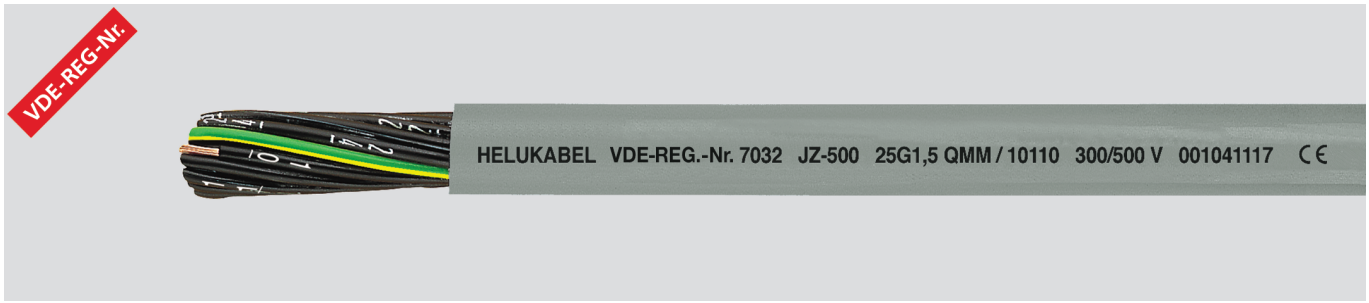
Step 6: Connect the arc detection sensor cable plug to the “ARC Detect” connector at the front side of the PIII housing.

Version Overview

Version	Date	Name	Description
1.0	2019-08-21	C. Palenzuela	First version
1.1	2022-02-04	C. Palenzuela	Updated several pages

JZ-500

flexible, number coded, meter marking



Technical data

- PVC cable adapted to DIN VDE 0285-525-2-51 / DIN EN 50525-2-51
- **Temperature range** flexing -15°C to +80°C fixed installation -40°C to +80°C
- **Nominal voltage** U_0/U 300/500 V
- **Test voltage** 4000 V
- **Breakdown voltage** min. 8000 V
- **Minimum bending radius** flexing 7,5x cable Ø fixed installation 4x cable Ø

Cable structure

- Bare copper conductor, fine wire acc. to DIN VDE 0295 cl.5 / IEC 60228 cl.5
- Core insulation of PVC compound type Z 7225
- Core identification to DIN VDE 0293 black cores with continuous white numbering
- GN-YE conductor, 3 cores and above in the outer layer
- Cores stranded in layers with optimal lay length
- Outer sheath of PVC compound type TM2 to DIN VDE 0207-363-4-1 / DIN EN 50363-4-1
- Sheath colour: grey (RAL 7001)
- With meter marking

Properties

- Extensively oil resistant, oil-/chemical resistance see "Technical Information"
- Conditional drag chain compatible
- Conditional suitability for torsion
- The materials used during manufacturing are cadmium-free, contain no silicone and are free from substances harmful to the wetting properties of lacquers

Tests

- Flame retardant acc. to DIN VDE 0482-332-1-2 / DIN EN 60332-1-2 / IEC 60332-1-2

Note

- G = with GN-YE conductor x = without GN-YE conductor (OZ)
- Please note "cleanroom qualified" when ordering.
- AWG sizes are approximate equivalent values. The actual cross section is in mm².
- Screened analogue type: **F-CY-JZ, F-CY-OZ (LiY-CY), Y-CY-JB, Y-CY-JZ**

Application

These cables are appropriate for flexible use with medium mechanical stresses, and free movement without tensile stress or forced movements in dry, moist and wet rooms but not open air. Suitable to be used as connecting and control cables in tool machines, conveyor belts, assembly lines, plant engineering, AC technology, steel production and other manufacturing environments. Selected PVC compounds guarantee good flexibility as well as an economic and fast installation.

CE = Product conforms with Low-Voltage Directive 2014/35/EU.

Part no.	No.cores x cross-sec. mm²	Outer Ø app. mm	Cop. weight kg / km	Weight app. kg / km	AWG-No.
10001	2 x 0,5	4,8	9,6	40,0	20
10002	3 G 0,5	5,1	14,4	46,0	20
10003	3 x 0,5	5,1	14,4	46,0	20
10004	4 G 0,5	5,5	19,0	56,0	20
10005	4 x 0,5	5,5	19,0	56,0	20
10006	5 G 0,5	6,2	24,0	65,0	20
10007	5 x 0,5	6,2	24,0	65,0	20
10008	6 G 0,5	6,7	29,0	75,0	20
10009	7 G 0,5	6,7	33,6	80,0	20
10010	7 x 0,5	6,7	33,6	80,0	20
10011	8 G 0,5	7,4	38,0	97,0	20
10172	8 x 0,5	7,4	38,0	97,0	20
10012	10 G 0,5	8,6	48,0	116,0	20
10013	12 G 0,5	9,1	58,0	135,0	20
10014	12 x 0,5	9,1	58,0	135,0	20
10015	14 G 0,5	9,5	67,0	150,0	20

Part no.	No.cores x cross-sec. mm²	Outer Ø app. mm	Cop. weight kg / km	Weight app. kg / km	AWG-No.
10183	16 G 0,5	10,0	76,0	175,0	20
10016	18 G 0,5	10,7	86,0	196,0	20
10017	20 G 0,5	11,3	96,0	215,0	20
10018	21 G 0,5	11,3	101,0	240,0	20
10019	25 G 0,5	12,6	120,0	270,0	20
10020	30 G 0,5	13,5	144,0	310,0	20
10021	32 G 0,5	14,0	154,0	323,0	20
10022	34 G 0,5	14,7	163,0	362,0	20
10023	40 G 0,5	15,3	192,0	434,0	20
10024	42 G 0,5	15,8	202,0	449,0	20
10025	50 G 0,5	17,3	240,0	513,0	20
10169	52 G 0,5	17,3	252,0	534,0	20
10026	61 G 0,5	18,5	293,0	625,0	20
10027	65 G 0,5	19,2	312,0	682,0	20
10028	80 G 0,5	21,3	384,0	780,0	20
10029	100 G 0,5	23,8	480,0	980,0	20

Continuation ▸

02.05.2019 / Dimensions and specifications may be changed without prior notice.

JZ-500

flexible, number coded, meter marking

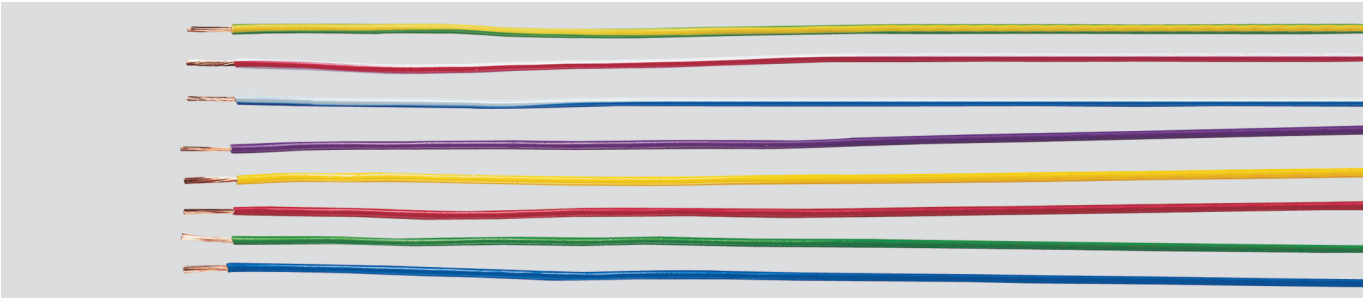
Part no.	No.cores x cross-sec. mm²	Outer Ø app. mm	Cop. weight kg / km	Weight app. kg / km	AWG-No.
10030	2 x 0,75	5,3	14,4	46,0	19
10031	3 G 0,75	5,6	21,6	54,0	19
10032	3 x 0,75	5,6	21,6	54,0	19
10033	4 G 0,75	6,3	28,8	66,0	19
10034	4 x 0,75	6,3	28,8	66,0	19
10035	5 G 0,75	6,9	36,0	80,0	19
10036	5 x 0,75	6,9	36,0	80,0	19
10037	6 G 0,75	7,7	43,0	99,0	19
10177	6 x 0,75	7,7	43,0	99,0	19
10038	7 G 0,75	7,7	50,0	110,0	19
10039	7 x 0,75	7,7	50,0	110,0	19
10040	8 G 0,75	8,3	58,0	130,0	19
10173	8 x 0,75	8,3	58,0	130,0	19
10041	9 G 0,75	9,1	65,0	153,0	19
10042	10 G 0,75	9,8	72,0	162,0	19
10043	12 G 0,75	10,1	86,0	179,0	19
10044	12 x 0,75	10,1	86,0	179,0	19
10045	14 G 0,75	10,8	101,0	214,0	19
10046	15 G 0,75	11,4	108,0	218,0	19
10047	18 G 0,75	12,2	130,0	257,0	19
10533	19 G 0,75	12,2	137,0	264,0	19
10048	20 G 0,75	12,8	144,0	286,0	19
10049	21 G 0,75	12,8	151,0	320,0	19
10050	25 G 0,75	14,3	180,0	365,0	19
10534	27 G 0,75	14,5	195,0	382,0	19
10051	32 G 0,75	15,9	230,0	455,0	19
10052	34 G 0,75	16,7	245,0	510,0	19
10182	37 G 0,75	16,7	266,0	537,0	19
10053	40 G 0,75	17,3	288,0	595,0	19
10054	41 G 0,75	18,1	296,0	607,0	19
10055	42 G 0,75	18,1	302,0	612,0	19
10056	50 G 0,75	19,8	360,0	735,0	19
10057	61 G 0,75	21,2	439,0	845,0	19
10178	65 G 0,75	22,0	468,0	895,0	19
10058	80 G 0,75	24,3	576,0	1070,0	19
10059	100 G 0,75	27,1	720,0	1322,0	19
10060	2 x 1	5,6	19,2	60,0	18
10061	3 G 1	6,1	29,0	72,0	18
10062	3 x 1	6,1	29,0	72,0	18
10063	4 G 1	6,6	38,0	86,0	18
10064	4 x 1	6,6	38,0	86,0	18
10065	5 G 1	7,5	48,0	104,0	18
10066	5 x 1	7,5	48,0	104,0	18
10067	6 G 1	8,1	58,0	125,0	18
10068	7 G 1	8,1	67,0	141,0	18
10069	7 x 1	8,1	67,0	141,0	18
10070	8 G 1	9,0	77,0	175,0	18
10071	9 G 1	9,8	86,0	200,0	18
10180	10 G 1	10,6	96,0	217,0	18
10170	10 x 1	10,6	96,0	217,0	18
10072	12 G 1	10,9	115,0	230,0	18
10073	12 x 1	10,9	115,0	230,0	18
10074	14 G 1	11,5	134,0	271,0	18
10075	16 G 1	12,3	154,0	300,0	18
10076	18 G 1	12,9	173,0	343,0	18
10174	18 x 1	12,9	173,0	343,0	18
10197	19 G 1	12,9	182,0	355,0	18
10077	20 G 1	13,8	192,0	375,0	18
10184	20 x 1	13,8	192,0	375,0	18
10179	21 G 1	13,8	205,0	420,0	18
10175	24 G 1	15,4	230,0	440,0	18
10078	25 G 1	15,4	240,0	485,0	18
10176	25 x 1	15,4	240,0	485,0	18
10196	26 G 1	15,4	252,0	500,0	18
10198	27 G 1	15,4	259,0	534,0	18
10168	30 x 1	16,5	288,0	550,0	18
10079	34 G 1	17,9	326,0	650,0	18
10080	36 G 1	17,9	346,0	668,0	18
10199	37 G 1	17,9	355,0	701,0	18
10081	40 G 1	18,6	384,0	755,0	18
10167	40 x 1	18,6	384,0	755,0	18
10082	41 G 1	19,4	394,0	770,0	18
10083	42 G 1	19,4	403,0	810,0	18
10084	50 G 1	21,3	480,0	936,0	18
10085	56 G 1	22,1	538,0	920,0	18
10086	61 G 1	22,7	586,0	1100,0	18
10087	65 G 1	23,6	628,0	1180,0	18
10088	80 G 1	26,3	768,0	1294,0	18
10089	100 G 1	29,3	960,0	1644,0	18
10090	2 x 1,5	6,4	29,0	70,0	16
10091	3 G 1,5	6,8	43,0	90,0	16
10092	3 x 1,5	6,8	43,0	90,0	16
10093	4 G 1,5	7,6	58,0	109,0	16
10094	4 x 1,5	7,6	58,0	109,0	16
10095	5 G 1,5	8,3	72,0	131,0	16
10096	5 x 1,5	8,3	72,0	131,0	16
10097	6 G 1,5	9,2	86,0	157,0	16
10098	7 G 1,5	9,2	101,0	184,0	16
10099	7 x 1,5	9,2	101,0	184,0	16
10100	8 G 1,5	10,1	115,0	216,0	16
11007735	8 x 1,5	10,1	115,0	216,0	16
10101	9 G 1,5	11,1	129,0	259,0	16
10181	10 G 1,5	12,0	144,0	275,0	16
10102	11 G 1,5	12,0	158,0	300,0	16
10103	12 G 1,5	12,4	173,0	309,0	16
10104	12 x 1,5	12,4	173,0	309,0	16
10105	14 G 1,5	13,0	202,0	345,0	16
10106	16 G 1,5	13,9	230,0	386,0	16
10107	18 G 1,5	14,8	259,0	440,0	16
10185	19 G 1,5	14,8	279,0	445,0	16
10108	20 G 1,5	15,6	288,0	490,0	16
10109	21 G 1,5	15,6	302,0	555,0	16
10110	25 G 1,5	17,6	360,0	620,0	16
10535	27 G 1,5	17,6	389,0	670,0	16
10111	32 G 1,5	19,5	461,0	790,0	16
10112	34 G 1,5	20,2	490,0	830,0	16
10536	37 G 1,5	20,2	533,0	892,0	16
10113	41 G 1,5	22,1	591,0	996,0	16
10114	42 G 1,5	22,1	605,0	1007,0	16
10115	50 G 1,5	24,2	720,0	1250,0	16
10116	56 G 1,5	25,1	806,0	1332,0	16
10117	61 G 1,5	25,8	878,0	1440,0	16
10187	65 G 1,5	26,9	936,0	1602,0	16
10118	80 G 1,5	29,8	1152,0	1871,0	16
10119	100 G 1,5	33,2	1440,0	2353,0	16
10120	2 x 2,5	7,8	48,0	112,0	14
10121	3 G 2,5	8,3	72,0	148,0	14
10122	3 x 2,5	8,3	72,0	148,0	14
10123	4 G 2,5	9,2	96,0	178,0	14
10124	4 x 2,5	9,2	96,0	178,0	14
10125	5 G 2,5	10,1	120,0	221,0	14
10126	5 x 2,5	10,1	120,0	221,0	14
10127	7 G 2,5	11,2	168,0	306,0	14
10128	7 x 2,5	11,2	168,0	306,0	14
10129	8 G 2,5	12,3	192,0	363,0	14
11007736	8 x 2,5	12,3	192,0	363,0	14
10548	10 G 2,5	14,8	240,0	429,0	14
10130	12 G 2,5	15,3	288,0	498,0	14
10131	14 G 2,5	16,2	336,0	569,0	14
10132	18 G 2,5	18,2	432,0	764,0	14
10133	21 G 2,5	19,4	504,0	914,0	14
10134	25 G 2,5	21,6	600,0	1044,0	14
10135	34 G 2,5	25,2	816,0	1470,0	14
10136	42 G 2,5	27,3	1008,0	1790,0	14
10137	50 G 2,5	30,0	1200,0	2095,0	14
10138	61 G 2,5	32,2	1464,0	2750,0	14
10139	100 G 2,5	41,4	2400,0	4450,0	14
10140	2 x 4	9,2	77,0	195,0	12
10141	3 G 4	9,7	115,0	230,0	12
10142	4 G 4	10,8	154,0	295,0	12
10143	5 G 4	12,1	192,0	361,0	12
10144	7 G 4	13,4	269,0	458,0	12
10145	8 G 4	14,7	307,0	590,0	12
10549	10 G 4	17,6	384,0	687,0	12
10146	12 G 4	18,2	461,0	790,0	12
10147	3 G 6	11,9	173,0	355,0	10
10148	4 G 6	13,2	230,0	424,0	10
10149	5 G 6	14,7	288,0	525,0	10
10150	7 G 6	16,2	403,0	625,0	10
10151	3 G 10	14,8	288,0	540,0	8
10152	4 G 10	16,4	384,0	701,0	8
10153	5 G 10	18,3	480,0	858,0	8
10154	7 G 10	20,2	672,0	1106,0	8
10190	3 G 16	18,4	461,0	827,0	6
10155	4 G 16	20,4	614,0	1035,0	6
10156	5 G 16	22,8	768,0	1259,0	6
10157	7 G 16	25,2	1075,0	1780,0	6
10191	3 G 25	22,4	720,0	1186,0	4
10158	4 G 25	25,1	960,0	1582,0	4
10159	5 G 25	27,9	1200,0	1999,0	4
10160	7 G 25	30,8	1680,0	2825,0	4
10192	3 G 35	25,2	1008,0	1585,0	2
10161	4 G 35	27,9	1344,0	2105,0	2
10162	5 G 35	31,0	1680,0	2633,0	2
10193	3 G 50	29,9	1440,0	2550,0	1
10163	4 G 50	33,0	1920,0	2940,0	1
10188	5 G 50	37,0	2400,0	2936,0	1
10194	3 G 70	34,1	2016,0	3180,0	2/0
10164	4 G 70	37,9	2688,0	4090,0	2/0
10189	5 G 70	42,4	3360,0	5443,0	2/0
10195	3 G 95	39,6	2736,0	4680,0	3/0
10165	4 G 95	43,9	3648,0	5540,0	3/0
10333	5 G 95	49,0	4560,0	6931,0	3/0
10166	4 G 120	48,8	4608,0	7000,0	4/0
13139	4 G 150	54,4	5760,0	8340,0	300 kcmil
13140	4 G 185	62,3	7104,0	9904,0	350 kcmil

Dimensions and specifications may be changed without prior notice. (RA01)

02.05.2019 / Dimensions and specifications may be changed without prior notice.

H07V-K / (H)07V-K

PVC-Single Cores, fine wire stranded



Technical data

- PVC single cores to DIN VDE 0285-525-2-31/ DIN EN 50525-2-31 and IEC 60227-3
- **Temperature range** flexing -5°C to +70°C fixed installation -30°C to +80°C
- **Nominal voltage** U_0/U 450/750 V
- **Test voltage** 2500 V
- **Insulation resistance** min. 10 MOhm x km
- **Minimum bending radius** fixed installation core Ø ⩽ 8 mm: 4x core Ø core Ø> 8-1 2 mm: 5x core Ø core Ø> 12 mm: 6x core Ø
- **Radiation resistance** up to 80x10^6 cJ/kg (up to 80 Mrad)

Cable structure

- Bare Cu-conductor, to DIN VDE 0295 cl.5, fine wire, BS 6360 cl.5, IEC 60228 cl.5
- Core insulation of PVC compound type TI1 to DIN VDE 0207-363-3 / DIN EN 50363-3 and IEC 60227-3
- Core identification: see table below

Properties

- The materials used during manufacturing are cadmium-free, contain no silicone and are free from substances harmful to the wetting properties of lacquers

Tests

- PVC self-extinguishing and flame retardant acc. to DIN VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1-2 (equivalent DIN VDE 0472 part 804 test method B)

Note

- The following colours are recommended (only single colour): black, white, blue, grey, brown, red, orange, turquoise, violet and pink. Two-coloured combinations are not allowed, with exceptions of green-yellow.
- Colours yellow, green, transparent only in (H)07V-K available.
- Two-coloured combination is only permitted for (H)07V-K.

Application

These single cores are suitable for laying in tubes, under and surface mounting of plasters and also in closed installation conduits. These are not allowed to install for direct laying on cable trays, channels or tanks. These types are permitted for the inner wiring of equipment, distributor and switchboards and also for protective laying to the lightings with a nominal voltage up to 1000 V alternating current or up to 750 V direct current against earth.

CE = Product conforms with Low-Voltage Directive 2014/35/EU.

H07V-K, (H)07V-K

Cross-sec. mm²	Outer Ø min. - max. mm	Cop. weight kg / km	BK	GN-YE	BU	BN	RD	WH	GY	VT	YE	PK	GN	TRANS	D-BU	OG	2-col.	U-BU
app. RAL			9005	-	5015	8003	3000	9003	7001	4005	1021	3015	6018	-	5010	2003	-	5002
Packing			**Coil in cardboard (100m)**															
H07V-K coil																		
Part no.			29129	29130	29131	29132	29133	29134	29135	29136	29137	29138	29139	29140	29141	29142	29144	26395
1,5	2,8 - 3,4	14,4																
Part no.			29145	29146	29147	29148	29149	29150	29151	29152	29153	29154	29155	29156	29157	29158	29160	26396
2,5	3,4 - 4,1	24,0																
Part no.			29161	29162	29163	29164	29165	29166	29167	29168	29169	29170	29171	29172	29173	29174	29176	26397
4	3,9 - 4,8	38,0																
Part no.			29177	29178	29179	29180	29181	29182	29183	29184	29185	29186	29187	29188	29189	29190	29192	26398
6	4,4 - 5,3	58,0																
Packing			**Spool (with various capacity)**															
H07V-K spool																		
Part no.			26690	26691	26692	26693	26694	26695	26696	26697	26698	26699	26700	26701	26702	26703	26705	26399
1,5	2,8 - 3,4	14,4																
Part no.			26706	26707	26708	26709	26710	26711	26712	26713	26714	26715	26716	26717	26718	26719	26721	26400
2,5	3,4 - 4,1	24,0																
Part no.			26722	26723	26724	26725	26726	26727	26728	26729	26730	26731	26732	26733	26734	26735	26737	26401
4	3,9 - 4,8	38,0																
Part no.			26738	26739	26740	26741	26742	26743	26744	26745	26746	26747	26748	26749	26750	26751	26753	26402
6	4,4 - 5,3	58,0																

Continuation ▸

27.09.2016 / Dimensions and specifications may be changed without prior notice.

H07V-K / (H)07V-K

PVC-Single Cores, fine wire stranded

H05V-U, (H)05V-U, (H)07V-U

Cross-sec. mm²	Outer Ø min. - max. mm	Cop. weight kg / km	BK	GN-YE	BU	BN	RD	WH	GY	VT	YE	PK	GN	TRANS	D-BU	OG	2-col.	U-BU
app. RAL			9005	-	5015	8003	3000	9003	7001	4005	1021	3015	6018	-	5010	2003	-	5002



Packing — **Barrel (with various capacity)**

H07V-K barrel																		
Part no.			26755	26756	26757	26758	26759	26760	26761	26762	26763	26764	26765	26766	26767	26768	26770	26403
1,5	2,8 - 3,4	14,4																
Part no.			26771	26772	26773	26774	26775	26776	26777	26778	26779	26780	26781	26782	26783	26784	26786	26404
2,5	3,4 - 4,1	24,0																
Part no.			26787	26788	26789	26790	26791	26792	26793	26794	26795	26796	26797	26798	26799	26800	26802	26819
4	3,9 - 4,8	38,0																
Part no.			26803	26804	26805	26806	26807	26808	26809	26810	26811	26812	26813	26814	26815	26816	26818	26820
6	4,4 - 5,3	58,0																



Packing — **Coil in foil (100m)**

H07V-K coil																		
Part no.			26060	26061	26062	26063	26064	26065	26066	26067	26068	26069	26092	26099	26108	26109	26111	26821
1,5	2,8 - 3,4	14,4																
Part no.			26112	26113	26114	26115	26116	26117	26118	26119	29855	29856	29857	29858	29859	29890	29892	26822
2,5	3,4 - 4,1	24,0																
Part no.			29893	29894	29895	29896	29897	29898	29899	29905	29906	29907	29908	29909	29910	29911	29913	26823
4	3,9 - 4,8	38,0																
Part no.			29914	29915	29916	29917	29918	29919	29921	29922	29923	29924	29925	29926	29927	29928	29933	26824
6	4,4 - 5,3	58,0																
Part no.			29193	29194	29195	29196	29197	29198	29199	29200	29201	29202	29203	29204	29205	29206	29208	-
10	5,7 - 6,8	96,0																
Part no.			29209	29210	29211	29212	29213	29214	29215	29216	29217	29218	29219	29220	29221	29222	29224	-
16	6,7 - 8,1	154,0																
Part no.			29225	29226	29227	29228	29229	29230	29231	29232	29233	29234	29235	29236	29237	29238	29240	-
25	8,4 - 10,2	240,0																
Part no.			29241	29242	29243	29244	29245	29246	29247	29248	29249	29250	29251	29252	29253	29254	29256	-
35	9,7 - 11,7	336,0																
Part no.			29257	29258	29259	29260	29261	29262	29263	29264	29265	29266	29267	29268	29269	29270	29272	-
50	11,5 - 13,9	480,0																
Part no.			29273	29274	29275	29276	29277	29278	29279	29280	29281	29282	29283	29284	29285	29286	29288	-
70	13,2 - 16,0	672,0																
Part no.			29289	29290	29291	29292	29293	29294	29295	29296	29297	29298	29299	29300	29301	29302	29304	-
95	15,1 - 18,2	912,0																
Part no.			29418	29419	29420	29421	29422	29423	29424	29425	29426	29427	29428	29429	29430	29431	29433	-
120	16,7 - 20,2	1152,0																
Part no.			29434	29435	29436	29437	29438	29439	29440	29441	29442	29443	29444	29445	29446	29447	29449	-
150	18,6 - 22,5	1440,0																
Part no.			29494	29495	29496	29497	29498	29499	29590	29591	29592	29593	29594	29595	29596	29597	29599	-
185	20,6 - 24,9	1776,0																
Part no.			29813	29814	29815	29816	29817	29818	29819	29840	29841	29842	29843	29844	29845	29846	29848	-
240	23,5 - 28,4	2304,0																



Packing — **Drum**

H07V-K drum																		
Part no.			26825	26826	26827	26828	26829	26830	26831	26832	26833	26834	26835	26836	26837	26838	26840	-
10	5,7 - 6,8	96,0																
Part no.			26841	26842	26843	26844	26845	26846	26847	26848	26849	26850	26851	26852	26853	26854	26856	-
16	6,7 - 8,1	154,0																
Part no.			26857	26858	26859	26860	26861	26862	26863	26864	26865	26866	26867	26868	26869	26870	26872	-
25	8,4 - 10,2	240,0																
Part no.			26873	26874	26875	26876	26877	26878	26879	26880	26881	26882	26883	26884	26885	26886	26888	-
35	9,7 - 11,7	336,0																
Part no.			26889	26890	26891	26892	26893	26894	26895	26896	26897	26898	26899	26900	26901	26902	26904	-
50	11,5 - 13,9	480,0																
Part no.			26905	26906	26907	26908	26909	26910	26911	26912	26913	26914	26915	26916	26917	26918	26920	-
70	13,2 - 16,0	672,0																
Part no.			26921	26922	26923	26924	26925	26926	26927	26928	26929	26930	26931	26932	26933	26934	26936	-
95	15,1 - 18,2	912,0																
Part no.			29305	29306	29307	29308	29309	29310	29311	29312	29313	29314	29315	29316	29317	29318	29320	-
120	16,7 - 20,2	1152,0																
Part no.			29321	29322	29323	29324	29325	29326	29327	29328	29329	29330	29331	29332	29333	29334	29336	-
150	18,6 - 22,5	1440,0																
Part no.			29337	29338	29339	29340	29341	29342	29343	29344	29345	29346	29347	29348	29349	29350	29352	-
185	20,6 - 24,9	1776,0																
Part no.			29353	29354	29355	29356	29357	29358	29359	29360	29361	29362	29363	29364	29365	29366	29368	-
240	23,5 - 28,4	2304,0																
Part no.			28878	28879	28880	28881	28882	28883	28884	28885	28886	28887	28888	-	28889	28890	28891	-
300	26,0 - 30,5	2880,0																

Dimensions and specifications may be changed without prior notice. (RK01)

27.09.2016 / Dimensions and specifications may be changed without prior notice.

NSGAFÖU 3 kV

Special Rubber-Insulated Cable, VDE approved, short-circuit up to 1000 V



Technical data

- Special rubber-insulated single core cables to DIN VDE 0250 part 602
- **Temperature range**
  flexing -25°C to +80°C
  fixed installation -40°C to +80°C
- Permissible conductor **operating temperature** +90°C
- **Nominal voltage**
  U_0/U 1,8/3 kV
- Max. permissible **operating voltage**
  - 3-Phase and single phase operation 2,1/3,6 kV
  - DC operation 2,7/5,4 kV
- **Test voltage**
  6 kV
- **Minimum bending radius**
  flexing 10x outer Ø
  fixed installation 6x outer Ø

Cable structure

- Tinned copper conductor, to DIN VDE 0295 cl.5, fine wire, BS 6360 cl.5, IEC 60228 cl.5
- EPR-insulation, compound type 3GI3 to DIN VDE 0207-20
- Outer casing: Polychloroprene 5GM3 acc. to DIN VDE 0207-21
- Sheath colour black or orange

Properties

Tests

- Oil resistant acc. to DIN VDE 0473-811-404/DIN EN 60811-404
- Behaviour in fire acc. to DIN VDE 0482-332-1-2 / DIN EN 60332-1-2 / IEC 60332-1-2

Note

- Considered as being short circuit safe and inherently earth-fault-proof are those operating materials and conducting assemblies where because of suitable measures and/or means applied, neither a short circuit nor a short to ground is to be expected under operating conditions which are in accordance with those specified for the intended application.
- Version in 6 kV available on request.
- AWG sizes are approximate equivalent values. The actual cross section is in mm².

Application

Particularly suitable for protection against short circuits in laying and for inherently earth-fault-proof routing in rail vehicles and omnibuses. Also suitable for laying in dry environments.

Sheath colour black

Part no.	No.cores x cross-sec. mm²	Outer Ø max. mm	Cop. weight kg / km	Weight app. kg / km	AWG-No.
38501	1 x 1,5	7,0	14,4	62,0	16
38502	1 x 2,5	7,5	24,0	76,0	14
38503	1 x 4	9,0	38,0	95,0	12
38504	1 x 6	9,5	58,0	140,0	10
38505	1 x 10	11,0	96,0	190,0	8
38506	1 x 16	13,0	154,0	270,0	6
38507	1 x 25	15,0	240,0	410,0	4
38508	1 x 35	16,5	336,0	490,0	2
38509	1 x 50	18,0	480,0	650,0	1
38510	1 x 70	20,5	672,0	900,0	2/0
38511	1 x 95	24,0	912,0	1200,0	3/0
38513	1 x 120	26,0	1152,0	1450,0	4/0
38514	1 x 150	28,0	1440,0	1800,0	300 kcmil
38512	1 x 185	31,0	1776,0	2200,0	350 kcmil
38515	1 x 240	34,5	2304,0	2650,0	500 kcmil
38516	1 x 300	38,0	2880,0	3250,0	600 kcmil

Sheath colour orange

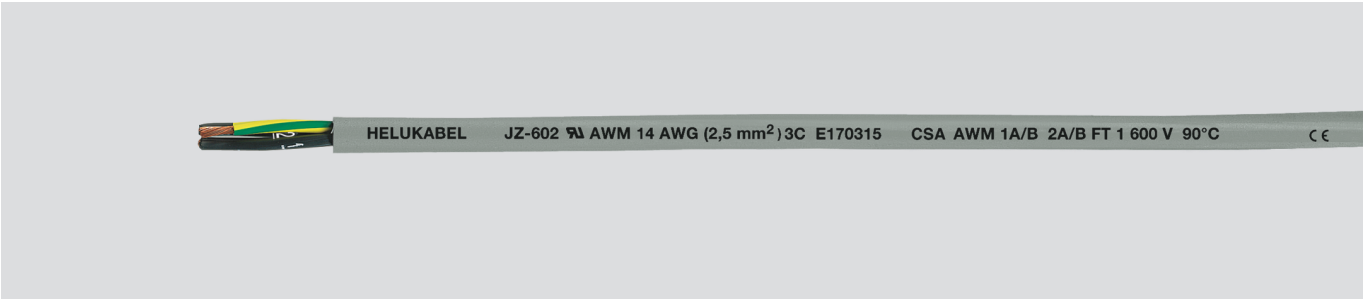
Part no.	No.cores x cross-sec. mm²	Outer Ø max. mm	Cop. weight kg / km	Weight app. kg / km	AWG-No.
710665	1 x 2,5	7,5	24,0	76,0	14
710666	1 x 4	9,0	38,0	95,0	12
710223	1 x 6	9,5	58,0	140,0	10

Dimensions and specifications may be changed without prior notice. (RK01)

11.04.2019 / Dimensions and specifications may be changed without prior notice.

JZ-602

two approval control cable, 90°C, 600 V, meter marking



Technical data

- Control cable of special-PVC acc. to UL CSA AWM I/II A/B Style 2587 and CSA
- **Temperature range**
  flexing -5°C to +90°C
  fixed installation -40°C to +90°C
- **Nominal voltage**
  UL/CSA 600 V
- **Test voltage**
  3000 V
- **Breakdown voltage**
  min. 6000 V
- **Minimum bending radius**
  flexing 7,5x cable Ø
  fixed installation 4x cable Ø

Cable structure

- Bare copper conductor, fine wire acc. to DIN VDE 0295 cl.5 / IEC 60228 cl.5
- Core insulation PVC
  UL type 90°C acc. to UL Std. 758 as well as CSA Std. C22.2 No.210
- Core identification to DIN VDE 0293 black cores with continuous white numbering
- GN-YE conductor, 3 cores and above in the outer layer
- Cores stranded in layers with optimal selected lay length
- Outer sheath PVC
  UL type 90°C acc. to UL Std. 758 as well as CSA Std. C22.2 No.210
- Sheath colour: grey (RAL 7001)
- With meter marking

Properties

- Extensively oil resistant
- The materials used during manufacturing are cadmium-free, contain no silicone and are free from substances harmful to the wetting properties of lacquers

Tests

- Flame retardant
  acc. to DIN VDE 0482-332-1-2 / DIN EN 60332-1-2 / IEC 60332-1-2 / UL VW-1 / CSA FT1

Note

- G = with GN-YE conductor
  x = without GN-YE conductor (OZ)
- Please note "cleanroom qualified" when ordering.
- AWG sizes are approximate equivalent values. The actual cross section is in mm².
- Screened analogue type:
  JZ-602-CY

Application

UL-approved and CSA certified flexible control cable rated at 600 V. Used in machine tools, control systems, connection between control panels and machines, assembly lines and other industrial equipment. Suitable for installation in dry, moist or wet environment and moderate flexing applications.
CE = Product conforms with Low-Voltage Directive 2014/35/EU.

Part no.	No.cores x cross-sec. mm²	AWG-No.	Outer Ø app. mm	Cop. weight kg / km	Weight app. kg / km
83090	2 x 0,5	20	5,0	9,6	49,0
83091	3 G 0,5	20	5,3	14,0	58,0
83092	4 G 0,5	20	5,7	19,0	69,0
83093	5 G 0,5	20	6,2	24,0	84,0
83094	7 G 0,5	20	6,7	34,0	123,0
83100	8 G 0,5	20	7,2	38,4	140,0
83101	9 G 0,5	20	7,8	43,2	177,0
83095	12 G 0,5	20	8,8	58,0	192,0
83096	18 G 0,5	20	10,5	86,0	256,0
83097	25 G 0,5	20	12,4	120,0	358,0
83098	34 G 0,5	20	14,3	163,0	487,0
83099	41 G 0,5	20	15,4	197,0	580,0
83080	2 x 1	18	5,8	19,2	53,0
83081	3 G 1	18	6,1	27,0	61,0
83565	3 x 1	18	6,1	27,0	61,0
83082	4 G 1	18	6,6	38,4	74,0
83083	5 G 1	18	7,3	48,0	90,0
83084	7 G 1	18	7,9	67,0	130,0
83102	8 G 1	18	8,8	76,8	144,0
83103	9 G 1	18	9,4	86,4	180,0
83085	12 G 1	18	10,6	115,2	198,0
83086	18 G 1	18	12,7	173,0	274,0
83087	25 G 1	18	15,0	240,0	384,0
83088	34 G 1	18	17,5	326,0	494,0
83089	41 G 1	18	18,8	394,0	508,0
83070	2 x 1,5	16	6,4	28,8	73,0
83071	3 G 1,5	16	6,8	44,0	94,0
83072	4 G 1,5	16	7,4	58,0	117,0
83073	5 G 1,5	16	8,1	72,0	140,0
83074	7 G 1,5	16	9,0	101,0	186,0
83104	9 G 1,5	16	10,7	129,7	244,0
83075	12 G 1,5	16	11,8	173,0	319,0
83076	18 G 1,5	16	14,4	260,0	451,0
83077	25 G 1,5	16	17,0	360,0	625,0
83078	34 G 1,5	16	19,8	490,0	840,0
83079	41 G 1,5	16	21,5	590,0	1032,0
83060	2 x 2,5	14	7,6	48,0	115,0
83061	3 G 2,5	14	8,1	72,0	143,0
83062	4 G 2,5	14	9,0	96,0	185,0
83063	5 G 2,5	14	9,9	120,0	221,0
83064	7 G 2,5	14	11,0	168,0	293,0
83065	9 G 2,5	14	13,1	216,0	429,0
83066	12 G 2,5	14	14,7	288,0	563,0
83067	18 G 2,5	14	17,8	432,0	854,0
83068	19 G 2,5	14	17,8	456,0	914,0
83069	25 G 2,5	14	21,2	600,0	1188,0
83051	3 G 4	12	9,5	115,0	232,0
83052	4 G 4	12	10,6	154,0	298,0
83053	5 G 4	12	11,7	192,0	358,0
83054	7 G 4	12	13,0	269,0	460,0
83041	3 G 6	10	11,5	173,0	360,0
83042	4 G 6	10	12,8	231,0	402,0
83043	5 G 6	10	14,3	288,0	484,0
83044	7 G 6	10	15,8	403,0	630,0
83031	3 G 10	8	14,9	288,0	535,0
83032	4 G 10	8	16,5	384,0	653,0
83033	5 G 10	8	18,5	480,0	786,0
83034	7 G 10	8	20,4	672,0	1100,0

Continuation ▸

13.02.2019 / Dimensions and specifications may be changed without prior notice.

JZ-602

two approval control cable, 90°C, 600 V, meter marking

Part no.	No.cores x cross-sec. mm²	AWG-No.	Outer Ø app. mm	Cop. weight kg / km	Weight app. kg / km
83020	2 x 16	6	17,6	307,0	640,0
83021	3 G 16	6	18,6	461,0	810,0
83022	4 G 16	6	20,5	615,0	1045,0
83023	5 G 16	6	23,0	768,0	1260,0
83024	7 G 16	6	25,2	1075,0	1760,0
83011	3 G 25	4	23,1	720,0	1180,0
83012	4 G 25	4	25,4	960,0	1507,0
83013	5 G 25	4	28,4	1200,0	1858,0
83014	7 G 25	4	31,4	1680,0	2830,0
83001	3 G 35	2	25,4	1008,0	1590,0
83002	4 G 35	2	28,2	1344,0	2123,0
83003	5 G 35	2	31,5	1680,0	2612,0

Part no.	No.cores x cross-sec. mm²	AWG-No.	Outer Ø app. mm	Cop. weight kg / km	Weight app. kg / km
83004	3 G 50	1	30,1	1440,0	2652,0
83005	4 G 50	1	33,4	1920,0	3058,0
83006	5 G 50	1	37,3	2400,0	4093,0
83007	3 G 70	2/0	34,2	2016,0	3307,0
83008	4 G 70	2/0	37,9	2688,0	4254,0
83009	5 G 70	2/0	42,4	3360,0	5661,0
83010	3 G 95	3/0	38,6	2736,0	4867,0
83015	4 G 95	3/0	42,7	3648,0	5762,0
83016	5 G 95	3/0	47,8	4560,0	7208,0
83017	3 G 120	4/0	42,9	3456,0	5580,0
83018	4 G 120	4/0	47,6	4608,0	7280,0
83019	5 G 120	4/0	53,1	5760,0	8692,0

Dimensions and specifications may be changed without prior notice. (RN01)

13.02.2019 / Dimensions and specifications may be changed without prior notice.

SIEMENS

SIMOTION Control Unit



Figure similar

MLFB-Ordering data : **6AU1320-4DE65-3AF0**

Client order no. :
Order no. :
Offer no. :
Remarks :

Item no. :
Consignment no. :
Project :

Product brand name	SIMOTION P
Product type designation	P320-4 E

Technical data are subject to change! There may be discrepancies between calculated and rating plate values.



SIMOTION P320-4 PC-based Motion Control

Powerful – maintenance-free – can be flexibly configured

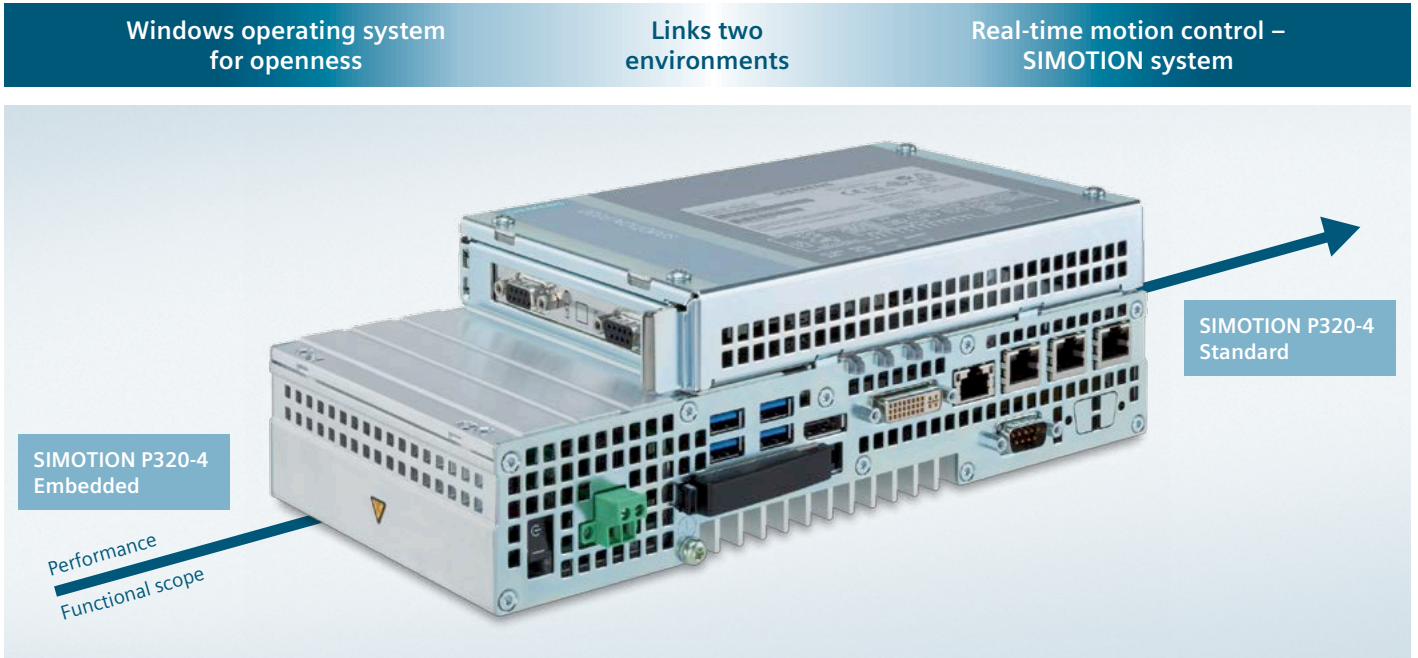
siemens.com/simotion

Fullest motion control functionality compact in an embedded industry PC: SIMOTION P320-4

SIMOTION P320-4 is a powerful, ultracompact and maintenance-free embedded industry PC, which has proven itself even under tough application conditions. The P320-4 combines the ruggedness of a PLC with the full motion control functionality of SIMOTION.

Your benefits

- PC-based solution for all production plants – new and retrofit projects (installation compatibility)
- High performance that can be selected to address your specific application
- Integrated motion control technology package (SIMOTION runtime)
- Integrated PC monitoring functions (watchdog, temperature, ...)
- Flexibility through individual mounting and installation options
- Simplified commissioning and troubleshooting using comprehensive test and diagnostic functions
- Operating control and monitoring functions can be simply integrated
- Visualization using scalable standard SIMATIC panels
- One engineering system for parameterizing and programming (SIMOTION SCOUT)



Can be universally used:


Packaging


Printing


Plastics


Textiles


Wood


Glass


Metal forming


Renewable energy


Handling

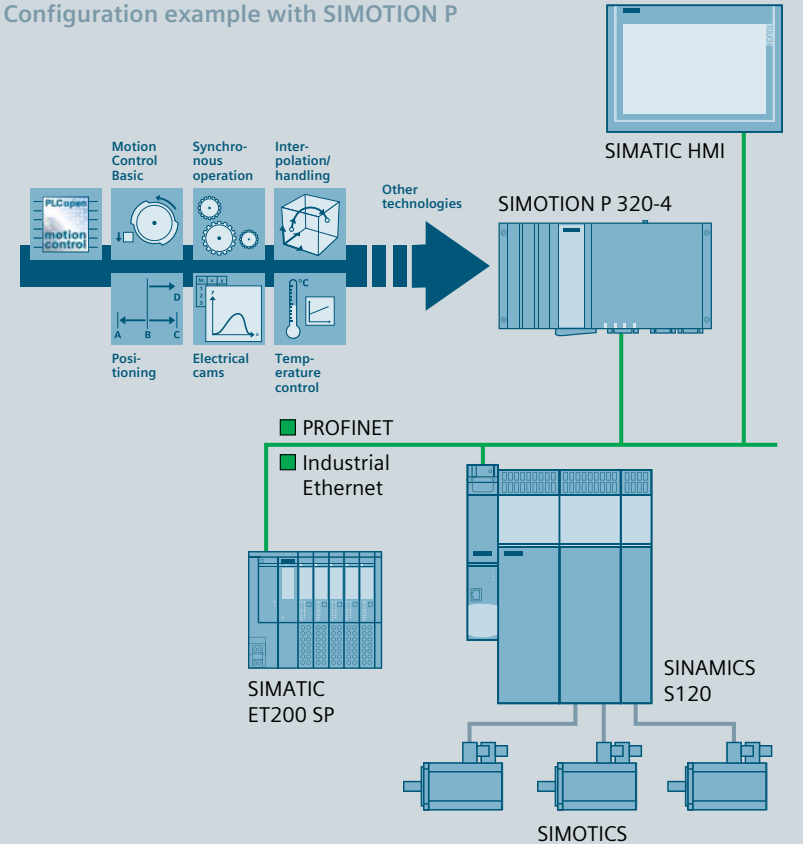

Converting

SIMOTION P320-4 – PC-based motion control

Technical data

Mechanical design/mounting position	• Mounting rail • Wall/panel mounting • Book-type mounting, front • Mounting position: horizontal (preferred position) and vertical
Processor	• P320-4 embedded: Intel Core i3-3217UE; 2x1.6 GHz, 3M cache • P320-4 standard: Intel Core i7-3517UE; 2x1.7 GHz, 4M cache
Power supply	• 24 V DC; 19.2 ... 28.8 V DC • Isolated
Main memory	• 4 Gbyte DDR3-SDRAM
CFast	• Can be exchanged (accessible): 4 Gbyte
SSD (only P320-4 **standard** internal)	• Internal (not accessible): 80 Gbyte
CFast (only P320-4 **embedded** internal)	• Internal (not accessible): 4 - 8 Gbyte
Application conditions	• No fan
Operating system	• P320-4 Embedded: Windows Embedded Standard 7 • P320-4 Standard: Windows 7 Ultimate
Start of delivery	• SIMOTION SCOUT Version V4.4
Graphics	• Integrated Intel HD 2000 or HD 4000 • Resolution DVI: 640*480 pixels up to max. 1920*1200 pixels for 32-bit colors • Resolution display port (>1920*1200 pixels for 32-bit colors) • Graphic memory is taken from the main memory • Dual-head operation to simultaneously connect two monitors (DVI-I and display port) with two different screen contents
Power supply	• 24 V DC; 19.2 ... 28.8 V DC • Isolated
Application conditions	• No fan
PC interfaces	• 4 x USB 3.0 interfaces • 1 x COM (RS232) • 1 x Ethernet Gbit • 1 x display port (connection ext. monitor, display) • 1 x DVI
PROFINET	• PROFINET on board (3 ports)
PROFIBUS (optional)	• IsoProfibus board, pluggable

Configuration example with SIMOTION P



Siemens AG
Digital Factory
Motion Control
P.O. Box 3180
91050 ERLANGEN
GERMANY

Subject to change without prior notice
Article No.: E20001-A500-P650-X-7600
Dispo 06372
SCHÖ/1000022620 V2.MKSIMO.WES SB 10141.5
Printed in Germany
© Siemens AG 2014

The information provided in this brochure contains merely general descriptions or characteristics of performance which in actual case of use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

All product designations may be trademarks or product names of Siemens AG or supplier companies whose use by third parties for their own purposes could violate the rights of the owners.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered.
For more information about industrial security, visit **http://www.siemens.com/industrialsecurity.**

SIEMENS

Data sheet 6EP1961-2BA41



SITOP PSE200U SELECTIVITY MODULE 10A
SITOP PSE200U 10 A Selectivity module 4-channel input: 24 V DC/40 A output: 24 V DC/4x 10 A Level adjustable 3-10 A mit status message for each output

Input	
Type of the power supply network	Controlled DC voltage
Supply voltage / at DC / Rated value	24 V
Input voltage / at DC	22 ... 30 V
Overvoltage overload capability	35 V
Input current / at rated input voltage 24 V / Rated value	40 A

Output	
Voltage curve / at output	controlled DC voltage
Formula for output voltage	Vin - approx. 0.2 V
Relative overall tolerance / of the voltage / Note	In accordance with the supplying input voltage
Number of outputs	4
Output current / up to 60 °C / per output / rated value	10 A
Adjustable pick-up value current / of the current-dependent overload release	3 ... 10 A
Type of response value setting	via potentiometer
Product feature / parallel switching of outputs	No
Product feature / bridging of equipments	Yes

Subject to change without notice
© Copyright Siemens

Type of outputs connection	Simultaneous connection of all outputs after power up of the supply voltage > 20 V, delay time of 25 ms, 100 ms or adjustable "load optimised" via DIP switch for sequential connection
Efficiency	
Efficiency in percent	99 %
Power loss [W] / at rated output current / for rated value of the output current / typical	10 W
Switch-off characteristic per output	
Switching characteristic	
• of the excess current	Iout = 1.0 ...1.5 x set value, switch-off after approx. 5 s
• of the current limitation	Iout = 1.5 x set value, switch-off after typ. 100 ms
• of the immediate switch-off	Iout > set value and Vin < 20 V, switch-off after approx. 0.5 ms
Residual current at switch-off / typical	1 mA
Design of the reset device/resetting mechanism	via sensor per output
Remote reset function	Non-electrically isolated 24 V input (signal level "high" at > 15 V)
Protection and monitoring	
Fuse protection type / at input	15 A per output (not accessible)
Display version / for normal operation	Three-color LED per output: green LED for "Output switched through"; yellow LED for "Output switched off manually"; red LED for "Output switched off due to overcurrent"
Design of the switching contact / for signaling function	Status signal output (pulse/pause signal, can be evaluated via Simatic function block)
Safety	
Galvanic isolation / between input and output at switch-off	No
Operating resource protection class	Class III
Certificate of suitability	
• CE marking	Yes
• as approval for USA	UL-Recognized (UL 2367) File E328600; cULus-Listed (UL 508, CSA C22.2 No. 107.1) File E197259
Standard / for safety	according to EN 60950-1 and EN 50178
Certificate of suitability / relating to ATEX	IECEx Ex nA IIC T4 Gc; ATEX (EX) II 3G Ex nA IIC T4 Gc; cULus Class I, Div. 2, Group ABCD, T4
Shipbuilding approval	DNV GL, ABS
Protection class IP	IP20
EMC	
Standard	
• for emitted interference	EN 55022 Class B
• for interference immunity	EN 61000-6-2
Operating data	
Ambient temperature	
• during operation	-25 ... +60 °C

© Copyright Siemens

— Note	with natural convection
• during transport	-40 ... +85 °C
• during storage	-40 ... +85 °C
Environmental category / acc. to IEC 60721	Climate class 3K3, no condensation

Mechanics

Type of electrical connection	screw-type terminals
• at input	+24 V: 2 screw terminals for 0.5 ... 16 mm²; 0 V: 2 screw terminals for 0.5 ... 4 mm²
• at output	Output 1 ... 4: 1 screw terminal each for 0.5 ... 4 mm²
• for signaling contact	1 screw terminal for 0.5 ... 4 mm²
• for auxiliary contacts	Remote reset: 1 screw terminal for 0.5 ... 4 mm²
Width / of the enclosure	72 mm
Height / of the enclosure	80 mm
Depth / of the enclosure	72 mm
Installation width	72 mm
Mounting height	180 mm
Net weight	0.2 kg
Mounting type	Snaps onto DIN rail EN 60715 35x7.5/15
Mechanical accessories	Device identification label 20 mm × 7 mm, TI-grey 3RT2900-1SB20
MTBF / at 40 °C	540 979 h
Other information	Specifications at rated input voltage and ambient temperature +25 °C (unless otherwise specified)

Subject to change without notice
© Copyright Siemens

SIEMENS

SITOP power supply

Selectivity modules

Manual

Overview

Safety notes 1

Description, device design, dimension drawing 2

Mounting/removal 3

Mounting position, mounting clearances 4

Installation 5

Technical data 6

Safety, approvals, EMC 7

Environmental conditions 8

Environment 9

Service & Support 10

SITOP select 4 x 10 A
6EP1961-2BA00

SITOP PSE200U 4 x 3 A
6EP1961-2BA11
6EP1961-2BA31
6EP1961-2BA51
6EP1961-2BA61

SITOP PSE200U 4 x 10 A
6EP1961-2BA21
6EP1961-2BA41

11.2017
C98130-A7579-A1-3-7629

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Division Process Industries and Drives
Postfach 48 48
90026 NÜRNBERG
GERMANY

C98130-A7579-A1-3-7629
℗ 12/2017 Subject to change

Copyright © Siemens AG 2017.
All rights reserved

Overview

Description



Figure 1 View of devices

In conjunction with a 24 V power supply, the selectivity module is used to distribute the load current across several branches and to monitor the individual currents in these branches. Faults in the individual branches caused by overload or short-circuit are detected and selectively switched off, so that the fault does not impact the other load circuits. This means fast troubleshooting and minimized downtimes.

The key benefits of the product include:

- A maximum of 4 load branches are monitored for each module
- The response threshold can be continually set for each output using a potentiometer
- Overcurrents are reliably switched off, independent of the cable length and cable cross-section
- The 24 V supply for the other loads is maintained
- Multi-colored LED for each output for faster troubleshooting on-site
- Floating group signal contact for remote diagnostics (for -2BA00, -2BA11, -2BA21, -2BA51)
- Single-channel signal to serially indicate the state of the individual outputs (for -2BA31, -2BA41, -2BA61)

- Evaluation using free-of-charge SIMATIC S7 function blocks (S7-300/400/1200/1500) for modules with single channel signal
- It can be selected that the load branches are sequentially switched on to reduce the total inrush current
- Versions for limited output power ratings according to NEC Class 2 (maximum, 100 VA).

Ordering data

The following device options are available:

Selectivity modules	
Type	**Order number**
SITOP select 24 V DC input Number of outputs: 4 Setting range of the response threshold: 2 - 10 A with group signaling contact	6EP1961-2BA00
SITOP PSE200U 24 V DC input Number of outputs: 4 Setting range of the response threshold: 0.5 - 3 A with group signaling contact	6EP1961-2BA11
SITOP PSE200U 24 V DC input Number of outputs: 4 Setting range of the response threshold: 3 - 10 A with group signaling contact	6EP1961-2BA21
SITOP PSE200U 24 V DC input Number of outputs: 4 Setting range of the response threshold: 0.5 - 3 A with group signaling contact	6EP1961-2BA31
SITOP PSE200U 24 V DC input Number of outputs: 4 Setting range of the response threshold: 3 - 10 A with group signaling contact	6EP1961-2BA41

Selectivity modules	
Type	**Order number**
SITOP PSE200U 24 V DC input Number of outputs: 4 Setting range of the response threshold: 0.5 - 3 A with group signaling contact, NEC Class 2	6EP1961-2BA51
SITOP PSE200U 24 V DC input Number of outputs: 4 Setting range of the response threshold: 0.5 - 3 A with single-channel signal, NEC Class 2	6EP1961-2BA61

Accessories	
Type	**Order number**
Flat insertable fuse: Manufacturer, Littelfuse, series FKS, 19 mm long (for 6EP1961-2BA00)	162.6185.* (FKS-32), 166.7000.* (FKS-80)
Device name plate 20 mm × 7 mm, TI grey (for 6EP1961-2BA11, -2BA21, -2BA31, -2BA41, -2BA51, -2BA61)	3RT2900-1SB20

Validity

This manual provides information on the following products:

- Selectivity module SITOP select 10 A
  Article number: 6EP1961-2BA00
  Product State: 4
- Selectivity module SITOP PSE200U 3 A
  Article number: 6EP1961-2BA11, 6EP1961-2BA31
  Product state: 3
  changes with respect to the previous version (PS: 2):
  – temperature range extended to -25 … 60 °C
  – terminal labeling changed from "NC" to "NF"
- Selectivity module SITOP PSE200U 3 A NEC Class 2
  Article number: 6EP1961-2BA51, 6EP1961-2BA61
  Product state: 2
  changes with respect to the previous version (PS: 1):
  – temperature range extended to -25 … 60 °C
  – terminal labeling changed from "NC" to "NF"
- Selectivity module SITOP PSE200U 10 A
  Article number: 6EP1961-2BA21, 6EP1961-2BA41
  Product state: 3
  changes with respect to the previous version (PS: 2):
  – temperature range extended to -25 … 60 °C
  – terminal labeling changed from "NC" to "NF"

Table of contents

Overview **3**

1 Safety notes **9**

1.1 General safety instructions 9

1.2 Safety instructions for hazardous zones 9

2 Description, device design, dimension drawing **11**

2.1 Device description 11

2.2 Connections and terminal designation 12

2.3 Potentiometer 14

2.4 Status displays and signaling 15

2.5 Buttons and selector switches 19
2.5.1 SITOP select 19
2.5.2 SITOP PSE200U 20

2.6 Electronic overload shutdown and reset 21
2.6.1 SITOP select 21
2.6.2 SITOP PSE200U 23

2.7 Setting the switch-on delay time 26
2.7.1 SITOP select 26
2.7.2 SITOP PSE200U 28

2.8 Block diagram 29

2.9 Dimensions and weight 31

3 Mounting/removal **33**

4 Mounting position, mounting clearances **35**

4.1 Standard mounting position 35

4.2 Other mounting positions 37
4.2.1 6EP1961-2BA00 37
4.2.2 6EP1961-2BA11, 6EP1961-2BA31, 6EP1961-2BA51 and 6EP1961-2BA61 39
4.2.3 6EP1961-2BA21 and 6EP1961-2BA41 41

5 Installation **43**

5.1 Input side connection 43

5.2 Output-side connection 45

6 Technical data **47**

6.1 Input 47

6.2 Output 47

6.3 Efficiency 50

6.4 Protection and monitoring 51
6.5 MTBF 51
6.6 Mechanical system 52
6.7 Accessories 53
6.8 Dimension drawing 53
7 Safety, approvals, EMC 55
7.1 Safety 55
7.2 Approvals 55
7.3 EMC 56
8 Environmental conditions 57
9 Environment 59
10 Service & Support 61

Safety notes

1

1.1 General safety instructions

⚠ WARNING
Correct handling of the devices When operating electrical devices, it is inevitable that certain components will carry dangerous voltages. Therefore, failure to handle the units properly can result in death or serious physical injury as well as extensive property damage. Only appropriately qualified personnel may work on or in the vicinity of this equipment. Perfect, safe, and reliable operation of this equipment is dependent on proper transportation, storage, installation and mounting. Before installation or maintenance work can begin, the system's main switch must be switched off and measures taken to prevent it being switched on again. If this instruction is not observed, touching live parts can result in death or serious injury.

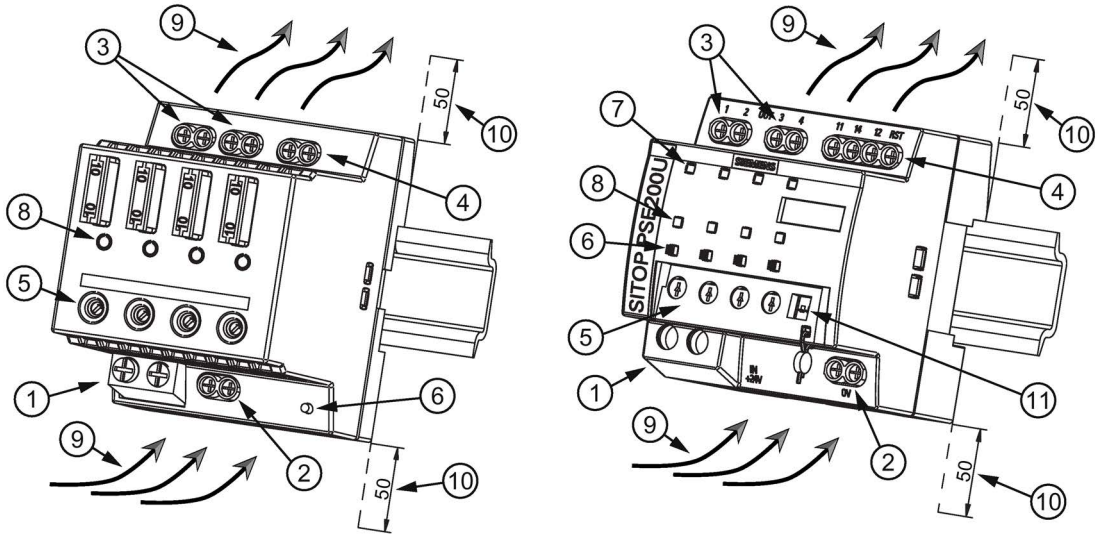
1.2 Safety instructions for hazardous zones

⚠ WARNING
OPERATE POTENTIOMETERS OR SWITCHES IN NON-HAZARDOUS AREAS ONLY!

Description, device design, dimension drawing 2

2.1 Device description

Using the selectivity module, a 24 V DC output voltage from a regulated power supply can be distributed across four load circuits. The response threshold of the output current can be individually set for each output using a potentiometer. When the set response threshold is exceeded, the output is automatically switched off according to a defined switch off characteristic, and can be switched on again after a wait time using a pushbutton or remote reset (SITOP PSE200U). The status of the output is displayed using a multi-color LED for each output. The status of the outputs can be processed via a group signaling contact or via a serial single-channel signal.



SITOP select SITOP PSE200U

① +24 V input
② 0 V connection for the internal supply
③ +24 V outputs
④ Group signal contact/status output/remote reset input
⑤ Potentiometer for each output
⑥ Button
⑦ Measuring point
⑧ Indicator light for each output
⑨ Natural convection
⑩ Clearance above/below
⑪ Selector switch for switch-on delay

Figure 2-1 Design

2.2 Connections and terminal designation

The input terminals ① can be used to establish the connection to the supply voltage. The 0 V connection ② is used to supply the internal electronics. Output terminals ③ are used to connect to the loads to be supplied (also see Chapter Installation (Page 43)).

Using the group signal contact or status output ④, the operating state of the device can be processed (function and contact rating, see Chapter Figure 2-4 Operating displays and signaling (SITOP select and SITOP PSE200U) (Page 15)).
The remote reset input ④ is used to reset outputs that have been automatically shut down (function, see Chapter Status displays and signaling (Page 15)).

Connections and terminal designations for 6EP1961-2BA00	
① + 24 V input	2 screw terminals
② 0 V connection	2 screw terminals
③ + 24 V output: 1, 2, 3, 4	One screw terminal each
④ group signal contact (13, 14)	One screw terminal each

Connections and terminal designations for 6EP1961-2BA11, 6EP1961-2BA21 and 6EP1961-2BA51	
① + 24 V input	2 screw terminals
② 0 V connection	2 screw terminals
③ + 24 V output: 1, 2, 3, 4	One screw terminal each
④ group signal contact (11, 12, 14); remote reset (RST)	One screw terminal each

Connections and terminal designations for 6EP1961-2BA31, 6EP1961-2BA41 and 6EP1961-2BA61	
① + 24 V input	2 screw terminals
② 0 V connection	2 screw terminals
③ + 24 V output: 1, 2, 3, 4	One screw terminal each
④ not assigned (NF)	2 screw terminals
④ status output (S); remote reset (RST)	One screw terminal each

	①	② + ③ + ④	⑤
	1 x 5,5 / PZ2 / PH2	0,6 x 3,5 / PZ1	0,6 x 3,5 / PZ1
	0,5 - 16 mm^2	0,2 - 6 mm^2	-
	0,5 - 16 mm^2	0,2 - 4 mm^2	-
	2,5 - 10 mm^2	0,25 - 4 mm^2	-
AWG	26 - 6	24 - 10	-
Nm	1,2 - 1,5 Nm	0,5 Nm	0,04 Nm *1)
	12 mm	8 mm	-

*1) Do not subject the end stop to higher loads

Figure 2-2 Terminal data

NOTICE

Overload of the wiring

The "0 V" connection is only used to supply the internal electronics of the selectivity module. The 0 V of the connected loads must be routed directly to the power supply using separate cables!

2.3 Potentiometer

The potentiometer ⑤ on the front of the device is used to set the response threshold of the output current. When delivered, the maximum possible response threshold is set.

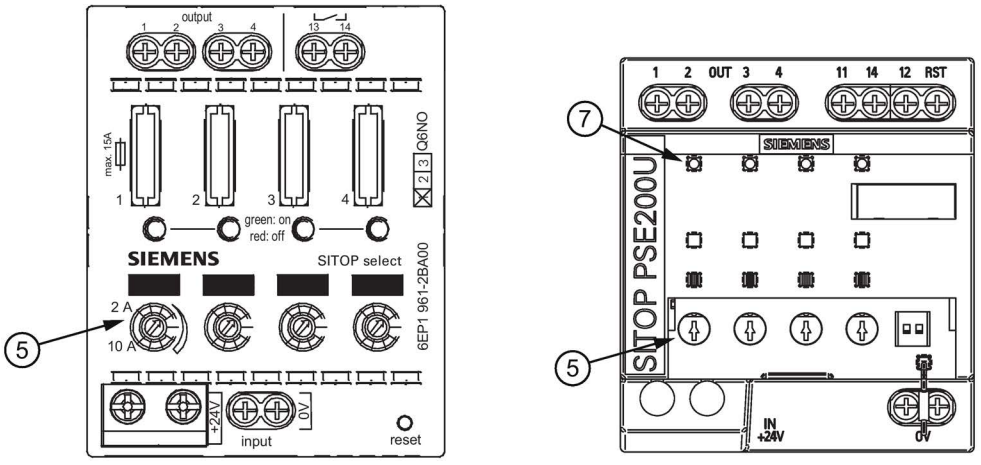


Figure 2-3 Potentiometer (SITOP select and SITOP PSE200U)

Note

It is only permissible to use an insulated screwdriver when actuating the potentiometer.

For information on actuating the potentiometer (screwdriver, torque), see Figure 2-2 Terminal data (Page 13).

Note

For SITOP PSE200U, the actual output current of a branch can be determined by measuring the voltage at measuring point "MP" ⑦ with respect to the "0 V" terminal. A measured voltage of 1 V corresponds to an output current of 1 A.

2.4 Status displays and signaling

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA21 6EP1961-2BA51	6EP1961-2BA31 6EP1961-2BA41 6EP1961-2BA61
Operating display ⑧	Two-color LED	Three-color LED	Three-color LED
Group signal contact (13, 14 or 11, 12, 14) ④	floating relay contact (NO contact), contact rating: 24 V/0.5 A	floating relay contact (changeover contact), contact rating: 24 V/0.1 A	-
Status output (S) ④	-	-	non-isolated 24 V DC output, max. 30 mA
Remote reset input (RST) ④	-	non-isolated 24 V DC input Signal level "High" for > 15 V	non-isolated 24 V DC input Signal level "High" for > 15 V

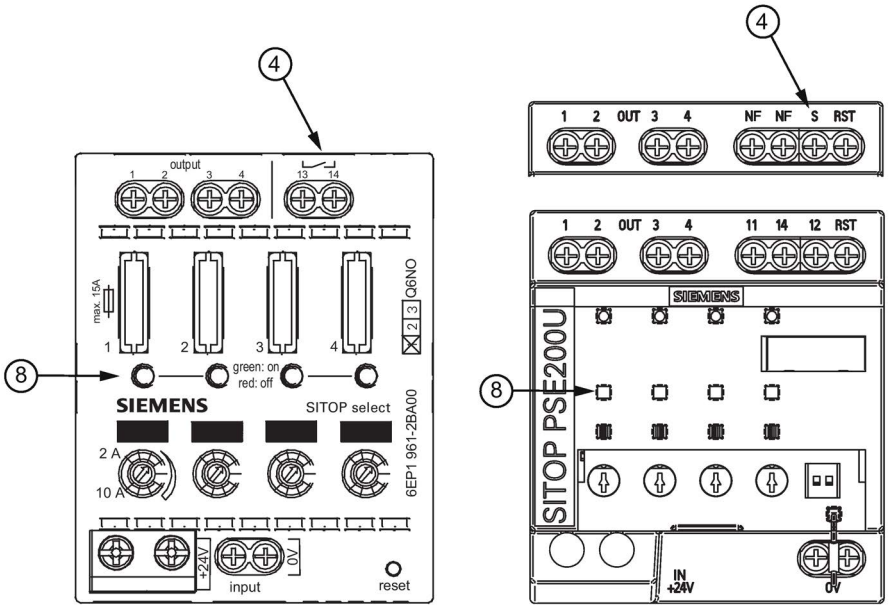


Figure 2-4 Operating displays and signaling (SITOP select and SITOP PSE200U)

The operating state of the outputs is displayed using multi-color LEDs at the front of the device. Symbols indicate the significance of each LED, which are listed in the following table.

○	LED off
●	LED is continuously lit
✷	LED flashes

SITOP select

LED ⑧ and group signaling contact ④

Signaling		6EP1961-2BA00
○	Off	All LEDs: • No supply voltage • Device powering up: After the device has powered up, the outputs are switched on, taking into consideration the switch-on delay that has been set.
●	Lights up green	Normal operation, output is switched on
●	Lights up red	Output switched off automatically to due overload
✷	Flashes red	Outputs ready to be reset after an automatic switch off by pressing the button
● ● ● ●	Light up red	All LEDs are red (after actuating the reset button for a minimum of 8 s): programming mode for the switch-on delay
✷ ✷ ✷ ✷	Flashes red	All LEDs flash red (in the programming mode): signals the programmed switch-on delay time: • all LEDs flash 1x simultaneously red, followed by a 2 s pause: 0 ms • all LEDs flash 2x simultaneously red, followed by a 2 s pause: 24 ms • all LEDs flash 3x simultaneously red, followed by a 2 s pause: 100 ms
Group signaling contact (NO contact)		Signal contact (13-14) opens (=quiescent position) when one/several outputs are switched off as a result of overload or when a fuse ruptures.

SITOP PSE200U

LED ⑧ and group signaling contact or status output ④

Signaling		6EP1961-2BA11 6EP1961-2BA21 6EP1961-2BA51	6EP1961-2BA31 6EP1961-2BA41 6EP1961-2BA61
○	Off	All LEDs: • No supply voltage • Device powering up: After the device has powered up, the outputs are switched on, taking into consideration the switch-on delay that has been set.	
		Group signal: Inactive	Status output[1*]: -
		LED, individual output: Output defective (internal fuse has ruptured)	
		Group signal: Inactive	Status output[1*]: Ci = '0'
●	Lights up green	Normal operation, output is switched on	
		Group signal: Active	Status output[1*]: Ci = '1'
✷	Flash-es green	The output current is in the overload range according to the shutdown characteristic (see Chapter SITOP PSE200U (Page 23)) -2BA11, -2BA21, -2BA31, -2BA41: overload at the output: Output current 101 - 150 % of the response threshold (for 5 s) -2BA51, -2BA61: overload at the output: Output current 101 - 110 % of the response threshold (for 5 s)	
		Group signal: Active	Status output[1*]: Ci = '1'
●	Lights up red	Output automatically shut down due to overload or external overvoltage > typ. 30 V/100 ms. The output can be switched on again after a typical wait time of 20 s. The wait time still to elapse is saved when switching off the device – and is reactivated after the device has been switched on again.	
		Group signal: Inactive	Status output[1*]: Ci = '0'
✷	Flash-es red	Output ready to be reset after an automatic switch off by actuating the button or remote reset (effective for all outputs that have been automatically switched off)	
		Group signal: Inactive	Status output[1*]: Ci = '0'
✷	Flash-es orange	Output manually switched off using the button: The state is saved when the device is switched off, and can only be reset again by pressing the up button again.	
		Group signal: Active	Status output[1*]: Ci = '0'
✷○○○ ➔➔➔➔	Red running light	Device overtemperature: The outputs can be switched-on again once the temperature is in the normal range.	
		Group signal: Inactive	Status output[1*]: Ci = '0'
Group signaling contact (changeover contact)		In the "inactive" state, 11-12 are connected and 11-14 open	-

Signaling	**6EP1961-2BA11** **6EP1961-2BA21** **6EP1961-2BA51**	**6EP1961-2BA31** **6EP1961-2BA41** **6EP1961-2BA61**
Status output	-	Serial signaling (see Figure 2-5 Status signaling (Page 18)), '1' = 24 V DC / '0' = 0 V (pull down)

1* The status of all four outputs is serially signaled using status output ④ (see Figure 2-5 Status signaling (Page 18)). A frame comprises a start bit START and four status bits Ci (i=1 … 4), which are each separated by a pause bit P. While the device powers up, or if the supply voltage is missing, nothing is signaled, the status remains continuously at '0'. For SIMATIC-S7 controllers (S7-300/400/1200/1500), a function block for evaluation is available under (http://www.siemens.com/sitop) or the direct link (https://support.industry.siemens.com/cs/us/en/view/61450284).

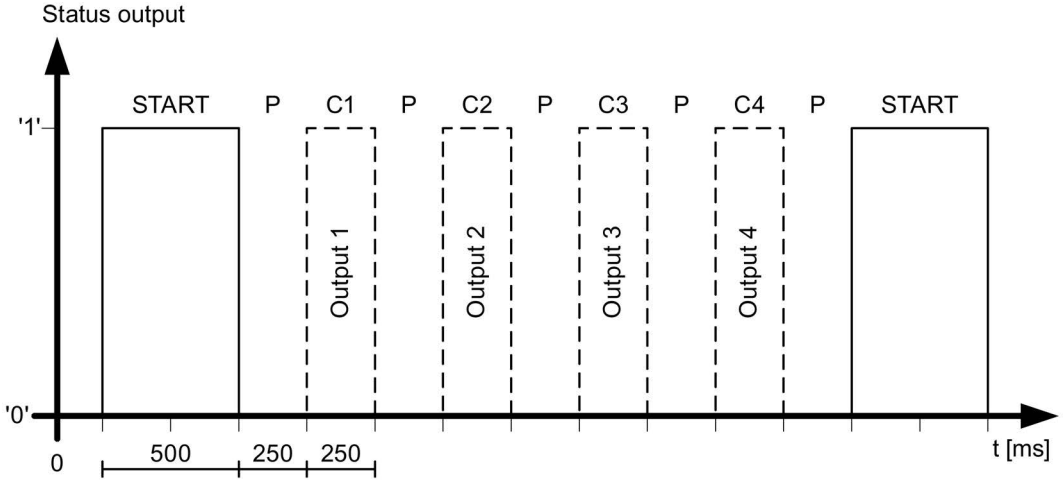


Figure 2-5 Status signaling

2.5 Buttons and selector switches

2.5.1 SITOP select

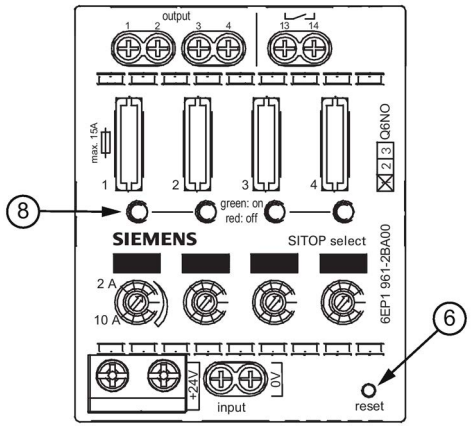


Figure 2-6 Reset button SITOP select

The reset button ⑥ for the SITOP select selectivity module has the following two functions:

1. resets all outputs automatically switched off due to an overload condition (see Chapter Electronic overload shutdown and reset (Page 21)).
2. is used to program the sequential switch-on delay (see Chapter Setting the switch-on delay time (Page 26).

Note

Switching off and switching on an output while commissioning the device

For selectivity module SITOP select, an output can be manually switched off and switched on, e.g. during commissioning, by removing and inserting the flat fuse of the corresponding output.

2.5.2 SITOP PSE200U

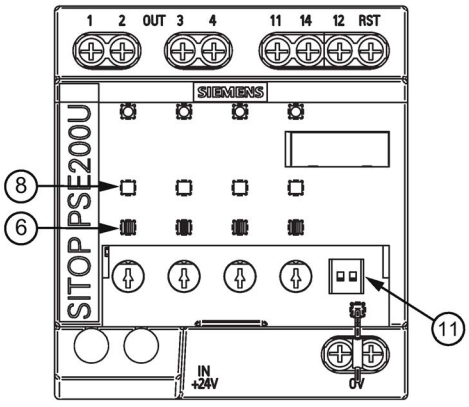


Figure 2-7 Buttons and selector switches, SITOP PSE200U

The button ⑥ for the SITOP PSE200U selectivity module has the following two functions:

1. manually switching an output off and on (see the following).
2. resetting an output automatically switched off due to an overload condition (see Chapter Electronic overload shutdown and reset (Page 21)).

The selector switch ⑪ can be used to select the delay time when switching on the individual outputs (see Chapter Setting the switch-on delay time (Page 26)).

Manually switching an output on and off

An individual output can be switched on and switched off using the button. When the device is delivered, the outputs are manually switched off.

Switching off an output:
For outputs that are switched on, LED ⑧ of the particular output is lit green. You can switch off the output by pressing the assigned button ⑥. The LED then flashes orange (output has been manually switched off).

Switching on an output:
For outputs that have been manually switched off, LED ⑧ of the particular output is lit orange. You can switch on the output by pressing the assigned button ⑥. The LED is then lit green (output is switched on).

Note

An output that has been manually switched-off can only be manually switched-on again by manually pressing the button again. It is not possible to switch on an output that has been manually switched off using the remote reset signal.

An output that has been manually switched off remains saved (latch) even when the supply voltage is no longer available, and is a manually switched off when the supply voltage returns.

2.6 Electronic overload shutdown and reset

An overload is permitted for a defined period of time for each selectivity module output. The output is electronically shut down according to the "Shutdown characteristic" diagram after the limit value has been exceeded.

2.6.1 SITOP select

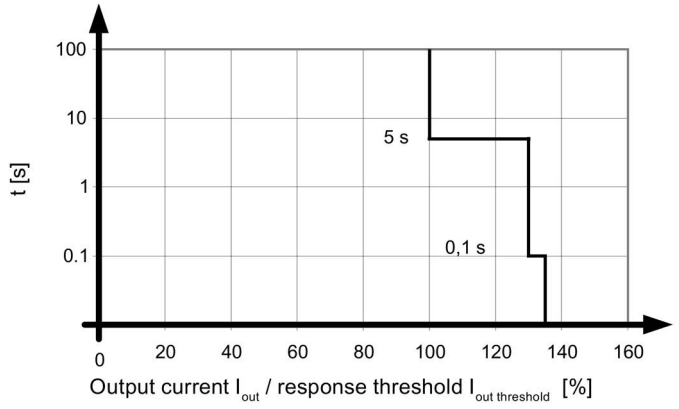


Figure 2-8 Shutdown characteristic SITOP select

- An output current is continuously permissible up to the selected current response threshold (LED of the output is lit green).
- In the range 101 - 129 % of the selected current response threshold, an overload current is permissible for 5 seconds; after this time, the output is electronically shut down (LED of the output is lit red).
- In the range > 130 % of the selected current response threshold, the current is limited to 130 %, after approx. 50 - 100 ms the output is electronically shut down (LED of the output is lit red).
- When the output current exceeds the selected current response threshold, and if the supply voltage simultaneously dips below 20 V, then the output is electronically shutdown (the LED of the output is lit red).

Reset of an electronic overload shutdown using the reset button

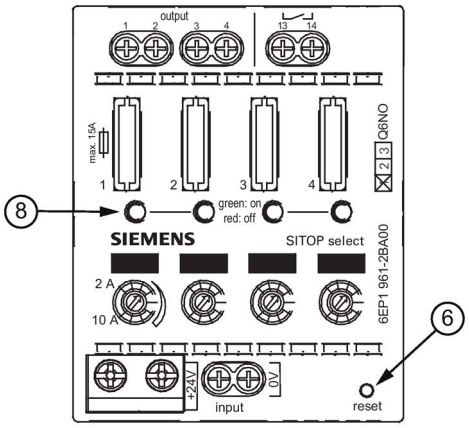


Figure 2-9 Reset button SITOP select

Using the reset button ⑥, after a delay time has elapsed, outputs that have been shut down due to an overload can be reset, i.e. the electronic shutdown can be reset.

The initial situation is an electronic shutdown of individual outputs as a result of an overload condition. This is signaled using the LED ⑧ of the particular output.

LED	Meaning/handling
Lit red	Electronic shutdown as a result of an overload; wait time until a reset is possible: approx. 20 seconds.
Flashes red	Output ready for a reset; press the button to switch-on the output again.
Lit green	The reset was carried out, the output was switched-on again.

Procedure to reset an electronic shutdown:

1. After an electronic shutdown (LED of the output is lit red), allow a wait time of 20 seconds to elapse.
2. Press the reset button ⑥
   Electronic shutdown was reset, and the output has been switched-on again (LED of the output is lit green).

Note

When pressing the button, all of the outputs shut down due to an overload, which are ready for reset (LED flashes red), are switched-in again together.

Note

If, after a reset, the cause of the overload is still present, then the output is again automatically shut down. Before carrying out a reset, remove the cause of the overload to prevent a new shutdown.

2.6.2 SITOP PSE200U

Shutdown characteristics SITOP PSE200U (with the exception of -2BA51, -2BA61) product version 1:

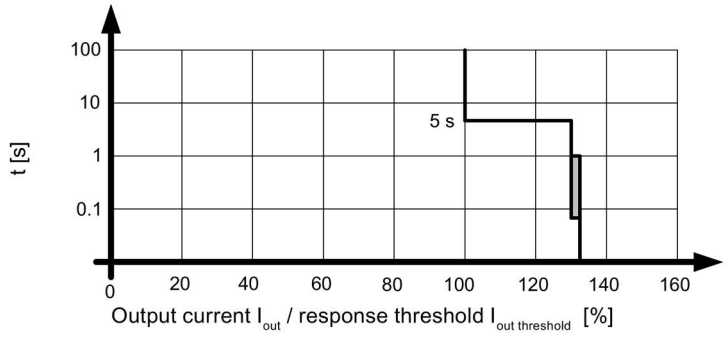


Figure 2-10 Shutdown characteristics SITOP PSE200U (product version 1)

- An output current is continuously permissible up to the selected current response threshold.
- In the range 101 - 129 % of the selected current response threshold, an overload current is permissible for 5 seconds; after this time, the output is electronically shut down.
- In the range > 130 % of the selected current response threshold, the current is limited to 130 %; typically after 100 ms the output is electronically shut down.
- When the output current exceeds the selected current response threshold, and if the supply voltage simultaneously dips below 20 V, then the output is electronically shutdown.

Shutdown characteristic SITOP PSE200U (with the exception of -2BA51, -2BA61) from product version 2 and higher:

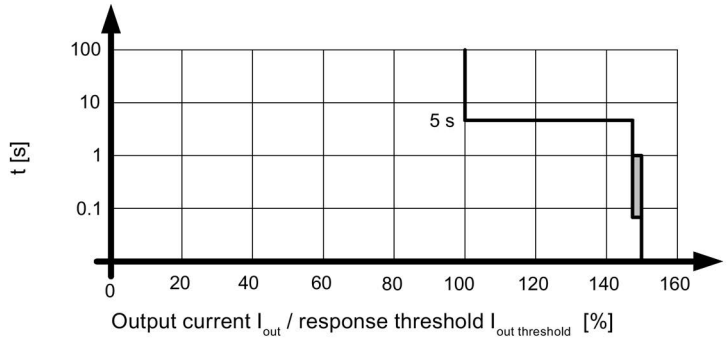


Figure 2-11 Shutdown characteristics SITOP PSE200U (from product version 2 and higher)

- An output current is continuously permissible up to the selected current response threshold (LED of the output is lit green).
- An overload current for 5 seconds is permissible in the range 101 - 149 % of the set current response threshold value (the LED of the output flashes green) - and then the output is electronically shut down (LED of the output is red).

- In the range > 150 % of the selected current response threshold, the current is limited to 150 %, typically after 100 ms, the output is electronically shut down (LED of the output is lit red).
- When the output current exceeds the selected current response threshold, and if the supply voltage simultaneously dips below 20 V, then the output is electronically shutdown (the LED of the output is lit red).

Shutdown characteristic 6EP1961-2BA51, -2BA61:

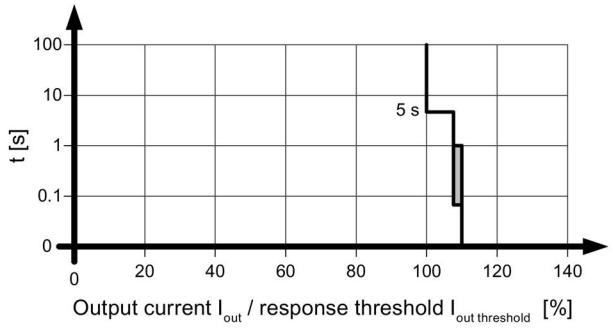


Figure 2-12 Shutdown characteristic 6EP1961-2BA51, -2BA61

- An output current is continuously permissible up to the selected current response threshold (LED of the output is lit green).
- An overload current for 5 seconds is permissible in the range 101 - 109 % of the set current response threshold value (the LED of the output flashes green) - and then the output is electronically shut down (LED of the output is red).
- In the range > 110 % of the selected current response threshold, the current is limited to 110 %, typically after 100 ms, the output is electronically shut down (LED of the output is lit red).
- When the output current exceeds the selected current response threshold, and if the supply voltage simultaneously dips below 20 V, then the output is electronically shutdown (the LED of the output is lit red).

Reset of an electronic overload shutdown using the reset button and remote reset

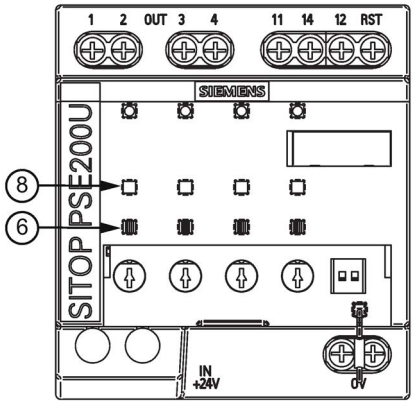


Figure 2-13 SITOP PSE200U button

An individual output can be reset using the button. This resets the electronic shutdown of the output, caused by an overload condition.

The initial situation is an electronic shutdown of individual outputs as a result of an overload condition. This is signaled using the LED ⑧ of the particular output.

LED	Meaning/handling
Lit red	Electronic shutdown as a result of an overload; wait time until a reset is possible: approx. 20 seconds.
Flashes red	Output ready for a reset; press the button to switch-on the output again.
Lit green	The reset was carried out, the output was switched-on again.

Procedure to reset an electronic shutdown:

1. After an electronic shutdown (LED of the output is lit red), allow a wait time of 20 seconds to elapse.
2. Press the reset button ⑥ of the particular output
   Electronic shutdown was reset, and the output has been switched-on again (LED of the output is lit green).

Remote reset:

Alternatively, a remote reset signal can be used. The non-isolated 24 V input (referred to the "0 V" terminal of the module) can be used at terminal "RST". A reset is executed for an input level of > 15 V.

Note

The rising edge of the remote reset signal is evaluated, i.e. for an additional remote reset signal, initially a voltage level of 13 V must be fallen below.

Using a remote reset signal at terminal "RST" all outputs that were shut down electronically due to an overload are reset at this time. Prerequisite: The output is ready to be reset, i.e. the electronic overload shutdown occurred longer than 20 s ago (LED of the output flashes red).

Note

If, after a reset, the cause of the overload is still present, then the output is again automatically shut down. Before carrying out a reset, remove the cause of the overload to prevent a new shutdown.

2.7 Setting the switch-on delay time

For specific loads, it can make sense to sequentially switch-on the outputs in order to reduce the peak inrush currents, and therefore the load on the power supply. To achieve this, the individual outputs of the selectivity module can be switched-in with a time delay between one another in a fixed sequence (output 1 ⇒ 2 ⇒ 3 ⇒ 4). The delay time set between the individual outputs is the same for all of the outputs. When supplied, the delay time is set to 0 ms (all outputs switch on simultaneously).

2.7.1 SITOP select

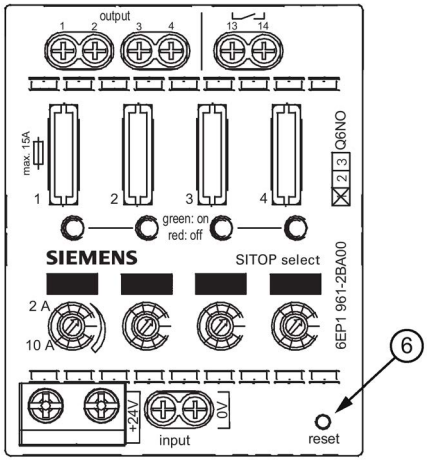


Figure 2-14 Reset button SITOP select

Programming the sequential switch-on delay

For specific loads, it can make sense to sequentially switch-on the outputs in order to reduce the peak inrush currents, and therefore the load on the power supply. To achieve this, the individual outputs of the selectivity module can be switched-in with a time delay between one another in a fixed sequence (output 1 ⇒ 2 ⇒ 3 ⇒ 4). The delay time between the individual outputs is the same for all outputs, and can be set to 0 ms, 24 ms or 100 ms. The selected setting is also kept for an unlimited time even when the power fails, and can be changed as often as required. When supplied, the delay time is set to 0 ms (all outputs switch on simultaneously).

Procedure when setting the delay time:

1. Keep the reset button ⑥ pressed for approximately 8 seconds. The selectivity module changes into the programming mode, all LEDs are lit red and the outputs are shut down.
2. Release the reset button. The LEDs signal the selected delay time using a specific flash rhythm. The meaning is as follows:

LED	Meaning
flash 1x simultaneously red, followed by a 2 s pause	Delay time of 0 ms selected
flash 2x simultaneously red, followed by a 2 s pause	Delay time of 24 ms selected
flash 3x simultaneously red, followed by a 2 s pause	Delay time of 100 ms selected

   The flashing rhythm is repeated after a pause of approx. 2 s.
3. Briefly press the reset button; this causes the actual setting to be moved forward by one stage (0 ms ⇒ 24 ms ⇒ 100 ms ⇒0 ms). Press the reset button several times until the required setting is signaled.
4. Then keep the reset button pressed for approximately 8 seconds. All LEDs light up red.
5. Release the reset button. The selectivity module saves the delay time that has been set and sequentially switches on the outputs.

The LEDs of the outputs are lit green, and the selectivity module is again in its normal operating mode.

Note

In the programming mode, if the reset button is not pressed within 30 s, then the selectivity module automatically returns to the normal operating state without saving any change made to the delay time. The setting is also not saved if, while programming, the supply voltage fails.

Note

The selectivity module outputs are shut down while programming, and are automatically switched-on again after the programming mode is either manually or automatically exited. They are also automatically switched on again after the voltage returns after a power failure!

2.7.2 SITOP PSE200U

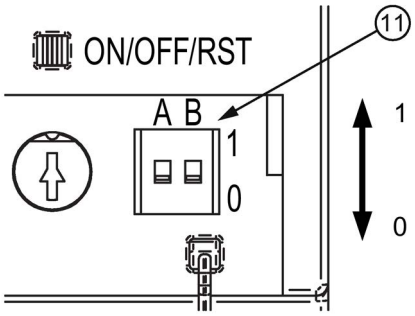


Figure 2-15 SITOP PSE200U selector switch

Setting the sequential switch-on delay

The switch-on delay is set at selector switch ⑪. When delivered, DIP switches "A" and "B" are in position "0" (no switch-on delay).

Procedure when setting the delay time:

With the selectivity module in a no-voltage condition, set DIP switches "A" and "B" to the required delay time.

	No delay, all four outputs are simultaneously switched-on (condition when delivered).
	25 ms delay between the outputs being switched on.
	100 ms delay between the outputs being switched on.
	Outputs switched on depending on the load: The next output is switched on as soon as the current of the previous output lies below the selected response threshold.

The next time that the selectivity module powers up, the outputs are sequentially switched on corresponding to the selected delay time.

2.8 Block diagram

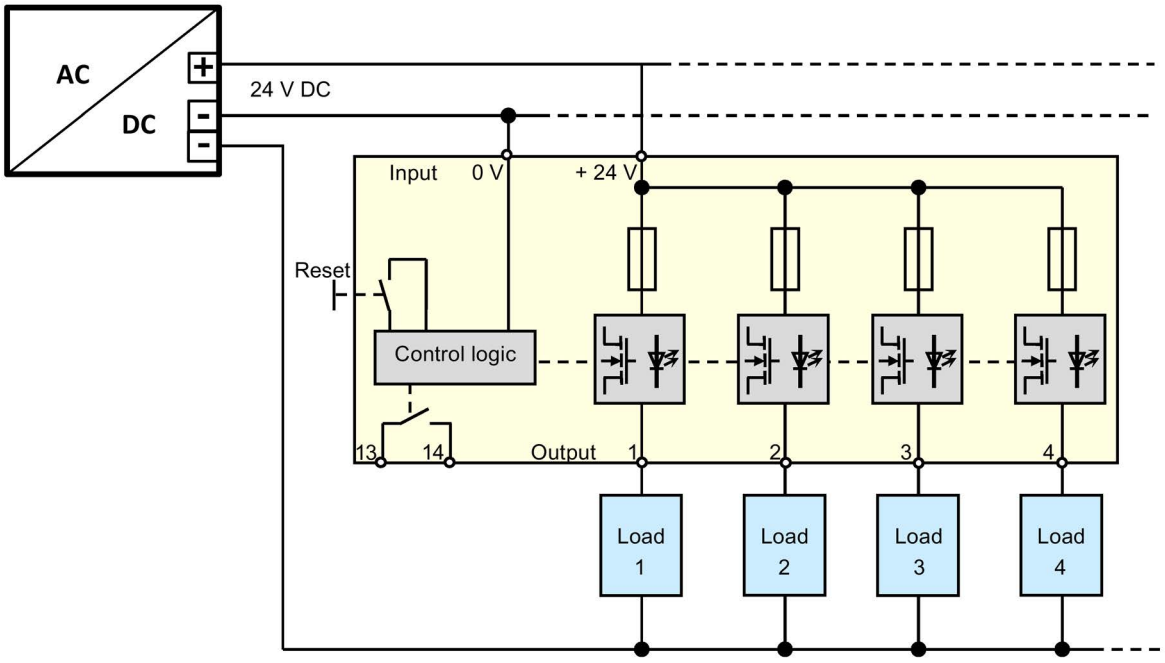


Figure 2-16 Block diagram of the 6EP1961-2BA00

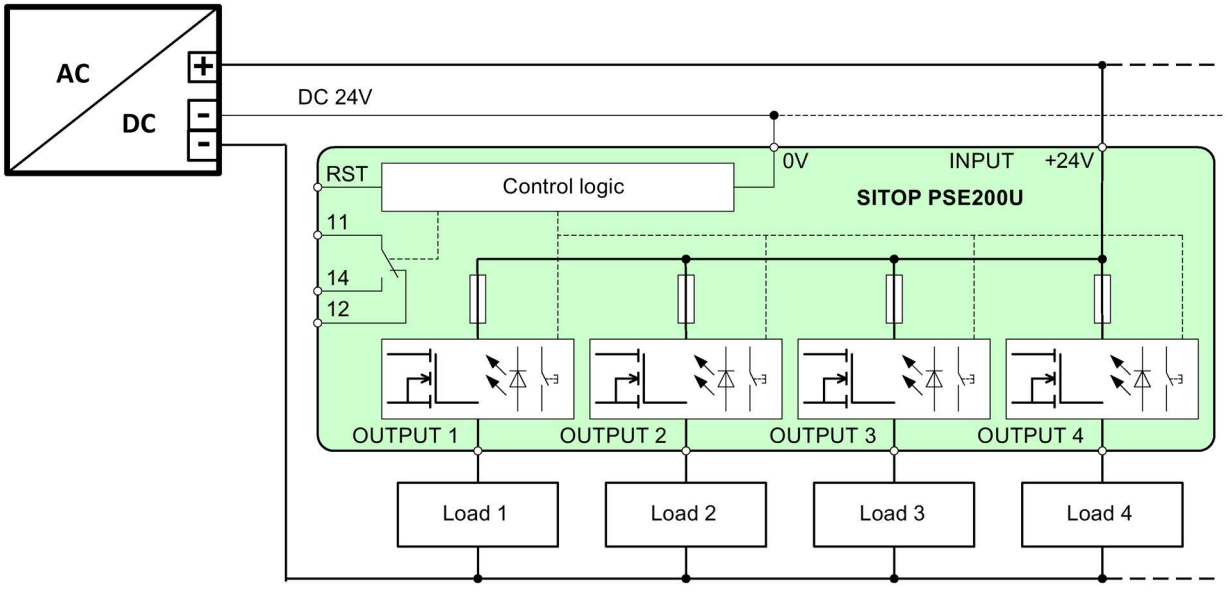


Figure 2-17 Block diagram for 6EP1961-2BA11, 6EP1961-2BA21 and 6EP1961-2BA51

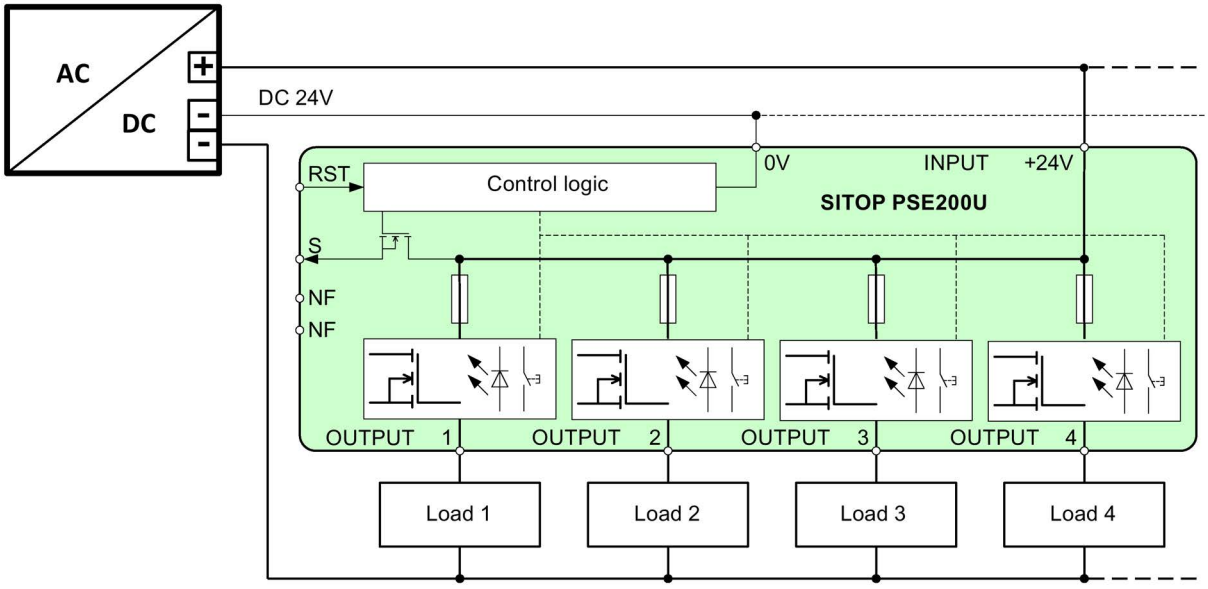


Figure 2-18 Block diagram 6EP1961-2BA31, 6EP1961-2BA41 and 6EP1961-2BA61

2.9 Dimensions and weight

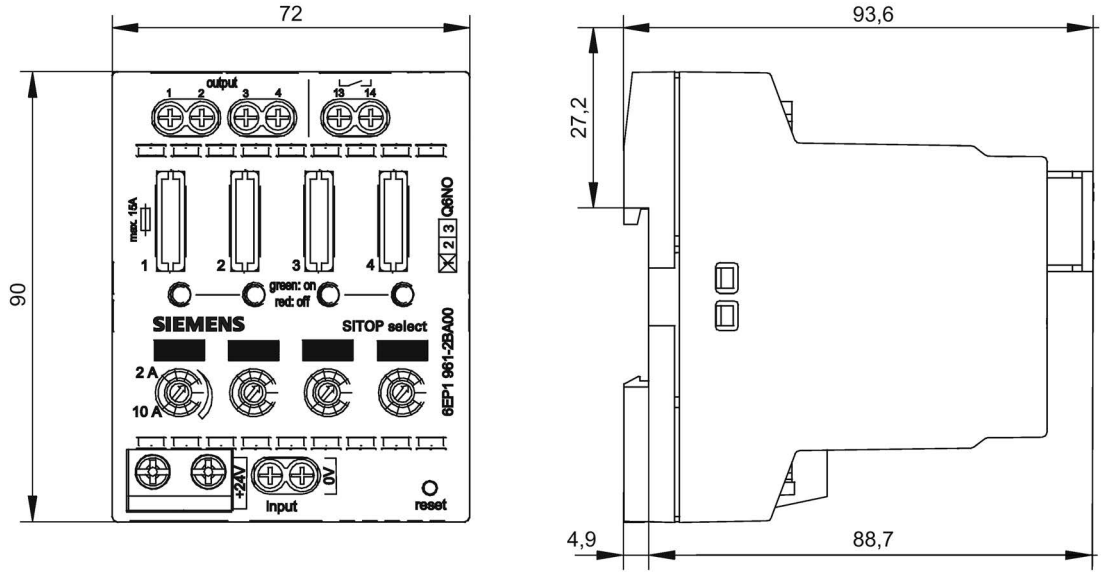


Figure 2-19 Dimension drawing 6EP1961-2BA00

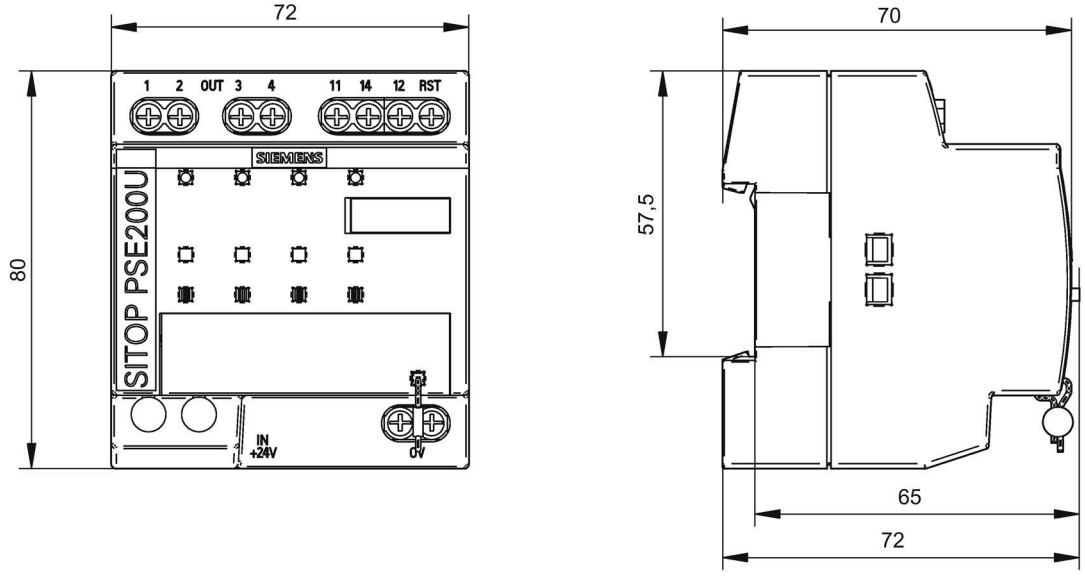


Figure 2-20 Dimension drawing 6EP1961-2BA*1

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA31 6EP1961-2BA21 6EP1961-2BA41 6EP1961-2BA51 6EP1961-2BA61
Dimensions (W × H × D) in mm	72 × 90 × 88.7	72 × 80 × 65
Weight	Approx. 0.4 kg	Approx. 0.2 kg

Mounting/removal

3

WARNING
Installing the device in a housing or a control cabinet The SITOP select and SITOP PSE200U selectivity modules are built-in units. They must be installed in a housing or control cabinet where only qualified personnel have access.

The device can be mounted in a control cabinet on standard mounting rails (see Chapter Mechanical system (Page 52))

Mounting

To mount the device, position it with the mounting rail guide at the upper edge of the standard mounting rail and press down to lock it into place. If it is too difficult to snap them into place, press slider ① at the same time, as described under "Removal".

Removal

To remove the device, pull slider ① using a screwdriver ② (see Figure 3-1 Mounting/removal (example): 6EP1961-2BA11) (Page 33)) and detach it at the lower edge of the standard mounting rail. Then you can remove the device from the upper edge of the standard mounting rail.

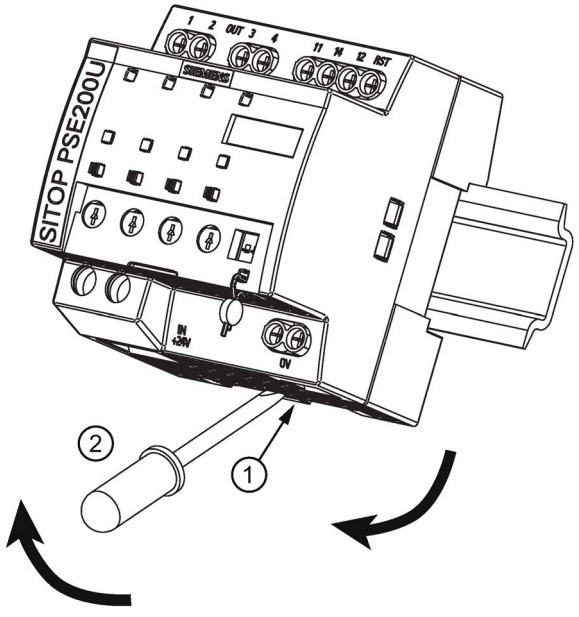


Figure 3-1 Mounting/removal (example): 6EP1961-2BA11)

WARNING

Use in hazardous zones

If the device is installed in a hazardous zone (II 3G Ex nA nC IIC T4 Gc (-2BA11, -2BA21, -2BA51) / II 3G Ex nA IIC T4 Gc (-2BA31, -2BA41, -2BA61)), then it must be installed in a distribution box with degree of protection IP54 or higher.

Mounting position, mounting clearances

4

4.1 Standard mounting position

The device is mounted on standard mounting rails. The device must be mounted vertically in such a way that the input terminals are at the bottom.

A clearance of at least 50 mm should be maintained above and below the device (maximum depth of the cable duct, 50 mm).

No space is required at the side.

Individual output current as a function of the ambient temperature and installation altitude

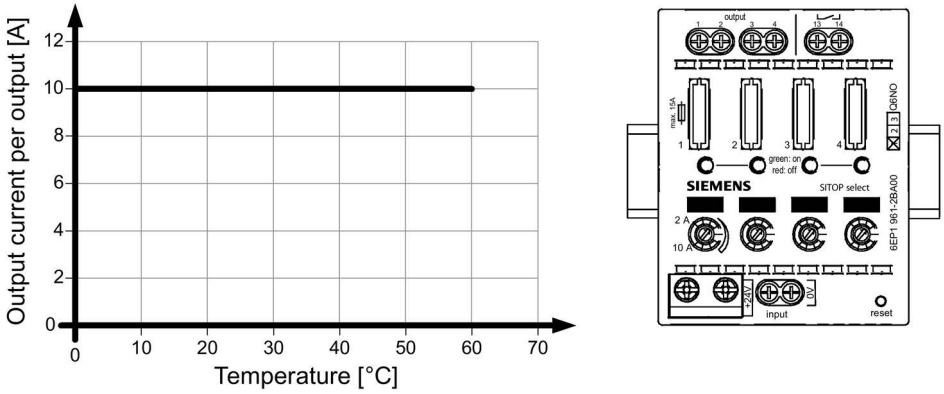


Figure 4-1 6EP1961-2BA00: Output current in the standard mounting position

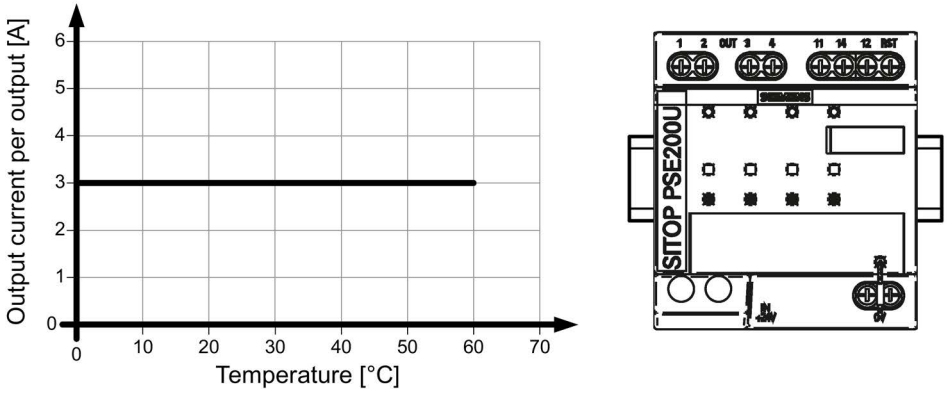


Figure 4-2 6EP1961-2BA11, 6EP1961-2BA31, 6EP1961-2BA51 and 6EP1961-2BA61 output current in the standard mounting position

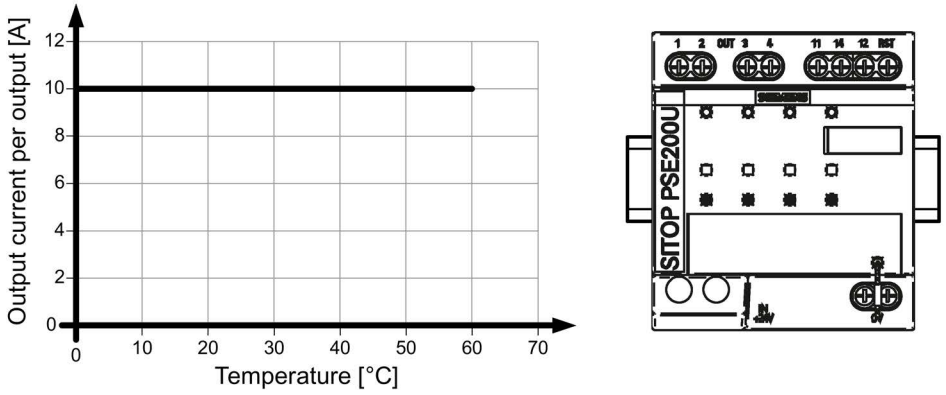


Figure 4-3 6EP1961-2BA21 and 6EP1961-2BA41: Output current in the standard mounting position

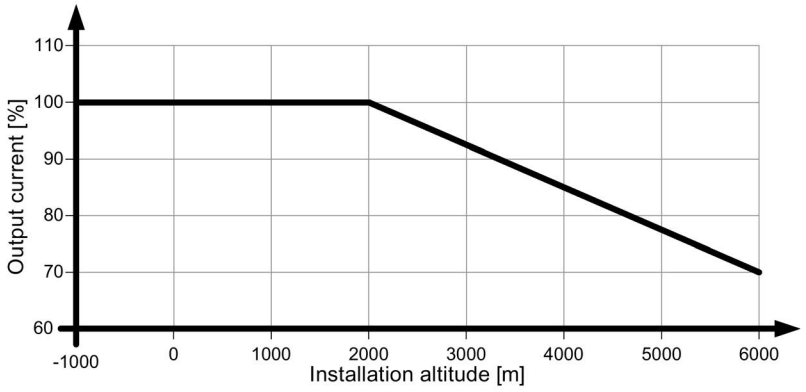


Figure 4-4 Mounting height derating

4.2 Other mounting positions

For mounting positions that deviate from the standard mounting position, derating factors (reduction of the output power or the permissible ambient temperature) must be observed in accordance with the following diagrams.

Note

In the case of mounting positions that deviate from the standard mounting position, reduced mechanical resistance of the devices against vibration and shock must be expected.

Particularly when installing on a vertically fastened standard mounting rail, additional measures may be required, e.g. to prevent the device from slipping on the standard mounting rail.

4.2.1 6EP1961-2BA00

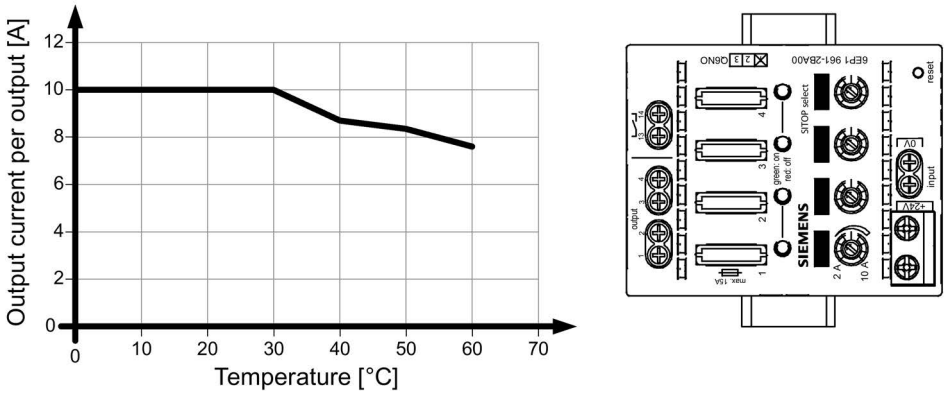


Figure 4-5 Mounting position (1)

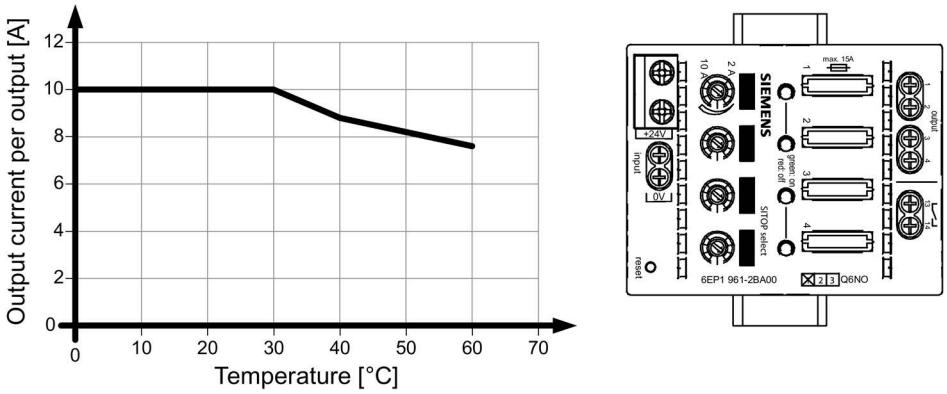


Figure 4-6 Mounting position (2)

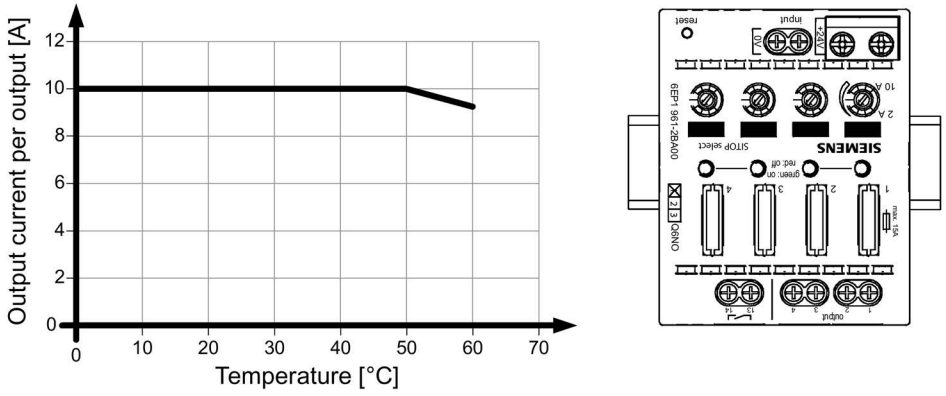


Figure 4-7 Mounting position (3)

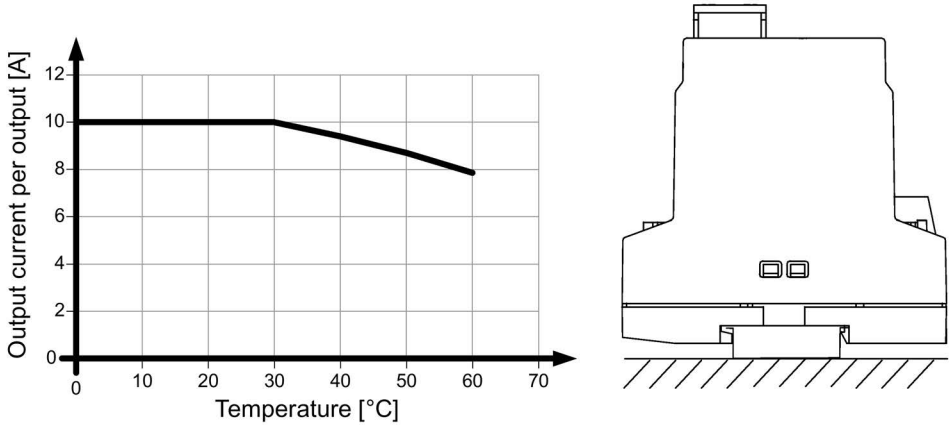


Figure 4-8 Mounting position (4)

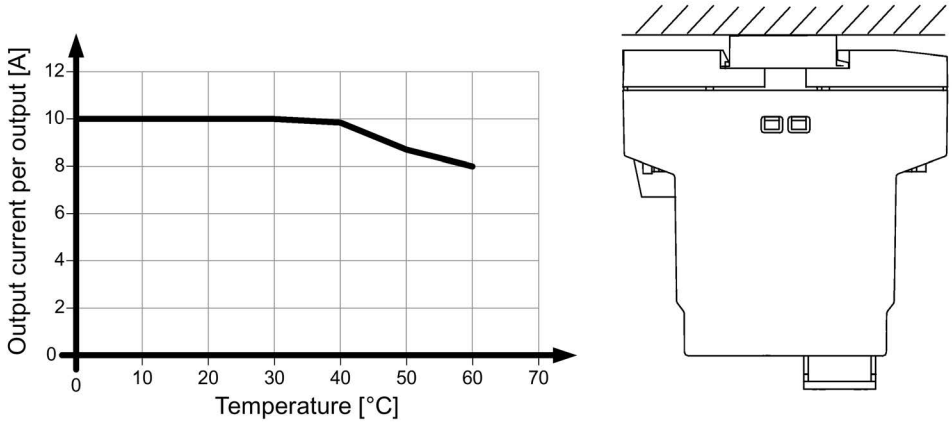


Figure 4-9 Mounting position (5)

4.2.2 6EP1961-2BA11, 6EP1961-2BA31, 6EP1961-2BA51 and 6EP1961-2BA61

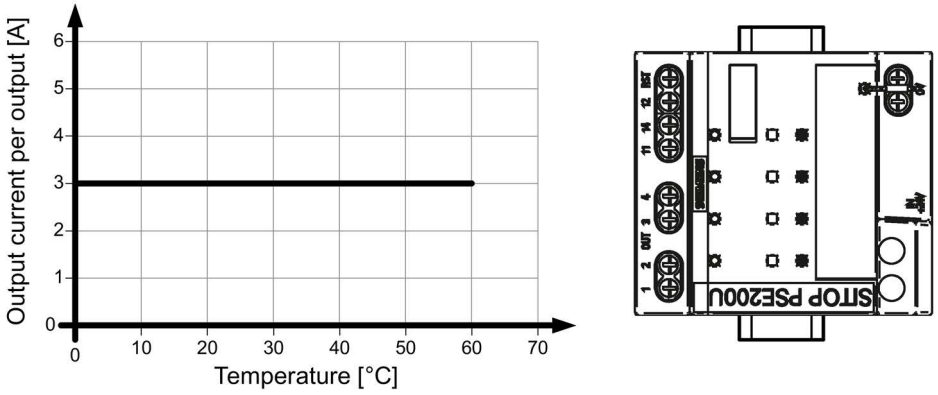


Figure 4-10 Mounting position (1)

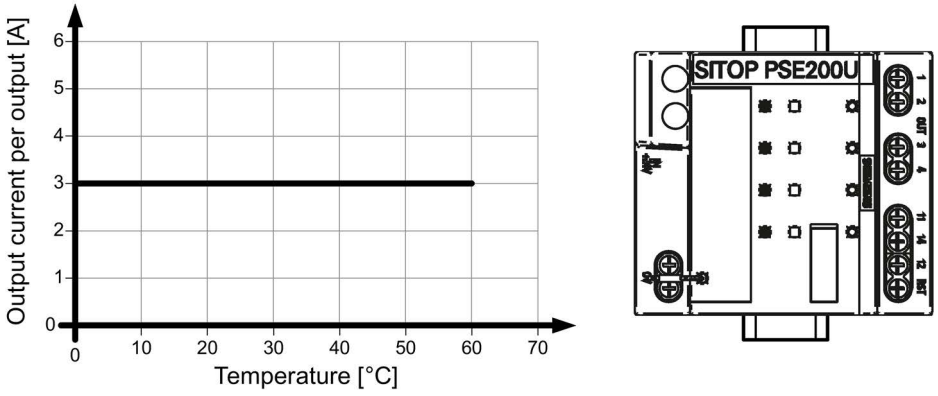


Figure 4-11 Mounting position (2)

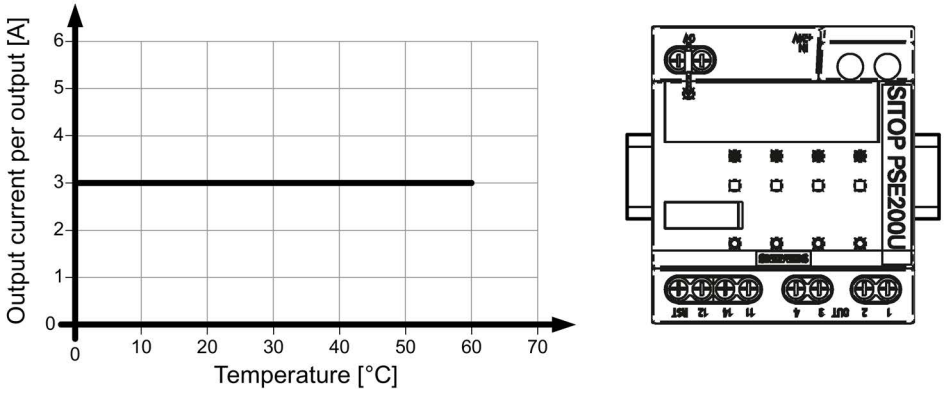


Figure 4-12 Mounting position (3)

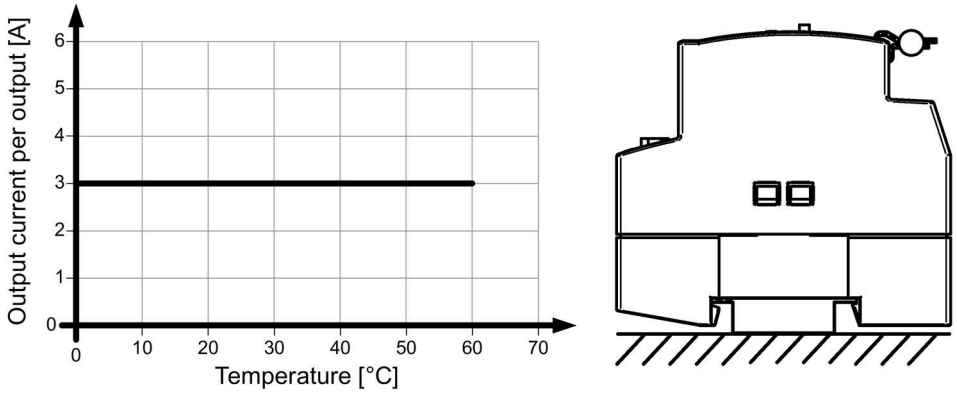


Figure 4-13 Mounting position (4)

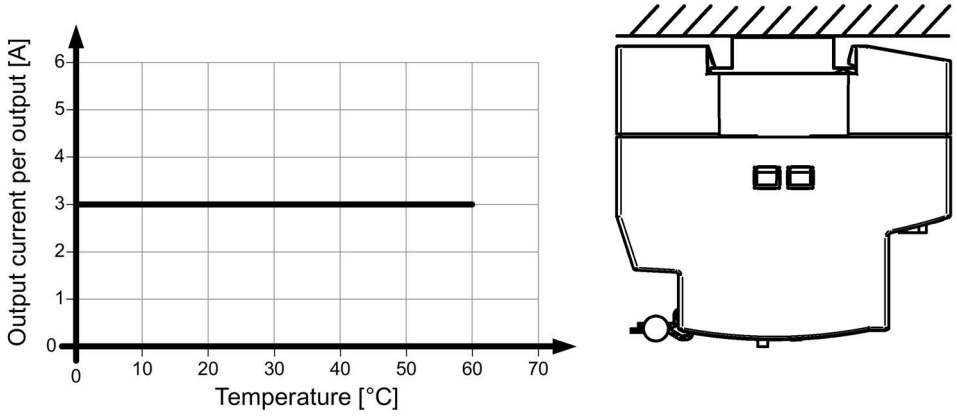


Figure 4-14 Mounting position (5)

4.2.3 6EP1961-2BA21 and 6EP1961-2BA41

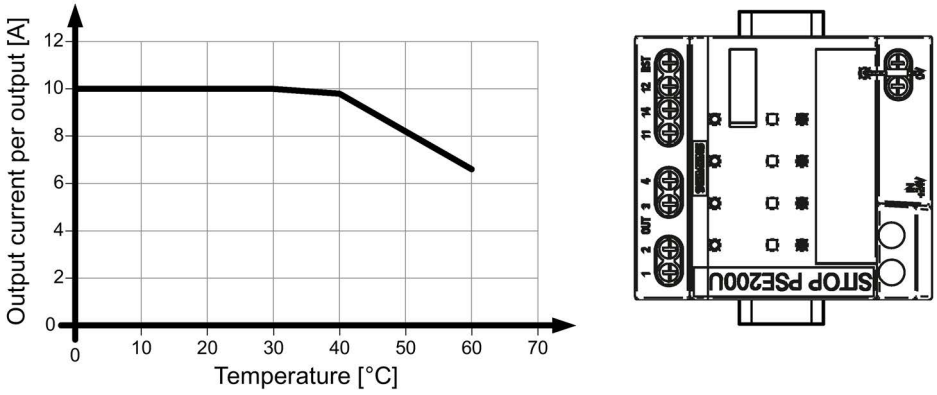


Figure 4-15 Mounting position (1)

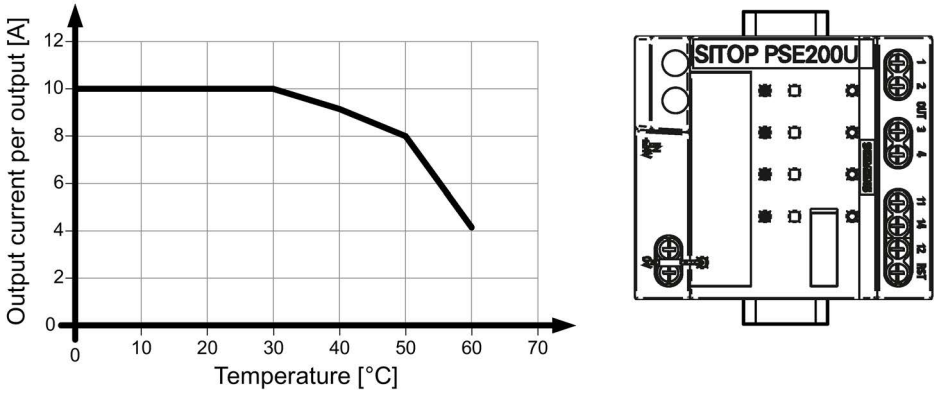


Figure 4-16 Mounting position (2)

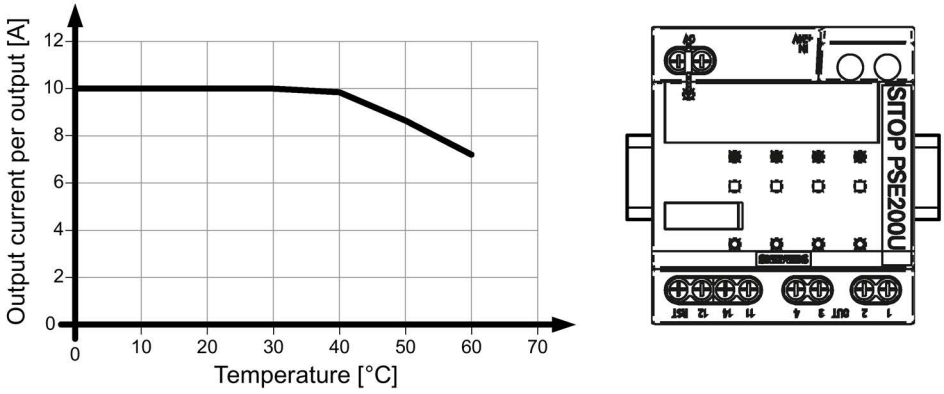


Figure 4-17 Mounting position (3)

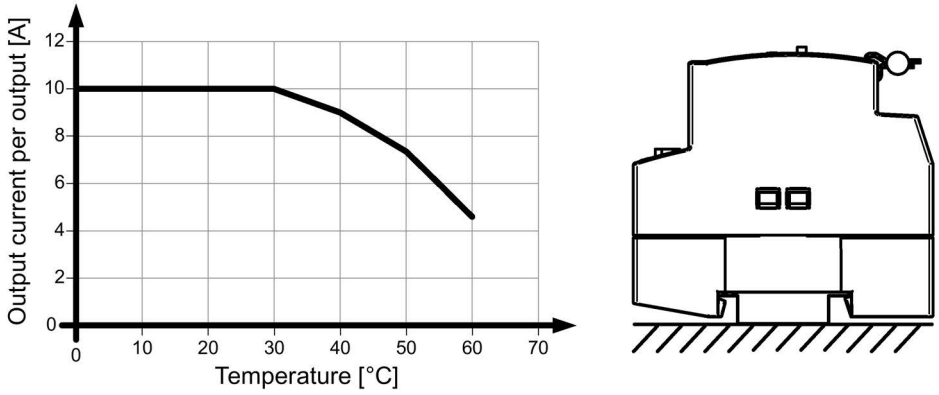


Figure 4-18 Mounting position (4)

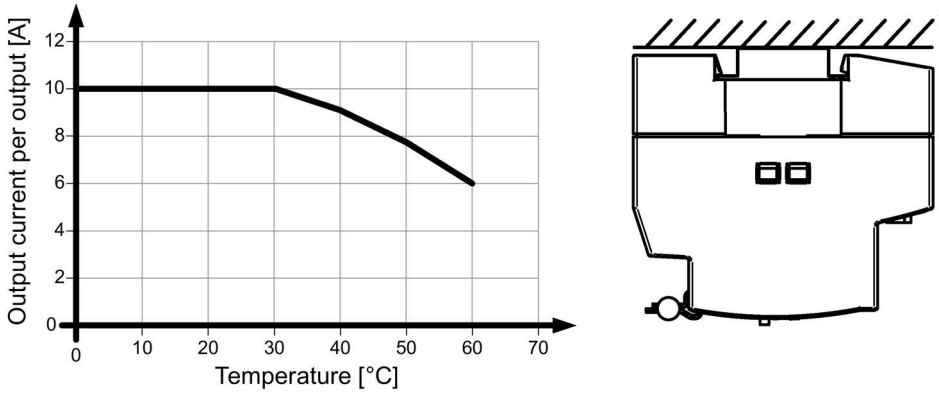


Figure 4-19 Mounting position (5)

Installation

5

WARNING

Hazard due to electric shock

Before installation or maintenance work can begin, the system's main switch must be switched off and measures taken to prevent it being switched on again. If this instruction is not observed, touching live parts can result in death or serious injury.

5.1 Input side connection

WARNING

The device is only suitable for operation with **24 V DC voltages** (safety extra low voltage). If this device is connected to line supplies with higher voltage levels this can result in death or serious injury as well as extensive material damage.

Only appropriately qualified personnel may work on or in the vicinity of this equipment. Perfect, safe, and reliable operation of this equipment is dependent on proper transportation, storage, installation and mounting.

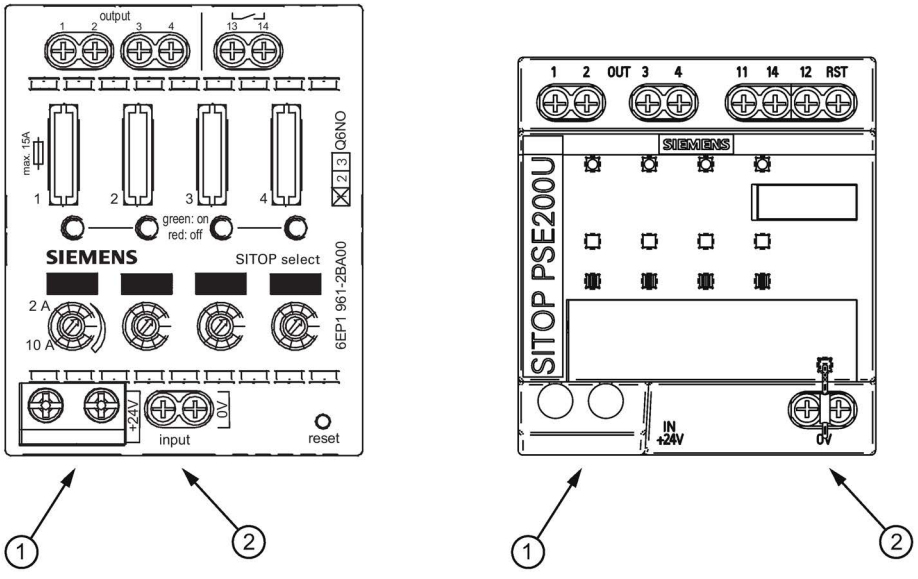


Figure 5-1 Input connection

The supply is connected via input terminal ①, designated "24 V" and the 0 V terminal ②, designated "0 V"; the "0 V" connection is not used for the load supply, but only to supply the internal electronics of the selectivity module (terminal cross-sections, see Figure 2-2 Terminal data (Page 13)).

NOTICE

Overload of the wiring

The "0 V" connection is only used to supply the internal electronics of the selectivity module. The 0 V of the connected loads must be routed directly to the power supply using separate cables!

NOTICE

Overload of the wiring

The input terminals of the selectivity module are designed for a maximum input current of 40 A. This must be taken into account when connecting several selectivity modules in parallel using "loop through". If the total current demand of all selectivity modules connected in parallel is more than 40 A, then the maximum current should be reduced to 40 A per branch by using additional feeder cables directly from the power supply to the selectivity modules connected in parallel.

5.2 Output-side connection

(see Chapter Technical data (Page 47))

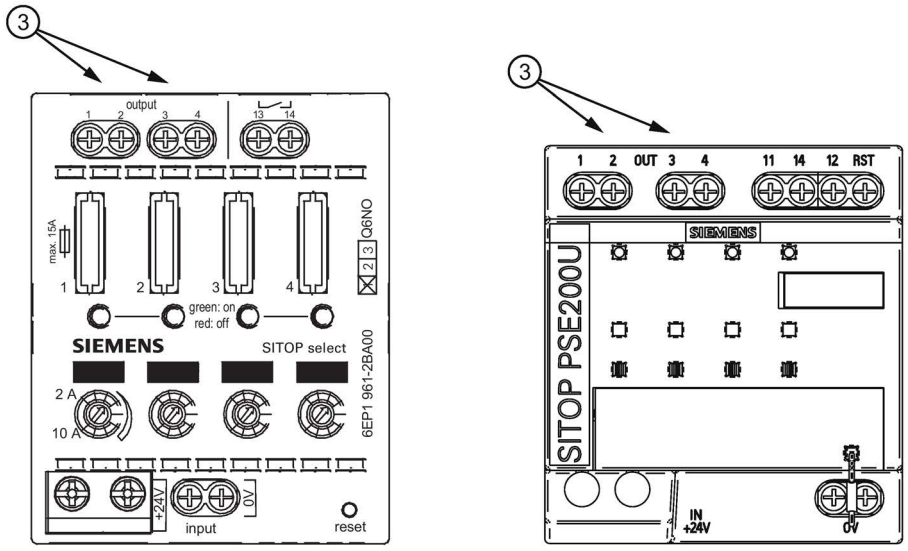


Figure 5-2 Output connection

The load to be supplied is connected through output terminals ③ labeled OUT 1, 2, 3, 4. (terminal cross-sections, see Figure Terminal data (Page 13)).

Note

The 0 V of the loads must be routed directly to the power supply using separate cables!

Technical data

6

Note

Technical data apply for a rated input voltage, rated load and 25 °C ambient temperature if nothing else is specified.

6.1 Input

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA31 6EP1961-2BA51 6EP1961-2BA61	6EP1961-2BA21 6EP1961-2BA41
Input	Regulated DC voltage [1*)]	Regulated DC voltage	Regulated DC voltage
Rated voltage $U_{in\ rated}$	24 V	24 V	24 V
Voltage range	22 - 30 V	22 - 30 V	22 - 30 V
Overvoltage strength	35 V; 100 ms	35 V	35 V
Input current at $U_{in\ rated}$	40 A	12 A	40 A

[1*)] SITOP select (6EP1961-2BA00) cannot be operated with the DC-UPS module 40 A (6EP1931-2FC21/-2FC42).

6.2 Output

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA31 6EP1961-2BA51 6EP1961-2BA61	6EP1961-2BA21 6EP1961-2BA41
Output	Regulated DC voltage	Regulated DC voltage	Regulated DC voltage
Output voltage	U_{in} - approx. 0.3 V	U_{in} - approx. 0.2 V	U_{in} - approx. 0.2 V
Total tolerance	Corresponding to the supplying input voltage	Corresponding to the supplying input voltage	Corresponding to the supplying input voltage
Number of outputs	4	4	4
Output current up to 60 °C for each output (rated value)	10 A	3 A	10 A

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA31 6EP1961-2BA51 6EP1961-2BA61	6EP1961-2BA21 6EP1961-2BA41
Adjustable response threshold	2 - 10 A	0.5 - 3 A	3 - 10 A
Connecting outputs in parallel	No	No	No
Switching on outputs	All outputs are simultaneously switch on after the supply voltage has ramped up, delay time of 24 ms or 100 ms can be programmed for outputs to be sequentially switched on.	All outputs are simultaneously switched-on after the supply voltage ramps up > 20 V, delay time of 25 ms, 100 ms – or "load optimized" where the outputs are sequentially switched-on, selected using the DIP switch.	

Shutdown characteristics SITOP select:

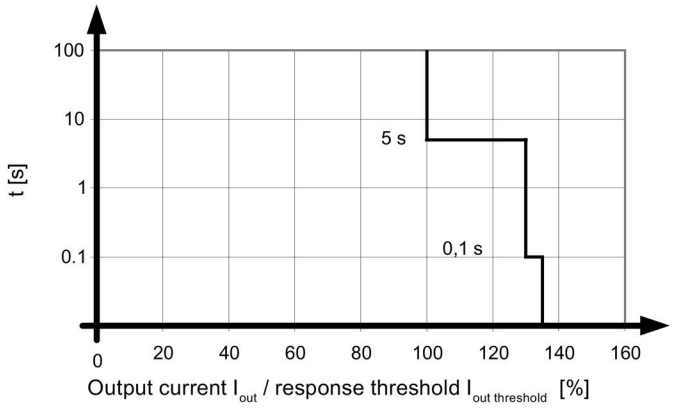


Figure 6-1 Shutdown characteristic SITOP select

- An output current is continuously permissible up to the selected current response threshold.
- In the range 101 - 129 % of the selected current response threshold, an overload current is permissible for 5 seconds; after this time, the output is electronically shut down.
- In the range > 130 % of the selected current response threshold, the current is limited to 130 %; after approximately 50 - 100 ms, the output is electronically shut down.
- When the output current exceeds the selected current response threshold, and if the supply voltage simultaneously dips below 20 V, then the output is electronically shutdown.

Shutdown characteristics SITOP PSE200U (with the exception of -2BA51, -2BA61) product version 1:

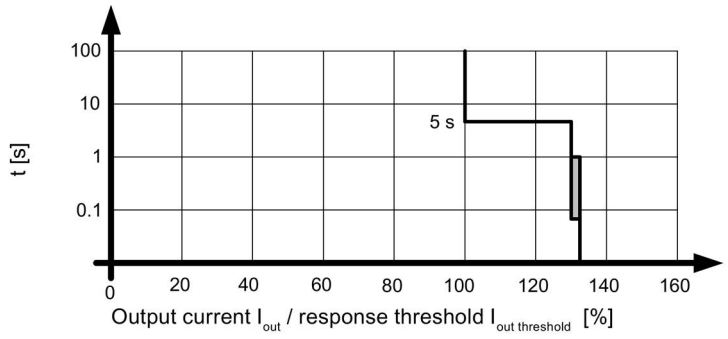


Figure 6-2 Shutdown characteristics SITOP PSE200U (product version 1)

- An output current is continuously permissible up to the selected current response threshold.
- In the range 101 - 129 % of the selected current response threshold, an overload current is permissible for 5 seconds; after this time, the output is electronically shut down.
- In the range > 130 % of the selected current response threshold, the current is limited to 130 %; typically after 100 ms the output is electronically shut down.
- When the output current exceeds the selected current response threshold, and if the supply voltage simultaneously dips below 20 V, then the output is electronically shutdown.

Shutdown characteristics SITOP PSE200U (with the exception of -2BA51, -2BA61) from product version 2 and higher:

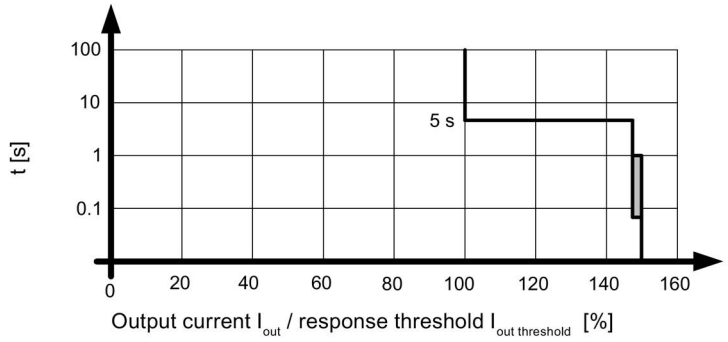


Figure 6-3 Shutdown characteristics SITOP PSE200U (from product version 2 and higher)

- An output current is continuously permissible up to the selected current response threshold.
- In the range 101 - 149 % of the selected current response threshold, an overload current is permissible for 5 seconds; after this time, the output is electronically shut down.

- In the range > 150 % of the selected current response threshold, the current is limited to 150 %; typically after 100 ms the output is electronically shut down.
- When the output current exceeds the selected current response threshold, and if the supply voltage simultaneously dips below 20 V, then the output is electronically shutdown.

Shutdown characteristic 6EP1961-2BA51, -2BA61:

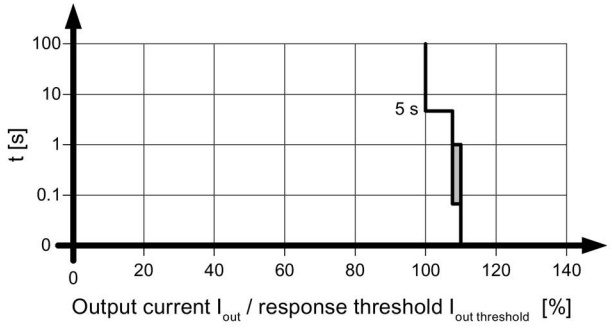


Figure 6-4 Shutdown characteristic 6EP1961-2BA51, -2BA61

- An output current is continuously permissible up to the selected current response threshold (LED of the output is lit green).
- In the range 101 - 109 % of the selected current response threshold, an overload current is permissible for 5 seconds (LED of the output flashes green), then the output is electronically shut down (LED of the output is lit red).
- In the range > 110 % of the selected current response threshold, the current is limited to 110 %, typically after 100 ms, the output is electronically shut down (LED of the output is lit red).
- When the output current exceeds the selected current response threshold, and if the supply voltage simultaneously dips below 20 V, then the output is electronically shutdown (the LED of the output is lit red).

6.3 Efficiency

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA31 6EP1961-2BA51 6EP1961-2BA61	6EP1961-2BA21 6EP1961-2BA41
Efficiency at $U_{out\ rated}$, $I_{out\ rated}$, approx.	97 %	97 %	99 %
Power loss at $U_{out\ rated}$, $I_{out\ rated}$, approx.	30 W	9 W	10 W

6.4 Protection and monitoring

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA51	6EP1961-2BA21	6EP1961-2BA31 6EP1961-2BA61	6EP1961-2BA41
Device protection	Flat fuse for each output (a 15 A fuse is inserted when the device is shipped) [1*)]	Internal fuse 5 A for each output (not accessible)	Internal fuse 15 A for each output (not accessible)	Internal fuse 5 A for each output (not accessible)	Internal fuse 15 A for each output (not accessible)
Operating display	One LED per output: Green LED for "Output switched through", red LED for "Output shutdown due to overcurrent"	One LED per output: Green LED for "Output switched through", orange LED for "Output manually switched off", red LED for "Output shutdown due to overcurrent".			
Signaling	Group signaling contact (NO contact, contact rating 0.5 A/24 V)	Group signaling contact (changeover contact, contact rating 0.1 A/24 V)		Status signal output (pulse position signal that can be evaluated using a Simatic function block)	

[1*)] Note for 6EP1961-2BA00:
When required, depending on the potentiometer setting, lower fuse values can be selected.
Setting to → fuse from
2 A → 3 A
3 A → 4 A
4 A → 5 A
6 A → 7.5 A
8 A → 10 A
10 A → 15 A

6.5 MTBF

	6EP1961-2BA00 6EP1961-2BA11 6EP1961-2BA21	6EP1961-2BA31 6EP1961-2BA41	6EP1961-2BA51 6EP1961-2BA61
Mean Time Between Failures	> 500,000 hours at 40 °C, rated load, 24 hour operation		

6.6 Mechanical system

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA21 6EP1961-2BA51	6EP1961-2BA31 6EP1961-2BA41 6EP1961-2BA61
Connection system	Screw connection	Screw connection	Screw connection
+24 V input	2 screw terminals for 0.5 - 16 mm²	2 screw terminals for 0.5 - 16 mm²	2 screw terminals for 0.5 - 16 mm²
0 V connection	2 screw terminals for 0.2 - 6 (4) mm² solid (finely stranded)	2 screw terminals for 0.2 - 6 (4) mm² solid (finely stranded)	2 screw terminals for 0.2 - 6 (4) mm² solid (finely stranded)
Output 1, 2, 3, 4	One screw-type terminal for each output for 0.2 - 6 (4) mm² solid (finely stranded)	One screw-type terminal for each output for 0.2 - 6 (4) mm² solid (finely stranded)	One screw-type terminal for each output for 0.2 - 6 (4) mm² solid (finely stranded)
Group signal contact	2 screw terminals for 0.2 - 6 (4) mm² solid (finely stranded)	3 screw terminals for 0.2 - 6 (4) mm² solid (finely stranded)	-
Status output	-	-	One screw terminal for 0.2 - 6 (4) mm² solid (finely stranded)
Remote reset	-	One screw terminal for 0.2 - 6 (4) mm² solid (finely stranded)	One screw terminal for 0.2 - 6 (4) mm² solid (finely stranded)
Width of the housing	72 mm	72 mm	72 mm
Height of the housing	90 mm	80 mm	80 mm
Depth of the housing	approx. 90 mm	72 mm	72 mm
Installation width	72 mm	72 mm	72 mm
Mounting height	190 mm	180 mm	180 mm
Weight, approx.	0.4 kg	0.2 kg	0.2 kg
Mounting	Can be snapped onto standard TH35-15/7,5 mounting rails (EN 60715)		

6.7 Accessories

Accessories

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA21 6EP1961-2BA31 6EP1961-2BA41 6EP1961-2BA51 6EP1961-2BA61
Electrical accessories	Flat insertable fuse: Manufacturer, Littelfuse, FKS series, 19 mm long	-
Mechanical accessories	-	Device name plate 20 mm x 7 mm TI grey 3RT2900-1SB20

6.8 Dimension drawing

See chapter Dimensions and weight (Page 31)

CAD data that can be downloaded from the Internet:

6EP1961-2BA00
(http://www.automation.siemens.com/bilddb/index.aspx?objKey=G_KT01_XX_00575)

6EP1961-2BA11
(http://www.automation.siemens.com/bilddb/index.aspx?objKey=G_KT01_XX_00423)

6EP1961-2BA21
(http://www.automation.siemens.com/bilddb/index.aspx?objKey=G_KT01_XX_00427)

6EP1961-2BA31
(http://www.automation.siemens.com/bilddb/index.aspx?objKey=G_KT01_XX_00742)

6EP1961-2BA41
(http://www.automation.siemens.com/bilddb/index.aspx?objKey=G_KT01_XX_00745)

6EP1961-2BA51
(http://www.automation.siemens.com/bilddb/index.aspx?objKey=G_KT01_XX_01240)

6EP1961-2BA61
(http://www.automation.siemens.com/bilddb/index.aspx?objKey=G_KT01_XX_01241)

Safety, approvals, EMC

7

7.1 Safety

	6EP1961-2BA00 6EP1961-2BA11 6EP1961-2BA21	6EP1961-2BA31 6EP1961-2BA41	6EP1961-2BA51 6EP1961-2BA61
Standard for safety	acc. to EN 60950-1 and EN 50178		
Protection class	Class III		

7.2 Approvals

	6EP1961-2BA00	6EP1961-2BA11 6EP1961-2BA21 6EP1961-2BA51	6EP1961-2BA31 6EP1961-2BA41 6EP1961-2BA61
CE marking	Yes	Yes	Yes
Degree of protection (EN 60529)	IP20	IP20	IP20
UL/cUL (CSA) approval	UL-Recognized (UL 2367) File E328600; cULus (UL 508, CSA C22.2 No. 107.1) File E197259; cURus (UL 60950, CSA C22.2 No. 60950) File E151273	UL-Recognized (UL 2367) File E328600; cULus (UL 508, CSA C22.2 No. 107.1) File E197259	
• Remark:		The combination of the listed Siemens AG power supply and solid-state overcurrent protector models 6EP1961, followed by -2BA51 or -2BA61 additionally create a limited voltage/current circuit. Devices 6EP1961-2BA51 and -2BA61 additionally fulfill the conditions for "Class 2 output" according to UL 1310 (maximum 100 VA)	
Explosion protection	ATEX (EX) II 3G Ex nA nC IIC T4 Gc cCSAus Class I, Div. 2, Group A,B,C,D, T4	ATEX (EX) II 3G Ex nA nC IIC T4 Gc cCSAus Class I, Div. 2, Group A,B,C,D, T4	ATEX (EX) II 3G Ex nA IIC T4 Gc cCSAus Class I, Div. 2, Group A,B,C,D, T4
Marine approvals	-	DNV-GL, ABS	DNV-GL, ABS

7.3 EMC

	6EP1961-2BA00 6EP1961-2BA11 6EP1961-2BA21	6EP1961-2BA31 6EP1961-2BA41	6EP1961-2BA51 6EP1961-2BA61
Emitted interference	EN 55022 Class B		
Noise immunity	EN 61000-6-2		

Environmental conditions

8

	6EP1961-2BA00 6EP1961-2BA11 6EP1961-2BA21	6EP1961-2BA31 6EP1961-2BA41	6EP1961-2BA51 6EP1961-2BA61
Ambient temperature	-25 … 60 °C for natural convection		
	Tested according to: • EN 60068-2-1 cold • EN 60068-2-2 dry heat • EN 60068-2-78 humid heat, constant • EN 60068-2-14 temperature change		
Transport and storage temperature	-40 … 85 °C Tests (packed for shipping) according to: • EN 60068-2-1 cold • EN 60068-2-2 dry heat • EN 60068-2-30 humid heat, cyclic		
Humidity class	Climatic class 3K3 according to EN 60721, 5 - 95 % no condensation		
Degree of pollution	2		
Mechanical stressing in operation	• Tested according to EN 60068-2-6 vibration, test Fc:		
	3.5 mm deflection in the range 5 - 8.4 Hz 2 g acceleration in the range 8.4 - 150 Hz		
	• Tested according to EN 60068-2-27 shock, test Ea: acceleration 150 m/s², test duration 11 ms		
Damaging gases	Tested according to: • EN 60068-2-42 sulfur dioxide • EN 60068-2-43 hydrogen sulfide		
Atmospheric pressure	Operation: • 1080 - 795 hPa (-1000 - 2000 m) • For operation at altitudes of 2000 - 6000 m above sea level: output must be derated by -7.5% / 1000 m or the ambient temperature must be reduced by 5 K / 1000 m (see Figure 4-4 Mounting height derating (Page 36)) Storage: • 1080 - 660 hPa (-1000 - 3500 m)		

Environment

9

The devices are in conformance with RoHS.

As a rule, only non-silicon precipitating materials are used.

Disposal guidelines



Packaging and packaging aids can and should always be recycled. The product itself may not be disposed of as domestic refuse.

Service & Support

10

Technical support

Technical support for all IA/DT products can be accessed through the following communication channels:

- Telephone: + 49 (0) 911 895 7222
- Internet:
  Web form for support request (http://www.siemens.de/automation/support-request)

Technical documentation on the Internet

Operating instructions and manuals for SITOP are available in the Internet:
Operating instructions/manuals (http://www.siemens.com/sitop/manuals)

SITOP power supply homepage

General news about our power supplies is available in the Internet at the SITOP home page:
SITOP (http://www.siemens.com/sitop)

Information material

SITOP information can be downloaded from the Internet:
Information and download center (http://www.siemens.com/sitop-infomaterial)

CAx data

2D/3D data and circuit diagram macros can be downloaded from the Internet:
Siemens image database (http://www.siemens.com/sitop-cax)

Request all CAx data via the CAx download manager:
CAx shopping cart (http://www.siemens.com/cax)

SITOP Selection Tool

Simply and quickly select the optimum the power supply or DC-UPS:
SITOP Selection Tool (http://www.siemens.com/sitop-selection-tool)

Online catalog and ordering system

The online catalog and the online ordering system are available through the Industry Mall homepage:
Industry Mall (http://www.siemens.com/industrymall/de)

Contact persons

If you have any questions regarding the use of our products, then contact the Siemens contact person in your regional Siemens sales office.

You can find these addresses as follows:

- On the Internet (http://www.automation.siemens.com/partner)
- Industry Mall (http://www.siemens.com/industrymall/de)

SIEMENS

DE/EN

EG-Konformitätserklärung
EC Declaration of Conformity

Nr. Select-A1-3

Hersteller: *Manufacturer:*	Siemens Aktiengesellschaft Österreich Siemens Industrial Manufacturing, Engineering and Applications (SIMEA)
Anschrift: *Address:*	Siemensstraße 90 1210 Wien, Österreich
Produkt-bezeichnung: *Productdescription*	SITOP Stromversorgung / power supply PSE200U 6EP1961-2BA10, 6EP1961-2BA11, 6EP1961-2BA31, 6EP1961-2BA51 6EP1961-2BA20, 6EP1961-2BA21, 6EP1961-2BA41, 6EP1961-2BA61

Das bezeichnete Produkt stimmt in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender Europäischer Richtlinien überein:
The product described above in the form as delivered is in conformity with the provisions of the following European Directives:

2014/30/EU Richtlinie des europäischen Parlaments und des Rates zur Harmonisierung der Rechtsvorschriften der Mitgliedsstaaten über die Elektromagnetische Verträglichkeit.
Directive of the European Parliament and of the council on the harmonisation of the laws of the Member States relating to electromagnetic compatibility

2011/65/EU RICHTLINIE DES EUROPÄISCHEN PARLAMENTS UND DES RATES vom 8. Juni 2011 zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro – und Elektronikgeräten
DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

Die Konformität mit den Richtlinien wird nachgewiesen durch die Einhaltung folgender Normen:
Conformity to the Directives is assured through the application of the following standards:

Referenznummer Reference number	Ausgabedatum Date of issue
EN 61000-6-2	2005
EN 61000-6-3	2007+A1:2011

Anhang/Annex Ex
Anhang/Annex multilingual

Wien / *Vienna*, den / *the* 20.07.2017

Siemens AG Österreich

Fr. Gamsjäger SIMEA	Hr. Kogard SIMEA PD-PA PLM2
i. V.	i. V. H. Kogard
Name, Funktion *Name, function*	Unterschrift *Signature*
Name, Funktion *Name, function*	Unterschrift *Signature*

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Beschaffenheits- oder Haltbarkeitsgarantie. Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.
This declaration certifies the conformity to the specified directives but contains no assurance of properties. The safety documentation accompanying the product shall be considered in detail.

SIEMENS

Anhang EX zur EG-Konformitätserklärung
Annex EX to the EC - Declaration of Conformity

Nr. Select-A1-3

Produktbezeichnung: SITOP Stromversorgung / power supply PSE200U
6EP1961-2BA10, 6EP1961-2BA11, 6EP1961-2BA31, 6EP1961-2BA51
6EP1961-2BA20, 6EP1961-2BA21, 6EP1961-2BA41, 6EP1961-2BA61

Die Übereinstimmung des bezeichneten Produkts mit den Vorschriften der Richtlinie 2014/34/EU wird nachgewiesen durch die vollständige Einhaltung folgender Normen:
The conformity of the designated product with the provisions of Directive 2014/34/EU is proved by full compliance with the following standards:

Harmonisierte Europäische Normen:
Harmonised European standards:

Referenznummer Reference number	Ausgabedatum Date of issue	Referenznummer Reference number	Ausgabedatum Date of issue
EN 60079 - 15	2010.....	.....	.....
EN 60079 - 0	2012 + A11:2013	.....	.....

Name der zertifizierten Prüfstelle:
Bureau Veritas Consumer Product Services Germany GmbH
Business Park A96
D-86842 Türkheim
Germany

Zertifikat Nr: EPS 09 ATEX 1 169 X

Besondere Bedingungen / special conditions:

1) Die Stromversorgung ist in einem geeigneten Übergehäuse mit einem Schutzgrad von min. IP54 zu installieren, welches die Umgebungsbedingungen unter denen das Produkt betrieben wird, berücksichtigt.
The power supply types shall be installed in a suitable enclosure with a degree of protection of min. IP 54 taking into account, the environmental conditions under which the equipment will be used.

2) An den Ausgangsstromkreis dürfen nur Geräte angeschlossen werden, welche für den Betrieb in explosionsgefährdeten Bereichen der Zone 2 und die am Einsatzort vorliegenden Bedingungen geeignet sind.
Devices connected to the output shall be suitable for utilization in potentially explosive atmospheres of zone 2 as well as for the conditions at the field installation.

3) Vor Öffnen des umgebenden Schaltschrankes muss die Versorgungsspannung des Gerätes unterbrochen sein.
Before opening the enclosure the supply voltage of the device has to be disconnecte

4) Die zulässige Umgebungstemperatur beträgt -25° bis +60°C (70°C mit Derating).
The max. ambient range is: -25°...+60°C (70°C with derating)

EU-Konformitätserklärung Nr. 2320296.CE.04
EU-Declaration of Conformity No.

Hersteller / *Manufacturer*: **PHOENIX CONTACT GMBH & CO. KG**

Anschrift / *Address*: Flachsmarktstraße 8, D-32825 Blomberg, Germany

Produktbezeichnung / *Product description*: **UPS-BAT/VRLA/24DC/ 1.3AH**

(Artikelbezeichnung, / *Article description*, Artikel-Nr. / *Article no.*) **2320296**

Der obige Hersteller erklärt in alleiniger Verantwortung, dass das/die hier bezeichnete(n) Produkt(e) mit den wesentlichen Anforderungen der nachfolgend genannten Richtlinie(n) übereinstimmt / *The above manufacturer declares in sole responsibility, that the here specified product(s) is/are in line with the essential requirements of the following directive(s):*

2011/65/EU	**Beschränkung der Verwendung bestimmter gefährlicher Stoffe Restriction of the use of certain hazardous substances (RoHS)**
2014/30/EU	**EMV-Richtlinie (Elektromagnetische Verträglichkeit) Electromagnetic Compatibility Directive (EMC)**

Für die Beurteilung der Übereinstimmung wurden folgende einschlägige Normen herangezogen:
For evaluation of the conformity following relevant standards were consulted:

EN 61000-6-3:2007+A1:2011 EN 61000-6-2:2005 EN 50581:2012

Weitere Informationen (z. B. Dokumente, Prüfberichte, Einschränkungen, etc.) zur Konformitätsbewertung:
Additional information (for example documents, test reports, restrictions etc.,) of the conformity assessment:

Zertifikate einer benannten Stelle / *Certificates by a notified body*:

Anschrift / *Address*:

Referenz / *Reference*:

Anschrift / *Address*:

Referenz / *Reference*:

Die letzten beiden Ziffern des Jahres in dem die CE-Kennzeichnung angebracht wurde:
The last two figures of the year in which the CE marking was applied:
(nur einzutragen, bei der Niederspannungsrichtlinie / *only to be entered on the low voltage directive*)

☒ Diese Erklärung gilt auch für die im Anhang aufgelisteten Produkte. (wenn angekreuzt)
This declaration also applies for the products listed in the annex. (if marked with a cross)

Diese Erklärung bescheinigt die Übereinstimmung mit den wesentlichen Anforderungen der genannten Richtlinie(n), enthält jedoch keine Zusicherung von Eigenschaften. Die Sicherheits- und Einbauhinweise der mitgelieferten Produktdokumentation sind zu beachten.
This declaration certifies the conformity with the essential requirements of the indicated directive(s), it does not, however, covenant any characteristics. The instructions for safety and installation of the enclosed product documentation have to be observed.

Blomberg, 2018-01-08

i. A. Werner Meyer
Werner Meyer
Business Unit Power Supplies
Manager Quality Engineering & Testing
Ansprechpartner / *contact person*

i. A. Hartmut Henkel
Hartmut Henkel
Business Unit Power Supplies
Head of Marketing & Sales
Zeichnungsberechtigter / *authorized signatory*

PHOENIX CONTACT

Anhang zur EU-Konformitätserklärung Nr. 2320296.CE.04
Annex on EU Declaration of Conformity No.
vom / dated 2018-01-08

Produktbezeichnung / *Product description*: **UPS-BAT/VRLA/24DC/ 1.3AH**

(Artikelbezeichnung, / *Article description*,
Artikel-Nr. / *Article no.*) **2320296**

Die Konformität mit den wesentlichen Anforderungen der Richtlinie(n) wird auch für folgende Produkte bescheinigt:
The conformity with the essential requirements of the directive(s) is also certified by the declaration for following products.

Artikel-Nr. / *Article no.*	Artikelbezeichnung / *Article description*
2320306	UPS-BAT/VRLA/24DC/ 3.4AH
2320319	UPS-BAT/VRLA/24DC/ 7.2AH
2320322	UPS-BAT/VRLA/24DC/12AH
2320335	UPS-BAT/VRLA/24DC/38AH

PHOENIX CONTACT GmbH & Co. KG
Flachsmarktstraße 8
32825 Blomberg, Germany
Telefon: +49 5235 300
Telefax: +49 5235 3-41200
Internet: http://www.phoenixcontact.com
USt-Id-Nr.: DE124613250
WEEE-Reg.-Nr.: DE50738265

CCC-Exempt Declaration

As we know, CCC certification is mandatory in China for defined products, and CNCA is the responsible committee for the definition of CCC application range. So please visit the website below for the latest bulletin (No. 45 of year 2014) of CNCA for CCC:

http://www.cnca.gov.cn/xxgk/ggxx/2014/201512/t20151230_44252.shtml

Energy storage devices

Description of product, product group or product family

Product list:
See list on next page(s).

Description of product function:

Energy storage device based on batteries or double layer capacitors for 12Vdc or 24Vdc.

Reason why CCC certification is not required:

For electrical and electronic products, CCC categories only apply to products that can be directly or indirectly connected to power supply over 36V (dc or ac RMS) except for telecommunication terminals, electric welding machines.

Date of creation: 18.07.2018

PHOENIX CONTACT GmbH & Co. KG
Flachsmarktstr. 8
D-32825 Blomberg

Seal

Michael Heinemann
Executive Vice President, Business Unit Power Supplies

Product list:

Part-No.	Product-Description
2320296	UPS-BAT/VRLA/24DC/1.3AH
2320306	UPS-BAT/VRLA/24DC/3.4AH
2320319	UPS-BAT/VRLA/24DC/7.2AH
2320322	UPS-BAT/VRLA/24DC/12AH
2320335	UPS-BAT/VRLA/24DC/38AH
2320351	UPS-BAT/LI-ION/24DC/120WH
2320364	STEP-BAT/LIPO/18.5DC/1.4AH
2320377	UPS-CAP/24DC/10A/10KJ
2320380	UPS-CAP/24DC/20A/20KJ
2320393	QUINT-BUFFER/24DC/24DC/40
2320416	UPS-BAT/VRLA-WTR/24DC/13AH
2320429	UPS-BAT/VRLA-WTR/24DC/26AH
2320539	QUINT4-CAP/24DC/5/4KJ
2320571	QUINT4-CAP/24DC/10/8KJ
2866213	QUINT-BUFFER/24DC/20
2866349	QUINT-BAT/24DC/ 3.4AH
2866352	QUINT-BAT/24DC/ 7.2AH
2866365	QUINT-BAT/24DC/12AH
2866417	MINI-BAT/24DC/1.3AH
2866569	MINI-BAT/12DC/2.6AH
2866572	MINI-BAT/12DC/1.6AH
2866666	MINI-BAT/24DC/0.8AH
2868936	QUINT-BAT/24DC/ 7.2AH/SO1
2868949	QUINT-BAT/24DC/12AH/SO1
2907913	QUINT4-BUFFER/24DC/20
2908232	UPS-BAT/LI-ION/24DC/924WH
2908233	UPS-BAT-KIT-VRLA 2X12V/3,4AH
2908234	UPS-BAT-KIT-VRLA 2X12V/7,2AH
2908235	UPS-BAT-KIT-VRLA 2X12V/12AH
2908237	UPS-BAT-KIT-VRLA 2X12V/38AH
2908283	QUINT4-BUFFER/24DC/40
2908368	UPS-BAT-KIT-WTR 2X12V/13AH
2908665	UPS-BAT-KIT-VRLA 2X12V/1,3AH
2909830	UPS-BAT/CTRL/24DC/05AH/120WH

Declaration of compliance with China RoHS – Devices

Energy storage - UPS-BAT/VRLA/24DC/12AH - 2320322

Energy storage device, lead AGM, VRLA technology, 24 V DC, 12 Ah, tool-free battery replacement, automatic detection, and communication with QUINT UPS-IQ

We herewith declare the compliance of this product with the Chinese marking requirements set forth in the “Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products” (Order No. 32 of the MITT, etc.) and SJ/T 11364-2014 marking for the restriction of the use of hazardous substances in electrical and electronic product.

This product can be recycled and used safely during its environmentally friendly use period.



The Environmentally Friendly Use Period (EFUP) for the product is 3 years, unless otherwise marked. The Environmentally Friendly Use Period is valid only when the product is operated under the conditions defined in the product documentation.

This product should be recycled after its environmental protection use period has expired because it may contain substances or elements as shown in the following table:

	Hazardous Substance					
Part Name	**Lead (Pb)**	**Mercury (Hg)**	**Cadmium (Cd)**	**Hexavalent Chromium (Cr(VI))**	**Polybrominated biphenyls (PBB)**	**Polybrominated diphenyl ethers (PBDE)**
Battery	O	O	O	O	O	O
PCB (printed circuit board)[1]	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572

The table shows where these substances may be found in this Electrical and Electronic Product.

[1]) Printed circuit board includes a printed circuit board and its components.

Declaration of compliance with China RoHS – Devices

The information on substances corresponds to our present knowledge as well as the status of legislation mentioned in this declaration on the date of issue. In this respect we specifically take the statements and indications of our suppliers and service providers as a basis.

Issued at 2018-02-09 by:

Phoenix Contact GmbH & Co. KG
Flachsmarktstr. 8
32825 Blomberg
Germany

Phone: +49 52 35/3-00
Fax: +49 52 35/3-4 12 00

www.phoenixcontact.net/product/2320322
Download this document

Should you have any further questions please contact: DE-product_compliance@phoenixcontact.com

© All rights reserved.

Power Supplies



User Manual

UPS-CONF

Order No.: -

Configuration and Management Software
UPS-CONF

Power Supplies

User Manual

Configuration and Management Software UPS-CONF

2012-07-02

Designation: UPS-CONF

Revision: 01

Order No.: -

This manual is valid for:

Designation	Order No.
UPS-CONF	2320403

Please observe the following notes

In order to ensure the safe use of the product described, you have to read and understand this manual. The following notes provide information on how to use this manual.



The pictured products do always exemplify the concerned topic.

Target audience for this documentation

The use of products described here solely addresses persons, who are qualified and familiar with electrical equipment and the appropriate and relevant safety concepts. Please also read the section titled "Qualified personnel" in the topic titled "Important safety notes (see page 10)".
Phoenix Contact accepts no liability for erroneous handling or damage to products from Phoenix Contact or third-party products resulting from disregard of information contained in this documentation.

Explanation of symbols used and signal words



DANGER
The danger symbol is used to indicate instructions where non-compliance may result in damage to hardware/software or personal injury (in indirect connection with dangerous process peripherals).



NOTE
The note symbol precedes notes that must be strictly observed in order to ensure error-free operation. It also gives you tips and advice on the efficient use of hardware and on software optimization to save you extra work.



The "Additional Details" symbol indicates cross references (hypertext links or bibliographical references) which lead to detailed descriptions of a term or additional details on the context in question.

General terms and conditions of use for technical documentation

Phoenix Contact reserves the right to alter, correct, and/or improve the technical documentation and the products described in the technical documentation at any time and without giving prior notice, insofar as this is reasonable for the user. The same applies to any technical changes that serve the purpose of technical progress. Technical documentation does not contain any guarantees regarding quality, does not describe any fair marketable quality, and does not make any claims in terms of quality guarantees or guarantees regarding suitability for a specific purpose.

The receipt of technical documentation (data sheets, installation instructions, manuals, online help, etc.) does not constitute any further duty on the part of Phoenix Contact to furnish information on alterations to products and/or technical documentation. Any other agreement shall only apply if expressly confirmed in writing by Phoenix Contact.

Please note that the supplied documentation is intended to serve as product-specific documentation only and that you are responsible for checking the suitability and intended use of the products in your specific application, in particular with regard to observing the applicable standards and directives. Although Phoenix Contact makes every effort to ensure that the information and content is accurate, up-to-date, and refers to the state of the art, technical inaccuracies and/or printing errors in the information cannot be ruled out. Phoenix Contact does not offer any guarantees as to the reliability, accuracy or completeness of the information. All information made available in the technical documentation is supplied without any accompanying guarantee, whether expressly mentioned, implied or tacitly assumed.

Phoenix Contact accepts no liability or responsibility for errors or omissions in the content of the technical documentation (data sheets, installation instructions, manuals, online help, etc.).

The aforementioned limitations of liability and exemptions from liability do not apply insofar as liability must be assumed, e.g., in accordance with product liability law, in cases of premeditation, gross negligence, on account of loss of life, physical injury or damage to health, or on account of the violation of important contractual obligations. Claims for damages for the violation of important contractual obligations are, however, limited to contract-typical, predictable damages, provided there is no premeditation or gross negligence, or unless liability is assumed on account of loss of life, physical injury, or damage to health. This ruling does not imply a change in the burden of proof to the detriment of the user.

Statement of legal authority

This documentation, including all illustrations contained herein, is copyright protected. This documentation is to be used for its intended purpose only. All other means of usage are prohibited. Reproduction, translation, and public disclosure, as well as electronic and photographic archiving and modification, require written consent by Phoenix Contact. Violators are liable for damages.

Phoenix Contact reserves all rights in the case of patent award or listing of a registered design. Third-party products are always named without reference to patent rights. The existence of such rights shall not be excluded.

How to contact us

Internet

Up-to-date information on Phoenix Contact products and our Terms and Conditions can be found on the Internet at:
www.phoenixcontact.com
Make sure you always use the latest documentation.
It can be downloaded at:
www.phoenixcontact.net/catalog

Subsidiaries

If there are any problems that cannot be solved using the documentation, please contact your Phoenix Contact subsidiary. Subsidiary contact information is available at:

www.phoenixcontact.com

Table of Contents

1 Functional overview 1

2 Software setup 3

2.1 System requirements 4

2.2 Installation 5

2.3 Software settings 5

3 Hardware overview 7

3.1 Important safety notes 10

4 Hardware setup 11

4.1 Buffer time selection 12

4.2 Data port 13

4.3 Connecting the PC 14

5 Software overview 15

5.1 User interface 15

5.2 Status bar 17

6 Status - Reported information 20

6.1 System 20

6.2 Battery 25

6.3 Battery Advanced 26

6.4 UPS 27

6.5 UPS Advanced 28

7 Settings - Defining UPS device parameters 29

7.1 Reporting 31

7.2 Time Setting 36

7.3 Service 39

7.4 Advanced 41

8 Monitoring - Statistics and logging 44

9 Stick usage 45

9.1 Configuration stick usage 46

9.2 Service stick usage - service mode 47

10 Application samples 52

10.1 Functional test 52
10.2 PC-Mode: PC shutdown and restart 52

11 Troubleshooting 53
11.1 Unexpected status symbols 54
11.2 Communication port 56

Index 57

1 Functional overview

UPS-CONF is a management software to configure and monitor QUINT-UPS devices, that come with the IQ technology.

This technology with continuous battery monitoring and intelligent management provides you with information about the charging state, remaining runtime, and service life of your battery at all times. Intelligent communication informs you when a situation becomes critical. This reduces the amount of maintenance involved and increases your system availability.

IQ technology means

- Intelligent Battery Control: automatically detects the connected battery type and maximizes the remaining service life of the battery unit via an optimally adapted charging characteristic.
- Intelligent Battery Management: continuous status information is shown for
  - SOC (State of Charge): current charging state and remaining back-up time of the battery unit
  - SOH (State of Health): remaining life expectancy of the battery unit, provides early warning for a potential battery unit failure
  - SOF (State of Function): determines the current performance of the battery unit.
- Intelligent Charging: adapts the charging current and thereby ensures the fastest possible recharging and availability.
- Intelligent communication: the communication of UPS and PC allows configuration, extensive signaling and parameterization.



The IQ technology also works without UPS-CONF. With this software you have an easier monitoring and configurations can be done.



The UPS-CONF software is intended for a PC as well as an IPC (Industrial PC). In this documentation the term "PC" is used to address both.



The configurable QUINT-UPS device is also referred to as the "UPS" in this documentation.

Features supported by the UPS-CONF software

In order to optimally support the IQ technology, UPS-CONF provides the following features:

- Clear overview about condition of mains, battery, UPS device and connection from PC to UPS
- Automatic PC shutdown and restart functionality while the UPS runs in PC-Mode
- Start of application specific programs for system shutdown
- Configuration of switching outputs
- Chronological event logging
- Setting of customized parameters like the maximum charging current
- Choice of user interface language in the Software settings (see page 5).
  Currently supported languages: English, German



The topic titled Application samples (see page 52) guides through some typical scenarios.

2 Software setup

The UPS-CONF software has to be installed on a PC in order to configure and monitor an UPS system. If the buffered load is a PC, the UPS can be operated in the PC-Mode to additionally enable the automatic PC shutdown and restart functionality.

To setup the software, the following steps have to be executed:

1. Make sure all system requirements (see page 4) for the hardware and software are met.
2. Download and install the software (see page 5).
3. Follow the steps in the hardware setup (see page 11).
4. Start the software (see page 15).
5. Become familiar with the software settings (see page 5) supported by the UPS-CONF software and carry out the required settings.

2.1 System requirements

In order to run the UPS-CONF software, your computer must meet the following software and hardware requirements:

Software requirements

- Supported operating systems:
  - Windows 7, 32bit and 64bit
  - Windows Vista SP1
  - XP SP3 (requires .NET Framework 3.5 SP1)
- Supported browser: Internet Explorer version 6 or later

Hardware requirements		
CPU	1 GHz min. 2 GHz recommended	Windows 7 Windows Vista SP1
	Pentium III 1GHz min. 2 GHz recommended	Windows XP SP3
Main memory	1 GB RAM min. 2 GB RAM recommended	Windows 7 Windows Vista SP1
	512 MB RAM min. 1 GB RAM recommended	Windows XP SP3
Main memory used by UPS-CONF	max. 96 MB	
Hard disk drive (recommended) Hard disk used by UPS-CONF	850 MB max. 50 MB	
CD-ROM drive	not necessarily needed	
Interfaces	1 x USB 2.0	
Monitor	VGA, resolution 800 x 600 pixels minimum, 256 colors	
Network	Internet connection needed for program download	

2.2 Installation



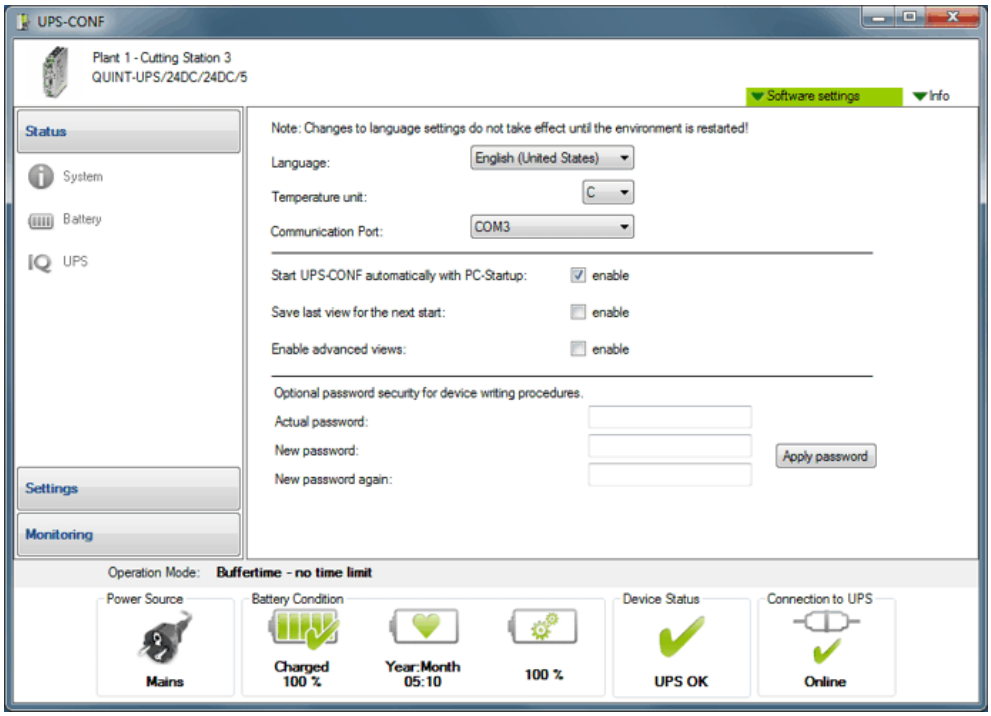
The UPS-CONF configuration and management software can be downloaded free of charge at www.phoenixcontact.net/catalog.

To install the software, proceed as follows:

1. Find UPS-CONF at www.phoenixcontact.net/catalog.
2. Save the UPS-CONF_Setup_v....exe file to the preferred download folder.
3. Make sure the IFS-USB-DATACABLE is unplugged.
4. Install UPS-CONF from the selected download folder. Simply follow the screen instructions.
   Read the EULA (End User License Agreement) carefully when it is displayed and agree it to continue the installation.
5. After having completed the UPS-CONF installation, connect the UPS device to the PC (see page 14). If required, select PC-Mode as operating mode (see page 12).
6. As soon as Windows detects the new USB hardware follow the instructions of the driver installation.

2.3 Software settings

The software settings can be shown by clicking the "Software settings" item in the system menu.



The following settings can be defined:

- Language of the user interface (English, German)

NOTE
To apply the changed language setting, you have to restart the UPS-CONF software.

- Temperature unit (Celsius, Kelvin, Fahrenheit)
- Communication (USB) port at the PC for the IFS-USB-DATACABLE (COMx)

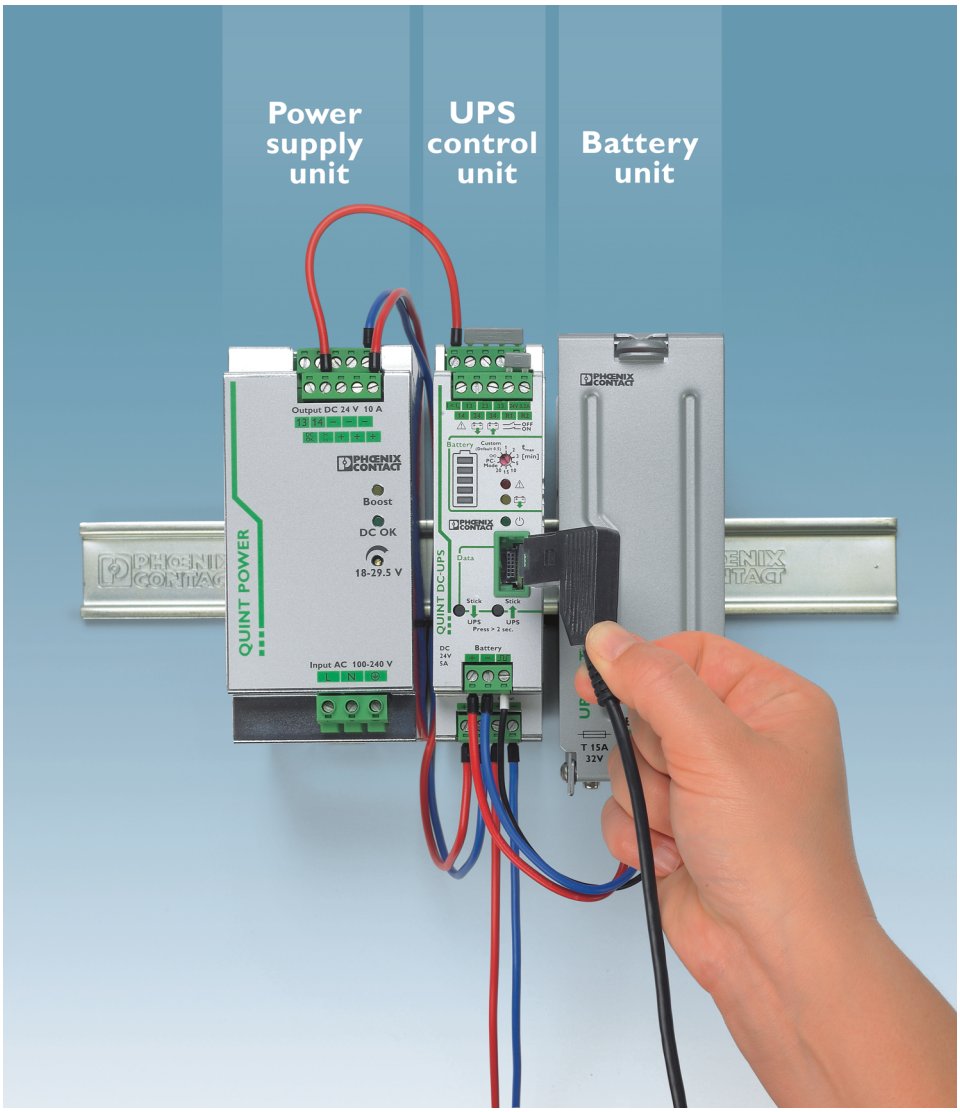
Normally, the communication port is set automatically by the UPS-CONF software when connecting the UPS devices. Under normal conditions there is no need to change this setting. If it has not been set automatically during the software installation, refer to the section Communication port (see page 56) in the Troubleshooting topic.

- Enable/disable automatic UPS-CONF startup after PC startup. This option must be checked if the UPS device shall buffer this PC.
- Restore the last view after the next software start.
- Hide or show the advanced views ("Battery Advanced" and "UPS Advanced" in the "Status" group and "Advanced" in the "Settings" group).
- An optional password, when parameters are written to the UPS device.

3 Hardware overview

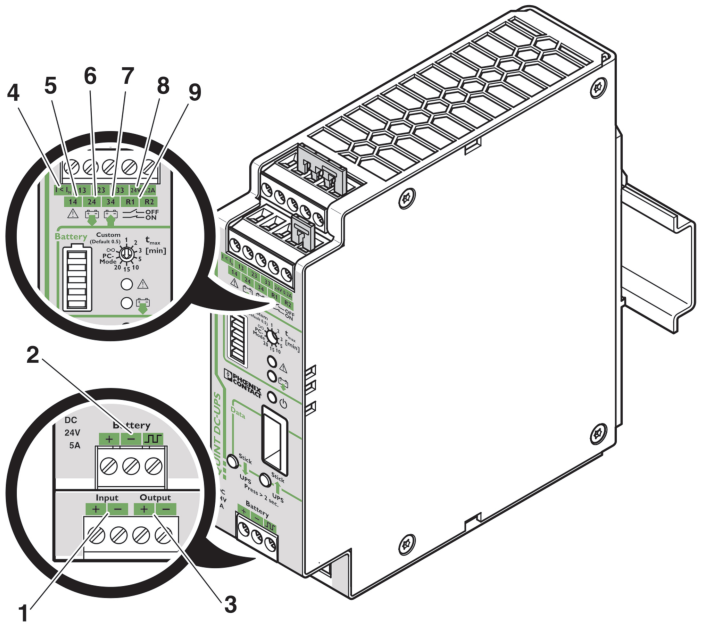
Choose your customized solution - for your application.

1. Choose your power supply.
2. Choose your UPS unit.
3. Choose your energy storage.

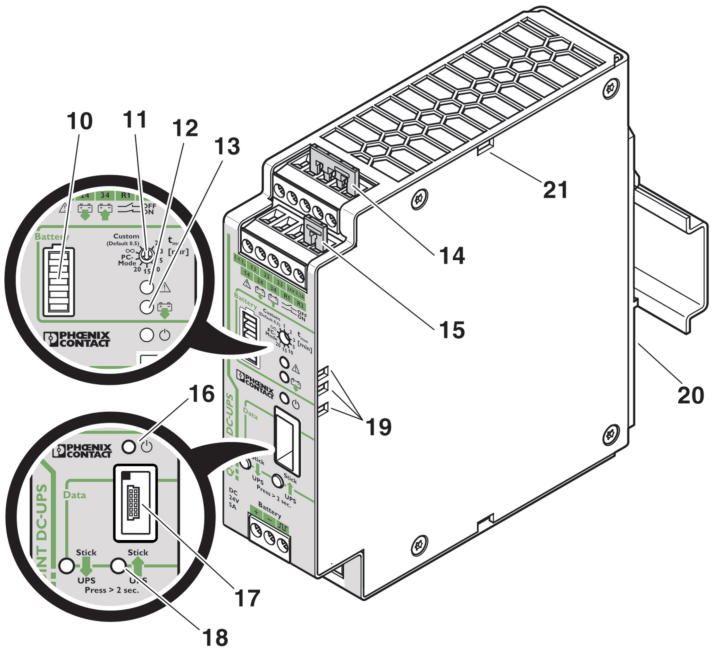


All Products are available in the e-shop: www.phoenixcontact.net/catalog

In the next two graphics and their corresponding lists you can see the location of the main parts of the QUINT DC-UPS.



No.	Connections / Operating elements
1	DC input 18 V DC ... 30V DC
2	Power storage device connection, 24V DC (+,-, communication between UPS and power storage device)
3	DC output, 24 V DC, buffered
4	$I < I_N$, fast battery charging
5	Floating relay contact 13/14: alarm (Related parameter settings are provided in the "Reporting" view (see page 31).)
6	Floating relay contact 23/24: battery mode (Related parameter settings are provided in the "Reporting" view (see page 31).)
7	Floating relay contact 33/34 : battery charge (Related parameter settings are provided in the "Reporting" view (see page 31).)
8	24 V DC supply voltage, maximum current limit 0.2 A for the signal contacts 13, 23, 33
9	Remote control (R1, R2). (Related UPS parameter "Remote Status" (see page 27).)



No.	Connections / Operating elements
10	Bar graph for displaying the current charging state of the power storage device
11	Buffer time setting: unlimited ∞, 1 ... 20 mins., customized (customized default: 0.5), PC mode (refer to topic Buffer time selection (see page 12)).
12	Red LED: alarm (Corresponding indicators are displayed in the software's "Status" view (see page 20).)
13	Yellow LED: battery mode (Corresponding indicators are displayed in the software's "Status" view (see page 20).)
14	Plug-in bridge for signal contact supply voltages, pre-installed
15	Remote control plug-in bridge, pre-installed
16	Green LED: Power In OK, mains mode (Corresponding indicators are displayed in the software's "Status" view (see page 20).)
17	Data port (see page 13) for data linking to the PC or the use of a memory block
18	Button for use of the memory block
19	LED windows for flat mounting position
20	Universal snap-on foot for DIN rails
21	Accommodation for cable binders

3.1 Important safety notes



Please observe all the safety notes outlined in this topic when using UPS-CONF together with the QUINT-UPS device.

Requirements

Knowledge of the following is required:

- QUINT-UPS system
- UPS-CONF configuration software
- Safety regulations in the field of application

Qualified personnel

In the context of using the QUINT-UPS system and the UPS-CONF configuration software described in this documentation, the following operations may only be carried out by qualified personnel:

- Planning, configuration
- Installation, startup, servicing
- Maintenance, decommissioning

This documentation is therefore aimed at:

Qualified personnel who plan and design electrical equipment for machines and systems and are familiar with regulations governing safety in the workplace and accident prevention.

Within the context of the safety notes in this documentation, qualified personnel are persons who, because of their education, experience and instruction, and their knowledge of relevant standards, regulations, accident prevention regulations, and service conditions, have been authorized to carry out any required operations, and who are able to recognize and avoid any possible dangers.

4 Hardware setup

NOTE
Before setting up the hardware, install the software (see page 5).

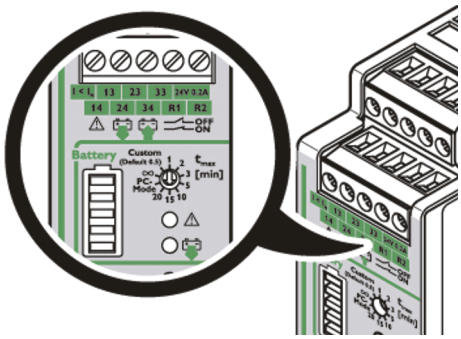
Regarding the communication with the PC and the UPS operation mode, it needs only three steps to setup the hardware:

1. Set the buffer time at the buffer time potentiometer, as described in the topic Buffer time selection. (see page 12)
2. Connect the Data port either with a PC or plug in a configuration stick, as described in the topic Data port (see page 13).
3. Connect the load to be supplied by the UPS (see technical datasheet for each QUINT-UPS).

NOTE
For further information about the hardware installation (connecting the battery module, etc.) please refer to the QUINT DC-UPS technical datasheet.

4.1 Buffer time selection

The buffer time potentiometer at the front of the QUINT-UPS has to be switched to the desired mode with a screwdriver.



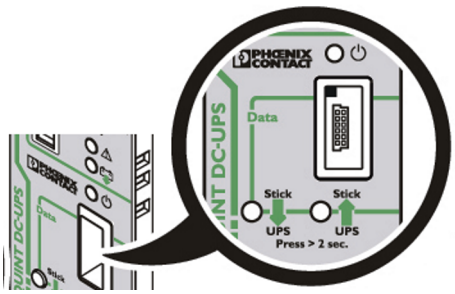
The following settings are available:

Operating mode	Description
Custom (default 0.5)	Buffer time can be set to a user-defined value; if no value is set 0.5 minutes is used, as described in the topic Custom Mode (see page 37).
1, 2, 3, 5, 10, 15, 20	Buffer time 1, 2, 3, 5, 10, 15, 20 minute(s).
PC-Mode	This mode is intended to buffer a PC and to initiate a controlled shut-down in battery mode. The buffer time depends on the "Shutdown Delay" time and on the "PC-Shutdown" time, as described in the PC-Mode (see page 38).
∞	No time limit, buffering is continued until the battery is empty (deep discharge security).

The current set buffer time is shown as "Operation mode" in the status bar (see page 17).

4.2 Data port

The Data port is located at the front of the UPS. Via this port, configuration and maintainance of the UPS is done.



The configuration can be done in 2 different ways, depending on what is connected to the Data port:

- Connect the PC (see page 14) with the installed UPS-CONF software, if you want to configure by software.
- Plug in a memory stick which is declared as configuration stick, if you want to configure by configuration stick (see page 46).

In order to perfom maintenance tasks (such as changing a battery), a service stick can be plugged into the Data port, so the UPS switches to service mode (see page 47).

4.3 Connecting the PC

A PC has to be connected to the UPS in one of the following cases:

- You want to configure or monitor the UPS by the UPS-CONF software.
- You want to display currently set QUINT-UPS parameters or modify them using UPS-CONF.
- You want to initiate a controlled PC shutdown in case of a mains failure and if battery runs low.

NOTE
First, install the software (see page 5) and then connect the PC afterwards.

To connect the PC to the QUINT-UPS, proceed as follows:

1. Connect the USB connector of the IFS-USB-DATACABLE to a free USB connector of your PC. After detecting the device, the used USB port is entered automatically in the software settings of UPS-CONF.



2. Connect the other side of the IFS-USB-DATACABLE to the Data port of the UPS:



5 Software overview

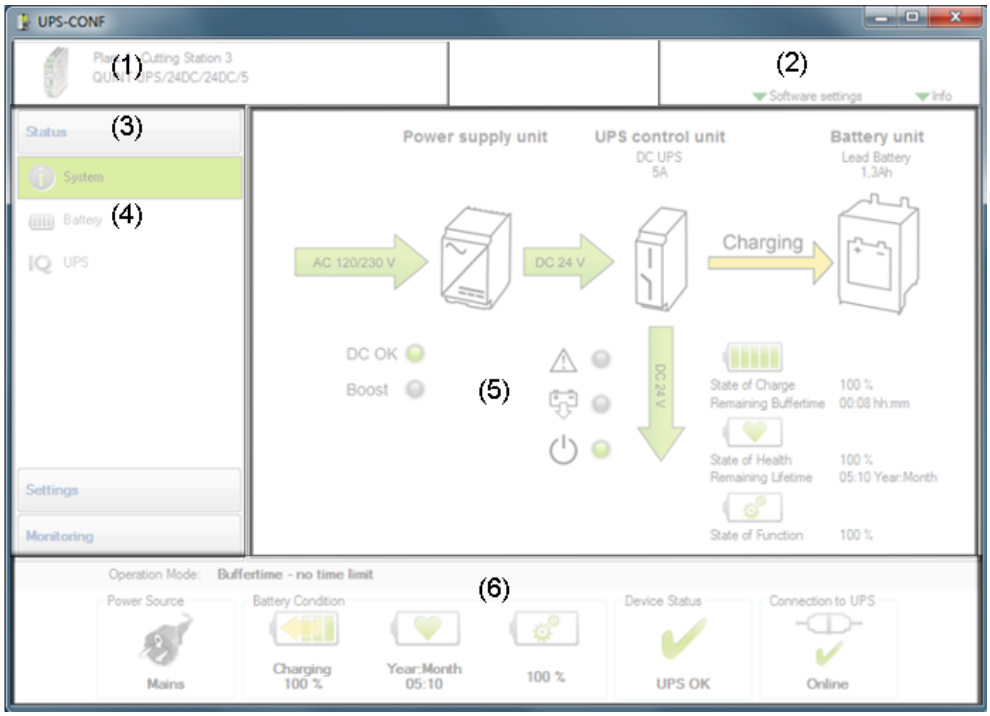
After installing the UPS-CONF software, the program starts up automatically.

As long as you do not change the related default software setting (see page 5), UPS-CONF always starts automatically after every PC reboot.

In the following sections you can get an overview about the screen areas of the UPS-CONF software and you can learn about the different status bar (see page 17) symbols and their meanings.

5.1 User interface

The screen layout consists of the following areas:



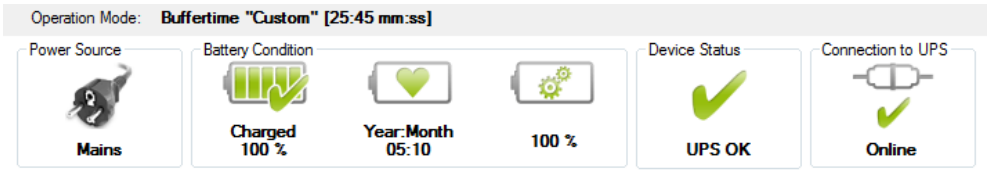
The following table explains the several areas.

Area	Description
(1)	Device information: Here, the type of the connected UPS is displayed. If text has been entered for the advanced UPS parameter "Place of installation" (see page 41), it is displayed above the UPS type.
(2)	System menu: Software settings (see page 5): A mouse click leads to the screen, where various software settings can be made. Info: A mouse click shows the contact information of Phoenix Contact.
(3)	Software menu: The Software menu provides various topic buttons such as status information display, parameter settings or monitoring values. A software menu button is expanded/collapsed by simply clicking it. When a software menu button is expanded the corresponding navigation items are listed.
(4)	Navigation items: After clicking a navigation item the corresponding information and parameters are displayed in the action area.
(5)	Action area: The content of the action area depends on the currently selected navigation item. This can be, for example, information, read from the device, or a parameterization table used for configuring the connected UPS.
(6)	Status bar (see page 17): Displays the status of all involved components thus providing a quick system overview. The status bar is always visible, also if the navigation and action area change.

5.2 Status bar

The status bar in the lower part of the screen shows information about the current system state.

When the power supply is available and the system is online and the battery is fully charged, the status bar looks like this:



The operation mode in the upper part of the status bar shows the current setting of the buffer time potentiometer of the UPS, as described in topic Buffer time selection (see page 12).

If it looks different, e.g. Power Source status "UPS off" or no connection to UPS ("Offline"), verify the following:

- All UPS components (QUINT-UPS, battery, power supply) are functional and properly connected.
- The QUINT-UPS is supplied with 24 V DC.
- The IFS-USB-DATACABLE is properly connected between QUINT-UPS and PC.

If an alarm is detected or an existing online connection between the PC and the QUINT-UPS is interrupted, the UPS-CONF software automatically becomes the active window. The status is queried every 5 seconds.

If your system status is like described, you can

- evaluate the UPS system status by displaying the various views contained in the software menu "Status" (see page 20) and/or
- start configuring the UPS by modifiying the default parameter settings in the various views of the software menu "Settings" (see page 29) and/or
- monitor your system.

In the topic Application samples (see page 52), some typical application scenarios are described.

The following tables explain the different status symbols that can be visible in the status bar:

Power Source	Symbol meaning
	The status "Mains" is shown, if the power supply is switched on and available.
	The status "Battery" is shown, if the power supply is switched off or not available. That means, the battery is discharging.
	The status "UPS off" is shown in either case: • The UPS is off, because battery mode is finished. The set buffer time has elapsed. • The power supply is available, but delivers an invalid output voltage.

Battery Condition	Symbol meaning
State of charge: 	Battery is "Fully charged".
State of charge: 	"Charging" is shown, if the battery is currently charging and not yet fully charged.
State of charge: 	The "Discharging" status is shown, if the battery is currently discharging because the system runs in battery mode. Usually, this status is shown in combination with the power source status "Battery".
State of charge: 	"Uncharged" is shown, if the battery mode is finished and the battery is empty.
State of health: 	The "State of Health" status shows the remaining lifetime of the battery. The lifetime value is shown below the symbol.

Battery Condition	Symbol meaning
State of function: 	The "State of Function" status shows the current performance of the battery. This efficiency value is measured in percent and is shown below the symbol.



During battery charging the battery conditions "State of Charge", "State of Health" and "State of Function" are shown as "unknown".

Device Status	Symbol meaning
	The "UPS OK" status is shown during normal UPS operation, i.e., when mains is available (battery mode not active) and no other event is currently upcoming.
	"Bat.-Mode deactivated" is shown, if the bridge is removed from the terminals R1 and R2. Refer to the parameter "Remote Status" in the topic UPS (see page 27).
	The "Alarm" status is shown, when a failure or critical situation exists, for example: • battery almost empty • battery not detected • battery replacement required

Connection to UPS	Symbol meaning
	This status informs about the communication connection between UPS-CONF and the QUINT-UPS device. The "Online" status is shown, if the IFS-USB-DATACABLE is connected. Normally, this status is automatically entered after connecting the UPS to the PC via the IFS-USB-DATACABLE.
	"Offline" means that no communication connection is established via the IFS-USB-DATACABLE.

6 Status - Reported information

If the "Status" group is selected, the following navigation items are available:

- "System (see page 20)": overview on the current system status
- "Battery (see page 25)": status information for all connected batteries
- "Battery Advanced (see page 26)": advanced status information for all connected batteries
- "UPS (see page 27)" : status information for the connected UPS
- "UPS Advanced (see page 28)": anvanced status information for the connected UPS

6.1 System

If the "System" item is selected in the software menu "Status", an overview on the current system status is visible in the action area. The values shown here are read cyclically from the UPS device, as long as a communication connection to the UPS is established.

The system components and their status information are arranged on the screen as "Power supply unit" on the left hand side, "UPS control unit" in the middle and "Battery unit" on the right hand side. The tables explain the symbols corresponding to the units.



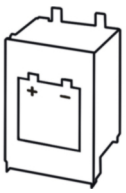
Power supply unit symbols:

Icon	Meaning of LEDs
DC OK	Green LED on: DC output is available. LED off: DC output is not available.
Boost	Yellow LED on: Boost signal is ON (power supply delivers additional current for a connected load). LED off: Boost signal is OFF.



UPS control unit symbols:

Icon	Meaning of LEDs
⚠	Red LED on: UPS alarm due to one of the reasons: • battery almost empty • battery not detected • battery replacement required LED off: No UPS alarm, power supply available, normal operation.
	Yellow LED on: Battery mode is ON, battery is discharging because power supply failed. LED off: Battery mode is OFF, i.e. mains available.
⏻	Green LED on: Mains is ON. LED off: Mains is OFF.

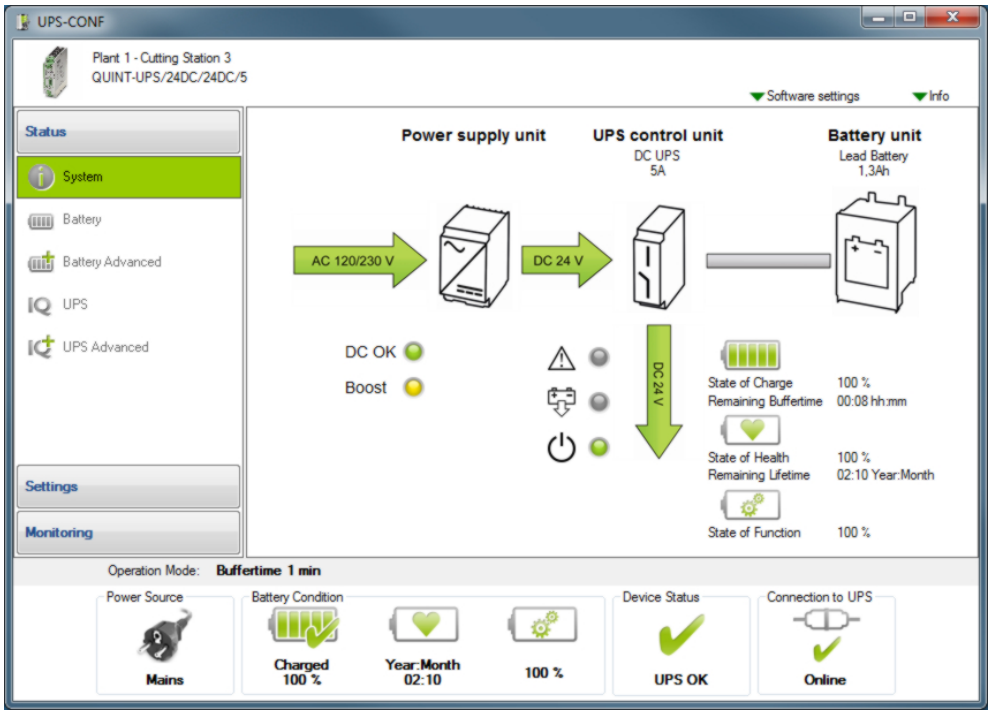


Battery unit symbols:

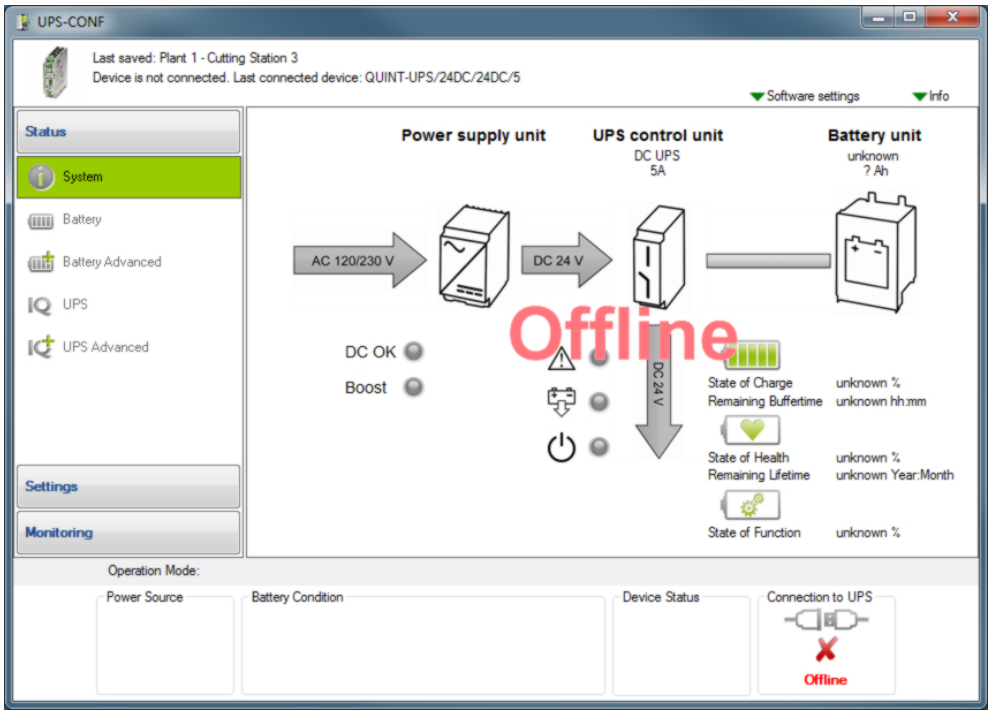
Icon	Meaning of LEDs
	SOC (State Of Charge) – current charging state and remaining back-up time of the battery unit.
	SOH (State Of Health) – remaining life expectancy of the battery unit, provides early warning for a potential battery unit failure.
	SOF (State Of Function) – determines the current performance of the battery unit.

NOTE
While charging the battery the status is "unknown".

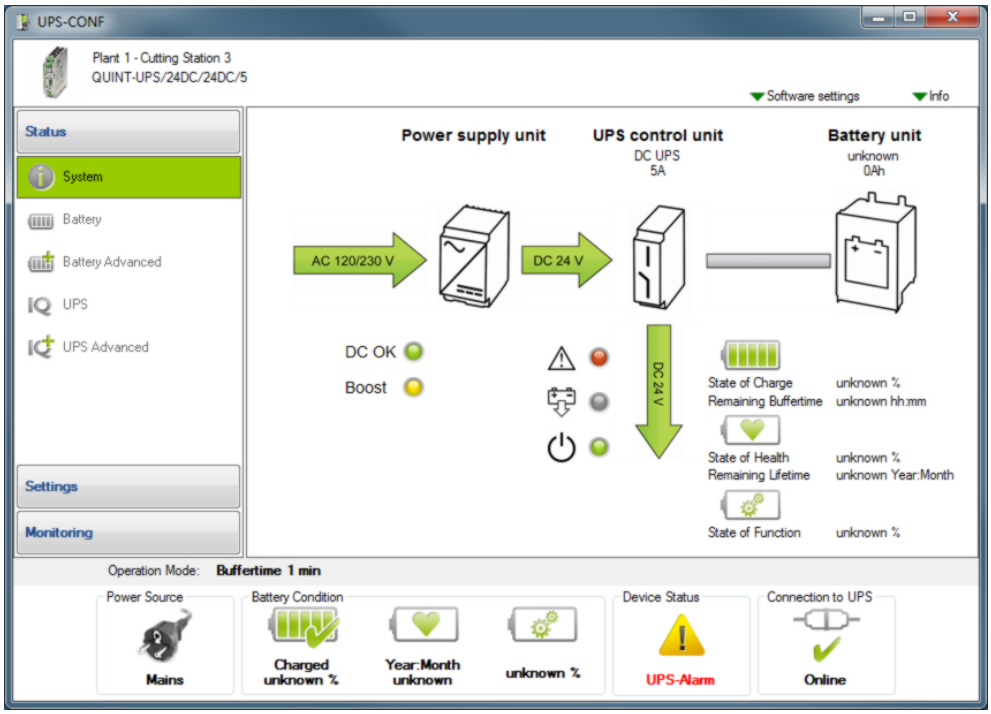
When the system is in normal operation (online and running), the screen looks like this:



When the UPS is offline and has no connection to the PC, the screen looks like this:



When the system status shows an alarm, the screen looks like this:



In such case refer to the topic Troubleshooting (see page 53).

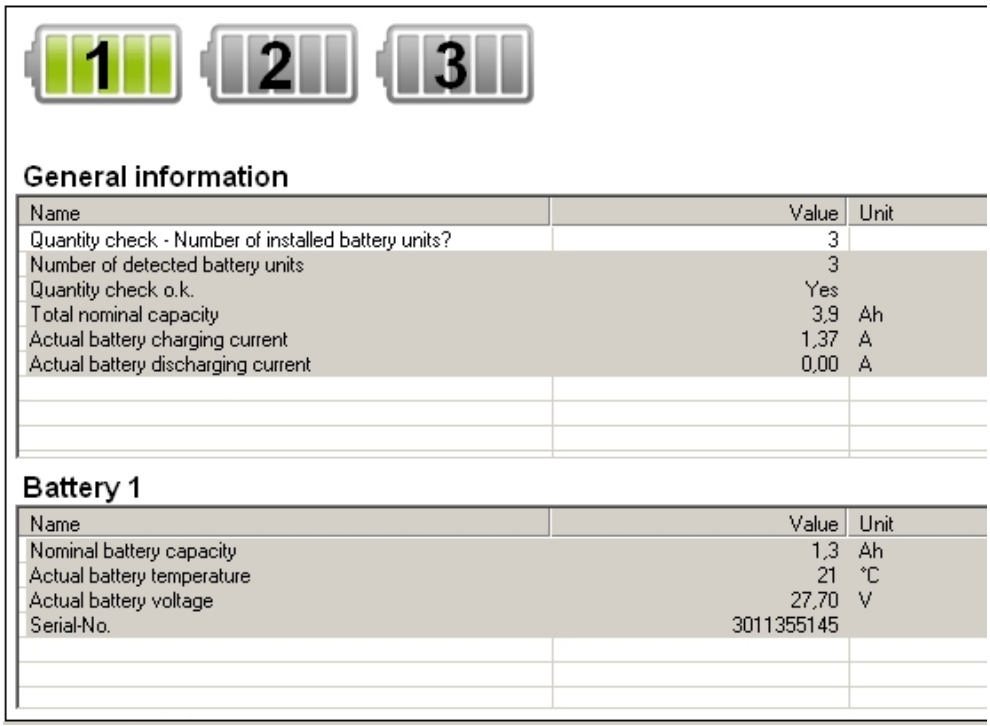
6.2 Battery

If the "Battery" item is selected in the software menu "Status", status information for all connected batteries is shown in the action area.

The information is headed by "General information" for all connected batteries, such as "Number of detected battery units" or "Total nominal capacity".

Individual information for every battery follows.
If several battery units are installed, the data of the individual units can be displayed by clicking on the battery icons on top of the action area:

The status information in the action area could for instance look similar like this:



Battery parameters	Meaning
Except of some parameters explained here, the status information is self-explanatory, this is why it is not explained in detail.	
Quantity check - Number of installed battery units?	This value can be set to the amount of batteries, that were built in.
Number of detected battery units	Number of batteries detected by the QUINT-UPS.

Battery parameters	Meaning
Quantity check o.k.	Shows "Yes", if the number of installed battery units complies with the number of detected batteries. Otherwise "No" is displayed.

6.3 Battery Advanced

This navigation item is only available if the "Enable advanced views" checkbox is marked in the software settings (see page 5).

If the "Battery Advanced" item is selected in the software menu "Status", advanced status information for all connected batteries is shown in the action area.

In normal operation it looks something like this:

Name	Value	Unit
Actual state of charge	100	%
Remaining backup time	00:08	hh:mm
Remaining battery life time	01:03	Year:Month
Actual battery performance	100	%
Actual battery voltage	27,57	V
Actual battery temperature (Average of all units)	26	°C

6.4 UPS

If the "UPS" item is selected in the software menu "Status", status information for the connected UPS is shown in the action area.

In normal operation it looks like this:



Name	Value	Unit
Actual Alarm	No Alarm	
Last Alarm	No Alarm	
Remote Status	UPS ready	
UPS in battery operation (Battery-Mode)	No	
Selected operation mode	Buffertime - no time limit	
Battery is charging (Battery-Charge)	No	

Parameter	Meaning
	Except of some parameters explained here, the status information is self-explanatory, this is why it is not explained in detail.
Remote Status	Remote control (contact R1, R2) The module can be switched on and off via a signal to contacts R1 / R2. Shutdown can take place in mains mode or while battery mode is active. Remote shutdown is deactivated UPS in function (delivery state) – The "R1" and "R2" terminal points are short circuited (delivery with plug-in bridge) OR 24 V DC is present at terminal point "R2". – In the event of a voltage supply failure, the UPS switches over to battery mode. Remote shutdown is activated – The "R1" and "R2" terminal points are not short circuited AND 0 V is present at terminal point "R2". – In the event of a voltage supply failure, the UPS does not switch over to battery mode and the device shuts down.
Selected operation mode	Shows the operation mode that is set via the buffer time potentiometer, as described in topic Buffer time selection (see page 12).

6.5 UPS Advanced

This navigation item is only available if the "Enable advanced views" checkbox is marked in the software settings (see page 5).

If the "UPS Advanced" item is selected in the software menu "Status", advanced status information for the connected UPS is shown in the action area.

The status information is self-explanatory, this is why it is not explained in detail here.

In normal operation it looks something like this:

Name	Value	Unit
Device type	QUINT-UPS/24DC/24DC/5	
Actual input voltage	23,91	V
Actual output voltage	23,66	V
Actual Device Temperature	30	°C
Shutdown event started	No	
UPS serial number	3012001033	
Device firmware	0x00000110	

7 Settings - Defining UPS device parameters

The navigation items contained in the "Settings" group allow access to the various UPS device parameters.
Parameter values can be entered in UPS-CONF and written to the device (see page 29) with only one click of the mouse.

If the software menu "Settings" is selected, the following navigation items are available:

- Reporting (see page 31): Trigger thresholds, switching outputs for UPS alarm, battery mode and battery charging as well as Email settings
- Time Setting (see page 36): Buffer times, (delay) times and programs to execute for PC shutdown
- Service (see page 39): Service mode activation and rights granting, declaration of service stick and configuration stick
- Advanced (see page 41): Battery charging values, wire sizes, thresholds, signaling times and others

How to write parameters

In each of the navigation items, different settings can be made in the action area in order to write it to the UPS.

Beneath settings, that can be made by checking a checkbox or by entering data into an input box, also numerical or textual values contained in the parameter tables can be changed.

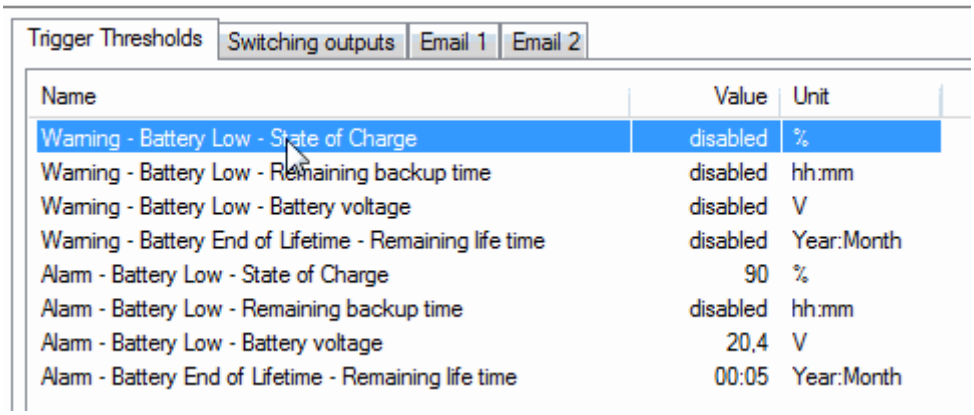
In these parameter tables, changeable parameter values have a white background color. Read-only values, i.e. the ones that are read from the device for monitoring purposes, are shown on a gray background.

To enter a new value for a parameter and write it to the UPS, proceed as follows:

1. Double-click the line, where the parameter text is located or click the "Write..." button in the lower right corner.
   An input box opens showing the currently set value.
2. Enter a value into the input box. Make sure that the chosen value is within the allowed value range and is suitable for your UPS system!
3. Click the "Write to device" button.
4. Verify that the new value is now displayed in the parameter table, i.e., has been accepted by the device.

Sample:

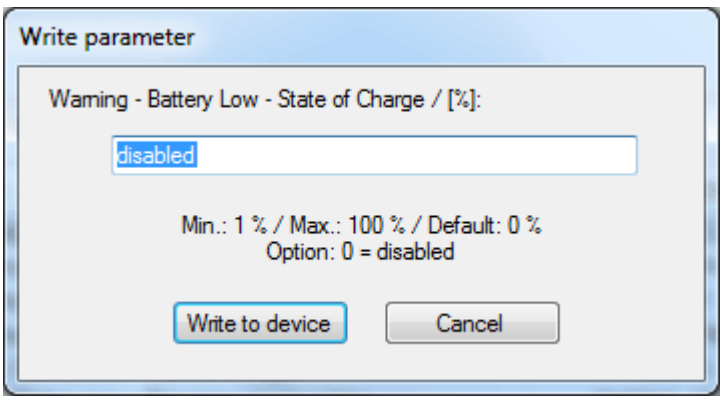
Select the "Reporting" navigation item in the "Settings" group and click the "Trigger Thresholds" tab in the action area.
In this tab, you can set a trigger value, at which battery charging level a "battery low" warning should be generated (first entry in the tab Trigger Thresholds (see page 31)). The value is entered as percentage, see below. By default, the trigger is "disabled", i.e. no warning is reported.



Set the trigger to 20% as follows:

1. Double-click the marked line, as shown in the figure above or left-click the line and then press the "Write..." button in the lower right corner.

   The following dialog appears:

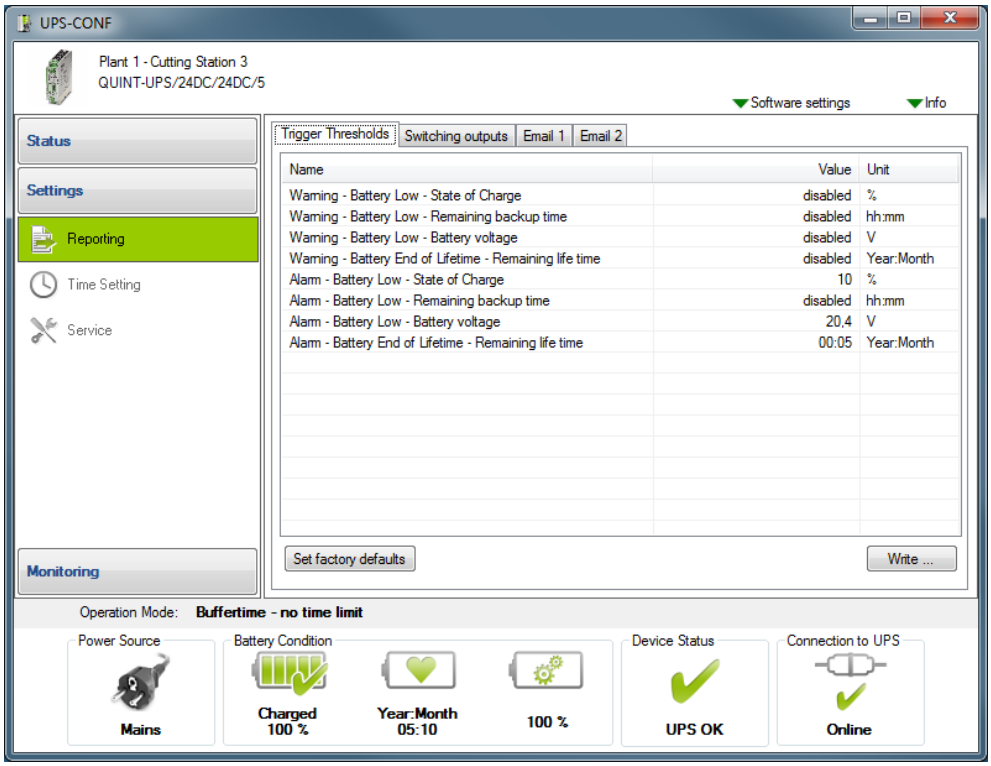
   Below the text field you can see the allowed input range.
2. Enter `20` in the input box and click the "Write to device" button.
3. Verify that the new value is shown in the table.

7.1 Reporting

If the "Reporting" item is selected in the software menu "Settings", the tabs "Trigger Thresholds", "Switching outputs", "Email 1" and "Email 2" are visible in the action area.

Trigger Thresholds

On the "Trigger Thresholds" tab you can define, whether warnings or alarms shall be reported by the UPS and define the threshold values which must be exceeded in order to trigger a message.



For each of the following conditions, both a warning and an alarm threshold value can be defined:

- Battery is low and the state of charge falls below a certain percentage number.
- Battery is low and the remaining backup time falls below a defined time.
- Battery is low and the battery voltage falls below a certain voltage.
- Battery is at it's end of lifetime and the remaining life time falls below a defined time.

If a warning or alarm is reported, you can define that a switching output must be triggered. For some of the warnings or alarms an Email to be sent can also be defined.

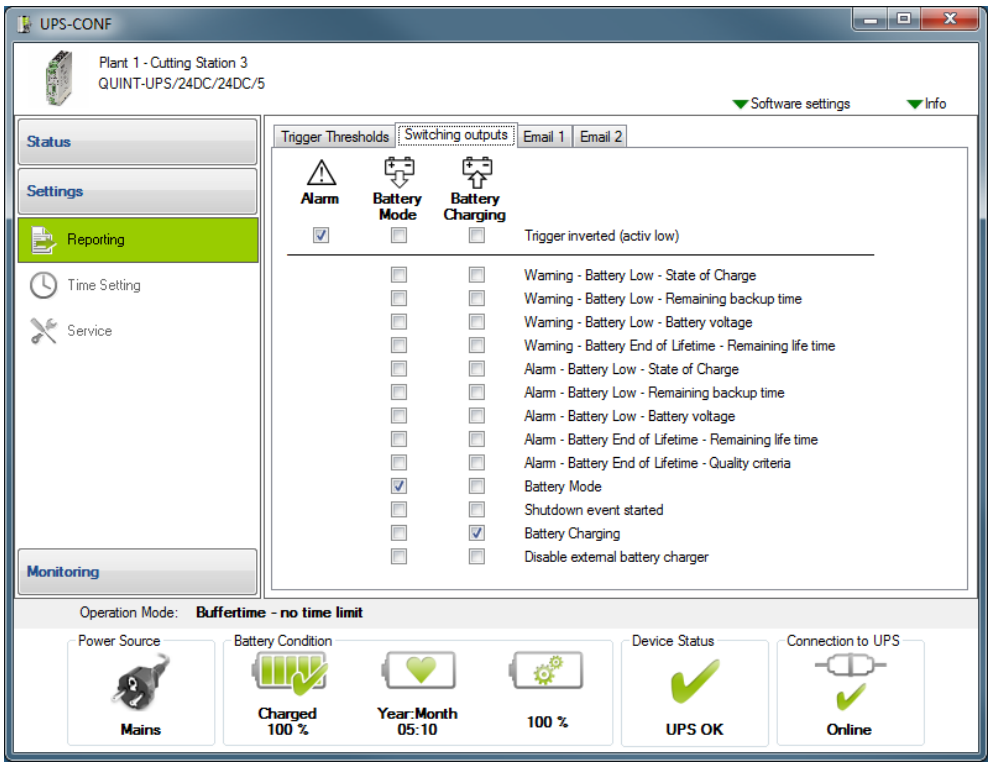
A reported alarm is additionally signaled by the LED at the front of the UPS device as well as in the status bar of the UPS-CONF software.

By means of warnings and alarms you can implement a two-level detection system:

1. Report a warning, when the first threshold value is exceeded.
   Example: battery lifetime is still one year.
2. Report an alarm, when the second threshold value is exceeded.
   Example: remaining lifetime of the battery is only some few months or weeks. Now an Email is additionally sent to the responsible person to ensure that a new battery is ordered in time.

Switching outputs

On the "Switching outputs" tab you can define a QUINT-UPS device output signal to be switched, when a certain trigger occurs. With such an output signal you can, for example, control a buzzer, that sounds, if the battery is low or the shutdown has been initiated.



Three different outputs are available to be switched:

- "Alarm",
- "Battery Mode"
- "Battery Charging"

All switching outputs can be triggered inverted, i.e., active low.

The "Battery Mode" and "Battery Charging" output signals can be switched with the following triggers:

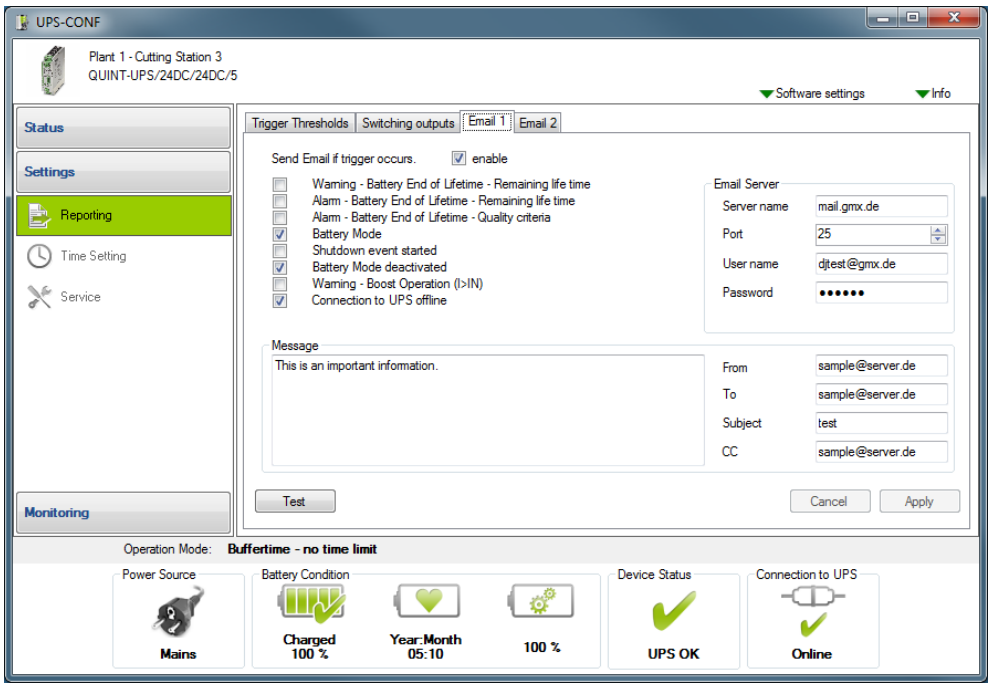
- The same triggers as described in section "Trigger Thresholds" for warning and/or alarm, e.g. triggers that are released by an exceeded or underrun threshold.
- The quality criteria is no more fulfilled. The IQ-Technology of the QUINT-UPS-IQ is able to calculate it's own save remaining lifetime for the battery. Based on this calculation, the quality criteria is evaluated as met or not.
- The system switches to battery mode.

- A shutdown event started.
- The battery switches to the "Battery Charging" status.
- For the "Disable external battery charger" trigger, see technical datasheet for the QUINT-UPS.

For "Alarm" switching output, no further options can be defined.

Email 1 / Email 2

On the "Email 1" and "Email 2" tabs you can define two separate Email addresses, to which Emails can be sent if certain events occur. To access the input fields, mark the "enable" checkbox in the upper part of the screen.



The available triggers to initiate Emails to be sent are:

- A warning occurs as battery is at it's end of lifetime and the remaining life time falls below a defined time.
- An alarm occurs as battery is at it's end of lifetime and the remaining life time falls below a defined time.
- An alarm occurs as the quality criteria is no more met.
- The battery switches to battery mode.
- A shutdown event started.
- The battery switches to "Battery Charging" status (battery mode deactivated).

- A warning occurs because boost operation was activated. The power supply now delivers BOOST current, which is up to 1.5 times the nominal current of the power supply (only available with QUINT POWER).
- The connection to the UPS was interrupted ("Offline" status).

In the Email Server area, you have to enter:

- "Server name" for the server managing your outgoing mail. Ask your administrator for details.
- "Port" for outgoing Emails is usually 25. The predefined port 25, however, can be changed.
- "User name" and "Password" of your Email account. In some accounts the "User name" is the Email address.

The Message area contains:

- Messagebox: A short explanation of the trigger, that caused the Email, is sent as default message. You can enter additional text, that will be appended to the default text.
- "From" textbox: Any Email address can be entered here.
- "To" textbox: A valid Email address has to be entered here, where the Email is sent to; it must be an Email address, that exists in the Email server´s configuration.
- "Subject" textbox: the title of your Email is user-defined; it is only used with the Email "Test" button. When the Email is successfully sent, click the "Apply" button.
- "CC" textbox: you can enter an Email address, where a copy is sent to.

You can test your settings by clicking on the "Test" button.

Sample Email:

A sample Email would look like this:

Email part	Content of Email part	Explanation
Subject	[UPS CONF: Parameters change notification]	
Message	*** UPS Status Mail ***	Header of the status mail message
	Hall 125	Place of installation, refer to the topic Advanced (see page 41)
	QUINT-UPS/24DC/24DC/5	Type of connected UPS, refer to the device information area in the User interface (see page 15)
	Trigger: Battery Mode Trigger	Kind of active trigger
	Threshold: -	Threshold (if applicable)
	This is an important information.	User defined text from the message textbox

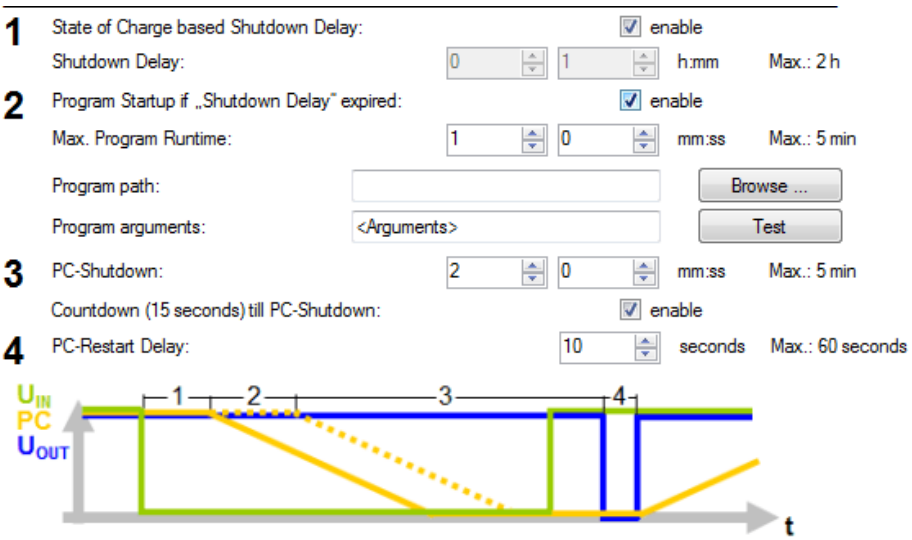
7.2 Time Setting

If the "Time setting" navigation item is selected in the "Settings" group, the action area provides various settings for two different UPS operating modes:

- The upper part (above the separation line) specifies the "Custom" mode.



- In the lower part (below the separation line), four different parameter categories can be set concerning the PC-Mode.

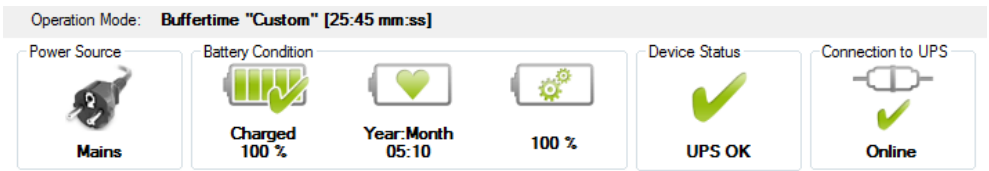


Custom mode

NOTE
These settings only apply if the UPS runs in Custom mode. To set this mode, the buffer time potentiometer located at the device front must be set to "Custom" (refer to topic buffer time selection (see page 12)).

In Custom mode the buffer time for the battery can be set to a maximum of 1 hour (30 seconds default).
When the power supply was interrupted the load will loose it's power after the user-defined buffer time has elapsed. The battery will buffer exactly the set buffer time. If no user-defined time is entered, the buffer time selected by the potentiometer is used.

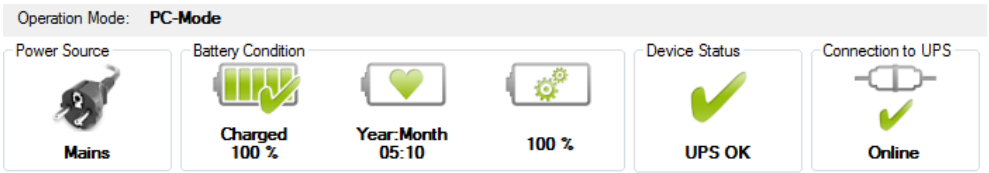
The set time is displayed in the "Operation Mode" of the status bar. An example with 25 minutes and 45 seconds set, shows the following status bar and operation mode:



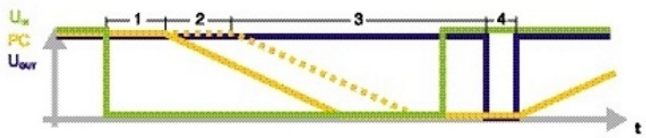
PC-Mode

NOTE
These settings only apply if the UPS runs in PC-Mode. To set this mode, the buffer time potentiometer located at the device front must be set to "PC-Mode" (refer to topic buffer time selection (see page 12).

When the PC-Mode is set, the status bar shows the operation mode "PC-Mode", as shown in the following screenshot:



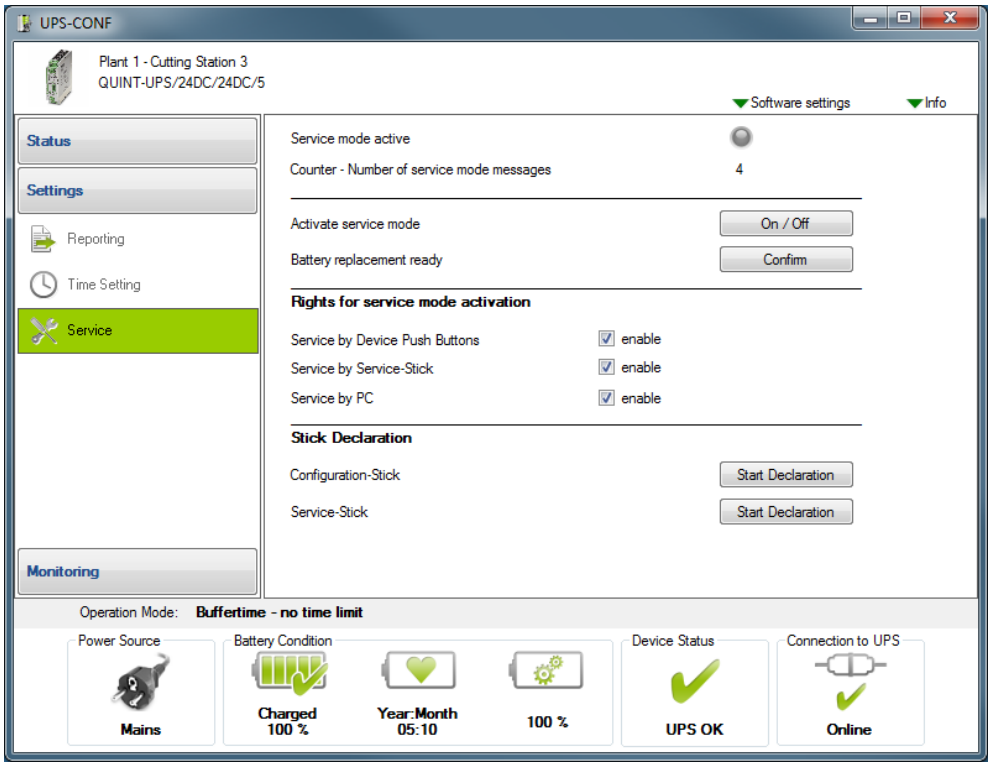
In the "PC Mode" setting on the UPS potentiometer, the UPS functionality follows a chronological sequence that can be parameterized via software, and is thus individually customized to the respective application.



Parameter	Meaning / Possible settings
1 Shutdown delay	Delay time is calculated automatically from the current remaining battery life minus the time required by the PC to shutdown. Alternatively, a fixed delay time may be chosen.
2 Program startup	After the delay time has expired it is possible to start a program. Example: a software starts that gradually backs up system data. You can test your settings by clicking on the "Test" button.
3 PC shutdown	The time required by the PC/IPC to shut down is set here.
4 PC restart delay	Only if the PC/IPC is shut down, and the mains has returned in the meantime, the output voltage will be interrupted for the reset time. The PC/IPC is then automatically restarted.

7.3 Service

If the "Service" item is selected in the software menu "Settings", all parameters of switching the UPS to service mode are accessible in the action area.



Here, you can:

- Operate the UPS in service mode (see page 47).
- Grant or deny rights for the service mode activation (see section below).
- Declare memory sticks as either configuration sticks or service sticks, as described in the topic Stick usage (see page 45).

Rights for service mode activation

The rights for all possible methods to activate or terminate the service mode can be defined in the "Rights for service mode activation" part of the "Service" navigation item´s action area. Possible activation methods are:

- Pressing both push buttons ("Stick -> UPS" and "UPS -> Stick") on the device front simultaneously.
- Plugging a service stick into the Data port of the UPS device.

- Clicking the service mode activation button in the "Service" navigation item´s action area in UPS-CONF.

When allowing a service stick for activating the service mode and disabling the use of the push buttons at the same time, the stick can be considered as a kind of hardware key: Only authorized persons who possess a service stick are allowed to switch the device to service mode. For that purpose, a memory stick must be declared accordingly as described in Stick usage (see page 45).



For further information please refer to the "Service stick usage - service mode (see page 47)".

7.4 Advanced



This navigation item is only available if the "Enable advanced views" checkbox is marked in the Software Settings (see page 5).

The "Advanced" navigation item within the "Settings" group allows to set more specific parameters. These are in detail:

Name of parameter:	Sample value:	Unit:	Explanation:
Place of installation (user defined)	Hall 125	(none)	The text entered here is dislayed in the device information area of the User interface (see page 15).
Initial charging current	1.36	A	The battery is charged with this current, when the power supply is available.
Absorption charging end voltage	28.00	V	An equalizing charge, that increases charging voltage to a higher value than the nominal capacity for a short period. This prevents battery stratification and reduces sulfation. When the battery is fully loaded, this voltage is tolerated as a maximum, before the voltage level gets a stable end value.
Float charging end voltage	27.60	V	The charger adjusts the end voltage based upon battery temperature. During high temperature periods, the actual battery voltage will be reduced and during low temperature periods it will be increased.
Temperature compensation	42	mV/K	High ambient temperatures have a negative impact on the service life of the battery. Therefore, the charging voltage should be lower with higher ambient temperatures. The adjustable values relate to one battery cell each.
Wire distance to the battery unit	300	mm	The maximal wire length from the UPS control unit to the battery unit.
Wire cross section to the battery unit	6.0	qmm	The wire cross section from the UPS control unit to the battery unit.

Name of parameter:	Sample value:	Unit:	Explanation:
Fast battery charging	On	(none)	Boost mode is allowed or not.
Dynamic backup threshold	Off	(none)	This parameter can be defined additionally to the overvoltage and undervoltage related parameters, see below. If set to On the voltage increase or decrease within a certain time period is watched (dynamically). The UPS switches to battery mode, if the relative increase/decrease is too much. In contrast the overvoltage and undervoltage parameters have static values. They can become active regardless the dynamic backup threshold did not trigger, because the voltage was alright.
Undervoltage backup threshold	19.00	V	When the DC voltage falls under this threshold (undervoltage), the system switches to battery mode.
Overvoltage backup threshold	30.00	V	When the DC voltage exceeds this threshold (overvoltage), the system switches to battery mode.
Return to mains time	3	seconds	After this time the system returns to mains, when it is in battery mode and the power supply is available again.
Discharging end voltage	19.20	V	The battery voltage may not sink below this voltage value, otherwise it would be deeply discharged and become defective.
Signaling time after battery low cutoff	00:10	hh:mm	When the battery low status has arrived, the UPS cuts off and the status of the power source firstly switches to "UPS off (see page 27)". After the time set here no more power or battery status is displayed, but only the Connection to UPS (see page 17) is offline.
Signaling time after time cutoff	00:10	hh:mm	When the buffer time has elapsed, the UPS cuts off and the status of the power source firstly switches to "UPS off (see page 27)". After the time set here no more power or battery status is displayed, but only the Connection to UPS (see page 17) is offline.

Name of parameter:	Sample value:	Unit:	Explanation:
Battery type (imported item)	"No value assigned"	(none)	The type of battery delivered by the manufacturer. This value is read by the UPS-CONF software.
Nominal capacity (imported item)	"No value assigned"	Ah	The nominal capacity of the battery delivered by the manufacturer. This value is read by the UPS-CONF software.



You can restore the default settings anytime by clicking the "Set factory defaults" button.



You can import / export the list in a .csv file by clicking the button "Import " or "Export".

8 Monitoring - Statistics and logging

If the "Monitoring" group is selected, the navigation items "Statistic (user defined)", "Statistic (system defined)" and "Logging" are available.

The items inform about counted and time measured statistic values and show logged information.

Statistic (user defined)

The "Statistic (user defined)" navigation item shows counter values which start at a user-defined value. If, for example, batteries have been replaced, you can set the values manually to "0" in order to start a new logging period. The following values are displayed and can be reset:

- Number of battery modes: How often did the UPS already change to battery mode?
- Total time of battery mode: How long altogether did the UPS stay in battery mode?
- Number of operation startups: How often was the UPS started?
- Total operation time: How long altogether did the UPS run?

Statistic (device defined)

The "Statistic (system defined)" navigation item shows counter values which always start from the value "0" with the initial device installation. Beneath the same values as shown in the "Statistic (user defined)" navigation item, additional values are displayed:

- Runtime of the current battery operation: How long does the current battery operation (if relevent) altready last?
- Number of battery low cutoffs: How often was the battery completely discharged?
- Number of all messages: How many warnings and alarms were signaled altogether?
- Number of remaining lifetime messages: How often was a remaining lifetime signaled?
- Number of quality criteria messages: How often was signaled, that the quality criteria is no more met?
- Number of battery presence messages: How often was a battery unit not detected, e.g. no fuse plugged or circuit broken?

Logging

The logging is done by the software itself.
The "Logging" navigation item lists events like "Offline", "Online" or "UPS in battery mode" with date and time stamp. The event colors differ between green and red depending on the type of event. They are chronologically sorted, the latest uppermost.



You can delete the list by clicking the button "Delete history".
You can export the list in a .csv file by clicking the button "Export".

9 Stick usage

At the Data port of the UPS device, a memory stick can be connected (see image below). After plugging in, the UPS either acts as configuration stick or as service stick, depending on how the respective stick has been declared before in the "Service" screen of the UPS-CONF software.



A configuration stick is used to copy parameterization data from/to the UPS device, as described in the topic Configuration stick usage (see page 46).

A service stick can be used to switch the device to service mode (see page 47) in order to perform maintenance tasks.

To declare a memory stick proceed as follows:

NOTE
When declaring a stick, its current content is deleted, i.e. already stored configuration data are lost.

1. Open the software menu "Settings".
2. Click the "Service" navigation item.
3. In the "Stick declaration" area of the action area, click the appropriate "Start declaration" button.

After this declaration, the UPS device automatically formats the stick after plugging it into the Data port the next time and then acts accordingly.

9.1 Configuration stick usage

A configuration stick stores UPS configurations, i.e.complete parameter sets. Configurations can be copied from the UPS to the stick and vice versa. This way, the stick can be used to transfer configurations from one UPS to another.



NOTE
The configuration stick cannot be used, while the UPS runs in battery mode. The power supply must be available.

The usage of configuration sticks is explained by the following steps:

1. Make sure that the used memory stick is already declared as configuration stick as described in the topic Stick usage (see page 45).
2. To transfer parameters between the stick and the UPS, execute one of the following steps:
   - To copy parameters from the stick to the QUINT-UPS push the "Stick -> UPS" button for more than 2 seconds.
   - To copy parameters from the QUINT-UPS to the stick push the "UPS -> Stick" button for more than 2 seconds.
3. Connect the configuration stick to the Data port of the UPS under consideration of the plug direction.
   The parameter transfer is started automatically and the progress is signalled by the LEDs:
   - While data is transferred they flash red - yellow - green.
   - A successful tranfer completion is signalled by a permanent green LED.
   - A faulty tranfer completion is signalled by a permanent red LED.
4. Remove the stick from the Data port.
5. After copying a parameter set from an UPS to the stick you can "clone" this configuration by plugging this stick into another UPS and copying the stored data from the stick into this UPS.

9.2 Service stick usage - service mode

The service mode is used, when installation and maintenance work has to be achieved, such as a battery has to be replaced.

There are several possibilities to switch the UPS to service mode.

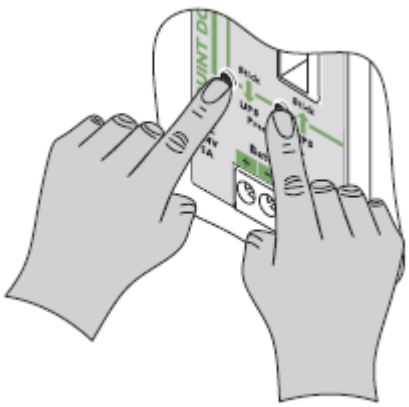
The corresponding activation rights have to be granted for service mode activation and deactivation, as described in the topic Rights for service mode activation (see page 39).

Service mode activation

The service mode cannot be activated, while the QUINT-UPS runs in battery mode. The power supply must be available.

Depending on the granted activation rights, the service mode can be activated in three different ways:

- By holding down both push buttons on the QUINT-UPS named "Stick -> UPS" and "UPS -> Stick" for at least 6 seconds.

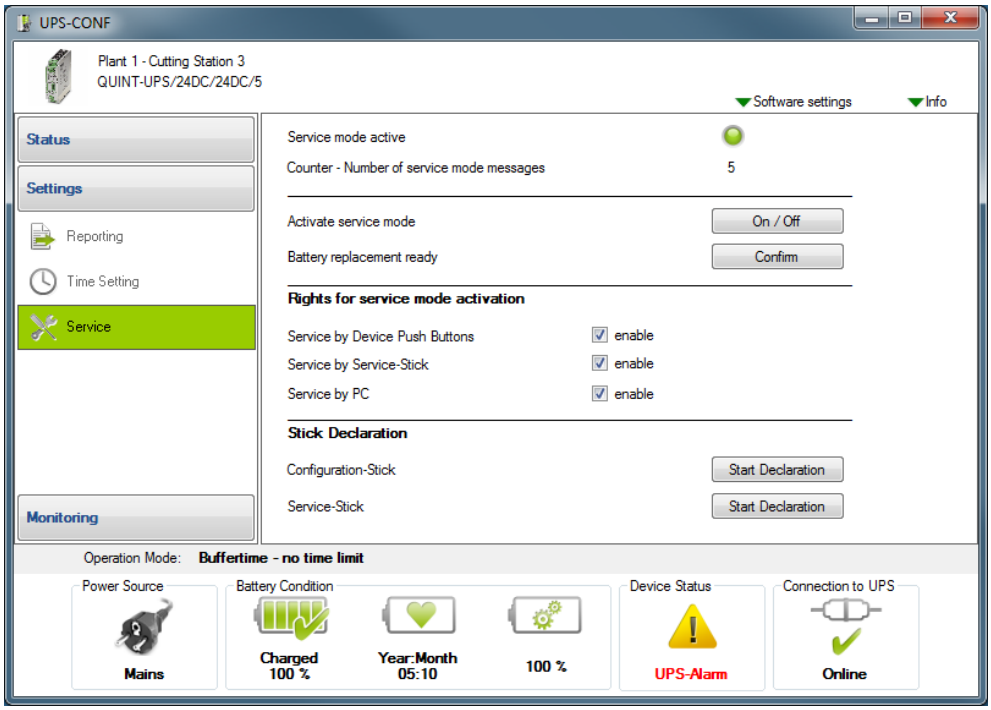


- By connecting a service stick (see page 45) to the Data port (see page 13) of the UPS.
- By using the UPS-CONF software as follows:
  In the "Settings" group, select the "Service" item, and click the "On / Off" button near the "Activate service mode" text.

While the service mode is active

- the alarm status is activated,

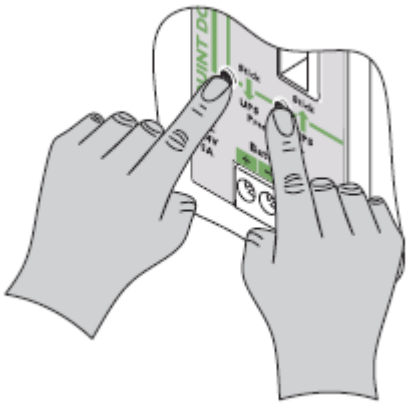
- the charging current is interrupted,
- the status LED "Service mode active" in the UPS-CONF software ("Settings" group / "Service" item) is green.



Service mode deactivation

The service mode can be deactivated in different ways:

- By holding down both push buttons on the QUINT-UPS named "Stick -> UPS" and "UPS -> Stick" for at least 6 seconds.



- By removing the service stick from the Data port of the UPS.
- By using the UPS-CONF software as follows:
  In the "Settings" group, select the "Service" item, and click the "On / Off" button near the "Activate service mode" text.

After the service mode is deactivated, the status LED "Service mode active" in the UPS-CONF software ("Settings" / "Status") switches back from green to gray.

Service mode operation

To operate the QUINT-UPS in the service mode in order to replace a battery for example, execute the steps described below.

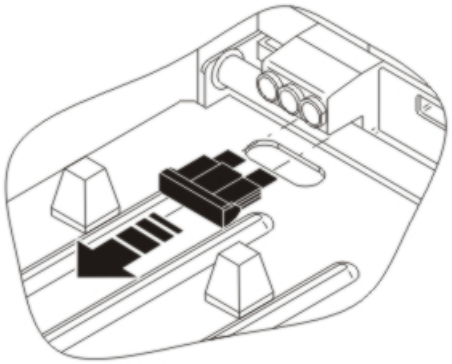
DANGER
Before activating the service mode read and obey carefully the safety instructions in the topic Important safety notes (see page 10).

DANGER
Watch polarity when connecting cables!

1. Activate the service mode by one of the ways described above.
2. Replace the battery as follows:.

   i. Open battery housing.

   ii. Remove fuses.

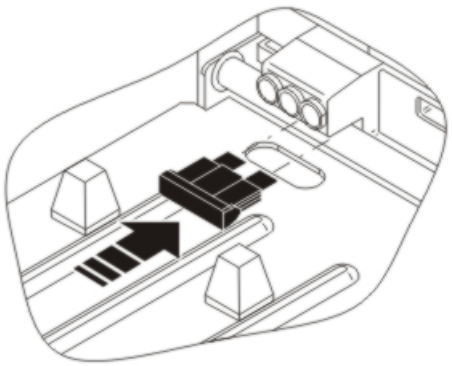


iii. Remove cabling.

iv. Change battery.

v. Connect cabling.

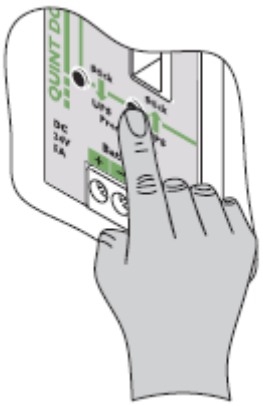
vi. Insert fuses.



vii. Close battery housing.

3. As soon as the work is finished, the parameters of the new battery have to be read into the UPS, so it's status information is available. To introduce this battery registration, do one of the following actions:

   - Push one of the push buttons on the QUINT-UPS named "Stick -> UPS" or "UPS -> Stick" and hold it down for more than 6 seconds.



or

- In the "Settings" group of the UPS-CONF software select the "Service" item, locate the text "Battery replacement ready" and click the "Confirm" button near the text.

The bar graph at the QUINT-UPS flashes, the alarm status is still active.

NOTE

If the service mode has been deactivated by removing the service stick from the Data port before the battery replacement has been confirmed, it can be confirmed by the UPS-CONF software. A popup window will remind the user to confirm the battery replacement.

4. Deactivate the service mode as described above.

10 Application samples



For further information, please take a look at the Software Tutorials or the Quick Start Poster on www.phoenixcontact.net/catalog. You will find the data if you link to UPS-CONF or QUINT-UPS.

10.1 Functional test

One of the main functions of the QUINT-UPS is to supply the load, when the mains fails. To test, if the UPS buffers the load, follow these steps:

1. Switch off the power supply of the QUINT-UPS.
2. Check if the QUINT-UPS buffers the load as long as set with the buffer time potentiometer, refer to Buffer time selection (see page 12).

10.2 PC-Mode: PC shutdown and restart

The IQ technology of the QUINT-UPS is able to control the power supply for a PC. For that purpose the PC with the UPS-CONF software installed has to be connected to the UPS and the PC-Mode activated. The PC-Mode enables the automatic PC shutdown and restart functionality.

To test the PC shutdown and restart functionality in the PC-Mode, proceed as follows:

1. Switch the buffer time potentiometer to "PC-Mode", as described in the topic Buffer time selection (see page 12).
2. Connect the UPS device to a USB port of the PC where UPS-CONF is installed (refer to topic Hardware setup (see page 11)).
3. Open the software menu "Settings" and click "Time Settings".
4. Set the parameters for the four different parameter categories, as described in the topic PC-Mode (see page 38).
5. Check if the PC shuts down and restarts corresponding to the set parameters. If a program execution has been set, verify that it is executed.

11 Troubleshooting

If your system does not work properly for any reason, approach the problem in the following manner:

1. Check the system status:

   - If the UPS-CONF software is installed, check the status bar (see page 17) and take a look at the system status.
   - If the UPS-CONF software is not installed, take a look at the front side of the UPS and check the LEDs (see page 20).

2. Proceed with the section Unexpected status symbols (see page 54) to find out, what is wrong.



The section Unexpected status symbols (see page 54) will lead you closer to the solution of the problem. If there are specific solutions for a single problem, you will be lead to the section, that describes the problem solving.

11.1 Unexpected status symbols

The meaning of status symbols showing an unexpected status is explained in the following topic.
The first table lists the symbols for the system status, that you can find in the action area and the second table lists the symbols from the status bar.

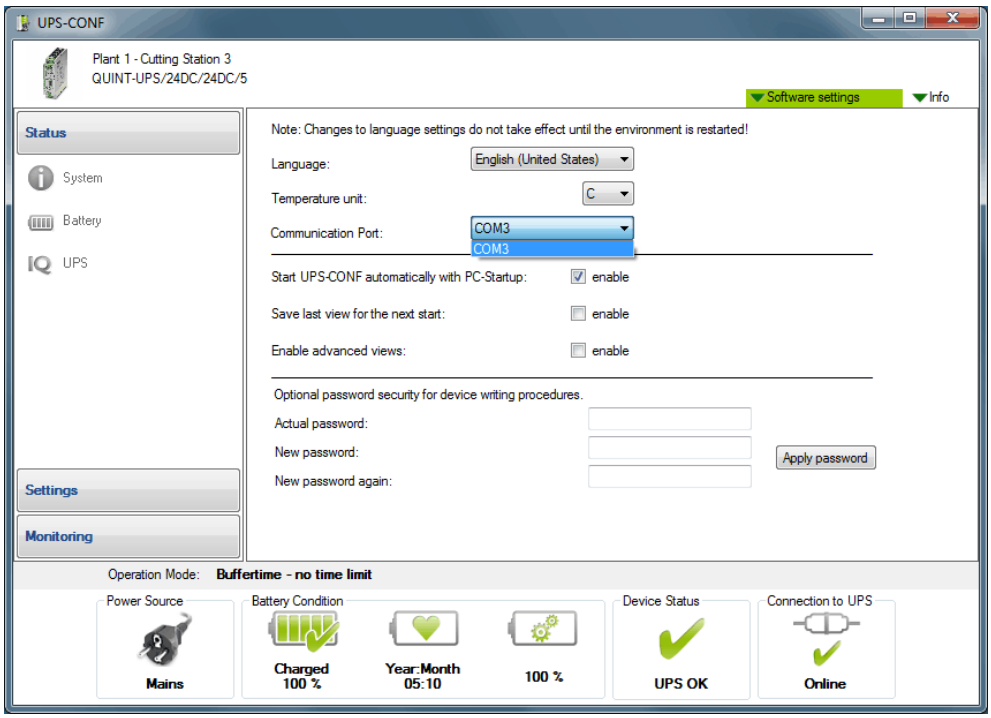
System status Symbol	Current situation and possible reason	Possible correction
 Gray: Mains OFF	There is no current available. Probably the Mains is switched OFF.	• Switch the Mains ON. • Take care that the power supply is available again.
DC  Gray: DC output not available	The power supply unit cannot deliver DC. Either the power supply is not available or the Mains switch is set to OFF.	• Switch the Mains ON. • Take care that the power supply is available again.
 Yellow: Battery mode	No current is available, thus the load gets it's power supply from the battery.	• Switch the Mains ON. • Take care that the power supply is available again.
 Red: UPS alarm	There may be different reasons: • No power supply is available. • The battery is soon empty. • The battery has to be replaced. • The battery cannot be detected. • There is another battery problem. • A set threshold has been reached.	• Switch the Mains ON. • Take care that the power supply is available again. • Check the set thresholds and compare with the current status. • Solve the battery problem. • Replace the battery. • Check the cables between UPS and battery. • Verify that the fuse is installed in the battery.

Status bar Symbol	Current situation and possible reason	Possible correction
	The UPS is in battery mode, because no power supply is available.	• Switch the Mains ON. • Take care that the power supply is available again.
	The bridge between the UPS terminals R1 and R2 is removed. Battery is deactivated therefore. Refer to the parameter "Remote Status" in the topic UPS (see page 27).	If you want the battery to be activated and the battery mode to be introduced, when the mains fail, bridge the terminals R1 and R2. Refer to the hardware overview (see page 7).
	There is no power supply available. One of these states is ongoing: • The UPS is off, because battery mode is finished. The set buffer time has elapsed. • The power source is not ok, because input voltage is in an invalid range.	If the UPS is off, because battery mode is finished, but the battery is funcional: • Switch the Mains ON. • Take care that the power supply is available again. If the UPS is off, because battery mode is finished, and the battery is no more funcional or at it's end of lifetime: • Change the battery. If the power source is not ok, because input voltage is in an invalid range: • Check the power supply.
	The battery is discharging, because no power supply is available.	• Switch the Mains ON. • Take care that the power supply is available again.
	The battery mode is finished, because the battery is empty.	• Take care that the power supply is available again to reload the battery. • Change the battery, if battery lifetime is exhausted.
	(see UPS alarm in the table above)	(see UPS alarm in the table above)
	• The connection between PC and UPS via the IFS-USB-DATACABLE is interrupted. • The communication port is not set.	• Connect the UPS and PC via the IFS-USB-DATACABLE. • Check if the communication port is set, as described in the topic Communication port (see page 56).

11.2 Communication port

The PC USB communication port for the communication between the UPS and the PC is automatically set during software installation. In case the communication port has not been set, the status bar shows the "Connection to UPS: Offline" status.

Although the communication port has not been set, it is detected automatically. Thus you can set it manually. You just have to select it in the software settings of the system menu.



If you click the combo box near the text "Communication port" the correct port is shown and you can select it.

Index

A

Advanced view setting 5

Automatic software start 5

B

Battery replacement 47

Battery status 25

Buffer time potentiometer 12

Buffer time setting 12

C

Communication port 5

Configuration parameters 29

Configuration stick 46

Custom mode 36

D

Data cable 14

Download web address 5

E

Emails 31

Error conditions 53, 54

G

GUI 15

H

Hardware overview 7

I

Indication elements 15

IPC connection 14

L

Language setting 5

Logging 44

M

Memory stick 46

N

Navigation 15

O

Operating elements 15

Overview of system functions 1

Overview of the user interface 15

P

Parameter settings 29

Password setting 5

PC connection 14

PC-Mode 36

Performance characteristics 1

Port setting 5

Preserve last view 5

S

Safety information 10

Safety requirements 10
Sending Emails 31
Service mode 47
Service mode rights 39
Service stick 47
Setting advanced parameters 41
Setting parameters 29
Software download 5
Software settings 5
Statistic values 44
Status bar 17
Status symbols 20
Switching outputs 31
Symbols used 4
System requirements 4

T

time settings 36
Trigger Thresholds 31

U

UPS status 27
User interface 15

W

Writing parameters 29

EU-Konformitätserklärung Nr. 2866404.CE.02
EU-Declaration of Conformity No.

Hersteller / *Manufacturer*: **PHOENIX CONTACT GmbH & Co. KG**

Anschrift / *Address*: Flachsmarktstraße 8, 32825 Blomberg, Germany

Produktbezeichnung / *Product description*: **TRIO-PS/3AC/24DC/40**

(Artikelbezeichnung, / *Article description*, Artikel-Nr. / *Article no.*) **2866404**

Das vorstehend bezeichnete Produkt stimmt mit den wesentlichen Anforderungen der nachfolgenden Richtlinie(n) und deren Änderungsrichtlinien überein / *The above mentioned product is in line with the essential requirements of the below directive(s) and their modification directive(s):*

2014/30/EU	**EMV-Richtlinie (Elektromagnetische Verträglichkeit)** **Electromagnetic Compatibility Directive (EMC)**
2014/35/EU	**Niederspannungs-Richtlinie** **Low Voltage Directive (LVD)**

Für die Beurteilung der Übereinstimmung wurden folgende einschlägige Normen herangezogen:
For evaluation of the conformity following relevant standards were consulted:

EN 60950-1:2006+A11:2009+A1:2010+A12:2011+A2:2013

EN 61000-6-3:2007+A1:2011

EN 61000-6-2:2005

EN 61000-3-2:2014

Weitere Informationen (z. B. Dokumente, Prüfberichte, Einschränkungen, etc.) zur Konformitätsbewertung:
Additional information (for example documents, test reports, restrictions etc.,) of the conformity assessment:

Zertifikate einer benannten Stelle / *Certificates by a notified body*:

Anschrift / *Address*:

Referenz / *Reference*:

Anschrift / *Address*:

Referenz / *Reference*:

Die letzten beiden Ziffern des Jahres in dem die CE-Kennzeichnung angebracht wurde: 06
The last two figures of the year in which the CE marking was applied:
(nur einzutragen, bei der Niederspannungsrichtlinie / *only to be entered on the low voltage directive*)

☐ Diese Erklärung gilt auch für die im Anhang aufgelisteten Produkte. (wenn angekreuzt)
This declaration also applies for the products listed in the annex. (if marked with a cross)

Diese Erklärung bescheinigt die Übereinstimmung mit den wesentlichen Anforderungen der genannten Richtlinie(n), enthält jedoch keine Zusicherung von Eigenschaften. Die Sicherheits- und Einbauhinweise der mitgelieferten Produktdokumentation sind zu beachten.
This declaration certifies the conformity with the essential requirements of the indicated directive(s), it does not, however, covenant any characteristics. The instructions for safety and installation of the enclosed product documentation have to be observed.

Blomberg, 2017-05-12

i. A. Werner Meyer
Werner Meyer
Business Unit Power Supplies
Manager Quality Engineering & Testing
Ansprechpartner / *contact person*

i. A.
Dr.-Ing. Mathias Emsermann
Business Unit Power Supplies
Director Research and Development
Zeichnungsberechtigter / *authorized signatory*

PHOENIX CONTACT GmbH & Co. KG
Flachsmarktstraße 8
32825 Blomberg, Germany
Telefon: +49 5235 300
Telefax: +49 5235 3-41200
Internet: http://www.phoenixcontact.com
USt-Id-Nr.: DE124613250
WEEE-Reg.-Nr.: DE50738265

CCC-Exempt Declaration

As we know, CCC certification is mandatory in China for defined products, and CNCA is the responsible committee for the definition of CCC application range. So please visit the website below for the latest bulletin (No. 45 of year 2014) of CNCA for CCC:

http://www.cnca.gov.cn/xxgk/ggxx/2014/201512/t20151230_44252.shtml

Primary-switched power supplies

Description of product, product group or product family

Product list:
See list on next page(s).

Description of product function:

Primary-switched power supplies for DIN rail mounting in industrial switch cabinets.

Reason why CCC certification is not required:

The listed power supplies are not for computers and adapters for information technology equipment (such as laptop) and they are not for audio/video products. So these above mentioned products do not belong to CCC categories and therefore are not in CCC application range.

Date of creation: 01. July 2018

PHOENIX CONTACT GmbH & Co. KG
Flachsmarktstr. 8
D-32825 Blomberg

Seal

i. V.

Michael Heinemann
Vice President, Business Unit Power Supplies

Product list:

Part-No.	Product-Description
2866268	TRIO-PS/1AC/24DC/ 2.5
2866310	TRIO-PS/1AC/24DC/ 5
2866323	TRIO-PS/1AC/24DC/10
2866381	TRIO-PS/1AC/24DC/20
2866394	TRIO-PS/3AC/24DC/20
2866404	TRIO-PS/3AC/24DC/40
2866459	TRIO-PS/3AC/24DC/10
2866462	TRIO-PS/3AC/24DC/ 5
2866475	TRIO-PS/1AC/12DC/ 5
2866488	TRIO-PS/1AC/12DC/10
2866491	TRIO-PS/1AC/48DC/ 5
2866501	TRIO-PS/1AC/48DC/10
2866530	TRIO-PS/600DC/24DC/20
2902646	TRIO-PS/1AC/5DC/10
2903144	TRIO-PS-2G/1AC/24DC/5/B+D
2903145	TRIO-PS-2G/1AC/24DC/10/B+D
2903147	TRIO-PS-2G/1AC/24DC/3/C2LPS
2903148	TRIO-PS-2G/1AC/24DC/5
2903149	TRIO-PS-2G/1AC/24DC/10
2903151	TRIO-PS-2G/1AC/24DC/20
2903153	TRIO-PS-2G/3AC/24DC/5
2903154	TRIO-PS-2G/3AC/24DC/10
2903155	TRIO-PS-2G/3AC/24DC/20
2903156	TRIO-PS-2G/3AC/24DC/40
2903157	TRIO-PS-2G/1AC/12DC/5/C2LPS
2903158	TRIO-PS-2G/1AC/12DC/10
2903159	TRIO-PS-2G/1AC/48DC/5
2903160	TRIO-PS-2G/1AC/48DC/10
2909900	TRIO-PS-2G/3AC/150DC/6

TRIO-PS/3AC/24DC/40

Primary switched power supply, 3-phase, output current: 40 A



INTERFACE

Data Sheet
102782_01_en

© PHOENIX CONTACT - 06/2007

Description

TRIO POWER is the rail mountable 24 V power supply unit with basic functions. With an output voltage of 24 V DC and 1-phase and 3-phase versions with 60 W or 960 W, it is particularly suited for use in series production in mechanical engineering. The wide-range input and international certification package allows worldwide implementation.
The high MTBF of 500,000 h stands for high supply reliability. The devices can be connected in parallel to increase the capacity and redundancy.
The clear LED signaling and the device connection with double terminal block for plus and minus for fast potential distribution are further advantages of this device series. A third terminal block for minus simplifies the grounding on the secondary side. All power supply units are idle proof and short circuit proof and provide a regulated and settable output voltage of 22.5 V DC to 29.5 V DC with output currents of 2.5 A, 5 A, 10 A, 20 A or 40 A.

- Reliable power supply unit even at high ambient temperatures
- No load and short circuiting resistance
- High dielectric strength
- Can be used worldwide in all industrial sectors due to a wide-range input and an international approval package

DANGER OF EXPLOSION!
Remove an item only when it is not connected to power or if it is located in the non-explosive area.

DANGER
Components with dangerously high voltage and high stored energy are located in the device!
Never carry out work on live parts!
Depending on the ambient temperature and the load, the housing can become very hot!

Make sure you always use the the latest documentation.
It can be downloaded at www.download.phoenixcontact.com.

A conversion table is available on the Internet at
www.download.phoenixcontact.com/general/7000_en_00.pdf.

Table of contents

Description 1
Table of contents 2
Order data 3
Technical data 3
Structure 6
Block diagram 7
Safety and warning notes 7
Installation 8
Installation position 8
Assembly 9
Removing 9
Connection to various network forms 9
Input 10
Protection of the primary side 10
Required backup fuse (device and line protection) 10
Output 11
Protection of the secondary side 11
Signaling 11
Function 12
Output characteristic curve 12
Thermal behavior 12
Parallel operation 13

Order data

Description	Type	Order No.	Pcs./Pkt.
Primary switched power supply, 3-phase, output current: 40 A	TRIO-PS/3AC/24DC/40	2866404	1

Accessories	Type	Order No.	Pcs./Pkt.
Universal wall adapter	UWA 182/52	2938235	1

Technical data

Input data	
Input nominal voltage range	2x / 3x 400 V AC ... 500 V AC
AC input voltage range	320 V AC ... 575 V AC (for 3-phase operation) 2x 360 V AC ... 575 V AC (for 2-phase operation)
AC frequency range	45 Hz ... 65 Hz
Current consumption	3x 2 A (400 V AC) 3x 1.6 A (480 V AC)
Inrush current limitation	< 20 A
I^2t	1.3 A^2s
Power failure bypass	> 16 ms (400 V AC) > 20 ms (480 V AC)
Typical response time	< 1 s
Power factor (cos phi)	0.76
Protective circuitry	Transient surge protection Varistor
Recommended backup fuse for mains protection	3x 10 A (characteristic B) 3x 16 A (characteristic B)
Required backup fuse (device and line protection)	(externally via 3 10 A or 16 A circuit breakers, characteristic B)
Discharge current to PE	< 3.5 mA

Output data	
Nominal output voltage	24 V DC ±1%
Setting range of the output voltage	22.5 V DC ... 29.5 V DC
Output current	40 A (-25 °C ... 55 °C)
Derating	Above +55°C: 2.5% per Kelvin
Current limitation	Approx. 48 A
Max. capacitive load	Unlimited
Control deviation	< 1 % (change in load, static 10% ... 90%) < 2 % (change in load, dynamic 10% ... 90%) < 0.1 % (change in input voltage ±10%)
Power loss nominal load max.	87 W
Maximum power dissipation idling	11 W
Efficiency	> 91.5 %
Ascent time	< 2 ms (U_{OUT} (10% ... 90%))
Residual ripple	< 20 mV_{PP}
Peak switching voltages	< 40 mV_{PP}
Connection in parallel	Yes, for redundancy and increased capacity
Connection in series	No
Surge protection against internal surge voltages	Yes, < 35 V DC
Resistance to reverse feed	35 V DC

Signal output DC OK active	
Status display	"DC OK" LED green / U_{OUT} > 21.5 V: LED lights up

General data	
Insulation voltage input/output	4 kV AC (Type test) 2 kV AC (routine test)
Insulation voltage input / PE	2 kV AC (type test) 2 kV AC (routine test)
Insulation voltage output / PE	500 V DC (routine test)
Degree of protection	IP20
Class of protection	I, with PE connection
MTBF	> 500 000 h in acc. with IEC 61709 (SN 29500)
Housing version	Steel sheet, zinc-plated
Side element version	Aluminum
Dimensions W / H / D (state of delivery)	139 mm / 130 mm / 190 mm
Weight	3.2 kg

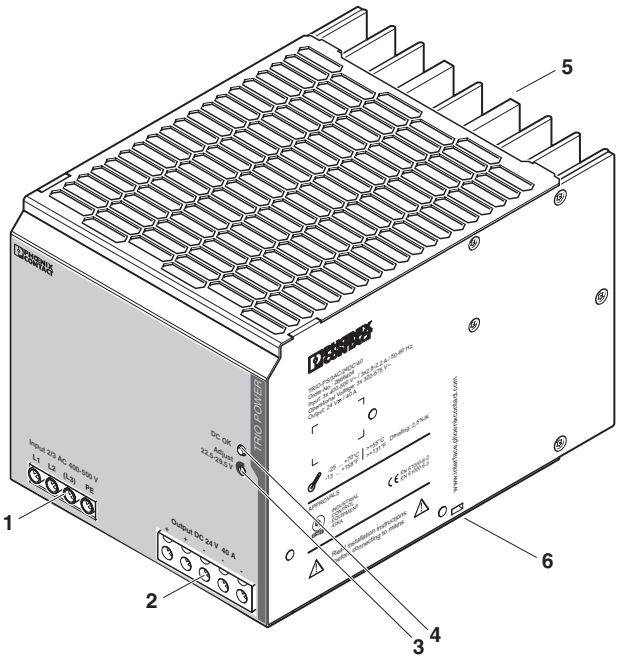
Ambient conditions	
Ambient temperature (operation)	-25 °C ... 70 °C (> 55° C derating)
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Max. permissible relative humidity (operation)	95 % (at 25°C, no condensation)
Vibration (operation)	< 15 Hz, amplitude ±2.5 mm in acc. with IEC 60068-2-6 15 Hz ... 150 Hz, 2.3g, 90 min.
Shock	15g in all directions in acc. with IEC 60068-2-27
Pollution degree in acc. with EN 50178	2
Climatic class	3K3 (in acc. with EN 60721)

Standards	
Electrical Equipment for Machinery	EN 60204
Safety transformers for power supply units	EN 61558-2-17
Electrical safety (of information technology equipment)	EN 60950/VDE 0805 (SELV) EN 61558-2-17
Electronic equipment for use in electrical power installations	EN 50178/VDE 0160 (PELV)
SELV	EN 60950 (SELV) EN 60204 (PELV)
Safe isolation	DIN VDE 0100-410 DIN VDE 0106-1010
Protection against electric shock	DIN 57100-410
Protection against electric shock, basic requirements for safe isolation in electrical equipment	DIN VDE 0106-101
Limitation of mains harmonic currents	EN 61000-3-2

Approvals	
UL rating	UL Listed UL 508 UL/C-UL Recognized UL 60950

Conformance with EMC directive 89/336/EEC		
Immunity to interference in acc. with EN 61000-6-2		
Discharge of static electricity		
	Housing	Level 3
	Contact discharge	6 kV
	Discharge in air	8 kV
	Comments	Criterion B
Electromagnetic HF field		
	Housing	Level 3
	Frequency range	80 MHz ... 3 GHz
	Field intensity	10 V/m
	Comments	Criterion A
Fast transients (burst)		
	Input	4 kV (level 4 - asymmetrical: conductor to ground)
	Output	2 kV (level 3 - asymmetrical: conductor to ground)
	Comments	Criterion A
Surge current loads (Surge)		
	Input/Output	4 kV (level 4 - asymmetrical: conductor to ground) 2 kV (level 4 - symmetrical: conductor to conductor)
	Comments	Criterion A
Conducted interference		
	Input/output	Level 3 - asymmetrical
	Frequency range	0.1 MHz ... 80 MHz
	Voltage	10 V
	Comments	Criterion A
Voltage dips		
	Input	(mains buffering > 10 ms)
	Comments	Criterion B
Emitted interference in acc. with EN 61000-6-3		
Radio interference voltage in acc. with EN 55011		EN 55011 (EN 55022) Class B, area of application: Industry and residential
Emitted radio interference in acc. with EN 55011		EN 55011 (EN 55022) Class B, area of application: Industry and residential

Structure



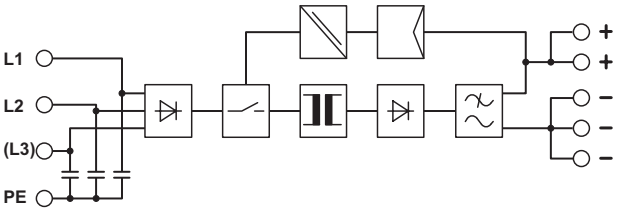
1 AC input
2 DC output
3 Potentiometer 22.5 V DC ... 29.5 V DC
4 "DC OK" LED
5 DIN rail adapter
6 Take-up for cable binders

	[mm²]		AWG	[Nm]
	solid	stranded		Torque
Input	0.2 - 6	0.2 - 4	22 - 10	0.5 - 0.6
Output	0.5 - 16	0.5 - 10	8 - 6	1.2 - 1.5

Input data	
Input nominal voltage range	2x / 3x 400 V AC ... 500 V AC
AC input voltage range	320 V AC ... 575 V AC (for 3-phase operation) 2x 360 V AC ... 575 V AC (for 2-phase operation)
AC frequency range	45 Hz ... 65 Hz
Recommended backup fuse for mains protection	3x 10 A (characteristic B) 3x 16 A (characteristic B)
Required backup fuse (device and line protection)	(externally via 3 10 A or 16 A circuit breakers, characteristic B)
Type of connection	Screw connection
Stripping length	8 mm

Output data	
Nominal output voltage	24 V DC ±1%
Setting range of the output voltage	22.5 V DC ... 29.5 V DC
Output current	40 A (-25 °C ... 55 °C)
Type of connection	Screw connection
Stripping length	10 mm

Block diagram



Safety and warning notes

The power supply units are built-in devices. The device may only be installed and put into operation by qualified personnel. The corresponding national regulations must be observed.

DANGER OF EXPLOSION!
Remove an item only when it is not connected to power or if it is located in the non-explosive area.

DANGER
Components with dangerously high voltage and high stored energy are located in the device!
Never carry out work on live parts!
Depending on the ambient temperature and the load, the housing can become very hot!

Before startup please ensure:

The mains connection has been carried out by a competent person and protection against electric shock is guaranteed!

The device can be disconnected outside the power supply unit in accordance with the regulations as in EN 60950 (e.g. through primary side line protection)!

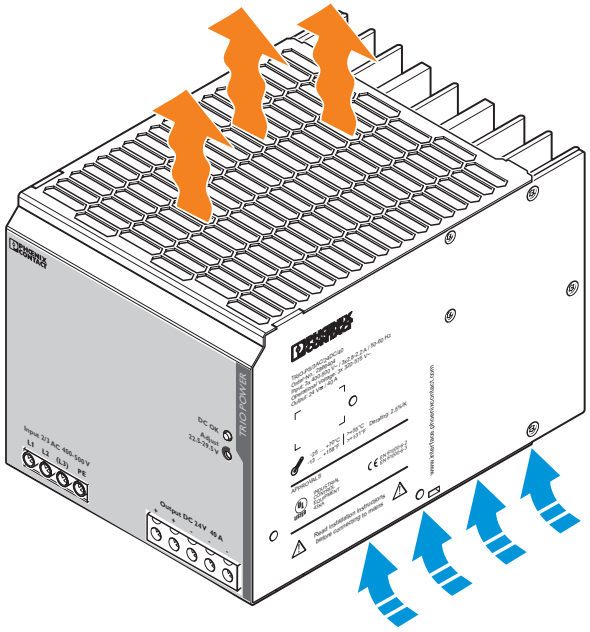
The ground conductor is connected!

All feed lines are sufficiently protected and dimensioned!

All output lines are dimensioned according to the maximum output current of the device or separately protected!

Sufficient convection is guaranteed!

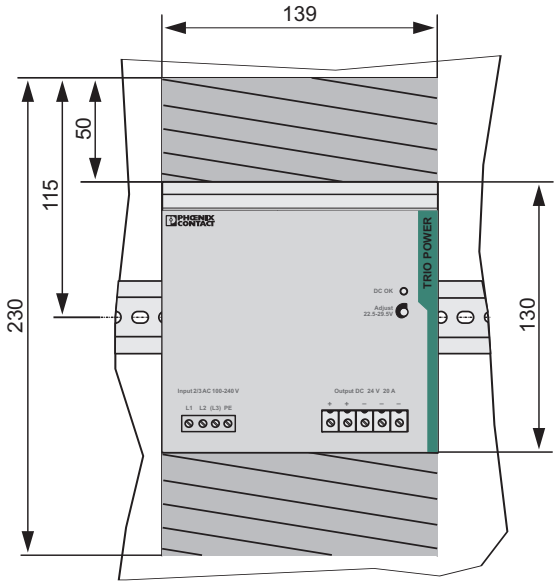
Installation



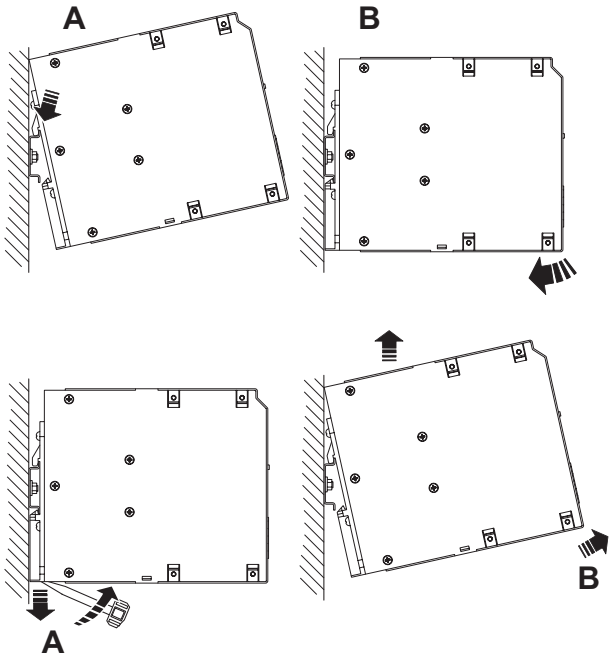
In order to guarantee sufficient convection, we recommend observing the following minimum distance to other modules: 5 cm in a vertical direction and 0 cm in a horizontal direction.

The power supply unit can be snapped onto all DIN rails in acc. with EN 60715. They must be mounted horizontally (connecting terminal blocks bottom).

Installation position



Mounting position: Installation depth 190 mm (+ DIN rail)



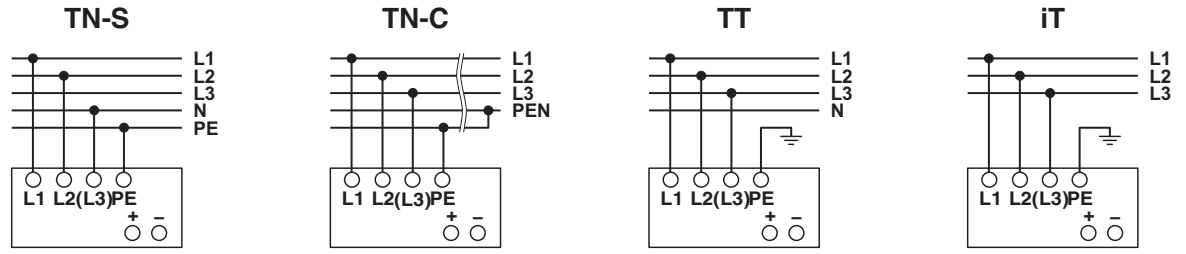
Assembly

Position the module with the DIN rail guide on the upper edge of the DIN rail, and snap it in with a downward motion.

Removing

Pull the snap lever open with the aid of a screwdriver and slide the module out at the lower edge of the DIN rail.

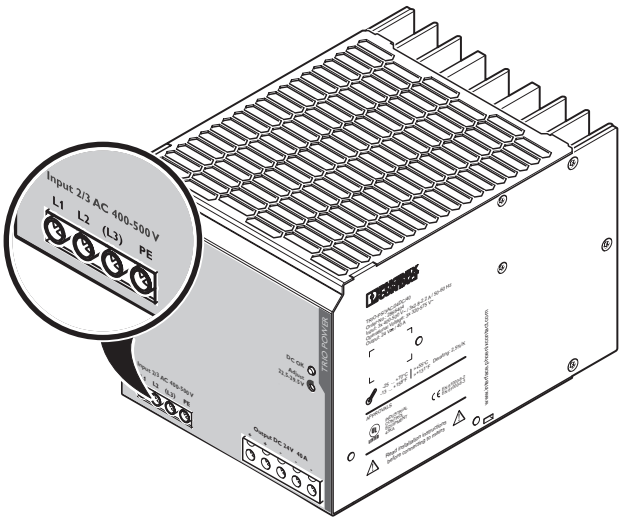
Connection to various network forms



The connection for 2x/3x 400 V AC ... 500 V AC is made using the L1, L2, L3 and PE screw connections.
The device can be connected to 2/3-phase AC networks with nominal voltages 2x/3x 400 V AC ... 500 V AC.
In the event of a phase failure, unrestricted operation is possible with nominal capacity.

In order to comply with the UL certification, use copper cables that are designed for operating temperatures of > 75°C.
In order to comply with EN 60950/UL 60950, flexible cables require ferrules. To safely connect a device, the ferrules should have a length of at least 10 mm (AC input) or 12 mm (DC output). To achieve a reliable and shock-proof connection, strip the connecting ends according to section "Structure".

Input



Protection of the primary side

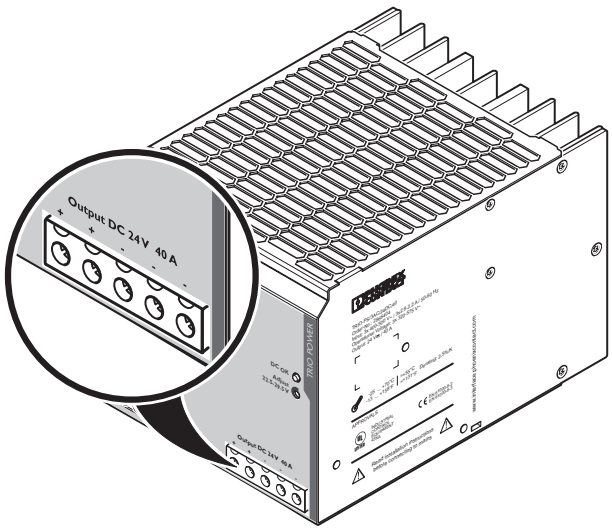
The device must be installed in acc. with the regulations as in EN 60950. It must be possible to disconnect the device using a suitable isolating facility outside the power supply. Primary circuit mains protection, for example, is suitable for this purpose.

Required backup fuse (device and line protection)

Three external thermo-magnetic fuses are necessary as device protection: 3 x 10 A or 16 A power circuit breaker, characteristic B (or identical function).

If an external fuse is triggered, there is most probably a malfunction in the device. In this case, the device must be inspected in the factory!

Output



Make sure that all output lines are dimensioned according to the maximum output current or are separately protected. The cables on the secondary side must have sufficiently large cross sections in order to keep the voltage drops on the lines as low as possible.

You can fasten the connection cables to the housing using cable binders.
Ensure that the cable binders and the connection cables are designed for the surface temperatures that occur in operation.
Make sure that the insulation of the connection cables is not damaged when tightening the cable binders.

The connection is made using the "+" and "-" screw connections on the screw connection of the DC output. At the time of delivery, the output voltage is 24 V DC. The output voltage can be set on the potentiometer.

Protection of the secondary side

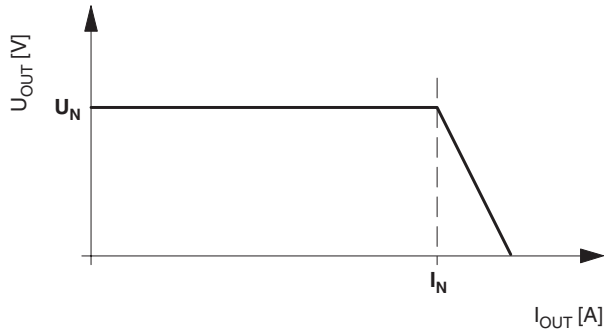
The device is electronically protected against short circuit and idling. In the event of a malfunction, the output voltage is limited to 35 V DC.

Signaling

The "DC OK" LED enables evaluation of the function of the power supply directly on site.

	State 1	State 2
"DC OK" LED	ON	OFF
Cause	Output voltage > 21.5 V	Output voltage < 21.5 V or no voltage at the output
Meaning	Output voltage and output current OK	TRIO POWER is in operation, but there is a fault on the side of the consumer; the current consumption is greater than I_N or the output is short circuited. TRIO POWER is out of operation because there is no mains voltage, the fuse on the primary side has been triggered, or the device is faulty.

Function



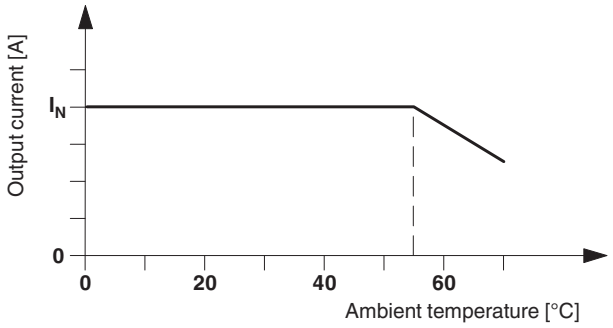
Output characteristic curve

The device functions following the U/I characteristic curve. Under load, the working point follows this curve. The output current is limited in the event of a short circuit or overload. Thereby, the device does not switch off, but rather supplies a continuous output current.
The secondary voltage is reduced until the short circuit or overload on the secondary side has been remedied. The U/I characteristic curve ensures that both heavily capacitive loads and loads with DC/DC converters in the primary circuit can be supplied. Downstream fuses are triggered. Selectivity in the design of your system is guaranteed at all times.

U_N = 24 V

I_N = 40 A

P_N = 960 W

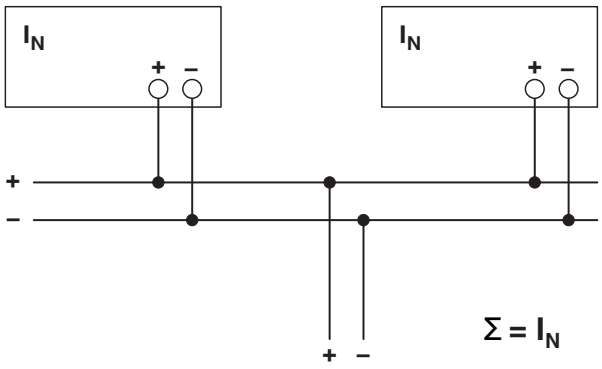


Thermal behavior

With an ambient temperature of up to +55°C, the device supplies the continuous output current of I_N. In the case of ambient temperatures above +55°C, the output current must be reduced by 2.5% per Kelvin increase in temperature. The device does not switch off at ambient temperatures of +70°C or thermal overload. The output capacity is reduced as far as necessary to provide device protection. After it has cooled down, the output capacity is increased again.

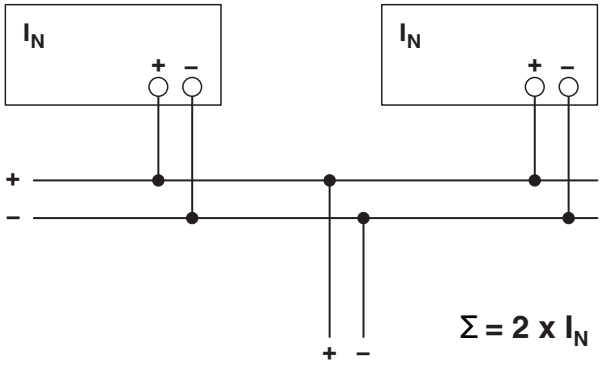
Parallel operation

Devices of the same type can be connected in parallel to enable both redundancy and an increase in efficiency. No other alignment is necessary when in the state of delivery.
If the output voltage is adjusted, a uniform distribution of power is guaranteed by setting all parallel operated power supply units to exactly the same output voltage.
To ensure symmetrical distribution of power, we recommend designing all cable connections from the power supply unit to a busbar of the same length and with the same conductor cross section. The system makes it advisable to install a protective circuit at the output of each device when more than two power supply units are connected in parallel (e.g. decoupling diode or DC fuse). This prevents high reverse feed currents in the event of a secondary device fault.



Redundant operation

Redundant circuits are suitable for the supply of systems which make especially high requirements on the operational safety. If a fault occurs in the primary circuit of the first power supply unit, the second device automatically takes over the entire power supply, without interruption, and vice versa. For this reason, the power supply units to be connected in parallel are dimensioned in such a way that the total current requirement of all consumers can be completely covered by one power supply unit. 100% redundancy makes external decoupling diodes necessary (QUINT-DIODE/40, Order No. 2938963)!



Increased performance

For n parallel connected devices, the output current can be increased to n x I_N. Parallel connection to increase efficiency is used for the expansion of existing systems. It is advisable to use parallel connection if the power supply unit does not cover the current requirement of the most powerful consumer. Otherwise the consumers should be spread among individual devices independent of one another. A maximum of five devices can be connected in parallel!

Declaration of compliance with China RoHS – Devices

Power supply unit - TRIO-PS/3AC/24DC/40 - 2866404

Primary-switched TRIO POWER power supply for DIN rail mounting, input: 3-phase, output: 24 V DC/40 A

We herewith declare the compliance of this product with the Chinese marking requirements set forth in the “Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products” (Order No. 32 of the MITT, etc.) and SJ/T 11364-2014 marking for the restriction of the use of hazardous substances in electrical and electronic product.

This product can be recycled and used safely during its environmentally friendly use period.



The Environmentally Friendly Use Period (EFUP) for the product is 25 years, unless otherwise marked. The Environmentally Friendly Use Period is valid only when the product is operated under the conditions defined in the product documentation.

This product should be recycled after its environmental protection use period has expired because it may contain substances or elements as shown in the following table:

	Hazardous Substance					
Part Name	**Lead (Pb)**	**Mercury (Hg)**	**Cadmium (Cd)**	**Hexavalent Chromium (Cr(VI))**	**Polybrominated biphenyls (PBB)**	**Polybrominated diphenyl ethers (PBDE)**
Electronic supplement[1]	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572

The table shows where these substances may be found in this Electrical and Electronic Product.

[1]) Electronic supplement includes additional parts which are not independent devices and are delivered with this article, for example a memory card for a controller.

Declaration of compliance with China RoHS – Devices

The information on substances corresponds to our present knowledge as well as the status of legislation mentioned in this declaration on the date of issue. In this respect we specifically take the statements and indications of our suppliers and service providers as a basis.

Issued at 2018-02-15 by:

Phoenix Contact GmbH & Co. KG
Flachsmarktstr. 8
32825 Blomberg
Germany

Phone: +49 52 35/3-00
Fax: +49 52 35/3-4 12 00

www.phoenixcontact.net/product/2866404
Download this document

Should you have any further questions please contact: DE-product_compliance@phoenixcontact.com

© All rights reserved.

EU-Konformitätserklärung Nr. 2320212.CE.06
EU-Declaration of Conformity No.

Hersteller / *Manufacturer*: **PHOENIX CONTACT GMBH & CO. KG**

Anschrift / *Address*: Flachsmarktstraße 8, D-32825 Blomberg, Germany

Produktbezeichnung / *Product description*: **QUINT-UPS/24DC/24DC/ 5**

(Artikelbezeichnung, / *Article description*, Artikel-Nr. / *Article no.*) **2320212**

Der obige Hersteller erklärt in alleiniger Verantwortung, dass das/die hier bezeichnete(n) Produkt(e) mit den wesentlichen Anforderungen der nachfolgend genannten Richtlinie(n) übereinstimmt / *The above manufacturer declares in sole responsibility, that the here specified product(s) is/are in line with the essential requirements of the following directive(s):*

2011/65/EU	**Beschränkung der Verwendung bestimmter gefährlicher Stoffe** **Restriction of the use of certain hazardous substances (RoHS)**
2014/30/EU	**EMV-Richtlinie (Elektromagnetische Verträglichkeit)** **Electromagnetic Compatibility Directive (EMC)**

Für die Beurteilung der Übereinstimmung wurden folgende einschlägige Normen herangezogen:
For evaluation of the conformity following relevant standards were consulted:

EN 61000-6-2:2005 EN 61000-6-3:2007+A1:2011 EN 50581:2012

Weitere Informationen (z. B. Dokumente, Prüfberichte, Einschränkungen, etc.) zur Konformitätsbewertung:
Additional information (for example documents, test reports, restrictions etc.,) of the conformity assessment:

Zertifikate einer benannten Stelle / *Certificates by a notified body*:

Anschrift / *Address*:

Referenz / *Reference*:

Anschrift / *Address*:

Referenz / *Reference*:

Die letzten beiden Ziffern des Jahres in dem die CE-Kennzeichnung angebracht wurde:
The last two figures of the year in which the CE marking was applied:
(nur einzutragen, bei der Niederspannungsrichtlinie / *only to be entered on the low voltage directive*)

☒ Diese Erklärung gilt auch für die im Anhang aufgelisteten Produkte. (wenn angekreuzt)
This declaration also applies for the products listed in the annex. (if marked with a cross)

Diese Erklärung bescheinigt die Übereinstimmung mit den wesentlichen Anforderungen der genannten Richtlinie(n), enthält jedoch keine Zusicherung von Eigenschaften. Die Sicherheits- und Einbauhinweise der mitgelieferten Produktdokumentation sind zu beachten.
This declaration certifies the conformity with the essential requirements of the indicated directive(s), it does not, however, covenant any characteristics. The instructions for safety and installation of the enclosed product documentation have to be observed.

Blomberg, 2018-05-02

i. A. Werner Meyer
Werner Meyer
Business Unit Power Supplies
Manager Quality Engineering & Testing
Ansprechpartner / *contact person*

i. A. Dr. Emsermann
Dr.-Ing. Mathias Emsermann
Business Unit Power Supplies
Director Research and Development
Zeichnungsberechtigter / *authorized signatory*

Anhang zur EU-Konformitätserklärung Nr. 2320212.CE.06
Annex on EU Declaration of Conformity No.
vom / dated 2018-05-02

Produktbezeichnung / *Product description*: **QUINT-UPS/24DC/24DC/ 5**

(Artikelbezeichnung, / *Article description*,
Artikel-Nr. / *Article no.*) **2320212**

Die Konformität mit den wesentlichen Anforderungen der Richtlinie(n) wird auch für folgende Produkte bescheinigt:
The conformity with the essential requirements of the directive(s) is also certified by the declaration for following products.

Artikel-Nr. / *Article no.*	Artikelbezeichnung / *Article description*
2320225	QUINT-UPS/24DC/24DC/ 10
2320238	QUINT-UPS/24DC/24DC/ 20
2320241	QUINT-UPS/24DC/24DC/ 40
2320254	QUINT-UPS/ 24DC/ 24DC/ 5/1.3AH
2320267	QUINT-UPS/ 24DC/ 24DC/10/3.4AH

QUINT-UPS/ 24DC/ 24DC/40



Uninterruptible power supply

INTERFACE

Data sheet
104660_en_03

© PHOENIX CONTACT 2019-05-22

1 Description

Uninterruptible power supplies (UPS) continue to deliver power even if the mains breaks down.

An uninterruptible solution consists of three function units:

- Power supply
- Electronic switchover unit
- Power storage device

The product described here is an electronic switchover unit. In the event of mains breakdowns or failures, it switches to battery operation without interruption so that loads continue to be consistently supplied.

As an option, you can monitor and configure the device with the free UPS-CONF software. The IFS-CONFSTICK memory stick is available for convenient transfer of parameters between more than one QUINT-UPS.

Features

- IQ technology for maximum system availability. The intelligent battery management optimizes and keeps you informed on the remaining runtime, current state of charge, service life and performance of the power storage device.
- Generous power reserve POWER BOOST
- Optimum use of the buffer time
- Preventive battery monitoring
- Fast battery charging
- Extensive signaling and parameterization
- SFB technology

Make sure you always use the latest documentation.
It can be downloaded from the product at www.phoenixcontact.net/catalog.

This data sheet is valid for all products listed on the following page:

2 Table of contents

1 Description ... 1
2 Table of contents ... 2
3 Ordering data ... 3
4 Technical data ... 4
5 Safety regulations and installation notes ... 8
6 Structure ... 9
7 Basic circuit diagram ... 11
8 Installation ... 12
8.1 Convection ... 12
8.2 Mounting position ... 12
8.3 Mounting on a DIN rail ... 13
8.4 Connection terminal blocks ... 14
8.5 Installation of individual components ... 15
9 Connection and protection ... 16
9.1 Input and protection of the primary side ... 16
9.2 Output and protection on the secondary side ... 16
9.3 Power storage device ... 17
9.4 SFB technology ... 17
9.5 Power reserves ... 17
9.6 Temperature response ... 17
10 Signaling ... 18
10.1 LED and bar graph test ... 19
10.2 LED indicator ... 19
10.3 Bar graph-display when the communication cable is installed ... 20
10.4 Bar graph display without communication cable ... 20
11 Function ... 21
11.1 IQ technology ... 21
11.2 SOC application example ... 21
11.3 SOH/SOF application example ... 21
11.4 Charging characteristic ... 22
11.5 Fast battery charging, intelligent charging (contact I< IN) ... 22
11.6 Setting the buffer time ... 23
11.7 PC mode ... 23
11.8 Remote control (contact R1, R2) ... 25
12 Interfaces ... 25
12.1 IFS-USB-DATACABLE ... 25
12.2 IFS-CONFSTICK ... 25
13 Servicing ... 26
14 Application examples ... 27
14.1 Parallel connection of the power storage devices ... 27
14.2 Parallel connection for redundancy ... 28

3 Ordering data

Description	Type	Order No.	Pcs. / Pkt.
Uninterruptible power supply with IQ technology 24 V/40 A. Provides information regarding the charging state, remaining runtime, and service life of your rechargeable battery module at all times and thereby increases system availability.	QUINT-UPS/ 24DC/ 24DC/40	2320241	1

Accessories	Type	Order No.	Pcs. / Pkt.
Rechargeable battery module, lead AGM, VRLA technology, 24 V DC, 7.2 Ah, tool-free battery replacement, automatic detection and communication with QUINT UPS-IQ	UPS-BAT/VRLA/ 24DC/ 7.2AH	2320319	1
Rechargeable battery module, lead AGM, VRLA technology, 24 V DC, 12 Ah, tool-free battery replacement, automatic detection and communication with QUINT UPS-IQ	UPS-BAT/VRLA/ 24DC/12AH	2320322	1
Rechargeable battery module, LI-ION technology, 24 V DC, 60 Wh, for ambient temperatures of -20°C ... +60°C, automatic detection and communication with QUINT UPS-IQ	UPS-BAT/LI-ION/24DC/60WH	2320351	1
Rechargeable battery module, lead AGM, VRLA technology, 24 V DC, 38 Ah, automatic detection and communication with the QUINT UPS-IQ	UPS-BAT/VRLA/ 24DC/38AH	2320335	1
Configuration software for QUINT UPS can be downloaded free of charge.	UPS-CONF	2320403	1
Used for communication between the UPS CONF configuration software and the QUINT UPS IQ and TRIO UPS uninterruptible power supply units.	IFS-USB-DATACABLE	2320500	1
Multi-functional memory blockfor the INTERFACE systemf for easy storage and backup of the configuration.	IFS-CONFSTICK	2986122	1

4 Technical data

Input data	
Nominal input voltage	24 V DC
DC input voltage range	18 V DC ... 30 V DC
Buffer period	0.5 h ()
Current consumption mains mode Max. No load Charging process	 51.9 A 66 mA 6.9 A
Fixed connect threshold	≤ 22 V DC

Output data	
Nominal output voltage	24 V DC
Output voltage range	18 V DC ... 30 V DC
Nominal output current	40 A
Derating	60 °C ... 70 °C (2.5%/K)
Output current limit	(In mains mode according to connected upstream current limiting device) > 45 A (Battery operation)
Power dissipation (mains mode) Idle Nominal Load BOOST	 1.6 W 9.3 W 10.3 W
Power dissipation (battery operation) Idle Nominal Load BOOST	 1.4 W 20.9 W 26.5 W
Output power	960 W
Efficiency	> 98.7 %
Connection in parallel	Yes, up to 2 modules with redundancy module
Connection in series	No

Output data (mains operation)	
Nominal output voltage	24 V DC
Output voltage range	18 V DC ... 30 V DC
Output current (according to connected upstream power supply unit) Nominal output current I_N POWER BOOST I_{BOOST} SFB technology I_{SFB}	 40 A (-25 °C ... +60 °C) 45 A (-25 °C ... +40 °C) 215 A (-25 °C ... +60 °C)
Duration	12 ms (SFB technology)

Output data (battery operation)	
Nominal output voltage	24 V DC
Output voltage range	19.2 V DC ... 27.6 V DC (U_{OUT} = U_{BAT} - 0.5 V DC)
Output current Nominal output current I_N POWER BOOST I_{BOOST} SFB technology I_{SFB}	 40 A (-25 °C ... +60 °C) 45 A (-25 °C ... +40 °C) 215 A (-25 °C ... +60 °C)
Duration	15 ms (SFB technology)

Power storage device	
Nominal voltage U_N	24 V DC
End-of-charge voltage	24 V DC ... 29 V DC (temperature compensated)
Temperature compensation	42 mV/K (preset)
Nominal capacity range	7 Ah ... 200 Ah
Charge current	0.2 A ... 5 A
Battery presence check (time interval)	1 min

Power In OK	
Status display	LED / Static to / green

Alarm	
Inverting with the UPS-CONF configuration and management software	
Switching output	Relay
Maximum switching voltage	≤ 30 V AC/DC
Maximum switching current	≤ 100 mA
Status display	LED / Static to / red

Battery charge	
Signal options are adjustable with the UPS-CONF configuration and management software	
Switching output	Relay
Maximum switching voltage	≤ 30 V AC/DC
Maximum switching current	≤ 100 mA
Status display	LED bar graph / dynamic / green

Battery mode	
Signal options are adjustable with the UPS-CONF configuration and management software	
Switching output	Relay
Maximum switching voltage	≤ 30 V AC/DC
Maximum switching current	≤ 100 mA
Status display	LED / Static to / yellow

General data	
MTBF	> 500000 h
Mounting position	horizontal DIN rail NS 35, EN 60715
Housing material	Steel sheet, zinc-plated
Dimensions W / H / D	47 mm / 130 mm / 125 mm
Dimensions W / H / D (90° turned)	122 mm / 130 mm / 50 mm
Weight	0.7 kg

Security	
Degree of protection	IP20
Protection class	III

Connection data

Connection method	Screw connection
Conductor cross section, solid	0.5 mm² ... 16 mm²
Conductor cross section, stranded	0.5 mm² ... 16 mm²
Conductor cross section AWG/kcmil	8 ... 6
Stripping length	10 mm
Screw thread	M4
Tightening torque	1.2 Nm ... 1.5 Nm

Ambient conditions

Ambient temperature (operation)	-25 °C ... 70 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Max. permissible relative humidity (operation)	≤ 95 % (25°C, no condensation)
Vibration (operation)	< 15 Hz, amplitude ±2.5 mm in acc. with IEC 60068-2-6 15 Hz ... 150 Hz, 2.3 g t_v = 90 min.
Shock	30g in all directions in acc. with IEC 60068-2-27
Climatic class	3K3 (in acc. with EN 60721)

Standards

Electrical safety (of information technology equipment)	EN 60950-1/VDE 0805 (SELV) EN 61558-2-17
Electronic equipment for use in electrical power installations	EN 50178/VDE 0160 (PELV)

Approvals

UL approvals	UL/C-UL Recognized UL 60950 UL Listed UL 508

Conformance with EMC Directive 2004/108/EC		
Noise immunity according to EN 61000-6-2		
	EN 61000-6-2 requirement	**Tested**
Electrostatic discharge EN 61000-4-2		
Housing contact discharge	4 kV (Test intensity 2)	8 kV (Test intensity 4)
Housing air discharge	8 kV (Test intensity 3)	15 kV (Test intensity 4)
Comments	Criterion B	Criterion A
Electromagnetic HF field EN 61000-4-3		
Frequency range	80 MHz ... 1 GHz	80 MHz ... 1 GHz
Test field strength	10 V/m	20 V/m
Frequency range	1.4 GHz ... 2 GHz	1 GHz ... 3 GHz
Test field strength	3 V/m (Criterion A)	10 V/m (Test intensity X / 3)
Fast transients (burst) EN 61000-4-4		
Input	2 kV (Test intensity 3 - asymmetrical)	2 kV (Test intensity 3 - asymmetrical)
Output	2 kV (Test intensity 3 - asymmetrical)	2 kV (Test intensity 3 - asymmetrical)
Signal	1 kV (Test intensity 3 - asymmetrical)	2 kV (Test intensity 4 - asymmetrical)
Comments	Criterion B	Criterion A
Surge current loads (surge) EN 61000-4-5		
Input/Output	+/- 0.5 kV (Asymmetrical) 0.5 kV (symmetrical)	1 kV (symmetrical) 2 kV (Asymmetrical)
Signal	+/- 1 kV (Asymmetrical)	1 kV (Asymmetrical)
Comments	Criterion B	Criterion A
Conducted interference EN 61000-4-6		
Input/Output/Signal	asymmetrical	asymmetrical
Frequency range	0.15 MHz ... 80 MHz	0.15 MHz ... 80 MHz
Voltage	10 V (Test intensity 3)	10 V (Test intensity 3)
Comments	Criterion A	Criterion A

Emitted interference in acc. with EN 61000-6-3	
Radio interference voltage in acc. with EN 55011	EN 55011 (EN 55022) Class B, area of application: Industry and residential
Emitted radio interference in acc. with EN 55011	EN 55011 (EN 55022) Class B, area of application: Industry and residential

5 Safety regulations and installation notes



EXPLOSION HAZARD

Only remove equipment when it is disconnected and not in the potentially explosive area!

DANGER

Never carry out work on live parts!
The housing can become very hot, depending on the ambient temperature and load!



CAUTION:

Before startup please ensure:

The connection must be carried out by a competent person and protection against electric shock guaranteed.

It must be possible to switch off power to device according to EN 60950.

All feed lines are sufficiently protected and dimensioned!

All output lines are dimensioned according to the maximum output current of the device or separately protected!

Sufficient convection must be guaranteed.

Observe mechanical and thermal limits.



ATTENTION: Danger if used improperly

Uninterruptible power supplies are installable devices. Installation and startup may only be carried out by qualified personnel. The relevant country-specific regulations must be observed.



CAUTION: Risk of injury

Cover termination area after installation in order to avoid accidental contact with live parts (e. g., installation in control cabinet).



Do not dispose of used batteries in the household waste! Dispose of these according to the currently valid national regulations.



They can also be returned to Phoenix Contact or the manufacturer.



CAUTION: Risk of injury

Use the device with the UPS-BAT.... recommended in the table of accessories. When using power storage devices other than UPS-BAT..., make sure that the corresponding parameters for the charging characteristics are adjusted and adhered to.

Phoenix Contact accepts no liability or responsibility for possible for any consequential damage.

6 Structure

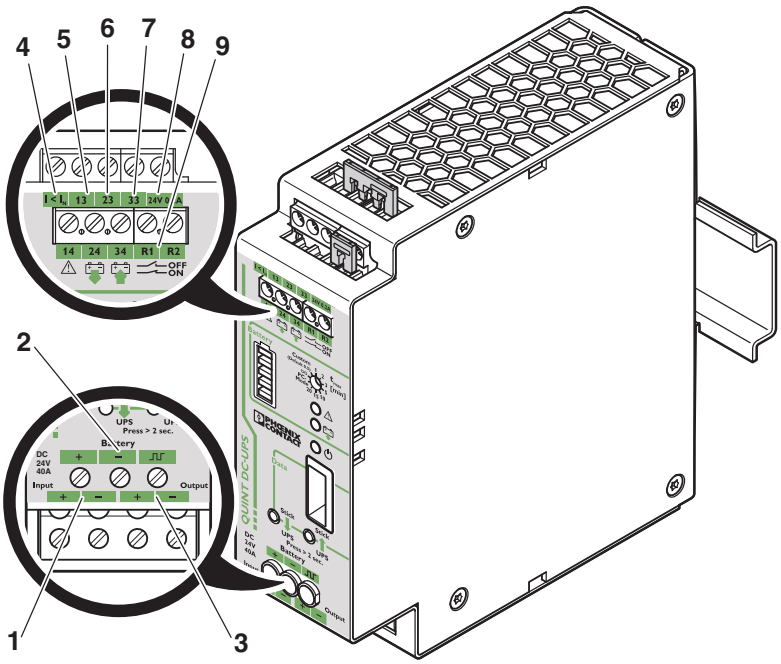


Figure 1 Connection terminal blocks

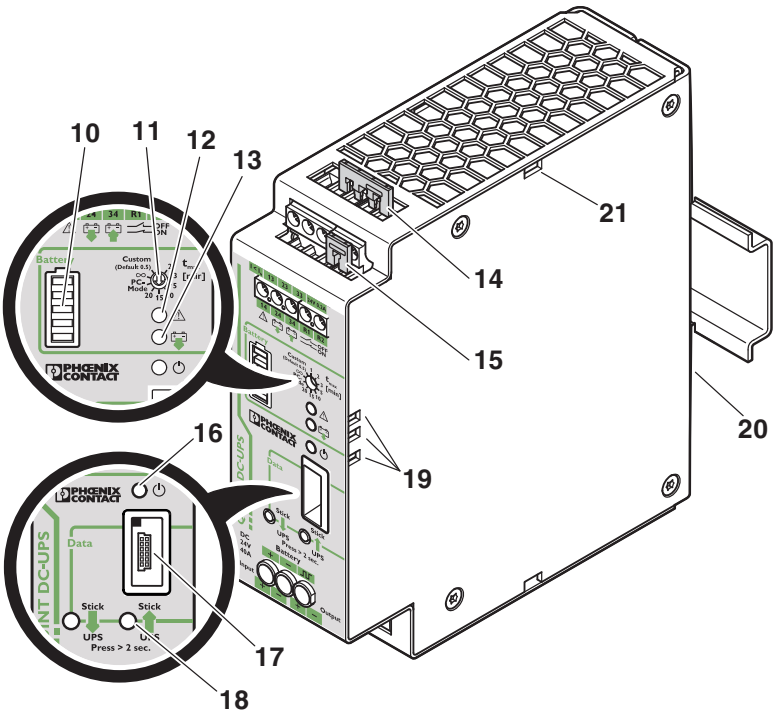


Figure 2 Function elements

Connections / Operating elements

1 DC input, 18 V DC ... 30 V DC

2 Power storage device connection, 24 V DC (+, -, communication between UPS and power storage device)

3 DC output, 24 V DC, buffered

17 Data port for data linking to the PC or the use of a memory block

18 Button for use of the memory block

Mains mode, charging

16 Green LED: Power In OK, mains mode

10 Bar graph for displaying the current charging state of the power storage device

7 Floating relay contact 33/34: battery charge

4 $I < I_N$, fast battery charging

Battery operation, discharging

13 Yellow LED: battery mode

6 Floating relay contact 23/24: battery mode

11 Buffer time setting: unlimited ≤ , 1 ... 20 mins., customized (customized default: 0.5), PC mode

9 Remote control (R1, R2)

15 Remote control plug-in bridge, pre-installed

General

12 Red LED: alarm

5 Floating contact 13/14: alarm

8 24 V DC supply voltage, maximum current limit 0.2 A for the signal contacts 13, 23, 33

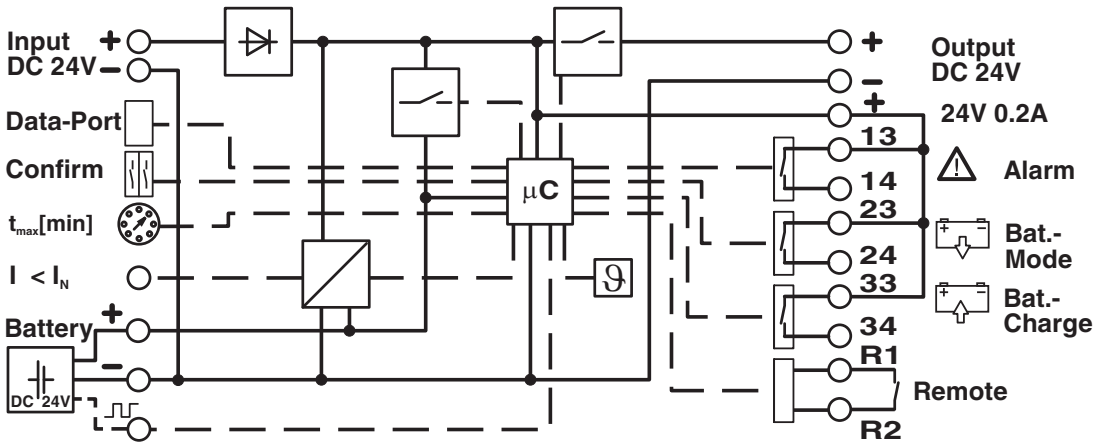
14 Plug-in bridge for signal contact supply voltages, pre-installed

19 LED windows for flat mounting position

21 Accommodation for cable binders

20 Universal snap-on foot for EN DIN rails

7 Basic circuit diagram



Element	Meaning
µC	Microprocessor
	Decoupling
	Charging unit
	Switch
ϑ	Temperature sensor
	Selector switch

8 Installation

8.1 Convection

The device supplies the specified values in the case of sufficient convection cooling and when mounted on a horizontal DIN rail.

To enable sufficient convection, we recommend a minimum vertical gap to other modules of 5 cm.
A lateral gap of 5 mm is recommendable.

The module can be snapped onto all DIN rails according to EN 60715 and must be mounted horizontally (connecting terminal blocks on top and bottom).

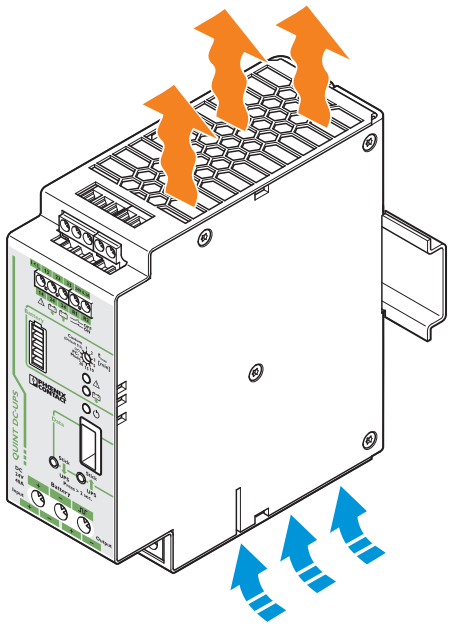


Figure 3 Convection

8.2 Mounting position

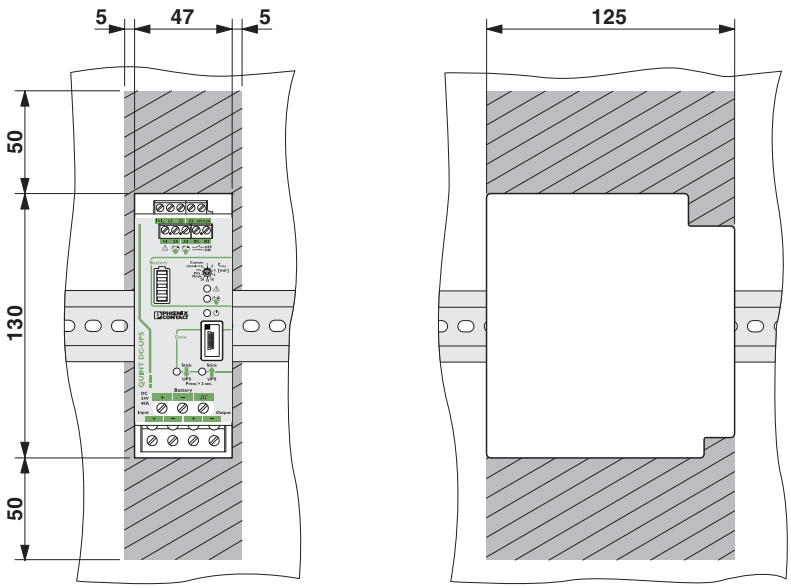


Figure 4 Installation dimensions

Installation depth 125 mm

8.3 Mounting on a DIN rail

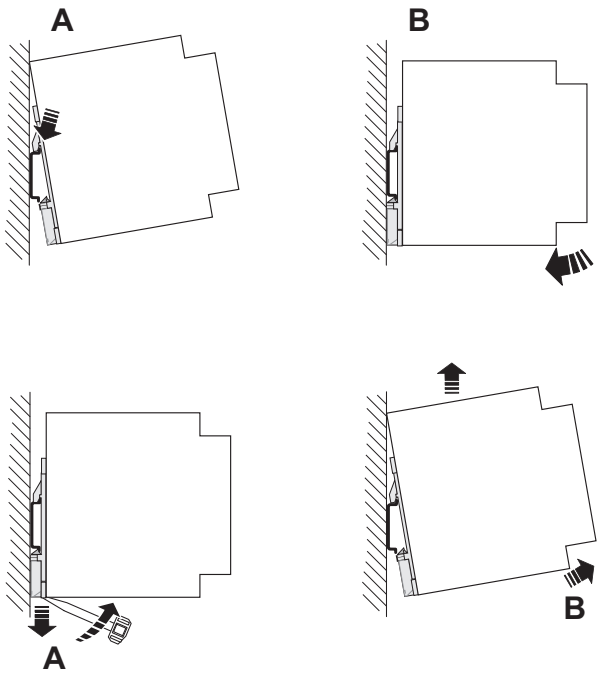


Figure 5 Mounting and removing

Slim-style installation

Assembly:

Position the module with the DIN rail guide on the upper edge of the DIN rail, and snap it in with a downward motion.

Removing:

Pull the snap lever open with the aid of a screwdriver and slide the module out at the lower edge of the DIN rail.

Mounting position rotated 90°

Low-profile installation can be achieved by mounting the device at right-angles to the DIN rail. Mount the DIN rail adapter (UTA 107) as described in the figure. No additional mounting material is required. Fixing screws: Torx T10 (torque 0.8 Nm ... 0.9 Nm).

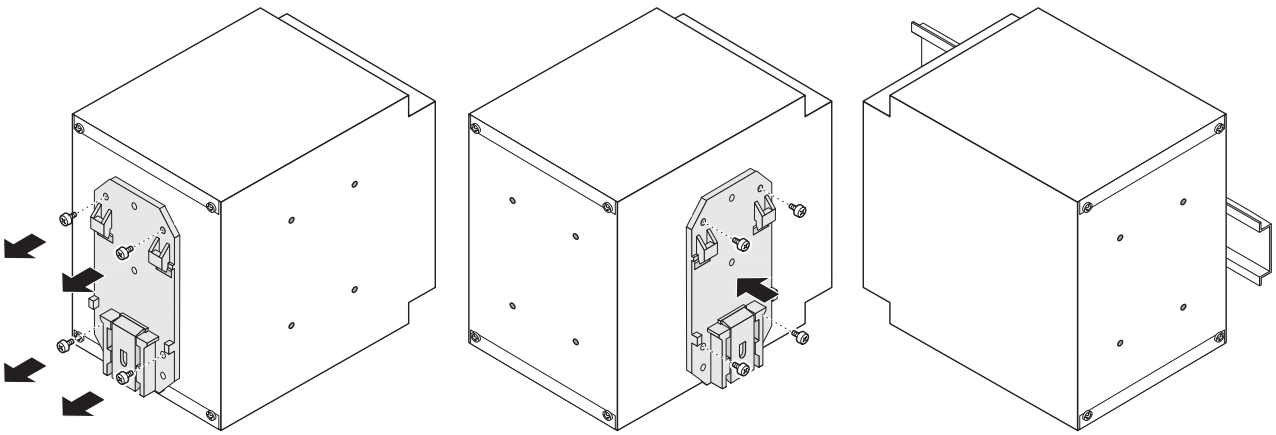


Figure 6 Mounting position rotated 90°

8.4 Connection terminal blocks

Use a screwdriver with a suitable blade width for wiring. For a reliable and touch-proof connection, use a suitable cable cross section and insulate the cable ends according to the above-mentioned specifications.

Terminal block	Solid conductor [mm^2]	stranded conductor [mm^2]	AWG	Stripping length [mm]	Torque [Nm]	Torque [lb in]
DC input: +/-	0.5 ... 16	0.5 ... 16	8 ... 6	10	1.2 ... 1.5	15
DC output: +/-	0.5 ... 16	0.5 ... 16	8 ... 6	10	1.2 ... 1.5	15
Battery: +/-/signal	0.5 ... 16	0.5 ... 16	20 ... 6	10	1.2 ... 1.5	15
Signals: R1, R2/I<I_N	0.2 ... 4	0.2 ... 2.5	24 ... 12	8	0.5 ... 0.6	5 ... 7

508:

Copper cable; operating temperature > 75°C (ambient temperature < 55°C) and > 90°C (ambient temperature < 75°C).

60950:

Use ferrules for flexible cables.

8.5 Installation of individual components

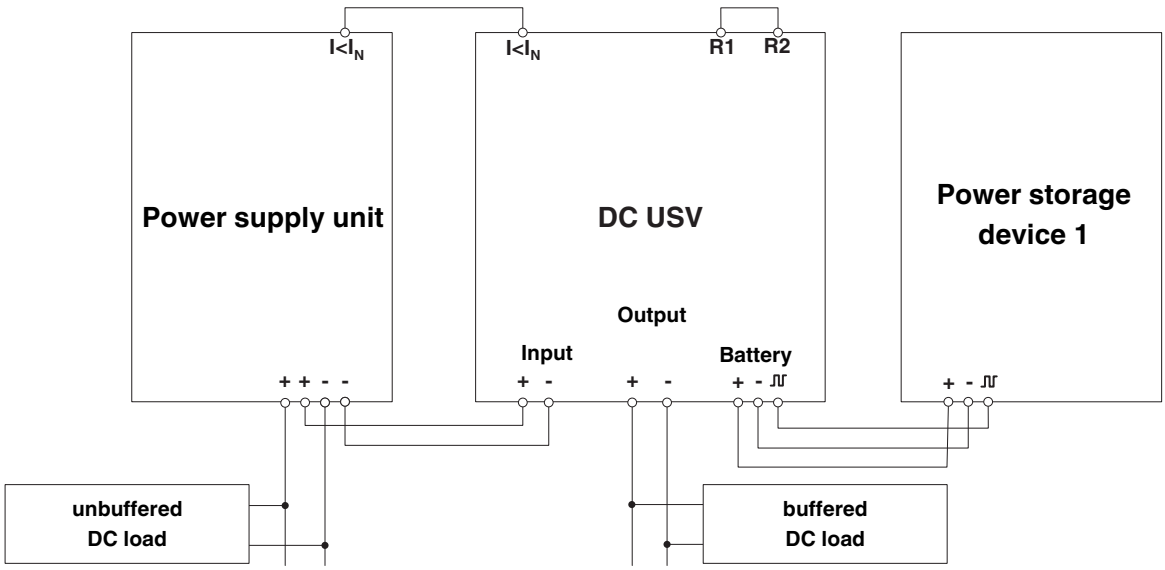


Figure 7 Schematic design

The image is a schematic representation of the design and does not contain all parts.

Observe the installation instructions.

Power supply unit

Use current-limited source (e. g., QUINT POWER power supply) or a suitable fuse. If loads must **not** be supplied in the event of a mains breakdown or failure, they must be connected directly to the output of the power supply as unbuffered DC load.

DC UPS

- Input: the input is supplied with 18 … 30 V DC.
- Output: in the event of mains interruption or failure, the connected DC load is supplied with voltage without interruption.
- Battery: the required power is made available by the power storage device. The signal cable is used for communication between the UPS and power storage device.
- Signal $I<I_N$: when connected to the $I<I_N$ output of the QUINT POWER power supply unit, the power supply unit is charged with the maximum charging current as quickly as possible (fast battery charging). Supply of the buffered DC load always has priority. This function is available when the power supply unit makes a static power reserve available with corresponding signal contact e. g., QUINT POWER with POWER BOOST and preventive function monitoring. Without this, charging is performed at reduced current.
- Signal R1, R2: remote control

Power storage device

Depending on the desired buffering time, select the power storage device listed under accessories.

VRLA power storage devices are temperature dependent. If possible and to ensure optimum function, install at a cool location e. g., at the bottom of the control cabinet.

9 Connection and protection

9.1 Input and protection of the primary side

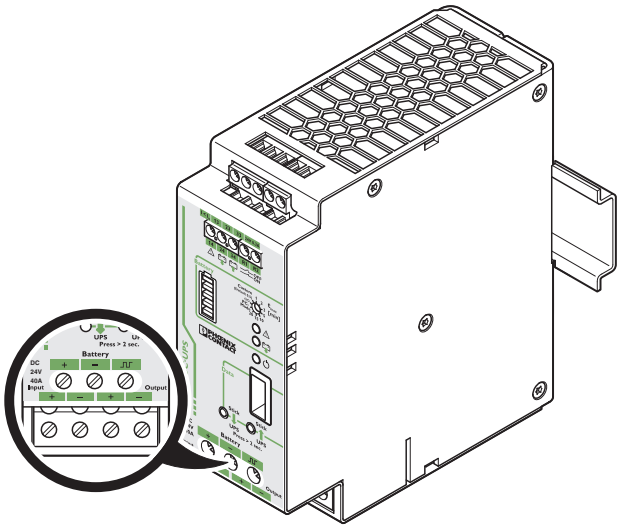


Figure 8 Input

Connection of the input is made via connection terminal blocks "Input +/-" (input reverse polarity protection).

The maximum current for each input is 53 A.

Therefore use a current-limited source (e. g., QUINT POWER) or a suitable fuse.

Installation of the device must correspond to EN 60950 regulations.

All cables must have large cross sections in order to keep voltage drops as small as possible.

9.2 Output and protection on the secondary side

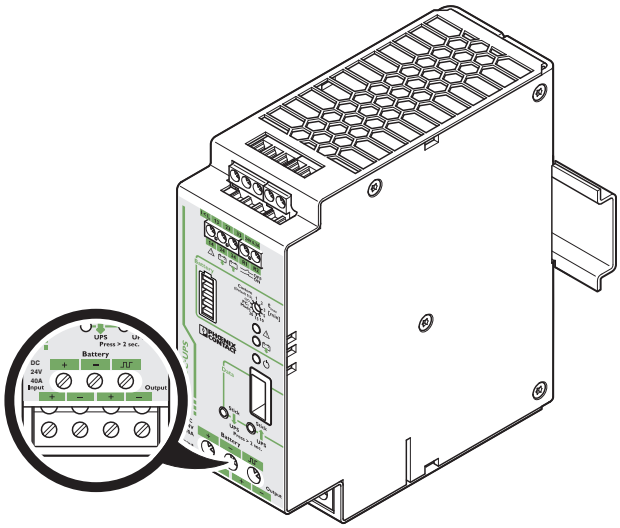


Figure 9 Output

Connection of the output takes place via the connection terminal block "Output +/-".

The device is electronically short-circuit-proof and idle-proof. In the event of a malfunction, the output voltage is limited to a maximum of 35 V DC. It must be ensured that all output cables are dimensioned or separately protected according to the maximum output current. All cables must have large cross sections in order to keep voltage drops as small as possible.

9.3 Power storage device

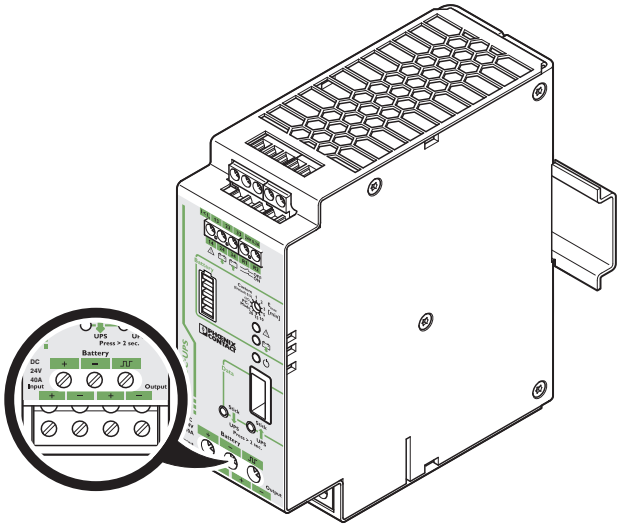


Figure 10 Output, battery

Connection of the power storage device takes place via the connection terminal block "Battery +/-". To make use of intelligent IQ technology, you must also install a cable for the communication between the UPS and power storage device.

You will find a clearly arranged selection table for suitable power storage devices next to the product at www.phoenixcontact.net/catalog.

9.4 SFB technology

SFB (Selective Fuse Breaking) technology reliably switches off faulty current paths in the event of a short circuit. It supplies six times the nominal current for 12 ms in mains mode and for 15 ms in battery mode. SFB technology therefore safely triggers standard circuit breakers. Faults are located reliably and important system parts remain in operation.

9.5 Power reserves

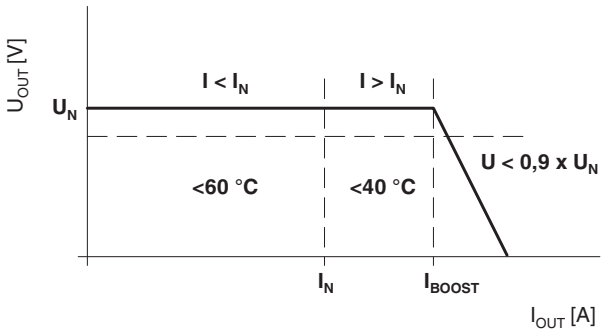


Figure 11 Output characteristic curve

Both the POWER BOOST static power reserve and the SFB (Selective Fuse Breaking) technology dynamic power reserve are available in mains and battery mode if a QUINT POWER power supply unit from Phoenix Contact is connected upstream.

In mains mode, the power reserve is forwarded to the buffered DC load via the UPS.

In battery mode, the power storage device supplies sufficient power to ensure the same behavior as a QUINT POWER power supply unit with SFB technology.

9.6 Temperature response

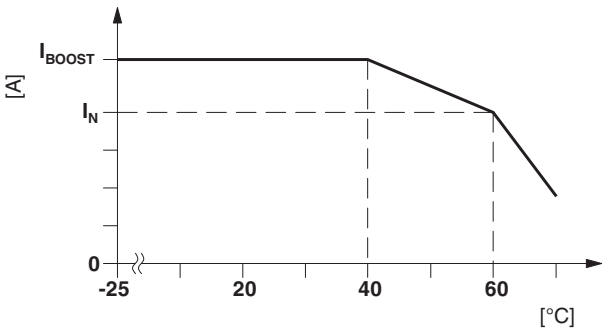


Figure 12 Derating diagram

At an ambient operating temperature of up to +40 °C, the UPS makes the I_{BOOST} continuous output current available. The device can supply the I_N nominal output current up to ambient temperatures of +60 °C. In the case of ambient temperatures above +60 °C, The output power must be decreased by 2.5 % per Kelvin temperature increase.

10 Signaling

Three LED indicators, an LED bar graph and three floating relay contacts are available for function monitoring.

In addition, you can use the UPS-CONF configuration and management software.

The software and the associated user manual are available free of charge at www.phoenixcontact.net/catalog.

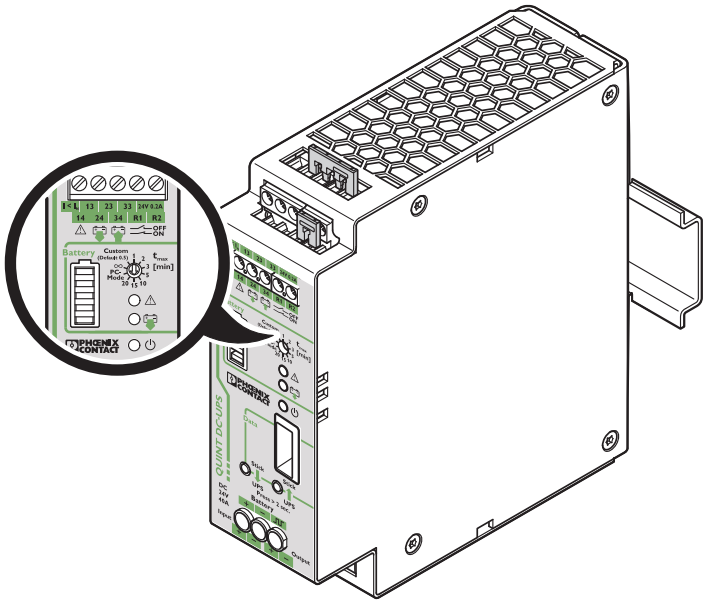


Figure 13 Display elements

State	LED	Switching output	Signal, default
Power In OK, mains mode	Green	-	-
Alarm	Red	13/14	Active low
Battery mode	Yellow	23/24	Active high
Battery charge	Bar graph	33/34	Active high

Alarms, warnings and/or operating states can be individually assigned to the battery mode and battery charge switching outputs via the UPS-CONF configuration and management software. Warnings are not indicated by the LED indicators.

ATTENTION:

LED indicator states are also simultaneously signaled via the switching outputs in the default settings. If an individual assignment of the switching outputs takes place, signal states deviating from the LED indicators are possible. Make sure that only sensible combinations are signaled.

10.1 LED and bar graph test

An LED test is performed automatically during startup of the device. The LEDs indicate the following error states:

1. All LEDs and the bar graph light up.
2. The LEDs light up, the bar graph does not light up, the lower bar changes its color from green to red.
3. All LEDs and the bar graph are off.
4. The LEDs and the bar graph light up according to their current status.

10.2 LED indicator

State	Green LED	Red LED	Yellow LED	Description
1	OFF	OFF	Lit	Battery mode, bar graph displays current charging state
2	OFF	Lit	Lit	Battery mode, power storage device is almost empty, lower bar graph LED is red
3	Lit	OFF	OFF	Mains mode, bar graph displays current charging state
4	Lit	Lit	OFF	Mains mode, alarm in the event of battery problem: lower bar graph LED flashes red

Green LED (mains mode), yellow LED (battery mode)

Either the green or the yellow LED lights up.

Green LED lights up, yellow LED is off: the load connected to the UPS is supplied from the mains.

Green LED off, yellow LED lights up: mains is not available. The load connected to the UPS is supplied by the power storage device.

Red LED, alarm in mains mode

Red LED lights up, the lower bar graph LED flashes red: there is a problem with the power storage device.

When using the UPS-BAT... power storage device and a connected communication cable, the current life expectancy (SOH, State of Health) is determined via the IQ technology. An alarm is signaled in the following cases:

– The adjustable threshold "remaining life expectancy" is reached.
– Different types of battery technology were connected that cannot be charged simultaneously, e. g. VRLA and LI-ION.
– The presence check is negative.
– The quality check is negative.

When using power storage devices other than UPS-BAT..., an alarm is signaled if it is not present or if the quality of the power storage device is no longer sufficient for supplying the load in the event of a mains failure.

If the lower bar graph LED does not flash, the alarm indicates overload or service mode.

Red LED, alarm in battery mode

Red LED lights up: the power storage device is almost completely discharged.

When using the recommended UPS-BAT power storage device and connected communication cable, the current charging state (SOC, State of Charge)., is displayed via the IQ technology. The preset alarm signaling threshold is 10%. The lower bar graph LED lights up red.

As an option, a time can be set via the UPS-CONF software, for example, 10 mins. In this case, the UPS signals an alarm when the power storage device is able to supply the connected load for a further 10 minutes.

When using power storage devices other than the UPS-BAT..., the alarm indicates battery voltage too low (default: 20.4 V).



ATTENTION:

Signaling of all states is determined by calculated, individual or preset thresholds and operating states. The detection that is the base of signaling takes place with high accuracy. However, detection is subject to the respective ambient conditions in each case. In particular power storage devices can contribute to further deviations, irrespective of the storage technology.

10.3 Bar graph-display when the communication cable is installed

The current charging state and the remaining runtime of the power storage device is determined during startup of the UPS. The LED light lights up from bottom to top during this (charging the battery in mains mode) or from top to bottom (discharging the battery in battery mode).

When the power storage device is fully charged and the charging state is determined, this is displayed by the bar graph. Depending on the charging state and the size of the power storage device, this can range from a few minutes to hours.

Each LED corresponds to 20% of the total capacity. The lowest LED is divided into two parts: red for 0-10%, green for 11-20%.

The current capacity level is indicated by flashing during charging.

10.4 Bar graph display without communication cable

If no communication cable is installed between the UPS and the power storage device, the LEDs indicate the following states during startup of the UPS in mains mode.

The upper 4 LEDs are off.

The lower LED can indicate the following states.

– Flashing: power storage device is being charged
– Off: power storage device is not being charged
– Red: battery problem

11 Function

In mains mode (DC input voltage present), the output voltage corresponds to the applied input voltage. In the event of a failure of the voltage supply, switching to battery mode takes place without interruption. The output voltage is not directly dependent on the battery voltage.

11.1 IQ technology

Intelligent Battery Management

- SOC (State of Charge): current charging state and remaining runtime of the power storage device is always available.
- SOH (State of Health): displays the remaining life expectancy of the power storage device and warns of failures at an early stage.
- SOF (State of Function): determines the current performance of the power storage device.

Intelligent Battery Control

Intelligent Battery Control – automatically detects the connected battery type via the connected communication cable and maximizes the remaining service life of the power storage device via an optimally adapted charging characteristic.

Intelligent Charging

The device adapts the charging current and thereby ensures the fastest possible recharging and maximum availability

Intelligent Communication

The data port is used for communication between the UPS and PC, e. g., for configuring the UPS.

11.2 SOC application example

Task: an industrial PC must be continuously supplied with 24 V DC.

Previous solution: the UPS is buffered with 3.4 Ah and supplies 24 V DC / 5 A for 20 under optimum conditions Minutes

Problem: can the power storage device actually bridge this time? Charging state, performance and remaining runtime of the battery are unknown.

Solution with IQ technology:
The intelligent UPS determines all relevant battery states. This ensures the transparency required to guarantee the stability of the supply and optimum use of the battery at all times.

The intelligent battery management detects the current charging state of the connected battery and uses this to calculate the remaining runtime.

The QUINT UPS-IQ also signals whether the buffer time is actually 20 minutes. As soon as an adjustable threshold value is reached, the floating relay contact or the software generates a warning message or the PC is shut down. The industrial PC works for as long as possible and is shut down only if absolutely necessary.

11.3 SOH/SOF application example

Task: electrical loads in remote systems widely separated from each other must be continuously supplied with 24 V DC.

Previous solution: The user invests in a new battery every two years assuming that the system is reliably protected by this.

Problem: is the power storage device really 100% available for two years? Hs the battery aged more quickly as a result of higher ambient temperatures and cannot deliver sufficient performance?

Solution with IQ technology:
The remaining life expectancy of the battery is known. This allows servicing to be planned. If the battery is replaced at the ideal time, costs are also avoided that would occur by replacing the battery too early or after failure. It is particularly important for applications that are widely separated from each other to ascertain whether the battery works reliably for another two years or only two months. For example, replacing power storage devices in offshore wind power plants is associated with high costs. Indication of the current life expectancy of the battery saves unnecessary labor and material costs.

11.4 Charging characteristic

When the recommended UPS-BAT… power storage device is used, the intelligent battery management of the UPS adapts itself to the respective connected storage technology such as Lithium or lead (VRLA – Valve Regulated Lead Acid) batteries. Additional settings of charging parameters are not necessary due to automatic detection.

The UPS is equipped with an integrated charging unit. Charging is performed according to the current battery state. By measuring the current temperature at the battery, temperature-compensated charging takes place. The intelligent battery management ensures fast availability and maximum service life of the power storage device. Depending on the performance class of the UPS, the integrated charging unit can have the following maximum charging current.

UPS	Max. charging current
5 A	1.36 A
10 A	2.88 A
20 A	5 A
40 A	5 A

The recharging time results from the maximum available charging current and the total capacity of the storage device type connected.

Charge control depends on the IUoU charging characteristic. This is a 3-stage charging process that is represented as follows.

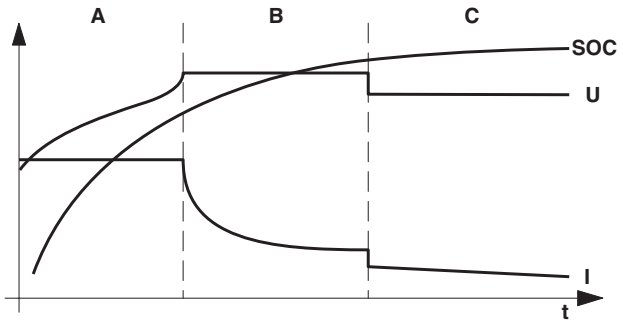


Figure 14 Charging curve

Stage	Name	Description
A	Main charge	Constant current charging phase (CC), initial charging current
B	Compensation charging	Constant voltage charging phase (CV), compensation trickle charge voltage
C	Trickle charging	Constant voltage charging phase (CV), trickle charging final voltage

If the communication cable between the UPS and the power storage device is interrupted, the temperature detected in the UPS module is used temporarily to ensure temperature compensation.

Temperature recording only takes place in the UPS module when using power storage devices other than the UPS-BAT…. In addition, adjustment and adherence to the charging parameters is necessary.

11.5 Fast battery charging, intelligent charging (contact $I < I_N$)

The adaptive current management of the charging unit charges the power storage device considerably faster when the $I<I_N$ input of the UPS is connected to the corresponding output of the power supply. This ensures shorter recharging times and the power storage device is available with full capacity much more quickly.

At the same time, the module supplies sufficient power for buffered DC loads. As long as the upstream connected power supply unit has sufficient power reserves, charging continues with high current. If the load requires a higher current, this is supplied at the highest priority. In this case the power storage device is charged more slowly.

The fast battery charging function is only available when the power supply unit makes a static power reserve available with corresponding signal contact, e. g., QUINT POWER with POWER BOOST and preventive function monitoring.

11.6 Setting the buffer time

You can set the time for exiting battery mode via the selection switch on the front of the device.

t_{max} [min] setting	Meaning
1, 2, 3, 5, 10, 15, 20	The UPS switches off after the set buffer time.
Custom (default 0.5)	The UPS switches off after the individual buffer time set via UPS-CONF.
≤ (unlimited, delivery state)	Buffering with the total stored power. A warning is generated as soon as the power storage device only has 10 % charge (default).
PC mode	In PC mode, it is possible to continue working with a PC after a mains failure, perform a controlled shutdown and restart automatically.

11.7 PC mode

In "PC mode", the UPS function follows a chronological sequence that can be parameterized via the software and individually optimized for the relevant application.

In the event of a mains failure, PC can continue to work, perform a controlled shutdown and restart automatically.



It is required that the following is installed:

IFS-USB-DATACABLE data cable (Order No. 2320500)

UPS-CONF software (Order No. 2320403, available free of charge at www.phoenixcontact.net/catalog)

Communication cable between the UPS and the power storage device

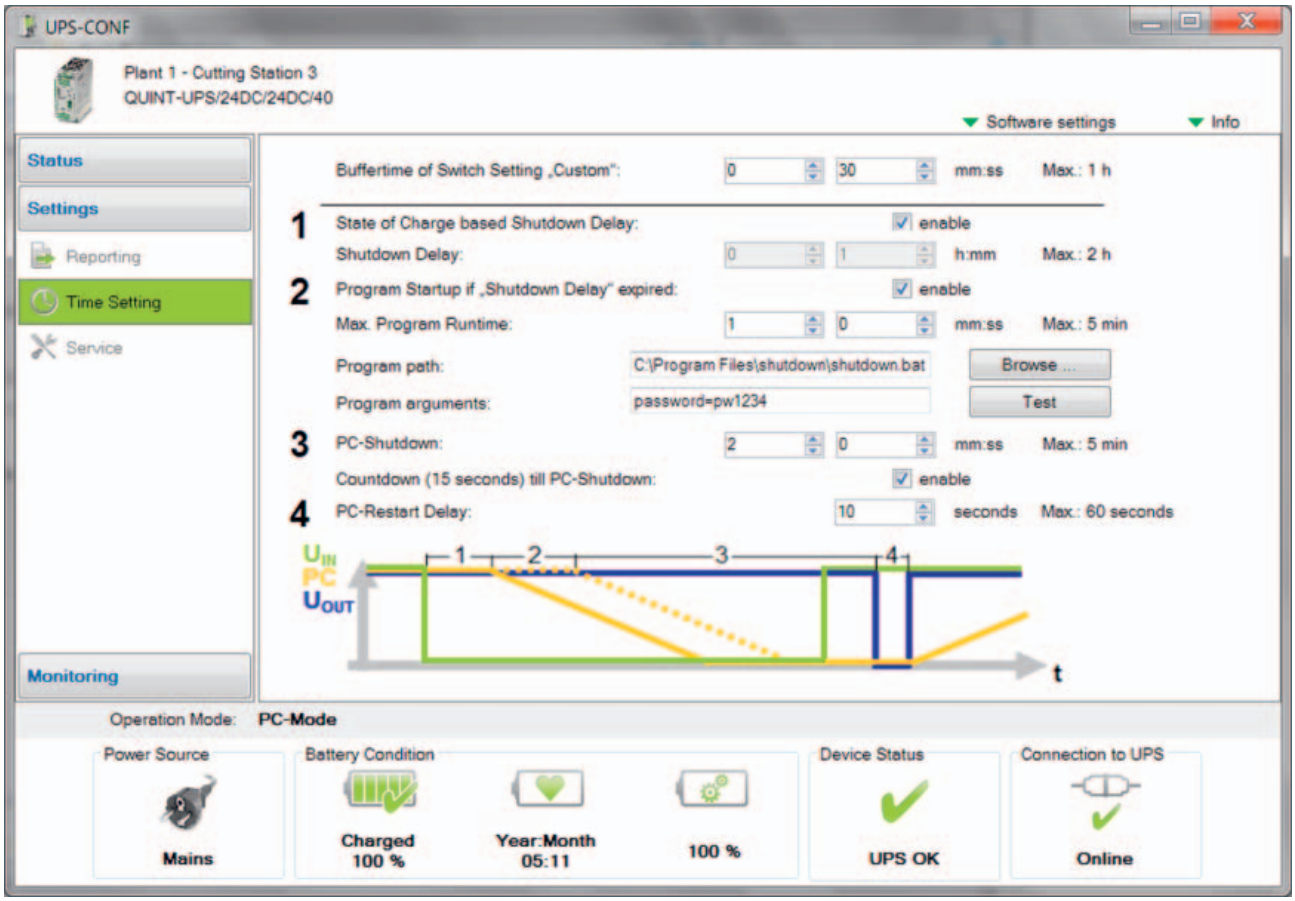


Figure 15 PC mode

1: Delay time

Delay time is calculated automatically from the current remaining battery life minus the time required by the PC to shut Delay time is calculated automatically from the current remaining battery life minus the time required by the PC / IPC to shut-down. Alternatively, a fixed delay time may be chosen.

Example: setting is 10 mins. and if mains power has not returned within 10 minutes, a corresponding alarm is signaled.

2: Program start

After the delay time has expired, it is possible to start a program.

Example: the software starts and begins successive back up of system data.

In the "PC-Mode" setting, on the selection switch of the UPS, the UPS function follows a chronological sequence that can be parameterized via the software and individually optimized for the relevant application

Menu: Settings > Time setting

3: PC shut-down

The time required for shutdown of the PC is set here.

4: PC idle time

The output voltage is interrupted during the reset time and the PC automatically restarted only if the PC is shut down and the mains returned in the mean time

11.8 Remote control (contact R1, R2)

The module can be switched on and off via a signal to contacts R1 / R2. Shutdown can take place in mains mode or while battery mode is active

Remote shutdown is deactivated

UPS in function (delivery state)

– The "R1" and "R2" terminal points are short circuited (delivery with plug-in bridge) OR 24 V DC is present at terminal point "R2".
– In the event of a voltage supply failure, the UPS switches over to battery mode.

Remote shutdown is activated

– The "R1" and "R2" terminal points are not short circuited AND O V is present at terminal point "R2".
– In the event of a voltage supply failure, the UPS does not switch over to battery mode and the device shuts down.

12 Interfaces

Optionally, you can the data port interface.

12.1 IFS-USB-DATACABLE

The module is connected via the data port to the USB port of the PC using the IFS-USB-DATACABLE.

The data cable between the PC and the UPS is necessary for parameterization and monitoring. It contains the interface electronics and electrical isolation.

12.2 IFS-CONFSTICK

The IFS-CONFSTICK is a multi-functional memory block for easy storage and backup of configuration and parameter data. You can copy the parameterization of one UPS to another UPS of the same type using the IFS-CONFSTICK.

Transferring UPS parameters to the IFS-CONFSTICK

1. Press the "UPS -> Stick" button and hold for at least 2 seconds.
2. Insert the IFS-CONFSTICK carefully into the "Data Port" of the UPS while observing the plug-in direction.
3. Parameter transfer is started and indicated by cyclic control of the three LED indicators. Light-up sequence: green/yellow/red

– Error-free transfer: green LED indicator on
– Transfer error: red LED indicator on

Transferring IFS-CONFSTICK parameters to the UPS

1. Press the "Stick -> UPS" button and hold for at least 2 seconds.
2. Insert the IFS-CONFSTICK carefully into the "Data Port" of the UPS while observing the plug-in direction.
3. Parameter transfer is started and indicated by cyclic control of the three LED indicators. Light-up sequence: green/yellow/red

– Error-free transfer: green LED indicator on
– Transfer error: red LED indicator on

13 Servicing

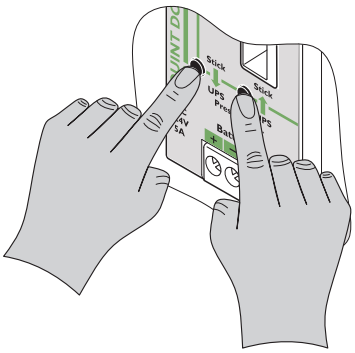
To switch to service mode, the following options are available:

– Button on the front of the UPS
– UPS-CONF software
– Service stick

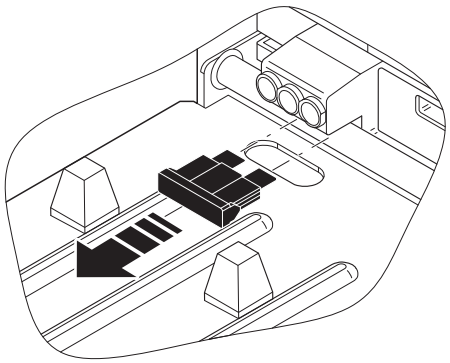
Details can be found in the UPS-CONF user manual at www.phoenixcontact.net/catalog.

Replacing the battery

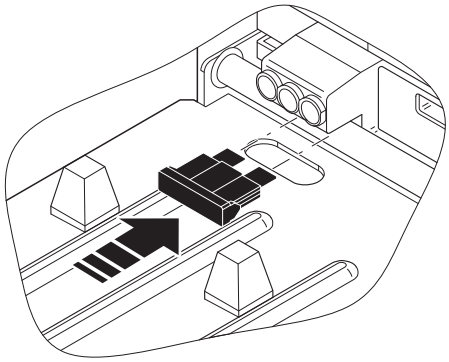
- Press and hold down both buttons on the front of the UPS longer than 6 s to switch to service mode.
  The red LED lights up.



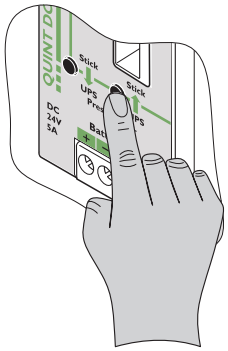
- Remove the fuses.



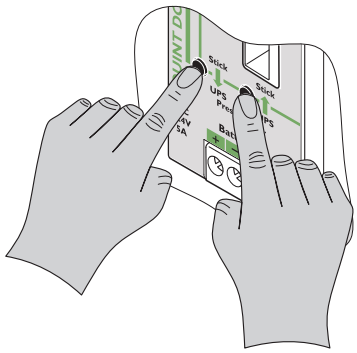
- Remove the cabling of the battery blocks.
- Remove the batteries.
- Install new batteries.
- Connect the cabling of the battery blocks.
- Insert the fuses.



- Press and hold down both buttons on the front of the UPS for longer than 6 s to register the batteries.
  The bar graph flashes.



- Press and hold down both buttons on the front of the UPS for longer than 6 s to exit the service mode.
  The red LED extinguishes.



An exact description of the replacement procedure for all power storage devices can be found in the corresponding data sheet at www.phoenixcontact.net/catalog.

14 Application examples

14.1 Parallel connection of the power storage devices

To increase the buffer time, a maximum of 15 power storage devices can be switched in parallel. It is recommended to keep the number as low as possible and use power storage devices with a higher capacity of necessary. For parallel operation, only use power storage devices with the same batch number .

After discharging of the power storage device, the recharging time depends on the maximum charging current that the UPS can make available.

Use a suitable fuse. Flat-type fuse inserts with the same nominal values from the battery used are recommended.

If possible, install at a cool location e. g., at the bottom of the control cabinet to ensure optimum function. For this, the following cabling design is advantageous.

Value	Description
l_1	Cable distance to the power storage device, to the node in the case of parallel connection, including fuse terminal block
mm^2	Conductor cross section to the power storage device
l_2	Cable distance between the power storage device and node

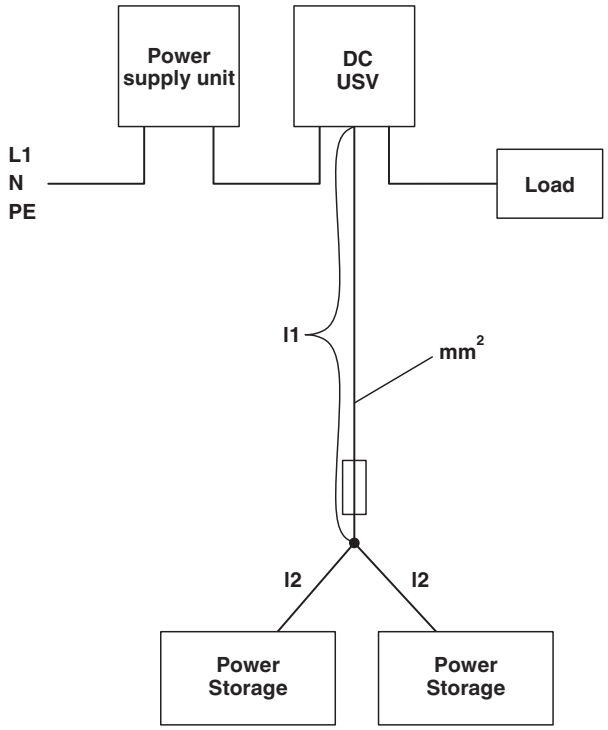


Figure 16 Parallel connection of the power storage devices in the control cabinet

14.2 Parallel connection for redundancy

Redundant circuits are suitable for supplying systems, which place particularly high demands on operational safety.

In order to set up a redundant power supply solution, two UPS systems of the same type (consisting of a power supply unit, DC-PS, redundant 1 .... n) are connected in parallel and decoupled. No further adjustments to the default setting are necessary.

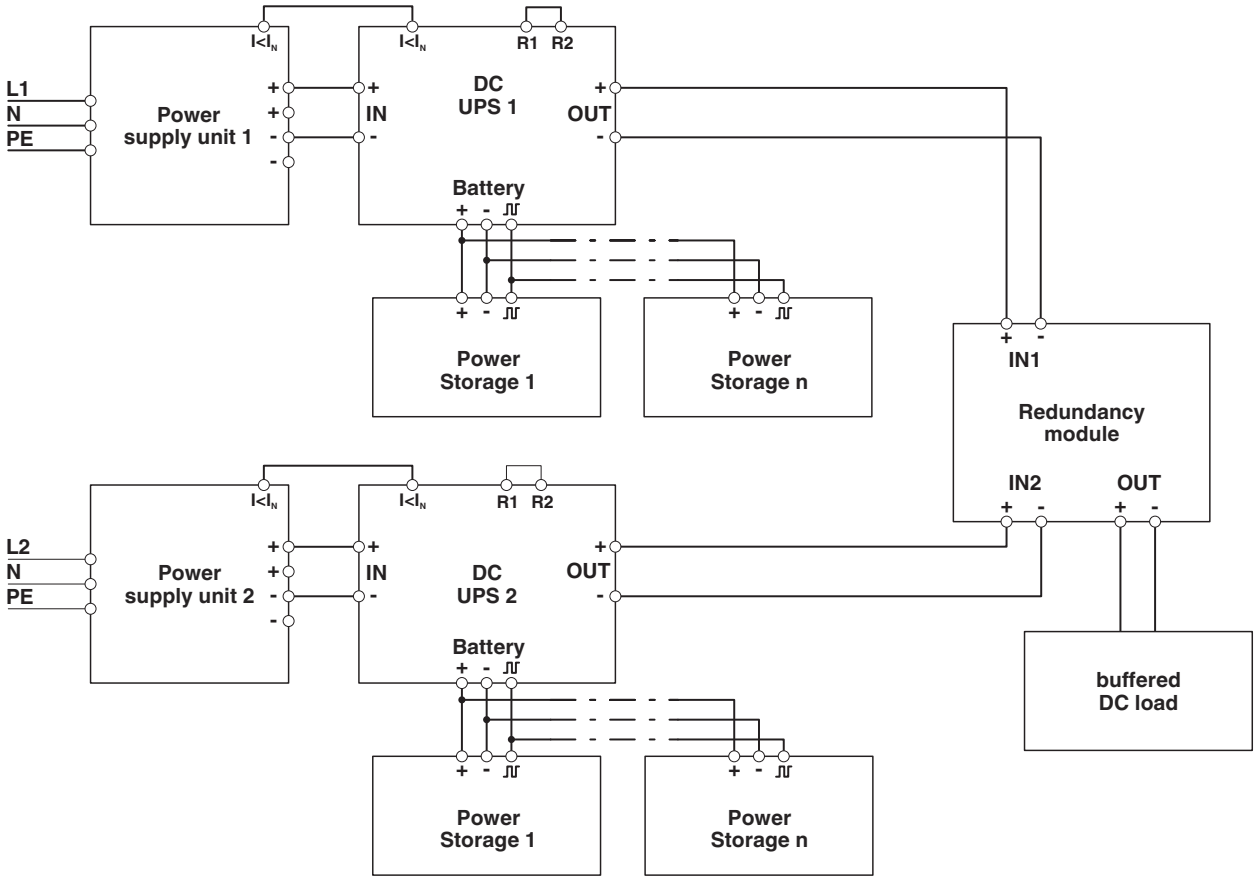


Figure 17 Parallel connection for redundancy

If a fault occurs in the first UPS system, the second UPS system automatically takes over the entire supply without interruption and vice versa. For this purpose, the UPS systems to be connected in parallel are dimensioned so that the total current requirements of all loads can be fully met by one UPS system.

Uninterruptible power supply - QUINT-UPS/ 24DC/ 24DC/40 - 2320241

Uninterruptible power supply with IQ technology for DIN rail mounting, input: 24 V DC, output: 24 V DC/40 A, including mounted universal DIN rail adapter UTA 107/30

We herewith declare the compliance of this product with the Chinese marking requirements set forth in the “Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products” (Order No. 32 of the MITT, etc.) and SJ/T 11364-2014 marking for the restriction of the use of hazardous substances in electrical and electronic product.

This product can be recycled and used safely during its environmentally friendly use period.



The Environmentally Friendly Use Period (EFUP) for the product is 25 years, unless otherwise marked. The Environmentally Friendly Use Period is valid only when the product is operated under the conditions defined in the product documentation.

This product should be recycled after its environmental protection use period has expired because it may contain substances or elements as shown in the following table:

	Hazardous Substance					
Part Name	**Lead (Pb)**	**Mercury (Hg)**	**Cadmium (Cd)**	**Hexavalent Chromium (Cr(VI))**	**Polybrominated biphenyls (PBB)**	**Polybrominated diphenyl ethers (PBDE)**
Electronic supplement[1]	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572

The table shows where these substances may be found in this Electrical and Electronic Product.

[1]) Electronic supplement includes additional parts which are not independent devices and are delivered with this article, for example a memory card for a controller.

Declaration of compliance with China RoHS – Devices

The information on substances corresponds to our present knowledge as well as the status of legislation mentioned in this declaration on the date of issue. In this respect we specifically take the statements and indications of our suppliers and service providers as a basis.

Issued at 2018-02-15 by:

Phoenix Contact GmbH & Co. KG
Flachsmarktstr. 8
32825 Blomberg
Germany

Phone: +49 52 35/3-00
Fax: +49 52 35/3-4 12 00

www.phoenixcontact.net/product/2320241
Download this document

Should you have any further questions please contact: DE-product_compliance@phoenixcontact.com

© All rights reserved.

Power Supplies



User Manual

UPS-CONF

Order No.: -

Configuration and Management Software
UPS-CONF

Power Supplies

User Manual

Configuration and Management Software UPS-CONF

2012-07-02

Designation: UPS-CONF

Revision: 01

Order No.: -

This manual is valid for:

Designation	Order No.
UPS-CONF	2320403

Please observe the following notes

In order to ensure the safe use of the product described, you have to read and understand this manual. The following notes provide information on how to use this manual.



The pictured products do always exemplify the concerned topic.

Target audience for this documentation

The use of products described here solely addresses persons, who are qualified and familiar with electrical equipment and the appropriate and relevant safety concepts. Please also read the section titled "Qualified personnel" in the topic titled "Important safety notes (see page 10)".
Phoenix Contact accepts no liability for erroneous handling or damage to products from Phoenix Contact or third-party products resulting from disregard of information contained in this documentation.

Explanation of symbols used and signal words



DANGER
The danger symbol is used to indicate instructions where non-compliance may result in damage to hardware/software or personal injury (in indirect connection with dangerous process peripherals).



NOTE
The note symbol precedes notes that must be strictly observed in order to ensure error-free operation. It also gives you tips and advice on the efficient use of hardware and on software optimization to save you extra work.



The "Additional Details" symbol indicates cross references (hypertext links or bibliographical references) which lead to detailed descriptions of a term or additional details on the context in question.

General terms and conditions of use for technical documentation

Phoenix Contact reserves the right to alter, correct, and/or improve the technical documentation and the products described in the technical documentation at any time and without giving prior notice, insofar as this is reasonable for the user. The same applies to any technical changes that serve the purpose of technical progress. Technical documentation does not contain any guarantees regarding quality, does not describe any fair marketable quality, and does not make any claims in terms of quality guarantees or guarantees regarding suitability for a specific purpose.

The receipt of technical documentation (data sheets, installation instructions, manuals, online help, etc.) does not constitute any further duty on the part of Phoenix Contact to furnish information on alterations to products and/or technical documentation. Any other agreement shall only apply if expressly confirmed in writing by Phoenix Contact.

Please note that the supplied documentation is intended to serve as product-specific documentation only and that you are responsible for checking the suitability and intended use of the products in your specific application, in particular with regard to observing the applicable standards and directives. Although Phoenix Contact makes every effort to ensure that the information and content is accurate, up-to-date, and refers to the state of the art, technical inaccuracies and/or printing errors in the information cannot be ruled out. Phoenix Contact does not offer any guarantees as to the reliability, accuracy or completeness of the information. All information made available in the technical documentation is supplied without any accompanying guarantee, whether expressly mentioned, implied or tacitly assumed.

Phoenix Contact accepts no liability or responsibility for errors or omissions in the content of the technical documentation (data sheets, installation instructions, manuals, online help, etc.).

The aforementioned limitations of liability and exemptions from liability do not apply insofar as liability must be assumed, e.g., in accordance with product liability law, in cases of premeditation, gross negligence, on account of loss of life, physical injury or damage to health, or on account of the violation of important contractual obligations. Claims for damages for the violation of important contractual obligations are, however, limited to contract-typical, predictable damages, provided there is no premeditation or gross negligence, or unless liability is assumed on account of loss of life, physical injury, or damage to health. This ruling does not imply a change in the burden of proof to the detriment of the user.

Statement of legal authority

This documentation, including all illustrations contained herein, is copyright protected. This documentation is to be used for its intended purpose only. All other means of usage are prohibited. Reproduction, translation, and public disclosure, as well as electronic and photographic archiving and modification, require written consent by Phoenix Contact. Violators are liable for damages.

Phoenix Contact reserves all rights in the case of patent award or listing of a registered design. Third-party products are always named without reference to patent rights. The existence of such rights shall not be excluded.

How to contact us

Internet

Up-to-date information on Phoenix Contact products and our Terms and Conditions can be found on the Internet at:
www.phoenixcontact.com
Make sure you always use the latest documentation.
It can be downloaded at:
www.phoenixcontact.net/catalog

Subsidiaries

If there are any problems that cannot be solved using the documentation, please contact your Phoenix Contact subsidiary. Subsidiary contact information is available at:

www.phoenixcontact.com

Table of Contents

1 Functional overview 1

2 Software setup 3

2.1 System requirements 4

2.2 Installation 5

2.3 Software settings 5

3 Hardware overview 7

3.1 Important safety notes 10

4 Hardware setup 11

4.1 Buffer time selection 12

4.2 Data port 13

4.3 Connecting the PC 14

5 Software overview 15

5.1 User interface 15

5.2 Status bar 17

6 Status - Reported information 20

6.1 System 20

6.2 Battery 25

6.3 Battery Advanced 26

6.4 UPS 27

6.5 UPS Advanced 28

7 Settings - Defining UPS device parameters 29

7.1 Reporting 31

7.2 Time Setting 36

7.3 Service 39

7.4 Advanced 41

8 Monitoring - Statistics and logging 44

9 Stick usage 45

9.1 Configuration stick usage 46

9.2 Service stick usage - service mode 47

10 Application samples 52

10.1 Functional test 52
10.2 PC-Mode: PC shutdown and restart 52

11 Troubleshooting 53
11.1 Unexpected status symbols 54
11.2 Communication port 56

Index 57

1 Functional overview

UPS-CONF is a management software to configure and monitor QUINT-UPS devices, that come with the IQ technology.

This technology with continuous battery monitoring and intelligent management provides you with information about the charging state, remaining runtime, and service life of your battery at all times. Intelligent communication informs you when a situation becomes critical. This reduces the amount of maintenance involved and increases your system availability.

IQ technology means

- Intelligent Battery Control: automatically detects the connected battery type and maximizes the remaining service life of the battery unit via an optimally adapted charging characteristic.
- Intelligent Battery Management: continuous status information is shown for
  - SOC (State of Charge): current charging state and remaining back-up time of the battery unit
  - SOH (State of Health): remaining life expectancy of the battery unit, provides early warning for a potential battery unit failure
  - SOF (State of Function): determines the current performance of the battery unit.
- Intelligent Charging: adapts the charging current and thereby ensures the fastest possible recharging and availability.
- Intelligent communication: the communication of UPS and PC allows configuration, extensive signaling and parameterization.



The IQ technology also works without UPS-CONF. With this software you have an easier monitoring and configurations can be done.



The UPS-CONF software is intended for a PC as well as an IPC (Industrial PC). In this documentation the term "PC" is used to address both.



The configurable QUINT-UPS device is also referred to as the "UPS" in this documentation.

Features supported by the UPS-CONF software

In order to optimally support the IQ technology, UPS-CONF provides the following features:

- Clear overview about condition of mains, battery, UPS device and connection from PC to UPS
- Automatic PC shutdown and restart functionality while the UPS runs in PC-Mode
- Start of application specific programs for system shutdown
- Configuration of switching outputs
- Chronological event logging
- Setting of customized parameters like the maximum charging current
- Choice of user interface language in the Software settings (see page 5).
  Currently supported languages: English, German



The topic titled Application samples (see page 52) guides through some typical scenarios.

2 Software setup

The UPS-CONF software has to be installed on a PC in order to configure and monitor an UPS system. If the buffered load is a PC, the UPS can be operated in the PC-Mode to additionally enable the automatic PC shutdown and restart functionality.

To setup the software, the following steps have to be executed:

1. Make sure all system requirements (see page 4) for the hardware and software are met.
2. Download and install the software (see page 5).
3. Follow the steps in the hardware setup (see page 11).
4. Start the software (see page 15).
5. Become familiar with the software settings (see page 5) supported by the UPS-CONF software and carry out the required settings.

2.1 System requirements

In order to run the UPS-CONF software, your computer must meet the following software and hardware requirements:

Software requirements

- Supported operating systems:
  - Windows 7, 32bit and 64bit
  - Windows Vista SP1
  - XP SP3 (requires .NET Framework 3.5 SP1)
- Supported browser: Internet Explorer version 6 or later

Hardware requirements		
CPU	1 GHz min. 2 GHz recommended	Windows 7 Windows Vista SP1
	Pentium III 1GHz min. 2 GHz recommended	Windows XP SP3
Main memory	1 GB RAM min. 2 GB RAM recommended	Windows 7 Windows Vista SP1
	512 MB RAM min. 1 GB RAM recommended	Windows XP SP3
Main memory used by UPS-CONF	max. 96 MB	
Hard disk drive (recommended) Hard disk used by UPS-CONF	850 MB max. 50 MB	
CD-ROM drive	not necessarily needed	
Interfaces	1 x USB 2.0	
Monitor	VGA, resolution 800 x 600 pixels minimum, 256 colors	
Network	Internet connection needed for program download	

2.2 Installation



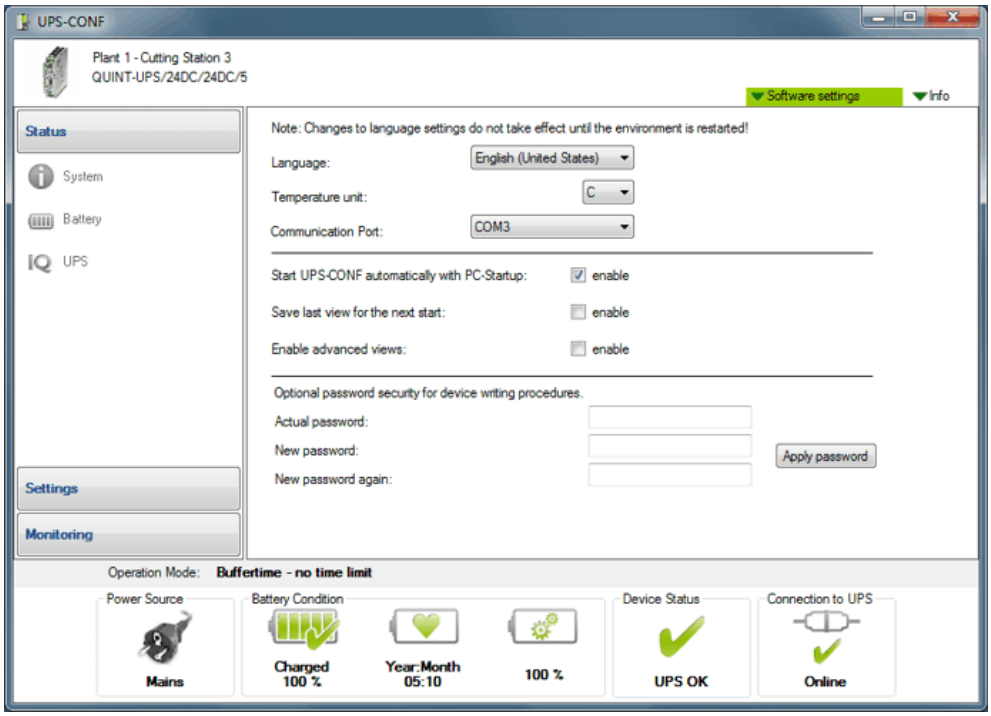
The UPS-CONF configuration and management software can be downloaded free of charge at www.phoenixcontact.net/catalog.

To install the software, proceed as follows:

1. Find UPS-CONF at www.phoenixcontact.net/catalog.
2. Save the UPS-CONF_Setup_v....exe file to the preferred download folder.
3. Make sure the IFS-USB-DATACABLE is unplugged.
4. Install UPS-CONF from the selected download folder. Simply follow the screen instructions.
   Read the EULA (End User License Agreement) carefully when it is displayed and agree it to continue the installation.
5. After having completed the UPS-CONF installation, connect the UPS device to the PC (see page 14). If required, select PC-Mode as operating mode (see page 12).
6. As soon as Windows detects the new USB hardware follow the instructions of the driver installation.

2.3 Software settings

The software settings can be shown by clicking the "Software settings" item in the system menu.



The following settings can be defined:

- Language of the user interface (English, German)

NOTE
To apply the changed language setting, you have to restart the UPS-CONF software.

- Temperature unit (Celsius, Kelvin, Fahrenheit)
- Communication (USB) port at the PC for the IFS-USB-DATACABLE (COMx)

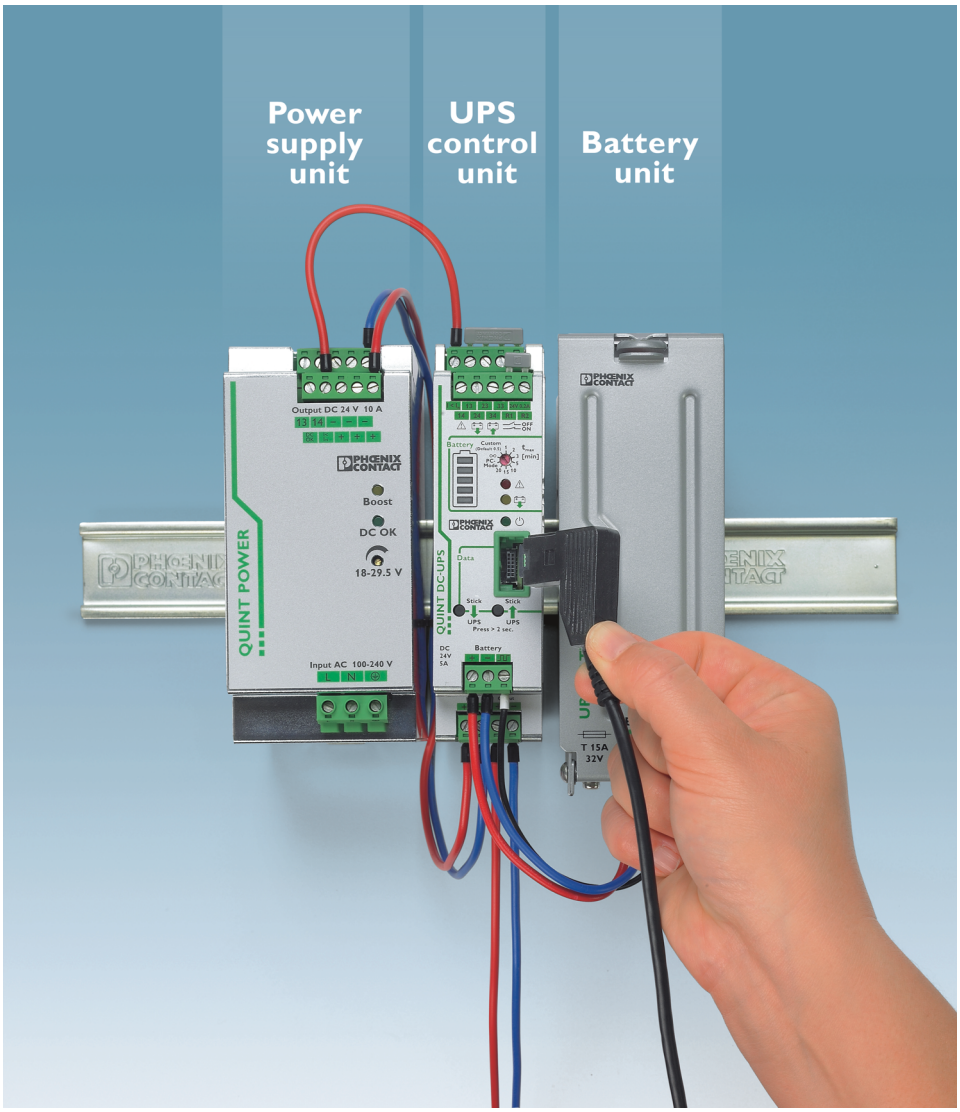
Normally, the communication port is set automatically by the UPS-CONF software when connecting the UPS devices. Under normal conditions there is no need to change this setting. If it has not been set automatically during the software installation, refer to the section Communication port (see page 56) in the Troubleshooting topic.

- Enable/disable automatic UPS-CONF startup after PC startup. This option must be checked if the UPS device shall buffer this PC.
- Restore the last view after the next software start.
- Hide or show the advanced views ("Battery Advanced" and "UPS Advanced" in the "Status" group and "Advanced" in the "Settings" group).
- An optional password, when parameters are written to the UPS device.

3 Hardware overview

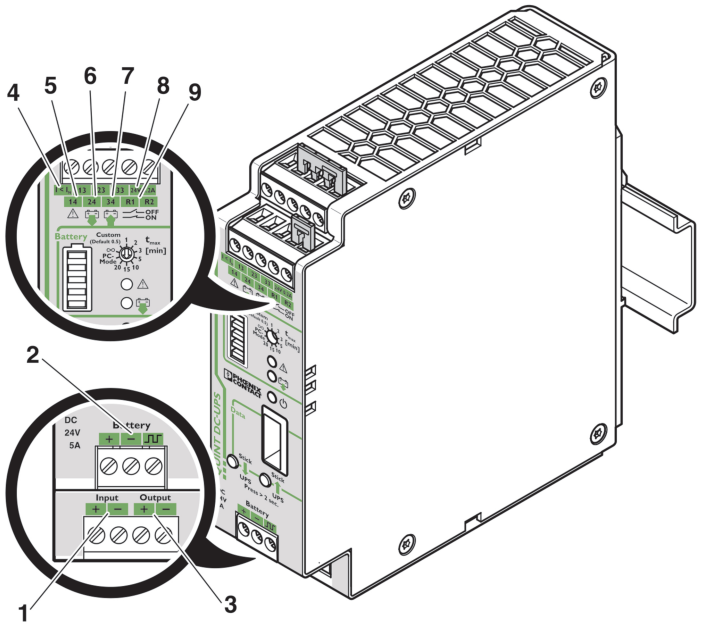
Choose your customized solution - for your application.

1. Choose your power supply.
2. Choose your UPS unit.
3. Choose your energy storage.

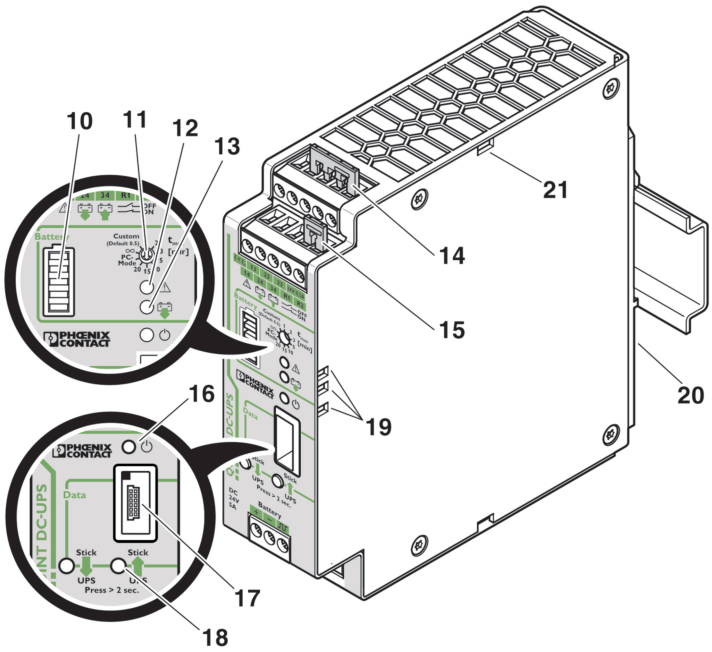


All Products are available in the e-shop: www.phoenixcontact.net/catalog

In the next two graphics and their corresponding lists you can see the location of the main parts of the QUINT DC-UPS.



No.	Connections / Operating elements
1	DC input 18 V DC ... 30V DC
2	Power storage device connection, 24V DC (+,-, communication between UPS and power storage device)
3	DC output, 24 V DC, buffered
4	$I < I_N$, fast battery charging
5	Floating relay contact 13/14: alarm (Related parameter settings are provided in the "Reporting" view (see page 31).)
6	Floating relay contact 23/24: battery mode (Related parameter settings are provided in the "Reporting" view (see page 31).)
7	Floating relay contact 33/34 : battery charge (Related parameter settings are provided in the "Reporting" view (see page 31).)
8	24 V DC supply voltage, maximum current limit 0.2 A for the signal contacts 13, 23, 33
9	Remote control (R1, R2). (Related UPS parameter "Remote Status" (see page 27).)



No.	Connections / Operating elements
10	Bar graph for displaying the current charging state of the power storage device
11	Buffer time setting: unlimited ∞, 1 ... 20 mins., customized (customized default: 0.5), PC mode (refer to topic Buffer time selection (see page 12)).
12	Red LED: alarm (Corresponding indicators are displayed in the software's "Status" view (see page 20).)
13	Yellow LED: battery mode (Corresponding indicators are displayed in the software's "Status" view (see page 20).)
14	Plug-in bridge for signal contact supply voltages, pre-installed
15	Remote control plug-in bridge, pre-installed
16	Green LED: Power In OK, mains mode (Corresponding indicators are displayed in the software's "Status" view (see page 20).)
17	Data port (see page 13) for data linking to the PC or the use of a memory block
18	Button for use of the memory block
19	LED windows for flat mounting position
20	Universal snap-on foot for DIN rails
21	Accommodation for cable binders

3.1 Important safety notes



Please observe all the safety notes outlined in this topic when using UPS-CONF together with the QUINT-UPS device.

Requirements

Knowledge of the following is required:

- QUINT-UPS system
- UPS-CONF configuration software
- Safety regulations in the field of application

Qualified personnel

In the context of using the QUINT-UPS system and the UPS-CONF configuration software described in this documentation, the following operations may only be carried out by qualified personnel:

- Planning, configuration
- Installation, startup, servicing
- Maintenance, decommissioning

This documentation is therefore aimed at:

Qualified personnel who plan and design electrical equipment for machines and systems and are familiar with regulations governing safety in the workplace and accident prevention.

Within the context of the safety notes in this documentation, qualified personnel are persons who, because of their education, experience and instruction, and their knowledge of relevant standards, regulations, accident prevention regulations, and service conditions, have been authorized to carry out any required operations, and who are able to recognize and avoid any possible dangers.

4 Hardware setup

NOTE
Before setting up the hardware, install the software (see page 5).

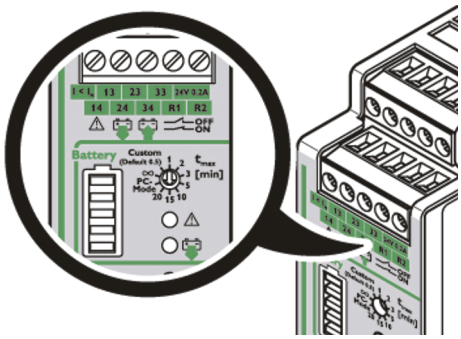
Regarding the communication with the PC and the UPS operation mode, it needs only three steps to setup the hardware:

1. Set the buffer time at the buffer time potentiometer, as described in the topic Buffer time selection. (see page 12)
2. Connect the Data port either with a PC or plug in a configuration stick, as described in the topic Data port (see page 13).
3. Connect the load to be supplied by the UPS (see technical datasheet for each QUINT-UPS).

NOTE
For further information about the hardware installation (connecting the battery module, etc.) please refer to the QUINT DC-UPS technical datasheet.

4.1 Buffer time selection

The buffer time potentiometer at the front of the QUINT-UPS has to be switched to the desired mode with a screwdriver.



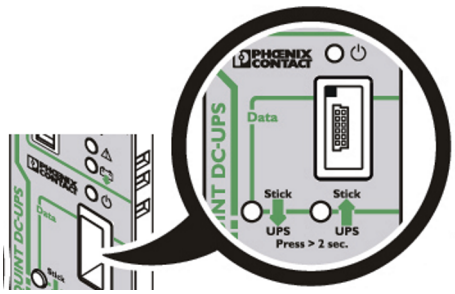
The following settings are available:

Operating mode	Description
Custom (default 0.5)	Buffer time can be set to a user-defined value; if no value is set 0.5 minutes is used, as described in the topic Custom Mode (see page 37).
1, 2, 3, 5, 10, 15, 20	Buffer time 1, 2, 3, 5, 10, 15, 20 minute(s).
PC-Mode	This mode is intended to buffer a PC and to initiate a controlled shut-down in battery mode. The buffer time depends on the "Shutdown Delay" time and on the "PC-Shutdown" time, as described in the PC-Mode (see page 38).
∞	No time limit, buffering is continued until the battery is empty (deep discharge security).

The current set buffer time is shown as "Operation mode" in the status bar (see page 17).

4.2 Data port

The Data port is located at the front of the UPS. Via this port, configuration and maintainance of the UPS is done.



The configuration can be done in 2 different ways, depending on what is connected to the Data port:

- Connect the PC (see page 14) with the installed UPS-CONF software, if you want to configure by software.
- Plug in a memory stick which is declared as configuration stick, if you want to configure by configuration stick (see page 46).

In order to perfom maintenance tasks (such as changing a battery), a service stick can be plugged into the Data port, so the UPS switches to service mode (see page 47).

4.3 Connecting the PC

A PC has to be connected to the UPS in one of the following cases:

- You want to configure or monitor the UPS by the UPS-CONF software.
- You want to display currently set QUINT-UPS parameters or modify them using UPS-CONF.
- You want to initiate a controlled PC shutdown in case of a mains failure and if battery runs low.

NOTE
First, install the software (see page 5) and then connect the PC afterwards.

To connect the PC to the QUINT-UPS, proceed as follows:

1. Connect the USB connector of the IFS-USB-DATACABLE to a free USB connector of your PC. After detecting the device, the used USB port is entered automatically in the software settings of UPS-CONF.



2. Connect the other side of the IFS-USB-DATACABLE to the Data port of the UPS:



5 Software overview

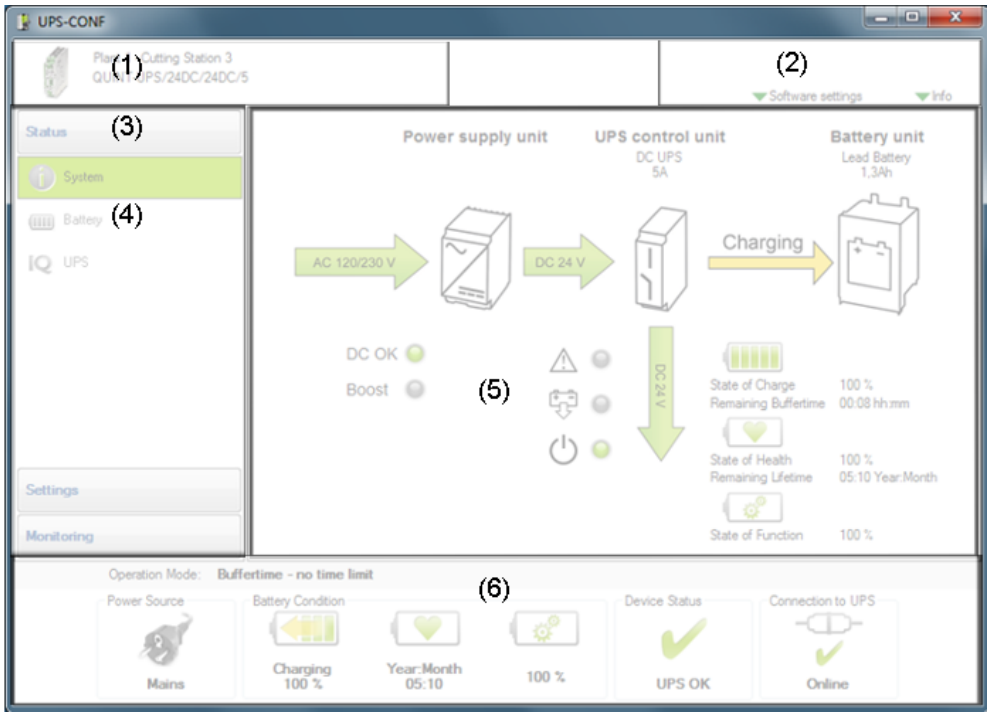
After installing the UPS-CONF software, the program starts up automatically.

As long as you do not change the related default software setting (see page 5), UPS-CONF always starts automatically after every PC reboot.

In the following sections you can get an overview about the screen areas of the UPS-CONF software and you can learn about the different status bar (see page 17) symbols and their meanings.

5.1 User interface

The screen layout consists of the following areas:



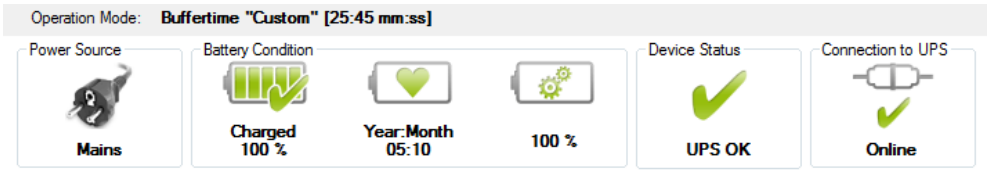
The following table explains the several areas.

Area	Description
(1)	Device information: Here, the type of the connected UPS is displayed. If text has been entered for the advanced UPS parameter "Place of installation" (see page 41), it is displayed above the UPS type.
(2)	System menu: Software settings (see page 5): A mouse click leads to the screen, where various software settings can be made. Info: A mouse click shows the contact information of Phoenix Contact.
(3)	Software menu: The Software menu provides various topic buttons such as status information display, parameter settings or monitoring values. A software menu button is expanded/collapsed by simply clicking it. When a software menu button is expanded the corresponding navigation items are listed.
(4)	Navigation items: After clicking a navigation item the corresponding information and parameters are displayed in the action area.
(5)	Action area: The content of the action area depends on the currently selected navigation item. This can be, for example, information, read from the device, or a parameterization table used for configuring the connected UPS.
(6)	Status bar (see page 17): Displays the status of all involved components thus providing a quick system overview. The status bar is always visible, also if the navigation and action area change.

5.2 Status bar

The status bar in the lower part of the screen shows information about the current system state.

When the power supply is available and the system is online and the battery is fully charged, the status bar looks like this:



The operation mode in the upper part of the status bar shows the current setting of the buffer time potentiometer of the UPS, as described in topic Buffer time selection (see page 12).

If it looks different, e.g. Power Source status "UPS off" or no connection to UPS ("Offline"), verify the following:

- All UPS components (QUINT-UPS, battery, power supply) are functional and properly connected.
- The QUINT-UPS is supplied with 24 V DC.
- The IFS-USB-DATACABLE is properly connected between QUINT-UPS and PC.

If an alarm is detected or an existing online connection between the PC and the QUINT-UPS is interrupted, the UPS-CONF software automatically becomes the active window. The status is queried every 5 seconds.

If your system status is like described, you can

- evaluate the UPS system status by displaying the various views contained in the software menu "Status" (see page 20) and/or
- start configuring the UPS by modifiying the default parameter settings in the various views of the software menu "Settings" (see page 29) and/or
- monitor your system.

In the topic Application samples (see page 52), some typical application scenarios are described.

The following tables explain the different status symbols that can be visible in the status bar:

Power Source	Symbol meaning
	The status "Mains" is shown, if the power supply is switched on and available.
	The status "Battery" is shown, if the power supply is switched off or not available. That means, the battery is discharging.
	The status "UPS off" is shown in either case: • The UPS is off, because battery mode is finished. The set buffer time has elapsed. • The power supply is available, but delivers an invalid output voltage.

Battery Condition	Symbol meaning
State of charge: 	Battery is "Fully charged".
State of charge: 	"Charging" is shown, if the battery is currently charging and not yet fully charged.
State of charge: 	The "Discharging" status is shown, if the battery is currently discharging because the system runs in battery mode. Usually, this status is shown in combination with the power source status "Battery".
State of charge: 	"Uncharged" is shown, if the battery mode is finished and the battery is empty.
State of health: 	The "State of Health" status shows the remaining lifetime of the battery. The lifetime value is shown below the symbol.

Battery Condition	Symbol meaning
State of function: 	The "State of Function" status shows the current performance of the battery. This efficiency value is measured in percent and is shown below the symbol.



During battery charging the battery conditions "State of Charge", "State of Health" and "State of Function" are shown as "unknown".

Device Status	Symbol meaning
	The "UPS OK" status is shown during normal UPS operation, i.e., when mains is available (battery mode not active) and no other event is currently upcoming.
	"Bat.-Mode deactivated" is shown, if the bridge is removed from the terminals R1 and R2. Refer to the parameter "Remote Status" in the topic UPS (see page 27).
	The "Alarm" status is shown, when a failure or critical situation exists, for example: • battery almost empty • battery not detected • battery replacement required

Connection to UPS	Symbol meaning
	This status informs about the communication connection between UPS-CONF and the QUINT-UPS device. The "Online" status is shown, if the IFS-USB-DATACABLE is connected. Normally, this status is automatically entered after connecting the UPS to the PC via the IFS-USB-DATACABLE.
	"Offline" means that no communication connection is established via the IFS-USB-DATACABLE.

6 Status - Reported information

If the "Status" group is selected, the following navigation items are available:

- "System (see page 20)": overview on the current system status
- "Battery (see page 25)": status information for all connected batteries
- "Battery Advanced (see page 26)": advanced status information for all connected batteries
- "UPS (see page 27)" : status information for the connected UPS
- "UPS Advanced (see page 28)": anvanced status information for the connected UPS

6.1 System

If the "System" item is selected in the software menu "Status", an overview on the current system status is visible in the action area. The values shown here are read cyclically from the UPS device, as long as a communication connection to the UPS is established.

The system components and their status information are arranged on the screen as "Power supply unit" on the left hand side, "UPS control unit" in the middle and "Battery unit" on the right hand side. The tables explain the symbols corresponding to the units.



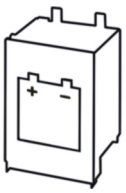
Power supply unit symbols:

Icon	Meaning of LEDs
DC OK	Green LED on: DC output is available. LED off: DC output is not available.
Boost	Yellow LED on: Boost signal is ON (power supply delivers additional current for a connected load). LED off: Boost signal is OFF.



UPS control unit symbols:

Icon	Meaning of LEDs
⚠	Red LED on: UPS alarm due to one of the reasons: • battery almost empty • battery not detected • battery replacement required LED off: No UPS alarm, power supply available, normal operation.
	Yellow LED on: Battery mode is ON, battery is discharging because power supply failed. LED off: Battery mode is OFF, i.e. mains available.
⏻	Green LED on: Mains is ON. LED off: Mains is OFF.

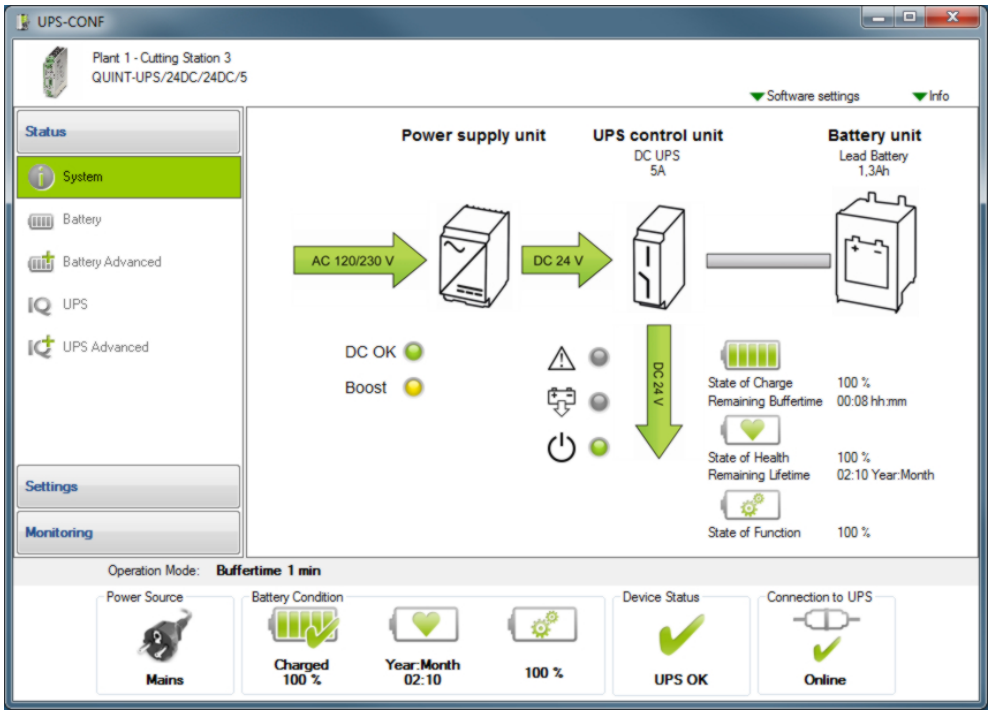


Battery unit symbols:

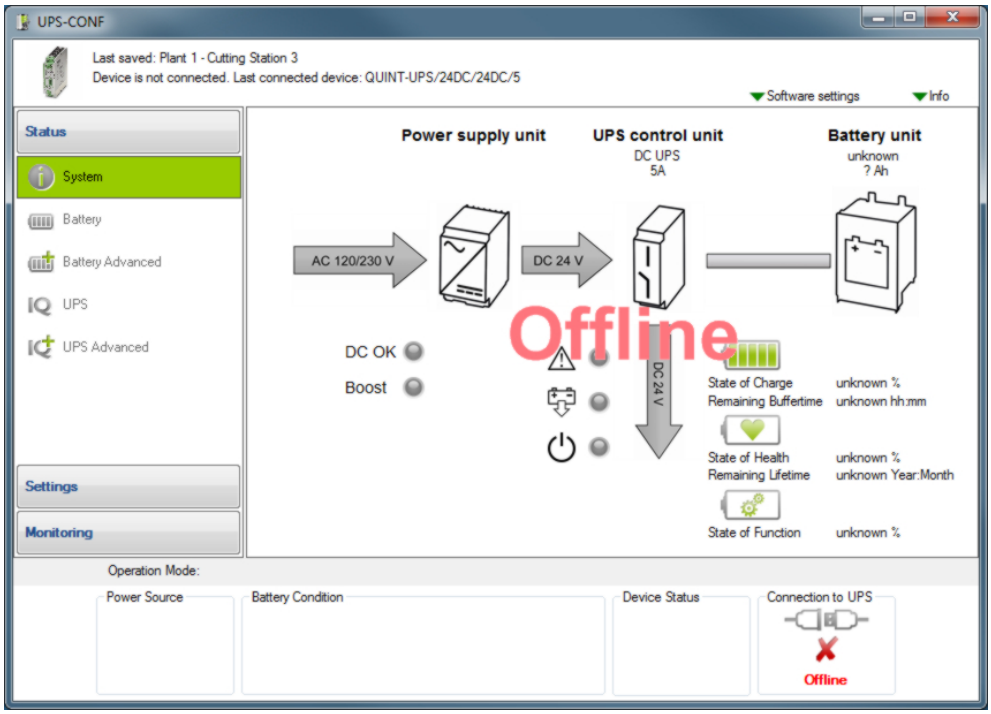
Icon	Meaning of LEDs
	SOC (State Of Charge) – current charging state and remaining back-up time of the battery unit.
	SOH (State Of Health) – remaining life expectancy of the battery unit, provides early warning for a potential battery unit failure.
	SOF (State Of Function) – determines the current performance of the battery unit.

NOTE
While charging the battery the status is "unknown".

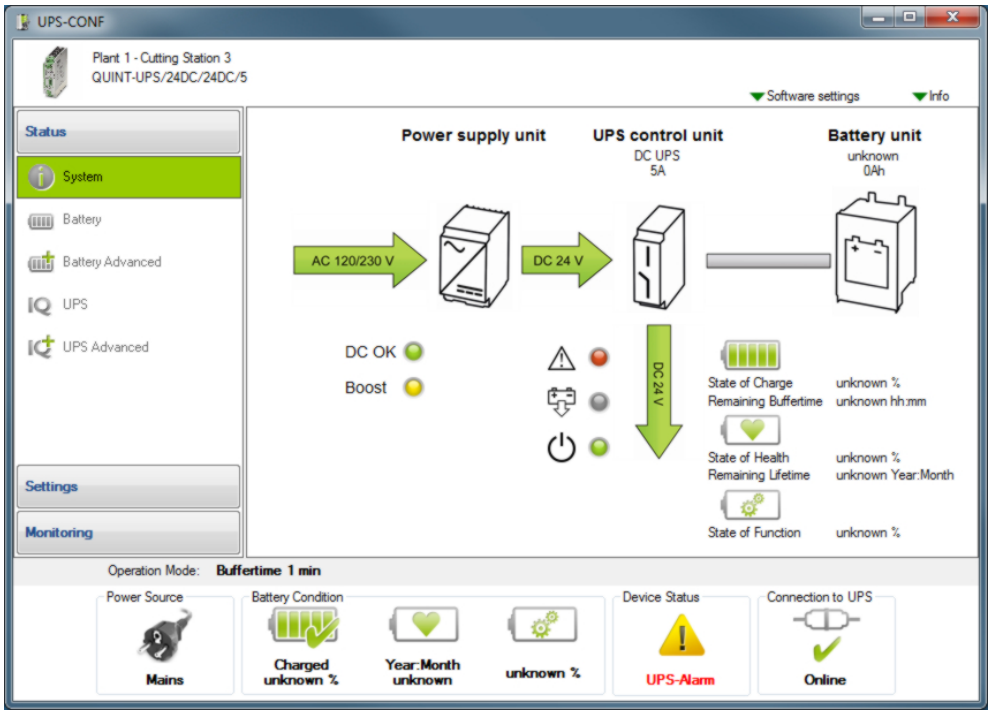
When the system is in normal operation (online and running), the screen looks like this:



When the UPS is offline and has no connection to the PC, the screen looks like this:



When the system status shows an alarm, the screen looks like this:



In such case refer to the topic Troubleshooting (see page 53).

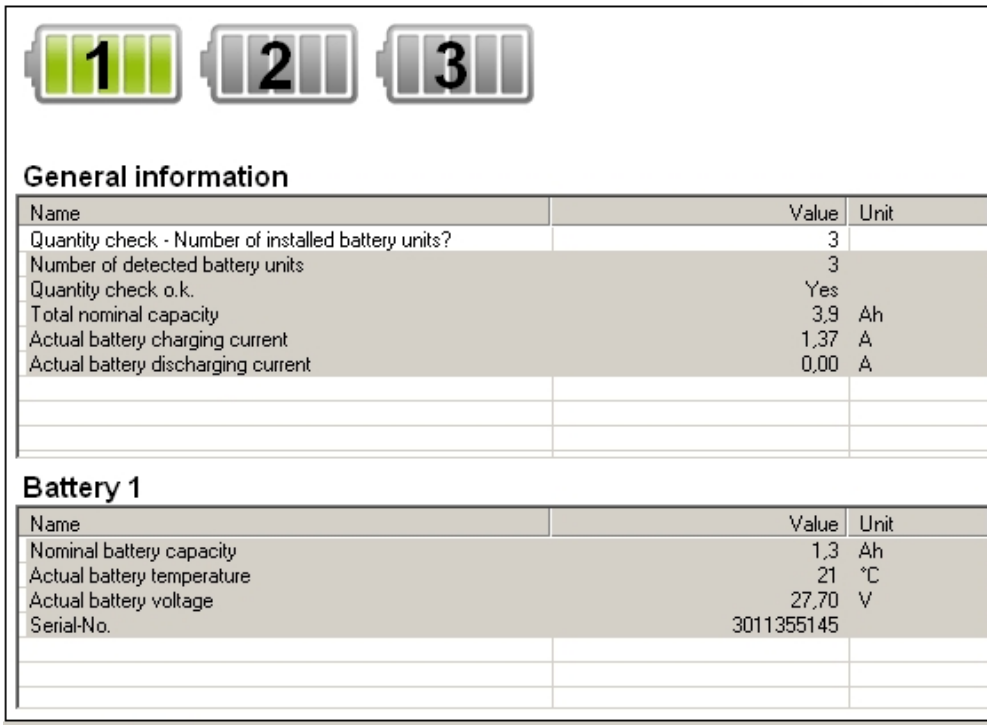
6.2 Battery

If the "Battery" item is selected in the software menu "Status", status information for all connected batteries is shown in the action area.

The information is headed by "General information" for all connected batteries, such as "Number of detected battery units" or "Total nominal capacity".

Individual information for every battery follows.
If several battery units are installed, the data of the individual units can be displayed by clicking on the battery icons on top of the action area:

The status information in the action area could for instance look similar like this:



Battery parameters	Meaning
Except of some parameters explained here, the status information is self-explanatory, this is why it is not explained in detail.	
Quantity check - Number of installed battery units?	This value can be set to the amount of batteries, that were built in.
Number of detected battery units	Number of batteries detected by the QUINT-UPS.

Battery parameters	Meaning
Quantity check o.k.	Shows "Yes", if the number of installed battery units complies with the number of detected batteries. Otherwise "No" is displayed.

6.3 Battery Advanced

This navigation item is only available if the "Enable advanced views" checkbox is marked in the software settings (see page 5).

If the "Battery Advanced" item is selected in the software menu "Status", advanced status information for all connected batteries is shown in the action area.

In normal operation it looks something like this:

Name	Value	Unit
Actual state of charge	100	%
Remaining backup time	00:08	hh:mm
Remaining battery life time	01:03	Year:Month
Actual battery performance	100	%
Actual battery voltage	27,57	V
Actual battery temperature (Average of all units)	26	°C

6.4 UPS

If the "UPS" item is selected in the software menu "Status", status information for the connected UPS is shown in the action area.

In normal operation it looks like this:



Name	Value	Unit
Actual Alarm	No Alarm	
Last Alarm	No Alarm	
Remote Status	UPS ready	
UPS in battery operation (Battery-Mode)	No	
Selected operation mode	Buffertime - no time limit	
Battery is charging (Battery-Charge)	No	

Parameter	Meaning
	Except of some parameters explained here, the status information is self-explanatory, this is why it is not explained in detail.
Remote Status	Remote control (contact R1, R2) The module can be switched on and off via a signal to contacts R1 / R2. Shutdown can take place in mains mode or while battery mode is active. Remote shutdown is deactivated UPS in function (delivery state) – The "R1" and "R2" terminal points are short circuited (delivery with plug-in bridge) OR 24 V DC is present at terminal point "R2". – In the event of a voltage supply failure, the UPS switches over to battery mode. Remote shutdown is activated – The "R1" and "R2" terminal points are not short circuited AND 0 V is present at terminal point "R2". – In the event of a voltage supply failure, the UPS does not switch over to battery mode and the device shuts down.
Selected operation mode	Shows the operation mode that is set via the buffer time potentiometer, as described in topic Buffer time selection (see page 12).

6.5 UPS Advanced

This navigation item is only available if the "Enable advanced views" checkbox is marked in the software settings (see page 5).

If the "UPS Advanced" item is selected in the software menu "Status", advanced status information for the connected UPS is shown in the action area.

The status information is self-explanatory, this is why it is not explained in detail here.

In normal operation it looks something like this:

Name	Value	Unit
Device type	QUINT-UPS/24DC/24DC/5	
Actual input voltage	23,91	V
Actual output voltage	23,66	V
Actual Device Temperature	30	°C
Shutdown event started	No	
UPS serial number	3012001033	
Device firmware	0x00000110	

7 Settings - Defining UPS device parameters

The navigation items contained in the "Settings" group allow access to the various UPS device parameters.
Parameter values can be entered in UPS-CONF and written to the device (see page 29) with only one click of the mouse.

If the software menu "Settings" is selected, the following navigation items are available:

- Reporting (see page 31): Trigger thresholds, switching outputs for UPS alarm, battery mode and battery charging as well as Email settings
- Time Setting (see page 36): Buffer times, (delay) times and programs to execute for PC shutdown
- Service (see page 39): Service mode activation and rights granting, declaration of service stick and configuration stick
- Advanced (see page 41): Battery charging values, wire sizes, thresholds, signaling times and others

How to write parameters

In each of the navigation items, different settings can be made in the action area in order to write it to the UPS.

Beneath settings, that can be made by checking a checkbox or by entering data into an input box, also numerical or textual values contained in the parameter tables can be changed.

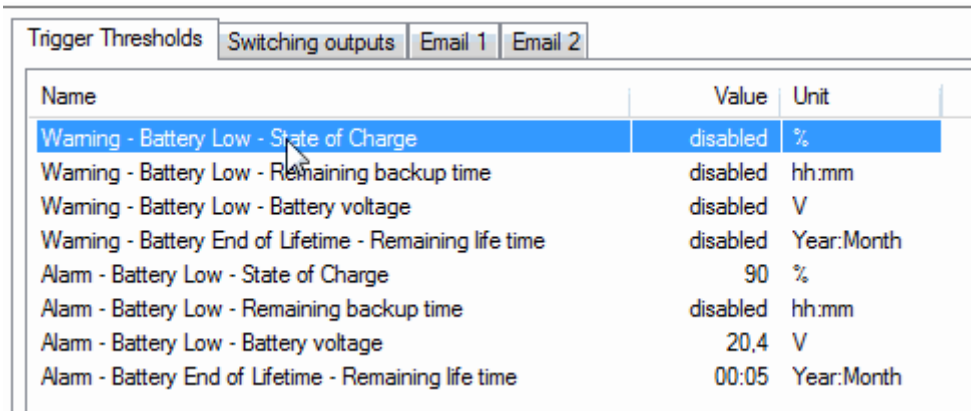
In these parameter tables, changeable parameter values have a white background color. Read-only values, i.e. the ones that are read from the device for monitoring purposes, are shown on a gray background.

To enter a new value for a parameter and write it to the UPS, proceed as follows:

1. Double-click the line, where the parameter text is located or click the "Write..." button in the lower right corner.
   An input box opens showing the currently set value.
2. Enter a value into the input box. Make sure that the chosen value is within the allowed value range and is suitable for your UPS system!
3. Click the "Write to device" button.
4. Verify that the new value is now displayed in the parameter table, i.e., has been accepted by the device.

Sample:

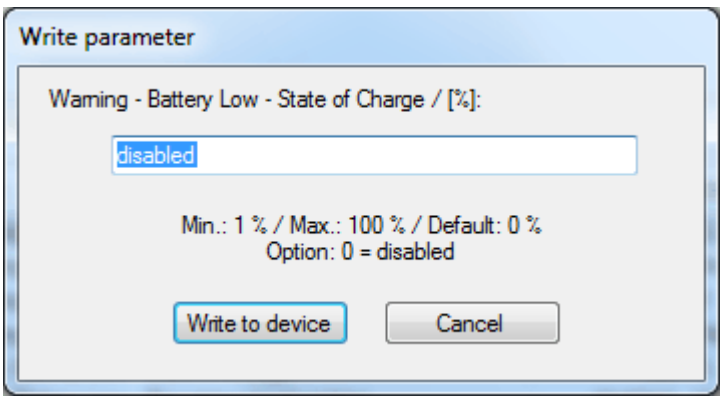
Select the "Reporting" navigation item in the "Settings" group and click the "Trigger Thresholds" tab in the action area.
In this tab, you can set a trigger value, at which battery charging level a "battery low" warning should be generated (first entry in the tab Trigger Thresholds (see page 31)). The value is entered as percentage, see below. By default, the trigger is "disabled", i.e. no warning is reported.



Set the trigger to 20% as follows:

1. Double-click the marked line, as shown in the figure above or left-click the line and then press the "Write..." button in the lower right corner.

   The following dialog appears:

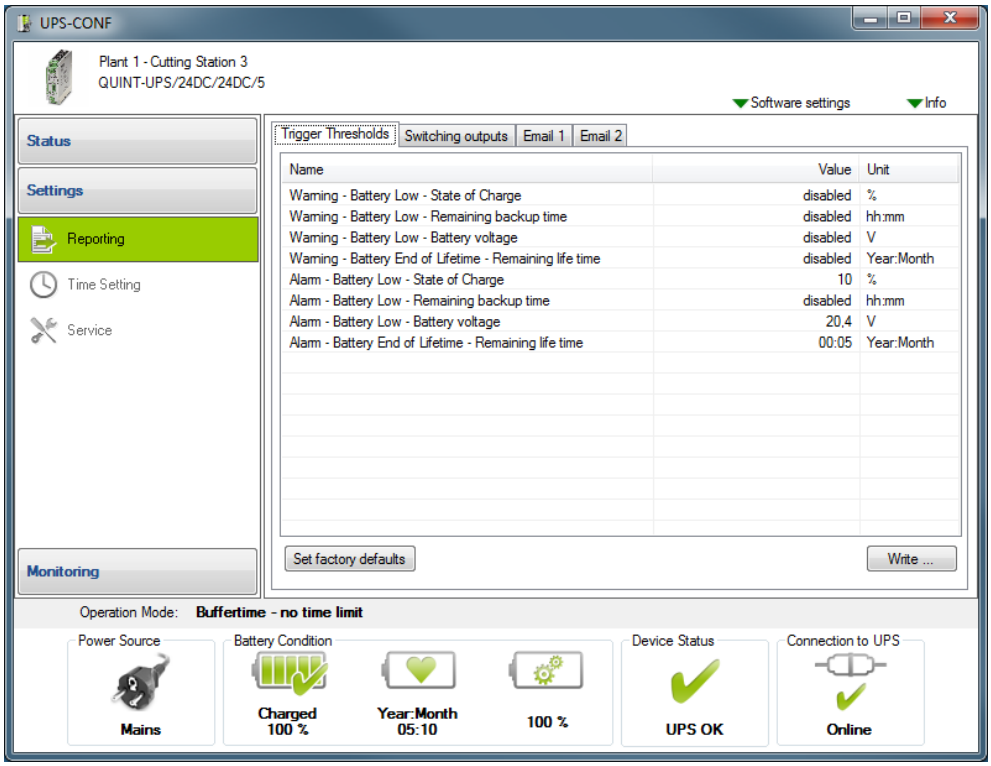
   Below the text field you can see the allowed input range.
2. Enter `20` in the input box and click the "Write to device" button.
3. Verify that the new value is shown in the table.

7.1 Reporting

If the "Reporting" item is selected in the software menu "Settings", the tabs "Trigger Thresholds", "Switching outputs", "Email 1" and "Email 2" are visible in the action area.

Trigger Thresholds

On the "Trigger Thresholds" tab you can define, whether warnings or alarms shall be reported by the UPS and define the threshold values which must be exceeded in order to trigger a message.



For each of the following conditions, both a warning and an alarm threshold value can be defined:

- Battery is low and the state of charge falls below a certain percentage number.
- Battery is low and the remaining backup time falls below a defined time.
- Battery is low and the battery voltage falls below a certain voltage.
- Battery is at it's end of lifetime and the remaining life time falls below a defined time.

If a warning or alarm is reported, you can define that a switching output must be triggered. For some of the warnings or alarms an Email to be sent can also be defined.

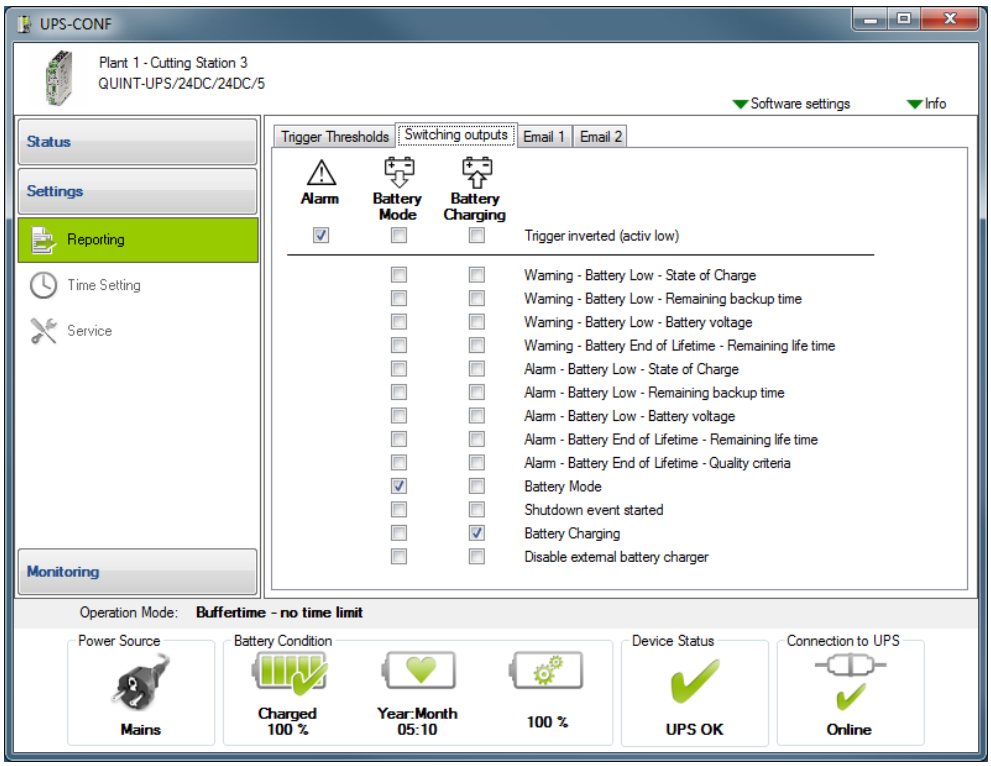
A reported alarm is additionally signaled by the LED at the front of the UPS device as well as in the status bar of the UPS-CONF software.

By means of warnings and alarms you can implement a two-level detection system:

1. Report a warning, when the first threshold value is exceeded.
   Example: battery lifetime is still one year.
2. Report an alarm, when the second threshold value is exceeded.
   Example: remaining lifetime of the battery is only some few months or weeks. Now an Email is additionally sent to the responsible person to ensure that a new battery is ordered in time.

Switching outputs

On the "Switching outputs" tab you can define a QUINT-UPS device output signal to be switched, when a certain trigger occurs. With such an output signal you can, for example, control a buzzer, that sounds, if the battery is low or the shutdown has been initiated.



Three different outputs are available to be switched:

- "Alarm",
- "Battery Mode"
- "Battery Charging"

All switching outputs can be triggered inverted, i.e., active low.

The "Battery Mode" and "Battery Charging" output signals can be switched with the following triggers:

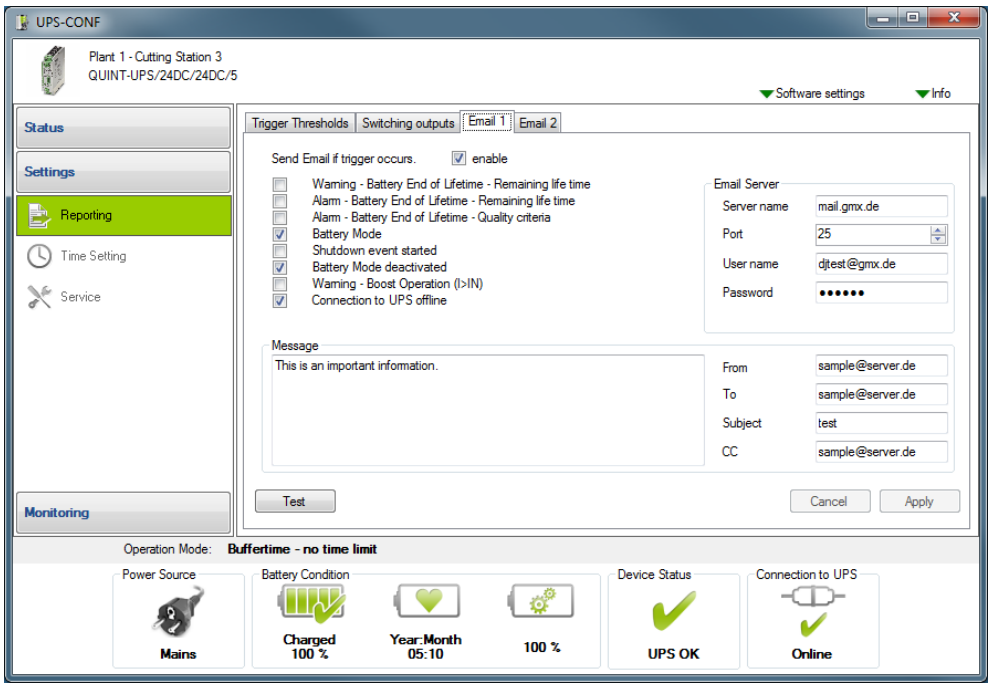
- The same triggers as described in section "Trigger Thresholds" for warning and/or alarm, e.g. triggers that are released by an exceeded or underrun threshold.
- The quality criteria is no more fulfilled. The IQ-Technology of the QUINT-UPS-IQ is able to calculate it's own save remaining lifetime for the battery. Based on this calculation, the quality criteria is evaluated as met or not.
- The system switches to battery mode.

- A shutdown event started.
- The battery switches to the "Battery Charging" status.
- For the "Disable external battery charger" trigger, see technical datasheet for the QUINT-UPS.

For "Alarm" switching output, no further options can be defined.

Email 1 / Email 2

On the "Email 1" and "Email 2" tabs you can define two separate Email addresses, to which Emails can be sent if certain events occur. To access the input fields, mark the "enable" checkbox in the upper part of the screen.



The available triggers to initiate Emails to be sent are:

- A warning occurs as battery is at it's end of lifetime and the remaining life time falls below a defined time.
- An alarm occurs as battery is at it's end of lifetime and the remaining life time falls below a defined time.
- An alarm occurs as the quality criteria is no more met.
- The battery switches to battery mode.
- A shutdown event started.
- The battery switches to "Battery Charging" status (battery mode deactivated).

- A warning occurs because boost operation was activated. The power supply now delivers BOOST current, which is up to 1.5 times the nominal current of the power supply (only available with QUINT POWER).
- The connection to the UPS was interrupted ("Offline" status).

In the Email Server area, you have to enter:

- "Server name" for the server managing your outgoing mail. Ask your administrator for details.
- "Port" for outgoing Emails is usually 25. The predefined port 25, however, can be changed.
- "User name" and "Password" of your Email account. In some accounts the "User name" is the Email address.

The Message area contains:

- Messagebox: A short explanation of the trigger, that caused the Email, is sent as default message. You can enter additional text, that will be appended to the default text.
- "From" textbox: Any Email address can be entered here.
- "To" textbox: A valid Email address has to be entered here, where the Email is sent to; it must be an Email address, that exists in the Email server´s configuration.
- "Subject" textbox: the title of your Email is user-defined; it is only used with the Email "Test" button. When the Email is successfully sent, click the "Apply" button.
- "CC" textbox: you can enter an Email address, where a copy is sent to.

You can test your settings by clicking on the "Test" button.

Sample Email:

A sample Email would look like this:

Email part	Content of Email part	Explanation
Subject	[UPS CONF: Parameters change notification]	
Message	*** UPS Status Mail ***	Header of the status mail message
	Hall 125	Place of installation, refer to the topic Advanced (see page 41)
	QUINT-UPS/24DC/24DC/5	Type of connected UPS, refer to the device information area in the User interface (see page 15)
	Trigger: Battery Mode Trigger	Kind of active trigger
	Threshold: -	Threshold (if applicable)
	This is an important information.	User defined text from the message textbox

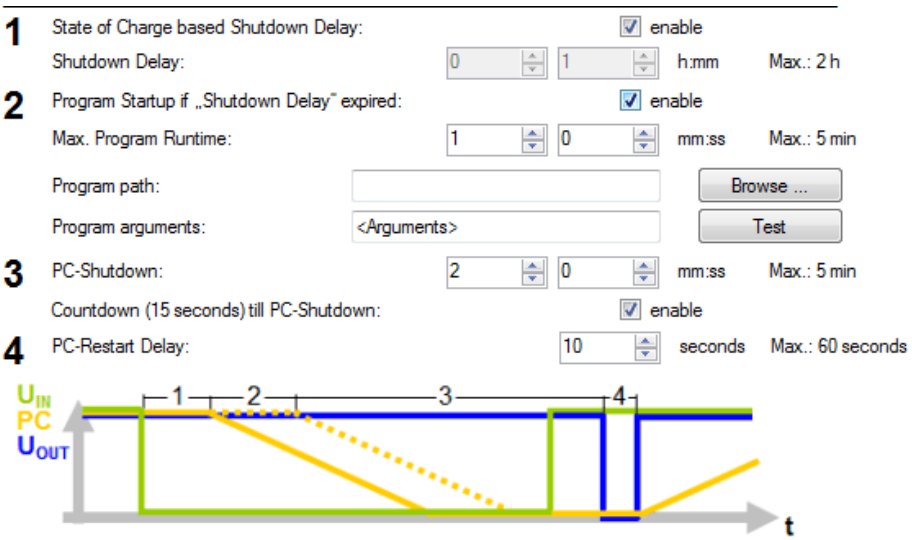
7.2 Time Setting

If the "Time setting" navigation item is selected in the "Settings" group, the action area provides various settings for two different UPS operating modes:

- The upper part (above the separation line) specifies the "Custom" mode.



- In the lower part (below the separation line), four different parameter categories can be set concerning the PC-Mode.

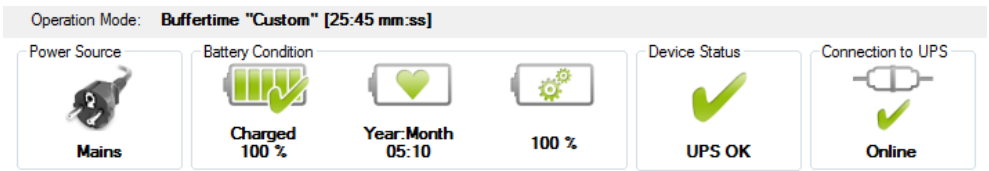


Custom mode

NOTE
These settings only apply if the UPS runs in Custom mode. To set this mode, the buffer time potentiometer located at the device front must be set to "Custom" (refer to topic buffer time selection (see page 12)).

In Custom mode the buffer time for the battery can be set to a maximum of 1 hour (30 seconds default).
When the power supply was interrupted the load will loose it's power after the user-defined buffer time has elapsed. The battery will buffer exactly the set buffer time. If no user-defined time is entered, the buffer time selected by the potentiometer is used.

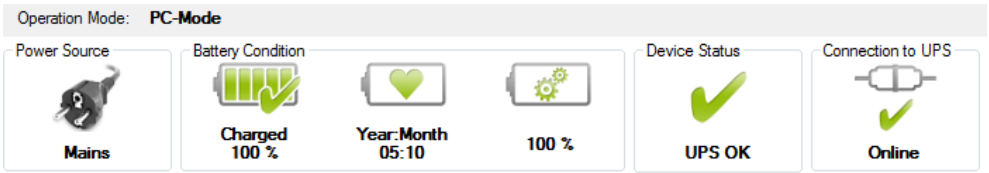
The set time is displayed in the "Operation Mode" of the status bar. An example with 25 minutes and 45 seconds set, shows the following status bar and operation mode:



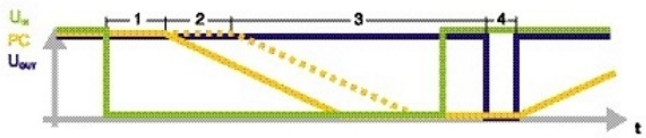
PC-Mode

NOTE
These settings only apply if the UPS runs in PC-Mode. To set this mode, the buffer time potentiometer located at the device front must be set to "PC-Mode" (refer to topic buffer time selection (see page 12).

When the PC-Mode is set, the status bar shows the operation mode "PC-Mode", as shown in the following screenshot:



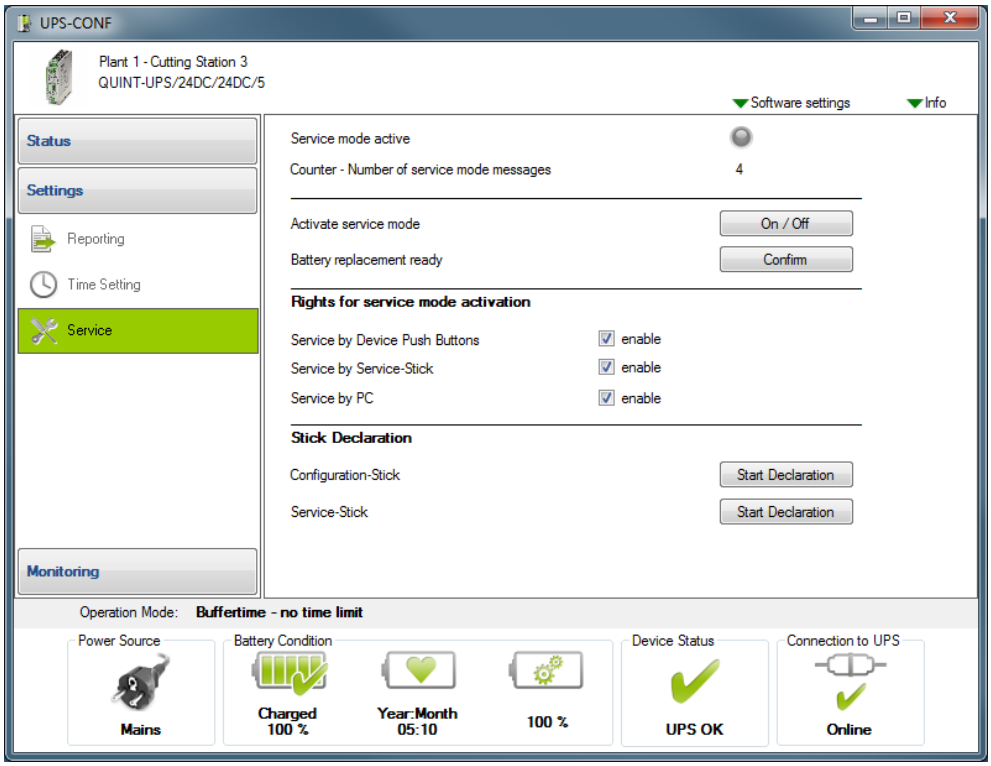
In the "PC Mode" setting on the UPS potentiometer, the UPS functionality follows a chronological sequence that can be parameterized via software, and is thus individually customized to the respective application.



Parameter	Meaning / Possible settings
1 Shutdown delay	Delay time is calculated automatically from the current remaining battery life minus the time required by the PC to shutdown. Alternatively, a fixed delay time may be chosen.
2 Program startup	After the delay time has expired it is possible to start a program. Example: a software starts that gradually backs up system data. You can test your settings by clicking on the "Test" button.
3 PC shutdown	The time required by the PC/IPC to shut down is set here.
4 PC restart delay	Only if the PC/IPC is shut down, and the mains has returned in the meantime, the output voltage will be interrupted for the reset time. The PC/IPC is then automatically restarted.

7.3 Service

If the "Service" item is selected in the software menu "Settings", all parameters of switching the UPS to service mode are accessible in the action area.



Here, you can:

- Operate the UPS in service mode (see page 47).
- Grant or deny rights for the service mode activation (see section below).
- Declare memory sticks as either configuration sticks or service sticks, as described in the topic Stick usage (see page 45).

Rights for service mode activation

The rights for all possible methods to activate or terminate the service mode can be defined in the "Rights for service mode activation" part of the "Service" navigation item´s action area. Possible activation methods are:

- Pressing both push buttons ("Stick -> UPS" and "UPS -> Stick") on the device front simultaneously.
- Plugging a service stick into the Data port of the UPS device.

- Clicking the service mode activation button in the "Service" navigation item´s action area in UPS-CONF.

When allowing a service stick for activating the service mode and disabling the use of the push buttons at the same time, the stick can be considered as a kind of hardware key: Only authorized persons who possess a service stick are allowed to switch the device to service mode. For that purpose, a memory stick must be declared accordingly as described in Stick usage (see page 45).



For further information please refer to the "Service stick usage - service mode (see page 47)".

7.4 Advanced



This navigation item is only available if the "Enable advanced views" checkbox is marked in the Software Settings (see page 5).

The "Advanced" navigation item within the "Settings" group allows to set more specific parameters. These are in detail:

Name of parameter:	Sample value:	Unit:	Explanation:
Place of installation (user defined)	Hall 125	(none)	The text entered here is dislayed in the device information area of the User interface (see page 15).
Initial charging current	1.36	A	The battery is charged with this current, when the power supply is available.
Absorption charging end voltage	28.00	V	An equalizing charge, that increases charging voltage to a higher value than the nominal capacity for a short period. This prevents battery stratification and reduces sulfation. When the battery is fully loaded, this voltage is tolerated as a maximum, before the voltage level gets a stable end value.
Float charging end voltage	27.60	V	The charger adjusts the end voltage based upon battery temperature. During high temperature periods, the actual battery voltage will be reduced and during low temperature periods it will be increased.
Temperature compensation	42	mV/K	High ambient temperatures have a negative impact on the service life of the battery. Therefore, the charging voltage should be lower with higher ambient temperatures. The adjustable values relate to one battery cell each.
Wire distance to the battery unit	300	mm	The maximal wire length from the UPS control unit to the battery unit.
Wire cross section to the battery unit	6.0	qmm	The wire cross section from the UPS control unit to the battery unit.

Name of parameter:	Sample value:	Unit:	Explanation:
Fast battery charging	On	(none)	Boost mode is allowed or not.
Dynamic backup threshold	Off	(none)	This parameter can be defined additionally to the overvoltage and undervoltage related parameters, see below. If set to On the voltage increase or decrease within a certain time period is watched (dynamically). The UPS switches to battery mode, if the relative increase/decrease is too much. In contrast the overvoltage and undervoltage parameters have static values. They can become active regardless the dynamic backup threshold did not trigger, because the voltage was alright.
Undervoltage backup threshold	19.00	V	When the DC voltage falls under this threshold (undervoltage), the system switches to battery mode.
Overvoltage backup threshold	30.00	V	When the DC voltage exceeds this threshold (overvoltage), the system switches to battery mode.
Return to mains time	3	seconds	After this time the system returns to mains, when it is in battery mode and the power supply is available again.
Discharging end voltage	19.20	V	The battery voltage may not sink below this voltage value, otherwise it would be deeply discharged and become defective.
Signaling time after battery low cutoff	00:10	hh:mm	When the battery low status has arrived, the UPS cuts off and the status of the power source firstly switches to "UPS off (see page 27)". After the time set here no more power or battery status is displayed, but only the Connection to UPS (see page 17) is offline.
Signaling time after time cutoff	00:10	hh:mm	When the buffer time has elapsed, the UPS cuts off and the status of the power source firstly switches to "UPS off (see page 27)". After the time set here no more power or battery status is displayed, but only the Connection to UPS (see page 17) is offline.

Name of parameter:	Sample value:	Unit:	Explanation:
Battery type (imported item)	"No value assigned"	(none)	The type of battery delivered by the manufacturer. This value is read by the UPS-CONF software.
Nominal capacity (imported item)	"No value assigned"	Ah	The nominal capacity of the battery delivered by the manufacturer. This value is read by the UPS-CONF software.



You can restore the default settings anytime by clicking the "Set factory defaults" button.



You can import / export the list in a .csv file by clicking the button "Import " or "Export".

8 Monitoring - Statistics and logging

If the "Monitoring" group is selected, the navigation items "Statistic (user defined)", "Statistic (system defined)" and "Logging" are available.

The items inform about counted and time measured statistic values and show logged information.

Statistic (user defined)

The "Statistic (user defined)" navigation item shows counter values which start at a user-defined value. If, for example, batteries have been replaced, you can set the values manually to "0" in order to start a new logging period. The following values are displayed and can be reset:

- Number of battery modes: How often did the UPS already change to battery mode?
- Total time of battery mode: How long altogether did the UPS stay in battery mode?
- Number of operation startups: How often was the UPS started?
- Total operation time: How long altogether did the UPS run?

Statistic (device defined)

The "Statistic (system defined)" navigation item shows counter values which always start from the value "0" with the initial device installation. Beneath the same values as shown in the "Statistic (user defined)" navigation item, additional values are displayed:

- Runtime of the current battery operation: How long does the current battery operation (if relevent) altready last?
- Number of battery low cutoffs: How often was the battery completely discharged?
- Number of all messages: How many warnings and alarms were signaled altogether?
- Number of remaining lifetime messages: How often was a remaining lifetime signaled?
- Number of quality criteria messages: How often was signaled, that the quality criteria is no more met?
- Number of battery presence messages: How often was a battery unit not detected, e.g. no fuse plugged or circuit broken?

Logging

The logging is done by the software itself.
The "Logging" navigation item lists events like "Offline", "Online" or "UPS in battery mode" with date and time stamp. The event colors differ between green and red depending on the type of event. They are chronologically sorted, the latest uppermost.



You can delete the list by clicking the button "Delete history".
You can export the list in a .csv file by clicking the button "Export".

9 Stick usage

At the Data port of the UPS device, a memory stick can be connected (see image below). After plugging in, the UPS either acts as configuration stick or as service stick, depending on how the respective stick has been declared before in the "Service" screen of the UPS-CONF software.



A configuration stick is used to copy parameterization data from/to the UPS device, as described in the topic Configuration stick usage (see page 46).

A service stick can be used to switch the device to service mode (see page 47) in order to perform maintenance tasks.

To declare a memory stick proceed as follows:

NOTE
When declaring a stick, its current content is deleted, i.e. already stored configuration data are lost.

1. Open the software menu "Settings".
2. Click the "Service" navigation item.
3. In the "Stick declaration" area of the action area, click the appropriate "Start declaration" button.

After this declaration, the UPS device automatically formats the stick after plugging it into the Data port the next time and then acts accordingly.

9.1 Configuration stick usage

A configuration stick stores UPS configurations, i.e.complete parameter sets. Configurations can be copied from the UPS to the stick and vice versa. This way, the stick can be used to transfer configurations from one UPS to another.



NOTE
The configuration stick cannot be used, while the UPS runs in battery mode. The power supply must be available.

The usage of configuration sticks is explained by the following steps:

1. Make sure that the used memory stick is already declared as configuration stick as described in the topic Stick usage (see page 45).
2. To transfer parameters between the stick and the UPS, execute one of the following steps:
   - To copy parameters from the stick to the QUINT-UPS push the "Stick -> UPS" button for more than 2 seconds.
   - To copy parameters from the QUINT-UPS to the stick push the "UPS -> Stick" button for more than 2 seconds.
3. Connect the configuration stick to the Data port of the UPS under consideration of the plug direction.
   The parameter transfer is started automatically and the progress is signalled by the LEDs:
   - While data is transferred they flash red - yellow - green.
   - A successful tranfer completion is signalled by a permanent green LED.
   - A faulty tranfer completion is signalled by a permanent red LED.
4. Remove the stick from the Data port.
5. After copying a parameter set from an UPS to the stick you can "clone" this configuration by plugging this stick into another UPS and copying the stored data from the stick into this UPS.

9.2 Service stick usage - service mode

The service mode is used, when installation and maintenance work has to be achieved, such as a battery has to be replaced.

There are several possibilities to switch the UPS to service mode.

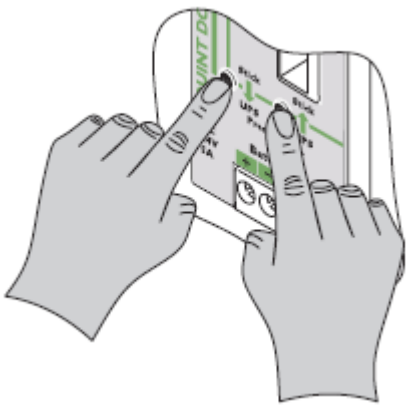
The corresponding activation rights have to be granted for service mode activation and deactivation, as described in the topic Rights for service mode activation (see page 39).

Service mode activation

The service mode cannot be activated, while the QUINT-UPS runs in battery mode. The power supply must be available.

Depending on the granted activation rights, the service mode can be activated in three different ways:

- By holding down both push buttons on the QUINT-UPS named "Stick -> UPS" and "UPS -> Stick" for at least 6 seconds.

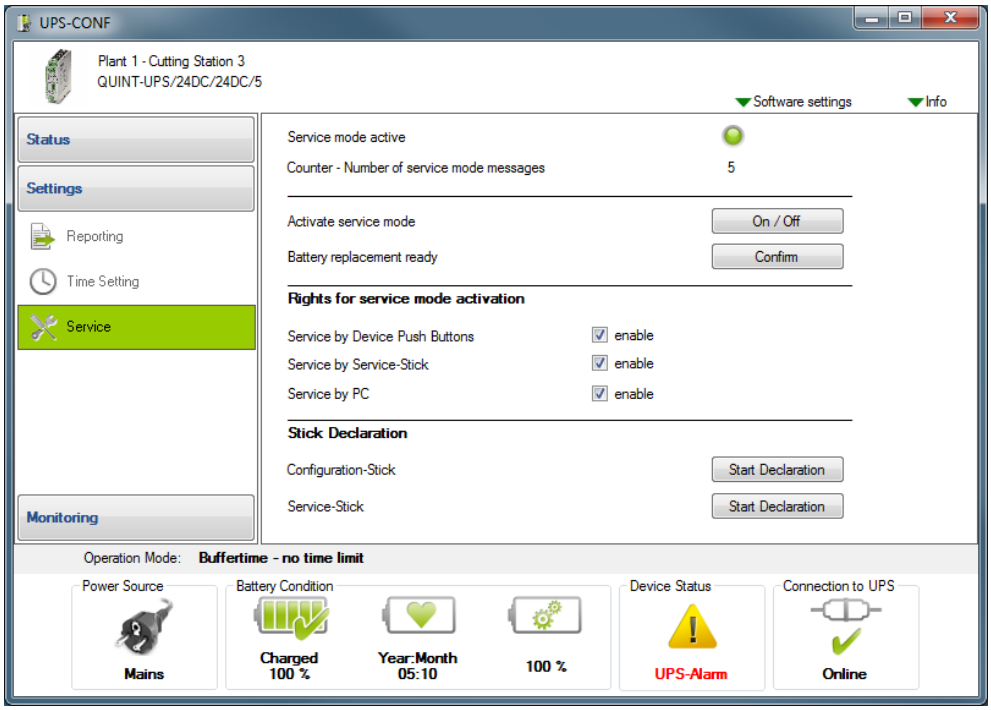


- By connecting a service stick (see page 45) to the Data port (see page 13) of the UPS.
- By using the UPS-CONF software as follows:
  In the "Settings" group, select the "Service" item, and click the "On / Off" button near the "Activate service mode" text.

While the service mode is active

- the alarm status is activated,

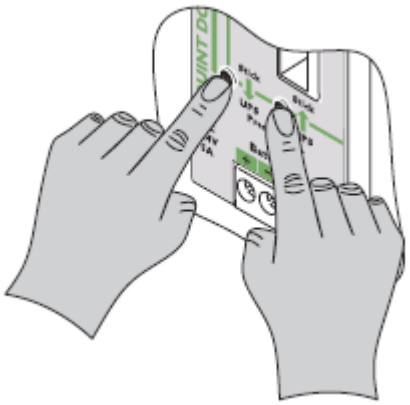
- the charging current is interrupted,
- the status LED "Service mode active" in the UPS-CONF software ("Settings" group / "Service" item) is green.



Service mode deactivation

The service mode can be deactivated in different ways:

- By holding down both push buttons on the QUINT-UPS named "Stick -> UPS" and "UPS -> Stick" for at least 6 seconds.



- By removing the service stick from the Data port of the UPS.
- By using the UPS-CONF software as follows:
  In the "Settings" group, select the "Service" item, and click the "On / Off" button near the "Activate service mode" text.

After the service mode is deactivated, the status LED "Service mode active" in the UPS-CONF software ("Settings" / "Status") switches back from green to gray.

Service mode operation

To operate the QUINT-UPS in the service mode in order to replace a battery for example, execute the steps described below.

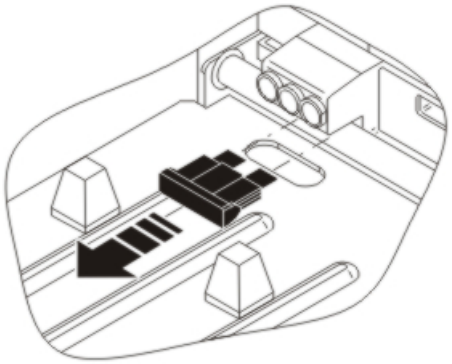
DANGER
Before activating the service mode read and obey carefully the safety instructions in the topic Important safety notes (see page 10).

DANGER
Watch polarity when connecting cables!

1. Activate the service mode by one of the ways described above.
2. Replace the battery as follows:.

   i. Open battery housing.

   ii. Remove fuses.

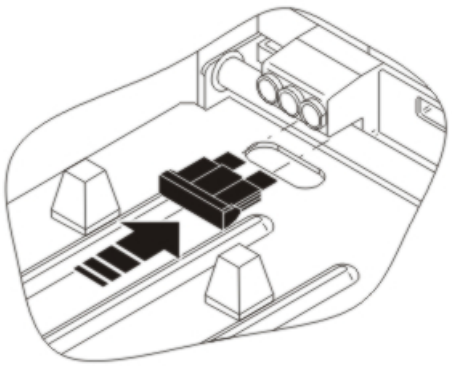


iii. Remove cabling.

iv. Change battery.

v. Connect cabling.

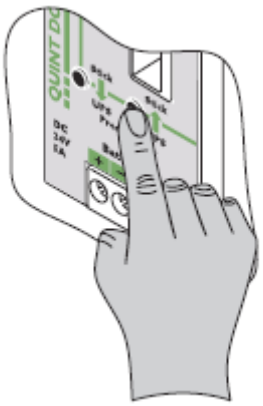
vi. Insert fuses.



vii. Close battery housing.

3. As soon as the work is finished, the parameters of the new battery have to be read into the UPS, so it's status information is available. To introduce this battery registration, do one of the following actions:

   - Push one of the push buttons on the QUINT-UPS named "Stick -> UPS" or "UPS -> Stick" and hold it down for more than 6 seconds.



or

- In the "Settings" group of the UPS-CONF software select the "Service" item, locate the text "Battery replacement ready" and click the "Confirm" button near the text.

The bar graph at the QUINT-UPS flashes, the alarm status is still active.

NOTE

If the service mode has been deactivated by removing the service stick from the Data port before the battery replacement has been confirmed, it can be confirmed by the UPS-CONF software. A popup window will remind the user to confirm the battery replacement.

4. Deactivate the service mode as described above.

10 Application samples



For further information, please take a look at the Software Tutorials or the Quick Start Poster on www.phoenixcontact.net/catalog. You will find the data if you link to UPS-CONF or QUINT-UPS.

10.1 Functional test

One of the main functions of the QUINT-UPS is to supply the load, when the mains fails. To test, if the UPS buffers the load, follow these steps:

1. Switch off the power supply of the QUINT-UPS.
2. Check if the QUINT-UPS buffers the load as long as set with the buffer time potentiometer, refer to Buffer time selection (see page 12).

10.2 PC-Mode: PC shutdown and restart

The IQ technology of the QUINT-UPS is able to control the power supply for a PC. For that purpose the PC with the UPS-CONF software installed has to be connected to the UPS and the PC-Mode activated. The PC-Mode enables the automatic PC shutdown and restart functionality.

To test the PC shutdown and restart functionality in the PC-Mode, proceed as follows:

1. Switch the buffer time potentiometer to "PC-Mode", as described in the topic Buffer time selection (see page 12).
2. Connect the UPS device to a USB port of the PC where UPS-CONF is installed (refer to topic Hardware setup (see page 11)).
3. Open the software menu "Settings" and click "Time Settings".
4. Set the parameters for the four different parameter categories, as described in the topic PC-Mode (see page 38).
5. Check if the PC shuts down and restarts corresponding to the set parameters. If a program execution has been set, verify that it is executed.

11 Troubleshooting

If your system does not work properly for any reason, approach the problem in the following manner:

1. Check the system status:

   - If the UPS-CONF software is installed, check the status bar (see page 17) and take a look at the system status.
   - If the UPS-CONF software is not installed, take a look at the front side of the UPS and check the LEDs (see page 20).

2. Proceed with the section Unexpected status symbols (see page 54) to find out, what is wrong.



The section Unexpected status symbols (see page 54) will lead you closer to the solution of the problem. If there are specific solutions for a single problem, you will be lead to the section, that describes the problem solving.

11.1 Unexpected status symbols

The meaning of status symbols showing an unexpected status is explained in the following topic.
The first table lists the symbols for the system status, that you can find in the action area and the second table lists the symbols from the status bar.

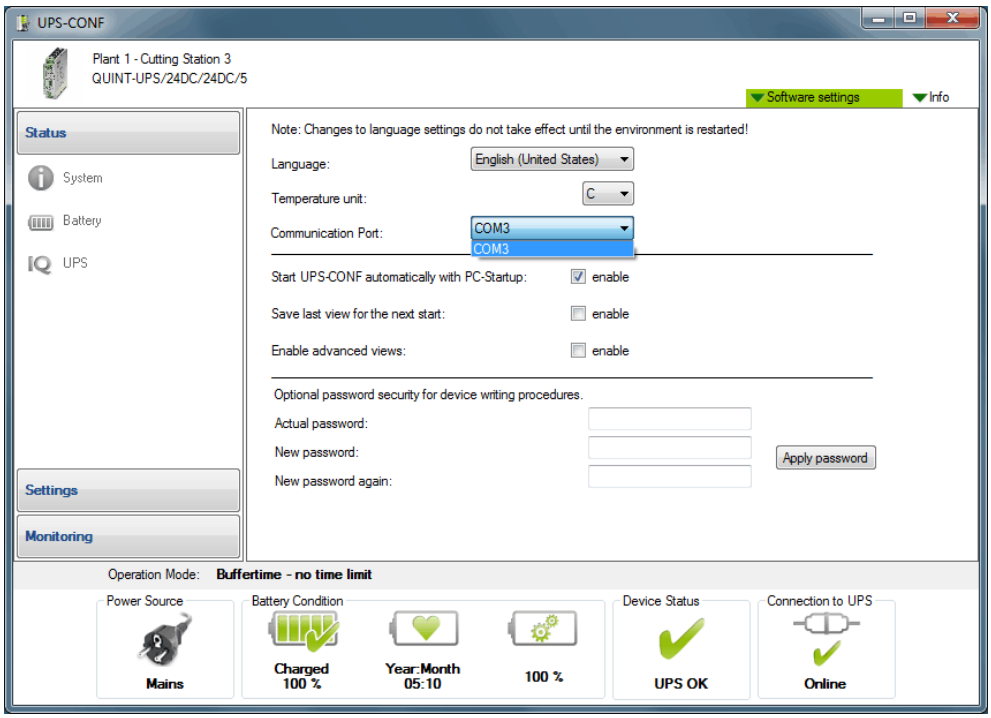
System status Symbol	Current situation and possible reason	Possible correction
 Gray: Mains OFF	There is no current available. Probably the Mains is switched OFF.	• Switch the Mains ON. • Take care that the power supply is available again.
DC  Gray: DC output not available	The power supply unit cannot deliver DC. Either the power supply is not available or the Mains switch is set to OFF.	• Switch the Mains ON. • Take care that the power supply is available again.
 Yellow: Battery mode	No current is available, thus the load gets it's power supply from the battery.	• Switch the Mains ON. • Take care that the power supply is available again.
 Red: UPS alarm	There may be different reasons: • No power supply is available. • The battery is soon empty. • The battery has to be replaced. • The battery cannot be detected. • There is another battery problem. • A set threshold has been reached.	• Switch the Mains ON. • Take care that the power supply is available again. • Check the set thresholds and compare with the current status. • Solve the battery problem. • Replace the battery. • Check the cables between UPS and battery. • Verify that the fuse is installed in the battery.

Status bar Symbol	Current situation and possible reason	Possible correction
	The UPS is in battery mode, because no power supply is available.	• Switch the Mains ON. • Take care that the power supply is available again.
	The bridge between the UPS terminals R1 and R2 is removed. Battery is deactivated therefore. Refer to the parameter "Remote Status" in the topic UPS (see page 27).	If you want the battery to be activated and the battery mode to be introduced, when the mains fail, bridge the terminals R1 and R2. Refer to the hardware overview (see page 7).
	There is no power supply available. One of these states is ongoing: • The UPS is off, because battery mode is finished. The set buffer time has elapsed. • The power source is not ok, because input voltage is in an invalid range.	If the UPS is off, because battery mode is finished, but the battery is funcional: • Switch the Mains ON. • Take care that the power supply is available again. If the UPS is off, because battery mode is finished, and the battery is no more funcional or at it's end of lifetime: • Change the battery. If the power source is not ok, because input voltage is in an invalid range: • Check the power supply.
	The battery is discharging, because no power supply is available.	• Switch the Mains ON. • Take care that the power supply is available again.
	The battery mode is finished, because the battery is empty.	• Take care that the power supply is available again to reload the battery. • Change the battery, if battery lifetime is exhausted.
	(see UPS alarm in the table above)	(see UPS alarm in the table above)
	• The connection between PC and UPS via the IFS-USB-DATACABLE is interrupted. • The communication port is not set.	• Connect the UPS and PC via the IFS-USB-DATACABLE. • Check if the communication port is set, as described in the topic Communication port (see page 56).

11.2 Communication port

The PC USB communication port for the communication between the UPS and the PC is automatically set during software installation. In case the communication port has not been set, the status bar shows the "Connection to UPS: Offline" status.

Although the communication port has not been set, it is detected automatically. Thus you can set it manually. You just have to select it in the software settings of the system menu.



If you click the combo box near the text "Communication port" the correct port is shown and you can select it.

Index

A

Advanced view setting 5

Automatic software start 5

B

Battery replacement 47

Battery status 25

Buffer time potentiometer 12

Buffer time setting 12

C

Communication port 5

Configuration parameters 29

Configuration stick 46

Custom mode 36

D

Data cable 14

Download web address 5

E

Emails 31

Error conditions 53, 54

G

GUI 15

H

Hardware overview 7

I

Indication elements 15

IPC connection 14

L

Language setting 5

Logging 44

M

Memory stick 46

N

Navigation 15

O

Operating elements 15

Overview of system functions 1

Overview of the user interface 15

P

Parameter settings 29

Password setting 5

PC connection 14

PC-Mode 36

Performance characteristics 1

Port setting 5

Preserve last view 5

S

Safety information 10

Safety requirements 10
Sending Emails 31
Service mode 47
Service mode rights 39
Service stick 47
Setting advanced parameters 41
Setting parameters 29
Software download 5
Software settings 5
Statistic values 44
Status bar 17
Status symbols 20
Switching outputs 31
Symbols used 4
System requirements 4

T

time settings 36
Trigger Thresholds 31

U

UPS status 27
User interface 15

W

Writing parameters 29

SIEMENS

Datenblatt 6ES7214-1AG40-0XB0



SIMATIC S7-1200, CPU 1214C, Kompakt-CPU, DC/DC/DC, onboard I/O: 14 DI DC 24V; 10 DO 24V DC; 2 AI 0-10V DC, Stromversorgung: DC 20,4-28,8V DC, Programm-/Datenspeicher 100 KB

Allgemeine Informationen	
Produkttyp-Bezeichnung	CPU 1214C DC/DC/DC
Firmware-Version	V4.4
Engineering mit	
● Programmierpaket	ab STEP 7 V16
Versorgungsspannung	
Nennwert (DC)	
● DC 24 V	Ja
zulässiger Bereich, untere Grenze (DC)	20,4 V
zulässiger Bereich, obere Grenze (DC)	28,8 V
Verpolschutz	Ja
Lastspannung L+	
● Nennwert (DC)	24 V
● zulässiger Bereich, untere Grenze (DC)	20,4 V
● zulässiger Bereich, obere Grenze (DC)	28,8 V
Eingangsstrom	
Stromaufnahme (Nennwert)	500 mA; nur CPU
Stromaufnahme, max.	1 500 mA; CPU mit allen Erweiterungsbaugruppen
Einschaltstrom, max.	12 A; bei 28,8 V
I^2t	0,5 $A^2 \cdot s$
Ausgangsstrom	
für Rückwandbus (DC 5 V), max.	1 600 mA; max. DC 5 V für SM und CM
Geberversorgung	
24 V-Geberversorgung	
● 24 V	L+ minus 4 V DC min.
Verlustleistung	
Verlustleistung, typ.	12 W
Speicher	
Arbeitsspeicher	
● integriert	100 kbyte
● erweiterbar	Nein
Ladespeicher	
● integriert	4 Mbyte
● steckbar (SIMATIC Memory Card), max.	mit SIMATIC Memory Card
Pufferung	
● vorhanden	Ja
● wartungsfrei	Ja

Änderungen vorbehalten
© Copyright Siemens

• ohne Batterie	Ja
CPU-Bearbeitungszeiten	
für Bitoperationen, typ.	0,08 µs; / instruction
für Wortoperationen, typ.	1,7 µs; / instruction
für Gleitpunktarithmetik, typ.	2,3 µs; / instruction
CPU-Bausteine	
Anzahl Bausteine (gesamt)	DBs, FCs, FBs, Zähler und Timer. Die maximale Anzahl adressierbarer Bausteine reicht von 1 bis 65535. Es besteht keine Einschränkung, Nutzung des gesamten Arbeitsspeichers
OB	
• Anzahl, max.	Begrenzung nur durch Arbeitsspeicher für Code
Datenbereiche und deren Remanenz	
remanenter Datenbereich (inklusive Zeiten, Zähler, Merker), max.	10 kbyte
Merker	
• Anzahl, max.	8 kbyte; Größe des Merkerbereichs
Lokaldaten	
• je Prioritätsklasse, max.	16 kbyte; Prioritätsklasse 1 (Programmzyklus): 16 kbyte, Prioritätsklasse 2 bis 26: 6 kbyte
Adressbereich	
Prozessabbild	
• Eingänge, einstellbar	1 kbyte
• Ausgänge, einstellbar	1 kbyte
Hardware-Ausbau	
Anzahl Baugruppen je System, max.	3 Communication Module, 1 Signal Board, 8 Signal Module
Uhrzeit	
Uhr	
• Hardware-Uhr (Echtzeituhr)	Ja
• Pufferungsdauer	480 h; typisch
• Abweichung pro Tag, max.	±60 s/Monat bei 25 °C
Digitaleingaben	
Anzahl der Eingänge	14; integriert
• davon für technologische Funktionen nutzbare Eingänge	6; HSC (High Speed Counting)
M/P-lesend	Ja
Anzahl gleichzeitig ansteuerbarer Eingänge	
alle Einbaulagen	
— bis 40 °C, max.	14
Eingangsspannung	
• Nennwert (DC)	24 V
• für Signal "0"	DC 5 V bei 1 mA
• für Signal "1"	DC 15 V bei 2,5 mA
Eingangsverzögerung (bei Nennwert der Eingangsspannung)	
für Standardeingänge	
— parametrierbar	0,2 ms, 0,4 ms, 0,8 ms, 1,6 ms, 3,2 ms, 6,4 ms und 12,8 ms, wählbar in 4er Gruppen
— bei "0" nach "1", min.	0,2 ms
— bei "0" nach "1", max.	12,8 ms
für Alarmeingänge	
— parametrierbar	Ja
für Technologische Funktionen	
— parametrierbar	Einphasig: 3 @ 100 kHz & 3 @ 30 kHz, Differenziell: 3 @ 80 kHz & 3 @ 30 kHz
Leitungslänge	
• geschirmt, max.	500 m; 50 m für technologische Funktionen
• ungeschirmt, max.	300 m; für technologische Funktionen: Nein
Digitalausgaben	
Anzahl der Ausgänge	10
• davon schnelle Ausgänge	4; 100 kHz Impulsfolge

Änderungen vorbehalten
© Copyright Siemens

Begrenzung der induktiven Abschaltspannung auf	L+ (-48 V)
Schaltvermögen der Ausgänge	
● bei ohmscher Last, max.	0,5 A
● bei Lampenlast, max.	5 W
Ausgangsspannung	
● für Signal "0", max.	0,1 V; mit 10 kOhm Last
● für Signal "1", min.	20 V
Ausgangsstrom	
● für Signal "1" Nennwert	0,5 A
● für Signal "0" Reststrom, max.	0,1 mA
Ausgangsverzögerung bei ohmscher Last	
● "0" nach "1", max.	1 µs
● "1" nach "0", max.	5 µs
Schaltfrequenz	
● der Impulsausgänge, bei ohmscher Last, max.	100 kHz
Relaisausgänge	
● Anzahl Relaisausgänge	0
Leitungslänge	
● geschirmt, max.	500 m
● ungeschirmt, max.	150 m
Analogeingaben	
Anzahl Analogeingänge	2
Eingangsbereiche	
● Spannung	Ja
Eingangsbereiche (Nennwerte), Spannungen	
● 0 bis +10 V	Ja
— Eingangswiderstand (0 bis 10 V)	≥100 KOhm
Leitungslänge	
● geschirmt, max.	100 m; verdreht und geschirmt
Analogausgaben	
Anzahl Analogausgänge	0
Analogwertbildung für die Eingänge	
Integrations- und Wandlungszeit/Auflösung pro Kanal	
● Auflösung mit Übersteuerungsbereich (Bit inklusive Vorzeichen), max.	10 bit
● Integrationszeit parametrierbar	Ja
● Wandlungszeit (pro Kanal)	625 µs
Geber	
Anschließbare Geber	
● 2-Draht-Sensor	Ja
1. Schnittstelle	
Schnittstellentyp	PROFINET
potenzialgetrennt	Ja
automatische Ermittlung der Übertragungsgeschwindigkeit	Ja
Autonegotiation	Ja
Autocrossing	Ja
Schnittstellenphysik	
● RJ 45 (Ethernet)	Ja
● Anzahl der Ports	1
● integrierter Switch	Nein
Protokolle	
● PROFINET IO-Controller	Ja
● PROFINET IO-Device	Ja
● SIMATIC-Kommunikation	Ja
● Offene IE-Kommunikation	Ja; optional auch verschlüsselt möglich
● Webserver	Ja
● Medienredundanz	Nein
PROFINET IO-Controller	

Änderungen vorbehalten
© Copyright Siemens

● Übertragungsgeschwindigkeit, max.	100 Mbit/s
Dienste	
— PG/OP-Kommunikation	Ja
— Taktsynchronität	Nein
— IRT	Nein
— PROFIenergy	Nein
— Priorisierter Hochlauf	Ja
— Anzahl IO-Devices mit priorisiertem Hochlauf, max.	16
— Anzahl anschließbarer IO-Device, max.	16
— Anzahl anschließbarer IO-Device für RT, max.	16
— davon in Linie, max.	16
— Aktivieren/Deaktivieren von IO-Devices	Ja
— Anzahl gleichzeitig aktivierbarer/deaktivierbarer IO-Devices, max.	8
— Aktualisierungszeit	Der Minimalwert der Aktualisierungszeit ist auch abhängig vom eingestellten Kommunikationsanteil für PROFINET IO, von der Anzahl der IO-Devices und der projektierten Nutzdaten.
PROFINET IO-Device	
Dienste	
— PG/OP-Kommunikation	Ja
— Taktsynchronität	Nein
— IRT	Nein
— PROFIenergy	Ja
— Shared Device	Ja
— Anzahl IO-Controller bei Shared Device, max.	2
Protokolle	
PROFINET IO	Ja
PROFIBUS	Ja; CM 1243-5 (Master) oder CM 1242-5 (Slave) erforderlich
AS-Interface	Ja; CM 1243-2 notwendig
Protokolle (Ethernet)	
● TCP/IP	Ja
● DHCP	Nein
● SNMP	Ja
● DCP	Ja
● LLDP	Ja
Redundanzbetrieb	
Medienredundanz	
— MRP	Nein
— MRPD	Nein
SIMATIC-Kommunikation	
● S7-Routing	Ja
Offene IE-Kommunikation	
● TCP/IP	Ja
— Datenlänge, max.	8 kbyte
● ISO-on-TCP (RFC1006)	Ja
— Datenlänge, max.	8 kbyte
● UDP	Ja
— Datenlänge, max.	1 472 byte
Webserver	
● unterstützt	Ja
● anwenderdefinierte Webseiten	Ja
OPC UA	
● Runtime-Lizenz erforderlich	Ja; Lizenz "Basic" erforderlich
● OPC UA Server	Ja; Data Access (Read, Write, Subscribe), Runtime-Lizenz erforderlich
— Applikations-Authentifizierung	verfügbare Security Policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256
— Benutzer-Authentifizierung	"Anonym" oder mittels Benutzername & Passwort
— Anzahl Sessions, max.	5

Änderungen vorbehalten
© Copyright Siemens

— Anzahl erreichbarer Variablen, max.	1 000
— Anzahl Subscriptions je Session, max.	5
— Abtastintervall, min.	100 ms
— Sendeintervall, min.	200 ms
— Anzahl überwachter Elemente (monitored items), max.	500
— Anzahl der Server-Schnittstellen, max.	2
— Anzahl Knoten bei benutzerdefinierten Server-Schnittstellen, max.	1 000
Weitere Protokolle	
• MODBUS	Ja
Kommunikationsfunktionen	
S7-Kommunikation	
• unterstützt	Ja
• als Server	Ja
• als Client	Ja
• Nutzdaten pro Auftrag, max.	siehe Online-Hilfe (S7 communication, User data size)
Anzahl Verbindungen	
• gesamt	8 Verbindungen für die offene Benutzerkommunikation (aktiv oder passiv): TSEND_C, TRCV_C, TCON, TDISCON, TSEND und TRCV, 8 CPU/CPU-Verbindungen (Client oder Server) für GET/PUT-Daten, 6 Verbindungen für dynamische Zuordnung zu GET/PUT oder offener Benutzerkommunikation
Test- Inbetriebnahmefunktionen	
Status/Steuern	
• Status/Steuern Variable	Ja
• Variablen	Ein-/Ausgänge, Merker, DB, Peripherieein-/ausgänge, Zeiten, Zähler
Forcen	
• Forcen	Ja
Diagnosepuffer	
• vorhanden	Ja
Traces	
• Anzahl projektierbarer Traces	2
• Speichergröße je Trace, max.	512 kbyte
Alarme/Diagnosen/Statusinformationen	
Diagnoseanzeige LED	
• RUN/STOP-LED	Ja
• ERROR-LED	Ja
• MAINT-LED	Ja
Integrierte Funktionen	
Anzahl Zähler	6
Zählfrequenz (Zähler) max.	100 kHz
Frequenzmessung	Ja
gesteuertes Positionieren	Ja
Anzahl lagegeregelte Positionierachsen, max.	8
Anzahl Positionierachsen über Puls-Richtungs-Schnittstelle	4; mit integrierten Ausgängen
PID-Regler	Ja
Anzahl Alarmeingänge	4
Anzahl Impulsausgänge	4
Grenzfrequenz (Impuls)	100 kHz
Potenzialtrennung	
Potenzialtrennung Digitaleingaben	
• Potenzialtrennung Digitaleingaben	Nein
• zwischen den Kanälen, in Gruppen zu	1
Potenzialtrennung Digitalausgaben	
• Potenzialtrennung Digitalausgaben	Ja
• zwischen den Kanälen	Nein
• zwischen den Kanälen, in Gruppen zu	1

Änderungen vorbehalten
© Copyright Siemens

EMV	
Störfestigkeit gegen Entladen statischer Elektrizität	
● Störfestigkeit gegen Entladen statischer Elektrizität nach IEC 61000-4-2	Ja
— Prüfspannung bei Luftentladung	8 kV
— Prüfspannung bei Kontaktentladung	6 kV
Störfestigkeit gegen leitungsgebundene Störgrößen	
● Störfestigkeit auf Versorgungsleitungen nach IEC 61000-4-4	Ja
● Störfestigkeit auf Signalleitungen nach IEC 61000-4-4	Ja
Störfestigkeit gegen Stoßspannungen (Surge)	
● Störfestigkeit auf Versorgungsleitungen nach IEC 61000-4-5	Ja
Störfestigkeit gegen leitungsgeführte Störgrößen, induziert durch hochfrequente Felder	
● Störfestigkeit gegen Hochfrequenzeinstrahlung nach IEC 61000-4-6	Ja
Emission von Funkstörungen nach EN 55 011	
● Grenzwertklasse A, für den Einsatz im Industriebereich	Ja; Gruppe 1
● Grenzwertklasse B, für den Einsatz in Wohngebieten	Ja; wenn durch geeignete Maßnahmen gewährleistet wird, dass die Grenzwerte für Klasse B nach EN 55011 eingehalten werden
Schutzart und Schutzklasse	
Schutzart IP	IP20
Normen, Zulassungen, Zertifikate	
CE-Kennzeichen	Ja
UL-Zulassung	Ja
cULus	Ja
FM-Zulassung	Ja
RCM (ehemals C-TICK)	Ja
KC-Zulassung	Ja
Schiffbau-Zulassung	Ja
Umgebungsbedingungen	
Freier Fall	
● Fallhöhe, max.	0,3 m; fünfmal, in Versandverpackung
Umgebungstemperatur im Betrieb	
● min.	-20 °C
● max.	60 °C; Anzahl gleichzeitig eingeschalteter Ein- bzw. Ausgänge: 7 bzw. 5 (keine benachbarten Punkte) bei 60 °C horizontal oder 50 °C vertikal, 14 bzw. 10 bei 55 °C horizontal oder 45 °C vertikal
● waagerechte Einbaulage, min.	-20 °C
● waagerechte Einbaulage, max.	60 °C
● senkrechte Einbaulage, min.	-20 °C
● senkrechte Einbaulage, max.	50 °C
Umgebungstemperatur bei Lagerung/Transport	
● min.	-40 °C
● max.	70 °C
Luftdruck nach IEC 60068-2-13	
● Betrieb, min.	795 hPa
● Betrieb, max.	1 080 hPa
● Lagerung/Transport, min.	660 hPa
● Lagerung/Transport, max.	1 080 hPa
Höhe im Betrieb bezogen auf Meeresspiegel	
● Aufstellungshöhe, min.	-1 000 m
● Aufstellungshöhe, max.	2 000 m
Relative Luftfeuchte	
● Betrieb, max.	95 %; keine Betauung
Schwingungen	
● Schwingfestigkeit während Betrieb gemäß IEC 60068-2-6	2 g (m/s²) Wandmontage, 1 g (m/s²) DIN Hutschiene

Änderungen vorbehalten
© Copyright Siemens

● Betrieb, geprüft nach IEC 60068-2-6	Ja
Schockprüfung	
● geprüft nach IEC 60068-2-27	Ja; IEC 68, Teil 2-27; Halbsinus: Stärke des Stoßes 15 g (Scheitelwert), Dauer 11 ms
Schadstoff-Konzentrationen	
● SO2 bei RH < 60% ohne Kondensation	S02: < 0.5 ppm; H2S: < 0.1 ppm; RH < 60% kondensationsfrei
Projektierung	
Programmierung	
Programmiersprache	
— KOP	Ja
— FUP	Ja
— SCL	Ja
Know-how-Schutz	
● Anwenderprogrammschutz/Passwortschutz	Ja
● Kopierschutz	Ja
● Bausteinschutz	Ja
Zugriffschutz	
● Schutzstufe: Schreibschutz	Ja
● Schutzstufe: Schreib-/Leseschutz	Ja
● Schutzstufe: Complete Protection	Ja
Zykluszeitüberwachung	
● einstellbar	Ja
Maße	
Breite	110 mm
Höhe	100 mm
Tiefe	75 mm
Gewichte	
Gewicht, ca.	415 g

letzte Änderung: 16.01.2021

Änderungen vorbehalten
© Copyright Siemens

SIEMENS

Datenblatt 6ES7241-1CH30-1XB0



SIMATIC S7-1200, Communication Board CB 1241, RS-485, Klemmenblock, unterstützt Freeport

Allgemeine Informationen	
Produkttyp-Bezeichnung	CB 1241 RS 485
Eingangsstrom	
aus Rückwandbus DC 5 V, typ.	50 mA
Verlustleistung	
Verlustleistung, typ.	1,5 W
Schnittstellen	
Punkt-zu-Punkt-Kopplung	
● Leitungslänge, max.	1 000 m
Integrierte Protokolltreiber	
— Freeport	Ja
— ASCII	Ja; als Bibliotheksfunktion verfügbar
— Modbus RTU Master	Ja
— Modbus RTU Slave	Ja
— USS	Ja; als Bibliotheksfunktion verfügbar
Protokolle	
Integrierte Protokolle	
Freeport	
— Telegrammlänge, max.	1 kbyte
— Bit pro Zeichen	7 oder 8
— Anzahl Stoppbits	1 (Standard), 2
— Parity	keine Parität (Standard); gerade, ungerade, Mark (Paritätsbit immer auf 1); Space (Paritätsbit immer auf 0)
3964 (R)	
— Telegrammlänge, max.	1 kbyte
— Bit pro Zeichen	7 oder 8
— Anzahl Stoppbits	1 (Standard), 2
— Parity	keine Parität (Standard); gerade, ungerade, Mark (Paritätsbit immer auf 1); Space (Paritätsbit immer auf 0)
Modbus RTU Master	
— Adressbereich	1 bis 49 999 (Standard-Modbus-Adressierung)
— Anzahl Slaves, max.	247; Slave-Nummern 1 bis 247, über Modbus-Netzwerksegment max. 32 Geräte, weitere Repeater sind notwendig, um das Netzwerk maximal zu erweitern
Modbus RTU Slave	
— Adressbereich	1 bis 49 999 (Standard-Modbus-Adressierung)
Alarme/Diagnosen/Statusinformationen	
Diagnosefunktion	Ja

Änderungen vorbehalten
© Copyright Siemens

Schutzart und Schutzklasse	
Schutzart IP	IP20
Normen, Zulassungen, Zertifikate	
CE-Kennzeichen	Ja
CSA-Zulassung	Ja
UL-Zulassung	Ja
cULus	Ja
FM-Zulassung	Ja
RCM (ehemals C-TICK)	Ja
KC-Zulassung	Ja
Schiffbau-Zulassung	Ja
Umgebungsbedingungen	
Freier Fall	
• Fallhöhe, max.	0,3 m; fünfmal, in Versandverpackung
Umgebungstemperatur im Betrieb	
• min.	-20 °C
• max.	60 °C
• waagerechte Einbaulage, min.	-20 °C
• waagerechte Einbaulage, max.	60 °C
• senkrechte Einbaulage, min.	-20 °C
• senkrechte Einbaulage, max.	50 °C
• zulässige Temperaturänderung	5 °C bis 55 °C, 3 °C / Minute
Umgebungstemperatur bei Lagerung/Transport	
• min.	-40 °C
• max.	70 °C
Luftdruck nach IEC 60068-2-13	
• Betrieb, min.	795 hPa
• Betrieb, max.	1 080 hPa
• Lagerung/Transport, min.	660 hPa
• Lagerung/Transport, max.	1 080 hPa
Relative Luftfeuchte	
• Betrieb bei 25 °C ohne Kondensation, max.	95 %
Mechanik/Material	
Material des Gehäuses (frontseitig)	
• Kunststoff	Ja
Maße	
Breite	38 mm
Höhe	62 mm
Tiefe	21 mm
Gewichte	
Gewicht, ca.	40 g

letzte Änderung: 05.08.2020

Änderungen vorbehalten
© Copyright Siemens

Dachlüfter, Dachentlüftung – SK 3140.100

erstellt am: 12.07.2021 auf www.rittal.com/de-de



Produktbeschreibung

Beschreibung:	Dachlüfter mit hoher Schutzart und flexibler Montage von innen oder außen.
Farbe:	RAL 7035
Schutzart IP nach IEC 60 529:	IP 21 ohne Filtermatte IP 55 inkl. Filtermatte
Schutzart NEMA:	NEMA 12
Lieferumfang:	Komplett einbaufertige Einheit, inkl. Filtermatte
Hinweis:	Zur Verbesserung der Energieeffizienz und Erhöhung der Gerätelebensdauer wird der Einsatz von Temperaturreglern oder -anzeigen empfohlen.

Produktbeschreibung

Luftleistung (freiblasend):	873 m³/h
Luftleistung freiblasend (ohne Filtermatten):	873 m³/h / 965 m³/h
Luftleistung freiblasend (mit Filtermatten):	725 m³/h / 759 m³/h
Bemessungsbetriebsspannung:	220 V - 240 V, 1~, 50 Hz/60 Hz
Abmessungen:	Breite: 400 mm Höhe: 133 mm Tiefe: 400 mm

Erforderlicher Montageausbruch:	Breite: 258 mm Tiefe: 258 mm
Einbautiefe:	34,6 mm
Temperaturbereich:	Lagerung: -40 °C...+70 °C Betrieb (Umgebung): -20 °C...+55 °C
Nennleistung P_{el}:	Bei 50 Hz: 99 W Bei 60 Hz: 130 W
Bemessungsstrom max.:	Bei 50 Hz: 0,43 A Bei 60 Hz: 0,56 A
Sicherungsautomat/Schmelzsicherung:	3 A
Lebensdauer bei 50 Hz:	62800 h
Lebensdauer bei 60 Hz:	65800 h
Schalldruckpegel:	Bei 50 Hz: 58 dB(A) Bei 60 Hz: 60 dB(A)
Ventilator:	Radial, Kondensatormotor
eCl@ss 8.0/8.1:	27180716
Verpackungseinheit:	1 St.
Gewicht/VE:	6 kg
EAN:	4028177709140
Zolltarifnummer:	84145915
ETIM 7.0:	EC000320
ETIM 6.0:	EC000320
eCl@ss 8.0/8.1:	27180716
eCl@ss 6.0/6.1:	27180716
Produktbeschreibung:	SK Dachlüfter TopTherm, 873/965 m³/h, 220-240 V, 1~, 50/60 Hz, BHT: 400 x 133 x 400 mm

Approbationen

Approbationen:	Approbationsübersicht CSA TÜV-geprüfte Sicherheit UL + C-UL - FTTA UR + C-UR
Zertifikate:	EAC
Erklärungen:	Konformitätserklärung

Ausschreibungstext

Die neue Dachlüfter-Generation ist ein System für alle Größen: es wird
Nennleistung 50/60 Hz: 99 / 130 W

Bemessungsstrom 50/60 Hz: 0,43 / 0,56 A

Bemessungsbetriebsspannung: 220-240 V, 1~, 50/60 Hz,,

Ausführung Ventilator: Radial, Kondensatormotor

Abmessungen [BxHxT]: 400x133x400 mm
Einbautiefe: 34,6 mm
Erforderlicher Montageausbruch [BxT]: 258x258 mm

Betriebstemperatur: -20°C bis +55°C
Lagertemperatur: -40°C bis +70°C

Farbe: RAL 7035

Schutzart NEMA: NEMA 12

Schalldruckpegel 50/60 Hz: 58 / 60 dB(A)

Lebensdauer 50/60 Hz: 62.800 / 65.800 h

Gewicht: 6 kg

Certificate of Compliance

Certificate: 70071163 **Master Contract:** 153184

Project: 70071163 **Date Issued:** 2016-04-10

Issued to: **Rittal GmbH & Co. KG**
Auf dem Stuetzelberg
Herborn, 35745
GERMANY

Attention: Thorsten Heimberg

The products listed below are eligible to bear the CSA Mark shown

Issued by: Sven Renke
Sven Renke

PRODUCTS

CLASS 3211 02 - INDUSTRIAL CONTROL EQUIPMENT - Kits

Filter fan kits, models SK 3139.100, 3139.110, 3140.100, 3140.110, 3140.140, 3140.500, 3140.510
Filter kits, models SK 3138.000
Filter mat, accessory, cat. No.: 3174.100

RATINGS
Filter fan kits bear the following ratings.

Model Cat. No.	Voltage	AC/DC	Frequency	Wattage	Max. Surrounding temp.
	[V]		[Hz]	[W]	[°C]
3139.100	230	ac	50 / 60	52 / 65	55
3139.110	115	ac	50 / 60	53 / 66	55
3140.100	230	ac	50 / 60	102 / 135	55

3140.110	115	ac	50 / 60	105 / 140	55
3140.140	400	ac	50 / 60	98 / 130	55
3140.500	230	ac	50 / 60	168	55
3140.510	115	ac	50 / 60	170	55

Filter kit bear the following ratings.

Model Cat. No.	Voltage	AC/DC	Frequency	Wattage	Max. Surrounding temp.
	[V]		[Hz]	[W]	[°C]
3138.000	N/A	N/A	N/A	N/A	55

Notes:

1. These devices have been evaluated for environmental Type Ratings, Type 12, if mounted according to manufacturing instruction and used with manufacturer's filter mat, cat. No.: 3174.100.
2. The suitability of these fans for use with a solid state control has not been evaluated.
3. Filter mat, accessory, cat. No.: 3174.100 is intended for use with filter fan kits, cat. No.: 3139.100, 3139.110, 3140.100, 3140.110, 3140.140, 3140.500, 3140.510 and filter kits, cat. No.: 3138.000. Suitability with other than the above noted models was not evaluated and shall be considered in the end use.

APPLICABLE REQUIREMENTS

CSA C22.2 No.14-13 - Industrial control equipment - Twelfth Edition
CSA C22.2 NO.94.1-15 - Enclosures for electrical equipment, non-environmental considerations - Second Edition
CSA C22.2 NO.94.2-15 - Enclosures for electrical equipment, environmental considerations - Second Edition

Supplement to Certificate of Compliance

Certificate: 70071163 (059132_0_000) **Master Contract:** 153184

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
70071163	2016-04-10	Original certification of Filter fan kits type SK31xx.

EU-Konformitätserklärung / EU Declaration of Conformity

Dri171781400

Wir, / We,

Rittal GmbH & Co. KG • Auf dem Stützelberg • 35745 Herborn

Erklären, dass die Produkte / declare that the products

Dachlüfter
Roof Mounted Fan

SK 3138.000 SK 3139.100 SK 3139.110 SK 3140.100 SK 3140.110 SK 3140.140
SK 3140.500 SK 3140.510

folgenden Richtlinien entsprechen: / conform to the following Directives

Maschinenrichtlinie 2006/42/EG - Machinery Directive 2006/42/EC
EMV-Richtlinie 2014/30/EU – EMC Directive 2014/30/EU

Angewandte harmonisierte Normen: / Applied harmonised standards

EN ISO 12100
Sicherheit von Maschinen – Allgemeine Gestaltungsleitsätze – Risikobeurteilung und Risikominderung
Safety of machinery – General principles for design – Risk assessment and risk reduction
EN 60335-1
Sicherheit elektrischer Geräte für den Hausgebrauch und ähnliche Zwecke – Teil 1: Allgemeine Anforderungen
Household and similar electrical appliances – Safety – Part 1: General requirements
EN 60529
Schutzarten durch Gehäuse (IP-Code)
Degrees of protection provided by enclosures (IP code)
EN 61000-6-2:2005
Elektromagnetische Verträglichkeit (EMV) – Teil 6-2: Fachgrundnormen; Störfestigkeit ....
Electromagnetic compatibility (EMC) – Part 6-2: Generic standards; Immunity ...
EN 61000-6-3:2007, A1:2011
Elektromagnetische Verträglichkeit (EMV) – Teil 6-3: Fachgrundnormen; Störaussendung....
Electromagnetic compatibility (EMC) – Part 6-3: Generic standards; Emission ...
EN 61000-3-2:2014
Elektromagnetische Verträglichkeit (EMV) - Teil 3-2: Grenzwerte - Grenzwerte für Oberschwingungsströme
Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions
EN 61000-3-3:2013
Elektromagnetische Verträglichkeit (EMV) - Teil 3-3: Grenzwerte - Begrenzung von Spannungsänderungen...
Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes

Herborn, 01.03.19

Verantwortlich für Dokumentation
responsible for documentation

Rittal GmbH & Co. KG
Auf dem Stützelberg
35745 Herborn

Frank Himmelhuber, Geschäftsbereichsleiter FuE
Executive Vice President R&D

Bei einer nicht mit uns abgestimmten Änderung des Produkts verliert diese EU-Konformitätserklärung ihre Gültigkeit.
In case of any amendments to the assembly not explicitly agreed with us, this EU Declaration of Conformity shall be invalidated.

Id. Nr. 335612
Dok. Nr. D-0000-00000434.

ZERTIFIKAT
CERTIFICATE

Hiermit wird bescheinigt, dass die Firma / *This certifies that the company*

Rittal GmbH & Co. KG
Auf dem Stüzelberg 18
35745 Herborn
Deutschland

berechtigt ist, das unten genannte Produkt mit dem abgebildeten Zeichen zu kennzeichnen
is authorized to provide the product mentioned below with the mark as illustrated

Fertigungsstätte *Manufacturing plant*	**LKH Kunststoffwerk Heiligenroth GmbH & Co.KG** **Auf der Birke 2** **56412 Heiligenroth** **Deutschland**
Beschreibung des Produktes (Details s. Anlage 1) *Description of product* *(Details see Annex 1)*	**Einbauventilatoren für Schaltschränke (Dachlüfter)** **Typen SK 3139.100,SK 3140.100** *Built-in fans for cabinets (roof fans)* *models SK 3139.100, SK 3140.100*
Geprüft nach *Tested in accordance with*	**DIN EN 60335-1 : 2012-10**

Das Produkt entspricht den Anforderungen des Produktsicherheitsgesetzes ProdSG § 21
The product is conform with the requirements of the Product Safety Act - ProdSG § 21

Registrier-Nr. / *Registered No.* 44 327 13151207
Prüfbericht Nr. / *Test Report No.* 3518 9050
Aktenzeichen / *File reference* 2.4-4156/16

Gültigkeit / Validity
von / *from* 2019-03-29
bis / *until* 2024-03-28

TÜV NORD CERT GmbH
Zertifizierungsstelle Konsumgüter

Essen, 2019-03-29

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.de prodcert@tuev-nord.de

Bitte beachten Sie auch die umseitigen Hinweise
Please also pay attention to the information stated overleaf

ANLAGE
ANNEX

zum Zertifikat Registrier-Nr. / *to Certificate Registration No.* 44 327 13151207

Typbezeichnung: *Type designation:*	**SK 3139.100, SK 3140.100**
Bemessungsspannung: *Rated voltage:*	**220 – 240 V**
Bemessungsaufnahme: *Rated input:*	**51 / 62 W (SK 3139.100), 99 / 130 W (SK 3140.100)**
Bemessungsfrequenz: *Rated frequency:*	**50 / 60 Hz**
Schutzklasse: *Protection Class:*	**I**
Schutzart: *Degree of protection:* **Innen- / Aussenkreislauf**	**IP 55 (Gehäuse Kategorie 2)**
Netzanschluss: *Main connection:*	**Spannungsversorgung durch Endgerät über eine Steckverbindung**

TÜV NORD CERT GmbH
Zertifizierungsstelle Konsumgüter

Essen, 2019-03-29

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.de prodcert@tuev-nord.de

CERTIFICATE OF COMPLIANCE

Certificate Number	UL-US-L491171-12-10607102
Report Reference	E491171-20170601
Date	21-Dec-2021
Issued to:	RITTAL GmbH & Co. KG Auf dem Stuetzelberg Herborn Germany 35745
This is to certify that representative samples of	FTTA - Environmental-rated Accessories for Enclosures See Addendum Page for Product Designation(s).
	Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 508A, 3rd Ed., Issue Date: 2018-04-24, Revision Date: 2021-08-05
Additional Information:	See the UL Online Certifications Directory at https://iq.ulprospector.com for additional information

This Certificate of Compliance does not provide authorization to apply the UL Mark. Only the UL Follow-Up Services Procedure provides authorization to apply the UL Mark.

Only those products bearing the UL Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

CERTIFICATE OF COMPLIANCE

Certificate Number UL-US-L491171-12-10607102
Report Reference E491171-20170601
Date 21-Dec-2021

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements

Model	Category Description	Environmental Type Rating
3138.000	Filter Kits	Type 12
3139.100	Filter Fan Kits	Type 12
3139.110	Filter Fan Kits	Type 12
3140.100	Filter Fan Kits	Type 12
3140.110	Filter Fan Kits	Type 12
3140.140	Filter Fan Kits	Type 12
3140.500	Filter Fan Kits	Type 12
3140.510	Filter Fan Kits	Type 12

Bruce Mahrenholz, Director North American Certification Program

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

CERTIFICATE OF COMPLIANCE

Certificate Number	UL-CA-L491171-32-10607102
Report Reference	E491171-20170601
Date	21-Dec-2021
Issued to:	RITTAL GmbH & Co. KG Auf dem Stuetzelberg Herborn Germany 35745
This is to certify that representative samples of	FTTA7 - Environmental-rated Accessories for Enclosures Certified for Canada See Addendum Page for Product Designation(s). Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	CSA C22.2 NO. 14-18, 13th Ed., Issue Date: 2018-03-01
Additional Information:	See the UL Online Certifications Directory at https://iq.ulprospector.com for additional information

This Certificate of Compliance does not provide authorization to apply the UL Mark. Only the UL Follow-Up Services Procedure provides authorization to apply the UL Mark.

Only those products bearing the UL Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

CERTIFICATE OF COMPLIANCE

Certificate Number UL-CA-L491171-32-10607102
Report Reference E491171-20170601
Date 21-Dec-2021

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements

Model	Category Description	Environmental Type Rating
3138.000	Filter Kits	Type 12
3139.100	Filter Fan Kits	Type 12
3139.110	Filter Fan Kits	Type 12
3140.100	Filter Fan Kits	Type 12
3140.110	Filter Fan Kits	Type 12
3140.140	Filter Fan Kits	Type 12
3140.500	Filter Fan Kits	Type 12
3140.510	Filter Fan Kits	Type 12

Bruce Mahrenholz, Director North American Certification Program

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

EVE Power Co., Ltd
Product Specification

File No	:	LF280K-72174
Version	:	B
Effective Date	:	Mar 23, 2021

Product name	:	LFP Power Battery
Model name	:	LF280K
Specification	:	3.2V 280Ah
Draft	:	
Checked	:	
Approved	:	
Customer Approved	:	

Mail : sales@evebattery.com

Address : No .68 Jingnan Avenue, Jiaodao District, Jingmen High-tech Zone, Jingmen City, Hubei Province.

History of specification

Date	Contents	Remarks
2020-09-23	First issue	Rf
2021-01-16	First issue	A
2021-03-23	Name change	B

Contents

1. Scope 1

2. Description and Model 1

3. General Technical Parameter 1

4. Test conditions 2

5. Main Performance 3

6. Transportation 4

7. Storage 4

8. Points for attention 5

AppendixI：Two-dimensional graphs of Battery 6

AppendixII: Battery coding rules 7

Appendix III：Photos of battery appearance 7

Appendix IV: Battery packaging drawing 8

Appendix V: Electric performance curve 8

1. Scope

This specification is applied to Rechargeable LFP Power Battery with aluminum shell (3.2V 280Ah) manufactured by EVE Energy Co., Ltd., in which the description and model, main performance, test conditions and precautions of the product are included.

The product can be applied for Vehicle power supply, Storage system, etc.

2. Description and Model

2.1 Description：LFP Li-ion Power Battery with aluminum shell.

2.2 Model：LF280K

3. General Technical Parameter

#	Item		Parameter	Remark
1	Nominal Capacity		280.0 Ah	(25±2)℃，Standard charge and discharge
2	Typical Voltage		3.2 V	
3	AC Impedance Resistance(1KHz)		≤0.25 mΩ	
4	Standard charge and discharge	Charge / discharge current	0.5 C/0.5 C	
		Cut off voltage of charge / discharge	3.65 V/2.5 V	
5	Maximum charge / discharge current	Continuous charge / discharge	1 C/1 C	According to continuous / pulse charge and discharge ammeters
		Pulse charge / discharge (30s)	2 C/2 C	
6	Recommended scope of SOC		10%～90%	N.A.
7	Charging Temperature		0 ℃～55 ℃	According to continuous / pulse charge and discharge ammeters
8	Discharging Temperature		-20 ℃～55 ℃	

#	Item		Parameter	Remark
9	Storage temperature	Short term (within 1 month)	-20℃～45℃	N.A.
		Long term (within 1 year)	0℃～35℃	
10	Storage humidity range		＜90%	
11	Self-discharge rate per month		≤3%/month	Temperature：(25±2)℃, Storage scope of SOC：30%~50%SOC
12	Dimension	Width	173.7 ±0.5 mm	Refer to Appendix I
13		Thickness (under 300±20 kgf , 30%～40% SOC)	72.0 ±1.0 mm	
		Average thickness (200 pcs, under 300±20 kgf , 30%～40% SOC)	72.0 ±0.5 mm	
14		High（total）	207.5 ±0.5 mm	
15		High（subject）	204.6 ±0.5 mm	
16		Tabs Distance	123.0±0.3 mm	
17	Battery weight		5.42±0.3 kg	

4. Test conditions

4.1 Test environment conditions

Temperature：25±2℃

Relative humidity (RH)： 15%~85%

Atmospheric condition：86KPa~106KPa

4.2 Standard Charge

The standard charge means charging the cell with charge current 0.5C(A) and constant voltage 3.65V at (25±2)℃, 0.05C cutoff.

4.3 Standard Discharge

The standard discharge means discharging the cell with discharge current 0.5C(A) and cutoff voltage 2.5V at (25±2) ℃.

4.4 Pole and Busbar welding requirements

No.	Item	Parameter	Remark
1	Penetration	≤ 2.5mm	
2	Pulling force	60-100kgf	
3	Temperature of pole plastic part	≤ 150℃	Related to power and time
4	The pressure on the pole	≤ 700N	

5. Main Performance

5.1 Electrical performance

No.	Item	Requirements	Measuring Procedure
1	Rate discharge performance at 25℃	Discharge capacity/nominal capacity×100％ A）0.5C (A) ≥100％ B）1.0C (A) ≥98％	After standard charge and 1h rest, discharge to 2.5V cutoff with the current of 0.5 C (A), 1.0C (A), respectively. If the discharge capacity fails to meet the technical requirements, this test is allowed to be repeated three times
2	Discharge performance at different temperature	Discharge capacity/nominal capacity×100％ A)55℃≥95%（Cutoff 2.5V） B)-20℃≥70%（Cutoff 2.0V）	Measure the initial capacity and state of the battery：A) after standard charge and 5h rest at 55℃, discharge to 2.5V cutoff with the current of 0.5C(A)；B) after standard charge at 25±2℃ and 24h rest at -20℃±2℃, discharge to 2.0V cutoff with the current of 0.5C(A).
3	The capacity retention and recovery at 25℃	Capacity Retention ≥ nominal capacity×95％ Capacity Recovery ≥ nominal capacity×97％	Measure the initial capacity and state of the battery, after standard charge and stored for 28 days, discharge to 2.5V cutoff with the current of 0.5C (A), calculate the remaining capacity, the retention can be expressed as a percentage of nominal capacity. After standard charged and 30mins rest, calculate the discharging capacity (Ah), the recovery can be expressed as a percentage of nominal capacity. The recovery is measured with discharge current 0.5C (A) with 2.5V cut-off at (25±2) ℃.
4	cycle life at 25℃	≥6000 cycle @0.5C/0.5C	Under the 300kgf clamp, after standard charged and 30mins rest, discharge to 2.5V cutoff with the current of 0.5C(A) at (25±2) ℃, and then start the next cycle，end with the capacity decreasing to 80% of the

			initial capacity. The number of cycles is defined as the cycle life of the battery.
5	cycle life at 45℃	≥2500 cycle @0.5C/0.5C	Under the 300kgf clamp, after standard charged and 30mins rest, discharge to 2.5V cutoff with the current of 0.5C(A) at (45±2) ℃, and then start the next cycle，end with the capacity decreasing to 80% of the initial capacity. The number of cycles is defined as the cycle life of the battery.
6	End of life managem ent	capacity/nominal capacity ＜70%	During the use of the battery, the battery s hall be stopped when the end of life regul ations are exceeded.

5.2 Safety performance

No.	Item	Requirements	Measuring Procedure
1	Over Discharge	No fire、No explosion	Reference: GB/T 36276-2018《Lithium ion battery for electrical energy storage》
2	Over Charging	No fire、No explosion	
3	Short-Circuit Test	No fire、No explosion	
4	Drop Test	No fire、No explosion	
5	Heating	No fire、No explosion	
6	Extrusion Test	No fire、No explosion	
7	Low pressure test	No fire、No explosion、No leakage	
8	Thermal runaway	No fire、No explosion	

6. Transportation

Battery for shipping should be packed in boxes with the State of charge (30%~50%SOC). The Violent vibration, impact extrusion, sun and rain should be prevented during shipping.

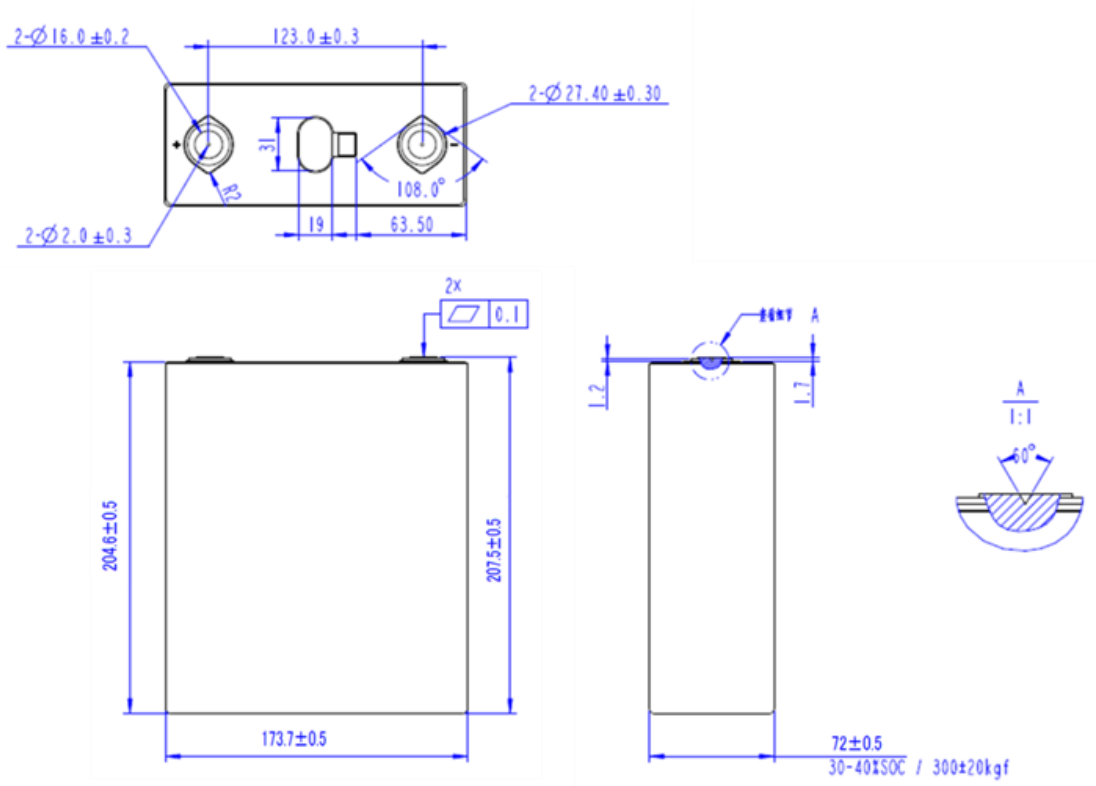
7. Storage

Batteries should be stored (more than 1 month) indoor with a dry and clean environment at 0 ℃~35 ℃. Avoiding contact with corrosive substances and staying away from fire and heat source. The battery should be charged and discharged every 6 months. The SOC for storage is between 30% ~ 50%.

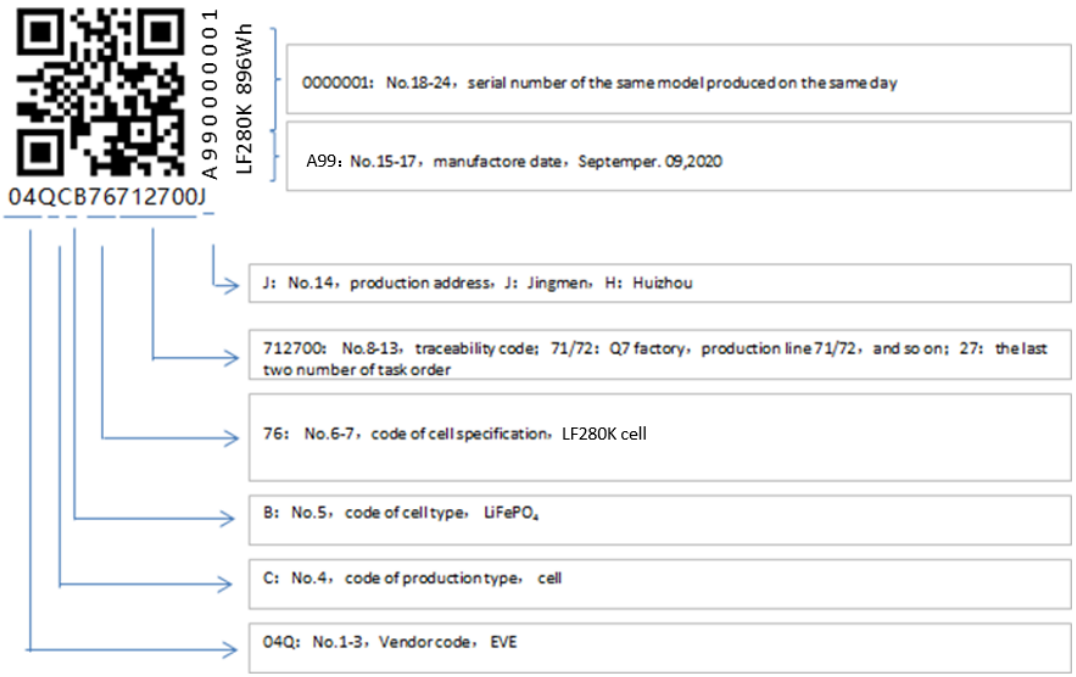
8. Points for attention

1. When the battery is charged and discharged, the conditions for monitoring and protecting the battery voltage, current and temperature shall be ensured.
2. Please keep the battery away from the heat source, fire source and other corrosive environments such as heating, strong acid and strong alkali.
3. Do not short circuit the battery or install it with incorrect polarity at any time，otherwise it can cause serious damage to the battery and cause danger.
4. Do not mix batteries of different models or manufacturers.
5. Do not use external force to make the battery fall, impact or puncture. Do not disassemble the battery or change the external structure.
6. When the battery is not used for a long time, please keep the battery in the state of 30%-50% SOC, and avoid the environment of strong direct sunlight or high temperature and humidity.
7. When operating the battery, it is necessary to wear rubber gloves and other protective devices.
8. In case of leakage, smoke or damage of battery, please stop using immediately and contact our company for handling.

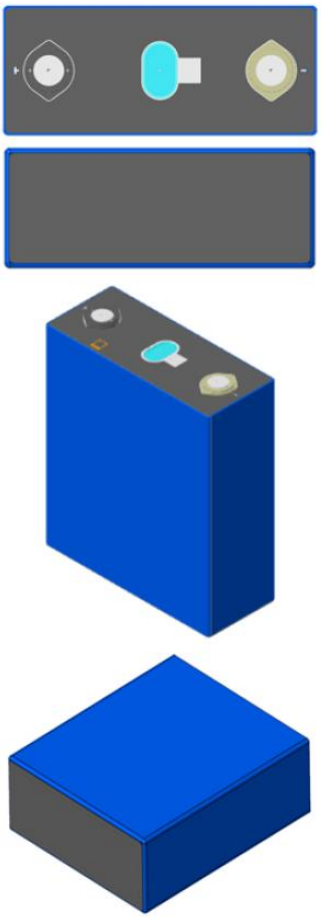
Appendix Ⅰ： Two-dimensional graphs of Battery：



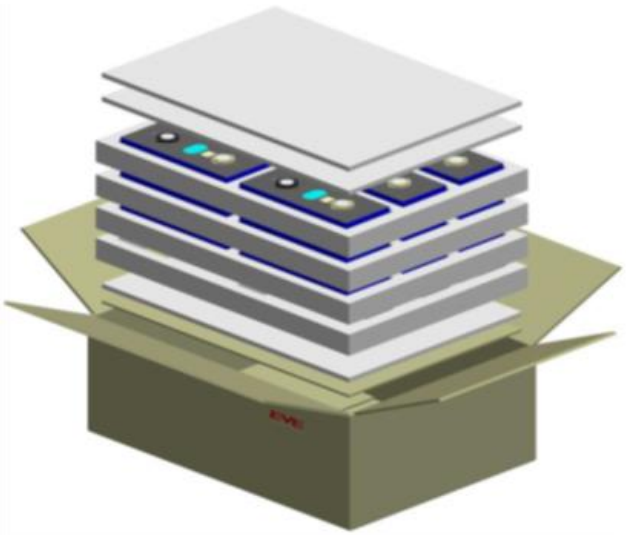
Appendix Ⅱ：Battery coding rules：



Appendix Ⅲ：photos of battery appearance：



Appendix IV: battery packaging drawing



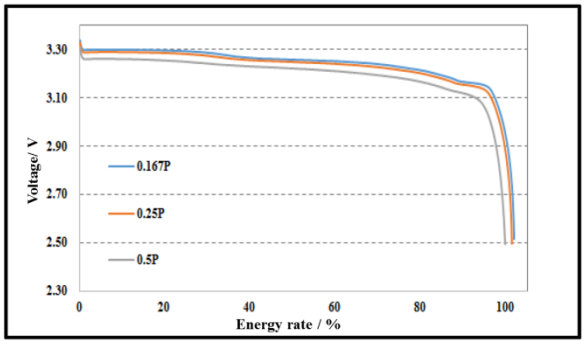
Length*width*height 426*302*245mm



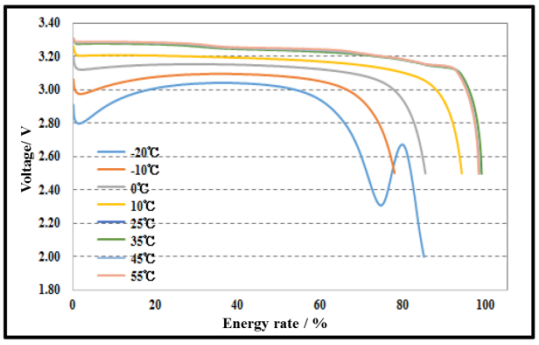
Length*width*height 1300*1100*1140mm

Appendix V: electric performance curve：

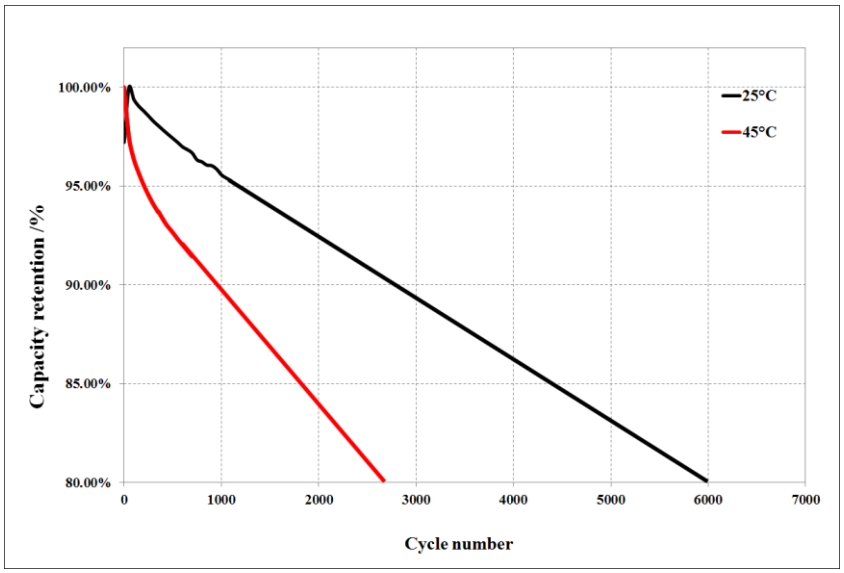
1、Rate discharge curve at 25℃



2、Discharge curve at different temperatures(0.5P)



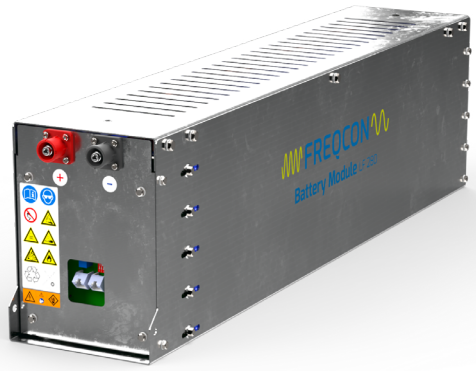
3. Cycle curve (charge/discharge:0.5C/0.5C, 3.65V-2.5V)



Battery Module LF280

Key component of FREQCON LFP battery energy storage solutions

FREQCON



- Safest LFP chemistry, thermally and structurally stable design for robustness and longest battery lifetime
- Compatible for all long duration applications (up to 1C operation)
- Active battery monitoring with individual PCB and numerous sensors per module
- Compact design with high energy density (137 Wh/kg)

High Energy Density for all Applications

- 4x higher density than lead-acid batteries
- Up to 1C continuous operation for applications such as long duration UPS, grid ancillary services, off-grid storage and more

Longest Lifetime

- > 6000 full load cycles at 0.5C operation
- LFP batteries have no memory effect with very little calendar life degradation

Active Monitoring

- Each battery module is equipped with monitoring PCB, temperature sensors, thermal runaway detectors
- Data exchange per module provides high resolution data for increased analysis and safety

Safe and Robust Design

- Safest LFP batteries on the market
- Thermally and structurally stable housing design to secure batteries during operation and transport
- Highly recyclable environmentally friendly solution

Function

The LF280 Battery Module is the central component in turnkey energy storage systems provided by FREQCON GmbH. The modules are an ideal economical solution for a variety of applications. Each module consists of 10 powerful lithium iron phosphate cells, offering many safety advantages. The corresponding reliable BMS ensures high longevity of the battery cells. Each cabinet is equipped with 28 battery modules and a control system.

System Design

The lithium iron phosphate cells (LiFePO4) inside the LFP battery modules are connected in series and provide a total energy content of 8.96 kWh per module.

Each module is equipped with a monitoring PCB, providing the following functions:

- Voltage monitoring of single cells for charging and discharging
- Battery temperature monitoring
- Selective cell balancing
- Data exchange with central BESS controller
- Local insulation measurement
- Robust industrial design for transport, assembly and operation

Battery cabinet with 28 modules in series

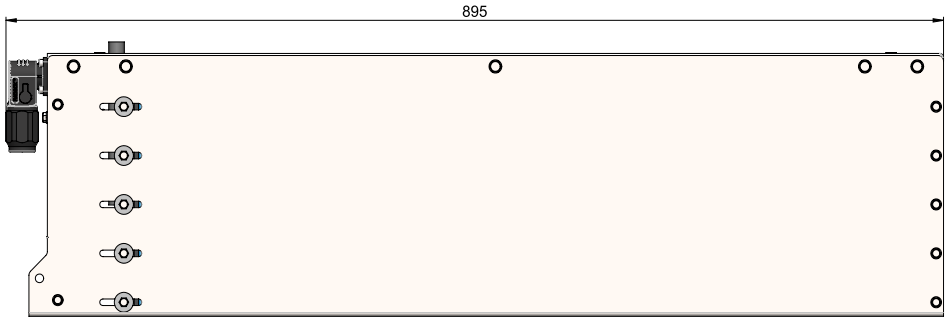


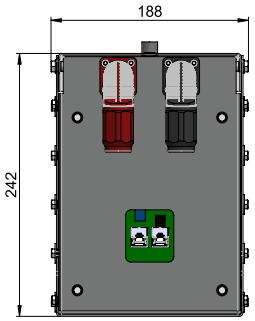
FREQCON GmbH Bürgerwiesenweg 5 27336 Rethem +49 (0) 5165 291760-0 sales@freqcon.com www.freqcon.com

Technical Data
Battery Module

Module Data	Value
Part number	52365 / 52375 / 52157
Voltage (rated)	32 V DC
Total capacity	280 Ah
Number of cells per battery module	10
Stored energy	8960 Wh
Maximum voltage	36 V DC
Max. current	280 A
Max. charge and discharge rate (continuous)	1 C
Temperature range (storage)	-20 °C … +45 °C (long-term storage at 0…35°C)
Temperature range (continuous operation)	0 °C … +55 °C
Connections for DC+ / DC-	Surlock Plus
Communication connections	RJ45
Protection class	IP 20
Weight	65.3 kg
Dimensions (WxHxD)	188 mm x 239 mm x 908 mm
Single Cell Data	
Type	Prismatic cells
Capacity (typ.)	280 Ah
Voltage (typ.)	3.2 V
Voltage (max.)	3.65 V
Voltage (min.)	2.5 V
Battery life (@1C continuous operation)	>3500 cycles (80% remaining capacity)
Impedance (AC)	<0.25 mΩ
BMS Back Universal	
Power supply (external)	24 V DC (rated), <0.5 W
Power supply (internal)	36 V DC (max.), < 0.2 W
Communication	EIA-485, Modbus RTU
Baud rate (max.)	19200 Bit/s
Bus participants (max.)	32
Balancer Design	Load resistor
Balancer current @3.5 V	1.06 A
Voltage measurement	10 measurements per 14-bit resolution
Temperature measurements	8x NTC 10 kΩ (up to 14 bit analogue/digital converter) / 1x PT100 (12 bit analogue/digital converter)
Isolation measurement	Earth fault monitoring

Dimensions





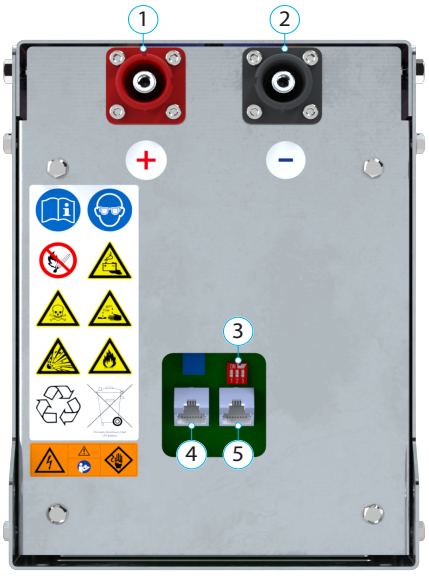
FREQCON
Battery Module LF280

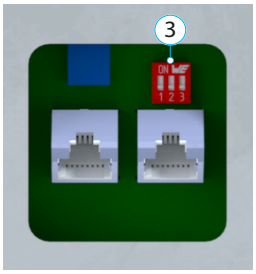
System Overview



Pos.	Component
1	Battery module LF280
2	Boreholes for lifting device (M6)
3	DC positive (+) socket
4	DC negative (-) socket
5	COM-Connection RJ45 and DIP-switches
6	Boreholes for transport handle mounting
7	Label with safety and warning instructions

Connections and Operating Elements





Connection Elements

Pos.	Terminal	Description	Connection type	Cable
1	X1	DC + Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
2	X2	DC – Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
4	X3	Communication (input)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7
5	X4	Communication (Output)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7

Operating Elements

Pos.	Design.	Description	Function
3	S1	Dip switch for termination resistor and safety chain	ON (first switch): activates termination resistor for EIA-485 communication and safety chain (for last battery module)

The dip switch located on the modules front side is used for activation of the termination resistor and the safety chain of the system and must be set to "ON" position at the last module of a string connected in series.

"ON" switch position for **last module:**



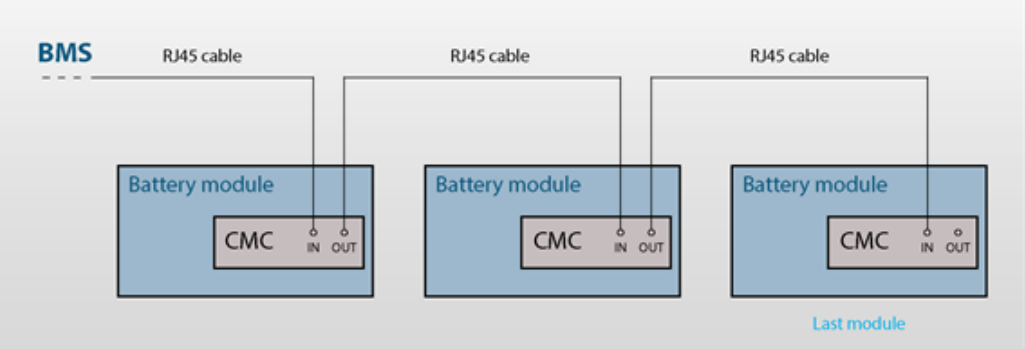
Only first dip switch set to ON position

"OFF" switch positions for **all remaining modules:**



All three dip switches set to OFF position

BMS Communication



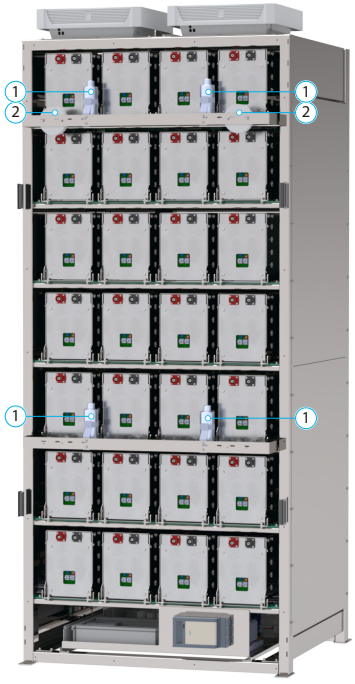
Energy Storage System



Turnkey Battery Energy Storage System (BESS) equipped with battery cabinets and active cooling system housed in a 20ft HC container with side doors.

(2 MWh installed per 20 ft HC container)

Battery Cabinets



Fully equipped battery cabinet with smoke detectors and active fire extinguishing system consisting of self-activating aerosol cartridges.

Pos.	Component
1	Active Stat-X aerosol cartridge
2	Smoke detector

Battery Module LF280

Part No. 52365 /52375 / 52157

Version 1.0



The LF280 Battery Module is the central component in turnkey energy storage systems provided by FREQCON GmbH.

The modules are an ideal economical solution for a variety of applications. Each module consists of 10 powerful lithium iron phosphate cells, offering many safety advantages. The corresponding reliable BMS ensures high longevity of the battery cells. Each cabinet is equipped with 28 battery modules and a battery control system.

System Design

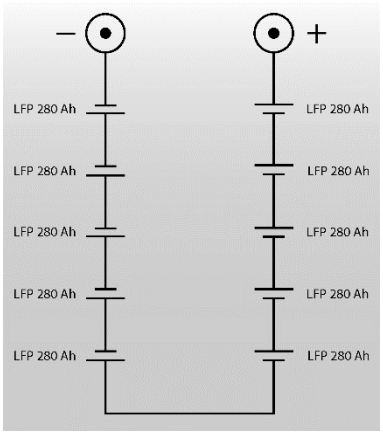
The lithium iron phosphate cells ($LiFePO_4$) inside the L280 battery modules are connected in series and provide a total energy content of 8.96 kWh per module.

Each module is equipped with a monitoring PCB, providing the following functions:

- Voltage monitoring of single cells for charging and discharging
- Battery temperature monitoring
- Selective cell balancing
- Data exchange with central BESS controller
- Local insulation measurement
- Robust industrial design for transport, assembly und operation

Battery cabinet
28 modules connected in series







FREQCON BESS
Battery Storage Container

FREQCON GmbH
Bürgerwiesenweg 5
27336 Rethem
Tel: +49 (0) 5165 – 291 760 – 0
www.freqcon.com

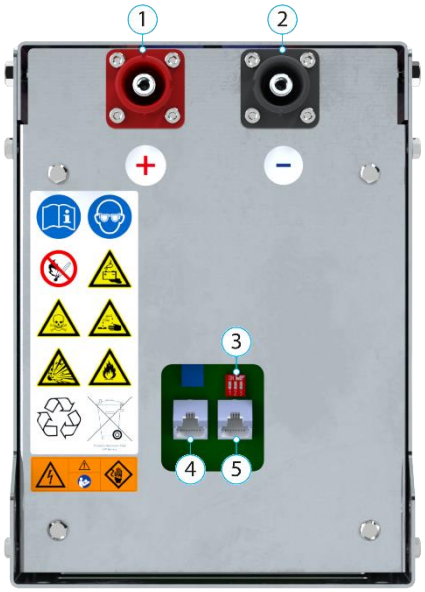
Technical Data

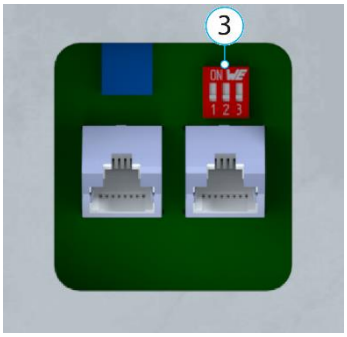
Technical Data Battery Module LF280	
FREQCON Order No.	52365 / 52375 / 52157
Voltage (rated)	32 V DC
Total capacity	280 Ah
Number of cells per battery module	10
Stored energy	8960 Wh
Maximum voltage	36 V DC
Max. current	280 A
Max. charge and discharge rate	1 C
Temperature range storage	-20 °C … +45 °C (long-term storage at 0…35°C)
Temperature range operation	0 °C … +55 °C
Connections for DC+ / DC-	Surlock Plus
Communication connections	RJ 45
Protection class	IP 20
Weight	65.3 kg
Dimensions (WxHxD)	188 mm x 239 mm x 908 mm
Cell Data (Single Cell)	
Type	Prismatic cells
Capacity (typ.)	280 Ah
Voltage (typ.)	3.2 V
Voltage (max.)	3.65 V
Voltage (min.)	2.5 V
Battery life	>3500 cycles (80% remaining capacity)
Impedance (AC)	<0.25 mΩ
BMS Pack Universal	
Power supply (external)	24 V DC (rated), <0.5 W
Power supply (internal)	36 V DC (max.), < 0.2 W
Communication	EIA-485, Modbus RTU
Baud rate (max.)	19200 Bit/s
Bus participants (max.)	32
Balancer Design	Load resistor
Balancer current @3.5 V	1.06 A
Voltage measurement	10 measurements per 14-bit resolution
Temperature measurements	8x NTC 10 kΩ (up to 14 bit analogue/digital converter) 1x PT100 (12 bit analogue/digital converter)
Isolation measurement	Earth fault monitoring



No.	Component
①	Battery module LF280
②	Boreholes for lifting device (M6)
③	DC positive (+) socket
④	DC negative (-) socket
⑤	COM-Connection RJ45 and DIP-switches
⑥	Boreholes for transport handle mounting
⑦	Label with safety and warning instructions

Connections and Operating Elements





Connection Elements

Pos.	Terminal	Description	Connection type	Cable
①	X1	DC + Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
②	X2	DC – Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
④	X3	Communication (input)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7
⑤	X4	Communication (Output)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7

Operation Elements

Pos.	Designator	Description	Function
③	S1	Dip switch for termination resistor and safety chain	ON (first switch): activates termination resistor for EIA-485 communication and safety chain (for last battery module)

The dip switch located on the modules front side is used for activation of the termination resistor and the safety chain of the system and must be set to "ON" position at the last module of a string connected in series.

"ON" switch position for **last module:**



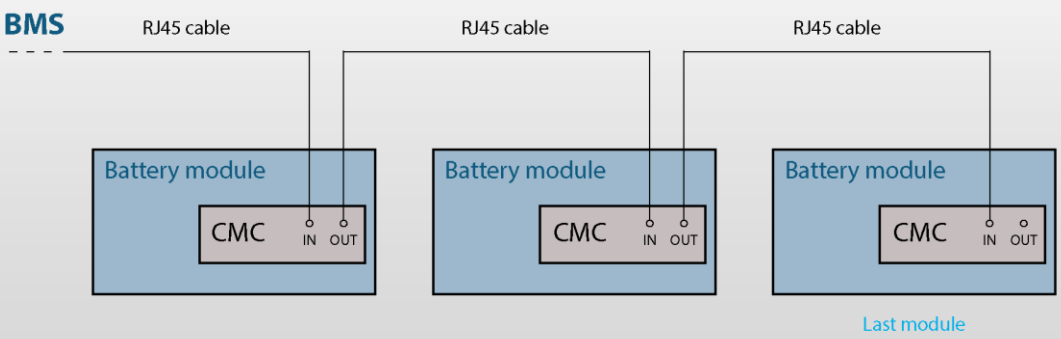
Only first dip switch set to ON position

"OFF" switch positions for **all remaining modules:**



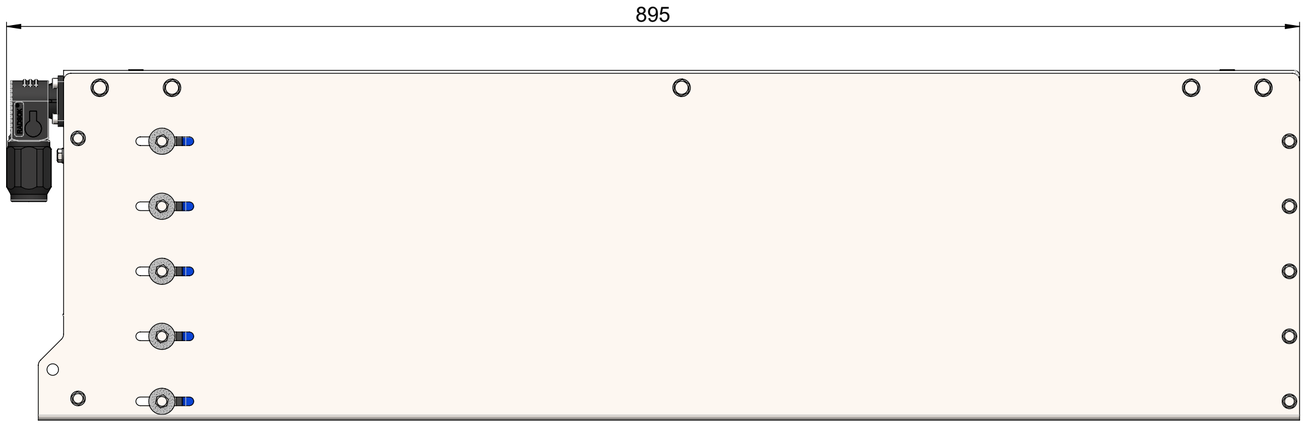
All three dip switches set to OFF position

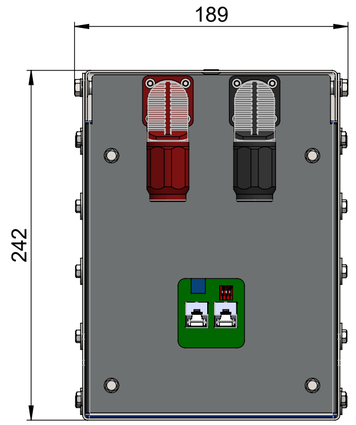
BMS Communication



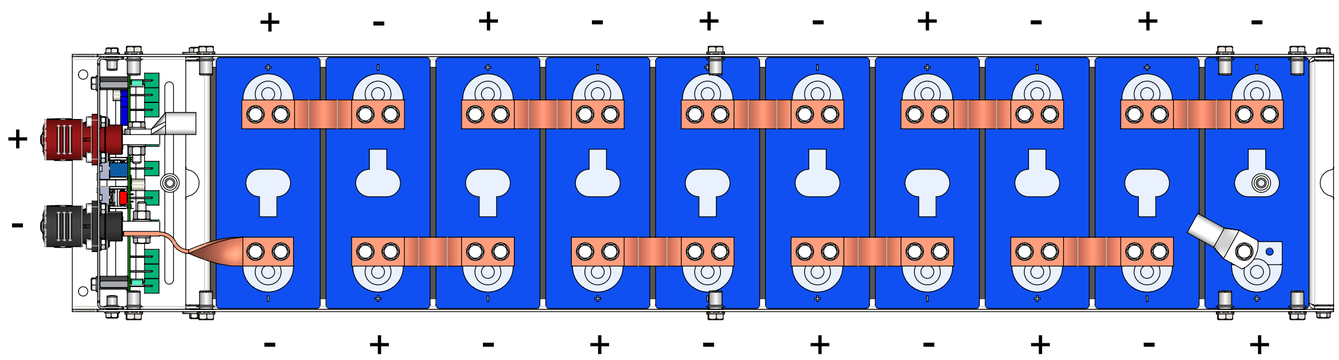
Version Overview

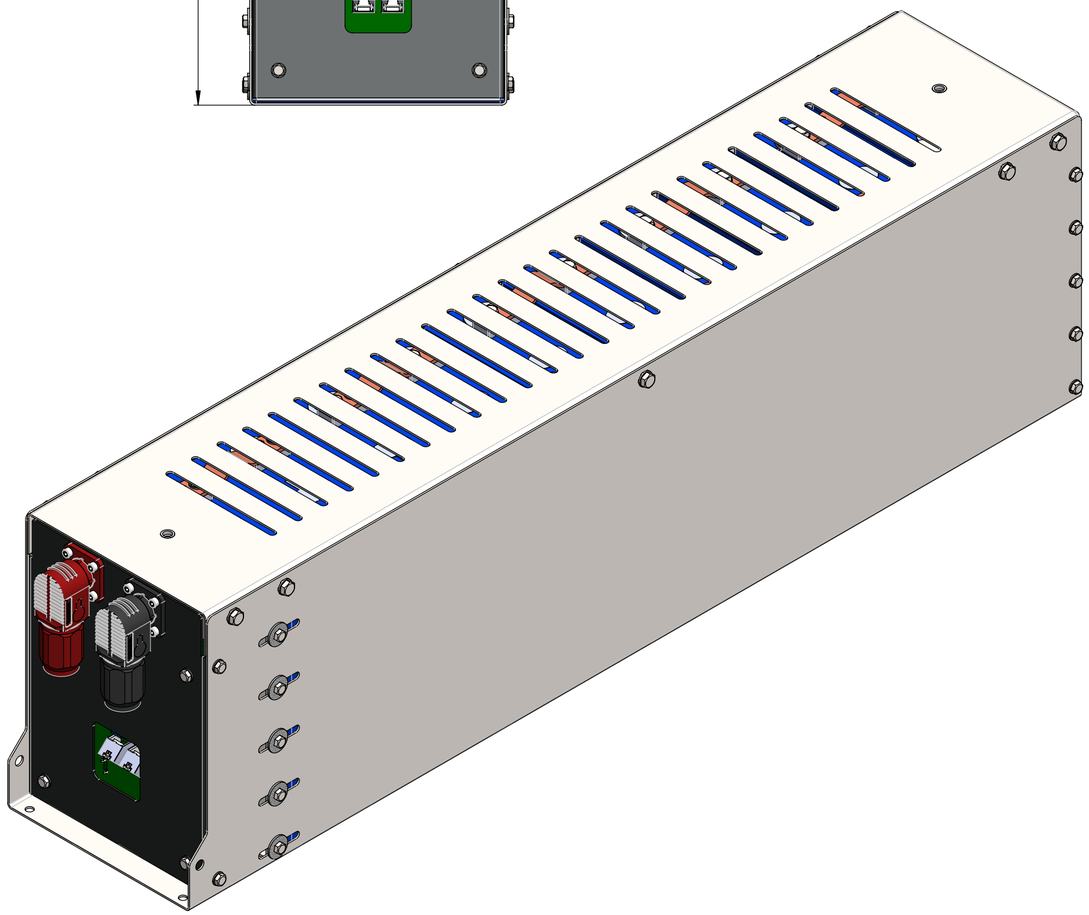
Version	Date	Name	Description
v1.0	2022-03-08	Carlos Palenzuela	First final version





Polausrichtungen
Abdeckhaube ausgelendet





Pos. Nr.	Menge	Bezeichnung	Art.-Nr.	Lieferant	Lieferanten Nr.
1	1	Batterietrog	52363		
2	1	Abdeckhaube	52367		
3	12	Blindnietmutter M6 KSGRSO (e=0,5-3,0)	501165	Böllhoff	34367060230
4	20	Blindnietmutter M5 KSGRSO (e=0,5-3,0)	501164		34367050230
5	4	Blindnietmutter M5 KSGRSO (e=0,5-3,0)	501164		34367050230
6	49	Sechskantschraube ISO 4017 - M6 x 16 - 8.8 - St.	503733	--	--
7	20	Sechskantschraube ISO 4017 - M5 x 16 - 8.8 - St.	505256	--	--
8	2	Sechskantschraube ISO 4017 - M6 x 25 - 8.8 - St.	503774	--	--
9	8	Sechskantschraube ISO 4017 - M5 x 12 - 8.8 - St.	505319	--	--
10	10	Sperrkantscheibe - NSK K - M6	505906	--	--
11	18	Sperrkantscheibe - Form S - M5	504284	--	--
12	43	Sperrkantscheibe - Form S - M6	503797	--	--
13	10	LFP Power Battery	52368	EVE Energy	LF 280K
14	10	Ausgleichsplatte	52110		Ethafoam10
15	2	Spannplatte	52137	--	--

Pos. Nr.	Menge	Bezeichnung	Art.-Nr.	Lieferant	Lieferanten Nr.
16	10	Sperrkantscheibe - Form B - M5	505747	--	--
17	8	Scheibe ISO 7089- 4 - 200 HV	503707	--	--
18	2	Sechskantmutter ISO 4032 - M6 - 8	501045	--	--
19	8	Zylinderschraube mit ISK ISO 4762 - M4 x 12 - 8.8 - St.	500964	--	--
20	9	Verbinder aus Kupfergeflecht	52380	--	--
21	1	Verbinder aus Kupfergeflecht	52381	--	--
22	1	Surlock Plus Buchse 10,3mm - rot	52140	Amphenol	SLPIRCBPSR0
23	1	Surlock Plus Buchse 10,3mm - schwarz	52139	Amphenol	SLPIRCBPSB0
24	1	Abdeckung Leiterplatte	52370		
25	1	BMS Pack Universal	507198	FREQCON	507198
26	2	70²-M6 Rohrkabelschuh Cu vz	52299	Weitkowitz	13229
27	8	Sechskantmutter mit Klemmteil DIN 985 - M4 - 8	501051	--	--

Rev.		Datum (Date):	Name:
A	geprüft	03.09.2021	JK
B	Drehmoment MA005 angepasst	12.01.2022	MH

Änderung (changes):

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

ISO 13715

	Datum (Date):	Name:
Drawn:	01.07.2021	J. Klettke
Checked:	12.01.2022	M. Horstmann

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

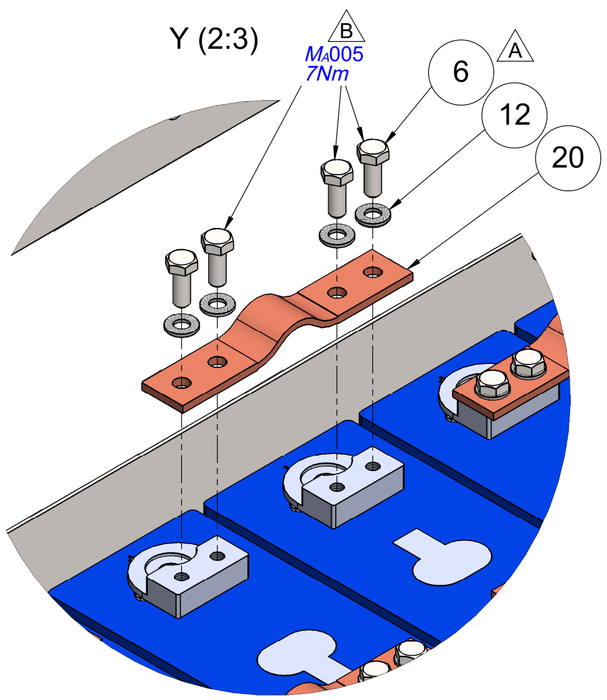
Oberfläche: (surface) -
Werkstoff (material):
Gewicht (weight): 67.41 kg

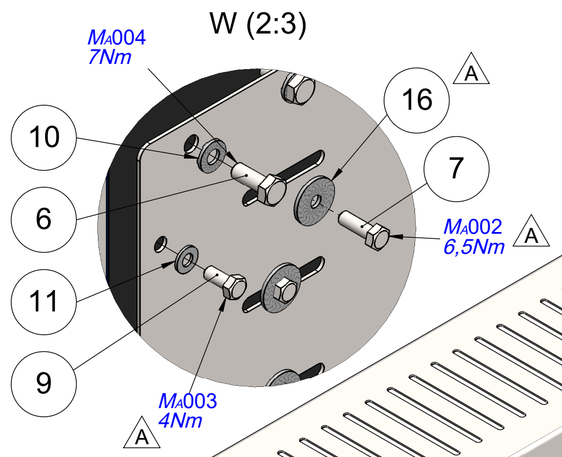
Bezeichnung (description):
Batteriemodul LF 280K
Battery module LF280K

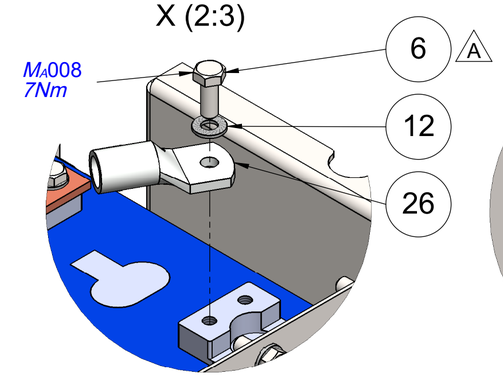
Scale: 1:3
Sheet: 1 (A2)
1 of: 2
Revision: B

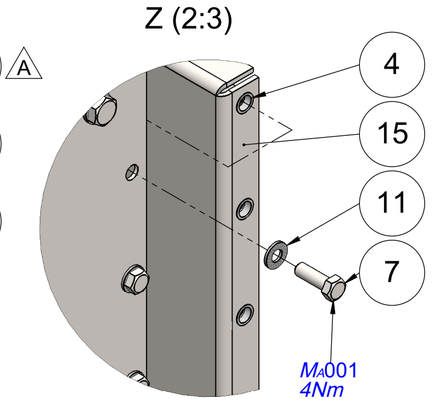
Artikel-Nr. (article number): 52365
alte Zeichnungs-Nr. (old drawing number):

CAD System SolidWorks
Status: Freigegeben









Pos. Nr.	Menge	Bezeichnung	Art.-Nr.	Lieferant	Lieferanten Nr.
1	1	Batterietrog	52363		
2	1	Abdeckhaube	52367		
3	12	Blindnietmutter M6 KSGRSO (e=0,5-3,0)	501165	Böllhoff	34367060230
4	20	Blindnietmutter M5 KSGRSO (e=0,5-3,0)	501164		34367050230
5	4	Blindnietmutter M5 KSGRSO (e=0,5-3,0)	501164		34367050230
6	49	Sechskantschraube ISO 4017 - M6 x 16 - 8.8 - St.	503733	--	--
7	20	Sechskantschraube ISO 4017 - M5 x 16 - 8.8 - St.	505256	--	--
8	2	Sechskantschraube ISO 4017 - M6 x 25 - 8.8 - St.	503774	--	--
9	8	Sechskantschraube ISO 4017 - M5 x 12 - 8.8 - St.	505319	--	--
10	10	Sperrkantscheibe - NSK K - M6	505906	--	--
11	18	Sperrkantscheibe - Form S - M5	504284	--	--
12	43	Sperrkantscheibe - Form S - M6	503797	--	--
13	10	LFP Power Battery	52368	EVE Energy	LF 280K
14	10	Ausgleichsplatte	52110		Ethafoam10
15	2	Spannplatte	52137	--	--
16	10	Sperrkantscheibe - Form B - M5	505747	--	--
17	8	Scheibe ISO 7089- 4 - 200 HV	503707	--	--
18	2	Sechskantmutter ISO 4032 - M6 - 8	501045	--	--
19	8	Zylinderschraube mit ISK ISO 4762 - M4 x 12 - 8.8 - St.	500964	--	--
20	9	Verbinder aus Kupfergeflecht	52380	--	--
21	1	Verbinder aus Kupfergeflecht	52381	--	--
22	1	Surlock Plus Buchse 10,3mm - rot	52140	Amphenol	SLPIRCBPSR0
23	1	Surlock Plus Buchse 10,3mm - schwarz	52139	Amphenol	SLPIRCBPSB0
24	1	Abdeckung Leiterplatte	52370		
25	1	BMS Pack Universal	507198	FREQCON	507198
26	2	70²-M6 Rohrkabelschuh Cu vz	52299	Weitkowitz	13229
27	8	Sechskantmutter mit Klemmteil DIN 985 - M4 - 8	501051	--	--

Rev.:	Änderung (changes):	Datum (Date):	Name:
A	geprüft	03.09.2021	JK
B	Drehmoment MA005 angepasst	12.01.2022	MH

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material):

Gewicht (weight): 67.41 kg

ISO 13715

	Datum (Date):	Name:
Drawn:	01.07.2021	J. Klettke
Checked:	12.01.2022	M. Horstmann

Bezeichnung (description):

Batteriemodul LF 280K

Battery module LF280K

Scale: 2:7

Sheet: 2 (A2)

2 of: 2

Revision: B

Artikel-Nr. (article number): 52365

alte Zeichnungs-Nr. (old drawing number):

CAD System SolidWorks

Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

SIEMENS

Datenblatt 3NP1153-1DA10



SENTRON, Sicherungslasttrennschalter 3NP1, 3-polig, NH2, 400 A, für Aufbau und Einbau auf Montageplatte, Flachanschluss, Abdeckebene 70mm

Ausführung	
Produkt-Markenname	SENTRON
Produkt-Bezeichnung	Sicherungslasttrennschalter 3NP1
Ausführung des Produkts	Abdeckebene 70 mm
Ausführung der Sicherungsüberwachung	ohne
Ausführung des Betätigungselements	Deckelgriff
Ausführung des Lastschalters / Leistenform	Nein
Ausführung des Schaltantriebs / Motorantrieb	Nein
Allgemeine technische Daten	
Polzahl	3
Bauart des Geräts	für Aufbau und Einbau auf Montageplatte
Baugröße der Trennlasche	2 und 1
Baugröße des Sicherungseinsatzes	NH1, NH2
Durchlassstrom / bei geschlossenem Schalter / maximal zulässig	40 kA
mechanische Lebensdauer (Schaltspiele) / typisch	1 000
Leistungsfaktor	
● bei AC-22 B	0,65
● bei AC-23 B	0,35
● bei kapazitiver Last	-0,25
Sicherungssystem	NH-Sicherung
Verschmutzungsgrad	3
Spannung	
Isolationsspannung	
● Bemessungswert	690 V
● bei Verschmutzungsgrad 3 / bei AC / Bemessungswert	690 V
● bei Verschmutzungsgrad 2 / bei AC / Bemessungswert	1 000 V
Leistungsfaktor / bei AC-21 B	0,95
Stoßspannungsfestigkeit / Bemessungswert	8 kV
Betriebsspannung	
● bei AC / Bemessungswert / maximal	690 V
● bei DC / Bemessungswert	440 V
● bei DC / Bemessungswert / maximal	440 V
Schutzart und Schutzklasse	
Schutzart IP	
● bei geschlossenem Schalter / mit Blende oder	IP40

Änderungen vorbehalten
© Copyright Siemens

Kabelschuhabdeckung	
● bei geschlossenem Schalter / ohne Blende oder Kabelschuhabdeckung	IP30
● frontseitig	IP40
● offen	IP20
Verlustleistung	
Verlustleistung [W]	
● bei konventionellem thermischen Bemessungsstrom / ohne Sicherung / je Pol	14 W
● bei konventionellem thermischen Bemessungsstrom / ohne Sicherung / je Gerät	42 W
● bei Bemessungswert Strom / bei AC / bei warmem Betriebszustand / je Pol	48 W
● der Sicherung / je Sicherung / maximal	34 W
Strom	
Betriebsstrom	
● bei 35 °C / Bemessungswert	400 A
● bei 40 °C / Bemessungswert	400 A
● bei 45 °C / Bemessungswert	392 A
● bei 50 °C / Bemessungswert	372 A
● bei 55 °C / Bemessungswert	356 A
● bei AC / Bemessungswert	400 A
● bei AC-23 B / bei 690 V / Bemessungswert	125 A
● bei AC-23 B / bei 500 V / Bemessungswert	315 A
● bei AC-23 B / bei 400 V / Bemessungswert	400 A
● bei AC-23 B / bei 240 V / Bemessungswert	400 A
● bei AC-22 B / bei 690 V / Bemessungswert	400 A
● bei AC-22 B / bei 500 V / Bemessungswert	400 A
● bei AC-22 B / bei 400 V / Bemessungswert	400 A
● bei AC-22 B / bei 240 V / Bemessungswert	400 A
● bei AC-21 B / bei 690 V / Bemessungswert	400 A
● bei AC-21 B / bei 500 V / Bemessungswert	400 A
● bei AC-21 B / bei 400 V / Bemessungswert	400 A
● bei AC-21 B / bei 240 V / Bemessungswert	400 A
● bei DC-23 B / bei 440 V / Bemessungswert	160 A
● bei DC-23 B / bei 240 V / Bemessungswert	250 A
● bei DC-23 B / bei 120 V / Bemessungswert	250 A
● bei DC-22 B / bei 440 V / Bemessungswert	315 A
● bei DC-22 B / bei 240 V / Bemessungswert	400 A
● bei DC-22 B / bei 120 V / Bemessungswert	400 A
● bei DC-21 B / bei 440 V / Bemessungswert	400 A
● bei DC-21 B / bei 240 V / Bemessungswert	400 A
● bei DC-21 B / bei 120 V / Bemessungswert	400 A
Durchlassstrom / bei zügigem Einschalten / maximal zulässig	40 kA
Hauptstromkreis	
Betriebsstrom	
● Bemessungswert	400 A
● bei kapazitiver Last / bei 400 V / Bemessungswert	72 A
● bei kapazitiver Last / bei 500 V / Bemessungswert	55 A
Hilfsstromkreis	
Anzahl der Wechsler / für Hilfskontakte	0
Anzahl der Öffner / für Hilfskontakte	0
Anzahl der Schließer / für Hilfskontakte	0
Eignung	
Eignung zur Verwendung	
● Hauptschalter	Nein
● Lasttrennschalter	Ja
● NOT-AUS-Schalter	Nein

Änderungen vorbehalten
© Copyright Siemens

● Sicherheitsschalter	Ja
● Wartungs-/Reparaturschalter	Ja
Produktdetails	
Produktausstattung / Verriegelung	Ja
● Produktbestandteil / Ausgelöstmelder	Nein
● Produktfunktion / Phasenausfallüberwachung	Nein
● Produktbestandteil / Unterspannungsauslöser	Nein
● Produktbestandteil / Unterspannungsauslöser mit voreilendem Kontakt	Nein
Produkteigenschaft / plombierbar	Ja
Produkterweiterung / Hilfsschalter	Ja
Produkterweiterung / optional	
● Abschließbarkeit	Ja
● Motorantrieb	Nein
● Phasenausfallüberwachung	Ja
● Sicherungsüberwachung	Ja
● Spannungsauslöser	Nein
● Überspannungsschutzüberwachung	Ja
Produktfunktion	
Produktfunktion	
● Sicherungsüberwachung	Nein
● Überspannungsschutzüberwachung	Nein
Kurzschluss	
● bedingter Kurzschlussstrom (Iq) / Bemessungswert	80 kA
● bedingter Kurzschlussstrom (Iq) / bei AC / bei 240 V / bei zügigem Einschalten / Bemessungswert	80 kA
● bedingter Kurzschlussstrom (Iq) / bei AC / bei 500 V / bei zügigem Einschalten / Bemessungswert	80 kA
● bedingter Kurzschlussstrom (Iq) / bei AC / bei 690 V / bei zügigem Einschalten / Bemessungswert	50 kA
● bedingter Kurzschlussstrom (Iq) / bei geschlossenem Schalter / bei AC / bei 240 V / Bemessungswert	100 kA
● bedingter Kurzschlussstrom (Iq) / bei geschlossenem Schalter / bei AC / bei 500 V / Bemessungswert	100 kA
● bedingter Kurzschlussstrom (Iq) / bei geschlossenem Schalter / bei AC / bei 690 V / Bemessungswert	100 kA
Anschlüsse	
Anordnung des elektrischen Anschlusses / für Hauptstromkreis	sonstige
anschließbarer Leiterquerschnitt / für Hauptkontakte	
● eindrähtig oder mehrdrähtig / minimal	25 mm²
● eindrähtig oder mehrdrähtig / maximal	240 mm²
● mehrdrähtig / minimal	25 mm²
● mehrdrähtig / maximal	240 mm²
Anzugsdrehmoment / bei Schraubanschluss	
● minimal	10 N·m
● maximal	12 N·m
Art der anschließbaren Leiterquerschnitte / der lamellierten Leiter / maximal	34 x 18 mm
Art der Anschlusstechnik	Flachanschluss
Ausführung des elektrischen Anschlusses / für Hauptstromkreis	Schienenanschluss
Mechanischer Aufbau	
Höhe	306 mm
Breite	209,4 mm
Tiefe	130 mm
Befestigungsart	Montageplatte

Änderungen vorbehalten
© Copyright Siemens

Befestigungsart	
● Bodenmontage	Ja
● Frontmontage mit 4-Loch Befestigung	Nein
● Frontmontage mit Zentralbefestigung	Nein
● Schienen-Montage	Nein
Einbaulage	horizontal/vertikal
Nettogewicht	4,21 kg

Umgebungsbedingungen

Umgebungstemperatur / während Betrieb	
● minimal	-25 °C
● maximal	55 °C
Umgebungstemperatur / während Lagerung	
● minimal	-50 °C
● maximal	80 °C

allgemeine Produktzulassung | **Konformitätserklärung**

CCC UR VDE Sonstige EAC EG-Konf.

Prüfbescheinigungen | **Marine / Schiffbau**

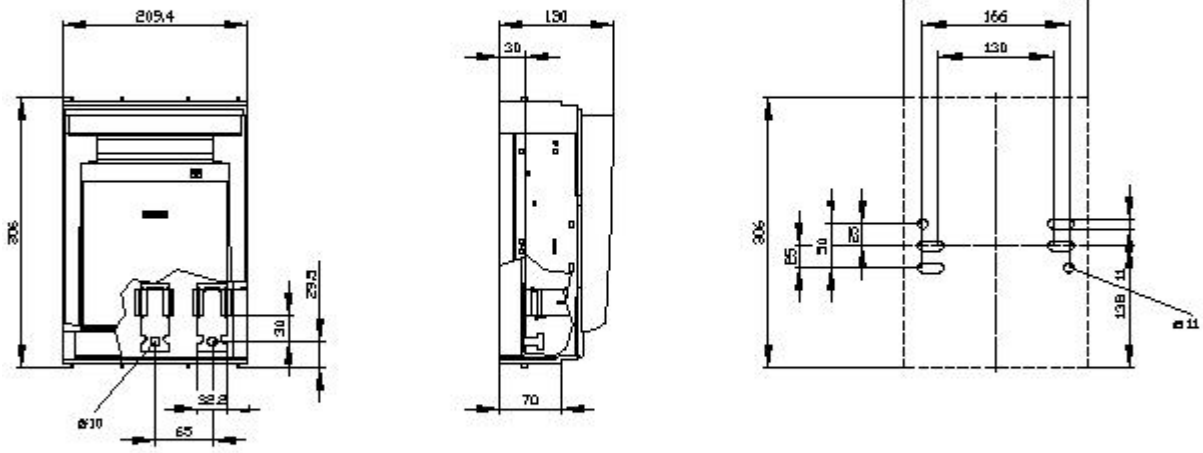
spezielle Prüfbescheinigungen | Typprüfbescheinigung/Werkszeugnis

LRS

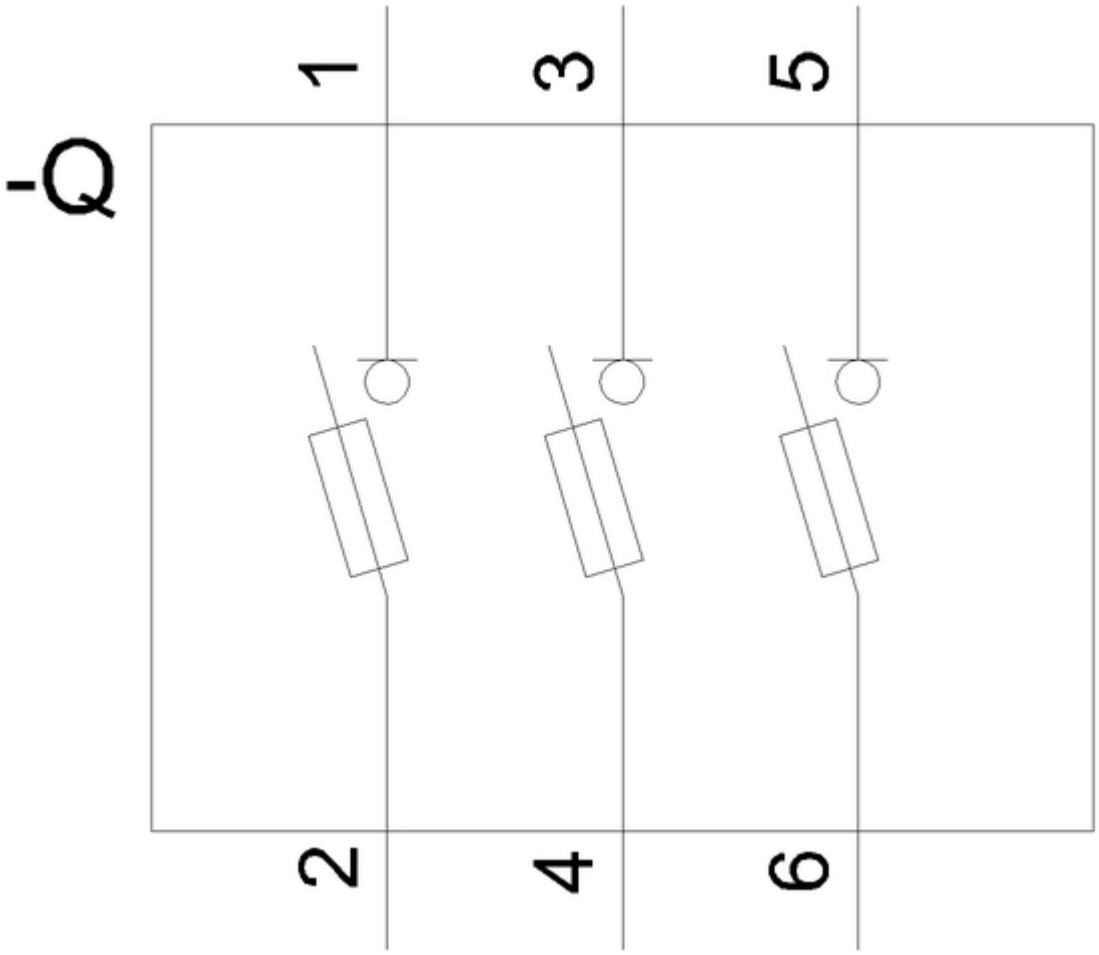
Weitere Informationen

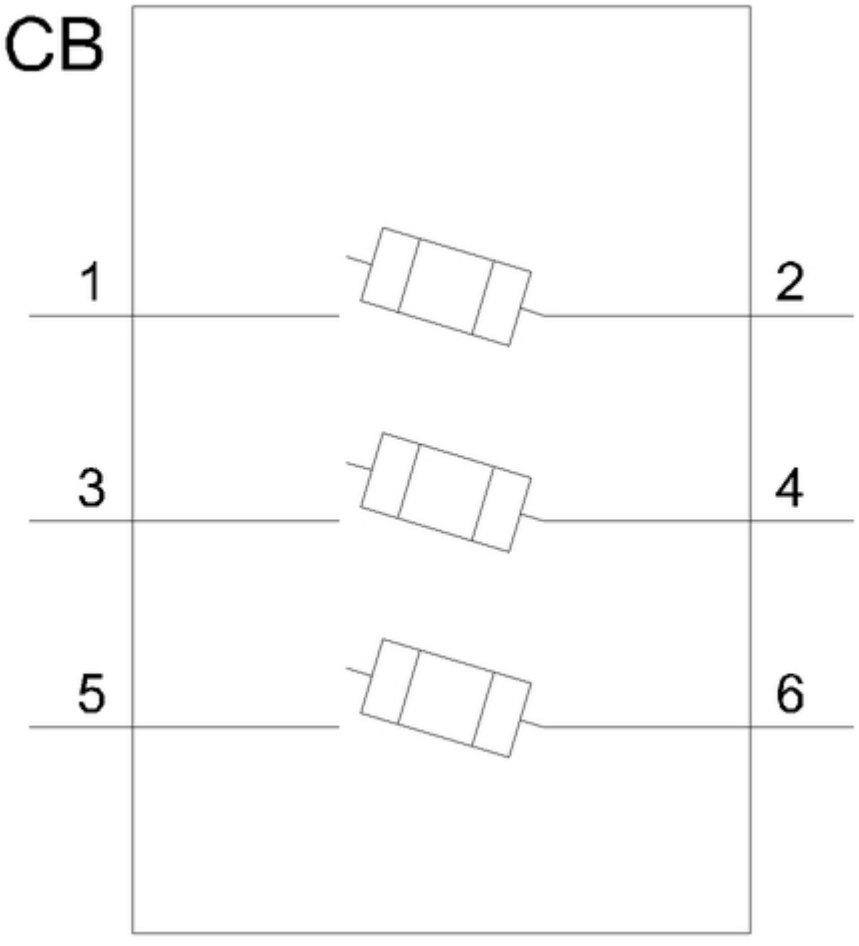
Information- and Downloadcenter (Kataloge, Broschüren,…)
http://www.siemens.de/lowvoltage/kataloge
Industry Mall (Online-Bestellsystem)
https://mall.industry.siemens.com/mall/de/de/Catalog/product?mlfb=3NP1153-1DA10
Service&Support (Handbücher, Betriebsanleitungen, Zertifikate, Kennlinien, FAQs,…)
https://support.industry.siemens.com/cs/ww/de/ps/3NP1153-1DA10
Bilddatenbank (Produktfotos, 2D-Maßzeichnungen, 3D-Modelle, Geräteschaltpläne, …)
http://www.automation.siemens.com/bilddb/cax_de.aspx?mlfb=3NP1153-1DA10
CAx-Online-Generator
http://www.siemens.com/cax
Ausschreibungstexte (Leistungsverzeichnisse)
http://www.siemens.de/ausschreibungstexte

Änderungen vorbehalten
© Copyright Siemens



© Copyright Siemens





Änderungen vorbehalten
© Copyright Siemens

Änderungen vorbehalten
© Copyright Siemens

SIEMENS

Sicherungslasttrennschalter Baugrößen (BG) 1, 2, 3 — **3NP1143**
Fuse switch disconnector frame size (FS) 1, 2, 3 — **3NP1153**
Fusible-interrupteur-sectionneur désignation de carcasse 1, 2, 3 — **3NP1163**
Interruptor-seccionador-fusible tamaños 1, 2, 3 — **3NP1943**
Sezionatore sottocarico con fusibili, dimensioni costruttive 1, 2, 3 — **3NP1953**
Seccionador de carga com fusíveis, tamanhos 1, 2, 3 — **3NP1963**
Sigortalı yük kesici Ebatlar 1, 2, 3
Разъединитель-предохранитель, типоразмеры 1, 2, 3
熔断器式负载隔离开关结构尺寸 1, 2, 3

Betriebsanleitung | **Operating Instructions** | **Instructions de service** | **Instructivo** | **Istruzioni operative**
Instruções de Serviço | **İşletme kılavuzu** | **Руководство по эксплуатации** | **使用说明**

	Deutsch	English	Français
	Vor der Installation, dem Betrieb oder der Wartung des Geräts muss diese Anleitung gelesen und verstanden werden.	Read and understand these instructions before installing, operating, or maintaining the equipment.	Ne pas installer, utiliser ou intervenir sur cet équipement avant d'avoir lu et assimilé les présentes instructions et notamment les conseils de sécurité et mises en garde qui y figurent.
	⚠ GEFAHR	**⚠ DANGER**	**⚠ DANGER**
	Gefährliche Spannung. **Lebensgefahr oder schwere Verletzungsgefahr.** Vor Beginn der Arbeiten Anlage und Gerät spannungsfrei schalten.	**Hazardous voltage.** **Will cause death or serious injury.** Turn off and lock out all power supplying this device before working on this device.	**Tension électrique.** **Danger de mort ou risque de blessures graves.** Mettre hors tension avant d'intervenir sur l'appareil.
	VORSICHT	**CAUTION**	**PRUDENCE**
	Eine sichere Gerätefunktion ist nur mit zertifizierten Komponenten gewährleistet!	Reliable functioning of the equipment is only ensured with certified components.	La sécurité de fonctionnement de l'appareil n'est garantie qu'avec des composants certifiés.

	Español	Italiano	Português
	Leer y comprender este instructivo antes de la instalación, operación o mantenimiento del equipo.	Leggere con attenzione queste istruzioni prima di installare, utilizzare o eseguire manutenzione su questa apparecchiatura.	Ler e compreender estas instruções antes da instalação, operação ou manutenção do equipamento.
	⚠ PELIGRO	**⚠ PERICOLO**	**⚠ PERIGO**
	Tensión peligrosa. **Puede causar la muerte o lesiones graves.** Desconectar la alimentación eléctrica antes de trabajar en el equipo.	**Tensione pericolosa.** **Può provocare morte o lesioni gravi.** Scollegare l'alimentazione prima di eseguire interventi sull'apparecchiatura.	**Tensão perigosa.** **Perigo de morte ou ferimentos graves.** Desligue a alimentação elétrica e proteja contra o religamento, antes de iniciar o trabalho no equipamento.
	PRECAUCIÓN	**CAUTELA**	**CUIDADO**
	El funcionamiento seguro del aparato sólo está garantizado con componentes certificados.	Il funzionamento sicuro dell'apparecchiatura è garantito soltanto con componenti certificati.	O funcionamento seguro do aparelho apenas pode ser garantido se forem utilizados os componentes certificados.

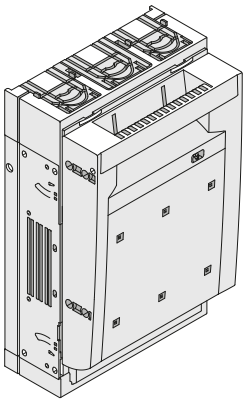
	Türkçe	Русский	中文
	Cihazın kurulumundan, çalıştırılmasından veya bakıma tabi tutulmasından önce, bu kılavuz okunmuş ve anlanmış olması gerekmektedir.	Перед установкой, вводом в эксплуатацию или обслуживанием устройства необходимо прочесть и понять данное руководство.	安装、使用和维修本设备前必须先阅读并理解本说明。
	⚠ TEHLİKE	**⚠ ОПАСНО**	**⚠ 危险**
	Tehlikeli gerilim. **Ölüm tehlikesi veya ağır yaralanma tehlikesi.** Çalışmalara başlamadan önce, sistemin ve cihazın gerilim beslemesini kapatınız.	**Опасное напряжение.** **Опасность для жизни или возможность тяжелых травм.** Перед началом работ отключить подачу питания к установке и к устройству.	**危险电压。** **可能导致生命危险或重伤危险。** 操作设备时必须确保切断电源。
	DİKKAT	**ОСТОРОЖНО**	**小心**
	Cihazın güvenli çalışması ancak sertifikalı bileşenler kullanılması halinde garanti edilebilir.	Безопасность работы устройства гарантировано только при использовании сертифицированных компонентов.	只有使用经过认证的部件才能保证设备的正常运转！

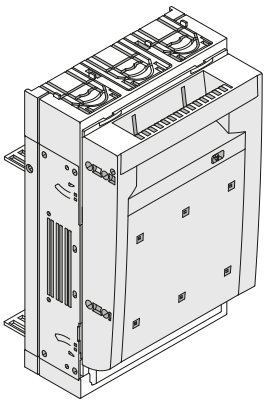
Technical Support: Internet: http://www.siemens.de/lowvoltage/technical-support

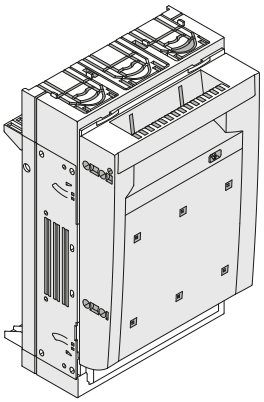
GWA 4NEB 711 2902-10 DS 05 — Last update: 23 July 2019
Bestell-Nr. / Order No.: 3ZX1012-0NP11-4CA1

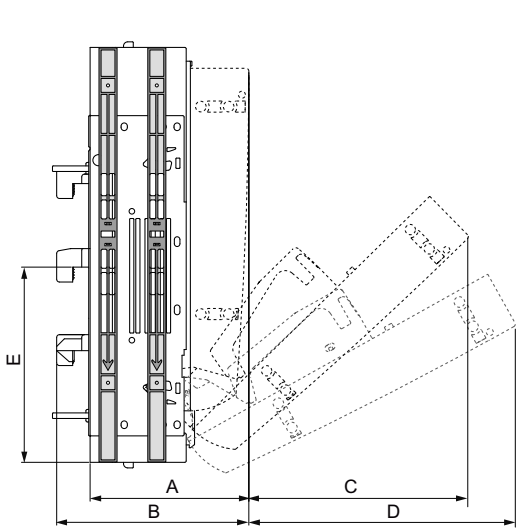
UL4248		
3NP114	600 V	250 A
3NP115	600 V	400 A
3NP1163-1__1_	600 V	630 A
3NP1163-1__2_	600 V	420 A

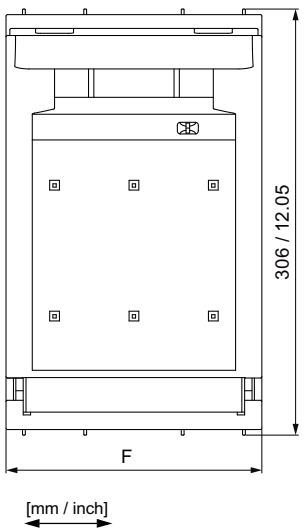
UL-File			
E171267	Vol 2	Sec 2	Fuseholders
E337672	Vol 1	Sec 1	Fuseholder Accessories

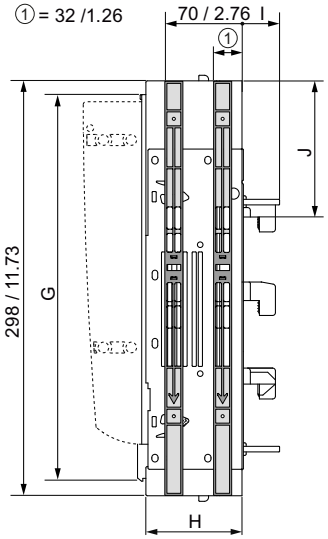


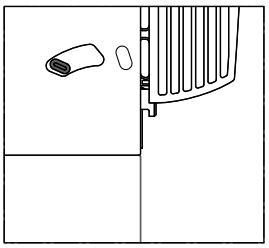


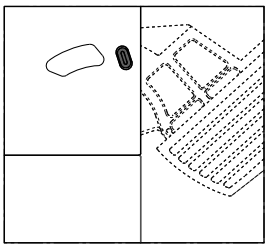


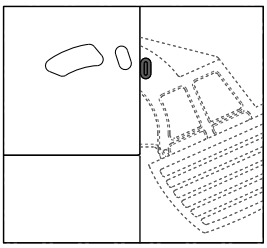






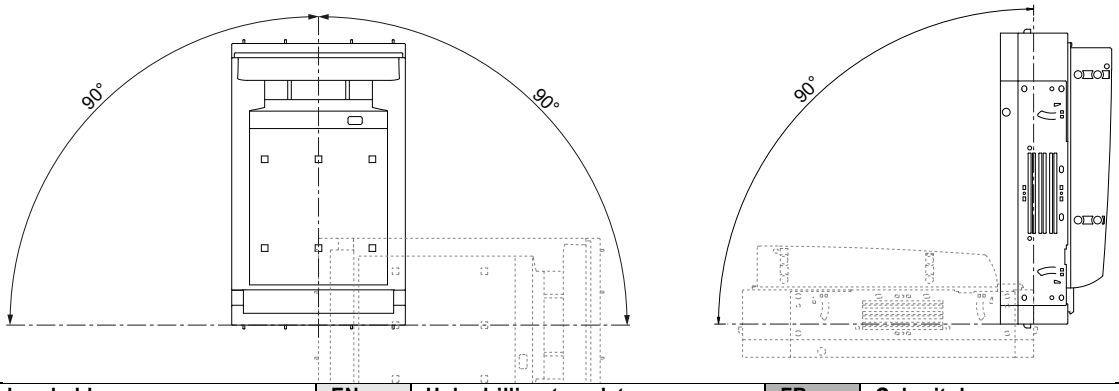






mm / inch	A	B	C	D	E	F	G	H	I	J
3NP1143-1CA_0	115 / 4.52	—	180 / 7.08	186 / 7.32	—	183,7 / 7.23	275,6 / 10.85	—	—	—
3NP1153-1CA_0	129,9 / 5.11	—	200 / 7.87	207 / 8.15	—	209,4 / 8.24	280 / 11.02	90 / 3.54	—	—
3NP1163-1CA_0	138,5 / 5.45	—	200 / 7.87	207 / 8.15	—	249,4 / 9.82	280 / 11.02	90 / 3.54	—	—
3NP1143-_BC_0	115 / 4.52	138 / 5.43	180 / 7.08	186 / 7.32	144,2 / 5.68	183,7 / 7.23	275,6 / 10.85	—	26 / 1.02	97,8 / 3.85
3NP1153-_BC_0	129,9 / 5.11	153 / 6.02	200 / 7.87	207 / 8.15	144,2 / 5.68	209,4 / 8.24	280 / 11.02	90 / 3.54	26 / 1.02	97,8 / 3.85
3NP1163-_BC_0	138,5 / 5.45	161,5 / 6.36	200 / 7.87	207 / 8.15	144,2 / 5.68	249,4 / 9.82	280 / 11.02	90 / 3.54	26 / 1.02	97,8 / 3.85

DE	Einbaulage	EN	Mounting position	FR	Position de montage
ES	Posición de montaje	IT	Posizione di montaggio	PT	Posição de montagem
TR	Montaj pozisyonu	РУ	Монтажное положение	中文	安装位置



DE	Bohrschablone	EN	Hole drilling template	FR	Gabarit de perçage
ES	Plantilla para taladrado	IT	Schema di foratura	PT	Gabarito de furação
TR	Delme şablonu	РУ	Шаблон для сверления	中文	钻模

ACHTUNG

Nicht korrekt platzierte Bohrlöcher durch Verwendung dieser Zeichnung als Bohrschablone.
Diese Bohrschablone ist nicht im Maßstab 1:1 dargestellt. Fertigen Sie auf Grundlage der Zeichnung eine korrekte Bohrschablone an.

ATTENTION

Incorrectly placed drill holes as a result of using this drawing as a drilling template.
This hole drilling template is not exactly to scale (1:1). Please make a correct hole drilling template on the basis of the drawing.

ATTENTION

Ce dessin ne peut pas être utilisé comme gabarit de perçage.
En effet, il n'est pas à l'échelle. Il peut cependant être utilisé pour créer un gabarit à l'échelle.

ATENCIÓN

Taladros de fijación mal posicionados si este dibujo se usa como plantilla para taladrar.
Este dibujo no está a escala 1:1, por ello no sirve como plantilla. Elabore una plantilla correcta en base a las dimensiones reales indicadas en el dibujo.

ATTENZIONE

Fori situati non correttamente a causa dell'utilizzo di questo disegno quale schema di foratura.
Questo schema di foratura non è raffigurato in scala 1:1. Preparare uno schema di foratura corretto sulla base del disegno.

ATENÇÃO

Furos posicionados incorretamente devido ao uso do presente desenho como gabarito de furação.
O gabarito de furação não está representado em escala 1:1. Produza um gabarito de furação correto com base no desenho.

DİKKAT

Delik şablonu olarak bu çizimin kullanılması nedeniyle doğru yerleştirilmemiş matkap delikleri.
Bu delik şablonu 1:1 ölçekte gösterilmemektedir. Çizimi temel alarak doğru bir delik şablonu hazırlayın.

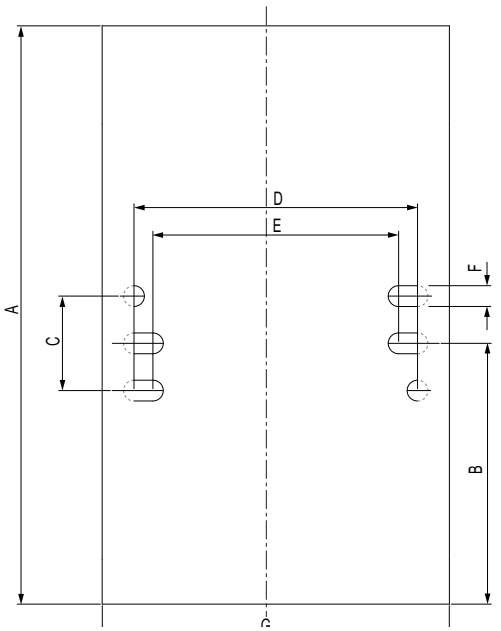
ВНИМАНИЕ

Неправильное положение просверленных отверстий при использовании данного чертежа в качестве шаблона для сверления.
Данный шаблон для сверления представлен не в масштабе 1:1. На основе чертежа подготовьте правильный шаблон для сверления.

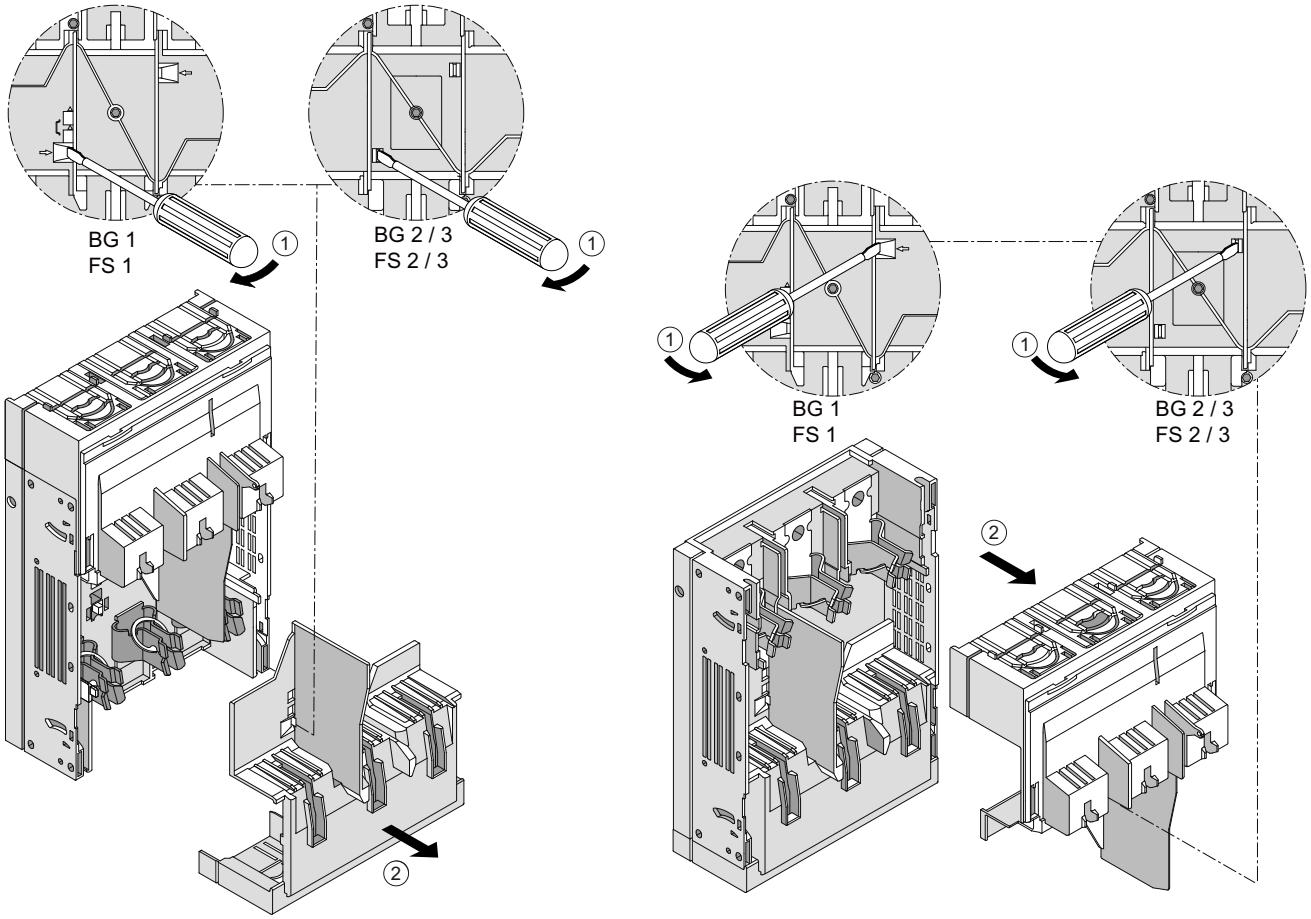
注意

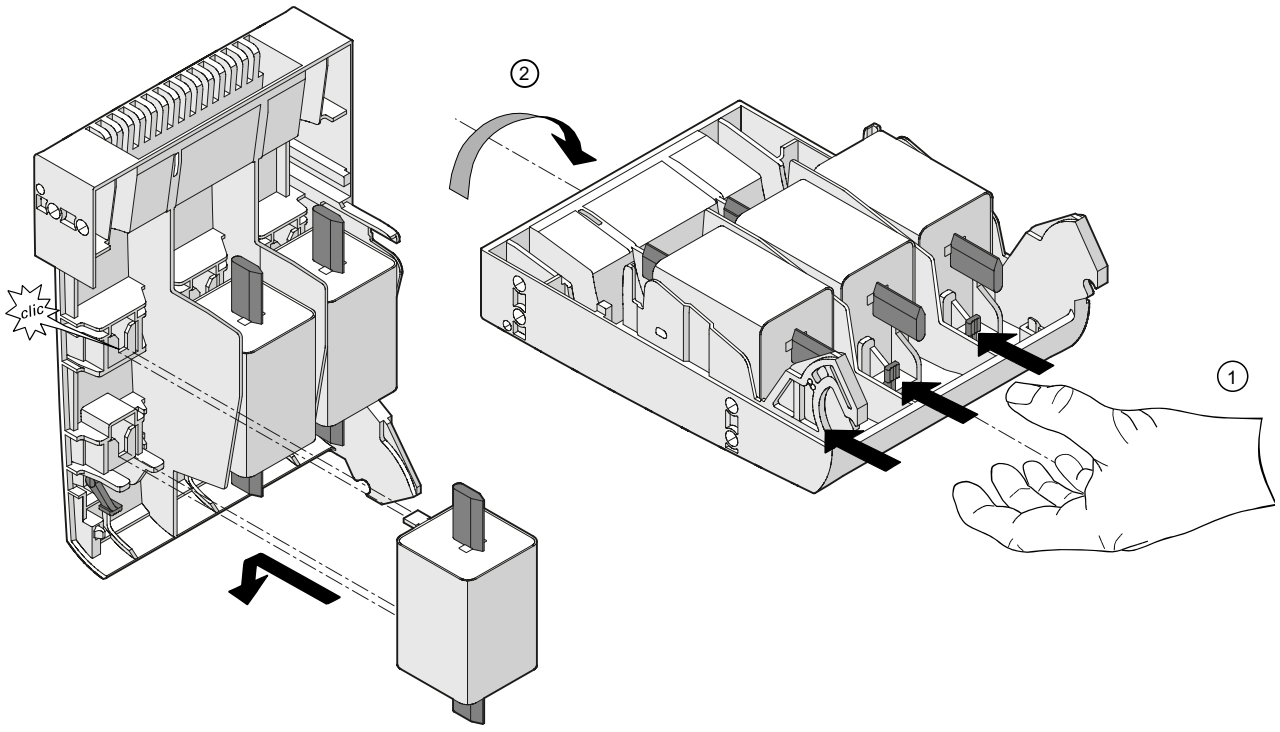
使用该图纸作为钻孔模板导致钻孔选位错误。

该钻孔模板的比例不正好是 1:1。请根据图纸制作正确的钻孔模板。



mm / inch	A	B	C	D	E	F	G
3NP1143-1CA_0	306 / 12.05	138 / 5.43	50 / 1.97	150 / 5.91	130 / 5.12	11 / 0.43	183,7 / 7.23
3NP1153-1CA_0	306 / 12.05	138 / 5.43	50 / 1.97	166 / 6.54	130 / 5.12	11 / 0.43	209,4 / 8.24
3NP1163-1CA_0	306 / 12.05	138 / 5.43	50 / 1.97	195 / 7.68	160 / 6.30	11 / 0.43	249,4 / 9.82

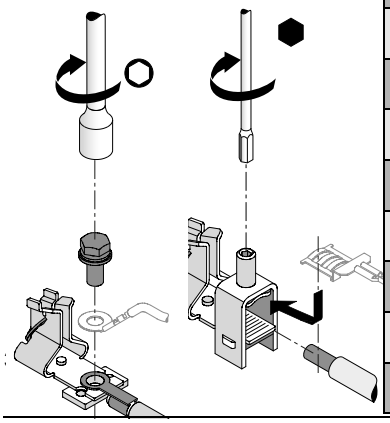

BG 1
FS 1
BG 2 / 3
FS 2 / 3
1
2


clic
2
1

					WxT	+
3NP1143-1__10	○ 17 mm / 0.67 inch	10 ... 12 Nm / 88.5 ... 106.2 lbf in	16 ... 150 mm² / 6 AWG ... 300 kcmil 2 x 120 mm² / 2 x 250 kcmil	–	–	3NP1943-1BG10
3NP1153-1__10	○ 17 mm / 0.67 inch	10 ... 12 Nm / 88.5 ... 106.2 lbf in	25 ... 240 mm² / 4 AWG ... 500 kcmil 2 x 185 mm² / 2 x 350 kcmil	–	–	3NP1943-1BG10
3NP1163-1__10	○ 17 mm / 0.67 inch	25 Nm / 221.3 lbf in	50 ... 300 mm² / 1/0 AWG ... 600 kcmil 2 x 240 mm² / 2 x 500 kcmil	–	–	3NP1943-1BG10
3NP1143-1__20	◢ 5 mm / 0.20 inch	10 Nm / 88.5 lbf in	70 ... 185 mm² / 2/0 AWG ... 350 kcmil	70 ... 120 mm² 2/0 AWG ... 250 kcmil	20 mm x 10 mm / 0.79 inch x 0.39 inch	3NP1943-1BG40
3NP1153-1__20	◢ 8 mm / 0.31 inch	25 Nm / 221.3 lbf in	120 ... 300 mm² / 250 kcmil ... 600 kcmil	120 ... 240 mm² 250 kcmil ... 500 kcmil	32 mm x 10 mm / 1.26 inch x 0.39 inch	3NP1953-1BG40
3NP1163-1__20	◢ 8 mm / 0.31 inch	25 Nm / 221.3 lbf in	120 ... 300 mm² / 250 kcmil ... 600 kcmil UL no standard cable Flexibar 32 mm x 14 mm / 1.26 inch x 0.55 inch	120 ... 240 mm² 250 kcmil ... 500 kcmil UL no standard cable	32 mm x 20 mm / 1.26 inch x 0.79 inch	3NP1953-1BG40

\+

DE	Hilfsleiteranschluss	**EN**	Auxiliary conductor connection	**FR**	Raccordement de connecteur auxiliaire
ES	Conexión de conductor auxiliar	**IT**	Collegamento conduttore ausiliario	**PT**	Conexão de condutor auxiliar
TR	Yardımcı iletken bağlantısı	**РУ**	Подключение вспомогательного провода	**中文**	辅助导线连接

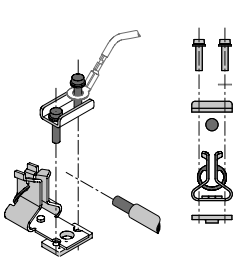


DE	**ACHTUNG**	Höhere Verlustleitung durch höhere Erwärmungswerte, wenn bei 3NP11_3-1__20 die Kabel nicht mittig angeschlossen sind. Schließen Sie bei 3NP11_3-1__20 die Kabel immer mittig an.
EN	**ATTENTION**	Higher power losses as a result of higher heat rise values if the cables are not connected in the center on 3NP11_3-1__20. On 3NP11_3-1__20 always connect the cables in the center
FR	**ATTENTION**	La puissance dissipée en raison de l'échauffement est plus élevée lorsque les câbles ne sont pas raccordés au milieu pour 3NP11_3-1__20. Veiller à raccorder les câble au milieu sur 3NP11_3-1__20.
ES	**ATENCIÓN**	Mayores pérdidas debido a mayor calentamiento si en el 3NP11_3-1__20 los cable no se conectan centrados. Conecte en el 3NP11_3-1__20 los cables siempre centrados.
IT	**ATTENZIONE**	Potenza dissipata più elevata a causa di valori termici più alti, se non si collegano i cavi del 3NP11_3-1__20 al centro. Collegare i cavi del 3NP11_3-1__20 sempre al centro
PT	**ATENÇÃO**	O valores de aquecimento superiores fazem aumentar a potência dissipada, quando os cabos não estão conectados no meio no 3NP11_3-1__20. No 3NP11_3-1__20 sempre conectar o cabo no meio.
TR	**DİKKAT**	3NP11_3-1__20'de kablolar ortaya bağlanmamışsa, artan ısınma kayıpları nedeniyle daha yüksek kayıp güç. 3NP11_3-1__20'de kabloları her zaman ortaya bağlayın
РУ	**ВНИМАНИЕ**	Из-за более высоких показателей нагрева возникают большие потери мощности, если в 3NP11_3-1__20 кабели подсоединены не по центру. В 3NP11_3-1__20 кабель всегда подсоединять по центру.
中文	**注意**	如果电缆没有连接到 3NP11_3-1__20 的中心位置，将由于温升较高而导致更高的功率损耗。请始终将电缆连接到 3NP11_3-1__20 的中心位置。

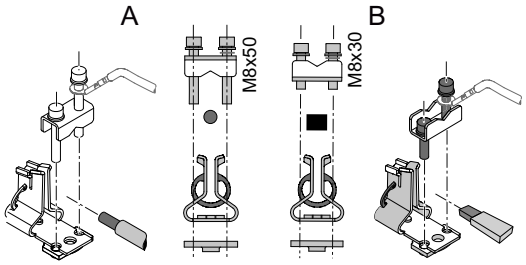
					WxT	+
3NP1943-1BA00	◢ 5 mm / 0.20 inch	6 Nm / 53.1 lbf in	70 ... 120 mm² / 2/0 AWG ... 250 kcmil	70 ... 120 mm² / 2/0 AWG ... 250 kcmil	18 mm x 10 mm 0.71 inch x 0.39 inch	3NP1943-1BG30
3NP1953-1BA00 A/B	◢ 6 mm / 0.24 inch	8 Nm / 8 Nm, 70.8 lbf in / 70.8 lbf in	120 .... 240 mm² / 250 kcmil ... 500 kcmil	120 ... 240 mm² / 250 kcmil ... 500 kcmil	20 mm x 12 mm 0.79 inch x 0.47 inch	3NP1953-1BG30
3NP1963-1BA00 A/B	◢ 6 mm / 0.24 inch	10 Nm / 8 Nm, 88.5 lbf in / 70.8 lbf in	150 .... 300 mm² / 300 kcmil ... 600 kcmil	150 ... 300 mm² / 300 kcmil ... 600 kcmi	24 mm x 16 mm 0.94 inch x 0.63 inch	3NP1953-1BG30
3NP1943-1BB10	◢ 5 mm / 0.20 inch	6 Nm / 53.1 lbf in	70 ... 150 mm² / 2/0 AWG ... 300 kcmil	70 ... 150 mm² / 2/0 AWG ... 300 kcmil	18 mm x 10 mm 0.71 inch x 0.39 inch	3NP1943-1BG30
3NP1953-1BB10	◢ 6 mm / 0.24 inch	8 Nm / 70.8 lbf in	120 .... 240 mm² / 250 kcmil ... 500 kcmil	120 ... 240 mm² /250 kcmil ... 500 kcmi	20 mm x 10 mm 0.79 inch x 0.39 inch	3NP1953-1BG30
3NP1963-1BB10	○ 13 mm / 0.51 inch	25 Nm / 221.3 lbf in	150 .... 300 mm² / 300 kcmil ... 600 kcmil	150 ... 300 mm² / 300 kcmil ... 600 kcmil	24 mm x 10 mm 0.94 inch x 0.39 inch	3NP1953-1BG30
3NP1943-1BB20	◢ 5 mm / 0.20 inch	6 Nm / 53.1 lbf in	2 x 35 .... 70 mm² / 2 x 2AWG ... 2/0 AWG	2 x 35 .... 70 mm² / 2 x 2AWG ... 2/0 AWG	–	3NP1943-1BG30
3NP1953-1BB20	◢ 6 mm / 0.24 inch	8 Nm / 70.8 lbf in	2 x 70 ... 120 mm² 2 x 2/0 AWG ... 250 kcmil	2 x 70 ... 120 mm² / 2 x 2/0 AWG ... 250 kcmil	–	3NP1953-1BG30
3NP1963-1BB20	○ 13 mm / 0.51 inch	25 Nm / 221.3 lbf in	2 x 150 .... 185 mm² 2 x 300 kcmil ... 350 kcmil	2 x 150 ... 185 mm² 2 x 300 kcmil ... 350 kcmil	–	3NP1953-1BG30

\+

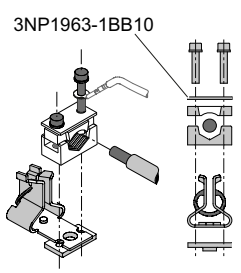
DE	Hilfsleiteranschluss	**EN**	Auxiliary conductor connection	**FR**	Raccordement de connecteur auxiliaire
ES	Conexión de conductor auxiliar	**IT**	Collegamento conduttore ausiliario	**PT**	Conexão de condutor auxiliar
TR	Yardımcı iletken bağlantısı	**РУ**	Подключение вспомогательного провода	**中文**	辅助导线连接



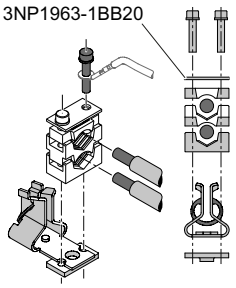
3NP1943-1BA00



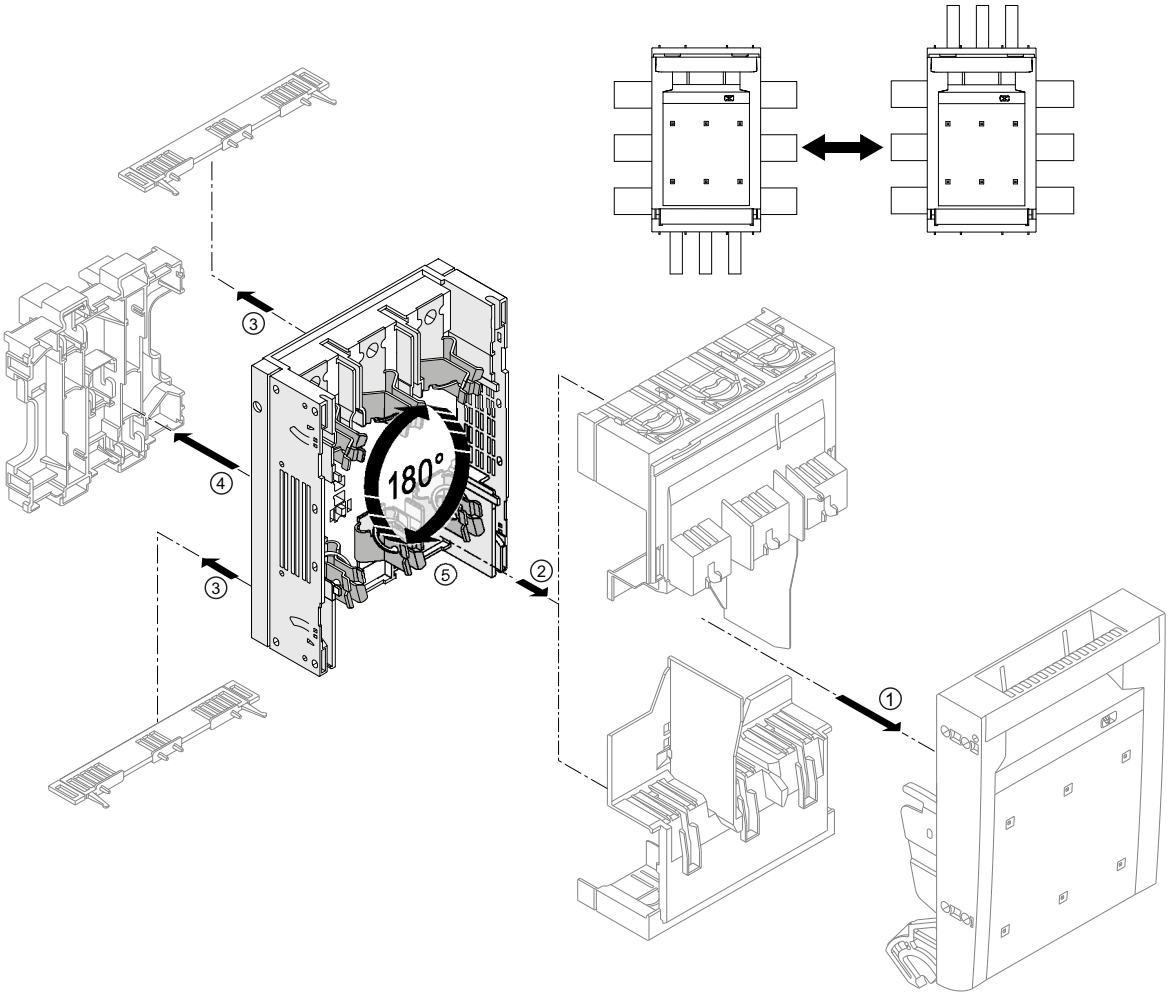
3NP1953-1BA00
3NP1963-1BA00

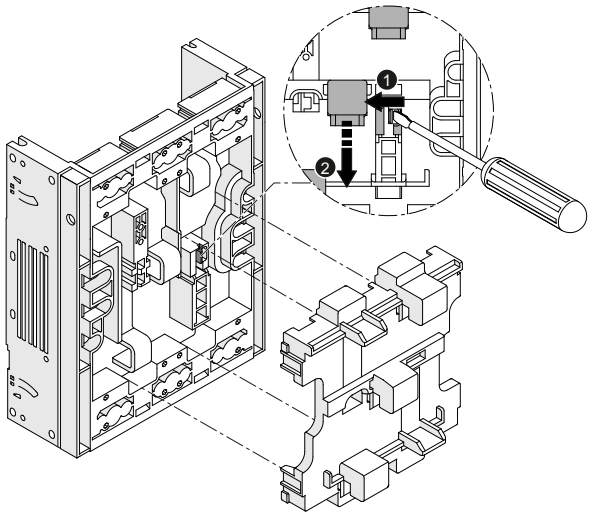


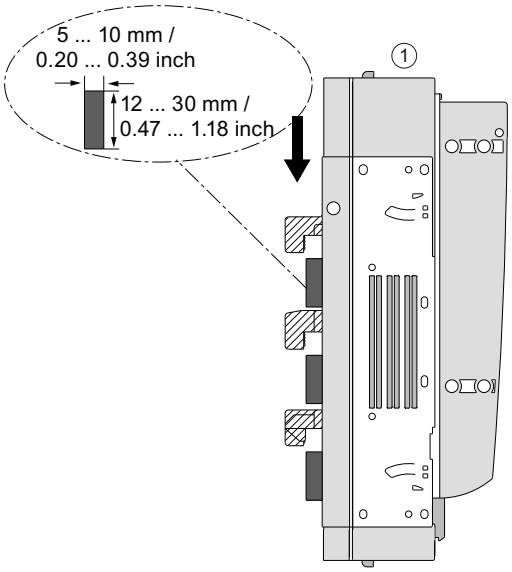
3NP19.3-1BB10

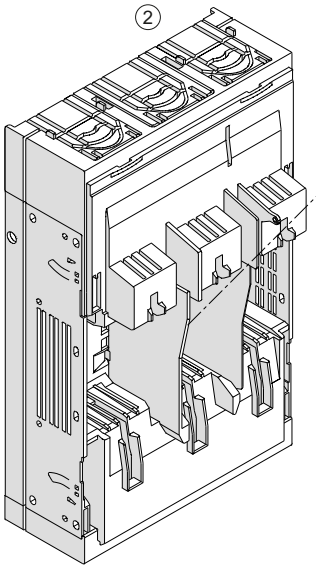


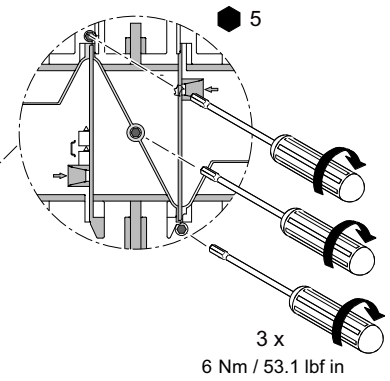
3NP19.3-1BB20

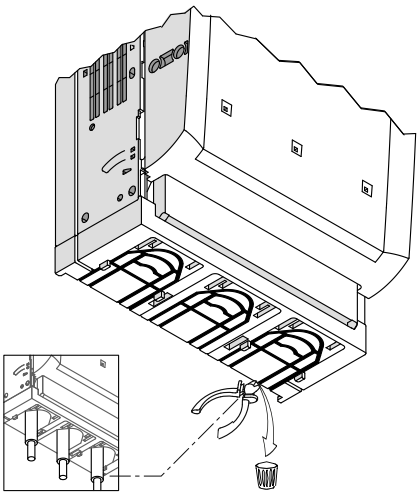

180°
①
②
③
④
⑤

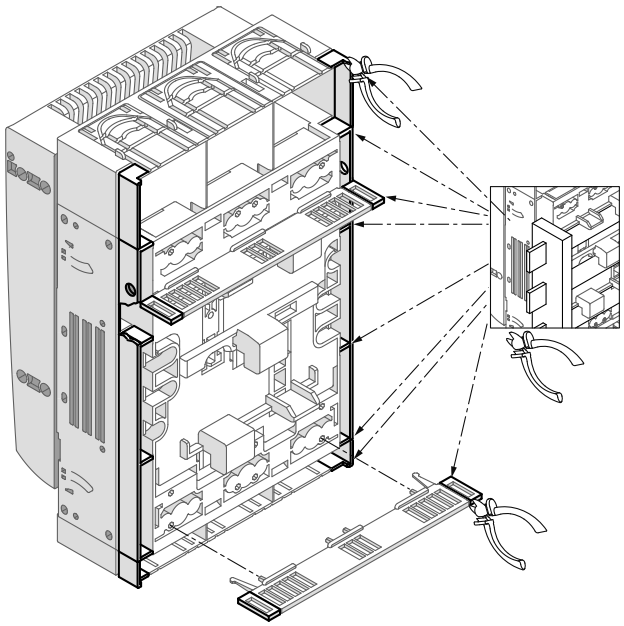

1
2

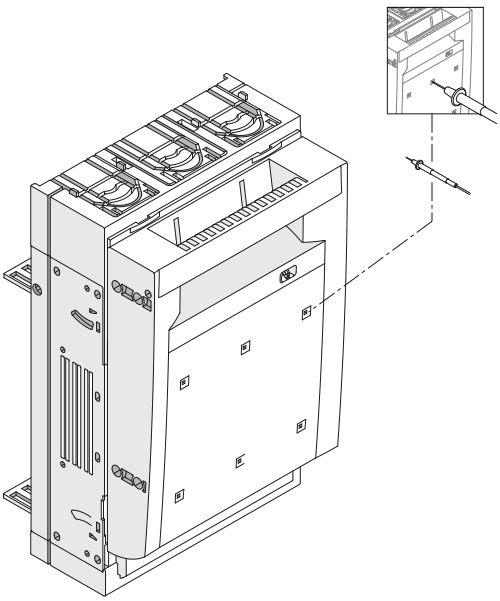

5 ... 10 mm /
0.20 ... 0.39 inch
12 ... 30 mm /
0.47 ... 1.18 inch
①

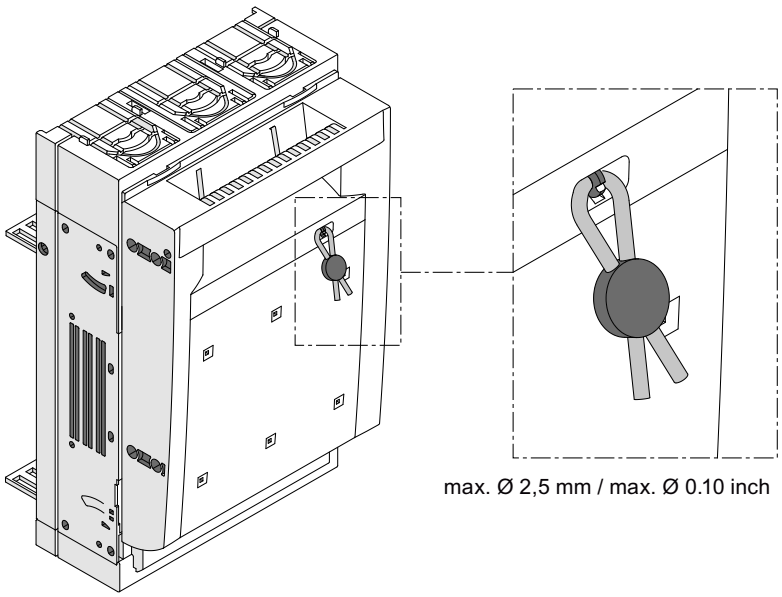

②


5
3 x
6 Nm / 53.1 lbf in









DE	Weitere Informationen finden Sie im Systemhandbuch "Sicherungslasttrennschalter 3NP1" (3ZX1012-0NP10-1AB1).
EN	Further information can be found in the system manual "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
FR	Vous trouverez des informations supplémentaires dans le manuel système "Fusible-interrupteur-sectionneur 3NP1" (3ZX1012-0NP10-1AD1).
ES	Podrá obtener información adicional en el manual de sistema "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
IT	Per ulteriori informazioni, consultare il manuale di sistema "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
PT	Maiores informações você encontra no Manual de Sistema "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
TR	Ayrıntılı bilgiyi "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1) sistem kılavuzundan edinebilirsiniz.
РУ	Дополнительную информацию Вы найдете в Системном руководстве "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
中文	更多信息请参见系统手册 "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).

Technische Änderungen vorbehalten. Zum späteren Gebrauch aufbewahren.
Subject to change without prior notice. Store for use at a later date.

Bestell-Nr./Order No.: 3ZX1012-0NP11-4CA1
© Siemens AG 2008

SIEMENS

Sicherungsüberwachung MFM / EFM 10 / EFM 20 / EFM 25
Fuse Monitoring MFM / EFM 10 / EFM 20 / EFM 25
Dispositif de contrôle des fusibles MFM / EFM 10 / EFM 20 / EFM 25
Control de fusibles MFM / EFM 10 / EFM 20 / EFM 25
Controllo fusibili MFM / EFM 10 / EFM 20 / EFM 25
Supervisão de fusíveis MFM / EFM 10 / EFM 20 / EFM 25
Sigorta kontrolü MFM / EFM 10 / EFM 20 / EFM 25
Устройство контроля предохранителей MFM / EFM 10 / EFM 20 / EFM 25
保险器监控装置 MFM / EFM 10 / EFM 20 / EFM 25

3NP11_3-___1 / 3NP19_3-1GB10
3NP11_3-___2 / 3NP19_3-1GB20
3NP11_3-___3 / 3NP19_3-1GB30
3NP11_3-___5 / 3NP19_3-1GB50

Betriebsanleitung | **Operating Instructions** | **Instructions de service** | **Instructivo** | **Istruzioni operative**
Instruções de Serviço | **İşletme kılavuzu** | **Руководство по эксплуатации** | **使用说明**

	Deutsch	English	Français
	Vor der Installation, dem Betrieb oder der Wartung des Geräts muss diese Anleitung gelesen und verstanden werden.	Read and understand these instructions before installing, operating, or maintaining the equipment.	Ne pas installer, utiliser ou intervenir sur cet équipement avant d'avoir lu et assimilé les présentes instructions et notamment les conseils de sécurité et mises en garde qui y figurent.
	⚠ GEFAHR	**⚠ DANGER**	**⚠ DANGER**
	Gefährliche Spannung. **Lebensgefahr oder schwere Verletzungsgefahr.** Vor Beginn der Arbeiten Anlage und Gerät spannungsfrei schalten.	**Hazardous voltage.** **Will cause death or serious injury.** Turn off and lock out all power supplying this device before working on this device.	**Tension électrique.** **Danger de mort ou risque de blessures graves.** Mettre hors tension avant d'intervenir sur l'appareil.
	VORSICHT	**CAUTION**	**PRUDENCE**
	Eine sichere Gerätefunktion ist nur mit zertifizierten Komponenten gewährleistet!	Reliable functioning of the equipment is only ensured with certified components.	La sécurité de fonctionnement de l'appareil n'est garantie qu'avec des composants certifiés.

	Español	Italiano	Português
	Leer y comprender este instructivo antes de la instalación, operación o mantenimiento del equipo.	Leggere con attenzione queste istruzioni prima di installare, utilizzare o eseguire manutenzione su questa apparecchiatura.	Ler e compreender estas instruções antes da instalação, operação ou manutenção do equipamento.
	⚠ PELIGRO	**⚠ PERICOLO**	**⚠ PERIGO**
	Tensión peligrosa. **Puede causar la muerte o lesiones graves.** Desconectar la alimentación eléctrica antes de trabajar en el equipo.	**Tensione pericolosa.** **Può provocare morte o lesioni gravi.** Scollegare l'alimentazione prima di eseguire interventi sull'apparecchiatura.	**Tensão perigosa.** **Perigo de morte ou ferimentos graves.** Desligue a alimentação elétrica e proteja contra o religamento, antes de iniciar o trabalho no equipamento.
	PRECAUCIÓN	**CAUTELA**	**CUIDADO**
	El funcionamiento seguro del aparato sólo está garantizado con componentes certificados.	Il funzionamento sicuro dell'apparecchiatura è garantito soltanto con componenti certificati.	O funcionamento seguro do aparelho apenas pode ser garantido se forem utilizados os componentes certificados.

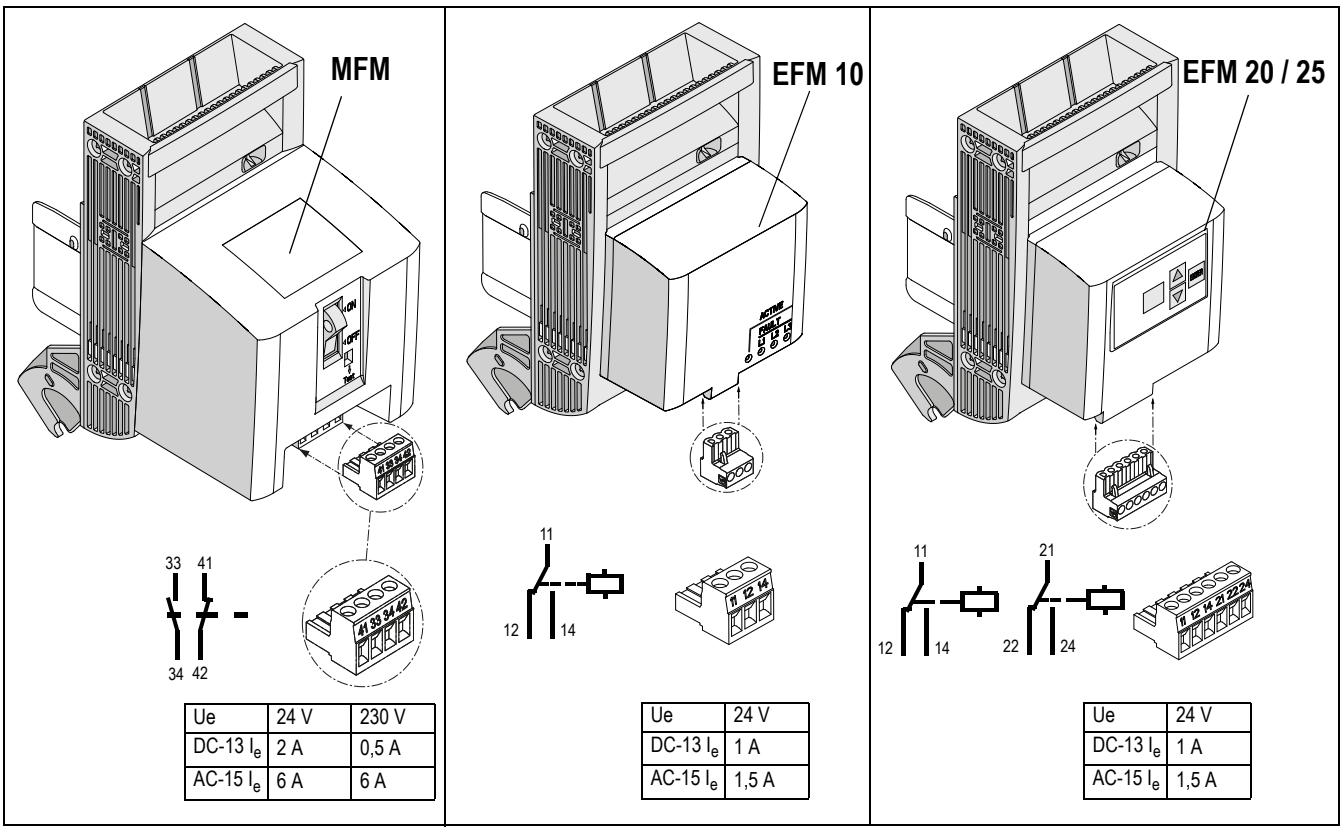
	Türkçe	Русский	中文
	Cihazın kurulumundan, çalıştırılmasından veya bakıma tabi tutulmasından önce, bu kılavuz okunmuş ve anlanmış olması gerekmektedir.	Перед установкой, вводом в эксплуатацию или обслуживанием устройства необходимо прочесть и понять данное руководство.	安装、使用和维修本设备前必须先阅读并理解本说明。
	⚠ TEHLİKE	**⚠ ОПАСНО**	**⚠ 危险**
	Tehlikeli gerilim. **Ölüm tehlikesi veya ağır yaralanma tehlikesi.** Çalışmalara başlamadan önce, sistemin ve cihazın gerilim beslemesini kapatınız.	**Опасное напряжение.** **Опасность для жизни или возможность тяжелых травм.** Перед началом работ отключить подачу питания к установке и к устройству.	**危险电压。** **可能导致生命危险或重伤危险。** 操作设备时必须确保切断电源。
	DİKKAT	**ОСТОРОЖНО**	**小心**
	Cihazın güvenli çalışması ancak sertifikalı bileşenler kullanılması halinde garanti edilebilir.	Безопасность работы устройства гарантировано только при использовании сертифицированных компонентов.	只有使用经过认证的部件才能保证设备的正常运转！

Technical Support: Internet: https://www.siemens.de/lowvoltage/technical-support

UL4248		
3NP112	600 V	160 A
3NP113	600 V	160 A
3NP114	600 V	250 A
3NP115	600 V	400 A
3NP1163-1__1_	600 V	630 A
3NP1163-1__2_	600 V	420 A

UL-File			
E171267	Vol 2	Sec 2	Fuseholders
E337672	Vol 1	Sec 1	Fuseholder Accessories

DE	**Sicherungsüberwachung MFM / Standard EFM 10 / High-End EFM 20 / 25**
EN	**Fuse Monitoring MFM / Standard EFM 10 / High-End EFM 20 / 25**
FR	**Dispositif de contrôle des fusibles MFM / Standard EFM 10 / High-End EFM 20 / 25**
ES	**Control de fusibles MFM / Standard EFM 10 / High-End EFM 20 / 25**
IT	**Controllo fusibili MFM /Standard EFM 10 / High-End EFM 20 / 25**
PT	**Supervisão de fusíveis MFM / Standard EFM 10 / High-End EFM 20 / 25**
TR	**Sigorta kontrolü MFM /Standard EFM 10 / High-End EFM 20 / 25**
РУ	**Устройство контроля предохранителей MFM / стандарт EFM 10/ High-End EFM 20 / 25**
中文	**保险器监控装置 MFM / 标准 EFM 10 / 高端 EFM 20 / 25**



Ue	24 V	230 V
DC-13 I_e	2 A	0,5 A
AC-15 I_e	6 A	6 A

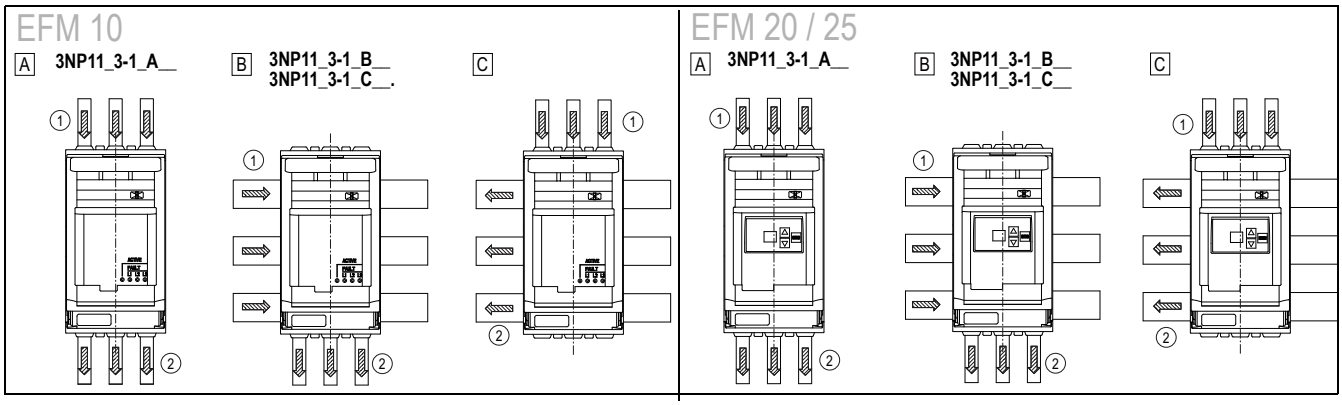
Ue	24 V
DC-13 I_e	1 A
AC-15 I_e	1,5 A

Ue	24 V
DC-13 I_e	1 A
AC-15 I_e	1,5 A

					~ / ±
3NP11_3 -____1	3NP19_3-1GB10	3,0 x 0,5 mm / 0.12 .x 0.02 inch	0,5 ... 1,2 Nm / 4.4 ... 10.6 lbf in	0,2 ... 2,5 mm^2 / 20 AWG ... 14 AWG	AC / DC
3NP11_3 - ____2	3NP19_3-1GB20	3,0 x 0,5 mm / 0.12 .x 0.02 inch	0,5 ... 1,2 Nm / 4.4 ... 10.6 lbf in	0,2 ... 2,5 mm^2 / 20 AWG ... 14 AWG	AC
3NP11_3 - ____3	3NP19_3-1GB30	3,0 x 0,5 mm / 0.12 .x 0.02 inch	0,5 ... 1,2 Nm / 4.4 ... 10.6 lbf in	0,2 ... 2,5 mm^2 / 20 AWG ... 14 AWG	AC
3NP11_3 - ____5	3NP19_3-1GB50	3,0 x 0,5 mm / 0.12 .x 0.02 inch	0,5 ... 1,2 Nm / 4.4 ... 10.6 lbf in	0,2 ... 2,5 mm^2 / 20 AWG ... 14 AWG	DC

DE	**Einbau und Anschluss**	**EN**	**Installation and Connection**	**FR**	**Installation et raccordement**
ES	**Montaje y conexión**	**IT**	**Montaggio e collegamento**	**PT**	**Instalação e conexão**
TR	**Montaj ve bağlantı**	**РУ**	**Монтаж и подключение**	**中文**	**安装和连接**

DE	**Korrekte Einspeisungsformen**	**EN**	**Correct Infeed Forms**	**FR**	**Formes d'alimentation correctes**
ES	**Formas correctas de alimentación**	**IT**	**Forme di alimentazione corrette**	**PT**	**Formas corretas de alimentação**
TR	**Doğru besleme tarzları**	**РУ**	**Правильные виды питания**	**中文**	**正确的供电形式**



DE	(1) Einspeisung	(2) Abgang	**EN**	(1) Infeed	(2) Outgoing feeder	**FR**	(1) Alimentation	(2) Départ
ES	(1) Alimentación	(2) Derivación	**IT**	(1) Alimentazione	(2) Uscita	**PT**	(1) Alimentação	(2) Saída
TR	(1) Besleme	(2) Çıkış	**РУ**	(1) питание	(2) выход	**中文**	(1) 供电	(2) 输出

DE	**ACHTUNG**	Falls bei spannungsführender Einspeisung eine andere Anschlussform der elektronischen Sicherungsüberwachung EFM als die oben genannte gewählt wurde und mehr als eine Sicherung defekt ist, leuchtet bei EFM 10 die grüne LED oder EFM 20 / 25 die Anzeige nicht. Die Eigenversorgung der elektronischen Sicherungsüberwachung EFM ist in diesem Fall nicht gewährleistet. Tauschen Sie die defekten Sicherungen aus.
EN	**ATTENTION**	If the green LED on EFM 10 or the display on EFM 20 / 25 does not light up although the electronic fuse monitoring device is correctly connected and the infeed is live, no signal or an incorrect signal is transmitted. Replace the electronic fuse monitoring device straight away.
FR	**ATTENTION**	Si la LED verte de l'EFM 10 ou l'affichage de l'EFM 20 / 25 ne sont pas allumés alors que l'alimentation fournit la tension et que la surveillance électonique de fusible est correctement raccordée, aucun signal ou un signal erronné sont émis. Remplacer immédiatement la surveillance électronique de fusible
ES	**ATENCIÓN**	Si estando presente la tensión de alimentación a la entrada y correctamente conectado el dispositivo electrónico de control de fusibles no lucen el LED verde en el EFM 10 o el display en el EFM 20 / 25, entonces no se envía señal o ésta es incorrecta. Sustituya inmediatamente el dispositivo electrónico de control de fusibles.
IT	**ATTENZIONE**	Se nonostante l'alimentazione di tensione presente e il collegamento corretto del controllo elettronico dei fusibili, il LED verde su EFM 10 o il display su EFM 20 / 25 non si accendono, non si ha l'invio di alcun segnale o si ha l'invio di un segnale errato. Sostituire immediatamente il controllo elettronico dei fusibili.
PT	**ATENÇÃO**	Se numa alimentação condutora de tensão e conexão correta da supervisão eletrônica de fusíveis o LED verde na EFM 10 ou o display na EFM 20 / 25 não acender, não é enviado qualquer sinal ou é enviado um sinal errado. É imprescindível a substituição imediata da supervisão eletrônica de fusíveis
TR	**DIKKAT**	Gerilim ileten besleme ve elektronik sigorta denetiminin doğru şekilde bağlanması durumunda EFM 10'da yeşil LED veya EFM 20 / 25'de gösterge yanmazsa, sinyal gönderilmemektedir ya da yanlış sinyal gönderilmektedir. Zaman kaybetmeden elektronik sigorta denetimini değiştirin
РУ	**ВНИМАНИЕ**	В случае если при подаче напряжения и правильном подключении устройства электронного контроля предохранителей на EFM 10 не горит зеленый светодиод или на EFM 20 / 25 индикатор, то не передается сигнал или передается неправильный сигнал. Немедленно замените устройство электронного контроля предохранителей
中文	**注意**	如果电子熔断器监视设备正确连接且馈电线路带电，但 EFM 10 上的绿色 LED 或 EFM 20 / 25 上的指示灯没有点亮，则不会传送信号或可能传送错误信号。 请立即更换该电子熔断器监视设备。

DE	**VORSICHT**	Falls bei spannungsführender Einspeisung und korrektem Anschluss der elektronischen Sicherungsüberwachung bei EFM 10 die grüne LED oder EFM 20 / 25 die Anzeige nicht leuchtet, wird kein Signal oder ein falsches Signal gesendet. Tauschen Sie unverzüglich die elektronische Sicherungsüberwachung aus.
EN	**CAUTION**	The green LED on EFM 10 or the display on EFM 20 / 25 does not light up if the electronic fuse monitoring device EFM is connected in a way other than that described above when the infeed is live and more than one fuse is faulty. In this case, the internal power supply of the electronic fuse monitoring device EFM can no longer be guaranteed. Replace the defective fuses.
FR	**PRUDENCE**	Lorsque la tenison d'alimentation est délivrée correctement et qu'une autre type de raccordement de la surveillance élecronique de fusible a été choisi, la LED verte de l'EFM 10 s'allume et l'affichage de l'EFM 20 / 25 n'est pas allumé lorsque plus d'un fusible est défectueux. L'alimentation interne de la surveillance électronique de fsible EFM n'est alors pas assurée. Remplacer les fusibles défectueux.
ES	**PRECAUCIÓN**	Si estando presente la tensión de alimentación a la entrada y la forma de conexión del dispositivo electrónico de control de fusibles EFM difiere de la arriba mencionada y está defectuoso más de un fusible, entonces no luce el LED verde en el EFM 10 o en el EFM 20 / 25 el display. En tal caso no está garantizada la alimentación correcta del dispositivo electrónico de control de fusibles EFM. Sustituya los fusibles defectuosos.
IT	**CAUTELA**	Se con alimentazione di tensione presente è stato scelto un tipo di collegamento del controllo elettronico dei fusibili EFM diverso da quello sopra citato e più di un fusibile è guasto, il LED verde su EFM 10 o il display su EFM 20 / 25 non si accendono. In questo caso l'autoalimentazione del controllo elettronico dei fusibili EFM non è assicurata. Sostituire i fusibili guasti.
PT	**CUIDADO**	Se numa alimentação condutora de tensão foi escolhida uma outra forma de conexão da supervisão eletrônica de fusíveis EFM do que a acima mencionada, e se mais de um fusível estiverem defeituosos, o LED verde na EFM 10 ou o display na EFM 20 / 25 não acenderá. Neste caso, não está assegurada a alimentação própria da supervisão eletrônica de fusíveis EFM. Substitua os fusíveis defeituosos.
TR	**DIKKAT**	Gerilim ileten beslemede EFM elektronik sigorta denetiminin yukarıda belirtilenden farklı bir bağlantı şekli seçilmişse ve birden çok sigorta arızalıysa, EFM 10'da yeşil LED ve EFM 20 / 25'de gösterge yanmaz. Bu durumda, EFM elektronik sigorta denetiminin giriş beslemesi sağlanmamaktadır. Arızalı sigortaları değiştirin.
РУ	**ОСТО-РОЖНО**	В случае если при подаче напряжения выбран иной вид подключения электронного контроля предохранителей EFM, отличный от указанного выше, и при дефекте более одного предохранителя зеленый светодиод EFM 10 или индикатор EFM 20 / 25 не горят. В данном случае не обеспечивается автономное питание устройства электронного контроля предохранителей EFM. Замените дефектные предохранители.
中文	小心	如果电子熔断器监视设备 EFM 不是按照上述方式进行连接，则当馈电线路带电且多个熔断器故障时，EFM 10 上的绿色 LED 或 EFM 20 / 25 上的指示灯不会点亮。在这种情况下，无法再保证该电子熔断器监视设备 EFM 的内部供电。 请更换有故障的熔断器。

DE	Weitere Informationen finden Sie im Systemhandbuch "Sicherungslasttrennschalter 3NP1" (3ZX1012-0NP10-1AB1).
EN	Further information can be found in the system manual "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
FR	Vous trouverez des informations supplémentaires dans le manuel système "Fusible-interrupteur-sectionneur 3NP1" (3ZX1012-0NP10-1AD1).
ES	Podrá obtener información adicional en el manual de sistema "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
IT	Per ulteriori informazioni, consultare il manuale di sistema "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
PT	Maiores informações você encontra no Manual de Sistema "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
TR	Ayrıntılı bilgiyi "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1) sistem kılavuzundan edinebilirsiniz.
РУ	Дополнительную информацию Вы найдете в Системном руководстве "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).
中文	更多信息请参见系统手册 "Fuse switch disconnector 3NP1" (3ZX1012-0NP10-1AC1).

Technische Änderungen vorbehalten. Zum späteren Gebrauch aufbewahren.
Subject to change without prior notice. Store for use at a later date.
© **Siemens AG 2008**

12 V Optical Smoke Detector

Art. no. RM1000



- Suitable for connecting to alarm and fire detection systems
- Detects visible smoke particles
- Self-adjusting
- Potential-free alarm relay
- Tested according to EN54-7

The 12 V optical smoke detector reacts to visible smoke particles. If too much smoke enters its measuring chamber, an alarm is triggered. In the measuring chamber, an integrated infrared light source generates a light pulse every 8 seconds. Smoke particles from a fire change the light signal received by the light diode. A relay trips and the alarm center reports a fire alarm. The 12 V optical smoke detector is mounted on the ceiling in the center of the room. The minimum distance to the side wall should be 30cm. We recommend a separate smoke detector for each entrance area, staircase, living-room, and bedroom. By changing a jumper, you can configure the optical smoke detector as NO or as NC detector. It is therefore suitable for every wired alarm system. The smoke detector is supplied externally with 12V operating voltage and is EN54 certified.

Technical Data:

Dimensions	(HxD) 46x100 mm
Connections	Screw terminal NO or NC, 1A at 30V DC
Width	100 mm
Type of detection	Optical
Housing material	ABS
Height	46 mm
Power consumption	0,368
Max. operating temperature	50 °C
Max. humidity	95 %

Installation location	Ceiling
Net weight	0.13 kg
Sensor type	Photodiode
DC voltage supply	10,5-13,8 V
Status display	Yes
Power consumption	35 mA
Certifications	EN54-7

Technical alterations reserved. Misprints and errors excepted. Copyright. © ABUS 12/2014

Air Conditioning

Product Information

PCA-M R32 Standard Inverter
Ceiling Suspended System
Standard Inverter Heat Pump (Single Phase)

Making a World of Difference

Mr.SLIM



The **PCA-M Standard Inverter** range is a ceiling suspended system that blends a host of outstanding features with a sophisticated streamlined design. Offering advanced control options and quiet operation, this range provides extreme flexibility and ease of installation whilst being cost effective..

Key Features

- Flush to wall installation for concealment of service connections
- High / Low ceiling height modes
- Improved airflow control, including automatic air speed adjustment for greater comfort
- Replace Technology available
- New single fan chassis on 12.5 and 14kW models

MITSUBISHI ELECTRIC

Cooling | Heating | Ventilation | Controls

R32

Air Conditioning

Product Information

PCA-M R32 Standard Inverter Ceiling Suspended System

Standard Inverter Heat Pump (Single Phase)

Making a World of Difference







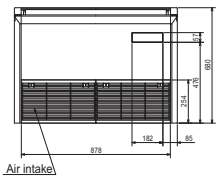

PCA-M - INDOOR UNITS		PCA-M50KA	PCA-M60KA	PCA-M71KA	PCA-M100KA	PCA-M125KA	PCA-M140KA
CAPACITY (kW)	Heating (nominal)	6.0 (1.5-7.2)	7.0 (1.6-8.0)	8.0 (2.0-10.2)	11.2 (2.8-12.5)	13.5 (4.1-15.0)	15.0 (4.2-15.8)
	Cooling (nominal)	5.0 (1.5-5.6)	6.1 (1.6-6.3)	7.1 (2.2-8.1)	9.5 (4.0-10.6)	12.1 (5.7-13.0)	13.4 (5.7-14.1)
	Heating (UK)	5.10 (1.28-6.12)	5.95 (1.36-6.80)	6.80 (1.70-8.67)	9.63 (2.41-10.75)	11.61 (3.53-12.90)	12.90 (3.61-13.59)
	Cooling (UK)	4.60 (1.38-5.15)	5.61 (1.47-5.80)	6.53 (1.56-7.45)	8.65 (3.64-9.65)	11.01 (5.19-11.83)	12.19 (5.19-12.83)
SHF (nominal)		0.79	0.81	0.76	0.77	0.72	0.72
COP / EER (nominal)		3.71 / 3.30	4.00 / 3.70	3.61 / 3.60	3.41 / 3.23	3.41 / 3.01	3.50 / 2.50
SCOP (ηsh) / SEER (ηsc) (BS EN14825)		4.10 / 6.00	4.10 / 6.40	4.10 / 6.50	4.10 / 6.00	4.1 (162.7%) / 5.2 (213%)	4.0 (158.7%) / 5.1 (208%)
ErP ENERGY EFFICIENCY CLASS	Heating/Cooling	A+ / A+	A+ / A++	A+ / A++	A+ / A+	A+ / A	A+ / A
AIRFLOW (l/s)	Lo-Mi1-Mi2-Hi	167-183-217-250	250-267-283-317	267-283-300-333	367-400-433-467	383-417-450-483	400-433-483-533
PIPE SIZE mm (in)	Gas/Liquid	12.7 (1/2") / 6.35 (1/4")	15.88 (5/8") / 6.35 (1/4")	15.88 (5/8") / 9.52 (3/8")	15.88 (5/8") / 9.52 (3/8")	15.88 (5/8") / 9.52 (3/8")	15.88 (5/8") / 9.52 (3/8")
SOUND PRESSURE LEVEL (dBA)	Lo-Mi1-Mi2-Hi	32-34-37-40	33-35-37-40	35-37-39-41	37-39-41-43	39-41-43-45	41-43-45-48
SOUND POWER LEVEL (dBA)		60	60	62	63	65	68
DIMENSIONS (mm)	Width x Depth x Height	960 x 680 x 230	1280 x 680 x 230	1280 x 680 x 230	1600 x 680 x 230	1600 x 680 x 230	1600 x 680 x 230
WEIGHT (kg)		26	32	32	37	38	40
ELECTRICAL SUPPLY		Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit
FUSE RATING (BS88) - HRC (A)		6	6	6	6	6	6
INTERCONNECTING CABLE No. Cores		4	4	4	4	4	4
WIRED REMOTE CONTROLLER REFERENCE		PAR-40MAA	PAR-40MAA	PAR-40MAA	PAR-40MAA	PAR-40MAA	PAR-40MAA
WIRELESS REMOTE CONTROLLER REFERENCE		PAR-SL94B	PAR-SL94B	PAR-SL94B	PAR-SL94B	PAR-SL94B	PAR-SL94B

SUZ-M / PUZ-M - OUTDOOR UNITS		SUZ-M50VA	SUZ-M60VA	SUZ-M71VA	PUZ-M100VKA	PUZ-M125VKA	PUZ-M140VKA
SOUND PRESSURE LEVEL (dBA)	Heating/Cooling	48 / 49	49 / 51	49 / 51	51 / 54	54 / 56	55 / 57
SOUND POWER LEVEL (dBA	Cooling	64	65	66	70	72	73
WEIGHT (kg)		41	54	55	76	84	84
DIMENSIONS (mm)	Width x Depth x Height	800 x 285 x 714	840 x 330 x 880	840 x 330 x 880	1050 x 330 x 981	1050 x 330 x 981	1050 x 330 x 981
ELECTRICAL SUPPLY		220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz
PHASE		Single	Single	Single	Single	Single	Single
SYSTEM POWER INPUT (kW)	Heating/Cooling (nominal)	1.61 / 1.51	1.75 / 1.64	2.21 / 1.97	3.28 / 2.94	3.95 / 4.01	4.28 / 5.36
	Heating/Cooling (UK)	1.37 / 1.30	1.49 / 1.41	1.88 / 1.69	2.95 / 2.44	3.56 / 3.33	3.85 / 4.45
STARTING CURRENT (A)		8.0	9.3	9.5	14.2	17.3	23.2
SYSTEM RUNNING CURRENT (A)	Heating/Cooling [MAX]	8.0 / 7.1 [13.5]	9.3 / 8.4 [14.8]	9.5 / 9.1 [14.8]	14.2 / 12.6 [20.0]	17.0 / 17.3 [26.5]	18.4 / 23.2 [30.0]
FUSE RATING (BS88) - HRC (A)		20	20	20	32	32	40
MAINS CABLE No. Cores		3	3	3	3	3	3
MAX PIPE LENGTH (m)		30	30	30	55	65	65
MAX HEIGHT DIFFERENCE (m)		30	30	30	30	30	30
CHARGE REFRIGERANT (KG) / CO_2 EQUIVALENT (T)	R32 (GWP 675)	1.20 / 0.81 (7m)	1.25 / 0.84 (7m)	1.45 / 0.98 (7m)	3.10 / 2.09 (30m)	3.60 / 2.43 (30m)	3.60 / 2.43 (30m)
MAX ADDITIONAL REFRIGERANT (KG) / CO_2EQUIVALENT (T)	R32 (GWP 675)	1.66 / 1.12	1.71 / 1.15	2.37 / 1.80	4.10 / 2.77	5.00 / 3.38	5.00 / 3.38

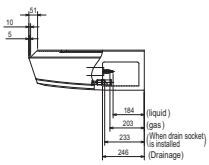
Note: Duty/standby not available on SUZ-M50/60/71VA.

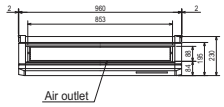
Product Dimensions PCA-M50KA

Upper View



Side View

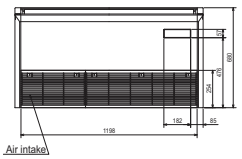




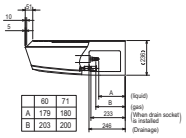
Front View

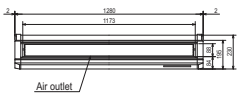
Product Dimensions PCA-M60/71KA

Upper View



Side View

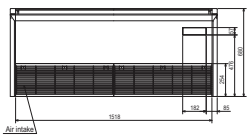




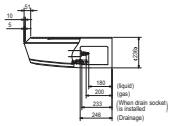
Front View

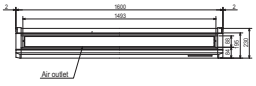
Product Dimensions PCA-M100/125/140KA

Upper View



Side View





Front View

MITSUBISHI ELECTRIC
Changes for the Better

Telephone: 01707 282880
email: air.conditioning@meuk.mee.com
web: airconditioning.mitsubishielectric.co.uk

UNITED KINGDOM Mitsubishi Electric Europe Living Environment Systems Division
Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England General Enquiries Telephone: 01707 282880 Fax: 01707 278881
IRELAND Mitsubishi Electric Europe Westgate Business Park, Ballymount, Dublin 24, Ireland
Telephone: Dublin (01) 419 8800 Fax: Dublin (01) 419 8890 International code: (003531)

Green Gateway

www.greengateway.mitsubishielectric.co.uk

Mitsubishi Electric UK's commitment to the environment

Follow us @meuk_les
Follow us @green_gateway

Mitsubishi Electric
Living Environmental Systems UK

mitsubishielectric2

BLOG thehub.mitsubishielectric.co.uk

Country of origin: United Kingdom – Japan – Thailand – Malaysia. ©Mitsubishi Electric Europe 2019. Mitsubishi and Mitsubishi Electric are trademarks of Mitsubishi Electric Europe B.V. The company reserves the right to make any variation in technical specification to the equipment described, or to withdraw or replace products without prior notification or public announcement. Mitsubishi Electric is constantly developing and improving its products. All descriptions, illustrations, drawings and specifications in this publication present only general particulars and shall not form part of any contract. All goods are supplied subject to the Company's General Conditions of Sale, a copy of which is available on request. Third-party product and brand names may be trademarks or registered trademarks of their respective owners.

Note: The fuse rating is for guidance only. Please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774) or R134a (GWP:1430). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP: 550), R407C (GWP:1650) or R134a (GWP:1300).

Effective as of January 2019

PUMA FIRE

OPERATING AND MAINTENANCE INSTRUCTIONS

FIRE EXTINGUISHANT EXTRACT UNITS - SERIES 200-550 DIRECT DRIVEN (DD)

DESCRIPTION

The Puma fire extinguishant extract units are manufactured to a very high standard of construction. A double inlet, single phase, centrifugal fan is selected to meet the required performance, then is fixed directly to the internal sections of the main casing.

The casing, internal sections and lid are formed using 18, 16 or 14 SWG mild steel plate. The units are then finished in an attractive satin black, polyester powdercoat paint to RAL 9005. Weatherproof or external units are finished in blue to RAL 5017.

Both intake and discharge ends of the unit are internally flanged, and fitted with M6 nutserts. These are for connection to suitable ducts and external weather louvre. The room air intake end is fitted with a 1/2" Square Weld Mesh as a Finger Guard.

Puma extract units fitted with Fire / Smoke Dampers (FSD) are situated on the air discharge side. The damper should be located as close as possible to the wall cut out. This will then ensure the fire integrity of the wall is maintained. The fire rating of the FSD is 2 hours tested to BS 476 Part 8 & 23.

OPERATION

The extract unit requires a 230 V ac single phase supply or where specified a 380/415 V ac three phase supply may be required on larger fans (check serial plate on side of unit). This supply will normally be interlocked with the fire detection system in relation to power shutdown in the event of fire detection.

When a damper and motor is fitted to the unit, the damper motor is wired in lieu with the fan controls and proceeds to open when power is supplied to the fan unit. The motor takes approximately 75 seconds to fully open and will then 'Spring Return' on power failure at approximately 15 seconds.

Unit C Alexander Bell Centre, Hopkinson Way, West Portway Business Park, Andover, Hampshire, England, SP10 3UR
Telephone: 0044 1264 333305 Co Reg No 3230570
Email: sales@pumafire.co.uk Website: www.pumaproducts.co.uk
Director Mr Phillip Newton M Inst.R, M.A.S.H.R.A.E.

INSTALLATION

The unit must be situated in a position with sufficient access to the top of the unit. A distance of at least the given height of the unit must be allowed, as access to the serviceable components are via the flat plate lid.

The clearance height is not necessary when the units are located underneath raised modular floors, as it is assumed that the appropriate floor tile/s are accessible and removable.

The mains supply to all units must be disconnected at source before removing the lid.

The unit may be suspended or supported by correctly sized anti-vibration isolators if required (supplied by others).

SERVICE AND MAINTENANCE

Periodically the extract unit must be electrically tested to ensure that the supply to the unit is continuous and that mechanically the FSD and motor open and close effectively.

It is recommended that this test be carried out twice yearly or to fit in with existing service and maintenance contracts.

The air flow failure switch should be checked for free movement and electrical conductance.

Refer to Puma technical sales leaflet for further information regarding dimensions, weights and unit performance and fan curves.

FAULT FINDING

FAN FAILS TO RUN

The extract unit is normally wired directly to via fire panel, if the fan fails to run the supply and control circuit should be checked first then the fan/unit.

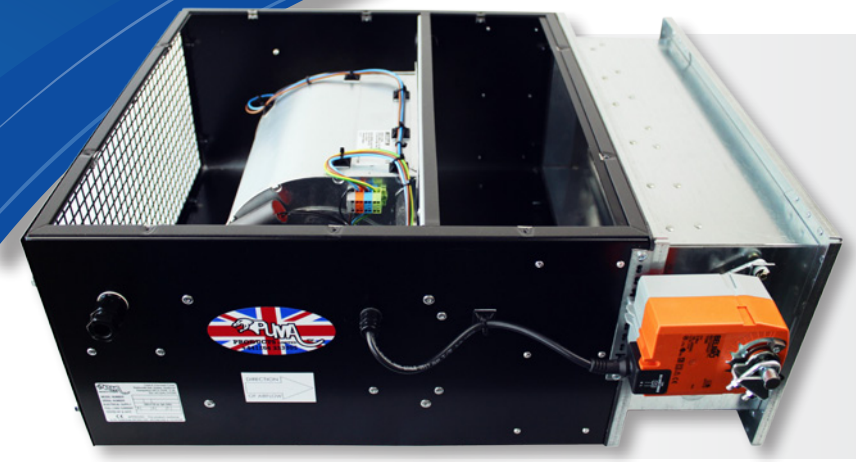
1. Check there is a voltage at the fan.
2. Check all connections.
3. If the above are ok a faulty/damaged fan is likely.

Most faults/problems can be resolved by following the above, if the unit still fails please contact Puma Fire Products Ltd for technical assistance.

PUMA
PRODUCTS

Post Discharge Fire Extinguishant Extract Units Direct Driven Range

Bespoke Fire Extinguishant Gas Extract Units for Data or Server Rooms



Internal Duct Mounted Unit

- Monocoque construction - single skin
- Ral 9005 satin black powder coat finish
- Top or bottom access lid
- Vertical / ceiling mounting
- Internal flange duct connections
- Fully sealed 2hr fire/smoke damper (FSD)

Options and Accessories available on request



Weatherproof Roof Mounted Unit

- Channel & Tray construction
- RAL 5017 mid blue powder coat finish
- Top access pitched lid
- Weather cowl on discharge
- Ducted both ends version available
- External flange duct connection
- Internal fire/smoke damper available (FSD)

Fire Extinguishant Extract Units (denoted **FE**) models are selected for Electronic Data Processing areas (EDP) to extract harmful fire extinguishing gases. Refer to BS ISO 14520 & BS EN 15004-1:2008 Section 5.1

Fitted as standard with 2 Hr rated (BS EN 1634-1:2008) fully sealed damper & motor, (power open spring return), and a single or three phase, double inlet direct driven centrifugal fan.

Pre-wired to terminal block for mains supply and Volt Free Contacts (VFC) for airflow indication normally interlocking with fire detection panel or BMS.

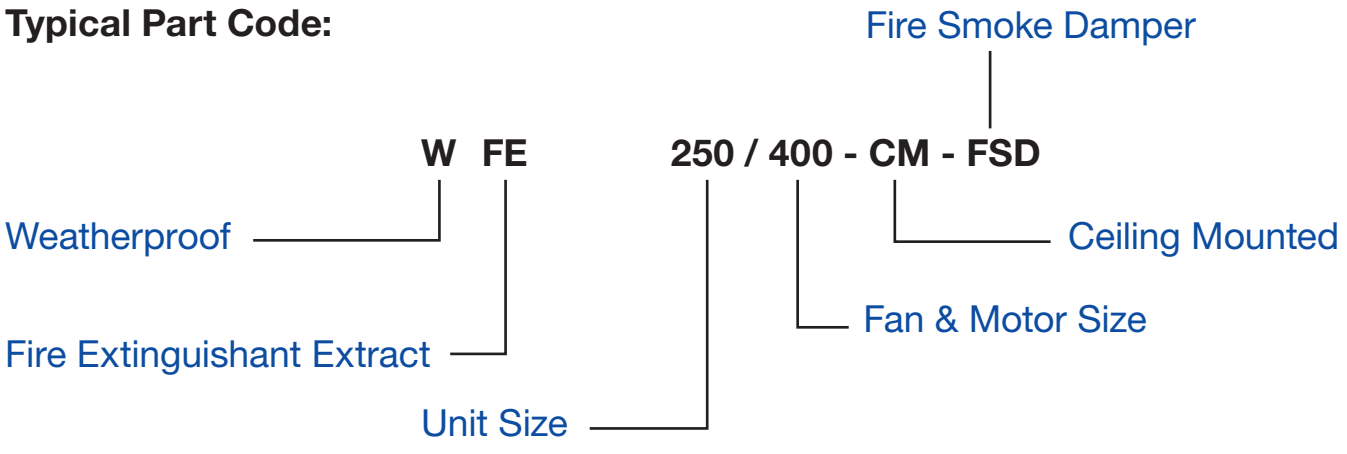
Ventilate your environment with

puma
FIRE PRODUCTS LTD

Performance Data

Model Number	Duty in m3/sec @ given External Static Pressure (Pa)											
	0	50	75	100	125	150	200	250	300	350	400	450
FE 200/200	0.1	0.09	0.08	0.08	0.07	0.07	0.06	0.05	0.01	-	-	-
FE 200/250	0.12	0.11	0.1	0.095	0.09	0.085	0.08	0.07	0.06	-	-	-
FE 200/300	0.15	0.14	0.13	0.125	0.12	0.11	0.1	0.09	0.085	0.06	-	-
FE 250/400	0.2	0.2	0.18	0.17	0.16	0.15	0.13	0.1	0.07	-	-	-
FE 250/600	0.27	0.26	0.25	0.24	0.23	0.22	0.21	0.19	0.17	-	-	-
FE 300/1400	0.65	0.64	0.63	0.61	0.6	0.59	0.58	0.55	0.53	0.51	0.49	0.46
FE 350/850	0.42	0.4	0.39	0.37	0.33	0.3	0.23	0.1	-	-	-	-
FE 350/1000	0.53	0.48	0.43	0.4	0.38	0.31	0.24	0.1	-	-	-	-
FE 350/1200	0.59	0.57	0.56	0.55	0.55	0.54	0.49	0.41	0.25	0.01	-	-
FE 400/1800	0.95	0.9	0.89	0.89	0.89	0.88	0.83	0.81	0.76	0.68	-	-
FE 450/2500	1.27	1.2	1.1	1.07	1.03	0.97	0.89	0.84	0.72	0.55	-	-
FE 550/3600	1.8	1.72	1.6	1.55	1.5	1.43	1.35	1.15	0.89	-	-	-
FE 550/3700	1.79	1.75	1.72	1.68	1.66	1.58	1.51	1.42	1.36	1.3	1.16	0.86
FE 550/4500	2.1	2.05	1.92	1.85	1.8	1.7	1.6	1.25	1.0	-	-	-

Typical Part Code:



PUMA FIRE PRODUCTS LTD

Over 35 years supplying the
Fire Suppression and Ventilation Industry

Electrical and Sound Data

Model Number	Motor Running Current (Amps)	Motor Starting Current (Amps)	Motor Power (Watts)	Induct Sound Power Levels dBW @ Octave Band Mid Frequency Hz								Breakout Noise Level dBA*	
				63	125	250	500	1K	2K	4K	8K	SSK	DSK
FE 200/200	0.3	0.75	67	32	34	46	55	56	54	51	50	40	25
FE 200/250	0.44	1.1	99	25	29	38	43	39	40	34	26	36	21
FE 200/300	0.8	2.0	175	63	57	55	54	54	47	41	32	44	29
FE 250/400	0.8	2.0	190	40	44	46	52	52	50	45	41	41	26
FE 250/600	1.2	3.0	273	68	62	61	61	59	54	47	37	48	33
FE 300/1400	7.6	19.0	1000	93	91	84	82	79	75	67	60	65	50
FE 350/850	1.9	4.75	184	67	69	70	69	66	62	59	54	44	29
FE 350/1000	2.3	5.75	300	71	72	73	72	70	66	62	57	48	33
FE 350/1200	2.6	6.5	420	75	72	67	63	61	60	58	54	50	35
FE 400/1800	4.2	12.5	550	76	74	66	64	60	57	49	41	53	38
FE 450/2500	6.8	17.5	550	80	78	70	68	64	61	53	45	61	46
FE 550/3600	4.3**	21.5**	1100	87	84	82	81	79	75	67	55	64	49
FE 550/3700	4.7**	23.5**	1500	87	88	89	88	86	82	78	73	71	56
FE 550/4500	4.5**	22.5**	1100	79	76	74	72	67	64	58	48	62	47

* The dBA quoted is the mean 'A' weighted sound pressure level measured at a distance of 3m. It is included for comparative purposes only, and the actual sound level experienced will depend on the acoustic characteristics of the area being served. Ductwork and Silencers also have a major influence on breakout noise and actual noise levels in the system.

** 380/415 V ac Three Phase Motor

Options and Accessories

SSK **Single Skin**

FSD **Fire / Smoke Damper & Motor**

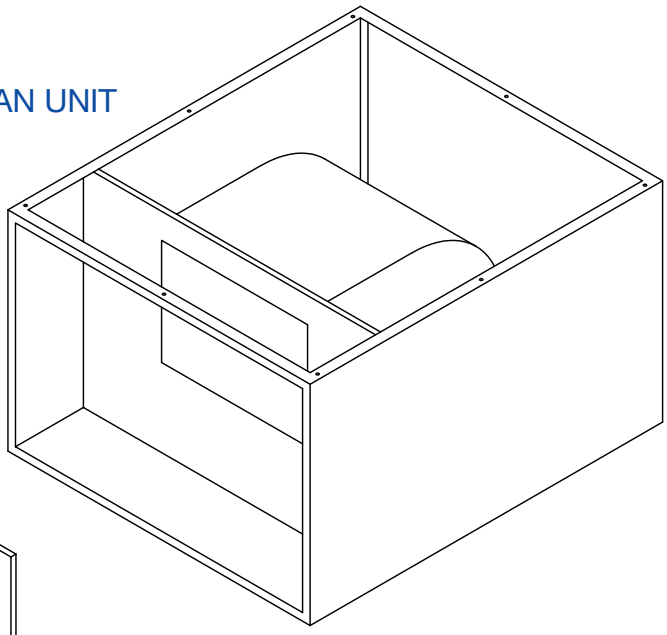
TD **Telescopic Duct**

WL **Weather Louvre**

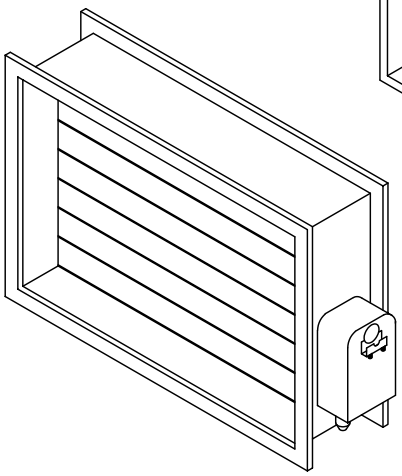
VM **Vertically Mounted**

CM **Ceiling Mounted**

FAN UNIT

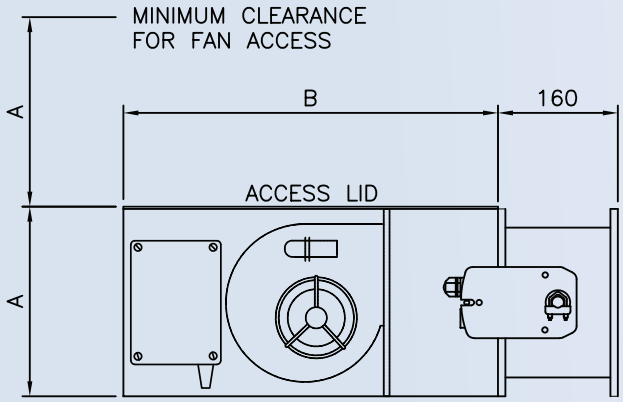


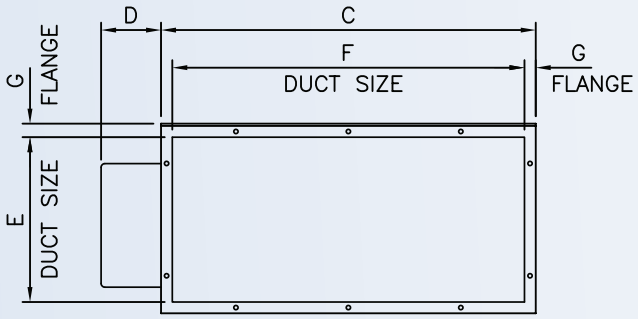
FSD



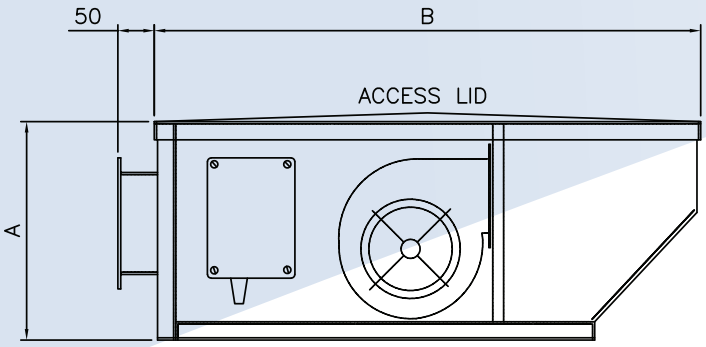
Dimensional Data

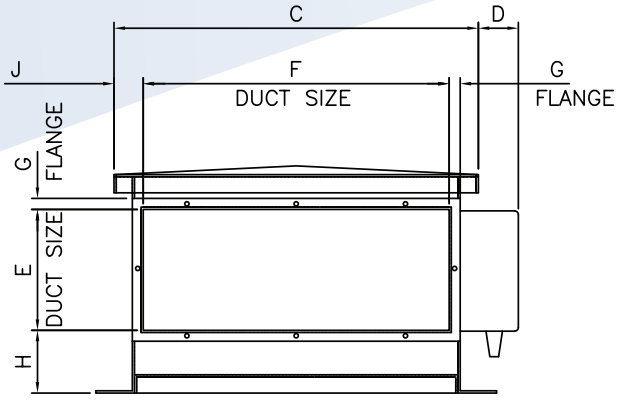
Internal Duct Mounted Unit





Weatherproof Roof Mounted Unit





Model Number	Dimensions in Millimetres									
	A	B	C	D	E	F	G	H	J	WEIGHT
FE 200	200	450	450	100	166	420	15	-	-	20 Kg
FE 250	250	500	500	100	220	470	15	-	-	25 Kg
FE 300	300	600	500	100	260	460	20	-	-	30 Kg
FE 350	350	700	600	175	310	560	20	-	-	40 Kg
FE 400	415	700	600	175	375	560	20	-	-	50 Kg
FE 450	450	700	700	175	410	660	20	-	-	60 Kg
FE 550	550	900	800	175	500	750	25	-	-	90 Kg
WFE 200	225	650	500	75	126	314	13	50	93	25 Kg
WFE 250	300	750	500	75	166	420	15	86	40	35 Kg
WFE 300	350	800	600	75	166	420	15	125	90	40 Kg
WFE 350	400	850	700	75	220	470	15	135	115	45 Kg
WFE 400	450	950	800	150	260	460	20	155	170	60 Kg
WFE 450	500	1000	800	150	310	560	20	120	120	70 Kg
WFE 550	600	1150	1000	150	375	560	20	195	220	100 Kg

Unit C, Alexander Bell Centre, Hopkinson Way, West Portway, Business Park, Andover, Hampshire, SP10 3UR, England
Telephone: +44 (0) 1264 333305 Facsimile: +44 (0) 1264 333310 Email: sales@pumaproducts.co.uk

PUMA AIR

OPERATING AND MAINTENANCE INSTRUCTIONS

TWIN FAN EXTRACT DIRECT DRIVEN UNITS – RUN & STANDBY

DESCRIPTION

All units are manufactured to a very high standard of construction.

The casing, internal fan plates, lid and spigots are formed from 18 swg or 16 swg mild steel plate. The units are generally finished in an attractive RAL 5017 blue polyester powder coat for weather proof units. Internal units have galvanised panels or powder coated to RAL 9005 satin black.

The supply and extract fans are of the double inlet, direct drive centrifugal type fitted with single phase motors to class E insulation. They are sized to suit the duty required with allowances for internal pressure drop within the unit. The extract air section is insulated with 25mm thick pyrosorb class O insulation, this has excellent noise absorption qualities and anti-condensation properties.

OPERATION

The twin fan units generally require a 240 Vac single phase supply. Where specified a 380/415 V ac 3 phase and neutral supply may be required (check serial plate on side of unit or sales literature).

Each unit is provided with cable entry glands and suitable terminal block. This is wired through a mains isolator switch.

Internal speed control devices for each fan are available to commission fan airflow duties when required.

All twin fan extract units require a Puma auto changeover panel to operate correctly.

When energised, the selected fan will run as the duty fan, if the fan fails then an airflow switch automatically switches on the standby fan and illuminates a fan fail (red) light on the auto changeover panel (see data sheet on auto changeover panels for differences in the basic and deluxe panel models). The duty fan can be manually selected by the fan selector switch on the auto changeover panel.

Unit C Alexander Bell Centre, Hopkinson Way, West Portway Business Park, Andover, Hampshire, England, SP10 3UR
Telephone: 0044 1264 333310 Co Reg No 12192146
Email: sales@pumaair.co.uk Website: www.pumaproducts.co.uk
Director Mr Phillip Newton M Inst.R, M.A.S.H.R.A.E.

INSTALLATION

The unit must be situated in a position with sufficient access to the removable panel/s. A distance given on the certified drawing of the unit must be allowed for access to the serviceable components.

The units are suitable for floor mounting on 'tico' pad or anti-vibration isolators if required (by others). Flexible connections may be required between spigot connections and solid ductwork if noise levels are appropriate (by others).

Twin fan extract units are available as weather proof versions (denoted WTFE). Anti-vibration isolators are recommended when installed on flat roofs.

SERVICE AND MAINTENANCE

The mains supply to all units must be disconnected at source before removing the lid.

The airflow failure switches should be checked for free movement and electrical conductance.

These fans are fitted with direct drive motors with sealed for life bearings that require no maintenance.

Refer to Puma colour technical sales leaflet for further information regarding dimensions, weights and unit performance and fan curves.

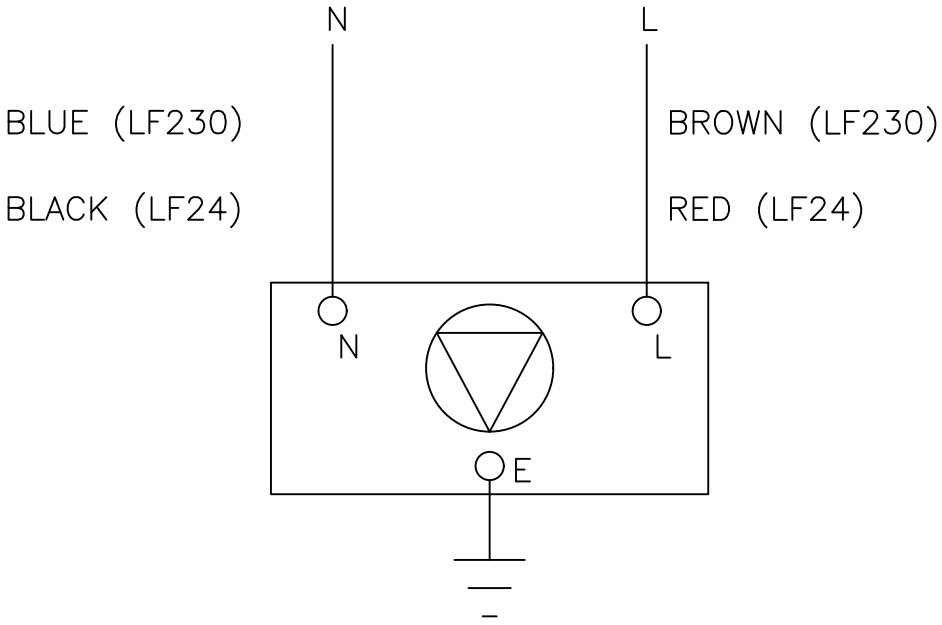
Unit C Alexander Bell Centre, Hopkinson Way, West Portway Business Park, Andover, Hampshire, England, SP10 3UR
Telephone: 0044 1264 333310 Co Reg No 12192146
Email: sales@pumaair.co.uk Website: www.pumaproducts.co.uk
Director Mr Phillip Newton M Inst.R, M.A.S.H.R.A.E.

FAULT FINDING

FAN/MOTOR FAILS TO RUN

1. Check the unit is connected correctly, as per the supplied wiring diagram.
2. Check the mains supply.
3. Check the control circuit fuse.
4. Is there a voltage at the fan? Yes would indicate motor failure or a neutral/phase problem. If no follow steps 4-7 below.
5. Check the mains isolator fitted to the side of the unit, if ok is the SR link (where fitted L1 L2 or SR1 SR2) in place.
6. Check the fan fuse, located below the isolator.(single phase fans only)
7. Three phase fans and belt driven units check the MCB is on, and the fan overload is on by pushing the manual reset button(red) on the fan contactor.(usually situated to the side of the fan on the fan plate left or right depending on handing of the unit)
8. If the MCB keeps tripping check the phases are ok, on belt drive units check the belt tension is correct and the fan motor overload is set to the rating of the motor. See motor serial plate for size/rating.

Most faults/problems can be resolved by following the above if the unit still fails to work correctly please contact Puma Air Movement Ltd for technical assistance.



TECHNICAL DATA	LF230	LF24
NOMINAL VOLTAGE	AC 230 V 50/60 Hz	AC/DC 24 V
VOLTAGE RANGE	AC 198...265 V	19.2...28.8 V
FOR WIRING SIZING	7 VA (IMAX 150mA @ 10 MS)	7 VA
POWER CONSUPTION		
– MOTORING	5W	5W
– HOLDING	3W	2.5W
CONNECTING CABLE	1m LONG, 2 x 0.75mm^2	1m LONG
TORQUE		
– MOTOR	MIN. 4 Nm (AT RATED VOLTAGE)	MIN. 4 Nm
– SPRING RETURN	MIN. 4 Nm	MIN. 4 Nm
RUNNING TIME		
– MOTOR	40...75 SEC (0...4 Nm)	40...75 SEC
– SPRING RETURN	~20 SEC	~20 SEC

REV		DATE	DRN
A	TECHNICAL DATA ADDED	28.04.05	P.N.

This Document is the Property of Puma Fire Products Limited and contains information of a Proprietary nature and is submitted to you in confidence and shall not be disclosed or transmitted to others without written authorisation from Puma Fire Products Limited

TITLE

WIRING DIAGRAM

TF230 & TF24 DAMPER MOTOR

POWER OPEN/SPRING RETURN

DATE 8-5-01

DRAWN A.L.

CHECKED

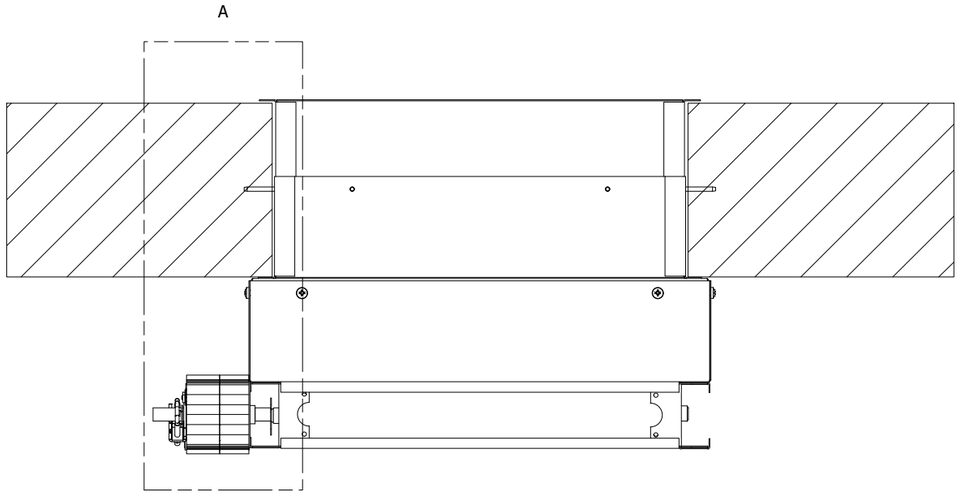
APPROVED

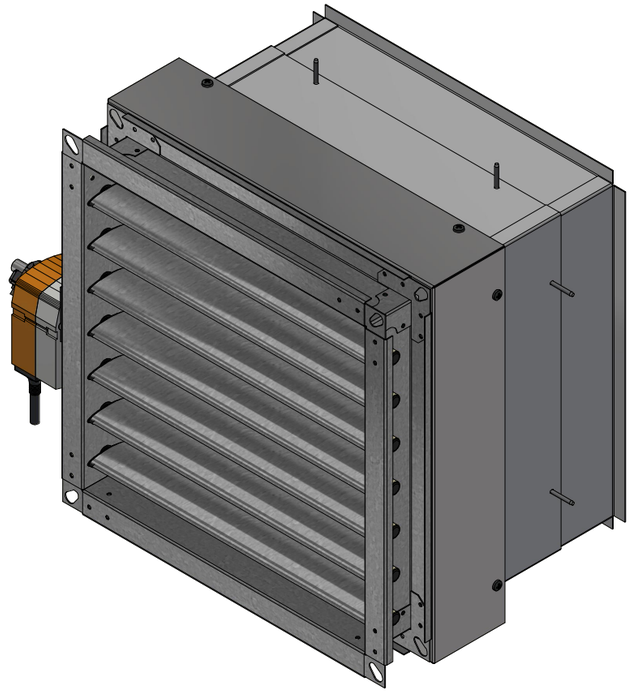
PUMA FIRE

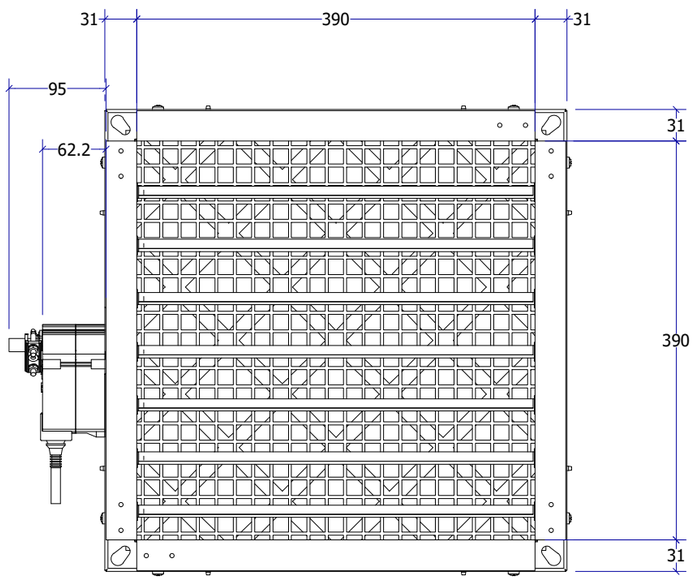
ANDOVER–HAMPSHIRE–ENGLAND

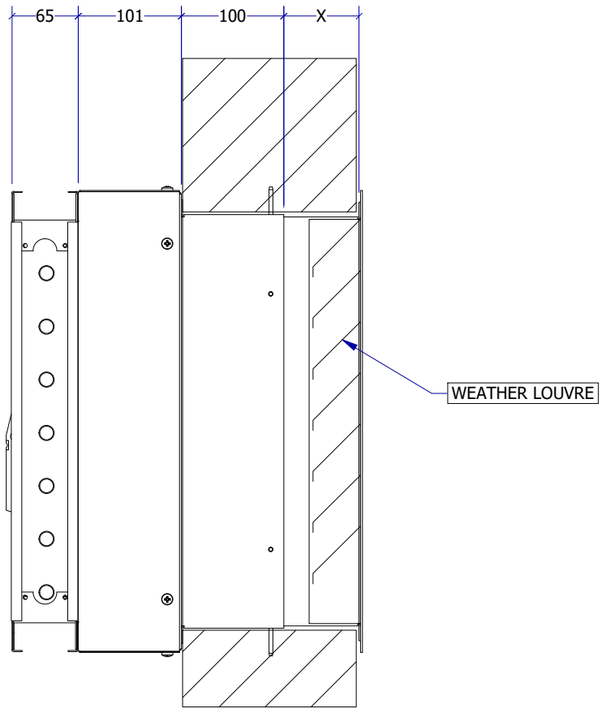
A4	DRAWING NUMBER E4/W/PNL 051–01	REV A

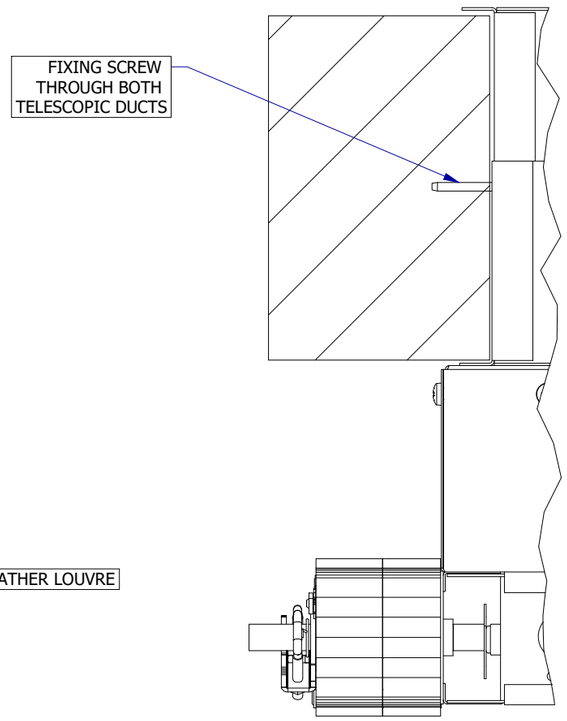
HOLE CUTOUT SIZE: 412mm W X 410mm H











DETAIL A
SCALE 1 / 3

IF IN DOUBT ASK

Rev	Date	DESCRIPTION

TITLE: Certified Drawing

POSITIVE SHUT OFF DAMPER
400x400 - MOTOR DRIVEN.
c/w COASTAL FILTER,
TELESCOPIC DUCT &
WEATHER LOUVRE

3rd ANGLE PROJECTION

Scale: 1 / 6 @ A3

Drawn By:	*Date:*
BHarris	25/01/2024
Material:	*Grade:*
Thickness:	*Quantity:* 1

Finish:

Flat Pattern Size:
N/A x N/A

Sheet Metal Rule:

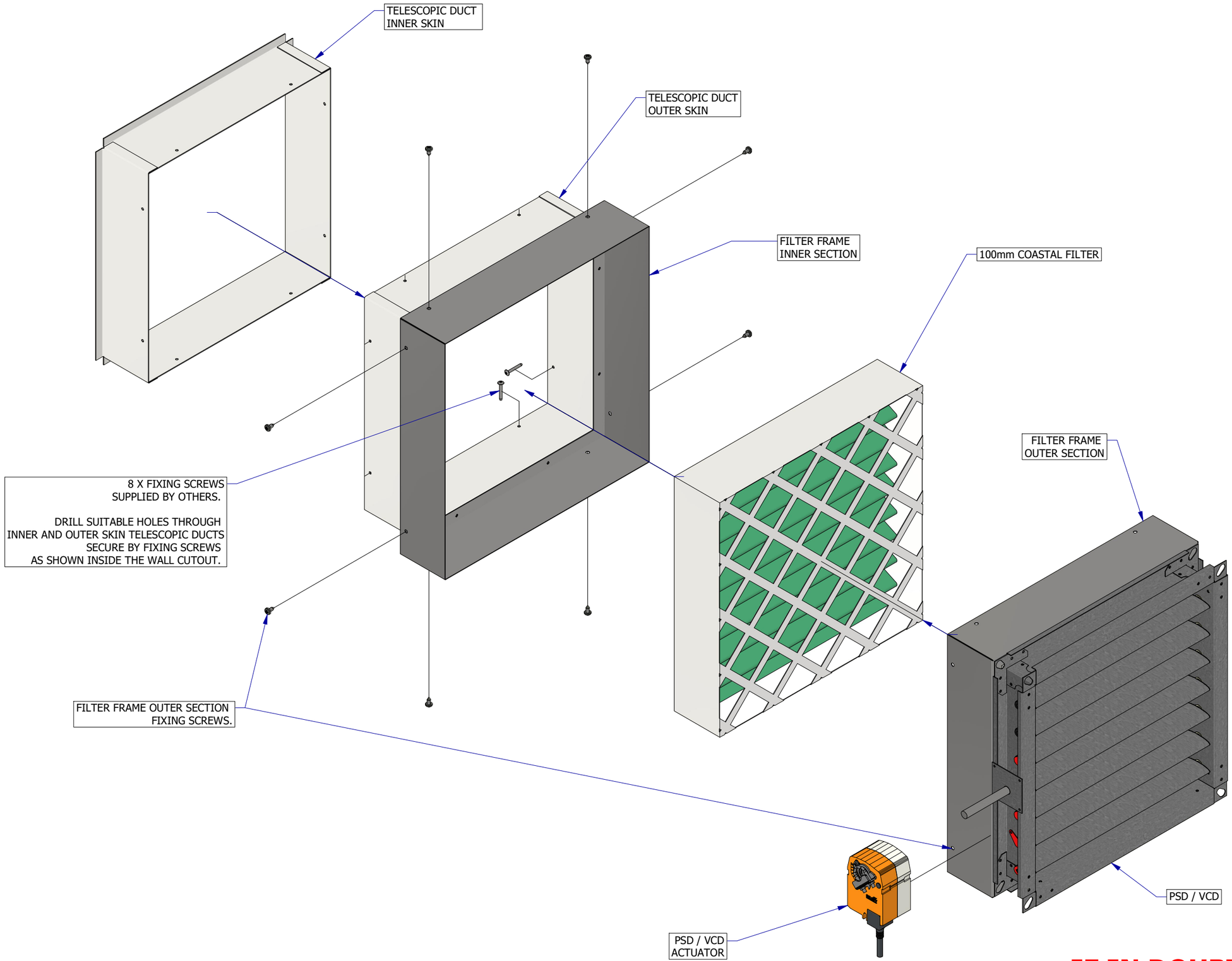
Drawing Number:
2023-22817-02

PUMA FIRE

ANDOVER - HAMPSHIRE - ENGLAND

THIS IS THE PROPERTY OF PUMA FIRE PRODUCT LTD AND CONTAINS INFORMATION OF A PROPRIETARY NATURE AND IS SUBMITTED TO YOU IN CONFIDENCE AND SHALL NOT BE DISCLOSED OR TRANSMITTED TO OTHERS WITHOUT WRITTEN AUTHORISATION FROM PUMA FIRE PRODUCTS LIMITED

TEL (01264) 333305 sales@pumafire.co.uk
www.pumafire.co.uk



IF IN DOUBT ASK

TITLE: Certified Drawing

POSITIVE SHUT OFF DAMPER
400x400 - MOTOR DRIVEN.
c/w COASTAL FILTER,
TELESCOPIC DUCT &
WEATHER LOUVRE

3rd ANGLE PROJECTION

Scale: 1 / 6 @ A3

Drawn By:	*Date:*
BHarris	25/01/2024
Material:	*Grade:*
Thickness:	*Quantity:*

Finish:

Flat Pattern Size:
N/A x N/A

Sheet Metal Rule:

Drawing Number:
2023-22817-02

PUMA FIRE

ANDOVER - HAMPSHIRE - ENGLAND

THIS IS THE PROPERTY OF PUMA FIRE PRODUCT LTD AND CONTAINS INFORMATION OF A PROPRIETARY NATURE AND IS SUBMITTED TO YOU IN CONFIDENCE AND SHALL NOT BE DISCLOSED OR TRANSMITTED TO OTHERS WITHOUT WRITTEN AUTHORISATION FROM PUMA FIRE PRODUCTS LIMITED

TEL (01264) 333305 sales@pumafire.co.uk
www.pumafire.co.uk

PUMA FIRE

OPERATING AND MAINTENANCE INSTRUCTIONS

AIR MAKE UP DAMPERS (A.M.D) ALL UNITS

GENERAL DESCRIPTION

Air Make up Dampers (AMD), are designed to provide replacement air to the protected space whilst extracting gaseous extinguishant via a Puma gas extract unit. Refer to drawing No. COMMS 001.

The damper should be located as close as possible to the wall aperture. This will maintain the fire integrity of the wall. The fire rating of the fire smoke damper is 2 hours, tested to BS EN 1634.1:2008.

The casing and blades are constructed from galvanised steel. 25mm external flanges are fitted as standard, 50mm flanges are available upon request. Optional circular / rectangular spigot connections are also available on request.

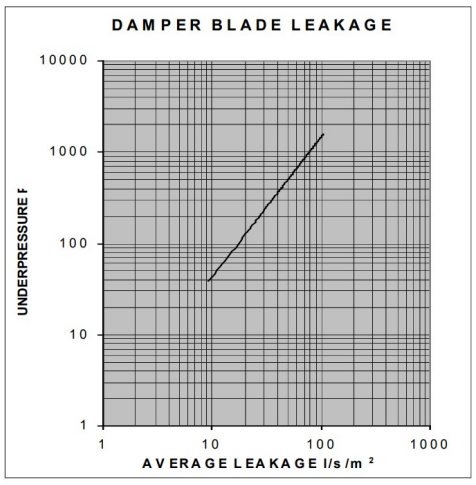
External Walls require a Telescopic Duct (TD) and Weather Louvre (WL).

Internal Walls require a Wall Sleeve (WS) and Egg Crate Grille (ECG).

The blades are fitted with high temperature silicon blade seals. They have a leakage performance of 53 ltr/s/m2 @ 250 Pa to 103 ltr/s/m2 @ 1000Pa.

All Dampers are available with a fusible link rated at 75˚C, electro thermal link or pneumatic actuators. HEVAC installation frames for masonry walls are available.

Compliant to BS EN 1366-2 with regards to leakage rates not exceeding 200m³/hr/m².



Unit C Alexander Bell Centre, Hopkinson Way, West Portway Business Park, Andover, Hampshire, England, SP10 3UR
Telephone: 0044 1264 333305 Co Reg No 3230570
Email: sales@pumafire.co.uk Website: www.pumaproducts.co.uk
Director Mr Phillip Newton M Inst.R, M.A.S.H.R.A.E.

DAMPER MOTOR

This motor type is 'powered open' and will 'spring return' on power failure. The mains supply must be interlocked with the Puma FE gas extract unit to open simultaneously.

The damper motor is a fully sealed unit and is provided with 1.5m mains supply cable. The motor is factory fitted to the damper casing to prevent any movement of the motor during operation.
Any tampering of the motor seal or cable will invalidate warranty.

In the event of a fire condition, the damper motor will commence opening and be fully open in 75 seconds. When power is removed, the damper will shut in 20 Seconds.

INSTALLATION

The fresh air make up damper is to be installed directly to the face of the wall using self-tapping screws or raw plugs and sufficient fixings, depending on the wall construction. Before fixing the damper to the wall, ensure the flange is lined with fire-rated sealant to allow for a tight seal between the wall and the damper.

SERVICE & MAINTENANCE

The Damper and motor require no service as such, but a periodic mechanical and electrical test of the working mechanisms should be carried out at least twice yearly, or to coincide with existing service and maintenance contracts.
See appropriate certified drawing of units for further information re: sizes etc.

Unit C Alexander Bell Centre, Hopkinson Way, West Portway Business Park, Andover, Hampshire, England, SP10 3UR
Telephone: 0044 1264 333305 Co Reg No 3230570
Email: sales@pumafire.co.uk Website: www.pumaproducts.co.uk
Director Mr Phillip Newton M Inst.R, M.A.S.H.R.A.E.

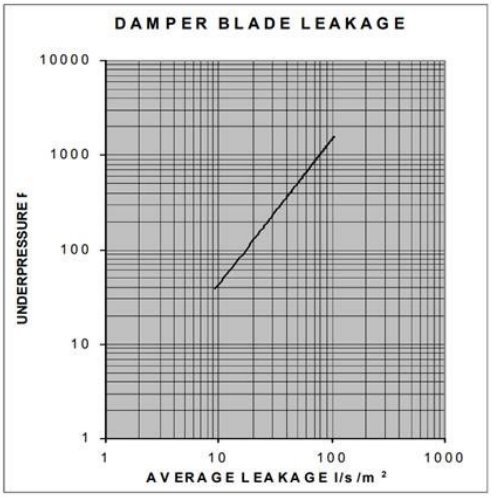
Puma™

Air Makeup Dampers and Fire/ Smoke & Volume Control Dampers



Fire Smoke Damper & Actuator

Fire Smoke Dampers are fitted to the intake section of an air handling unit or fitted to an opening in a fire rated wall to maintain the integrity whilst allowing movement of air in normal operation.



Tested to BS 476 Part 20 and BS EN 1634-1:2008 - 2 Hr Fire Rating.

Complies to BS EN 1366-2 for leakage rates. The standard states the damper must leak no more than 200m^3/hr/m^2 which as you can see from the graph our dampers do not exceed 200m^3/hr/m^2.

Minimum size of 100x100mm
Maximum size of 1200x1800mm (in one section)
For large dampers we can supply in sections with multiple actuators to be assembled on site.

Frame and blades are constructed from 1.6mm galvinised mild steel (430 stainless steel option available). Die formed corner channels 'button locked' for strength and rigidity. All blades are linked externally out of the airstream connected by a shaft suitable for actuators. Complete with close silicon sealed blades, stainless steel side jambs and oilite bearings, they provide an excellent seal from smoke and fire.

Fitted with a Power Failure Spring Return Actuator, the F.S.D will open in 75 seconds and shut in 20 seconds after power has been removed.

TECHNICAL SUPPORT

PUMA can offer a wealth of experience in sales, application, and technical support
Using the latest CAD design software, we can provide detailed drawings in dxf or pdf formats

BESPOKE SOLUTIONS

Puma Products operates a continuous design and improvement policy, and reserves the right to change designs and specifications without notice

CONTACT DETAILS

For more information on any of our products or services please visit us on the Web at:

www.pumaproducts.co.uk
Telephone + 44 (0)1264 333305
sales@pumaproducts.co.uk

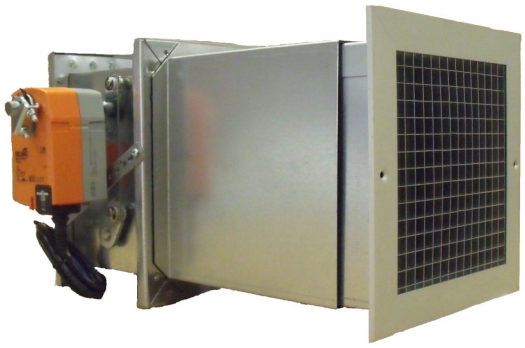
ISO 9001 CERTIFIED

FIRE PRODUCTS LTD

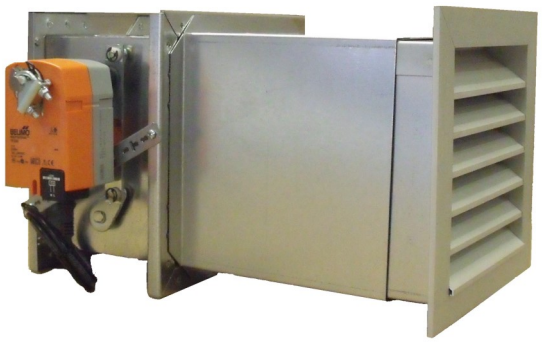
Unit C, Alexander Bell Centre, Hopkinson Way, West Portway Business Park, Andover, Hampshire, SP10 3UR, England

Puma™

Air Makeup Dampers and Fire/ Smoke & Volume Control Dampers



Air Make up Damper with Telescopic Duct and Egg Crate Grille



Air Make up Damper with Telescopic Duct and Weather Louvre

Air Makeup Damper (A.M.D) assemblies are required for areas that have Fire Extinguishant extract facility. Comprising of a Fire Smoke Damper (F.S.D), power failure spring return motor, telescopic wall liner, Egg Crate Grille (Internal Walls) or Weather Louvre (External Walls). On energisation of the Extract Fan the AMD simultaneously opens, allowing sufficient air to make up the negative pressure created by the Fire Extinguishant. For selection, please contact sales.



Volume Control Damper

Volume Control Dampers are generally fitted to the intake section of a unit. Complete with aerofoil blades and st/st side jambs, they provide an effective semi seal fitted with either a Power Failure Spring Return Motor that opens in 75 seconds and shuts in 20 seconds after the power has been removed, or is fitted with a hand control (as shown above).

TECHNICAL SUPPORT

PUMA can offer a wealth of experience in sales, application, and technical support
Using the latest CAD design software, we can provide detailed drawings in dxf or pdf formats

BESPOKE SOLUTIONS

Puma Products operates a continuous design and improvement policy, and reserves the right to change designs and specifications without notice

CONTACT DETAILS

For more information on any of our products or services please visit us on the Web at:

www.pumaproducts.co.uk
Telephone + 44 (0)1264 333305
sales@pumaproducts.co.uk

ISO 9001 CERTIFIED

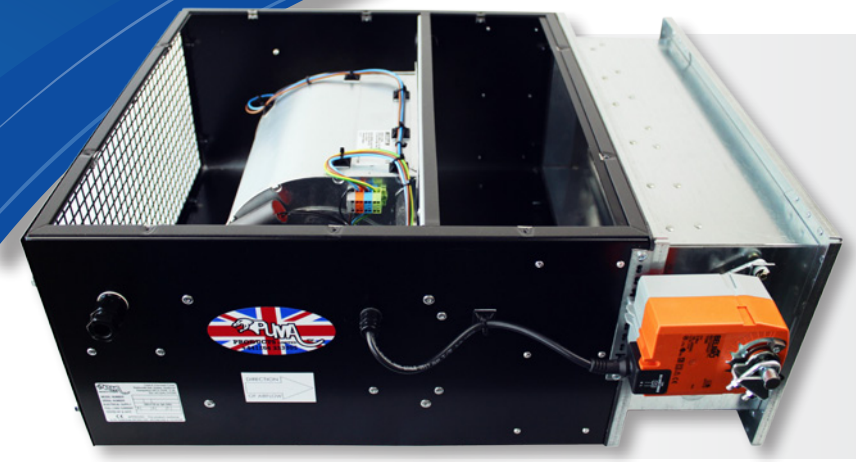
PUMA FIRE PRODUCTS LTD

Unit C, Alexander Bell Centre, Hopkinson Way, West Portway Business Park, Andover, Hampshire, SP10 3UR, England

PUMA
PRODUCTS

Post Discharge Fire Extinguishant Extract Units Direct Driven Range

Bespoke Fire Extinguishant Gas Extract Units for Data or Server Rooms



Internal Duct Mounted Unit

- Monocoque construction - single skin
- Ral 9005 satin black powder coat finish
- Top or bottom access lid
- Vertical / ceiling mounting
- Internal flange duct connections
- Fully sealed 2hr fire/smoke damper (FSD)

Options and Accessories available on request



Weatherproof Roof Mounted Unit

- Channel & Tray construction
- RAL 5017 mid blue powder coat finish
- Top access pitched lid
- Weather cowl on discharge
- Ducted both ends version available
- External flange duct connection
- Internal fire/smoke damper available (FSD)

Fire Extinguishant Extract Units (denoted **FE**) models are selected for Electronic Data Processing areas (EDP) to extract harmful fire extinguishing gases. Refer to BS ISO 14520 & BS EN 15004-1:2008 Section 5.1

Fitted as standard with 2 Hr rated (BS EN 1634-1:2008) fully sealed damper & motor, (power open spring return), and a single or three phase, double inlet direct driven centrifugal fan.

Pre-wired to terminal block for mains supply and Volt Free Contacts (VFC) for airflow indication normally interlocking with fire detection panel or BMS.

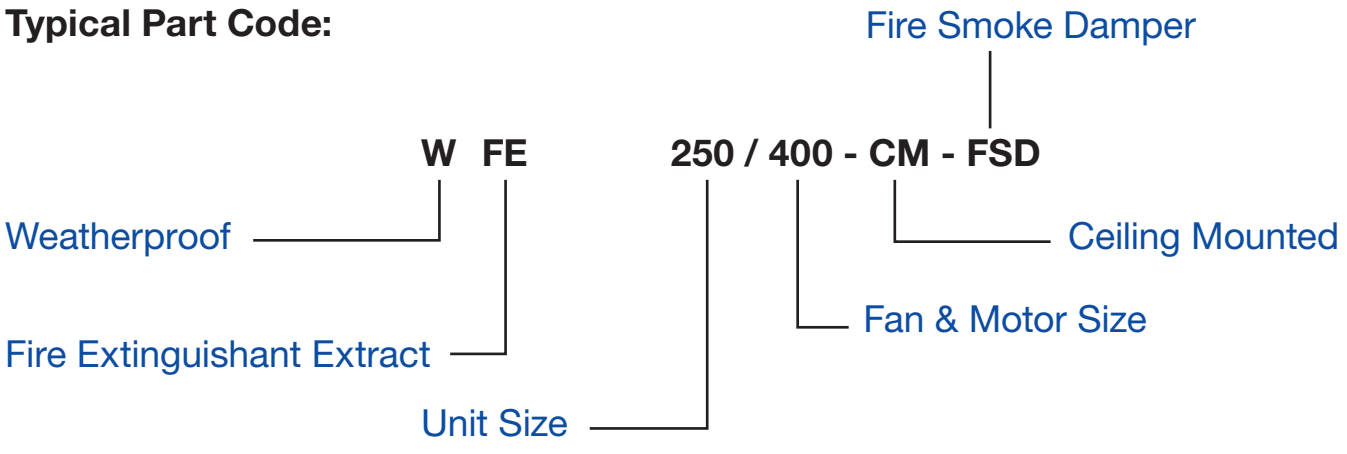
Ventilate your environment with

puma
FIRE PRODUCTS LTD

Performance Data

Model Number	Duty in m3/sec @ given External Static Pressure (Pa)											
	0	50	75	100	125	150	200	250	300	350	400	450
FE 200/200	0.1	0.09	0.08	0.08	0.07	0.07	0.06	0.05	0.01	-	-	-
FE 200/250	0.12	0.11	0.1	0.095	0.09	0.085	0.08	0.07	0.06	-	-	-
FE 200/300	0.15	0.14	0.13	0.125	0.12	0.11	0.1	0.09	0.085	0.06	-	-
FE 250/400	0.2	0.2	0.18	0.17	0.16	0.15	0.13	0.1	0.07	-	-	-
FE 250/600	0.27	0.26	0.25	0.24	0.23	0.22	0.21	0.19	0.17	-	-	-
FE 300/1400	0.65	0.64	0.63	0.61	0.6	0.59	0.58	0.55	0.53	0.51	0.49	0.46
FE 350/850	0.42	0.4	0.39	0.37	0.33	0.3	0.23	0.1	-	-	-	-
FE 350/1000	0.53	0.48	0.43	0.4	0.38	0.31	0.24	0.1	-	-	-	-
FE 350/1200	0.59	0.57	0.56	0.55	0.55	0.54	0.49	0.41	0.25	0.01	-	-
FE 400/1800	0.95	0.9	0.89	0.89	0.89	0.88	0.83	0.81	0.76	0.68	-	-
FE 450/2500	1.27	1.2	1.1	1.07	1.03	0.97	0.89	0.84	0.72	0.55	-	-
FE 550/3600	1.8	1.72	1.6	1.55	1.5	1.43	1.35	1.15	0.89	-	-	-
FE 550/3700	1.79	1.75	1.72	1.68	1.66	1.58	1.51	1.42	1.36	1.3	1.16	0.86
FE 550/4500	2.1	2.05	1.92	1.85	1.8	1.7	1.6	1.25	1.0	-	-	-

Typical Part Code:



PUMA FIRE PRODUCTS LTD

Over 35 years supplying the
Fire Suppression and Ventilation Industry

Electrical and Sound Data

Model Number	Motor Running Current (Amps)	Motor Starting Current (Amps)	Motor Power (Watts)	Induct Sound Power Levels dBW @ Octave Band Mid Frequency Hz								Breakout Noise Level dBA*	
				63	125	250	500	1K	2K	4K	8K	SSK	DSK
FE 200/200	0.3	0.75	67	32	34	46	55	56	54	51	50	40	25
FE 200/250	0.44	1.1	99	25	29	38	43	39	40	34	26	36	21
FE 200/300	0.8	2.0	175	63	57	55	54	54	47	41	32	44	29
FE 250/400	0.8	2.0	190	40	44	46	52	52	50	45	41	41	26
FE 250/600	1.2	3.0	273	68	62	61	61	59	54	47	37	48	33
FE 300/1400	7.6	19.0	1000	93	91	84	82	79	75	67	60	65	50
FE 350/850	1.9	4.75	184	67	69	70	69	66	62	59	54	44	29
FE 350/1000	2.3	5.75	300	71	72	73	72	70	66	62	57	48	33
FE 350/1200	2.6	6.5	420	75	72	67	63	61	60	58	54	50	35
FE 400/1800	4.2	12.5	550	76	74	66	64	60	57	49	41	53	38
FE 450/2500	6.8	17.5	550	80	78	70	68	64	61	53	45	61	46
FE 550/3600	4.3**	21.5**	1100	87	84	82	81	79	75	67	55	64	49
FE 550/3700	4.7**	23.5**	1500	87	88	89	88	86	82	78	73	71	56
FE 550/4500	4.5**	22.5**	1100	79	76	74	72	67	64	58	48	62	47

* The dBA quoted is the mean 'A' weighted sound pressure level measured at a distance of 3m. It is included for comparative purposes only, and the actual sound level experienced will depend on the acoustic characteristics of the area being served. Ductwork and Silencers also have a major influence on breakout noise and actual noise levels in the system.

** 380/415 V ac Three Phase Motor

Options and Accessories

SSK **Single Skin**

FSD **Fire / Smoke Damper & Motor**

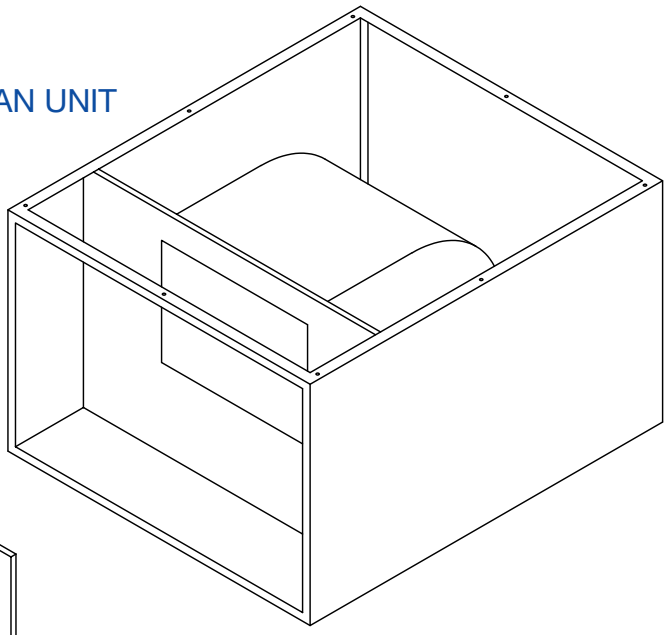
TD **Telescopic Duct**

WL **Weather Louvre**

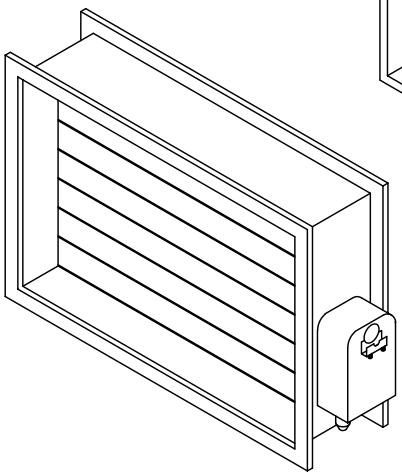
VM **Vertically Mounted**

CM **Ceiling Mounted**

FAN UNIT

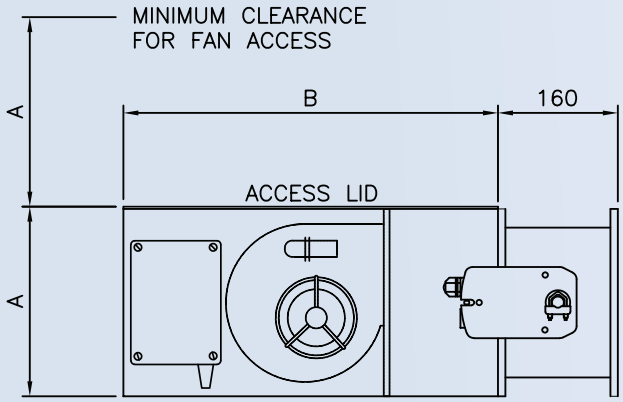


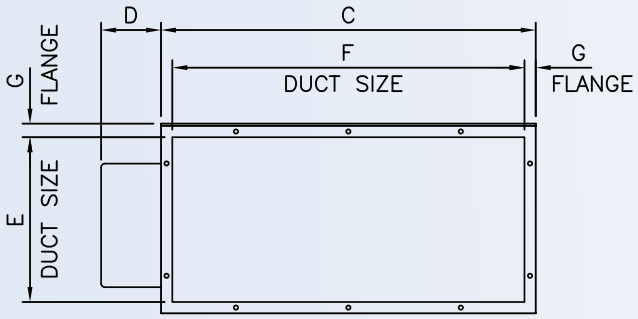
FSD



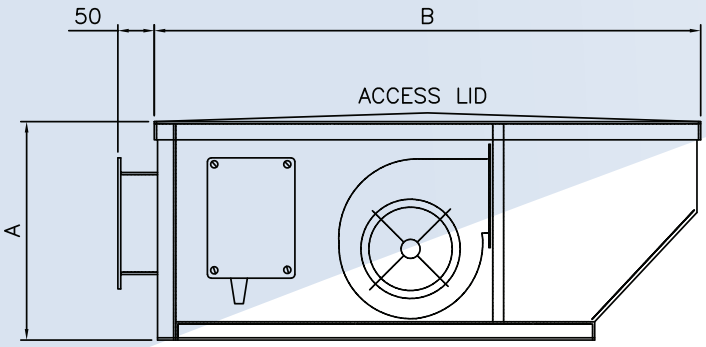
Dimensional Data

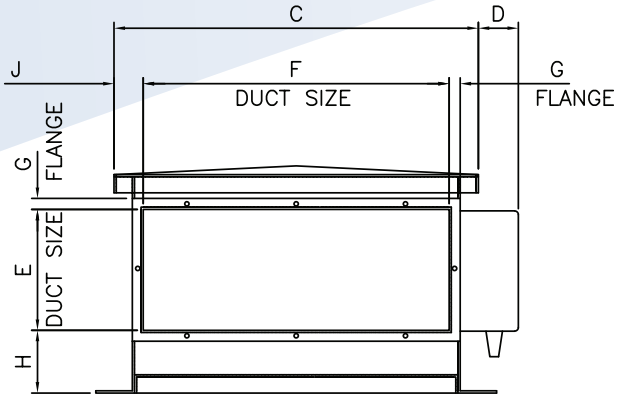
Internal Duct Mounted Unit





Weatherproof Roof Mounted Unit





Model Number	Dimensions in Millimetres									
	A	B	C	D	E	F	G	H	J	WEIGHT
FE 200	200	450	450	100	166	420	15	-	-	20 Kg
FE 250	250	500	500	100	220	470	15	-	-	25 Kg
FE 300	300	600	500	100	260	460	20	-	-	30 Kg
FE 350	350	700	600	175	310	560	20	-	-	40 Kg
FE 400	415	700	600	175	375	560	20	-	-	50 Kg
FE 450	450	700	700	175	410	660	20	-	-	60 Kg
FE 550	550	900	800	175	500	750	25	-	-	90 Kg
WFE 200	225	650	500	75	126	314	13	50	93	25 Kg
WFE 250	300	750	500	75	166	420	15	86	40	35 Kg
WFE 300	350	800	600	75	166	420	15	125	90	40 Kg
WFE 350	400	850	700	75	220	470	15	135	115	45 Kg
WFE 400	450	950	800	150	260	460	20	155	170	60 Kg
WFE 450	500	1000	800	150	310	560	20	120	120	70 Kg
WFE 550	600	1150	1000	150	375	560	20	195	220	100 Kg

Unit C, Alexander Bell Centre, Hopkinson Way, West Portway, Business Park, Andover, Hampshire, SP10 3UR, England
Telephone: +44 (0) 1264 333305 Facsimile: +44 (0) 1264 333310 Email: sales@pumaproducts.co.uk

DECLARATION OF PERFORMANCE

Model: **Volume Control Damper / Positive Shut-off Damper**

Manufacturer:

Puma Fire Products Limited
Unit C, Alexander Bell Centre
Hopkinson Way
West Portway Business Park
Andover, Hampshire SP10 3UR
United Kingdom

Source Data: 1. Manufacturer

DECLARED PERFORMANCE

CHARACTERISTIC	DECLARED PERFORMANCE	HARMONISED STANDARD
Casing Leakage	Class A,B or C	DW144
Maximum Operating Pressure	1000Pa	
Maximum Duct Velocity	15m/s	

The performance of the product is in conformity with the declared performance outlined above.
The Declaration of Performance is issued under the sole responsibility if the manufacturer identified above.

Signed for on Behalf of the manufacturer by: Date:



Dräger Polytron 8200/8310

Instructions for use

WARNING

Strictly follow the Instructions for Use.
The user must fully understand and strictly observe the instructions. Use the product only for the purposes specified in the Intended use section of this document.

Contents

1 For your safety 4
1.1 General safety statements 4
1.2 Definitions of alert icons 4

2 Description 5
2.1 Product overview 5
2.2 Functional description 6
2.3 Intended use 6
2.4 Intended operating area and operating conditions . . . 7
2.5 Approvals 7
2.6 Device marking 7

3 Installation 7
3.1 General information for the installation 7
3.2 Restrictions on the installation 8
3.3 Impedance range of the signal loop 8
3.4 Mechanical installation 8
3.5 Electrical installation without e-Box 9
3.6 Electrical installation with e-Box 10
3.7 Connecting the device to a Dräger control unit 10
3.8 Connecting the device to a PC 10
3.9 PolySoft 8000 PC software (optional) 10
3.10 Installing software dongles 10

4 Operation 11
4.1 Operating fundamentals 11
4.2 Display and LEDs 11
4.3 Activating the Info mode 12
4.4 Switching to the Quick Menu mode 13
4.5 Switching to Menu mode (password protected) 13
4.6 Measurement mode 13

5 Calibration 14
5.1 Calibrating the device 14
5.2 Performing Auto Calibration 15

6 Menu overview 16

7 Information menu 17
7.1 Device settings 17
7.2 Sensor information 17
7.3 Datalogger information (only with data dongle) 17

8 Settings menu 18
8.1 Switching SIL lock on or off 18
8.2 Device settings 18
8.3 Communication settings 20
8.4 Sensor settings 23
8.5 Datalogger settings (only with data dongle) 24

9 Troubleshooting 25
9.1 Fault reference 25
9.2 Warning reference 26

10 Maintenance 27
10.1 Maintenance intervals 27
10.2 Changing the sensor 27
10.3 Changing the main electronics 27

11 Disposal 27

12 Technical data 28
12.1 Torques 29
12.2 Tightening torque and cable size for field wiring terminals 29
12.3 Factory settings 29

13 Order list 31
13.1 Dräger Polytron 8200/83X0 31
13.2 Sensors for remote versions 31
13.3 Replacement sensors (except for remote versions) 31
13.4 Accessories 32
13.5 Replacement parts 32

14 Declaration of Conformity 33

1 For your safety

1.1 General safety statements

- Before using this product, carefully read the Instructions for Use.
- Strictly follow the Instructions for Use. The user must fully understand and strictly observe the instructions. Use the product only for the purposes specified in the Intended use section of this document.
- Do not dispose of the Instructions for Use. Ensure that they are retained and appropriately used by the product user.
- Only fully trained and competent users are permitted to use this product.
- Comply with all local and national rules and regulations associated with this product.
- Only trained and competent personnel are permitted to inspect, repair and service the product as detailed in these Instructions for Use. Further maintenance work that is not detailed in these Instructions for Use must only be carried out by Dräger or personnel qualified by Dräger.
- Properly trained service personnel must inspect and service this product as detailed in the Maintenance section of this document.
- Use only genuine Dräger spare parts and accessories, or the proper functioning of the product may be impaired.
- Do not use a faulty or incomplete product, and do not modify the product.
- The flameproof threads for the explosion proof enclosure do not conform to the minimum/maximum values in EN/IEC 60079-1. The threads must not be modified by the user.
- The measuring function of the gas measurement transmitter for explosion protection according to Annex II, Sections 1.5.5, 1.5.6 and 1.5.7 of Directive 94/9/EG is not covered at present.
- Exchanging components may compromise the intrinsic safety. This only applies if the device is intrinsically safe.
- Only operate the product within the framework of a risk-based alarm signalling concept.

Safe coupling with electrical devices

- Electrical connections to devices which are not listed in these Instructions for Use should only be made following consultation with the respective manufacturers or an expert.

Use in areas subject to explosion hazards

- Devices or components for use in explosion-hazard areas which have been tested and approved according to national, European or international Explosion Protection Regulations may only be used under the conditions specified in the approval and with consideration of the relevant legal regulations. The devices or components may not be modified in any manner. The use of faulty or incomplete parts is forbidden. The appropriate regulations must be observed at all times when carrying out repairs on these devices or components.

1.2 Definitions of alert icons

The following alert icons are used in this document to provide and highlight areas of the associated text that require a greater awareness by the user. A definition of the meaning of each icon is as follows:



WARNING

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in physical injury, or damage to the product or environment. It may also be used to alert against unsafe practices.



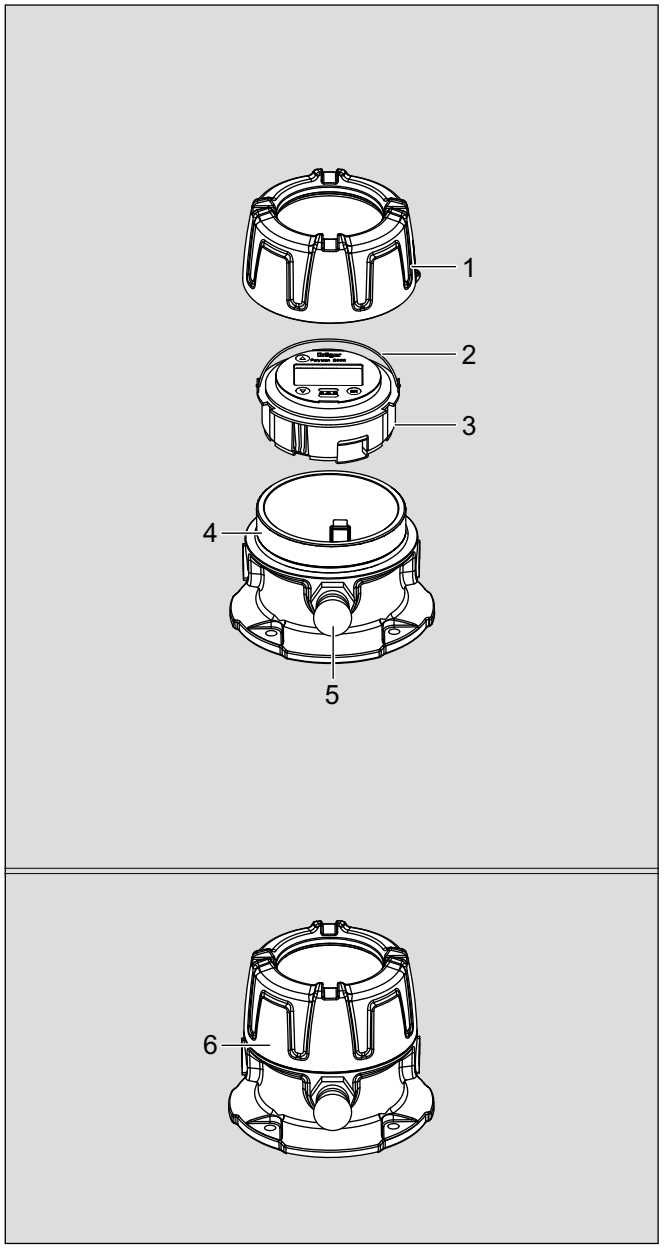
NOTICE

Indicates additional information on how to use the product.

2 Description

2.1 Product overview

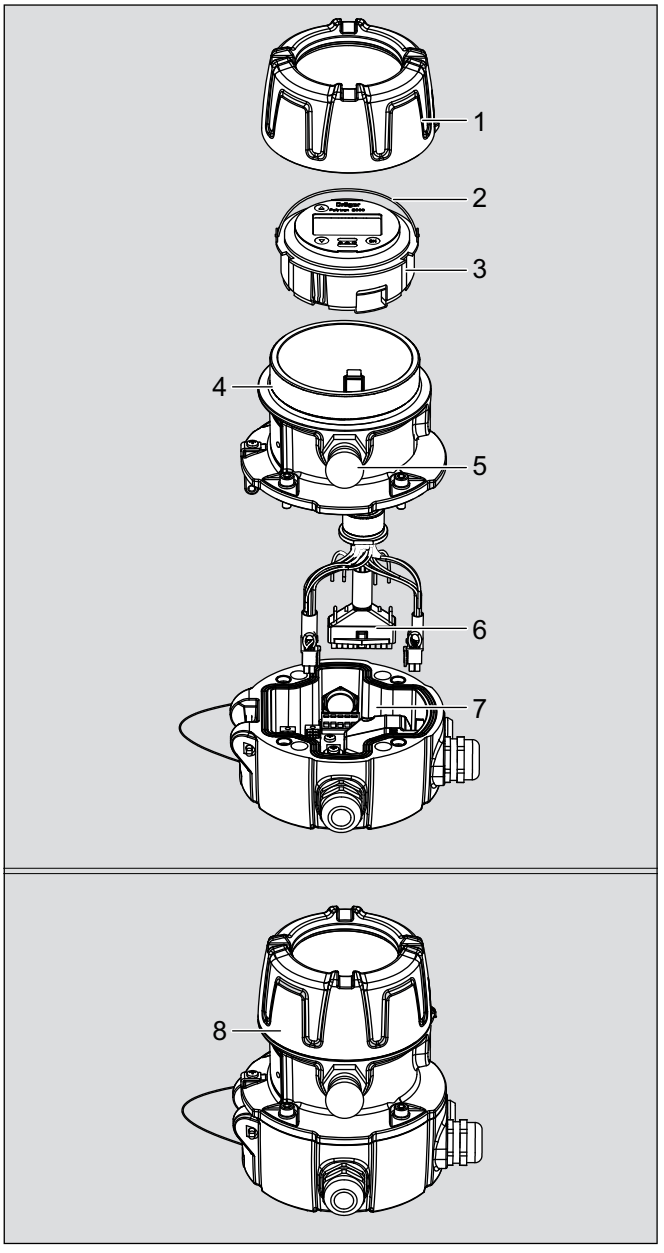
2.1.1 Explosion proof device



001233299.eps

1 Housing cover
2 Clip
3 Enclosure with main electronics (and optional relay)
4 Lower part of housing
5 Sensor
6 Assembled device

2.1.2 Explosion proof device with e-Box for increased safety



002233299.eps

1 Housing cover
2 Clip
3 Enclosure with main electronics (and optional relay)
4 Lower part of housing
5 Sensor
6 Feed through cable
7 e-Box
8 Assembled device

2.2 Functional description

2.2.1 Principle of operation of the DrägerSensor DD, LC

The DrägerSensor is a transducer for measuring the partial pressure of flammable gases and vapors in ambient air. It operates on the heat of combustion principle.

The ambient air to be monitored diffuses through the flame arrestor in the sensor. The mixture of flammable gases and vapors is burned catalytically on the heated measuring element (pellistor). The oxygen required for combustion is taken from the monitored ambient air (must be greater than 12 vol.%). The measuring element receives additional warming from the heat arising from the combustion. This warming causes a change in the resistance of the measuring element which is proportional to the concentration of the mixture of flamable gases and vapors in the air being monitored.

In addition to the catalytically activated measuring element, the sensor also has a compensating element. Both elements are part of a Wheatstone bridge circuit. Consequently, environmental influences such as changes in temperature or humidity are almost completely compensated for.

The DrägerSensor LC includes additional processing and amplification of the measuring signal. As a result, the sensor is suitable for the measuring range 0 - 10 %LEL.

2.2.2 Principle of operation of the DrägerSensor IR

The DrägerSensor IR infrared gas sensor is a gas transmitter for determining the concentration of gases and vapors in ambient air. The measuring principle is based on the concentration-dependent absorption of infrared radiation in the measured gases.

The ambient air to be monitored diffuses through a sintered body into the pressure-tight housing of a measurement cuvette. The broadband light produced by the emitter passes through the gas in the cuvette, is reflected from the cuvette walls and is focused on the entrance window of a dual-element detector. One channel of the detector measures the gas-dependent light transmission of the cuvette (measuring channel) and the other is used as the reference. The gas concentration in the cuvette can be determined from the ratio of the measured signal to the reference signal. The cuvette is heated to prevent condensation of atmospheric humidity.

The calculation of the concentration is performed by internal electronics and software. For the output signal, the gas sensor emulates the half bridge of a catalytic bead sensor.

2.2.3 Contaminating gases for the DrägerSensor DD, LC

NOTICE

Certain substances in the atmosphere to be measured can impair the sensitivity of the sensors.

a) Polymerizing substances such as acrylonitrile, butadiene and styrene

b) Corrosive compunds such as halogenated hydrocarbons (which release halogens such as bromine, chlorine or fluorine on oxidation) and halogen hydracids, as well as gaseous acidic compounds such as sulfur dioxide and oxides of nitrogen.

c) Catalyst poisons such as sulfur and phosphorus compounds, silicon compounds (particularly silicones) and organometallic vapors. The sensors used work with measuring elements (pellistors) that are poison-resistant (PR) and thus have a longer life than conventional sensors when catalyst poisons are present.

It may be necessary to check the calibration if the sensor has been exposed for a long time to a high concentration of flammable gases or vapors or the above-mentioned contaminating substances.

2.3 Intended use

The Dräger Polytron 8200/8310 is an explosion proof device for continuous monitoring of the concentration of gases and vapors containing hydrocarbons. The housing for the device consists of robust, non-corroding stainless steel or aluminum and is suitable for indoor or outdoor applications. The unit can be connected to a Dräger monitoring system or a programmable logic controller (PLC) by means of a sealed conduit or an appropriately approved cable gland. With the optionally integrated relay module, the device can be operated without a central controller (with additional local alarm signalling). The device is designed for fixed installation and is approved for use in potentially explosive atmospheres, see chapter 2.5 on page 7.

WARNING

Not tested in oxygen enriched atmospheres (>21% O_2). High off-scale readings may indicate an explosive concentration.

2.3.1 Dräger Polytron 8200 with DrägerSensor® [1] Ex DD

Catalytic bead sensor for monitoring flammable gases and vapors containing hydrocarbons

- Detection range: 0 to 100 % LEL [2]

2.3.2 Dräger Polytron 8200 with DrägerSensor Ex LC

Catalytic bead sensor for monitoring flammable gases and vapors containing hydrocarbons

- Detection range: 0 to 10 % LEL [2)]

1 DrägerSensor® is a registered trademark of Dräger.
2 Lower Explosion Limit, depending on substance and the locally applicable regulations.

2.3.3 Dräger Polytron 8310 with DrägerSensor IR

Infrared sensor for monitoring flammable gases and vapors containing hydrocarbons

- Detection range: 0 to 100 % LEL [2)]

WARNING

Explosive. Not to be used in oxygen enriched atmospheres. None of the Polytron 8000 transmitters is certified and approved to be operated in oxygen enriched atmospheres.

2.4 Intended operating area and operating conditions

Hazardous areas classified by zones:
The device is only designed for use in Zone 1 or Zone 2 potentially explosive atmospheres for which a temperature range as specified on the device must be observed and in which gases of Explosion Groups IIA, IIB or IIC and Temperature Classes T4 or T6 (depending on maximum ambient temperature) or dust of Groups IIIA, IIIB or IIIC may occur.

Hazardous areas classified by divisions:
The device is only designed for use in potentially explosive atmospheres of Classes I&II, Div. 1 or 2, for which a temperature range as specified on the device must be observed and in which gases or dust of Groups A, B, C, D or E, F, G and Temperature Classes T4 or T6 (depending on maximum ambient temperature) may occur.

2.5 Approvals



See printed version for approval markings.

2.6 Device marking

The device marking is supplied with the device as a copy on a separate document.

Key to the Serial Number: The third letter of the Serial Number specifies the year of manufacture: A = 2009, B = 2010, C = 2011, D = 2012, E = 2013, F = 2014, H = 2015, J = 2016, K = 2017 etc. Example: Serial Number ARBH-0054: The third letter is B, i.e. the device was manufactured in 2010.

3 Installation

3.1 General information for the installation

The selection of a suitable mounting location is crucial for the effectiveness and performance of the entire system. Every detail of the installation must be thoroughly thought out. The following must be noted in particular:

- the local and national rules and regulations for the installation of gas monitoring systems,
- the applicable regulations for running and connecting power and signal cables to gas monitoring systems,
- the full extent of environmental influences to which the device will be subjected,
- the physical properties of the gases and vapors to be measured,
- the details of the particular application (e.g., potential leaks, air movements/flows, etc.),
- accessibility for required maintenance activities,
- the geometric of the accessories that are used with the system,
- all other limiting factors and stipulations that may affect the installation of the system.
- For installation without a conduit, an approved cable gland (e.g. Hawke A501/421/A/¾" NPT or equivalent) must be used (see chapter 12 on page 28). To increase the RF interference immunity, it may be necessary to connect the cable screen to the cable gland and to the control unit.
- The explosion proof enclosure has three ¾" NPT connections, which can be used for field wiring, the direct attachment of a sensor or wiring an external sensor. Unused openings must be closed off with a plug. For the correct tightening torques for cable bushings, plugs, sensors and connectors, see chapter 12 on page 28.
- The secondary are supposed to be supplied from an isolating source (does not apply to relay contacts).
- The optional e-Box has up to four 20 mm connections, which can be used for field wiring or wiring an external sensor. The permissible cable diameter is 7 to 12 mm.
- If the device is installed in locations where ambient temperatures of over 55 °C prevail, appropriate cables which are specified for use at temperatures of 25 °C above the maximum ambient temperature must be used.
- Strip back the insulation on conductors by 5 to 7 mm.
- Connect the cable as shown in Chapter 3.5 on page 9 (shown here also with protective ground) oder Chapter 3.6 on page 10.
- The connecting wires for the optional relay module must be selected and fused according to the rated voltages, currents and environmental conditions.
- When stranded conductors are used, an end ferrule must also be used.

3.2 Restrictions on the installation

- The device requires a DC voltage between 10 and 30 V. The minimum supply voltage of 10 V and the cross-section of the conductors used determine the distance of the device from the supply or the central controller (see chapter 12 on page 28). The device is designed for cables of sizes 12 to 24 AWG (0.2 to 2.5 mm^2). Use a three-wire, shielded cable as a minimum.
- The device must not be subjected to any radiant heat (e.g. direct sunlight) as this will result in a temperature rise above the specified thresholds (see chapter 12 on page 28). The use of a reflective screen is recommended.
- The housing is weather resistant and suitable for outdoor applications. The use of the optional splash guard is recommended to protect the sensor from water and dust.
- The device must be installed and operated in an environment which conforms to the stated specifications (see chapter 12 on page 28).
- To insure proper operation of the device, the impedance of the 4 to 20 mA signal loop must not exceed 500 ohms. Depending on the operating voltage and according to the application (e.g. HART operation), certain minimum impedances must be adhered to (see chapter 3.3 on page 8). The conductors for the power supply must have an adequately low resistance to insure the correct supply voltage at the device.

NOTICE

A dust cap can be fitted to the cable entry of the device. This cap is only used for transport purposes and must be removed before the device is connected to a sealed conduit.

3.3 Impedance range of the signal loop

Devices with a HART interface can be operated with HART communication or in HART Multidrop mode.

Operating mode	Impedance range of the signal loop	Supply voltage range
Operation without HART communication	0 to 230 Ω	at 10 V DC
	Rising linearly with the supply voltage from: 0 to 230 Ω at 10 V to 0 to 500 Ω at 16 V	10 to 18 V DC
	0 to 500 Ω	18 to 30 V DC
Operation with HART communication (HART mode)	230 to 270 Ω	at 13 V DC
	Rising linearly with the supply voltage from: 230 to 270 Ω at 11 V to 230 to 500 Ω at 16 V	11 to 16 V DC
	230 to 500 Ω	18 to 30 V DC
HART Multidrop operation	230 to 500 Ω	10 to 30 V DC

3.4 Mechanical installation

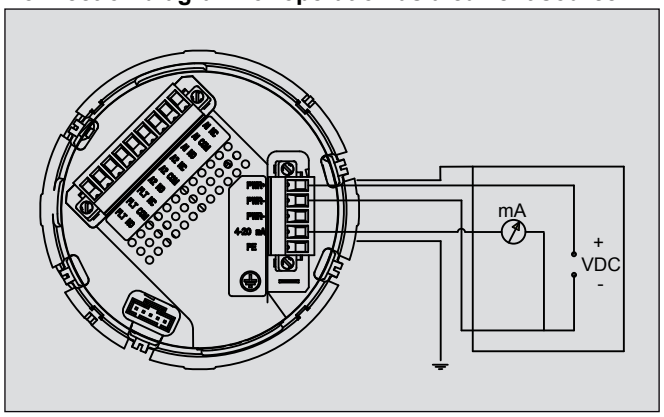
- Use the supplied drilling template for mounting on a wall.
- The mounting surface should be even and free of sharp edges.
- Dräger recommends using M6 Allen bolts.
- The openings must be readily accessible to the surrounding atmosphere.

3.5 Electrical installation without e-Box

CAUTION

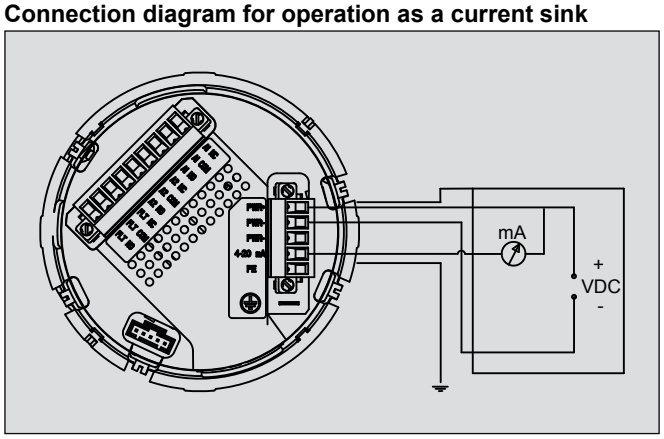
First connect the cables for the relays and make the connections to the sensor before connecting the device to the power supply.

Connection diagram for operation as a current source



01133300.eps

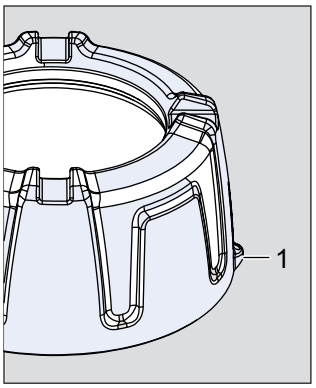
Connection diagram for operation as a current sink



01033300.eps

3.5.1 Power and signal cables

1. Release the set screw (1) and unscrew the housing cover from the device.
2. Lift the handle and remove the enclosure with the main electronics.
3. Connect the device electrically to the protective ground.
4. Rotate the main electronics and disconnect the 5-way plug.



00933300.eps

5. Connect the three cables for the power supply and the signal to the corresponding terminals (see following table of connections for the 5-way plug).

Connections for 5-way plug (power supply and signal):

5-way plug (power supply and signal)					
Terminal	1	2	3	4	5
Ident.	PWR+	PWR-	PWR-	4 to 20 mA signal	PE
Function	V+	V-	V-	4 to 20 mA signal (Operation as source or sink)	PE

6. For operation without a central controller: connect Terminal 3 to Terminal 4.
7. Fit the plug back in the socket and tighten the screws.
8. The screen of the cable must only be connected to the control unit.
9. Insert the main electronics back in the housing.
10. Screw the cover on again and tighten the set screw.

3.5.2 Version with relays

WARNING

At voltages >30 V AC or >42.4 V DC, the relay cables must be enclosed in protective tubing, or double-insulated cables must be used.

When the relay module is fitted, the wires for the alarm device are connected to the 9-way plug.

1. Disconnect the 9-way plug on the rear of the main electronics.
2. Connect the wires for Alarm Relay 1, Alarm Relay 2 and the Fault relay to the corresponding terminals, (see following table of connections for the 9-way plug).
3. The relays are energized when the default settings are used and in the measurement mode. This insures "fail-safe" operation. The terminal assignments in the connection table below apply when the default settings are used and when in measuring mode (see chapter 4.6 on page 13).
4. Fit the plug back in the socket and tighten the screws.
5. Fit the enclosed protective cover over the plug and secure it with cable ties if necessary.

NOTICE

For clear and far-ranging detection of a device fault, an alarm device should be switched by the fault relay.

Connections for 9-way plug (relays):

9-way plug (relays)									
	Fault relay			A2 relay			A1 relay		
Terminal	1	2	3	4	5	6	7	8	9
Ident.	FLT NO	FLT C	FLT NC	A2 NO	A2 C	A2 NC	A1 NO	A1 C	A1 NC

(NO = Normally open, NC = Normally closed, C = Common)

3.5.3 Remote Sensor

The remote junction box (Order Number 45 44 098 for stainless steel / Order Number 45 44 099 for aluminum) permits the installation of the sensors remote from the device electronics. This installation enables operation of the device in difficult to access or unfavourable positions (see the Instructions for Use for the Dräger Polytron 5000 Junction Box). The maximum permissible distance between the Polytron 8200/8310 and the sensors is 30 m.

3.6 Electrical installation with e-Box

- Install the e-Box in accordance with the Installation Instructions for the Polytron 5000/8000 e-Box.

NOTICE

The e-Box can be pre-installed, wired and closed off with the supplied cover. As soon as the installation is ready for commissioning, the device is connected to the e-Box and put into operation. This prevents the device from being damaged during the construction phase.

3.7 Connecting the device to a Dräger control unit

NOTICE

Information on connection can be found in the Instructions for Use accompanying the particular Dräger control unit (e.g. Regard, QuadGard).

Electrical connections to the control unit

- Connect the screen for the wires to the grounding point in the control unit (e.g., chassis, grounding rail).

3.8 Connecting the device to a PC

The separately available Polytron 5000/8000 IR connection kit is intended for use with the Polytron 5000/8000 and enables communication between the Polytron 5000/8000 and a PC.

3.9 PolySoft 8000 PC software (optional)

The PolySoft 8000 PC software is used to display device information, edit configuration settings and read out from the measurements memory.

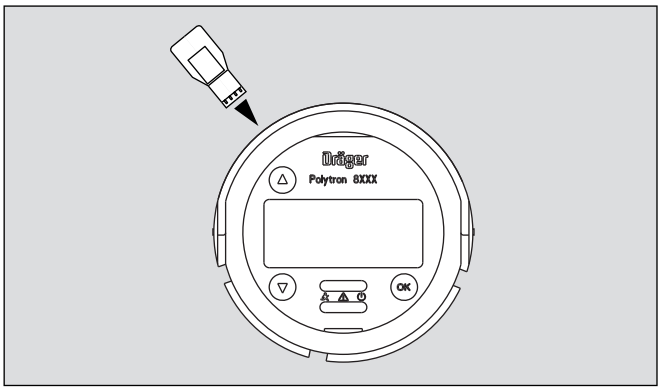
3.10 Installing software dongles

The following SW dongles are available for the Polytron 8200:

Datalogger dongle 83 17 618	Enables the datalogger and the graphic display of concentrations.
Sensor test dongle 83 17 619	Enables the sensor self test (for certain versions only)
Diagnostic dongle 83 17 860	Enables the sensor self test, the display of the remaining sensor activity and the sensor diagnostic function (for certain functions only)

Combi-dongle (datalogger and sensor test dongle)
83 23 218

Combi-dongle (datalogger and diagnostic dongle)
83 23 219



00833300.eps

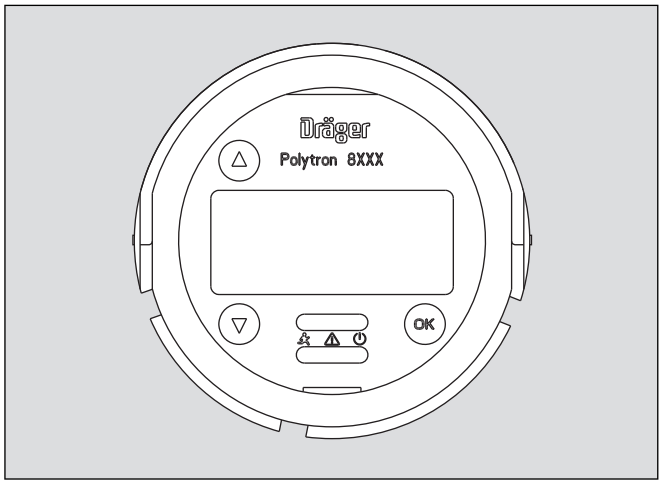
To install a SW dongle:

1. Switch off the power to the unit or declassify the area according to the local regulations.
2. Release the set screw and unscrew the housing cover from the device.
3. Lift the handle and remove the enclosure with the main electronics.
4. Insert the dongle in the slot with the Dräger lettering facing upwards.
5. Insert the main electronics back in the housing.
6. Screw the cover on again and tighten the set screw.
   The dongle is installed.
7. Switch on the power.

4 Operation

4.1 Operating fundamentals

4.1.1 Menu navigation



00733300.eps

It is possible to scroll throught he menu items by tapping the ▲ and ▼ symbols with the magnetic wand (Part Number 4544101, blue). OK confirms a function.

NOTICE

The housing cover should be fitted when using the magnetic wand. If the housing cover is not fitted, the magnetic wand might activate two or more buttons at the same time (crosstalk).

Graphic symbols facilitate navigation in the various menus.

- Together with the text » Back «, » Menu «, etc., exit the menu or go back 1 step.
- Closed folder
  Further functions or sub-menus are located under this item.
- Opened folder
  The functions and sub-menus available here are listed under this item.
- Function
  When activated, functions can be executed in one or more steps.
- Selection activated
  For functions that can be selected and activated, the activation is initiated by taping » OK «.
- List closed above / complete
  There are no further functions, menus or sub-menus listed above.
- List can be scrolled upwards
  There are further functions, menus or sub-menus listed above.
- List closed below / complete
  There are no further functions, menus or sub-menus listed below.
- List can be scrolled downwards
  There are further functions, menus or sub-menus listed below.
- Next
  Perform context-related action.
- 3/3 Number / total number of steps (screens) within the function.
- 2/2 Entry
  Enter data with » ▲ « and » ▼ «.

4.1.2 Changing parameter values or the parameter status

1. Select the desired menu item with ▲ and ▼.
2. Confirm the menu item with OK.
   The current value or status will be displayed.
3. Using ▲ and ▼, the value of a numerical parameter can be changed or preset values can be selected.
4. As soon as the desired value or the selection is displayed, tap OK to validate/confirm the new parameter.
5. Tap OK to access the next higher level.

- If exiting using **Back to menu** or **Previous**, all changes will be discarded.

4.1.3 Exiting menus

- ▲ Tap **Back to measurement** and OK to exit the menu.

4.2 Display and LEDs

In measurement mode, the current gas concentration, the name of the gas and the measurement units are shown on the display. The green LED lights.

In addition, the following symbols may be displayed:

- " ↑ ↑ ↑ ↑ ", if the measurement range is exceeded
- " **- - - -** " and " **X** " in the event of a malfunction. The yellow LED lights, (see chapter 4.2.2 on page 12).
- "SIL", when SIL status is activated.

When the optional relay PCB is used:

- If the first alarm has been triggered, the red LED gives single flashes.
- If the second alarm has been triggered, the red LED gives double flashes.

4.2.1 Special symbols

The following special symbols, which indicate the device state, may be displayed on the right hand side in measurement mode.

- Warning message present –
  to display warnings, see chapter 7.1.1 on page 17.
  Information can be called up in Info mode, see chapter 4.3 on page 12.
- Fault message present –
  To display the fault, see chapter 7.1.2 on page 17
- Maintenance signal will be output on the interface, see chapter 8.3.2 on page 21.
- Measurement range of analog interface exceeded
- Measurement less than range of analog interface
- Analog interface is set to a fixed value (e.g. Multidrop HART communication) and is not transmitting any measurements.
- "Preventive" maintenance: The sensor is ready for operation
- "Preventive" maintenance: The sensor is ready for operation but is close to the end of its life cycle.
- "Preventive" maintenance: The sensor is still ready for operation but should be changed as soon as possible.
- The datalogger is active in rolling mode.
  To activate/deactivate, see chapter 8.5.2 on page 24.
- The datalogger is active in stacking mode.
  To activate/deactivate, see chapter 8.5.2 on page 24.
- SIL SIL is activated (observe Safety Manual - Order Number 9033307).

4.2.2 LED symbols

Symbol	LED	Description
	red	Alarm triggered
	yellow	Malfunction / Warning
	green	Switched on Measurement mode

NOTICE

The alarm triggering function is only available when the optionally integrated relay module is used.

When the optional relay PCB is used:

- If the first alarm has been triggered, the red LED gives single flashes. A1 relay is activated.
- If the second alarm has been triggered, the red LED gives double flashes. A2 relay is activated.
- If an alarm can be acknowledged and is acknowledged, the LED stops flashing and lights continuously instead until the alarm condition is no longer present. The corresponding relay is deactivated.

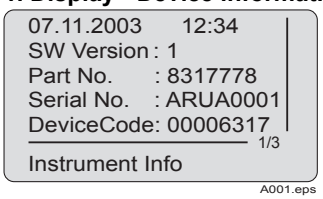
4.3 Activating the Info mode

The Info mode is used to present information about the central device settings and states.

- Tap ▲ and hold for 3 seconds.
  The device information appears on several displays. No changes can be made.
- Tap ▲ or ▼ briefly to switch between the displays.
- The Info mode can be ended at any time by selecting OK.
- If no button is selected within 30 seconds, the device reverts automatically to the measurement mode.

Example of the Info mode
(Displays vary depending on sensor):

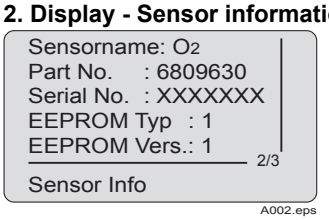
1. Display - Device information:



A001.eps

- Date and Time
- Software version
- Part number of the device
- Serial number of the device
- Device code

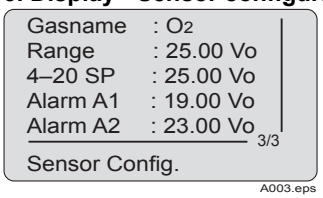
2. Display - Sensor information:



A002.eps

- Sensor description
- Part number of sensor (only for certain sensors)
- Serial number of sensor (only for certain sensors)
- Software version (only for certain sensors)
- Software revision (only for certain sensors)

3. Display - Sensor configuration:



A003.eps

- Gas description
- Maximum measurement limit and measurement units for the sensor
- Measurement range and measurement units for the analog interface. Only displayed when the 4-20 mA interface is enabled.

- A1 Alarm limit and measurement units[1]
- A2 Alarm limit and measurement units[1]

4.4 Switching to the Quick Menu mode

- Tap ▼ and hold for 1 to 2 seconds.
  The Quick Menu will open. This menu is displayed without any password request. No changes can be made.
  The selected information about status and device settings can be retrieved (e.g. warning messages, error messages, installed modules and calibration data).

4.5 Switching to Menu mode (password protected)

1. Tap ▼ and hold for longer than 3 seconds.
   The password request appears.
2. **Enter the password** and confirm.
   The screen for password entry appears.
3. Set the password and confirm the entry.
   The menu hierarchy corresponding to the entered password will open.

- An error message appears if the entered password is invalid.

Password presets:
Password for the **Calibration** menu: _ _ _ 1
Password for the **Settings** menu: _ _ _ 2

4.6 Measurement mode

WARNING

The configuration and calibration settings must be checked before the device is operated in measurement mode.

- Switch on the power.
  - The device runs through a start-up sequence (LCD test by inverting the video, LED test, software version and initialization) and starts the warm-up phase. The display indicates that the sensor will be ready to operate in hh:mm:ss (the countdown begins) and the Polytron 8200/8310 sends the Maintenance signal.
  - After the warm-up phase, the device passes into the measurement mode.
  - The current gas concentration, the selected gas and the units of measure appear on the display.
  - The ⏻ LED lights green.
  - The sensor is ready to take measurements.

NOTICE

The correct date and time settings are important for many functions (see chapter 8.2.3 on page 19).

4.6.1 Analog signals

In measurement mode the output current of the device is between 4 and 20 mA and is proportional to the measured gas concentration.

The device uses various current values to indicate different operating modes. This conforms to the NAMUR NE43 recommendation. The 4-20 mA interface on the device can be customized and configured to individual requirements. The device is provided with suitable standard settings at the factory (see chapter 12.3 on page 29).

1 Only displayed when relay is configured.

5 Calibration

Repeat the calibration of the device at regular intervals as specified in the particular sensor data sheet.

CAUTION

Danger to health! Do not inhale the test gas. Observe the hazard information in the corresponding safety data sheets. Provide venting into a fume cupboard or outside the building.

Always calibrate the zero point first before the sensitivity. Otherwise the calibration will be faulty!

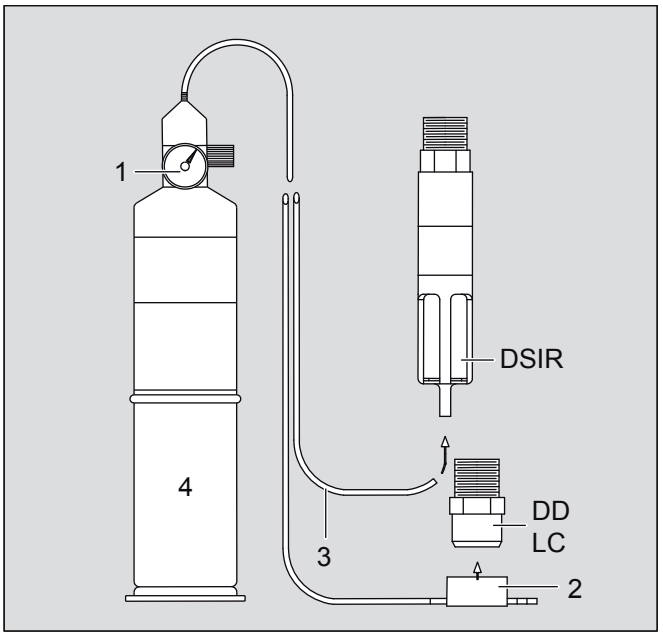
NOTICE

Calibration is not possible if the date and time are not set (see chapter 8.2.3 on page 19).

Dräger recommends calibrating devices with the gas that is to be measured operationally. This method of measured gas calibration is more accurate than a surrogate gas calibration. A surrogate gas calibration may only be performed as an alternative if a measured gas calibration is not possible.

5.1 Calibrating the device

1. Connect the pressure reducer to the calibration gas cylinder.
2. Attach the calibration adapter to the sensor.
3. The gas flow should be between 0.5 and 2.0 L/min.
4. Connect the hose to the calibration adapter.



1 Pressure reducer
2 Calibration adapter
3 Test gas cylinder
4 Hose

For DSIR only (see also Instructions for Use for DrägerSensor IR)

1. Position the magnetic wand on the sensor button marked with ⇩0 and hold it there for at least 5 seconds.
   A negative value will be displayed for as long as the magnetic wand is held on the button (e.g. -10 %LEL). This will start the automatic zeroing of the sensor.
2. Remove the magnetic wand.
   The sensor ends the automatic zeroing after approx. 30 seconds. A negative value (e.g. -10 %LEL) is displayed again as confirmation.

After the zero-point calibration of the DrägerSensor IR, the instrument should show 0 %LEL in the display. If this is not the case, a zero-point calibration must be performed on the instrument (see chapter 5.1.1 on page 14).

5.1.1 Zero point calibration

NOTICE

Ambient air can also be used instead of nitrogen or synthetic air to zero the sensor, provided it is insured that the ambient air contains no measured gas or any other gas for which the sensor may exhibit cross-sensitivity (see the details in the sensor data sheet). In this case, neither a gas cylinder nor a calibration adapter is required for the zero point calibration.

1. Select **Calibration > Zero Calibration** and confirm.
   The Maintenance signal is transmitted.
   The message **Apply zero gas** appears.
2. Apply zero gas (synthetic air or nitrogen) to the sensor.
3. Select **Next** and confirm.
   The current value is displayed.

After the displayed value is stable:

4. Set the value to 0 and confirm.
   The message **Please wait…** appears.
   The actual value is displayed.

- Actual value within the permissible range:
  - Select **Next** and confirm.
  - Shut off the test gas and remove the calibration adapter from the sensor or disconnect the hose.

5.1.2 Span calibration

1. Check which gas category is set (only for DrägerSensor IR, see also the Instructions for Use for the DrägerSensor IR).
1. Select **Calibration > Span calibration** and confirm.
2. Apply calibration gas (e.g., 50 % LEL methane).
   The current value is displayed.

After the displayed value is stable:

3. Set the value to 50 and confirm.
4. Shut off the test gas and remove the calibration adapter from the sensor or disconnect the hose.

5.2 Performing Auto Calibration

The device offers the option of an automatically sequenced calibration. This reduces the number of otherwise manual interactions with the device. The auto calibration is only suitable for experienced users, as calibration errors can occur here as a result of tightened procedures.

NOTICE

Not all of the available sensors and gases support auto calibration. If the function is not available, a manual calibration must be performed.

1. Select **Settings > Sensor > Autocal. set.** to enable or disable the function.
2. Supply fresh air or feed nitrogen or compressed air at a flow rate of 0.5 - 2.0 L/min to the sensor.

WARNING

It must be insured that during the zero point calibration, no measured gas is present in the supplied calibration gas. Particularly with a fresh air calibration, Dräger recommends performing a second, independent measurement. Some sensors may only be calibrated with synthetic air or nitrogen (observe the relevant sensor data sheets).

3. Select **Calibration > Auto cal.** and confirm.
   - **Please wait...** is displayed and a calibration of the zero point is performed automatically.
   - After a successful zero point calibration, the span calibration is started.
   - The calibration gas concentration, the units and, where appropriate, the calibration gas are displayed and can be changed.
4. Start the calibration with **Next**; **Back to menu** aborts the calibration.

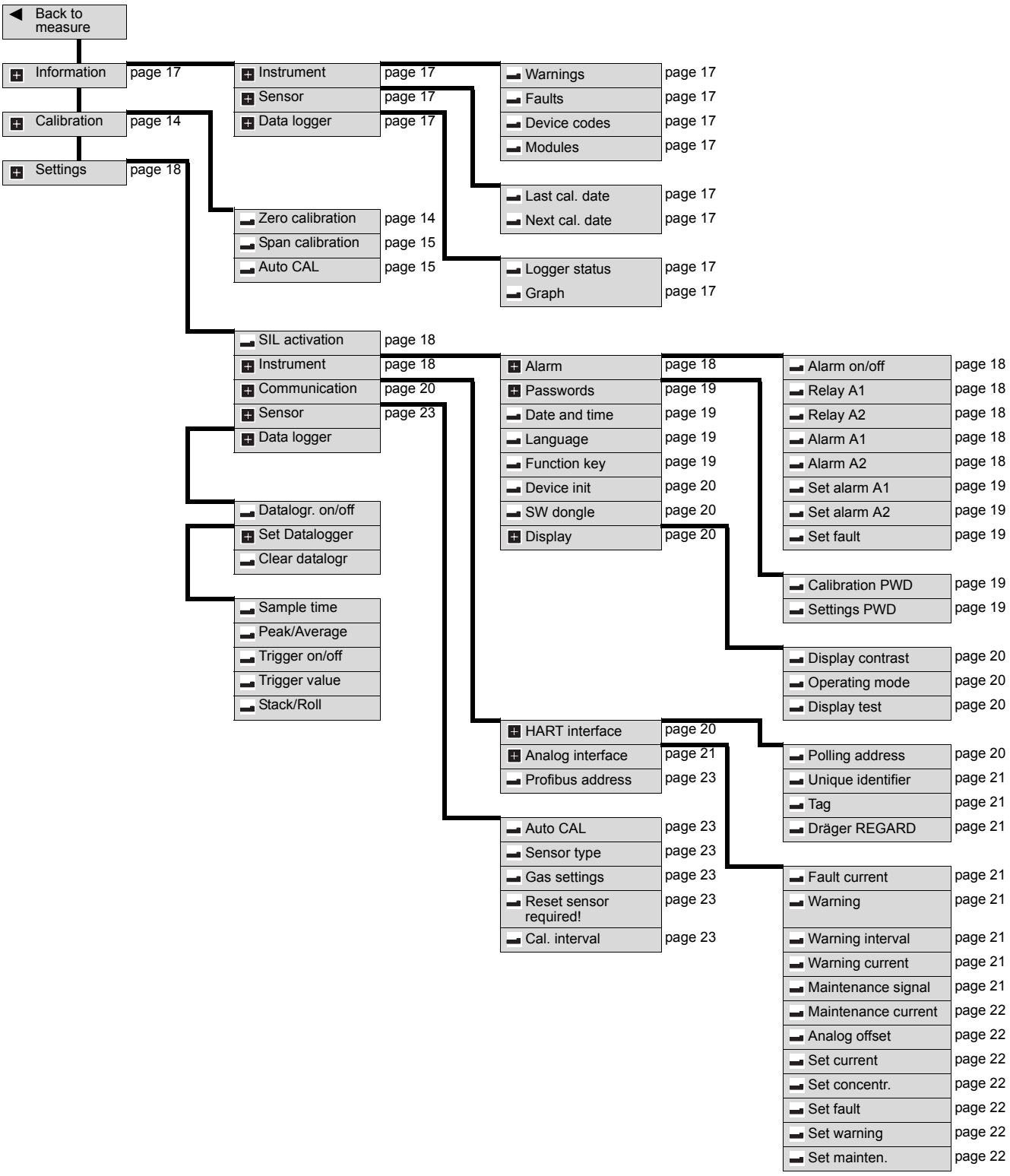
NOTICE

After 10 minutes, without confirmation the device reverts to measurement mode without performing a calibration.

5. Feed the relevant calibration gas to the sensor at a flow rate of 0.5 - 2.0 L/min.
   - When the measured value is stable, the device performs the calibration automatically.
   - After a successful calibration, the measurement and the message **Value OK?** are displayed
6. When the measurement is stable, shut off the calibration gas and wait until the measurement is below any possible alarm thresholds again.

- The calibration is performed again with **Redo**.
- Complete the calibration with **Accept value**.
  The device returns to the measurement mode.

6 Menu overview



7 Information menu

Specific data about the device, the sensor used and the measured gas are summarized in this menu. The menu can be accessed without a password. Changes to the data are not possible.

7.1 Device settings

7.1.1 Displaying warning messages

To display warnings in plain text with warning numbers, see chapter 9 on page 25.
The ⚠ symbol is displayed when there is a warning present.

- Select **Information > Instrument > Warnings** and confirm.
  Warnings are displayed in plain text.
  If several warnings are present, this is indicated in the upper right-hand corner of the display, e.g., 1/3 = Screen 1 of 3.

7.1.2 displaying fault messages

To display faults present in plain text with fault numbers, see chapter 9 on page 25.
The ☒ symbol is displayed when there is a fault present.

- Select **Information > Instrument > Faults** and confirm.
  Faults are displayed in plain text.
  If several faults are present, this is indicated in the upper right-hand corner of the display, e.g., 1/2 = Screen 1 of 2.

7.1.3 Displaying device codes

Display of codes for faults/warnings in a numerical table (hexadecimal).
The ☒ symbol is displayed when there is a fault present.

- Select **Information > Instrument > Device codes** and confirm.
  Faults are displayed as a hexadecimal numerical code in tabular form. If all the numerical groups are displayed as **00**, there are no faults or warnings present.

NOTICE

The fault code is very helpful for technical support and should always be stated in full in the event of a fault.

7.1.4 Displaying installed modules

Display of the installed hardware modules.

- Select **Information > Instrument > Modules** and confirm.
  A list of all possible modules is displayed. The installed modules are identified by a ■, those not installed by a □.
- Mark a module and request detailed information with OK.

7.2 Sensor information

This menu contains the functions for retrieving the calibration data.

7.2.1 Display last calibration date

Display the date of the last calibration.

- Select **Information > Sensor > Last cal. date** and confirm.
  The date of the last calibration is displayed

7.2.2 Display next calibration date

Display the date of the next calibration.

- Select **Information > Sensor > Next cal. date** and confirm.
  The date when the next calibration of the sensor is due is displayed.

7.3 Datalogger information (only with data dongle)

This menu contains the functions for querying the datalogger.

7.3.1 Displaying the datalogger status

- Select **Information > Datalogger > Logger status** and confirm.
  The current status of the datalogger is displayed: Datalogr. : on or off (datalogger on or off)
- To switch the datalogger on/off, see chapter 8.5.1 on page 24.

7.3.2 Displaying a graph of measured values

Show the measurements from the sensor on a 15-minute time axis.

- Select **Information > Datalogger > Graph** and confirm.

8 Settings menu

This menu contains all the functions that are required for the individual configuration of the device.

8.1 Switching SIL lock on or off

NOTICE

SIL lock is only available for certain sensors (see also the sensor data sheets or the Dräger Polytron 8X00 Safety Manual).

With this function, the device can be protected against unauthorized changes to the configuration with a password. Changing the configuration (e.g., changing the measurement range from 100 %LEL to 50 %LEL) will cause the device to display all the safety-relevant parameters to the user once more before it returns to the measurement mode. The correctness of the parameters and settings must be confirmed.

1. Select **Settings > Instrument > Set SIL**.
2. Select the desired state **On** or **Off** and confirm.

NOTICE

When SIL is activated, the device displays all the important parameters and setting before returning to measurement mode. Check the parameters and settings carefully and confirm.

8.2 Device settings

8.2.1 Alarm settings (only with installed relay module)

Alarms issued via relays and LEDs.

CAUTION

In the normal state, the relays in the relay module are energized. That is, the relays change their state if the power supply is interrupted!

Switching the alarm on or off

1. Select **Settings > Instrument > Alarm > Alarm on/off**.
2. Select the desired state **On** or **Off** and confirm.

CAUTION

If the alarm is inactive, the alarm state will not be issued by the LEDs or the relay interface! A warning message ▯ will be shown on the display!

Configuring Relay A1 or A2

This function is used to define whether the alarm relay is energized in standard operation or in an alarm state. If the configuration of the relay is set to "Normally energized", the corresponding relay contact is closed in the normal case and drops out in the event of an alarm. This configuration results in an alarm being triggered in the event of a loss of power to the transmitter (fail-safe). The fault relay is factory-configured to "Normally energized" and cannot be changed.

1. Select **Settings > Instrument > Alarm > Relay A1** or **Relay A2** and confirm.
2. Select **Normal energy supply** oder **Energy supply during alarm** and confirm.

Configuring Alarm A1 or A2

1. Select **Settings > Instrument > Alarm > Alarm A1** or **Alarm A2** and confirm.
2. Select the line for entering the alarm limit and confirm.
3. Set the threshold and confirm.
   The setting for the alarm threshold is displayed.
4. Select **Next** and confirm.
   The setting for the alarm direction is displayed.
5. Select **Rising** or **Falling** and confirm.
6. Select **Next** and confirm.
   The setting for the alarm direction is displayed.
7. Select **Latching** or **Non Latching** and confirm.
8. Select **Next** and confirm.
   The setting for the acknowledgement is displayed.
9. Select **Acknowledgeable** or **NonAcknowledgeabl** or **PreAcknowledgeabl** and confirm.
10. Select **Next** and confirm.
    The function for setting the A1 hysteresis is opened.

NOTICE

This function permits the setting of a zone within which a triggered relay maintains its status until the gas concentration is outside the zone. This function prevents relays from chattering at an alarm threshold.
Example: A2 at 40 %LEL methane
Maximum possible hysteresis: 3 %LEL
Alarm activation at measured values ≥40 %LEL
Alarm deactivation at measured values ≤37 %LEL (40 %LEL - 3 %LEL)

11. Select the line for entering the hysteresis and confirm.
12. Set the hysteresis for A1 and confirm.
    The hysteresis setting for A1 is displayed.
13. Select **Next** and confirm.
    The settings for A1 are displayed.
14. Select and confirm with **Confirm**.
    The settings for the A1 alarm are now complete.

The functional relationship between the various settings is explained in the following table:

Latching and acknowledgeable	The alarm must be acknowledged manually. The alarm can be acknowledged when the alarm condition is still present.
Latching and not acknowledgeable	The alarm must be acknowledged manually. The alarm can only be acknowledged when the alarm condition is no longer present.
Latching and pre-acknowledgeable	The alarm must be acknowledged manually. The alarm can be acknowledged when the alarm condition is still present but will only be reset when the alarm condition is no longer present.
Non-latching and acknowledgeable	The alarm is acknowledged automatically when there is no longer any alarm condition present, or it can be acknowledged manually.
Non-latching and not acknowledgeable	The alarm is acknowledged automatically when there is no longer any alarm condition present. The alarm cannot be acknowledged manually.
Non-latching and pre-acknowledgeable	Corresponds to the alarm behavior for "Non-latching" and "Not acknowledgeable".

Testing Alarm A1

NOTICE

When the function **Set Alarm A1** is exited in the menu, the Polytron 8200/8310 reverts automatically to measurement mode.

This function simulates the A1 alarm status.

1. Select **Settings > Instrument > Alarm > Set Alarm A1** and confirm.
2. Select **On** or **Off** and confirm.

When the function is activated, the relay and the interface are set to the A1 alarm status and the red LED gives single flashes.

Testing Alarm A2

NOTICE

When the function **Set Alarm A2** is exited in the menu, the Polytron 8200/8310 reverts automatically to measurement mode.

This function simulates the A2 alarm status.

1. Select **Settings > Instrument > Alarm > Set Alarm A2** and confirm.
2. Select **On** or **Off** and confirm.

When the function is activated, the relay and the interface are set to the A2 alarm status and the red LED gives double flashes.

Testing Fault status

NOTICE

When the function **Set fault** is exited in the menu, the Polytron 8200/8310 reverts automatically to measurement mode.

This function simulates the Fault alarm.

1. Select **Settings > Instrument > Alarm > Set fault** and confirm.
2. Select **On** or **Off** and confirm.

When the function is activated, the Fault relay and the 4-20 mA interface are set to the fault current and the yellow LED lights.

8.2.2 Changing passwords

The passwords for calibration (zero and span calibrations) and for the settings (full configuration) can be defined in this menu.

1. Select **Settings > Instrument > Passwords > Calibration/ Settings PWD** and confirm.
2. Select the line for the password settings and confirm.
3. Set the password and confirm.
   The setting for the password is displayed.
4. Select **Confirm** and confirm.

8.2.3 Setting the date and time

1. Select **Settings > Instrument > Date and time** and confirm.
2. Select the desired line and confirm in order to switch to the Change mode.
3. Set each digit and confirm each setting.
4. Select **Confirm** and confirm.

8.2.4 Changing the display language

1. Select **Settings > Instrument > Language** and confirm.
2. Select the desired language from the list and confirm.

8.2.5 Configuring the function key

This function is used to assign a predefined function to the ▲ key. The selected function is activated by briefly taping the ▲ key.

1. Select **Settings> Instrument > Function key** and confirm.
2. Select the desired function and confirm.

- Repeating the confirmation deactivates the selected function.
- If **Bumptest** is selected:
  The maintenance symbol 🔧 is shown on the right hand side of the display and the maintenance signal is output. Repeating the confirmation ends the bump test and the device reverts to the normal measurement mode.
- In measurement mode, the selected function can be activated by briefly taping ▲.

Selection options:

Graph (only with datalogger)	The measurements from the sensor are displayed graphically on a time axis (see chapter 7.3.2 on page 17).
Faults	Faults are displayed in plain text (see chapter 7.1.2 on page 17).
Warnings	Warnings are displayed in plain text (see chapter 7.1.1 on page 17).
Bump test	The bump test allows gas to be applied without an alarm being issued. The maintenance signal is output on the 4-20 mA output.
Sensor vitality	Shows the remaining sensor vitality (only available for certain sensors).

8.2.6 Resetting the device to factory settings

The following device parameters are reset to the factory settings with this function (see chapter 12.3 on page 29).

- Alarm parameters
- Passwords
- Language
- Function key
- HART interface
- Data logger
- Analog interface
- Relay configuration

1. Select **Settings > Instrument > Device init.** and confirm.
2. Select **Confirm** and confirm in order to reset the device to the factory settings.

8.2.7 Deactivating the software dongle

This function allows the SW dongles to be deactivated before they are removed or in the event of a fault.
A dongle can only be reactivated by switching the power to the device off and on.

1. Select **Settings > Instrument > SW dongle > Dongle datalogger/Dongle sensortest/Dongle diagnostic** and confirm.
2. Select **Deactivate func.** and deactivate Dongle datalogger/ Dongle sensortest/Dongle diagnostic with ⓞⓚ.

8.2.8 Display settings

Changing the contrast

1. Select **Settings > Instrument > Display > Display contrast** and confirm.
2. Change the contrast and confirm.

Changing the display mode
The display of measured values can be turned on or off with this function.

1. Select **Settings > Instrument > Display > Display mode** and confirm.
2. Select **Standard** or **Non display** and confirm.

If "Non display" has been selected, the display shows the start screen and the symbols.

If the relay option is set and an alarm is triggered, the display shows the current gas concentration and the red LED flashes, regardless of the selected display mode.

Switching the display test on or off
The function of the display and the LEDs is tested with this function.

1. Select **Settings > Instrument > Display > Displaytest** and confirm.
2. Select **On** or **Off** and confirm.

When this function is activated, the display is shown inverted and all the LEDs are lit.

8.3 Communication settings

8.3.1 Settings for the HART interface (only for devices with the optional HART interface)

This group contains the setting functions for the HART interface.

Setting the polling address
The polling address configures the device for analog operation (4 to 20 mA) or multidrop operation. Analog operation (4 to 20 mA) is activated by setting the polling address to 0. For multidrop operation the polling address must be configured to a value between 1 and 15, which will result in the analog interface being deactivated and set to a constant current of approx. 1 mA. To allow the control unit to request the Unique Identifier (unique HART address) with HART command #0, all the devices on a line must be configured with different polling addresses. It is advisable to choose a sequence starting with 1 and incrementing continuously.
This setting corresponds to HART command #6 (Write Polling Address).

1. Select **Settings > Communication > HART interface > Polling address** and confirm.
2. Select the address line for the entry and confirm in order to switch to the Change mode.
3. Set the polling address and confirm.
4. Select **Confirm** and confirm.

Displaying the Unique Identifier
This function enables reading of the Unique Identifier (unique HART address), which has to be known for almost all the HART addressing commands. However this information is only required for those systems that are not able to read back the Unique Identifier using HART command #0 in Short-Frame Format or HART command #11. The display corresponds to the address for HART command #0 (Read Unique Identifier) or #11 (Read Unique Identifier associated with Tag).

- Select **Settings > Communication > HART interface > Unique Identifier** and confirm.
  The Unique Identifier is displayed.

Changing the measuring point name
The tag can be used to identify special devices. It can contain up to 8 alphanumeric characters. The tag can also function as an address for reading the unique identifier from the device using HART command #11 (Read Unique Identifier Associated With Tag), even when the polling address is unknown.
This requires that a unique tag has previously been configured.

1. Select **Settings > Communication > HART interface > Tag** and confirm.
2. Select the tag line for the entry and confirm.
3. Set the tag and confirm.
4. Select **Confirm** and confirm.

Selecting Dräger REGARD
This function enables switching between different HART protocols.

NOTICE

REGARD SW 2.0 is the standard setting. REGARD SW 1.4 must be set on REGARD controllers with SW 1.4.

1. Select **Settings > Communication > HART interface > Dräger REGARD** and confirm.
2. Select **REGARD SW 2.0** or **REGARD SW 1.4** and confirm.

8.3.2 Settings for the analog interface

The test and setting functions for the analog interface are summarized in this menu.

Setting the fault current
This function is used to set the current for the fault signal on the analog interface.

1. Select **Settings > Communication > Analog interface > Fault current** and confirm.
2. Select the fault current line and confirm.
3. Set the currrent and confirm.
4. Select **Confirm** and confirm.

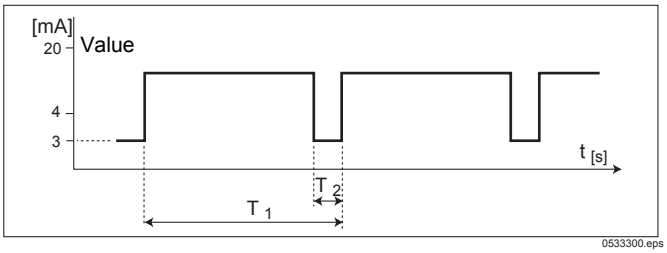
Switching the warning signal on or off
This function is used to switch the warning signal on the analog interface on and off. If an existing warning is to be output over the analog interface, the warning signal must be turned on. During a warning, the current on the analog interface is switched to the "Warning" status for one second. The measurement is transmitted for the rest of the time. The interval between warning signals and the analog signal phase can be customized.

To switch the warning signal on or off:

1. Select **Settings > Communication > Analog interface > Warning** and confirm.
2. Select **On** or **Off** and confirm.

Setting the warning interval
This function is used to set the interval between the warning signals and the analog interface.

1. Select **Settings > Communication > Analog interface > Warning interval** and confirm.
2. Select line **T1** for the entry and confirm.
3. Set the time and confirm.
   The setting for Time T1 is displayed.
4. Select **Next** and confirm.
5. Select line **T2** for the entry and confirm.
6. Set the time and confirm each setting.
   The setting for Time T2 is displayed.
7. Select **Confirm** and confirm.



Setting the warning current
This function is used to set the current for the warning signal on the analog interface.

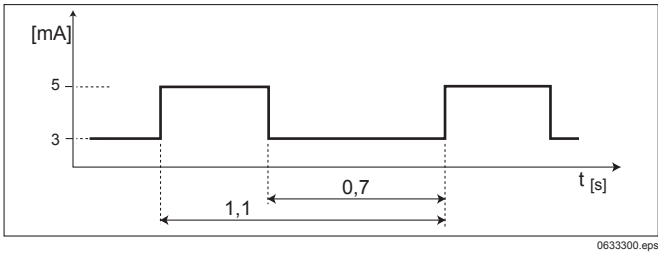
1. Select **Settings > Communication > Analog interface > Warning current** and confirm.
2. Select the current line for the entry and confirm.
3. Set the currrent and confirm.
   The setting for the warning current is displayed.
4. Select **Confirm** and confirm.

Changing the maintenance signal type
This function is sets the type of signal used on the analog interface for the maintenance signal.

1. Select **Settings > Communication > Analog interface > Maint. signal** and confirm.
2. Select **static** or **dynamic** signal type and confirm.

NOTICE

The **static** signal type is a constant current. The current can be configured.
The **dynamic** signal type is a square wave signal with the following characteristics:



Setting the maintenance current
This function is used to set the current for the maintenance signal on the analog interface.

1. Select **Settings > Communication > Analog interface > Maint. current** and confirm.
2. Select the current line for the entry and confirm.
3. Set the currrent and confirm.
   The setting for the maintenance current is displayed.
4. Select **Confirm** and confirm.

NOTICE

The maintenance current can only be set if the maintenance signal has been set to static. This function is not available otherwise.

Setting the 4-20 mA offset
This function can be used to set an adjustable offset current on the analog interface. The offset is constant over the entire range of the output signal.

1. Select **Settings > Communication > Analog interface > Analog offset** and confirm.
2. Select the current line for the entry (max. range: -0.2 to 1.5 mA) and confirm.
3. Set the currrent and confirm.
   The setting for the 4-20 mA offset is displayed.
4. Select **Confirm** and confirm.

Test functions for the analog interface

NOTICE

Alarms in the central controller may be triggered by these functions! If necessary, the alarms in the central controller must be disabled beforehand.

Setting current signals
Using this function, various currents in the range from 0 to 22 mA can be set on the analog interface.

1. Select **Settings > Communication > Analog interface > Set current** and confirm.
2. If the alarm in the control unit is disabled, confirm the message **Disable all alarm settings**.
3. Select the current line for the entry and confirm.
4. Set the currrent and confirm.
   The setting for the current is displayed.
5. Select **Next** and confirm.
6. Select **Set current out** or **Current off** and confirm.
7. Select **Next** and confirm. The function is terminated.
8. After the alarm settings in the control unit have been re-enabled, confirm the **Enable all alarm settings** message.

Setting the concentration
This function is used to set various concentrations in the range between 0 and 100 % of the selected unit of measure. The current output is set to correspond to the selected concentration.

1. Select **Settings > Communication > Analog interface > Set concentr.** and confirm.
2. If the alarm in the control unit is disabled, confirm the message **Disable all alarm settings**.
3. Select the concentration line for the entry and confirm.
4. Set the concentration and confirm.
   The setting for the concentration is displayed.
5. Select **Next** and confirm.
6. Select **Define concentr. output** or **Conc. off** and activate.
7. Select **Next** and confirm. The function is terminated.
8. After the alarm settings in the control unit have been re-enabled, confirm the **Enable all alarm settings** message.

Testing the Fault signal
This function is used to set the analog interface for the fault signal.

1. Select **Settings > Communication > Analog interface > Set fault** and confirm.
2. Select **On** or **Off** and confirm.
   The current for the Fault signal will be transmitted on the analog interface.

Testing the warning signal
This function is used to set the analog interface for the warning signal.

1. Select **Settings > Communication > Analog interface > Set warning** and confirm.
2. Select **On** or **Off** and confirm.
   The current for the warning signal will be transmitted on the analog interface.

Testing the maintenance signal
This function is used to set the analog interface for the maintenance signal.

1. Select **Settings > Communication > Analog interface > Set mainten.** and confirm.
2. Select **On** or **Off** and confirm.
   The current for the maintenance signal will be transmitted on the analog interface.

8.3.3 Profibus address

Not yet active - for future functions.

8.4 Sensor settings

8.4.1 Switching Auto CAL on or off

NOTICE

The auto-calibration from the **Calibration** menu is only available if this function is enabled.

1. Select **Settings > Sensor > Set auto calibration** and confirm.
2. Select **On** or **Off** and confirm.

8.4.2 Setting the sensor type (for DrägerSensor DD only)

This function is used to set the sensor type.

1. Select **Settings > Sensor > Sensor type** and confirm.

8.4.3 Changing the gas settings

Settings for gas type, measuring range and measurement units can be made in this menu.

1. Select **Settings > Sensor > Gas setting** and confirm.
2. Select the measured gas from the list and confirm.
   The measurement units display will be shown.
3. Select the measurement units and confirm.
   The full scale reading display will be shown.
4. Set the full scale reading and confirm.
   The setting for the full scale reading is displayed.
5. Select **Next** and confirm.
   an overview of the new gas settings is displayed.

- Return to the previous view with **Previous** or confirm the settings with **Confirm**.

Information about measurement units

The Polytron 8200/8310 represents the measured value in various optional units. The following are available:

- %LEL
- %LIE
- %UEG

The Polytron 8000 automatically calculates the correct value.

Information about the 20 mA measuring range

The full scale reading can be set with this function. At the full scale reading set, the device outputs 20 mA on the 4-20 mA interface.

8.4.4 Resetting the sensor to factory settings

This function resets all the sensor parameters to the factory default settings (see chapter 12.3 on page 29).

1. Select **Settings > Sensor > Reset sensor required!** and confirm.
2. Select **Confirm** and confirm.

8.4.5 Setting the calibration interval

NOTICE

The calibration interval can be set between 0 and 720 days.

1. Select **Settings > Sensor > Calibration interval** and confirm.
2. Set the calibration interval and confirm.

8.5 Datalogger settings (only with data dongle)

NOTICE

The functions are only available if the Polytron 8000 is fitted with the data dongle (Order Number 83 17 618), see chapter 3.10 on page 10.

The datalogger has a storage capacity of approx. 3000 measurements. At a sampling interval of 1 minute, this would allow monitoring for approx. 50 hours. The monitoring time can be significantly increased if the **Trigger** function is enabled.

The results in the datalogger can only be evaluated with the PolySoft 8000 PC software. An evaluation of the datalogger contents over the last 15 minutes is available in the menu under **Information > Datalogger > Graph** (see chapter 7.3.2 on page 17).

8.5.1 Switching the datalogger on or off

1. Select **Settings > Datalogger > Datalogr. on/off** and confirm.
2. Select **On** or **Off** and confirm.

8.5.2 Setting up the datalogger

Setting the sampling interval

1. Select **Settings > Datalogger > Datalogr. on/off > Sample time** and confirm.
2. Select the sample time and confirm.

Setting peak/average

1. Select **Settings > Datalogger > Set datalogger > Peak/average** and confirm.
2. Select the desired function and confirm.

Peak value	The measured maximum (for O_2, the minimum value) value of the concentration within the selected sampling interval is stored.
Average	The average value of all the concentrations measured within the selected sampling time is stored.

Switching the trigger on or off

1. Select **Settings > Datalogger > Set datalogger > Trigger on/off** and confirm.
2. Select **On** or **Off** and confirm.

On	Concentrations will only be stored if they exceed (relative to the last stored value) a threshold set under Trigger Value.
Off	The measurements made within the set sampling time are always stored.

Setting the trigger threshold

The trigger threshold is specified as a percentage of the full scale reading.
Example: A trigger threshold of 2 % is entered for a full scale reading of 500 ppm. Consequently the datalogger will only store measurements if they deviate (relative to the last stored value) by 10 ppm.

1. Select **Settings > Datalogger > Datalogr. on/off > Trigger value** and confirm.
2. Set the trigger value and confirm.

Setting the storage mode

1. Select **Settings > Datalogger > Set Datalogger > Stack/Roll** and confirm.
2. Select the desired condition and confirm

Overwrite	When the capacity of the datalogger is used up, the older data will be overwritten.
Hold	When the capacity of the datalogger is used up, no more data can be stored. An appropriate warning is issued.

8.5.3 Clearing the datalogger

1. Select **Settings > Datalogger > Clear Datalogr.** and confirm.
2. To clear the datalogger, select **Confirm** and confirm.

9 Troubleshooting

9.1 Fault reference

Fault number	Cause	Remedy
#001 #003 #004 #005 #011 - #014 #020 - #024 #043 #060 #067	Serious device fault, various causes.	Have the device checked by DrägerService®[1].
#002 #025 - #027 #030 - #034 #041 #042 #044 #050 #052 #081 #085	Serious data error in the device, various causes.	Reset the device to factory settings (see chapter 8.2.6 on page 20). If this fault occurs again: Have the device checked by DrägerService.
#10	4-20 mA interface cable not connected.	Disconnect the powwer supply, connect the 4-20 mA interface and reconnect the power supply.
#045	Device not detecting any sensor.	Check contacts. If this fault occurs again: Have the device checked by DrägerService.
#051 #054	Faulty zero-point.	Perform zero-point calibration (see chapter 5.1.1 on page 14).
#055	Faulty span calibration was performed.	Perform new span calibration (see chapter 5.1.2 on page 15).
#076 #080 - #084	Device fault.	Check contacts. If this fault occurs again: Have the device checked by DrägerService.

1 DrägerService® is a registered trademark of Dräger.

9.2 Warning reference

Warning number	Cause	Remedy
#101	Datalogger in Stack mode is 100 % full and is not logging any more data.	Read out the data, clear the datalogger and start again.
#102	Datalogger in Stack mode is 90 % full.	Read out the data as soon as possible, clear the datalogger and start again.
#103 #106	Data error in the device. Functions such as the datalogger or dongle functions may no longer be available.	Reset the device to factory settings (see chapter 8.2.6 on page 20). If this fault occurs again: Have the device checked by DrägerService.
#105	Device fault.	Have the device checked by DrägerService.
#104	No valid date or time set.	Set time and date (see chapter 8.2.3 on page 19).
#107	Battery almost used up.	Have the device checked by DrägerService.
#110 #111 #112	SW dongle has been removed without logging out.	Disable SW dongle (see chapter 8.2.7 on page 20).
#113	Alarms disabled.	Enable alarms (see chapter 8.2.1 on page 18).
#137	Device fault.	Restart. If this fault occurs again: Have device checked by DrägerService.
#164 #165	Sensor warm-up phase has not ended yet. Increased measurement error must be expected.	Wait until the sensor has warmed up.
#167 #170	Calibration interval expired.	Recalibrate the device (see chapter 5.1 on page 14).

10 Maintenance

10.1 Maintenance intervals

10.1.1 During commissioning

- Check calibration.
- Check signal transmission to controller and triggering of alarms.

10.1.2 Every 6 months

- Inspection by trained service personnel.

The inspection intervals must be established in each individual case and shortened if necessary, depending on technical safety considerations, engineering conditions, and the technical requirements of the equipment.
Contact DrägerService if you wish to take out a service contract and have any repairs carried out.

10.1.3 As required

- Change the sensor, see chapter 10.2 on page 27.

10.2 Changing the sensor

WARNING

As a matter of principle, always check a newly installed sensor with measured gas to insure correct operation.

CAUTION

When the sensor is changed, all settings and parameters must be checked for correctness.

The sensor is changed as follows:

1. Switch off the power to the device or declassify the area according to the local regulations.
2. Release the set screw and unscrew the housing cover from the device.
3. Lift the handle and remove the enclosure with the main electronics.
4. Disconnect the sensor cable.
5. Unscrew the DrägerSensor.
6. Pass the sensor cable through the threaded connection in the housing.
7. Screw in the DrägerSensor.

WARNING

Five threads must be engaged to insure explosion protection (see chapter 12.1 on page 29).

8. Plug the sensor cable into the socket.
9. Re-fit the sensor electronics and enclosure.
10. Screw the housing cover on again and tighten the set screw.
11. Switch on the power to the device.
12. If necessary, switch off SIL activation (see chapter 8.1 on page 18).
13. Calibrate the device if necessary (see chapter 5 on page 14).
14. If required, switch on SIL activation (see chapter 8.1 on page 18).

10.3 Changing the main electronics

CAUTION

When the main electronics are changed, all settings and parameters must be checked for correctness.

1. Switch off the power to the device or declassify the area according to the local regulations.
2. Release the set screw and unscrew the housing cover from the device.
3. Lift the handle and remove the enclosure with the main electronics.
4. Remove the protective caps for the connectors.
5. Unscrew the connector locking ring for the power supply and relay and withdraw the connector.
6. Change the main electronics.
7. Plug the sensor cable and the connector for the power supply and relay into the corresponding sockets and screw them tight.
8. Re-fit the dust caps for the connectors.
9. Re-fit the sensor electronics and enclosure.
10. Screw the housing cover on again and tighten the set screw.
11. Switch on the power to the device.
12. Check and adjust the configuration as required.
13. Calibrate the device if necessary (see chapter 5 on page 14).

11 Disposal

Disposal of electrical and electronic equipment:
EU-wide regulations governing the disposal of electric and electronic appliances which have been defined in the EU Directive 2002/96/EC and in national laws have been effective from August 2005 and apply to this device. Common household appliances can be disposed of using special collecting and recycling facilities. However, as this device has not been registered for household usage, it must not be disposed of through these means. The device can be returned to your national Dräger Safety Sales Organization for disposal. Please do not hesitate to contact the above if you have any further questions on this issue.

12 Technical data

CAUTION

Specifications and restrictions in the Instructions for Use and/or data sheets for the sensors used must be observed. For SIL applications the Dräger Polytron 8X00 Safety Manual must be observed.

The measuring range and performance characteristics are dependent on the sensor installed, see the Instructions for Use and/or data sheets for the sensors used.

Signal transmission to the central controller	
Analog	
Output current	4 mA to 20 mA
Drift below zero-point	3.8 mA to 4 mA
Measuring range exceeded	20 mA to 20.5 mA
Device malfunction	≤1.2 mA
Fault on analog output	>21 mA
Maintenance signal	3.4 mA constant signal or 1 Hz modulation between 3 and 5 mA (selectable)
Supply voltage	
Operating voltage	3-wire shielded cable, 10 to 30 V DC
Inrush current	2.5 A for 0.8 ms at 24 V DC, 10 Ω conductor resistance
Operating current (max.)	
with DrägerSensor Ex DD	105 mA at 24 V DC, no relay, sensor not remote 145 mA at 24 V DC, with relay, remote sensor
with DrägerSensor Ex LC	130 mA at 24 V DC, no relay, sensor not remote 165 mA at 24 V DC, with relay, remote sensor
with DrägerSensor IR	145 mA at 24 V DC, no relay, sensor not remote 185 mA at 24 V DC, with relay, remote sensor
Relay design (optional)	SPDT, 5 A at 230 V AC, 5 A at 30 V DC, resistive load For safety-related applications (SIL2), the maximum contact rating is reduced (see also the Dräger Polytron 8X00 Safety Manual).
Housing	NEMA 4X
Protection Class	IP 65/66/67
Dimensions (LxWxD)	
Without e-Box (DrägerSensor LC, DD)	approx. 180 x 150 x 130 mm (7" x 5.8" x 5.1")
With e-Box (DrägerSensor LC, DD)	approx. 185 x 180 x 190 mm (7.3" x 7.1" x 7.4")
Without e-Box (DrägerSensor IR)	approx. 295 x 150 x 130 mm (11,6" x 5,8" x 5,1")
With e-Box (DrägerSensor IR)	approx. 300 x 180 x 190 mm (11,9" x 7,1" x 7,4")
Weight	
Without e-Box, aluminum	approx. 2.2 kg (4.9 lbs.)
Without e-Box, stainless steel 316	approx. 4.0 kg (8.8 lbs.)
With e-Box, aluminum	approx. 3.5 kg (7.7 lbs.)
With e-Box, stainless steel 316	approx. 5.4 kg (11.9 lbs.)
Display	Resolution 128 x 64, back-lit

Environmental conditions	Specifications for the sensor: see sensor data sheet
Pressure	700 to 1300 hPa (20.7 to 38.4 in. Hg)
Humidity	0 to 100 % R. H., non-condensing
Temperature	
DrägerSensor DD, LC no relay	-40 to +80 °C (-40 to +176 °F)
DrägerSensor DD, LC with relay	-40 to +70 °C (-40 to +158 °F)
DrägerSensor IR no relay	-40 to +65 °C (-40 to +149 °F)
DrägerSensor IR with relay	-40 to +65 °C (-40 to +149 °F)
Environmental influences	See respective sensor data sheets.

12.1 Torques

(The torques are valid for the aluminum and stainless steel 316 variants)

Part	Torque Lb. In.	Torque Nm
Housing cover	min. 266	min. 30
Sensors	min. 266	min. 30
Plug	min. 266	min. 30
Cable bushing	min. 443	min. 50
Device to e-Box	71	8

If an optional e-Box is being used, fasten the device securely to the e-Box with 4 screws and a tightening torque of 8 Nm.

12.2 Tightening torque and cable size for field wiring terminals

Electronic		
Torque Lb. In.	**Cable size in AWG**	**Cable size in mm^2**
All field wiring terminals 4.4–7.0 (0.5–0.8 Nm)	20–12	0.5–2.5

12.3 Factory settings

12.3.1 Alterable settings for the Polytron 8200/8310

Menu	Standard setting	
	DrägerSensor DD, IR	**DrägerSensor LC**
A1 Alarm	20 %LEL	2.0 %LEL
A2 Alarm	40 %LEL	4.0 %LEL
A1 Relay alarm: Direction	Rising	Rising
A2 Relay Alarm: Direction	Rising	Rising
A1 latching mode	Non-latching	Non-latching
A2 latching mode	Latching	Latching
A1 Acknowledgement mode	Acknowledgeable	Acknowledgeable
A2 Acknowledgement mode	Not acknowledgeable	Not acknowledgeable
A1 enrg / wired in e-Box	Energized / NO	Energized / NO
A2 enrg / wired in e-Box	Energized / NO	Energized / NO
Maintenance password	0000	0000
LCD setting	on	on
Configuration/SIL password	_ _ _2	_ _ _2
SIL status	Off	Off
Language	English	English
Fault current	1.2 mA	1.2 mA
Warning current	3.0 mA	3.0 mA
Maintenance current	3.4 mA	3.4 mA
HART address	0	0
Auto-cal.	Off	Off
Calibration interval	360	360
Function key	Faults	Faults

12.3.2 Unalterable settings

Fault	Meaning
Fault relay / wired in e-Box	Energized / NO
Yellow Fault LED	Lights when a fault is present (see chapter 9 on page 25).
Red Alarm LED	Gives single flashes when an A1 alarm is present. Gives double flashes when an A2 alarm is present. If an alarm is configured as acknowledgeable and the alarm is acknowledged, the LED lights. Alarm hierarchy: A2 has a higher priority for the LED than A1. However the A1 and A2 relays operate independently of one another, i.e. if A1 is acknowledgeable and A2 is not and the gas concentration is so high that A1 and A2 are triggered, an acknowledgement results in the A1 relay dropping out. However the red LED continues to give double flashes as long as the A2 condition exists.

13 Order list

13.1 Dräger Polytron 8200/83X0

Name and description	Order Number
Dräger Polytron 8200 DD d A 4-20/HART	45 44 439
Dräger Polytron 8200 DD d A 4-20/HART Relay	45 44 440
Dräger Polytron 8200 DD d S 4-20/HART	45 44 448
Dräger Polytron 8200 DD d S 4-20/HART Relay	45 44 449
Dräger Polytron 8200 DD e A 4-20/HART	45 44 457
Dräger Polytron 8200 DD e A 4-20/HART Relay	45 44 458
Dräger Polytron 8200 DD e S 4-20/HART	45 44 466
Dräger Polytron 8200 DD e S 4-20/HART Relay	45 44 467
Dräger Polytron 8200 Remote DD e A 4-20/HART	45 44 511
Dräger Polytron 8200 Remote DD e A 4-20/ HART Relay	45 44 512
Dräger Polytron 8200 Remote DD e S 4-20/HART	45 44 520
Dräger Polytron 8200 Remote DD e S 4-20/ HART Relay	45 44 521
Dräger Polytron 8200 LC d A 4-20/HART	45 44 475
Dräger Polytron 8200 LC d A 4-20/HART Relay	45 44 476
Dräger Polytron 8200 LC d S 4-20/HART	45 44 484
Dräger Polytron 8200 LC d S 4-20/HART Relay	45 44 485
Dräger Polytron 8200 LC e A 4-20/HART	45 44 493
Dräger Polytron 8200 LC e A 4-20/HART Relay	45 44 494
Dräger Polytron 8200 LC e S 4-20/HART	45 44 502
Dräger Polytron 8200 LC e S 4-20/HART Relay	45 44 503
Dräger Polytron 8200 Remote e A 4-20/HART	45 44 529
Dräger Polytron 8200 Remote LC e A 4-20/ HART Relay	45 44 530
Dräger Polytron 8200 Remote LC e S 4-20/HART	45 44 538
Dräger Polytron 8200 Remote LC e S 4-20/ HART Relay	45 44 539
Dräger Polytron 8310 d A 4-20/HART	45 44 807
Dräger Polytron 8310 d A 4-20/HART Relay	45 44 808
Dräger Polytron 8310 d S 4-20/HART	45 44 816
Dräger Polytron 8310 d S 4-20/HART Relay	45 44 817
Dräger Polytron 8310 e A 4-20/HART	45 44 825
Dräger Polytron 8310 e A 4-20/HART Relay	45 44 826
Dräger Polytron 8310 e S 4-20/HART	45 44 834
Dräger Polytron 8310 e S 4-20/HART Relay	45 44 835
Dräger Polytron 8310 Remote e A 4-20/HART	45 44 843

Name and description	Order Number
Dräger Polytron 8310 Remote e A 4-20/ HART Relay	45 44 844
Dräger Polytron 8310 Remote e S 4-20/HART	45 44 852
Dräger Polytron 8310 Remote e S 4-20/ HART Relay	45 44 853
e-Box standard version (power only)	68 12 420
e-Box power / relay / remote version (with 2 cable glands)	68 12 275

13.2 Sensors for remote versions

NOTICE

The sensors are not included with the remote versions.

Name and description	Order Number
For Polytron 8200 DD remote e	
Sensing head, Polytron SE Ex PR M1 DD	68 12 711
Sensing head, Polytron SE Ex PR M2 DD	68 12 710
Sensing head, Polytron SE Ex PR M3 DD	68 12 718
Sensing head, Polytron SE Ex HT M DD	68 12 720
For Polytron 8200 LC remote e	
Sensing head, Polytron SE Ex LC M1 DD	68 12 722
Sensing head, Polytron SE Ex LC M2 DD	68 12 721
Sensing head, Polytron SE Ex LC M3 DD	68 12 719
For Polytron 8310 remote e	
Sensing head, DrägerSensor IR, complete set e	68 11 165
Sensing head, DrägerSensor IR, complete set e2	68 11 265

13.3 Replacement sensors (except for remote versions)

Name and description	Order Number
DrägerSensor Ex DD NPT	68 12 380
DrägerSensor Ex LC NPT	68 10 675
DrägerSensor IR NPT	68 11 901

13.4 Accessories

Name and description	Order Number
Accessories for Polytron 8200/83X0	
D-Junction Box, aluminum	45 44 099
D-Junction Box, stainless steel 316	45 44 098
Duct mounting kit, Polytron 5000 for DrägerSensor DD, LC, IR	68 12 725
Pipe mounting kit, Polytron 5000/8000	45 44 198
IR connection kit, 5000/8000	45 44 197
Magnetic wand with key chain	45 44 101
Accessories for DrägerSensor DD, LC	
Splash guard	68 12 510
Calibration adapter PE	45 09 314
Calibration adapter PE, Europe	68 06 978
Calibration adapter Viton	68 10 536
Process adapter (stainless steel, with M30 x 1.5 locking nut) for DrägerSensor DD	68 12 470
Process adapter (stainless steel, with M36 x 1.5 locking nut) for DrägerSensor LC	68 12 465
Calibration chamber	68 02 206
Accessories for DrägerSensor IR	
Splash guard	68 10 796
Calibration adapter	68 10 859
Process adapter	68 11 330
Labyrinth seal	68 11 135

13.5 Replacement parts

Description	Order Number
Bucket Polytron 8200/8310 4-20/HART,SPPT	45 44 788
Bucket Polytron 8200/8310 4-20/HART Relay, SPPT	45 44 789
Cable bushing, 3-pin	45 44 182
Cable bushing, 9-pin	45 44 169
Cable bushing, 14-pin	45 44 168
Hardware set, housing	45 44 167
Hardware set, e-Box	68 12 838
Cable gland, e-Box	68 12 868
e-Box PCB	60 12 839

14 Declaration of Conformity

EG-Konformitätserklärung
EC-Declaration of Conformity

Dokument Nr. / *Document No.* SE23109-00

Wir / *we* Dräger Safety AG & Co. KGaA, Revalstraße 1, 23560 Lübeck, Germany

erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product

Gasmess-Transmitter Typ I/XTR 04/5 (Polytron 8**0)**
*Gas Detection Instrument type I/XTR 04/5** (Polytron 8**0)*

mit der EG-Baumusterprüfbescheinigung
is in conformity with the EC-Type Examination Certificate **PTB 11 ATEX 1005X**

ausgestellt von der benannten Stelle
issued by the Notified Body **PTB, Bundesallee 100, D-38116 Braunschweig**

Kenn-Nr. der benannten Stelle
Identification Number of Notified Body **0102**

und mit den folgenden Richtlinien unter Anwendung der aufgeführten Normen übereinstimmt
and with the following directives by application of the listed standards

Bestimmungen der Richtlinie *provisions of directive*	**Nummer sowie Ausgabedatum der Norm** *Number and date of issue of standard*
94/9/EG: **ATEX-Richtlinie** *94/9/EC: ATEX Directive*	EN 60079-0:2009, EN 60079-1:2007, EN 60079-7:2007, EN 60079-31:2009
2004/108/EG: **EMV-Richtlinie** *2004/108/EC: EMC Directive*	EN 50270:2006 (type 2), EN 61000-6-3:2007
2006/95/EG: **Niederspannungs-Richtlinie** *2006/95/EC: Low Voltage Directive*	EN 61010-1:2010

Überwachung der Qualitätssicherung Produktion durch
Surveillance of Quality Assurance Production by **DEKRA EXAM GmbH, Dinnendahlstraße 9, D-44809 Bochum**

Kenn-Nr. der benannten Stelle
Identification Number of Notified Body **0158**

Lübeck, 2011.12.22

Ort und Datum (jjjj.mm.tt)
Place and date (yyyy.mm.dd)

Ingo Pooch
Leiter
Forschung & Entwicklung
Gasmessgeräte

Ingo Pooch
Manager
Research & Development
Gas Detection Instruments

Dräger Safety AG & Co. KGaA
Revalstraße 1
23560 Lübeck, Germany
Tel +49 451 882 0
Fax +49 451 882 20 80
www.draeger.com

Manufacturing Location:
Draeger Safety, Inc.
101 Technology Drive
Pittsburgh, PA 15275-1057, USA
Phone +1 412 7 87 - 83 83
Fax +1 412 7 87 - 22 07

90 33 302 - GA 4683.610
© Dräger Safety AG & Co. KGaA
Edition 01 - September 2011
Subject to alteration

Instructions for use

Dräger Polytron® 8000 Series

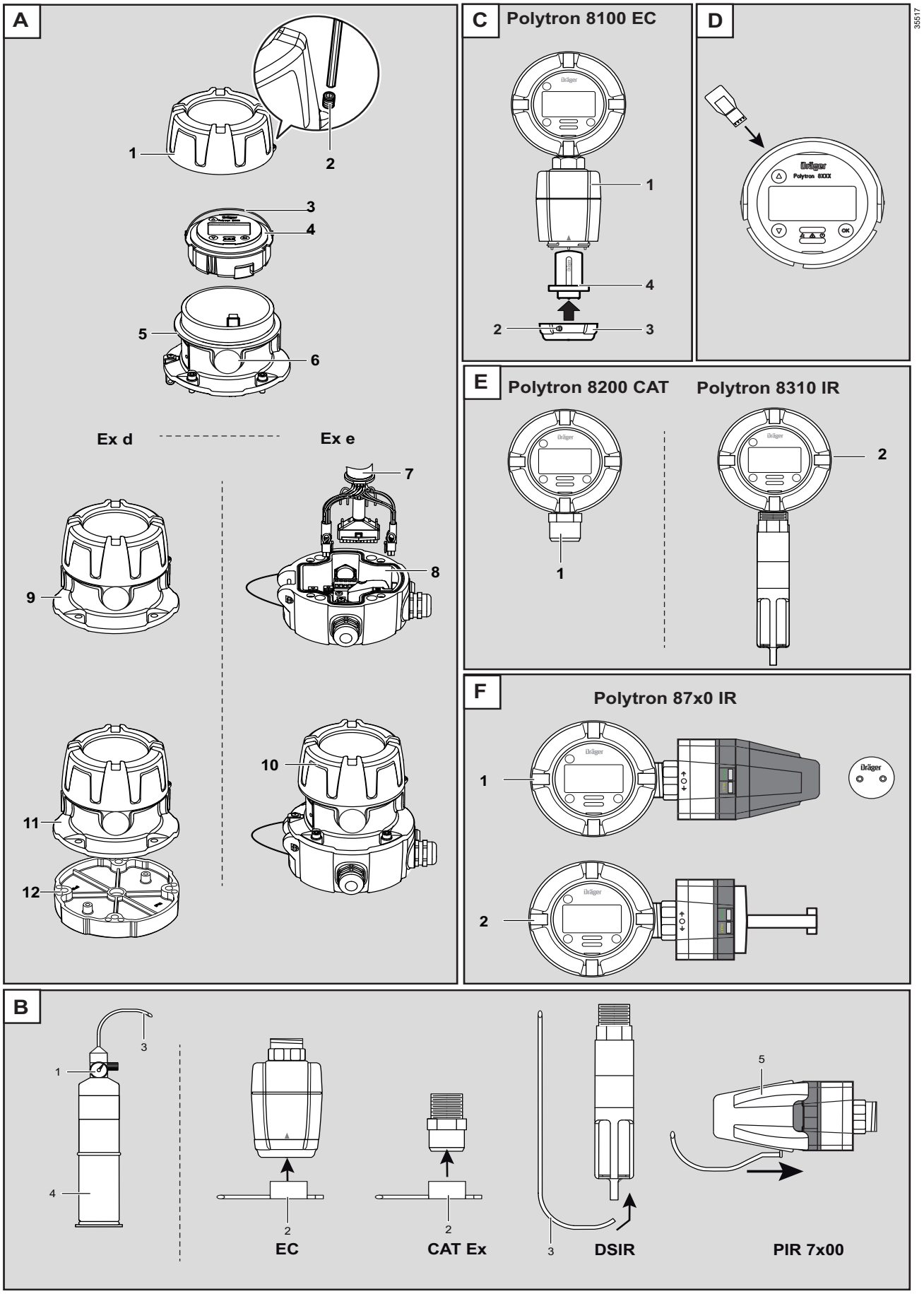


enUS, de, fr, es

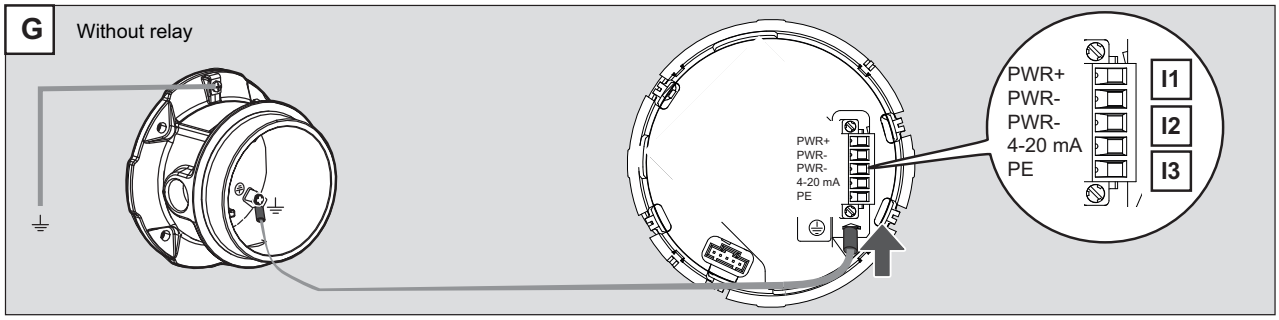
⚠ WARNING
To properly use this product, read and comply with these instructions for use.

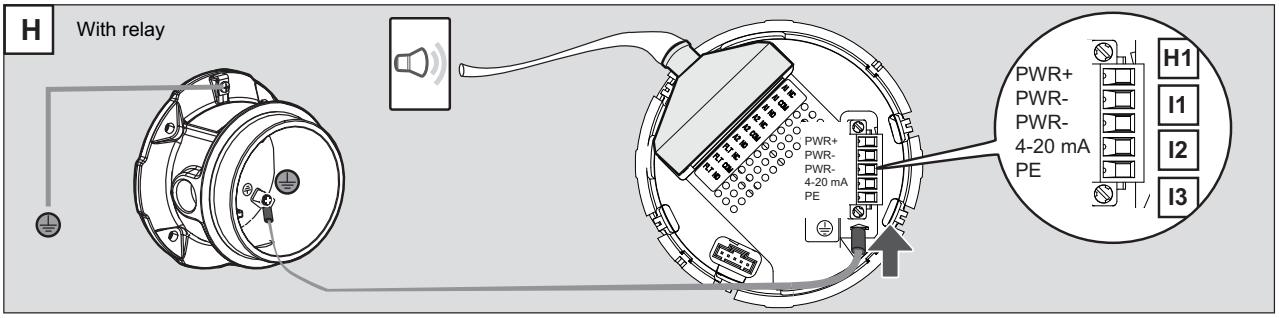
Dräger. Technology for Life®

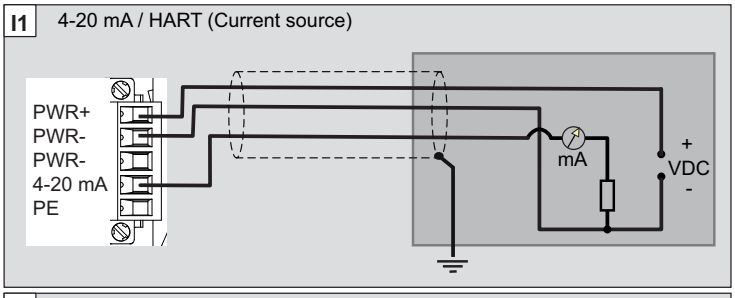
enUS Instructions for use 6
de Gebrauchsanweisung 50
fr Notice d'utilisation 98
es Instrucciones de uso 145

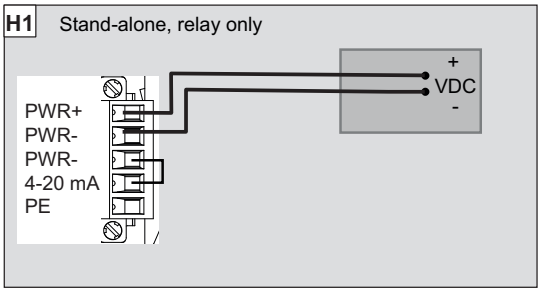

A
1
2
3
4
5
6
Ex d
Ex e
7
8
9
10
11
12
C
Polytron 8100 EC
1
2
3
4
D
35517
E
Polytron 8200 CAT
Polytron 8310 IR
1
2
F
Polytron 87x0 IR
1
2
B
1
2
3
4
EC
CAT Ex
DSIR
5
PIR 7x00

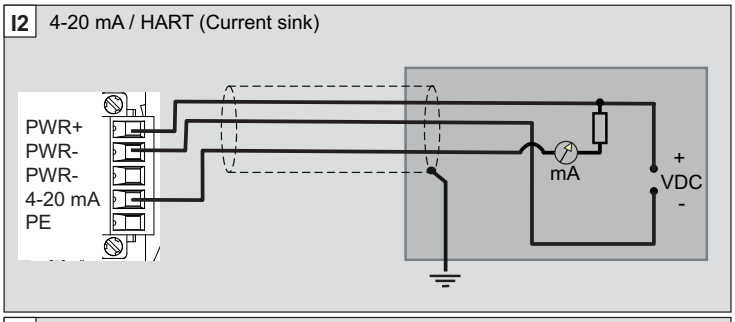
54807

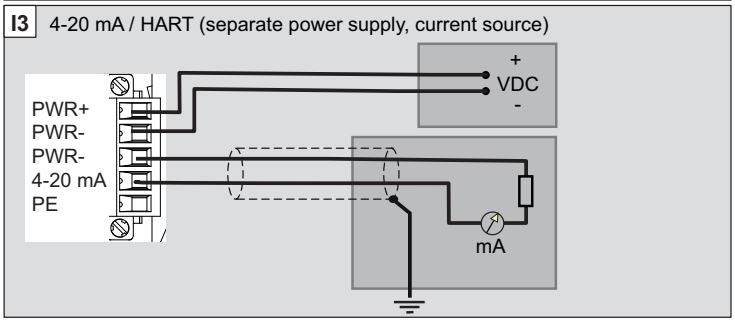






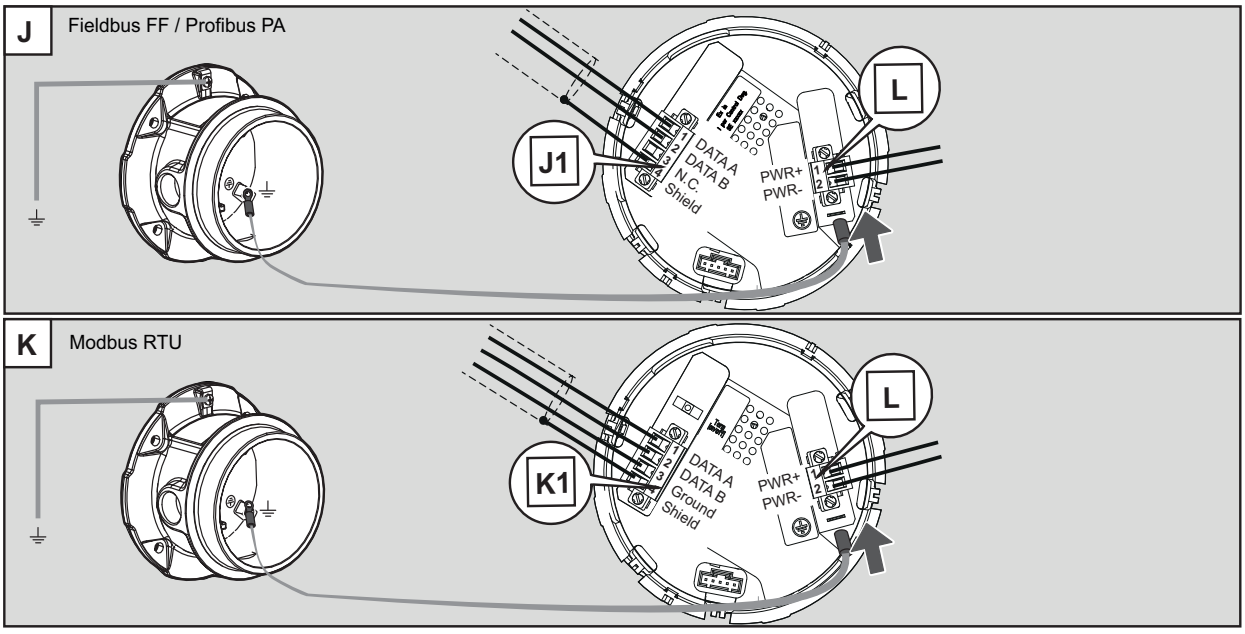


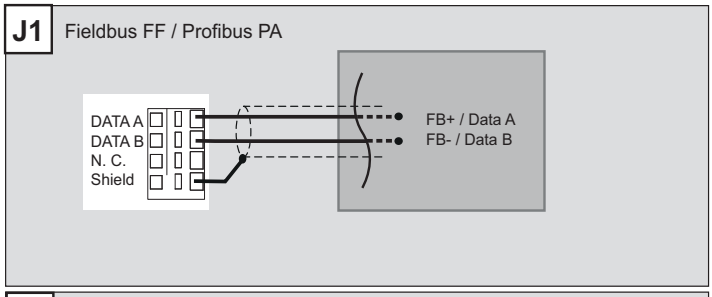


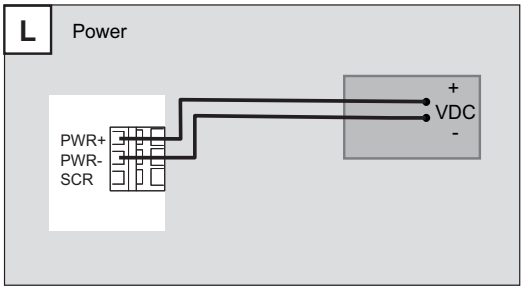


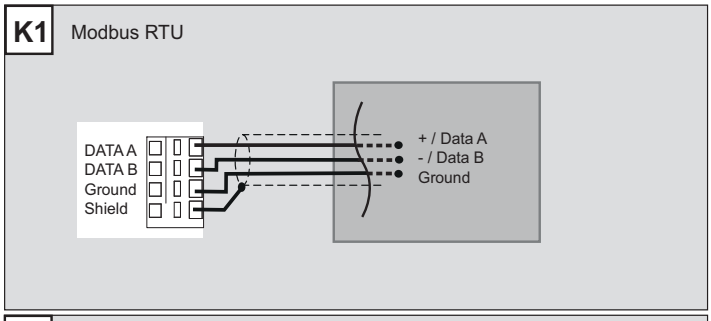
Cable specifications
Power supply and signals: 24 - 12 AWG / 0.2 - 2.5 mm²
Relays: 20 - 12 AWG / 0.5 - 2.5 mm²

35519









Cable specifications
Power supply and signals: 24 - 12 AWG / 0.2 - 2.5 mm²

M

Dräger **Polytron Xxx0**
XTR 0XXX
Dräger Safety 23560 Lübeck, Germany
CE 0158 Ex II 2G Ex II 2D
Part No: XXXXXXX
Serial No: **XXXX-XXXX**
Data Matrix Code
Gas Detector for Use in Hazardous Locations Subject to Fire, Electrical Shock and Explosion Hazards Only
Class I, Div 1, Groups A,B,C,D | Class II, Div 1, Groups E,F,G
Class I, Zone 1, Group IIC | T6/T4 | Type 4X | C22.2 No. 152
Supply: 10 ...30V ⎓, 0.08 ... Relays: 5A, 30V ⎓ or 230V ~
Ex db IIC T6/T4 Gb | PTB 11 ATEX 1005X
Ex tb IIIC T80 °C ... °C | IECEx PTB 11.0005X | BVS 15 ATEX G 001X
-40°C ≤ Ta ≤ ... °C | IP6X | P ≤ 5W | UL only: -40°C ≤ Ta ≤ +70°C
WARNING: Do not open when energized- risk of Ignition of Harzadous Atmospheres.
AVERTISSEMENT: Lire attentivement le manuel avant utilisation.
WARNING: To reduce the risk of Ignition of Hazardous Atmospheres, the conduit must be sealed within 18" of the enclosure.
WARNING: Read Manual before operating.

SAMPLE

Contents

1 Safety-related information 8
1.1 Safety instructions 8
1.2 Operating area and conditions 8

2 Conventions in this document 9
2.1 Meaning of the warnings 9
2.2 Trademarks 9

3 Description 9
3.1 Product overview 9
3.2 Feature description 9
3.3 Intended use 10
3.4 Approvals 10
3.4.1 ATEX, IECEx, UL, CSA 10
3.4.2 Additional information 10

4 Transmitter installation 10
4.1 Explosion proof (Ex d) installation - without Docking Station 10
4.1.1 Mechanical installation 10
4.1.2 Electrical installation 11
4.2 Increased safety (Ex e) installation - with Docking Station 13

5 Installation of sensors or sensing heads 14
5.1 Installing the EC sensor on the Polytron 8100 EC 14
5.2 Installing the sensing head 14

6 Commissioning 14
6.1 General information 14
6.2 Commissioning the gas detector 15

7 Operation 15
7.1 Control panel 15
7.2 LEDs and symbols 15
7.3 Readings on the display 15
7.3.1 All devices 15
7.3.2 Polytron 8100 EC-specific symbols 16
7.3.3 Measuring mode 16
7.3.4 Special states 16
7.3.5 Ending special states 17
7.4 Info mode and function keys 17
7.4.1 Opening Info mode 17
7.4.2 Navigating in Info mode 17
7.4.3 Using function key 17
7.5 Menus 17
7.5.1 Navigating in a menu 17
7.5.2 Opening menus 18
7.5.3 Passwords 18
7.5.4 The Information menu 18
7.5.5 Menu overviews 19
7.6 Information on operation with a Dräger SensorAlive 22

8 Calibration 22
8.1 General information 22
8.2 Test gases 22
8.3 Gas flow for adjustments 22
8.4 Preparing for adjustment 22
8.5 Zero calibration 23
8.5.1 General information 23
8.5.2 Performing a zero calibration 24
8.6 Span calibration 24
8.6.1 General information 24
8.6.2 Performing a span adjustment 24
8.7 Automatic calibration 25
8.7.1 General information 25
8.7.2 Perform automatic calibration 25

9 Troubleshooting 25
9.1 Faults 25
9.2 Warnings 26

10 Maintenance 28
10.1 Performing a bump test and checking the response time (t90) 28
10.2 Sensor replacement 28
10.2.1 Polytron® 8100 EC 28
10.2.2 Polytron® 8200 CAT, 8310 IR, 87x0 IR 29
10.3 Performing a display test 29

11 Instrument settings 29
11.1 Setting passwords 29
11.2 Setting date and time 29
11.3 Setting language 29
11.4 Configuring function key 29
11.5 Resetting to default settings 30
11.6 Changing the display contrast 30
11.7 Changing the display mode 30
11.8 Relays 30
11.8.1 Combinations of latching and alarm acknowledgment 30
11.8.2 Configuring relay A1 or A2 30
11.8.3 Setting fault relay warm-up 1 30
11.9 Alarm configuration 30
11.9.1 Turning the alarms on and off 30
11.9.2 Configuring alarms 30
11.9.3 Testing alarms/relays 31
11.10 Data logger settings 31
11.10.1 Displaying graph 31
11.10.2 Switching data logger on or off 31
11.10.3 Setting the sampling time 31
11.10.4 Setting peak/average 31
11.10.5 Switching triggering mode on or off 32
11.10.6 Setting trigger value 32
11.10.7 Setting stack/roll function 32
11.10.8 Clearing data logger 32

12 Interface settings 32
12.1 4-20mA interface 32
12.1.1 Full scale deflection 32
12.1.2 Setting fault current 32
12.1.3 Information regarding the warning signal 32
12.1.4 Switching the warning signal on or off 32

12.1.5 Setting warning interval ... 32
12.1.6 Setting warning current ... 32
12.1.7 Setting the warnings of the Dräger SensorAlive ... 33
12.1.8 Setting maintenance signal ... 33
12.1.9 Setting the maintenance current ... 33
12.1.10 Setting analog offset ... 33
12.1.11 Setting analog span ... 33
12.1.12 Testing the analog interface ... 33
12.1.13 Beam block ... 34
12.2 HART interface ... 34
12.2.1 Setting the polling address ... 34
12.2.2 Displaying the Unique Identifier ... 34
12.2.3 Setting the HART tag ... 34
12.2.4 Setting the Dräger REGARD protocol ... 34
12.3 Digital interfaces ... 34

13 Sensor settings ... 35

13.1 Switching automatic calibration on or off ... 35
13.2 Capture range ... 35
13.2.1 Setting capture range ... 35
13.2.2 Switching capture range off ... 35
13.3 Resetting sensor ... 35
13.4 Setting calibration interval ... 35
13.5 Setting sensor lock ... 35
13.6 Software dongles for EC sensors ... 35
13.6.1 Installing the dongle ... 35
13.6.2 Deactivating dongles ... 35
13.7 Sensor settings Polytron® 8100 EC ... 35
13.7.1 Sensor self-test ... 35
13.7.2 Gas settings ... 36
13.7.3 Dräger SensorAlive settings ... 36
13.8 Sensor settings Polytron® 8200 CAT / 8310 IR ... 36
13.8.1 Sensor type ... 36
13.8.2 Gas settings ... 37
13.8.3 Setting the DQ sensor latching ... 37
13.9 Sensor settings Polytron 8310 IR ... 37
13.9.1 Changing the gas category ... 37
13.9.2 Changing the gas category ... 37
13.10 Sensor settings Polytron® 87x0 IR ... 38
13.10.1 Gas settings ... 38

14 Factory default settings ... 38

14.1 Unchangeable settings for relay, LED, and alarm ... 38
14.2 Settings which can be changed via the menu ... 38
14.3 Sensor-specific values ... 39
14.3.1 Polytron 8100 EC ... 39
14.3.2 Polytron 8100 EC with O_2 sensors ... 39
14.3.3 Polytron 8100 EC with Dräger SensorAlive ... 39
14.3.4 Polytron 8200 CAT DrägerSensor® DQ ... 40
14.3.5 Polytron 8200 CAT DrägerSensor® LC ... 40
14.3.6 Polytron 8310 IR ... 40
14.3.7 Polytron 8700 IR ... 40
14.3.8 Polytron 8720 IR ... 41

15 Disposal ... 42

16 Technical data ... 42

16.1 Measuring ranges ... 42
16.2 Signal transmission to the controller ... 42
16.3 Cable specifications ... 43
16.4 Power supply and relays ... 43
16.5 General specifications ... 43
16.6 Environmental parameters ... 44
16.7 Tightening torques ... 44

17 Accessories and spare parts ... 44

17.1 Polytron® 8xx0 ... 44
17.1.1 Docking station ... 44
17.2 Polytron® 8100 EC ... 45
17.3 Polytron® 8200 CAT ... 45
17.3.1 CAT sensors ... 45
17.4 Polytron® 8310 IR ... 45
17.4.1 DSIR sensors ... 45
17.5 Polytron® 87x0 IR ... 45
17.5.1 Sensors ... 46

18 Performance Approvals ... 46

18.1 EU-TYPE Examination Certificate, BVS 13 ATEX G 001 X ... 46
18.2 Type Examination Certificate, PFG 14 G 001 X ... 46
18.3 DrägerSensor O_2, O_2LS and Dräger SensorAlive certified operating conditions ... 47
18.3.1 DrägerSensor O_2 (6809720) ... 47
18.3.2 DrägerSensor O_2LS (6809630) ... 47
18.3.3 Dräger SensorAlive (6814014) ... 48
18.4 FM performance approval for DrägerSensor H_2S and H_2S LC ... 49

1 Safety-related information

Both the latest edition and other languages of these instructions for use can be downloaded in the Technical Documentation database (www.draeger.com/ifu). Due to product actualizations, Dräger recommends always using the latest edition of the instructions for use.

1.1 Safety instructions

- Before using this product, carefully read these Instructions for Use and those of the associated products.
- Strictly follow the instruction for use. The user must fully understand and strictly observe the instructions. Use the product only for the purposes and under the conditions specified in this document.
- Do not dispose of the Instructions for Use. Ensure that they are retained and appropriately used by the product user.
- Only trained and competent users are permitted to use this product.
- Notify Dräger in the event of any component fault or failure.
- Comply with all local and national laws, rules, and regulations associated with this product.
- Only trained and competent personnel are permitted to inspect, repair and service the product as detailed in these instructions for use. Further maintenance work that is not detailed in these instructions for use must only be carried out by Dräger or personnel qualified by Dräger.
- Dräger recommends a Dräger service contract for all maintenance activities and that all repairs are carried out by Dräger.
- Use only genuine Dräger spare parts and accessories. Otherwise the proper functioning of the product may be impaired.
- Maintenance must be performed as described, see 10 Maintenance.
- Only operate the product within the framework of a risk-based alarm signaling concept.
- Before connecting this instrument to electrical devices not mentioned in the IFU consult Dräger
- The instruments or components may not be modified in any manner.
- The use of faulty or incomplete parts is forbidden.
- The appropriate regulations must be observed at all times when carrying out repairs on these instruments or components.
- Do not open the instrument during operation.
- The corresponding regulations must be observed when carrying out repairs on these instruments or components.
- Follow the directions of EN 60079-29-2 for the measurement of flammable gases and oxygen.
- Follow the directions of EN 45544-4 for the measurement of toxic gases.

Polytron® 8100 EC-specific:

- **WARNING**: Risk of ignition of flammable or explosive atmospheres! Substitution of components may impair Intrinsic Safety.

1.2 Operating area and conditions

- For SIL applications, observe the Dräger Polytron® 8xx0 safety manual.
- Only applies for Polytron 8200 CAT:
  If the device is exposed to a targeted flow of air that is mixed with gas, the measured values may be elevated. For deviating values, see the instructions for use provided with the corresponding sensor.
- Observe the information and restrictions in the instructions for use for the sensors used.
- **CAUTION** Risk of ignition of flammable or explosive atmospheres! Not tested in oxygen enriched atmospheres (>21% O_2).
- **Using the product in areas subject to explosion hazards:** Instruments or components for use in explosion-hazard areas which have been tested and approved according to national, European or international Explosion Protection Regulations may only be used under the conditions specified in the approval and with consideration of the relevant legal regulations.

Hazardous areas classified by zones:

- The instrument is designed for use in Zone 1 or Zone 2 hazardous areas where gases of explosion groups IIA, IIB or IIC and temperature class T4 or T6 may be present. Temperature classes depend on the maximum ambient temperature. The instrument must not be operated in ambient temperatures outside of the temperature range indicated on the instrument.
- The instrument is designed for use in Zone 21 or Zone 22 hazardous areas where dusts of explosion groups IIIA, IIIB or IIIC and dust temperatures of T80 °C or T130 °C (T135 °C for the Polytron 5100 EC and Polytron 8100 EC) may be present. Dust temperatures depend on the maximum ambient temperature. The instrument must not be operated in ambient temperatures outside of the temperature range indicated on the instrument.

Hazardous areas classified by divisions:

- The instrument is designed for use in Class I, Div. 1 or Div. 2 hazardous areas where gases of groups A, B, C or D and temperature class T4 or T6 may be present. Temperature classes depend on the maximum ambient temperature. The instrument must not be operated in ambient temperatures outside of the temperature range indicated on the instrument.
- The instrument is designed for use in Class II, Div. 1 or Div. 2 hazardous areas where dusts of groups E, F or G may be present. The instrument must not be operated in ambient temperatures outside of the temperature range indicated on the instrument.

2 Conventions in this document

2.1 Meaning of the warnings

The following warnings are used in this document to alert the user to potential dangers. A definition of the meaning of each warning is as follows:

Alert icon	Signal word	Warning classification
⚠	WARNING	Indicates a potentially hazardous situation. If not avoided, it could result in death or serious injury.
⚠	CAUTION	Indicates a potentially hazardous situation. If not avoided, it could result in physical injury. It may also be used to alert against unsafe practices.
	NOTICE	Indicates a potentially hazardous situation. If not avoided, it could result in damage to the product or environment.

2.2 Trademarks

Trademark	Trademark owner
PROFIBUS®	PROFIBUS Nutzerorganisation e. V.
HART®	HART Communication Foundation
Polytron®	Dräger Safety AG & Co. KGaA
DrägerSensor®	Dräger Safety AG & Co. KGaA

The following webpage lists the countries in which Dräger's trademarks are registered: www.draeger.com/trademarks.

3 Description

3.1 Product overview

Refer to the figures on the fold-out page

A 1	Enclosure lid
A 2	Set screw (2 mm Allen screw)
A 3	Handle
A 4	PCB unit (and optional relay)
A 5	Enclosure bottom
A 6	Port for Sensor
A 7	Feed-through cable
A 8	Docking station
A 9	Explosion-proof instrument
A 10	Explosion-proof instrument with docking station for increased safety
A 11	Explosion-proof instrument with mounting spacer (only for Polytron 87x0 IR)
A 12	Mounting spacer (only for Polytron 87x0 IR)
B	Test setup for calibration
C	Polytron 8100 EC
D	Sensor dongle connection (only Polytron 8100 EC)
E 1	Polytron 8200 CAT
E 2	Polytron 8310 IR
F 1	Polytron 8710 IR with splash guard
F 2	Polytron 8710 IR without splash guard

3.2 Feature description

The Polytron 8000 family includes the following instrument versions:

– Polytron 8100 EC, operates with electrochemical sensors (EC sensors)
– Polytron 8200 CAT, operates with catalytic Ex sensors (CatEx sensors/catalytic, DQ or LC DrägerSensors)
– Polytron 8310 IR, operates with infrared Ex sensors (IREx sensors)
– Polytron 8700 IR, operates with infrared sensors (PIR 7000 sensors)
– Polytron 8720 IR, operates with infrared sensors (PIR 7200 sensors)

The following interfaces are possible:

– 4 to 20 mA analog (per NAMUR recommendation NE43)
– Relay board
– Digital HART output signal
– Foundation Fieldbus[1)]
– PROFIBUS PA[1)]
– Modbus RTU[1)]

If the 4 to 20 mA interface is used, the current must be monitored between 0 mA and 3.5 mA. Currents between 0 mA and 3.5 mA can indicate a special state (see "Special states", page 16).

If a relay board is used, local alarm devices can be activated. If no relay board is used and an alarm is pending, only the red LED on the instrument will flash.

Gas concentrations, status messages, and menu choices are displayed on a backlit graphic LC-display and 3 colored LEDs.

Navigation through the menu takes place by tapping the relevant key on the pane of the enclosure lid with a magnetic wand. The instrument can be configured, calibrated and maintained non-intrusively without declassifying the area.

The instruments are supplied with a data logger. The data logger can store up to 35,000 values. At a sampling interval of 1 measurement per minute, the data logger can store the measurement history of approximately 24 days. This time can be significantly increased if the trigger function is activated. The data logger can only be downloaded using the PolySoft

1) No relays are available when the fieldbus interface is used. The fieldbus interface does not conform to BVS 13 ATEX G 001 X. Dräger SensorAlive is not supported.

PC software. The download generates an .ofb file and a .txt file. The .txt file includes the data logger information in readable form.

The instruments can be connected to a Dräger controller or a programmable logic control (PLC) with a sealed conduit or approved cable gland.

The instruments can be operated as a current source or current sink if the power is supplied by the controller. If the instruments are connected to a separate power supply, they can only operate as a current source.

The enclosures of the instruments are made of sturdy stainless steel or aluminum, and are suitable for indoor and outdoor application.

The instruments are designed for stationary installation. They are available in the following designs:

– Explosion-proof instrument (Ex d)
  The flameproof, explosion-proof enclosure provides three ¾ " NPT connections which can be used for field wiring, direct connection of a sensor, or wiring of a remote sensor.
– Instrument for increased safety (Ex e)
  The instrument is supplemented by an increased safety terminal box (docking station) providing up to four 20 mm connections for field wiring or wiring of a remote sensor. If the cable gland from Dräger is used, the permissible cable diameter is 7 mm to 12 mm.

The following dongles are available for the Polytron 8100 EC:

Sensor-test dongle	Activates the sensor self-test (not for hydrazine sensor 6810180)
Diagnostic dongle	Activates the sensor self-test, the display of the sensor vitality and the sensor diagnostic functions (not for hydrazine sensor 6810180)

3.3 Intended use

The instruments in the Polytron 8000 family are intended for continuous monitoring of the ambient air.

With the optionally integrated relay module, the instrument can be operated without a central controller (with additional local alarm signaling).

The instrument can be connected to a Dräger controller or a programmable logic control (PLC) with a sealed conduit or approved cable gland.

If the 4-20 mA interface is used, the current between 0 mA and 3.5 mA must be monitored. Currents between 0 mA and 3.5 mA can indicate a special state.

The instruments are designed for permanent installation and are approved for use in hazardous areas.

– Polytron 8100 EC is a combined intrinsically safe/explosion proof instrument for continuous monitoring of toxic gases or oxygen in the ambient air.
– Polytron 8200 CAT with catalytic DrägerSensor DQ or LC is an explosion-proof instrument for continuous monitoring of combustible gases and vapors containing hydrocarbons and non-hydrocarbons (e.g., hydrogen or ammonia) in ambient air.
– Polytron 8310 IR with infrared DrägerSensor IR is an explosion-proof instrument for continuous monitoring of combustible gases and vapors containing hydrocarbons in ambient air.
– Polytron 8700 IR with PIR 7000 is an explosion proof instrument for the continuous monitoring of combustible gases and vapors containing hydrocarbons in an appropriate atmosphere.
– Polytron 8720 IR with PIR 7200 is an explosion proof instrument for the continuous monitoring of carbon dioxide in ambient air.

3.4 Approvals

3.4.1 ATEX, IECEx, UL, CSA

An example of a name plate is shown on the fold-out page. A print-out of the name plate can also be found on the instrument's shipping box.

3.4.2 Additional information

Declaration of conformity: see supplement 4544300 or www.draeger.com/product-certificates

For additional information on approvals, see supplement 4544300.

4 Transmitter installation

4.1 Explosion proof (Ex d) installation - without Docking Station

4.1.1 Mechanical installation

4.1.1.1 General information on mechanical installation

– Local, state, and national rules and regulations that govern the installation of gas monitoring equipment must be strictly observed.
– The physical properties of the gas or vapor to be detected and the details of the corresponding application (e.g., possible leaks, air movement/drafts, etc.) must be taken into account.
– The future use of accessories and maintenance equipment must be considered.
– The free gas or vapor flow to the sensor must not be obstructed.
– The instrument must not be exposed to radiant heat that will cause the temperature to rise beyond the indicated limit values (16.6 Environmental parameters). The use of a reflective shield is recommended.
– A dust cap may be attached to the cable entry of the instrument. This cap is neither explosion-proof nor watertight and must be removed before connecting the instrument to a sealed conduit or before installation of a flameproof cable gland.

– Unused openings must be closed with blind plugs. For the required tightening torques for cable bushings, cable glands, plugs and sensors, see 16.7 Tightening torques.
– For non-conduit installations, an approved cable gland must be used (e.g., Hawke A501/421/A/¾ " NPT or equivalent).
– **WARNING:** Only for conduit installations: To reduce the risk of ignition of hazardous atmospheres, the conduit must be sealed within 45 cm (18 ") of the enclosure.
– **CAUTION:** If the gas detector is connected to controllers, the total response time may be delayed. The entire measurement path must be taken into account (e.g., latency of the controller). Ensure that the required response time is kept.

Polytron® 8100 EC-specific:

– Recommended sensor orientation: Downwards (see Figure C on the fold-out page).

Polytron® 8200 CAT-specific:

– Preferred sensor orientation: Downwards (see Figure E on the fold-out page). If the sensor inlet is protected against mechanical damage and the ingress of dirt and water, any orientation is permitted.
– For CSA-conform operation only:
The use of the optional splash guard (6812510) is required for CSA approval.

Polytron® 8310 IR-specific:

– Recommended sensor orientation: Downwards (see Figure E on the fold-out page).

Polytron® 87x0 IR-specific:

– The preferred orientation of the Dräger PIR 7x00 sensor must be observed (see Figure F on the fold-out page). Larger deviations and the use of the preassembled splash guard will increase the response time (see PIR 7x00 instructions for use).
– Any other orientation is only permissible if the PIR 7x00 is used without a splash guard, e.g., for use in ducts. If the sensor is installed vertically, there is an increased risk of deposits forming on the optical surfaces.
– The use of the preassembled splash guard is recommended to protect the sensor from water and dust.
– If a splash guard (part number 6811911 or 6811912) is used, the status lights must be arranged in a vertical line and the Dräger logo on the splash guard must be horizontal. A maximum deviation of ±30 degrees from the horizontal position is permissible.
– Liquid and/or deposits on the optical surfaces of the PIR 7x00 may result in a warning or fault.
– For the explosion-proof version, using a spacer (part number 6812617) when the instrument is mounted on a wall or to a level surface is recommended.

Special conditions in accordance with EN/IEC 60079-1

– The threads for the flameproof / explosion-proof enclosure do not conform to the minimum/maximum values indicated in EN/IEC 60079-1. The threads must not be re-worked by the user.

4.1.1.2 Installation

The instrument can be mounted for measuring gases in ambient air or inside of a duct/pipe.

1. Use M6 (1/4'') bolts with hex socket caps to mount the enclosure to one of the following options.

Option	Accessory
Mounting on a flat surface	Drilling template: 4544300 Additionally for Polytron 87x0 IR: Spacer 6812617
Mounting on a pole	Pole mount kit: 4544198
Mounting on a duct/pipe	Duct mount kit: 6812725 For Polytron® 87x0 IR:: 6812300

4.1.2 Electrical installation

4.1.2.1 General information on electrical installation

– For tightening torques, see 16.7, for permissible cable specifications, see 16.3.
– Strict compliance must be given to the electrical codes that govern the routing and connection of electrical power and signal cables to gas monitoring equipment.
– Ferrules must be used.
– The conductors for the power supply must have an adequately low resistance to ensure the correct supply voltage at the instrument.
– Wire insulation must be stripped by 5 to 7mm.
– The secondary circuit supplying power must be electrically isolated from the mains circuit (does not apply for the relay circuit).
– When installed at locations exceeding ambient temperatures of 55 °C, use only appropriate wiring, specified for at least 25 °C above the maximum ambient temperature.
– Only use cable glands that are approved in the country the system is installed in and suitable for the application.
– In accordance with EU Directive 2014/30/EU, this instrument may not be connected to a DC system. Providing the instrument with its own source of supply is recommended.

Analog interface

– To ensure proper operation of the instrument, the resistance of the 4 to 20 mA signal loop must not exceed 500 ohms.
When used in accordance with the metrological suitability test compliant with EN IEC 62990-1, EN IEC 60079-29-1 or EN 50104, the resistance must not exceed 300 ohms. With values above 300 ohms, supply voltage monitoring cannot be ensured.
Depending on the operating voltage and the application (e. g. HART® operation), a specified minimum resistance must be observed (see "Signal transmission to the controller", page 42).

Relay option

– At voltages >30 V AC or >42.4 V DC, the relay cables must be enclosed in protective tubing, or double-insulated cables must be used.
– The wiring for the optional relay module must be selected and fused according to the rated voltages, currents and environmental conditions.
– To ensure that a fault is recognized - without having to look at the instrument - an alarm device must be connected to the fault relay.
– Voltage differences can cause insulation faults. Do not mix electric loads with different voltage types (AC or DC). Using DC loads, ensure that relay contacts only control devices with the same DC voltage rating. Using AC loads, ensure that relay contacts are only connected to devices sharing a common phase.

Special conditions in accordance with IEC 60664-1

– The device variants incorporating a FISCO fieldbus interface as well as gas detection transmitter type ETR 02…5** must operate in circuits that are limited to overvoltage category I/II/III in accordance with IEC 60664-1.

4.1.2.2 Connection diagrams

The fold-out pages show the following connection diagrams:

Figure	Connection diagram for instruments
G	Without relay, enclosure grounding
H	With relay, enclosure grounding
I1	4-20 mA / HART (current source)
I2	4-20 mA / HART (current sink)
I3	4-20 mA / HART (separate power supply, current source)
H1	Standalone, relay only
J	Foundation Fieldbus / PROFIBUS PA, enclosure grounding
K	Modbus RTU, enclosure grounding
J1	Foundation Fieldbus / PROFIBUS PA, field wiring
K1	Modbus RTU, field wiring
L	Power supply digital interfaces

4.1.2.3 Wiring tables

4 to 20 mA/HART interface

Pin	Mark	Function
1	PWR+	V+
2	PWR-	V-
3	PWR-	V- Use if the instrument is connected to a separate power supply (operation as source).
4	4-20 mA	4 to 20 mA signal (Operation as source or sink)
5	PE	Protective earth Optional PE for relay connection. Connecting PE together with the 4-20mA analog output may cause ground loops.

Fieldbus interface

Pin	Mark	Function
1	Data-A	Signal Line A
2	Data-B	Signal Line B
3	GND	Ground
4	SHIELD	Cable Shield

Pin	Mark	Function
1	PWR+	V+
2	PWR-	V-

Relay connectors

All relays (A1, A2, FLT) of the device can be configured as "normally energized" (normally closed relay) or "energized on alarm" (normally open relay). The relays are configured at the factory as normally closed relays ("normally energized"). This ensures fail-safe operation.
Contrary to convention, the NO, COM, NC markings on the instrument are selected to correspond to the normally energized state. When the device is energized, the marking corresponds to the function of the pins.

Pin	Mark		Relay	
1	NO	FLT	Fault	Normally open
2	COM		Fault	Common connection
3	NC		Fault	Normally closed
4	NO	A2	A2	Normally open
5	COM		A2	Common connection
6	NC		A2	Normally closed
7	NO	A1	A1	Normally open
8	COM		A1	Common connection
9	NC		A1	Normally closed

4.1.2.4 Preparing the electrical installation

1. Loosen the set screw (2) and unscrew the enclosure lid from the lower part of the enclosure, see figure A on the fold-out page.
2. Pull out the PCB unit.
3. Proceed with the figure that contains your Polytron® model and signal output, see fold-out page.

4.1.2.5 Connecting the device with relays (stand-alone)

The wires for alarm devices must be connected to the 9-pin relay connector. A piece of wire insulation (heat-shrink tube) and a protective cover are included for extra protection of the relay wires.

1. Remove the 5-pin connector.
2. Connect the cable for the power supply to the corresponding connection terminals, see figure H1 on the fold-out page..
3. Bridge pins 3 and 4 of the 5-pin connector.
4. Remove the 9-pin connector.
5. Cut the heat-shrink tube as needed and slide it over the relay wires before insertion into the 9-pin connector.
6. Position the heat-shrink tube at the edge of the wire insulation and use a heat gun to shrink the tubing securely onto the wire insulation.
7. Slide the protective cover over the wires.
8. Connect the wires for alarm 1 (pre-alarm), alarm 2 (main alarm), and error alert to the relevant terminals as indicated in the following wiring table.
9. Plug the connector back into the socket and tighten the screws.
10. Close the device, see 4.1.2.9 Closing the gas detector.

The following tables display the status of a connected alarm indicator and whether it indicates faults (e.g., power failure for the gas detector).

The behavior of the relay depends on the alarm configuration and the relay contact the alarm indicator is connected to.

Relay configuration: Normally energized

Contact	Alarm indicator status and fault indication by the alarm indicator		
	Alarm triggered	Gas detector-specific fault	Field wiring fault
Normally closed	ON	displayed	not displayed
Normally open	OFF	displayed	displayed

Relay configuration: Energized on alarm

Contact	Alarm indicator status and fault indication by the alarm indicator		
	Alarm triggered	Gas detector-specific fault	Field wiring fault
Normally closed	OFF	not displayed	displayed
Normally open	ON	not displayed	not displayed

4.1.2.6 Connecting the 4-20mA/HART® interface

For connections to a control unit (PLC), refer to the documentation corresponding to the control unit.

1. Pull off the 5-pin connector.
2. Connect the three wires for power and signal to the appropriate terminal as indicated in the wiring table and figure.
3. Plug connector back into socket and tighten screws.
4. Close the instrument, see 4.1.2.9 Closing the gas detector.

4.1.2.7 Grounding

1. Ground the enclosure of the instrument locally at the grounding lug, see figures G and H on the fold-out page..
2. Connect the shield of the wires only to the instrument earth ground of the controller (e g. chassis, ground busbar, etc.).

ℹ Unless special measures are taken (e. g. capacitive earthing), the shield must only be connected at one end.

Information on grounding fieldbus and Modbus connections is provided in the following documents.

Interface	Document
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

4.1.2.8 Connecting the fieldbus interface

1. Pull off the 2-pin and 4-pin connector.
2. Connect the two wires for power and the four wires for signal to the appropriate terminals as indicated in the wiring table and figure.
3. Plug connector back into socket and tighten screws.
4. Close the instrument, see 4.1.2.9 Closing the gas detector.

For further information regarding the fieldbus interface installation consult the corresponding Technical Handbook.

4.1.2.9 Closing the gas detector

1. Ensure that the following connections are correctly established:
   a. The screws for the wiring are tightened with the correct torque.
   b. All cable connections are secured with screws.
   c. The front port of the sensor is inserted.
   d. The grounding cable that leads from the enclosure is connected with the eye on the PCB unit, see figures G and H on the fold-out page.
2. Place the PCB unit in the lower part of the enclosure.
3. Screw the enclosure lid onto the lower part of the enclosure and tighten with the correct torque.
4. Tighten the set screw.

4.2 Increased safety (Ex e) installation - with Docking Station

The installation with enhanced safety (Ex e) is described in the assembly instructions for the docking station (part number 9033242).

5 Installation of sensors or sensing heads

5.1 Installing the EC sensor on the Polytron 8100 EC

See figure C on the fold-out page.

1. Unscrew the locking screw (2) (2 mm hexagon socket screw).
2. Unscrew and remove the bayonet ring (3) and remove the dummy disk.
3. Insert the sensor (4) in the opening and turn until it engages in the gas detector. This does not damage the sensor connector.
4. Secure the sensor with the corresponding bayonet ring (3).

   ℹ For Dräger SensorAlive, a different bayonet ring must be used than for other EC sensors.

5. Tighten the locking screw (2) so that the bayonet ring cannot come loose (required for installations in zone 22).

   ℹ If the Dräger SensorAlive is being installed in an existing system for the first time, the firmware must be updated to version 4.0.0 or higher. Contact Dräger for support.

5.2 Installing the sensing head

Depending on the type of explosion protection, there will be various sensing heads used. Information relating to the installation of the sensing heads can be found in the respective sensing head manual.

For remote applications, the cable shielding must be attached on both the sensor and transmitter side. The cable length should be ≤ 30 m.

Remote versions with "Explosion-proof (Ex d)" explosion protection

Transmitter	Sensing head IFU part numbers
Polytron 8100 EC	Remote EC sensing head (9033247)
Polytron 8200 CAT (for DQ sensors)	DQ NPT aluminum remote sensor, DQ NPT steel remote sensor (4544286)
Polytron 87x0 IR	Remote PIR 7000 (334) with stainless steel or aluminum sensor connection housing (4544286)
Polytron 8200 CAT (for LC sensors) Polytron 8310 IR Polytron 87x0 IR	Stainless steel or aluminum sensor connection housing (4544286)

Remote versions with "Increased safety (Ex e)" explosion protection

Transmitter	Sensing head IFU part numbers
Polytron 8100 EC	Remote EC sensing head (9033247)
Polytron 8200 CAT	Polytron SE Ex sensing heads (9033888)
Polytron 8310 IR	DrägerSensor IR (9023843)
Polytron 87x0 IR	PIR 7x00 (9023885)

6 Commissioning

6.1 General information

– Before connecting the instrument to the power supply, connect the wires for the relay and connect up the sensor.
– Before starting normal operation of the instrument, check whether the configuration and adjustment settings are correct.

In order to guarantee its safe operation according to BVS 13 ATEX G 001 X and PFG 14 G 001 X, the following standard alarm settings for the instrument must remain unchanged.

– The relays must be set to ***Normally energ.*** and the alarm A2 (main alarm) to ***Latching*** and ***Non-acknowledgeable*** or ***Pre-Acknowledgeable***.
– Alarm A1 (pre-alarm) may only be set to ***Acknowledgeable*** if used for activation of an acoustic alarm device.
– Latching in the event of over range (see "Setting the DQ sensor latching", page 37).

When operating in accordance with BVS 13 ATEX G 001 X and PFG 14 G 001 X, consideration must be given to the following special conditions:

– Polytron 8200 CAT:
  – When streaming the DQ or LC sensor with air containing measured gas, measured values may increase by up to 32 %.
    These values may increase by up to 70 % when operating with the DQ remote calibration adapter.
  – The transmitter with LC sensor must be operated in combination with a control unit that indicates over range with a latching signal. Internal transmitter alarm relays are not permitted.
  – The transmitter with LC sensor must be adjusted with its sensor in the standard operating position.
  – False alarms may be triggered during the warm up period of the LC sensor.
– Polytron 8100 EC:
  Minor changes to the concentration may see the setting time t20 of the transmitter with EC sensor exceed the EN 50104 threshold.

6.2 Commissioning the gas detector

1. To prevent false alarms, turn off the alarm activation for the gas detector (see "Turning the alarms on and off", page 30).
2. Switch on the power supply.
   ⇒ The device performs a start-up sequence (LCD/LED test, software version, and initialization).
   ⇒ The display indicates that the sensor will be ready for measurement in hh:mm:ss (countdown). The device transmits the maintenance signal. The fault relay is activated.
   ⇒ The sensor warms up. The maintenance signal on the 4 to 20 mA interface remains until the sensor has warmed up. The length of the warm-up time depends on the type of sensor and the ambient conditions. Maximum warm-up time of a new sensor: See the instructions for use of the sensor.
3. Check the date and time. Settings can be changed during the sensor's warm-up time.
   ⇒ After the sensor's warm-up time, the device switches to normal operation. The display shows the current gas concentration, the unit of measurement, and the selected gas if applicable. The green LED is lit.

If the device is operated with a Dräger SensorAlive, Dräger recommends setting the correct date and time. The sensor's warm-up time is followed by the start-up period of the Dräger SensorAlive. The sensor is ready for measurement during this phase, but the self diagnostics do not yet take place.

4. Adjust the device as necessary.
5. Turn on the alarm activation for the gas detector (see "Turning the alarms on and off", page 30).

7 Operation

7.1 Control panel

The control panel contains

– buttons for navigating in the menu
– a display
– LEDs and associated symbols

The buttons for navigation have different functions depending on the menu that is in use.

The instrument is operated with a magnetic wand. To do so, the enclosure lid must be in place on the instrument. If the enclosure lid is not in place, the magnetic wand may activate two or more buttons at once (cross-talk).

7.2 LEDs and symbols

The following symbols and LEDs can be found on the control panel:

Symbol	LED	Description
	Red	Alarm Triggered
	Yellow	Fault
	Green	Power on

LED status

– If alarm A1 (pre-alarm) has been triggered, the red LED will flash once .
– If alarm A2 (main alarm) has been triggered, the red LED will flash twice .
– If an alarm is acknowledged before the reason for the alarm has been rectified, the red LED will light continuously to indicate that there is a fault.

7.3 Readings on the display

7.3.1 All devices

Symbol	Explanation
	An error message is present. Additional information is available in the ***Information*** menu.
	A warning message is present. Additional information is available in the ***Information*** menu.
	Maintenance signal is transmitted.
	The set full scale deflection is exceeded at the 4-20 mA interface.
	The set threshold limit value is not met at the 4-20 mA interface.
	HART® operation is active. Analog interface is set to a fixed value and is not transmitting any measurement signal.
	Once the capacity of the data logger is reached, the old data are overwritten by new values ("roll" function).
	Once the capacity of the data logger is reached, no more data can be stored ("stack" function).
SIL	SIL operation mode is activated.

7.3.2 Polytron 8100 EC-specific symbols

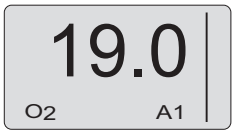
Symbol	Explanation
	The sensor is ready for operation.
	The sensor is ready for operation but is close to the end of its useful life.
	The sensor is still ready for operation but should be changed as soon as possible. The vitality is <25%.
LT	A LifeTest of the Dräger SensorAlive is carried out.

7.3.3 Measuring mode

The following display examples show the Polytron 8100 EC.

Gas names are not predefined for the Polytron 8200 CAT and Polytron 8310 IR. Gas names must be entered via the DrägerPolysoft PC software. After modifying parameters with the DrägerPolysoft PC software or another software, verify all parameters by downloading them from the Polytron® 8xx0 or by checking them directly on the instrument.

The following is displayed in measuring mode:

Display example	Description
	In normal operation, the display shows the measured gas concentration, the selected gas type, and the unit of measurement. **Analog interface:** Corresponding current value **Relays:** All relays are in the normal state
	Exceeding the alarm thresholds. Example shows pre-alarm A1. **Analog interface:** Corresponding current value **Relays:** Relay A1 is in alarm state.

7.3.4 Special states

If the instrument is in a special state, proper measurement or alarm activation can no longer be guaranteed.

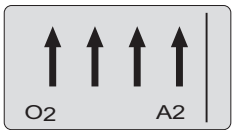
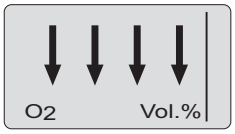
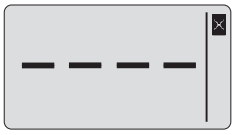
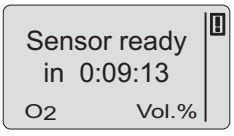
This is the case:

- When the gas concentration exceeds the measuring range.
- When a fault occurs.
- When alarms are deactivated.
- When calibrations are performed.
- When bump tests are performed.
- When a sensor is in the warm-up phase.
- When the system is in maintenance mode.
- When a Dräger SensorAlive is used and the system is configured such that the measured value is not indicated during a LifeTest.

For the current of the analog interface corresponding to the analog signal, see 16.2.

The signals of the digital interfaces are described in the following documents.

Interface	Document
PROFIBUS PA	9033782
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

Display example	Description
	**Value above measuring range** The gas concentration is outside of the measuring range of the sensor[1]. **Analog interface:** Over range **Relays:** A2 relay switch ***Note for the Polytron 8200 and Polytron 8310:*** The message that the measuring range has been exceeded can also be caused by a short circuit or an interruption in the line to a remote sensor.
	**Value below measuring range** The gas concentration is outside of the measuring range of the sensor. **Analog interface:** Drift below zero **Relays:** Fault relay switch
	**Fault display** The ⊠ symbol is displayed on the right side of the display. **Analog interface:** Fault current **Relays:** Fault relay switch
	**Maintenance display** The 🔧 symbol is displayed on the right side of the display. This is displayed when alarms are deactivated, and during adjustment, bump tests, and maintenance work. **Analog interface:** Maintenance current **Relays:** No change
	**Warning display** The ⚠ symbol is displayed on the right side of the display. **Analog interface:** Warning current[2] **Relays:** No change
	**Warm-up phase 1** The ⚠ symbol is displayed on the right side of the display. The remaining time is displayed on the left side. **Analog interface:** Maintenance current **Relays:** Fault relay switch The fault relay behavior can be configured for warm-up phase 1 (see "Setting fault relay warm-up 1", page 30).

Display example	Description
	**Warm-up phase 2** The ! symbol is displayed on the right side of the display. The measured value is displayed on the left side. **Analog interface:** Measured value **Relays:** Behavior as in measuring mode (the fault relay does not indicate warm-up phase 2).

1) When the gas concentration exceeds the full scale deflection of the 4 to 20 mA interface, the display continues to display the measured value plus "Analog interface over range" .
2) Only when warning current is activated. Factory setting: Deactivated.

7.3.5 Ending special states

Error display / warning display

Error displays and warning displays are usually non-latching. As soon as the causes of the errors or warnings have been rectified, no more error or warning is displayed. Exceptions are "SensorAlive fault detection" and "SensorAlive clogging detection".

To eliminate the causes, display the error or warning (see "The Information menu", page 18) and start troubleshooting (see "Troubleshooting", page 25).

Value exceeds/falls below the measuring range

The display indicates that the gas concentration is beyond the measuring range of the sensor. The information on the display disappears as soon as the gas concentration is back within the measuring range. After an over range occurrence, the sensitivity and response time of the sensor may deteriorate.

NOTICE

Sensor malfunction

Gas concentrations outside the sensor's measuring range can cause the sensor to malfunction.

► Recalibrate the sensor if necessary.

Polytron® 8200 CAT with DQ sensor:

An over range has to be acknowledged with [OK] after verifying that the gas concentration is below 100 %LEL (e.g. using a portable instrument).

Latching alarms is the default setting of the instrument.

For instruments without relays, the over range can be set to non-latching. In this case, the over range indication disappears. The control unit must support this function! For further information see: "Setting the DQ sensor latching", page 37.

Polytron® 8200 CAT with LC sensor:

⚠ WARNING

Ambiguous readings for measured values that exceed the measuring range

Latching alarms for over range situations are not supported by LC sensors.

For safe operation in line with BVS 13 ATEX G 001 X, the gas detector must be operated with a controller that can display latching alarms. Do not use internal alarm relays of the gas detector.

► Make sure that over range latching is active at the controller.

After over range measuring values, verify that the gas concentration is below 100 %LEL (e.g. using a portable instrument).

7.4 Info mode and function keys

7.4.1 Opening Info mode

Info mode is used to show relevant device information. This does not interrupt the normal operation of the device.

- Tap and hold ▲ for 3 seconds in measuring mode.

7.4.2 Navigating in Info mode

Button	Function
▲	Switches to the next screen
▼M	Switches to the previous screen
OK	Ends info mode

If no key is tapped within 30 seconds, the instrument will automatically return to normal operation.

7.4.3 Using function key

Using the function key, a pre-set function can be executed. By default the faults are displayed.

- Tap and hold ▲ for 1 seconds in measuring mode.

To configure the function key, see 11.4 Configuring function key.

7.5 Menus

7.5.1 Navigating in a menu

Button	Function
▲	Scrolls upwards. Sets values.
▼M	Scrolls downwards. Sets values.
OK	Confirms entry. Selects menus and functions.

7.5.2 Opening menus

- To open the ***Information*** menu:
  a. Tap and hold ▼ for 1 second in measuring mode.
- To open the ***Calibration*** menu:
  a. Tap and hold ▼ for 3 seconds in measuring mode.
  b. Select ***Enter password***.
  c. Enter the corresponding password and confirm with [OK].
- To access all menus:
  a. Tap and hold ▼ for 3 seconds in measuring mode.
  b. Select ***Enter password***.
  c. Enter the corresponding password and confirm with [OK].

7.5.3 Passwords

Calibration PWD	Permits access to the ***Information*** menu and the ***Calibration*** menu (adjustment settings) Default value: **_ _ _ 1**
Settings PWD	Permits access to all configurations and menus Default value: **_ _ _ 2**

Information on changing the passwords can be found in 11.1.

7.5.4 The *Information* menu

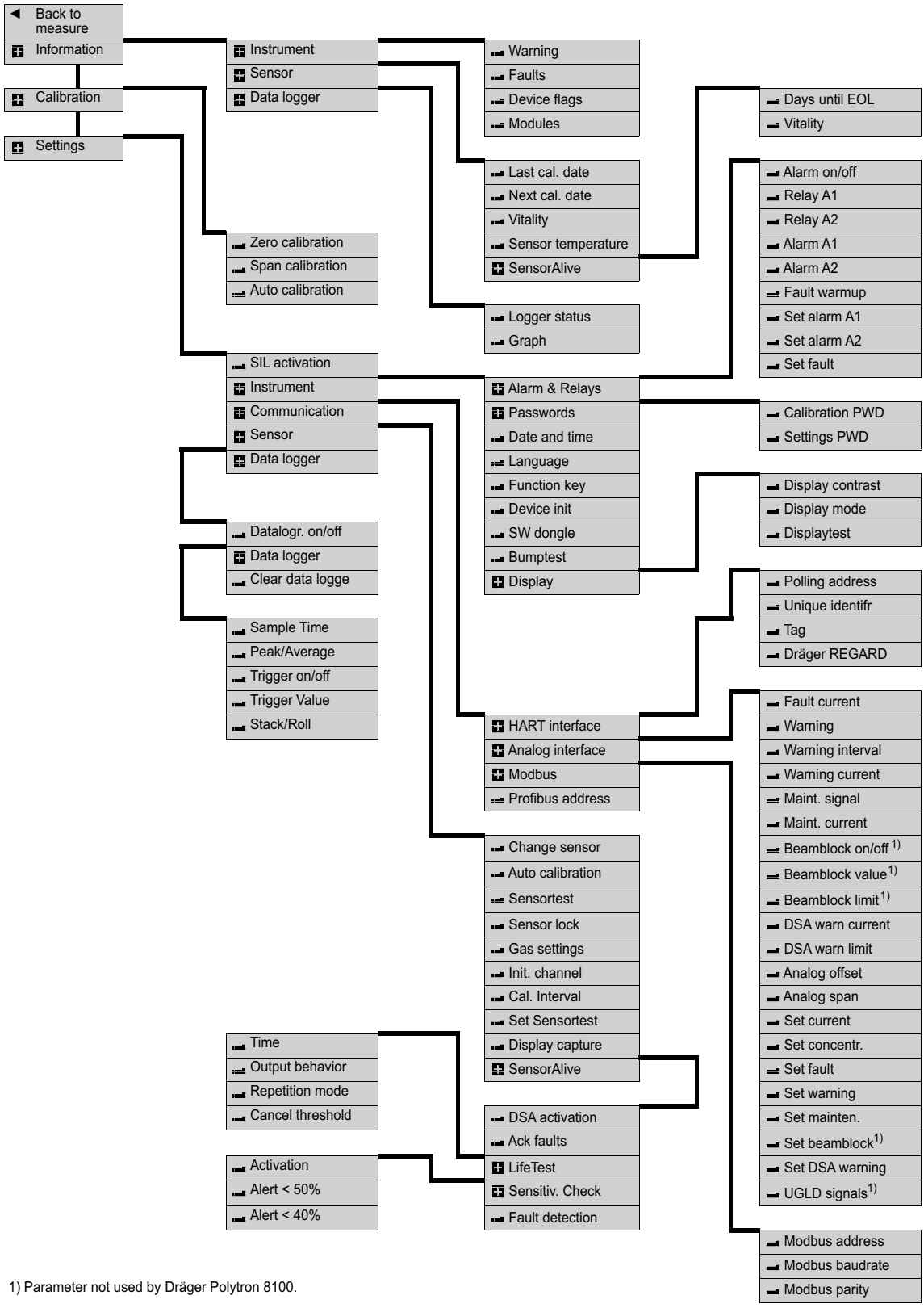
In the ***Information*** menu, the following information can be called up:

Instrument	
Warnings	Warning messages in plain text, including the corresponding number. If there are several warning messages, this will be shown accordingly (e.g. with 1/3 = screen 1 of 3).
Faults	Error messages in plain text, including the corresponding number. If there are several errors, this will be shown accordingly (e.g. with 1/3 = screen 1 of 3).
Device flag	With this function, the warning and error codes are shown in table format. If the value 00 is shown for all codes, then there are no warning or error messages present.
Modules	An overview of the installed hardware modules, as well as the software version of the SIOS-specified EC sensor interface, will be shown. For more detailed information, select the corresponding module. ■ = installed modules □ = modules not installed
Sensor	
Last cal. date	Adjustment date, unit, gas and concentration of the last adjustment are shown.
Next cal. date	Shows the date of the adjustment that is due next.
Vitality[1)]	The sensor vitality is shown in %. Dräger recommends replacing the sensor when vitality is < 25 %.
Sensor temperature[1)]	The current and highest sensor temperature will be shown.
SensorAlive	The sub-menu shows the number of days left for the expected service life and the vitality in %.
Data logger	
Logger status	Data logger status display (active or inactive)
Graph	Display of progress over last 15 minutes in a time/concentration graph.

1) The function is only available with the diagnostic dongle.

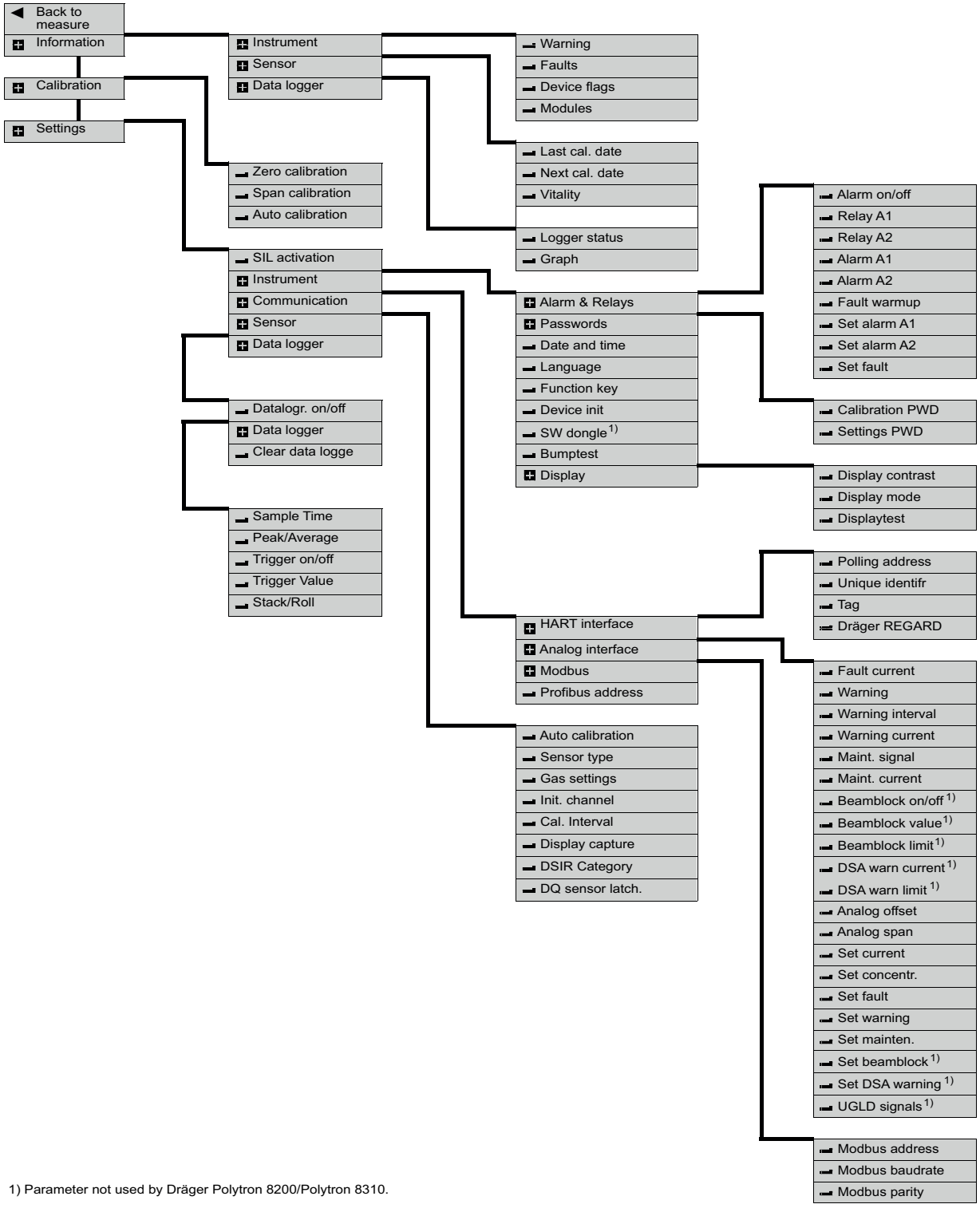
7.5.5 Menu overviews

Polytron 8100



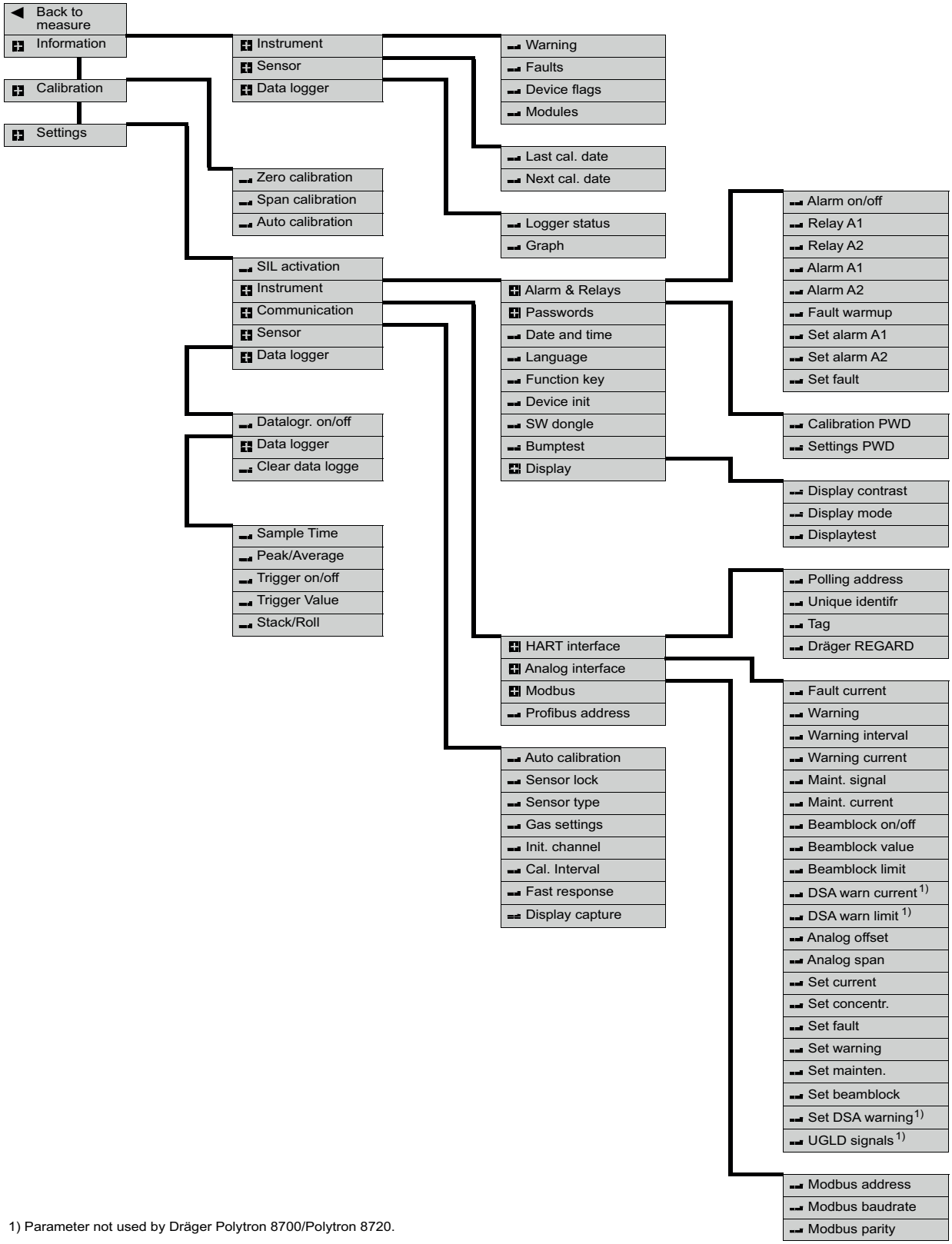
1) Parameter not used by Dräger Polytron 8100.

Polytron 8200, Polytron 8310



1) Parameter not used by Dräger Polytron 8200/Polytron 8310.

Polytron 8700, Polytron 8720



1) Parameter not used by Dräger Polytron 8700/Polytron 8720.

7.6 Information on operation with a Dräger SensorAlive

– If a menu is accessed on the transmitter or certain errors are set, the Dräger SensorAlive does not perform a LifeTest.
– The Dräger SensorAlive can suppress the instrument calibration for a certain period of time (H_2S sensor: 30 minutes).
– If a high level of accuracy is required for the duration of the LifeTests, the time on the transmitter should be regularly checked and adjusted as necessary.
– The menu entries for the Dräger SensorAlive are only displayed if a Dräger SensorAlive is connected. The dongle functions are also visible in this case, but are not active.

8 Calibration

8.1 General information

– To ensure proper operation, adjust the zero-point first and then the sensitivity. If these procedures are performed in the incorrect order, adjustment cannot be continued due to software settings.
– If the intended operation is at high altitudes, the display value will be lower than that at sea level (reduced partial pressure). New span adjustment is recommended if the altitude or the ambient pressure changes. The factory adjustment is set to sea level.
– Dräger recommends adjusting instruments with the gas to be detected. This method is more accurate than a surrogate gas adjustment. A surrogate gas adjustment may only be performed as an alternative if a measured gas adjustment is not possible.
– Sensors for methane and hydrogen should only be adjusted with measured gas and not with surrogate gas.
– For the Polytron 8310 IR: Also observe the information in the instructions for use for the DrägerSensor IR[1].

During adjustment, the measurement accuracy of the sensor is checked and adjusted with a known test gas concentration. Adjustment must be performed on a regular basis. The length of the adjustment intervals depends on the ambient conditions in which the sensor is operated.

Ambient conditions and aging results in sensor drift. Sensor drift reduces the display accuracy of measured gases. Adjustment restores this display accuracy. Shorter adjustment intervals must be selected depending on the extent of the drift.

To gauge the ambient conditions for new installations, selecting short adjustment intervals and documenting the drift is recommended. The system operator should define the adjustment interval length with the aid of the collected data.

If a Dräger SensorAlive is used, the drift is compensated and can be read out.

Under normal conditions, Dräger recommends the following adjustment intervals[2]:
– Electrochemical sensors (EC): 6–12 months[3]
– Catalytic sensors (CAT): 4 months
– Infrared sensors (IR): 6–24 months[3]

8.2 Test gases

Please refer to the instructions for use provided for the respective sensor for the test gas properties (e.g. relative humidity, concentration). If there is no information provided relating to relative humidity, dry test gas can be used for the adjustment. The humidity of the test gas is not relevant for O_2 sensors.

Depending on the type of adjustment, various types of test gas are used.

Zero gas

The zero gas is a test gas used for adjustment of the zero-point of a sensor. Nitrogen (N_2) is used for O_2 and CO_2 sensors. With other sensors, ambient air can be used once it is free from disruptive contamination and the measured gas.

Adjustment gas

The adjustment gas is a test gas used for adjustment of the sensitivity of a sensor. The adjustment gas is a known concentration of the measured gas, diluted with clean air and nitrogen. Adjustment gas is not required for O_2 sensors, as oxygen from the ambient air is used.

8.3 Gas flow for adjustments

The gas flow varies according to each sensor.

EC sensor, CAT sensor	0.5 L/min ± 10 %
All other sensors	0.5 L/min - 2 L/min

The gas flow should correspond with the ambient conditions during operation (e.g. duct measurement with flow higher than 2 L/min)

8.4 Preparing for adjustment

General information

⚠ WARNING
Health hazard due to test gas
Inhaling test gas may risk health or lead to death.
► Do not inhale test gas.
► Observe risks and security statements related to the test gas (Refer to data sheets and instructions figuring on calibration devices).

1) 9023981 (English), 9033555 (Bulgarian, Romanian), 9023984 (Spanish, Portuguese), 9023986 (Danish, Norwegian), 9033556 (Czech, Croatian), 9033809 (Chinese), 9023985 (Hungarian, Polish), 9023982 (French), 9033557 (Slovak, Slovenian), 9033558 (Greek, Turkish), 9023987 (Italian, Dutch), 9023983 (Finnish, Swedish), 9023843 (German)

2) Observe the instructions for use for the sensor.
3) For applications in accordance with EN 45544-1 and EN IEC 62990-1, the adjustment interval must not exceed 6 months.

⚠ CAUTION
Triggering alerts by test gas
Applied test gas may trigger alerts.
► Make sure that test gas is no longer applied after calibration.

Prerequisites
– The sensor warm-up phase has been completed (see "Commissioning the gas detector", page 15).
– The date and time have been set (see "Setting date and time", page 29).
– If a Dräger SensorAlive is used, the last LifeTest must be sufficiently long ago (see the instructions for use of the sensor).

Special feature of the Polytron 8310
Dräger recommends carrying out an automatic zero calibration on the sensor before adjustment of the zero-point. This resets the zero-point tracking of the DrägerSensor IR, and the full tracking range is available.
1. Turn off the alarm activation for the gas detector (see "Turning the alarms on and off", page 30).
2. Use the calibration adapter to apply nitrogen, synthetic air, or clean air to the sensor and wait until a stable measured value is shown.
3. Set the magnetic wand on the area marked with the ⇩0 symbol (inside of the black border) on the surface of the sensor shell and hold it in place for at least 5 seconds. After 5 seconds, the sensor output signal switches to the display of the calibration signal (display change by approx. –10 %LEL) for as long as the magnetic wand is held in place. At the same time, a zero calibration of the optical measurement system is automatically performed.
4. Remove the magnetic wand. After 30 seconds, the instrument exits the automatic zero calibration routine. To confirm the automatic zero calibration, the output signal switches back to the calibration signal (display change to approx. –10 %LEL). This signal is also displayed for the same length of time as when starting the automatic zero calibration routine.
5. Turn on the alarm activation for the gas detector.

Polytron 8100, Polytron 8200, Polytron 8310
See figure B on the fold-out page.

Adjustment equipment:
– Dräger pressure regulator (1), use a stainless steel pressure regulator for reactive gases
– Dräger calibration adapter (2) (part number 6810536)
– Hose (3)
– Dräger test gas cylinder (4)

Preparing adjustment:
1. Connect the pressure regulator to the test gas cylinder.
2. Mount the calibration adapter on the sensor.
3. Connect the hose to the plug nipple connection.
4. Open the menu (see "Opening menus", page 18).

Polytron 87x0 IR
See figure B on the fold-out page.

Adjustment equipment:
– Dräger pressure regulator (1), use a stainless steel pressure regulator for reactive gases
– Dräger calibration adapter (5) (part number 6811610)
– Hose (3)
– Dräger test gas cylinder (4)

Preparing adjustment:
1. Connect the pressure regulator to the test gas cylinder.
2. Fit the calibration adapter to the splash guard so it snaps into place.
   This does not apply for mounting on ducts or if a process adapter or process cuvette is used (see installation instructions for the corresponding PIR 7x00 accessory).
3. Ensure that the sealing surfaces around the openings of the splash guard are clean. The insect guard does not have to be removed.
4. Connect the hose to the plug nipple connection.
5. Open the menu (see "Opening menus", page 18).

8.5 Zero calibration

8.5.1 General information

Ambient air can be used to calibrate the zero-point of the sensor instead of nitrogen or synthetic air only if the ambient air is known to be free of the target gas and any other gas to which the sensor may be cross-sensitive (as listed on the sensor data sheet). In this case, no cylinder or calibration adapter is needed for the zero calibration.

⚠ WARNING
Calibration fault at zero calibration
Insufficient ambient air flow may cause calibration errors.
► Make sure that the ambient air flow to the sensor is sufficient.

Polytron® 8100 EC-specific:

For Oxygen (O_2) sensors a zero calibration does not change any value in the firmware or sensor. Thus, the zero calibration function can be used to check the correct zero reading when Nitrogen is applied to the sensor. The Polytron 8100 EC will indicate a fault state if a zero check fails with a deviation of more than 0.6 Vol% O_2 from zero. In case of a fault, repeat the zero check or change the sensor if necessary. Use Nitrogen (N_2) for verification.

Polytron® 8200 CAT-specific:

Sensors must not be calibrated with pure nitrogen. Catalytic sensors need oxygen to work properly.

Polytron® 8720 IR-specific:

For Polytron 8720 IR (with PIR 7200 to detect carbon dioxide), only Nitrogen or Synthetic Air without any CO_2 content may be used for a zero calibration.

8.5.2 Performing a zero calibration

ℹ Calibration can be aborted at any time. To abort calibration select ***back***.

Prerequisites:
– Sensor has finished the warm-up phase
– Calibration is prepared.

Calibrate the zero-point as follows:
1. Select ***Calibration*** > ***Zero calibration*** and confirm.
   ⇒ The maintenance signal is transmitted via the analog interface. No alarms or fault relays are activated and the 🔧 symbol is displayed.
   ⇒ The message ***Apply zero gas*** is displayed.
2. Apply Synthetic Air or Nitrogen if ambient air cannot be used.
   a. Set the gas flow corresponding to the sensor used (see "Gas flow for adjustments", page 22)
3. Select ***Next*** and confirm.
   ⇒ The current value is displayed.

ℹ After 15 minutes without confirmation, the instrument reverts to the calibration menu without performing a calibration.

After the test gas has been applied to the sensor for 3 minutes and the displayed value is stable perform calibration.
4. Select ***calibrate*** and confirm.
   ⇒ The message ***please wait...*** is displayed.
   ⇒ The new current value is displayed.
5. Select ***Next*** and confirm.
6. Turn off the gas flow and remove the calibration adapter from the sensor or disconnect the hose.
   If the current value is not within the alarm range:
7. Select ***Next*** and confirm.
   ⇒ The instrument returns to the calibration menu.

8.6 Span calibration

8.6.1 General information

Polytron® 8310 IR-specific:

Due to the design of the DSIR gas sensor, the output signal of the gas sensor is limited to 45 %. . . 55 % of the internal supply voltage. If the gas concentrations increase further after the maximum sensor output signal has been reached, this does not lead to an increase of the values displayed on the instrument response transmitted to the central device. In case of substances with particularly low calibration factors and/or manual configuration of a high span calibration factor at the sensor, this may already happen at concentrations below 100 %LEL. For substitute gas calibrations, correct triggering of the alarm should therefore be checked with a test gas concentration corresponding to the alarm threshold. If necessary, the measuring range that can be displayed can be increased by reducing the sensor output signal as required with subsequent calibration on the instrument (see chapter "Manual span calibration of the output signal" in the instructions for use of the DSIR gas sensor).

8.6.2 Performing a span adjustment

ℹ Calibration can be aborted at any time. To abort calibration select ***back***.

Prerequisites:
– Adjustment is prepared.
– The zero-point has been adjusted.
– Specifically for all Polytron 8xx0 except the Polytron 8100 EC:
  The last valid zero adjustment was no longer than 24 hours ago.

Adjust the sensitivity as follows:
1. Select and confirm ***Calibration*** > ***Span calibration***.
   ⇒ The maintenance signal is transmitted via the analog interface. No alarms or fault relays are triggered and the 🔧 symbol is displayed.
   ⇒ The parameters for the adjustment gas are displayed, e.g.:[1)]
   Gas : H_2S
   Unit: ppm
   Concentr.: 25
2. If the displayed parameters do not match the target gas, adjust the parameters:
   a. Select and confirm ***Gas***.
   b. Select and confirm the adjustment gas from the list.
   c. Select and confirm ***Unit***.
   d. Select and confirm the unit of measurement from the list.
   e. Select and confirm ***Conc.***.
   f. Set the concentration of the adjustment gas.
3. If the settings are correct:
   a. Select and confirm ***Next***.
      ⇒ A message like ***Gas flow ON H_2S*** is displayed.
4. Apply adjustment gas.
   a. Set the gas flow corresponding to the sensor used (see "Gas flow for adjustments", page 22).
5. Select and confirm ***Next***.
   ⇒ The current value is displayed

ℹ After 15 minutes without confirmation, the instrument returns to the adjustment menu without performing an adjustment.

After the test gas has been applied to the sensor for 3 minutes and the displayed value is stable, perform adjustment.[2)]:
6. Select and confirm ***Next***.
   ⇒ The message ***please wait...*** is displayed.
   ⇒ The newly detected (current) value is displayed.

1) Not applicable for all sensors (see "Measuring mode", page 16).
2) For LC sensors, the test gas must be applied for at least 6 minutes.

7. Select and confirm ***Next***.
8. Turn off the gas flow and remove the calibration adapter from the sensor or disconnect the hose.

   If the current value is not within the alarm range:
9. Select and confirm ***Next***.
   ⇒ The instrument returns to the adjustment menu.

8.7 Automatic calibration

8.7.1 General information

Automatic calibration includes the zero calibration and a subsequent span calibration. It is an alternative to manually carrying out the zero and span calibration.

Not all sensors and gases support automatic calibration. If the function is not available, perform the calibration manually.

8.7.2 Perform automatic calibration

i After 24 hours, zero calibration is not up-to-date any more. Thus, automatic calibration cannot be performed unless zero calibration is performed again.

i Calibration can be aborted at any time. To abort calibration select ***back***.

Prerequisites:

– Automatic calibration is enabled.
– Sensor has finished the warm-up phase.
– Calibration is prepared.

Perform the automatic calibration as follows:

1. Apply Synthetic Air or Nitrogen if ambient air cannot be used.
2. Select ***Calibration*** > ***Auto calibration*** and confirm.
   ⇒ The message ***please wait...*** is displayed and the instrument automatically performs the zero calibration.
   ⇒ In the case of an O_2 sensor, ***Fresh air cal.*** is displayed.

   i The Maintenance signal is transmitted by the analog interface, no alarm or fault relays are switched and the symbol is displayed.
3. After a successful zero calibration, the span calibration is started.
   ⇒ The parameters for the gas are displayed, e. g.:[1)]
   Gas : H_2S
   Unit: ppm
   Concentr.:25
4. If the displayed parameters do not match the target gas, adjust the parameters:[2)]
   a. Select ***Gas*** and confirm.
   b. Select the calibration gas from the list and confirm.
   c. Select ***Unit*** and confirm.
   d. Select the unit of measurement from the list and confirm.
   e. Select ***Conc.*** and confirm.
   f. Set the concentration of the calibration gas.
5. If settings are correct:
   a. Select ***Next*** and confirm.
      ⇒ A message like ***Gas flow ON H_2S*** is displayed.
6. Apply calibration gas.
   a. Set the gas flow corresponding to the sensor used (see "Gas flow for adjustments", page 22)
7. Select ***Next*** and confirm.
   ⇒ The current value is displayed

   i After 15 minutes without confirmation, the instrument reverts to the calibration menu without performing a calibration.
8. Once the current value is stable, the instrument automatically performs the span calibration.
9. After a successful calibration, the new current value and the message ***Value OK?*** are displayed.
   - If not, select Redo and confirm to perform the calibration again.
   - If the value corresponds the target value, proceed.
10. Turn off the gas flow and remove the calibration adapter from the sensor or disconnect the hose.
11. Select ***Accept value*** and confirm to finish the calibration. The instrument returns to the calibration menu.

9 Troubleshooting

9.1 Faults

Number	Cause	Remedy
001, 003 - 004, 012 - 014, 020 - 024, 043, 060, 067	Serious instrument fault, various causes.	Have the instrument checked by DrägerService.
002, 025 - 027, 030 - 034, 041, 042, 044, 050, 052, 081, 085	Serious data error in the instrument, various causes.	Reset the instrument to factory settings. If the fault occurs again: Have the instrument checked by DrägerService.
005	Supply voltage is out of range.	Check the power supply.
010	4 to 20 mA interface cable not connected.	Check the 4 to 20 mA interface connection. If operated as a stand-alone instrument without a central controller, wire pin 3 to pin 4.

1) Not applicable for all sensors (see "Measuring mode", page 16).
2) Only possible for certain sensors.

Number	Cause	Remedy
011	Serious instrument fault, various causes.	Have the instrument checked by DrägerService. If the fault occurs again: Check the load or the cables.
045	Instrument does not detect any sensor.	Check the connections. If the fault occurs again: Have the instrument checked by DrägerService.
051, 054	Faulty zero adjustment.	Perform zero adjustment.
055	Faulty span adjustment.	Perform span adjustment.
076, 080 - 084	Instrument fault.	Check the electrical connections. If the fault occurs again: Have the instrument checked by DrägerService.
090	Sensor lock feature is activated. A sensor with a different part number has been connected.	Use a sensor with the same part number or deactivate the sensor lock feature.
105	Instrument fault.	Have the instrument checked by DrägerService.
137, 64, 91	Instrument fault.	Turn the instrument off and back on. If the fault occurs again: Have the instrument checked by DrägerService.

Only for Polytron 8100 EC with Dräger SensorAlive

Number	Cause	Remedy
220	Sensor opening is clogged.	Clean the sensor opening or replace the dust filter. Then confirm the clogged sensor in the menu (see "Dräger SensorAlive settings", page 36).
221	Sensor sensitivity is less than 40 % (calculated value).	Adjust or replace the sensor.
222	Gas value is too high after electrolysis due to a fault.	Replace the sensor or contact DrägerService.
223	Sensor sensitivity is too low.	Adjust or replace the sensor.
224	Conditioning current is not within the permissible range.	Replace the sensor or contact DrägerService.

Only for Polytron 87x0 IR

Number	Cause	Remedy
064, 071	Communication fault.	Check connection to PIR 7x00.
083	PIR 7x00 optics dirty.	Clean PIR 7x00 optics.
086	Supply voltage outside range	Check supply voltage.
087	4 to 20 mA fault at PIR 7x00 sensor.	Check 4 to 20 mA connection to PIR 7x00.
094, 095	Data error in the instrument.	Reset the sensor to factory default settings. If this error occurs again: Have the instrument checked by DrägerService.
096	SIL password does not match with PIR 7x00.	Enter password again.

9.2 Warnings

Number	Cause	Remedy
101	Data logger in Stack mode is 100 % full and is not logging any more data.	Have the instrument checked by DrägerService.
102	Data logger in Stack mode is 90 % full.	Download the data as soon as possible and clear the data logger.
103, 106	Data error in the instrument. Some dongle functions like the data logger, sensor test, etc. may no longer be available.	Reset the instrument to factory settings. If this error occurs again: Have the instrument checked by DrägerService.
104	Date or time setting not valid.	Set the date and time.
105	Instrument fault.	Have the instrument checked by DrägerService.
107	Battery for data memory empty.	Have the instrument checked by DrägerService.
110, 111, 112	The SW dongle has been removed without first being deactivated.	Deactivate the SW dongle.
113	Alarms inhibited.	Activate the alarms.
164, 165	Sensor warm-up phase not yet complete. Increased measurement errors must be expected.	Wait until the sensor warm-up phase has ended. Do not adjust the sensor before it is fully warmed-up.

Number	Cause	Remedy
167, 170	Adjustment interval expired.	Readjust the instrument.

Only for Polytron 8100 EC

Number	Cause	Remedy
163	Low EC sensor vitality	Replace sensor.
171	Negative reading. Value below range minimum.	Recalibrate zero point.

Only for Polytron 8100 EC with Dräger SensorAlive

Number	Cause	Remedy
320	Communication with the sensor failed. Diagnosis and gas generator no longer work.	Remove the sensor, do not use it for approx. 1 day and reinsert it. Check the firmware version and have it updated by DrägerService if necessary. Replace the sensor.
321	Evaluation of the sensor data failed. The sensor cannot perform or evaluate a LifeTest (preconditions are not met).	Change the time of the LifeTest or set the repeat profile to "Flexible" (see "Dräger SensorAlive settings", page 36). If the warning occurs again, contact DrägerService.
322	Sensor data set is faulty.	Replace the sensor.
323	Sensor data set is incompatible.	Contact DrägerService.
324	Sensor sensitivity is less than 50 % (calculated value).	Adjust the sensor and prepare for sensor replacement (e.g., order the spare part).
325	Sensor sensitivity is less than 40 % (calculated value).	Adjust or replace the sensor.
326	Sensor cannot be adjusted during a LifeTest and for a certain period afterwards.	To be able to perform a scheduled adjustment, the LifeTest can be temporarily inhibited in PolySoft via the Inhibit mode.
327, 330, 344, 347	Gas generator is not working.	Adjust or replace the sensor.
331	Gas generation failed.	Adjust the sensor.
332	Sensor is in the safe state. No LifeTests are performed (group warning).	Determine the cause and rectify it.
333	Real time clock of sensor is not working correctly.	Set the clock.
334	Sensor synchronization not complete.	Wait until synchronization is complete. Depending on the condition of the sensor, this state may last for several minutes. Have the firmware updated by DrägerService if necessary.
336	Internal sensor checks return faulty results.	Restart the system.
337	Transmitter firmware must be updated.	Contact DrägerService.
340	Sensor is synchronized after the system is restarted.	Wait until synchronization is complete.
342	Temperature difference between the two temperature measurement points is too great.	Wait and check if the LifeTest is evaluated, or replace the sensor.
347	Configuration failed due to an interruption in the communication between the transmitter and the sensor.	Reconfigure the sensor and check the configuration.
350	Gas generator is in the start-up phase.	Wait until the start-up phase has ended. During the start-up phase, the error detection and clogging detection functions are not active.
352	Sensor self-test failed.	Replace the sensor or contact DrägerService.
353	Sensor is temporarily in Inhibit mode. No LifeTests are performed during this time.	Inhibit mode can be exited manually via PolySoft or is exited automatically.
354	Error during system start.	Perform manual restart.
355	Sensor firmware is incompatible with the hardware.	Have the firmware updated by DrägerService.
356	Hardware data faulty.	Perform a restart or replace the sensor.
357	Sensor was set to the safe state manually, e.g., to perform a firmware update.	To exit the mode, restart the sensor.

Only for Polytron 87x0 IR:

Number	Cause	Remedy
163	Sensor temperature is very high.	
171	Zero drift too high.	Perform zero calibration.
172	PIR 7x00 optics dirty.	Clean PIR 7x00 optics.
173	Zero calibration expired for span calibration	Perform zero calibration.
182	Automatic calibration not possible with PIR 7200.	Perform new zero and span calibration

10 Maintenance

– The maintenance intervals must be established for each individual installation. Depending on safety considerations and application specific conditions the instrument is used in, these might need to be shortened.

Every 6 months:

– Inspection by trained service personnel.
– Check signal transmission to the controller (see "Testing the analog interface", page 33).
– Check LEDs as well as the triggering of the alarm device (see "Testing alarms/relays", page 31).

Regularly:

– Perform calibrations, see 8 Calibration

10.1 Performing a bump test and checking the response time (t90)

A bump test checks the response time without setting off an alarm.

1. Select and confirm ***Settings*** > ***Instrument*** > ***Bump test***.
   ⇒ The Maintenance symbol is displayed.
   ⇒ The analog output is set to the maintenance signal.
2. Apply a known gas concentration to the sensor.
3. Check the response time and compare it with the t90 value indicated in the corresponding sensor data sheet.
4. Press [OK] to return to measurement.

10.2 Sensor replacement

⚠ WARNING
Faulty Calibration
Faulty Calibration may cause inaccurate readings.
► If the sensor is replaced, all settings and parameters must be checked for correctness.
► Check calibration to verify proper operation.

10.2.1 Polytron® 8100 EC

A sensor can be replaced in the hazardous, classified area, without interrupting the power supply.

Sensor lock feature

If a sensor of the same type (same part number) was previously installed, the instrument-specific configuration is retained (gas type, measuring range, test gas, adjustment interval, etc.). Otherwise, the factory default settings of the new sensor are uploaded and will overwrite the instrument-specific configuration. This can be prevented if the sensor lock feature is activated (see "Setting sensor lock", page 35).

Sensor change function

The ***Change Sensor*** menu function lets you replace a sensor during operation without triggering a fault signal at the controller. It also ensures that all sensor data in the microprocessor can be saved in the sensor memory (EEPROM) before disconnecting the sensor.

Replacing a sensor

See figure C on the fold-out page.

A sensor can be replaced at any time.

1. Select ***Settings*** > ***Sensor*** > ***Change Sensor*** and confirm.
   ⇒ The maintenance signal is generated on the 4-20mA interface.
   ⇒ The display shows the following: ***Please remove the sensor***.
   ⇒ The Maintenance symbol is displayed.
2. Replace the old sensor with a new sensor:
   a. Loosen the locking screw (2) (2 mm Allen screw).
   b. Unscrew bayonet ring (3)
   c. Insert the sensor (4) into the opening and turn until it engages in the gas detector. This does not damage the sensor plug.
   d. Secure the sensor with the associated bayonet ring (3).

   ℹ For Dräger SensorAlive, a different bayonet ring needs to be used than for other EC sensors.

   e. Tighten the locking screw (2) so that the bayonet ring cannot come loose (required for installations in zone 22).
      ⇒ The display shows the following: ***Loading data, please wait***
3. If necessary, apply the label included with the sensor to the instrument. This identifies the gas type from a distance, even if the power has failed.
4. When the sensor data are loaded, the display shows: ***Data loaded***.
5. Select ***Back to menu*** and confirm.
   ⇒ The maintenance signal on the 4-20mA interface remains pending until the sensor is warmed-up.

   Maximum warm-up time of a new sensor: see the Instructions for Use for the sensor. For Oxygen: EN 50104 approvals.

6. Check calibration. If necessary, calibrate the instrument (see "Calibration", page 22).
7. Check the installation requirements and instrument for SIL status.
   See sections "Explosion proof (Ex d) installation - without Docking Station" to "Installation of sensors or sensing heads".

10.2.2 Polytron® 8200 CAT, 8310 IR, 87x0 IR

Replacing a sensor

1. If necessary, set the maintenance current for the analog interface.
2. Turn off power to the instrument or declassify the area according to local regulations.
3. Loosen set-screw and unscrew lid from instrument.
4. Pull out the PCB unit.
5. Turn PCB unit over and pull off the sensor connector.
6. Unscrew the sensor.
7. Insert the sensor wires through he threaded port of the enclosure.

⚠ WARNING
Explosion hazard!
The enclosure openings must be sealed to prevent ignition of hazardous atmospheres in case of an ignition inside the enclosure.

► Five threads must be engaged to ensure explosion proof status.

8. Screw in the sensor and tighten with the correct tightening torque (min. 266 in-lbs / min. 30 Nm)
9. Polytron® 8200 CAT-specific:
   Twist the sensor wires together. If necessary, fit a cable tie to keep the wires tight.
10. Plug the sensor connector back into socket.
11. Place PCB unit back into the enclosure.
12. Screw the cover on the instrument until it is correctly engaged (min. ≥44 in-lbs / min. ≥5 Nm) and tighten the locking screw.
13. Apply power to the instrument, if necessary.
    ⇒ The maintenance signal on the 4-20mA interface remains pending until the sensor is warmed-up.

    Maximum warm-up time of a new sensor: see the Instructions for Use for the sensor.
14. Check calibration. If necessary, calibrate the instrument (see "Calibration", page 22).
15. Check the installation requirements and instrument for SIL status.
    See sections "Explosion proof (Ex d) installation - without Docking Station" to "Installation of sensors or sensing heads".

10.3 Performing a display test

1. Select and confirm ***Settings*** > ***Instrument*** > ***Display*** > ***Displaytest***.
2. Select and confirm ***Enable***.
   ⇒ The information on the display is shown inverted. All LEDs are turned on.
   When the menu is exited, the inversion is ended.

11 Instrument settings

11.1 Setting passwords

1. Select ***Settings*** > ***Instrument*** > ***Passwords*** the desired password and confirm.

Calibration PWD	Access to zero and span calibration
Settings PWD	Access to all configuration parameters

2. Select the line for editing the password and confirm.
3. Set the password and confirm.
4. Select ***Confirm*** and confirm with [OK].

11.2 Setting date and time

1. Select ***Settings*** > ***Instrument*** > ***Date and time*** and confirm.
2. Select the line for editing the date or time and confirm.
3. Select ***Confirm*** and confirm with [OK].

11.3 Setting language

1. Select ***Settings*** > ***Instrument*** > ***Language*** and confirm.
2. Select a language from the list and confirm.

11.4 Configuring function key

1. Select ***Settings*** > ***Instrument*** > ***Function key*** and confirm.
2. Select a function and confirm.

Graph	The measurements of the past 15 minutes are displayed as a time/concentration graph.
Faults	Fault messages are displayed in plain text.
Warnings	Warning messages are displayed in plain text.
Bump test	The bump-test allows applying gas to the sensor without generating an alarm. The maintenance signal is transmitted. After 15 minutes or tapping [OK] again ends the bump test and the instrument returns to normal operation.
Sensor vitality[1)]	Shows the remaining sensor vitality.

1) Only with diagnostic dongle

11.5 Resetting to default settings

This function resets the instrument to factory default settings.

1. Select ***Settings*** > ***Instrument*** > ***Device init*** and confirm.
2. Select ***Confirm*** and confirm with [OK].

11.6 Changing the display contrast

1. Select ***Settings*** > ***Instrument*** > ***Display*** > ***Display contrast*** and confirm.
2. Change the contrast and confirm.

11.7 Changing the display mode

1. Select ***Settings*** > ***Instrument*** > ***Display*** > ***Display mode*** and confirm.
2. Select the desired mode and confirm.

Standard	Shows the standard display.
Non-display	Shows the start screen and the applicable symbols.

If an alarm is triggered, the display shows the current gas concentration and the red LED blinks regardless of the selected display mode.

11.8 Relays

11.8.1 Combinations of latching and alarm acknowledgment

The following examples give an overview of relay acknowledgment combinations.

	Latching (Manual relay reset)	**Non-Latching** (Automatic relay reset after alarm condition cleared)
Acknowledgeable	Relay reset possible at any time.	
Non-acknowledgeable	Relay reset not possible before alarm condition cleared.	
Pre-acknowledgeable	Alarm acknowledgment possible before the alarm condition cleared. The relay resets automatically after the alarm condition cleared.	

Latching and non-latching signals are not time-limited. Latching signals stay active until they are acknowledged. Non-latching signals stop as soon as the triggering condition clears.

11.8.2 Configuring relay A1 or A2

This function defines whether the alarm relay is energized during normal operation or energized at an alarm condition.

1. Select ***Settings*** > ***Instrument*** > ***Alarm***> ***Relay A1*** or ***Relay A2*** and confirm.
2. Select the desired option and confirm.

Normally energized	The relay contact is energized during normal operation and changes if an alarm is triggered. At a loss of power this triggers an alarm (fail-safe).
Energ. on alarm	If an alarm is triggered, the relay contact is energized.

11.8.3 Setting fault relay warm-up 1

This function is used to set operation of the fault relay during warm-up 1 to indicate the warm-up 1 state on the relay output.

1. Select ***Settings*** > ***Instrument*** > ***Alarm***> ***Fault warm up*** the desired option and confirm.

static	The fault relay triggers a connected alarm indicator permanently. The orange LED is lit continuously.
dynamic	The fault relay switches state for 9 seconds. *Example:* – A horn is connected to fault relay output Normally Open. – Relays are configured as normally energized. ⇒ The horn and the orange LED of the transmitter are 1 second active and 9 seconds in-active.

11.9 Alarm configuration

11.9.1 Turning the alarms on and off

1. Select ***Settings*** > ***Instrument*** > ***Alarm*** > ***Alarm on/off***.

Enable	Alarm activation is switched on.
Disable	Alarm activation is switched off. LEDs, relays and interfaces do not indicate an alarm condition. The 4-to-20 mA interface transmits the maintenance signal. The value determined and the ! symbol will be shown. The fault relay indicates an error.

2. Select and confirm ***Enable*** or ***Disable***.

11.9.2 Configuring alarms

1. Select and confirm ***Settings*** > ***Instrument*** > ***Alarm*** > ***Alarm A1*** or ***Alarm A2***.
   The current alarm threshold is displayed.
2. Accept the displayed suggestion or change the following settings (confirm the configuration steps one after the other with ***Next***):
   a. Set the value for the alarm threshold.

b. Set the alarm direction.

Rising	The alarm direction is called rising if the gas concentration has to exceed a certain value to activate an alarm.
Falling	The alarm direction is called falling if the gas concentration has to fall below a certain value to activate an alarm.

c. Set the latch mode.

Latching	Once the alarm threshold is reached, the instrument will trigger the alarm. It will remain in the alarm state even if the gas concentration no longer meets the alarm condition. To clear a latching alarm, it must be acknowledged.
Non-latching	The alarm state clears if the gas concentration no longer meets the alarm condition.

d. Set the acknowledgement mode.

Acknowledgeable	The alarm relay and the alarm LED can be reset before the alarm condition clears.
Non-acknowledgeable	The alarm relay and the alarm LED cannot be reset until the alarm condition clears.
Pre-Acknowledgeable	The alarm state can be acknowledged before the alarm condition clears. The alarm relay and the alarm LED stay active until the alarm condition clears, however.

e. Set the hysteresis value.
The hysteresis function defines a range in which a triggered relay will remain in its state until the gas concentration is outside the defined range again. Example: The alarm threshold is set to 40 ppm and hysteresis to 3 ppm. The alarm remains active until the value falls below 37 ppm. This prevents relays from closing and opening in rapid succession at an alarm threshold ("chattering").

ℹ If the direction of an alarm is changed (from falling to rising or vice versa), the hysteresis value must be checked and corrected if necessary.

⇒ A confirmation screen shows all settings.

f. Select ***Confirm*** and confirm with OK.

✓ The new settings are saved.

11.9.3 Testing alarms/relays

These functions change the statuses of a relay and an LED for test purposes (e.g., to check the function of alarm devices connected to the relay). The ℹ symbol is displayed. After exiting this function, the statuses of the relay and the LED will automatically return to their previous statuses.

1. Select and confirm the desired alarm condition via ***Settings*** > ***Instrument*** > ***Alarm***.

Set Alarm A1	Simulates a pre-alarm
Set alarm A2	Simulates a main alarm
Set fault	Simulates a fault signal

2. Select and confirm ***Enable***.
⇒ The fault relay is de-energized and the 4 to 20 mA interface is set to fault current. The yellow LED is lit, the symbol for maintenance is shown.
When the menu is exited, the simulation is ended.

11.10 Data logger settings

11.10.1 Displaying graph

The last 15 minutes as a time/concentration graph can be viewed.

1. Select ***Information*** > ***Data logger*** > ***Graph***

11.10.2 Switching data logger on or off

1. Select ***Settings*** > ***Data logger*** > ***Datalogr. on/off*** and confirm.
2. Select ***Enable*** or ***Disable*** and confirm.

11.10.3 Setting the sampling time

This function defines how often a value is stored.

1. Select ***Settings*** > ***Data logger*** > ***Datalogr. on/off*** > ***Sample time*** and confirm.
2. Select the sample time and confirm.

11.10.4 Setting peak/average

This function determines which value is stored.

1. Select ***Settings*** > ***Data logger*** > ***Data logger*** > ***Peak/Average*** and confirm.
2. Select ***Peak*** or ***Average*** and confirm.

Peak	The maximum value (if monitoring falling concentrations, the minimum value) of the measured concentrations within the selected sampling time is stored.
Average	The average value of all the measured concentrations within the selected sampling time is stored

11.10.5 Switching triggering mode on or off

This function allows storing values from a certain value on.

1. Select ***Settings*** > ***Data logger*** > ***Data logger*** > ***Trigger on/off*** and confirm.
2. Select ***On*** or ***Off*** and confirm.

On	Measurements are stored if they exceed a threshold beyond the trigger value (relative to the last stored value).
Off	Measurements within the sampling time are stored.

11.10.6 Setting trigger value

This function defines the trigger threshold to store a value.The trigger value is defined as a percentage of the full scale deflection.

Example: A trigger value of 2 % at full scale deflection of 500 ppm will only store values if they deviate by 10 ppm (relative to the previously stored value).

1. Select ***Settings*** > ***Data logger*** > ***Datalogr. on/off Trigger value*** and confirm.
2. Set the trigger value and confirm.

11.10.7 Setting stack/roll function

1. Select ***Settings*** > ***Data logger*** > ***Data logger*** > ***Stack/Roll*** and confirm.
2. Select ***Stack*** or ***Roll*** and confirm.

Roll	Once the capacity of the data logger is reached, the old data are overwritten by new values.
Stack	Once the capacity of the data logger is reached, no more data can be stored. The instrument issues a warning.

11.10.8 Clearing data logger

This function deletes the stored data.

1. Select ***Settings*** > ***Data logger*** >***Clear data logger*** and confirm.
2. To clear the data-logger, select ***Confirm*** and confirm with [OK].

12 Interface settings

12.1 4-20mA interface

The current output of the instrument during normal operation is between 4 and 20 mA and is proportional to the detected gas concentration.

Polytron 8xx0 uses different current values to indicate various modes of operation. The factory default settings are user adjustable for application specific requirements. This follows the NAMUR recommendation NE43.

12.1.1 Full scale deflection

Polytron® 8100 EC, 87x0 IR and 8200 CAT LC only

Some sensors offer an adjustable full scale deflection to limit the measuring range for the 4-20 mA interface.

The full scale deflection (FSD) sets an endpoint within the measuring range of the sensor. If the gas concentration reaches this endpoint, the 4-20mA interface transmits 20mA.

Example: Required range 0 to 500 ppm CO (e.g. part number 6809605 default 300 ppm, range min/max = 50/1000 ppm).Select full scale deflection as 500 ppm. The analog output will be linear between 4 mA = 0 ppm and 20 mA = 500 ppm.

12.1.2 Setting fault current

This function defines the current for the fault signal.

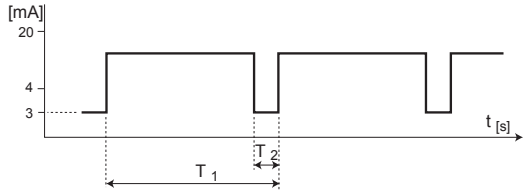
1. Select ***Settings*** > ***Communication*** > ***Analog interface*** >***Fault current*** and confirm.
2. Select the line for editing the current and confirm.
3. Set the current and confirm.
   ⇒ The setting for the ***Fault current*** is displayed.
4. Select ***Confirm*** and confirm with [OK].

12.1.3 Information regarding the warning signal

To transmit a warning signal via the analog interface, it must be switched on.
The warning signal alternates between the warning current and the measurement current.

– Warning current (interval T2)
– Measurement current (interval T1-T2)

Time intervals and the warning current are configurable.



12.1.4 Switching the warning signal on or off

1. Select ***Settings*** > ***Communication*** > ***Analog interface*** > ***Warning*** and confirm.
2. Select ***Enable*** or ***Disable*** and confirm.

12.1.5 Setting warning interval

1. Select ***Settings*** > ***Communication*** > ***Analog interface*** > ***Warning interval*** and confirm.
2. Set times for warning intervals T1 and T2 and confirm.

12.1.6 Setting warning current

1. Select ***Settings*** > ***Communication*** > ***Analog interface*** > ***Warning current*** and confirm.
2. Set the current and confirm with [OK].

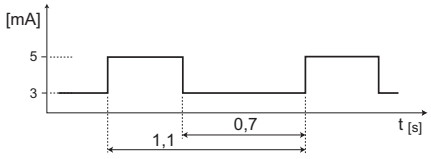
12.1.7 Setting the warnings of the Dräger SensorAlive

This menu can be used to set various parameters of the warning current:

- To set the warning current, select ***Settings*** > ***Communication*** > ***Analog interface*** > ***DSA warn current*** and enter the value.
- To set the threshold value for the warning, select ***Settings*** > ***Communication*** > ***Analog interface*** > ***DSA warn limit*** and enter the value.
- To enable or disable the warning, select ***Settings*** > ***Communication*** > ***Analog interface*** > ***Set DSA warning*** and confirm.
  Select ***Enable*** or ***Disable*** and confirm.

12.1.8 Setting maintenance signal

1. Select ***Settings*** > ***Communication*** > ***Analog interface*** > ***Maint. signal*** and confirm.
2. Set the signal type and confirm.

static	A constant current that can be configured.
dynamic	A square wave signal with the following characteristics: 

12.1.9 Setting the maintenance current

The maintenance current can only be set if the maintenance signal has been set to static.

1. Select ***Settings*** > ***Communication*** > ***Analog interface*** >***Maint. current*** and confirm.
2. Set the current and confirm.

12.1.10 Setting analog offset

This function adds an offset to the analog output at 4 mA. The offset adjusts the current at 4 mA without affecting the 20 mA set point.

1. Select ***Settings*** > ***Communication*** > ***Analog interface*** >***Analog offset*** and confirm.
2. Select the line for editing the offset (range: -0.5 to 0.5 mA, SIL: -0.1 to 0.1) and confirm.
3. Set the current and confirm.
   ⇒ The setting for the ***Analog offset*** is displayed.
4. Select ***Confirm*** and confirm with [OK].

12.1.11 Setting analog span

This function adjusts the analog output at 20 mA without affecting the 4 mA set point.

1. Select ***Settings*** > ***Communication*** > ***Analog interface*** > ***Analog span*** and confirm.
2. Select the line for editing the offset (range: -0.5 to 0.5 mA, SIL: -0.1 to 0.1) and confirm.
3. Set the current and confirm.
   ⇒ The setting for the ***Analog span*** is displayed.
4. Select ***Confirm*** and confirm with [OK].

12.1.12 Testing the analog interface

These functions change the current of the analog interface for test purposes (e.g., to check the programming of the controller). It may be necessary to temporarily inhibit the alarms at the controller to avoid false alarms. After exiting these functions, the currents automatically return to the maintenance signal. During the test, the maintenance symbol is displayed.

- To set the current or concentration:

1. Select the desired option via ***Settings*** > ***Communication*** > ***Analog interface***.

Set Current	This function sets the current to any value between 0 and 22 mA. Offset current and analog span are not used in this function.
Set concentr.	This function sets the current to any measured value between 0 ppm and full scale deflection.

2. Once the alarms at the controller are inhibited, confirm the message ***Inhibit all alarms*** with ***Next***.
3. Select the line for editing and confirm with [OK].
4. Set the desired value.
5. Select and confirm ***Next***.
6. Select the desired option:

Set concentr. out / ***set current out***	This function simulates the preset measured value or test current value. During the test, the maintenance symbol is displayed.
concentration off / ***current off***	This function aborts the transmission of the preset test value.

7. Select and confirm ***Next***.
   ⇒ The function is aborted.
8. Once the alarms at the controller are enabled again, confirm the following message: ***Enable all alarms***.

- To set the test signal:

1. Select the desired test via ***Settings*** > ***Communication*** > ***Analog interface***.

Set fault	This function sets the current to the fault current.
Set warning	This function sets the current to the warning current.
Set mainten.	This function sets the current to the maintenance current.

2. Once the alarms at the controller are inhibited, confirm the message ***Inhibit all alarms***.
3. Select and confirm ***Enable*** or ***Disable***.

12.1.13 Beam block

This function is only available for Polytron 87x0 IR (using the sensor PIR 7000/7200).

The factory default setting for the beam block function is off.

If turned On, the beam block signal will be transmitted on the analog interface if the optics of the PIR 7000/7200 sensor is “dirty”. The optics of the PIR 7000/7200 can become “dirty” if there is a build-up of deposits on the optical surfaces. However, if the gas concentration rises to a level above beam block limit, the instrument returns to normal operation.

If the build-up of deposits on the optical surfaces increases beyond the point where a measurement is possible, the instrument will go into fault.

- To set beam block signals on/off:

1. Select ***Settings*** > ***Communication*** > ***Analog interface*** and the desired option.

Beamblock on/off	This function switches the beam block on or off
Set beamblock	This function sets the current to the beam block warning current

2. Select ***Enable*** or ***Disable*** and confirm.

- To set beam block signals:

1. Select ***Settings*** > ***Communication*** > ***Analog interface*** and the desired option.

Beambl. current	This function defines the current for the beam block signal.
Beamblock limit.	This function defines the maximum limit if the beam block signal will be transmitted on the analog interface.

2. Select the current line for editing the current and confirm.
3. Set the current and confirm.
   ⇒ The setting for the beam block current is displayed.
4. Select ***Confirm*** and confirm with OK.

12.2 HART interface

12.2.1 Setting the polling address

The polling address (query address) configures the gas detector for analog operation or multidrop operation.

HART command: #6 (Write Polling Address)

1. Select ***Settings*** > ***Communication*** > ***Hart interface*** > ***Polling address***.
2. Set the polling address and select ***Confirm***.

0	Activates analog operation.
1 to 15	Activates multidrop operation. The 4 to 20 mA interface is deactivated and set to a constant current of approx. 1 mA.

ℹ Configure all instruments on a line with different polling addresses. It is advised to choose a sequence starting with 1.

12.2.2 Displaying the Unique Identifier

The Unique Identifier (unique HART address) must be known for almost all HART addressing commands.

HART commands:

– #0 (Read Unique Identifier)
– #11 (Read Unique Identifier associated with Tag)

1. Select ***Settings*** > ***Communication*** > ***Hart interface*** > ***Unique identifier***.
2. The Unique Identifier is displayed.

12.2.3 Setting the HART tag

The HART tag (measurement point identification) is used to mark a measurement point.

1. Select ***Settings*** > ***Communication*** > ***Hart interface*** > ***Tag***.
2. Set the HART tag and select ***Confirm***. The HART tag can consist of up to 8 alphanumeric characters.

12.2.4 Setting the Dräger REGARD protocol

This function switches between different HART protocols.

1. Select ***Settings*** > ***Communication*** > ***Hart interface*** > ***Dräger REGARD***.
2. Select the software version corresponding to the REGARD controller.

12.3 Digital interfaces

Information on configuring the other interfaces is provided in the following documents:

Interface	Document
PROFIBUS PA	9033782
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

13 Sensor settings

13.1 Switching automatic calibration on or off

1. Select ***Settings*** > ***Sensor*** > ***Auto calibration*** and confirm.
2. Select ***Enable*** or ***Disable*** confirm with [OK].

13.2 Capture range

The capture range blanks out measurement fluctuations. Measurement fluctuations are minor variations in measured values (such as signal noise, variations in concentration). Those variations do not change the transmitted or displayed value. Measured values within this range will be displayed with the capture value. Measured values outside the capture range will be displayed with the actual measured value.

Capture value (offset)

The capture value is displayed continuously, as long as the measured value ranges between the upper and lower capture value limits.

Upper capture value limit

The upper capture value limit marks the upper limit of the range in which the capture value is displayed.

Lower capture value limit

The lower capture value limit marks the lower limit of the range in which the capture value is displayed.

13.2.1 Setting capture range

1. Select ***Settings*** > ***Sensor*** > ***Display Capture*** and confirm.
2. Set offset in the first window.
3. Set the lowest value of the capture range and confirm with ***Next***.
4. Set the highest value of the capture range and confirm with ***Next***.
5. Check all the values and confirm with ***Next***.

13.2.2 Switching capture range off

1. Select ***Settings*** > ***Sensor*** > ***Display Capture*** and confirm.
2. Set offset in the first window.
3. Set the lowest value of the capture range to 0 and confirm with ***Next***.
4. Set the highest value of the capture range to 0 and confirm with ***Next***.
5. Check all the values and confirm with ***Next***.

13.3 Resetting sensor

This function resets the sensor to factory default settings.

1. Select ***Settings*** > ***Sensor*** > ***Init. channel*** and confirm.
2. Select ***Confirm*** and confirm with [OK].

13.4 Setting calibration interval

After the calibration interval expires, the instrument will issue a warning that the calibration is past due.

1. Select ***Settings*** > ***Sensor*** > ***Cal. interval*** and confirm.
2. Set the calibration interval and confirm with [OK].

13.5 Setting sensor lock

This point is only valid for Polytron 8100 EC and Polytron 87x0 IR.

1. Select ***Settings*** >***Sensor*** > ***Sensor lock*** and confirm.
2. Select ***On*** or ***Off***.

On	The instrument rejects any sensor whose part number does not match the part number of the previously installed sensor.
Off	The instrument accepts any suitable sensor, uploading the default settings of this sensor. However, this overwrites any customized settings with the default settings of the new sensor.

13.6 Software dongles for EC sensors

13.6.1 Installing the dongle

1. Switch off power to the instrument or declassify the area according to the local regulations.
2. Loosen set-screw and unscrew lid from instrument.
3. Insert the dongle with the Dräger logo facing upwards in the slot of the PCB unit, See figure D on the fold-out page..
4. Position the PCB unit back cover and close the instrument (see "Closing the gas detector", page 13).

13.6.2 Deactivating dongles

This function deactivates a dongle to safely remove the dongle or if the dongle is faulty.

A dongle can only be reactivated by cycling the power to the instrument.

1. Select ***Settings*** > ***Instrument*** > ***SW dongle*** > and the dongle to be deactivated, and confirm.
2. Select ***Deactivation func.***. The selected dongle is deactivated.

13.7 Sensor settings Polytron® 8100 EC

13.7.1 Sensor self-test

This function is only active if the sensor-test dongle or diagnostic dongle is installed. If the sensor does not pass the self-test, a warning or error message is issued.

Setting regular sensor self-tests

This feature triggers the sensor self-test at regular intervals. The instrument then routinely checks that the sensor is functioning correctly.

1. Select and confirm ***Settings*** > ***Sensor*** > ***Set Sensortest***.
2. Select and confirm ***Enable*** or ***Disable***.

Starting sensor test manually

This function starts a single sensor self-test.

1. Select ***Settings*** > ***Sensor*** > ***Sensor test*** and confirm.
2. ***Start sensor test*** is displayed.
3. Select ***Confirm***.

✓ The test result is displayed.

13.7.2 Gas settings

This function sets the gas type, measuring range, and units of measurement. Different settings are possible depending on the installed sensor.

1. Select and confirm ***Settings*** > ***Sensor*** > ***Gas settings***.
   ⇒ The current measured gas is displayed.
2. Select and confirm the measured gas from the list.
   ⇒ The current unit of measurement is displayed.
3. Select and confirm the unit of measurement from the list.
   ⇒ The current full scale deflection is displayed.
4. For certain EC sensors only: Set and confirm the full scale deflection.
   ⇒ The new full scale deflection is displayed.
5. Select and confirm ***Next***.
   ⇒ An overview of the new gas settings is displayed.
6. After reviewing it, select ***Back to menu*** or ***Confirm***.

Back to menu	Select Back to menu to exit the function without changes and confirm with [OK].
Confirm	Select Confirm to accept the settings and confirm with [OK].

13.7.3 Dräger SensorAlive settings

This menu lets you select various parameters that define the behavior of the Dräger SensorAlive:

- To activate or deactivate the LifeTest functions of the sensor, select and confirm ***Settings*** > ***Sensor*** > ***SensorAlive*** > ***DSA activation***.
  Select and confirm ***Enable*** or ***Disable***.
- To acknowledge a clogged sensor, select ***Settings*** > ***Sensor*** > ***SensorAlive*** > ***Ack faults***.
- To enable or disable fault detection, select and confirm ***Settings*** > ***Sensor*** > ***SensorAlive*** > ***Fault detection***.
  Select and confirm ***Enable*** or ***Disable***.

The ***SensorAlive*** menu has the following sub-menus:

– LifeTest
– Sensitivity monitoring

The following parameters can be set in the LifeTest sub-menu:

- To define when to start a test run, select ***Time***.
  Enter a time and confirm. The test run is started when this time is reached on the transmitter.

  ℹ Transmitters do not support an automatic daylight savings changeover.

- To define the value to be output via the transmitter during the LifeTest, select ***Output behavior***.
  Select and confirm ***Fixed***, ***Maintenance*** or ***Measurement val.***.
- To define whether retests are to be carried out in a test run if a LifeTest has a negative test result, select ***Repetition mode***.
  Select and confirm ***Flexible***.
  If ***Static*** is selected, no retests are carried out and a new test run is carried out at the indicated time instead.
- To define when to abort a LifeTest, select ***Cancel threshold***.
  Enter a value and confirm.

  ℹ During a LifeTest, test gas is applied to the Dräger SensorAlive. This causes the measured value to rise. To prevent an alarm from being triggered, the measured value is not transmitted for a maximum of 15 minutes by default. The behavior during a LifeTest can be configured in the ***Output behavior*** menu, however. Independent of this, the sensor detects a gas leak if the measured gas concentration is greater than the gas concentration expected as a result of the LifeTest. The difference corresponds to the concentration of the gas leak and is compared with the value entered in ***Cancel threshold***. If this value is exceeded, the LifeTest is immediately aborted. The sensor switches back to measuring mode and the transmitter once again outputs a measured value. If relays are used, these are tripped on the transmitter and, where applicable, an alarm is triggered.

The following parameters can be set in the ***Sensitiv. check*** sub-menu:

- To define whether a warning needs to be issued, select and confirm ***Activation***.
- To define when a warning must be output, select and confirm ***Alert < 50%*** or ***Alert < 40%***.

13.8 Sensor settings Polytron® 8200 CAT / 8310 IR

13.8.1 Sensor type

This function defines the sensor type installed.

1. Select ***Settings*** > ***Sensor*** > ***Sensor type*** and confirm.
2. Select the sensor type and confirm.

13.8.2 Gas settings

This function sets the unit of measurement.

For LC sensors, this function also sets the full scale deflection.

1. Select ***Settings*** > ***Sensor*** > ***Gas settings*** and confirm.
2. Select the unit of measurement from the list and confirm.
   ⇒ For DQ sensors and DSIR:
   An overview of the new gas settings is displayed.
   Continue with step 4.
   ⇒ For LC sensors:
   The current full scale deflection is displayed. Continue with step 3.
3. Set the full scale deflection and confirm (only for LC sensors).
   ⇒ An overview of the new gas settings is displayed.
4. After review, select ***Back to menu*** or ***Confirm***.

Back to menu	Select Back to menu for leaving the function without changes and confirm with [OK].
Confirm	Select Confirm to accept the settings and confirm with [OK].

13.8.3 Setting the DQ sensor latching

This feature is only available if there are no relays installed.
This feature is used to determine whether the DQ sensor must be acknowledged after measuring a concentration higher than 100 %LEL.
This setting does not apply for LC sensors.

1. Select and confirm ***Settings*** > ***Sensor*** > ***DQ Sensor latch.***.
   ⇒ The current setting is displayed.
2. Select and confirm ***Enable*** or ***Disable***.

⚠ WARNING
Explosion Hazard
If sensor latching is disabled and an alarm indicating an explosion hazard is acknowledged, the instrument informs the end user of such hazard by having the red LED on the display being continuously lit.

► Before acknowledging an over range, ensure that the gas concentration has fallen under 100%LEL.

⚠ WARNING
Explosion Hazard possible
Operation is non-compliant with BVS type examination.
If DQ sensor latching is disabled, for safe operation in accordance with BVS 13 ATEX G 001 X, the central controller must support this function.

► Make sure that over range latching is active at the display unit.

13.9 Sensor settings Polytron 8310 IR

13.9.1 Changing the gas category

The DrägerSensor IR can measure gases and vapors that belong to the methane, propane, or ethene (ethylene) gas categories. A gas category must be set for the DrägerSensor IR depending on which target gas is to be measured. For the assignment of gases and vapors to the gas categories, see the DrägerSensor IR documentation.

13.9.2 Changing the gas category

Prerequisites

– The gas detector was turned on less than an hour ago.
– The automatic zero calibration on the sensor was performed less than an hour ago (see "Special feature of the Polytron 8310", page 23).
– The gas concentration measures by the gas detector is below 10 %LEL (apply zero gas to the sensor if necessary).

1. Turn off the alarm activation for the gas detector (see "Turning the alarms on and off", page 30).
2. Select ***Settings*** > ***Sensor*** > ***DSIR Category*** and confirm.
   ⇒ The gas category is displayed on the instrument.

ℹ The next steps are carried out on the sensor.

3. To select the gas category on the sensor, tap the ⇧S or ⇩0 symbol with the magnetic wand.
   ⇒ START is displayed on the gas detector.
4. Remove the magnetic wand.
   ⇒ The sensor switches to an output signal that represents the gas category currently set:
   Output signal 20 %LEL: Methane gas category
   Output signal 40 %LEL: Propane gas category
   Output signal 60 %LEL: Ethene (ethylene) gas category
5. This output signal is maintained for 30 seconds. During this period, the next gas can be selected by placing the magnetic wand on the area marked with the ⇧S symbol.
   ⇒ The sensor's output signal then switches to the value that matches the newly selected gas category. If no further input with the magnetic wand takes place for more than 30 seconds, the setting is saved.
6. Check the span calibration on the gas detector (see "Span calibration", page 24)
7. Turn on the alarm activation for the gas detector (see "Turning the alarms on and off", page 30).

ℹ The setting on the sensor can result in an incorrect gas category being displayed in the ***DSIR Category*** menu item or that a change in gas category is no longer visible.

13.10 Sensor settings Polytron® 87x0 IR

13.10.1 Gas settings

This function sets the gas type, measuring range and units of measurement. Only certain sensors support these settings.

1. Select ***Settings*** > ***Sensor*** > ***Gas settings*** and confirm.
   ⇒ The current measured gas is displayed.
2. Select a measured gas from the list and confirm.
   ⇒ The current unit of measurement is displayed.
3. Select the unit of measurement from the list and confirm.
   ⇒ If the unit of measurement is set to %LEL, %UEG, or %LIE, the category will be displayed. Continue with step 4.
   ⇒ Otherwise the current full scale deflection is displayed. Continue with step 6.
4. Select a category and confirm.
5. Set the LEL value and confirm.
6. Set the full scale deflection and confirm.
   ⇒ The new full scale deflection is displayed.
7. Select ***Next*** and confirm.
   ⇒ An overview of the new gas settings is displayed.
8. After review, select ***Back to menu*** or ***Confirm***.

Back to menu	Select Back to menu for leaving the function without changes and confirm with [OK].
Confirm	Select Confirm to accept the settings and confirm with [OK].

9. Check the alarm settings after changing the category or the LEL value.

14 Factory default settings

14.1 Unchangeable settings for relay, LED, and alarm

	Setting
Fault relay:	Energized / Normally Open
Yellow LED:	Lit if a fault message is available
Red LED:	Single flash if A1 alarm is present. Double flash if A2 alarm is present. If an alarm is configured as acknowledgeable and the alarm is acknowledged, single/double flash changes to continuously lit.
Alarm Hierarchy	A2 overrides A1 on the LED. However, the A1 and A2 relays operate independently. (Example: if A1 is acknowledgeable, A2 is not, and the gas concentration is such that it triggers A1 and A2: acknowledging the alarm will cause the A1 relay to release. But the red LED continues its double flash as long as the state that triggers the A2 alarm persists.

14.2 Settings which can be changed via the menu

Menu	Default setting	Range
Relay active on alarm / No alarm	Active on alarm	On/Off
A1 alarm: direction	Rising (falling for O_2 sensors)	Falling/Rising
A2 alarm: direction	Rising	
A1 latch mode	Non-latching	Latching/Non-latching
A2 latch mode	Latching	
A1 acknowledge mode	Acknowledgeable	Acknowledgeable/Non-acknowledgeable/Pre-acknowledgeable
A2 acknowledge mode	Not acknowledgeable	
Normal operation A1 relay	Energized	Energized/Not energized
Normal operation A2 relay		
Calibration password	_ _ _ 1	
Settings password	_ _ _ 2	
LCD setting	On	On/Off
SIL status	Off	On/Off
Language	EN	DE / EN / FR / ES / RU / ZH
Automatic calibration	Off	On/Off
Function key	Error	Graphic, fault, warning, vitality, bump test

Interface	Default setting	Range
Fault current	1.2 mA	0 to 3.5 mA
Warning	Off	On/Off
Warning current	3.0 mA	0 to 3.5 mA
Warning cycle interval T1	10 s	5 to 60 s

Interface	Default setting	Range
Warning cycle interval T2 (warning current)	1 s	1 to (T1-1) s
Maintenance signal	static	Static/dynamic
Maintenance current	3.4 mA	0 to 3.5 mA
Analog offset	0 mA	-0.5 to 0.5 mA
Sensitivity analog output	0 mA	-0.5 to 0.5 mA
HART® address	0	0 to 15
Modbus address[1)]	126	2-126
Modbus parity[1)]	even (default)	even, odd parity, no parity
Modbus baud rate[1)]	9600 bps	9600 or 19200 bps
PROFIBUS® address[1)]	126	2-126

1) Fieldbus interfaces are not in accordance with the BVS 13 ATEX G001 X. Using the fieldbus interface no relays are available.

14.3 Sensor-specific values

Further specifications are provided in the instructions for use for the relevant sensor.

14.3.1 Polytron 8100 EC

Menu	Default setting	Range
Alarm A1	Depending on sensor	
Alarm A2	Depending on sensor	
Hysteresis for A1 alarm in rising direction	0	0 to A1
Hysteresis for A2 alarm in rising direction	0	0 to A2
Hysteresis for A1 alarm in falling direction	0	0 to full scale deflection -A1
Hysteresis for A2 alarm in falling direction	0	0 to full scale deflection -A2
Calibration interval [days]	Depending on sensor	0 to 720

14.3.2 Polytron 8100 EC with O_2 sensors

Menu	Default setting	Range
Display capture range offset	20.9 Vol% (O_2)	0 to 25 Vol% (O_2 LS) 0 to 100 Vol% (O_2)
Display capture range low	-0.25 Vol% (O_2)	0 to -0.75 Vol%
Display capture range high	0.25 Vol% (O_2)	0 to 0.75 Vol%
Full scale value	25 Vol% (O_2, O_2 LS)	5 to 25 Vol% (O_2 LS) 5 to 100 Vol% (O_2)

14.3.3 Polytron 8100 EC with Dräger SensorAlive

Menu	Default setting	Range
DSA warn current	2.0 mA	0 mA to 3.5 mA
DSA warn limit	Depending on sensor	
DSA activation	On	On / Off
LifeTest		
Time	Depending on sensor	
Output behavior	Fixed	Fixed/maintenance/measured value
Repeat profile	Flexible	Flexible/static
Cancel threshold	Depending on sensor	
Senor monitoring		
Activation	Depending on sensor	
Alarm <50 %	Off	Off/warning
Alarm <40 %	DSA warning	Off/DSA warning/error
Fault detection	On	On / Off

14.3.4 Polytron 8200 CAT DrägerSensor® DQ

Menu	Default setting	Range
Alarm A1	20 %LEL	1 to 100 %LEL
Alarm A2	40 %LEL	
Hysteresis for alarm A1 with increasing direction	1 %LEL	0 to A1
Hysteresis for alarm A2 with increasing direction	1 %LEL	0 to A2
Adjustment interval [days]	180	0 to 360
Display capture range offset	0 %LEL	-5 to 4 %LEL
Display capture range low	-5 %LEL	-5 to 0 %LEL
Display capture range high	2 %LEL	0 to 4 %LEL
Full scale value	100 %LEL	Not possible to set range

14.3.5 Polytron 8200 CAT DrägerSensor® LC

Menu	Default setting	Range
Alarm A1	2.0 %LEL	0.1 to 10 %LEL
Alarm A2	4.0 %LEL	
Hysteresis for alarm A1 with increasing direction	0.1 %LEL	0 to A1
Hysteresis for alarm A2 with increasing direction	0.1 %LEL	0 to A2
Full scale value	10 %LEL	5 to 10[1] % LEL 1 to 10 %LEL
Adjustment interval [days]	180	0 to 360
Display capture range offset	0 %LEL	-0.5 to 0.4 %LEL
Display capture range low	-0.5 %LEL	-0.5 to 0 %LEL
Display capture range high	0.2 %LEL	0 to 0.4 %LEL

1) For firmware versions < 3.0.0

14.3.6 Polytron 8310 IR

Menu	Default setting	Range
Alarm A1	20 %LEL	1 to 100 %LEL
Alarm A2	40 %LEL	
Hysteresis for alarm A1 with increasing direction	1 %LEL	0 to A1
Hysteresis for alarm A2 with increasing direction	1 %LEL	0 to A2
Adjustment interval [days]	180	0 to 360
Display capture range offset	0 %LEL	-3 to 4 %LEL
Display capture range low	-3 %LEL	-3 to 0 %LEL
Display capture range high	2 %LEL	0 to 4 %LEL
Full scale value	100 %LEL	Not possible to set range

14.3.7 Polytron 8700 IR

Type 334

Menu	Default setting	Range
Test gas	Methane	
Test gas units	%LEL	
Test gas concentrations	50 %LEL	
Alarm A1	20 %LEL	0.01 to 100 Vol% with %LEL = 0.3 to 100 %LEL
Alarm A2	40 %LEL	
LEL type	NIOSH	IEC / PTB / NIOSH / configurable
Measured gas	Methane	
Units of measured gas	%LEL	Vol.% / PPM / %LEL / %LIE
Full scale value	100 %LEL	20 to 100 %LEL
Beam block	Off	On/Off
Beam block current	2 mA	0 to 3.5 mA
Beam block limit	7.5 %LEL	0 to max. 15 %LEL[1]
Adjustment interval [days]	360	0 to 720

Menu	Default setting	Range
Response behavior	normal	normal / fast
Display capture range offset	0	The absolute values of the display capture range must be within these limits: -1000 to 2200 ppm (Methane type 334) -850 to 850 ppm (Propane type 334) -1200 to 1150 ppm (Ethylene type 334)
Display capture range low	-750 ppm (Methane) -315 ppm (Propane) -405 ppm (Ethylene)	
Display capture range high	750 ppm (Methane) 315 ppm (Propane) 405 ppm (Ethylene)	

1) The maximum limit of the beam block depends on the type of gas detector and the measured gas selected.

Type 340

Menu	Default setting	Range
Test gas	Propane	
Test gas units	%LEL	
Test gas concentrations	50 %LEL	
Alarm A1	20 %LEL	0.01 to 100 Vol% with %LEL = 0.3 to 100 %LEL
Alarm A"	40 %LEL	
LEL type	NIOSH	IEC / PTB / NIOSH / configurable
Measured gas	Propane	
Units of measured gas	%LEL	Vol% / PPM / %LEL / %LIE
Full scale value	100 %LEL	20 to 100 %LEL
Beam block	Off	On/Off
Beam block current	2 mA	0 to 3.5 mA
Beam block limit	2.5 %LEL	0 to max. 15 %LEL[1)]
Adjustment interval [days]	360	0 to 720
Response behavior	normal	normal / fast
Display capture range offset	0	The absolute values of the display capture range must be within these limits: -850 to 425 ppm (Propane type 340) -1800 to 2200 ppm (Methane type 340)
Display capture range low	-750 ppm (Methane) -85 ppm (Propane)	
Display capture range high	750 ppm (Methane) 85 ppm (Propane)	

1) The maximum limit of the beam block depends on the type of gas detector and the measured gas selected.

14.3.8 Polytron 8720 IR

Menu	Default setting	Range
Test gas	CO_2	
Test gas units	Vol%	
Test gas concentrations	4.0 Vol%	0.2 to 100 Vol%
Alarm A1	1 Vol%	0.01 to 100 Vol%
Alarm A2	2 Vol%	
LEL type	-	
Measured gas	CO_2	
Units of measured gas	Vol%	Vol% / ppm
Full scale value	10 Vol%	0.2 to 100 Vol%
Beam block	Off	On/Off
Beam block current	2 mA	0 to 3.5 mA
Beam block limit	0.1 Vol%	0 to 0.1 Vol%
Adjustment interval [days]	360	0 to 720
Response behavior	normal	normal / fast
Display capture range offset	340 ppm	The absolute values of the display capture range must be within these limits: -1000 to 1000 ppm (carbon dioxide)
Display capture range low	-200 ppm	
Display capture range high	200 ppm	

15 Disposal

This product must not be disposed of as household waste. This is indicated by the adjacent icon.
You can return this product to Dräger free of charge. For information please contact the national marketing organisations and Dräger.

Disposal of electrochemical sensors

⚠ WARNING
Danger of explosions and risk of chemical burns!
Sensor fluids may leak out and can cause acid burns.
► Do not dispose sensors in fire.
► Do not open with force.

16 Technical data

16.1 Measuring ranges

Sensor	Measuring range
Polytron 8100 EC with DrägerSensor® EC	Depending on sensor
Polytron 8200 CAT with DrägerSensor® DQ	0 to 100 %LEL
Polytron 8200 CAT with DrägerSensor®LC	0 to 10 %LEL[1)]
Polytron 8310 IR with DrägerSensor® IR	0 to 100 %LEL
Polytron 8700 IR with PIR 7000 infrared gas sensor	
Type 334 (IDS 01x1)	0 to 10,000 ppm[1)] 0 to 100 %LEL,[1)] 0 to (1.25 x LEL_{max}) Vol%,[1)2)] For CH4 (methane) 0 to 100 Vol%[1)]
Type 340 (IDS 01x2)	0 to 10,000 ppm[1)] 0 to 100 %LEL[1)] 0 to 5 Vol%[1)]
Polytron 8720 IR with PIR 7200 infrared gas sensor (IDS 01x5)	0 to 100 Vol%[1)]

1) For adjustable full scale deflection, see 14.3.
2) Range changes depending on the substance to be measured

16.2 Signal transmission to the controller

The measuring range and performance characteristics depend on the installed sensor (see the instructions for use for the installed sensor).

Frequency of measurement calculation: 1 x per second (update of display, analog interface and relays).

Analog signal	
Normal operation	4 ... 20 mA
Drift below zero	3.8 ... 4 mA
Over range	20 ... 20.5 mA
Instrument fault	≤ 1.2 mA
Fault on analog interface	> 21 mA
Maintenance signal	3.4 mA steady signal or 1 Hz modulation between 3 and 5 mA (selectable)

Resistance of the signal loop

Operating mode	Resistance range of the signal loop	Power supply range
Operation without HART® communication	0 to 230 Ω	at 10 V DC
	Rising linearly with the supply voltage from: 0 to 230 Ω at 10 V to 0 to 500 Ω at 16 V	10 to 18 V DC
	0 to 500 Ω	18 to 30 V DC
Operation with HART® communication	230 to 270 Ω	at 13 V DC
	Rising linearly with the supply voltage from: 230 to 270 Ω at 11 V to 230 to 500 Ω at 16 V	11 to 16 V DC
	230 to 500 Ω	18 to 30 V DC
HART® multidrop operation	230 to 500 Ω	10 to 30 V DC

When used in accordance with the metrological suitability test compliant with EN IEC 62990-1, EN IEC 60079-29-1 or EN 50104, the resistance must not exceed 300 ohms. Further information on installing the fieldbus interface is provided in document 9033783.

16.3 Cable specifications

For non-conduit installations, use shielded cables.

Analog and HART® connection with controller and power supply	
Power supply and signals	3-core shielded cable 24 - 12 AWG / 0.2 - 2.5 mm²
Relays	20 - 12 AWG / 0.5 - 2.5 mm²

Digital connection with controller	
Instruments with fieldbus interfaces and remote sensors must be installed with shielded cables.	
Modbus RTU	2-core or 3-core[1], ≥ 26 AWG
PROFIBUS PA Foundation Fieldbus	2-core, cable type A Wave impedance Rw: 135 - 165 Ω Capacitance / unit length C‘: < 30 pF/m Loop resistance R‘: 110 Ω/km Core diameter d: 0.64 mm Core cross section q: > 0.34 mm² Shield coverage: ≥ 90 %
Power supply	2-core, 24 - 12 AWG / 0.2 - 2.5 mm²

1) If the distance between the controller and the transmitter is very long (>1 km) and the power supplies of the controller and the transmitter are separate, interference or differential differences can occur. In this case, 3-core cabling with ground must be selected. Ground is then connected to the transmitter and looped through to the ground of the controller.

16.4 Power supply and relays

Relay rating[1] SPDT[2]	
230 V ~	0.1 A - 5 A
30 V ⎓, resistive load	0.1 A (minimum) - 5 A

1) For safety-related applications (SIL 2), the maximum contact rating is reduced (see Polytron® 8xx0 Safety Manual).
2) Single pole, double throw, (changeover electrical contacts)

Power supply Polytron 8xx0	
Operating voltage	10[1] to 30 V⎓ at the instrument
Inrush current	2.3 A for 2 ms at 24 V⎓,10 Ω resistor

1) At supply voltages of < 7 V DC the instrument provides a fault signal. The warning signal "undervoltage" depends on the connected load at the 4-20 mA output and the cable resistance. In case of lower load (e.g. 230 Ω), the fault relay drops out and the current output is 0 mA. In case of higher load (e.g. 500 Ω), warning message 011 is indicated.

Operating current	
Polytron® 8100 EC	
without relay, non-remote sensor	80 mA
with relay, remote sensor	100 mA
Polytron® 8200 CAT	
without relay, non-remote sensor	105 mA (DrägerSensor DQ) 130 mA (DrägerSensor LC)
with relay, remote sensor	145 mA (DrägerSensor DQ) 165 mA (DrägerSensor LC)
Polytron® 8310 IR	
without relay, non-remote sensor	145 mA
with relay, remote sensor	185 mA
Polytron® 87x0 IR	
without relay, non-remote sensor	330 mA
with relay, remote sensor	350 mA

16.5 General specifications

Polytron 8xx0 enclosure	
Enclosure material	Copper-free aluminum
Enclosure guard	NEMA 4X[1] IP 65/66/67[2]
Display	Resolution 128 x 64 pixels, backlit[3]

1) Polytron 8100 EC NEMA 4X enclosure guard pending.
2) The IP degrees of protection do not cover the detection of a gas, during or after exposure of the equipment to these conditions. In the event of dust deposits and contact with water through immersion or a jet of water, check the adjustment and functional integrity of the instrument.
3) There is only a limited visibility of the display at high temperatures (>65 °C).

16.6 Environmental parameters

Further sensor specifications and influences can be found in the instructions for use provided for the respective sensor.

The values for accessories and spare parts may deviate from the values given here. The exact values can be found in the corresponding manual.

Polytron 8xx0	
Values in accordance with explosion protection testing	
During operation:	
Pressure	23.6 to 32.5 in. Hg (800 to 1100 hPa)
Humidity	0 to 100 % RH, non-condensing
Temperatures	
Polytron 8100 EC	-40 to +70 °C (-40 to +158 °F)
Polytron 8200 CAT	-40 to +80 °C (-40 to +176 °F)
Polytron 8310 IR	-40 to +65 °C (-40 to +149 °F)
Polytron 87x0 IR	-40 to +80 °C (-40 to +176 °F)
Values according to performance approval	
During operation:	
Pressure	20.7 to 38.4 in. Hg (700 to 1300 hPa)[1)]
Humidity	0 to 95 % RH, non-condensing
Temperatures	
Polytron 8100 EC[2)]	-40 to +65 °C (-40 to +149 °F)
Polytron 8200 CAT	-40 to +80 °C (-40 to +176 °F)
Polytron 8310 IR	-40 to +65 °C (-40 to +149 °F)
Polytron 87x0 IR	-40 to +77 °C (-40 to +170 °F)
During storage:	
Pressure	26.5 to 32.4 in. Hg (900 to 1100 hPa)
Humidity	0 to 100 % RH, non-condensing
Temperature	-20 to +65 °C (-4 to +149 °F)
Recommended storage period	5 years
Values for relay option and installations with UL approval	
During operation:	
Temperatures	
Polytron 8200 CAT	-40 to +70 °C (-40 to +158 °F)
Polytron 87x0 IR	-40 to +70 °C (-40 to +158 °F)

1) Polytron 8200 CAT: 23.6 to 35.44 in. Hg (800 to 1200 hPa)
2) See 18.3, 18.3.2 and the instructions for use provided for the EC sensor for the constraints of the maximum specification.

16.7 Tightening torques

Instrument threads	
Enclosure cover	≥44 in-lbs / ≥5 Nm
Sensor	min. 266 in-lbs / min. 30 Nm
Blind plugs	min. 266 in-lbs / min. 30 Nm
Ports (for conduits or cable glands)	min. 443 in-lbs / min. 50 Nm
Docking Station blind plugs	62 in-lbs / 7 Nm
Docking Station cable glands	70 in-lbs / 8 Nm
Remote EC sensing head	177 in-lbs ±9 in-lbs / 20 Nm ±1 Nm
Field wiring terminals	
Power supply, signals and relays	4.4 - 7.0 in-lbs / 0.5 - 0.8 Nm
Grounding screw	10.6 in-lbs / 1.2 Nm

17 Accessories and spare parts

This chapter provides an overview of the components that are covered by the BVS 13 ATEX G 001 X- and PFG 14 G 001 X-type examination. Further parts are listed in the spare parts list or can be requested from DrägerService.

17.1 Polytron® 8xx0

Description	Part number
IRDA to PC interface	4544197
Magnetic wand with key chain	4544101
Dräger PolySoft, configuration software	8328600 / 8328639
EXd blind plug, stainless steel, 2 pcs.	4544897
Exd blind plug, galvanic steel, 3 pcs.	8344041

17.1.1 Docking station

Description	Part number
Docking Station Power Only Version	8344027
Docking Station Power, Relay (includes 2 cable glands)	8344028
Docking Station Fieldbus	8344029
Cable Gland Docking Station	6812868
Blind plug Docking Station	8344042

17.2 Polytron® 8100 EC

Description	Part number
Polytron 8100 4-20/HART printed circuit board	4544781
Polytron 8100 4-20/HART printed circuit board, relay	4544782
Bayonet ring	4544366
Bayonet ring for Dräger SensorAlive	6800132
Duct adapter for remote EC sensing head[1)]	8317617
Rod attachment for remote EC sensing head	4544213
Sensor-test dongle	8317619
Diagnostic dongle	8317860
Calibration adapter	6810536

1) May influence the measurement, e.g. extend the response time. Not covered by BVS 13 ATEX G 001 X and PFG 14 G 001 X.

17.3 Polytron® 8200 CAT

Description	Part number
Polytron 8200 PCB unit 4-20/HART	4544788
Polytron 8200 PCB unit 4-20/HART relay	4544789
PE calibration adapter, Europe	6806978
DQ remote calibration adapter	6812480
LC remote calibration adapter[1)]	6812482
21.50X14.50 membranes spare part set, 2 pcs.	8326840
Dust filters for DrägerSensor DQ, 10 pcs.	6810537
DQ process adapter	6812470
LC process adapter[1)]	6812465
Splash guard	6812510

1) not covered by performance approval.

17.3.1 CAT sensors

Description	Part number
DrägerSensor DQ NPT	6814150
DrägerSensor DQ NPT S[1)]	3701800
DrägerSensor LC NPT	6810675
Sensing head, Polytron SE Ex PR M1 DQ	6812711
Sensing head, Polytron SE Ex PR M2 DQ	6812710
Sensing head, Polytron SE Ex HT M DQ	6812720
DQ NPT aluminum remote sensor	3706933
DQ NPT steel remote sensor	3706934

1) The DrägerSensor DQ NPT S can also be used instead of the DrägerSensor DQ NPT.

17.4 Polytron® 8310 IR

Description	Part Number
Splash Guard	6810796
Process Adapter	6811330
Protection Labyrinth	6811135
Calibration adapter	6810859
PCB unit Polytron 8310 4-20/HART	4544788
PCB unit Polytron 8310 4-20/HART Relay	4544789

17.4.1 DSIR sensors

Description	Part number
DrägerSensor IR NPT	6811901
Sensing head, DrägerSensor IR complete set e	6811165
Sensing head, DrägerSensor IR complete set e2	6811265

17.5 Polytron® 87x0 IR

Description	Part number
Polytron 87x0 PCB unit 4-20/HART[1)]	4544795
Polytron 87x0 PCB unit 4-20/HART relay[1)]	4544796
PIR 7000 attachment set	6811648
PIR 7000 process cuvette, stainless steel	6811415
PIR 7000 SGR process cuvette	6813219
PIR 7000 / 7200 status indicator	6811625 / 6811920
PIR 7000 / 7200 splash guard	6811911 / 6811912
PIR 7000 / 7200 flowcell	6811490 / 6811910

Description	Part number
PIR 7000 / 7200 remote test adapter	6811630 / 6811930
PIR 7000 insect protection	6811609
PIR 7000 hydrophobic filter	6811890
PIR 7000 calibration adapter	6811610
PIR 7000 / 7200 POM process adapter (polyoxymethylene)	6811915
PIR 7000 assembly set	6811648
Terminal box Ex e	6811989
Terminal box Ex d	4520561
Magnetic wand	4544101

1) Check firmware compatibility of sensor and gas detector. Changing the PCB unit may require a firmware update. Contact Dräger for support.

17.5.1 Sensors

Check firmware compatibility of sensor and gas detector. Changing the sensor may require a firmware update. Contact Dräger for support.

Description	Part number
Dräger PIR 7000 type 334 (NPT)	6811822
Dräger PIR 7000 type 340 (NPT)	6811832
Dräger PIR 7000 334 (M25) complete set	6811825
Dräger PIR 7000 340 (M25) complete set	6811819
Dräger PIR 7200 (NPT)	6811572
Dräger PIR 7200 (M25) HART complete set	6812290

18 Performance Approvals

In combination with certain sensors, Polytron 8xx0 is performance approved based on the following standards:

– EU and Type Examination Certificates in line with EN 60079-29-1, EN 50104, EN 45544 and DIN IEC 62990-1. Issued by DEKRA Testing and Certification GmbH, Handwerkstr. 15, D-70565 Stuttgart.
– FM performance approval in line with ANSI/ISA-92.00.01 FM6340

For further information on sensor specifications and restrictions (e.g., measuring principles, performance, cross-sensitivity), refer to the instructions for use for the relevant sensor.

18.1 EU-TYPE Examination Certificate, BVS 13 ATEX G 001 X

Measurement of flammable gases and vapors mixed with air.

– Polytron 8200 CAT with DrägerSensor DQ
  Special conditions:
  - When streaming with air containing measured gas, measured values may increase by up to 32 %.
  - When operating with the DQ remote calibration adapter, measured values may increase by up to 70 %.
– Polytron 8200 CAT with DrägerSensor LC
  Approved with 10 %LEL full scale deflection.
  A connection to a controller with approved measuring function (e.g., REGARD® 7000) is required. Latching alarms for over range measured values must be activated at the controller.
– Polytron 8310 IR with DrägerSensor IR
– Polytron 8700 IR with PIR 7000 type 334 and 340

Measurement of oxygen (inertization)

– Polytron 8100 EC with DrägerSensor O_2 (6809720) and DrägerSensor O_2 LS (6809630) within a measuring range of 0-5...25 Vol% O_2.

Approved are:

– 4 to 20 mA interface
– Relay module
– Remote sensor
– HART
– Factory default full scale deflections

Not approved are the fieldbus interface and the data logger.

18.2 Type Examination Certificate, PFG 14 G 001 X

Measurement of oxygen (deficiency and excess oxygen)

– Polytron 8100 EC with DrägerSensor O_2 (6809720) and DrägerSensor O_2 LS (6809630) within a measuring range of 0–25 Vol% O_2.

Measurement of hydrogen sulfide

– Polytron 8100 EC with Dräger SensorAlive (6809630) within the following measuring ranges:
  - 0.5 - 100 ppm (Type HM)
  - 0 - 100 ppm (Type SM)

Measurement of carbon dioxide

– Polytron 8720 IR with PIR 7200 within the following measuring ranges:
  - 1 Vol% and 10 Vol% – EN 45544-2
  - 2000 ppm, 1 Vol% and 10 Vol% – EN 45544-3

Approved are:

– 4 to 20 mA interface
– Relay module
– Remote sensor

Not approved are:
– Fieldbus interface
– Data logger
– Only Polytron 8100 EC with Dräger SensorAlive: Self-test functionality when using a gas generator

18.3 DrägerSensor O_2, O_2LS and Dräger SensorAlive certified operating conditions

Cross-sensitivities

There are no known cross-sensitivities against interfering gases with a concentration of up to 100 ppm. Further information can be requested from Dräger.

18.3.1 DrägerSensor O_2 (6809720)

The DrägerSensor O_2 (6809720) is an electrochemical two-electrode sensor for measuring oxygen (O_2) in ambient air.

Environmental parameters	
Pressure	20.7 to 38.4 in. Hg (700 to 1300 hPa)
Humidity	10 to 95 % RH, non-condensing
Temperature	Application of EN 50104 limits the temperature range to 0 °C to +55 °C.

Storage	
Pressure	no influence
Humidity	30 to 70 % RH, non-condensing (only relevant if sensor packaging is open)
Temperature	0 to +40 °C
Time	Storage of sensors is not intended. Sensors should be used immediately. Remaining life span = expected life span - storage time

Influence of environmental parameters	**Zero-point**	**Sensitivity[1)]**
Temperature[2)3)]		
0 to 55 °C	≤ 0.3 Vol% O_2	≤ 0.9 Vol% O_2
Pressure	< ± 0.2 Vol% O_2	Relative deviation from the reading at 1013 hPa: < 10 % of the measured value / 100 hPa
Humidity	No influence	Relative deviation from the reading at 50 % rel. humidity: < 1 % of the measured value

1) Relative deviation of the display reading is caused by atmospheric pressure fluctuations.
2) At temperatures below -5 °C, the measurement deviation is higher than specified in EN 50104.
3) For operating temperatures outside -5 °C to 40 °C, an adjustment at operating temperature must be performed.

Response time[1)]	**$t_{0...20}$**	**$t_{0...90}$**
0-5 Vol% O_2	≤ 15 seconds[2)]	≤ 33 seconds
0-25 Vol% O_2	≤ 10 seconds	≤ 26 seconds

1) At temperatures below -5 °C, the response time may increase.
2) Response time is higher than the permissible limit of EN 50104.

Stabilization time: 5 x $t_{0...90}$

Measuring range

0-5 Vol% O_2 to 0-100 Vol% O_2

Default value: 25 Vol% O_2 Minimum reading: -1.25 Vol% O_2

Sensor warm-up time

Operation: <20 minutes / Adjustment: ≤ 2 hours

18.3.2 DrägerSensor O_2LS (6809630)

The DrägerSensor O_2LS (6809630) is an electrochemical three-electrode sensor for measuring oxygen (O_2) in ambient air.

Environmental parameters	
Pressure	20.7 to 38.4 in. Hg (700 to 1300 hPa)
Humidity	5 to 95 % RH, non-condensing
Temperature	-40 to +60 °C short-term +65 °C

Storage	
Pressure	no influence
Humidity	30 to 70 % RH, non-condensing (only relevant if sensor packaging is open)
Temperature	0 to +40 °C
Time	Storage of sensors is not intended. Sensors should be used immediately. Remaining life span = expected life span - storage time

Influence of environmental parameters	Zero-point	Sensitivity
Temperature		
-20 to 40 °C	≤ 0.1 Vol% O_2	≤ 0.1 Vol% O_2
-40 to 65 °C	≤ 0.2 Vol% O_2	≤ 0.5 Vol% O_2
Pressure	< ± 0.1 Vol% O_2	≤ 0.8 Vol% O_2
Humidity	≤ 0.1 Vol% O_2	≤ 0.9 Vol% O_2

When measuring oxygen in the presence of helium, helium compensation can be used. The option of helium compensation is no certified measuring function according to EN 50104.

⚠ CAUTION

Sensor failure

The exposure of the sensor to higher concentrations of unsaturated hydrocarbons, alcohols, or hydrogen over an extended period of time (dose approx. 100,000 ppm x hours) can cause the instrument to fail.

► Ensure that the sensor is not exposed to such concentrations over an extended period of time.

Response time	$t_{0...20}$	$t_{0...90}$
0-5 Vol% O_2	≤ 14 seconds[1)]	≤ 45 seconds
0-25 Vol% O_2	≤ 10 seconds	≤ 27 seconds

1) Response time is higher than the permissible limit of EN 50104.

Stabilization time: 5 x $t_{0...90}$

Measuring range

0-5...25 Vol% O_2, 0-25 Vol% O_2

Default value: 25 Vol% O_2

Minimum reading: -1.25 Vol% O_2

Sensor warm-up time

Operation: ≤ 20 minutes / Adjustment: ≤ 6 hours

18.3.3 Dräger SensorAlive (6814014)

The Dräger SensorAlive (6814014) is an electrochemical diffusion sensor with an integrated gas generator for measuring hydrogen sulfide (H_2S) in ambient air.

Environmental parameters	
Pressure	20.7 to 35.5 in. Hg (700 to 1200 hPa)
Humidity	5 to 95 % RH, non-condensing
Temperature	-40 to +65 °C
Maximum flow speed of the ambient air	6 m/s

Storage	
Pressure	no influence
Humidity	30 to 70 % RH, non-condensing (only relevant if sensor packaging is open)
Temperature	0 to +40 °C
Time	Storage of sensors is not intended. Sensors should be used immediately. Remaining life span = expected life span - storage time

Influence of environmental parameters	Relative deviation from the reading
Pressure	At 1000 hPa: ≤ 0.15 ppm
Humidity (at +40 °C)	at 0 and 95 %RH: ≤ 0.29 ppm
Temperature	at 20 °C: ≤ 0.44 ppm

Interference gases (e.g., NH_3) can impair the function of the sensor.

Response times in diffusion operation	
t(50)	≤ 20 s
t(90)	≤ 55 s

Decay times in diffusion operation	
t(50)	≤ 20 s
t(10)	≤ 55 s

18.4 FM performance approval for DrägerSensor H_2S and H_2S LC

The DrägerSensor H_2S and H_2S LC are electrochemical diffusion sensors measuring hydrogen sulfide (H_2S) in ambient air.

DrägerSensor H_2S (6810435)	
Examination Type P8100	ETR 0400, 0401, 0500, 0501
Interface[1)]	4-20mA, relay
Environmental parameters	
Humidity	5 to 95%RH, non-condensing
Temperature	-40/+65 °C (-40/149 °F)
Storage temperature	0/+40°C (32/104°F)
Enclosure protection [2)]	IP 65/66/67
Range	0-100 ppm
Accuracy (whichever is greater)	measurement uncertainly (of meas. value) ≤ ±3 % or minimum ≤ ±0.5 ppm
Accessory	
Dust filter	6809595
Adapter kit	6810536
Standard	ANSI/ISA-92.00.01FM6340

1) HART communication must not be used for safety-relevant communication.
2) After submersion and jet water the sensor must be replaced.

DrägerSensor H_2S LC (6809610)	
Examination Type P8100	ETR 0400, 0401, 0500, 0501
Interface[1)]	4-20mA, relay
Environmental parameters	
Humidity	5 to 95%RH, non-condensing
Temperature	-20/+65 °C (-4/149 °F)
Storage temperature	0/+40°C (32/104°F)
Enclosure protection [2)]	IP 65/66/67
Range	0-100 ppm
Accuracy (whichever is greater)	measurement uncertainly (of meas.value) ≤ ±3 % or minimum ≤ ±0.5 ppm in the range >50 ppm, ±10 % or ±3 ppm
Accessory	
Dust filter	6809595
Adapter kit	6810536
Standard	ANSI/ISA-92.00.01FM6340

1) HART communication must not be used for safety-relevant communication.
2) After submersion and jet water the sensor must be replaced.

Inhaltsverzeichnis

1 Sicherheitsbezogene Informationen 52
1.1 Sicherheitshinweise 52
1.2 Einsatzbereich und Betriebsbedingungen 52

2 Konventionen in diesem Dokument 53
2.1 Bedeutung der Warnhinweise 53
2.2 Marken 53

3 Beschreibung 53
3.1 Produktübersicht 53
3.2 Funktionsbeschreibung 53
3.3 Verwendungszweck 54
3.4 Zulassungen 55
3.4.1 ATEX, IECEx, UL, CSA 55
3.4.2 Weitere Informationen 55

4 Installation des Transmitters 55
4.1 Explosionsgeschützte (Ex d) Installation - ohne Docking Station 55
4.1.1 Mechanische Installation 55
4.1.2 Elektrische Installation 56
4.2 Installation mit erhöhter Sicherheit (Ex e) - mit Docking Station 59

5 Installation von Sensoren oder Messköpfen 59
5.1 EC-Sensor am Polytron 8100 EC installieren 59
5.2 Messkopf installieren 59

6 Inbetriebnahme 59
6.1 Allgemeine Hinweise 59
6.2 Gasmessgerät in Betrieb nehmen 60

7 Betrieb 60
7.1 Bedienfeld 60
7.2 LEDs und Symbole 60
7.3 Anzeigen am Display 60
7.3.1 Alle Geräte 60
7.3.2 Polytron 8100 EC-spezifische Symbole 61
7.3.3 Messbetrieb 61
7.3.4 Sonderzustände 61
7.3.5 Beendigung der Sonderzustände 62
7.4 Infomodus und Funktionstaste 62
7.4.1 Infomodus aufrufen 62
7.4.2 Im Infomodus navigieren 63
7.4.3 Funktionstaste verwenden 63
7.5 Menüs 63
7.5.1 In einem Menü navigieren 63
7.5.2 Menüs aufrufen 63
7.5.3 Kennwörter 63
7.5.4 Das Menü Information 63
7.5.5 Menüübersichten 64
7.6 Informationen zum Betrieb mit einem Dräger SensorAlive 67

8 Justierung 67
8.1 Allgemeine Hinweise 67
8.2 Prüfgase 67
8.3 Gasdurchfluss für Justierungen 67
8.4 Justierungen vorbereiten 68
8.5 Nullpunktjustierung 68
8.5.1 Allgemeines 68
8.5.2 Nullpunktjustierung durchführen 69
8.6 Empfindlichkeitsjustierung 69
8.6.1 Allgemeines 69
8.6.2 Empfindlichkeitsjustierung durchführen 70
8.7 Automatische Justierung 70
8.7.1 Allgemeines 70
8.7.2 Automatische Justierung durchführen 70

9 Störungsbeseitigung 71
9.1 Fehler 71
9.2 Warnungen 72

10 Instandhaltung 74
10.1 Begasungstest durchführen und Ansprechzeit (t90) prüfen 74
10.2 Sensoren austauschen 74
10.2.1 Polytron® 8100 EC 74
10.2.2 Polytron® 8200 CAT, 8310 IR, 87x0 IR 75
10.3 Displaytest durchführen 75

11 Geräteeinstellungen 75
11.1 Kennwörter einstellen 75
11.2 Datum und Uhrzeit einstellen 75
11.3 Sprache einstellen 75
11.4 Funktionstaste konfigurieren 76
11.5 Auf Standardeinstellungen zurücksetzen 76
11.6 Kontrast des Displays ändern 76
11.7 Anzeigemodus ändern 76
11.8 Relais konfigurieren 76
11.8.1 Kombinationen von selbsthaltenden Alarmen und Alarmquittierung 76
11.8.2 Relais A1 oder A2 konfigurieren 76
11.8.3 Fehlerrelais Einlaufen 1 einstellen 77
11.9 Alarmkonfiguration 77
11.9.1 Alarme ein- oder ausschalten 77
11.9.2 Alarme konfigurieren 77
11.9.3 Alarme/Relais testen 78
11.10 Einstellungen des Datenloggers 78
11.10.1 Grafik anzeigen 78
11.10.2 Datenlogger ein- oder ausschalten 78
11.10.3 Probennahmezeitfenster einstellen 78
11.10.4 Spitzen-/Mittelwert einstellen 78
11.10.5 Auslösemodus ein- oder ausschalten 78
11.10.6 Triggerschwelle einstellen 78
11.10.7 Stackfunktion oder Rollfunktion einstellen 79
11.10.8 Leeren des Datenloggers 79

12 Schnittstelleneinstellungen 79
12.1 4–20-mA-Schnittstelle 79
12.1.1 Messbereichsendwert 79
12.1.2 Fehlerstrom einstellen 79
12.1.3 Informationen zum Warnungssignal 79
12.1.4 Warnungssignal ein- oder ausschalten 79
12.1.5 Warnungsintervall einstellen 79

12.1.6 Warnungsstrom einstellen 79
12.1.7 Warnungen des Dräger SensorAlive einstellen ... 80
12.1.8 Wartungssignal einstellen 80
12.1.9 Wartungsstrom einstellen 80
12.1.10 Analogen Offset einstellen 80
12.1.11 Analogempfindlichkeit einstellen 80
12.1.12 Analogschnittstelle testen 80
12.1.13 Beam Block-Signal einstellen 81
12.2 HART-Schnittstelle 81
12.2.1 Polling-Adresse einstellen 81
12.2.2 Unique Identifier anzeigen 81
12.2.3 HART-Tag einstellen 81
12.2.4 Dräger REGARD-Protokoll einstellen 81
12.3 Digitale Schnittstellen 82

13 Sensoreinstellungen 82
13.1 Automatische Justierung ein- oder ausschalten .. 82
13.2 Fangbereich 82
13.2.1 Fangbereich einstellen 82
13.2.2 Fangbereich deaktivieren 82
13.3 Sensor zurücksetzen 82
13.4 Justierintervall einstellen 82
13.5 Sensor-Sperrfunktion einstellen 82
13.6 Software-Dongle für EC-Sensoren 82
13.6.1 Dongle installieren 82
13.6.2 Dongle deaktivieren 83
13.7 Sensoreinstellungen Polytron® 8100 EC 83
13.7.1 Sensorselbsttest 83
13.7.2 Gaseinstellungen 83
13.7.3 Einstellungen des Dräger SensorAlive 83
13.8 Sensoreinstellungen Polytron® 8200 CAT / 8310 IR 84
13.8.1 Sensortyp 84
13.8.2 Gaseinstellungen 84
13.8.3 DQ-Sensorverriegelung einstellen 84
13.9 Sensoreinstellungen Polytron 8310 IR 84
13.9.1 Änderung der Gaskategorie 84
13.9.2 Gaskategorie wechseln 85
13.10 Sensoreinstellungen Polytron® 87x0 IR 85
13.10.1 Gaseinstellungen 85

14 Werkseinstellungen 85
14.1 Unveränderbare Einstellungen für Relais, LED und Alarm 85
14.2 Einstellungen, die sich über das Menü ändern lassen 86
14.3 Sensorspezifische Werte 86
14.3.1 Polytron 8100 EC 86
14.3.2 Polytron 8100 EC mit O_2-Sensoren 86
14.3.3 Polytron 8100 EC mit Dräger SensorAlive 87
14.3.4 Polytron 8200 CAT DrägerSensor® DQ 87
14.3.5 Polytron 8200 CAT DrägerSensor® LC 87
14.3.6 Polytron 8310 IR 87
14.3.7 Polytron 8700 IR 88
14.3.8 Polytron 8720 IR 89

15 Entsorgung 89

16 Technische Daten 89
16.1 Messbereiche 89
16.2 Signalübertragung zur Auswerteeinheit 89
16.3 Kabeleigenschaften 90
16.4 Spannungsversorgung und Relais 90
16.5 Allgemeine Spezifikationen 91
16.6 Umgebungsparameter 91
16.7 Anzugsdrehmomente 92

17 Zubehör und Ersatzteile 92
17.1 Polytron® 8xx0 92
17.1.1 Docking Station 92
17.2 Polytron® 8100 EC 92
17.3 Polytron® 8200 CAT 92
17.3.1 CAT-Sensoren 93
17.4 Polytron® 8310 IR 93
17.4.1 DSIR-Sensoren 93
17.5 Polytron® 87x0 IR 93
17.5.1 Sensoren 93

18 Messtechnisches Gutachten 94
18.1 EU-Prüfbescheinigung, BVS 13 ATEX G 001 X . 94
18.2 Prüfbescheinigung, PFG 14 G 001 X 94
18.3 Zertifizierte Betriebsbedingungen DrägerSensor O_2, O_2LS und Dräger SensorAlive 94
18.3.1 DrägerSensor O_2 (6809720) 94
18.3.2 DrägerSensor O_2LS (6809630) 95
18.3.3 Dräger SensorAlive (6814014) 96
18.4 FM-Messtechnisches Gutachten für DrägerSensor H_2S und H_2S LC 96

1 Sicherheitsbezogene Informationen

Die aktuelle Ausgabe und weitere Sprachen dieser Gebrauchsanweisung können in der Datenbank für Technische Dokumentation (www.draeger.com/ifu) in elektronischer Form heruntergeladen werden. Dräger empfiehlt aufgrund von Produktaktualisierungen, immer die aktuelle Ausgabe der Gebrauchsanweisung zu verwenden.

1.1 Sicherheitshinweise

- Vor Gebrauch des Produkts diese Gebrauchsanweisung und die der zugehörigen Produkte aufmerksam lesen.
- Gebrauchsanweisung genau beachten. Der Anwender muss die Anweisungen vollständig verstehen und den Anweisungen genau Folge leisten. Das Produkt nur für die in diesem Dokument angegebenen Zwecke und unter den angegebenen Bedingungen verwenden.
- Gebrauchsanweisung nicht entsorgen. Aufbewahrung und ordnungsgemäße Verwendung durch die Nutzer sicherstellen.
- Nur geschultes und fachkundiges Personal darf dieses Produkt verwenden.
- Wenn eine Komponente fehlerhaft ist oder eine Funktionsstörung vorliegt, Dräger benachrichtigen.
- Alle lokalen und nationalen Vorschriften und Bestimmungen im Zusammenhang mit diesem Produkt einhalten.
- Nur entsprechend geschultes Personal darf das Produkt, wie in dieser Gebrauchsanweisung beschrieben, überprüfen, reparieren und instand halten. Instandhaltungsarbeiten, die in dieser Gebrauchsanweisung nicht beschrieben sind, dürfen nur von Dräger oder von durch Dräger qualifiziertem Fachpersonal durchgeführt werden.
- Dräger empfiehlt, einen Servicevertrag mit Dräger abzuschließen und alle Instandhaltungsarbeiten durch Dräger durchführen zu lassen.
- Für Instandhaltungsarbeiten nur Original-Dräger-Teile und -Zubehör verwenden. Sonst könnte die korrekte Funktion des Produkts beeinträchtigt werden.
- Die Wartungsarbeiten müssen gemäß den Anweisungen durchgeführt werden, siehe 10 Instandhaltung.
- Produkt nur im Rahmen eines risikobasierten Alarmgebungskonzepts betreiben.
- Bevor dieses Gerät an elektrische Geräte angeschlossen wird, welche nicht in der Gebrauchsanweisung beschrieben werden, muss Dräger zu Rate gezogen werden.
- An Geräten und Komponenten dürfen keine Änderungen vorgenommen werden.
- Der Einsatz von defekten oder unvollständigen Teilen ist unzulässig.
- Bei Instandsetzung an diesen Geräten oder Bauteilen müssen die entsprechenden Bestimmungen beachtet werden.
- Gerät nicht während des Betriebs öffnen.
- Bei Instandsetzung an diesen Geräten oder Bauteilen müssen die entsprechenden Bestimmungen beachtet werden.
- Für die Messung von brennbaren Gasen und Sauerstoff die Anweisungen der EN 60079-29-2 beachten.
- Für die Messung von toxischen Gasen die Anweisungen der EN 45544-4 beachten.

Polytron® 8100 EC-spezifisch:

- **WARNUNG**: Gefahr der Entzündung von brennbarem oder explosivem Gas! Der Austausch von Komponenten kann die Eigensicherheit beeinträchtigen.

1.2 Einsatzbereich und Betriebsbedingungen

- Für SIL-Anwendungen muss das Dräger Polytron® 8xx0 Safety Manual beachtet werden.
- Gilt nur für Polytron 8200 CAT:
  Ist das Gerät einem gerichteten Luftstrom ausgesetzt, der mit Gas vermischt ist, können die Messwerte erhöht sein. Zu abweichenden Werten siehe Gebrauchsanweisung des entsprechenden Sensors.
- Angaben und Einschränkungen aus den Gebrauchsanweisungen der verwendeten Sensoren beachten.
- **VORSICHT** Gefahr der Entzündung von brennbarem oder explosivem Gas. Nicht in Umgebungen mit erhöhtem Sauerstoffgehalt geprüft (> 21 % O_2).
- **Einsatz des Produkts in explosionsgefährdeten Bereichen:** Geräte oder Bauteile, die in explosionsgefährdeten Bereichen genutzt werden und nach nationalen, europäischen oder internationalen Explosionsschutz-Richtlinien geprüft und zugelassen sind, dürfen nur unter den in der Zulassung angegebenen Bedingungen und unter Beachtung der gesetzlichen Bestimmungen eingesetzt werden.

Gefahrenbereiche in Zonen klassifiziert:

- Das Gerät ist für den Einsatz in Ex-Bereichen der Zone 1 oder Zone 2 ausgelegt, in denen Gase der Explosionsgruppen IIA, IIB oder IIC und Temperaturklassen T4 oder T6 auftreten können. Temperaturklassen hängen von der maximalen Umgebungstemperatur ab. Das Gerät darf nicht in Umgebungstemperaturen außerhalb des auf dem Gerät angegebenen Temperaturbereichs verwendet werden.
- Das Gerät ist für den Einsatz in Ex-Bereichen der Zone 21 oder 22 ausgelegt, in denen Stäube der Explosionsgruppen IIIA, IIIB oder IIIC und Staubtemperaturen von T80 °C oder T130 °C (T135 °C für Polytron 5100 EC und Polytron 8100 EC) auftreten können. Staubtemperaturen hängen von der maximalen Umgebungstemperatur ab. Das Gerät darf nicht in Umgebungstemperaturen außerhalb des auf dem Gerät angegebenen Temperaturbereichs verwendet werden.

Gefahrenbereiche in Divisionen klassifiziert:

– Das Gerät ist für den Einsatz in Ex-Bereichen der Klasse I, Div. 1 oder Div. 2, ausgelegt, in denen Gase der Gruppen A, B, C, D und Temperaturklassen T4 oder T6 auftreten können. Temperaturklassen hängen von der maximalen Umgebungstemperatur ab. Das Gerät darf nicht in Umgebungstemperaturen außerhalb des auf dem Gerät angegebenen Temperaturbereichs verwendet werden.
– Das Gerät ist für den Einsatz in Ex-Bereichen der Klasse II, Div. 1 oder Div. 2, ausgelegt, in denen Stäube der Gruppen E, F, G auftreten können. Das Gerät darf nicht in Umgebungstemperaturen außerhalb des auf dem Gerät angegebenen Temperaturbereichs verwendet werden.

2 Konventionen in diesem Dokument

2.1 Bedeutung der Warnhinweise

Die folgenden Warnhinweise werden in diesem Dokument verwendet, um den Anwender auf mögliche Gefahren hinzuweisen. Die Bedeutungen der Warnhinweise sind wie folgt definiert:

Warnzeichen	Signalwort	Klassifizierung des Warnhinweises
⚠	WARNUNG	Weist auf eine potenziell gefährliche Situation hin. Eine Missachtung kann zu schweren Verletzungen oder zum Tod führen.
⚠	VORSICHT	Weist auf eine potenziell gefährliche Situation hin. Eine Missachtung kann zu körperlichen Verletzungen führen. Kann auch verwendet werden, um vor unsicheren Praktiken zu warnen.
	HINWEIS	Weist auf eine potenziell gefährliche Situation hin. Eine Missachtung kann zu Produkt- und Umweltschäden führen.

2.2 Marken

Marke	Markeninhaber
PROFIBUS®	PROFIBUS Nutzerorganisation e. V.
HART®	HART Communication Foundation
Polytron®	Dräger Safety AG & Co. KGaA
DrägerSensor®	Dräger Safety AG & Co. KGaA

Die folgende Internetseite führt die Länder auf, in denen die Marken von Dräger eingetragen sind: www.draeger.com/trademarks.

3 Beschreibung

3.1 Produktübersicht

Siehe die Abbildungen auf der Ausklappseite

A 1	Gehäuseabdeckung
A 2	Gewindestift (2-mm-Innensechskantschraube)
A 3	Bügel
A 4	Leiterplatteneinheit (und optionales Relais)
A 5	Gehäuseunterteil
A 6	Anschluss für Sensor
A 7	Durchführungskabel
A 8	Docking Station
A 9	Explosionsgeschütztes Gerät
A 10	Explosionsgeschütztes Gerät mit Docking Station für erhöhte Sicherheit
A 11	Explosionsgeschütztes Gerät mit Abstandshalter (nur für Polytron 87x0 IR)
A 12	Abstandshalter (nur für Polytron 87x0 IR)
B	Prüfaufbau zum Justieren
C	Polytron 8100 EC
D	Sensor-Dongle-Anschluss (nur Polytron 8100 EC)
E 1	Polytron 8200 CAT
E 2	Polytron 8310 IR
F 1	Polytron 8710 IR mit Spritzschutz
F 2	Polytron 8710 IR ohne Spritzschutz

3.2 Funktionsbeschreibung

Zur Polytron 8000-Familie gehören folgende Gerätevarianten:

– Polytron 8100 EC arbeitet mit elektrochemischen Sensoren (EC-Sensoren).
– Polytron 8200 CAT arbeitet mit katalytischen Ex-Sensoren (CatEx-Sensoren//katalytischer, DQ- oder LC-Dräger-Sensor).
– Polytron 8310 IR arbeitet mit Infrarot-Ex-Sensoren (IREx-Sensoren).
– Polytron 8700 IR arbeitet mit Infrarot-Sensoren (PIR 7000-Sensoren).
– Polytron 8720 IR arbeitet mit Infrarot-Sensoren (PIR 7200-Sensoren).

Folgende Schnittstellen sind möglich:
– 4 bis 20 mA analog (nach NAMUR-Empfehlung NE43)
– Relais-Platine
– Digitales HART-Ausgangssignal
– Foundation Fieldbus[1)]
– PROFIBUS PA[1)]
– Modbus RTU[1)]

Wenn die 4–20-mA-Schnittstelle verwendet wird, muss die Stromstärke zwischen 0 mA und 3,5 mA überwacht werden. Stromstärken zwischen 0 mA und 3,5 mA können einen Sonderzustand anzeigen (siehe „Sonderzustände“, Seite 61).

Wenn eine Relais-Platine verwendet wird, können lokal Alarmmittel aktiviert werden. Wenn keine Relais-Platine verwendet wird und ein Alarm anliegt, blinkt nur die rote LED am Gerät.

Gaskonzentrationen, Statusmeldungen und Menüelemente werden auf einem beleuchteten Grafikdisplay (LCD) und über 3 farbige LEDs angezeigt.

Die Navigation durch das Menü erfolgt durch Antippen der entsprechenden Taste auf der Glasscheibe der Gehäuseabdeckung mit einem Magnetstab. Das Gerät kann ohne Deklassifizierung des Bereichs und ohne dieses zu öffnen konfiguriert, justiert und gewartet werden.

Die Geräte werden mit einem Datenlogger geliefert. Der Datenlogger kann bis zu 35 000 Werte speichern. Bei einem Abtastinvervall von 1 Messung pro Minute speichert der Datenlogger den Messverlauf von ca 24 Tagen. Diese Zeit kann durch die Aktivierung der Trigger-Funktion deutlich verlängert werden. Der Datenlogger kann nur über die PC-Software PolySoft ausgelesen werden. Beim Auslesen erhält man eine .ofb-Datei und eine .txt-Datei. Die .txt-Datei enthält die Informationen des Datenloggers in lesbarer Form.

Über eine versiegelte Rohrleitung oder eine zugelassene Kabelverschraubung können die Geräte an eine Dräger-Auswerteeinheit oder eine speicherprogrammierbare Steuerung (SPS) angeschlossen werden.

Die Geräte können als Stromquelle oder Stomsenke betrieben werden, wenn die Spannungsversorgung über die Auswerteeinheit erfolgt. Wenn die Geräte an eine separate Spannungsversorgung angeschlossen sind, können sie nur als Stromquelle betrieben werden.

Das Gehäuse der Geräte besteht aus robustem rostfreiem Edelstahl oder Aluminium und ist für Innen- und Außenanwendungen geeignet.

Die Geräte sind für eine stationäre Installation ausgelegt. Sie sind in folgender Ausführung erhältlich:
– Explosionsgeschütztes Gerät (Ex d)
  Das druckfest gekapselte, explosionsgeschützte Gehäuse weist drei ¾"-NPT-Anschlüsse auf, die für die Feldverdrahtung, das direkte Anschließen eines Sensors oder die Verdrahtung eines abgesetzten Sensors genutzt werden können.
– Gerät mit erhöhter Sicherheit (Ex e)
  Das Gerät wird durch einen Klemmenkasten für erhöhte Sicherheit (Docking Station) erweitert, der über bis zu vier 20-mm-Anschlüsse verfügt, die für die Feldverdrahtung oder die Verdrahtung eines abgesetzten Sensors genutzt werden können. Wenn die Kabelverschraubung von Dräger verwendet wird, beträgt der zulässige Kabeldurchmesser 7 mm bis 12 mm.

Folgende Dongles sind für Polytron 8100 EC verfügbar:

Sensortestdongle	Aktiviert den Sensor-Selbsttest (nicht für den Hydrazinsensor 6810180)
Diagnosedongle	Aktiviert den Sensor-Selbsttest, die Anzeige der Sensorvitalität und die Sensordiagnosefunktionen (nicht für den Hydrazinsensor 6810180)

3.3 Verwendungszweck

Die Geräte der Polytron 8000-Familie sind für eine kontinuierliche Überwachung der Umgebungsluft bestimmt.

Mit dem optional integrierten Relais-Modul kann das Gerät unabhängig ohne Auswerteeinheit (mit zusätzlicher lokaler Alarmgebung) betrieben werden.

Über eine versiegelte Rohrleitung oder eine zugelassene Kabelverschraubung kann das Gerät an eine Dräger-Auswerteeinheit oder eine speicherprogrammierbare Steuerung (SPS) angeschlossen werden.

Wird die 4–20-mA-Schnittstelle verwendet, muss die Stromstärke zwischen 0 mA und 3,5 mA überwacht werden. Stromstärken zwischen 0 mA und 3,5 mA können einen Sonderzustand anzeigen.

Die Geräte sind für eine stationäre Installation ausgelegt und für den Gebrauch in Ex-Bereichen zugelassen.
– Polytron 8100 EC ist ein kombiniertes eigensicheres / explosionsgeschütztes Gerät für die kontinuierliche Überwachung von toxischen Gasen oder Sauerstoff in der Umgebungsluft.
– Polytron 8200 CAT mit katalytischem DQ- oder LC-Dräger-Sensor ist ein explosionsgeschütztes Gerät für die kontinuierliche Überwachung von brennbaren Gasen und Dämpfen in Umgebungsluft, die Kohlenwasserstoffe und Nicht-Kohlenwasserstoffe (z. B. Wasserstoff oder Ammoniak) enthalten.
– Polytron 8310 IR mit dem Infrarotsensor DrägerSensor IR ist ein explosionsgeschütztes Gerät für die kontinuierliche Überwachung von brennbaren und kohlenwasserstoffhaltigen Gasen und Dämpfen in der Umgebungsluft.

1) Bei Verwendung mit der Feldbus-Schnittstelle sind keine Relais vorhanden. Die Feldbus-Schnittstelle entspricht nicht BVS 13 ATEX G 001 X.
DrägerSensorAlive wird nicht unterstützt.

– Polytron 8700 IR mit PIR 7000 ist ein explosionsgeschütztes Gerät für die kontinuierliche Überwachung von brennbaren und kohlenwasserstoffhaltigen Gasen und Dämpfen in geeigneter Atmosphäre.
– Polytron 8720 IR mit PIR 7200 ist ein explosionsgeschütztes Gerät für die kontinuierliche Überwachung von Kohlenstoffdioxid in der Umgebungsluft.

3.4 Zulassungen

3.4.1 ATEX, IECEx, UL, CSA

Ein Beispiel für ein Typenschild ist auf der Ausklappseite abgebildet. Außerdem befindet sich ein Ausdruck des Typenschilds in der Versandverpackung des Geräts.

3.4.2 Weitere Informationen

Konformitätserklärung: siehe Einlegeblatt 4544300 oder www.draeger.com/product-certificates

Weitere Informationen zu Zulassungen siehe Einlegeblatt 4544300.

4 Installation des Transmitters

4.1 Explosionsgeschützte (Ex d) Installation - ohne Docking Station

4.1.1 Mechanische Installation

4.1.1.1 Allgemeine Hinweise zur mechanischen Installation

– Die Bestimmungen und Vorschriften auf lokaler, bundesstaatlicher und nationaler Ebene für die Installation von Gasmesssystemen müssen strikt eingehalten werden.
– Die physikalischen Eigenschaften der zu messenden Gase oder Dämpfe und die Details zur jeweiligen Anwendung (z. B. mögliche Leckagen, Luftbewegungen/-strömungen usw.) müssen berücksichtigt werden.
– Die zukünftige Verwendung von Zubehörteilen und Wartungsausrüstung muss berücksichtigt werden.
– Der freie Gas- oder Dampfzustrom zum Sensor darf nicht behindert werden.
– Das Gerät darf keiner Strahlungswärme ausgesetzt werden, da diese zu einem Temperaturanstieg über die angegebenen Grenzwerte (16.6 Umgebungsparameter) führt. Es wird empfohlen, eine reflektierende Abschirmung zu verwenden.
– An der Kabeleinführung des Geräts kann eine Staubkappe angebracht sein. Diese Kappe ist weder explosionsgeschützt noch wasserdicht und muss vor Anschluss des Geräts an eine versiegelte Rohrleitung oder vor Installation einer feuerfesten Kabelverschraubung entfernt werden.
– Unbenutzte Öffnungen sind durch einen Verschlussstopfen zu verschließen. Siehe 16.7 Anzugsdrehmomente für die erforderlichen Anzugsdrehmomente für Kabeldurchführungen, Kabelverschraubung, Stecker und Sensor.
– Bei Installationen ohne Rohrleitung muss eine zugelassene Kabelverschraubung (z. B. Hawke A501/421/A/¾" NPT oder gleichwertig) verwendet werden.
– **WARNUNG:** Nur bei Installation mit Rohrleitung: Um die Entzündungsgefahr von gefährlicher atmosphärischer Luft zu reduzieren, die ersten 45 cm (18 Zoll) der Rohrleitung vom Gehäuse aus versiegeln.
– **VORSICHT:** Wenn das Gasmessgerät an Auswerteeinheiten angeschlossen ist, kann die gesamte Ansprechzeit verzögert werden. Die gesamte Messstrecke muss berücksichtigt werden (z. B. Latenzzeit der Auswerteeinheit). Sicherstellen, dass die benötigte Ansprechzeit eingehalten wird.

Polytron® 8100 EC-spezifisch:

– Empfohlene Ausrichtung des Sensors: nach unten (siehe Abbildung C auf der Ausklappseite).

Polytron® 8200 CAT-spezifisch:

– Vorzugsausrichtung des Sensors: nach unten (siehe Abbildung E auf der Ausklappseite). Wenn der Sensoreinlass vor mechanischem Schaden, Schmutz- und Wassereintritt geschützt ist, ist jede Ausrichtung zulässig.
– Nur für CSA-konformen Betrieb:
Die Verwendung des optionalen Spritzschutzes (6812510) ist durch die CSA-Zulassung vorgeschrieben.

Polytron® 8310 IR-spezifisch:

– Empfohlene Ausrichtung des Sensors: nach unten (siehe Abbildung E auf der Ausklappseite).

Polytron® 87x0 IR-spezifisch:

– Die Vorzugsstellung des Dräger PIR 7x00 Sensors ist einzuhalten (siehe Abbildung F auf der Ausklappseite). Größere Abweichungen und die Verwendung des vormontierten Spritzschutzes erhöhen die Ansprechzeit (siehe Gebrauchsanweisung für PIR 7x00).
– Jegliche andere Ausrichtung ist nur zulässig, wenn der PIR 7x00 ohne Spritzschutz verwendet wird, z. B. bei Anwendungen in Lüftungskanälen. Wird der Sensor senkrecht installiert, können sich verstärkt Ablagerungen auf den optischen Oberflächen ansammeln.
– Es wird empfohlen, den vormontierten Spritzschutz zu verwenden, um den Sensor vor Wasser und Staub zu schützen.
– Wird ein Spritzschutz (Sachnummer 6811911 oder 6811912) verwendet, muss sichergestellt sein, dass die Statusleuchten vertikal angeordnet sind und das Dräger-Logo des Spritzschutzes horizontal ausgerichtet ist. Eine maximale Abweichung von ±30 Grad von der horizontalen Position ist zulässig.
– Flüssigkeiten bzw. Ablagerungen auf den optischen Oberflächen des PIR 7x00 können eine Warnung oder Störung auslösen.
– Für die explosionsgeschützte Version ist es empfehlenswert, einen Abstandhalter (Sachnummer 6812617) zu verwenden, wenn das Gerät an einer Wand oder einer ebenen Oberfläche angebracht wird.

Besondere Bedingungen gemäß EN/IEC 60079-1

– Die Gewinde für die druckfeste / explosionsgeschützte Kapselung entsprechen nicht den Mindest-/Höchstwerten aus EN/IEC 60079-1. Die Gewinde dürfen nicht durch den Benutzer überarbeitet werden.

4.1.1.2 Installation

Das Gerät kann zur Messung von Gasen in Umgebungsluft oder in einem Lüftungskanal/Rohr montiert werden.

1. Es sind M6 (1/4") Sechskant-Zylinderschrauben zur Montage des Gehäuses in einer der folgenden Ausführungen zu verwenden.

Option	Zubehör
Befestigung an einer ebenen Oberfläche	Bohrbild: 4544300 Zusätzlich für das Polytron 87x0 IR: Abstandshalter 6812617
Befestigung an einer Stange	Set für Stangenbefestigung: 4544198
Befestigung in einem Lüftungskanal/Rohr	Set für Kanalbefestigung: 6812725 Für Polytron® 87x0 IR:: 6812300

4.1.2 Elektrische Installation

4.1.2.1 Allgemeine Hinweise zur elektrischen Installation

– Anzugsdrehmomente siehe 16.7, zulässige Kabelspezifikationen siehe 16.3.
– Die einschlägigen Vorschriften für die Verlegung und den Anschluss von Strom- und Signalleitungen an Gasmesssysteme müssen strikt eingehalten werden.
– Es müssen Aderendhülsen verwendet werden.
– Die Leiter der Stromversorgung müssen einen ausreichend niedrigen Widerstand haben, damit die korrekte Versorgungsspannung am Gerät gewährleistet ist.
– Die Kabelisolierung muss auf 5 bis 7 mm entfernt werden.
– Der speisende Sekundärstromkreis muss galvanisch vom Netzstromkreis getrennt sein (gilt nicht für die Relais-Stromkreise).
– Wenn das Gerät an Standorten installiert wird, an denen eine Umgebungstemperatur von über 55 °C herrscht, sind entsprechende Kabel zu verwenden, die für eine Verwendung bei Temperaturen von mindestens 25 °C über der maximalen Umgebungstemperatur ausgelegt sind.
– Nur Kabeldurchführungen verwenden, die in dem Land zugelassen sind, in dem die Anlage installiert wird, und die für die Anwendung geeignet sind.
– Gemäß der EU-Richtlinie 2014/30/EU darf dieses Gerät nicht an ein Gleichstromnetz angeschlossen werden. Es wird empfohlen, eine eigene Stromversorgung für das Gerät einzurichten.

Analogschnittstelle

– Damit ein korrekter Betrieb des Geräts sichergestellt ist, darf der Widerstand der 4-bis-20-mA-Signalschleife 500 Ohm nicht überschreiten.
Bei Einsatz gemäß Messtechnischer Eignungsprüfung nach EN IEC 62990-1, EN IEC 60079-29-1 oder EN 50104 darf der Widerstand 300 Ohm nicht überschreiten. Bei Werten über 300 Ohm kann eine Überwachung der Versorgungsspannung nicht garantiert werden.
Je nach Betriebsspannung und Anwendung (z. B. Verwendung mit HART®) ist ein bestimmter Mindestwiderstand zu beachten (siehe „Signalübertragung zur Auswerteeinheit“, Seite 89).

Ausführung mit Relais

– Bei Spannungen von >30 VAC bzw. >42,4 VDC sind die Relais-Leitungen mit einem Schutzschlauch zu überziehen, oder es sind doppelt isolierte Leitungen zu verwenden.
– Die Drähte zum optionalen Relais-Modul sind entsprechend den Bemessungsspannungen, Strömen und Umweltbedingungen auszuwählen und abzusichern.
– Um sicherzustellen, dass eine Störung erkannt wird, ohne auf das Gerät blicken zu müssen, muss an das Störungsrelais ein Alarmgeber angeschlossen werden.
– Spannungsunterschiede können zu Isolationsfehlern führen. Keine elektrischen Lasten mit unterschiedlicher Spannungsart (AC oder DC) miteinander vermischen. Bei DC-Lasten sicherstellen, dass über die Relaiskontakte nur Geräte mit derselben DC-Nennspannung gesteuert werden. Bei AC-Lasten sicherstellen, dass die Relaiskontakte nur mit Geräten verbunden sind, mit denen diese eine Phase teilen.

Besondere Bedingungen gemäß IEC 60664-1

– Die Gerätevarianten, die sowohl eine FISCO-Feldbus-Schnittstelle als auch einen Gastransmitter ETR 02…5** verwenden, müssen über Stromkreise versorgt werden, die gegen Überspannungen der Kategorie I/II/III nach IEC 60664-1 geschützt sind.

4.1.2.2 Anschlussschemata

Auf den Ausklappseiten sind folgende Anschlussschemata dargestellt:

Abbildung	Anschlussschema für Geräte
G	Ohne Relais, Gehäuseerdung
H	Mit Relais, Gehäuseerdung
I1	4-20 mA / HART (Stromquelle)
I2	4-20 mA / HART (Stromsenke)
I3	4-20 mA / HART (separate Spannungsversorgung, Stromquelle)
H1	Standalone, nur Relais
J	Foundation Fieldbus / PROFIBUS PA, Gehäuseerdung
K	Modbus RTU, Gehäuseerdung

Abbildung	Anschlussschema für Geräte
J1	Foundation Fieldbus / PROFIBUS PA, Feldverdrahtung
K1	Modbus RTU, Feldverdrahtung
L	Spannungsversorgung digitaler Schnittstellen

4.1.2.3 Verdrahtungstabellen

4-bis-20-mA- / HART-Schnittstelle

Pin	Kennz.	Funktion
1	PWR+	V+
2	PWR-	V-
3	PWR-	V- Zu verwenden, wenn das Gerät an eine separate Spannungsversorgung angeschlossen wird (Betrieb als Quelle).
4	4-20 mA	4-20 mA-Signal (Betrieb als Quelle oder Senke)
5	PE	Schutzleiter Optionaler Schutzleiter für den Relaisanschluss. Bei einem Anschluss des Schutzleiters zusammen mit dem 4-20-mA-Analogausgang kann es zu Masseschleifen kommen.

Feldbus-Schnittstelle

Pin	Kennz.	Funktion
1	Daten-A	Signalführung A
2	Daten-B	Signalführung B
3	GND	Erdung
4	ABSCHIRMUNG	Kabelabschirmung

Pin	Kennz.	Funktion
1	PWR+	V+
2	PWR-	V-

Steckverbinder Relais

Alle Relais (A1, A2, FLT) des Geräts können als "normal erregt" (Ruhestromrelais) oder "bei Alarm erregt" (Arbeitsstromrelais) konfiguriert werden. Werkseitig sind die Relais als Ruhestromrelais ("normal erregt") konfiguriert. Hierdurch wird ein ausfallsicherer Betrieb gewährleistet. Entgegen der Konventionen sind die Kennzeichnungen NO, COM, NC am Gerät so gewählt, dass sie dem normal erregten Zustand entsprechen. Wenn das Gerät mit Spannung versorgt wird, stimmt die Kennzeichnung mit der Funktion der Pins überein.

Pin	Kennz.		Relais	
1	NO	FLT	Störung	Arbeitskontakt (Normally Open)
2	COM		Störung	Gemeinsamer Anschluss (Common)
3	NC		Störung	Ruhekontakt (Normally Closed)
4	NO	A2	A2	Arbeitskontakt (Normally Open)
5	COM		A2	Gemeinsamer Anschluss (Common)
6	NC		A2	Ruhekontakt (Normally Closed)
7	NO	A1	A1	Arbeitskontakt (Normally Open)
8	COM		A1	Gemeinsamer Anschluss (Common)
9	NC		A1	Ruhekontakt (Normally Closed)

4.1.2.4 Elektrische Installation vorbereiten

1. Gewindestift (2) lösen und die Gehäuseabdeckung vom Gehäuseunterteil abschrauben, siehe Abbildung A auf der Ausklappseite.
2. Die Leiterplatteneinheit herausziehen.
3. Mit der Abbildung fortfahren, die das entsprechende Polytron®-Modell und den Signalausgang enthält, siehe Ausklappseite.

4.1.2.5 Anschluss des Geräts mit Relais (Stand-Alone)

Die Leitungen für die Alarmgeber müssen an den 9-poligen Relais-Anschluss angeschlossen werden. Ein Stück Kabelisolierung (Wärmeschrumpfschlauch) und eine Schutzhülle sind als zusätzlicher Schutz für die Relais-Kabel mitgeliefert.

1. Den 5-poligen Steckverbinder entfernen.
2. Kabel für Stromversorgung an die entsprechenden Anschlussklemmen anschließen, siehe Abbildung H1 auf der Ausklappseite.
3. Kontakte 3 und 4 des 5-poligen Steckverbinders überbrücken.
4. Den 9-poligen Steckverbinder entfernen.

5. Den Schrumpfschlauch nach Bedarf zurechtschneiden und vor dem Einstecken in den 9-poligen Stecker über die Relais-Kabel schieben.
6. Den Schrumpfschlauch am Rand der Kabelisolierung platzieren und mit einer Wärmepistole vorsichtig über der Kabelisolierung schrumpfen lassen.
7. Die Schutzhülle über die Drähte schieben.
8. Die Drähte für Alarm 1 (Voralarm), Alarm 2 (Hauptalarm) und Fehleralarm an die entsprechenden Klemmen anschließen, wie in der folgenden Anschlusstabelle angegeben.
9. Den Stecker wieder in die Buchse stecken und die Schrauben anziehen.
10. Gerät schließen, siehe 4.1.2.9 Gasmessgerät schließen.

Die folgenden Tabellen zeigen den Status einer angeschlossenen Alarmanzeige und ob diese Fehler (z. B. Stromausfall am Gasmessgerät) anzeigt.

Das Verhalten des Relais ist abhängig von der Alarmkonfiguration und dem Relaiskontakt, mit dem die Alarmanzeige verbunden ist.

Relais-Konfiguration: Normal erregt

Kontakt	Status der Alarmanzeige und Fehlerangabe durch die Alarmanzeige		
	Alarm ausgelöst	Gasmessgerät-spezifischer Fehler	Fehler der Feldverdrahtung
Ruhekontakt (Normally Closed)	EIN	angezeigt	nicht angezeigt
Arbeitskontakt (Normally Open)	AUS	angezeigt	angezeigt

Relais-Konfiguration: Bei Alarm erregt

Kontakt	Status der Alarmanzeige und Fehlerangabe durch die Alarmanzeige		
	Alarm ausgelöst	Gasmessgerät-spezifischer Fehler	Fehler der Feldverdrahtung
Ruhekontakt (Normally Closed)	AUS	nicht angezeigt	angezeigt
Arbeitskontakt (Normally Open)	EIN	nicht angezeigt	nicht angezeigt

4.1.2.6 Anschluss der 4-20-mA- / HART®-Schnittstelle

Informationen zum Anschluss an eine Auswerteeinheit (SPS) entnehmen Sie der Dokumentation der jeweiligen Auswerteeinheit.

1. Den 5-poligen Anschlussstecker herausziehen.
2. Die drei Drähte für Spannung und Signal gemäß Verdrahtungstabelle und Abbildung an die jeweilige Klemme anschließen.
3. Den Stecker wieder an der Buchse anschließen und die Schrauben anziehen.
4. Das Gerät schließen, siehe 4.1.2.9 Gasmessgerät schließen.

4.1.2.7 Erdung

1. Das Gehäuse des Geräts lokal an der Erdungsöse erden, siehe Abbildungen G und H auf der Ausklappseite..
2. Den Schirm der Drähte nur an die Geräteerdung der Auswerteeinheit (z. B. Masse, Erdungsschiene) anschließen.

> ℹ Sofern keine besonderen Maßnahmen getroffen werden (z. B. kapazitive Erdung), muss der Schirm nur an einem Ende angeschlossen werden.

Informationen zur Erdung von Feldbus- und Modbus-Verbindungen sind den folgenden Dokumenten zu entnehmen.

Schnittstelle	Dokument
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

4.1.2.8 Anschluss der Feldbus-Schnittstelle

1. Den 2-poligen und 4-poligen Steckverbinder entfernen.
2. Die zwei Kabel für Stromversorgung und die vier Kabel für das Signal an die entsprechenden Anschlussklemmen anschließen, wie in der Anschlusstabelle und im Anschlussbild dargestellt.
3. Den Stecker wieder in die Buchse stecken und die Schrauben anziehen.
4. Gerät schließen, siehe 4.1.2.9 Gasmessgerät schließen.

Weitere Informationen zur Installation der Feldbus-Schnittstelle sind dem entsprechenden Technischen Handbuch zu entnehmen.

4.1.2.9 Gasmessgerät schließen

1. Sicherstellen, dass die folgenden Verbindungen korrekt hergestellt wurden:
   a. Die Schrauben der Verdrahtung sind mit dem richtigen Drehmoment angezogen.
   b. Alle Kabelverbindungen sind mit Schrauben gesichert.
   c. Das Anschlussstück des Sensors ist eingesteckt.
   d. Das Erdungskabel, das aus dem Gehäuse führt, ist mit der Öse an der Leiterplatteneinheit angeschlossen, siehe Abbildungen G und H auf der Ausklappseite.
2. Die Leiterplatteneinheit in das Gehäuseunterteil einsetzen.
3. Die Gehäuseabdeckung auf das Gehäuseunterteil schrauben und mit dem korrekten Drehmoment festziehen.
4. Gewindestift festziehen.

4.2 Installation mit erhöhter Sicherheit (Ex e) - mit Docking Station

Die Installation mit erhöhter Sicherheit (Ex e) ist in der Montageanleitung der Docking Station beschrieben (Sachnummer 9033242).

5 Installation von Sensoren oder Messköpfen

5.1 EC-Sensor am Polytron 8100 EC installieren

Siehe Abbildung C auf der Ausklappseite.

1. Feststellschraube (2) lösen (2 mm-Innensechskantschraube).
2. Bajonettring (3) abschrauben und Blindscheibe entfernen.
3. Sensor (4) in die Öffnung einsetzen und drehen, bis er im Gasmessgerät einrastet. Der Sensorstecker wird dabei nicht beschädigt.
4. Sensor mit dem zugehörigen Bajonettring (3) sichern.

   ℹ Für Dräger SensorAlive muss ein anderer Bajonettring verwendet werden als für andere EC-Sensoren.

5. Feststellschraube (2) so weit anziehen, dass der Bajonettring nicht gelöst werden kann (für Installationen in Zone 22 vorgeschrieben).

   ℹ Wenn Dräger SensorAlive zum ersten Mal in einer bestehenden Anlage installiert wird, muss sichergestellt werden, dass die Firmware Version 4.0.0 oder höher ist. Zur Unterstützung Dräger kontaktieren.

5.2 Messkopf installieren

Abhängig von der Explosionsschutzart werden unterschiedliche Messköpfe verwendet. Informationen zur Installation der Messköpfe sind der jeweiligen Anleitung des Messkopfs zu entnehmen.

Bei abgesetzten Anwendungen muss die Kabelabschirmung sowohl auf der Sensor- als auch auf der Transmitterseite aufgelegt werden. Die Kabellänge sollte ≤ 30 m sein.

Abgesetzte Versionen mit Explosionsschutz „explosionsgeschützt (Ex d)“

Transmitter	Messkopf-GA-Sachnummern
Polytron 8100 EC	Abgesetzter EC-Messkopf (9033247)
Polytron 8200 CAT (für DQ-Sensoren)	Abgesetzter Sensor DQ NPT Alu, abgesetzter Sensor DQ NPT Stahl (4544286)
Polytron 87x0 IR	Abgesetzter PIR 7000 (334) mit Sensoranschlussgehäuse Edelstahl oder Aluminium (4544286)
Polytron 8200 CAT (für LC-Sensoren) Polytron 8310 IR Polytron 87x0 IR	Sensoranschlussgehäuse Edelstahl oder Aluminium (4544286)

Abgesetzte Versionen mit Explosionsschutz „erhöhte Sicherheit (Ex e)“

Transmitter	Messkopf-GA-Sachnummern
Polytron 8100 EC	Abgesetzter EC-Messkopf (9033247)
Polytron 8200 CAT	Messköpfe Polytron SE Ex (9033888)
Polytron 8310 IR	DrägerSensor IR (9023843)
Polytron 87x0 IR	PIR 7x00 (9023885)

6 Inbetriebnahme

6.1 Allgemeine Hinweise

– Zuerst die Drähte für die Relais anschließen und die Anschlüsse für den Sensor herstellen, bevor das Gerät an die Spannungsversorgung angeschlossen wird.
– Bevor das Gerät für den Normalbetrieb in Betrieb genommen wird, überprüfen, ob die Konfigurations- und Justiereinstellungen korrekt sind.

Um den sicheren Betrieb gemäß BVS 13 ATEX G 001 X und PFG 14 G 001 X zu gewährleisten, müssen folgende Standardalarmeinstellungen des Geräts beibehalten werden.

– Die Relais müssen auf ***Normal erregt*** und der Alarm A2 (Hauptalarm) auf ***Selbsthaltend*** und ***Nicht quittierbar*** bzw. ***Vorquittierbar*** eingestellt sein.
– Der Alarm A1 (Voralarm) darf nur auf ***Quittierbar*** eingestellt sein, wenn dieser zur Ansteuerung eines akustischen Alarmmittels verwendet wird.
– Verriegelung bei Messbereichsüberscheitung (siehe „DQ-Sensorverriegelung einstellen“, Seite 84).

Beim Betrieb gemäß BVS 13 ATEX G 001 X und PFG 14 G 001 X müssen folgende besondere Bedingungen berücksichtigt werden:

– Polytron 8200 CAT:
  – Bei Anströmung mit messgashaltiger Luft des DQ- oder LC-Sensors können um bis zu 32% erhöhte Messwerte auftreten.
    Bei Betrieb mit dem Fernkalibrieradapter DQ kann diese Erhöhung bis zu 70% betragen.
  – Der Transmitter mit LC-Sensor muss in Verbindung mit einer Steuereinheit betrieben werden, die eine Messbereichsüberschreitung selbsthaltend signalisiert. Interne Alarmrelais des Transmitters dürfen nicht verwendet werden.
  – Der Transmitter mit LC-Sensor muss mit seinem Sensor in seiner betriebsüblichen Gebrauchslage justiert werden.
  – Während der Anwärmzeit des LC-Sensors können Fehlalarme auftreten.
– Polytron 8100 EC:
  Die Einstellzeit t20 der Transmitter mit EC-Sensor kann bei kleinen Konzentrationsänderungen den Grenzwert der EN 50104 überschreiten.

6.2 Gasmessgerät in Betrieb nehmen

1. Zur Vermeidung von Fehlalarmen die Alarmgebung des Gasmessgeräts ausschalten (siehe „Alarme ein- oder ausschalten“, Seite 77).
2. Die Spannungsversorgung einschalten.
   ⇒ Das Gerät durchläuft eine Startsequenz (LCD-/LED-Test, Softwareversion und Initialisierung).
   ⇒ Das Display zeigt an, dass der Sensor in hh:mm:ss (Countdown) bereit für die Messung ist. Das Gerät überträgt das Wartungssignal. Das Fehlerrelais wird aktiviert.
   ⇒ Der Sensor läuft ein. Das Wartungssignal auf der 4–20-mA-Schnittstelle bleibt bestehen, bis der Sensor eingelaufen ist. Die Länge der Einlaufzeit hängt von der Art des Sensors sowie den Umweltbedingungen ab. Maximale Einlaufzeit eines neuen Sensors: Siehe Gebrauchsanweisung des Sensors.
3. Datum und Uhrzeit prüfen. Einstellungen können während der Einlaufzeit des Sensors gemacht werden.
   ⇒ Nach der Einlaufzeit des Sensors geht das Gerät in den Normalbetrieb über. Auf dem Display wird die aktuelle Gaskonzentration, die Messeinheit und ggf. das gewählte Gas angezeigt. Die grüne LED leuchtet.

   ℹ Wenn das Gerät mit einem Dräger SensorAlive betrieben wird, empfiehlt Dräger, Datum und Uhrzeit korrekt einzustellen. Nach der Einlaufzeit des Sensors findet die Anlaufzeit des Dräger SensorAlive statt. Während dieser Phase ist der Sensor messfähig, die Selbstdiagnose findet aber noch nicht statt.
4. Das Gerät bei Bedarf justieren.
5. Die Alarmgebung des Gasmessgeräts einschalten (siehe „Alarme ein- oder ausschalten“, Seite 77).

7 Betrieb

7.1 Bedienfeld

Auf dem Bedienfeld befinden sich
– Tasten zur Navigation im Menü
– ein Display
– LEDs und zugehörige Symbole

Die Tasten zur Navigation haben unterschiedliche Funktionen, je nachdem, in welchem Menü man sich befindet.

Das Gerät wird mit einem Magnetstab bedient. Dabei muss die Gehäuseabdeckung auf dem Gerät aufgesetzt sein. Wenn die Gehäuseabdeckung nicht aufgesetzt ist, kann der Magnetstab möglicherweise zwei oder mehr Schaltflächen auf einmal aktivieren (Crosstalk).

7.2 LEDs und Symbole

Auf dem Bedienfeld befinden sich folgende Symbole und LEDs:

Symbol	LED	Beschreibung
	Rot	Alarm ausgelöst
	Gelb	Störung
	Grün	Eingeschaltet

LED-Status

– Wenn der Alarm A1 (Voralarm) ausgelöst wurde, blinkt die rote LED einfach .
– Wenn der Alarm A2 (Hauptalarm) ausgelöst wurde, blinkt die rote LED zweifach .
– Wenn ein Alarm quittiert wurde, bevor die Ursache behoben worden ist, leuchtet die rote LED dauerhaft, um anzuzeigen, dass eine Störung vorliegt.

7.3 Anzeigen am Display

7.3.1 Alle Geräte

Symbol	Erklärung
	Eine Fehlermeldung liegt vor. Weitere Informationen sind im Menü ***Information*** erhältlich.
	Eine Warnmeldung liegt vor. Weitere Informationen sind im Menü ***Information*** erhältlich.
	Wartungssignal wird ausgegeben.
	Der eingestellte Messbereichsendwert wird an der 4-20-mA-Schnittstelle überschritten.
	Der eingestellte Messbereichsanfangswert wird an der 4-20-mA-Schnittstelle unterschritten.

Symbol	Erklärung
	HART®-Betrieb ist aktiviert. Die Analogschnittstelle ist auf einen festen Wert eingestellt und überträgt kein Messsignal.
	Sobald die Kapazität des Datenloggers erschöpft ist, werden die alten Daten durch neue Werte überschrieben (Funktion "roll").
	Sobald die Kapazität des Datenloggers erschöpft ist, werden keine weiteren Daten gespeichert (Funktion "stack").
SIL	Der SIL-Betriebsmodus ist aktiv.

7.3.2 Polytron 8100 EC-spezifische Symbole

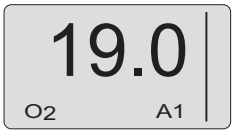
Symbol	Erklärung
	Der Sensor ist betriebsbereit.
	Der Sensor ist betriebsbereit, jedoch nahe dem Ende der Nutzungsdauer.
	Der Sensor ist noch betriebsbereit, sollte aber so bald wie möglich gewechselt werden. Die Vitalität ist <25%.
LT	Ein LifeTest des Dräger SensorAlive wird durchgeführt.

7.3.3 Messbetrieb

Die folgenden Beispielanzeigen stammen von Polytron 8100 EC.

Für Polytron 8200 CAT und Polytron 8310 IR sind keine Gasbezeichnungen vordefiniert. Die Gasbezeichnungen müssen über die PC-Software DrägerPolysoft eingegeben werden. Wenn einzelne Parameter mit der PC-Software DrägerPolysoft oder einer anderen Software verändert werden, müssen alle Parameter aus dem Polytron® 8xx0 ausgelesen oder direkt am Gerät verifiziert werden.

Im Messbetrieb wird folgendes angezeigt:

Beispiel für Anzeige	Beschreibung
	Im Normalbetrieb werden auf dem Display die gemessene Gaskonzentration, die gewählte Gasart und die Messeinheit angezeigt. **Analogschnittstelle:** korrespondierender Stromwert **Relais:** alle Relais sind im Normalzustand
	Überschreiten der Alarmschwellen. Das Beispiel zeigt Voralarm A1. **Analogschnittstelle:** korrespondierender Stromwert **Relais:** Relais A1 ist im Alarmzustand.

7.3.4 Sonderzustände

Wenn sich das Gerät in einem Sonderzustand befindet, kann eine ordnungsgemäße Messung oder Alarmgebung nicht mehr garantiert werden.

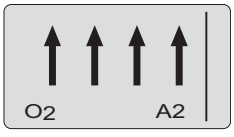
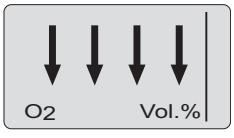
Dies ist der Fall,

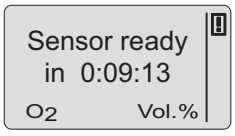
- wenn die Gaskonzentration den Messbereich überschreitet.
- wenn eine Störung auftritt.
- wenn Alarme deaktiviert sind.
- wenn Justierungen durchgeführt werden.
- wenn Begasungstests durchgeführt werden.
- wenn ein Sensor in der Einlaufphase ist.
- wenn das System im Wartungsmodus ist.
- wenn ein Dräger SensorAlive verwendet wird und das System so konfiguriert ist, dass der Messwert während eines LifeTests nicht ausgegeben wird.

Welche Stromstärke der Analogschnittstelle mit welchem Analogsignal verknüpft ist, siehe 16.2.

Die Signale der digitalen Schnittstellen sind den folgenden Dokumenten zu entnehmen.

Schnittstelle	Dokument
PROFIBUS PA	9033782
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

Beispiel für Anzeige	Beschreibung
	**Wert liegt über dem Messbereich** Die Gaskonzentration liegt außerhalb des Messbereichs des Sensors[1)]. **Analogschnittstelle:** Messbereichsüberschreitung **Relais:** A2-Relais-Schalter ***Hinweis für Polytron 8200 und Polytron 8310:*** Die Meldung, dass der Messbereich überschritten wurde, kann auch auf einen Kurzschluss oder eine Unterbrechung der Verbindung zu einem abgesetzten Sensor zurückzuführen sein.
	**Wert liegt unter dem Messbereich** Die Gaskonzentration liegt außerhalb des Messbereichs des Sensors. **Analogschnittstelle:** Drift unter Null **Relais:** Fehlerrelais-Schalter
	**Fehleranzeige** Auf der rechten Seite wird das Symbol ⊠ angezeigt. **Analogschnittstelle:** Fehlerstrom **Relais:** Fehlerrelais-Schalter

Beispiel für Anzeige	Beschreibung
	**Instandhaltungsanzeige** Auf der rechten Seite wird das Symbol angezeigt. Dies wird angezeigt, wenn Alarme deaktiviert sind, während der Justierung, eines Begasungstests und Instandhaltungsarbeiten. **Analogschnittstelle:** Wartungsstrom **Relais:** Keine Änderung
	**Warnanzeige** Auf der rechten Seite wird das Symbol angezeigt. **Analogschnittstelle:** Warnungsstrom[2)] **Relais:** Keine Änderung
	**Einlaufphase 1** Auf der rechten Seite wird das Symbol angezeigt. Die verbleibende Zeit wird auf der linken Seite angezeigt. **Analogschnittstelle:** Wartungsstrom **Relais:** Fehlerrelais-Schalter Das Fehlerrelais-Verhalten lässt sich für Einlaufphase 1 konfigurieren (siehe „Fehlerrelais Einlaufen 1 einstellen“, Seite 77)
	**Einlaufphase 2** Auf der rechten Seite wird das Symbol angezeigt. Der gemessene Wert wird auf der linken Seite angezeigt. **Analogschnittstelle:** Messwert **Relais:** Verhalten wie im Messbetrieb (das Fehlerrelais zeigt nicht Einlaufphase 2 an.)

1) Wenn die Gaskonzentration den Messbereichsendwert der 4-20 mA-Schnittstelle überschreitet, wird auf dem Display weiterhin der Messwert sowie der Hinweis „Messbereichsüberschreitung der analogen Schnittstelle“ angezeigt .
2) Nur wenn der Warnungsstrom aktiviert ist. Werkseinstellung: deaktiviert.

7.3.5 Beendigung der Sonderzustände

Fehleranzeige / Warnanzeige

Fehleranzeigen und Warnanzeigen sind in der Regel nicht selbsthaltend. Sobald die Ursachen der Fehler oder Warnungen behoben sind, wird kein Fehler und keine Warnung mehr angezeigt. Ausnahmen sind "SensorAlive Fehlererkennung" und "SensorAlive Verstopfungserkennung".

Um die Ursachen zu beheben, den Fehler oder die Warnung anzeigen lassen (siehe „Das Menü Information“, Seite 63) und mit der Störungsbeseitigung (siehe „Störungsbeseitigung“, Seite 71) beginnen.

Wert über-/unterschreitet den Messbereich

Die Anzeige gibt an, dass die Gaskonzentration außerhalb des Messbereichs des Sensors ist. Die Anzeige erlischt, sobald die Gaskonzentration wieder im Messbereich ist. Nach einer Messbereichsüberschreitung kann sich die Empfindlichkeit und die Ansprechzeit des Sensors verschlechtern.

HINWEIS

Fehlfunktion des Sensors

Gaskonzentrationen außerhalb des Messbereichs des Sensors können Fehlfunktionen des Sensors verursachen.

► Sensor ggf. neu justieren.

Polytron® 8200 CAT mit DQ-Sensor:

Eine Messbereichsüberschreitung muss mit [OK] bestätigt werden, nachdem geprüft wurde, dass die Gaskonzentration unter 100 %UEG liegt (z. B. mit einem tragbaren Gasmessgerät).

Die Standardeinstellung des Geräts ist: selbsthaltende Alarme.

Bei Geräten ohne Relais lässt sich die Messbereichsüberschreitung auf nicht selbsthaltend stellen. In diesem Fall erlischt die Anzeige Messbereichsüberschreitung. Diese Funktion muss von der Auswerteeinheit unterstützt werden! Für weitere Informationen siehe: „DQ-Sensorverriegelung einstellen“, Seite 84.

Polytron® 8200 CAT mit LC-Sensor:

⚠ WARNUNG

Missverständliche Anzeigen bei Messwerten, die den Messbereich überschreiten

Selbsthaltende Alarme bei Messbereichsüberschreitungen werden von LC-Sensoren nicht unterstützt.
Für einen sicheren Betrieb entsprechend BVS 13 ATEX G 001 X muss das Gasmessgerät mit einer Auswerteeinheit betrieben werden, die selbsthaltende Alarme anzeigen kann. Die internen Alarmrelais des Gasmessgeräts dürfen nicht verwendet werden.

► Sicherstellen, dass eine selbsthaltende Anzeige von Messbereichsüberschreitungen an der Auswerteeinheit aktiviert ist.

Nach der Anzeige von Werten mit Messbereichsüberschreitung muss sichergestellt werden, dass die Gaskonzentration unter 100 %UEG liegt (z. B. mit einem tragbaren Gasmessgerät).

7.4 Infomodus und Funktionstaste

7.4.1 Infomodus aufrufen

Der Infomodus wird verwendet, um für das Gerät relevante Informationen einzusehen. Dadurch wird der Normalbetrieb des Geräts nicht unterbrochen.

- Im Messbetrieb 3 Sekunden lang die Taste gedrückt halten.

7.4.2 Im Infomodus navigieren

Taste	Funktion
▲	Blättert zur nächsten Seite.
▼	Blättert zur vorherigen Seite.
OK	Beendet den Infomodus.

Nach 30 Sekunden ohne Tastenbetätigung beendet das Gasmessgerät den Infomodus automatisch.

7.4.3 Funktionstaste verwenden

Mit der Funktionstaste kann eine der Funktionstaste zugewiesene Funktion direkt aufgerufen werden. Per Voreinstellung wird der Fehlerbericht angezeigt.

- Im Messmodus ▲ ca. 1 Sekunde gedrückt halten.

Funktionstaste konfigurieren (siehe Kapitel 11.4 Funktionstaste konfigurieren).

7.5 Menüs

7.5.1 In einem Menü navigieren

Taste	Funktion
▲	Navigiert aufwärts. Stellt Werte ein.
▼	Navigiert abwärts. Stellt Werte ein.
OK	Bestätigt Eingaben. Wählt Menüs und Funktionen.

7.5.2 Menüs aufrufen

- Um das Menü ***Information*** aufzurufen:
  a. Im Messbetrieb ▼ 1 Sekunde lang gedrückt halten.
- Um das Menü ***Kalibrierung*** aufzurufen:
  a. Im Messbetrieb ▼ 3 Sekunden lang gedrückt halten.
  b. ***Kennw. eingeben*** wählen.
  c. Das entsprechende Kennwort eingeben und mit [OK] bestätigen.
- Um auf alle Menüs zuzugreifen:
  a. Im Messbetrieb ▼ 3 Sekunden lang gedrückt halten.
  b. ***Kennw. eingeben*** wählen.
  c. Das entsprechende Kennwort eingeben und mit [OK] bestätigen.

7.5.3 Kennwörter

Kennwort Kalibr.	erlaubt den Zugriff auf das Menü ***Information*** und das das Menü ***Kalibrierung*** (Justiereinstellungen) Standardwert: **_ _ _ 1**
Kennwort Einst.	erlaubt den Zugriff auf Konfigurationen und Menüs Standardwert: **_ _ _ 2**

Informationen zur Änderung des Passworts können 11.1 entnommen werden.

7.5.4 Das Menü *Information*

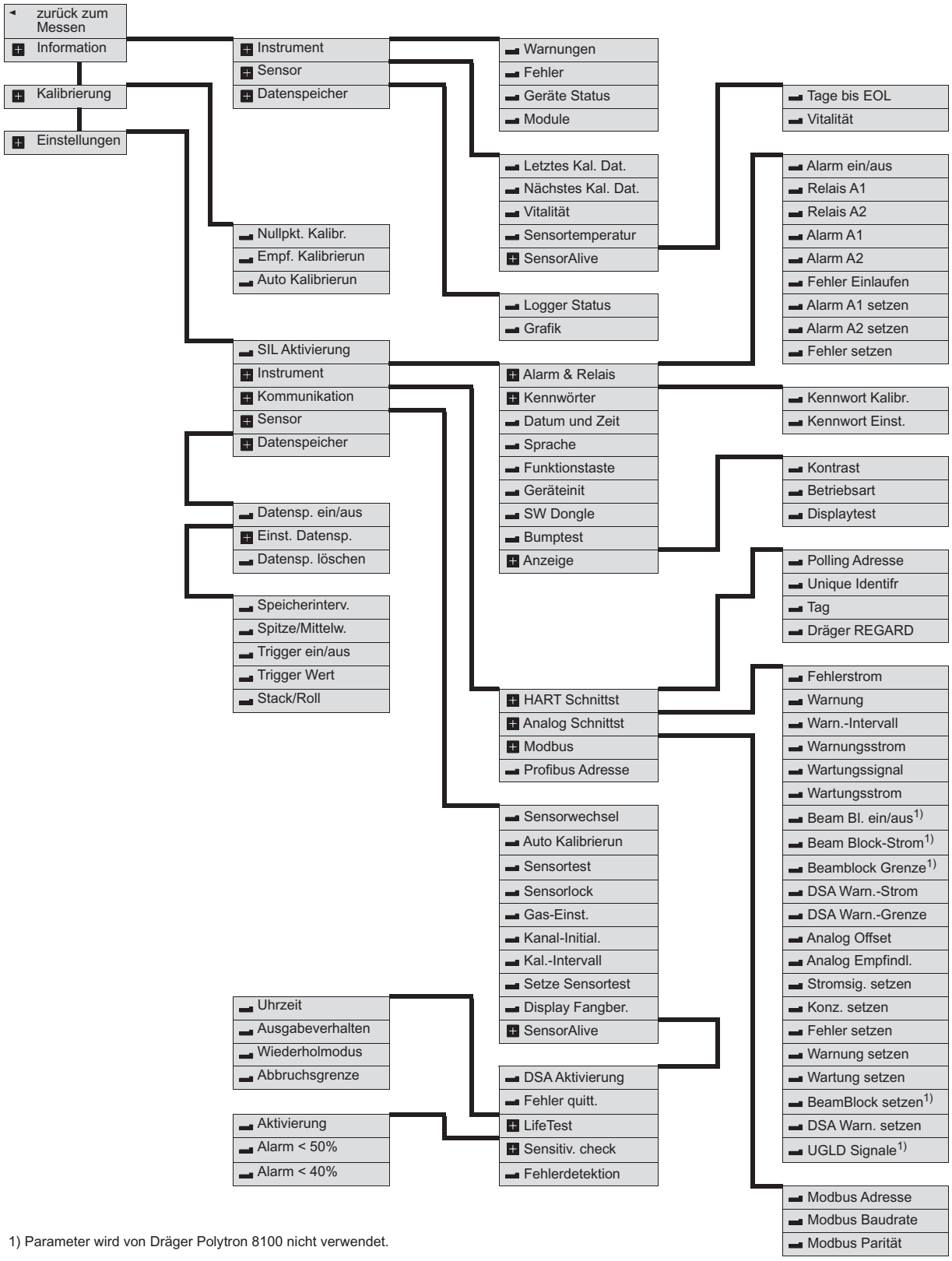
Im Menü ***Information*** können folgende Informationen aufgerufen werden:

Instrument	
Warnungen	Anzeige von Warnmeldungen in Klartext samt der dazugehörigen Nummer. Wenn mehrere Warnmeldungen vorliegen, wird dies entsprechend angezeigt (z. B. durch 1/3 = Bildschirm 1 von 3).
Fehler	Anzeige von Fehlermeldungen in Klartext samt der dazugehörigen Nummer. Wenn mehrere Fehler vorliegen, wird dies entsprechend angezeigt (z. B. durch 1/3 = Bildschirm 1 von 3).
Geräte Status	Mit dieser Funktion werden Warn- und Fehlercodes in Form einer Tabelle angezeigt. Wenn für sämtliche Codes der Wert 00 angezeigt wird, liegen keine Warn- oder Fehlermeldungen vor.
Module	Installierte Hardware-Module sowie die Softwareversion der SIOS genannten EC-Sensorschnittstelle werden in einer Übersicht angezeigt. Für Detailangaben das entsprechende Modul auswählen. ■ = installierte Module □ = nicht installierte Module
Sensor	
Letztes Kal. Dat.	Justierdatum, Einheit, Gas und Konzentration der letzten Justierung werden angezeigt.
Nächstes Kal. Dat.	Zeigt das Datum der nächsten fälligen Justierung an.
Vitalität[1)]	Die Sensorvitalität wird in % angezeigt. Dräger empfiehlt, den Sensor auszutauschen, wenn die Vitalität < 25 % beträgt.
Sensortemperatur[1)]	Es werden die aktuelle und die höchste Sensortemperatur angezeigt.
SensorAlive	Im Untermenü werden die Tage bis zum Ende der prognostizierten Nutzungsdauer und die Vitalität in % angezeigt.
Datenspeicher	
Logger Status	Anzeige des Datenlogger-Status (aktiv oder nicht aktiv)
Grafik	Anzeige des Verlaufs der letzten 15 Minuten in einer Zeit/Konzentrations-Grafik.

1) Die Funktion ist nur mit dem Diagnosedongle verfügbar.

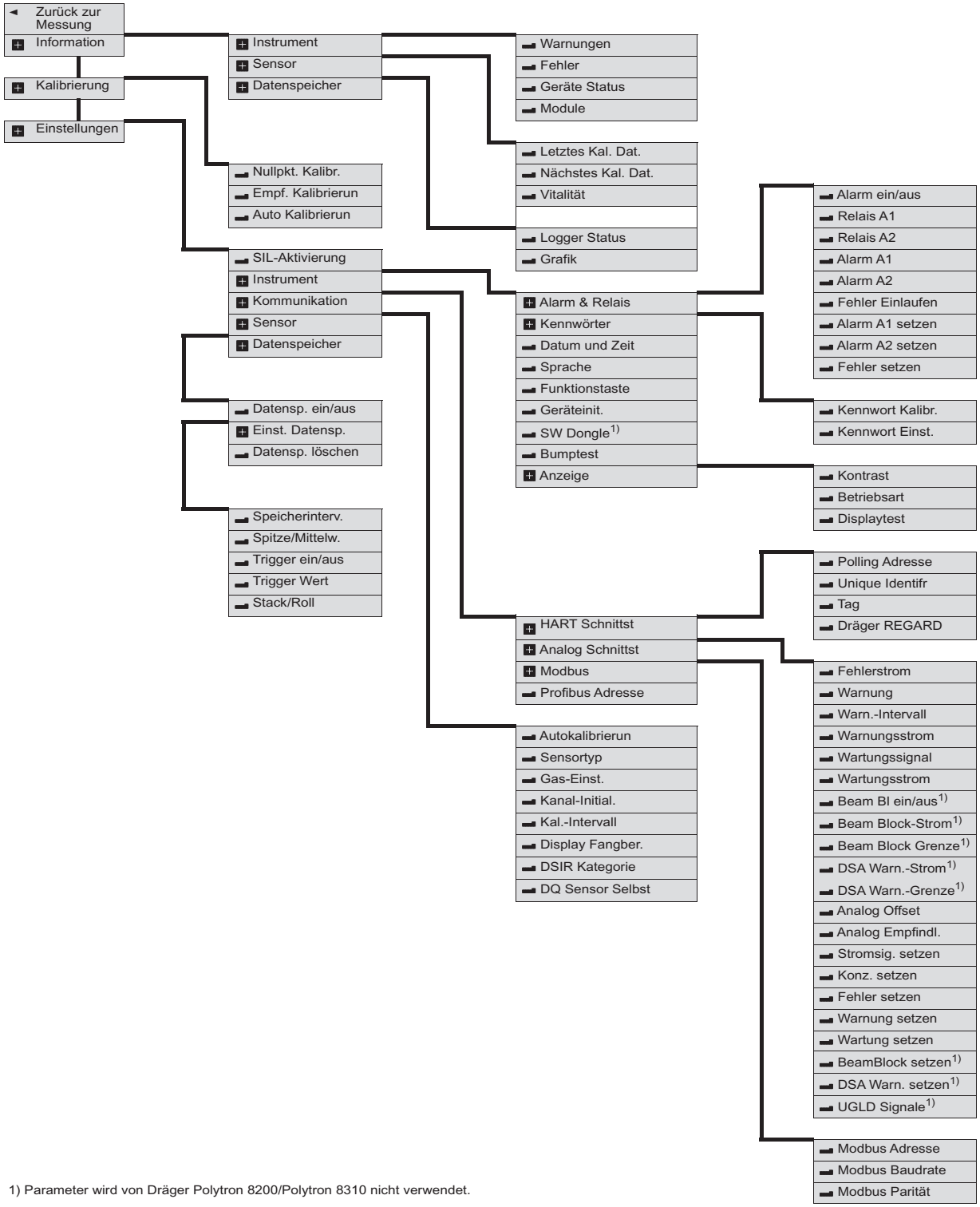
7.5.5 Menüübersichten

Polytron 8100



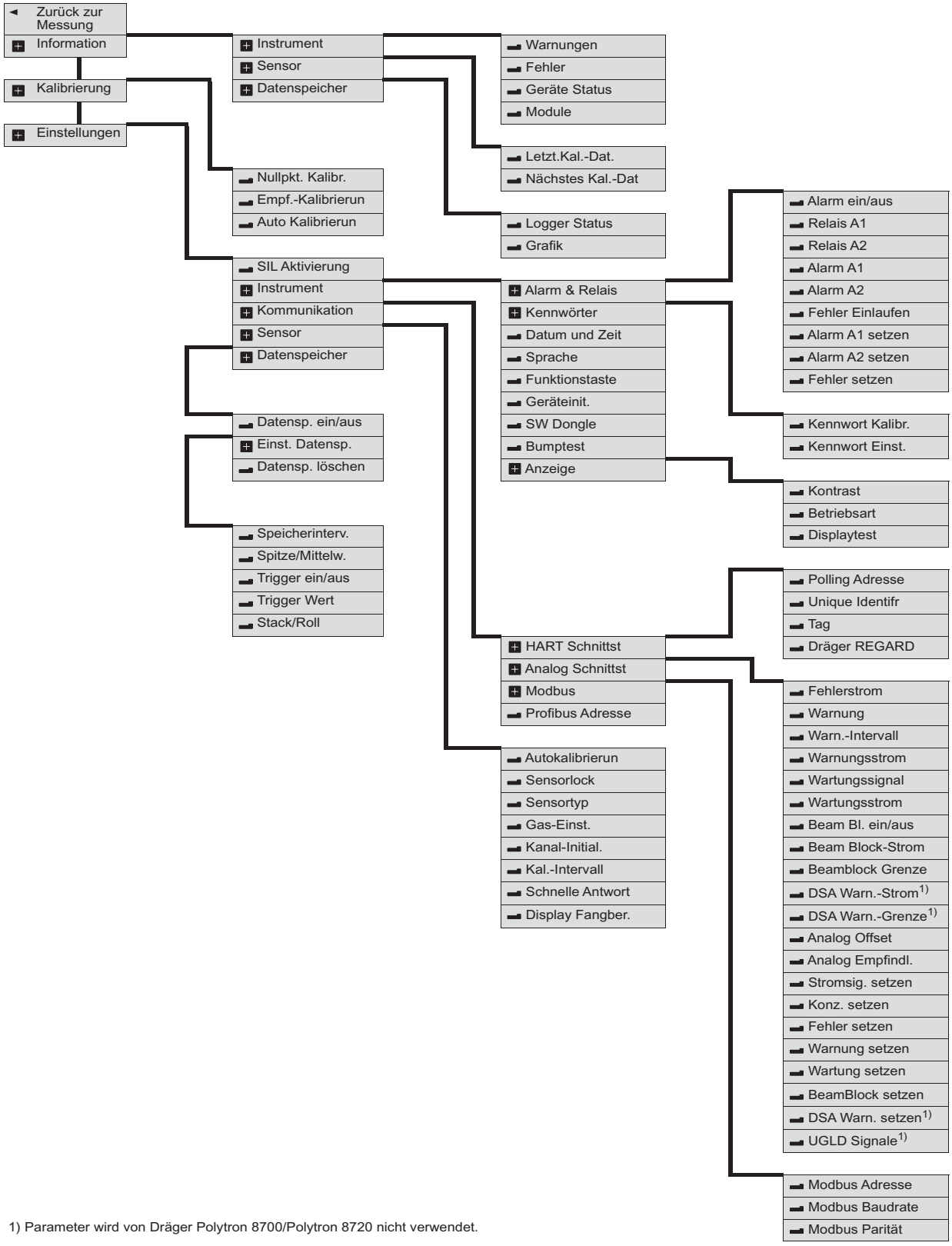
1) Parameter wird von Dräger Polytron 8100 nicht verwendet.

Polytron 8200, Polytron 8310



1) Parameter wird von Dräger Polytron 8200/Polytron 8310 nicht verwendet.

Polytron 8700, Polytron 8720



1) Parameter wird von Dräger Polytron 8700/Polytron 8720 nicht verwendet.

7.6 Informationen zum Betrieb mit einem Dräger SensorAlive

– Wenn am Transmitter ein Menü aufgerufen ist oder bestimmte Fehler gesetzt sind, führt der Dräger SensorAlive keinen LifeTest durch.
– Der Dräger SensorAlive kann die Justierung des Geräts für eine bestimmte Zeit unterdrücken (H_2S-Sensor: 30 Minuten).
– Wenn eine hohe Genauigkeit für die Durchführungszeit der LifeTests gefordert ist, sollte die Uhrzeit am Transmitter regelmäßig geprüft und ggf. neu eingestellt werden.
– Die Menüeinträge für den Dräger SensorAlive werden nur angezeigt, wenn ein Dräger SensorAlive eingesteckt ist. Die Dongle-Funktionen sind dann auch sichtbar, aber nicht aktiv.

8 Justierung

8.1 Allgemeine Hinweise

– Zur Sicherstellung eines ordnungsgemäßen Betriebs erst den Nullpunkt justieren und dann die Empfindlichkeit. Werden diese Vorgänge in der falschen Reihenfolge durchgeführt, kann die Justierung aufgrund der Softwareeinstellungen nicht weiter durchgeführt werden.
– Ist ein Betrieb in großen Höhen vorgesehen, fällt der Anzeigewert niedriger aus als beim Ablesen auf Meereshöhe (verringerter Partialdruck). Eine neue Empfindlichkeitsjustierung wird empfohlen, wenn sich die Höhe oder der Umgebungsdruck ändern. Die werkseitige Justierung ist auf Meereshöhe eingestellt.
– Dräger empfiehlt, Geräte mit dem Gas zu justieren, das nachgewiesen werden soll. Diese Methode ist genauer als eine Ersatzgasjustierung. Nur wenn eine Messgasjustierung nicht möglich ist, kann alternativ eine Ersatzgasjustierung durchgeführt werden.
– Sensoren für Methan und Wasserstoff sollten nur mit Messgas und nicht mit Ersatzgas justiert werden.
– Für Polytron 8310 IR: Außerdem die Angaben in der Gebrauchsanweisung für den DrägerSensor IR beachten[1)].

Beim Justieren wird die Messgenauigkeit des Sensors mit einer bekannten Prüfgaskonzentration überprüft und eingestellt. Justierungen müssen regelmäßig durchgeführt werden. Die Länge der Justierintervalle hängt von den Umgebungseinflüssen ab, bei denen der Sensor betrieben wird.

Umgebungseinflüsse und Alterung führen zum Drift von Sensoren. Bei einem Sensordrift sinkt die Anzeigegenauigkeit von Messgasen. Justierungen stellen die Anzeigegenauigkeit wieder her. Je nach Stärke des Drifts müssen kürzere Justierintervalle gewählt werden.

Um die Umgebungseinflüsse bei Neuinstallationen abzuschätzen, wird empfohlen kurze Justierintervalle zu wählen und den Drift zu dokumentieren. Anhand der ermittelten Daten sollte der Anlagenbetreiber die Länge der Justierintervalle festlegen.

Wenn ein Dräger SensorAlive verwendet wird, wird der Drift kompensiert und kann ausgelesen werden.

Unter normalen Bedingungen empfiehlt Dräger die folgenden Justierintervalle[2)]:

– Elektrochemische Sensoren (EC): 6-12 Monate[3)]
– Katalytische Sensoren (CAT): 4 Monate
– Infrarotsensoren (IR): 6-24 Monate[3)]

8.2 Prüfgase

Prüfgaseigenschaften (z. B. relative Feuchte, Konzentration) sind der Gebrauchsanweisung des jeweiligen Sensors zu entnehmen. Sind keine Angaben zur Feuchte enthalten, kann trockenes Prüfgas zur Justierung verwendet werden. Die Feuchte des Prüfgases ist bei O_2-Sensoren nicht relevant.

Je nach Art der Justierung werden unterschiedliche Prüfgase verwendet.

Nullgas

Das Nullgas ist ein Prüfgas, das verwendet wird, um den Nullpunkt eines Sensors zu justieren. Für O_2- und CO_2-Sensoren wird Stickstoff (N_2) verwendet. Bei anderen Sensoren kann die Umgebungsluft verwendet werden, wenn sie frei von störenden Verunreinigungen und dem Messgas ist.

Justiergas

Das Justiergas ist ein Prüfgas, das verwendet wird, um die Empfindlichkeit eines Sensors zu justieren. Das Justiergas ist eine bekannte Konzentration des Messgases, verdünnt mit Frischluft und Stickstoff. Für O_2-Sensoren wird kein Justiergas benötigt, da Sauerstoff aus der Umgebungsluft verwendet wird.

8.3 Gasdurchfluss für Justierungen

Der Gasdurchfluss variiert je nach Sensor.

EC-Sensor, CAT-Sensor	0,5 l/min ± 10 %
Alle anderen Sensoren	0,5 l/min - 2 l/min

Der Gasdurchfluss sollte mit den Umweltbedingungen während des Betriebs übereinstimmen (z. B. Lüftungskanalmessung mit höherem Durchfluss als 2 l/min)

1) 9023981 (Englisch), 9033555 (Bulgarisch, Rumänisch), 9023984 (Spanisch, Portugiesisch), 9023986 (Dänisch, Norwegisch), 9033556 (Tschechisch, Kroatisch), 9033809 (Chinesisch), 9023985 (Ungarisch, Polnisch), 9023982 (Französisch), 9033557 (Slowakisch, Slowenisch), 9033558 (Griechisch, Türkisch), 9023987 (Italienisch, Niederländisch), 9023983 (Finnisch, Schwedisch), 9023843 (Deutsch)

2) Gebrauchsanweisung des Sensors beachten
3) Für Anwendungen gemäß EN 45544-1 und EN IEC 62990-1 darf das Justierintervall 6 Monate nicht überschreiten.

8.4 Justierungen vorbereiten

Allgemeine Hinweise

⚠ WARNUNG
Gesundheitsgefährdung durch Prüfgas
Das Einatmen von Prüfgas kann die Gesundheit gefährden oder zum Tod führen.
► Prüfgas nicht einatmen.
► Vom Prüfgas ausgehende Gefahren, Gefahrenhinweise und Sicherheitsratschläge beachten (siehe z. B. Sicherheitsdatenblätter, Anweisungen auf den Prüfmitteln).

⚠ VORSICHT
Auslösen von Alarmen durch Prüfgas
Bei noch anstehendem Prüfgas können Alarme ausgelöst werden.
► Sicherstellen, dass das Zuführen von Prüfgas beendet wird.

Voraussetzungen
– Die Einlaufphase des Sensors ist abgeschlossen (siehe „Gasmessgerät in Betrieb nehmen“, Seite 60).
– Datum und Uhrzeit sind eingestellt (siehe „Datum und Uhrzeit einstellen“, Seite 75).
– Wenn ein Dräger SensorAlive verwendet wird, muss der letzte LifeTest lange genug her sein (siehe Gebrauchsanweisung des Sensors).

Besonderheit beim Polytron 8310

Dräger empfiehlt, einen automatischen Nullpunktabgleich am Sensor zu machen, bevor der Nullpunkt justiert wird. Dadurch wird die Nullpunktnachführung des DrägerSensor IR zurückgesetzt und der volle Nachführbereich steht wieder zur Verfügung.

1. Alarmgebung des Gasmessgeräts ausschalten (siehe „Alarme ein- oder ausschalten“, Seite 77).
2. Sensor über den Kalibrieradapter mit Stickstoff, synthetischer Luft bzw. Frischluft begasen und stabilen Messwert abwarten.
3. Magnetstab auf den mit dem Symbol ⇩0 markierten Bereich (innerhalb des schwarzen Rahmens) auf der Sensormantelfläche aufsetzen und für mindestens 5 Sekunden halten. Das Ausgangssignal des Sensors wechselt nach 5 Sekunden auf die Anzeige des Kalibriersignals (Anzeigeänderung um ca. –10 %UEG), solange der Magnetstab gehalten wird. Gleichzeitig wird automatisch ein Nullpunktabgleich des optischen Messsystems durchgeführt.
4. Magnetstab entfernen. Nach 30 Sekunden verlässt das Gerät die automatische Nullpunktabgleich-Routine. Zur Bestätigung des automatischen Nullpunktabgleichs wechselt das Ausgangssignal wieder auf das Kalibriersignal (Anzeigeänderung auf ca. –10 %UEG). Dieses Signal wird ebenso lange angezeigt wie beim Einstieg in die automatische Nullpunktabgleich-Routine.
5. Alarmgebung des Gasmessgeräts einschalten.

Polytron 8100, Polytron 8200, Polytron 8310
Siehe Abbildung B auf der Ausklappseite.

Justierausrüstung:
– Dräger Druckminderer (1), für reaktive Gase Druckminderer aus Edelstahl verwenden
– Dräger Kalibrieradapter (2) (Sachnummer 6810536)
– Schlauch (3)
– Dräger-Prüfgasflasche (4)

Justierung vorbereiten:
1. Den Druckminderer an die Prüfgasflasche anschließen.
2. Den Kalibrieradapter am Sensor befestigen.
3. Den Schlauch an die Stecknippelverbindung anschließen.
4. Auf das Menü zugreifen (siehe „Menüs aufrufen“, Seite 63).

Polytron 87x0 IR
Siehe Abbildung B auf der Ausklappseite.

Justierausrüstung:
– Dräger Druckminderer (1), für reaktive Gase Druckminderer aus Edelstahl verwenden
– Dräger Kalibrieradapter (5) (Sachnummer 6811610).
– Schlauch (3)
– Dräger-Prüfgasflasche (4)

Justierung vorbereiten:
1. Den Druckminderer an die Prüfgasflasche anschließen.
2. Den Kalibrieradapter am Spritzschutz befestigen, so dass er einrastet.
   Dies gilt nicht für die Anbringung an Lüftungskanälen oder wenn ein Prozessadapter oder eine Prozessküvette verwendet wird (siehe Installationsanweisung für das jeweilige PIR 7x00-Zubehör).
3. Darauf achten, dass die Dichtflächen um die Öffnungen des Spritzschutzes sauber sind. Der Insektenschutz muss nicht entfernt werden.
4. Den Schlauch an die Stecknippelverbindung anschließen.
5. Auf das Menü zugreifen (siehe „Menüs aufrufen“, Seite 63).

8.5 Nullpunktjustierung

8.5.1 Allgemeines

Anstelle von Stickstoff oder synthetischer Luft kann nur dann Umgebungsluft verwendet werden, um den Nullpunkt des Sensors zu justieren, wenn sichergestellt ist, dass die Umgebungsluft kein Zielgas und kein anderes Gas enthält, für das der Sensor möglicherweise Querempfindlichkeit aufweist (vgl. die Angaben im Datenblatt des Sensors). In diesem Fall wird keine Gasflasche bzw. kein Kalibrieradapter für die Nullpunktjustierung benötigt.

⚠ WARNUNG
Justierungsfehler bei Nullpunktjustierung
Unzureichende Umgebungsluftströmung kann zu Justierungsfehlern führen.
► Sicherstellen, dass ausreichend viel Umgebungsluft an den Sensor gelangt.

Polytron® 8100 EC-spezifisch:

Bei Sauerstoffsensoren (O_2) verändert eine Nullpunktjustierung keine Werte in der Firmware oder dem Sensor. Die Nullpunktjustierung kann also dazu eingesetzt werden, eine korrekte Nullpunktanzeige zu überprüfen, wenn Stickstoff auf den Sensor gegeben wird. Das Polytron 8100 EC zeigt einen Fehlerzustand an, wenn eine Nullpunktkontrolle mit einer Abweichung von mehr als 0,6 Vol% O_2 von Null fehlschlägt. Im Fall eines Fehlers die Nullpunktkontrolle wiederholen oder bei Bedarf den Sensor austauschen. Stickstoff (N_2) zur Verifizierung verwenden.

Polytron® 8200 CAT-spezifisch:

Sensoren dürfen nicht mit reinem Stickstoff justiert werden. Katalytische Sensoren benötigen Sauerstoff, um korrekt zu funktionieren.

Polytron® 8720 IR-spezifisch:

Für die Nullpunktjustierung von Polytron 8720 IR (mit PIR 7200 zum Nachweis von Kohlenstoffdioxid) dürfen nur Stickstoff oder synthetische Luft ohne CO_2-Bestandteil verwendet werden.

8.5.2 Nullpunktjustierung durchführen

ℹ Die Justierung kann jederzeit abgebrochen werden. Zum Abbrechen ***zurück*** wählen.

Voraussetzungen:
– Die Einlaufphase des Sensors ist abgeschlossen
– Die Justierung wurde vorbereitet.

Nullpunkt folgendermaßen justieren:
1. ***Kalibrierung*** > ***Nullpkt. Kalibr.*** wählen und bestätigen.
   ⇒ Das Wartungssignal wird über die analoge Schnittstelle übertragen. Es werden keine Alarme oder Fehlerrelais geschaltet und das Symbol 🔧 wird angezeigt.
   ⇒ Die Meldung ***Nullgas zuführen*** wird angezeigt.
2. Wenn die Umgebungsluft nicht verwendet werden kann, synthetische Luft oder Stickstoff benutzen.
   a. Den Gasdurchfluss entsprechend dem verwendeten Sensor einstellen (siehe „Gasdurchfluss für Justierungen“, Seite 67)
3. ***weiter*** wählen und bestätigen.
   ⇒ Der aktuelle Wert wird angezeigt.

ℹ Nach 15 Minuten ohne Bestätigung kehrt das Gerät ohne eine Justierung durchzuführen in das Justierungsmenü zurück.

Nachdem das Prüfgas 3 Minuten lang auf den Sensor gegeben wurde und der angezeigte Wert stabil ist, ist die Justierung durchzuführen.
4. ***justieren*** wählen und bestätigen.
   ⇒ Die Meldung ***bitte warten...*** wird angezeigt.
   ⇒ Der neu ermittelte aktuelle Wert wird angezeigt.
5. ***weiter*** wählen und bestätigen.
6. Den Gasdurchfluss abstellen und den Kalibrieradapter vom Sensor entfernen oder den Schlauch lösen.
   Liegt der aktuelle Wert außerhalb des Alarmbereichs:
7. ***weiter*** wählen und bestätigen.
   ⇒ Das Gerät schaltet in das Justierungsmenü zurück.

8.6 Empfindlichkeitsjustierung

8.6.1 Allgemeines

Polytron® 8310 IR-spezifisch:

Aufgrund der Gestaltung des DSIR-Gassensors ist das Ausgangssignal des Gassensors auf 45 % . . . 55 % der geräteinternen Versorgungsspannung begrenzt. Sollte die Gaskonzentration nach Erreichen der Obergrenze des Ausgangssignals des Sensors weiter ansteigen, erhöhen sich die vom Gerät an die Auswerteeinheit zurückgemeldeten und dort dargestellten Werte nicht. Bei Substanzen mit besonders niedrigen Justierungsfaktoren bzw. manueller Konfiguration eines hohen Empfindlichkeitsjustierungsfaktors am Sensor kann dies bereits bei Konzentrationen unterhalb von 100 %UEG der Fall sein. Bei Justierung mit Ersatzgas sollte daher mithilfe der zur Alarmschwelle passenden Prüfgaskonzentration überprüft werden, ob der Alarm richtig ausgelöst wird. Bei Bedarf kann der darstellbare Messbereich dadurch erhöht werden, dass das Sensorausgangssignal den Anforderungen entsprechend reduziert und anschließend am Gerät justiert wird (siehe Kapitel "Manuelle Empfindlichkeitskalibrierung des Ausgangssignals" in der Gebrauchsanweisung des DSIR-Gassensors).

8.6.2 Empfindlichkeitsjustierung durchführen

ℹ Die Justierung kann jederzeit abgebrochen werden. Zum Abbrechen ***zurück*** wählen.

Voraussetzungen:
- Die Justierung wurde vorbereitet.
- Der Nullpunkt wurde justiert.
- Spezifisch für alle Polytron 8xx0 außer Polytron 8100 EC: Die letzte gültige Nullpunktjustierung liegt nicht länger als 24 Stunden zurück.

Empfindlichkeit folgendermaßen justieren:

1. ***Kalibrierung*** > ***Empf. Kalibrierun*** wählen und bestätigen.
   ⇒ Das Wartungssignal wird über die analoge Schnittstelle übertragen. Es werden keine Alarme oder Fehlerrelais geschaltet und das Symbol 🔧 wird angezeigt.
   ⇒ Die Parameter für das Justiergas werden angezeigt, z. B.:[1)]
   Gas : H_2S
   Einheit: ppm
   Konzentr.: 25
2. Wenn die angezeigten Parameter nicht zum Zielgas passen, müssen die Parameter angepasst werden:
   a. ***Gas*** wählen und bestätigen.
   b. Das Justiergas aus der Liste wählen und bestätigen.
   c. ***Einheit*** wählen und bestätigen.
   d. Messeinheit aus der Liste wählen und bestätigen.
   e. ***Konz.*** wählen und bestätigen.
   f. Die Konzentration des Justiergases einstellen.
3. Wenn die Einstellungen korrekt sind:
   a. ***weiter*** wählen und bestätigen.
      ⇒ Eine Meldung wie ***Gasflow an H_2S*** wird angezeigt.
4. Justiergas einleiten.
   a. Den Gasdurchfluss entsprechend dem verwendeten Sensor einstellen (siehe „Gasdurchfluss für Justierungen“, Seite 67)
5. ***weiter*** wählen und bestätigen.
   ⇒ Der aktuelle Wert wird angezeigt

   ℹ Nach 15 Minuten ohne Bestätigung kehrt das Gerät ohne eine Justierung durchzuführen in das Justierungsmenü zurück.

   Nachdem das Prüfgas 3 Minuten lang auf den Sensor gegeben wurde und der angezeigte Wert stabil ist, ist die Justierung durchzuführen.[2)]:
6. ***weiter*** wählen und bestätigen.
   ⇒ Die Meldung ***bitte warten...*** wird angezeigt.
   ⇒ Der neu ermittelte aktuelle Wert wird angezeigt.
7. ***weiter*** wählen und bestätigen.
8. Den Gasdurchfluss abstellen und den Kalibrieradapter vom Sensor entfernen oder den Schlauch lösen.

   Liegt der aktuelle Wert außerhalb des Alarmbereichs:
9. ***weiter*** wählen und bestätigen.
   ⇒ Das Gerät schaltet in das Justierungsmenü zurück.

8.7 Automatische Justierung

8.7.1 Allgemeines

Die automatische Justierung umfasst die Nullpunktjustierung und eine anschließende Empfindlichkeitsjustierung. Sie stellt eine Alternative zur manuellen Durchführung der Nullpunkt- und Empfindlichkeitsjustierung dar.

Nicht alle Sensoren und Gase unterstützen die automatische Justierung. Wenn die Funktion nicht verfügbar ist, muss die Justierung manuell durchgeführt werden.

8.7.2 Automatische Justierung durchführen

ℹ Nach 24 Stunden ist die Nullpunktjustierung nicht mehr auf dem neuesten Stand. Daher ist die automatische Justierung nur möglich, nachdem die Nullpunktjustierung erneut durchgeführt wurde.

ℹ Die Justierung kann jederzeit abgebrochen werden. Zum Abbrechen ***zurück*** wählen.

Voraussetzungen:
- Die automatische Justierung ist aktiviert.
- Die Einlaufphase des Sensors ist abgeschlossen.
- Die Justierung wurde vorbereitet.

Automatische Justierung folgendermaßen durchführen:

1. Wenn die Umgebungsluft nicht verwendet werden kann, synthetische Luft oder Stickstoff benutzen.
2. ***Kalibrierung*** > ***Auto Kalibrierun*** wählen und bestätigen.
   ⇒ Die Meldung ***bitte warten...*** wird angezeigt und das Gerät führt die Nullpunktjustierung automatisch durch.
   ⇒ Bei einem O_2-Sensor wird ***Frischluft Kal.*** angezeigt.

   ℹ Die 4-20-mA-Schnittstelle gibt das Wartungssignal aus. Alarm oder Fehlerrelais werden nicht gesetzt und das Display zeigt das Wartungssymbol 🔧.
3. Nach erfolgreicher Nullpunktjustierung wird die Empfindlichkeitsjustierung gestartet.
   ⇒ Die Parameter für das Gas werden angezeigt, z. B.:[3)]
   Gas : H_2S
   Einheit: ppm
   Konzentr.:25
4. Wenn die angezeigten Parameter nicht zum Zielgas passen, müssen die Parameter angepasst werden:[4)]
   a. ***Gas*** wählen und bestätigen.
   b. Das Justiergas aus der Liste wählen und bestätigen.
   c. ***Einheit*** wählen und bestätigen.
   d. Messeinheit aus der Liste wählen und bestätigen.

1) Nicht für alle Sensoren zutreffend (siehe „Messbetrieb“, Seite 61).
2) Bei LC-Sensoren muss das Prüfgas mindestens 6 Minuten lang aufgegeben werden.
3) Gilt nicht für alle Sensoren (siehe „Messbetrieb“, Seite 61).
4) Nur bei bestimmten Sensoren möglich.

e. ***Konz.*** wählen und bestätigen.
f. Die Konzentration des Justiergases einstellen.

5. Wenn die Einstellungen korrekt sind:
   a. ***weiter*** wählen und bestätigen.
      ⇒ Eine Meldung wie ***Gasflow an H_2S*** wird angezeigt.
6. Justiergas einleiten.
   a. Den Gasdurchfluss entsprechend dem verwendeten Sensor einstellen (siehe „Gasdurchfluss für Justierungen“, Seite 67)
7. ***weiter*** wählen und bestätigen.
   ⇒ Der aktuelle Wert wird angezeigt

ℹ Nach 15 Minuten ohne Bestätigung kehrt das Gerät ohne eine Justierung durchzuführen in das Justierungsmenü zurück.

8. Sobald der aktuelle Wert stabil ist, führt das Gerät automatisch die Empfindlichkeitsjustierung durch.
9. Nach erfolgreicher Justierung wird der neu ermittelte aktuelle Wert mit der Meldung ***Messwert OK?*** angezeigt.
   - Ist dies nicht der Fall, Ändern wählen und bestätigen, um die Justierung erneut durchzuführen.
   - Wenn der Wert dem Sollwert entspricht, fortfahren.
10. Den Gasdurchfluss abstellen und den Kalibrieradapter vom Sensor entfernen oder den Schlauch lösen.
11. ***Speichern*** wählen und bestätigen, um die Justierung zu beenden. Das Gerät schaltet in das Justierungsmenü zurück.

9 Störungsbeseitigung

9.1 Fehler

Nummer	Ursache	Abhilfe
001, 003 - 004, 012 - 014, 020 - 024, 043, 060, 067	Schwerwiegender Gerätefehler, diverse Ursachen.	Gerät durch den Dräger-Service überprüfen lassen.
002, 025 - 027, 030 - 034, 041, 042, 044, 050, 052, 081, 085	Schwerwiegender Datenfehler im Gerät, diverse Ursachen.	Gerät auf Werkseinstellungen zurücksetzen. Falls der Fehler erneut auftritt: Gerät durch den DrägerService überprüfen lassen.
005	Versorgungsspannung außerhalb des zulässigen Bereichs.	Spannungsversorgung prüfen.
010	Kabel der 4-bis-20-mA-Schnittstelle nicht angeschlossen.	Die 4-bis-20-mA-Schnittstellenverbindung prüfen. Bei Betrieb als Standalone-Gerät ohne Auswerteeinheit, Stift 3 mit Stift 4 verdrahten.
011	Schwerwiegender Gerätefehler, diverse Ursachen.	Gerät durch den Dräger-Service überprüfen lassen. Falls der Fehler erneut auftritt: Bürde bzw. Kabel überprüfen.
045	Gerät erkennt keinen Sensor.	Anschlüsse prüfen. Falls der Fehler erneut auftritt: Gerät durch den Dräger-Service überprüfen lassen.
051, 054	Fehlerhafte Nullpunktjustierung.	Nullpunktjustierung durchführen.
055	Fehlerhafte Empfindlichkeitsjustierung.	Empfindlichkeitsjustierung durchführen.
076, 080 - 084	Gerätefehler.	Elektrische Anschlüsse prüfen. Falls der Fehler erneut auftritt: Gerät durch den DrägerService überprüfen lassen.
090	Sensor-Sperrfunktion ist aktiviert. Es wurde ein Sensor mit abweichender Sachnummer eingesetzt.	Einen Sensor mit derselben Sachnummer verwenden oder die Sensor-Sperrfunktion deaktivieren.
105	Gerätefehler.	Gerät durch den Dräger-Service überprüfen lassen.
137, 64, 91	Gerätefehler.	Aus- und wieder einschalten. Falls der Fehler erneut auftritt: Gerät durch den DrägerService überprüfen lassen.

nur bei Polytron 8100 EC mit Dräger SensorAlive

Nummer	Ursache	Abhilfe
220	Die Sensoröffnung ist verstopft.	Sensoröffnung reinigen oder den Staubfilter tauschen. Anschließend die Verstopfung im Menü bestätigen (siehe „Einstellungen des Dräger SensorAlive“, Seite 83).
221	Die Empfindlichkeit des Sensors ist kleiner als 40% (berechneter Wert).	Sensor justieren oder austauschen.
222	Aufgrund eines Fehlers ist nach der Elektrolyse ein zu hoher Gaswert vorhanden.	Sensor austauschen oder DrägerService kontaktieren.
223	Die Empfindlichkeit des Sensors ist zu niedrig.	Sensor justieren oder austauschen.

Nummer	Ursache	Abhilfe
224	Der Konditionierungsstrom ist nicht im erlaubten Bereich.	Sensor austauschen oder DrägerService kontaktieren.

nur bei Polytron 87x0 IR

Nummer	Ursache	Abhilfe
064, 071	Kommunikationsfehler.	Anschluss an PIR 7x00 prüfen.
083	Optisches System des PIR 7x00 verschmutzt.	Optisches System des PIR 7x00 reinigen.
086	Spannungsversorgung außerhalb des Bereichs	Spannungsversorgung prüfen.
087	4-bis-20-mA-Störung am PIR 7x00-Sensor.	4-bis-20-mA-Anschluss am PIR 7x00 prüfen.
094, 095	Datenfehler im Gerät.	Sensor auf Werkseinstellungen zurücksetzen. Wenn dieser Fehler wiederholt auftritt: Gerät durch den DrägerService überprüfen lassen.
096	SIL-Kennwort stimmt nicht mit PIR 7x00 überein.	Kennwort erneut eingeben.

9.2 Warnungen

Nummer	Ursache	Abhilfe
101	Der Datenlogger im Stackmodus ist zu 100 % voll und protokolliert keine weiteren Daten.	Gerät durch den DrägerService überprüfen lassen.
102	Der Datenlogger im Stackmodus ist zu 90 % voll.	Die Daten so bald wie möglich herunterladen und den Datenlogger leeren.
103, 106	Datenfehler im Gerät. Einige Dongle-Funktionen wie Datenlogger, Sensortest usw. stehen ggf. nicht mehr zur Verfügung.	Gerät auf Werkseinstellungen zurücksetzen. Wenn dieser Fehler wiederholt auftritt: Gerät durch den DrägerService überprüfen lassen.
104	Ungültige Datums- oder Uhrzeiteinstellung.	Datum und Uhrzeit einstellen.
105	Gerätefehler.	Gerät durch den DrägerService überprüfen lassen.
107	Die Batterie für den Datenspeicher ist leer.	Gerät durch den DrägerService überprüfen lassen.
110, 111, 112	Der SW-Dongle wurde entfernt, ohne zuvor deaktiviert zu werden.	SW-Dongle deaktivieren.
113	Alarme sind gesperrt.	Alarme aktivieren.
164, 165	Die Einlaufphase des Sensors ist noch nicht abgeschlossen. Es ist von erhöhten Messfehlern auszugehen.	Das Ende der Einlaufphase des Sensors abwarten. Sensor nicht justieren, bevor dieser vollständig eingelaufen ist.
167, 170	Justierintervall abgelaufen.	Gerät neu justieren.

nur bei Polytron 8100 EC

Nummer	Ursache	Abhilfe
163	Niedrige Vitalität des EC-Sensors	Sensor austauschen.
171	Negative Anzeige. Wert unterhalb des Mindestbereichs.	Nullpunkt neu justieren.

nur bei Polytron 8100 EC mit Dräger SensorAlive

Nummer	Ursache	Abhilfe
320	Die Kommunikation mit dem Sensor ist fehlgeschlagen. Diagnose und Gasgenerator funktionieren nicht mehr.	Sensor ziehen, ca. 1 Tag liegen lassen und wieder einstecken. Die Firmwareversion prüfen und ggf durch den DrägerService aktualisieren lassen.. Sensor austauschen.
321	Die Auswertung der Sensordaten ist fehlgeschlagen. Der Sensor kann keinen LifeTest durchführen (weil Vorbedingungen nicht erfüllt sind) oder auswerten.	Die Uhrzeit des LifeTests ändern oder das Wiederholprofil auf "Flexibel" stellen (siehe „Einstellungen des Dräger SensorAlive“, Seite 83). Falls die Warnung wiederholt auftritt, DrägerService kontaktieren.
322	Der Datensatz des Sensors ist defekt.	Sensor austauschen.
323	Der Datensatz des Sensors ist inkompatibel.	DrägerService kontaktieren.
324	Die Empfindlichkeit des Sensors ist kleiner als 50% (berechneter Wert).	Sensor justieren und Sensortausch vorbereiten (z. B. Ersatzteil bestellen).

Nummer	Ursache	Abhilfe
325	Die Empfindlichkeit des Sensors ist kleiner als 40% (berechneter Wert).	Sensor justieren oder austauschen.
326	Während eines LifeTests und eine bestimmte Zeit danach kann der Sensor nicht justiert werden.	Um eine geplante Justierung durchführen zu können, kann der LifeTest in der PolySoft temporär über den Inhibit-Modus unterdrückt werden.
327, 330, 344, 347	Der Gasgenerator funktioniert nicht.	Sensor justieren oder austauschen.
331	Die Gaserzeugung ist fehlgeschlagen.	Sensor justieren.
332	Der Sensor ist im sicheren Zustand. Es werden keine LifeTests durchgeführt (Sammelwarnung).	Grund herausfinden und diesen beheben.
333	Die Echtzeituhr des Sensors funktioniert nicht richtig.	Uhr stellen.
334	Die Synchronisierung des Sensors ist nicht beendet.	Warten, bis die Synchronisierung abgeschlossen ist. Je nach Zustand des Sensors kann dieser Zustand mehrere Minuten anliegen. Gegebenenfalls Firmware durch den DrägerService aktualisieren lassen.
336	Interne Überprüfungen im Sensor haben fehlerhafte Ergebnisse.	System neu starten
337	Die Firmware des Transmitters muss aktualisiert werden.	DrägerService kontaktieren.
340	Der Sensor wird sychronisiert, nachdem das System neu gestartet worden ist.	Warten, bis die Synchronisierung abgeschlossen ist.
342	Die Temperaturdifferenz zwischen den beiden Temperaturmesspunkten ist zu hoch.	Warten und überprüfen, ob der LifeTest ausgewertet wird oder Sensor austauschen.
347	Die Konfiguration ist wegen einer Unterbrechung in der Kommunikation zwischen Transmitter und Sensor fehlgeschlagen.	Sensor erneut konfigurieren und die Konfiguration überprüfen.
350	Der Gasgenerator ist in der Anlaufphase.	Warten, bis die Anlaufphase beendet ist. Während der Anlaufphase werden die Funktionen Fehlererkennung und Verstopfungserkennung nicht durchgeführt.
352	Der Selbsttest des Sensors ist fehlgeschlagen.	Sensor austauschen oder DrägerService kontaktieren.
353	Der Sensor ist temporär im Inhibit-Modus. Während dieser Zeit werden keine LifeTests durchgeführt.	Der Inhibit-Modus kann über die PolySoft manuell verlassen werden oder wird automatisch verlassen.
354	Fehler beim Starten der Anlage.	Neustart manuell durchführen.
355	Die Firmware des Sensors ist mit der Hardware nicht kompatibel.	Firmware durch den DrägerService aktualisieren lassen.
356	Hardware-Daten defekt.	Neustart durchführen oder Sensor austauschen.
357	Der Sensor wurde manuell in den sicheren Zustand gesetzt, z. B. um ein Firmware-Update durchzuführen.	Um den Modus zu verlassen, einen Neustart des Sensors durchführen.

nur bei Polytron 87x0 IR:

Nummer	Ursache	Abhilfe
163	Sensortemperatur ist sehr hoch.	
171	Nullpunktdrift zu hoch.	Nullpunktjustierung durchführen.
172	Optisches System des PIR 7x00 verschmutzt.	Optisches System des PIR 7x00 reinigen.
173	Nullpunktjustierung für Empfindlichkeitsjustierung abgelaufen	Nullpunktjustierung durchführen.

Nummer	Ursache	Abhilfe
182	Automatische Justierung mit PIR 7200 nicht möglich.	Nullpunkt- und Empfindlichkeitsjustierung erneut durchführen.

10 Instandhaltung

– Die Wartungsintervalle sind für jede einzelne Installation festzulegen. Je nach Sicherheitsüberlegungen und den anwendungsspezifischen Bedingungen, in denen das Gerät verwendet wird, müssen diese ggf. verkürzt werden.

Alle 6 Monate:

– Inspektion durch Fachleute.
– Signalübertragung zur Auswerteeinheit prüfen (siehe „Analogschnittstelle testen“, Seite 80).
– LEDs sowie die Auslösung der Alarmgeber prüfen (siehe „Alarme/Relais testen“, Seite 78).

regelmäßig:

– Justierungen durchführen, siehe 8 Justierung

10.1 Begasungstest durchführen und Ansprechzeit (t90) prüfen

Ein Begasungstest (Bump Test) prüft die Ansprechzeit, ohne einen Alarm auszulösen.

1. ***Einstellungen*** > ***Instrument*** > ***Bumptest*** wählen und bestätigen.
   ⇒ Das Wartungssymbol wird angezeigt
   ⇒ Der Analogausgang wird auf das Wartungssignal eingestellt.
2. Den Sensor einer bekannten Gaskonzentration aussetzen.
3. Die Ansprechzeit prüfen und mit dem t90-Wert vergleichen, der im entsprechenden Sensordatenblatt angegeben sind.
4. [OK] drücken, um zur Messung zurückzukehren.

10.2 Sensoren austauschen

⚠ WARNUNG
Fehlerhafte Justierung
Eine fehlerhafte Justierung kann zu fehlerhaften Anzeigewerten führen.

► Nach Austauschen des Sensors, müssen sämtliche Einstellungen und Parameter auf Richtigkeit überprüft werden.
► Justierung überprüfen, um korrekten Betrieb sicherzustellen.

10.2.1 Polytron® 8100 EC

Der Austausch eines Sensors ist, falls erforderlich, ohne Unterbrechung der Versorgungsspannung im Ex-Bereich möglich.

Sensor-Sperrfunktion

Wenn zuvor ein Sensor des gleichen Typs (gleiche Sachnummer) installiert wurde, bleibt die gerätespezifische Konfiguration erhalten (Gasart, Messbereich, Prüfgas, Justierintervall usw.). Andernfalls werden die werkseitigen Standardeinstellungen des neuen Sensors geladen und überschreiben die gerätespezifische Konfiguration. Dies kann verhindert werden, wenn die Sensor-Sperrfunktion aktiviert ist (siehe „Sensor-Sperrfunktion einstellen“, Seite 82).

Sensorwechsel-Funktion

Mit der Menüfunktion ***Sensorwechsel*** lässt sich ein Sensor im Betrieb auswechseln, ohne dass ein Fehlersignal an der Auswerteeinheit ausgelöst wird. Außerdem wird sichergestellt, dass alle im Mikroprozessor vorliegenden Sensordaten vor dem Ziehen des Sensorsteckers noch im Speicherbaustein (EEPROM) des Sensors abgespeichert werden können.

Sensor austauschen

Siehe Abbildung C auf der Ausklappseite.

Ein Sensorwechsel kann grundsätzlich zu jeder Zeit erfolgen.

1. ***Einstellungen*** > ***Sensor*** > ***Sensorwechsel*** wählen und bestätigen.
   ⇒ An der 4–20-mA-Schnittstelle wird das Wartungssignal erzeugt.
   ⇒ Auf dem Display wird Folgendes angezeigt: ***Bitte entfernen Sie den Sensor***.
   ⇒ Das Wartungssymbol wird angezeigt.
2. Alten Sensor durch einen neuen Sensor ersetzen:
   a. Feststellschraube (2) lösen (2 mm-Innensechskantschraube).
   b. Bajonettring (3) abschrauben.
   c. Sensor (4) in die Öffnung einsetzen und drehen, bis er im Gasmessgerät einrastet. Der Sensorstecker wird dabei nicht beschädigt.
   d. Sensor mit dem zugehörigen Bajonettring (3) sichern.

   ℹ Für Dräger SensorAlive muss ein anderer Bajonettring verwendet werden als für andere EC-Sensoren.

   e. Feststellschraube (2) so weit anziehen, dass der Bajonettring nicht gelöst werden kann (für Installationen in Zone 22 vorgeschrieben).
      ⇒ Auf dem Display wird Folgendes angezeigt: ***Daten werden geladen, bitte warten***
3. Falls erforderlich, das im Lieferumfang des Sensors inbegriffene Etikett am Gerät anbringen. Dadurch lässt sich auch bei Stromausfall bereits von Weitem erkennen, welche Gasart gemessen wird.
4. Wenn die Sensordaten geladen sind, wird auf dem Display Folgendes angezeigt: ***Daten geladen***.

5. ***Zurück zum Menü*** wählen und bestätigen.
   ⇒ Das Wartungssignal auf der 4–20-mA-Schnittstelle bleibt solange bestehen, bis der Sensor eingelaufen ist.

   Maximale Einlaufzeit eines neuen Sensors: siehe Gebrauchsanweisung des Sensors. Für Sauerstoff: Zulassungen gemäß EN 50104.
6. Justierung überprüfen. Das Gerät bei Bedarf justieren (siehe „Justierung“, Seite 67).
7. Die Installationsanforderungen und den SIL-Status des Geräts überprüfen.
   Siehe Abschnitt „Explosionsgeschützte (Ex d) Installation - ohne Docking Station“ bis „Installation von Sensoren oder Messköpfen“.

10.2.2 Polytron® 8200 CAT, 8310 IR, 87x0 IR

Sensor austauschen

1. Falls erforderlich, den Wartungsstrom für die analoge Schnittstelle einstellen.
2. Die Spannungsversorgung zum Gerät ausschalten oder den Bereich gemäß den örtlichen Vorschriften deklassifizieren.
3. Feststellschraube lösen und Abdeckung vom Gerät abschrauben.
4. Die Leiterplatteneinheit herausziehen.
5. Die Leiterplatteneinheit umdrehen und den Sensoranschluss abziehen.
6. Den Sensor abschrauben.
7. Die Sensordrähte durch den Gewindeanschluss im Gehäuse einführen.

⚠ WARNUNG
Explosionsgefahr!
Die Öffnungen des Gehäuses müssen versiegelt werden, um eine Zündung von gefährlicher atmosphärischer Luft im Fall einer Zündung im Gehäuse zu verhindern.

► Es müssen fünf Gewindegänge eingreifen, um den Explosionsschutz zu gewährleisten.

8. Den Sensor einschrauben und mit dem richtigen Anzugsdrehmoment anziehen (min. 266 in-lbs / min. 30 Nm)
9. Polytron® 8200 CAT-spezifisch:
   Die Leitungen des Sensors zusammendrehen. Bei Bedarf einen Kabelbinder verwenden, um die Kabel dicht zusammen zu halten.
10. Den Sensoranschluss wieder in die Buchse stecken.
11. Die Leiterplatteneinheit wieder in das Gehäuse einsetzen.
12. Die Abdeckung auf das Gerät schrauben, bis sie richtig verriegelt ist (min. ≥44 in-lbs / min. ≥5 Nm), und die Feststellschraube anziehen.
13. Die Spannungsversorgung zum Gerät einschalten, wenn nötig.
    ⇒ Das Wartungssignal auf der 4–20-mA-Schnittstelle bleibt solange bestehen, bis der Sensor eingelaufen ist.

    Maximale Einlaufzeit eines neuen Sensors: siehe Gebrauchsanweisung des Sensors.
14. Justierung überprüfen. Das Gerät bei Bedarf justieren (siehe „Justierung“, Seite 67).
15. Die Installationsanforderungen und den SIL-Status des Geräts überprüfen.
    Siehe Abschnitt „Explosionsgeschützte (Ex d) Installation - ohne Docking Station“ bis „Installation von Sensoren oder Messköpfen“.

10.3 Displaytest durchführen

1. ***Einstellungen*** > ***Instrument*** > ***Anzeige*** > ***Displaytest*** wählen und bestätigen.
2. ***Ein*** wählen und bestätigen.
   ⇒ Die Informationen auf dem Display werden invertiert dargestellt. Alle LEDs werden eingeschaltet.
   Wenn das Menü verlassen wird, wird die Invertierung beendet.

11 Geräteeinstellungen

11.1 Kennwörter einstellen

1. Unter ***Einstellungen*** > ***Instrument*** > ***Kennwörter*** > das gewünschte Kennwort wählen und bestätigen.

Kennwort Kalibr.	Zugriff auf Nullpunkt- und Empfindlichkeitsjustierung
Kennwort Einst.	Zugriff auf alle Konfigurationsparameter

2. Die Zeile zur Bearbeitung des Kennworts wählen und bestätigen.
3. Kennwort einstellen und bestätigen.
4. ***Bestätigen*** wählen und mit [OK] bestätigen.

11.2 Datum und Uhrzeit einstellen

1. ***Einstellungen*** > ***Instrument*** > ***Datum und Zeit*** wählen und bestätigen.
2. Zeile zur Bearbeitung von Datum und Uhrzeit wählen und bestätigen.
3. ***Bestätigen*** wählen und mit [OK] bestätigen.

11.3 Sprache einstellen

1. ***Einstellungen*** > ***Instrument*** > ***Sprache*** wählen und bestätigen.
2. Sprache aus der Liste wählen und bestätigen.

11.4 Funktionstaste konfigurieren

1. ***Einstellungen*** > ***Instrument*** > ***Funktionstaste*** wählen und bestätigen.
2. Eine Funktion wählen und bestätigen.

Grafik	Die Messwerte der letzten 15 Minuten werden als Zeit/Konzentrations-Grafik dargestellt.
Fehler	Fehlermeldungen werden als Klartext angezeigt.
Warnungen	Warnmeldungen werden als Klartext angezeigt.
Bumptest	Mithilfe des Begasungstests kann Gas auf den Sensor geleitet werden, ohne dass ein Alarm ausgelöst wird. Das Wartungssignal wird übertragen. Nach 15 Minuten oder durch erneutes Antippen von [OK] wird der Begasungstest beendet und das Gerät in den Normalbetrieb zurückgeschaltet.
Vitalität[1)]	Zeigt die verbleibende Sensorvitalität an.

1) Nur mit Diagnosedongle

11.5 Auf Standardeinstellungen zurücksetzen

Diese Funktion setzt das Gerät auf die Standardeinstellungen zurück.

1. ***Einstellungen*** > ***Instrument*** > ***Geräteinit*** wählen und bestätigen.
2. ***Bestätigen*** wählen und mit [OK] bestätigen.

11.6 Kontrast des Displays ändern

1. ***Einstellungen*** > ***Instrument*** > ***Anzeige*** > ***Kontrast*** wählen und bestätigen.
2. Kontrast ändern und bestätigen.

11.7 Anzeigemodus ändern

1. ***Einstellungen*** > ***Instrument*** > ***Anzeige*** > ***Betriebsart*** wählen und bestätigen.
2. Gewünschten Modus wählen und bestätigen.

Standard	Zeigt die Standardanzeige.
Keine Anzeige	Zeigt den Startbildschirm und die entsprechenden Symbole.

Wenn ein Alarm ausgelöst wird, wird auf dem Display die aktuelle Gaskonzentration angezeigt und die rote LED blinkt, unabhängig vom ausgewählten Anzeigemodus.

11.8 Relais konfigurieren

11.8.1 Kombinationen von selbsthaltenden Alarmen und Alarmquittierung

Die folgenden Beispiele geben einen Überblick der Relaisquittierungskombinationen.

	selbsthaltend (Manuelles Zurücksetzen des Relais)	**Nicht selbsthaltend** (Relais wird nach behobener Alarmbedingung automatisch zurückgesetzt)
quittierbar	Ein Zurücksetzen des Relais ist jederzeit möglich.	
nicht quittierbar	Ein Zurücksetzen des Relais ist nicht möglich, bevor die Alarmbedingung behoben wurde.	
vor-quittierbar	Eine Alarmquittierung ist möglich, bevor die Alarmbedingung behoben wurde. Das Relais wird automatisch zurückgesetzt, nachdem die Alarmbedingung behoben wurde.	

Es gibt keine Zeitbeschränkung für selbsthaltende und nicht selbsthaltende Signale. Selbsthaltende Signale bleiben bis zu ihrer Quittierung aktiv. Nicht selbsthaltende Signale enden, sobald die auslösende Bedingung behoben ist.

11.8.2 Relais A1 oder A2 konfigurieren

Mit dieser Funktion wird festgelegt, ob das Alarmrelais im Normalbetrieb oder im Alarmzustand erregt ist.

1. ***Einstellungen*** > ***Instrument*** > ***Alarm & Relais*** > ***Relais A1*** oder ***Relais A2*** wählen und bestätigen.
2. Gewünschte Option wählen und bestätigen.

Normal erregt	Der Relaiskontakt ist im Normalbetrieb erregt und wird durch Auslösen eines Alarms geändert. Bei Stromausfall wird dadurch ein Alarm (ausfallsicher) ausgelöst.
Alarm erregt	Wenn ein Alarm ausgelöst wird, wird der Relaiskontakt erregt.

11.8.3 Fehlerrelais Einlaufen 1 einstellen

Mit dieser Funktion wird der Betrieb des Fehlerrelais während Einlaufen 1 eingestellt, um den Status Einlaufen 1 auf dem Relaisausgang darzustellen.

1. Unter ***Einstellungen*** > ***Instrument*** > ***Alarm & Relais*** > ***Fehler Einlaufen*** die gewünschte Option wählen und bestätigen.

Statisch	Das Fehlerrelais löst eine angeschlossene Alarmanzeige dauerhaft aus. Die orangefarbene LED leuchtet dauerhaft.
Dynamisch	Das Fehlerrelais wechselt den Status für 9 Sekunden. *Beispiel:* – Ein Signalhorn ist an den Arbeitskontakt (Normally Open) des Fehlerrelais angeschlossen. – Die Relais sind als normal erregt konfiguriert. ⇒ Das Signalhorn und die orangefarbene LED des Gasmessgeräts sind für 1 Sekunde aktiviert und für 9 Sekunden deaktiviert.

11.9 Alarmkonfiguration

11.9.1 Alarme ein- oder ausschalten

1. ***Einstellungen*** > ***Instrument*** > ***Alarm & Relais*** > ***Alarm ein/aus*** wählen.

Einschalten	Alarmgebung ist eingeschaltet.
Ausschalten	Alarmgebung ist ausgeschaltet. LEDs, Relais und Schnittstellen zeigen keine Alarmbedingung an. Die 4-bis-20-mA-Schnittstelle überträgt das Wartungssignal. Der ermittelte Wert und das Symbol ⚠ werden angezeigt. Das Fehlerrelais zeigt einen Fehler an.

2. ***Einschalten*** oder ***Ausschalten*** wählen und bestätigen.

11.9.2 Alarme konfigurieren

1. ***Einstellungen*** > ***Instrument*** > ***Alarm & Relais*** > ***Alarm A1*** oder ***Alarm A2*** wählen und bestätigen.
   Die aktuelle Alarmschwelle wird angezeigt.
2. Den angezeigten Vorschlag übernehmen oder folgende Einstellungen verändern (die Konfigurationsschritte nacheinander mit ***Weiter*** bestätigen):
   a. Den Wert für die Alarmschwelle einstellen.
   b. Die Alarmrichtung einstellen.

Steigend	Die Alarmrichtung wird als "steigend" bezeichnet, wenn die Gaskonzentration einen bestimmten Wert übersteigen muss, um einen Alarm auszulösen.
Fallend	Die Alarmrichtung wird als "fallend" bezeichnet, wenn die Gaskonzentration einen bestimmten Wert unterschreiten muss, um einen Alarm auszulösen.

   c. Den Selbsthaltungsmodus einstellen.

Selbsthaltend	Wenn die Alarmschwelle erreicht wird, löst das Gerät den Alarm aus. Es verbleibt auch dann im Alarmzustand, wenn die Gaskonzentration die Alarmbedingung nicht mehr erfüllt. Um einen selbsthaltenden Alarm aufzuheben, muss dieser quittiert werden.
Nicht selbsth.	Der Alarmzustand wird aufgehoben, wenn die Gaskonzentration die Alarmbedingung nicht mehr erfüllt.

   d. Den Quittierungsmodus einstellen.

Quittierbar	Das Alarmrelais und die Alarm-LED können zurückgesetzt werden, bevor die Alarmbedingung behoben wird.
Nicht quittierbar	Das Alarmrelais und die Alarm-LED können nicht zurückgesetzt werden, bevor die Alarmbedingung behoben wird.
Vorquittierbar	Der Alarmzustand kann quittiert werden, bevor die Alarmbedingung behoben wird. Das Alarmrelais und die Alarm-LED bleiben jedoch aktiv, bis die Alarmbedingung behoben wird.

e. Den Hysteresewert einstellen.
Mit der Hysteresefunktion wird ein Bereich definiert, in dem ein ausgelöstes Relais seinen Zustand beibehält, bis die Gaskonzentration sich wieder außerhalb des definierten Bereichs befindet. Beispiel: Die Alarmschwelle wird auf 40 ppm eingestellt und die Hysterese wird auf 3 ppm eingestellt. Der Alarm bleibt aktiv, bis der Wert unter 37 ppm sinkt. Hierdurch wird verhindert, dass Relais an einer Alarmschwelle mehrfach kurzzeitig schließen und öffnen ("prellen").

ℹ Wenn die Richtung eines Alarms geändert wurde (von fallend zu steigend oder andersherum), muss der Hysteresewert überprüft und ggf. korrigiert werden.

⇒ Auf einem Bestätigungsbildschirm werden alle Einstellungen angezeigt.

f. ***Bestätigen*** wählen und mit OK bestätigen.

✓ Die neuen Einstellungen werden gespeichert.

11.9.3 Alarme/Relais testen

Mit diesen Funktionen lassen sich die Status eines Relais und einer LED für Testzwecke ändern (z. B. um die Funktion von an das Relais angeschlossen Alarmgeräten zu überprüfen). Das Symbol wird angezeigt. Nach Beenden dieser Funktion werden die Status des Relais und der LED automatisch wieder auf den vorherigen Status zurückgesetzt.

1. Unter ***Einstellungen*** > ***Instrument*** > ***Alarm & Relais*** > die gewünschte Alarmbedingung wählen und bestätigen.

Alarm A1 setzen	Simuliert einen Voralarm
Alarm A2 setzen	Simuliert einen Hauptalarm
Fehler setzen	Simuliert ein Fehlersignal

2. ***Ein*** wählen und bestätigen.
⇒ Das Fehlerrelais wird aberregt und die 4-bis-20-mA-Schnittstelle auf Fehlerstrom gesetzt. Die gelbe LED leuchtet auf, das Wartungssymbol wird angezeigt. Wenn das Menü verlassen wird, wird die Simulation beendet.

11.10 Einstellungen des Datenloggers

11.10.1 Grafik anzeigen

Die letzten 15 Minuten werden als Zeit/Konzentrations-Grafik angezeigt.

1. ***Information*** > ***Datenspeicher*** > ***Grafik*** wählen.

11.10.2 Datenlogger ein- oder ausschalten

1. ***Einstellungen*** > ***Datenspeicher*** > ***Datensp. ein/aus*** wählen und bestätigen.
2. ***Ein*** oder ***Aus*** wählen und bestätigen.

11.10.3 Probennahmezeitfenster einstellen

Mithilfe dieser Funktion lässt sich einstellen, wie oft ein Wert gespeichert werden soll.

1. ***Einstellungen*** > ***Datenspeicher*** > ***Datensp. ein/aus*** > ***Speicherinterv.*** wählen und bestätigen.
2. Speicherintervall wählen und bestätigen.

11.10.4 Spitzen-/Mittelwert einstellen

Mithilfe dieser Funktion lässt sich festlegen, welcher Wert gespeichert wird.

1. ***Einstellungen*** > ***Datenspeicher*** > ***Einst. Datensp.*** > ***Spitze/Mittelw.*** wählen und bestätigen.
2. ***Spitze*** oder ***Mittelwert*** wählen und bestätigen.

Spitze	Es wird der Höchstwert (bei Überwachung fallender Konzentrationen der niedrigste Wert) der gemessenen Konzentrationen innerhalb des gewählten Probennahmezeitfensters gespeichert.
Mittelwert	Es wird der Mittelwert aller gemessenen Konzentrationswerte innerhalb des gewählten Probennahmezeitfensters gespeichert.

11.10.5 Auslösemodus ein- oder ausschalten

Mithilfe dieser Funktion lassen sich Werte ab einem bestimmten Wert speichern.

1. ***Einstellungen*** > ***Datenspeicher*** > ***Einst. Datensp.*** > ***Trigger ein/aus*** wählen und bestätigen.
2. ***Ein*** oder ***Aus*** wählen und bestätigen.

Ein	Messungen werden gespeichert, wenn sie einen Grenzwert oberhalb der Triggerschwelle übersteigen (bezogen auf den zuletzt gespeicherten Wert).
Aus	Messungen innerhalb des Probennahmezeitfensters werden gespeichert.

11.10.6 Triggerschwelle einstellen

Mit dieser Funktion lässt sich der Grenzwert für den Trigger bestimmen, um einen Wert zu speichern. Die Triggerschwelle bezieht sich prozentual auf den Messbereichsendwert.

Beispiel: Bei einer Triggerschwelle von 2 % und einem Messbereichsendwert von 500 ppm werden nur solche Werte gespeichert, die um 10 ppm abweichen (bezogen auf den zuvor gespeicherten Wert).

1. ***Einstellungen*** > ***Datenspeicher*** > ***Datensp. ein/aus Trigger Wert*** wählen und bestätigen.
2. Triggerschwelle einstellen und bestätigen.

11.10.7 Stackfunktion oder Rollfunktion einstellen

1. ***Einstellungen*** > ***Datenspeicher*** > ***Einst. Datensp.*** > ***Stack/Roll*** wählen und bestätigen.
2. ***Stack*** oder ***Roll*** wählen und bestätigen.

Roll	Sobald die Kapazität des Datenloggers erschöpft ist, werden die alten Daten durch neue Werte überschrieben.
Stack	Sobald die Kapazität des Datenloggers erschöpft ist, können keine weiteren Daten gespeichert werden. Das Gerät gibt eine Warnung aus.

11.10.8 Leeren des Datenloggers

Diese Funktion löscht die gespeicherten Daten.

1. ***Einstellungen*** > ***Datenspeicher*** >***Datensp. löschen*** wählen und bestätigen.
2. Um den Datenlogger zu leeren, ***Bestätigen*** auswählen und mit [OK] bestätigen.

12 Schnittstelleneinstellungen

12.1 4–20-mA-Schnittstelle

Der Stromausgang des Geräts im Normalbetrieb beträgt zwischen 4 und 20 mA und ist proportional zur gemessenen Gaskonzentration.

Polytron 8xx0 verwendet verschiedene Stromwerte zur Anzeige unterschiedlicher Betriebsarten. Die Werkseinstellungen können für anwendungsspezifische Anforderungen durch den Benutzer geändert werden. Dies entspricht den NAMUR-Empfehlungen NE43.

12.1.1 Messbereichsendwert

Nur Polytron® 8100 EC, 87x0 IR und 8200 CAT LC

Manche Sensoren bieten einen justierbaren Messbereichsendwert zur Begrenzung des Messbereichs für die 4-bis-20-mA-Schnittstelle.

Über den Messbereichsendwert wird ein Endpunkt innerhalb des Messbereichs des Sensors bestimmt. Falls die Gaskonzentration diesen Endpunkt erreicht, überträgt die 4-bis-20-mA-Schnittstelle 20 mA.

Beispiel: Erforderlicher Bereich 0 bis 500 ppm CO (z. B. Sachnummer 6809605 Standard 300 ppm, min./max. Bereich = 50/1000 ppm). Messbereichsendwert von 500 ppm wählen. Das Analogsignal wird zwischen 4 mA = 0 ppm und 20 mA = 500 ppm linear ausgegeben.

12.1.2 Fehlerstrom einstellen

Mithilfe dieser Funktion lässt sich der Strom für die Fehlermeldung bestimmen.

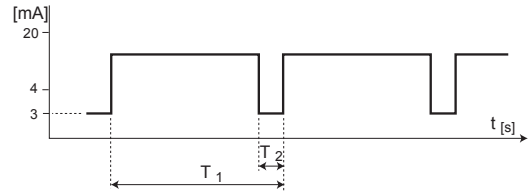
1. ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** >***Fehlerstrom*** wählen und bestätigen.
2. Die Zeile zur Bearbeitung des Stroms wählen und bestätigen.
3. Stromstärke einstellen und bestätigen.
   ⇒ Die Einstellung für die ***Fehlerstrom*** wird angezeigt.
4. ***Bestätigen*** wählen und mit [OK] bestätigen.

12.1.3 Informationen zum Warnungssignal

Damit ein Warnungssignal über die Analogschnittstelle gesendet werden kann, muss dieses eingeschaltet sein. Das Warnungssignal wechselt zwischen dem Warnungsstrom und dem Messstrom.

– Warnungsstrom (Intervall T2)
– Messstrom (Intervall T1-T2)

Die Zeitintervalle und der Warnungsstrom können konfiguriert werden.



12.1.4 Warnungssignal ein- oder ausschalten

1. ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > ***Warnung*** wählen und bestätigen.
2. ***Ein*** oder ***Aus*** wählen und bestätigen.

12.1.5 Warnungsintervall einstellen

1. ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > ***Warn.-Intervall*** wählen und bestätigen.
2. Zeiten für Warnungsintervalle T1 und T2 einstellen und bestätigen.

12.1.6 Warnungsstrom einstellen

1. ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > ***Warnungsstrom*** wählen und bestätigen.
2. Stromstärke einstellen und mit [OK] bestätigen.

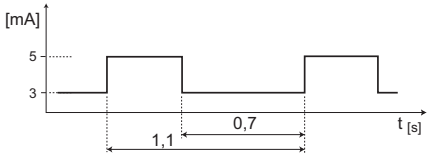
12.1.7 Warnungen des Dräger SensorAlive einstellen

In diesem Menü können verschiedene Parameter des Warnungsstroms eingestellt werden:

- Um den Warnungsstrom einzustellen, ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > ***DSA Warn.-Strom*** wählen und den Wert eingeben.
- Um einen Schwellenwert für die Warnung einzustellen, ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > ***DSA Warn.-Grenze*** wählen und den Wert eingeben.
- Um die Warnung zu aktivieren oder zu deaktivieren, ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > ***DSA Warn. setzen*** wählen und bestätigen.
  Ein oder ***Aus*** wählen und bestätigen.

12.1.8 Wartungssignal einstellen

1. ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > ***Wartungssignal*** wählen und bestätigen.
2. Den Signaltyp festlegen und bestätigen.

Statisch	Ein Konstantstrom, der konfiguriert werden kann.
Dynamisch	Ein Rechtecksignal mit folgenden Eigenschaften: 

12.1.9 Wartungsstrom einstellen

Der Wartungsstrom kann nur dann eingestellt werden, wenn für das Wartungssignal die Einstellung „statisch“ gewählt wurde.

1. ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** >***Wartungsstrom*** wählen und bestätigen.
2. Strom festlegen und bestätigen.

12.1.10 Analogen Offset einstellen

Diese Funktion fügt dem analogen Ausgang bei 4 mA ein Offset hinzu. Das Offset passt den Strom bei 4 mA an, ohne den 20 mA-Sollwert zu beeinflussen.

1. ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** >***Analog Offset*** wählen und bestätigen.
2. Die Zeile zur Bearbeitung des Offset (Bereich: –0,5 bis 0,5 mA, SIL: –0,1 bis 0,1) wählen und bestätigen.
3. Stromstärke einstellen und bestätigen.
   ⇒ Die Einstellung für das ***Analog Offset*** wird angezeigt.
4. ***Bestätigen*** wählen und mit [OK] bestätigen.

12.1.11 Analogempfindlichkeit einstellen

Mit dieser Funktion kann der 20-mA-Analogausgang angepasst werden, ohne den 4-mA-Sollwert zu beeinflussen.

1. ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > ***Analog Empfindl.*** wählen und bestätigen.
2. Die Zeile zur Bearbeitung des Offset (Bereich: –0,5 bis 0,5 mA, SIL: –0,1 bis 0,1) wählen und bestätigen.
3. Stromstärke einstellen und bestätigen.
   ⇒ Die Einstellung für das ***Analog Empfindl.*** wird angezeigt.
4. ***Bestätigen*** wählen und mit [OK] bestätigen.

12.1.12 Analogschnittstelle testen

Mithilfe dieser Funktionen lässt sich der Strom der Analogschnittstelle für Prüfzwecke ändern (z. B. um die Programmierung der Auswerteeinheit zu überprüfen). Gegebenenfalls ist es erforderlich, die Alarme an der Auswerteeinheit vorübergehend zu sperren, um Fehlalarme zu vermeiden. Nach Beenden dieser Funktion werden die Ströme automatisch auf das Wartungssignal zurückgestellt. Während der Prüfung wird das Wartungssymbol angezeigt.

- Um Strom oder Konzentration einzustellen:

1. Unter ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** die gewünschte Option auswählen.

Stromsig. setzen	Mithilfe dieser Funktion lässt sich der Strom auf einen beliebigen Wert zwischen 0 und 22 mA einstellen. Offsetstrom und Analogempfindlichkeit werden bei dieser Funktion nicht verwendet.
Konz. setzen	Mithilfe dieser Funktion lässt sich der Strom auf einen frei wählbaren Messwert zwischen 0 ppm und dem Messbereichsendwert einstellen.

2. Nachdem die Alarme an der Auswerteeinheit gesperrt wurden, die Meldung ***Alle Alarme ausschalten*** mit ***Weiter*** bestätigen.
3. Die Zeile zur Bearbeitung wählen und mit [OK] bestätigen.
4. Den gewünschten Wert einstellen.
5. ***Weiter*** wählen und bestätigen.
6. Gewünschte Option auswählen:

Konzentration aus / ***Setze Stromausg.***	Diese Funktion simuliert den voreingestellten Messwert bzw. den Teststromwert. Während der Prüfung wird das Wartungssymbol angezeigt.
Konzentration aus / ***Strom aus***	Mithilfe dieser Funktion kann die Übertragung des voreingestellten Testwerts abgebrochen werden.

7. ***Weiter*** wählen und bestätigen.
   ⇒ Die Funktion wird abgebrochen.
8. Nachdem die Alarme an der Auswerteeinheit wieder aktiviert wurden, folgende Meldung bestätigen: ***Alle Alarme einschalten***.

- Um das Prüfsignal einzustellen:

1. Unter ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** den gewünschten Test auswählen.

Fehler setzen	Mithilfe dieser Funktion lässt sich die Stromstärke auf den Fehlerstrom setzen.
Warnung setzen	Mithilfe dieser Funktion lässt sich die Stromstärke auf den Warnungsstrom setzen.
Wartung setzen	Mithilfe dieser Funktion lässt sich die Stromstärke auf den Wartungsstrom setzen.

2. Nachdem die Alarme an der Auswerteeinheit gesperrt wurden, die Meldung ***Alle Alarme ausschalten*** bestätigen.
3. ***Ein*** oder ***Aus*** wählen und bestätigen.

12.1.13 Beam Block-Signal einstellen

Diese Funktion steht nur für Polytron 87x0 IR (mit PIR 7000/7200-Sensor) zur Verfügung.

Wenn die Beam Block-Funktion eingeschaltet und das optische System des PIR 7000/7200-Sensors verschmutzt ist, wird das Beam Block-Signal auf die Analogschnittstelle übertragen. Das optische System des Sensors kann durch Ablagerungen auf der optischen Oberfläche verschmutzt werden. Steigt die Gaskonzentration jedoch auf ein Niveau über der Beam Block-Grenze, kehrt das Gerät in den Normalbetrieb zurück.

Übersteigen die Ablagerungen auf der optischen Oberfläche ein Maß, das eine Messung unmöglich macht, schaltet das Gerät in den Störbetrieb.

- Um das Beam Block-Signal zu aktivieren/deaktivieren:

1. Unter ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > die gewünschte Option auswählen.

Beam Bl. ein/aus	Mithilfe dieser Funktion lässt sich der Beam Block ein- bzw. ausschalten.
BeamBlock setzen	Mithilfe dieser Funktion lässt sich der Strom auf den Beam Block-Warnungsstrom setzen.

2. ***Ein*** oder ***Aus*** wählen und bestätigen.

- Um Beam Block-Signale einzustellen:

1. Unter ***Einstellungen*** > ***Kommunikation*** > ***Analog Schnittst*** > die gewünschte Option auswählen.

Beam Block-Strom	Mithilfe dieser Funktion lässt sich der Strom für den Beam Block bestimmen.
Beamblock Grenze	Mit dieser Funktion wird die Höchstgrenze definiert, wenn das Beam Block-Signal mit der Analogschnittstelle übertragen wird.

2. Die Zeile zur Bearbeitung des Stroms auswählen und bestätigen.
3. Stromstärke einstellen und bestätigen.
   ⇒ Der eingestellte Beam Block-Strom wird angezeigt.
4. ***Bestätigen*** wählen und mit [OK] bestätigen.

12.2 HART-Schnittstelle

12.2.1 Polling-Adresse einstellen

Die Polling-Adresse (Abfrageadresse) konfiguriert das Gasmessgerät für den Analogbetrieb oder den Multidrop-Betrieb.

HART-Kommando: #6 (Write Polling Adress)

1. ***Einstellungen*** > ***Kommunikation*** > ***HART Schnittst*** > ***Polling Adresse*** wählen.
2. Polling-Adresse einstellen und ***bestätigen*** wählen.

0	Aktiviert den Analogbetrieb
1 bis 15	Aktiviert den Multidrop-Betrieb. Die 4-20-mA-Schnittstelle wird deaktiviert und auf einen konstanten Strom von ca. 1 mA gesetzt.

ℹ Alle Geräte einer Leitung mit unterschiedlichen Polling-Adressen konfigurieren. Sinnvollerweise eine bei 1 beginnende Folge verwenden.

12.2.2 Unique Identifier anzeigen

Der Unique Identifier (eindeutige HART-Adresse) muss für fast alle HART-Kommandos zur Adressierung bekannt sein.

HART-Kommandos:

– #0 (Read Unique Identifier)
– #11 (Read Unique Identifier associated with Tag)

1. ***Einstellungen*** > ***Kommunikation*** > ***HART Schnittst*** > ***Unique Identifr*** wählen.
2. Der Unique Identifier wird angezeigt.

12.2.3 HART-Tag einstellen

Das HART-Tag (Messstellenbezeichnung) dient zum Kennzeichnen einer Messstelle.

1. ***Einstellungen*** > ***Kommunikation*** > ***HART Schnittst*** > ***Tag*** wählen.
2. HART-Tag einstellen und ***bestätigen*** wählen. Das HART-Tag kann aus bis zu 8 alphanumerischen Zeichen bestehen.

12.2.4 Dräger REGARD-Protokoll einstellen

Mit dieser Funktion wird zwischen verschiedenen HART-Protokollen gewechselt.

1. ***Einstellungen*** > ***Kommunikation*** > ***HART Schnittst*** > ***Dräger REGARD*** auswählen.
2. Die der REGARD-Auswerteeinheit entsprechende Softwareversion auswählen.

12.3 Digitale Schnittstellen

Informationen zur Konfiguration der anderen Schnittstellen sind den folgenden Dokumenten zu entnehmen:

Schnittstelle	Dokument
PROFIBUS PA	9033782
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

13 Sensoreinstellungen

13.1 Automatische Justierung ein- oder ausschalten

1. ***Einstellungen*** > ***Sensor*** > ***Auto Kalibrierun*** wählen und bestätigen.
2. ***Ein*** oder ***Aus*** wählen und mit [OK] bestätigen.

13.2 Fangbereich

Der Fangbereich blendet Messwertschwankungen aus. Messwertschwankungen sind geringe Variationen in den Messwerten (auf Grund von Signalrauschen, Schwankungen der Konzentration). Diese Variationen ändern den übertragenen oder angezeigten Wert nicht. Messwerte innerhalb des Bereichs werden mit dem Fangbereichswert angezeigt. Messwerte außerhalb des Bereichs werden mit dem tatsächlichen Wert angezeigt.

Fangbereichswert (Offset)

Der Fangbereichswert wird dauerhaft angezeigt, solange der Messwert sich zwischen der oberen und unteren Fangbereichsgrenze befindet.

Obere Fangbereichsgrenze

Die obere Fangbereichsgrenze bestimmt den höchsten Wert des Bereichs, in welchem der Fangwert angezeigt wird.

Untere Fangbereichsgrenze

Die untere Fangbereichsgrenze bestimmt den niedrigsten Wert des Bereichs, in welchem der Fangwert angezeigt wird.

13.2.1 Fangbereich einstellen

1. ***Einstellungen*** > ***Sensor*** > ***Display Fangber.*** wählen und bestätigen.
2. Den Offset im ersten Fenster einstellen.
3. Den niedrigsten Wert für den Fangbereich einstellen und mit ***Weiter*** bestätigen.
4. Den höchsten Wert für den Fangbereich einstellen und mit ***Weiter*** bestätigen.
5. Die Werte prüfen und mit ***Weiter*** bestätigen.

13.2.2 Fangbereich deaktivieren

1. ***Einstellungen*** > ***Sensor*** > ***Display Fangber.*** wählen und bestätigen.
2. Den Offset im ersten Fenster einstellen.
3. Den niedrigsten Wert für den Fangbereich auf 0 einstellen und mit ***Weiter*** bestätigen.
4. Den höchsten Wert für den Fangbereich auf 0 einstellen und mit ***Weiter*** bestätigen.
5. Alle Werte prüfen und mit ***Weiter*** bestätigen.

13.3 Sensor zurücksetzen

Diese Funktion setzt den Sensor auf die Standardeinstellungen zurück.

1. ***Einstellungen*** > ***Sensor*** > ***Kanal Initial.*** wählen und bestätigen.
2. ***Bestätigen*** wählen und mit [OK] bestätigen.

13.4 Justierintervall einstellen

Nach Ablauf des Justierintervalls, gibt das Gerät die Warnung aus, dass eine Justierung überfällig ist.

1. ***Einstellungen*** > ***Sensor*** > ***Kal.-Intervall*** wählen und bestätigen.
2. Justierintervall einstellen und mit [OK] bestätigen.

13.5 Sensor-Sperrfunktion einstellen

Dieser Punkt gilt nur für Polytron 8100 EC und Polytron 87x0 IR.

1. ***Einstellungen*** >***Sensor*** > ***Sensorlock*** wählen und bestätigen.
2. ***Ein*** oder ***Aus*** wählen.

Ein	Das Gerät lehnt jeden Sensor ab, dessen Sachnummer nicht mit der Sachnummer des zuvor installierten Sensors übereinstimmt.
Aus	Das Gerät nimmt jeden geeigneten Sensor an und liest die Standardeinstellungen für diesen Sensor ein. Dadurch werden allerdings sämtliche benutzerdefinierten Einstellungen durch die Standardeinstellungen des neuen Sensors überschrieben.

13.6 Software-Dongle für EC-Sensoren

13.6.1 Dongle installieren

1. Die Spannungsversorgung des Geräts ausschalten oder den Bereich gemäß den örtlichen Vorschriften deklassifizieren.
2. Feststellschraube lösen und Abdeckung vom Gerät abschrauben.
3. Dongle mit Dräger-Logo nach oben in den Steckplatz auf der Leiterplatteneinheit einsetzen, Siehe Abbildung D auf der Ausklappseite.
4. Die Rückabdeckung der Leiterplatteneinheit auflegen und das Gerät schließen (siehe „Gasmessgerät schließen“, Seite 58).

13.6.2 Dongle deaktivieren

Diese Funktion deaktiviert einen Dongle, damit der Dongle sicher entfernt werden kann bzw. falls dieser defekt ist.

Ein Dongle lässt sich nur durch Ein- und Ausschalten der Spannungsversorgung am Gerät reaktivieren.

1. ***Einstellungen*** > ***Instrument*** > ***SW Dongle*** > und den zu deaktivierenden Dongle wählen und bestätigen.
2. ***Deaktivierung Funktion*** wählen. Der gewählte Dongle wird deaktiviert.

13.7 Sensoreinstellungen Polytron® 8100 EC

13.7.1 Sensorselbsttest

Diese Funktion ist nur aktiv, wenn der Sensortestdongle oder der Diagnosedongle installiert ist. Wenn der Sensor den Selbsttest nicht besteht, wird eine Warnung oder Fehlermeldung ausgegeben.

Regelmäßige Sensorselbsttests einstellen

Diese Funktion löst in regelmäßigen Abständen den Sensorselbsttest aus. Das Gerät überprüft dann routinemäßig das ordnungsgemäße Funktionieren des Sensors.

1. ***Einstellungen*** > ***Sensor*** > ***Setze Sensortest*** wählen und bestätigen.
2. ***Ein*** oder ***Aus*** wählen und bestätigen.

Sensorselbsttest manuell starten

Mit dieser Funktion wird ein einzelner Sensorselbsttest gestartet.

1. ***Einstellungen*** > ***Sensor*** > ***Sensortest*** wählen und bestätigen.
2. ***Start Sensortest*** wird angezeigt.
3. ***Bestätigen*** wählen.

✓ Das Testergebnis wird angezeigt.

13.7.2 Gaseinstellungen

Mit dieser Funktion lassen sich Gasart, Messbereich und Messeinheiten einstellen. Je nachdem, welcher Sensor installiert ist, sind unterschiedliche Einstellungen möglich.

1. ***Einstellungen*** > ***Sensor*** > ***Gas-Einst.*** wählen und bestätigen.
   ⇒ Das aktuelle Messgas wird angezeigt.
2. Messgas aus der Liste wählen und bestätigen.
   ⇒ Die aktuelle Messeinheit wird angezeigt.
3. Messeinheit aus der Liste wählen und bestätigen.
   ⇒ Der aktuelle Messbereichsendwert wird angezeigt.
4. Nur für bestimmte EC-Sensoren: Messbereichsendwert einstellen und bestätigen.
   ⇒ Der neue Messbereichsendwert wird angezeigt.
5. ***Weiter*** wählen und bestätigen.
   ⇒ Eine Übersicht mit den neuen Gaseinstellungen wird angezeigt.
6. Nach der Überprüfung ***Zurück zum Menü*** oder ***Bestätigen*** wählen.

Zurück zum Menü	Zurück zum Menü wählen, um die Funktion ohne Änderung zu verlassen und mit [OK] bestätigen.
Bestätigen	Bestätigen wählen, um die Einstellungen zu übernehmen, und mit [OK] bestätigen.

13.7.3 Einstellungen des Dräger SensorAlive

In diesem Menü können verschiedene Parameter eingestellt werden, die das Verhalten des Dräger SensorAlive definieren:

- Um die LifeTest-Funktionen des Sensors zu aktivieren oder zu deaktivieren, ***Einstellungen*** > ***Sensor*** > ***SensorAlive*** > ***DSA-Aktivierung*** wählen und bestätigen. ***Ein*** oder ***Aus*** wählen und bestätigen.
- Um eine Verstopfung des Sensors zu quittieren, ***Einstellungen*** > ***Sensor*** > ***SensorAlive*** > ***Fehler quitt.*** wählen.
- Um die Fehlererkennung zu aktivieren oder zu deaktivieren, ***Einstellungen*** > ***Sensor*** > ***SensorAlive*** > ***Fehlerdetektion*** wählen und bestätigen. ***Ein*** oder ***Aus*** wählen und bestätigen.

Im Menü ***SensorAlive*** gibt es folgende Untermenüs:

– LifeTest
– Sensitivitätsüberwachung

Im Untermenü LifeTest können folgende Parameter eingestellt werden:

- Um festzulegen, wann ein Testdurchlauf gestartet werden soll, ***Uhrzeit*** wählen.
  Eine Uhrzeit eingeben und bestätigen. Der Testdurchlauf wird begonnen, wenn diese Zeit am Transmitter erreicht wird.

  ℹ Transmitter unterstützen keine automatische Sommer-/Winterzeitumstellung.

- Um festzulegen, welcher Wert während des LifeTests über den Transmitter ausgeben werden soll, ***Ausgabeverhalten*** wählen.
  Festgesetzt, ***Wartung*** oder ***Messwert*** wählen und bestätigen.
- Um festzulegen, ob Wiederholungstests in einem Testdurchlauf gemacht werden sollen, wenn ein LifeTest ein negatives Testergebnis hat, ***Wiederholmodus*** wählen.
  Flexibel wählen und bestätigen.
  Wenn ***Statisch*** gewählt wird, werden keine Wiederholungstests gemacht, sondern zur angegebenen Uhrzeit ein neuer Testdurchlauf gemacht.
- Um festzulegen, wann ein LifeTest abgebrochen wird, ***Abbruchsgrenze*** wählen.
  Einen Wert eingeben und bestätigen.

ℹ Während eines LifeTests wird der Dräger SensorAlive mit Testgas beaufschlagt. Daher steigt der Messwert. Um zu verhindern, dass ein Alarm ausgelöst wird, wird der Messwert standardmäßig für max. 15 Minuten nicht übertragen. Das Verhalten während eines LifeTests kann jedoch im Menü ***Ausgabeverhalten*** konfiguriert werden. Trotzdem erkennt der Sensor einen Gasausbruch, wenn die gemessene Gaskonzentration größer wird als die durch den LifeTest zu erwartende Gaskonzentration. Die Differenz entspricht der Konzentration des Gasausbruchs und wird mit dem Wert verglichen, der unter ***Abbruchsgrenze*** eingegeben wurde. Wenn dieser Wert überschritten wird, wird der LifeTest sofort abgebrochen. Der Sensor schaltet in den Messbetrieb zurück und der Transmitter gibt wieder einen Messwert aus. Wenn Relais verwendet werden, werden diese am Transmitter geschaltet und ggf. Alarme ausgelöst.

Im Untermenü ***Sensitiv. check*** können folgende Parameter eingestellt werden:

- Um festzulegen, ob eine Warnung ausgegeben werden soll, ***Aktivierung*** wählen und bestätigen.
- Um festzulegen, wann eine Warnung ausgegeben werden soll, ***Alarm < 50%*** oder ***Alarm < 40%*** wählen und bestätigen.

13.8 Sensoreinstellungen Polytron® 8200 CAT / 8310 IR

13.8.1 Sensortyp

Mit dieser Funktion wird der installierte Sensortyp definiert.

1. ***Einstellungen*** > ***Sensor*** > ***Sensortyp*** wählen und bestätigen.
2. Den Sensortyp festlegen und bestätigen.

13.8.2 Gaseinstellungen

Mit dieser Funktion wird die Messeinheit eingestellt.

Bei LC-Sensoren wird mit dieser Funktion außerdem der Messbereichsendwert eingestellt.

1. ***Einstellungen*** > ***Sensor*** > ***Gas-Einst.*** wählen und bestätigen.
2. Messeinheit aus der Liste wählen und bestätigen.
   ⇒ Bei DQ-Sensoren und DSIR:
   Eine Übersicht mit den neuen Gaseinstellungen wird angezeigt. Mit Schritt 4. fortfahren
   ⇒ Bei LC-Sensoren:
   Der aktuelle Messbereichsendwert wird angezeigt. Mit Schritt 3. fortfahren
3. Messbereichsendwert einstellen und bestätigen (nur bei LC-Sensoren).
   ⇒ Eine Übersicht mit den neuen Gaseinstellungen wird angezeigt.
4. Nach der Überprüfung ***Zurück zum Menü*** oder ***Bestätigen*** wählen.

Zurück zum Menü	Zurück zum Menü wählen, um die Funktion ohne Änderung zu verlassen und mit [OK] bestätigen.
Bestätigen	Bestätigen wählen, um die Einstellungen zu übernehmen, und mit [OK] bestätigen.

13.8.3 DQ-Sensorverriegelung einstellen

Diese Funktion steht nur zur Verfügung, wenn keine Relais installiert sind. Mit dieser Funktion wird eingestellt, ob der DQ-Sensor nach einer Messung einer höheren Konzentration als 100 %UEG quittiert werden muss.
Diese Einstellung gilt nicht für LC-Sensoren.

1. ***Einstellungen*** > ***Sensor*** > ***DQ Sensor Selbst.*** wählen und bestätigen.
   ⇒ Die aktuelle Einstellung wird angezeigt.
2. ***Ein*** oder ***Aus*** wählen und bestätigen.

⚠ WARNUNG
Explosionsgefahr
Wenn die Sensorverriegelung deaktiviert ist und ein Alarm mit einer Explosionsgefahr quittiert wird, informiert das Gerät den Endbenutzer über eine solche Gefahr durch dauerhaftes Leuchten der roten LED.

► Vor der Quittierung einer Messbereichsüberschreitung sicherstellen, dass die Gaskonzentration unter 100 %UEG gesunken ist.

⚠ WARNUNG
Mögliche Explosionsgefahr
Betrieb ist nicht mit der BVS-Baumusterprüfung konform.
Ist die DQ-Sensorverriegelung deaktiviert, muss die Auswerteeinheit diese Funktion für den sicheren Betrieb gemäß BVS 13 ATEX G 001 X unterstützen.

► Sicherstellen, dass eine selbsthaltende Anzeige von Messbereichsüberschreitungen an der Anzeigeeinheit aktiviert ist.

13.9 Sensoreinstellungen Polytron 8310 IR

13.9.1 Änderung der Gaskategorie

Der DrägerSensor IR kann Gase und Dämpfe messen, die zu den Gaskategorien Methan, Propan oder Ethen (Ethylen) gehören. Je nachdem, welches Zielgas gemessen werden soll, muss eine Gaskategorie für den DrägerSensor IR eingestellt werden. Für die Zuordnung der Gase und Dämpfe zu den Gaskategorien siehe die Dokumentation des DrägerSensor IR.

13.9.2 Gaskategorie wechseln

Voraussetzungen

– Das Gasmessgerät wurde vor weniger als einer Stunde eingeschaltet.
– Der automatische Nullpunktabgleich am Sensor wurde vor weniger als einer Stunde durchgeführt (siehe „Besonderheit beim Polytron 8310“, Seite 68).
– Die vom Gasmessgerät gemessene Gaskonzentration liegt unter 10 %UEG (Sensor gegebenenfalls mit Nullgas begasen).

1. Alarmgebung des Gasmessgeräts ausschalten (siehe „Alarme ein- oder ausschalten“, Seite 77).
2. ***Einstellungen*** > ***Sensor*** > ***DSIR Kategorie*** wählen und bestätigen.
   ⇒ Die Gaskategorie wird am Gerät angezeigt.

ℹ Die weiteren Schritte werden am Sensor durchgeführt.

3. Zum Auswählen der Gaskategorie am Sensor das Symbol ⇧S oder ⇩0 mit dem Magnetstab berühren.
   ⇒ Am Gasmessgerät wird START angezeigt.
4. Magnetstab entfernen.
   ⇒ Der Sensor wechselt auf ein Ausgangssignal, das die aktuell eingestellte Gaskategorie repräsentiert:
   Ausgangssignal 20 %UEG: Gaskategorie Methan
   Ausgangssignal 40 %UEG: Gaskategorie Propan
   Ausgangssignal 60 %UEG: Gaskategorie Ethen (Ethylen)
5. Dieses Ausgangssignal wird für 30 Sekunden gehalten. Innerhalb dieses Zeitraums kann durch Aufsetzen des Magnetstabs auf den mit dem Symbol ⇧S markierten Bereich das nächstfolgende Gas gewählt werden.
   ⇒ Das Ausgangssignal des Sensors wechselt dabei auf den der neu gewählten Gaskategorie entsprechenden Wert. Erfolgt für mehr als 30 Sekunden keine weitere Eingabe mit dem Magnetstift, wird die Einstellung gespeichert.
6. Empfindlichkeitskalibrierung am Gasmessgerät überprüfen (siehe „Empfindlichkeitsjustierung“, Seite 69)
7. Alarmgebung des Gasmessgeräts einschalten (siehe „Alarme ein- oder ausschalten“, Seite 77).

ℹ Die Einstellung am Sensor kann dazu führen, dass im Menüpunkt ***DSIR Kategorie*** eine falsche Gaskategorie angezeigt wird oder kein Wechsel der Gaskategorie mehr sichtbar ist.

13.10 Sensoreinstellungen Polytron® 87x0 IR

13.10.1 Gaseinstellungen

Mithilfe dieser Funktion lassen sich Gasart, Messbereich und Messeinheiten einstellen. Nur bestimmte Sensoren unterstützen diese Einstellungen.

1. ***Einstellungen*** > ***Sensor*** > ***Gas-Einst.*** wählen und bestätigen.
   ⇒ Das aktuelle Messgas wird angezeigt.
2. Messgas aus der Liste wählen und bestätigen.
   ⇒ Die aktuelle Messeinheit wird angezeigt.
3. Messeinheit aus der Liste wählen und bestätigen.
   ⇒ Wenn die Messeinheit %LEL, %UEG oder %LIE eingestellt ist, wird die Kategorie angezeigt. Weiter mit Schritt 4.
   ⇒ Andernfalls wird der aktuelle Messbereichsendwert angezeigt. Weiter mit Schritt 6.
4. Eine Kategorie wählen und bestätigen.
5. UEG-Wert einstellen und bestätigen.
6. Messbereichsendwert einstellen und bestätigen.
   ⇒ Der neue Messbereichsendwert wird angezeigt.
7. ***Weiter*** wählen und bestätigen.
   ⇒ Eine Übersicht mit den neuen Gaseinstellungen wird angezeigt.
8. Nach der Überprüfung ***Zurück zum Menü*** oder ***Bestätigen*** wählen.

Zurück zum Menü	Zurück zum Menü wählen, um die Funktion ohne Änderung zu verlassen und mit [OK] bestätigen.
Bestätigen	Bestätigen wählen, um die Einstellungen zu übernehmen, und mit [OK] bestätigen.

9. Die Alarmeinstellungen prüfen, nachdem die Kategorie oder der UEG-Wert geändert wurde.

14 Werkseinstellungen

14.1 Unveränderbare Einstellungen für Relais, LED und Alarm

	Einstellung
Fehler-Relais:	Erregt / Arbeitskontakt (Normally Open)
Gelbe LED:	Leuchtet, wenn eine Fehlermeldung vorliegt
Rote LED:	Blinkt einfach, wenn ein Alarm A1 vorliegt. Blinkt zweifach, wenn ein Alarm A2 vorliegt. Wenn ein Alarm als quittierbar konfiguriert ist und der Alarm quittiert wurde, hört die LED auf, einfach oder zweifach zu blinken und leuchtet durchgehend.
Alarmhierarchie:	A2 hat an der LED eine höhere Priorität als A1. Die Relais A1 und A2 arbeiten jedoch unabhängig voneinander. (Beispiel: Wenn A1 quittierbar ist und A2 nicht und die Gaskonzentration so hoch ist, dass A1 und A2 ausgelöst werden, fällt das Relais A1 ab, wenn der Alarm quittiert wird. Die rote LED blinkt jedoch weiterhin zweifach, solange der Zustand besteht, der den Alarm A2 auslöst.

14.2 Einstellungen, die sich über das Menü ändern lassen

Menü	Standardeinstellung	Bereich
Relais aktiv bei Alarm / kein Alarm	Aktiv bei Alarm	Ein / Aus
Alarm A1: Richtung	steigend (fallend für O_2-Sensoren)	Fallend / steigend
Alarm A2: Richtung	Steigend	
A1 Selbsthaltungsmodus	Nicht selbsthaltend	Selbsthaltend / nicht selbsthaltend
A2 Selbsthaltungsmodus	Selbsthaltend	
A1 Quittiermodus	Quittierbar	Quittierbar / nicht quittierbar / vorab quittierbar
A2 Quittiermodus	Nicht quittierbar	
Normalbetrieb Relais A1	Erregt	Erregt / nicht erregt
Normalbetrieb Relais A2		
Justierungs-Kennwort	_ _ _ 1	
Einstellungen Kennwort	_ _ _ 2	
LCD-Einstellung	Ein	Ein / Aus
SIL-Status	Aus	Ein / Aus
Sprache	EN	DE / EN / FR / ES / RU / ZH
Automatische Justierung	Aus	Ein / Aus
Funktionstaste	Fehler	Graph, Fehler, Warnung, Vitalität, Begasungstest

Schnittstelle	Standardeinstellung	Bereich
Fehlerstrom	1,2 mA	0 bis 3,5 mA
Warnung	Aus	Ein / Aus
Warnungsstrom	3,0 mA	0 bis 3,5 mA
Warnungszyklusintervall T1	10 s	5 bis 60 s
Warnzyklusintervall T2 (Warnstrom)	1 s	1 bis (T1-1) s
Wartungssignal	statisch	Statisch / dynamisch
Wartungsstrom	3,4 mA	0 bis 3,5 mA
Analog-Offset	0 mA	-0,5 bis 0,5 mA
Empfindlichkeit Analogausgang	0 mA	-0,5 bis 0,5 mA
HART®-Adresse	0	0 bis 15
Modbus-Adresse[1)]	126	2-126
Modbus-Parität[1)]	gerade (Standard)	gerade, ungerade Parität, keine Parität
Modbus-Baudrate[1)]	9600 bit/s	9600 oder 19200 bit/s
PROFIBUS®-Adresse[1)]	126	2-126

1) Feldbus-Schnittstellen entsprechen nicht BVS 13 ATEX G001 X. Bei Verwendung der Feldbus-Schnittstelle stehen keine Relais zur Verfügung.

14.3 Sensorspezifische Werte

Weitere Spezifikationen sind der Gebrauchsanweisung des jeweiligen Sensors zu entnehmen.

14.3.1 Polytron 8100 EC

Menü	Standardeinstellung	Bereich
Alarm A1	Sensor-abhängig	
Alarm A2	Sensor-abhängig	
Hysterese für Alarm A1 bei steigender Richtung	0	0 bis A1
Hysterese für Alarm A2 bei steigender Richtung	0	0 bis A2
Hysterese für Alarm A1 bei fallender Richtung	0	0 bis Messbereichsendwert -A1
Hysterese für Alarm A2 bei fallender Richtung	0	0 bis Messbereichsendwert -A2
Justierintervall [Tage]	Sensor-abhängig	0 bis 720

14.3.2 Polytron 8100 EC mit O_2-Sensoren

Menü	Standardeinstellung	Bereich
Display-Fangbereichsoffset	20,9 Vol% (O_2)	0 bis 25 Vol% (O_2 LS) 0 bis 100 Vol% (O_2)
Display-Fangbereich niedrig	-0,25 Vol% (O_2)	0 bis -0,75 Vol%
Display-Fangbereich hoch	0,25 Vol% (O_2)	0 bis 0,75 Vol%

Menü	Standardeinstellung	Bereich
Messbereichsendwert	25 Vol% (O_2, O_2 LS)	5 bis 25 Vol% (O_2 LS) 5 bis 100 Vol% (O_2)

14.3.3 Polytron 8100 EC mit Dräger SensorAlive

Menü	Standardeinstellung	Bereich
DSA Warn.-Strom	2,0 mA	0 mA bis 3,5 mA
DSA Warn.-Grenze	Sensor-abhängig	
DSA Aktivierung	Ein	Ein/Aus
LifeTest		
Uhrzeit	Sensor-abhängig	
Ausgabeverhalten	festgesetzt	festgesetzt/Wartung/Messwert
Wiederholprofil	flexibel	flexibel/statisch
Abbruchsgrenze	Sensor-abhängig	
Sens.-Überwachung		
Aktivierung	Sensor-abhängig	
Alarm <50%	Aus	Aus/Warnung
Alarm <40%	DSA Warnung	Aus/DSA Warnung/Fehler
Fehlerdetektion	Ein	Ein/Aus

14.3.4 Polytron 8200 CAT DrägerSensor® DQ

Menü	Standardeinstellung	Bereich
Alarm A1	20 %UEG	1 bis 100 %UEG
Alarm A2	40 %UEG	
Hysterese für Alarm A1 bei steigender Richtung	1 %UEG	0 bis A1
Hysterese für Alarm A2 bei steigender Richtung	1 %UEG	0 bis A2
Justierintervall [Tage]	180	0 bis 360
Display-Fangbereichsoffset	0 %UEG	-5 bis 4 %UEG
Display-Fangbereich niedrig	-5 %UEG	-5 bis 0 %UEG
Display-Fangbereich hoch	2 %UEG	0 bis 4 %UEG
Messbereichsendwert	100 %UEG	Bereich ist nicht einstellbar

14.3.5 Polytron 8200 CAT DrägerSensor® LC

Menü	Standardeinstellung	Bereich
Alarm A1	2,0 %UEG	0,1 bis 10 %UEG
Alarm A2	4,0 %UEG	
Hysterese für Alarm A1 bei steigender Richtung	0,1 %UEG	0 bis A1
Hysterese für Alarm A2 bei steigender Richtung	0,1 %UEG	0 bis A2
Messbereichsendwert	10 %UEG	5 bis 10[1)] % UEG 1 bis 10 %UEG
Justierintervall [Tage]	180	0 bis 360
Display-Fangbereichsoffset	0 %UEG	-0,5 bis 0,4 %UEG
Display-Fangbereich niedrig	-0,5 %UEG	-0,5 bis 0 %UEG
Display-Fangbereich hoch	0,2 %UEG	0 bis 0,4 %UEG

1) Für Firmwareversionen < 3.0.0

14.3.6 Polytron 8310 IR

Menü	Standardeinstellung	Bereich
Alarm A1	20 %UEG	1 bis 100 % UEG
Alarm A2	40 %UEG	
Hysterese für Alarm A1 bei steigender Richtung	1 %UEG	0 bis A1
Hysterese für Alarm A2 bei steigender Richtung	1 %UEG	0 bis A2
Justierintervall [Tage]	180	0 bis 360
Display-Fangbereichsoffset	0 %UEG	-3 bis 4 %UEG
Display-Fangbereich niedrig	-3 %UEG	-3 bis 0 %UEG
Display-Fangbereich hoch	2 %UEG	0 bis 4 %UEG
Messbereichsendwert	100 %UEG	Bereich ist nicht einstellbar

14.3.7 Polytron 8700 IR

Typ 334

Menü	Standardeinstellung	Bereich
Prüfgas	Methan	
Prüfgaseinheiten	%UEG	
Prüfgaskonzentrationen	50 %UEG	
Alarm A1	20 %UEG	0,01 bis 100 Vol% bei %UEG = 0,3 bis 100 %UEG
Alarm A2	40 %UEG	
UEG-Typ	NIOSH	IEC / PTB / NIOSH / konfigurierbar
Messgas	Methan	
Messgaseinheiten	%UEG	%UEG / Vol.-% / PPM / %LEL / %LIE
Messbereichsendwert	100 %UEG	20 bis 100 %UEG
Beam Block	Aus	Ein / Aus
Beam Block-Strom	2 mA	0 bis 3,5 mA
Beam Block-Grenze	7,5 %UEG	0 bis max. 15 %UEG[1)]
Justierintervall [Tage]	360	0 bis 720
Ansprechverhalten	normal	normal / schnell
Display-Fangbereichsoffset	0	Die Absolutwerte des Display-Fangbereichs müssen innerhalb dieser Grenzen liegen: -1000 bis 2200 ppm (Methan Typ 334) -850 bis 850 ppm (Propan Typ 334) -1200 bis 1150 ppm (Ethylen Typ 334)
Display-Fangbereich niedrig	-750 ppm (Methan) -315 ppm (Propan) -405 ppm (Ethylen)	
Display-Fangbereich hoch	750 ppm (Methan) 315 ppm (Propan) 405 ppm (Ethylen)	

1) Die Höchstgrenze des Beam Blocks ist abhängig von der Art des Gasmessgeräts und des gewählten Messgases.

Typ 340

Menü	Standardeinstellung	Bereich
Prüfgas	Propan	
Prüfgaseinheiten	%UEG	
Prüfgaskonzentrationen	50 %UEG	
Alarm A1	20 %UEG	0,01 bis 100 Vol% bei %UEG = 0,3 bis 100 %UEG
Alarm A"	40 %UEG	
UEG-Typ	NIOSH	IEC / PTB / NIOSH / konfigurierbar
Messgas	Propan	
Messgaseinheiten	%UEG	%UEG / Vol.-% / PPM / %LEL / %LIE
Messbereichsendwert	100 %UEG	20 bis 100 %UEG
Beam Block	Aus	Ein / Aus
Beam Block-Strom	2 mA	0 bis 3,5 mA
Beam Block-Grenze	2,5 %UEG	0 bis max. 15 %UEG[1)]
Justierintervall [Tage]	360	0 bis 720
Ansprechverhalten	normal	normal / schnell
Display-Fangbereichsoffset	0	Die Absolutwerte des Display-Fangbereichs müssen innerhalb dieser Grenzen liegen: -850 bis 425 ppm (Propan Typ 340) -1800 bis 2200 ppm (Methan Typ 340)
Display-Fangbereich niedrig	-750 ppm (Methan) -85 ppm (Propan)	
Display-Fangbereich hoch	750 ppm (Methan) 85 ppm (Propan)	

1) Die Höchstgrenze des Beam Blocks ist abhängig von der Art des Gasmessgeräts und des gewählten Messgases.

14.3.8 Polytron 8720 IR

Menü	Standardeinstellung	Bereich
Prüfgas	CO_2	
Prüfgaseinheiten	Vol.-%	
Prüfgaskonzentrationen	4,0 Vol%	0,2 bis 100 Vol%
Alarm A1	1 Vol%	0,01 bis 100 Vol%
Alarm A2	2 Vol%	
UEG-Typ	-	
Messgas	CO_2	
Messgaseinheiten	Vol.-%	Vol% / ppm
Messbereichsendwert	10 Vol%	0,2 bis 100Vol%
Beam Block	Aus	Ein / Aus
Beam Block-Strom	2 mA	0 bis 3,5 mA
Beam Block-Grenze	0,1 Vol%	0 bis 0,1 Vol%
Justierintervall [Tage]	360	0 bis 720
Ansprechverhalten	normal	normal / schnell
Display-Fangbereichsoffset	340 ppm	Die Absolutwerte des Display-Fangbereichs müssen innerhalb dieser Grenzen liegen: -1000 bis 1000 ppm (Kohlenstoffdioxid)
Display-Fangbereich niedrig	-200 ppm	
Display-Fangbereich hoch	200 ppm	

15 Entsorgung

Dieses Produkt darf nicht als Siedlungsabfall entsorgt werden. Es ist daher mit dem nebenstehenden Symbol gekennzeichnet.
Dräger nimmt dieses Produkt kostenlos zurück. Informationen dazu geben die nationalen Vertriebsorganisationen und Dräger.

Entsorgung elektrochemischer Sensoren:

⚠ WARNUNG
Gefahr von Explosionen und Verätzungsgefahr!
Sensorflüssigkeiten können austreten und Verätzungen verursachen.
► Sensoren nicht im Feuer entsorgen.
► Nicht gewaltsam öffnen.

16 Technische Daten

16.1 Messbereiche

Sensor	Messbereich
Polytron 8100 EC mit Dräger-Sensor® EC	Sensor-abhängig
Polytron 8200 CAT mit DrägerSensor® DQ	0 bis 100 %UEG
Polytron 8200 CAT mit DrägerSensor®LC	0 bis 10 %UEG[1)]
Polytron 8310 IR mit Dräger-Sensor® IR	0 bis 100 %UEG
Polytron 8700 IR mit PIR 7000-Infrarot-Gassensor	
Typ 334 (IDS 01x1)	0 bis 10.000 ppm[1)] 0 bis 100 %UEG,[1)] 0 bis (1,25 x UEG_{max}) Vol%,[1)2)] Für CH4 (Methan) 0 bis 100 Vol%[1)]
Typ 340 (IDS 01x2)	0 bis 10.000 ppm[1)] 0 bis 100 %UEG[1)] 0 bis 5 Vol%[1)]
Polytron 8720 IR mit PIR 7200-Infrarot-Gassensor (IDS 01x5)	0 bis 100 Vol%[1)]

1) Für anpassbaren Messbereichsendwert, siehe 14.3.
2) Bereich ändert sich je nach zu messender Substanz

16.2 Signalübertragung zur Auswerteeinheit

Messbereich und messtechnische Eigenschaften hängen vom installierten Sensor ab (siehe Gebrauchsanweisung des installierten Sensors).

Frequenz der Messwertberechnung: 1 x pro Sekunde (Aktualisierung der Anzeige, der Analogschnittstelle und der Relais).

Analogsignal	
Normalbetrieb	4 ... 20 mA
Drift unter Null	3,8 ... 4 mA
Messbereichsüberschreitung	20 ... 20,5 mA
Gerätefehler	≤ 1,2 mA
Fehler an der Analogschnittstelle	> 21 mA
Wartungssignal	3,4 mA stetiges Signal oder 1 Hz-Modulation zwischen 3 und 5 mA (wählbar)

Widerstand der Signalschleife

Betriebsmodus	Widerstandsbereich der Signalschleife	Bereich der Spannungsversorgung
Betrieb ohne HART®-Kommunikation	0 bis 230 Ω	bei 10 V DC
	Linearer Anstieg mit der Versorgungsspannung von: 0 bis 230 Ω bei 10 V auf 0 bis 500 Ω bei 16 V	10 bis 18 V DC
	0 bis 500 Ω	18 bis 30 V DC
Betrieb mit HART®-Kommunikation	230 bis 270 Ω	bei 13 V DC
	Linearer Anstieg mit der Versorgungsspannung von: 230 bis 270 Ω bei 11 V auf 230 bis 500 Ω bei 16 V	11 bis 16 V DC
	230 bis 500 Ω	18 bis 30 V DC
HART®-Multidrop-Betrieb	230 bis 500 Ω	10 bis 30 V DC

Bei Einsatz gemäß Messtechnischer Eignungsprüfung nach EN IEC 62990-1, EN IEC 60079-29-1 oder EN 50104 darf der Widerstand 300 Ohm nicht überschreiten. Weitere Informationen zur Installation der Feldbus-Schnittstelle sind dem Dokument 9033783 zu entnehmen.

16.3 Kabeleigenschaften

Bei Installation ohne Rohrleitung geschirmte Kabel verwenden.

Analoger Anschluss und HART®-Anschluss mit Auswerteeinheit und Spannungsversorgung	
Spannungsversorgung und Signale	3-adriges geschirmtes Kabel 24 - 12 AWG / 0,2 - 2,5 mm²
Relais	20 - 12 AWG / 0,5 - 2,5 mm²

Digitale Verbindung mit Auswerteeinheit	
Geräte mit Feldbus-Schnittstellen und abgesetzten Sensoren müssen mit geschirmten Kabeln installiert werden.	
Modbus RTU	2-adrig oder 3-adrig[1], ≥ 26 AWG

Digitale Verbindung mit Auswerteeinheit	
PROFIBUS PA Foundation Fieldbus	2-adrig, Kabeltyp A Wellenwiderstand R_W: 135 - 165 Ω Kapazität / Längeneinheit C‘: < 30 pF/m Schleifenwiderstand R‘: 110 Ω/km Aderdurchmesser d: 0,64 mm Aderquerschnitt q: > 0,34 mm² Geflechtschirm: ≥ 90 %
Spannungsversorgung	2-adrig, 24 - 12 AWG / 0,2 - 2,5 mm²

1) Wenn der Weg zwischen Auswerteeinheit und Transmitter sehr lang ist (>1 km) und die Spannungsversorgung von Auswerteeinheit und Transmitters getrennt ist, können Störungen oder Differentialunterschiede entstehen. In diesem Fall sollte die 3-adrige Verkabelung mit Ground gewählt werden. Ground wird dann am Transmitter angeschlossen und zum Ground der Auswerteeinheit durchgeschleift.

16.4 Spannungsversorgung und Relais

Relais-Auslegung[1] SPDT[2]	
230 V ~	0,1 A - 5 A
30 V ⎓, ohmsche Last	0,1 A (Minimum) - 5 A

1) Bei sicherheitsrelevanten Anwendungen (SIL 2) reduziert sich die maximale Schaltleistung (siehe Polytron® 8xx0 Safety Manual).
2) Einpoliger Umschalter (Wechsel elektrischer Kontakte)

Spannungsversorgung Polytron 8xx0	
Betriebsspannung	10[1] bis 30 V⎓ am Gerät
Einschaltstrom	2,3 A für 2 ms bei 24 V⎓,10-Ω-Widerstand

1) Bei einer Versorgungsspannung von <9,5 V DC gibt das Gerät ein Fehlersignal aus.

Betriebsstrom	
Polytron® 8100 EC	
ohne Relais, kein abgesetzter Sensor	80 mA
mit Relais, abgesetzter Sensor	100 mA
Polytron® 8200 CAT	
ohne Relais, kein abgesetzter Sensor	105 mA (DrägerSensor DQ) 130 mA (DrägerSensor LC)
mit Relais, abgesetzter Sensor	145 mA (DrägerSensor DQ) 165 mA (DrägerSensor LC)
Polytron® 8310 IR	
ohne Relais, kein abgesetzter Sensor	145 mA
mit Relais, abgesetzter Sensor	185 mA
Polytron® 87x0 IR	
ohne Relais, kein abgesetzter Sensor	330 mA
mit Relais, abgesetzter Sensor	350 mA

16.5 Allgemeine Spezifikationen

Gehäuse Polytron 8xx0	
Gehäusematerial	kupferfreies Aluminium
Gehäuseschutz	NEMA 4X[1)] IP 65/66/67[2)]
Display	Auflösung 128 x 64 Pixel, hinterleuchtet[3)]

1) Polytron 8100 EC NEMA 4X-Gehäuseschutz ausstehend.
2) Die IP-Schutzarten beinhalten nicht, dass die Ausrüstung ein Gas nachweist, während oder nachdem sie diesen Bedingungen ausgesetzt war. Im Falle von Staubablagerungen und dem Kontakt mit Wasser durch Eintauchen oder einen Wasserstrahl die Justierung und die Funktionstüchtigkeit des Geräts überprüfen.
3) Bei hohen Temperaturen (>65 °C) ist das Display nur eingeschränkt ablesbar.

16.6 Umgebungsparameter

Weitere Sensorspezifikationen und Einflüsse sind der Gebrauchsanweisung des jeweiligen Sensors zu entnehmen.

Die Werte für Zubehörteile und Ersatzteile können von den hier genannten Werten abweichen. Genaue Werte sind der entsprechenden Anleitung zu entnehmen.

Polytron 8xx0	
Werte gemäß Explosionsschutzprüfung	
während des Betriebs:	
Druck	23,6 bis 32,5 in. Hg (800 bis 1100 hPa)
Feuchte	0 bis 100 % r. F., nicht kondensierend
Temperaturen	
Polytron 8100 EC	-40 bis +70 °C (-40 bis +158 °F)
Polytron 8200 CAT	-40 bis +80 °C (-40 bis +176 °F)
Polytron 8310 IR	-40 bis +65 °C (-40 bis +149 °F)
Polytron 87x0 IR	-40 bis +80 °C (-40 bis +176 °F)
Werte gemäß messtechnischem Gutachten	
während des Betriebs:	
Druck	20,7 bis 38,4 in. Hg (700 bis 1300 hPa)[1)]
Feuchte	0 bis 95 % r. F., nicht kondensierend
Temperaturen	
Polytron 8100 EC[2)]	-40 bis +65 °C (-40 bis +149 °F)
Polytron 8200 CAT	-40 bis +80 °C (-40 bis +176 °F)
Polytron 8310 IR	-40 bis +65 °C (-40 bis +149 °F)
Polytron 87x0 IR	-40 bis +77 °C (-40 bis +170 °F)
während der Lagerung:	
Druck	26,5 bis 32,4 in. Hg (900 bis 1100 hPa)
Feuchte	0 bis 100 % r. F., nicht kondensierend
Temperatur	-20 bis +65 °C (-4 bis +149 °F)
empfohlene Lagerdauer	5 Jahre
Werte für Relais-Option und Installationen mit UL-Zulassung	
während des Betriebs:	
Temperaturen	
Polytron 8200 CAT	-40 bis +70 °C (-40 bis +158 °F)
Polytron 87x0 IR	-40 bis +70 °C (-40 bis +158 °F)

1) Polytron 8200 CAT: 23,6 bis 35,44 in. Hg (800 bis 1200 hPa)
2) Siehe 18.3, 18.3.2 und Gebrauchsanweisung des EC-Sensors für die Einschränkungen der maximalen Spezifikation.

16.7 Anzugsdrehmomente

Gerätegewinde	
Gehäuseabdeckung	≥44 in-lbs / ≥5 Nm
Sensor	min. 266 in-lbs / min. 30 Nm
Blindstopfen	min. 266 in-lbs / min. 30 Nm
Anschlüsse (für Rohrleitungen oder Kabelverschraubungen)	min. 443 in-lbs / min. 50 Nm
Blindstopfen für Docking Station	62 in-lbs / 7 Nm
Kabeldurchführungen für Docking-Station	70 in-lbs / 8 Nm
abgesetzter EC-Messkopf	177 in-lbs ±9 in-lbs / 20 Nm ±1 Nm

Feldverdrahtungsklemmen	
Spannungsversorgung, Signale und Relais	4,4 - 7,0 in-lbs / 0,5 - 0,8 Nm
Erdungsschraube	10,6 in-lbs / 1,2 Nm

17 Zubehör und Ersatzteile

Dieses Kapitel enthält einen Überblick über die Komponenten, die durch die BVS 13 ATEX G 001 X- und PFG 14 G 001 X-Baumusterprüfung abgedeckt sind. Weitere Teile sind in der Ersatzteilliste aufgeführt oder über den DrägerService zu erfragen.

17.1 Polytron® 8xx0

Beschreibung	Sachnummer
IRDA zu PC-Schnittstelle	4544197
Magnetstab mit Schlüsselanhänger	4544101
Dräger PolySoft, Konfigurationssoftware	8328600 / 8328639
EXd Blindstopfen, Edelstahl, 2 St.	4544897
EXd Blindstopfen, verzinkter Stahl, 3 St.	8344041

17.1.1 Docking Station

Beschreibung	Sachnummer
Docking Station, Version nur Spannung	8344027
Docking Station Spannung, Relais (enthält 2 Kabelverschraubungen)	8344028
Docking Station, Feldbus	8344029
Kabelverschraubung Docking Station	6812868
Docking Station, Blindstopfen	8344042

17.2 Polytron® 8100 EC

Beschreibung	Sachnummer
Leiterplatteneinheit Polytron 8100 4-20/HART	4544781
Leiterplatteneinheit Polytron 8100 4-20/HART, Relais	4544782
Bajonettring	4544366
Bajonettring für Dräger SensorAlive	6800132
Lüftungskanaladapter für abgesetzten EC-Messkopf[1)]	8317617
Stangenbefestigung für abgesetzten EC-Messkopf	4544213
Sensortestdongle	8317619
Diagnosedongle	8317860
Kalibrieradapter	6810536

1) Kann Einfluss auf die Messleistung haben, z. B. die Ansprechzeit vergrößern. Wird nicht durch BVS 13 ATEX G 001 X und PFG 14 G 001 X abgedeckt.

17.3 Polytron® 8200 CAT

Beschreibung	Sachnummer
Leiterplatteneinheit Polytron 8200 4-20/HART	4544788
Leiterplatteneinheit Polytron 8200 4-20/HART Relais	4544789
Justieradapter PE, Europa	6806978
Fernkalibrieradapter DQ	6812480
Fernkalibrieradapter LC[1)]	6812482
E-Set Membrane 21,50x14,50, 2 Stück	8326840
Staubfilter für DrägerSensor DQ, 10 Stück	6810537
Prozessadapter DQ	6812470
Prozessadapter LC[1)]	6812465
Spritzschutz	6812510

1) nicht durch das Messtechnische Gutachten abgedeckt.

17.3.1 CAT-Sensoren

Beschreibung	Sachnummer
DrägerSensor DQ NPT	6814150
DrägerSensor DQ NPT S[1)]	3701800
DrägerSensor LC NPT	6810675
Messkopf, Polytron SE Ex PR M1 DQ	6812711
Messkopf, Polytron SE Ex PR M2 DQ	6812710
Messkopf, Polytron SE Ex HT M DQ	6812720
Abgesetzter Sensor DQ NPT Alu	3706933
Abgesetzter Sensor DQ NPT Stahl	3706934

1) Der DrägerSensor DQ NPT S kann auch anstelle des DrägerSensor DQ NPT verwendet werden.

17.4 Polytron® 8310 IR

Beschreibung	Sachnummer
Spritzschutz	6810796
Prozessadapter	6811330
Schutzlabyrinth	6811135
Kalibrieradapter	6810859
Leiterplatteneinheit Polytron 8310 4-20/HART	4544788
Leiterplatteneinheit Polytron 8310 4-20/HART Relais	4544789

17.4.1 DSIR-Sensoren

Beschreibung	Sachnummer
DrägerSensor IR NPT	6811901
Messkopf, DrägerSensor IR Komplettsatz e	6811165
Messkopf, DrägerSensor IR Komplettsatz e2	6811265

17.5 Polytron® 87x0 IR

Beschreibung	Sachnummer
Leiterplatteneinheit Polytron 87x0 4-20/HART[1)]	4544795
Leiterplatteneinheit Polytron 87x0 4-20/HART Relais[1)]	4544796
Befestigungsset PIR 7000	6811648
Prozessküvette PIR 7000, Edelstahl	6811415
Prozessküvette PIR 7000 SGR	6813219
Statusanzeige PIR 7000 / 7200	6811625 / 6811920
Spritzschutz PIR 7000 / 7200	6811911 / 6811912
Flowcell PIR 7000 / 7200	6811490 / 6811910
Ferntestadapter PIR 7000 / 7200	6811630 / 6811930
Insektenschutz PIR 7000	6811609
Hydrophobes Filter PIR 7000	6811890
Kalibrieradapter PIR 7000	6811610
Prozessadapter PIR 7000 / 7200 POM (Polyoxymethylen)	6811915
Montageset PIR 7000	6811648
Klemmenkasten Ex e	6811989
Klemmenkasten Ex d	4520561
Magnetstab	4544101

1) Die Kompatibilität der Firmware von Sensor und Gasmessgerät prüfen. Der Wechsel der Leiterplatteneinheit erfordert möglicherweise eine Firmware-Aktualisierung. Zur Unterstützung Dräger kontaktieren.

17.5.1 Sensoren

Die Kompatibilität der Firmware von Sensor und Gasmessgerät prüfen. Der Wechsel des Sensors erfordert möglicherweise eine Firmware-Aktualisierung. Zur Unterstützung Dräger kontaktieren.

Beschreibung	Sachnummer
Dräger PIR 7000 Typ 334 (NPT)	6811822
Dräger PIR 7000 Typ 340 (NPT)	6811832
Dräger PIR 7000 334 (M25) Komplettsatz	6811825
Dräger PIR 7000 340 (M25) Komplettsatz	6811819
Dräger PIR 7200 (NPT)	6811572
Dräger PIR 7200 (M25) HART Komplettsatz	6812290

18 Messtechnisches Gutachten

In Kombination mit bestimmten Sensoren hat Polytron 8xx0 ein messtechnisches Gutachten gemäß folgender Normen:

– EU- und Baumusterprüfbescheinigungen nach EN 60079-29-1, EN 50104, EN 45544 und DIN IEC 62990-1. Ausgestellt durch DEKRA Testing and Certification GmbH, Handwerkstr. 15, D-70565 Stuttgart.
– FM Messtechnisches Gutachten nach ANSI/ISA-92.00.01 FM6340

Weitere Informationen zu den Spezifikationen und Einschränkungen der Sensoren (z. B. Messgrundlagen, Leistung, Querempfindlichkeit) siehe Gebrauchsanweisung des jeweiligen Sensors.

18.1 EU-Prüfbescheinigung, BVS 13 ATEX G 001 X

Messung von mit Luft vermischten brennbaren Gasen und Dämpfen.

– Polytron 8200 CAT mit DrägerSensor DQ

  Besondere Bedingungen:

  - Bei Anströmung mit messgashaltiger Luft können um bis zu 32% erhöhte Messwerte auftreten.
  - Bei Betrieb mit dem Fernkalibrieradapter DQ können um bis zu 70% erhöhte Messwerte auftreten.

– Polytron 8200 CAT mit DrägerSensor LC
  Zugelassen mit 10 %UEG Messbereichsendwert.
  Es ist eine Verbindung zu einer Auswerteeinheit mit zugelassener Messfunktion (z. B. REGARD® 7000) erforderlich. Selbsthaltende Alarme für Messwerte mit Messbereichsüberschreitung müssen an der Auswerteeinheit aktiviert sein.
– Polytron 8310 IR mit DrägerSensor IR
– Polytron 8700 IR mit PIR 7000 Typ 334 und 340

Messung von Sauerstoff (Inertisierung)

– Polytron 8100 EC mit DrägerSensor O_2 (6809720) und DrägerSensor O_2 LS (6809630) innerhalb eines Messbereichs von 0-5...25 Vol% O_2.

Zugelassen sind:

– 4-20-mA-Schnittstelle
– Relaismodul
– Abgesetzter Sensor
– HART
– Werksseitige Standard-Messbereichsendwerte

Nicht zugelassen sind Feldbus-Schnittstelle und Datenlogger.

18.2 Prüfbescheinigung, PFG 14 G 001 X

Messung von Sauerstoff (Sauerstoffmangel und -überschuss)

– Polytron 8100 EC mit DrägerSensor O_2 (6809720) und DrägerSensor O_2 LS (6809630) innerhalb eines Messbereichs von 0-25 Vol% O_2.

Messung von Schwefelwasserstoff

– Polytron 8100 EC mit Dräger SensorAlive (6809630) innerhalb der folgenden Messbereiche:
  - 0,5 - 100 ppm (Typ HM)
  - 0 - 100 ppm (Typ SM)

Messung von Kohlenstoffdioxid

– Polytron 8720 IR mit PIR 7200 innerhalb der folgenden Messbereiche:
  - 1 Vol% und 10 Vol% – EN 45544-2
  - 2000 ppm, 1 Vol% und 10 Vol% – EN 45544-3

Zugelassen sind:

– 4-20-mA-Schnittstelle
– Relaismodul
– Abgesetzter Sensor

Nicht zugelassen sind:

– Feldbus-Schnittstelle
– Datenlogger
– nur Polytron 8100 EC mit Dräger SensorAlive: Selbsttest-Funktionalität bei Betrieb des Gasgenerators

18.3 Zertifizierte Betriebsbedingungen DrägerSensor O_2, O_2LS und Dräger SensorAlive

Querempfindlichkeiten

Es sind keine Querempfindlichkeiten gegenüber Störgasen mit einer Konzentration von bis zu 100 ppm bekannt. Weitere Informationen erhalten Sie von Dräger.

18.3.1 DrägerSensor O_2 (6809720)

Der DrägerSensor O_2 (6809720) ist ein elektrochemischer 2-Elektrodensensor zur Messung von Sauerstoff (O_2) in der Umgebungsluft.

Umgebungsparameter	
Druck	20,7 bis 38,4 in. Hg (700 bis 1300 hPa)
Feuchte	10 bis 95 % r. F., nicht kondensierend
Temperatur	Bei Anwendung der EN 50104 ist der Temperaturbereich auf 0° C bis +55 °C eingeschränkt.

Lagerung	
Druck	kein Einfluss
Feuchte	30 bis 70 % r. F., nicht kondensierend (nur relevant, wenn Sensorverpackung offen ist)
Temperatur	0 bis +40 °C
Zeit	Die Lagerung von Sensoren ist nicht vorgesehen. Gelieferte Sensoren sollten sofort in Betrieb genommen werden. Verbleibende Lebensdauer = Erwartete Lebensdauer - Lagerzeit

Einfluss von Umgebungsparametern	Nullpunkt	Empfindlichkeit[1)]
Temperatur[2)3)]		
0 bis 55 °C	≤ 0,3 Vol% O_2	≤ 0,9 Vol% O_2
Druck	< ± 0,2 Vol% O_2	Relative Abweichung von der Anzeige bei 1013 hPa: < 10 % des Messwertes / 100 hPa
Feuchte	Kein Einfluss	Relative Abweichung von der Anzeige bei 50 % r. F.: < 1 % des Messwertes

1) Die relative Abweichung des Anzeigewerts wird durch Schwankungen des atmosphärischen Drucks verursacht.
2) Bei Temperaturen unter -5 °C ist die Messabweichung höher als in EN 50104 angegeben.
3) Für Betriebstemperaturen außerhalb von -5 °C bis 40 °C muss eine Justierung bei Betriebstemperatur durchgeführt werden.

Ansprechzeit[1)]	$t_{0...20}$	$t_{0...90}$
0-5 Vol% O_2	≤ 15 Sekunden[2)]	≤ 33 Sekunden
0-25 Vol% O_2	≤ 10 Sekunden	≤ 26 Sekunden

1) Bei Temperaturen unterhalb von -5 °C kann sich die Ansprechzeit erhöhen.
2) Die Ansprechzeit liegt über dem gemäß EN 50104 zulässigen Grenzwert.

Stabilisierungszeit: 5 x $t_{0...90}$

Messbereich

0-5 Vol% O_2 bis 0-100 Vol% O_2

Standardwert: 25 Vol% O_2 Minimalwert: -1,25 Vol% O_2

Einlaufzeit des Sensors

Betrieb: < 20 Minuten / Justierung: ≤ 2 Stunden

18.3.2 DrägerSensor O_2LS (6809630)

Der DrägerSensor O_2LS (6809630) ist ein elektrochemischer 3-Elektrodensensor zur Messung von Sauerstoff (O_2) in der Umgebungsluft.

Umgebungsparameter	
Druck	20,7 bis 38,4 in. Hg (700 bis 1300 hPa)
Feuchte	5 bis 95 % r. F., nicht kondensierend
Temperatur	-40 bis +60 °C kurzzeitig +65 °C

Lagerung	
Druck	kein Einfluss
Feuchte	30 bis 70 % r. F., nicht kondensierend (nur relevant, wenn Sensorverpackung offen ist)
Temperatur	0 bis +40 °C
Zeit	Die Lagerung von Sensoren ist nicht vorgesehen. Gelieferte Sensoren sollten sofort in Betrieb genommen werden. Verbleibende Lebensdauer = Erwartete Lebensdauer - Lagerzeit

Einfluss von Umgebungsparametern	Nullpunkt	Empfindlichkeit
Temperatur		
-20 bis 40 °C	≤ 0,1 Vol% O_2	≤ 0,1 Vol% O_2
-40 bis 65 °C	≤ 0,2 Vol% O_2	≤ 0,5 Vol% O_2
Druck	< ± 0,1 Vol% O_2	≤ 0,8 Vol% O_2
Feuchte	≤ 0,1 Vol% O_2	≤ 0,9 Vol% O_2

Bei der Messung von Sauerstoff in Gegenwart von Helium kann die Heliumkompensation verwendet werden. Die optionale Heliumkompensation ist keine zertifizierte Messfunktion nach EN 50104.

⚠ VORSICHT

Sensorfehler

Wird der Sensor über einen längeren Zeitraum höheren Konzentrationen an ungesättigten Kohlenwasserstoffen, Alkoholen oder Wasserstoff ausgesetzt (Dosierung ca. 100.000 ppm x Stunden), kann dies zum Ausfall des Geräts führen.

► Stellen Sie sicher, dass der Sensor solchen Konzentrationen nicht über einen längeren Zeitraum ausgesetzt wird.

Ansprechzeit		
	$t_{0...20}$	$t_{0...90}$
0-5 Vol% O_2	≤ 14 Sekunden[1)]	≤ 45 Sekunden
0-25 Vol% O_2	≤ 10 Sekunden	≤ 27 Sekunden

1) Die Ansprechzeit liegt über dem gemäß EN 50104 zulässigen Grenzwert.

Stabilisierungszeit: 5 x $t_{0...90}$

Messbereich

0-5...25 Vol% O_2, 0-25 Vol% O_2

Standardwert: 25 Vol% O_2

Minimalwert: -1,25 Vol% O_2

Einlaufzeit des Sensors

Betrieb: ≤ 20 Minuten / Justierung: ≤ 6 Stunden

18.3.3 Dräger SensorAlive (6814014)

Der Dräger SensorAlive (6814014) ist ein elektrochemischer Diffusionssensor mit integriertem Gasgenerator zur Messung von Schwefelwasserstoff (H_2S) in der Umgebungsluft.

Umgebungsparameter	
Druck	20,7 bis 35,5 in. Hg (700 bis 1200 hPa)
Feuchte	5 bis 95 % r. F., nicht kondensierend
Temperatur	-40 bis +65 °C
maximale Strömungsgeschwindigkeit der Umgebungsluft	6 m/s

Lagerung	
Druck	kein Einfluss
Feuchte	30 bis 70 % r. F., nicht kondensierend (nur relevant, wenn Sensorverpackung offen ist)
Temperatur	0 bis +40 °C
Zeit	Die Lagerung von Sensoren ist nicht vorgesehen. Gelieferte Sensoren sollten sofort in Betrieb genommen werden. Verbleibende Lebensdauer = Erwartete Lebensdauer - Lagerzeit

Einfluss von Umgebungsparametern	
	Relative Abweichung von der Anzeige
Druck	bei 1000 hPa: ≤ 0,15 ppm
Feuchte (bei +40 °C)	bei 0 und 95 % r. F.: ≤ 0,29 ppm
Temperatur	bei 20 °C: ≤ 0,44 ppm

ℹ Interferenzgase (z. B. NH_3) können die Funktion des Sensors beeinträchtigen.

Ansprechzeiten im Diffusionsbetrieb	
t(50)	≤ 20 s
t(90)	≤ 55 s

Abklingzeiten im Diffusionsbetrieb	
t(50)	≤ 20 s
t(10)	≤ 55 s

18.4 FM-Messtechnisches Gutachten für DrägerSensor H_2S und H_2S LC

DrägerSensor H_2S und H_2S LC sind elektrochemische Diffusionssensoren, die Schwefelwasserstoff (H_2S) in Umgebungsluft messen.

DrägerSensor H_2S (6810435)	
Untersuchungsart P8100	ETR 0400, 0401, 0500, 0501
Schnittstelle[1)]	4-20 mA, Relais
Umgebungsparameter	
Feuchte	5 bis 95 % r. F., nicht kondensierend
Temperatur	-40/+65 °C (-40/149 °F)
Lagertemperatur	0/+40 °C (32/104 °F)
Gehäuseschutz [2)]	IP 65/66/67
Bereich	0-100 ppm
Genauigkeit (je nachdem was größer ist)	Messunsicherheit (des Messwertes) ≤ ±3 % oder mindestens ≤ ±0,5 ppm
Zubehör	
Staubfilter	6809595
Adapterkit	6810536
Standard	ANSI/ISA-92.00.01FM6340

1) HART-Kommunikation darf nicht für sicherheitsrelevante Kommunikation verwendet werden.
2) Nach Untertauchen und Wasserstrahlen muss der Sensor ausgetauscht werden.

DrägerSensor H_2S LC (6809610)	
Untersuchungsart P8100	ETR 0400, 0401, 0500, 0501
Schnittstelle[1)]	4-20 mA, Relais
Umgebungsparameter	
Feuchte	5 bis 95 % r. F., nicht kondensierend
Temperatur	-20/+65 °C (-4/149 °F)
Lagertemperatur	0/+40 °C (32/104 °F)
Gehäuseschutz [2)]	IP 65/66/67
Bereich	0-100 ppm
Genauigkeit (je nachdem was größer ist)	Messunsicherheit (des Messwertes) ≤ ±3 % oder mindestens ≤ ±0,5 ppm im Bereich >50 ppm, ±10 % oder ±3 ppm
Zubehör	
Staubfilter	6809595
Adapterkit	6810536
Standard	ANSI/ISA-92.00.01FM6340

1) HART-Kommunikation darf nicht für sicherheitsrelevante Kommunikation verwendet werden.
2) Nach Untertauchen und Wasserstrahlen muss der Sensor ausgetauscht werden.

Sommaire

1 Informations relatives à la sécurité 100
1.1 Consignes de sécurité 100
1.2 Domaine d'application et conditions d'utilisation . 100

2 Conventions utilisées dans ce document 101
2.1 Signification des avertissements 101
2.2 Marques 101

3 Description 101
3.1 Aperçu du produit 101
3.2 Description du fonctionnement 101
3.3 Domaine d'application 102
3.4 Homologations 102
3.4.1 ATEX, IECEx, UL, CSA 102
3.4.2 Autres informations 102

4 Installation du transmetteur 103
4.1 Installation antidéflagrante (Ex d) - sans station d'accueil 103
4.1.1 Installation mécanique 103
4.1.2 Installation électrique 104
4.2 Installation avec sécurité augmentée (Ex e) - avec station d'accueil 106

5 Installation des capteurs ou des têtes de mesure 106
5.1 Installation du capteur EC sur le Polytron 8100 EC 106
5.2 Installation de la tête de mesure 107

6 Mise en service 107
6.1 Remarques générales 107
6.2 Mise en service du détecteur de gaz 107

7 Fonctionnement 108
7.1 Panneau de commande 108
7.2 LED et symboles 108
7.3 Affichages à l'écran 108
7.3.1 Tous les appareils 108
7.3.2 Symboles spécifiques au Polytron 8100 EC 108
7.3.3 Mode mesure 108
7.3.4 Statuts spéciaux 109
7.3.5 Terminer les status spéciaux 110
7.4 Mode Info et touche de fonction 110
7.4.1 Affichage du mode Info 110
7.4.2 Navigation en mode Info 110
7.4.3 Utiliser la touche de fonction 111
7.5 Menus 111
7.5.1 Navigation dans le menu 111
7.5.2 Affichage des menus 111
7.5.3 Mots de passe 111
7.5.4 Le menu Information 111
7.5.5 Vues d'ensemble des menus 112
7.6 Informations sur le fonctionnement avec un Dräger SensorAlive 115

8 Calibrage 115
8.1 Remarques générales 115
8.2 Gaz étalons 115
8.3 Débit de gaz pour les ajustages 115
8.4 Préparation de l'ajustage 116
8.5 Ajustage du point zéro 116
8.5.1 Généralités 116
8.5.2 Ajustage du point zéro 117
8.6 Calibrage sensibilité 117
8.6.1 Généralités 117
8.6.2 Ajustage sensibilité 117
8.7 Ajustage automatique 118
8.7.1 Généralités 118
8.7.2 Exécution de l'ajustage automatique 118

9 Dépannage 119
9.1 Défauts 119
9.2 Rapport d'Info 120

10 Maintenance 121
10.1 Réalisation d'un test au gaz et contrôle du temps de réponse (t90) 122
10.2 Remplacement du capteur 122
10.2.1 Polytron® 8100 EC 122
10.2.2 Polytron® 8200 CAT, 8310 IR, 87x0 IR 122
10.3 Exécution du test de l'écran 123

11 Réglages de l'appareil 123
11.1 Configuration des mots de passe 123
11.2 Réglage de la date et de l'heure 123
11.3 Réglage de la langue 123
11.4 Configuration de la touche de fonction 123
11.5 Réinitialisation des réglages par défaut 123
11.6 Modifier le contraste de l'affichage 123
11.7 Changer le mode d'affichage 124
11.8 Configuration d'un relais 124
11.8.1 Associations d'auto-maintien et d'acquittement d'alarme 124
11.8.2 Configuration du relais A1 ou A2 124
11.8.3 Réglage relais défaut période de stabilisation 1 .. 124
11.9 Configuration de l'alarme 124
11.9.1 Activer ou désactiver une alarme 124
11.9.2 Configuration des alarmes 124
11.9.3 Test des alarmes / relais 125
11.10 Configuration de l'enregistreur de données 125
11.10.1 Afficher le graphe 125
11.10.2 Activation/désactivation de l'enregistreur de données 125
11.10.3 Régler la période d'échantillonnage 125
11.10.4 Régler la valeur de pic/moyenne 126
11.10.5 Activation ou désactivation du mode de déclenchement 126
11.10.6 Régler la valeur de déclenchement 126
11.10.7 Réglage de la fonction Stack ou Roll 126
11.10.8 Vider l'enregistreur de données 126

12 Réglages de l'interface 126
12.1 Interface 4-20mA 126
12.1.1 Dépassement d'échelle 126

12.1.2 Réglage du signal d'erreur 126
12.1.3 Informations sur le signal d'avertissement 127
12.1.4 Pour activer ou désactiver le courant d'avertissement 127
12.1.5 Réglage de l'intervalle d'avertissement 127
12.1.6 Régler le courant d'avertissement 127
12.1.7 Réglage des avertissements du Dräger SensorAlive 127
12.1.8 Réglage du signal de maintenance 127
12.1.9 Réglage du courant de maintenance 127
12.1.10 Ajustage signal sortie 127
12.1.11 Ajustage signal sortie 127
12.1.12 Test de l'interface analogique 127
12.1.13 Beam Block 128
12.2 Interface HART 128
12.2.1 Définition de l'adresse de polling 128
12.2.2 Affichage de l'identificateur unique 129
12.2.3 Configuration du Tag HART 129
12.2.4 Configuration du protocole Dräger REGARD 129
12.3 Interfaces numériques 129

13 Configuration du capteur 129

13.1 Activation ou désactivation du calibrage automatique 129
13.2 Plage de capture 129
13.2.1 Réglage de la plage de capture 129
13.2.2 Désactivation de la plage de capture 129
13.3 Réinitialiser le capteur 129
13.4 Configuration période de calibrage 129
13.5 Réglage du verrouillage du capteur 130
13.6 Dongles logciels pour capteurs EC 130
13.6.1 Installation du dongle 130
13.6.2 Désactivation du dongle 130
13.7 Réglages du capteur sur le Polytron® 8100 EC 130
13.7.1 Autotest du capteur 130
13.7.2 Configuration du gaz 130
13.7.3 Configuration du Dräger SensorAlive 130
13.8 Réglages du capteur sur le Polytron® 8200 CAT / 8310 IR 131
13.8.1 Type de capteur 131
13.8.2 Configuration de gaz 131
13.8.3 Configuration du verrouillage du capteur DQ 131
13.9 Configuration du capteur Polytron 8310 IR 132
13.9.1 Modification de la catégorie du gaz 132
13.9.2 Modification de la catégorie du gaz 132
13.10 Réglages du capteur Polytron® 87x0 IR 132
13.10.1 Configuration de gaz 132

14 Réglages par défaut d'usine 133

14.1 Réglages fixes pour relais, LED et alarme 133
14.2 Configurations modifiables dans le menu 133
14.3 Valeurs spécifiques du capteur 134
14.3.1 Polytron 8100 EC 134
14.3.2 Polytron 8100 EC Avec capteurs O_2 134
14.3.3 Polytron 8100 EC avec Dräger SensorAlive 134
14.3.4 Polytron 8200 CAT DrägerSensor® DQ 134
14.3.5 Polytron 8200 CAT DrägerSensor® LC 135
14.3.6 Polytron 8310 IR 135
14.3.7 Polytron 8700 IR 135
14.3.8 Polytron 8720 IR 136

15 Élimination 136

16 Caractéristiques techniques 137

16.1 Plages de mesure 137
16.2 Transmission du signal vers la centrale de commande 137
16.3 Caractéristiques du câble 138
16.4 Alimentation électrique et relais 138
16.5 Spécifications générales 138
16.6 Paramètres ambiants 139
16.7 Couples de serrage 139

17 Accessoires et pièces détachées 139

17.1 Polytron® 8xx0 139
17.1.1 Station d'accueil 139
17.2 Polytron® 8100 EC 140
17.3 Polytron® 8200 CAT 140
17.3.1 Capteurs CAT 140
17.4 Polytron® 8310 IR 140
17.4.1 Capteurs DSIR 140
17.5 Polytron® 87x0 IR 141
17.5.1 Capteurs 141

18 Homologations de performance 141

18.1 Certificat d'essai UE, BVS 13 ATEX G 001 X 141
18.2 Certificat d'essai, PFG 14 G 001 X 142
18.3 Conditions de fonctionnement certifiées DrägerSensor O_2, O_2LS et Dräger SensorAlive 142
18.3.1 DrägerSensor O_2 (6809720) 142
18.3.2 DrägerSensor O_2LS (6809630) 143
18.3.3 Dräger SensorAlive (6814014) 143
18.4 Expertise métrologique FM pour DrägerSensor H_2S et H_2S LC 144

1 Informations relatives à la sécurité

La dernière édition de cette notice d'utilisation et la version de la notice dans d'autres langues peuvent être téléchargées dans la base de données de la documentation technique (www.draeger.com/ifu). En raison de la mise à jour des produits, Dräger recommande de toujours utiliser la dernière édition de la notice d'utilisation.

1.1 Consignes de sécurité

- Avant d'utiliser cet appareil, veuillez lire attentivement la présente notice d'utilisation et celles des produits correspondants.
- Observer scrupuleusement la notice d'utilisation. L'utilisateur doit comprendre complètement les indications et les exécuter très précisément. Utiliser l'appareil uniquement pour les applications et dans les conditions spécifiées dans ce document.
- Ne pas jeter la notice d'utilisation. Veillez à ce que les utilisateurs conservent et utilisent cette notice de manière adéquate.
- Seul un personnel formé et compétent est autorisé à utiliser ce produit.
- Aviser Dräger en cas du défaut ou d'une panne de tout composant.
- Respecter toutes les lois, règles et réglementations locales et nationales s'appliquant à cet appareil.
- Seul le personnel formé en conséquence peut contrôler, réparer et entretenir ce produit, comme décrit dans cette notice d'utilisation. Les opérations de maintenance qui ne sont pas décrites dans cette notice d'utilisation doivent exclusivement être exécutées par Dräger ou par le personnel spécialisé agréé par Dräger.
- Dräger recommande de souscrire un contrat de service avec Dräger pour tous les travaux de maintenance et de confier toutes les réparations à Dräger.
- Pour la maintenance, n'utiliser que des pièces et accessoires Dräger authentiques. Dans le cas contraire, le bon fonctionnement du produit ne pourrait plus être garanti.
- La maintenance doit être effectuée comme décrit, voir 10 Maintenance.
- N'utiliser le produit que si les risques encourus par l'environnement ont été évalués.
- Avant de connecter cet instrument à d'autres appareils électriques non mentionnés dans la notice d'utilisation, consulter Dräger
- Les instruments ou composants ne doivent pas être modifiés, de quelque manière que ce soit.
- L'utilisation de pièces défectueuses ou incomplètes n'est pas autorisée.
- Toujours observer la réglementation applicable lors des travaux de réparation effectués sur ces instruments ou composants.
- Ne pas ouvrir l’appareil pendant son utilisation.
- Respecter les dispositions correspondantes lors de la maintenance de ces appareils ou de ces composants.
- Observer les instructions indiquées dans EN 60079-29-2 relatives à la mesure des gaz inflammables et de l’oxygène.
- Observer les instructions indiquées dans EN 45544-4 relatives à la mesure des gaz toxiques.

Polytron® 8100 spécifique EC :

- **AVERTISSEMENT** : Risque d'incendie dans les atmosphères inflammables ou explosives ! Le remplacement de composants peut entraver la sécurité intrinsèque.

1.2 Domaine d’application et conditions d’utilisation

- Pour les applications SIL, tenir compte du manuel de sécurité du Dräger Polytron® 8xx0.
- Valable uniquement pour Polytron 8200 CAT : L’exposition à un flux d’air direct mélangé avec du gaz peut entraîner une augmentation des valeurs mesurées. Pour les valeurs différentes, voir la notice d’utilisation du capteur correspondant.
- Tenir compte des indications et restrictions des notices d’utilisation des capteurs utilisés.
- **ATTENTION** Risque d'incendie dans les atmosphères inflammables ou explosives ! Non testé dans les atmosphères enrichies en oxygène (>21 % d'O_2).
- **Utilisation du produit dans les environnements à risque d'explosion :** Les instruments ou les composants stipulés pour une utilisation dans des zones à risque d'explosion et ayant été testés et homologués selon les règlements nationaux, européens ou internationaux de protection contre les explosions peuvent seulement être utilisés dans les conditions spécifiées dans l'attestation et dans le respect des dispositions légales pertinentes.

Zones de danger, classées en sections :

- L’appareil est prévu pour être utilisé dans des zones de danger classées zone 1 ou zone 2, pouvant contenir des gaz des groupes d’explosion IIA, IIB ou IIC et des classes de températures T4 ou T6. Les classes de température dépendent de la température ambiante maximale. L’appareil ne doit pas être utilisé à la température ambiante si celle-ci est en-dehors de la plage indiquée sur l'appareil.
- L’appareil est prévu pour être utilisé dans les zones de danger 21 ou 22 pouvant contenir des poussières des groupes d’explosion IIIA, IIIB ou IIIC et des températures de poussière de T80 °C ou T130 °C (T135 °C pour Polytron 5100 EC et Polytron 8100 EC). Les températures de poussière dépendent de la température ambiante maximale. L’appareil ne doit pas être utilisé à la température ambiante si celle-ci est en-dehors de la plage indiquée sur l'appareil.

Zones de danger, classées par divisions :

– L'appareil est prévu pour être utilisé dans des zones de danger de classe I, Div. 1 ou Div. 2, pouvant contenir des gaz des groupes A, B, C, D et des classes de températures T4 ou T6. Les classes de température dépendent de la température ambiante maximale. L'appareil ne doit pas être utilisé à la température ambiante si celle-ci est en-dehors de la plage indiquée sur l'appareil.
– L'appareil est prévu pour être utilisé dans des zones de danger de classe II, Div. 1 ou Div. 2, pouvant contenir des poussières des groupes E, F, G. L'appareil ne doit pas être utilisé à la température ambiante si celle-ci est en-dehors de la plage indiquée sur l'appareil.

2 Conventions utilisées dans ce document

2.1 Signification des avertissements

Les avertissements suivants sont utilisés dans ce document ; ils signalent à l'utilisateur des dangers potentiels. Les avertissements sont définis comme suit :

Symbole d'avertissement	Mention d'avertissement	Classification de l'avertissement
⚠	AVERTISSEMENT	Indique une situation dangereuse potentielle. Si elle n'est pas évitée, elle peut entraîner de graves blessures ou la mort.
⚠	ATTENTION	Indique une situation dangereuse potentielle. Si elle n'est pas évitée, elle peut entraîner des blessures physiques. Peut également signaler des pratiques à risque.
	REMARQUE	Indique une situation dangereuse potentielle. Si elle n'est pas évitée, elle peut entraîner des dommages produits ou environnementaux.

2.2 Marques

Marque	Propriétaire de la marque
PROFIBUS®	PROFIBUS Nutzerorganisation e. V.
HART®	HART Communication Foundation
Polytron®	Dräger Safety AG & Co. KGaA
DrägerSensor®	Dräger Safety AG & Co. KGaA

Vous trouverez sur la page internet suivante les pays dans lesquels les marques de Dräger sont déposées : www.draeger.com/trademarks.

3 Description

3.1 Aperçu du produit

Voir les figures de la page dépliante

A 1	Couvercle du boîtier
A 2	Vis de réglage (vis creuse six pans 2 mm)
A 3	Étrier
A 4	Carte de circuit imprimé (et relais en option)
A 5	Embase du boîtier
A 6	Raccord pour le capteur
A 7	Presse-étoupe
A 8	Station d'accueil
A 9	Appareil antidéflagrant
A 10	Appareil antidéflagrant avec station d'accueil pour une sécurité renforcée
A 11	Appareil antidéflagrant avec entretoise (pour Polytron 87x0 IR seulement)
A 12	Entretoise (pour Polytron 87x0 IR seulement)
B	Montage de test pour ajustage
C	Polytron 8100 EC
D	Raccord pour dongle du capteur (Polytron 8100 EC seulement)
E 1	Polytron 8200 CAT
E 2	Polytron 8310 IR
F 1	Polytron 8710 IR avec protection anti-éclaboussures
F 2	Polytron 8710 IR sans protection anti-éclaboussures

3.2 Description du fonctionnement

La série Polytron 8000 comprend les variantes d'appareils suivantes :

– Polytron 8100 EC, fonctionne avec des capteurs électrochimiques (capteurs EC).
– Polytron 8200 CAT, fonctionne avec des capteurs Ex catalytiques (capteurs CatEx//capteurs catalytiques, capteurs Dräger DQ ou LC).
– Polytron 8310 IR, fonctionne avec des capteurs Ex à infrarouge (capteurs IREx).
– Polytron 8700 IR, fonctionne avec des capteurs à infrarouge (capteurs PIR 7000).
– Polytron 8720 IR, fonctionne avec des capteurs à infrarouge (capteurs PIR 7200).

Interfaces disponibles :

– 4 à 20 mA analogique (recommandation NAMUR NE43)
– Plaque de relais
– Signal de sortie numérique HART
– Foundation Fieldbus[1)]
– PROFIBUS PA[1)]
– Modbus RTU[1)]

Si l’interface 4 à 20 mA est utilisée, surveiller l’intensité électrique entre 0 et 3,5 mA. Des intensités électriques entre 0 et 3,5 mA peuvent indiquer un statut spécial (Voir "Statuts spéciaux", page 109).

Si une plaque de relais est utilisée, des dispositifs d’alarme peuvent être activés localement. Si aucune plaque de relais n’est utilisée, une alarme n’entraîne que le clignotement de la LED rouge de l’appareil.

Les concentrations de gaz, les informations d'état et le menu déroulant sont affichés sur un écran LCD rétroéclairé et 3 LED de couleur.

Pour naviguer à l’intérieur du menu, appuyer sur la touche correspondante de la vitre du couvercle du boîtier en verre avec une baguette magnétique. L’appareil peut être configuré, ajusté et entretenu de manière non intrusive sans avoir besoin de déclasser la zone.

Les appareils livrés sont dotés d'un enregistreur de données. Il peut conserver jusqu’à 35 000 valeurs. Avec un intervalle d’échantillonnage d’une mesure par minute, l’enregistreur conserve l’historique des mesures d’environ 24 jours. Cette durée peut être considérablement prolongée si la fonction Trigger est activée. Le dispositif peut uniquement être téléchargé avec le logiciel PC PolySoft. La lecture génère un fichier .ofb et un fichier .txt. Le fichier .txt contient les informations de l’enregistreur de données sous une forme lisible.

Les appareils peuvent être connectés à une centrale de commande Dräger ou à un automate programmable industriel (API) avec une conduite scellée ou un presse-étoupe agréé.

Les appareils peuvent être utilisés comme source ou réception de courant si l’alimentation électrique est fournie par la centrale de commande. Si les appareils sont connectés à une alimentation électrique séparée, ils ne peuvent être utilisés que comme source de courant.

Le boîtier des appareils en acier inoxydable robuste ou en aluminium convient aux applications intérieures et extérieures.

Les appareils sont conçus pour une installation fixe. Versions disponibles :

– Appareil antidéflagrant (Ex d)
  Le boîtier antidéflagrant encapsulé étanche à la pression présente trois raccords avec filetage NPT ¾" pour le câblage de terrain, la connexion directe d'un capteur ou le câblage d’un capteur déporté.
– Appareil à sécurité renforcée (Ex e)
  La sécurité de l’appareil est renforcée par un bornier (station d'accueil) comprenant jusqu’à quatre raccords 20 mm pour le câblage de terrain ou d’un capteur déporté. Si le presse-étoupe de Dräger est utilisé, le diamètre de câble autorisé est de 7 à 12 mm.

Dongles disponibles pour le Polytron 8100 EC :

Dongle de test capteur	Active l’autotest du capteur (incompatible avec le capteur d'hydrazine 6810180)
Dongle Diagnostics	Active l’auto-test, l’affichage de la vitalité et les fonctions de diagnostic du capteur (incompatible avec le capteur Hydrazine 6810180)

3.3 Domaine d'application

Les appareils de la série Polytron 8000 sont prévus pour la surveillance continue de l’air ambiant.

Avec le module relais intégré en option, l’appareil peut fonctionner sans centrale de commande (avec déclenchement local de l’alarme).

L’appareil peut être connecté à une centrale de commande Dräger ou à un automate programmable industriel (API) avec une conduite scellée ou un presse-étoupe agréé.

Si l’interface 4 à 20 mA est utilisée, l’intensité électrique entre 0 et 3,5 mA doit être surveillée. Des intensités électriques entre 0 et 3,5 mA peuvent indiquer un statut spécial.

Les appareils sont conçus pour une installation fixe et homologués pour une utilisation en zones Ex.

– Le Polytron 8100 EC est un appareil antidéflagrant combiné à sécurité intrinsèque destiné à la surveillance continue des gaz toxiques ou de l’oxygène dans l’air ambiant.
– Le Polytron 8200 CAT avec DrägerSensor catalytique DQ ou LC est un appareil antidéflagrant conçu pour la surveillance continue de gaz et vapeurs combustibles de l’air ambiant contenant des substances hydrocarbures ou non (comme l’hydrogène ou l’ammoniac).
– Le Polytron 8310 IR avec capteur infrarouge DrägerSensor IR est un appareil antidéflagrant destiné à la surveillance continue des gaz et vapeurs inflammables de l’air ambiant contenant des hydrocarbures.
– Le Polytron 8700 IR avec PIR 7000 est un appareil antidéflagrant destiné à la surveillance continue des gaz et vapeurs inflammables de l’air ambiant contenant des hydrocarbures.
– Le Polytron 8720 IR avec PIR 7200 est un appareil antidéflagrant destiné à la surveillance continue du dioxyde de carbone dans l’air ambiant.

3.4 Homologations

3.4.1 ATEX, IECEx, UL, CSA

Un exemple de plaque signalétique est illustré sur la page dépliante. De plus, une image de la plaque signalétique se trouve dans l’emballage d’expédition de l’appareil.

3.4.2 Autres informations

Déclaration de conformité, voir le Complément 4544300 ou www.draeger.com/product-certificates

Vous trouverez de plus amples informations sur les homologations dans le Complément 4544300.

1) Aucun relais n’est disponible avec une interface bus de terrain. L’interface bus de terrain n’est pas conforme à BVS 13 ATEX G 001 X. DrägerSensorAlive n’est pas pris en charge.

4 Installation du transmetteur

4.1 Installation antidéflagrante (Ex d) - sans station d'accueil

4.1.1 Installation mécanique

4.1.1.1 Remarques générales sur l'installation mécanique

– Respecter strictement les règles et réglementations locales, fédérales et nationales relatives à l'installation de systèmes de détection de gaz.
– Tenir compte des données physiques du gaz ou de la vapeur à détecter et des spécificités de l'application, (par ex. fuites possibles, mouvement d'air/courant d'air, etc.).
– Prendre en compte l'utilisation future des accessoires et des équipements de maintenance.
– La libre circulation du gaz ou de la vapeur vers le capteur ne doit pas être entravée.
– L'appareil ne doit pas être exposé à une chaleur radiante entraînant une augmentation de la température supérieure aux limites indiquées (16.6 Paramètres ambiants). L'utilisation d'un blindage écran est recommandée.
– L'entrée de la conduite de l'appareil peut être équipée d'un cache anti-poussière. Ce cache n'est ni antidéflagrant ni étanche à l'eau et doit être retiré avant de connecter l'appareil à une conduite scellée ou d'installer 'un presse-étoupe ignifuge.
– Poser des bouchons sur les ouvertures non utilisées. Les couples de serrage des connexions des conduites, des presse-étoupes, des obturateurs et du capteur sont détaillés ici : 16.7 Couples de serrage.
– Pour les installations hors conduite, utiliser un presse-étoupe agréé (par ex. Hawke A501/421/A/filetage ¾" NPT ou équivalent).
– **AVERTISSEMENT :** pour installations avec conduites seulement : Pour réduire le risque d'incendie dans des atmosphères dangereuses, sceller les premiers 45 cm (18 pouces) de la conduite à partir du boîtier.
– **ATTENTION :** Si le détecteur de gaz est connecté à des centrales de commande, le temps de réponse total peut être différé. La course de mesure complète doit être prise en compte (p. ex. la latence de la centrale de commande). Vérifier que le temps de réponse requis est respecté.

Polytron® 8100 spécifique EC :

– Orientation du capteur recommandée : vers le bas (voir figure C de la page dépliante).

Polytron® 8200 spécifique CAT :

– Orientation du capteur recommandée : vers le bas (voir figure E de la page dépliante). Si l'entrée du capteur est protégée contre les dommages mécaniques et la pénétration de saletés et d'eau, il peut être orienté dans toutes les directions.
– Pour le fonctionnement conformes CSA seulement : L'utilisation de la protection anti-éclaboussures (6812510) en option est obligatoire pour se conformer à l'homologation CSA.

Polytron® 8310 spécifique IR :

– Orientation du capteur recommandée : vers le bas (voir figure E de la page dépliante).

Polytron® 87x0 spécifique IR :

– Respecter l'orientation recommandée du capteur Dräger PIR 7x00 (voir figure F de la page dépliante). Un écart plus important et l'utilisation de la protection anti-éclaboussures préinstallée augmenteront le temps de réponse (voir notice d'utilisation du PIR 7x00).
– Le PIR 7x00 ne peut être orienté autrement que s'il est utilisé sans protection anti-éclaboussures, par exemple pour les applications dans des conduites de ventilation. Installer le capteur verticalement peut augmenter l'accumulation de dépôts sur les surfaces optiques.
– L'utilisation de la protection anti-éclaboussures préinstallée est recommandée pour protéger le capteur de l'eau et de la poussière.
– Lorsque la protection anti-éclaboussures préinstallée (référence de pièce 6811911 ou 6811912) est installée, vérifier que les voyants d'état sont alignés verticalement et que le logo Dräger est à l'horizontal. Un écart maximal de ±30 degrés par rapport à l'horizontale est acceptable.
– Les liquides et dépôts sur les surfaces optiques du PIR 7x00 peuvent entraîner le déclenchement d'un avertissement ou d'un défaut.
– Pour la version antidéflagrante, il est recommandé d'utiliser une entretoise (référence de pièce 6812617) si l'appareil est monté au mur ou sur une surface plane.

Conditions particulières selon la norme EN/IEC 60079-1

– Les filetages pour capsule antidéflagrante/étanche à la pression ne sont pas conformes aux valeurs minimales/maximales de la norme EN/IEC 60079-1. Les filetage ne sont pas prévus pour être modifiés par l'utilisateur.

4.1.1.2 Installation

L'appareil peut être fixé pour mesurer des gaz dans l'air ambiant ou à l'intérieur d'une conduite de ventilation / d'un tuyau.

1. Utiliser des boulons M6 (1/4") avec des vis à tête hexagonale pour monter le boîtier sur l'une des options suivantes.

Option	Accessoires
Montage sur surface plane	Gabarit de perçage : 4544300 Supplément pour Polytron 87x0 IR : entretoise 6812617
Montage sur poteau	Kit de montage sur poteau : 4544198
Montage dans un tube/une conduite de ventilation	Kit de montage sur conduite : 6812725 Pour Polytron® 87x0 IR :: 6812300

4.1.2 Installation électrique

4.1.2.1 Remarques générales sur l’installation mécanique

– Pour les couples de serrage, voir 16.7, pour les spécifications de câble autorisées, voir 16.3.
– Les codes en matière d'électricité régissant la mise en place et la connexion du courant électrique et des câbles de signalisation vers les équipements de surveillance doivent être strictement observés.
– L'utilisation d'embouts est obligatoire.
– Les conducteurs de l'alimentation électrique doivent avoir une résistance suffisamment faible afin de garantir l'alimentation électrique correcte de l'instrument.
– L'isolation du câble doit être dénudée de 5 à 7 mm.
– Le circuit électrique secondaire doit être séparé galvaniquement du circuit du réseau (ne s’applique pas aux circuits des relais).
– En cas d'installation sur des sites dont la température ambiante est supérieure à 55 °C, utiliser uniquement le câblage approprié, spécifié pour une température supérieure d'au moins 25 °C à la température ambiante maximale.
– N’utiliser que des presse-étoupes adaptés à l’application et homologués dans le pays où l’équipement est installé.
– Conformément à la directive européenne 2014/30/UE, cet appareil ne doit pas être raccordé à un réseau d’alimentation en courant continu. Il est recommandé de mettre en place une alimentation électrique propre à l’appareil.

Interface analogique

– Pour garantir un fonctionnement correct de l’appareil, la résistance de la boucle de signaux de 4 à 20 mA ne doit pas dépasser 500 ohms.
  En cas d’utilisation conformément au test d’aptitude métrologique selon EN IEC 62990-1, EN IEC 60079-29-1 ou EN 50104, la résistance ne doit pas dépasser 300 ohms. Pour des valeurs supérieures à 300 ohms, la surveillance de la tension d’alimentation ne peut pas être garantie.
  En fonction de la tension de fonctionnement et de l’application (p. ex. opération HART®), respecter une résistance minimale (Voir "Transmission du signal vers la centrale de commande", page 137).

Option de relais

– Pour les tensions > 30 V CA ou > 42,4 V CA, on recouvrira les lignes de relais avec une gaine de protection ou on utilisera des lignes à double isolation.
– Les câbles de raccord au module de relais en option doivent être sélectionnés et sécurisés en fonction des tensions de mesure, des intensités électriques et des conditions ambiantes.
– Pour garantir la détection des défauts, sans devoir consulter le dispositif, un système d'alarme doit être connecté au relais de défaut.
– Les différences de tension peuvent provoquer des défauts au niveau de l'isolement. Ne pas mélanger différentes charges électriques avec différents types de tension (AC ou DC). Lors de l'utilisation de charges DC, s'assurer que les contacts de relais ne contrôlent que les dispositifs qui partagent la même tension DC. Lors de l'utilisation de charges AC, s'assurer que les contacts de relais ne sont connectés qu'aux dispositifs qui partagent la même phase.

Conditions particulières selon la norme IEC 60664-1

– Les variantes d’appareils qui utilisent à la fois une interface de bus de terrain FISCO et un transmetteur de gaz ETR 02...5** doivent être alimentées par des circuits électriques protégés contre les surtensions de catégorie I/II/III selon la norme IEC 60664-1.

4.1.2.2 Schémas de raccordement

Les schémas de raccordement suivants sont présentés sur les pages dépliantes :

Figure	Schéma de raccordement des appareils
G	Sans relais, mise à la terre du boîtier
H	Avec relais, mise à la terre du boîtier
I1	4-20 mA / HART (source de courant)
I2	4-20 mA / HART (réception de courant)
I3	4-20 mA / HART (alimentation électrique séparée, source de courant)
H1	Autonome, relais uniquement
J	Foundation Fieldbus / PROFIBUS PA, mise à la terre du boîtier
V	Modbus RTU, mise à la terre du boîtier
J1	Foundation Fieldbus / PROFIBUS PA, câblage de terrain
K1	Modbus RTU, câblage de terrain
L	Interfaces numériques de l’alimentation électrique

4.1.2.3 Tableaux de câblage

Interface 4 à 20 mA / HART

Broche	Marquage	Fonction
1	PWR+	V+
2	PWR-	V-
3	PWR-	V- À utiliser lorsque l’appareil est raccordé à une alimentation électrique séparée (fonctionnement comme source).
4	4 à 20 mA	Signal 4 à 20 mA (fonctionnement comme source ou réception)
5	PE	Terre de protection En option pour le raccordement des relais. La raccordement de la terre de protection à une sortie analogique 4 à 20 mA peut causer des boucles de terre.

Interface bus de terrain

Broche	Marquage	Fonction
1	Données A	Acheminement du signal A
2	Données B	Acheminement du signal B
3	GND	Mise à la terre
4	BLINDAGE	Blindage de câble

Broche	Marquage	Fonction
1	PWR+	V+
2	PWR-	V-

Connecteur de relais

ℹ Tous les relais (A1, A2, FLT) de l'appareil peuvent être configurés comme « normalement excités » (relais de courant de repos) ou « excités en cas d'alarme » (relais de courant de travail). En usine, les relais sont configurés comme des relais de courant de repos (« normalement excités »). Ceci garantit une utilisation à « sûreté intégrée ».
Contrairement aux conventions, les marquages NO, COM, NC sur l'appareil sont choisis pour correspondre à un état normalement excité. Lorsque l'appareil est sous tension, le marquage correspond à la fonction des broches.

Broche	Marquage		Relais	
1	NO	FLT	Défaut	Contact de travail (Normally Open)
2	COM		Défaut	Raccordement commun (Common)
3	NC		Défaut	Contact de repos (Normally Closed)
4	NO	A2	A2	Contact de travail (Normally Open)
5	COM		A2	Raccordement commun (Common)
6	NC		A2	Contact de repos (Normally Closed)
7	NO	A1	A1	Contact de travail (Normally Open)
8	COM		A1	Raccordement commun (Common)
9	NC		A1	Contact de repos (Normally Closed)

4.1.2.4 Préparation de l'installation électrique

1. Desserrer la vis de réglage (2) et dévisser le couvercle du boîtier de la partie inférieure du boîtier, voir la figure A de la page dépliante.
2. Sortir la carte de circuit imprimé.
3. Suivre les indications sur la figure comprenant le modèle Polytron® et la sortie de signal, voir la page dépliante.

4.1.2.5 Raccordement de l'appareil avec relais (autonome)

Les câbles des dispositifs d'alarme doivent être connectés au raccord de relais à 9 broches. Une isolation de câble (gaine thermorétractable) et une enveloppe protectrice fournies assurent la protection supplémentaire des câbles du relais.

1. Retirer le connecteur à 5 broches.
2. Connecter les câbles d'alimentation aux bornes correspondantes, voir la figure H1 de la page dépliante.
3. Ponter les broches 3 et 4 du connecteur à 5 broches.
4. Retirer le connecteur à 9 broches.
5. Couper la gaine thermorétractable à la longueur désirée et l'enfiler sur les câbles du relais avant d'insérer le connecteur à 9 broches.
6. Positionner la gaine thermorétractable sur le bord de l'isolation de câble puis utiliser un pistolet à air chaud avec précaution pour la faire se rétracter sur l'isolation du câble.
7. Faire glisser l'enveloppe protectrice sur les câbles.
8. Connecter les câbles des alarmes 1 (pré-alarme), 2 (alarme principale) et de défaut aux bornes, comme indiqué dans le tableau de câblage.
9. Rebrancher le connecteur sur la prise et serrer les vis.
10. Fermer l'appareil, voir 4.1.2.9 Fermeture du détecteur de gaz.

Les tableaux suivants indiquent le statut d'un indicateur d'alarme connecté et s'il indique des défaut (par exemple, une panne de courant sur le détecteur de gaz).

Le comportement du relais dépend de la configuration des alarmes et du contact du relais auquel l'indicateur d'alarme est connecté.

Configuration des relais : Normalement excité

Contact	Statut de l'indicateur d'alarme et indication de défaut par celui-ci		
	Alarme déclenchée	Défaut spécifique au détecteur de gaz	Défaut du câblage de terrain
Contact de repos (Normally Closed)	MARCHE	indiqué	non indiqué
Contact de travail (Normally Open)	ARRÊT	indiqué	indiqué

Configuration des relais : Excité en cas d'alarme

Contact	Statut de l'indicateur d'alarme et indication de défaut par celui-ci		
	Alarme déclenchée	Défaut spécifique au détecteur de gaz	Défaut du câblage de terrain
Contact de repos (Normally Closed)	ARRÊT	non indiqué	indiqué
Contact de travail (Normally Open)	MARCHE	non indiqué	non indiqué

4.1.2.6 Raccordement de l'interface 4-20 mA/HART®

Vous trouverez des informations sur le raccordement à une centrale de commande (API) dans sa documentation.

1. Retirer le connecteur à 5 broches.
2. Raccorder les trois fils pour la tension et le signal à la borne correspondante conformément au tableau de câblage et à l'illustration.
3. Rebrancher le connecteur sur la prise et serrer les vis.
4. Fermer l'appareil, voir 4.1.2.9 Fermeture du détecteur de gaz.

4.1.2.7 Mise à la terre

1. Mettre localement à la terre l'instrument sur la crosse de terre, voir les figures G et H de la page dépliante..
2. Connecter le blindage des câbles uniquement à la prise de terre du système de commande (par ex. le châssis, la barre omnibus de terre, etc.).

ℹ À moins que des mesures spéciales soient prises (p.ex. mise à la terre capacitive), le blindage doit être connecté à l'autre extrémité.

Les documents suivants contiennent de plus amples informations sur la mise à la terre des connexions bus de terrain et Modbus.

Interface	Document
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

4.1.2.8 Connexion de l'interface bus de terrain

1. Retirer le connecteur à 2 et à 4 broches.
2. Connecter les deux câbles électriques et les quatre câbles de signalisation aux bornes correspondantes comme indiqué sur le tableau et la figure.
3. Rebrancher le connecteur sur la prise et serrer les vis.
4. Fermer l'instrument, voir 4.1.2.9 Fermeture du détecteur de gaz.

Pour obtenir de plus amples renseignements concernant l'installation de l'interface bus de terrain, consulter le Manuel technique correspondant.

4.1.2.9 Fermeture du détecteur de gaz

1. Vérifier que les connexions suivantes sont établies correctement :
   a. Les vis de câblage sont serrées avec le bon couple de serrage.
   b. Tous les connecteurs de câble sont sécurisés par des vis.
   c. La pièce de raccordement est branchée.
   d. Le câble de mise à la terre venant du boîtier est connecté à l'œillet de la carte de circuit imprimé, voir les figures G et H de la page dépliante.
2. Mettre la carte de circuit imprimé dans la partie inférieure du boîtier.
3. Visser le couvercle du boîtier sur la partie inférieure du boîtier et serrer au couple correct.
4. Serrer fermement la vis de réglage.

4.2 Installation avec sécurité augmentée (Ex e) - avec station d'accueil

L'installation à sécurité renforcée (Ex e) est décrite dans la notice de montage de la station d'accueil (référence de pièce 9033242).

5 Installation des capteurs ou des têtes de mesure

5.1 Installation du capteur EC sur le Polytron 8100 EC

Voir la figure C de la page dépliante.

1. Desserrer la vis de blocage (2) (vis creuse six pans 2 mm).
2. Dévisser l'anneau à baïonnette (3) et retirer le joint plein.
3. Insérer le capteur (4) dans l'ouverture et le tourner jusqu'à ce qu'il s'enclenche dans le détecteur de gaz. Veiller à ne pas endommager la fiche du capteur.
4. Sécuriser le capteur avec l'anneau à baïonnette (3) correspondant.

ℹ Le Dräger SensorAlive requiert un anneau à baïonnette différent des autres capteurs EC.

5. Serrer la vis de blocage (2) jusqu'à ce que l'anneau à baïonnette ne puisse pas être desserré (obligatoire pour les installations en zone 22).

ℹ Si le Dräger SensorAlive est installé pour la première fois dans une installation, vérifier que la version de son micrologiciel est 4.0.0 ou supérieure. Contacter Dräger en cas de besoin.

5.2 Installation de la tête de mesure

Différentes têtes de mesure sont utilisées en fonction du type de protection contre l'explosion. La notice de chaque tête de mesure comprend des informations sur son installation.

Pour les applications déportées, le blindage du câble doit être posé à la fois du côté du capteur et du côté du transmetteur. La longueur du câble doit être inférieure ou égale à 30 m.

Versions déportées avec protection contre l'explosion « antidéflagrante (Ex d) »

Transmetteur	Références de pièce de la notice d'utilisation de la tête de mesure
Polytron 8100 EC	Tête de mesure EC déportée (9033247)
Polytron 8200 CAT (pour capteurs DQ)	Capteur déporté DQ NPT aluminium, capteur déporté DQ NPT acier (4544286)
Polytron 87x0 IR	PIR 7000 déporté (334) avec boîtier de raccordement du capteur acier inoxydable ou aluminium (4544286)
Polytron 8200 CAT (pour capteurs LC) Polytron 8310 IR Polytron 87x0 IR	Boîtier de raccordement du capteur en acier inoxydable ou aluminium (4544286)

Versions déportées avec protection contre l'explosion « Sécurité renforcée (Ex e) »

Transmetteur	Références de pièce de la notice d'utilisation de la tête de mesure
Polytron 8100 EC	Tête de mesure EC déportée (9033247)
Polytron 8200 CAT	Têtes de mesure Polytron SE Ex (9033888)
Polytron 8310 IR	DrägerSensor IR (9023843)
Polytron 87x0 IR	PIR 7x00 (9023885)

6 Mise en service

6.1 Remarques générales

– Connecter d'abord les fils pour les relais et établir les connexions pour le capteur avant de connecter l'appareil à l'alimentation électrique.
– Avant d'activer le mode de fonctionnement normal de l'appareil, vérifier que les réglages de configuration et d'ajustage sont corrects.

Pour garantir un fonctionnement sûr conformément à BVS 13 ATEX G 001 X et PFG 14 G 001 X, conserver les paramètres d'alarme par défaut de l'appareil suivants.

– Les relais doivent être réglés sur ***Normal actif*** et l'alarme A2 (alarme principale) sur ***Auto-maintien*** et ***Non-acquittable*** ou ***Pre-acquittement***.
– L'alarme A1 (pré-alarme) ne doit être réglée sur ***Acquittable*** que si elle est utilisée pour commander un dispositif d'alarme sonore.
– Verrouillage en cas de dépassement de la plage de mesure (Voir "Configuration du verrouillage du capteur DQ", page 131).

Pour garantir un fonctionnement sûr conformément à BVS 13 ATEX G 001 X et PFG 14 G 001 X, il faut observer les conditions suivantes :

– Polytron 8200 CAT :
  – En cas d'écoulement d'air contenant des gaz de mesure du capteur DQ ou LC, les valeurs mesurées peuvent augmenter jusqu'à 32 %.
  En cas d'utilisation avec l'adaptateur de calibrage à distance DQ, cette augmentation peut aller jusqu'à 70 %.
  – Le transmetteur avec capteur LC doit être utilisé en combinaison avec une unité de contrôle qui signale de manière auto-maintenue un dépassement de la plage de mesure. Ne pas utiliser les relais d'alarme interne du transmetteur.
  – Le transmetteur avec capteur LC doit être ajusté avec celui-ci dans sa position d'utilisation normale.
  – De fausses alarmes peuvent se produire pendant le temps de préchauffage du capteur LC.
– Polytron 8100 EC :
  Le temps de réglage t20 des transmetteurs avec capteur EC peut dépasser la valeur limite de la norme EN 50104 en cas de faibles variations de concentration.

6.2 Mise en service du détecteur de gaz

1. Pour éviter les fausses alertes, désactiver l'alarme du détecteur de gaz (Voir "Activer ou désactiver une alarme", page 124).
2. Mettre l'appareil sous tension.
   ⇒ L'appareil passe par une séquence de démarrage (test LCD/LED, version du logiciel et initialisation).
   ⇒ L'écran indique que le capteur est prêt pour la mesure dans hh:mm:ss (compte à rebours). L'appareil transmet le signal de maintenance. Le relais de défaut est activé.
   ⇒ Le capteur se stabilise. Le signal de maintenance sur l'interface 4 à 20 mA demeure jusqu'à ce que le capteur soit stabilisé. Le temps de stabilisation dépend du capteur et des conditions ambiantes. Temps de stabilisation maximal d'un nouveau capteur : voir sa notice d'utilisation.

3. Contrôler la date et l'heure. Les réglages peuvent être effectués pendant le temps de stabilisation du capteur.
   ⇒ Après le temps de stabilisation du capteur, l'appareil passe en mode de fonctionnement normal. L'écran affiche la concentration de gaz actuelle, l'unité de mesure et, le cas échéant, le gaz sélectionné. La LED verte est allumée.

   Si l'appareil est utilisé avec un Dräger SensorAlive, Dräger recommande de régler correctement la date et l'heure. Lorsque le temps de stabilisation du capteur est écoulée, le temps de démarrage du Dräger SensorAlive commence. Pendant cette phase, le capteur est prêt pour la mesure, mais l'autodiagnostic n'a pas encore lieu.

4. Si nécessaire, ajuster l'appareil.
5. Activer l'alarme du détecteur de gaz (Voir "Activer ou désactiver une alarme", page 124).

7 Fonctionnement

7.1 Panneau de commande

Composants du panneau de commande :
– Touches de navigation dans le menu
– Écran
– LED et symboles correspondants

Les touches de navigation ont des fonctions différentes selon le menu dans lequel vous vous trouvez.

L'appareil est actionné par une baguette magnétique. Pour cela, le couvercle du boîtier doit être placé sur l'appareil. Sinon, la baguette magnétique peut activer deux ou plusieurs touches la fois (activation croisée).

7.2 LED et symboles

Symboles et LED du panneau de commande :

Symbole	LED	Description
	Rouge	Alarme déclenchée
⚠	Jaune	Dysfonctionnement
	Vert	Sous tension

Statut LED
– Lorsque l'alarme A1 (pré-alarme) a été déclenchée, la LED rouge clignote une fois .
– Lorsque l'alarme A2 (alarme principale) a été déclenchée, la LED rouge clignote deux fois .
– Si une alarme a été acquittée avant que la cause n'ait été corrigée, la LED rouge s'allume en continu pour indiquer la présence d'un problème.

7.3 Affichages à l'écran

7.3.1 Tous les appareils

Symbol	Explication
	Message d'erreur actif. Le menu ***Information*** contient de plus amples informations.
	Message d'avertissement actif. Le menu ***Information*** contient de plus amples informations.
	Le signal de maintenance est transmis.
	La valeur maximale de la plage de mesure réglée est dépassée sur l'interface 4 à 20 mA.
	La valeur inférieure de la plage de mesure réglée n'est pas atteinte sur l'interface 4 à 20 mA.
	L'opération HART® est activée. L'interface analogique est réglée sur une valeur fixe et ne transmet aucun signal de mesure.
	Dès que la capacité de l'enregistreur de données est épuisée, les anciennes données sont écrasées par de nouvelles valeurs (fonction « roll »).
	Dès que la capacité de l'enregistreur de données est épuisée, aucune nouvelle valeur n'est enregistrée (fonction « stack »).
SIL	Le mode de fonctionnement SIL est activé.

7.3.2 Symboles spécifiques au Polytron 8100 EC

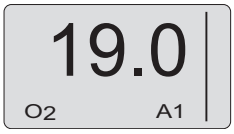
Symbol	Explication
	Le capteur est opérationnel.
	Le capteur est opérationnel, mais sa durée de vie est pratiquement épuisée.
	Le capteur est encore opérationnel, mais il devrait être remplacé le plus tôt possible. Vitalité <25 %.
LT	Un LifeTest du Dräger SensorAlive est en cours d'exécution.

7.3.3 Mode mesure

Les exemples suivants montrent l'affichage du Polytron 8100 EC.

Pour le Polytron 8200 CAT et le Polytron 8310 IR, aucun nom de gaz n'est prédéfini. Les noms de gaz doivent être saisis via le logiciel PC DrägerPolysoft. Si certains paramètres ont été modifiés avec le logiciel PC DrägerPolysoft ou un autre logiciel, relire tous les paramètres à partir du Polytron® 8xx0 ou les vérifier directement sur l'appareil.

Affichage en mode mesure :

Exemple d'affichage	Description
	En mode normal de fonctionnement, l'affichage montre la concentration de gaz mesurée, le gaz sélectionné et l'unité de mesure. **Interface analogique :** valeur de courant correspondante **Relais :** tous les relais sont à l'état normal
	Dépassement des seuils d'alarme. L'exemple montre la préalarme A1. **Interface analogique :** valeur de courant correspondante **Relais :** le relais A1 est à l'état d'alarme.

7.3.4 Statuts spéciaux

Si l'appareil se trouve dans un état spécial, la validité de la mesure ou de l'alarme ne peut plus être garantie.

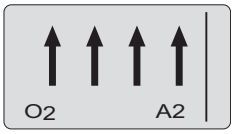
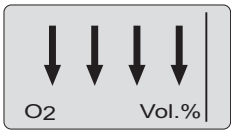
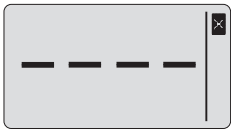
Cela est le cas :

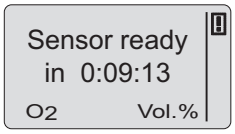
- Lorsque la concentration en gaz dépasse la plage de mesure.
- Lorsqu'un défaut survient.
- Lorsque des alarmes sont désactivées.
- Lorsque des ajustages sont effectués.
- Lorsque des tests au gaz sont effectués.
- Lorsqu'un capteur est en phase de stabilisation.
- Lorsque le système est mode maintenance.
- lorsqu'un Dräger SensorAlive est utilisé et que le système est configuré de manière à ce que la valeur de mesure ne soit pas émise pendant un LifeTest.

Pour l'intensité électrique de l'interface analogique correspondant au signal analogique, voir 16.2.

Les documents suivants détaillent les signaux des interfaces numériques.

Interface	Document
PROFIBUS PA	9033782
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

Exemple d'affichage	Description
	**La valeur dépasse la plage de mesure** La concentration en gaz se situe hors de la plage de mesure du capteur[1]. **Interface analogique :** Dépassement de la plage de mesure **Relais :** commutateur de relais A2 ***Remarques relatives aux Polytron 8200 et 8310 :*** le message indiquant que la plage de mesure a été dépassée peut également être causé par un court-circuit ou une interruption de la ligne reliée au capteur déporté.
	**La valeur est en dessous de la plage de mesure** La concentration en gaz se situe en dehors de la plage de mesure du capteur. **Interface analogique :** Dérive en-dessous de zéro **Relais :** commutateur de relais de défaut
	**Voyant de défaut** Le symbole ⊠ s'affiche sur le côté droit. **Interface analogique :** Courant de défaut **Relais :** Commutateur de relais de défaut
	**Voyant de maintenance** Le symbole 🔧 s'affiche sur le côté droit. Il est affiché lorsque les alarmes sont désactivées, pendant les ajustages, le test au gaz et les interventions de maintenance. **Interface analogique :** courant de maintenance **Relais :** aucune modification
	**Voyant d'avertissement** Le symbole ▯ s'affiche sur le côté droit. **Interface analogique :** courant d´avertissement[2] **Relais :** aucune modification

Exemple d'affichage	Description
	**Phase de stabilisation 1** Le symbole ▯ s'affiche sur le côté droit. Le temps restant est indiqué sur le côté gauche. **Interface analogique :** courant de maintenance **Relais :** commutateur de relais de défaut Pendant la phase de stabilisation 1, le fonctionnement du relais de défaut est configurable (Voir "Réglage relais défaut période de stabilisation 1", page 124)
	**Phase de stabilisation 2** Le symbole ▯ s'affiche sur le côté droit. La valeur mesurée est indiquée sur le côté gauche. **Interface analogique :** valeur mesurée **Relais :** comportement conformément au mode de mesure (le relais de défaut n'indique pas une phase de stabilisation 2.)

1) Si la concentration en gaz dépasse la valeur maximale de la plage de mesure de l'interface 4 à 20 mA, l'écran continue d'afficher la valeur mesurée et la remarque « Dépassement de la plage de mesure de l'interface analogique » .
2) Uniquement lorsque le courant d'avertissement est activé. Configuration d'usine : désactivé.

7.3.5 Terminer les status spéciaux

Voyant de défaut / voyant d'avertissement

Les voyants de défaut et d'avertissement ne sont généralement pas auto-maintenus. Une fois que les causes des défauts ou des avertissements ont été résolues, ils disparaissent. Exceptions : « Détection de défaut SensorAlive » et « Détection d'obstruction SensorAlive ».

Pour y remédier, afficher le défaut ou l'avertissement (Voir "Le menu Information", page 111) et commencer le dépannage (Voir "Dépannage", page 119).

La valeur est en dehors de la plage de mesure

L'écran indique que la concentration en gaz se situe en dehors de la plage de mesure du capteur. Le voyant disparaît dès que la concentration en gaz revient dans la plage de mesure. Un dépassement de la plage de mesure peut entraîner une diminution de la sensibilité et du temps de réponse du capteur.

REMARQUE
Dysfonctionnement du capteur
Des concentrations en gaz en dehors de la plage de mesure du capteur peuvent provoquer son dysfonctionnement.
► Ajuster à nouveau le capteur le cas échéant.

Polytron® 8200 CAT avec capteur DQ :

Un dépassement de la plage de mesure doit être acquitté avec [OK] après avoir vérifié que la concentration de gaz est en dessous de 100 % LIE (p.ex. en utilisant un instrument portatif).

L'auto-maintien des alarmes est le réglage par défaut de l'instrument.

Pour les instruments sans relais, le dépassement de la plage peut être réglé sur Sans auto-maintien. Dans ce cas, l'indication de dépassement de la plage disparaît. L'unité de commande doit prendre en charge cette fonction ! Pour plus d'informations voir : "Configuration du verrouillage du capteur DQ", page 131.

Polytron® 8200 CAT avec capteur LC :

⚠ AVERTISSEMENT
Indicateurs équivoques dans le cas de valeurs mesurées en dehors de la plage de mesure
Des alarmes auto-maintenues en cas de dépassement de la plage de mesure ne sont pas prises en charge par les capteurs LC.
Pour un fonctionnement sûr conformément à BVS 13 ATEX G 001 X, le détecteur de gaz doit être utilisé avec une centrale de commande capable d'afficher des alarmes auto-maintenues. Ne pas utiliser les relais d'alarme interne du détecteur de gaz.
► S'assurer qu'un indicateur auto-maintenu de dépassement de la plage de mesure est activé sur la centrale de commande.

Après avoir obtenu des valeurs mesurées hors plage, vérifiez que la concentration de gaz soit inférieure à 100 % LIE, par exemple, en utilisant un instrument portable.

7.4 Mode Info et touche de fonction

7.4.1 Affichage du mode Info

Le mode Info sert à afficher les informations relatives à l'appareil. Le fonctionnement normal de l'appareil n'est pas interrompu.

- Appuyer sur la touche ▲ pendant 3 secondes en mode mesure et la maintenir enfoncée.

7.4.2 Navigation en mode Info

Bouton	Fonction
▲	Passe à l'écran suivant
▼	Revient à l'écran précédent
OK	Met fin au mode Info

Si aucune touche n'est actionnée pendant 30 secondes, l'instrument repasse automatiquement en fonctionnement normal.

7.4.3 Utiliser la touche de fonction

En utilisant la touche de fonction, une fonction préréglée peut être exécutée. Par défaut, les dysfonctionnements sont affichés.

- Appuyer et maintenir la pression sur ▲ pendant 1 seconde en mode de mesure.

Pour configurer la touche de fonction, voir 11.4 Configuration de la touche de fonction.

7.5 Menus

7.5.1 Navigation dans le menu

Bouton	Fonction
▲	Défiler vers le haut. Définir des valeurs.
▼	Défiler vers le bas. Définir des valeurs.
OK	Confirmer la saisie. Sélectionner des menus et des fonctions.

7.5.2 Affichage des menus

- Pour afficher le menu ***Information*** :
  a. appuyer sur ▼ pendant 1 seconde en mode mesure en maintenant enfoncé.
- Pour afficher le menu ***Calibrage*** :
  a. Appuyer sur ▼ pendant 3 secondes en mode mesure en maintenant enfoncé.
  b. Sélectionner ***Entrer code***.
  c. Saisir le mot de passe correspondant et confirmer avec [OK].
- Pour accéder à tous les menus :
  a. appuyer sur ▼ pendant 3 secondes en mode mesure en maintenant enfoncé.
  b. Sélectionner ***Entrer code***.
  c. Saisir le mot de passe correspondant et confirmer avec [OK].

7.5.3 Mots de passe

Code Mainten.	Pour accéder aux menus ***Information*** et ***Calibrage*** (paramètres d'ajustage) Valeur standard : **_ _ _ 1**
Code Config.	Permet d'accéder aux configurations et menus Valeur standard : **_ _ _ 2**

Pour modifier les mots de passe, voir 11.1.

7.5.4 Le menu *Information*

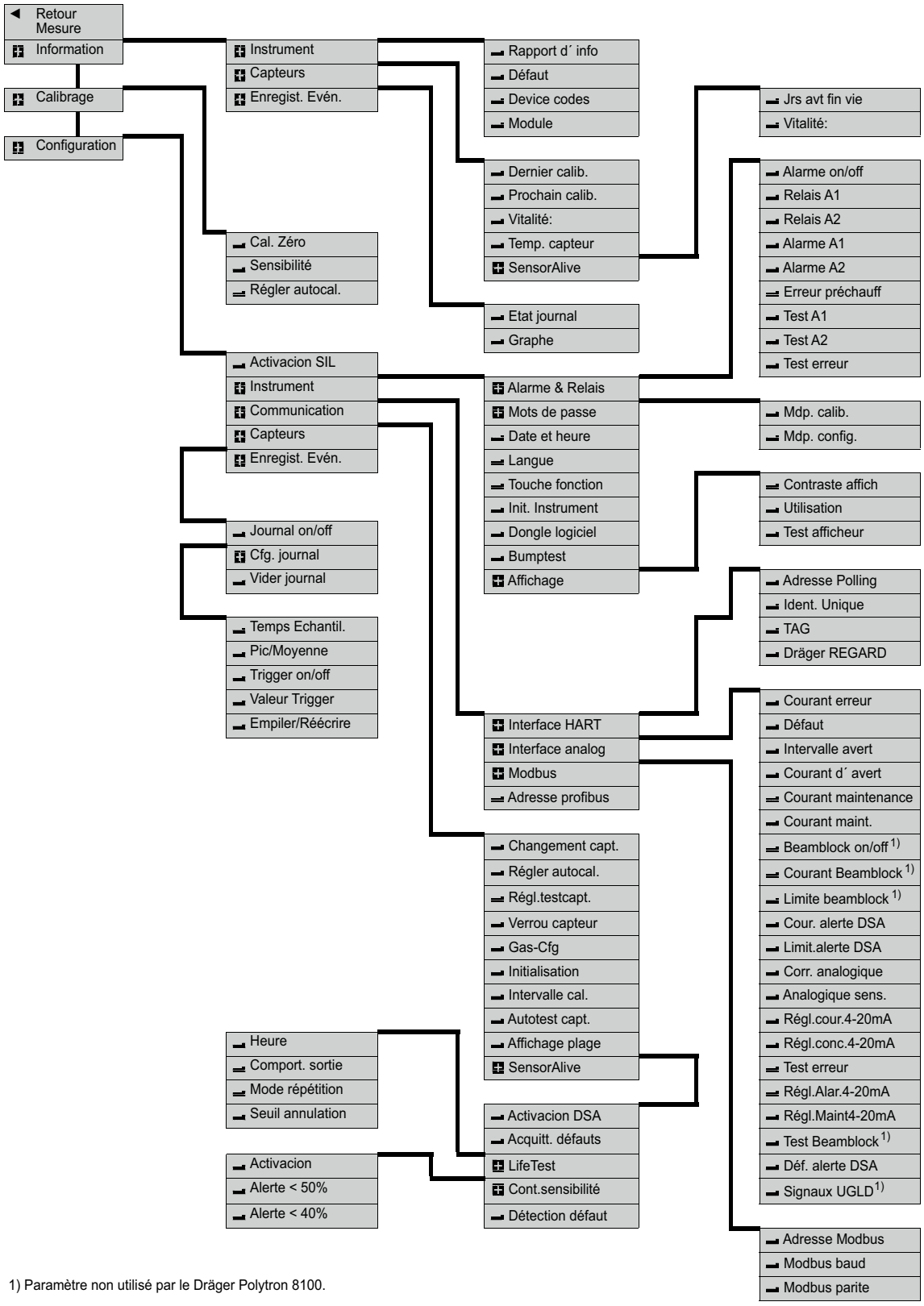
Le menu ***Information*** contient les informations suivantes :

Instrument	
Rapport d' Info	Affiche les messages d'avertissement en texte clair avec leur numéro. Si plusieurs messages d'avertissement sont actifs, cela est indiqué (par exemple 1/3 = écran 1 sur 3).
Liste d'erreurs	Affiche les messages de défaut en texte clair avec leur numéro. Si plusieurs défauts sont actifs, cela est indiqué (par exemple 1/3 = écran 1 sur 3).
Drapeaux de l'appareil	Les codes d'avertissement et de défaut sont affichés dans un tableau. Si tous les codes sont 00, il n'y a pas de message d'avertissement ou de défaut actif.
Afficher Modules	Affiche un aperçu des modules matériels installés et de la version logicielle de l'interface de capteur EC, appelée SIOS. Sélectionner le module correspondant pour afficher les informations détaillées. ■ = modules installés □ = modules non installés
Capteurs	
Date du dernier calibrage	Date de l'ajustage, unité, gaz et concentration du concentration du dernier ajustage sont affichés.
Date du prochain calibrage	Affiche la date du prochain ajustage.
Vitalité[1)]	Affiche la vitalité du capteur en %. Dräger recommande de remplacer le capteur lorsque sa vitalité est < 25 %.
Temp, du capteur[1)]	Affiche la température actuelle et la plus élevée du capteur.
SensorAlive	Le sous-menu affiche les jours restants jusqu'à la fin de la durée de vie prévue et la vitalité en %.
Mémoire	
État de la mémoire	Affiche le statut de l'enregistreur de données (actif ou non)
Graphe	Affiche l'historique des 15 dernières minutes sous forme de graphique temps/concentration.

1) La fonction n'est disponible qu'avec le dongle Diagnostic.

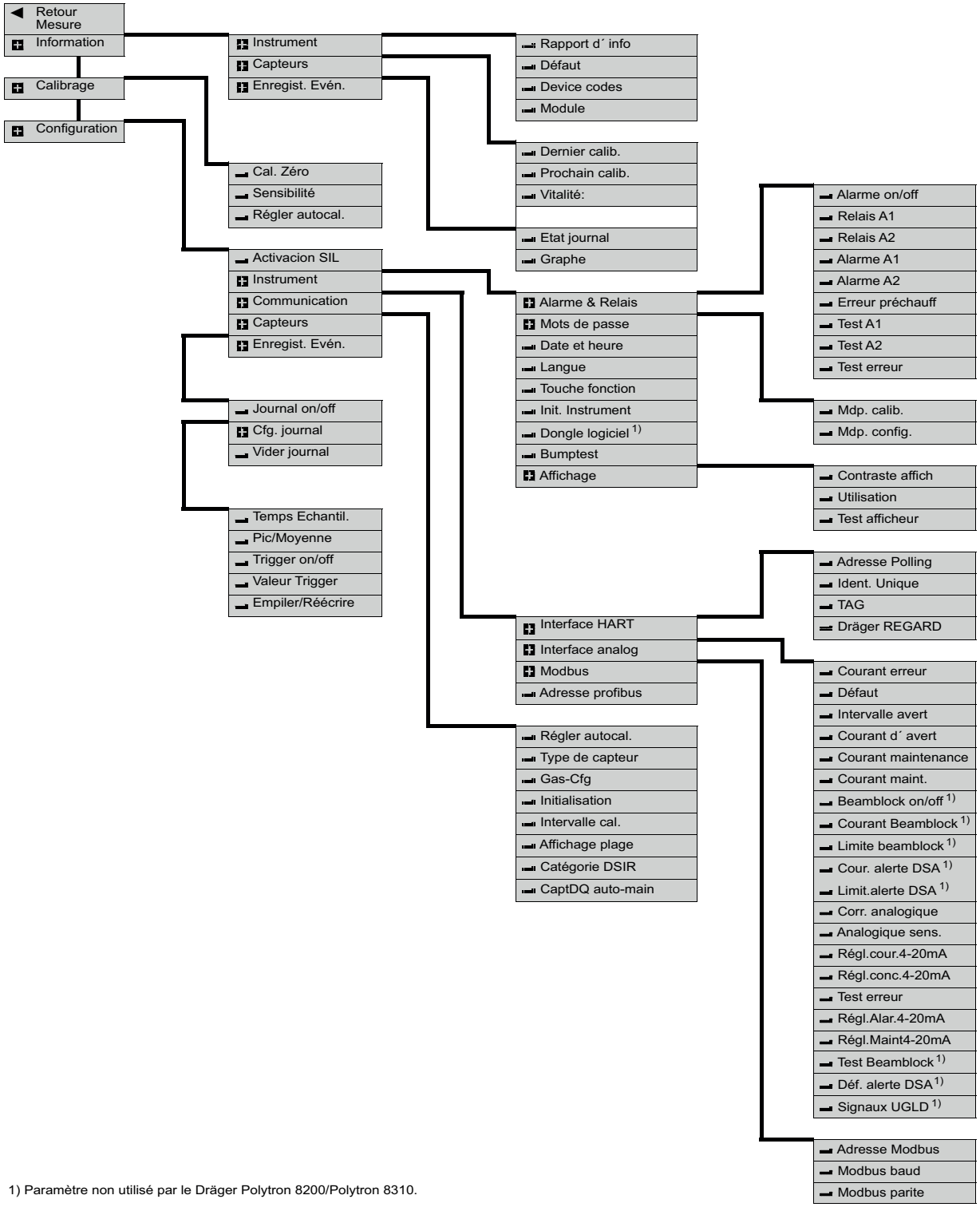
7.5.5 Vues d’ensemble des menus

Polytron 8100



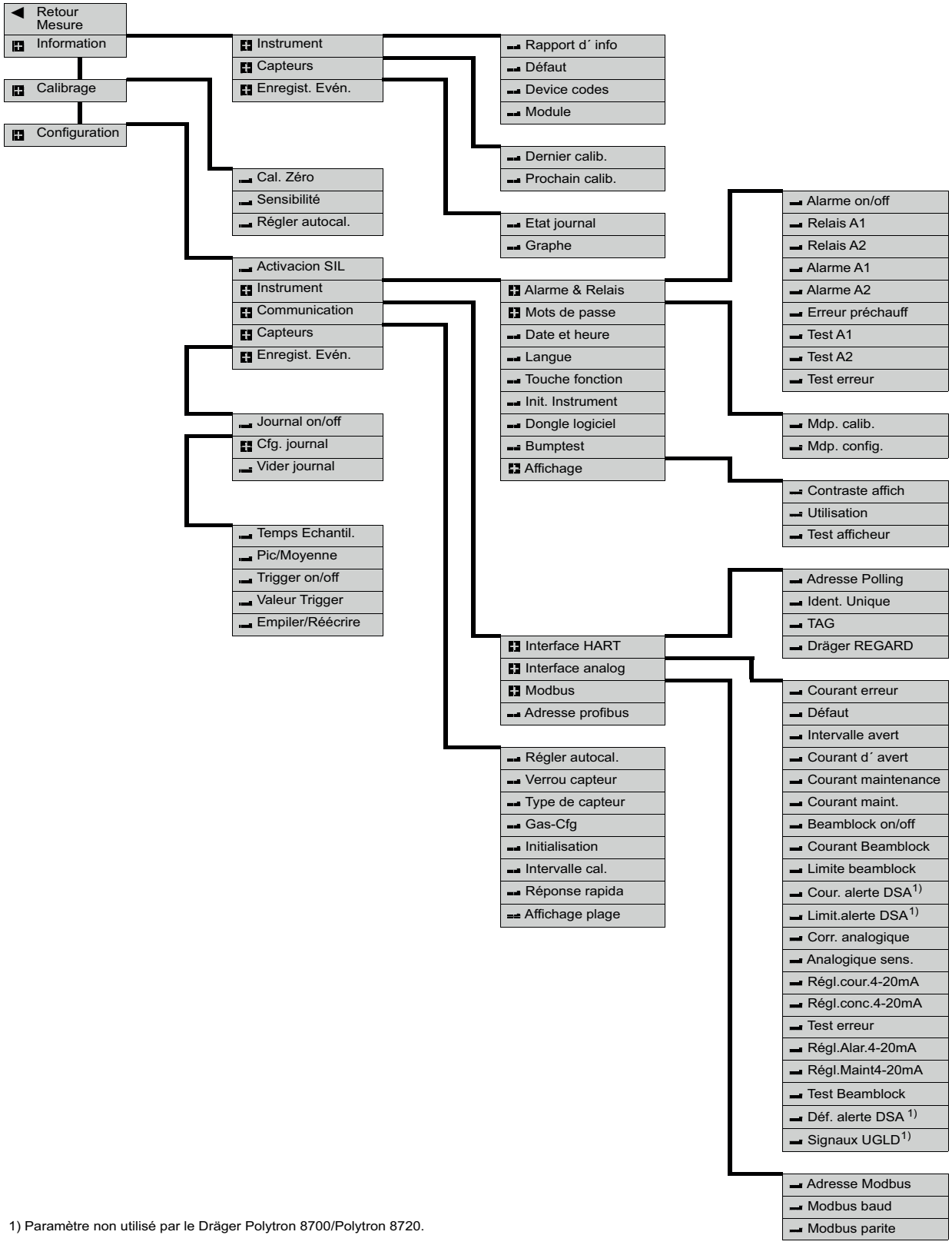
1) Paramètre non utilisé par le Dräger Polytron 8100.

Polytron 8200, Polytron 8310



1) Paramètre non utilisé par le Dräger Polytron 8200/Polytron 8310.

Polytron 8700, Polytron 8720



1) Paramètre non utilisé par le Dräger Polytron 8700/Polytron 8720.

7.6 Informations sur le fonctionnement avec un Dräger SensorAlive

– Si un menu est appelé sur le transmetteur ou si certains défauts sont définis, le Dräger SensorAlive n'effectue pas de LifeTest.
– Le Dräger SensorAlive peut empêcher l'ajustage de l'appareil pendant un certain temps (capteur H_2S : 30 minutes).
– Si une grande précision est requise pour le temps d'exécution des LifeTests, l'horloge du transmetteur doit être vérifiée régulièrement et à nouveau réglée au besoin.
– Les éléments de menu pour le Dräger SensorAlive ne sont affichés que si un Dräger SensorAlive est connecté. Les fonctions du dongle sont alors également visibles, mais pas actives.

8 Calibrage

8.1 Remarques générales

– Pour garantir un fonctionnement correct, ajuster d'abord le zéro, puis la sensibilité. Si ces opérations sont effectuées dans le mauvais ordre, les paramètres du logiciel empêchent la poursuite de l'ajustage.
– Si l'appareil est utilisé à haute altitude, la valeur affichée est inférieure à celle au niveau de la mer (réduction de la pression partielle). Il est recommandé de refaire ll'ajustage sensibilité en cas de changement d'altitude ou de pression ambiante. l'ajustage a été fait en usine au niveau de la mer.
– Dräger recommande d'ajuster les appareils avec le gaz qui devra ensuite être détecté. Cette méthode est plus précise qu'un ajustage de remplacement. Un ajustage de remplacement ne peut être effectué que si un ajustage du gaz à mesurer est impossible.
– Les capteurs pour méthane et hydrogène ne doivent être ajustés qu'avec un gaz cible et non avec un gaz remplacement.
– Polytron 8310 IR : Tenir compte en outre des indications de la notice d'utilisation du DrägerSensor IR[1)].

Lors de l'ajustage, la précision de mesure du capteur est vérifiée et réglée avec une concentration de gaz étalon connue. Les ajustages doivent être effectués régulièrement. La longueur des intervalles d'ajustage dépend des conditions ambiantes dans lesquels le capteur est utilisé.

Dérives du capteur dues aux conditions ambiantes et à son vieillissement. Les dérives du capteur ont un impact négatif sur la précision de la mesure. Les ajustages rétablissent la précision. Les intervalles d'ajustage doivent être raccourcis en fonction de l'ampleur des dérives du capteur.

Pour évaluer les conditions ambiantes d'une nouvelle installation, des intervalles d'ajustage plus courts doivent être définis et la dérive du capteur doit être consignée. L'exploitant de l'installation doit définir les intervalles d'ajustage avec les données obtenues.

Si un Dräger SensorAlive est utilisé, la dérive est compensée et peut être lue.

Dans des conditions normales, Dräger recommande les intervalles d'ajustage suivants[2)]:

– Capteurs électrochimiques (EC) : 6 à 12 mois[3)]
– Capteurs catalytiques (CAT) : 4 mois
– Capteurs infrarouges (IR) : 6 à 24 mois[3)]

8.2 Gaz étalons

La notice d'utilisation du capteur détaille les propriétés du gaz étalon (p.ex. humidité, concentration). Si aucune indication relative à l'humidité n'est fournie, un gaz étalon sec peut être utilisé pour l'ajustage. L'humidité du gaz étalon n'est pas pertinente pour les capteurs d'O_2.

Différents gaz étalons sont utilisés selon le type d'ajustage.

Gaz neutre

Le gaz neutre est un gaz étalon utilisé pour ajuster le point zéro. Pour les capteurs O_2 et CO_2, on utilise de l'azote (N_2). Pour les autres capteurs, l'air ambiant peut être utilisé s'il ne contient ni impuretés gênantes ni gaz de mesure.

Gaz d'ajustage

Le gaz d'ajustage est un gaz étalon utilisé pour ajuster la sensibilité d'un capteur. Le gaz d'ajustage a une concentration connue du gaz de mesure, diluée avec de l'air pur ou de l'azote. Pour les capteurs d'O_2, aucun gaz d'ajustage n'est requis, puisque l'on utilise l'oxygène de l'air ambiant.

8.3 Débit de gaz pour les ajustages

Le débit de gaz varie en fonction du capteur.

Capteur EC, capteur CAT	0,5 L/min ± 10 %
Tous les autres capteurs	0,5 L/min - 2 L/min

Le débit de gaz doit correspondre aux conditions ambiantes pendant le fonctionnement (par ex., mesure dans une conduite de ventilation avec un débit supérieur à 2 L/min)

1) 9023981 (Anglais), 9033555 (Bulgare, Roumain), 9023984 (Espagnol, Portugais), 9023986 (Danois, Norvégien), 9033556 (Tchèque, Croate), 9033809 (Chinois), 9023985 (Hongrois, Polonais), 9023982 (Français), 9033557 (Slovaque, Slovène), 9033558 (Grec, Turc), 9023987 (Italien, Néerlandais), 9023983 (Finnois, Suédois), 9023843 (Allemand)

2) Tenir compte de la notice d'utilisation du capteur
3) Pour les applications conformes aux normes EN 45544-1 et EN CEI 62990-1, l'intervalle d'ajustage ne doit pas dépasser 6 mois.

8.4 Préparation de l'ajustage

Remarques générales

⚠ AVERTISSEMENT
Risque pour la santé en raison du gaz étalon
Respirer le gaz étalon peut poser un risque pour la santé ou entraîner la mort.
► Ne pas respirer le gaz étalon.
► Respecter les consignes en matière de risques et de sécurité concernant le gaz étalon (se reporter aux fiches techniques et aux instructions des dispositifs de calibrage).

⚠ ATTENTION
Déclenchement d'alertes pour les gaz étalons
Les gaz étalons peuvent déclencher des alertes.
► S'assurer de ne plus appliquer le gaz étalon une fois le calibrage terminé.

Conditions préalables
– La phase de stabilisation du capteur est terminée (Voir "Mise en service du détecteur de gaz", page 107).
– La date et l'heure sont réglées (Voir "Réglage de la date et de l'heure", page 123).
– Pour utiliser le Dräger SensorAlive, le dernier LifeTest doit avoir été effectué depuis suffisamment de temps (voir la notice d'utilisation du capteur).

Particularité du Polytron 8310
Dräger recommande d'effectuer sur le capteur une compensation automatique du point zéro avant de l'ajuster. Cela réinitialise le suivi du point zéro du DrägerSensor IR et la plage complète de suivi est à nouveau disponible.
1. Désactiver l'alarme du détecteur de gaz (Voir "Activer ou désactiver une alarme", page 124).
2. Injecter de l'azote, de l'air synthétique ou de l'air frais dans le capteur avec l'adaptateur d'ajustage et attendre que la valeur mesurée soit stable.
3. Maintenir la baguette magnétique sur la zone marquée avec le symbole ⇩0 (à l'intérieur du cadre noir) sur la surface du capteur pendant au moins 5 secondes. Le signal de sortie du capteur passe à l'affichage du signal d'ajustage après 5 secondes (changement d'affichage d'environ -10 %LIE) tant que la baguette magnétique est maintenue. Un réglage du point zéro du système de mesure optique est automatiquement effectué simultanément.
4. Retirer la baguette magnétique. Après 30 secondes, l'appareil quitte la procédure de compensation automatique du point zéro. Pour confirmer la compensation automatique du point zéro, le signal de sortie repasse au signal d'ajustage (changement d'affichage à environ -10 %LIE). Ce signal est affiché aussi longtemps que lors de l'entrée dans la procédure de compensation automatique du point zéro.
5. Activer l'alarme du détecteur de gaz.

Polytron 8100, Polytron 8200, Polytron 8310
Voir la figure B de la page dépliante.

Équipement d'ajustage :
– Détendeur Dräger (1) ; pour les gaz réactifs, utiliser un détendeur en acier inoxydable
– Adaptateur d'ajustage Dräger (2) (référence de pièce 6810536)
– Tuyau (3)
– Bouteille de gaz étalon Dräger (4)

Préparation de l'ajustage :
1. Raccorder le détendeur à la bouteille de gaz étalon.
2. Fixer l'adaptateur d'ajustage sur le capteur.
3. Brancher le tuyau au raccord cannelé.
4. Accéder au menu (Voir "Affichage des menus", page 111).

Polytron 87x0 IR
Voir la figure B de la page dépliante.

Équipement d'ajustage :
– Détendeur Dräger (1) ; pour les gaz réactifs, utiliser un détendeur en acier inoxydable
– Adaptateur d'ajustage Dräger (5) (référence de pièce 6811610).
– Tuyau (3)
– Bouteille de gaz étalon Dräger (4)

Préparation de l'ajustage :
1. Raccorder le détendeur à la bouteille de gaz étalon.
2. Fixer l'adaptateur d'ajustage sur la protection anti-éclaboussures jusqu'à ce qu'il s'enclenche.
   Cela ne vaut pas pour le montage sur des conduites de ventilation ou en cas d'utilisation d'un adaptateur de processus ou d'une cuvette de processus (voir la notice d'installation de l'accessoire PIR 7x00).
3. Vérifier la propreté des surfaces d'étanchéité autour des ouvertures de la protection anti-éclaboussures. Il n'est pas nécessaire de retirer la protection contre les insectes.
4. Brancher le tuyau au raccord cannelé.
5. Afficher le menu (Voir "Affichage des menus", page 111).

8.5 Ajustage du point zéro

8.5.1 Généralités

L'air ambiant ne peut être utilisé à la place de l'azote ou de l'air synthétique pour ajuster le point zéro du capteur que s'il est certain que l'air ambiant ne contient pas de gaz cible ni d'autre gaz pour lesquels le capteur peut présenter une sensibilité transversale (voir les informations dans la fiche technique du capteur). Dans ce cas, l'ajustage du point zéro ne requiert ni bouteille de gaz ni adaptateur d'ajustage.

⚠ AVERTISSEMENT
Défaut de calibrage du point zéro
Un débit insuffisant de l'air ambiant peut causer des erreurs de calibrage.
► S'assurer que le débit de l'air ambiant au niveau du capteur est suffisant.

Polytron® 8100 spécifique EC :

En ce qui concerne les capteurs d'oxygène (O_2), le réglage du point zéro ne modifie aucune valeur du micrologiciel ou du capteur. Ainsi, la fonction de calibrage du point zéro peut être utilisée pour vérifier la mesure du point zéro lorsque le capteur détecte de l'azote. Le Polytron 8100 EC affiche un état de défaut si une vérification du point zéro échoue avec un écart de plus de 0,6 Vol% d'O_2 par rapport à zéro. Dans le cas d'un défaut, refaire la vérification du point zéro ou remplacer le capteur au besoin. Utiliser de l'azote (N_2) pour effectuer la vérification.

Polytron® 8200 spécifique CAT :

Les capteurs ne doivent pas être calibrés avec de l'azote pur. Les capteurs catalytiques ont besoin d'oxygène pour fonctionner correctement.

Polytron® 8720 spécifique IR :

Pour le Polytron 8720 IR (avec PIR 7200 pour détecter le dioxyde de carbone), vous pouvez utiliser uniquement de l'azote ou de l'air synthétique sans CO_2 pour le réglage du point zéro.

8.5.2 Ajustage du point zéro

ℹ Il est possible d'interrompre un calibrage à tout moment. Pour interrompre un calibrage, sélectionner ***Retour***.

Conditions préalables :

– Le capteur a terminé sa phase de stabilisation
– Le calibrage est préparé.

Ajustage du point zéro :

1. sélectionner ***Calibrage*** > ***Calibrage Zéro*** et confirmer.
   ⇒ Le signal de maintenance est transmis via l'interface analogique. Aucune alarme et aucun relais de défaut n'est activé et le symbole 🔧 est affiché.
   ⇒ Le message ***Appliquer Gaz zé*** s'affiche.
2. Appliquer de l'air synthétique ou de l'azote si l'air ambiant ne peut pas être utilisé.
   a. Régler le débit de gaz en fonction du capteur utilisé (Voir "Débit de gaz pour les ajustages", page 115)
3. Sélectionner ***Suite*** et confirmer.
   ⇒ La valeur actuelle est affichée.

ℹ Au bout de 15 minutes sans validation, l'appareil revient au menu ajustage sans effectuer celui-ci.

Effectuer l'ajustage après avoir appliqué le gaz étalon sur le capteur pendant 3 minutes et attendu que la valeur affichée devienne stable.

4. Sélectionner ***Calibrage*** et confirmer.
   ⇒ Le message ***Attendre SVP..*** s'affiche.
   ⇒ La nouvelle valeur actuelle est affichée.
5. Sélectionner ***Suite*** et confirmer.
6. Couper le débit de gaz et retirer l'adaptateur d'ajustage du capteur ou desserrer le tuyau.
   Si la valeur actuelle n'est pas dans la plage d'alarme :
7. Sélectionner ***Suite*** et confirmer.
   ⇒ L'appareil retourne au menu ajustage.

8.6 Calibrage sensibilité

8.6.1 Généralités

Polytron® 8310 spécifique IR :

La conception du capteur de gaz DSIR limite le signal de sortie du capteur de gaz à 45 %. . . 55 % de la tension d'alimentation interne de l'appareil. Si la concentration en gaz continue d'augmenter après que le signal de sortie maximal du capteur a été atteint, cela ne fait pas augmenter les valeurs affichées sur la réponse de l'appareil transmise à la centrale de commande. Dans le cas des substances ayant des facteurs d'ajustage particulièrement bas et / ou de la configuration manuelle d'un facteur d'ajustage sensibilité élevé, cela peut se produire dès une concentration inférieure à 100 % LIE. Pour les ajustages de gaz de substitution, le déclenchement correct de l'alarme doit pour cette raison être contrôlé au moyen d'une concentration de gaz étalon correspondant au seuil d'alarme. Si nécessaire, augmenter la plage de mesure affichable en réduisant le signal de sortie du capteur en fonction des exigences avant de l'ajuster sur l'appareil (voir le chapitre « Ajustage manuel de la sensibilité du signal de sortie » dans la notice d'utilisation du capteur de gaz DSIR).

8.6.2 Ajustage sensibilité

ℹ Il est possible d'interrompre un calibrage à tout moment. Pour interrompre un calibrage, sélectionner ***Retour***.

Conditions préalables :

– L'ajustage a été préparé.
– Le point zéro a été ajusté.
– Spécifiquement pour tous les Polytron 8xx0 à part le Polytron 8100 EC :
  le dernier ajustage du point zéro valide a été effectué il y a moins de 24 heures.

Pour ajuster la sensibilité :

1. Sélectionner ***Calibrage*** > ***Calibrage Sens.*** et confirmer.
   ⇒ Le signal de maintenance est transmis via l'interface analogique. 🔧Aucune alarme et aucun relais de défaut n'est activé et le symbole 🔧 est affiché.
   ⇒ Les paramètres pour le gaz d'ajustage sont affichés, par ex. :[1)]
   Gaz : H_2S
   Unité: ppm
   Concentr.: 25
2. Si les paramètres affichés ne correspondent pas au gaz cible, régler les paramètres :
   a. Sélectionner ***Gaz*** et confirmer.
   b. Sélectionner le gaz d'ajustage dans la liste et valider.
   c. Sélectionner ***Unité*** et confirmer.
   d. Sélectionner l'unité de mesure dans la liste et valider.

1) Ne s'applique pas à tous les capteurs (Voir "Mode mesure", page 108).

e. Sélectionner ***Conc.*** et confirmer.
f. Régler la concentration du gaz d'ajustage.

3. Si les réglages sont corrects :
   a. Sélectionner ***Suite*** et confirmer.
      ⇒ Un message de type ***Débit de gaz ON H_2S*** s'affiche.
4. Appliquer du gaz d'ajustage.
   a. Régler le débit de gaz correspondant au capteur utilisé (Voir "Débit de gaz pour les ajustages", page 115)
5. Sélectionner ***Suite*** et confirmer.
   ⇒ La valeur actuelle est affichée

ℹ Au bout de 15 minutes sans validation, l'appareil revient au menu ajustage sans effectuer celui-ci.

Effectuer l'ajustage après avoir appliqué le gaz étalon sur le capteur pendant 3 minutes et attendu que la valeur affichée devienne stable.[1]:

6. Sélectionner ***Suite*** et confirmer.
   ⇒ Le message ***Attendre SVP..*** s'affiche.
   ⇒ La nouvelle valeur actuelle est affichée.
7. Sélectionner ***Suite*** et confirmer.
8. Couper le débit de gaz et retirer l'adaptateur d'ajustage du capteur ou desserrer le tuyau.

Si la valeur actuelle n'est pas dans la plage d'alarme :

9. Sélectionner ***Suite*** et confirmer.
   ⇒ L'appareil retourne au menu ajustage.

8.7 Ajustage automatique

8.7.1 Généralités

L'ajustage automatique comprend l'ajustage du point zéro suivi de celui de la sensibilité. Il constitue une alternative à leur exécution manuelle.

L'ajustage automatique n'est possible que pour certains capteurs et gaz. Si cette fonction n'est pas disponible, effectuer l'ajustage manuellement.

8.7.2 Exécution de l'ajustage automatique

ℹ Au bout de 24 heures, le calibrage du point zéro n'est plus à jour. Par conséquent, le calibrage automatique ne peut pas être effectué à moins que le calibrage du point zéro ne soit effectué à nouveau.

ℹ Il est possible d'interrompre un calibrage à tout moment. Pour interrompre un calibrage, sélectionner ***Retour***.

Conditions préalables :

– L'ajustage automatique est activé.
– La phase de stabilisation du capteur est terminée.
– L'ajustage a été préparé.

Pour exécuter l'ajustage automatique :

1. Appliquer de l'air synthétique ou de l'azote si l'air ambiant ne peut pas être utilisé.
2. Sélectionner ***Calibrage*** > ***Autocalibrage*** et confirmer.
   ⇒ Le message ***Attendre SVP..*** s'affiche et l'appareil effectue automatiquement l'ajustage du point zéro.
   ⇒ Dans le cas d'un capteur d'O_2, ***Cal. air frais*** s'affiche.

ℹ Le signal de maintenance est transmis par l'interface analogique, aucune alarme ou aucun relais de défaut n'est activé et le symbole 🔧 est affiché.

3. Une fois l'ajustage du point zéro exécuté avec succès, l'ajustage sensibilité démarre.
   ⇒ Les paramètres pour le gaz s'affichent, par exemple :[2]
   Gaz : H_2S
   Unité: ppm
   Concentr.:25
4. Si les paramètres affichés ne correspondent pas au gaz cible, régler les paramètres :[3]
   a. Sélectionner ***Gaz*** et confirmer.
   b. Sélectionner le gaz d'ajustage dans la liste et valider.
   c. Sélectionner ***Unité*** et confirmer.
   d. Sélectionner l'unité de mesure dans la liste et valider.
   e. Sélectionner ***Conc.*** et confirmer.
   f. Régler la concentration du gaz d'ajustage.
5. Si les réglages sont corrects :
   a. Sélectionner ***Suite*** et confirmer.
      ⇒ Un message de type ***Débit de gaz ON H_2S*** s'affiche.
6. Appliquer du gaz d'ajustage.
   a. Régler le débit de gaz en fonction du capteur utilisé (Voir "Débit de gaz pour les ajustages", page 115)
7. Sélectionner ***Suite*** et confirmer.
   ⇒ La valeur actuelle est affichée

ℹ Au bout de 15 minutes sans validation, l'appareil revient au menu ajustage sans effectuer celui-ci.

8. Une fois que la valeur actuelle est stable, l'appareil effectue automatiquement l'ajustage sensibilité.
9. ***Valeur OK?***Une fois l'ajustage exécuté avec succès, la nouvelle valeur s'affiche, ainsi que le message ***Valeur OK?***.
   - Sinon, sélectionner Modifier et confirmer pour refaire l'ajustage.
   - Si la valeur correspond à la valeur de consigne, poursuivre la procédure.
10. Couper le débit de gaz et retirer l'adaptateur d'ajustage du capteur ou desserrer le tuyau.
11. Sélectionner ***Valeur OK*** et confirmer pour terminer l'ajustage. L'appareil retourne au menu ajustage.

1) Pour les capteurs LC, le gaz d'ajustage doit être appliqué pendant au moins 6 minutes.

2) Ne s'applique pas à tous les capteurs (Voir "Mode mesure", page 108).
3) ceci n'est possible que pour certains capteurs.

9 Dépannage

9.1 Défauts

Numéro	Cause	Solution
001, 003 - 004, 012 - 014, 020 - 024, 043, 060, 067	Défaut fatal de l'appareil, causes diverses.	Faire contrôler l'appareil par le DrägerService.
002, 025 - 027, 030 - 034, 041, 042, 044, 050, 052, 081, 085	Erreurs de données graves dans l'appareil, causes diverses.	Rétablir les paramètres d'usine de l'appareil. Si cette erreur persiste : faire contrôler l'appareil par le DrägerService.
005	Tension d'alimentation en dehors de la plage réglée.	Contrôler l'alimentation électrique.
010	Le câble de l'interface 4 à 20 mA n'est pas raccordé.	Contrôler la connexion à l'interface 4 à 20 mA. Si le dispositif est utilisé de manière autonome sans contrôleur central, raccorder les broches 3 et 4.
011	Défaut fatal de l'appareil, causes diverses.	Faire contrôler l'appareil par le DrägerService. Si cette erreur persiste : vérifier la charge ou le câble.
045	L'appareil ne détecte pas de capteur.	Vérifier les connexions. Si cette erreur persiste : faire contrôler l'appareil par le DrägerService.
051, 054	Échec de l'ajustage du point zéro.	Effectuer un ajustagedu point zéro.
055	Échec de l'ajustage sensibilité.	Effectuer un ajustage sensibilité.
076, 080 - 084	Défaut de l'appareil.	Vérifier les connexions électriques. Si cette erreur persiste : faire contrôler l'appareil par le DrägerService.
090	La fonction de blocage du capteur est activée. La référence de pièce du capteur utilisé est différente.	Utiliser un capteur avec la même référence de pièce ou désactiver la fonction de blocage du capteur.
105	Défaut de l'appareil.	Faire contrôler l'appareil par le DrägerService.
137, 64, 91	Défaut de l'appareil.	Éteindre puis rallumer l'appareil. Si cette erreur persiste : faire contrôler l'appareil par le DrägerService.

Polytron 8100 EC avec Dräger SensorAlive seulement

Numéro	Cause	Solution
220	L'ouverture du capteur est bouchée.	Nettoyer l'ouverture du capteur ou remplacer le filtre à poussière. Confirmer ensuite l'obstruction dans le menu (Voir "Configuration du Dräger SensorAlive", page 130).
221	La sensibilité du capteur est inférieure à 40 % (valeur calculée).	Ajuster ou remplacer le capteur.
222	Un défaut induit une valeur de gaz trop élevée après l'électrolyse.	Remplacer le capteur ou contacter le DrägerService.
223	La sensibilité du capteur est trop faible.	Ajuster ou remplacer le capteur.
224	Le flux de conditionnement n'est pas dans la plage autorisée.	Remplacer le capteur ou contacter le DrägerService.

Polytron 87x0 IR seulement

Numéro	Cause	Solution
064, 071	Défaut de communication.	Contrôler la connexion au PIR 7x00.
083	Système optique du PIR 7x00 sale.	Nettoyer le système optique du PIR 7x00.
086	Alimentation en tension en dehors de la plage	Contrôler l'alimentation électrique.
087	Panne 4 à 20 mA sur le capteur PIR 7x00.	Contrôler la connexion 4 à 20 mA sur le PIR 7x00.
094, 095	Erreur de données dans l'appareil.	Rétablir les paramètres d'usine du capteur. Si ce défaut persiste : faire contrôler l'appareil par le DrägerService.
096	Le mot de passe SIL ne correspond pas à celui du PIR 7x00.	Saisir à nouveau le mot de passe.

9.2 Rapport d'Info

Numéro	Cause	Solution
101	L'enregistreur de données en mode Stack est plein et n'enregistre plus de données.	Faire contrôler l'appareil par le DrägerService.
102	L'enregistreur de données en mode Stack est plein à 90 %.	Télécharger les données dès que possible et vider l'enregistreur de données.
103, 106	Erreur de données dans l'appareil. Il est possible que certaines fonctions du dongle comme l'enregistreur de données, le test du capteur, etc. ne soient plus disponibles.	Rétablir les paramètres d'usine de l'appareil. Si ce défaut persiste : faire contrôler l'appareil par le DrägerService.
104	Le réglage de la date ou de l'heure n'est pas valide.	Régler la date et l'heure.
105	Défaut de l'appareil.	Faire contrôler l'appareil par le DrägerService.
107	La batterie de la mémoire de données est vide.	Faire contrôler l'appareil par le DrägerService.
110, 111, 112	Le dongle du logiciel a été retiré sans avoir été désactivé au préalable.	Désactiver le dongle du logiciel.
113	Les alarmes sont verrouillées.	Activer les alarmes.
164, 165	La phase de stabilisation du capteur n'est pas encore terminée. Les erreurs de mesure seront probablement plus importantes.	Attendre jusqu'à ce que le capteur se soit stabilisé. Ne pas procéder à l'ajustage avant que le capteur se soit complètement stabilisé.
167, 170	Intervalle d'ajustage écoulé.	Ajuster à nouveau l'appareil.

Polytron 8100 EC seulement

Numéro	Cause	Solution
163	La vitalité du capteur EC est faible	Remplacer le capteur.
171	Affichage négatif. Valeur inférieure au minimum de la plage.	Ajuster à nouveau le point zéro.

Polytron 8100 EC avec Dräger SensorAlive seulement

Numéro	Cause	Solution
320	Échec de la communication avec le capteur. Le diagnostic et le générateur de gaz ne fonctionnent plus.	Débrancher le capteur, laisser reposer pendant environ 1 jour et le rebrancher. Vérifier la version du micrologiciel et, le cas échéant, la faire mettre à jour par le DrägerService. Remplacer le capteur.
321	Échec de l'analyse des données du capteur. Le capteur ne peut pas effectuer ou analyser un LifeTest (les conditions préalables ne sont pas remplies).	Modifier l'heure du LifeTest ou régler le profil de répétition sur « Flexible » (Voir "Configuration du Dräger SensorAlive", page 130). Si l'avertissement se répète, contacter le DrägerService.
322	Le jeu de données du capteur est défectueux.	Remplacer le capteur.
323	Le jeu de données du capteur est incompatible.	Contacter le DrägerService.
324	La sensibilité du capteur est inférieure à 50 % (valeur calculée).	Ajuster le capteur et préparer son remplacement (par exemple, commander une pièce détachée).
325	La sensibilité du capteur est inférieure à 40 % (valeur calculée).	Ajuster ou remplacer le capteur.
326	Pendant un LifeTest et un certain temps après, le capteur ne peut pas être ajusté.	Pour pouvoir effectuer un ajustage planifié, le LifeTest peut être temporairement supprimé dans PolySoft avec le mode Inhibit.
327, 330, 344, 347	Le générateur de gaz ne fonctionne as.	Ajuster ou remplacer le capteur.
331	Échec de la génération de gaz.	Ajuster le capteur.
332	Le capteur est à l'état sécurisé. Aucun LifeTest n'est exécuté (avertissement collectif).	Déterminer la raison et l'éliminer.
333	L'horloge en temps réel du capteur ne fonctionne pas correctement.	Régler l'horloge.

Numéro	Cause	Solution
334	La synchronisation du capteur n’est pas terminée.	Attendre la fin de la synchronisation. Selon l’état du capteur, ceci peut durer plusieurs minutes. Le cas échéant, faire mettre à jour le micrologiciel par le DrägerService.
336	Les contrôles internes dans le capteur donnent des résultats erronés.	Redémarrer le système
337	Le micrologiciel du transmetteur doit être mis à jour.	Contacter le DrägerService.
340	Le capteur est synchronisé après le redémarrage du système.	Attendre la fin de la synchronisation.
342	La différence de température entre les deux points de mesure de la température est trop élevée.	Attendre et vérifier si le LifeTest est analysé ou remplacer le capteur.
347	La configuration a échoué en raison d’une interruption de la communication entre le transmetteur et le capteur.	Reconfigurer le capteur et vérifier la configuration.
350	Le générateur de gaz est en phase de démarrage.	Attendre la fin de la phase de démarrage. Pendant la phase de démarrage, les fonctions de détection des erreurs et de détection des obstructions ne sont pas exécutées.
352	Échec de l’autotest du capteur.	Remplacer le capteur ou contacter le DrägerService.
353	Le capteur est temporairement en mode Inhibit. Pendant ce temps, aucun LifeTest n’est exécuté.	Le mode Inhibit peut être quitté manuellement avec PolySoft ou est quitté automatiquement.
354	Défaut au démarrage de l’installation.	Effectuer un redémarrage manuel.
355	Le micrologiciel du capteur n’est pas compatible avec le matériel.	Faire mettre à jour le micrologiciel par le DrägerService.
356	Données matérielles invalides.	Effectuer un redémarrage ou remplacer le capteur.
357	Le capteur a été placé manuellement à l'état sécurisé, par exemple pour mettre à jour le micrologiciel .	Pour quitter ce mode, redémarrer le capteur.

Polytron 87x0 IR seulement :

Numéro	Cause	Solution
163	La température du capteur est très élevée.	
171	Dérive du point zéro trop haute.	Effectuer un ajustage du point zéro.
172	Système optique du PIR 7x00 sale.	Nettoyer le système optique du PIR 7x00.
173	Ajustage du point zéro expiré pour l'ajustage sensibilité	Effectuer un ajustage du point zéro.
182	Ajustage automatique avec le PIR 7200 impossible.	Effectuer à nouveau l’ajustage du point zéro et l'ajustage sensibilité.

10 Maintenance

– Les intervalles de maintenance doivent être définis pour chaque installation. Selon les considérations de sécurité et les conditions particulières à une application dans lesquelles l'instrument est utilisé, il peut être nécessaire de réduire les intervalles.

Tous les 6 mois :

– Faire contrôler par des spécialistes.
– Contrôler la transmission de signaux à la centrale de commande (Voir "Test de l’interface analogique", page 127).
– Contrôler les LED et le déclenchement de l’alarme (Voir "Test des alarmes / relais", page 125).

Régulièrement :

– Effectuer un ajustage, voir 8 Calibrage

10.1 Réalisation d'un test au gaz et contrôle du temps de réponse (t90)

Un test au gaz (Bump Test) permet de vérifier le temps de réponse sans déclencher d'alarme.

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Bumptest*** et confirmer.
   ⇒ Le symbole de maintenance est affiché
   ⇒ La sortie analogique est réglée sur le signal de maintenance.
2. Appliquer une concentration connue de gaz.
3. Comparer le temps de réponse à la valeur t90 indiquée dans la fiche technique du capteur correspondant.
4. Appuyer sur [OK] pour retourner à la mesure.

10.2 Remplacement du capteur

⚠ AVERTISSEMENT
Calibrage erroné
Un calibrage erroné peut entraîner des lectures imprécises.
► En cas de remplacement du capteur, il faudra contrôler toutes les configurations et les paramètres.
► Vérifier le calibrage pour garantir un fonctionnement correct.

10.2.1 Polytron® 8100 EC

Un capteur peut être remplacé dans la zone classée dangereuse sans interrompre l'alimentation électrique.

Fonction de blocage du capteur

Si le capteur installé auparavant était de même type (référence de pièce identique), garder la configuration spécifique à l'appareil (type de gaz, plage de mesure, gaz étalon, intervalle d'ajustage, etc.). Sinon, les réglages par défaut du nouveau capteur sont téléchargés et écrasent la configuration spécifique à l'appareil. Activer la fonction verrouillage du capteur (Voir "Réglage du verrouillage du capteur", page 130)permet d'éviter cette situation (Voir "Réglage du verrouillage du capteur", page 130).

Fonction de remplacement de capteur

La fonction ***Changement capt.*** du menu permet de remplacer un capteur en cours de fonctionnement sans déclencher de signal de défaut sur la centrale de commande. Elle permet en outre de garantir que toutes les données du capteur présentes dans le microprocesseur sont sauvegardées dans sa mémoire (EEPROM) avant de débrancher sa fiche.

Remplacement du capteur

Voir la figure C de la page dépliante.

En principe, le capteur peut être remplacé à tout moment.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Changement capt.*** et confirmer.
   ⇒ Le signal de maintenance est généré sur l'interface 4 à 20 mA.
   ⇒ L'écran affiche : ***Retirer capteur***.
   ⇒ Le symbole de maintenance est affiché.
2. Pour remplacer l'ancien capteur :
   a. Desserrer la vis de blocage (2) (vis creuse six pans 2 mm).
   b. Dévisser l'anneau à baïonnette (3).
   c. Insérer le capteur (4) dans l'ouverture et le tourner jusqu'à ce qu'il s'enclenche dans le détecteur de gaz. Veiller à ne pas endommager la fiche du capteur.
   d. Sécuriser le capteur avec l'anneau à baïonnette (3) correspondant.

   ℹ Le Dräger SensorAlive requiert un anneau à baïonnette différent des autres capteurs EC.

   e. Serrer la vis de blocage (2) jusqu'à ce que l'anneau à baïonnette ne puisse pas être desserrée (obligatoire pour les installations en zone 22).
      ⇒ L'écran affiche : ***Chargement des données en cours, veuillez patienter***
3. Le cas échéant, coller l'étiquette incluse avec le capteur sur l'appareil. Cela permet d'identifier le type de gaz à distance, même en cas de coupure de courant.
4. Lorsque les données du capteur sont chargées, l'écran affiche : ***Données chargées***.
5. Sélectionner ***Retour Menu*** et confirmer.
   ⇒ Le signal de maintenance sur l'interface 4 à 20 mA demeure jusqu'à ce que le capteur soit stabilisé.

   Temps maximal de stabilisation d'un nouveau capteur : voir sa notice d'utilisation. Pour l'oxygène : homologation selon EN 50104.
6. Vérifier l'ajustage. Si nécessaire, ajuster l'appareil (Voir "Calibrage", page 115).
7. Contrôler les exigences de l'installation et le niveau d'intégrité de sécurité SIL de l'appareil.
   Voir les sections "Installation antidéflagrante (Ex d) - sans station d'accueil" à "Installation des capteurs ou des têtes de mesure".

10.2.2 Polytron® 8200 CAT, 8310 IR, 87x0 IR

Remplacement du capteur

1. Le cas échéant, ajuster le courant de maintenance pour l'interface analogique.
2. Mettre l'appareil hors tension ou déclasser la zone conformément aux règlementations locales.
3. Desserrer la vis de blocage et dévisser le couvercle de l'appareil.
4. Sortir la carte de circuit imprimé.
5. Retourner la carte de circuit imprimé et retirer le connecteur du capteur.
6. Dévisser le capteur.
7. Insérer les câbles du capteur au travers du raccord fileté du boîtier.

⚠ AVERTISSEMENT
Risque d'explosion !
Les ouvertures du boîtier doivent être étanches pour éviter l'inflammation de l'atmosphère dangereuse en cas de feu à l'intérieur du boîtier.
► Cinq filets doivent être engagés pour assurer la protection contre les explosions.

8. Visser le capteur et serrer au couple prescrit (min. 266 in-lbs / min. 30 Nm)
9. Polytron® 8200 spécifique CAT :
   Entortiller ensemble les câbles du capteur. Si nécessaire, utiliser une attache de câble pour maintenir les câbles serrés.
10. Rebrancher le connecteur sur sa prise.
11. Remettre la carte de circuit imprimé dans le boîtier.
12. Visser le couvercle sur l'appareil jusqu'à ce qu'il soit correctement verrouillé (min. ≥44 in-lbs / min. ≥5 Nm) et serrer la vis de blocage.
13. Mettre au besoin l'appareil sous tension.
    ⇒ Le signal de maintenance sur l'interface 4 à 20 mA demeure jusqu'à ce que le capteur soit stabilisé.

    Temps maximal de stabilisation d'un nouveau capteur : voir sa notice d'utilisation.
14. Vérifier l'ajustage. Si nécessaire, ajuster 'appareil (Voir "Calibrage", page 115).
15. Contrôler les exigences de l'installation et le niveau d'intégrité de sécurité SIL de l'appareil.
    Voir les sections "Installation antidéflagrante (Ex d) - sans station d'accueil" à "Installation des capteurs ou des têtes de mesure".

10.3 Exécution du test de l'écran

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Affichage*** > ***Test afficheur*** et confirmer.
2. Sélectionner ***Activée*** et confirmer.
   ⇒ Les informations affichées à l'écran sont inversées. Les LED sont allumées.
   L'inversion est terminée à la sortie du menu.

11 Réglages de l'appareil

11.1 Configuration des mots de passe

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Code*** le mot de passe souhaité et confirmer.

Code Mainten.	Accès au calibrage du point zéro et de la sensibilité
Code Config.	Accès à tous les paramètres de configuration

2. Sélectionner la ligne correspondant à la modification du mot de passe et valider.
3. Régler le mot de passe et valider.
4. Sélectionner ***Confirmer*** et valider avec [OK].

11.2 Réglage de la date et de l'heure

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Date et Heure*** et confirmer.
2. Sélectionner la ligne pour modifier la date ou l'heure et confirmer.
3. Sélectionner ***Confirmer*** et confirmer avec [OK].

11.3 Réglage de la langue

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Langue*** et confirmer.
2. Sélectionner la langue dans la liste et confirmer.

11.4 Configuration de la touche de fonction

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Touche Fonction*** et confirmer.
2. Sélectionner une fonction et valider.

Graphe	Les mesures des 15 dernières minutes s'affichent sous forme de graphique temps/concentration.
Liste d'erreurs	Les messages de défaut s'affichent en texte clair.
Rapport d' Info	Les messages d'avertissement s'affichent en texte clair.
Bumptest	Le test au gaz permet d'appliquer du gaz sur le capteur sans générer d'alarme. Le signal de maintenance est transmis. Au bout de 15 minutes, ou en appuyant à nouveau sur [OK], le test au gaz s'arrête et l'appareil revient en fonctionnement normal.
Vitalité Capteur[1)]	Affiche la vitalité restante du capteur.

1) Avec le dongle Diagnostic seulement

11.5 Réinitialisation des réglages par défaut

Cette fonction restaure les paramètres par défauts d'usine de l'instrument.

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Init. instrument*** et confirmer.
2. Sélectionner ***Confirmer*** et valider avec [OK].

11.6 Modifier le contraste de l'affichage

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Affichage*** > ***Contraste affich*** et confirmer.
2. Modifier le contraste et valider les changements.

11.7 Changer le mode d'affichage

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Affichage*** > ***Utilisation*** et confirmer.
2. Sélectionner le mode de son choix et confirmer.

Standard	Affiche l'écran standard.
Aucun affichage	Affiche l'écran d'accueil et les symboles applicables.

Si une alarme est déclenchée, l'écran affiche la concentration de gaz actuelle et la LED rouge clignote, peu importe le mode d'affichage sélectionné.

11.8 Configuration d'un relais

11.8.1 Associations d'auto-maintien et d'acquittement d'alarme

Les exemples suivants donnent une vue d'ensemble des combinaisons d'acquittement d'alarme.

	Auto-maintien (Réinitialisation manuelle de relais)	**Sans auto-maintien** (Le relais se réinitialise une fois que la condition d'alarme a été supprimée)
Acquittable	Réinitialisation de relais possible à tout moment.	
Non acquittable	Réinitialisation de relais impossible avant d'avoir supprimé la condition d'alarme.	
Pré-acquittable	Acquittement d'alarme possible avant la suppression de la condition d'alarme. Le relais se réinitialise automatiquement une fois que la condition d'alarme a été supprimée.	

Les signaux d'auto-maintien / sans auto-maintien ne sont pas limités dans le temps. Les signaux d'auto-maintien restent actifs jusqu'à ce qu'ils soient acquittés. Les signaux sans auto-maintien s'arrêtent dès que la condition d'activation est supprimée.

11.8.2 Configuration du relais A1 ou A2

Cette fonction définit si le relais d'alarme est alimenté en fonctionnement normal ou en état d'alarme.

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Alarme*** > ***Relais A1*** ou ***Relais A2*** et confirmer.
2. Sélectionner l'option de son choix et confirmer.

Normal actif	Le contact du relais est actif pendant un fonctionnement normal et change si une alarme est déclenchée. En cas de perte de tension, une alarme se déclenche (sécurité intégrée).
Alarme actif	Si une alarme est déclenchée, le contact du relais devient actif.

11.8.3 Réglage relais défaut période de stabilisation 1

Cette fonction est utilisée pour régler le fonctionnement du relais de défaut pendant la stabilisation 1 afin d'indiquer l'état de stabilisation 1 à la sortie du relais.

1. Sélectionner sous ***Configuration*** > ***Instrument*** > ***Alarme*** > ***Erreur de stabilisation*** l'option souhaitée et confirmer.

Statique	Le relais de défaut active en permanence un indicateur d'alarme connecté. La LED orange LED est allumée en continu.
Dynamique	Le relais de défaut commute l'état pendant 9 secondes. *Exemple :* – Un avertisseur sonore est connecté à la sortie du relais de défaut « normalement ouvert ». – Les relais sont configurés sur « normal actif ». ⇒ L'avertisseur sonore et la LED orange du transmetteur sont actifs 1 seconde et inactifs 9 secondes.

11.9 Configuration de l'alarme

11.9.1 Activer ou désactiver une alarme

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Alarme*** > ***Alarme on/off***.

Activée	L'alarme est activée.
Désactivée	L'alarme est désactivée. Les LED, les relais et les interfaces n'indiquent aucune condition d'alarme. L'interface 4-20 mA transmet le signal de maintenance. La valeur actuelle et le symbole [!] sont affichés. Le relais de défaut signale un défaut.

2. Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.

11.9.2 Configuration des alarmes

1. Sélectionner ***Configuration*** > ***Instrument*** > ***Alarme*** > ***Alarme A1*** ou ***Alarme A2*** et confirmer.
   Le seuil d'alarme actuel de l'alarme s'affiche.
2. Accepter la proposition affichée ou modifier les paramètres suivants (confirmer les étapes de configuration les unes après les autres avec ***Suite***) :
   a. Définir la valeur pour le seuil d'alarme.

b. Définir le sens de l’alarme.

En Hausse	Le sens de l’alarme est dit ascendant, si la concentration de gaz doit être supérieure à une certaine valeur pour déclencher une alarme.
En Baisse	Le sens de l’alarme est dit descendant, si la concentration de gaz doit être inférieure à une certaine valeur pour déclencher une alarme.

c. Définir le mode d’auto-maintien.

Auto-maintien	Lorsque le seuil d’alarme est atteint, l’appareil déclenche l’alarme. L’appareil conserve l’état d’alarme même si la concentration de gaz ne satisfait plus la condition d’alarme. Pour effacer une alarme d’auto-maintien, celle-ci doit être acquittée.
Sans auto-maintie	L’état d’alarme s’efface si la concentration de gaz ne satisfait plus la condition d’alarme.

d. Définir le mode d'acquittement.

Acquittable	Le relais d’alarme et la LED peuvent être réinitialisés avant que la condition d’alarme ne s’efface.
Non-acquittable	Le relais d’alarme et la LED ne peuvent pas être réinitialisés tant que la condition d’alarme n’est pas effacée.
Pre-acquittement	L’état d’alarme peut être acquitté avant que la condition d’alarme ne s’efface. Cependant, le relais d’alarme et la LED restent actifs tant que la condition d’alarme n’est pas effacée.

e. Régler la valeur d’hystérésis.
La fonction d’hystérésis définit un intervalle durant lequel un relais déclenché maintient son état jusqu’à ce que la concentration de gaz soit en dehors de l’intervalle défini. Exemple : le seuil d’alarme est réglé sur 40 ppm et l’hystérésis sur 3 ppm. L’alarme reste active jusqu’à ce que la valeur devienne inférieure à 37 ppm. Cela permet d’éviter que les relais ne se ferment et s'ouvrent plusieurs fois à un seuil d’alarme (« rebond »).

ℹ Lorsque le sens d’une alarme a été modifié (de descendante à ascendante ou vice versa), vérifier et corriger à nouveau la valeur de l’hystérésis le cas échéant.

⇒ Un écran de confirmation affiche tous les paramètres.

f. Sélectionner ***Confirmer*** et confirmer avec OK.

✓ Les nouveaux paramètres sont enregistrés.

11.9.3 Test des alarmes / relais

Ces fonctions changent l’état d’un relais et d’une LED dans un but de test (par exemple pour vérifier le fonctionnement des appareils d’alarme connectés au relais). Le symbole 🔧 est affiché. Après avoir quitté cette fonction, les statuts du relais et de la LED retourneront automatiquement à leur valeur précédente.

1. Sélectionner la condition d’alarme souhaitée dans ***Configuration*** > ***Instrument*** > ***Alarme*** > et confirmer.

Alarme A1	Simule une pré-alarme
Alarme A2	Simule une alarme principale
test. Erreur	Simule un signal de défaut

2. Sélectionner ***Activée*** et confirmer.
   ⇒ Le relais de défaut est désexcité et l’interface 4 à 20 mA est réglée sur courant de défaut. La LED jaune est allumée, le symbole maintenance s’affiche. La simulation est terminée à la sortie du menu.

11.10 Configuration de l’enregistreur de données

11.10.1 Afficher le graphe

Il est possible de visualiser les 15 dernières minutes sous forme de graphe temps / concentration.

1. Sélectionner ***Information*** > ***Mémoire*** > ***Graphe***

11.10.2 Activation/désactivation de l’enregistreur de données

1. Sélectionner ***Configuration*** > ***Mémoire*** > ***Mémoire on/off*** et confirmer.
2. Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.

11.10.3 Régler la période d'échantillonnage

Cette fonction définit la fréquence à laquelle une valeur sera enregistrée.

1. Sélectionner ***Configuration*** > ***Mémoire*** > ***Mémoire on/off*** > ***Temps Echantil.*** et confirmer.
2. Sélectionner l'intervalle d'enregistrement et valider.

11.10.4 Régler la valeur de pic/moyenne

Cette fonction permet de définir la valeur à enregistrer.

1. Sélectionner ***Configuration*** > ***Mémoire*** > ***Cfg. Mémoire*** > ***Pic/Moyenne*** et confirmer.
2. Sélectionner ***Pic*** ou ***Moyenne*** et confirmer.

Pic	La valeur maximale (en cas de surveillance de concentrations décroissantes, la valeur la plus basse) des concentrations mesurées dans la période d'échantillonnage sélectionnée est enregistrée.
Moyenne	La valeur moyenne de toutes les valeurs de concentration mesurées pendant la période d'échantillonnage sélectionnée est enregistrée.

11.10.5 Activation ou désactivation du mode de déclenchement

Cette fonction permet l'enregistrement de valeurs à partir d'une certaine valeur.

1. Sélectionner ***Configuration*** > ***Mémoire*** > ***Cfg. Mémoire*** > ***Trigger on/off*** et confirmer.
2. Sélectionner ***On*** ou ***Off*** et confirmer.

On	Les mesures sont enregistrées si elles dépassent un seuil supérieur à la valeur de déclenchement (par rapport à la dernière valeur enregistrée).
Off	Les mesures dans la période d'échantillonnage sont enregistrées.

11.10.6 Régler la valeur de déclenchement

Cette fonction définit le seuil de déclenchement pour enregistrer une valeur. La valeur de déclenchement est définie en pourcentage du dépassement d'échelle.

Exemple : Une valeur de déclenchement de 2 % pour un dépassement d'échelle de 500 ppm n'enregistrera que les valeurs s'écartant de 10 ppm de la valeur précédemment enregistrée.

1. Sélectionner ***Configuration*** > ***Mémoire*** > ***Mémoire on/off Valeur trigger*** et confirmer.
2. Régler et valider le seuil de déclenchement.

11.10.7 Réglage de la fonction Stack ou Roll

1. Sélectionner ***Configuration*** > ***Mémoire*** > ***Cfg. Mémoire*** > ***Empiler/Réécrire*** et confirmer.
2. Sélectionner ***Empiler*** ou ***Réécrire*** et confirmer.

Roll	Dès que la capacité de l'enregistreur de données est épuisée, les anciennes données sont écrasées par de nouvelles valeurs.
Stack	Dès que la capacité de l'enregistreur de données est épuisée, aucune nouvelle valeur ne peut être enregistrée. L'appareil émet un avertissement.

11.10.8 Vider l'enregistreur de données

Cette fonction supprime les données enregistrées.

1. Sélectionner ***Configuration*** > ***Mémoire*** >***Effacer Mémoire*** et confirmer.
2. Pour vider l'enregistreur de données, sélectionner ***Confirmer*** et confirmer avec [OK].

12 Réglages de l'interface

12.1 Interface 4-20mA

La sortie électrique de l'instrument en mode normal de fonctionnement est comprise entre 4 et 20 mA et est proportionnelle à la concentration de gaz détectée.

Polytron 8xx0 utilise plusieurs valeurs de courant pour indiquer plusieurs modes de fonctionnement. Les paramètres par défaut sont réglables par l'utilisateur selon les exigences de ses applications particulières. Cela est conforme à la recommandation NAMUR NE43.

12.1.1 Dépassement d'échelle

Polytron® 8100 EC, 87x0 IR et 8200 CAT LC uniquement

Certains capteurs permettent un dépassement d'échelle ajustable pour limiter la plage de mesures pour l'interface de 4-20 mA.

Le dépassement d'échelle (FSD) détermine un point final dans la plage de mesure du capteur. Si la concentration de gaz atteint ce point final, l'interface de 4-20 mA transmet 20°mA.

Exemple : Plage requise de 0 à 500 ppm CO (par exemple numéro de référence 6809605, par défaut 300 ppm, plage min/max = 50 / 1000 ppm). Sélectionner un dépassement d'échelle de 500 ppm. La sortie analogique est linéaire entre 4 mA = 0 ppm et 20 mA = 500 ppm.

12.1.2 Réglage du signal d'erreur

Cette fonction définit l'intensité pour le signal d'erreur.

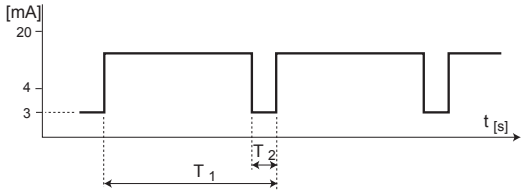
1. Sélectionner ***Configuration*** > ***Interface analog*** >***Courant erreur*** > ***Communication*** et confirmer.
2. Sélectionner la ligne pour modifier le courant et confirmer.
3. Régler et valider le courant.
   ⇒ Le réglage du ***Courant erreur*** est affiché.
4. Sélectionner ***Confirmer*** et valider avec [OK].

12.1.3 Informations sur le signal d'avertissement

Pour transmettre un signal d'avertissement via l'interface analogique, celui-ci doit être activé.
Le signal d'avertissement alterne entre le courant d'avertissement et le courant de mesure.

– Courant d'avertissement (intervalle T2)
– Courant de mesure (intervalle T1-T2)

Les intervalles de temps et le courant d'avertissement sont configurables.



35869

12.1.4 Pour activer ou désactiver le courant d'avertissement

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface analog*** > ***Rapport d' Info*** et confirmer.
2. Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.

12.1.5 Réglage de l'intervalle d'avertissement

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface analog*** > ***Interval avert.*** et confirmer.
2. Régler l'heure et les intervalles d'avertissement T1 et T2 et confirmer.

12.1.6 Régler le courant d'avertissement

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface analog*** > ***Courant d'avert.*** et confirmer.
2. Régler l'intensité et valider avec [OK].

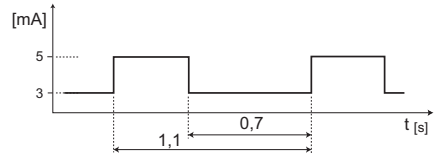
12.1.7 Réglage des avertissements du Dräger SensorAlive

Ce menu sert à configurer divers paramètres du courant d'avertissement :

- Pour régler le courant d'avertissement, sélectionner ***Configuration*** > ***Communication*** > ***Interface Analog*** > ***Cour. alerte DSA*** et saisir la valeur.
- Pour régler un seuil de l'avertissement, sélectionner ***Configuration*** > ***Communication*** > ***Interface Analog*** > ***Limit.alerte DSA*** et saisir la valeur.
- Pour activer/désactiver la fonction d'avertissement, sélectionner ***Configuration*** > ***Communication*** > ***Interface Analog*** > ***Déf. alerte DSA*** et confirmer. Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.

12.1.8 Réglage du signal de maintenance

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface analog*** > ***Signal Mainten.*** et confirmer.
2. Régler le type de signal et confirmer.

Statique	Un courant constant configurable.
Dynamique	Un signal d'onde carré avec les caractéristiques suivantes : 

12.1.9 Réglage du courant de maintenance

Le courant de maintenance ne peut être réglé que si le signal de maintenance a été réglé sur « statique ».

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface analog*** >***Courant Maint.*** et confirmer.
2. Régler le courant et confirmer.

12.1.10 Ajustage signal sortie

Cette fonction ajoute une correction à la sortie analogique à 4 mA. Cette correction règle l'intensité à 4 mA sans affecter la valeur de consigne de 20 mA.

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface analog*** >***Corr. Analogique*** et confirmer.
2. Sélectionner la ligne correspondant à la modification de la correction (Plage : –0,5 à 0,5 mA, SIL : –0,1 à 0,1) et confirmer.
3. Régler et valider le courant.
   ⇒ Le réglage pour ***Corr. Analogique*** est affiché.
4. Sélectionner ***Confirmer*** et valider avec [OK].

12.1.11 Ajustage signal sortie

Cette fonction règle la sortie analogique à 20 mA sans affecter la valeur de consigne de 4 mA.

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface analog*** > ***Sensibilité analogique*** et confirmer.
2. Sélectionner la ligne correspondant à la modification de la correction (Plage : –0,5 à 0,5 mA, SIL : –0,1 à 0,1) et confirmer.
3. Régler et valider le courant.
   ⇒ Le réglage pour ***Sensibilité analogique*** est affiché.
4. Sélectionner ***Confirmer*** et valider avec [OK].

12.1.12 Test de l'interface analogique

Ces fonctions modifient l'intensité de l'interface analogique dans un but de test (par exemple pour contrôler la programmation de la centrale de commande). Il peut être nécessaire de bloquer les alarmes sur la centrale de commande pour éviter les fausses alarmes. Une fois cette fonction quittée, les intensités reviennent automatiquement au signal de maintenance. Durant le test, le symbole de maintenance s'affiche.

- Pour régler le courant ou la concentration :

1. Sélectionner l'option souhaitée dans ***Configuration*** > ***Communication*** > ***Interface analog***.

Régl. courant	Cette fonction règle le courant sur une valeur entre 0 et 22 mA. Le courant de décalage et la sensibilité analogique ne sont pas utilisés dans cette fonction.
Régl. concentr.	Cette fonction permet de régler le courant sur une valeur de mesure librement sélectionnable entre 0 ppm et la valeur maximale de la plage de mesure.

2. Une fois que les alarmes ont été bloquées sur la centrale de commande, confirmer le message ***Alarmes désactivées*** avec ***Suite***.
3. Sélectionner la ligne à modifier et valider avec [OK].
4. Sélectionner la valeur souhaitée.
5. Sélectionner ***Suite*** et confirmer.
6. Sélectionner l'option souhaitée :

Reglage concentr. / ***Régl.cour.sort***	Cette fonction définit la valeur de mesure ou la valeur test de courant prédéfinie. Durant le test, le symbole de maintenance s'affiche.
Concentr. off / ***Courant off***	Cette fonction annule la transmission de la valeur test prédéfinie.

7. Sélectionner ***Suite*** et confirmer.
   ⇒ La fonction est interrompue.
8. Une fois que les alarmes ont été réactivées sur la centrale de commande, confirmer le message : ***Alarmes activées***.

- Pour régler le signal de test :

1. Sélectionner le test à réaliser dans ***Configuration*** > ***Communication*** > ***Interface analog***.

test. Erreur	Règle l'intensité électrique sur la valeur du courant de défaut.
Régl. alarme	Règle l'intensité électrique sur la valeur du courant d'avertissement.
Régl.mainten.	Règle l'intensité électrique sur la valeur du courant de maintenance.

2. Une fois que les alarmes ont été bloquées sur la centrale de commande, confirmer le message ***Alarmes désactivées***.
3. Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.

12.1.13 Beam Block

Cette fonction est disponible seulement pour le Polytron 87x0 IR (avec le capteur PIR 7000/7200).

Par défaut, la fonction beam block est désactivée en réglage d'usine.

S'il est activé, le signal du beam block sera transmis à l'interface analogique si le système optique du capteur PIR 7000/7200 est « sale ». Le système optique du PIR 7000/7200 peut devenir « sale » s'il y a formation de dépôts sur les surfaces optiques. Cependant, si la concentration de gaz dépasse la limite du beam block, l'instrument revient en fonctionnement normal.

Si les dépôts sur les surfaces optiques sont tels que la mesure n'est plus possible, l'instrument passe en défaut.

- Pour mettre les signaux beam block sur activé/désactivé :

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface analog*** et l'option souhaitée.

Beamblock On/Off	Cette fonction active ou désactive le beam block
Régl.beamblock	Cette fonction définit l'intensité sur l'intensité d'avertissement du beam block

2. Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.

- Pour régler les signaux du beam block :

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface analog*** et l'option souhaitée.

Courant beambl.	Cette fonction définit l'intensité pour le signal du beamblock.
Limite Beamblock	Cette fonction définit la limite maximale si le signal du beam block doit être transmis par l'interface analogique.

2. Sélectionner la ligne correspondant à la modification du signal et valider.
3. Régler le courant et confirmer.
   ⇒ Le réglage du signal du beam block est affiché.
4. Sélectionner ***Confirmer*** et confirmer avec OK.

12.2 Interface HART

12.2.1 Définition de l'adresse de polling

L'adresse de polling (adresse de requête) configure le détecteur de gaz pour le mode analogique ou multipoint.

Commande HART : #6 (Write Polling Adress)

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface Hart*** > ***Polling address***.
2. Définir l'adresse de polling et sélectionner ***Confirmer***.

0	Active le mode analogique
1 à 15	Active le mode multipoint. L'interface 4 à 20 mA est désactivée et configurée pour un courant constant d'environ 1 mA.

ℹ Configurer tous les appareils d'une ligne avec des adresses de polling différentes. Utiliser de préférence une séquence commençant à 1.

12.2.2 Affichage de l'identificateur unique

L'identificateur unique (adresse HART unique) doit être connu pour pratiquement toutes les commandes HART d'adressage.

Commandes HART :

– #0 (Read Unique Identifier)
– #11 (Read Unique Identifier associated with Tag)

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface Hart*** > ***Unique identifr***.
2. L'identificateur unique s'affiche.

12.2.3 Configuration du Tag HART

Le Tag HART (désignation du point de mesure) sert à repérer un point de mesure.

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface Hart*** > ***TAG***.
2. Définir le Tag HART et sélectionner ***Confirmer***. Le Tag HART peut comporter jusqu'à 8 caractères alphanumériques.

12.2.4 Configuration du protocole Dräger REGARD

Cette fonction permet de basculer entre différents protocoles HART.

1. Sélectionner ***Configuration*** > ***Communication*** > ***Interface Hart*** > ***Dräger REGARD***.
2. Sélectionner la version logicielle correspondant à la centrale de commande REGARD.

12.3 Interfaces numériques

Les documents suivants détaillent la configuration des autres interfaces :

Interface	Document
PROFIBUS PA	9033782
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

13 Configuration du capteur

13.1 Activation ou désactivation du calibrage automatique

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Autocalibrage*** et confirmer.
2. Sélectionner ***Activée*** ou ***Désactivée*** et valider avec [OK].

13.2 Plage de capture

La plage de capture masque les de mesure. Les fluctuations de mesure sont des variations mineures des valeurs mesurées (telles que le bruit du signal, les variations de concentration). Ces variations ne modifient pas la valeur transmise ou affichée. Les valeurs mesurées dans cette plage sont affichées avec la valeur de capture. Les valeurs mesurées en dehors de la plage de capture sont affichées avec la valeur mesurée actuelle.

Valeur de capture (correction)

La valeur de capture est affichée en permanence, tant que la valeur mesurée se situe entre les limites supérieure et inférieure de la valeur de capture.

Limite supérieure de la valeur de capture

La limite supérieure de la valeur de capture indique la limite supérieure de la plage dans laquelle la valeur de capture est affichée.

Limite inférieure de la valeur de capture

La limite inférieure de la valeur de capture indique la limite inférieure de la plage dans laquelle la valeur de capture est affichée.

13.2.1 Réglage de la plage de capture

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Affichage plage*** et confirmer.
2. Régler la correction dans la première fenêtre.
3. Régler la valeur minimale de la plage de capture et valider avec ***Suite***.
4. Régler la valeur maximale de la plage de capture et valider avec ***Suite***.
5. Vérifier toutes les valeurs et valider avec ***Suite***.

13.2.2 Désactivation de la plage de capture

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Affichage plage*** et confirmer.
2. Définir la correction dans la première fenêtre.
3. Régler la valeur minimale de la plage de capture sur 0 et confirmer avec ***Suite***.
4. Régler la valeur maximale de la plage de capture sur 0 et confirmer avec ***Suite***.
5. Contrôler toutes les valeurs et confirmer avec ***Suite***.

13.3 Réinitialiser le capteur

Cette fonction rétablit les paramètres d'usine sur le capteur.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Init basic Canal*** et confirmer.
2. Sélectionner ***Confirmer*** et valider avec [OK].

13.4 Configuration période de calibrage

Une fois l'intervalle de calibration expiré, l'instrument émet un avertissement indiquant que le calibrage doit être effectué.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Interval de cal.*** et confirmer.
2. Régler et valider l'intervalle de calibrage avec [OK].

13.5 Réglage du verrouillage du capteur

Ce point ne s'applique qu'au Polytron 8100 EC et au Polytron 87x0 IR.

1. Sélectionner ***Configuration*** >***Capteurs*** > ***Verrou capteur*** et confirmer.
2. Sélectionner ***On*** ou ***Off***.

On	L'instrument rejettera tout capteur dont la référence ne correspond pas à la référence du capteur installée précédemment.
Off	L'instrument accepte tous types de capteur et chargera les réglages par défaut de ce capteur. Cependant, ces paramètres par défaut recouvriront tout réglage personnalisé du nouveau capteur.

13.6 Dongles logciels pour capteurs EC

13.6.1 Installation du dongle

1. Mettre l’appareil hors tension ou déclasser la zone conformément aux règlementations locales.
2. Desserrer la vis de blocage et dévisser le couvercle de l’appareil.
3. Insérer le module de test avec son logo Dräger vers le haut dans l’emplacement de la carte de circuit imprimé, Voir la figure D de la page dépliante.
4. Positionner la carte de circuit imprimé et fermer l’appareil (Voir "Fermeture du détecteur de gaz", page 106).

13.6.2 Désactivation du dongle

Cette fonction désactive un dongle pour le retirer de manière sûre ou s’il est défectueux.

Un dongle ne peut être réactivé qu’en coupant puis en rétablissant l'alimentation électrique de l’appareil.

1. Sélectionner***Configuration*** > ***Instrument*** > ***Fiche logiciel*** > et le dongle à désactivé puis confirmer.
2. Sélectionner ***Désactivation fonc.***. Le dongle sélectionné est désactivé.

13.7 Réglages du capteur sur le Polytron® 8100 EC

13.7.1 Autotest du capteur

Cette fonction n’est active que si le dongle de test du capteur ou de diagnostic est installé. Si le capteur échoue à l’autotest, le système émet un message d’avertissement ou d’erreur.

Configurer l’autotest régulier du capteur

Cette fonction déclenche périodiquement l’autotest du capteur. L’appareil contrôle régulièrement le bon fonctionnement du capteur.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Autotest capt.*** et confirmer.
2. Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.

Démarrage manuel d’un autotest du capteur

Cette fonction permet le démarrage manuel d’un autotest du capteur.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Autotest capt.*** et confirmer.
2. ***Start test du capteur*** s'affiche.
3. Sélectionner ***Confirmer***.

✓ Le résultat du test est affiché.

13.7.2 Configuration du gaz

Cette fonction règle le type de gaz ainsi que la plage et les unités de mesure. Les réglages dépendent du capteur installé.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Gas-Cfg*** et confirmer.
   ⇒ Le gaz de mesure actuel s’affiche.
2. Sélectionner le gaz de mesure dans la liste et valider.
   ⇒ L’unité de mesure actuelle s’affiche.
3. Sélectionner l’unité de mesure dans la liste et valider.
   ⇒ La valeur maximale actuelle de la plage de mesure s’affiche.
4. Pour certains capteurs EC seulement : régler la valeur maximale de la plage de mesure et confirmer.
   ⇒ La nouvelle valeur maximale de la plage de mesure s’affiche.
5. Sélectionner ***Suite*** et confirmer.
   ⇒ Une vue d’ensemble des nouveaux réglages du gaz s’affiche.
6. Après les avoir contrôlé, sélectionner ***Retour Menu*** ou ***Confirmer***.

Retour Menu	Sélectionner Retour au menu pour quitter la fonction sans apporter de modifications et valider avec [OK].
Confirmer	Sélectionner Confirmer pour accepter les réglages et valider avec [OK].

13.7.3 Configuration du Dräger SensorAlive

Ce menu permet de régler différents paramètres définissant le comportement du Dräger SensorAlive :

- Pour activer ou désactiver les fonctions LifeTest du capteur, sélectionner ***Configuration*** > ***Capteurs*** > ***SensorAlive*** > ***Activation DSA*** et confirmer.
  Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.
- Pour confirmer une obstruction du capteur, sélectionner ***Configuration*** > ***Capteurs*** > ***SensorAlive*** > ***Acquitt. défauts***.
- Pour activer ou désactiver la détection des défauts, sélectionner ***Configuration*** > ***Capteurs*** > ***SensorAlive*** > ***Détection défaut*** et confirmer.
  Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.

Le menu ***SensorAlive*** contient les sous-menus suivants :

– LifeTest
– Surveillance de la sensibilité

Le sous-menu LifeTest permet de régler les paramètres suivants :

- Pour définir le moment où un test doit être lancé, sélectionner ***Heure***.
  Saisir une heure et confirmer. Le test est lancé lorsque cette heure est atteinte sur le transmetteur.

  ℹ Les transmetteurs ne prennent pas en charge le passage automatique à l'heure d'été/d'hiver.

- Pour déterminer quelle valeur doit être émise par le transmetteur pendant le LifeTest, sélectionner ***Comport. sortie***.
  Sélectionner ***Fixé***, ***Maintenance*** ou ***Valeur mesurée*** et confirmer.
- Pour spécifier si les tests répétés doivent être effectués en une seule fois lorsqu'un LifeTest donne un résultat négatif, sélectionner ***Mode répétition***.
  Sélectionner ***Flexible*** et confirmer.
  Si l'option ***Statique*** est sélectionnée, les tests ne seront pas répétés, mais une nouvelle série de tests sera effectuée à l'heure indiquée.
- Pour définir le moment où un LifeTest est interrompu, sélectionner ***Seuil annulation***.
  Saisir une valeur et confirmer.

  ℹ Pendant un LifeTest, le Dräger SensorAlive est exposé à un gaz de test. La valeur mesurée augmente. Pour éviter qu'une alarme ne se déclenche, la valeur mesurée n'est pas transmise par défaut pendant 15 minutes au maximum. Le comportement pendant un LifeTest peut toutefois être configuré dans le menu ***Comport. sortie***. Néanmoins, le capteur détecte une éruption de gaz lorsque la concentration de gaz mesurée devient supérieure à celle attendue par le LifeTest. La différence correspond à la concentration de l'éruption de gaz et est comparée à la valeur saisie dans ***Seuil annulation***. Si cette valeur est dépassée, le LifeTest est immédiatement interrompu. Le capteur repasse en mode mesure et le transmetteur affiche une nouvelle valeur. Si des relais sont utilisés, ils sont commutés sur le transmetteur et des alarmes sont déclenchées le cas échéant.

Le sous-menu ***Cont.sensibilité*** permet de régler les paramètres suivants :

- Pour indiquer si un avertissement doit être émis, sélectionner ***Activation*** et confirmer.
- Pour définir le moment où un avertissement doit être émis, sélectionner ***Alerte < 50%*** ou ***Alerte < 40%*** et confirmer.

13.8 Réglages du capteur sur le Polytron® 8200 CAT / 8310 IR

13.8.1 Type de capteur

Cette fonction définit le type de capteur installé.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Type de capteur*** et valider.
2. Sélectionner le type de capteur et valider.

13.8.2 Configuration de gaz

Cette fonction règle l'unité de mesure.

Pour les capteurs LC, cette fonction permet également de régler le dépassement d'échelle.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Gas-Cfg*** et valider.
2. Sélectionner l'unité de mesure de votre choix dans la liste et valider.
   ⇒ Pour les capteurs DQ et DSIR :
   Une vue d'ensemble des nouveaux réglages du gaz apparaît. Poursuivez avec l'étape 4.
   ⇒ Pour les capteurs LC :
   L'actuel dépassement d'échelle complet s'affiche. Poursuivez avec l'étape 3.
3. Régler le dépassement d'échelle et valider (seulement pour les capteurs LC).
   ⇒ Une vue d'ensemble des nouveaux réglages du gaz apparaît.
4. Après avoir effectué la révision, sélectionnez ***Retour Menu*** ou ***Confirmer***.

Retour Menu	Sélectionner Retour au menu pour quitter la fonction sans apporter de modifications, et valider avec [OK].
Confirmer	Sélectionner Confirmer pour accepter les réglages et valider avec [OK].

13.8.3 Configuration du verrouillage du capteur DQ

Cette fonction n'est disponible que si aucun relais n'est installé. Cette fonction permet de définir si le capteur DQ doit être acquitté après une mesure de concentration supérieure à 100 %LIE.
Ce réglage ne s'applique pas aux capteurs LC.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Verrouillage du capteur DD*** et confirmer.
   ⇒ Le réglage actuel s'affiche.
2. Sélectionner ***Activée*** ou ***Désactivée*** et confirmer.

⚠ AVERTISSEMENT
Risque d'explosion
Si l'auto-maintien du capteur est désactivé et qu'une alarme indiquant un risque d'explosion est acquittée, l'instrument informe l'utilisateur final de ce danger en allumant en permanence la LED rouge à l'écran.

► Avant d'acquitter un dépassement de plage, s'assurer que la concentration du gaz est passée en dessous de 100 %LIE.

⚠ AVERTISSEMENT
Risque d'explosion potentiel
Fonctionnement non conforme aux épreuves de test BVS.
Si le verrouillage du capteur DQ est désactivé, la centrale de commande doit prendre en charge cette fonction pour assurer le fonctionnement sécurisé conformément à BVS 13 ATEX G 001 X.

► Vérifier qu'un indicateur automaintenu de dépassement de la plage de mesure est activé sur Il'unité d'affichage.

13.9 Configuration du capteur Polytron 8310 IR

13.9.1 Modification de la catégorie du gaz

Le DrägerSensor IR peut mesurer des gaz et des vapeurs appartenant aux catégories de gaz méthane, propane ou éthène (éthylène). La catégorie de gaz doit être définie pour le DrägerSensor IR en fonction du gaz cible à mesurer. La documentation du DrägerSensor IR détaille l'affectation des gaz et des vapeurs aux catégories de gaz.

13.9.2 Modification de la catégorie du gaz

Conditions nécessaires

– Le détecteur de gaz a été mis en marche il y a moins d'une heure.
– La compensation automatique du point zéro. sur le capteur a été effectué il y a moins d'une heure (Voir "Particularité du Polytron 8310", page 116).
– La concentration de gaz mesurée par le détecteur de gaz est inférieure à 10 %LIE (exposer le capteur à un gaz neutre le cas échéant).

1. Désactiver la fonction d'alarme du détecteur de gaz (Voir "Activer ou désactiver une alarme", page 124).
2. Sélectionner ***Configuration*** > ***Capteurs*** > ***Catégorie DSIR*** et confirmer.
   ⇒ La catégorie du gaz est affichée sur l'appareil.

ℹ Les autres étapes sont effectuées sur le capteur.

3. Pour sélectionner la catégorie du gaz sur le capteur, appuyer sur le symbole ⇧S ou ⇩0 avec la baguette magnétique.
   ⇒ Le détecteur de gaz affiche START.
4. Retirer la baguette magnétique.
   ⇒ Le capteur passe à un signal de sortie qui représente la catégorie de gaz actuellement définie :
   Signal de sortie 20 %LIE : Catégorie de gaz Méthane
   Signal de sortie 40 %LIE : Catégorie de gaz Propane
   Signal de sortie 60 %LIE : Catégorie de gaz éthène (éthylène)
5. Ce signal de sortie est maintenu pendant 30 secondes. Pendant cette période, le gaz suivant peut être sélectionné en plaçant la barrette magnétique sur la zone marquée par le symbole ⇧S.
   ⇒ Le signal de sortie du capteur passe alors à la valeur correspondant à la nouvelle catégorie de gaz sélectionnée. Si aucune autre saisie n'est effectuée avec la baguette magnétique pendant plus de 30 secondes, le réglage est enregistré.
6. Vérifier l'ajustage sensibilité sur le détecteur de gaz (Voir "Calibrage sensibilité", page 117)
7. Activer la fonction d'alarme du détecteur de gaz (Voir "Activer ou désactiver une alarme", page 124).

ℹ Le réglage sur le capteur peut entraîner l'affichage d'une catégorie de gaz incorrecte dans le menu ***Catégorie DSIR*** ou l'impossibilité de voir le changement de catégorie de gaz.

13.10 Réglages du capteur Polytron® 87x0 IR

13.10.1 Configuration de gaz

Cette fonction règle le type de gaz, la plage de mesure et les unités de mesure. Seuls certains capteurs peuvent prendre ces réglages en charge.

1. Sélectionner ***Configuration*** > ***Capteurs*** > ***Gas-Cfg*** et confirmer.
   ⇒ Le gaz actuellement mesuré s'affiche.
2. Sélectionner le gaz cible dans la liste et valider.
   ⇒ L'unité de mesure actuelle s'affiche.
3. Sélectionner l'unité de mesure de votre choix dans la liste et valider.
   ⇒ Si l'unité de mesure est réglée sur %LEL, %UEG ou %LIE, la catégorie s'affiche. Poursuivre à l'étape 4.
   ⇒ Sinon, le dépassement d'échelle du signal s'affiche. Poursuivre à l'étape 6.
4. Sélectionner une fonction et valider.
5. Régler et valider le seuil de LIE.
6. Régler le dépassement d'échelle et confirmer.
   ⇒ Le nouveau dépassement d'échelle du signal s'affiche.
7. Sélectionner ***Suite*** et confirmer.
   ⇒ Une vue d'ensemble des nouveaux réglages du gaz apparaît.
8. Après révision, sélectionner ***Retour Menu*** ou ***Confirmer***.

Retour Menu	Sélectionner Retour au menu pour quitter la fonction sans apporter de modifications, et valider avec [OK].
Confirmer	Sélectionner Confirmer pour accepter les réglages et valider avec [OK].

9. Contrôler les réglages d'alarme après avoir modifié la catégorie ou la valeur LIE.

14 Réglages par défaut d'usine

14.1 Réglages fixes pour relais, LED et alarme

	Réglage
Relais de défaut :	Excité / contact de travail (Normally Open)
LED jaune :	Allumée lorsqu'un message de défaut est actif
LED rouge :	Clignote une fois lorsqu'une alarme A1 est active. Clignote deux fois lorsqu'une alarme A2 est active. Si une alarme a été configurée comme pouvant être acquittée et qu'elle a effectivement été acquittée, la LED arrête de clignoter une ou deux fois et reste allumée.
Hiérarchie des alarmes :	A2 est prioritaire sur A1 sur la LED. Toutefois, les relais A1 et A2 fonctionnent indépendamment. (Exemple : si A1 peut être acquittée et A2 ne l'est pas et que la concentration de gaz est suffisamment élevée pour déclencher A1 et A2, le relais A1 se désexcite lorsque l'alarme est acquittée. Toutefois, la LED rouge continue de clignoter deux fois tant que la condition ayant déclenché l'alarme A2 est présente.

14.2 Configurations modifiables dans le menu

Menu	Réglage par défaut	Plage
Relais actif en cas d'alarme/aucune alarme	Actif en cas d'alarme	Marche/Arrêt
Alarme A1 : Sens	Ascendante (descendante pour les capteurs O_2)	Descendante/Ascendante
Alarme A2 : Sens	Ascendante	
Mode automaintien A1	Sans automaintien	Avec automaintien/sans automaintien
Mode automaintien A2	Automaintien	
Mode d'acquittement A1	Acquittable	Acquittable/Non acquittable/préaquittable
Mode d'acquittement A2	Non acquittable	
Mode de fonctionnement normal Relais A1	Excité	Excité/Non excité
Mode de fonctionnement normal Relais A2		

Menu	Réglage par défaut	Plage
Mot de passe Ajustage	_ _ _ 1	
Mot de passe Réglages	_ _ _ 2	
Réglage LCD	Marche	Marche/Arrêt
Statut SIL	Arrêt	Marche/Arrêt
Langue	EN	DE / EN / FR / ES / RU / ZH
Ajustage automatique	Arrêt	Marche/Arrêt
Touche de fonction	Défaut	Graphique, défaut, avertissement, vitalité, test au gaz

Interface	Réglage par défaut	Plage
Courant de défaut	1,2 mA	0 à 3,5 mA
Avertissement	Arrêt	Marche/Arrêt
Courant d´avertissement	3,0 mA	0 à 3,5 mA
Intervalle du cycle d'avertissement T1	10 s	5 à 60 s
Intervalle du cycle d'avertissement T2 (courant d'avertissement)	1 s	1 à (T1-1) sec
Signal de maintenance	statique	Statique/dynamique
Courant de maintenance	3,4 mA	0 à 3,5 mA
Décalage analogique	0 mA	-0,5-0,5 mA
Sensibilité sortie analogique	0 mA	-0,5-0,5 mA
Adresse HART®	0	0-15
Adresse Modbus[1)]	126	2-126
Parité Modbus[1)]	Pair (par défaut)	Pair, impair, sans parité
Vitesse en bauds Modbus[1)]	9600 bit/s	9600 ou 19200 bit/s
Adresse PROFIBUS®[1)]	126	2-126

1) Les interfaces bus de terrain ne sont pas conformes à BVS 13 ATEX G001 X. Aucun relais n'est disponible en utilisant une interface bus de terrain.

14.3 Valeurs spécifiques du capteur

La notice d'utilisation du capteur contient d'autres spécifications.

14.3.1 Polytron 8100 EC

Menu	Réglage par défaut	Plage
Alarme A1	En fonction du capteur utilisé	
Alarme A2	En fonction du capteur utilisé	
Hystérésis pour l'alarme A1 dans le sens ascendant	0	0 à A1
Hystérésis pour l'alarme A2 dans le sens ascendant	0	0 à A2
Hystérésis pour l'alarme A1 dans le sens descendant	0	0 à valeur maximale de la plage de mesure -A1
Hystérésis pour l'alarme A2 dans le sens descendant	0	0 à valeur maximale de la plage de mesure -A2
Intervalle d'ajustage [jours]	En fonction du capteur utilisé	0 à 720

14.3.2 Polytron 8100 EC Avec capteurs O_2

Menu	Réglage par défaut	Plage
Décalage de la plage de capture de l'écran	20,9 Vol% (O_2)	0-25 Vol% (O_2 LS) 0 à 100 Vol% (O_2)
Plage de capture de l'écran bas	-0,25 Vol% (O_2)	0 à -0,75 Vol%
Plage de capture de l'écran haut	0,25 Vol% (O_2)	0 à 0,75 Vol%
Valeur maximale de la plage de mesure	25 Vol% (O_2, O_2 LS)	5 à 25 Vol% (O_2 LS) 5 à 100 Vol% (O_2)

14.3.3 Polytron 8100 EC avec Dräger SensorAlive

Menu	Réglage par défaut	Plage
Courant d'avertissement DSA	2,0 mA	0 à 3,5 mA
Limit d'avertissement DSA	En fonction du capteur utilisé	
Activation DSA	Marche	Marche/Arrêt
LifeTest		
Heure	En fonction du capteur utilisé	
Comportement de sortie	Fixe	Fixe/maintenance/valeur mesuré
Profil de répétition	Flexible	Flexible/statique
Seuil d'annulation	En fonction du capteur utilisé	
Surveillance de sensibilité		
Activation	En fonction du capteur utilisé	
Alarme <50 %	Arrêt	Arrêt/avertissement
Alarme <40 %	Avertissement DSA	Arrêt/avertissement DSA/défaut
Détection des défauts	Marche	Marche/Arrêt

14.3.4 Polytron 8200 CAT DrägerSensor® DQ

Menu	Réglage par défaut	Plage
Alarme A1	20 %LIE	1 à 100 %LIE
Alarme A2	40 %LIE	
Hystérésis pour l'alarme A1 dans le sens ascendant	1 %LIE	0 à A1
Hystérésis pour l'alarme A2 dans le sens ascendant	1 %LIE	0 à A2
Intervalle d'ajustage [jours]	180	0 à 360
Décalage de la plage de capture de l'écran	0 %LIE	-5 à 4 %LIE
Plage de capture de l'écran bas	-5 %LIE	-5 à 0 %LIE
Plage de capture de l'écran haut	2 %LIE	0 à 4 %LIE
Valeur maximale de la plage de mesure	100 %LIE	La plage ne peut pas être ajustée

14.3.5 Polytron 8200 CAT DrägerSensor® LC

Menu	Réglage par défaut	Plage
Alarme A1	2,0 %LIE	0,1 à 10 %LIE
Alarme A2	4,0 %LIE	
Hystérésis pour l'alarme A1 dans le sens ascendant	0,1 %LIE	0 à A1
Hystérésis pour l'alarme A2 dans le sens ascendant	0,1 %LIE	0 à A2
Valeur maximale de la plage de mesure	10 %LIE	5 à 10[1] %LIE 1 à 10 %LIE
Intervalle d'ajustage [jours]	180	0 à 360
Décalage de la plage de capture de l'écran	0 %LIE	-0,5 à 0,4 %LIE
Plage de capture de l'écran bas	-0,5%LIE	-0,5 à 0 %LIE
Plage de capture de l'écran haut	0,2 %LIE	0 à 0,4 %LIE

1) Pour les versions du micrologiciel < 3.0.0

14.3.6 Polytron 8310 IR

Menu	Réglage par défaut	Plage
Alarme A1	20 %LIE	1 à 100 %LIE
Alarme A2	40 %LIE	
Hystérésis pour l'alarme A1 dans le sens ascendant	1 %LIE	0 à A1
Hystérésis pour l'alarme A2 dans le sens ascendant	1 %LIE	0 à A2
Intervalle d'ajustage [jours]	180	0 à 360
Décalage de la plage de capture de l'écran	0 %LIE	-3 à 4 %LIE
Plage de capture de l'écran bas	-3 %LIE	-3 à 0 %LIE
Plage de capture de l'écran haut	2 %LIE	0 à 4 %LIE
Valeur maximale de la plage de mesure	100 %LIE	La plage ne peut pas être ajustée

14.3.7 Polytron 8700 IR

Type 334

Menu	Réglage par défaut	Plage
Gaz étalon	Méthane	
Unités de gaz étalon	%LIE	
Concentrations de gaz étalon	50 %LIE	
Alarme A1	20 %LIE	0,01 à 100 Vol% pour %LIE = 0,3 à 100 %LIE
Alarme A2	40 %LIE	
Type LIE	NIOSH	IEC/PTB/NIOSH/configurable
Gaz de mesure	Méthane	
Unités du gaz de mesure	%LIE	%LIE/Vol%/PPM/%LEL/%LIE
Valeur maximale de la plage de mesure	100 %LIE	20 à 100 %LIE
Beam Block	Arrêt	Marche/Arrêt
Courant Beam Block	2 mA	0 à 3,5 mA
Limite du Beam Block	7,5 %LIE	0 à 15 %LIE max[1]
Intervalle d'ajustage [jours]	360	0 à 720
Comportement de réponse	Normal	Normal/rapide
Décalage de la plage de capture de l'écran	0	Les valeurs absolues de la plage de capture d'écran doivent rester à l'intérieur de ces limites : -1000 à 2200 ppm (méthane type 334) -850 à 850 ppm (propane type 334) -1200 à 1150 ppm (éthylène Type 334)
Plage de capture de l'écran bas	-750 ppm (méthane) -315 ppm (propane) -405 ppm (éthylène)	
Plage de capture de l'écran haut	750 ppm (méthane) 315 ppm (propane) 405 ppm (éthylène)	

1) La limite max. du Beam Block dépend du type de détecteur de gaz et du gaz de mesure sélectionné.

Type 340

Menu	Réglage par défaut	Plage
Gaz étalon	Propane	
Unités de gaz étalon	%LIE	
Concentrations de gaz étalon	50 %LIE	
Alarme A1	20 %LIE	0,01 à 100 Vol% pour %LIE = 0,3 à 100 %LIE
Alarme A"	40 %LIE	
Type LIE	NIOSH	IEC/PTB/NIOSH/configurable
Gaz de mesure	Propane	
Unités du gaz de mesure	%LIE	%LIE/Vol%/PPM/%LEL/%LIE
Valeur maximale de la plage de mesure	100 %LIE	20 à 100 %LIE
Beam Block	Arrêt	Marche/Arrêt
Courant Beam Block	2 mA	0 à 3,5 mA
Limite du Beam Block	2,5 %LIE	0 à 15 %LIE max[1)]
Intervalle d'ajustage [jours]	360	0 à 720
Comportement de réponse	Normal	Normal/rapide
Décalage de la plage de capture de l'écran	0	Les valeurs absolues de la plage de capture d'écran doivent rester à l'intérieur de ces limites : -850 à 425 ppm (propane de type 340) -1800 à 2200 ppm (méthane de type 340)
Plage de capture de l'écran bas	-750 ppm (méthane) -85 ppm (propane)	
Plage de capture de l'écran haut	750 ppm (méthane) 85 ppm (propane)	

1) La limite max. du Beam Block dépend du type de détecteur de gaz et du gaz de mesure sélectionné.

14.3.8 Polytron 8720 IR

Menu	Réglage par défaut	Plage
Gaz étalon	CO_2	
Unités de gaz étalon	Vol%	
Concentrations de gaz étalon	4,0 Vol%	0,2 à 100 Vol%
Alarme A1	1 Vol%	0,01 à 100 Vol%
Alarme A2	2 Vol%	
Type LIE	-	
Gaz de mesure	CO_2	
Unités du gaz de mesure	Vol%	Vol%/ppm
Valeur maximale de la plage de mesure	10 Vol%	0,2 à 100 Vol%
Beam Block	Arrêt	Marche/Arrêt
Courant Beam Block	2 mA	0 à 3,5 mA
Limite du Beam Block	0,1 Vol%	0 à 0,1 Vol%
Intervalle d'ajustage [jours]	360	0 à 720
Comportement de réponse	Normal	Normal/rapide
Décalage de la plage de capture de l'écran	340 ppm	Les valeurs absolues de la plage de capture d'écran doivent rester à l'intérieur de ces limites : -1000 à 1000 ppm (dioxyde de carbone)
Plage de capture de l'écran bas	-200 ppm	
Plage de capture de l'écran haut	200 ppm	

15 Élimination



Il est interdit d'éliminer ce produit avec les déchets domestiques. C'est pourquoi, il est marqué du symbole ci-contre.
Dräger reprend gratuitement ce produit. Pour de plus amples informations, veuillez contacter les distributeurs nationaux ou vous adresser directement à Dräger.

Mise au rebut des capteurs électrochimiques

⚠ AVERTISSEMENT
Danger d'explosion et risque de brûlures chimiques !
Des fluides peuvent s'échapper du capteur et causer des brûlures à l'acide.
► Ne pas jeter les capteurs au feu.
► Ne pas ouvrir en forçant.

16 Caractéristiques techniques

16.1 Plages de mesure

Capteur	Plage de mesure
Polytron 8100 EC avec DrägerSensor® EC	En fonction du capteur utilisé
Polytron 8200 CAT avec DrägerSensor® DQ	0 à 100 %LIE
Polytron 8200 CAT avec DrägerSensor®LC	0 à 10 %LIE[1)]
Polytron 8310 IR avec DrägerSensor® IR	0 à 100 %LIE
Polytron 8700 IR avec détecteur de gaz à infrarouge PIR 7000	
Type 334 (IDS 01x1)	0 à 10 000 ppm[1)] 0 à 100 %LIE, [1)] 0 à (1,25 x LIE_{max}) Vol%,[1)2)] Pour CH4 (méthane) de 0 à 100 Vol%[1)]
Type 340 (IDS 01x2)	0 à 10 000 ppm[1)] 0 à 100 %LIE[1)] 0 à 5 Vol%[1)]
Polytron 8720 IR avec détecteur de gaz à infrarouge PIR 7200 (IDS 01x5)	0 à 100 Vol%[1)]

1) Pour une valeur maximale de la plage de mesure adaptable, voir 14.3.
2) La plage change en fonction de la substance à mesurer

16.2 Transmission du signal vers la centrale de commande

La plage de mesure et les caractéristiques techniques de mesure dépendent du capteur installé (voir la notice d'utilisation du capteur installé).

Fréquence du calcul de la valeur mesurée : 1 x par seconde (mise à jour de l'affichage, de l'interface analogique et du relais).

Signal analogique	
Fonctionnement normal	4 ... 20 mA
Dérive en-dessous de zéro	3,8 ... 4 mA
Dépassement de la plage de mesure	20 ... 20,5 mA
Erreur de l'appareil	≤ 1,2 mA
Défaut sur l'interface analogique	> 21 mA
Signal de maintenance	Signal fixe 3,4 mA ou modulation de 1 Hz entre 3 et 5 mA (sélectionnable)

Résistance de la boucle de signal

Mode de fonctionnement	Plage de résistance de la boucle de signal	Plage de l'alimentation électrique
Fonctionnement sans communication HART®	0 à 230 Ω	à 10 V CC
	Augmentation linéaire avec la tension d'alimentation de : 0 à 230 Ω à 10 V 0 à 500 Ω à 16 V	10 à 18 V CC
	0 à 500 Ω	18 à 30 V CC
Fonctionnement avec communication HART®	230 à 270 Ω	à 13 V CC
	Augmentation linéaire avec la tension d'alimentation de : 230 à 270 Ω à 11 V sur 230 à 500 Ω à 16 V	11 à 16 V CC
	230 à 500 Ω	18 à 30 V CC
Mode multipoint HART®	230 à 500 Ω	10 à 30 V CC

En cas d'utilisation conformément au test d'aptitude métrologique selon EN IEC 62990-1, EN IEC 60079-29-1 ou EN 50104, la résistance ne doit pas dépasser 300 ohms. Vous trouverez de plus amples informations sur l'installation de l'interface bus de terrain dans le document 9033783.

16.3 Caractéristiques du câble

Pour les installations hors conduite, utiliser des câbles blindés.

Connexion analogique et HART®Connexion analogique et HART® avec centrale de commande et alimentation électrique	
Alimentation électrique et signaux	Câble blindé 3 fils 24 à 12 AWG / 0,2 à 2,5 mm²
Relais	20 à 12 AWG / 0,5 à 2,5 mm²

Connexion numérique avec centrale de commande	
Les appareils avec interfaces bus de terrain et capteurs déportés doivent être installés avec des câbles blindés.	
Modbus RTU	2 ou 3 fils[1], ≥ 26 AWG
PROFIBUS PA Foundation Fieldbus	2 fils, câble type A Résistance d'onde R_W : 135 à 165 Ω Capacité / longueur d'unité C' : < 30 pF/m Résistance de la boucle R' : 110 Ω/km Diamètre du fil d : 0,64 mm Coupe transversale du fil q : > 0,34 mm² Couverture du blindage : ≥ 90 %
Alimentation électrique	2 fils, 24 à 12 AWG / 0,2 à 2,5 mm²

1) Si la distance entre la centrale de commande et le transmetteur est très longue (>1 km) et que l'alimentation électrique de la centrale de commande et du transmetteur est séparée, des défauts ou des différences de différentiel peuvent apparaître. Dans ce cas, choisir le câblage à 3 fils avec terre. La terre est ensuite connectée au transmetteur et bouclée vers la terre de la centrale de commande.

16.4 Alimentation électrique et relais

Puissance du relais[1] SPDT[2]	
230 V ~	0,1 A à 5 A
30 V ⎓, charge ohmique	0,1 A (minimum) à 5 A

1) Pour les applications liées à la sécurité (SIL 2), la puissance de couplage max. est réduite (voir Manuel de sécurité du Polytron® 8xx0).
2) Commutateur unipolaire (contacts électriques inverseurs)

Alimentation électrique Polytron 8xx0	
Tension de service	10[1] jusqu'à 30 V⎓ sur l'appareil
Courant de démarrage	2,3 A pour 2 ms à 24 V⎓, résistance 10 Ω

1) L'appareil déclenche une alarme de défaut lorsque la tension d'alimentation inférieure à 9,5 V CC.

Courant de fonctionnement	
Polytron® 8100 EC	
sans relais, capteur non déporté	80 mA
avec relais, capteur déporté	100 mA
Polytron® 8200 CAT	
sans relais, capteur non déporté	105 mA (DrägerSensor DQ) 130 mA (DrägerSensor LC)
avec relais, capteur déporté	145 mA (DrägerSensor DQ) 165 mA (DrägerSensor LC)
Polytron® 8310 IR	
sans relais, capteur non déporté	145 mA
avec relais, capteur déporté	185 mA
Polytron® 87x0 IR	
sans relais, capteur non déporté	330 mA
avec relais, capteur déporté	350 mA

16.5 Spécifications générales

Boîtier Polytron 8xx0	
Matériau du boîtier	Aluminium sans cuivre
Protection du boîtier	NEMA 4X[1] IP 65/66/67[2]
Écran	Résolution 128 x 64 pixels, rétroéclairé[3]

1) Absence de protection du boîtier Polytron 8100 EC NEMA 4X.
2) Les indices de protection IP n'impliquent pas que l'équipement détecte un gaz pendant ou après son exposition à ces conditions. En cas de dépôt de poussière et de contact avec de l'eau suite à une immersion ou un jet d'eau, vérifier l'ajustage et le bon fonctionnement de l'appareil.
3) Dans le cas de températures élevées : (>65 °C), la lisibilité de l'écran est limitée.

16.6 Paramètres ambiants

La notice d'utilisation du capteur contient d'autres spécifications et influences.

Les valeurs des accessoires et des pièces détachée peuvent différer de celles indiquées ici. Les valeurs exactes sont indiquées dans le manuel correspondant.

Polytron 8xx0	
Valeurs selon l'essai de protection contre l'explosion	
Pendant le fonctionnement :	
Pression	23,6 à 32,5 po. Hg (800 à 1100 hPa)
Humidité	0 à 100 % d'humidité relative, sans condensation
Températures	
Polytron 8100 EC	-40 à +70 °C (-40 à +158 °F)
Polytron 8200 CAT	-40 à +80 °C (-40 à +176 °F)
Polytron 8310 IR	-40 à +65 °C (-40 à +149 °F)
Polytron 87x0 IR	-40 à +80 °C (-40 à +176 °F)
Valeurs selon l'expertise métrologique	
Pendant le fonctionnement :	
Pression	20,7 à 38,4 po. Hg (700 à 1300 hPa)[1)]
Humidité	0 à 95 % d'humidité relative, sans condensation
Températures	
Polytron 8100 EC[2)]	-40 à +65 °C (-40 à +149 °F)
Polytron 8200 CAT	-40 à +80 °C (-40 à +176 °F)
Polytron 8310 IR	-40 à +65 °C (-40 à +149 °F)
Polytron 87x0 IR	-40 à +77 °C (-40 à +170 °F)
Pendant le stockage :	
Pression	26,5 à 32,4 po. Hg (900 à 1100 hPa)
Humidité	0 à 100 % d'humidité relative, sans condensation
Température	-20 à +65 °C (-4 à +149 °F)
Durée de stockage recommandée	5 ans
Valeurs pour l'option relais et les installations avec homologation UL	
Pendant le fonctionnement :	
Températures	
Polytron 8200 CAT	-40 à +70 °C (-40 à +158 °F)
Polytron 87x0 IR	-40 à +70 °C (-40 à +158 °F)

1) Polytron 8200 CAT : 23,6 à 35,44 in. Hg (800 à 1200 hPa)
2) Les restrictions relatives à la spécification maximale sont détaillées dans 18.3, 18.3.2 et dans la notice d'utilisation du capteur EC.

16.7 Couples de serrage

Filetage de l'appareil	
Couvercle du boîtier	≥44 in-lbs / ≥5 Nm
Capteur	min. 266 in-lbs / min. 30 Nm
Bouchons aveugles	min. 266 in-lbs / min. 30 Nm
Raccords (pour les conduites et les presse-étoupe)	min. 443 in-lbs / min. 50 Nm
Bouchons aveugles de la station d'accueil	62 in-lbs / 7 Nm
Presse-étoupes pour la station d'accueil	70 in-lbs / 8 Nm
Tête de mesure EC déportée	177 in-lbs ±9 in-lbs / 20 Nm ±1 Nm
Bornes de câblage de terrain	
Alimentation électrique, signaux et relais	4,4 à 7,0 in-lbs / 0,5 à 0,8 Nm
Vis de mise à la terre	10,6 in-lbs / 1,2 Nm

17 Accessoires et pièces détachées

Ce chapitre présente les composants couverts par l'examen de type BVS 13 ATEX G 001 X et PFG 14 G 001 X. D'autres pièces sont mentionnés dans la liste des pièces de rechange ou peuvent être obtenues auprès du DrägerService.

17.1 Polytron® 8xx0

Description	Référence de pièce
IRDA vers interface PC	4544197
Baguette magnétique avec porte-clés	4544101
Dräger PolySoft, logiciel de configuration	8328600 / 8328639
Bouchons aveugles EXd, acier inoxydable, 2x	4544897
Bouchons aveugles EXd, acier galvanisé, 3x	8344041

17.1.1 Station d'accueil

Description	Référence de pièce
Version seulement électrique de la station d'accueil	8344027
Alimentation de la station d'accueil, relais (comprend 2 presse-étoupes)	8344028
Station d'accueil bus de terrain	8344029

Description	Référence de pièce
Presse-étoupe, station d'accueil	6812868
Prise aveugle de station d'accueil	8344042

17.2 Polytron® 8100 EC

Description	Référence de pièce
Carte de circuit imprimé Polytron 8100 4–20/HART	4544781
Carte de circuit imprimé Polytron 8100 4–20/HART, relais	4544782
Anneau à baïonnette	4544366
Anneau à baïonnette pour Dräger SensorAlive	6800132
Adaptateur pour montage sur conduite de ventilation pour tête de mesure EC déportée[1)]	8317617
Kit de montage sur poteau pour tête de mesure déportée EC	4544213
Dongle de test capteur	8317619
Dongle Diagnostics	8317860
Adaptateur d'ajustage	6810536

1) Peut influencer la mesure, p.ex. en augmentant le temps de réponse. Non couvert par BVS 13 ATEX G 001 X et PFG 14 G 001 X.

17.3 Polytron® 8200 CAT

Description	Référence de pièce
Carte de circuit imprimé Polytron 8200 4–20/HART	4544788
Carte de circuit imprimé Polytron 8200 Relais 4–20/HART	4544789
Adaptateur d'ajustage PE, Europe	6806978
Adaptateur d'ajustage à distance DQ	6812480
Adaptateur d'ajustage à distance LC[1)]	6812482
Jeu de pièces détachées Membrane 21,50x14,50, 2x	8326840
Filtre à poussière pour DrägerSensor DQ, 10x	6810537
Adaptateur de processus DQ	6812470
Adaptateur de processus LC[1)]	6812465
Protection anti-éclaboussures	6812510

1) Non couverts par l'expertise métrologique.

17.3.1 Capteurs CAT

Description	Référence de pièce
DrägerSensor DQ NPT	6814150
DrägerSensor DQ NPT S[1)]	3701800
DrägerSensor LC NPT	6810675
Tête de mesure, Polytron SE Ex PR M1 DQ	6812711
Tête de mesure, Polytron SE Ex PR M2 DQ	6812710
Tête de mesure Polytron SE Ex HT M DQ	6812720
Capteur déporté DQ NPT alu	3706933
Capteur déporté DQ NPT acier	3706934

1) Le DrägerSensor DQ NPT S peut aussi être utilisé à la place du DrägerSensor DQ NPT.

17.4 Polytron® 8310 IR

Description	Référence de pièce
Protection anti-éclaboussures	6810796
Adaptateur de processus	6811330
Labyrinthe de protection	6811135
Adaptateur de calibrage	6810859
Carte de circuits imprimés Polytron 8310 4–20/HART	4544788
Carte de circuits imprimés Polytron 8310 Relais 4–20/HART	4544789

17.4.1 Capteurs DSIR

Description	Référence de pièce
DrägerSensor IR NPT	6811901
Tête de mesure, DrägerSensor IR set complet e	6811165
Tête de mesure, DrägerSensor IR set complet e2	6811265

17.5 Polytron® 87x0 IR

Description	Référence de pièce
Carte de circuit imprimé Polytron 87x0 4–20/HART[1)]	4544795
Carte de circuit imprimé Polytron 87x0 Relais 4–20/HART[1)]	4544796
Kit de montage PIR 7000	6811648
Cuvette de processus PIR 7000, acier inoxydable	6811415
Cuvette de processus PIR 7000 SGR	6813219
Indicateur d'état PIR 7000 / 7200	6811625 / 6811920
Protection anti-éclaboussures PIR 7000 / 7200	6811911 / 6811912
Flowcell PIR 7000/7200	6811490 / 6811910
Adaptateur pour essai à distance PIR 7000/7200	6811630 / 6811930
Protection contre les insectes PIR 7000	6811609
Filtre hydrophobique PIR 7000	6811890
Adaptateur de calibrage PIR 7000	6811610
Adaptateur de processus PIR 7000 / 7200 POM (polyoxyméthylène)	6811915
Kit de montage PIR 7000	6811648
Boîte à bornes Ex e	6811989
Boîte à bornes Ex d	4520561
Barre magnétique	4544101

1) Vérifier la compatibilité des micrologiciels du capteur et du détecteur de gaz. Le remplacement de la carte de circuit imprimé peut nécessiter une actualisation du micrologiciel . Contacter Dräger le cas échéant.

17.5.1 Capteurs

Vérifier la compatibilité des micrologiciels du capteur et du détecteur de gaz. Le remplacement du capteur peut nécessiter une actualisation du micrologiciel. Contacter Dräger le cas échéant.

Description	Référence de pièce
Dräger PIR 7000 Type 334 (NPT)	6811822
Dräger PIR 7000 Type 340 (NPT)	6811832
Dräger PIR 7000 334 (M25) Kit complet	6811825
Dräger PIR 7000 340 (M25) Kit complet	6811819
Dräger PIR 7200 (NPT)	6811572
Dräger PIR 7200 (M25) HART Kit complet	6812290

18 Homologations de performance

En combinaison avec certains capteurs, Polytron 8xx0 a un avis métrologique selon les normes suivantes :

– Certificats d'examen UE et de type selon les normes EN 60079-29-1, EN 50104, EN 45544 et DIN IEC 62990-1. Publié par DEKRA Testing and Certification GmbH, Handwerkstr. 15, 70565 Stuttgart, Allemagne.
– Expertise métrologique FM selon ANSI/ISA-92.00.01 FM6340

La notice d'utilisation de chaque capteur détaille ses spécifications et restrictions (p.ex. principes de mesure, performances, sensibilités transversales).

18.1 Certificat d'essai UE, BVS 13 ATEX G 001 X

Mesure de gaz et vapeurs inflammables mélangés avec de l'air.

– Polytron 8200 CAT avec DrägerSensor DQ

  Conditions particulières :

  - En cas d'écoulement d'air contenant des gaz de mesure, les valeurs mesurées peuvent augmenter jusqu'à 32 %.
  - En cas d'utilisation avec l'adaptateur de télécalibrage DQ, les valeurs mesurées peuvent augmenter jusqu'à 70 %.

– Polytron 8200 CAT avec DrägerSensor LC
  Homologué avec la valeur maximale de la plage de mesure 10 %LIE.
  Établir une liaison avec une centrale de commande disposant d'une fonction de mesure homologuée (par exemple, REGARD® 7000). Les alarmes auto-maintenues pour les valeurs mesurées dépassant la plage de mesure doivent être activées sur la centrale de commande.
– Polytron 8310 IR avec DrägerSensor IR
– Polytron 8700 IR avec PIR 7000 de types 334 et 340

Mesure de l'oxygène (inertisation)

– Polytron 8100 EC avec DrägerSensor O_2 (6809720) et DrägerSensor O_2 LS (6809630) dans une plage de mesure de 0 à 5...25 Vol% d'O_2.

Homologués :
– Interface 4 à 20 mA
– Module relais
– Capteur déporté
– HART
– Valeurs maximales de la plage de mesure par défaut définies en usine

L'interface bus de terrain et l'enregistreur de données ne sont pas homologués.

18.2 Certificat d'essai, PFG 14 G 001 X

Mesure de l'oxygène (carence et enrichissement)
– Polytron 8100 EC avec DrägerSensor O_2 (6809720) et DrägerSensor O_2 LS (6809630) dans la plage de mesure 0 à 25 Vol% d'O_2.

Mesure de l'hydrogène sulfuré
– Polytron 8100 EC avec Dräger SensorAlive (6809630) dans les plages de mesure suivantes :
  ● 0,5 – 100 ppm (Type HM)
  ● 0 – 100 ppm (Type SM)

Mesure du dioxyde de carbone
– Polytron 8720 IR avec PIR 7200 dans les plages de mesure suivantes :
  ● 1 Vol% et 10 Vol% – EN 45544-2
  ● 2000 ppm, 1 Vol% et 10 Vol% – EN 45544-3

Homologués :
– Interface 4 à 20 mA
– Module relais
– Capteur déporté

Non homologués :
– Interface bus de terrain
– Enregistreur de données
– Polytron 8100 EC avec Dräger SensorAlive seulement : Fonctionnalité d'autotest en cas d'utilisation du générateur de gaz

18.3 Conditions de fonctionnement certifiées DrägerSensor O_2, O_2LS et Dräger SensorAlive

Sensibilités transversales

Il n'y a pas de sensibilité transversale connue à des gaz d'interférence avec une concentration allant jusqu'à 100 ppm. Contacter Dräger pour de plus amples informations.

18.3.1 DrägerSensor O_2 (6809720)

Le DrägerSensor O_2 (6809720) est un capteur électrochimique à 2 électrodes pour la mesure de l'oxygène (O_2) dans l'air ambiant.

Paramètres ambiants	
Pression	20,7 à 38,4 po. Hg (700 à 1300 hPa)
Humidité	10 à 95 % d'humidité relative, sans condensation
Température	En cas d'application de la norme EN 50104, la plage de température est comprise entre 0 °C et +55 °C.

Stockage	
Pression	Aucune influence
Humidité	30 à 70 % d'humidité relative, sans condensation (uniquement si l'emballage du capteur est ouvert)
Température	0 à +40 °C
Durée	Le stockage des capteurs n'est pas prévu. Les capteurs doivent être utilisés dès leur réception. Durée de vie restante = durée de vie prévue - durée de stockage

Influence des paramètres ambiants	**Point zéro**	**Sensibilité[1)]**
Température[2)3)]		
0 à 55 °C	≤ 0,3 Vol% d'O_2	≤ 0,9 Vol% d'O_2
Pression	< 0,2 Vol% d'O_2	Écart relatif par rapport à la valeur à 1013 hPa : < 10 % de la valeur mesurée / 100 hPa
Humidité	Aucune influence	Écart relatif par rapport à la valeur à 50 % d'humidité relative : < 1 % de la valeur mesurée

1) L'écart relatif de la valeur affichée est causé par les changements de pression atmosphérique.
2) À des températures inférieures à -5 °C, l'écart de la valeur mesurée est supérieur à celui indiqué dans EN 50104.
3) Effectuer un ajustage à la température de fonctionnement si les températures de fonctionnement sont en dehors de la plage -5 °C à +40 °C.

Temps de réponse[1)]	**$t_{0...20}$**	**$t_{0...90}$**
0 à 5 Vol% d'O_2	≤ 15 secondes[2)]	≤ 33 secondes
0 à 25 Vol% d'O_2	≤ 10 secondes	≤ 26 secondes

1) En dessous de -5 °C, le temps de réponse peut augmenter.
2) Le temps de réponse est supérieur à la valeur limite autorisée par la norme EN 50104.

Temps de stabilisation : 5 x $t_{0...90}$

Plage de mesure

0 à 5 Vol% d'O_2 à 0 à 100 Vol% d'O_2

Valeur standard : 25 Vol% d'O_2 Valeur minimale : -1,25 Vol% d'O_2

Temps de stabilisation du capteur

En fonctionnement : <20 minutes / Ajustage : ≤ 2 heures

18.3.2 DrägerSensor O_2LS (6809630)

Le DrägerSensor O_2LS (6809630) est un capteur électrochimique à 3 électrodes pour mesurer l'oxygène (O_2) dans l'air ambiant.

Paramètres ambiants	
Pression	20,7 à 38,4 po. Hg (700 à 1300 hPa)
Humidité	5 à 95 % d'humidité relative, sans condensation
Température	-40 à +60 °C +65 °C pendant une courte période

Stockage	
Pression	Aucune influence
Humidité	30 à 70 % d'humidité relative, sans condensation (uniquement si l'emballage du capteur est ouvert)
Température	0 à +40 °C
Durée	Le stockage des capteurs n'est pas prévu. Les capteurs doivent être utilisés dès leur réception. Durée de vie restante = durée de vie prévue - durée de stockage

Influence des paramètres ambiants	Point zéro	Sensibilité
Température		
-20 à 40 °C	≤ 0,1 Vol% d'O_2	≤ 0,1 Vol% d'O_2
-40 à +65 °C	≤ 0,2 Vol% d'O_2	≤ 0,5 Vol% d'O_2
Pression	< ± 0,1 Vol% d'O_2	≤ 0,8 Vol% d'O_2
Humidité	≤ 0,1 Vol% d'O_2	≤ 0,9 Vol% d'O_2

ℹ Lors de la mesure de l'oxygène en présence d'hélium, la compensation d'hélium peut être utilisée. L'option de compensation d'hélium n'est pas une fonction de mesure certifiée conforme à la norme EN 50104.

⚠ ATTENTION

Défaut du capteur

Cette exposition à des concentrations plus élevées d'hydrocarbures non saturés, d'alcool ou d'hydrogène pendant une période prolongée (environ 100 000 ppm x nombre d'heures) peut provoquer une panne du capteur.

► Vérifier que le capteur n'est pas exposé à de telles concentrations pendant une période prolongée.

Temps de réponse	$t_{0...20}$	$t_{0...90}$
0 à 5 Vol% d'O_2	≤ 14 secondes[1)]	≤ 45 secondes
0 à 25 Vol% d'O_2	≤ 10 secondes	≤ 27 secondes

1) Le temps de réponse est supérieur à la valeur limite autorisée par la norme EN 50104.

Temps de stabilisation : 5 x $t_{0...90}$

Plage de mesure

0 à 5...25 Vol% d'O_2, 0 à 25 Vol% d'O_2

Valeur standard : 25 Vol% d'O_2

Valeur minimale : -1,25 Vol% d'O_2

Temps de stabilisation du capteur

En fonctionnement : ≤ 20 minutes / Ajustage : ≤ 6 heures

18.3.3 Dräger SensorAlive (6814014)

Le Dräger SensorAlive (6814014) est un capteur électrochimique de diffusion avec générateur de gaz intégré pour la mesure de l'hydrogène sulfuré (H_2S) dans l'air ambiant.

Paramètres ambiants	
Pression	20,7 à 35,5 po. Hg (700 à 1200 hPa)
Humidité	5 à 95 % d'humidité relative, sans condensation
Température	-40 à +65 °C
Vitesse maximale du flux d'air ambiant	6 m/s

Stockage	
Pression	Aucune influence
Humidité	30 à 70 % d'humidité relative, sans condensation (uniquement si l'emballage du capteur est ouvert)
Température	0 à +40 °C
Durée	Le stockage des capteurs n'est pas prévu. Les capteurs doivent être utilisés dès leur réception. Durée de vie restante = durée de vie prévue - durée de stockage

Influence des paramètres ambiants	
	Écart relatif par rapport à la valeur affichée
Pression	à 1000 hPa : ≤ 0,15 ppm
Humidité (à +40 °C)	à 0 et 95 % d'humidité relative : ≤ 0,29 ppm
Température	à 20 °C : ≤ 0,44 ppm

Des gaz d'interférence (par exemple, NH_3) peuvent affecter le fonctionnement du capteur.

Temps de réponse en mode diffusion	
t(50)	≤ 20 s
t(90)	≤ 55 s

Temps de décroissance en mode diffusion	
t(50)	≤ 20 s
t(10)	≤ 55 s

18.4 Expertise métrologique FM pour DrägerSensor H_2S et H_2S LC

Les DrägerSensor H_2S et H_2S LC sont des capteurs électrochimiques de diffusion mesurant l'hydrogène sulfuré (H_2S) dans l'air ambiant.

DrägerSensor H_2S (6810435)	
Type d'examen P8100	ETR 0400, 0401, 0500, 0501
Interface[1)]	4 à 20 mA, relais
Paramètres ambiants	
Humidité	5 à 95 % d'humidité relative, sans condensation
Température	-40/+65 °C (-40/149 °F)
Température de stockage	0/+40 °C (32/104 °F)
Protection du boîtier [2)]	IP 65/66/67
Plage	0 à 100 ppm
Précision (selon la valeur la plus élevée)	incertitude de mesure (de la valeur mesurée) ≤ ±3 % ou minimum ≤ ±0,5 ppm
Accessoires	
Filtre à poussières	6809595
Kit adaptateur	6810536
Standard	ANSI/ISA-92.00.01FM6340

1) La communication HART ne doit pas être utilisée pour la communication relative à la sécurité.
2) Le capteur doit être remplacé après immersion ou s'il a été exposé à des projections d'eau.

DrägerSensor H_2S LC (6809610)	
Type d'examen P8100	ETR 0400, 0401, 0500, 0501
Interface[1)]	4 à 20 mA, relais
Paramètres ambiants	
Humidité	5 à 95 % d'humidité relative, sans condensation
Température	-20/+65 °C (-4/149 °F)
Température de stockage	0/+40 °C (32/104 °F)
Protection du boîtier [2)]	IP 65/66/67
Plage	0 à 100 ppm
Précision (selon la valeur la plus élevée)	incertitude de mesure (de la valeur mesurée) ≤ ±3 % ou minimum ≤ ±0,5 ppm dans la plage >50 ppm, ±10 % ou ±3 ppm
Accessoires	
Filtre à poussières	6809595
Kit adaptateur	6810536
Standard	ANSI/ISA-92.00.01FM6340

1) La communication HART ne doit pas être utilisée pour la communication relative à la sécurité.
2) Le capteur doit être remplacé après immersion ou s'il a été exposé à des projections d'eau.

Contenido

1 Información relativa a la seguridad 147
1.1 Indicaciones de seguridad 147
1.2 Condiciones de funcionamiento y ámbito de aplicación 147

2 Convenciones en este documento 148
2.1 Significado de las advertencias 148
2.2 Marcas comerciales 148

3 Descripción 148
3.1 Vista general del producto 148
3.2 Descripción del funcionamiento 148
3.3 Uso previsto 149
3.4 Homologaciones 149
3.4.1 ATEX, IECEx, UL, CSA 149
3.4.2 Información adicional 150

4 Instalación del transmisor 150
4.1 Instalación a prueba de explosión (Ex d) - sin estación de acoplamiento 150
4.1.1 Instalación mecánica 150
4.1.2 Instalación eléctrica 151
4.2 Instalación de seguridad aumentada (Ex e) - con estación de acoplamiento 153

5 Instalación de sensores o cabezales detectores 154
5.1 Instalación del sensor EC en el Polytron 8100 EC 154
5.2 Instalación del cabezal detector 154

6 Puesta en marcha 154
6.1 Indicaciones generales 154
6.2 Puesta en funcionamiento del detector de gases 155

7 Funcionamiento 155
7.1 Panel de mandos 155
7.2 LED y símbolos 155
7.3 Indicadores en la pantalla 155
7.3.1 Todos los equipos 155
7.3.2 Símbolos específicos para Polytron® 8100 EC 156
7.3.3 Modo de medición 156
7.3.4 Estados especiales 156
7.3.5 Finalización de estados especiales 157
7.4 Modo de información y tecla de función 157
7.4.1 Abrir el modo de información 157
7.4.2 Navegación en el modo de información 158
7.4.3 Uso de la tecla de función 158
7.5 Menús 158
7.5.1 Navegación por menús 158
7.5.2 Abrir los menús 158
7.5.3 Contraseñas 158
7.5.4 El menú Información 158
7.5.5 Vistas generales de los menús 159
7.6 Información acerca del funcionamiento con un Dräger SensorAlive 162

8 Calibración 162
8.1 Indicaciones generales 162
8.2 Gases de prueba 162
8.3 Flujo de gas para los ajustes 162
8.4 Preparación del ajuste 163
8.5 Ajuste del punto cero 163
8.5.1 Aspectos generales 163
8.5.2 Ejecución del ajuste del punto cero 164
8.6 Calibración de la sensibilidad 164
8.6.1 Aspectos generales 164
8.6.2 Ejecución del ajuste de sensibilidad 164
8.7 Ajuste automático 165
8.7.1 Aspectos generales 165
8.7.2 Ejecución del ajuste automático 165

9 Eliminación de averías 166
9.1 Fallos 166
9.2 Noticia report 167

10 Mantenimiento 169
10.1 Realización de la prueba con gas y comprobación del tiempo de respuesta (t90) 169
10.2 Sustitución del sensor 169
10.2.1 Polytron® 8100 EC 169
10.2.2 Polytron® 8200 CAT, 8310 IR, 87x0 IR 170
10.3 Realización de una prueba de visualización 170

11 Ajustes del dispositivo 170
11.1 Ajuste de contraseñas 170
11.2 Ajuste de la fecha y la hora 170
11.3 Ajuste del idioma 170
11.4 Configuración de la tecla de función 171
11.5 Restablecimiento de los ajustes por defecto 171
11.6 Cambio del contraste de la pantalla 171
11.7 Cambio del modo de pantalla 171
11.8 Configuración del relé 171
11.8.1 Combinaciones de autoenclavador y confirmación de alarmas 171
11.8.2 Configuración del relé A1 o A2 171
11.8.3 Ajuste del calentamiento 1 del relé de fallo 172
11.9 Configuración de alarma 172
11.9.1 Conexión o desconexión de alarmas 172
11.9.2 Configuración de la alarma 172
11.9.3 Comprobación de alarmas/relés 172
11.10 Configuración del registrador de datos 173
11.10.1 Visualización del gráfico 173
11.10.2 Conexión o desconexión de un registrador de datos 173
11.10.3 Ajuste del tiempo de muestreo 173
11.10.4 Ajuste de pico/media 173
11.10.5 Conexión y desconexión del modo de disparo 173
11.10.6 Ajuste del valor de disparo 173
11.10.7 Configuración de la función "stack" o "roll" 173
11.10.8 Vaciado del registrador de datos 173

12 Ajustes de interfaz 174
12.1 Interfaz de 4-20 mA 174

12.1.1 Desviación total de la escala ... 174
12.1.2 Ajuste de la corriente de fallo ... 174
12.1.3 Información sobre la señal de advertencia ... 174
12.1.4 Conexión o desconexión de la señal de aviso ... 174
12.1.5 Ajuste del intervalo de aviso ... 174
12.1.6 Ajuste de la corriente de aviso ... 174
12.1.7 Configuración de las advertencias del Dräger SensorAlive ... 174
12.1.8 Configuración de la señal de mantenimiento ... 174
12.1.9 Configuración de la corriente de mantenimiento ... 175
12.1.10 Ajuste de la desviación analógica ... 175
12.1.11 Ajuste de la sensibilidad analógica ... 175
12.1.12 Comprobación de la interfaz analógica ... 175
12.1.13 Beam block ... 176
12.2 Interfaz HART ... 176
12.2.1 Ajuste de la dirección de sondeo ... 176
12.2.2 Mostrar el identificador único ... 176
12.2.3 Ajuste de la etiqueta HART ... 176
12.2.4 Ajuste del protocolo Dräger REGARD ... 176
12.3 Interfaces digitales ... 176

13 Ajustes del sensor ... 177

13.1 Conexión y desconexión de la calibración automática ... 177
13.2 Rango de captura ... 177
13.2.1 Ajuste del rango de captura ... 177
13.2.2 Desactivación del rango de captura ... 177
13.3 Reinicio del sensor ... 177
13.4 Ajuste del intervalo de calibración ... 177
13.5 Ajuste del bloqueo del sensor ... 177
13.6 Mochilas de software para sensores EC ... 177
13.6.1 Instalación de la mochila ... 177
13.6.2 Desactivación de la mochila ... 177
13.7 Ajustes de sensor Polytron® 8100 EC ... 178
13.7.1 Autocomprobación del sensor ... 178
13.7.2 Ajustes de gas ... 178
13.7.3 Ajustes del Dräger SensorAlive ... 178
13.8 Ajustes de sensor Polytron® 8200 CAT / 8310 IR ... 179
13.8.1 Tipo de sensor ... 179
13.8.2 Ajustes de gas ... 179
13.8.3 Ajuste del enclavamiento del sensor DQ ... 179
13.9 Ajustes del sensor para Polytron 8310 IR ... 179
13.9.1 Cambio de la categoría de gas ... 179
13.9.2 Cambio de la categoría de gas ... 179
13.10 Ajustes de sensor Polytron® 87x0 IR ... 180
13.10.1 Ajustes de gas ... 180

14 Ajustes por defecto de fábrica ... 180

14.1 Ajustes inalterables para relés, LED y alarma ... 180
14.2 Ajustes que pueden modificarse a través del menú ... 180
14.3 Valores específicos del sensor ... 181
14.3.1 Polytron 8100 EC ... 181
14.3.2 Polytron 8100 EC con sensores de O_2 ... 181
14.3.3 Polytron 8100 EC con Dräger SensorAlive ... 182
14.3.4 Polytron 8200 CAT DrägerSensor® DQ ... 182
14.3.5 Polytron 8200 CAT DrägerSensor® LC ... 182
14.3.6 Polytron 8310 IR ... 182
14.3.7 Polytron 8700 IR ... 183
14.3.8 Polytron 8720 IR ... 184

15 Eliminación ... 184

16 Características técnicas ... 184

16.1 Rangos de medición ... 184
16.2 Transmisión de la señal a la unidad de control ... 185
16.3 Propiedades del cable ... 185
16.4 Alimentación eléctrica y relés ... 186
16.5 Especificaciones generales ... 186
16.6 Parámetros ambientales ... 186
16.7 Pares de apriete ... 187

17 Accesorios y piezas de repuesto ... 187

17.1 Polytron® 8xx0 ... 187
17.1.1 Estación de acoplamiento ... 187
17.2 Polytron® 8100 EC ... 187
17.3 Polytron® 8200 CAT ... 188
17.3.1 Sensores CAT ... 188
17.4 Polytron® 8310 IR ... 188
17.4.1 Sensores DSIR ... 188
17.5 Polytron® 87x0 IR ... 188
17.5.1 Sensores ... 189

18 Homologaciones de rendimiento ... 189

18.1 Certificado de examen UE, BVS 13 ATEX G 001 X ... 189
18.2 Certificado de examen, PFG 14 G 001 X ... 189
18.3 Condiciones de funcionamiento certificadas DrägerSensor O_2, O_2LS y Dräger SensorAlive ... 190
18.3.1 DrägerSensor O_2 (6809720) ... 190
18.3.2 DrägerSensor O_2LS (6809630) ... 190
18.3.3 Dräger SensorAlive (6814014) ... 191
18.4 Informe metrológico FM para DrägerSensor H_2S y H_2S LC ... 192

1 Información relativa a la seguridad

En la base de datos Technical Documentation (Documentación técnica) (www.draeger.com/ifu), podrá descargar tanto la última edición como estas instrucciones de uso en otros idiomas. Debido a las actualizaciones del producto, Dräger recomienda utilizar la edición más reciente de las instrucciones de uso.

1.1 Indicaciones de seguridad

- Antes de usar este producto, leer detenidamente estas instrucciones de uso y las de los productos asociados.
- Observar con exactitud las instrucciones de uso. El usuario debe comprender íntegramente las instrucciones y cumplirlas estrictamente. Utilizar el producto exclusivamente para aquellos fines y bajo las condiciones especificadas en este documento.
- No eliminar las instrucciones de uso. Se debe garantizar que los usuarios guarden y usen las instrucciones correctamente.
- Solo personal especializado y formado debe utilizar este producto.
- Notificar a Dräger en caso de que algún componente falle o esté defectuoso.
- Cumplir todas las leyes, normas y reglamentos locales y nacionales asociados a este producto.
- Únicamente personal con la formación correspondiente debe inspeccionar, reparar o mantener el producto según se describe en estas instrucciones de uso. Los trabajos de mantenimiento no descritos en estas instrucciones de uso deben efectuarse exclusivamente por Dräger o por personal cualificado por Dräger.
- Dräger recomienda cerrar un contrato de mantenimiento con Dräger para todas las actividades de mantenimiento y que todas las reparaciones sean llevadas a cabo por Dräger.
- Utilizar únicamente piezas y accesorios originales Dräger para realizar los trabajos de mantenimiento. En caso contrario, el funcionamiento correcto del producto podría verse afectado.
- Los trabajos de mantenimiento se tienen que realizar del modo descrito; véase 10 Mantenimiento.
- Utilizar el producto solo en el marco de un concepto de alarma basado en riesgo.
- Antes de conectar este instrumento a dispositivos eléctricos no mencionados en las instrucciones de uso, consultar primero a Dräger.
- Los instrumentos o componentes no pueden modificarse en ningún modo.
- Queda prohibido el uso de componentes defectuosos o incompletos.
- Deberán observarse las normativas adecuadas en cada momento cuando se lleven a cabo reparaciones en estos instrumentos o componentes.
- No abra el equipo durante el funcionamiento.
- En caso de reparación de estos instrumentos o de sus componentes se deben observar las normativas aplicables.
- Siga las directrices de la norma EN 60079-29-2 para la medición de gases inflamables y oxígeno.
- Siga las directrices de la norma EN 45544-4 para la medición de gases tóxicos.

Específico para Polytron® 8100 EC:

- **ADVERTENCIA**: ¡Riesgo de ignición de atmósferas inflamables o explosivas! La sustitución de componentes puede perjudicar la seguridad intrínseca del producto.

1.2 Condiciones de funcionamiento y ámbito de aplicación

- Observe el manual de seguridad del Dräger Polytron® 8xx0 para aplicaciones SIL.
- Válido solo para Polytron 8200 CAT:
  Cuando se expone a un flujo de aire dirigido mezclado con gas, los valores medidos pueden incrementarse. Consulte las instrucciones de uso del sensor correspondiente para conocer los valores de desviación.
- Observe las especificaciones y limitaciones contenidas en las instrucciones de uso de los sensores utilizados.
- **PRECAUCIÓN** ¡Riesgo de ignición de atmósferas inflamables o explosivas! No probado en atmósferas sobreoxigenadas (>21 % de O_2).
- **Uso del producto en zonas sujetas a peligros de explosión:** Los instrumentos o componentes para uso en zonas de peligro de explosión, que han sido probados y aprobados de acuerdo a las disposiciones nacionales, europeas o internacionales en materia de protección contra explosiones, sólo se podrán utilizar en las condiciones especificadas de conformidad y en consideración con las disposiciones legales relevantes.

Áreas peligrosas clasificadas por zonas:

- El dispositivo está destinado al uso en áreas con peligro de explosión con clasificación de Zona 1 y Zona 2, en las que puede haber presencia de gases de explosión de los Grupos IIA, IIB o IIC y clase de temperatura T4 o T6. Las clases de temperatura dependen de la temperatura ambiente máxima. El dispositivo no debe ser operado a temperaturas ambiente que se encuentren fuera del rango de temperaturas indicado en el dispositivo.
- El dispositivo ha sido diseñado para ser utilizado en áreas con peligro de explosión con clasificación de Zona 21 o Zona 22 en el que puede haber presencia de polvos de explosión de los Grupos IIIA, IIIB o IIIC y temperatura del polvo T80 °C o T130 °C (T135 °C para Polytron 5100 EC y Polytron 8100 EC). La temperatura del polvo depende de la temperatura ambiente máxima. El dispositivo no debe ser operado a temperaturas ambiente que se encuentren fuera del rango de temperaturas indicado en el dispositivo.

Áreas peligrosas clasificadas por divisiones:

– El dispositivo está destinado al uso en áreas con peligro de explosión de clase I, división 1 o 2, en las que puede haber presencia de gases de los grupos A, B, C, D y clase de temperatura T4 o T6 . Las clases de temperatura dependen de la temperatura ambiente máxima. El dispositivo no debe ser operado a temperaturas ambiente que se encuentren fuera del rango de temperaturas indicado en el dispositivo.
– El dispositivo está destinado al uso en áreas con peligro de explosión de clase II, división 1 o 2, en las que puede haber presencia de gases de los grupos E, F, G. El dispositivo no debe ser operado a temperaturas ambiente que se encuentren fuera del rango de temperaturas indicado en el dispositivo.

2 Convenciones en este documento

2.1 Significado de las advertencias

Las siguientes advertencias se utilizan en este documento para alertar al usuario sobre posibles peligros. Los significados de las advertencias se definen de la siguiente manera:

Señal de advertencia	Palabra de advertencia	Clasificación de la advertencia
⚠	ADVERTENCIA	Indica una situación potencialmente peligrosa. De no evitarse, podría conllevar lesiones graves o incluso la muerte.
⚠	PRECAUCIÓN	Indica una situación potencialmente peligrosa. De no evitarse, podría conllevar lesiones físicas. También puede utilizarse para alertar de prácticas no seguras.
	AVISO	Indica una situación potencialmente peligrosa. De no evitarse, podría ocasionar daños en el producto o el medio ambiente.

2.2 Marcas comerciales

Marca comercial	Propietario de marca
PROFIBUS®	PROFIBUS Nutzerorganisation e. V.
HART®	HART Communication Foundation
Polytron®	Dräger Safety AG & Co. KGaA
DrägerSensor®	Dräger Safety AG & Co. KGaA

En el siguiente sitio web se enumeran los países en los que están registradas las marcas de Dräger: www.draeger.com/trademarks.

3 Descripción

3.1 Vista general del producto

Consulte las figuras en la página desplegable

A 1	Tapa de la carcasa
A 2	Tornillo prisionero (tornillo Allen de 2 mm)
A 3	Estribo
A 4	Unidad de tarjeta de circuito impreso (y relé opcional)
A 5	Parte inferior de la carcasa
A 6	Puerto para sensor
A 7	Cable de paso
A 8	Estación de acoplamiento
A 9	Instrumento a prueba de explosión
A 10	Instrumento a prueba de explosión con estación de acoplamiento de seguridad aumentada
A 11	Instrumento a prueba de explosión con distanciador (solo para Polytron 87x0 IR)
A 12	Distanciador (solo para Polytron 87x0 IR)
B	Montaje de prueba para el ajuste
C	Polytron 8100 EC
D	Conexión de mochila de sensor (Polytron 8100 EC)
E 1	Polytron 8200 CAT
E 2	Polytron 8310 IR
F 1	Polytron 8710 IR con protector contra salpicaduras
F 2	Polytron 8710 IR sin protector contra salpicaduras

3.2 Descripción del funcionamiento

La familia Polytron 8000 incluye las siguientes variantes del equipo:

– Polytron 8100 EC, que trabaja con sensores electroquímicos (sensores EC).
– Polytron 8200 CAT, que trabaja con sensores Ex catalíticos (sensores CatEx//catalíticos, DrägerSensor DQ o LC).
– Polytron 8310 IR, que trabaja con sensores Ex infrarrojos (sensores IREx).
– Polytron 8700 IR, que trabaja con sensores infrarrojos (sensores PIR 7000).
– Polytron 8720 IR, que trabaja con sensores infrarrojos (sensores PIR 7200).

Son posibles las siguientes interfaces:

– 4 a 20 mA analógica (según recomendación NAMUR NE43)
– Placa de relés
– Señal de salida HART digital
– Foundation Fieldbus[1)]
– PROFIBUS PA[1)]
– Modbus RTU[1)]

Si se usa la interfaz de 4–20 mA, debe monitorizarse la intensidad de corriente entre 0 y 3,5 mA. Las intensidades de corriente entre 0 y 3,5 mA pueden indicar un estado especial (consulte "Estados especiales", página 156).

Si se usa una placa de relés, pueden activarse dispositivos de alarma localmente. Si no se usa una placa de relés y hay una alarma activa, solo se encenderá el LED rojo en el dispositivo.

Las concentraciones de gas, los mensajes de estado y las opciones de menú del software se visualizan en una pantalla LCD retroiluminada y 3 indicadores LED a color.

Se puede navegar a través del menú pulsando con una varita magnética en el botón correspondiente en el vidrio de la tapa de la carcasa. El instrumento se puede configurar, ajustar y mantener sin abrirlo y sin desclasificar el área.

El instrumento incluye un registrador de datos. El registrador de datos puede almacenar hasta 35 000 valores. En un intervalo de muestreo de 1 medición por minuto, el registrador de datos almacena el historial de mediciones de aproximadamente 24 días. Este tiempo se puede incrementar notablemente si la función de disparo está habilitada. El registrador de datos solo se puede descargar con el software para PC PolySoft. Durante la lectura se genera un archivo .ofb y otro .txt. El archivo .txt contiene la información del registrador de datos en formato legible.

Con un conducto hermético o racor de cable homologado, los instrumentos se pueden conectar a una unidad de control Dräger o a un controlador lógico programable (PLC).

Los instrumentos pueden utilizarse como fuente o como sumidero de corriente si la alimentación eléctrica se efectúa a través de la unidad de control. Si los instrumentos están conectados a una fuente de alimentación separada, solo podrán funcionar como fuente de corriente.

La carcasa de los instrumentos está fabricada en acero inoxidable o aluminio reforzado y es adecuada para aplicaciones interiores y exteriores.

Los instrumentos están diseñados para la instalación en ubicaciones permanentes. Están disponibles en las siguientes versiones:

– Instrumento a prueba de explosión (Ex d)
  La carcasa encapsulada a prueba de llamas/explosión presenta tres conexiones NPT de ¾", que pueden utilizarse para el cableado de campo, para la conexión directa de un sensor o para el cableado de un sensor remoto.
– Instrumento con mayor seguridad (Ex e)
  El dispositivo se amplía por medio de una caja de conexiones para una mayor seguridad (Docking Station). Esta cuenta con un máx. de cuatro conexiones de 20 mm que se pueden utilizar para el cableado de campo o el cableado de un sensor remoto. Si se utiliza el racor de cable de Dräger, el diámetro de cable admisible es de 7 mm hasta 12 mm.

Las siguientes mochilas están disponibles para Polytron 8100 EC:

Mochila de test de sensor	Activa la autocomprobación del sensor (no disponible para el sensor de hidracina 6810180)
Mochila de diagnóstico	Activa el autotest del sensor, la visualización de la vitalidad del sensor y las funciones de diagnóstico del sensor (no disponible para el sensor de hidracina 6810180)

3.3 Uso previsto

Los instrumentos de la familia Polytron 8000 están pensados para una monitorización continua del aire ambiente.

Con el módulo de relé integrado opcionalmente, el instrumento puede funcionar sin una unidad de control (con señalización de alarma local adicional).

Con un conducto hermético o racor de cable homologado, el instrumento se puede conectar a una unidad de control Dräger o a un controlador lógico programable (PLC).

Si se usa la interfaz de 4–20 mA, debe monitorizarse la intensidad de corriente entre 0 y 3,5 mA. Las intensidades de corriente entre 0 y 3,5 mA pueden indicar un estado especial.

Los instrumentos están diseñados para la instalación en ubicaciones permanentes y homologados para el uso en áreas con peligro de explosión.

– El Polytron 8100 EC es un instrumento combinado de seguridad intrínseca / a prueba de explosión para la monitorización continua de gases tóxicos u oxígeno en el aire ambiental.
– El Polytron 8200 CAT con sensor catalítico DrägerSensor DQ o LC es un instrumento a prueba de explosión para la monitorización continua de gases y vapores combustibles que contienen hidrocarburos y no hidrocarburos (p. ej., hidrógeno o amoniaco) en el aire ambiente.
– El Polytron 8310 IR con el sensor infrarrojo DrägerSensor IR es un instrumento a prueba de explosión para la monitorización continua de gases y vapores combustibles que contienen hidrocarburos en el aire ambiente.
– El Polytron 8700 IR con PIR 7000 es un instrumento a prueba de explosión para la monitorización continua de gases y vapores combustibles que contienen hidrocarburos en una atmósfera adecuada.
– El Polytron 8720 IR con PIR 7200 es un instrumento a prueba de explosión para la monitorización continua de dióxido de carbono en el aire ambiental.

3.4 Homologaciones

3.4.1 ATEX, IECEx, UL, CSA

En la página desplegable se muestra una placa de características a modo de ejemplo. También hay una copia impresa de la placa de características en el interior de la caja de envío del equipo.

1) Si se utiliza la interfaz de bus de campo, no se dispondrá de relés. La interfaz de bus de campo no está en conformidad con la norma BVS 13 ATEX G 001 X.
No hay compatibilidad con DrägerSensorAlive.

3.4.2 Información adicional

Declaración de conformidad: consulte el anexo 4544300 o visite la página www.draeger.com/product-certificates

Para más información acerca de las homologaciones, consulte el anexo 4544300.

4 Instalación del transmisor

4.1 Instalación a prueba de explosión (Ex d) - sin estación de acoplamiento

4.1.1 Instalación mecánica

4.1.1.1 Indicaciones generales sobre la instalación mecánica

– Se deben cumplir estrictamente las disposiciones y normativas locales, estatales, nacionales que rigen la instalación de sistemas de monitorización de gas.
– Deben tenerse en cuenta las propiedades físicas de los gases o vapores que van a ser medidos y las especificaciones de la aplicación correspondiente (p. ej., posibles fugas, movimiento de aire, corrientes de aire, etc.).
– Debe considerarse el uso futuro de accesorios y equipamiento de mantenimiento.
– El acceso del gas o vapor al sensor no debe estar obstruido.
– El instrumento no debe exponerse a calor radiante, ya que esto provocaría un aumento de la temperatura por encima de los valores límites (16.6 Parámetros ambientales). Se recomienda el uso de un blindaje reflectante.
– El instrumento se puede equipar con una tapa antipolvo en la entrada de cables. Esta tapa no es a prueba de explosiones ni resistente al agua, y se debe retirar antes de conectar el instrumento a un conducto hermético o antes de instalar un racor de cable a prueba de llamas.
– Las aberturas no utilizadas deben cerrarse con un tapón ciego. Para los pares de apriete correctos de los pasos de cable, racores de cable, enchufes y sensores, véase 16.7 Pares de apriete.
– Para instalaciones sin tubo, debe utilizarse un racor de cable homologado (p. ej., Hawke A501/421/A/¾" NPT o equivalente).
– **ADVERTENCIA:** Solo en caso de instalación con tubo: para reducir el riesgo de ignición del aire atmosférico peligroso, deben sellarse los primeros 45 cm (18 pulgadas) del tubo desde la carcasa.
– **PRECAUCIÓN:** Si el detector de gases está conectado a una unidad de control, se puede retrasar el tiempo de respuesta total. Debe tenerse en cuenta todo el trayecto de medición (p. ej., latencia de la unidad de control). Asegúrese de que se mantenga el tiempo de respuesta requerido.

Específico para Polytron® 8100 EC:

– Orientación recomendada del sensor: hacia abajo (véase la figura C de la página desplegable).

Específico para Polytron® 8200 CAT:

– Orientación preferente del sensor: hacia abajo (véase la figura E de la página desplegable). Si la entrada del sensor está protegida frente a daños mecánicos, suciedad y entrada de agua, se permite cualquier otra orientación.
– Solo para operaciones conformes a CSA:
El uso del protector opcional contra salpicaduras (6812510) es obligatorio en virtud de la homologación CSA.

Específico para Polytron® 8310 IR:

– Orientación recomendada del sensor: hacia abajo (véase la figura E de la página desplegable).

Específico para Polytron® 87x0 IR:

– Se debe observar la posición preferente del sensor Dräger PIR 7x00 (véase la figura F en la página desplegable). Unas desviaciones grandes y el uso del protector contra salpicaduras preinstalado aumentarán el tiempo de respuesta (véanse las instrucciones de uso del PIR 7x00).
– Cualquier otra orientación solamente estará permitida si el PIR 7x00 es utilizado sin protector contra salpicaduras, p.ej., para aplicaciones en conductos de ventilación. Si el sensor se instala en posición vertical, es posible que se produzca una fuerte acumulación de sedimentos sobre la superficie óptica del sensor.
– Se recomienda utilizar el protector contra salpicaduras preinstalado para proteger el sensor contra el agua y el polvo.
– Si se utiliza el protector contra salpicaduras preinstalado (número de referencia 6811911 o 6811912), debe asegurarse de que las luces indicadoras de estado estén dispuestas verticalmente y el logotipo de Dräger en el protector contra salpicaduras esté en posición horizontal. Se admite una desviación máxima de ±30 grados de la posición horizontal.
– Los líquidos y/o la formación de depósitos en las superficies ópticas del PIR 7x00 pueden provocar un mensaje de advertencia o un fallo.
– Para la versión a prueba de explosión se recomienda utilizar un distanciador (número de pieza 6812617) si el instrumento es montado en una pared o en una superficie plana.

Condiciones especiales según EN/IEC 60079-1

– Las roscas para la protección contra llamas/explosión no cumplen los valores mínimos o máximos relevantes de la norma EN/IEC 60079-1. Dichas roscas no deben ser retocadas por parte del usuario.

4.1.1.2 Instalación

El instrumento se puede montar para medir gases en aire ambiental o en el interior de un conducto de ventilación/tubería.

1. Utilice pernos de cabeza cilíndrica hexagonal M6 (1/4'') para montar la carcasa conforme a una de las siguientes opciones.

Opción	Accesorios
Montaje en una superficie plana	Plantilla de taladro: 4544300 Adicionalmente para Polytron 87x0 IR: Distanciador 6812617
Montaje en una barra	Kit de montaje en barra: 4544198
Montaje en un conducto de ventilación/tubería	Kit de montaje en conducto: 6812725 Para Polytron® 87x0 IR:: 6812300

4.1.2 Instalación eléctrica

4.1.2.1 Indicaciones generales sobre la instalación eléctrica

- Para los pares de apriete, consulte 16.7; para las especificaciones de cable permitidas, consulte 16.3.
- Se deben cumplir estrictamente los códigos eléctricos que rigen el tendido y la conexión de cables de señal y corriente eléctrica a equipos de monitorización de gas.
- Se deben utilizar férrulas.
- Los cables de la alimentación eléctrica deben tener una resistencia suficientemente baja para garantizar una tensión de alimentación correcta para el instrumento.
- El aislamiento del cable se debe pelar entre 5 y 7 mm.
- El circuito eléctrico secundario debe estar separado mediante aislamiento galvánico del circuito de corriente de red (no se aplica a circuitos con relé).
- Si se instala en lugares con una temperatura ambiente que exceda los 55 °C, utilice únicamente cableado adecuado, especificado para al menos 25 °C por encima de la temperatura ambiente máxima.
- Utilice solo los pasos de cable homologados en el país en el que se va a instalar el equipo y que sean adecuados para la aplicación.
- De conformidad con la Directiva de la UE 2014/30/UE, este instrumento no debe conectarse a una red de corriente continua. Se recomienda instalar una fuente de alimentación independiente para el instrumento.

Interfaz analógica

- Para garantizar el correcto funcionamiento del instrumento, la resistencia del bucle de señal de 4 a 20 mA no debe superar los 500 ohmios.
  Para el uso de acuerdo con la prueba de idoneidad metrológica según las normas EN IEC 62990-1, EN IEC 60079-29-1 o EN 50104, la resistencia no debe superar los 300 ohmios. Si los valores superan los 300 ohmios no se puede garantizar la monitorización de la tensión de alimentación.
  Dependiendo de la tensión operativa y de la aplicación (ejemplo de operación HART®), debe respetarse una resistencia mínima determinada (consulte "Transmisión de la señal a la unidad de control", página 185).

Opción con relé

- Con tensiones > 30 V CA o > 42,4 V CC, los cables de los relés deben revestirse con una manguera de protección o deben utilizarse cables con doble aislamiento.
- Los cables de conexión para el módulo de relés opcional deben seleccionarse y asegurarse con fusibles según las tensiones y corrientes nominales y las condiciones medioambientales.
- Para asegurar que se detecta un fallo -sin tener que mirar al instrumento- debe haber una alarma conectada al relé de fallo.
- Las diferencias de tensión eléctrica pueden causar fallos de aislamiento. No mezclar cargas eléctricas con diferentes tipos de tensión (CA o CC). Al usar cargas de CC, asegurarse de que los contactos de los relés solo controlan dispositivos con el mismo rango de tensión eléctrica de CC. Al usar cargas de CA, asegurarse de que los contactos de los relés solo están conectados a los dispositivos que comparten una fase común.

Condiciones especiales según EN/IEC 60664-1

- Las variantes de instrumento que utilizan tanto una interfaz de bus de campo FISCO como un transmisor de gas ETR 02...5** deben alimentarse a través de circuitos protegidos contra sobretensiones de categoría I/II/III según la norma IEC 60664-1.

4.1.2.2 Diagramas de conexiones

En las páginas desplegables se muestran los siguientes esquemas de conexión:

Figura	Esquema de conexión para equipos
G	Sin relé, puesta a tierra de la carcasa
H	Con relé, puesta a tierra de la carcasa
I1	4-20 mA / HART (fuente de corriente)
I2	4-20 mA / HART (sumidero de corriente)
I3	4-20 mA / HART (alimentación separada, fuente de corriente)
H1	Autónomo, solo relé
J	Foundation Fieldbus / PROFIBUS PA, puesta a tierra de la carcasa
K	Modbus RTU, puesta a tierra de la carcasa
J1	Foundation Fieldbus / PROFIBUS PA, cableado de campo
K1	Modbus RTU, cableado de campo
L	Alimentación eléctrica interfaces digitales

4.1.2.3 Tablas de cableado

Interfaz de 4 a 20 mA/HART®

Clavija	Marca	Función
1	PWR+	V+
2	PWR-	V-
3	PWR-	V- Debe utilizarse cuando el instrumento se conecta a una fuente de alimentación separada (funcionamiento como fuente).
4	4-20 mA	Señal de 4-20 mA (operación como fuente o sumidero de corriente)
5	PE	Conductor de protección Conductor de protección opcional para conexión de relé. La conexión del conductor de protección junto con la salida analógica de 4-20 mA puede causar bucles de masa.

Interfaz de bus de campo

Clavija	Marca	Función
1	Datos A	Enrutamiento de señal A
2	Datos B	Enrutamiento de señal B
3	GND	Conexión a tierra
4	SHIELD (blindaje)	Blindaje de cable

Clavija	Marca	Función
1	PWR+	V+
2	PWR-	V-

Conector de relé

Todos los relés del instrumento (A1, A2, FLT) pueden configurarse como "normalmente excitado" (relé de corriente estática) o "excitado en alarma" (relé de corriente de trabajo). Los relés están configurados de fábrica como "relé de corriente estática" ("normalmente excitado"). Esto permite un funcionamiento a prueba de fallos.
Contrario a las convenciones, las marcas NO, COM, NC en el instrumento han sido elegidas de tal manera que se correspondan con el estado normalmente excitado. Si el instrumento es alimentado con tensión eléctrica, el marcado coincide plenamente con la función de las clavijas.

Clavija	Marca		Relé	
1	NO	FLT	Fallo	Contacto normalmente abierto (Normally Open)
2	COM		Fallo	Conexión común (Common)
3	NC		Fallo	Contacto normalmente cerrado (Normally Closed)
4	NO	A2	A2	Contacto normalmente abierto (Normally Open)
5	COM		A2	Conexión común (Common)
6	NC		A2	Contacto normalmente cerrado (Normally Closed)
7	NO	A1	A1	Contacto normalmente abierto (Normally Open)
8	COM		A1	Conexión común (Common)
9	NC		A1	Contacto normalmente cerrado (Normally Closed)

4.1.2.4 Preparación de la instalación eléctrica

1. Suelte el tornillo prisionero (2) y desenrosque la tapa de la carcasa de la parte inferior de la carcasa, véase la figura A en la página desplegable..
2. Extraiga la unidad de tarjeta de circuito impreso.
3. Proceda con la figura correspondiente a la salida de señal y el modelo Polytron®, véase la página desplegable.

4.1.2.5 Conexión del equipo con relé (autónomo)

Los cables de dispositivos de alarma tienen que conectarse al conector de relé de 9 clavijas. Se incluyen un aislamiento de cable (tubo termorretráctil) y una funda protectora para una protección adicional de los cables de relé.

1. Extraiga el conector de 5 clavijas.
2. Conecte los cables de alimentación al borne adecuado, véase la figura H1 en la página desplegable.
3. Puentee las clavijas 3 y 4 del conector de 5 clavijas.
4. Retire el conector de 9 clavijas.
5. Corte el tubo termorretráctil según las necesidades y deslícelo por encima de los cables de relé antes de insertarlos al conector de 9 clavijas.
6. Posicione el tubo termorretráctil en el canto del aislamiento de cable y emplee una pistola de aire caliente para contraer el tubo de forma segura sobre el aislamiento.
7. Deslice funda protectora por encima de los cables.
8. Conecte los cables para alarma 1 (prealarma), alarma 2 (alarma principal) y alarma de fallo a los bornes respectivos, tal y como se indica en la siguiente tabla de conexiones.
9. Vuelva a enchufar el conector a la toma y apriete los tornillos.
10. Cierre el instrumento, véase 4.1.2.9 Cierre del detector de gases.

Las siguientes tablas muestran el estado de un indicador de alarma conectado y si éste indica fallos, como un fallo de alimentación en el detector de gases.

El comportamiento del relé depende de la configuración de la alarma y del contacto del relé al que está conectado el indicador de alarma.

Configuración de relé: Normalmente excitado

Contacto	Estado del indicador de alarma e indicación de fallos por el indicador de alarma		
	Alarma activada	Fallo específico del detector de gases	Fallo de cableado de campo
Contacto normalmente cerrado (Normally Closed)	ON	indicado	no indicado
Contacto normalmente abierto (Normally Open)	OFF	indicado	indicado

Configuración de relé: Excitado en alarma

Contacto	Estado del indicador de alarma e indicación de fallos por el indicador de alarma		
	Alarma activada	Fallo específico del detector de gases	Fallo de cableado de campo
Contacto normalmente cerrado (Normally Closed)	OFF	no indicado	indicado
Contacto normalmente abierto (Normally Open)	ON	no indicado	no indicado

4.1.2.6 Conexión de la interfaz de 4-20 mA HART®

Para obtener información acerca de la conexión a una unidad de control (PLC), consulte la documentación de la unidad de control correspondiente.

1. Extraiga el conector de 5 clavijas.
2. Conecte los tres cables de tensión eléctrica y señal al borne correspondiente según se indica en la tabla de cableado y la figura.
3. Vuelva a conectar el conector a la toma y apriete los tornillos.
4. Cierre el instrumento, véase 4.1.2.9 Cierre del detector de gases.

4.1.2.7 Conexión a tierra

1. Ponga la caja del instrumento a tierra localmente en la lengüeta de tierra, véanse las figuras G y H en la página desplegable.
2. Conecte el blindaje de los cables únicamente a la toma de tierra del controlador (p. ej., caja, conductor de tierra colectiva, etc.).

ℹ A menos que se tomen medidas especiales (p. ej., puesta a tierra capacitiva), el blindaje solamente se debe conectar al final.

Encontrará información acerca de la puesta a tierra de las conexiones del bus de campo y del modbus en los siguientes documentos.

Interfaz	Documento
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

4.1.2.8 Conexión de la interfaz de bus de campo

1. Quite el conector de 4 y de 2 clavijas.
2. Conecte los dos hilos para alimentación eléctrica y los cuatro hilos para señales a los bornes adecuados, tal y como se indica en la tabla de conexiones y figura.
3. Vuelva a insertar el conector en el enchufe y apriete los tornillos.
4. Cierre el instrumento, véase 4.1.2.9 Cierre del detector de gases.

Para más información sobre la instalación de la interfaz de bus de campo, consulte el manual técnico correspondiente.

4.1.2.9 Cierre del detector de gases

1. Cerciórese de que las siguientes conexiones estén establecidas correctamente:
   a. Los tornillos del cableado están apretados con el par de apriete correcto.
   b. Todas las conexiones de cables están aseguradas con tornillos.
   c. El conector del sensor está enchufado.
   d. El cable de puesta a tierra proveniente de la carcasa está conectado a la lengüeta en la unidad de tarjeta de circuito impreso, véanse las figuras G y H en la página desplegable
2. Introduzca la unidad de tarjeta de circuito impreso en la parte inferior de la carcasa.
3. Enrosque la tapa de la carcasa sobre la parte inferior de la carcasa y apriétela con el par de apriete correcto.
4. Apriete el tornillo prisionero.

4.2 Instalación de seguridad aumentada (Ex e) - con estación de acoplamiento

La instalación de seguridad aumentada (Ex e) se describe en las instrucciones de montaje de la estación de acoplamiento (número de referencia 9033242).

5 Instalación de sensores o cabezales detectores

5.1 Instalación del sensor EC en el Polytron 8100 EC

Véase la figura C en la página desplegable.

1. Suelte el tornillo de sujeción (2) (tornillo Allen de 2 mm).
2. Desenrosque el anillo de bayoneta (3) y retire la arandela ciega.
3. Inserte el sensor (4) en la abertura y gírelo hasta que encaje en el detector de gases. El conector del sensor no sufrirá ningún daño.
4. Bloquee el sensor con el anillo de bayoneta (3) correspondiente.

   ℹ Para Dräger SensorAlive debe utilizarse un anillo de bayoneta distinto al que se usa para otros sensores EC.

5. Apriete el tornillo de sujeción (2) de modo que el anillo de bayoneta no pueda soltarse (obligatorio para instalaciones de Zona 22).

   ℹ Si el Dräger SensorAlive se instala por primera vez en una instalación existente, es necesario asegurarse de que la versión de firmware sea la 4.0.0 o superior. Contacte con Dräger para obtener asistencia.

5.2 Instalación del cabezal detector

Dependiendo del tipo de protección contra explosiones, se utilizan diferentes cabezales detectores. Encontrará la información de los cabezales detectores en las instrucciones del detector correspondiente.

En las aplicaciones remotas, el blindaje del cable debe terminar tanto en el lado del sensor como en el del transmisor. El cable debe tener ≤ 30 m de longitud.

Versiones remotas con protección contra explosiones "a prueba de explosiones (Ex d)"

Transmisor	Números de referencia cabezal detector GA
Polytron 8100 EC	Cabezal detector EC remoto (9033247)
Polytron 8200 CAT (para sensores DQ)	Sensor remoto DQ NPT aluminio, sensor remoto DQ NPT acero (4544286)
Polytron 87x0 IR	PIR 7000 (334) remoto con carcasa de conexión de sensor de acero inoxidable o aluminio (4544286)
Polytron 8200 CAT (para sensores LC) Polytron 8310 IR Polytron 87x0 IR	Carcasa de conexión de sensor de acero inox. o aluminio (4544286)

Versiones remotas con protección contra explosiones "Mayor seguridad (Ex e)"

Transmisor	Números de referencia cabezal detector GA
Polytron 8100 EC	Cabezal detector EC remoto (9033247)
Polytron 8200 CAT	Cabezal detector Polytron SE Ex (9033888)
Polytron 8310 IR	DrägerSensor IR (9023843)
Polytron 87x0 IR	PIR 7x00 (9023885)

6 Puesta en marcha

6.1 Indicaciones generales

– Asegúrese de conectar primero los cables para los relés y las conexiones para el sensor antes de conectar el instrumento a la corriente.
– Antes de dejar el instrumento preparado para el funcionamiento normal, compruebe si está configurado y ajustado correctamente.

Para un funcionamiento seguro según las normas BVS 13 ATEX G 001 X y PFG 14 G 001 X, deben mantenerse los ajustes de alarma por defecto del instrumento como se indica a continuación.

– Los relés deben estar ajustados a ***Normal. tensión*** y la alarma A2 (alarma principal) a ***Latching*** y ***No-achknowledgeable*** o ***Preconfirm.***.
– La alarma A1 (prealarma) solo se debe ajustar a ***Acknowledging*** si se utiliza para disparar un dispositivo de alarma acústica.
– Bloqueo en caso de valores por encima del rango de medición (consulte "Ajuste del enclavamiento del sensor DQ", página 179).

Para un funcionamiento seguro según las normas BVS 13 ATEX G 001 X y PFG 14 G 001 X, deben mantenerse las siguientes condiciones especiales:

– Polytron 8200 CAT:
  – Si el sensor DQ o LC se expone a un flujo de aire que contenga gas de medición, los valores medidos pueden aumentar hasta un 32 %.
    Cuando funciona con el adaptador de calibración remota DQ, este aumento puede ser de hasta el 70 %.
  – El transmisor con sensor LC debe funcionar junto con una unidad de control que señale un exceso de rango de medición de forma autónoma. No emplee los relés de alarma internos del transmisor.
  – El transmisor con sensor LC debe ajustarse con el sensor en su posición de uso operativa habitual.
  – Pueden producirse falsas alarmas durante el tiempo de calentamiento del sensor LC.
– Polytron 8100 EC:
  El tiempo de ajuste t20 de los transmisores con sensor EC puede superar el valor límite de la norma EN 50104 con pequeños cambios en la concentración.

6.2 Puesta en funcionamiento del detector de gases

1. Para evitar falsas alarmas, apague la señalización de alarma del detector de gases (consulte "Conexión o desconexión de alarmas", página 172).
2. Active la alimentación eléctrica.
   ⇒ El instrumento llevará a cabo una secuencia de arranque (prueba LCD / LED, versión de software e inicialización).
   ⇒ La pantalla indica que el sensor estará listo para la medición en hh:mm:ss (cuenta atrás). El instrumento transmite la señal de mantenimiento. El relé de fallo se activa.
   ⇒ El sensor comienza la fase de iniciación. La señal de mantenimiento en la interfaz de 4-20 mA sigue pendiente hasta que el sensor haya finalizado la fase de iniciación. El periodo de iniciación depende del tipo de sensor y de las condiciones del entorno. Tiempo de iniciación máximo de un sensor nuevo: consulte las instrucciones de uso del sensor.
3. Compruebe la fecha y hora. Los ajustes se pueden realizar durante el periodo de iniciación del sensor.
   ⇒ Después del periodo de iniciación del sensor, el instrumento pasa al modo de funcionamiento normal. En la pantalla se muestra la concentración de gas actual, la unidad de medición y, dado el caso, el gas seleccionado. El LED verde se enciende.

Si el instrumento se pone en funcionamiento con un Dräger SensorAlive, Dräger recomienda configurar la fecha y la hora correctamente. Después del periodo de iniciación del sensor se inicia el periodo de puesta en marcha del Dräger SensorAlive. Durante esta fase, el sensor puede realizar mediciones, pero el autodiagnóstico no se lleva a cabo.

4. Si es necesario, ajuste el instrumento.
5. Encienda la señalización de alarma del detector de gases (consulte "Conexión o desconexión de alarmas", página 172).

7 Funcionamiento

7.1 Panel de mandos

El panel de mandos contiene:
– Botones para navegar por el menú
– Una pantalla
– LED y símbolos correspondientes

Los botones de navegación tienen diferentes funciones dependiendo del menú en el que uno se encuentre.

El instrumento se maneja por medio de una varita magnética. Para ello es necesario que la tapa de la carcasa esté colocada en el instrumento. Si la tapa de la carcasa no está en su lugar, la varita magnética podría activar dos o más botones a la vez (interferencia).

7.2 LED y símbolos

El panel de mandos contiene los siguientes símbolos y LED:

Símbolo	LED	Descripción
	Roja	Alarma activada
	Amarillo	Avería
	Verde	Encendido

LED de estados
– Cuando se ha activado la alarma A1 (prealarma), el LED rojo parpadea emitiendo destellos individuales .
– Cuando se ha activado la alarma A2 (alarma principal), el LED rojo parpadea emitiendo destellos dobles .
– Cuando se confirma una alarma, antes de que se haya subsanado la causa, se enciende el LED rojo de forma permanente para indicar que hay un fallo.

7.3 Indicadores en la pantalla

7.3.1 Todos los equipos

Símbolo	Explicación
	Mensaje de error activo. En el menú ***Información*** hay más información disponible.
	Mensaje de advertencia activo. En el menú ***Información*** hay más información disponible.
	Señal de mantenimiento transmitida.
	El valor final del rango de medición ajustado se sobrepasa en la interfaz de 4-20 mA.
	El valor inicial del rango de medición ajustado no es alcanzado en la interfaz de 4-20 mA.
	La operación HART® está activa. La interfaz analógica se establece en un valor fijo y no está transmitiendo ninguna señal de medición.
	Cuando se haya agotado la capacidad del registrador de datos, los datos antiguos se sobrescribirán con nuevos valores (función "roll").
	Cuando se haya agotado la capacidad del registrador de datos, no se almacenarán nuevos datos (función "stack").
SIL	El modo de funcionamiento SIL está activado.

7.3.2 Símbolos específicos para Polytron® 8100 EC

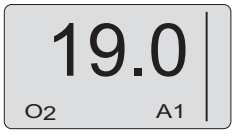
Símbolo	Explicación
	El sensor está operativo.
	El sensor está operativo, pero se acerca al final de su vida útil.
	El sensor está aún operativo, pero debería sustituirse cuanto antes. La vitalidad es < 25 %.
LT	Se está ejecutando un LifeTest del Dräger SensorAlive.

7.3.3 Modo de medición

Los siguientes ejemplos de visualización son tomados del Polytron 8100 EC.

Para Polytron 8200 CAT y Polytron 8310 IR no hay nombres de gases predefinidos. Los nombres de gases se tienen que introducir mediante el software para PC DrägerPolysoft. Después de modificar parámetros con el software para PC DrägerPolysoft u otro software, deben leerse todos los parámetros del Polytron® 8xx0 o verificarse directamente en el instrumento.

En el modo de funcionamiento se muestra lo siguiente:

Ejemplo de visualización	Descripción
	Durante el funcionamiento normal, la pantalla muestra la concentración de gas medida, el gas seleccionado y la unidad de medida. **Interfaz analógica:** valor de corriente correspondiente **Relé:** todos los relés se encuentran en estado normal
	Se sobrepasan los umbrales de alarma. El ejemplo muestra la prealarma A1. **Interfaz analógica:** valor de corriente correspondiente **Relé:** el relé A1 se encuentra en estado de alarma.

7.3.4 Estados especiales

Si el instrumento se encuentra en un estado especial, ya no se puede garantizar una alarma o medición correcta.

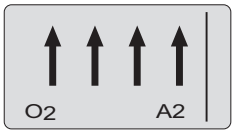
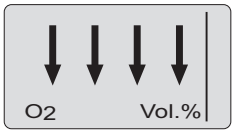
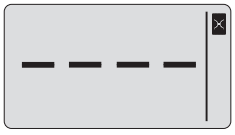
Este es el caso:

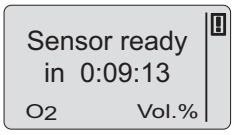
- Cuando la concentración de gas excede el rango de medición.
- Cuando ocurre un fallo.
- Cuando las alarmas están desactivadas.
- Cuando se realizan ajustes.
- Cuando se realizan pruebas con gas.
- Cuando un sensor está en fase de inicialización.
- Cuando el sistema está en modo de mantenimiento.
- Cuando se utiliza un Dräger SensorAlive y el sistema está configurado para que no se emita el valor de medición durante un LifeTest.

Para la corriente de la interfaz analógica que corresponde a la señal analógica, véase 16.2.

Las señales de las interfaces digitales pueden consultarse en los siguientes documentos.

Interfaz	Documento
PROFIBUS PA	9033782
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

Ejemplo de visualización	Descripción
	**El valor está por encima del rango de medición** La concentración de gas se encuentra fuera del rango de medición del sensor[1)]. **Interfaz analógica:** Superación del rango de medición **Relé:** Interruptores de relé A2 ***Aviso para Polytron 8200 y Polytron 8310:*** El mensaje de que se ha excedido el rango de medición puede también haber sido causado por un cortocircuito o una interrupción en la conexión a un sensor remoto.
	**El valor está por debajo del rango de medición** La concentración de gas se encuentra fuera del rango de medición del sensor. **Interfaz analógica:** Deriva por debajo de cero **Relé:** Interruptores de relé de fallo
	**Indicación de fallo** El símbolo ⊠ aparece en el lado derecho de la pantalla. **Interfaz analógica:** Corriente de fallo **Relé:** Interruptores de relé de fallo
	**Indicación de mantenimiento** El símbolo 🔧 aparece en el lado derecho de la pantalla. Esto es visualizado cuando las alarmas están desactivadas, durante el ajuste, pruebas con gas y trabajos de mantenimiento. **Interfaz analógica:** Corriente de mantenimiento **Relé:** Ningún cambio

Ejemplo de visualización	Descripción
	**Indicación de advertencia** El símbolo ▯ aparece en el lado derecho de la pantalla. **Interfaz analógica:** Corrientede advertencia[2)] **Relé:** Ningún cambio
	**Fase de iniciación 1** El símbolo ▯ aparece en el lado derecho de la pantalla. El tiempo restante se indica en el lado izquierdo de la pantalla. **Interfaz analógica:** Corriente de mantenimiento **Relé:** Interruptores de relé de fallo Para la fase de iniciación 1, el comportamiento del relé de fallo es configurable (consulte "Ajuste del calentamiento 1 del relé de fallo", página 172)
	**Fase de iniciación 2** El símbolo ▯ aparece en el lado derecho de la pantalla. El valor medido se indica en el lado izquierdo de la pantalla. **Interfaz analógica:** Valor de medición **Relé:** Comportamiento como en el modo de medición (el relé de fallo no indica fase de iniciación 2).

1) Si la concentración de gas supera el valor final del rango de medición de la interfaz de 4-20 mA, la pantalla sigue indicando el valor medido, así como la indicación "Rango de medición de la interfaz analógica excedido" .
2) Solo cuando la corriente de advertencia está activada. Ajuste de fábrica: desactivada.

7.3.5 Finalización de estados especiales

Indicación de fallo / indicación de advertencia

Por regla general, las indicaciones de fallo y de aviso son sin enclavamiento. Una vez subsanadas las causas de los fallos o las advertencias, no se indicará más un fallo o una advertencia. Se exceptúan: "Detección de fallos SensorAlive" y "Detección de obstrucciones SensorAlive".

Para subsanar las causas, visualice el fallo o la advertencia (consulte "El menú Información", página 158) y empiece con la eliminación de averías (consulte "Eliminación de averías", página 166).

Valor por encima/por debajo del rango de medición

La pantalla indica que la concentración de gas se encuentra fuera del rango de medición del sensor. La indicación desaparece en cuanto la concentración de gas se encuentre dentro del rango de medición. Si se ha superado el rango de medición, la sensibilidad y el tiempo de respuesta del sensor pueden desmejorarse.

AVISO
Fallo de funcionamiento del sensor
Las concentraciones de gas que sobrepasen el rango de medición del sensor podrían provocar fallos de funcionamiento en el sensor.
► Vuelva a ajustar el sensor, si es necesario.

Polytron® 8200 CAT con sensor DQ:

Un valor por encima del rango tiene que ser confirmado con [OK] después de haber verificado que la concentración de gas es inferior a 100 %LIE (p. ej., utilizando un instrumento portátil).

Las alarmas en modo autoenclavador son el ajuste por defecto del instrumento.

Para instrumentos sin relés, valores por encima del rango se pueden ajustar a no autoenclavador. En este caso, la indicación de un valor por encima del rango desaparece. ¡La unidad de control tiene que apoyar esta función! Para obtener más información, consulte: "Ajuste del enclavamiento del sensor DQ", página 179.

Polytron® 8200 CAT con sensor LC:

⚠ ADVERTENCIA
Lecturas ambiguas en valores de medición por encima del rango
Las alarmas de enclavamiento por encima del rango no son compatibles con los sensores LC.
Para un funcionamiento seguro conforme a BVS 13 ATEX G 001 X, el detector de gases debe ser operado con una unidad de control que pueda mostrar alarmas de enclavamiento. No emplee los relés de alarma internos del detector de gases.
► Asegúrese de que la indicación de enclavamiento por encima del rango de medición esté activa en la unidad de control.

Después de obtener valores de medición por encima del rango, verificar que la concentración de gas es inferior a 100 %LIE (p. ej., utilizando un instrumento portátil).

7.4 Modo de información y tecla de función

7.4.1 Abrir el modo de información

El modo de información se utiliza para mostrar información relevante del instrumento. Esto no interrumpe el funcionamiento normal del instrumento.

- Pulse y mantenga ▲ durante 3 segundos en el modo de medición.

7.4.2 Navegación en el modo de información

Botón	Función
▲	Cambiar a la pantalla siguiente
▼M	Cambiar a la pantalla anterior
OK	Terminar el modo de información

Si no se pulsa ninguna tecla durante 30 segundos, el instrumento retornará automáticamente al modo de funcionamiento normal.

7.4.3 Uso de la tecla de función

Mediante la tecla de función se puede ejecutar una función preconfigurada. De forma predeterminada, se muestran todos los fallos.

- Pulsar y mantener ▲ durante 1 segundo en el modo de medición.

Para configurar la tecla de función, véase 11.4 Configuración de la tecla de función.

7.5 Menús

7.5.1 Navegación por menús

Botón	Función
▲	Desplazarse hacia arriba. Ajustar valores.
▼M	Desplazarse hacia abajo. Ajustar valores.
OK	Confirmar introducción. Seleccionar menús y funciones.

7.5.2 Abrir los menús

- Para abrir el menú ***Información***:
  a. Mantenga presionado ▼ durante 1 segundo en el modo de medición.
- Para abrir el menú ***Calibracion***:
  a. Mantenga presionado ▼ durante 3 segundos en el modo de medición.
  b. Seleccione ***Intro. Clave***.
  c. Introduzca la contraseña respectiva y confirme con [OK].
- Para entrar en todos los menús:
  a. Mantenga presionado ▼ durante 3 segundos en el modo de medición.
  b. Seleccione ***Intro. Clave***.
  c. Introduzca la contraseña respectiva y confirme con [OK].

7.5.3 Contraseñas

Clave calibr.	Permite el acceso al menú ***Información*** y al menú ***Calibracion*** (configuración de ajustes) Por defecto: **_ _ _ 1**
Clave Ajuste	Permite el acceso a los ajustes y a los menús Por defecto: **_ _ _ 2**

Para cambiar las contraseñas, véase 11.1.

7.5.4 El menú *Información*

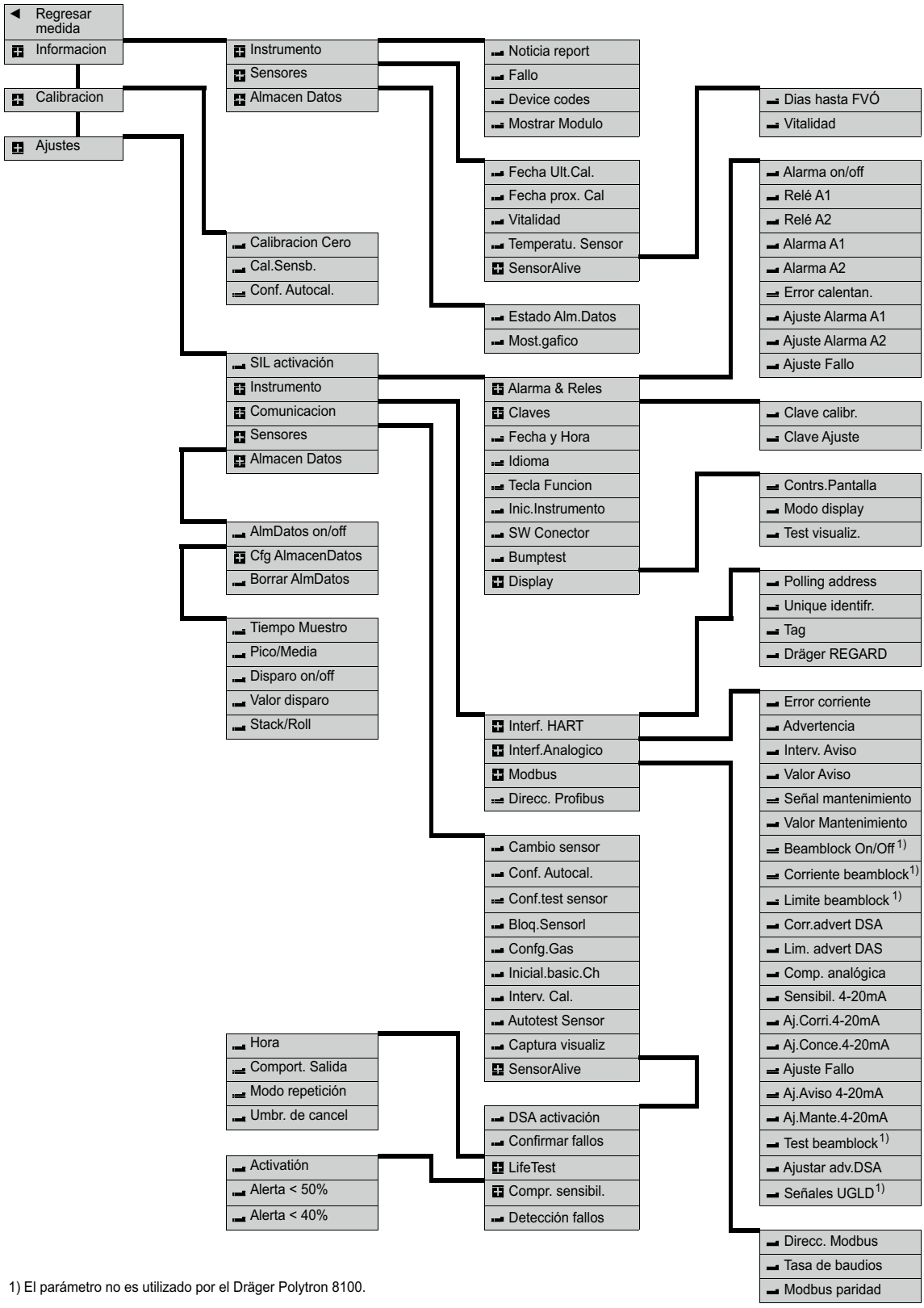
En el menú ***Información*** se puede acceder a la siguiente información:

Instrumento	
Noticia report	Visualización de mensajes de advertencia en texto legible junto con el número correspondiente. Si hay varios mensajes de advertencia disponibles, existirá un indicador (por ejemplo, 1/3 = pantalla 1 de 3).
Error report	Visualización de mensajes de fallos en texto legible junto con el número correspondiente. Si hay varios fallos, existirá un indicador (por ejemplo, 1/3 = pantalla 1 de 3).
Indicadores del dispositivo	Con esta función se muestran los códigos de advertencia y fallo en forma de tabla. Si se muestra el valor 00 para todos los códigos, significará que no hay mensajes de advertencia o fallo disponibles.
Módulos	Muestra una descripción general de los módulos de hardware instalados y la versión del software de la interfaz de sensor EC llamada SIOS. Para acceder a información detallada, seleccione el módulo correspondiente. ■ = módulos instalados □ = módulos no instalados
Sensores	
Fecha últ.cal.	Se muestran la fecha, la unidad, el gas y la concentración del último ajuste.
Fecha próx. cal.	Muestra la fecha límite del próximo ajuste.
Vitalidad[1)]	La vitalidad del sensor se muestra en %. Dräger recomienda sustituir el sensor cuando la vitalidad sea de < 25 %.
Temp. sensor[1)]	Se muestra la temperatura actual y la temperatura más alta del sensor.
SensorAlive	En el submenú se muestran los días restantes hasta el final de la vida útil pronosticada y la vitalidad en %.
Almacen Datos	
Estado registrador	Muestra el estado del registrador de datos (activo o no activo)
Grafico	Muestra el historial de los últimos 15 minutos en un gráfico de tiempo/concentración.

1) Función solo disponible con la mochila de diagnóstico.

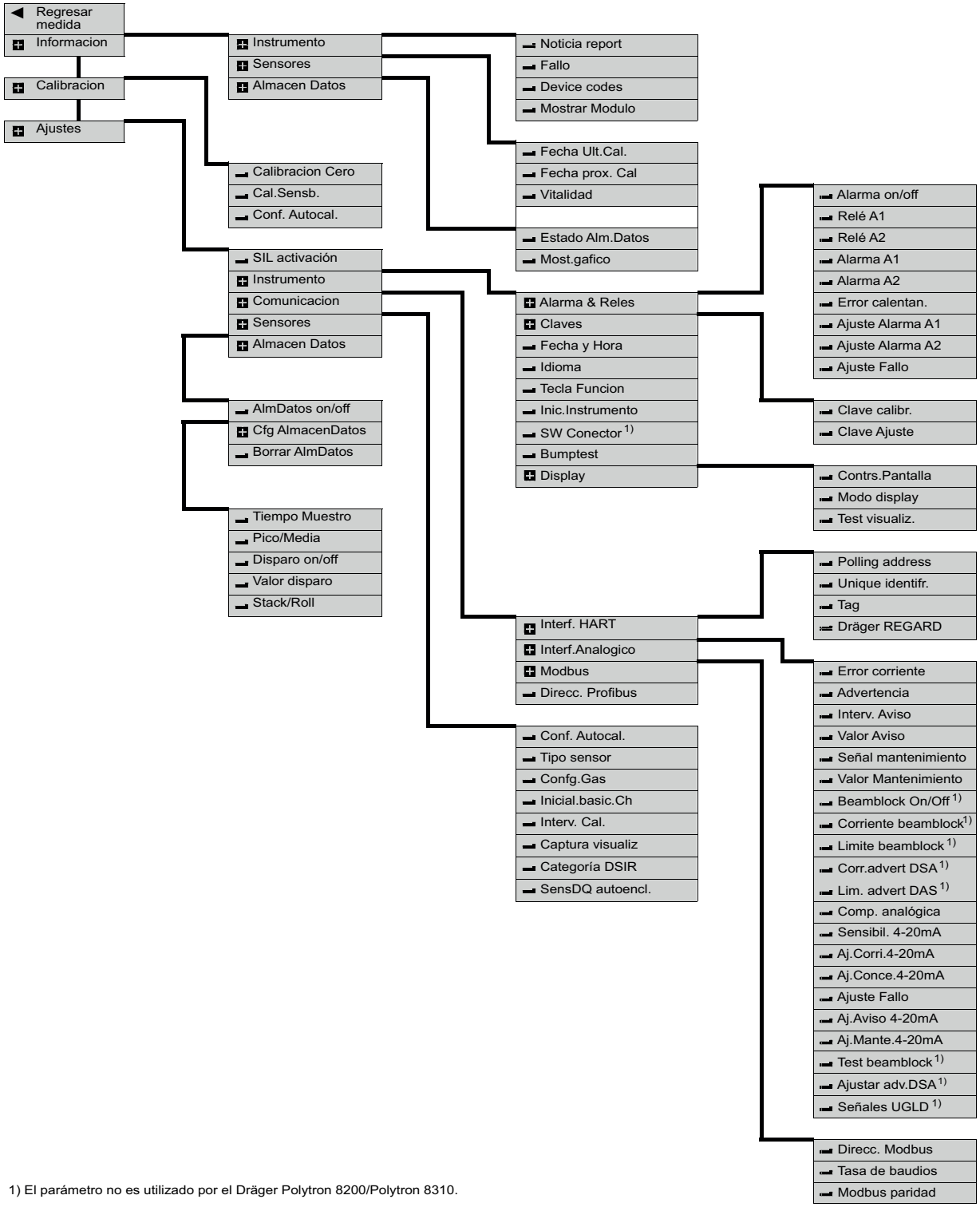
7.5.5 Vistas generales de los menús

Polytron 8100



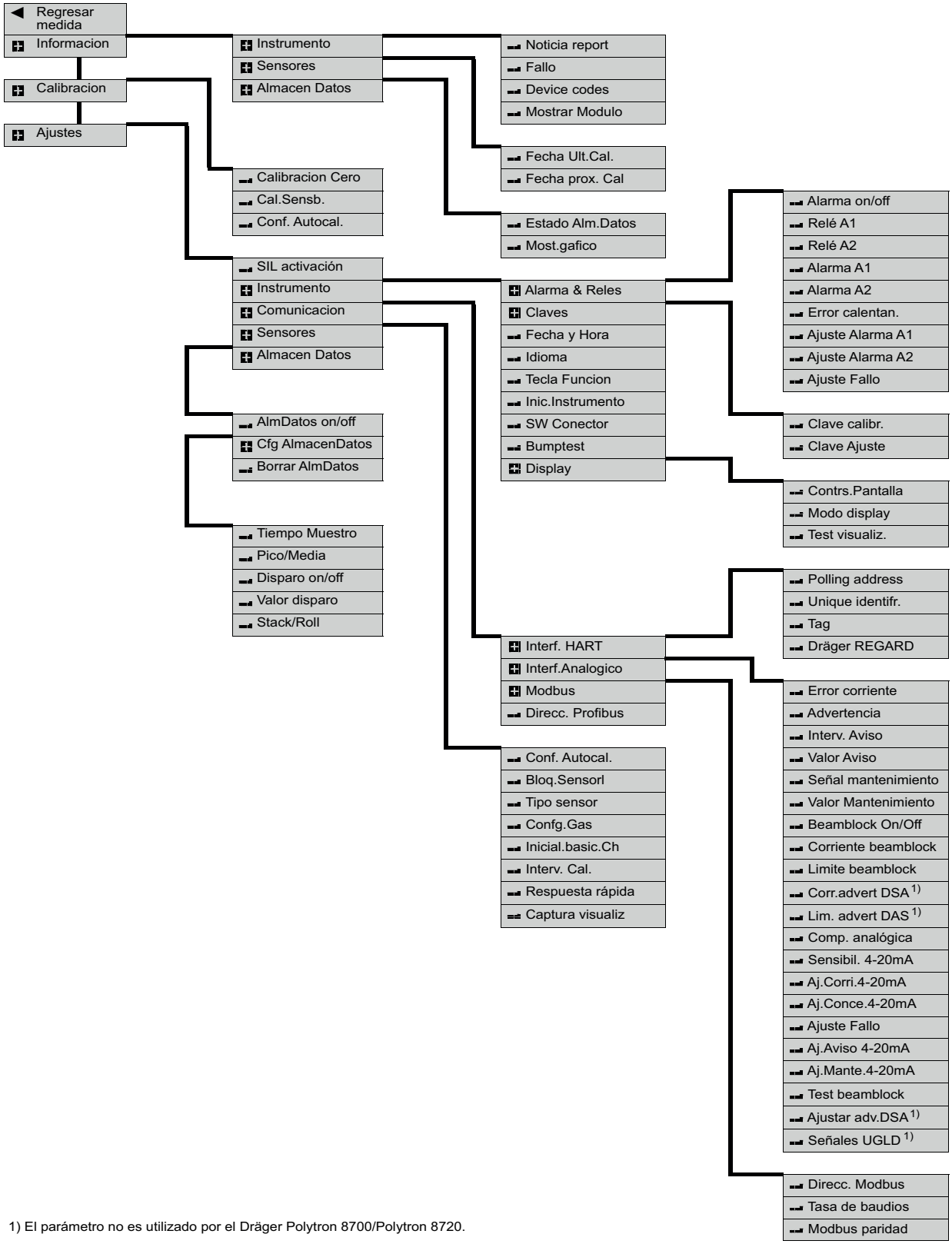
1) El parámetro no es utilizado por el Dräger Polytron 8100.

Polytron 8200, Polytron 8310



1) El parámetro no es utilizado por el Dräger Polytron 8200/Polytron 8310.

Polytron 8700, Polytron 8720



1) El parámetro no es utilizado por el Dräger Polytron 8700/Polytron 8720.

7.6 Información acerca del funcionamiento con un Dräger SensorAlive

– El Dräger SensorAlive no ejecutará ningún LifeTest cuando está abierto un menú o están pendientes determinados errores en el transmisor.
– El Dräger SensorAlive puede suprimir el ajuste del instrumento durante un tiempo determinado (sensor H_2S: 30 minutos).
– Cuando se requiere una alta precisión del tiempo de ejecución del LifeTest, se debe comprobar la hora en el transmisor periódicamente y reajustar, si es necesario.
– Las entradas del menú para el Dräger SensorAlive solo se muestran si el Dräger SensorAlive está enchufado. Las funciones de la mochila pueden visualizarse pero no están activas.

8 Calibración

8.1 Indicaciones generales

– Para garantizar un funcionamiento correcto, ajuste primero el punto cero y luego la sensibilidad. Si estos procesos se ejecutan en el orden incorrecto, no se podrá continuar con el ajuste debido a la configuración del software.
– Si el uso está previsto a alturas elevadas, la lectura será más baja que la lectura a nivel del mar (presión parcial reducida). Se recomienda un nuevo ajuste de sensibilidad si la altura o la presión ambiental ha variado. El ajuste de fábrica está ajustado a la presión a nivel del mar.
– Dräger recomienda ajustar los instrumentos con el gas objetivo de la medición. Este método es más preciso que un ajuste con gas sustituto. Solo cuando no sea posible realizar un ajuste con gas objetivo, puede recurrirse alternativamente a un ajuste con gas sustituto.
– Los sensores para metano e hidrógeno solo se deberían ajustar con gas de medición y no con un gas sustituto.
– Para Polytron 8310 IR: deben tenerse en cuenta adicionalmente las instrucciones de uso del DrägerSensor IR.[1)].

Al realizar el ajuste se comprueba y se ajusta la exactitud de medición del sensor con una concentración del gas de prueba conocida. Los ajustes se tienen que realizar regularmente. La duración de los intervalos de ajuste depende de las condiciones ambientales en las cuales funciona el sensor.

Las condiciones ambientales y envejecimiento causan derivas del sensor. Las derivas del sensor tienen un impacto negativo sobre la exactitud de medición. Los ajustes restauran dicha exactitud. Dependiendo de la gravedad de la deriva, deben establecerse unos intervalos de ajuste más cortos.

Para evaluar las condiciones ambientales de instalaciones nuevas, se recomienda establecer unos intervalos de ajuste más cortos y documentar la deriva. El operador de la planta debería establecer unos intervalos de ajuste personalizados con los datos obtenidos.

Si se utiliza un Dräger SensorAlive, la deriva es compensada y se puede leer.

Bajo condiciones normales, Dräger recomienda los siguientes intervalos de ajuste[2)]:

– Sensores electroquímicos (EC): 6-12 meses[3)]
– Sensores catalíticos (CAT): 4 meses
– Sensores infrarrojos (IR): 6-24 meses[3)]

8.2 Gases de prueba

Para las propiedades de los gases de prueba (p. ej., humedad, concentración), consulte las instrucciones de uso del sensor correspondiente. Si no hay información sobre la humedad, se puede utilizar gas de prueba seco para el ajuste. La humedad del gas de prueba es irrelevante para los sensores de O_2.

Dependiendo del tipo de ajuste se utilizan diferentes gases de prueba.

Gas de ajuste de cero

El gas de ajuste de cero es un gas de prueba que se utiliza para ajustar el punto cero de un sensor. Para sensores de O_2 y CO_2, se utiliza nitrógeno (N_2). Para otros sensores se puede utilizar el aire ambiental, siempre que esté libre de contaminantes que interfieran y de gases de medición.

Gas de ajuste

El gas de ajuste es un gas de prueba que se utiliza para ajustar la sensibilidad de un sensor. El gas de ajuste es una concentración conocida del gas de medición diluido con aire limpio o nitrógeno. Para sensores de O_2 no se requiere ningún gas de ajuste, ya que se utiliza el oxígeno del aire ambiental.

8.3 Flujo de gas para los ajustes

El flujo de gas varía en función del sensor.

Sensor EC, sensor CAT	0,5 L/min ± 10 %
Resto de sensores	0,5 L/min - 2 L/min

El flujo de gas debe coincidir con las condiciones ambientales durante el funcionamiento (por ejemplo, medición del conducto de ventilación con un flujo superior a 2 L/min)

1) 9023981 (inglés), 9033555 (búlgaro, rumano), 9023984 (español, portugués), 9023986 (danés, noruego), 9033556 (checo, croata), 9033809 (chino), 9023985 (húngaro, polaco), 9023982 (francés), 9033557 (eslovaco, esloveno), 9033558 (griego, turco), 9023987 (italiano, neerlandés), 9023983 (finés, sueco), 9023843 (alemán)

2) Observar las instrucciones de uso del sensor
3) Para aplicaciones según las normas EN 45544-1 y EN IEC 62990-1, el intervalo de ajuste no debe superar los 6 meses.

8.4 Preparación del ajuste

Indicaciones generales

⚠ ADVERTENCIA
Peligro para la salud por gas de prueba
Inhalar gas de prueba puede poner en riesgo la salud o incluso provocar la muerte.
► No inhalar el gas de prueba.
► Observar los riesgos y los avisos de seguridad relacionados con el gas de prueba (consultar las hojas de datos y las instrucciones que figuran en los dispositivos de calibración).

⚠ PRECAUCIÓN
Activación de advertencias por el gas de prueba
El gas de prueba aplicado puede activar advertencias.
► Asegurarse de que el gas de prueba ya no se aplica tras la calibración.

Condiciones previas
– La fase de iniciación del sensor ha finalizado (consulte "Puesta en funcionamiento del detector de gases", página 155).
– Se ha ajustado la fecha y la hora (consulte "Ajuste de la fecha y la hora", página 170).
– Si se utiliza un Dräger SensorAlive, el último LifeTest debe haberse realizado hace suficiente tiempo (véanse las instrucciones de uso del sensor).

Particularidad del Polytron 8310

Dräger recomienda realizar un ajuste automático del punto cero en el sensor antes de ajustar el punto cero. Esto restablece el seguimiento del punto cero del DrägerSensor IR y todo el rango de seguimiento vuelve a estar disponible.

1. Desactive la señalización de alarma del detector de gases (consulte "Conexión o desconexión de alarmas", página 172).
2. Aplique nitrógeno, aire sintético o aire limpio al sensor por medio del adaptador de calibración y espere a que se estabilice el valor medido.
3. Coloque la varita magnética en el área marcada con el símbolo ⇩0 (dentro del marco negro) de la superficie del sensor y manténgala así durante al menos 5 segundos. La señal de salida del sensor cambia a la indicación de la señal de calibración después de 5 segundos (cambio de indicación en aprox. –10 %LIE) mientras se mantenga la varita magnética. Simultáneamente se realiza automáticamente un ajuste del punto cero del sistema óptico de medición.
4. Retire la varita magnética. Transcurridos 30 segundos, el instrumento termina la rutina de ajuste del punto cero automática. Para confirmar el ajuste automático del punto cero, la señal de salida vuelve a cambiar a la señal de calibración (cambio de la indicación a aprox. –10 %LIE). Esta señal se visualiza durante el mismo tiempo que al entrar en la rutina de ajuste automático del punto cero.
5. Encienda la señalización de alarma del detector de gases.

Polytron 8100, Polytron 8200, Polytron 8310

Véase la figura B en la página desplegable.

Equipo de ajuste:
– Manorreductor Dräger (1); para gases reactivos, utilice un manorreductor de acero inoxidable
– Adaptador de calibración Dräger (2) (número de referencia 6810536)
– Tubo (3)
– Botella de gas de ajuste Dräger (4)

Preparación del ajuste:
1. Conecte el manorreductor a la botella de gas de ajuste.
2. Coloque el adaptador de calibración en el sensor.
3. Conecte el tubo al empalme estriado.
4. Entre al menú; véase (consulte "Abrir los menús", página 158).

Polytron 87x0 IR

Véase la figura B en la página desplegable.

Equipo de ajuste:
– Manorreductor Dräger (1); para gases reactivos, utilice un manorreductor de acero inoxidable
– Adaptador de calibración Dräger (5) (número de referencia 6811610).
– Tubo (3)
– Botella de gas de ajuste Dräger (4)

Preparación del ajuste:
1. Conecte el manorreductor a la botella de gas de ajuste.
2. Acople el adaptador de calibración al protector contra salpicaduras hasta que encaje en su sitio.
   Esto no se aplica para el montaje en un conducto de ventilación o si se utiliza el adaptador de proceso o una cubeta de proceso (véanse las instrucciones de instalación para el correspondiente accesorio PIR 7x00).
3. Cerciórese de que las superficies de sellado alrededor de las aberturas del protector contra salpicaduras estén limpias. El protector contra insectos no se tiene que desmontar.
4. Conecte el tubo al empalme estriado.
5. Entre al menú; véase (consulte "Abrir los menús", página 158).

8.5 Ajuste del punto cero

8.5.1 Aspectos generales

El aire ambiental solo se puede utilizar para ajustar el punto cero del sensor en lugar de nitrógeno o aire sintético si se tiene seguridad de que el aire ambiental está libre del gas objetivo o de cualquier otro gas al que el sensor pueda reaccionar con interferencia cruzada (consulte lo indicado en la hoja de datos del sensor). En este caso no se requiere ningún adaptador de botella o de calibración para el ajuste del punto cero.

⚠ ADVERTENCIA
Fallo de calibración en la calibración del punto cero
Un flujo insuficiente de aire ambiental puede causar errores de calibración.
► Asegurarse de que el flujo de aire ambiental al sensor es suficiente.

Específico para Polytron® 8100 EC:

En los sensores de oxígeno (O_2), una calibración del punto cero no modifica ningún valor en el firmware o en el sensor. Por ello, la función de calibración del punto cero se puede utilizar para comprobar la lectura correcta de punto cero cuando nitrógeno es aplicado al sensor. El Polytron 8100 EC indicará un estado de fallo si la comprobación del punto cero falla con una desviación de más de 0,6 vol% de O_2 del punto cero. En caso de un fallo, repita la comprobación del punto cero o cambie el sensor en caso necesario. Utilice nitrógeno (N_2) para la verificación.

Específico para Polytron® 8200 CAT:

Los sensores no se deben calibrar con nitrógeno puro. Los sensores catalíticos necesitan oxígeno para funcionar correctamente.

Específico para Polytron® 8720 IR:

Para Polytron 8720 IR (con sensor PIR 7200 para la detección de dióxido de carbono), solamente se debe utilizar nitrógeno o aire sintético sin ningún contenido de CO_2 para una calibración del punto cero.

8.5.2 Ejecución del ajuste del punto cero

ℹ La calibración puede cancelarse en cualquier momento. Para cancelar la calibración, seleccionar ***Regresar***.

Requisitos previos:
– El sensor ha finalizado la fase de calentamiento
– La calibración está preparada.

Ajuste el punto cero de la siguiente manera:
1. Seleccione ***Calibracion*** > ***Calibracion Cero*** y confirme.
   ⇒ La señal de mantenimiento se transmite a través de la interfaz analógica. No se conmuta ninguna alarma ni ningún relé de error y se muestra el símbolo 🔧.
   ⇒ Se muestra el mensaje ***Sumin.gas cero***.
2. Aplique aire sintético o nitrógeno si no se puede usar aire ambiental.
   a. Ajuste el flujo de gas según el sensor utilizado (consulte "Flujo de gas para los ajustes", página 162)
3. Seleccione ***Siguiente*** y confirme.
   ⇒ Se muestra el valor actual.

ℹ Después de 15 minutos sin confirmación, el instrumento regresa al menú de ajuste sin realizar un ajuste.

Después de que el gas de prueba se haya aplicado al sensor durante 3 minutos y el valor mostrado sea estable, realice el ajuste.

4. Seleccione ***Calibrar*** y confirme.
   ⇒ Se muestra el mensaje ***Porfavor Espere***.
   ⇒ Se muestra un valor actual nuevo.
5. Seleccione ***Siguiente*** y confirme.
6. Cierre el flujo de gas y retire el adaptador de calibración del sensor o suelte el tubo.
   Si el valor actual no se encuentra dentro del rango de alarma:
7. Seleccione ***Siguiente*** y confirme.
   ⇒ El instrumento retorna al menú de ajuste.

8.6 Calibración de la sensibilidad

8.6.1 Aspectos generales

Específico para Polytron® 8310 IR:

Debido al diseño del sensor de gas DSIR, la señal de salida del sensor de gas está limitada a 45 %. . . 55 % de la tensión de alimentación interna del instrumento. Si las concentraciones de gas aumentan más después de haber alcanzado la señal de salida máxima del sensor, esto no conduce a un aumento de los valores visualizados en la respuesta del instrumento transmitida a la unidad de control. En caso de sustancias con unos factores de ajuste particularmente bajos y/o la configuración manual de un factor alto de ajuste de sensibilidad en el sensor, esto ya puede suceder a concentraciones inferiores a 100 % LIE. Para ajustes con gas sustituto, la activación correcta de la alarma se debería comprobar utilizando una concentración de gas de prueba que corresponda al umbral de alarma. En caso necesario, el rango de medición representable puede aumentarse reduciendo la señal de salida del sensor en función de las necesidades y ajustándola a continuación en la unidad (véase el capítulo "Calibración manual de la sensibilidad de la señal de salida" en las instrucciones de uso del sensor de gas DSIR).

8.6.2 Ejecución del ajuste de sensibilidad

ℹ La calibración puede cancelarse en cualquier momento. Para cancelar la calibración, seleccionar ***Regresar***.

Condiciones previas:
– El ajuste ha sido preparado.
– El punto cero ha sido ajustado.
– Indicaciones específicas para todos los Polytron 8xx0 salvo el Polytron 8100 EC:
  el último ajuste válido del punto cero se realizó hace menos de 24 horas.

Ajuste la sensibilidad de la siguiente manera:

1. Seleccione ***Calibracion*** > ***Calib. Sensibil.*** y confirme.
   ⇒ La señal de mantenimiento se transmite a través de la interfaz analógica. No se conmuta ninguna alarma ni ningún relé de error y se muestra el símbolo .
   ⇒ Se muestran los parámetros para el gas de ajuste, p. ej.:[1)]
   Gas : H_2S
   Unidad: ppm
   Concentr.: 25
2. Si los parámetros mostrados no coinciden con el gas objetivo, ajuste los parámetros:
   a. Seleccione ***Gas*** y confirme.
   b. Seleccione el gas de ajuste de la lista y confírmelo.
   c. Seleccione ***Unidad*** y confirme.
   d. Seleccione la unidad de medida deseada de la lista y confírmela.
   e. Seleccione ***Conc.*** y confirme.
   f. Ajuste la concentración del gas de ajuste.
3. Si los ajustes son correctos:
   a. Seleccione ***Siguiente*** y confirme.
      ⇒ Se muestra un mensaje como ***Flujo de gas ON H_2S***.
4. Aplique el gas de ajuste.
   a. Ajuste el flujo de gas según el sensor utilizado (consulte "Flujo de gas para los ajustes", página 162)
5. Seleccione ***Siguiente*** y confirme.
   ⇒ Se muestra el valor actual.

Después de 15 minutos sin confirmación, el instrumento regresa al menú de ajuste sin realizar un ajuste.

Después de que el gas de prueba se haya aplicado al sensor durante 3 minutos y el valor mostrado sea estable, realice el ajuste.[2)]:

6. Seleccione ***Siguiente*** y confirme.
   ⇒ Se muestra el mensaje ***Porfavor Espere***.
   ⇒ Se muestra un valor actual nuevo.
7. Seleccione ***Siguiente*** y confirme.
8. Cierre el flujo de gas y retire el adaptador de calibración del sensor o suelte el tubo.

   Si el valor actual no se encuentra dentro del rango de alarma:
9. Seleccione ***Siguiente*** y confirme.
   ⇒ El instrumento retorna al menú de ajuste.

1) No aplicable a todos los sensores (consulte "Modo de medición", página 156).
2) En los sensores LC, el gas de prueba debe aplicarse durante al menos 6 minutos.

8.7 Ajuste automático

8.7.1 Aspectos generales

El ajuste automático incluye el ajuste del punto cero y un ajuste posterior de sensibilidad. Es una alternativa al ajuste del punto cero y de la sensibilidad de forma manual.

No todos los sensores y gases son compatibles con el ajuste automático. Si la función no está disponible, realice el ajuste manualmente.

8.7.2 Ejecución del ajuste automático

Después de 24 horas, la calibración del punto cero deja de estar actualizada. Por lo tanto, la calibración automática no podrá realizarse a menos que se realice de nuevo la calibración del punto cero.

La calibración puede cancelarse en cualquier momento. Para cancelar la calibración, seleccionar ***Regresar***.

Condiciones previas:

– El ajuste automático está activado.
– La fase de iniciación del sensor ha finalizado.
– El ajuste ha sido preparado.

Ejecute el ajuste automático de la siguiente manera:

1. Aplique aire sintético o nitrógeno si no se puede usar aire ambiental.
2. Seleccione ***Calibracion*** > ***Auto calibracion*** y confirme.
   ⇒ Se muestra el mensaje ***Porfavor Espere*** y el instrumento realiza automáticamente el ajuste del punto cero.
   ⇒ En caso de un sensor de O_2, se muestra ***Aire fresco cal.***.

   La señal de mantenimiento se transmite por la interfaz analógica, no se conmutan relés de alarma o fallo y se muestra el símbolo .
3. Después de un ajuste del punto cero correcto, se inicia el ajuste de sensibilidad.
   ⇒ Se visualizan los parámetros para el gas, p. ej.:[3)]
   Gas : H_2S
   Unidad: ppm
   Concentr.:25
4. Si los parámetros mostrados no coinciden con el gas objetivo, ajuste los parámetros:[4)]
   a. Seleccione ***Gas*** y confirme.
   b. Seleccione el gas de ajuste de la lista y confírmelo.
   c. Seleccione ***Unidad*** y confirme.
   d. Seleccione la unidad de medida deseada de la lista y confírmela.
   e. Seleccione ***Conc.*** y confirme.
   f. Ajuste la concentración del gas de ajuste.

3) Esto no es aplicable a todos los sensores (consulte "Modo de medición", página 156).
4) Solo es posible para determinados sensores.

5. Si los ajustes son correctos:
   a. Seleccione ***Siguiente*** y confirme.
      ⇒ Se muestra un mensaje como ***Flujo de gas ON H_2S***.
6. Aplique el gas de ajuste.
   a. Ajuste el flujo de gas según el sensor utilizado (consulte "Flujo de gas para los ajustes", página 162)
7. Seleccione ***Siguiente*** y confirme.
   ⇒ Se muestra el valor actual.

   Después de 15 minutos sin confirmación, el instrumento regresa al menú de ajuste sin realizar un ajuste.

8. Una vez que el valor actual se estabilice, el instrumento realizará automáticamente el ajuste de sensibilidad.
9. Después de un ajuste correcto, se muestran el nuevo valor actual determinado y el mensaje ***Valor ok?***.
   - Si no es así, seleccione «Rehacer» y confírmelo para volver a realizar el ajuste.
   - Si el valor se corresponde con el valor de consigna, continúe.
10. Cierre el flujo de gas y retire el adaptador de calibración del sensor o suelte el tubo.
11. Seleccione ***Aceptar valor*** y confirme para terminar el ajuste. El instrumento retorna al menú de ajuste.

9 Eliminación de averías

9.1 Fallos

Número	Causa	Solución
001, 003 - 004, 012 - 014, 020 - 024, 043, 060, 067	Error grave del instrumento, diversas causas.	Haga que DrägerService compruebe el instrumento.
002, 025 - 027, 030 - 034, 041, 042, 044, 050, 052, 081, 085	Error de datos grave en el instrumento, varias causas.	Restablezca el instrumento a los ajustes de fábrica. Si este fallo se vuelve a producir: Haga que DrägerService compruebe el instrumento.
005	La tensión de alimentación está fuera del rango admisible.	Compruebe la alimentación eléctrica.
010	El cable no está conectado a la interfaz de 4 a 20 mA.	Compruebe la conexión de la interfaz de 4 a 20 mA. Si se utiliza como instrumento autónomo sin un controlador central, cablee la clavija 3 a la clavija 4.
011	Error grave del instrumento, diversas causas.	Haga que DrägerService compruebe el instrumento. Si este fallo se vuelve a producir: Compruebe la carga o el cable.
045	El instrumento no detecta ningún sensor.	Compruebe las conexiones. Si este fallo se vuelve a producir: Haga que DrägerService compruebe el instrumento.
051, 054	Fallo en el ajuste del punto cero.	Realice el ajuste del punto cero.
055	Fallo en el ajuste de sensibilidad.	Realice el ajuste de sensibilidad.
076, 080 - 084	Fallo del instrumento.	Compruebe las conexiones eléctricas. Si este fallo se vuelve a producir: Haga que DrägerService compruebe el instrumento.
090	La función de bloqueo del sensor está activada. Se ha utilizado un sensor con un número de referencia diferente.	Utilice un sensor con el mismo número de referencia o desactive la función de bloqueo del sensor.
105	Fallo del instrumento.	Haga que DrägerService compruebe el instrumento.
137, 64, 91	Fallo del instrumento.	Apague y vuelva a encender. Si este fallo se vuelve a producir: Haga que DrägerService compruebe el instrumento.

Solo para Polytron 8100 EC con Dräger SensorAlive

Número	Causa	Solución
220	La abertura del sensor está obstruida.	Limpie la abertura del sensor o sustituya el filtro de polvo. A continuación, confirme la obstrucción en el menú (consulte "Ajustes del Dräger SensorAlive", página 178).
221	La sensibilidad del sensor es inferior al 40 % (valor calculado).	Ajuste o sustituya el sensor.
222	Debido a un error, hay un valor de gas demasiado alto después de la electrólisis.	Sustituya el sensor o póngase en contacto con DrägerService.
223	La sensibilidad del sensor es demasiado baja.	Ajuste o sustituya el sensor.

Número	Causa	Solución
224	El flujo de acondicionamiento está fuera del rango permitido.	Sustituya el sensor o póngase en contacto con DrägerService.

Solo para Polytron 87x0 IR

Número	Causa	Solución
064, 071	Fallo de comunicación.	Compruebe la conexión al sensor PIR 7x00.
083	El sistema óptico del PIR 7x00 está sucio.	Limpie el sistema óptico del PIR 7x00.
086	La tensión de alimentación está fuera de rango	Compruebe la alimentación eléctrica.
087	Fallo de 4 a 20 mA en el sensor PIR 7x00.	Compruebe la conexión de 4 a 20 mA en el sensor PIR 7x00.
094, 095	Error de datos en el instrumento.	Restablezca el sensor a los ajustes de fábrica. Si se repite este error: Haga que DrägerService compruebe el instrumento.
096	La contraseña SIL no coincide con el PIR 7x00.	Introduzca la contraseña nuevamente.

9.2 Noticia report

Número	Causa	Solución
101	El registrador de datos en el modo "Stack" está lleno al 100 % y ya no registra más datos.	Haga que DrägerService compruebe el instrumento.
102	El registrador de datos en modo "Stack" está lleno al 90 %.	Descargue los datos lo antes posible y vacíe el registrador de datos.
103, 106	Error de datos en el instrumento. Es posible que algunas funciones de la mochila como el registrador de datos, la prueba del sensor, etc., ya no estén disponibles.	Restablezca el instrumento a los ajustes de fábrica. Si se repite este error: Haga que DrägerService compruebe el instrumento.
104	El ajuste de fecha u hora no es válido.	Ajuste la fecha y la hora.
105	Fallo del instrumento.	Haga que DrägerService compruebe el instrumento.
107	La batería de la memoria de datos está vacía.	Haga que DrägerService compruebe el instrumento.
110, 111, 112	La mochila de software se ha retirado sin haber sido desactivada.	Desactive la mochila de software.
113	Alarmas inhibidas.	Active las alarmas.
164, 165	La fase de iniciación del sensor no ha terminado. Se debe prever un aumento de los errores de medición.	Espere hasta que el sensor finalice la fase de iniciación. No ajuste el sensor antes de que la iniciación haya finalizado completamente.
167, 170	El intervalo de ajuste ha expirado.	Ajuste de nuevo el instrumento.

Solo para Polytron 8100 EC

Número	Causa	Solución
163	Baja vitalidad del sensor EC	Sustituya el sensor.
171	Lectura negativa. Valor por debajo del rango mínimo.	Ajuste de nuevo el punto cero.

Solo para Polytron 8100 EC con Dräger SensorAlive

Número	Causa	Solución
320	La comunicación con el sensor ha fallado. El diagnóstico y el generador de gas ya no funcionan.	Extraiga el sensor, déjelo a un lado durante aprox. 1 día y vuélvalo a enchufar. Compruebe la versión del firmware y, si es necesario, pida una actualización a DrägerService. Sustituya el sensor.
321	La evaluación de los datos del sensor ha fallado. El sensor no puede realizar ni evaluar un LifeTest (porque no se cumplen las condiciones previas).	Cambie la hora del LifeTest o ajuste el perfil de repetición a "Flexible" (consulte "Ajustes del Dräger SensorAlive", página 178). Si vuelve a repetirse la advertencia, póngase en contacto con DrägerService.
322	El conjunto de datos del sensor es defectuoso.	Sustituya el sensor.
323	El conjunto de datos del sensor es incompatible.	Póngase en contacto con DrägerService.
324	La sensibilidad del sensor es inferior al 50 % (valor calculado).	Ajuste el sensor y prepare su sustitución (p. ej., pida la pieza de repuesto).

Número	Causa	Solución
325	La sensibilidad del sensor es inferior al 40 % (valor calculado).	Ajuste o sustituya el sensor.
326	Durante un LifeTest y durante cierto tiempo después, el sensor no puede ser ajustado.	Para poder realizar un ajuste planificado, se puede inhibir temporalmente el LifeTest en el PolySoft mediante el modo de inhibición.
327, 330, 344, 347	El generador de gas no funciona.	Ajuste o sustituya el sensor.
331	La generación de gas ha fallado.	Ajuste el sensor.
332	El sensor está en estado seguro. No se realizan LifeTest (advertencia colectiva).	Encuentre la causa y subsánela.
333	El reloj en tiempo real del sensor no funciona correctamente.	Ajuste el reloj.
334	La sincronización del sensor no ha terminado.	Espere a que la sincronización haya finalizado. En función del estado del sensor, este estado puede estar presente durante varios minutos. Si es necesario, solicite a DrägerService la actualización del firmware.
336	Las comprobaciones internas del sensor arrojan resultados erróneos.	Reinicie el sistema.
337	Es necesario actualizar el firmware del transmisor.	Póngase en contacto con DrägerService.
340	El sensor se sincroniza después de que se ha reiniciado el sistema.	Espere a que la sincronización haya finalizado.
342	La diferencia de temperatura entre los dos puntos de medición de la temperatura es demasiado elevada.	Espere y compruebe si se evalúa el LifeTest o sustituya el sensor.
347	La configuración ha fallado debido a una interrupción en la comunicación entre el transmisor y el sensor.	Vuelva a configurar el sensor y compruebe la configuración.
350	El generador de gas está en fase de puesta en marcha.	Espere a que la fase de puesta en marcha haya finalizado. Durante la fase de puesta en marcha no se ejecutan las funciones de detección de errores y detección de obstrucciones.
352	La autocomprobación del sensor ha fallado.	Sustituya el sensor o póngase en contacto con DrägerService.
353	El sensor se encuentra temporalmente en modo inhibición. No se realizan LifeTest durante este tiempo.	Se puede salir del modo de inhibición manualmente a través de PolySoft o se sale automáticamente.
354	Error al iniciar el sistema.	Realice un reinicio manualmente.
355	El firmware del sensor no es compatible con el hardware.	Solicite a DrägerService la actualización del firmware.
356	Los datos del hardware son defectuosos.	Realice un reinicio o sustituya el sensor.
357	El sensor ha sido puesto manualmente en estado seguro, p. ej., para ejecutar una actualización del firmware.	Para salir de dicho modo, reinicie el sensor.

Solo para Polytron 87x0 IR:

Número	Causa	Solución
163	La temperatura del sensor es muy alta.	
171	La deriva del punto cero es demasiado elevada.	Realice el ajuste del punto cero.
172	El sistema óptico del PIR 7x00 está sucio.	Limpie el sistema óptico del PIR 7x00.
173	El ajuste del punto cero ha expirado para el ajuste de sensibilidad.	Realice el ajuste del punto cero.

Número	Causa	Solución
182	No es posible el ajuste automático con PIR 7200.	Realice un nuevo ajuste del punto cero y de sensibilidad.

10 Mantenimiento

– Los intervalos de mantenimiento se tienen que establecer para cada una de las instalaciones. Dependiendo de las consideraciones de seguridad y condiciones específicas de la aplicación en las que se utiliza el instrumento, éstos tal vez se tengan que acortar.

Cada 6 meses:

– Inspección por parte del personal especializado.
– Compruebe la transmisión de la señal a la unidad de control (consulte "Comprobación de la interfaz analógica", página 175).
– Compruebe los LED y la activación de los dispositivos de alarma (consulte "Comprobación de alarmas/relés", página 172).

Regularmente:

– Realice los ajustes, véase 8 Calibración

10.1 Realización de la prueba con gas y comprobación del tiempo de respuesta (t90)

En una prueba con gas (Bump Test) se comprueba el tiempo de respuesta sin activar una alarma.

1. Seleccione ***Ajustes*** > ***Instrumento*** > ***Bumptest*** y confirme.
   ⇒ Se muestra el símbolo de mantenimiento
   ⇒ La salida analógica es ajustada a la señal de mantenimiento.
2. Aplique al sensor una concentración de gas conocida.
3. Compruebe el tiempo de respuesta y compárelo con el valor t90 indicado en la hoja de datos correspondiente del sensor.
4. Pulse [OK] para volver a la medición.

10.2 Sustitución del sensor

⚠ ADVERTENCIA
Calibración defectuosa
Una calibración defectuosa puede causar lecturas inexactas.
► Si se sustituye el sensor, es preciso comprobar que todos los ajustes y parámetros son correctos.
► Comprobar la calibración para verificar el funcionamiento correcto.

10.2.1 Polytron® 8100 EC

Un sensor se puede sustituir en el área clasificada como peligrosa sin interrumpir la alimentación eléctrica.

Función de bloqueo del sensor

Si previamente se había instalado un sensor del mismo tipo (mismo número de referencia), se conservará la configuración específica del dispositivo (tipo de gas, rango de medición, gas de prueba, intervalo de ajuste, etc.). De lo contrario, se cargarán los ajustes predeterminados de fábrica del nuevo sensor y se sobrescribirá la configuración específica del dispositivo. Esto puede evitarse si la función de bloqueo del sensor (consulte "Ajuste del bloqueo del sensor", página 177) está activada.

Función de cambio de sensor

Con la función de menú ***Cambio sensor***, puede realizarse un cambio de sensor durante el funcionamiento sin activar una señal de fallo en la unidad de control. Además se asegura que todos los datos del sensor, que se encuentran en el microprocesador, se pueden guardan en la memoria enchufable (EEPROM) del sensor antes de desenchufar el conector del sensor.

Sustitución del sensor

Véase la figura C en la página desplegable.

En principio, es posible realizar una sustitución del sensor en cualquier momento.

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Cambio sensor*** y confirme.
   ⇒ La señal de mantenimiento se genera en la interfaz de 4-20 mA.
   ⇒ En la pantalla se muestra lo siguiente: ***Por favor retire sensor***.
   ⇒ Se muestra el símbolo de mantenimiento.
2. Sustituya el sensor usado por un sensor nuevo:
   a. Suelte el tornillo de sujeción (2) (tornillo Allen de 2 mm).
   b. Desenrosque el anillo de bayoneta (3).
   c. Inserte el sensor (4) en la abertura y gírelo hasta que encaje en el detector de gases. El conector del sensor no sufrirá ningún daño.
   d. Bloquee el sensor con el anillo de bayoneta (3) correspondiente.

   Para Dräger SensorAlive debe utilizarse un anillo de bayoneta distinto al que se usa para otros sensores EC.

   e. Apriete el tornillo de sujeción (2) de modo que el anillo de bayoneta no pueda soltarse (obligatorio para instalaciones de Zona 22).
      ⇒ En la pantalla se muestra lo siguiente: ***Cargando datos, por favor espere***
3. Si fuera necesario, coloque la etiqueta suministrada con el sensor en el instrumento. Esto permite identificar desde la distancia el tipo de gas que se está midiendo, incluso si hay un fallo del suministro eléctrico.

4. Cuando los datos del sensor se han cargado, la pantalla muestra: ***Datos cargados***.
5. Seleccione ***Regresar al menu*** y confirme.
   ⇒ La señal de mantenimiento en la interfaz 4-20 mA sigue pendiente hasta que el sensor haya finalizado la iniciación.

   Tiempo de iniciación máximo de un nuevo sensor: consulte las instrucciones de uso del sensor. Para oxígeno: homologaciones según la norma EN 50104.
6. Compruebe el ajuste. Si es necesario, ajuste el instrumento (consulte "Calibración", página 162).
7. Compruebe los requisitos de instalación y el estado SIL del instrumento.
   Véanse las secciones "Instalación a prueba de explosión (Ex d) - sin estación de acoplamiento" hasta "Instalación de sensores o cabezales detectores".

10.2.2 Polytron® 8200 CAT, 8310 IR, 87x0 IR

Sustitución del sensor

1. Si fuera necesario, ajuste la corriente de mantenimiento para la interfaz analógica.
2. Desconecte la alimentación eléctrica del instrumento o desclasifique el área según lo especificado en las normativas locales.
3. Afloje el tornillo de fijación y desenrosque la tapa del instrumento.
4. Extraiga la unidad de tarjeta de circuito impreso.
5. Gire la unidad de tarjeta de circuito impreso y retire el conector del sensor.
6. Desenrosque el sensor.
7. Inserte los cables del sensor a través del puerto roscado de la carcasa.

⚠ ADVERTENCIA
¡Peligro de explosión!
Las aberturas de la carcasa se deben sellar para prevenir una ignición de aire atmosférico peligroso en caso de ignición en el interior de la carcasa.
► Cinco pasos de la rosca deben enroscarse para garantizar el estado a prueba de explosiones.

8. Enrosque el sensor y apriete con el par de apriete correcto (mín. 266 in-lbs / mín. 30 Nm).
9. Específico para Polytron® 8200 CAT:
   Una los cables del sensor torciéndolos. Si fuera necesario, coloque una brida sujetacables para mantenerlos apretados.
10. Inserte el conector del sensor de nuevo en la hembrilla.
11. Coloque la unidad de tarjeta de circuito impreso nuevamente en la carcasa.
12. Atornille la tapa en el instrumento hasta que quede bien encajada (mín. ≥44 in-lbs / mín. ≥5 Nm) y apriete el tornillo de fijación.
13. Si es necesario, conecte la alimentación eléctrica del instrumento.
    ⇒ La señal de mantenimiento en la interfaz 4-20 mA sigue pendiente hasta que el sensor haya finalizado la iniciación.

    Tiempo de iniciación máximo de un nuevo sensor: consulte las instrucciones de uso del sensor.
14. Compruebe el ajuste. Si es necesario, ajuste el instrumento (consulte "Calibración", página 162).
15. Compruebe los requisitos de instalación y el estado SIL del instrumento.
    Véanse las secciones "Instalación a prueba de explosión (Ex d) - sin estación de acoplamiento" hasta "Instalación de sensores o cabezales detectores".

10.3 Realización de una prueba de visualización

1. Seleccione ***Ajustes*** > ***Instrumento*** > ***Display*** > ***Test visualiz.*** y confirme.
2. Seleccione ***Activado*** y confirme.
   ⇒ La información de la pantalla se muestra invertida. Se encienden todos los LED.
   Al salir del menú, finaliza la inversión.

11 Ajustes del dispositivo

11.1 Ajuste de contraseñas

1. Seleccionar ***Ajustes*** > ***Instrumento*** > ***Claves*** la contraseña deseada y confirmar.

Clave calibr.	Acceder a la calibración del punto cero y de la sensibilidad.
Clave Ajustes	Acceder a todos los parámetros de configuración.

2. Seleccionar la línea para editar la contraseña y confirmar.
3. Ajustar la contraseña y confirmar.
4. Seleccionar ***Confirmar*** y confirmar con [OK].

11.2 Ajuste de la fecha y la hora

1. Seleccione ***Ajustes*** > ***Instrumento*** > ***Fecha y hora*** y confirme.
2. Seleccione la línea para editar la fecha y la hora y confirme.
3. Seleccione ***Confirmar*** y confírmelo con [OK].

11.3 Ajuste del idioma

1. Seleccione ***Ajustes*** > ***Instrumento*** > ***Idioma*** y confirme.
2. Seleccionar el idioma deseado de la lista y confirme.

11.4 Configuración de la tecla de función

1. Seleccione ***Ajustes*** > ***Instrumento*** > ***Tecla Funcion*** y confirme.
2. Seleccione una función y confirme.

Grafico	Las mediciones de los últimos 15 minutos son visualizadas en forma de gráfico de tiempo/concentración.
Error report	Los mensajes de fallo se muestran en texto legible.
Noticia report	Los mensajes de advertencia se muestran en texto legible.
Bumptest	La prueba con gas permite aplicar gas a un sensor sin generar una alarma. La señal de mantenimiento es transmitida. Después de 15 minutos, o pulsando nuevamente [OK], se termina la prueba con gas y el instrumento retorna al funcionamiento normal.
Vida Sensor[1)]	Muestra la vitalidad restante del sensor.

1) Solo con mochila de diagnóstico.

11.5 Restablecimiento de los ajustes por defecto

Esta función reinicia el instrumento a los ajustes por defecto de fábrica.

1. Seleccionar ***Ajustes*** > ***Instrumento*** > ***Inic.Instrumento*** y confirmar.
2. Seleccionar ***Confirmar*** y confirmar con [OK].

11.6 Cambio del contraste de la pantalla

1. Seleccionar ***Ajustes*** > ***Instrumento*** > ***Display*** > ***Contrs.Pantalla*** y confirmar.
2. Cambiar el contraste y confirmar.

11.7 Cambio del modo de pantalla

1. Seleccionar ***Ajustes*** > ***Instrumento*** > ***Display*** > ***Modo display*** y confirmar.
2. Seleccionar el modo deseado y confirmar.

Estándar	Muestra la pantalla estándar.
No display	Muestra la pantalla de inicio y los símbolos aplicables.

Si se activa una alarma, la pantalla muestra la concentración de gas actual y el LED rojo parpadea sea cual sea el modo de pantalla seleccionado.

11.8 Configuración del relé

11.8.1 Combinaciones de autoenclavador y confirmación de alarmas

Los siguientes ejemplos proporcionan una visión general de combinaciones de confirmación de relé.

	Autoenclavador (Reinicio manual de relé)	**No autoenclavador** (Reinicio automático del relé después de que la condición de alarma desaparezca)
Confirmable	Reinicio de relé posible en cualquier momento.	
No confirmable	Reinicio de relé no posible antes de que la condición de alarma desaparezca.	
Preconfirmable	Confirmación de alarma posible antes de que la condición de alarma desaparezca. El relé se reinicia automáticamente después de que la condición de alarma desaparezca.	

Las señales «autoenclavador» y «no autoenclavador» no están limitadas en el tiempo. Las señales «autoenclavador» permanecen activas hasta que se confirmen. Las señales «no autoenclavador» se detienen en cuanto la condición de activación desaparezca.

11.8.2 Configuración del relé A1 o A2

Esta función define si el relé de alarma está excitado durante el funcionamiento normal o excitado en una condición de alarma.

1. Seleccionar ***Ajustes*** > ***Instrumento*** > ***Alarma***> ***Relé A1*** o ***Relé A2*** y confirmar.
2. Seleccionar la opción deseada y confirmar.

Normal. Tensión	El contacto del relé se excita durante el funcionamiento normal y cambia si se activa una alarma. En caso de pérdida de energía eléctrica, se dispara una alarma (a prueba de fallos).
Tension en Alarm	Si se dispara una alarma, se excita el contacto de relé.

11.8.3 Ajuste del calentamiento 1 del relé de fallo

Esta función se utiliza para ajustar el funcionamiento del relé de fallo durante el calentamiento 1 para indicar el estado de calentamiento 1 en la salida del relé.

1. Seleccione ***Ajustes*** > ***Instrumento*** > ***Alarma*** > ***Fallo calentamiento*** la opción deseada y confírmelo.

Estático	El relé de fallo activa un indicador de alarma conectado permanentemente. El indicador LED naranja se ilumina continuamente.
Dinámico	El relé de fallo conmuta el estado por 9 segundos. *Ejemplo:* – Una bocina está conectada a la salida del relé de fallo «normalmente abierto». – Los relés están configurados como «normalmente excitado». ⇒ La bocina y el indicador LED naranja del transmisor están activos 1 segundo e inactivos 9 segundos.

11.9 Configuración de alarma

11.9.1 Conexión o desconexión de alarmas

1. Seleccione ***Ajustes*** > ***Instrumento*** > ***Alarma*** > ***Alarma on/off***.

Activado	La señalización de alarma está conectada.
Desactivado	La señalización de alarma está desconectada. Los LED, relés y las interfaces no muestran ninguna condición de alarma. La interfaz de 4 a 20 mA transmite la señal de mantenimiento. Se muestran el valor determinado y el símbolo [!]. El relé de fallo indica un fallo.

2. Seleccione ***Activado*** o ***Desactivado*** y confirme.

11.9.2 Configuración de la alarma

1. Seleccione ***Ajustes*** > ***Instrumento*** > ***Alarma*** > ***Alarma A1*** o ***Alarma A2*** y confirme.
   Se muestra el umbral de alarma actual.
2. Acepte la sugerencia mostrada o modifique los siguientes ajustes (confirme los pasos de configuración uno tras otro con ***Sigue***):
   a. Ajuste el valor para el umbral de alarma.
   b. Ajuste la dirección de alarma.

Subida	La dirección de alarma se denomina "ascendente", si la concentración de gas tiene que superar un determinado valor para activar una alarma.
Caída	La dirección de alarma se denomina "descendente", si la concentración de gas tiene que caer por debajo de un determinado valor para activar una alarma.

   c. Establezca el modo de enclavamiento.

Latching	Una vez que se alcance el umbral de alarma, el instrumento activará la alarma. Permanecerá en estado de alarma aunque la concentración de gas ya no cumpla la condición de alarma. Para eliminar una alarma de enclavamiento, hay que confirmarla.
Non Latching	El estado de alarma se borrará en cuanto la concentración de gas ya no cumpla la condición de alarma.

   d. Establezca el modo de confirmación.

Acknowledging	El relé de alarma y el LED pueden restablecerse antes de que desaparezca la condición de alarma.
No-achknowledgeable	El relé de alarma y el LED no pueden restablecerse hasta que la condición de alarma haya desaparecido.
Preconfirm.	El estado de alarma se puede confirmar antes de que la condición de alarma desaparezca. Sin embargo, el relé de alarma y el LED permanecen activos hasta que la condición de alarma haya desaparecido.

   e. Ajuste el valor de histéresis.
   La función de histéresis define un intervalo en el que un relé activado mantiene su estado hasta que la concentración de gas vuelva a estar fuera del intervalo definido. Ejemplo: el umbral de alarma se establece en 40 ppm y la histéresis en 3 ppm. La alarma se mantiene activa hasta que el valor caiga por debajo de 37 ppm. Esto evita que los relés se cierren y abran brevemente en un umbral de alarma.

   [i] Cuando se cambia la dirección de una alarma (de descendente a ascendente o viceversa), hay que comprobar el valor de la histéresis y corregirlo en caso necesario.

   ⇒ Una pantalla de confirmación muestra todos los ajustes.
   f. Seleccione ***Confirmar*** y confirme con OK.
   ✓ Los nuevos ajustes se guardan.

11.9.3 Comprobación de alarmas/relés

Estas funciones cambian el estado de un relé y un indicador LED para fines de prueba (p. ej., para comprobar el funcionamiento de dispositivos de alarma conectados al relé).

Se muestra el símbolo . Al salir de esta función, el estado del relé y el indicador LED volverán automáticamente a su estado anterior.

1. En ***Ajustes*** > ***Instrumento*** > ***Alarma*** > seleccione la condición de alarma deseada y confírmela.

Alarma A1	Simula una prealarma
Alarma A2	Simula una alarma principal
Ajuste fallo	Simula una señal de fallo

2. Seleccione ***Activado*** y confirme.
   ⇒ El relé de fallo deja de estar excitado y la interfaz de 4 a 20 mA se ajusta a la corriente de fallo. El LED amarillo se enciende, se muestra el símbolo de mantenimiento.
   Al salir del menú, finaliza la simulación.

11.10 Configuración del registrador de datos

11.10.1 Visualización del gráfico

Se pueden ver los últimos 15 minutos como gráfico de tiempo/concentración.

1. Seleccionar ***Información*** > ***Almacen Datos*** > ***Grafico***

11.10.2 Conexión o desconexión de un registrador de datos

1. Seleccione ***Ajustes*** > ***Almacen Datos*** > ***AlmDatos on/off*** y confirme.
2. Seleccione ***Activado*** o ***Desactivado*** y confirme.

11.10.3 Ajuste del tiempo de muestreo

Esta función define con qué frecuencia se guarda un valor.

1. Seleccionar ***Ajustes*** > ***Almacen Datos*** > ***AlmDatos on/off*** > ***Tiempo muestreo*** y confirmar.
2. Seleccionar el intervalo de memorización y confirmar.

11.10.4 Ajuste de pico/media

Con ayuda de esta función se puede establecer qué valor se guarda.

1. Seleccione ***Ajustes*** > ***Almacen Datos*** > ***Cfg AlmacenDatos*** > ***Pico/Media*** y confirme.
2. Seleccione ***Pico*** o ***Media*** y confirme.

Pico	Se guarda el valor más alto (el valor más bajo cuando se monitorizan concentraciones decrecientes) de las concentraciones medidas dentro de la ventana de tiempo de muestreo seleccionada.
Media	Se guarda la media de todos los valores de concentración medidos dentro de la ventana de tiempo de muestreo seleccionada.

11.10.5 Conexión y desconexión del modo de disparo

Esta función permite guardar valores a partir de un valor determinado.

1. Seleccionar ***Ajustes*** > ***Almacen Datos*** > ***Cfg AlmacenDatos*** > ***Disparo on/off*** y confirmar.
2. Seleccionar ***On*** o ***Off*** y confirmar.

On	Se guardan las mediciones si exceden un valor umbral más allá del valor de disparo (relativo al último valor guardado).
Off	Se guardan las mediciones que están dentro del tiempo de muestreo.

11.10.6 Ajuste del valor de disparo

Esta función define el valor límite de disparo para guardar un valor. El valor de disparo o trigger está definido como un porcentaje de la desviación total de la escala.

Ejemplo: un valor de disparo de 2 % a una desviación a plena escala de 500 ppm solamente guardará valores si estos se desvían por 10 ppm (relativo al valor previamente guardado).

1. Seleccionar ***Ajustes*** > ***Almacen Datos*** > ***AlmDatos on/off Valor disparo*** y confirmar.
2. Ajustar y confirmar el umbral de disparo.

11.10.7 Configuración de la función "stack" o "roll"

1. Seleccione ***Ajustes*** > ***Almacen Datos*** > ***Cfg AlmacenDatos*** > ***Stack/Roll*** y confirme.
2. Seleccione ***Stack*** o ***Roll*** y confirme.

Roll	Cuando se haya agotado la capacidad del registrador de datos, los datos antiguos se sobrescribirán con nuevos valores.
Stack	Cuando se haya agotado la capacidad del registrador de datos, no se almacenarán nuevos datos. El instrumento emite una advertencia.

11.10.8 Vaciado del registrador de datos

Esta función borra los datos almacenados.

1. Seleccione ***Ajustes*** > ***Almacen Datos*** >***Borrar AlmDatos*** y confirme.
2. Para vaciar el registrador de datos, seleccione ***Confirmar*** y confirme con [OK].

12 Ajustes de interfaz

12.1 Interfaz de 4-20 mA

La salida de corriente del instrumento durante el funcionamiento normal es de 4 a 20 mA y es proporcional a la concentración de gas detectada.

El Polytron 8xx0 emplea diferentes valores de corriente para indicar varios modos de funcionamiento. Los ajustes por defecto establecidos en fábrica pueden ser adaptados por el usuario a requisitos específicos de la aplicación. Esto se atiene a la recomendación NE43 de la norma NAMUR.

12.1.1 Desviación total de la escala

Solo Polytron® 8100 EC, 87x0 IR y 8200 CAT LC

Algunos sensores ofrecen una desviación a plena escala para limitar el rango de medición de la interfaz 4-20 mA.

La desviación a plena escala (FSD) determina un extremo en el rango de medición del sensor. Si la concentración de gas alcanza este extremo, la interfaz 4-20 mA transmite 20 mA.

Ejemplo: Rango requerido 0 a 500 ppm CO (p. ej., número de referencia 6809605, valor por defecto 300 ppm, rango mín./máx. = 50/1000 ppm). Seleccionar la desviación total de la escala como 500 ppm. La salida analógica será lineal entre 4 mA = 0 ppm y 20 mA = 500 ppm.

12.1.2 Ajuste de la corriente de fallo

Esta función define la corriente para la señal de fallo.

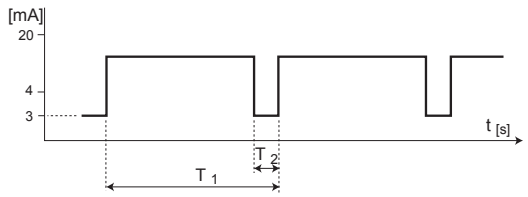
1. Seleccionar ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** >***Error corriente*** y confirmar.
2. Seleccionar la línea para editar la corriente y confirmar.
3. Ajustar y confirmar la corriente.
   ⇒ Se muestra el ajuste de la ***Error corriente***.
4. Seleccionar ***Confirmar*** y confirmar con [OK].

12.1.3 Información sobre la señal de advertencia

Para transmitir una señal de advertencia a través de una interfaz analógica, la señal de advertencia debe estar activada.
La señal de advertencia alterna entre la corriente de advertencia y la corriente de medición.

– Corriente de advertencia (intervalo T2)
– Corriente de medición (intervalo T1-T2)

Los intervalos de tiempo y la corriente de advertencia son configurables.



12.1.4 Conexión o desconexión de la señal de aviso

1. Seleccionar ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** > ***Noticia report*** y confirmar.
2. Seleccionar ***Activado*** o ***Desactivado*** y confirmar.

12.1.5 Ajuste del intervalo de aviso

1. Seleccionar ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** > ***Interv. Aviso*** y confirmar.
2. Ajustar el tiempo para los intervalos de aviso T1 y T2 y confirmar.

12.1.6 Ajuste de la corriente de aviso

1. Seleccionar ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** > ***Corriente Aviso*** y confirmar.
2. Ajustar la corriente y confirmar con [OK].

12.1.7 Configuración de las advertencias del Dräger SensorAlive

En este menú se pueden ajustar diversos parámetros de la corriente de advertencia:

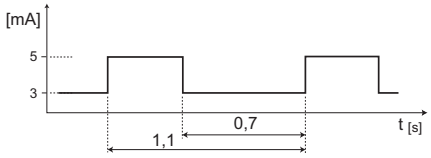
- Para configurar la corriente de advertencia, seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf.Analogico*** > ***Corr.advert. DSA*** e introduzca el valor.
- Para establecer un valor para la advertencia, seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf.Analogico*** > ***Lím. advert. DSA*** e introduzca un valor.
- Para activar o desactivar la advertencia, seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf.Analogico*** > ***Ajustar adv. DSA*** y confirme.
  Seleccione ***Activado*** o ***Desactivado*** y confirme.

12.1.8 Configuración de la señal de mantenimiento

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** > ***Señal mantenim.*** y confirme.
2. Establezca el tipo de señal y confirme.

Estático	Una corriente constante que puede configurarse.

Dinámico	Una señal de onda cuadrada con las siguientes características:



12.1.9 Configuración de la corriente de mantenimiento

La corriente de mantenimiento solo puede configurarse si la señal de mantenimiento se ha establecido en "estática".

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** >***Corri. mantenim.*** y confirme.
2. Establezca la corriente y confirme.

12.1.10 Ajuste de la desviación analógica

Esta función añade una desviación a la salida analógica a 4 mA. La desviación ajusta la corriente a 4 mA sin afectar al valor de consigna de 20 mA.

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** >***Comp. analógica*** y confirme.
2. Seleccione la línea para editar la desviación (rango: –0,5 a 0,5 mA, SIL: –0,1 a 0,1) y confirme.
3. Ajustar y confirmar la corriente.
   ⇒ Se muestra el ajuste de la ***Comp. analógica***.
4. Seleccione ***Confirmar*** y confírmelo con [OK].

12.1.11 Ajuste de la sensibilidad analógica

Esta función ajusta la salida analógica a 20 mA sin afectar al valor de consigna de 4 mA.

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** > ***Sensibilidad analógica*** y confirme.
2. Seleccione la línea para editar la desviación (rango: –0,5 a 0,5 mA, SIL: –0,1 a 0,1) y confirme.
3. Ajustar y confirmar la corriente.
   ⇒ Se muestra el ajuste de la ***Sensibilidad analógica***.
4. Seleccione ***Confirmar*** y confírmelo con [OK].

12.1.12 Comprobación de la interfaz analógica

Estas funciones cambian la corriente de la interfaz analógica para fines de prueba (p. ej., para comprobar la programación de la unidad de control). Puede que sea necesario inhibir temporalmente las alarmas en la unidad de control para evitar falsas alarmas. Tras salir de esta función, las corrientes se restablecen automáticamente a la señal de mantenimiento. Durante la prueba se muestra el símbolo de mantenimiento .

- Para ajustar la corriente o la concentración:

1. En ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** seleccione la opción deseada.

Ajuste corriente	Esta función permite ajustar la corriente a cualquier valor entre 0 y 22 mA. La desviación analógica y la sensibilidad analógica no se utilizan para esta función.
Ajuste concentr.	Esta función permite ajustar la corriente a cualquier valor de medición entre 0 ppm y el valor final del rango de medición.

2. Una vez que se hayan inhibido las alarmas en la unidad de control, confirme el mensaje ***Por favor apaga el alarma*** con ***Sigue***.
3. Seleccione la línea a editar y confírmelo con [OK].
4. Ajuste el valor deseado.
5. Seleccione ***Sigue*** y confirme.
6. Seleccione la opción deseada:

Ponga concentr. / ***Corriente on***	Esta función simula el valor de medición preestablecido o el valor de la corriente de prueba. Durante la prueba se muestra el símbolo de mantenimiento .
apagar concentr. / ***Corriente off***	Esta función permite interrumpir la transmisión del valor de prueba preestablecido.

7. Seleccione ***Sigue*** y confirme.
   ⇒ La función se cancela.
8. Una vez que se hayan activado nuevamente las alarmas en la unidad de control, confirme el mensaje: ***Por favor ponga el alarma***.

- Para ajustar la señal de prueba:

1. En ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** seleccione la prueba deseada.

Ajuste fallo	Con esta función se ajusta la intensidad de corriente para la corriente de fallo.
Ajuste aviso	Con esta función se ajusta la intensidad de corriente para la corriente de advertencia.
Ajuste mantenim.	Con esta función se ajusta la intensidad de corriente para la corriente de mantenimiento.

2. Una vez que se hayan inhibido las alarmas en la unidad de control, confirme el mensaje ***Por favor apaga el alarma***.

3. Seleccione ***Activado*** o ***Desactivado*** y confirme.

12.1.13 Beam block

Esta función solamente está disponible para Polytron 87x0 IR (utilizando el sensor PIR 7000/7200).

El ajuste por defecto de fábrica para la función beam block está «apagado».

Si se activa, la señal beamblock será transmitida por la interfaz analógica si la óptica del sensor PIR 7000/7200 está “sucia”. La óptica del PIR 7000/7200 puede “ensuciarse” si se forman depósitos en las superficies ópticas. No obstante, si la concentración de gas aumenta hasta llegar a un nivel por encima del límite beamblock, el instrumento retornará al funcionamiento normal.

Si la formación de depósitos en las superficies ópticas aumenta tanto que ya no es posible realizar mediciones, el instrumento emitirá un mensaje de fallo.

- Para ajustar las señales beam block a encendido/apagado:

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** y la opción deseada.

Beamblock on/off	Esta función activa o desactiva el beam block
Ajustar beambloc	Esta función ajusta la corriente para la corriente de aviso beam block

2. Seleccione ***Activado*** o ***Desactivado*** y confirme.

- Para ajustar las señales beam block:

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf.analogico*** y la opción deseada.

Corriente Beamb.	Esta función define la corriente para la señal beamblock.
Límite beamblock	Esta función define el límite máximo si la señal beamblock será transmitida vía interfaz analógica.

2. Seleccione la línea de corriente para editar la corriente y confirme.
3. Ajustar y confirmar la corriente.
   ⇒ Se muestra el ajuste de la corriente beamblock.
4. Seleccione ***Confirmar*** y confirme con OK.

12.2 Interfaz HART

12.2.1 Ajuste de la dirección de sondeo

La dirección de sondeo (polling address) configura el detector de gases para el funcionamiento analógico o Multidrop.

Comando HART: #6 (Write Polling Address)

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf. Hart*** > ***Polling address***.
2. Ajuste la dirección de sondeo y seleccione ***Confirmar***.

0	Activa el funcionamiento analógico
1 a 15	Activa el funcionamiento Multidrop. La interfaz 4-20 mA se desactiva y se establece a una corriente constante de aprox. 1 mA.

ℹ Configure todos los equipos de un cable con diferentes direcciones de sondeo. Se recomienda utilizar una serie que comience por 1.

12.2.2 Mostrar el identificador único

El identificador único (dirección HART inequívoca) debe ser conocido para casi todos los comandos HART de direccionamiento.

Comandos HART:

– #0 (Read Unique Identifier)
– #11 (Read Unique Identifier associated with Tag)

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf. Hart*** > ***Unique identifr.***.
2. Se muestra el identificador único.

12.2.3 Ajuste de la etiqueta HART

La etiqueta HART (definición de punto de medición) sirve para identificar un punto de medición.

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf. Hart*** > ***Tag***.
2. Ajuste la etiqueta HART y seleccione ***Confirmar***. La etiqueta HART puede estar compuesta por un máx. de 8 caracteres alfanuméricos.

12.2.4 Ajuste del protocolo Dräger REGARD

Esta función se utiliza para cambiar entre diferentes protocolos HART.

1. Seleccione ***Ajustes*** > ***Comunicacion*** > ***Interf. Hart*** > ***Dräger REGARD***.
2. Seleccione la versión de software correspondiente a la unidad de control REGARD.

12.3 Interfaces digitales

Para obtener más información sobre la configuración de otras interfaces, consulte los siguientes documentos:

Interfaz	Documento
PROFIBUS PA	9033782
Foundation Fieldbus FF	9033783
Modbus RTU	9033781

13 Ajustes del sensor

13.1 Conexión y desconexión de la calibración automática

1. Seleccionar ***Ajustes*** > ***Sensores*** > ***Auto calibracion*** y confirmar.
2. Seleccionar ***Activado*** o ***Desactivado*** y confirmar con [OK].

13.2 Rango de captura

El rango de captura elimina las fluctuaciones de medición. Las fluctuaciones de medición son unas variaciones menores existentes en valores medidos (como ruido de señal, variaciones en la concentración). Esas variaciones no cambian el valor transmitido o visualizado. Los valores medidos dentro de este rango serán visualizados con el valor de captura. Los valores medidos fuera del rango de captura serán visualizados con el valor medido real.

Valor de captura (desviación)

El valor de captura se visualiza continuamente, siempre y cuando el valor medido oscile entre los límites de valor de captura superior e inferior.

Límite de valor de captura superior

El límite de valor de captura superior marca el límite superior del rango en el cual el valor de captura es visualizado.

Límite de valor de captura inferior

El límite de valor de captura inferior marca el límite inferior del rango en el cual el valor de captura es visualizado.

13.2.1 Ajuste del rango de captura

1. Seleccionar ***Ajustes*** > ***Sensores*** > ***Captura visualiz*** y confirmar.
2. Ajustar la desviación en la primera ventana.
3. Ajustar el valor más bajo del rango de captura y confirmar con ***Sigue***.
4. Ajustar el valor más alto del rango de captura y confirmar con ***Sigue***.
5. Comprobar todos los valores y confirmar con ***Sigue***.

13.2.2 Desactivación del rango de captura

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Captura visualiz*** y confírmelo.
2. Ajuste desviación (offset) en la primera ventana.
3. Ajuste el valor inferior del rango de captura a 0 y confírmelo con ***Sigue***.
4. Ajuste el valor superior del rango de captura a 0 y confírmelo con ***Sigue***.
5. Compruebe todos los valores y confírmelo con ***Sigue***.

13.3 Reinicio del sensor

Esta función reinicia el sensor a los ajustes por defecto de fábrica.

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Inicial. basic. Ch*** y confírmelo.
2. Seleccione ***Confirmar*** y confírmelo con [OK].

13.4 Ajuste del intervalo de calibración

Una vez expirado el intervalo de calibración, el instrumento emitirá un aviso indicando que la calibración está atrasada.

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Interv. Cal.*** y confírmelo.
2. Ajuste el intervalo de calibración y confírmelo con [OK].

13.5 Ajuste del bloqueo del sensor

Este punto solo es válido para Polytron 8100 EC y Polytron 87x0 IR.

1. Seleccionar ***Ajustes*** >***Sensores*** > ***Bloq.sensor*** y confirmar.
2. Seleccionar ***On*** o ***Off***.

On	El instrumento rechaza cualquier sensor cuyo número de pieza no coincida con el número de pieza del sensor previamente instalado.
Off	El instrumento acepta cualquier sensor adecuado, cargando los ajustes por defecto de este sensor. Sin embargo, esto sobrescribe los ajustes personalizados con los ajustes por defecto del nuevo sensor.

13.6 Mochilas de software para sensores EC

13.6.1 Instalación de la mochila

1. Desconecte la alimentación eléctrica del instrumento o desclasifique el área según las normativas locales.
2. Afloje el tornillo de fijación y desenrosque la tapa del instrumento.
3. Inserte la mochila con el logotipo de Dräger mirando hacia arriba en la unidad de tarjeta de circuito impreso, Véase la figura D en la página desplegable.
4. Coloque la tapa trasera de la unidad de tarjeta de circuito impreso y cierre el instrumento (consulte "Cierre del detector de gases", página 153).

13.6.2 Desactivación de la mochila

Esta función desactiva una mochila para poder retirarla de manera segura o si la mochila está defectuosa.

Una mochila se puede reactivar únicamente desconectando y conectando de nuevo la alimentación del equipo.

1. Seleccione ***Ajustes*** > ***Instrumento*** > ***SW conector*** > y la mochila que desea desactivar confírmelo.
2. Seleccione ***Desactivar func.***. La mochila seleccionada se desactiva.

13.7 Ajustes de sensor Polytron® 8100 EC

13.7.1 Autocomprobación del sensor

Esta función solamente está activa si la mochila de test del sensor o la mochila de diagnóstico está instalada. Si el sensor no supera la autocomprobación, se emite un mensaje de advertencia o de fallo correspondiente.

Configuración de autocomprobaciones periódicas del sensor

Esta función inicia la autocomprobación del sensor en intervalos regulares. El instrumento comprueba el funcionamiento correcto del sensor de manera rutinaria.

1. Seleccione y confirme ***Ajustes*** > ***Sensores*** > ***Autotest Sensor***.
2. Seleccione ***Activado*** o ***Desactivado*** y confirme.

Inicio manual de la autocomprobación del sensor

Esta función inicia una autocomprobación del sensor.

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Auto test sensor*** y confirme.
2. Se muestra ***Iniciar test de sensor***.
3. Seleccione ***Confirmar***.

✓ Se muestra el resultado de la prueba.

13.7.2 Ajustes de gas

Con esta función se ajusta el tipo de gas, el rango de medición y las unidades de medida. En función del sensor instalado, es posible realizar diferentes ajustes.

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Confg. Gas*** y confirme.
   ⇒ Se muestra el gas actualmente medido.
2. Seleccione un gas medido de la lista y confírmelo.
   ⇒ Se muestra la unidad de medida actual.
3. Seleccione la unidad de medida deseada de la lista y confírmela.
   ⇒ Se muestra el valor final actual del rango de medición.
4. Solo para determinados sensores EC: ajuste el valor final del rango de medición y confirme.
   ⇒ Se muestra el nuevo valor final del rango de medición.
5. Seleccione ***Sigue*** y confirme.
   ⇒ Se muestra una relación de los nuevos ajustes de gas.
6. Después de la comprobación, seleccione ***Regresar al menu*** o ***Confirmar***.

Regresar al menu	Seleccione «Regresar al menú» para abandonar la función sin ningún cambio y confírmelo con [OK].
Confirmar	Seleccione «Confirmar» para aceptar los ajustes y confírmelo con [OK].

13.7.3 Ajustes del Dräger SensorAlive

En este menú se pueden ajustar diversos parámetros que definen el comportamiento del Dräger SensorAlive:

- Para activar o desactivar las funciones LifeTest del sensor, seleccione ***Ajustes*** > ***Sensores*** > ***SensorAlive*** > ***Activación DSA*** y confirme.
  Seleccione ***Activado*** o ***Desactivado*** y confirme.
- Para confirma una obstrucción del sensor, seleccione ***Ajustes*** > ***Sensores*** > ***SensorAlive*** > ***Confirmar fallos***.
- Para activar o desactivar la detección de fallos, seleccione ***Ajustes*** > ***Sensores*** > ***SensorAlive*** > ***Detección fallos*** y confirme.
  Seleccione ***Activado*** o ***Desactivado*** y confirme.

En el menú ***SensorAlive*** existen los siguientes submenús:

– LifeTest
– Control de la sensibilidad

En el submenú LifeTest se pueden ajustar los siguientes parámetros:

- Para definir cuándo debe iniciarse un ciclo de prueba, seleccione ***Hora***.
  Indique una hora y confirme. El ciclo de prueba comenzará cuando se alcance dicho tiempo en el transmisor.

  ℹ Los transmisores no admiten el cambio automático entre horario de verano/invierno.

- Para definir qué valor debe emitirse a través del transmisor durante el LifeTest, seleccione ***Comport. salida***.
  Seleccione ***Fijado***, ***Mantenimiento*** o ***Val. de medición*** y confirme.
- Para definir si se deben realizar nuevas pruebas en un ciclo de prueba si un LifeTest arroja un resultado negativo, seleccione ***Modo repetición***.
  Seleccione ***Flexible*** y confirme.
  Si se selecciona ***Estático*** no se repite ninguna prueba, sino que se ejecuta un nuevo ciclo de prueba a la hora especificada.
- Para definir cuando se debe cancelar un LifeTest, seleccione ***Umbr. de cancel.***.
  Indique un valor y confirme.

  ℹ Durante un LifeTest se aplica gas de prueba al Dräger SensorAlive. Por ello, el valor medido aumenta. Para evitar que se active una alarma, de forma estandarizada el valor medido no se transmite durante un máximo de 15 minutos. Sin embargo, el comportamiento durante un LifeTest puede configurarse en el menú ***Comport. salida***. No obstante, el sensor detecta una erupción de gas, cuando la concentración de gas medida supera la concentración de gas esperada por el LifeTest. La diferencia corresponde a la concentración de la erupción de gas y se compara con el valor introducido en ***Umbr. de cancel.***. Si se supera este valor, el LifeTest se interrumpe de inmediato. El sensor vuelve al modo de medición y el transmisor emite de nuevo el valor medido. Si se utilizan relés, estos se conmutan en el transmisor y se disparan las alarmas, dado el caso.

En el submenú ***Compr. sensibil.*** se pueden ajustar los siguientes parámetros:

- Para definir si debe emitirse una advertencia, seleccione ***Activación*** y confirme.
- Para definir cuándo debe emitirse una advertencia, seleccione ***Alerta < 50%*** o ***Alerta < 40%*** y confirme.

13.8 Ajustes de sensor Polytron® 8200 CAT / 8310 IR

13.8.1 Tipo de sensor

Esta función define el tipo de sensor instalado.

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Tipo sensor*** y confirme.
2. Seleccione el tipo de sensor y confirme.

13.8.2 Ajustes de gas

Esta función ajusta la unidad de medida.

Para los sensores LC, esta función ajusta también la desviación total de la escala.

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Confg. Gas*** y confirme.
2. Seleccione la unidad de medida deseada de la lista y confírmelo.
   ⇒ Para sensores DQ y DSIR:
   Se muestra una relación de los nuevos ajustes de gas.
   Continúe con el paso 4.
   ⇒ Para sensores LC:
   Se muestra la desviación total actual de la escala.
   Continúe con el paso 3.
3. Ajuste la desviación total de la escala y confirme (solo para sensores LC).
   ⇒ Se muestra una relación de los nuevos ajustes de gas.
4. Después de la revisión, seleccione ***Regresar al menu*** o ***Confirmar***.

Regresar al menu	Seleccione «Regresar al menú» para abandonar la función sin ningún cambio y confírmelo con [OK].
Confirmar	Seleccione «Confirmar» para aceptar los ajustes y confír-melo con [OK].

13.8.3 Ajuste del enclavamiento del sensor DQ

Esta función solo está disponible si no hay relés instalados.
Esta función se utiliza para establecer si el sensor DQ debe ser confirmado después de una medición de una concentración superior al 100 % LIE.
Este ajuste no es aplicable para sensores LC.

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Sensor DD autoencl.*** y confirme.
   ⇒ Se muestra el ajuste actual.
2. Seleccione ***Activado*** o ***Desactivado*** y confirme.

⚠ ADVERTENCIA
Peligro de explosión
Si el enclavamiento de sensor está desactivado y una alarma indicando un peligro de explosión es confirmada, el instrumento informa al usuario final de tal peligro iluminando el indicador LED rojo de forma continua.

► Antes de confirmar un valor por encima del rango, cerciórese de que la concentración de gas ha caído por debajo de 100 %LIE.

⚠ ADVERTENCIA
Posible peligro de explosión
Funcionamiento no compatible con el examen de tipo BVS.
Si el enclavamiento del sensor DQ está desactivado, la unidad de control debe admitir esta función para un funcionamiento seguro conforme a la norma BVS 13 ATEX G 001 X.

► Asegúrese de que la indicación de enclavamiento por encima del rango de medición esté activa en la unidad de visualización.

13.9 Ajustes del sensor para Polytron 8310 IR

13.9.1 Cambio de la categoría de gas

El DrägerSensor IR puede medir gases y vapores pertenecientes a las categorías de gas metano, propano o eteno (etileno). Dependiendo del gas objetivo que se vaya a medir, se debe definir una categoría de gas para el DrägerSensor IR. Para la asignación de gases y vapores a las categorías de gas, consulte la documentación del DrägerSensor IR.

13.9.2 Cambio de la categoría de gas

Requisitos previos

– El detector de gases se encendió hace menos de una hora.
– El ajuste automático del punto cero en el sensor se ha realizado hace menos de una hora (consulte "Particularidad del Polytron 8310", página 163).
– La concentración de gas medida por el detector de gases es inferior al 10 % LIE (aplique gas de ajuste de cero al sensor, si es necesario).

1. Desactive la señalización de alarma del detector de gases (consulte "Conexión o desconexión de alarmas", página 172).
2. Seleccione ***Ajustes*** > ***Sensores*** > ***Categoría DSIR*** y confirme.
   ⇒ La categoría de gas se muestra en el instrumento.

ℹ Los pasos siguientes se realizan en el instrumento.

3. Para seleccionar la categoría de gas en el sensor, toque el símbolo ⇧S o ⇩0 con la varita magnética.
   ⇒ En el detector de gases se muestra START.

4. Retire la varita magnética.
   ⇒ El sensor cambia a una señal de salida que representa la categoría de gas ajustada en ese momento:
   Señal de salida 20 % LIE: categoría de gas metano
   Señal de salida 40 % LIE: categoría de gas propano
   Señal de salida 60 % LIE: categoría de gas eteno (etileno)
5. Esta señal de salida se mantiene durante 30 segundos. Durante dicho periodo se puede seleccionar el siguiente gas colocando la varita magnética en el área marcada con el símbolo ⇧S.
   ⇒ Al hacerlo, la señal de salida del sensor cambia al valor correspondiente a la nueva categoría de gas seleccionada. Si durante más de 30 segundos no se realiza ninguna otra entrada con la varita magnética, el ajuste se guarda.
6. Compruebe el ajuste de sensibilidad en el detector de gases (consulte "Calibración de la sensibilidad", página 164).
7. Encienda la señalización de alarma del detector de gases (consulte "Conexión o desconexión de alarmas", página 172).

ℹ El ajuste en el sensor puede provocar que el elemento de menú ***Categoría DSIR*** muestre una categoría de gas incorrecta o que ya no sea visible un cambio de categoría de gas.

13.10 Ajustes de sensor Polytron® 87x0 IR

13.10.1 Ajustes de gas

Esta función ajusta el tipo de gas, el rango de medición y las unidades de medida. Solo determinados sensores permiten estos ajustes.

1. Seleccione ***Ajustes*** > ***Sensores*** > ***Confg. Gas*** y confírmelo.
   ⇒ Se muestra el gas actualmente medido.
2. Seleccione un gas medido de la lista y confírmelo.
   ⇒ Se muestra la unidad de medida actual.
3. Seleccione la unidad de medida deseada de la lista y confírmelo.
   ⇒ Si la unidad de medida es ajustada a % LEL, % UEG o % LIE, la categoría será visualizada. Continúe con el paso 4.
   ⇒ De lo contrario, se muestra la actual desviación a plena escala. Continúe con el paso 6.
4. Seleccione una categoría y confirme.
5. Ajuste el valor LIE y confirme.
6. ajustar la desviación total de la escala y confirmar.
   ⇒ Se muestra la nueva desviación total de la escala.
7. Seleccione ***Sigue*** y confírmelo.
   ⇒ Se muestra una relación de los nuevos ajustes de gas.
8. Después de la revisión, seleccione ***Regresar al menu*** o ***Confirmar***.

Regresar al menu	Seleccione «Regresar al menú» para abandonar la función sin ningún cambio y confírmelo con [OK].
Confirmar	Seleccione «Confirmar» para aceptar los ajustes y confírmelo con [OK].

9. Compruebe los ajustes de alarma después de cambiar la categoría o valor LIE.

14 Ajustes por defecto de fábrica

14.1 Ajustes inalterables para relés, LED y alarma

	Ajuste
Relé de fallo:	Excitado / contacto normalmente abierto (Normally Open)
LED amarillo:	Está iluminado si existe un mensaje de fallo
LED rojo:	Parpadea una vez cuando hay una alarma A1. Parpadea dos veces cuando hay una alarma A2. Si una alarma está configurada como confirmable y es confirmada, el parpadeo simple/doble cambia a luz continua.
Jerarquía de alarmas:	A2 tiene mayor prioridad que A1 en el LED. Sin embargo, los relés A1 y A2 funcionan independientemente. (Ejemplo: Si A1 es confirmable y A2 no y la concentración de gas es tan alta que A1 y A2 se disparan, el relé A1 se abre cuando se reconoce la alarma. Sin embargo, el LED rojo seguirá parpadeando dos veces mientras exista la condición que activa la alarma A2.

14.2 Ajustes que pueden modificarse a través del menú

Menú	**Ajuste por defecto**	**Rango**
Relé activo con alarma/sin alarma	Activo con alarma	Activo/inactivo
Alarma A1: Dirección	ascendente (descendente para sensores de O_2)	Descendente/ascendente
Alarma A2: Dirección	Ascendente	
Modo de enclavamiento A1	Sin enclavamiento	Enclavamiento / sin enclavamiento
Modo de enclavamiento A2	Enclavamiento	

Menú	Ajuste por defecto	Rango
Modo de confirmación A1	Confirmable	Confirmable/No confirmable/Pre-confirmable
Modo de confirmación A2	No confirmable	
Funcionamiento normal relé A1	Excitado	Excitado /no excitado
Funcionamiento normal relé A2		
Contraseña de ajuste	_ _ _ 1	
Contraseña de ajustes	_ _ _ 2	
Ajustes de la LCD	Activo	Activo/inactivo
SIL de estados	Inactivo	Activo/inactivo
Idioma	EN	DE / EN / FR / ES / RU / ZH
Ajuste automático	Inactivo	Activo/inactivo
Tecla de función	Fallo	Gráfico, fallo, advertencia, vitalidad, prueba con gas

Interfaz	Ajuste por defecto	Rango
Corriente de fallo	1,2 mA	Entre 0 y 3,5 mA
Advertencia	Inactivo	Activo/inactivo
Corriente de advertencia	3,0 mA	Entre 0 y 3,5 mA
Intervalo del ciclo de advertencia T1	10 s	Entre 5 y 60 s
Intervalo del ciclo de advertencia T2 (corriente de advertencia)	1 s	Entre 1 y (T1-1) s
Señal de mantenimiento	estática	estática/dinámica
Corriente de mantenimiento	3,4 mA	Entre 0 y 3,5 mA
Compensación analógica	0 mA	-0,5 a 0,5 mA
Sensibilidad salida analógica	0 mA	-0,5 a 0,5 mA
Dirección HART®	0	Entre 0 y 15
Dirección Modbus[1)]	126	2-126
Paridad Modbus[1)]	par (por defecto)	paridad par, impar, sin paridad
Tasa de baudios Modbus[1)]	9600 bit/s	9600 o 19200 bit/s
Dirección PROFIBUS® [1)]	126	2-126

1) Las interfaces de bus de campo no cumplen la norma BVS 13 ATEX G001 X. Si se utiliza la interfaz de bus de campo, no se dispondrá de relés.

14.3 Valores específicos del sensor

Encontrará más especificaciones en las instrucciones de uso del sensor correspondiente.

14.3.1 Polytron 8100 EC

Menú	Ajuste por defecto	Rango
Alarma A1	En función del sensor	
Alarma A2	En función del sensor	
Histéresis para alarma A1 en dirección ascendente	0	0 a A1
Histéresis para alarma A2 en dirección ascendente	0	0 a A2
Histéresis para alarma A1 en dirección descendente	0	0 a valor final del rango de medición - A1
Histéresis para alarma A2 en dirección descendente	0	0 a valor final del rango de medición - A2
Intervalo de ajuste [días]	En función del sensor	0 a 720

14.3.2 Polytron 8100 EC con sensores de O_2

Menú	Ajuste por defecto	Rango
Offset de rango de captura pantalla	20,9 Vol% (O_2)	0 a 25 Vol% (O_2 LS) 0 a 100 Vol% (O_2)
Rango de captura pantalla bajo	-0,25 Vol% (O_2)	0 a -0,75 Vol%
Rango de captura pantalla alto	0,25 Vol% (O_2)	0 a 0,75 Vol%
Valor final del rango de medición	25 Vol% (O_2, O_2 LS)	5 a 25 Vol% (O_2 LS) 5 a 100 Vol% (O_2)

14.3.3 Polytron 8100 EC con Dräger SensorAlive

Menú	Ajuste por defecto	Rango
Corr. advert. DSA	2,0 mA	0 mA a 3,5 mA
Lim. advert DAS	En función del sensor	
Activación DSA	Activo	Activo/inactivo
LifeTest		
Hora	En función del sensor	
Comport. salida	establecido	establecido/mantenimiento/valor medido
Perfil de repetición	flexible	flexible/estático
Umbr. de cancel	En función del sensor	
Monitoriz. sens.		
Activación	En función del sensor	
Alarma <50%	Inactivo	Inactivo/advertencia
Alarma <40%	Advertencia DSA	Inactivo/advertencia DSA/fallo
Detección fallos	Activo	Activo/inactivo

14.3.4 Polytron 8200 CAT DrägerSensor® DQ

Menú	Ajuste por defecto	Rango
Alarma A1	20 % LIE	1 a 100 % LIE
Alarma A2	40 % LIE	
Histéresis para alarma A1 en dirección ascendente	1 % LIE	0 a A1
Histéresis para alarma A2 en dirección ascendente	1 % LIE	0 a A2
Intervalo de ajuste [días]	180	0 a 360
Offset de rango de captura pantalla	0 % LIE	-5 a 4 % LIE
Rango de captura pantalla bajo	-5 % LIE	-5 a 0 % LIE
Rango de captura pantalla alto	2 % LIE	0 a 4 % LIE
Valor final del rango de medición	100 % LIE	Rango no ajustable

14.3.5 Polytron 8200 CAT DrägerSensor® LC

Menú	Ajuste por defecto	Rango
Alarma A1	2,0 % LIE	0,1 a 10 % LIE
Alarma A2	4,0 % LIE	
Histéresis para alarma A1 en dirección ascendente	0,1 % LIE	0 a A1
Histéresis para alarma A2 en dirección ascendente	0,1 % LIE	0 a A2
Valor final del rango de medición	10 % LIE	5 a 10[1)] % LIE 1 a 10 % LIE
Intervalo de ajuste [días]	180	0 a 360
Offset de rango de captura pantalla	0 % LIE	-0,5 a 0,4 % LIE
Rango de captura pantalla bajo	-0,5 % LIE	-0,5 a 0 % LIE
Rango de captura pantalla alto	0,2 % LIE	0 a 0,4 % LIE

1) Para versiones de firmware < 3.0.0

14.3.6 Polytron 8310 IR

Menú	Ajuste por defecto	Rango
Alarma A1	20 % LIE	1 a 100 % LIE
Alarma A2	40 % LIE	
Histéresis para alarma A1 en dirección ascendente	1 % LIE	0 a A1
Histéresis para alarma A2 en dirección ascendente	1 % LIE	0 a A2
Intervalo de ajuste [días]	180	0 a 360
Offset de rango de captura pantalla	0 % LIE	-3 a 4 % LIE
Rango de captura pantalla bajo	-3 % LIE	-3 a 0 % LIE
Rango de captura pantalla alto	2 % LIE	0 a 4 % LIE
Valor final del rango de medición	100 % LIE	Rango no ajustable

14.3.7 Polytron 8700 IR

Tipo 334

Menú	Ajuste por defecto	Rango
Gas de prueba	Metano	
Unidades de gas de prueba	% LIE	
Concentraciones de gas de prueba	50 % LIE	
Alarma A1	20 % LIE	0,01 a 100 Vol% con % LIE = 0,3 a 100 % LIE
Alarma A2	40 % LIE	
Tipo de LIE	NIOSH	IEC / PTB / NIOSH / configurable
Gas de medición	Metano	
Unidades de gas de medición	% LIE	%LIE / Vol% / PPM / %LIE / %LIE
Valor final del rango de medición	100 % LIE	20 a 100 % LIE
Beam block	Inactivo	Activo/inactivo
Corriente beamblock	2 mA	Entre 0 y 3,5 mA
Límite beamblock	7,5 % LIE	0 a máx. 15 % LIE[1)]
Intervalo de ajuste [días]	360	0 a 720
Comportamiento de respuesta	normal	normal / Rápida
Offset de rango de captura pantalla	0	Los valores absolutos del rango de captura de pantalla tienen que estar dentro de estos límites: -1000 a 2200 ppm (metano tipo 334) -850 a 850 ppm (propano tipo 334) -1200 a 1150 ppm (etileno tipo 334)
Rango de captura pantalla bajo	-750 ppm (metano) -315 ppm (propano) -405 ppm (etileno)	
Rango de captura pantalla alto	750 ppm (metano) 315 ppm (propano) 405 ppm (etileno)	

1) El límite máximo beamblock depende del tipo de detector de gases y del gas de medición seleccionado.

Tipo 340

Menú	Ajuste por defecto	Rango
Gas de prueba	Propano	
Unidades de gas de prueba	% LIE	
Concentraciones de gas de prueba	50 % LIE	
Alarma A1	20 % LIE	0,01 a 100 Vol% con % LIE = 0,3 a 100 % LIE
Alarma A2	40 % LIE	
Tipo de LIE	NIOSH	IEC / PTB / NIOSH / configurable
Gas de medición	Propano	
Unidades de gas de medición	% LIE	%LIE / Vol% / PPM / %LIE / %LIE
Valor final del rango de medición	100 % LIE	20 a 100 % LIE
Beam block	Inactivo	Activo/inactivo
Corriente beamblock	2 mA	Entre 0 y 3,5 mA
Límite beamblock	2,5 % LIE	0 a máx. 15 % LIE[1)]
Intervalo de ajuste [días]	360	0 a 720
Comportamiento de respuesta	normal	normal / Rápida
Offset de rango de captura pantalla	0	Los valores absolutos del rango de captura de pantalla tienen que estar dentro de estos límites: -850 a 425 ppm (propano tipo 340) -1800 a 2200 ppm (metano tipo 340)
Rango de captura pantalla bajo	-750 ppm (metano) -85 ppm (propano)	
Rango de captura pantalla alto	750 ppm (metano) 85 ppm (propano)	

1) El límite máximo beamblock depende del tipo de detector de gases y del gas de medición seleccionado.

14.3.8 Polytron 8720 IR

Menú	Ajuste por defecto	Rango
Gas de prueba	CO_2	
Unidades de gas de prueba	Vol%	
Concentraciones de gas de prueba	4,0 Vol%	0,2 a 100 Vol%
Alarma A1	1 Vol%	0,01 a 100 Vol%
Alarma A2	2 Vol%	
Tipo de LIE	-	
Gas de medición	CO_2	
Unidades de gas de medición	Vol%	Vol% / ppm
Valor final del rango de medición	10 Vol%	0,2 a 100 Vol%
Beam block	Inactivo	Activo/inactivo
Corriente beamblock	2 mA	Entre 0 y 3,5 mA
Límite beamblock	0,1 Vol%	0 a 0,1 Vol%
Intervalo de ajuste [días]	360	0 a 720
Comportamiento de respuesta	normal	normal / Rápida
Offset de rango de captura pantalla	340 ppm	Los valores absolutos del rango de captura de pantalla tienen que estar dentro de estos límites: -1000 a 1000 ppm (dióxido de carbono)
Rango de captura pantalla bajo	-200 ppm	
Rango de captura pantalla alto	200 ppm	

15 Eliminación

Este producto no debe eliminarse como residuo doméstico. Por este motivo está identificado con el símbolo contiguo.
Dräger recoge el producto de forma totalmente gratuita. La información a este respecto le puede ser proporcionada por los distribuidores nacionales y por Dräger.

Eliminación de sensores electroquímicos

⚠ ADVERTENCIA
¡Peligro de explosiones y riesgo de quemaduras químicas!
Los fluidos del sensor se pueden escapar y causar quemaduras de ácido.
- ► No elimine los sensores arrojándolos al fuego.
- ► No abra los sensores a la fuerza.

16 Características técnicas

16.1 Rangos de medición

Sensor	Rango de medición
Polytron 8100 EC con DrägerSensor® EC	En función del sensor
Polytron 8200 CAT con DrägerSensor® DQ	0 a 100 % LIE
Polytron 8200 CAT con DrägerSensor®LC	0 a 10 % LIE[1)]
Polytron 8310 IR con DrägerSensor® IR	0 a 100 % LIE
Polytron 8700 IR con sensor de gas infrarrojo PIR 7000	
Tipo 334 (IDS 01x1)	0 a 10.000 ppm[1)] 0 a 100 % LIE,[1)] 0 a (1,25 x LIE_{max}) Vol%,[1)2)] Para CH4 (metano) 0 a 100 vol%[1)]
Tipo 340 (IDS 01x2)	0 a 10.000 ppm[1)] 0 a 100 % LIE[1)] 0 a 5 vol%[1)]
Polytron 8720 IR con sensor de gas infrarrojo PIR 7200 (IDS 01x5)	0 a 100 vol%[1)]

1) Para conocer el valor final del rango de medición ajustable, consulte 14.3.
2) El rango varía en función de la sustancia a medir

16.2 Transmisión de la señal a la unidad de control

El rango de medición y las características de rendimiento dependen del sensor instalado (véanse las instrucciones de uso del sensor instalado).

Frecuencia de cálculo del valor de medición: 1 vez por segundo (actualización de la indicación, de la interfaz analógica y de los relés).

Señal analógica	
Funcionamiento normal	4 ... 20 mA
Deriva por debajo de cero	3,8 ... 4 mA
Superación del rango de medición	20 ... 20,5 mA
Error del dispositivo	≤ 1,2 mA
Fallo en la interfaz analógica	> 21 mA
Señal de mantenimiento	Señal constante de 3,4 mA o modulación de 1 Hz entre 3 y 5 mA (seleccionable)

Resistencia del bucle de señal

Modo de funcionamiento	**Rango de resistencia del bucle de señal**	**Rango de la tensión de suministro**
Funcionamiento sin comunicación HART®	0 a 230 Ω	a 10 V CC
	Ascendente linealmente con la tensión de suministro de: 0 a 230 Ω a 10 V a 0 a 500 Ω a 16 V	10 a 18 V CC
	0 a 500 Ω	18 a 30 V CC
Funcionamiento con comunicación HART®	230 a 270 Ω	a 13 V CC
	Ascendente linealmente con la tensión de suministro de: 230 a 270 Ω a 11 V a 230 a 500 Ω a 16 V	11 a 16 V CC
	230 a 500 Ω	18 a 30 V CC
Funcionamiento multipunto HART®	230 a 500 Ω	10 a 30 V CC

Para el uso de acuerdo con la prueba de idoneidad metrológica según las normas EN IEC 62990-1, EN IEC 60079-29-1 o EN 50104, la resistencia no debe superar los 300 ohmios. Para más información sobre la instalación de la interfaz de bus de campo, consulte el documento 9033783.

16.3 Propiedades del cable

Para instalaciones sin conductos, utilice cables blindados.

Conexión analógica y HART® con unidad de control y fuente de alimentación	
Alimentación eléctrica y señales	Cable blindado de 3 hilos 24 - 12 AWG / 0,2 - 2,5 mm²
Relé	20 - 12 AWG / 0,5 - 2,5 mm²

Conexión digital con unidad de control	
Los instrumentos con interfaces de bus de campo y sensores remotos se tienen que instalar con cables blindados.	
Modbus RTU	2 o 3 hilos[1], ≥ 26 AWG
PROFIBUS PA Foundation Fieldbus	2 hilos, cable de tipo A Impedancia de onda R_W: 135 - 165 Ω Capacidad / longitud de unidad C‘: < 30 pF/m Resistencia en bucle R‘: 110 Ω/km Diámetro del hilo d: 0,64 mm Sección transversal del hilo q: > 0,34 mm² Cobertura del blindaje: ≥ 90 %
Alimentación eléctrica	2 hilos, 24 - 12 AWG / 0,2 - 2,5 mm²

1) Si la distancia entre la unidad de control y el transmisor es muy grande (>1 km) y la fuente de alimentación de la unidad de control y del transmisor están separadas, pueden producirse interferencias o discrepancias diferenciales. En este caso, debe seleccionarse el cableado de 3 hilos con toma de tierra. A continuación, la toma de tierra se conecta al transmisor y se pasa en bucle hasta la toma de tierra de la unidad de control.

16.4 Alimentación eléctrica y relés

Capacidad de relés[1] SPDT[2]	
230 V ~	0,1 A - 5 A
30 V ⎓, carga resistiva	0,1 A (mínimo) - 5 A

1) En caso de aplicaciones relevantes para la seguridad (SIL 2), la potencia de ruptura máxima se reduce (véase Manual de seguridad Polytron® 8xx0).
2) Conmutador unipolar (inversión de contactos eléctricos)

Alimentación eléctrica Polytron 8xx0	
Tensión de servicio	10[1] hasta 30 V⎓ en el instrumento
Corriente de conexión	2,3 A durante 2 ms a 24 V⎓, resistencia de 10 Ω

1) Con una tensión de alimentación <9,5 V CC, el instrumento proporciona una señal de fallo.

Corriente de servicio	
Polytron® 8100 EC	
sin relé, sensor no remoto	80 mA
con relé, sensor remoto	100 mA
Polytron® 8200 CAT	
sin relé, sensor no remoto	105 mA (DrägerSensor DQ) 130 mA (DrägerSensor LC)
con relé, sensor remoto	145 mA (DrägerSensor DQ) 165 mA (DrägerSensor LC)
Polytron® 8310 IR	
sin relé, sensor no remoto	145 mA
con relé, sensor remoto	185 mA
Polytron® 87x0 IR	
sin relé, sensor no remoto	330 mA
con relé, sensor remoto	350 mA

16.5 Especificaciones generales

Carcasa Polytron 8xx0	
Material de la carcasa	Aluminio libre de cobre
Protección de la carcasa	NEMA 4X[1] IP 65/66/67[2]
Pantalla	Resolución 128 x 64 píxeles, con retroiluminación[3]

1) Polytron 8100 EC NEMA 4X con protección de carcasa pendiente
2) Los grados de protección IP no implican que el equipo vaya a detectar un gas durante o después de la exposición a estas condiciones. En caso de depósitos de polvo y de contacto con el agua por inmersión o con un chorro de agua, compruebe el ajuste y el funcionamiento del instrumento.
3) Con temperaturas elevadas (>65 °C), la pantalla solo puede leerse de forma limitada.

16.6 Parámetros ambientales

Encontrará otras especificaciones del sensor e influencias en las instrucciones de uso del sensor correspondiente.

Los valores de los accesorios y las piezas de repuesto pueden diferir de los valores aquí indicados. Para valores exactos, consulte las instrucciones correspondientes.

Polytron 8xx0	
Valores de acuerdo con la homologación de la protección contra explosiones	
durante el funcionamiento:	
Presión	23,6 a 32,5 in. Hg (800 a 1100 hPa)
Humedad	0 al 100 % HR, sin condensación
Temperaturas	
Polytron 8100 EC	-40 a +70 °C (-40 a +158 °F)
Polytron 8200 CAT	-40 a +80 °C (-40 a +176 °F)
Polytron 8310 IR	-40 a +65 °C (-40 a +149 °F)
Polytron 87x0 IR	-40 a +80 °C (-40 a +176 °F)
Valores de acuerdo con informe metrológico	
durante el funcionamiento:	
Presión	20,7 a 38,4 in. Hg (700 a 1300 hPa)[1]
Humedad	0 a 95 % h.r., sin condensación
Temperaturas	
Polytron 8100 EC[2]	-40 a +65 °C (-40 a +149 °F)
Polytron 8200 CAT	-40 a +80 °C (-40 a +176 °F)
Polytron 8310 IR	-40 a +65 °C (-40 a +149 °F)
Polytron 87x0 IR	-40 a +77 °C (-40 a +170 °F)

Polytron 8xx0	
durante el almacenamiento:	
Presión	26,5 a 32,4 in. Hg (900 a 1100 hPa)
Humedad	0 al 100 % HR, sin condensación
Temperatura	-20 a +65 °C (-4 a +149 °F)
Periodo de almacenamiento recomendado	5 años
Valores para opción de relé e instalaciones con homologación UL	
durante el funcionamiento:	
Temperaturas	
Polytron 8200 CAT	-40 a +70 °C (-40 a +158 °F)
Polytron 87x0 IR	-40 a +70 °C (-40 a +158 °F)

1) Polytron 8200 CAT: 23,6 a 35,44 in. Hg (800 a 1200 hPa)
2) Consulte 18.3, 18.3.2 y las instrucciones de uso del sensor EC para las limitaciones de la especificación máxima.

16.7 Pares de apriete

Rosca del instrumento	
Tapa de la carcasa	≥44 in-lbs / ≥5 Nm
Sensor	mín. 266 in-lbs / mín. 30 Nm
Tapones ciegos	mín. 266 in-lbs / mín. 30 Nm
Conexiones (para tuberías o racores de cable)	mín. 443 in-lbs / mín. 50 Nm
Tapones ciegos de la estación de acoplamiento	62 in-lbs / 7 Nm
Pasos de cable de la estación de acoplamiento	70 n-lbs / 8 Nm
Cabezal detector EC remoto	177 in-lbs ±9 in-lbs / 20 Nm ±1 Nm
Bornes de cableado de campo	
Alimentación eléctrica, señales y relés	4,4 - 7,0 in-lbs / 0,5 - 0,8 Nm
Tornillos de puesta a tierra	10,6 in-lbs / 1,2 Nm

17 Accesorios y piezas de repuesto

Este capítulo contiene un resumen de los componentes cubiertos por el examen de tipo BVS 13 ATEX G 001 X- y PFG 14 G 001 X. Otras piezas se enumeran en la lista de repuestos o se pueden consultar a través de DrägerService.

17.1 Polytron® 8xx0

Descripción	Número de referencia
IRDA a interfaz de PC	4544197
Varita magnética con llavero	4544101
Dräger PolySoft, Software de configuración	8328600 / 8328639
Tapones ciegos EXd, acero inoxidable, 2 uds.	4544897
Tapón ciego EXd, acero galvanizado, 3 uds.	8344041

17.1.1 Estación de acoplamiento

Descripción	Número de pieza
Versión solo Docking Station Power	8344027
Docking Station Power, relé (incluye 2 prensaestopas)	8344028
Docking Station Fieldbus	8344029
Prensaestopas estación de acoplamiento	6812868
Tapón ciego estación de acoplamiento	8344042

17.2 Polytron® 8100 EC

Descripción	Número de referencia
Unidad de tarjeta de circuito impreso Polytron 8100 4-20/HART	4544781
Unidad de tarjeta de circuito impreso Polytron 8100 4-20/HART, relé	4544782
Anillo de bayoneta	4544366
Anillo de bayoneta para Dräger SensorAlive	6800132
Adaptador para montaje en conducto de aire para cabezal detector EC remoto[1)]	8317617
Kit de montaje en barra para cabezal detector remoto EC	4544213
Mochila de test de sensor	8317619
Mochila de diagnóstico	8317860
Adaptador de calibración	6810536

1) Puede tener influencia sobre el rendimiento de medición, p. ej., puede incrementar el tiempo de respuesta. No cubierto por BVS 13 ATEX G 001 X ni PFG 14 G 001 X.

17.3 Polytron® 8200 CAT

Descripción	Número de referencia
Unidad de tarjeta de circuito impreso Polytron 8200 4-20/HART	4544788
Unidad de tarjeta de circuito impreso Polytron 8200 4-20/HART relé	4544789
Adaptador de ajuste PE, Europa	6806978
Adaptador de calibración remota DQ	6812480
Adaptador de calibración remota LC[1)]	6812482
Juego de repuestos membrana 21,50x14,50, 2 uds.	8326840
Filtro de polvo para DrägerSensor DQ, 10 uds.	6810537
Adaptador de proceso DQ	6812470
Adaptador de proceso LC[1)]	6812465
Protector contra salpicaduras	6812510

1) no cubierto por el informe metrológico.

17.3.1 Sensores CAT

Descripción	Número de referencia
DrägerSensor DQ NPT	6814150
DrägerSensor DQ NPT S[1)]	3701800
DrägerSensor LC NPT	6810675
Detector, Polytron SE Ex PR M1 DQ	6812711
Detector, Polytron SE Ex PR M2 DQ	6812710
Detector Polytron SE Ex HT M DQ	6812720
Sensor remoto DQ NPT aluminio	3706933
Sensor remoto DQ NPT acero	3706934

1) El DrägerSensor DQ NPT S también puede utilizarse en lugar del DrägerSensor DQ NPT.

17.4 Polytron® 8310 IR

Descripción	Número de pieza
Protector contra salpicaduras	6810796
Adaptador de proceso	6811330
Laberinto de protección	6811135
Adaptador de calibración	6810859
Placa de C.I. Polytron 8310 4-20/HART	4544788
Placa de C.I. Polytron 8310 4-20/HART relé	4544789

17.4.1 Sensores DSIR

Descripción	Número de pieza
DrägerSensor IR NPT	6811901
Cabezal detector, DrägerSensor IR juego completo e	6811165
Cabezal detector, DrägerSensor IR juego completo e2	6811265

17.5 Polytron® 87x0 IR

Descripción	Número de referencia
Unidad de tarjeta de circuito impreso Polytron 87x0 4-20/HART[1)]	4544795
Unidad de tarjeta de circuito impreso Polytron 87x0 4-20/HART relé[1)]	4544796
Kit de montaje PIR 7000	6811648
Cubeta de proceso PIR 7000, acero inoxidable	6811415
Cubeta de proceso PIR 7000 SGR	6813219
Indicador de estado PIR 7000 / 7200	6811625 / 6811920
Protector contra salpicaduras PIR 7000 / 7200	6811911 / 6811912
Flowcell PIR 7000 / 7200	6811490 / 6811910
Adaptador de prueba a distancia PIR 7000 / 7200	6811630 / 6811930
Protector contra insectos PIR 7000	6811609
Filtro hidrófobo PIR 7000	6811890
Adaptador de calibración PIR 7000	6811610
Adaptador de proceso PIR 7000 / 7200 POM (polioximetileno)	6811915

Descripción	Número de referencia
Set de montaje PIR 7000	6811648
Caja de conexiones Ex e	6811989
Caja de conexiones Ex d	4520561
Varita magnética	4544101

1) Verifique la compatibilidad del firmware del sensor y del detector de gases. Posiblemente sea necesaria una actualización de firmware para cambiar la unidad de tarjeta de circuito impreso. Contacte con Dräger para obtener asistencia.

17.5.1 Sensores

Verifique la compatibilidad del firmware del sensor y del detector de gases. Posiblemente sea necesaria una actualización de firmware para cambiar el sensor. Contacte con Dräger para obtener asistencia.

Descripción	Número de referencia
Dräger PIR 7000 tipo 334 (NPT)	6811822
Dräger PIR 7000 tipo 340 (NPT)	6811832
Dräger PIR 7000 334 (M25) Juego completo	6811825
Dräger PIR 7000 340 (M25) Juego completo	6811819
Dräger PIR 7200 (NPT)	6811572
Dräger PIR 7200 (M25) HART Juego completo	6812290

18 Homologaciones de rendimiento

En combinación con determinados sensores, Polytron 8xx0 dispone de un informe metrológico de acuerdo con las siguientes normas:

– Certificados UE y de examen de tipo según EN 60079-29-1, EN 50104, EN 45544 y DIN IEC 62990-1. Expedidos por DEKRA Testing and Certification GmbH, Handwerkstr. 15, D-70565 Stuttgart.
– Informe metrológico FM según la norma ANSI/ISA-92.00.01 FM6340

Para más información sobre las especificaciones y restricciones de los sensores (p. ej., principios de medición, rendimiento, interferencia cruzada), consulte las instrucciones de uso del sensor correspondiente.

18.1 Certificado de examen UE, BVS 13 ATEX G 001 X

Medición de gases y vapores inflamables mezclados con aire.

– Polytron 8200 CAT con DrägerSensor DQ

  Condiciones especiales:

  - En caso de exposición a un flujo de aire que contenga gas de medición, los valores medidos pueden aumentar hasta un 32 %.
  - En caso de funcionamiento con el adaptador de calibración remota DQ, los valores medidos pueden aumentar hasta un 70 %.

– Polytron 8200 CAT con DrägerSensor LC
  Homologado con valor final del rango de medición del 10 % LIE.
  Se necesita una conexión a una unidad de control con función de medición homologada (p. ej., REGARD® 7000). Las alarmas de enclavamiento para valores de medición por encima del rango deben habilitarse en la unidad de control.
– Polytron 8310 IR con DrägerSensor IR
– Polytron 8700 IR con PIR 7000 tipo 334 y 340

Medición de oxígeno (inertización)

– Polytron 8100 EC con DrägerSensor O_2 (6809720) y DrägerSensor O_2 LS (6809630) dentro de un rango de medición de 0-5...25 Vol% de O_2.

Están homologados:

– Interfaz de 4-20 mA
– Módulo de relé
– Sensor remoto
– HART
– Valores finales del rango de medición predeterminados de fábrica

No están homologados la interfaz de bus de campo ni el registrador de datos.

18.2 Certificado de examen, PFG 14 G 001 X

Medición de oxígeno (deficiencia y exceso de oxígeno)

– Polytron 8100 EC con DrägerSensor O_2 (6809720) y DrägerSensor O_2 LS (6809630) dentro de un rango de medición de 0-25 Vol% O_2.

Medición del sulfuro de hidrógeno

– Polytron 8100 EC con Dräger SensorAlive (6809630) dentro de los siguientes rangos de medición:
  - 0,5 - 100 ppm (tipo HM)
  - 0 - 100 ppm (tipo SM)

Medición de dióxido de carbono

– Polytron 8720 IR con PIR 7200 dentro de los siguientes rangos de medición:
  - 1 Vol% y 10 Vol% - EN 45544-2
  - 2000 ppm, 1 Vol% y 10 Vol% – EN 45544-3

Están homologados:
– Interfaz de 4-20 mA
– Módulo de relé
– Sensor remoto

No están homologados:
– Interfaz de bus de campo
– Registrador de datos
– Solo Polytron 8100 EC con Dräger SensorAlive: Funcionalidad de autocomprobación cuando se utiliza el generador de gas

18.3 Condiciones de funcionamiento certificadas DrägerSensor O_2, O_2LS y Dräger SensorAlive

Interferencias cruzadas

No hay interferencias cruzadas conocidas contra gases de interferencia con una concentración de hasta 100 ppm. Para obtener información más detallada, póngase en contacto con Dräger.

18.3.1 DrägerSensor O_2 (6809720)

El DrägerSensor O_2 (6809720) es un sensor electroquímico de dos electrodos para medir el oxígeno (O_2) en el aire ambiental.

Parámetros ambientales	
Presión	20,7 a 38,4 in. Hg (700 a 1300 hPa)
Humedad	10 a 95 % h.r., sin condensación
Temperatura	Cuando se aplica la norma EN 50104, el rango de temperaturas se limita de 0 °C a +55 °C.

Almacenamiento	
Presión	no influye
Humedad	30 a 70 % h.r., sin condensación (solo relevante si el embalaje del sensor está abierto)
Temperatura	0 a +40 °C
Tiempo	No está previsto el almacenamiento de sensores. Los sensores deberían ponerse en funcionamiento inmediatamente después de recibidos. Vida útil restante = vida útil esperada - tiempo de almacenamiento

Influencia de los parámetros ambientales		
	Punto cero	**Sensibilidad[1)]**
Temperatura[2)3)]		
0 a 55 °C	≤ 0,3 Vol% de O_2	≤ 0,9 Vol% de O_2
Presión	< ± 0,2 Vol% de O_2	Desviación relativa de la lectura a 1013 hPa: < 10% del valor de medición / 100 hPa
Humedad	no influye	Desviación relativa de lectura con 50 % h.r.: < 1 % del valor de medición

1) La desviación relativa de la lectura mostrada en pantalla está provocada por los cambios de presión atmosférica.
2) A temperaturas por debajo de -5 °C, la desviación de la medición es superior a lo indicado en la norma EN 50104.
3) Para temperaturas de funcionamiento fuera de -5 °C a 40 °C es necesario efectuar un ajuste a la temperatura de funcionamiento.

Tiempo de respuesta[1)]		
	$t_{0...20}$	**$t_{0...90}$**
0-5 Vol% de O_2	≤ 15 segundos[2)]	≤ 33 segundos
0-25 Vol% O_2	≤ 10 segundos	≤ 26 segundos

1) A temperaturas inferiores a -5 °C, el tiempo de respuesta puede aumentar.
2) El tiempo de respuesta es superior al valor límite permitido según EN 50104.

Tiempo de estabilización: 5 x $t_{0...90}$

Rango de medición

0-5 Vol% de O_2 a 0-100 Vol% de O_2

Por defecto: 25 Vol% de O_2, valor mínimo: -1,25 Vol% de O_2

Tiempo de iniciación del sensor

Funcionamiento: < 20 minutos / ajuste: ≤ 2 horas

18.3.2 DrägerSensor O_2LS (6809630)

El DrägerSensor O_2LS (6809630) es un sensor electroquímico de 3 electrodos para la medición de oxígeno (O_2) en el aire ambiental.

Parámetros ambientales	
Presión	20,7 a 38,4 in. Hg (700 a 1300 hPa)
Humedad	5 a 95 % h.r., sin condensación
Temperatura	-40 a +60 °C brevemente +65 °C

Almacenamiento	
Presión	no influye
Humedad	30 a 70 % h.r., sin condensación (solo relevante si el embalaje del sensor está abierto)
Temperatura	0 a +40 °C
Tiempo	No está previsto el almacenamiento de sensores. Los sensores deberían ponerse en funcionamiento inmediatamente después de recibidos. Vida útil restante = vida útil esperada - tiempo de almacenamiento

Influencia de los parámetros ambientales	Punto cero	Sensibilidad
Temperatura		
-20 a 40 °C	≤ 0,1 Vol% de O_2	≤ 0,1 Vol% de O_2
de -40 a +65 °C	≤ 0,2 Vol% de O_2	≤ 0,5 Vol% de O_2
Presión	< ± 0,1 Vol% de O_2	≤ 0,8 Vol% de O_2
Humedad	≤ 0,1 Vol% de O_2	≤ 0,9 Vol% de O_2

ℹ Si al medir oxígeno hay helio presente, puede utilizarse la compensación de helio. La opción de compensación de helio no es una función de medición certificada conforme a EN 50104.

⚠ PRECAUCIÓN

Fallo del sensor

La exposición a concentraciones elevadas de hidrocarburos no saturados, alcoholes o hidrógeno a lo largo de un periodo prolongado (dosis de aprox. 100.000 ppm x horas) podría provocar el fallo del sensor.

► Asegúrese de que el sensor no se expone a concentraciones de esas características durante un periodo prolongado.

Tiempo de respuesta	$t_{0...20}$	$t_{0...90}$
0-5 Vol% de O_2	≤ 14 segundos[1)]	≤ 45 segundos
0-25 Vol% O_2	≤ 10 segundos	≤ 27 segundos

1) El tiempo de respuesta es superior al valor límite permitido según EN 50104.

Tiempo de estabilización: 5 x $t_{0...90}$

Rango de medición

0-5...25 Vol% de O_2, 0-25 Vol% de O_2

Por defecto: 25 Vol% O_2

Lectura mínima: -1,25 Vol% de O_2

Tiempo de iniciación del sensor

Funcionamiento: ≤ 20 minutos / ajuste: ≤ 6 horas

18.3.3 Dräger SensorAlive (6814014)

El Dräger SensorAlive (6814014) es un sensor de difusión electroquímico con generador de gas integrado para medir el sulfuro de hidrógeno (H_2S) en el aire ambiente.

Parámetros ambientales	
Presión	20,7 a 35,5 in. Hg (700 a 1200 hPa)
Humedad	5 a 95 % h.r., sin condensación
Temperatura	de -40 a +65 °C
Velocidad de circulación máxima del aire ambiental	6 m/s

Almacenamiento	
Presión	no influye
Humedad	30 a 70 % h.r., sin condensación (solo relevante si el embalaje del sensor está abierto)
Temperatura	0 a +40 °C
Tiempo	No está previsto el almacenamiento de sensores. Los sensores deberían ponerse en funcionamiento inmediatamente después de recibidos. Vida útil restante = vida útil esperada - tiempo de almacenamiento

Influencia de los parámetros ambientales	Desviación relativa de la lectura
Presión	a 1000 hPa: ≤ 0,15 ppm
Humedad (a +40 °C)	a 0 y 95 % h.r.: ≤ 0,29 ppm
Temperatura	a 20 °C: ≤ 0,44 ppm

ℹ Los gases de interferencia (p. ej., NH_3) pueden perjudicar el funcionamiento del sensor.

Tiempos de respuesta en modo difusión	
t(50)	≤ 20 s
t(90)	≤ 55 s

Tiempos de relajación en modo difusión	
t(50)	≤ 20 s
t(10)	≤ 55 s

18.4 Informe metrológico FM para DrägerSensor H_2S y H_2S LC

DrägerSensor H_2S y H_2S LC son sensores de difusión electroquímicos que miden el sulfuro de hidrógeno (H_2S) en el aire ambiente.

DrägerSensor H_2S (6810435)	
Tipo de examen P8100	ETR 0400, 0401, 0500, 0501
Interfaz[1)]	4-20 mA, relé
Parámetros ambientales	
Humedad	5 a 95 % h.r., sin condensación
Temperatura	-40/+65 °C (–40/149 °F)
Temperatura de almacenamiento	0/+40 °C (32/104 °F)
Protección de la carcasa [2)]	IP 65/66/67
Rango	0 a 100 ppm
Exactitud (lo que sea mayor)	Incertidumbre de medición (del valor med.) ≤ ±3 % o mínimo ≤ ±0,5 ppm
Accesorios	
Filtro de polvo	6809595
Kit adaptador	6810536
Estándar	ANSI/ISA-92.00.01FM6340

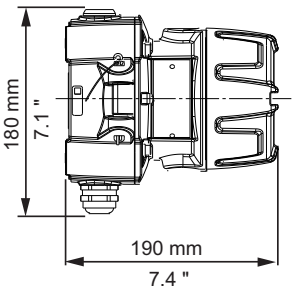
1) La comunicación HART no debe usarse para comunicación relevante para la seguridad.
2) Después de una inmersión y chorros de agua, debe sustituirse el sensor.

DrägerSensor H_2S LC (6809610)	
Tipo de examen P8100	ETR 0400, 0401, 0500, 0501
Interfaz[1)]	4-20 mA, relé
Parámetros ambientales	
Humedad	5 a 95 % h.r., sin condensación
Temperatura	-20/+65 °C (-4/149 °F)
Temperatura de almacenamiento	0/+40 °C (32/104 °F)
Protección de la carcasa [2)]	IP 65/66/67
Rango	0 a 100 ppm
Exactitud (lo que sea mayor)	Incertidumbre de medición (del valor med.) ≤ ±3 % o mínimo ≤ ±0,5 ppm en el rango >50 ppm, ±10 % o ±3 ppm

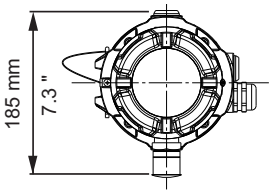
DrägerSensor H_2S LC (6809610)	
Accesorios	
Filtro de polvo	6809595
Kit adaptador	6810536
Estándar	ANSI/ISA-92.00.01FM6340

1) La comunicación HART no debe usarse para comunicación relevante para la seguridad.
2) Después de una inmersión y chorros de agua, debe sustituirse el sensor.

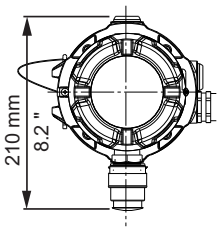
Dimensions Ex e Versions (approx.)



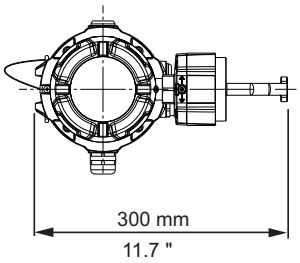
DrägerSensor DQ



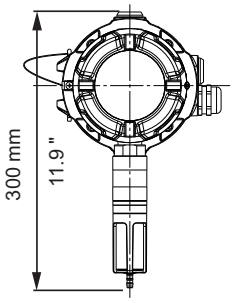
DrägerSensor LC



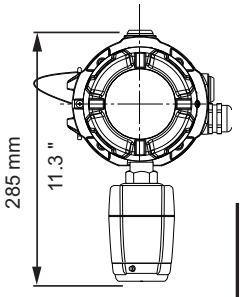
PIR 7x00



DrägerSensor IR

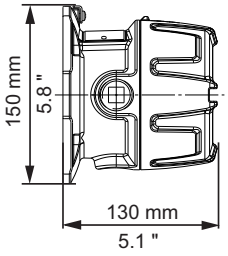


DrägerSensor EC

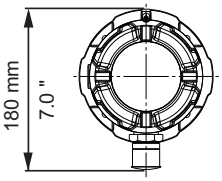


Weight Ex e versions:	Stainless Steel 316L 11.9 lbs 5.4 kg	Aluminum 7.7 lbs 3.5 kg	Stainless Steel 316L 15.6 lbs 7.1 kg	Aluminum 11.5 lbs 5.2 kg

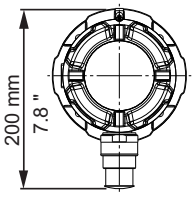
Dimensions Ex d versions (approx.)



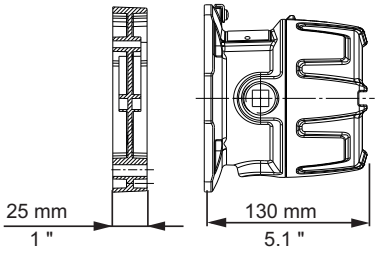
DrägerSensor DQ



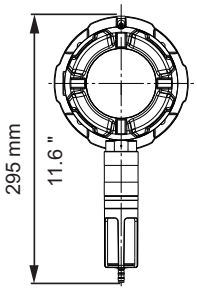
DrägerSensor LC



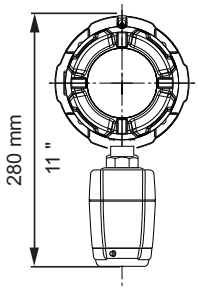
PIR 7x00

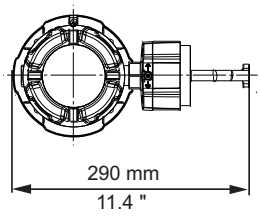


DrägerSensor IR



DrägerSensor EC / UGLD





Weight Ex d versions:	Stainless Steel 316L 8.8 lbs 4.0 kg	Aluminum 4.9 lbs 2.2 kg	Stainless Steel 316L 12.6 lbs 5.7 kg	Aluminum 8.5 lbs 3.9 kg

Manufacturer
Dräger Safety AG & Co. KGaA
Revalstraße 1
D-23560 Lübeck
Germany
+49 451 8 82-0

9033828 – 4683.601 me
© Dräger Safety AG & Co. KGaA
Edition: 08 – 2023-08 (Edition: 1 – 2018-01)
Subject to alterations

www.draeger.com



Dräger Polytron® 8200 CAT
Detektion brennbarer Gase und Dämpfe

Der Dräger Polytron® 8200 CAT ist ein explosionsgeschützter Highend-Transmitter zur Detektion von brennbaren Gasen und Dämpfen. Er nutzt den katalytischen DrägerSensor® Ex ... DQ. Neben dem 3-Leiterbetrieb 4 bis 20 mA Analogausgang, bietet er auch HART®, Feldbusoptionen und Modbus, so dass Sie den Transmitter mit den meisten Auswertesystemen in Ihrer Gaswarnanlage kombinieren können.

Dräger

Technik für das Leben

Dräger Polytron® 8200 CAT



Produktvorteile

Schnell und stabil – der DrägerSensor® Ex ... DQ

Der eingebaute Gassensor vom Typ DQ basiert auf dem bewährten Messprinzip der katalytischen Wärmetönung. Er ist sehr langzeitstabil. Ebenso hervorragend ist seine Vergiftungsbeständigkeit. Und hierauf begründet sich seine Langlebigkeit. Durch die neuartige Gaseintrittsöffnung spricht der Sensor in nur wenigen Sekunden auf Gas an. So können Sie unverzüglich mit Gegenmaßnahmen reagieren und das Entstehen zündfähiger Atmosphäre verhindern.

Einfaches Gerätemanagement durch digitale Kommunikation

Der Dräger Polytron 8200 ist mit digitalen Schnittstellen ausgestattet. Durch diese beurteilen Sie den Transmitterzustand einfach und schnell aus der Ferne. Die Integration in bereits bestehende Managementsysteme (z. B. PACTware™) ist mittels DTM möglich. Neben der gängigen HART®-Kommunikation, sind auch die Feldbus-Schnittstellen PROFIBUS® PA, FOUNDATION fieldbus™ H1 und Modbus RTU verfügbar.

Gleiche Struktur, gleiche Handhabung

Der Dräger Polytron 8200 gehört zur Polytron 8000-Serie. Alle Transmitter dieser Serie sind gleich aufgebaut und haben die gleiche Benutzeroberfläche. Das ermöglicht Ihnen eine einheitliche Bedienung mit geringerem Schulungs- und Wartungsaufwand. Auf der beleuchteten Anzeige lesen Sie Statusinformationen strukturiert und übersichtlich ab. Im Normalbetrieb werden die gemessene Gaskonzentration und die Maßeinheit angezeigt. Farbige LEDs (grün, gelb, rot) informieren zusätzlich über den Status. Das Sensorsignal kann ausgewertet werden, indem Sie das 4 bis 20 mA Signal nutzen. Sie bedienen den Polytron 8200 mit einem Magnetstift über Kontaktflächen.

Drei Relais zur Schaltung externer Betriebsmittel

Auf Wunsch erhalten Sie den Polytron 8200 auch mit drei eingebauten Relais. So können Sie ihn als unabhängige Gaswarnanlage mit zwei frei einstellbaren Konzentrationsalarmen und einem Störungsalarm verwenden. Hupen, Signalleuchten oder ähnliches lassen sich damit lokal schalten, ohne dass Sie ein zusätzliches Kabel zwischen Transmitter und Zentraleinheit verlegen müssen.

Sicheres, robustes Gehäuse für jede Anwendung

Der Polytron 8200 ist druckfestgekapselt und entspricht damit der Explosionsschutzart ›d‹. Für die Schutzart erhöhte Sicherheit ›e‹ gibt es zusätzlich einen Klemmenkasten. Dieser erleichtert Ihnen auch die Vormontage. Je nach Umgebungsbedingung können Sie den Dräger Polytron 8200 mit Aluminium- oder Edelstahlgehäuse wählen.

Unmögliches möglich machen mit Remote-Sensor

Das abgesetzte Sensoranschlussgehäuse ermöglicht Ihnen die Installation des Sensors getrennt vom Transmitter. So platzieren Sie den Sensor einfach näher an der Gaswolke an schwer zu erreichenden Stellen. Das Display bleibt dabei sichtbar auf Augenhöhe.

Datenlogger

Das Polytron 8200 verfügt über einen Datenlogger. In diesem können Mess- und Ereignisdaten der letzten Jahre gespeichert werden.

Systemkomponenten



D-6806-2016

Dräger REGARD® 7000

Das Dräger REGARD® 7000 ist ein modulares und damit auf lange Sicht erweiterbares Auswertesystem für die Überwachung von verschiedenen Gasen und Dämpfen. Geeignet für Gaswarnanlagen unterschiedlichster Komplexität und Anzahl von Transmittern, zeichnet sich das Dräger REGARD® 7000 durch ein hohes Maß an Zuverlässigkeit und Effizienz aus. Ein weiterer Pluspunkt: die Rückwärtskompatibilität zum REGARD®.



D-1130-2010

Dräger REGARD® 3900 Serie

Die Geräte der Dräger REGARD® 3900 Serie sind eigenständige Auswerteeinheiten. Sie sind konfigurierbar für bis zu 16 Messkanäle. Der modulare Aufbau erlaubt Ihnen, die Auswerteeinheit den Bedingungen Ihrer Anlage anzupassen. Beispielweise, indem Sie weitere Alarmmittel einbinden.



D-39957-2021

Dräger REGARD® 3000

Überwachen Sie verschiedene Gase und Dämpfe mit dem modularen Auswertesystem Dräger REGARD® 3000. Sein mehrfarbiges Status-Licht signalisiert Ihnen den Zustand Ihrer Gaswarnanlage. Der Controller ermöglicht Ihnen drei verschiedene Module zu kombinieren: Input-, Relais- und Gateway-Modul. Dabei können Sie bis zu vier analoge Transmitter und acht Relais in Kombination anschließen.

Zubehör



D-15035-2010

Docking Station

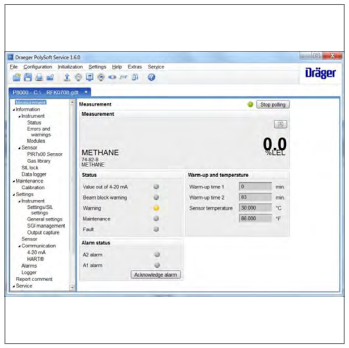
Für die Schutzart erhöhte Sicherheit ›e‹ gibt es eine Docking Station. Diese erleichtert Ihnen auch die Vormontage. Die Docking Station ist bei allen Transmittern der Polytron® 5000 und Polytron® 8000 Serien mit erhöhter Sicherheit inklusive.



D-85345-2013

Rohranschluss-Set

Mit dem Rohranschluss-Set messen Sie die Gaskonzentration direkt in Rohrleitungen.



D-4316-2019

Dräger PolySoft Software

Die optionale Dräger PolySoft Windows®-Software wird für die Konfiguration, Firmware-Upgrades, Diagnose und den Download desim Datenlogger integrierten Polytron® verwendet. Alles bequem von Ihrem Kontrollraum aus mit dem digitalen HART®-Signal, das auf demanalogen 4-20 mA-Signal fährt. Im Außeneinsatz verbindet ein IRDongle den Polytron® problemlos mit der PolySoft.

Verwandte Produkte



D-15005-2010

Dräger Polytron® 5200 CAT

Der Dräger Polytron® 5200 CAT ist ein kostengünstiger, explosionsgeschützter Transmitter zur Detektion von brennbaren Gasen und Dämpfen. Er nutzt den katalytischen DrägerSensor® Ex ... DQ. Durch den 3-Leiterbetrieb und den 4 bis 20 mA Analogausgang können Sie den Transmitter mit den meisten Auswertesystemen in Ihrer Gaswarnanlage kombinieren.



D-1047-2024

Dräger PEX 3000

Der Transmitter Dräger PEX 3000 detektiert brennbare Gase und Dämpfe in Konzentrationen unterhalb der Unteren Explosionsgrenze (100 % UEG). Er erhöht so den Ex-Schutz Ihrer Anlage. Sein Wärmetönungssensor reagiert in nur wenigen Sekunden auf Gas und das Messsignal ist besonders langzeitstabil.



D-6572-2023

Dräger PointGard 3200

Das Dräger PointGard 3200 ist eine vollständige 1-Kanal-Gaswarnanlage zur Messung von brennbaren Gasen oder Dämpfen in der Umgebungsluft. In dem robusten und gleichzeitig kompakten Gehäuse mit der Schutzklasse IP66 sind bereits alle notwendigen Alarmmittel enthalten.

Technische Daten

Dräger Polytron® 8200 CAT

Typ	Druckfest gekapselter Transmitter (›d‹) oder kombiniert mit erhöhter Sicherheit (›d/e‹)		
Gase	Brennbare Gase und Dämpfe		
Messbereiche	DQ	0 bis 100 % UEG	
	LC	0 bis 10 % UEG	
Anzeige	Hintergrundbeleuchtetes Grafik-LCD; 3 Status-LEDs (grün/gelb/rot)		
Messtechnische Eigenschaften	Genauigkeit/Wiederholbarkeit	Nullpunkt	≤ 1 % UEG
		Empfindlichkeit	≤ 1 % UEG
		Langzeit-Drift	≤ 3 % UEG nach 6 Monaten
	Ansprechzeit	T50	5 Sekunden (Methan)
		T90	10 Sekunden (Methan)

Elektrische Daten

Signalausgang analog	Normalbetrieb	4 bis 20 mA, 3- oder 4-Draht, Stromquelle oder Stromsenke
	Wartung	konstant 3,4 mA oder 4 mA ±1 mA 1 Hz Modulation; (einstellbar)
	Fehler	< 1,2 mA
Signalausgang digital	HART® mit 3- oder 4-Draht, PROFIBUS® PA, FOUNDATION fieldbus™ H1 und Modbus RTU mit 4-Draht	
Stromversorgung	10 bis 30 V DC	
Relais Spezifikation (Option)	2 Alarm- und 1 Fehlerrelais, einpoliger Wechsler 5 A @ 230 VAC, 5 A @ 30 VDC, widerstandsgebunden	

Gehäuse

Transmittergehäuse	Pulverbeschichtetes kupferfreies Aluminium oder Edelstahl SS316 L	
Sensorgehäuse	Edelstahl 303 oder 316L	
Gehäuseschutzart	NEMA 4X, IP65/66/67	
Kabeleinführung	3/4" NPT Gewindeöffnungen oder M20 Kabeleinführung	
Maße (H x B x T), ca.	ohne Docking Station	280 x 150 x 130 mm
	mit Docking Station	280 x 180 x 190 mm
Gewicht, ca.	ohne Docking Station, Aluminium	2,2 kg
	ohne Docking Station, 316 Edelstahl	4,0 kg
	mit Docking Station, Aluminium	3,5 kg
	mit Docking Station, 316 Edelstahl	5,4 kg

Technische Daten

Umgebungsbedingungen (siehe auch Sensordatenblatt)

Temperatur	-40 bis 80 °C (-40 bis 176 °F) ohne Relais
	-40 bis 70 °C (-40 bis 158 °F) mit Relais
Feuchte	0 bis 100 % rel. Feuchte, nicht kondensierend
Druck	700 bis 1.300 mbar

Zulassungen*

UL	Class I, Div 1, Groups A, B, C, D;	
	Class II, Div 1, Groups E, F, G;	
	Class I, Zone 1, Group IIC;	
	T-Code T6/T4	
CSA	Class I, Div 1, Groups A, B, C, D;	
	Class II, Div 1, Groups E, F, G;	
	Class I, Zone 1, Group IIC;	
	T-Code T6/T4	
IECEx	4-20-mA HART®	Ex db IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C; ‘d’ version
		Ex db eb IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C; ‘e’ version; Ex tb IIIC T135 °C Db
	PROFIBUS® & FF	Ex db ia IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C; ‘d’ version
		Ex db eb ia IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C; ‘e’ version; Ex tb IIIC T135 °C Db
ATEX	4-20-mA HART®	II 2G Ex db IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C; ‘d’ version
		II 2G Ex db eb IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C; ‘e’ version II 2D Ex tb IIIC T135 °C Db
	PROFIBUS® & FF	II 2G Ex db ia IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C; ‘d’ version
		II 2G Ex db eb ia IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C; ‘e’ version II 2D Ex tb IIIC T135 °C Db

Technische Daten

CE-Kennzeichen	ATEX (Richtlinie 2014/34/EU)
	Elektromagnetische Verträglichkeit (Richtlinie2014/30/EU)
	Niederspannung (Richtlinie 2014/35/EU)
Schiffszulassungen (nur für DQ Sensoren)	DNV GL, ABS, LR, CCS, RMRS
MED Zulassung (nur für DQ Sensoren)	Zertifikat Nr. MEDB0000411
Messtechnische Eignungsprüfung (nur für DQ Sensoren)	Zertifikat Nr. BVS 13 ATEX G 001 X
SIL 2 Zertifikat TÜV Süd	Zertifikat Nr. Z10 17 05 53474 023

* Alle Docking Station-Versionen sind nur ATEX-/IECEx-zugelassen

Bestellinformationen

Dräger Polytron® 8200 CAT

	Zulassungscode	Bestellnummer
Dräger Polytron® 8200 CAT DQ d A 4-20/HART®	XTR 0410	83 44 439
Dräger Polytron® 8200 CAT DQ d A 4-20/HART® Relais	XTR 0411	83 44 440
Dräger Polytron® 8200 CAT DQ d S 4-20/HART®	XTR 0510	83 44 448
Dräger Polytron® 8200 CAT DQ d S 4-20/HART® Relais	XTR 0511	83 44 449
Dräger Polytron® 8200 CAT DQ e A 4-20/HART® (inkl. Docking Station)	XTR 041I	83 44 457
Dräger Polytron® 8200 CAT DQ e A 4-20/HART® Relais (inkl. Docking Station)	XTR 041J	83 44 458
Dräger Polytron® 8200 CAT DQ e S 4-20/HART® (inkl. Docking Station)	XTR 051I	83 44 466
Dräger Polytron® 8xx0 Baukasten (Konfiguration gemäß Kundenwunsch: z. B. Edelstahlgehäuse)		83 44 800

Zubehör	Bestellnummer
DrägerSensor® PR NPT DQ	68 14 150
DrägerSensor® PR NPT DQ S	37 01 800
DrägerSensor® LC NPT	68 10 675
Dräger Polytron® SE Ex PR M1 DQ	68 12 711
Dräger Polytron® SE Ex PR M2 DQ	68 12 710
Dräger Polytron® SE Ex PR LC M1	68 12 722
Dräger Polytron® SE Ex PR LC M2	68 12 721
Dräger Remote Sensor DQ NPT Alu	37 06 933
Dräger Remote Sensor DQ NPT Steel	37 06 934
Magnetstift	45 44 101
Rohrmontageset	45 44 198
Rohranschluss-Set	68 12 725
IR-Anschluss-Set Polytron® 5000/8000	45 44 197
PolySoft Lizenz (1 Jahr)	83 28 600
PolySoft Lizenz (Abonnement)	83 28 601
Spritzschutz	68 12 510

Bestellinformationen

Begasungsadapter	PE, Europa	68 06 978
	PE inkl. Schlauch	45 09 314
Kalibrieradapter Viton®		68 10 536
Fernkalibrieradapter für DQ		68 12 480
Fernkalibrieradapter für LC		68 12 482
Prozessadapter (Edelstahl, mit Überwurfmutter M30 x 1,5) für DQ		68 12 470
Prozessadapter (Edelstahl, mit Überwurfmutter M36 x 1,5) für LC		68 12 465

HART® ist eine Marke der HART Communication Foundation.

FOUNDATION fieldbus™ ist eine Marke der Fieldbus Foundation™.

PROFIBUS® ist eine Marke von PROFIBUS and PROFINET International (PI).

PACTware™ ist eine Marke von Pepperl+Fuchs GmbH.

Viton® ist eine Marke der Firma DuPont.

Windows® ist eine Marke der Microsoft Corporation.

Nicht alle Produkte, Funktionen oder Dienstleistungen sind in allen Ländern verfügbar.
Genannte Marken sind nur in bestimmten Ländern eingetragen und nicht unbedingt in dem Land, wo dieses Material herausgebracht wurde. Den aktuellen Stand finden Sie unter www.draeger.com/trademarks.

Unternehmenszentrale
Drägerwerk AG & Co. KGaA
Moislinger Allee 53–55
23558 Lübeck, Deutschland
www.draeger.com

Deutschland
Dräger Safety AG & Co. KGaA
Revalstraße 1
23560 Lübeck
0800 882 883 0
+49 451 882-2080
info@draeger.com

Österreich
Dräger Austria GmbH
Perfektastraße 67
1230 Wien
+43 1 609 04 0
+43 1 699 45 97
office.austria@draeger.com

Schweiz
Dräger Schweiz AG
Waldeggstrasse 30
3097 Liebefeld
+41 58 748 74 74
+41 58 748 74 01
info.ch@draeger.com

Ihren Ansprechpartner vor Ort finden Sie unter:
www.draeger.com/contact

101865 | 01.65 | Änderungen vorbehalten | © 2024 Drägerwerk AG & Co. KGaA

STATRON
NON STOP POWER

Noise Level Data Sheets

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: D04
Sequence Number: 001
Rev: 002
Document number: K559-2254-CWIWP4202201-D04-001
Document description: Noise Level Data Sheets

Revision	Date	Name	Description
001	27.02.2023	CPA / ADI	First Version
002	12.04.2023	CPA / ADI	Updated according to KBR comments

Noise Level Data Sheets
D04

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	D04
Document name	Noise Level Data Sheets
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-27-02	C. Palenzuela	First version
2.0	2023-04-11	C. Palenzuela	Updated according to KBR comments

Table 1: Version overview

	Date	Name
Editor	2023-04-11	C. Palenzuela
Checked by	2023-04-12	A. Fritz
Approved by	2023-04-13	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Noise Level Data Sheets 8
3.1 PCS Container 8
3.2 BESS Container 1 8
3.3 BESS Container 2 8

Identification

Product Version / Document Version

Product version
Prototype

Document release date
April 2023

Doc Code
K559-2254-CWIWP4202201-D04-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Test Protocol - Determination of sound pressure level referring to EN ISO 3744	FREQCON Noise Level Test and Certification.pdf
Product data sheet – BESS air conditioning units	PCA-M_R32_Standard_Inverter__SP__Product_Information_Sheet_2019 7kw roof

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The noise emission from the offered BESS is 77.1 dBA at 1 m distance. This noise is generated primarily by the heat exchangers installed on the front side of the PCS container.

The test protocol "Determination of sound pressure level referring to EN ISO 3744" of a sound level test conducted by of SLG Prüf- und Zertifzierungs GmbH is attached to this document (*see section 1.3 "Other Applicable Documents"*).

The BESS containers which come without heat exchangers generate noise emissions of 50.5 dBA at 1 m distance. This value was determined during sound level tests performed by FREQCON. The data sheet of the air conditioning units located at the cooling niche of the BESS containers is also attached to this document (*see section 1.3 "Other Applicable Documents"*).

3 Noise Level Data Sheets

3.1 PCS Container

Noise Levels PCS Container	
Type of Container	PCS Container
Noise level (L_{pA})	77.1 dBA @ 1 m distance

3.2 BESS Container 1

Noise Levels BESS Container	
Type of Container	BESS Container
Noise level (L_{pA})	50.5 dBA @ 1 m distance

3.3 BESS Container 2

Noise Levels BESS Container	
Type of Container	BESS Container
Noise level (L_{pA})	50.5 dBA @ 1 m distance

SLG Prüf- und Zertifizierungs GmbH

TEST PROTOCOL

Determination of sound pressure level referring to EN ISO 3744

Protocol

Protocol No. ..... : 1369-16-EA-17-PP001

Edited by (+ signature) ..... : Schädlich, E.

Approved by (+ signature) ..... : Andreis

Date of issue ..... : 2017-05-23

Contents ..... : 5 Pages

Testing laboratory

Name ..... : SLG Prüf- und Zertifizierungs GmbH

Address ..... : Burgstädter Straße 20, 09232 Hartmannsdorf, Germany

Testing location ..... : As above

Client

Name ..... : Freqcon GmbH

Address ..... : Bürgerwiesenweg 5

..... : 27336 Rethem, Germany

Test specification

Standard ..... : Test according to customer's test plan referring to EN ISO 3744

Test procedure ..... : Noise

Test item

Description ..... : Converter with cooler and fan

Model and/or type reference ..... : MSC 1000 kW Universal A

Serial number ..... : none (special test type)

Ratings ..... : 3~ 620 V (L1, L2, L3, N, PE); 50 Hz, 1000 kW

Dimensions ..... : 420 x 240 x 60 cm

Weight ..... : 3000 kg

Results of measurement

Measuring-surface sound pressure level, measured at distance of 1 m

Converter and cooler fan ..... : L_{pA} = 77,1 dB

Only Converter ..... : L_{pA} = 63,0 dB

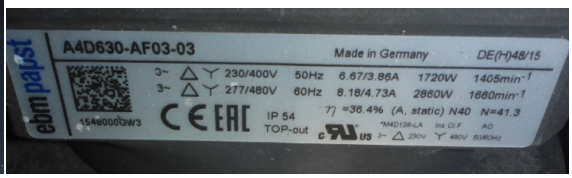
Background noise ..... : L_{pA} = 43,9 dB

For detailed information see page 3.

SLG Prüf- und Zertifizierungs GmbH

COPY OF MARKING PLATE





Type label of cooler and fan (external)





Internal fans in converter (6x K2E200-AH20-05 and 3x K2S165-AA17-05)

GENERAL INFORMATION

Testing

Date (s) of performance of tests..... : 2017-05-11

Place of performance of tests ..... : EMC Lab 3 for large appliances of SLG,

Tested by (+ signature)..... : Schädlich, E.

C. Schädlich

.....

General remarks

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

Throughout this report a comma is used as the decimal separator.

CHRONOLOGY OF PROTOCOL

Protocol / Date	Valid	Version / Change	Editor
1369-16-EA-17-PP001 from 2017-05-23	Yes	First edition	Schädlich, E.

SLG Prüf- und Zertifizierungs GmbH

SUMMARY OF TESTING

Measuring instruments:

- Hand-held Analyser System Type 2250, S.-No.: 3008766, Brüel & Kjær, Denmark Calibration Certificate 1276-2017-04, D-K-15183-01-00, Spektra Dresden, Germany
- Meteorology monitoring system Type OPUS 10, S.-No.: 049.1206, G. Lufft Mess- und Regeltechnik GmbH Fellbach, Germany, Calibration Certificate 1606072, SLG Prüf- und Zertifizierungs GmbH, Germany
- Digital Barometer Type GPB 1300, Inv.-No.: 5049, Greisinger electronic, Germany, Calibration Certificate 1606071, SLG Prüf- und Zertifizierungs GmbH, Germany

Measurement referring to:

EN ISO 3740:2000 Acoustics - Determination of sound power levels of noise sources - Guidelines for the use of basic standards

EN ISO 3744:2000 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane

Test conditions:

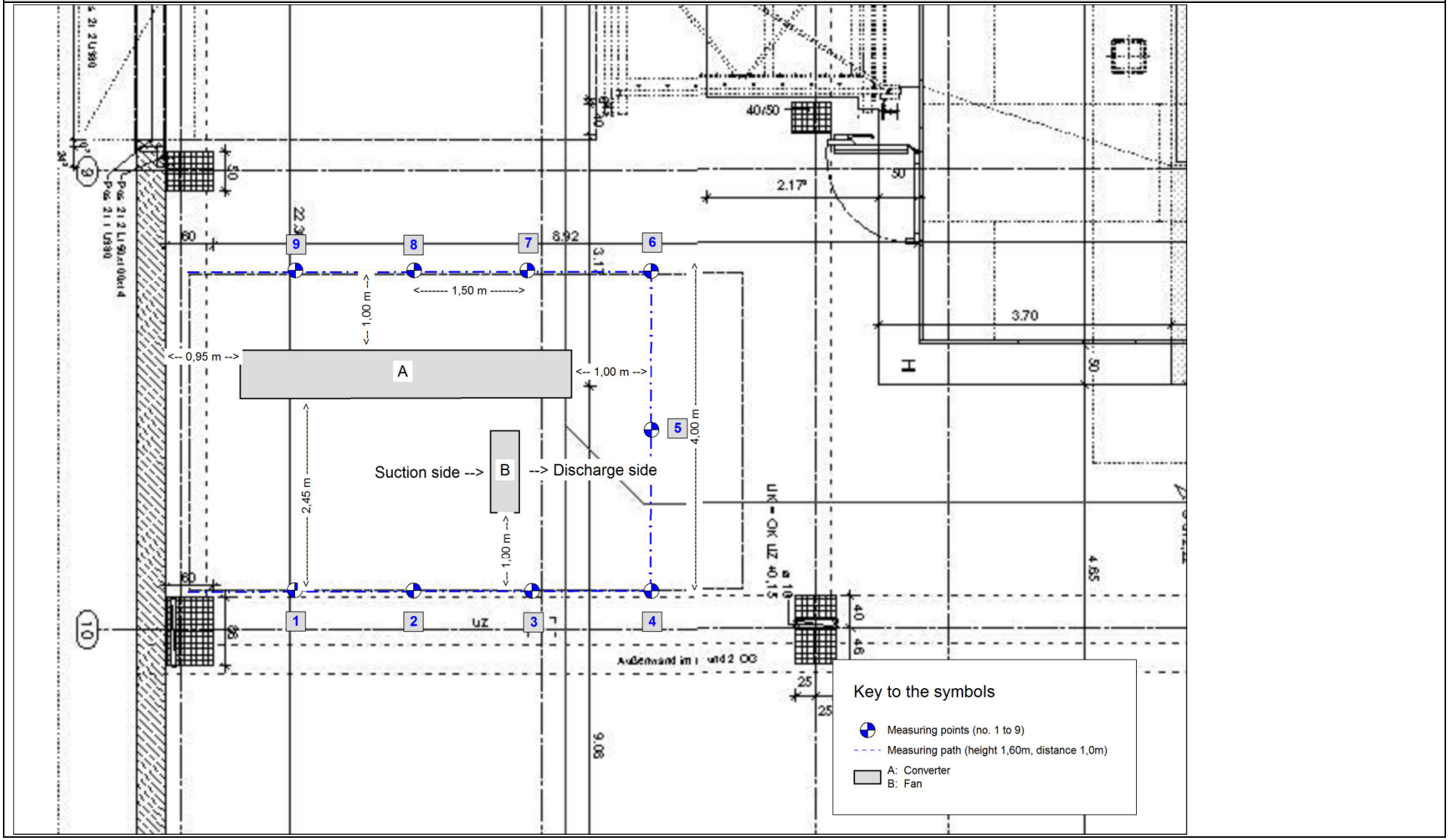
- The measurements were carried out in the EMC Laboratory of SLG without specific acoustic requirements. The test conditions of converter and fans were defined by the customer.
- Determination of averaged sound pressure level on rectangular parallelepiped with nine microphone positions (1,60 m height above ground and measurement distance 1 m)
- For detailed information see sketch on page 4.
- The measured values were determined as energetic mean value over at least 30 s per measuring point in the frequency range 6,3 Hz up to 20k Hz. The results were not corrected by the effect of background noise and environmental conditions.
- The following operating conditions were tested
  - converter and cooler fan
  - only converter (without cooler fan)
  - background noise (UUT switched off)
- climatic conditions: temperature: 23 °C; atmospheric pressure: 986 hPa; humidity: 45 %

Test results

Measuring point	Sound pressure level $L_{pA,\,1m}$ for operating conditions		
	converter and cooler fan	only converter	background noise
1	77,9	58,9	45,7
2	78,3	58,4	44,5
3	78,9	57,0	43,5
4	78,0	57,1	43,7
5	78,8	59,2	44,2
6	75,2	62,3	43,6
7	74,8	66,1	43,3
8	74,6	68,1	42,9
9	74,3	64,0	43,3
Average	**77,1**	**63,0**	**43,9**

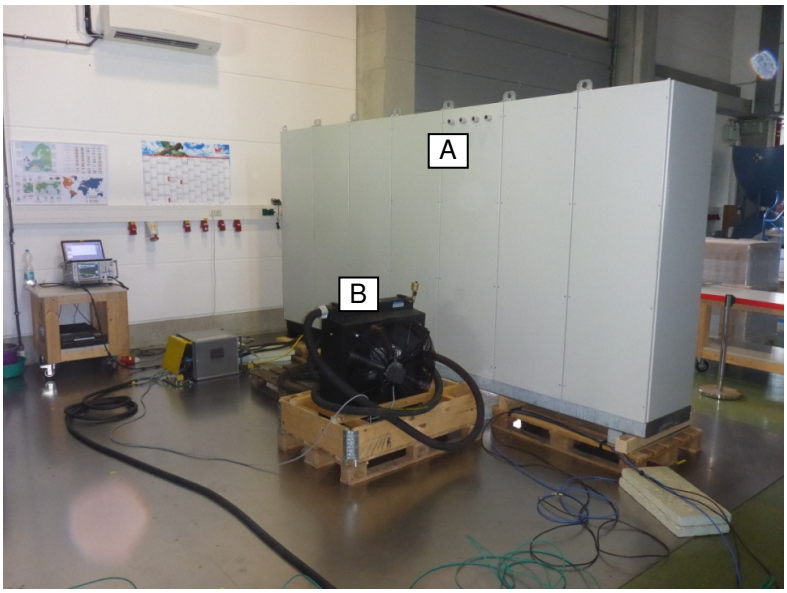
SLG Prüf- und Zertifizierungs GmbH

SKETCH OF TEST SETUP (NO SCALE)

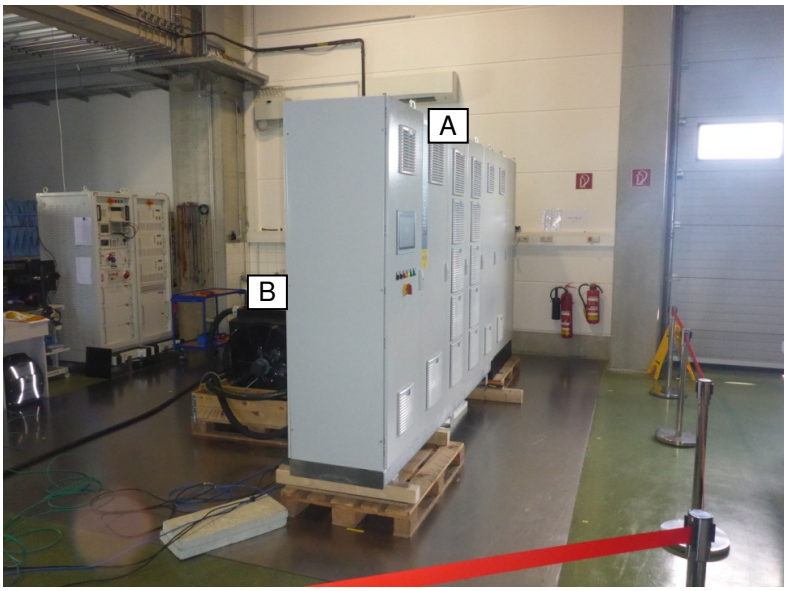


SLG Prüf- und Zertifizierungs GmbH

PICTORIAL DOCUMENTATION



Picture 1: View of test setup in the EMC-Lab with A: converter and B: fan



Picture 2: as picture 1



Picture 3: View of the converter with the cabinets

Air Conditioning

Product Information

PCA-M R32 Standard Inverter
Ceiling Suspended System
Standard Inverter Heat Pump (Single Phase)

Making a World of Difference

Mr.SLIM



The **PCA-M Standard Inverter** range is a ceiling suspended system that blends a host of outstanding features with a sophisticated streamlined design. Offering advanced control options and quiet operation, this range provides extreme flexibility and ease of installation whilst being cost effective..

Key Features

- Flush to wall installation for concealment of service connections
- High / Low ceiling height modes
- Improved airflow control, including automatic air speed adjustment for greater comfort
- Replace Technology available
- New single fan chassis on 12.5 and 14kW models

MITSUBISHI ELECTRIC

Cooling | Heating | Ventilation | Controls

R32

Air Conditioning

Product Information

PCA-M R32 Standard Inverter Ceiling Suspended System

Standard Inverter Heat Pump (Single Phase)

Making a World of Difference







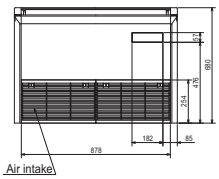

PCA-M - INDOOR UNITS		PCA-M50KA	PCA-M60KA	PCA-M71KA	PCA-M100KA	PCA-M125KA	PCA-M140KA
CAPACITY (kW)	Heating (nominal)	6.0 (1.5-7.2)	7.0 (1.6-8.0)	8.0 (2.0-10.2)	11.2 (2.8-12.5)	13.5 (4.1-15.0)	15.0 (4.2-15.8)
	Cooling (nominal)	5.0 (1.5-5.6)	6.1 (1.6-6.3)	7.1 (2.2-8.1)	9.5 (4.0-10.6)	12.1 (5.7-13.0)	13.4 (5.7-14.1)
	Heating (UK)	5.10 (1.28-6.12)	5.95 (1.36-6.80)	6.80 (1.70-8.67)	9.63 (2.41-10.75)	11.61 (3.53-12.90)	12.90 (3.61-13.59)
	Cooling (UK)	4.60 (1.38-5.15)	5.61 (1.47-5.80)	6.53 (1.56-7.45)	8.65 (3.64-9.65)	11.01 (5.19-11.83)	12.19 (5.19-12.83)
SHF (nominal)		0.79	0.81	0.76	0.77	0.72	0.72
COP / EER (nominal)		3.71 / 3.30	4.00 / 3.70	3.61 / 3.60	3.41 / 3.23	3.41 / 3.01	3.50 / 2.50
SCOP (ηsh) / SEER (ηsc) (BS EN14825)		4.10 / 6.00	4.10 / 6.40	4.10 / 6.50	4.10 / 6.00	4.1 (162.7%) / 5.2 (213%)	4.0 (158.7%) / 5.1 (208%)
ErP ENERGY EFFICIENCY CLASS	Heating/Cooling	A+ / A+	A+ / A++	A+ / A++	A+ / A+	A+ / A	A+ / A
AIRFLOW (l/s)	Lo-Mi1-Mi2-Hi	167-183-217-250	250-267-283-317	267-283-300-333	367-400-433-467	383-417-450-483	400-433-483-533
PIPE SIZE mm (in)	Gas/Liquid	12.7 (1/2") / 6.35 (1/4")	15.88 (5/8") / 6.35 (1/4")	15.88 (5/8") / 9.52 (3/8")	15.88 (5/8") / 9.52 (3/8")	15.88 (5/8") / 9.52 (3/8")	15.88 (5/8") / 9.52 (3/8")
SOUND PRESSURE LEVEL (dBA)	Lo-Mi1-Mi2-Hi	32-34-37-40	33-35-37-40	35-37-39-41	37-39-41-43	39-41-43-45	41-43-45-48
SOUND POWER LEVEL (dBA)		60	60	62	63	65	68
DIMENSIONS (mm)	Width x Depth x Height	960 x 680 x 230	1280 x 680 x 230	1280 x 680 x 230	1600 x 680 x 230	1600 x 680 x 230	1600 x 680 x 230
WEIGHT (kg)		26	32	32	37	38	40
ELECTRICAL SUPPLY		Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit	Fed by Outdoor Unit
FUSE RATING (BS88) - HRC (A)		6	6	6	6	6	6
INTERCONNECTING CABLE No. Cores		4	4	4	4	4	4
WIRED REMOTE CONTROLLER REFERENCE		PAR-40MAA	PAR-40MAA	PAR-40MAA	PAR-40MAA	PAR-40MAA	PAR-40MAA
WIRELESS REMOTE CONTROLLER REFERENCE		PAR-SL94B	PAR-SL94B	PAR-SL94B	PAR-SL94B	PAR-SL94B	PAR-SL94B

SUZ-M / PUZ-M - OUTDOOR UNITS		SUZ-M50VA	SUZ-M60VA	SUZ-M71VA	PUZ-M100VKA	PUZ-M125VKA	PUZ-M140VKA
SOUND PRESSURE LEVEL (dBA)	Heating/Cooling	48 / 49	49 / 51	49 / 51	51 / 54	54 / 56	55 / 57
SOUND POWER LEVEL (dBA	Cooling	64	65	66	70	72	73
WEIGHT (kg)		41	54	55	76	84	84
DIMENSIONS (mm)	Width x Depth x Height	800 x 285 x 714	840 x 330 x 880	840 x 330 x 880	1050 x 330 x 981	1050 x 330 x 981	1050 x 330 x 981
ELECTRICAL SUPPLY		220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz
PHASE		Single	Single	Single	Single	Single	Single
SYSTEM POWER INPUT (kW)	Heating/Cooling (nominal)	1.61 / 1.51	1.75 / 1.64	2.21 / 1.97	3.28 / 2.94	3.95 / 4.01	4.28 / 5.36
	Heating/Cooling (UK)	1.37 / 1.30	1.49 / 1.41	1.88 / 1.69	2.95 / 2.44	3.56 / 3.33	3.85 / 4.45
STARTING CURRENT (A)		8.0	9.3	9.5	14.2	17.3	23.2
SYSTEM RUNNING CURRENT (A)	Heating/Cooling [MAX]	8.0 / 7.1 [13.5]	9.3 / 8.4 [14.8]	9.5 / 9.1 [14.8]	14.2 / 12.6 [20.0]	17.0 / 17.3 [26.5]	18.4 / 23.2 [30.0]
FUSE RATING (BS88) - HRC (A)		20	20	20	32	32	40
MAINS CABLE No. Cores		3	3	3	3	3	3
MAX PIPE LENGTH (m)		30	30	30	55	65	65
MAX HEIGHT DIFFERENCE (m)		30	30	30	30	30	30
CHARGE REFRIGERANT (KG) / CO_2 EQUIVALENT (T)	R32 (GWP 675)	1.20 / 0.81 (7m)	1.25 / 0.84 (7m)	1.45 / 0.98 (7m)	3.10 / 2.09 (30m)	3.60 / 2.43 (30m)	3.60 / 2.43 (30m)
MAX ADDITIONAL REFRIGERANT (KG) / CO_2EQUIVALENT (T)	R32 (GWP 675)	1.66 / 1.12	1.71 / 1.15	2.37 / 1.80	4.10 / 2.77	5.00 / 3.38	5.00 / 3.38

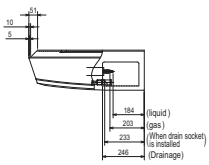
Note: Duty/standby not available on SUZ-M50/60/71VA.

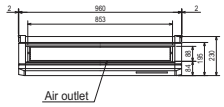
Product Dimensions PCA-M50KA

Upper View



Side View

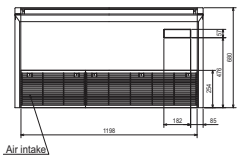




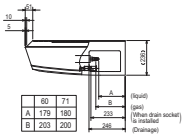
Front View

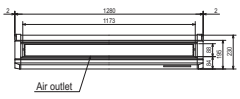
Product Dimensions PCA-M60/71KA

Upper View



Side View

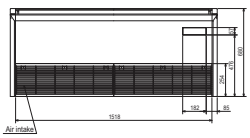




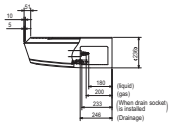
Front View

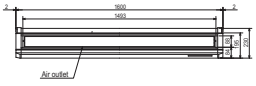
Product Dimensions PCA-M100/125/140KA

Upper View



Side View





Front View

MITSUBISHI ELECTRIC
Changes for the Better

Telephone: 01707 282880
email: air.conditioning@meuk.mee.com
web: airconditioning.mitsubishielectric.co.uk

UNITED KINGDOM Mitsubishi Electric Europe Living Environment Systems Division
Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England General Enquiries Telephone: 01707 282880 Fax: 01707 278881
IRELAND Mitsubishi Electric Europe Westgate Business Park, Ballymount, Dublin 24, Ireland
Telephone: Dublin (01) 419 8800 Fax: Dublin (01) 419 8890 International code: (003531)

Green Gateway

www.greengateway.mitsubishielectric.co.uk

Mitsubishi Electric UK's commitment to the environment

Follow us @meuk_les
Follow us @green_gateway

Mitsubishi Electric
Living Environmental Systems UK

mitsubishielectric2

BLOG thehub.mitsubishielectric.co.uk

Country of origin: United Kingdom – Japan – Thailand – Malaysia. ©Mitsubishi Electric Europe 2019. Mitsubishi and Mitsubishi Electric are trademarks of Mitsubishi Electric Europe B.V. The company reserves the right to make any variation in technical specification to the equipment described, or to withdraw or replace products without prior notification or public announcement. Mitsubishi Electric is constantly developing and improving its products. All descriptions, illustrations, drawings and specifications in this publication present only general particulars and shall not form part of any contract. All goods are supplied subject to the Company's General Conditions of Sale, a copy of which is available on request. Third-party product and brand names may be trademarks or registered trademarks of their respective owners.

Note: The fuse rating is for guidance only. Please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774) or R134a (GWP:1430). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP: 550), R407C (GWP:1650) or R134a (GWP:1300).

Effective as of January 2019

STATRON
NON STOP POWER

Material Safety Data Sheets

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: D05
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-D05-001
Document description: Material Safety Data Sheets

KBR CROSSWIND FREQCON

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Material Safety Data Sheets
D05

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	D05
Document name	Material Safety Data Sheets
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-20-02	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-20-02	C. Palenzuela
Checked by	2023-28-02	A. Fritz
Approved by	2023-28-02	M. Maaz

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-D05-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Battery Cells LF280K - Material Safety Data Sheet	LF280K MSDS.pdf
Stat-X – Material Safety Data Sheet	19012.10-SDSR-Stat-X-Class-1.4S
Antifrogen N coolant - Material Safety Data Sheet	MSDS-Antifrogen-N_EN_2019-1.pdf

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System
MSDS	Material Safety Data Sheet

Table 3: Generic terms and abbreviations used

2 General

The following components of the proposed PCS and BESS unit are falling under REACH regulation and thereby require a Material Safety Data Sheet (MSDS):

Item	Component	Purpose	Manufacturer	Type
1	Battery cells	Used for energy storage, packed inside modules	EVE	LF280K
2	Fire suppression aerosol cartridges	Fire suppression system inside battery cabinets	Stat-X	Aero-X Stat-X 60E Aerosol Extinguisher
3	Coolant	Coolant used for PCS water-cooling system	Clariant	Antifrogen N

Table 4: Other applicable documents

The Material Safety Data Sheets are attached to this document (*see section 1.3 "Other Applicable Documents"*).

3 Appendix

1. MSDS - Battery cells - EVE LF280K
2. MSDS - Fire suppression aerosol cartridges – Aero-X Stat-X 60E Aerosol Extinguisher
3. MSDS - Coolant – Clariant Antifrogen N

Material Safety Data Sheet

Section 1 – IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product Name: Li-ion Battery

Battery type: Li-ion Battery

Model	Voltage	Capacity（Ah）			Energy（Wh）
		Typical	Min	MAX	
LF280K	3.2V	280	/	/	896

Product Use: Energy Storage System

MSDS Date of Preparation: April 6th, 2021 ； Updated：/

Company Identification:

Name： EVE POWER Co., Ltd.

Address: No.68, Jingnan Avenue, Jingmen Hi-teck Zone, 448000 Jingmen City, Hubei Province

Post Code: 448000

Tel: +86-724-6079630

Fax:+86-724-6079688

Section 2 - Hazards Identification

- **Health Hazards (Acute and Chronic)**

These chemicals are contained in a sealed Al foil. Risk of exposure occurs only if the battery is mechanically or electrically abused. Contact of electrolyte with skin and eyes should be avoided.

- **Sign/Symptoms of Exposure**

A shorted battery can cause thermal and chemical burns upon contact with the skin. Maybe a reproductive hazard.

These products are classified as Articles under REACH and are not subject to the requirements for Information in the Supply Chain (Safety Data Sheets and Labels). While batteries may release hazardous substances if damaged, this is not an intended release as defined under REACH. Batteries are not classified as hazardous under the CLP.

The following information is provided to assist in the safe use of our products.

CAUTION: Battery can explode or leak if heated, disassembled, shorted, recharged, exposed to fire or high temperature or inserted incorrectly. Keep in original package until ready to use. Do not carry batteries

loose in your pocket or purse. Keep batteries away from children. If swallowed, consult a physician at once.

Under certain misuse conditions and by abusively opening the battery, exposed lithium can react with water or moisture in the air causing potential thermal burns or fire.

Section 3 – Composition/Information on Ingredient

Material or ingredient	Chemical Formula	CAS No.	Wt %

Lithium iron phosphate	$LiFePO_4$	/	37.0
Phosphate(1-),hexafluoro,lithium	$LiPF_6$	(CAS-No.)21324-40-3 (EC-No.)244-334-7	3.2
Graphite	C	(CAS-No.)7782-42-5 (EC-No.)231-955-3	19.1
Aluminum	Al	(CAS-No.)7429-90-5 (EC-No.)231-072-3 (EC Index-No.)013-002-00-1	4.6
Copper	Cu	(CAS-No.)7440-50-8 (EC-No.)231-159-6	7.5
Polypropylene	PP	(CAS-No.) 9003-07-0 (EC-No.)618-352-4	4.8

Section 4 - First Aid Measures

- **General Advice**

  The chemicals in this product are contained in a sealed package. Exposure to the contents will not occur unless the battery leaks, is exposed to high temperatures or is mechanically, physically, or electrically abused.

- **Eye**

  Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

- **Skin**

  Remove contaminated clothes and rinse skin with plenty of water or shower for 15 minutes. Get medical aid.

- **Inhalation**

  Remove from exposure and move to fresh air immediately. Use oxygen if available.

- **Ingestion**

  Give at least 2 glasses of milk or water. Induce vomiting unless patient is unconscious. Call a physician.

- **Note to Physician**

  Published reports recommend removal from the esophagus be done endoscopically (under direct visualization). Batteries beyond the esophagus need not be retrieved unless there are signs of injury to the GI tract or a large diameter battery fails to pass the pylorus. If asymptomatic, follow up x rays are necessary only to confirm the passage of larger batteries. Confirmation by stool inspection is preferable under most circumstances. Potential leakage of less than 50 milligrams of dimethoxyethane and propylene carbonate. Dimethoxyethane rapidly evaporates. Do not give ipecac.

Section 5 - Fire Fighting Measures

- **Fire and Explosion Hazards**: Batteries may burst and release hazardous decomposition products when exposed to a fire situation.
- **Extinguishing Media**

  CO_2.

- **Special Fire-Fighting Procedures**

  Self-contained breathing apparatus.
- **Unusual Fire and Explosion Hazards**

  Cell may vent when subjected to excessive heat-exposing battery contents.
- **Hazardous Combustion Products**

  Carbon monoxide, carbon dioxide, lithium oxide fumes.

Section 6 - Accidental Release Measures

- **Steps to be Taken in case Material is Released or Spilled**

  If the battery material is released, remove personnel from area until fumes dissipate. Provide maximum ventilation to clear out hazardous gases. Wipe it up with a cloth, and dispose of it in a plastic bag and put into a steel can. The preferred response is to leave the area and allow the battery to cool and vapors to dissipate. Provide maximum ventilation. Avoid skin and eye contact or inhalation of vapors. Remove spilled liquid with absorbent and incinerate.
- **Waste Disposal Method**

  It is recommended to discharge the battery to the end, handing in the abandoned batteries to related department unified, dispose of the batteries in accordance with approved local, state, and federal requirements. Consult state environmental protection agency and/or federal EPA.

Section 7 - Handling and Storage

The battery should not be opened, destroyed or incinerate, since they may leak or rupture and release to the environment the ingredients that they contain in the hermetically sealed container.

Do not short circuit terminals, or over charge the battery, forced over-discharge, throw to fire. Do not crush or puncture the battery, or immerse in liquids.

- **Precautions to be taken in Handling and Storing**

  Avoid mechanical or electrical abuse. Storage preferably in cool, dry and ventilated area, which is subject to little temperature change. Storage at high temperatures should be avoided.

  Do not place the battery near heating equipment, nor expose to direct sunlight for long periods.
- **Other Precautions**

  The battery may explode or cause burns, if disassembled, crushed or exposed to fire or high temperatures.

  Do not short or install with incorrect polarity.
- **Storage**

  Store batteries in a dry place at normal room temperature.

Section 8 - Exposure Controls, Personal Protection

- **Exposure Limits**: No exposure to the battery components should occur during normal use.
- **Ventilation:** Not necessary under conditions of normal use.
- **Respiratory Protection**

  In case of battery venting, provide as much ventilation as possible. Avoid confined areas with venting cell cores. Respiratory Protection is not necessary under conditions of normal use.
- **Skin Protection:** None required for normal use. Use butyl rubber gloves when handling leaking

batteries..

- **Eye Protection:** None required for normal use. Wear safety goggles when handling leaking batteries.
- **Protective Gloves**

  Not need
- **Other Protective Clothing or Equipment**

  Not necessary under conditions of normal use.

  Personal Protection is recommended for venting battery: Respiratory protection, Protective gloves, protective clothing and safety glass with side shields.

Section 9 - Physical and Chemical Properties

Appearance and Odor: prismatic cell, no odor.

Water Solubility: Insoluble

Flash Point: Not Applicable

Section 10 - Stability and Reactivity

- **Stability**

  Stable
- **Conditions to Avoid**

  Heating, mechanical abuse and electrical abuse.
- **Hazardous Decomposition Products**

  N/A.
- **Hazardous Polymerization**

  N/A.

Section 11 - Toxicological Information

- **Potential Health Effects**: The chemicals in this product are contained in a sealed package. Exposure to the contents will not occur unless the battery leaks, is exposed to high temperatures or is mechanically, physically, or electrically abused.
- **Eye Contact**: Contact with battery contents may cause irritation.
- **Skin Contact**: Contact with battery contents may cause irritation.
- **Inhalation**: Inhalation of vapors or fumes released due to heat or a large number of leaking batteries may cause respiratory and eye irritation.
- **Ingestion**: Seek immediate medical advice. Batteries lodged in the esophagus should be removed immediately since leakage, caustic burns and perforation package occur as soon as two hours after ingestion. Irritation to the internal/external mouth areas, may occur following exposure to a leaking battery.

Section 12 - Ecological Information

When promptly used or disposed the battery does not present environmental hazard. When disposed, keep away from water, rain and snow.

Section 13 - Disposal Considerations

- **APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION**

  If batteries are still fully charged or only partially discharged, they can be considered a reactive hazardous waste because of significant amount of not reaction or unconsumed lithium remaining in the spent battery. The battery must be neutralized through an approved secondary treatment facility prior to disposal as a hazardous waste. Recycling of battery can be done in authorized facility, through licensed waste carrier.

  lithium ion cell batteries are labeled in compliance with the EU Battery Directive 2006/66/EC.

Section 14 - Transport Information

Emergency Phone Number:

CHEMTREC 24 Hour Emergency Response Hotline （+86-752-2606966）

Persons who prepare or offer lithium batteries for transport are required by regulation to be trained and certified.

The information provided below is for informational purposes only.

Lithium Ion Batteries
UN No.：UN3480
EmS No.:F-A,S-I
Marine pollutant:No
Proper shipping name:Lithium ion battery（Including lithium ion ploymer batteries）
Hazard classification: The goods shall be complied with the requirements of section IA of Packing Instructions 965 of 61 th DGR Manual of IATA（2020）Edition and special provision 188 of IMDG CODE（Amdt.39-18）Edition,including the passing of the UN38.3 test.

The products meet all the requirements of the IATA DGR 61th edition, under special provisions including UN 38.3 test . If the package exceeds the table 965 - the - standard, so it belongs to the ninth category of dangerous goods. Only cargo transport. According to the packing instructions 965 Part IA IATA 61th version of the DGR requirements.

Lithium ion cells and batteries must be offered for transport at a state of charge (SoC) not exceeding 30% of their rated design capacity from 1 April 2016.

Shipping packages containing rechargeable lithium batteries must be labeled, regardless of size or number of batteries, with a lithium battery handling label.

More information concerning shipping, testing, marking and packaging can be obtained from Label master at http://www.labelmaster.com.

Separate battery when shipping to prevent short-circuiting. They should be packed in strong packaging for support during transport. Take in a cargo of them without falling, dropping, and breakage. Prevent

collapse of cargo piles and wet by rain.

Section 15 - Regulatory Information

- **Law Information**

  《Dangerous Goods Regulation》

  《Recommendations on the Transport of Dangerous Goods Model Regulations》

  《International Maritime Dangerous Goods》

  《Technical Instructions for the Safe Transport of Dangerous Goods》

  《Classification and code of dangerous goods》

  《Occupational Safety and Health Act》(OSHA)

  《Toxic Substances Control Act》(TSCA)

  《Consumer Product Safety Act》(CPSA)

  《Federal Environmental Pollution Control Act》(FEPCA)

  《The Oil Pollution Act》(OPA)

  《Superfund Amendments and Reauthorization Act Title III (302/311/312/313)》(SARA)

  《Resource Conservation and Recovery Act》(RCRA)

  《Safety Drinking Water Act》(CWA)

  《California Proposition 65》

  《Code of Federal Regulations》(CFR)

EU BATTERY DIRECTIVE: These batteries comply with the Directive substance limits and labeling requirements.

EU REACH REGISTRATION: These products are manufactured articles and not subject to REACH registration requirements.

EU Labeling: lithium ion cell batteries are labeled in compliance with the EU Battery Directive 2006/66/EC.

Section 16 – Other Information

EVE Hazard Rating: Health: 0 Fire: 0 Reactivity: 0

==========

Data supplied is for use only in connection with occupational safety and health.

DISCLAIMER: This MSDS is intended to provide a brief summary of our knowledge and guidance regarding the use of this material. The information contained here has been compiled from sources considered by EVE to be dependable and is accurate to the best of the Company's knowledge. It is not meant to be an all inclusive document on worldwide hazard communication regulations.

Stat-X® Aerosol Fire Suppression

Fireaway

Safety Data Sheet according to Regulation (EC) No. 1907/2006 & Amendment 987/2008 (REACH) & HazCom 2012

5852 Baker Road
Minnetonka, MN
55345
USA

SDSR# FU011B
DATE: 11/18

SECTION 1: Identification of the Substance/Mixture and of the Company/undertaking Product Identifier

Stat-X® Condensed Aerosol Generators - Models 30 to 2500.

Details of the supplier of the safety data sheet:
Fireaway Inc., 5852 Baker Road, Minnetonka, MN, 55345, USA
Telephone +1 (952) 935-9745, Fax +1 (952) 935-9757
Email address of the competent person: info@statx.com

For information only, call 1-952-935-9745.
For emergencies, call
INFOTRAC
USA & CANADA: +1-800-535-5053
INTERNATIONAL: +1-352-323-3500 (collect)

Only Representative Contact:
Blue Frog Scientific Limited, Quantum House,
91 George Street, Edinburgh, EH2 3ES
+44 (0) 131 523 1412

SECTION 2: Hazards Identification

Possible exposure to aerosol suppression agent if generator is activated. May cause temporary, mild irritation of mucous membranes if inhaled. US EPA listed under US EPA SNAP List for use as a total flooding fire suppression agent in normally occupied spaces.

2.1 Classification

OSHA Regulatory Status

All 3 chemicals listed below are not stored as raw loose powder but homogenously blended and pressed into a single solid aerosol forming compound pellet. Exposure to raw dust from the pellet is very limited which may contain any of the 3 chemicals listed in Section 3.

Potassium nitrate: Oxidizer solid

Dicyandiamide: Not a hazardous substance or mixture

Phonolic resin: This chemical is considered hazardous under 29 CFR 1910.1200 (Hazard Communication)

2.2 Label Elements

Signal Word

WARNING



Hazard Statements

Potassium nitrate dust:

May intensity fire; oxidizer (H272)

Dicyandiamide dust: Not a hazardous substance or mixture

Phenolic Resin dust:

Causes skin irritation (H315)

Causes eye irritation (H319)

May cause respiratory irritation (H335)

Precautionary Statements

Potassium nitrate: Keep/store away from clothing/combustible materials

Prevention

Wash face, hands and any exposed skin thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Avoid breathing particles/dust/gas. Handle in accordance with good industrial hygiene and safety practice. Keep away from heat.

Response

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rising. If eye irritation persists: Get medical advice/attention.

IF ON SKIN: Wash with plenty of soap and water. If skin irritation or rash occurs: Get medical advice/attention.

IF ON CLOTHING: Dispose of contaminated clothing and gloves after use in accordance with applicable laws and good industrial hygiene practices. Contaminated clothing should not be allowed out of the workplace unless well rinsed with water.

Disposal

Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards Not Otherwise Classified (HNOC)

Not applicable.

SECTION 3: Composition/Information on Ingredients

Hazardous components: Does not contain dangerous materials as defined by ordinance on hazardous materials.

Components – Chemical (Hazardous Components ≥ 1%)	**CAS#**	**Weight %**	**COMMENTS:**
Potassium Nitrate ECHA Registration no. 01-2119488224-35-0066	7757-79-1	75.0	Components are blended and pressed into a highly stable, molded form. Molded composition is contained within a sealed double-walled stainless steel housing – no environmental exposure. Upon generator unit activation these chemical elements are not discharged from the unit but are fully consumed by an internal chemical reaction.
DCDA	461-58-5	16.5	
Organic Resin	9003-35-4	8.5	
Appearance & Odor:			Beige to white in color. No odor.
Auto-Ignition Temperature:			300^0 C
Solubility in Water:			Slightly Soluble

SECTION 4: First aid measures

Contact Method:	**Procedure:**
Inhalation	Remove to fresh air
Eye Contact	Flush with water
Skin Contact	Wash with soap and water.
Ingestion	Not a likely route of exposure.
Seek medical attention for further treatment, observation, and support if necessary.	

SECTION 5: Firefighting Measures

In the event of a fire, evacuate the area and inform emergency services. Ignition of Stat-X produces a fire-suppression aerosol. Water may be used as an additional suppression agent.

SECTION 6: Accidental Release Measures

If these devices are spilled they can be safely recovered by hand and should be inspected for damage prior to repacking. Suspect or damaged articles should be labeled and consigned for correct destruction.

SECTION 7: Handling and Storage

Store in temperate conditions. Avoid shock, electric currents, static discharge, excessive heat and extended periods of storage at temperatures greater than 65°C.

SECTION 8: Exposure Controls/Personal Protection

Respiratory Protection	Ventilate area completely after discharge. Do not enter area prior to complete venting of enclosure. Use filter mask as necessary during clean-up.
Hand Protection	Wear gloves if handling generators prior to cooling.
Eye Protection	Safety glasses are advisable.
Skin Protection	N/A

SECTION 9: Physical and Chemical Properties

Appearance:	Stainless Steel Cylinder up to 270 mm in length

SECTION 10: Stability and Reactivity

These devices are extremely stable below 125°C. They are packaged to protect the articles from electrical power and shock. As with any stored products, stored packaging should be protected from fire and high temperatures.

SECTION 11: Toxicological Information

Toxic by-products of combustion are extremely low. Main by-products are listed below with 15-minute TWA values for a maximum 100g/m^3 concentration in a hermetically sealed volume.

Gas	15 minute Time Weighted Average in parts per million
NO_2	1.08
NO	0.97
CO	84.20

SECTION 12: Ecological Information

These devices are sealed and present no ecological hazards. The aerosol produced upon ignition has very low global warming potential and an ozone depletion potential = 0.

SECTION 13: Disposal Considerations

Comply with all local, state, and federal/international regulations.

SECTION 14: Transport Information

UN Number: 0432	Authorized Modes of Transport: Motor Vehicle, Rail, Cargo Vessel, Cargo and Passenger Air
UN Classification: Class 1.4S Articles Pyrotechnic for Technical Purposes	Shipping Limitations: Cargo Aircraft: Max single packaging – 100 kg. Passenger Aircraft: Max single packaging – 25 kg.

SECTION 15: Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture
EU regulations

Phenolic Resin:

Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex I, as amended:
Not listed.
Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex II, as amended:
Not listed.
Regulation (EC) No. 850/2004 On persistent organic pollutants, Annex I as amended:
Not listed.
Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1 as amended:
Not listed.
Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2 as amended:
Not listed.
Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3 as Amended:
Not listed.
Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V as amended
Not listed.
Regulation (EC) No. 166/2006 Annex II Pollutant Release and Transfer Registry, as amended
Not listed.
Regulation (EC) No. 1907/2006, REACH Article 59(1) Candidate List as currently published by ECHA
Not listed.

Authorizations

Regulation (EC) No. 143/2011 Annex XIV Substances Subject to Authorization:
Not listed.
Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorization, as amended:
FORMALDEHYDE (CAS 50-00-0):

Restrictions on use

Regulation (EC) No. 1907/2006, REACH Annex XVII Substances subject to restriction on marketing and use as amended

FORMALDEHYDE (CAS 50-00-0)

Directive 2004/37/EC: on the protection of workers from the risks related to exposure to carcinogens and mutagens at work, as amended:

FORMALDEHYDE (CAS 50-00-0)

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breastfeeding, as amended:

FORMALDEHYDE (CAS 50-00-0)

Other EU regulations

Directive 2012/18/EU on major accident hazards involving dangerous substances:

FORMALDEHYDE (CAS 50-00-0)

Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work, as amended:

FORMALDEHYDE (CAS 50-00-0)

Directive 94/33/EC on the protection of young people at work, as amended

FORMALDEHYDE (CAS 50-00-0)

Other regulations

The product is classified and labelled in accordance with EC directives or respective national laws.

National regulations

This preparation is not classified as dangerous according to European Union legislation. Young people under 18 years old are not allowed to work with this product according to EU Directive 94/33/EC on the protection of young people at work. Follow national regulation for work with chemical agents.

U.S. INFORMATION

Potassium Nitrate:

TSCA 8(b) inventory: Potassium Nitrate
CALIFORNIA PROPOSITION 65: Potassium Nitrate (CAS 7757-79-1) is not listed.
Clean Water Act (CWA): No product found

Phenolic Resin:

CALIFORNIA PROPOSITION 65: Formaldehyde (CAS 50-00-0) is listed.
Clean Water Act (CWA): Hazardous substance

SECTION 16: Other Information

Comply with manufacturer's installation and maintenance procedures.

Disclaimer: The information contained herein is accurate to the best knowledge and belief of Fireaway Inc., and is intended to describe the product for health, safety, and environmental requirements only. It is not intended and should not be construed as a warranty. Consult Fireaway for further information.

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Trade name
ANTIFROGEN N

Material number: 107601

Chemical nature: Monoethylene glycol (1,2-ethane diol) with corrosion inhibitors

1.2. Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses of the substance or mixture

Industry sector :	Functional Fluids
Type of use :	Brine for refrigeration

Exposure scenarios: see annex

1.3. Details of the supplier of the safety data sheet

Identification of the company
Clariant Produkte (Deutschland) GmbH
65926 Frankfurt am Main
Telephone no. : +49 69 305 18000

Information about the substance/mixture
BU Industrial & Consumer Specialties
Product Stewardship
e-mail: SDS.Europe@clariant.com

1.4. Emergency telephone number

00800-5121 5121 (24 h)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification (REGULATION (EC) No 1272/2008)

Acute toxicity, Category 4	H302: Harmful if swallowed.
Specific target organ toxicity - repeated exposure, Category 2	H373: May cause damage to organs through prolonged or repeated exposure.

2.2 Label elements

Labelling (REGULATION (EC) No 1272/2008)

Hazard pictograms :



Signal word : Warning

Hazard statements : H302 Harmful if swallowed.

H373 May cause damage to organs through prolonged or repeated exposure.

Precautionary statements :

Prevention:

P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response:

P314 Get medical advice/ attention if you feel unwell.
P337 + P313 If eye irritation persists: Get medical advice/ attention.

Disposal:

P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Other hazards

After consideration of all available toxicity and ecotoxicity data it is concluded that the substance does not fulfil the PBT or vPvB criteria.

No additional hazards are known except those derived from the labelling.

SECTION 3: Composition/information on ingredients

3.2 Mixtures

Hazardous components

Chemical name	CAS-No. EC-No. Index-No. Registration number	Classification	Concentration (% w/w)
Ethanediol	107-21-1 203-473-3 603-027-00-1 01-2119456816-28 01-2119456816-28-0000 01-2119456816-28-0003 01-2119456816-28-0038 01-2119456816-28-XXXX	STOT RE 2; H373 Acute Tox. 4; H302	>= 90 - <= 95

For explanation of abbreviations see section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice : Remove/Take off immediately all contaminated clothing.

If inhaled	:	Get medical attention if symptoms occur.
In case of skin contact	:	In case of contact, immediately flush skin with plenty of water.
In case of eye contact	:	In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
If swallowed	:	Get medical attention immediately.

4.2 Most important symptoms and effects, both acute and delayed

Symptoms	:	No symptoms known currently.
Risks	:	No hazards known at this time.

4.3 Indication of any immediate medical attention and special treatment needed

Treatment	:	Treat symptomatically.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media	:	Water spray jet Alcohol-resistant foam Carbon dioxide (CO2) Dry powder

5.2 Special hazards arising from the substance or mixture

Specific hazards during firefighting	:	In case of fires, hazardous combustion gases are formed: Carbon monoxide (CO) Nitrogen oxides (NOx)

5.3 Advice for firefighters

Special protective equipment for firefighters	:	Self-contained breathing apparatus

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Personal precautions	:	Ensure adequate ventilation. Wear suitable protective equipment.

6.2 Environmental precautions

Environmental precautions	:	Do not allow to enter drains or waterways

6.3 Methods and material for containment and cleaning up

Methods for cleaning up : Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust).

Can be landfilled or incinerated, when in compliance with local regulations.

6.4 Reference to other sections

Information regarding Safe handling, see chapter 7., For personal protection see section 8., For disposal considerations see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling : Handle and open container with care.
Provide adequate ventilation.

Advice on protection against fire and explosion : Observe the general rules of industrial fire protection

Hygiene measures : Keep away from food and drink.

7.2 Conditions for safe storage, including any incompatibilities

Advice on common storage : Do not store with alkalies
Do not store with strong oxidizing agents

7.3 Specific end use(s)

Specific use(s) : No further recommendations.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Occupational Exposure Limits

Components	CAS-No.	Value type (Form of exposure)	Control parameters	Basis
Ethanediol	107-21-1	TWA	20 ppm 52 mg/m3	2000/39/EC
Further information	Identifies the possibility of significant uptake through the skin, Indicative			
		STEL	40 ppm 104 mg/m3	2000/39/EC
Further information	Identifies the possibility of significant uptake through the skin, Indicative			

Derived No Effect Level (DNEL) according to Regulation (EC) No. 1907/2006:

Substance name	End Use	Exposure routes	Potential health effects	Value
Ethanediol CAS-No.: 107-21-1	Workers	Dermal	Long-term systemic effects	106 mg/kg bw/day

Remarks:	DNEL			
	Workers	Inhalation	Long-term local effects	35 mg/m3
Remarks:	DNEL			
	General population	Dermal	Long-term systemic effects	53 mg/kg bw/day
Remarks:	DNEL			
	General population	Inhalation	Long-term local effects	7 mg/m3

Predicted No Effect Concentration (PNEC) according to Regulation (EC) No. 1907/2006:

Substance name	Environmental Compartment	Value
Ethanediol CAS-No.: 107-21-1	Fresh water	10 mg/l
	salt water	1 mg/l
	Water (intermittent release)	10 mg/l
	Fresh water sediment	37 mg/kg dry weight (d.w.)
	Soil	1,53 mg/kg dry weight (d.w.)
	Sewage treatment plant	199,5 mg/l
	Marine sediment	3,7 mg/kg dry weight (d.w.)

8.2 Exposure controls

Personal protective equipment

Eye protection : Depending on the risk, wear sufficient eye protection (safety glasses with side protection or goggles, and if necessary, face shield.)

Hand protection
- Break through time : 480 min
- Glove thickness : 0,7 mm
- Remarks : Long-term exposure Impervious butyl rubber gloves

- Break through time : 30 min
- Glove thickness : 0,4 mm
- Remarks : For short-term exposure (splash protection): Nitrile rubber gloves.

- Remarks : These types of protective gloves are offered by various manufacturers. Please note the manufacturers´ detailed statements, especially about the minimum thickness and the minimum breakthrough time. Consider also the particular working conditions under which the gloves are being used.

Respiratory protection : Use respiratory protection in case of insufficient exhaust ventilation or prolonged exposure
Full mask to standard DIN EN 136
Filter A (organic gases and vapours) to standard DIN EN 141
The use of filter apparatus presupposes that the environment atmosphere contains at least 17% oxygen by volume, and does not exceed the maximum gas concentration, usually

0.5% by volume. Relevant guidelines to be considered include EN 136/141/143/371/372 as well as other national regulations.

Protective measures : Do not inhale vapours
Avoid contact with skin and eyes.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance	:	Liquid
Colour	:	yellow
Odour	:	slightly perceptible
Odour Threshold	:	not tested.
pH	:	approx. 8 (20 °C) Concentration: 100 g/l Method: DIN 19268
Melting point	:	-32 °C Method: DIN 51583
Boiling point	:	approx. 165 °C (1.013 hPa) Method: ASTM D 1120 166 °C (1.013 hPa) Method: ASTM D 1120
Flash point	:	119 °C Method: ASTM D6450 (closed cup)
Evaporation rate	:	not tested.
Flammability (solid, gas)	:	Not applicable
Burning number	:	Not applicable
Upper explosion limit / upper flammability limit	:	not tested.
Lower explosion limit / Lower flammability limit	:	3 %(V) Data relate to solvent
Vapour pressure	:	< 0,01 kPa (20 °C) Method: Calculated by Syracuse.
Relative vapour density	:	not tested.

Density	:	1,1138 g/cm3 (20 °C) Method: DIN 51757
Bulk density	:	Not applicable
Solubility(ies)		
Water solubility	:	completely miscible (20 °C)
Solubility in other solvents	:	not tested. Solvent: fat
Partition coefficient: n-octanol/water	:	Not applicable
Auto-ignition temperature	:	> 400 °C Method: DIN 51794
Decomposition temperature	:	> 300 °C Method: DSC Measurement under nitrogen No decomposition up to 300 °C.
Viscosity		
Viscosity, dynamic	:	20,3 mPa.s (20 °C)
Viscosity, kinematic	:	20,3 mm2/s (20 °C) Method: DIN 51562
Explosive properties	:	Not explosive Method: Expert judgement
Oxidizing properties	:	The substance or mixture is not classified as oxidizing. Method: Expert judgement

9.2 Other information

Surface tension	:	33,8 mN/m
Molecular weight	:	Not applicable
Metal corrosion rate	:	< 6,25 mm/a
Minimum ignition energy	:	not tested.
Particle size	:	Not applicable
Self-ignition	:	Not applicable

SECTION 10: Stability and reactivity

10.1 Reactivity

See section 10.3. "Possibility of hazardous reactions"

10.2 Chemical stability

Stable under normal conditions.
hygroscopic

10.3 Possibility of hazardous reactions

Hazardous reactions : Reactions with alkalies.
Reactions with oxidising agents.

Stable

10.4 Conditions to avoid

Conditions to avoid : None known.

10.5 Incompatible materials

Materials to avoid : not known

10.6 Hazardous decomposition products

When handled and stored appropriately, no dangerous decomposition products are known

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Product:

Acute oral toxicity : Acute toxicity estimate: 519,54 mg/kg
Method: Calculation method

Acute inhalation toxicity : LC50 (Rat, male and female): > 2,5 mg/l
Exposure time: 6 h
Test atmosphere: dust/mist
Remarks: Information refers to the main component.

Acute dermal toxicity : LD50 (Mouse, male and female): > 3.500 mg/kg
Remarks: Information refers to the main component.

Components:

Ethanediol:

Acute oral toxicity : LD50 (Rat, male and female): 22.000 mg/kg
Method: Other
GLP: no

Acute inhalation toxicity : LC50 (Rat, male and female): > 2,5 mg/l
Exposure time: 6 h

Test atmosphere: dust/mist
Method: Other
GLP: yes

Acute dermal toxicity : LD50 (Mouse, male and female): > 3.500 mg/kg
Method: Other
GLP: yes

Skin corrosion/irritation

Product:

Species : Rabbit
Result : No skin irritation
Remarks : Information refers to the main component.

Components:

Ethanediol:

Species : Rabbit
Exposure time : 20 h
Method : Other
Result : No skin irritation
GLP : no

Serious eye damage/eye irritation

Product:

Remarks : no data available

Components:

Ethanediol:

Species : Rabbit
Exposure time : 24 h
Method : Other
Result : No eye irritation
GLP : no

Respiratory or skin sensitisation

Product:

Test Type : Guinea pig maximization test
Species : Guinea pig
Method : Magnusson/Kligman
Result : non-sensitizing
Remarks : Information refers to the main component.

Components:

Ethanediol:

Test Type : Maximisation Test
Exposure routes : Dermal

Species	:	Guinea pig
Method	:	OECD Test Guideline 406
Result	:	Not a skin sensitizer.
GLP	:	yes

Assessment : Harmful if swallowed.

Germ cell mutagenicity

Product:

Germ cell mutagenicity- Assessment : It is concluded that the product is not mutagenic based on evaluation of several mutagenicity tests.

Information refers to the main component.

Components:

Ethanediol:

Genotoxicity in vitro :
Test Type: Ames test
Test system: Salmonella typhimurium
Concentration: 33 - 5000 µg/plate
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
GLP: yes

Test Type: Ames test
Test system: Escherichia coli
Concentration: 33 - 5000 µg/plate
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
GLP: yes

Test Type: Chromosome aberration test in vitro
Test system: Chinese hamster ovary cells
Metabolic activation: with and without metabolic activation
Method: Other
Result: negative
GLP: yes

Test Type: In vitro mammalian cell gene mutation test
Test system: mouse lymphoma cells
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 476
Result: negative
GLP: yes

Genotoxicity in vivo :
Test Type: Dominant lethal assay
Species: Rat (male and female)
Strain: Fischer F344
Application Route: oral (feed)

Exposure time: 3 generation
Dose: 40 - 200 - 1000 mg/kg
Method: Other
Result: negative
GLP: no

Germ cell mutagenicity-Assessment : It is concluded that the product is not mutagenic based on evaluation of several mutagenicity tests.

Carcinogenicity

Product:

Carcinogenicity - Assessment : No evidence of carcinogenicity in animal studies.

Information refers to the main component.

Components:

Ethanediol:

Species	:	Mouse, male and female
Application Route	:	oral (feed)
Exposure time	:	2 a
Dose	:	6250-12500-25000-50000 ppm
Group	:	yes
Frequency of Treatment	:	daily
NOAEL	:	1.500 mg/kg bw/day
Method	:	Other
GLP	:	yes

Carcinogenicity - Assessment : Not classifiable as a human carcinogen.

Reproductive toxicity

Product:

Reproductive toxicity - Assessment : No indications of toxic effects were observed in reproduction studies in animals.

No reproductive toxicity to be expected.

Information refers to the main component.

Information refers to the main component.

Components:

Ethanediol:

Effects on fertility : Test Type: Three-generation study
Species: Rat, male and female
Strain: Fischer F344
Application Route: oral (feed)
Dose: 40 - 200 - 1000

General Toxicity - Parent: NOAEL: > 1.000 mg/kg body weight
General Toxicity F1: NOAEL: > 1.000 mg/kg body weight
General Toxicity F2: NOAEL: > 1.000 mg/kg body weight
Method: Other
GLP: no

Effects on foetal development	:	Test Type: reproductive and developmental toxicity study Species: Rat, female Strain: Sprague-Dawley Application Route: oral (gavage) Dose: 150 - 500 - 1000 - 2500 mg/kg Duration of Single Treatment: 9 d General Toxicity Maternal: NOEL: 1.500 mg/kg body weight Teratogenicity: NOEL: 150 mg/kg body weight Method: Other GLP: yes
Reproductive toxicity - Assessment	:	No reproductive toxicity to be expected. No teratogenic effects to be expected.

STOT - single exposure

Product:

Remarks : no data available

Components:

Ethanediol:

Assessment : The substance or mixture is not classified as specific target organ toxicant, single exposure.

STOT - repeated exposure

Product:

Remarks : no data available

Components:

Ethanediol:

Target Organs : Kidney
Assessment : May cause damage to organs through prolonged or repeated exposure.

Repeated dose toxicity

Product:

Species : Rat, male and female
NOAEL : 200 mg/kg
Application Route : oral (gavage)
Method : OECD Test Guideline 407
Remarks : Information refers to the main component.

Species	:	Rat, male
NOAEL	:	150 mg/kg
Application Route	:	oral (feed)
Method	:	OECD Test Guideline 408
Remarks	:	Information refers to the main component.

Species	:	Dog, male
NOAEL	:	2,22 mg/kg
Application Route	:	Dermal
Method	:	OECD Test Guideline 410
Remarks	:	Information refers to the main component.

Components:

Ethanediol:

Species	:	Rat, male
NOAEL	:	150 mg/kg bw/day
Application Route	:	oral (feed)
Exposure time	:	16 w
Number of exposures	:	daily
Dose	:	50 - 150 - 500 - 1000 mg/kg
Group	:	yes
Method	:	OECD Test Guideline 408
GLP	:	No information available.

Species	:	Dog, male
NOAEL	:	2.200 - 4.400 mg/kg bw/day
Application Route	:	Dermal
Exposure time	:	4 w
Number of exposures	:	daily
Dose	:	2 - 4 mL/kg bw
Group	:	yes
Method	:	OECD Test Guideline 410
GLP	:	yes

Aspiration toxicity

Product:

no data available

Components:

Ethanediol:

No aspiration toxicity classification

Further information

Product:

Remarks	:	Kidney injury may occur.
Remarks	:	Poisoning affects the central nervous system
Remarks	:	The classification was made by the conventional (calculation)

method of the CLP Regulation (EC) No 1272/2008.

SECTION 12: Ecological information

12.1 Toxicity

Product:

Toxicity to fish	:	LC0 (Leuciscus idus (Golden orfe)): 1.000 mg/l LL50 (Danio rerio (zebra fish)): > 100 mg/l Exposure time: 96 h Test Type: static test Method: OECD Test Guideline 203 GLP: yes Remarks: By analogy with a product of similar composition
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): > 100 mg/l Exposure time: 48 h Method: OECD Test Guideline 202 Remarks: Information refers to the main component.
Toxicity to algae	:	EC50 (Selenastrum capricornutum (green algae)): 6.500 - 13.000 mg/l Exposure time: 96 h Remarks: Information refers to the main component.
Toxicity to microorganisms	:	EC20 (activated sludge): > 1.995 mg/l Exposure time: 30 min Method: ISO 8192 Remarks: Information refers to the main component.

Components:

Ethanediol:

Toxicity to fish	:	LC50 (Pimephales promelas (fathead minnow)): 72.860 mg/l Exposure time: 96 h Test Type: static test Analytical monitoring: yes Method: EPA GLP: no Remarks: The details of the toxic effect relate to the nominal concentration.
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): > 100 mg/l Exposure time: 48 h Test Type: static test Analytical monitoring: yes Method: OECD Test Guideline 202 GLP: yes
Toxicity to algae	:	EC50 (Pseudokirchneriella subcapitata (green algae)): 6.500 - 13.000 mg/l End point: Growth rate

Exposure time: 7 d
Test Type: static test
Analytical monitoring: no data available
Method: EPA
GLP: No information available.

Toxicity to microorganisms : EC20 (activated sludge, domestic): > 1.995 mg/l
End point: Bacteria toxicity (respiration inhibition)
Exposure time: 0,5 h
Analytical monitoring: no
Method: ISO 8192
GLP: no

Toxicity to fish (Chronic toxicity) : Chronic Toxicity Value: 2.629 mg/l
End point: Other
Exposure time: 30 d
Species: Fish
Method: Other
GLP: no
Remarks: The value is given based on a SAR/AAR approach using OECD Toolbox, DEREK, VEGA QSAR models (CAESAR models), etc.

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : NOEC: 8.590 mg/l
End point: Reproduction rate
Exposure time: 7 d
Species: Ceriodaphnia spec.
Test Type: semi-static test
Analytical monitoring: yes
Method: Other
GLP: No information available.
Remarks: The details of the toxic effect relate to the nominal concentration.

12.2 Persistence and degradability

Product:

Biodegradability : Biodegradation: 90 - 100 %
Exposure time: 10 d
Method: OECD Test Guideline 301A
Remarks: Readily biodegradable, according to appropriate OECD test.
Information refers to the main component.

Components:

Ethanediol:

Biodegradability : Test Type: aerobic
Inoculum: activated sludge
Concentration: 53 mg/l
Result: Readily biodegradable.
Biodegradation: 90 - 100 %
Related to: Dissolved organic carbon (DOC)

Exposure time: 10 d
Method: OECD Test Guideline 301A
GLP: yes

12.3 Bioaccumulative potential

Product:

Bioaccumulation	:	Remarks: no data available

Components:

Ethanediol:

Bioaccumulation	:	Remarks: Due to the low logPow bioaccumulation is not expected
Partition coefficient: n-octanol/water	:	log Pow: -1,36 Method: estimated GLP: no

12.4 Mobility in soil

Product:

Distribution among environmental compartments	:	Remarks: no data available

Components:

Ethanediol:

Distribution among environmental compartments	:	Adsorption/Soil Medium: water - soil log Koc: 0 Method: other (calculated)

12.5 Results of PBT and vPvB assessment

Product:

Assessment	:	After consideration of all available toxicity and ecotoxicity data it is concluded that the substance does not fulfil the PBT or vPvB criteria. . Remarks: Information refers to the main component.

Components:

Ethanediol:

Assessment	:	This substance is not considered to be persistent, bioaccumulating and toxic (PBT)..

12.6 Other adverse effects

Product:

Additional ecological information	:	If handled correctly it causes no disturbance in treatment plants. The classification was made by the conventional (calculation) method of the CLP Regulation (EC) No 1272/2008.

Components:

Ethanediol:

Environmental fate and pathways	:	not available
Additional ecological information	:	Do not allow to enter ground water, waterways or waste water.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product	:	Dispose of in accordance with local regulations.
Contaminated packaging	:	Uncontaminated packaging may be reused Packaging that cannot be cleaned should be disposed of as product waste

SECTION 14: Transport information

Section 14.1. to 14.5.

ADR	not restricted
ADN	not restricted
RID	not restricted
IATA	not restricted
IMDG	not restricted

14.6. Special precautions for user

See sections 6 to 8 of this Safety Data Sheet.

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code (International Bulk Chemicals Code)

No transport as bulk according IBC - Code.

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Volatile organic compounds	:	Directive 1999/13/EC on the limitation of emissions of volatile organic compounds According to the composition the product contains no VOC

component as defined by Directive 1999/13/EC.

Directive 2004/42/EC
According to the composition, the product contains no VOC components as defined by Directive 2004/42/EC.

Other regulations:

Apart from the data/regulations specified in this chapter, no further information is available concerning safety, health and environmental protection.

15.2 Chemical safety assessment

Chemical Safety Assessments (CSAs) are available for one or more of the component substances contained in this product.

SECTION 16: Other information

Full text of H-Statements

H302	:	Harmful if swallowed.
H373	:	May cause damage to organs through prolonged or repeated exposure if swallowed.

Full text of other abbreviations

Acute Tox.	:	Acute toxicity
STOT RE	:	Specific target organ toxicity - repeated exposure
2000/39/EC	:	Europe. Commission Directive 2000/39/EC establishing a first list of indicative occupational exposure limit values
2000/39/EC / TWA	:	Limit Value - eight hours
2000/39/EC / STEL	:	Short term exposure limit

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road; AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECHA - European Chemicals Agency; EC-Number - European Community number; ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention;

PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RID - Regulations concerning the International Carriage of Dangerous Goods by Rail; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; SVHC - Substance of Very High Concern; TCSI - Taiwan Chemical Substance Inventory; TRGS - Technical Rule for Hazardous Substances; TSCA - Toxic Substances Control Act (United States); UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative

Further information

Other information : Observe national and local legal requirements

Classification of the mixture:		**Classification procedure:**
Acute Tox. 4	H302	Calculation method
STOT RE 2	H373	Calculation method

This information corresponds to the present state of our knowledge and is intended as a general description of our products and their possible applications. Clariant makes no warranties, express or implied, as to the information's accuracy, adequacy, sufficiency or freedom from defect and assumes no liability in connection with any use of this information. Any user of this product is responsible for determining the suitability of Clariant's products for its particular application. Nothing included in this information waives any of Clariant's General Terms and Conditions of Sale, which control unless it agrees otherwise in writing. Any existing intellectual/industrial property rights must be observed. Due to possible changes in our products and applicable national and international regulations and laws, the status of our products could change. Material Safety Data Sheets providing safety precautions, that should be observed when handling or storing Clariant products, are available upon request and are provided in compliance with applicable law. You should obtain and review the applicable Material Safety Data Sheet information before handling any of these products. For additional information, please contact Clariant.

REG_EU / EN

Exposure scenario

Number	Title
ES 1	**Industrial use; Use as an intermediate** PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC15 - ERC6a Ethane-1,2-diol
ES 2	**Industrial use; Use of non-reactive processing aid at industrial site (no inclusion into or onto article)** PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC13, PROC14, PROC15 - ERC4 Ethane-1,2-diol
ES 3	**Industrial use; Distribution of substance** PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC15 - ERC1, ERC2, ERC3, ERC4, ERC5, ERC6a, ERC6b, ERC6c, ERC6d, ERC7 Ethane-1,2-diol
ES 4	**Industrial use; Formulation [mixing] of preparations and/or re-packaging** PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC14, PROC15 - ERC2 Ethane-1,2-diol
ES 5	**Industrial use; Use in polymer production** PROC1, PROC2, PROC3, PROC4, PROC5, PROC6, PROC8a, PROC8b, PROC9, PROC15 - ERC6c Ethane-1,2-diol
ES 6	**Industrial use; Coatings and paints, thinners, paint removers** PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC10, PROC13, PROC15 - ERC4 Ethane-1,2-diol
ES 7	**Professional use; Coatings and paints, thinners, paint removers, Adhesives, sealants, Foaming, Use in polymer processing** PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC10, PROC11, PROC13, PROC14, PROC15, PROC19 - ERC8a, ERC8c, ERC8d, ERC8f Ethane-1,2-diol
ES 8	**Consumer use; Coatings and paints, thinners, paint removers, Surface treatment** PC9a, PC15, PC18, PC31, PC24, PC34 - ERC8a, ERC8c, ERC8d, ERC8f Ethane-1,2-diol
ES 9	**Industrial use; Use in cleaning agents** PROC1, PROC2, PROC3, PROC4, PROC7, PROC8a, PROC8b, PROC10, PROC13 - ERC4 Ethane-1,2-diol
ES 10	**Professional use; Use in cleaning agents**

	PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC10, PROC11, PROC13 - ERC8a, ERC8d Ethane-1,2-diol
ES 11	**Consumer use; Use in cleaning agents** PC35 - ERC8a, ERC8d Ethane-1,2-diol
ES 12	**Industrial use; Use in lubricants** PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC9, PROC10, PROC13, PROC17, PROC18 - ERC4, ERC7 Ethane-1,2-diol
ES 13	**Industrial use; Metal working fluids** PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC9, PROC10, PROC13, PROC17 - ERC4 Ethane-1,2-diol
ES 14	**Professional use; Metal working fluids** PROC1, PROC2, PROC3, PROC5, PROC8a, PROC8b, PROC9, PROC10, PROC11, PROC13, PROC17 - ERC8a, ERC8d Ethane-1,2-diol
ES 15	**Professional use; Use in agrochemicals** PROC1, PROC2, PROC4, PROC8a, PROC8b, PROC9, PROC11, PROC13 - ERC8a, ERC8d Ethane-1,2-diol
ES 16	**Industrial use; Use in functional fluids** PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9 - ERC7 Ethane-1,2-diol
ES 17	**Professional use; Use in functional fluids** PROC1, PROC2, PROC3, PROC4, PROC8a, PROC9, PROC20 - ERC9a, ERC9b Ethane-1,2-diol
ES 18	**Consumer use; Heat transfer fluids, Hydraulic fluids** PC16, PC17 - ERC9a, ERC9b Ethane-1,2-diol
ES 19	**Professional use; Anti-freeze and de-icing products** PROC1, PROC2, PROC8a, PROC8b, PROC11 - ERC8d Ethane-1,2-diol
ES 20	**Consumer use; Anti-freeze and de-icing products** PC4 - ERC8d Ethane-1,2-diol
ES 21	**Industrial use, Professional use; Use in laboratories** PROC15 - ERC8a Ethane-1,2-diol
ES 22	**Industrial use; Use in water treatment agents**

	PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC13 - ERC3, ERC4 Ethane-1,2-diol
ES 23	**Consumer use; Adhesives, sealants** PC1 - ERC8c, ERC8f Ethane-1,2-diol
ES 24	**Industrial use; Manufacture of substance, Adhesives, sealants, Foaming, Use in coatings, Use in polymer production** PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC9, PROC10, PROC13, PROC14, PROC15 - ERC2, ERC3, ERC5, ERC6c Ethane-1,2-diol
ES 25	**Consumer use; Insulation foams** PC32 - ERC8c, ERC8f Ethane-1,2-diol

1. ES 1: Industrial use; Use as an intermediate

1.1. Title section

Environment		
CS1:	Industrial use (Use of intermediate)	ERC6a
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Mixing or blending in batch processes)	PROC5
CS6:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS7:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS8:	Industrial use (Use as laboratory reagent)	PROC15

1.2. ES 1 Conditions of use affecting exposure

1.2.1 ES 1 - CS 1: Control of environmental exposure: Industrial use (Use of intermediate) (ERC6a)

Remarks	:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

1.2.2 ES 1 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

1.2.3 ES 1 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

1.2.4 ES 1 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

1.2.5 ES 1 - CS 5: Control of worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

1.2.6 ES 1 - CS 6: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.

Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : inhalative
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 90 %
Personal protective measures : If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

1.2.7 ES 1 - CS 7: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

1.2.8 ES 1 - CS 8: Control of worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Product characteristics
Concentration of the Substance in : <= 100 %

Mixture/Article

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Storage : < 1 kg, < 1 l

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Use as laboratory reagent
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

1.3. ES 1 Exposure estimation and reference to its source

1.3.2 ES 1 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

1.3.3 ES 1 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

1.3.4 ES 1 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

1.3.5 ES 1 - CS 5: Worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,38

1.3.6 ES 1 - CS 6: Worker exposure: Industrial use (Transfer of substance or mixture

(charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

1.3.7 ES 1 - CS 7: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,43
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43

1.3.8 ES 1 - CS 8: Worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,37

1.4. ES 1 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

2. ES 2: Industrial use; Use of non-reactive processing aid at industrial site (no inclusion into or onto article)

2.1. Title section

Environment		
CS1:	Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article))	ERC4
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Mixing or blending in batch processes)	PROC5
CS6:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS7:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS8:	Industrial use (Treatment of articles by dipping and pouring)	PROC13
CS9:	Industrial use (Tabletting, compression, extrusion, pelettisation, granulation)	PROC14
CS10:	Industrial use (Use as laboratory reagent)	PROC15

2.2. ES 2 Conditions of use affecting exposure

2.2.1 ES 2 - CS 1: Control of environmental exposure: Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article)) (ERC4)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

2.2.2 ES 2 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent

containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

2.2.3 ES 2 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

2.2.4 ES 2 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

2.2.5 ES 2 - CS 5: Control of worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

2.2.6 ES 2 - CS 6: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative

Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

2.2.7 ES 2 - CS 7: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

2.2.8 ES 2 - CS 8: Control of worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min

Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

2.2.9 ES 2 - CS 9: Control of worker exposure: Industrial use (Tabletting, compression, extrusion, pelettisation, granulation) (PROC14)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

2.2.10 ES 2 - CS 10: Control of worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Product characteristics
Concentration of the Substance in : <= 100 %

Mixture/Article

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Storage : < 1 kg, < 1 l

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Use as laboratory reagent
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

2.3. ES 2 Exposure estimation and reference to its source

2.3.2 ES 2 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

2.3.3 ES 2 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

2.3.4 ES 2 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

2.3.5 ES 2 - CS 5: Worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,38

2.3.6 ES 2 - CS 6: Worker exposure: Industrial use (Transfer of substance or mixture

(charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

2.3.7 ES 2 - CS 7: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,43
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43

2.3.8 ES 2 - CS 8: Worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,75

2.3.9 ES 2 - CS 9: Worker exposure: Industrial use (Tabletting, compression, extrusion, pelettisation, granulation) (PROC14)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	3,43 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,40

2.3.10 ES 2 - CS 10: Worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,37

2.4. ES 2 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

3. ES 3: Industrial use; Distribution of substance

3.1. Title section

Environment		
CS1:	Industrial use (Manufacture of the substance, Formulation into mixture, Formulation into solid matrix, Use of non-reactive processing aid at industrial site (no inclusion into or onto article), Use at industrial site leading to inclusion into/onto article, Use of intermediate, Use of reactive processing aid at industrial site (no inclusion into or onto article), Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article), Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article), Use of functional fluid at industrial site)	ERC1, ERC2, ERC3, ERC4, ERC5, ERC6a, ERC6b, ERC6c, ERC6d, ERC7
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with	PROC2

	equivalent containment conditions)	
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS6:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS7:	Industrial use (Use as laboratory reagent)	PROC15

3.2. ES 3 Conditions of use affecting exposure

3.2.1 ES 3 - CS 1: Control of environmental exposure: Industrial use (Manufacture of the substance, Formulation into mixture, Formulation into solid matrix, Use of non-reactive processing aid at industrial site (no inclusion into or onto article), Use at industrial site leading to inclusion into/onto article, Use of intermediate, Use of reactive processing aid at industrial site (no inclusion into or onto article), Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article), Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article), Use of functional fluid at industrial site) (ERC1, ERC2, ERC3, ERC4, ERC5, ERC6a, ERC6b, ERC6c, ERC6d, ERC7)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

3.2.2 ES 3 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use

Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management

Dermal exposure : Palm of one hand
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor use

Risk Management Measures
Technical conditions and measures : Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

3.2.3 ES 3 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm^2

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

3.2.4 ES 3 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

3.2.5 ES 3 - CS 5: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

3.2.6 ES 3 - CS 6: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

3.2.7 ES 3 - CS 7: Control of worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Amount used
Storage : < 1 kg, < 1 l

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Use as laboratory reagent
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

3.3. ES 3 Exposure estimation and reference to its source

3.3.2 ES 3 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

3.3.3 ES 3 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term -	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01

systemic		
combined routes	ECETOC TRA worker v2.0	0,08

3.3.4 ES 3 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

3.3.5 ES 3 - CS 5: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

3.3.6 ES 3 - CS 6: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type	Exposure estimate	RCR

of effects		
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,43
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43

3.3.7 ES 3 - CS 7: Worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,37

3.4. ES 3 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

4. ES 4: Industrial use; Formulation [mixing] of preparations and/or re-packaging

4.1. Title section

Environment	
CS1: Industrial use (Formulation into mixture)	ERC2
Workers	

CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Mixing or blending in batch processes)	PROC5
CS6:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS7:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS8:	Industrial use (Tabletting, compression, extrusion, pelettisation, granulation)	PROC14
CS9:	Industrial use (Use as laboratory reagent)	PROC15

4.2. ES 4 Conditions of use affecting exposure

4.2.1 ES 4 - CS 1: Control of environmental exposure: Industrial use (Formulation into mixture) (ERC2)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

4.2.2 ES 4 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use

Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management

Dermal exposure : Palm of one hand
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor use

Risk Management Measures
Technical conditions and measures : Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

4.2.3 ES 4 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm^2

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

4.2.4 ES 4 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

4.2.5 ES 4 - CS 5: Control of worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

4.2.6 ES 4 - CS 6: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

4.2.7 ES 4 - CS 7: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

4.2.8 ES 4 - CS 8: Control of worker exposure: Industrial use (Tabletting, compression, extrusion, pelettisation, granulation) (PROC14)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

4.2.9 ES 4 - CS 9: Control of worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Storage : < 1 kg, < 1 l

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Use as laboratory reagent
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

4.3. ES 4 Exposure estimation and reference to its source

4.3.2 ES 4 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

4.3.3 ES 4 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

4.3.4 ES 4 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

4.3.5 ES 4 - CS 5: Worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,38

4.3.6 ES 4 - CS 6: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

4.3.7 ES 4 - CS 7: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,43
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43

4.3.8 ES 4 - CS 8: Worker exposure: Industrial use (Tabletting, compression, extrusion, pelettisation, granulation) (PROC14)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	3,43 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,40

4.3.9 ES 4 - CS 9: Worker exposure: Industrial use (Use as laboratory reagent)

(PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,37

4.4. ES 4 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

5. ES 5: Industrial use; Use in polymer production

5.1. Title section

Environment		
CS1:	Industrial use (Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article))	ERC6c
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Mixing or blending in batch processes)	PROC5
CS6:	Industrial use (Calendering operations)	PROC6
CS7:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS8:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS9:	Industrial use (Use as laboratory reagent)	PROC15

5.2. ES 5 Conditions of use affecting exposure

5.2.1 ES 5 - CS 1: Control of environmental exposure: Industrial use (Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article)) (ERC6c)

Remarks	:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

5.2.2 ES 5 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

5.2.3 ES 5 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

5.2.4 ES 5 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

5.2.5 ES 5 - CS 5: Control of worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

5.2.6 ES 5 - CS 6: Control of worker exposure: Industrial use (Calendering operations) (PROC6)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

5.2.7 ES 5 - CS 7: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

5.2.8 ES 5 - CS 8: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

5.2.9 ES 5 - CS 9: Control of worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Amount used

Storage	:	< 1 kg, < 1 l

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Use as laboratory reagent
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

5.3. ES 5 Exposure estimation and reference to its source

5.3.2 ES 5 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

5.3.3 ES 5 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

5.3.4 ES 5 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or	0,22

- local and systemic	formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

5.3.5 ES 5 - CS 5: Worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,38

5.3.6 ES 5 - CS 6: Worker exposure: Industrial use (Calendering operations) (PROC6)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,40

5.3.7 ES 5 - CS 7: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07

Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

5.3.8 ES 5 - CS 8: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,43
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43

5.3.9 ES 5 - CS 9: Worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,37

5.4. ES 5 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

6. ES 6: Industrial use; Coatings and paints, thinners, paint

removers

6.1. Title section

Environment		
CS1:	Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article))	ERC4
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Mixing or blending in batch processes)	PROC5
CS6:	Industrial use (Industrial spraying)	PROC7
CS7:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS8:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities)	PROC8b
CS9:	Industrial use (Roller application or brushing)	PROC10
CS10:	Industrial use (Treatment of articles by dipping and pouring)	PROC13
CS11:	Industrial use (Use as laboratory reagent)	PROC15

6.2. ES 6 Conditions of use affecting exposure

6.2.1 ES 6 - CS 1: Control of environmental exposure: Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article)) (ERC4)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

6.2.2 ES 6 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Palm of one hand
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Technical conditions and measures : Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

6.2.3 ES 6 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

6.2.4 ES 6 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

6.2.5 ES 6 - CS 5: Control of worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

6.2.6 ES 6 - CS 6: Control of worker exposure: Industrial use (Industrial spraying) (PROC7)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,6 L/min

Frequency and duration of use

Exposure duration	:	360 min
Frequency of use	:	<= 5 days per week

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	> 1000 m3

Risk Management Measures

Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	50 %
Note	:	Ensure that the direction of airflow is clearly away from the worker.
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Personal protective measures	:	Wear suitable protective clothing. Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure)	:	80 %
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that direction of application is only horizontal or downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

6.2.7 ES 6 - CS 7: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation

Effectiveness (of a measure)	:	90 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

6.2.8 ES 6 - CS 8: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Transfer of substance or mixture (charging/discharging) at dedicated facilities No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

6.2.9 ES 6 - CS 9: Control of worker exposure: Industrial use (Roller application or brushing) (PROC10)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

6.2.10 ES 6 - CS 10: Control of worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

6.2.11 ES 6 - CS 11: Control of worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Storage : < 1 kg, < 1 l

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Use as laboratory reagent
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

6.3. ES 6 Exposure estimation and reference to its source

6.3.2 ES 6 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

6.3.3 ES 6 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type	Exposure estimate	RCR

of effects		
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

6.3.4 ES 6 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

6.3.5 ES 6 - CS 5: Worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,38

6.3.6 ES 6 - CS 6: Worker exposure: Industrial use (Industrial spraying) (PROC7)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	9,79 mg/m³ (Stoffenmanager v4.0)	0,28
Worker - dermal, long-term - systemic	54,6 mg/kg bw/day (RISKOFDERM v2.1)	0,52
combined routes	Not applicable	0,80

6.3.7 ES 6 - CS 7: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

6.3.8 ES 6 - CS 8: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0)	0,06
combined routes	ECETOC TRA worker v2.0	0,43

6.3.9 ES 6 - CS 9: Worker exposure: Industrial use (Roller application or brushing) (PROC10)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,77

6.3.10 ES 6 - CS 10: Worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type	Exposure estimate	RCR

of effects		
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,75

6.3.11 ES 6 - CS 11: Worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,37

6.4. ES 6 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

7. ES 7: Professional use; Coatings and paints, thinners, paint removers, Adhesives, sealants, Foaming, Use in polymer processing

7.1. Title section

Environment		
CS1:	Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use leading to inclusion into/onto article (indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor), Widespread use leading to inclusion into/onto article (outdoor))	ERC8a, ERC8c, ERC8d, ERC8f
Workers		
CS2:	Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	PROC1, PROC2, PROC3

CS3:	Professional use (Chemical production where opportunity for exposure arises, Mixing or blending in batch processes)	PROC4, PROC5
CS4:	Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS5:	Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS6:	Professional use (Roller application or brushing)	PROC10
CS7:	Professional use (Non-industrial spraying)	PROC11
CS8:	Professional use (Treatment of articles by dipping and pouring, Tabletting, compression, extrusion, pelettisation, granulation)	PROC13, PROC14
CS9:	Professional use (Use as laboratory reagent)	PROC15
CS10:	Professional use (Manual activities involving hand contact)	PROC19

7.2. ES 7 Conditions of use affecting exposure

7.2.1 ES 7 - CS 1: Control of environmental exposure: Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use leading to inclusion into/onto article (indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor), Widespread use leading to inclusion into/onto article (outdoor)) (ERC8a, ERC8c, ERC8d, ERC8f)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

7.2.2 ES 7 - CS 2: Control of worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC1, PROC2, PROC3)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use

Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management

Dermal exposure : Palm of one hand
Covers skin contact area up to : 240 cm²

Remarks	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.
Technical conditions and measures	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition With occasional controlled exposure

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

7.2.3 ES 7 - CS 3: Control of worker exposure: Professional use (Chemical production where opportunity for exposure arises, Mixing or blending in batch processes) (PROC4, PROC5)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

7.2.4 ES 7 - CS 4: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : inhalative
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 80 %
Personal protective measures : If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure) : 80 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

7.2.5 ES 7 - CS 5: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

7.2.6 ES 7 - CS 6: Control of worker exposure: Professional use (Roller application or brushing) (PROC10)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Exposure routes : inhalative
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 80 %

Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	80 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

7.2.7 ES 7 - CS 7: Control of worker exposure: Professional use (Non-industrial spraying) (PROC11)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,05 L/min

Frequency and duration of use

Exposure duration	:	150 min
Frequency of use	:	<= 5 days per week

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	<= 1000 m3

Risk Management Measures

Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	Wear suitable protective clothing. Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure)	:	80 %
Personal protective measures	:	Wear a respirator conforming to EN140.
Effectiveness (of a measure)	:	40 %
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that direction of application is only horizontal or downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the direction of airflow is clearly away from the worker.
Note	:	Not applicable

Organisational measures to prevent /limit releases, dispersion and exposure	:	Provide enhanced general ventilation by mechanical means.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the task is not carried out by more than one worker simultaneously.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

7.2.8 ES 7 - CS 8: Control of worker exposure: Professional use (Treatment of articles by dipping and pouring, Tabletting, compression, extrusion, pelettisation, granulation) (PROC13, PROC14)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %
Note	:	Treatment of articles by dipping and pouring

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice : Wear solely goggles.

7.2.9 ES 7 - CS 9: Control of worker exposure: Professional use (Use as laboratory reagent) (PROC15)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Storage : < 1 kg, < 1 l

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Use as laboratory reagent
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

7.2.10 ES 7 - CS 10: Control of worker exposure: Professional use (Manual activities involving hand contact) (PROC19)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : < 15 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands and forearms.
Covers skin contact area up to : 1980 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

7.3. ES 7 Exposure estimation and reference to its source

7.3.2 ES 7 - CS 2: Worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC1, PROC2, PROC3)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,003
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions	0,004
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,01
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	0,38
Worker - inhalative, long-term	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or	0,22

- local and systemic	formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23

7.3.3 ES 7 - CS 3: Worker exposure: Professional use (Chemical production where opportunity for exposure arises, Mixing or blending in batch processes) (PROC4, PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,80
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Mixing or blending in batch processes)	0,74
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0, Mixing or blending in batch processes)	0,01
combined routes	ECETOC TRA worker v2.0, Mixing or blending in batch processes	0,75

7.3.4 ES 7 - CS 4: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,50

7.3.5 ES 7 - CS 5: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,80
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,80

7.3.6 ES 7 - CS 6: Worker exposure: Professional use (Roller application or brushing) (PROC10)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,40

7.3.7 ES 7 - CS 7: Worker exposure: Professional use (Non-industrial spraying) (PROC11)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	14,05 mg/m³ (Stoffenmanager v4.0)	0,40
Worker - dermal, long-term - systemic	53,75 mg/kg bw/day (RISKOFDERM v2.1)	0,51
combined routes	Not applicable	0,91

7.3.8 ES 7 - CS 8: Worker exposure: Professional use (Treatment of articles by dipping and pouring, Tabletting, compression, extrusion, pelettisation, granulation) (PROC13, PROC14)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Treatment of articles by dipping and pouring)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0, Treatment of articles by dipping and pouring)	0,01
combined routes	ECETOC TRA worker v2.0, Treatment of articles by dipping and pouring	0,75
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Tabletting, compression, extrusion, pelettisation, granulation)	0,74
Worker - dermal, long-term - systemic	3,43 mg/kg bw/day (ECETOC TRA worker v2.0, Tabletting, compression, extrusion, pelettisation, granulation)	0,03
combined routes	ECETOC TRA worker v2.0, Tabletting, compression, extrusion, pelettisation, granulation	0,77

7.3.9 ES 7 - CS 9: Worker exposure: Professional use (Use as laboratory reagent) (PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,37

7.3.10 ES 7 - CS 10: Worker exposure: Professional use (Manual activities involving hand contact) (PROC19)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	6,47 mg/m³ (ECETOC TRA worker v2.0)	0,18
Worker - dermal, long-term - systemic	14,14 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,31

7.4. ES 7 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

8. ES 8: Consumer use; Coatings and paints, thinners, paint removers, Surface treatment

8.1. Title section

Coatings and paints, thinners, paint removers (PC9a) Non-metal surface treatment products (PC15) Ink and toners (PC18) Polishes and wax blends (PC31) Lubricants, greases, release products (PC24) Textile dyes and impregnating products (PC34)		
Environment		
CS1:	Consumer use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use leading to inclusion into/onto article (indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor), Widespread use leading to inclusion into/onto article (outdoor))	ERC8a, ERC8c, ERC8d, ERC8f
Consumer		
CS2:	Consumer use (Coatings and paints, thinners, paint removers, Non-metal surface treatment products)	PC9a, PC15
CS3:	Consumer use (Coatings and paints, thinners, paint removers, Non-metal surface treatment products)	PC9a, PC15
CS4:	Consumer use (Ink and toners)	PC18
CS5:	Consumer use (Ink and toners)	PC18
CS6:	Consumer use (Polishes and wax blends)	PC31

8.2. ES 8 Conditions of use affecting exposure

8.2.1 ES 8 - CS 1: Control of environmental exposure: Consumer use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use leading to inclusion into/onto article (indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor), Widespread use leading to inclusion into/onto article (outdoor)) (ERC8a, ERC8c, ERC8d, ERC8f)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

8.2.2 ES 8 - CS 2: Control of consumer exposure: Consumer use (Coatings and paints, thinners, paint removers, Non-metal surface treatment products) (PC9a, PC15)

Remarks : Waterborne paint
Rolling, Brushing
No spraying

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 5 %
Molecular weight	:	45 g/mol
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	1,25 kg/day

Frequency and duration of use

Application duration	:	120 min
Frequency of use	:	1 days per year
Exposure duration	:	132 min

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands and forearms.
Covers skin contact area up to	:	1900 cm²
dermal	:	0,00003 kg/min

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	20 m3
Temperature	:	25 °C
Ventilation rate per hour	:	0,6
Mass transfer rate	:	0,331 m/min
Release area	:	10 m2

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	No specific measures identified.

8.2.3 ES 8 - CS 3: Control of consumer exposure: Consumer use (Coatings and paints, thinners, paint removers, Non-metal surface treatment products) (PC9a, PC15)

Remarks	:	Spraying

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 5 %
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,0198 kg/min

Frequency and duration of use

Application duration	:	15 min
Frequency of use	:	2 days per year
Exposure duration	:	15 min

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands and forearms.
Covers skin contact area up to	:	1900 cm²
dermal	:	0,0001 kg/min
Uptake fraction, oral	:	100 %

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	34 m3
Temperature	:	25 °C
Ventilation rate per hour	:	1,5
Room height	:	2,25 m
Weight percent	:	30 %
Remarks	:	Non-Volatile
Density	:	1,5 g/cm3
Remarks	:	Non-Volatile
Airborne fraction	:	100 %
Remarks	:	Non-Volatile
Inhalation cut-off diameter	:	0,015 mm

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	Ensure spraying away from persons.

8.2.4 ES 8 - CS 4: Control of consumer exposure: Consumer use (Ink and toners) (PC18)

Remarks	:	Refilling

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 5 %
Molecular weight	:	22 g/mol
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amount per use	:	0,05 kg

Frequency and duration of use

Application duration	:	0,3 min
Frequency of use	:	104 days per year
Exposure duration	:	0,75 min

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	215 cm²

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Temperature	:	25 °C
Ventilation rate per hour	:	0,5
Mass transfer rate	:	0,331 m/min
Release area	:	20 cm²

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	No specific measures identified.

8.2.5 ES 8 - CS 5: Control of consumer exposure: Consumer use (Ink and toners) (PC18)

Remarks	:	Printing process

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 5 %
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

: 0,016 kg/day

Frequency and duration of use

Exposure duration	:	600 min
Frequency of use	:	365 days per year

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	25 m3
Temperature	:	25 °C
Ventilation rate per hour	:	0,6

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	No specific measures identified.

8.2.6 ES 8 - CS 6: Control of consumer exposure: Consumer use (Polishes and wax blends) (PC31)

Remarks	:	No spraying

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 2,5 %
Molecular weight	:	272 g/mol
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used
: 0,55 kg/day

Frequency and duration of use
Application duration : 900 min
Frequency of use : 1 days per year
Release duration : 120 min
Exposure duration : 240 min

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 430 cm²
dermal : 0,00003 kg/min

Other given operational conditions affecting consumers exposure
Outdoor / Indoor : Indoor use
Room size : 58 m3
Temperature : 25 °C
Ventilation rate per hour : 0,5

Mass transfer rate : 4740 m/min
Release area : 22 m2

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)
Consumer Measures : No specific measures identified.

8.3. ES 8 Exposure estimation and reference to its source

8.3.2 ES 8 - CS 2: Consumer exposure: Consumer use (Coatings and paints, thinners, paint removers, Non-metal surface treatment products) (PC9a, PC15)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,72 mg/m³ (Consexpo v4.1)	0,10
Chronic dermal systemic exposure	2,77 mg/kg bw/day (Consexpo v4.1)	0,05
Consumer - oral, long-term - systemic	Consexpo v4.1, Not applicable	
combined routes	Consexpo v4.1	0,15

8.3.3 ES 8 - CS 3: Consumer exposure: Consumer use (Coatings and paints, thinners, paint removers, Non-metal surface treatment products) (PC9a, PC15)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,26 mg/m³ (Consexpo v4.1)	0,04
Chronic dermal systemic exposure	1,15 mg/kg bw/day (Consexpo v4.1)	0,02
Consumer - oral, long-term - systemic	0,13 mg/kg bw/day (Consexpo v4.1, Risk management measures are based on qualitative risk characterisation.)	
combined routes	Consexpo v4.1	0,06

8.3.4 ES 8 - CS 4: Consumer exposure: Consumer use (Ink and toners) (PC18)

Route of exposure and type of effects	Exposure estimate	RCR
Chronic dermal systemic exposure	0,008 mg/kg bw/day (Consexpo v4.1)	0,0002

8.3.5 ES 8 - CS 5: Consumer exposure: Consumer use (Ink and toners) (PC18)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	1,29 mg/m³ (Consexpo v4.1)	0,18

8.3.6 ES 8 - CS 6: Consumer exposure: Consumer use (Polishes and wax blends) (PC31)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	3,93 mg/m³ (Consexpo v4.1)	0,56
Chronic dermal systemic exposure	2,12 mg/kg bw/day (Consexpo v4.1)	0,04
combined routes	Consexpo v4.1	0,60

8.4. ES 8 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

9. ES 9: Industrial use; Use in cleaning agents

9.1. Title section

Environment		
CS1:	Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article))	ERC4
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Industrial spraying)	PROC7
CS6:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS7:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities)	PROC8b
CS8:	Industrial use (Roller application or brushing)	PROC10
CS9:	Industrial use (Treatment of articles by dipping and pouring)	PROC13

9.2. ES 9 Conditions of use affecting exposure

9.2.1 ES 9 - CS 1: Control of environmental exposure: Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article)) (ERC4)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Concentration of the Substance in Mixture/Article : <= 100 %

9.2.2 ES 9 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use

Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Palm of one hand
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Technical conditions and measures : Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

9.2.3 ES 9 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

9.2.4 ES 9 - CS 4: Control of worker exposure: Industrial use (Manufacture or

formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

9.2.5 ES 9 - CS 5: Control of worker exposure: Industrial use (Industrial spraying) (PROC7)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,6 L/min

Frequency and duration of use

Exposure duration	:	360 min
Frequency of use	:	<= 5 days per week

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	> 1000 m3

Risk Management Measures

Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	50 %
Note	:	Ensure that the direction of airflow is clearly away from the worker.
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	Wear suitable protective clothing. Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure)	:	80 %
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that direction of application is only horizontal or downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

9.2.6 ES 9 - CS 6: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %

Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

9.2.7 ES 9 - CS 7: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Transfer of substance or mixture (charging/discharging) at dedicated facilities No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

9.2.8 ES 9 - CS 8: Control of worker exposure: Industrial use (Roller application or brushing) (PROC10)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

9.2.9 ES 9 - CS 9: Control of worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

9.3. ES 9 Exposure estimation and reference to its source

9.3.2 ES 9 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

9.3.3 ES 9 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

9.3.4 ES 9 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

9.3.5 ES 9 - CS 5: Worker exposure: Industrial use (Industrial spraying) (PROC7)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	9,79 mg/m³ (Stoffenmanager v4.0)	0,28
Worker - dermal, long-term - systemic	54,6 mg/kg bw/day (RISKOFDERM v2.1)	0,52
combined routes	Not applicable	0,80

9.3.6 ES 9 - CS 6: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

9.3.7 ES 9 - CS 7: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0)	0,06
combined routes	ECETOC TRA worker v2.0	0,43

9.3.8 ES 9 - CS 8: Worker exposure: Industrial use (Roller application or brushing) (PROC10)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,77

9.3.9 ES 9 - CS 9: Worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,75

9.4. ES 9 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

10. ES 10: Professional use; Use in cleaning agents

10.1. Title section

Environment		
CS1:	Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use of non-reactive	ERC8a, ERC8d

	processing aid (no inclusion into or onto article, outdoor))	
Workers		
CS2:	Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	PROC1, PROC2, PROC3
CS3:	Professional use (Chemical production where opportunity for exposure arises)	PROC4
CS4:	Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS5:	Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities)	PROC8b
CS6:	Professional use (Roller application or brushing)	PROC10
CS7:	Professional use (Non-industrial spraying)	PROC11
CS8:	Professional use (Treatment of articles by dipping and pouring)	PROC13

10.2. ES 10 Conditions of use affecting exposure

10.2.1 ES 10 - CS 1: Control of environmental exposure: Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8a, ERC8d)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

10.2.2 ES 10 - CS 2: Control of worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC1, PROC2, PROC3)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use

Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.
Technical conditions and measures	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition With occasional controlled exposure

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

10.2.3 ES 10 - CS 3: Control of worker exposure: Professional use (Chemical production where opportunity for exposure arises) (PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside

hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

10.2.4 ES 10 - CS 4: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : inhalative
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 80 %
Personal protective measures : If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure) : 80 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

10.2.5 ES 10 - CS 5: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

10.2.6 ES 10 - CS 6: Control of worker exposure: Professional use (Roller application or brushing) (PROC10)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : inhalative
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 80 %
Personal protective measures : If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure) : 80 %

Exposure routes : dermal

Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

10.2.7 ES 10 - CS 7: Control of worker exposure: Professional use (Non-industrial spraying) (PROC11)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,05 L/min

Frequency and duration of use

Exposure duration	:	150 min
Frequency of use	:	<= 5 days per week

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	<= 1000 m3

Risk Management Measures

Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	Wear suitable protective clothing. Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure)	:	80 %
Personal protective measures	:	Wear a respirator conforming to EN140.
Effectiveness (of a measure)	:	40 %
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that direction of application is only horizontal or downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the direction of airflow is clearly away from the worker.
Note	:	Not applicable

Organisational measures to prevent /limit releases, dispersion and exposure	:	Provide enhanced general ventilation by mechanical means.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the task is not carried out by more than one worker simultaneously.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

10.2.8 ES 10 - CS 8: Control of worker exposure: Professional use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

10.3. ES 10 Exposure estimation and reference to its source

10.3.2 ES 10 - CS 2: Worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC1, PROC2, PROC3)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,003
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions	0,004
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,01
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	0,38
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003

combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23

10.3.3 ES 10 - CS 3: Worker exposure: Professional use (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0)	0,06
combined routes	ECETOC TRA worker v2.0	0,80

10.3.4 ES 10 - CS 4: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,50

10.3.5 ES 10 - CS 5: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,80

10.3.6 ES 10 - CS 6: Worker exposure: Professional use (Roller application or brushing) (PROC10)

Route of exposure and type of effects	Exposure estimate	RCR

Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,40

10.3.7 ES 10 - CS 7: Worker exposure: Professional use (Non-industrial spraying) (PROC11)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	14,05 mg/m³ (Stoffenmanager v4.0)	0,40
Worker - dermal, long-term - systemic	53,75 mg/kg bw/day (RISKOFDERM v2.1)	0,51
combined routes	Not applicable	0,91

10.3.8 ES 10 - CS 8: Worker exposure: Professional use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Treatment of articles by dipping and pouring)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0, Treatment of articles by dipping and pouring)	0,01
combined routes	ECETOC TRA worker v2.0, Treatment of articles by dipping and pouring	0,75

10.4. ES 10 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

11. ES 11: Consumer use; Use in cleaning agents

11.1. Title section

Washing and cleaning products (PC35)		
Environment		
CS1:	Consumer use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use of non-reactive	ERC8a, ERC8d

	processing aid (no inclusion into or onto article, outdoor))	
Consumer		
CS2:	Consumer use (Washing and cleaning products)	PC35
CS3:	Consumer use (Washing and cleaning products)	PC35
CS4:	Consumer use (Washing and cleaning products)	PC35
CS5:	Consumer use (Washing and cleaning products)	PC35
CS6:	Consumer use (Washing and cleaning products)	PC35
CS7:	Consumer use (Washing and cleaning products)	PC35

11.2. ES 11 Conditions of use affecting exposure

11.2.1 ES 11 - CS 1: Control of environmental exposure: Consumer use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8a, ERC8d)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

11.2.2 ES 11 - CS 2: Control of consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Remarks : No spraying
Default database: cleaning and washing/all purpose cleaner/liquid/mixing and loading

Product characteristics

Concentration of the Substance in Mixture/Article : <= 20 %

Molecular weight : 22 g/mol
Physical Form (at time of use) : Liquid
Vapour pressure : 0,123 hPa

Amount used

Amounts used : 0,5 kg/day

Frequency and duration of use

Application duration : 0,3 min
Frequency of use : 104 days per year
Exposure duration : 0,75 min

Human factors not influenced by risk management

Dermal exposure : Palm of one hand
Covers skin contact area up to : 215 cm^2

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Temperature	:	25 °C
Ventilation rate per hour	:	0,5
Mass transfer rate	:	4740 m/min
Release area	:	20 cm²

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	No specific measures identified.

11.2.3 ES 11 - CS 3: Control of consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Remarks	:	No spraying Application

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 4 %
Molecular weight	:	18 g/mol
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,4 kg/day

Frequency and duration of use

Application duration	:	20 min
Frequency of use	:	104 days per year
Exposure duration	:	240 min

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	215 cm²

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	58 m3
Temperature	:	25 °C
Ventilation rate per hour	:	0,5
Mass transfer rate	:	4740 m/min
Release area	:	10 m2

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	No specific measures identified.

11.2.4 ES 11 - CS 4: Control of consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Remarks	:	Sprays Spraying

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 5 %
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,0468 kg/min

Frequency and duration of use

Spray duration	:	0,41 min
Frequency of use	:	365 days per year
Exposure duration	:	60 min
Release duration	:	2,6 s

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands and forearms.
Covers skin contact area up to	:	1900 cm²
dermal	:	0,000046 kg/min
Uptake fraction, oral	:	100 %

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	15 m3
Temperature	:	25 °C
Ventilation rate per hour	:	2,5
Room height	:	2,5 m
Weight percent	:	5 %
Remarks	:	Non-Volatile
Density	:	1,8 g/cm3
Remarks	:	Non-Volatile
Airborne fraction	:	20 %
Remarks	:	Non-Volatile
Inhalation cut-off diameter	:	0,015 mm

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	Ensure spraying away from persons.

11.2.5 ES 11 - CS 5: Control of consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Remarks	:	Sprays Cleaning

Product characteristics

Concentration of the Substance in	:	<= 5 %

Mixture/Article

Molecular weight	:	22 g/mol
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,0162 kg/day

Frequency and duration of use

Application duration	:	10 min
Frequency of use	:	365 days per year
Exposure duration	:	60 min

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	215 cm²

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	15 m3
Temperature	:	25 °C
Ventilation rate per hour	:	2,5
Mass transfer rate	:	4740 m/min
Release area	:	17100 cm²

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	No specific measures identified.

11.2.6 ES 11 - CS 6: Control of consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Remarks	:	Floor cleaning (liquids) Mixing operations (open systems) Loading of application equipment

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 2,5 %
Molecular weight	:	22 g/mol
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,5 kg/day

Frequency and duration of use

Application duration	:	0,3 min
Frequency of use	:	104 days per year
Exposure duration	:	0,75 min

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	215 cm²

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Temperature	:	25 °C
Ventilation rate per hour	:	1,0
Mass transfer rate	:	4740 m/min
Release area	:	20 cm²

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	No specific measures identified.

11.2.7 ES 11 - CS 7: Control of consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Remarks	:	Floor cleaning (liquids) Application

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 2,5 %
Molecular weight	:	18 g/mol
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,88 kg/day

Frequency and duration of use

Application duration	:	30 min
Frequency of use	:	104 days per year
Exposure duration	:	240 min

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	215 cm²

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	58 m3
Temperature	:	25 °C
Ventilation rate per hour	:	0,5
Mass transfer rate	:	4740 m/min
Release area	:	22 m2

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)
Consumer Measures : No specific measures identified.

11.3. ES 11 Exposure estimation and reference to its source

11.3.2 ES 11 - CS 2: Consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,01 mg/m³ (Consexpo v4.1)	0,001
Chronic dermal systemic exposure	0,03 mg/kg bw/day (Consexpo v4.1)	0,0006
Consumer - oral, long-term - systemic	Consexpo v4.1, Not applicable	
combined routes	Consexpo v4.1	0,002

11.3.3 ES 11 - CS 3: Consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,61 mg/m³ (Consexpo v4.1)	0,09
Chronic dermal systemic exposure	11,70 mg/kg bw/day (Consexpo v4.1)	0,22
Consumer - oral, long-term - systemic	Consexpo v4.1, Not applicable	
combined routes	Consexpo v4.1	0,31

11.3.4 ES 11 - CS 4: Consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,000011 mg/m³ (Consexpo v4.1)	
Chronic dermal systemic exposure	0,01 mg/kg bw/day (Consexpo v4.1)	0,0002
Consumer - oral, long-term - systemic	0,0006 mg/kg bw/day (Consexpo v4.1)	
combined routes	Consexpo v4.1	0,0002

11.3.5 ES 11 - CS 5: Consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,11 mg/m³ (Consexpo v4.1)	0,02
Chronic dermal systemic exposure	0,12 mg/kg bw/day (Consexpo v4.1)	0,002
Consumer - oral, long-term - systemic	Consexpo v4.1, Not applicable	
combined routes	Consexpo v4.1	0,02

11.3.6 ES 11 - CS 6: Consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,01 mg/m³ (Consexpo v4.1)	0,001
Chronic dermal systemic exposure	0,04 mg/kg bw/day (Consexpo v4.1)	0,0008
Consumer - oral, long-term - systemic	Consexpo v4.1, Not applicable	
combined routes	Consexpo v4.1	0,002

11.3.7 ES 11 - CS 7: Consumer exposure: Consumer use (Washing and cleaning products) (PC35)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,38 mg/m³ (Consexpo v4.1)	0,05
Chronic dermal systemic exposure	7,31 mg/kg bw/day (Consexpo v4.1)	0,14
Consumer - oral, long-term - systemic	Consexpo v4.1, Not applicable	
combined routes	Consexpo v4.1	0,19

11.4. ES 11 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

12. ES 12: Industrial use; Use in lubricants

12.1. Title section

Environment		
CS1:	Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article), Use of functional fluid at industrial site)	ERC4, ERC7
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Mixing or blending in batch processes)	PROC5
CS6:	Industrial use (Industrial spraying)	PROC7
CS7:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS8:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS9:	Industrial use (Roller application or brushing)	PROC10
CS10:	Industrial use (Treatment of articles by dipping and pouring)	PROC13
CS11:	Industrial use (Lubrication at high energy conditions in metal working operations, General greasing/lubrication at high kinetic energy conditions)	PROC17, PROC18

12.2. ES 12 Conditions of use affecting exposure

12.2.1 ES 12 - CS 1: Control of environmental exposure: Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article), Use of functional fluid at industrial site) (ERC4, ERC7)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

12.2.2 ES 12 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

12.2.3 ES 12 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Chemical production or refinery in closed continuous process

with occasional controlled exposure or processes with equivalent containment conditions
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

12.2.4 ES 12 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

12.2.5 ES 12 - CS 5: Control of worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

12.2.6 ES 12 - CS 6: Control of worker exposure: Industrial use (Industrial spraying) (PROC7)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Amounts used : 0,6 L/min

Frequency and duration of use
Exposure duration : 360 min
Frequency of use : <= 5 days per week

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use
Room size : > 1000 m3

Risk Management Measures
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 50 %

Note	:	Ensure that the direction of airflow is clearly away from the worker.
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	Wear suitable protective clothing. Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure)	:	80 %
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that direction of application is only horizontal or downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

12.2.7 ES 12 - CS 7: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

12.2.8 ES 12 - CS 8: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

12.2.9 ES 12 - CS 9: Control of worker exposure: Industrial use (Roller application or brushing) (PROC10)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid

Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

12.2.10 ES 12 - CS 10: Control of worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

12.2.11 ES 12 - CS 11: Control of worker exposure: Industrial use (Lubrication at high energy conditions in metal working operations, General greasing/lubrication at high kinetic energy conditions) (PROC17, PROC18)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %
Note	:	Lubrication at high energy conditions in metal working operations

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

12.3. ES 12 Exposure estimation and reference to its source

12.3.2 ES 12 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR

Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

12.3.3 ES 12 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

12.3.4 ES 12 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

12.3.5 ES 12 - CS 5: Worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,38

12.3.6 ES 12 - CS 6: Worker exposure: Industrial use (Industrial spraying) (PROC7)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	9,79 mg/m³ (Stoffenmanager v4.0)	0,28
Worker - dermal, long-term - systemic	54,6 mg/kg bw/day (RISKOFDERM v2.1)	0,52
combined routes	Not applicable	0,80

12.3.7 ES 12 - CS 7: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

12.3.8 ES 12 - CS 8: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,43
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated	0,37

	filling line, including weighing))	
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43

12.3.9 ES 12 - CS 9: Worker exposure: Industrial use (Roller application or brushing) (PROC10)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,77

12.3.10 ES 12 - CS 10: Worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,75

12.3.11 ES 12 - CS 11: Worker exposure: Industrial use (Lubrication at high energy conditions in metal working operations, General greasing/lubrication at high kinetic energy conditions) (PROC17, PROC18)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0, Lubrication at high energy conditions in metal working operations)	0,07
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0, Lubrication at high energy conditions in metal working operations)	0,03
combined routes	ECETOC TRA worker v2.0, Lubrication at high energy conditions in metal working operations	0,10
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0, General greasing/lubrication at high kinetic energy conditions)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0, General greasing/lubrication at high kinetic energy conditions)	0,13

combined routes	ECETOC TRA worker v2.0, General greasing/lubrication at high kinetic energy conditions	0,20

12.4. ES 12 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

13. ES 13: Industrial use; Metal working fluids

13.1. Title section

Environment		
CS1:	Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article))	ERC4
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Mixing or blending in batch processes)	PROC5
CS6:	Industrial use (Industrial spraying)	PROC7
CS7:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS8:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS9:	Industrial use (Roller application or brushing)	PROC10
CS10:	Industrial use (Treatment of articles by dipping and pouring)	PROC13
CS11:	Industrial use (Lubrication at high energy conditions in metal working operations)	PROC17

13.2. ES 13 Conditions of use affecting exposure

13.2.1 ES 13 - CS 1: Control of environmental exposure: Industrial use (Use of non-reactive processing aid at industrial site (no inclusion into or onto article)) (ERC4)

Remarks : As no environmental hazard was identified no environmental-

related exposure assessment and risk characterization was performed.

13.2.2 ES 13 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

13.2.3 ES 13 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside

hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

13.2.4 ES 13 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Palm of one hand
Covers skin contact area up to : 240 cm²
Remarks : Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²
Remarks : Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Technical conditions and measures : Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Note : Chemical production where opportunity for exposure arises
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

13.2.5 ES 13 - CS 5: Control of worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm^2

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

13.2.6 ES 13 - CS 6: Control of worker exposure: Industrial use (Industrial spraying) (PROC7)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Amounts used : 0,6 L/min

Frequency and duration of use
Exposure duration : 360 min
Frequency of use : <= 5 days per week

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	> 1000 m3

Risk Management Measures

Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	50 %
Note	:	Ensure that the direction of airflow is clearly away from the worker.
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	Wear suitable protective clothing. Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure)	:	80 %
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that direction of application is only horizontal or downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

13.2.7 ES 13 - CS 7: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min

Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : inhalative
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 90 %
Personal protective measures : If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

13.2.8 ES 13 - CS 8: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

13.2.9 ES 13 - CS 9: Control of worker exposure: Industrial use (Roller application or

brushing) (PROC10)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

13.2.10 ES 13 - CS 10: Control of worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

13.2.11 ES 13 - CS 11: Control of worker exposure: Industrial use (Lubrication at high energy conditions in metal working operations) (PROC17)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

13.3. ES 13 Exposure estimation and reference to its source

13.3.2 ES 13 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

13.3.3 ES 13 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

13.3.4 ES 13 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

13.3.5 ES 13 - CS 5: Worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,38

13.3.6 ES 13 - CS 6: Worker exposure: Industrial use (Industrial spraying) (PROC7)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	9,79 mg/m³ (Stoffenmanager v4.0)	0,28
Worker - dermal, long-term - systemic	54,6 mg/kg bw/day (RISKOFDERM v2.1)	0,52
combined routes	Not applicable	0,80

13.3.7 ES 13 - CS 7: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

13.3.8 ES 13 - CS 8: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or	0,43

	mixture (charging/discharging) at dedicated facilities	
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43

13.3.9 ES 13 - CS 9: Worker exposure: Industrial use (Roller application or brushing) (PROC10)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,77

13.3.10 ES 13 - CS 10: Worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,75

13.3.11 ES 13 - CS 11: Worker exposure: Industrial use (Lubrication at high energy conditions in metal working operations) (PROC17)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0, Lubrication at high energy conditions in metal working operations)	0,07
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0, Lubrication at high energy conditions in metal working operations)	0,03
combined routes	ECETOC TRA worker v2.0, Lubrication at high energy conditions in metal working operations	0,10

13.4. ES 13 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

14. ES 14: Professional use; Metal working fluids

14.1. Title section

Environment		
CS1:	Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor))	ERC8a, ERC8d
Workers		
CS2:	Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	PROC1, PROC2, PROC3
CS3:	Professional use (Mixing or blending in batch processes)	PROC5
CS4:	Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS5:	Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS6:	Professional use (Roller application or brushing)	PROC10
CS7:	Professional use (Non-industrial spraying)	PROC11
CS8:	Professional use (Treatment of articles by dipping and pouring)	PROC13
CS9:	Professional use (Lubrication at high energy conditions in metal working operations)	PROC17

14.2. ES 14 Conditions of use affecting exposure

14.2.1 ES 14 - CS 1: Control of environmental exposure: Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8a, ERC8d)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

14.2.2 ES 14 - CS 2: Control of worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC1, PROC2, PROC3)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.
Technical conditions and measures	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition With occasional controlled exposure

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

14.2.3 ES 14 - CS 3: Control of worker exposure: Professional use (Mixing or blending in batch processes) (PROC5)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

14.2.4 ES 14 - CS 4: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	80 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	80 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

14.2.5 ES 14 - CS 5: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

14.2.6 ES 14 - CS 6: Control of worker exposure: Professional use (Roller application or brushing) (PROC10)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	80 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	80 %
Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

14.2.7 ES 14 - CS 7: Control of worker exposure: Professional use (Non-industrial spraying) (PROC11)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,05 L/min

Frequency and duration of use

Exposure duration	:	150 min
Frequency of use	:	<= 5 days per week

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	<= 1000 m3

Risk Management Measures

Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

Effectiveness (of a measure)	:	90 %
Personal protective measures	:	Wear suitable protective clothing. Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure)	:	80 %
Personal protective measures	:	Wear a respirator conforming to EN140.
Effectiveness (of a measure)	:	40 %
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that direction of application is only horizontal or downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the direction of airflow is clearly away from the worker.
Note	:	Not applicable
Organisational measures to prevent /limit releases, dispersion and exposure	:	Provide enhanced general ventilation by mechanical means.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the task is not carried out by more than one worker simultaneously.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

14.2.8 ES 14 - CS 8: Control of worker exposure: Professional use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid

Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

14.2.9 ES 14 - CS 9: Control of worker exposure: Professional use (Lubrication at high energy conditions in metal working operations) (PROC17)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : inhalative
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 90 %

Exposure routes : dermal
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

14.3. ES 14 Exposure estimation and reference to its source

14.3.2 ES 14 - CS 2: Worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC1, PROC2, PROC3)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,003
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions	0,004
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,01
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	0,38
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled	0,003

	exposure or processes with equivalent containment condition)	
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23

14.3.3 ES 14 - CS 3: Worker exposure: Professional use (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Mixing or blending in batch processes)	0,74
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0, Mixing or blending in batch processes)	0,01
combined routes	ECETOC TRA worker v2.0, Mixing or blending in batch processes	0,75

14.3.4 ES 14 - CS 4: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,50

14.3.5 ES 14 - CS 5: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,80
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,74

Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,80

14.3.6 ES 14 - CS 6: Worker exposure: Professional use (Roller application or brushing) (PROC10)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,40

14.3.7 ES 14 - CS 7: Worker exposure: Professional use (Non-industrial spraying) (PROC11)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	14,05 mg/m³ (Stoffenmanager v4.0)	0,40
Worker - dermal, long-term - systemic	53,75 mg/kg bw/day (RISKOFDERM v2.1)	0,51
combined routes	Not applicable	0,91

14.3.8 ES 14 - CS 8: Worker exposure: Professional use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,75

14.3.9 ES 14 - CS 9: Worker exposure: Professional use (Lubrication at high energy conditions in metal working operations) (PROC17)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37

- local and systemic		
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,40

14.4. ES 14 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

15. ES 15: Professional use; Use in agrochemicals

15.1. Title section

Environment		
CS1:	Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor))	ERC8a, ERC8d
Workers		
CS2:	Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC1, PROC2
CS3:	Professional use (Chemical production where opportunity for exposure arises)	PROC4
CS4:	Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS5:	Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS6:	Professional use (Non-industrial spraying)	PROC11
CS7:	Professional use (Treatment of articles by dipping and pouring)	PROC13

15.2. ES 15 Conditions of use affecting exposure

15.2.1 ES 15 - CS 1: Control of environmental exposure: Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor), Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8a, ERC8d)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was

performed.

15.2.2 ES 15 - CS 2: Control of worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC1, PROC2)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.
Technical conditions and measures	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

15.2.3 ES 15 - CS 3: Control of worker exposure: Professional use (Chemical production where opportunity for exposure arises) (PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

15.2.4 ES 15 - CS 4: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and	:	Local exhaust ventilation

measures
Effectiveness (of a measure) : 80 %
Personal protective measures : If technical measures not practical:
Wear suitable respiratory protection.
Effectiveness (of a measure) : 80 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

15.2.5 ES 15 - CS 5: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

15.2.6 ES 15 - CS 6: Control of worker exposure: Professional use (Non-industrial spraying) (PROC11)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Amounts used : 0,05 L/min

Frequency and duration of use

Exposure duration	:	150 min
Frequency of use	:	<= 5 days per week

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	<= 1000 m3

Risk Management Measures

Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	Wear suitable protective clothing. Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure)	:	80 %
Personal protective measures	:	Wear a respirator conforming to EN140.
Effectiveness (of a measure)	:	40 %
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that direction of application is only horizontal or downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the direction of airflow is clearly away from the worker.
Note	:	Not applicable
Organisational measures to prevent /limit releases, dispersion and exposure	:	Provide enhanced general ventilation by mechanical means.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the task is not carried out by more than one worker simultaneously.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

15.2.7 ES 15 - CS 7: Control of worker exposure: Professional use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm^2

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

15.3. ES 15 Exposure estimation and reference to its source

15.3.2 ES 15 - CS 2: Worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC1, PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m^3 (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,0007

Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,003
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions	0,004
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,01
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	0,38

15.3.3 ES 15 - CS 3: Worker exposure: Professional use (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0)	0,06
combined routes	ECETOC TRA worker v2.0	0,80

15.3.4 ES 15 - CS 4: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,50

15.3.5 ES 15 - CS 5: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type	Exposure estimate	RCR

of effects		
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,80
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,80

15.3.6 ES 15 - CS 6: Worker exposure: Professional use (Non-industrial spraying) (PROC11)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	14,05 mg/m³ (Stoffenmanager v4.0)	0,40
Worker - dermal, long-term - systemic	53,75 mg/kg bw/day (RISKOFDERM v2.1)	0,51
combined routes	Not applicable	0,91

15.3.7 ES 15 - CS 7: Worker exposure: Professional use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,75

15.4. ES 15 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

16. ES 16: Industrial use; Use in functional fluids

16.1. Title section

Environment		
CS1:	Industrial use (Use of functional fluid at industrial site)	ERC7
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS6:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9

16.2. ES 16 Conditions of use affecting exposure

16.2.1 ES 16 - CS 1: Control of environmental exposure: Industrial use (Use of functional fluid at industrial site) (ERC7)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

16.2.2 ES 16 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use

Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

16.2.3 ES 16 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

16.2.4 ES 16 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical

production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

16.2.5 ES 16 - CS 5: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

16.2.6 ES 16 - CS 6: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year
Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use
Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	No specific measures identified.

Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

16.3. ES 16 Exposure estimation and reference to its source

16.3.2 ES 16 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

16.3.3 ES 16 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

16.3.4 ES 16 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term -	0,34 mg/kg bw/day (ECETOC TRA worker v2.0,	0,003

systemic	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

16.3.5 ES 16 - CS 5: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

16.3.6 ES 16 - CS 6: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,43
combined routes	ECETOC TRA worker v2.0, Transfer of substance or	0,43

	mixture (charging/discharging) at dedicated facilities	
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,37
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43

16.4. ES 16 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

17. ES 17: Professional use; Use in functional fluids

17.1. Title section

Environment		
CS1:	Professional use (Widespread use of functional fluid (indoor), Widespread use of functional fluid (outdoor))	ERC9a, ERC9b
Workers		
CS2:	Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	PROC1, PROC2, PROC3
CS3:	Professional use (Chemical production where opportunity for exposure arises)	PROC4
CS4:	Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS5:	Professional use (Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC9

CS6: Professional use (Use of functional fluids in small devices)	PROC20

17.2. ES 17 Conditions of use affecting exposure

17.2.1 ES 17 - CS 1: Control of environmental exposure: Professional use (Widespread use of functional fluid (indoor), Widespread use of functional fluid (outdoor)) (ERC9a, ERC9b)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

17.2.2 ES 17 - CS 2: Control of worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC1, PROC2, PROC3)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use

Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management

Dermal exposure : Palm of one hand
Covers skin contact area up to : 240 cm²
Remarks : Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²
Remarks : Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.
Technical conditions and measures	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition With occasional controlled exposure

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

17.2.3 ES 17 - CS 3: Control of worker exposure: Professional use (Chemical production where opportunity for exposure arises) (PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

17.2.4 ES 17 - CS 4: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in	:	<= 100 %

Mixture/Article

Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	80 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	80 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

17.2.5 ES 17 - CS 5: Control of worker exposure: Professional use (Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC9)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

17.2.6 ES 17 - CS 6: Control of worker exposure: Professional use (Use of functional fluids in small devices) (PROC20)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

17.3. ES 17 Exposure estimation and reference to its source

17.3.2 ES 17 - CS 2: Worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC1, PROC2, PROC3)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood	0,0007

	of exposure or processes with equivalent containment conditions)	
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,003
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions	0,004
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,01
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	0,38
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23

17.3.3 ES 17 - CS 3: Worker exposure: Professional use (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0)	0,06
combined routes	ECETOC TRA worker v2.0	0,80

17.3.4 ES 17 - CS 4: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type	Exposure estimate	RCR

of effects		
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,50

17.3.5 ES 17 - CS 5: Worker exposure: Professional use (Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,80

17.3.6 ES 17 - CS 6: Worker exposure: Professional use (Use of functional fluids in small devices) (PROC20)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	1,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,02
combined routes	ECETOC TRA worker v2.0	0,39

17.4. ES 17 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

18. ES 18: Consumer use; Heat transfer fluids, Hydraulic fluids

18.1. Title section

Heat transfer fluids (PC16)		
Hydraulic fluids (PC17)		
Environment		
CS1:	Consumer use (Widespread use of functional fluid (indoor), Widespread use of functional fluid (outdoor))	ERC9a, ERC9b
Consumer		
CS2:	Consumer use (Heat transfer fluids, Hydraulic fluids)	PC16, PC17

18.2. ES 18 Conditions of use affecting exposure

18.2.1 ES 18 - CS 1: Control of environmental exposure: Consumer use (Widespread use of functional fluid (indoor), Widespread use of functional fluid (outdoor)) (ERC9a, ERC9b)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

18.2.2 ES 18 - CS 2: Control of consumer exposure: Consumer use (Heat transfer fluids, Hydraulic fluids) (PC16, PC17)

Remarks : Transfer of substance or mixture (charging/discharging) at non dedicated-facilities

Product characteristics

Concentration of the Substance in Mixture/Article : <= 30 %

Physical Form (at time of use) : Liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use

Exposure duration : < 15 min

Human factors not influenced by risk management

Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other given operational conditions affecting consumers exposure

Outdoor / Indoor : Indoor use
Temperature : 25 °C

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures : No specific measures identified.

18.3. ES 18 Exposure estimation and reference to its source

18.3.2 ES 18 - CS 2: Consumer exposure: Consumer use (Heat transfer fluids, Hydraulic fluids) (PC16, PC17)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	1,93 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	0,28
Worker - dermal, long-term - systemic	4,11 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	0,08
oral	Not applicable	
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at non dedicated-facilities	0,36

18.4. ES 18 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

19. ES 19: Professional use; Anti-freeze and de-icing products

19.1. Title section

Environment		
CS1:	Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor))	ERC8d
Workers		
CS2:	Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC1, PROC2
CS3:	Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS4:	Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities)	PROC8b
CS5:	Professional use (Non-industrial spraying)	PROC11

19.2. ES 19 Conditions of use affecting exposure

19.2.1 ES 19 - CS 1: Control of environmental exposure: Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8d)

Remarks	:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

19.2.2 ES 19 - CS 2: Control of worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC1, PROC2)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent

containment conditions
Sample via a closed loop or other system to avoid exposure.

Technical conditions and measures : Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

19.2.3 ES 19 - CS 3: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : inhalative
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 80 %
Personal protective measures : If technical measures not practical:
Wear suitable respiratory protection.
Effectiveness (of a measure) : 80 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

19.2.4 ES 19 - CS 4: Control of worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm^2

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

19.2.5 ES 19 - CS 5: Control of worker exposure: Professional use (Non-industrial spraying) (PROC11)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Amounts used : 0,05 L/min

Frequency and duration of use
Exposure duration : 150 min
Frequency of use : <= 5 days per week

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use
Room size : <= 1000 m3

Risk Management Measures
Personal protective measures : Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure) : 90 %

Personal protective measures : Wear suitable protective clothing.
Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure) : 80 %

Personal protective measures : Wear a respirator conforming to EN140.
Effectiveness (of a measure) : 40 %

Organisational measures to : Ensure that direction of application is only horizontal or

prevent /limit releases, dispersion and exposure		downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the direction of airflow is clearly away from the worker.
Note	:	Not applicable
Organisational measures to prevent /limit releases, dispersion and exposure	:	Provide enhanced general ventilation by mechanical means.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the task is not carried out by more than one worker simultaneously.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

19.3. ES 19 Exposure estimation and reference to its source

19.3.2 ES 19 - CS 2: Worker exposure: Professional use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC1, PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment	0,0007

	conditions)	
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	0,003
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions	0,004
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	0,01
combined routes	ECETOC TRA worker v2.0, Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	0,38

19.3.3 ES 19 - CS 3: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,50

19.3.4 ES 19 - CS 4: Worker exposure: Professional use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,88 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,74
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,80

19.3.5 ES 19 - CS 5: Worker exposure: Professional use (Non-industrial spraying) (PROC11)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	14,05 mg/m³ (Stoffenmanager v4.0)	0,40
Worker - dermal, long-term - systemic	53,75 mg/kg bw/day (RISKOFDERM v2.1)	0,51
combined routes	Not applicable	0,91

19.4. ES 19 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

20. ES 20: Consumer use; Anti-freeze and de-icing products

20.1. Title section

Anti-freeze and de-icing products (PC4)	
Environment	
CS1: Consumer use (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor))	ERC8d
Consumer	
CS2: Consumer use (Anti-freeze and de-icing products)	PC4
CS3: Consumer use (Anti-freeze and de-icing products)	PC4
CS4: Consumer use (Anti-freeze and de-icing products)	PC4

20.2. ES 20 Conditions of use affecting exposure

20.2.1 ES 20 - CS 1: Control of environmental exposure: Consumer use (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8d)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

20.2.2 ES 20 - CS 2: Control of consumer exposure: Consumer use (Anti-freeze and de-icing products) (PC4)

Remarks : De-icing of vehicles and similar equipment by spraying

Spraying

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,0468 kg/min

Frequency and duration of use

Spray duration	:	0,7 min
Frequency of use	:	365 days per year
Exposure duration	:	240 min

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands and forearms.
Covers skin contact area up to	:	1900 cm²
dermal	:	0,000046 kg/min
Uptake fraction, oral	:	100 %

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	58 m3
Temperature	:	25 °C
Ventilation rate per hour	:	0,5
Room height	:	2,5 m
Weight percent	:	100 %
Remarks	:	Non-Volatile
Density	:	1,8 g/cm3
Remarks	:	Non-Volatile
Airborne fraction	:	100 %
Remarks	:	Non-Volatile
Inhalation cut-off diameter	:	0,015 mm

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	Ensure spraying away from persons.

20.2.3 ES 20 - CS 3: Control of consumer exposure: Consumer use (Anti-freeze and de-icing products) (PC4)

Remarks	:	De-icing of vehicles and similar equipment by spraying Cleaning

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %

Physical Form (at time of use) : Liquid
Vapour pressure : 0,123 hPa

Amount used
Amounts used : 0,00029 kg/day

Frequency and duration of use
Frequency of use : 365 days per year

Human factors not influenced by risk management
Dermal exposure : Palm of one hand
Covers skin contact area up to : 215 cm²

Other given operational conditions affecting consumers exposure
Temperature : 25 °C

20.2.4 ES 20 - CS 4: Control of consumer exposure: Consumer use (Anti-freeze and de-icing products) (PC4)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 30 %

Physical Form (at time of use) : Liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : < 15 min

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm²

Other given operational conditions affecting consumers exposure
Outdoor / Indoor : Indoor use
Temperature : 25 °C

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)
Consumer Measures : No specific measures identified.

20.3. ES 20 Exposure estimation and reference to its source

20.3.2 ES 20 - CS 2: Consumer exposure: Consumer use (Anti-freeze and de-icing products) (PC4)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,0006 mg/m³ (Consexpo v4.1)	0,0001
Chronic dermal systemic exposure	0,50 mg/kg bw/day (Consexpo v4.1)	0,009
Consumer - oral, long-term - systemic	0,005 mg/kg bw/day (Consexpo v4.1)	
combined routes	Consexpo v4.1	0,009

20.3.3 ES 20 - CS 3: Consumer exposure: Consumer use (Anti-freeze and de-icing products) (PC4)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	Not applicable	
Chronic dermal systemic exposure	4,46 mg/kg bw/day (Consexpo v4.1)	0,08
Consumer - oral, long-term - systemic	Not applicable	
combined routes	Consexpo v4.1	0,08

20.3.4 ES 20 - CS 4: Consumer exposure: Consumer use (Anti-freeze and de-icing products) (PC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	1,93 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	0,28
Worker - dermal, long-term - systemic	4,11 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	0,08
oral	Not applicable	
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at non dedicated-facilities	0,36

20.4. ES 20 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

21. ES 21: Industrial use, Professional use; Use in

laboratories

21.1. Title section

Environment		
CS1:	Industrial use, Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor))	ERC8a
Workers		
CS2:	Industrial use, Professional use (Use as laboratory reagent)	PROC15

21.2. ES 21 Conditions of use affecting exposure

21.2.1 ES 21 - CS 1: Control of environmental exposure: Industrial use, Professional use (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor)) (ERC8a)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

21.2.2 ES 21 - CS 2: Control of worker exposure: Industrial use, Professional use (Use as laboratory reagent) (PROC15)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use

Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management

Dermal exposure : Palm of one hand
Covers skin contact area up to : 240 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor : Indoor use

Risk Management Measures

Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice : Wear solely goggles.

21.3. ES 21 Exposure estimation and reference to its source

21.3.2 ES 21 - CS 2: Worker exposure: Industrial use, Professional use (Use as laboratory reagent) (PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

21.4. ES 21 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

22. ES 22: Industrial use; Use in water treatment agents

22.1. Title section

Environment		
CS1:	Industrial use (Formulation into solid matrix, Use of non-reactive processing aid at industrial site (no inclusion into or onto article))	ERC3, ERC4
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS6:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities)	PROC8b
CS7:	Industrial use (Treatment of articles by dipping and pouring)	PROC13

22.2. ES 22 Conditions of use affecting exposure

22.2.1 ES 22 - CS 1: Control of environmental exposure: Industrial use (Formulation into solid matrix, Use of non-reactive processing aid at industrial site (no inclusion into or onto article)) (ERC3, ERC4)

Remarks	:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

22.2.2 ES 22 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

22.2.3 ES 22 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics

Concentration of the Substance in	:	<= 100 %

Mixture/Article

Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

22.2.4 ES 22 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Technical conditions and measures : Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Note : Chemical production where opportunity for exposure arises
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

22.2.5 ES 22 - CS 5: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to : 960 cm^2

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Exposure routes : inhalative
Technical conditions and measures : Local exhaust ventilation
Effectiveness (of a measure) : 90 %
Personal protective measures : If technical measures not practical:
Wear suitable respiratory protection.
Effectiveness (of a measure) : 90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

22.2.6 ES 22 - CS 6: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Product characteristics
Concentration of the Substance in : <= 100 %

Mixture/Article

Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Transfer of substance or mixture (charging/discharging) at dedicated facilities No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

22.2.7 ES 22 - CS 7: Control of worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

22.3. ES 22 Exposure estimation and reference to its source

22.3.2 ES 22 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

22.3.3 ES 22 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

22.3.4 ES 22 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled	0,003

	exposure or processes with equivalent containment condition)	
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

22.3.5 ES 22 - CS 5: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

22.3.6 ES 22 - CS 6: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0)	0,06
combined routes	ECETOC TRA worker v2.0	0,43

22.3.7 ES 22 - CS 7: Worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,75

22.4. ES 22 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

23. ES 23: Consumer use; Adhesives, sealants

23.1. Title section

Adhesives, sealants (PC1)		
Environment		
CS1:	Consumer use (Widespread use leading to inclusion into/onto article (indoor), Widespread use leading to inclusion into/onto article (outdoor))	ERC8c, ERC8f
Consumer		
CS2:	Consumer use (Adhesives, sealants)	PC1

23.2. ES 23 Conditions of use affecting exposure

23.2.1 ES 23 - CS 1: Control of environmental exposure: Consumer use (Widespread use leading to inclusion into/onto article (indoor), Widespread use leading to inclusion into/onto article (outdoor)) (ERC8c, ERC8f)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

23.2.2 ES 23 - CS 2: Control of consumer exposure: Consumer use (Adhesives, sealants) (PC1)

Remarks : Worst case assumption
Mixing operations (open systems)
Loading of application equipment

Product characteristics

Concentration of the Substance in Mixture/Article : <= 0,075 %

Molecular weight : 3.000 g/mol
Physical Form (at time of use) : Liquid
Vapour pressure : 0,123 hPa

Amount used

Amounts used : 9 kg/day

Frequency and duration of use

Application duration	:	75 min
Frequency of use	:	0,25 days per year
Exposure duration	:	75 min

Human factors not influenced by risk management

Covers skin contact area up to	:	110 cm²
dermal	:	0,00003 kg/min

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	58 m3
Temperature	:	25 °C
Ventilation rate per hour	:	0,5
Mass transfer rate	:	4740 m/min
Release area	:	4 m2

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	No specific measures identified.

23.3. ES 23 Exposure estimation and reference to its source

23.3.2 ES 23 - CS 2: Consumer exposure: Consumer use (Adhesives, sealants) (PC1)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	4,1 mg/m³ (Consexpo v4.1)	0,59
Chronic dermal systemic exposure	0,26 mg/kg bw/day (Consexpo v4.1)	0,005
Consumer - oral, long-term - systemic	Not applicable	
combined routes	Consexpo v4.1	0,60

23.4. ES 23 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

24. ES 24: Industrial use; Manufacture of substance,

Adhesives, sealants, Foaming, Use in coatings, Use in polymer production

24.1. Title section

Environment		
CS1:	Industrial use (Formulation into mixture, Formulation into solid matrix, Use at industrial site leading to inclusion into/onto article, Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article))	ERC2, ERC3, ERC5, ERC6c
Workers		
CS2:	Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS3:	Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS4:	Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises)	PROC3, PROC4
CS5:	Industrial use (Mixing or blending in batch processes)	PROC5
CS6:	Industrial use (Industrial spraying)	PROC7
CS7:	Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS8:	Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC8b, PROC9
CS9:	Industrial use (Roller application or brushing)	PROC10
CS10:	Industrial use (Treatment of articles by dipping and pouring)	PROC13
CS11:	Industrial use (Tabletting, compression, extrusion, pelettisation, granulation)	PROC14
CS12:	Industrial use (Use as laboratory reagent)	PROC15

24.2. ES 24 Conditions of use affecting exposure

24.2.1 ES 24 - CS 1: Control of environmental exposure: Industrial use (Formulation into mixture, Formulation into solid matrix, Use at industrial site leading to inclusion into/onto article, Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article)) (ERC2, ERC3, ERC5, ERC6c)

Remarks : As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

24.2.2 ES 24 - CS 2: Control of worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with

equivalent containment conditions) (PROC1)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Sample via a closed loop or other system to avoid exposure.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

24.2.3 ES 24 - CS 3: Control of worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

24.2.4 ES 24 - CS 4: Control of worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Palm of one hand
Covers skin contact area up to	:	240 cm²
Remarks	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²
Remarks	:	Chemical production where opportunity for exposure arises

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Technical conditions and measures	:	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Note	:	Chemical production where opportunity for exposure arises No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

24.2.5 ES 24 - CS 5: Control of worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

24.2.6 ES 24 - CS 6: Control of worker exposure: Industrial use (Industrial spraying) (PROC7)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Amount used

Amounts used	:	0,6 L/min

Frequency and duration of use

Exposure duration	:	360 min
Frequency of use	:	<= 5 days per week

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	> 1000 m3

Risk Management Measures

Technical conditions and	:	Local exhaust ventilation

measures		
Effectiveness (of a measure)	:	50 %
Note	:	Ensure that the direction of airflow is clearly away from the worker.
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	Wear suitable protective clothing. Wear suitable coveralls to prevent exposure to the skin.
Effectiveness (of a measure)	:	80 %
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that the distance from worker to task is greater than 1 m.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure that direction of application is only horizontal or downward.
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of work area
Organisational measures to prevent /limit releases, dispersion and exposure	:	Regular cleaning of equipment
Organisational measures to prevent /limit releases, dispersion and exposure	:	Ensure regular inspection, cleaning and maintenance of equipment and machines.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

24.2.7 ES 24 - CS 7: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm^2

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	inhalative
Technical conditions and measures	:	Local exhaust ventilation
Effectiveness (of a measure)	:	90 %
Personal protective measures	:	If technical measures not practical: Wear suitable respiratory protection.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

24.2.8 ES 24 - CS 8: Control of worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Note	:	No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

24.2.9 ES 24 - CS 9: Control of worker exposure: Industrial use (Roller application or brushing) (PROC10)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %

Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to hands.
Covers skin contact area up to	:	960 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment

Additional good practice advice	:	Wear solely goggles.

24.2.10 ES 24 - CS 10: Control of worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 100 %
Physical Form (at time of use)	:	Low volatile liquid
Vapour pressure	:	0,123 hPa

Frequency and duration of use

Exposure duration	:	<= 480 min
Frequency of use	:	<= 240 days per year

Human factors not influenced by risk management

Dermal exposure	:	Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to	:	480 cm²

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Indoor use

Risk Management Measures

Exposure routes	:	dermal
Personal protective measures	:	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Effectiveness (of a measure)	:	90 %

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

24.2.11 ES 24 - CS 11: Control of worker exposure: Industrial use (Tabletting, compression, extrusion, pelettisation, granulation) (PROC14)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 480 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

24.2.12 ES 24 - CS 12: Control of worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Product characteristics
Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Low volatile liquid
Vapour pressure : 0,123 hPa

Amount used
Storage : < 1 kg, < 1 l

Frequency and duration of use
Exposure duration : <= 480 min
Frequency of use : <= 240 days per year

Human factors not influenced by risk management
Dermal exposure : Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.
Covers skin contact area up to : 240 cm²

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor use

Risk Management Measures
Note : Use as laboratory reagent
No specific measures identified.

Additional good practice advice beyond the REACH Chemical Safety Assessment
Additional good practice advice : Wear solely goggles.

24.3. ES 24 Exposure estimation and reference to its source

24.3.2 ES 24 - CS 2: Worker exposure: Industrial use (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	0,03 mg/m³ (ECETOC TRA worker v2.0)	0,0007
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,004

24.3.3 ES 24 - CS 3: Worker exposure: Industrial use (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,08

24.3.4 ES 24 - CS 4: Worker exposure: Industrial use (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Chemical production where opportunity for exposure arises) (PROC3, PROC4)

Route of exposure and type of effects	Exposure estimate	RCR

Worker - inhalative, long-term - local and systemic	7,76 mg/m³ (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,22
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	0,003
combined routes	ECETOC TRA worker v2.0, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	0,23
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises)	0,06
combined routes	ECETOC TRA worker v2.0, Chemical production where opportunity for exposure arises	0,43

24.3.5 ES 24 - CS 5: Worker exposure: Industrial use (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,38

24.3.6 ES 24 - CS 6: Worker exposure: Industrial use (Industrial spraying) (PROC7)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	9,79 mg/m³ (Stoffenmanager v4.0)	0,28
Worker - dermal, long-term - systemic	54,6 mg/kg bw/day (RISKOFDERM v2.1)	0,52
combined routes	Not applicable	0,80

24.3.7 ES 24 - CS 7: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term	2,59 mg/m³ (ECETOC TRA worker v2.0)	0,07

- local and systemic		
Worker - dermal, long-term - systemic	13,71 mg/kg bw/day (ECETOC TRA worker v2.0)	0,13
combined routes	ECETOC TRA worker v2.0	0,20

24.3.8 ES 24 - CS 8: Worker exposure: Industrial use (Transfer of substance or mixture (charging/discharging) at dedicated facilities, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC8b, PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities)	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture (charging/discharging) at dedicated facilities	0,43
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,37
Worker - dermal, long-term - systemic	6,86 mg/kg bw/day (ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	0,06
combined routes	ECETOC TRA worker v2.0, Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	0,43

24.3.9 ES 24 - CS 9: Worker exposure: Industrial use (Roller application or brushing) (PROC10)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74
Worker - dermal, long-term - systemic	2,74 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,77

24.3.10 ES 24 - CS 10: Worker exposure: Industrial use (Treatment of articles by dipping and pouring) (PROC13)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term	25,87 mg/m³ (ECETOC TRA worker v2.0)	0,74

- local and systemic		
Worker - dermal, long-term - systemic	1,37 mg/kg bw/day (ECETOC TRA worker v2.0)	0,01
combined routes	ECETOC TRA worker v2.0	0,75

24.3.11 ES 24 - CS 11: Worker exposure: Industrial use (Tabletting, compression, extrusion, pelettisation, granulation) (PROC14)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	3,43 mg/kg bw/day (ECETOC TRA worker v2.0)	0,03
combined routes	ECETOC TRA worker v2.0	0,40

24.3.12 ES 24 - CS 12: Worker exposure: Industrial use (Use as laboratory reagent) (PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
Worker - inhalative, long-term - local and systemic	12,94 mg/m³ (ECETOC TRA worker v2.0)	0,37
Worker - dermal, long-term - systemic	0,34 mg/kg bw/day (ECETOC TRA worker v2.0)	0,003
combined routes	ECETOC TRA worker v2.0	0,37

24.4. ES 24 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

25. ES 25: Consumer use; Insulation foams

25.1. Title section

Polymer preparations and compounds (PC32)	
Environment	
CS1: Consumer use (Widespread use leading to inclusion into/onto article (indoor), Widespread use leading to inclusion into/onto article (outdoor))	ERC8c, ERC8f
Consumer	
CS2: Consumer use (Polymer preparations and compounds)	PC32

25.2. ES 25 Conditions of use affecting exposure

25.2.1 ES 25 - CS 1: Control of environmental exposure: Consumer use (Widespread use leading to inclusion into/onto article (indoor), Widespread use leading to inclusion into/onto article (outdoor)) (ERC8c, ERC8f)

Remarks	:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

25.2.2 ES 25 - CS 2: Control of consumer exposure: Consumer use (Polymer preparations and compounds) (PC32)

Product characteristics

Concentration of the Substance in Mixture/Article	:	<= 5 %
Physical Form (at time of use)	:	Liquid
Vapour pressure	:	0,123 hPa

Amount used

Amount per use	:	0,825 kg

Frequency and duration of use

Exposure duration	:	30 min
Frequency of use	:	0,2 days per year

Human factors not influenced by risk management

Covers skin contact area up to	:	1900 cm^2
Breathing volume	:	1,5 m3/day

Other given operational conditions affecting consumers exposure

Outdoor / Indoor	:	Indoor use
Room size	:	57,5 m3
Temperature	:	25 °C

Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene)

Consumer Measures	:	No specific measures identified.

25.3. ES 25 Exposure estimation and reference to its source

25.3.2 ES 25 - CS 2: Consumer exposure: Consumer use (Polymer preparations and compounds) (PC32)

Route of exposure and type of effects	Exposure estimate	RCR
Consumer- inhalative, long-term - local and systemic	0,06 mg/m³ (Consexpo v4.1)	0,009
Chronic dermal systemic exposure	0,007 mg/kg bw/day (Consexpo v4.1)	0,0008
Consumer - oral, long-term - systemic	Not applicable	
combined routes	Consexpo v4.1	0,01

25.4. ES 25 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

ECHA guidance for downstream users
Section 2

STATRON
NON STOP POWER

Interconnection Diagram

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E01
Sequence Number: 001
Rev: 005
Document number: K559-2254-CWIWP4202201-E01-001
Document description: Interconnection Diagram

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Interconnection Diagram
E01

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E01
Document name	Interconnection Diagram
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-02-20	C. Palenzuela	First version
2.0	2023-03-13	C. Palenzuela	Added earthing cables to interconnection diagram
3.0	2023-04-12	C. Palenzuela	Updated according to KBR comments
4.0	2024-12-13	C. Palenzuela	Updated labeling of Container 1 and 2 in interconnection diagram to as build
5.0	2025-01-22	C. Palenzuela	Updated scheme to as build Added cable tags

Table 1: Version overview

	Date	Name
Editor	2023-04-12	C. Palenzuela
Checked by	2023-04-13	A. Fritz
Approved by	2023-04-14	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
January 2025

Doc Code
K559-2254-CWIWP4202201-E01-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Interconnection Diagram	23A2007_250122_FREQCON_Interconnection_Diagram_v5.0

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The interconnection of the proposed BESS and PCS system is depicted in the interconnection diagram, attached to this document (*see section 1.3 "Other Applicable Documents"*).

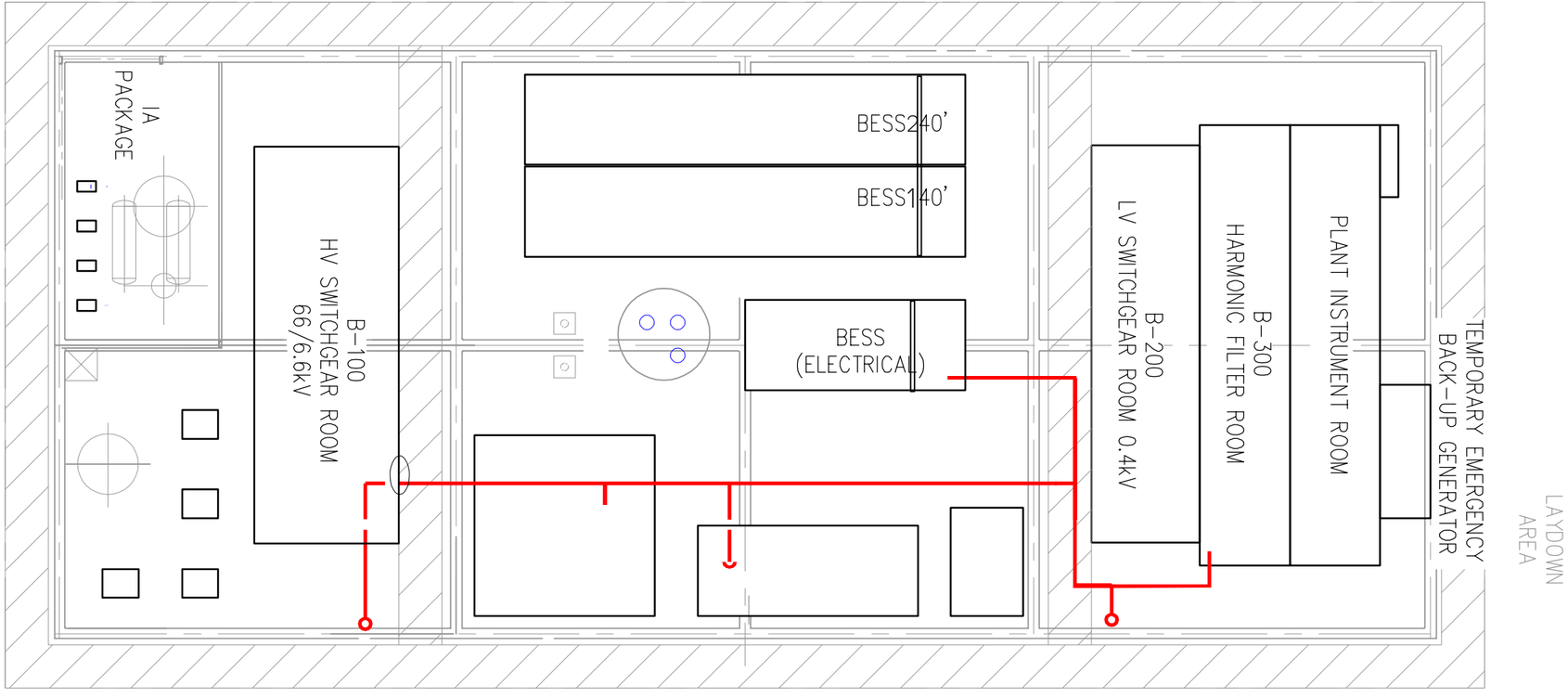
3 Appendix

1. FREQCON Interconnection Diagram:
   23A2007_250122_FREQCON_Interconnection_Diagram_v5.0

FREQCON

FREQCON CABLE CONNECTIONS
Version: v1.1
Date: 01.03.2023

- DC CABLE ROUTE
- 66kV CABLE ROUTE
- 6.6kV CABLE ROUTE
- 400V CABLE ROUTE
- CABLE RISING
- CABLE DROPPING



FREQCON

FREQCON INTERCONNECTION DIAGRAM

Version: v5.0

Date: 2025-01-23

- DC power cables
- 400 V aux. supply
- Communication cables
- 6.6 kV supply
- Earthing cables
- Hard wired signal cables

BESS 2

BAT 1 | BAT 3 | BAT 5 | BAT 7 | BAT 9 | Distribution Cabinet +DISTR 2

BAT 2 | BAT 4 | BAT 6 | BAT 8 | BAT 10 | BAT 11

BESS 1

BAT 12 | BAT 14 | BAT 16 | BAT 18 | BAT 20 | BAT 22

BAT 13 | BAT 15 | BAT 17 | BAT 19 | BAT 21 | Distribution Cabinet +DISTR 1

PCS

Converter (+CONV)

Control Cabinet (+CTRL)

- 111A2 Ethernet switches
- 111A1 Wall IE NAT device
- 114A1 XT1 Terminal
- -XT1 HVIO module
- -161U1
- -120A1

MV Transformer 18T1

L1 L2 L3

Earthing bracket (outside container)

DC+3_3_BAT / DC-3_3_BAT / DC+4_1_BAT - DC+4_3_BAT / DC-4_1_BAT - DC-4_3_BAT
DC+2_1_BAT - DC+2_3_BAT / DC-2_1_BAT - DC-2_3_BAT / DC+3_1_BAT / DC-3_ 1_BAT
4x2x1x70mm² HELUTHERM 145 Multi

4x2x1x70mm² HELUTHERM 145 Multi

113W4 RJ45 / CAT6 4x2x0,25 mm² - Ethernet cable

113W8 RJ45 / CAT6 4x2x0,25 mm² - Ethernet cable

2x95 mm² - Earthing Cable - H07

RJ45 / CAT6 4x2x0,25 mm² - PROFINET cable
120W2

RJ45 / CAT6 4x2x0,25 mm² - PROFINET cable
613W6

4x10 mm² - 400 V Aux Supply Cable - Not part of supply
from LV Switchroom B-200
83014-CEL

4x10 mm² - 400 V Aux Supply Cable - Not part of supply
from LV Switchroom B-200
83015-CEL

4x10 mm² - 400 V Aux Supply Cable - Not part of supply
from LV Switchroom B-200
83011-CEL

3x70 mm² - 6.6 kV Supply Cable - Not part of supply
Short circuit rating: 10 kA for 1s
from HV Switchroom B-100
82005- L1,L2,L3

2x95 mm² - Earthing Cable - H07

2x95 mm² - Earthing Cable - Not part of supply
from BLPH Central Earthing Point

P320 PLC / B400-NET-001.01 RJ45 / CAT6 4x2x0,25 mm² - PROFINET - remote control - Not part of supply
from Plant Instrument Room - B400

P320 PLC / B400-NET-001.02 RJ45 / CAT6 4x2x0,25 mm² - MODBUS - monitoring cable - Not part of supply
from Plant Instrument Room - B400

85001-CEC / 85002-CEC / C-85-XS-001 / B400-SIS-001 / P320PLC / B400-FGS-002 / P320PLC / B400-SIS-001 Hard wired signal cables - staus and command signals - Not part of supply

82006-CEC / 82007-CEC Hard wired signal cables - voltage measurement signals - Not part of supply

STATRON
NON STOP POWER

Panel Cabinet Layout

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E03
Sequence Number: 001
Rev: 002
Document number: K559-2254-CWIWP4202201-E03-001
Document description: Panel Cabinet Layout

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Panel Cabinet Layout
E03

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E03
Document name	Panel Cabinet Layout
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-01	C. Palenzuela	First version
2.0	2024-11-29	C. Palenzuela	First revised version

Table 1: Version overview

	Date	Name
Editor	2023-06-08	C. Palenzuela
Checked by	2023-06-09	A. Fritz
Approved by	2023-06-09	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8

Identification

Product Version / Document Version

Product version
Prototype

Document release date
November 2024

Doc Code
K559-2254-CWIWP4202201-E03-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

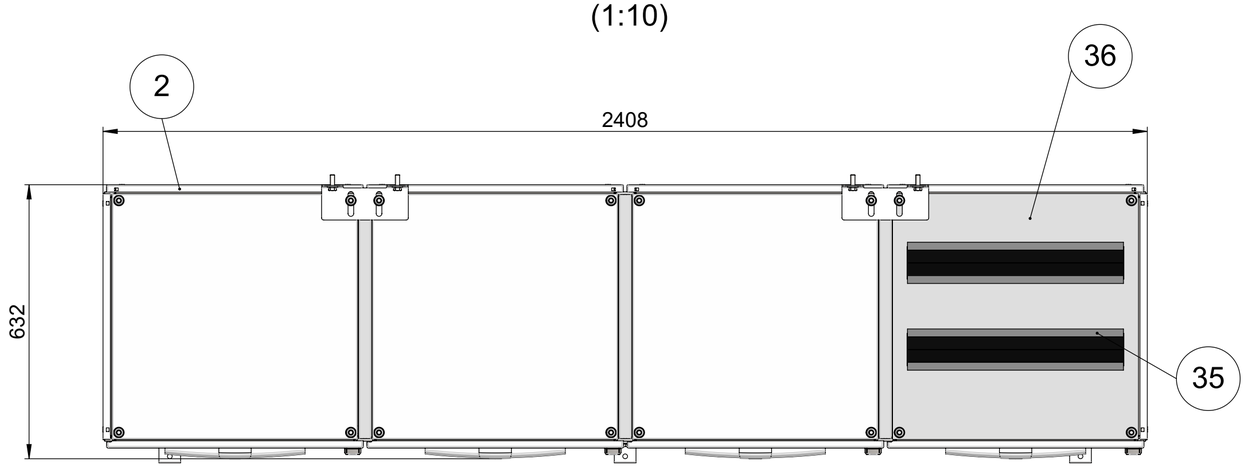
The following panel cabinet layouts of the components and switch cabinets inside the BESS and PCS containers are attached to this document.

Component	Manufacturer	FRQ part no.	File Name
Converter	FREQCON	53399	53399 Converter.pdf
Converter base		53400	53400 Converter Base.pdf
Control Cabinet		53402	53402 Control Cabinet.pdf
Battery Cabinets		52420	52420 Battery Cabinet with Modules LF280K_28
Cooling System Cabinet		52254	52254 Cooling System Cabinet
Distribution Cabinet		53409	53409 Distribution Cabinet

Table 4: Applicable documents



(1:10)



Item no.	Quantitiy	Description	Art.-no.	Supplier
1	1	Base	53400	--
2	4	Modular cabinet	52699	Rittal
3	4	Roof sheet VX25	52700	Rittal
4	4	Door VX multi cabinet	51453	
5	16	Door hinges 130°	507534	Rittal
6	16	Closing parts for VX	507533	Rittal
7	3	VX Power Stack 3*250A with TS	52867	--
8	3	VX Power Stack 1000A with TS	52872	--
9	3	VX Inductor 3x250A	53046	---
10	3	VX Inductor 1x1000A	53053	--
11	3	VX DC Switch & Fuse 3*250A	52882	--
12	1	VX BG Circuit breaker IEC 1000 A	52955	--
13	1		52918	--
14	8	System chassis 23x64mm	52116	Rittal
15	8	Connection 100x195	50604	--
16	2	PE+N rail VX 50x380 - 600 MTS	53290	--
17	1	AC connection VX U-shape	53190	--
18	2	Side panel VX	51612	Rittal
19	3	Socket holder	52082	
20	3	Hexagon head screw ISO 4017 - M10 x 20 - 8.8 - St.	503647	--
21	4	Hexagon head screw ISO 4017 - M10 x 30 - 8.8 - St.	503689	--
22	3	Washer	503802	--
23	3	Blind rivet nut	505721	Böllhoff
24	18	Baying connector outside VX	505595	Rittal
25	3		500497	Rittal
26	2	Bracket	51748	
27	4	Plain washers ISO 7089 - 12 - 200HV	500844	--
28	8	Filter fan (550m³)	500596	Rittal
29	12	Outlet filter	500529	Rittal
30	1	Grounding switch	53475	Freqcon
31	2	Splash guard simple VX	53193	
32	1	Protective cover 900	52609	---
33	1	Protective cover	52366	---
34	10	Angle protective cover	50538	--
35	4	Brush strip	52045	Rittal
36	1	Roof with cable gland	53509	Rittal
37	33	Support strip 540	500698	Rittal
38	4	Low voltage insulator M10-30	500628	Teknomega
39	4	Plain washers ISO 7093 - 10 - 200HV	503708	--
40	4	Hexagon head screw ISO 4017 - M10 x 16 - 8.8 - St.	503379	--
41	1	Abdeckung AC Filter 600x300	54643	

				IH
A	Lüfter Anordnung geändert		17.06.2024	MvD
Rev.:	Änderung (changes):		Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	16.01.2023	i. Hirsch
Checked:	17.06.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

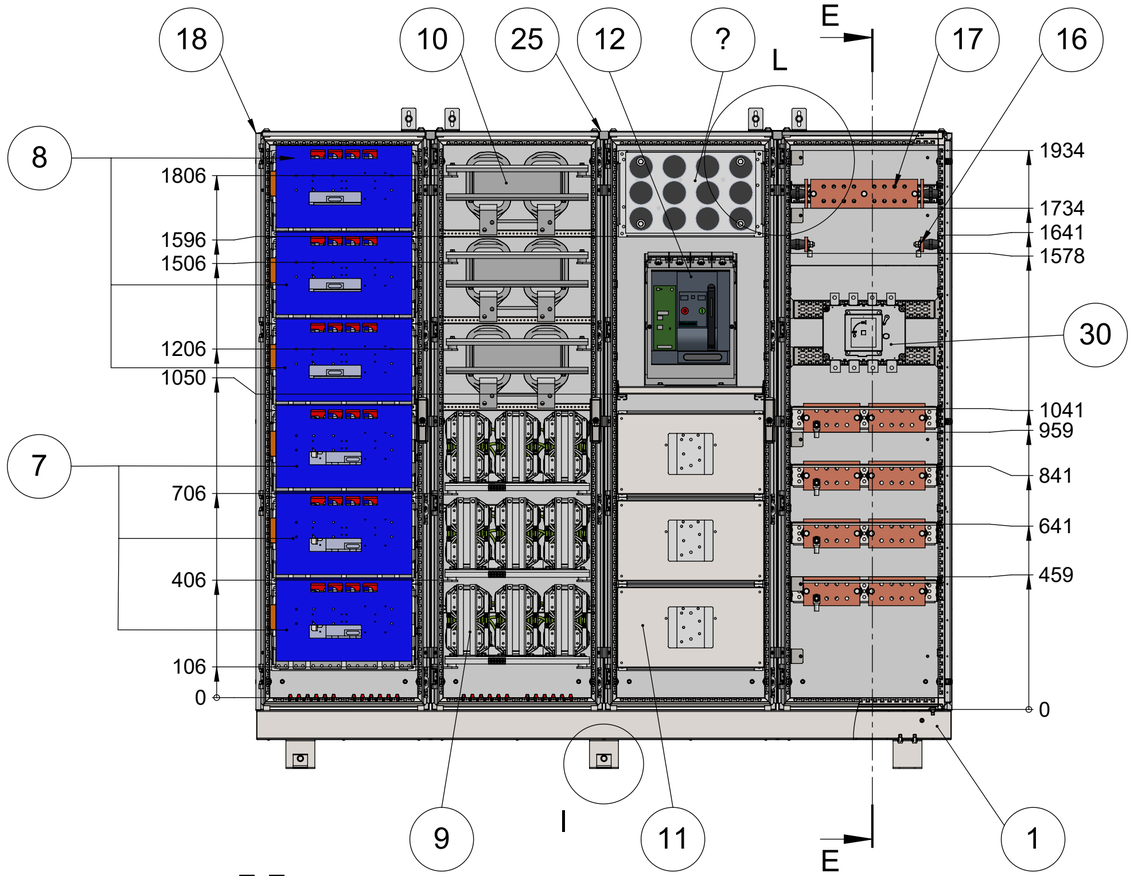
Oberfläche: - (surface)
Werkstoff (material):
Gewicht (weight): 2150kg

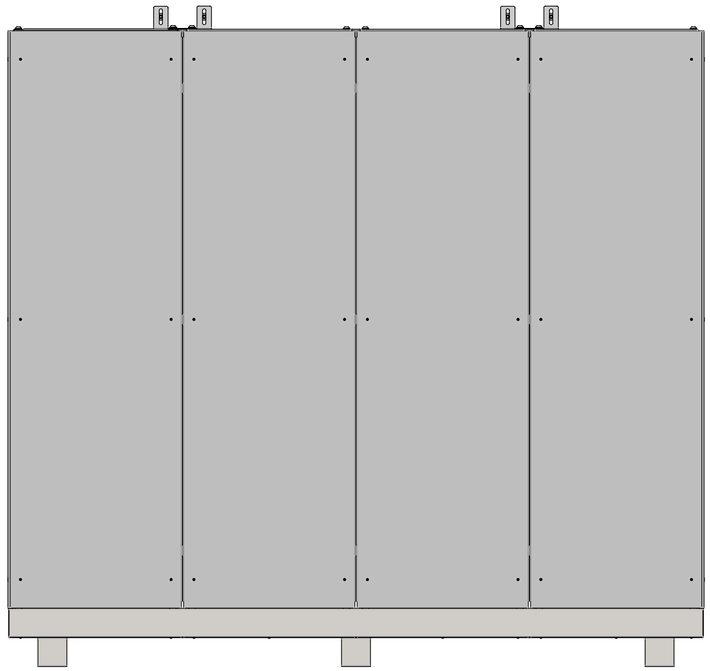
Bezeichnung (description):
Umrichter
Converter System

Scale: 1:15
Sheet: 1 (A2)
1 of: 3
Revision:

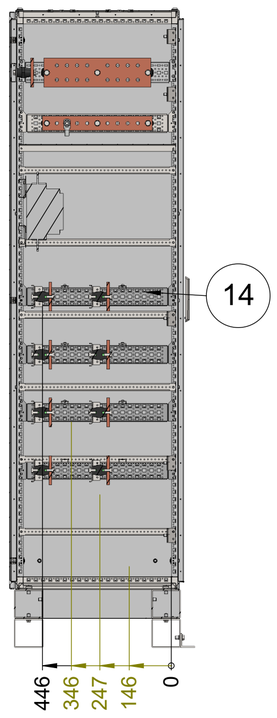
Artikel-Nr. (article number): 53399
alte Zeichnungs-Nr. (old drawing number):

CAD System SolidWorks
Status: Freigegeben

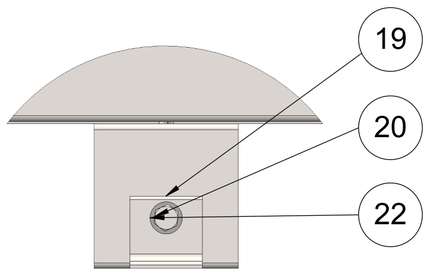




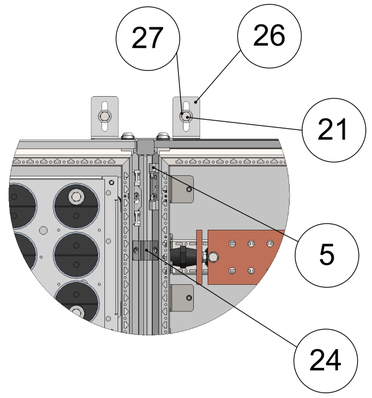
E-E



I (1:3)



L (1:8)



Rev.:	Änderung (changes):	Datum (Date):	Name:
			IH
A	Lüfter Anordnung geändert	17.06.2024	MvD

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

ISO 13715

	Datum (Date):	Name:
Drawn:	16.01.2023	i. Hirsch
Checked:	17.06.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material):

Gewicht (weight): 2150.00 kg

Bezeichnung (description):

Umrichter

Converter System

Scale: 1:15

Sheet: 2 (A2)

Artikel-Nr. (article number): 53399

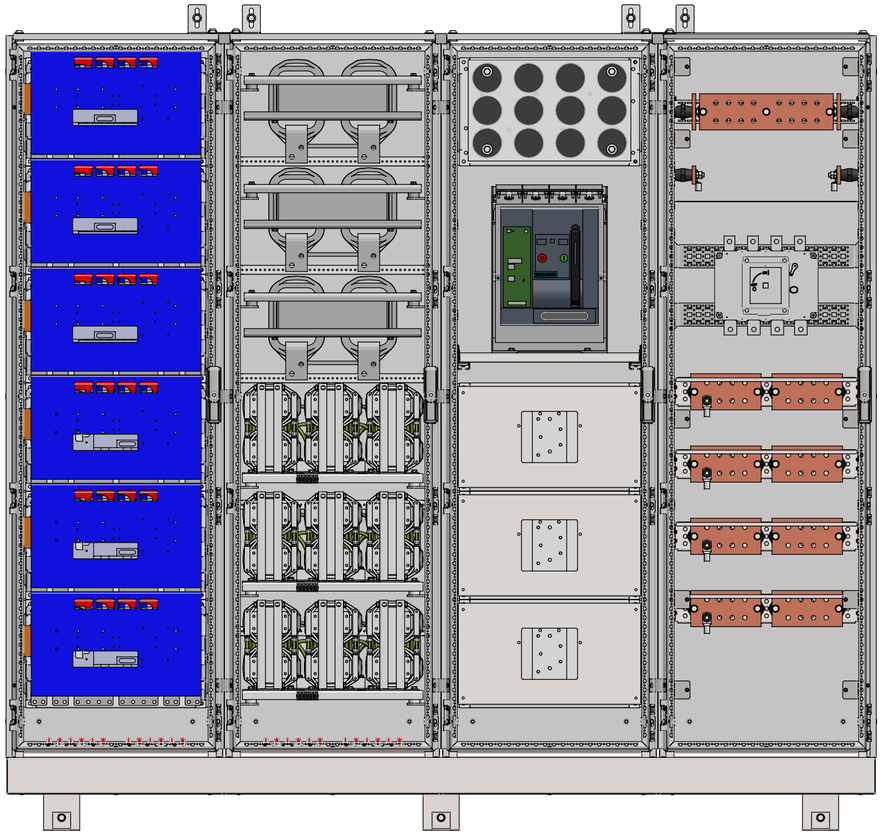
2 of: 3

Revision:

alte Zeichnungs-Nr. (old drawing number):

CAD System SolidWorks

Status: Freigegeben



			IH
A	Lüfter Anordnung geändert	17.06.2024	MvD
Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK							
	Abmaße in mm für Nennmaßbereiche						
Genauigkeitsgrad	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 2150.00 kg

ISO 13715

	Datum (Date):	Name:
Drawn:	17.02.2023	i. Hirsch
Checked:	17.06.2024	MvD

Bezeichnung (description):

Umrichter

Converter System

Scale: 1:15

Sheet: 3 (A2)

3 of: 3

Revision:

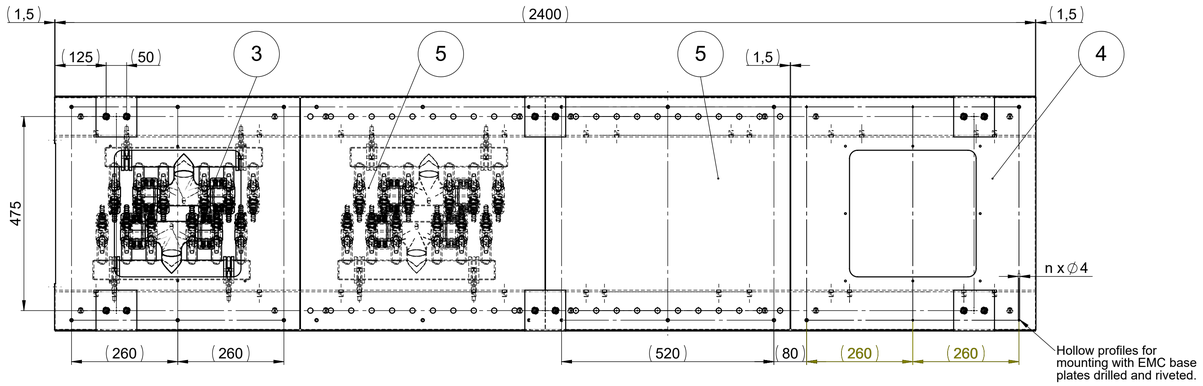
Artikel-Nr. (article number): 53399

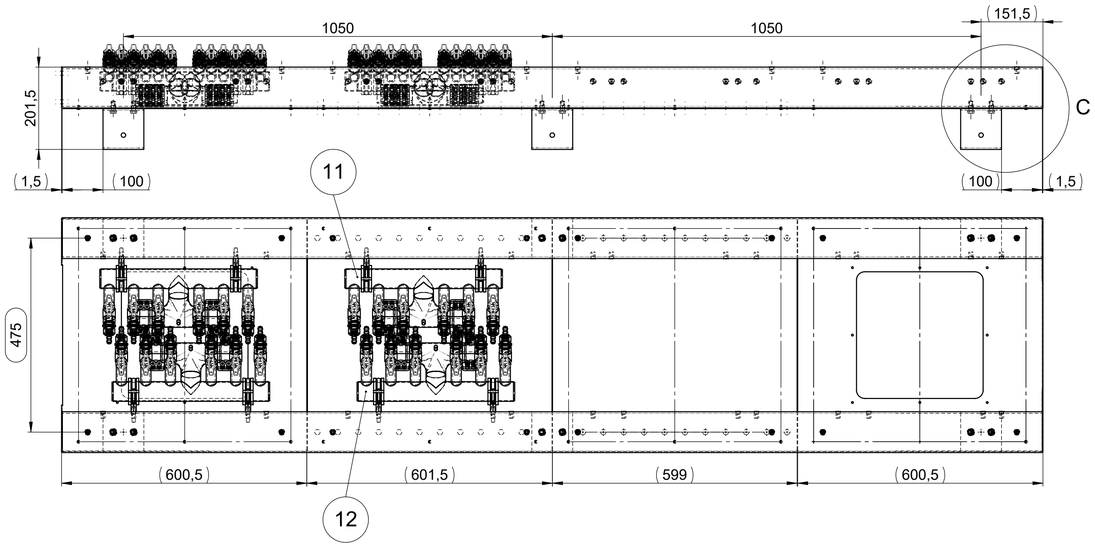
Projekt-Nr. & Kunde (project number & customer):

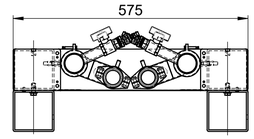
CAD System SolidWorks | Status: Freigegeben

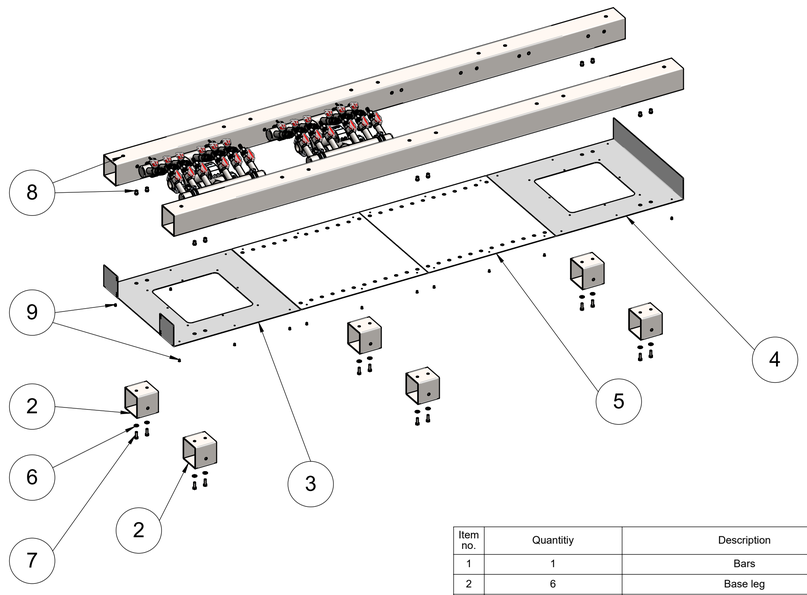
Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

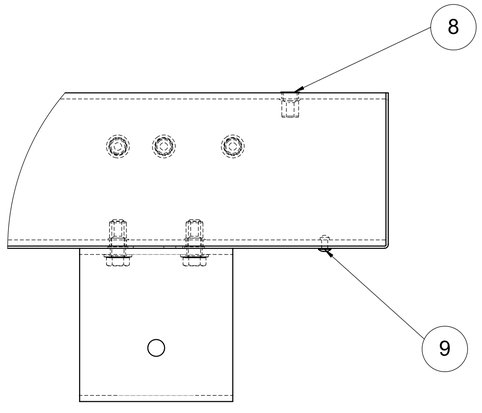








C (1 : 2)



Item no.	Quantitiy	Description	Art.-no.	Supplier
1	1	Bars	53401	Freqcon
2	6	Base leg	50011	---
3	1	EMC cover plate open 600xD600 cut-out	51242	---
4	1	EMC cover plate 600xD600 cut-out	51307	---
5	2	EMC base plate 600xD600	50886	---
6	12	Locking washer M8 - form M	503801	--
7	12	Hexagon head screw ISO 4017 - M8 x 25 - 8.8 - St.	503683	--
8	60	Blind rivet nut	505060	Böllhoff
9	20	Blind rivet aluminium/steel flat round head	505069	Gesipa
10	2	Water manifold outlet 6	50563	--
11	1	Water manifold end piece 6 left	50557	--
12	1	Water manifold end piece 6 right	51567	--

Rev.:	Änderung (changes):	Datum (Date):	Name:
A	geprüft und freigegeben	19.03.2024	IH

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK
Abmaße in mm für Nennmaßbereiche

Genauigkeitsgrad	0,5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material):

Gewicht (weight): 98.84 kg

ISO 13715

	Datum (Date):	Name:
Drawn:	02.02.2023	i. Hirsch
Checked:	19.03.2024	MvD

Bezeichnung (description):

Sockel

Base

Scale: 1:7.5

Sheet: 1 (A1)

1 of: 2

Revision:

Artikel-Nr. (article number): 53400

alte Zeichnungs-Nr. (old drawing number):

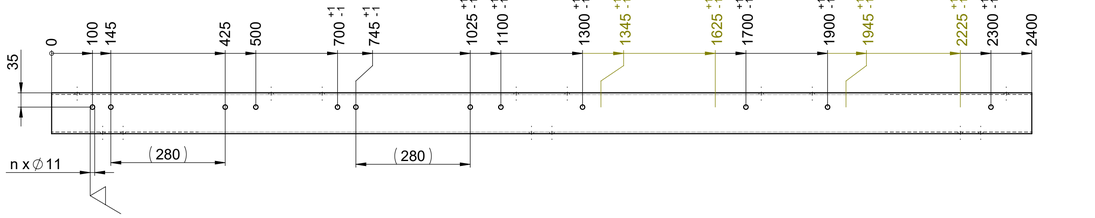
CAD System SolidWorks

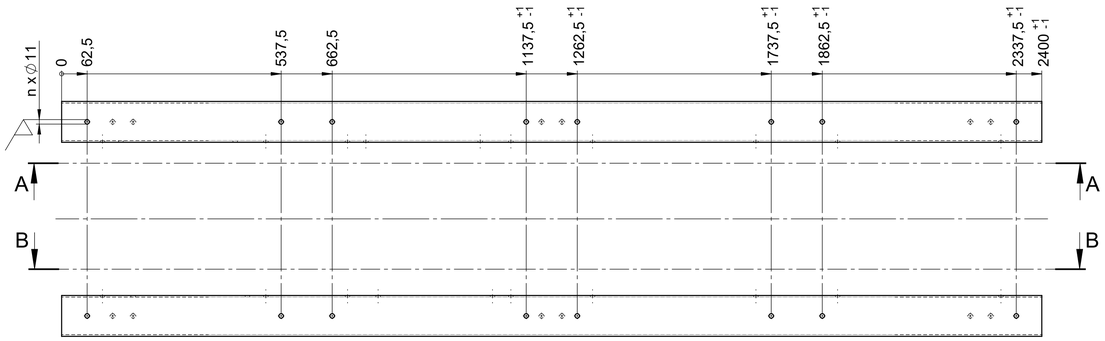
Status: Freigegeben

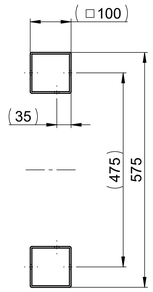
Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

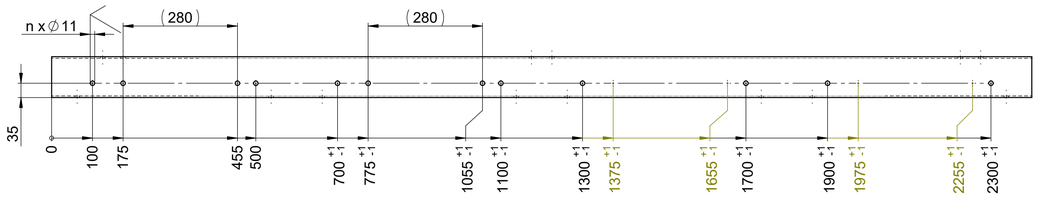
A-A



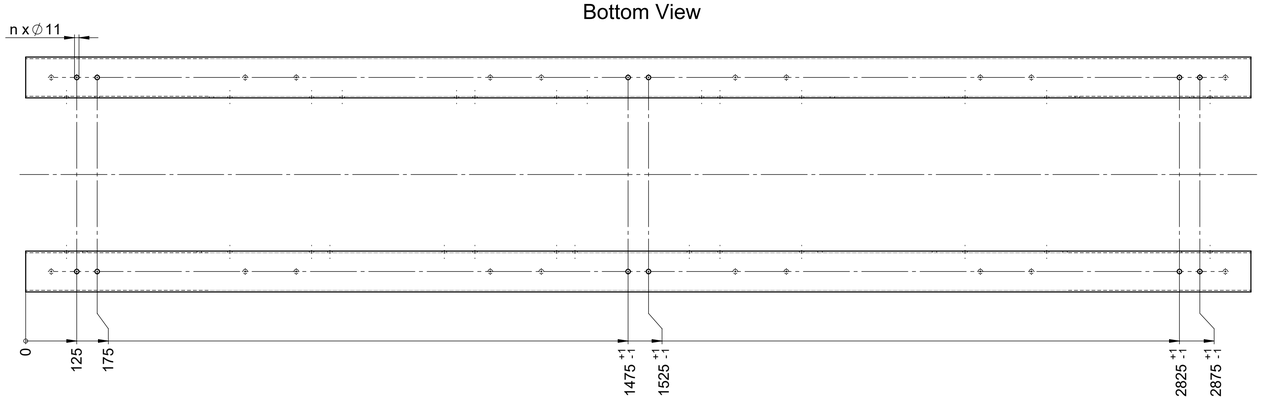




B-B



Bottom View



Rev.:	Änderung (changes):	Datum (Date):	Name:
A	geprüft und freigegeben	19.03.2024	IH

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0,5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0,1	± 0,1	± 0,2	± 0,3	± 0,5	± 0,8	± 1,2

Oberfläche: (surface) -

Werkstoff (material): 1.0037 (S235JR)

Gewicht (weight): 56.84 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	02.02.2023	I. Hirsch
Checked:	19.03.2024	MvD

Bezeichnung (description):

Holme

Bars

Scale: 1:7.5

Sheet: 2 (A1)

2 of: 2

Revision:

Artikel-Nr. (article number): 53401

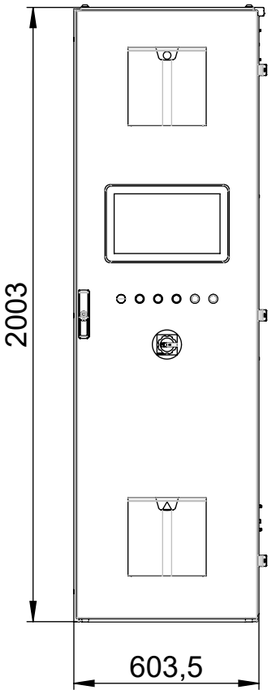
alte Zeichnungs-Nr. (old drawing number):

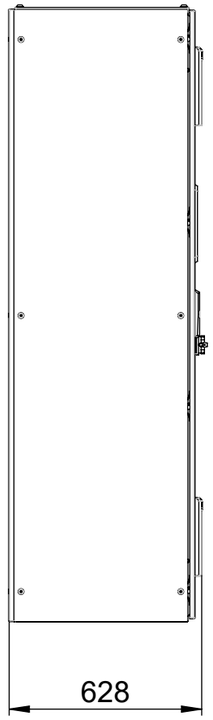
CAD System SolidWorks

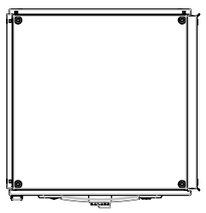
Status: Freigegeben

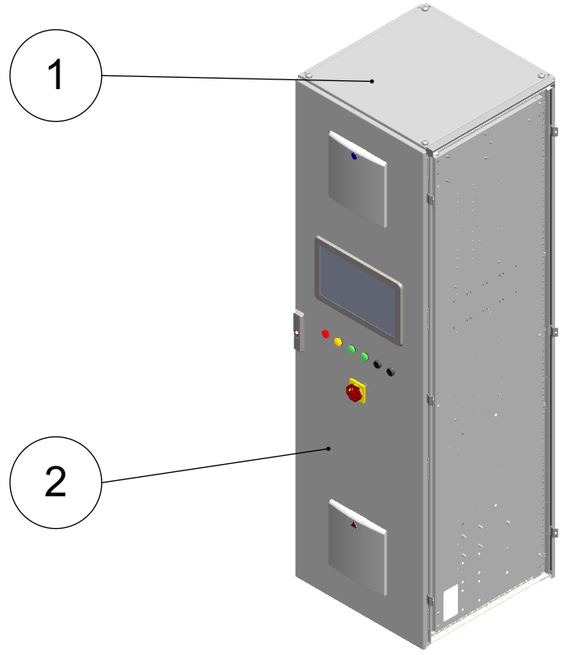
Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0









Item no.	Quantitiy	Description	Art.-no.	Supplier	Supplier number
1	1	VX control cabinet standardized	53187	--	--
2	1	Control cabinet components 1	53457	--	--

Rev.:	Änderung (changes):	Datum (Date):	Name:
A	geprüft und freigegeben	19.03.2024	IH

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 204.06 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	19.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Steuerschrank 1

Control Cabinet 1

Scale: 1:20

Sheet: 1 (A3)

1 of: 2

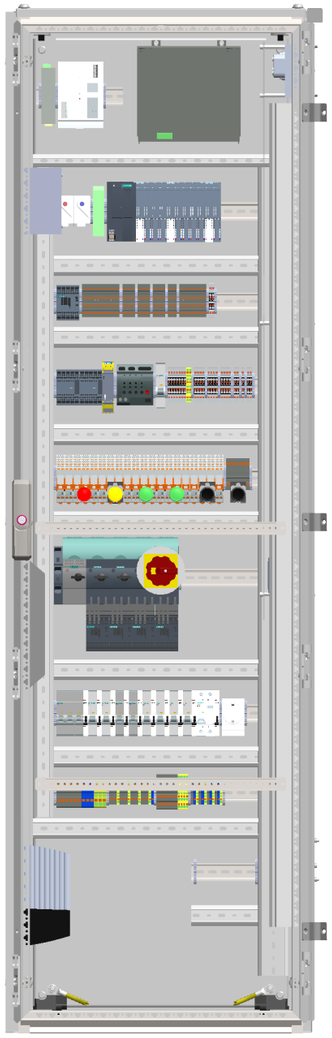
Artikel-Nr. (article number): 53402

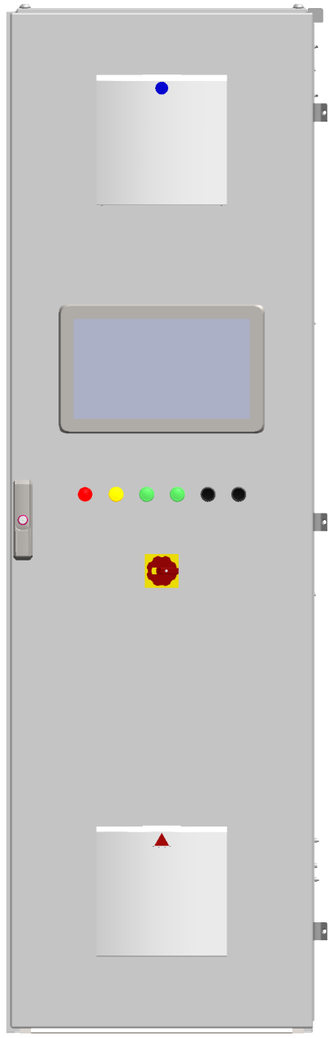
alte Zeichnungs-Nr. (old drawing number):

Revision:

CAD System SolidWorks

Status: Freigegeben





A	geprüft und freigegeben	19.03.2024	IH
Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	19.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 204.06 kg

Bezeichnung (description):

Steuerschrank 1
Control Cabinet 1

Scale: 1:12

Sheet: 2 (A3)

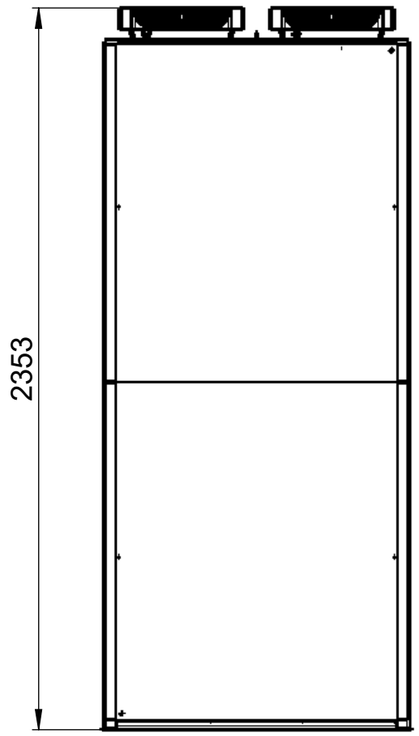
2 of: 2

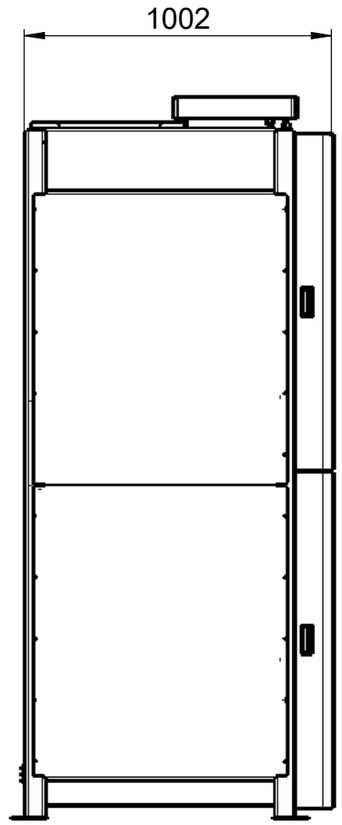
Revision:

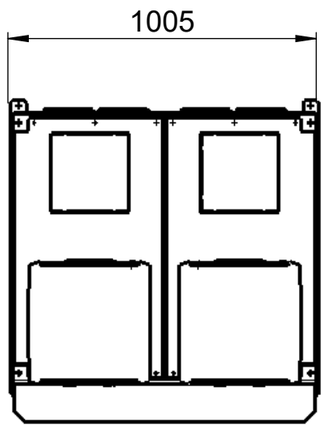
Artikel-Nr. (article number): 53402

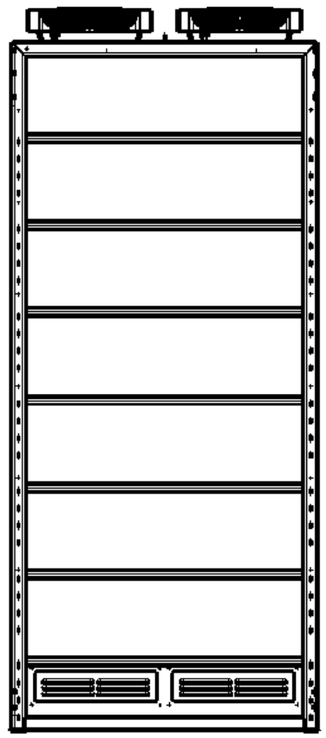
Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben

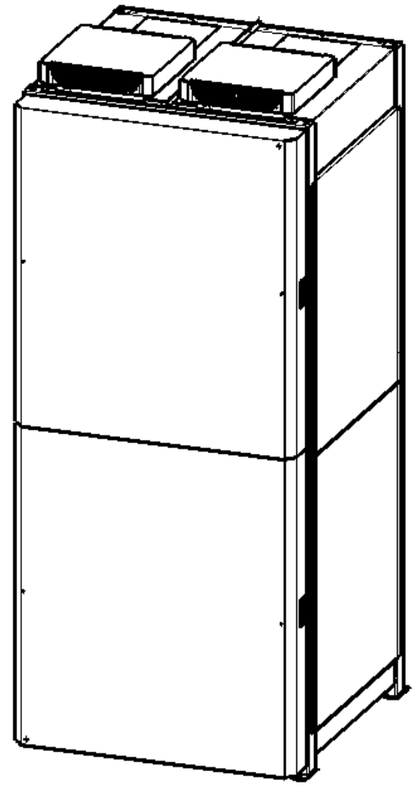


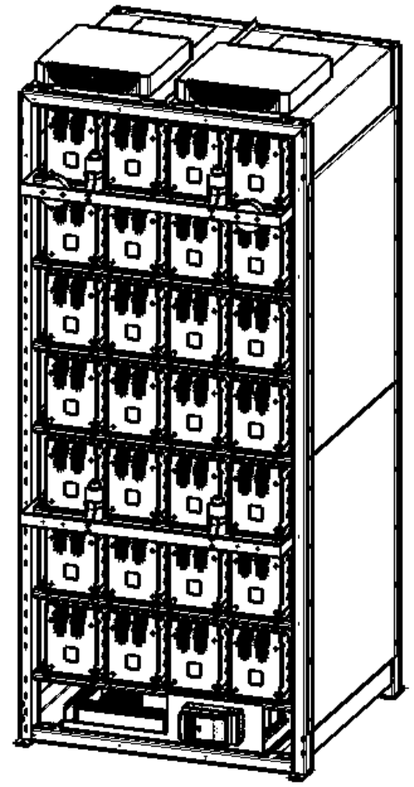






Fully equipped battery cabinet with smoke detectors and active fire extinguishing system consisting of self-activating aerosol cartridges.





Further information can be found in the attached data sheets
50_20_01_220330_DS_Battery_Module_LF280_v1.0 and
50_20_220308_52365_Datasheet_Battery_Module_LF280_v1.0_EN.

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK							
Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	13.08.2021	Irina Hirsch
Checked:		

Oberfläche: (surface) -

Werkstoff (material): 2194.33 kg

Bezeichnung (description):

Batterieschrank LF280K

Battery Cabinet

Scale: 1:20

Sheet: 1 (A3)

1 of: 2

Artikel-Nr. (article number): 52420

alte Zeichnungs-Nr. (old drawing number):

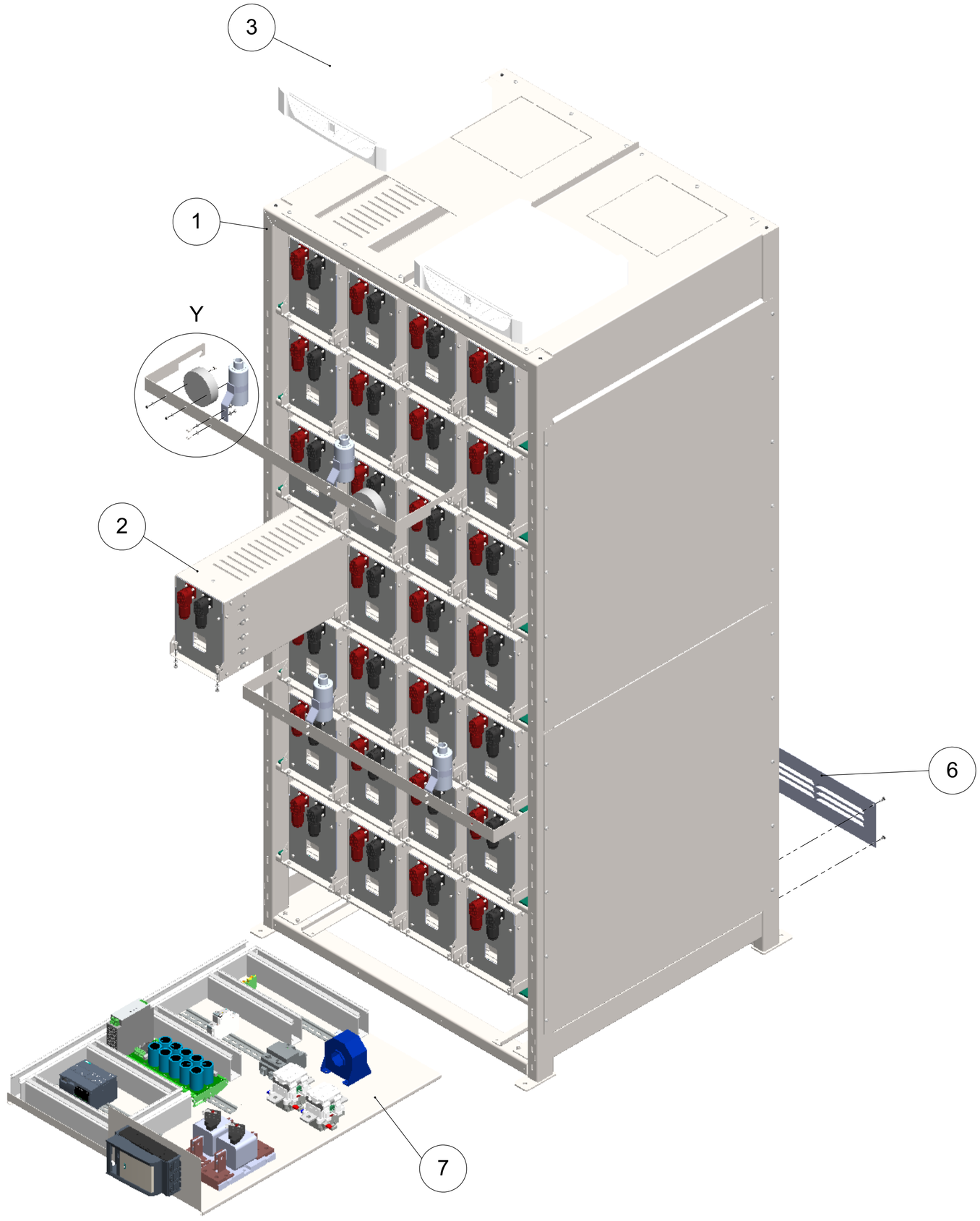
Revision: A

CAD System SolidWorks

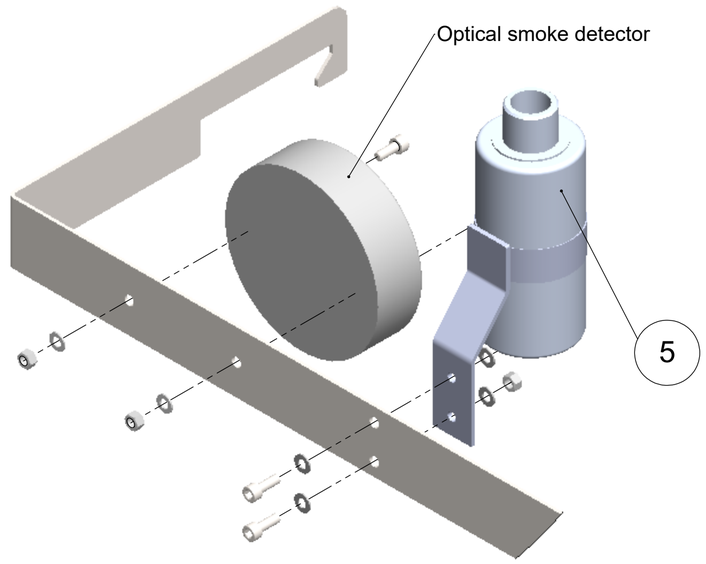
Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.“

Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0



Y (1:2)



Item no.	Quantitiy	Description	Art.-no.	Supplier
1	1	battery cabinet	52182	--
2	28	Battery module LF280K	52365	FREQCON
3	2	Roof vent	505587	
5	4	Aerosol extinguisher	506501	Aero-X
6	2	Weather protection grille	52413	Upmann
7	1	Control unit 28 modules	53001	FREQCON

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

ISO 13715

	Datum (Date):	Name:
Drawn:	13.08.2021	Irina Hirsch
Checked:		

Schutzvermerk ISO 16016:
Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material):

Gewicht (weight): 2194.33 kg

Bezeichnung (description):

Batterieschrank LF280K

Battery Cabinet

Artikel-Nr. (article number): 52420

alte Zeichnungs-Nr. (old drawing number):

Scale: 1:8

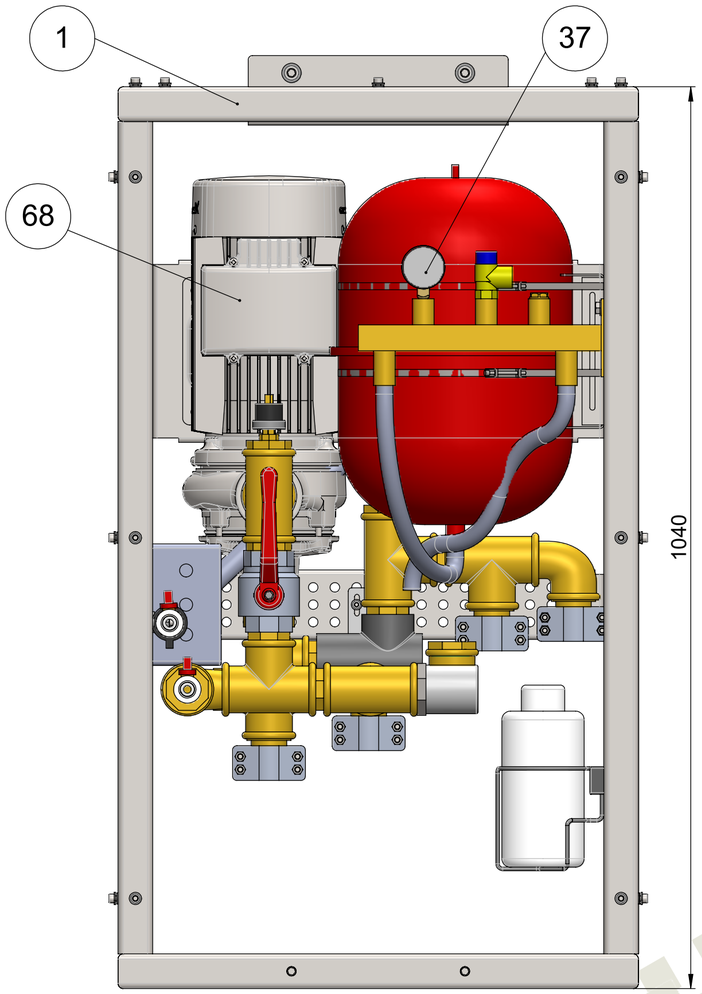
Sheet: 2 (A2)

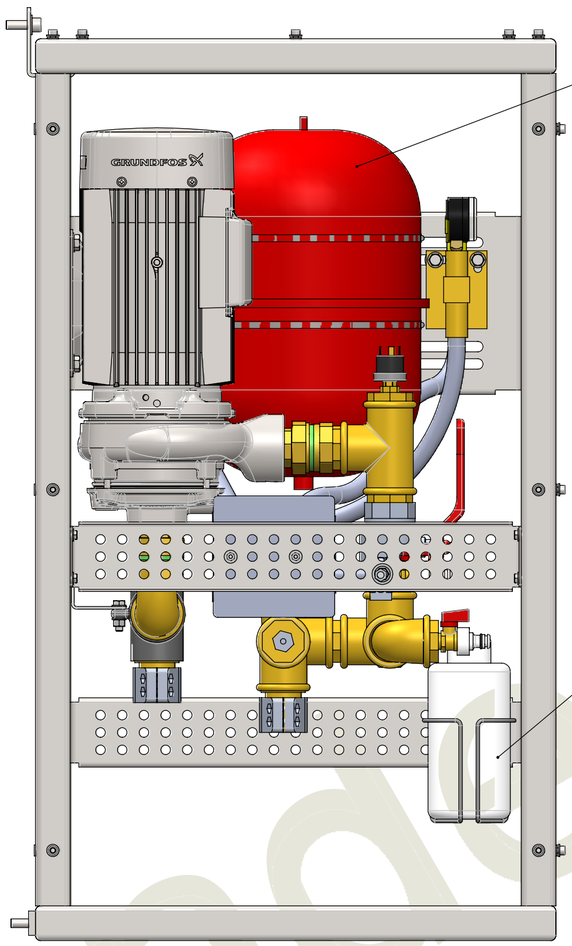
2 of: 2

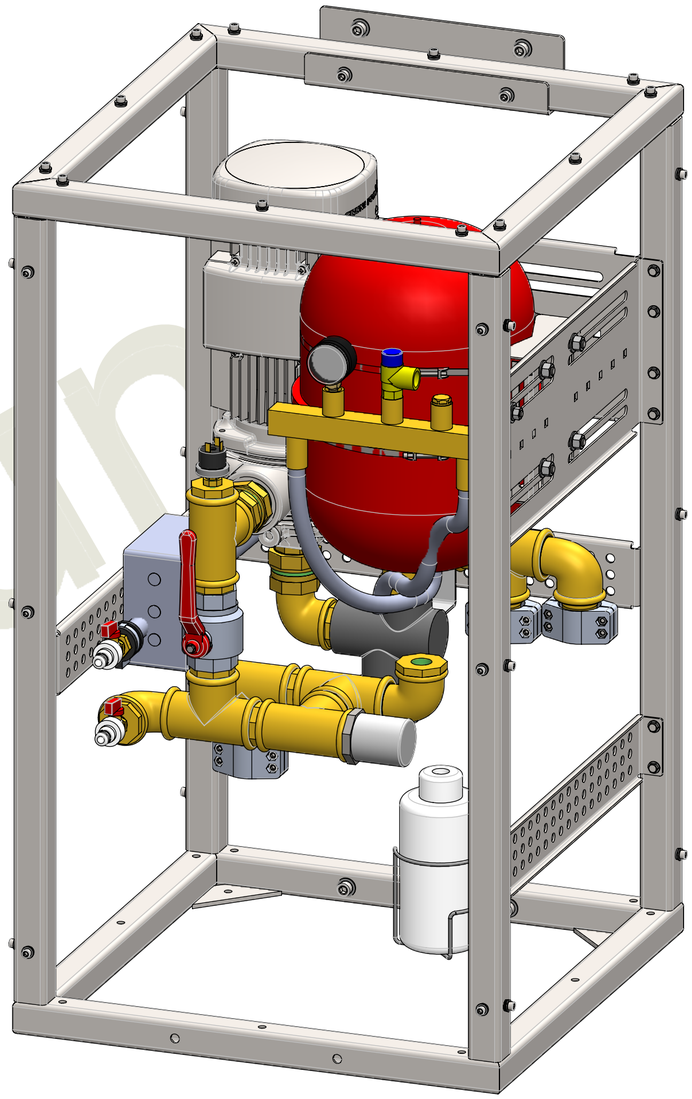
Revision: A

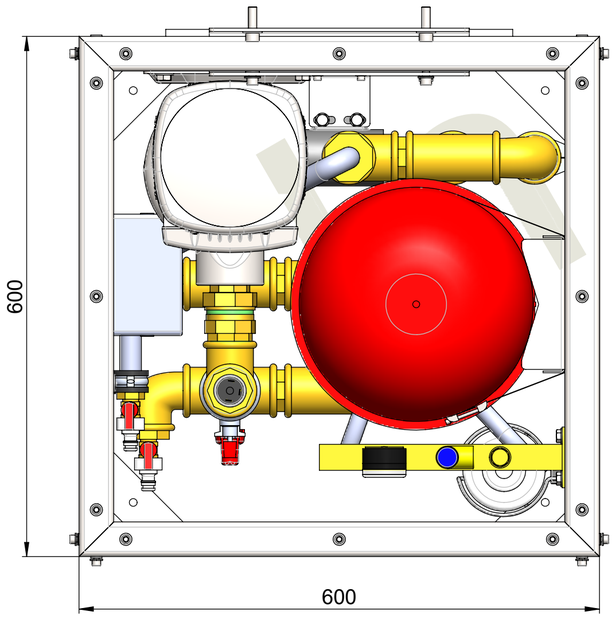
CAD System SolidWorks

Status: Freigegeben









Item no.	Quantitiy	Description	Art.-no.
1	1	Rack cooling system	52253
33	1	Expansion vessel	506507
37	1	Pressure gauge	506509
41	1	Overflow vessel	501613
68	1	Pump	501409

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material):

Gewicht (weight): 172.47 kg

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	03.06.2021	Irina Hirsch
Checked:		

Bezeichnung (description):

Pumpensystem Universal

Universal pump system

Scale: 1:5

Sheet: 1 (A2)

1 of: 7

Revision: A

Artikel-Nr. (article number): 52254

alte Zeichnungs-Nr. (old drawing number):

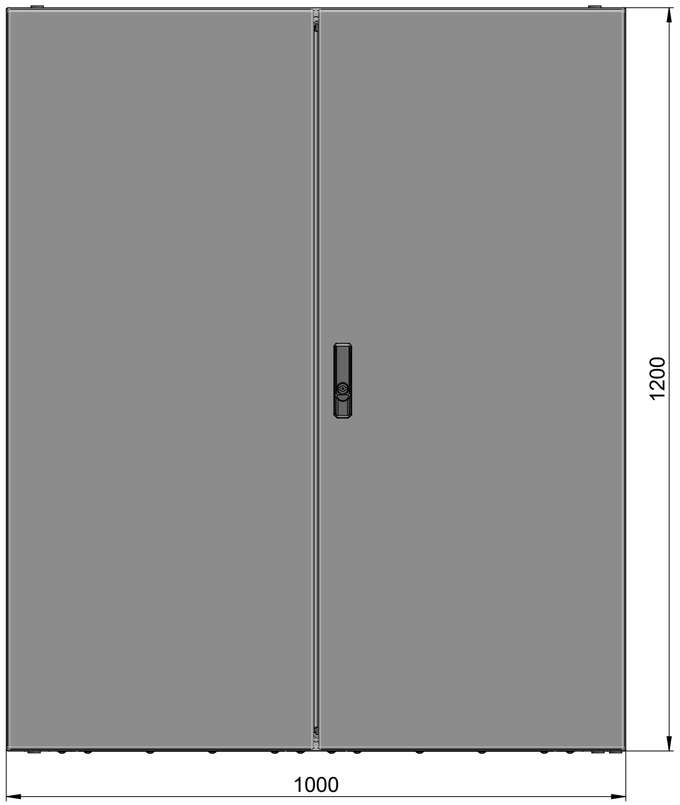
CAD System SolidWorks

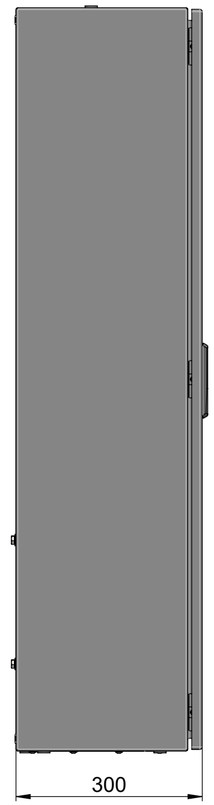
Status: In Bagatelländerung

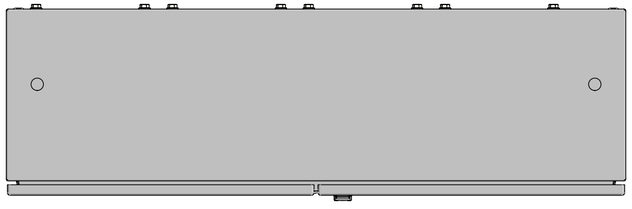
Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.*

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Änderung







Rev.:	Änderung (changes):											Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK							
	Abmaße in mm für Nennmaßbereiche						
Genauigkeitsgrad	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	03.05.24	I. Hirsch
Checked:	27.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 31.36 kg

Bezeichnung (description):

Hilfsversorgungsschrank 1

Distribution Cabinet 1

Scale: 1:7

Sheet: 1 (A2)

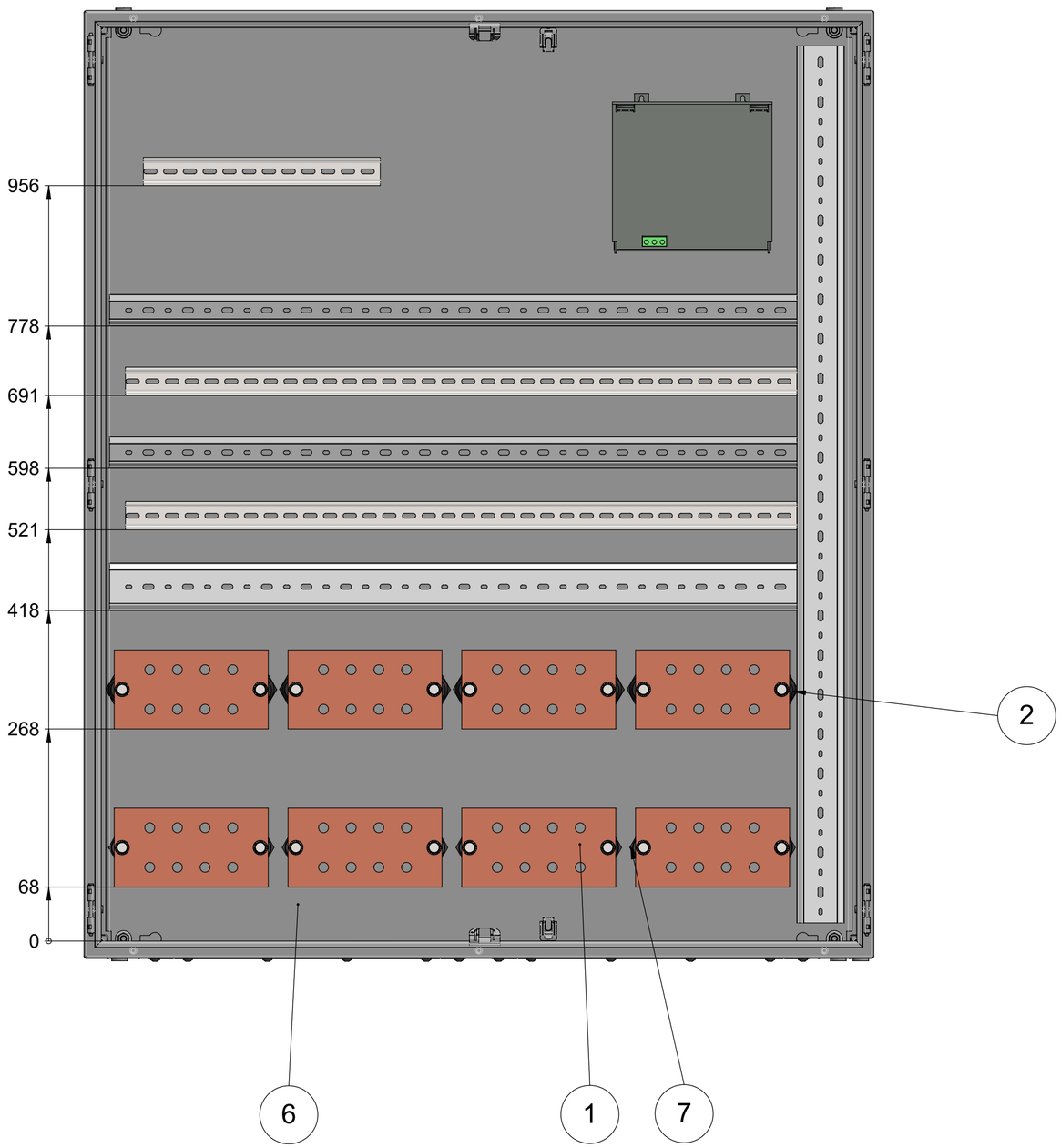
Artikel-Nr. (article number): 53409

1 of: 2

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Pos. Nr.	Menge	Bezeichnung	Art.-Nr.	Lieferant	Lieferanten Nr.
1	8	Anschluß 100x195	50602	---	---
2	8	Isolator M10-50	500629	Teknomega	ISO2090
3	30	Sperrkantscheibe M8 - Form M - St.	503801	--	--
4	22	Sechskantschraube ISO 4017 - M8 x 20 - 8.8 - St.	503682	--	--
5	8	Sechskantschraube ISO 4017 - M8 x 25 - 8.8 - St.	503683	--	--
6	1	AX Kompaktschrank 1000x1200	54576	Rittal	1213000
7	8	Isolator M10-30	500628	Teknomega	ISO9297

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

ISO 13715

	Datum (Date):	Name:
Drawn:	03.05.24	I. Hirsch
Checked:	27.05.2024	MvD

Oberfläche: (surface) -

Werkstoff (material): 31.36 kg

Bezeichnung (description):

Hilfsversorgungsschrank 1

Distribution Cabinet 1

Scale: 1:5

Sheet: 2 (A2)

2 of: 2

Revision:

Artikel-Nr. (article number): 53409

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks

Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.*

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Terminal Block Diagrams

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E04
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-E04-001
Document description: Terminal Block Diagrams

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version

Terminal Block Diagrams
E04

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E04
Document name	Terminal Block Diagrams
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	C. Palenzuela
Checked by	2023-03-14	A. Fritz
Approved by	2023-03-14	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-E04-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
BESS and PCS circuit diagram	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20230316_V0.01_preliminary

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The terminal block diagrams are integrated in the electrical schematics, that are attached to this document (*see section 1.3 "Other Applicable Documents"*).

3 Appendix

1. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20230316_V0.01_preliminary

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	CONVERTER CONTAINER	
Circuit diagram No:	10354_23A2007	20250805_V2.0

Producer (company):	Freqcon GmbH	53396
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	CT_Ausbau_1 53457 CT_Ausbau_2 53765
Type:	BESS MSC-1000-620-8	CONV 53399
Project manager:	Freqcon_CP	

created on:	17.09.2019			
edited on:	05.08.2025	edited by:	Freqcon_DG	total pages: 492

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	05.11.2024	Freqcon_DG
	3	INDEX	23.01.2025	Freqcon_DG
	4	INDEX	23.01.2025	Freqcon_DG
	5	INDEX	23.01.2025	Freqcon_DG
	6	INDEX	05.11.2024	Freqcon_DG
	7	INDEX	23.01.2025	Freqcon_DG
	8	INDEX	21.01.2025	Freqcon_DG
	9	INDEX	23.01.2025	Freqcon_DG
	10	INDEX	21.01.2025	Freqcon_DG
	11	INDEX	21.01.2025	Freqcon_DG
	12	INDEX	21.01.2025	Freqcon_DG
	13	INDEX	23.01.2025	Freqcon_DG
	14	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&ELU		Cabinet Overview		
	5a	CABINETS OVERVIEW	05.11.2024	Freqcon_DG
&EFS ++TRA		Circuit diagram medium voltage transformer		
	18	MV-TRANSFORMER UNIT_01+02	05.11.2024	Freqcon_DG
	18a	TEMPERATURE TRANSFORMER UNIT_01+02	05.11.2024	Freqcon_DG
&EFS ++CONV		Circuit diagram Converter		
	78	GRID CONNECTION	18.06.2024	Freqcon_JD
	80	BG CIRCUIT BREAKER 1000A AC GRID	18.06.2024	Freqcon_JD
	82	PI INDUCTORS GRID SIDE	18.06.2024	Freqcon_JD
	83	GRID AC FILTER 3* 600 µF + OVERVOLTAGE PROTECTOR	18.06.2024	Freqcon_JD
	99	BUSBARS N, PE	18.06.2024	Freqcon_JD
	200	POWER CIRCUITS COVER PAGE	14.06.2024	Freqcon_JD
	201	IGBT & INDUCTOR FOR GRID PHASE 1	18.06.2024	Freqcon_JD
	202	IGBT & INDUCTOR FOR GRID PHASE 2	18.06.2024	Freqcon_JD
	203	IGBT & INDUCTOR FOR GRID PHASE 3	18.06.2024	Freqcon_JD
	207	IGBT & INDUCTOR SUB 3_1 - 3_3	18.06.2024	Freqcon_JD
	211	IGBT & INDUCTOR SUB 2_1 -2_3	18.06.2024	Freqcon_JD
	217	IGBT & INDUCTOR SUB 4_1 -4_3	18.06.2024	Freqcon_JD
	227	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	18.06.2024	Freqcon_JD
	227.a	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	18.06.2024	Freqcon_JD
	228	DC SURGE ARRESTER 3_1 - 3_3	18.06.2024	Freqcon_JD
	231	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	231.a	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	237	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	237.a	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	29.07.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CONV		Circuit diagram Converter		
	238a	DC SURGE ARRESTER 2_1 - 2_3	18.06.2024	Freqcon_JD
	238b	DC SURGE ARRESTER 4_1 - 4_3	18.06.2024	Freqcon_JD
	260	SMOKE DETECTOR	18.06.2024	Freqcon_JD
	279	CONVERTER CABINET CLIMATE	18.06.2024	Freqcon_JD
	281	CIRCUIT BREAKER CABINET CLIMATE	18.06.2024	Freqcon_JD
&EFS ++CT		Circuit diagram Control cabinets		
	84	FEEDING CONTROL CABINET (CTRL)	29.07.2024	Freqcon_DG
	85	SUPPLY UDC	29.07.2024	Freqcon_DG
	100	CONTROL CABINET COVER PAGE	18.06.2024	Freqcon_JD
	101	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	102	CONTROL VOLTAGE UPS	18.06.2024	Freqcon_JD
	103	CONTROL VOLTAGE FUSE	29.07.2024	Freqcon_DG
	110	MAIN PLC	20.06.2024	Freqcon_JD
	111	ETHERNET SWITCH	23.01.2025	Freqcon_DG
	112	PANEL PC HMI	18.06.2024	Freqcon_JD
	113a	ETHERNET / PROFINET ISOLATOR	18.06.2024	Freqcon_JD
	113b	ETHERNET / PROFINET ISOLATOR	18.06.2024	Freqcon_JD
	113c	PROFINET	25.11.2024	Freqcon_DG
	114	HELMHOLZ	23.01.2025	Freqcon_DG
	115	UMTS ROUTER	18.06.2024	Freqcon_JD
	120	ET200 24V DC	25.11.2024	Freqcon_DG
	121	ET200SP DIGITAL INPUTS DI_01 - DI_03	14.06.2024	Freqcon_JD
	122	ET200SP DIGITAL INPUTS DI_04 + DI_05	14.06.2024	Freqcon_JD
	123	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	14.06.2024	Freqcon_JD
	123.a	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	18.06.2024	Freqcon_JD
	124	ET200SP ANALOG INPUTS AI_01 - AI_03	14.06.2024	Freqcon_JD

previous page: 2

next page: 4

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram Control cabinets		
	125	ET200SP ANALOG INPUTS AI_04	14.06.2024	Freqcon_JD
	126	INPUTS CONTROL ELEMENTS	02.07.2024	Freqcon_JD
	127	DIGITAL INPUTS CB 1	18.06.2024	Freqcon_JD
	128	DIGITAL INPUTS CB 2	18.06.2024	Freqcon_JD
	129	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	18.06.2024	Freqcon_JD
	130	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	18.06.2024	Freqcon_JD
	131	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	29.07.2024	Freqcon_DG
	132	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	29.07.2024	Freqcon_DG
	133	DIGITAL INPUTS SPARE	05.11.2024	Freqcon_DG
	134	DIGITAL INPUTS SMOKE DETECTORS	18.06.2024	Freqcon_JD
	135	OUTPUTS FAN	19.06.2024	Freqcon_JD
	136	OUTPUTS COMMUNICATION	12.09.2024	Freqcon_DG
	137	OUTPUTS CIRCUIT BREAKER	18.06.2024	Freqcon_JD
	138	OUTPUTS CONTROL ELEMENTS	03.07.2024	Freqcon_JD
	139	OUTPUTS COOLING	14.06.2024	Freqcon_JD
	140	OUTPUTS CONTROL ELEMENTS	14.06.2024	Freqcon_JD
	145	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	14.06.2024	Freqcon_JD
	146	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	18.06.2024	Freqcon_JD
	147	ANALOG INPUTS CABINET TEMPERATURE	18.06.2024	Freqcon_JD
	148	ANALOG INPUTS COOLING WATER TEMPERATURE	18.06.2024	Freqcon_JD
	149	ANALOG INPUTS MEASURING VOLTAGE	18.06.2024	Freqcon_JD
	150	OUTPUTS DC CONTACTORS 2_1	18.06.2024	Freqcon_JD
	151	OUTPUTS DC CONTACTORS 2_2, 2_3	18.06.2024	Freqcon_JD
	160	INTERFACE HVIO 1	29.07.2024	Freqcon_DG
	161	INTERFACE HVIO 2	05.11.2024	Freqcon_DG
	162	INTERFACE HVIO 2 ANALOG	18.06.2024	Freqcon_JD
	163	INTERFACE HVIO 3	18.06.2024	Freqcon_JD

previous page: 3

next page: 5

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram Control cabinets		
	164	INTERFACE HVIO 4	18.06.2024	Freqcon_JD
	171	PRE-CHARGING UDC	18.06.2024	Freqcon_JD
	173	DISCHARGE UDC	18.06.2024	Freqcon_JD
	181	WATER SYSTEM	29.07.2024	Freqcon_DG
	182	HEAT EXCHANGER	18.06.2024	Freqcon_JD
	183	Supply for cabinet fan	29.07.2024	Freqcon_DG
	185	FAN / HEATING CONTROL CABINET	18.06.2024	Freqcon_JD
	186	THERMOSTAT	18.06.2024	Freqcon_JD
	187	24V DC SUPPLY CB	18.06.2024	Freqcon_JD
	188	24V DC SUPPLY CON / CB GRID	18.06.2024	Freqcon_JD
	189	TEST TERMINAL BLOCK	18.06.2024	Freqcon_JD
	190	CONTAINER COOLING, LIGHT 230V SUPPLY	29.07.2024	Freqcon_DG
	191	CONTAINER COOLING	29.07.2024	Freqcon_DG
	195	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	29.07.2024	Freqcon_DG
	278	CONTROL CABINET CLIMATE	29.07.2024	Freqcon_DG
	306	Feedback DC contactors 1_4 - 1_6	18.06.2024	Freqcon_JD
	307	Feedback DC contactors 2_1 - 2_3	18.06.2024	Freqcon_JD
	308	Feedback DC contactors 2_4 - 2_6	29.07.2024	Freqcon_DG
	350	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	18.06.2024	Freqcon_JD
	351	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	29.07.2024	Freqcon_DG
	352	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	29.07.2024	Freqcon_DG
	353	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	29.07.2024	Freqcon_DG
	440	PIII PROFINET IGBT IRT INTERFACE 1	18.06.2024	Freqcon_JD
	441	PIII PROFINET IGBT IRT INTERFACE 2	18.06.2024	Freqcon_JD
	442	PIII PROFINET IGBT IRT INTERFACE 3	18.06.2024	Freqcon_JD
	443	PIII PROFINET IGBT IRT INTERFACE 4	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
&EPC ++TRA		Parts List medium voltage transformer		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV		Parts List Converter		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +CON		Parts List Converter Converter cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +IND		Parts List Converter Inductor cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +CIR		Parts List Converter Circuit Breaker cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
	6	PARTS LIST	05.11.2024	Freqcon_DG
	7	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CONV +CIR		Parts List Converter Circuit Breaker cabinet		
	8	PARTS LIST	05.11.2024	Freqcon_DG
	9	PARTS LIST	05.11.2024	Freqcon_DG
	10	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +AC_DC		Parts List Converter AC and DC connection cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT		Parts List Control cabinets		
	1	PARTS LIST	21.01.2025	Freqcon_DG
&EPC ++CT +CTRL_1.1		Parts List Control cabinets Control cabinet 1 Cabinet door		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.2		Parts List Control cabinets Control cabinet 1 Left side		
	1	PARTS LIST	23.01.2025	Freqcon_DG
&EPC ++CT +CTRL_1.3		Parts List Control cabinets Control cabinet 1 Main mounting plate		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
	6	PARTS LIST	05.11.2024	Freqcon_DG
	7	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL_1.3		Parts List Control cabinets Control cabinet 1 Main mounting plate		
	8	PARTS LIST	21.01.2025	Freqcon_DG
	9	PARTS LIST	21.01.2025	Freqcon_DG
	10	PARTS LIST	05.11.2024	Freqcon_DG
	11	PARTS LIST	05.11.2024	Freqcon_DG
	12	PARTS LIST	21.01.2025	Freqcon_DG
	13	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.4		Parts List Control cabinets Control cabinet 1 Right side		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.5		Parts List Control cabinets Control cabinet 1 above		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1		Parts List Control cabinets Control cabinet 1		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_2.1		Parts List Control cabinets Control cabinet 2 Cabinet door		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL.4		Parts List Control cabinets		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++FAN		Parts List FAN		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++TRA		Summarized part list medium voltage transformer		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++CONV		Summarized part list Converter		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
	2	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++CT		Summarized part list Control cabinets		
	1	SUMMARIZED PARTS LIST	23.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	23.01.2025	Freqcon_DG
&EMB ++TRA		Cable list medium voltage transformer		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CONV		Cable list Converter		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG

previous page: 8

next page: 10

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CONV		Cable list Converter		
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	05.11.2024	Freqcon_DG
	11	CABEL LIST	05.11.2024	Freqcon_DG
	12	CABEL LIST	05.11.2024	Freqcon_DG
	13	CABEL LIST	05.11.2024	Freqcon_DG
	14	CABEL LIST	05.11.2024	Freqcon_DG
	15	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CONV +CIR		Cable list Converter Circuit Breaker cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CT		Cable list Control cabinets		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	21.01.2025	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CT		Cable list Control cabinets		
	10	CABEL LIST	05.11.2024	Freqcon_DG
	11	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++FAN		Cable list FAN		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++EXTERN		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMZ ++CONV +IND		Terminals Converter Inductor cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+IND-207L1.1 - =UNIT_01++CONV+IND-217L1.3	05.11.2024	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+IND-207L1.1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+IND-207L1.2	05.11.2024	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+IND-207L1.3	05.11.2024	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+IND-211L1.1	05.11.2024	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+IND-211L1.2	05.11.2024	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+IND-211L1.3	05.11.2024	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CONV+IND-217L1.1	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_01++CONV+IND-217L1.2	05.11.2024	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CONV+IND-217L1.3	05.11.2024	Freqcon_DG
&EMZ ++CONV +CIR		Terminals Converter Circuit Breaker cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+CIR-227U1-X3.1 - =UNIT_01++CONV+CIR-237U1-X3.2	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.1	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CONV +CIR		Terminals Converter Circuit Breaker cabinet		
	2003	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.2	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.2	21.01.2025	Freqcon_DG
&EMZ ++CONV +AC_DC		Terminals Converter AC and DC connection cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+AC_DC-X3.43 - =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
&EMZ ++CT		Terminals Control cabinets		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+-XT1 - =UNIT_01++CT+-XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+-XT1	21.01.2025	Freqcon_DG
&EMZ ++CT +CTRL_1.3		Terminals Control cabinets Control cabinet 1 Main mounting plate		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.3-X1 - =UNIT_01++CT+CTRL_1.3-XV	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.11	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.12	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.13	21.01.2025	Freqcon_DG
	2007	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CT +CTRL_1.3		Terminals Control cabinets Control cabinet 1 Main mounting plate		
	2009	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5.1	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC3	23.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC4	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.1	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.2	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_01++CT+CTRL_1.3-XE	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_01++CT+CTRL_1.3-190XT1	21.01.2025	Freqcon_DG
	2024	Klemmenplan =UNIT_01++CT+CTRL_1.3-191XT1	21.01.2025	Freqcon_DG
	2025	Klemmenplan =UNIT_01++CT+CTRL_1.3-XV	21.01.2025	Freqcon_DG
&EMZ ++CT +CTRL_1.4		Terminals Control cabinets Control cabinet 1 Right side		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.4-350X1.21 - =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.4-XE2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CT +CTRL_2.1		Terminals Control cabinets Control cabinet 2 Cabinet door		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_2.1-149X1 - =UNIT_01++CT+CTRL_2.1-149X1	05.11.2024	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_2.1-149X1	05.11.2024	Freqcon_DG
&EMZ ++FAN		Terminals FAN		
	1000	Klemmenleistenübersicht : =UNIT_01++FAN+-52G1-181X1 - =UNIT_01++FAN+-52G1-181X3	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++FAN+-52G1-181X1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++FAN+-52G1-181X3	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/14

next page: 6a

SPECIFICATION of grounding

	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Editor	Freqcon_JD			Statron	FREQCON	Specification Earthing	20250805_V2.0	= UNIT_01	Converter Container 1
Date	14.06.2024	Norm						& EAC	Explanatory documents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 6a
Date								+	total: 492

Single line diagram

=UNIT_01++TRA

=UNIT_01++CONV

+AC_DC

+CIR

+IND

+CON

+IND

+CIR

+AC_DC

medium voltage transformer
-18T1
&EFS++TRA/18.2
1,25MVA
6,6kV/0,62 kV AC

Gehäuse Erdung

V1_L1 V1_L2 V1_L3

-78W1 - 78W3
GRID L1 -L3
&EFS++CONV/78.1

NSGAFöu 3x4x50mm²

3WL1112-2BB36-1BJ2-Z
A08+H07+M06+M21+R10

-80Q1
max.
1250 A
&EFS++CONV/80.0

-83U1
Filter Caps 3*600µF
Overvoltage protect
&EFS++CONV/83.2

PT100
201L1 - 203L1
Inductor
1*1000A
0,2mH
&EFS++CONV/201.1

PIII 1_1
-
PIII_1_3
201Q1 - 203Q1
1000A Stack x 3
AC
DC

V1_DC+ V1_DC-
UDC +
UDC N
UDC -

PIII 2_1
-
PIII_2_3
-211Q1
3X250A Stack
DC DC DC DC DC

PT100
-211L1
&EFS++CONV/211.1
0,6mH
3*250A

V3_L2 V3_L3 -231U1 VA_182
&EFS++CONV/231.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V3_L1 VA_186 VA_184

NSGAFöu 6x1x50mm²

-224W10 DC 1.4 + Pos.
-224W11 DC 1.4 - Pos.
-224W12 DC 1.5 + Pos.
-224W13 DC 1.5 - Pos.
-224W14 DC 1.6 + Pos.
-224W15 DC 1.6 - Pos.

HELUTHERM 2x1x70mm²

=UNIT_02++
BAT 1-3
BAT 4-5
BAT 6-8
LFP Battery Modul

V3_DC- V3_Ub -227U1 VA_188
&EFS++CONV/227.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V3_DC+ VA_192 VA_190

-231W10 DC 2.1 + Pos.
-231W11 DC 2.1 - Pos.
-231W12 DC 2.2 + Pos.
-231W13 DC 2.2 - Pos.
-231W14 DC 2.3 + Pos.
-231W15 DC 2.3 - Pos.

BAT 9-11
BAT 1-3

V4_L1 V4_L3 -237U1 V4_L2
&EFS++CONV/237.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V4_DC+ V4_DC- V4_Ub

-237W10 DC 2.4 + Pos.
-237W11 DC 2.4 - Pos.
-237W12 DC 2.5 + Pos.
-237W13 DC 2.5 - Pos.
-237W14 DC 2.6 + Pos.
-237W15 DC 2.6 - Pos.

BAT 4-6
BAT 7-8
BAT 9-11

PIII 3_1
-
PIII_3_3
-207Q1
3X250A Stack

PT100
-207L1
&EFS++CONV/207.1
0,6mH
3*250A

PIII 4_1
-
PIII_4_3
-217Q1
3X250A Stack

PT100
-217L1
&EFS++CONV/217.1
0,6mH
3*250A

N
78W4:N
&EFS++CONV/78.3
PEN
78W5:PE
&EFS++CONV/78.2

UDC_LINK_+ 2a.2 /
UDC_LINK_N 2a.5 /
UDC_LINK_- 2a.2 /

previous page: &EAC/6a

next page: 2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0
Date	18.06.2024	Norm		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Proved by							
Date							

=	UNIT_01	Converter Container 1	
&	EFA	Single line diagram	
++			page: 1a
+			total: 492

Single line diagram

Control circuit

++CONV

++CT
+CTRL_1

CTRL

UDC_LINK_+ / 1a.4

UDC_LINK_- / 1a.4

UDC_LINK_N / 1a.4

+4

-173F2 &EFS++CT/173.2 10A

-173F3 &EFS++CT/173.4 1A

-173K2 1500V 30A DC

-173R3 500 Ohm 150 W

-173R4 500 Ohm 150 W

-173K1 1500V 30A DC

-173R1 500 Ohm 150 W

-173R2 500 Ohm 150 W

V1_DC-

V1_DC+

+4

V1_L1 V1_L2 V1_L3

-85U1 &EFS++CT/85.6 L1 L2 L3 DC+ DC-

-171F1 &EFS++CT/171.2 10A

-171K1 &EFS++CT/171.7 1500V 50A DC

-171K2 &EFS++CT/171.8 1500V 50A DC

-171R1 &EFS++CT/171.1 15 Ohm 300W

-171R2 &EFS++CT/171.2 15 Ohm 300W

Precharge Resistors

Grid 400V
inc. overvotage fuse
& Fuse ??A(20A)

+3
Main mounting plate

1-6
-XE
1

-84F2

>+
CTRL_1.1
-84Q1

AC L1,L2,L3

101T1 &EFS++CT/101.2

24V DC supply unit

102G1 &EFS++CT/102.2
24V DC UPS

+24VDC
GND

+ 24V DC
24V GND

-102G2 &EFS++CT/102.6 Battery

-103F1 - 103F4 &EFS++CT/103.2 F2, 10A 60VDC

-103F5 &EFS++CT/103.9 F2, 10A 60VDC

-186K1 &EFS++CT/186.6

-186B1 &EFS++CT/186.6

24V Supply
Main PLC
ET200SP

+24V DC
for Control Cabinet

24V GND

400V AC
Control Cabinet

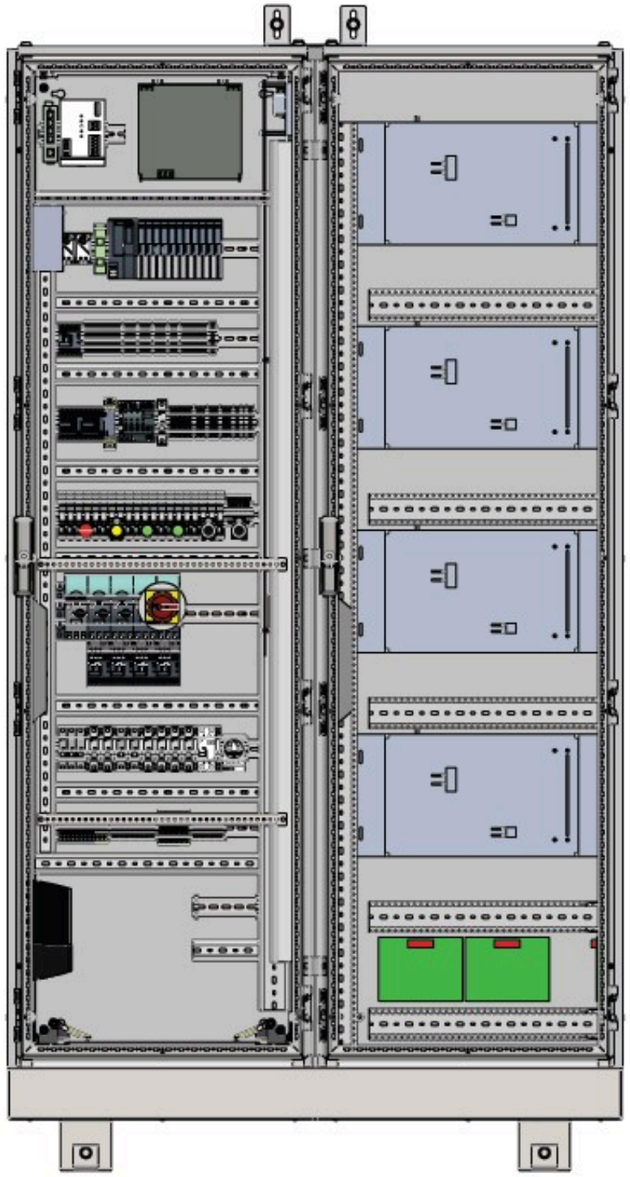
Thermostat
for start PLC

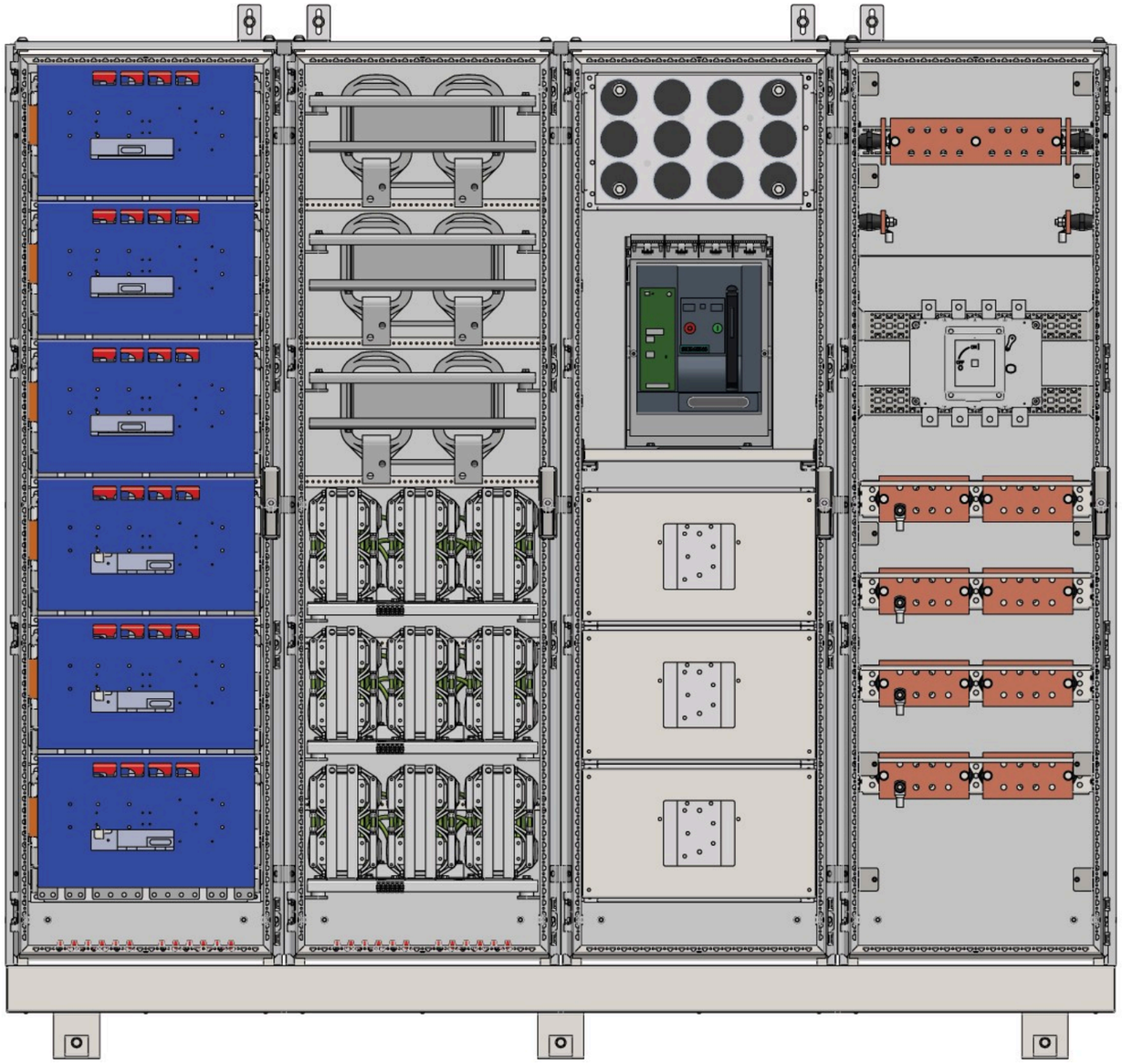
previous page: 1a

next page: &ELU/5a

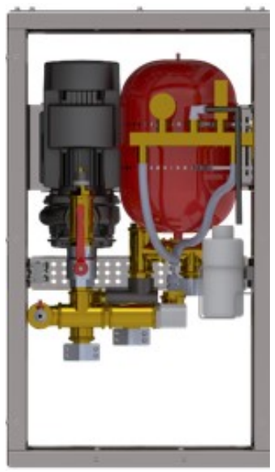
Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 2a
Date								+	total: 492

0	1	2	3	4	5	6	7	8	9









+CTRL_1
Control cabinet 1

+CTRL_2
Control cabinet 2

++CT Control cabinets

+CON
Converter cabinet

+IND
Inductor cabinet

+CIR
Circuit Breaker cabinet

+AC_DC
AC and DC connection cabinet

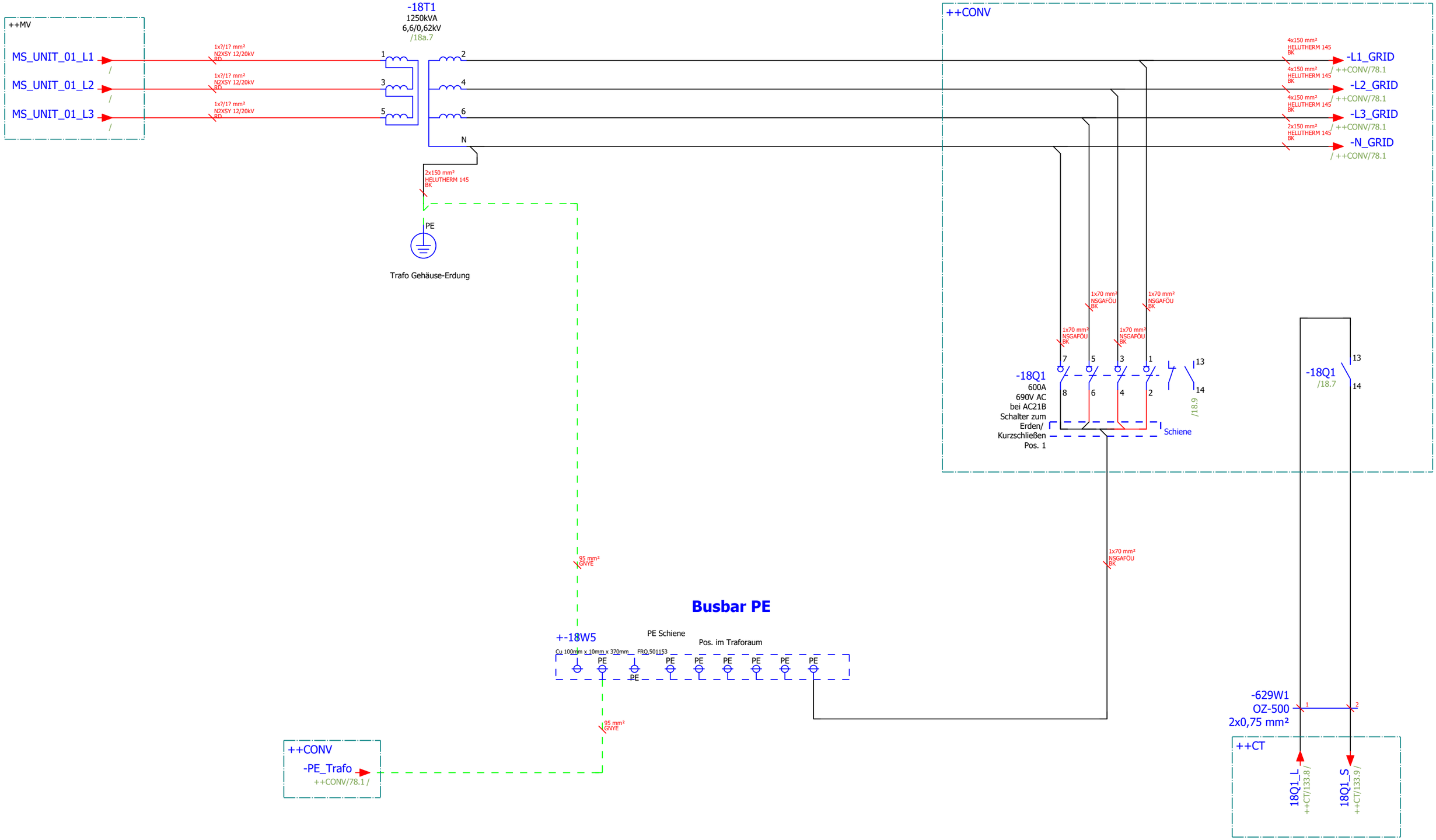
++CONV Converter

++FAN
FAN

previous page:
&EFA/2a

next page:
&EFS++TRA/18

Editor	Freqcon_DG			Statron	FREQCON	CABINETS OVERVIEW	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024	Norm						& ELU	Cabinet Overview
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
18a

Editor	Freqcon_DG			Statron	FREQCON	MV-TRANSFORMER UNIT_01+02	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer page: 18
Date								+ total: 492

++CT
+CTRL_1.2
-18B1
PWR07
Trafo-
Temperaturüberwachung
Pos: in Tür +ASC

SUPPLY
24-240V AC DC

ALARM

FAULT

FAN

PT100 SENSORS

CH 1

CH 2

CH 3

CH 4

40 41 42 4 5 6 7 8 9 1 2 3 4 5 6 13 14 15 16 17 18 19 20 21 22 23 24

0,75 mm² RT

-18W2
JZ-500
8G1,5 mm²

1 GNYE 2 3 4 5 6

-18W1
F-CY-OZ (LiY-CY)
10x1,5 mm²
500V
geschirmt

1 2 3 4 5 6 7 8 9

-18T1
/18.2

3x PT100 Fühler in NS-Wicklung Trafo

CH 3 CH 2 CH 1

3 2 1 3 2 1 3 2 1

++CT

-1L+3 ++CT/103.2/
-1PE5 ++CT/103.4/
-1M6 ++CT/103.3/
-PreAlarm ++CT/133.0/
-Trip ++CT/133.0/
-Fault ++CT/133.0/
-Fan ++CT/133.0/

previous page:
18

next page:
++CONV/78

Editor	Freqcon_DG			Statron	FREQCON	TEMPERATURE TRANSFORMER UNIT_01+02	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer	page: 18a
Date								+		total: 492

Grid Busbars L1, L2, L3

++TRA

-L1_GRID ++TRA/18.9 /
-L2_GRID ++TRA/18.9 /
-L3_GRID ++TRA/18.9 /

+AC_DC-78W1 GRID L1 Pos. 1/ Links
Cu 100mm x 10mm x 370mm FRQ.52163 &EFA++/1a.0
+AC_DC-78W2 GRID L2 Pos. 1/ Mitte
Cu 100mm x 10mm x 370mm FRQ.52163
+AC_DC-78W3 GRID L3 Pos. 1/ Rechts
Cu 100mm x 10mm x 370mm FRQ.52163

4x50 mm² NSGAFöu BK → -L1CON1 / 80.0
4x50 mm² NSGAFöu BK → -L2CON1 / 80.0
4x50 mm² NSGAFöu BK → -L3CON1 / 80.0

25 mm² NSGAFöu BK
+AC_DC -78F1 690Vac 100A gL/gG NH00 /78.8
1 3 5 13 21 / 2 4 6 14 22

-1F2 / ++CT/127.4
F3 / 238b.9

-238W7 OZ-500 2x0,75 mm² /238a.2
0,75 mm² BU
+AC_DC -X3.43 20 19

-78W7 OZ-500 2x0,75 mm²
1 2 / 13 14

25 mm² BK
+AC_DC -78F2 Typ 1 + Typ 2 400/690 V~
L1 L2 L3 / PE PE

+AC_DC -78F3 20A, aR
1 3 5 / 2 4 6

-78W6 OZ-600 3x2,5 mm² 0,6kV/1kV
1 2 3

+AC_DC -78F1 /78.6

-CHA_L1 ++CT/85.1 /
-CHA_L2 ++CT/85.1 /
-CHA_L3 ++CT/85.1 /

35 mm² GNYE

Busbars N

-N_GRID ++TRA/18.9 /

+AC_DC-78W4 GRID N &EFA++/1a.1 Pos. unten Links
Cu 50mm x 10mm x 370mm FRQ.50622
16 mm² NSGA Föu BK
-AC_F_N.1 83.3 /
-AC_F_N.2 83.3 /
-AC_F_N.3 83.3 /
2x50 mm² NSGAFöu BK → GRID_N / 99.5

Busbars PE

Einspeisung_IEC_Seite 78
Einbauort_Sicherung in Connection cabinet

-PE_Trafo ++TRA/18.2 /

+AC_DC-78W5 GRID PE &EFA++/1a.1 Pos. unten rechts
Cu 100mm x 10mm x 370mm FRQ.50070

95 mm² GNYE
35 mm² GNYE

PE_2_1 238a.1 /
PE_2_2 238a.4 /
PE_2_3 238a.8 /
PE_3_1 228.1 /
PE_3_2 228.4 /
PE_3_3 228.8 /
PE_4_1 238b.1 /
PE_4_2 238b.4 /
PE_4_3 238b.8 /

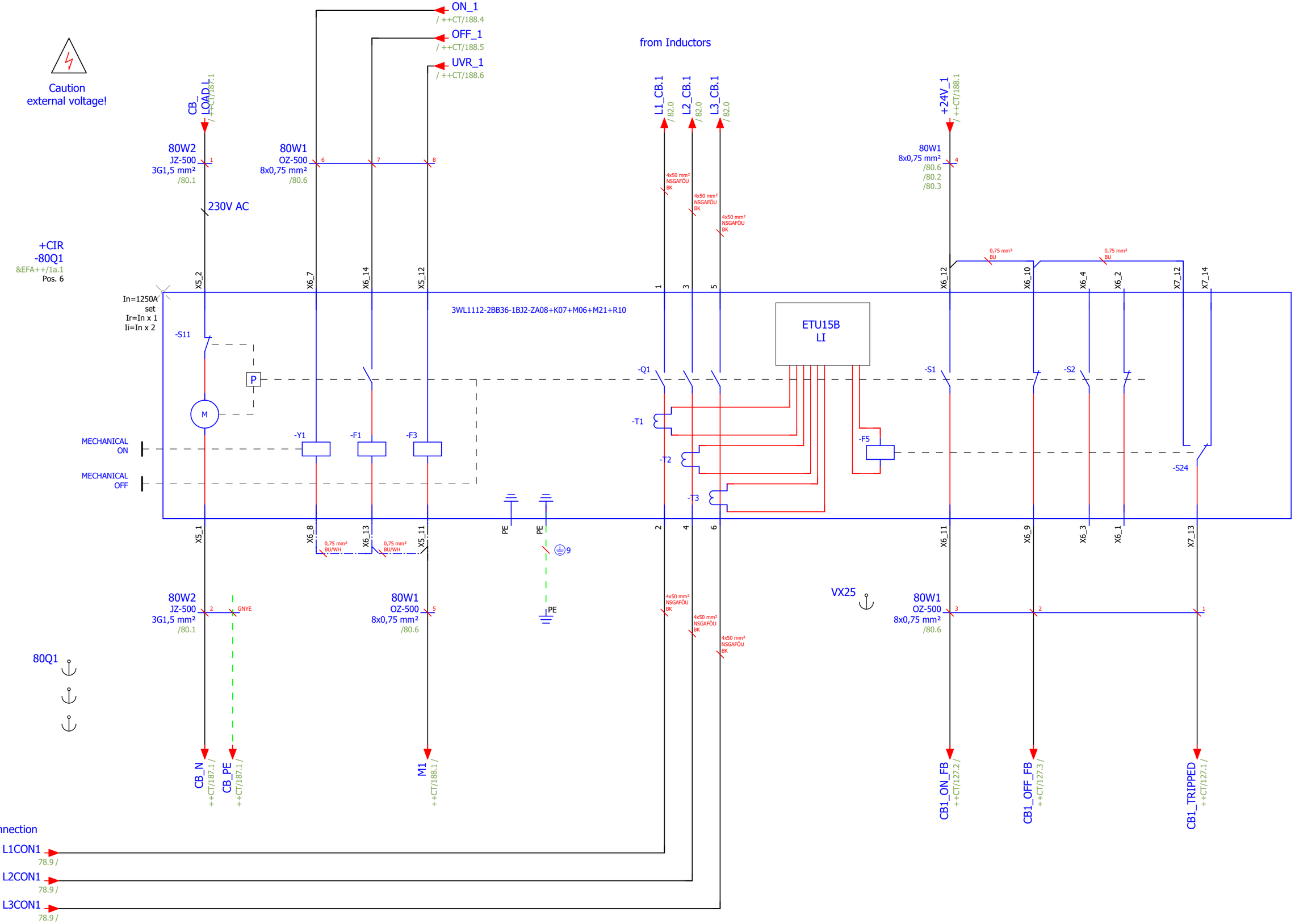
=UNIT_02 PE_BAT_CONV_1 =UNIT_02++Container/278.5 /
=UNIT_03 PE_BAT_CONV_2 =UNIT_03++Container/278.5 /

PE Container
PE Cabinet base frame front side
PE Cabinet base frame back side

400V TYP 1

previous page: ++TRA/18a
next page: 80

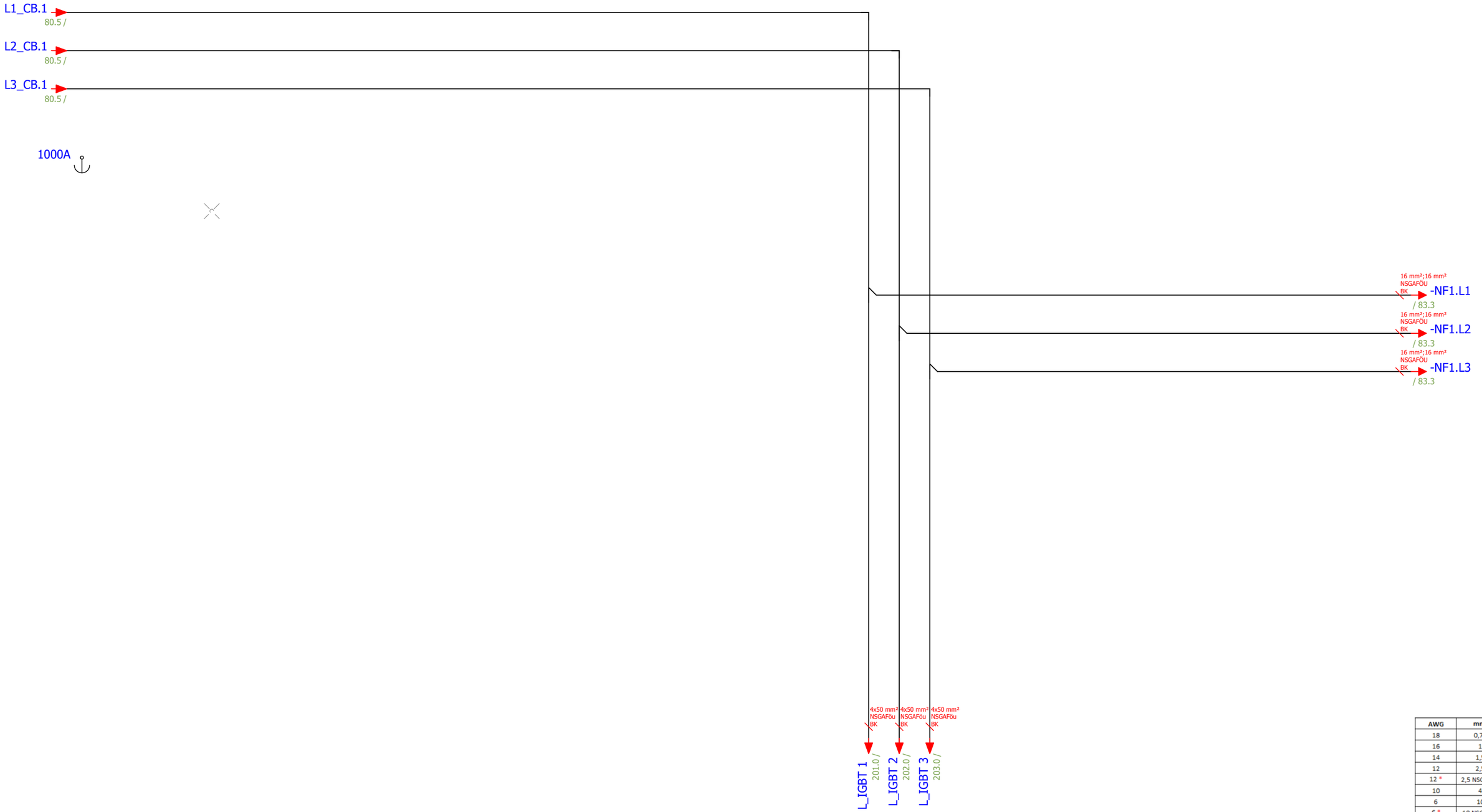
Editor	Freqcon_JD			Statron	FREQCON	GRID CONNECTION	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	



previous page: 78

next page: 82

Editor	Freqcon_JD			Statron		BG CIRCUIT BREAKER 1000A AC GRID	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024				FREQCON			& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 80
Date								+	total: 492



AWG	mm²
18	0,75
16	1
14	1,5
12	2,5
12 *	2,5 NSGAFÖu
10	4
6	10
6 *	10 NSGAFÖu
4	16
2	25
2 *	16 NSGAFÖu
1	35
250 kcmil	95 ALU
2x2	1x70 NSGAFÖu
2x4	2x70 NSGAFÖu
4x250 kcmil	4x70 NSGAFÖu
6x250 kcmil	6x70 NSGAFÖu

*cable into seperate UL protective tube

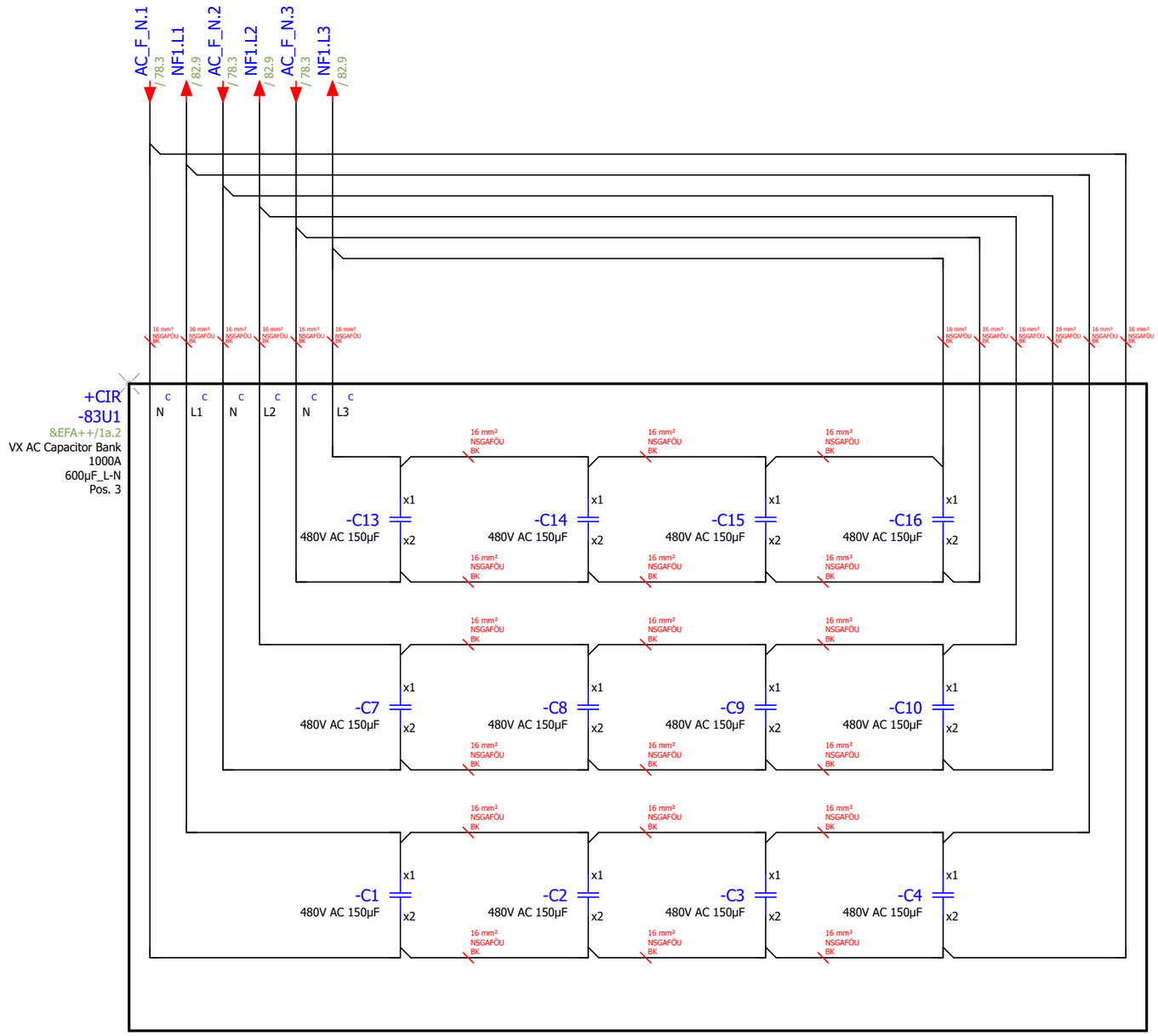
previous page:
80

next page:
83

Editor	Freqcon_JD			Statron	FREQCON	PI INDUCTORS GRID SIDE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 82
Date								+		total: 492

to polarity bar

behind main breaker



AWG	mm²	
18	0,75	
16	1	
14	1,5	
12	2,5	
12 *	2,5 NSGAFöu	
10	4	
6	10	
6 *	10 NSGAFöu	
4	16	
2	25	
2 *	16 NSGAFöu	
1	35	
250 kcmil	95 ALU	
2x2	1x70 NSGAFöu	
2x4	2x70 NSGAFöu	
4x250 kcmil	4x70 NSGAFöu	
6x250 kcmil	6x70 NSGAFöu	

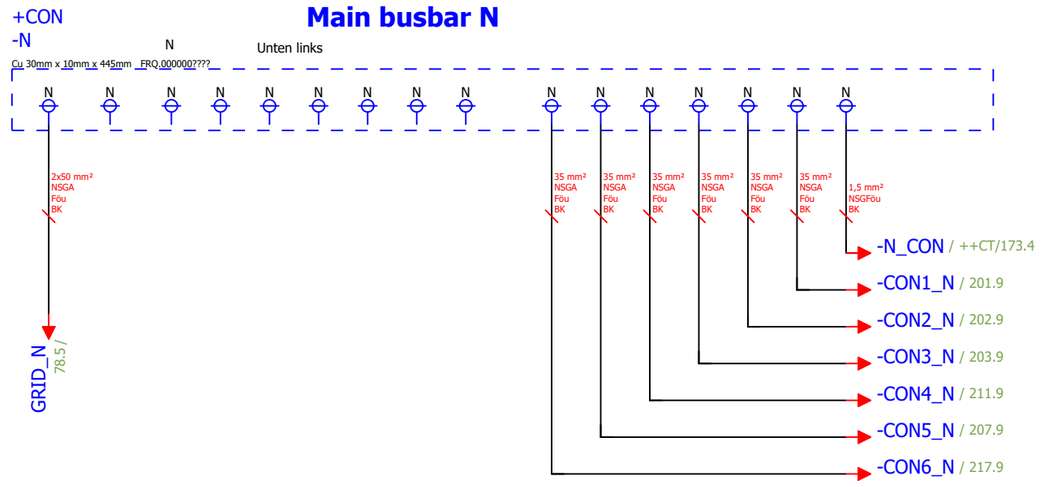
*cable into seperate UL protective tube

83U1

previous page: 82

next page: 99

in converter cabinet



1000A

previous page: 83

next page: 200

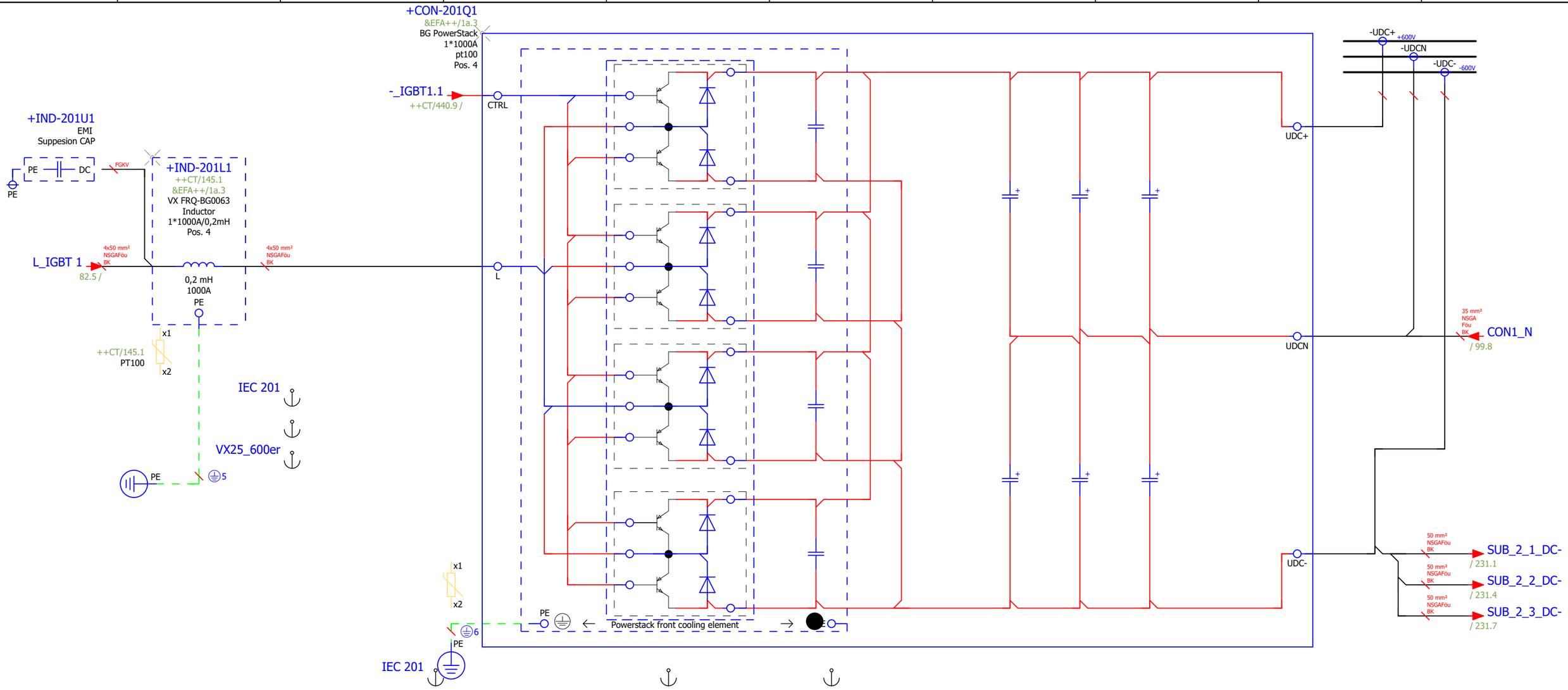
Editor	Freqcon_JD			Statron	FREQCON	BUSBARS N, PE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 99
Date								+	total: 492

Power Circuits

Pages 200 - 299

- Converter cabinet
- Inductor cabinet
- Circuit Breaker cabinet

Editor	Freqcon_JD			Statron	FREQCON	POWER CIRCUITS COVER PAGE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 200
Date								+	total: 492



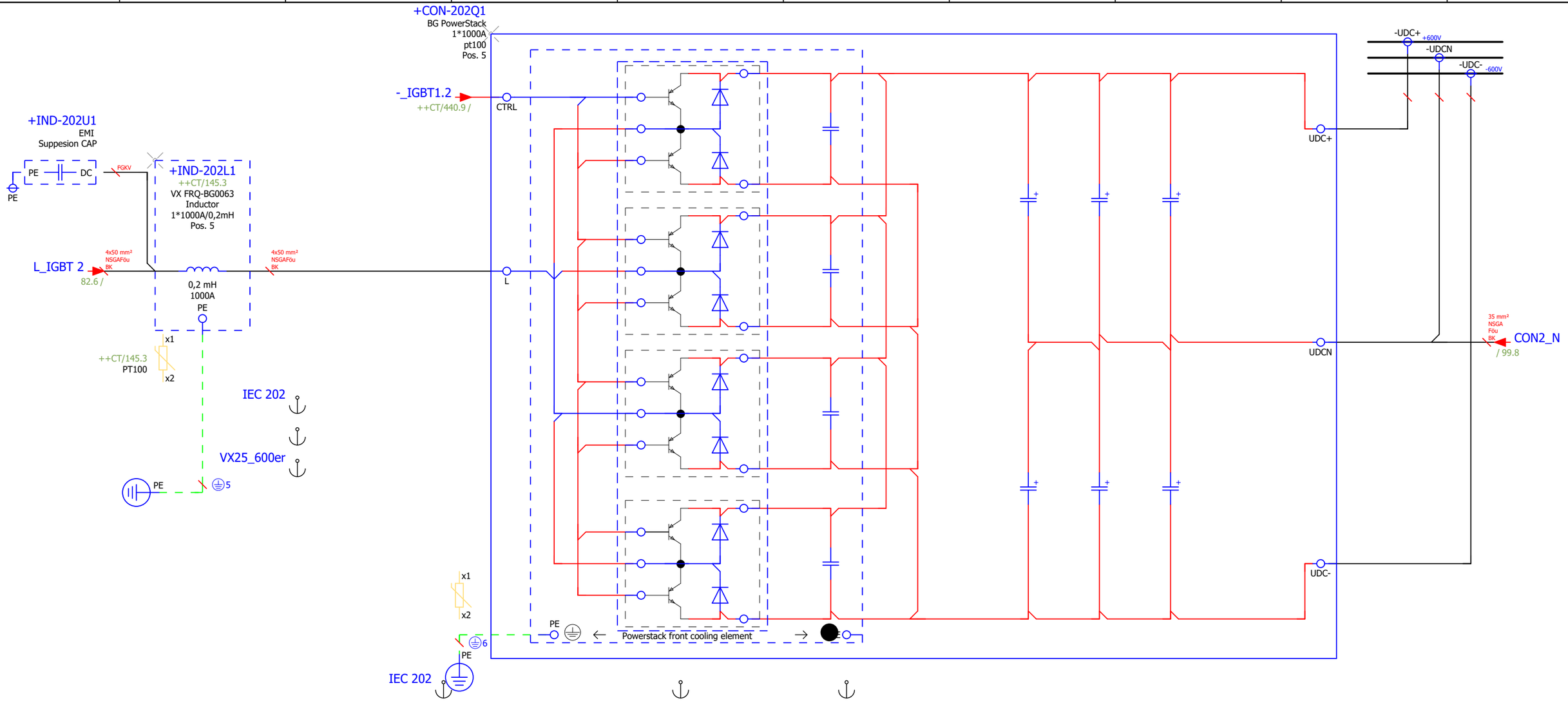
previous page: 200

next page: 202

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR FOR GRID PHASE 1	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 201

total: 492

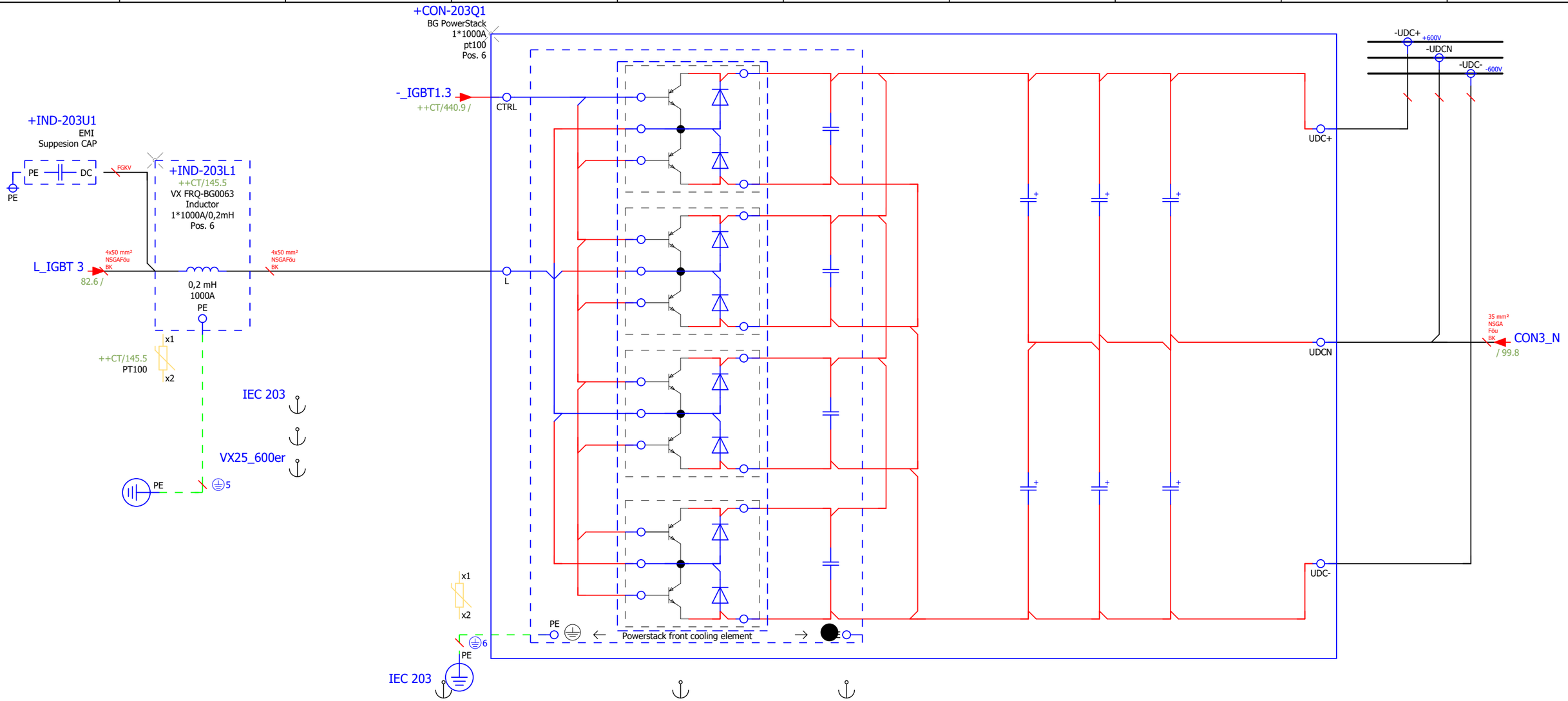


previous page:
201

next page:
203

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR FOR GRID PHASE 2	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 202
total: 492



previous page:
202

next page:
207

Editor	Freqcon_JD			Statron		IGBT & INDUCTOR FOR GRID PHASE 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 203
Date								+	total: 492

+CON-207Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 1

-_IGBT3.1_2
207.9 /
CTRL

+IND-207L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 1

L_IGBT 3_1
227.0 /
50 mm² NSGAFöu BK
0,6mH
L:1

L_IGBT 3_2
227.3 /
50 mm² NSGAFöu BK
0,6mH
L:2

L_IGBT 3_3
227.6 /
50 mm² NSGAFöu BK
0,6mH
L:3

PE.1 PE.2 PE.3

IEC 204 DC

++CT/146.5
PT100
x1 x2
++CT/146.7
x1 x2
++CT/147.1
x1 x2

VX25

PE
5

PE
5

PE
5

x1
x2
6
PE

IEC 204

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON5_N
/ 99.8

+CON-207Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT3.1
++CT/442.9 /
X1
25-POL SUB-D SOCKET

-_IGBT3.2
++CT/442.9 /
X2
25-POL SUB-D SOCKET

-_IGBT3.3
++CT/442.9 /
X3
25-POL SUB-D SOCKET

SKiiP 3 Adapter

FRQ-M00080
FREQCON

Shield connect by a ring cable lug
SH

X4
26-POL Stiftleiste (für Flachband) SOCKET
-_IGBT3.1_2
/ 207.3

previous page: 203
next page: 211

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 3_1 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 207
Date								+ total: 492

+CON-211Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 2

-_IGBT2.1_2
211.9 /

CTRL

+IND-211L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 2

L_IGBT 2_1
231.0 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:1

L_IGBT 2_2
231.3 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:2

L_IGBT 2_3
231.6 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:3

PE.1 PE.2 PE.3

IEC 211 DC

++CT/145.7
PT100
x1 x2
++CT/146.1
x1 x2
++CT/146.3
x1 x2

VX25

PE 5

PE 5

PE 5

x1 x2

6 PE

IEC 211

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON4_N
/ 99.8

+CON-211Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT2.1
++CT/441.9 /
X1
25-POL SUB-D SOCKET

-_IGBT2.2
++CT/441.9 /
X2
25-POL SUB-D SOCKET

-_IGBT2.3
++CT/441.9 /
X3
25-POL SUB-D SOCKET

Shield connect by a ring cable lug
SH

SKiiP 3 Adapter

FRQ-M00080
FREQCON

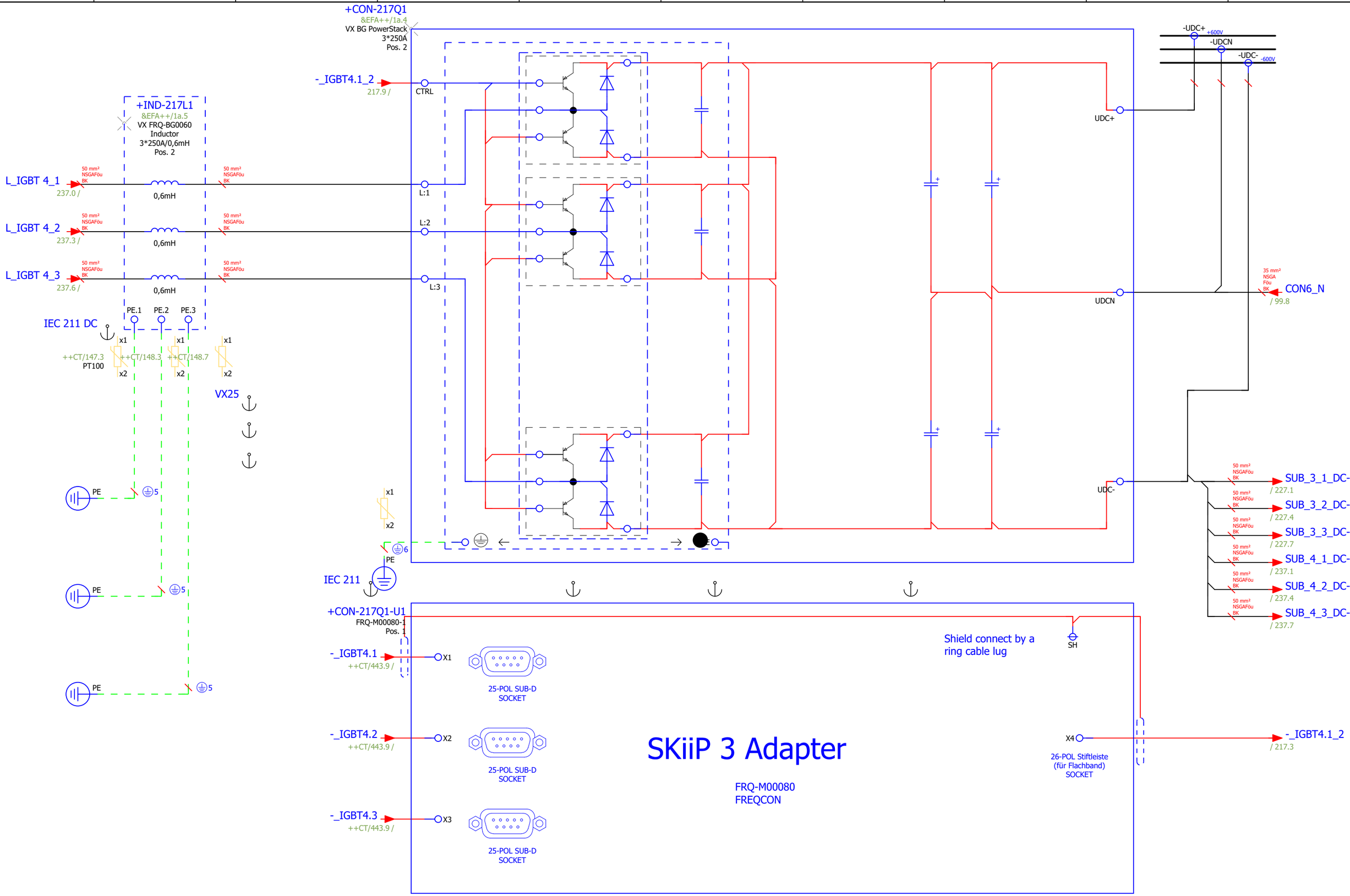
X4
26-POL Stiftleiste (für Flachband) SOCKET

-_IGBT2.1_2
/ 211.3

previous page: 207

next page: 217

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 2_1 -2_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	



previous page: 211

next page: 227

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 4_1 -4_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 217

total: 492

VX25

224

Spare connections, if the BSU will be from here 20A supplied.

* cable intro seperate UL protrctive tube

L_IGBT 3_1 / 207.0 — SUB_3_1_V / ++CT/163.9 — SUB_3_1_DC- / 217.9 — SUB_3_1_V.1 / ++CT/162.9

L_IGBT 3_2 / 207.0 — SUB_3_2_V / ++CT/163.9 — SUB_3_2_DC- / 217.9 — SUB_3_2_V.1 / ++CT/162.9

L_IGBT 3_3 / 207.0 — SUB_3_3_V / ++CT/163.9 — SUB_3_3_DC- / 217.9 — SUB_3_3_V.1 / ++CT/162.9

227W1 OZ-600 2x0,75 mm² (1 / 2)

227W2 OZ-600 2x0,75 mm² (1 / 2)

227W3 OZ-600 2x0,75 mm² (1 / 2)

+CIR
-227U1
/227.a.0
&EFA++/1a.6
VX DC switch and Fuse
3*250A
1000V
Pos. 1

50 mm² NSGAFöu BK

PE

7

PE

Rear mounting plate

IGBT1 1+ — V_IGBT1 1+ — V_DC1 1+ — V_DC 1-

UDC [1]-

IGBT2 2+ — V_IGBT2 2+ — V_DC2 2+

UDC [2]-

IGBT3 3+ — V_IGBT3 3+ — V_DC3 3+

UDC [3]-

F3 1A — -C1 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F4 1A [20A, aR (BSU)] — F0 [20A, aR (BSU)]

F7 1A — -C7 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F8 1A

F11 1A — -C13 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F12 1A

16 mm² NSGAFöu BK

AWG	mm²	*cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

Front mounting plate — PE — -U1 EMI Suppesion CAP — PE — Front mounting plate — PE

16 mm² FGKV

PE

1 2 3 4 5 6

16 mm² in Shrin-kable Tube FGKV

-K1 /227.a.1 1500V 300A — -K7 /227.a.3 1500V 300A

-K2 /227.a.2 1500V 300A — -K8 /227.a.4 1500V 300A

-K3 /227.a.2 1500V 300A — -K9 /227.a.5 1500V 300A

A1 A2

70 mm² NSGAFöu BK

-F1 /227.a.7 1250V 400A 1KN/110 HLS Datenblatt

-F2 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F5 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F6 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F9 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F10 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

IEC

DC1 + — DC1 -

DC2 + — DC2 -

DC3 + — DC3 -

*2

The single conductor must be placed in the protective tube

EEC

DC+ and DC- Busbars in Connection cabinet

+AC_DC-227W10 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_1 + Pos. =UNIT_02 — DC+3_1_BAT / =UNIT_02++ASC/678.7

+AC_DC-227W11 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_1 - Pos. — DC-3_1_BAT / =UNIT_02++ASC/678.7

DC+3_1 / 228.1

DC-3_1 / 228.1

+AC_DC-227W12 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_2 + Pos.

+AC_DC-227W13 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_2 - Pos.

DC+3_2 / 228.4

DC-3_2 / 228.4

+AC_DC-227W14 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_3 + Pos. =UNIT_03 — DC+3_3_BAT / =UNIT_03++ASC/678.0

+AC_DC-227W15 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_3 - Pos. — DC-3_3_BAT / =UNIT_03++ASC/678.0

DC+3_3 / 228.7

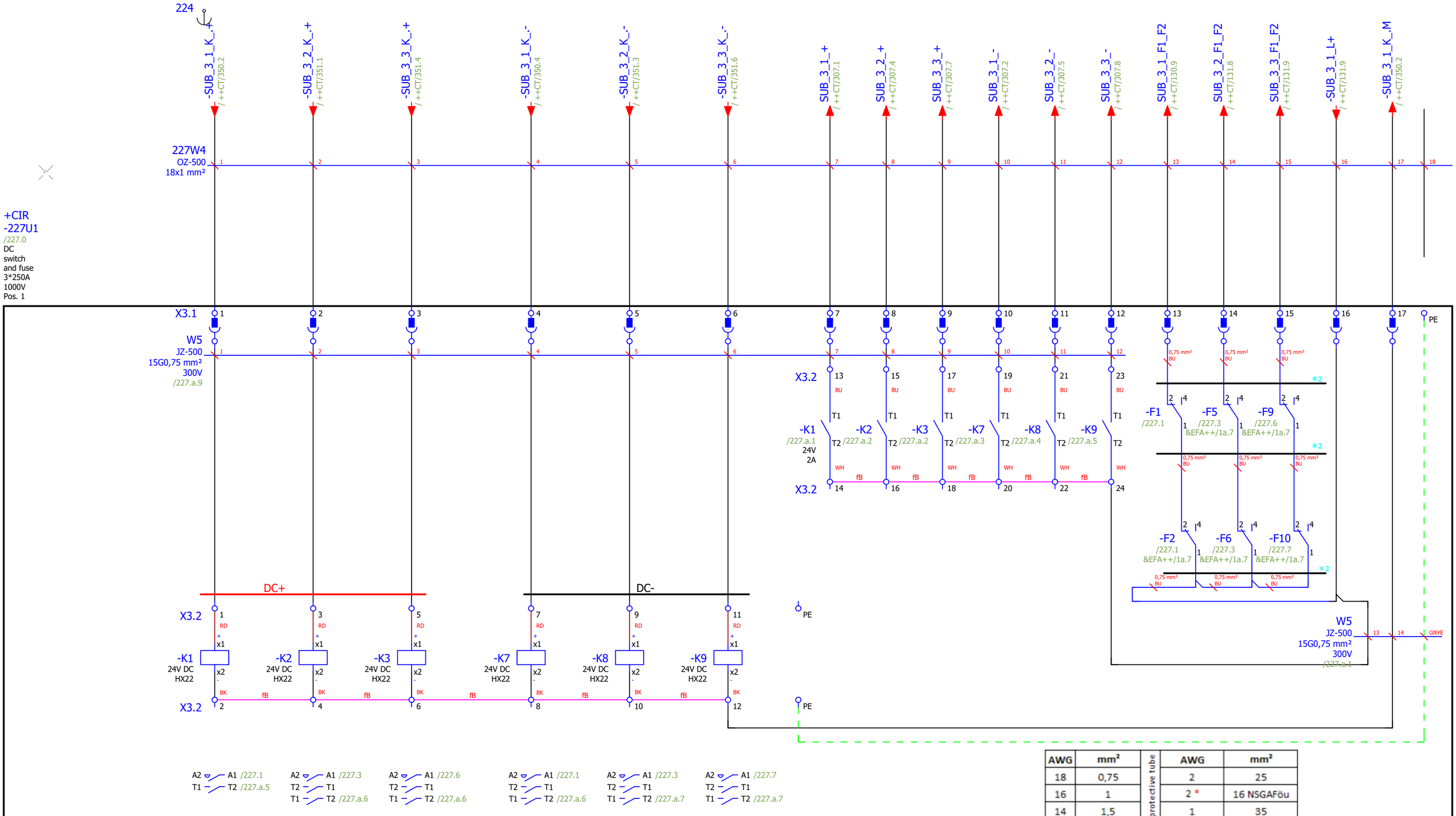
DC-3_3 / 228.8

previous page: 217

next page: 227.a

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 227
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 227

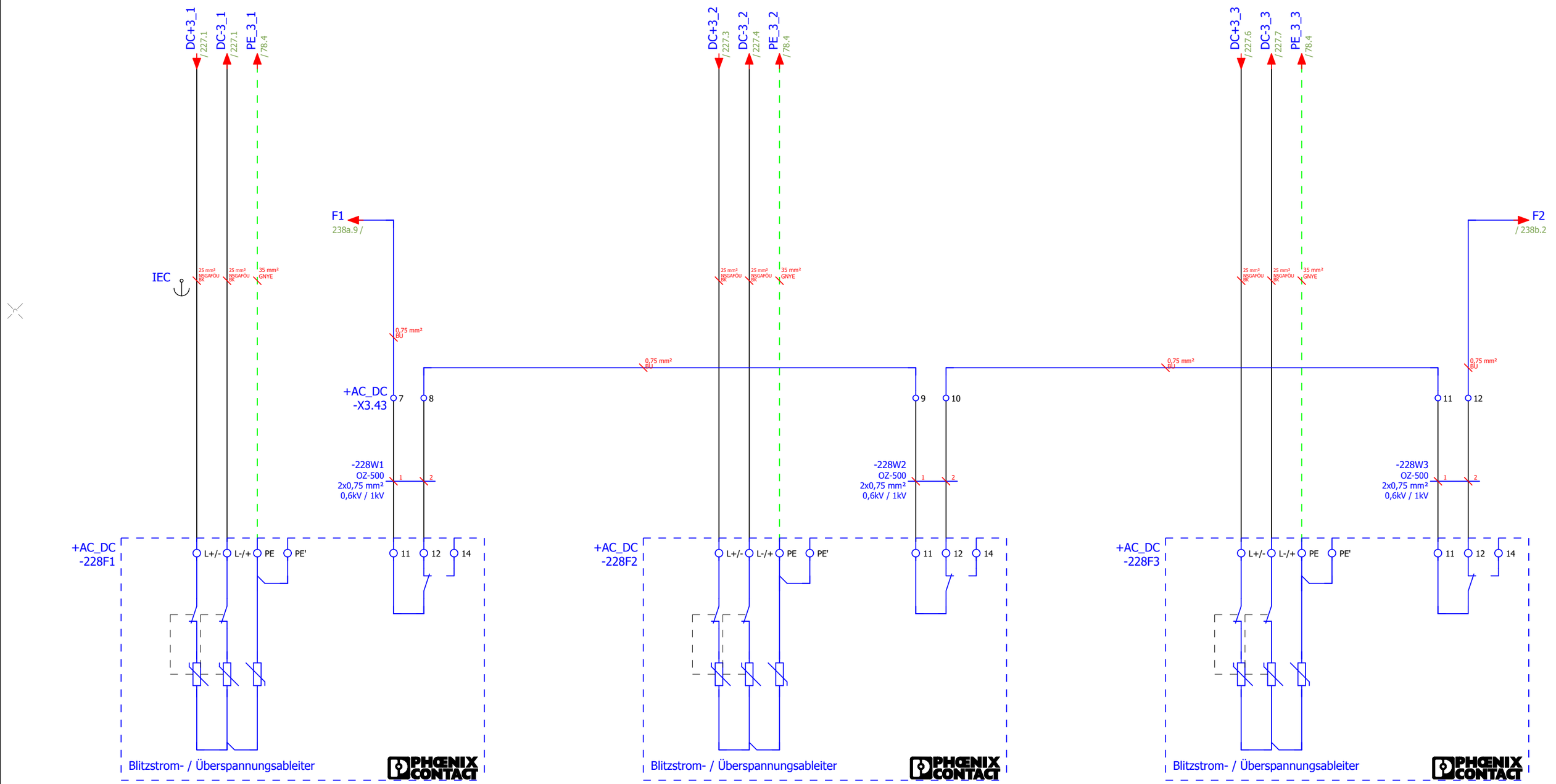
next page: 228

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 227.a
							+ total: 492

DC+ and DC- Busbars

DC+ and DC- Busbars

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 3_1

SURGE ARRESTER
DC SUBSYSTEM 3_2

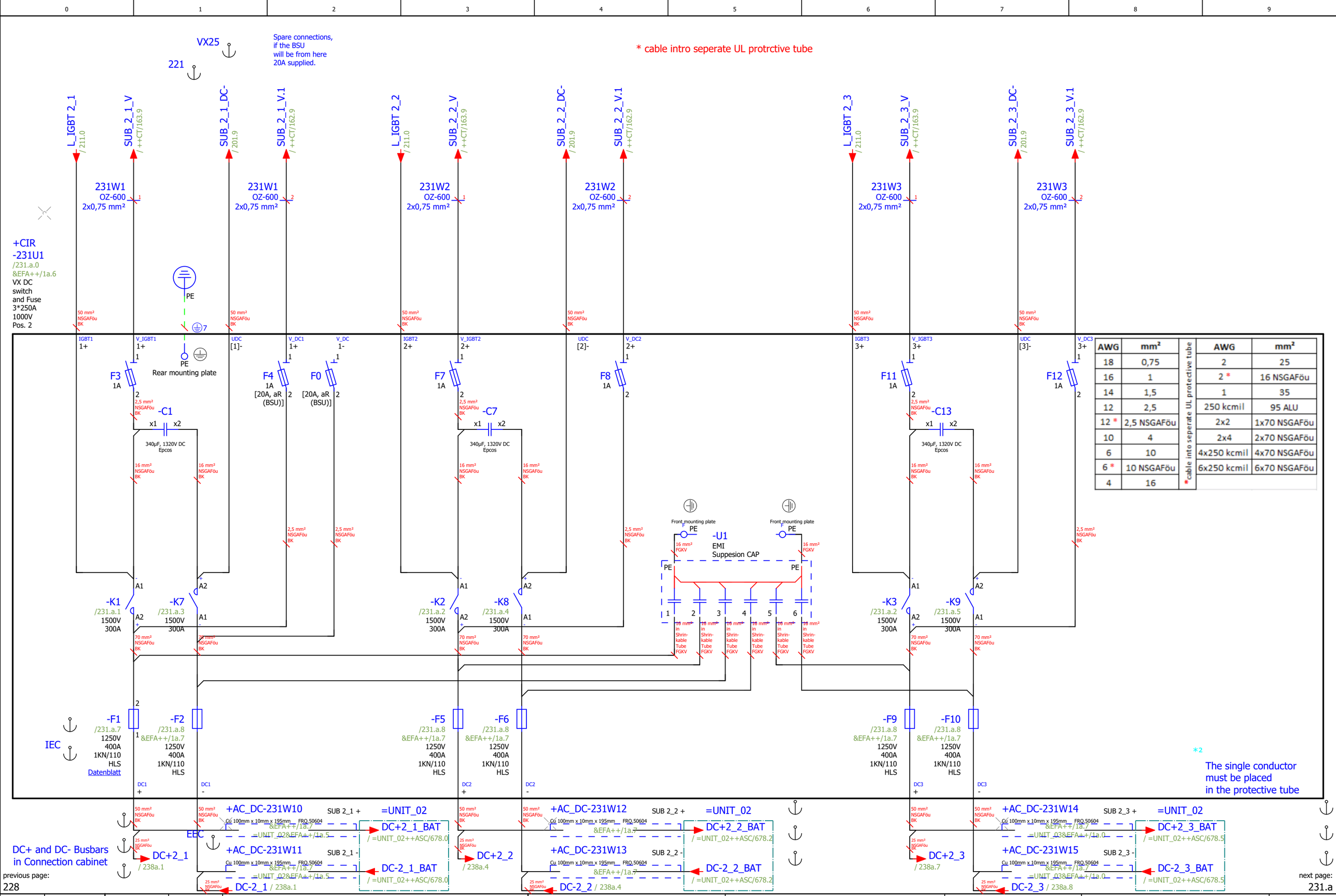
SURGE ARRESTER
DC SUBSYSTEM 3_3

in Connection cabinet

previous page:
227.a

next page:
231

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 3_1 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 228
Date								+	total: 492

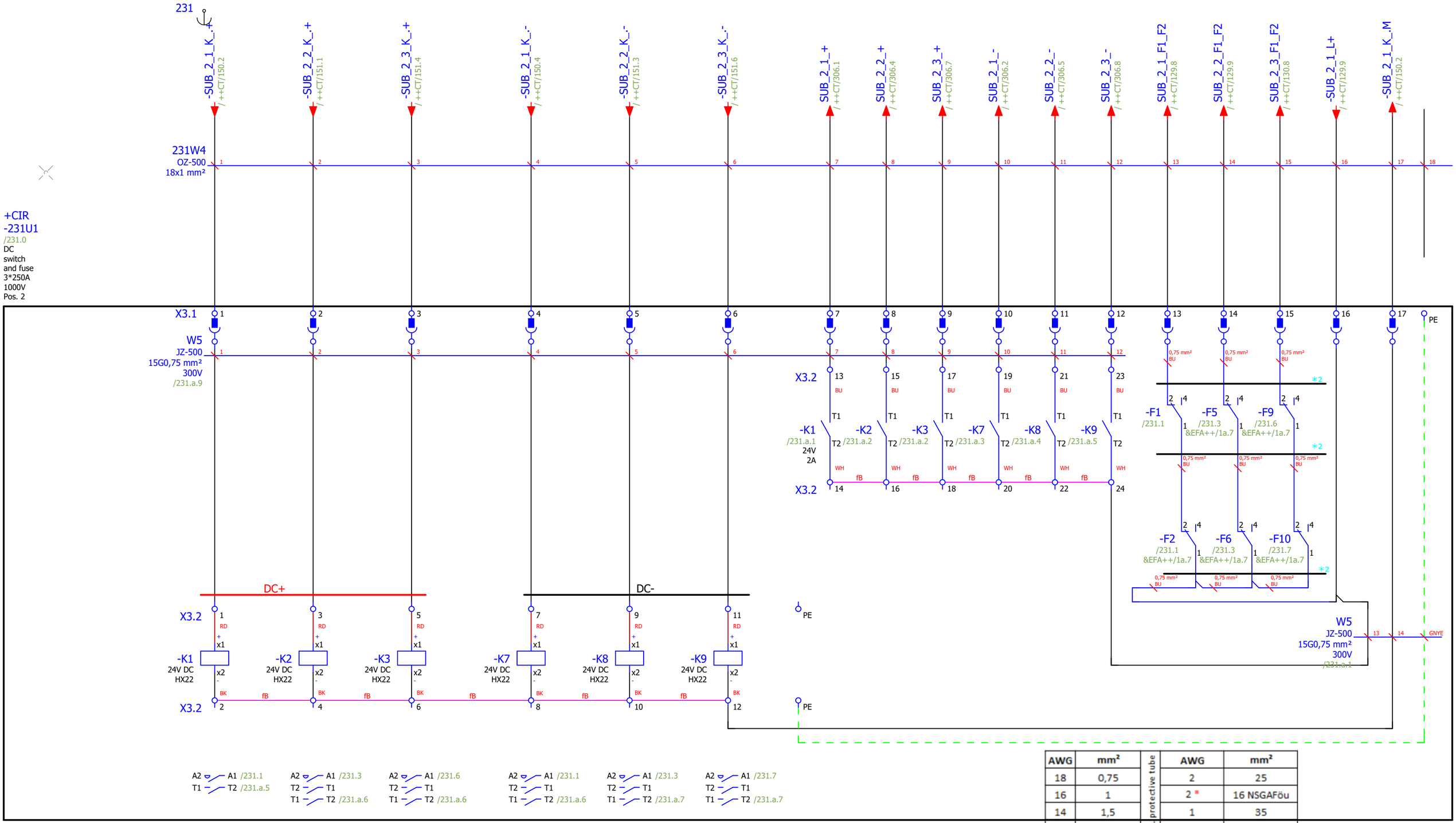


AWG	mm²	AWG	mm²
18	0,75	2	25
16	1	2 *	16 NSGAFöu
14	1,5	1	35
12	2,5	250 kcmil	95 ALU
12 *	2,5 NSGAFöu	2x2	1x70 NSGAFöu
10	4	2x4	2x70 NSGAFöu
6	10	4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu	6x250 kcmil	6x70 NSGAFöu
4	16		

*cable into seperate UL protective tube

Editor	Freqcon_JD			Statron		SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024			Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Proved by							
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 231
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 231

next page: 237

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 231.a
							+ total: 492

VX25
224

Spare connections,
if the BSU
will be from here
20A supplied.

* cable intro seperate UL protrctive tube

+CIR
-237U1
/237.a.0
&EFA++/1a.6
VX DC
switch
and Fuse
3*250A
1000V
Pos. 3

L_IGBT 4_1 / 217.0
SUB_4_1_V / ++CT/164.9
SUB_4_1_DC- / 217.9
SUB_4_1_V.1 / ++CT/164.9
L_IGBT 4_2 / 217.0
SUB_4_2_V / ++CT/164.9
SUB_4_2_DC- / 217.9
SUB_4_2_V.1 / ++CT/164.9
L_IGBT 4_3 / 217.0
SUB_4_3_V / ++CT/164.9
SUB_4_3_DC- / 217.9
SUB_4_3_V.1 / ++CT/164.9

237W1 OZ-600 2x0,75 mm²
237W1 OZ-600 2x0,75 mm²
237W2 OZ-600 2x0,75 mm²
237W2 OZ-600 2x0,75 mm²
237W3 OZ-600 2x0,75 mm²
237W3 OZ-600 2x0,75 mm²

50 mm² NSGAFöu BK

PE
PE
Rear mounting plate
7

IGBT1 1+ | V_IGBT1 1+ | V_DC1 1+ | V_DC 1-
UDC [1]-
IGBT2 2+ | V_IGBT2 2+ | V_DC2 2+
UDC [2]-
IGBT3 3+ | V_IGBT3 3+ | V_DC3 3+
UDC [3]-

F3 1A
F4 1A [20A, aR (BSU)]
F0 [20A, aR (BSU)]
F7 1A
F8 1A
F11 1A
F12 1A

2,5 mm² NSGAFöu BK

-C1
-C7
-C13
x1 x2
340µF, 1320V DC Epcos
16 mm² NSGAFöu BK

Front mounting plate
PE
-U1
EMI
Suppesion CAP
16 mm² FGKV
1 2 3 4 5 6
16 mm² in Shrin-kable Tube FGKV

-K1 /237.a.1 1500V 300A
-K7 /237.a.3 1500V 300A
-K2 /237.a.2 1500V 300A
-K8 /237.a.4 1500V 300A
-K3 /237.a.2 1500V 300A
-K9 /237.a.5 1500V 300A
A1 A2

70 mm² NSGAFöu BK

-F1 /237.a.7 1250V 400A 1KN/110 HLS Datenblatt
-F2 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F5 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F6 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F9 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F10 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
IEC

DC1 + / DC1 -
DC2 + / DC2 -
DC3 + / DC3 -

*2
The single conductor
must be placed
in the protective tube

AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

EEC

+AC_DC-237W10 SUB 4_1 + Pos. =UNIT_03 → DC+4_1_BAT / =UNIT_03++ASC/678.2
+AC_DC-237W11 SUB 4_1 - Pos. → DC-4_1_BAT / =UNIT_03++ASC/678.2
+AC_DC-237W12 SUB 4_2 + Pos. =UNIT_03 → DC+4_2_BAT / =UNIT_03++ASC/678.5
+AC_DC-237W13 SUB 4_2 - Pos. → DC-4_2_BAT / =UNIT_03++ASC/678.5
+AC_DC-237W14 SUB 4_3 + Pos. =UNIT_03 → DC+4_3_BAT / =UNIT_03++ASC/678.7
+AC_DC-237W15 SUB 4_3 - Pos. → DC-4_3_BAT / =UNIT_03++ASC/678.7

Cu 100mm x 10mm x 195mm FRQ.50604 &EFA++/1a.7 =UNIT_03&EFA++/1a.0
Cu 100mm x 10mm x 195mm FRQ.50604 &EFA++/1a.7 =UNIT_03&EFA++/1a.5

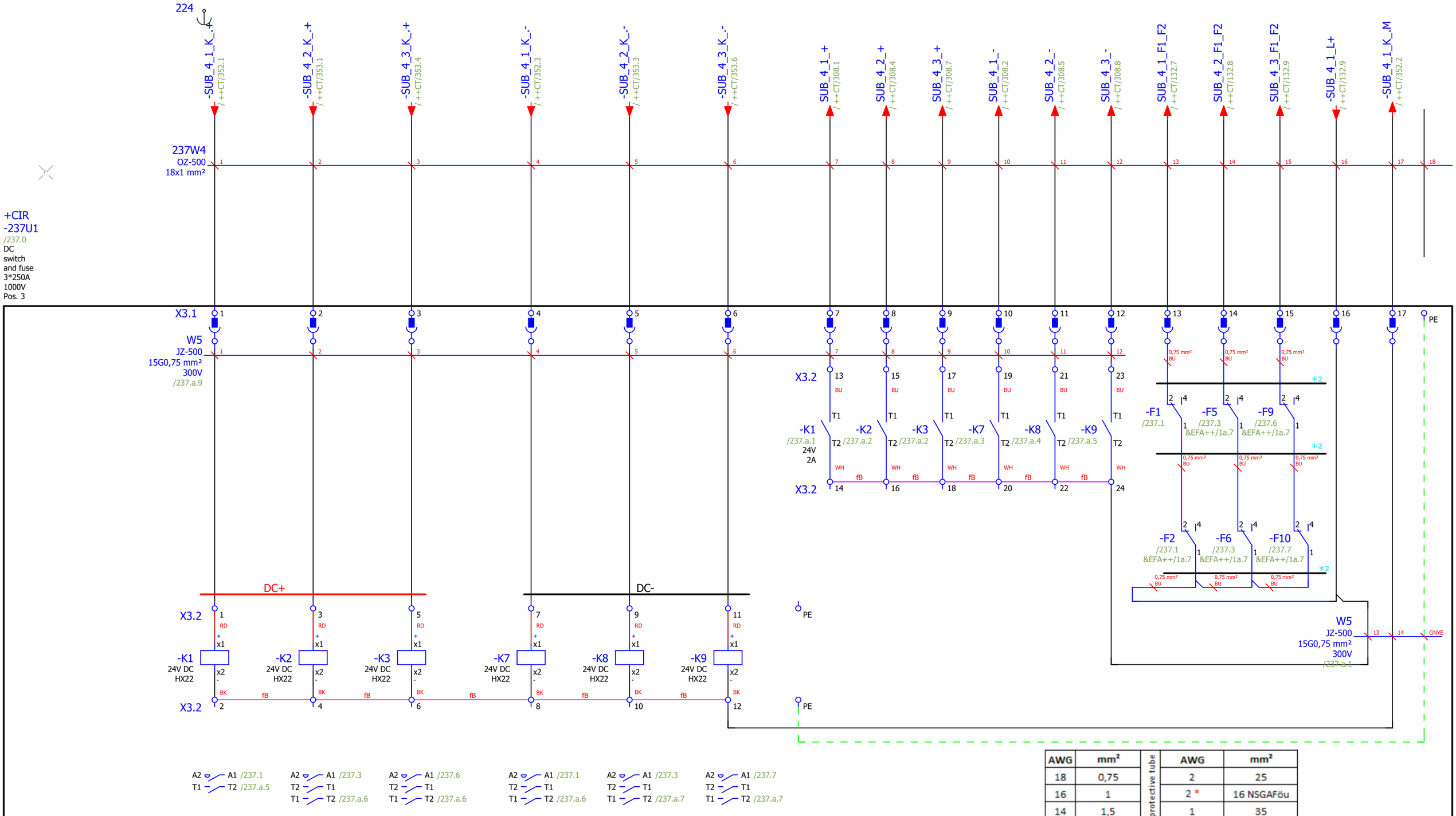
DC+4_1 / 238b.1
DC-4_1 / 238b.1
DC+4_2 / 238b.4
DC-4_2 / 238b.4
DC+4_3 / 238b.7
DC-4_3 / 238b.8

DC+ and DC- Busbars
in Connection cabinet

previous page: 231.a
next page: 237.a

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						10354_23A2007
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 237
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 237

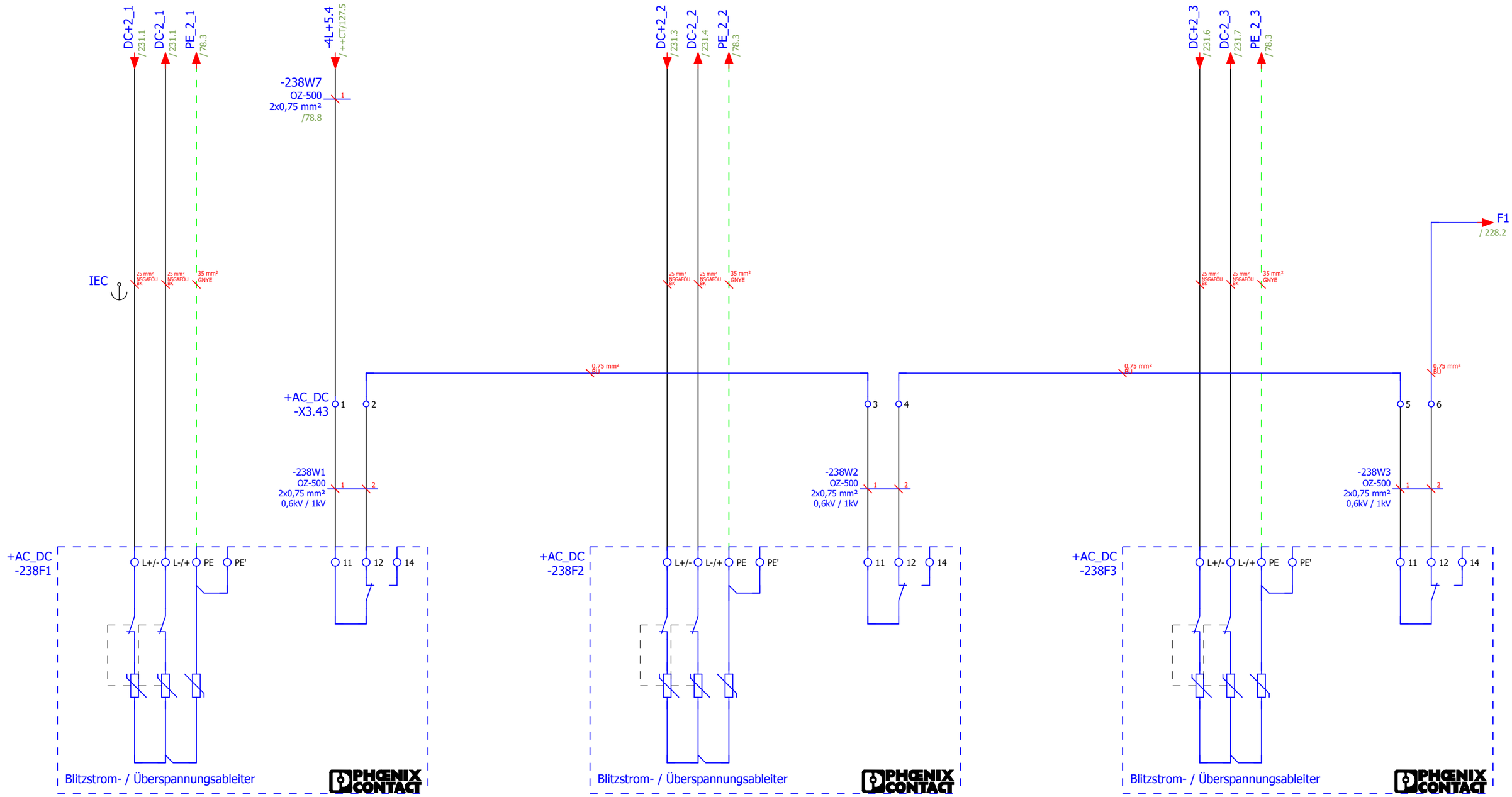
next page: 238a

Editor	Freqcon_DG			Statron	FREQCON	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	20250805_V2.0
Date	29.07.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 237.a
							+ total: 492

DC+ and DC- Busbars

DC+ and DC- Busbars

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 2_1

SURGE ARRESTER
DC SUBSYSTEM 2_2

SURGE ARRESTER
DC SUBSYSTEM 2_3

in Connection cabinet

previous page:
237.a

next page:
238b

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 2_1 - 2_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 238a
Date								+ total: 492

DC+ and DC- Busbars

DC+4_1 / 237.1
DC-4_1 / 237.1
PE_4_1 / 78.4

IEC

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F2
228.9 /

0,75 mm² BU

+AC_DC
-X3.43
13 14

-238W4
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F4
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_1

DC+ and DC- Busbars

DC+4_2 / 237.3
DC-4_2 / 237.4
PE_4_2 / 78.4

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

0,75 mm² BU

15 16

-238W5
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F5
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_2

DC+ and DC- Busbars

DC+4_3 / 237.6
DC-4_3 / 237.7
PE_4_3 / 78.5

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F3
/ 78.9

0,75 mm² BU

17 18

-238W6
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F6
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

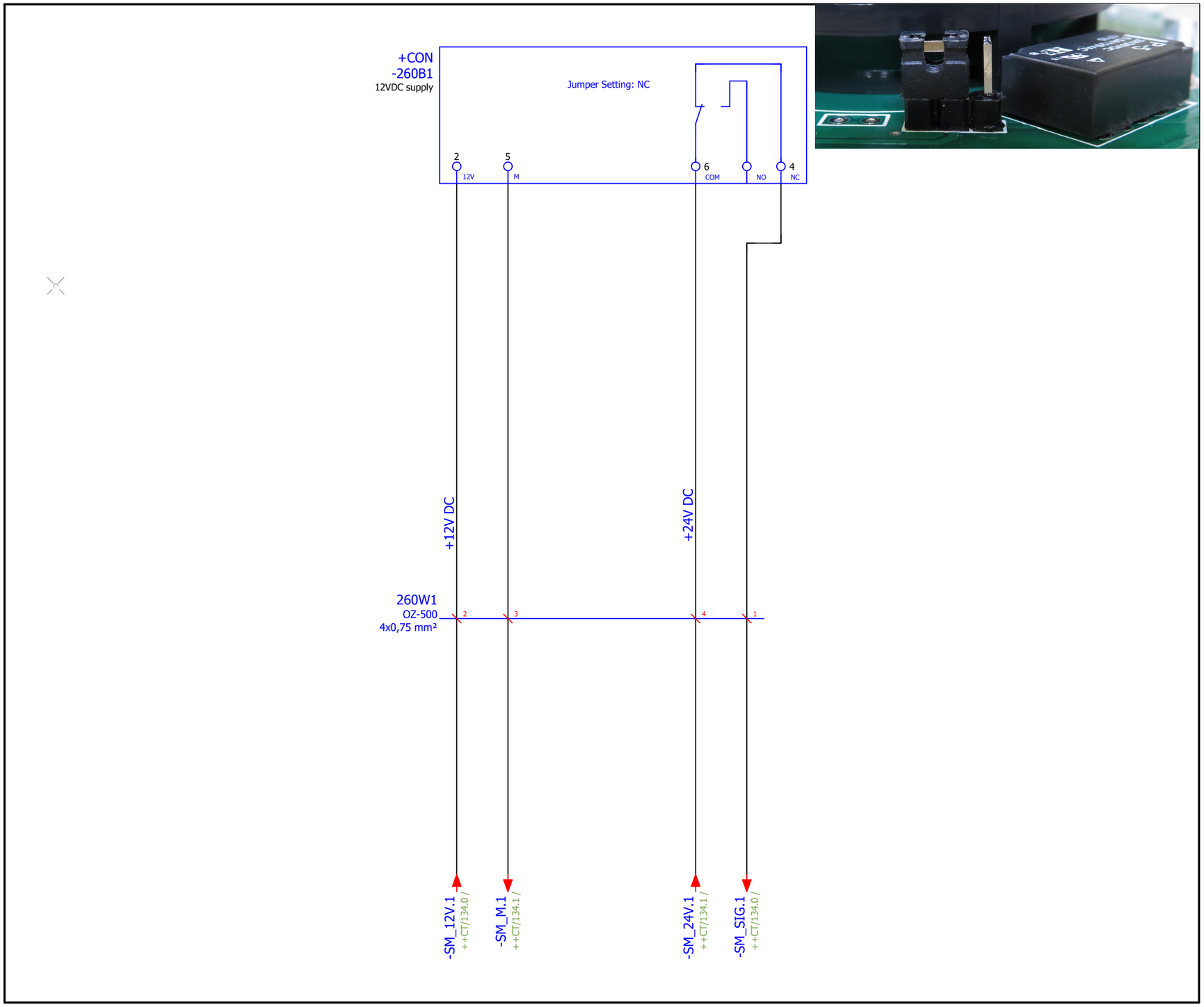
SURGE ARRESTER
DC SUBSYSTEM 4_3

in Connection cabinet

previous page: 238a

next page: 260

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 4_1 - 4_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 238b
Date								+	total: 492

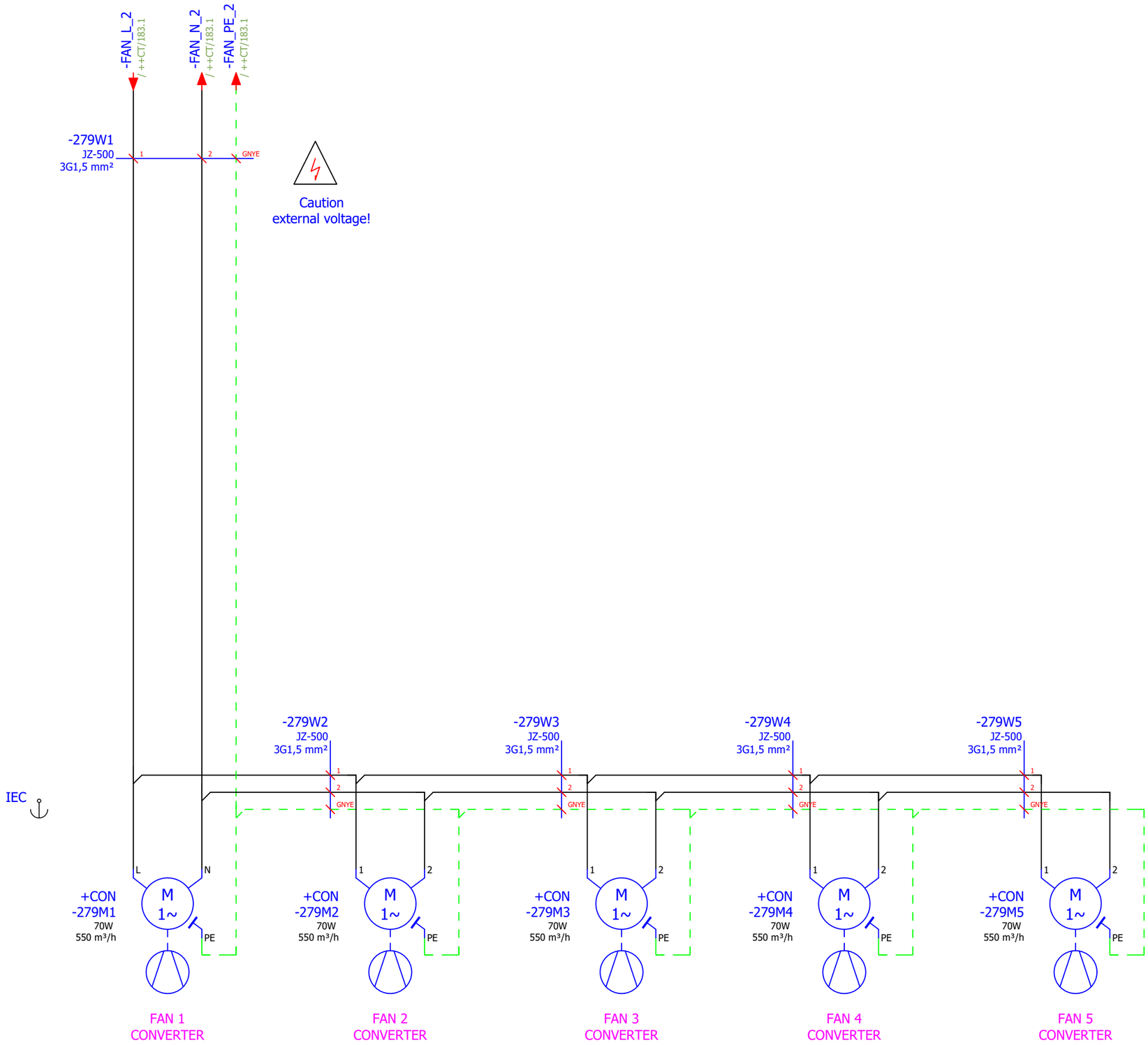


SMOKE DETECTOR
+CON CABINET

previous page:
238b

next page:
279

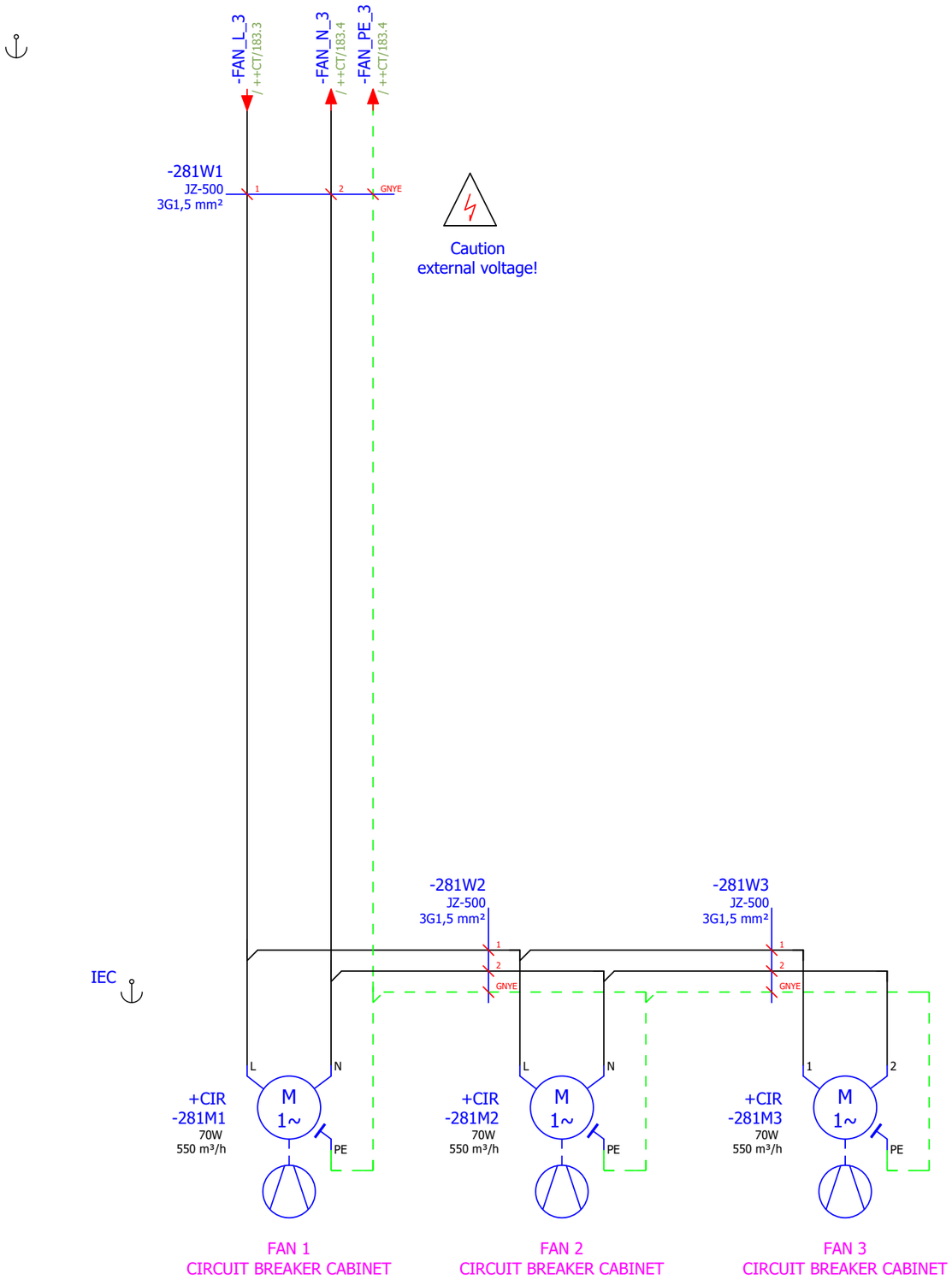
Editor	Freqcon_JD			Statron	FREQCON	SMOKE DETECTOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 260
Date								+	total: 492



previous page:
260

next page:
281

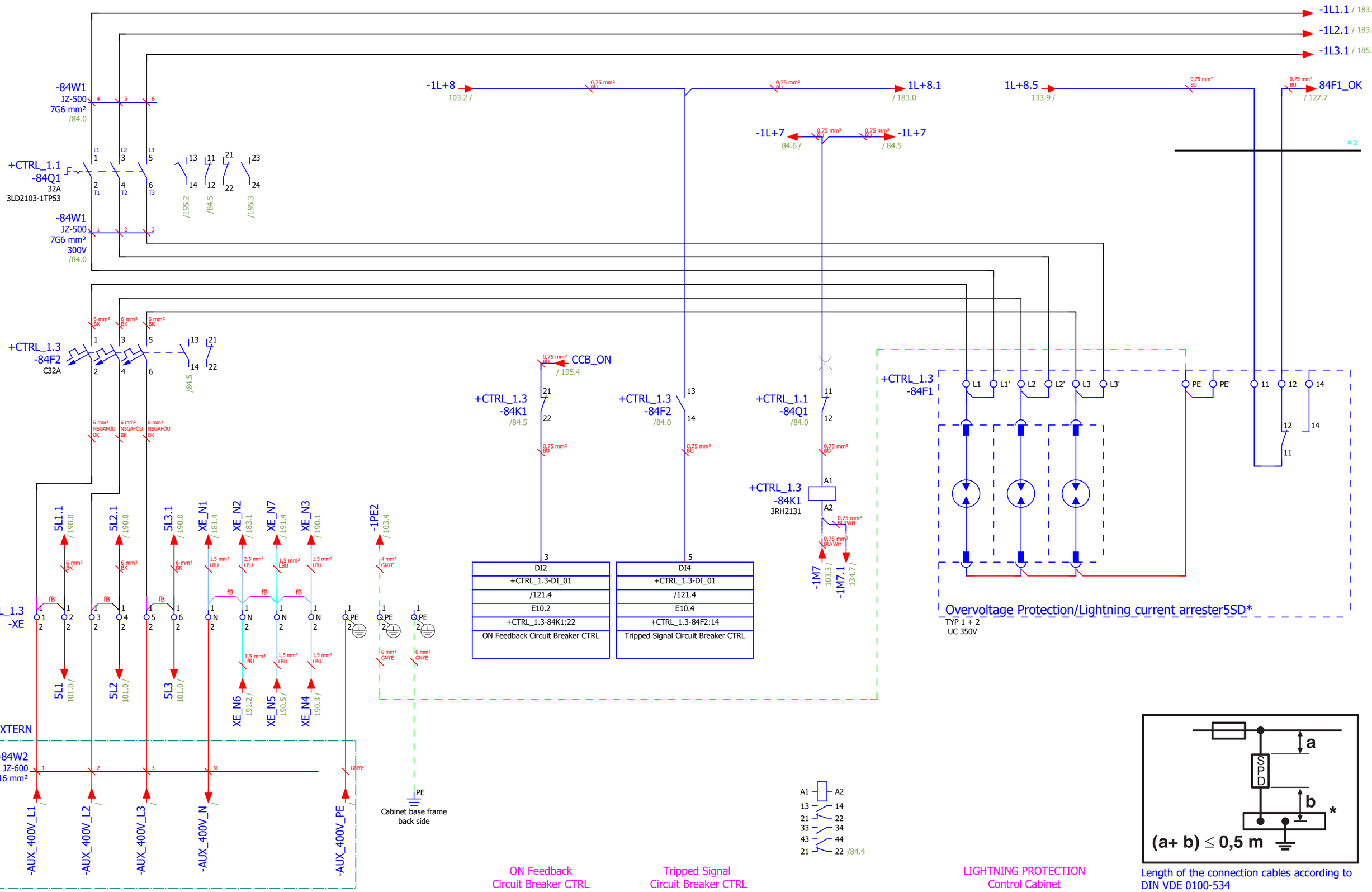
Editor	Freqcon_JD			Statron	FREQCON	CONVERTER CABINET CLIMATE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 279
Date								+	total: 492



previous page:
279

next page:
++CT/84

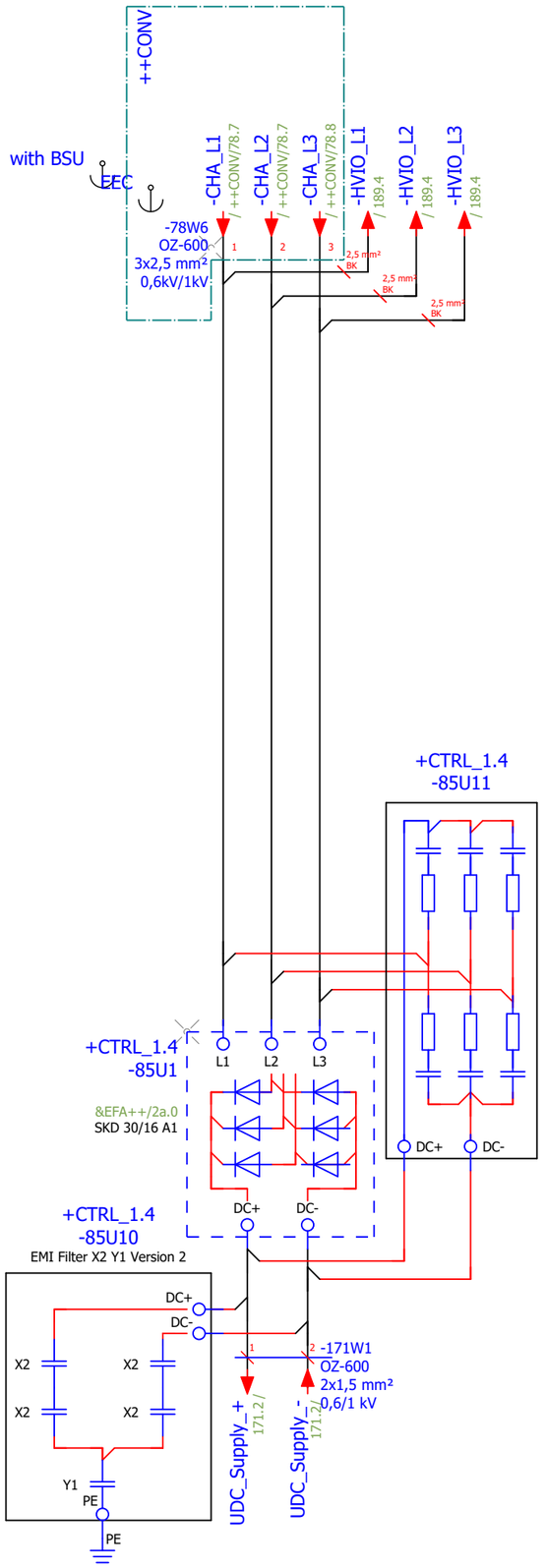
Editor	Freqcon_JD			Statron	FREQCON	CIRCUIT BREAKER CABINET CLIMATE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 281
Date								+	total: 492



previous page:
++CONV/281

next page:
85

Editor	Freqcon_DG			Statron	FREQCON	FEEDING CONTROL CABINET (CTRL)	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	



previous page: 84

earthing via cooling element

next page: 100

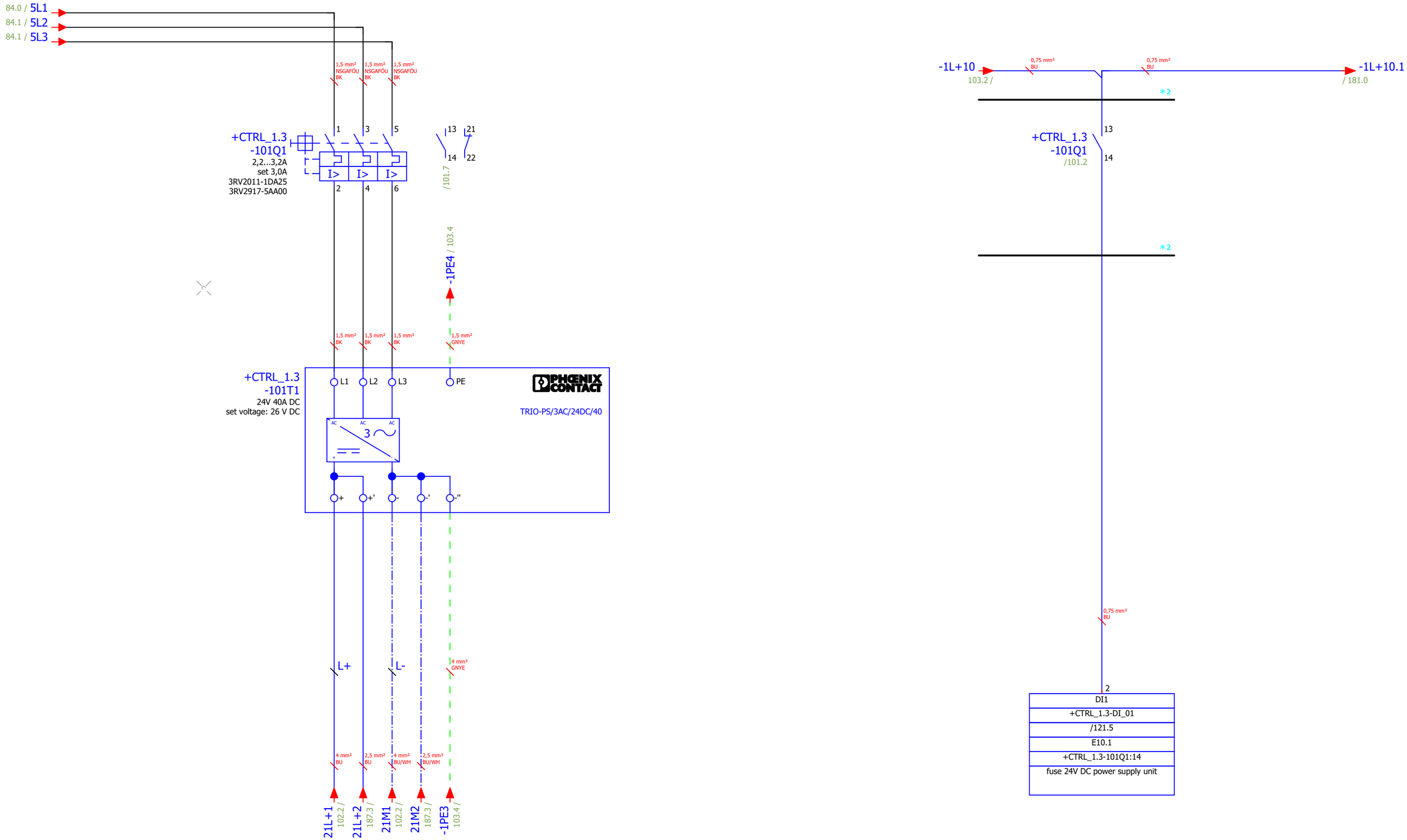
Editor	Freqcon_DG			Statron		SUPPLY UDC	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	29.07.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 85
Date								+		total: 492

Control Cabinet

Pages 100 - 199

previous page: 85

next page: 101

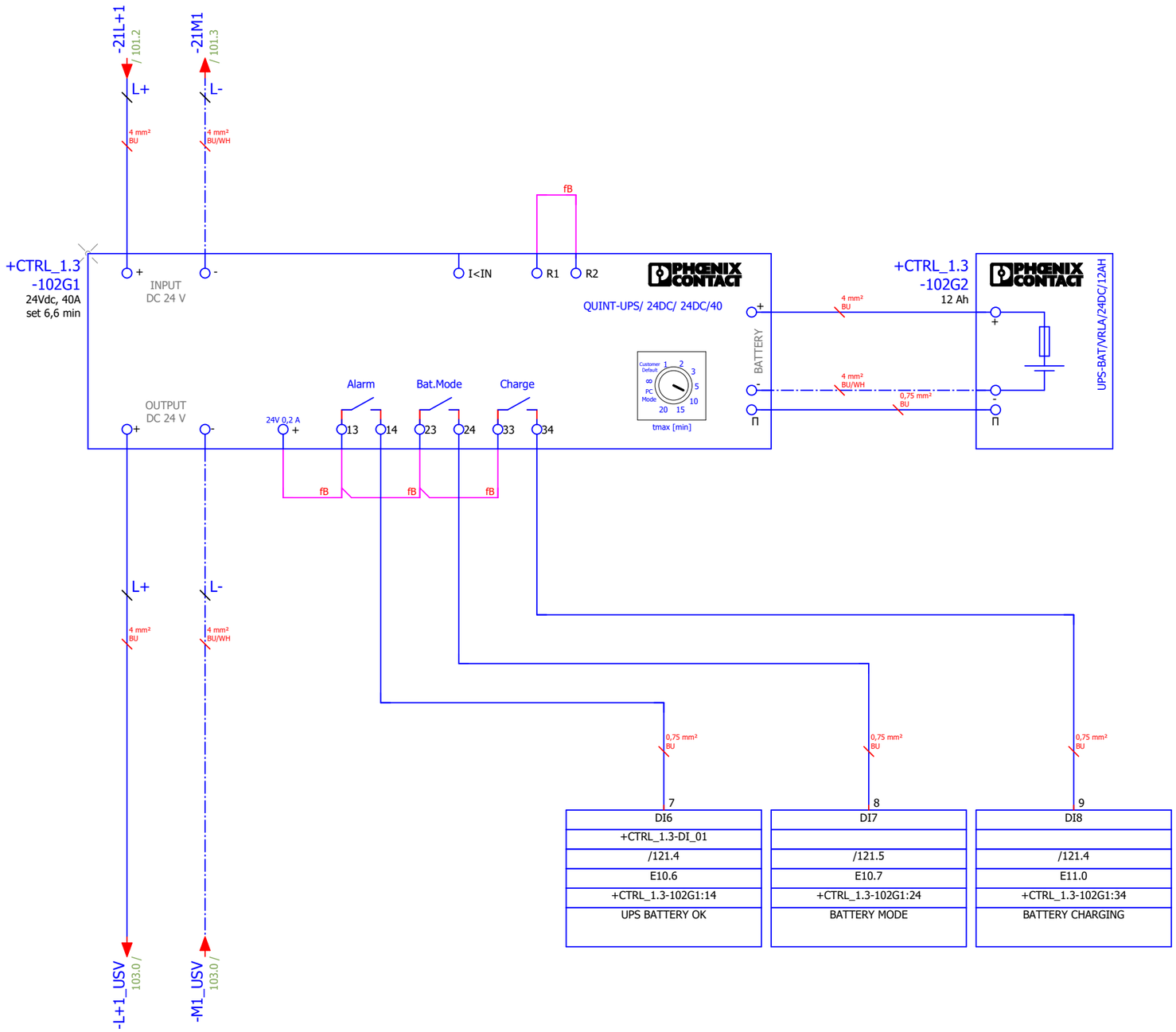


previous page: 100

Power supply unit from 400V AC

next page: 102

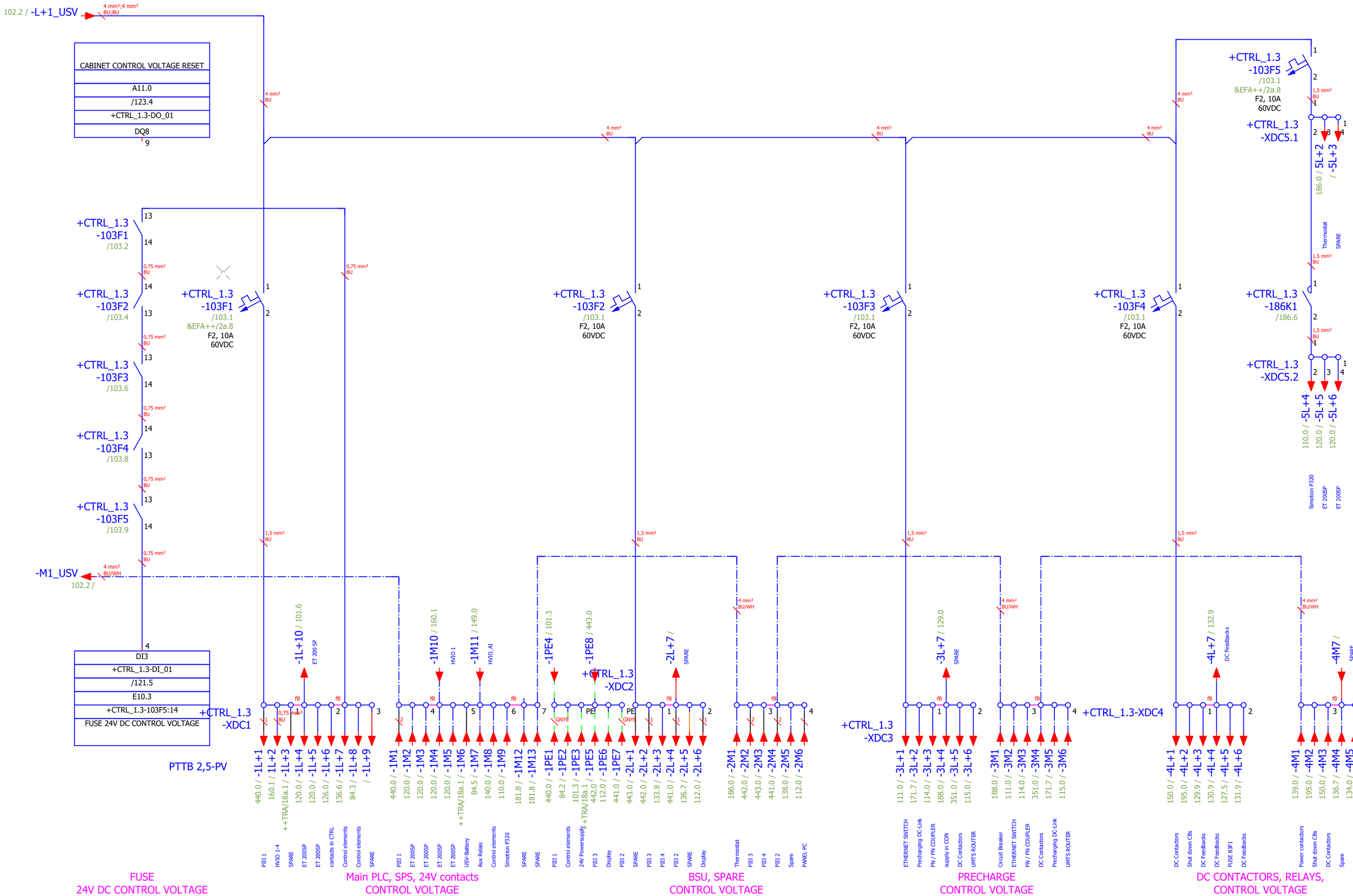
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 101
Date								+	total: 492



previous page:
101

next page:
103

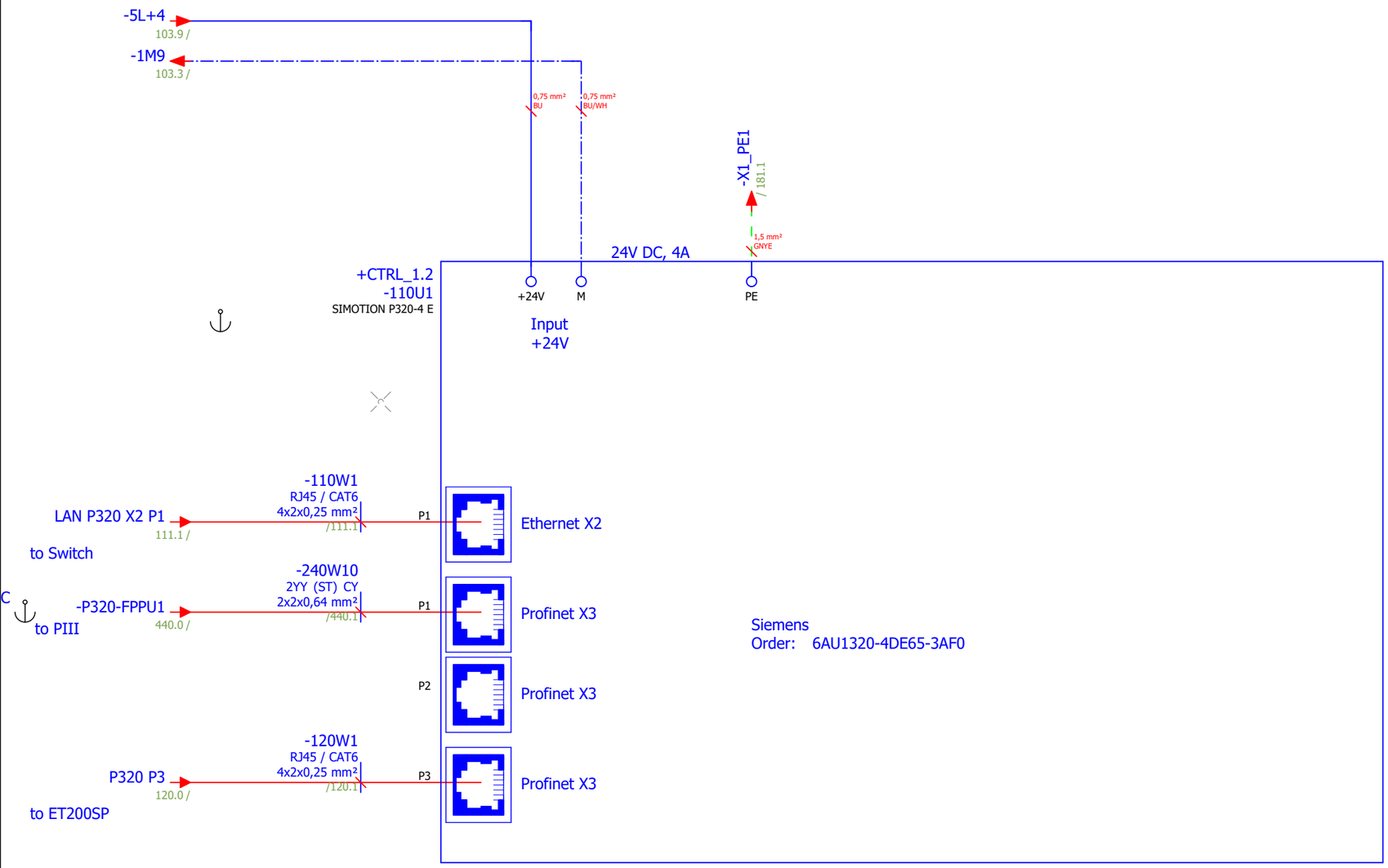
Editor	Freqcon_JD			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 102
Date								+ total: 492



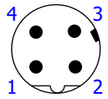
previous page: 102

next page: 110

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 103
Date								+	total: 492



Plug with D-coded



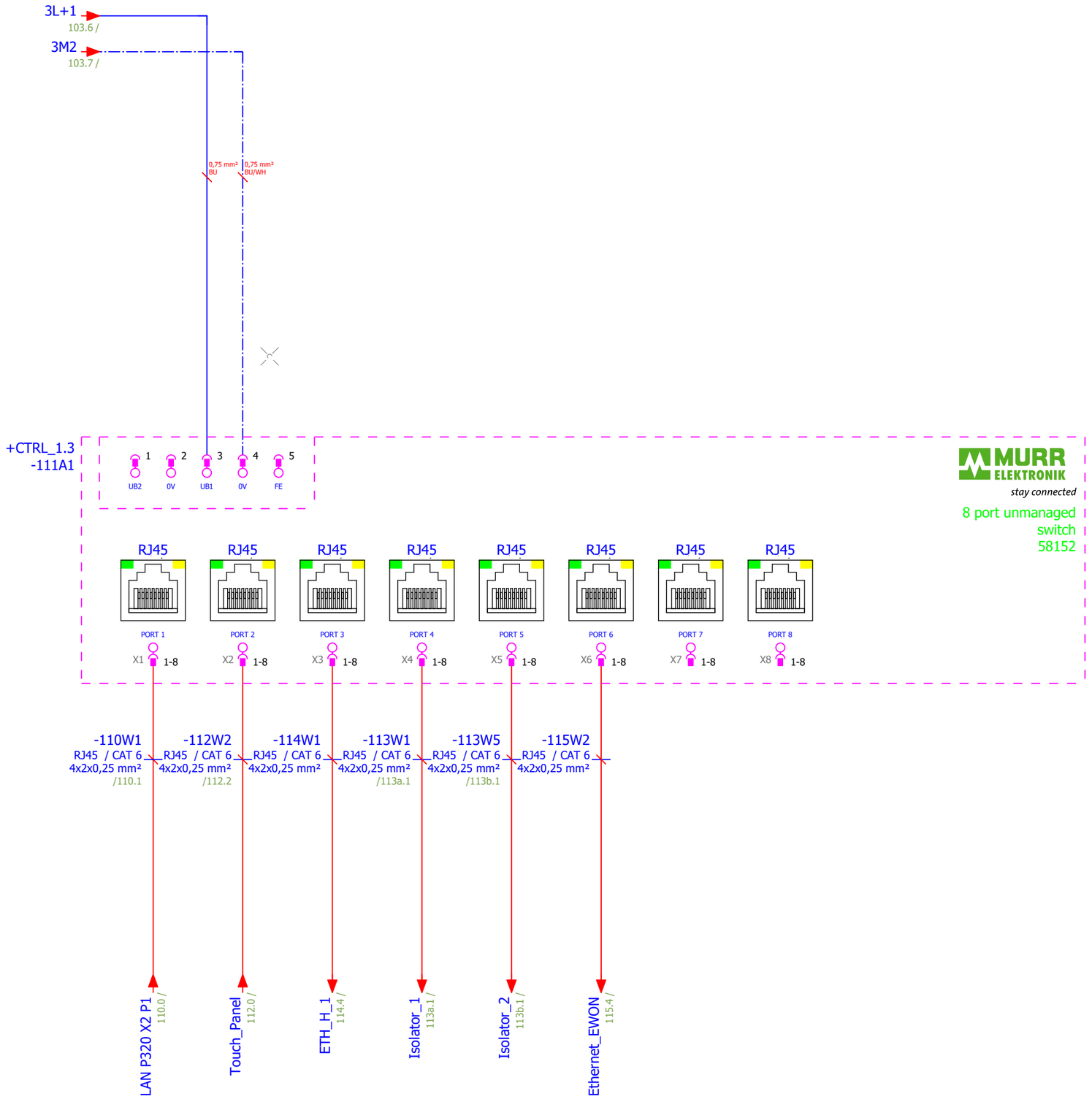
Top view of the pinheader

Signal	Colour	RJ45	M12 plug
TD+	yellow	1	1
TD-	orange	2	3
RD+	white	3	2
RD-	blue	6	4

Connection P320 -- PIII

previous page: 103

next page: 111

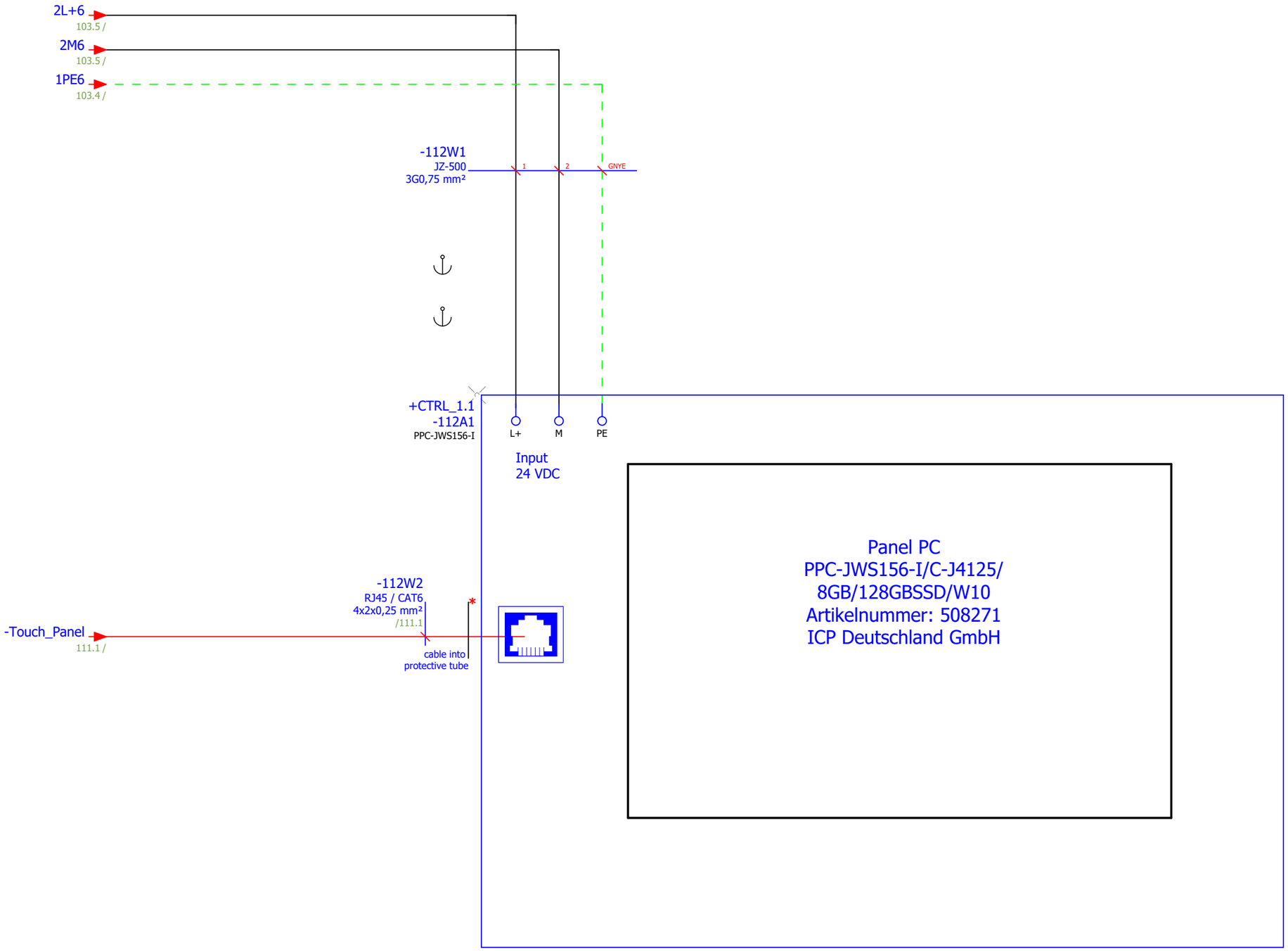


previous page:
110

next page:
112

Editor	Freqcon_DG			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_01	Converter Container 1
Date	23.01.2025							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

page: 111
total: 492



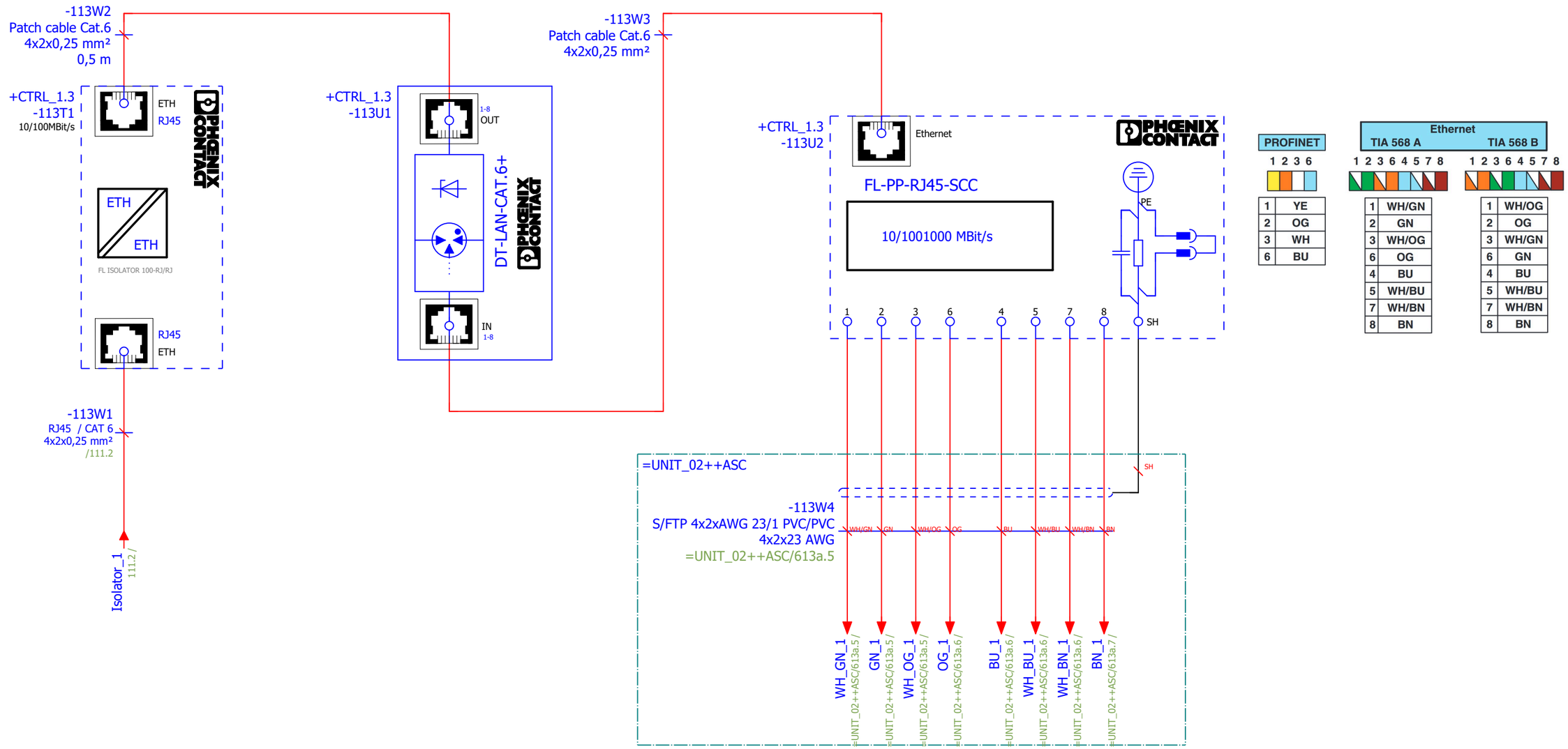
PANEL PC

previous page:
111

next page:
113a

Editor	Freqcon_JD			Statron	FREQCON	PANEL PC HMI	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

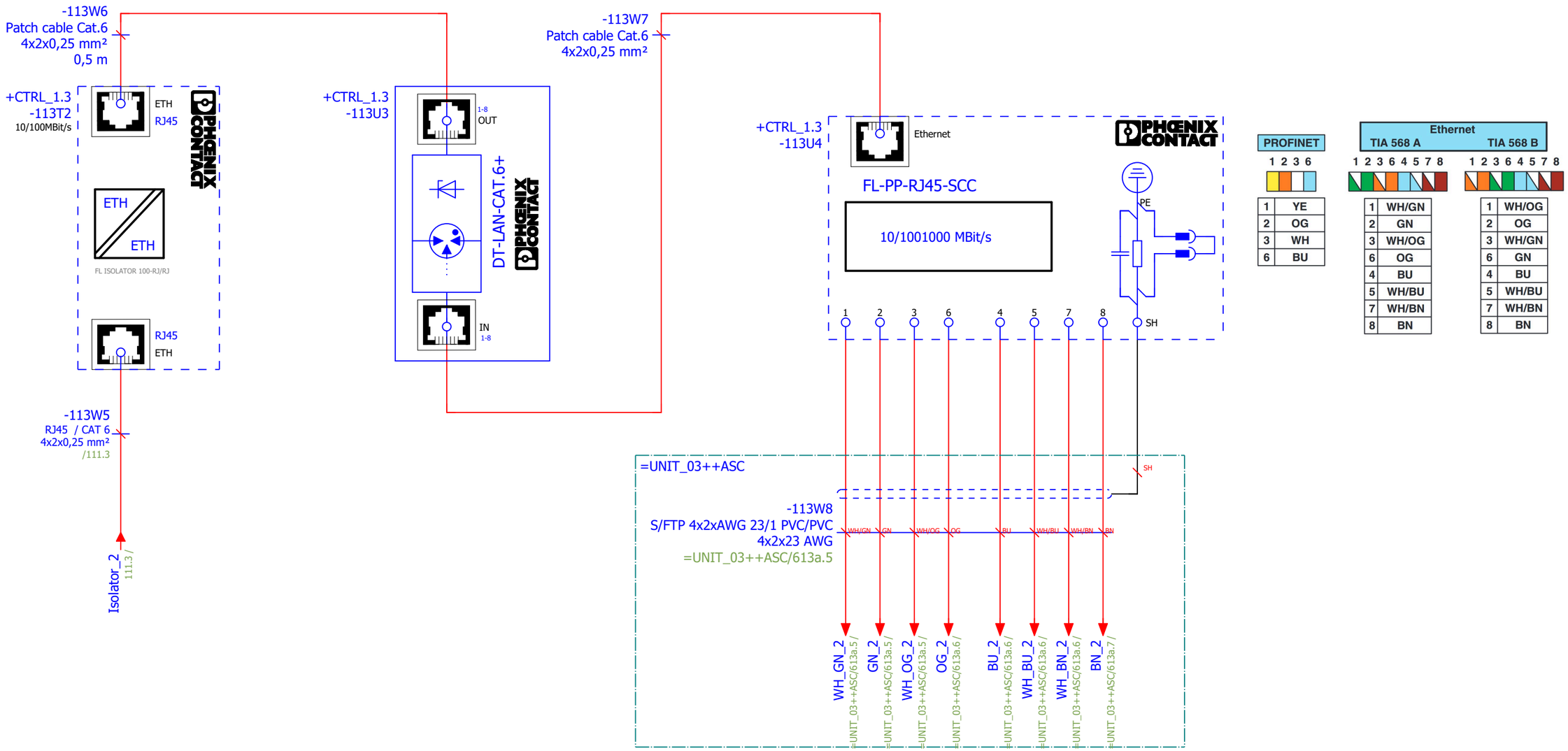
page: 112
total: 492



previous page:
112

next page:
113b

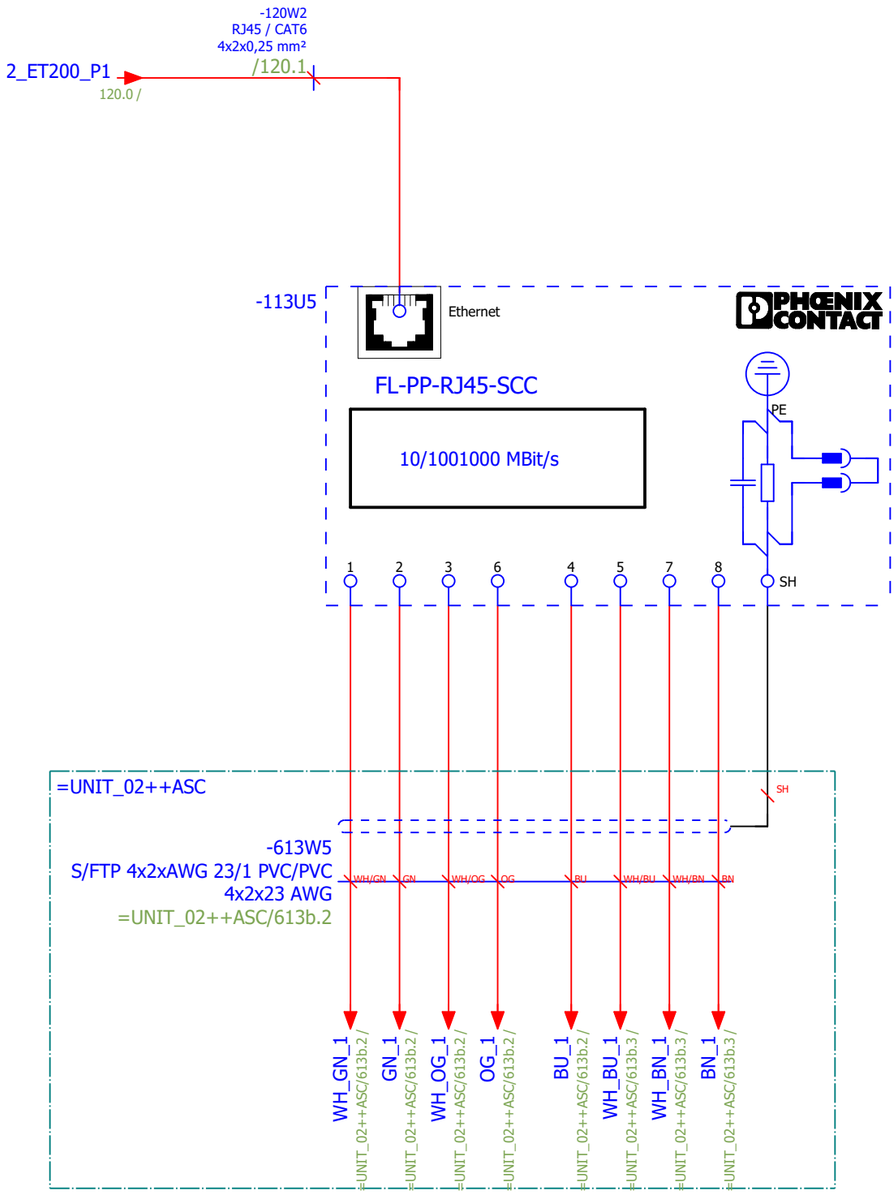
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 113a
Date								+	total: 492



previous page:
113a

next page:
113c

Editor	Freqcon_JD			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 113b
Date								+	total: 492



PROFINET

1 2 3 6

1	YE
2	OG
3	WH
6	BU

Ethernet

TIA 568 A

1 2 3 6 4 5 7 8

1	WH/GN
2	GN
3	WH/OG
6	OG
4	BU
5	WH/BU
7	WH/BN
8	BN

TIA 568 B

1 2 3 6 4 5 7 8

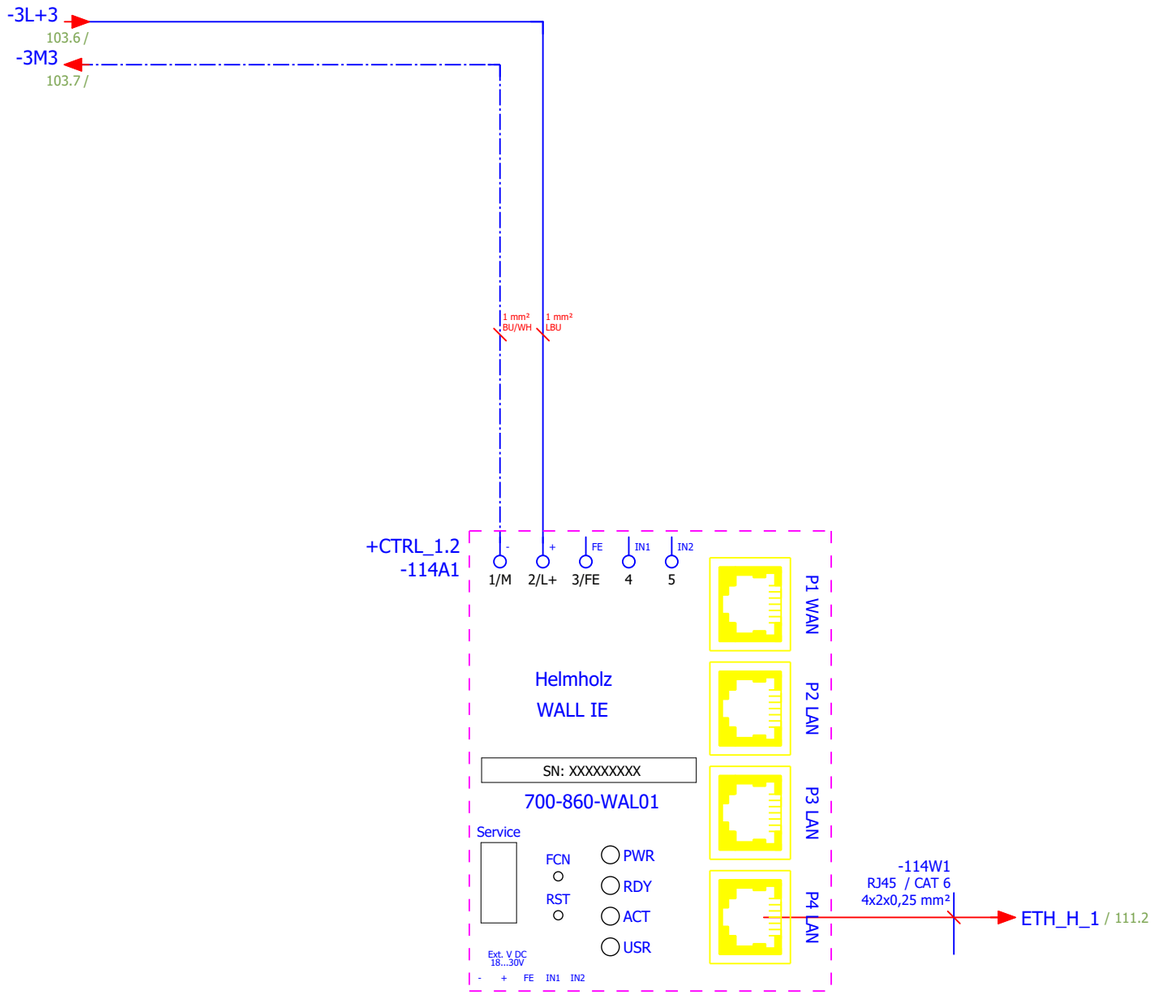
1	WH/OG
2	OG
3	WH/GN
6	GN
4	BU
5	WH/BU
7	WH/BN
8	BN

previous page: 113b

next page: 114

Editor	Freqcon_DG			Statron		PROFINET	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 113c
Date								+		total: 492

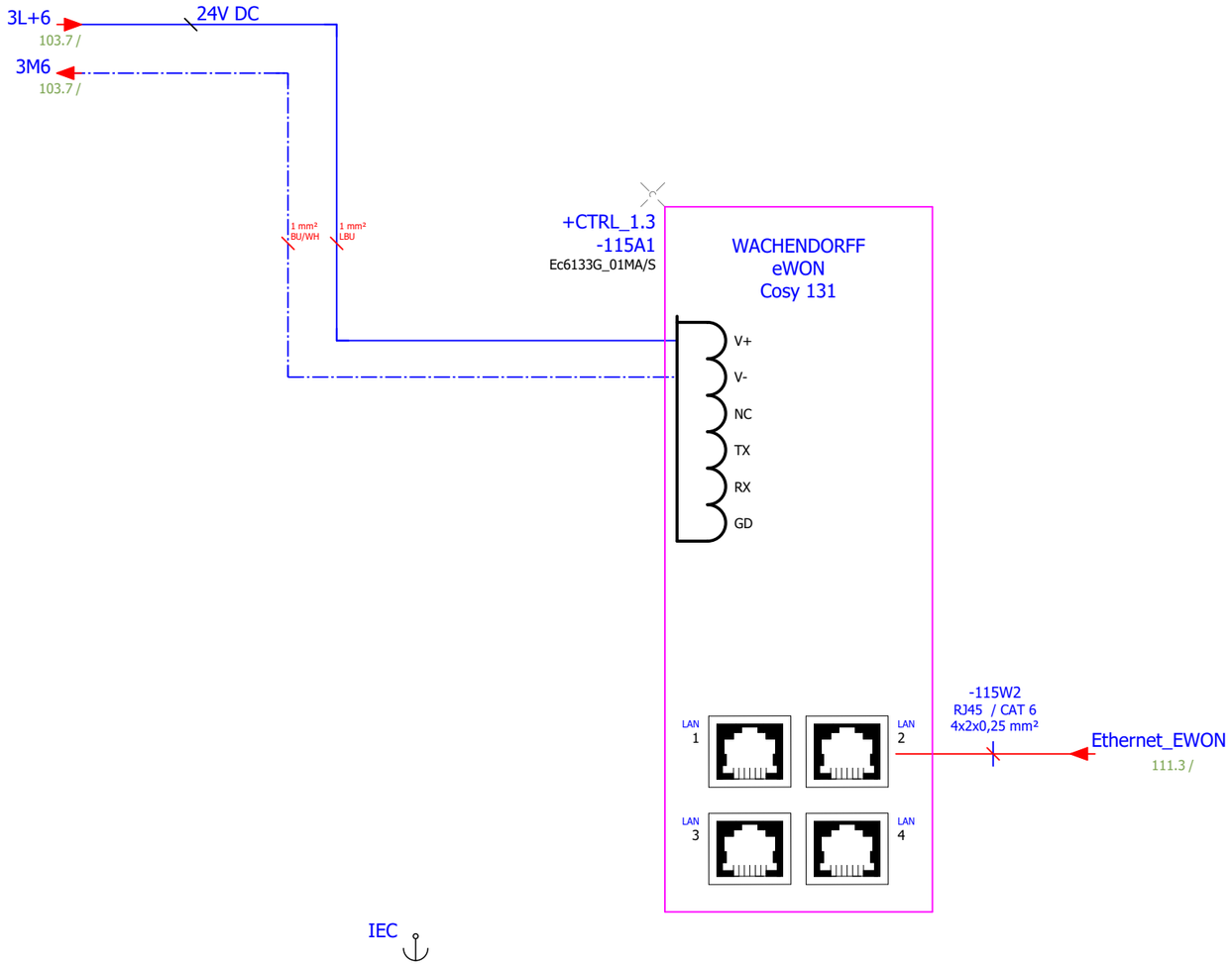
0	1	2	3	4	5	6	7	8	9



previous page:
113c

next page:
115

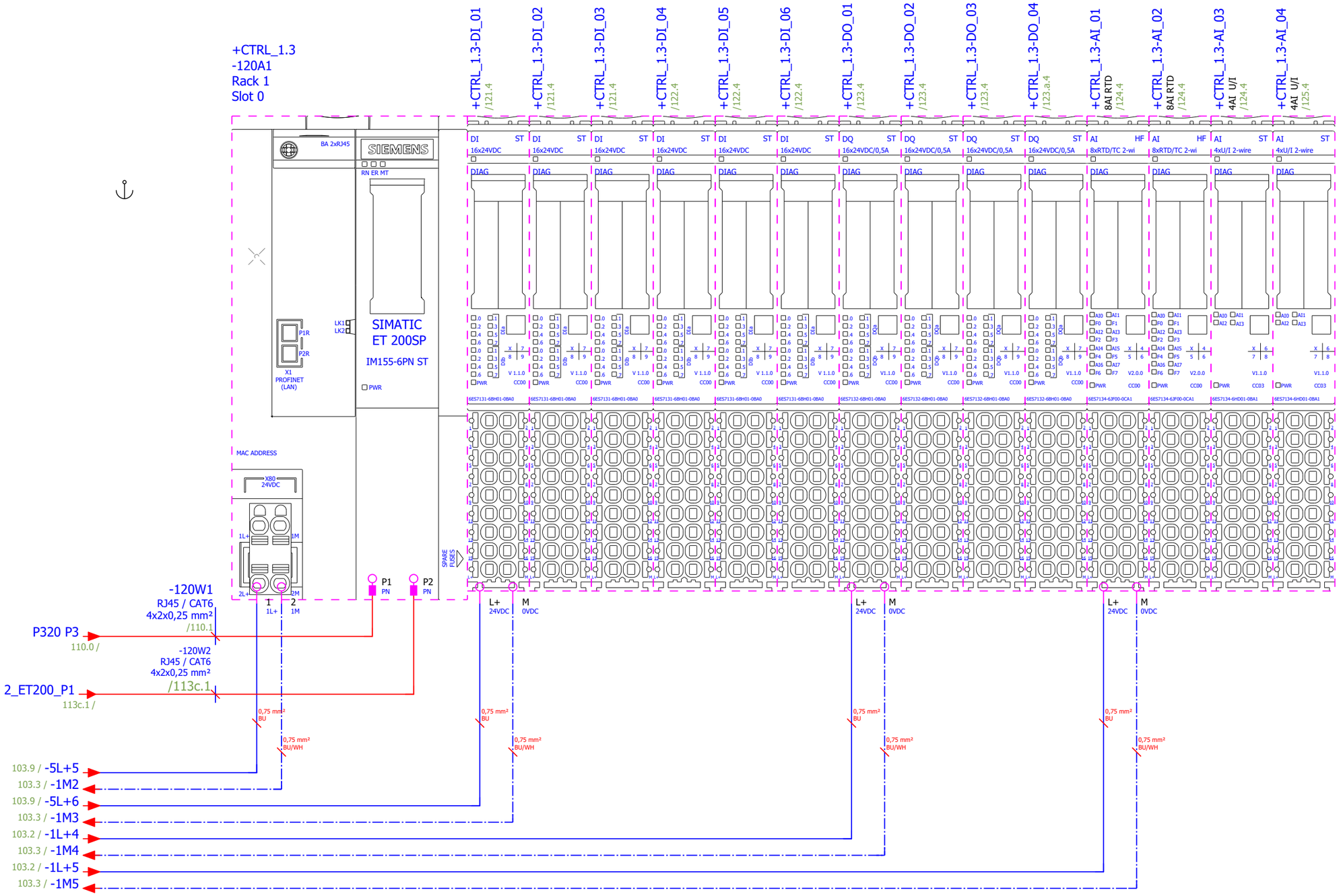
Editor	Freqcon_DG			Statron	FREQCON	HELMHOLZ	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	23.01.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 114
Date								+	total: 492



previous page:
114

next page:
120

Editor	Freqcon_JD			Statron	FREQCON	UMTS ROUTER	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 115
Date								+	total: 492



previous page: 115

next page: 121

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 120
Date								+		total: 492

+CTRL_1.3-DI_01

/120.3

		DI0 1	E10.0	E10.1 2 DI1	/101.7	fuse 24V DC power supply unit
ON Feedback Circuit Breaker CTRL	/84.4	DI2 3	E10.2	E10.3 4 DI3	/103.1	FUSE 24V DC CONTROL VOLTAGE
Tripped Signal Circuit Breaker CTRL	/84.5	DI4 5	E10.4	E10.5 6 DI5	/127.7	LIGHTNING PROTECTION in Control Cabinet OPTIONAL
UPS BATTERY OK	/102.5	DI6 7	E10.6	E10.7 8 DI7	/102.6	BATTERY MODE
BATTERY CHARGING	/102.7	DI8 9	E11.0	E11.1 10 DI9	/126.1	RESET -126S1
FUSE FOR PUMP	/181.2	DI10 11	E11.2	E11.3 12 DI11	/182.2	FAN 1 HEAT EXCHANGER
FUSE FOR HEATER	/181.5	DI12 13	E11.4	E11.5 14 DI13		
Fuse Fans CON, IND Cabinets	/183.6	DI14 15	E11.6	E11.7 16 DI15	/185.9	supply light, fan, heater, power unit in cabinet
	/120.3	24VDC L+		M 0VDC	/120.3	

+CTRL_1.3-DI_02

/120.3

FAULT SIGNAL SAFETY RELAY	/195.4	DI0 1	E12.0	E12.1 2 DI1	/187.6	FUSES SUPPLY FOR CIRCUIT BREAKER 1+2
CB 1 ON GRID	/127.2	DI2 3	E12.2	E12.3 4 DI3	/127.3	CB 1 OFF GRID
CB 1 Tripped GRID	/127.1	DI4 5	E12.4	E12.5 6 DI5	/127.4	FUSE AND LIGHTNING PROTECTION
Smoke detector CON	/134.0	DI6 7	E12.6	E12.7 8 DI7	/129.0	SUBSYSTEM 2_1_DC + Contactor K1 is on
SUBSYSTEM 2_1_DC -Contactor K7 is on	/129.1	DI8 9	E13.0	E13.1 10 DI9	/129.2	SUBSYSTEM 2_2_DC + Contactor K2 is on
SUBSYSTEM 2_2_DC -Contactor K8 is on	/129.3	DI10 11	E13.2	E13.3 12 DI11	/129.4	SUBSYSTEM 2_3_DC + Contactor K3 is on
SUBSYSTEM 2_3_DC -Contactor K9 is on	/129.5	DI12 13	E13.4	E13.5 14 DI13	/129.6	SUBSYSTEM 2_3_DC + SPARE
SUBSYSTEM 2_DC -SPARE	/129.7	DI14 15	E13.6	E13.7 16 DI15	/129.8	SUBSYSTEM 2_1_DC FUSE OK
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_03

/120.3

SUBSYSTEM 2_2_DC FUSE OK	/129.9	DI0 1	E14.0	E14.1 2 DI1	/130.0	SUBSYSTEM 3_1_DC + Contactor K1 is on
SUBSYSTEM 3_1_DC -Contactor K7 is on	/130.1	DI2 3	E14.2	E14.3 4 DI3	/130.2	SUBSYSTEM 3_2_DC + Contactor K2 is on
SUBSYSTEM 3_2_DC -Contactor K8 is on	/130.3	DI4 5	E14.4	E14.5 6 DI5	/130.4	SUBSYSTEM 3_3_DC + Contactor K3 is on
SUBSYSTEM 3_3_DC -Contactor K9 is on	/130.5	DI6 7	E14.6	E14.7 8 DI7	/130.6	SUBSYSTEM 3_DC + SPARE
SUBSYSTEM 3_DC -SPARE	/130.7	DI8 9	E15.0	E15.1 10 DI9	/130.8	SUBSYSTEM 2_DC FUSE OK
SUBSYSTEM 3_1_DC FUSE OK	/130.9	DI10 11	E15.2	E15.3 12 DI11	/131.0	SUBSYSTEM 4_1_DC + Contactor K1 is on
SUBSYSTEM 4_1_DC -Contactor K7 is on	/131.1	DI12 13	E15.4	E15.5 14 DI13	/131.2	SUBSYSTEM 4_2_DC + Contactor K2 is on
SUBSYSTEM 4_2_DC -Contactor K8 is on	/131.3	DI14 15	E15.6	E15.7 16 DI15	/131.4	SUBSYSTEM 4_3_DC + Contactor K3 is on
		24VDC L+		M 0VDC		

previous page: 120

next page: 122

+CTRL_1.3-DI_04

/120.4

SPARE	/133.1	DI0 1	E16.0	E16.1 2 DI1	/133.2	SPARE
SPARE	/133.3	DI2 3	E16.2	E16.3 4 DI3	/133.4	TRIP
Earthing switch in On Transformer 620V side	/133.9	DI4 5	E16.4	E16.5 6 DI5		
		DI6 7	E16.6	E16.7 8 DI7		
		DI8 9	E17.0	E17.1 10 DI9		
Fuse 230V AC for Container Air Conditioning	/133.6	DI10 11	E17.2	E17.3 12 DI11	/128.1	CB 2 Tripped ISLAND GRID
CB 2 ON ISLAND GRID	/128.2	DI12 13	E17.4	E17.5 14 DI13	/128.3	CB 2 OFF ISLAND GRID
FUSE AND LIGHTNING PROTECTION 2	/128.4	DI14 15	E17.6	E17.7 16 DI15	/182.5	FAN 2 HEAT EXCHANGER (OPTIONAL)
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_05

/120.4

SUBSYSTEM 4_3_DC -Contactor K9 is on	/131.5	DI0 1	E18.0	E18.1 2 DI1	/131.6	SUBSYSTEM 4_DC + SPARE
SUBSYSTEM 4_DC -SPARE	/131.7	DI2 3	E18.2	E18.3 4 DI3	/131.8	SUBSYSTEM 3_2_DC FUSE OK
SUBSYSTEM 3_3_DC FUSE OK	/131.9	DI4 5	E18.4	E18.5 6 DI5	/132.0	
	/132.1	DI6 7	E18.6	E18.7 8 DI7	/132.2	
	/132.3	DI8 9	E19.0	E19.1 10 DI9	/132.4	
	/132.5	DI10 11	E19.2	E19.3 12 DI11	/132.6	
SUBSYSTEM 4_1_DC FUSE OK	/132.7	DI12 13	E19.4	E19.5 14 DI13	/132.8	SUBSYSTEM 4_2_DC FUSE OK
SUBSYSTEM 4_3_DC FUSE OK	/132.9	DI14 15	E19.6	E19.7 16 DI15		
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_06

/120.4

Shut-down to BESS	/136.6	DI0 1	E20.0	E20.1 2 DI1		
		DI2 3	E20.2	E20.3 4 DI3		
		DI4 5	E20.4	E20.5 6 DI5		
		DI6 7	E20.6	E20.7 8 DI7		
incoming CB is open	/136.8	DI8 9	E21.0	E21.1 10 DI9	/136.9	cmd island mode
		DI10 11	E21.2	E21.3 12 DI11		
		DI12 13	E21.4	E21.5 14 DI13		
		DI14 15	E21.6	E21.7 16 DI15		
		24VDC L+		M 0VDC		

previous page: 121

next page: 123

+CTRL_1.3-DO_01

/120.5

CON Fans 1-5 in door	/135.1	DQ0 1	A10.0	A10.1 2 DQ1	/135.2	FAN 1 Control cabinet
CIR Fans 1-3 in door	/135.3	DQ2 3	A10.2	A10.3 4 DQ3	/135.4	SPARE 230V
CB2 ON ISLAND GRID OPTIONAL	/137.3	DQ4 5	A10.4	A10.5 6 DQ5	/137.4	CB 2 OFF ISLAND GRID OPTIONAL
Precharging DC-Link Capacitors	/171.5	DQ6 7	A10.6	A10.7 8 DQ7	/173.6	Discharge CON
CABINET CONTROL VOLTAGE RESET	/103.1	DQ8 9	A11.0	A11.1 10 DQ9	/137.1	CB1 ON GRID
CB 1 OFF GRID	/137.2	DQ10 11	A11.2	A11.3 12 DQ11	/189.1	GRID FAULT
FAULT 140H1	/140.1	DQ12 13	A11.4	A11.5 14 DQ13	/140.2	PREHEATING 140H2
READY FOR OPERATION 140H3	/140.3	DQ14 15	A11.6	A11.7 16 DQ15	/140.4	OPERATING 140H4
	/120.5	24VDC L+		M 0VDC	/120.5	

+CTRL_1.3-DO_02

/120.5

SUBSYSTEM 2_1 CONTACTOR DC+ ON	/150.1	DQ0 1	A12.0	A12.1 2 DQ1	/150.3	SUBSYSTEM 2_1 CONTACTOR DC-ON
SUBSYSTEM 2_2 CONTACTOR DC+ ON	/151.0	DQ2 3	A12.2	A12.3 4 DQ3	/151.2	SUBSYSTEM 2_2 CONTACTOR DC-ON
SUBSYSTEM 2_3 CONTACTOR DC+ ON	/151.3	DQ4 5	A12.4	A12.5 6 DQ5	/151.5	SUBSYSTEM 2_3 CONTACTOR DC-ON
		DQ6 7	A12.6	A12.7 8 DQ7	/135.5	SPARE
		DQ8 9	A13.0	A13.1 10 DQ9		
		DQ10 11	A13.2	A13.3 12 DQ11	/139.4	Fan 2 Heat exchanger optional
Heater On converter coolingsystem	/139.1	DQ12 13	A13.4	A13.5 14 DQ13	/139.2	Pump converter coolingsystem
Fan 1 Heat exchanger	/139.3	DQ14 15	A13.6	A13.7 16 DQ15	/134.8	Reset the smoke detectors
		24VDC L+		M 0VDC		

+CTRL_1.3-DO_03

/120.5

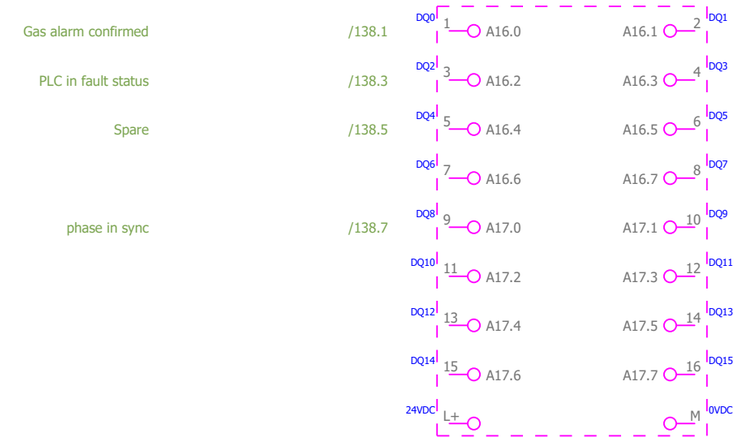
SUBSYSTEM 3_1 CONTACTOR DC+ ON	/350.1	DQ0 1	A14.0	A14.1 2 DQ1	/350.3	SUBSYSTEM 3_1 CONTACTOR DC-ON
		DQ2 3	A14.2	A14.3 4 DQ3		
SUBSYSTEM 3_3 CONTACTOR DC+ ON	/351.4	DQ4 5	A14.4	A14.5 6 DQ5	/351.5	SUBSYSTEM 3_3 CONTACTOR DC-ON
SUBSYSTEM 4_1 CONTACTOR DC+ ON	/352.0	DQ6 7	A14.6	A14.7 8 DQ7	/352.2	SUBSYSTEM 4_1 CONTACTOR DC-ON
SUBSYSTEM 4_2 CONTACTOR DC+ ON	/353.0	DQ8 9	A15.0	A15.1 10 DQ9	/353.2	SUBSYSTEM 4_2 CONTACTOR DC-ON
SUBSYSTEM 4_3 CONTACTOR DC+ ON	/353.3	DQ10 11	A15.2	A15.3 12 DQ11	/353.5	SUBSYSTEM 4_3 CONTACTOR DC-ON
		DQ12 13	A15.4	A15.5 14 DQ13		
		DQ14 15	A15.6	A15.7 16 DQ15		
		24VDC L+		M 0VDC		

previous page: 122

next page: 123.a

+CTRL_1.3-DO_04

/120.6



previous page: 123

next page: 124

Editor	Freqcon_JD			Statron	FREQCON	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 123.a
Date								+	total: 492

+CTRL_1.3-AI_01

/120.6

INDUCTOR GRID PHASE L1 TEMPERATURE 1_1	/145.1	M0+	1	PIW150	PIW152	2	M1+	/145.3	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3	/145.5	M2+	3	PIW154	PIW156	4	M3+	/145.7	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2	/146.1	M4+	5	PIW158	PIW160	6	M5+	/146.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1	/146.5	M6+	7	PIW162	PIW164	8	M7+	/146.7	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2
INDUCTOR GRID PHASE L1 TEMPERATURE 1_1	/145.1	M0-	9	PIW150	PIW152	10	M1-	/145.3	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3	/145.5	M2-	11	PIW154	PIW156	12	M3-	/145.7	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2	/146.1	M4-	13	PIW158	PIW160	14	M5-	/146.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1	/146.5	M6-	15	PIW162	PIW164	16	M7-	/146.7	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2
	/120.6	24VDC	L+		M	0VDC		/120.6	

+CTRL_1.3-AI_02

/120.6

INDUCTOR DC SUB 3_3 TEMPERATURE 3_3	/147.1	M0+	1	PIW166	PIW168	2	M1+	/147.3	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1
CONTROL CABINET TEMPERATURE	/147.5	M2+	3	PIW170	PIW172	4	M3+	/147.7	CONVERTER CABINET TEMPERATURE
COOLING WATER TEMPERATURE	/148.1	M4+	5	PIW174	PIW176	6	M5+	/148.3	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2
CIR CABINET TEMPERATURE	/148.5	M6+	7	PIW178	PIW180	8	M7+	/148.7	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3	/147.1	M0-	9	PIW166	PIW168	10	M1-	/147.3	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1
CONTROL CABINET TEMPERATURE	/147.5	M2-	11	PIW170	PIW172	12	M3-	/147.7	CONVERTER CABINET TEMPERATURE
COOLING WATER TEMPERATURE	/148.1	M4-	13	PIW174	PIW176	14	M5-	/148.3	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2
CIR CABINET TEMPERATURE	/148.5	M6-	15	PIW178	PIW180	16	M7-	/148.7	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3
		24VDC	L+		M	0VDC			

+CTRL_1.3-AI_03

/120.7

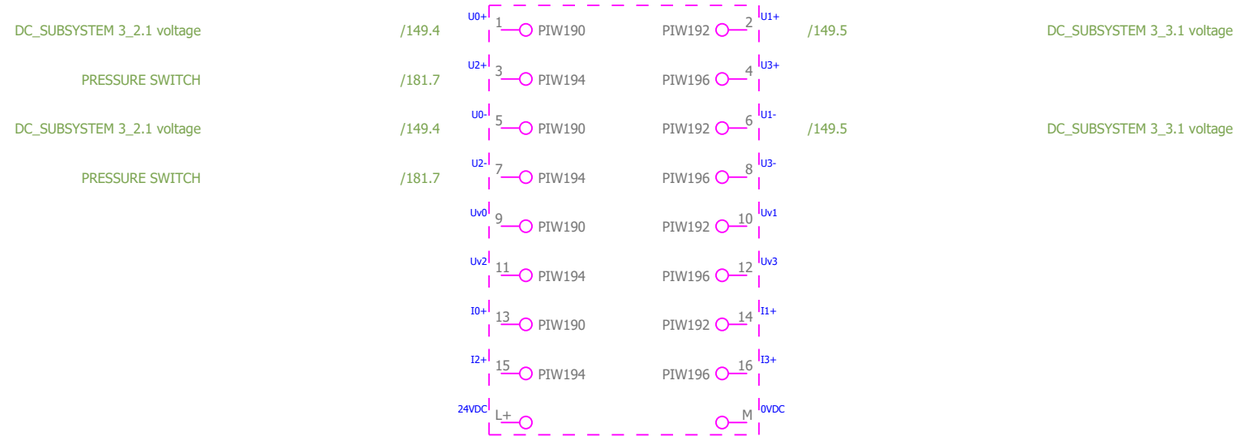
DC_SUBSYSTEM 2_1.1 voltage	/149.0	U0+	1	PIW182	PIW184	2	U1+	/149.1	DC_SUBSYSTEM 2_2.1 voltage
DC_SUBSYSTEM 2_3.1 voltage	/149.2	U2+	3	PIW186	PIW188	4	U3+	/149.3	DC_SUBSYSTEM 3_1.1 voltage
DC_SUBSYSTEM 2_1.1 voltage	/149.0	U0-	5	PIW182	PIW184	6	U1-	/149.1	DC_SUBSYSTEM 2_2.1 voltage
DC_SUBSYSTEM 2_3.1 voltage	/149.2	U2-	7	PIW186	PIW188	8	U3-	/149.3	DC_SUBSYSTEM 3_1.1 voltage
		Uv0	9	PIW182	PIW184	10	Uv1		
		Uv2	11	PIW186	PIW188	12	Uv3		
		I0+	13	PIW182	PIW184	14	I1+		
		I2+	15	PIW186	PIW188	16	I3+		
		24VDC	L+		M	0VDC			

previous page: 123.a

next page: 125

+CTRL_1.3-AI_04

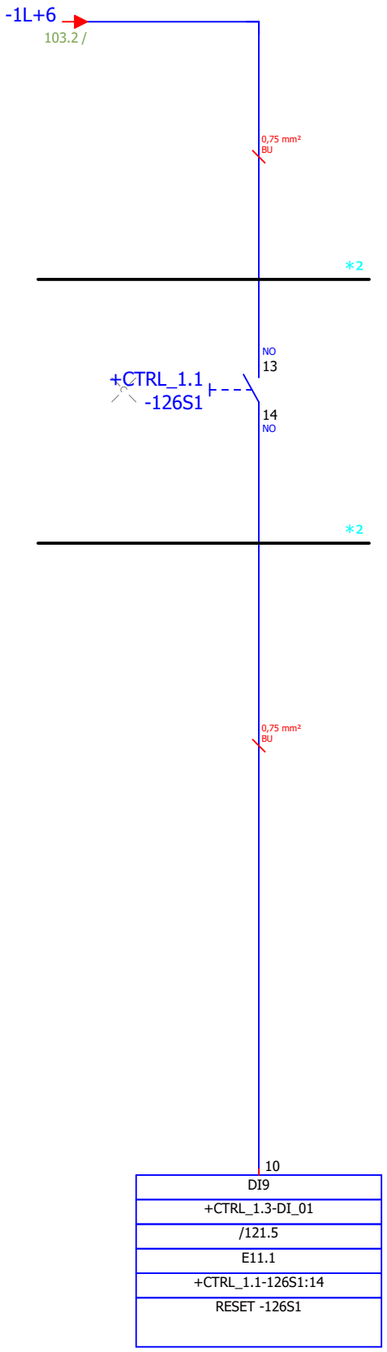
/120.7



previous page: 124

next page: 126

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_04	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 125
Date								+	total: 492



RESET
-126S1

*2
The single conductor
must be placed
in the protective tube

previous page:
125

next page:
127

Editor	Freqcon_JD			Statron	FREQCON	INPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	02.07.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 126
Date								+		total: 492

EC

3WL

++CONV

-CB1_TRIPPED / ++CONV/80.8

-CB1_ON_FB / ++CONV/80.7

-CB1_OFF_FB / ++CONV/80.7

-1F2 / ++CONV/78.9

-4L+5.4 / ++CONV/238a.2

-80W1
OZ-500
8x0,75 mm²

-238W7
OZ-500
2x0,75 mm²

-24V_Signal / 189.5

-4L+5.3 / 134.0

84F1_OK / 84.9

+CTRL_1.3
-X3

fB

bridge

0,75 mm² BU

-4L+5 / 103.8

-4L+5.1 / 128.5

DI14	DI2	DI3	DI5
+CTRL_1.3-DI_02	+CTRL_1.3-DI_02		
/121.4	/121.4	/121.5	/121.5
E12.4	E12.2	E12.3	E12.5
++CONV+CIR-80Q1:X7_13	++CONV+CIR-80Q1:X6_11	++CONV+CIR-80Q1:X6_9	++CONV+AC_DC-78F1:13
CB 1 Tripped GRID	CB 1 ON GRID	CB 1 OFF GRID	FUSE AND LIGHTNING PROTECTION

DI5
+CTRL_1.3-DI_01
/121.5
E10.5
+CTRL_1.3-84F1:12
LIGHTNING PROTECTION in Control Cabinet OPTIONAL

Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 1 Tripped GRID

CB 1 ON GRID

CB 1 OFF GRID

FUSE AND LIGHTNING PROTECTION

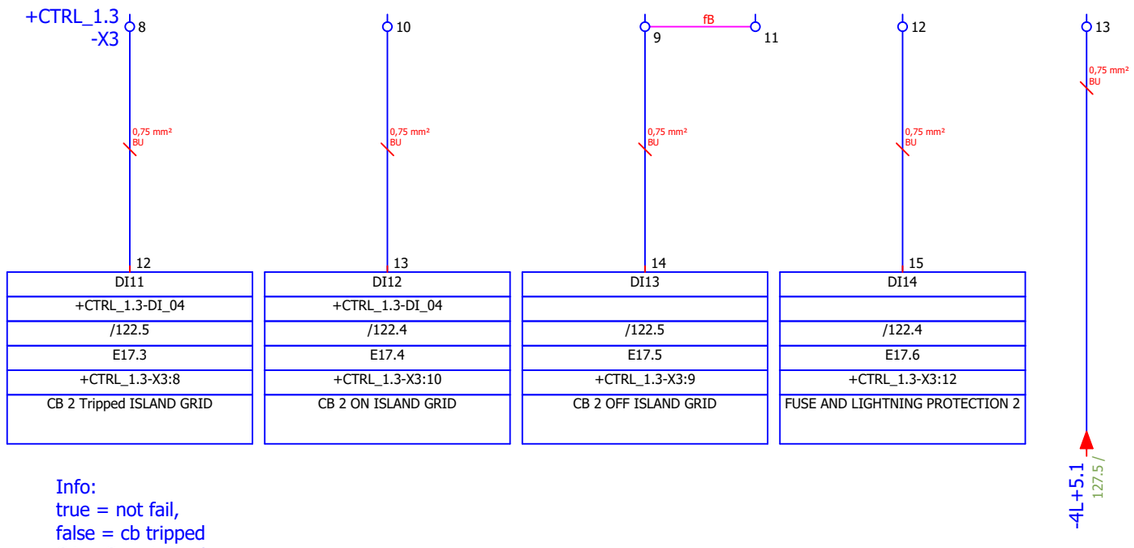
LIGHTNING PROTECTION in Control Cabinet OPTIONAL

previous page: 126

next page: 128

Editor	Freqcon_JD			Statron		DIGITAL INPUTS CB 1	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

0	1	2	3	4	5	6	7	8	9



Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 2 Tripped ISLAND GRID

CB 2 ON ISLAND GRID

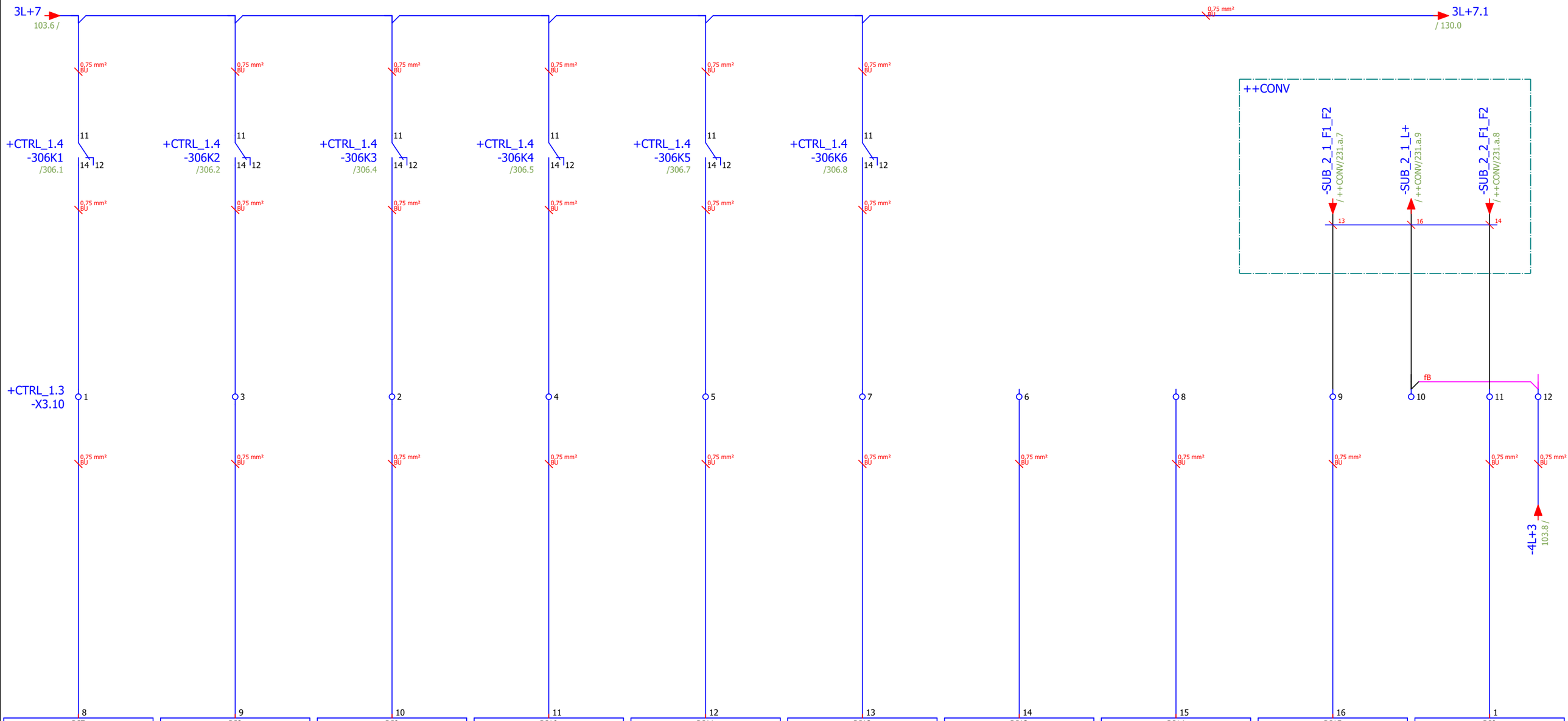
CB 2 OFF ISLAND GRID

FUSE AND LIGHTNING PROTECTION 2

previous page: 127

next page: 129

Editor	Freqcon_JD			Statron		DIGITAL INPUTS CB 2	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 128
Date								+	total: 492



8	9	10	11	12	13	14	15	16	1
DI7	DI8	DI9	DI10	DI11	DI12	DI13	DI14	DI15	DI0
+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_03
/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4
E12.7	E13.0	E13.1	E13.2	E13.3	E13.4	E13.5	E13.6	E13.7	E14.0
+CTRL_1.4-306K1:14	+CTRL_1.4-306K2:14	+CTRL_1.4-306K3:14	+CTRL_1.4-306K4:14	+CTRL_1.4-306K5:14	+CTRL_1.4-306K6:14	+CTRL_1.3-X3.10:6	+CTRL_1.3-X3.10:8	++CONV+CIR-231U1-F1:2	++CONV+CIR-231U1-F5:2
SUBSYSTEM 2_1_DC + Contactor K1 is on	SUBSYSTEM 2_1_DC -Contactor K7 is on	SUBSYSTEM 2_2_DC + Contactor K2 is on	SUBSYSTEM 2_2_DC -Contactor K8 is on	SUBSYSTEM 2_3_DC + Contactor K3 is on	SUBSYSTEM 2_3_DC -Contactor K9 is on	SUBSYSTEM 2_3_DC + SPARE	SUBSYSTEM 2_DC -SPARE	SUBSYSTEM 2_1_DC FUSE OK	SUBSYSTEM 2_2_DC FUSE OK

Feedback of DC Contactors

SUBSYSTEM 2_1_DC + Contactor K1 is on

SUBSYSTEM 2_1_DC - Contactor K7 is on

SUBSYSTEM 2_2_DC + Contactor K2 is on

SUBSYSTEM 2_2_DC - Contactor K8 is on

SUBSYSTEM 2_3_DC + Contactor K3 is on

SUBSYSTEM 2_3_DC - Contactor K9 is on

SUBSYSTEM 2_3_DC + SPARE

SUBSYSTEM 2_DC - SPARE

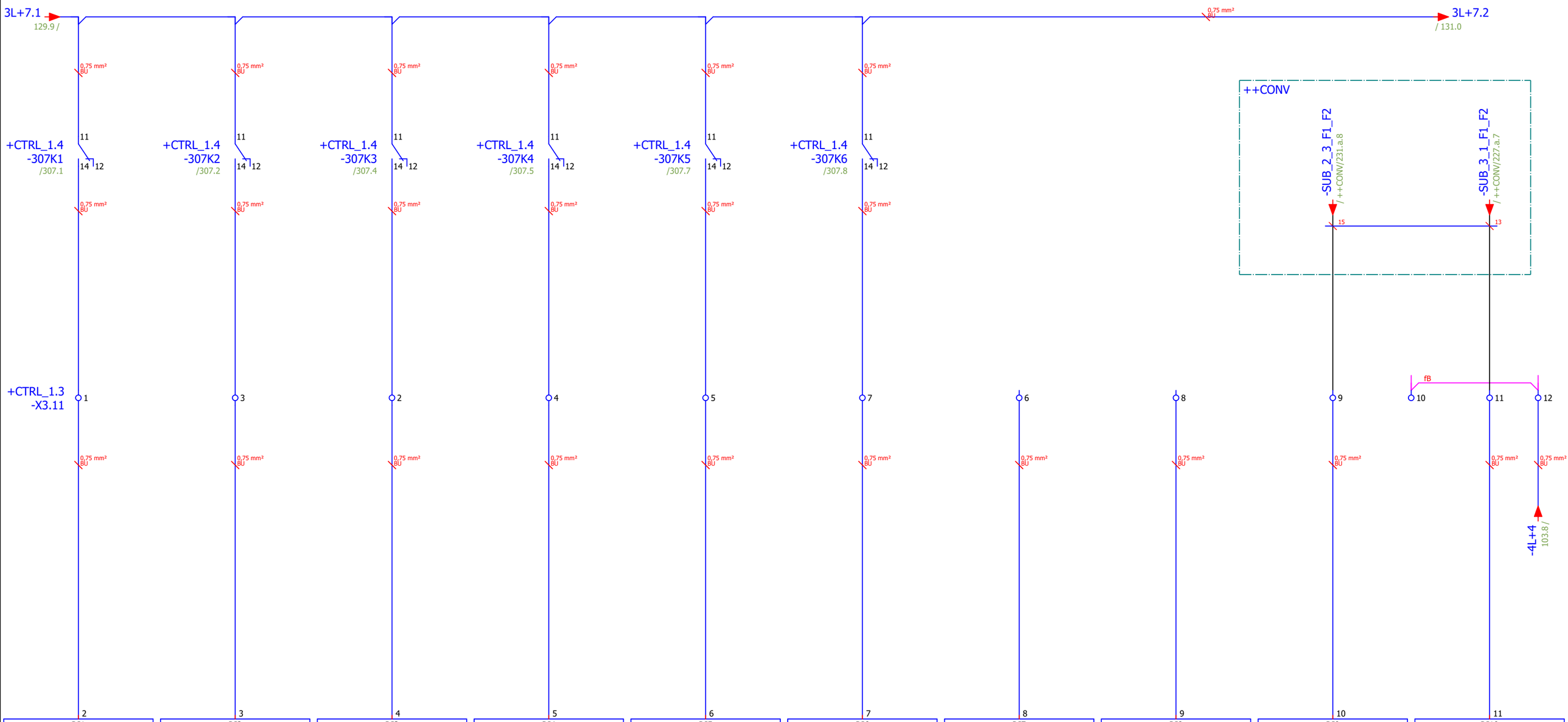
SUBSYSTEM 2_1_DC FUSE OK

SUBSYSTEM 2_2_DC FUSE OK

previous page: 128

next page: 130

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 129
Date								+ total: 492



2	3	4	5	6	7	8	9	10	11
DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	DI9	DI10
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03
/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4
E14.1	E14.2	E14.3	E14.4	E14.5	E14.6	E14.7	E15.0	E15.1	E15.2
+CTRL_1.4-307K1:14	+CTRL_1.4-307K2:14	+CTRL_1.4-307K3:14	+CTRL_1.4-307K4:14	+CTRL_1.4-307K5:14	+CTRL_1.4-307K6:14	+CTRL_1.3-X3.11:6	+CTRL_1.3-X3.11:8	++CONV+CIR-231U1-F9:2	++CONV+CIR-227U1-F1:2
SUBSYSTEM 3_1_DC + Contactor K1 is on	SUBSYSTEM 3_1_DC -Contactor K7 is on	SUBSYSTEM 3_2_DC + Contactor K2 is on	SUBSYSTEM 3_2_DC -Contactor K8 is on	SUBSYSTEM 3_3_DC + Contactor K3 is on	SUBSYSTEM 3_3_DC -Contactor K9 is on	SUBSYSTEM 3_DC + SPARE	SUBSYSTEM 3_DC -SPARE	SUBSYSTEM 2_DC FUSE OK	SUBSYSTEM 3_1_DC FUSE OK

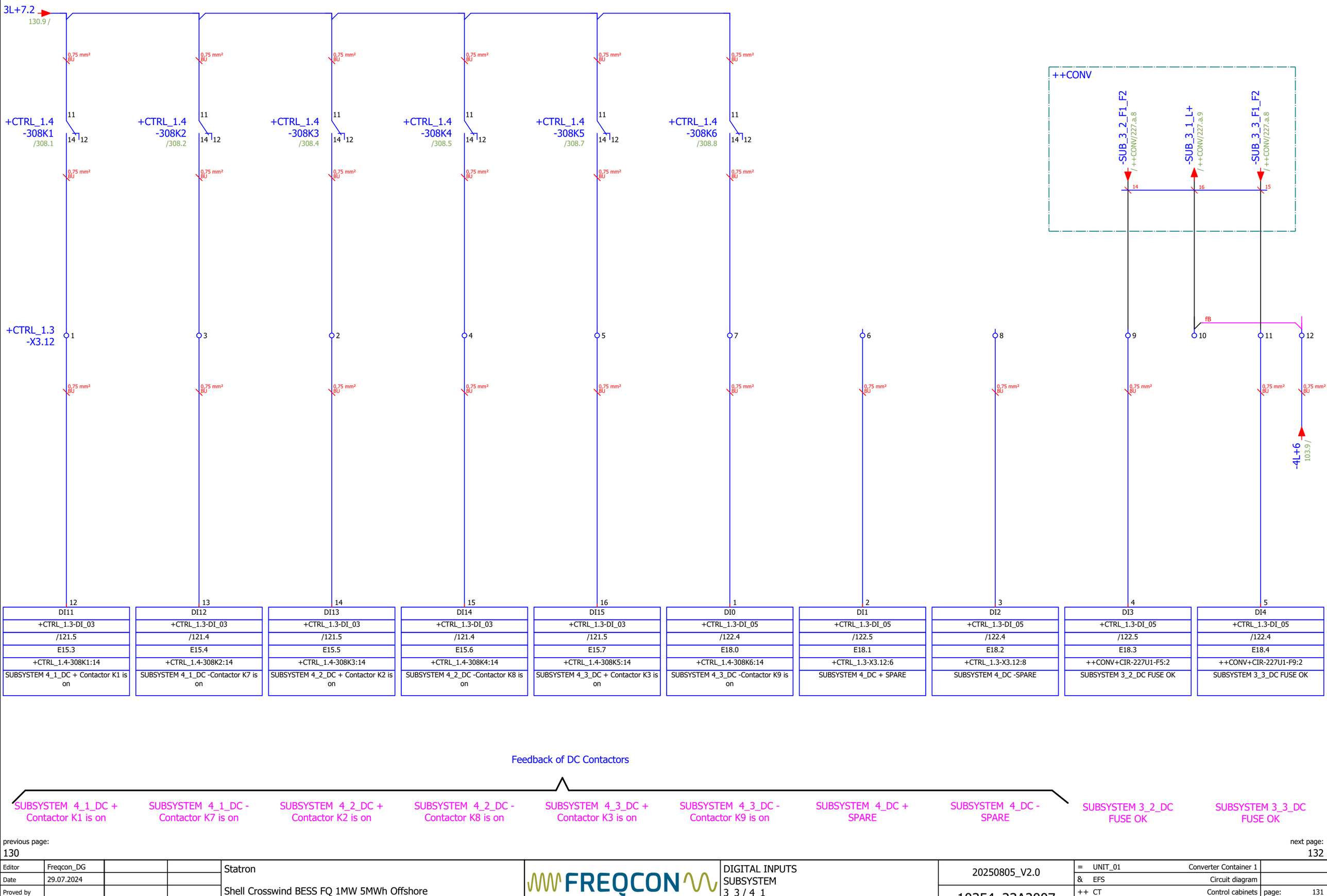
Feedback of DC Contactors

SUBSYSTEM 3_1_DC + Contactor K1 is on | SUBSYSTEM 3_1_DC - Contactor K7 is on | SUBSYSTEM 3_2_DC + Contactor K2 is on | SUBSYSTEM 3_2_DC - Contactor K8 is on | SUBSYSTEM 3_3_DC + Contactor K3 is on | SUBSYSTEM 3_3_DC - Contactor K9 is on | SUBSYSTEM 3_DC + SPARE | SUBSYSTEM 3_DC - SPARE | SUBSYSTEM 2_DC FUSE OK | SUBSYSTEM 3_1_DC FUSE OK

previous page: 129

next page: 131

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 130
Date								+ total: 492



12	13	14	15	16	1	2	3	4	5
DI11	DI12	DI13	DI14	DI15	DI0	DI1	DI2	DI3	DI4
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05
/121.5	/121.4	/121.5	/121.4	/121.5	/122.4	/122.5	/122.4	/122.5	/122.4
E15.3	E15.4	E15.5	E15.6	E15.7	E18.0	E18.1	E18.2	E18.3	E18.4
+CTRL_1.4-308K1:14	+CTRL_1.4-308K2:14	+CTRL_1.4-308K3:14	+CTRL_1.4-308K4:14	+CTRL_1.4-308K5:14	+CTRL_1.4-308K6:14	+CTRL_1.3-X3.12:6	+CTRL_1.3-X3.12:8	++CONV+CIR-227U1-F5:2	++CONV+CIR-227U1-F9:2
SUBSYSTEM 4_1_DC + Contactor K1 is on	SUBSYSTEM 4_1_DC -Contactor K7 is on	SUBSYSTEM 4_2_DC + Contactor K2 is on	SUBSYSTEM 4_2_DC -Contactor K8 is on	SUBSYSTEM 4_3_DC + Contactor K3 is on	SUBSYSTEM 4_3_DC -Contactor K9 is on	SUBSYSTEM 4_DC + SPARE	SUBSYSTEM 4_DC -SPARE	SUBSYSTEM 3_2_DC FUSE OK	SUBSYSTEM 3_3_DC FUSE OK

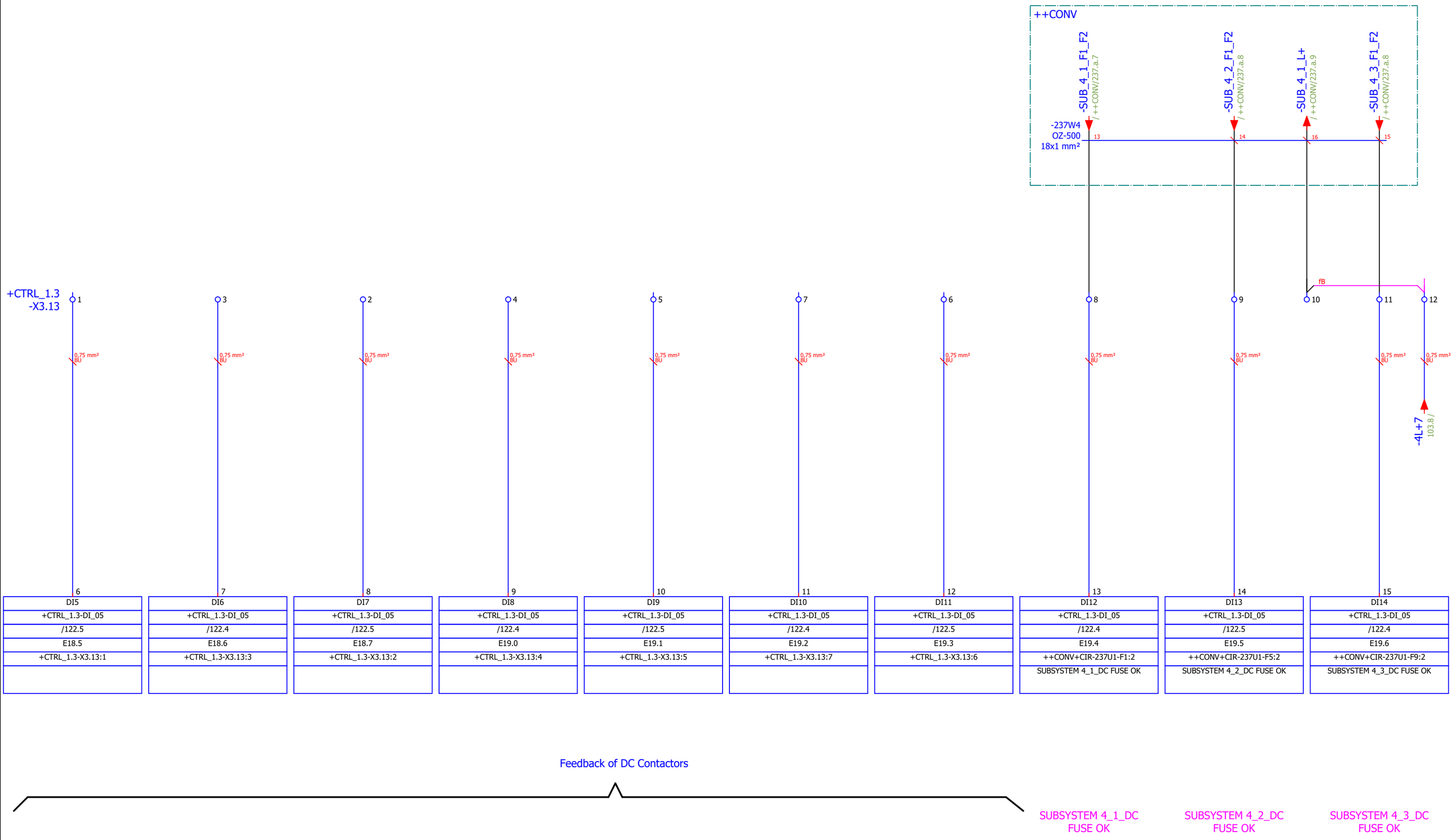
Feedback of DC Contactors

SUBSYSTEM 4_1_DC + Contactor K1 is on | SUBSYSTEM 4_1_DC - Contactor K7 is on | SUBSYSTEM 4_2_DC + Contactor K2 is on | SUBSYSTEM 4_2_DC - Contactor K8 is on | SUBSYSTEM 4_3_DC + Contactor K3 is on | SUBSYSTEM 4_3_DC - Contactor K9 is on | SUBSYSTEM 4_DC + SPARE | SUBSYSTEM 4_DC - SPARE | SUBSYSTEM 3_2_DC FUSE OK | SUBSYSTEM 3_3_DC FUSE OK

previous page: 130

next page: 132

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 131
Date								+ total: 492



Feedback of DC Contactors

SUBSYSTEM 4_1_DC FUSE OK

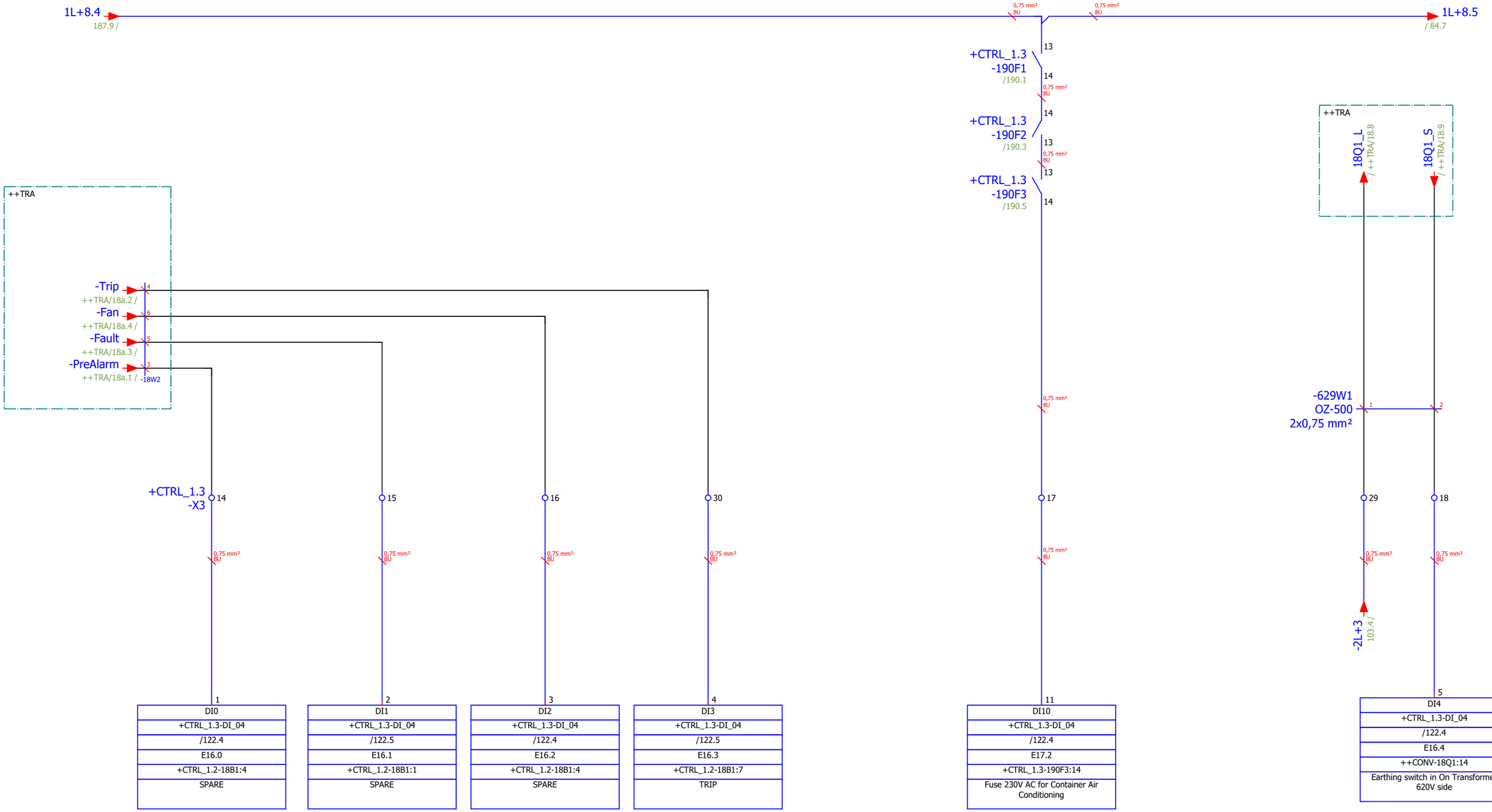
SUBSYSTEM 4_2_DC FUSE OK

SUBSYSTEM 4_3_DC FUSE OK

previous page: 131

next page: 133

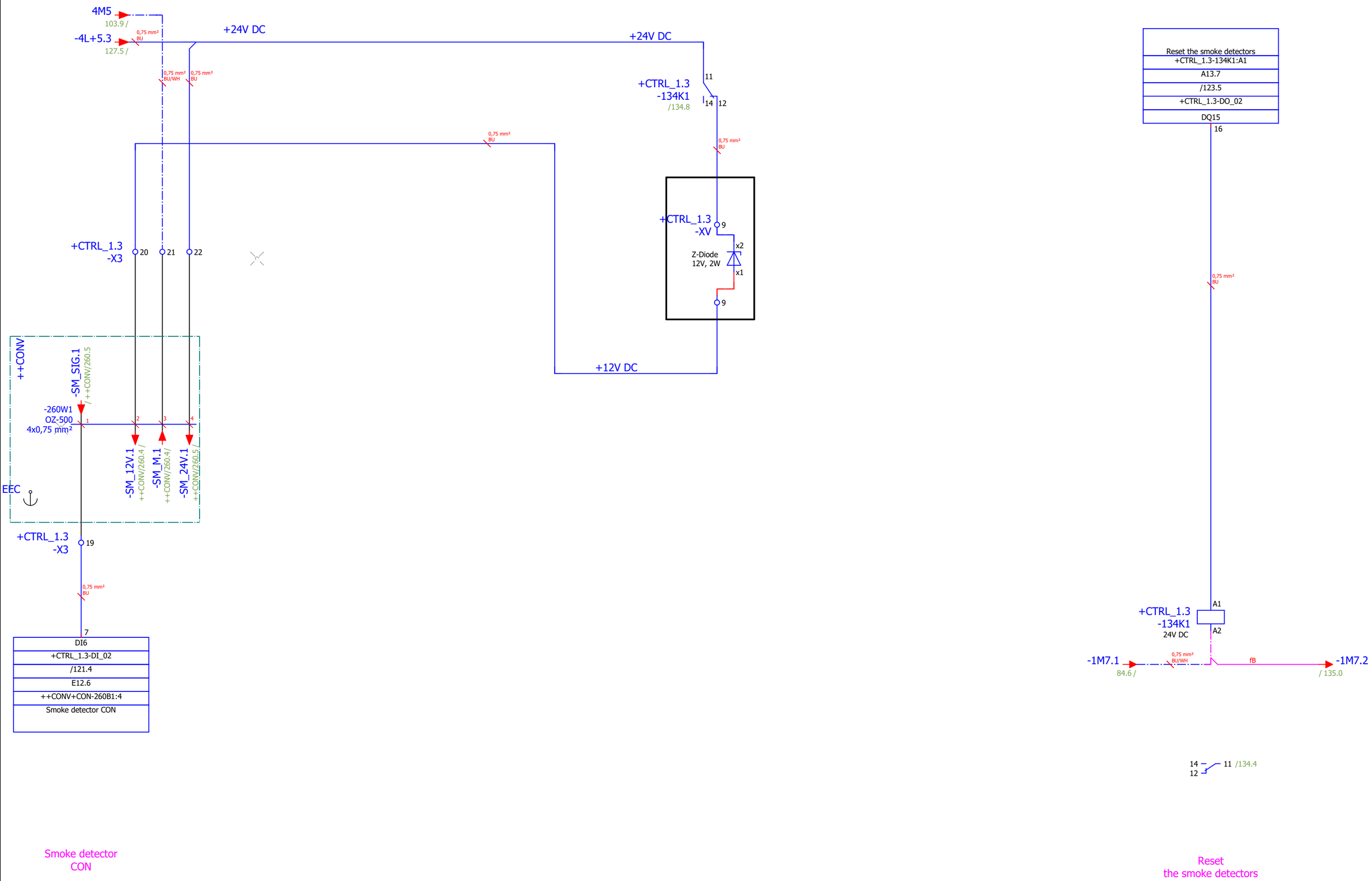
Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 132
Date								+	total: 492



previous page: 132

next page: 134

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SPARE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 133
Date								+	total: 492



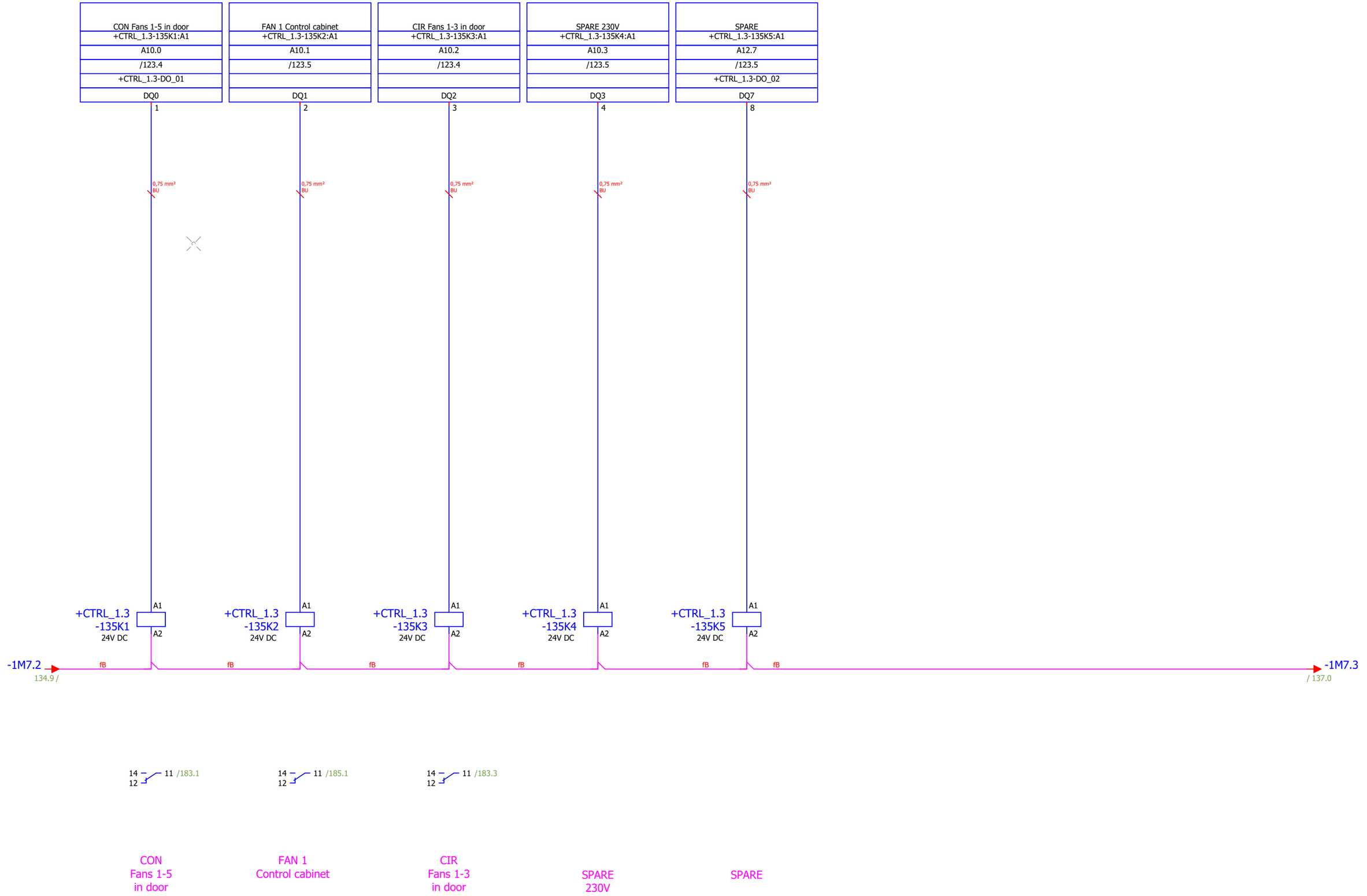
previous page:
133

next page:
135

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SMOKE DETECTORS	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

page: 134
total: 492

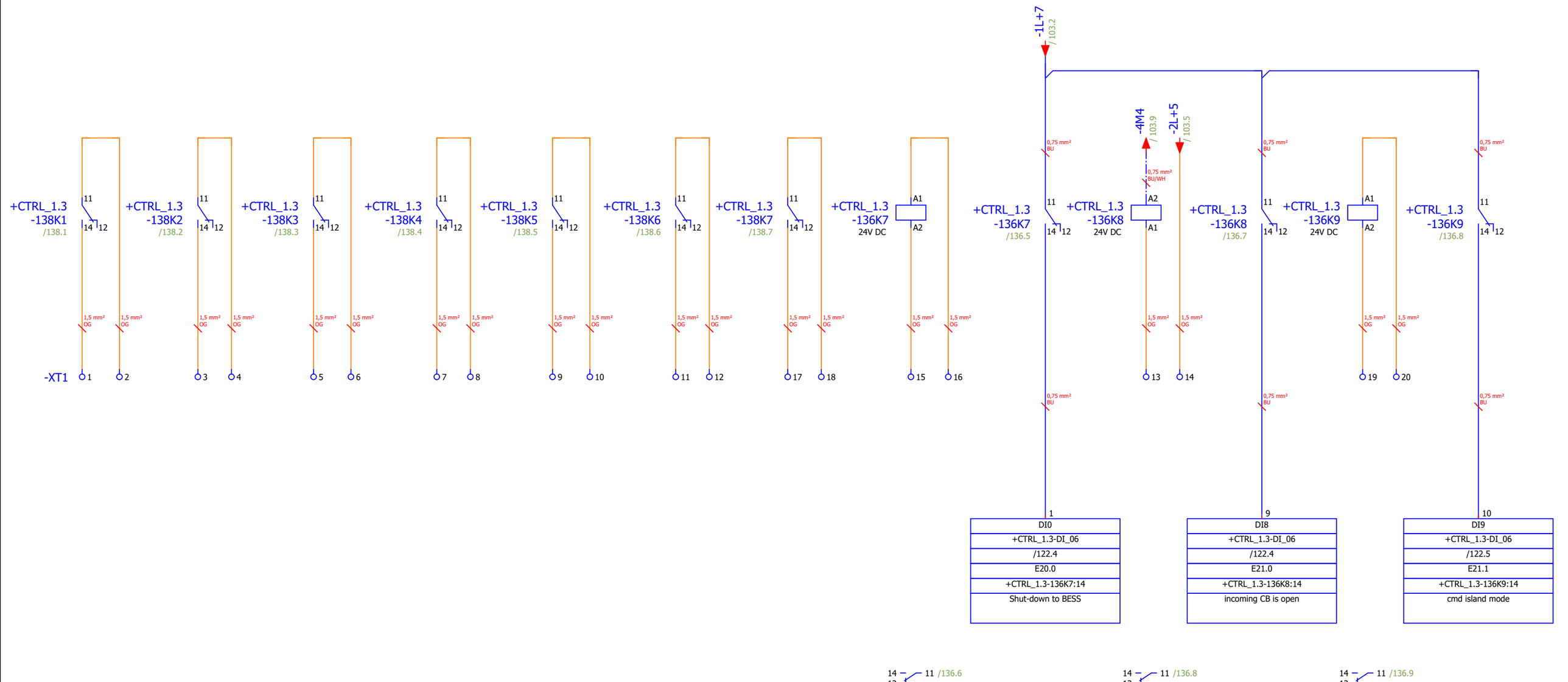
0	1	2	3	4	5	6	7	8	9



previous page: 134

next page: 136

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FAN	20250805_V2.0	= UNIT_01	Converter Container 1
Date	19.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 135
Date								+	total: 492

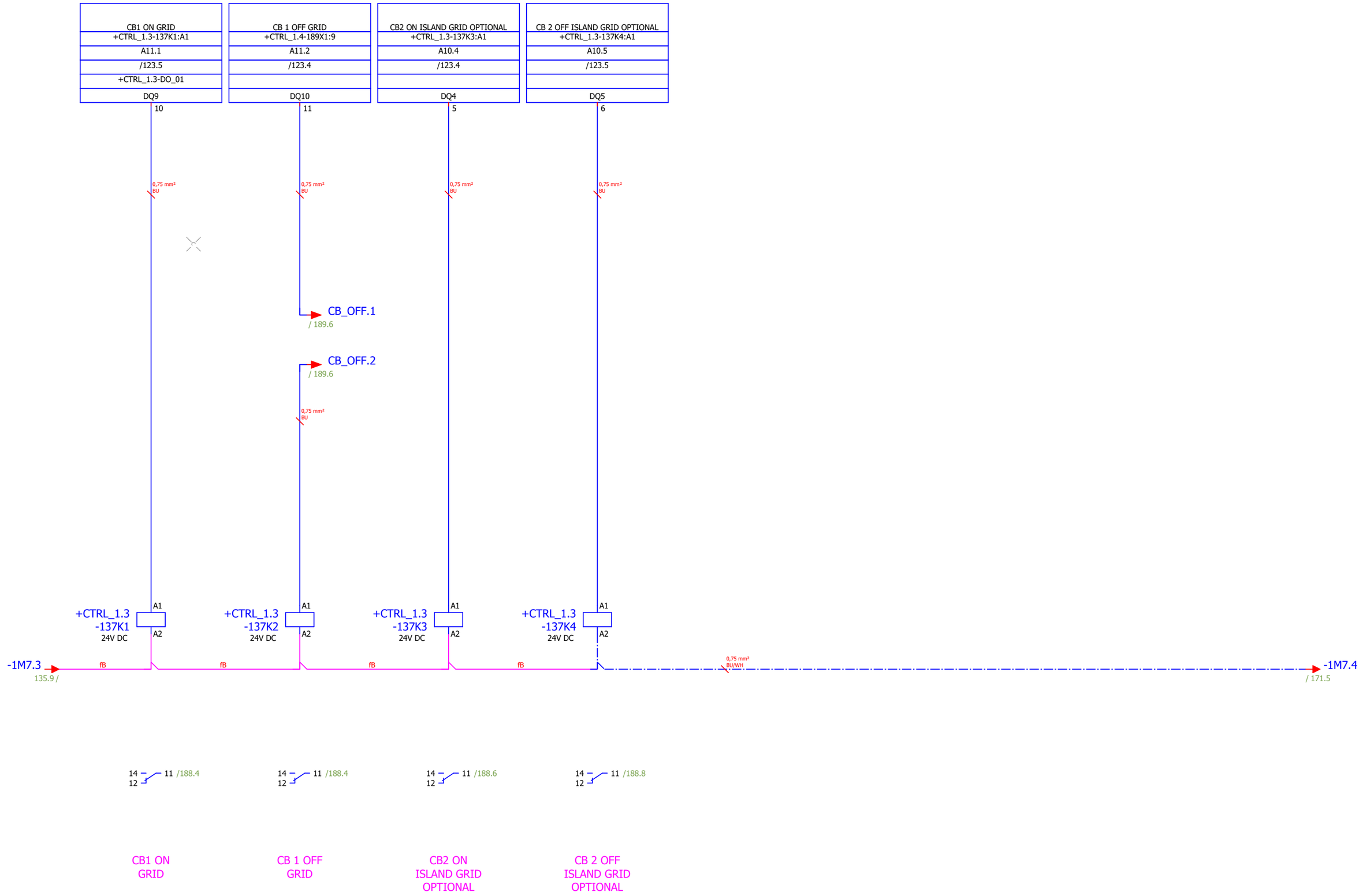


Gas confirmed FGS	Smoke confirmed FGS	PLC fault status SIS	Thermal runaway SIS	Spare	Spare	phase in sync	Shut-down to BESS	Shut-down to BESS	incoming CB is open	incoming CB is open	cmd island mode	cmd island mode

previous page: 135

next page: 137

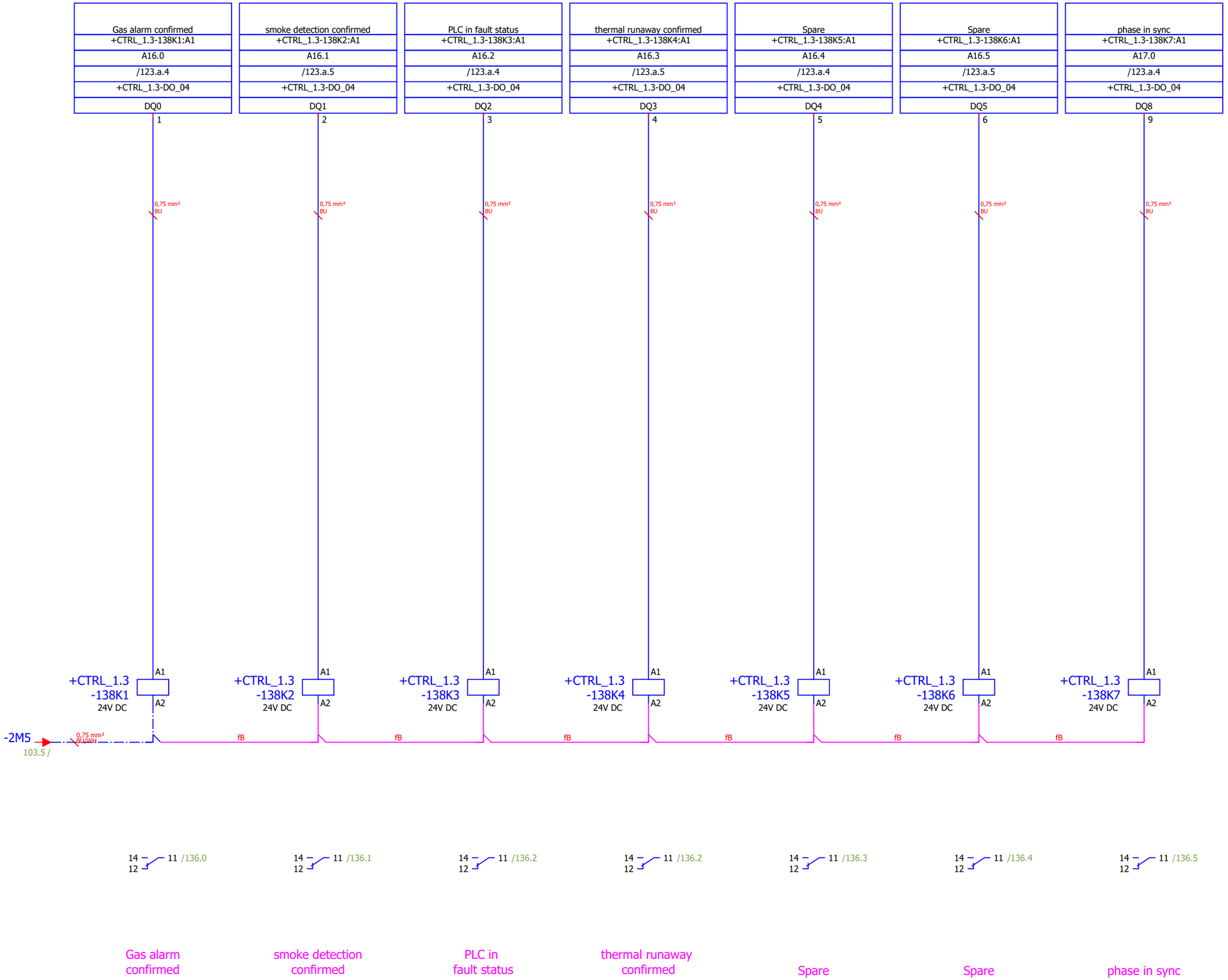
Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 136
Date								+	total: 492



previous page: 136

next page: 138

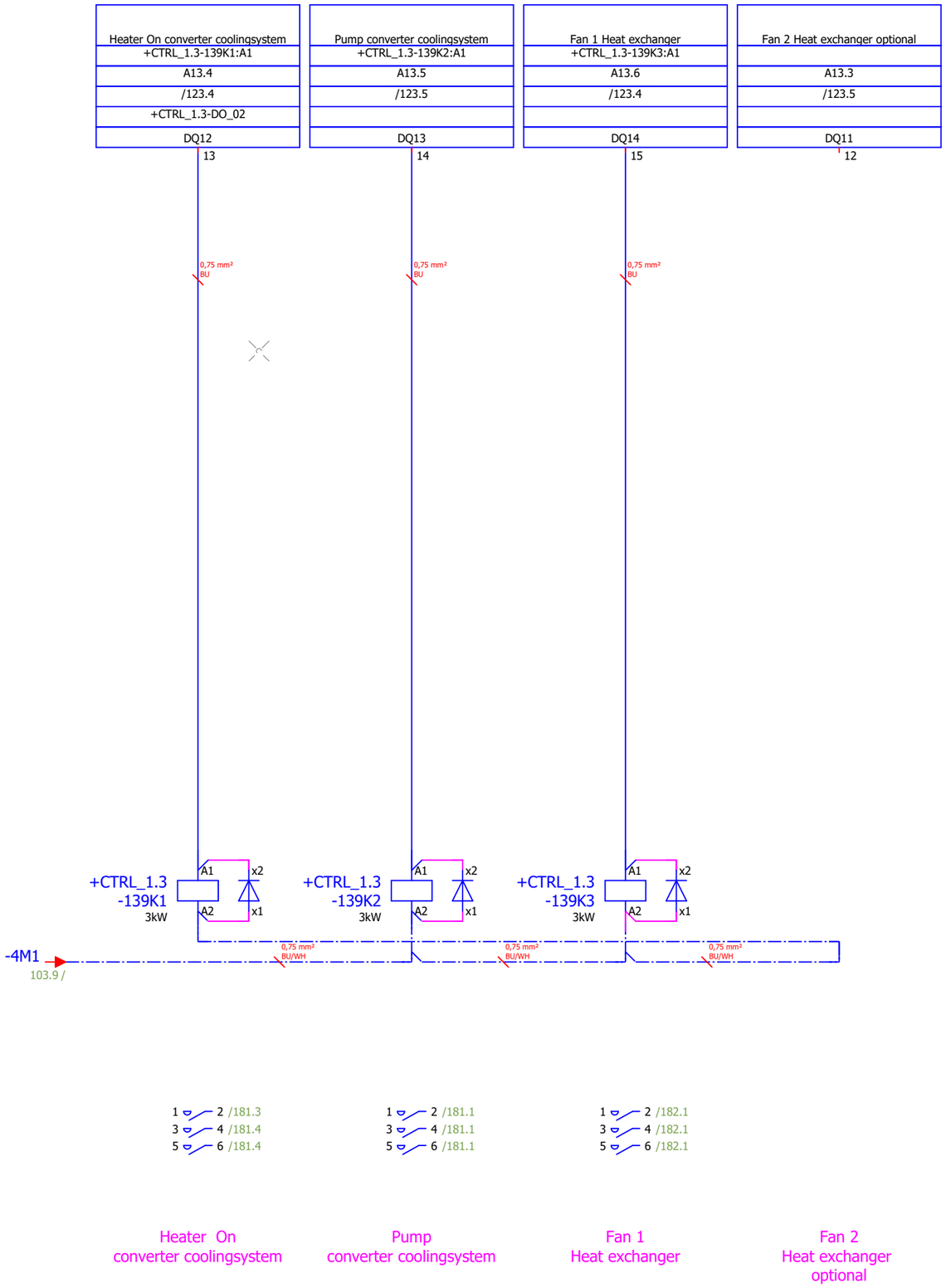
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CIRCUIT BREAKER	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 137
Date								+	total: 492



previous page: 137

next page: 139

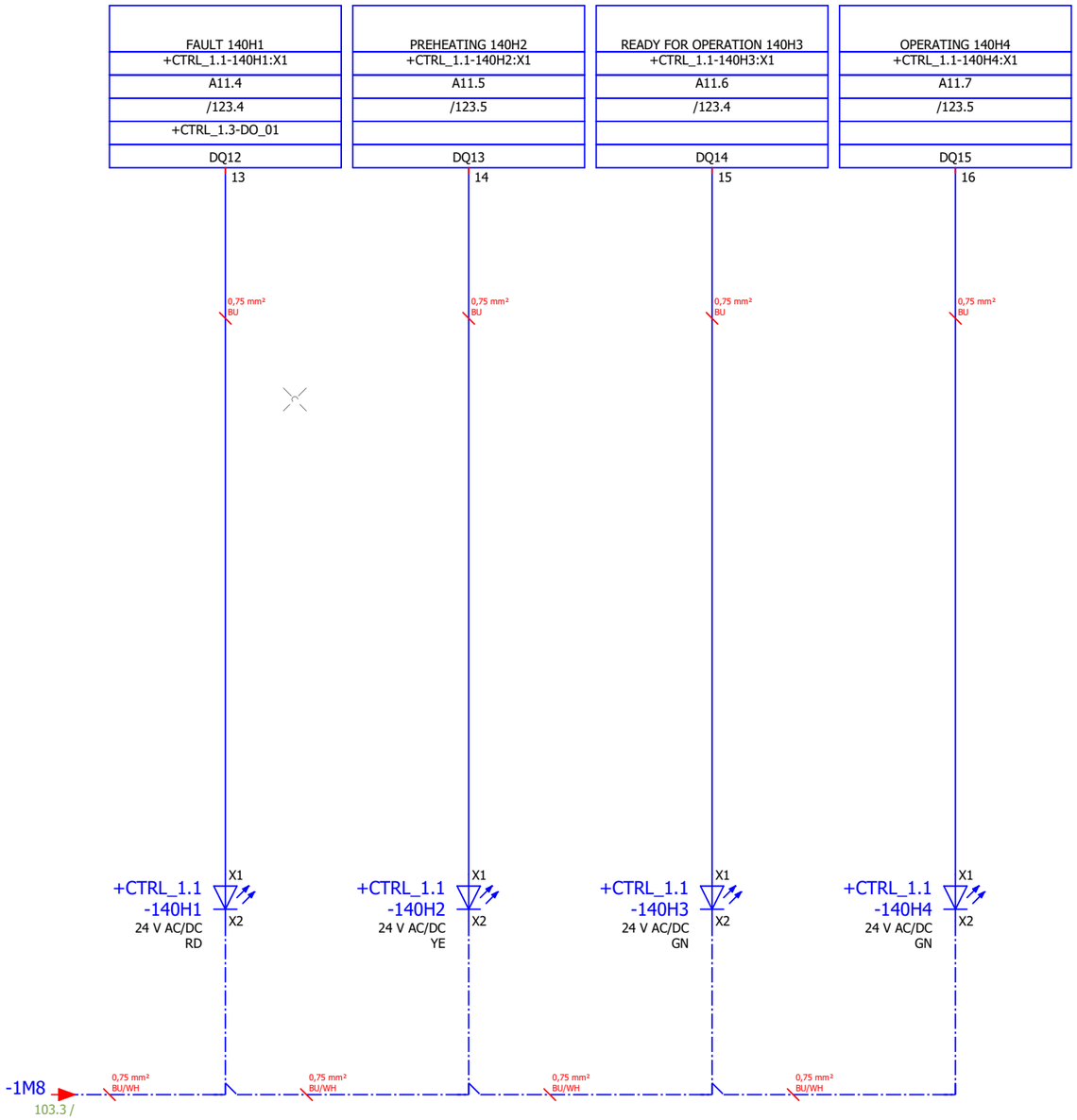
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	03.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 138
Date								+	total: 492



previous page:
138

next page:
140

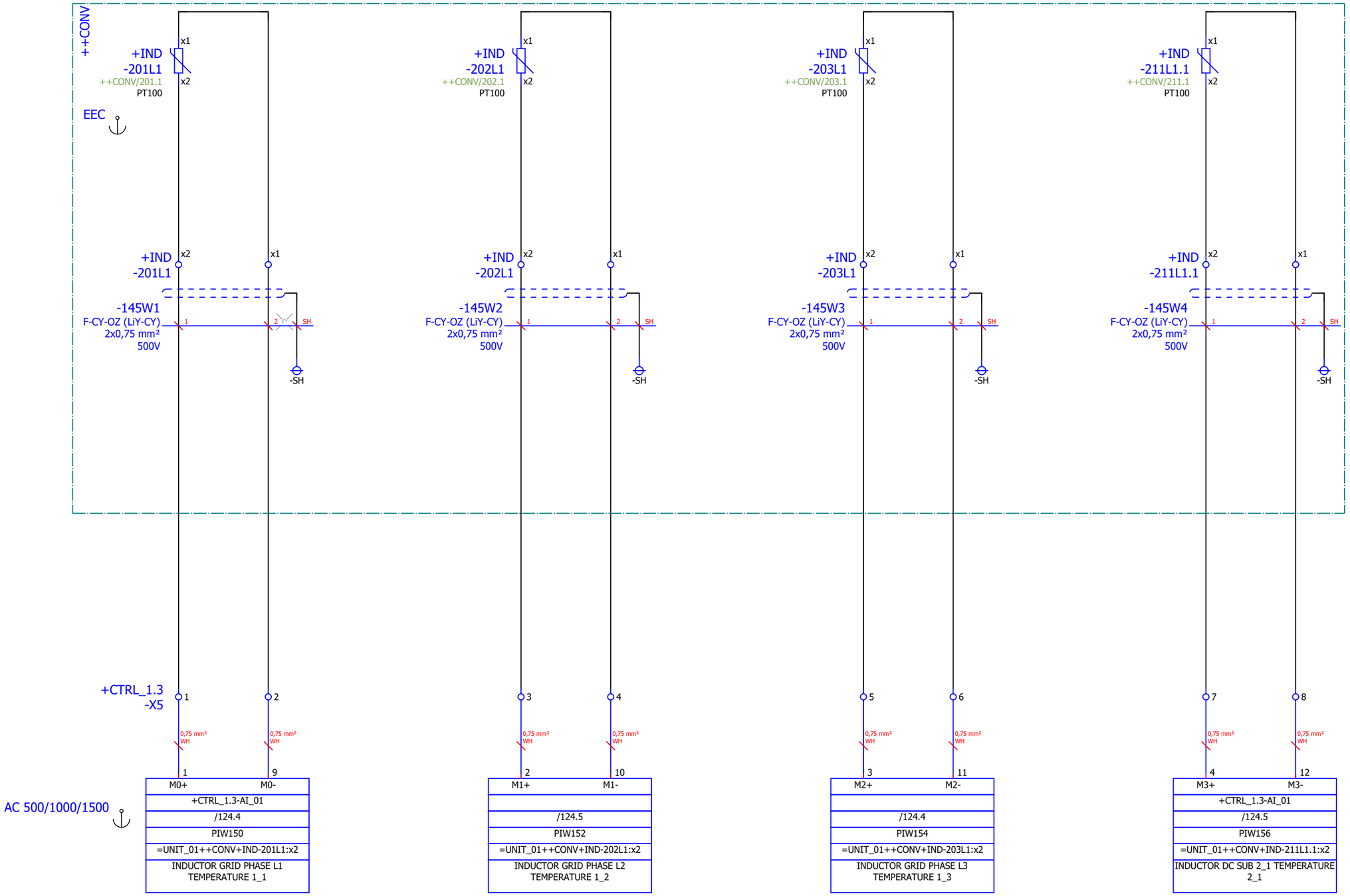
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COOLING	20250805_V2.0	= UNIT_01	Converter Container 1
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 139
Date								+	total: 492



previous page: 139

next page: 145

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	14.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 140
Date								+		total: 492



INDUCTOR
GRID PHASE L1
TEMPERATURE 1_1

INDUCTOR
GRID PHASE L2
TEMPERATURE 1_2

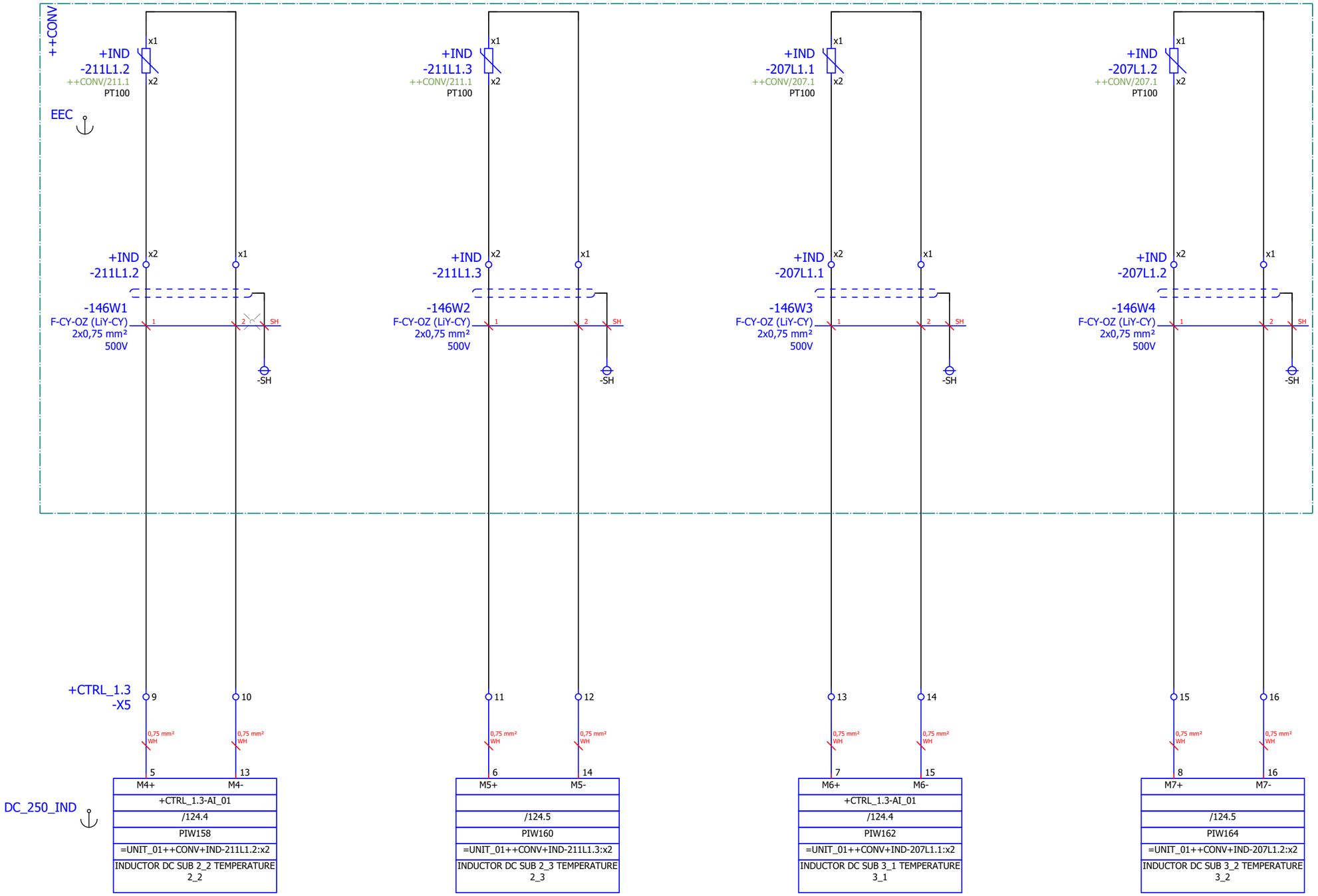
INDUCTOR
GRID PHASE L3
TEMPERATURE 1_3

INDUCTOR
DC SUB 2_1
TEMPERATURE 2_1

previous page:
140

next page:
146

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	14.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 145
Date								+		total: 492



INDUCTOR
DC SUB 2_2
TEMPERATURE 2_2

INDUCTOR
DC SUB 2_3
TEMPERATURE 2_3

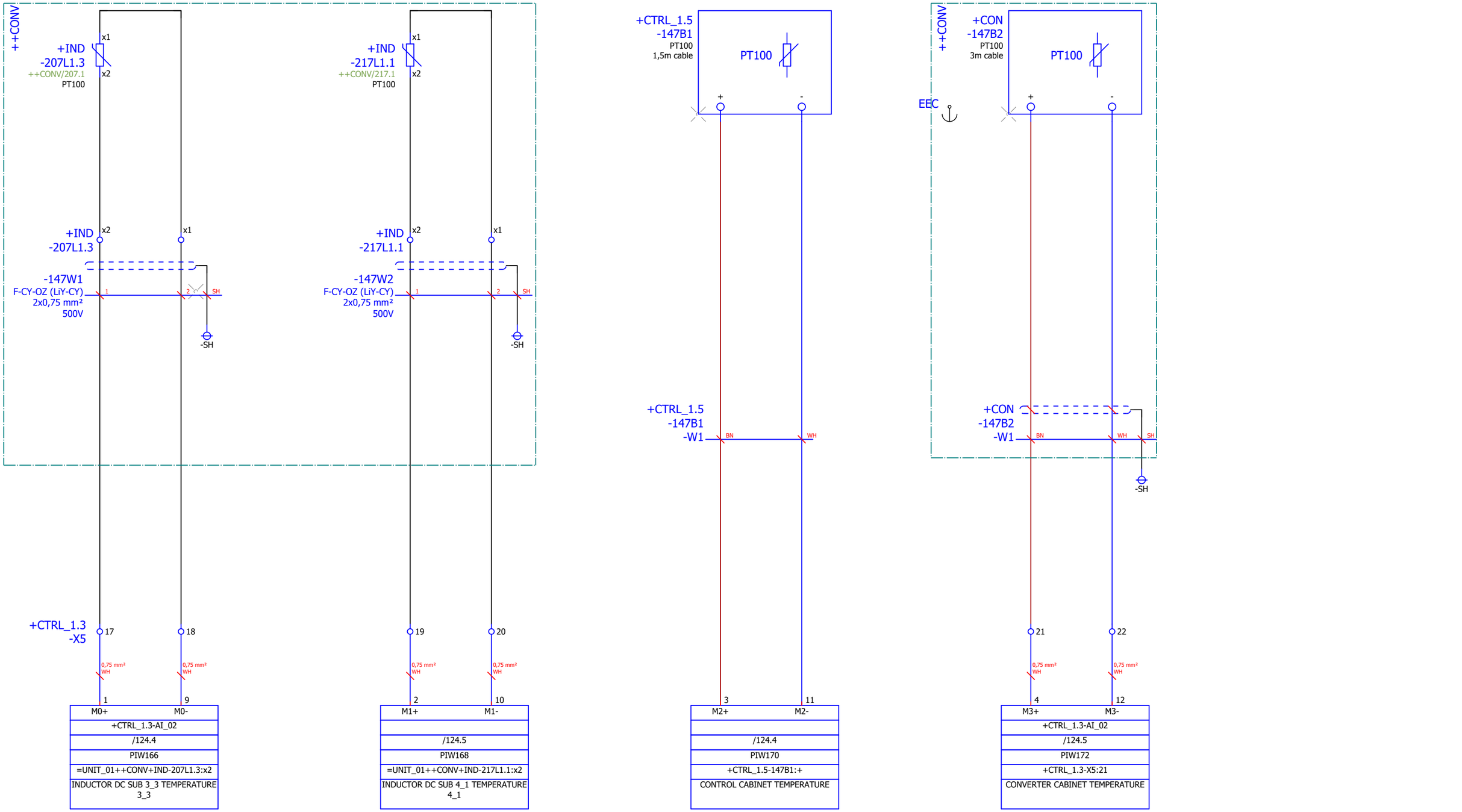
INDUCTOR
DC SUB 3_1
TEMPERATURE 3_1

INDUCTOR
DC SUB 3_2
TEMPERATURE 3_2

previous page: 145

next page: 147

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 146
Date								+		total: 492



INDUCTOR DC SUB 3_3 TEMPERATURE 3_3

INDUCTOR DC SUB 4_1 TEMPERATURE 4_1

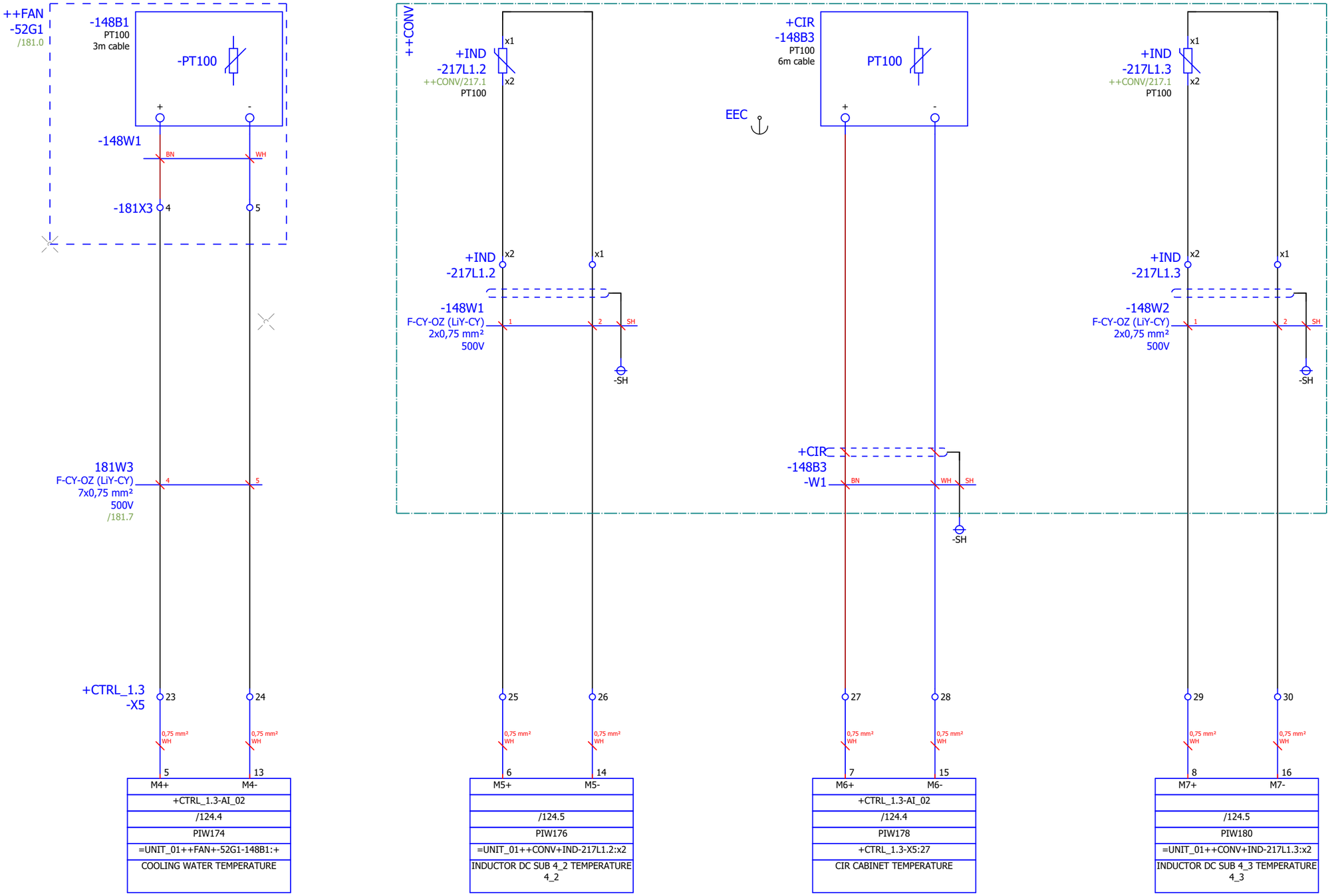
CONTROL CABINET TEMPERATURE

CONVERTER CABINET TEMPERATURE

previous page: 146

next page: 148

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS CABINET TEMPERATURE	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 147
Date								+	total: 492



COOLING WATER TEMPERATURE

INDUCTOR DC SUB 4_2 TEMPERATURE 4_2

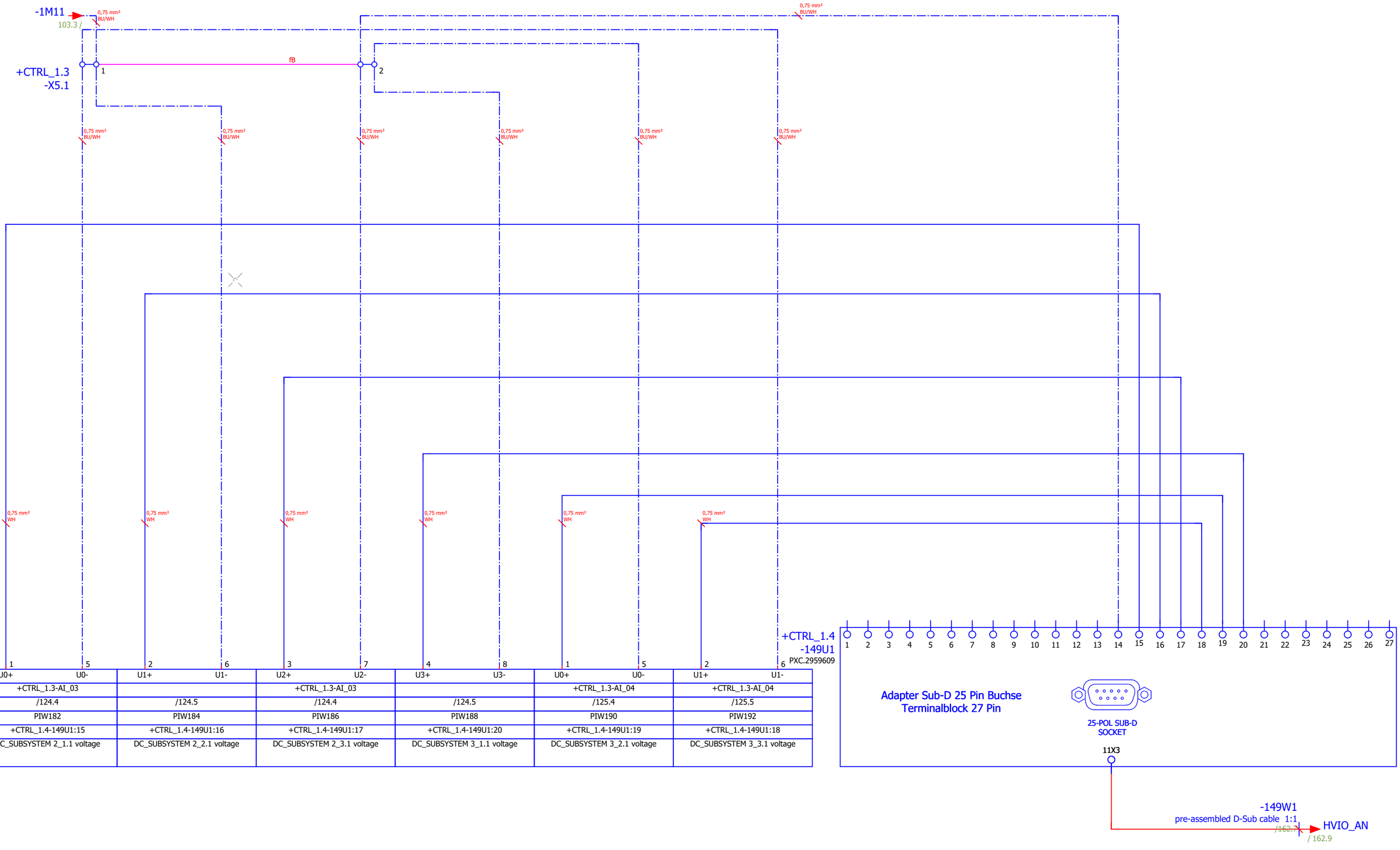
CIR CABINET TEMPERATURE

INDUCTOR DC SUB 4_3 TEMPERATURE 4_3

previous page: 147

next page: 149

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS COOLING WATER TEMPERATURE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 148
Date								+		total: 492

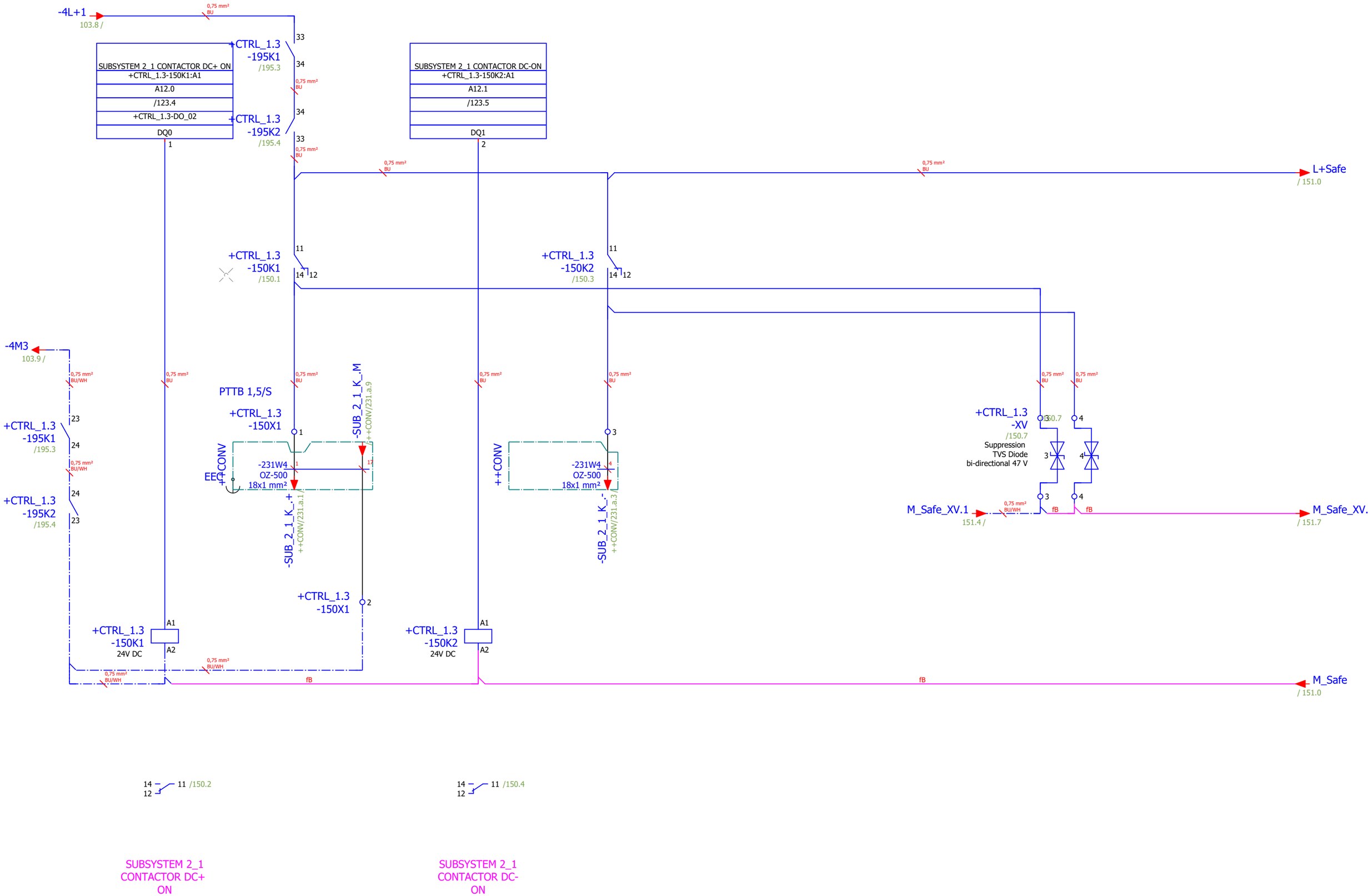


Voltage measurement

previous page: 148

next page: 150

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS MEASURING VOLTAGE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 149
Date							10354_23A2007	+		total: 492



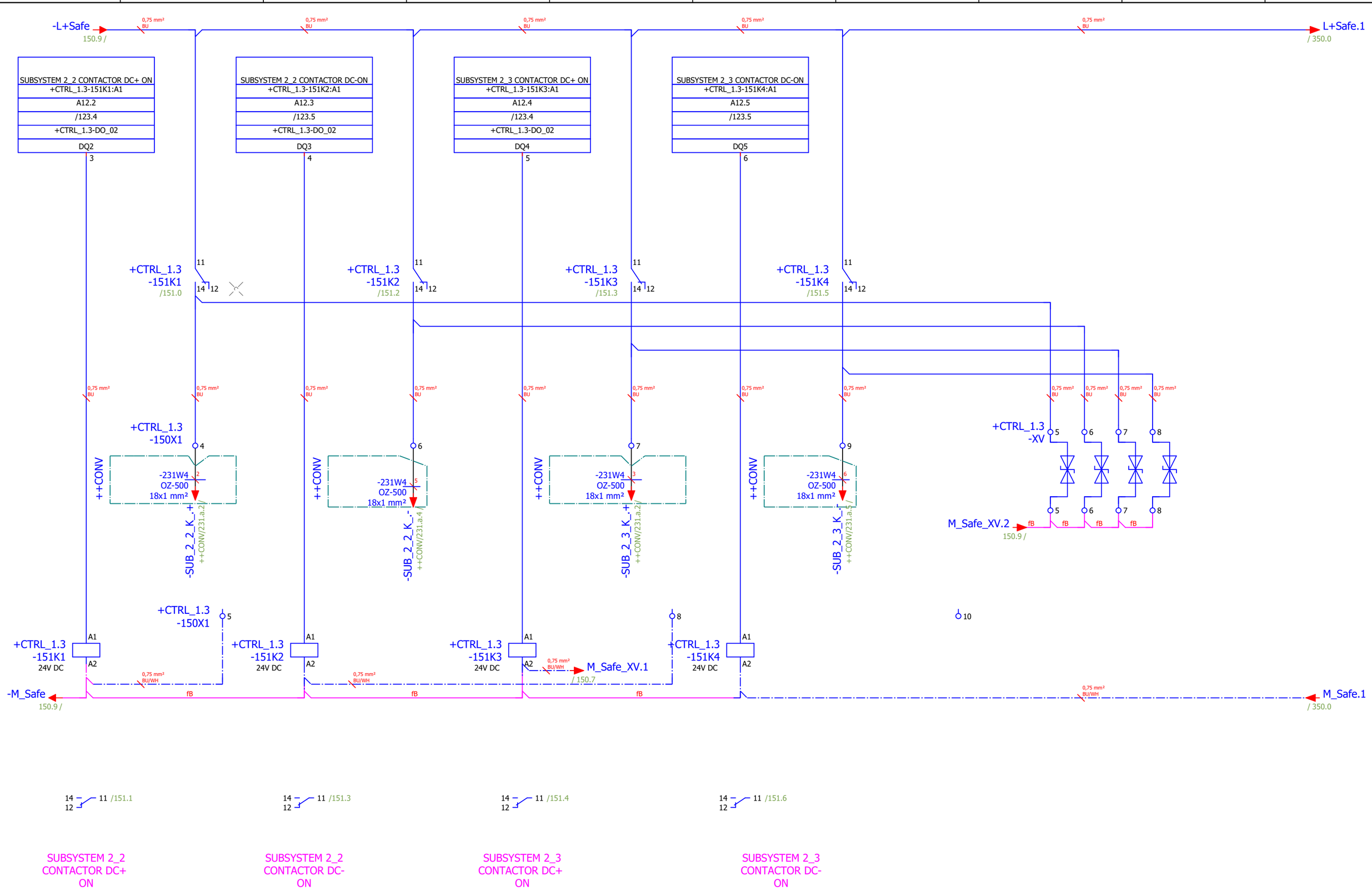
14 12 11 /150.2

14 12 11 /150.4

SUBSYSTEM 2_1 CONTACTOR DC+ ON

SUBSYSTEM 2_1 CONTACTOR DC- ON

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 150
Date								+	total: 492



14 12 11 /151.1

14 12 11 /151.3

14 12 11 /151.4

14 12 11 /151.6

SUBSYSTEM 2_2 CONTACTOR DC+ ON

SUBSYSTEM 2_2 CONTACTOR DC- ON

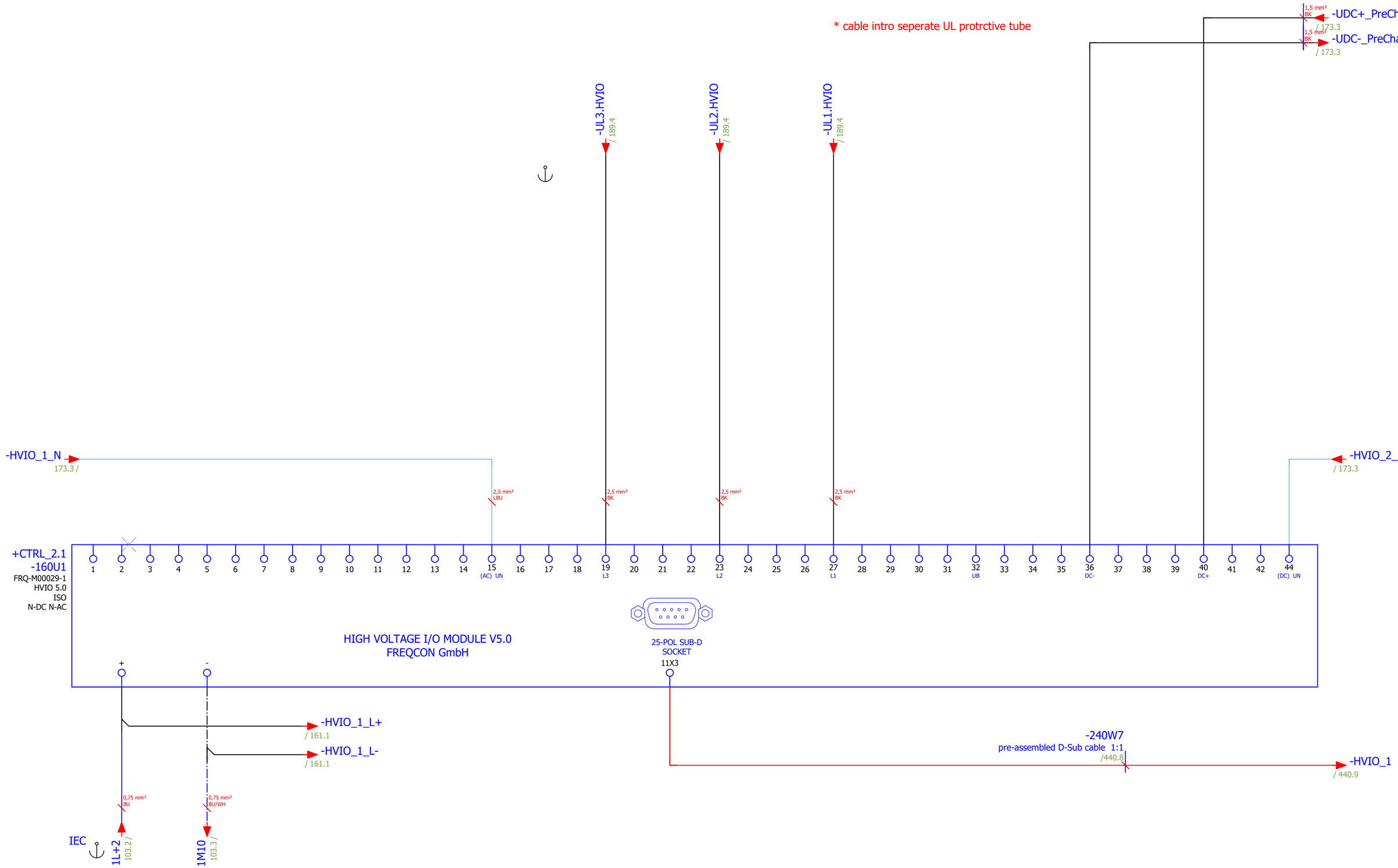
SUBSYSTEM 2_3 CONTACTOR DC+ ON

SUBSYSTEM 2_3 CONTACTOR DC- ON

previous page: 150

next page: 160

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_2, 2_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 151
Date								+	total: 492

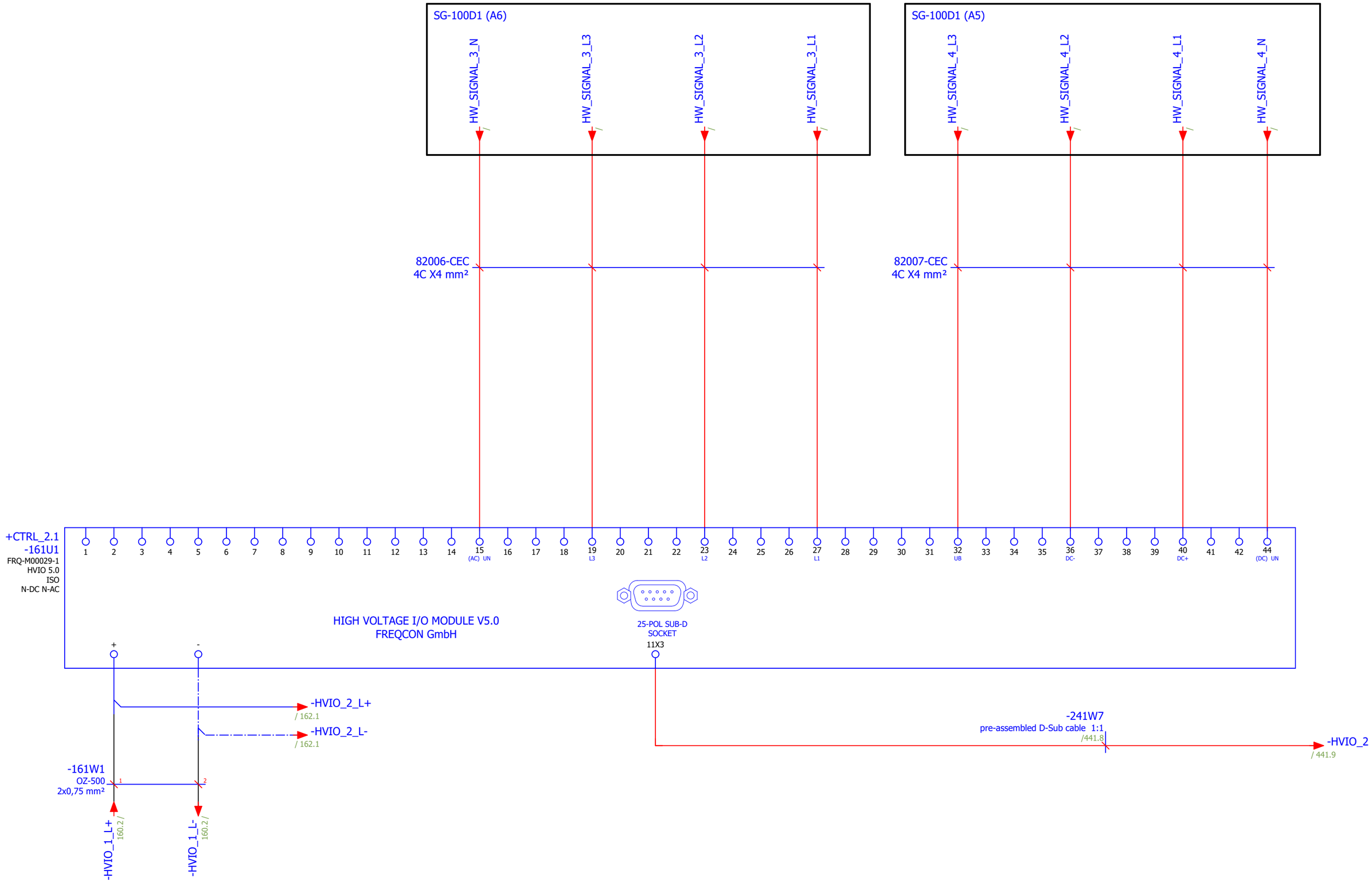


previous page: 151

Measuring: Grid side voltage / DC-Link

next page: 161

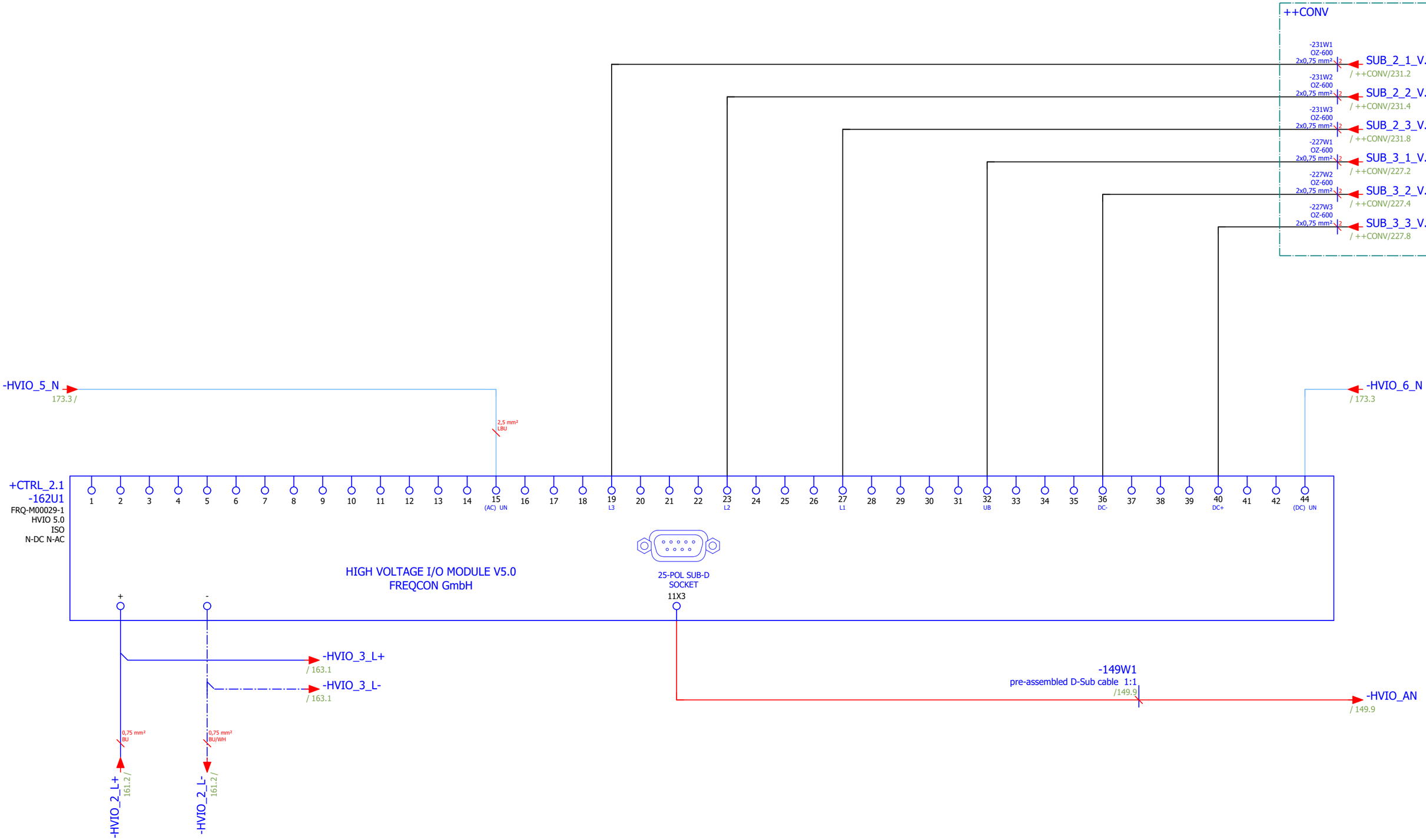
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 160
Date								+	total: 492



previous page:
160

next page:
162

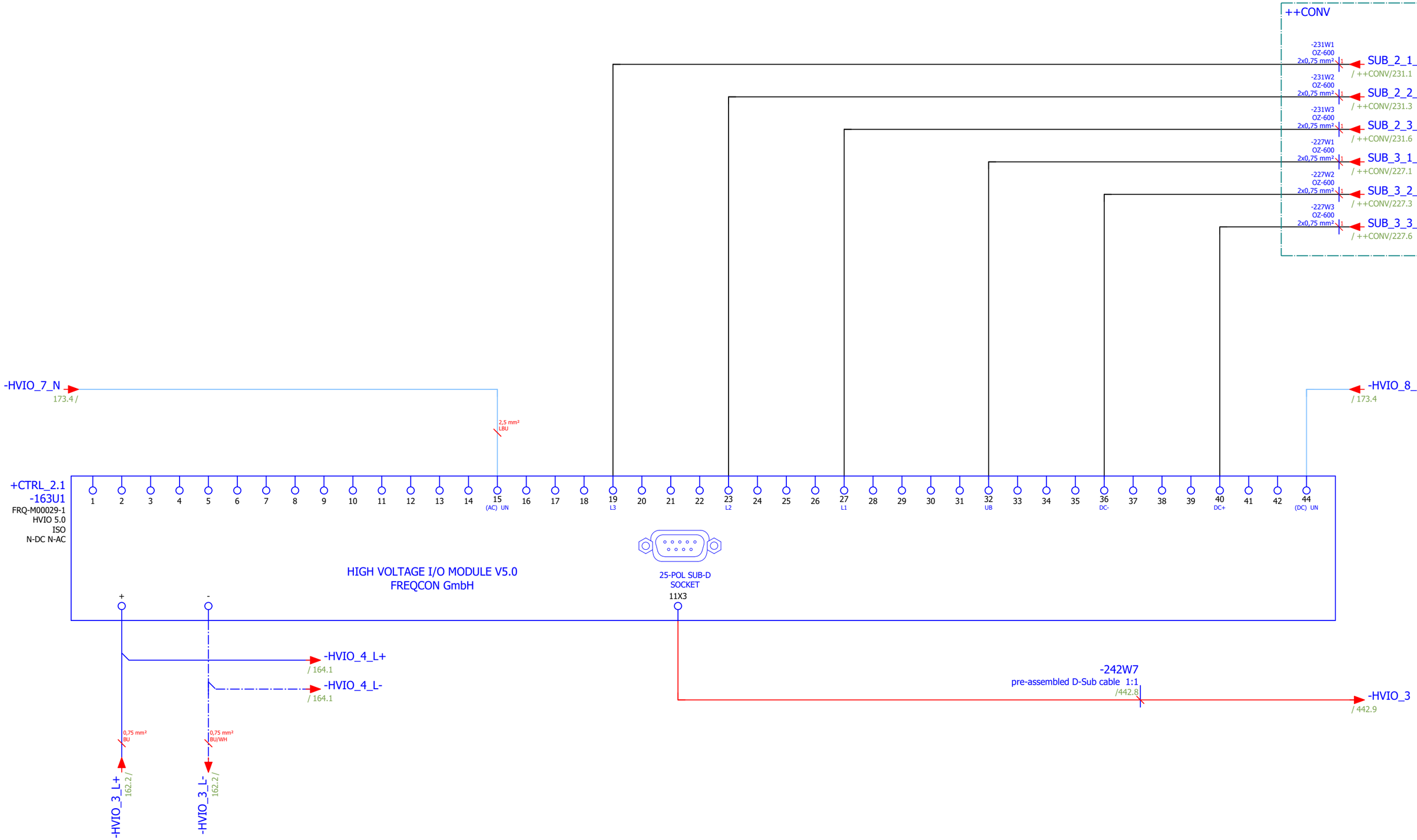
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 2	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.08.2025							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 161
Date								+		total: 492



previous page:
161

next page:
163

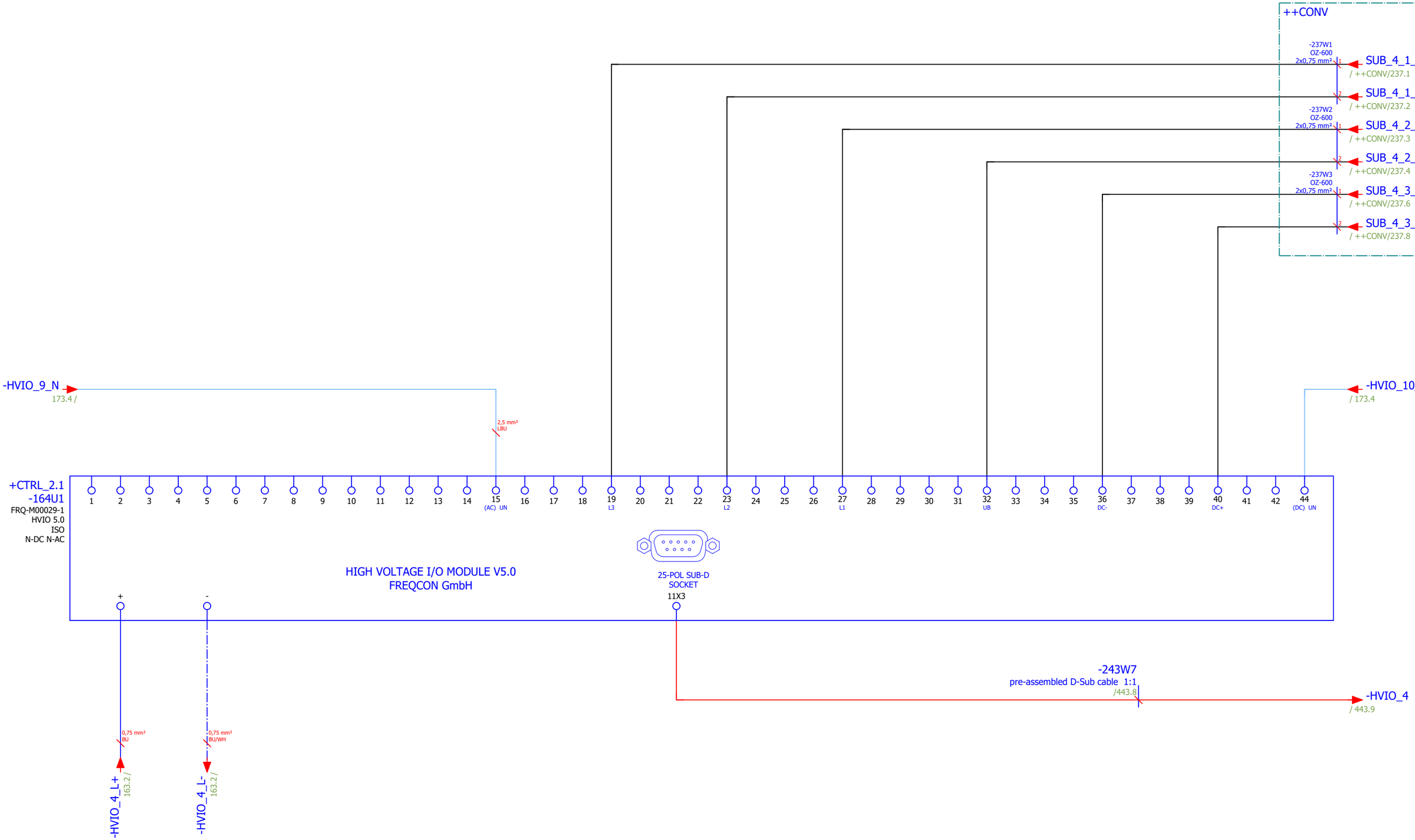
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 2 ANALOG	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 162
Date								+	total: 492



previous page:
162

next page:
164

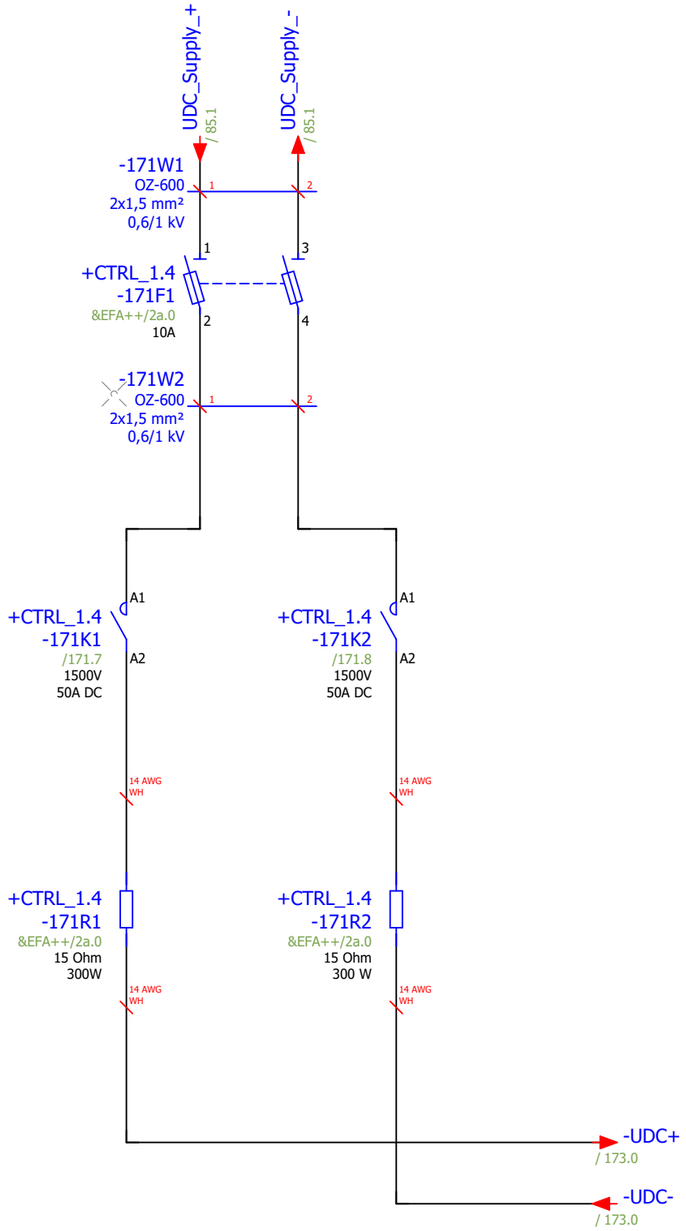
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 163
Date								+	total: 492



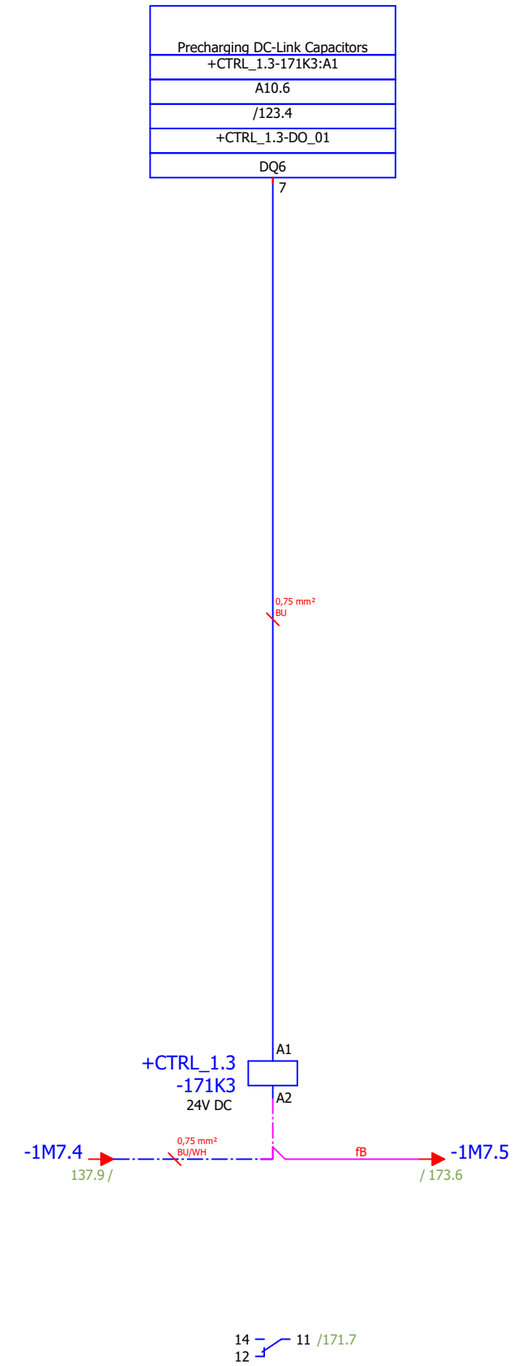
previous page:
163

next page:
171

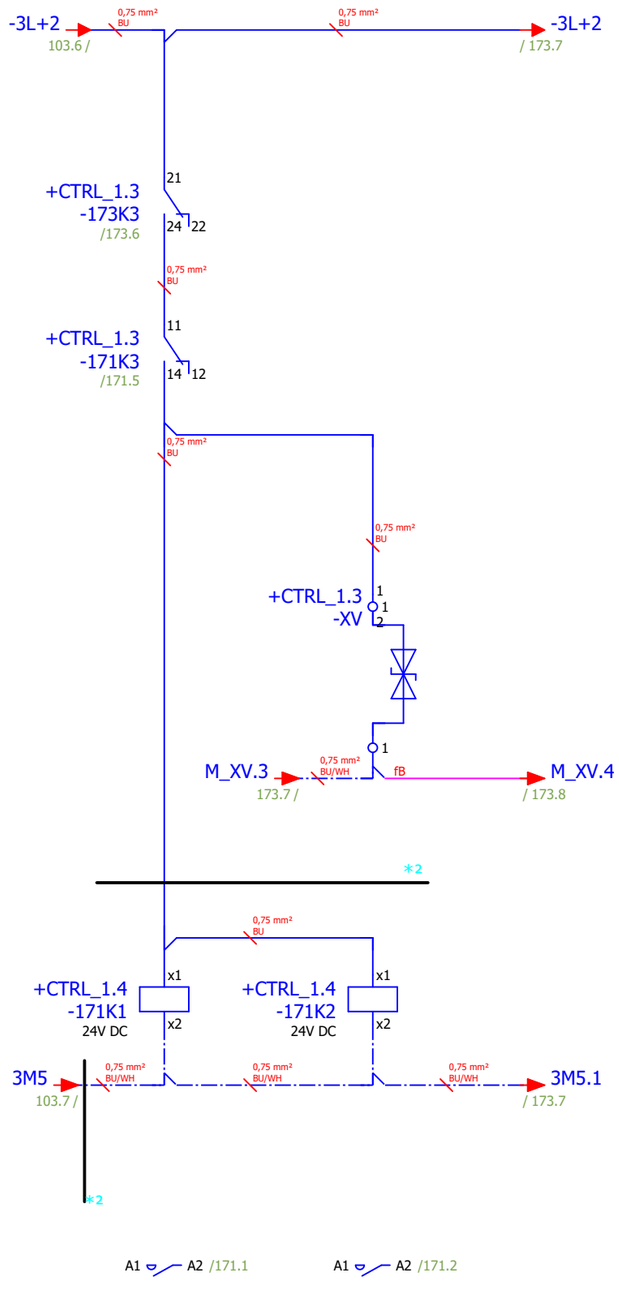
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 4	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 164
Date								+	total: 492



RESISTORS
FOR PRECHARGING
from Grid or Battery or DC-Link



Precharging
DC-Link Capacitors

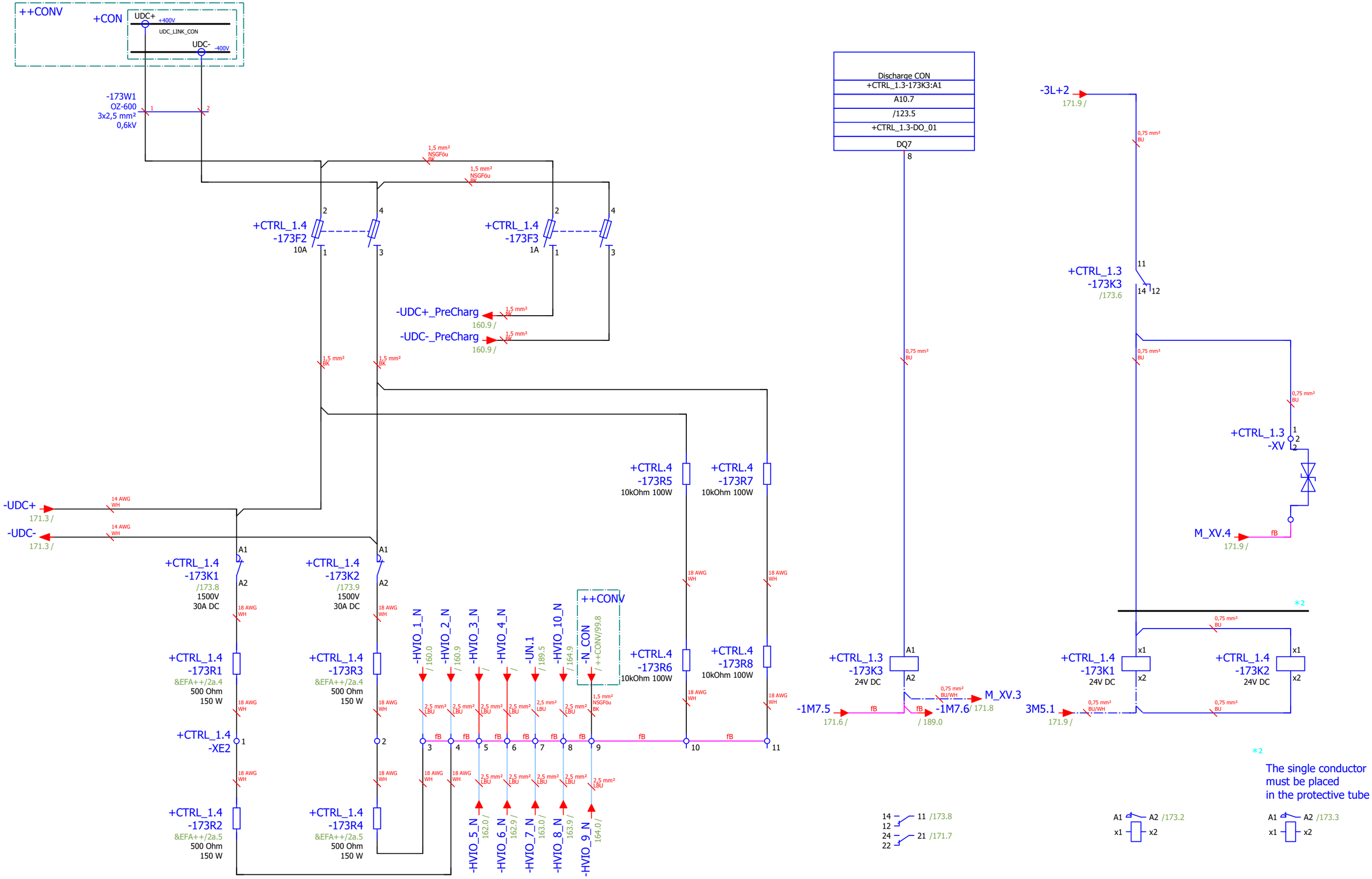


*2 The single conductor must be placed in the protective tube

previous page: 164

next page: 173

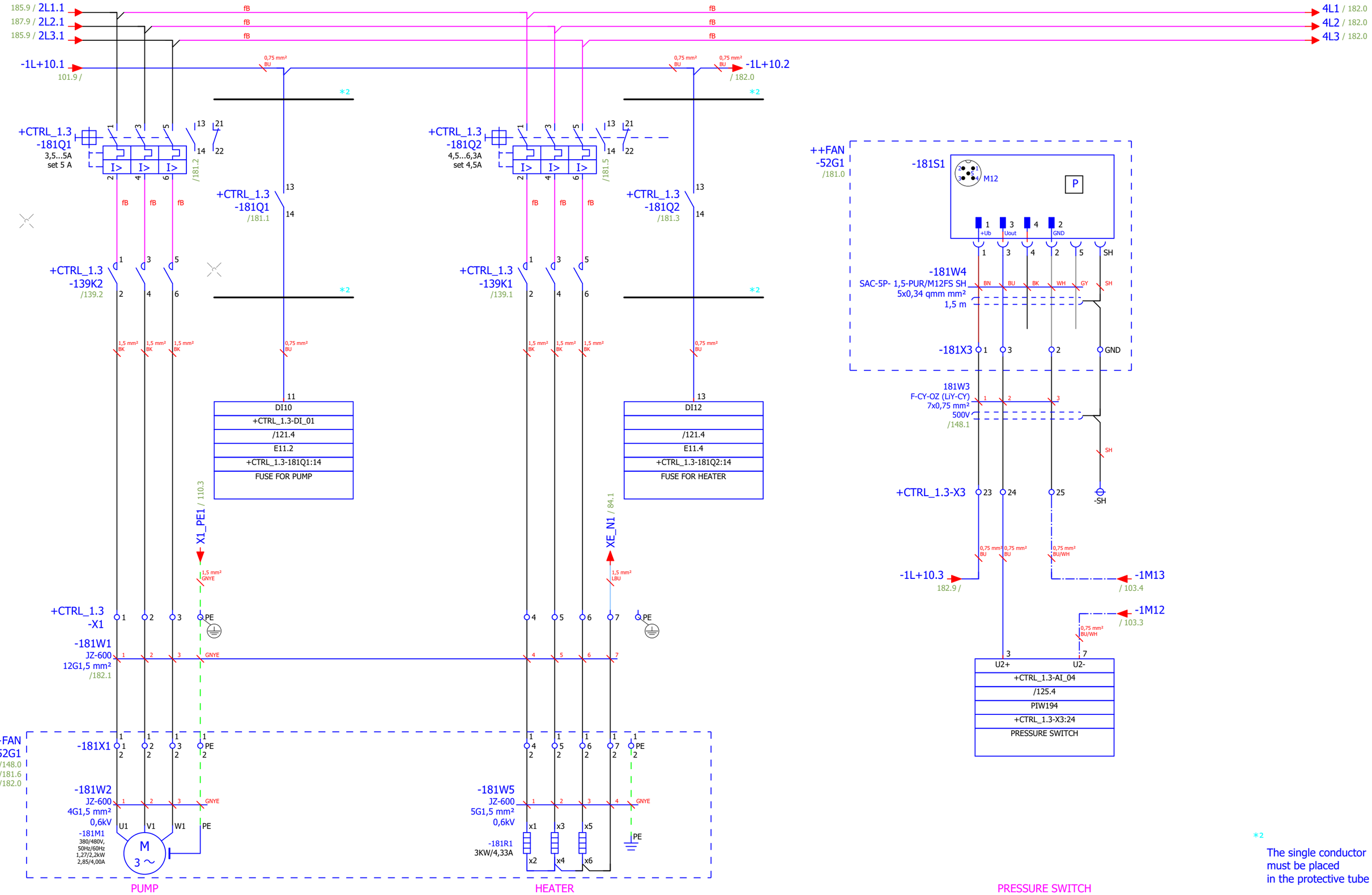
Editor	Freqcon_JD			Statron	FREQCON	PRE-CHARGING UDC	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 171
Date								+	total: 492



previous page: 171

next page: 181

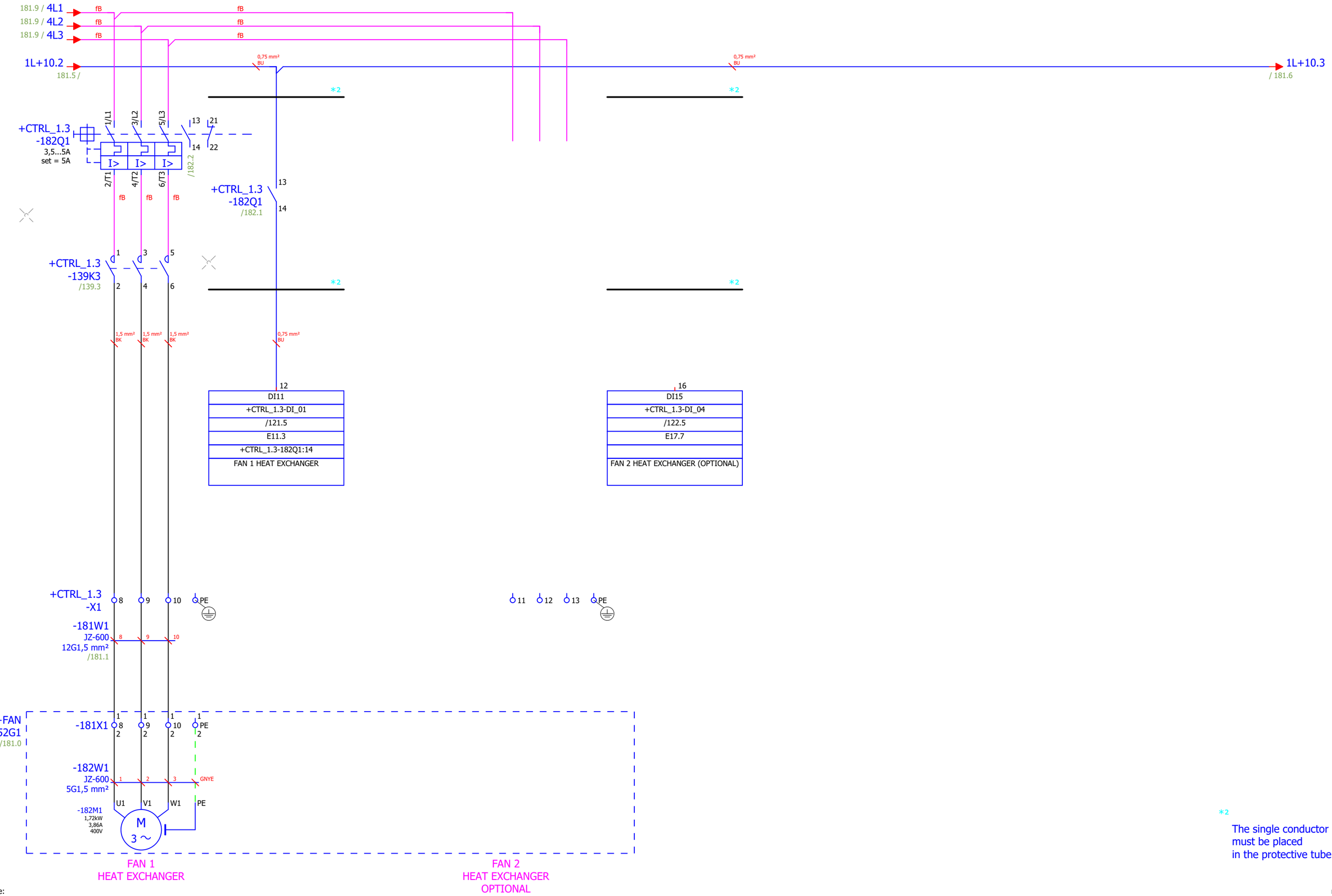
Editor	Freqcon_DG			Statron	FREQCON	DISCHARGE UDC	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 173
Date								+	total: 492



previous page: 173

next page: 182

Editor	Freqcon_DG			Statron	FREQCON	WATER SYSTEM	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 181
Date								+	total: 492



*2 The single conductor must be placed in the protective tube

previous page: 181

next page: 183

Editor	Freqcon_JD			Statron	FREQCON	HEAT EXCHANGER	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 182
Date								+	total: 492

84.9 / 1L1.1
84.9 / 1L2.1
fB
1L1.2 / 185.0
1L2.2 / 187.0

-1L+8.1
84.6 /
0,75 mm² BU
-1L+8.2
/ 185.8

+CTRL_1.3
-183F1
C16A
/183.6
+CTRL_1.3
-183F2
C10A
/183.6

*2
+CTRL_1.3
-183F1
/183.1
0,75 mm² BU
*2
+CTRL_1.3
-183F2
/183.3
0,75 mm² BU
*2

1,5 mm² BK
1,5 mm² BK

+CTRL_1.3
-135K1
/135.1
XE_N2 / 84.1
+CTRL_1.3
-135K3
/135.3

1,5 mm² BK
2,5 mm² LBU
1,5 mm² BK

fB
fB
FB_XT.4-6
/ 185.1

PT 2,5 +CTRL_1.3
-XT
PE
PE

15
DI14
+CTRL_1.3-DI_01
/121.4
E11.6
+CTRL_1.3-183F2:13
Fuse Fans CON, IND Cabinets

++CONV
-279W1
JZ-500
3G1,5 mm²
GNYE
-FAN_L_2 ++CONV/279.1/
-FAN_N_2 ++CONV/279.1/
-FAN_PE_2 ++CONV/279.1/
EEC

++CONV
-281W1
JZ-500
3G1,5 mm²
GNYE
-FAN_L_3 ++CONV/281.1/
-FAN_N_3 ++CONV/281.1/
-FAN_PE_3 ++CONV/281.1/
EEC

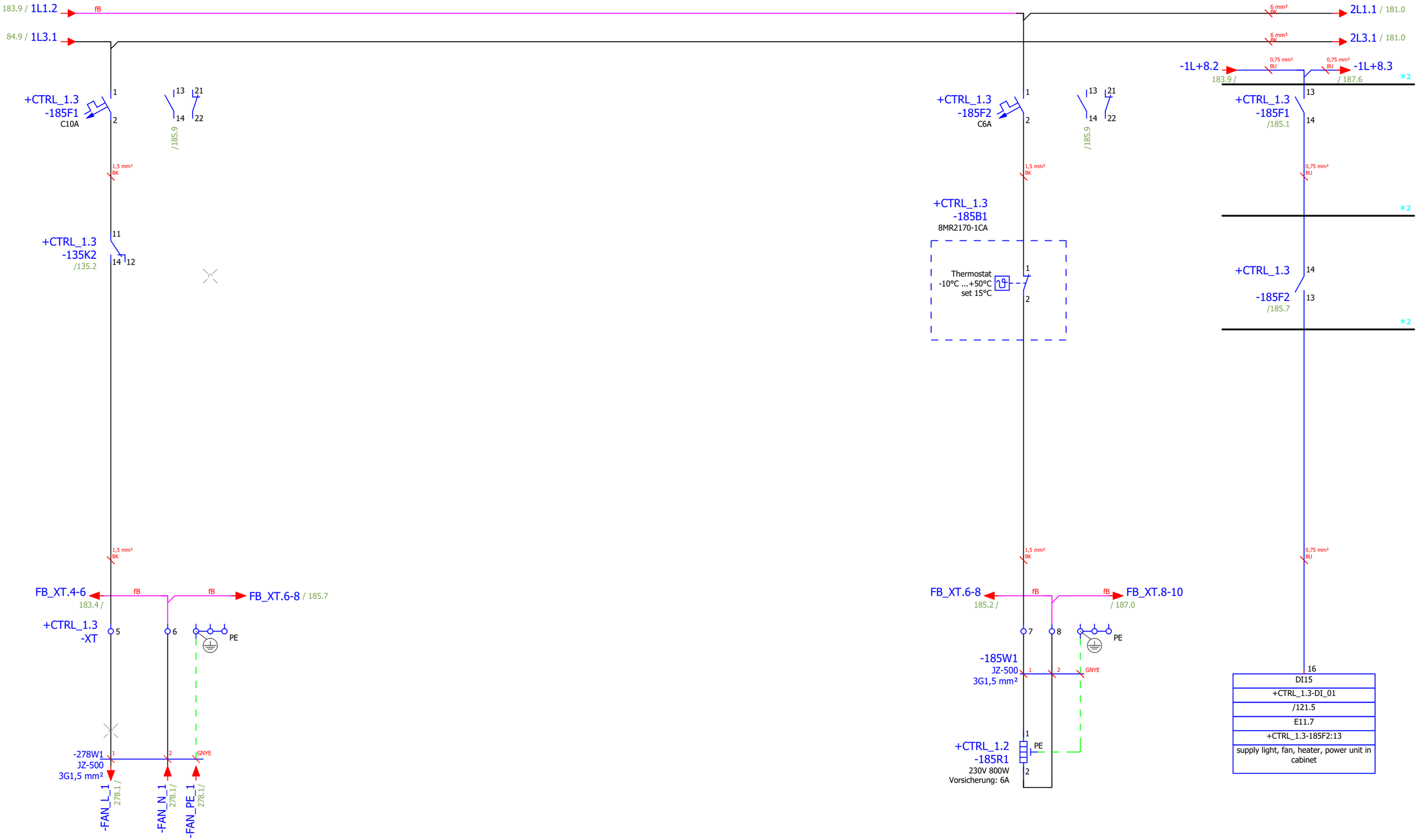
CON
Fans 1-5
in door

CIR
Fans 1-3
in door

*2
The single conductor
must be placed
in the protective tube

previous page: 182
next page: 185

Editor	Freqcon_DG			Statron	FREQCON	Supply for cabinet fan	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 183
Date								+	total: 492



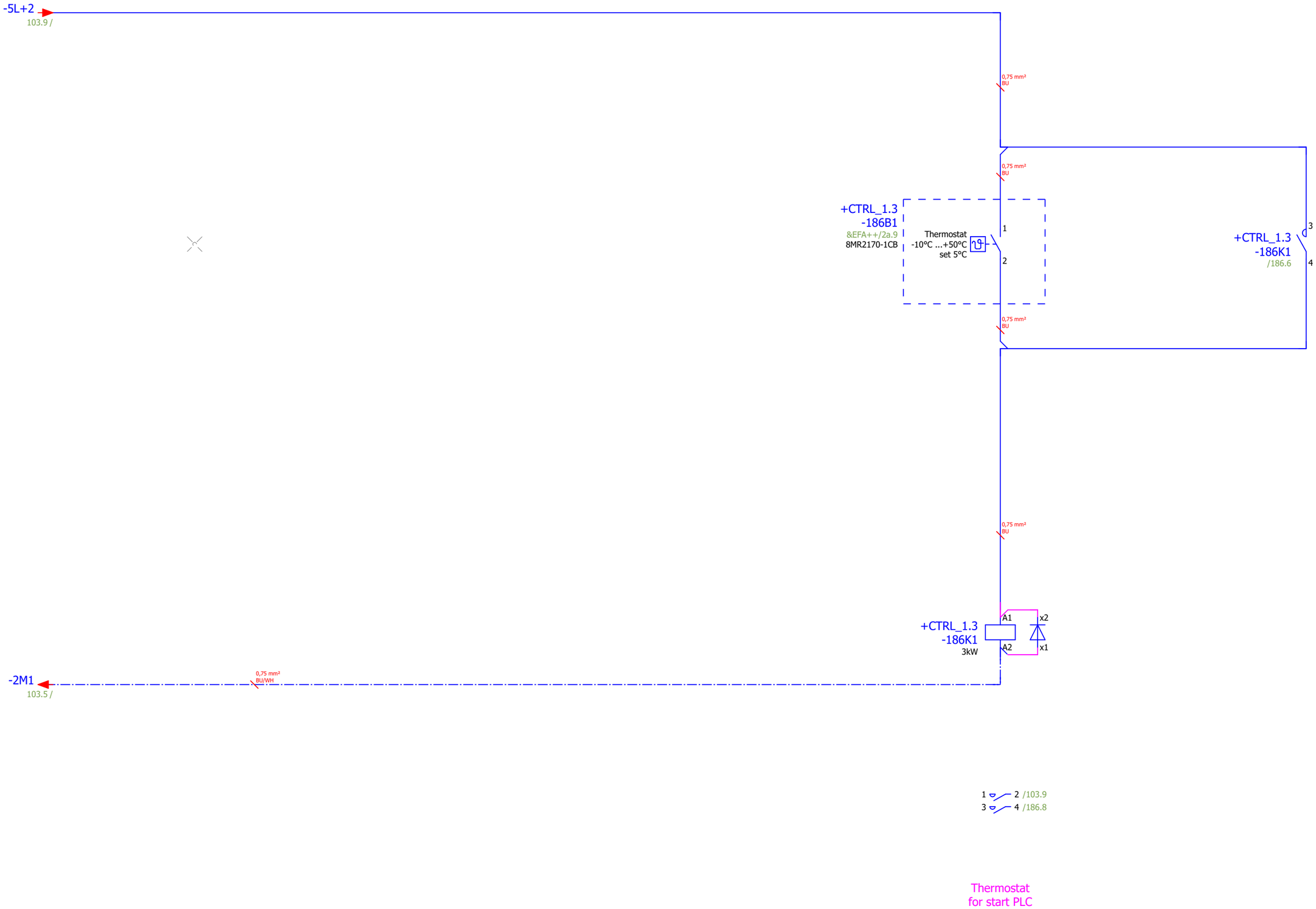
FAN 1
CONTROL CABINET

HEATING
CONTROL CABINET

previous page: 183

next page: 186

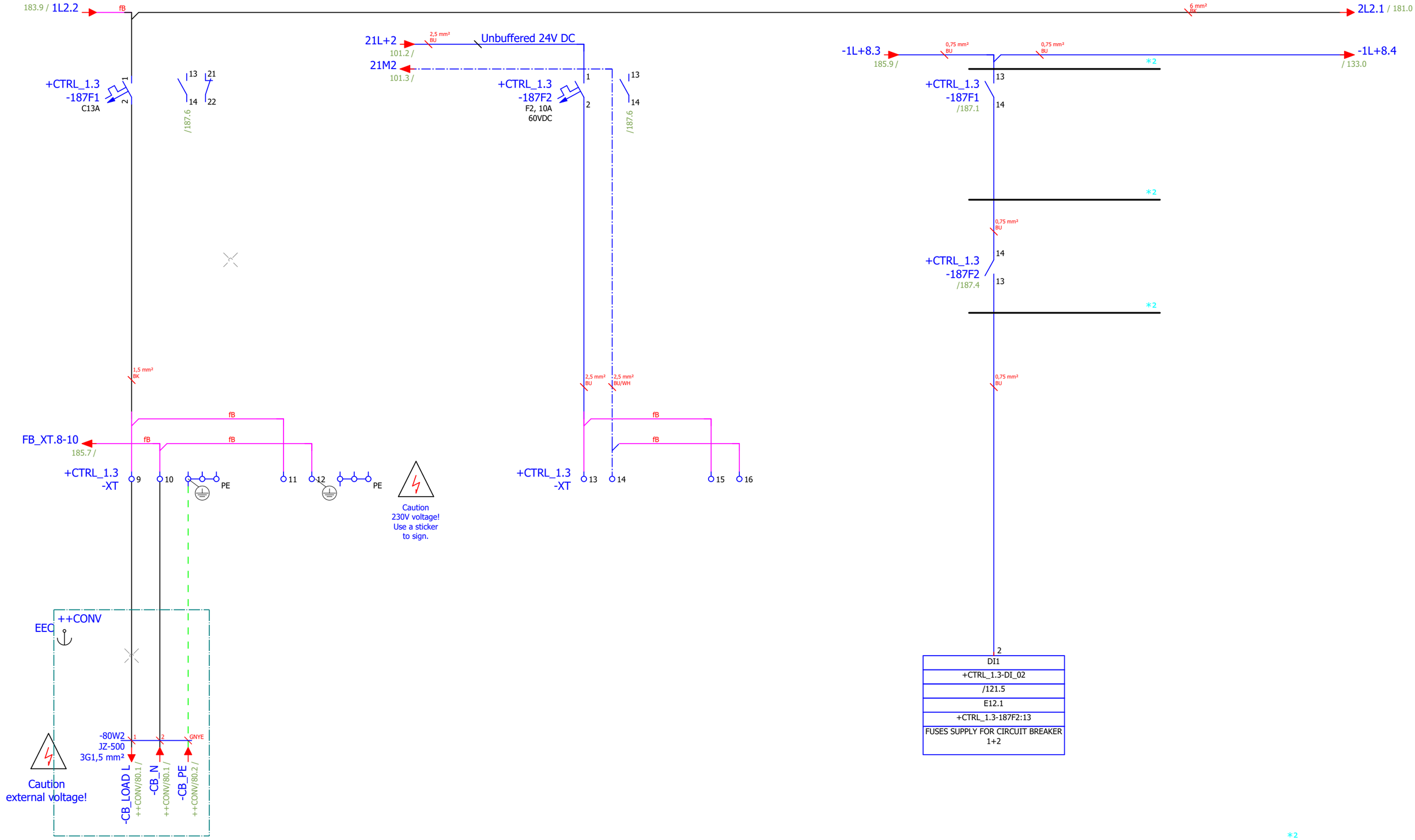
Editor	Freqcon_JD			Statron	FREQCON	FAN / HEATING CONTROL CABINET	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 185
Date								+	total: 492



previous page: 185

next page: 187

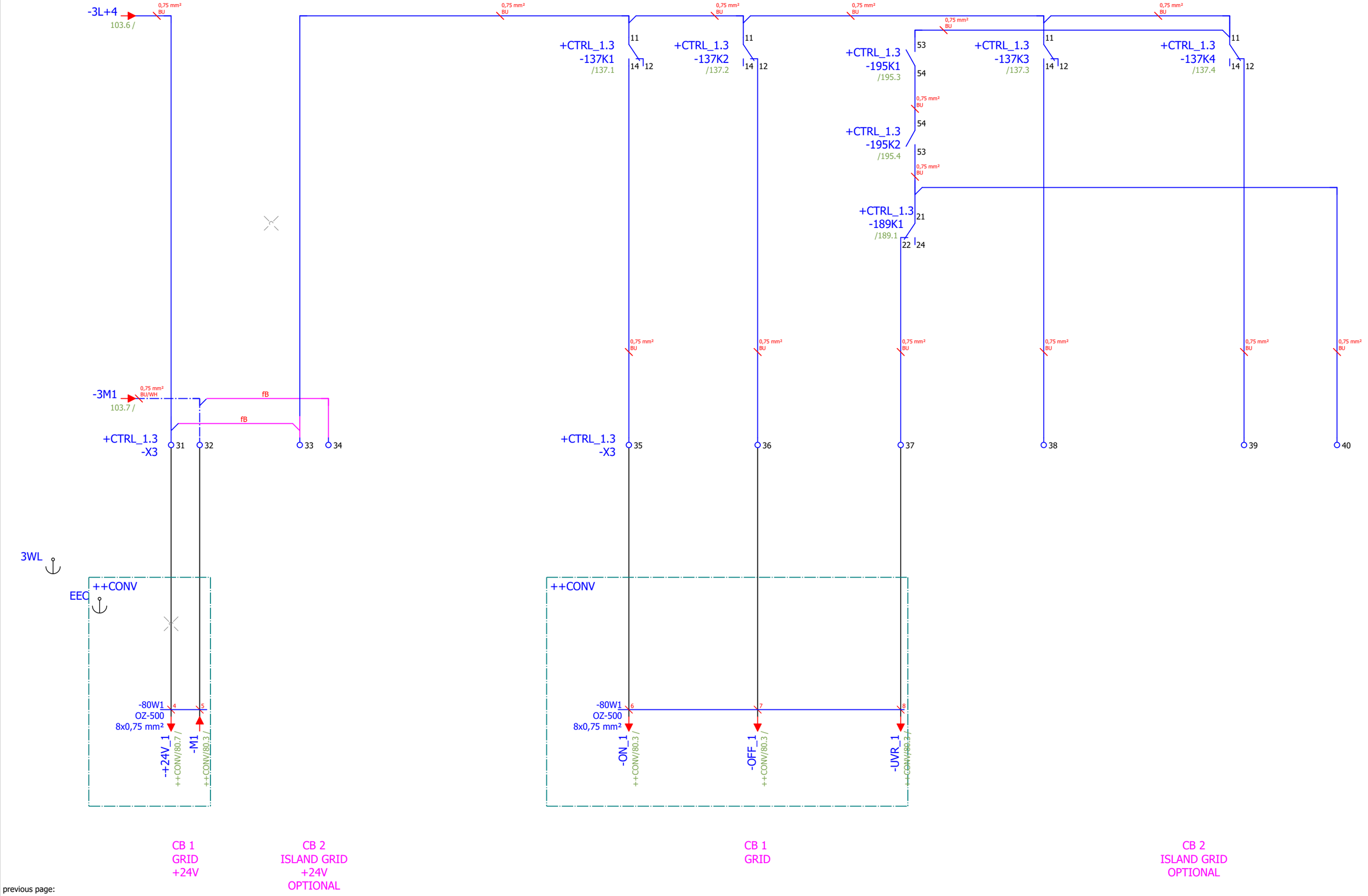
Editor	Freqcon_JD			Statron	FREQCON	THERMOSTAT	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 186
Date								+	total: 492



previous page: 186

next page: 188

Editor	Freqcon_JD			Statron	FREQCON	24V DC SUPPLY CB	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 187
Date								+	total: 492



previous page: 187

next page: 189

Editor	Freqcon_JD			Statron	FREQCON	24V DC SUPPLY CON / CB GRID	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 188
Date								+	total: 492

GRID FAULT
+CTRL_1.3-189K1:A1
A11.3
/123.5
+CTRL_1.3-DO_01
DQ11
12

0,75 mm² BU

+CTRL_1.3
-189K1
24V DC
A1
A2

-1M7.6 fB 0,75 mm² BU/WH -M_(GND)
173.6 / / 189.5

14 11 /189.6
12
24 21 /188.6
22

Voltage inputs
3 phases 620V AC

Grid Circuit Breaker:
if OFF then 24V;
if ON then 0V

Grid OK

-UL1.HVIO / 160.5 — 2,5 mm² BK
-UL2.HVIO / 160.5 — 2,5 mm² BK
-UL3.HVIO / 160.4 — 2,5 mm² BK
-UN.1 / 173.4 — 2,5 mm² LBU
-24V_Signal / 127.4 — 0,75 mm² BU
-M_(GND) / 189.1 — 0,75 mm² BU/WH
+CTRL_1.3 -189K1 /189.1 — 0,75 mm² BU (11 / 12 / 14)
CB_OFF.1 / 137.2 — 0,75 mm² BU

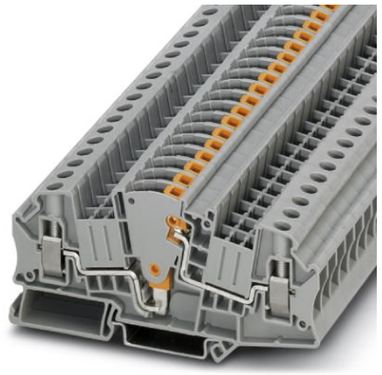
+CTRL_1.4
-189X1
Test disconnect
terminal block
Phoenix Contact
PTME 6

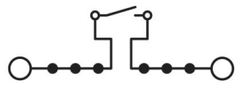
1 2 3 4 5 6 7 8 9

2,5 mm² BK
2,5 mm² BK
2,5 mm² BK
0,75 mm² BU

-HVIO_L1 / 85.1 /
-HVIO_L2 / 85.1 /
-HVIO_L3 / 85.2 /
CB_OFF.2 / 137.2 /

Relais
Circuit Breaker
OFF



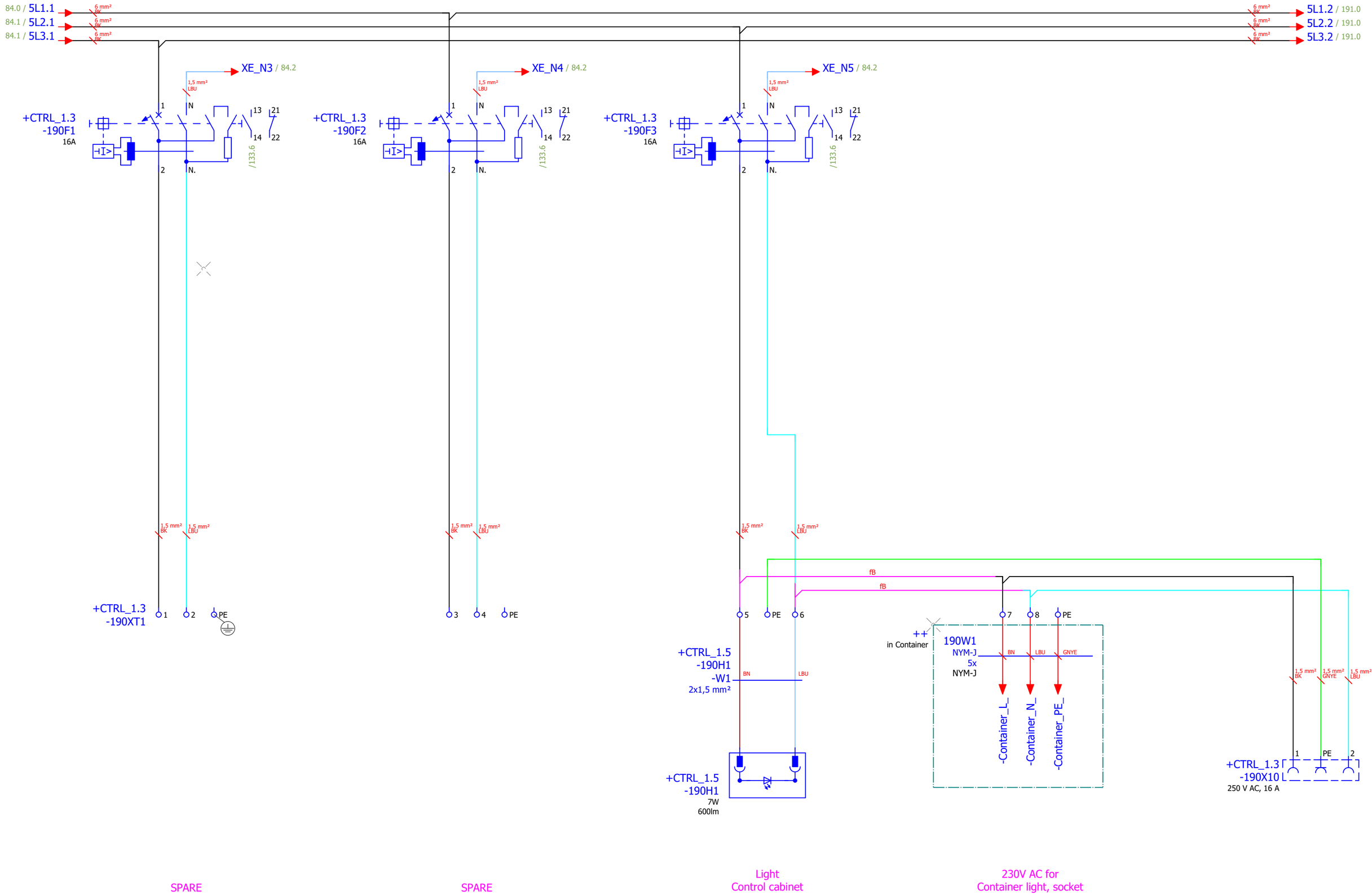


GRID FAULT

Test terminal block for protection tests

previous page: 188
next page: 190

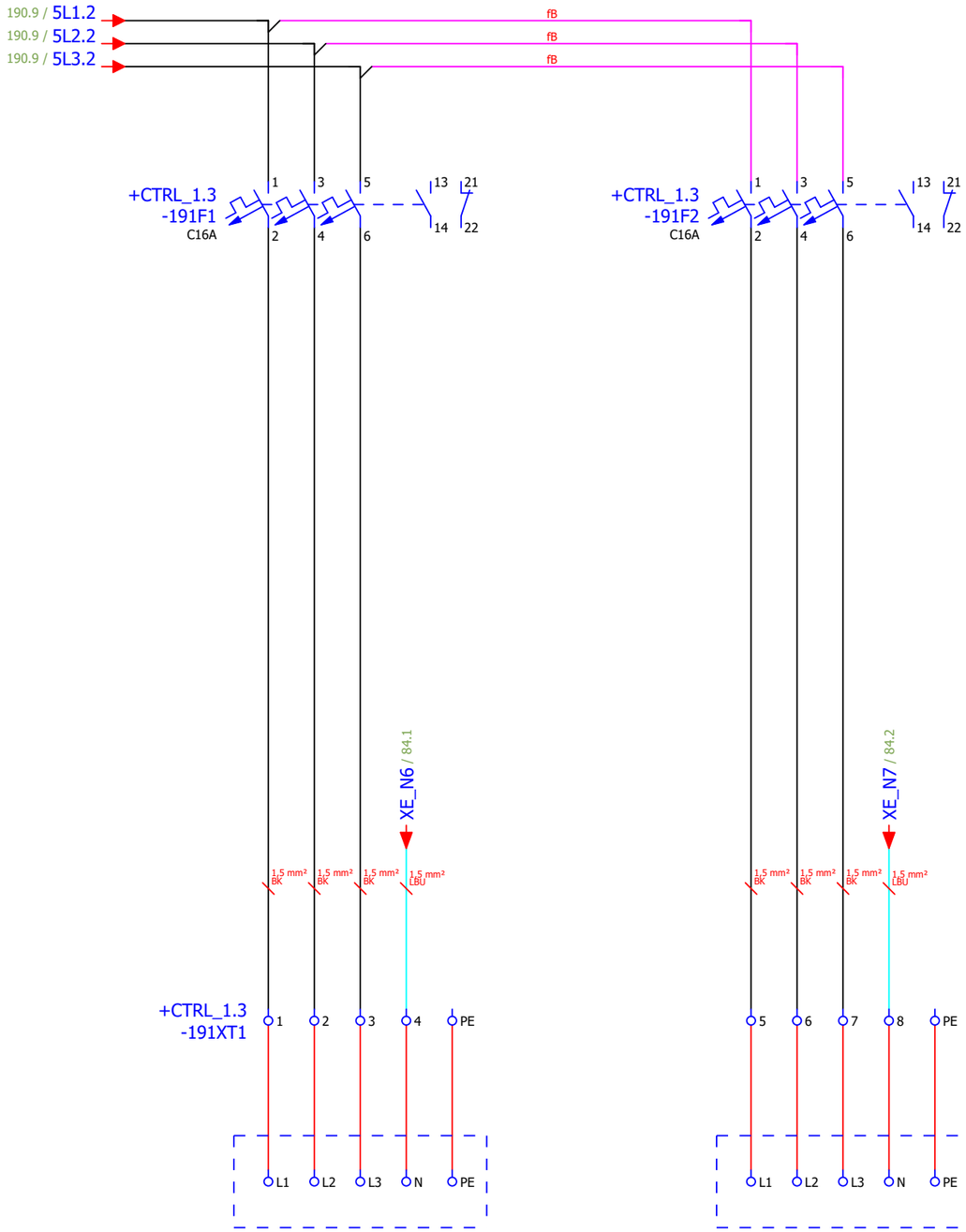
Editor	Freqcon_JD			Statron	FREQCON	TEST TERMINAL BLOCK	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 189
Date								+ total: 492



previous page: 189

next page: 191

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING, LIGHT 230V SUPPLY	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 190
Date								+	total: 492

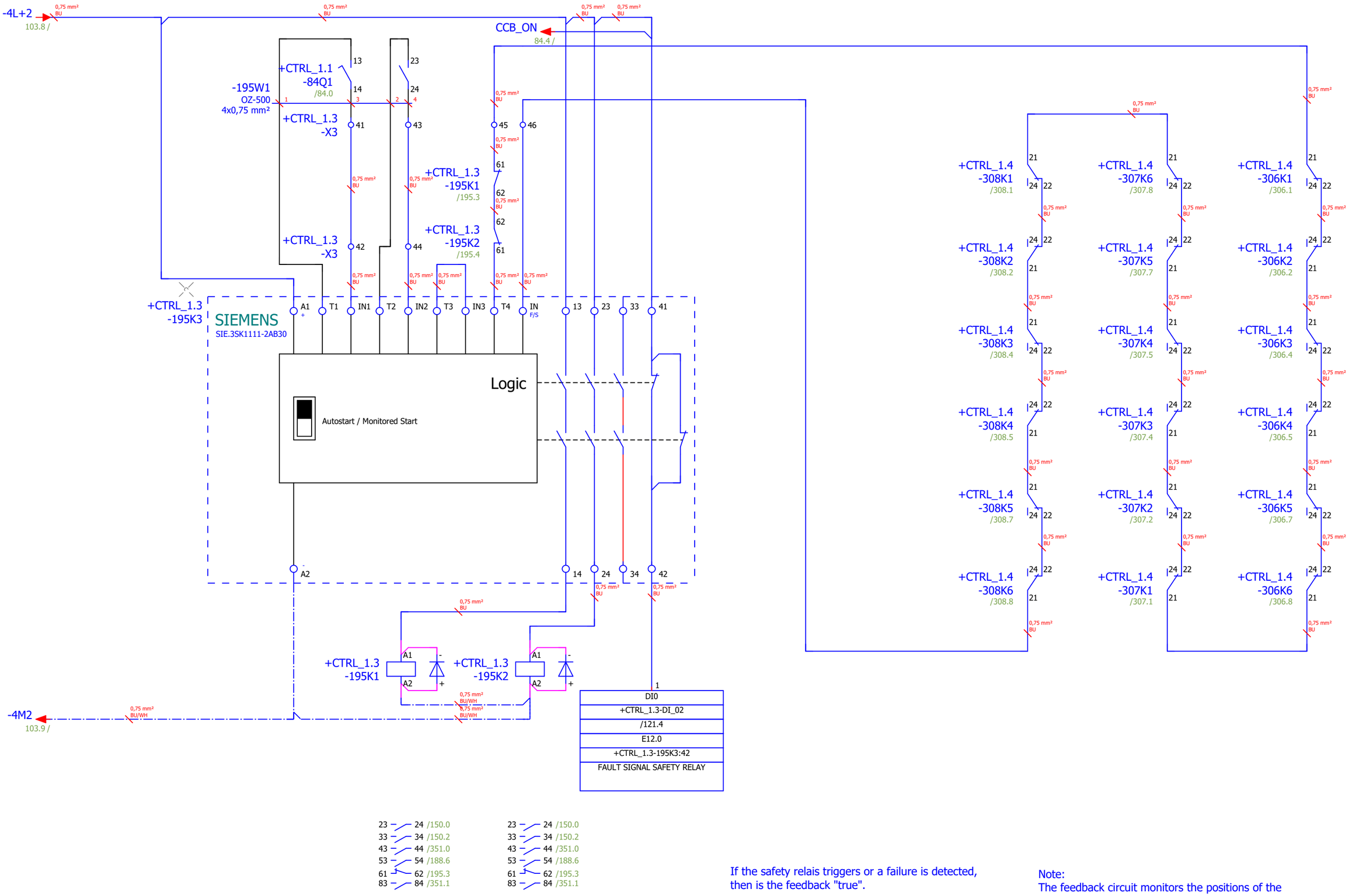


400V AC for
Container Air Conditioning 1

400V AC for
Container Air Conditioning 2

previous page: 190

next page: 195



23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
83 — 84 /351.1

23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
83 — 84 /351.1

SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS

FAULT SIGNAL SAFETY RELAY

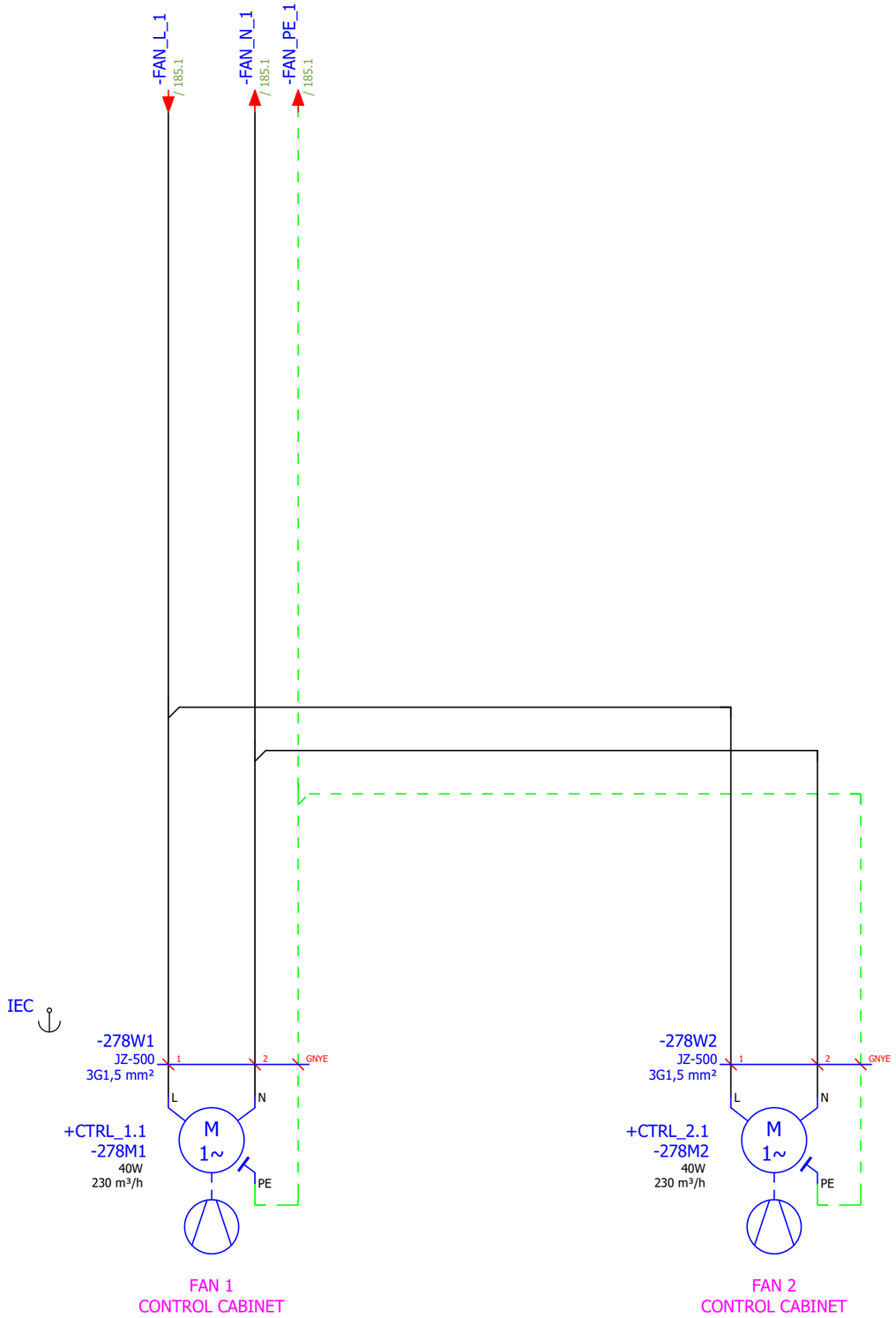
If the safety relais triggers or a failure is detected, then is the feedback "true".

Note:
The feedback circuit monitors the positions of the positive-guided NC contacts on the contactors 195K1 and 195K2. If one of their contacts latsches, then it is not possible to switch the contactors back on.

previous page: 191

next page: 278

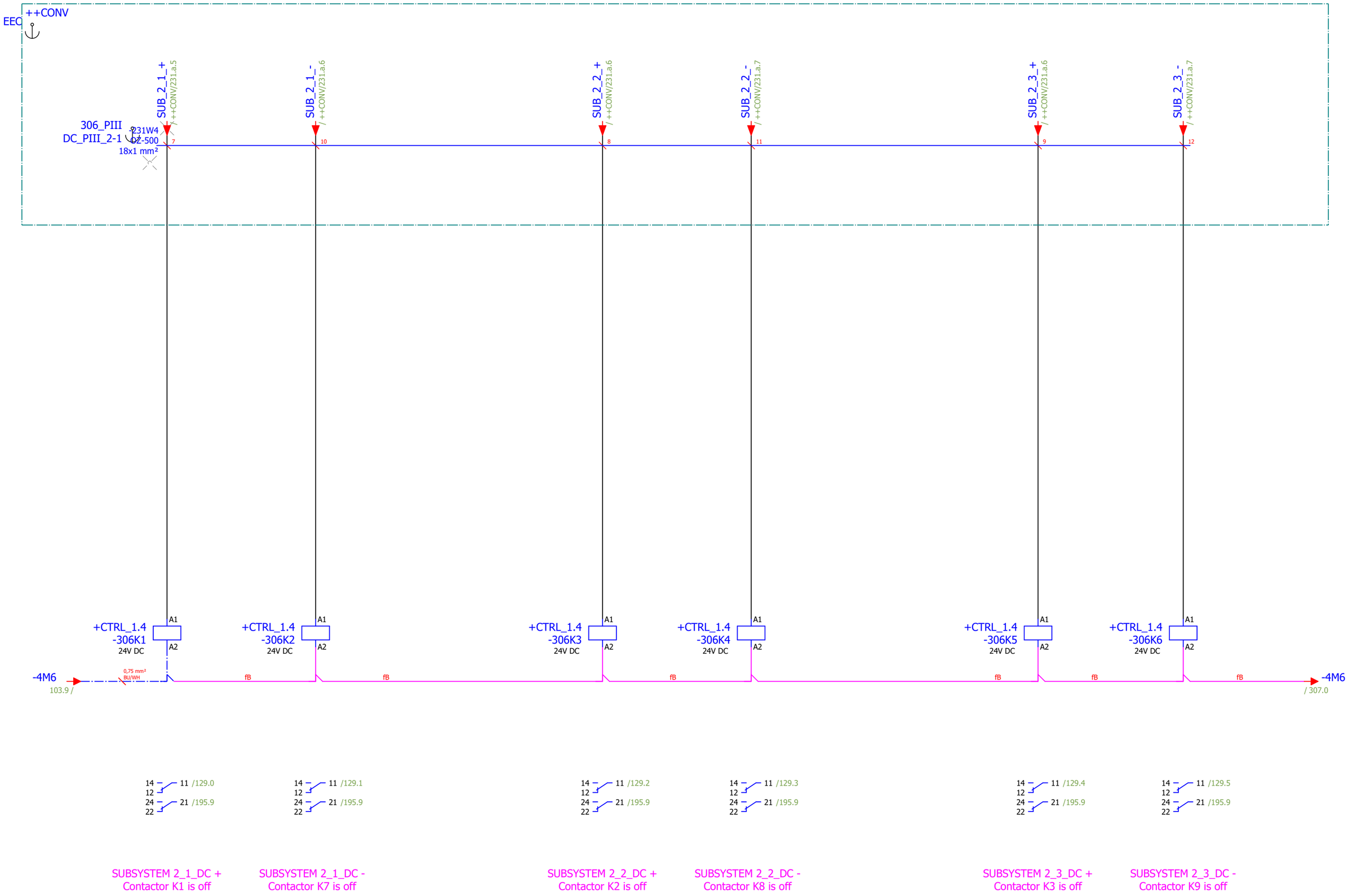
Editor	Freqcon_DG			Statron	FREQCON	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 195
Date								+ total: 492



previous page:
195

next page:
306

Editor	Freqcon_DG			Statron	FREQCON	CONTROL CABINET CLIMATE	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 278
Date								+	total: 492



previous page: 278

next page: 307

Editor	Freqcon_JD			Statron	FREQCON	Feedback DC contactors 1_4 - 1_6	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 306
Date								+	total: 492

EEC ++CONV

306_PIII
DC_PIII_3-1
227W4
D2-500
18x1 mm²

SUB_3_1_+ /++CONV/227.a.5 — 7
SUB_3_1_- /++CONV/227.a.6 — 10
SUB_3_2_+ /++CONV/227.a.6 — 8
SUB_3_2_- /++CONV/227.a.7 — 11
SUB_3_3_+ /++CONV/227.a.6 — 9
SUB_3_3_- /++CONV/227.a.7 — 12

+CTRL_1.4 -307K1 24V DC A1 A2
+CTRL_1.4 -307K2 24V DC A1 A2
+CTRL_1.4 -307K3 24V DC A1 A2
+CTRL_1.4 -307K4 24V DC A1 A2
+CTRL_1.4 -307K5 24V DC A1 A2
+CTRL_1.4 -307K6 24V DC A1 A2

-4M6 306.9 / — fB — fB — fB — fB — fB — fB — -4M6 / 308.0

14 12 11 /130.0 21 /195.8 22 24
14 12 11 /130.1 21 /195.8 22 24
14 12 11 /130.2 21 /195.8 22 24
14 12 11 /130.3 21 /195.8 22 24
14 12 11 /130.4 21 /195.8 22 24
14 12 11 /130.5 21 /195.8 22 24

SUBSYSTEM 3_1_DC +
Contactor K1 is off

SUBSYSTEM 3_1_DC -
Contactor K7 is off

SUBSYSTEM 3_2_DC +
Contactor K2 is off

SUBSYSTEM 3_2_DC -
Contactor K8 is off

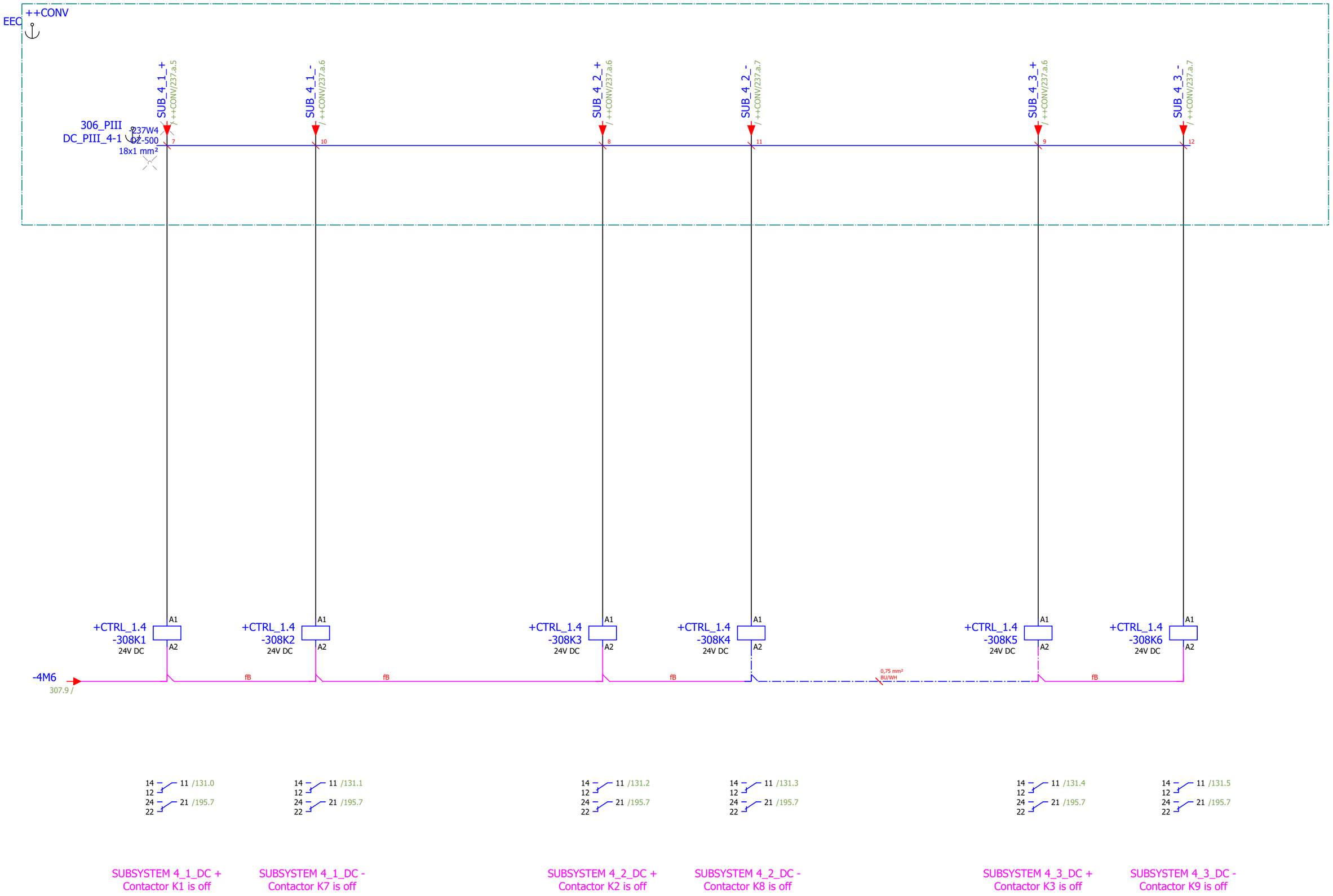
SUBSYSTEM 3_3_DC +
Contactor K3 is off

SUBSYSTEM 3_3_DC -
Contactor K9 is off

previous page: 306

next page: 308

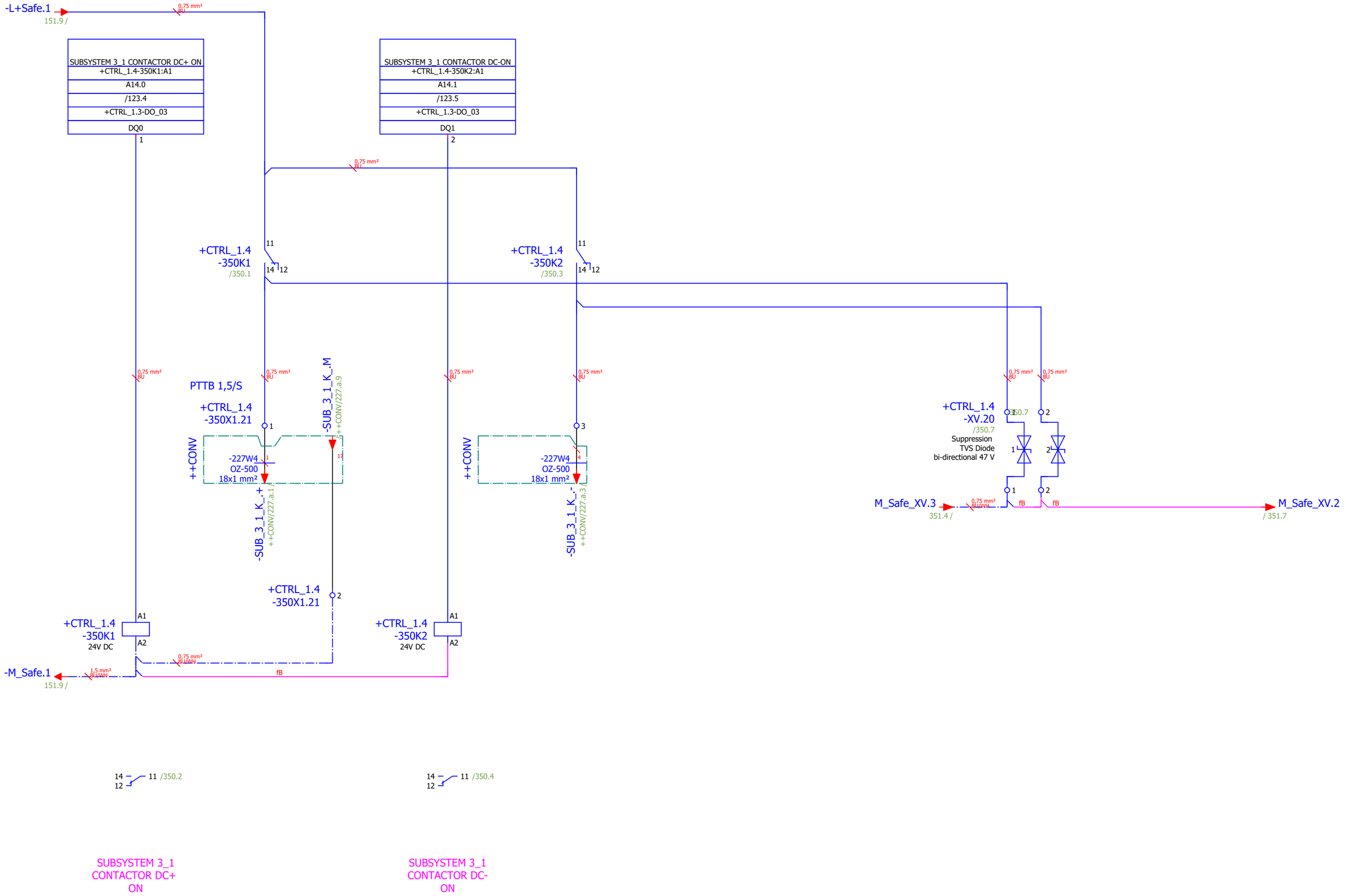
Editor	Freqcon_JD			Statron	FREQCON	Feedback DC contactors 2_1 - 2_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 307
Date								+	total: 492



previous page: 307

next page: 350

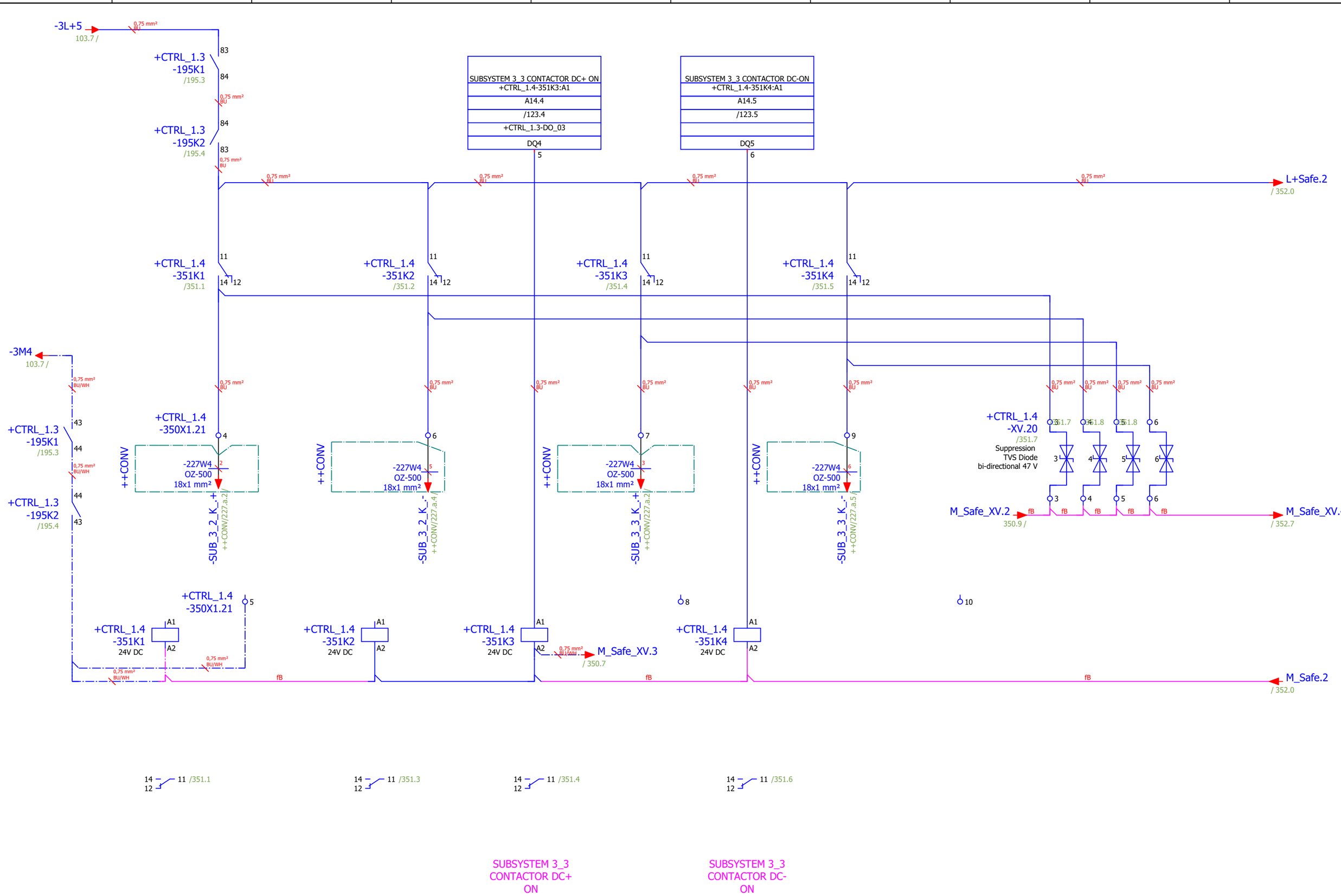
Editor	Freqcon_DG			Statron	FREQCON	Feedback DC contactors 2_4 - 2_6	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 308
Date								+	total: 492



previous page: 308

next page: 351

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 350
Date								+	total: 492



previous page: 350

next page: 352

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 351
Date								+	total: 492

-L+Safe.2
351.9 /

SUBSYSTEM 4_1 CONTACTOR DC+ ON
+CTRL_1.4-352K1:A1
A14.6
/123.4
+CTRL_1.3-DO_03
DQ6
7

SUBSYSTEM 4_1 CONTACTOR DC-ON
+CTRL_1.4-352K2:A1
A14.7
/123.5
DQ7
8

L+Safe.3
/ 353.0

0,75 mm² BU

+CTRL_1.4
-352K1
/352.0
11 14 12

+CTRL_1.4
-352K2
/352.2
11 14 12

+CTRL_1.4
-350X1.21
11

-SUB_4_1_K_M
/++CONV/237.a.9

++CONV
-237W4
OZ-500
18x1 mm²
1 17

-SUB_4_1_K_+
/++CONV/237.a.1

13

++CONV
-237W4
OZ-500
18x1 mm²
4

-SUB_4_1_K_-
/++CONV/237.a.3

+CTRL_1.4
-XV.20
/352.7
Suppression
TVS Diode
bi-directional 47 V
7 8

M_Safe_XV.4
351.9 /
fB

M_Safe_XV.5
/ 353.7

+CTRL_1.4
-350X1.21
12

+CTRL_1.4
-352K1
24V DC
A1 A2

+CTRL_1.4
-352K2
24V DC
A1 A2

-M_Safe.2
351.9 /

M_Safe.3
/ 353.0

14 12 11 /352.1

14 12 11 /352.3

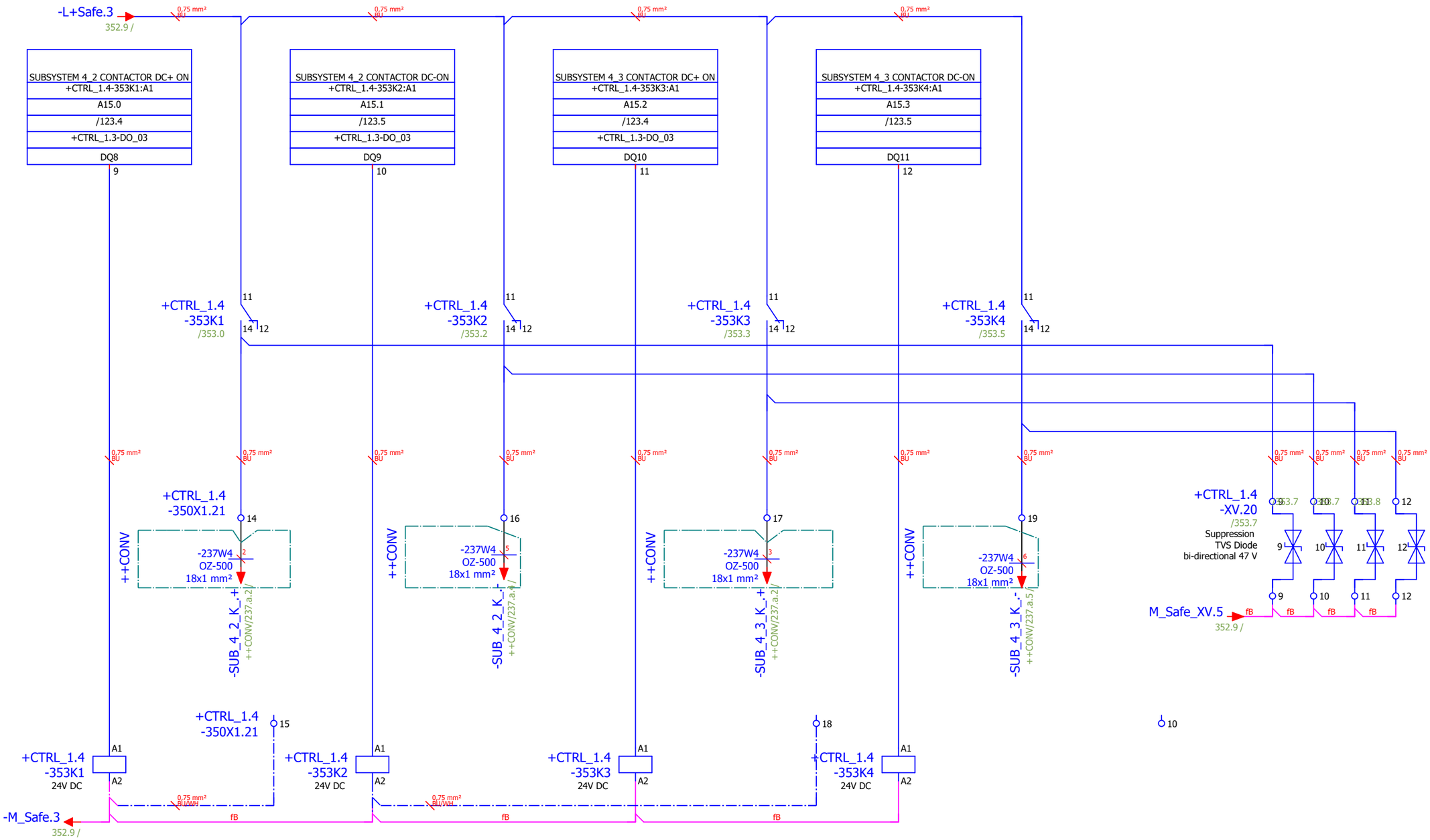
SUBSYSTEM 4_1
CONTACTOR DC+
ON

SUBSYSTEM 4_1
CONTACTOR DC-
ON

previous page:
351

next page:
353

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 352
Date								+	total: 492



14 12 — 11 /353.1

14 12 — 11 /353.3

14 12 — 11 /353.4

14 12 — 11 /353.6

SUBSYSTEM 4_2 CONTACTOR DC+ ON

SUBSYSTEM 4_2 CONTACTOR DC- ON

SUBSYSTEM 4_3 CONTACTOR DC+ ON

SUBSYSTEM 4_3 CONTACTOR DC- ON

previous page: 352

next page: 440

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 353
Date								+ total: 492

-1L+1
103.2 /
-1M1
103.3 /
-1PE1
103.4 /
240W9
JZ-500
3G0,75 mm²
1 2 GNYE

4 3
1 2
Stecker A-Codiert

PIII_1

+CTRL_2.1
-240U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
4 3
1 2
Ansicht
Stiftleiste
24 VDC
M12 System-
steckverbinder

Ansicht
Buchsenleiste
240W10
2YY (ST) CY
2x2x0,64 mm²
/110.1
-P320-FPPU1
110.0 /
P1
3 4
(IN)
2 1
M12 System-
steckverbinder

240W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU1-FPPU2
441.0 /
P2
3 4
(OUT)
2 1

Arc Detect
3 4
2 1

M6 Bolzen
-PE

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_1
CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1 X1
IGBT2 X2
IGBT3 X3
IGBT4 X4
25-POL SUB-D SOCKET

++CONV
240W1
pre-assembled D-Sub cable 1:1
-_IGBT1.1
/ ++CONV/201.3
240W2
pre-assembled D-Sub cable 1:1
-_IGBT1.2
/ ++CONV/202.3
240W3
pre-assembled D-Sub cable 1:1
-_IGBT1.3
/ ++CONV/203.3

IEC
PE
19

PIII_1
-240W7
pre-assembled D-Sub cable 1:1
/160.7
-HVIO_1
/ 160.9

PIII_Version
2_6_V_4

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

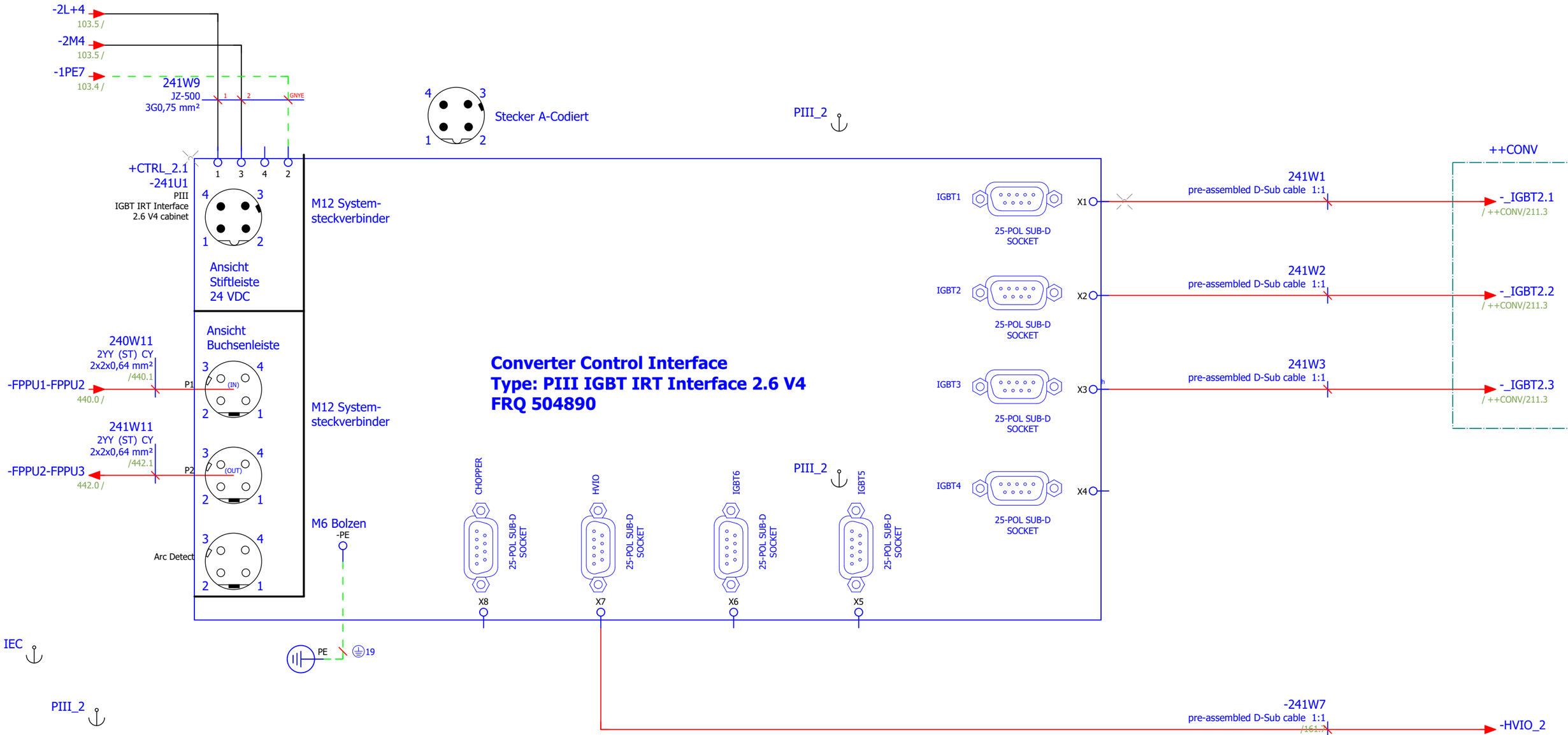
3 4
2 1
Plug D-coded

P2 LAN OUT
P1 LAN IN
Supply 24 V DC
Arc Detect
Fuse 6A F
IGBT6 IGBT4 IGBT2 HVIO
IGBT5 IGBT3 IGBT1 CHOPPER
25-POL SUB-D

connector view PIII

previous page: 353
next page: 441

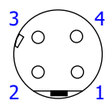
Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 440
Date								+	total: 492

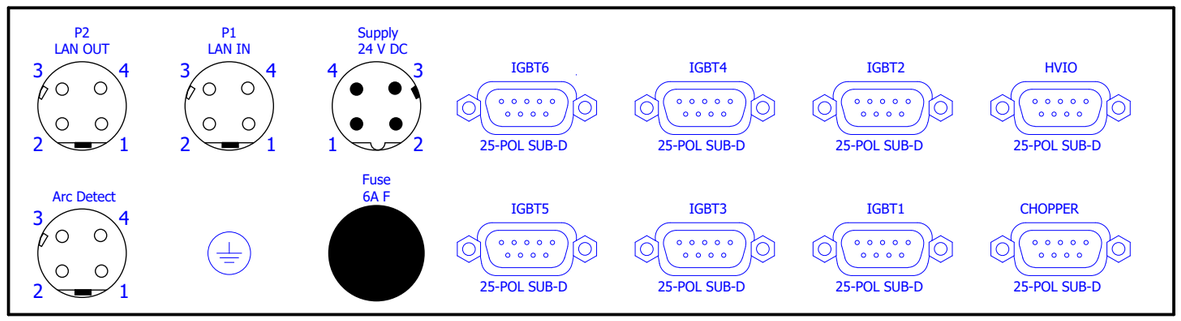


Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320





connector view PIII

previous page: 440
next page: 442

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 441
Date								+ total: 492

-2L+2
103.4 /
-2M2
103.5 /
-1PE5
103.4 /
242W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-242U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

241W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU2-FPPU3
441.0 /
P1 (IN)

242W11
2YY (ST) CY
2x2x0,64 mm²
/443.1
-FPPU3-FPPU4
443.0 /
P2 (OUT)

Arc Detect

M12 System-
steckverbinder

M6 Bolzen
-PE

PE
19

IEC

PIII_3

PIII_Version
2_6_V_4

Stecker A-Codiert

PIII_3

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1 X1
IGBT2 X2
IGBT3 X3
IGBT4 X4
25-POL SUB-D SOCKET

242W1
pre-assembled D-Sub cable 1:1
-_IGBT3.1
/ ++CONV/207.3

242W2
pre-assembled D-Sub cable 1:1
-_IGBT3.2
/ ++CONV/207.3

242W3
pre-assembled D-Sub cable 1:1
-_IGBT3.3
/ ++CONV/207.3

++CONV

-242W7
pre-assembled D-Sub cable 1:1
/163.7
-HVIO_3
/ 163.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

P2 LAN OUT
P1 LAN IN
Supply 24 V DC
Arc Detect
Fuse 6A F
IGBT6 IGBT4 IGBT2 HVIO
IGBT5 IGBT3 IGBT1 CHOPPER
25-POL SUB-D

connector view PIII

previous page: 441
next page: 443

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 442
Date								+	total: 492

-2L+1
103.4 /
-2M3
103.5 /
-1PE8
103.4 /
243W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-243U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

242W11
2YY (ST) CY
2x2x0,64 mm²
/442.1
-FPPU3-FPPU4
442.0 /
P1 (IN)
P2 (OUT)
Arc Detect

M12 System-
steckverbinder

M6 Bolzen
-PE
PE
19

Stecker A-Codiert

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_2

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1
IGBT2
IGBT3
IGBT4
25-POL SUB-D SOCKET
X1 X2 X3 X4

243W1
pre-assembled D-Sub cable 1:1
-_IGBT4.1
/ ++CONV/217.3

243W2
pre-assembled D-Sub cable 1:1
-_IGBT4.2
/ ++CONV/217.3

243W3
pre-assembled D-Sub cable 1:1
-_IGBT4.3
/ ++CONV/217.3

++CONV

IEC

PIII_4

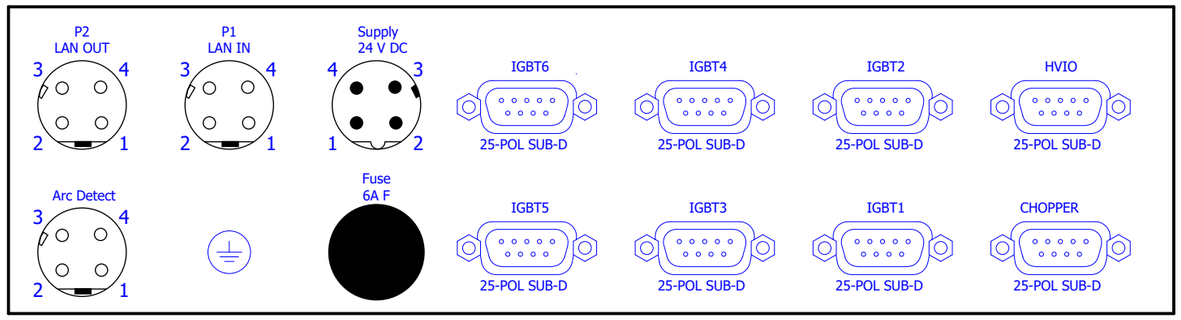
PIII_Version
2_6_V_4

-243W7
pre-assembled D-Sub cable 1:1
/164.7
-HVIO_4
/ 164.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

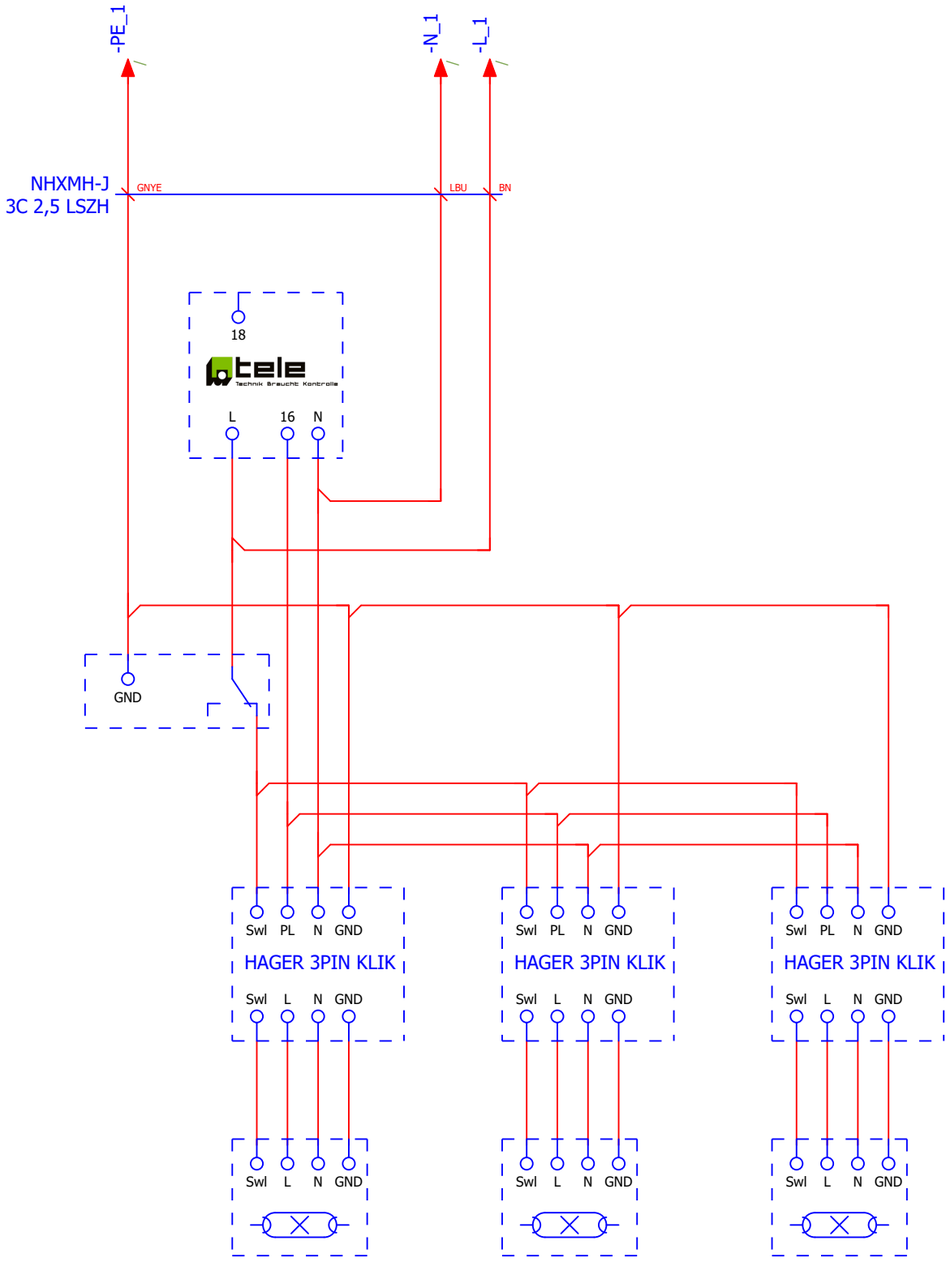


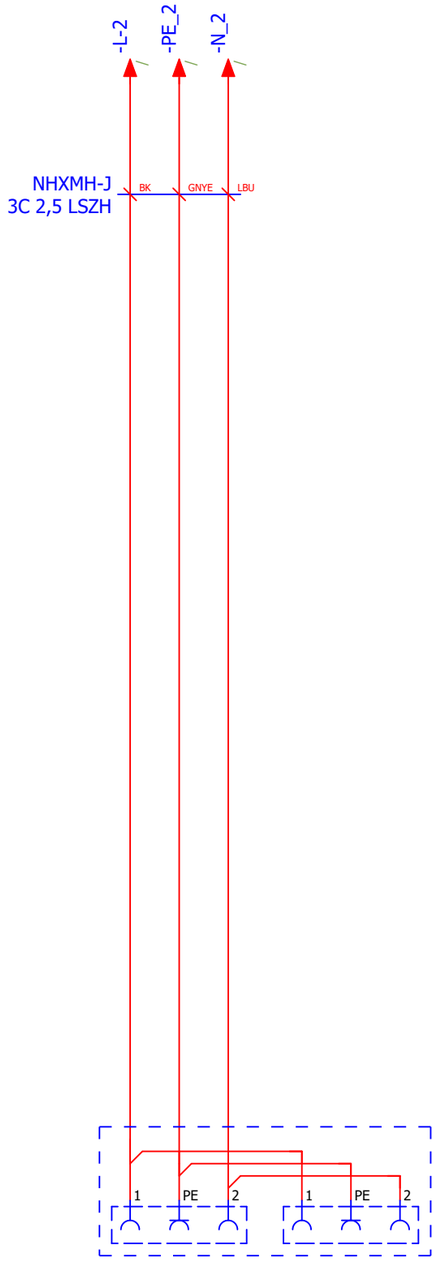
connector view PIII

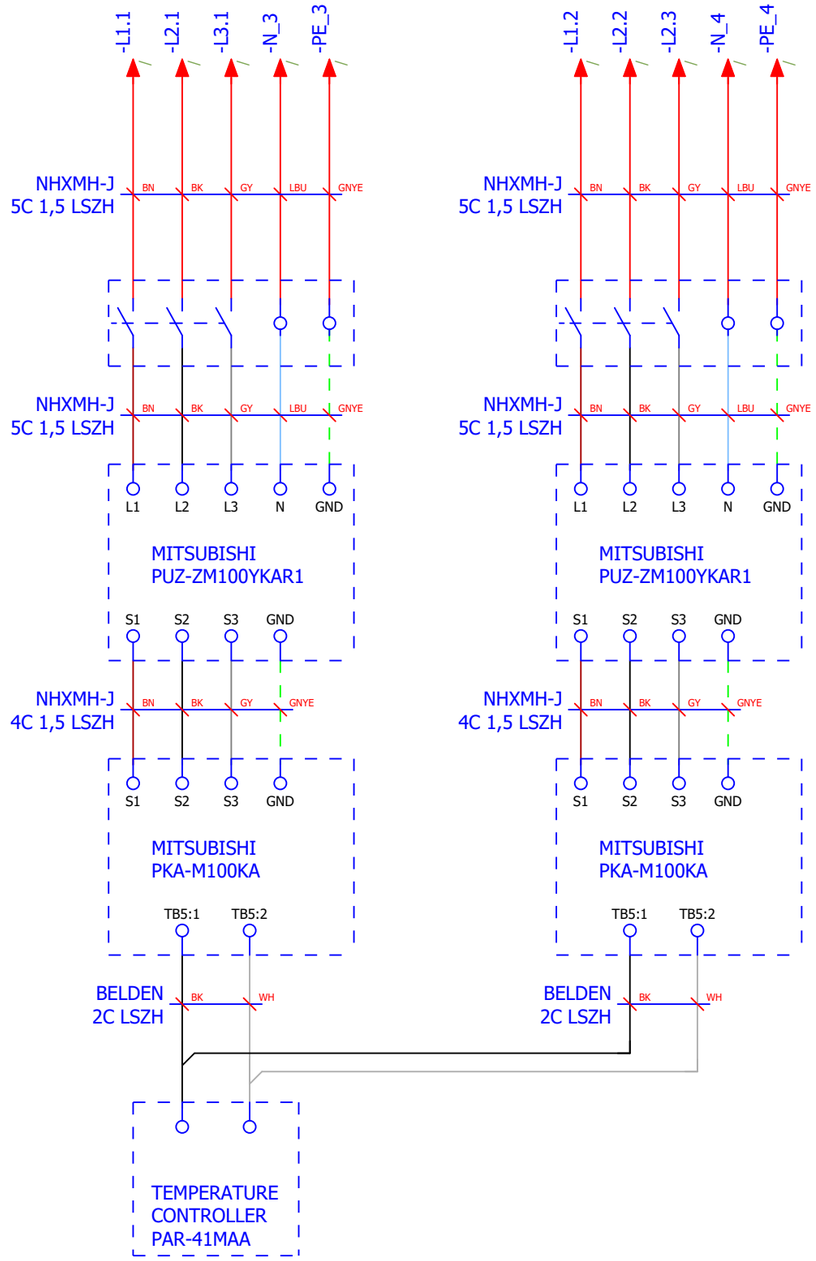
previous page: 442

next page: ++Container/190

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 4	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 443
Date								+		total: 492







previous page:
++CT/443

next page:
&EPC++TRA/1

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18T1 &EFS/18.2	1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555	
-18W5 &EFS/18.3	1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153	

previous page:
&EFS++Container/190

next page:
++CONV/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18Q1 &EFS++TRA/18.7	1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172	
-18Q1 &EFS++TRA/18.7	1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044	
-18Q1 &EFS++TRA/18.7	1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039	

previous page:
++TRA/1

next page:
+CON/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B2 &EFS++CT+/147.7	1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648	
-201Q1 &EFS+/201.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-201Q1 &EFS+/201.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-201Q1 &EFS+/201.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-201Q1 &EFS+/201.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-201Q1 &EFS+/201.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-201Q1 &EFS+/201.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-201Q1-C &EFS+/201.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-201Q1-C &EFS+/201.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-202Q1 &EFS+/202.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-202Q1 &EFS+/202.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-202Q1 &EFS+/202.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-202Q1 &EFS+/202.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-202Q1 &EFS+/202.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-202Q1 &EFS+/202.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-202Q1-C &EFS+/202.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-202Q1-C &EFS+/202.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

previous page:
+/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-202Q1-C &EFS+/202.6;&EFS+/202.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-202Q1-C &EFS+/202.6;&EFS+/202.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-203Q1 &EFS+/203.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-203Q1 &EFS+/203.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-203Q1 &EFS+/203.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-203Q1 &EFS+/203.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-203Q1 &EFS+/203.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-203Q1 &EFS+/203.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-203Q1-C &EFS+/203.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-203Q1-C &EFS+/203.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1 &EFS+/207.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-207Q1 &EFS+/207.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-207Q1 &EFS+/207.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-207Q1 &EFS+/207.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-207Q1 &EFS+/207.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-207Q1-C &EFS+/207.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-207Q1-C &EFS+/207.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-207Q1-C &EFS+/207.6;&EFS+/207.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-207Q1-C &EFS+/207.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1-U1 &EFS+/207.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-211Q1 &EFS+/211.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-211Q1 &EFS+/211.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-211Q1 &EFS+/211.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-211Q1 &EFS+/211.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-211Q1 &EFS+/211.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-211Q1-C &EFS+/211.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-211Q1-C &EFS+/211.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-211Q1-C &EFS+/211.6;&EFS+/211.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-211Q1-C &EFS+/211.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-211Q1-U1 &EFS+/211.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-217Q1 &EFS+/217.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-217Q1 &EFS+/217.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-217Q1 &EFS+/217.3	1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524	
-217Q1 &EFS+/217.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-217Q1 &EFS+/217.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-217Q1 &EFS+/217.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-217Q1-C &EFS+/217.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-217Q1-C &EFS+/217.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-217Q1-C &EFS+/217.6;&EFS+/217.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-217Q1-C &EFS+/217.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-217Q1-U1 &EFS+/217.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-260B1 &EFS+/260.3	1	Optical smoke detector 12V, with alarm relais	130-60-457	ABUS Security-Center GmbH & Co. KG	500713	X
-279M1 &EFS+/279.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M2 &EFS+/279.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M3 &EFS+/279.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M4 &EFS+/279.5	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M5 &EFS+/279.6	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-N &EFS+/99.5	2	Busbar holder for busbars 12x 5 (10)-30x 5 (10) and 6x 6 mm	8US1923-1AA01	Siemens	501271	X

previous page:
3

next page:
+IND/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-201L1 &EFS+/201.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-201L1 &EFS+/201.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-201U1 &EFS+/201.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-202L1 &EFS+/202.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-202L1 &EFS+/202.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-202U1 &EFS+/202.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-203L1 &EFS+/203.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-203L1 &EFS+/203.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-203U1 &EFS+/203.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-207L1 &EFS+/207.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-207L1 &EFS+/207.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-211L1 &EFS+/211.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-211L1 &EFS+/211.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-217L1 &EFS+/217.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-217L1 &EFS+/217.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X

previous page: +CON/4

next page: +CIR/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-80Q1 &EFS+/80.0	1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955	
-80Q1 &EFS+/80.1	1	Circuit breaker 3WL1112, 1250A, 42kA 690V, size 1, 3-pole, IEC, ETU15B, withdrawable	3WL1112-2BB36-1BJ2-ZA08+K07+M06+M21+R10	Siemens	501430	X
-83U1 &EFS+/83.2	1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918	
-83U1-C1 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C2 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C3 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C4 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C7 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C8 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C9 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C10 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C13 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C14 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C15 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C16 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-148B3 &EFS++CT+/148.5	1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649	
-227U1 &EFS+/227.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-227U1-C1 &EFS+/227.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-C7 &EFS+/227.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

previous page:
+IND/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-C13 &EFS+/227.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-F0 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F1 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F1 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F1 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F2 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F2 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F2 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F3 &EFS+/227.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F3 &EFS+/227.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F3 &EFS+/227.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-F4 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F4 &EFS+/227.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F5 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F5 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F5 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F6 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F6 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F6 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-F7 &EFS+/227.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F7 &EFS+/227.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F8 &EFS+/227.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F8 &EFS+/227.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F9 &EFS+/227.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F9 &EFS+/227.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F9 &EFS+/227.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F10 &EFS+/227.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F10 &EFS+/227.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F10 &EFS+/227.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F11 &EFS+/227.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F11 &EFS+/227.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F12 &EFS+/227.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-K1 &EFS+/227.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K2 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K3 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K7 &EFS+/227.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-K8 &EFS+/227.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K9 &EFS+/227.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-U1 &EFS+/227.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-227U1-X3.1 &EFS+/227.a.0;&EFS+/227.a.9	0					
-227U1-X3.1 &EFS+/227.a.1...&EFS+/227.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-227U1-X3.1 &EFS+/227.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-227U1-X3.1 &EFS+/227.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-227U1-X3.1 &EFS+/227.a.2...&EFS+/227.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-227U1-X3.1 &EFS+/227.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-227U1-X3.2 &EFS+/227.a.0	0					
-227U1-X3.2 &EFS+/227.a.1...&EFS+/227.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-227U1-X3.2 &EFS+/227.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-231U1 &EFS+/231.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-231U1-C1 &EFS+/231.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-C7 &EFS+/231.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-C13 &EFS+/231.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-F0 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F1 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F1 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F1 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F2 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F2 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F2 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F3 &EFS+/231.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F3 &EFS+/231.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F3 &EFS+/231.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-F4 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F4 &EFS+/231.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F5 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F5 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F5 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F6 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F6 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F6 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-F7 &EFS+/231.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F7 &EFS+/231.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F8 &EFS+/231.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F8 &EFS+/231.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F9 &EFS+/231.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F9 &EFS+/231.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F9 &EFS+/231.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F10 &EFS+/231.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F10 &EFS+/231.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F10 &EFS+/231.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F11 &EFS+/231.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F11 &EFS+/231.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F12 &EFS+/231.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-K1 &EFS+/231.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K2 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K3 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K7 &EFS+/231.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

previous page: 5

next page: 7

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-K8 &EFS+/231.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K9 &EFS+/231.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-U1 &EFS+/231.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-231U1-X3.1 &EFS+/231.a.0;&EFS+/231.a.9	0					
-231U1-X3.1 &EFS+/231.a.1...&EFS+/231.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-231U1-X3.1 &EFS+/231.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-231U1-X3.1 &EFS+/231.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-231U1-X3.1 &EFS+/231.a.2...&EFS+/231.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-231U1-X3.1 &EFS+/231.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-231U1-X3.2 &EFS+/231.a.0	0					
-231U1-X3.2 &EFS+/231.a.1...&EFS+/231.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-231U1-X3.2 &EFS+/231.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-237U1 &EFS+/237.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-237U1-C1 &EFS+/237.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-C7 &EFS+/237.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-C13 &EFS+/237.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-F0 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F1 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F1 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F1 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F2 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F2 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F2 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F3 &EFS+/237.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F3 &EFS+/237.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F3 &EFS+/237.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-F4 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F4 &EFS+/237.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F5 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F5 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F5 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F6 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F6 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F6 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-F7 &EFS+/237.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F7 &EFS+/237.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F8 &EFS+/237.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F8 &EFS+/237.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F9 &EFS+/237.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F9 &EFS+/237.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F9 &EFS+/237.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F10 &EFS+/237.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F10 &EFS+/237.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F10 &EFS+/237.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F11 &EFS+/237.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F11 &EFS+/237.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F12 &EFS+/237.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-K1 &EFS+/237.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K2 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K3 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K7 &EFS+/237.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-K8 &EFS+/237.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K9 &EFS+/237.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-U1 &EFS+/237.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-237U1-X3.1 &EFS+/237.a.0;&EFS+/237.a.9	0					
-237U1-X3.1 &EFS+/237.a.1...&EFS+/237.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-237U1-X3.1 &EFS+/237.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-237U1-X3.1 &EFS+/237.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-237U1-X3.1 &EFS+/237.a.2...&EFS+/237.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-237U1-X3.1 &EFS+/237.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-237U1-X3.2 &EFS+/237.a.0	0					
-237U1-X3.2 &EFS+/237.a.1...&EFS+/237.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-237U1-X3.2 &EFS+/237.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-281M1 &EFS+/281.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M2 &EFS+/281.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M3 &EFS+/281.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-78F1 &EFS+/78.6	1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738	
-78F1 &EFS+/78.6	3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539	
-78F2 &EFS+/78.6	1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055	
-78F3 &EFS+/78.7;&EFS+/78.8	3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	
-78F3 &EFS+/78.7;&EFS+/78.8	3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545	
-78W1 &EFS+/78.3	1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W2 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W3 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W4 &EFS+/78.3	1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290	
-78W5 &EFS+/78.2	1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070	
-227W10 &EFS+/227.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W11 &EFS+/227.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W12 &EFS+/227.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W13 &EFS+/227.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W14 &EFS+/227.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W15 &EFS+/227.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-228F1 &EFS+/228.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F2 &EFS+/228.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F3 &EFS+/228.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231W10 &EFS+/231.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W11 &EFS+/231.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W12 &EFS+/231.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W13 &EFS+/231.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W14 &EFS+/231.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W15 &EFS+/231.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W10 &EFS+/237.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W11 &EFS+/237.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W12 &EFS+/237.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W13 &EFS+/237.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W14 &EFS+/237.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W15 &EFS+/237.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-238F1 &EFS+/238a.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F2 &EFS+/238a.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F3 &EFS+/238a.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F4 &EFS+/238b.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F5 &EFS+/238b.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F6 &EFS+/238b.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-X3.43	20	Multi-level terminal block	3208511	Phoenix Contact	500560	X

previous page:
1

next page:
++CT+/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113U5 &EFS/113c.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-XT1 &EFS/136.0...&EFS/136.8	20	Feed-through terminal block	3209510	Phoenix Contact	500583	
-XT1 &EFS/136.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT1 &EFS/136.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT1 &EFS/136.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
++CONV+AC_DC/2

next page:
+CTRL_1.1/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84Q1 &EFS+/84.0	1	EMERGENCY STOP SWITCH	3LD2203-1TP53	Siemens	500810	X
-84Q1 &EFS+/84.0	1	Auxiliary switch	3LD9200-5B	Siemens	504922	X
-112A1 &EFS+/112.2	1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475	
-126S1 &EFS+/126.1	1	PUSHBUTTON, BLACK, 1 NO	3SU1100-0AB10-3BA0	Siemens	10026	X
-126S1 &EFS+/126.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H1 &EFS+/140.1	1	Complete device, round, indicator light RED	3SU1102-6AA20-3AA0	Siemens	10019	X
-140H1 &EFS+/140.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H2 &EFS+/140.2	1	Complete device, round, indicator light YELLOW	3SU1102-6AA30-3AA0	Siemens	10021	X
-140H2 &EFS+/140.2	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H3 &EFS+/140.3	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H3 &EFS+/140.3	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H4 &EFS+/140.4	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H4 &EFS+/140.4	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-278M1 &EFS+/278.1	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
+/1

next page:
+.2/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-110U1 &EFS+/110.2	1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789	
-110U1 &EFS+/110.2	1	Connector RJ45, 4 Pol., Profinet, VS-PN-RJ45-5-Q/IP20	1658435	Phoenix Contact	500806	X
-114A1 &EFS+/114.2	1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505	
-114A1 &EFS+/114.2	1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944	
-185R1 &EFS+/185.7	1	SK Enclosure heater, 800/870 W, 230 V, 1~, 50/60 Hz, WHD: 103x200x103 mm	3105400	Rittal	500621	X

previous page:
+.1/1

next page:
+.3/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	23.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+ CTRL_1.2 Left side	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84F1 &EFS+/84.6	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-84F2 &EFS+/84.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	X
-84F2 &EFS+/84.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-84K1 &EFS+/84.5	1	CONT.RELAY,3NO+1NC,DC24V,DIODE	3RH2131-2FB40	Siemens	501288	X
-101Q1 &EFS+/101.2	1	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	X
-101Q1 &EFS+/101.2	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	X
-101Q1 &EFS+/101.2	1	3-PHASE BUSBAR W. INFEED	3RV2917-1A	Siemens	500799	X
-101Q1 &EFS+/101.2	1	3-phase busbar including extension connector for 3 circuit breakers Size S00 and S0	3RV2917-4B	Siemens	504254	X
-101T1 &EFS+/101.2	1	Power supply unit	2866404	Phoenix Contact	502745	X
-102G1 &EFS+/102.2	1	Uninterruptible power supply	2320241	Phoenix Contact	501836	X
-102G2 &EFS+/102.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	X
-103F1 &EFS+/103.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F2 &EFS+/103.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F3 &EFS+/103.6	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F4 &EFS+/103.8	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F5 &EFS+/103.9	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-111A1 &EFS+/111.0	1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287	
-113T1 &EFS+/113a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T1 &EFS+/113a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	

previous page:
+.2/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113T2 &EFS+/113b.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T2 &EFS+/113b.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-113U1 &EFS+/113a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U2 &EFS+/113a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-113U3 &EFS+/113b.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U4 &EFS+/113b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-115A1 &EFS+/115.3	1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt	
-120A1 &EFS+/120.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	X
-134K1 &EFS+/134.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-134K1 &EFS+/134.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K1 &EFS+/135.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K1 &EFS+/135.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K2 &EFS+/135.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K2 &EFS+/135.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K3 &EFS+/135.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K3 &EFS+/135.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K4 &EFS+/135.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K4 &EFS+/135.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K5 &EFS+/135.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-135K5 &EFS+/135.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-136K7 &EFS+/136.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K8 &EFS+/136.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K9 &EFS+/136.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-137K1 &EFS+/137.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K1 &EFS+/137.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K2 &EFS+/137.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K2 &EFS+/137.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K3 &EFS+/137.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K3 &EFS+/137.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K4 &EFS+/137.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K4 &EFS+/137.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-138K1 &EFS+/138.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K1 &EFS+/138.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K2 &EFS+/138.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K2 &EFS+/138.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K3 &EFS+/138.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K3 &EFS+/138.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K4 &EFS+/138.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-138K4 &EFS+/138.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K5 &EFS+/138.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K5 &EFS+/138.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K6 &EFS+/138.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K6 &EFS+/138.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K7 &EFS+/138.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K7 &EFS+/138.7	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-139K1 &EFS+/139.1	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K2 &EFS+/139.2	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K3 &EFS+/139.3	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-150K1 &EFS+/150.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K1 &EFS+/150.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150K2 &EFS+/150.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K2 &EFS+/150.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150X1 &EFS+/150.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-150X1 &EFS+/150.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-150X1 &EFS+/150.2;&EFS+/150.4;&EFS+/151.1;&EFS+/151.4;&EFS+/151.6	5	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-151K1 &EFS+/151.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K1 &EFS+/151.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-151K2 &EFS+/151.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K2 &EFS+/151.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K3 &EFS+/151.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K3 &EFS+/151.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K4 &EFS+/151.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K4 &EFS+/151.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-171K3 &EFS+/171.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-171K3 &EFS+/171.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-173K3 &EFS+/173.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-173K3 &EFS+/173.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-181Q1 &EFS+/181.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-181Q1 &EFS+/181.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q1 &EFS+/181.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-181Q2 &EFS+/181.3	1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671	
-181Q2 &EFS+/181.3	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q2 &EFS+/181.3	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-182Q1 &EFS+/182.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-182Q1 &EFS+/182.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-182Q1 &EFS+/182.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-183F1 &EFS+/183.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	X
-183F1 &EFS+/183.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-183F1 &EFS+/183.1	1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364	X
-183F1 &EFS+/183.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	X
-183F2 &EFS+/183.3	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-183F2 &EFS+/183.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185B1 &EFS+/185.6	1	Thermostat NC contact, -10 to 50 °C	8MR2170-1CA	Siemens	500816	X
-185F1 &EFS+/185.1	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-185F1 &EFS+/185.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185F2 &EFS+/185.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	X
-185F2 &EFS+/185.7	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-186B1 &EFS+/186.6	1	Thermostat NO contact, -10 to 50 °C	8MR2170-1CB	Siemens	501577	X
-186K1 &EFS+/186.6	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-187F1 &EFS+/187.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C13	5SY4113-7	Siemens	504323	X
-187F1 &EFS+/187.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-187F2 &EFS+/187.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-189K1 &EFS+/189.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-190F1 &EFS+/190.1	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F1 &EFS+/190.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-190F1 &EFS+/190.1	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F2 &EFS+/190.3	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F2 &EFS+/190.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F2 &EFS+/190.3	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F3 &EFS+/190.5	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F3 &EFS+/190.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F3 &EFS+/190.5	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190X10 &EFS+/190.9	1	5TE6 REG Socket Outlets, 16 A	5TE6800	Siemens	503215	X
-190XT1 &EFS+/190.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-190XT1 &EFS+/190.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-190XT1 &EFS+/190.1;&EFS+/190.5	3	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-191F1 &EFS+/191.1	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F1 &EFS+/191.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191F2 &EFS+/191.3	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F2 &EFS+/191.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191XT1 &EFS+/191.1;&EFS+/191.3	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-191XT1 &EFS+/191.1	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-191XT1 &EFS+/191.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-195K1 &EFS+/195.3	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K1 &EFS+/195.3	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K2 &EFS+/195.4	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K2 &EFS+/195.4	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K3 &EFS+/195.1	1	SIRIUS SAFETY RELAY STD RELAY 3NO+1NC	3SK1111-2AB30	Siemens	501260	X
-AI_01 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_01 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-AI_02 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_02 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_03 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_03 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_04 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_04 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_01 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_01 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X

previous page: 7

next page: 9

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-DI_02 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_02 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_03 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_03 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_04 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_04 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_05 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_05 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_06 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_06 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_01 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_01 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-DO_02 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_02 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_03 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_03 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_04 &EFS+/120.6	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_04 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-X1 &EFS+/181.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X1 &EFS+/181.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-X1 &EFS+/181.1;&EFS+/181.3;&EFS+/181.4;&EFS+/182.1;&EFS+/182.3;&EFS+/182.4	12	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-X1 &EFS+/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-X1 &EFS+/181.1;&EFS+/181.4;&EFS+/182.1;&EFS+/182.4	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-X3 &EFS+/127.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3 &EFS+/127.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.10 &EFS+/129.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0;&EFS+/129.2;&EFS+/129.4;&EFS+/129.6;&EFS+/129.8;&EFS+/129.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.10 &EFS+/129.0;&EFS+/129.4;&EFS+/129.6;&EFS+/129.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.11 &EFS+/130.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.11 &EFS+/130.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.11 &EFS+/130.0;&EFS+/130.2;&EFS+/130.4;&EFS+/130.6;&EFS+/130.8;&EFS+/130.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.11 &EFS+/130.0;&EFS+/130.4;&EFS+/130.6;&EFS+/130.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.12 &EFS+/131.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.12 &EFS+/131.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.12 &EFS+/131.0;&EFS+/131.2;&EFS+/131.4;&EFS+/131.6;&EFS+/131.8;&EFS+/131.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.12 &EFS+/131.0;&EFS+/131.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.13 &EFS+/132.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X3.13 &EFS+/132.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.13 &EFS+/132.0;&EFS+/132.2;&EFS+/132.4;&EFS+/132.6;&EFS+/132.8;&EFS+/132.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.13 &EFS+/132.0;&EFS+/132.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3	21	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3 &EFS+/127.1;&EFS+/127.5;&EFS+/128.3;&EFS+/188.1	5	Plug-in bridge FBS 2-3,5	3213014	Phoenix Contact	500802	X
-X5 &EFS+/145.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X5 &EFS+/145.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-X5.1 &EFS+/149.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0;&EFS+/149.2	2	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-X5.1 &EFS+/149.0	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-X5	15	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-XDC1 &EFS+/103.1	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC1 &EFS+/103.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC1 &EFS+/103.2;&EFS+/103.3	7	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC1 &EFS+/103.2	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	X
-XDC1 &EFS+/103.3	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	X
-XDC1 &EFS+/103.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XDC2 &EFS+/103.3	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X

previous page: 10

next page: 12

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC2 &EFS+/103.3	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC2 &EFS+/103.4;&EFS+/103.5	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC2 &EFS+/103.4;&EFS+/103.5	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC3 &EFS+/103.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC3 &EFS+/103.5	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC3 &EFS+/103.6;&EFS+/103.7	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC3 &EFS+/103.6;&EFS+/103.7	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC4 &EFS+/103.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC4 &EFS+/103.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC4 &EFS+/103.8;&EFS+/103.9	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC4 &EFS+/103.8;&EFS+/103.9	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC5.1 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.1 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.1 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC5.2 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.2 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.2 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XE &EFS+/84.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-XE &EFS+/84.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XE &EFS+/84.0;&EFS+/84.1	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XE &EFS+/84.0;&EFS+/84.1	3	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	X
-XE &EFS+/84.1;&EFS+/84.2	4	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-XE &EFS+/84.1	1	Plug-in bridge FBS 3-8	3030297	Phoenix Contact	501568	X
-XE &EFS+/84.2;&EFS+/84.3	3	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-XT &EFS+/183.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XT &EFS+/183.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XT &EFS+/183.1;&EFS+/183.2;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2;&EFS+/187.4;&EFS+/187.5	8	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-XT &EFS+/183.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XT &EFS+/187.4	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XT &EFS+/183.1;&EFS+/183.4;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2	6	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XV &EFS+/171.8	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-XV &EFS+/171.8	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Base terminal for component connector	3210185	Phoenix Contact	500828	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Component plug terminal block	3036796	Phoenix Contact	500533	X
-XV &EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	8	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	X
-XV &EFS+/171.8	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XV &EFS+/134.5	1	Diode ZY12 - zener diode, DO-41, plastic, 12V, 2W	17060488	Distrelec Schuricht GmbH	500556	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-85U1 &EFS+/85.0	1	Power Bridge Rectifiers SKD 30/16A1, Vrrm = 1600V, Id = 30A	07122150	Semikron	501556	X
-85U10 &EFS+/85.0	1	EMI Filter X2 Y1 Version 2	505722	Freqcon GmbH	505722	X
-85U11 &EFS+/85.1	1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702	
-149U1 &EFS+/149.5	1	Interface module	2959609	Phoenix Contact	501595	X
-171F1 &EFS+/171.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-171F1 &EFS+/171.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-171K1 &EFS+/171.7	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171K2 &EFS+/171.8	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171R1 &EFS+/171.1	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-171R2 &EFS+/171.2	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-173F2 &EFS+/173.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F2 &EFS+/173.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-173F3 &EFS+/173.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F3 &EFS+/173.4	2	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-173K1 &EFS+/173.8	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173K2 &EFS+/173.9	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173R1 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R2 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R3 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X

previous page:
+.3/13

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R4 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-189X1 &EFS+/189.4	9	Measuring transformer disconnect terminal	3035696	Phoenix Contact	54498	X
-189X1 &EFS+/189.4	9	Test adapter - PAIS-4-FIX GY	3032791	Phoenix Contact	501482	X
-189X1 &EFS+/189.4	1	End cover D-DTME 6	3034426	Phoenix Contact	505468	X
-189X1 &EFS+/189.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-306K1 &EFS+/306.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K1 &EFS+/306.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K2 &EFS+/306.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K2 &EFS+/306.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K3 &EFS+/306.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K3 &EFS+/306.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K4 &EFS+/306.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K4 &EFS+/306.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K5 &EFS+/306.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K5 &EFS+/306.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K6 &EFS+/306.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K6 &EFS+/306.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K1 &EFS+/307.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K1 &EFS+/307.1	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-307K2 &EFS+/307.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K2 &EFS+/307.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K3 &EFS+/307.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K3 &EFS+/307.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K4 &EFS+/307.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K4 &EFS+/307.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K5 &EFS+/307.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K5 &EFS+/307.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K6 &EFS+/307.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K6 &EFS+/307.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K1 &EFS+/308.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K1 &EFS+/308.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K2 &EFS+/308.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K2 &EFS+/308.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K3 &EFS+/308.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K3 &EFS+/308.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K4 &EFS+/308.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K4 &EFS+/308.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K5 &EFS+/308.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-308K5 &EFS+/308.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K6 &EFS+/308.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K6 &EFS+/308.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K1 &EFS+/350.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K1 &EFS+/350.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K2 &EFS+/350.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K2 &EFS+/350.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350X1.21 &EFS+/350.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	
-350X1.21 &EFS+/350.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-350X1.21 &EFS+/350.1&EFS+/350.2&EFS+/350.4&EFS+/351.1&EFS+/351.3&EFS+/351.4&EFS+/352.1&EFS+/352.3&EFS+/353.1&EFS+/353.4&EFS+/352.4	9	Multi-level terminal block	3208511	Phoenix Contact	500560	
-350X1.21 &EFS+/352.1	0					
-351K1 &EFS+/351.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K1 &EFS+/351.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K2 &EFS+/351.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K2 &EFS+/351.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K3 &EFS+/351.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K3 &EFS+/351.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-351K4 &EFS+/351.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K4 &EFS+/351.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

previous page: 3

next page: 5

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-352K1 &EFS+/352.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K1 &EFS+/352.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-352K2 &EFS+/352.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K2 &EFS+/352.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K1 &EFS+/353.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K1 &EFS+/353.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K2 &EFS+/353.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K2 &EFS+/353.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K3 &EFS+/353.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K3 &EFS+/353.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K4 &EFS+/353.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K4 &EFS+/353.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-XE2 &EFS+/173.1	0					
-XE2 &EFS+/173.2...&EFS+/173.5	11	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Base terminal for component connector	3210185	Phoenix Contact	500828	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Component plug terminal block	3036796	Phoenix Contact	500533	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B1 &EFS+/147.5	1	Temperature sensor PT100, cable 1.5m, PVC	1101-6030-1211-110	S+S Regeltechnik GmbH	501787	X
-190H1 &EFS+/190.5	1	LED system light, Without socket, Length: 337 mm, Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500110	Rittal	10007	X
-190H1 &EFS+/190.5	1	Infeed, 2-pole (with socket, without connector), Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500420	Rittal	10009	X
-190H1 &EFS+/190.5	1	Door-Operated Switch, Input voltage: 230 V AC, 24 V DC, - 240 V, 1~, 50 Hz/60 Hz,	2500460	Rittal	500736	X

previous page:
+.4/5

next page:
+CTRL_1/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-20BG1 &EFS+/100.2	1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550	
-20BG1-X &EFS+/100.2	55	End bracket for terminal block	3022276	Phoenix Contact	500588	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-149X1 &EFS+/161.4...&EFS+/161.8	6	Feed-through terminal block Push-in PT 4	3211757	Phoenix Contact	500582	X
-149X1 &EFS+/161.4	1	End cover D-ST 4	3030420	Phoenix Contact	500502	
-149X1 &EFS+/161.4	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-149X1 &EFS+/161.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-160U1 &EFS+/160.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-161U1 &EFS+/161.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-162U1 &EFS+/162.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-163U1 &EFS+/163.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-164U1 &EFS+/164.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-240U1 &EFS+/440.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-240U1 &EFS+/440.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-240U1 &EFS+/440.1	1	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-241U1 &EFS+/441.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-241U1 &EFS+/441.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-241U1 &EFS+/441.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-242U1 &EFS+/442.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-242U1 &EFS+/442.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-242U1 &EFS+/442.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-243U1 &EFS+/443.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-243U1 &EFS+/443.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-243U1 &EFS+/443.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-278M2 &EFS+/278.3	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
1

next page:
+CTRL.4/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R5 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R6 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R7 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R8 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	

previous page:
+CTRL_2.1/2

next page:
++FAN+/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-52G1 &EFS++CT/181.0;&EFS++CT/181.7	0					
-52G1-148B1 &EFS++CT/148.1	1	Temperature sensor PT100, cable 3m, PVC	1101-6030-1231-110	S+S Regeltechnik GmbH	501575	X
-52G1-181M1 &EFS++CT/181.1	1	Pump CM10-2, 3x380V-415V, 50Hz, 1,27 kW, 2,85-2,9 A, 2.950 - 2.960 rpm / 440V-480V, 60Hz, 2,2 kW, 4,0-3,7A, 3.520-3.530 rpm	99080211	GRUNDFOS GmbH	501409	X
-52G1-181R1 &EFS++CT/181.3	1	Screw-in heater SEHK, 3kW, 400V	106066	Siekerkotte GmbH & Co. KG	500620	X
-52G1-181S1 &EFS++CT/181.7	0					
-52G1-181X1 &EFS++CT/181.0	0					
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.3;&EFS++CT/181.4;&EFS++CT/182.1	9	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-52G1-181X1 &EFS++CT/181.3	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-52G1-181X1 &EFS++CT/181.3	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X1 &EFS++CT/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.4;&EFS++CT/182.1	3	Ground terminal block	3209536	Phoenix Contact	500813	X
-52G1-181X3 &EFS++CT/148.1;&EFS++CT/181.7	2	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-52G1-181X3 &EFS++CT/181.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-52G1-181X3 &EFS++CT/181.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X3 &EFS++CT/181.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-52G1-182M1 &EFS++CT/182.1	1	Heat exchanger 40kW cooling capacity, alluminium, 1,72kW, 3,86A, 400V	FR6555950001	Bondioli & Pavesi S.p.A.	500850	X

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153
1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555

Editor	Freqcon_DG			Statron	FREQCON	SUMMARIZED PARTS LIST	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EPA	Summarized part list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070
9	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604
1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524
3	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867
3	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872
3	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882
1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918
1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955
3	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046
3	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053
1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190
1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290
3	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157
3	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426
3	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449
1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648
1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649
3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055
1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044
1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039
1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172
9	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130
3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545
1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738
3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779

previous page:
1

next page:
++CT/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550
4	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890
1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702
5	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390
1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505
1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475
1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287
4	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805
2	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
2	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
38	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
41	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944
2	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
3	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845
2	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740
1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671

Summarized parts list

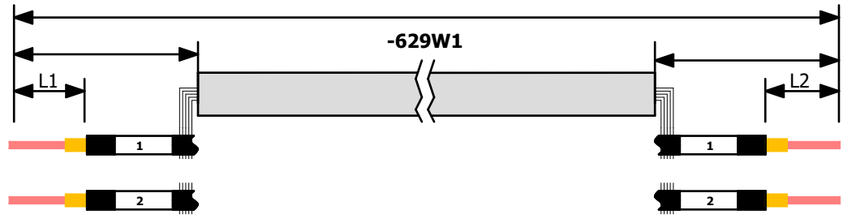
Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797
1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789
2	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
2	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
7	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804
1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt
4	Power Resistor 100W 1% 10K J	160141	Widap AG	501614

0	1	2	3	4	5	6	7	8	9

Cable name =UNIT_01++TRA+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:29	Fuse 230V AC for Container Air Conditioning		
Control cabinet 1	++CT+CTRL_1.3-X3:18	Earthing switch in On Transformer 620V side		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Fuse 230V AC for Container Air Conditioning	++CONV-18Q1:13	
		Earthing switch in On Transformer 620V side	++CONV-18Q1:14	

FRQ_Kabelplan_04_groß_de_en

previous page:
&EPA++CT/2

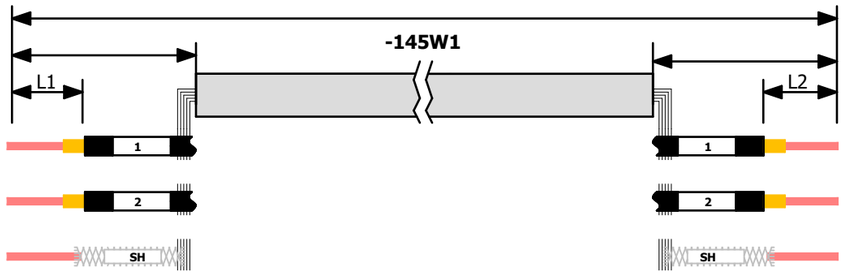
next page:
++CONV/1

Editor	Freqcon_DG			Statron		CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

page: 1
total: 492

Cable name =UNIT_01++CONV+-145W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

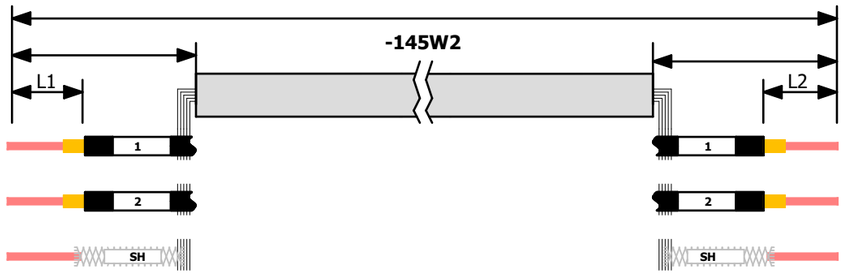


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-201L1:	INDUCTOR GRID PHASE L1 TEMPERATURE 1_1		
Inductor cabinet	+IND-201L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L1	++CT+CTRL_1.3-X5:1	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:2	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

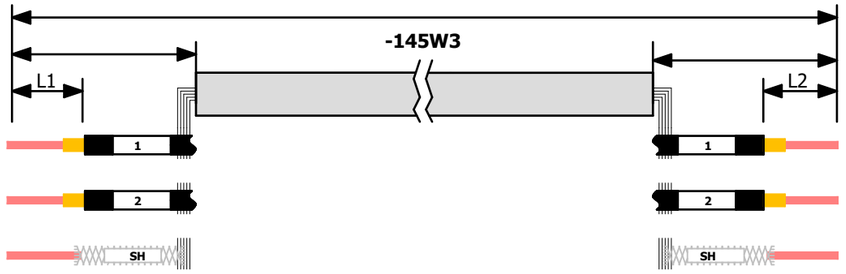


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-202L1:	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2		
Inductor cabinet	+IND-202L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L2	++CT+CTRL_1.3-X5:3	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:4	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

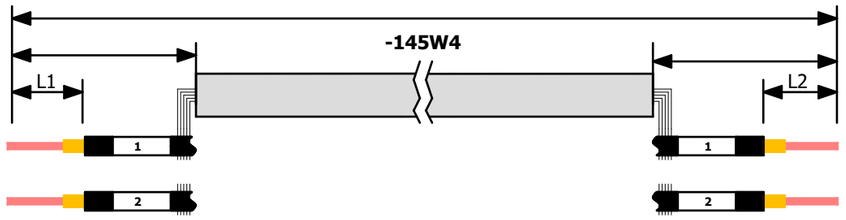


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-203L1:	INDUCTOR GRID PHASE L3 TEMPERATURE 1_3		
Inductor cabinet	+IND-203L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L3	++CT+CTRL_1.3-X5:5	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:6	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.1:	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		
Inductor cabinet	+IND-211L1.1	=		

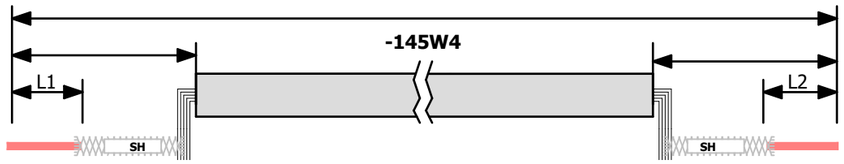
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1	++CT+CTRL_1.3-X5:7	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:8	*Control cabinet 1*

previous page: ++TRA/1
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

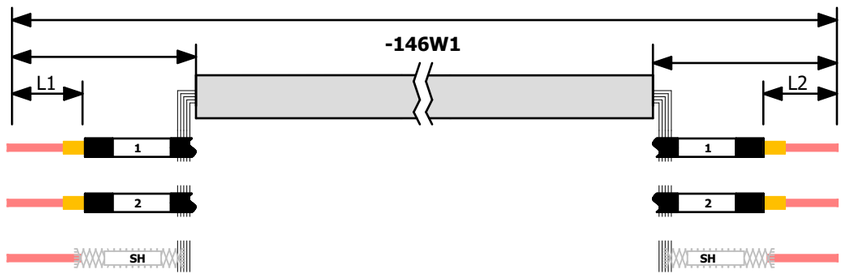


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1		

Cable name =UNIT_01++CONV+-146W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

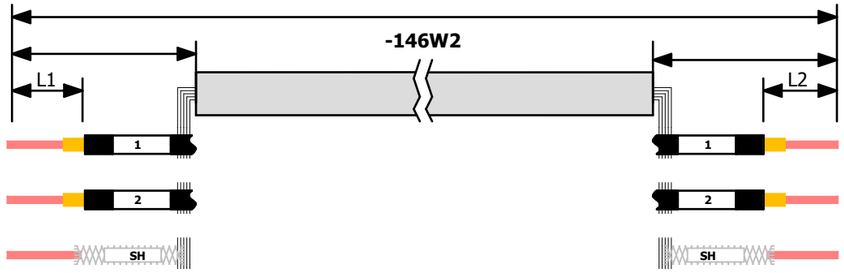


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.2	INDUCTOR DC SUB 2_2 TEMPERATURE 2_2		
Inductor cabinet	+IND-211L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_2	++CT+CTRL_1.3-X5:9	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:10	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3		
Inductor cabinet	+IND-211L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_3	++CT+CTRL_1.3-X5:11	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:12	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.1	INDUCTOR DC SUB 3_1 TEMPERATURE 3_1		
Inductor cabinet	+IND-207L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_1	++CT+CTRL_1.3-X5:13	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:14	***Control cabinet 1***
		=		

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-146W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

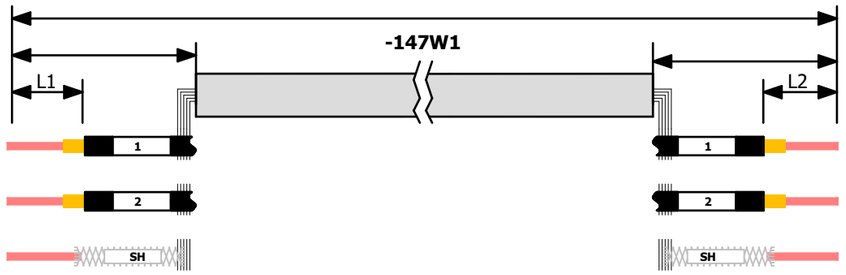


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.2	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2		
Inductor cabinet	+IND-207L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_2	++CT+CTRL_1.3-X5:15	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:16	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-147W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

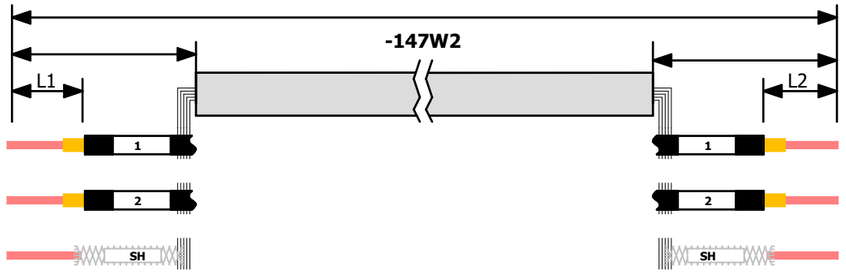


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.3:	INDUCTOR DC SUB 3_3 TEMPERATURE 3_3		
Inductor cabinet	+IND-207L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_3	++CT+CTRL_1.3-X5:17	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:18	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-147W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

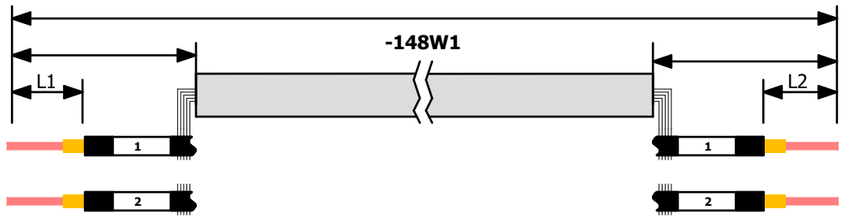


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.1:	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1		
Inductor cabinet	+IND-217L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_1	++CT+CTRL_1.3-X5:19	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:20	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.2:	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		
Inductor cabinet	+IND-217L1.2	=		

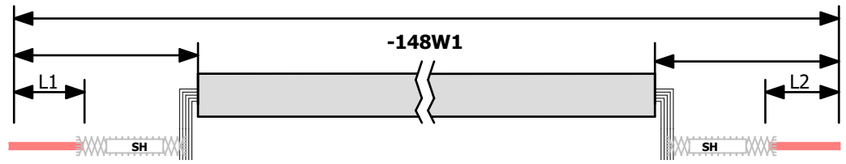
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2	++CT+CTRL_1.3-X5:25	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:26	*Control cabinet 1*

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2		

Cable name =UNIT_01++CONV+-148W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

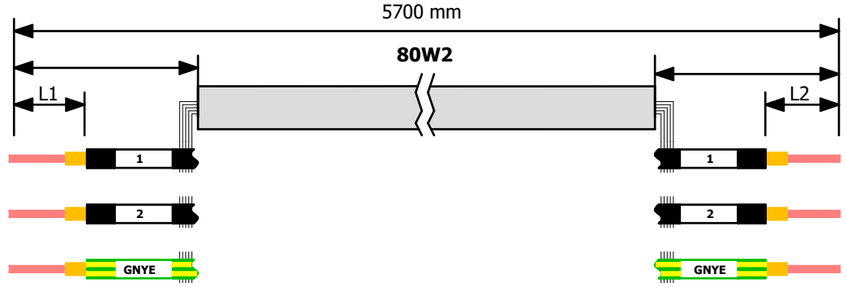


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.3:	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3		
Inductor cabinet	+IND-217L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_3	++CT+CTRL_1.3-X5:29	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:30	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-80W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

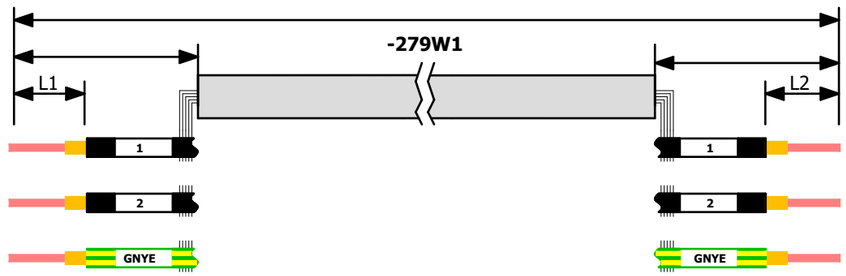


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:9	230V AC for Circuit Breaker 1	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:10	=	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	230V AC for Circuit Breaker 1	+CIR-80Q1:X5_2	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-80Q1:X5_1	***Circuit Breaker cabinet***
		=		

Cable name =UNIT_01++CONV+-279W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:1	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:2	=	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CON-279M1:L	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:N	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:PE	***Converter cabinet***

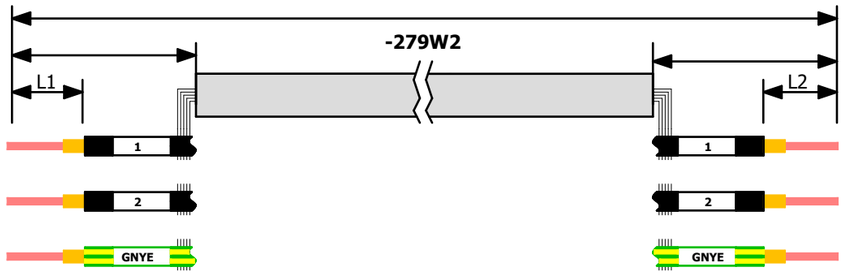
previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M1:L	FAN 1 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M1:N	=	stripped	8 mm
Converter cabinet	+CON-279M1:PE	=	stripped	8 mm

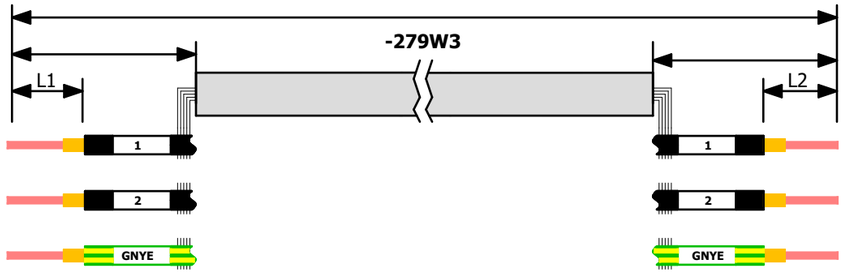


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CONVERTER	+CON-279M2:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M2:1	FAN 2 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M2:2	=	stripped	8 mm
Converter cabinet	+CON-279M2:PE	=	stripped	8 mm

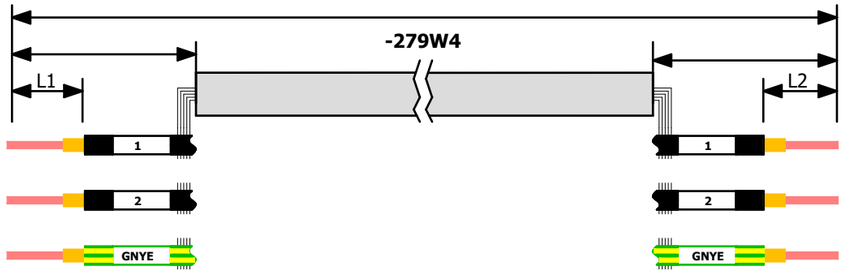


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CONVERTER	+CON-279M3:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W4
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M3:1	FAN 3 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M3:2	=	stripped	8 mm
Converter cabinet	+CON-279M3:PE	=	stripped	8 mm

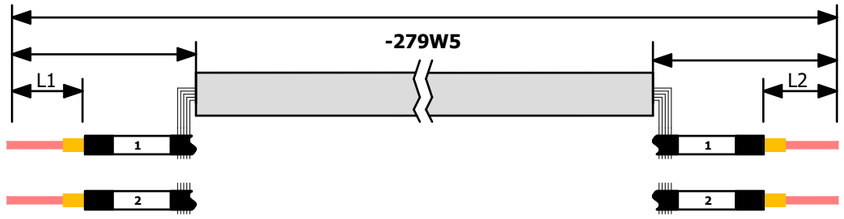


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 3 CONVERTER	+CON-279M4:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:1	FAN 4 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M4:2	=	stripped	8 mm



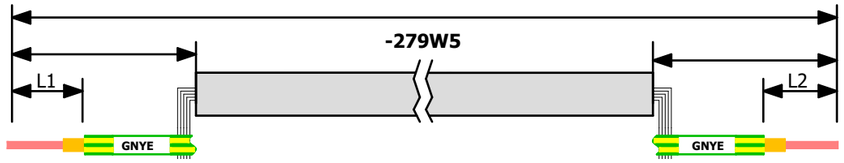
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M5:2	***Converter cabinet***

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

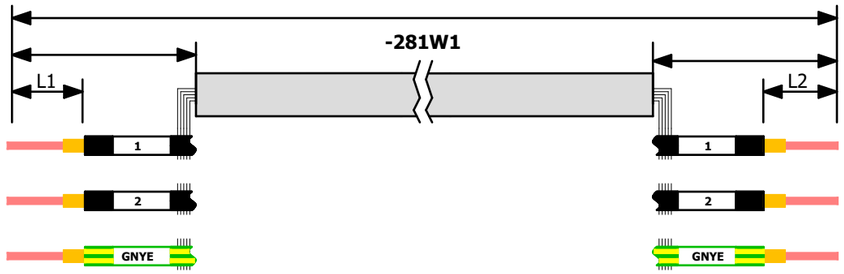


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:PE	FAN 4 CONVERTER	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:PE	*Converter cabinet*

Cable name =UNIT_01++CONV+-281W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:3	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:4	CIR Fans 1-3 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CIR-281M1:L	*Circuit Breaker cabinet*
8 mm	stripped	CIR Fans 1-3	+CIR-281M1:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M1:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

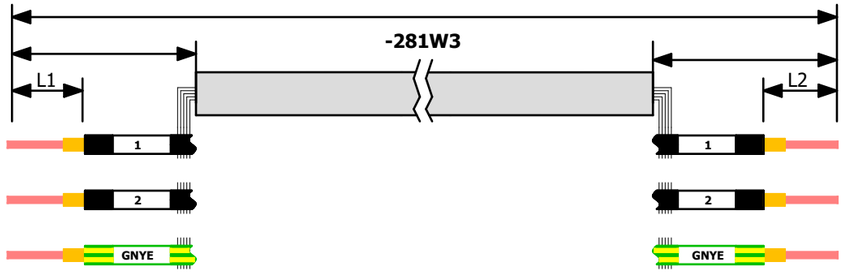


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M1:L	FAN 1 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CIRCUIT BREAKER CABINET	+CIR-281M2:L	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M2:L	FAN 2 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:PE	=	stripped	8 mm

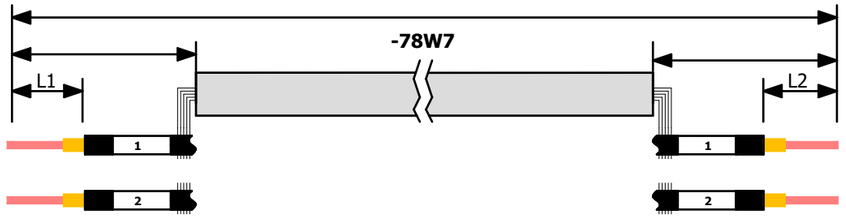
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CIRCUIT BREAKER CABINET	+CIR-281M3:1	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:2	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:PE	*Circuit Breaker cabinet*

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-78W7
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

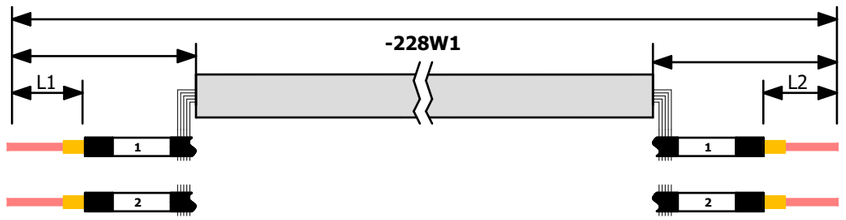


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:20			
AC and DC connection cabinet	+AC_DC-X3.43:19			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+AC_DC-78F1:13	AC and DC connection cabinet
			+AC_DC-78F1:14	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:7	SURGE ARRESTER DC SUBSYSTEM 3_1		
AC and DC connection cabinet	+AC_DC-X3.43:8	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_1	+AC_DC-228F1:11	AC and DC connection cabinet
		=	+AC_DC-228F1:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

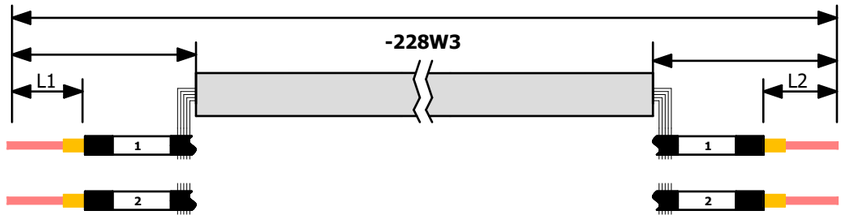


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:9	SURGE ARRESTER DC SUBSYSTEM 3_2		
AC and DC connection cabinet	+AC_DC-X3.43:10	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_2	+AC_DC-228F2:11	AC and DC connection cabinet
		=	+AC_DC-228F2:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:11	SURGE ARRESTER DC SUBSYSTEM 3_3		
AC and DC connection cabinet	+AC_DC-X3.43:12	=		

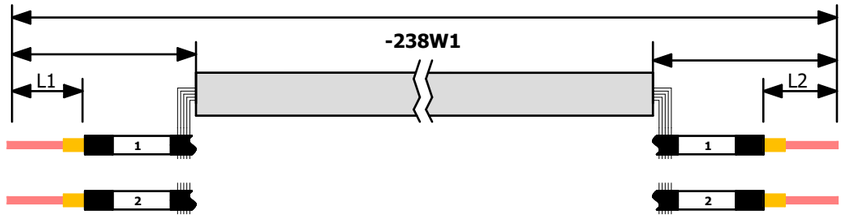
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_3	+AC_DC-228F3:11	AC and DC connection cabinet
		=	+AC_DC-228F3:12	AC and DC connection cabinet

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

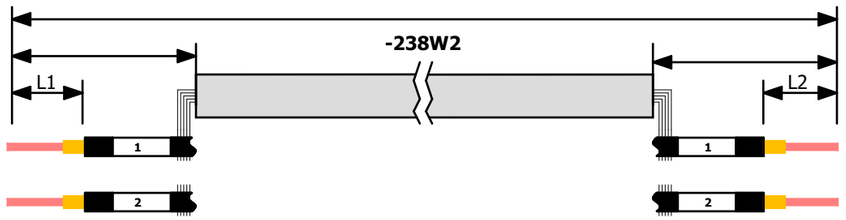


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1		
AC and DC connection cabinet	+AC_DC-X3.43:2	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_1	+AC_DC-238F1:11	***AC and DC connection cabinet***
		=	+AC_DC-238F1:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

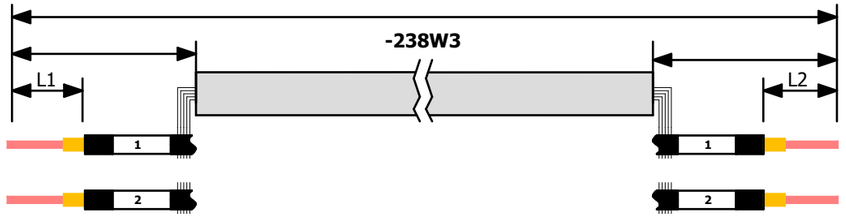


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:3	SURGE ARRESTER DC SUBSYSTEM 2_2		
AC and DC connection cabinet	+AC_DC-X3.43:4	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_2	+AC_DC-238F2:11	***AC and DC connection cabinet***
		=	+AC_DC-238F2:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

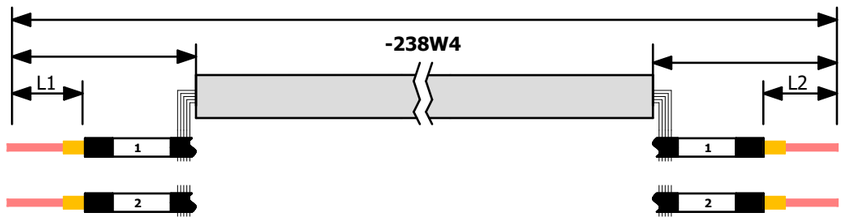


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:5	SURGE ARRESTER DC SUBSYSTEM 2_3		
AC and DC connection cabinet	+AC_DC-X3.43:6	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_3	+AC_DC-238F3:11	***AC and DC connection cabinet***
		=	+AC_DC-238F3:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W4
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:13	SURGE ARRESTER DC SUBSYSTEM 4_1		
AC and DC connection cabinet	+AC_DC-X3.43:14	=		

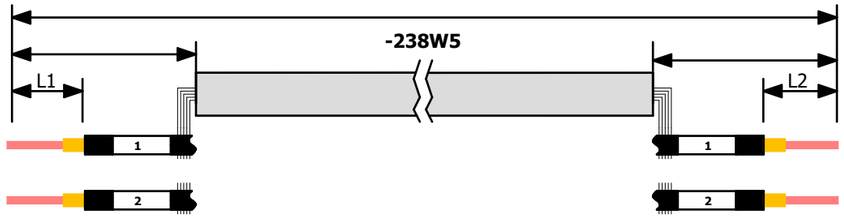
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_1	+AC_DC-238F4:11	***AC and DC connection cabinet***
		=	+AC_DC-238F4:12	***AC and DC connection cabinet***

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W5
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

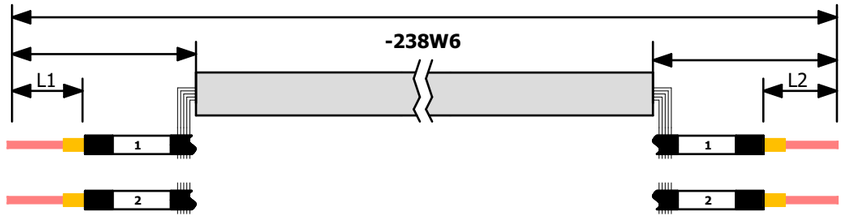


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:15	SURGE ARRESTER DC SUBSYSTEM 4_2		
AC and DC connection cabinet	+AC_DC-X3.43:16	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_2	+AC_DC-238F5:11	***AC and DC connection cabinet***
		=	+AC_DC-238F5:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W6
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

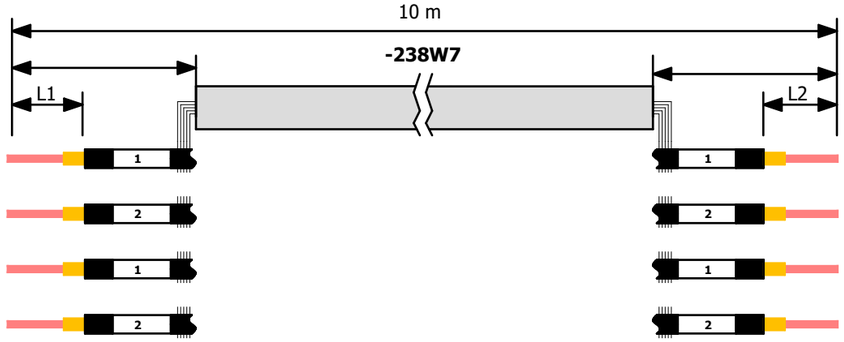


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:17	SURGE ARRESTER DC SUBSYSTEM 4_3		
AC and DC connection cabinet	+AC_DC-X3.43:18	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_3	+AC_DC-238F6:11	***AC and DC connection cabinet***
		=	+AC_DC-238F6:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W7
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030;10030

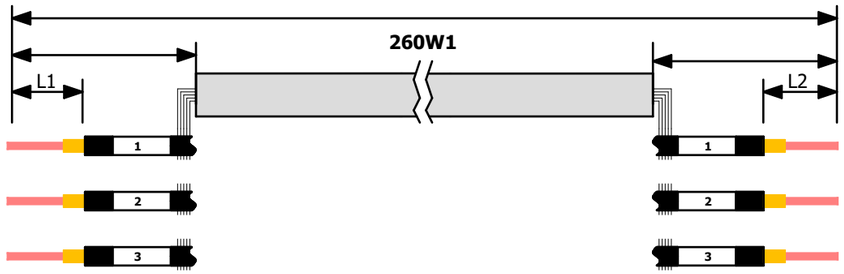


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1	stripped	7mm
AC and DC connection cabinet	+AC_DC-X3.43:20		stripped	7mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8mm	stripped	SURGE ARRESTER DC SUBSYSTEM 2_1	++CT+CTRL_1.3-X3:5	***Control cabinet 1***
8mm	stripped		++CT+CTRL_1.3-X3:6	***Control cabinet 1***

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors 3

Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:19	Smoke detector CON		
Control cabinet 1	++CT+CTRL_1.3-X3:20	=		
Control cabinet 1	++CT+CTRL_1.3-X3:21	=		

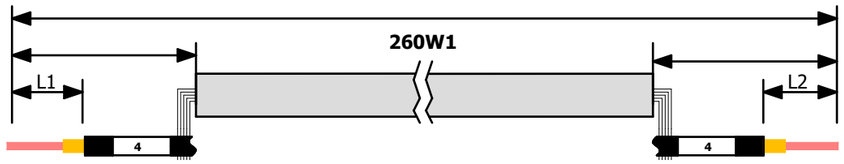
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Smoke detector CON	+CON-260B1:4	***Converter cabinet***
		=	+CON-260B1:2	***Converter cabinet***
		=	+CON-260B1:5	***Converter cabinet***

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors

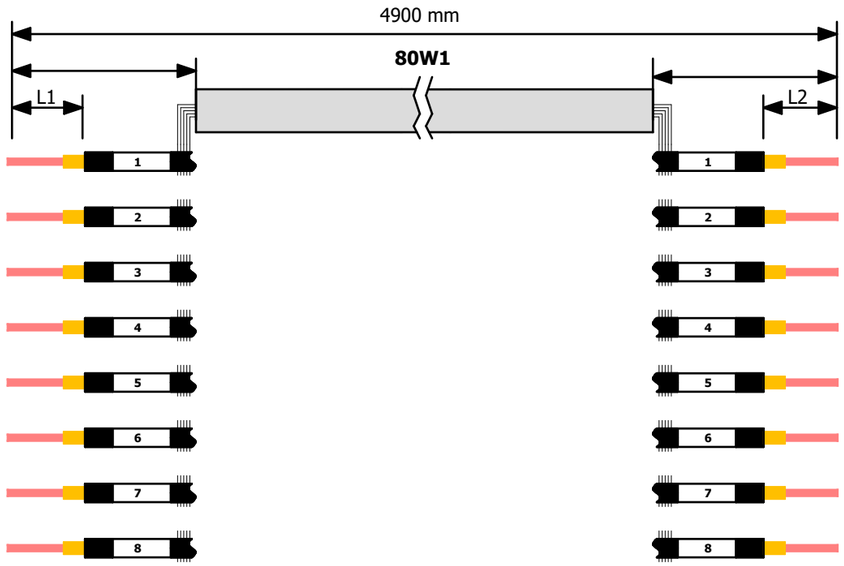
Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:22	Smoke detector CON					Smoke detector CON	+CON-260B1:6	*Converter cabinet*

Cable name =UNIT_01++CONV+-80W1
Cable type OZ-500 8x0,75 mm²
Free conductors

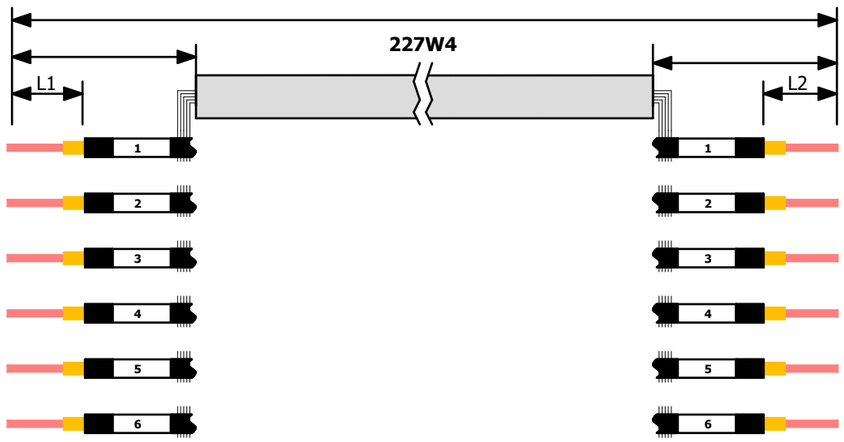
Cable parts HELU.10173
Order number 10173



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:1	CB 1 Tripped GRID	stripped	8 mm	8 mm	stripped	CB 1 Tripped GRID	+CIR-80Q1:X7_13	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:2	CB 1 OFF GRID	stripped	8 mm	8 mm	stripped	CB 1 OFF GRID	+CIR-80Q1:X6_9	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:3	CB 1 ON GRID	stripped	8 mm	8 mm	stripped	CB 1 ON GRID	+CIR-80Q1:X6_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:31	CB 1 GRID +24V	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_12	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:32	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:35	CB 2 ISLAND GRID +24V OPTIONAL	stripped	8 mm	8 mm	stripped	CB 2 ISLAND GRID	+CIR-80Q1:X6_7	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:36	CB 1 GRID	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_14	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:37	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_12	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



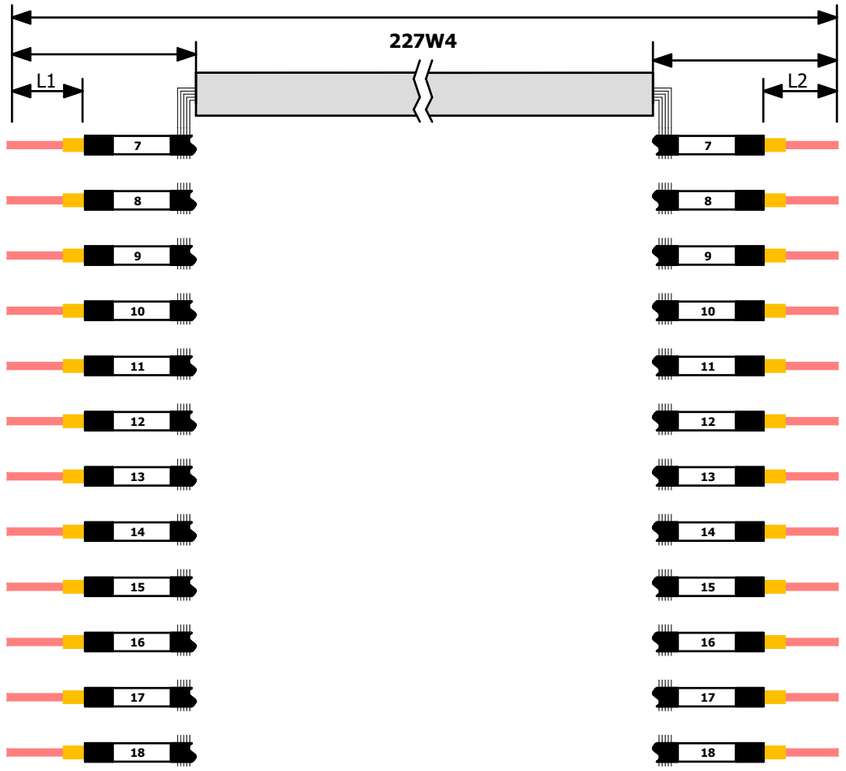
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:1	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:4	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:7	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:3	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:6	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:9	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EMB Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 10
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

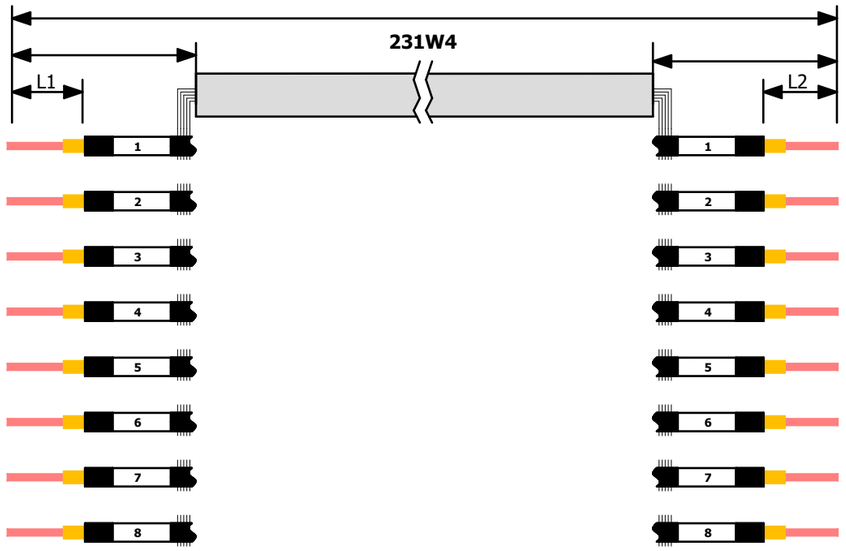
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K3:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

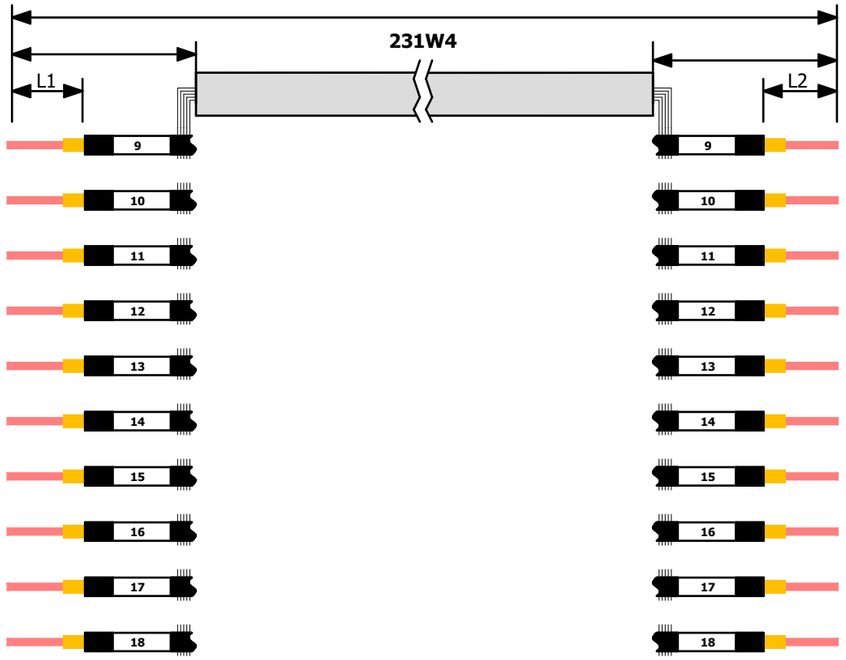


Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:4	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:7	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:3	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:6	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K3:A1	***Control cabinet 1***

previous page: 10
next page: 12

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

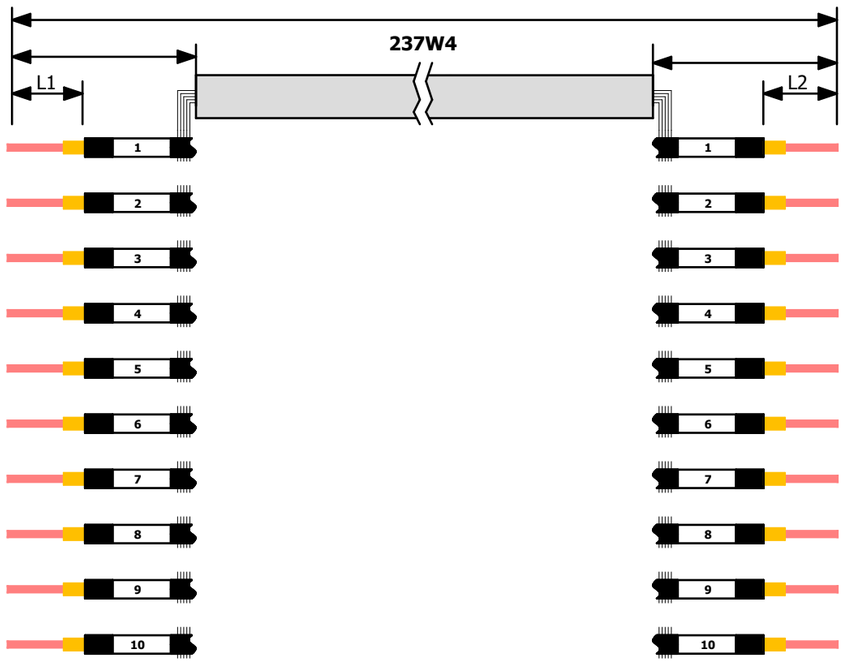
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



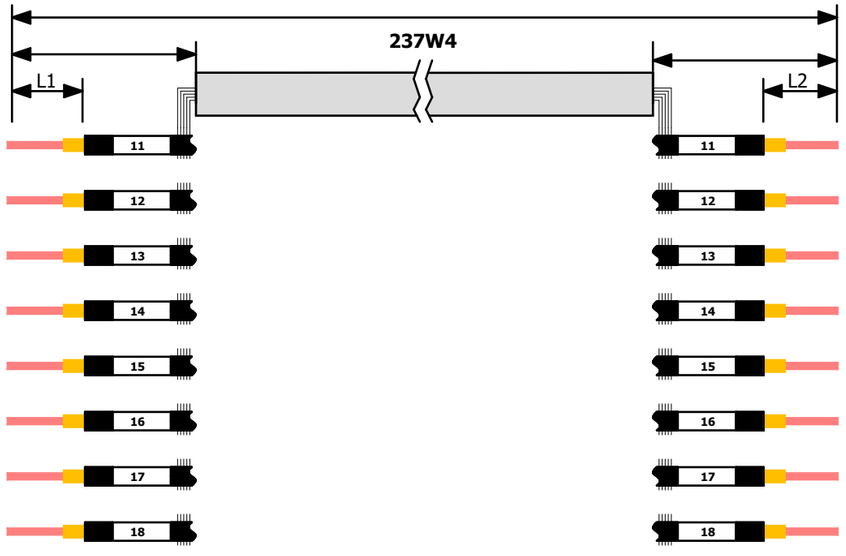
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-237U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:14	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:17	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:13	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:16	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:19	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K3:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K2:A1	***Control cabinet 1***

previous page: 11
next page: 13

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-X3.1:11		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:12		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:13		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:14		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:15		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:16		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:17		stripped	8 mm
			stripped	8 mm

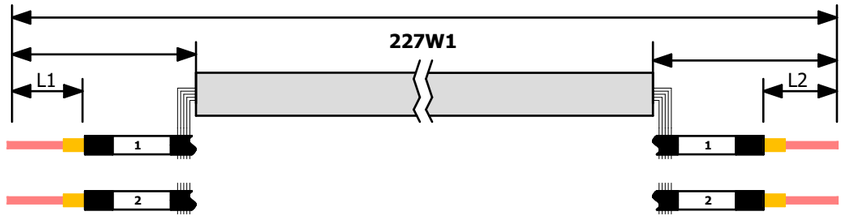


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped		++CT+CTRL_1.4-308K4:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-308K6:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:8	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:9	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:11	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:10	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-350X1.21:12	*Control cabinet 1*
8 mm	stripped			

Cable name =UNIT_01++CONV+-227W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F3:1			
Circuit Breaker cabinet	+CIR-227U1-F4:1			

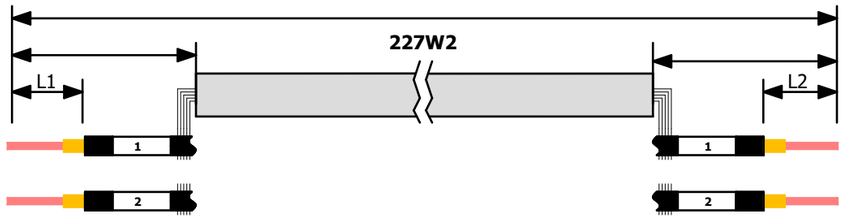


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:32	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-227W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F7:1			
Circuit Breaker cabinet	+CIR-227U1-F8:1			



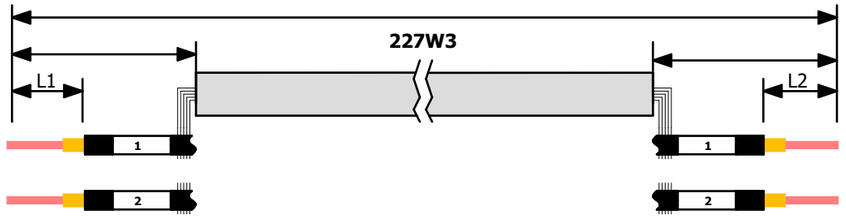
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:36	*Control cabinet 2*

previous page: 12
next page: 14

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-227W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

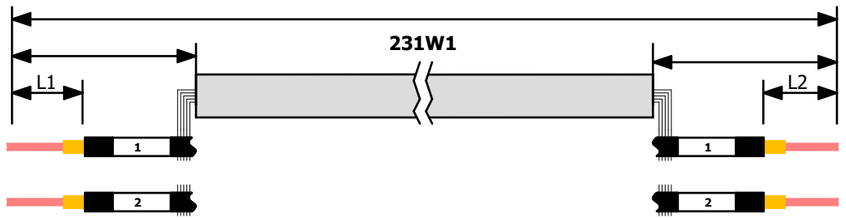


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F11:1			
Circuit Breaker cabinet	+CIR-227U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:40	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

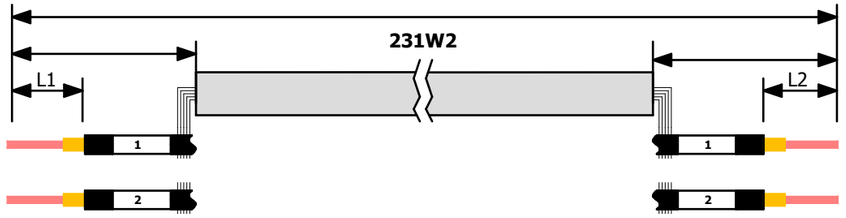


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F3:1			
Circuit Breaker cabinet	+CIR-231U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:19	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

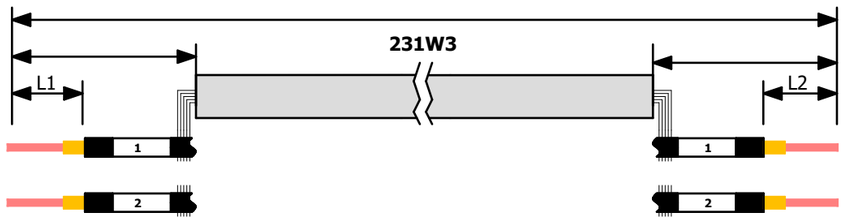


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F7:1			
Circuit Breaker cabinet	+CIR-231U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:23	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F11:1			
Circuit Breaker cabinet	+CIR-231U1-F12:1			

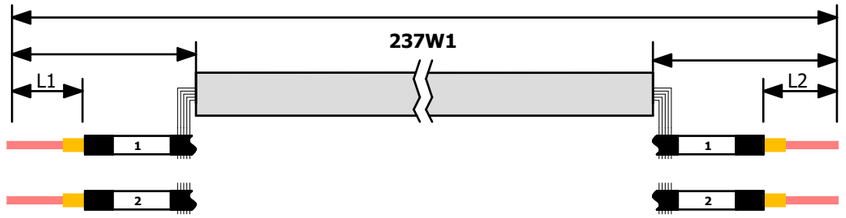
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:27	*Control cabinet 2*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 14
Date								+		total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-237W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

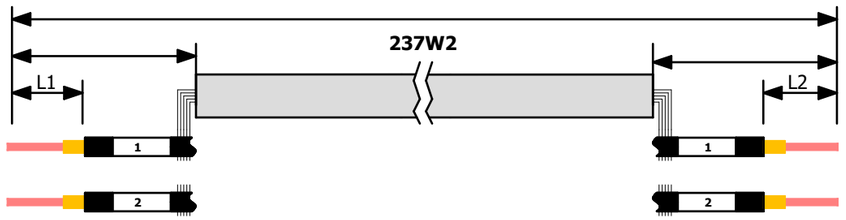


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F3:1			
Circuit Breaker cabinet	+CIR-237U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

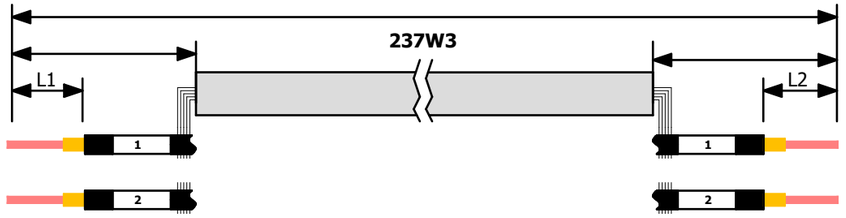


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F7:1			
Circuit Breaker cabinet	+CIR-237U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

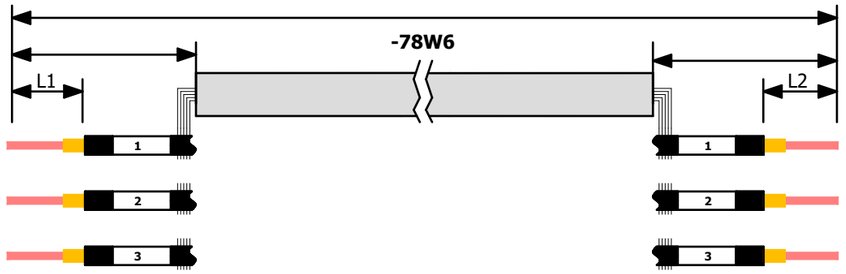


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F11:1			
Circuit Breaker cabinet	+CIR-237U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-78W6
Cable type OZ-600 3x2,5 mm²
Free conductors

Cable parts HELU.10691
Order number 10691



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-78F3:2			
AC and DC connection cabinet	+AC_DC-78F3:4			
AC and DC connection cabinet	+AC_DC-78F3:6			

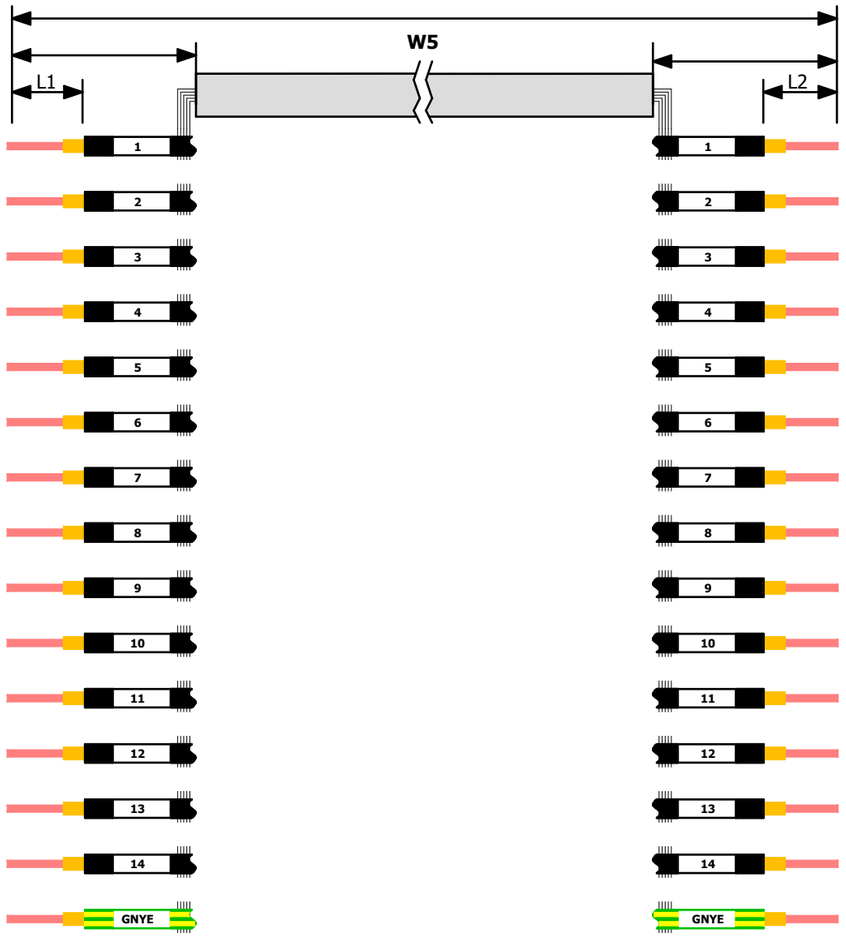
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_1.4-85U1:L1	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L2	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L3	*Control cabinet 1*

previous page: 14
next page: +CIR/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-227U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

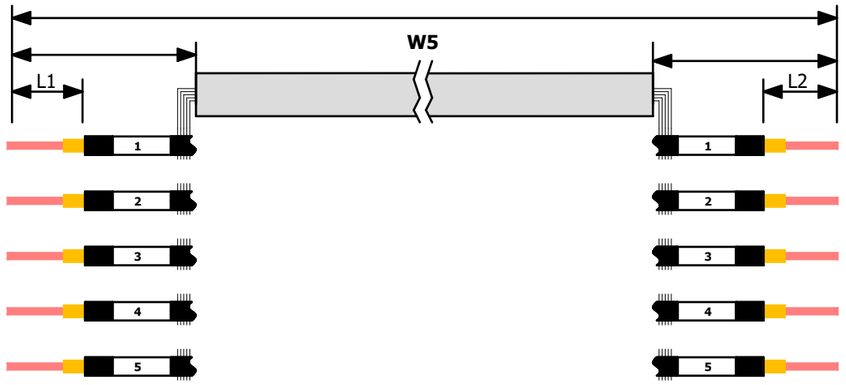
Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-227U1-X3.1:1							-227U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:2							-227U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:3							-227U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:4							-227U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:5							-227U1-X3.2:9	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:6							-227U1-X3.2:11	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:7							-227U1-X3.2:13	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:8							-227U1-X3.2:15	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:9							-227U1-X3.2:17	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:10							-227U1-X3.2:19	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:11							-227U1-X3.2:21	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:12							-227U1-X3.2:23	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:16							-227U1-X3.2:24	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:17							-227U1-X3.2:12	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:PE							-227U1-X3.2:PE	Circuit Breaker cabinet

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-231U1-X3.1:1							-231U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:2							-231U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:3							-231U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:4							-231U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:5							-231U1-X3.2:9	Circuit Breaker cabinet

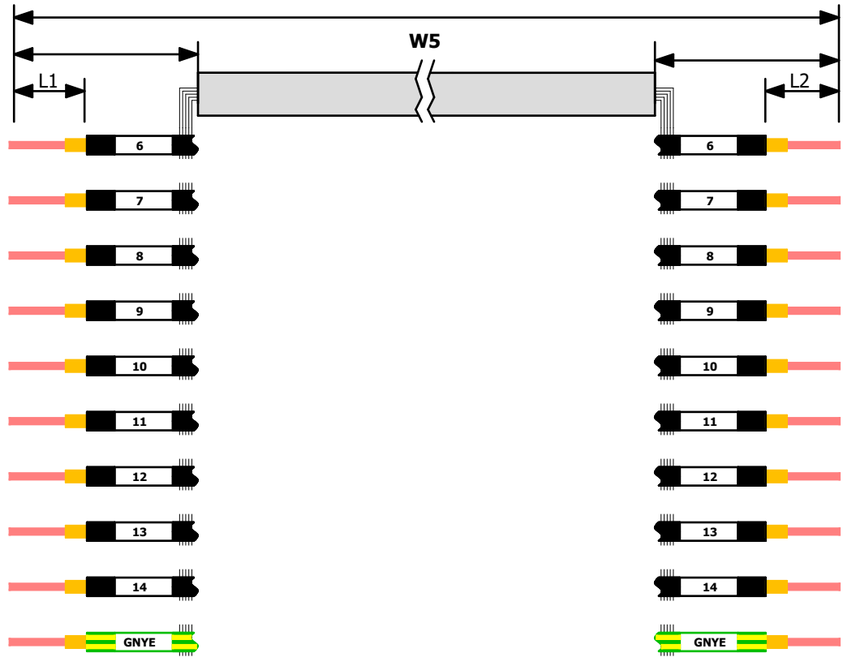
previous page: +/15
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-231U1-X3.1:6			
Circuit Breaker cabinet	-231U1-X3.1:7			
Circuit Breaker cabinet	-231U1-X3.1:8			
Circuit Breaker cabinet	-231U1-X3.1:9			
Circuit Breaker cabinet	-231U1-X3.1:10			
Circuit Breaker cabinet	-231U1-X3.1:11			
Circuit Breaker cabinet	-231U1-X3.1:12			
Circuit Breaker cabinet	-231U1-X3.1:16			
Circuit Breaker cabinet	-231U1-X3.1:17			
Circuit Breaker cabinet	-231U1-X3.1:PE			

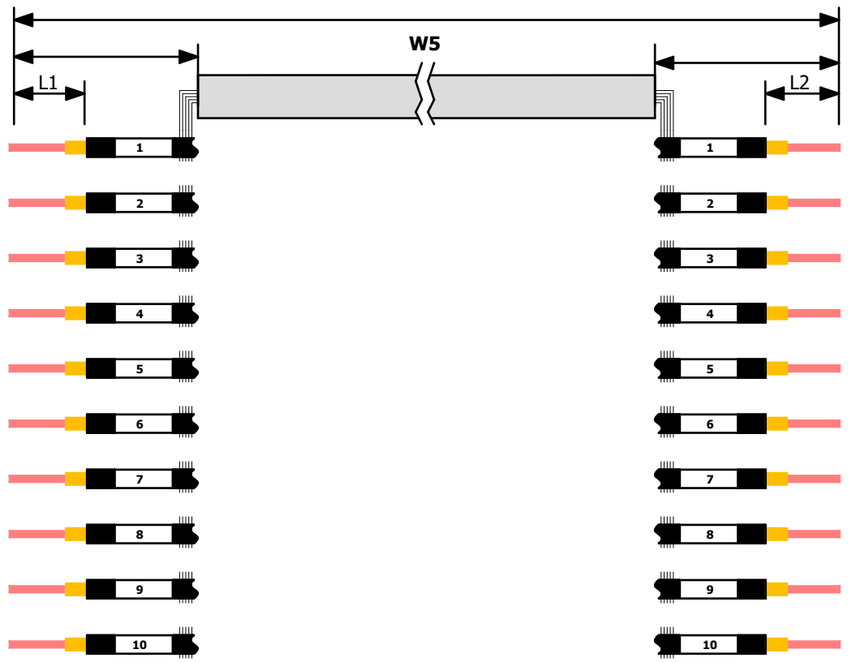


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-231U1-X3.2:11	*Circuit Breaker cabinet*
			-231U1-X3.2:13	*Circuit Breaker cabinet*
			-231U1-X3.2:15	*Circuit Breaker cabinet*
			-231U1-X3.2:17	*Circuit Breaker cabinet*
			-231U1-X3.2:19	*Circuit Breaker cabinet*
			-231U1-X3.2:21	*Circuit Breaker cabinet*
			-231U1-X3.2:23	*Circuit Breaker cabinet*
			-231U1-X3.2:24	*Circuit Breaker cabinet*
			-231U1-X3.2:12	*Circuit Breaker cabinet*
			-231U1-X3.2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:1			
Circuit Breaker cabinet	-237U1-X3.1:2			
Circuit Breaker cabinet	-237U1-X3.1:3			
Circuit Breaker cabinet	-237U1-X3.1:4			
Circuit Breaker cabinet	-237U1-X3.1:5			
Circuit Breaker cabinet	-237U1-X3.1:6			
Circuit Breaker cabinet	-237U1-X3.1:7			
Circuit Breaker cabinet	-237U1-X3.1:8			
Circuit Breaker cabinet	-237U1-X3.1:9			
Circuit Breaker cabinet	-237U1-X3.1:10			



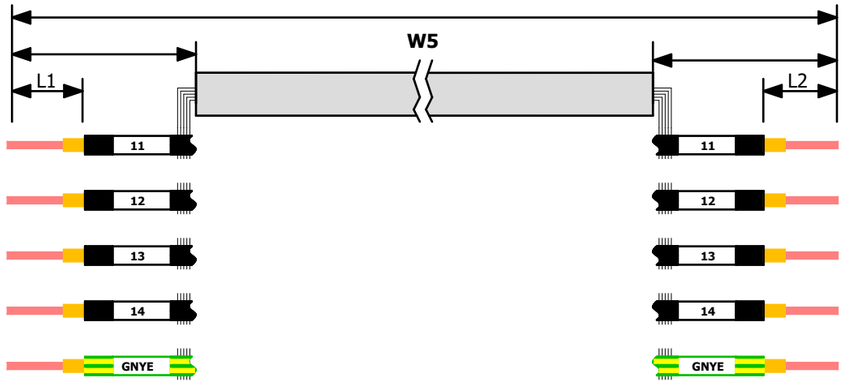
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:1	*Circuit Breaker cabinet*
			-237U1-X3.2:3	*Circuit Breaker cabinet*
			-237U1-X3.2:5	*Circuit Breaker cabinet*
			-237U1-X3.2:7	*Circuit Breaker cabinet*
			-237U1-X3.2:9	*Circuit Breaker cabinet*
			-237U1-X3.2:11	*Circuit Breaker cabinet*
			-237U1-X3.2:13	*Circuit Breaker cabinet*
			-237U1-X3.2:15	*Circuit Breaker cabinet*
			-237U1-X3.2:17	*Circuit Breaker cabinet*
			-237U1-X3.2:19	*Circuit Breaker cabinet*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



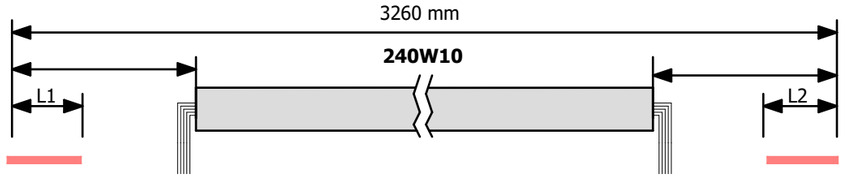
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:11			
Circuit Breaker cabinet	-237U1-X3.1:12			
Circuit Breaker cabinet	-237U1-X3.1:16			
Circuit Breaker cabinet	-237U1-X3.1:17			
Circuit Breaker cabinet	-237U1-X3.1:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:21	*Circuit Breaker cabinet*
			-237U1-X3.2:23	*Circuit Breaker cabinet*
			-237U1-X3.2:24	*Circuit Breaker cabinet*
			-237U1-X3.2:12	*Circuit Breaker cabinet*
			-237U1-X3.2:PE	*Circuit Breaker cabinet*

FRQ_Kabelplan_04_gro8_de_en

previous page: 2
next page: ++CT+/1

Cable name =UNIT_01++CT+-240W10
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

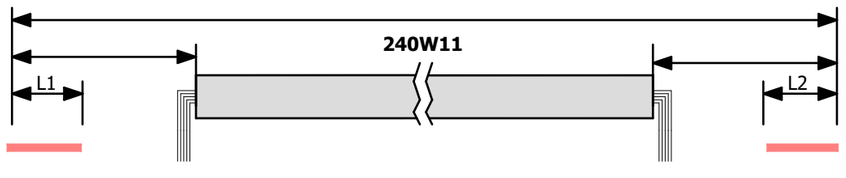


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

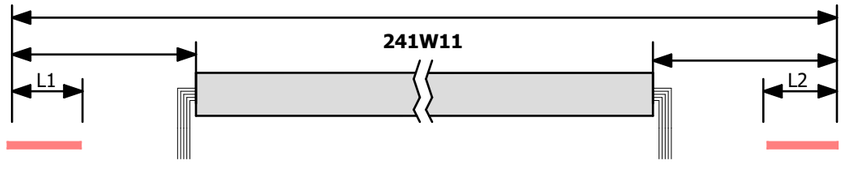


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-240U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

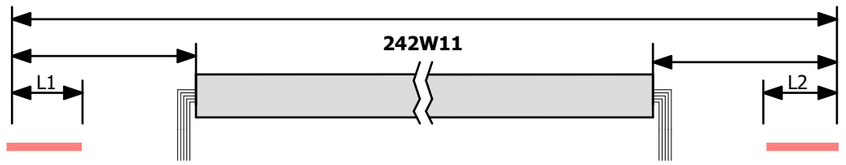


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-241U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

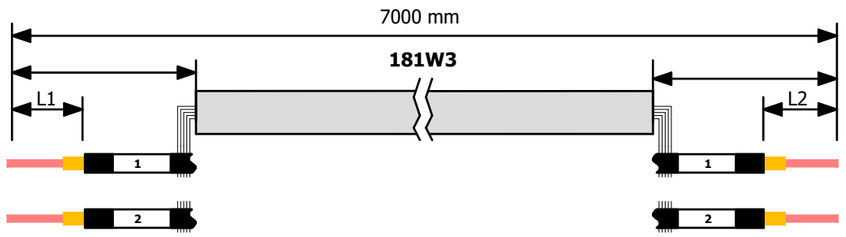


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-242U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2



Cable parts HELU.16563
Order number 16563

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:23	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X3:24	=	stripped	8 mm

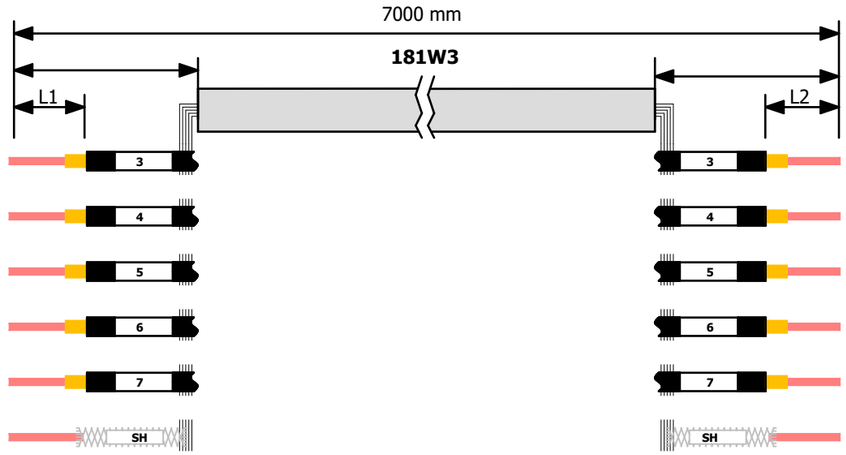
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:1	
	Flat connector	=	++FAN-52G1-181X3:3	

previous page: ++CONV+CIR/3
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2

Cable parts HELU.16563
Order number 16563

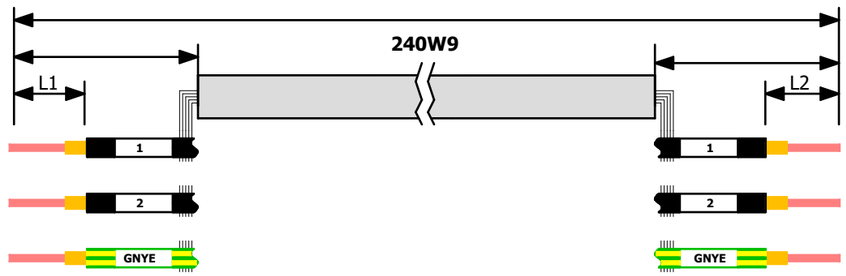


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:25	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X5:23	COOLING WATER TEMPERATURE	End splice	8 mm
Control cabinet 1	+CTRL_1.3-X5:24	=	End splice	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:2	
8 mm	stripped	COOLING WATER TEMPERATURE	++FAN-52G1-181X3:4	
8 mm	stripped	=	++FAN-52G1-181X3:5	

Cable name =UNIT_01++CT+-240W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031

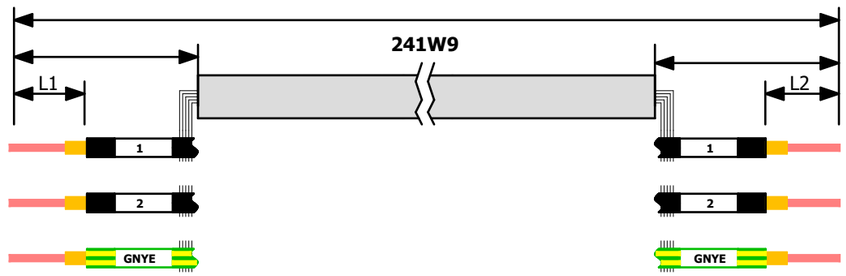


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC1:1	FUSE 24V DC CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:4	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	FUSE 24V DC CONTROL VOLTAGE	+CTRL_2.1-240U1:1	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-240U1:3	*Control cabinet 2*
	Connector	=	+CTRL_2.1-240U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:4	=	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

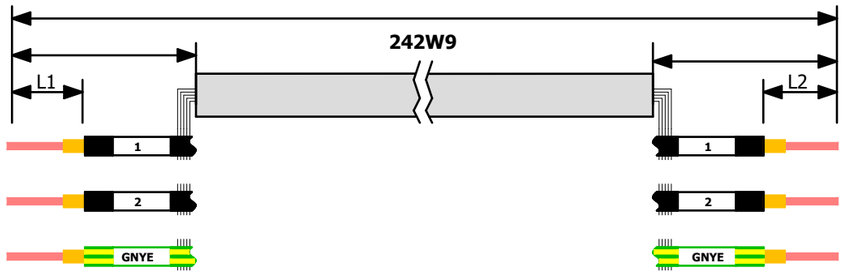
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-241U1:1	*Control cabinet 2*
	Connector	=	+CTRL_2.1-241U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-241U1:2	*Control cabinet 2*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

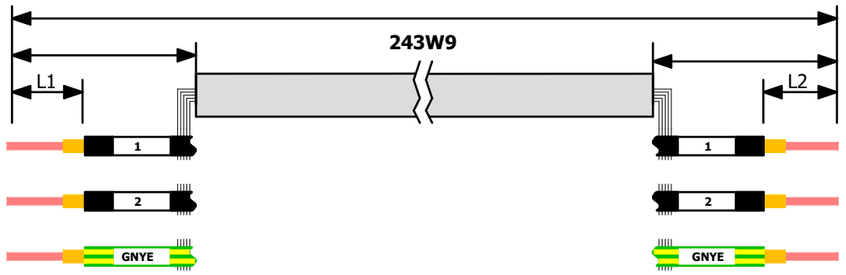


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-242U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

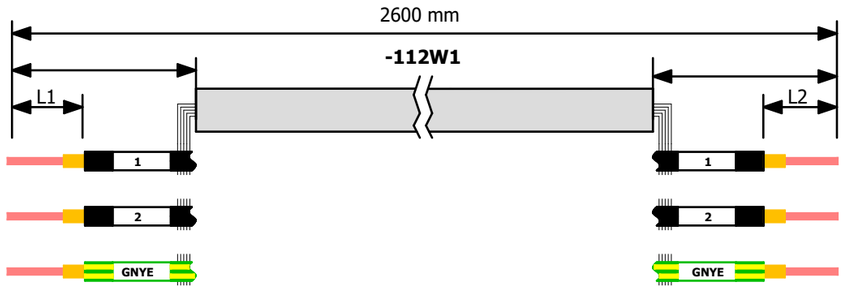


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-243U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-112W1
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

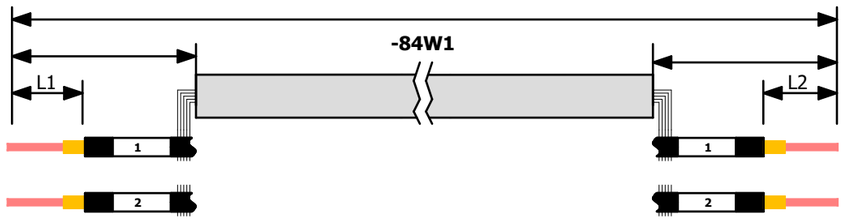


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE		
Control cabinet 1	+CTRL_1.3-XDC2:4	=		
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		BSU, SPARE CONTROL VOLTAGE	+CTRL_1.1-112A1:L+	*Control cabinet 1*
		=	+CTRL_1.1-112A1:M	*Control cabinet 1*
		Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_1.1-112A1:PE	*Control cabinet 1*

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors 1

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:2		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:4		stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	End splice		+CTRL_1.3-84F1:L1'	*Control cabinet 1*
8 mm	End splice		+CTRL_1.3-84F1:L2'	*Control cabinet 1*

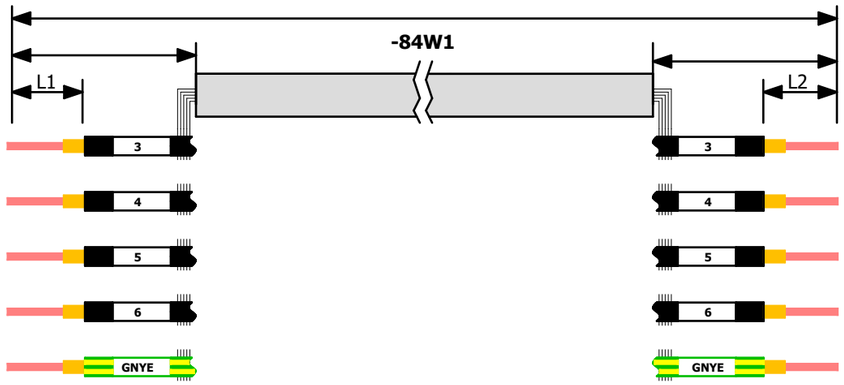
previous page: 2

next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors

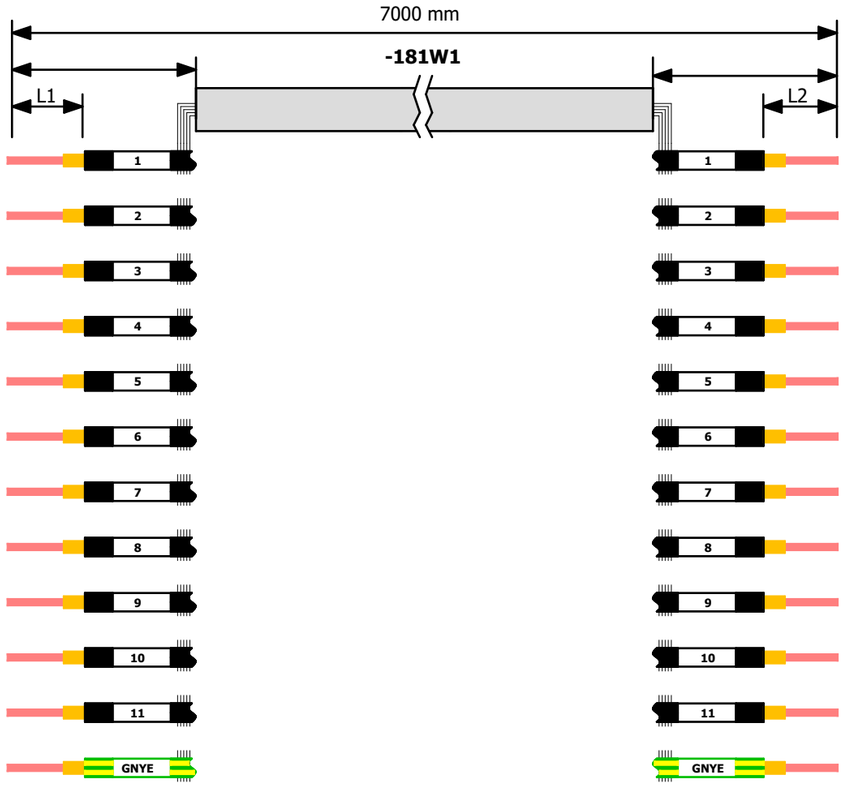
Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.1-84Q1:6		stripped	8 mm	8 mm	End splice		+CTRL_1.3-84F1:L3'	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:1		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F1:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:3		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F2:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:5		stripped	8 mm	8 mm	End splice		+CTRL_1.3-185F1:1	Control cabinet 1

Cable name =UNIT_01++CT+-181W1
Cable type JZ-600 12G1,5 mm²
Free conductors

Cable parts HELU.10670
Order number 10670



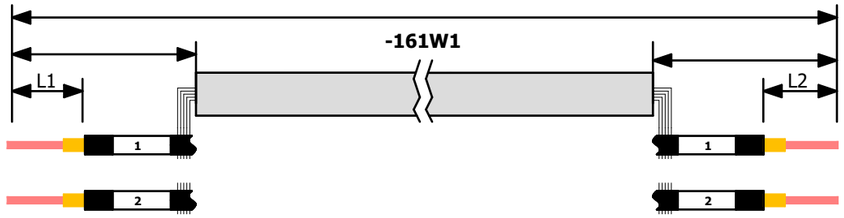
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.3-X1:1	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:1:1	
Control cabinet 1	+CTRL_1.3-X1:2	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:2:1	
Control cabinet 1	+CTRL_1.3-X1:3	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:3:1	
Control cabinet 1	+CTRL_1.3-X1:4	FUSE FOR PUMP	stripped	8 mm	8 mm	stripped	FUSE FOR PUMP	++FAN-52G1-181X1:4:1	
Control cabinet 1	+CTRL_1.3-X1:5	HEATER	stripped	8 mm	8 mm	stripped	HEATER	++FAN-52G1-181X1:5:1	
Control cabinet 1	+CTRL_1.3-X1:6	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:6:1	
Control cabinet 1	+CTRL_1.3-X1:7	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:7:1	
Control cabinet 1	+CTRL_1.3-X1:8	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	++FAN-52G1-181X1:8:1	
Control cabinet 1	+CTRL_1.3-X1:9	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:9:1	
Control cabinet 1	+CTRL_1.3-X1:10	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:10:1	
Control cabinet 1	+CTRL_1.3-X1:PE	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:PE:1	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-161W1
Cable type OZ-500 2x0,75 mm²
Free conductors 0

Cable parts HELU.10030
Order number 10030

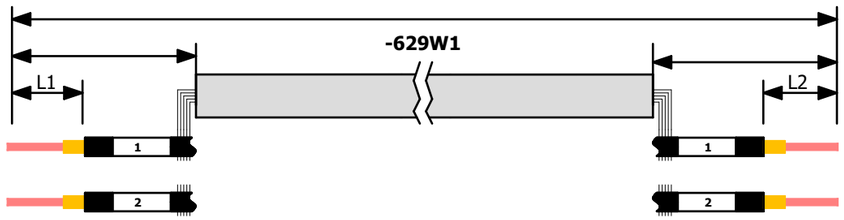


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:+			
Control cabinet 2	+CTRL_2.1-160U1:-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_2.1-161U1:+	Control cabinet 2
			+CTRL_2.1-161U1:-	Control cabinet 2

Cable name =UNIT_01++CT+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_01++CT+-195W1
Cable type OZ-500 4x0,75 mm²
Free conductors 0

Cable parts HELU.10034
Order number 10034

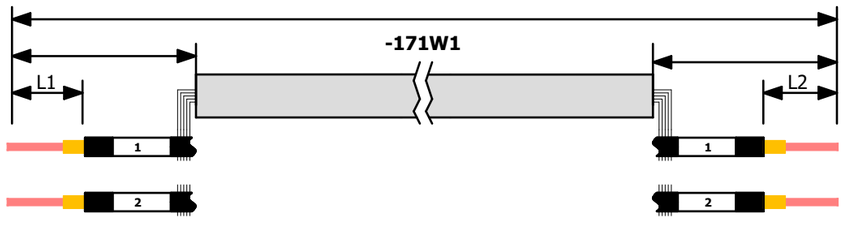


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:13	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:23			
Control cabinet 1	+CTRL_1.1-84Q1:14	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:24			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-195K3:T1	Control cabinet 1
			+CTRL_1.3-195K3:T2	Control cabinet 1
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-X3:41	Control cabinet 1
			+CTRL_1.3-X3:43	Control cabinet 1

Cable name =UNIT_01++CT+-171W1
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:1			
Control cabinet 1	+CTRL_1.4-171F1:3			

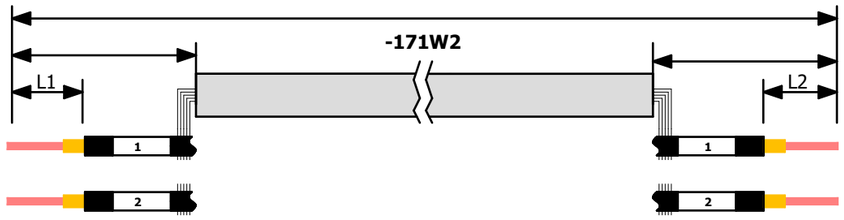
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-85U1:DC+	Control cabinet 1
			+CTRL_1.4-85U1:DC-	Control cabinet 1

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-171W2
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656

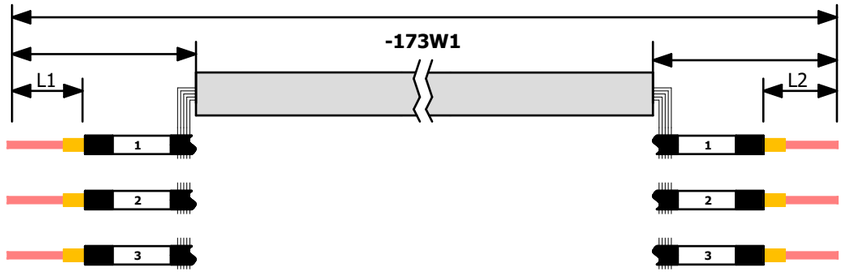


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:2			
Control cabinet 1	+CTRL_1.4-171F1:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-171K1:A1	*Control cabinet 1*
			+CTRL_1.4-171K2:A1	*Control cabinet 1*

Cable name =UNIT_01++CT+-173W1
Cable type OZ-600 3x2,5 mm²
Free conductors 3

Cable parts HELU.10691
Order number 10691

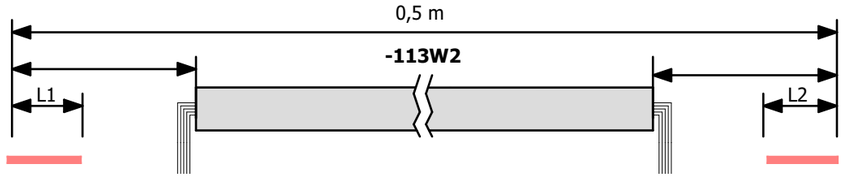


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-UDC+			
Converter cabinet	++CONV+CON-UDC-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-173F2:2	*Control cabinet 1*
			+CTRL_1.4-173F2:4	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

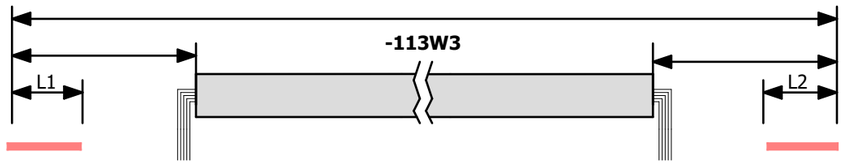


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U1:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U1:IN			

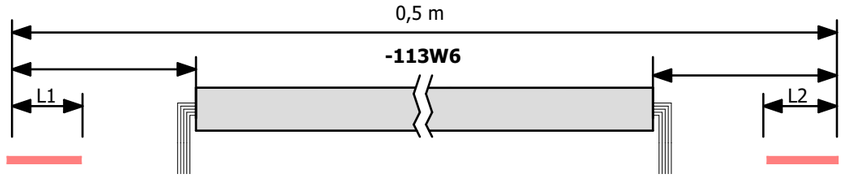
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U2:8	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 6
Date								+ total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-113W6
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

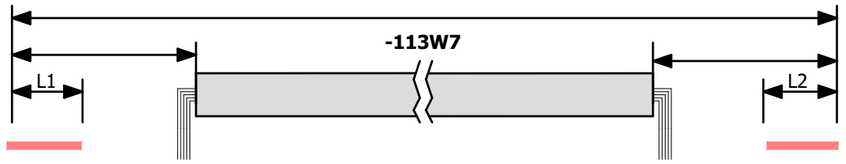


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T2:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U3:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W7
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

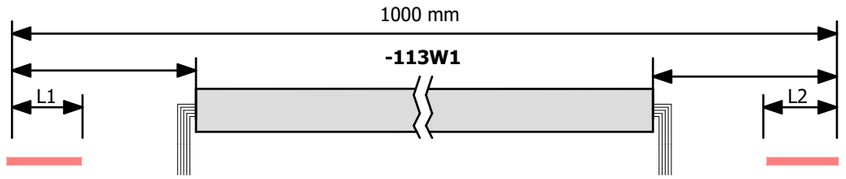


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U3:IN			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U4:8	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W1
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

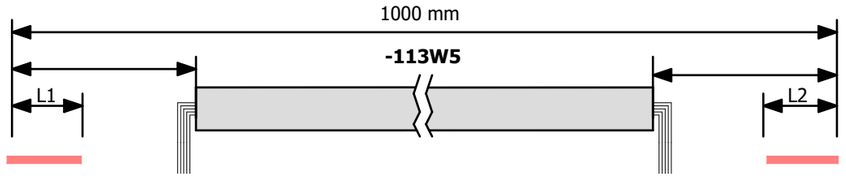


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X4:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T1:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W5
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

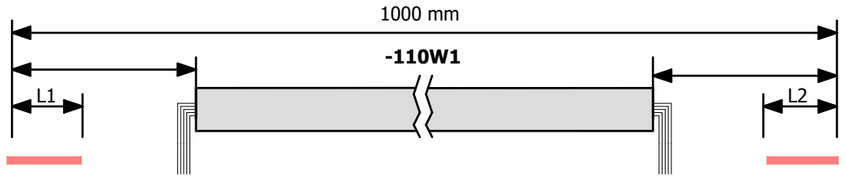


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X5:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T2:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-110W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



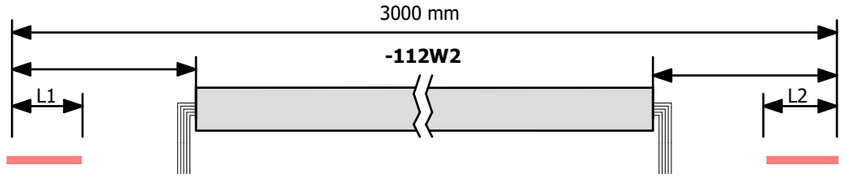
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X1:1-8	*Control cabinet 1*

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-112W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

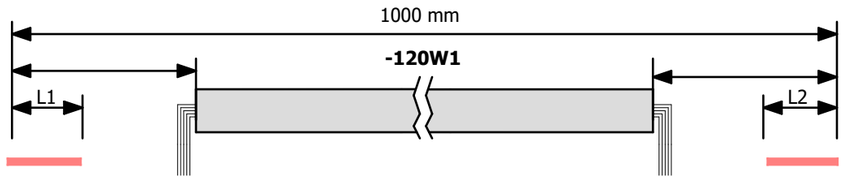


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-112A1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X2:1-8	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

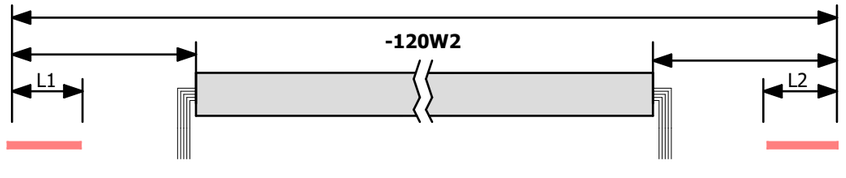


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P3		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-120A1:-X1:P1	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

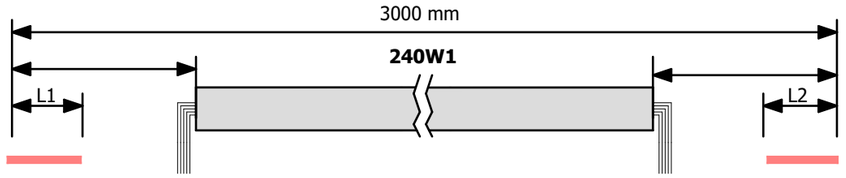


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-113U5:8			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-120A1:-X1:P2	*Control cabinet 1*

Cable name =UNIT_01++CT+-240W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

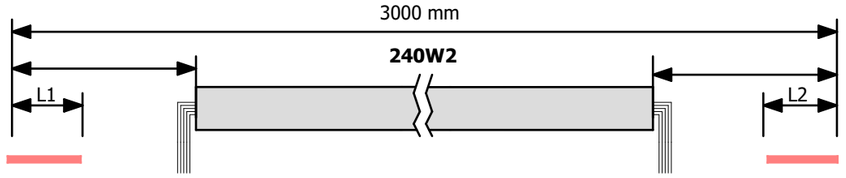


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-201Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

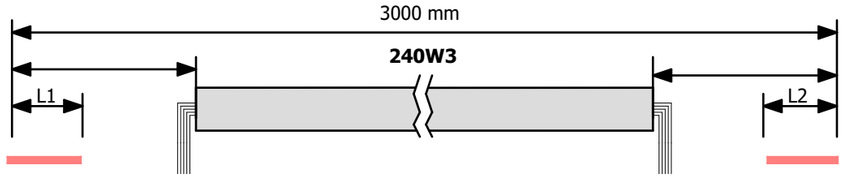
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-202Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X2	*Control cabinet 2*

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-240W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

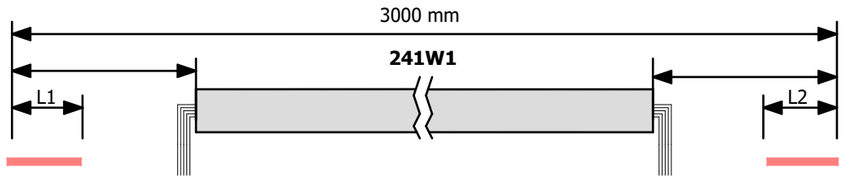


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-203Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

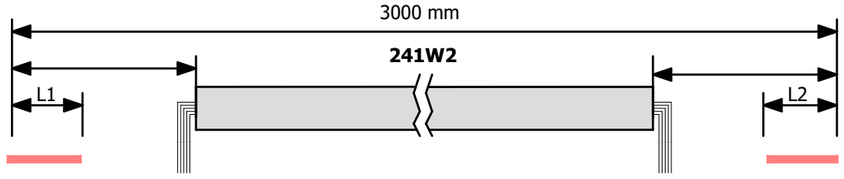


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

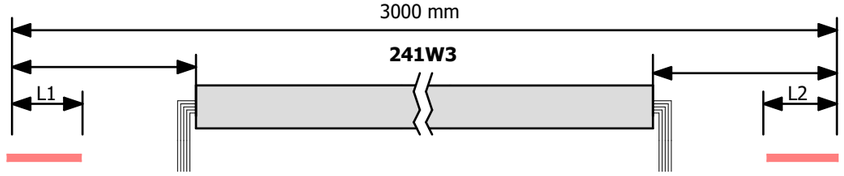


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

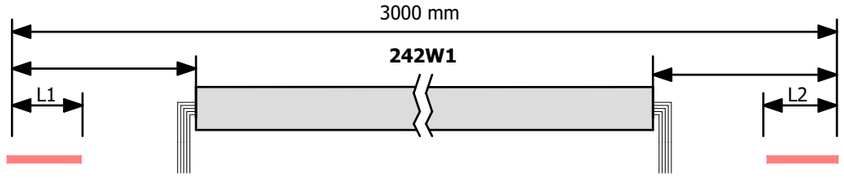


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X1		Connector	

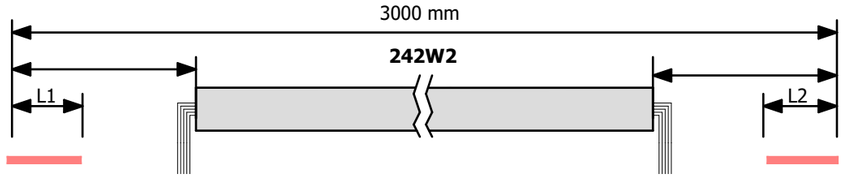
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X1	***Control cabinet 2***

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

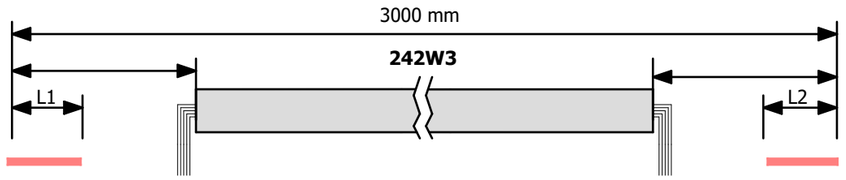


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

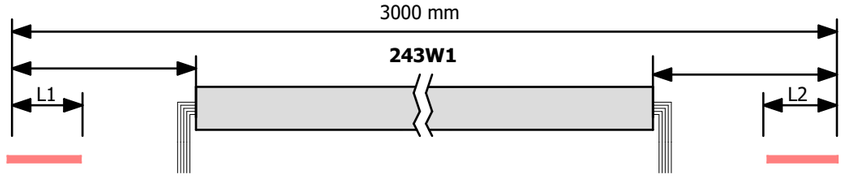


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

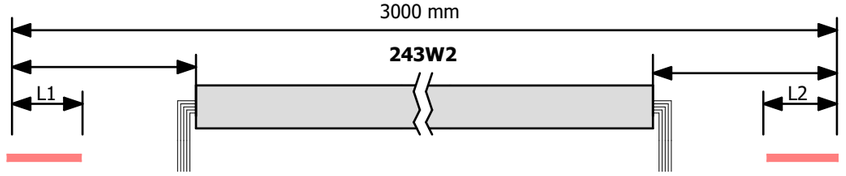


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

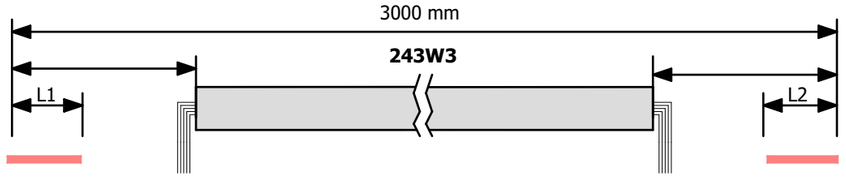


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X3		Connector	

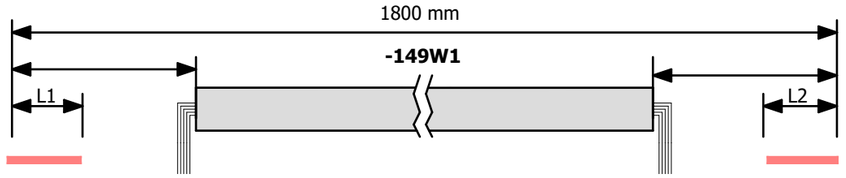
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X3	***Control cabinet 2***

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 10
Date							10354_23A2007	+		total: 492

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_01++CT+-149W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.671476
Order number

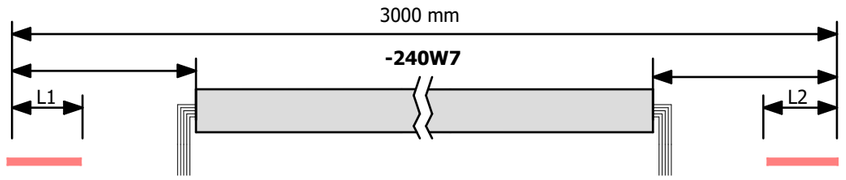


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-149U1:11X3		Connecor	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-162U1:11X3	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

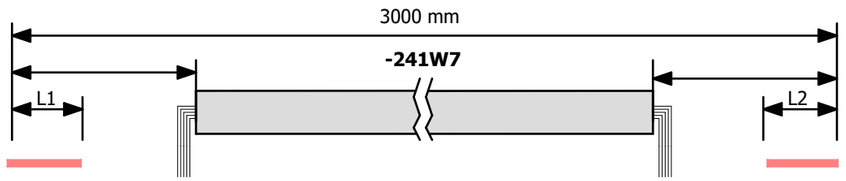


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

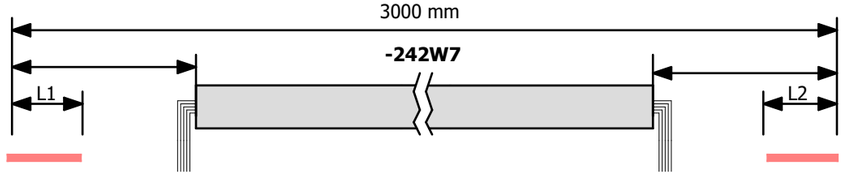


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-161U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

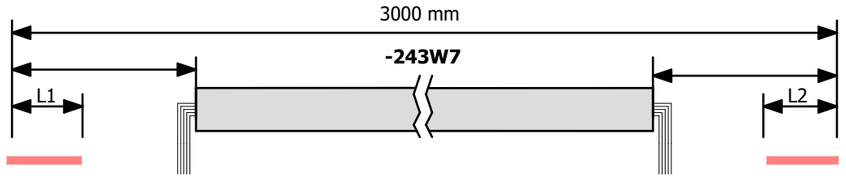


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-163U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-164U1:11X3		Connector	

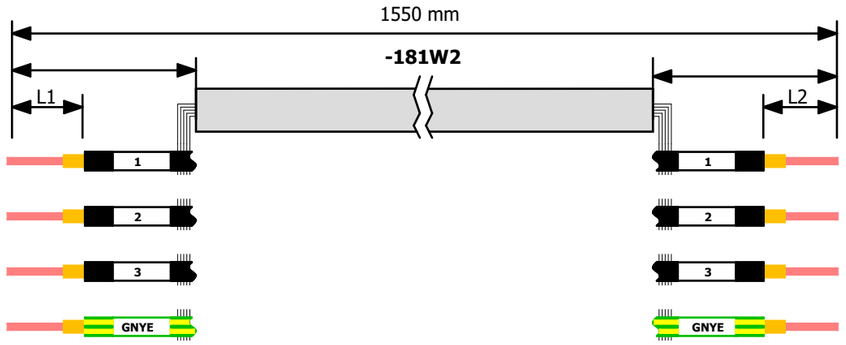
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:X7	*Control cabinet 2*

previous page: 10
next page: ++FAN/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++FAN+-52G1-181W2
Cable type JZ-600 4G1,5 mm²
Free conductors

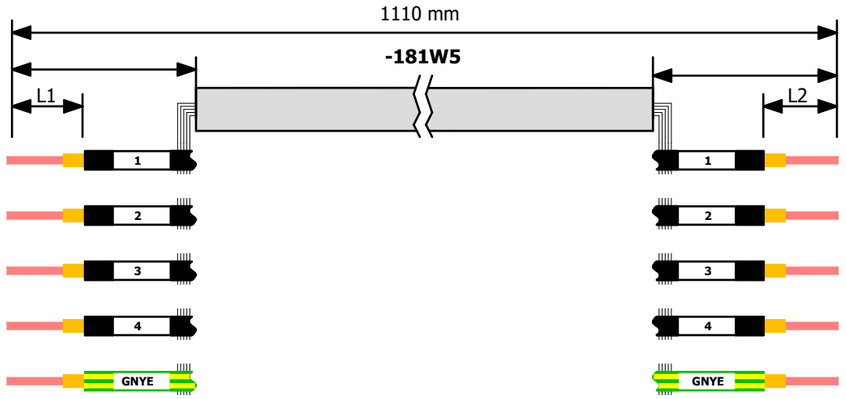
Cable parts HELU.10659
Order number 10659



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:1:2	PUMP	stripped	8 mm	5 mm	Ring cable lug M4	PUMP	-52G1-181M1:U1	
	-52G1-181X1:2:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:V1	
	-52G1-181X1:3:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:PE	

Cable name =UNIT_01++FAN+-52G1-181W5
Cable type JZ-600 5G1,5 mm²
Free conductors

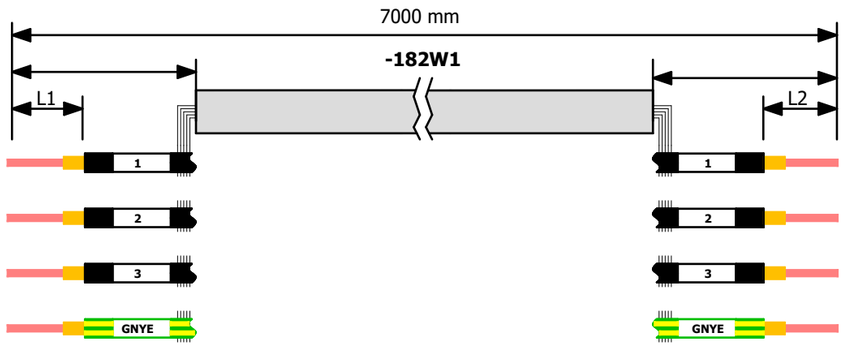
Cable parts HELU.10661
Order number 10661



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:4:2	FUSE FOR PUMP	stripped	8 mm	5 mm	Ring cable lug M4	FUSE FOR PUMP	-52G1-181R1:x1	
	-52G1-181X1:5:2	HEATER	stripped	8 mm	5 mm	Ring cable lug M4	HEATER	-52G1-181R1:x3	
	-52G1-181X1:6:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x5	
	-52G1-181X1:7:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x6	
	-52G1-181X1:PE:2	=					=	-52G1-181R1:PE	

Cable name =UNIT_01++FAN+-52G1-182W1
Cable type JZ-600 5G1,5 mm²
Free conductors

Cable parts HELU.10659
Order number 10659



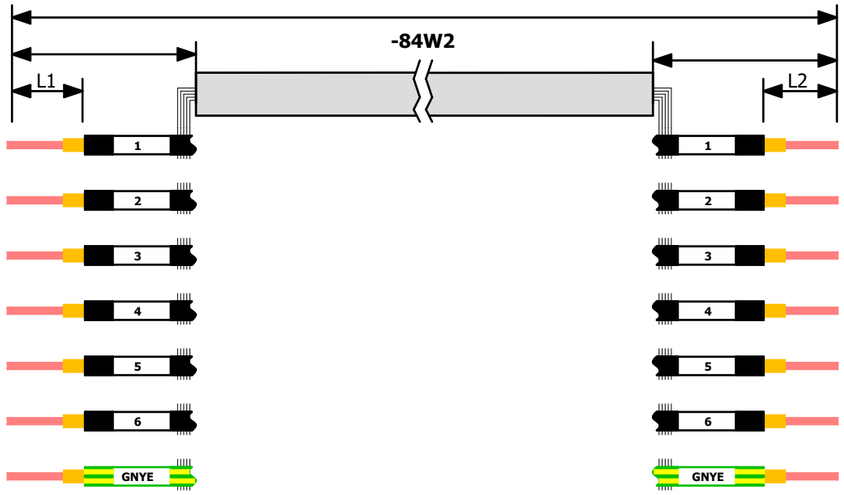
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:8:2	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	-52G1-182M1:U1	
	-52G1-181X1:9:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:V1	
	-52G1-181X1:10:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:PE	

previous page: ++CT/11
next page: ++EXTERN/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++EXTERN+-84W2
Cable type JZ-600 5G16 mm²
Free conductors 7

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page:
++FAN/1

next page:
&EMZ++CONV+IND/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-207L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2000
-207L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2001
-207L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2002
-211L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2003
-211L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2004
-211L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2005
-217L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2006
-217L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2007
-217L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2008

previous page:
&EMB++EXTERN+/1

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text			-146W3	Cable name	Strip =UNIT_01++CONV+IND-207L1.1						Cable name												Page / column
			F-CY-0Z (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1			1		++CT+CTRL_1.3-X5	13		,	-207L1.1	x2													&EFS++CT+/146.5
=			2		++CT+CTRL_1.3-X5	14		,	-207L1.1	x1													&EFS++CT+/146.5

Terminal diagram

Freqcon_F13_001_02

Function text			-146W4	Cable name	Strip =UNIT_01++CONV+IND-207L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2			1		++CT+CTRL_1.3-X5	15		,	-207L1.2	x2													&EFS++CT+/146.7
=			2		++CT+CTRL_1.3-X5	16		,	-207L1.2	x1													&EFS++CT+/146.7

Terminal diagram

Freqcon_F13_001_02

Function text			-147W1	Cable name	Strip =UNIT_01++CONV+IND-207L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3			1		++CT+CTRL_1.3-X5	17		,	-207L1.3	x2													&EFS++CT+/147.1
=			2		++CT+CTRL_1.3-X5	18		,	-207L1.3	x1													&EFS++CT+/147.1

Terminal diagram

Freqcon_F13_001_02

Function text			-145W4	Cable name	Strip =UNIT_01++CONV+IND-211L1.1						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1			1		++CT+CTRL_1.3-X5	7		,	-211L1.1	x2													&EFS++CT+/145.7
=			2		++CT+CTRL_1.3-X5	8		,	-211L1.1	x1													&EFS++CT+/145.7

Terminal diagram

Freqcon_F13_001_02

Function text			-146W1	Cable name	Strip =UNIT_01++CONV+IND-211L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2			1		++CT+CTRL_1.3-X5	9		,	-211L1.2	x2													&EFS++CT+/146.1
=			2		++CT+CTRL_1.3-X5	10		,	-211L1.2	x1													&EFS++CT+/146.1

Terminal diagram

Freqcon_F13_001_02

Function text			-146W2	Cable name	Strip =UNIT_01++CONV+IND-211L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3			1		++CT+CTRL_1.3-X5	11		,	-211L1.3	x2													&EFS++CT+/146.3
=			2		++CT+CTRL_1.3-X5	12		,	-211L1.3	x1													&EFS++CT+/146.3

Terminal diagram

Freqcon_F13_001_02

Function text			-147W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.1						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1			1		++CT+CTRL_1.3-X5	19		,	-217L1.1	x2													&EFS++CT+/147.3
=			2		++CT+CTRL_1.3-X5	20		,	-217L1.1	x1													&EFS++CT+/147.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W1	Cable name	Strip =UNIT_01++CONV+IND-217L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2			1		++CT+CTRL_1.3-X5	25		,	-217L1.2	x2													&EFS++CT+/148.3
=			2		++CT+CTRL_1.3-X5	26		,	-217L1.2	x1													&EFS++CT+/148.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3			1		++CT+CTRL_1.3-X5	29		,	-217L1.3	x2													&EFS++CT+/148.7
=			2		++CT+CTRL_1.3-X5	30		,	-217L1.3	x1													&EFS++CT+/148.7

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-227U1-X3.1	DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2000
-227U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2001
-231U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2002
-231U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2003
-237U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2004
-237U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2005

previous page: +IND/2008

next page: 2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-227U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-227W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-227U1-W5	Page / column
			0Z-500	Cable type							Cable type	1Z-500	
			1		++CT+CTRL_1.4-350X1.21	1	1	,	-227U1-X3.2	1		1	&EFS+/227.a.1
			2		++CT+CTRL_1.4-350X1.21	4	2	,	-227U1-X3.2	3		2	&EFS+/227.a.2
			3		++CT+CTRL_1.4-350X1.21	7	3	,	-227U1-X3.2	5		3	&EFS+/227.a.2
			4		++CT+CTRL_1.4-350X1.21	3	4	,	-227U1-X3.2	7		4	&EFS+/227.a.3
			5		++CT+CTRL_1.4-350X1.21	6	5	,	-227U1-X3.2	9		5	&EFS+/227.a.4
			6		++CT+CTRL_1.4-350X1.21	9	6	,	-227U1-X3.2	11		6	&EFS+/227.a.5
			7		++CT+CTRL_1.4-307K1	A1	7	,	-227U1-X3.2	13		7	&EFS+/227.a.5
			8		++CT+CTRL_1.4-307K3	A1	8	,	-227U1-X3.2	15		8	&EFS+/227.a.6
			9		++CT+CTRL_1.4-307K5	A1	9	,	-227U1-X3.2	17		9	&EFS+/227.a.6
			10		++CT+CTRL_1.4-307K2	A1	10	,	-227U1-X3.2	19		10	&EFS+/227.a.6
			11		++CT+CTRL_1.4-307K4	A1	11	,	-227U1-X3.2	21		11	&EFS+/227.a.7
			12		++CT+CTRL_1.4-307K6	A1	12	,	-227U1-X3.2	23		12	&EFS+/227.a.7
			13		++CT+CTRL_1.3-X3.11	11	13	,	-227U1-F1	2			&EFS+/227.a.7
			14		++CT+CTRL_1.3-X3.12	9	14	,	-227U1-F5	2			&EFS+/227.a.8
			15		++CT+CTRL_1.3-X3.12	11	15	,	-227U1-F9	2			&EFS+/227.a.8
			16		++CT+CTRL_1.3-X3.12	10	16	,	-227U1-F2	1			&EFS+/227.a.9
									-227U1-X3.2	24		13	
			17		++CT+CTRL_1.4-350X1.21	2	17	,	-227U1-X3.2	12		14	&EFS+/227.a.9
							PE	,	-227U1-X3.2	PE		GNYE	&EFS+/227.a.9

previous page: 1000

next page: 2001

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-227U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-227U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-227U1-X3.1	1		1										&EFS+/227.a.1
							2															&EFS+/227.a.1
							3		-227U1-X3.1	2		2										&EFS+/227.a.2
							4															&EFS+/227.a.2
							5		-227U1-X3.1	3		3										&EFS+/227.a.2
							6															&EFS+/227.a.2
							7		-227U1-X3.1	4		4										&EFS+/227.a.3
							8															&EFS+/227.a.3
							9		-227U1-X3.1	5		5										&EFS+/227.a.4
							10															&EFS+/227.a.4
							11		-227U1-X3.1	6		6										&EFS+/227.a.5
							12		-227U1-X3.1	17		14										&EFS+/227.a.5
							13		-227U1-X3.1	7		7										&EFS+/227.a.5
							14															&EFS+/227.a.5
							15		-227U1-X3.1	8		8										&EFS+/227.a.6
							16															&EFS+/227.a.6
							17		-227U1-X3.1	9		9										&EFS+/227.a.6
							18															&EFS+/227.a.6
							19		-227U1-X3.1	10		10										&EFS+/227.a.6
							20															&EFS+/227.a.6
							21		-227U1-X3.1	11		11										&EFS+/227.a.7
							22															&EFS+/227.a.7
							23		-227U1-X3.1	12		12										&EFS+/227.a.7
							24		-227U1-X3.1	16		13										&EFS+/227.a.7
							PE															&EFS+/227.a.5
							PE		-227U1-X3.1	PE		GNYE										&EFS+/227.a.5

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2001
+	CIR	Circuit Breaker cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-231U1-W5	Page / column
			0Z-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.3-150X1	1	1	,	-231U1-X3.2	1		1	&EFS+/231.a.1
			2		++CT+CTRL_1.3-150X1	4	2	,	-231U1-X3.2	3		2	&EFS+/231.a.2
			3		++CT+CTRL_1.3-150X1	7	3	,	-231U1-X3.2	5		3	&EFS+/231.a.2
			4		++CT+CTRL_1.3-150X1	3	4	,	-231U1-X3.2	7		4	&EFS+/231.a.3
			5		++CT+CTRL_1.3-150X1	6	5	,	-231U1-X3.2	9		5	&EFS+/231.a.4
			6		++CT+CTRL_1.3-150X1	9	6	,	-231U1-X3.2	11		6	&EFS+/231.a.5
			7		++CT+CTRL_1.4-306K1	A1	7	,	-231U1-X3.2	13		7	&EFS+/231.a.5
			8		++CT+CTRL_1.4-306K3	A1	8	,	-231U1-X3.2	15		8	&EFS+/231.a.6
			9		++CT+CTRL_1.4-306K5	A1	9	,	-231U1-X3.2	17		9	&EFS+/231.a.6
			10		++CT+CTRL_1.4-306K2	A1	10	,	-231U1-X3.2	19		10	&EFS+/231.a.6
			11		++CT+CTRL_1.4-306K4	A1	11	,	-231U1-X3.2	21		11	&EFS+/231.a.7
			12		++CT+CTRL_1.4-306K6	A1	12	,	-231U1-X3.2	23		12	&EFS+/231.a.7
			13		++CT+CTRL_1.3-X3.10	9	13	,	-231U1-F1	2			&EFS+/231.a.7
			14		++CT+CTRL_1.3-X3.10	11	14	,	-231U1-F5	2			&EFS+/231.a.8
			15		++CT+CTRL_1.3-X3.11	9	15	,	-231U1-F9	2			&EFS+/231.a.8
			16		++CT+CTRL_1.3-X3.10	10	16	,	-231U1-F2	1			&EFS+/231.a.9
									-231U1-X3.2	24		13	
			17		++CT+CTRL_1.3-150X1	2	17	,	-231U1-X3.2	12		14	&EFS+/231.a.9
							PE	,	-231U1-X3.2	PE		GNYE	&EFS+/231.a.9

previous page: 2001

next page: 2003

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-231U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-231U1-X3.1	1		1										&EFS+/231.a.1
							2															&EFS+/231.a.1
							3		-231U1-X3.1	2		2										&EFS+/231.a.2
							4															&EFS+/231.a.2
							5		-231U1-X3.1	3		3										&EFS+/231.a.2
							6															&EFS+/231.a.2
							7		-231U1-X3.1	4		4										&EFS+/231.a.3
							8															&EFS+/231.a.3
							9		-231U1-X3.1	5		5										&EFS+/231.a.4
							10															&EFS+/231.a.4
							11		-231U1-X3.1	6		6										&EFS+/231.a.5
							12		-231U1-X3.1	17		14										&EFS+/231.a.5
							13		-231U1-X3.1	7		7										&EFS+/231.a.5
							14															&EFS+/231.a.5
							15		-231U1-X3.1	8		8										&EFS+/231.a.6
							16															&EFS+/231.a.6
							17		-231U1-X3.1	9		9										&EFS+/231.a.6
							18															&EFS+/231.a.6
							19		-231U1-X3.1	10		10										&EFS+/231.a.6
							20															&EFS+/231.a.6
							21		-231U1-X3.1	11		11										&EFS+/231.a.7
							22															&EFS+/231.a.7
							23		-231U1-X3.1	12		12										&EFS+/231.a.7
							24		-231U1-X3.1	16		13										&EFS+/231.a.7
							PE															&EFS+/231.a.5
							PE		-231U1-X3.1	PE		GNYE										&EFS+/231.a.5

previous page: 2002

next page: 2004

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-237W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-237U1-W5	Page / column
			QZ-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.4-350X1.21	11	1	,	-237U1-X3.2	1		1	&EFS+/237.a.1
			2		++CT+CTRL_1.4-350X1.21	14	2	,	-237U1-X3.2	3		2	&EFS+/237.a.2
			3		++CT+CTRL_1.4-350X1.21	17	3	,	-237U1-X3.2	5		3	&EFS+/237.a.2
			4		++CT+CTRL_1.4-350X1.21	13	4	,	-237U1-X3.2	7		4	&EFS+/237.a.3
			5		++CT+CTRL_1.4-350X1.21	16	5	,	-237U1-X3.2	9		5	&EFS+/237.a.4
			6		++CT+CTRL_1.4-350X1.21	19	6	,	-237U1-X3.2	11		6	&EFS+/237.a.5
			7		++CT+CTRL_1.4-308K1	A1	7	,	-237U1-X3.2	13		7	&EFS+/237.a.5
			8		++CT+CTRL_1.4-308K3	A1	8	,	-237U1-X3.2	15		8	&EFS+/237.a.6
			9		++CT+CTRL_1.4-308K5	A1	9	,	-237U1-X3.2	17		9	&EFS+/237.a.6
			10		++CT+CTRL_1.4-308K2	A1	10	,	-237U1-X3.2	19		10	&EFS+/237.a.6
			11		++CT+CTRL_1.4-308K4	A1	11	,	-237U1-X3.2	21		11	&EFS+/237.a.7
			12		++CT+CTRL_1.4-308K6	A1	12	,	-237U1-X3.2	23		12	&EFS+/237.a.7
			13		++CT+CTRL_1.3-X3.13	8	13	,	-237U1-F1	2			&EFS+/237.a.7
			14		++CT+CTRL_1.3-X3.13	9	14	,	-237U1-F5	2			&EFS+/237.a.8
			15		++CT+CTRL_1.3-X3.13	11	15	,	-237U1-F9	2			&EFS+/237.a.8
			16		++CT+CTRL_1.3-X3.13	10	16	,	-237U1-F2	1			&EFS+/237.a.9
									-237U1-X3.2	24		13	
			17		++CT+CTRL_1.4-350X1.21	12	17	,	-237U1-X3.2	12		14	&EFS+/237.a.9
							PE	,	-237U1-X3.2	PE		GNYE	&EFS+/237.a.9

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 2004
Date								+ CIR Circuit Breaker cabinet total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-237U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-237U1-X3.1	1		1										&EFS+/237.a.1
							2															&EFS+/237.a.1
							3		-237U1-X3.1	2		2										&EFS+/237.a.2
							4															&EFS+/237.a.2
							5		-237U1-X3.1	3		3										&EFS+/237.a.2
							6															&EFS+/237.a.2
							7		-237U1-X3.1	4		4										&EFS+/237.a.3
							8															&EFS+/237.a.3
							9		-237U1-X3.1	5		5										&EFS+/237.a.4
							10															&EFS+/237.a.4
							11		-237U1-X3.1	6		6										&EFS+/237.a.5
							12		-237U1-X3.1	17		14										&EFS+/237.a.5
							13		-237U1-X3.1	7		7										&EFS+/237.a.5
							14															&EFS+/237.a.5
							15		-237U1-X3.1	8		8										&EFS+/237.a.6
							16															&EFS+/237.a.6
							17		-237U1-X3.1	9		9										&EFS+/237.a.6
							18															&EFS+/237.a.6
							19		-237U1-X3.1	10		10										&EFS+/237.a.6
							20															&EFS+/237.a.6
							21		-237U1-X3.1	11		11										&EFS+/237.a.7
							22															&EFS+/237.a.7
							23		-237U1-X3.1	12		12										&EFS+/237.a.7
							24		-237U1-X3.1	16		13										&EFS+/237.a.7
							PE															&EFS+/237.a.5
							PE		-237U1-X3.1	PE		GNYE										&EFS+/237.a.5

previous page:
2004

next page:
+AC_DC/1000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.2	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 2005
Date								+ CIR	Circuit Breaker cabinet	total: 492

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X3.43		1	20	0	0	40	=UNIT_01&EMZ++CONV+AC_DC/2000

previous page:
+CIR/2005

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text	-238W3 OZ-500	-238W2 OZ-500	-238W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-238W7 OZ-500	Page / column
SURGE ARRESTER DC SUBSYSTEM 2_1			1		-238F1	11	1	,	++CT+CTRL_1.3-X3	5		1	&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_1			2		-238F1	12	2	,	-X3.43	3			&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		1			-238F2	11	3	,	-X3.43	2			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		2			-238F2	12	4	,	-X3.43	5			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	1				-238F3	11	5	,	-X3.43	4			&EFS+/238a.9
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	2				-238F3	12	6	,	-X3.43	7			&EFS+/238a.9
SURGE ARRESTER DC SUBSYSTEM 2_3	2				-238F3	12	6	,	-X3.43	7			&EFS+/238a.9
								,					

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	20250805_V2.0
Date	21.01.2025					
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007
Date						

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2000
+	AC_DC	AC and DC connection cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	-228W3 OZ-500	-228W2 OZ-500	-228W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 3_1			1		-228F1	11	7	,	-X3.43	6		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_1			2		-228F1	12	8	,	-X3.43	9		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		1			-228F2	11	9	,	-X3.43	8		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		2			-228F2	12	10	,	-X3.43	11		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	1				-228F3	11	11	,	-X3.43	10		&EFS+/228.9
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	2				-228F3	12	12	,	-X3.43	13		&EFS+/228.9
								,				

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Function text	-238W6 OZ-500	-238W5 OZ-500	-238W4 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 4_1			1		-238F4	11	13	,	-X3.43	12		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_1			2		-238F4	12	14	,	-X3.43	15		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		1			-238F5	11	15	,	-X3.43	14		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		2			-238F5	12	16	,	-X3.43	17		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	1				-238F6	11	17	,	-X3.43	16		&EFS+/238b.9
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	2				-238F6	12	18	,	-X3.43	19		&EFS+/238b.9
								,				

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2002
+	AC_DC	AC and DC connection cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text			-78W7	Cable name	Strip =UNIT_01++CONV+AC_DC-X3.43						Cable name	-238W7										Page / column
			0Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	0Z-500										
			2		-78F1	14	19	,	-X3.43	18												&EFS+/78.8
								,														
			1		-78F1	13	20	,	++CT+CTRL_1.3-X3	6		2										&EFS+/78.8
								,														

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-XT1		1	20	0	0	20	=UNIT_01&EMZ++CT/2000

previous page:
++CONV+AC_DC/2003

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+-XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
Gas confirmed FGS							1	,	+CTRL_1.3-138K1	14			&EFS/136.0
=							2	,	+CTRL_1.3-138K1	11			&EFS/136.0
Smoke confirmed FGS							3	,	+CTRL_1.3-138K2	14			&EFS/136.1
=							4	,	+CTRL_1.3-138K2	11			&EFS/136.1
PLC fault status SIS							5	,	+CTRL_1.3-138K3	14			&EFS/136.2
=							6	,	+CTRL_1.3-138K3	11			&EFS/136.2
=							7	,	+CTRL_1.3-138K4	14			&EFS/136.2
Spare							8	,	+CTRL_1.3-138K4	11			&EFS/136.3
=							9	,	+CTRL_1.3-138K5	14			&EFS/136.3
=							10	,	+CTRL_1.3-138K5	11			&EFS/136.3
=							11	,	+CTRL_1.3-138K6	14			&EFS/136.4
=							12	,	+CTRL_1.3-138K6	11			&EFS/136.4
phase in sync							13	,	+CTRL_1.3-138K7	14			&EFS/136.5
=							14	,	+CTRL_1.3-138K7	11			&EFS/136.5
=							15	,	+CTRL_1.3-136K7	A2			&EFS/136.5
Shut-down to BESS							16	,	+CTRL_1.3-136K7	A1			&EFS/136.6
incoming CB is open							17	,	+CTRL_1.3-136K8	A2			&EFS/136.7
=							18	,	+CTRL_1.3-136K8	A1			&EFS/136.7
=							19	,	+CTRL_1.3-136K9	A2			&EFS/136.8
=							20	,	+CTRL_1.3-136K9	A1			&EFS/136.8

previous page: 1000

next page: +CTRL_1.3/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X1	Hauptsteuerstromkreis 400V/230V AC	1	PE	4	1	18	=UNIT_01&EMZ++CT+CTRL_1.3/2000
-X3	CONTROL VOLTAGE 24V DC	1	46	0	0	45	=UNIT_01&EMZ++CT+CTRL_1.3/2001
-X3.10	Rückmeldung DC Schütze Subsystem 1_4	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2003
-X3.11	=	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2004
-X3.12	=	1	12	0	0	14	=UNIT_01&EMZ++CT+CTRL_1.3/2005
-X3.13	Rückmeldung DC Schütze Subsystem 1_6	1	12	0	0	14	=UNIT_01&EMZ++CT+CTRL_1.3/2006
-X5	Kleinspannungssignale	1	30	0	0	30	=UNIT_01&EMZ++CT+CTRL_1.3/2007
-X5.1	DC Subsystem Spannungsmessung	1	2	0	0	4	=UNIT_01&EMZ++CT+CTRL_1.3/2009
-150X1	Subsysteme DC Schütz EIN	1	10	0	0	10	=UNIT_01&EMZ++CT+CTRL_1.3/2010
-XDC1	Steuerspannung 24VDC (USV) DC1	1	PE	2	0	16	=UNIT_01&EMZ++CT+CTRL_1.3/2011
-XDC2	Steuerspannung 24VDC (USV) DC2	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2013
-XDC3	Steuerspannung 24VDC (USV) DC3	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2016
-XDC4	Steuerspannung 24VDC (USV) DC4	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2017
-XDC5.1	Steuerspannung 24VDC (USV) DC5.1	1	1	0	0	2	=UNIT_01&EMZ++CT+CTRL_1.3/2018
-XDC5.2	Steuerspannung 24VDC (USV) DC5.2	1	1	0	0	2	=UNIT_01&EMZ++CT+CTRL_1.3/2019
-XE	Hauptstromversorgung 400V AC	1	6	3	4	14	=UNIT_01&EMZ++CT+CTRL_1.3/2020
-XT	Transfer Klemmenblock 24VDC/230VAC	1	16	6	0	22	=UNIT_01&EMZ++CT+CTRL_1.3/2021
-190XT1	230VAC Beleuchtung/Klimaanlage Container/Schrank	1	PE	4	4	16	=UNIT_01&EMZ++CT+CTRL_1.3/2023
-191XT1		1	PE	2	2	10	=UNIT_01&EMZ++CT+CTRL_1.3/2024
-XV	Suppression TVS Diode	1	4	0	0	27	=UNIT_01&EMZ++CT+CTRL_1.3/2025

previous page: +/2000

next page: 2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X1

Hauptsteuerstromkreis 400V/230V AC

Function text			-181W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
			1Z-600	Cable type							Cable type	
PUMP			1		++FAN-52G1-181X1	1:1	1	,	-139K2	2		&EFS+/181.1
=			2		++FAN-52G1-181X1	2:1	2	,	-139K2	4		&EFS+/181.1
=			3		++FAN-52G1-181X1	3:1	3	,	-139K2	6		&EFS+/181.1
=			GNYE		++FAN-52G1-181X1	PE:1	PE	,	+.2-110U1-PE			&EFS+/181.1
FUSE FOR PUMP			4		++FAN-52G1-181X1	4:1	4	,	-139K1	2		&EFS+/181.3
HEATER			5		++FAN-52G1-181X1	5:1	5	,	-139K1	4		&EFS+/181.4
=			6		++FAN-52G1-181X1	6:1	6	,	-139K1	6		&EFS+/181.4
=			7		++FAN-52G1-181X1	7:1	7	,	-XE	N:1		&EFS+/181.4
								,				
HEATER							PE	,				&EFS+/181.4
FAN 1 HEAT EXCHANGER			8		++FAN-52G1-181X1	8:1	8	,	-139K3	2		&EFS+/182.1
=			9		++FAN-52G1-181X1	9:1	9	,	-139K3	4		&EFS+/182.1
=			10		++FAN-52G1-181X1	10:1	10	,	-139K3	6		&EFS+/182.1
=							PE	,				&EFS+/182.1
FAN 2 HEAT EXCHANGER OPTIONAL							11	,				&EFS+/182.3
=							12	,				&EFS+/182.4
=							13	,				&EFS+/182.4
=							PE	,				&EFS+/182.4

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2000
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++CONV-80W1 OZ-500	-181W3 F-CY-OZ (LIY-CY)	++CONV-260W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CT+CTRL_1.3-X3 CONTROL VOLTAGE 24V DC — Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-80W1 OZ-500	++CONV-238W7 OZ-500	++TRA-629W1 OZ-500	++CONV-260W1 OZ-500	-181W3 F-CY-OZ (LIY-CY)	Page / column
CB 1 Tripped GRID					-DI_02	5	1		++CONV+CIR-80Q1	X7_13		1					&EFS+/127.1
CB 1 OFF GRID					-DI_02	4	2		++CONV+CIR-80Q1	X6_9		2					&EFS+/127.3
CB 1 ON GRID					-DI_02	3	3		++CONV+CIR-80Q1	X6_11		3					&EFS+/127.2
FUSE AND LIGHTNING PROTECTION							4		+.4-189X1	5							&EFS+/127.4
=					-XDC4	2	5		++CONV+AC_DC-X3.43	1			1				&EFS+/127.5
=					-DI_02	6	6		++CONV+AC_DC-X3.43	20			2				&EFS+/127.4
=					-X3	13	7		-134K1	11							&EFS+/127.5
CB 2 Tripped ISLAND GRID					-DI_04	12	8										&EFS+/128.1
CB 2 OFF ISLAND GRID					-DI_04	14	9										&EFS+/128.3
CB 2 ON ISLAND GRID					-DI_04	13	10										&EFS+/128.2
FUSE AND LIGHTNING PROTECTION 2							11										&EFS+/128.4
=					-DI_04	15	12										&EFS+/128.4
=					-X3	7	13										&EFS+/128.5
SPARE					-DI_04	1	14		+.2-18B1	4							&EFS+/133.1
SPARE					-DI_04	2	15		+.2-18B1	1							&EFS+/133.2
SPARE					-DI_04	3	16		+.2-18B1	4							&EFS+/133.3
Fuse 230V AC for Container Air Conditioning					-DI_04	11	17		-190F3	14							&EFS+/133.6
Earthing switch in On Transformer 620V side					-DI_04	5	18		++CONV-18Q1	14				2			&EFS+/133.9
Smoke detector CON					-DI_02	7	19		++CONV+CON-260B1	4					1		&EFS+/134.0
=			2		++CONV+CON-260B1	2	20		-XV	9							&EFS+/134.0
=			3		++CONV+CON-260B1	5	21		-XDC4	4							&EFS+/134.1
=			4		++CONV+CON-260B1	6	22		-134K1	11							&EFS+/134.1
PRESSURE SWITCH					-182Q1	13	23		++FAN-52G1-181X3	1						1	&EFS+/181.7
=		2			++FAN-52G1-181X3	3	24		-AI_04	3							&EFS+/181.7
=		3			++FAN-52G1-181X3	2	25		-XDC1	7							&EFS+/181.7
Fuse 230V AC for Container Air Conditioning					-XDC2	1	29		++CONV-18Q1	13				1			&EFS+/133.8
TRIP					-DI_04	4	30		+.2-18B1	7							&EFS+/133.4
CB 1 GRID +24V	4				++CONV+CIR-80Q1	X6_12	31		-XDC3	2							&EFS+/188.1
=	5				++CONV+CIR-80Q1	X5_11	32		-XDC3	3							&EFS+/188.1
CB 2 ISLAND GRID +24V OPTIONAL							33		-137K1	11							&EFS+/188.2
=							34										&EFS+/188.2
=	6				++CONV+CIR-80Q1	X6_7	35		-137K1	14							&EFS+/188.4
CB 1 GRID	7				++CONV+CIR-80Q1	X6_14	36		-137K2	12							&EFS+/188.5

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3

CONTROL VOLTAGE 24V DC

Function text			++CONV-80W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-195W1											Page / column
			OZ-500	Cable type							Cable type	OZ-500											
CB 1 GRID			8		++CONV+CIR-80Q1	X5_12	37	,	-189K1	22													&EFS+/188.6
=							38	,	-137K3	14													&EFS+/188.6
CB 2 ISLAND GRID OPTIONAL							39	,	-137K4	12													&EFS+/188.8
=							40	,	-189K1	21													&EFS+/188.8
SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS					-X3	42	41	,	+.1-84Q1	14		3											&EFS+/195.2
=					-195K3	IN1	42	,	-X3	41													&EFS+/195.2
=					-X3	44	43	,	+.1-84Q1	24		4											&EFS+/195.3
=					-195K3	IN2	44	,	-X3	43													&EFS+/195.3
=					-195K1	61	45	,	+.4-306K1	21													&EFS+/195.3
FAULT SIGNAL SAFETY RELAY					-195K3	IN	46	,	+.4-308K6	21													&EFS+/195.4
FAULT SIGNAL SAFETY RELAY					-195K3	IN	46	,	+.4-308K6	21													&EFS+/195.4

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 2002
Date							10354_23A2007	+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.10

Rückmeldung DC Schütze Subsystem 1_4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	OZ-500	++CONV-231W4	Page / column
SUBSYSTEM 2_1_DC + Contactor K1 is on			-DI_02	8	1		+.4-306K1	14					&EFS+/129.0
SUBSYSTEM 2_2_DC + Contactor K2 is on			+.4-306K3	14	2		-DI_02	10					&EFS+/129.2
SUBSYSTEM 2_1_DC -Contactor K7 is on			+.4-306K2	14	3		-DI_02	9					&EFS+/129.1
SUBSYSTEM 2_2_DC -Contactor K8 is on			+.4-306K4	14	4		-DI_02	11					&EFS+/129.3
SUBSYSTEM 2_3_DC + Contactor K3 is on			-DI_02	12	5		+.4-306K5	14					&EFS+/129.4
SUBSYSTEM 2_3_DC + SPARE			-DI_02	14	6								&EFS+/129.6
SUBSYSTEM 2_3_DC -Contactor K9 is on			-DI_02	13	7		+.4-306K6	14					&EFS+/129.5
SUBSYSTEM 2_DC -SPARE			-DI_02	15	8								&EFS+/129.7
SUBSYSTEM 2_1_DC FUSE OK			-DI_02	16	9		++CONV+CIR-231U1-X3.1	13		13			&EFS+/129.8
SUBSYSTEM 2_2_DC FUSE OK					10		++CONV+CIR-231U1-X3.1	16		16			&EFS+/129.9
=			-DI_03	1	11		++CONV+CIR-231U1-X3.1	14		14			&EFS+/129.9
=			-XDC4	1	12								&EFS+/129.9

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 2003
Date							10354_23A2007	+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.3-X3.11 Rückmeldung DC Schütze Subsystem 1_4					Cable name	++CONV-231W4	++CONV-227W4									Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	OZ-500	OZ-500									
SUBSYSTEM 3_1_DC + Contactor K1 is on					-DI_03	2	1		+.4-307K1	14												&EFS+/130.0
SUBSYSTEM 3_2_DC + Contactor K2 is on					+.4-307K3	14	2		-DI_03	4												&EFS+/130.2
SUBSYSTEM 3_1_DC -Contactor K7 is on					+.4-307K2	14	3		-DI_03	3												&EFS+/130.1
SUBSYSTEM 3_2_DC -Contactor K8 is on					+.4-307K4	14	4		-DI_03	5												&EFS+/130.3
SUBSYSTEM 3_3_DC + Contactor K3 is on					-DI_03	6	5		+.4-307K5	14												&EFS+/130.4
SUBSYSTEM 3_DC + SPARE					-DI_03	8	6															&EFS+/130.6
SUBSYSTEM 3_3_DC -Contactor K9 is on					-DI_03	7	7		+.4-307K6	14												&EFS+/130.5
SUBSYSTEM 3_DC -SPARE					-DI_03	9	8															&EFS+/130.7
SUBSYSTEM 2_DC FUSE OK					-DI_03	10	9		++CONV+CIR-231U1-X3.1	15		15										&EFS+/130.8
SUBSYSTEM 3_1_DC FUSE OK							10															&EFS+/130.9
=					-DI_03	11	11		++CONV+CIR-227U1-X3.1	13			13									&EFS+/130.9
=					-XDC4	2	12															&EFS+/130.9

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.12

Rückmeldung DC Schütze Subsystem 1_4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name ++CONV-227W4	Cable type OZ-500	Page / column
SUBSYSTEM 4_1_DC + Contactor K1 is on			-DI_03	12	1		+.4-308K1	14				&EFS+/131.0
SUBSYSTEM 4_2_DC + Contactor K2 is on			+.4-308K3	14	2		-DI_03	14				&EFS+/131.2
SUBSYSTEM 4_1_DC -Contactor K7 is on			+.4-308K2	14	3		-DI_03	13				&EFS+/131.1
SUBSYSTEM 4_2_DC -Contactor K8 is on			+.4-308K4	14	4		-DI_03	15				&EFS+/131.3
SUBSYSTEM 4_3_DC + Contactor K3 is on			-DI_03	16	5		+.4-308K5	14				&EFS+/131.4
SUBSYSTEM 4_DC + SPARE			-DI_05	2	6							&EFS+/131.6
SUBSYSTEM 4_3_DC -Contactor K9 is on			-DI_05	1	7		+.4-308K6	14				&EFS+/131.5
SUBSYSTEM 4_DC -SPARE			-DI_05	3	8							&EFS+/131.7
SUBSYSTEM 3_2_DC FUSE OK			-DI_05	4	9		++CONV+CIR-227U1-X3.1	14		14		&EFS+/131.8
SUBSYSTEM 3_3_DC FUSE OK					10		++CONV+CIR-227U1-X3.1	16		16		&EFS+/131.9
=			-DI_05	5	11		++CONV+CIR-227U1-X3.1	15		15		&EFS+/131.9
=			-XDC4	2	12							&EFS+/131.9

previous page: 2004

next page: 2006

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.13

Rückmeldung DC Schütze Subsystem 1_6

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	++CONV-237W4	OZ-500	Page / column
			-DI_05	6	1								&EFS+/132.0
					2		-DI_05	8					&EFS+/132.2
					3		-DI_05	7					&EFS+/132.1
					4		-DI_05	9					&EFS+/132.3
			-DI_05	10	5								&EFS+/132.4
			-DI_05	12	6								&EFS+/132.6
			-DI_05	11	7								&EFS+/132.5
SUBSYSTEM 4_1_DC FUSE OK			-DI_05	13	8		++CONV+CIR-237U1-X3.1	13			13		&EFS+/132.7
SUBSYSTEM 4_2_DC FUSE OK			-DI_05	14	9		++CONV+CIR-237U1-X3.1	14			14		&EFS+/132.8
SUBSYSTEM 4_3_DC FUSE OK					10		++CONV+CIR-237U1-X3.1	16			16		&EFS+/132.9
=			-DI_05	15	11		++CONV+CIR-237U1-X3.1	15			15		&EFS+/132.9
=			-XDC4	2	12								&EFS+/132.9

previous page: 2005

next page: 2007

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.13	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2006
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-145W1	++CONV-145W2	++CONV-145W3	++CONV-145W4	++CONV-146W1	++CONV-146W2	++CONV-146W3	++CONV-146W4	++CONV-147W1	++CONV-147W2	-181W3	Page / column
				Cable type							Cable type	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	
INDUCTOR GRID PHASE L1 TEMPERATURE 1_1					-AI_01	1	1	,	++CONV+IND-201L1			1											&EFS+/145.1
=					-AI_01	9	2	,	++CONV+IND-201L1			2											&EFS+/145.1
INDUCTOR GRID PHASE L2 TEMPERATURE 1_2					-AI_01	2	3	,	++CONV+IND-202L1				1										&EFS+/145.3
=					-AI_01	10	4	,	++CONV+IND-202L1				2										&EFS+/145.3
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3					-AI_01	3	5	,	++CONV+IND-203L1					1									&EFS+/145.5
=					-AI_01	11	6	,	++CONV+IND-203L1					2									&EFS+/145.5
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1					-AI_01	4	7	,	++CONV+IND-211L1.1						1								&EFS+/145.7
=					-AI_01	12	8	,	++CONV+IND-211L1.1						2								&EFS+/145.7
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2					-AI_01	5	9	,	++CONV+IND-211L1.2							1							&EFS+/146.1
=					-AI_01	13	10	,	++CONV+IND-211L1.2							2							&EFS+/146.1
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3					-AI_01	6	11	,	++CONV+IND-211L1.3								1						&EFS+/146.3
=					-AI_01	14	12	,	++CONV+IND-211L1.3								2						&EFS+/146.3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1					-AI_01	7	13	,	++CONV+IND-207L1.1									1					&EFS+/146.5
=					-AI_01	15	14	,	++CONV+IND-207L1.1									2					&EFS+/146.5
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2					-AI_01	8	15	,	++CONV+IND-207L1.2										1				&EFS+/146.7
=					-AI_01	16	16	,	++CONV+IND-207L1.2										2				&EFS+/146.7
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3					-AI_02	1	17	,	++CONV+IND-207L1.3											1			&EFS+/147.1
=					-AI_02	9	18	,	++CONV+IND-207L1.3											2			&EFS+/147.1
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1					-AI_02	2	19	,	++CONV+IND-217L1.1												1		&EFS+/147.3
=					-AI_02	10	20	,	++CONV+IND-217L1.1												2		&EFS+/147.3
CONVERTER CABINET TEMPERATURE					-AI_02	4	21	,	++CONV+CON-147B2	+													&EFS+/147.7
=					-AI_02	12	22	,	++CONV+CON-147B2	-													&EFS+/147.7
COOLING WATER TEMPERATURE					-AI_02	5	23	,	++FAN-52G1-181X3	4												4	&EFS+/148.1
=					-AI_02	13	24	,	++FAN-52G1-181X3	5												5	&EFS+/148.1

previous page: 2006

next page: 2008

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-148W1	++CONV-148W2										Page / column
				Cable type							Cable type	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)										
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2					-AI_02	6	25	,	++CONV+IND-217L1.2			1											&EFS+/148.3
=					-AI_02	14	26	,	++CONV+IND-217L1.2			2											&EFS+/148.3
CIR CABINET TEMPERATURE					-AI_02	7	27	,	++CONV+CIR-148B3	+													&EFS+/148.5
=					-AI_02	15	28	,	++CONV+CIR-148B3	-													&EFS+/148.5
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3					-AI_02	8	29	,	++CONV+IND-217L1.3				1										&EFS+/148.7
=					-AI_02	16	30	,	++CONV+IND-217L1.3				2										&EFS+/148.7

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5.1

DC Subsystem Spannungsmessung

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC_SUBSYSTEM 2_1.1 voltage			-AI_03	5	1		-AI_04	6			&EFS+/149.0
			-XDC1	6							
			-AI_03	6							
DC_SUBSYSTEM 2_3.1 voltage			-AI_03	7	2		+.4-149U1	14			&EFS+/149.2
			-AI_04	5							
			-AI_03	8							

previous page: 2008

next page: 2010

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_01++CT+CTRL_1.3-X5.1	20250805_V2.0	=	UNIT_01	Converter Container 1	
Date	21.01.2025							&	EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++	CT	Control cabinets	page: 2009
Date							10354_23A2007	+	CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-150X1

Subsysteme DC Schütz EIN

Function text			++CONV-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-231W4	Page / column
			OZ-500	Cable type							Cable type	OZ-500	
SUBSYSTEM 2_1 CONTACTOR DC+ ON			1		++CONV+CIR-231U1-X3.1	1	1	,	-150K1	14			&EFS+/150.2
=					-195K2	23	2	,	++CONV+CIR-231U1-X3.1	17		17	&EFS+/150.2
SUBSYSTEM 2_1 CONTACTOR DC-ON			4		++CONV+CIR-231U1-X3.1	4	3	,	-150K2	14			&EFS+/150.4
SUBSYSTEM 2_2 CONTACTOR DC+ ON			2		++CONV+CIR-231U1-X3.1	2	4	,	-151K1	14			&EFS+/151.1
=					-151K1	A2	5	,					&EFS+/151.1
SUBSYSTEM 2_3 CONTACTOR DC+ ON			5		++CONV+CIR-231U1-X3.1	5	6	,	-151K2	14			&EFS+/151.3
=			3		++CONV+CIR-231U1-X3.1	3	7	,	-151K3	14			&EFS+/151.4
=					-151K2	A2	8	,					&EFS+/151.4
SUBSYSTEM 2_3 CONTACTOR DC-ON			6		++CONV+CIR-231U1-X3.1	6	9	,	-151K4	14			&EFS+/151.6
=							10	,					&EFS+/151.6

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2010
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text	-112W1 / JZ-500	-242W9 / JZ-500	-240W9 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-243W9 / JZ-500	Page / column
FUSE 24V DC CONTROL VOLTAGE			1		+CTRL_2.1-240U1	1	1		-103F1	2			&EFS+/103.2
					+CTRL_2.1-160U1	+							
					+.2-18B1	40							
FUSE 24V DC CONTROL VOLTAGE					-DO_01	L+	2		-101Q1	13			&EFS+/103.2
					-AI_01	L+							
					+.1-126S1	13							
FUSE 24V DC CONTROL VOLTAGE					-136K7	11	3		-103F1	13			&EFS+/103.2
					-84F2	13							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			2		+CTRL_2.1-240U1	3	4		-102G1	OUTPUT DC 24 V:-			&EFS+/103.3
					-120A1	-X80:2							
					-DI_01	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-DO_01	M	5		+CTRL_2.1-160U1	-			&EFS+/103.3
					-AI_01	M							
					+.2-18B1	42							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-84K1	A2	6		-X5.1	1			&EFS+/103.3
					+.1-140H1	X2							
					+.2-110U1	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-AI_04	7	7						&EFS+/103.3
					-XDC2	3							
					-X3	25							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			GNYE		+CTRL_2.1-240U1	2	PE		-101T1	PE			&EFS+/103.4
					-XE	PE:1							
					-101T1	-"							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					+.2-18B1	41	PE		+CTRL_2.1-243U1	2		GNYE	&EFS+/103.4
		GNYE			+CTRL_2.1-242U1	2							
	GNYE				+.1-112A1	PE							

previous page: 2010

next page: 2012

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text			-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
			1Z-500	Cable type							Cable type	
			GNYE		+CTRL_2.1-241U1	2						

previous page: 2011

next page: 2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1
Date	21.01.2025					
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Date						

20250805_V2.0

10354_23A2007

=	UNIT_01	Converter Container 1		
&	EMZ	Terminals		
++	CT	Control cabinets	page:	2012
+	CTRL_1.3	Main mounting plate	total:	492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text	-241W9 / JZ-500	-242W9 / JZ-500	-243W9 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			1		+CTRL_2.1-243U1	1	1		-103F2	2		&EFS+/103.4
		1			+CTRL_2.1-242U1	1						
					-X3	29						
BSU, SPARE CONTROL VOLTAGE	1				+CTRL_2.1-241U1	1	2					&EFS+/103.5

previous page: 2012

next page: 2014

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2013
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text	-243W9 / JZ-500	-242W9 / JZ-500	-112W1 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
			1		+.1-112A1	L+						
BSU, SPARE CONTROL VOLTAGE					-186K1	A2	3		-XDC1	7		&EFS+/103.5
		2			+CTRL_2.1-242U1	3						
	2				+CTRL_2.1-243U1	3						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1		
&	EMZ	Terminals		
++	CT	Control cabinets	page:	2014
+	CTRL_1.3	Main mounting plate	total:	492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text		-112W1	-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
		1Z-500	1Z-500	Cable type							Cable type	
BSU, SPARE CONTROL VOLTAGE			2		+CTRL_2.1-241U1	3	4	⌟	-XDC3	3		&EFS+/103.5
					-138K1	A2						
		2			+.1-112A1	M						
								'				

previous page: 2014

next page: 2016

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2015
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC3

Steuerspannung 24VDC (USV) DC3

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
BSU, SPARE CONTROL VOLTAGE			-111A1	3	1		-103F3	2			&EFS+/103.6
			-173K3	21							
			+.2-114A1	2/L+							
BSU, SPARE CONTROL VOLTAGE			-X3	31	2		+.4-306K1	11			&EFS+/103.6
			-195K1	83							
			-115A1	V+							
PRECHARGE CONTROL VOLTAGE			-X3	32	3		-XDC2	4			&EFS+/103.7
			-111A1	4							
			+.2-114A1	1/M							
PRECHARGE CONTROL VOLTAGE			-195K1	43	4		-XDC4	3			&EFS+/103.7
			+.4-171K1	x2							
			-115A1	V-							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC4

Steuerspannung 24VDC (USV) DC4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
PRECHARGE CONTROL VOLTAGE			-195K1	33	1		-103F4	2			&EFS+/103.8
			-195K3	A1							
			-X3.10	12							
PRECHARGE CONTROL VOLTAGE			-X3.11	12	2		-X3.13	12			&EFS+/103.8
			-X3	5							
			-X3.12	12							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-139K2	A2	3		-XDC3	4			&EFS+/103.9
			-195K3	A2							
			-195K1	23							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-X3	21	4						&EFS+/103.9
			+.4-306K1	A2							
			+.4-306K1	A2							

previous page: 2016

next page: 2018

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.1

Steuerspannung 24VDC (USV) DC5.1

Function text				Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE						-186K1	1	1	,	-103F5	2			&EFS+/103.9
						-186K1	3							
									,					

previous page:
2017

next page:
2019

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2018
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.2

Steuerspannung 24VDC (USV) DC5.2

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			+.2-110U1	+24V	1	,	-186K1	2			&EFS+/103.9
			-120A1	-X80:1							
			-DI_01	L+							
						,					

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XE

Hauptstromversorgung 400V AC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
					1		-84F2	2			&EFS+/84.0
1-6					1						&EFA+++/2a.4
Supply Control Cabinet 3-phase 400V AC					N		-X1	7			&EFS+/84.1
=			-191XT1	4	N		-XT	2			&EFS+/84.1
=			-190F3	N	N		-191XT1	8			&EFS+/84.2
=			-190F2	N	N		-190F1	N			&EFS+/84.2
=					PE						&EFS+/84.2
=			-84F1	PE	PE		-XDC1	PE			&EFS+/84.2
=				PE	PE						&EFS+/84.3
			-101Q1	1	2		-190F2	1			&EFS+/84.0
					3		-84F2	4			&EFS+/84.0
Supply Control Cabinet 3-phase 400V AC			-101Q1	3	4		-190F3	1			&EFS+/84.1
=					5		-84F2	6			&EFS+/84.1
=			-101Q1	5	6		-190F1	1			&EFS+/84.1

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_01++CT+CTRL_1.3-XE	20250805_V2.0	=	UNIT_01	Converter Container 1	
Date	21.01.2025							&	EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++	CT	Control cabinets	page: 2020
Date							10354_23A2007	+	CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text	-278W1	++CONV-281W1	++CONV-279W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-279W1	++CONV-281W1	-278W1	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	1Z-500	1Z-500	1Z-500	
CON Fans 1-5 in door			1		++CONV+CON-279M1	L	1		-135K1	14					&EFS+/183.1
=			2		++CONV+CON-279M1	N	2		-XE	N:1					&EFS+/183.1
=							PE		++CONV+CON-279M1	PE		GNYE			&EFS+/183.1
=		1			++CONV+CIR-281M1	L	3		-135K3	14					&EFS+/183.3
CIR Fans 1-3 in door		2			++CONV+CIR-281M1	N	4								&EFS+/183.4
=							PE		++CONV+CIR-281M1	PE			GNYE		&EFS+/183.4
FAN 1 CONTROL CABINET	1				+.1-278M1	L	5		-135K2	14					&EFS+/185.1
=	2				+.1-278M1	N	6								&EFS+/185.1
=							PE		+.1-278M1	PE				GNYE	&EFS+/185.1

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2021
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text		++CONV-80W2	-185W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-185W1	++CONV-80W2										Page / column
		1Z-500	1Z-500	Cable type							Cable type	1Z-500	1Z-500										
HEATING CONTROL CABINET			1		+.2-185R1	1	7		-185B1	2													&EFS+/185.7
=			2		+.2-185R1	2	8																&EFS+/185.7
=							PE		+.2-185R1	PE		GNYE											&EFS+/185.7
230V AC for Circuit Breaker 1		1			++CONV+CIR-80Q1	X5_2	9		-187F1	2													&EFS+/187.1
=		2			++CONV+CIR-80Q1	X5_1	10																&EFS+/187.1
=							PE						GNYE										&EFS+/187.1
230V AC for Circuit Breaker Optional							11																&EFS+/187.2
=							12																&EFS+/187.2
=							PE																&EFS+/187.2
24V DC for Circuit Breaker 2 Optional							13		-187F2	2													&EFS+/187.4
=							14		-101T1	-													&EFS+/187.4
24V DC for Circuit Breaker Optional							15																&EFS+/187.5
=							16																&EFS+/187.5

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 2022
Date								+ CTRL_1.3 Main mounting plate total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-190XT1

230VAC Beleuchtung/Klimaanlage Container/Schrank

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
SPARE					1		-190F1	2			&EFS+/190.1
=					2		-190F1	N.			&EFS+/190.1
SPARE					PE						&EFS+/190.1
=					3		-190F2	2			&EFS+/190.3
=					4		-190F2	N.			&EFS+/190.3
SPARE					PE						&EFS+/190.3
Light Control cabinet		BN	+.5-190H1		5		-190F3	2			&EFS+/190.5
=					PE		-190X10	PE			&EFS+/190.5
=		LBU	+.5-190H1		6		-190F3	N.			&EFS+/190.5
230V AC for Container light, socket					7		-190X10	1			&EFS+/190.7
=					8		-190X10	2			&EFS+/190.7
230V AC for Container light, socket					PE						&EFS+/190.7

previous page: 2022

next page: 2024

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-190XT1	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 2023
Date								+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.3-191XT1					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
400V AC for Container Air Conditioning 1							1	,	-191F1	2												&EFS+/191.1
=							2	,	-191F1	4												&EFS+/191.1
=							3	,	-191F1	6												&EFS+/191.1
=							4	,	-XE	N:2												&EFS+/191.2
=							PE	,														&EFS+/191.2
400V AC for Container Air Conditioning 2							5	,	-191F2	2												&EFS+/191.3
=							6	,	-191F2	4												&EFS+/191.3
=							7	,	-191F2	6												&EFS+/191.3
=							8	,	-XE	N:1												&EFS+/191.4
=							PE	,														&EFS+/191.4

previous page: 2023

next page: 2025

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XV

Suppression TVS Diode

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
Suppression TVS Diode bi-directional 47 V					1		-171K3	14			&EFS+/171.8
Suppression TVS Diode bi-directional 47 V					5						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					6						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					7						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					8						&EFS+/151.8
Suppression TVS Diode bi-directional 47 V					9						&EFS+/134.5
Suppression TVS Diode bi-directional 47 V					2		-173K3	14			&EFS+/173.9
Suppression TVS Diode bi-directional 47 V					3						&EFS+/150.7
Suppression TVS Diode bi-directional 47 V					4						&EFS+/150.7

previous page: 2024

next page: +.4/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-350X1.21	Subsysteme DC Schütz EIN	1	19	0	0	21	=UNIT_01&EMZ++CT+CTRL_1.4/2000
-XE2	Gleichstromversorgung 1000VDC	1	11	0	0	11	=UNIT_01&EMZ++CT+CTRL_1.4/2001
-XV.20		1	12	0	0	36	=UNIT_01&EMZ++CT+CTRL_1.4/2002

previous page:
+.3/2025

next page:
2000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.4-350X1.21 - =UNIT_01++CT+CTRL_1.4-XV.20	20250805_V2.0	= UNIT_01	Converter Container 1
Date	21.01.2025							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+ CTRL_1.4	Right side

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-350X1.21

Subsysteme DC Schütz EIN

Function text		++CONV-237W4 OZ-500	++CONV-227W4 OZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-227W4 OZ-500	++CONV-237W4 OZ-500	Page / column
SUBSYSTEM 3_1 CONTACTOR DC+ ON			1		++CONV+CIR-227U1-X3.1	1	1	,	-350K1	14				&EFS+/350.2
=					-350K1	A2	2	,	++CONV+CIR-227U1-X3.1	17		17		&EFS+/350.2
SUBSYSTEM 3_1 CONTACTOR DC-ON			4		++CONV+CIR-227U1-X3.1	4	3	,	-350K2	14				&EFS+/350.4
			2		++CONV+CIR-227U1-X3.1	2	4	,	-351K1	14				&EFS+/351.1
					+.3-195K2	43	5	,						&EFS+/351.1
SUBSYSTEM 3_3 CONTACTOR DC+ ON			5		++CONV+CIR-227U1-X3.1	5	6	,	-351K2	14				&EFS+/351.3
=			3		++CONV+CIR-227U1-X3.1	3	7	,	-351K3	14				&EFS+/351.4
SUBSYSTEM 3_3 CONTACTOR DC-ON							8	,						&EFS+/351.5
=			6		++CONV+CIR-227U1-X3.1	6	9	,	-351K4	14				&EFS+/351.6
=							10	,						&EFS+/351.7
SUBSYSTEM 4_3 CONTACTOR DC-ON							10	,						&EFS+/353.6
SUBSYSTEM 4_1 CONTACTOR DC+ ON		1			++CONV+CIR-237U1-X3.1	1	11	,	-352K1	14				&EFS+/352.1
SUBSYSTEM 4_1 CONTACTOR DC-ON					-352K1	A2	12	,	++CONV+CIR-237U1-X3.1	17		17		&EFS+/352.2
=		4			++CONV+CIR-237U1-X3.1	4	13	,	-352K2	14				&EFS+/352.3
SUBSYSTEM 4_2 CONTACTOR DC+ ON		2			++CONV+CIR-237U1-X3.1	2	14	,	-353K1	14				&EFS+/353.1
=					-353K1	A2	15	,						&EFS+/353.1
SUBSYSTEM 4_3 CONTACTOR DC+ ON		5			++CONV+CIR-237U1-X3.1	5	16	,	-353K2	14				&EFS+/353.3
=		3			++CONV+CIR-237U1-X3.1	3	17	,	-353K3	14				&EFS+/353.4
=					-353K2	A2	18	,						&EFS+/353.4
SUBSYSTEM 4_3 CONTACTOR DC-ON		6			++CONV+CIR-237U1-X3.1	6	19	,	-353K4	14				&EFS+/353.6

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2000
Date								+ CTRL_1.4 Right side — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-XE2

Gleichstromversorgung 1000VDC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
RESISTORS FOR DISCHARGING UDC+			-173R2		1		-173R1				&EFS+/173.2
RESISTORS FOR DISCHARGING UDC-			-173R4		2		-173R3				&EFS+/173.3
=			-173R4		3		+CTRL_2.1-160U1	15			&EFS+/173.3
=			-173R2		4		+CTRL_2.1-160U1	44			&EFS+/173.3
=			+CTRL_2.1-162U1	15	5		+CTRL_2.1-161U1	15			&EFS+/173.3
=			+CTRL_2.1-162U1	44	6		+CTRL_2.1-161U1	44			&EFS+/173.3
=			+CTRL_2.1-163U1	15	7		-189X1	4			&EFS+/173.4
=			+CTRL_2.1-163U1	44	8		+CTRL_2.1-164U1	44			&EFS+/173.4
=			+CTRL_2.1-164U1	15	9		++CONV+CON-N	N			&EFS+/173.4
=					10		+CTRL.4-173R6				&EFS+/173.5
=					11		+CTRL.4-173R8				&EFS+/173.5

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.4-XV.20					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Suppression TVS Diode bi-directional 47 V							1															&EFS+/350.7
Suppression TVS Diode bi-directional 47 V							2															&EFS+/350.7
Suppression TVS Diode bi-directional 47 V							3															&EFS+/351.7
Suppression TVS Diode bi-directional 47 V							4															&EFS+/351.7
Suppression TVS Diode bi-directional 47 V							5															&EFS+/351.8
Suppression TVS Diode bi-directional 47 V							6															&EFS+/351.8
Suppression TVS Diode bi-directional 47 V							7															&EFS+/352.7
Suppression TVS Diode bi-directional 47 V							8															&EFS+/352.7
Suppression TVS Diode bi-directional 47 V							9															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							10															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							11															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							12															&EFS+/353.8

previous page: 2001

next page: 2003

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.4-XV.20						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-149X1		1	6	0	0	6	=UNIT_01&EMZ++CT+CTRL_2.1/2000

previous page:
+CTRL_1.4/2003

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_2.1-149X1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
					-161U1	19	1	,															&EFS+/161.4
					-161U1	23	2	,															&EFS+/161.5
					-161U1	27	3	,															&EFS+/161.5
					-161U1	32	4	,															&EFS+/161.6
					-161U1	36	5	,															&EFS+/161.7
					-161U1	40	6	,															&EFS+/161.8

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-52G1-181X1	400VAC Wassersystem	1	PE	3	1	14	=UNIT_01&EMZ++FAN/2000
-52G1-181X3		1	GND	0	0	6	=UNIT_01&EMZ++FAN/2001

previous page:
++CT+CTRL_2.1/2000

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++FAN+-52G1-181X1

400VAC Wassersystem

Function text	-52G1-182W1	-52G1-181W5	-52G1-181W2	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CT-181W1	Page / column
	1Z-600	1Z-600	1Z-600	Cable type							Cable type	1Z-600	
PUMP			1		-52G1-181M1	U1	1	,	++CT+CTRL_1.3-X1	1		1	&EFS++CT/181.1
=			2		-52G1-181M1	V1	2	,	++CT+CTRL_1.3-X1	2		2	&EFS++CT/181.1
=			3		-52G1-181M1	W1	3	,	++CT+CTRL_1.3-X1	3		3	&EFS++CT/181.1
FUSE FOR PUMP		1			-52G1-181R1	x1	4	,	++CT+CTRL_1.3-X1	4		4	&EFS++CT/181.3
HEATER		2			-52G1-181R1	x3	5	,	++CT+CTRL_1.3-X1	5		5	&EFS++CT/181.4
=		3			-52G1-181R1	x5	6	,	++CT+CTRL_1.3-X1	6		6	&EFS++CT/181.4
=		4			-52G1-181R1	x6	7	,	++CT+CTRL_1.3-X1	7		7	&EFS++CT/181.4
								,					
FAN 1 HEAT EXCHANGER	1				-52G1-182M1	U1	8	,	++CT+CTRL_1.3-X1	8		8	&EFS++CT/182.1
=	2				-52G1-182M1	V1	9	,	++CT+CTRL_1.3-X1	9		9	&EFS++CT/182.1
=	3				-52G1-182M1	W1	10	,	++CT+CTRL_1.3-X1	10		10	&EFS++CT/182.1
PUMP			GNYE		-52G1-181M1	PE	PE	,	++CT+CTRL_1.3-X1	PE		GNYE	&EFS++CT/181.1
HEATER		GNYE			-52G1-181R1	PE	PE	,					&EFS++CT/181.4
FAN 1 HEAT EXCHANGER	GNYE				-52G1-182M1	PE	PE	,					&EFS++CT/182.1

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++FAN+-52G1-181X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN FAN page: 2000
Date								+ total: 492

Terminal diagram

Freqcon_F13_001_02

Function text			++CT-181W3	Cable name	Strip =UNIT_01++FAN+-52G1-181X3					Cable name	++CT-181W3										Page / column
			F-CY-0Z (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-0Z (LiY-CY)										
PRESSURE SWITCH			1		++CT+CTRL_1.3-X3	23	1	,	-52G1	1												&EFS++CT/181.7
=					-52G1	2	2	,	++CT+CTRL_1.3-X3	25		3										&EFS++CT/181.7
=					-52G1	3	3	,	++CT+CTRL_1.3-X3	24		2										&EFS++CT/181.7
COOLING WATER TEMPERATURE			4		++CT+CTRL_1.3-X5	23	4	,	-52G1-148B1	+												&EFS++CT/148.1
=			5		++CT+CTRL_1.3-X5	24	5	,	-52G1-148B1	-												&EFS++CT/148.1
PRESSURE SWITCH					-52G1	SH	GND	,														&EFS++CT/181.7

previous page: 2000

next page: =UNIT_02&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++FAN+-52G1-181X3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN FAN page: 2001
Date								+ total: 492

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

FREQCON

Customer:	Statron		
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Type:	BESS MSC-1000-620-8		
Product	BATTERY CONTAINER 1		
Circuit diagram No:	10354_23A2007	20250805_V2.0	
Producer (company):	Freqcon GmbH	53406 ASC	53409
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Type:	BESS MSC-1000-620-8		
Project manager:	Freqcon_CP		

created on: 17.09.2019
edited on: 05.08.2025 edited by: Freqcon_DG total pages: 492

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	21.01.2025	Freqcon_DG
	3	INDEX	21.01.2025	Freqcon_DG
	4	INDEX	21.01.2025	Freqcon_DG
	5	INDEX	21.01.2025	Freqcon_DG
	6	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	05.11.2024	Freqcon_DG
	3a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
&ELU		Cabinet Overview		
	5a	Container overview	14.06.2024	Freqcon_JD
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	191	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	192	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	193	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	278	EARTHING CONTAINER	08.10.2024	Freqcon_DG
	290	BATTERY CABINETS 1-3	18.06.2024	Freqcon_JD
	291	BATTERY CABINETS 4+5	18.06.2024	Freqcon_JD
	292	BATTERY CABINETS 6-8	18.06.2024	Freqcon_JD
	293	BATTERY CABINETS 9-11	18.06.2024	Freqcon_JD
&EFS ++ASC		Circuit diagram auxillary cabinet		
	601	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	602	CONTROL VOLTAGE UPS	05.11.2024	Freqcon_DG
	603	CONTROL VOLTAGE FUSE	21.01.2025	Freqcon_DG
	611	ETHERNET SWITCH	18.06.2024	Freqcon_JD
	613a	ETHERNET / PROFINET ISOLATOR	25.11.2024	Freqcon_DG
	613b	PROFINET	25.11.2024	Freqcon_DG
	620	ET200 24V DC ASC	03.12.2024	Freqcon_DG
	621	ET200SP DIGITAL INPUTS DI_21 + DI_22	03.12.2024	Freqcon_DG
	623	ET200SP DIGITAL OUTPUTS DO_21	14.06.2024	Freqcon_JD
	624	ET200SP ANALOG INPUTS AI_21	14.06.2024	Freqcon_JD
	625	ET200SP ANALOG OUTPUTS AO_21	14.06.2024	Freqcon_JD
	636	OUTPUTS FIRE DAMPER	18.06.2024	Freqcon_JD
	669	SMOKE POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	670	GAS POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	678	DC BATTERY CABINETS	18.06.2024	Freqcon_JD
	680a	STATIONARY GAS DETECTOR BAT 1-4	14.06.2024	Freqcon_JD
	680b	STATIONARY GAS DETECTOR BAT 5-8	18.06.2024	Freqcon_JD
	680c	STATIONARY GAS DETECTOR BAT 9-11	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++ASC		Circuit diagram auxillary cabinet		
	681	EXTRACT FAN FIRE DAMPER	14.06.2024	Freqcon_JD
	684	AUXILIARY SUPPLY 400V AC	22.11.2024	Freqcon_DG
	685	AUXILIARY SUPPLY 400V AC	05.11.2024	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	29.10.2024	Freqcon_DG
	691	CONTAINER COOLING / LIGHTNING	05.11.2024	Freqcon_DG
&EPC ++Container		Parts List		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	21.01.2025	Freqcon_DG
	4	PARTS LIST	21.01.2025	Freqcon_DG
	5	PARTS LIST	21.01.2025	Freqcon_DG
	6	PARTS LIST	21.01.2025	Freqcon_DG
	7	PARTS LIST	21.01.2025	Freqcon_DG
&EPA ++Container		Summarized part list		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG

previous page: 2

next page: 4

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++Container		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	21.01.2025	Freqcon_DG
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_02++ASC+-X5.1 - =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_02++ASC+-X5.1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_02++ASC+-X5.2	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2002	Klemmenplan =UNIT_02++ASC+-X5.3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_02++ASC+-X6	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_02++ASC+-XDC1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_02++ASC+-XDC2	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_02++ASC+-XES	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2009	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2024	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2025	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2026	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2027	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2028	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG

previous page: 4

next page: 6

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2029	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2030	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2031	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2032	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2033	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/6

next page: 6a

SPECIFICATION of grounding

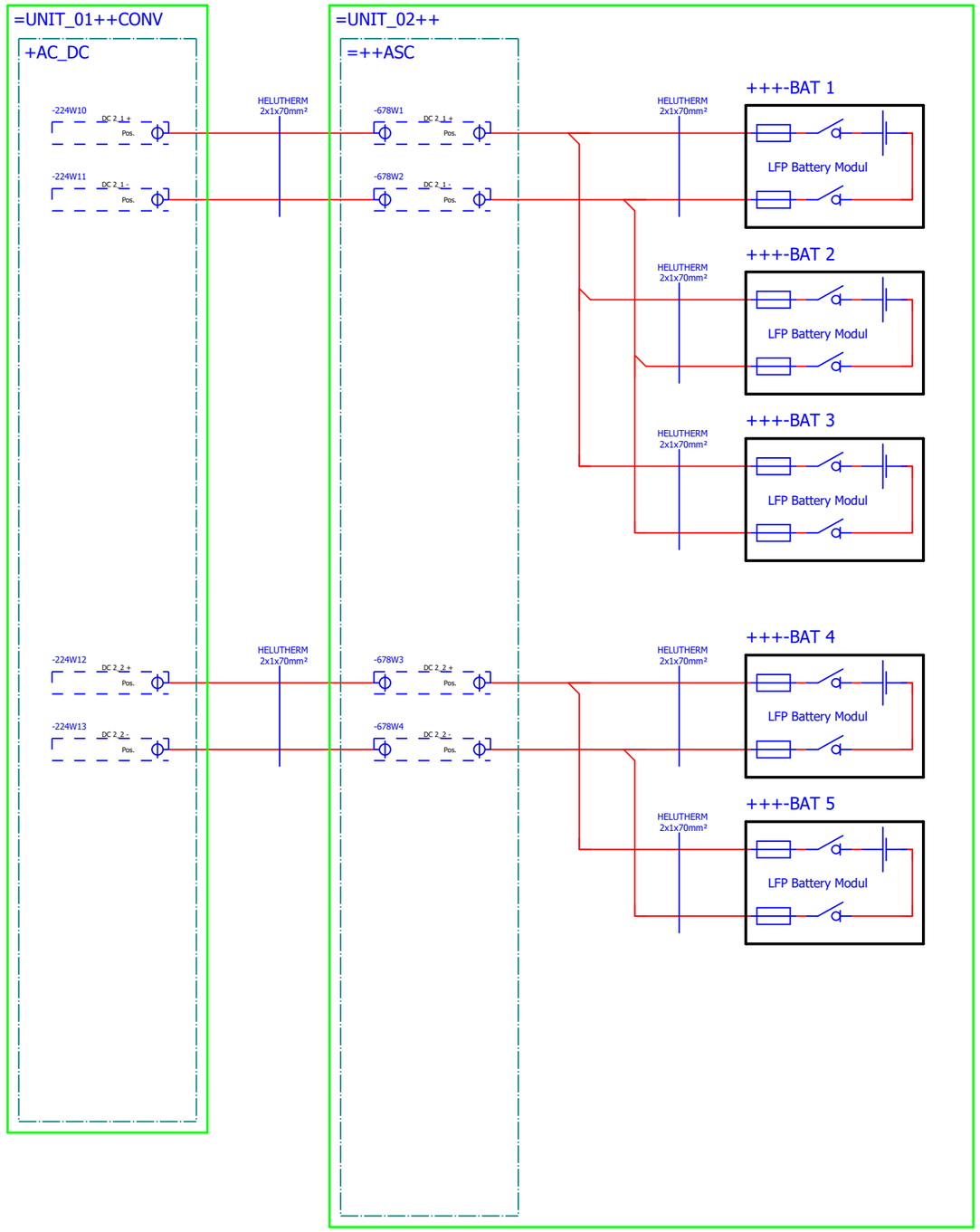
	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

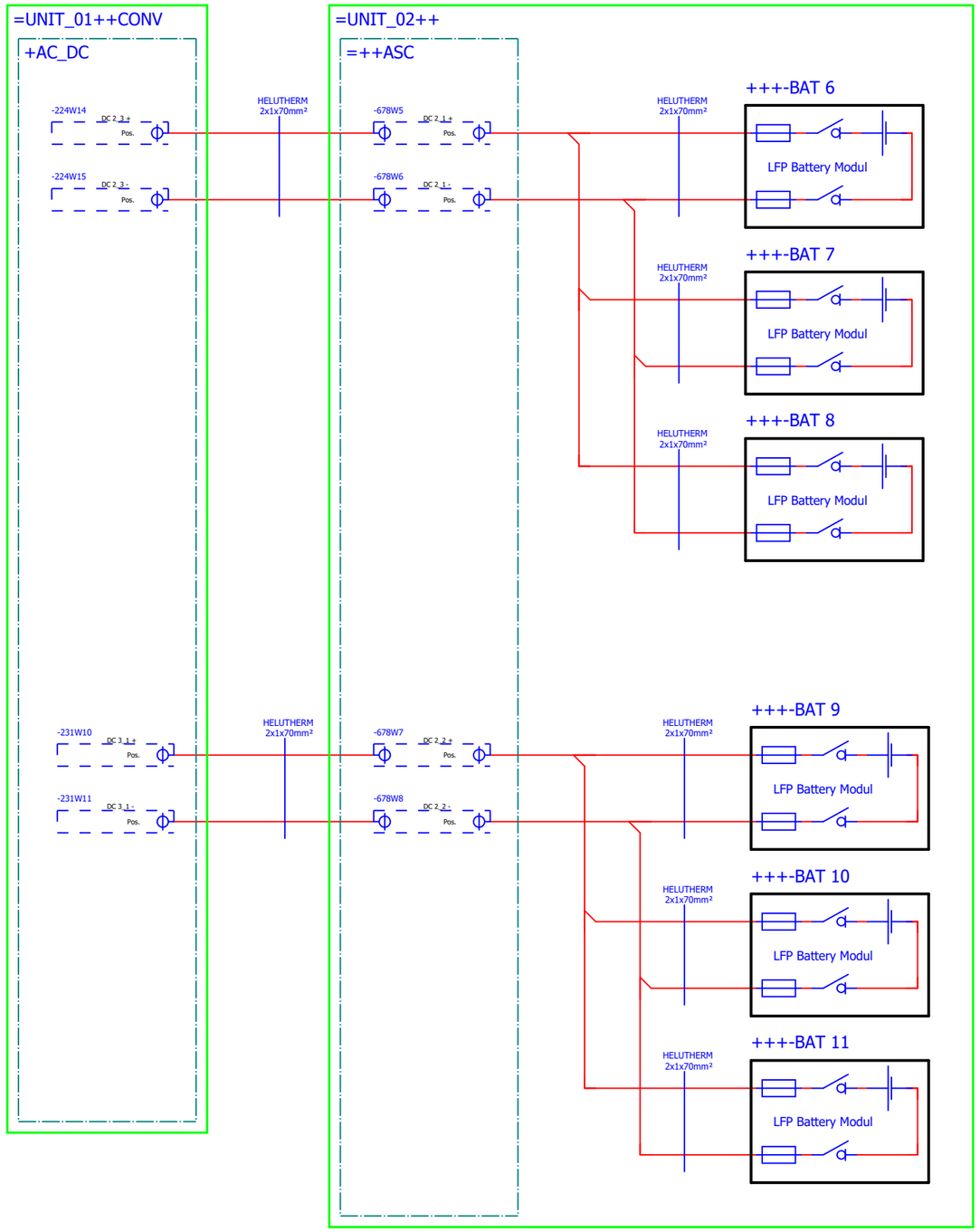
previous page: 1a

next page: &EFA/1a

Editor	Freqcon_JD			Statron	FREQCON	Specification Earthing	20250805_V2.0	= UNIT_02	Battery Container 1
Date	14.06.2024	Norm						& EAC	Explanatory documents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 6a
Date								+	total: 492

Single line diagram





previous page:
&EAC/6a

next page:
2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 1a
Date								+	total: 492

Single line diagram

Control circuit

++ASC

400V

-XES

-684F3 &EFS++ASC/684.2 C32A

-684F1 &EFS++ASC/684.0 C32A

-684F2 &EFS++ASC/684.5 TYP 1 + 2 SPD

-601F1 &EFS++ASC/601.1 TYP 1 + 2 SPD

-684F4 &EFS++ASC/685.0 C32A

-684F5 &EFS++ASC/685.5 TYP 1 + 2 SPD

-691F1 &EFS++ASC/691.1 C6A

-691F2 &EFS++ASC/691.3 C6A

-691F3 &EFS++ASC/691.4 C6A

-636K1 &EFS++ASC/636.1

-636K2 &EFS++ASC/636.2

-636K3 &EFS++ASC/636.4

M 1~

Exhaust Unit / shut-off flap Bat 1-4

Exhaust Unit / shut-off flap Bat 5-8

Exhaust Unit / shut-off flap Bat 9-11

Container Internal Lighting

-690F1 &EFS++ASC/690.1 16A

-690F3 &EFS++ASC/690.5 C6A

-690F4 &EFS++ASC/690.7 C6A

-690F5 &EFS++ASC/690.8 C6A

1/N/PE

crane 1

crane 2

crane 3

-691F4 &EFS++ASC/691.5 C16A

Cooling Units

-690F2 &EFS++ASC/690.3 16A

1/N/PE 1/N/PE

Container Sockets

-101Q1

20 A

Power Supply

-687F1 &EFS++ASC/687.1 C16A

-687F2 &EFS++ASC/687.3 C16A

-687F3 &EFS++ASC/687.4 C16A

-687F4 &EFS++ASC/687.5 C16A

-687F5 &EFS++ASC/687.7 C16A

Battery cabinet 1

Battery cabinet 2

Battery cabinet 3

Battery cabinet 4

Battery cabinet 5

-687F6 &EFS++ASC/687.8 C16A

-688F1 &EFS++ASC/688.1 C16A

-688F2 &EFS++ASC/688.2 C16A

-688F3 &EFS++ASC/688.4 C16A

-688F4 &EFS++ASC/688.5 C16A

-688F5 &EFS++ASC/688.7 C16A

Battery cabinet 6

Battery cabinet 7

Battery cabinet 8

Battery cabinet 9

Battery cabinet 10

Battery cabinet 11

previous page: 1a

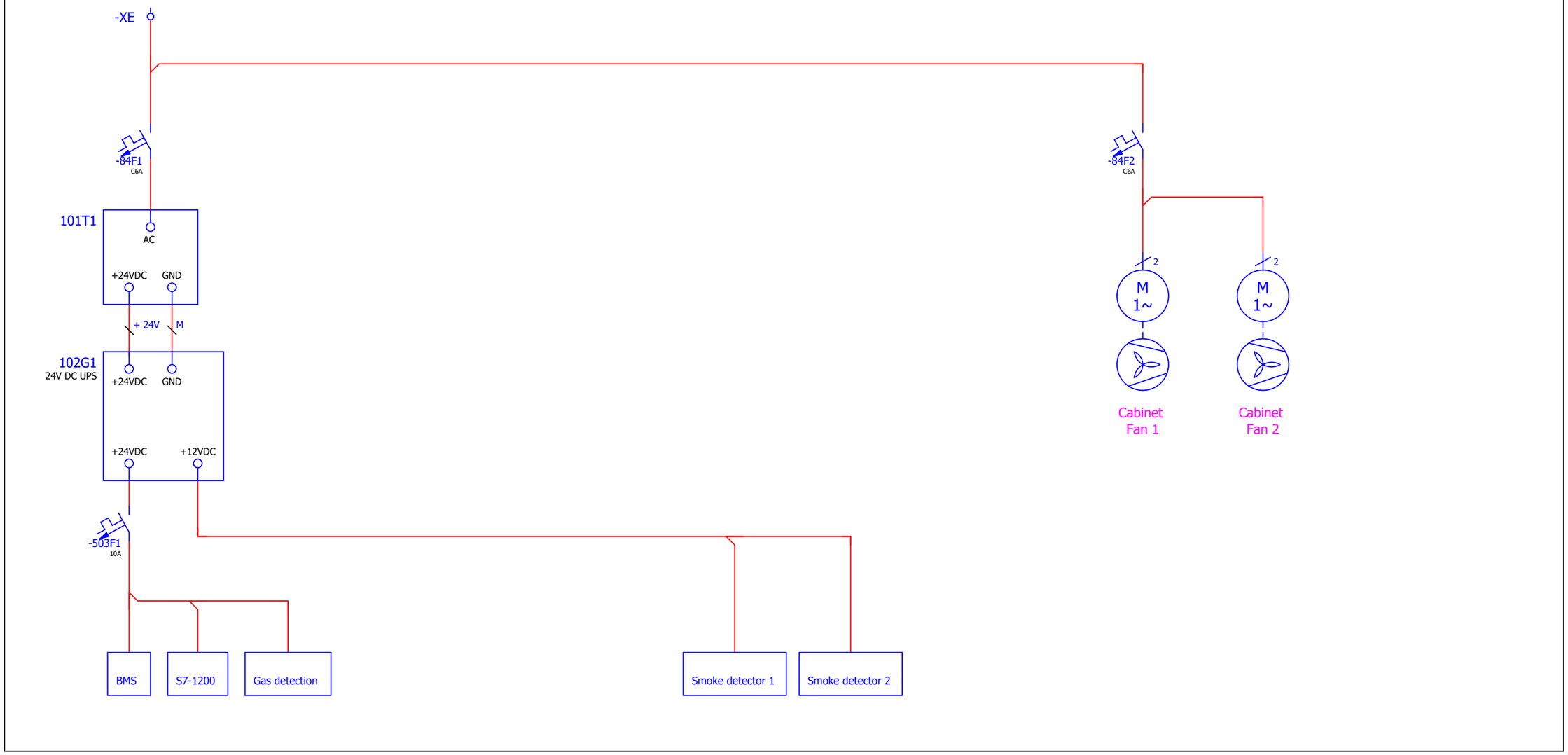
next page: 3a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2a
Date								+ total: 492

Single line diagram

Control circuit

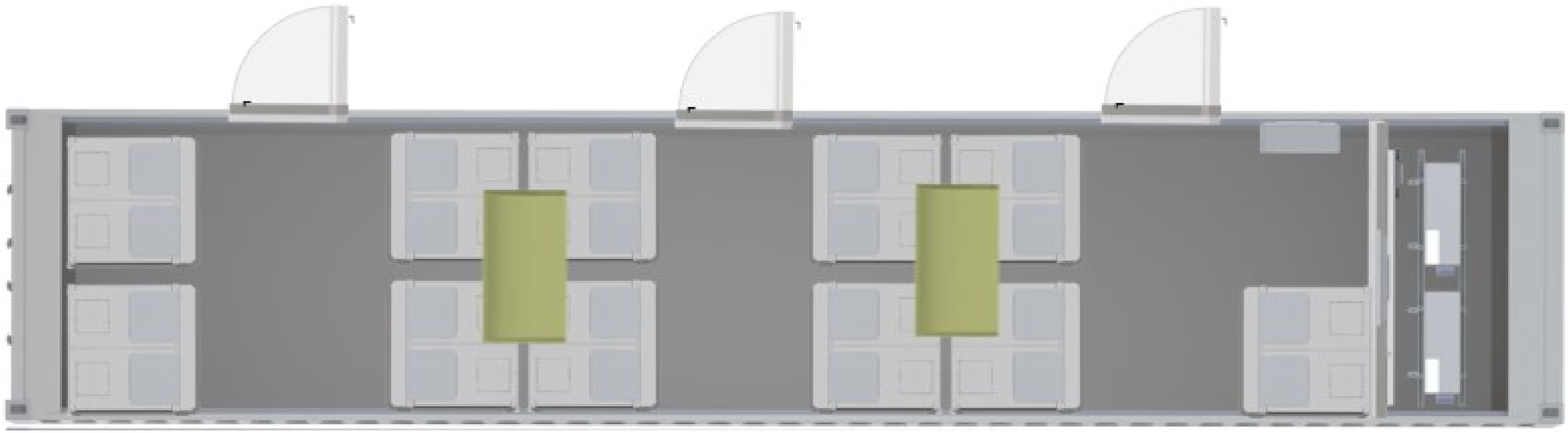
Battery Cabinet



previous page:
2a

next page:
&ELU/5a

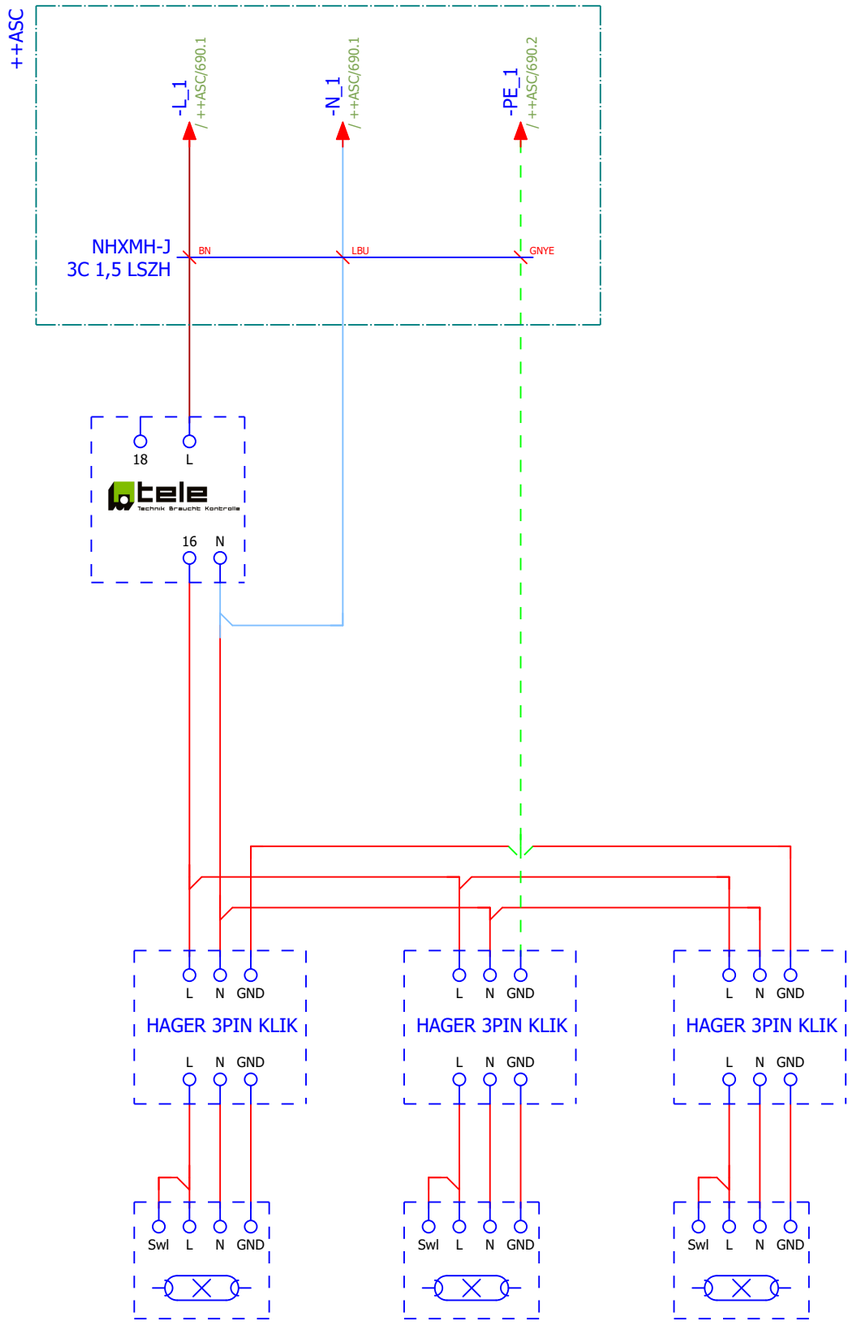
0	1	2	3	4	5	6	7	8	9



previous page:
&EFA/3a

next page:
&EFS++Container/190

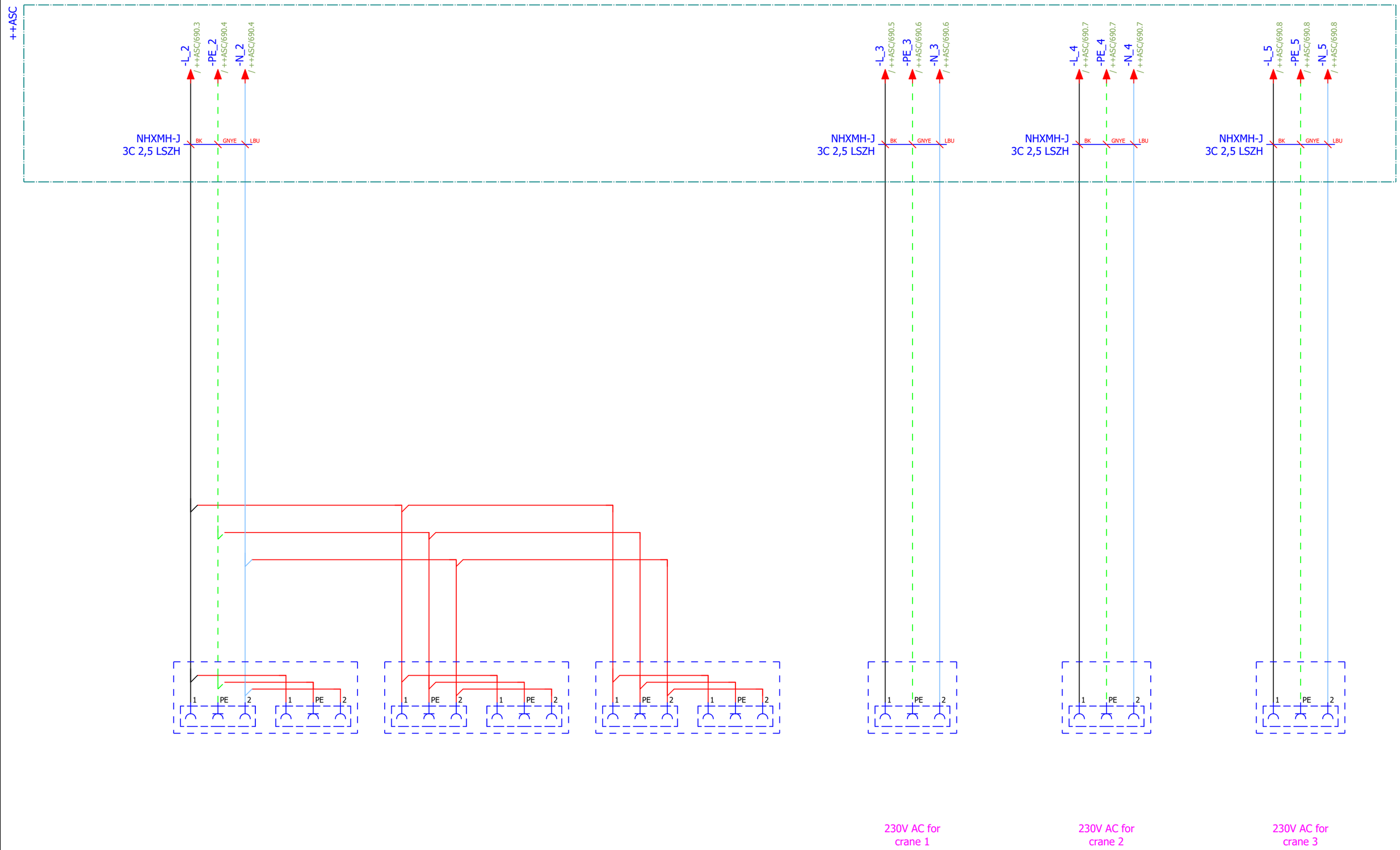
Editor	Freqcon_JD			Statron	FREQCON	Container overview	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024	Norm						& ELU Cabinet Overview	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
191

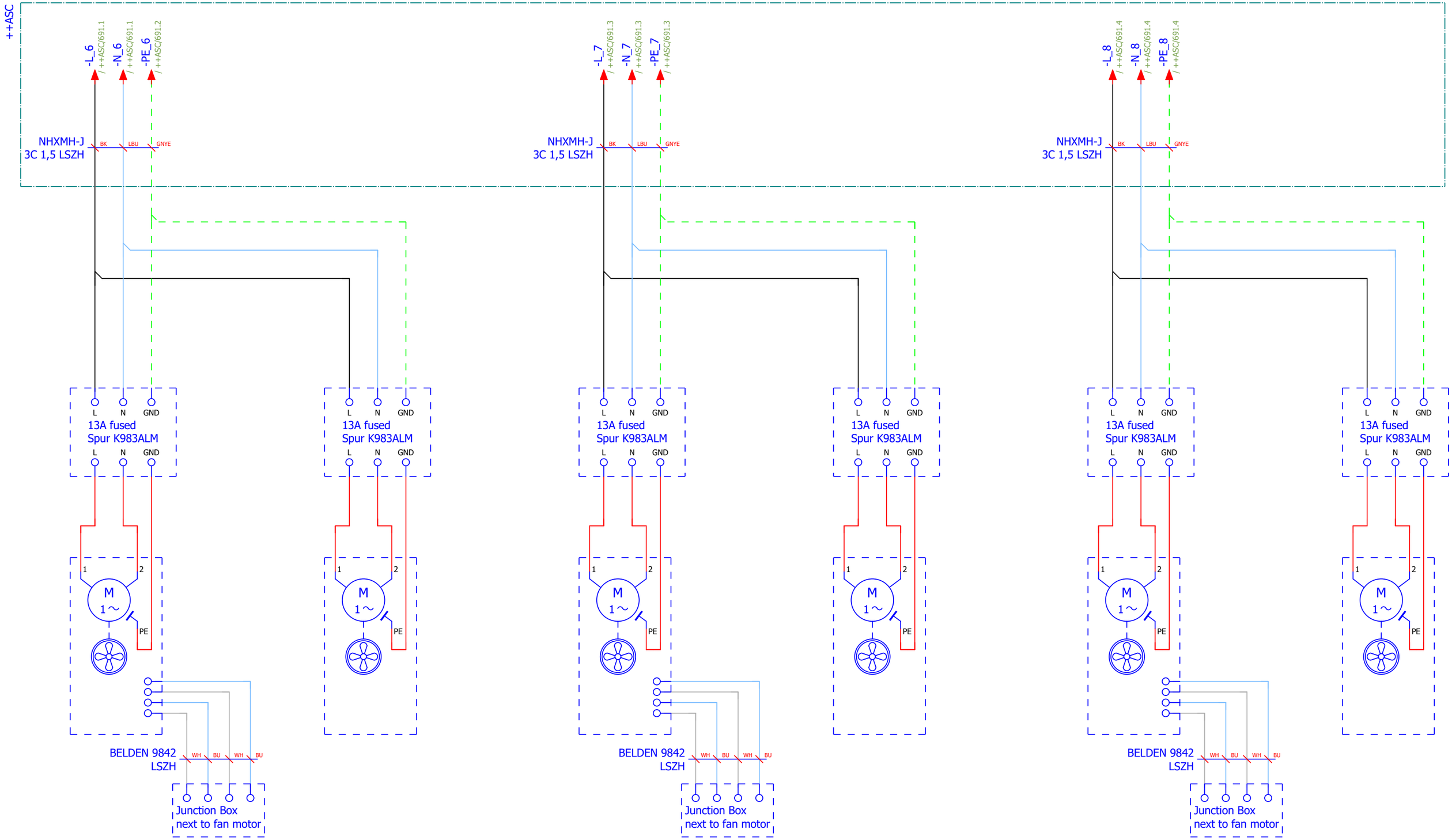
Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492



previous page: 190

next page: 192

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 191
Date								+	total: 492



230V AC for
Exhaust Unit
Battery cabinets 1-4

230V AC for
shut-off flap
Battery cabinets 1-4

230V AC for
Exhaust Unit
Battery cabinets 5-8

230V AC for
shut-off flap
Battery cabinets 5-8

230V AC for
Exhaust Unit
Battery cabinets 9-11

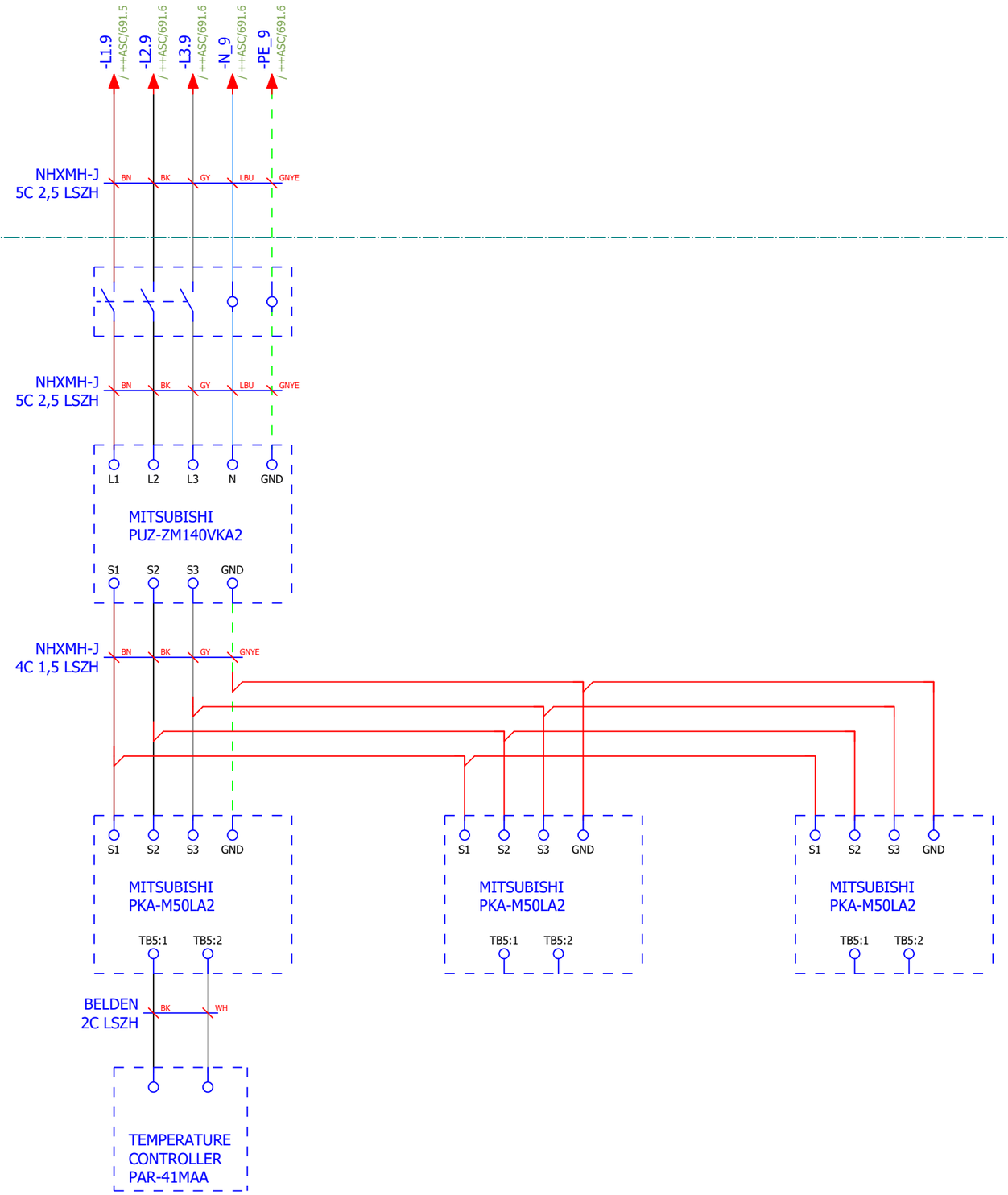
230V AC for
shut-off flap
Battery cabinets 9-11

previous page:
191

next page:
193

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 192
Date								+ total: 492

++ASC

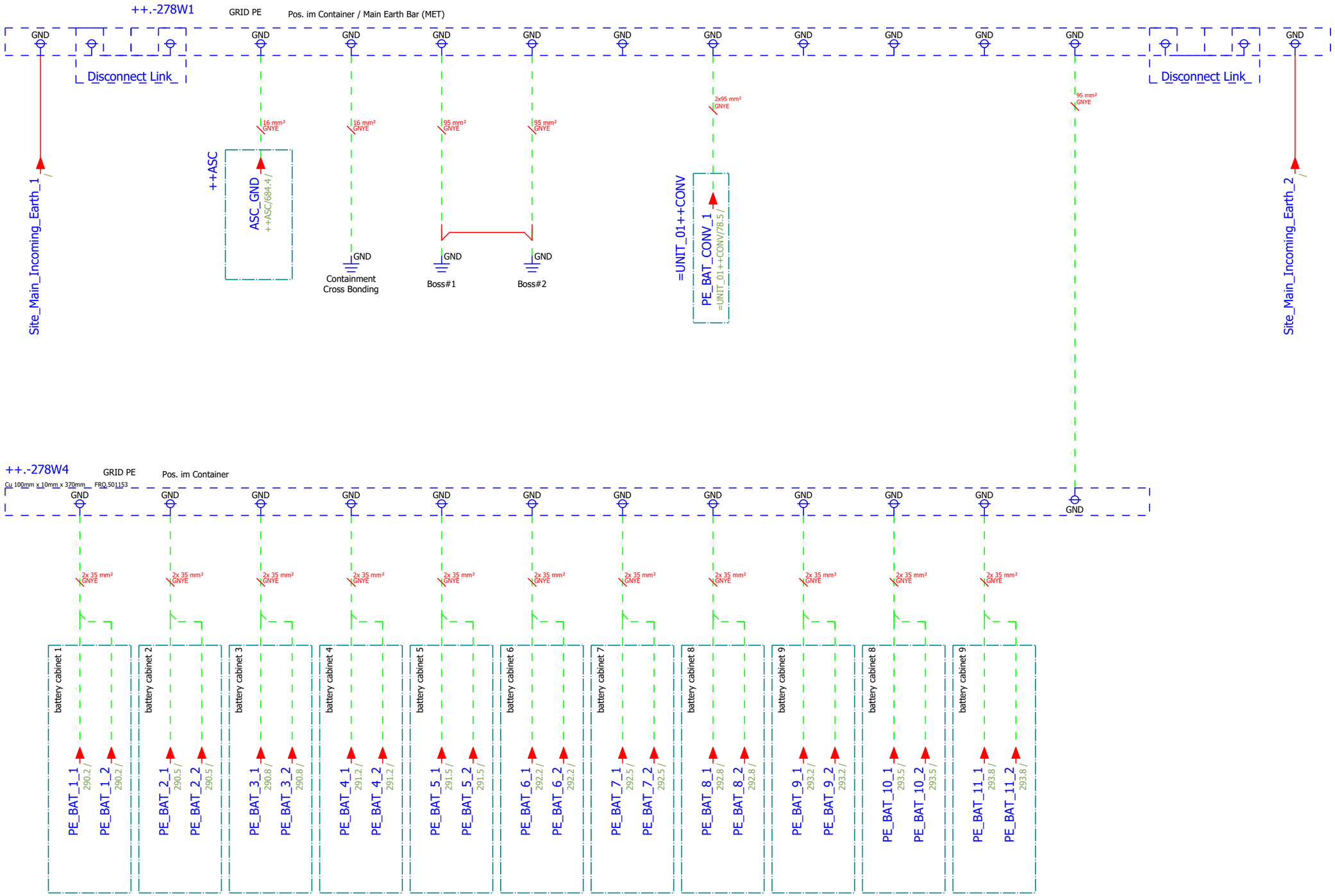


previous page:
192

next page:
278

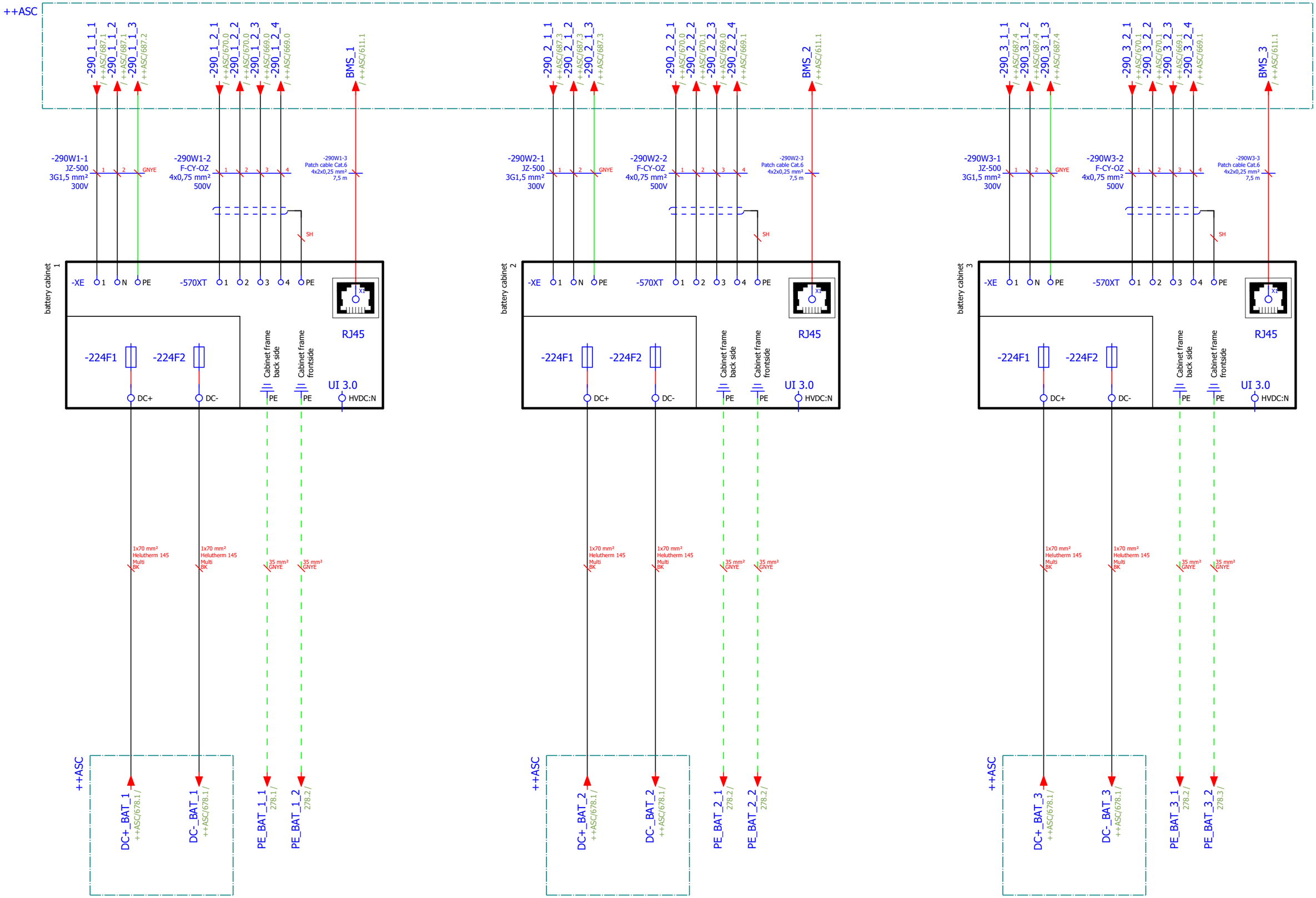
Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 193
Date								+	total: 492

Busbars PE



previous page: 193

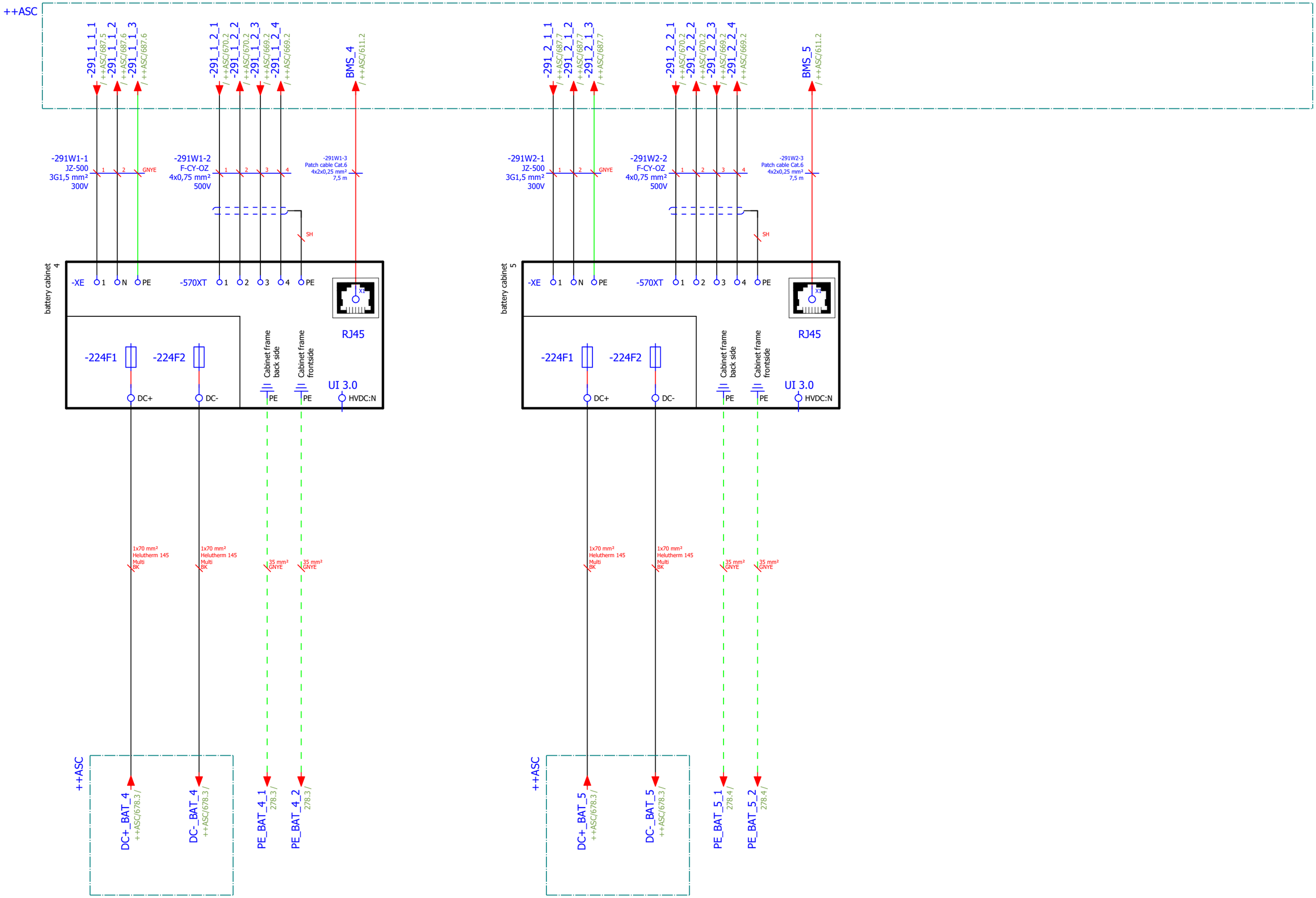
next page: 290



previous page: 278

next page: 291

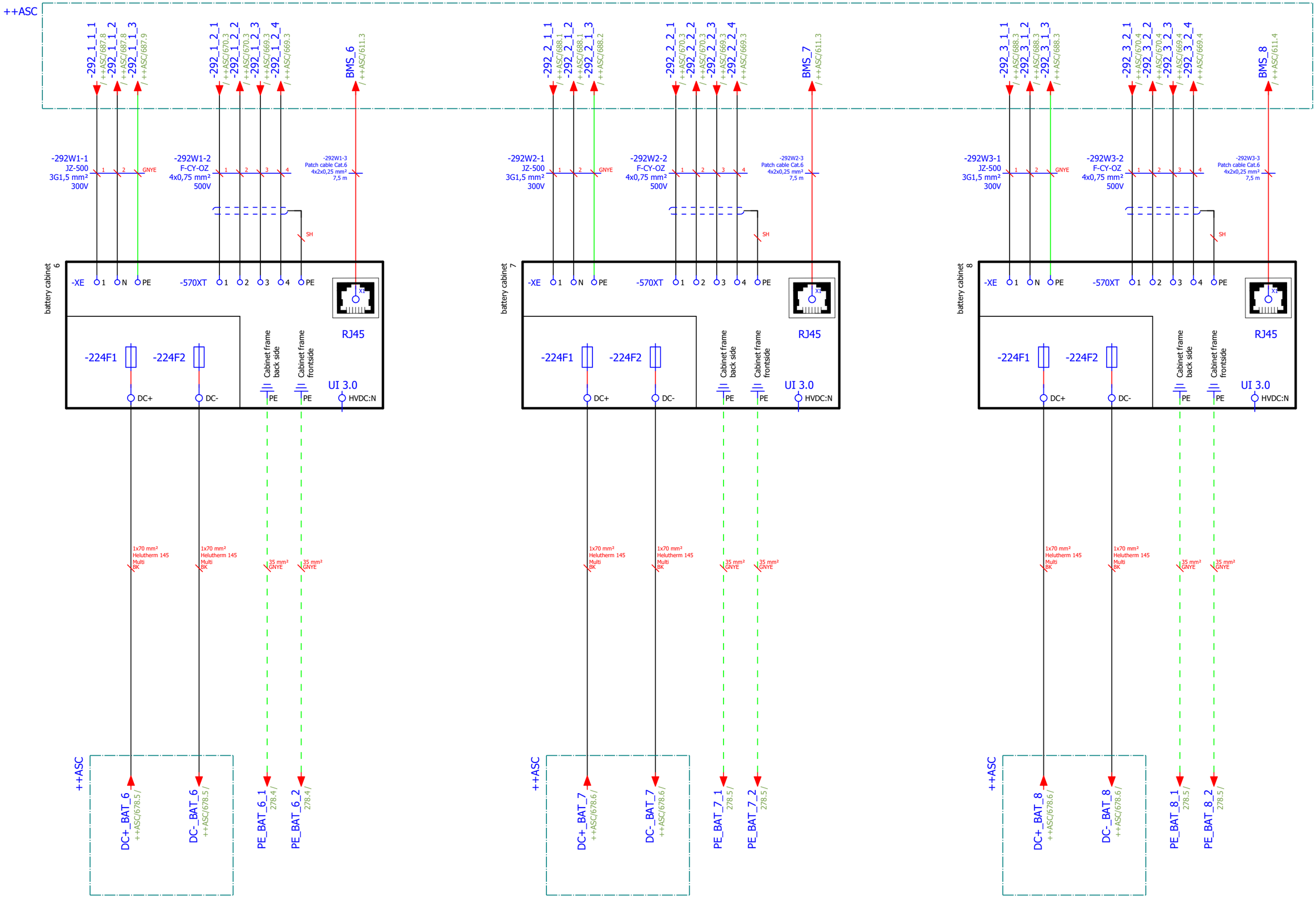
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 1-3	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 290
Date								+	total: 492



previous page: 290

next page: 292

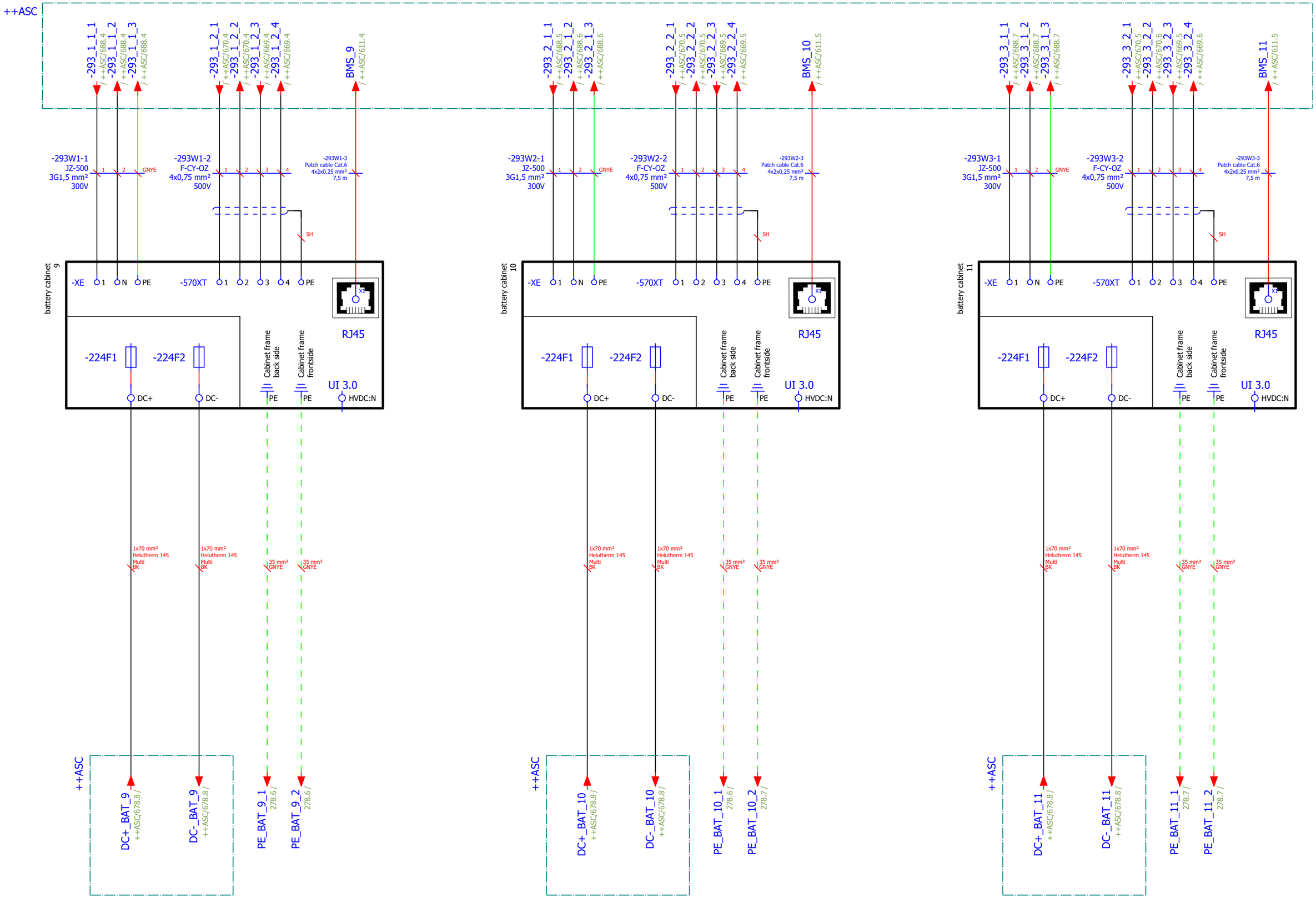
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 4+5	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 291
Date								+	total: 492



previous page: 291

next page: 293

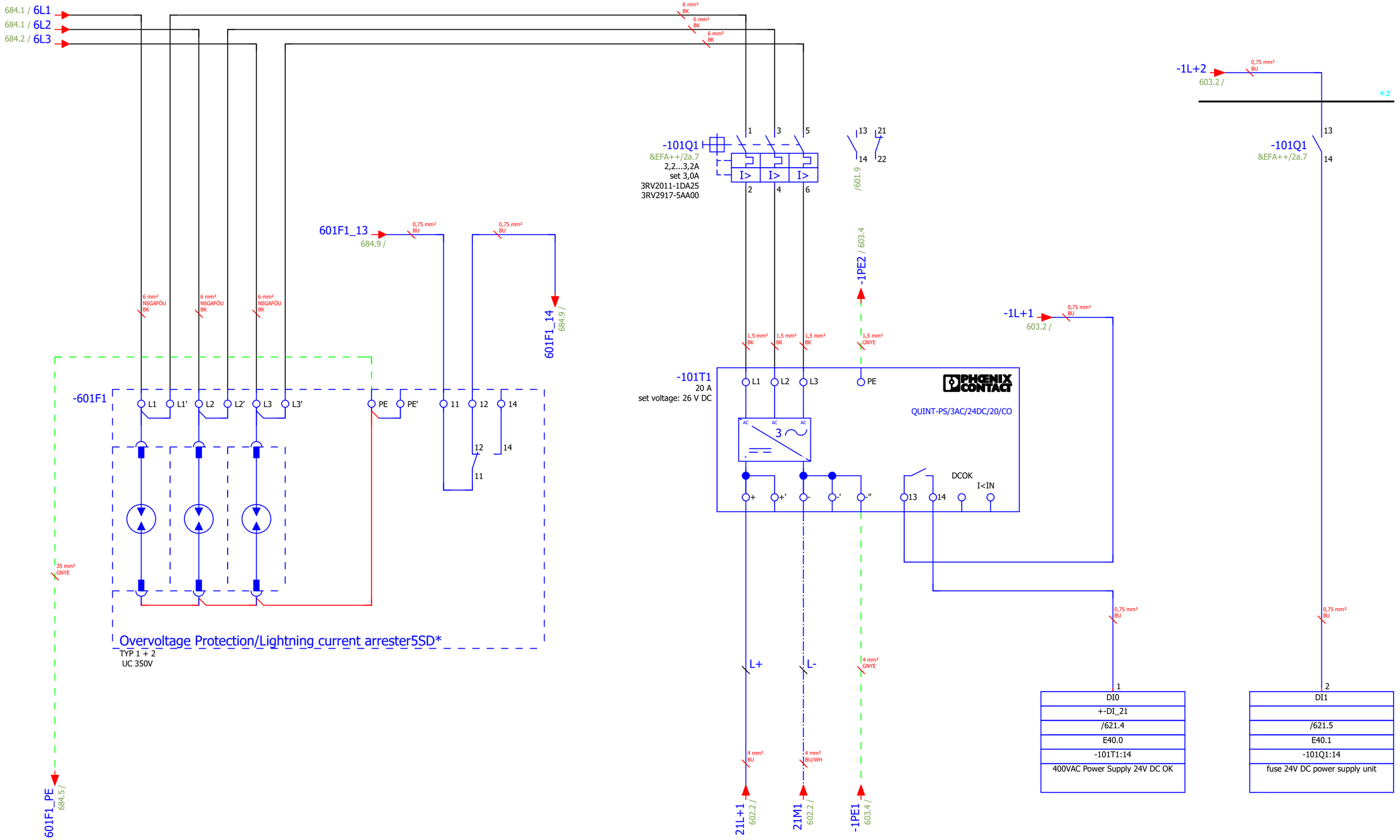
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 6-8	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 292
Date								+	total: 492



previous page: 292

next page: ++ASC/601

Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 9-11	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 293
Date								+	total: 492



previous page:
++Container/293

Power supply unit from 400V AC

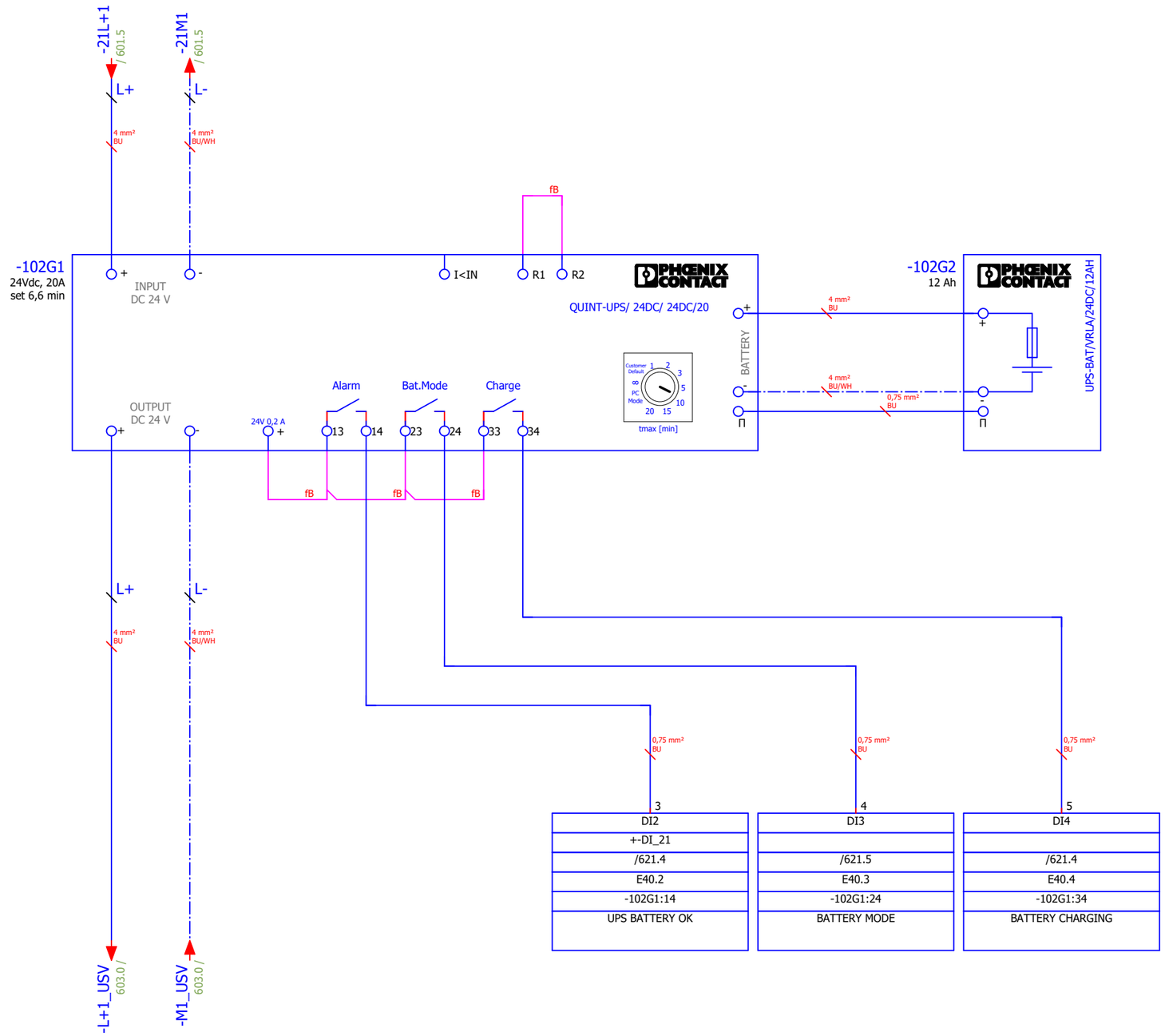
400VAC
Power Supply
24V DC OK

fuse
24V DC power supply unit

next page:
602

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

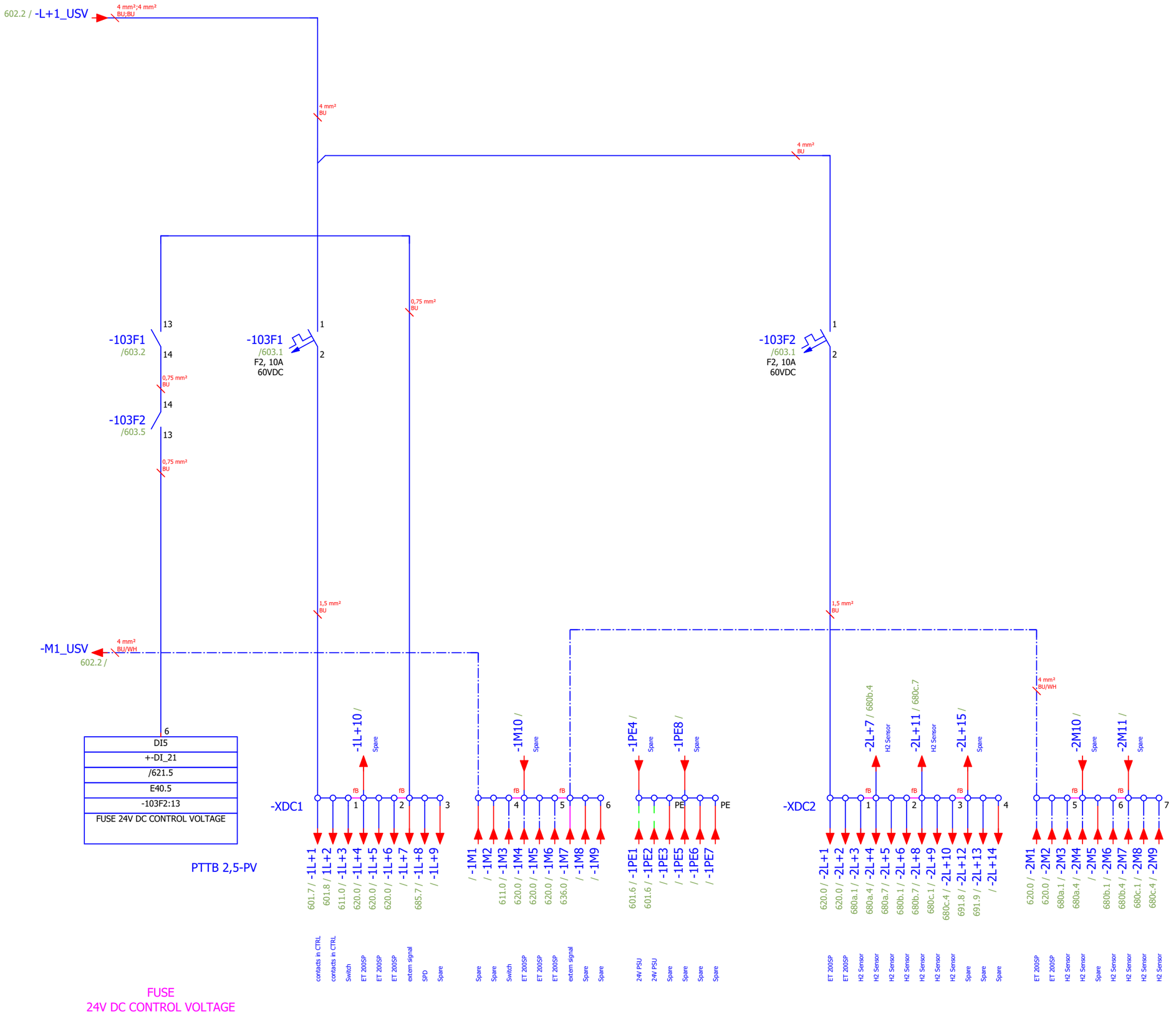
page: 601
total: 492



previous page:
601

next page:
603

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 602
Date								+ — total: 492

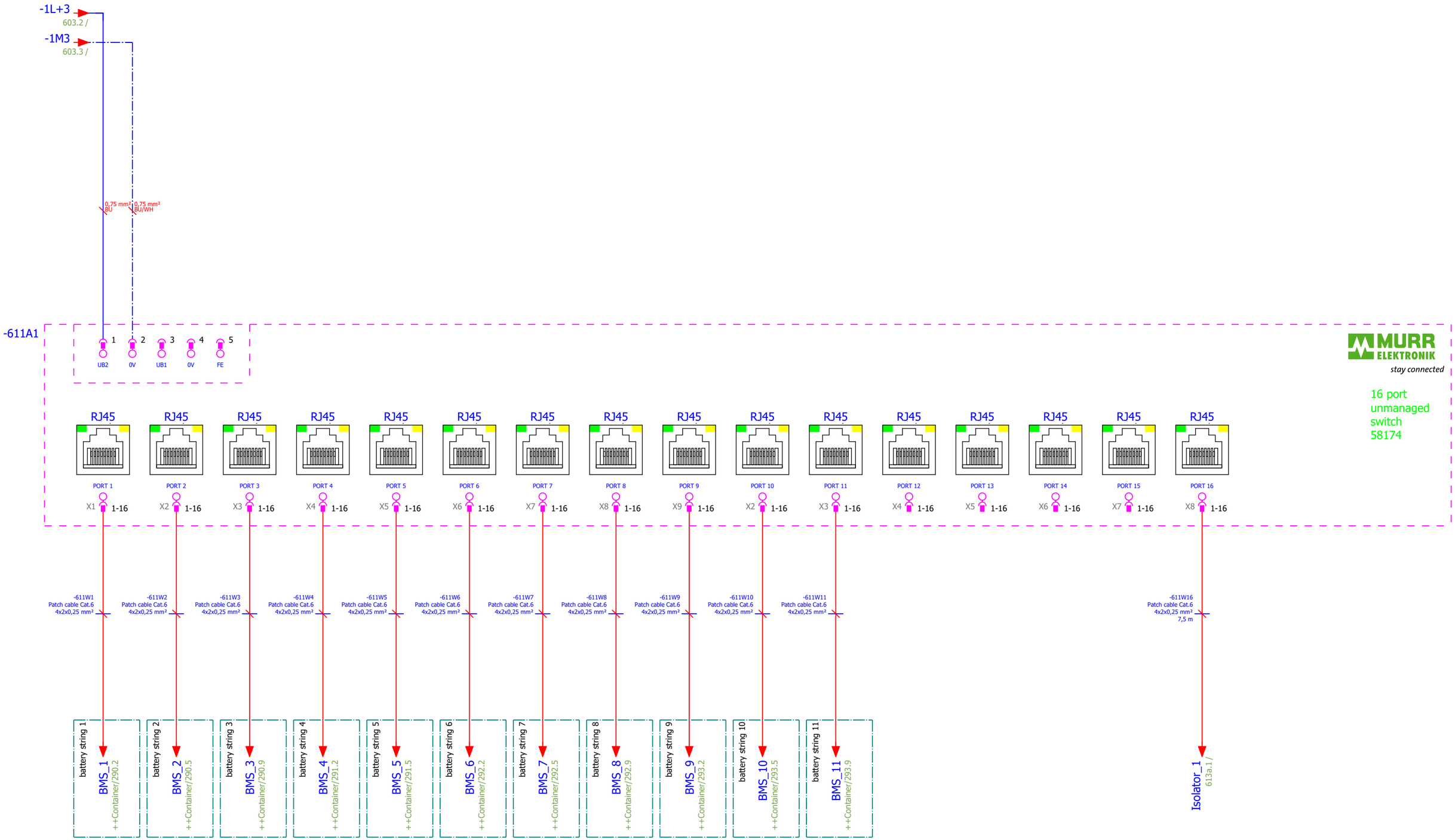


previous page:
602

next page:
611

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_02	Battery Container 1
Date	21.01.2025							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxiliary cabinet
Date								+	

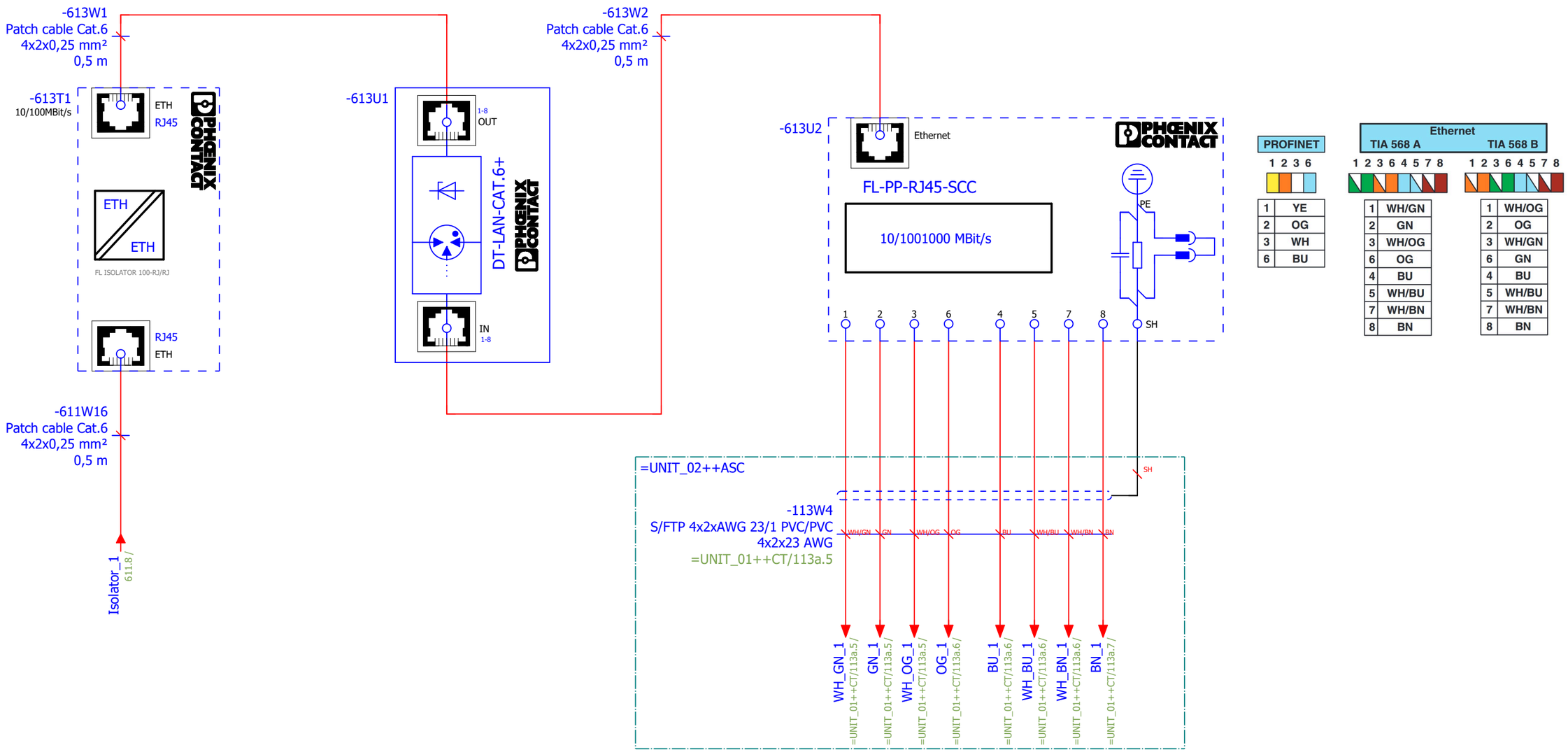
page: 603
total: 492



previous page: 603

next page: 613a

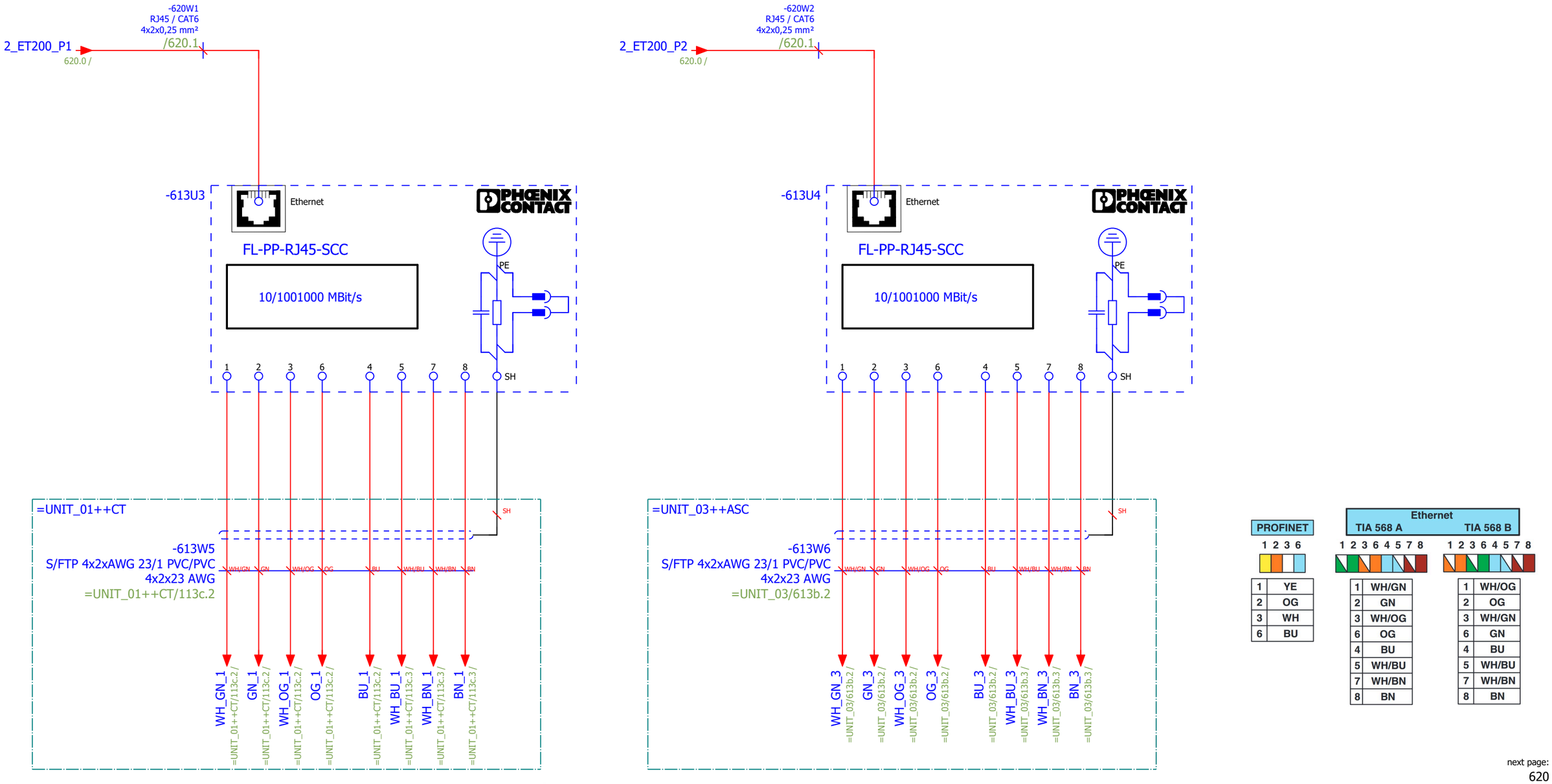
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 492



previous page:
611

next page:
613b

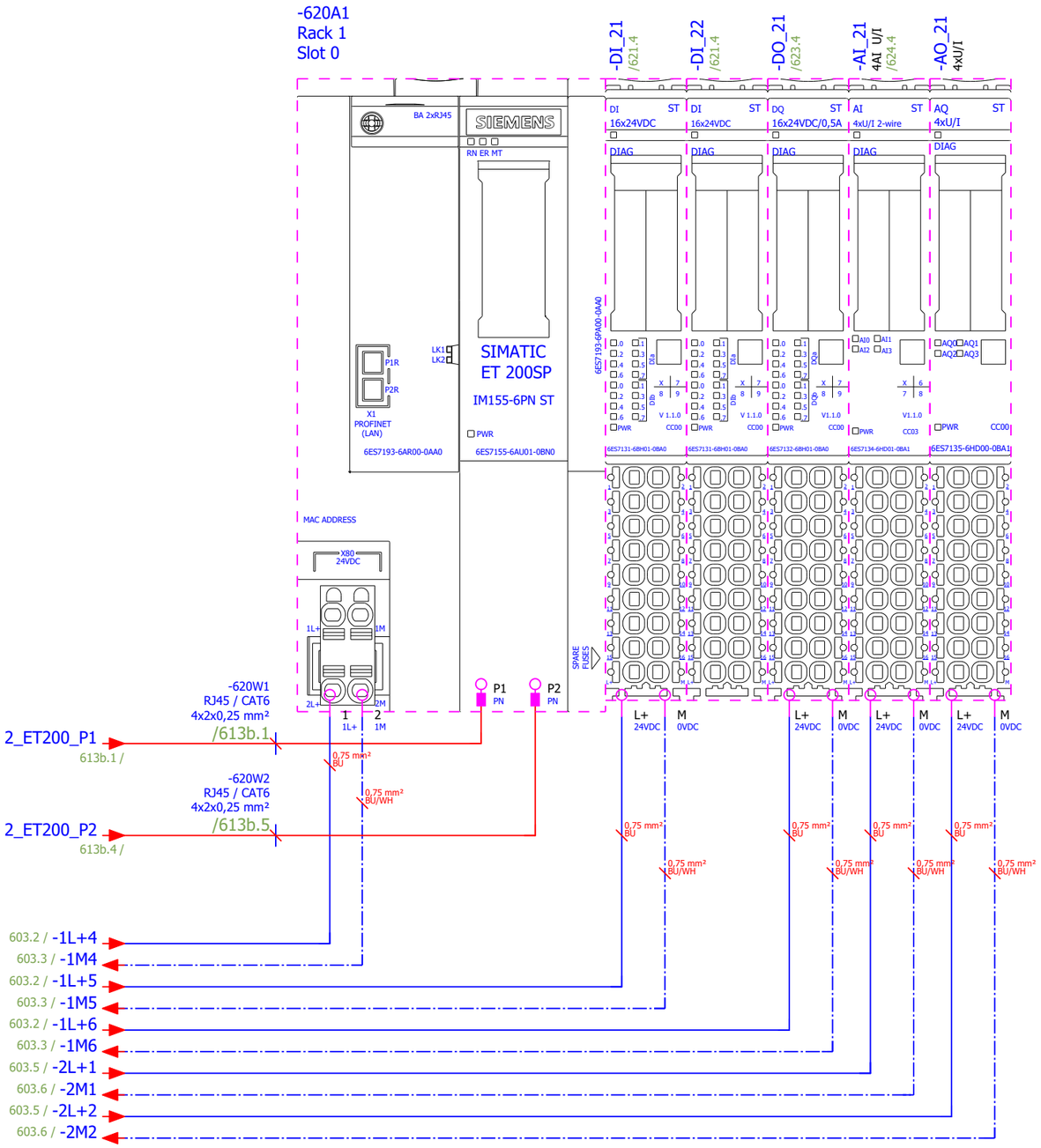
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	25.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 613a
Date								+	total: 492



previous page:
613a

next page:
620

Editor	Freqcon_DG			Statron	FREQCON	PROFINET	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613b
Date								+		total: 492



previous page:
613b

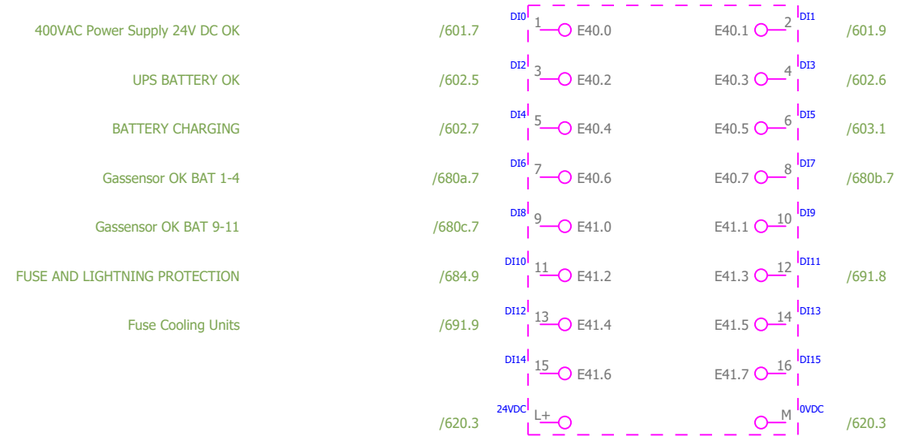
next page:
621

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC ASC	20250805_V2.0	= UNIT_02	Battery Container 1
Date	03.12.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 620
total: 492

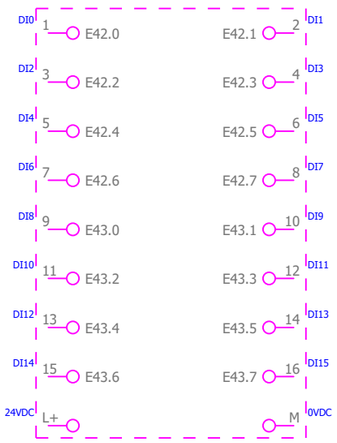
-DI_21

/620.3



-DI_22

/620.3



previous page: 620

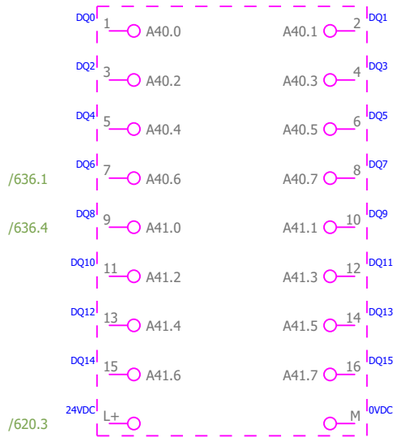
next page: 623

Editor	Freqcon_DG			Statron	FREQCON	ET200SP DIGITAL INPUTS DI_21 + DI_22	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	03.12.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 621
Date								+	total: 492

0	1	2	3	4	5	6	7	8	9

-DO_21

/620.3



230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4 /636.1

230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11 /636.4

/620.3

/636.2 230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8

/620.4

previous page: 621

next page: 624

Editor	Freqcon_JD			Statron	FREQCON	ET200SP DIGITAL OUTPUTS DO_21	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 623
Date								+	total: 492

-AI_21

/620.4



gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

/620.4

/680b.2 gas concentration BAT 5-8

/680b.2 gas concentration BAT 5-8

/620.4

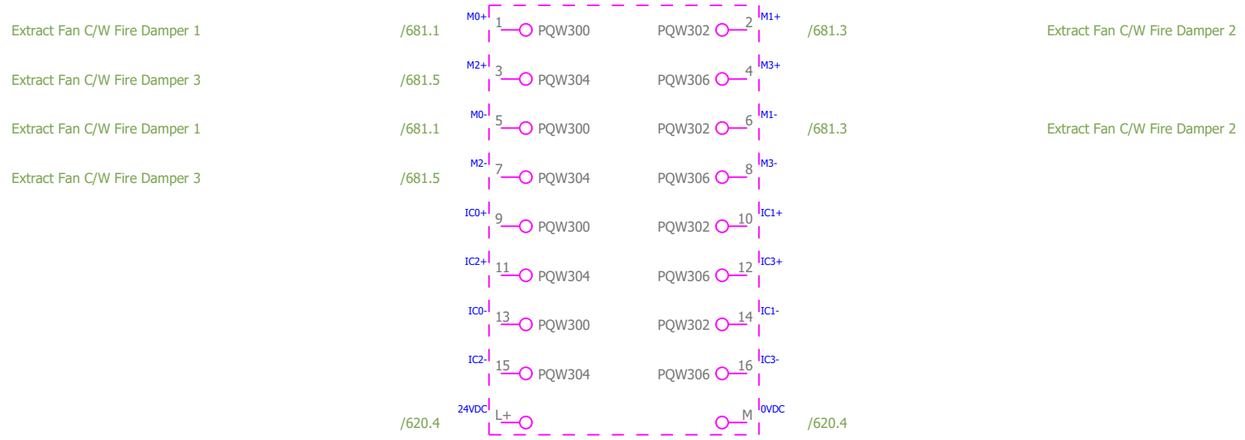
previous page: 623

next page: 625

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_21	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 624
Date								+	total: 492

-AO_21

/620.4



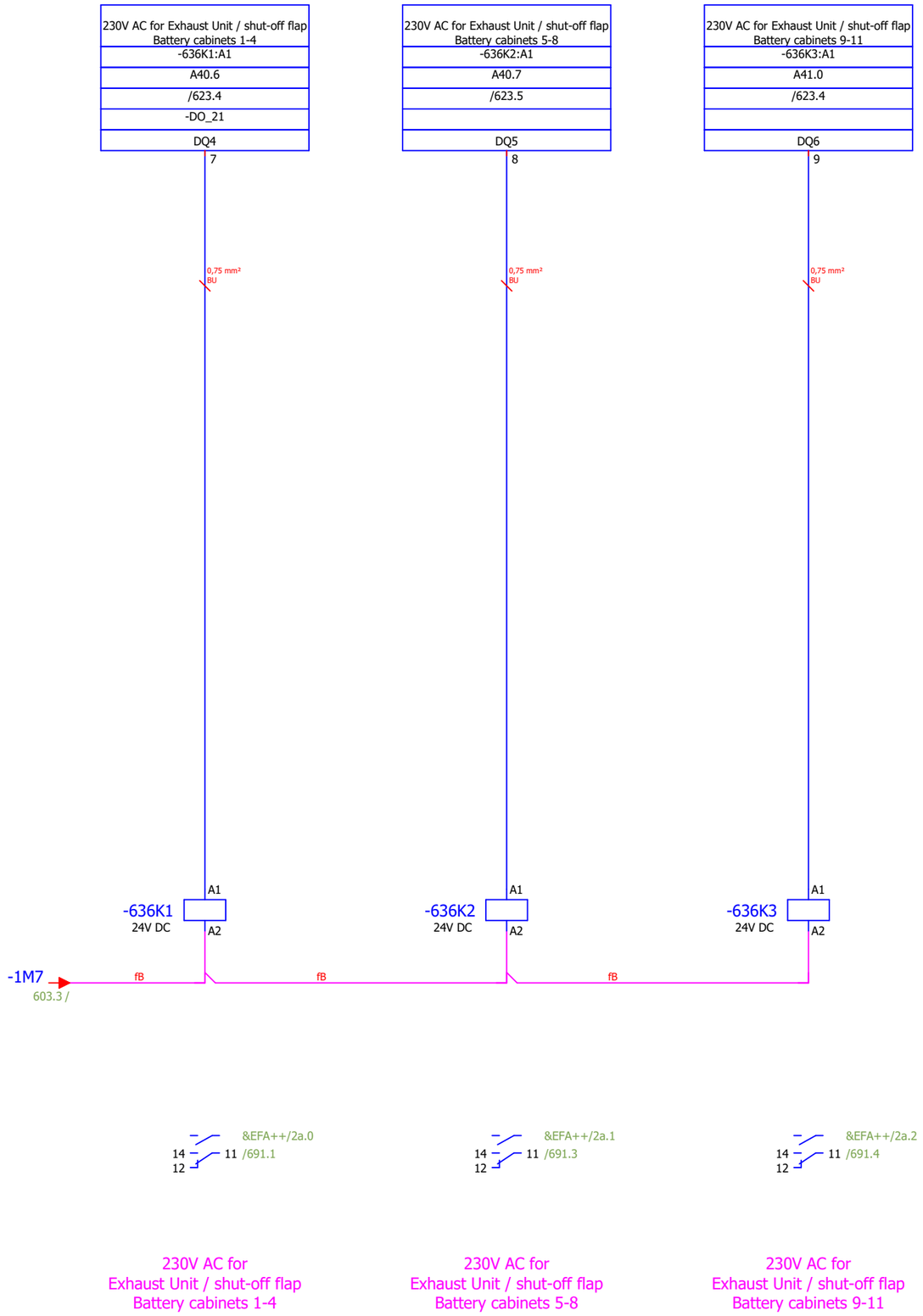
previous page: 624

next page: 636

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG OUTPUTS AO_21	20250805_V2.0	= UNIT_02	Battery Container 1
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 625

total: 492

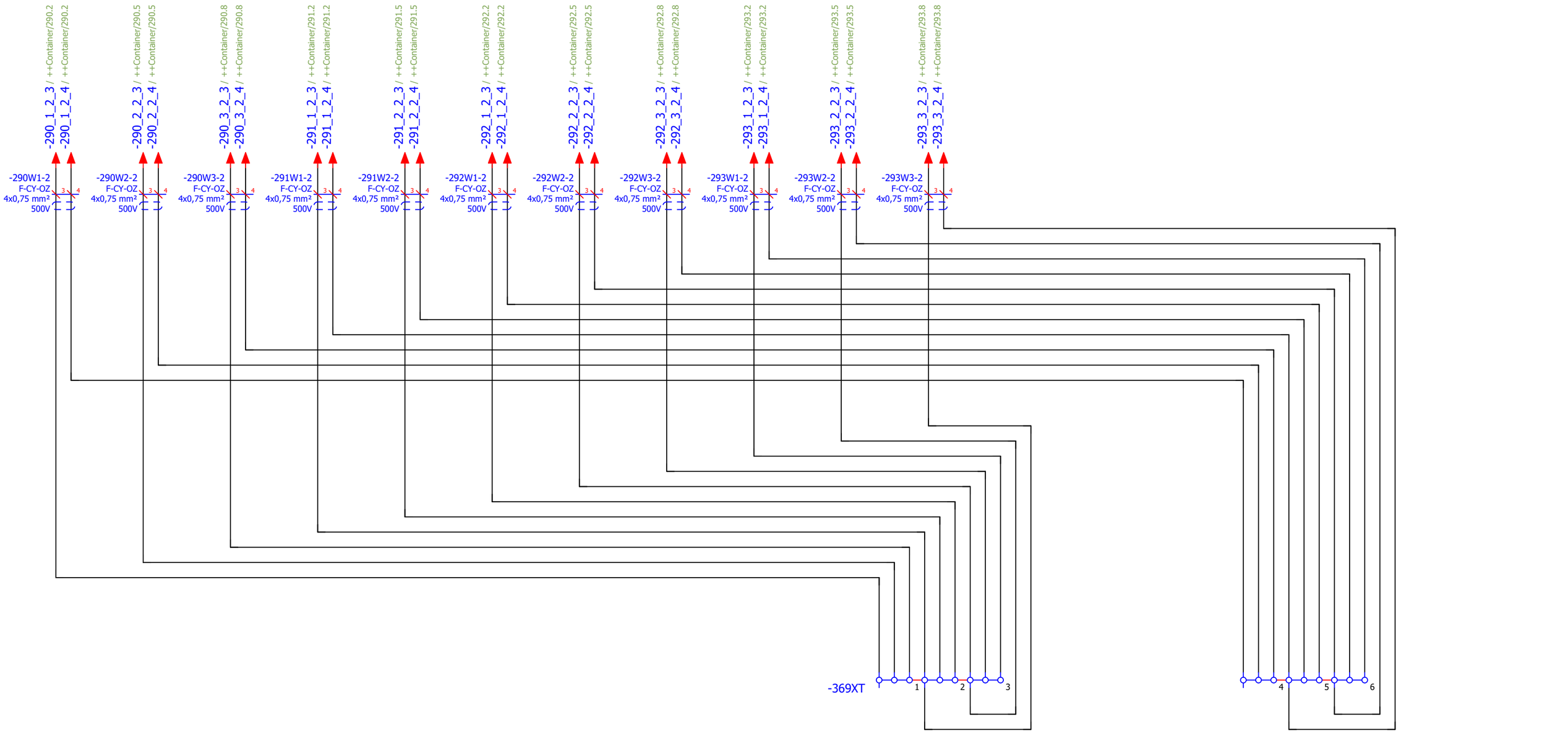


previous page: 625

next page: 669

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FIRE DAMPER	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 636
total: 492



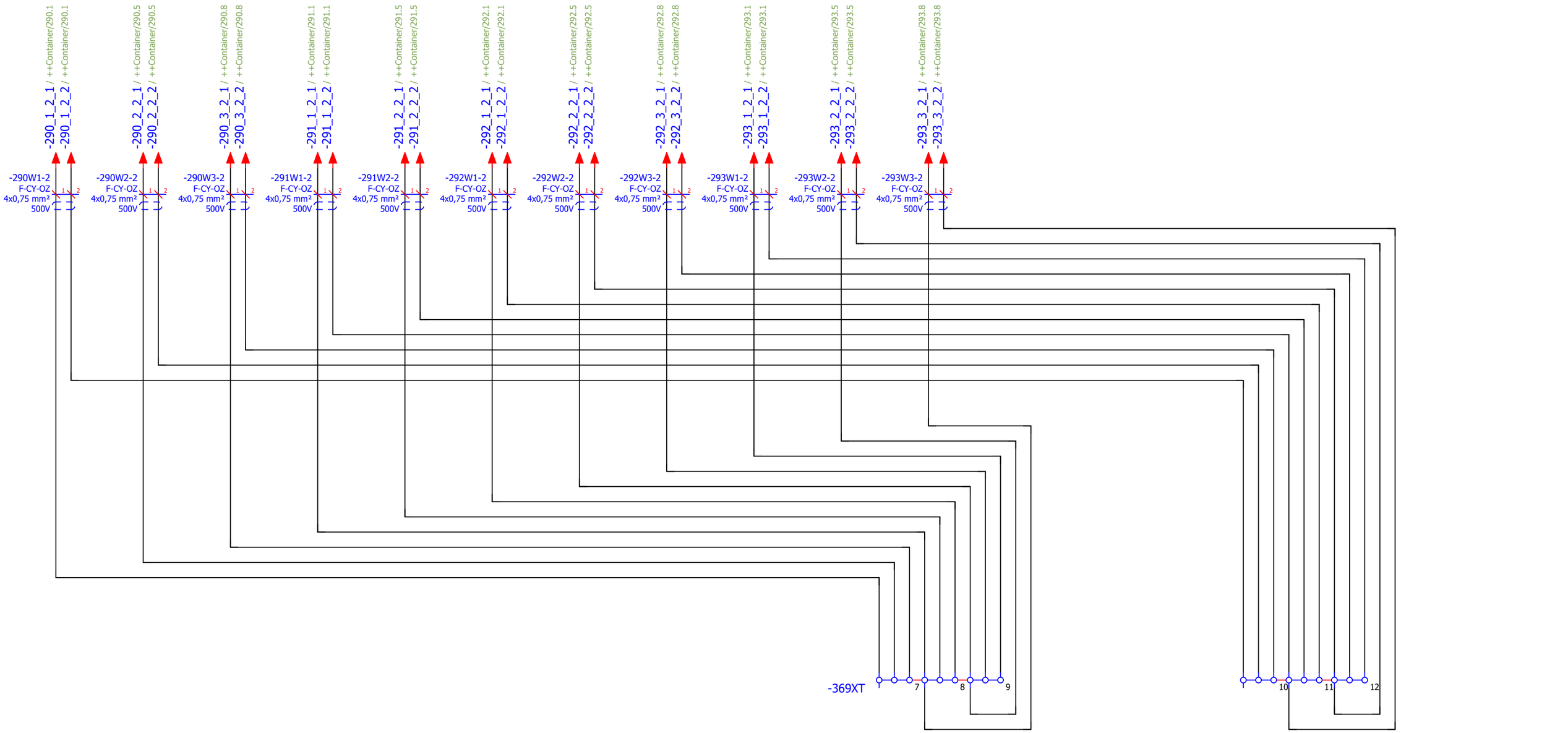
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page: 636

next page: 670

Editor	Freqcon_JD			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 492



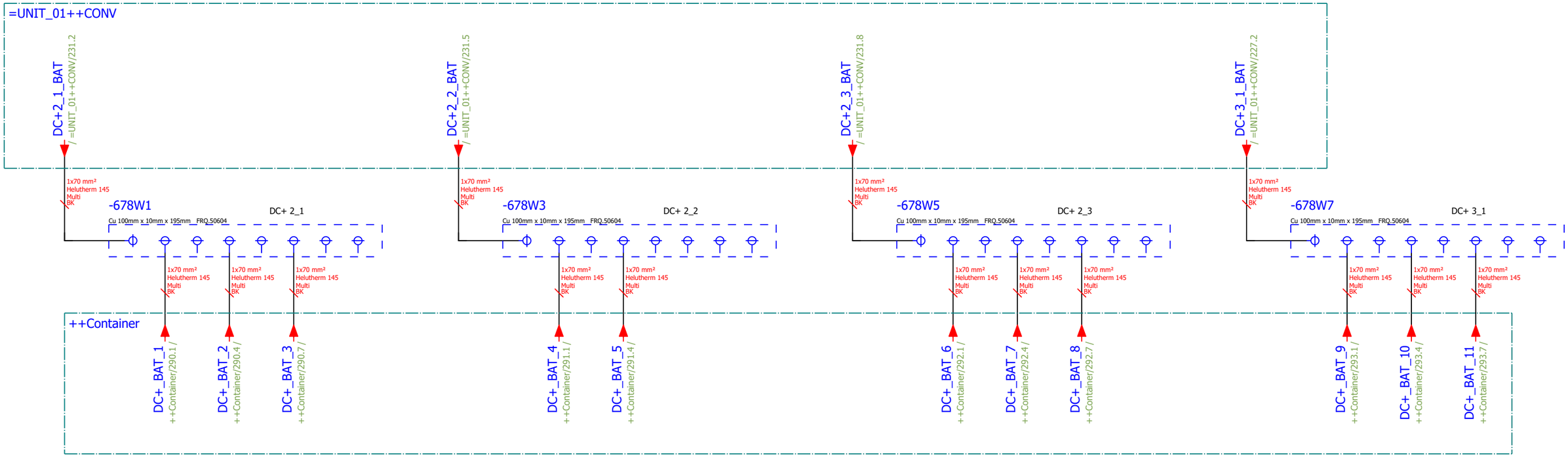
battery cabinet gas
potential-free contacts
customer

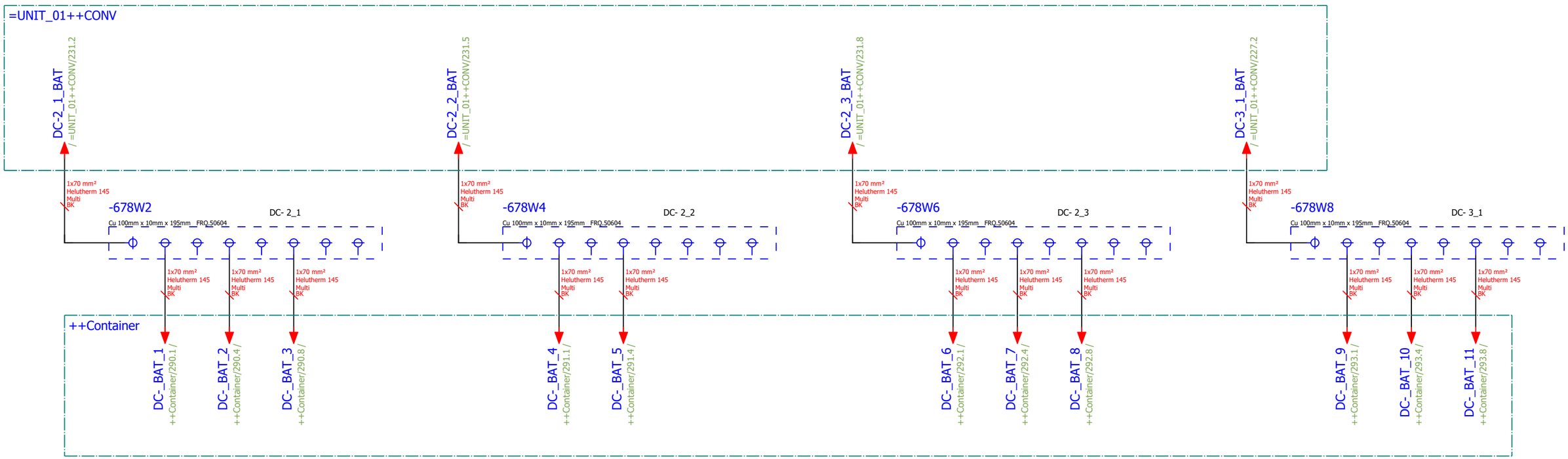
battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
678

Editor	Freqcon_JD			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 492





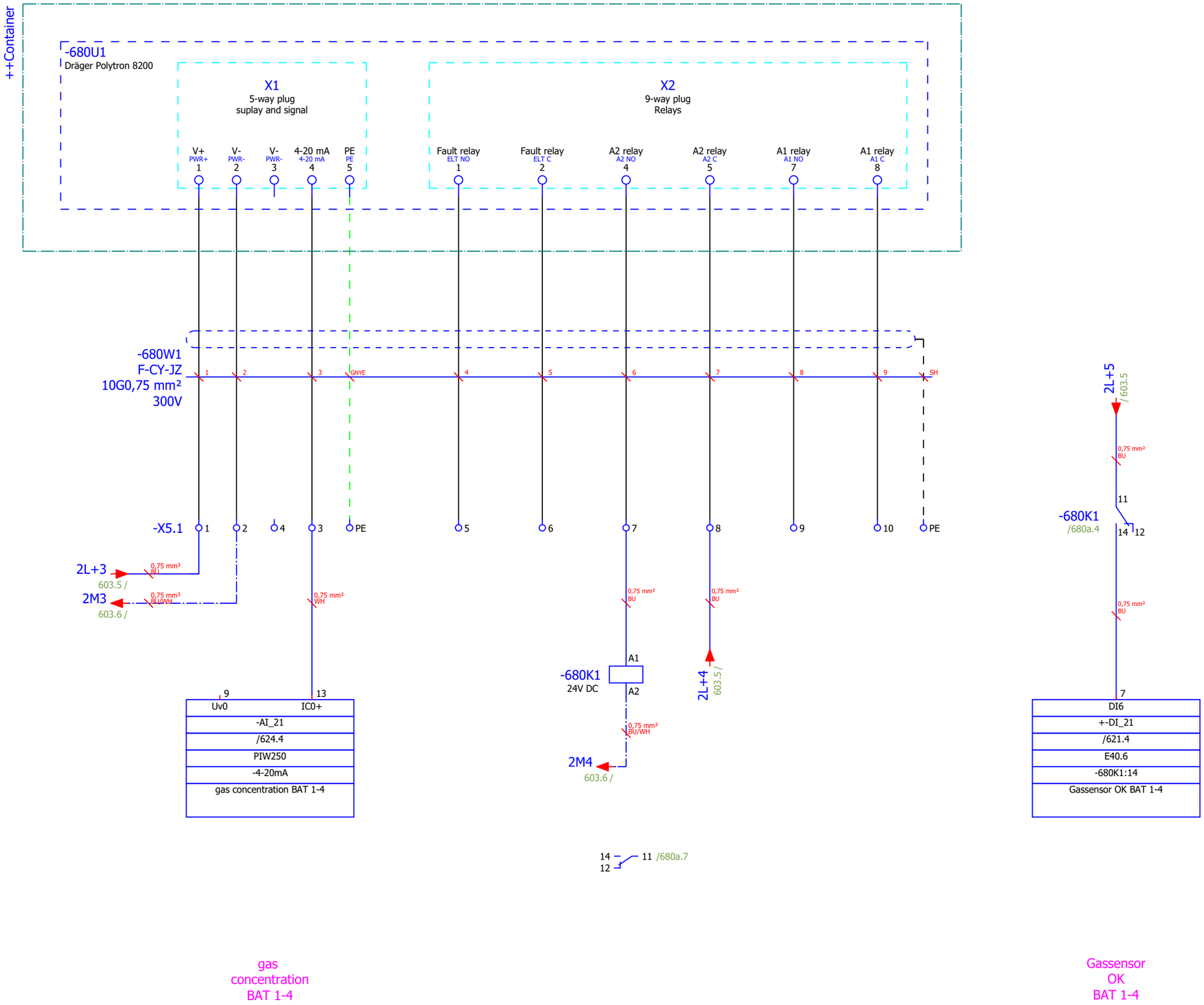
previous page: 670

next page: 680a

Editor	Freqcon_JD			Statron	FREQCON	DC BATTERY CABINETS	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 678

total: 492



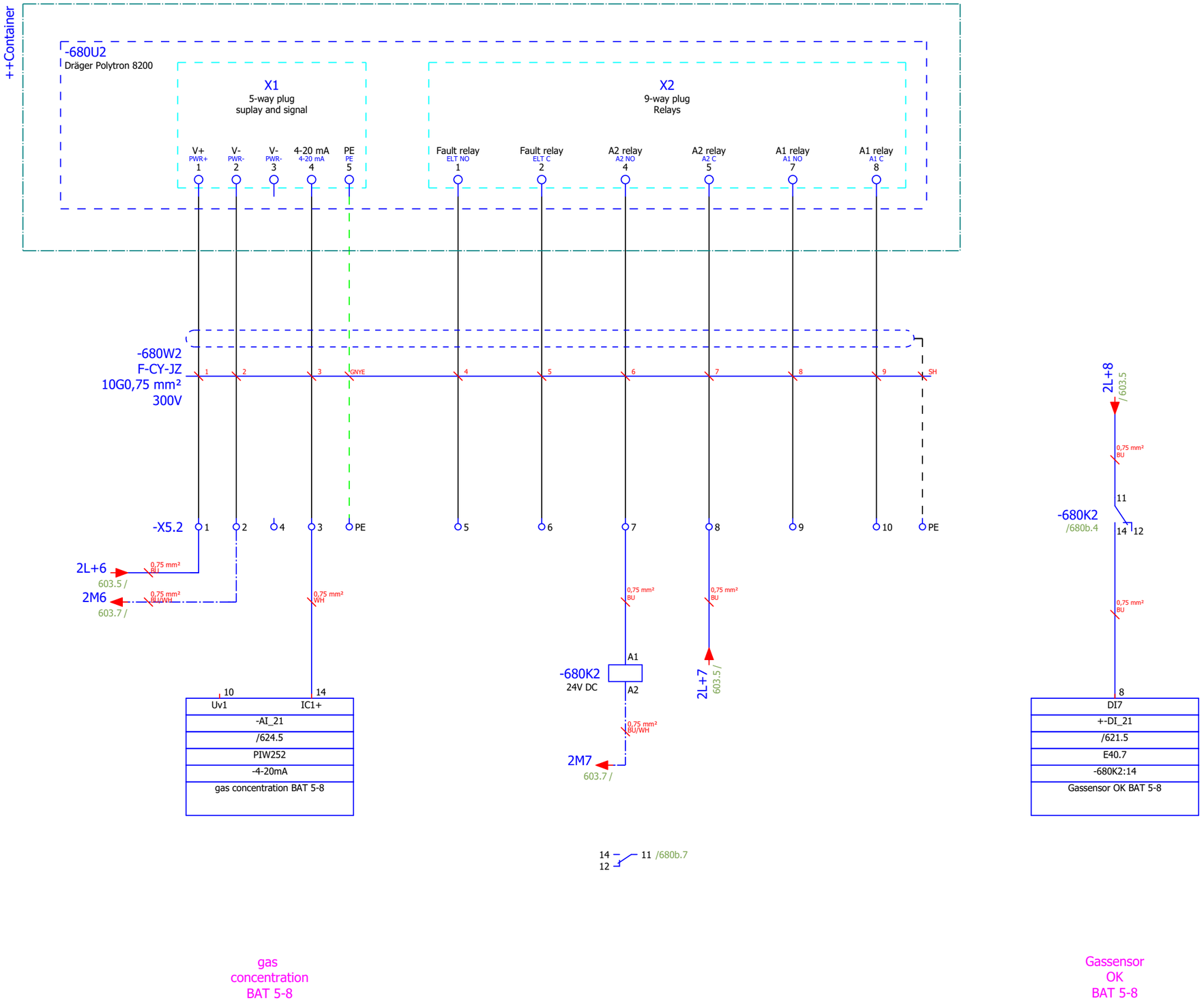
gas concentration BAT 1-4

Gassensor OK BAT 1-4

previous page: 678

next page: 680b

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 1-4	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680a
Date								+	total: 492



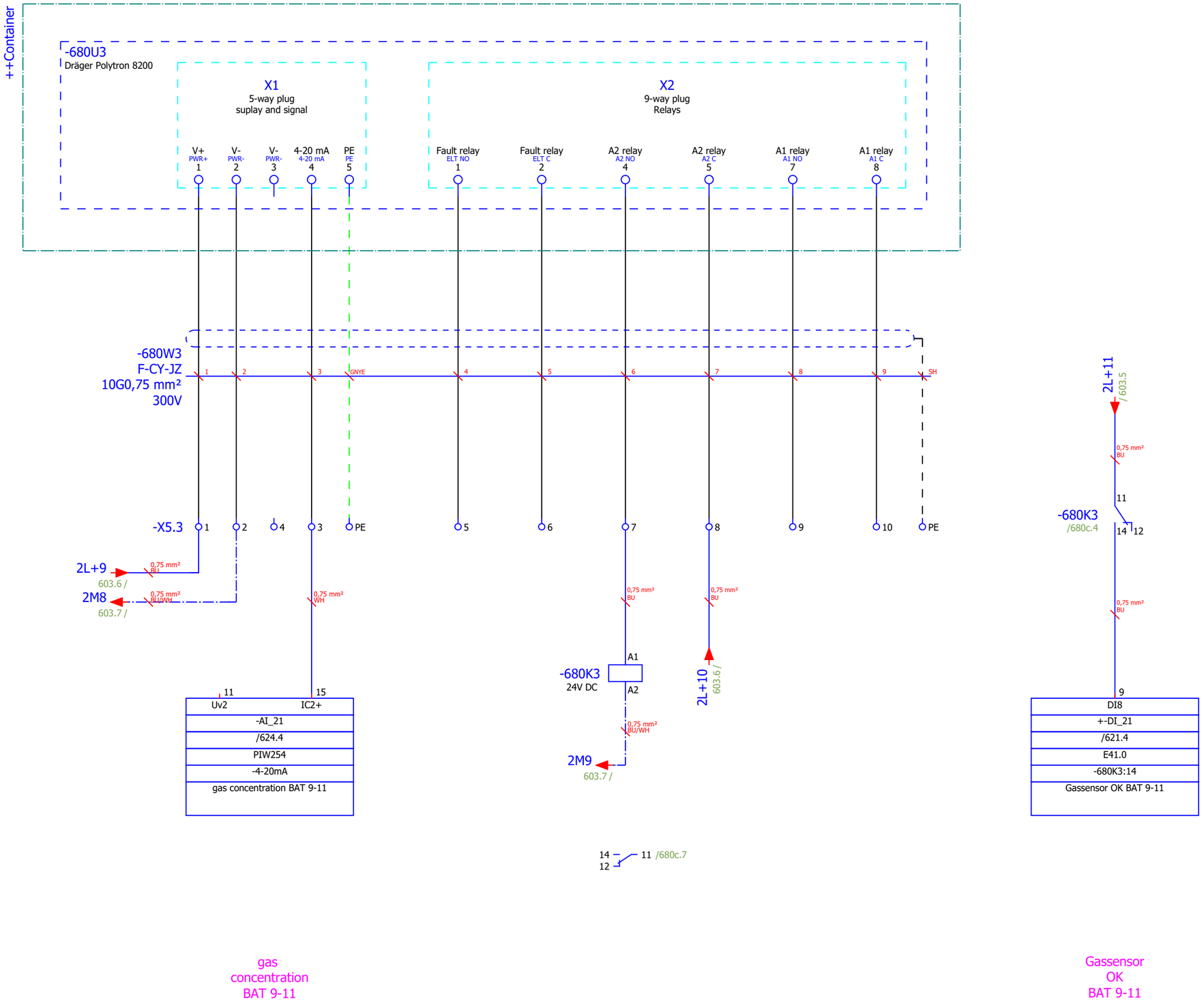
gas concentration BAT 5-8

Gassensor OK BAT 5-8

previous page: 680a

next page: 680c

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 5-8	20250805_V2.0	= UNIT_02 Battery Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 680b
Date								+ — total: 492



gas concentration BAT 9-11

Gassensor OK BAT 9-11

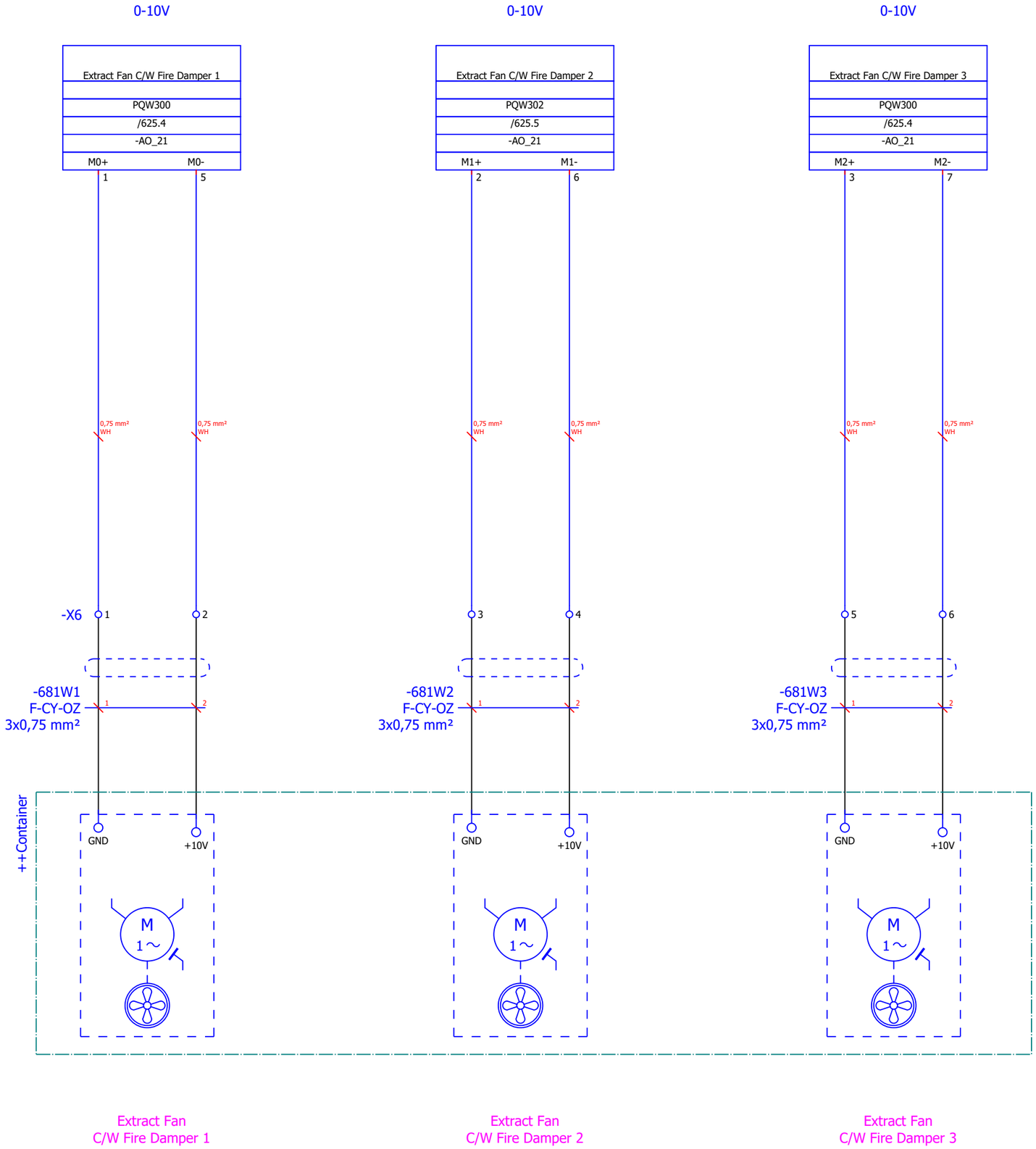
previous page: 680b

next page: 681

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 9-11	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 680c

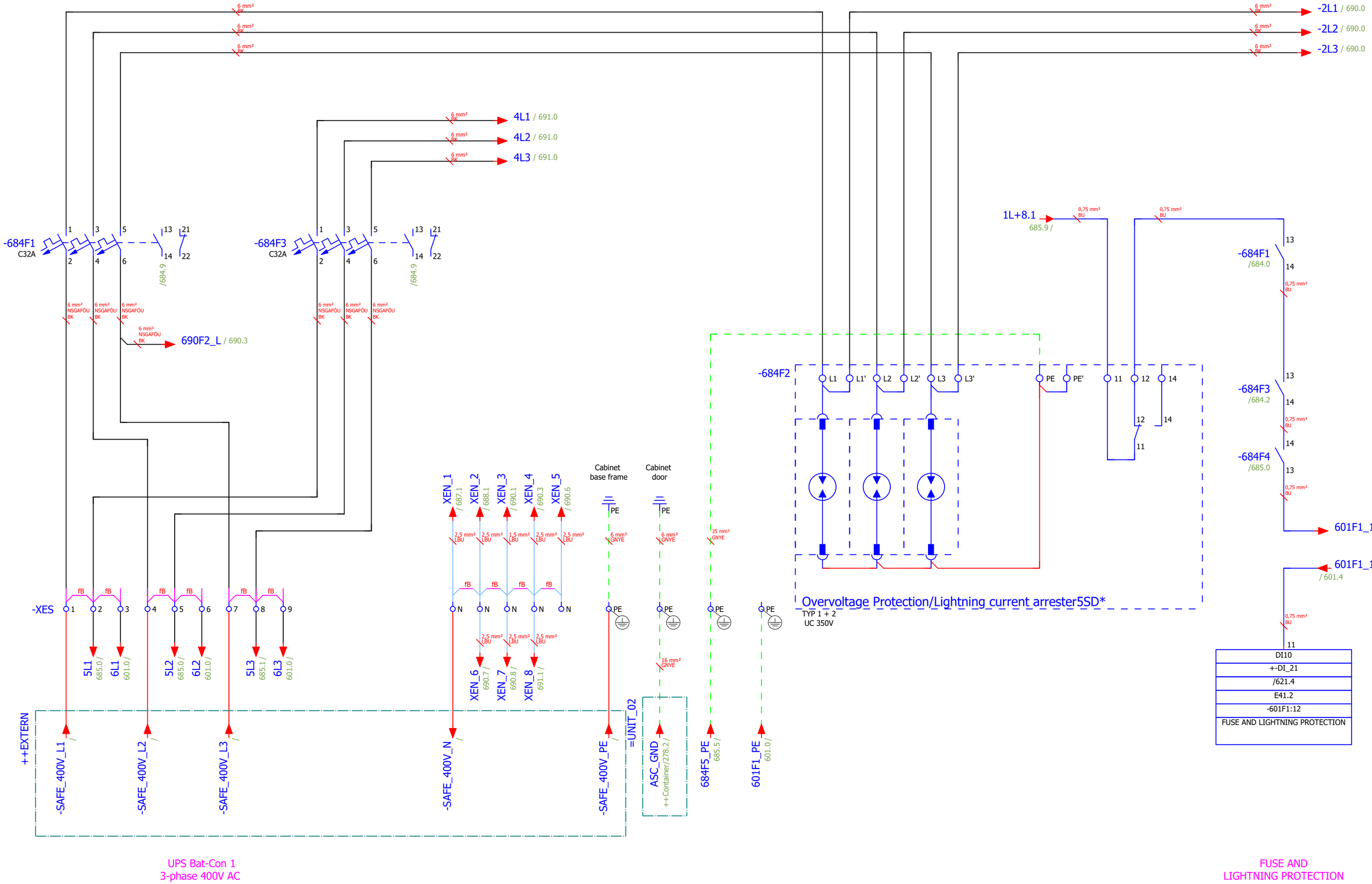
total: 492



previous page: 680c

next page: 684

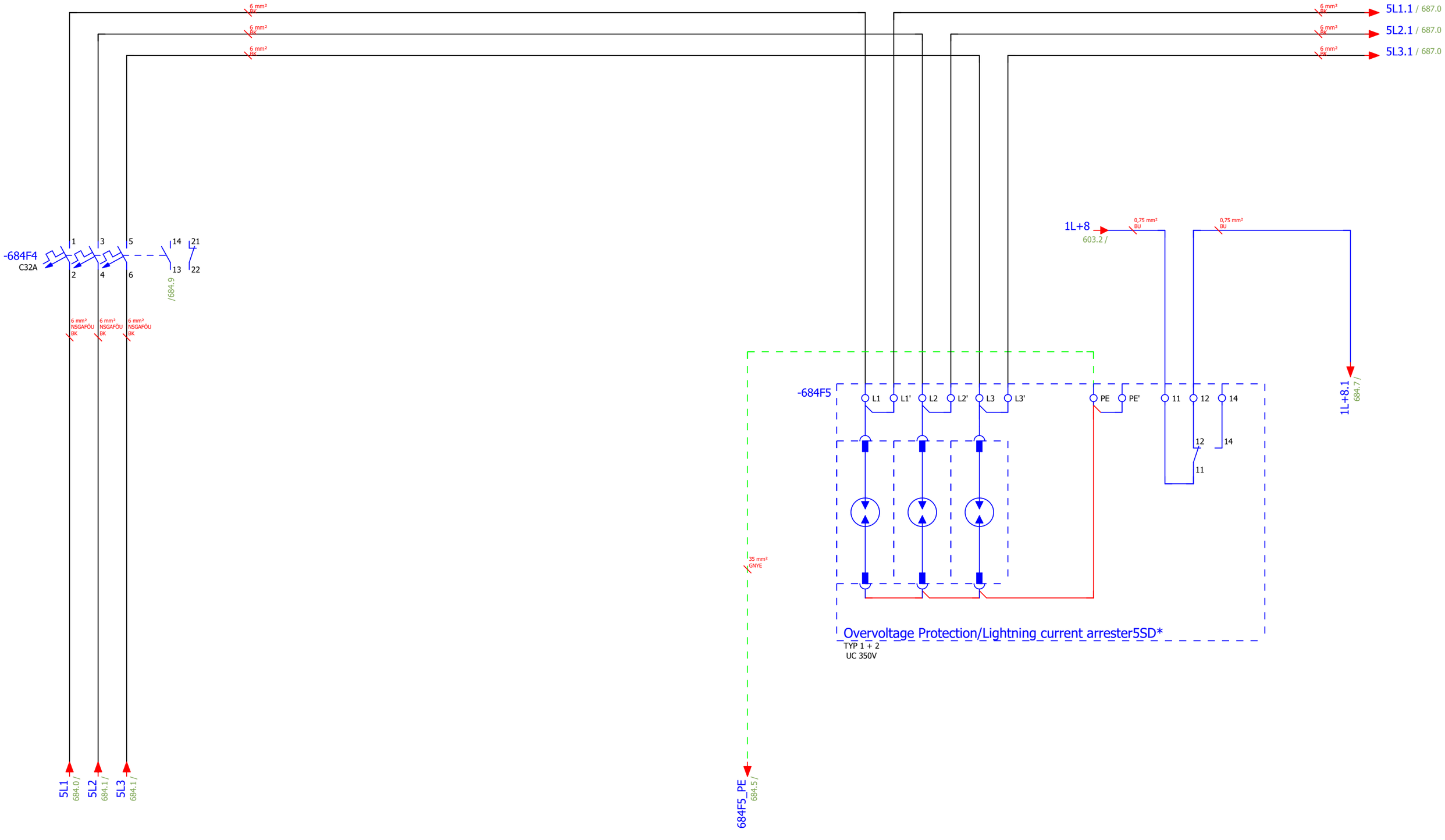
Editor	Freqcon_JD			Statron	FREQCON	EXTRACT FAN FIRE DAMPER	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 681
Date								+	total: 492



previous page: 681

next page: 685

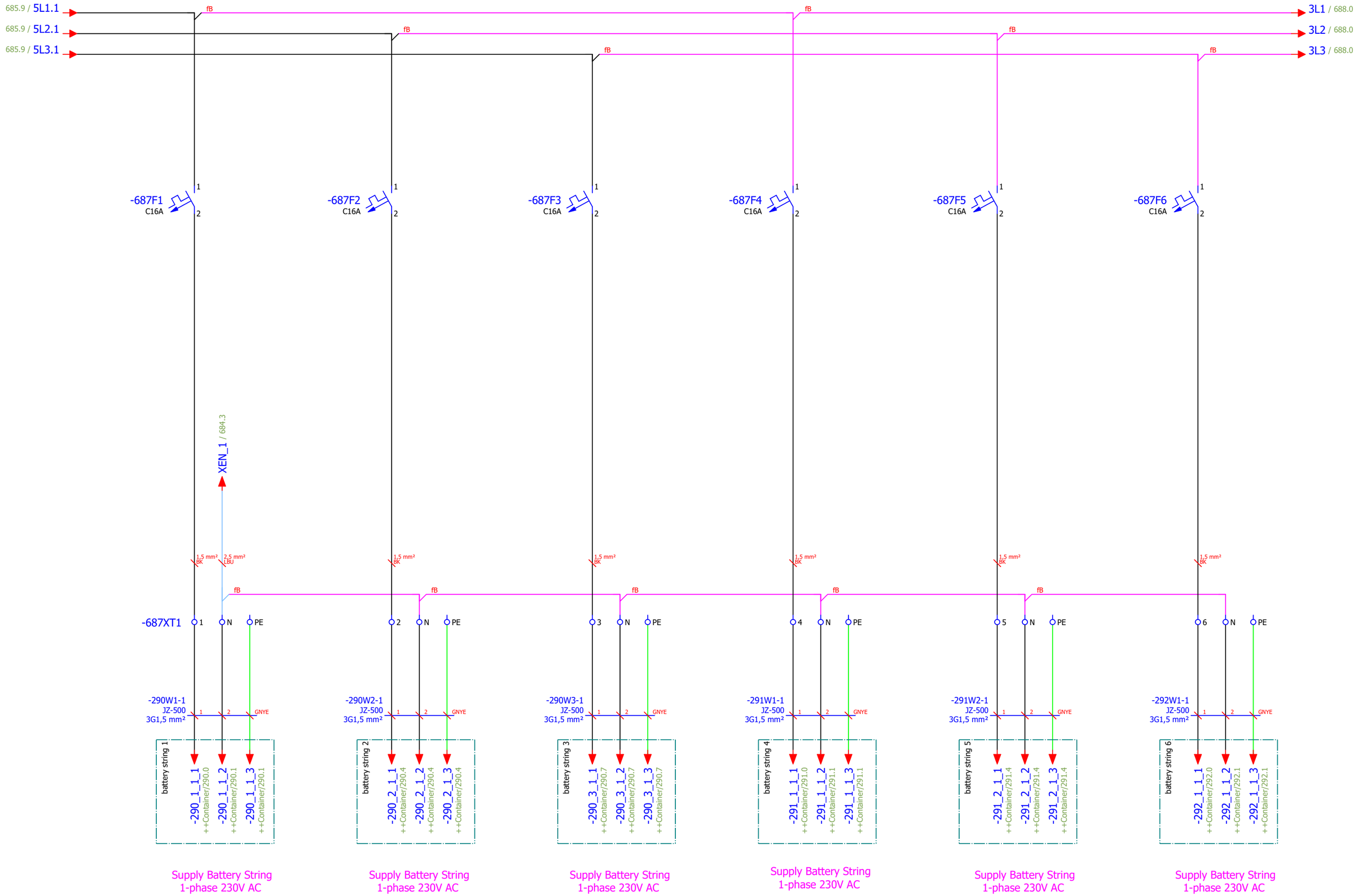
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	22.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 684
Date								+		total: 492



FUSE AND
LIGHTNING PROTECTION

previous page: 684
next page: 687

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	05.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 685
Date								+	total: 492



previous page: 685

next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 492

687.9 / 3L1
687.9 / 3L2
687.9 / 3L3

fB

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

XEN_2 / 684.3

1,5 mm² BK
2,5 mm² LBU

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

GNYE

battery string 7
-292_2_1_1 ++Container/292.4
-292_2_1_2 ++Container/292.4
-292_2_1_3 ++Container/292.4

battery string 8
-292_3_1_1 ++Container/292.7
-292_3_1_2 ++Container/292.7
-292_3_1_3 ++Container/292.7

battery string 9
-293_1_1_1 ++Container/293.0
-293_1_1_2 ++Container/293.1
-293_1_1_3 ++Container/293.1

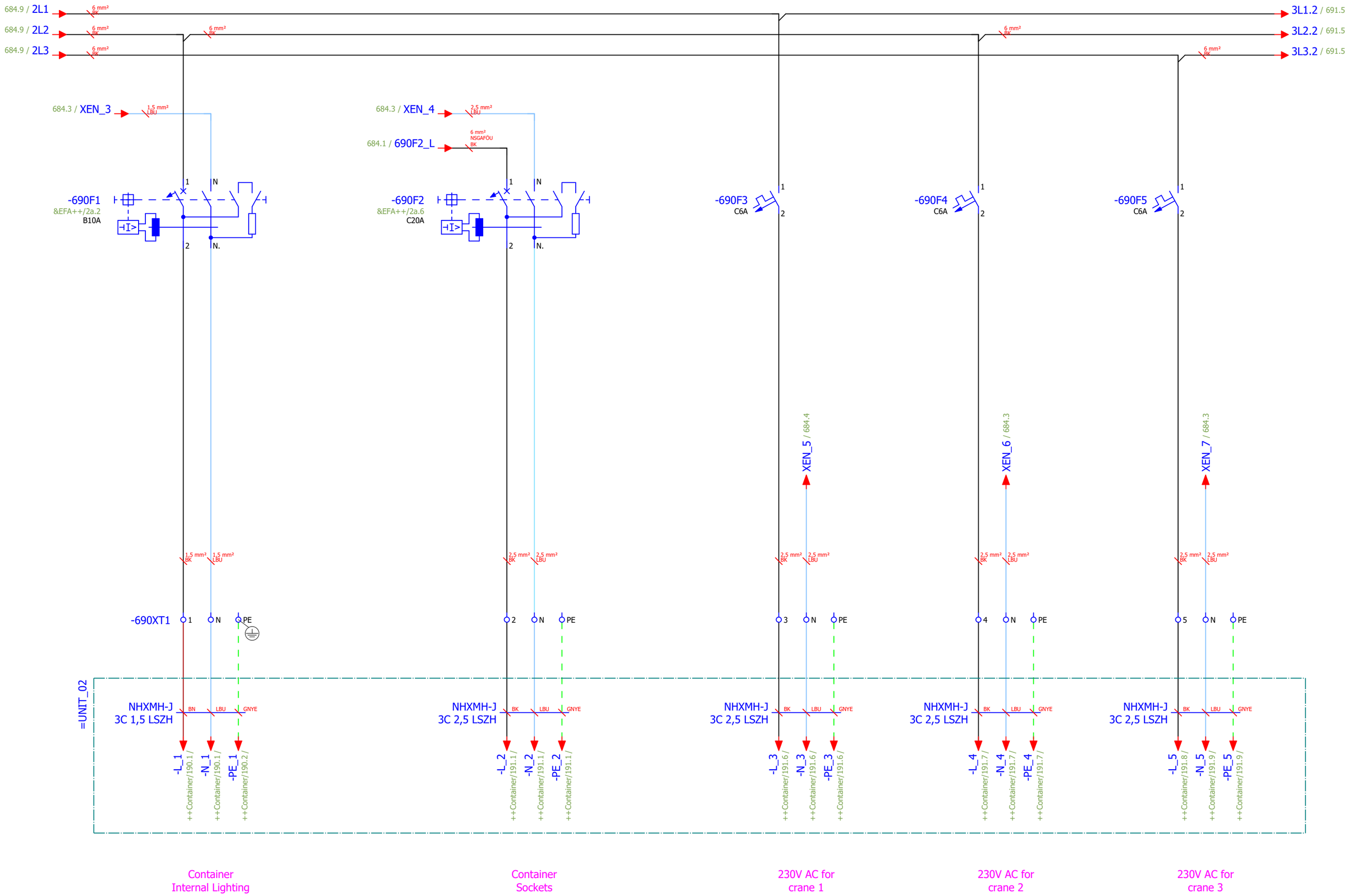
battery string 10
-293_2_1_1 ++Container/293.4
-293_2_1_2 ++Container/293.4
-293_2_1_3 ++Container/293.4

battery string 11
-293_3_1_1 ++Container/293.7
-293_3_1_2 ++Container/293.7
-293_3_1_3 ++Container/293.7

Supply Battery String 1-phase 230V AC

previous page: 687
next page: 690

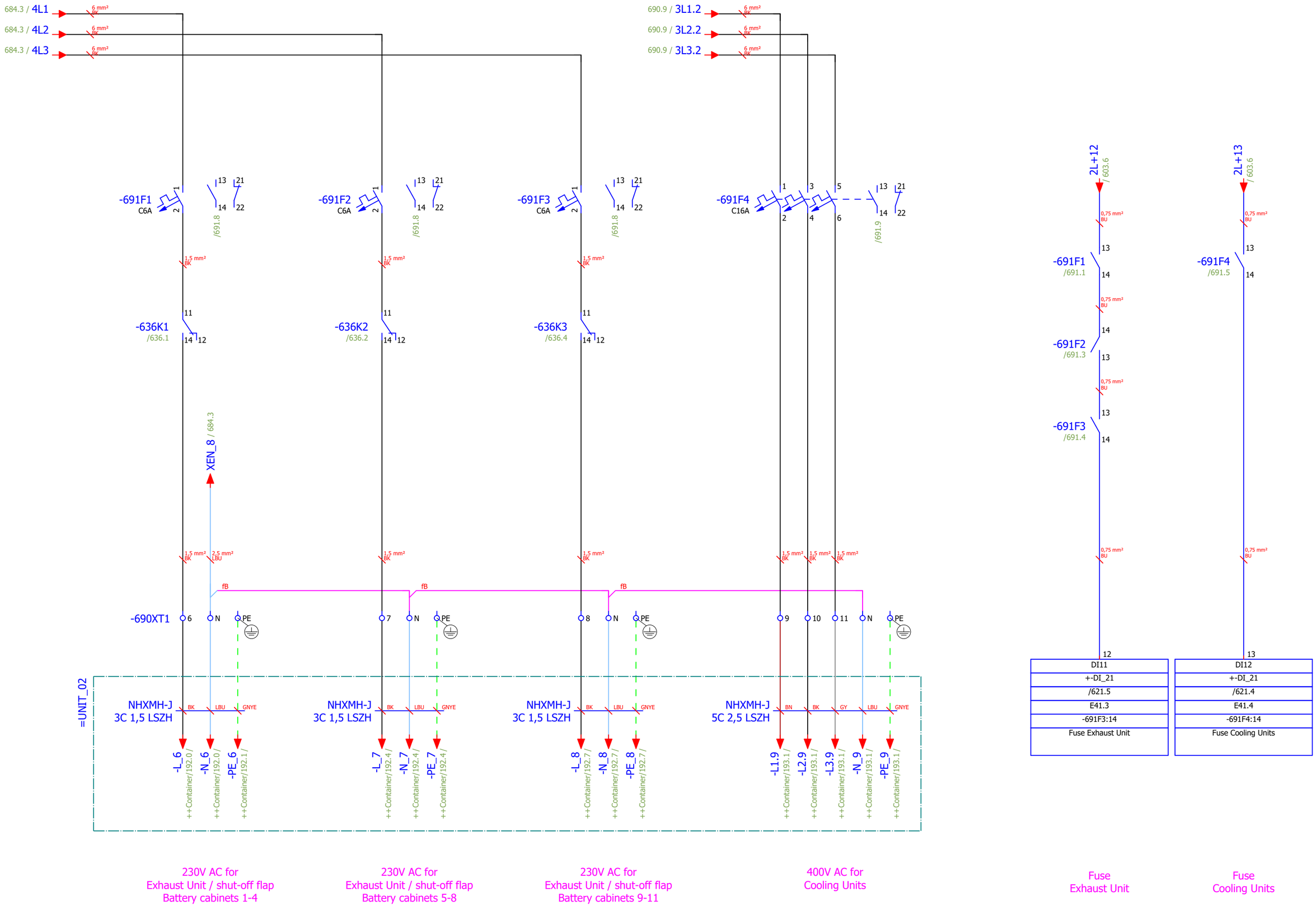
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 492



previous page: 688

next page: 691

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	29.10.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 690
Date								+		total: 492



previous page:
690

next page:
&EPC++Container/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 691
Date								+		total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U4 &EFS/613b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.3...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.3...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.1;&EFS/687.3;&EFS/687.4;&EFS/687.6...&EFS/687.8;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.9;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	

previous page:
6

next page:
&EPA++Container/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/7

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
6	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
3	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

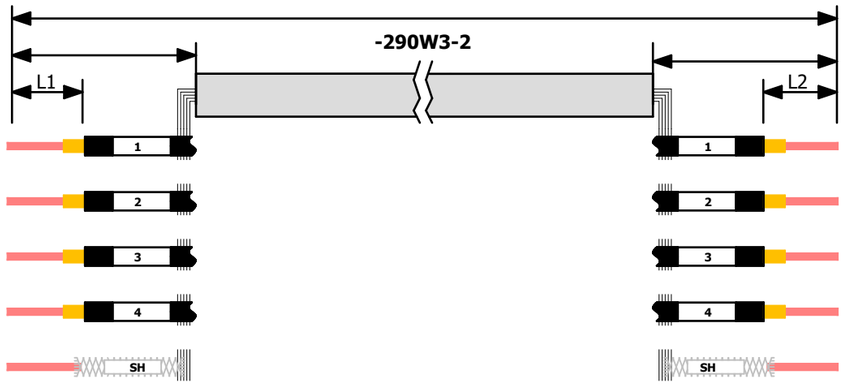
Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

Cable name =UNIT_02++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

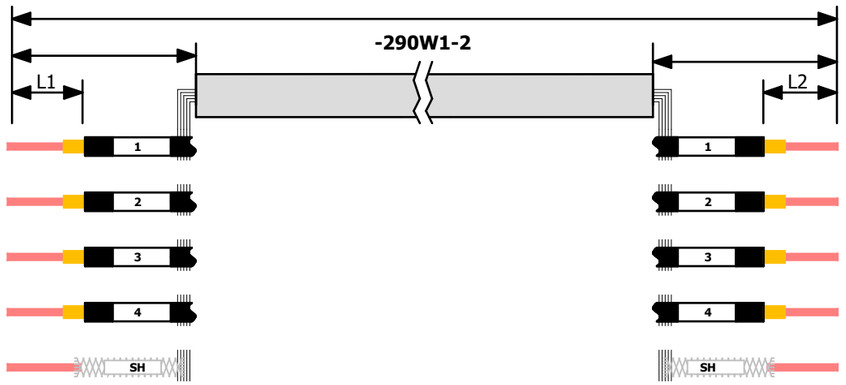


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

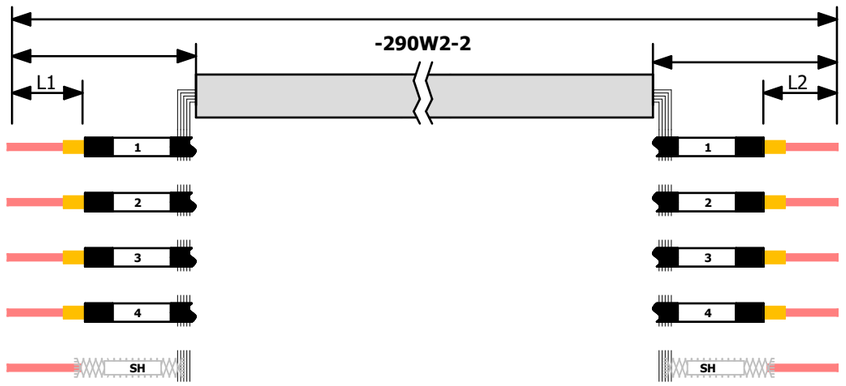


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

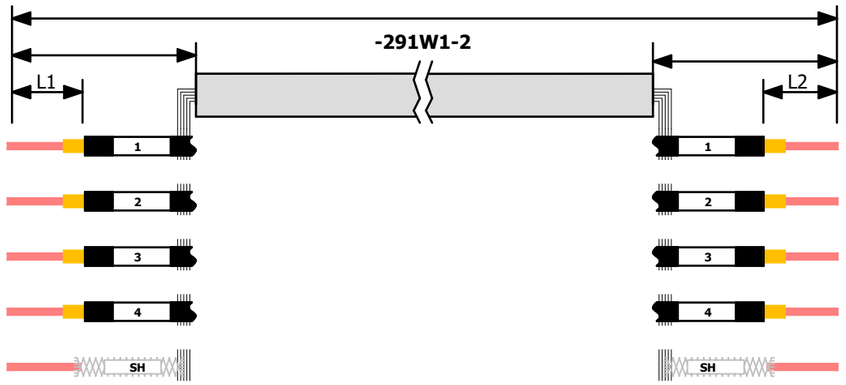
previous page:
&EPA++ASC/2

next page:
2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

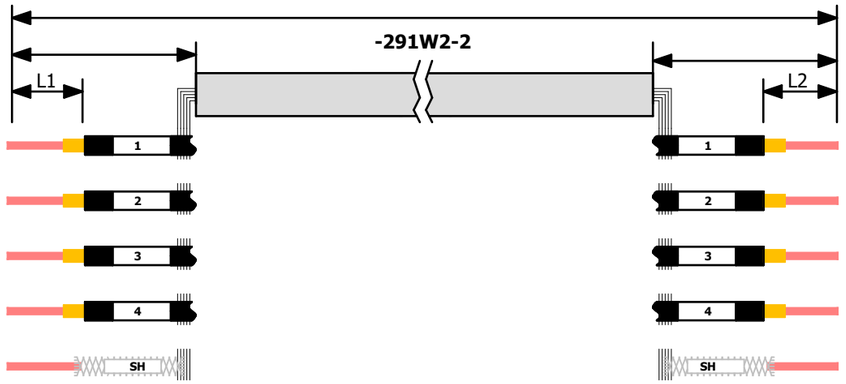


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

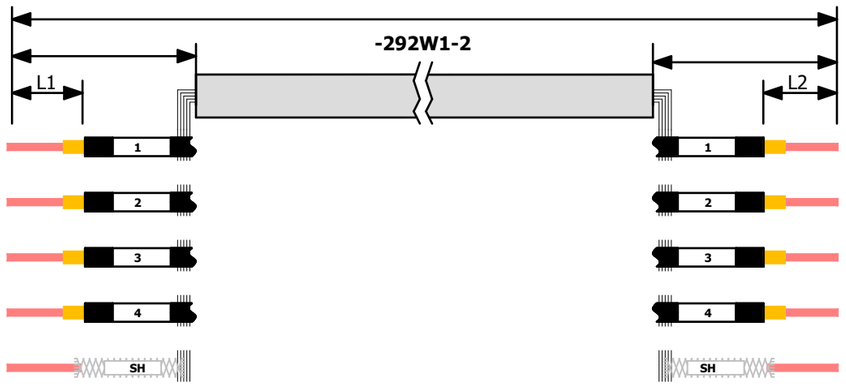


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

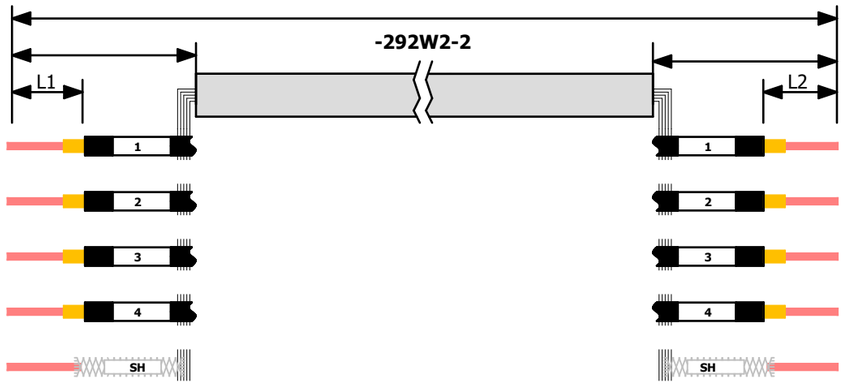
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

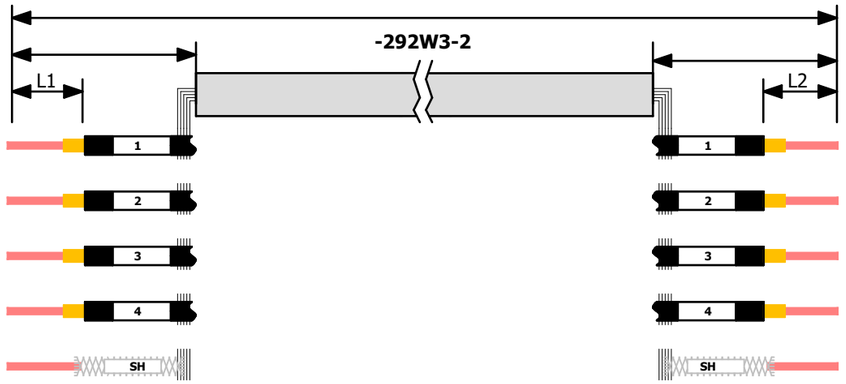


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

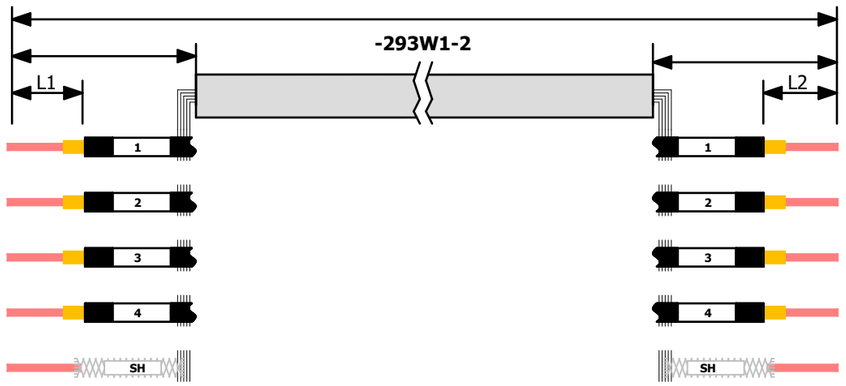


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

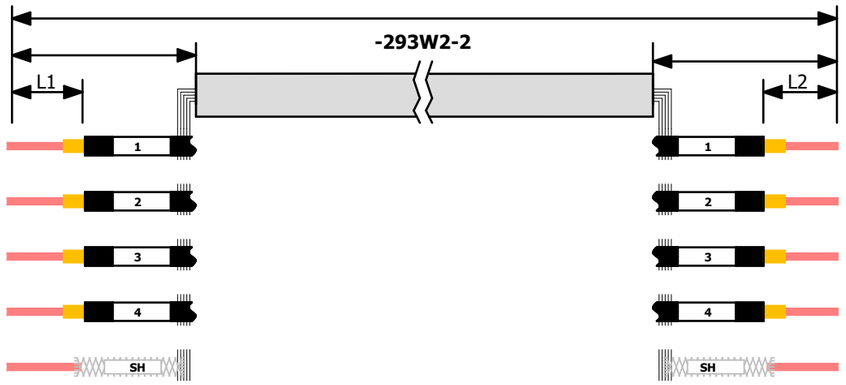
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

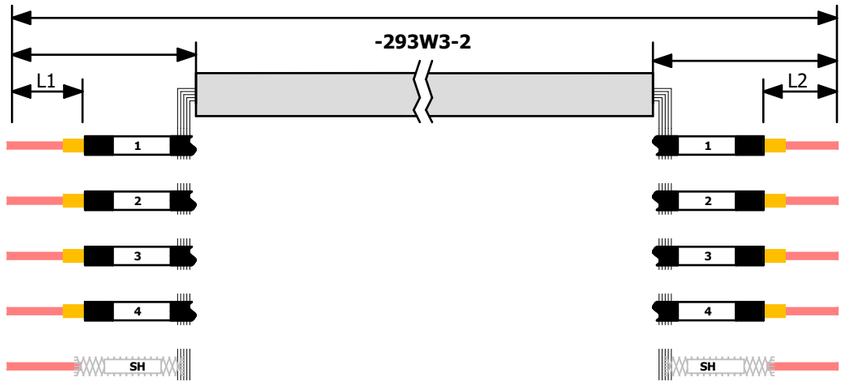


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

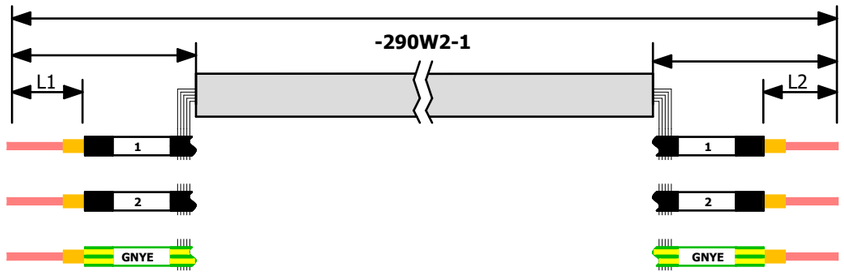
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

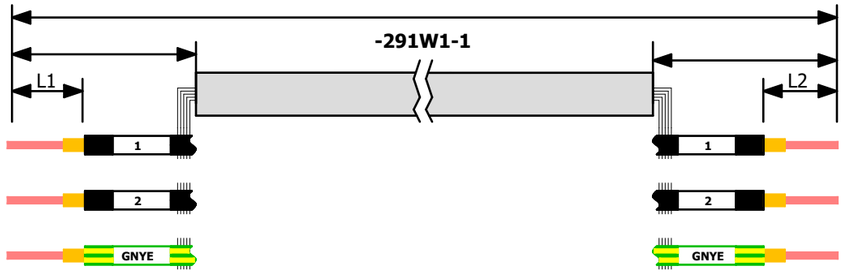


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

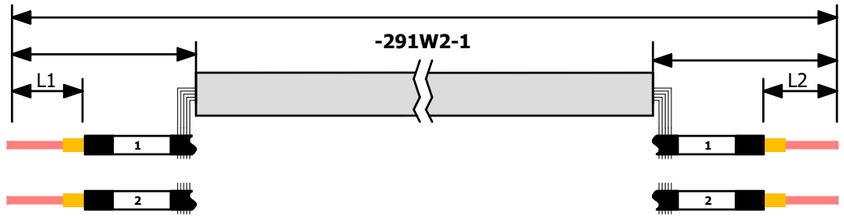


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

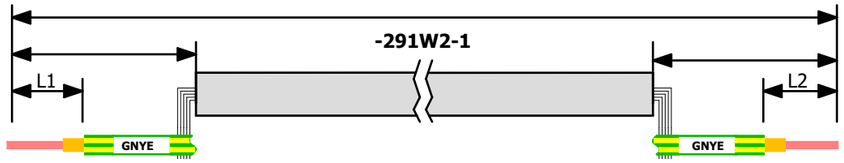
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

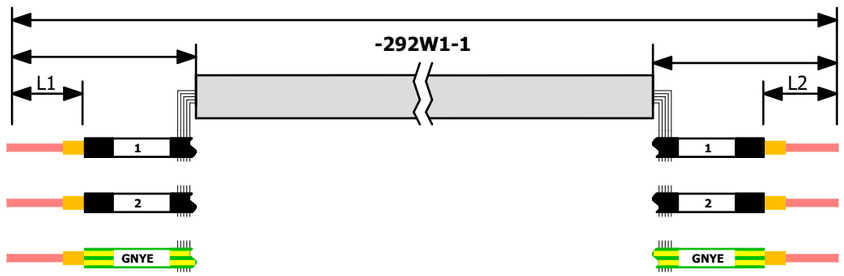


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

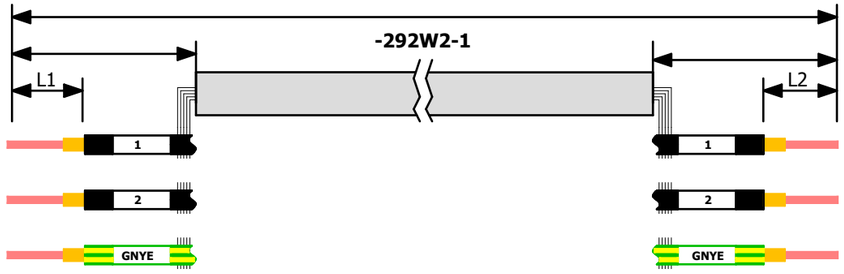


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

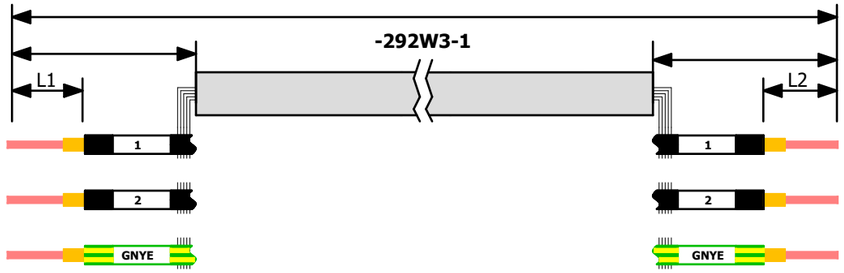


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

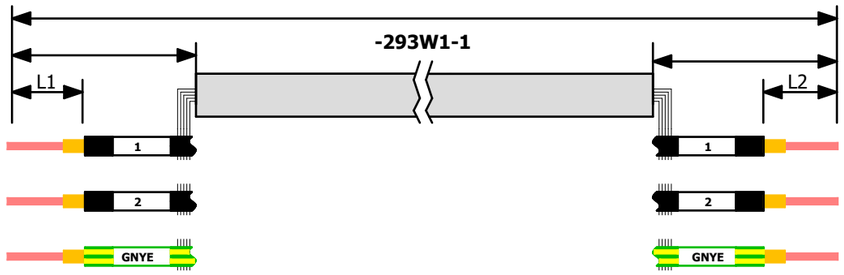
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

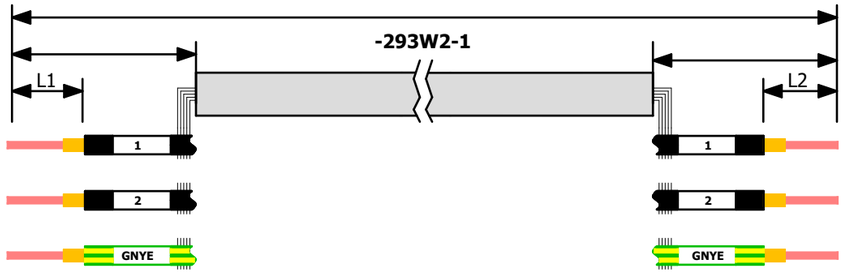


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

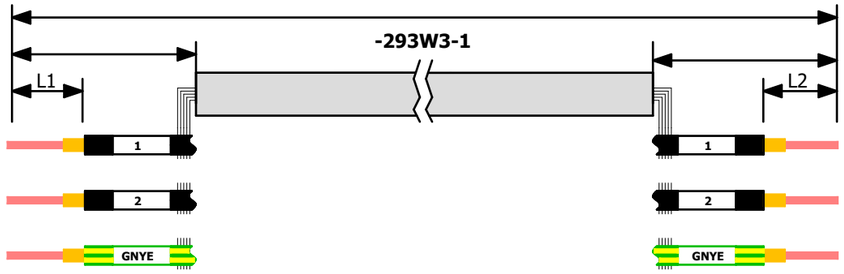


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

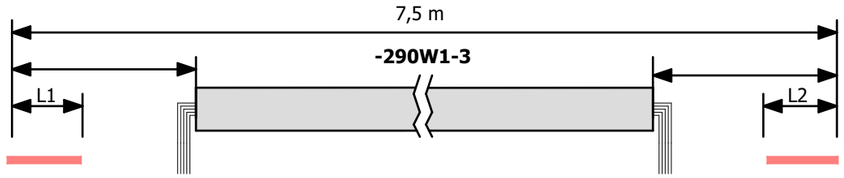


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

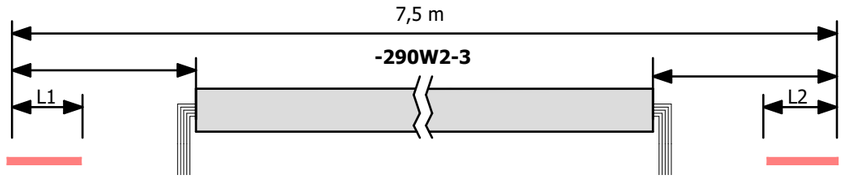
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 7
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

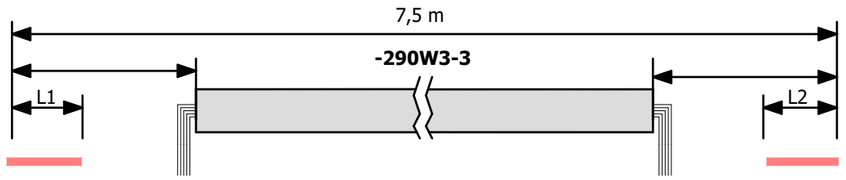


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

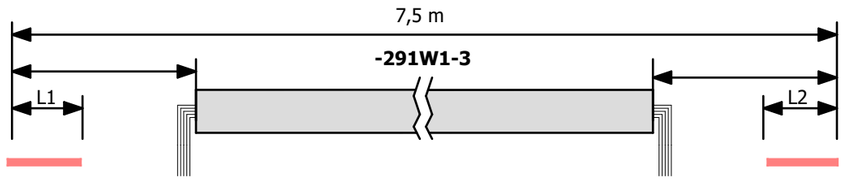


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_02++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

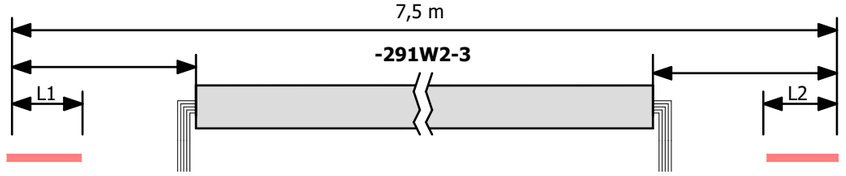


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

Cable name =UNIT_02++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

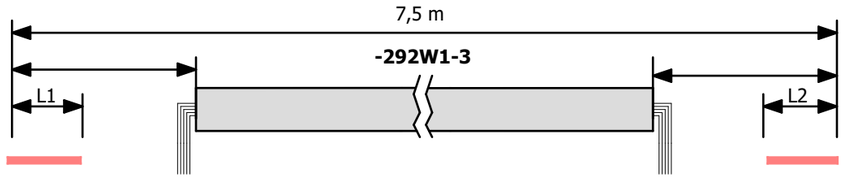


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_02++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



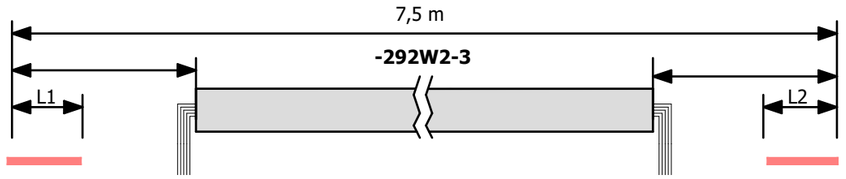
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

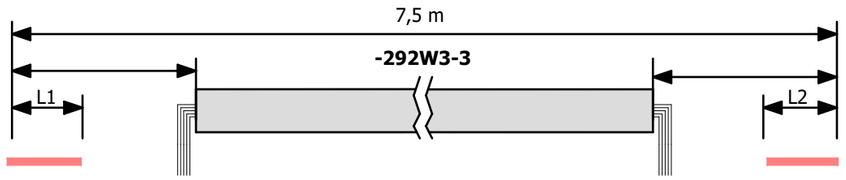


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X7:1-16	

Cable name =UNIT_02++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

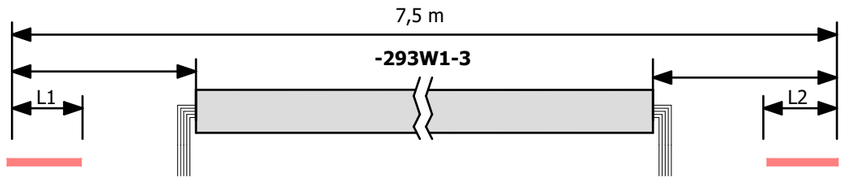


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X8:1-16	

Cable name =UNIT_02++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

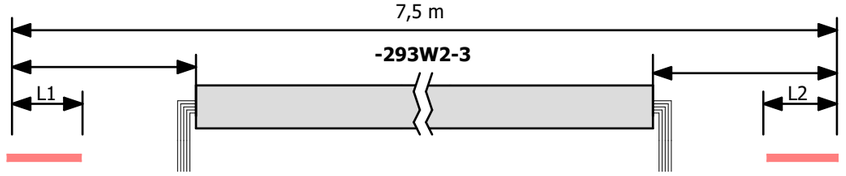


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X9:1-16	

Cable name =UNIT_02++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

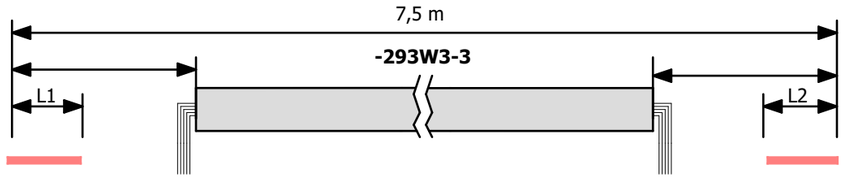


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

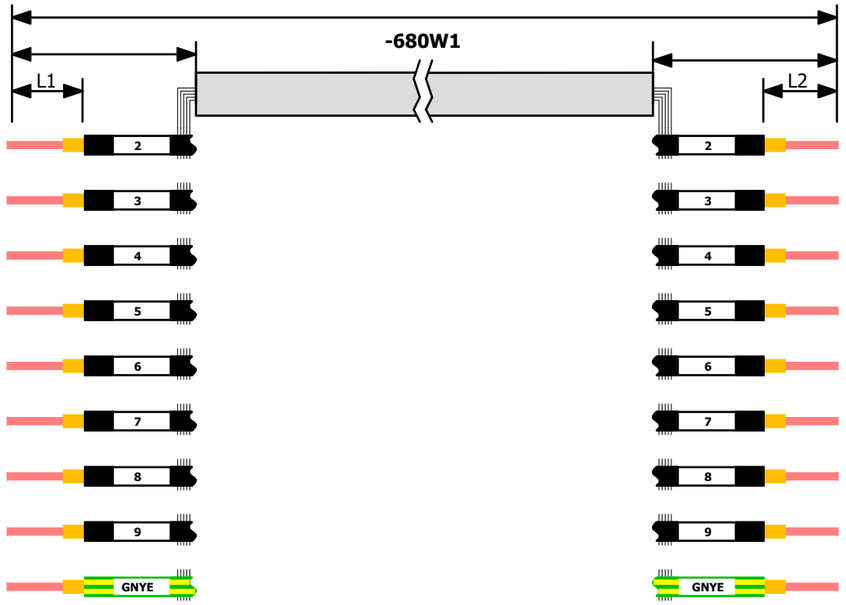
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

FRQ_Kabelplan_04_gro8_de_en

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 9
Date								+	total: 492

Cable name =UNIT_02++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

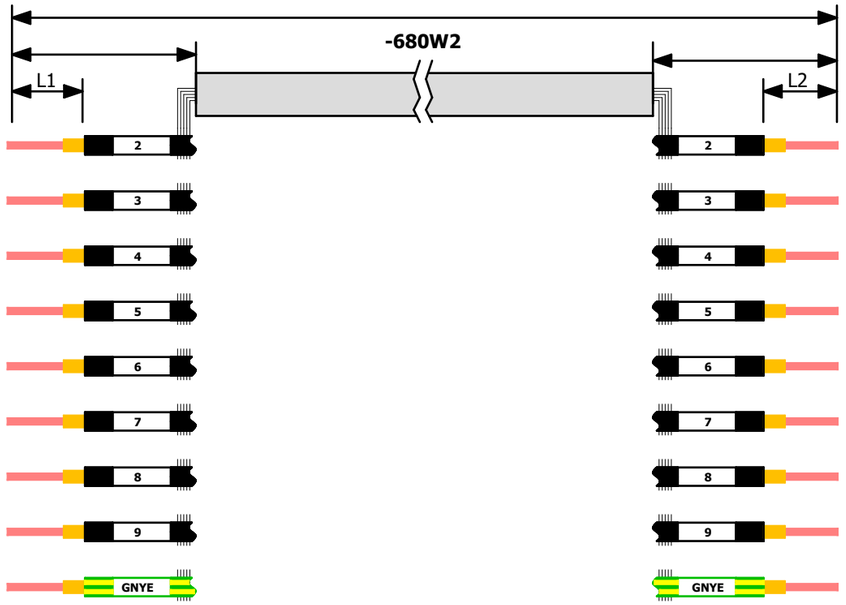


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_02++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

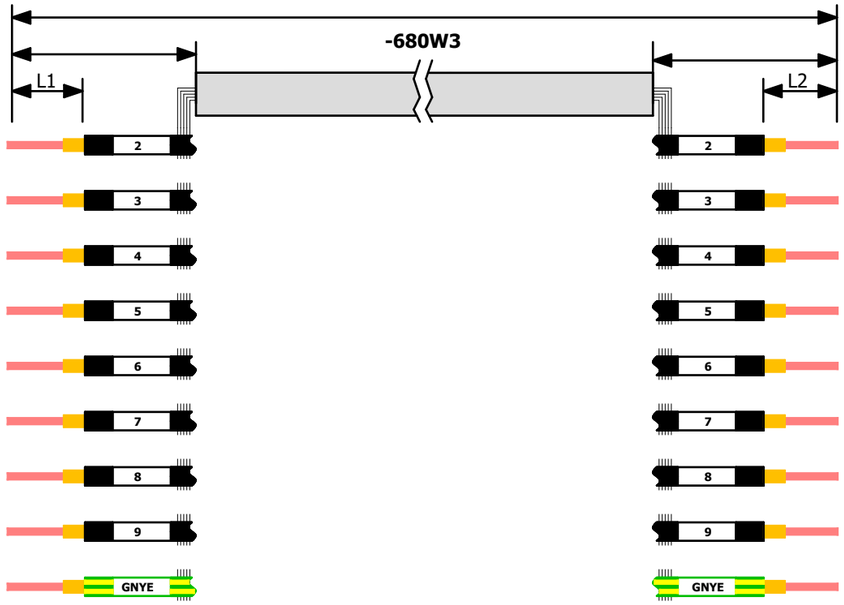
FRQ_Kabelplan_04_gro8_de_en

previous page: ++Container/9
next page: 2

Cable name =UNIT_02++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 9

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

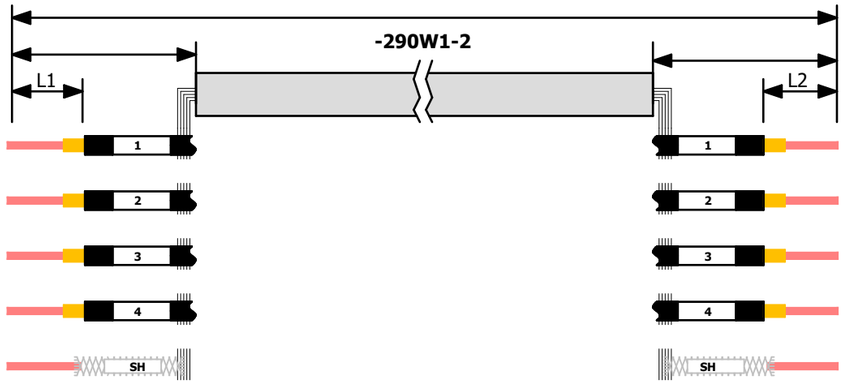


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_02++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

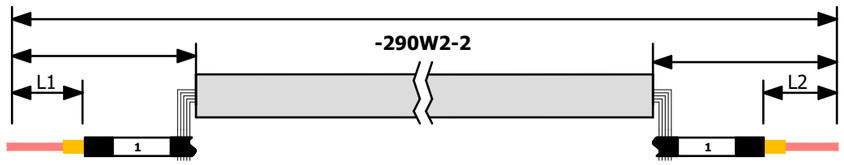


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

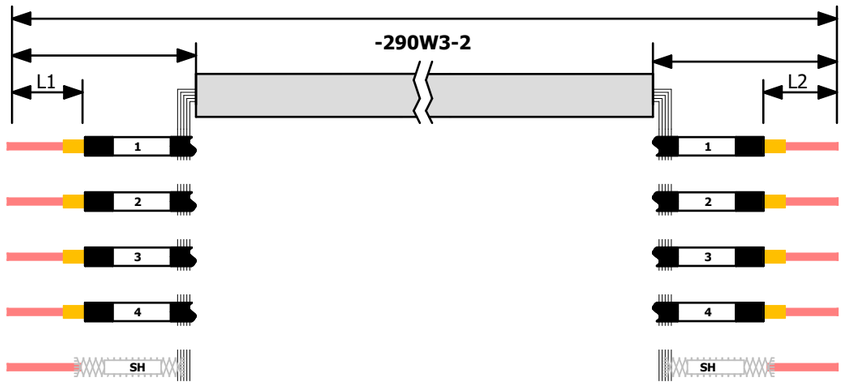


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

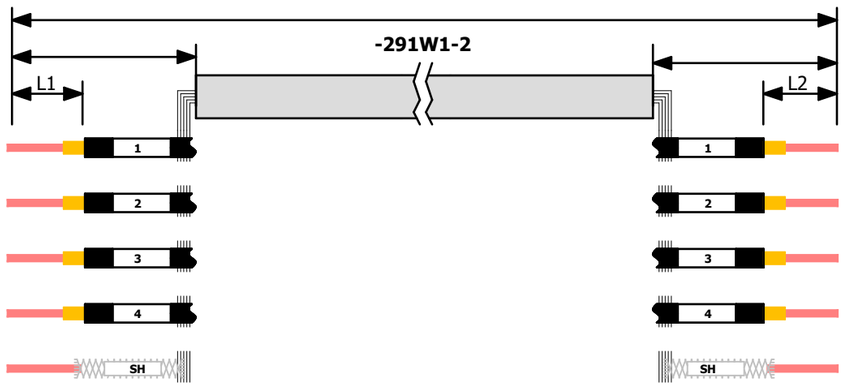


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

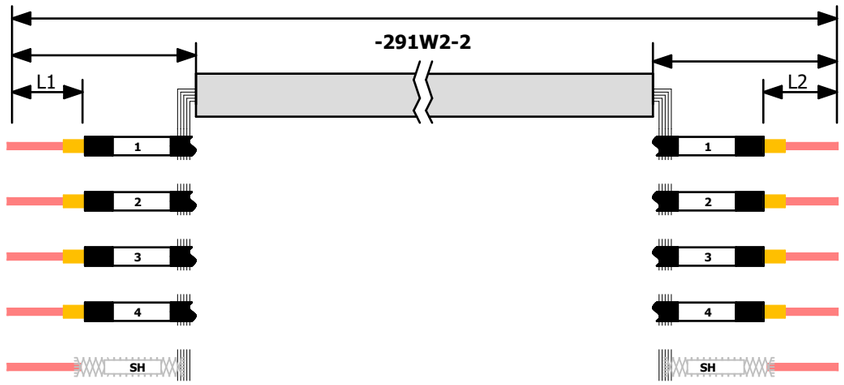
previous page: 2

next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

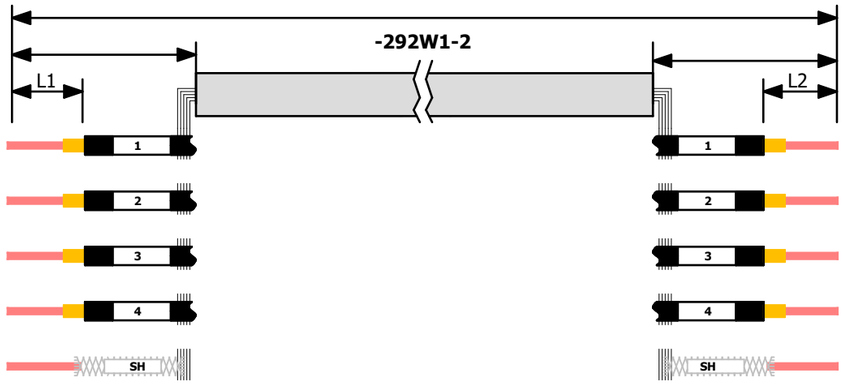


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

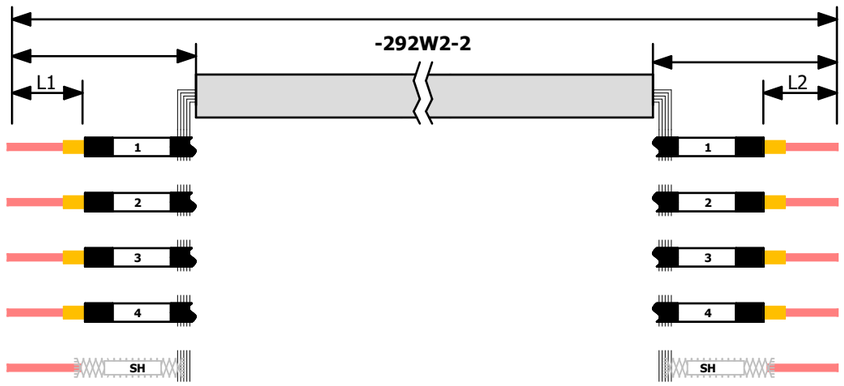


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

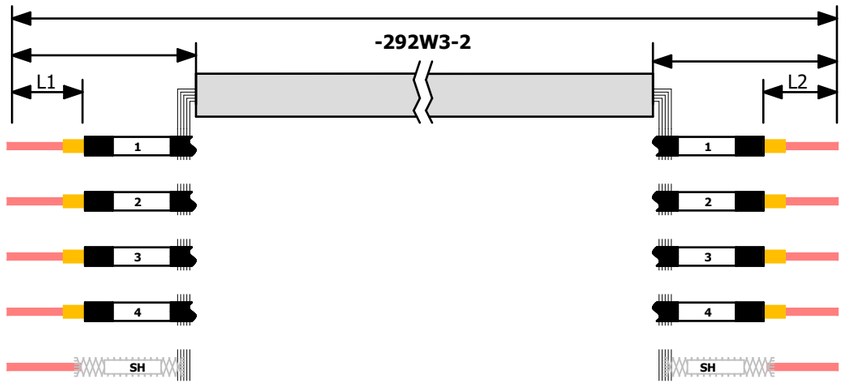
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

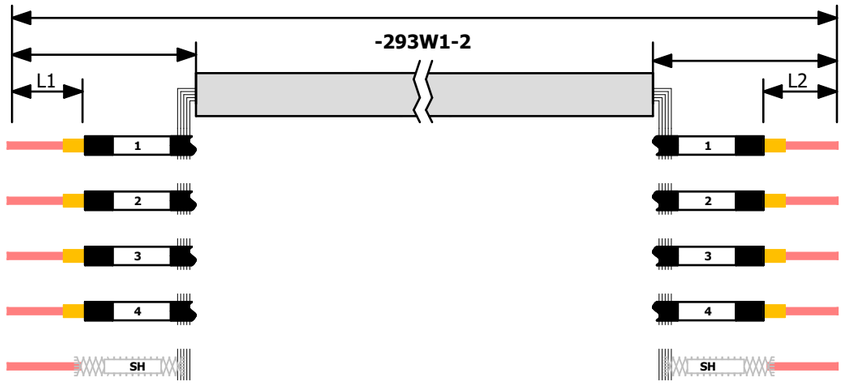


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

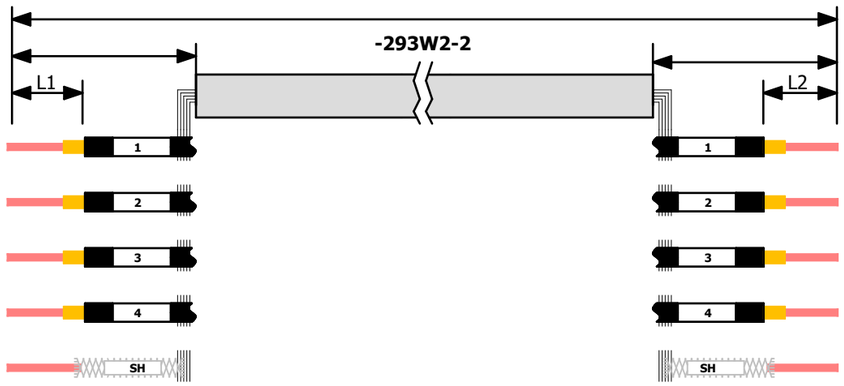


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

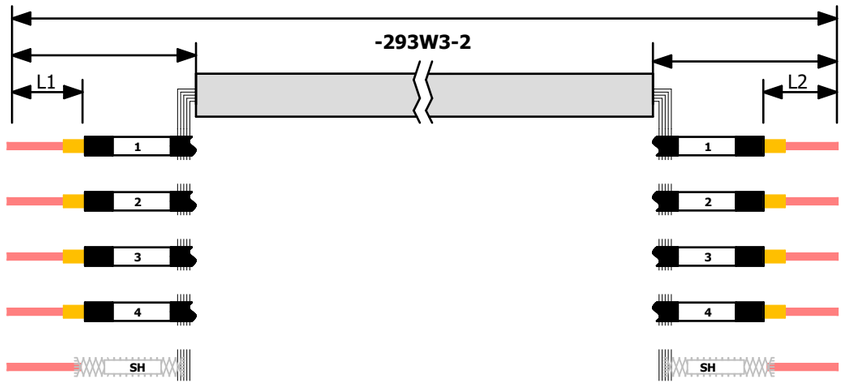
previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

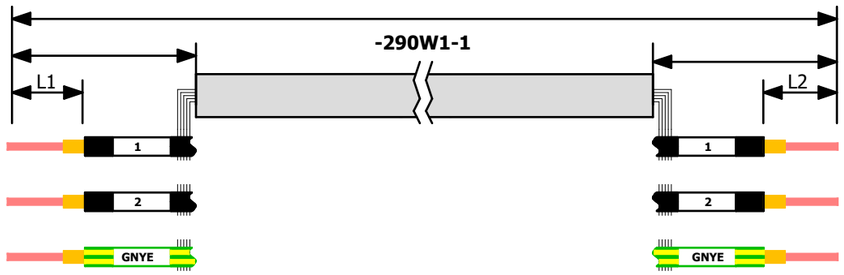


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

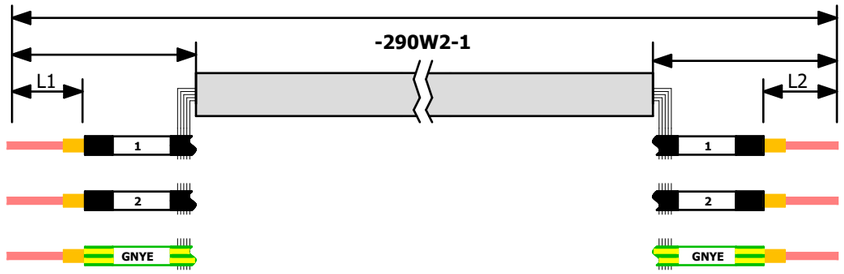


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

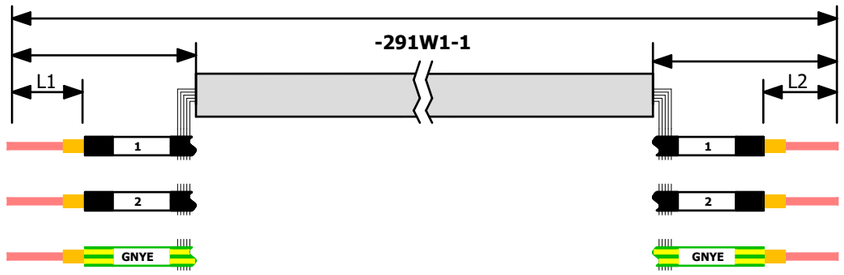


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

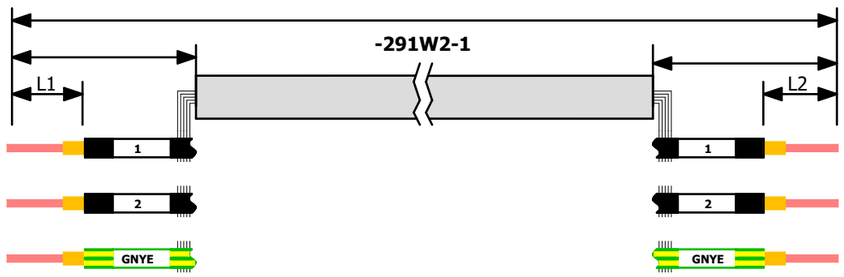


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

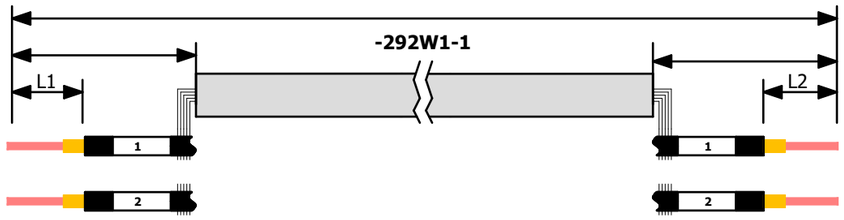


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

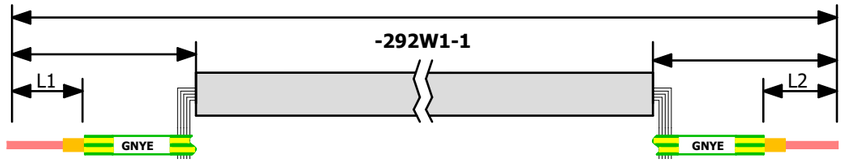
previous page: 6

next page: 8

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

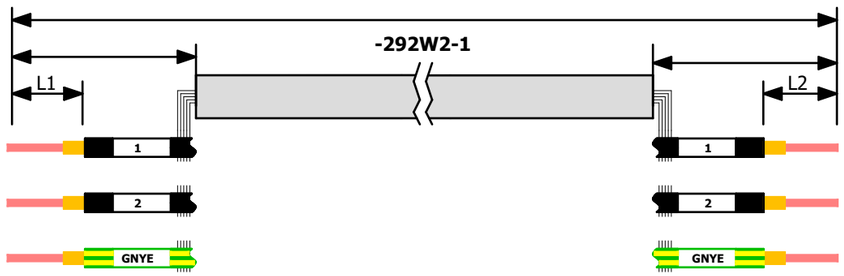


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

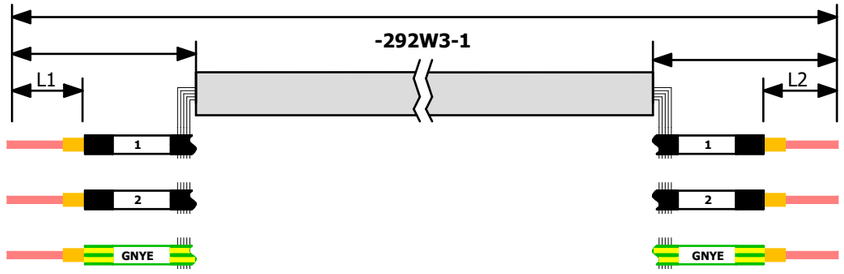


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

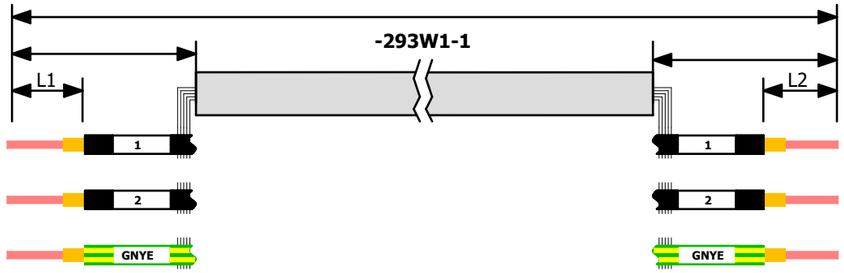


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

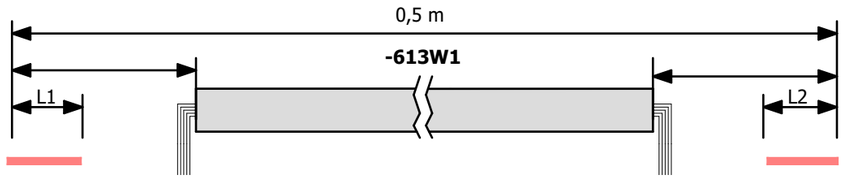


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

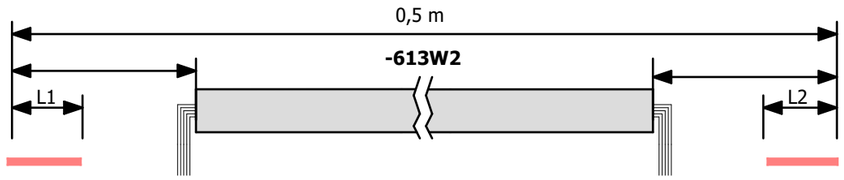


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_02++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			

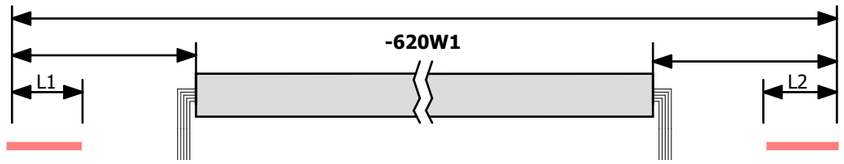
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 9
Date								+		total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_02++ASC+-620W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

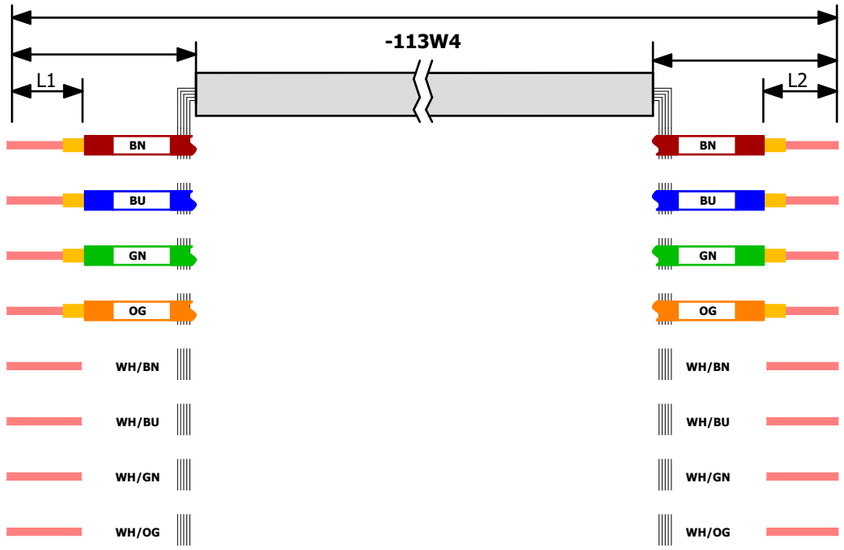
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U4:8							-620A1:-X1:P2	

Cable name =UNIT_02++ASC+-113W4
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:3							-613U2:3	

previous page: 9
next page: &EMZ/1000

FRQ_Kabelplan_04_groß_de_en

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X5.1		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2000
-X5.2		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2001
-X5.3		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2002
-X6		1	6	0	0	6	=UNIT_02&EMZ++ASC/2003
-XDC1		1	PE	2	0	14	=UNIT_02&EMZ++ASC/2004
-XDC2		1	7	0	0	14	=UNIT_02&EMZ++ASC/2005
-XES		1	9	4	5	18	=UNIT_02&EMZ++ASC/2006
-369XT		1	12	0	0	24	=UNIT_02&EMZ++ASC/2007
-687XT1		1	PE	11	11	44	=UNIT_02&EMZ++ASC/2019
-690XT1		1	PE	40	4	119	=UNIT_02&EMZ++ASC/2030

previous page:
&EMB/10

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-X5.1

Function text				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-JZ	-680W1	Page / column
gas concentration BAT 1-4					-XDC2	1	1	,	++Container-680U1-X1	1				&EFS/680a.2
=					-XDC2	5	2	,	++Container-680U1-X1	2		2		&EFS/680a.2
=					-AI_21	13	3	,	++Container-680U1-X1	4		3		&EFS/680a.2
=							4	,						&EFS/680a.2
=							5	,	++Container-680U1-X2	1		4		&EFS/680a.3
=							6	,	++Container-680U1-X2	2		5		&EFS/680a.3
=					-680K1	A1	7	,	++Container-680U1-X2	4		6		&EFS/680a.4
=					-XDC2	2	8	,	++Container-680U1-X2	5		7		&EFS/680a.4
=							9	,	++Container-680U1-X2	7		8		&EFS/680a.5
=							10	,	++Container-680U1-X2	8		9		&EFS/680a.5
=							PE	,	++Container-680U1-X1	5		GNYE		&EFS/680a.2
=							PE	,	-480W1					&EFS/680a.6

previous page:
1000

next page:
2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X5.1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2000
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X5.2						Cable name	-680W2										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-JZ											
gas concentration BAT 5-8					-XDC2	2	1	,	++Container-680U2-X1	1													&EFS/680b.2
=					-XDC2	6	2	,	++Container-680U2-X1	2		2											&EFS/680b.2
=					-AI_21	14	3	,	++Container-680U2-X1	4		3											&EFS/680b.2
=							4	,															&EFS/680b.2
=							5	,	++Container-680U2-X2	1		4											&EFS/680b.3
=							6	,	++Container-680U2-X2	2		5											&EFS/680b.3
=					-680K2	A1	7	,	++Container-680U2-X2	4		6											&EFS/680b.4
=					-XDC2	2	8	,	++Container-680U2-X2	5		7											&EFS/680b.4
=							9	,	++Container-680U2-X2	7		8											&EFS/680b.5
=							10	,	++Container-680U2-X2	8		9											&EFS/680b.5
=							PE	,	++Container-680U2-X1	5		GNYE											&EFS/680b.2
=							PE	,	-480W1														&EFS/680b.6

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X5.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1
&	EMZ	Terminals
++	ASC	auxillary cabinet
+		

page: 2001
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X5.3					Cable name	-680W3										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z										
gas concentration BAT 9-11					-XDC2	3	1	,	++Container-680U3-X1	1												&EFS/680c.2
=					-XDC2	7	2	,	++Container-680U3-X1	2		2										&EFS/680c.2
=					-AI_21	15	3	,	++Container-680U3-X1	4		3										&EFS/680c.2
=							4	,														&EFS/680c.2
=							5	,	++Container-680U3-X2	1		4										&EFS/680c.3
=							6	,	++Container-680U3-X2	2		5										&EFS/680c.3
=					-680K3	A1	7	,	++Container-680U3-X2	4		6										&EFS/680c.4
=					-XDC2	3	8	,	++Container-680U3-X2	5		7										&EFS/680c.4
=							9	,	++Container-680U3-X2	7		8										&EFS/680c.5
=							10	,	++Container-680U3-X2	8		9										&EFS/680c.5
=							PE	,	++Container-680U3-X1	5		GNYE										&EFS/680c.2
=							PE	,	-480W1													&EFS/680c.6

previous page:
2001

next page:
2003

Editor	Freqcon_DG			Statron		FREQCON	Klemmenplan =UNIT_02++ASC+-X5.3	20250805_V2.0	=	UNIT_02	Battery Container 1		
Date	21.01.2025								&	EMZ	Terminals		
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				10354_23A2007	++	ASC	auxillary cabinet	page:	2002
Date									+			total:	492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X6					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Extract Fan C/W Fire Damper 1						GND	1	,	-AO_21	1													&EFS/681.1
=						+10V	2	,	-AO_21	5													&EFS/681.1
Extract Fan C/W Fire Damper 2						GND	3	,	-AO_21	2													&EFS/681.3
=						+10V	4	,	-AO_21	6													&EFS/681.3
Extract Fan C/W Fire Damper 3						GND	5	,	-AO_21	3													&EFS/681.5
=						+10V	6	,	-AO_21	7													&EFS/681.5

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X6	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2003

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-XDC1

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FUSE 24V DC CONTROL VOLTAGE			-101T1	13	1		-103F1	2			&EFS/603.2
			-101Q1	13							
			-611A1	1							
FUSE 24V DC CONTROL VOLTAGE			-620A1	-X80:1	2						&EFS/603.2
			-DI_21	L+							
			-DO_21	L+							
FUSE 24V DC CONTROL VOLTAGE			-684F5	11	3		-103F1	13			&EFS/603.2
FUSE 24V DC CONTROL VOLTAGE			-611A1	2	4		-102G1	OUTPUT DC 24 V:-			&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE			-620A1	-X80:2	5						&EFS/603.3
			-DI_21	M							
			-DO_21	M							
FUSE 24V DC CONTROL VOLTAGE			-636K1	A2	6		-XDC2	5			&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE			-101T1	-"	PE						&EFS/603.4
			-101T1	PE							
FUSE 24V DC CONTROL VOLTAGE					PE						&EFS/603.4

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XDC1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2004

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-XDC2						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
FUSE 24V DC CONTROL VOLTAGE					-AI_21	L+	1		-103F2	2													&EFS/603.5
					-AO_21	L+																	
					-X5.1	1																	
FUSE 24V DC CONTROL VOLTAGE					-X5.1	8	2		-X5.2	8													&EFS/603.5
					-680K1	11																	
					-X5.2	1																	
FUSE 24V DC CONTROL VOLTAGE					-680K2	11	3		-680K3	11													&EFS/603.5
					-X5.3	1																	
					-X5.3	8																	
FUSE 24V DC CONTROL VOLTAGE					-691F1	13	4																&EFS/603.6
					-691F4	13																	
					-691F4	13																	
FUSE 24V DC CONTROL VOLTAGE					-AI_21	M	5		-XDC1	6													&EFS/603.6
					-AO_21	M																	
					-X5.1	2																	
FUSE 24V DC CONTROL VOLTAGE					-680K1	A2	6																&EFS/603.6
					-X5.2	2																	
FUSE 24V DC CONTROL VOLTAGE					-680K2	A2	7																&EFS/603.7
					-X5.3	2																	
					-680K3	A2																	

previous page: 2004

next page: 2006

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XDC2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2005
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-XES					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
							1		-684F1	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC							N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-690F1	N													&EFS/684.3
=					-690XT1	N	N		-690F2	N													&EFS/684.3
=							N		-690XT1	N													&EFS/684.4
=							PE			PE													&EFS/684.4
=					++Container-278W1	GND	PE			PE													&EFS/684.4
=					-684F5	PE	PE		-684F2	PE													&EFS/684.5
=					-601F1	PE	PE																&EFS/684.5
					-684F4	2	2		-684F3	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC					-601F1	L1	3																&EFS/684.1
=							4		-684F1	4													&EFS/684.1
=					-684F4	4	5		-684F3	4													&EFS/684.1
=					-601F1	L2	6																&EFS/684.1
=							7		-684F1	6													&EFS/684.1
=					-684F4	6	8		-684F3	6													&EFS/684.1
=					-601F1	L3	9																&EFS/684.2

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-OZ	++Container-290W2-2 F-CY-OZ	++Container-290W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	1					&EFS/669.5
		3			++Container-570XT	3						
	3				++Container-570XT	3						

previous page: 2006

next page: 2008

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2007

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	2		++Container-570XT	3		3	&EFS/669.5
		3			++Container-570XT	3							
	3				++Container-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	3		++Container-570XT	3		3	&EFS/669.6
		3			++Container-570XT	3							
	3				++Container-570XT	3							

previous page: 2008

next page: 2010

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 2009
Date								+ — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	4					&EFS/669.7
		4			++Container-570XT	4						
	4				++Container-570XT	4						

previous page:
2009

next page:
2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2010
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	5		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

previous page:
2010

next page:
2012

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2011
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	6		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

previous page: 2011

next page: 2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2012

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	7					&EFS/670.5
		1			++Container-570XT	1						
	1				++Container-570XT	1						

previous page: 2012

next page: 2014

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	8		++Container-570XT	1		1	&EFS/670.5
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	9		++Container-570XT	1		1	&EFS/670.6
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	10					&EFS/670.7
		2			++Container-570XT	2						
	2				++Container-570XT	2						

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	11		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	12		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

previous page: 2017

next page: 2019

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2018

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			++Container-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				++Container-XE	1	3	,	-687F3	2		&EFS/687.4

previous page:
2018

next page:
2020

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2019
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-1 JZ-500	++Container-291W2-1 JZ-500	++Container-291W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	4	,	-687F4	2		&EFS/687.5
=		1			++Container-XE	1	5	,	-687F5	2		&EFS/687.7
=	1				++Container-XE	1	6	,	-687F6	2		&EFS/687.8

previous page: 2019

next page: 2021

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025					& EMZ Terminals
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date						+

page: 2020

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-1	++Container-292W3-1	++Container-292W2-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	7	,	-688F1	2													&EFS/688.1
=		1			++Container-XE	1	8	,	-688F2	2													&EFS/688.3
=	1				++Container-XE	1	9	,	-688F3	2													&EFS/688.4

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W1-1 JZ-500	++Container-293W3-1 JZ-500	++Container-293W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	10	,	-688F4	2		&EFS/688.5
=		1			++Container-XE	1	11	,	-688F5	2		&EFS/688.7
=	2				++Container-XE	N	N	,	-XES	N		&EFS/687.1

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2022

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W1-1 JZ-500	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/687.6

previous page: 2022

next page: 2024

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2023

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W2-1 -XZ-500	++Container-292W1-1 -XZ-500	++Container-291W2-1 -XZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.7
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.8
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N		-XES	N		&EFS/688.1

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2024 of total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W2-1 -1Z-500	++Container-293W1-1 -1Z-500	++Container-292W3-1 -1Z-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/688.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/688.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/688.6

previous page: 2024

next page: 2026

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W2-1	++Container-290W1-1	++Container-293W3-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N																&EFS/688.7
Supply Battery String 1-phase 230V AC		GNYE			++Container-XE	PE	PE																&EFS/687.2
=	GNYE				++Container-XE	PE	PE																&EFS/687.3

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W2-1 -XZ-500	++Container-291W1-1 -XZ-500	++Container-290W3-1 -XZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,				&EFS/687.4
=		GNYE			++Container-XE	PE	PE	,				&EFS/687.6
=	GNYE				++Container-XE	PE	PE	,				&EFS/687.7

previous page: 2026

next page: 2028

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W3-1 / JZ-500	++Container-292W2-1 / JZ-500	++Container-292W1-1 / JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,				&EFS/687.9
=		GNYE			++Container-XE	PE	PE	,				&EFS/688.2
=	GNYE				++Container-XE	PE	PE	,				&EFS/688.3

previous page: 2027

next page: 2029

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02	Battery Container 1
Date	21.01.2025					& EMZ	Terminals
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date						+	

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W3-1	++Container-293W2-1	++Container-293W1-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/688.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Container Internal Lighting						L	1	,	-690F1	2													&EFS/690.1
=						1	2	,	-690F2	2													&EFS/690.3
Container Sockets						1	3	,	-690F3	2													&EFS/690.5
230V AC for crane 2						1	4	,	-690F4	2													&EFS/690.7
230V AC for crane 3						1	5	,	-690F5	2													&EFS/690.8
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						L	6	,	-636K1	14													&EFS/691.1
						L																	
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						L	7	,	-636K2	14													&EFS/691.3
						L																	
								,															
								,															

previous page: 2029

next page: 2031

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,		

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
400V AC for Cooling Units							10	,	-691F4	4													&EFS/691.6
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,														

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
												Cable type	
230V AC for crane 2						PE	PE						&EFS/690.7
230V AC for crane 3						PE	PE						&EFS/690.8
Container Sockets						2	N		-690F2	N.			&EFS/690.4
230V AC for crane 1						2	N		-XES	N			&EFS/690.6
230V AC for crane 2						2	N		-XES	N			&EFS/690.7
230V AC for crane 3						2	N		-XES	N			&EFS/690.8
Container Internal Lighting						N	N		-690F1	N.			&EFS/690.1
=						GND	PE						&EFS/690.2
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						N	N		-XES	N			&EFS/691.1
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						GND	PE						&EFS/691.2
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						N	N						&EFS/691.3
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						GND	PE						&EFS/691.3
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						N	N						&EFS/691.4
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						GND	PE						&EFS/691.4
						GND							
400V AC for Cooling Units							N						&EFS/691.6
=							PE						&EFS/691.6

previous page: 2032

next page: =UNIT_03&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-690XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet page: 2033
Date								+ total: 492

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	BATTERY CONTAINER 2	
Circuit diagram No:	10354_23A2007	20250805_V2.0

Producer (company):	Freqcon GmbH	53412 ASC 53409
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Project manager:	Freqcon_CP	

created on: 17.09.2019
edited on: 05.08.2025 edited by: Freqcon_DG total pages: 492

previous page:
=UNIT_02&EMZ++ASC/2033

next page:
&EAB/1

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	21.01.2025	Freqcon_DG
	3	INDEX	21.01.2025	Freqcon_DG
	4	INDEX	21.01.2025	Freqcon_DG
	5	INDEX	21.01.2025	Freqcon_DG
	6	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	05.11.2024	Freqcon_DG
	3a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
&ELU		Cabinet Overview		
	5a	Container overview	14.06.2024	Freqcon_JD
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	191	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	192	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	193	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	278	EARTHING CONTAINER	18.06.2024	Freqcon_JD
	290	BATTERY CABINETS 1-3	18.06.2024	Freqcon_JD
	291	BATTERY CABINETS 4+5	18.06.2024	Freqcon_JD
	292	BATTERY CABINETS 6-8	18.06.2024	Freqcon_JD
	293	BATTERY CABINETS 9-11	18.06.2024	Freqcon_JD
&EFS ++ASC		Circuit diagram auxillary cabinet		
	601	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	602	CONTROL VOLTAGE UPS	18.06.2024	Freqcon_JD
	603	CONTROL VOLTAGE FUSE	10.10.2024	Freqcon_DG
	611	ETHERNET SWITCH	18.06.2024	Freqcon_JD
	613a	ETHERNET / PROFINET ISOLATOR	25.11.2024	Freqcon_DG
	613b	PROFINET	25.11.2024	Freqcon_DG
	620	ET200 24V DC ASC	25.11.2024	Freqcon_DG
	621	ET200SP DIGITAL INPUTS DI_21 + DI_22	03.12.2024	Freqcon_DG
	623	ET200SP DIGITAL OUTPUTS DO_21	14.06.2024	Freqcon_JD
	624	ET200SP ANALOG INPUTS AI_21	14.06.2024	Freqcon_JD
	625	ET200SP ANALOG OUTPUTS AO_21	14.06.2024	Freqcon_JD
	635a	OUTPUTS COMMUNICATION	18.06.2024	Freqcon_JD
	635b	OUTPUTS COMMUNICATION	18.06.2024	Freqcon_JD
	636	OUTPUTS FIRE DAMPER	18.06.2024	Freqcon_JD
	669	SMOKE POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	670	GAS POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	678	DC BATTERY CABINETS	18.06.2024	Freqcon_JD
	680a	STATIONARY GAS DETECTOR BAT 1-4	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++ASC		Circuit diagram auxillary cabinet		
	680b	STATIONARY GAS DETECTOR BAT 5-8	18.06.2024	Freqcon_JD
	680c	STATIONARY GAS DETECTOR BAT 9-11	18.06.2024	Freqcon_JD
	681	EXTRACT FAN FIRE DAMPER	18.06.2024	Freqcon_JD
	684	AUXILIARY SUPPLY 400V AC	22.11.2024	Freqcon_DG
	685	AUXILIARY SUPPLY 400V AC	08.10.2024	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	29.10.2024	Freqcon_DG
	691	CONTAINER COOLING / LIGHTNING	05.11.2024	Freqcon_DG
&EPC ++Container		Parts List		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	21.01.2025	Freqcon_DG
	4	PARTS LIST	21.01.2025	Freqcon_DG
	5	PARTS LIST	21.01.2025	Freqcon_DG
	6	PARTS LIST	21.01.2025	Freqcon_DG
	7	PARTS LIST	21.01.2025	Freqcon_DG
	8	PARTS LIST	21.01.2025	Freqcon_DG
&EPA ++Container		Summarized part list		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
&EMB ++Container		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	21.01.2025	Freqcon_DG

previous page: 3

next page: 5

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_03++ASC+-X5.1 - =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_03++ASC+-X5.1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_03++ASC+-X5.2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_03++ASC+-X5.3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_03++ASC+-X6	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_03++ASC+-XDC1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_03++ASC+-XDC2	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_03++ASC+-XES	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_03++ASC+-XT	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2009	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2024	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG
	2025	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2026	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG
	2027	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2028	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2029	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2030	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2031	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2032	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2033	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2034	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/6

next page: 6a

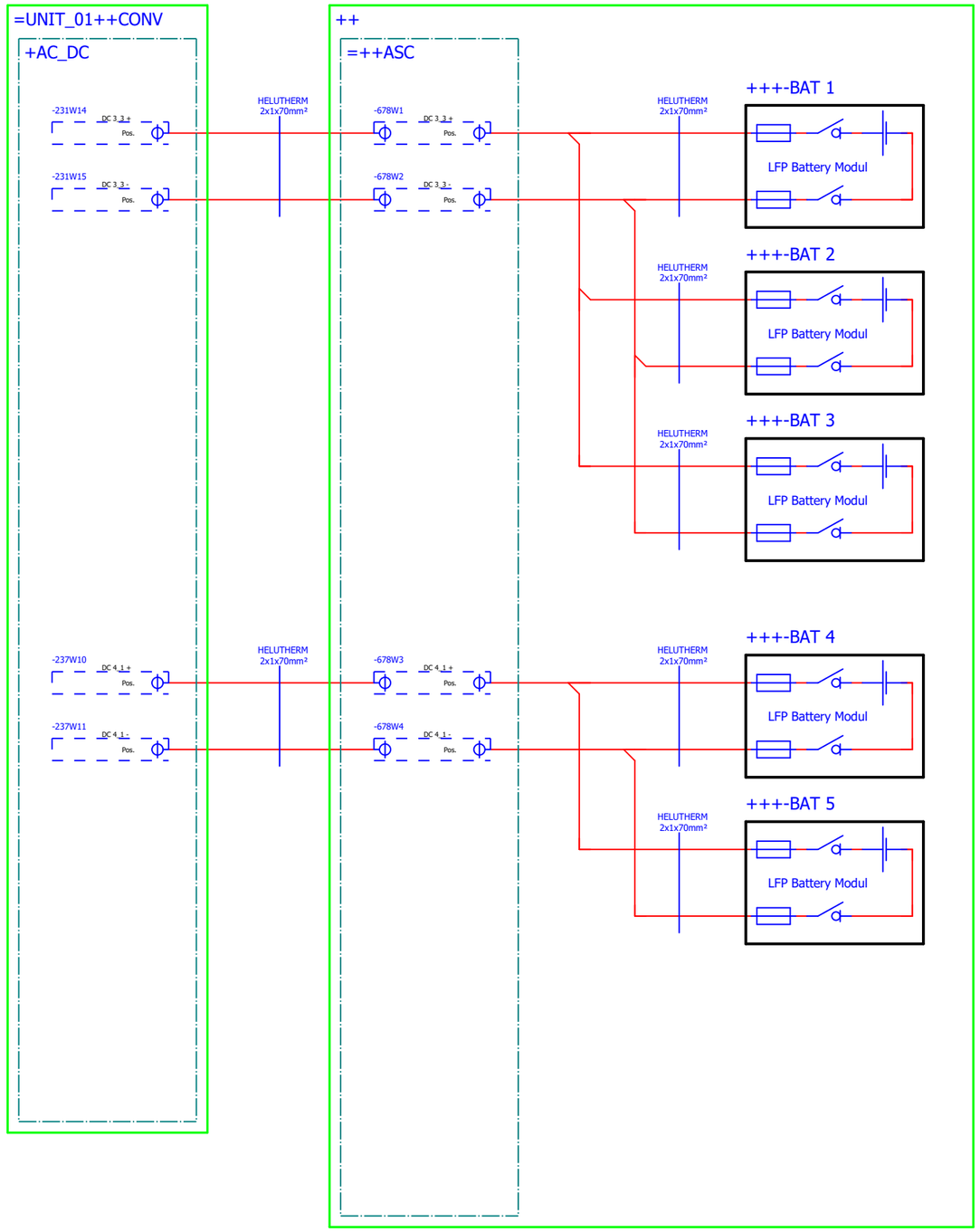
SPECIFICATION of grounding

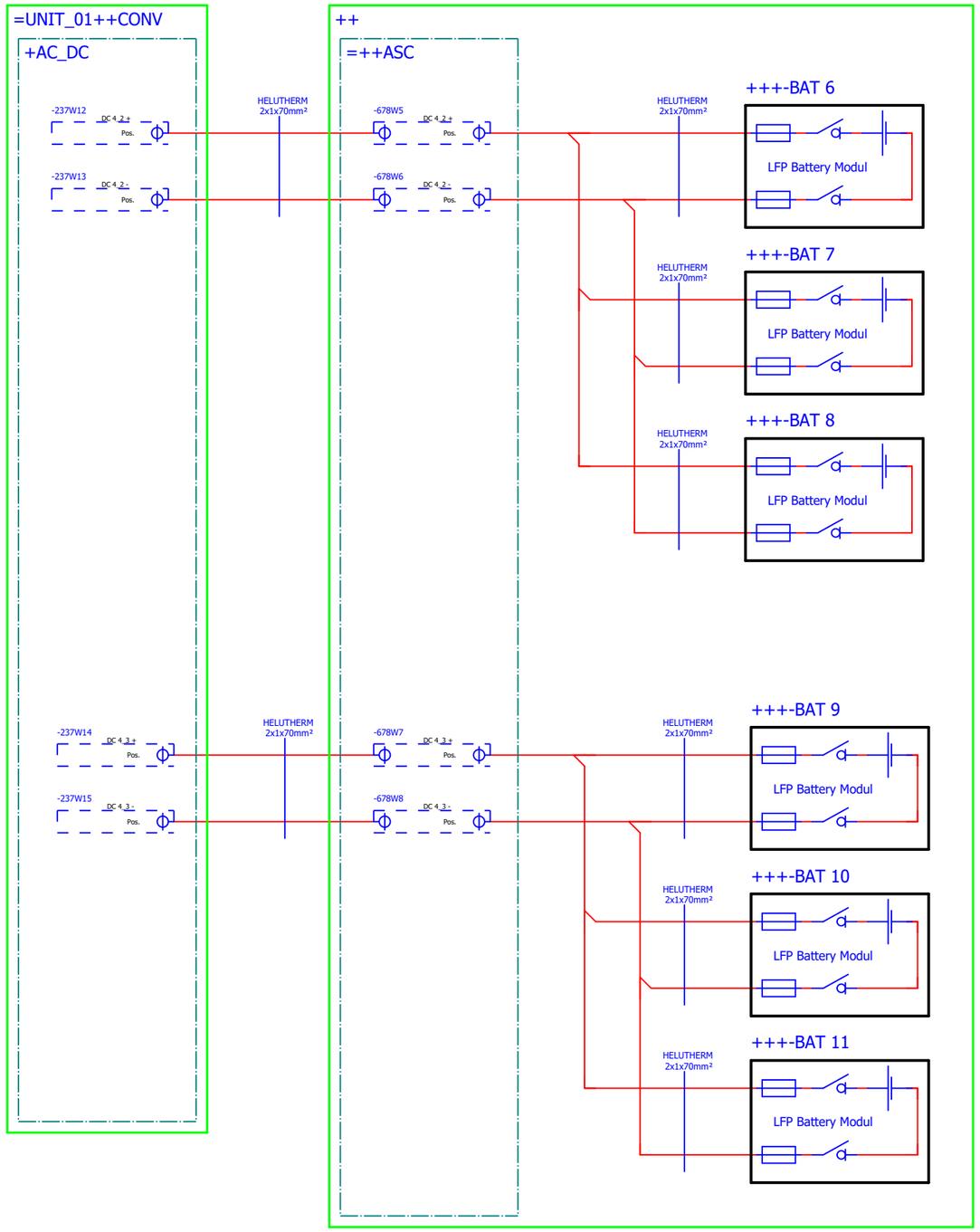
	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Single line diagram





previous page:
&EAC/6a

next page:
2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 1a
Date								+ total: 492

Single line diagram

Control circuit

++ASC

400V

-XES

-684F3 &EFS++ASC/684.2 C32A

-684F1 &EFS++ASC/684.0 C32A

-684F2 &EFS++ASC/684.5 TYP 1 + 2 SPD

-601F1 &EFS++ASC/601.1 TYP 1 + 2 SPD

-684F4 &EFS++ASC/685.0 C32A

-684F5 &EFS++ASC/685.5 TYP 1 + 2 SPD

-691F1 &EFS++ASC/691.1 C6A

-691F2 &EFS++ASC/691.3 C6A

-691F3 &EFS++ASC/691.4 C6A

-690F1 &EFS++ASC/690.1 16A

-690F3 &EFS++ASC/690.5 C6A

-690F4 &EFS++ASC/690.7 C6A

-690F5 &EFS++ASC/690.8 C6A

-691F4 &EFS++ASC/691.5 C16A

-690F2 &EFS++ASC/690.3 16A

-101Q1

-687F1 &EFS++ASC/687.1 C16A

-687F2 &EFS++ASC/687.3 C16A

-687F3 &EFS++ASC/687.4 C16A

-687F4 &EFS++ASC/687.5 C16A

-687F5 &EFS++ASC/687.7 C16A

-636K1 &EFS++ASC/636.1

-636K2 &EFS++ASC/636.2

-636K3 &EFS++ASC/636.4

M 1~

1/N/PE

1/N/PE

1/N/PE

1/N/PE 1/N/PE

20 A

Battery cabinet 1

Battery cabinet 2

Battery cabinet 3

Battery cabinet 4

Battery cabinet 5

-687F6 &EFS++ASC/687.8 C16A

-688F1 &EFS++ASC/688.1 C16A

-688F2 &EFS++ASC/688.2 C16A

-688F3 &EFS++ASC/688.4 C16A

-688F4 &EFS++ASC/688.5 C16A

-688F5 &EFS++ASC/688.7 C16A

Battery cabinet 6

Battery cabinet 7

Battery cabinet 8

Battery cabinet 9

Battery cabinet 10

Battery cabinet 11

Exhaust Unit / shut-off flap Bat 1-4

Exhaust Unit / shut-off flap Bat 5-8

Exhaust Unit / shut-off flap Bat 9-11

Container Internal Lighting

crane 1

crane 2

crane 3

Cooling Units

Container Sockets

Power Supply

previous page: 1a

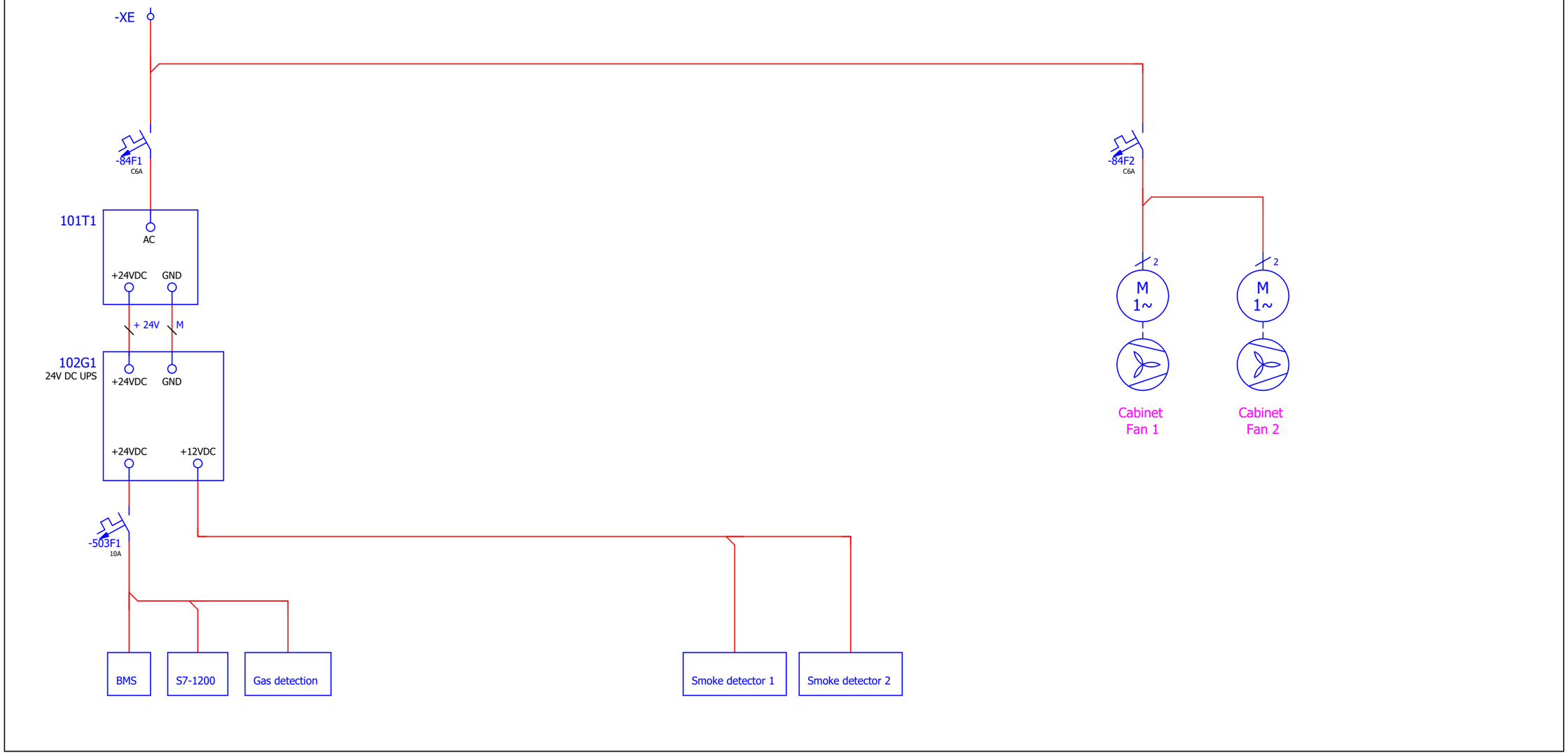
next page: 3a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2a
Date								+ total: 492

Single line diagram

Control circuit

Battery Cabinet

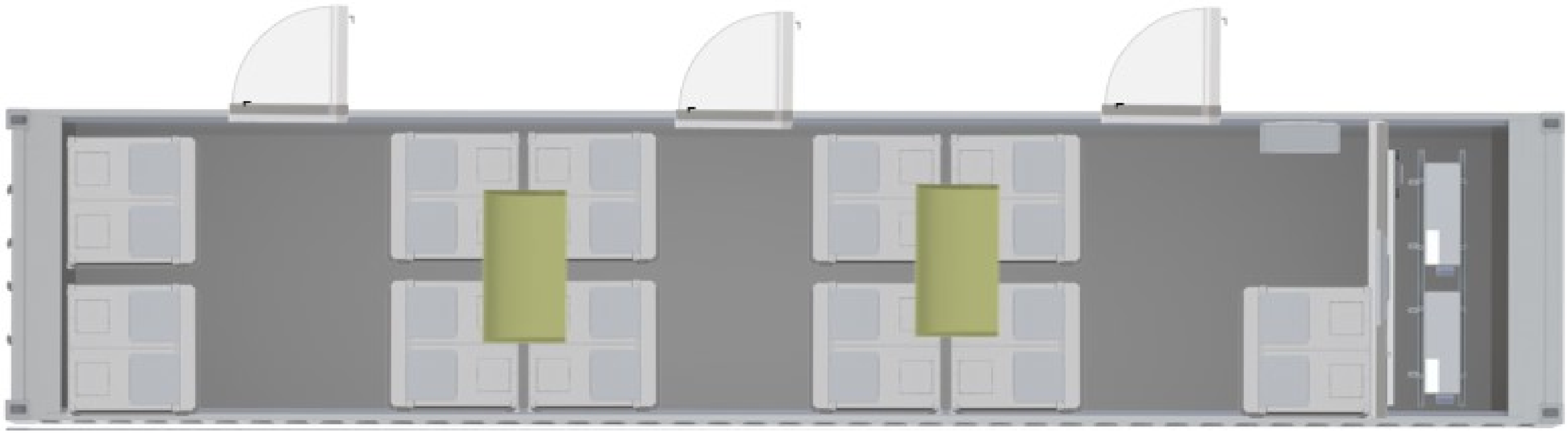


previous page:
2a

next page:
&ELU/5a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 3a
Date								+	total: 492

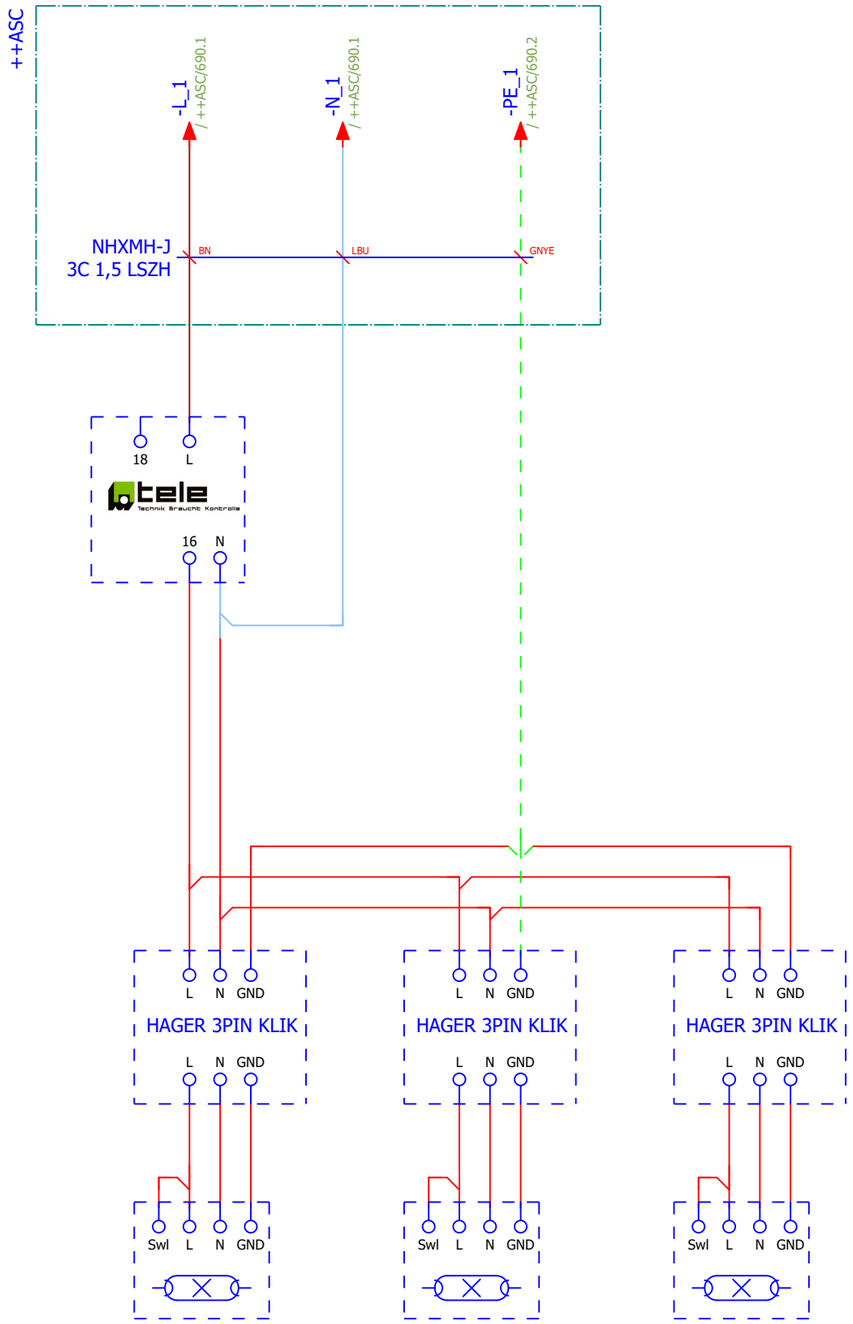
0	1	2	3	4	5	6	7	8	9



previous page:
&EFA/3a

next page:
&EFS++Container/190

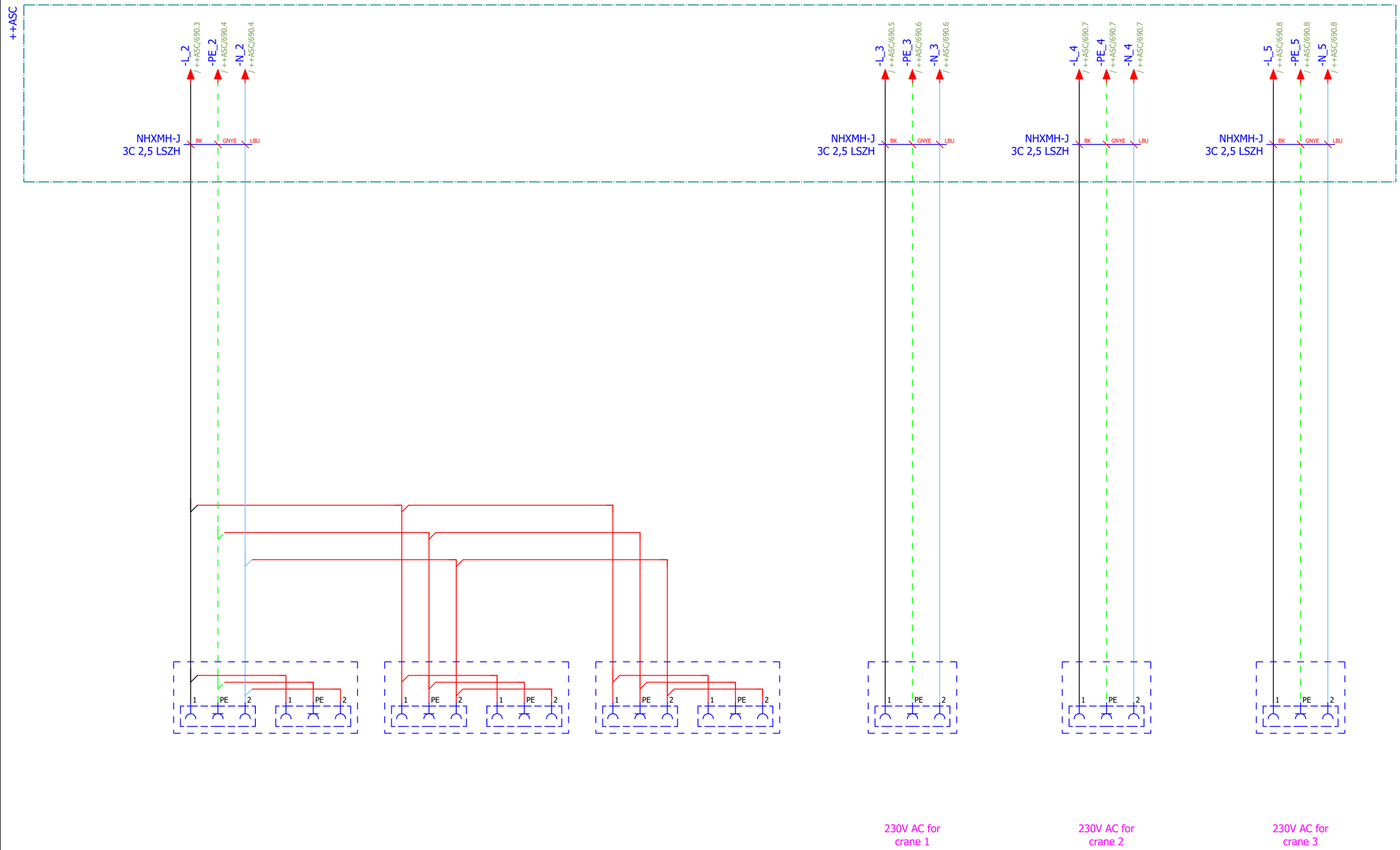
Editor	Freqcon_JD			Statron	FREQCON	Container overview	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	14.06.2024	Norm						& ELU Cabinet Overview	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
191

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492



previous page: 190

next page: 192

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 191
Date								+	total: 492

++ASC

-L_6 / ++ASC/691.1
-N_6 / ++ASC/691.1
-PE_6 / ++ASC/691.2

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 1-4

-L_6 / ++ASC/691.1
-N_6 / ++ASC/691.1
-PE_6 / ++ASC/691.2

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

230V AC for
shut-off flap
Battery cabinets 1-4

-L_7 / ++ASC/691.3
-N_7 / ++ASC/691.3
-PE_7 / ++ASC/691.3

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 5-8

-L_7 / ++ASC/691.3
-N_7 / ++ASC/691.3
-PE_7 / ++ASC/691.3

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

230V AC for
shut-off flap
Battery cabinets 5-8

-L_8 / ++ASC/691.4
-N_8 / ++ASC/691.4
-PE_8 / ++ASC/691.4

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 9-11

-L_8 / ++ASC/691.4
-N_8 / ++ASC/691.4
-PE_8 / ++ASC/691.4

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

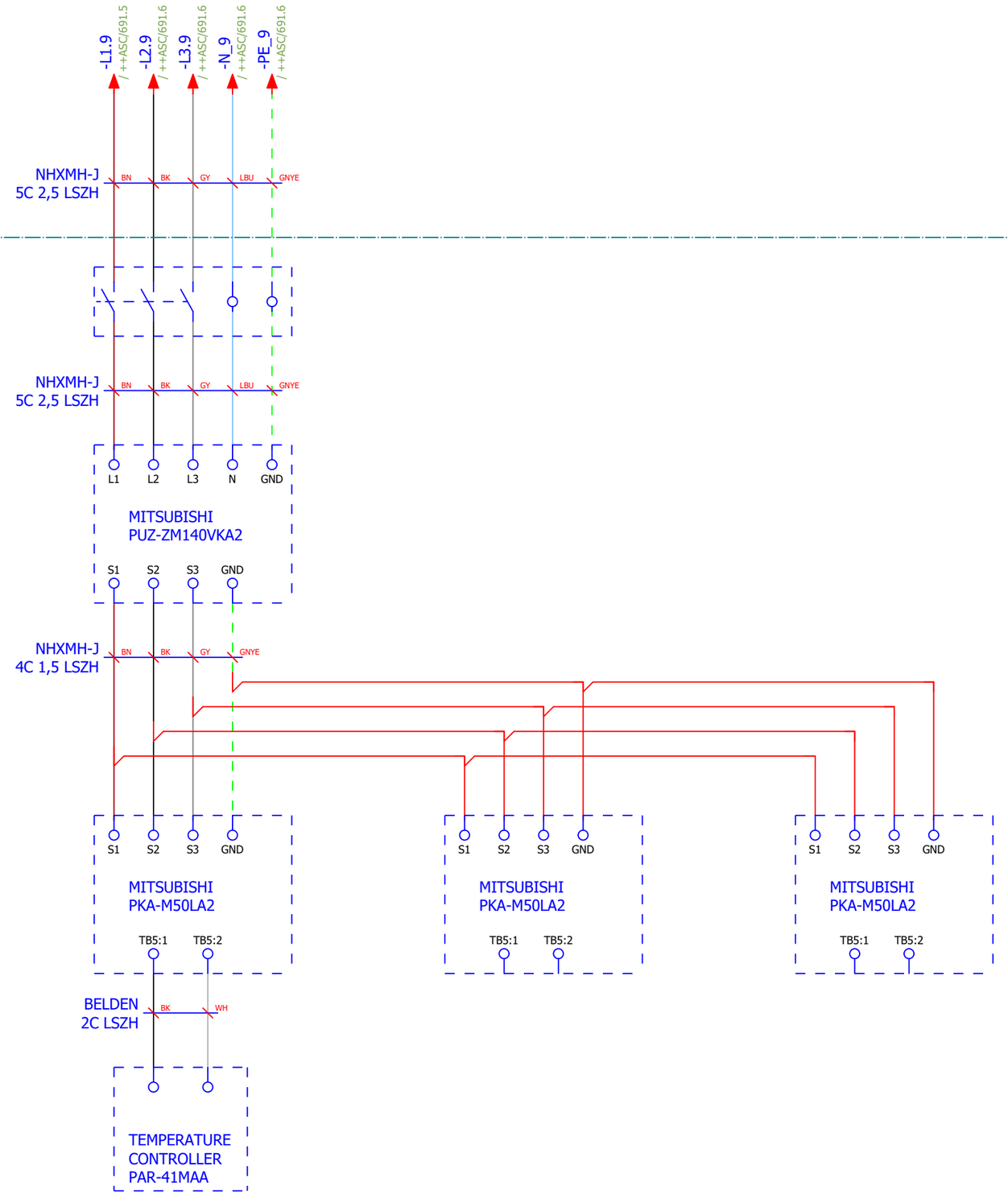
230V AC for
shut-off flap
Battery cabinets 9-11

previous page:
191

next page:
193

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 192
Date								+	total: 492

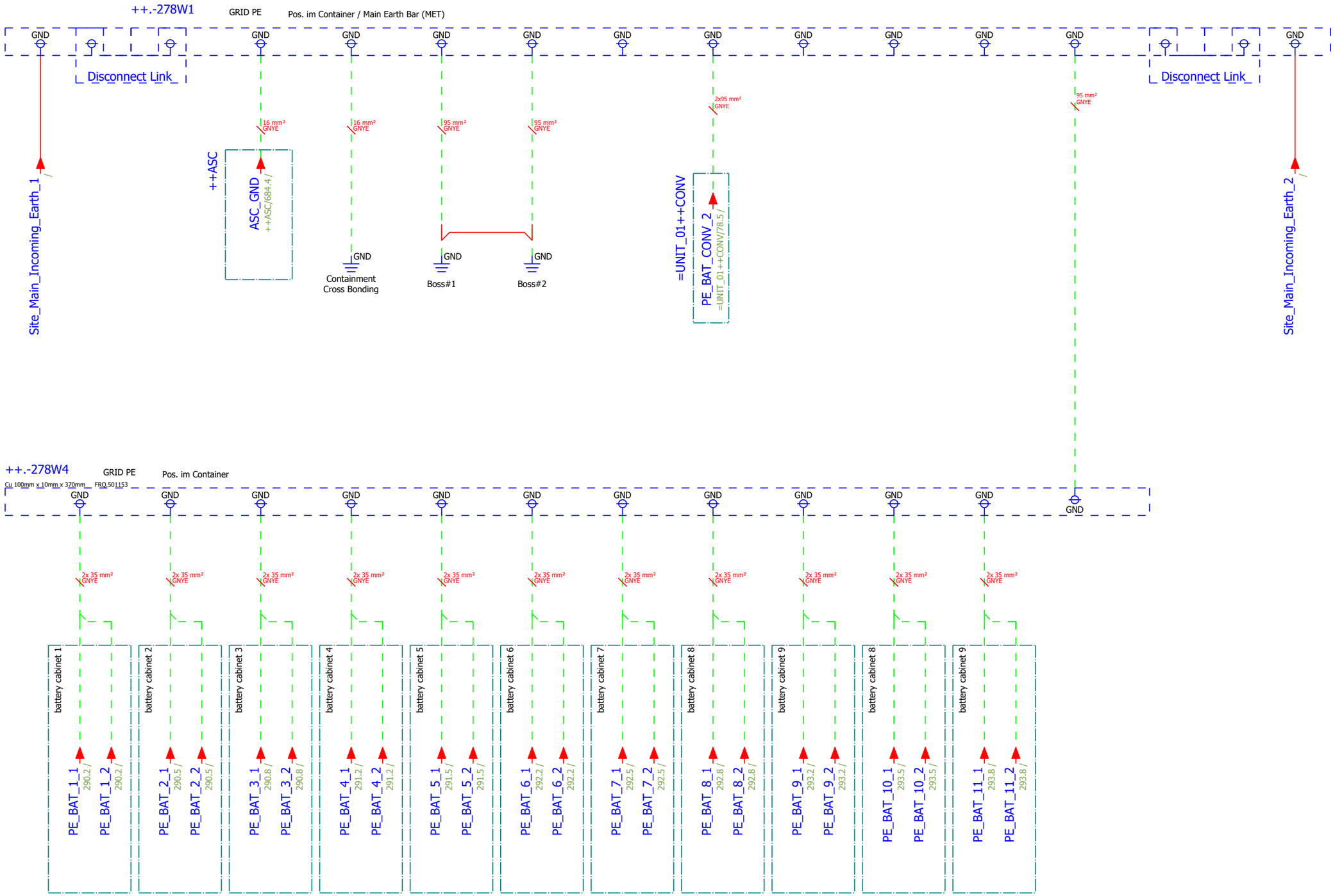
++ASC



previous page: 192

next page: 278

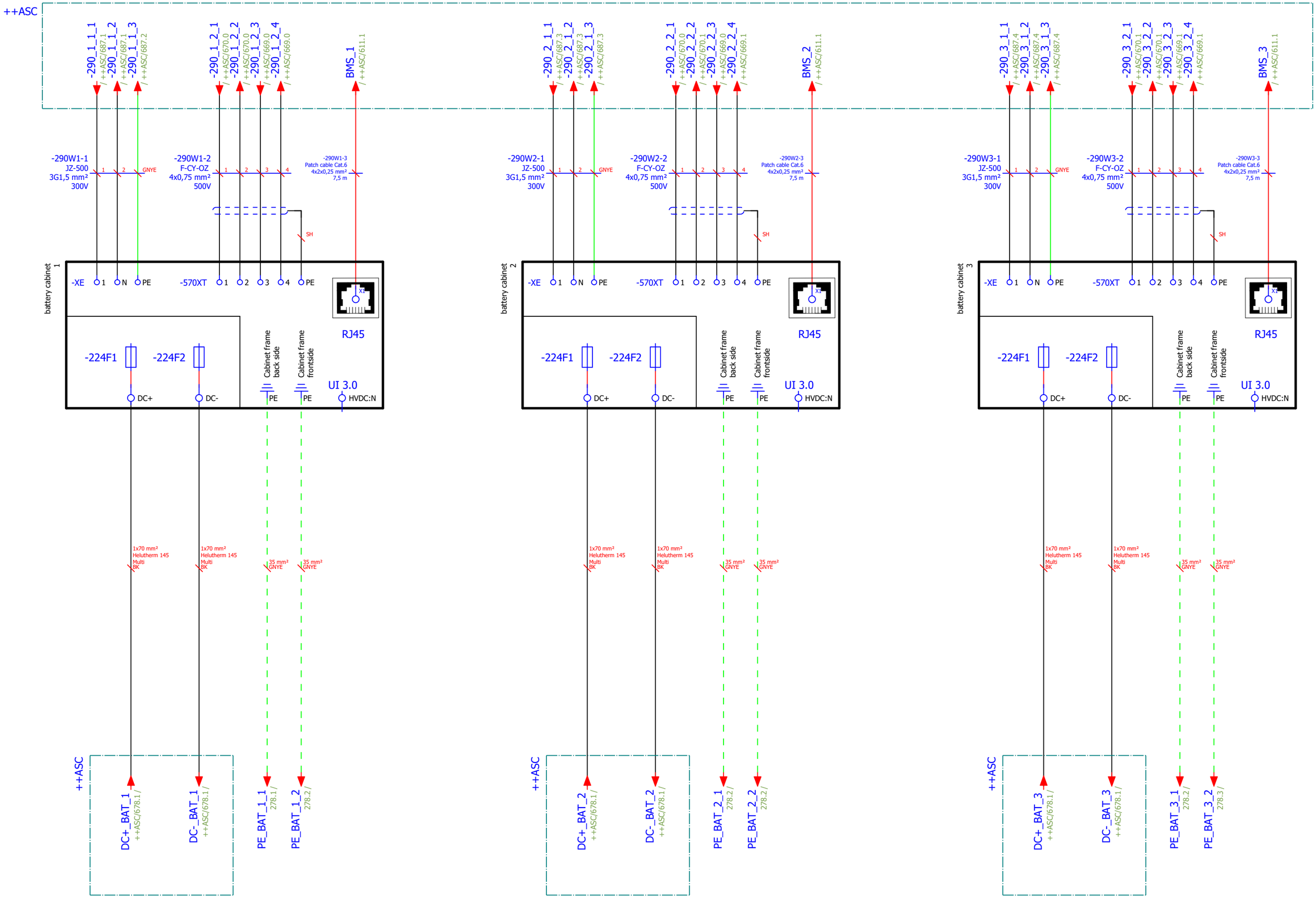
Busbars PE



previous page: 193

next page: 290

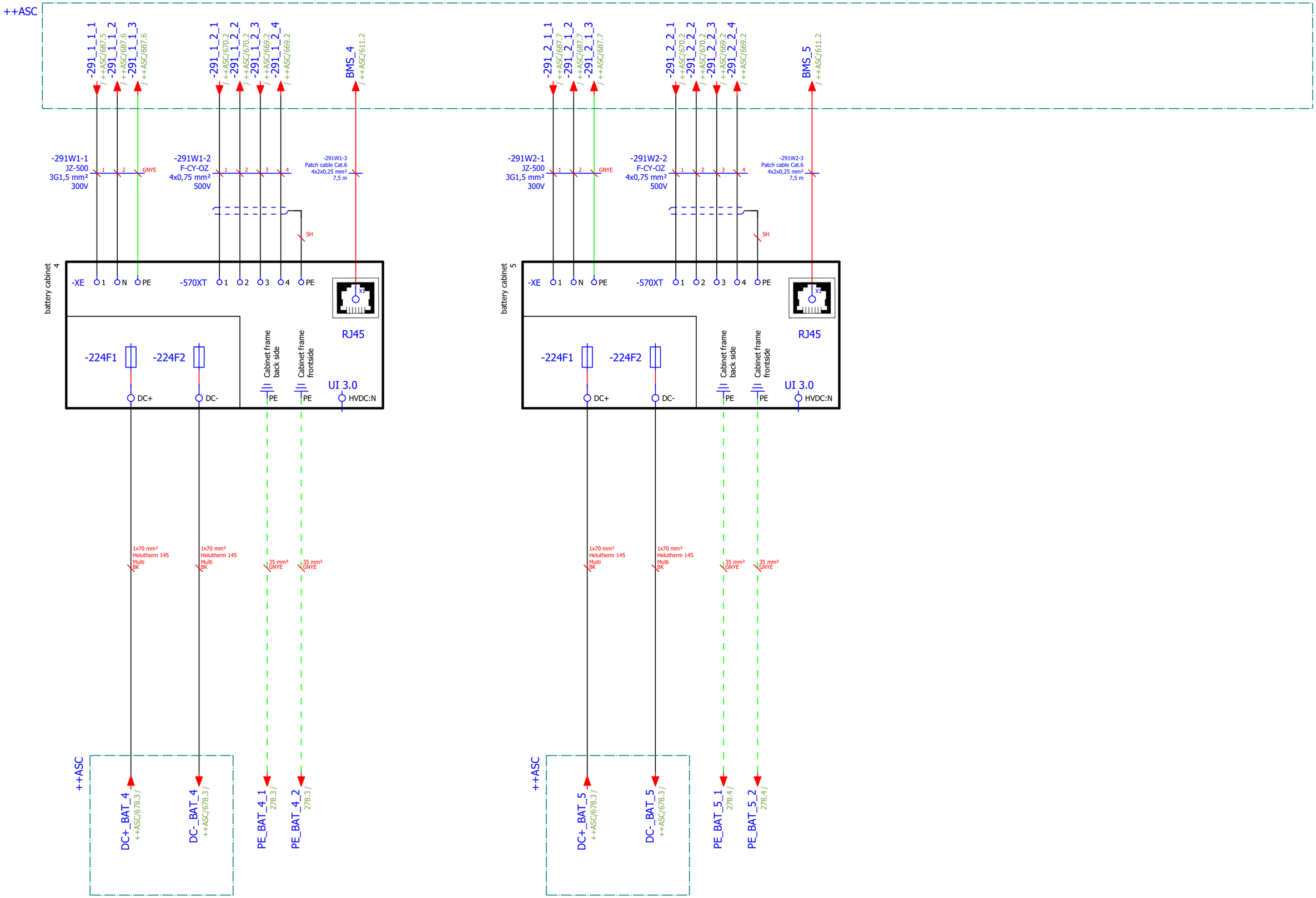
Editor	Freqcon_JD			Statron	FREQCON	EARTHING CONTAINER	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 278
Date								+	total: 492



previous page: 278

next page: 291

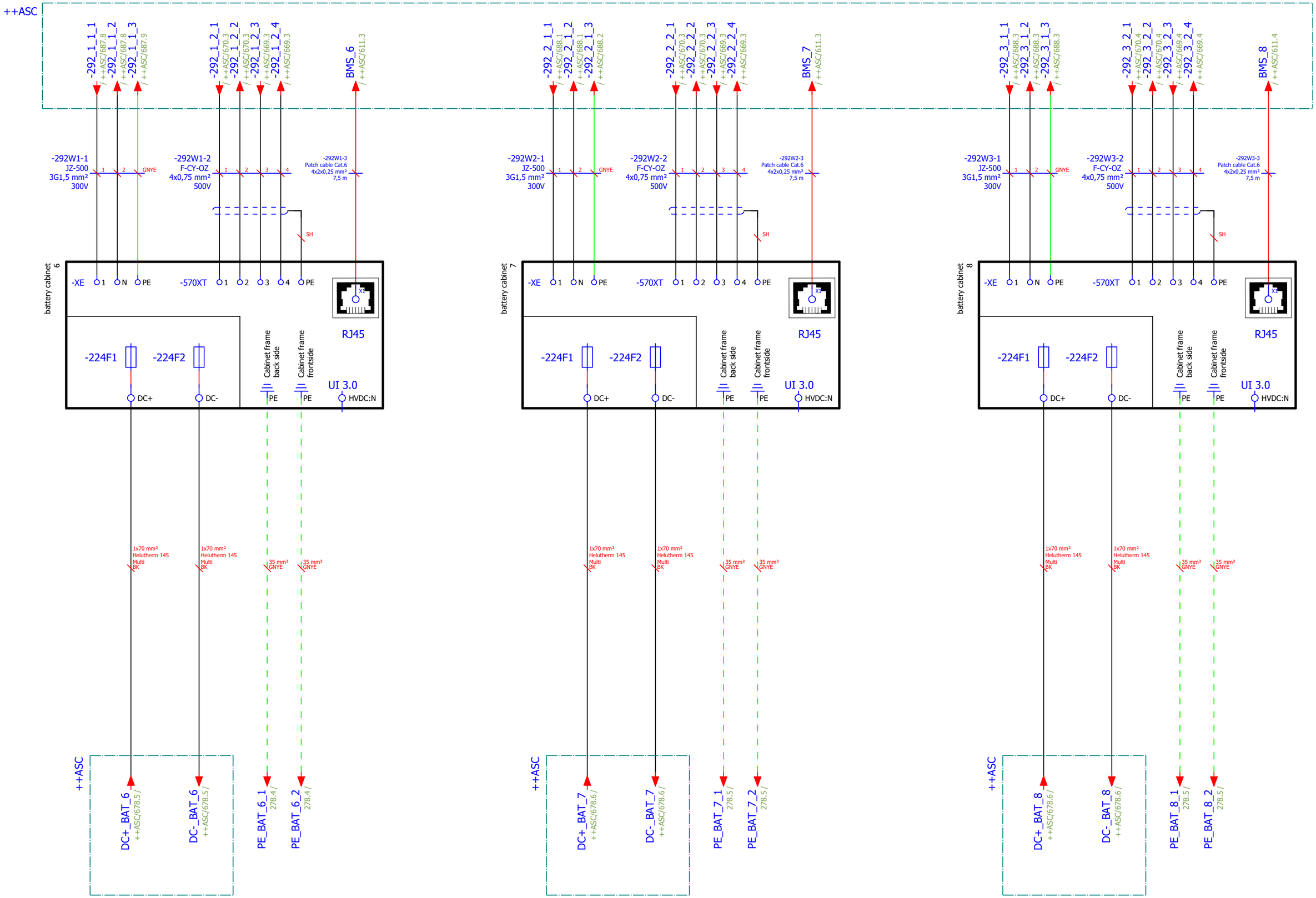
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 1-3	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 290
Date								+	total: 492



previous page: 290

next page: 292

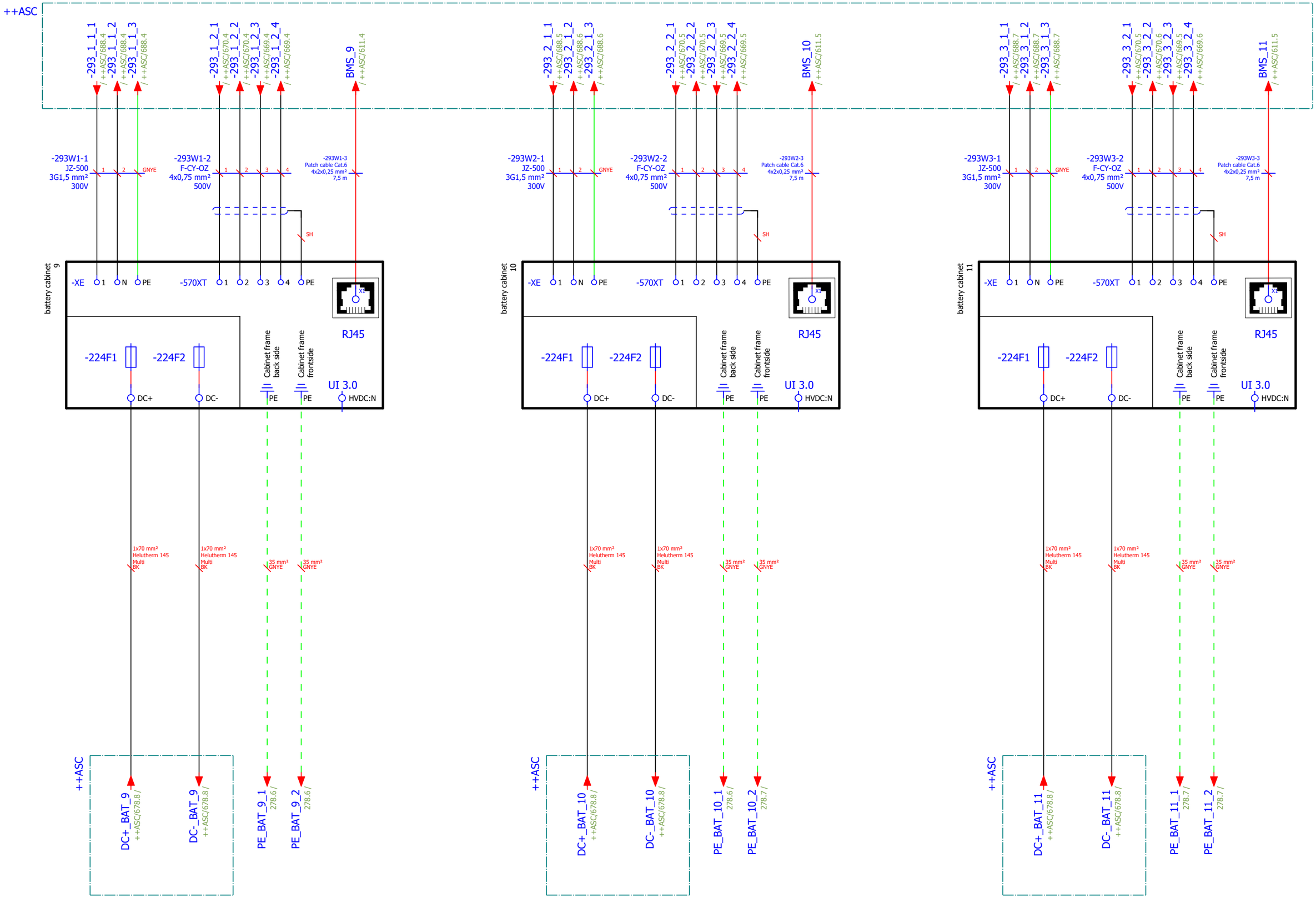
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 4+5	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 291
Date								+	total: 492



previous page: 291

next page: 293

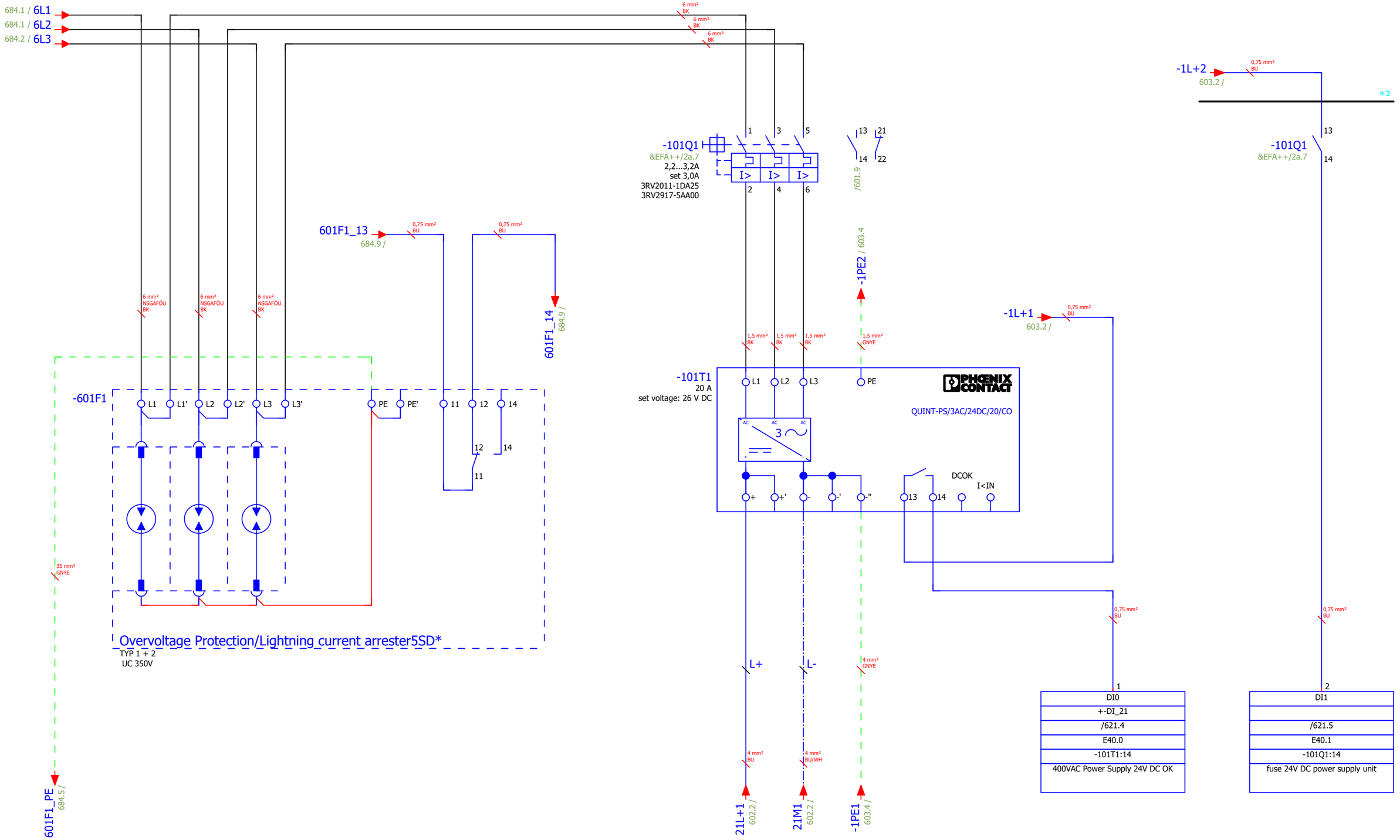
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 6-8	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 292
Date								+ total: 492



previous page: 292

next page: ++ASC/601

Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 9-11	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 293
Date								+ total: 492



previous page:
++Container/293

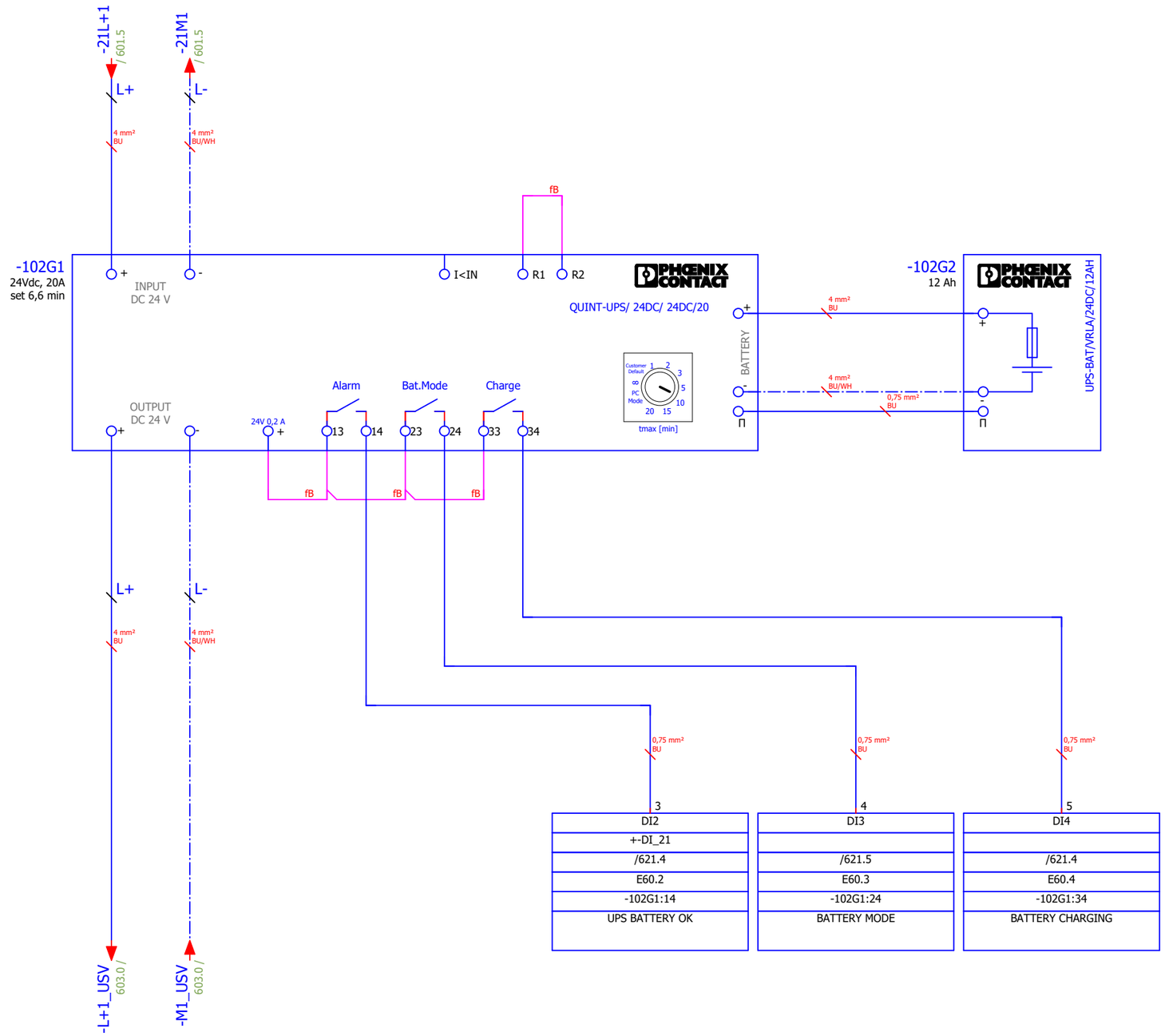
Power supply unit from 400V AC

400VAC
Power Supply
24V DC OK

fuse
24V DC power supply unit

next page:
602

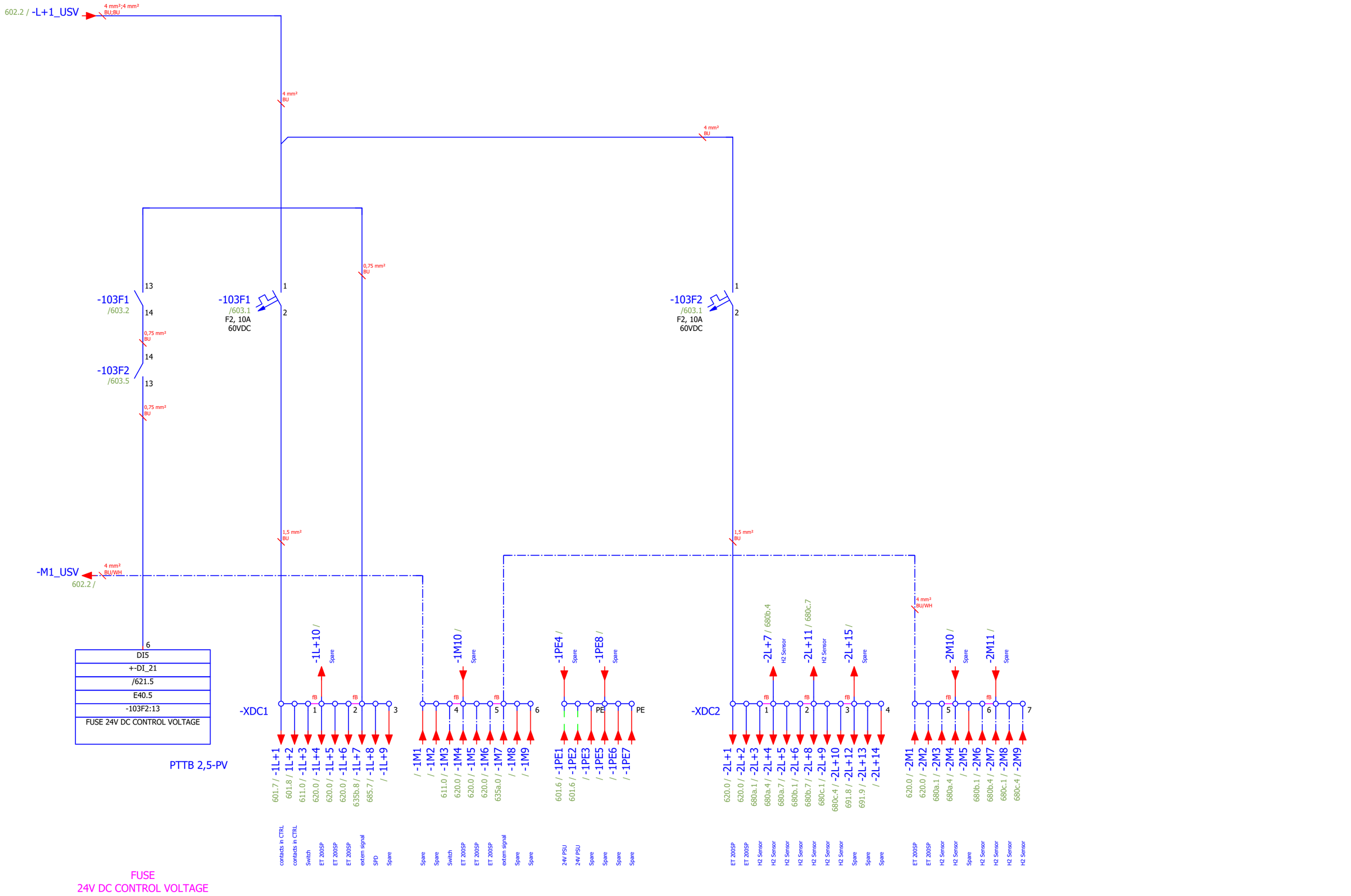
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_03	Battery Container 2
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	page: 601 / total: 492



previous page:
601

next page:
603

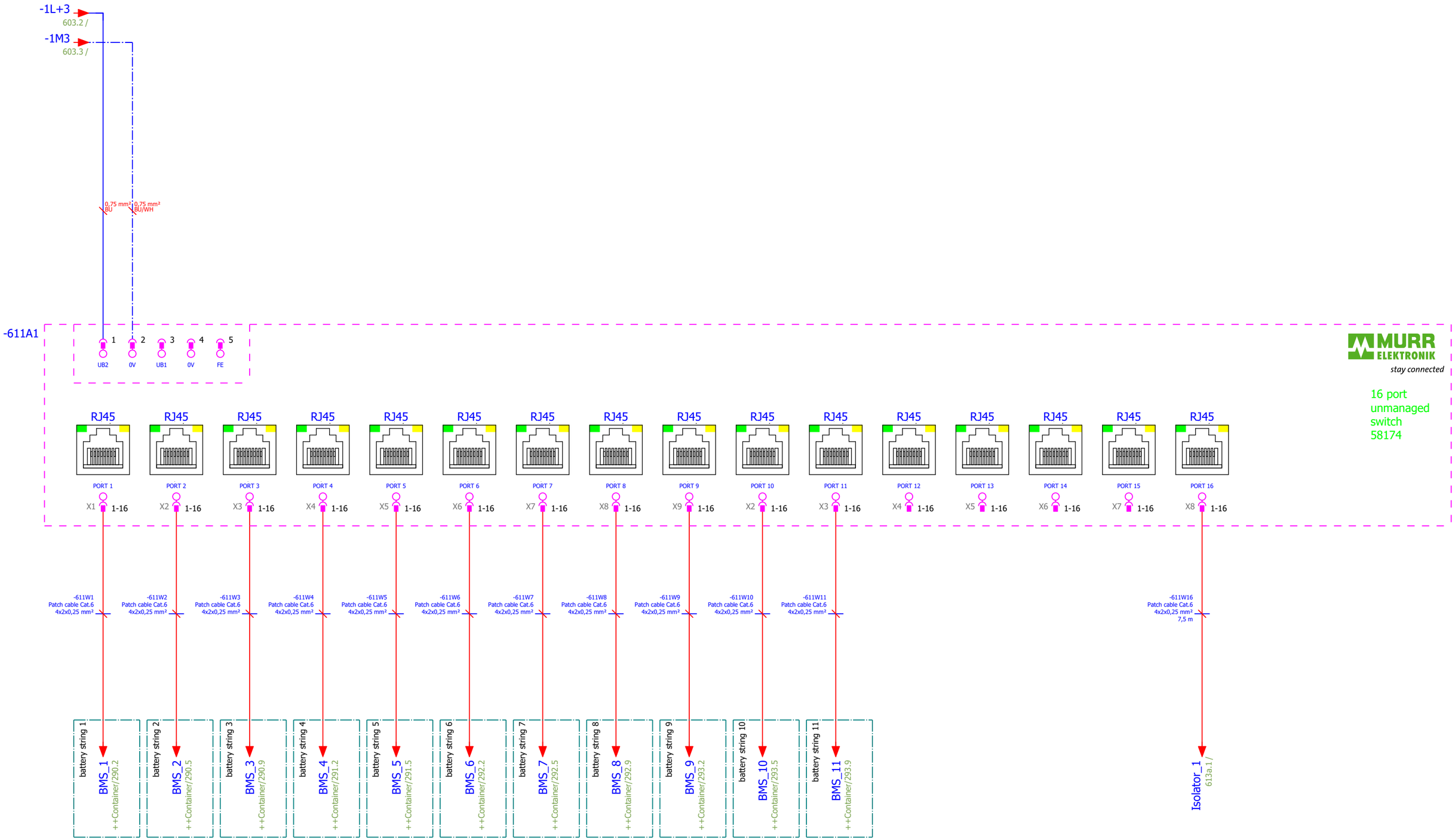
Editor	Freqcon_JD			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 602
Date								+	total: 492



previous page:
602

next page:
611

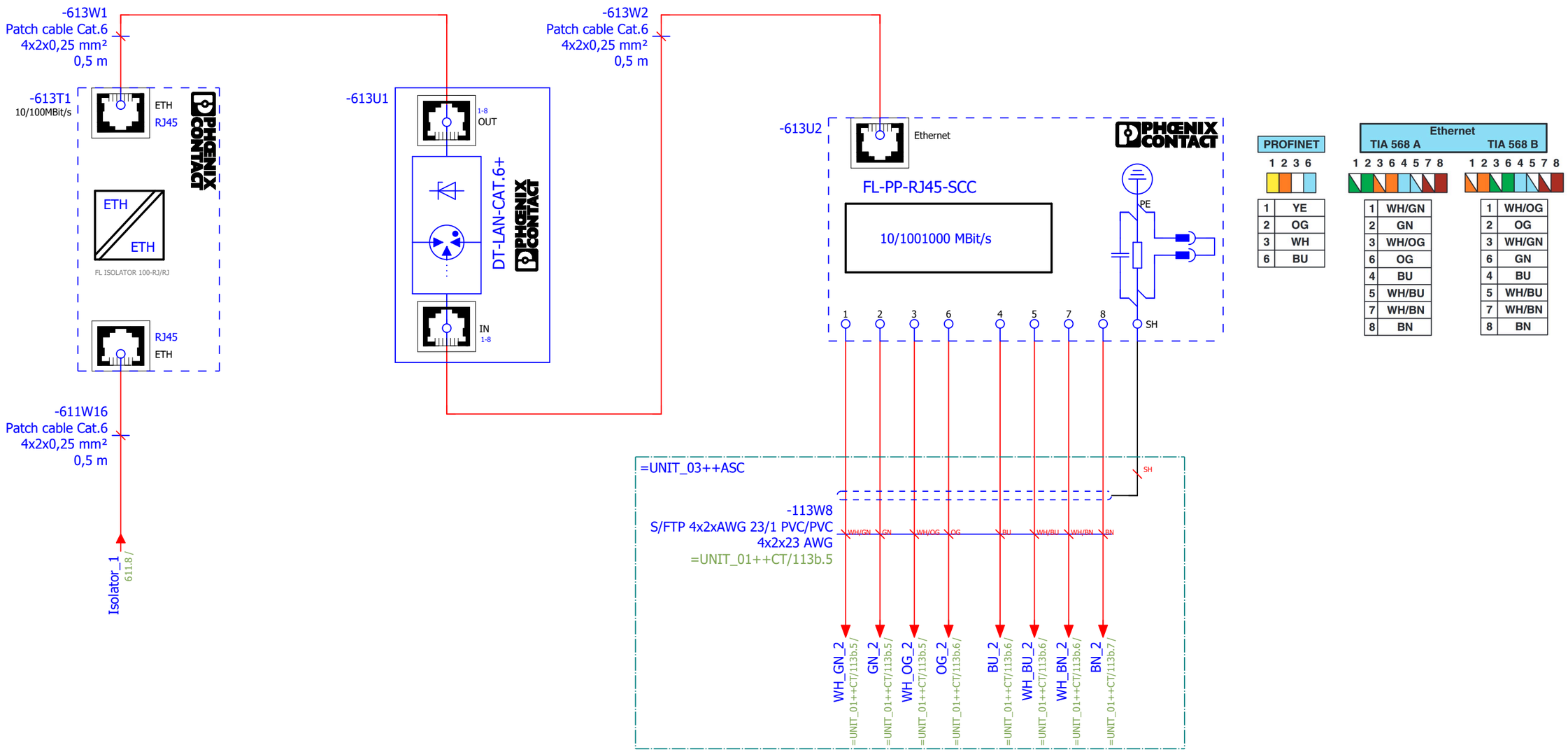
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	10.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxiliary cabinet	page: 603
Date								+	total: 492



previous page: 603

next page: 613a

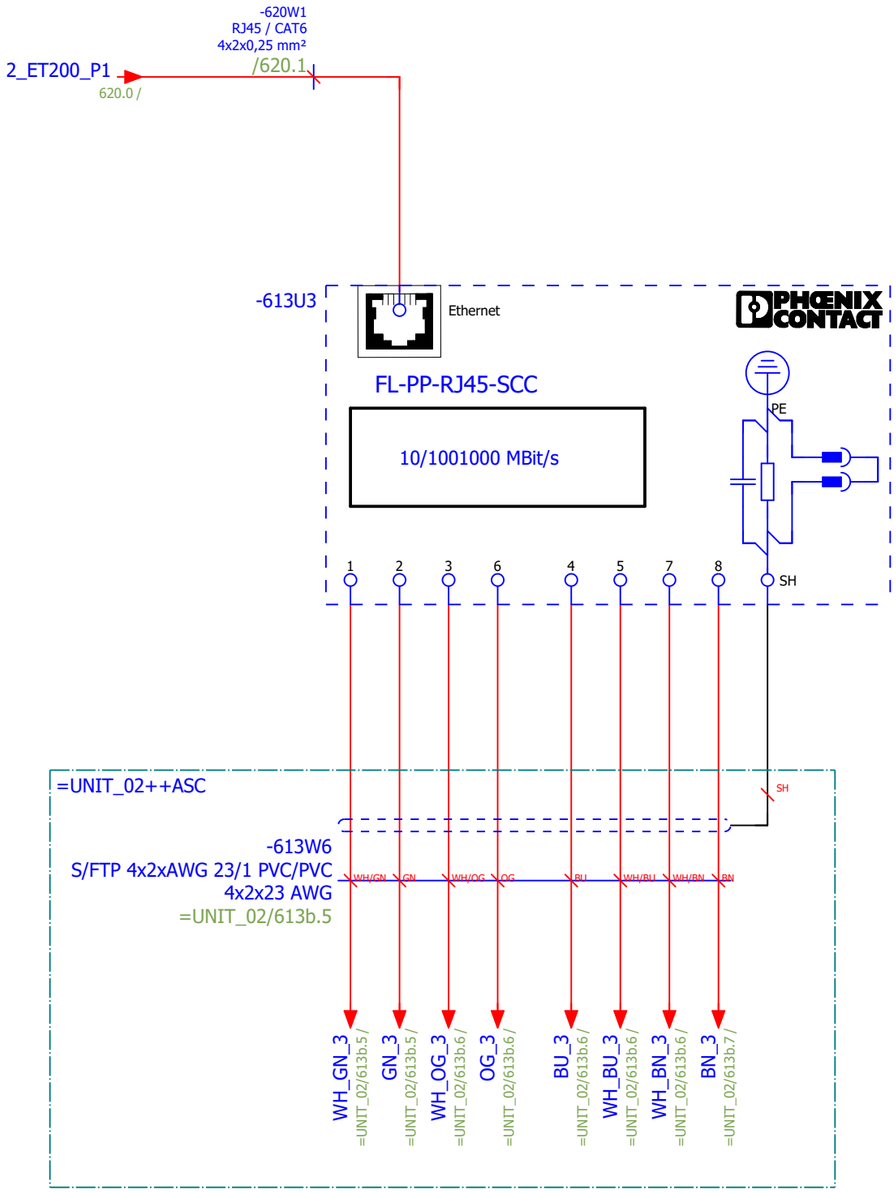
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 492



previous page:
611

next page:
613b

Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	25.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 613a
Date								+	total: 492



PROFINET

1 2 3 6

1	YE
2	OG
3	WH
6	BU

Ethernet

TIA 568 A

1 2 3 6 4 5 7 8

1	WH/GN
2	GN
3	WH/OG
6	OG
4	BU
5	WH/BU
7	WH/BN
8	BN

TIA 568 B

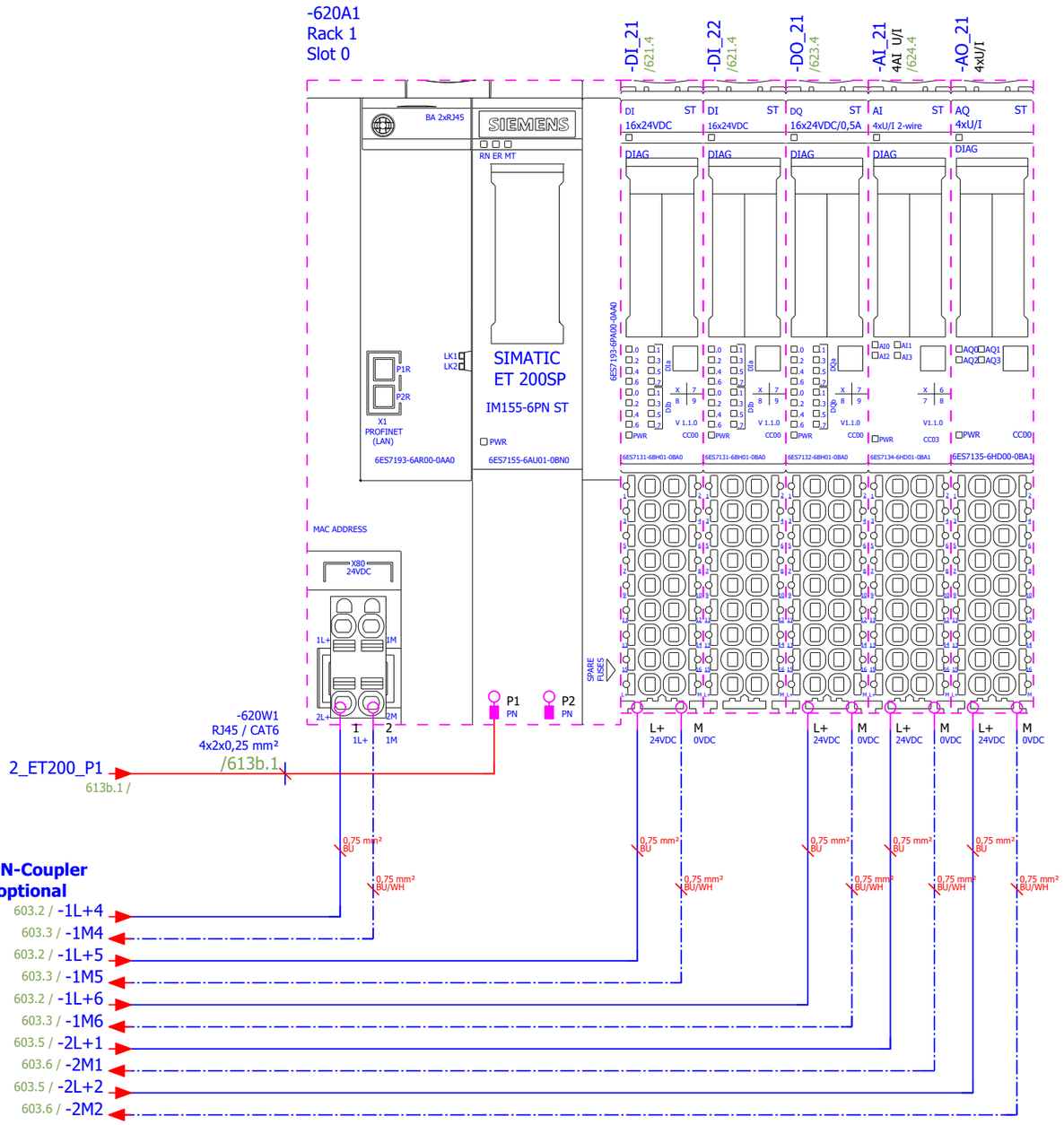
1 2 3 6 4 5 7 8

1	WH/OG
2	OG
3	WH/GN
6	GN
4	BU
5	WH/BU
7	WH/BN
8	BN

previous page:
613a

next page:
620

Editor	Freqcon_DG			Statron	FREQCON	PROFINET	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613b
Date								+		total: 492



previous page:
613b

next page:
621

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC ASC	20250805_V2.0	= UNIT_03	Battery Container 2
Date	25.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 620
total: 492

-DI_21

/620.3

400VAC Power Supply 24V DC OK	/601.7	DI0	1	E60.0	E60.1	2	DI1	/601.9	fuse 24V DC power supply unit
UPS BATTERY OK	/602.5	DI2	3	E60.2	E60.3	4	DI3	/602.6	BATTERY MODE
BATTERY CHARGING	/602.7	DI4	5	E60.4	E60.5	6	DI5	/603.1	FUSE 24V DC CONTROL VOLTAGE
Gassensor OK BAT 1-4	/680a.7	DI6	7	E60.6	E60.7	8	DI7	/680b.7	Gassensor OK BAT 5-8
Gassensor OK BAT 9-11	/680c.7	DI8	9	E61.0	E61.1	10	DI9	/635b.8	Shut-down to BESS
FUSE AND LIGHTNING PROTECTION	/684.9	DI10	11	E61.2	E61.3	12	DI11	/691.8	Fuse Exhaust Unit
Fuse Cooling Units	/691.9	DI12	13	E61.4	E61.5	14	DI13		
		DI14	15	E61.6	E61.7	16	DI15		
	/620.3	24VDC	L+			M	0VDC	/620.3	

-DI_22

/620.3

DI0	1	E62.0	E62.1	2	DI1
DI2	3	E62.2	E62.3	4	DI3
DI4	5	E62.4	E62.5	6	DI5
DI6	7	E62.6	E62.7	8	DI7
DI8	9	E63.0	E63.1	10	DI9
DI10	11	E63.2	E63.3	12	DI11
DI12	13	E63.4	E63.5	14	DI13
DI14	15	E63.6	E63.7	16	DI15
24VDC	L+			M	0VDC

previous page: 620

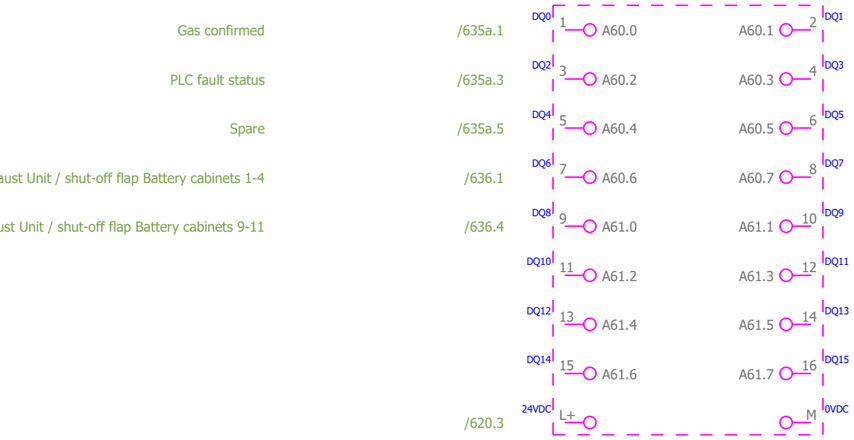
next page: 623

Editor	Freqcon_DG			Statron		ET200SP DIGITAL INPUTS DI_21 + DI_22	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	03.12.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 621
Date								+		total: 492

0	1	2	3	4	5	6	7	8	9

-DO_21

/620.3



Gas confirmed	/635a.1				/635a.2	Smoke confirmed
PLC fault status	/635a.3				/635a.4	Thermal runaway
Spare	/635a.5				/635a.6	Spare
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4	/636.1				/636.2	230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11	/636.4					
	/620.3				/620.4	

previous page: 621

next page: 624

Editor	Freqcon_JD			Statron		ET200SP DIGITAL OUTPUTS DO_21	20250805_V2.0	= UNIT_03	Battery Container 2
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

-AI_21

/620.4



gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

/620.4

/680b.2 gas concentration BAT 5-8

/680b.2 gas concentration BAT 5-8

/620.4

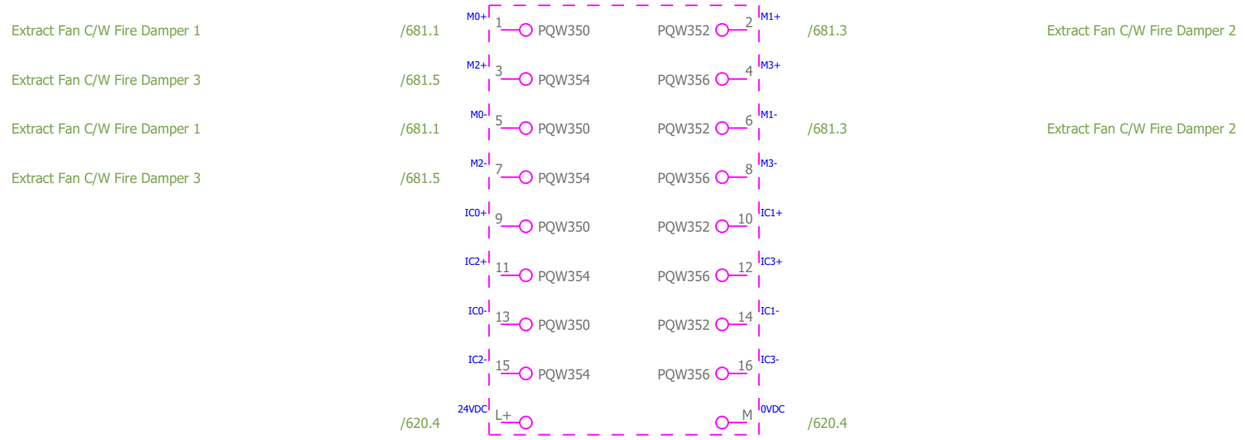
previous page: 623

next page: 625

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_21	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 624
Date								+	total: 492

-AO_21

/620.4



previous page: 624

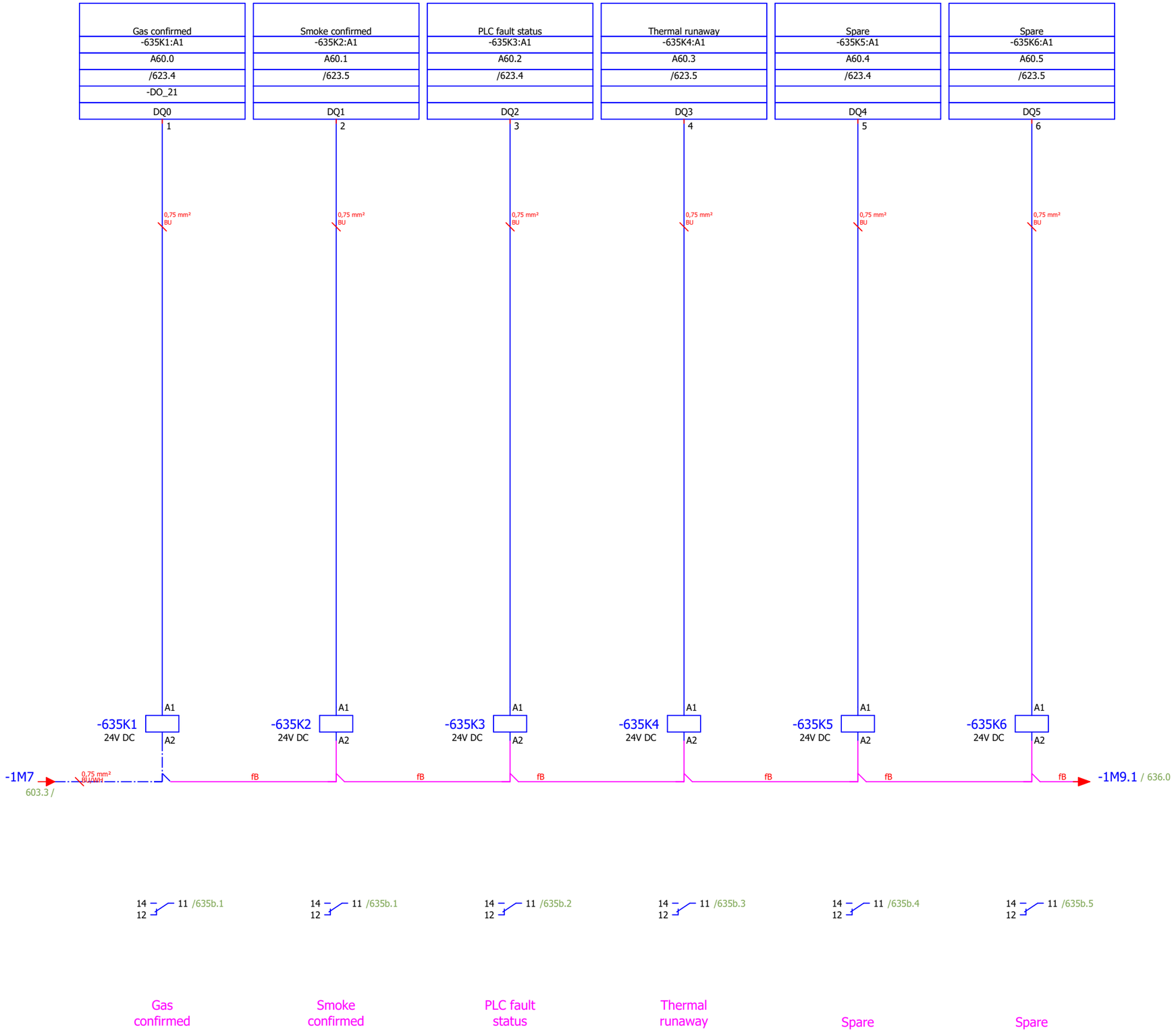
next page: 635a

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG OUTPUTS AO_21	20250805_V2.0	= UNIT_03	Battery Container 2
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 625

total: 492

0	1	2	3	4	5	6	7	8	9



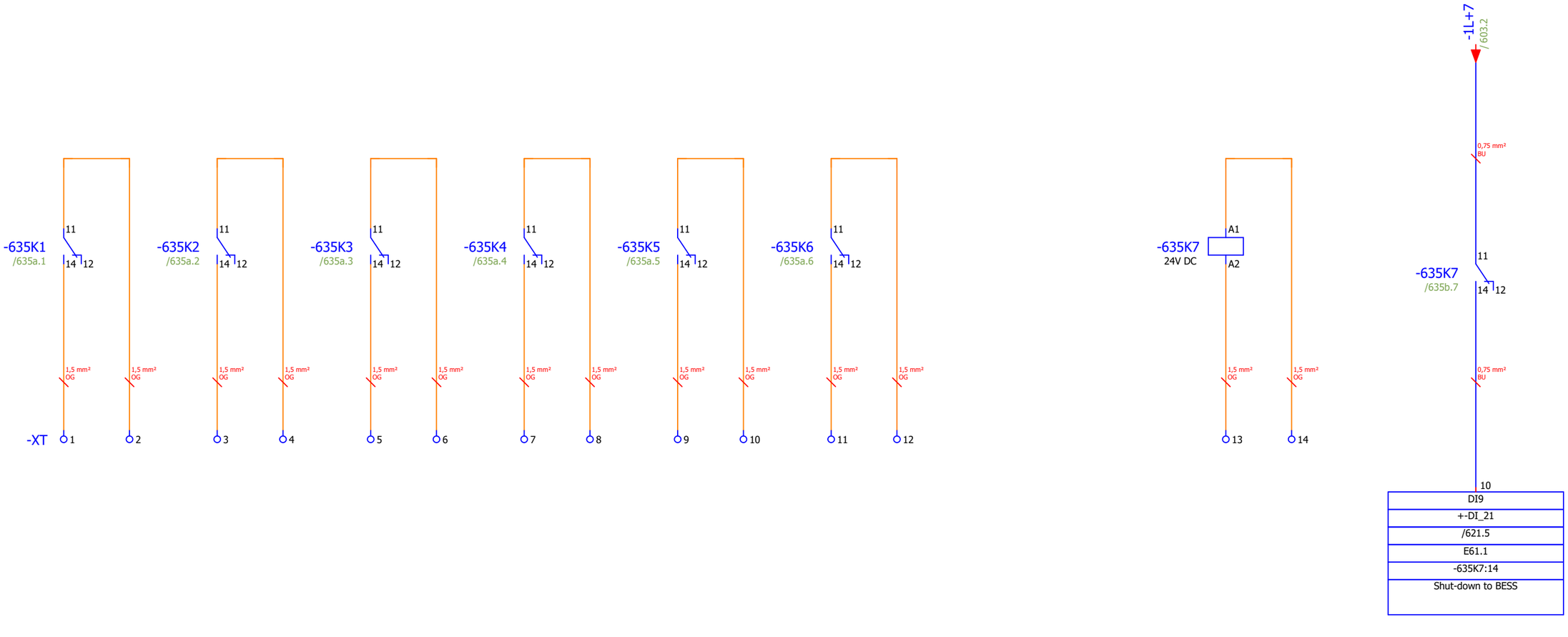
previous page: 625

next page: 635b

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 635a

total: 492



Gas confirmed FGS

Smoke confirmed FGS

PLC fault status SIS

Thermal runaway SIS

Spare

Spare

Shut-down to BESS

Shut-down to BESS

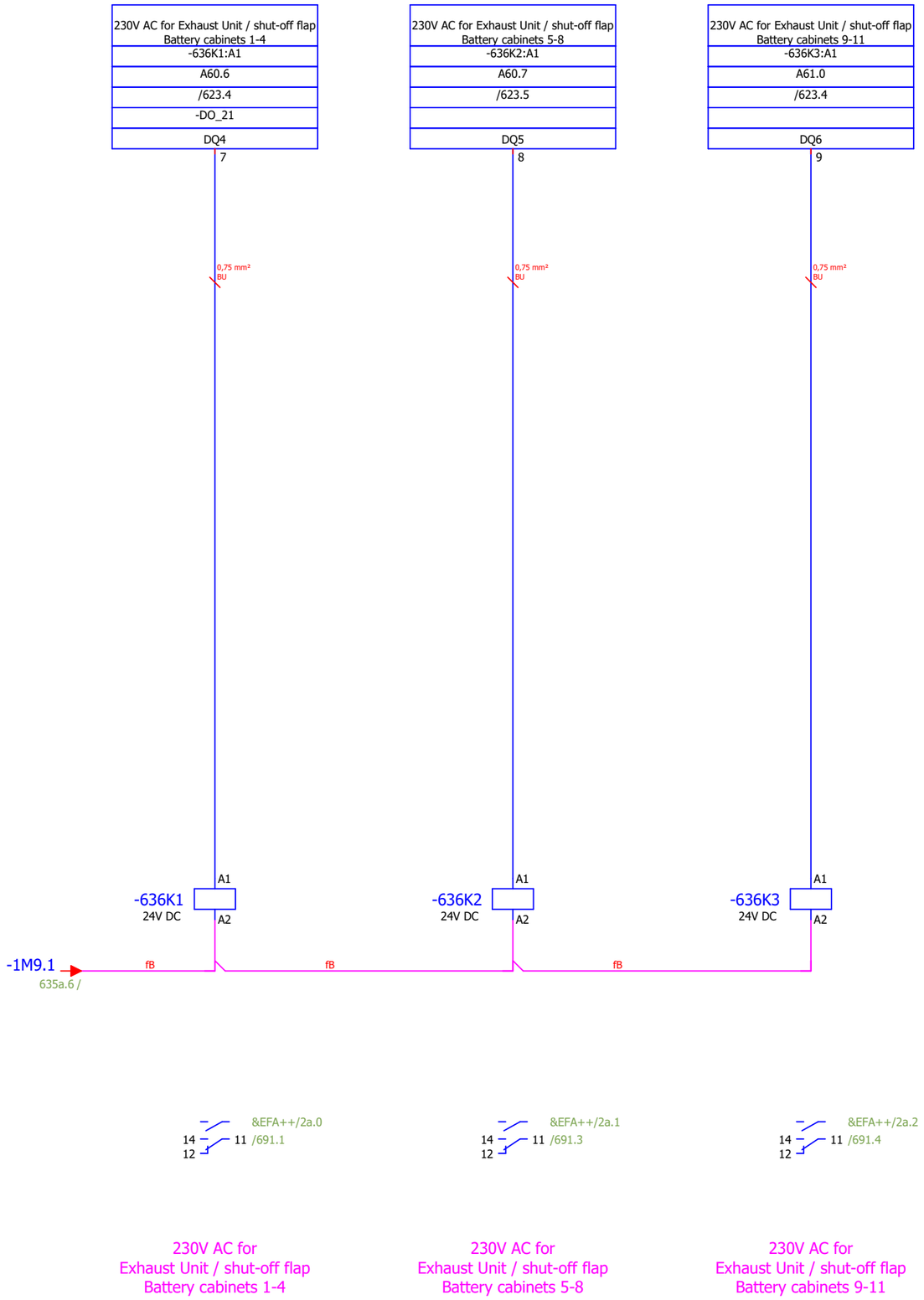
previous page: 635a

next page: 636

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 635b

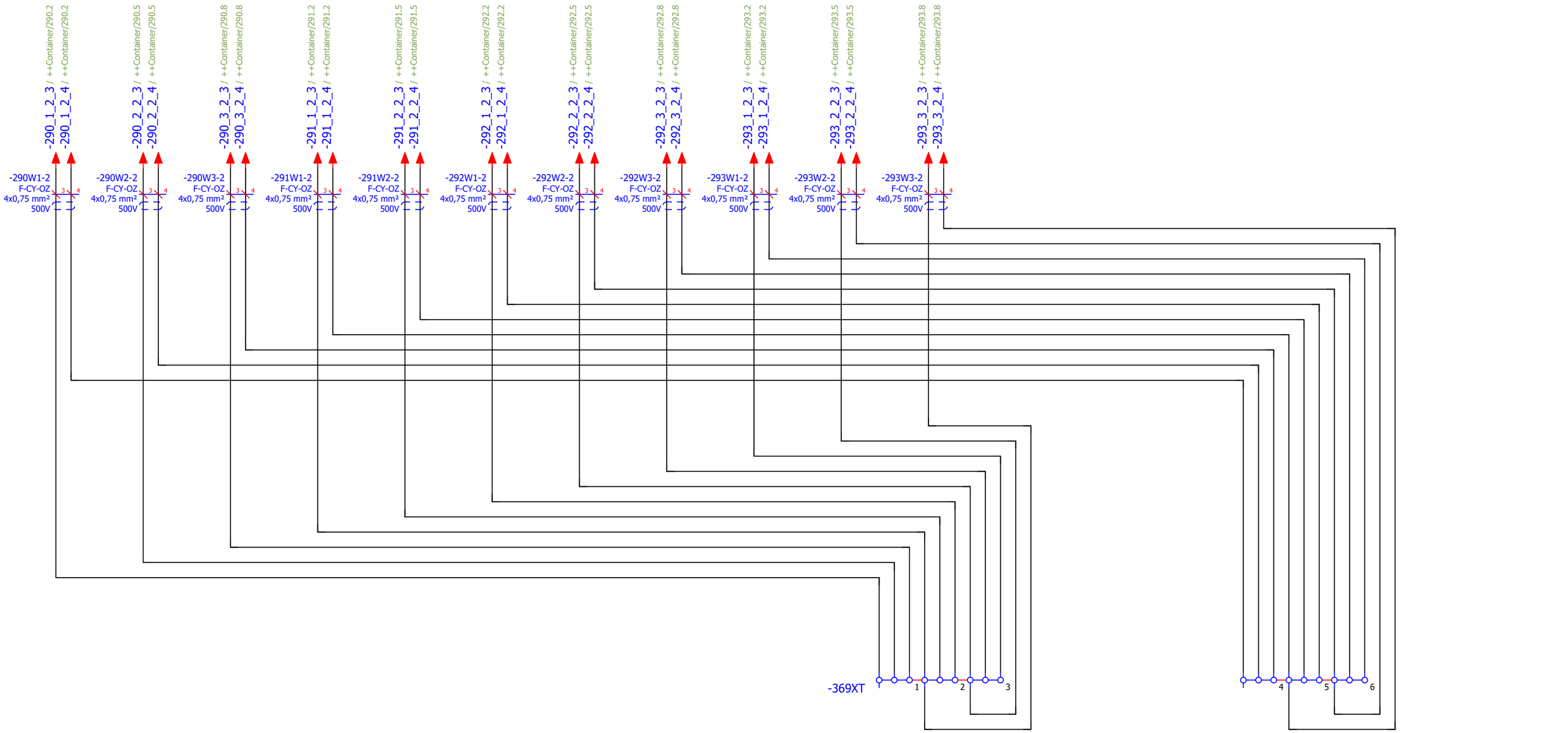
total: 492



previous page:
635b

next page:
669

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FIRE DAMPER	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 636
Date								+	total: 492



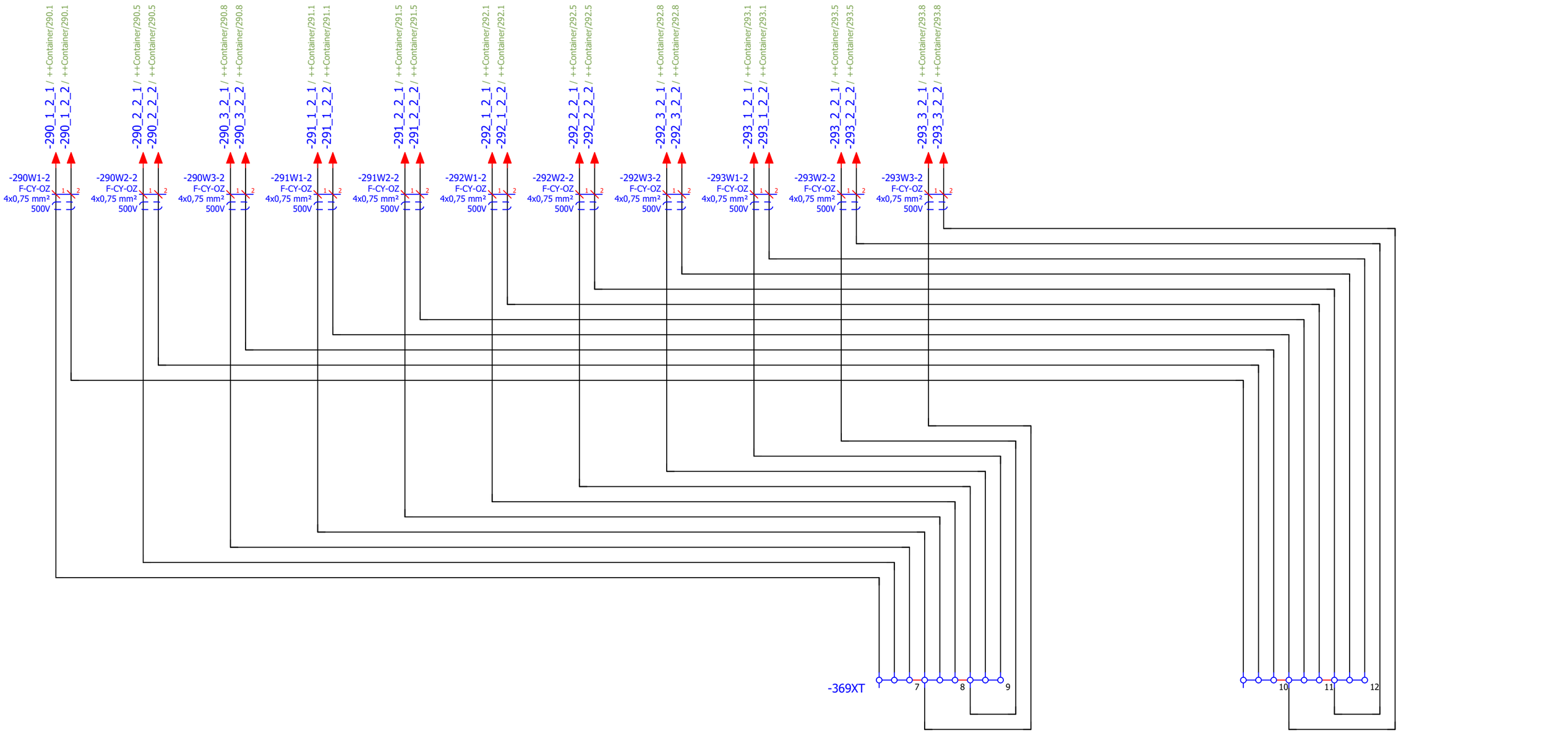
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page: 636

next page: 670

Editor	Freqcon_JD			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 492



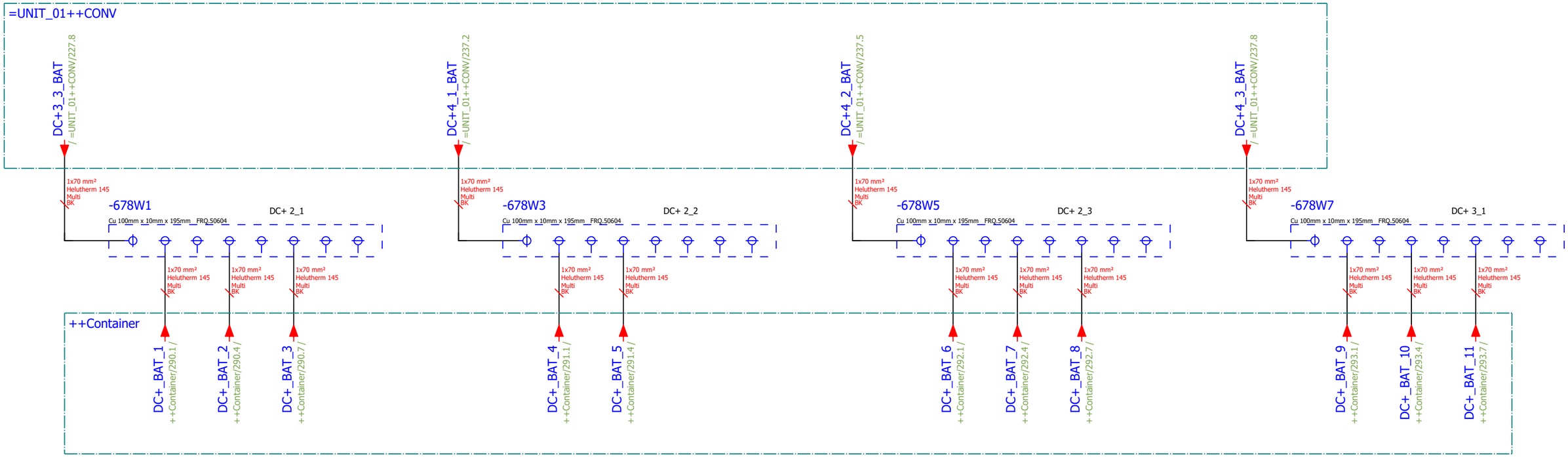
battery cabinet gas
potential-free contacts
customer

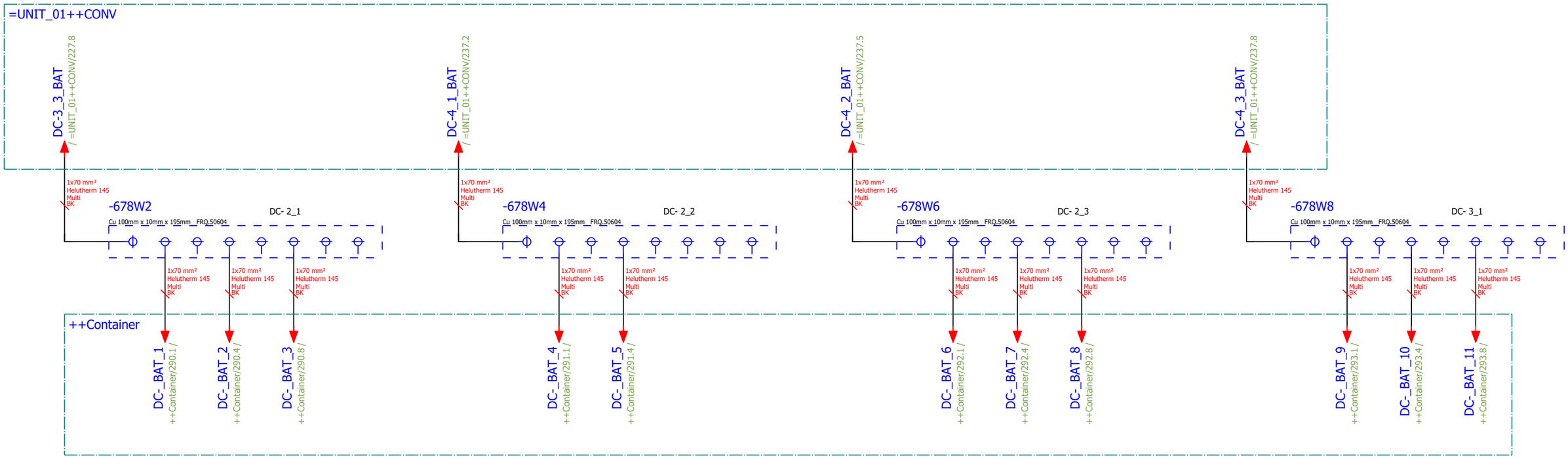
battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
678

Editor	Freqcon_JD			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 492





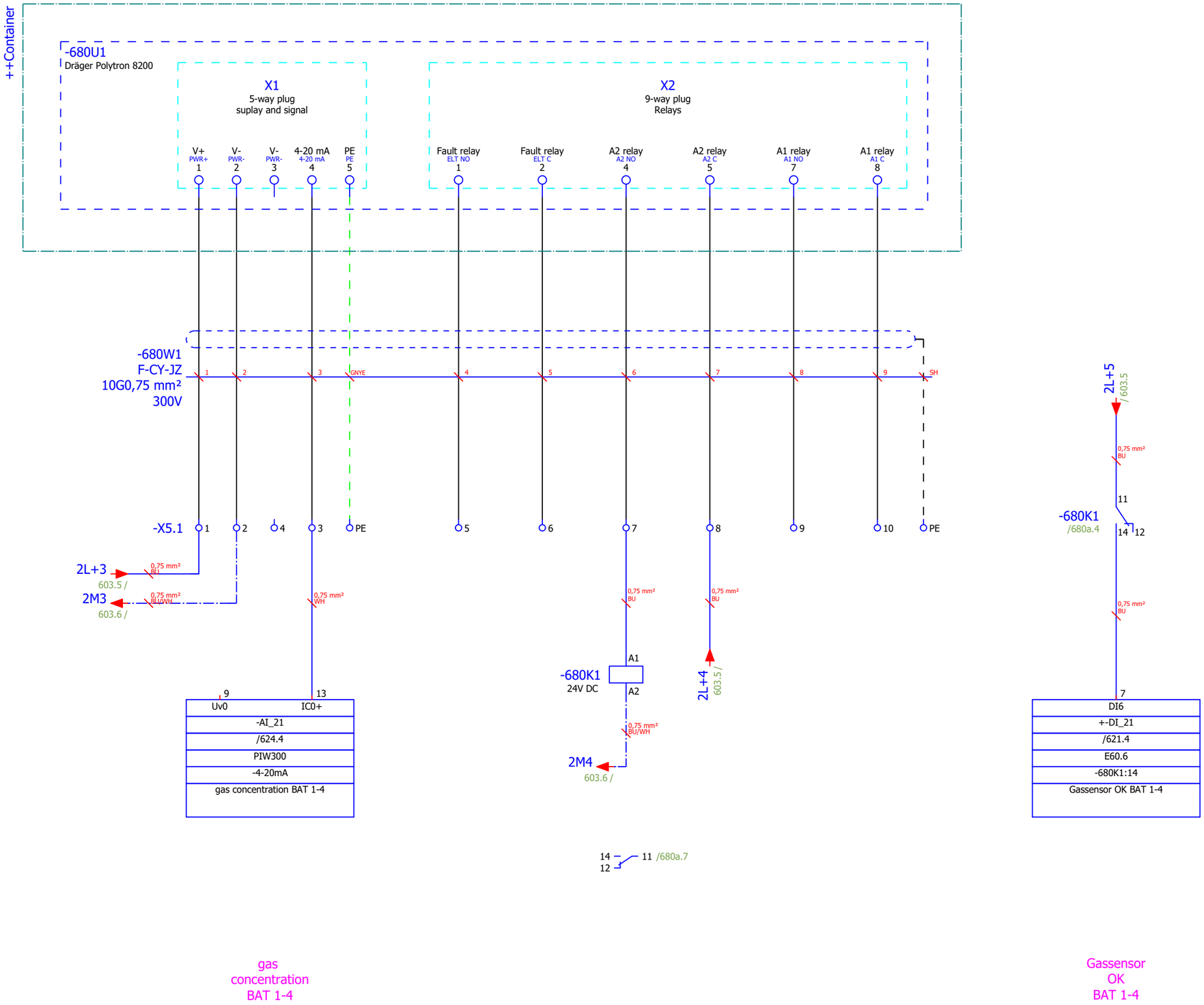
previous page: 670

next page: 680a

Editor	Freqcon_JD			Statron	FREQCON	DC BATTERY CABINETS	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 678

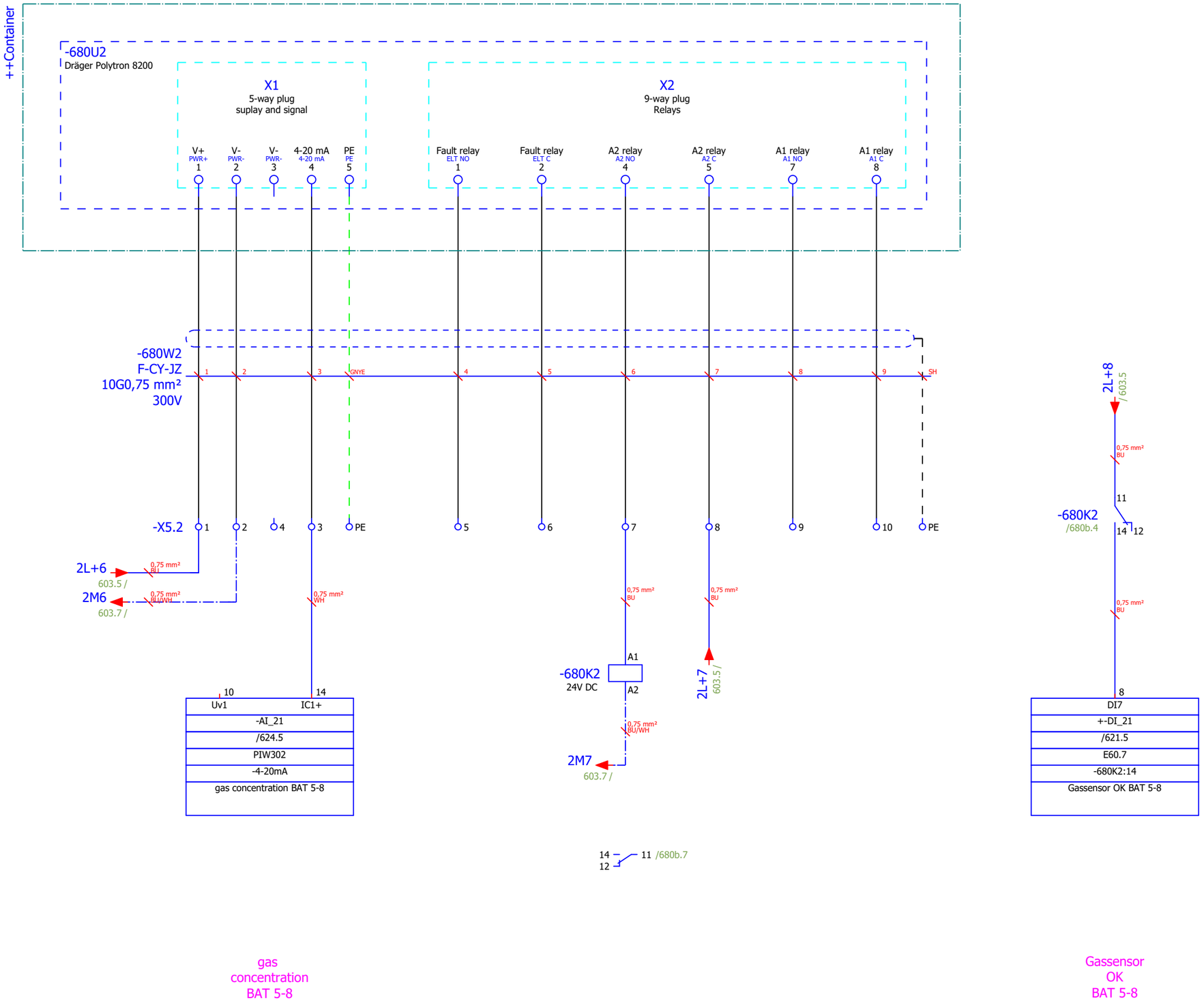
total: 492



previous page: 678

next page: 680b

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 1-4	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680a
Date								+	total: 492



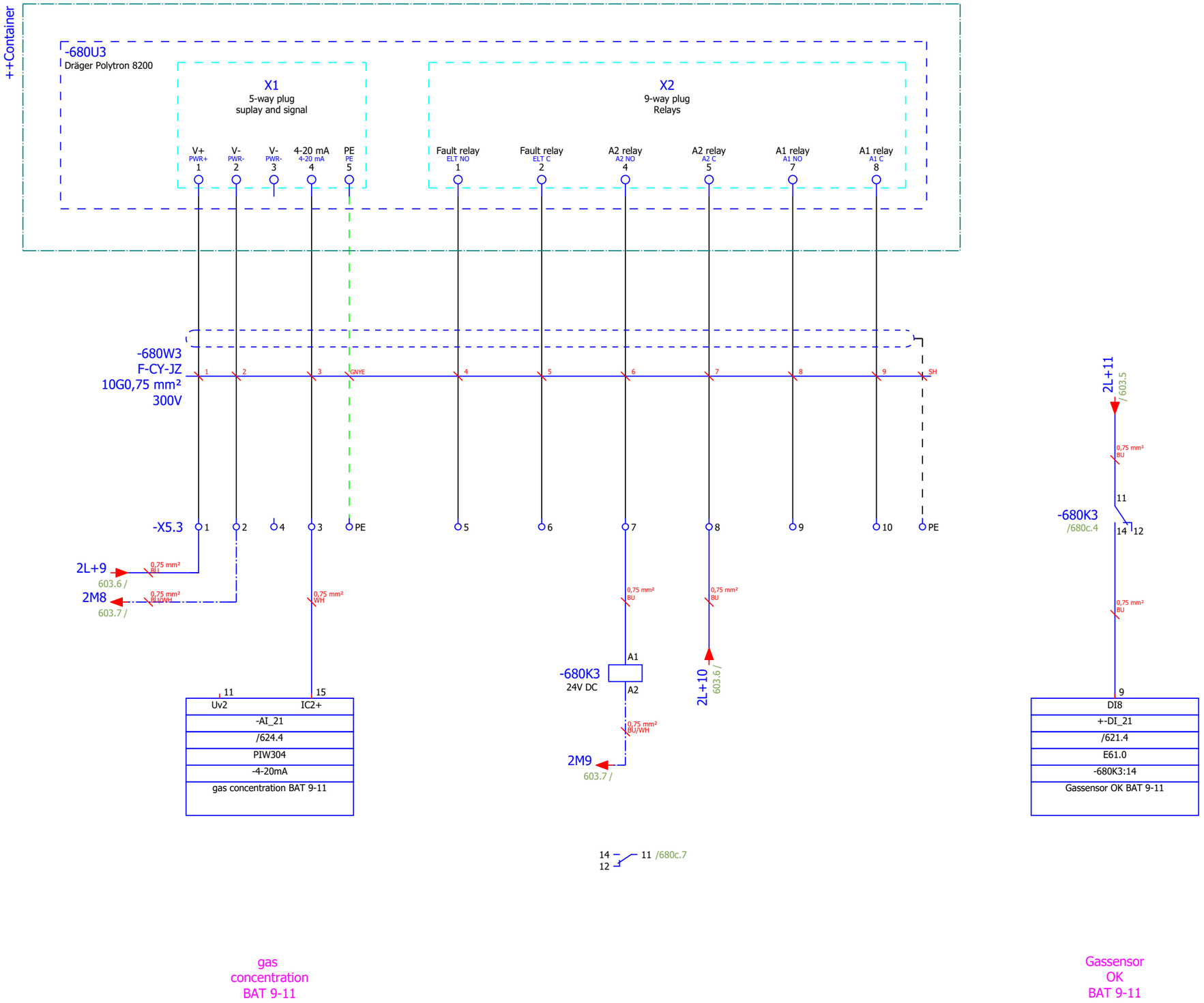
gas concentration BAT 5-8

Gassensor OK BAT 5-8

previous page: 680a

next page: 680c

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 5-8	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 680b
Date								+ — total: 492



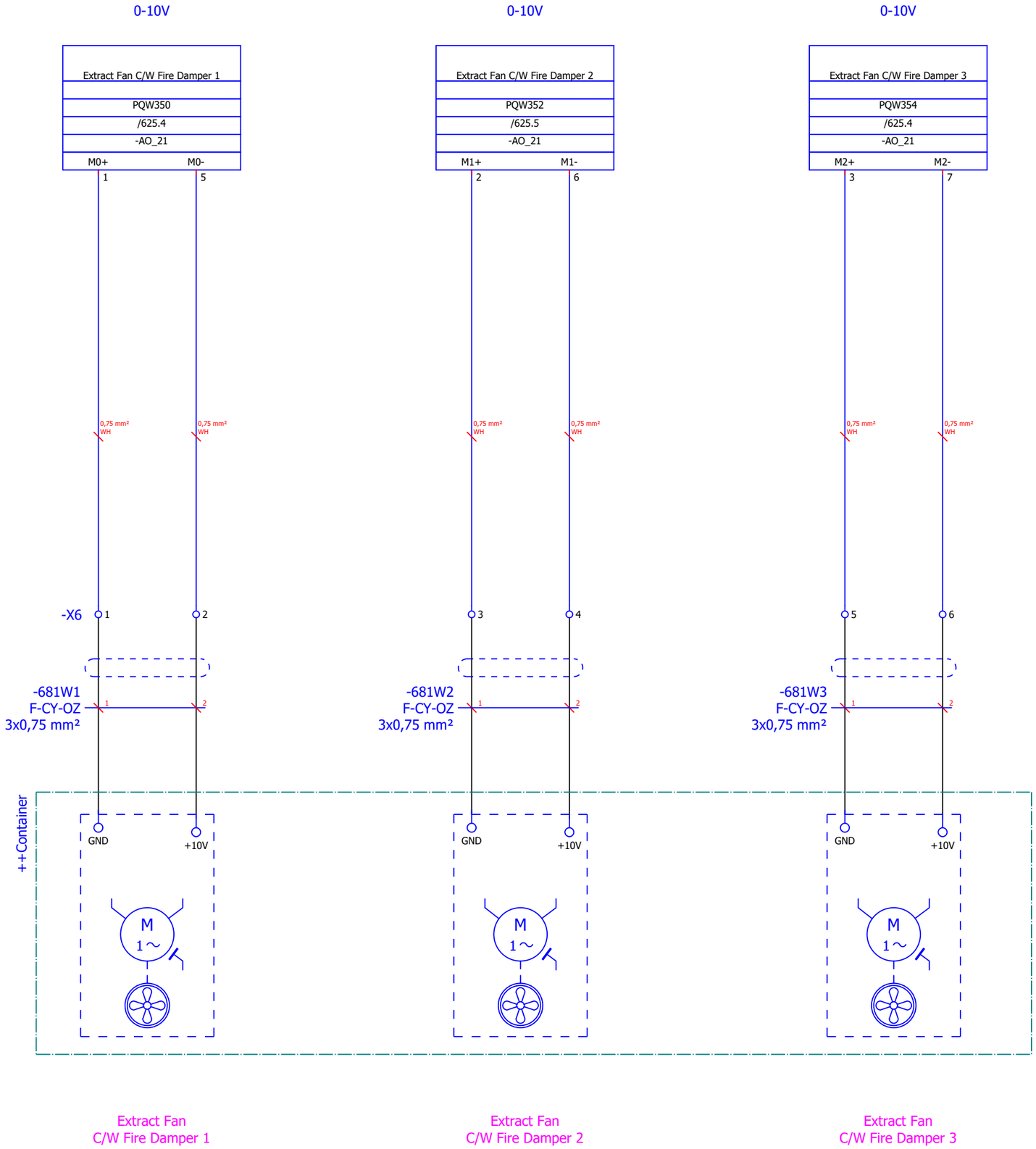
gas concentration BAT 9-11

Gassensor OK BAT 9-11

previous page: 680b

next page: 681

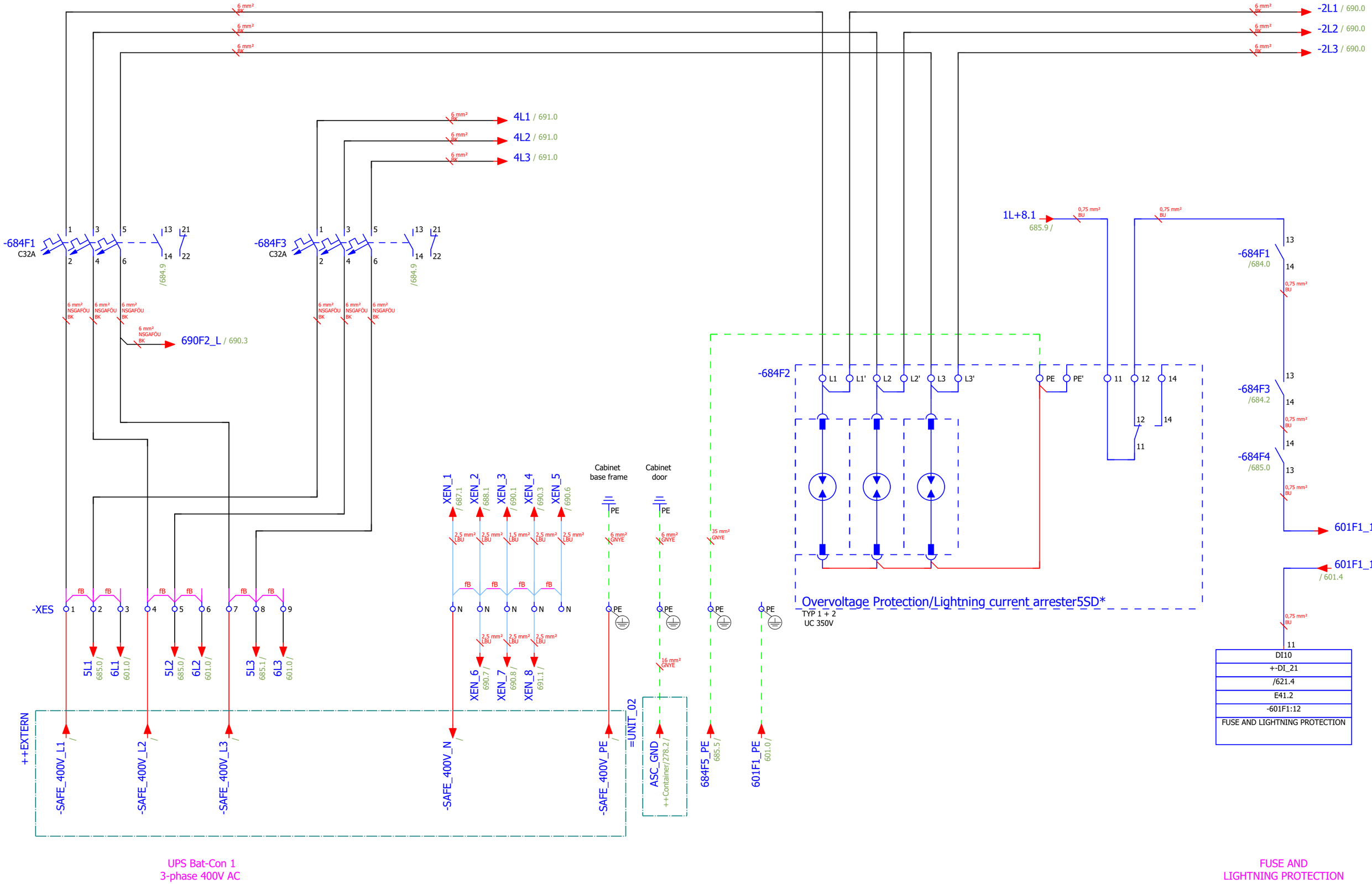
Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 9-11	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680c
Date								+	total: 492



previous page: 680c

next page: 684

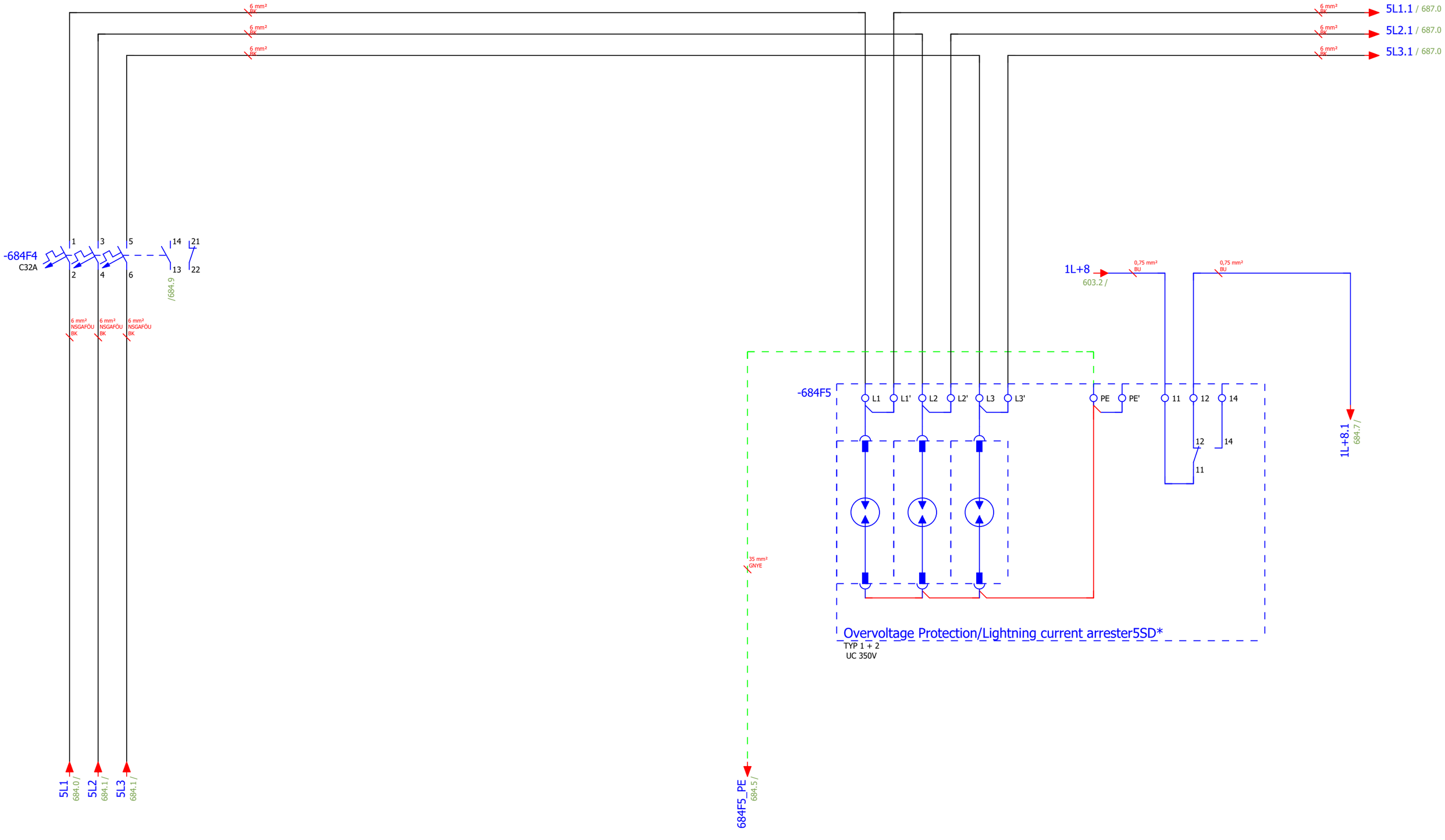
Editor	Freqcon_JD			Statron	FREQCON	EXTRACT FAN FIRE DAMPER	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 681
Date								+	total: 492



previous page: 681

next page: 685

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	22.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 684
Date								+	total: 492

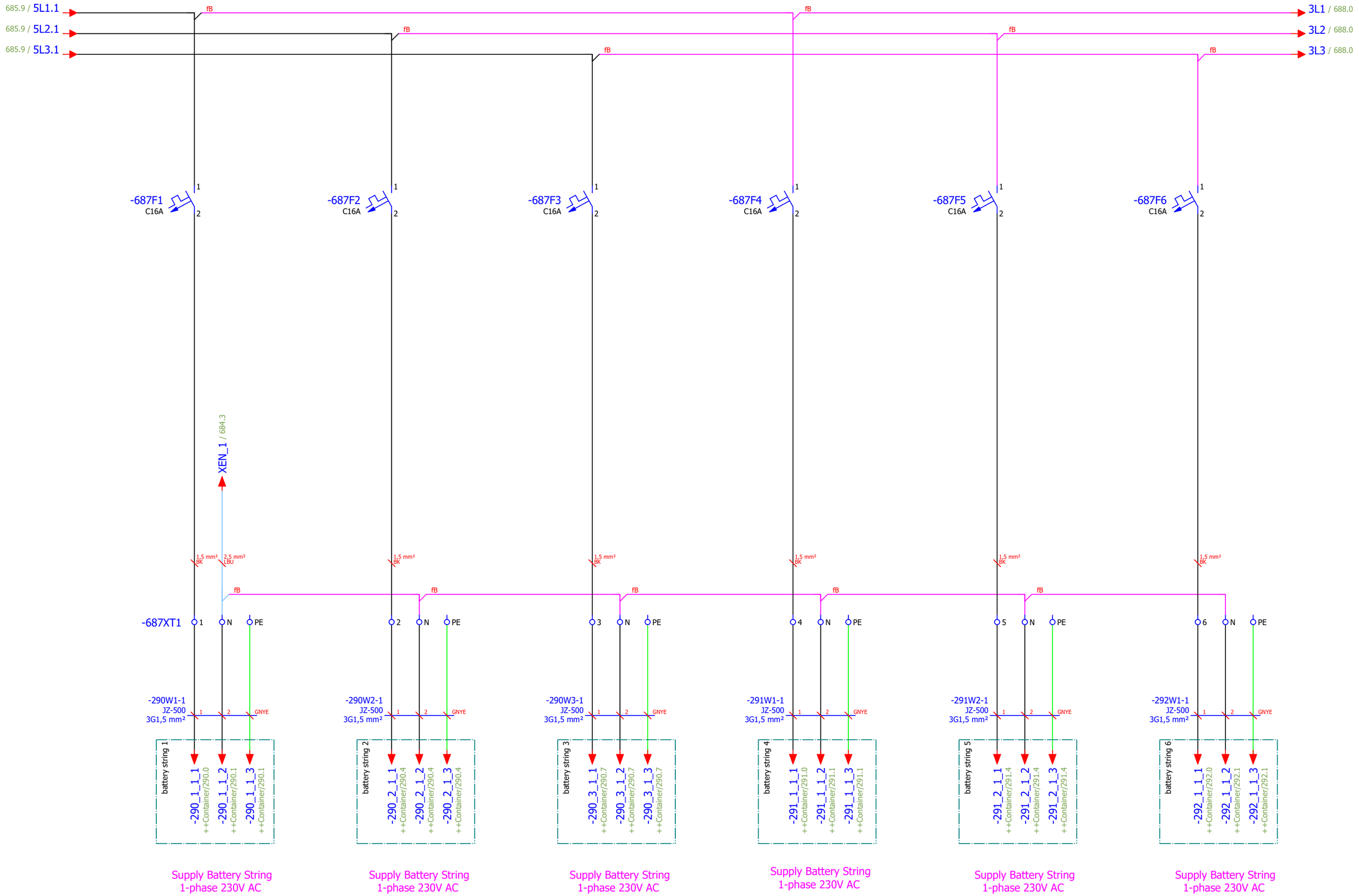


FUSE AND
LIGHTNING PROTECTION

previous page: 684

next page: 687

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 685
Date								+	total: 492



previous page: 685

next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 492

687.9 / 3L1
687.9 / 3L2
687.9 / 3L3

fB

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

XEN_2 / 684.3

1,5 mm² BK
2,5 mm² LBU

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

GNYE

battery string 7
-292_2_1_1 ++Container/292.4
-292_2_1_2 ++Container/292.4
-292_2_1_3 ++Container/292.4

battery string 8
-292_3_1_1 ++Container/292.7
-292_3_1_2 ++Container/292.7
-292_3_1_3 ++Container/292.7

battery string 9
-293_1_1_1 ++Container/293.0
-293_1_1_2 ++Container/293.1
-293_1_1_3 ++Container/293.1

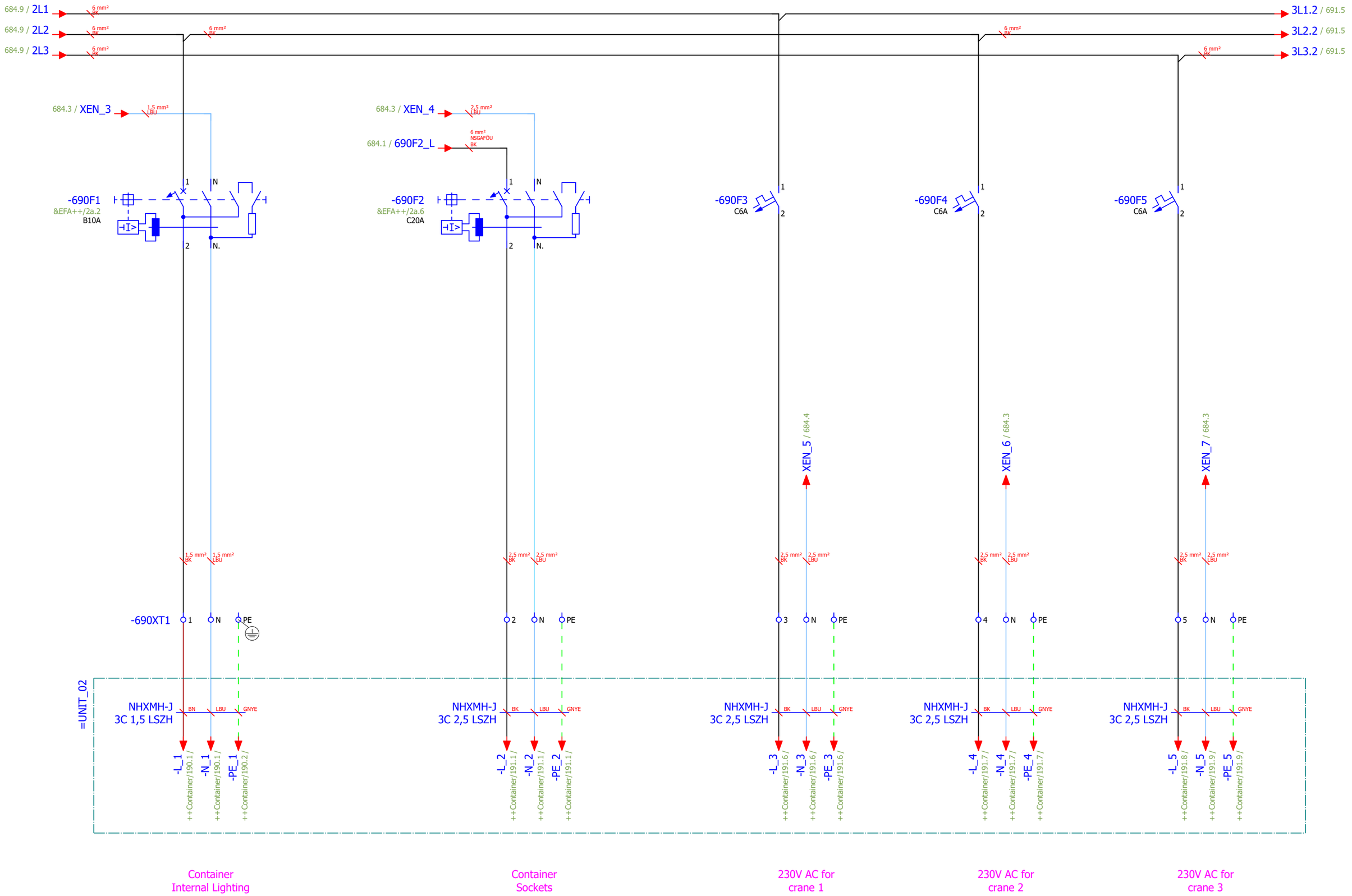
battery string 10
-293_2_1_1 ++Container/293.4
-293_2_1_2 ++Container/293.4
-293_2_1_3 ++Container/293.4

battery string 11
-293_3_1_1 ++Container/293.7
-293_3_1_2 ++Container/293.7
-293_3_1_3 ++Container/293.7

Supply Battery String 1-phase 230V AC

previous page: 687
next page: 690

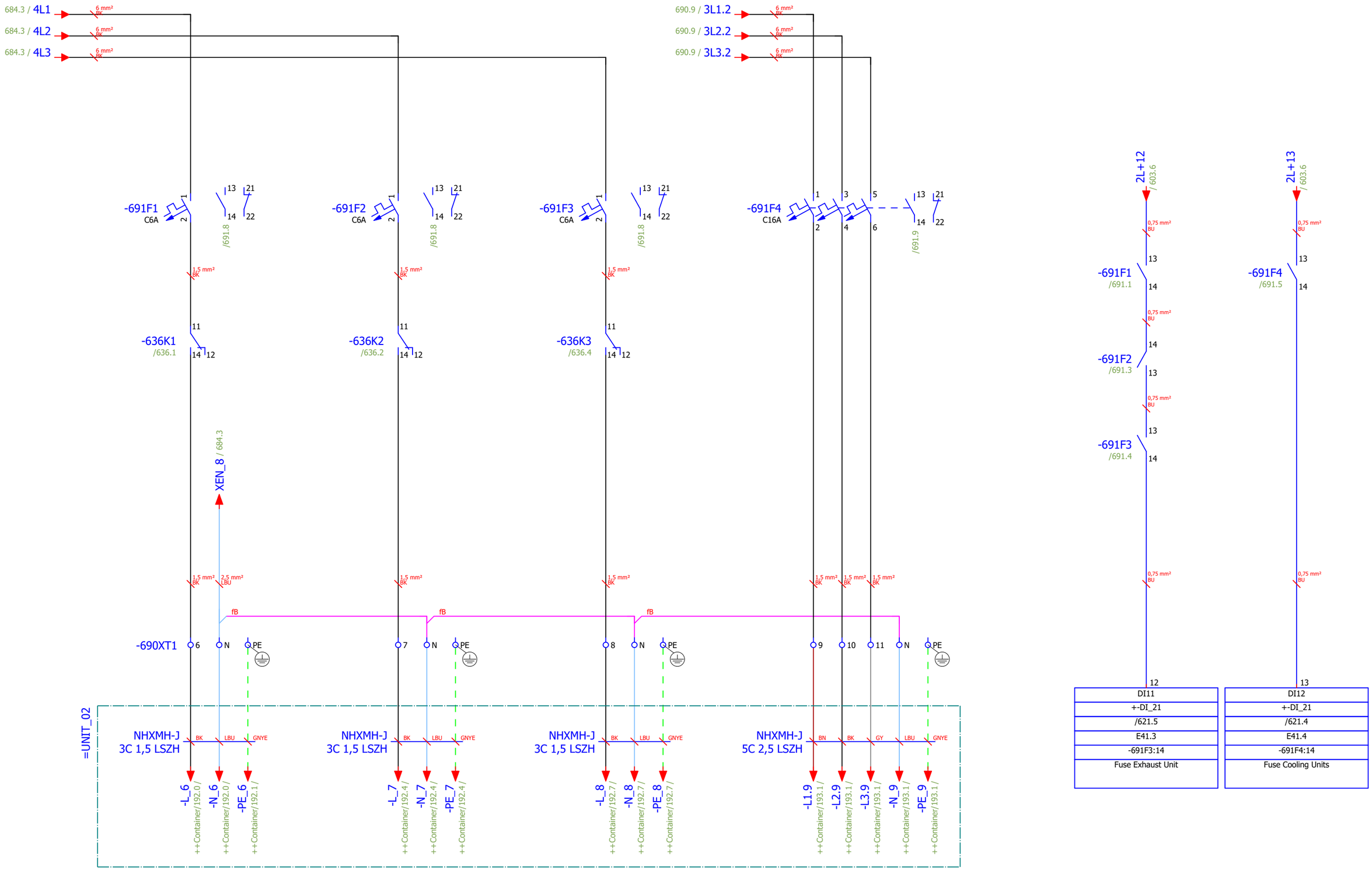
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 492



previous page: 688

next page: 691

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	29.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 690
Date								+	total: 492



previous page: 690

next page: &EPC++Container/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 691
Date								+		total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-635K1 &EFS/635a.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K1 &EFS/635a.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-635K2 &EFS/635a.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K2 &EFS/635a.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K3 &EFS/635a.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K3 &EFS/635a.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K4 &EFS/635a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K4 &EFS/635a.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K5 &EFS/635a.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K5 &EFS/635a.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K6 &EFS/635a.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K6 &EFS/635a.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K7 &EFS/635b.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.2...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.2...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	

previous page: 2

next page: 4

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.2;&EFS/687.3;&EFS/687.4;&EFS/687.5...&EFS/687.8;&EFS/688;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.8;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	
-XT &EFS/635b.1...&EFS/635b.5;&EFS/635b.7	14	Feed-through terminal block	3209510	Phoenix Contact	500583	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XT &EFS/635b.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT &EFS/635b.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT &EFS/635b.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
7

next page:
&EPA++Container/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 8
Date								+	total: 492

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/8

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
2	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
13	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
9	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

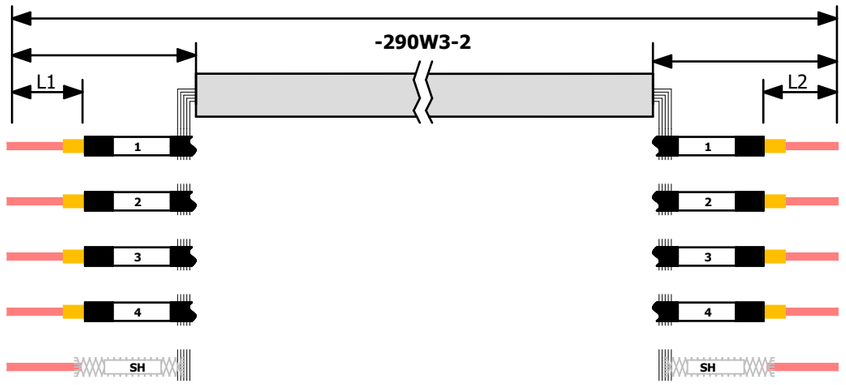
Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

Cable name =UNIT_03++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

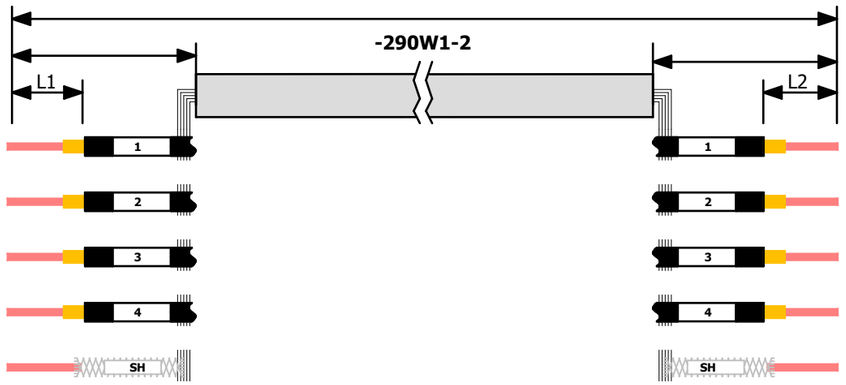


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

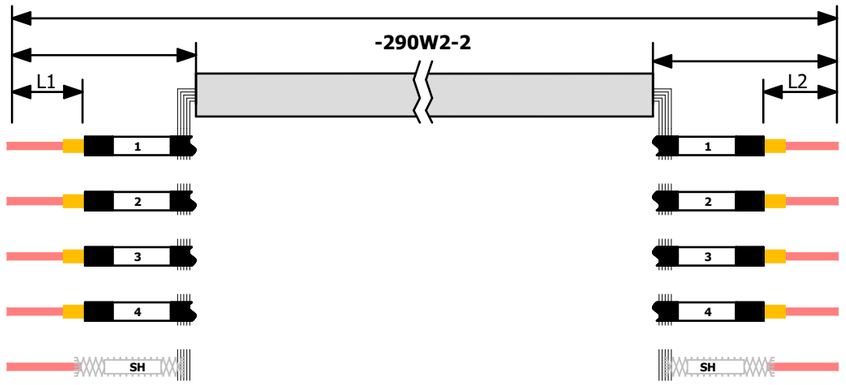


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

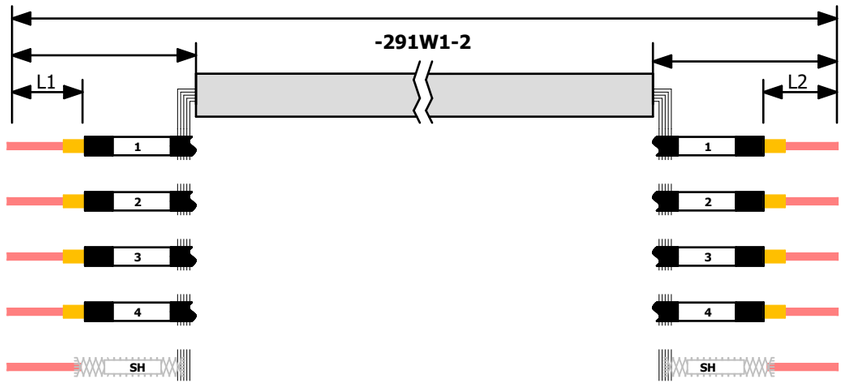
previous page:
&EPA++ASC/2

next page:
2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

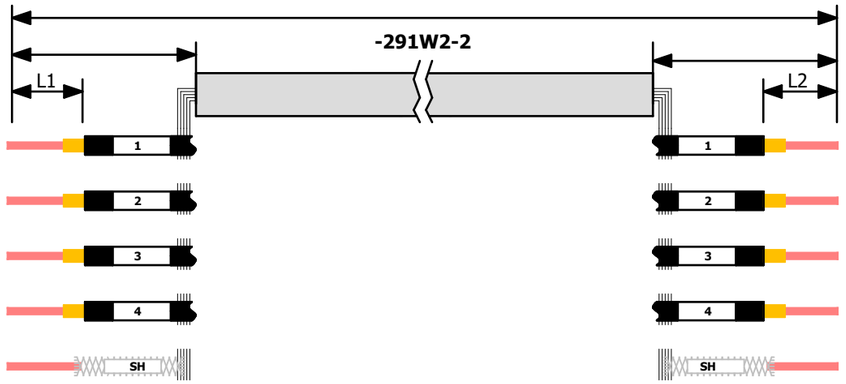


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

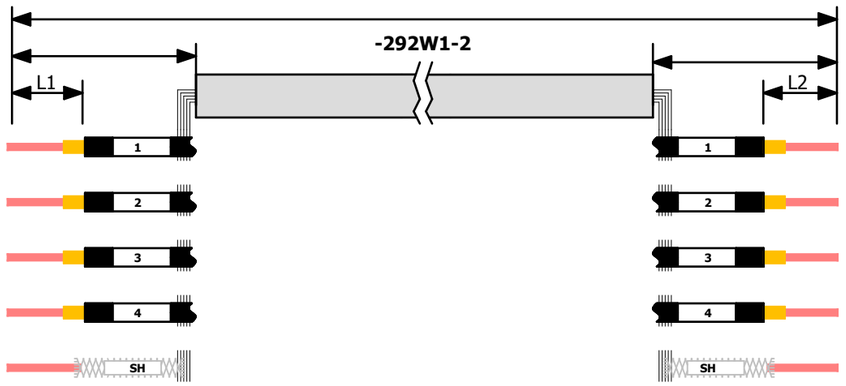


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

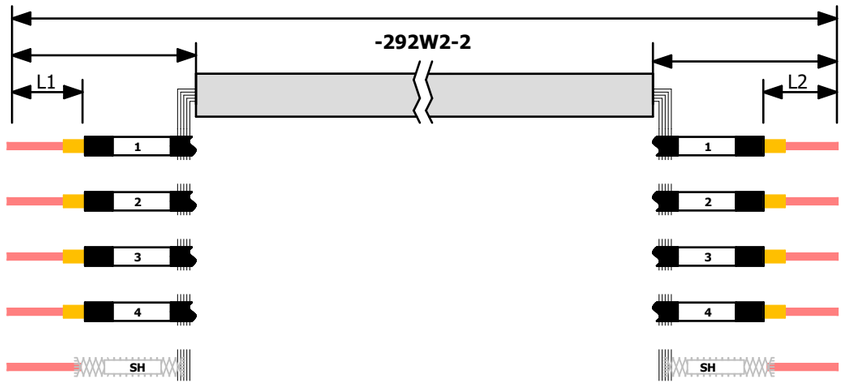
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

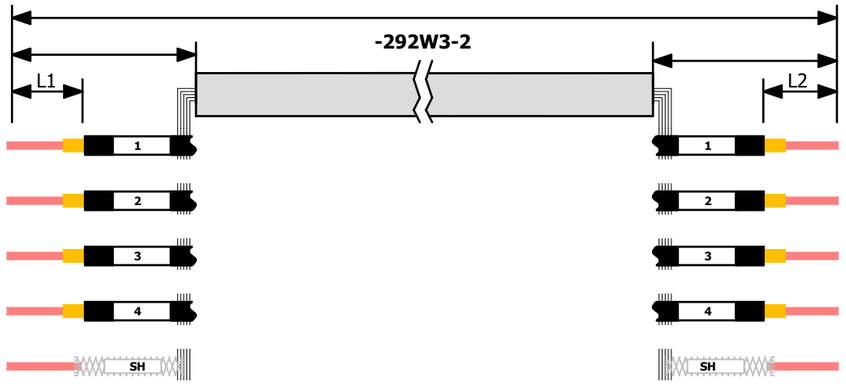


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

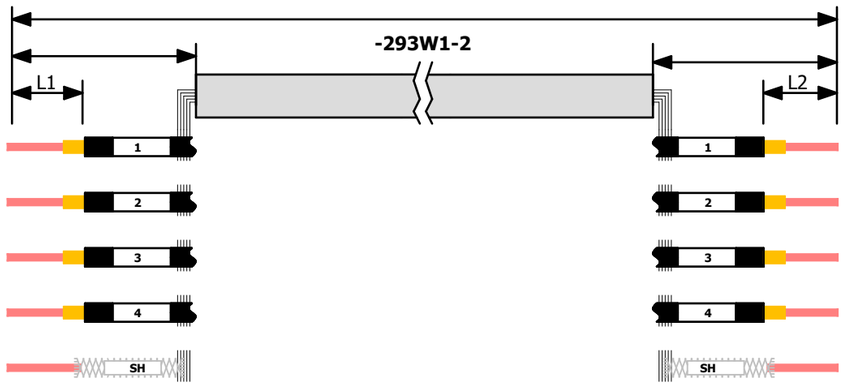


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

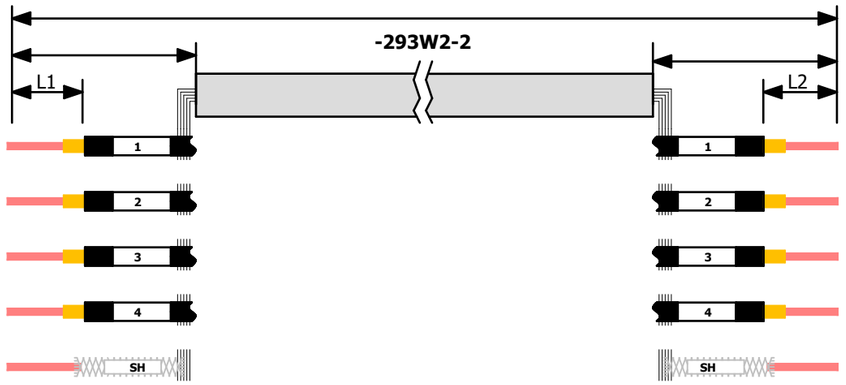
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

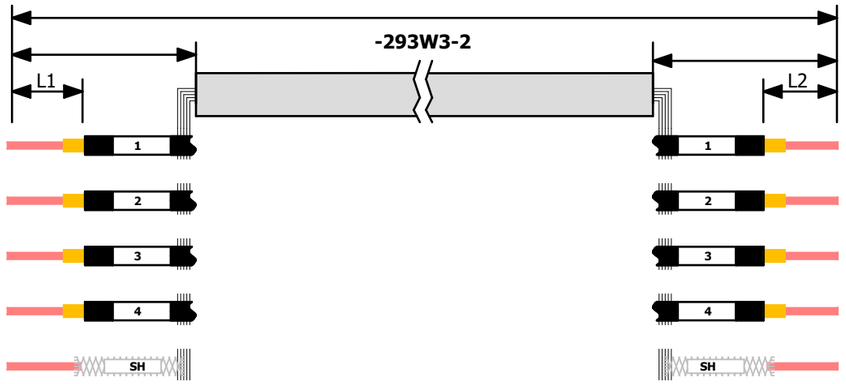


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_03	Battery Container 2
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 4
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

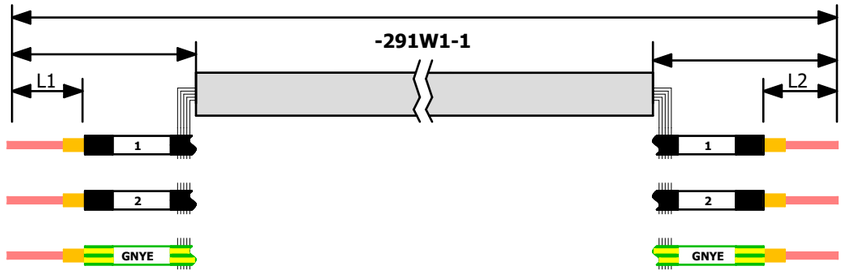


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

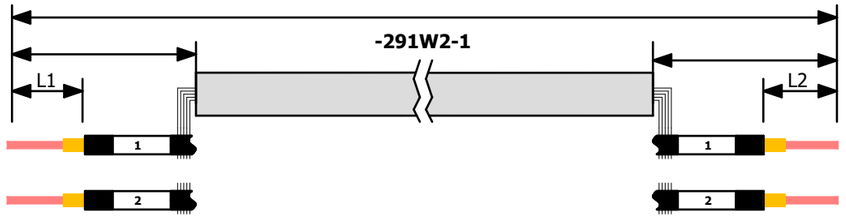


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

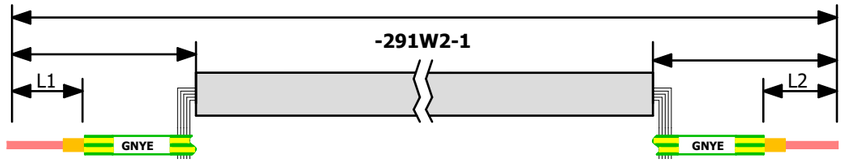
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

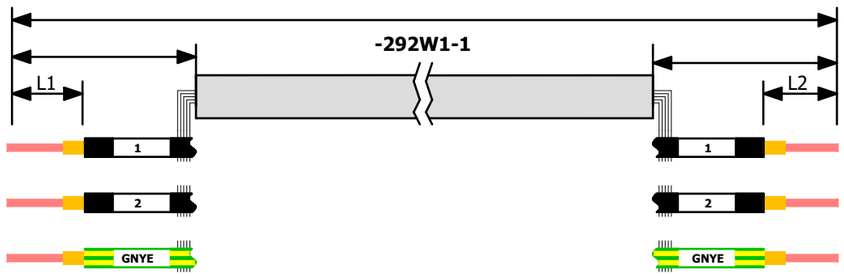


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

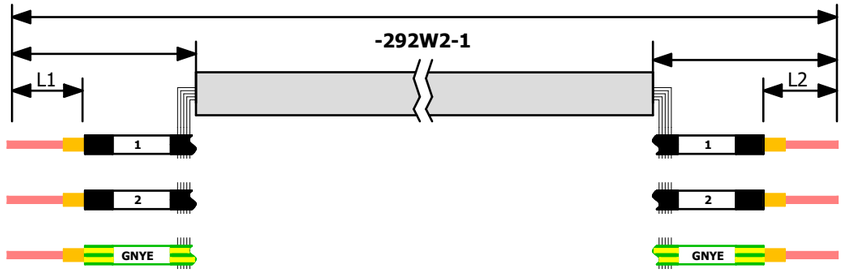


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

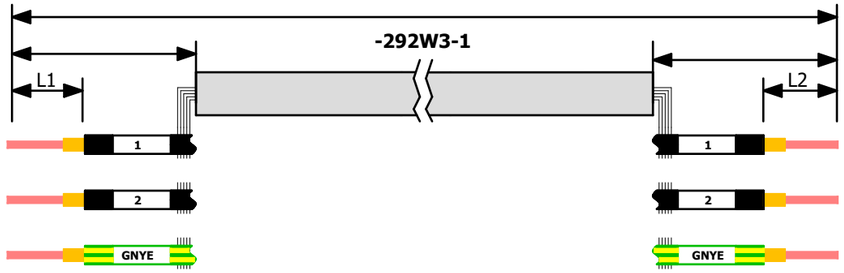


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

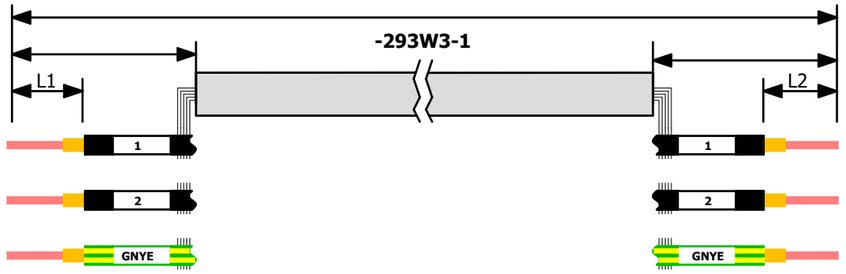


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

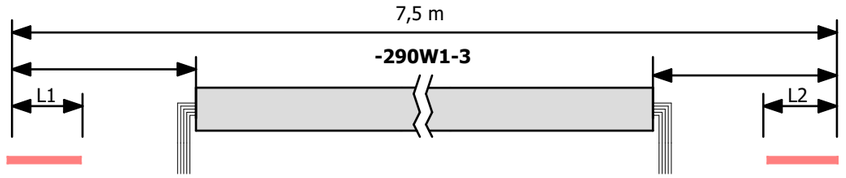


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

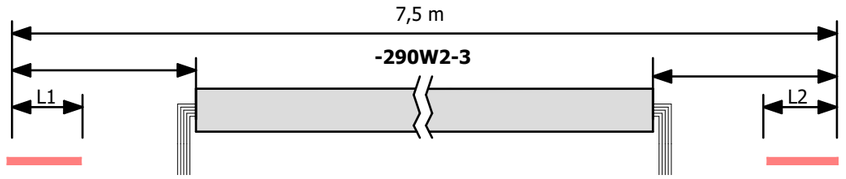


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Cable name =UNIT_03++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

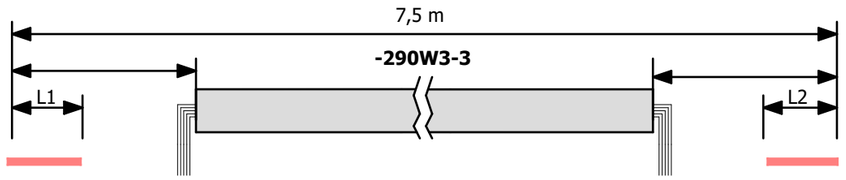


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

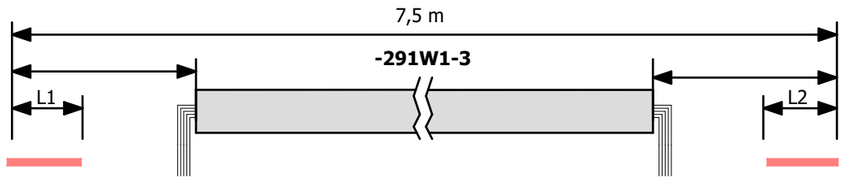


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_03++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

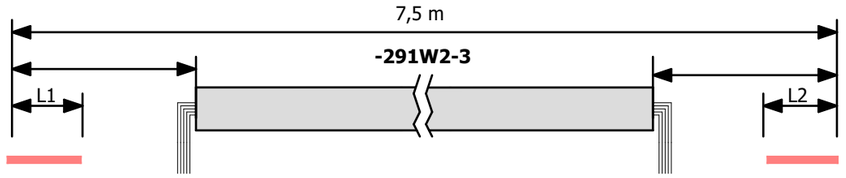


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

Cable name =UNIT_03++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

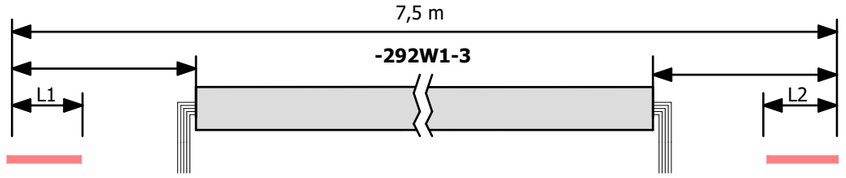


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_03++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



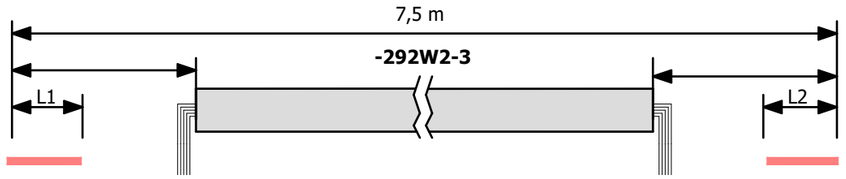
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

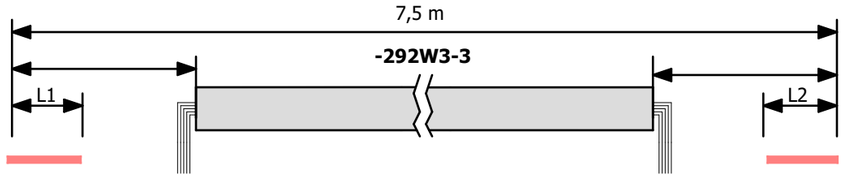
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X7:1-16	

Cable name =UNIT_03++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

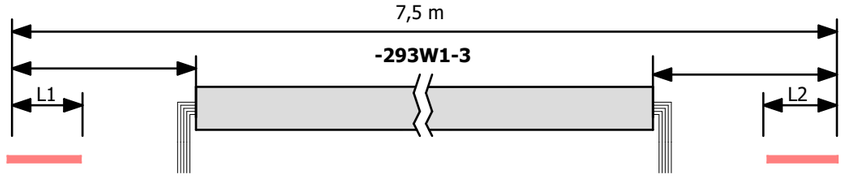
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X8:1-16	

Cable name =UNIT_03++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

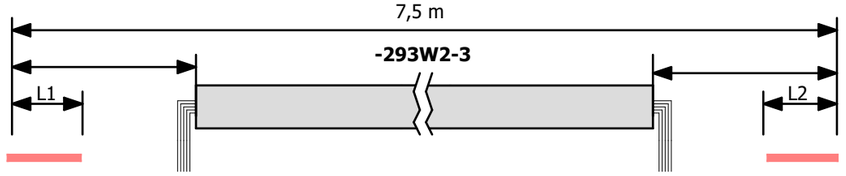
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X9:1-16	

Cable name =UNIT_03++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

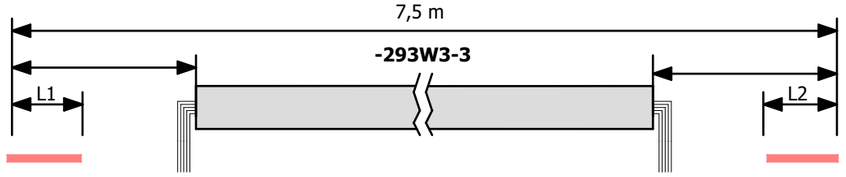
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



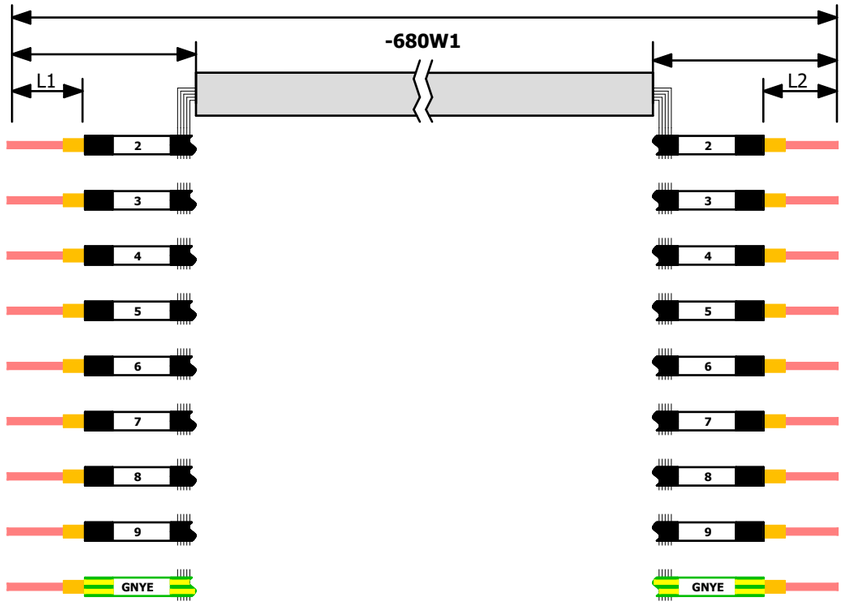
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X3:1-16	

previous page: 8
next page: ++ASC/1

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

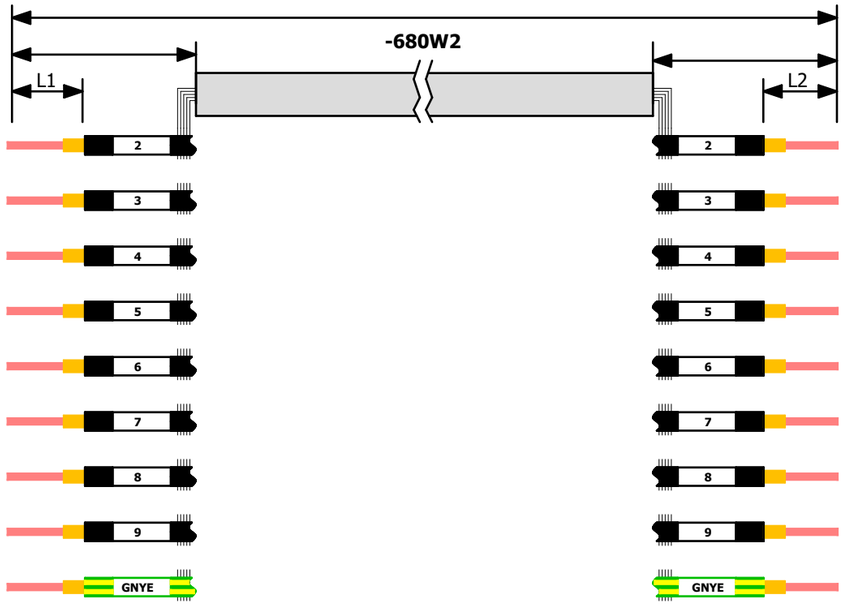


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_03++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

previous page:
++Container/9

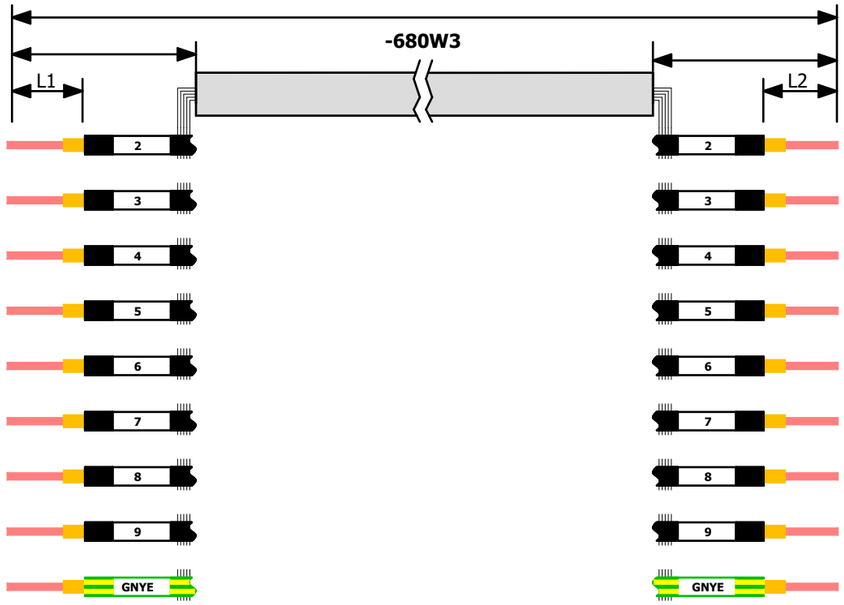
next page:
2

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 9

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

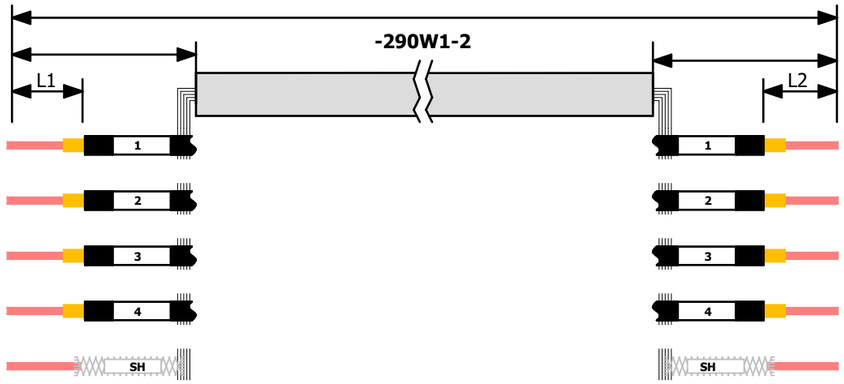


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_03++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

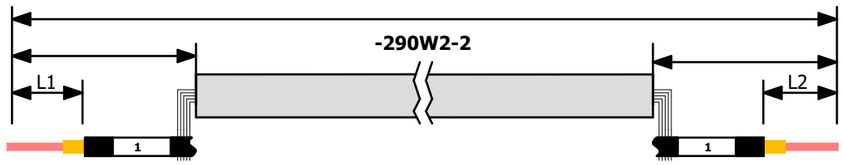


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

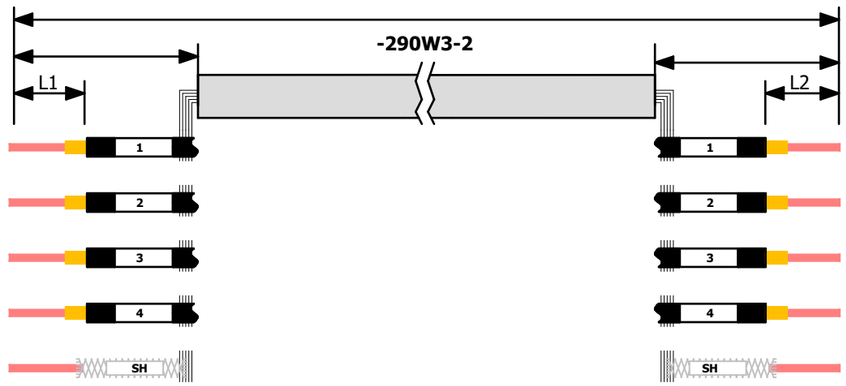


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

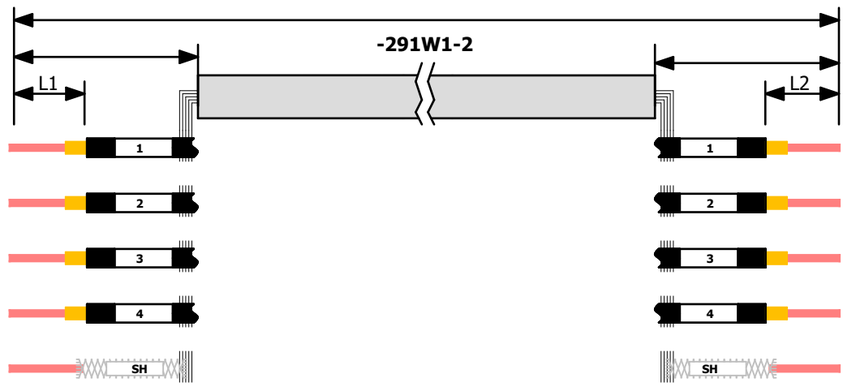


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 2

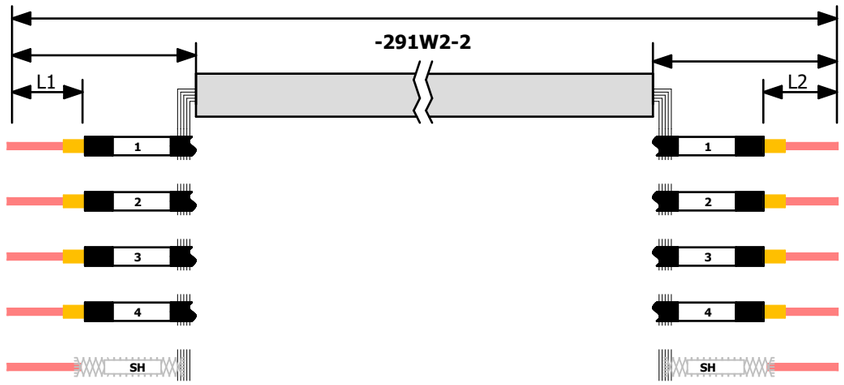
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

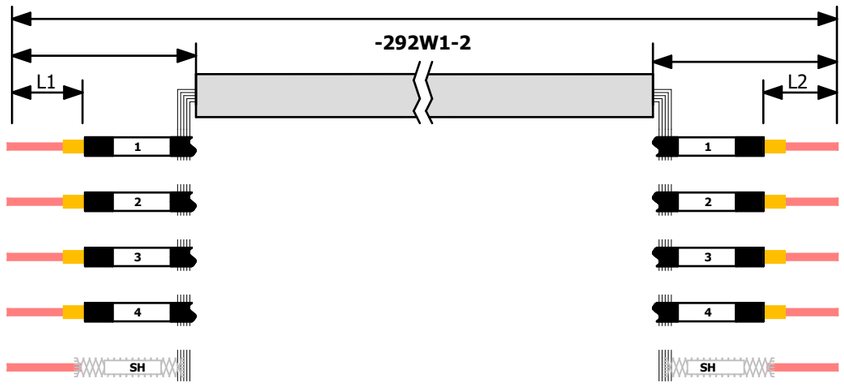


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

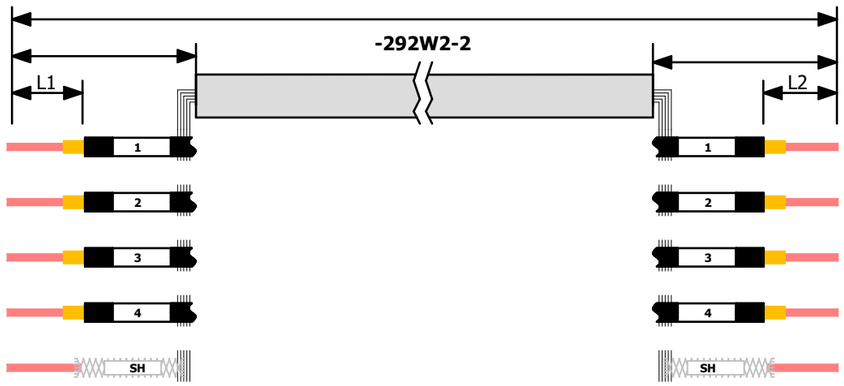


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



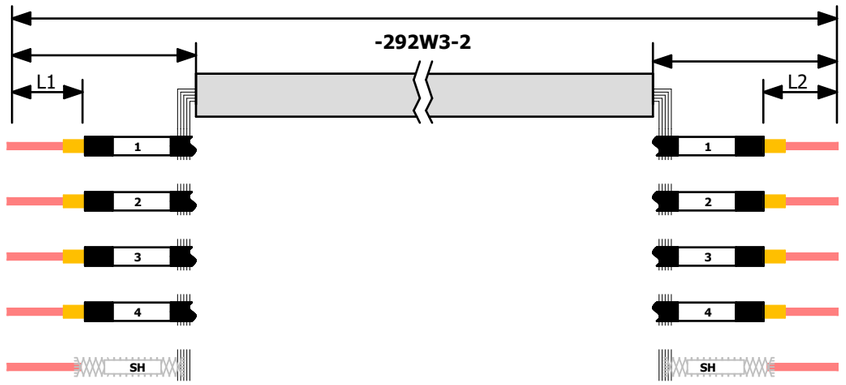
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

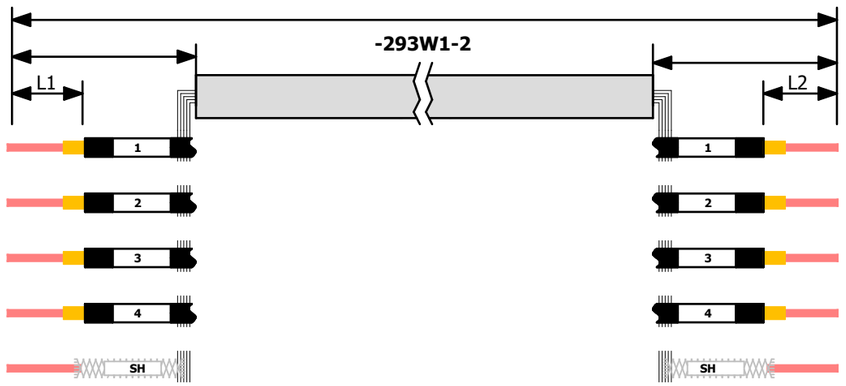
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

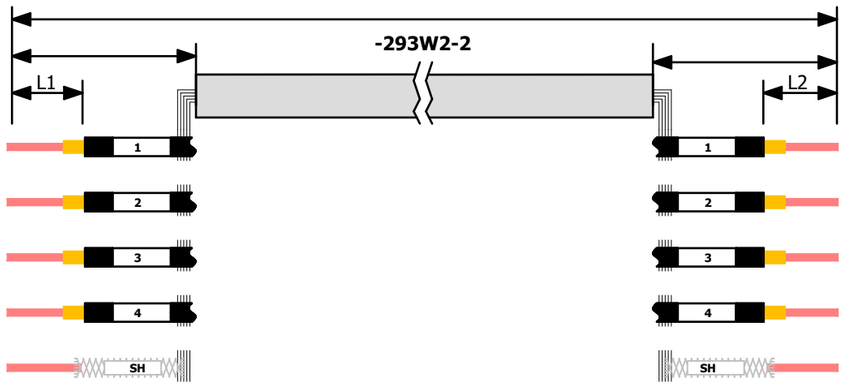
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



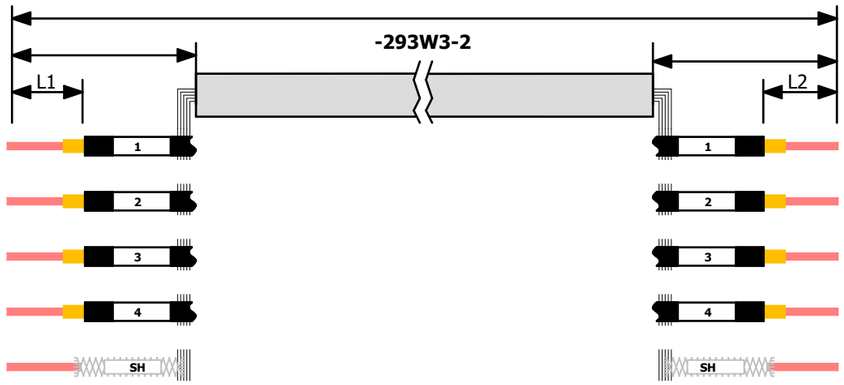
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

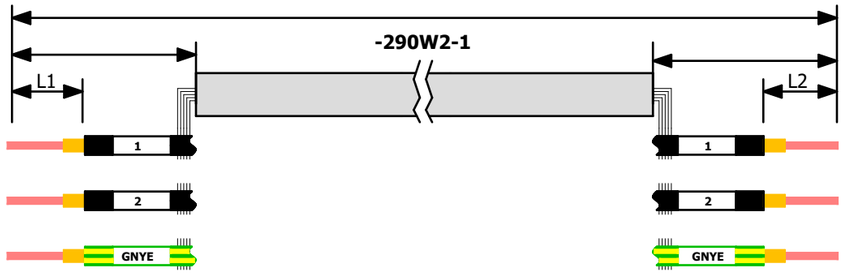


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

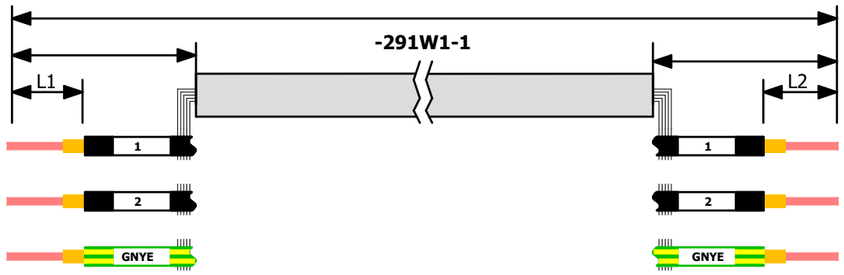


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

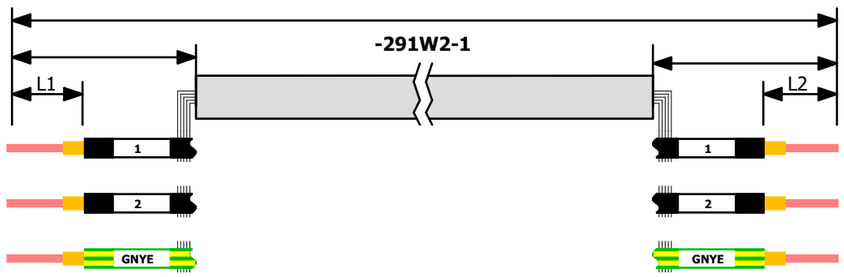


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

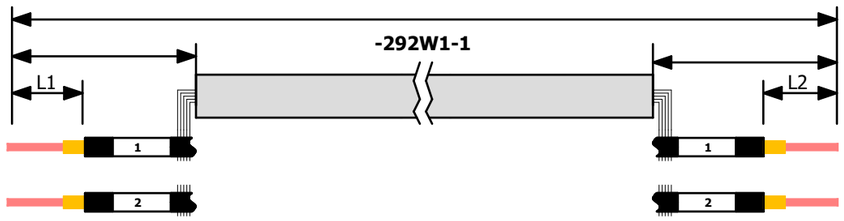


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

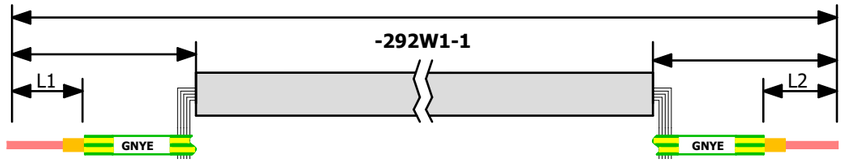
previous page: 6

next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

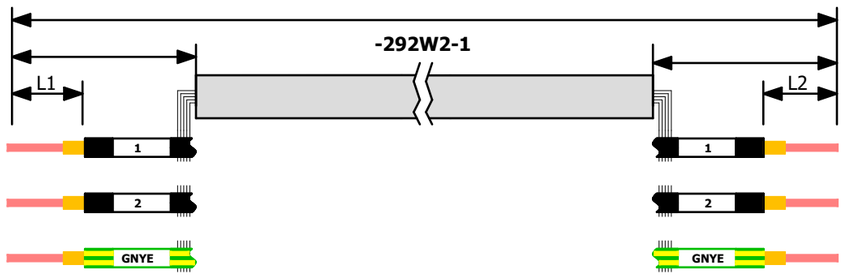


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

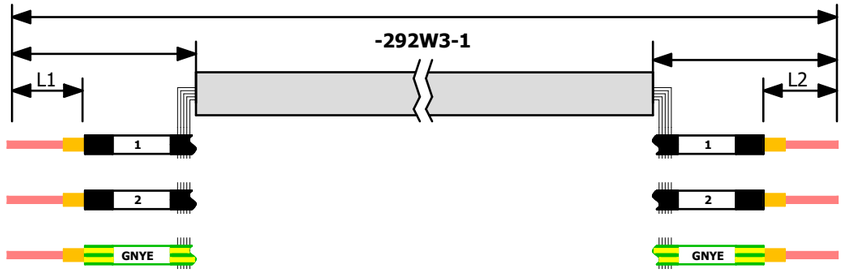


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

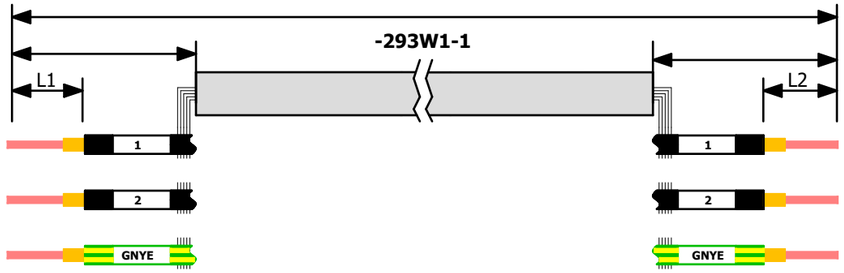


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

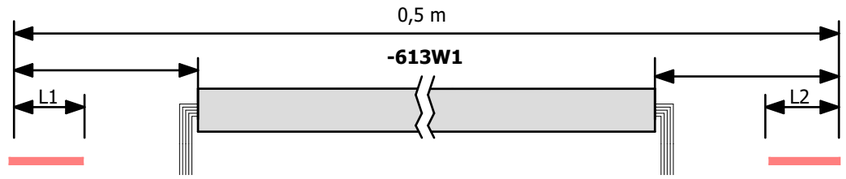


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

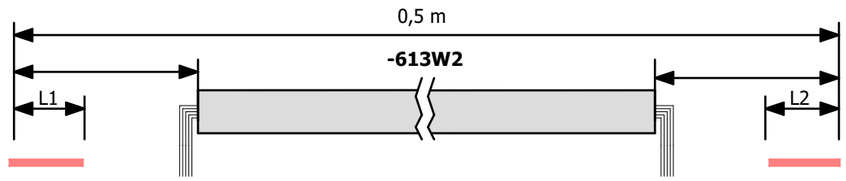


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_03++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			



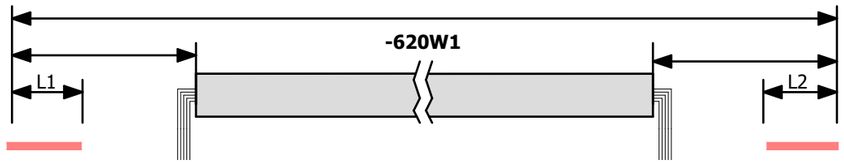
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

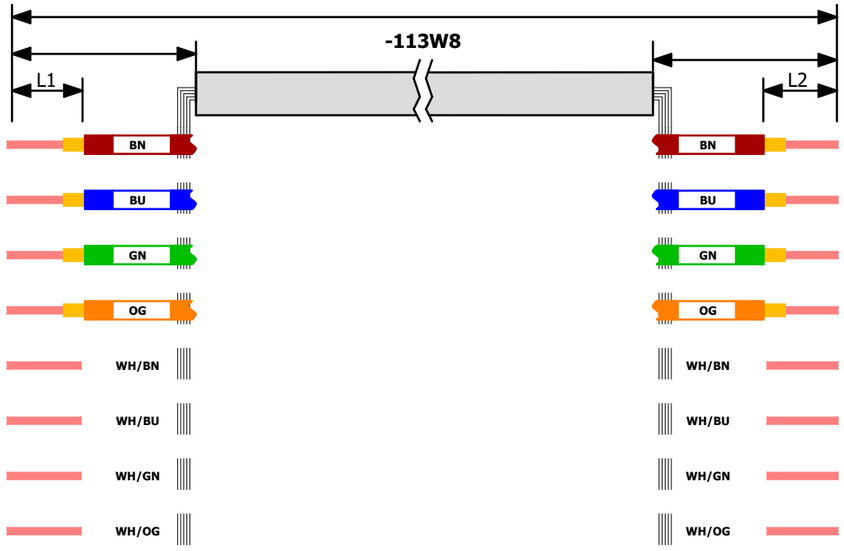
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_03++ASC+-113W8
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:3							-613U2:3	

previous page: 9

next page: &EMZ/1000

FRQ_Kabelplan_04_groß_de_en

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X5.1		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2000
-X5.2		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2001
-X5.3		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2002
-X6		1	6	0	0	6	=UNIT_03&EMZ++ASC/2003
-XDC1		1	PE	2	0	14	=UNIT_03&EMZ++ASC/2004
-XDC2		1	7	0	0	14	=UNIT_03&EMZ++ASC/2005
-XES		1	9	4	5	18	=UNIT_03&EMZ++ASC/2006
-XT		1	14	0	0	14	=UNIT_03&EMZ++ASC/2007
-369XT		1	12	0	0	24	=UNIT_03&EMZ++ASC/2008
-687XT1		1	PE	11	11	44	=UNIT_03&EMZ++ASC/2020
-690XT1		1	PE	40	4	119	=UNIT_03&EMZ++ASC/2031

previous page:
&EMB/10

next page:
2000

Editor	Freqcon_DG			Statron		Klemmenleistenübersicht : =UNIT_03++ASC+-X5.1 - =UNIT_03++ASC+-690XT1	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 1000
Date								+		total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.1						Cable name	-680W1										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 1-4					-XDC2	1	1	,	++Container-680U1-X1	1													&EFS/680a.2
=					-XDC2	5	2	,	++Container-680U1-X1	2		2											&EFS/680a.2
=					-AI_21	13	3	,	++Container-680U1-X1	4		3											&EFS/680a.2
=							4	,															&EFS/680a.2
=							5	,	++Container-680U1-X2	1		4											&EFS/680a.3
=							6	,	++Container-680U1-X2	2		5											&EFS/680a.3
=					-680K1	A1	7	,	++Container-680U1-X2	4		6											&EFS/680a.4
=					-XDC2	2	8	,	++Container-680U1-X2	5		7											&EFS/680a.4
=							9	,	++Container-680U1-X2	7		8											&EFS/680a.5
=							10	,	++Container-680U1-X2	8		9											&EFS/680a.5
=							PE	,	++Container-680U1-X1	5		GNYE											&EFS/680a.2
=							PE	,	-480W1														&EFS/680a.6

previous page:
1000

next page:
2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-X5.1	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2000
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.2						Cable name	-680W2										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 5-8					-XDC2	2	1	,	++Container-680U2-X1	1													&EFS/680b.2
=					-XDC2	6	2	,	++Container-680U2-X1	2		2											&EFS/680b.2
=					-AI_21	14	3	,	++Container-680U2-X1	4		3											&EFS/680b.2
=							4	,															&EFS/680b.2
=							5	,	++Container-680U2-X2	1		4											&EFS/680b.3
=							6	,	++Container-680U2-X2	2		5											&EFS/680b.3
=					-680K2	A1	7	,	++Container-680U2-X2	4		6											&EFS/680b.4
=					-XDC2	2	8	,	++Container-680U2-X2	5		7											&EFS/680b.4
=							9	,	++Container-680U2-X2	7		8											&EFS/680b.5
=							10	,	++Container-680U2-X2	8		9											&EFS/680b.5
=							PE	,	++Container-680U2-X1	5		GNYE											&EFS/680b.2
=							PE	,	-480W1														&EFS/680b.6

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-X5.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2001
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.3						Cable name	-680W3										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 9-11					-XDC2	3	1	,	++Container-680U3-X1	1													&EFS/680c.2
=					-XDC2	7	2	,	++Container-680U3-X1	2		2											&EFS/680c.2
=					-AI_21	15	3	,	++Container-680U3-X1	4		3											&EFS/680c.2
=							4	,															&EFS/680c.2
=							5	,	++Container-680U3-X2	1		4											&EFS/680c.3
=							6	,	++Container-680U3-X2	2		5											&EFS/680c.3
=					-680K3	A1	7	,	++Container-680U3-X2	4		6											&EFS/680c.4
=					-XDC2	3	8	,	++Container-680U3-X2	5		7											&EFS/680c.4
=							9	,	++Container-680U3-X2	7		8											&EFS/680c.5
=							10	,	++Container-680U3-X2	8		9											&EFS/680c.5
=							PE	,	++Container-680U3-X1	5		GNYE											&EFS/680c.2
=							PE	,	-480W1														&EFS/680c.6

previous page:
2001

next page:
2003

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_03++ASC+-X5.3	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2002
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X6					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Extract Fan C/W Fire Damper 1						GND	1	,	-AO_21	1													&EFS/681.1
=						+10V	2	,	-AO_21	5													&EFS/681.1
Extract Fan C/W Fire Damper 2						GND	3	,	-AO_21	2													&EFS/681.3
=						+10V	4	,	-AO_21	6													&EFS/681.3
Extract Fan C/W Fire Damper 3						GND	5	,	-AO_21	3													&EFS/681.5
=						+10V	6	,	-AO_21	7													&EFS/681.5

previous page: 2002

next page: 2004

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XDC1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
FUSE 24V DC CONTROL VOLTAGE					-101T1	13	1		-103F1	2													&EFS/603.2
					-101Q1	13																	
					-611A1	1																	
FUSE 24V DC CONTROL VOLTAGE					-620A1	-X80:1	2																&EFS/603.2
					-DI_21	L+																	
					-DO_21	L+																	
FUSE 24V DC CONTROL VOLTAGE					-635K7	11	3		-103F1	13													&EFS/603.2
					-684F5	11																	
FUSE 24V DC CONTROL VOLTAGE					-611A1	2	4		-102G1	OUTPUT DC 24 V:-													&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE					-620A1	-X80:2	5																&EFS/603.3
					-DI_21	M																	
					-DO_21	M																	
FUSE 24V DC CONTROL VOLTAGE					-635K1	A2	6		-XDC2	5													&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE					-101T1	-"	PE																&EFS/603.4
					-101T1	PE																	
FUSE 24V DC CONTROL VOLTAGE							PE																&EFS/603.4

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_03++ASC+-XDC1	20250805_V2.0	= UNIT_03	Battery Container 2
Date	21.01.2025							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 2004

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-XDC2

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FUSE 24V DC CONTROL VOLTAGE			-AI_21	L+	1		-103F2	2			&EFS/603.5
			-AO_21	L+							
			-X5.1	1							
FUSE 24V DC CONTROL VOLTAGE			-X5.1	8	2		-X5.2	8			&EFS/603.5
			-680K1	11							
			-X5.2	1							
FUSE 24V DC CONTROL VOLTAGE			-680K2	11	3		-680K3	11			&EFS/603.5
			-X5.3	1							
			-X5.3	8							
FUSE 24V DC CONTROL VOLTAGE			-691F1	13	4						&EFS/603.6
			-691F4	13							
			-691F4	13							
FUSE 24V DC CONTROL VOLTAGE			-AI_21	M	5		-XDC1	6			&EFS/603.6
			-AO_21	M							
			-X5.1	2							
FUSE 24V DC CONTROL VOLTAGE			-680K1	A2	6						&EFS/603.6
			-X5.2	2							
FUSE 24V DC CONTROL VOLTAGE			-680K2	A2	7						&EFS/603.7
			-X5.3	2							
			-680K3	A2							

previous page: 2004

next page: 2006

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XES						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
							1		-684F1	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC							N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-690F1	N													&EFS/684.3
=					-690XT1	N	N		-690F2	N													&EFS/684.3
=							N		-690XT1	N													&EFS/684.4
=							PE			PE													&EFS/684.4
=					++Container-278W1	GND	PE			PE													&EFS/684.4
=					-684F5	PE	PE		-684F2	PE													&EFS/684.5
=					-601F1	PE	PE																&EFS/684.5
					-684F4	2	2		-684F3	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC					-601F1	L1	3																&EFS/684.1
=							4		-684F1	4													&EFS/684.1
=					-684F4	4	5		-684F3	4													&EFS/684.1
=					-601F1	L2	6																&EFS/684.1
=							7		-684F1	6													&EFS/684.1
=					-684F4	6	8		-684F3	6													&EFS/684.1
=					-601F1	L3	9																&EFS/684.2

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
Gas confirmed FGS							1	,	-635K1	14			&EFS/635b.1
=							2	,	-635K1	11			&EFS/635b.1
=							3	,	-635K2	14			&EFS/635b.1
Smoke confirmed FGS							4	,	-635K2	11			&EFS/635b.2
=							5	,	-635K3	14			&EFS/635b.2
Thermal runaway SIS							6	,	-635K3	11			&EFS/635b.3
=							7	,	-635K4	14			&EFS/635b.3
=							8	,	-635K4	11			&EFS/635b.3
Spare							9	,	-635K5	14			&EFS/635b.4
=							10	,	-635K5	11			&EFS/635b.4
=							11	,	-635K6	14			&EFS/635b.5
=							12	,	-635K6	11			&EFS/635b.5
Shut-down to BESS							13	,	-635K7	A2			&EFS/635b.7
=							14	,	-635K7	A1			&EFS/635b.7

previous page: 2006

next page: 2008

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-OZ	++Container-290W2-2 F-CY-OZ	++Container-290W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	1					&EFS/669.5
		3			++Container-570XT	3						
	3				++Container-570XT	3						

previous page: 2007

next page: 2009

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2008

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	2		++Container-570XT	3		3	&EFS/669.5
		3			++Container-570XT	3							
	3				++Container-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	3		++Container-570XT	3		3	&EFS/669.6
		3			++Container-570XT	3							
	3				++Container-570XT	3							

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2010

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	4					&EFS/669.7
		4			++Container-570XT	4						
	4				++Container-570XT	4						

previous page:
2010

next page:
2012

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2011
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	5		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	6		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	7					&EFS/670.5
		1			++Container-570XT	1						
	1				++Container-570XT	1						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	8		++Container-570XT	1		1	&EFS/670.5
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	9		++Container-570XT	1		1	&EFS/670.6
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	10					&EFS/670.7
		2			++Container-570XT	2						
	2				++Container-570XT	2						

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	11		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	12		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

previous page: 2018

next page: 2020

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2019

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			++Container-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				++Container-XE	1	3	,	-687F3	2		&EFS/687.4

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2020 of total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-1 JZ-500	++Container-291W2-1 JZ-500	++Container-291W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	4	,	-687F4	2		&EFS/687.5
=		1			++Container-XE	1	5	,	-687F5	2		&EFS/687.7
=	1				++Container-XE	1	6	,	-687F6	2		&EFS/687.8

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-687XT1

Function text	++Container-293W1-1 JZ-500	++Container-292W3-1 JZ-500	++Container-292W2-1 JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	7	,	-688F1	2		&EFS/688.1
=		1			++Container-XE	1	8	,	-688F2	2		&EFS/688.3
=	1				++Container-XE	1	9	,	-688F3	2		&EFS/688.4

previous page: 2021

next page: 2023

Editor	Freqcon_DG	Statron	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	21.01.2025				& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007	++ ASC auxillary cabinet	page: 2022
Date					+	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W1-1	++Container-293W3-1	++Container-293W2-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	10	,	-688F4	2													&EFS/688.5
=		1			++Container-XE	1	11	,	-688F5	2													&EFS/688.7
=	2				++Container-XE	N	N	,	-XES	N													&EFS/687.1
								,															

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W1-1 JZ-500	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/687.6

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2024

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W2-1 -XZ-500	++Container-292W1-1 -XZ-500	++Container-291W2-1 -XZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.7
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.8
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N		-XES	N		&EFS/688.1

previous page: 2024

next page: 2026

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W2-1 -1Z-500	++Container-293W1-1 -1Z-500	++Container-292W3-1 -1Z-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/688.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/688.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/688.6

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	++Container-293W3-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N	⌟				&EFS/688.7
								,				
Supply Battery String 1-phase 230V AC		GNYE			++Container-XE	PE	PE	,				&EFS/687.2
=	GNYE				++Container-XE	PE	PE	,				&EFS/687.3

previous page: 2026

next page: 2028

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W2-1	++Container-291W1-1	++Container-290W3-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/687.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/687.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/687.7

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W3-1	++Container-292W2-1	++Container-292W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/687.9
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.2
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.3

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W3-1	++Container-293W2-1	++Container-293W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/688.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
				Cable type							Cable type	
Container Internal Lighting						L	1	,	-690F1	2		&EFS/690.1
=						1	2	,	-690F2	2		&EFS/690.3
Container Sockets						1	3	,	-690F3	2		&EFS/690.5
230V AC for crane 2						1	4	,	-690F4	2		&EFS/690.7
230V AC for crane 3						1	5	,	-690F5	2		&EFS/690.8
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						L	6	,	-636K1	14		&EFS/691.1
						L						
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						L	7	,	-636K2	14		&EFS/691.3
						L						
								,				
								,				

previous page: 2030

next page: 2032

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,		

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
400V AC for Cooling Units							10	,	-691F4	4													&EFS/691.6
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,														

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
				Cable type							Cable type		
230V AC for crane 2						PE	PE						&EFS/690.7
230V AC for crane 3						PE	PE						&EFS/690.8
Container Sockets						2	N		-690F2	N.			&EFS/690.4
230V AC for crane 1						2	N		-XES	N			&EFS/690.6
230V AC for crane 2						2	N		-XES	N			&EFS/690.7
230V AC for crane 3						2	N		-XES	N			&EFS/690.8
Container Internal Lighting						N	N		-690F1	N.			&EFS/690.1
=						GND	PE						&EFS/690.2
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						N	N		-XES	N			&EFS/691.1
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						GND	PE						&EFS/691.2
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						N	N						&EFS/691.3
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						GND	PE						&EFS/691.3
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						N	N						&EFS/691.4
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						GND	PE						&EFS/691.4
						GND							
400V AC for Cooling Units							N						&EFS/691.6
=							PE						&EFS/691.6

previous page: 2033

next page:

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-690XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

STATRON
NON STOP POWER

Computer System Documentation

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E06
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-E06-001
Document description: Computer System Documentation

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version

Computer System Documentation E06

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E06
Document name	Computer System Documentation
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-15	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-15	C. Palenzuela
Checked by	2023-03-15	A. Fritz
Approved by	2023-03-15	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 Main Control System Components 8
2.1 Main Controller 8
2.2 Network Structure PCS 12
3 BESS Control System 13
3.1 Controller 13
3.2 Battery Cabinet Control System 15
3.3 Network Structure BESS Control 16

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-E06-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
SIMOTION P320-4 E PLC - Manual	P320_4_operating_en-US.pdf
SIMATIC S7-1214 - Manual	s71200_system_manual_en-US_en-US

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System
PLC	Programming Logic Controller

Table 3: Generic terms and abbreviations used

2 Main Control System Components

The complete BESS/PCS is controlled and monitored by a main control system installed on a P320 PLC inside the control cabinet (CTRL) of the PCS container. Both, the PCS converter control system as well as the BESS control system are installed on the same PLC.

Data exchange between the individual battery cabinet control systems and BESS main control system is performed via MODBUS TCP protocol.

2.1 Main Controller

The main control system PLC of the BESS/PCS is of the following type.

Control system:

PLC:	Siemens industrial PLC SIMOTION P320-4 E
Development environment:	TIA Version 15.1



Figure 1: Main Control PLC - SIMOTION P320-4 E

Basic data	
Installation	• Standard rail mounting • Vertical mounting
Processor	
P320-4 E **P320-4 S**	Intel Core i3-3217UE, 2 x 1.6 GHz, 3 MB cache Intel Core i7-3517UE, 2 x 1.7 GHz, 4 MB cache
Main memory	4 GB DDR3 RAM
Optional IsoPROFIBUS board (PROFIBUS DP)	2 x SUB-D socket with configurable baud rates (9.6 Kbit/s - 12 Mbps)
Graphics	• Integrated Intel HD2000 or HD4000 • DVI resolution of 640 × 480 pixels up to 1920 × 1200 pixels • Display port resolution max. 1920 × 1200 pixels • Graphics memory is occupied in the main memory (dynamic UMA)
Power supply	24 VDC (-20%/+20%) max. 4 A
Operating conditions	Operation without fan
Drives and storage media	
CFast card or SSD (Solid State Disk)	Depending on the hardware version of the SIMOTION P320-4

Basic data	
P320-4 E	**2 x CFast card** Internal interface: CFast External interface: CFast
P320-4 S	**SSD (Solid State Disk)** Internal interface: SSD **CFast card** External interface: CFast
USB stick	External, can be connected via USB interface
Interfaces	
Serial	COM (RS 232)
Graphics	DVI-I: Suitable for use as DVI or VGA DPP++: Display port, DVI via DPP-to-DVI adapter
USB	4 × USB 3.0, simultaneous operation of high current, backward compatible with USB 2.0/1.1
Ethernet	1 × RJ45 (10/100/1000 Mbps)
PROFINET I/O	3 × RJ45 (100 Mbps)
Keyboard, mouse	Can be connected via USB interface

Software	
Operating systems	
P320-4 E	Windows Embedded Standard 7 32-bit
P320-4 S	Windows 7 Ultimate 32-bit

BESS Main Control System Overview

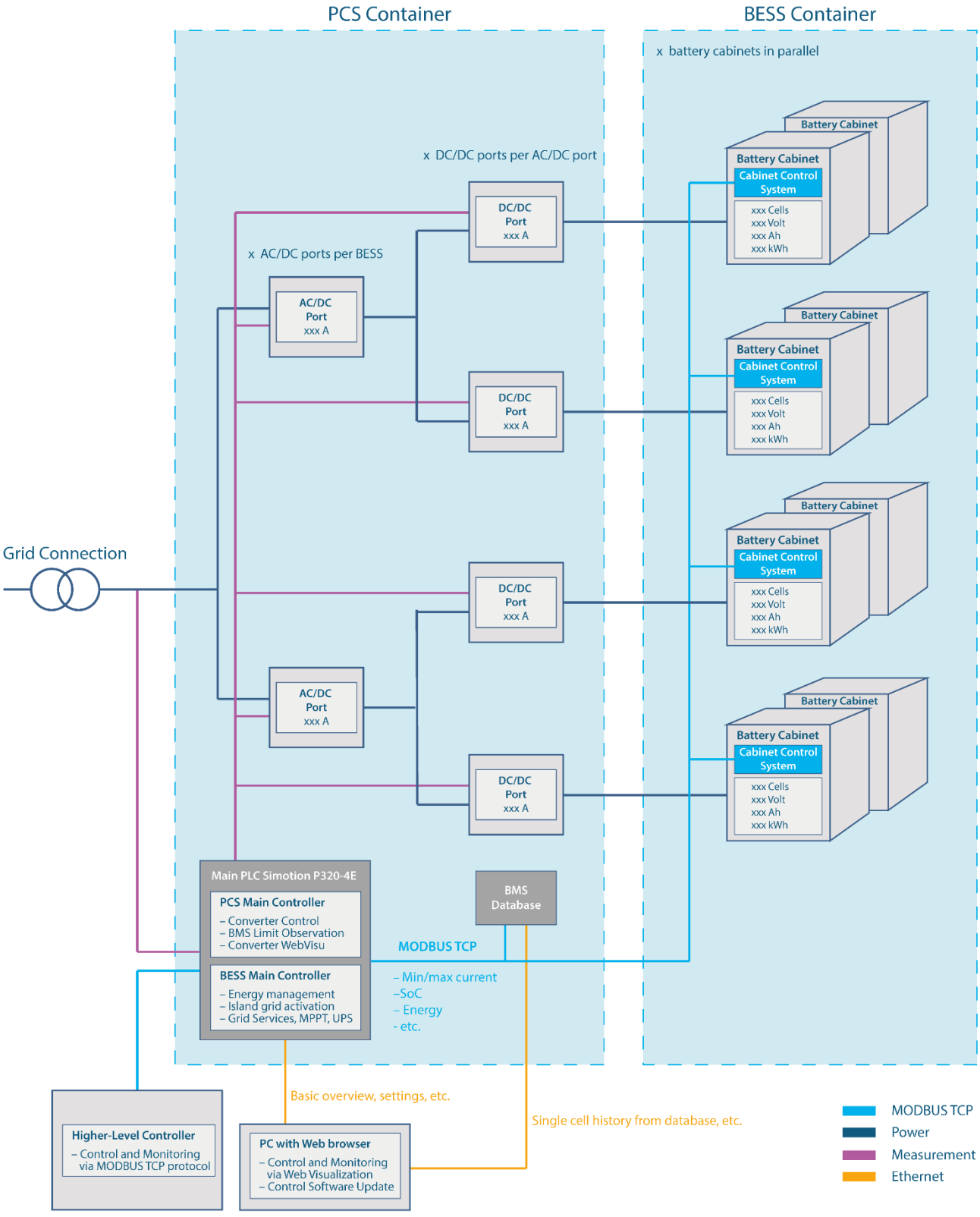


Figure 2: BESS main control system overview

2.2 Network Structure PCS

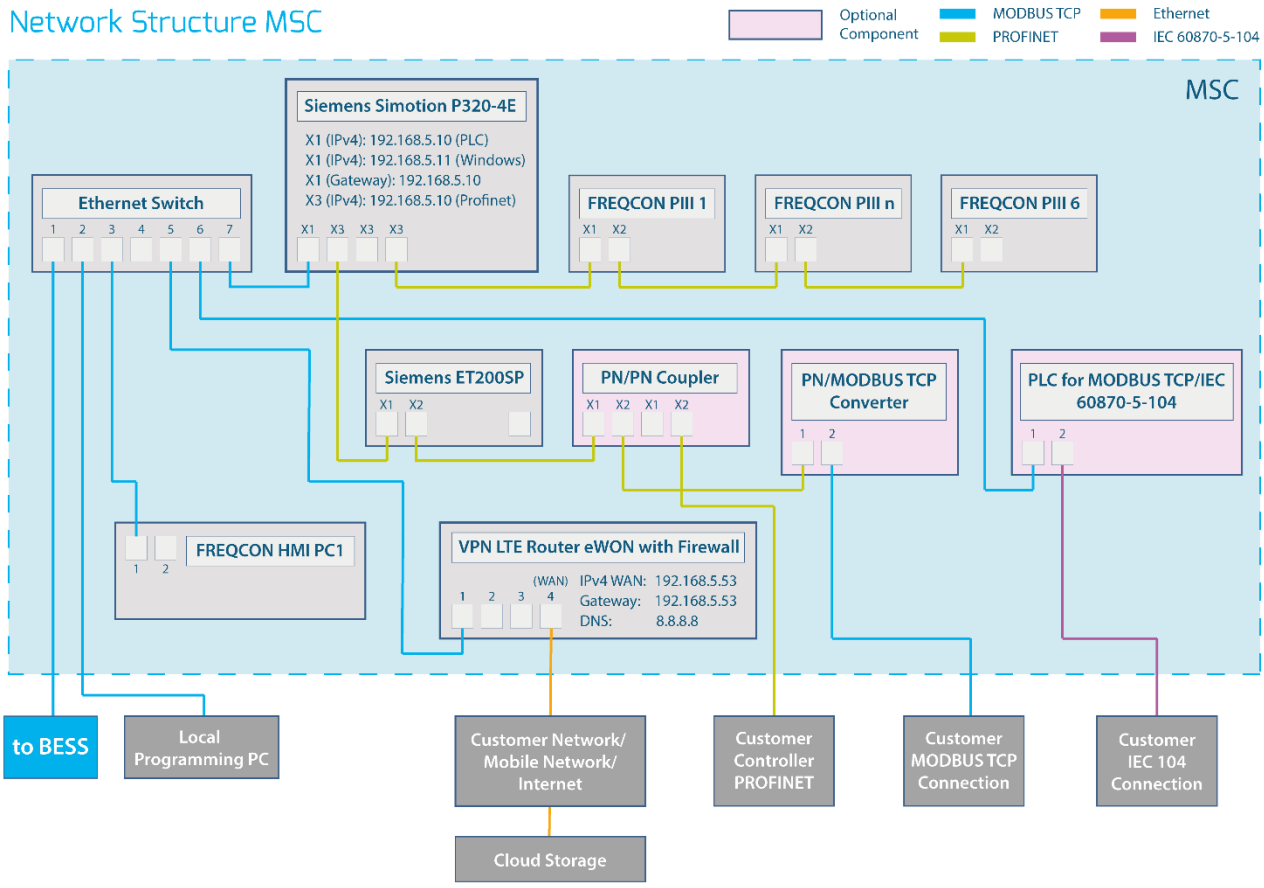


Figure 3: PCS (MSC 1000) Network Structure

3 BESS Control System

The aim of the ESS energy storage system is to store and release electrical energy.
energy. LiFePo4 (LFP) batteries are predominantly used for energy storage in the FREQCON system. The control system described in this document has the following functions and tasks.

- Monitoring of the battery cells
- Communication interface to consumers (converters) and chargers
- Communication interface to databases
- WebVisualisation for service purposes

Components of the system

- Battery cabinet control system
- Battery modules
- BMS
- Sensors (current, voltage, temperature, etc.)
- DC switches and line protection

3.1 Controller

Each battery cabinet of the BESS is equipped with a Siemens PLC.

Control system:

PLC:	Siemens industrial PLC SIMATIC S7-1214
Development environment:	TIA Version 15.1



Figure 4: Battery Cabinet PLC - SIMATIC S7-1214

Data sheet 6ES7214-1AG40-0XB0



SIMATIC S7-1200, CPU 1214C, compact CPU, DC/DC/DC, onboard I/O: 14 DI 24 V DC; 10 DO 24 V DC; 2 AI 0-10 V DC, Power supply: DC 20.4-28.8V DC, Program/data memory 100 KB

General information	
Product type designation	CPU 1214C DC/DC/DC
Firmware version	V4.4
Engineering with	
• Programming package	STEP 7 V16 or higher
Supply voltage	
Rated value (DC)	
• 24 V DC	Yes
permissible range, lower limit (DC)	20.4 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Load voltage L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	20.4 V
• permissible range, upper limit (DC)	28.8 V
Input current	
Current consumption (rated value)	500 mA
Current consumption, max.	1 500 mA; CPU with all expansion modules
Inrush current, max.	12 A; at 28.8 V
I^2t	0.5 $A^2 \cdot s$
Output current	
for backplane bus (5 V DC), max.	1 600 mA; Max. 5 V DC for SM and CM
Encoder supply	
24 V encoder supply	
• 24 V	L+ minus 4 V DC min.
Power loss	
Power loss, typ.	12 W
Memory	
Work memory	
• integrated	100 kbyte
• expandable	No
Load memory	
• integrated	4 Mbyte
• Plug-in (SIMATIC Memory Card), max.	with SIMATIC memory card
Backup	
• present	Yes
• maintenance-free	Yes

3.2 Battery Cabinet Control System

Each battery cabinet is equipped with its own control system (Siemens S7) collecting the relevant data from the individual battery modules and providing these to the BESS and PCS main control system.

The tasks and features of the battery cabinet control system are the following:

- Monitoring of battery cell voltages and temperatures
- Monitoring of the battery charging and discharging current
- Control of DC switches
- Monitoring of line protection and smoke detectors
- MODBUS RTU Master for communication with BMS system (battery monitoring system)
- MODBUS TCP Server provides the communication interface to other systems

Cabinet Control System Overview

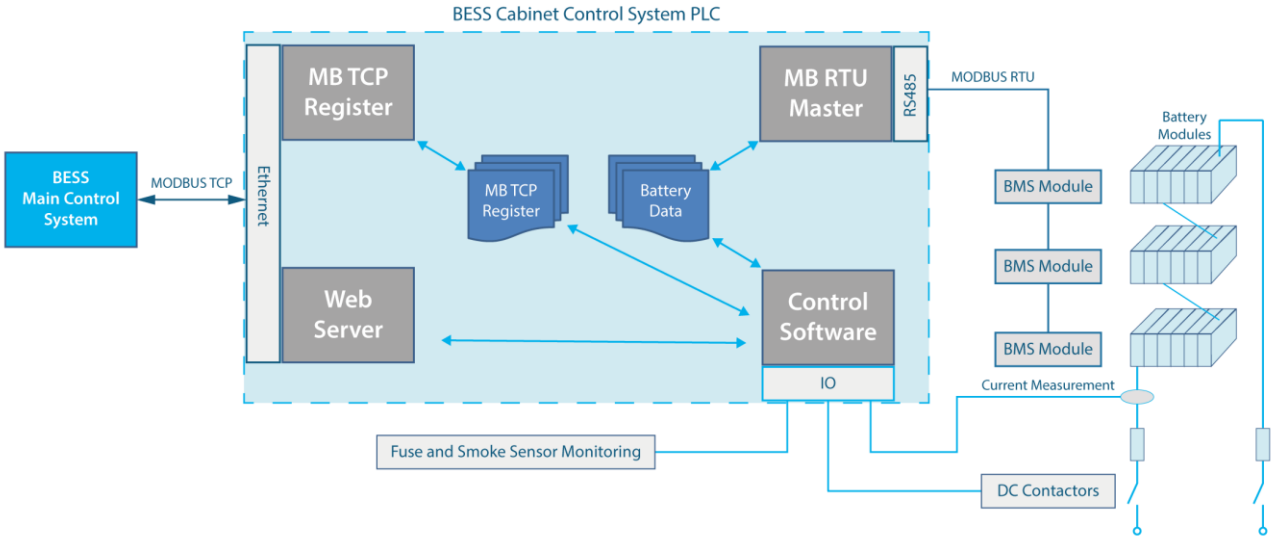


Figure 5: BESS cabinet control system overview

Data exchange between the cabinet control system and the individual battery modules is performed via MODBUS RTU protocol. Therefore, each battery cabinet is provided with several MODBUS RTU interfaces for Modbus connection of the battery modules.

3.3 Network Structure BESS Control

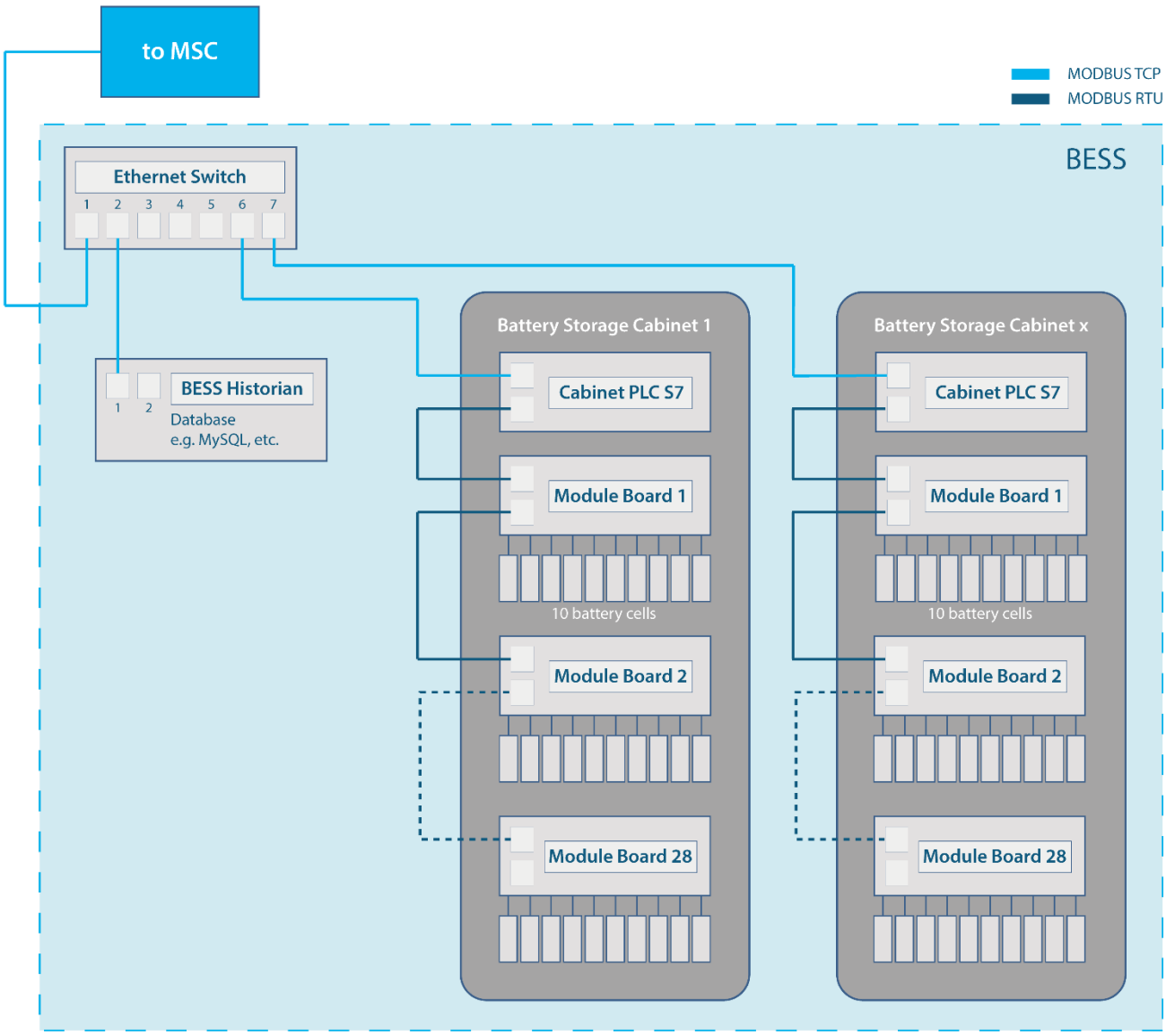


Figure 6: BESS Network Structure

SIEMENS

SIMATIC

S7
S7-1200 Programmable controller

System Manual

Preface

Product overview 1

New features 2

STEP 7 programming software 3

Installation 4

PLC concepts 5

Device configuration 6

Programming concepts 7

Basic instructions 8

Extended instructions 9

Technology instructions 10

Communication 11

Web server 12

Communication processor and Modbus TCP 13

TeleService communication (SMTP email) 14

Online and diagnostic tools 15

Technical specifications A

Calculating a power budget B

Ordering Information C

Device exchange and spare parts compatibility D

V4.2.3, 08/2018

A5E02486680-AL

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Division Digital Factory
Postfach 48 48
90026 NÜRNBERG
GERMANY

A5E02486680-AL
℗ 07/2018 Subject to change

Copyright © Siemens AG 2018.
All rights reserved

Preface

Purpose of the manual

The S7-1200 series is a line of programmable logic controllers (PLCs) that can control a variety of automation applications. Compact design, low cost, and a powerful instruction set make the S7-1200 a perfect solution for controlling a wide variety of applications. The S7-1200 models and the Windows-based STEP 7 programming tool (Page 37) give you the flexibility you need to solve your automation problems.

This manual provides information about installing and programming the S7-1200 PLCs and is designed for engineers, programmers, installers, and electricians who have a general knowledge of programmable logic controllers.

Required basic knowledge

To understand this manual, it is necessary to have a general knowledge of automation and programmable logic controllers.

Scope of the manual

This manual describes the following products:

- STEP 7 V15 Basic and Professional (Page 37)
- S7-1200 CPU firmware release V4.2.3

For a complete list of the S7-1200 products described in this manual, refer to the technical specifications (Page 1343).

Certification, CE label, C-Tick, and other approvals

Refer to the technical specifications (Page 1343) for more information.

Service and support

In addition to our documentation, Siemens offers technical expertise on the Internet and on the customer support web site (http://support.industry.siemens.com).

Contact your Siemens distributor or sales office for assistance in answering any technical questions, for training, or for ordering S7 products. Because your sales representatives are technically trained and have the most specific knowledge about your operations, process and industry, as well as about the individual Siemens products that you are using, they can provide the fastest and most efficient answers to any problems you might encounter.

Documentation and information

S7-1200 and STEP 7 provide a variety of documentation and other resources for finding the technical information that you require.

- The S7-1200 Programmable Controller System Manual provides specific information about the operation, programming, and the specifications for the complete S7-1200 product family.

  The system manual is available as an electronic (PDF) manuals. You can download or view this and other electronic manuals from the Siemens Industry Online Support Web site (http://support.industry.siemens.com). The system manual is also available on the Documents Disk that ships with every S7-1200 CPU.

- The online STEP 7 information system provides immediate access to the conceptual information and specific instructions that describe the operation and functionality of the programming package and basic operation of SIMATIC CPUs.

- The Siemens Industry Online Support Web site (http://support.industry.siemens.com) provides access to the electronic (PDF) versions of the SIMATIC documentation set, including the system manual, and the STEP 7 information system. Existing documents are available from the Product Support link. With this online documentation access, you can also drag and drop topics from various documents to create your own custom manual. Updates to previous-published system manuals are also available from Siemens Industry Online Support.

  You can access online documentation by clicking "mySupport" from the left side of the page and selecting "Documentation" from the navigation choices. To use the mySupport Documentation features, you must sign up as a registered user.

- The Siemens Industry Online Support Web site also provides FAQs and other helpful documents for S7-1200 and STEP 7.

- You can also follow or join product discussions on the Service & Support technical forum (https://support.industry.siemens.com/tf/ww/en/?Language=en&siteid=csius&treeLang=en&groupid=4000002&extranet=standard&viewreg=WW&nodeid0=34612486). These forums allow you to interact with various product experts.

  – Forum for S7-1200 (https://support.industry.siemens.com/tf/ww/en/threads/237?title=simatic-s7-1200&skip=0&take=10&orderBy=LastPostDate+desc)

  – Forum for STEP 7 Basic (https://support.industry.siemens.com/tf/ww/en/threads/243?title=step-7-tia-portal&skip=0&take=10&orderBy=LastPostDate+desc)

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (http://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under (http://www.siemens.com/industrialsecurity).

Table of contents

Preface **3**

1 Product overview **27**

1.1 Introducing the S7-1200 PLC 27

1.2 Expansion capability of the CPU 31

1.3 Basic HMI panels 33

2 New features **35**

3 STEP 7 programming software **37**

3.1 System requirements 38

3.2 Different views to make the work easier 39

3.3 Easy-to-use tools 40
3.3.1 Inserting instructions into your user program 40
3.3.2 Accessing instructions from the "Favorites" toolbar 41
3.3.3 Creating a complex equation with a simple instruction 42
3.3.4 Adding inputs or outputs to a LAD or FBD instruction 44
3.3.5 Expandable instructions 44
3.3.6 Selecting a version for an instruction 45
3.3.7 Modifying the appearance and configuration of STEP 7 45
3.3.8 Dragging and dropping between editors 46
3.3.9 Changing the operating mode of the CPU 47
3.3.10 Changing the call type for a DB 48
3.3.11 Temporarily disconnecting devices from a network 49
3.3.12 Virtual unplugging of devices from the configuration 50

3.4 Backward compatibility 51

4 Installation **53**

4.1 Guidelines for installing S7-1200 devices 53

4.2 Power budget 56

4.3 Installation and removal procedures 57
4.3.1 Mounting dimensions for the S7-1200 devices 57
4.3.2 Installing and removing the CPU 60
4.3.3 Installing and removing an SB, CB, or BB 62
4.3.4 Installing and removing an SM 64
4.3.5 Installing and removing a CM or CP 65
4.3.6 Removing and reinstalling the S7-1200 terminal block connector 67
4.3.7 Installing and removing the expansion cable 68
4.3.8 TS (TeleService) adapter 70
4.3.8.1 Connecting the TeleService adapter 70
4.3.8.2 Installing the SIM card 71
4.3.8.3 Installing the TS adapter unit on a DIN rail 73
4.3.8.4 Installing the TS adapter on a panel 74

4.4 Wiring guidelines ... 75

5 PLC concepts ... 83

5.1 Execution of the user program ... 83
5.1.1 Operating modes of the CPU ... 87
5.1.2 Processing the scan cycle in RUN mode ... 91
5.1.3 Organization blocks (OBs) ... 92
5.1.3.1 Program cycle OB ... 92
5.1.3.2 Startup OB ... 93
5.1.3.3 Time delay interrupt OB ... 93
5.1.3.4 Cyclic interrupt OB ... 93
5.1.3.5 Hardware interrupt OB ... 94
5.1.3.6 Time error interrupt OB ... 95
5.1.3.7 Diagnostic error interrupt OB ... 96
5.1.3.8 Pull or plug of modules OB ... 98
5.1.3.9 Rack or station failure OB ... 99
5.1.3.10 Time of day OB ... 100
5.1.3.11 Status OB ... 100
5.1.3.12 Update OB ... 101
5.1.3.13 Profile OB ... 101
5.1.3.14 MC-Servo and MC-Interpolator OB ... 101
5.1.3.15 MC-PreServo ... 101
5.1.3.16 MC-PostServo ... 102
5.1.3.17 Event execution priorities and queuing ... 103
5.1.4 Monitoring and configuring the cycle time ... 107
5.1.5 CPU memory ... 108
5.1.5.1 System and clock memory ... 110
5.1.6 Diagnostics buffer ... 112
5.1.7 Time of day clock ... 113
5.1.8 Configuring the outputs on a RUN-to-STOP transition ... 113

5.2 Data storage, memory areas, I/O and addressing ... 114
5.2.1 Accessing the data of the S7-1200 ... 114

5.3 Processing of analog values ... 120

5.4 Data types ... 122
5.4.1 Bool, Byte, Word, and DWord data types ... 123
5.4.2 Integer data types ... 124
5.4.3 Floating-point real data types ... 124
5.4.4 Time and Date data types ... 125
5.4.5 Character and String data types ... 127
5.4.6 Array data type ... 129
5.4.7 Data structure data type ... 130
5.4.8 PLC data type ... 130
5.4.9 Variant pointer data type ... 131
5.4.10 Accessing a "slice" of a tagged data type ... 131
5.4.11 Accessing a tag with an AT overlay ... 132

5.5 Using a memory card ... 134
5.5.1 Inserting a memory card in the CPU ... 135
5.5.2 Configuring the startup parameter of the CPU before copying the project to the memory card ... 138
5.5.3 Transfer card ... 138

5.5.4 Program card 141
5.5.5 Firmware update 144
5.6 Recovery from a lost password 147
6 Device configuration 149
6.1 Inserting a CPU 150
6.2 Uploading the configuration of a connected CPU 152
6.3 Adding modules to the configuration 154
6.4 Configuration control 155
6.4.1 Advantages and applications of configuration control 155
6.4.2 Configuring the central installation and optional modules 155
6.4.3 Example of configuration control 161
6.5 Changing a device 164
6.6 Configuring the operation of the CPU 165
6.6.1 Overview 165
6.6.2 Configuring digital input filter times 167
6.6.3 Pulse catch 168
6.7 Configuring multilingual support 171
6.8 Configuring the parameters of the modules 173
6.9 Configuring the CPU for communication 175
6.10 Time synchronization 177
7 Programming concepts 179
7.1 Guidelines for designing a PLC system 179
7.2 Structuring your user program 180
7.3 Using blocks to structure your program 182
7.3.1 Organization block (OB) 183
7.3.2 Function (FC) 184
7.3.3 Function block (FB) 185
7.3.4 Data block (DB) 186
7.3.5 Creating reusable code blocks 188
7.3.6 Passing parameters to blocks 189
7.4 Understanding data consistency 192
7.5 Programming language 193
7.5.1 Ladder logic (LAD) 193
7.5.2 Function Block Diagram (FBD) 194
7.5.3 SCL 195
7.5.3.1 SCL program editor 195
7.5.3.2 SCL expressions and operations 196
7.5.3.3 Indexed addressing with PEEK and POKE instructions 200
7.5.4 EN and ENO for LAD, FBD and SCL 202
7.6 Protection 204
7.6.1 Access protection for the CPU 204
7.6.2 External load memory 206
7.6.3 Know-how protection 207

7.6.4 Copy protection ... 208
7.7 Downloading the elements of your program ... 210
7.8 Synchronizing the online CPU and offline project ... 213
7.9 Uploading from the online CPU ... 215
7.9.1 Comparing the online CPU to the offline CPU ... 215
7.10 Debugging and testing the program ... 216
7.10.1 Monitor and modify data in the CPU ... 216
7.10.2 Watch tables and force tables ... 217
7.10.3 Cross reference to show usage ... 217
7.10.4 Call structure to examine the calling hierarchy ... 219
8 Basic instructions ... 221
8.1 Bit logic operations ... 221
8.1.1 Bit logic instructions ... 221
8.1.2 Set and reset instructions ... 224
8.1.3 Positive and negative edge instructions ... 227
8.2 Timer operations ... 230
8.3 Counter operations ... 238
8.4 Comparator operations ... 244
8.4.1 Compare values instructions ... 244
8.4.2 IN_Range (Value within range) and OUT_Range (Value outside range) ... 245
8.4.3 OK (Check validity) and NOT_OK (Check invalidity) ... 246
8.4.4 Variant and array comparison instructions ... 247
8.4.4.1 Equality and non-equality comparison instructions ... 247
8.4.4.2 Null comparsion instructions ... 248
8.4.4.3 IS_ARRAY (Check for ARRAY) ... 249
8.5 Math functions ... 249
8.5.1 CALCULATE (Calculate) ... 249
8.5.2 Add, subtract, multiply and divide instructions ... 250
8.5.3 MOD (return remainder of division) ... 252
8.5.4 NEG (Create twos complement) ... 253
8.5.5 INC (Increment) and DEC (Decrement) ... 254
8.5.6 ABS (Form absolute value) ... 255
8.5.7 MIN (Get minimum) and MAX (Get maximum) ... 256
8.5.8 LIMIT (Set limit value) ... 257
8.5.9 Exponent, logarithm, and trigonometry instructions ... 258
8.6 Move operations ... 260
8.6.1 MOVE (Move value), MOVE_BLK (Move block), UMOVE_BLK (Move block uninterruptible), and MOVE_BLK_VARIANT (Move block) ... 260
8.6.2 Deserialize ... 263
8.6.3 Serialize ... 266
8.6.4 FILL_BLK (Fill block) and UFILL_BLK (Fill block uninterruptible) ... 269
8.6.5 SWAP (Swap bytes) ... 271
8.6.6 LOWER_BOUND: (Read out ARRAY low limit) ... 272
8.6.7 UPPER_BOUND: (Read out ARRAY high limit) ... 274
8.6.8 Read / Write memory instructions ... 276
8.6.8.1 PEEK and POKE (SCL only) ... 276
8.6.8.2 Read and write big and little Endian instructions (SCL) ... 278

8.6.9 Variant instructions 280
8.6.9.1 VariantGet (Read VARIANT tag value) 280
8.6.9.2 VariantPut (Write VARIANT tag value) 281
8.6.9.3 CountOfElements (Get number of ARRAY elements) 282
8.6.10 Legacy instructions 283
8.6.10.1 FieldRead (Read field) and FieldWrite (Write field) instructions 283

8.7 Conversion operations 285
8.7.1 CONV (Convert value) 285
8.7.2 Conversion instructions for SCL 286
8.7.3 ROUND (Round numerical value) and TRUNC (Truncate numerical value) 289
8.7.4 CEIL and FLOOR (Generate next higher and lower integer from floating-point number) 290
8.7.5 SCALE_X (Scale) and NORM_X (Normalize) 291
8.7.6 Variant conversion instructions 294
8.7.6.1 VARIANT_TO_DB_ANY (Convert VARIANT to DB_ANY) 294
8.7.6.2 DB_ANY_TO_VARIANT (Convert DB_ANY to VARIANT) 295

8.8 Program control operations 297
8.8.1 JMP (Jump if RLO = 1), JMPN (Jump if RLO = 0), and Label (Jump label) instructions 297
8.8.2 JMP_LIST (Define jump list) 298
8.8.3 SWITCH (Jump distributor) 299
8.8.4 RET (Return) 301
8.8.5 ENDIS_PW (Enable/disable CPU passwords) 302
8.8.6 RE_TRIGR (Restart cycle monitoring time) 304
8.8.7 STP (Exit program) 305
8.8.8 GET_ERROR and GET_ERROR_ID (Get error and error ID locally) instructions 306
8.8.9 RUNTIME (Measure program runtime) 309
8.8.10 SCL program control statements 311
8.8.10.1 Overview of SCL program control statements 311
8.8.10.2 IF-THEN statement 312
8.8.10.3 CASE statement 313
8.8.10.4 FOR statement 314
8.8.10.5 WHILE-DO statement 315
8.8.10.6 REPEAT-UNTIL statement 316
8.8.10.7 CONTINUE statement 317
8.8.10.8 EXIT statement 318
8.8.10.9 GOTO statement 319
8.8.10.10 RETURN statement 319

8.9 Word logic operations 320
8.9.1 AND, OR, and XOR logic operation instructions 320
8.9.2 INV (Create ones complement) 321
8.9.3 DECO (Decode) and ENCO (Encode) instructions 321
8.9.4 SEL (Select), MUX (Multiplex), and DEMUX (Demultiplex) instructions 323

8.10 Shift and rotate 326
8.10.1 SHR (Shift right) and SHL (Shift left) instructions 326
8.10.2 ROR (Rotate right) and ROL (Rotate left) instructions 327

9 Extended instructions 329

9.1 Date, time-of-day, and clock functions 329
9.1.1 Date and time-of-day instructions 329
9.1.2 Clock functions 332
9.1.3 TimeTransformationRule data structure 335
9.1.4 SET_TIMEZONE (Set timezone) 336
9.1.5 RTM (Runtime meters) 337

9.2 String and character 339
9.2.1 String data overview 339
9.2.2 S_MOVE (Move character string) 339
9.2.3 String conversion instructions 340
9.2.3.1 S_CONV, STRG_VAL, and VAL_STRG (Convert to/from character string and number) instructions 340
9.2.3.2 Strg_TO_Chars and Chars_TO_Strg (Convert to/from character string and array of CHAR) instructions 349
9.2.3.3 ATH and HTA (Convert to/from ASCII string and hexadecimal number) instructions 351
9.2.4 String operation instructions 353
9.2.4.1 MAX_LEN (Maximum length of a character string) 353
9.2.4.2 LEN (Determine the length of a character string) 354
9.2.4.3 CONCAT (Combine character strings) 355
9.2.4.4 LEFT, RIGHT, and MID (Read substrings in a character string) instructions 356
9.2.4.5 DELETE (Delete characters in a character string) 357
9.2.4.6 INSERT (Insert characters in a character string) 358
9.2.4.7 REPLACE (Replace characters in a character string) 359
9.2.4.8 FIND (Find characters in a character string) 360
9.2.5 Runtime information 361
9.2.5.1 GetSymbolName (Read out a tag on the input parameter) 361
9.2.5.2 GetSymbolPath (Query composite global name of the input parameter assignment) 364
9.2.5.3 GetInstanceName (Read out name of the block instance) 367
9.2.5.4 GetInstancePath (Query composite global name of the block instance) 370
9.2.5.5 GetBlockName (Read out name of the block) 372

9.3 Distributed I/O (PROFINET, PROFIBUS, or AS-i) 374
9.3.1 Distributed I/O Instructions 374
9.3.2 RDREC and WRREC (Read/write data record) 375
9.3.3 GETIO (Read process image) 378
9.3.4 SETIO (Transfer process image) 379
9.3.5 GETIO_PART (Read process image area) 380
9.3.6 SETIO_PART (Transfer process image area) 381
9.3.7 RALRM (Receive interrupt) 383
9.3.8 D_ACT_DP (Enable/disable PROFINET IO devices) 387
9.3.9 STATUS parameter for RDREC, WRREC, and RALRM 391
9.3.10 Others 396
9.3.10.1 DPRD_DAT and DPWR_DAT (Read/write consistent data) 396
9.3.10.2 RCVREC (I-device/I-slave receive data record) 399
9.3.10.3 PRVREC (I-device/I-slave make data record available) 401
9.3.10.4 DPNRM_DG (Read diagnostic data from a PROFIBUS DP slave) 404

9.4 PROFIenergy 407

9.5 Interrupts 408
9.5.1 ATTACH and DETACH (Attach/detach an OB and an interrupt event) instructions 408
9.5.2 Cyclic interrupts 411

9.5.2.1 SET_CINT (Set cyclic interrupt parameters) 411
9.5.2.2 QRY_CINT (Query cyclic interrupt parameters) 413
9.5.3 Time of day interrupts 415
9.5.3.1 SET_TINTL (Set time of day interrupt) 415
9.5.3.2 CAN_TINT (Cancel time of day interrupt) 417
9.5.3.3 ACT_TINT (Activate time of day interrupt) 418
9.5.3.4 QRY_TINT (Query status of time of day interrupt) 419
9.5.4 Time delay interrupts 420
9.5.5 DIS_AIRT and EN_AIRT (Delay/enable execution of higher priority interrupts and asynchronous error events) instructions 423

9.6 Alarms 424
9.6.1 Gen_UsrMsg (Generate user diagnostic alarms) 424

9.7 Diagnostics (PROFINET or PROFIBUS) 427
9.7.1 Diagnostic instructions 427
9.7.2 RD_SINFO (Read current OB start information) 428
9.7.3 LED (Read LED status) 438
9.7.4 Get_IM_Data (Read the identification and maintenance data) 439
9.7.5 Get_Name (Read the name of a PROFINET IO device) 440
9.7.6 GetStationInfo (Read the IP or MAC address of a PROFINET IO device) 447
9.7.7 DeviceStates instruction 455
9.7.7.1 DeviceStates example configurations 456
9.7.8 ModuleStates instruction 460
9.7.8.1 ModuleStates example configurations 462
9.7.9 GET_DIAG (Read diagnostic information) 466
9.7.10 Diagnostic events for distributed I/O 472

9.8 Pulse 473
9.8.1 CTRL_PWM (Pulse width modulation) 473
9.8.2 CTRL_PTO (Pulse train output) 474
9.8.3 Operation of the pulse outputs 478
9.8.4 Configuring a pulse channel for PWM or PTO 480

9.9 Recipes and Data logs 484
9.9.1 Recipes 484
9.9.1.1 Recipe overview 484
9.9.1.2 Recipe example 485
9.9.1.3 Program instructions that transfer recipe data 488
9.9.1.4 Recipe example program 492
9.9.2 Data logs 494
9.9.2.1 Data log record structure 495
9.9.2.2 Program instructions that control data logs 496
9.9.2.3 Working with data logs 510
9.9.2.4 Limit to the size of data log files 512
9.9.2.5 Data log example program 515

9.10 Data block control 520
9.10.1 CREATE_DB (Create data block) 520
9.10.2 READ_DBL and WRIT_DBL (Read/write a data block in load memory) instructions 525
9.10.3 ATTR_DB (Read data block attribute) 528
9.10.4 DELETE_DB (Delete data block) 530

9.11 Address handling 532
9.11.1 GEO2LOG (Determine the hardware identifier from the slot) 532

9.11.2 LOG2GEO (Determine the slot from the hardware identifier) 534
9.11.3 IO2MOD (Determine the hardware identifier from an I/O address) 535
9.11.4 RD_ADDR (Determine the IO addresses from the hardware identifier) 537
9.11.5 GEOADDR system data type 538

9.12 Common error codes for the Extended instructions 540

10 Technology instructions 541

10.1 Counting (High-speed counters) 541
10.1.1 CTRL_HSC_EXT (Control high-speed counter) instruction 542
10.1.1.1 Instruction overview 542
10.1.1.2 Example 543
10.1.1.3 CTRL_HSC_EXT Instruction System Data Types (SDT) 546
10.1.2 Operating the high-speed counter 551
10.1.2.1 Synchronization function 551
10.1.2.2 Gate function 553
10.1.2.3 Capture function 555
10.1.2.4 Compare function 556
10.1.2.5 Applications 557
10.1.3 Configuring a high-speed counter 558
10.1.3.1 Type of Counting 559
10.1.3.2 Operating phase 560
10.1.3.3 Initial values 564
10.1.3.4 Input functions 564
10.1.3.5 Output function 565
10.1.3.6 Interrupt events 566
10.1.3.7 Hardware input pin assignment 566
10.1.3.8 Hardware output pin assignment 568
10.1.3.9 HSC input memory addresses 569
10.1.3.10 Hardware identifier 569
10.1.4 Legacy CTRL_HSC (Control high-speed counter) instruction 570
10.1.4.1 Instruction overview 570
10.1.4.2 Using CTRL_HSC 572
10.1.4.3 HSC current count value 573

10.2 PID control 574
10.2.1 Inserting the PID instruction and technology object 576
10.2.2 PID_Compact 578
10.2.2.1 PID_Compact instruction 578
10.2.2.2 PID_Compact instruction Process value limits 582
10.2.2.3 PID_Compact instruction ErrorBit parameters 583
10.2.2.4 PID_Compact instruction Warning parameters 585
10.2.3 PID_3Step 586
10.2.3.1 PID_3Step instruction 586
10.2.3.2 PID_3Step instruction ErrorBit parameters 593
10.2.3.3 PID_3Step instruction Warning parameters 595
10.2.4 PID_Temp 596
10.2.4.1 PID_Temp instruction 596
10.2.4.2 PID_Temp ErrorBit parameters 605
10.2.4.3 PID_Temp Warning parameters 607
10.2.5 Configuring the PID_Compact and PID_3Step controllers 608
10.2.6 Configuring the PID_Temp controller 611
10.2.7 Commissioning the PID_Compact and PID_3Step controllers 625

10.2.8 Commissioning the PID_Temp controller 627
10.3 Motion control 637
10.3.1 Phasing 642
10.3.2 Configuring a pulse generator 645
10.3.3 Open loop motion control 646
10.3.3.1 Configuring the axis 646
10.3.3.2 Commissioning 650
10.3.4 Closed loop motion control 656
10.3.4.1 Configuring the axis 656
10.3.4.2 ServoOBs 663
10.3.4.3 Speed controlled operation 665
10.3.4.4 Telegram 4 support 668
10.3.4.5 Simulation axis 672
10.3.4.6 Data adaptation 674
10.3.4.7 Axis control using the TM Pulse module 684
10.3.5 Configuring the TO_CommandTable_PTO 691
10.3.6 Operation of motion control for S7-1200 694
10.3.6.1 CPU outputs used for motion control 694
10.3.6.2 Hardware and software limit switches for motion control 696
10.3.6.3 Homing 706
10.3.6.4 Jerk limit 713
10.3.7 Motion control instructions 714
10.3.7.1 MC instruction overview 714
10.3.7.2 MC_Power (Release/block axis) 716
10.3.7.3 MC_Reset (Confirm error) 719
10.3.7.4 MC_Home (Home axis) 720
10.3.7.5 MC_Halt (Pause axis) 723
10.3.7.6 MC_MoveAbsolute (Position axis absolutely) 725
10.3.7.7 MC_MoveRelative (Position axis relatively) 728
10.3.7.8 MC_MoveVelocity (Move axis at predefined velocity) 730
10.3.7.9 MC_MoveJog (Move axis in jog mode) 732
10.3.7.10 MC_CommandTable (Run axis commans as movement sequence) 734
10.3.7.11 MC_ChangeDynamic (Change dynamc settings for the axis) 737
10.3.7.12 MC_WriteParam (write parameters of a technology object) 739
10.3.7.13 MC_ReadParam instruction (read parameters of a technology object) 741
10.3.8 Monitoring active commands 743
10.3.8.1 Monitoring MC instructions with a "Done" output parameter 743
10.3.8.2 Monitoring the MC_Velocity 747
10.3.8.3 Monitoring the MC_MoveJog 751
10.3.9 ErrorIDs and ErrorInfos for motion control 755
11 Communication 781
11.1 Asynchronous communication connections 783
11.2 PROFINET 786
11.2.1 Creating a network connection 787
11.2.2 Configuring the Local/Partner connection path 788
11.2.3 Assigning Internet Protocol (IP) addresses 791
11.2.3.1 Assigning IP addresses to programming and network devices 791
11.2.3.2 Checking the IP address of your programming device 793
11.2.3.3 Assigning an IP address to a CPU online 793
11.2.3.4 Configuring an IP address for a CPU in your project 795

11.2.4 Testing the PROFINET network ... 799
11.2.5 Locating the Ethernet (MAC) address on the CPU ... 800
11.2.6 Configuring Network Time Protocol (NTP) synchronization ... 802
11.2.7 PROFINET device start-up time, naming, and address assignment ... 804
11.2.8 Open user communication ... 805
11.2.8.1 Protocols ... 805
11.2.8.2 TCP and ISO on TCP ... 806
11.2.8.3 Communication services and used port numbers ... 807
11.2.8.4 Ad hoc mode ... 808
11.2.8.5 Connection IDs for the Open user communication instructions ... 808
11.2.8.6 Parameters for the PROFINET connection ... 811
11.2.8.7 TSEND_C and TRCV_C instructions ... 816
11.2.8.8 Legacy TSEND_C and TRCV_C instructions ... 828
11.2.8.9 TCON, TDISCON, TSEND, and TRCV instructions ... 836
11.2.8.10 Legacy TCON, TDISCON, TSEND, and TRCV instructions ... 847
11.2.8.11 T_RESET (Terminate and re-establish an existing connection) instruction ... 857
11.2.8.12 T_DIAG (Checks the status of connection and reads information) instruction ... 859
11.2.8.13 TMAIL_C (Send an email using the Ethernet interface of the CPU) instruction ... 863
11.2.8.14 UDP ... 873
11.2.8.15 TUSEND and TURCV ... 874
11.2.8.16 T_CONFIG ... 880
11.2.8.17 Common parameters for instructions ... 891
11.2.9 Communication with a programming device ... 892
11.2.9.1 Establishing the hardware communications connection ... 893
11.2.9.2 Configuring the devices ... 893
11.2.9.3 Assigning Internet Protocol (IP) addresses ... 894
11.2.9.4 Testing your PROFINET network ... 894
11.2.10 HMI-to-PLC communication ... 895
11.2.10.1 Configuring logical network connections between two devices ... 896
11.2.11 PLC-to-PLC communication ... 896
11.2.11.1 Configuring logical network connections between two devices ... 897
11.2.11.2 Configuring the Local/Partner connection path between two devices ... 898
11.2.11.3 Configuring transmit (send) and receive parameters ... 898
11.2.12 Configuring a CPU and PROFINET IO device ... 901
11.2.12.1 Adding a PROFINET IO device ... 901
11.2.12.2 Assigning CPUs and device names ... 902
11.2.12.3 Assigning Internet Protocol (IP) addresses ... 902
11.2.12.4 Configuring the IO cycle time ... 903
11.2.13 Configuring a CPU and PROFINET I-device ... 904
11.2.13.1 I-device functionality ... 904
11.2.13.2 Properties and advantages of the I-device ... 905
11.2.13.3 Characteristics of an I-device ... 906
11.2.13.4 Data exchange between higher- and lower-level IO system ... 909
11.2.13.5 Configuring the I-device ... 911
11.2.14 Shared devices ... 914
11.2.14.1 Shared device functionality ... 914
11.2.14.2 Example: Configuring a shared device (GSD configuration) ... 917
11.2.14.3 Example: Configuring an I-device as a shared device ... 923
11.2.15 Media Redundancy Protocol (MRP) ... 933
11.2.15.1 Media redundancy with ring topologies ... 933
11.2.15.2 Using Media Redundancy Protocol (MRP) ... 934
11.2.15.3 Configuring media redundancy ... 937

11.2.16 S7 routing 941
11.2.16.1 S7 routing between CPU and CP interfaces 942
11.2.16.2 S7 routing between two CP interfaces 942
11.2.17 Disabling SNMP 943
11.2.17.1 Disabling SNMP 944
11.2.18 Diagnostics 946
11.2.19 Distributed I/O instructions 946
11.2.20 Diagnostic instructions 946
11.2.21 Diagnostic events for distributed I/O 946

11.3 PROFIBUS 947
11.3.1 Communications services of the PROFIBUS CMs 949
11.3.2 Reference to the PROFIBUS CM user manuals 950
11.3.3 Configuring a DP master and slave device 950
11.3.3.1 Adding the CM 1243-5 (DP master) module and a DP slave 950
11.3.3.2 Configuring logical network connections between two PROFIBUS devices 951
11.3.3.3 Assigning PROFIBUS addresses to the CM 1243-5 module and DP slave 951
11.3.4 Distributed I/O instructions 953
11.3.5 Diagnostic instructions 953
11.3.6 Diagnostic events for distributed 953

11.4 AS-i 954
11.4.1 Configuring an AS-i master and slave device 955
11.4.1.1 Adding the AS-i master CM 1243-2 and AS-i slave 955
11.4.1.2 Configuring logical network connections between two AS-i devices 956
11.4.1.3 Configuring the properties of the AS-i master CM1243-2 956
11.4.1.4 Assigning an AS-i address to an AS-i slave 957
11.4.2 Exchanging data between the user program and AS-i slaves 960
11.4.2.1 STEP 7 basic configuration 960
11.4.2.2 Configuring slaves with STEP 7 961
11.4.3 Distributed I/O instructions 963
11.4.4 Working with AS-i online tools 963

11.5 S7 communication 965
11.5.1 GET and PUT (Read and write from a remote CPU) 965
11.5.2 Creating an S7 connection 970
11.5.3 Configuring the Local/Partner connection path between two devices 971
11.5.4 GET/PUT connection parameter assignment 971
11.5.4.1 Connection parameters 972
11.5.4.2 Configuring a CPU-to-CPU S7 connection 974

11.6 What to do when you cannot access the CPU by the IP address 980

12 Web server 981

12.1 Enabling the Web server 983

12.2 Configuring Web server users 984

12.3 Accessing the Web pages from a PC 987

12.4 Accessing the Web pages from a mobile device 989

12.5 Using a CP module to access Web pages 990

12.6 Standard Web pages 991
12.6.1 Layout of the standard Web pages 991
12.6.2 Basic pages 992

12.6.3 Logging in and user privileges ... 993
12.6.4 Introduction ... 997
12.6.5 Start ... 998
12.6.6 Diagnostics ... 999
12.6.7 Diagnostic Buffer ... 1002
12.6.8 Module Information ... 1002
12.6.9 Communication ... 1007
12.6.10 Tag status ... 1011
12.6.11 Watch tables ... 1012
12.6.12 Online backup ... 1015
12.6.13 File Browser ... 1017

12.7 User-defined Web pages ... 1020
12.7.1 Creating HTML pages ... 1021
12.7.2 AWP commands supported by the S7-1200 Web server ... 1022
12.7.2.1 Reading variables ... 1023
12.7.2.2 Writing variables ... 1024
12.7.2.3 Reading special variables ... 1026
12.7.2.4 Writing special variables ... 1028
12.7.2.5 Using an alias for a variable reference ... 1029
12.7.2.6 Defining enum types ... 1030
12.7.2.7 Referencing CPU variables with an enum type ... 1030
12.7.2.8 Creating fragments ... 1032
12.7.2.9 Importing fragments ... 1033
12.7.2.10 Combining definitions ... 1033
12.7.2.11 Handling tag names that contain special characters ... 1034
12.7.3 Configuring use of user-defined Web pages ... 1036
12.7.4 Configuring the entry page ... 1037
12.7.5 Programming the WWW instruction for user-defined web pages ... 1038
12.7.6 Downloading the program blocks to the CPU ... 1039
12.7.7 Accessing the user-defined Web pages ... 1040
12.7.8 Constraints specific to user-defined Web pages ... 1041
12.7.9 Example of a user-defined web page ... 1042
12.7.9.1 Web page for monitoring and controlling a wind turbine ... 1042
12.7.9.2 Reading and displaying controller data ... 1044
12.7.9.3 Using an enum type ... 1045
12.7.9.4 Writing user input to the controller ... 1046
12.7.9.5 Writing a special variable ... 1047
12.7.9.6 Reference: HTML listing of remote wind turbine monitor Web page ... 1047
12.7.9.7 Configuration in STEP 7 of the example Web page ... 1051
12.7.10 Setting up user-defined Web pages in multiple languages ... 1052
12.7.10.1 Creating the folder structure ... 1053
12.7.10.2 Programming the language switch ... 1053
12.7.10.3 Configuring STEP 7 to use a multi-language page structure ... 1057
12.7.11 Advanced user-defined Web page control ... 1057

12.8 Constraints ... 1061
12.8.1 Use of JavaScript ... 1062
12.8.2 Feature restrictions when the Internet options do not allow cookies ... 1062
12.8.3 Rules for entering tag names and values ... 1062
12.8.4 Importing the Siemens security certificate ... 1063
12.8.5 Importing CSV format data logs to non-USA/UK versions of Microsoft Excel ... 1065

13 Communication processor and Modbus TCP 1067

13.1 Using the serial communication interfaces 1067

13.2 Biasing and terminating an RS485 network connector 1068

13.3 Point-to-point (PtP) communication 1070
13.3.1 PtP, Freeport communication 1070
13.3.2 3964(R) communication 1072
13.3.3 Configuring the PtP Freeport communication 1073
13.3.3.1 Managing flow control 1075
13.3.3.2 Configuring transmit (send) parameters 1076
13.3.3.3 Configuring receive parameters 1077
13.3.4 Configuring 3964(R) communication 1085
13.3.4.1 Configuring the 3964(R) communication ports 1085
13.3.4.2 Configuring the 3964(R) priority and protocol parameters 1086
13.3.5 Point-to-point instructions 1088
13.3.5.1 Common parameters for Point-to-Point instructions 1088
13.3.5.2 Port_Config (Configure communication parameters dynamically) 1090
13.3.5.3 Send_Config (Configure serial transmission parameters dynamically) 1093
13.3.5.4 Receive_Config (Configure serial receive parameters dynamically) 1095
13.3.5.5 P3964_Config (Configuring the 3964(R) protocol) 1101
13.3.5.6 Send_P2P (Transmit send buffer data) 1103
13.3.5.7 Receive_P2P (Enable receive messages) 1108
13.3.5.8 Receive_Reset (Delete receive buffer) 1110
13.3.5.9 Signal_Get (Query RS-232 signals) 1110
13.3.5.10 Signal_Set (Set RS-232 signals) 1112
13.3.5.11 Get_Features 1113
13.3.5.12 Set_Features 1114
13.3.6 Programming the PtP communications 1115
13.3.6.1 Polling architecture 1117
13.3.7 Example: Point-to-Point communication 1118
13.3.7.1 Configuring the communication module 1119
13.3.7.2 RS422 and RS485 operating modes 1122
13.3.7.3 Programming the STEP 7 program 1125
13.3.7.4 Configuring the terminal emulator 1126
13.3.7.5 Running the example program 1127

13.4 Universal serial interface (USS) communication 1127
13.4.1 Selecting the version of the USS instructions 1130
13.4.2 Requirements for using the USS protocol 1131
13.4.3 USS instructions 1134
13.4.3.1 USS_Port_Scan (Edit communication using USS network) 1134
13.4.3.2 USS_Drive_Control (Swap data with drive) 1135
13.4.3.3 USS_Read_Param (Readout parameters from the drive) 1138
13.4.3.4 USS_Write_Param (Change parameters in the drive) 1139
13.4.4 USS status codes 1141
13.4.5 USS general drive setup requirements 1143
13.4.6 Example: USS general drive connection and setup 1143

13.5 Modbus communication 1147
13.5.1 Overview of Modbus RTU and Modbus TCP communication 1147
13.5.2 Modbus TCP 1150
13.5.2.1 Overview 1150
13.5.2.2 Selecting the version of the Modbus TCP instructions 1151

13.5.2.3 Modbus TCP instructions ... 1151
13.5.2.4 Modbus TCP examples ... 1170
13.5.3 Modbus RTU ... 1175
13.5.3.1 Overview ... 1175
13.5.3.2 Selecting the version of the Modbus RTU instructions ... 1177
13.5.3.3 Maximum number of supported Modbus slaves ... 1177
13.5.3.4 Modbus RTU instructions ... 1178
13.5.3.5 Modbus RTU examples ... 1200

13.6 Legacy PtP communication (CM/CB 1241 only) ... 1204
13.6.1 Legacy point-to-point instructions ... 1204
13.6.1.1 PORT_CFG (Configure communication parameters dynamically) ... 1204
13.6.1.2 SEND_CFG (Configure serial transmission parameters dynamically) ... 1206
13.6.1.3 RCV_CFG (Configure serial receive parameters dynamically) ... 1208
13.6.1.4 SEND_PTP (Transmit send buffer data) ... 1212
13.6.1.5 RCV_PTP (Enable receive messages) ... 1215
13.6.1.6 RCV_RST (Delete receive buffer) ... 1216
13.6.1.7 SGN_GET (Query RS-232 signals) ... 1217
13.6.1.8 SGN_SET (Set RS-232 signals) ... 1218

13.7 Legacy USS communication (CM/CB 1241 only) ... 1220
13.7.1 Selecting the version of the USS instructions ... 1221
13.7.2 Requirements for using the USS protocol ... 1222
13.7.3 Legacy USS instructions ... 1225
13.7.3.1 USS_PORT (Edit communication using USS network) instruction ... 1225
13.7.3.2 USS_DRV (Swap data with drive) instruction ... 1226
13.7.3.3 USS_RPM (Readout parameters from the drive) instruction ... 1229
13.7.3.4 USS_WPM (Change parameters in the drive) instruction ... 1230
13.7.4 Legacy USS status codes ... 1232
13.7.5 Legacy USS general drive setup requirements ... 1234

13.8 Legacy Modbus TCP communication ... 1235
13.8.1 Overview ... 1235
13.8.2 Selecting the version of the Modbus TCP instructions ... 1235
13.8.3 Legacy Modbus TCP instructions ... 1236
13.8.3.1 MB_CLIENT (Communicate using PROFINET as Modbus TCP client) ... 1236
13.8.3.2 MB_SERVER (Communicate using PROFINET as Modbus TCP server) ... 1243
13.8.4 Legacy Modbus TCP examples ... 1249
13.8.4.1 Example: Legacy MB_SERVER Multiple TCP connections ... 1249
13.8.4.2 Example: Legacy MB_CLIENT 1: Multiple requests with common TCP connection ... 1250
13.8.4.3 Example: Legacy MB_CLIENT 2: Multiple requests with different TCP connections ... 1251
13.8.4.4 Example: Legacy MB_CLIENT 3: Output image write request ... 1252
13.8.4.5 Example: Legacy MB_CLIENT 4: Coordinating multiple requests ... 1252

13.9 Legacy Modbus RTU communication (CM/CB 1241 only) ... 1253
13.9.1 Overview ... 1253
13.9.2 Selecting the version of the Modbus RTU instructions ... 1253
13.9.3 Legacy Modbus RTU instructions ... 1254
13.9.3.1 MB_COMM_LOAD (Configure port on the PtP module for Modbus RTU) ... 1254
13.9.3.2 MB_MASTER (Communicate using the PtP port as Modbus RTU master) ... 1257
13.9.3.3 MB_SLAVE (Communicate using the PtP port as Modbus RTU slave) ... 1263
13.9.4 Legacy Modbus RTU examples ... 1270
13.9.4.1 Example: Legacy Modbus RTU master program ... 1270
13.9.4.2 Example: Legacy Modbus RTU slave program ... 1272

13.10 Industrial Remote Communication (IRC) 1273
13.10.1 Telecontrol CPs overview 1273
13.10.2 Connection to a GSM network 1276
13.10.3 Applications of the CP 1242-7 1278
13.10.4 Other properties of the CP 1242-7 1279
13.10.5 Further information 1279
13.10.6 Accessories 1280
13.10.7 Configuration examples for telecontrol 1281

14 TeleService communication (SMTP email) 1287

14.1 TM_Mail (Send email) instruction 1287

15 Online and diagnostic tools 1295

15.1 Status LEDs 1295
15.2 Going online and connecting to a CPU 1299
15.3 Assigning a name to a PROFINET IO device online 1300
15.4 Setting the IP address and time of day 1302
15.5 Resetting to factory settings 1303
15.6 Updating firmware 1304
15.7 Formatting a SIMATIC memory card from STEP 7 1305
15.8 CPU operator panel for the online CPU 1306
15.9 Monitoring the cycle time and memory usage 1307
15.10 Displaying diagnostic events in the CPU 1308
15.11 Comparing offline and online CPUs 1309
15.12 Performing an online/offline topology comparison 1310
15.13 Monitoring and modifying values in the CPU 1311
15.13.1 Going online to monitor the values in the CPU 1312
15.13.2 Displaying status in the program editor 1313
15.13.3 Capturing a snapshot of the online values of a DB for restoring values 1313
15.13.4 Using a watch table to monitor and modify values in the CPU 1315
15.13.4.1 Using a trigger when monitoring or modifying PLC tags 1316
15.13.4.2 Enabling outputs in STOP mode 1317
15.13.5 Forcing values in the CPU 1318
15.13.5.1 Using the force table 1318
15.13.5.2 Operation of the Force function 1319
15.14 Downloading in RUN mode 1321
15.14.1 Prerequisites for "Download in RUN mode" 1322
15.14.2 Changing your program in RUN mode 1323
15.14.3 Downloading selected blocks 1324
15.14.4 Downloading a single selected block with a compile error in another block 1326
15.14.5 Modifying and downloading existing blocks in RUN mode 1327
15.14.6 System reaction if the download process fails 1329
15.14.7 Considerations when downloading in RUN mode 1330
15.15 Tracing and recording CPU data on trigger conditions 1332
15.16 Determining the type of wire break condition from an SM 1231 module 1334

15.17 Backing up and restoring a CPU ... 1337
15.17.1 Backup and restore options ... 1337
15.17.2 Backing up an online CPU ... 1338
15.17.3 Restoring a CPU ... 1341

A Technical specifications ... 1343

A.1 Siemens Online Support website ... 1343

A.2 General technical specifications ... 1343

A.3 PROFINET interface X1 port pinouts ... 1355

A.4 CPU 1211C ... 1356
A.4.1 General specifications and features ... 1356
A.4.2 Timers, counters, and code blocks supported by CPU 1211C ... 1358
A.4.3 Digital inputs and outputs ... 1362
A.4.4 Analog inputs ... 1363
A.4.4.1 Step response of the built-in analog inputs of the CPU ... 1364
A.4.4.2 Sample time for the built-in analog ports of the CPU ... 1364
A.4.4.3 Measurement ranges of the analog inputs for voltage (CPUs) ... 1364
A.4.5 CPU 1211C wiring diagrams ... 1365

A.5 CPU 1212C ... 1369
A.5.1 General specifications and features ... 1369
A.5.2 Timers, counters, and code blocks supported by CPU 1212C ... 1371
A.5.3 Digital inputs and outputs ... 1375
A.5.4 Analog inputs ... 1376
A.5.4.1 Step response of the built-in analog inputs of the CPU ... 1377
A.5.4.2 Sample time for the built-in analog ports of the CPU ... 1377
A.5.4.3 Measurement ranges of the analog inputs for voltage (CPUs) ... 1377
A.5.5 CPU 1212C wiring diagrams ... 1378

A.6 CPU 1214C ... 1382
A.6.1 General specifications and features ... 1382
A.6.2 Timers, counters and code blocks supported by CPU 1214C ... 1384
A.6.3 Digital inputs and outputs ... 1388
A.6.4 Analog inputs ... 1390
A.6.4.1 Step response of the built-in analog inputs of the CPU ... 1390
A.6.4.2 Sample time for the built-in analog ports of the CPU ... 1391
A.6.4.3 Measurement ranges of the analog inputs for voltage (CPUs) ... 1391
A.6.5 CPU 1214C wiring diagrams ... 1392

A.7 CPU 1215C ... 1396
A.7.1 General specifications and features ... 1396
A.7.2 Timers, counters and code blocks supported by CPU 1215C ... 1398
A.7.3 Digital inputs and outputs ... 1402
A.7.4 Analog inputs and outputs ... 1404
A.7.4.1 Step response of built-in analog inputs of the CPU ... 1404
A.7.4.2 Sample time for the built-in analog ports of the CPU ... 1405
A.7.4.3 Measurement ranges of the analog inputs for voltage (CPUs) ... 1405
A.7.4.4 Analog output specifications ... 1406
A.7.5 CPU 1215C wiring diagrams ... 1407

A.8 CPU 1217C ... 1412
A.8.1 General specifications and features ... 1412
A.8.2 Timers, counters and code blocks supported by CPU 1217C ... 1414

A.8.3 Digital inputs and outputs 1417
A.8.4 Analog inputs and outputs 1422
A.8.4.1 Analog input specifications 1422
A.8.4.2 Step response of built-in analog inputs of the CPU 1422
A.8.4.3 Sample time for the built-in analog ports of the CPU 1423
A.8.4.4 Measurement ranges of the analog inputs for voltage (CPUs) 1423
A.8.4.5 Analog output specifications 1424
A.8.5 CPU 1217C wiring diagrams 1425
A.8.6 CPU 1217C Differential Input (DI) detail and application example 1427
A.8.7 CPU 1217C Differential Output (DQ) detail and application example 1428

A.9 Digital signal modules (SMs) 1429
A.9.1 SM 1221 digital input specifications 1429
A.9.2 SM 1222 8-point digital output specifications 1431
A.9.3 SM 1222 16-point digital output specifications 1433
A.9.4 SM 1223 digital input/output V DC specifications 1438
A.9.5 SM 1223 digital input/output V AC specifications 1443

A.10 Analog signal modules (SMs) 1447
A.10.1 SM 1231 analog input module specifications 1447
A.10.2 SM 1232 analog output module specifications 1451
A.10.3 SM 1234 analog input/output module specifications 1453
A.10.4 Step response of the analog inputs 1457
A.10.5 Sample time and update times for the analog inputs 1458
A.10.6 Measurement ranges of the analog inputs for voltage and current (SB and SM) 1458
A.10.7 Measurement ranges of the analog outputs for voltage and current (SB and SM) 1460

A.11 Thermocouple and RTD signal modules (SMs) 1461
A.11.1 SM 1231 Thermocouple 1461
A.11.1.1 Basic operation for a thermocouple 1464
A.11.1.2 Selection tables for the SM 1231 thermocouple 1465
A.11.2 SM 1231 RTD 1467
A.11.2.1 Selection tables for the SM 1231 RTD 1471

A.12 Technology modules 1474
A.12.1 SM 1278 4xIO-Link Master SM 1474
A.12.1.1 SM 1278 4xIO-Link Master overview 1477
A.12.1.2 Connecting 1480
A.12.1.3 Parameters/address space 1482
A.12.1.4 Interrupt, error, and system alarms 1485

A.13 Digital signal boards (SBs) 1488
A.13.1 SB 1221 200 kHz digital input specifications 1488
A.13.2 SB 1222 200 kHz digital output specifications 1491
A.13.3 SB 1223 200 kHz digital input / output specifications 1494
A.13.4 SB 1223 2 X 24 V DC input / 2 X 24 V DC output specifications 1498

A.14 Analog signal boards (SBs) 1501
A.14.1 SB 1231 1 analog input specifications 1501
A.14.2 SB 1232 1 analog output specifications 1503
A.14.3 Measurement ranges for analog inputs and outputs 1505
A.14.3.1 Step response of the analog inputs 1505
A.14.3.2 Sample time and update times for the analog inputs 1506
A.14.3.3 Measurement ranges of the analog inputs for voltage and current (SB and SM) 1506
A.14.3.4 Measurement ranges of the analog outputs for voltage and current (SB and SM) 1507

A.14.4 Thermocouple signal boards (SBs) ... 1508
A.14.4.1 SB 1231 1 analog thermocouple input specifications ... 1508
A.14.4.2 Basic operation for a thermocouple ... 1510
A.14.5 RTD signal boards (SBs) ... 1514
A.14.5.1 SB 1231 1 analog RTD input specifications ... 1514
A.14.5.2 Selection tables for the SB 1231 RTD ... 1517
A.15 BB 1297 Battery board ... 1519
A.16 Communication interfaces ... 1522
A.16.1 PROFIBUS ... 1522
A.16.1.1 CM 1242-5 PROFIBUS DP SLAVE ... 1522
A.16.1.2 Pinout of the D-sub socket of the CM 1242-5 ... 1523
A.16.1.3 CM 1243-5 PROFIBUS DP Master ... 1524
A.16.1.4 Pinout of the D-sub socket of the CM 1243-5 ... 1525
A.16.2 CP 1242-7 ... 1526
A.16.2.1 CP 1242-7 GPRS ... 1526
A.16.2.2 GSM/GPRS antenna ANT794-4MR ... 1528
A.16.2.3 Flat antenna ANT794-3M ... 1529
A.16.3 CM 1243-2 AS-i master ... 1529
A.16.3.1 Technical data for the AS-i master CM 1243-2 ... 1529
A.16.3.2 Electrical connections of the AS-i master ... 1530
A.16.4 RS232, RS422, and RS485 ... 1532
A.16.4.1 CB 1241 RS485 specifications ... 1532
A.16.4.2 CM 1241 RS232 specifications ... 1535
A.16.4.3 CM 1241 RS422/485 specifications ... 1536
A.17 TeleService (TS Adapter and TS Adapter modular) ... 1538
A.18 SIMATIC memory cards ... 1538
A.19 Input simulators ... 1538
A.20 S7-1200 Potentiometer module ... 1540
A.21 I/O expansion cable ... 1542
A.22 Companion products ... 1542
A.22.1 PM 1207 power module ... 1542
A.22.2 CSM 1277 compact switch module ... 1543
A.22.3 CM CANopen module ... 1543
A.22.4 RF120C communications module ... 1544
A.22.5 SM 1238 Energy meter module ... 1544
A.22.6 SIWAREX electronic weighing systems ... 1544
B Calculating a power budget ... 1545
C Ordering Information ... 1549
C.1 CPU modules ... 1549
C.2 Signal modules (SMs), signal boards (SBs), and battery boards (BBs) ... 1550
C.3 Communication ... 1551
C.4 Fail-Safe CPUs and signal modules ... 1553
C.5 Other modules ... 1553
C.6 Memory cards ... 1553

C.7 Basic HMI devices 1554
C.8 Spare parts and other hardware 1554
C.9 Programming software 1559
D Device exchange and spare parts compatibility 1561
D.1 Exchanging a V3.0 CPU for a V4.2.x CPU 1561
D.2 S7-1200 V3.0 and earlier terminal block spare kits 1568
Index 1571

Product overview

1

1.1 Introducing the S7-1200 PLC

The S7-1200 controller provides the flexibility and power to control a wide variety of devices in support of your automation needs. The compact structure, flexible configuration, and powerful instruction set combine to make the S7-1200 a perfect solution for controlling a wide variety of applications.

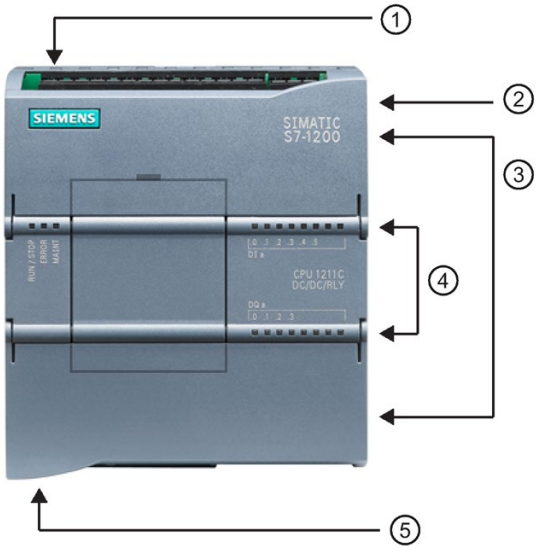
The CPU combines the following elements and more in a compact housing to create a powerful controller:

- A microprocessor
- An integrated power supply
- Input and output circuits
- Built-in PROFINET
- High-speed motion control I/O

After you download your program, the CPU contains the logic required to monitor and control the devices in your application. The CPU monitors the inputs and changes the outputs according to the logic of your user program, which can include Boolean logic, counting, timing, complex math operations, motion control, and communications with other intelligent devices.

The CPU provides a PROFINET port for communication over a PROFINET network. Additional modules are available for communicating over networks and protocols such as the following:

- PROFIBUS
- GPRS
- LTE
- WAN
- RS485
- RS232
- RS422
- IEC
- DNP3
- USS
- MODBUS



① Power connector
② Memory card slot under top door
③ Removable user wiring connectors (behind the doors)
④ Status LEDs for the onboard I/O
⑤ PROFINET connector (on the bottom of the CPU)

Several security features help protect access to both the CPU and the control program:

- Every CPU provides password protection (Page 204) that allows you to configure access to the CPU functions.
- You can use "know-how protection" (Page 207) to hide the code within a specific block.
- You can use copy protection (Page 208) to bind your program to a specific memory card or CPU.

Table 1- 1 Comparing the CPU models

Feature		CPU 1211C	CPU 1212C	CPU 1214C	CPU 1215C	CPU 1217C
Physical size (mm)		90 x 100 x 75		110 x 100 x 75	130 x 100 x 75	150 x 100 x 75
User memory	Work	50 Kbytes	75 Kbytes	100 Kbytes	125 Kbytes	150 Kbytes
	Load	1 Mbyte	2 Mbytes	4 Mbytes		
	Retentive	10 Kbytes				
Local onboard I/O	Digital	6 inputs/ 4 outputs	8 inputs/ 6 outputs	14 inputs/ 10 outputs		
	Analog	2 inputs			2 inputs/2 outputs	
Process image size	Inputs (I)	1024 bytes				
	Outputs (Q)	1024 bytes				
Bit memory (M)		4096 bytes		8192 bytes		
Signal module (SM) expansion		None	2	8		
Signal board (SB), Battery board (BB), or communication board (CB)		1				
Communication module (CM) (left-side expansion)		3				

Feature		CPU 1211C	CPU 1212C	CPU 1214C	CPU 1215C	CPU 1217C
High-speed counters	Total	Up to 6 configured to use any built-in or SB inputs				
	1 MHz	-				Ib.2 to Ib.5
	100/[1]80 kHz	Ia.0 to Ia.5				
	30/[1]20 kHz	--	Ia.6 to Ia.7	Ia.6 to Ib.5		Ia.6 to Ib.1
	200 kHz[3]					
Pulse outputs[2]	Total	Up to 4 configured to use any built-in or SB outputs				
	1 MHz	--				Qa.0 to Qa.3
	100 kHz	Qa.0 to Qa.3				Qa.4 to Qb.1
	20 kHz	--	Qa.4 to Qa.5	Qa.4 to Qb.1		--
Memory card		SIMATIC memory card (optional)				
Data logs	Number	Maximum 8 open at one time				
	Size	500 MB per data log or as limited by maximum available load memory				
Real time clock retention time		20 days, typ./12 day min. at 40 degrees C (maintenance-free Super Capacitor)				
PROFINET Ethernet communication port		1			2	
Real math execution speed		2.3 µs/instruction				
Boolean execution speed		0.08 µs/instruction				

1 The slower speed is applicable when the HSC is configured for quadrature mode of operation.

2 For CPU models with relay outputs, you must install a digital signal (SB) to use the pulse outputs.

3 Up to 200 kHz are available with the SB 1221 DI x 24 V DC 200 kHz and SB 1221 DI 4 x 5 V DC 200 kHz.

The different CPU models provide a diversity of features and capabilities that help you create effective solutions for your varied applications. For detailed information about a specific CPU, see the technical specifications (Page 1343).

Table 1- 2 Blocks, timers, and counters supported by S7-1200

Element			Description				
Blocks	Type		OB, FB, FC, DB				
	Size	CPU Model	CPU 1211C	CPU 1212C	CPU 1214C	CPU 1215C	CPU 1217C
		Code blocks	50KB	64KB	64KB	64KB	64KB
		Linked[1] data blocks	50KB	75KB	100KB	125KB	150KB
		Unlinked[2] data blocks	256KB	256KB	256KB	256KB	256KB
	Quantity		Up to 1024 blocks total (OBs + FBs + FCs + DBs)				
	Nesting depth		16 from the program cycle or startup OB; 6 from any interrupt event OB[3]				
	Monitoring		Status of 2 code blocks can be monitored simultaneously				
OBs	Program cycle		Multiple				
	Startup		Multiple				
	Time-delay interrupts		4 (1 per event)				
	Cyclic interrupts		4 (1 per event)				
	Hardware interrupts		50 (1 per event)				
	Time error interrupts		1				
	Diagnostic error interrupts		1				
	Pull or plug of modules		1				
	Rack or station failure		1				
	Time of day		Multiple				
	Status		1				
	Update		1				
	Profile		1				
Timers	Type		IEC				
	Quantity		Limited only by memory size				
	Storage		Structure in DB, 16 bytes per timer				
Counters	Type		IEC				
	Quantity		Limited only by memory size				
	Storage		Structure in DB, size dependent upon count type • SInt, USInt: 3 bytes • Int, UInt: 6 bytes • DInt, UDInt: 12 bytes				

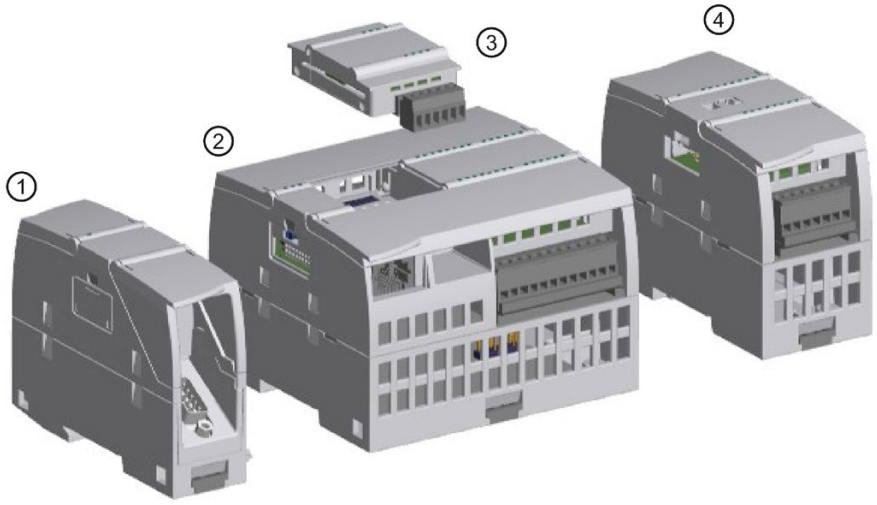
1 Stored in work memory and load memory

2 Stored only in load memory

3 Safety programs use two nesting levels. The user program therefore has a nesting depth of four in safety programs.

1.2 Expansion capability of the CPU

The S7-1200 family provides a variety of modules and plug-in boards for expanding the capabilities of the CPU with additional I/O or other communication protocols. For detailed information about a specific module, see the technical specifications (Page 1343).



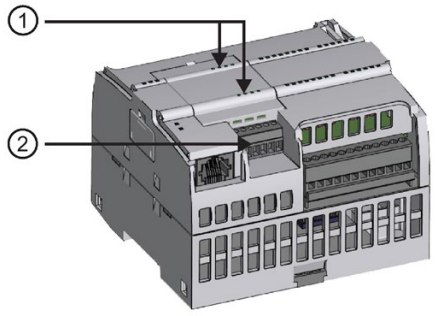
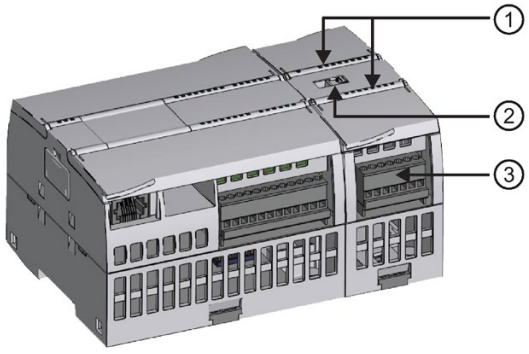
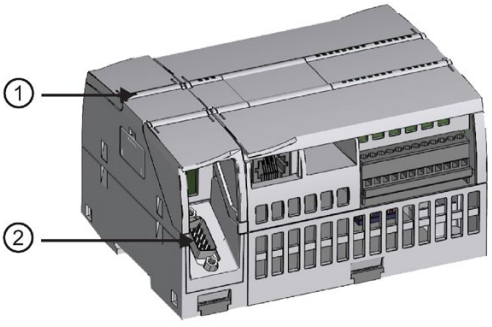
① Communication module (CM) or communication processor (CP) (Page 1522)

② CPU (CPU 1211C (Page 1356), CPU 1212C (Page 1369), CPU 1214C (Page 1382), CPU 1215C (Page 1396), CPU 1217C (Page 1412))

③ Signal board (SB) (digital SB (Page 1488), analog SB (Page 1501)), communication board (CB) (Page 1532), or Battery Board (BB) CPU (CPU 1211C, CPU 1212C, CPU 1214C, CPU 1215C, CPU 1217C) (Page 1519)

④ Signal module (SM) (digital SM (Page 1429), analog SM (Page 1447), thermocouple SM (Page 1461), RTD SM (Page 1467), technology SM) (Page 1474)

Table 1- 3 S7-1200 expansion modules

Type of module	Description
The CPU supports one plug-in expansion board: • A signal board (SB) provides additional I/O for your CPU. The SB connects on the front of the CPU. • A communication board (CB) allows you to add another communication port to your CPU. • A battery board (BB) allows you to provide long term backup of the realtime clock.	
	① Status LEDs on the SB
	② Removable user wiring connector
Signal modules (SMs) add additional functionality to the CPU. SMs connect to the right side of the CPU. • Digital I/O • Analog I/O • RTD and thermocouple • SM 1278 IO-Link Master • SM 1238 Energy Meter (https://support.industry.siemens.com/cs/ww/en/view/109483435)	
	① Status LEDs
	② Bus connector slide tab
	③ Removable user wiring connector
Communication modules (CMs) and communications processors (CPs) add communication options to the CPU, such as for PROFIBUS or RS232/RS485 connectivity (for PtP, Modbus or USS), or the AS-i master. A CP provides capabilities for other types of communication, such as connecting to the CPU over a GPRS, LTE, IEC, DNP3, or WDC network. • The CPU supports up to three CMs or CPs • Each CM or CP connects to the left side of the CPU (or to the left side of another CM or CP)	
	① Status LEDs
	② Communication connector

1.3 Basic HMI panels

The SIMATIC HMI Basic Panels provide touch-screen devices for basic operator control and monitoring tasks. All panels have a protection rating for IP65 and have CE, UL, cULus, and NEMA 4x certification.

The available Basic HMI panels (Page 1554)are described below:

- KTP400 Basic: 4" Touch screen with 4 configurable keys, a resolution of 480 x 272 and 800 tags
- KTP700 Basic: 7" Touch screen with 8 configurable keys, a resolution of 800 x 480 and 800 tags
- KTP700 Basic DP: 7" Touch screen with 8 configurable keys, a resolution of 800 x 480 and 800 tags
- KTP900 Basic: 9" Touch screen with 8 configurable keys, a resolution of 800 x 480 and 800 tags
- KTP1200 Basic: 12" Touch screen with 10 configurable keys, a resolution of 800 x 480 and 800 tags
- KTP 1200 Basic DP: 12" Touch screen with 10 configurable keys, a resolution of 800 x 400 and 800 tags

New features

2

The following features are new in the V4.2.3 release:

- Performance improvements in some library instructions
- Reading from and writing to multi-dimensional arrays from user-defined Web pages
- Corrections to this manual since the previous release

New Modbus capabilities

For the Modbus TCP, MB_SERVER and Modbus RTU, Modbus_Slave instructions, you can now perform the following:

- Limit the output bytes to which you can write using the variables, "QB_Start" and "QB_Count"
- Limit the output bytes from which you can read using the variables, "QB_Read_Start" and "QB_Read_Count"
- Limit the input bytes from which you can read using the variables, "IB_Read_Start" and "QI_Read_Count"

For the Modbus TCP, MB_SERVER and Modbus RTU, Modbus_Slave instructions, you can now perform the following:

- As of version V5.0 of the MB_SERVER instruction or V4.0 of the Modbus_Slave instruction and firmware (FW) version V4.2 of the S7-1200 CPU, you can access data areas in DBs instead of directly accessing process images and holding registers.

For the Modbus TCP, MB_SERVER, you can now perform the following:

- Update the New Data Ready (NDR) parameter in the same call that processes a Modbus TCP write request
- Update the Data Ready (DR) parameter in the same call that processes a Modbus TCP write request

Exchanging your V3.0 CPU for a V4.x.x CPU

If you are replacing an S7-1200 V3.0 CPU with an S7-1200 V4.x.x CPU, take note of the documented differences (Page 1561) in the versions and the required user actions.

See also

S7-1200 Functional Safety manual
(https://support.industry.siemens.com/cs/ww/en/view/104547552)

STEP 7 programming software

3

STEP 7 provides a user-friendly environment to develop, edit, and monitor the logic needed to control your application, including the tools for managing and configuring all of the devices in your project, such as controllers and HMI devices. To help you find the information you need, STEP 7 provides an extensive online help system.

STEP 7 provides standard programming languages for convenience and efficiency in developing the control program for your application.

- LAD (ladder logic) (Page 193) is a graphical programming language. The representation is based on circuit diagrams.
- FBD (Function Block Diagram) (Page 194) is a programming language that is based on the graphical logic symbols used in Boolean algebra.
- SCL (structured control language) (Page 195) is a text-based, high-level programming language.

When you create a code block, you select the programming language to be used by that block. Your user program can utilize code blocks created in any or all of the programming languages.

Note

STEP 7 is the programming and configuration software component of the TIA Portal. The TIA Portal, in addition to STEP 7, also includes WinCC for designing and executing runtime process visualization, and includes online help for WinCC as well as STEP 7.

3.1 System requirements

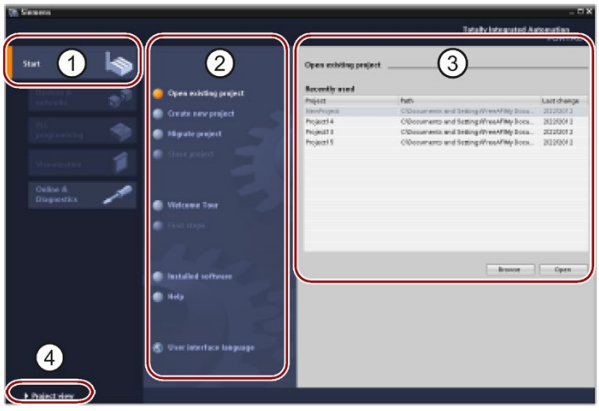
You must install STEP 7 with Administrator privileges.

Table 3- 1 System requirements

Hardware/software	Requirements
Processor type	Intel® Core™ i5-3320M 3.3 GHz or better
RAM	8 GB
Available hard disk space	2 GB on system drive C:\
Operating systems	You can use STEP 7 with the following operating systems (64-bit only): • Microsoft Windows 7 Home Premium SP1 or higher (STEP 7 Basic only, not supported for STEP 7 Professional) • Microsoft Windows 7 or higher (Professional SP1, Enterprise SP1, Ultimate SP1) • Microsoft Windows 8.1 (STEP 7 Basic only, not supported for STEP 7 Professional) • Microsoft Windows 8.1 (Professional, Enterprise) • Microsoft Server 2008 R2 StdE SP1 (STEP 7 Professional only) • Microsoft Server 2012 R2 StdE
Graphics card	32 MB RAM 24-bit color depth
Screen resolution	1920 x 1080 (recommended)
Network	10 Mbit/s Ethernet or faster, for communication between STEP 7 and the CPU
Optical drive	DVD-ROM

3.2 Different views to make the work easier

STEP 7 provides a user-friendly environment to develop controller logic, configure HMI visualization, and setup network communication. To help increase your productivity, STEP 7 provides two different views of the project: a task-oriented set of portals that are organized on the functionality of the tools (Portal view), or a project-oriented view of the elements within the project (Project view). Choose which view helps you work most efficiently. With a single click, you can toggle between the Portal view and the Project view.



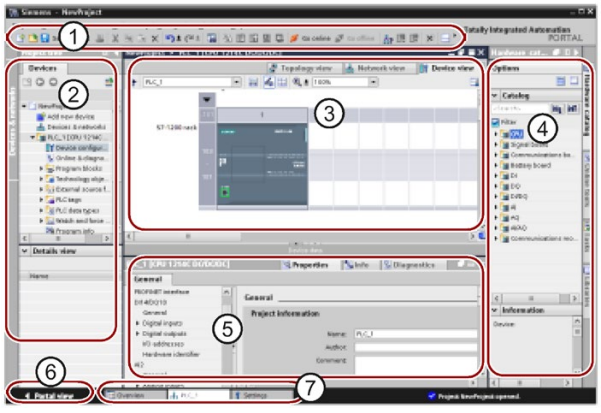
Portal view

① Portals for the different tasks

② Tasks for the selected portal

③ Selection panel for the selected action

④ Changes to the Project view



Project view

① Menus and toolbar

② Project navigator

③ Work area

④ Task cards

⑤ Inspector window

⑥ Changes to the Portal view

⑦ Editor bar

With all of these components in one place, you have easy access to every aspect of your project. The work area consists of three tabbed views:

- Device view: Displays the device that you have added or selected and its associated modules
- Network view: Displays the CPUs and network connections in your network
- Topology view: Displays the PROFINET topology of the network including devices, passive components, ports, interconnections, and port diagnostics

Each view also enables you to perform configuration tasks. The inspector window shows the properties and information for the object that you have selected in the work area. As you select different objects, the inspector window displays the properties that you can configure. The inspector window includes tabs that allow you to see diagnostic information and other messages.

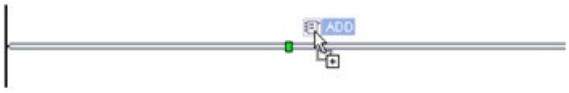
By showing all of the editors that are open, the editor bar helps you work more quickly and efficiently. To toggle between the open editors, simply click the different editor. You can also arrange two editors to appear together, arranged either vertically or horizontally. This feature allows you to drag and drop between editors.

The STEP 7 Information System provides extensive online help for all of the configuration, programming, and monitoring tools of STEP 7. You can refer to it for detailed explanations beyond what this manual provides.

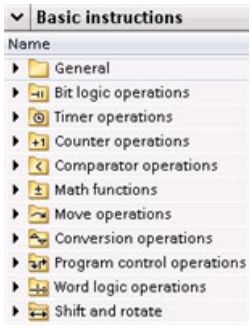
3.3 Easy-to-use tools

3.3.1 Inserting instructions into your user program

STEP 7 provides task cards that contain the instructions for your program. The instructions are grouped according to function.



To create your program, you drag instructions from the task card onto a network.

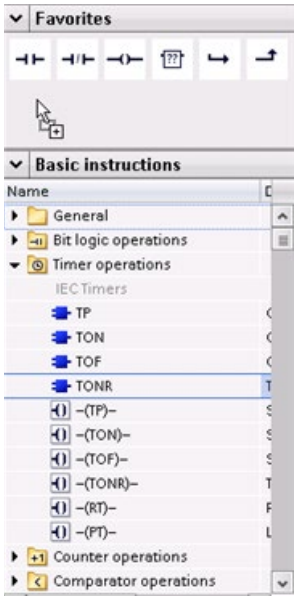


3.3.2 Accessing instructions from the "Favorites" toolbar

STEP 7 provides a "Favorites" toolbar to give you quick access to the instructions that you frequently use. Simply click the icon for the instruction to insert it into your network!



(For the "Favorites" in the instruction tree, double-click the icon.)



You can easily customize the "Favorites" by adding new instructions.

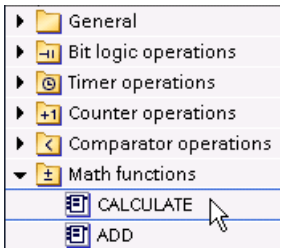
Simply drag and drop an instruction to the "Favorites".

The instruction is now just a click away!

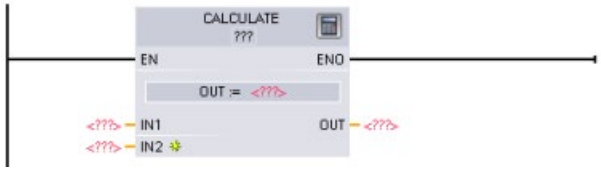


3.3.3 Creating a complex equation with a simple instruction

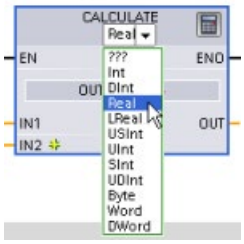
The Calculate instruction (Page 249) lets you create a math function that operates on multiple input parameters to produce the result, according to the equation that you define.



In the Basic instruction tree, expand the Math functions folder. Double-click the Calculate instruction to insert the instruction into your user program.



The unconfigured Calculate instruction provides two input parameters and an output parameter.

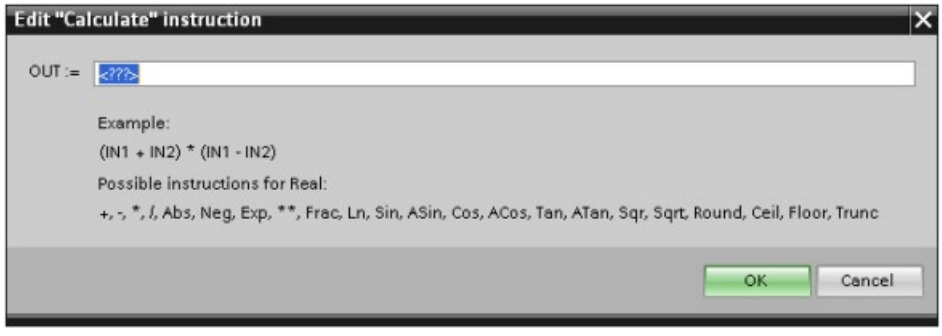


Click the "???" and select the data types for the input and output parameters. (The input and output parameters must all be the same data type.)

For this example, select the "Real" data type.



Click the "Edit equation" icon to enter the equation.



For this example, enter the following equation for scaling a raw analog value. (The "In" and "Out" designations correspond to the parameters of the Calculate instruction.)

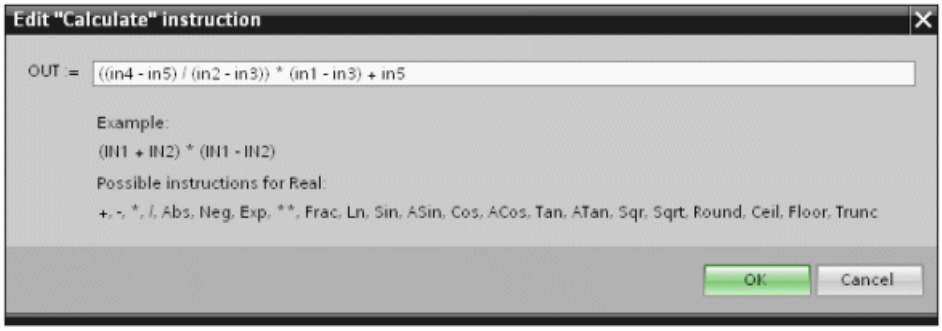
$Out_{value} = ((Out_{high} - Out_{low}) / (In_{high} - In_{low})) * (In_{value} - In_{low}) + Out_{low}$

Out = ((in4 - in5) / (in2 - in3)) * (in1 - in3) + in5

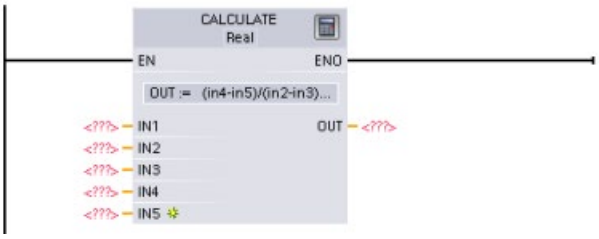
Where:			
	Out_{value}	(Out)	Scaled output value
	In_{value}	(in1)	Analog input value
	In_{high}	(in2)	Upper limit for the scaled input value
	In_{low}	(in3)	Lower limit for the scaled input value
	Out_{high}	(in4)	Upper limit for the scaled output value
	Out_{low}	(in5)	Lower limit for the scaled output value

In the "Edit Calculate" box, enter the equation with the parameter names:

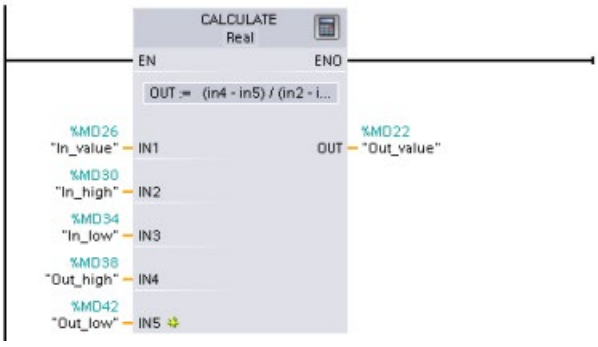
OUT = ((in4 - in5) / (in2 - in3)) * (in1 - in3) + in5



When you click "OK", the Calculate instruction creates the inputs required for the instruction.



Enter the tag names for the values that correspond to the parameters.



3.3.4 Adding inputs or outputs to a LAD or FBD instruction

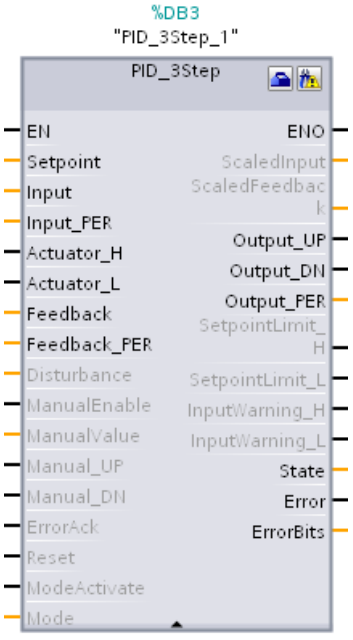


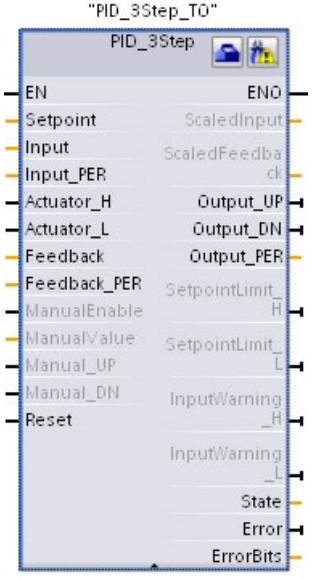
Some of the instructions allow you to create additional inputs or outputs.

- To add an input or output, click the "Create" icon or right-click on an input stub for one of the existing IN or OUT parameters and select the "Insert input" command.
- To remove an input or output, right-click on the stub for one of the existing IN or OUT parameters (when there are more than the original two inputs) and select the "Delete" command.

3.3.5 Expandable instructions

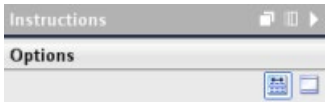
Some of the more complex instructions are expandable, displaying only the key inputs and outputs. To display all the inputs and outputs, click the arrow at the bottom of the instruction.



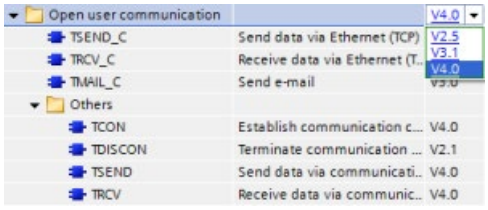


3.3.6 Selecting a version for an instruction

The development and release cycles for certain sets of instructions (such as Modbus, PID and motion) have created multiple released versions for these instructions. To help ensure compatibility and migration with older projects, STEP 7 allows you to choose which version of instruction to insert into your user program.



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.

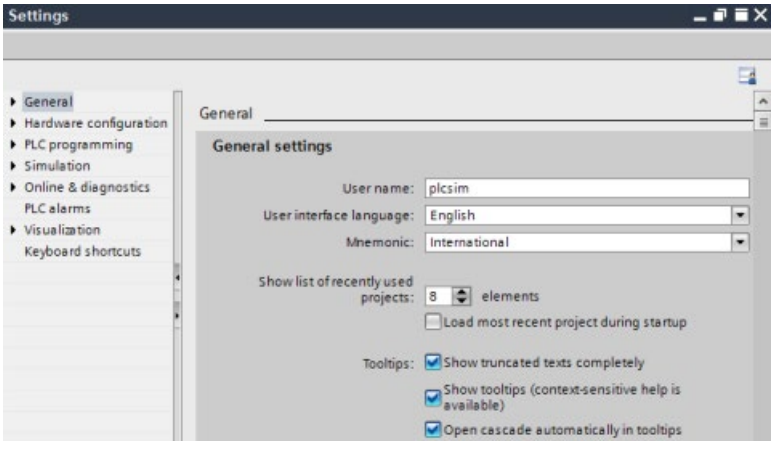


To change the version of the instruction, select the appropriate version from the drop-down list.

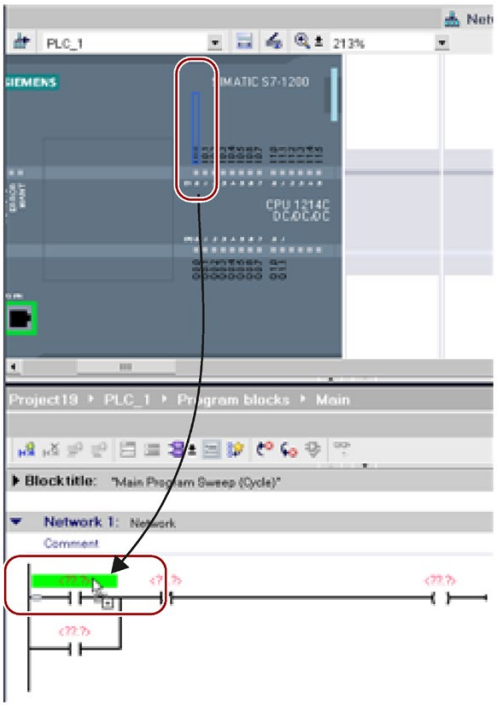
3.3.7 Modifying the appearance and configuration of STEP 7

You can select a variety of settings, such as the appearance of the interface, language, or the folder for saving your work.

Select the "Settings" command from the "Options" menu to change these settings.



3.3.8 Dragging and dropping between editors

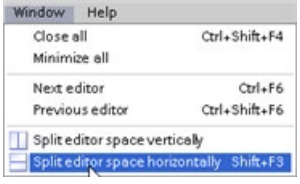


To help you perform tasks quickly and easily, STEP 7 allows you to drag and drop elements from one editor to another. For example, you can drag an input from the CPU to the address of an instruction in your user program.

You must zoom in at least 200% to select the inputs or outputs of the CPU.

Notice that the tag names are displayed not only in the PLC tag table, but also are displayed on the CPU.

To display two editors at one time, use the "Split editor" menu commands or buttons in the toolbar.





To toggle between the editors that have been opened, click the icons in the editor bar.



3.3.9 Changing the operating mode of the CPU

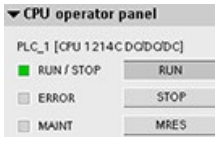
The CPU does not have a physical switch for changing the operating mode (STOP or RUN).

Use the "Start CPU" and "Stop CPU" toolbar buttons to change the operating mode of the CPU.



When you configure the CPU in the device configuration (Page 149), you configure the start-up behavior in the properties of the CPU (Page 165).

The "Online and diagnostics" portal also provides an operator panel for changing the operating mode of the online CPU. To use the CPU operator panel, you must be connected online to the CPU. The "Online tools" task card displays an operator panel that shows the operating mode of the online CPU. The operator panel also allows you to change the operating mode of the online CPU.



Use the button on the operator panel to change the operating mode (STOP or RUN). The operator panel also provides an MRES button for resetting the memory.

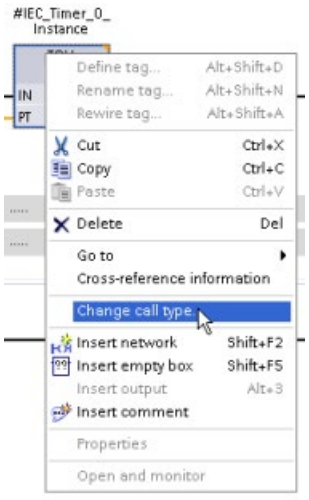
The color of the RUN/STOP indicator shows the current operating mode of the CPU. Yellow indicates STOP mode, and green indicates RUN mode.

From the device configuration in STEP 7 (Page 149) you can also configure the default operating mode on power up of the CPU (Page 87).

Note

You can also change the operating mode of the CPU from the Web server (Page 981) or the SIMATIC Automation Tool (https://support.industry.siemens.com/cs/ww/en/view/98161300).

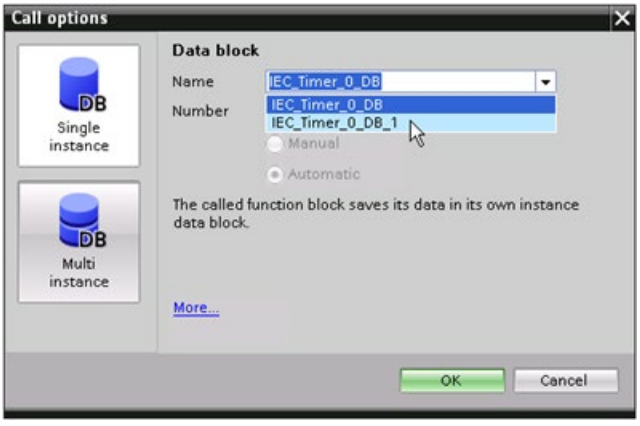
3.3.10 Changing the call type for a DB



STEP 7 allows you to easily create or change the association of a DB for an instruction or an FB that is in an FB.

- You can switch the association between different DBs.
- You can switch the association between a single-instance DB and a multi-instance DB.
- You can create an instance DB (if an instance DB is missing or not available).

You can access the "Change call type" command either by right-clicking the instruction or FB in the program editor or by selecting the "Block call" command from the "Options" menu.

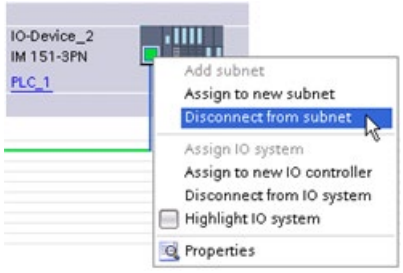


The "Call options" dialog allows you to select a single-instance or multi-instance DB. You can also select specific DBs from a drop-down list of available DBs.

3.3.11 Temporarily disconnecting devices from a network

From the network view, you can disconnect individual network devices from the subnet. Because the configuration of the device is not removed from the project, you can easily restore the connection to the device.





Right-click the interface port of the network device and select the "Disconnect from subnet" command from the context menu.

STEP 7 reconfigures the network connections, but does not remove the disconnected device from the project. While the network connection is deleted, the interface addresses are not changed.



When you download the new network connections, the CPU must be set to STOP mode.

To reconnect the device, simply create a new network connection to the port of the device.

3.3.12 Virtual unplugging of devices from the configuration



STEP 7 provides a storage area for "unplugged" modules. You can drag a module from the rack to save the configuration of that module. These unplugged modules are saved with your project, allowing you to reinsert the module in the future without having to reconfigure the parameters.

One use of this feature is for temporary maintenance. Consider a scenario where you might be waiting for a replacement module and plan to temporarily use a different module as a short-term replacement. You could drag the configured module from the rack to the "Unplugged modules" and then insert the temporary module.

3.4 Backward compatibility

STEP 7 V15 supports configuration and programming of the S7-1200 V4.2.x CPU and provides for all of the new features (Page 35).

You can download projects for S7-1200 V4.0 and V4.1 CPUs from STEP 7 (V13 SP1 or later) to an S7-1200 V4.2.x CPU. Your configuration and program will be limited to the set of features and instructions that the previous version of the S7-1200 CPU and your version of STEP 7 supported.

This backwards compatibility makes it possible for you to run programs on the new S7-1200 V4.2 CPU models that you have previously designed and programmed for older versions.

WARNING

Risks with copying and pasting program logic from older versions of STEP 7

Copying program logic from an older version of STEP 7 such as STEP 7 V12 into STEP 7 V15 can cause unpredictable behavior in program execution or failures to compile. Different versions of STEP 7 implement program elements differently. The compiler does not always detect the differences if you made the changes by pasting from an older version into STEP 7 V15. Executing unpredictable program logic could result in death or severe personal injury if you do not correct the program.

When using program logic from a release of STEP 7 earlier than STEP 7 V15, always upgrade the entire project to STEP 7 V15. Then you can copy, cut, paste, and edit program logic as necessary. In STEP 7 V15, you can open a project from STEP 7 V13 SP1 or later. STEP 7 then performs the necessary compatibility conversions and upgrades the program correctly. Such upgrade conversions and corrections are necessary for proper program compilation and execution. If your project is older than STEP 7 V13 SP1, you must upgrade the project incrementally to STEP 7 V15 (Page 1561).

You cannot download projects for V1.0, V2.0, or V3.0 S7-1200 CPUs to an S7-1200 V4.2.x CPU. See the Device exchange and spare parts compatibility (Page 1561) topic for guidelines on upgrading older projects to a project that you can download.

Note

Projects with S7-1200 V1.x CPU versions

You cannot open a STEP 7 project that contains S7-1200 V1.x CPUs in STEP 7 V15. In order to use your existing project, you must use STEP 7 V13 SP1 (with any update) to open your project and convert the S7-1200 V1.x CPUs to V2.0 or later. You can then use STEP 7 V15 to open the saved project with the converted CPUs.

Installation 4

4.1 Guidelines for installing S7-1200 devices

The S7-1200 equipment is designed to be easy to install. You can install an S7-1200 either on a panel or on a standard rail, and you can orient the S7-1200 either horizontally or vertically. The small size of the S7-1200 allows you to make efficient use of space.

Electrical equipment standards classify the SIMATIC S7-1200 system as Open Equipment. You must install the S7-1200 in a housing, cabinet, or electric control room. You should limit entry to the housing, cabinet, or electric control room to authorized personnel.

The installation should provide a dry environment for the S7-1200. SELV/PELV circuits are considered to provide protection against electric shock in dry locations.

The installation should provide the appropriate mechanical strength, flammability protection, and stability protection that is approved for open equipment in your particular location category according to applicable electrical and building codes.

Conductive contamination due to dust, moisture, and airborne pollution can cause operational and electrical faults in the PLC.

If you locate the PLC in an area where conductive contamination may be present, the PLC must be protected by an enclosure with appropriate protection rating. IP54 is one rating that is generally used for electronic equipment enclosures in dirty environments and may be appropriate for your application.

⚠WARNING

Improper installation of the S7-1200 can result in electrical faults or unexpected operation of machinery.

Electrical faults or unexpected machine operation can result in death, severe personal injury, and/or property damage.

All instructions for installation and maintenance of a proper operating environment must be followed to ensure the equipment operates safely.

Separate the S7-1200 devices from heat, high voltage, and electrical noise

As a general rule for laying out the devices of your system, always separate the devices that generate high voltage and high electrical noise from the low-voltage, logic-type devices such as the S7-1200.

When configuring the layout of the S7-1200 inside your panel, consider the heat-generating devices and locate the electronic-type devices in the cooler areas of your cabinet. Reducing the exposure to a high-temperature environment will extend the operating life of any electronic device.

Consider also the routing of the wiring for the devices in the panel. Avoid placing low-voltage signal wires and communications cables in the same tray with AC power wiring and high-energy, rapidly-switched DC wiring.

Provide adequate clearance for cooling and wiring

S7-1200 devices are designed for natural convection cooling. For proper cooling, you must provide a clearance of at least 25 mm above and below the devices. Also, allow at least 25 mm of depth between the front of the modules and the inside of the enclosure.

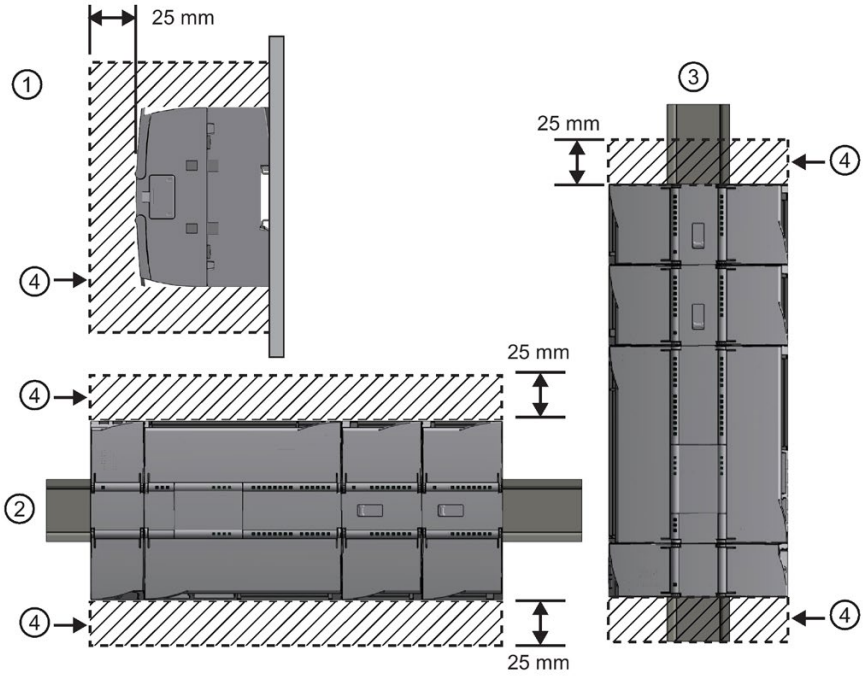
CAUTION

For vertical mounting, the maximum allowable ambient temperature is reduced by 10 degrees C.

Orient a vertically mounted S7-1200 system as shown in the following figure.

Ensure that the S7-1200 system is mounted correctly.

When planning your layout for the S7-1200 system, allow enough clearance for the wiring and communications cable connections.



①	Side view	③	Vertical installation
②	Horizontal installation	④	Clearance area

4.2 Power budget

Your CPU has an internal power supply that provides power for the CPU, the signal modules, signal board and communication modules and for other 24 V DC user power requirements.

Refer to the technical specifications (Page 1343) for information about the 5 V DC logic budget supplied by your CPU and the 5 V DC power requirements of the signal modules, signal boards, and communication modules. Refer to "Calculating a power budget" (Page 1545) to determine how much power (or current) the CPU can provide for your configuration.

The CPU provides a 24 V DC sensor supply that can supply 24 V DC for input points, for relay coil power on the signal modules, or for other requirements. If your 24 V DC power requirements exceed the budget of the sensor supply, then you must add an external 24 V DC power supply to your system. Refer to the technical specifications (Page 1343) for the 24 V DC sensor supply power budget for your particular CPU.

If you require an external 24 V DC power supply, ensure that the power supply is not connected in parallel with the sensor supply of the CPU. For improved electrical noise protection, it is recommended that the commons (M) of the different power supplies be connected.

WARNING

Connecting an external 24 V DC power supply in parallel with the 24 V DC sensor supply can result in a conflict between the two supplies as each seeks to establish its own preferred output voltage level

The result of this conflict can be shortened lifetime or immediate failure of one or both power supplies, with consequent unpredictable operation of the PLC system. Unpredictable operation could result in death, severe personal injury and/or property damage.

The DC sensor supply and any external power supply should provide power to different points.

Some of the 24 V DC power input ports in the S7-1200 system are interconnected, with a common logic circuit connecting multiple M terminals. For example, the following circuits are interconnected when designated as "not isolated" in the data sheets: the 24 V DC power supply of the CPU, the power input for the relay coil of an SM, or the power supply for a non-isolated analog input. All non-isolated M terminals must connect to the same external reference potential.

WARNING

Connecting non-isolated M terminals to different reference potentials will cause unintended current flows that may cause damage or unpredictable operation in the PLC and any connected equipment.

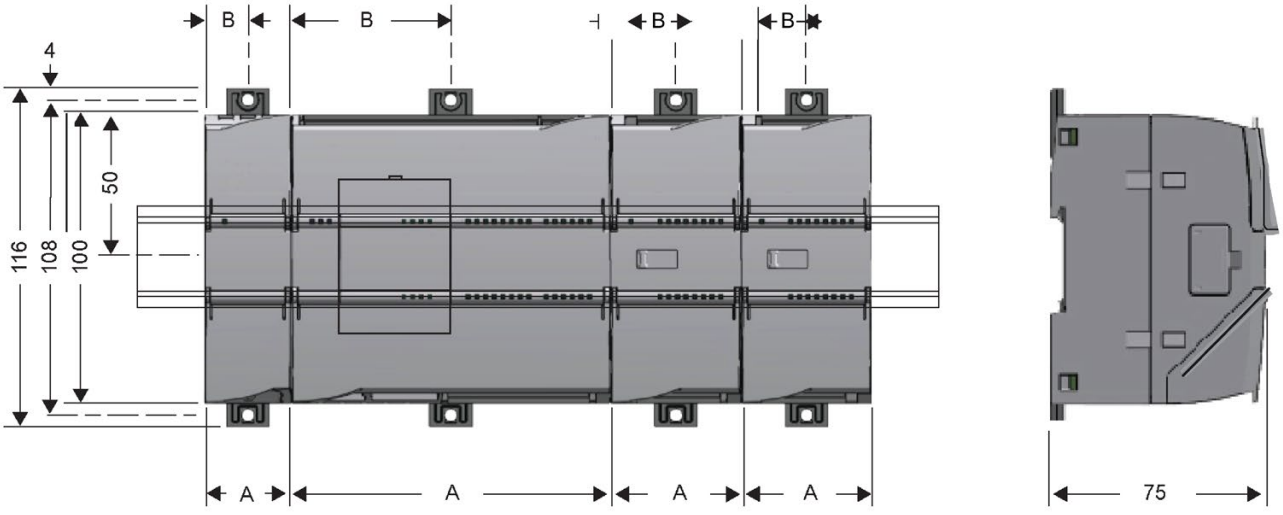
Failure to comply with these guidelines could cause damage or unpredictable operation which could result in death or severe personal injury and/or property damage.

Always ensure that all non-isolated M terminals in an S7-1200 system are connected to the same reference potential.

4.3 Installation and removal procedures

4.3.1 Mounting dimensions for the S7-1200 devices

CPU 1211C, CPU 1212C, CPU 1214C
(measurements in mm)



CPU 1215C, CPU 1217C
(measurements in mm)

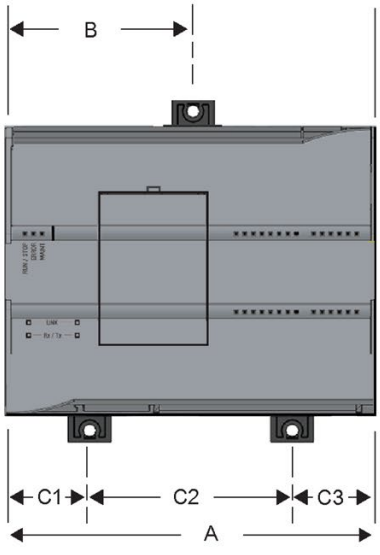


Table 4- 1 Mounting dimensions (mm)

S7-1200 Devices		Width A (mm)	Width B (mm)	Width C (mm)
CPU	CPU 1211C and CPU 1212C	90	45	--
	CPU 1214C	110	55	--
	CPU 1215C	130	65 (top)	Bottom: C1: 32.5 C2: 65 C3: 32.5
	CPU 1217C	150	75	Bottom: C1: 37.5 C2: 75 C3: 37.5
Signal modules	Digital 8 and 16 point Analog 2, 4, and 8 point Thermocouple 4 and 8 point RTD 4 point SM 1278 IO Link-Master	45	22.5	--
	Digital DQ 8 x Relay (Changeover)	70	35	--
	Analog 16 point RTD 8 point	70	35	--
	SM 1238 Energy Meter module	45	22.5	--
Communication interfaces	CM 1241 RS232, and CM 1241 RS422/485 CM 1243-5 PROFIBUS master and CM 1242-5 PROFIBUS slave CM 1242-2 AS-i Master CP 1242-7 GPRS V2 CP 1243-7 LTE-US CP 1243-7 LTE-EU CP 1243-1 CP 1243-8 IRC RF120C	30	15	--
	TS (TeleService) Adapter IE Advanced [1] TS (Teleservice) Adapter IE Basic [1] TS Adapter TS Module	 30 30	 15 15	 -- --

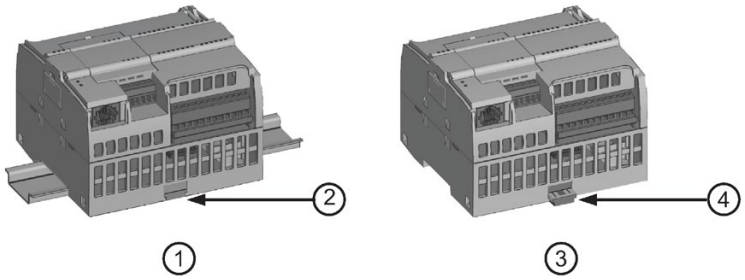
[1] Before installing the TS (TeleService) Adapter IE Advanced or IE Basic, you must first connect the TS Adapter and a TS module. The total width ("width A") is 60 mm.

Each CPU, SM, CM, and CP supports mounting on either a DIN rail or on a panel. Use the DIN rail clips on the module to secure the device on the rail. These clips also snap into an extended position to provide screw mounting positions to mount the unit directly on a panel. The interior dimension of the hole for the DIN clips on the device is 4.3 mm.

A 25 mm thermal zone must be provided above and below the unit for free air circulation.

Installing and removing the S7-1200 devices

The CPU can be easily installed on a standard DIN rail or on a panel. DIN rail clips are provided to secure the device on the DIN rail. The clips also snap into an extended position to provide a screw mounting position for panel-mounting the unit.



① DIN rail installation
② DIN rail clip in latched position
③ Panel installation
④ Clip in extended position for panel mounting

Before you install or remove any electrical device, ensure that the power to that equipment has been turned off. Also, ensure that the power to any related equipment has been turned off.

⚠ WARNING

Installation or removal of S7-1200 or related equipment with the power applied could cause electric shock or unexpected operation of equipment.

Failure to disable all power to the S7-1200 and related equipment during installation or removal procedures could result in death, severe personal injury and/or property damage due to electric shock or unexpected equipment operation.

Always follow appropriate safety precautions and ensure that power to the S7-1200 is disabled before attempting to install or remove S7-1200 CPUs or related equipment.

Always ensure that whenever you replace or install an S7-1200 device you use the correct module or equivalent device.

⚠ WARNING

Incorrect installation of an S7-1200 module may cause the program in the S7-1200 to function unpredictably.

Failure to replace an S7-1200 device with the same model, orientation, or order could result in death, severe personal injury and/or property damage due to unexpected equipment operation.

Replace an S7-1200 device with the same model, and be sure to orient and position it correctly.

WARNING

Do not disconnect equipment when a flammable or combustible atmosphere is present.

Disconnection of equipment when a flammable or combustible atmosphere is present may cause a fire or explosion which could result in death, serious injury and/or property damage.

Always follow appropriate safety precautions when a flammable or combustible atmosphere is present.

Note

Electrostatic discharge can damage the device or the receptacle on the CPU.

Make contact with a grounded conductive pad and/or wear a grounded wrist strap whenever you handle the device.

4.3.2 Installing and removing the CPU

You can install the CPU on a panel or on a DIN rail.

Note

Attach any communication modules to the CPU and install the assembly as a unit. Install signal modules separately after the CPU has been installed.

Consider the following when installing the units on the DIN rail or on a panel:

- For DIN rail mounting, make sure the upper DIN rail clip is in the latched (inner) position and that the lower DIN rail clip is in the extended position for the CPU and attached CMs.
- After installing the devices on the DIN rail, move the lower DIN rail clips to the latched position to lock the devices on the DIN rail.
- For panel mounting, make sure the DIN rail clips are pushed to the extended position.

To install the CPU on a panel, follow these steps:

1. Locate, drill, and tap the mounting holes (M4), using the dimensions shown in table, Mounting dimensions (mm) (Page 57).
2. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power.

3. Extend the mounting clips from the module. Make sure the DIN rail clips on the top and bottom of the CPU are in the extended position.
4. Secure the module to the panel, using a Pan Head M4 screw with spring and flat washer. Do not use a flat head screw.

Note

The type of screw will be determined by the material upon which it is mounted. You should apply appropriate torque until the spring washer becomes flat. Avoid applying excessive torque to the mounting screws. Do not use a flat head screw.

Note

Using DIN rail stops could be helpful if your CPU is in an environment with high vibration potential or if the CPU has been installed vertically. Use an end bracket (8WA1808 or 8WA1805) on the DIN rail to ensure that the modules remain connected. If your system is in a high-vibration environment, then panel-mounting the CPU will provide a greater level of vibration protection.

Table 4- 2 Installing the CPU on a DIN rail

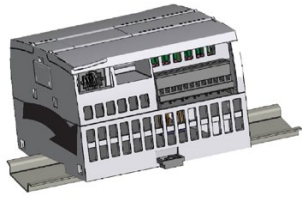
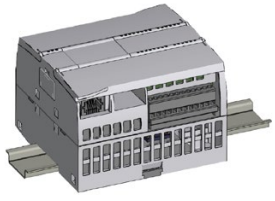
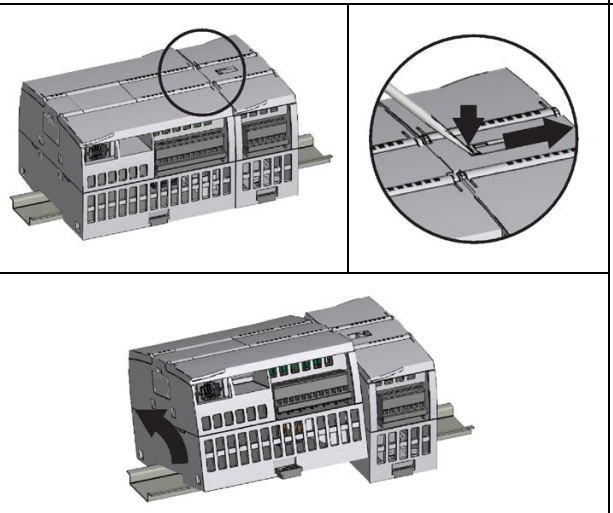
Task	Procedure
 	1. Install the DIN rail. Secure the rail to the mounting panel every 75 mm. 2. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 3. Hook the CPU over the top of the DIN rail. 4. Pull out the DIN rail clip on the bottom of the CPU to allow the CPU to fit over the rail. 5. Rotate the CPU down into position on the rail. 6. Push in the clips to latch the CPU to the rail.

Table 4- 3 Removing the CPU from a DIN rail

Task	Procedure
	1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Disconnect the I/O connectors, wiring, and cables from the CPU (Page 67). 3. Remove the CPU and any attached communication modules as a unit. All signal modules should remain installed. 4. If an SM is connected to the CPU, retract the bus connector: – Place a screwdriver beside the tab on the top of the signal module. – Press down to disengage the connector from the CPU. – Slide the tab fully to the right. 5. Remove the CPU: – Pull out the DIN rail clip to release the CPU from the rail. – Rotate the CPU up and off the rail, and remove the CPU from the system.

4.3.3 Installing and removing an SB, CB, or BB

Table 4- 4 Installing an SB, CB, or BB 1297

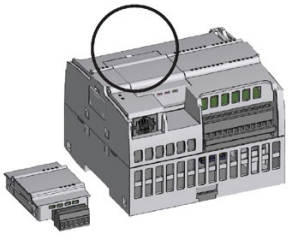
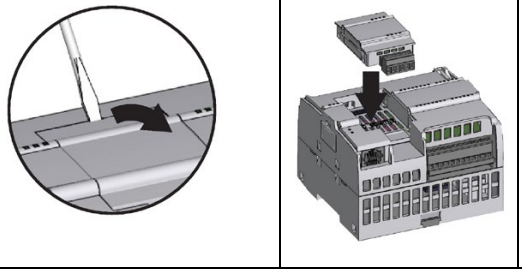
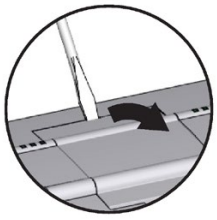
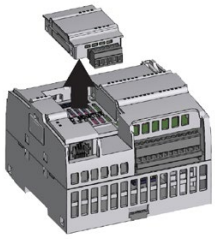
Task	Procedure
	1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Remove the top and bottom terminal block covers from the CPU. 3. Place a screwdriver into the slot on top of the CPU at the rear of the cover. 4. Gently pry the cover straight up and remove it from the CPU. 5. Place the module straight down into its mounting position in the top of the CPU. 6. Firmly press the module into position until it snaps into place. 7. Replace the terminal block covers.
	

Table 4- 5 Removing an SB, CB or BB 1297

Task	Procedure
  	1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Remove the top and bottom terminal block covers from the CPU. 3. Remove the signal board connector (if installed) by gently disengaging with a screwdriver. 4. Place a screwdriver into the slot on top of the module. 5. Gently pry the module up to disengage it from the CPU. 6. Without using a screwdriver, remove the module straight up from its mounting position in the top of the CPU. 7. Replace the cover onto the CPU. 8. Replace the terminal block covers.

Installing or replacing the battery in the BB 1297 battery board

The BB 1297 requires battery type CR1025. The battery is not included with the BB 1297 and must be purchased. To install or replace the battery, follow these steps:

1. In the BB 1297, install a new battery with the positive side of the battery on top, and the negative side next to the printed wiring board.
2. The BB 1297 is ready to be installed in the CPU. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power and follow the installation directions above to install the BB 1297.

To replace the battery in the BB 1297:

1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. Remove the BB 1297 from the CPU following the removal directions above.
2. Carefully remove the old battery using a small screwdriver. Push the battery out from under the clip.
3. Install a new CR1025 replacement battery with the positive side of the battery on top and the negative side next to the printed wiring board.
4. Re-install the BB 1297 battery board following the installation directions above.

WARNING
Installing an unspecified battery in the BB 1297, or otherwise connecting an unspecified battery to the circuit can result in fire or component damage and unpredictable operation of machinery. Fire or unpredictable operation of machinery can result in death, severe personal injury, or property damage. Use only the specified CR1025 battery for backup of the Real-time clock.

4.3.4 Installing and removing an SM

Table 4- 6 Installing an SM

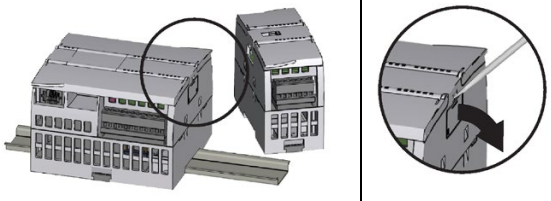
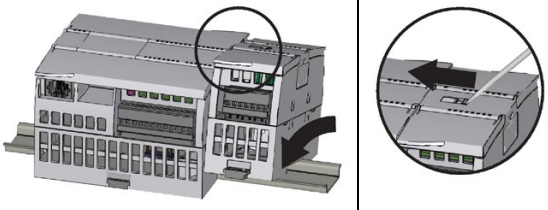
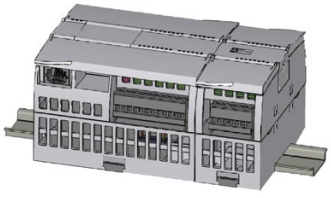
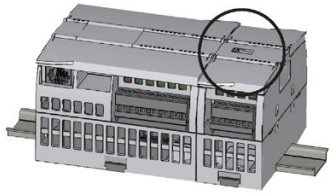
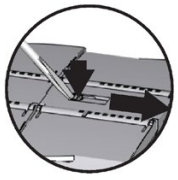
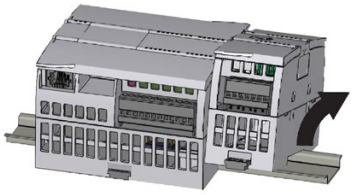
Task	Procedure
	Install your SM after installing the CPU. 1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Remove the cover for the connector from the right side of the CPU: – Insert a screwdriver into the slot above the cover. – Gently pry the cover out at its top and remove the cover. 3. Retain the cover for reuse.
	Connect the SM to the CPU: 1. Position the SM beside the CPU. 2. Hook the SM over the top of the DIN rail. 3. Pull out the bottom DIN rail clip to allow the SM to fit over the rail. 4. Rotate the SM down into position beside the CPU and push the bottom clip in to latch the SM onto the rail.
	Extending the bus connector makes both mechanical and electrical connections for the SM. 1. Place a screwdriver beside the tab on the top of the SM. 2. Slide the tab fully to the left to extend the bus connector into the CPU. Follow the same procedure to install a signal module to a signal module.

Table 4- 7 Removing an SM

Task	Procedure
 	You can remove any SM without removing the CPU or other SMs in place. 1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Remove the I/O connectors and wiring from the SM (Page 67). 3. Retract the bus connector. – Place a screwdriver beside the tab on the top of the SM. – Press down to disengage the connector from the CPU. – Slide the tab fully to the right. If there is another SM to the right, repeat this procedure for that SM.
	Remove the SM: 1. Pull out the bottom DIN rail clip to release the SM from the rail. 2. Rotate the SM up and off the rail. Remove the SM from the system. 3. If required, cover the bus connector on the CPU to avoid contamination. Follow the same procedure to remove a signal module from a signal module.

4.3.5 Installing and removing a CM or CP

Attach any communication modules to the CPU and install the assembly as a unit, as shown in Installing and removing the CPU (Page 60).

Table 4- 8 Installing a CM or CP

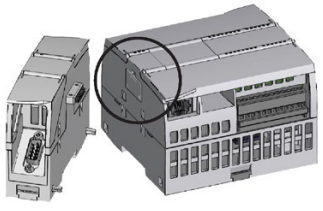
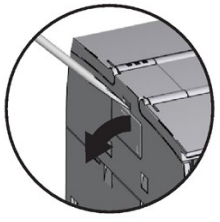
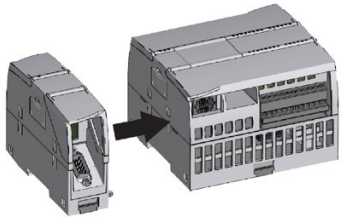
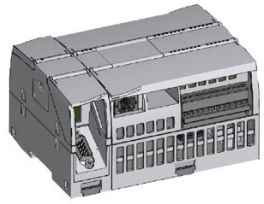
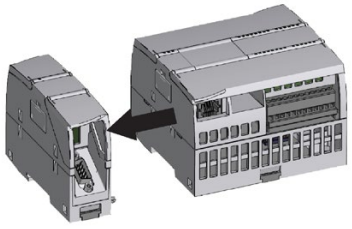
Task	Procedure
  	1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Attach the CM to the CPU before installing the assembly as a unit to the DIN rail or panel. 3. Remove the bus cover from the left side of the CPU: – Insert a screwdriver into the slot above the bus cover. – Gently pry out the cover at its top. 4. Remove the bus cover. Retain the cover for reuse. 5. Connect the CM or CP to the CPU: – Align the bus connector and the posts of the CM with the holes of the CPU – Firmly press the units together until the posts snap into place. 6. Install the CPU and CP on a DIN rail or panel.

Table 4- 9 Removing a CM or CP

Task	Procedure
 	Remove the CPU and CM as a unit from the DIN rail or panel. 1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Remove the I/O connectors and all wiring and cables from the CPU and CMs. 3. For DIN rail mounting, move the lower DIN rail clips on the CPU and CMs to the extended position. 4. Remove the CPU and CMs from the DIN rail or panel. 5. Grasp the CPU and CMs firmly and pull apart.

NOTICE
Separate modules without using a tool. Do not use a tool to separate the modules because this can damage the units.

4.3.6 Removing and reinstalling the S7-1200 terminal block connector

The CPU, SB and SM modules provide removable connectors to make connecting the wiring easy.

Table 4- 10 Removing the connector

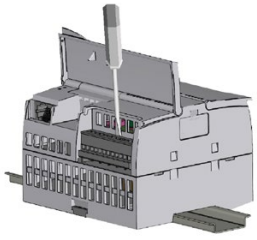
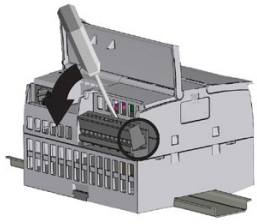
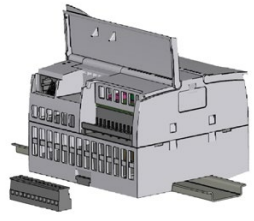
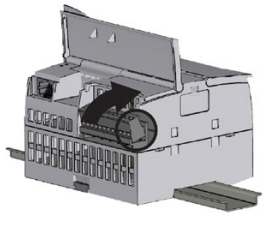
Task	Procedure
 	Prepare the system for terminal block connector removal by removing the power from the CPU and opening the cover above the connector. 1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Inspect the top of the connector and locate the slot for the tip of the screwdriver. 3. Insert a screwdriver into the slot. 4. Gently pry the top of the connector away from the CPU. The connector will release with a snap. 5. Grasp the connector and remove it from the CPU.

Table 4- 11 Installing the connector

Task	Procedure
 	Prepare the components for terminal block installation by removing power from the CPU and opening the cover for connector. 1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Align the connector with the pins on the unit. 3. Align the wiring edge of the connector inside the rim of the connector base. 4. Press firmly down and rotate the connector until it snaps into place. Check carefully to ensure that the connector is properly aligned and fully engaged.

4.3.7 Installing and removing the expansion cable

The S7-1200 expansion cable provides additional flexibility in configuring the layout of your S7-1200 system. Only one expansion cable is allowed per CPU system. You install the expansion cable either between the CPU and the first SM, or between any two SMs.

Table 4- 12 Installing and removing the male connector of the expansion cable

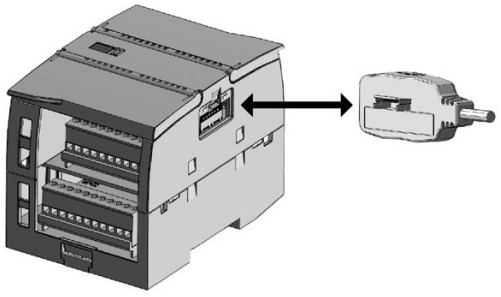
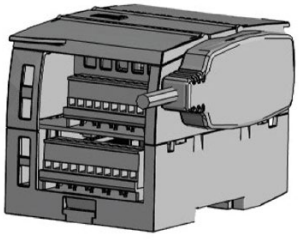
Task	Procedure
 	To install the male connector: 1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Push the connector into the bus connector on the right side of the signal module or CPU. To remove the male connector: 1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Pull out the male connector to release it from the signal module or CPU.

Table 4- 13 Installing the female connector of the expansion cable

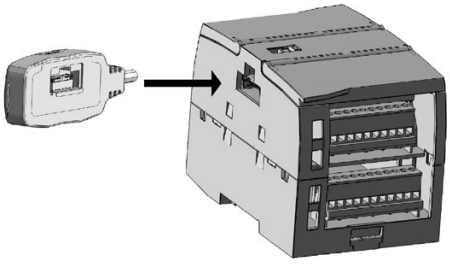
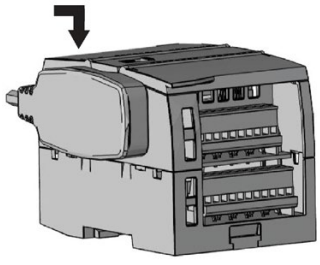
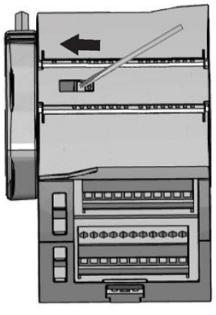
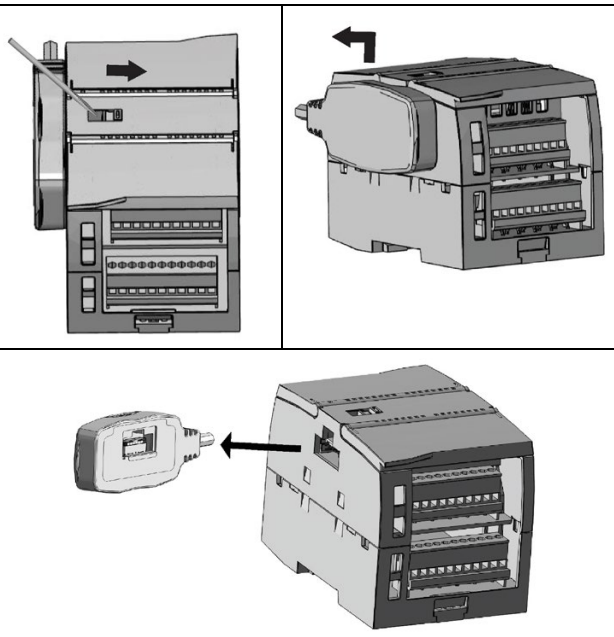
Task	Procedure
  	1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Place the female connector to the bus connector on the left side of the signal module. 3. Slip the hook extension of the female connector into the housing at the bus connector and press down slightly to engage the hook. 4. Lock the connector into place: – Place a screwdriver beside the tab on the top of the signal module. – Slide the tab fully to the left. To engage the connector, you must slide the connector tab all the way to the left. The connector tab must be locked into place.

Table 4- 14 Removing the female connector of the expansion cable

Task	Procedure
	1. Ensure that the CPU and all S7-1200 equipment are disconnected from electrical power. 2. Unlock the connector: – Place a screwdriver beside the tab on the top of the signal module. – Press down slightly and slide the tab fully to the right. 3. Lift the connector up slightly to disengage the hook extension. 4. Remove the female connector.

Note

Installing the expansion cable in a vibration environment

If the expansion cable is connected to modules that move, or are not firmly fixed, the cable male end snap-on connection can gradually become loose.

Use a cable tie to fix the male end cable on the DIN-rail (or other place) to provide extra strain relief.

Avoid using excessive force when you pull the cable during installation. Ensure the cable-module connection is in the correct position once installation is complete.

4.3.8 TS (TeleService) adapter

4.3.8.1 Connecting the TeleService adapter

Before installing the TS (TeleService) Adapter IE Basic or TS (TeleService) Adapter IE Advanced, you must first connect the TS Adapter and a TS module.

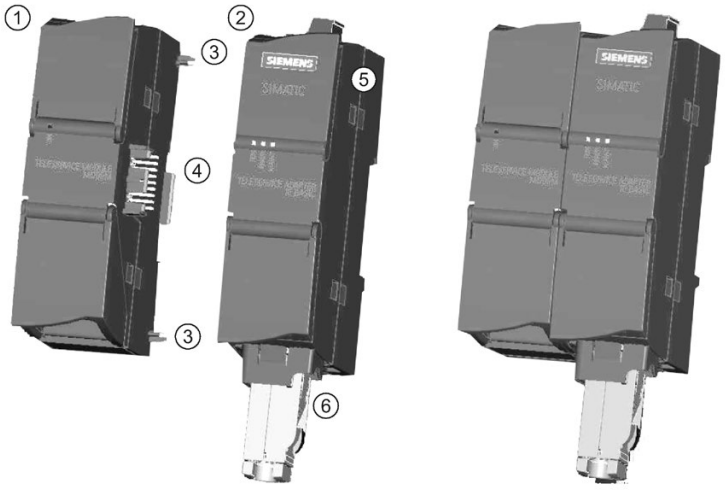
Available TS modules:

- TS module RS232
- TS module Modem
- TS module GSM
- TS module ISDN

Note

The TS module can be damaged if you touch the contacts of the plug connector ④ of the TS module.

Follow ESD guidelines in order to avoid damaging the TS module through electrostatic discharge. Before connecting a TS module and TS Adapter, make sure that both are in an idle state.



①	TS module	④	Plug connector from the TS module
②	TS Adapter	⑤	Cannot be opened
③	Elements	⑥	Ethernet port

Note

Before connecting a TS module and TS adapter basic unit, ensure that the contact pins ④ are not bent.

When connecting, ensure that the male connector and guide pins are positioned correctly.

Only connect a TS module into the TS adapter. Do not force a connection of the TS adapter to a different device, such as an S7-1200 CPU. Do not change the mechanical construction of the connector, and do not remove or damage the guide pins.

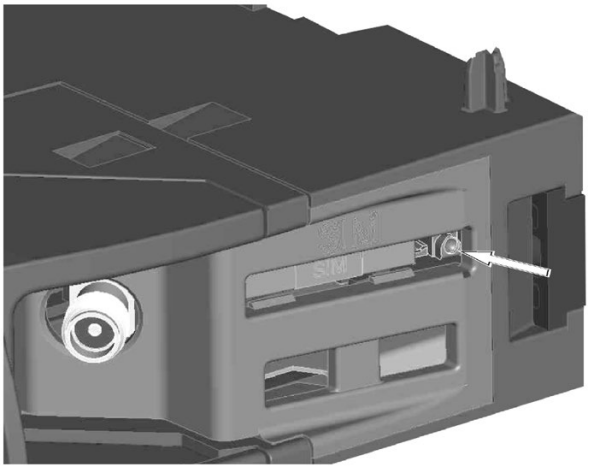
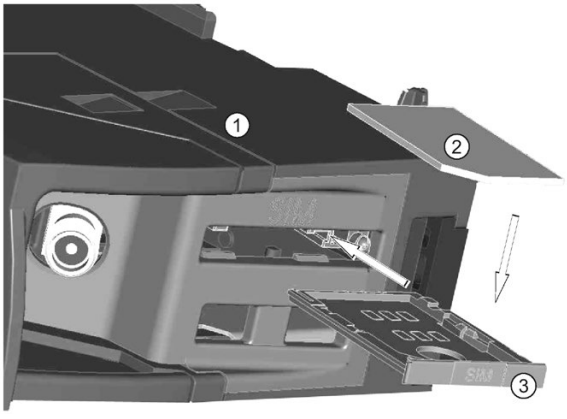
4.3.8.2 Installing the SIM card

Locate the SIM card slot on the underside of the TS module GSM.

Note

The SIM card may only be removed or inserted if the TS module GSM is de-energized.

Table 4- 15 Installing the SIM card

Task	Procedure
	Use a sharp object to press the eject button of the SIM card tray (in the direction of the arrow) and remove the SIM card tray.
	Place the SIM card in the SIM card tray as shown and put the SIM card tray back into its slot. ①TS Module GSM ② SIM card ③ SIM card tray

Note

Ensure that the SIM card is correctly oriented in the card tray. Otherwise, the SIM card will not make connection with the module, and the eject button may not remove the card tray.

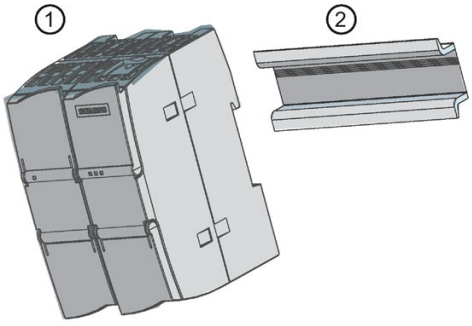
4.3.8.3 Installing the TS adapter unit on a DIN rail

Prerequisites: You must have connected the TS Adapter and a TS module together, and the DIN rail must have been installed.

Note

If you install the TS unit vertically or in high-vibration environment, the TS module can become disconnected from the TS Adapter. Use an end bracket 8WA1808 on the DIN rail to ensure that the modules remain connected.

Table 4- 16 Installing and removing the TS Adapter

Task	Procedure
	Installation: 1. Hook the TS Adapter with attached TS module ① on the DIN rail ②. 2. Rotate the unit back until it engages. 3. Push in the DIN rail clip on each module to attach each module to the rail.
	Removal: 1. Remove the analog cable and Ethernet cable from the underside of the TS Adapter. 2. Remove power from the TS Adapter. 3. Use a screwdriver to disengage the rail clips on both modules. 4. Rotate the unit upwards to remove the unit from the DIN rail.

⚠ WARNING

Safety requirements for installing or removing the TS Adapter.

Before you remove power from the unit, disconnect the grounding of the TS Adapter by removing the analog cable and Ethernet cable. Failure to observe this precaution could result in death, severe personal injury and/or property damage due to unexpected equipment operation.

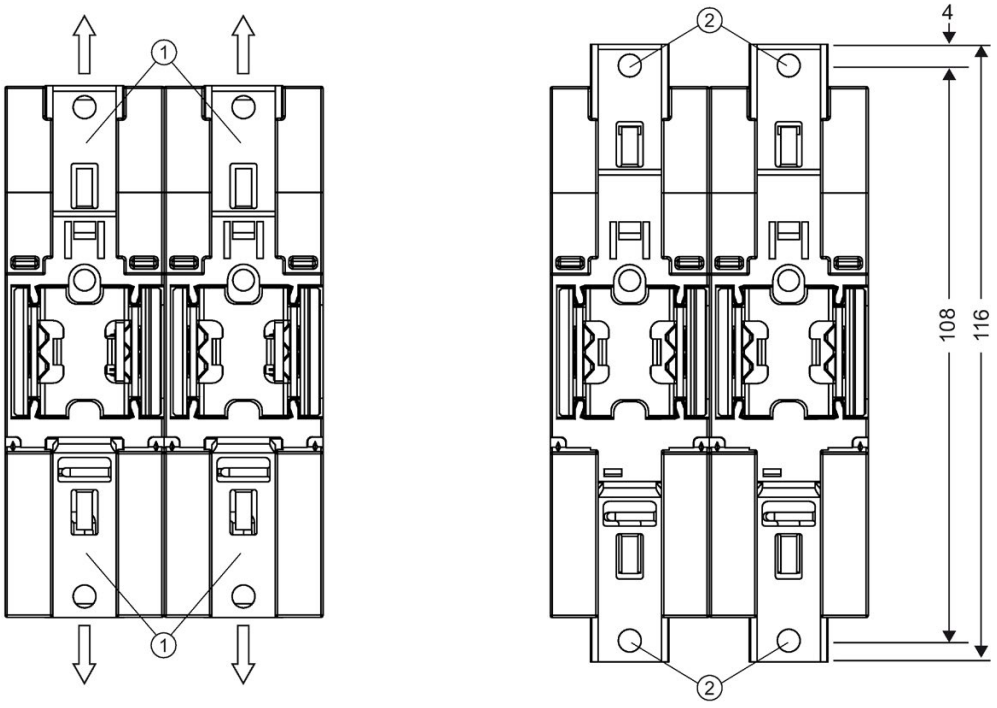
Always follow these requirements when installing or removing the TS Adapter.

4.3.8.4 Installing the TS adapter on a panel

Prerequisites: You must have connected the TS Adapter and TS module.

1. Move the attachment slider ① to the backside of the TS Adapter and TS module in the direction of the arrow until it engages.
2. Screw the TS Adapter and TS module to the position marked with ② to the designated assembly wall.

The following illustration shows the TS Adapter from behind, with the attachment sliders ① in both positions:



① Attachment slider
② Drill holes for wall mounting

4.4 Wiring guidelines

Proper grounding and wiring of all electrical equipment is important to help ensure the optimum operation of your system and to provide additional electrical noise protection for your application and the S7-1200. Refer to the technical specifications (Page 1343) for the S7-1200 wiring diagrams.

Prerequisites

Before you ground or install wiring to any electrical device, ensure that the power to that equipment has been turned off. Also, ensure that the power to any related equipment has been turned off.

Ensure that you follow all applicable electrical codes when wiring the S7-1200 and related equipment. Install and operate all equipment according to all applicable national and local standards. Contact your local authorities to determine which codes and standards apply to your specific case.

⚠ WARNING

Installation or wiring the S7-1200 or related equipment with power applied could cause electric shock or unexpected operation of equipment.

Failure to disable all power to the S7-1200 and related equipment during installation or removal procedures could result in death, severe personal injury, and/or damage due to electric shock or unexpected equipment operation.

Always follow appropriate safety precautions and ensure that power to the S7-1200 is disabled before attempting to install or remove the S7-1200 or related equipment.

Always take safety into consideration as you design the grounding and wiring of your S7-1200 system. Electronic control devices, such as the S7-1200, can fail and can cause unexpected operation of the equipment that is being controlled or monitored. For this reason, you should implement safeguards that are independent of the S7-1200 to protect against possible personal injury or equipment damage.

⚠ WARNING

Control devices can fail in an unsafe condition, resulting in unexpected operation of controlled equipment.

Such unexpected operations could result in death, severe personal injury and/or property damage.

Use an emergency stop function, electromechanical overrides, or other redundant safeguards that are independent of the S7-1200.

Guidelines for isolation

S7-1200 AC power supply boundaries and I/O boundaries to AC circuits have been designed and approved to provide safe separation between AC line voltages and low voltage circuits. These boundaries include double or reinforced insulation, or basic plus supplementary insulation, according to various standards. Components which cross these boundaries such as optical couplers, capacitors, transformers, and relays have been approved as providing safe separation. Only circuits rated for AC line voltage include safety isolation to other circuits. Isolation boundaries between 24 V DC circuits are functional only, and you should not depend on these boundaries for safety.

The sensor supply output, communications circuits, and internal logic circuits of an S7-1200 with included AC power supply are sourced as SELV (safety extra-low voltage) according to EN 61131-2.

To maintain the safe character of the S7-1200 low voltage circuits, external connections to communications ports, analog circuits, and all 24 V DC nominal power supply and I/O circuits must be powered from approved sources that meet the requirements of SELV, PELV, Class 2, Limited Voltage, or Limited Power according to various standards.

WARNING

Use of non-isolated or single insulation supplies to supply low voltage circuits from an AC line can result in hazardous voltages appearing on circuits that are expected to be touch safe, such as communications circuits and low voltage sensor wiring.

Such unexpected high voltages could cause electric shock resulting in death, severe personal injury and/or property damage.

Only use high voltage to low voltage power converters that are approved as sources of touch safe, limited voltage circuits.

Guidelines for grounding the S7-1200

The best way to ground your application is to ensure that all the common and ground connections of your S7-1200 and related equipment are grounded to a single point. This single point should be connected directly to the earth ground for your system.

All ground wires should be as short as possible and should use a large wire size, such as 2 mm^2 (14 AWG).

When locating grounds, consider safety-grounding requirements and the proper operation of protective interrupting devices.

Guidelines for wiring the S7-1200

When designing the wiring for your S7-1200, provide a single disconnect switch that simultaneously removes power from the S7-1200 CPU power supply, from all input circuits, and from all output circuits. Provide over-current protection, such as a fuse or circuit breaker, to limit fault currents on supply wiring. Consider providing additional protection by placing a fuse or other current limit in each output circuit.

Install appropriate surge suppression devices for any wiring that could be subject to lightning surges. For more information, see Surge immunity (Page 1343) in the General technical specifications section.

Avoid placing low-voltage signal wires and communications cables in the same wire tray with AC wires and high-energy, rapidly switched DC wires. Always route wires in pairs, with the neutral or common wire paired with the hot or signal-carrying wire.

Use the shortest wire possible and ensure that the wire is sized properly to carry the required current.

Wire and cable should have a temperature rating 30 °C higher than the ambient temperature around the S7-1200 (for example, a minimum of 85 °C-rated conductors for 55 °C ambient temperature). You should determine other wiring type and material requirements from the specific electrical circuit ratings and your installation environment.

Use shielded wires for optimum protection against electrical noise. Typically, grounding the shield at the S7-1200 gives the best results. You should ground communication cable shields to S7-1200 communication connector shells using connectors that engage the cable shield, or by bonding the communication cable shields to a separate ground. You should ground other cable shields using clamps or copper tape around the shield to provide a high surface area connection to the grounding point.

When wiring input circuits that are powered by an external power supply, include an overcurrent protection device in that circuit. External protection is not necessary for circuits that are powered by the 24 V DC sensor supply from the S7-1200 because the sensor supply is already current-limited.

All S7-1200 modules have removable connectors for user wiring. To prevent loose connections, ensure that the connector is seated securely and that the wire is installed securely into the connector.

To help prevent unwanted current flows in your installation, the S7-1200 provides isolation boundaries at certain points. When you plan the wiring for your system, you should consider these isolation boundaries. Refer to the technical specifications (Page 1412) for the amount of isolation provided and the location of the isolation boundaries. Circuits rated for AC line voltage include safety isolation to other circuits. Isolation boundaries between 24 V DC circuits are functional only, and you should not depend on these boundaries for safety.

A summary of Wiring rules for the S7-1200 CPUs, SMs and SBs is shown below:

Table 4- 17 Wiring rules for S7-1200 CPUs, SMs, and SBs

Wiring rules for...	CPU and SM connector	SB connector
Connectible conductor cross-sections for standard wires	2 mm^2 to 0.3 mm^2 (14 AWG to 22 AWG)	1.3 mm^2 to 0.3 mm^2 (16 AWG to 22 AWG)
Number of wires per connection	1 or combination of 2 wires up to 2 mm^2 (total)	1 or combination of 2 wires up to 1.3 mm^2 (total)
Wire strip length	6.4 mm	6.3 to 7 mm
Tightening torque* (maximum)	0.56 N-m (5 inch-pounds)	0.33 N-m (3 inch-pounds)
Tool	2.5 to 3.0 mm flathead screwdriver	2.0 to 2.5 mm flathead screwdriver

* To avoid damaging the connector, be careful that you do not over-tighten the screws.

Note

Ferrules or end sleeves on stranded conductors reduce the risk of stray strands causing short circuits. Ferrules longer than the recommended strip length should include an insulating collar to prevent shorts due to side movement of conductors. Cross-sectional area limits for bare conductors also apply to ferrules.

See also

Technical specifications (Page 1343)

Guidelines for lamp loads

Lamp loads, including LED lamp loads, are damaging to relay contacts because of the high turn-on surge current. This surge current will nominally be 10 to 15 times the steady state current for a Tungsten lamp. A replaceable interposing relay or surge limiter is recommended for lamp loads that will be switched a large number of times during the lifetime of the application.

Guidelines for inductive loads

Use suppressor circuits with inductive loads to limit the voltage rise when a control output turns off. Suppressor circuits protect your outputs from premature failure caused by the high voltage transient that occurs when current flow through an inductive load is interrupted.

In addition, suppressor circuits limit the electrical noise generated when switching inductive loads. High frequency noise from poorly suppressed inductive loads can disrupt the operation of the PLC. Placing an external suppressor circuit so that it is electrically across the load and physically located near the load is the most effective way to reduce electrical noise.

S7-1200 DC outputs include internal suppressor circuits that are adequate for inductive loads in most applications. Since S7-1200 relay output contacts can be used to switch either a DC or an AC load, internal protection is not provided.

A good suppressor solution is to use contactors and other inductive loads for which the manufacturer provides suppressor circuits integrated in the load device, or as an optional accessory. However, some manufacturer provided suppressor circuits may be inadequate for your application. An additional suppressor circuit may be necessary for optimal noise reduction and contact life.

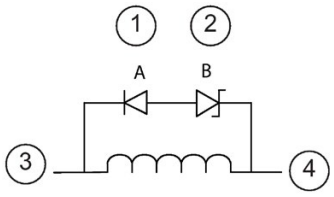
For AC loads, a metal oxide varistor (MOV) or other voltage clamping device may be used with a parallel RC circuit, but is not as effective when used alone. An MOV suppressor with no parallel RC circuit often results in significant high frequency noise up to the clamp voltage.

A well-controlled turn-off transient will have a ring frequency of no more than 10 kHz, with less than 1 kHz preferred. Peak voltage for AC lines should be within +/- 1200 V of ground. Negative peak voltage for DC loads using the PLC internal suppression will be ~40 V below the 24 V DC supply voltage. External suppression should limit the transient to within 36 V of the supply to unload the internal suppression.

Note

The effectiveness of a suppressor circuit depends on the application and must be verified for your particular usage. Ensure that all components are correctly rated and use an oscilloscope to observe the turn-off transient.

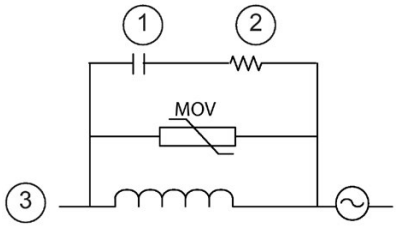
Typical suppressor circuit for DC or relay outputs that switch DC inductive loads



① 1N4001 diode or equivalent
② 8.2 V Zener (DC outputs), 36 V Zener (Relay outputs)
③ Output point
④ M, 24 V reference

In most applications, the addition of a diode (A) across a DC inductive load is suitable, but if your application requires faster turn-off times, then the addition of a zener diode (B) is recommended. Be sure to size your zener diode properly for the amount of current in your output circuit.

Typical suppressor circuit for relay outputs that switch AC inductive loads



① See table for C value
② See table for R value
③ Output point

Ensure that the working voltage of the metal oxide varistor (MOV) is at least 20% greater than the nominal line voltage.

Choose pulse-rated, non-inductive resistors, and capacitors recommended for pulse applications (typically metal film). Verify the components meet average power, peak power, and peak voltage requirements.

If you design your own suppressor circuit, the following table suggests resistor and capacitor values for a range of AC loads. These values are based on calculations with ideal component parameters. I rms in the table refers to the steady-state current of the load when fully ON.

Table 4- 18 AC suppressor circuit resistor and capacitor values

Inductive load			Suppressor values		
I rms	230 V AC	120 V AC	Resistor		Capacitor
Amps	VA	VA	Ω	W (power rating)	nF
0.02	4.6	2.4	15000	0.1	15
0.05	11.5	6	5600	0.25	470
0.1	23	12	2700	0.5	100
0.2	46	24	1500	1	150
0.5	115	60	560	2.5	470
1	230	120	270	5	1000
2	460	240	150	10	1500

Conditions satisfied by the table values:

Maximum turn-off transition step < 500 V
Resistor peak voltage < 500 V
Capacitor peak voltage < 1250 V
Suppressor current < 8% of load current (50 Hz)
Suppressor current < 11% of load current (60 Hz)
Capacitor dV/dt < 2 V/µs
Capacitor pulse dissipation : $\int(dv/dt)^2\ dt < 10000\ V^2/\mu s$
Resonant frequency < 300 Hz
Resistor power for 2 Hz max switching frequency
Power factor of 0.3 assumed for typical inductive load

Guidelines for differential inputs and outputs

Differential inputs and outputs behave differently than standard inputs and outputs. There are two pins per differential input and output. Determining whether a differential input or output is on or off requires that you measure the voltage difference between these two pins.

See the detailed specifications for the CPU 1217C in Appendix A (Page 1412).

PLC concepts

5

5.1 Execution of the user program

The CPU supports the following types of code blocks that allow you to create an efficient structure for your user program:

- Organization blocks (OBs) define the structure of the program. Some OBs have predefined behavior and start events, but you can also create OBs with custom start events.
- Functions (FCs) and function blocks (FBs) contain the program code that corresponds to specific tasks or combinations of parameters. Each FC or FB provides a set of input and output parameters for sharing data with the calling block. An FB also uses an associated data block (called an instance DB) to maintain the data values for that instance of the FB call. You can call an FB multiple times, each time with a unique instance DB. Calls to the same FB with different instance DBs do not affect the data values in any of the other instance DBs.
- Data blocks (DBs) store data that can be used by the program blocks.

Execution of the user program begins with one or more optional startup organization blocks (OBs) which execute once upon entering RUN mode, followed by one or more program cycle OBs that execute cyclically. You can also associate an OB with an interrupt event, which can be either a standard event or an error event. These OBs execute whenever the corresponding standard or error event occurs.

A function (FC) or a function block (FB) is a block of program code that can be called from an OB or from another FC or FB, down to the following nesting depths:

- 16 from the program cycle or startup OB
- 6 from any interrupt event OB
  Note: Safety programs use two nesting levels. The user program therefore has a nesting depth of four in safety programs.

FCs are not associated with any particular data block (DB). FBs are tied directly to a DB and use the DB for passing parameters and storing interim values and results.

The size of the user program, data, and configuration is limited by the available load memory and work memory in the CPU. There is no specific limit to the number of each individual OB, FC, FB and DB block. However, the total number of blocks is limited to 1024.

Each cycle includes writing the outputs, reading the inputs, executing the user program instructions, and performing background processing. The cycle is referred to as a scan cycle or scan.

Your S7-1200 automation solution can consist of a central rack with the S7-1200 CPU and additional modules. The term "central rack" refers to either the rail or panel installation of the CPU and associated modules. The modules (SM, SB, BB, CB, CM or CP) are detected and logged in only upon powerup.

- Inserting or removing a module in the central rack under power (hot) is not supported. Never insert or remove a module from the central rack when the CPU has power.

⚠ WARNING
Safety requirements for inserting or removing modules Failure to disable all power to the CPU before insertion or removal of a module (SM, SB, BB, CD, CM or CP) from the central rack could cause damage or unpredictable behavior which could result in death or severe personal injury and/or property damage. Always remove power from the CPU and central rack and follow appropriate safety precautions before inserting or removing a module from the central rack.

- You can insert or remove a SIMATIC memory card while the CPU is under power. However, inserting or removing a memory card when the CPU is in RUN mode causes the CPU to go to STOP mode.

NOTICE
Risks with removing memory card when CPU is in RUN mode. Insertion or removal of a memory card when the CPU is in RUN mode causes the CPU to go to STOP, which might result in damage to the equipment or the process being controlled. Whenever you insert or remove a memory card, the CPU immediately goes to STOP mode. Before inserting or removing a memory card, always ensure that the CPU is not actively controlling a machine or process. Always install an emergency stop circuit for your application or process.

- If you insert or remove a module in a distributed I/O rack (AS-i, PROFINET, or PROFIBUS) when the CPU is in RUN mode, the CPU generates an entry in the diagnostics buffer, executes the pull or plug of modules OB if present, and by default remains in RUN mode.

Process image update and process image partitions

The CPU updates local digital and analog I/O points synchronously with the scan cycle using an internal memory area called the process image. The process image contains a snapshot of the physical inputs and outputs (the physical I/O points on the CPU, signal board, and signal modules).

You can configure I/O points to be updated in the process image every scan cycle or when a specific event interrupt occurs. You can also configure an I/O point to be excluded from process image updates. For example, your process might only need certain data values when an event such as a hardware interrupt occurs. By configuring the process image update for these I/O points to be associated with a partition that you assign to a hardware interrupt OB, you avoid having the CPU update data values unnecessarily every scan cycle when your process does not need a continual update.

For I/O that is updated every scan cycle, the CPU performs the following tasks during each scan cycle:

- The CPU writes the outputs from the process image output area to the physical outputs.
- The CPU reads the physical inputs just prior to the execution of the user program and stores the input values in the process image input area. These values thus remain consistent throughout the execution of the user instructions.
- The CPU executes the logic of the user instructions and updates the output values in the process image output area instead of writing to the actual physical outputs.

  This process provides consistent logic through the execution of the user instructions for a given cycle and prevents the flickering of physical output points that might change state multiple times in the process image output area.

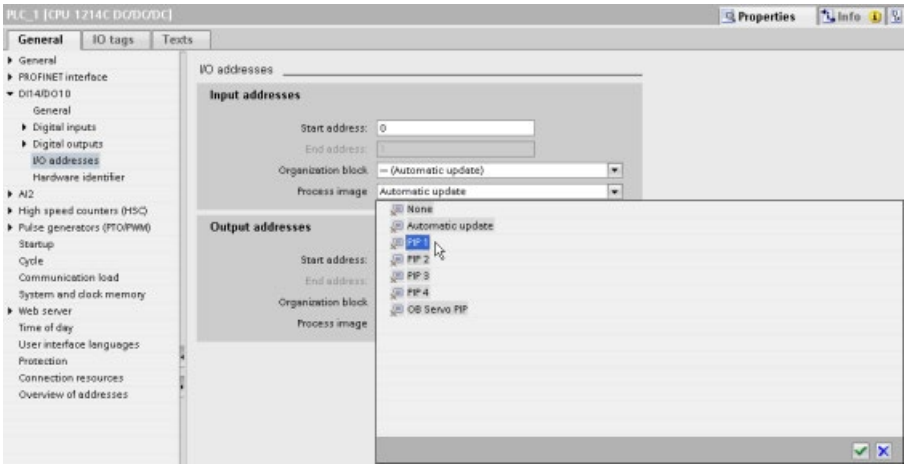
For controlling whether your process updates I/O points automatically on every scan cycle, or upon the triggering of events, the S7-1200 provides five process image partitions. The first process image partition, PIP0, is designated for I/O that is to be automatically updated every scan cycle, and is the default assignment. You can use the remaining four partitions, PIP1, PIP2, PIP3, and PIP4 for assigning I/O process image updates to various interrupt events. You assign I/O to process image partitions in Device Configuration and you assign process image partitions to interrupt events when you create interrupt OBs (Page 183) or edit OB properties (Page 183).

By default, when you insert a module in the device view, STEP 7 sets its I/O process image update to "Automatic update". For I/O configured for "Automatic update", the CPU handles the data exchange between the module and the process image area automatically during every scan cycle.

To assign digital or analog points to a process image partition, or to exclude I/O points from process image updates, follow these steps:

1. View the Properties tab for the appropriate device in Device configuration.
2. Expand the selections under "General" as necessary to locate the desired I/O points.
3. Select "I/O addresses".

4. Optionally select a specific OB from the "Organization block" drop-down list.
5. From the "Process image" drop-down list, change "Automatic update" to "PIP1", "PIP2", "PIP3", "PIP4" or "None". A selection of "None" means that you can only read from and write to this I/O using immediate instructions. To add the points back to the process image automatic update, change this selection back to "Automatic update".



You can immediately read physical input values and immediately write physical output values when an instruction executes. An immediate read accesses the current state of the physical input and does not update the process image input area, regardless of whether the point is configured to be stored in the process image. An immediate write to the physical output updates both the process image output area (if the point is configured to be stored in the process image) and the physical output point. Append the suffix ":P" to the I/O address if you want the program to immediately access I/O data directly from the physical point instead of using the process image.

Note

Use of process image partitions

If you assign I/O to one of the process image partitions PIP1 - PIP4, and do not assign an OB to that partition, then the CPU never updates that I/O to or from the process image. Assigning I/O to a PIP that does not have a corresponding OB assignment, is the same as assigning the process image to "None". You can read the I/O directly from the physical I/O with an immediate read instruction, or write to the physical I/O with an immediate write instruction. The CPU does not update the process image.

The CPU supports distributed I/O for PROFINET, PROFIBUS, and AS-i networks (Page 781).

5.1.1 Operating modes of the CPU

The CPU has three modes of operation: STOP mode, STARTUP mode, and RUN mode. Status LEDs on the front of the CPU indicate the current mode of operation.

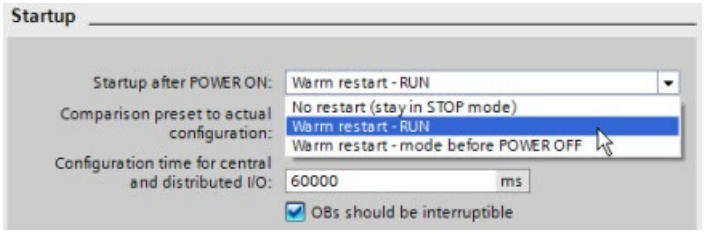
- In STOP mode, the CPU is not executing the program. You can download a project.
- In STARTUP mode, the startup OBs (if present) execute once. The CPU does not process interrupt events during the startup mode.
- In RUN mode, the program cycle OBs execute repeatedly. Interrupt events can occur at any point during RUN mode, which cause the corresponding interrupt event OBs to execute. You can download some parts of a project in RUN mode (Page 1321).

The CPU supports a warm restart for entering the RUN mode. Warm restart does not include a memory reset. The CPU initializes all non-retentive system and user data at warm restart, and retains the values of all retentive user data.

A memory reset clears all work memory, clears retentive and non-retentive memory areas, copies load memory to work memory, and sets outputs to the configured "Reaction to CPU STOP". A memory reset does not clear the diagnostics buffer or the permanently saved values of the IP address.

You can configure the "startup after POWER ON" setting of the CPU. This configuration item appears under the "Device configuration" for the CPU under "Startup". Upon powering up, the CPU performs a sequence of power-up diagnostic checks and system initialization. During system initialization, the CPU deletes all non-retentive bit (M) memory and resets all non-retentive DB contents to the initial values from load memory. The CPU retains retentive bit (M) memory and retentive DB contents and then enters the appropriate operating mode. Certain detected errors prevent the CPU from entering the RUN mode. The CPU supports the following configuration choices:

- No restart (stay in STOP mode)
- Warm restart - RUN
- Warm restart - mode prior to POWER OFF



NOTICE

Repairable faults can cause the CPU to enter STOP mode.

The CPU can enter STOP mode due to repairable faults, such as the following:

- Failure of a replaceable signal module
- Temporary faults, such as power line disturbance or erratic power up event

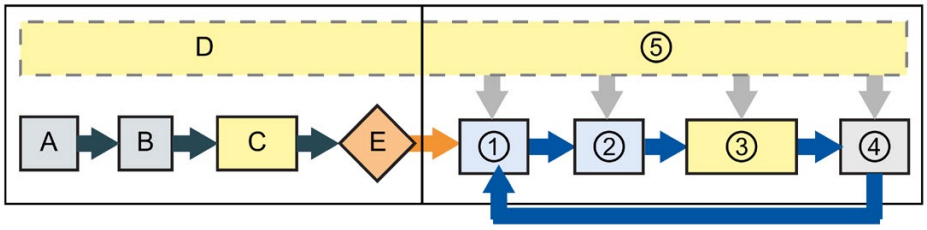
Such conditions could result in property damage.

If you have configured the CPU to "Warm restart - mode prior to POWER OFF", the CPU goes to the operating mode that the CPU was in prior to the loss of power or fault. If the CPU was in STOP mode at the time of power loss or fault, the CPU goes to STOP mode on power up. The CPU stays in STOP mode until the CPU receives a command to go to RUN mode. If the CPU was in RUN mode at the time of power loss or fault, the CPU goes to RUN mode on the next power up. The CPU goes to RUN mode providing the CPU detects no errors that would inhibit a transition to RUN mode.

Configure CPUs that you intend to operate independently of a STEP 7 connection to "Warm restart - RUN". This startup mode sets the CPU to return to RUN mode on the next power cycle.

You can use the "STOP" or "RUN" commands (Page 1306) from the online tools of the programming software to change the current operating mode. You can also include an STP instruction (Page 305) in your program to change the CPU to STOP mode. This instruction allows you to stop the execution of your program based on the program logic.

- In STOP mode, the CPU handles any communication requests (as appropriate) and performs self-diagnostics. The CPU does not execute the user program. Automatic updates of the process image do not occur.
- In STARTUP and RUN modes, the CPU performs the tasks shown in the following figure:



STARTUP		RUN	
A	Copies the state of the physical inputs to I memory	①	Writes Q memory to the physical outputs
B	Initializes the Q output (image) memory area with either zero, the last value, or the configured substitute value. Zeroes PB, PN, and AS-i outputs	②	Copies the state of the physical inputs to I memory
C	Initializes non-retentive M memory and data blocks to their initial value and enables configured cyclic interrupt and time of day events. Executes the startup OBs.	③	Executes the program cycle OBs
D	Stores any interrupt events into the queue to be processed after entering RUN mode	④	Performs self-test diagnostics
E	Enables the writing of Q memory to the physical outputs	⑤	Processes interrupts and communications during any part of the scan cycle

Note

Communication, including HMI communication, cannot interrupt OBs other than program cycle OBs.

STARTUP processing

Whenever the operating mode changes from STOP to RUN, the CPU clears the process image inputs, initializes the process image outputs and processes the startup OBs. Any read accesses to the process-image inputs by instructions in the startup OBs read zero rather than the current physical input value. Therefore, to read the current state of a physical input during the startup mode, you must perform an immediate read. The startup OBs and any associated FCs and FBs are executed next. If more than one startup OB exists, the CPU executes each OB in order according to the OB number, executing the lowest OB number first.

Each startup OB includes startup information that helps you determine the validity of retentive data and the time-of-day clock. You can program instructions inside the startup OBs to examine these startup values and to take appropriate action. The following startup locations are supported by the Startup OBs:

Table 5- 1 Startup locations supported by the startup OB

Input	Data Type	Description
LostRetentive	Bool	This bit is true if the retentive data storage areas have been lost
LostRTC	Bool	This bit is true if the time-of-day clock (Real time Clock) has been lost

The CPU also performs the following tasks during the startup processing:

- Interrupts are queued but not processed during the startup phase
- No cycle time monitoring is performed during the startup phase
- Configuration changes to HSC (high-speed counter), PWM (pulse-width modulation), and PtP (point-to-point communication) modules can be made in startup
- Actual operation of HSC, PWM and point-to-point communication modules only occurs in RUN

After the execution of the startup OBs finishes, the CPU goes to RUN mode and processes the control tasks in a continuous scan cycle.

5.1.2 Processing the scan cycle in RUN mode

For each scan cycle, the CPU writes the outputs, reads the inputs, executes the user program, updates communication modules, and responds to user interrupt events and communication requests. Communication requests are handled periodically throughout the scan.

These actions (except for user interrupt events) are serviced regularly and in sequential order. User interrupt events that are enabled are serviced according to priority in the order in which they occur. For interrupt events, the CPU reads the inputs, executes the OB, and then writes the outputs, using the associated process image partition (PIP), if applicable.

The system guarantees that the scan cycle will be completed in a time period called the maximum cycle time; otherwise a time error event is generated.

- Each scan cycle begins by retrieving the current values of the digital and analog outputs from the process image and then writing them to the physical outputs of the CPU, SB, and SM modules configured for automatic I/O update (default configuration). When a physical output is accessed by an instruction, both the output process image and the physical output itself are updated.
- The scan cycle continues by reading the current values of the digital and analog inputs from the CPU, SB, and SMs configured for automatic I/O update (default configuration), and then writing these values to the process image. When a physical input is accessed by an instruction, the value of the physical input is accessed by the instruction, but the input process image is not updated.
- After reading the inputs, the user program is executed from the first instruction through the end instruction. This includes all the program cycle OBs plus all their associated FCs and FBs. The program cycle OBs are executed in order according to the OB number with the lowest OB number executing first.

Communications processing occurs periodically throughout the scan, possibly interrupting user program execution.

Self-diagnostic checks include periodic checks of the system and the I/O module status checks.

Interrupts can occur during any part of the scan cycle, and are event-driven. When an event occurs, the CPU interrupts the scan cycle and calls the OB that was configured to process that event. After the OB finishes processing the event, the CPU resumes execution of the user program at the point of interruption.

5.1.3 Organization blocks (OBs)

OBs control the execution of the user program. Specific events in the CPU trigger the execution of an organization block. OBs cannot call each other. An FC or FB cannot call an OB. Only an event such as a diagnostic interrupt or a time interval can start the execution of an OB. The CPU handles OBs according to their respective priority classes, with higher priority OBs executing before lower priority OBs. The lowest priority class is 1 (for the main program cycle), and the highest priority class is 26.

5.1.3.1 Program cycle OB

Program cycle OBs execute cyclically while the CPU is in RUN mode. The main block of the program is a program cycle OB. This is where you place the instructions that control your program and where you call additional user blocks. You can have multiple program cycle OBs, which the CPU executes in numerical order. Main (OB 1) is the default.

Program cycle events

The program cycle event happens once during each program cycle (or scan). During the program cycle, the CPU writes the outputs, reads the inputs and executes program cycle OBs. The program cycle event is required and is always enabled. You might have no program cycle OBs, or you might have multiple OBs selected for the program cycle event. After the program cycle event occurs, the CPU executes the lowest numbered program cycle OB (usually "Main" OB 1). The CPU executes the other program cycle OBs sequentially (in numerical order) within the program cycle. Program execution is cyclical such that the program cycle event occurs at the following times:

- When the last startup OB finishes execution
- When the last program cycle OB finishes execution

Table 5- 2 Start information for a program cycle OB

Input	Data type	Description
Initial_Call	Bool	True for initial call of the OB
Remanence	Bool	True if retentive data are available

5.1.3.2 Startup OB

Startup OBs execute one time when the operating mode of the CPU changes from STOP to RUN, including powering up in the RUN mode and in commanded STOP-to-RUN transitions. After completion, the main "Program cycle" begins executing.

Startup events

The startup event happens one time on a STOP to RUN transition and causes the CPU to execute the startup OBs. You can configure multiple OBs for the startup event. The startup OBs execute in numerical order.

Table 5- 3 Start information for a startup OB

Input	Data type	Description
LostRetentive	Bool	True if retentive data are lost
LostRTC	Bool	True if date and time are lost

5.1.3.3 Time delay interrupt OB

Time delay interrupt OBs execute after a time delay that you configure.

Time delay interrupt events

You configure time delay interrupt events to occur after a specified delay time has expired. You assign the delay time with the SRT_DINT instruction. The time delay events interrupt the program cycle to execute the corresponding time delay interrupt OB. You can attach only one time delay interrupt OB to a time delay event. The CPU supports four time delay events.

Table 5- 4 Start information for a time delay interrupt OB

Input	Data type	Description
Sign	Word	Identifier passed to triggering call of SRT_DINT

5.1.3.4 Cyclic interrupt OB

Cyclic interrupt OBs execute at a specified interval. You can configure up to a total of four cyclic interrupt events, with one OB corresponding to each cyclic interrupt event.

Cyclic interrupt events

The cyclic interrupt events allow you to configure the execution of an interrupt OB at a configured cycle time. You configure the initial cycle time when you create the cyclic interrupt OB. A cyclic event interrupts the program cycle and executes the corresponding cyclic interrupt OB. Note that the cyclic interrupt event is at a higher priority class than the program cycle event.

You can attach only one cyclic interrupt OB to a cyclic event.

You can assign a phase shift to each cyclic interrupt so that the execution of cyclic interrupts can be offset from one another by the phase offset amount. For example, if you have a 5 ms cyclic event and a 10 ms cyclic event, every ten milliseconds both events occur at the same moment. If you phase shift the 5 ms event by 1 to 4 ms and the 10 ms event by 0 ms, then the two events do not occur at the same moment.

The default phase offset is 0. To change the initial phase shift, or to change the cyclic time for a cyclic event, follow these steps:

1. Right-click the cyclic interrupt OB in the project tree.
2. Select "Properties" from the context menu.
3. Click "Cyclic interrupt" from the "Cyclic interrupt [OB 30]" dialog, and enter the new initial values.

The maximum phase offset is 6000 ms (6 seconds) or the maximum Cyclic time, whichever is smaller.

You can also query and change the scan time and the phase shift from your program using the Query cyclic interrupt (QRY_CINT) and Set cyclic interrupt (SET_CINT) instructions. Scan time and phase shift values set by the SET_CINT instruction do not persist through a power cycle or a transition to STOP mode; scan time and phase shift values return to the initial values following a power cycle or a transition to STOP. The CPU supports a total of four cyclic interrupt events.

5.1.3.5 Hardware interrupt OB

Hardware interrupt OBs execute when the relevant hardware event occurs. A hardware interrupt OB interrupts normal cyclic program execution in reaction to a signal from a hardware event.

Hardware interrupt events

Changes in the hardware, such as a rising or falling edge on an input point, or an HSC (High Speed Counter) event trigger hardware interrupt events. The S7-1200 supports one interrupt OB for each hardware interrupt event. You enable the hardware events in the device configuration, and assign an OB for an event in the device configuration or with an ATTACH instruction in the user program. The CPU supports several hardware interrupt events. The CPU model and the number of input points determine the exact events that are available.

Limits on hardware interrupt events are as follows:

Edges:

- Rising edge events: maximum of 16
- Falling edge events: maximum of 16

HSC events:

- CV=PV: maximum of 6
- Direction changed: maximum of 6
- External reset: maximum of 6

Table 5- 5 Start information for a hardware interrupt OB

Input	Data type	Description
LADDR	HW_IO	Hardware identifier of the module that triggered the hardware interrupt
USI	WORD	User structure identifier (16#0001 to 16#FFFF), reserved for future use
IChannel	USINT	Number of the channel that triggered the interrupt
EventType	BYTE	Identifier for the module-specific event type associated with the event triggering the interrupt, for example falling edge or rising edge.

The bits in EventType depend on the triggering module as shown below:

Module / Submodule	Value	Process event
Onboard I/O from CPU or SB	16#0	Rising edge
	16#1	Falling edge
HSC	16#0	HSC CV=RV1
	16#1	HSC direction changed
	16#2	HSC reset
	16#3	HSC CV=RV2

5.1.3.6 Time error interrupt OB

If configured, the time error interrupt OB (OB 80) executes when either the scan cycle exceeds the maximum cycle time or a time error event occurs. If triggered, it executes, interrupting normal cyclic program execution or any other event OB.

The occurrence of either of these events generates a diagnostic buffer entry describing the event. The diagnostic buffer entry is generated regardless of the existence of the time error interrupt OB.

Time error interrupt events

The occurrence of any of several different time error conditions results in a time error event:

- Scan cycle exceeds maximum cycle time

  The "maximum cycle time exceeded" condition results if the program cycle does not complete within the specified maximum scan cycle time. See the section "Monitoring and configuring the cycle time" (Page 107) for more information regarding the maximum cycle time condition, how to configure the maximum scan cycle time in the properties of the CPU, and how to reset the cycle timer.

- CPU cannot start requested OB because a second time interrupt (cyclic or time-delay) starts before the CPU finishes execution of the first interrupt OB
- Queue overflow occurred

The "queue overflow occurred" condition results if the interrupts are occurring faster than the CPU can process them. The CPU limits the number of pending (queued) events by using a different queue for each event type. If an event occurs when the corresponding queue is full, the CPU generates a time error event.

All time error events trigger the execution of the time error interrupt OB if it exists. If the time error interrupt OB does not exist, then the CPU changes to STOP mode.

The user program can extend the program cycle execution time up to ten times the configured maximum cycle time by executing the RE_TRIGR instruction (Page 304) to restart the cycle time monitor. However, if two "maximum cycle time exceeded" conditions occur within the same program cycle without resetting the cycle timer, then the CPU transitions to STOP, regardless of whether the time error interrupt OB exists. See the section on "Monitoring the cycle time in the S7-1200 System Manual" (Page 107).

Time error interrupt OB includes start information that helps you determine which event and OB generated the time error. You can program instructions inside the OB to examine these start values and to take appropriate action.

Table 5- 6 Start information for the time error OB (OB 80)

Input	Data type	Description
fault_id	BYTE	16#01 - maximum cycle time exceeded 16#02 - requested OB cannot be started 16#07 and 16#09 - queue overflow occurred
csg_OBnr	OB_ANY	Number of the OB which was being executed when the error occurred
csg_prio	UINT	Priority of the OB causing the error

To include a time error interrupt OB in your project, you must add a time error interrupt by double-clicking "Add new block" under "Program blocks" in the tree, then choose "Organization block", and then "Time error interrupt".

The priority for a new V4.0 CPU is 22. If you exchange a V3.0 CPU for a V4.0 CPU (Page 1561), the priority is 26, the priority that was in effect for V3.0. In either case, the priority field is editable and you can set the priority to any value in the range 22 to 26.

5.1.3.7 Diagnostic error interrupt OB

The diagnostic error interrupt OB executes when the CPU detects a diagnostic error, or if a diagnostics-capable module recognizes an error and you have enabled the diagnostic error interrupt for the module. The diagnostic error interrupt OB interrupts the normal cyclic program execution. You can include an STP instruction in the diagnostic error interrupt OB to put the CPU in STOP mode if you desire your CPU to enter STOP mode upon receiving this type of error.

If you do not include a diagnostic error interrupt OB in your program, the CPU ignores the error and stays in RUN mode.

Diagnostic error events

Analog (local), PROFINET, PROFIBUS, and some digital (local) devices are capable of detecting and reporting diagnostic errors. The occurrence or removal of any of several different diagnostic error conditions results in a diagnostic error event. The following diagnostic errors are supported:

- No user power
- High limit exceeded
- Low limit exceeded
- Wire break
- Short circuit

Diagnostic error events trigger the execution of the diagnostic error interrupt OB (OB 82) if it exists. If it does not exist, then the CPU ignores the error.

To include a diagnostic error interrupt OB in your project, you must add a diagnostic error interrupt by double-clicking "Add new block" under "Program blocks" in the tree, then choose "Organization block", and then "Diagnostic error interrupt".

Note

Diagnostic errors for multi-channel local analog devices (I/O, RTD, and Thermocouple)

The diagnostic error interrupt OB can process only one channel's diagnostic error at a time.

If two channels of a multi-channel device have an error, then the second error only triggers the diagnostic error interrupt OB under the following conditions: the first channel error clears, the execution of the diagnostic error interrupt OB that the first error triggered is complete, and the second error still exists.

The diagnostic error interrupt OB includes startup information that helps you determine whether the event is due to the occurrence or removal of an error, and the device and channel which reported the error. You can program instructions inside the diagnostic error interrupt OB to examine these startup values and to take appropriate action.

Note

Diagnostic error OB Start information references the submodule as a whole if no diagnostic event is pending

In V3.0, the start information for an outgoing diagnostic error event always indicated the source of the event. In V4.0, if the outgoing event leaves the submodule with no pending diagnostics, the start information references the submodule as a whole (16#8000) even if the source of the event was a specific channel.

For example, if a wire break triggers a diagnostic error event on channel 2, the fault is then corrected, and the diagnostic error event is cleared, the Start information will not reference channel 2, but the submodule (16#8000).

Table 5- 7 Startup information for the diagnostic error interrupt OB

Input	Data type	Description
IOstate	WORD	IO state of the device: • Bit 0 = 1 if the configuration is correct, and = 0 if the configuration is no longer correct. • Bit 4 = 1 if an error is present (such as a wire break). (Bit 4 = 0 if there is no error.) • Bit 5 = 1 if the configuration is **not** correct, and = 0 if the configuration is correct again. • Bit 7 = 1 if an I/O access error has occurred. Refer to LADDR for the hardware identifier of the I/O with the access error. (Bit 6 = 0 if there is no error.)
LADDR	HW_ANY	Hardware identifier of the device or functional unit that reported the error[1]
Channel	UINT	Channel number
MultiError	BOOL	TRUE if more than one error is present

[1] The LADDR input contains the hardware identifier of the device or functional unit which returned the error. The hardware identifier is assigned automatically when components are inserted in the device or network view and appears in the Constants tab of PLC tags. A name is also assigned automatically for the hardware identifier. These entries in the Constants tab of the PLC tags cannot be changed.

5.1.3.8 Pull or plug of modules OB

The "Pull or plug of modules" OB executes when a configured and non-disabled distributed I/O module or submodule (PROFIBUS, PROFINET, AS-i) generates an event related to inserting or removing a module.

Pull or plug of modules event

The following conditions generate a pull of plug of modules event:

- Someone removes or inserts a configured module
- A configured module is not physically present in an expansion rack
- An incompatible module is in an expansion rack that does not correspond to the configured module
- A compatible module for a configured module is in an expansion rack, but the configuration does not allow substitutes
- A module or submodule has parameterization errors

If you have not programmed this OB, the CPU remains in RUN mode when any of these conditions occur with a configured and non-disabled distributed I/O module.

Regardless of whether you have programmed this OB, the CPU changes to STOP mode when any of these conditions occur with a module in the central rack.

Table 5- 8 Start information for pull or plug of modules OB

Input	Data type	Description
LADDR	HW_IO	Hardware identifier
Event_Class	Byte	16#38: module inserted 16#29: module removed
Fault_ID	Byte	Fault identifier

5.1.3.9 Rack or station failure OB

The "Rack or station failure" OB executes when the CPU detects the failure or communication loss of a distributed rack or station.

Rack or station failure event

The CPU generates a rack or station failure event when it detects one of the following:

- The failure of a DP master system or of a PROFINET IO system (in the case of either an incoming or an outgoing event).
- The failure of a DP slave or of an IO device (in the case of either an incoming or an outgoing event)
- Failure of some of the submodules of a PROFINET I-device

If you have not programmed this OB, the CPU remains in RUN mode when any of these conditions occur.

Table 5- 9 Start information for rack or station failure OB

Input	Data type	Description
LADDR	HW_IO	Hardware identifier
Event_Class	Byte	16#38: outgoing event 16#39: incoming event
Fault_ID	Byte	Fault identifier

5.1.3.10 Time of day OB

Time of day OBs execute based on configured clock time conditions. The CPU supports two time of day OBs.

Time of day events

You can configure a time of day interrupt event to occur once on a specified date or time or cyclically with one of the following cycles:

- Every minute: The interrupt occurs every minute.
- Hourly: The interrupt occurs every hour.
- Daily: The interrupt occurs every day at a specified time (hour and minute).
- Weekly: The interrupt occurs every week at a specified time on a specified day of the week (for example, every Tuesday at 4:30 in the afternoon).
- Monthly: The interrupt occurs every month at a specified time on a specified day of the month. The day number must be between 1 and 28, inclusive.
- Every end of month: The interrupt occurs on the last day of every month at a specified time.
- Yearly: The interrupt occurs every year on the specified date (month and day). You cannot specify a date of February 29.

Table 5- 10 Start information for a time of day event OB

Input	Data type	Description
CaughtUp	Bool	OB call is caught up because time was set forward
SecondTimes	Bool	OB call is started a second time because time was set backward

5.1.3.11 Status OB

Status OBs execute if a DPV1 or PNIO slave triggers a status interrupt. This might be the case if a component (module or rack) of a DPV1 or PNIO slave changes its operating mode, for example from RUN to STOP.

Status events

For detailed information on events that trigger a status interrupt, refer to the manufacturer's documentation for the DPV1 or PNIO slave.

Table 5- 11 Start information for status OB

Input	Data type	Description
LADDR	HW_IO	Hardware identifier
Slot	UInt	Slot number
Specifier	Word	Alarm specifier

5.1.3.12 Update OB

Update OBs execute if a DPV1 or PNIO slave triggers an update interrupt.

Update events

For detailed information on events that trigger an update interrupt, refer to the manufacturer's documentation for the DPV1 or PNIO slave.

Table 5- 12 Start information for update OB

Input	Data type	Description
LADDR	HW_IO	Hardware identifier
Slot	UInt	Slot number
Specifier	Word	Alarm specifier

5.1.3.13 Profile OB

Profile OBs execute if a DPV1 or PNIO slave triggers a profile-specific interrupt.

Profile events

For detailed information on events that trigger a profile interrupt, refer to the manufacturer's documentation for the DPV1 or PNIO slave.

Table 5- 13 Start information for profile OB

Input	Data type	Description
LADDR	HW_IO	Hardware identifier
Slot	UInt	Slot number
Specifier	Word	Alarm specifier

5.1.3.14 MC-Servo and MC-Interpolator OB

STEP 7 creates the read-only MC-Servo and MC-Interpolator OBs automatically when you create a motion technology object and set the drive interface to be "Analog drive connection" or "PROFIDrive". You do not need to edit any OB properties or create this OB directly. The CPU uses these OBs for closed loop control. Refer to the STEP 7 Information System for further details.

5.1.3.15 MC-PreServo

You can program the MC-PreServo OB to contain program logic for the STEP 7 program to execute directly before the MC-Servo OB executes.

MC-PreServo events

The MC-PreServo OB allows you to read out the configured application cycle information in microseconds.

Table 5- 14 Start information for MC-PreServo OB

Input	Data type	Description
Initial_Call	BOOL	TRUE indicates first call of this OB on transition from STOP to RUN
PIP_Input	BOOL	TRUE indicates the associated process image input is up to date.
PIP_Output	BOOL	TRUE indicates that the CPU transferred the associated process image output to the outpus in good time after the last cycle.
IO_System	USINT	Number of the distributed I/O system triggering the interrupt
Event_Count	INT	n: number of lost cycles -1: unknown number of cycles lost (for example, because cycle has changed)
Synchronous	BOOL	Reserved
CycleTime	UDINT	Display of the application cycle configured for the MC-Servo OB in microseconds

5.1.3.16 MC-PostServo

You can program the MC-PreServo OB to contain program logic for the STEP 7 program to execute directly after the MC-Servo OB executes.

MC-PostServo events

The MC-PreServo OB allows you to read out the configured application cycle information in microseconds.

Table 5- 15 Start information for MC-PostServo OB

Input	Data type	Description
Initial_Call	BOOL	TRUE indicates first call of this OB on transition from STOP to RUN
PIP_Input	BOOL	TRUE indicates the associated process image input is up to date.
PIP_Output	BOOL	TRUE indicates that the CPU transferred the associated process image output to the outpus in good time after the last cycle.
IO_System	USINT	Number of the distributed I/O system triggering the interrupt
Event_Count	INT	n: number of lost cycles -1: unknown number of cycles lost (for example, because cycle has changed)
Synchronous	BOOL	Reserved
CycleTime	UDINT	Display of the application cycle configured for the MC-Servo OB in microseconds

5.1.3.17 Event execution priorities and queuing

The CPU processing is controlled by events. An event triggers an interrupt OB to be executed. You can specify the interrupt OB for an event during the creation of the block, during the device configuration, or with an ATTACH or DETACH instruction. Some events happen on a regular basis like the program cycle or cyclic events. Other events happen only a single time, like the startup event and time delay events. Some events happen when the hardware triggers an event, such as an edge event on an input point or a high speed counter event. Events like the diagnostic error and time error event only happen when an error occurs. The event priorities and queues are used to determine the processing order for the event interrupt OBs.

The CPU processes events in order of priority where 1 is the lowest priority and 26 is the highest priority. Prior to V4.0 of the S7-1200 CPU, each type of OB belonged to a fixed priority class (1 to 26). From V4.0 forward, you can assign a priority class to each OB that you configure. You configure the priority number in the attributes of the OB properties.

Interruptible and non-interruptible execution modes

OBs (Page 92) execute in priority order of the events that trigger them. In the Startup properties of the device configuration of the CPU (Page 165), you can configure OB execution to be interruptible or non-interruptible. Note that program cycle OBs are always interruptible, but you can configure all other OBs to be either interruptible or non-interruptible.

If you set interruptible mode, then if an OB is executing and a higher priority event occurs before the OB completes its execution, the running OB is interrupted to allow the higher-priority event OB to run. The higher-priority event runs, and at its completion, the OB that was interrupted continues. When multiple events occur while an interruptible OB is executing, the CPU processes those events in priority order.

If you do not set interruptible mode, then an OB runs to completion when triggered regardless of any other events that trigger during the time that it is running.

Consider the following two cases where interrupt events trigger a cyclic OB and a time delay OB. In both cases, the time delay OB (OB 201) has no process image partition assignment (Page 83) and executes at priority 4. The cyclic OB (OB 200) has a process image partition assignment of PIP1 and executes at priority 2. The following illustrations show the difference in execution between non-interruptible and interruptible execution modes:

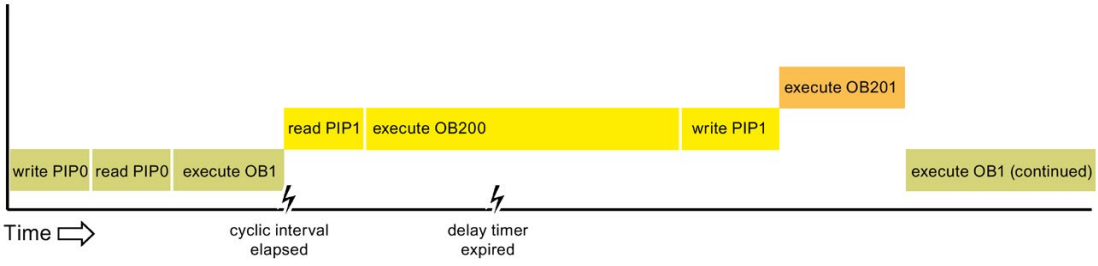


Figure 5-1 Case 1: Non-interruptible OB execution

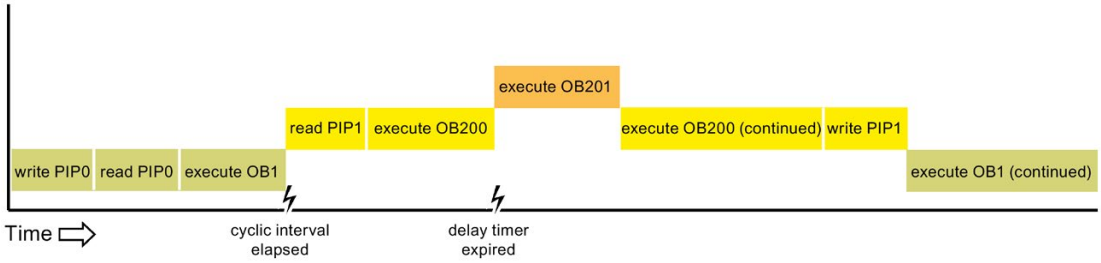


Figure 5-2 Case 2: Interruptible OB execution

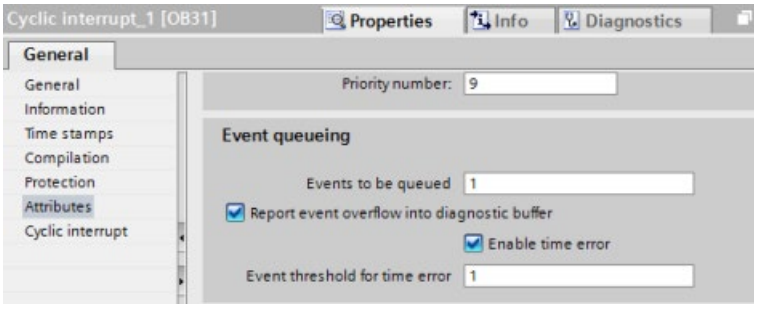
Note

If you configure the OB execution mode to be non-interruptible, then a time error OB cannot interrupt OBs other than program cycle OBs. Prior to V4.0 of the S7-1200 CPU, a time error OB could interrupt any executing OB. From V4.0 forward, you must configure OB execution to be interruptible if you want a time error OB (or any other higher priority OB) to be able to interrupt executing OBs that are not program cycle OBs.

Understanding event execution priorities and queuing

The CPU limits the number of pending (queued) events from a single source, using a different queue for each event type. Upon reaching the limit of pending events for a given event type, the next event is lost. You can use a time error interrupt OB (Page 95) to respond to queue overflows.

Note that STEP 7 allows you to configure some specific event queueing parameters for the Cyclic interrupt OB and the Time of day OB.



For further information on CPU overload behavior and event queueing, refer to the STEP 7 Information System.

Each CPU event has an associated priority. In general, the CPU services events in order of priority (highest priority first). The CPU services events of the same priority on a "first-come, first-served" basis.

Table 5- 16 OB events

Event	Quantity allowed	Default OB priority
Program cycle	1 program cycle event Multiple OBs allowed	1[4]
Startup	1 startup event [1] Multiple OBs allowed	1[4]
Time delay	Up to 4 time events 1 OB per event	OB 20: 3 OB 21: 4 OB 22: 5 OB 23: 6 OB 123 to OB 32767: 3
Cyclic interrupt	Up to 4 events 1 OB per event	OB 30: 8 OB 31: 9 OB 32: 10 OB 33: 11 OB 34: 12 OB 35: 13 OB 36: 14 OB 37: 16 OB 38: 17 OB 123 to OB 32767: 7
Hardware interrupt	Up to 50 hardware interrupt events[2]	18
	1 OB per event, but you can use the same OB for multiple events	18
Time error	1 event (only if configured)[3]	22 or 26[4]
Diagnostic error	1 event (only if configured)	5
Pull or plug of modules	1 event	6
Rack or station failure	1 event	6
Time of day	Up to 2 events	2
Status	1 event	4
Update	1 event	4
Profile	1 event	4

Event	Quantity allowed	Default OB priority
MC-Servo	1 event	25
MC-Interpolator	1 event	24

1 The startup event and the program cycle event never occur at the same time because the startup event runs to completion before the program cycle event starts.

2 You can have more than 50 hardware interrupt event OBs if you use the DETACH and ATTACH instructions.

3 You can configure the CPU to stay in RUN if the scan cycle exceeds the maximum scan cycle time or you can use the RE_TRIGR instruction to reset the cycle time. However, the CPU goes to STOP mode the second time that one scan cycle exceeds the maximum scan cycle time.

4 The priority for a new V4.0 or V4.1 CPU is 22. If you exchange a V3.0 CPU for a V4.0 or V4.1 CPU, the priority is 26: the priority that was in effect for V3.0. In either case, the priority field is editable and you can set the priority to any value in the range 22 to 26.

Refer to the topic "Exchanging a V3.0 CPU for a V4.2.x CPU (Page 1561)" for more details.

In addition, the CPU recognizes other events that do not have associated OBs. The following table describes these events and the corresponding CPU actions:

Table 5- 17 Additional events

Event	Description	CPU action
I/O access error	Direct I/O read/write error	The CPU logs the first occurrence in the diagnostic buffer and stays in RUN mode. You can access the error cause using the GET_ERROR_ID (Page 306) instruction.
Max cycle time error	CPU exceeds the configured cycle time twice	The CPU logs the error in the diagnostic buffer and transitions to STOP mode.
Peripheral access error	I/O error during process image update	The CPU logs the first occurrence in the diagnostic buffer and stays in RUN mode.
Programming error	program execution error	• If block-local error handling is enabled, the system enters an error cause in the error structure. You can access the error cause using the GET_ERROR_ID (Page 306) instruction. • If global error handling is enabled, the system enters an access error start event into the diagnostic buffer and stays in RUN mode.

Interrupt latency

The interrupt event latency (the time from notification of the CPU that an event has occurred until the CPU begins execution of the first instruction in the OB that services the event) is approximately 175 µsec, provided that a program cycle OB is the only event service routine active at the time of the interrupt event.

5.1.4 Monitoring and configuring the cycle time

The cycle time is the time that the CPU operating system requires to execute the cyclic phase of the RUN mode. The CPU provides two methods of monitoring the cycle time:

- Maximum scan cycle time
- Minimum scan cycle time

Scan cycle monitoring begins after the startup event is complete. Configuration for this feature appears under the "Device Configuration" for the CPU under "Cycle time".

The CPU monitors the scan cycle and reacts if the scan cycle time exceeds the configured maximum scan cycle time. The CPU generates an error and responds as follows if the scan cycle time exceeds the configured maximum scan cycle time:

- If the user program includes a time error interrupt OB (Page 95), then the CPU executes it.
- If the user program does not include a time error interrupt OB, then the time error event generates a diagnostic buffer entry. The CPU goes to STOP mode.

The RE_TRIGR instruction (Page 304) (re-trigger cycle time monitoring) allows you to reset the timer that measures the cycle time. If the elapsed time for the current program cycle execution is less than ten times the configured maximum scan cycle time, the RE_TRIGR instruction retriggers the cycle time monitoring and returns with ENO = TRUE. If not, the RE_TRIGR instruction does not retrigger the cycle time monitoring. It returns ENO = FALSE.

Typically, the scan cycle executes as fast as it can be executed and the next scan cycle begins as soon as the current one completes. Depending upon the user program and communication tasks, the time period for a scan cycle can vary from scan to scan. To eliminate this variation, the CPU supports an optional minimum scan cycle time. If you enable this optional feature and provide a minimum scan cycle time in ms, then the CPU delays after the execution of the program cycle OBs until the minimum scan cycle time elapses before repeating the program cycle.

In the event that the CPU completes the normal scan cycle in less time than the specified minimum cycle time, the CPU spends the additional time of the scan cycle performing runtime diagnostics and/or processing communication requests.

In the event that the CPU does not complete the scan cycle in the specified minimum cycle time, the CPU completes the scan normally (including communication processing) and does not create any system reaction as a result of exceeding the minimum scan time. The following table defines the ranges and defaults for the cycle time monitoring functions:

Table 5- 18 Range for the cycle time

Cycle time	Range (ms)	Default
Maximum scan cycle time[1]	1 to 6000	150 ms
Minimum scan cycle time[2]	1 to maximum scan cycle time	Disabled

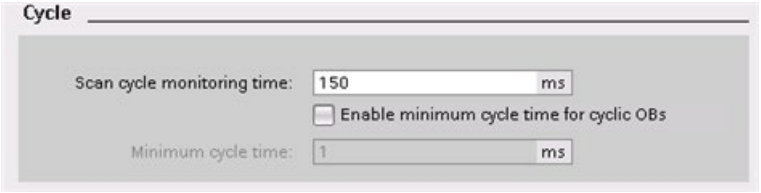
1 The maximum scan cycle time is always enabled. Configure a cycle time between 1 ms to 6000 ms. The default is 150 ms.

2 The minimum scan cycle time is optional, and is disabled by default. If required, configure a cycle time between 1 ms and the maximum scan cycle time.

Configuring the cycle time and communication load

You use the CPU properties in the Device configuration to configure the following parameters:

- Cycle: You can enter a maximum scan cycle monitoring time. You can also enable and enter a minimum scan cycle time.



- Communication load: You can configure a percentage of the time to be dedicated for communication tasks.



For more information about the scan cycle, see "Monitoring the cycle time". (Page 107)

5.1.5 CPU memory

Memory management

The CPU provides the following memory areas to store the user program, data, and configuration:

- Load memory is non-volatile storage for the user program, data and configuration. When you download a project to the CPU, the CPU first stores the program in the Load memory area. This area is located either in a memory card (if present) or in the CPU. The CPU maintains this non-volatile memory area through a power loss. The memory card supports a larger storage space than that built-in to the CPU.
- Work memory is volatile storage for some elements of the user project while executing the user program. The CPU copies some elements of the project from load memory into work memory. This volatile area is lost when power is removed, and is restored by the CPU when power is restored.
- Retentive memory is non-volatile storage for a limited quantity of work memory values. The CPU uses the retentive memory area to store the values of selected user memory locations during power loss. When a power down or power loss occurs, the CPU restores these retentive values upon power up.

To display the memory usage for a compiled program block, right-click the block in the "Program blocks" folder in the STEP 7 project tree and select "Resources" from the context menu. The Compiliation properties display the load memory and work memory for the compiled block.

To display the memory usage for the online CPU, double-click "Online and diagnostics" in STEP 7, expand "Diagnostics", and select "Memory".

Retentive memory

You can avoid data loss after power failure by marking certain data as retentive. The CPU allows you to configure the following data as retentive:

- Bit memory (M): You can define the size of retentive memory for bit memory in the PLC tag table or in the assignment list. Retentive bit memory always starts at MB0 and runs consecutively up through a specified number of bytes. Specify this value from the PLC tag table or in the assignment list by clicking the "Retain" toolbar icon. Enter the number of M bytes to retain starting at MB0.

  Note: For any block, you can display the assignment list by selecting a block in the Program Blocks folder and then selecting he **Tools > Assignment list** menu command.

- Tags of a function block (FB): If an FB is of type "Optimized block access", then the interface editor for this FB includes a "Retain" column. In this column, you can select either "Retain", "Non-retain", or "Set in IDB" individually for each tag. When you place such an FB in the program, the instance DB that corresponds to the FB includes this "Retain" column as well. You can only change the retentive state of a tag from within the instance DB interface editor if you selected "Set in IDB" (Set in instance data block) in the Retain selection for the tag in the optimized FB.

  If an FB is **not** of type "Optimized block access", then the interface editor for this FB does not include a "Retain" column. When you place such an FB in the program, the instance DB that corresponds to the FB does, however, include a "Retain" column that is available for edit. In this case, selecting the "Retain" option for any tag results in the selection of **all** tags. Similarly, deselecting the option for any tag results in the deselection of **all** tags.

  To view or modify whether an FB is optimized, open the properties of the FB and select the attributes.

- Tags of a global data block: The behavior of a global DB with regard to retentive state assignment is similar to that of an FB. Depending on the block access setting you can define the retentive state either for individual tags or for all tags of a global data block.
  - If you select "Optimized" when you create the DB, you can set the retentive state for each individual tag.
  - If you select "Standard - compatible with S7-300/400" when you create the DB, the retentive-state setting applies to all tags of the DB; either all tags are retentive or no tag is retentive.

The CPU supports a total of 10240 bytes of retentive data. To see how much is available, from the PLC tag table or the assignment list, click the "Retain" toolbar icon. Although this is where the retentive range is specified for M memory, the second row indicates the total remaining memory available for M and DB combined. Note that for this value to be accurate, you must compile all data blocks with retentive tags.

Note

Downloading a program does not clear or make any changes to existing values in retentive memory. If you want to clear retentive memory before a download, then reset your CPU to factory settings prior to downloading the program.

5.1.5.1 System and clock memory

You use the CPU properties to enable bytes for "system memory" and "clock memory". Your program logic can reference the individual bits of these functions by their tag names.

- You can assign one byte in M memory for system memory. The byte of system memory provides the following four bits that can be referenced by your user program by the following tag names:
  - First cycle: (Tag name "FirstScan") bit is set to1 for the duration of the first scan after the startup OB finishes. (After the execution of the first scan, the "first scan" bit is set to 0.)
  - Diagnostics status changed: (Tag name: "DiagStatusUpdate") is set to 1 for one scan after the CPU logs a diagnostic event. Because the CPU does not set the "DiagStatusUpdate" bit until the end of the first execution of the program cycle OBs, your user program cannot detect if there has been a diagnostic change either during the execution of the startup OBs or the first execution of the program cycle OBs.
  - Always 1 (high): (Tag name "AlwaysTRUE") bit is always set to 1.
  - Always 0 (low): (Tag name "AlwaysFALSE") bit is always set to 0.
- You can assign one byte in M memory for clock memory. Each bit of the byte configured as clock memory generates a square wave pulse. The byte of clock memory provides 8 different frequencies, from 0.5 Hz (slow) to 10 Hz (fast). You can use these bits as control bits, especially when combined with edge instructions, to trigger actions in the user program on a cyclic basis.

The CPU initializes these bytes on the transition from STOP mode to STARTUP mode. The bits of the clock memory change synchronously to the CPU clock throughout the STARTUP and RUN modes.

⚠ CAUTION

Risks with overwriting the system memory or clock memory bits

Overwriting the system memory or clock memory bits can corrupt the data in these functions and cause your user program to operate incorrectly, which can cause damage to equipment and injury to personnel.

Because both the clock memory and system memory are unreserved in M memory, instructions or communications can write to these locations and corrupt the data.

Avoid writing data to these locations to ensure the proper operation of these functions, and always implement an emergency stop circuit for your process or machine.

System memory configures a byte with bits that turn on (value = 1) for a specific event.

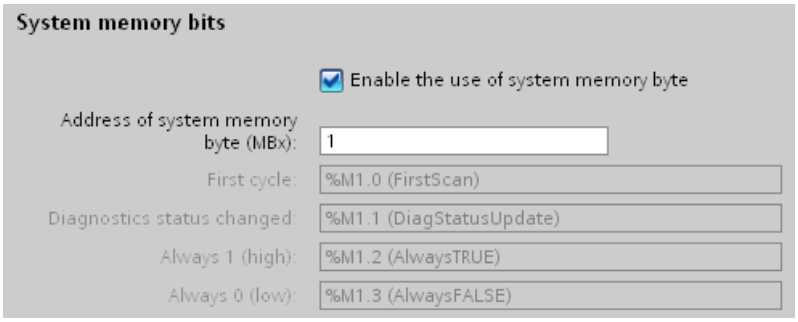


Table 5- 19 System memory

7	6	5	4	3	2	1	0
Reserved Value 0				Always off Value 0	Always on Value 1	Diagnostic status indicator • 1: Change • 0: No change	First scan indicator • 1: First scan after startup • 0: Not first scan

Clock memory configures a byte that cycles the individual bits on and off at fixed intervals. Each clock bit generates a square wave pulse on the corresponding M memory bit. These bits can be used as control bits, especially when combined with edge instructions, to trigger actions in the user code on a cyclic basis.

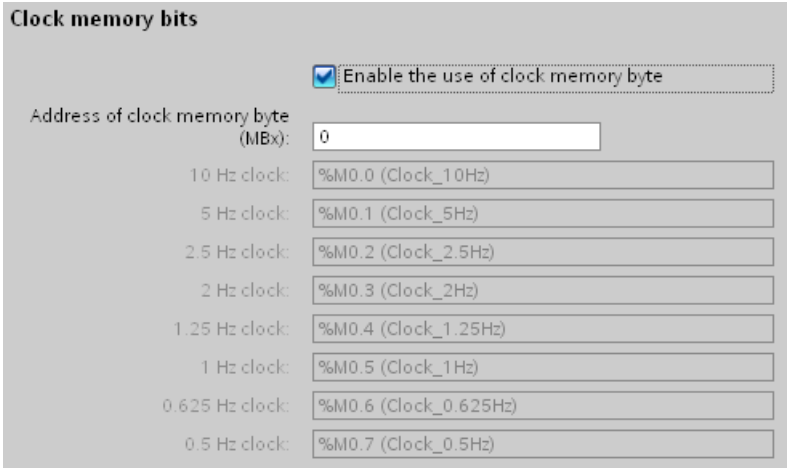


Table 5- 20 Clock memory

Bit number	7	6	5	4	3	2	1	0
Tag name								
Period (s)	2.0	1.6	1.0	0.8	0.5	0.4	0.2	0.1
Frequency (Hz)	0.5	0.625	1	1.25	2	2.5	5	10

Because clock memory runs asynchronously to the CPU cycle, the status of the clock memory can change several times during a long cycle.

5.1.6 Diagnostics buffer

The CPU supports a diagnostics buffer that contains an entry for each diagnostic event. Each entry includes a date and time the event occurred, an event category, and an event description. The entries are displayed in chronological order with the most recent event at the top. Up to 50 most recent events are available in this log. When the log is full, a new event replaces the oldest event in the log. When power is lost, the events are saved.

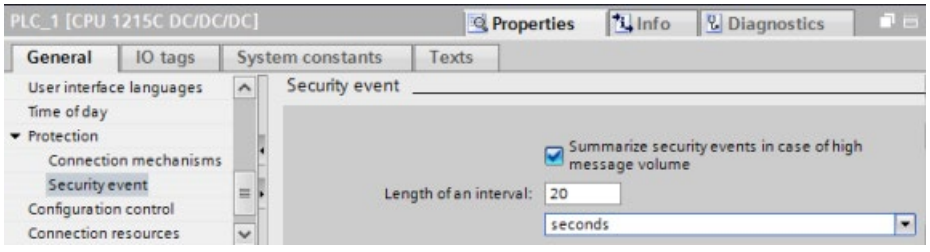
The following types of events are recorded in the diagnostics buffer:

- Each system diagnostic event; for example, CPU errors and module errors
- Each state change of the CPU (each power up, each transition to STOP, each transition to RUN)

To access the diagnostics buffer (Page 1308), you must be online. From the "Online & diagnostics" view, locate the diagnostics buffer under "Diagnostics > Diagnostics buffer".

Reducing the number of security diagnostic events

Some security events generate repeated entries in the diagnostics buffer. These messages can fill up the diagnostics buffer and potentially obscure other event messages. You can configure the PLC to limit the number of diagnostic messages from security events. You make selections in the device configuration of the CPU based on the time interval in which you want to suppress recurring messages:



If you choose to summarize security events within a time interval, you have the choice of setting a time interval in seconds, minutes, or hours, and a numerical value in the range 1 .. 255.

If you choose to restrict security events, you will be restricting these types of events:

- Going online with the correct or incorrect password
- Manipulated communications data detected
- Manipulated data detected on memory card
- Manipulated firmware update file detected
- Changed protection level (access protection) downloaded to the CPU
- Password legitimization restricted or enabled (by instruction or CPU display)
- Online access denied due to the possible number of simultaneous access attempts being exceeded
- Timeout when an existing online connection is inactive
- Logging in to the Web server with the correct or incorrect password

- Creating a backup of the CPU
- Restoring the CPU configuration

5.1.7 Time of day clock

The CPU supports a time-of-day clock. A super-capacitor supplies the energy required to keep the clock running during times when the CPU is powered down. The super-capacitor charges while the CPU has power. After the CPU has been powered up at least 24 hours, then the super-capacitor has sufficient charge to keep the clock running for typically 20 days.

STEP 7 sets the time-of-day clock to system time, which has a default value out of the box or following a factory reset. To utilize the time-of-day clock, you must set it. Timestamps such as those for diagnostic buffer entries, data log files, and data log entries are based on the system time. You set the time of day from the "Set time of day" function (Page 1302) in the "Online & diagnostics" view of the online CPU. STEP 7 then calculates the system time from the time you set plus or minus the Windows operating system offset from UTC (Coordinated Universal Time). Setting the time of day to the current local time produces a system time of UTC if your Windows operating system settings for time zone and daylight savings time correspond to your locale.

STEP 7 includes instructions (Page 332) to read and write the system time (RD_SYS_T and WR_SYS_T), to read the local time (RD_LOC_T), and to set the time zone (SET_TIMEZONE). The RD_LOC_T instruction calculates local time using the time zone and daylight saving time offsets that you set in the "Time of day" configuration in the general properties of the CPU (Page 165). These settings enable you to set your time zone for local time, optionally enable daylight saving time, and specify the start and end dates and times for daylight saving time. You can also use the SET_TIMEZONE instructions to configure these settings.

5.1.8 Configuring the outputs on a RUN-to-STOP transition

You can configure the behavior of the digital and analog outputs when the CPU is in STOP mode. For any output of a CPU, SB or SM, you can set the outputs to either freeze the value or use a substitute value:

- Substituting a specified output value (default): You enter a substitute value for each output (channel) of that CPU, SB, or SM device.

  The default substitute value for digital output channels is OFF, and the default substitute value for analog output channels is 0.

- Freezing the outputs to remain in last state: The outputs retain their current value at the time of the transition from RUN to STOP. After power up, the outputs are set to the default substitute value.

You configure the behavior of the outputs in Device Configuration. Select the individual devices and use the "Properties" tab to configure the outputs for each device.

Note

Some distibuted I/O modules offer additional settings for the reaction to CPU stop mode. Select from the list of choices in Device Configuration for those modules.

When the CPU changes from RUN to STOP, the CPU retains the process image and writes the appropriate values for both the digital and analog outputs, based upon the configuration.

5.2 Data storage, memory areas, I/O and addressing

5.2.1 Accessing the data of the S7-1200

STEP 7 facilitates symbolic programming. You create symbolic names or "tags" for the addresses of the data, whether as PLC tags relating to memory addresses and I/O points or as local variables used within a code block. To use these tags in your user program, simply enter the tag name for the instruction parameter.

For a better understanding of how the CPU structures and addresses the memory areas, the following paragraphs explain the "absolute" addressing that is referenced by the PLC tags. The CPU provides several options for storing data during the execution of the user program:

- Global memory: The CPU provides a variety of specialized memory areas, including inputs (I), outputs (Q) and bit memory (M). This memory is accessible by all code blocks without restriction.
- PLC tag table: You can enter symbolic names in the STEP 7 PLC tag table for specific memory locations. These tags are global to the STEP 7 program and allow programming with names that are meaningful for your application.
- Data block (DB): You can include DBs in your user program to store data for the code blocks. The data stored persists when the execution of the associated code block comes to an end. A "global" DB stores data that can be used by all code blocks, while an instance DB stores data for a specific FB and is structured by the parameters for the FB.
- Temp memory: Whenever a code block is called, the operating system of the CPU allocates the temporary, or local, memory (L) to be used during the execution of the block. When the execution of the code block finishes, the CPU reallocates the local memory for the execution of other code blocks.

Each different memory location has a unique address. Your user program uses these addresses to access the information in the memory location. References to the input (I) or output (Q) memory areas, such as I0.3 or Q1.7, access the process image. To immediately access the physical input or output, append the reference with ":P" (such as I0.3:P, Q1.7:P, or "Stop:P").

Table 5- 21 Memory areas

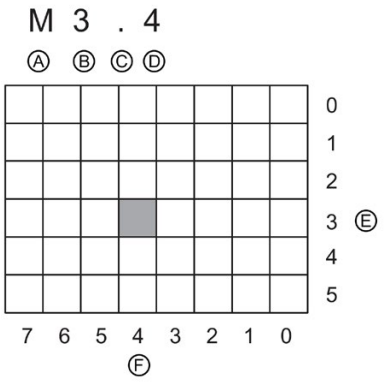
Memory area	Description	Force	Retentive
I Process image input	Copied from physical inputs at the beginning of the scan cycle	No	No
I_:P [1] (Physical input)	Immediate read of the physical input points on the CPU, SB, and SM	Yes	No
Q Process image output	Copied to physical outputs at the beginning of the scan cycle	No	No
Q_:P [1] (Physical output)	Immediate write to the physical output points on the CPU, SB, and SM	Yes	No
M Bit memory	Control and data memory	No	Yes (optional)
L Temp memory	Temporary data for a block local to that block	No	No
DB Data block	Data memory and also parameter memory for FBs	No	Yes (optional)

[1] To immediately access (read or write) the physical inputs and physical outputs, append a ":P" to the address or tag (such as I0.3:P, Q1.7:P, or "Stop:P").

Each different memory location has a unique address. Your user program uses these addresses to access the information in the memory location. The absolute address consists of the following elements:

- Memory area identifier (such as I, Q, or M)
- Size of the data to be accessed ("B' for Byte, "W" for Word, or "D" for DWord)
- Starting address of the data (such as byte 3 or word 3)

When accessing a bit in the address for a Boolean value, you do not enter a mnemonic for the size. You enter only the memory area, the byte location, and the bit location for the data (such as I0.0, Q0.1, or M3.4).



A	Memory area identifier	E	Bytes of the memory area
B	Byte address: byte 3	F	Bits of the selected byte
C	Separator ("byte.bit")		
D	Bit location of the byte (bit 4 of 8)		

In the example, the memory area and byte address (M = bit memory area, and 3 = Byte 3) are followed by a period (".") to separate the bit address (bit 4).

Accessing the data in the memory areas of the CPU

STEP 7 facilitates symbolic programming. Typically, you create tags either in the PLC tag table, a data block, or in the interface of an OB, FC, or FB. These tags include a name, data type, offset, and comment. Additionally, in a data block, you can specify a start value. You can use these tags when programming by entering the tag name at the instruction parameter. Optionally you can enter the absolute operand (memory area, size and offset) at the instruction parameter. The examples in the following sections show how to enter absolute operands. The % character is inserted automatically in front of the absolute operand by the program editor. You can toggle the view in the program editor to one of these: symbolic, symbolic and absolute, or absolute.

I (process image input): The CPU samples the peripheral (physical) input points just prior to the cyclic OB execution of each scan cycle and writes these values to the input process image. You can access the input process image as bits, bytes, words, or double words. Both read and write access is permitted, but typically, process image inputs are only read.

Table 5- 22 Absolute addressing for I memory

Bit	I[byte address].[bit address]	I0.1
Byte, Word, or Double Word	I[size][starting byte address]	IB4, IW5, or ID12

By appending a ":P" to the address, you can immediately read the digital and analog inputs of the CPU, SB, SM or distributed module. The difference between an access using I_:P instead of I is that the data comes directly from the points being accessed rather than from the input process image. This I_:P access is referred to as an "immediate read" access because the data is retrieved immediately from the source instead of from a copy that was made the last time the input process image was updated.

Because the physical input points receive their values directly from the field devices connected to these points, writing to these points is prohibited. That is, I_:P accesses are read-only, as opposed to I accesses which can be read or write.

I_:P accesses are also restricted to the size of inputs supported by a single CPU, SB, or SM, rounded up to the nearest byte. For example, if the inputs of a 2 DI / 2 DQ SB are configured to start at I4.0, then the input points can be accessed as I4.0:P and I4.1:P or as IB4:P. Accesses to I4.2:P through I4.7:P are not rejected, but make no sense since these points are not used. Accesses to IW4:P and ID4:P are prohibited since they exceed the byte offset associated with the SB.

Accesses using I_:P do not affect the corresponding value stored in the input process image.

Table 5- 23 Absolute addressing for I memory (immediate)

Bit	I[byte address].[bit address]:P	I0.1:P
Byte, Word, or Double word	I[size][starting byte address]:P	IB4:P, IW5:P, or ID12:P

Q (process image output): The CPU copies the values stored in the output process image to the physical output points. You can access the output process image in bits, bytes, words, or double words. Both read and write access is permitted for process image outputs.

Table 5- 24 Absolute addressing for Q memory

Bit	Q[byte address].[bit address]	Q1.1
Byte, Word, or Double word	Q[size][starting byte address]	QB5, QW10, QD40

By appending a ":P" to the address, you can immediately write to the physical digital and analog outputs of the CPU, SB, SM or distributed module. The difference between an access using Q_:P instead of Q is that the data goes directly to the points being accessed in addition to the output process image (writes to both places). This Q_:P access is sometimes referred to as an "immediate write" access because the data is sent immediately to the target point; the target point does not have to wait for the next update from the output process image.

Because the physical output points directly control field devices that are connected to these points, reading from these points is prohibited. That is, Q_:P accesses are write-only, as opposed to Q accesses which can be read or write.

Q_:P accesses are also restricted to the size of outputs supported by a single CPU, SB, or SM, rounded up to the nearest byte. For example, if the outputs of a 2 DI / 2 DQ SB are configured to start at Q4.0, then the output points can be accessed as Q4.0:P and Q4.1:P or as QB4:P. Accesses to Q4.2:P through Q4.7:P are not rejected, but make no sense since these points are not used. Accesses to QW4:P and QD4:P are prohibited since they exceed the byte offset associated with the SB.

Accesses using Q_:P affect both the physical output as well as the corresponding value stored in the output process image.

Table 5- 25 Absolute addressing for Q memory (immediate)

Bit	Q[byte address].[bit address]:P	Q1.1:P
Byte, Word, or Double word	Q[size][starting byte address]:P	QB5:P, QW10:P or QD40:P

M (bit memory area): Use the bit memory area (M memory) for both control relays and data to store the intermediate status of an operation or other control information. You can access the bit memory area in bits, bytes, words, or double words. Both read and write access is permitted for M memory.

Table 5- 26 Absolute addressing for M memory

Bit	M[byte address].[bit address]	M26.7
Byte, Word, or Double Word	M[size][starting byte address]	MB20, MW30, MD50

Temp (temporary memory): The CPU allocates the temp memory on an as-needed basis. The CPU allocates the temp memory for the code block and initializes the memory locations to 0 at the time when it starts the code block (for an OB) or calls the code block (for an FC or FB).

Temp memory is similar to M memory with one major exception: M memory has a "global" scope, and temp memory has a "local" scope:

- M memory: Any OB, FC, or FB can access the data in M memory, meaning that the data is available globally for all of the elements of the user program.
- Temp memory: The CPU restricts access to the data in temp memory to the OB, FC, or FB that created or declared the temp memory location. Temp memory locations remain local and different code blocks do not share temp memory, even when the code block calls another code block. For example: When an OB calls an FC, the FC cannot access the temp memory of the OB that called it.

The CPU provides temp (local) memory for each OB priority level:

- 16 Kbytes for startup and program cycle, including associated FBs and FCs
- 6 Kbytes for each additional interrupt event thread, including associated FBs and FCs

You access temp memory by symbolic addressing only.

You can find out the amount of temp (local) memory that the blocks in your program use through the call structure in STEP 7. From the project tree select Program info and then select the Call structure tab. You will see all of the OBs in your program and you can drill down to see the blocks that they call. For each block, you can see the local data allocation. You can also access the Call structure display from the STEP 7 **Tools > Call structure** menu command.

DB (data block): Use the DB memory for storing various types of data, including intermediate status of an operation or other control information parameters for FBs, and data structures required for many instructions such as timers and counters. You can access data block memory in bits, bytes, words, or double words. Both read and write access is permitted for read/write data blocks. Only read access is permitted for read-only data blocks.

Table 5- 27 Absolute addressing for DB memory

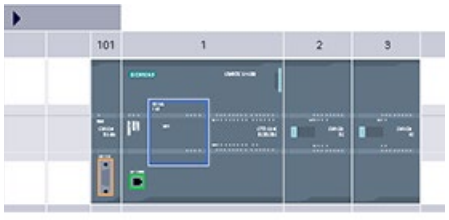
Bit	DB[data block number].DBX[byte address].[bit address]	DB1.DBX2.3
Byte, Word, or Double Word	DB[data block number].DB [size][starting byte address]	DB1.DBB4, DB10.DBW2, DB20.DBD8

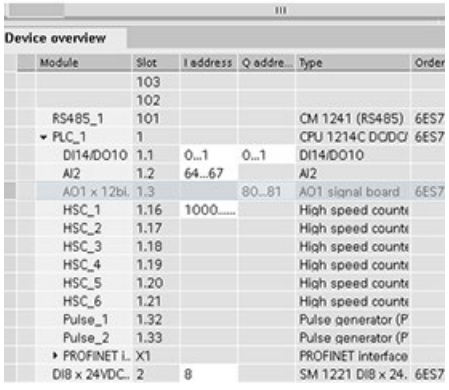
Note

When you specify an absolute address in LAD or FBD, STEP 7 precedes this address with a "%" character to indicate that it is an absolute address. While programming, you can enter an absolute address either with or without the "%" character (for example %I0.0 or I.0). If omitted, STEP 7 supplies the "%" character.

In SCL, you must enter the "%" before the address to indicate that it is an absolute address. Without the "%", STEP 7 generates an undefined tag error at compile time

Configuring the I/O in the CPU and I/O modules





When you add a CPU and I/O modules to your device configuration, STEP 7 automatically assigns I and Q addresses. You can change the default addressing by selecting the address field in the device configuration and entering new numbers.

- STEP 7 assigns digital inputs and outputs in groups of 8 points (1 byte), whether the module uses all the points or not.
- STEP 7 allocates analog inputs and outputs in groups of 2, where each analog point occupies 2 bytes (16 bits).

The figure shows an example of a CPU 1214C with two SMs and one SB. In this example, you could change the address of the DI8 module to 2 instead of 8. The tool assists you by changing address ranges that are the wrong size or conflict with other addresses.

5.3 Processing of analog values

Analog signal modules provide input signals or expect output values that represent either a voltage range or a current range. These ranges are ±10 V, ±5 V, ±2.5 V, or 0 - 20 mA. The values returned by the modules are integer values where 0 to 27648 represents the rated range for current, and -27648 to 27648 for voltage. Anything outside the range represents either an overflow or underflow. See the tables for analog input representation (Page 1458) and analog output representation (Page 1460) for details about the types of out-of-range values.

In your control program, you probably need to use these values in engineering units, for example to represent a volume, temperature, weight or other quantitative value. To do this for an analog input, you must first normalize the analog value to a real (floating point) value from 0.0 to 1.0. Then you must scale it to the minimum and maximum values of the engineering units that it represents. For values that are in engineering units that you need to convert to an analog output value, you first normalize the value in engineering units to a value between 0.0 and 1.0, and then scale it between 0 and 27648 or -27648 to 27648, depending on the range of the analog module. STEP 7 provides the NORM_X and SCALE_X instructions (Page 291) for this purpose. You can also use the CALCULATE instruction (Page 249) to scale the analog values (Page 42).

Example: analog value processing

Consider, for example, an analog input that has a current range of 0 - 20 mA. The analog input module returns values in the range 0 to 27648 for measured values. For this example, consider that you are using this analog input value to measure a temperature range from 50 °C to 100 °C. A few sample values would have the following meanings:

Analog input value	Engineering units
0	50 °C
6192	62.5 °C
12384	75 °C
18576	87.5 °C
27648	100 °C

The calculation for determining engineering units from the analog input value in this example is as follows:

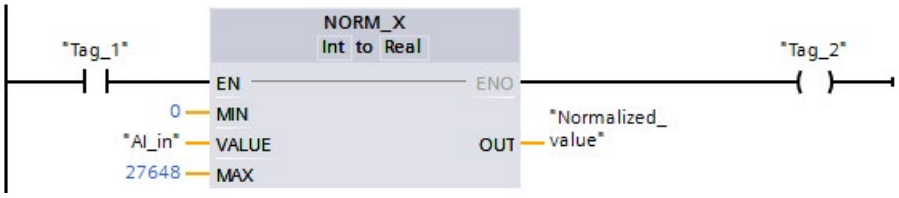
Engineering units value = 50 + (Analog input value) * (100 - 50) / (27648 - 0)

For the general case, the equation would be:

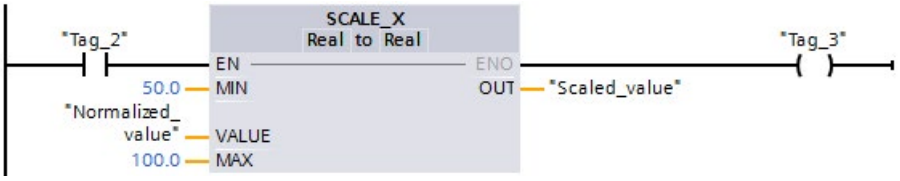
Englineering units value = (Low range of engineering units) +
(Analog input value) *
(High range of engineering units - Low range of engineering units) /
(Maximum analog input range - Minimum analog input range)

In PLC applications, the typical method is to normalize the analog input value to a floating point value between 0.0 and 1.0. Then, you would scale the resulting value to a floating point value in the range of your engineering units. For simplicity, the following LAD instructions use constant values for the ranges; you might actually choose to use tags:

Network 1



Network 2



5.4 Data types

Data types are used to specify both the size of a data element as well as how the data are to be interpreted. Each instruction parameter supports at least one data type, and some parameters support multiple data types. Hold the cursor over the parameter field of an instruction to see which data types are supported for a given parameter.

A formal parameter is the identifier on an instruction that marks the location of data to be used by that instruction (example: the IN1 input of an ADD instruction). An actual parameter is the memory location (preceded by a "%" character) or constant containing the data to be used by the instruction (example %MD400 "Number_of_Widgets"). The data type of the actual parameter specified by you must match one of the supported data types of the formal parameter specified by the instruction.

When specifying an actual parameter, you must specify either a tag (symbol) or an absolute (direct) memory address. Tags associate a symbolic name (tag name) with a data type, memory area, memory offset, and comment, and can be created either in the PLC tags editor or in the Interface editor for a block (OB, FC, FB and DB). If you enter an absolute address that has no associated tag, you must use an appropriate size that matches a supported data type, and a default tag will be created upon entry.

All data types except String, Struct, Array, and DTL are available in the PLC tags editor and the block Interface editors. String, Struct, Array, and DTL are available only in the block Interface editors. You can also enter a constant value for many of the input parameters.

- Bit and Bit sequences (Page 123): Bool (Boolean or bit value), Byte (8-bit byte value), Word (16-bit value), DWord (32-bit double word value)
- Integer (Page 124)
  - USInt (unsigned 8-bit integer), SInt (signed 8-bit integer),
  - UInt (unsigned 16-bit integer), Int (signed 16-bit integer)
  - UDInt (unsigned 32-bit integer), DInt (signed 32-bit integer)
- Floating-point Real (Page 124): Real (32-bit Real or floating-point value), LReal (64-bit Real or floating-point value)
- Time and Date (Page 125): Time (32-bit IEC time value), Date (16-bit date value), TOD (32-bit time-of-day value), DTL (12-byte date-and-time structure)
- Character and String (Page 127): Char (8-bit single character), String (variable-length string of up to 254 characters)
- Array (Page 129)
- Data structure (Page 130): Struct
- PLC data type (Page 130)
- Variant data type (Page 131)

Although not available as data types, the following BCD numeric format is supported by the conversion instructions:

Table 5- 28 Size and range of the BCD format

Format	Size (bits)	Numeric Range	Constant Entry Examples
BCD16	16	-999 to 999	123, -123
BCD32	32	-9999999 to 9999999	1234567, -1234567

5.4.1 Bool, Byte, Word, and DWord data types

Table 5- 29 Bit and bit sequence data types

Data type	Bit size	Number type	Number range	Constant examples	Address examples
Bool	1	Boolean	FALSE or TRUE	TRUE	I1.0 Q0.1 M50.7 DB1.DBX2.3 Tag_name
		Binary	2#0 or 2#1	2#0	
		Unsigned integer	0 or 1	1	
		Octal	8#0 or 8#1	8#1	
		Hexadecimal	16#0 or 16#1	16#1	
Byte	8	Binary	2#0 to 2#1111_1111	2#1000_1001	IB2 MB10 DB1.DBB4 Tag_name
		Unsigned integer	0 to 255	15	
		Signed integer	-128 to 127	-63	
		Octal	8#0 to 8#377	8#17	
		Hexadecimal	B#16#0 to B#16#FF, 16#0 to 16#FF	B#16#F, 16#F	
Word	16	Binary	2#0 to 2#1111_1111_1111_1111	2#1101_0010_1001_0110	MW10 DB1.DBW2 Tag_name
		Unsigned integer	0 to 65535	61680	
		Signed integer	-32768 to 32767	72	
		Octal	8#0 to 8#177_777	8#170_362	
		Hexadecimal	W#16#0 to W#16#FFFF, 16#0 to 16#FFFF	W#16#F1C0, 16#A67B	
DWord	32	Binary	2#0 to 2#1111_1111_1111_1111_1111_1111_1111_1111	2#1101_0100_1111_1110_1000_1100	MD10 DB1.DBD8 Tag_name
		Unsigned integer*	0 to 4_294_967_295	15_793_935	
		Signed integer*	-2_147_483_648 to 2_147_483_647	-400000	
		Octal	8#0 to 8#37_777_777_777	8#74_177_417	
		Hexadecimal	DW#16#0000_0000 to DW#16#FFFF_FFFF, 16#0000_0000 to 16#FFFF_FFFF	DW#16#20_F30A, 16#B_01F6	

* The underscore "_" is a thousands separator to enhance readability for numbers greater than eight digits.

5.4.2 Integer data types

Table 5- 30 Integer data types (U = unsigned, S = short, D= double)

Data type	Bit size	Number Range	Constant examples	Address examples
USInt	8	0 to 255	78, 2#01001110	MB0, DB1.DBB4, Tag_name
SInt	8	-128 to 127	+50, 16#50	
UInt	16	0 to 65,535	65295, 0	MW2, DB1.DBW2, Tag_name
Int	16	-32,768 to 32,767	30000, +30000	
UDInt	32	0 to 4,294,967,295	4042322160	MD6, DB1.DBD8, Tag_name
DInt	32	-2,147,483,648 to 2,147,483,647	-2131754992	

5.4.3 Floating-point real data types

Real (or floating-point) numbers are represented as 32-bit single-precision numbers (Real), or 64-bit double-precision numbers (LReal) as described in the ANSI/IEEE 754-1985 standard. Single-precision floating-point numbers are accurate up to 6 significant digits and double-precision floating point numbers are accurate up to 15 significant digits. You can specify a maximum of 6 significant digits (Real) or 15 (LReal) when entering a floating-point constant to maintain precision.

Table 5- 31 Floating-point real data types (L=Long)

Data type	Bit size	Number range	Constant Examples	Address examples
Real	32	-3.402823e+38 to -1.175 495e-38, ±0, +1.175 495e-38 to +3.402823e+38	123.456, -3.4, 1.0e-5	MD100, DB1.DBD8, Tag_name
LReal	64	-1.7976931348623158e+308 to -2.2250738585072014e-308, ±0, +2.2250738585072014e-308 to +1.7976931348623158e+308	12345.123456789e40, 1.2E+40	DB_name.var_name Rules: • No direct addressing support • Can be assigned in an OB, FB, or FC block interface table

Calculations that involve a long series of values including very large and very small numbers can produce inaccurate results. This can occur if the numbers differ by 10 to the power of x, where x > 6 (Real), or 15 (LReal). For example (Real): 100 000 000 + 1 = 100 000 000.

5.4.4 Time and Date data types

Table 5- 32 Time and date data types

Data type	Size	Range	Constant Entry Examples
Time	32 bits	T#-24d_20h_31m_23s_648ms to T#24d_20h_31m_23s_647ms Stored as: -2,147,483,648 ms to +2,147,483,647 ms	T#5m_30s T#1d_2h_15m_30s_45ms TIME#10d20h30m20s630ms 500h10000ms 10d20h30m20s630ms
Date	16 bits	D#1990-1-1 to D#2168-12-31	D#2009-12-31 DATE#2009-12-31 2009-12-31
Time_of_Day	32 bits	TOD#0:0:0.0 to TOD#23:59:59.999	TOD#10:20:30.400 TIME_OF_DAY#10:20:30.400 23:10:1
DTL (Date and Time Long)	12 bytes	Min.: DTL#1970-01-01-00:00:00.0 Max.: DTL#2262-04-11:23:47:16.854 775 807	DTL#2008-12-16-20:30:20.250

Time

TIME data is stored as a signed double integer interpreted as milliseconds. The editor format can use information for day (d), hours (h), minutes (m), seconds (s) and milliseconds (ms).

It is not necessary to specify all units of time. For example T#5h10s and 500h are valid.

The combined value of all specified unit values cannot exceed the upper or lower limits in milliseconds for the Time data type (-2,147,483,648 ms to +2,147,483,647 ms).

Date

DATE data is stored as an unsigned integer value which is interpreted as the number of days added to the base date 01/01/1990, to obtain the specified date. The editor format must specify a year, month and day.

TOD

TOD (TIME_OF_DAY) data is stored as an unsigned double integer which is interpreted as the number of milliseconds since midnight for the specified time of day (Midnight = 0 ms). The hour (24hr/day), minute, and second must be specified. The fractional second specification is optional.

DTL

DTL (Date and Time Long) data type uses a12 byte structure that saves information on date and time. You can define DTL data in either the Temp memory of a block or in a DB. A value for all components must be entered in the "Start value" column of the DB editor.

Table 5- 33 Size and range for DTL

Length (bytes)	Format	Value range	Example of value input
12	Clock and calendar Year-Month-Day:Hour:Minute:Second.Nanoseconds	Min.: DTL#1970-01-01-00:00:00.0 Max.: DTL#2554-12-31-23:59:59.999 999 999	DTL#2008-12-16-20:30:20.250

Each component of the DTL contains a different data type and range of values. The data type of a specified value must match the data type of the corresponding components.

Table 5- 34 Elements of the DTL structure

Byte	Component	Data type	Value range
0	Year	UINT	1970 to 2554
1			
2	Month	USINT	1 to 12
3	Day	USINT	1 to 31
4	Weekday [1]	USINT	1(Sunday) to 7(Saturday) [1]
5	Hour	USINT	0 to 23
6	Minute	USINT	0 to 59
7	Second	USINT	0 to 59
8	Nanoseconds	UDINT	0 to 999 999 999
9			
10			
11			

[1] The format Year-Month-Day:Hour:Minute:Second.Nanosecond does not include the weekday.

5.4.5 Character and String data types

Table 5- 35 Character and String data types

Data type	Size	Range	Constant Entry Examples
Char	8 bits	16#00 to 16#FF	'A', 't', '@', 'ä', '∑'
WChar	16 bits	16#0000 to 16#FFFF	'A', 't', '@', 'ä', '∑', Asian characters, Cyrillic characters, and others
String	n+ 2 bytes	n = (0 to 254 bytes)	"ABC"
WString	n+ 2 words	n = (0 to 65534 words)	"ä123@XYZ.COM"

Char and WChar

A Char occupies one byte in memory and stores a single character coded in ASCII format, including the extended ASCII character codes. A WChar occupies one word in memory and can contain any double-byte character representation.

The editor syntax uses a single quote character before and after the character. You can use visible characters and control characters.

String and WString

The CPU supports the String data type for storing a sequence of single-byte characters. The String data type contains a total character count (number of characters in the string) and the current character count. The String type provides up to 256 bytes for storing the maximum total character count (1 byte), the current character count (1 byte), and up to 254 bytes in the string. Each byte in a String data type can be any value from 16#00 - 16#FF.

The WString data type provides for longer strings of one-word (double-byte) values. The first word contains the maximum total character count; the next word contains the total character count, and the following string can contain up to 65534 words. Each word in a WString data type can be any value from 16#0000 - 16#FFFF.

You can use literal strings (constants) for instruction parameters of type IN using single quotes. For example, ‘ABC’ is a three-character string that could be used as input for parameter IN of the S_CONV instruction. You can also create string variables by selecting data type "String" or "WString" in the block interface editors for OB, FC, FB, and DB. You cannot create a string in the PLC tags editor.

You can specify the maximum string size in bytes (String) or words (WString) by entering square brackets after the keyword "String" or "WString" after you select one of those data types from the data type drop-down list. For example, "MyString String[10]" would specify a 10-byte maximum size for MyString. If you do not include the square brackets with a maximum size, then 254 is assumed for a string and 65534 for a WString. "MyWString WString[1000]" would specify a 1000-word WString.

The following example defines a String with maximum character count of 10 and current character count of 3. This means the String currently contains 3 one-byte characters, but could be expanded to contain up to 10 one-byte characters.

Table 5- 36 Example of a String data type

Total Character Count	Current Character Count	Character 1	Character 2	Character 3	...	Character 10
10	3	'C' (16#43)	'A' (16#41)	'T' (16#54)	...	-
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	...	Byte 11

The following example defines a WString with maximum character count of 500 and current character count of 300. This means the String currently contains 300 one-word characters, but could be expanded to contain up to 500 one-word characters.

Table 5- 37 Example of a WString data type

Total Character Count	Current Character Count	Character 1	Characters 2 to 299	Character 300	...	Character 500
500	300	'ä' (16#0084)	ASCII character words	'M' (16#004D)	...	-
Word 0	Word 1	Word 2	Words 3 to 300	Word 301	...	Word 501

ASCII control characters can be used in Char, Wchar, String and WString data. The following table shows examples of control character syntax.

Table 5- 38 Valid ASCII control characters

Control characters	ASCII Hex value (Char)	ASCII Hex value (WChar)	Control function	Examples
$L or $l	16#0A	16#000A	Line feed	'$LText', '$0AText'
$N or $n	16#0A and 16#0D	16#000A and 16#000D	Line break The new line shows two characters in the string.	'$NText', '$0A$0DText'
$P or $p	16#0C	16#000C	Form feed	'$PText', '$0CText'
$R or $r	16#0D	16#000D	Carriage return (CR)	'$RText','$0DText'
$T or $t	16#09	16#0009	Tab	'$TText', '$09Text'
$$	16#24	16#0024	Dollar sign	'100$$', '100$24'
$'	16#27	16#0027	Single quote	'$'Text$'','$27Text$27'

5.4.6 Array data type

Arrays

You can create an array that contains multiple elements of the same data type. Arrays can be created in the block interface editors for OB, FC, FB, and DB. You cannot create an array in the PLC tags editor.

To create an array from the block interface editor, name the array and choose data type "Array [lo .. hi] of type", then edit "lo", "hi", and "type" as follows:

- lo - the starting (lowest) index for your array
- hi - the ending (highest) index for your array
- type - one of the data types, such as BOOL, SINT, UDINT

Table 5- 39 ARRAY data type rules

Data Type	Array syntax		
ARRAY	Name [index1_min..index1_max, index2_min..index2_max] of <data type> • All array elements must be the same data type. • The index can be negative, but the lower limit must be less than or equal to the upper limit. • Arrays can have one to six dimensions. • Multi-dimensional index min..max declarations are separated by comma characters. • Nested arrays, or arrays of arrays, are not allowed. • The memory size of an array = (size of one element * total number of elements in array)		
	Array index	**Valid index data types**	**Array index rules**
	Constant or variable	USInt, SInt, UInt, Int, UDInt, DInt	• Value limits: -32768 to +32767 • Valid: Mixed constants and variables • Valid: Constant expressions • Not valid: Variable expressions

Example: array declarations	ARRAY[1..20] of REAL	One dimension, 20 elements
	ARRAY[-5..5] of INT	One dimension, 11 elements
	ARRAY[1..2, 3..4] of CHAR	Two dimensions, 4 elements
Example: array addresses	ARRAY1[0]	ARRAY1 element 0
	ARRAY2[1,2]	ARRAY2 element [1,2]
	ARRAY3[i,j]	If i =3 and j=4, then ARRAY3 element [3, 4] is addressed

5.4.7 Data structure data type

You can use the data type "Struct" to define a structure of data consisting of other data types. The struct data type can be used to handle a group of related process data as a single data unit. A Struct data type is named and the internal data structure declared in the data block editor or a block interface editor.

Arrays and structures can also be assembled into a larger structure. A structure can be nested up to eight levels deep. For example, you can create a structure of structures that contain arrays.

5.4.8 PLC data type

The PLC data type editor lets you define data structures that you can use multiple times in your program. You create a PLC data type by opening the "PLC data types" branch of the project tree and double-clicking the "Add new data type" item. On the newly created PLC data type item, use two single-clicks to rename the default name and double-click to open the PLC data type editor.

You create a custom PLC data type structure using the same editing methods that are used in the data block editor. Add new rows for any data types that are necessary to create the data structure that you want.

If a new PLC data type is created, then the new PLC type name will appear in the data type selector drop-down lists in the DB editor and code block interface editor.

You can potentially use PLC data types in the following ways:

- As a data type in a code block interface or in data blocks
- As a template for the creation of multiple global data blocks that use the same data structure
- As a data type for PLC tag declarations the I and Q memory areas of the CPU

For example, a PLC data type could be a recipe for mixing colors. You can then assign this PLC data type to multiple data blocks. You can adjust the variables within each data block to create a specific color.

5.4.9 Variant pointer data type

The data type Variant can point to variables of different data types or parameters. The Variant pointer can point to structures and individual structural components. The Variant pointer does not occupy any space in memory.

Table 5- 40 Properties of the Variant pointer

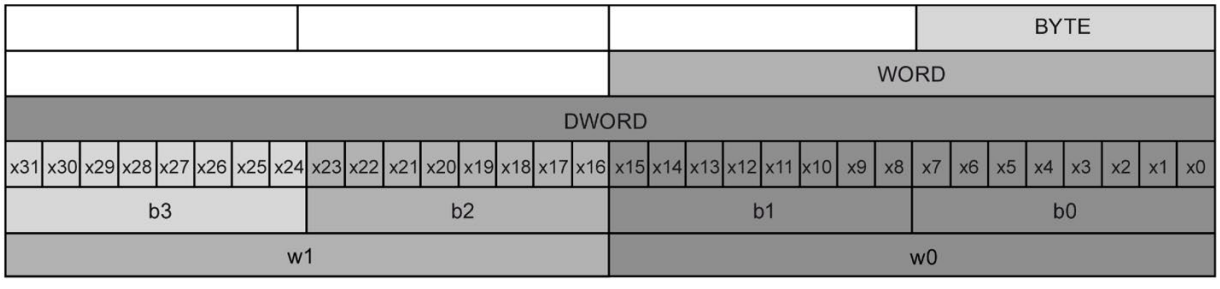
Length (Byte)	Representation	Format	Example entry
0	Symbolic	Operand	MyTag
		DB_name.Struct_name.element_name	MyDB.Struct1.pressure1
	Absolute	Operand	%MW10
		DB_number.Operand Type Length	P#DB10.DBX10.0 INT 12

5.4.10 Accessing a "slice" of a tagged data type

PLC tags and data block tags can be accessed at the bit, byte, or word level depending on their size. The syntax for accessing such a data slice is as follows:

- "<PLC tag name>".xn (bit access)
- "<PLC tag name>".bn (byte access)
- "<PLC tag name>".wn (word access)
- "<Data block name>".<tag name>.xn (bit access)
- "<Data block name>".<tag name>.bn (byte access)
- "<Data block name>".<tag name>.wn (word access)

A double word-sized tag can be accessed by bits 0 - 31, bytes 0 - 3, or word 0 - 1. A word-sized tag can be accessed by bits 0 - 15, bytes 0 - 1, or word 0. A byte-sized tag can be accessed by bits 0 - 7, or byte 0. Bit, byte, and word slices can be used anywhere that bits, bytes, or words are expected operands.



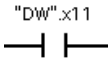
Note

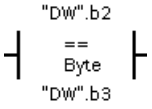
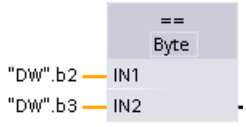
Valid data types that can be accessed by slice are Byte, Char, Conn_Any, Date, DInt, DWord, Event_Any, Event_Att, Hw_Any, Hw_Device, HW_Interface, Hw_Io, Hw_Pwm, Hw_SubModule, Int, OB_Any, OB_Att, OB_Cyclic, OB_Delay, OB_WHINT, OB_PCYCLE, OB_STARTUP, OB_TIMEERROR, OB_Tod, Port, Rtm, SInt, Time, Time_Of_Day, UDInt, UInt, USInt, and Word. PLC Tags of type Real can be accessed by slice, but data block tags of type Real cannot.

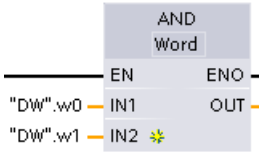
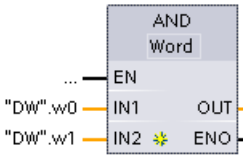
Examples

In the PLC tag table, "DW" is a declared tag of type DWORD. The examples show bit, byte, and word slice access:

	LAD	FBD	SCL

Bit access			`IF "DW".x11 THEN`
			`...`
			`END_IF;`

Byte access			`IF "DW".b2 = "DW".b3`
			`THEN`
			`...`
			`END_IF;`

Word access			`out:= "DW".w0 AND` `"DW".w1;`

5.4.11 Accessing a tag with an AT overlay

The AT tag overlay allows you to access an already-declared block tag with an overlaid declaration of a different data type. You can, for example, address the individual bits of a tag of a Byte, Word, or DWord data type with an Array of Bool. AT overlays are available for the following types of tags:

- Tags in a standard-access block
- Retentive tags in an optimized block

Declaration

To overlay a parameter, declare an additional parameter directly after the parameter that is to be overlaid and select the data type "AT". The editor creates the overlay, and you can then choose the data type, struct, or array that you wish to use for the overlay.

Example

This example shows the input parameters of a standard-access FB. An array of Booleans is an overlay for the byte tag B1:

B1		Byte	0.0
OV	AT "B1"	Array[0..7] of Bool	0.0
OV[0]		Bool	0.0
OV[1]		Bool	0.1
OV[2]		Bool	0.2
OV[3]		Bool	0.3
OV[4]		Bool	0.4
OV[5]		Bool	0.5
OV[6]		Bool	0.6
OV[7]		Bool	0.7

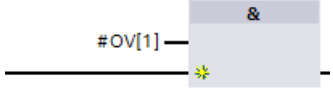
Another example is a DWord tag overlaid with a Struct. The Struct includes a Word, Byte, and two Booleans:

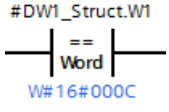
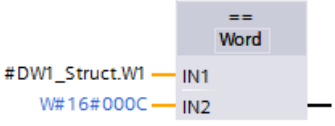
DW1		DWord	2.0
DW1_Struct	AT "DW1"	Struct	2.0
W1		Word	0.0
B1		Byte	2.0
BO1		Bool	3.0
BO2		Bool	3.1

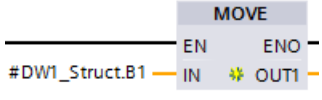
The Offset column of the block interface shows the location of the overlaid data types relative to the original tag.

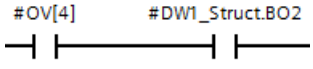
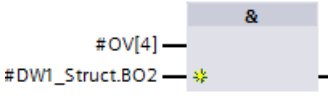
You can address the overlay types directly in the program logic:

LAD	FBD	SCL

		`IF #OV[1] THEN`
		`...`
		`END_IF;`

		`IF #DW1_Struct.W1 = W#16#000C THEN`
		`...`
		`END_IF;`

		`out1 := #DW1_Struct.B1;`

		`IF #OV[4] AND #DW1_Struct.BO2 THEN`
		`...`
		`END_IF;`

Rules

- In FB and FC blocks with standard (not optimized) access, overlaying of tags is possible.
- In optimized FB and FC blocks, overlaying of tags is possible for any tags that are retentive.
- You can overlay parameters for all block types and all declaration sections.
- You can use an overlaid parameter like any other block parameter.
- You cannot overlay parameters of type VARIANT.
- The size of the overlaying parameter must be less than or equal to the size of the overlaid parameter.
- You must declare the overlaying variable immediately after the variable that it overlays and select the keyword "AT" as the initial data type selection.

5.5 Using a memory card

Note

The CPU supports only the pre-formatted SIMATIC memory cards (Page 1538).

Before you copy any program to the formatted memory card, delete any previously saved program from the memory card.

You can use a memory card as either a transfer card or as a program card. Transfer cards and program cards contain all of the code blocks and data blocks, any technology objects, and the device configuration. Transfer cards and program cards do **not** contain, for example, force tables, watch tables, or PLC tag tables.

- Use a transfer card (Page 138) to copy a program to the internal load memory of the CPU without using STEP 7.

  You can use an empty transfer card to access a password-protected CPU when you have lost or forgotten the password (Page 147).

- Use a program card (Page 141) as external load memory for the CPU.

You also use a memory card when downloading firmware updates (Page 144).

5.5.1 Inserting a memory card in the CPU

NOTICE
Protect memory card and receptacle from electrostatic discharge Electrostatic discharge can damage the memory card or the receptacle on the CPU. Make contact with a grounded conductive pad and/or wear a grounded wrist strap when you handle the memory card. Store the memory card in a conductive container.



Check that the memory card is not write-protected. Slide the protection switch away from the "Lock" position.

Note that if you do insert a write-protected memory card into the CPU, STEP 7 will display a diagnostic message on the next power up alerting you to that fact. The CPU will power up without failure, but instructions involving recipes or data logs, for example, will return errors if the card is write-protected.

WARNING
Verify that the CPU is not running a process before inserting the memory card. If you insert a memory card (whether configured as a program card, transfer card, or firmware update card) into a running CPU, the CPU goes immediately to STOP mode, which might cause process disruption that could result in death or severe personal injury. Before inserting or removing a memory card, always ensure that the CPU is not actively controlling a machine or process. Always install an emergency stop circuit for your application or process.

Note

Do not insert V3.0 program transfer cards into S7-1200 V4.x CPUs.

Version 3.0 program transfer cards are not compatible with version S7-1200 V4.x CPUs. Inserting a memory card that contains a V3.0 program causes a CPU error.

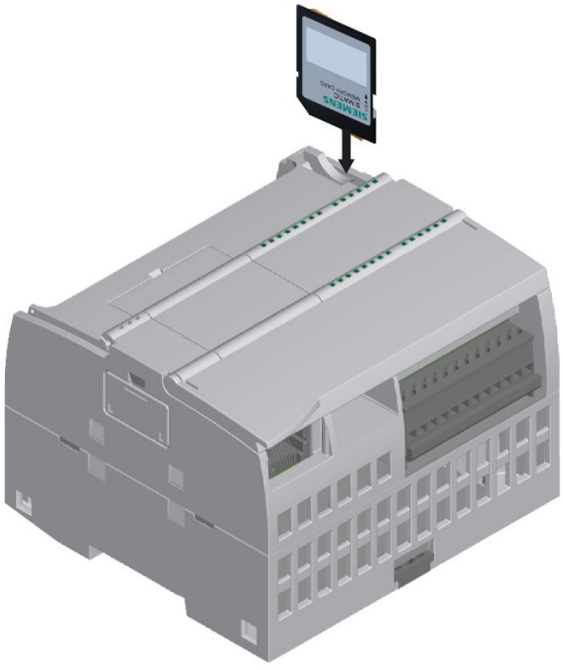
If you do insert an invalid version program transfer card (Page 138), you should remove the card, and perform a STOP to RUN transition, a memory reset (MRES), or cycle power. After you recover the CPU from the error condition, you can download a valid V4.x CPU program.

To transfer a V3.0 program to a V4.x program, you must use the TIA Portal to Change Device in the Hardware Configuration.

Note

If you insert a memory card with the CPU in STOP mode, the diagnostic buffer displays a message that the memory card evaluation has been initiated. The CPU will evaluate the memory card the next time you either change the CPU to RUN mode, reset the CPU memory with an MRES, or power-cycle the CPU.

Table 5- 41 Inserting a memory card

	To insert a memory card, open the top CPU door and insert the memory card in the slot. A push-push type connector allows for easy insertion and removal. The memory card is keyed for proper installation.

CPU behavior when you insert a memory card

When you insert a memory card in the CPU, the CPU peforms the following steps:

1. Transitions to STOP mode (if not already in STOP mode)
2. Prompts for one of the following choices:
   - Power cycle
   - Transition to RUN mode
   - Perform a memory reset
3. Evaluates the card

How the CPU evaluates the memory card

If you do not configure the CPU to "Disable copy from internal load memory to external load memory" in the Protection properties of the device configuration (Page 206), the CPU determines what type of memory card you inserted:

- **Empty memory card**: A blank memory card does not have a job file (S7_JOB.S7S). If you insert a blank memory card, the CPU adds a program job file. It then copies internal load memory to external load memory (the program file on the memory card) and erases internal load memory.
- **Blank program card**: A blank program card has a program job file that is empty. In this case, the CPU copies internal load memory to external load memory (the program file on the memory card) and erases internal load memory.

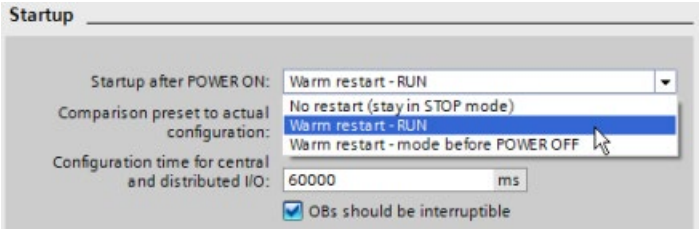
If you configured the CPU to "Disable copy from internal load memory to external load memory" in the Protection properties of the device configuration, the CPU behaves as follows:

- **Empty memory card**: A blank memory card does not have a job file (S7_JOB.S7S). If you insert a blank memory card, the CPU does nothing. It does not create a program job file and it does not copy internal load memory to external load memory (the program file on the memory card). It does not erase internal load memory.
- **Blank program card**: A blank program card has a program job file that is empty. In this case, the CPU performs no action. It does not copy internal load memory to external load memory (the program file on the memory card). It does not erase internal load memory.

If you insert a program card (Page 141), transfer card (Page 138), or card that contains a firmware update (Page 144)into the CPU, the configuration setting for "Disable copy from internal load memory to external load memory" has no effect on how the CPU evaluates the memory card.

5.5.2 Configuring the startup parameter of the CPU before copying the project to the memory card

When you copy a program to a transfer card or a program card, the program includes the startup parameter for the CPU. Before copying the program to the memory card, always ensure that you have configured the operating mode for the CPU following a power-cycle. Select whether the CPU starts in STOP mode, RUN mode, or in the previous mode (prior to the power cycle).



5.5.3 Transfer card

NOTICE
Protect memory card and receptacle from electrostatic discharge Electrostatic discharge can damage the memory card or the receptacle on the CPU. Handle the memory card safely through one or both of the following means: • Make contact with a grounded conductive pad. • Wear a grounded wrist strap whenever you handle the memory card. Store the memory card in a conductive container.

Creating a transfer card

Remember to configure the startup parameter of the CPU (Page 138) before copying a program to the transfer card. To create a transfer card, follow these steps:

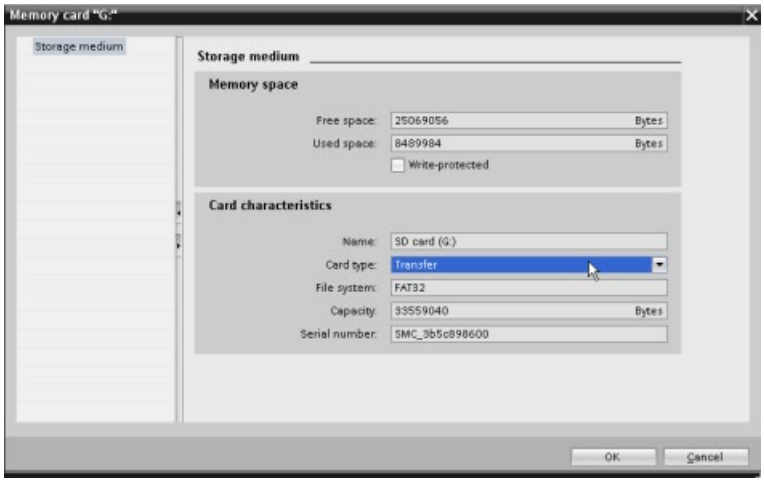
1. Insert a blank SIMATIC memory card that is not write-protected into an SD card reader/writer attached to your computer. (If the card is write-protected, slide the protection switch away from the "Lock" position.)

   If you are reusing a SIMATIC memory card that contains a user program, data logs, recipes, or a firmware update, you **must** delete the files before reusing the card. Use Windows Explorer to display the contents of the memory card and delete the "S7_JOB.S7S" file and also delete any existing folders (such as "SIMATIC.S7S","FWUPDATE.S7S", "DataLogs", and "Recipes").

NOTICE
Do NOT delete the hidden files "__LOG__" and "crdinfo.bin" from the memory card.
The "__LOG__" and "crdinfo.bin" files are required for the memory card. If you delete these files, you cannot use the memory card with the CPU.

2. In the Project tree (Project view), expand the "SIMATIC Card Reader" folder and select your card reader.
3. Display the "Memory card" dialog by right-clicking the drive letter corresponding to the memory card in the card reader and selecting "Properties" from the context menu.
4. In the "Memory card" dialog, select "Transfer" from the "Card type" drop-down menu.

   At this point, STEP 7 creates the empty transfer card. If you are creating an empty transfer card, such as to recover from a lost CPU password (Page 147), remove the transfer card from the card reader.



5. Add the program by selecting the CPU device (such as PLC_1 [CPU 1214C DC/DC/DC]) in the Project tree and dragging the CPU device to the memory card. (Another method is to copy the CPU device and paste it to the memory card.) Copying the CPU device to the memory card opens the "Load preview" dialog.

6. In the "Load preview" dialog, click the "Load" button to copy the CPU device to the memory card.
7. When the dialog displays a message that the CPU device (program) has been loaded without errors, click the "Finish" button.

Using a transfer card

WARNING

Verify that the CPU is not actively running a process before inserting the memory card.

Inserting a memory card will cause the CPU to go to STOP mode, which could affect the operation of an online process or machine. Unexpected operation of a process or machine could result in death or injury to personnel and/or property damage.

Before inserting a transfer card, always ensure that the CPU is in STOP mode and your process is in a safe state.

Note

Do not insert V3.0 program transfer cards into later model CPUs.

Version 3.0 program transfer cards are not compatible with later model S7-1200 CPUs. Inserting a memory card that contains a V3.0 program causes a CPU error.

If you do insert an invalid version program transfer card, then remove the card, perform a STOP to RUN transition, a memory reset (MRES), or cycle power. After you recover the CPU from the error condition, you can download a valid CPU program

To transfer the program to a CPU, follow these steps:

1. Insert the transfer card into the CPU (Page 135). If the CPU is in RUN, the CPU will go to STOP mode. The maintenance (MAINT) LED flashes to indicate that the memory card needs to be evaluated. At this point, the existing program is still in the CPU.
2. Power-cycle the CPU to evaluate the memory card. Alternative methods for rebooting the CPU are to perform either a STOP-to-RUN transition or a memory reset (MRES) from STEP 7.
3. After the reboot, The CPU evaluates the memory card and copies the program to the internal load memory of the CPU.

   The RUN/STOP LED alternately flashes green and yellow to indicate that the program is being copied. When the RUN/STOP LED turns on (solid yellow) and the MAINT LED flashes (yellow), the copy process has finished. You can then remove the memory card.
4. Reboot the CPU (either by restoring power or by the alternative methods for rebooting) to evaluate the new program that was transferred to internal load memory.

The CPU then goes to the start-up mode (RUN or STOP) that you configured for the project.

Note

You must remove the transfer card before setting the CPU to RUN mode.

5.5.4 Program card

NOTICE
Electrostatic discharge can damage the memory card or the receptacle on the CPU. Make contact with a grounded conductive pad and/or wear a grounded wrist strap when you handle the memory card. Store the memory card in a conductive container.



Check that the memory card is not write-protected. Slide the protection switch away from the "Lock" position.

Before you copy any program elements to the program card, delete any previously saved programs from the memory card.

Creating a program card

When used as a program card, the memory card is the external load memory of the CPU. If you remove the program card, the internal load memory of the CPU is empty.

Note

If you insert a blank memory card into the CPU and perform a memory card evaluation by either power cycling the CPU, performing a STOP to RUN transition, or performing a memory reset (MRES), the program and force values in internal load memory of the CPU are copied to the memory card. (The memory card is now a program card.) After the copy has been completed, the program in internal load memory of the CPU is then erased. The CPU then goes to the configured startup mode (RUN or STOP).

Always remember to configure the startup parameter of the CPU (Page 138) before copying a project to the program card. To create a program card, follow these steps:

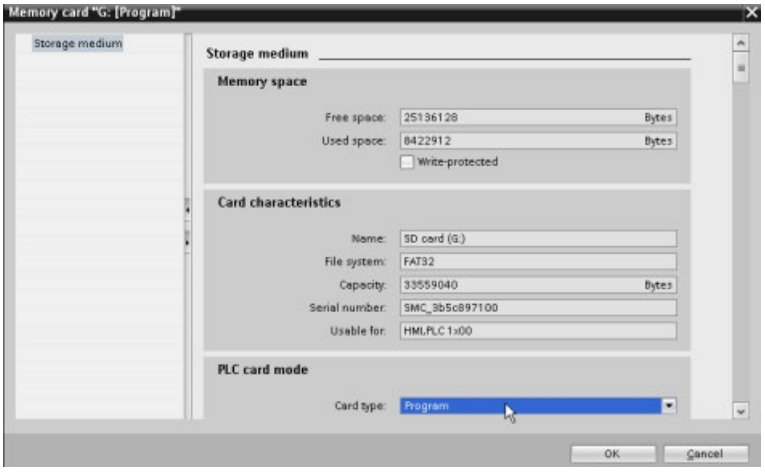
1. Insert a blank SIMATIC memory card that is not write-protected into an SD card reader/writer attached to your computer. (If the card is write-protected, slide the protection switch away from the "Lock" position.)

   If you are reusing a SIMATIC memory card that contains a user program, data logs, recipes, or a firmware update, you **must** delete the files before reusing the card. Use Windows Explorer to display the contents of the memory card and delete the following files and folders if they exist:

   – S7_JOB.S7S
   – SIMATIC.S7S
   – FWUPDATE.S7S
   – DataLogs
   – Recipes

NOTICE
Do NOT delete the hidden files "__LOG__" and "crdinfo.bin" from the memory card.
The "__LOG__" and "crdinfo.bin" files are required for the memory card. If you delete these files, you cannot use the memory card with the CPU.

2. In the Project tree (Project view), expand the "Card Reader/USB memory" folder and select your card reader.
3. Display the "Memory card" dialog by right-clicking the drive letter corresponding to the memory card in the card reader and selecting "Properties" from the context menu.
4. In the "Memory card" dialog, select "Program" from the shortcut menu.



5. Add the program by selecting the CPU device (such as PLC_1 [CPU 1214C DC/DC/DC]) in the Project tree and dragging the CPU device to the memory card. (Another method is to copy the CPU device and paste it to the memory card.) Copying the CPU device to the memory card opens the "Load preview" dialog.

6. In the "Load preview" dialog, click the "Load" button to copy the CPU device to the memory card.
7. When the dialog displays a message that the CPU device (program) has been loaded without errors, click the "Finish" button.

Using a program card as the load memory for your CPU

WARNING

Risks associated with inserting a program card

Verify that the CPU is not actively running a process before inserting the memory card.

Inserting a memory card will cause the CPU to go to STOP mode, which could affect the operation of an online process or machine. Unexpected operation of a process or machine could result in death or injury to personnel and/or property damage.

Before inserting a memory card, always ensure that the CPU is offline and in a safe state.

To use a program card with your CPU, follow these steps:

1. Insert the program card into the CPU. If the CPU is in RUN mode, the CPU goes to STOP mode. The maintenance (MAINT) LED flashes to indicate that the memory card needs to be evaluated.
2. Power-cycle the CPU to evaluate the memory card. Alternative methods for rebooting the CPU are to perform either a STOP-to-RUN transition or a memory reset (MRES) from STEP 7.
3. After the CPU reboots and evaluates the program card, the CPU erases the internal load memory of the CPU.

The CPU then goes to the start-up mode (RUN or STOP) that you configured for the CPU.

The program card must remain in the CPU. Removing the program card leaves the CPU with no program in internal load memory.

WARNING

Risks associated with removing a program card

If you remove the program card, the CPU loses its external load memory and generates an error. The CPU goes to STOP mode and flashes the error LED.

Control devices can fail in an unsafe condition, resulting in unexpected operation of controlled equipment. Such unexpected operations could result in death or serious injury to personnel, and/or damage to equipment.

Do not remove the program card without understanding that you are removing the program from CPU.

5.5.5 Firmware update

You can use a SIMATIC memory card for performing a firmware update.

NOTICE
Protect memory card and receptacle from electrostatic discharge Electrostatic discharge can damage the memory card or the receptacle on the CPU. Make contact with a grounded conductive pad and/or wear a grounded wrist strap whenever you handle the memory card. Store the memory card in a conductive container.

You use a SIMATIC memory card when downloading firmware updates from Siemens Industry Online Support (http://support.industry.siemens.com). From this Web site, navigate to "Downloads". From there search for the specific type of module that you need to update.

Alternatively, you can access the S7-1200 downloads Web page (https://support.industry.siemens.com/cs/ww/en/ps/13683/dl) directly.

Note

You cannot update an S7-1200 CPU V3.0 or earlier to S7-1200 V4.0 or V4.1 by firmware update.

You can also perform a firmware update by one of these methods:

- Using the online and diagnostic tools of STEP 7 (Page 1304)
- Using the Web server "Module Information" standard Web page (Page 1002)
- Using the SIMATIC Automation Tool (https://support.industry.siemens.com/cs/ww/en/view/98161300)

NOTICE
Do not use the Windows formatter utility or any other formatting utility to reformat the memory card. If a Siemens memory card is reformatted using the Microsoft Windows formatter utility, then the memory card will no longer be usable by a S7-1200 CPU.

To download the firmware update to your memory card, follow these steps:

1. Insert a blank SIMATIC memory card that is not write-protected into an SD card reader/writer attached to your computer. (If the card is write-protected, slide the protection switch away from the "Lock" position.)

   You can reuse a SIMATIC memory card that contains a user program or another firmware update, but you must delete some of the files on the memory card.

   To reuse a memory card, you **must** delete the "S7_JOB.S7S" file and any existing "Data Logs" folders or any folder (such as "SIMATIC.S7S" or "FWUPDATE.S7S") before downloading the firmware update. Use Windows Explorer to display the contents of the memory card and to delete the file and folders.

   NOTICE

   Do NOT delete the hidden files "__LOG__" and "crdinfo.bin" from the memory card.

   The "__LOG__" and "crdinfo.bin" files are required for the memory card. If you delete these files, you cannot use the memory card with the CPU.

2. Select the zip file for the firmware update that corresponds to your module, and download it to your computer. Double-click the file, set the file destination path to be the root directory of the SIMATIC memory card, and start the extraction process. After the extraction is complete, the root directory (folder) of the memory card will contain a "FWUPDATE.S7S" directory and the "S7_JOB.S7S" file.
3. Safely eject the card from the card reader/writer.

To install the firmware update, follow these steps:

⚠ WARNING

Verify that the CPU is not actively running a process before installing the firmware update.

Installing the firmware update will cause the CPU to go to STOP mode, which could affect the operation of an online process or machine. Unexpected operation of a process or machine could result in death or injury to personnel and/or property damage.

Before inserting the memory card, always ensure that the CPU is offline and in a safe state.

1. Insert the memory card into the CPU. If the CPU is in RUN mode, the CPU then goes to STOP mode. The maintenance (MAINT) LED flashes to indicate that the memory card needs to be evaluated.
2. Power-cycle the CPU to start the firmware update. Alternative methods for rebooting the CPU are to perform either a STOP-to-RUN transition or a memory reset (MRES) from STEP 7.

   Note

   To complete the firmware upgrade for the module, you must ensure that the external 24 V DC power to the module remains on.

After the CPU reboots, the firmware update starts. The RUN/STOP LED alternately flashes green and yellow to indicate that the update is being copied. When the RUN/STOP LED turns on (solid yellow) and the MAINT LED flashes, the copy process has finished. You must then remove the memory card.

3. After removing the memory card, reboot the CPU again (either by restoring power or by the alternative methods for rebooting) to load the new firmware.

The user program and hardware configuration are not affected by the firmware update. When the CPU is powered up, the CPU enters the configured start-up state. (If the startup mode for your CPU was configured to "Warm restart - mode before POWER OFF", the CPU will be in STOP mode because the last state of the CPU was STOP.)

Note

Updating multiple modules connected to CPU

If your hardware configuration contains multiple modules that correspond to a single firmware update file on the memory card, the CPU applies the updates to all applicable modules (CM, SM, and SB) in configuration order, that is, by increasing order of the module position in Device Configuration in STEP 7.

If you have downloaded multiple firmware updates to the memory card for multiple modules, the CPU applies the updates in the order in which you downloaded them to the memory card.

5.6 Recovery from a lost password

If you have lost the password for a password-protected CPU, use an empty transfer card to delete the password-protected program. The empty transfer card erases the internal load memory of the CPU. You can then download a new user program from STEP 7 to the CPU.

For information about the creation and use of an empty transfer card, see the section of transfer cards (Page 138).

WARNING

Verify that the CPU is not actively running a process before inserting the memory card

If you insert a transfer card in a running CPU, the CPU goes to STOP. Control devices can fail in an unsafe condition, resulting in unexpected operation of controlled equipment. Such unexpected operations could result in death or serious injury to personnel, and/or damage to equipment.

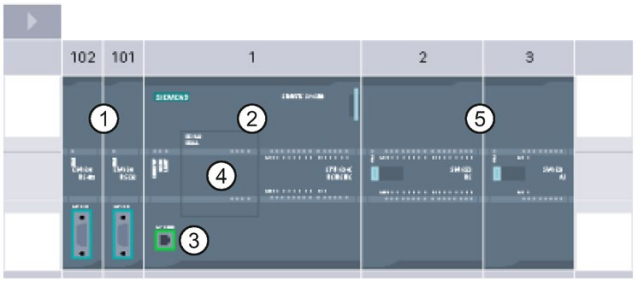
Before inserting a transfer card, always ensure that the CPU is in STOP mode and your process is in a safe state.

You must remove the transfer card before setting the CPU to RUN mode.

Device configuration

6

You create the device configuration for your PLC by adding a CPU and additional modules to your project.



① Communication module (CM) or communication processor (CP): Up to 3, inserted in slots 101, 102, and 103

② CPU: Slot 1

③ PROFINET port of CPU

④ Signal board (SB), communication board (CB) or battery board (BB): up to 1, inserted in the CPU

⑤ Signal module (SM) for digital or analog I/O: up to 8, inserted in slots 2 through 9

(CPU 1214C, CPU 1215C and CPU 1217C allow 8, CPU 1212C allows 2, CPU 1211C does not allow any)

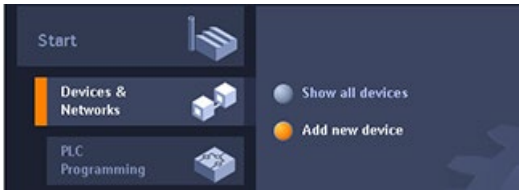
Configuration control

Device configuration for the S7-1200 also supports "configuration control (Page 155)" where you can configure a maximum configuration for a project including modules that you might not actually use. This feature, sometimes also called "option handling", allows you to configure a maximum configuration that you might use with variations in the installed modules in multiple applications.

6.1 Inserting a CPU

You can insert a CPU into your project from either the Portal view or the Project view of STEP 7:

- In the Portal view, select "Devices & Networks" and click "Add new device".
- In the Project view, under the project name, double-click "Add new device".



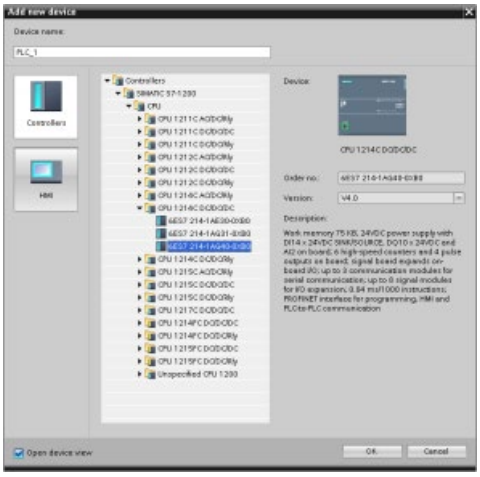


Be sure you insert the correct model and firmware version from the list. Selecting the CPU from the "Add new device" dialog creates the rack and CPU.

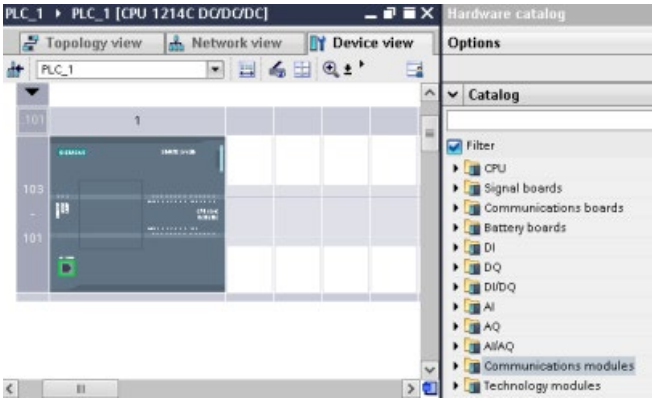
Note

With STEP 7 V14 and later, you cannot add a V1.0 S7-1200 CPU to your project.

"Add new device" dialog

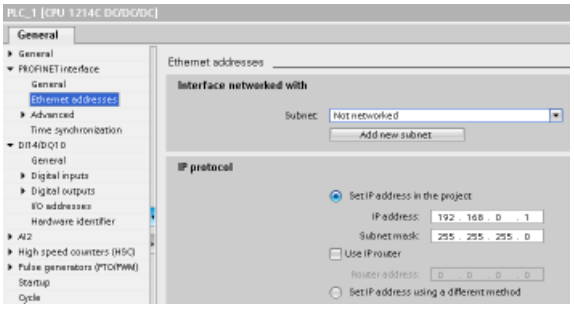


Device view of the hardware configuration



Selecting the CPU in the Device view displays the CPU properties in the inspector window.

The CPU does not have a preconfigured IP address. You must manually assign an IP address for the CPU during the device configuration. If your CPU is connected to a router on the network, you also enter the IP address for a router.



6.2 Uploading the configuration of a connected CPU

STEP 7 provides two methods for uploading the hardware configuration of a connected CPU:

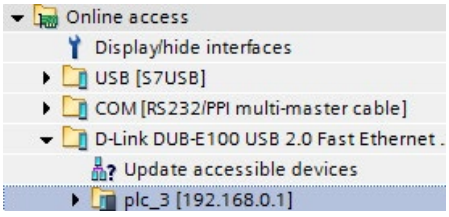
- Uploading the connected device as a new station
- Configuring an unspecified CPU and detecting the hardware configuration of the connected CPU

Note, however, that the first method uploads both the hardware configuration and the software of the connected CPU.

Uploading a device as a new station

To upload a connected device as a new station, follow these steps:

1. Expand your communications interface from the "Online access" node of the project tree.
2. Double-click "Update accessible devices".
3. Select the PLC from the detected devices.



4. From the Online menu of STEP 7, select the "Upload device as new station (hardware and software)" menu command.

STEP 7 uploads both the hardware configuration and the program blocks.

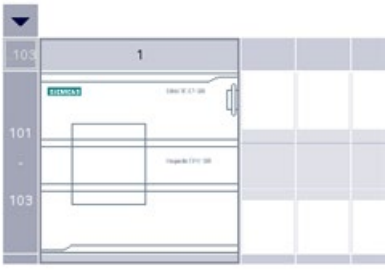
Detecting the hardware configuration of an unspecified CPU

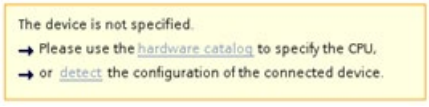


If you are connected to a CPU, you can upload the configuration of that CPU, including any modules, to your project. Simply create a new project and select the "unspecified CPU" instead of selecting a specific CPU. (You can also skip the device configuration entirely by selecting the "Create a PLC program" from the "First steps". STEP 7 then automatically creates an unspecified CPU.)

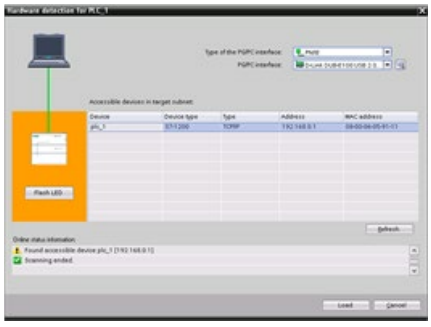
From the program editor, you select the "Hardware detection" command from the "Online" menu.

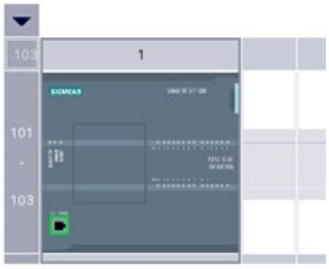
From the device configuration editor, you select the option for detecting the configuration of the connected device.





After you select the CPU from the online dialog and click the Load button, STEP 7 uploads the hardware configuration from the CPU, including any modules (SM, SB, or CM). You can then configure the parameters for the CPU and the modules (Page 165).





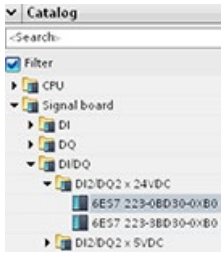
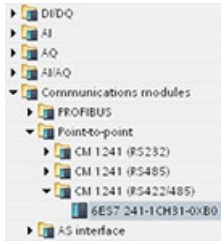
6.3 Adding modules to the configuration

Use the hardware catalog to add modules to the CPU:

- Signal module (SM) provides additional digital or analog I/O points. These modules are connected to the right side of the CPU.
- Signal board (SB) provides just a few additional I/O points for the CPU. The SB is installed on the front of the CPU.
- Battery Board 1297 (BB) provides long-term backup of the realtime clock. The BB is installed on the front of the CPU.
- Communication board (CB) provides an additional communication port (such as RS485). The CB is installed on the front of the CPU.
- Communication module (CM) and communication processor (CP) provide an additional communication port, such as for PROFIBUS or GPRS. These modules are connected to the left side of the CPU.

To insert a module into the device configuration, select the module in the hardware catalog and either double-click or drag the module to the highlighted slot. You must add the modules to the device configuration and download the hardware configuration to the CPU for the modules to be functional.

Table 6- 1 Adding a module to the device configuration

Module	Select the module	Insert the module	Result
SM			
SB, BB or CB			
CM or CP			

With the "configuration control" feature (Page 155), you can add signal modules and signal boards to your device configuration that might not correspond to the actual hardware for a specific application, but that will be used in related applications that share a common user program, CPU model, and perhaps some of the configured modules.

6.4 Configuration control

6.4.1 Advantages and applications of configuration control

Configuration control can be a useful solution when you create an automation solution (machine) that you intend to use with variations in multiple installations.

You can load a STEP 7 device configuration and user program to different installed PLC configurations. You only need to make a few easy adaptations to make the STEP 7 project correspond to the actual installation.

6.4.2 Configuring the central installation and optional modules

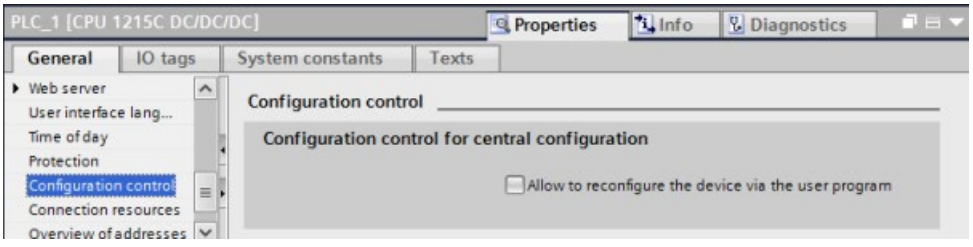
Configuration control with STEP 7 and the S7-1200 enables you to configure a maximum configuration for a standard machine and to operate versions (options) that use a subset of this configuration. The PROFINET with STEP 7 manual (http://support.automation.siemens.com/WW/view/en/49948856) refers to these types of projects as "standard machine projects".

A control data record that you program in the startup program block notifies the CPU as to which modules are missing in the real installation as compared to the configuration or which modules are located in different slots as compared to the configuration. Configuration control does not have an impact on the parameter assignment of the modules.

Configuration control gives you the flexibility to vary the installation as long as you can derive the real configuration from the maximum device configuration in STEP 7.

To activate configuration control and structure the required control data record, follow these steps:

1. Optionally, reset the CPU to factory settings to ensure that an incompatible control data record is not present in the CPU.
2. Select the CPU in device configuration in STEP 7.
3. From the Configuration control node in the CPU properties, select the "Enable reconfiguration of device with user program" check box.

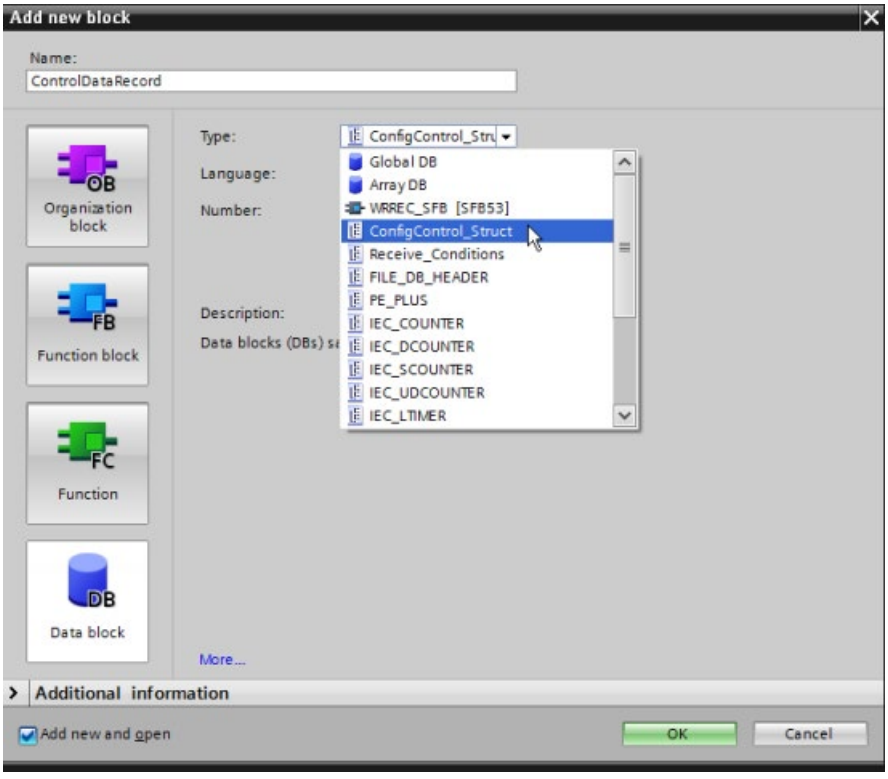


4. Create a PLC data type to contain the control data record. Configure it as a struct that includes four USints for configuration control information and additional USints to correspond to the slots of a maximum S7-1200 device configuration, as follows:

ConfigControl_Struct

	Name	Data type	Default value	Comment
1	ConfigControl	Struct		
2	Block_length	USInt	16	Length of control data record, including header
3	Block_ID	USInt	196	Data record number
4	Version	USInt	5	
5	Subversion	USInt	0	
6	Slot_1	USInt	255	Assignment for CPU annex card/Actual annex card
7	Slot_2	USInt	255	Configured slot 2/ Assigned "real" slot
8	Slot_3	USInt	255	Configured slot 3 / Assigned "real" slot
9	Slot_4	USInt	255	Configured slot 4 / Assigned "real" slot
10	Slot_5	USInt	255	Configured slot 5 / Assigned "real" slot
11	Slot_6	USInt	255	Configured slot 6 / Assigned "real" slot
12	Slot_7	USInt	255	Configured slot 7 / Assigned "real" slot
13	Slot_8	USInt	255	Configured slot 8 / Assigned "real" slot
14	Slot_9	USInt	255	Configured slot 9 / Assigned "real" slot
15	Slot_101	USInt	255	Configured slot 101 / Assigned "real" slot
16	Slot_102	USInt	255	Configured slot 102 / Assigned "real" slot
17	Slot_103	USInt	255	Configured slot 103 / Assigned "real" slot

5. Create a data block of the PLC data type that you created.



6. In this data block, configure the Block_length, Block_ID, Version, and Subversion as shown below. Configure the values for the slots based on their presence or absence and position in your actual installation:
   - 0: Configured module is not present in the actual configuration. (The slot is empty.)
   - 1 to 9, 101 to 103: The actual slot position for the configured slot
   - 255: The STEP 7 device configuration does not include a module in this slot.

Note

Configuration control not available for HSCs and PTOs on the signal board

If you have a signal board in the CPU that you configure for HSCs or PTOs, you must not disable it with a "0" in Slot_1 of the configuration control data record. Configured HSC and PTO devices of the CPU are mandatory regarding configuration control.

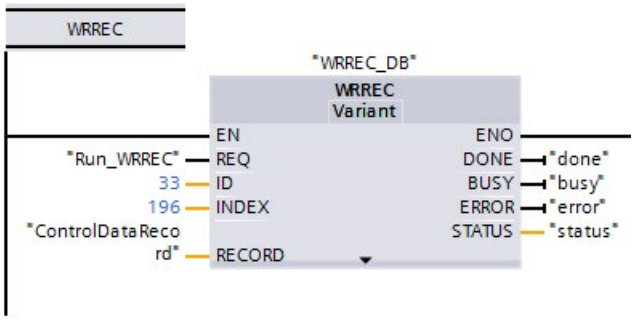
ControlDataRecord

	Name	Data type	Start value	Comment
1	Static			
2	ConfigControl	Struct		
3	Block_length	USInt	16	Length of control data record, including header
4	Block_ID	USInt	196	Data record number
5	Version	USInt	5	
6	Subversion	USInt	0	
7	Slot_1	USInt	255	Assignment for CPU annex card/Actual annex c...
8	Slot_2	USInt	255	Configured slot 2/ Assigned "real" slot
9	Slot_3	USInt	255	Configured slot 3 / Assigned "real" slot
10	Slot_4	USInt	255	Configured slot 4 / Assigned "real" slot
11	Slot_5	USInt	255	Configured slot 5 / Assigned "real" slot
12	Slot_6	USInt	255	Configured slot 6 / Assigned "real" slot
13	Slot_7	USInt	255	Configured slot 7 / Assigned "real" slot
14	Slot_8	USInt	255	Configured slot 8 / Assigned "real" slot
15	Slot_9	USInt	255	Configured slot 9 / Assigned "real" slot
16	Slot_101	USInt	255	Configured slot 101 / Assigned "real" slot
17	Slot_102	USInt	255	Configured slot 102 / Assigned "real" slot
18	Slot_103	USInt	255	Configured slot 103 / Assigned "real" slot

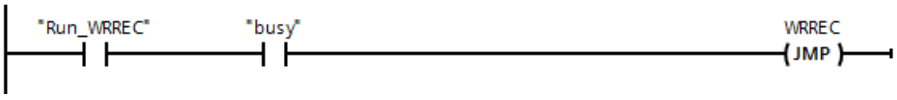
See Example of configuration control (Page 161) for an explanation of how to assign the slot values.

7. In the startup OB, call the extended WRREC (Write data record) instruction to transfer the control data record that you created to index 196 of hardware ID 33. Use a label and JMP (jump) instruction to wait for the WRREC instruction to complete.

Network 1:



Network 2:



Note

Configuration control is not in effect until the WRREC instruction transfers the control data record in the startup OB. If you have enabled configuration control and the CPU does not have the control data record, it will go to STOP mode when it exits STARTUP mode. Be sure that you program the startup OB to transfer the control data record.

Module arrangement

The following table shows the slot number assignment:

Slot	Modules
1	Signal board or communication board (CPU annex card)
2 to 9	Signal modules
101 to 103	Communication modules

Control data record

A control data record 196 contains the slot assignment and represents the actual configuration, as shown below:

Byte	Element	Value	Explanation
0	Block length	16	Header
1	Block ID	196	
2	Version	5	
3	Subversion	0	
4	Assignment of CPU annex card	Actual annex card, 0, or 255*	Control element Describes in each element which real slot in the device is assigned to the configured slot.
5	Assignment of configured slot 2	Actual slot, 0, or 255*	
...	...	...	
12	Assignment of configured slot 9	Actual slot, 0, or 255*	
13	Assignment of configured slot 101	Actual slot or 255*	Unlike signal modules, the actual slot for physically-present communication modules must be the same as the configured slot.
14	Assignment of configured slot 102	Actual slot or 255*	
15	Assignment of configured slot 103	Actual slot or 255*	

***Slot values:**

0: Configured module is not present in the actual configuration. (The slot is empty.)

1 to 9, 101 to 103: The actual slot position for the configured slot

255: The STEP 7 device configuration does not include a module in this slot.

Note

Alternative to creating a PLC tag type

As an alternative to creating a custom PLC tag type, you can create a data block directly with all of the structure elements of a control data record. You could even configure multiple structs in this data block to serve as multiple control data record configurations. Either implementation is an effective way to transfer the control data record during startup.

Rules

Observe the following rules:

- Configuration control does not support position changes for communication modules. The control data record slot positions for slots 101 to 103 must correspond to the actual installation. If you have not configured a module for the slot in your device configuration, enter 255 for that slot position in the control data record. If you have configured a module for the slot, enter the configured slot as the actual slot for that slot position.
- F-I/O modules do not support configuration control. The control data record slot positions for an F-I/O module must equal the configured slot position for the F-I/O module. If you attempt to move or delete a configured F-I/O module using the control data record, then all actually-installed F-I/O modules will raise a "parameter assignment" error and disallow exchange.

- You cannot have embedded empty (unused) slots between filled (used) slots. For example, if the actual configuration has a module in slot 4, then the actual configuration must also have modules in slots 2 and 3. Correspondingly, if the actual configuration has a communication module in slot 102, then the actual configuration must also have a module in slot 101.
- If you have enabled configuration control, the CPU is not ready for operation without a control data record. The CPU returns from startup to STOP if a startup OB does not transfer a valid control data record. The CPU does not initialize the central I/O in this case and enters the cause for the STOP mode in the diagnostics buffer.
- The CPU saves a successfully-transferred control data record in retentive memory, which means that it is not necessary to write the control data record 196 again at a restart if you have not changed the configuration.
- Each real slot must be present only once in the control data record.
- You can only assign a real slot to one configured slot.

Note

Modifying a configuration

The writing of a control data record with a modified configuration triggers the following automatic reaction by the CPU: Memory reset with subsequent startup with this modified configuration.

As a result of this reaction, the CPU deletes the original control data record and saves the new control data record retentively.

Behavior during operation

For the online display and for the display in the diagnostics buffer (module OK or module faulty), STEP 7 uses the device configuration and not the differing real configuration.

Example: A module outputs diagnostics data. This module is configured in slot 4, but is actually inserted in slot 3. The online view indicates that configured slot 4 is faulty. In the real configuration, the module at slot 3 indicates an error by its LED display.

If you have configured modules as missing in the control data record (0 entry), the automation system behaves as follows:

- Modules designated as not present in the control data record do not supply diagnostics and their status is always OK. The value status is OK.
- Direct writing access to the outputs or writing access to the process image of outputs that are not present proceeds with no effect; the CPU reports no access error.
- Direct read access to the inputs or read access to the process image of inputs that are not present results in a value "0" for each input; the CPU reports no access error.
- Writing a data record to a module that is not present proceeds with no effect; the CPU reports no error.
- Attempting to read a data record from module that is not present resuls in an error because the CPU cannot return a valid data record.

Error messages

The CPU returns the following error messages if an error occurs during writing of the control data record:

Error code	Meaning
16#80B1	Invalid length; the length information in the control data record is not correct.
16#80B5	Configuration control parameters not assigned
16#80E2	Data record was transferred in the wrong OB context. The data record must be transferred in the startup OB.
16#80B0	Block type (byte 2) of control data record is not equal to 196.
16#80B8	Parameter error; module signals invalid parameters, for example: • The control data record attempts to modify the configuration of a communication module or a communication annex card. The real configuration for communication modules and a communication annex card must equal the STEP 7 configuration. • The assigned value for an unconfigured slot in the STEP 7 project is not equal to 255. • The assigned value for a configured slot is out of range. • The assigned configuration has an "internal" empty slot, for example, slot n is assigned and slot n-1 is not assigned.

6.4.3 Example of configuration control

This example describes a configuration consisting of a CPU and three I/O modules.The module at slot 3 is not present in the first actual installation, so you use configuration control to "hide" it.

In the second installation, the application includes the module that was initially hidden but now includes it in the last slot. A modified control data record provides the information about the slot assignments of the modules.

Example: Actual installation with configured but unused module

The device configuration contains all modules that can be present in an actual installation (maximum configuration). In this case, the module that is in slot 3 in the device configuration is not present in the real installation.

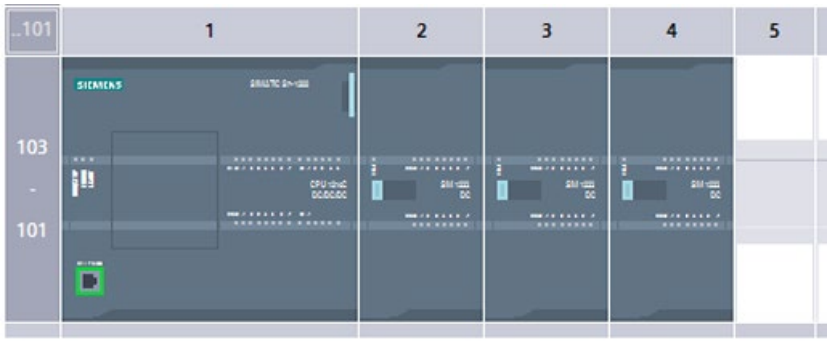


Figure 6-1 Device configuration of maximum installation with three signal modules



Figure 6-2 Actual installation with module configured in slot 3 absent, and module configured for slot 4 in actual slot 3

To indicate the absence of the missing module, you must configure slot 3 in the control data record with 0.

ControlDataRecord

		Name	Data type	Start value	Comment
1		Static			
2		ConfigControl	Struct		
3		Block_length	USInt	16	Length of control data record, including header
4		Block_ID	USInt	196	Data record number
5		Version	USInt	5	
6		Subversion	USInt	0	
7		Slot_1	USInt	255	Assignment for CPU annex card/Actual annex ca..
8		Slot_2	USInt	2	Configured slot 2 / Assigned "real" slot
9		Slot_3	USInt	0	Configured slot 3 / Assigned "real" slot
10		Slot_4	USInt	3	Configured slot 4 / Assigned "real" slot
11		Slot_5	USInt	255	Configured slot 5 / Assigned "real" slot
12		Slot_6	USInt	255	Configured slot 6 / Assigned "real" slot
13		Slot_7	USInt	255	Configured slot 7 / Assigned "real" slot
14		Slot_8	USInt	255	Configured slot 8 / Assigned "real" slot
15		Slot_9	USInt	255	Configured slot 9 / Assigned "real" slot
16		Slot_101	USInt	255	Configured slot 101 / Assigned "real" slot
17		Slot_102	USInt	255	Configured slot 102 / Assigned "real" slot
18		Slot_103	USInt	255	Configured slot 103 / Assigned "real" slot

Example: Actual installation with module subsequently added to a different slot

In the second example, the module in slot 3 of the device configuration is present in the actual installation but is in slot 4.

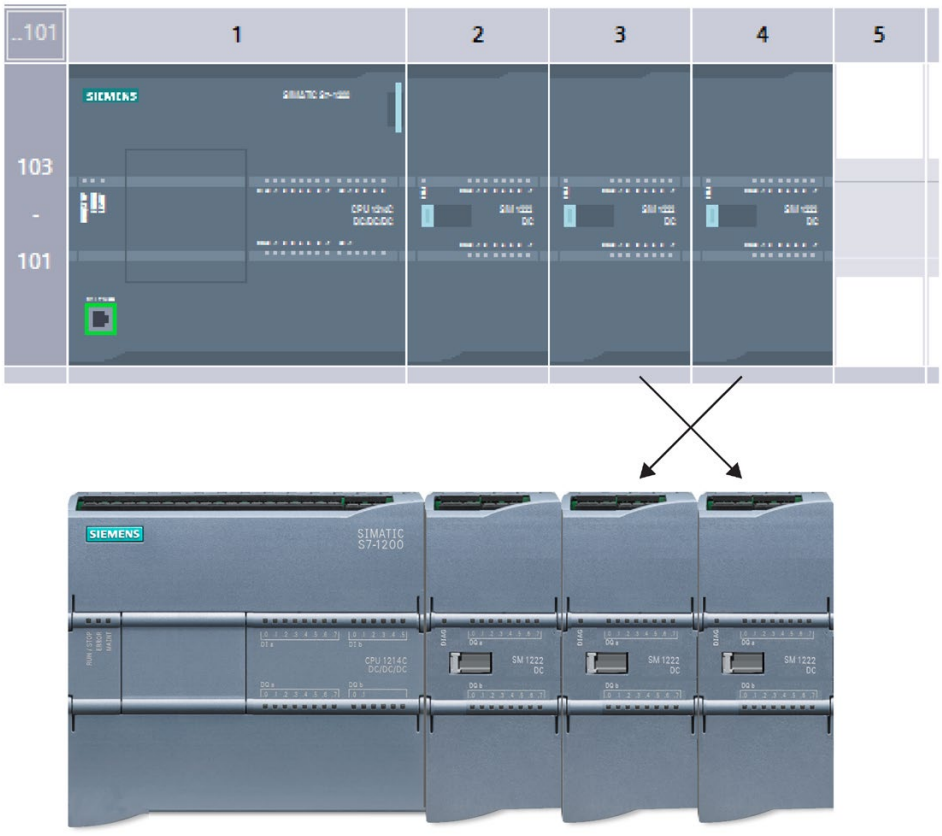


Figure 6-3 Device configuration compared to actual installation with modules in slots 3 and 4 swapped

To correlate the device configuration to the actual installation, edit the control data record to assign the modules to the correct slot positions.

ControlDataRecord

	Name	Data type	Start value	Comment
1	Static			
2	ConfigControl	Struct		
3	Block_length	USInt	16	Length of control data record, including header
4	Block_ID	USInt	196	Data record number
5	Version	USInt	5	
6	Subversion	USInt	0	
7	Slot_1	USInt	255	Assignment for CPU annex card/Actual annex card
8	Slot_2	USInt	2	Configured slot 2/ Assigned "real" slot
9	Slot_3	USInt	4	Configured slot 3 / Assigned "real" slot
10	Slot_4	USInt	3	Configured slot 4 / Assigned "real" slot
11	Slot_5	USInt	255	Configured slot 5 / Assigned "real" slot
12	Slot_6	USInt	255	Configured slot 6 / Assigned "real" slot
13	Slot_7	USInt	255	Configured slot 7 / Assigned "real" slot
14	Slot_8	USInt	255	Configured slot 8 / Assigned "real" slot
15	Slot_9	USInt	255	Configured slot 9 / Assigned "real" slot
16	Slot_101	USInt	255	Configured slot 101 / Assigned "real" slot
17	Slot_102	USInt	255	Configured slot 102 / Assigned "real" slot
18	Slot_103	USInt	255	Configured slot 103 / Assigned "real" slot

6.5 Changing a device

You can change the device type of a configured CPU or module. From Device configuration, right-click the device and select "Change device" from the context menu. From the dialog, navigate to and select the CPU or module that you want to replace. The Change device dialog shows you compatibility information between the two devices.

For considerations on changing devices between different CPU versions, refer to Exchanging a V3.0 CPU for a V4.2.x CPU (Page 1561).

6.6 Configuring the operation of the CPU

6.6.1 Overview

To configure the operational parameters for the CPU, select the CPU in the Device view (blue outline around whole CPU), and use the "Properties" tab of the inspector window.

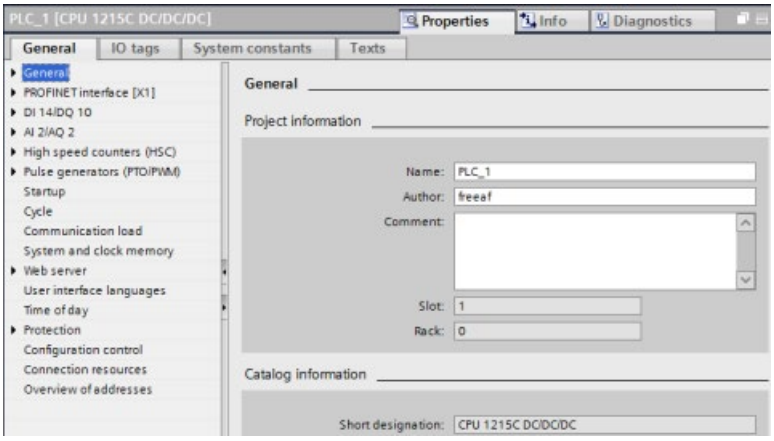


Table 6- 2 CPU properties

Property	Description
PROFINET interface	Sets the IP address for the CPU and time synchronization
DI, DO, and AI	Configures the behavior of the local (onboard) digital and analog I/O (for example, digital input filter times and digital output reaction to a CPU stop).
High-speed counters (Page 541) and pulse generators (Page 478)	Enables and configures the high-speed counters (HSC) and the pulse generators used for pulse-train operations (PTO) and pulse-width modulation (PWM) When you configure the outputs of the CPU or signal board as pulse generators (for use with the PWM or motion control instructions), the corresponding output addresses are removed from the Q memory and cannot be used for other purposes in your user program. If your user program writes a value to an output used as a pulse generator, the CPU does not write that value to the physical output.
Startup (Page 87)	**Startup after POWER ON:** Selects the behavior of the CPU following an off-to-on transition, such as to start in STOP mode or to go to RUN mode after a warm restart
	Supported hardware compatibility: Configures the substitution strategy for all system components (SM, SB, CM, CP and CPU): • Allow acceptable substitute • Allow any substitute (default) Each module internally contains substitution compatibility requirements based on the number of I/O, electrical compatibility, and other corresponding points of comparison. For example, a 16-channel SM could be an acceptable substitute for an 8-channel SM, but an 8-channel SM could not be an acceptable substitute for a 16-channel SM. If you select "Allow acceptable substitute", STEP 7 enforces the substitution rules; otherwise, STEP 7 allows any substitution.
	Parameter assignment time for distributed I/O: Configures a maximum amount of time (default: 60000 ms) for the distributed I/O to be brought online. (The CMs and CPs receive power and communication parameters from the CPU during startup. This assignment time allows time for the I/O connected to the CM or CP to be brought online.) The CPU goes to RUN as soon as the distributed I/O is online, regardless of the assignment time. If the distributed I/O has not been brought online within this time, the CPU still goes to RUN--without the distributed I/O. **Note:** If your configuration uses a CM 1243-5 (PROFIBUS master), do not set this parameter below 15 seconds (15000 ms) to ensure that the module can be brought online.
	OBs should be interruptible: Configures whether OB execution (for all OBs) in the CPU is interruptible or non-interruptible (Page 103)
Cycle (Page 107)	Defines a maximum cycle time or a fixed minimum cycle time
Communication load	Allocates a percentage of the CPU time to be dedicated to communication tasks
System and clock memory (Page 110)	Enables a byte for "system memory" functions and enables a byte for "clock memory" functions (where each bit toggles on and off at a predefined frequency)
Web server (Page 981)	Enables and configures the Web server feature
Time of day	Selects the time zone and configures daylight saving time
Multilingual support (Page 171)	Assigns a project language for the Web server to use for displaying diagnostic buffer entry texts for each of the possible Web server user interface display languages.
Protection (Page 204)	Sets the read/write protection and passwords for accessing the CPU
Configuration control (Page 155)	Enables configuring a master device configuration that you can control for different actual device configurations
Connection resources (Page 783)	Provides a summary of the communication connection resources that are available for the CPU and the number of connection resources that have been configured
Overview of addresses	Provides a summary of the I/O addresses that have been configured for the CPU

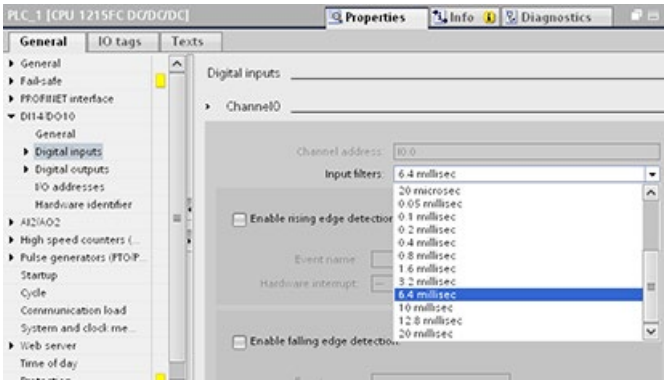
6.6.2 Configuring digital input filter times

The digital input filters protect your program from responding to unwanted fast changes in the input signals, as may result from switch contact bounce or electrical noise. The default filter time of 6.4 ms blocks unwanted transitions from typical mechanical contacts. Different points in your application can require shorter filter times to detect and respond to inputs from fast sensors, or longer filter times to block slow contact bounce or longer impulse noise.

An input filter time of 6.4 ms means that a single signal change, from ‘0’ to ‘1’ or from ‘1’ to ‘0’, must continue for approximately 6.4 ms to be detected, and a single high or low pulse shorter than approximately 6.4 ms is not detected. If an input signal switches between ‘0’ and ‘1’ more rapidly than the filter time, the input point value can change in the user program when the accumulated duration of new value pulses over old value pulses exceeds the filter time.

The digital input filter works this way:

- When a "1" is input, it counts up, stopping at the filter time. The image register point changes from "0" to "1" when the count reaches the filter time.
- When a "0" is input, it counts down, stopping at "0". The image register point changes from "1" to "0" when the count reaches "0".
- If the input is changing back and forth, the counter will count up some and count down some. The image register will change when the net accumulation of counts reaches either the filter time or "0".
- A rapidly-changing signal with more "0’s" than "1’s" will eventually go to "0", and if there are more "1’s" than "0’s", the image register will eventually change to "1".



Each input point has a single filter configuration that applies to all uses: process inputs, interrupts, pulse catch, and HSC inputs. To configure input filter times, select "Digital Inputs".

The default filter time for the digital inputs is 6.4 ms. You can select a filter time from the Input filters drop-down list. Valid filter times range from 0.1 us to 20.0 ms.

WARNING

Risks with changes to filter time for digital input channel

If you change the filter time for a digital input channel from a previous setting, a new "0" level input value may need to stay at "0" for up to 20.0 ms before the filter becomes fully responsive to new inputs. During this time, short "0" pulse events of duration less than 20.0 ms may not be detected or counted.

This changing of filter times can result in unexpected machine or process operation, which may cause death or serious injury to personnel, and/or damage to equipment.

To ensure that a new filter time goes immediately into effect, a power cycle of the CPU must be applied.

Configuring filter times for digital inputs used as HSCs

For inputs that you use as high-speed counters (HSCs), change the input filter time to an appropriate value to avoid missing counts.

Siemens recommends the following settings:

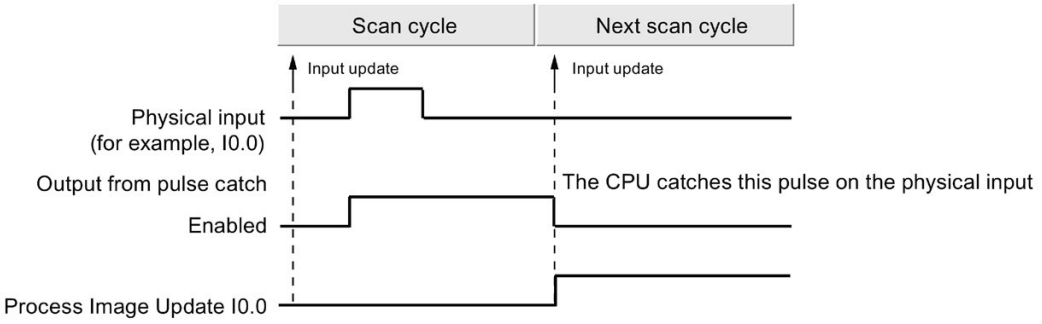
Type of HSC	Recommended input filter time
1 MHz	0.1 microseconds
100 kHz	0.8 microseconds
30 kHz	3.2 microseconds

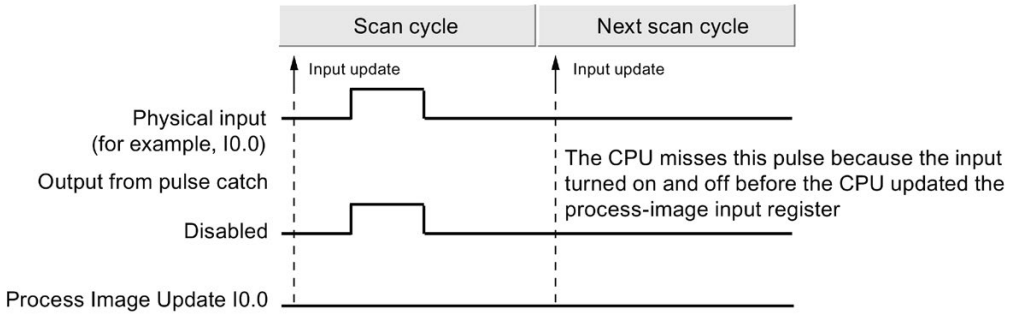
6.6.3 Pulse catch

The S7-1200 CPU provides a pulse catch feature for digital input points. The pulse catch feature allows you to capture high-going pulses or low-going pulses that are of such a short duration that they would not always be seen when the CPU reads the digital inputs at the beginning of the scan cycle.

When you enable pulse catch for an input, a change in state of the input is latched and held until the next input cycle update. This ensures that a pulse that lasts for a short period of time will be caught and held until the CPU reads the inputs.

The figures below show the basic operation of the S7-1200 CPU with and without pulse catch enabled:

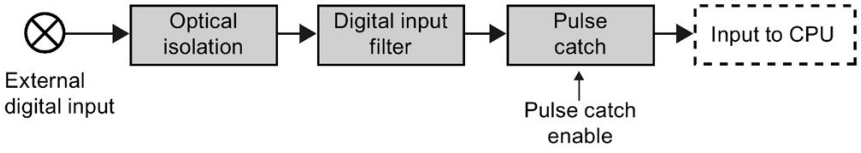




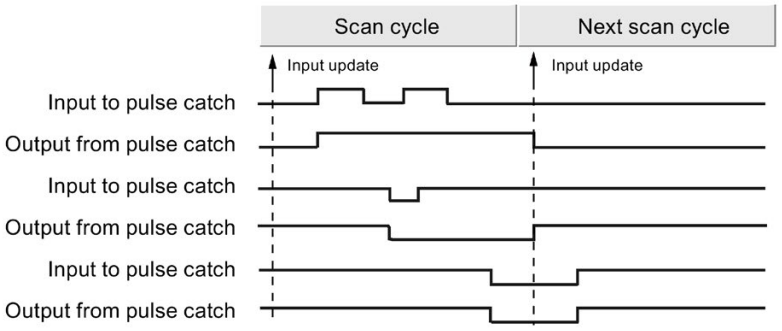
Note

Because the pulse catch function operates on the input after it passes through the input filter, you must adjust the input filter time so that the filter does not remove the pulse.

The figure below shows a block diagram of the digital input circuit:



The figure below shows the response of an enabled pulse catch function to various input conditions. If you have more than one pulse in a given scan, only the first pulse is read. If you have multiple pulses in a given scan, you should use the rising/falling edge interrupt events:



6.7 Configuring multilingual support

The Multilingual support settings allow you to assign one of two project languages for each user interface language for the S7-1200 Web server (Page 981). You can also configure no project language for a user interface language.

What is a project language?

The project language is the language that the TIA Portal uses to display user-defined project texts as network comments and block comments.

You select project languages in the TIA Portal from the **Tools > Project languages** menu command for the selected project in the project tree.

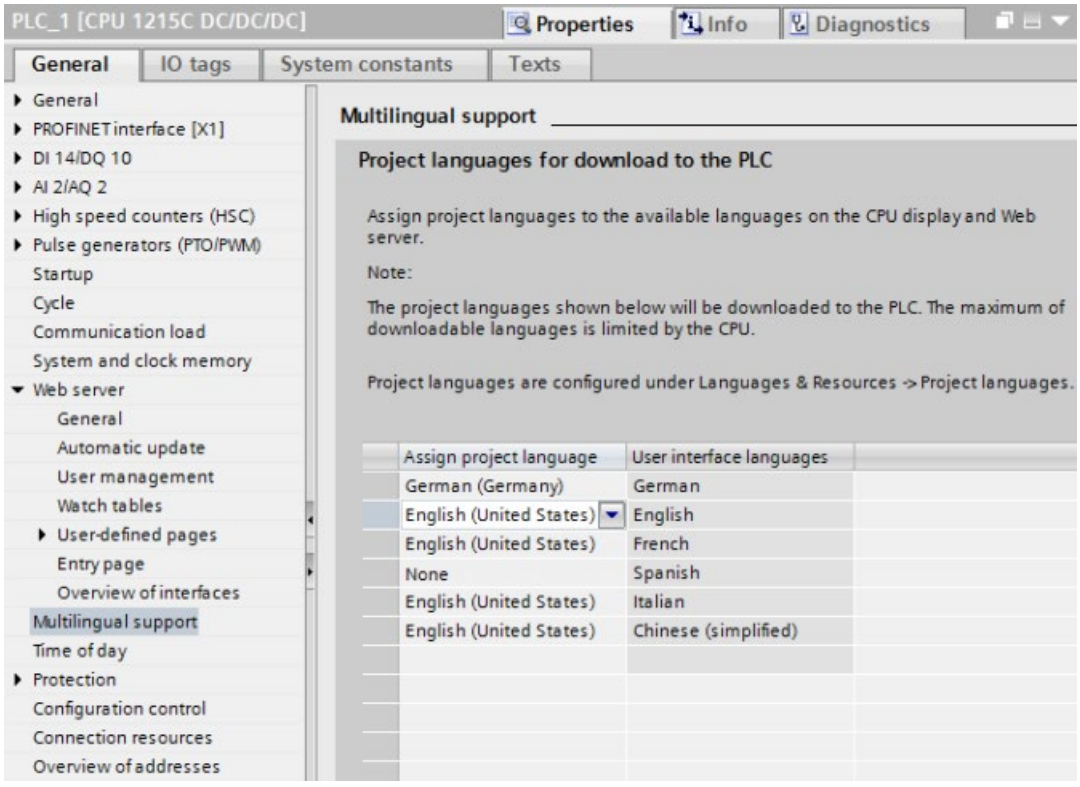
You can then configure user texts such as network comments and block comments in each project language from the **Tools > Project texts** menu command. Then when you change the TIA Portal user interface language, the network comments, block comments, and other multilingual project texts display in the corresponding project language. You set the TIA Portal user interface language from the **Options > Settings** project language menu command.

Project languages and project texts are also configurable from the **Languages & resources** node of the project tree.

The Web server can use one or two of the STEP 7 project languages for the display of diagnostic buffer messages.

Project language correspondence to user interface language in the Web server

The Web server supports the same user interface languages as the TIA Portal; however, it only supports up to two project languages. You can configure the Web server to use one of two project languages for diagnostic buffer text entries depending on the user interface language of the Web server. You configure these settings in the "Multilingual support" properties in the device configuration of the CPU. (Network comments and block comments and other multilingual texts are not visible from the Web server.)



In the Multilingual support properties, the user interface languages on the right are not editable. They are the pre-defined languages that are available for both the TIA Portal and for the Web server user interfaces. The "Assign project language" setting is configurable and can be one of two of your configured project languages, or it can be "None". Because the S7-1200 CPU only supports two project languages, you cannot configure the project language to be the same as the user interface language for all of the supported user interface languages.

In the configuration below, the Web server displays diagnostic buffer entries (Page 1002) in German when the Web server user interface is German, displays no texts for diagnostic buffer events when the Web server user interface is Spanish, and displays diagnostic buffer entries in English for all other languages.

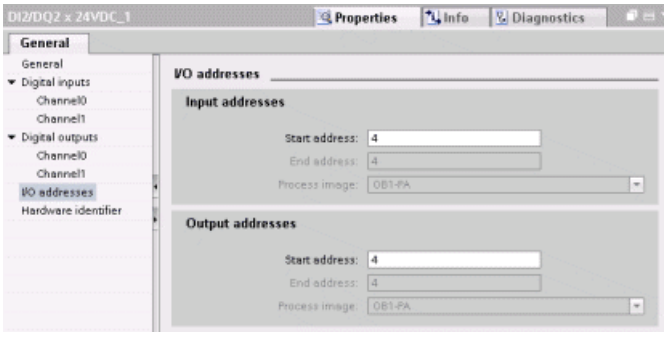
6.8 Configuring the parameters of the modules

To configure the operational parameters for the modules, select the module in the Device view and use the "Properties" tab of the inspector window to configure the parameters for the module.

Configuring a signal module (SM) or a signal board (SB)

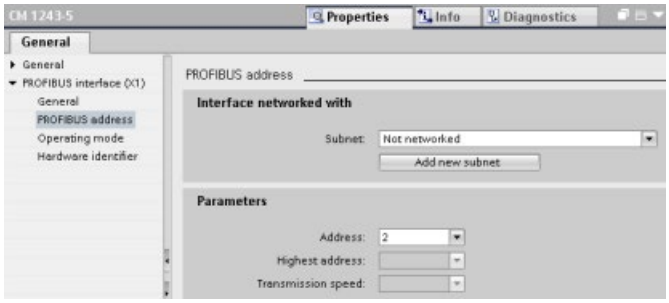
The device configuration for signal modules and signal boards provides the means to configure the following:

- Digital I/O: You can configure inputs for rising-edge detection or falling-edge detection (associating each with an event and hardware interrupt) or for "pulse catch" (to stay on after a momentary pulse) through the next update of the input process image. Outputs can use a freeze or substitute value.
- Analog I/O: For individual inputs, configure parameters, such as measurement type (voltage or current), range and smoothing, and to enable underflow or overflow diagnostics. Analog outputs provide parameters such as output type (voltage or current) and for diagnostics, such as short circuit (for voltage outputs) or upper/lower limit diagnostics. You do not configure ranges of analog inputs and outputs in engineering units on the Properties dialog. You must handle this in your program logic as described in the topic "Processing of analog values (Page 120)".
- I/O addresses: You configure the start address for the set of inputs and outputs of the module. You can also assign the inputs and outputs to a process image partition (PIP0, PIP1, PIP2, PIP3, PIP4) or to automatically update, or to use no process image partition. See "Execution of the user program" (Page 83) for an explanation of the process image and process image partitions.



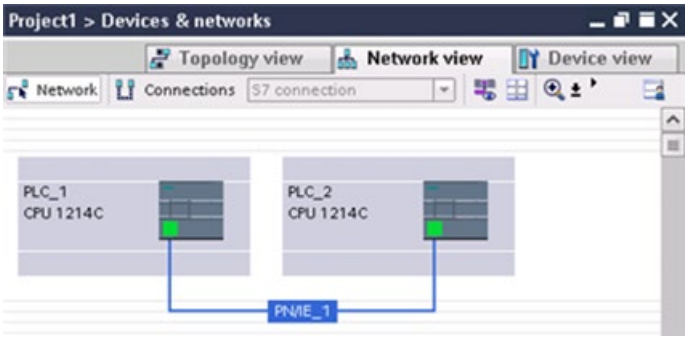
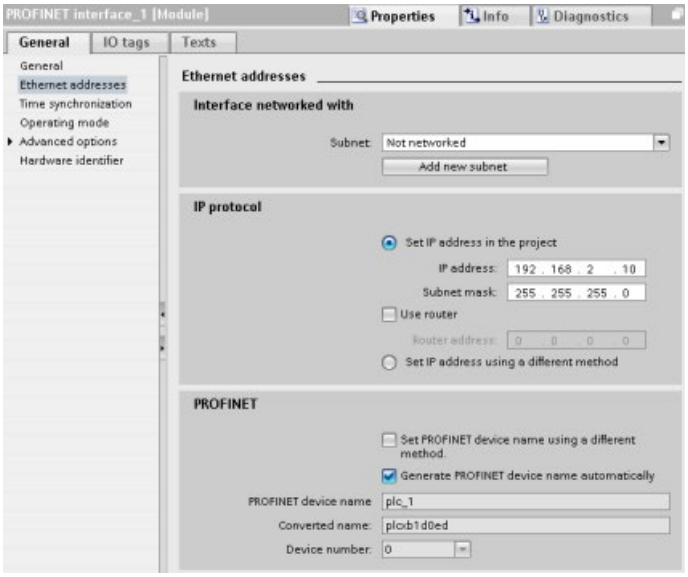
Configuring a communication interface (CM, CP or CB)

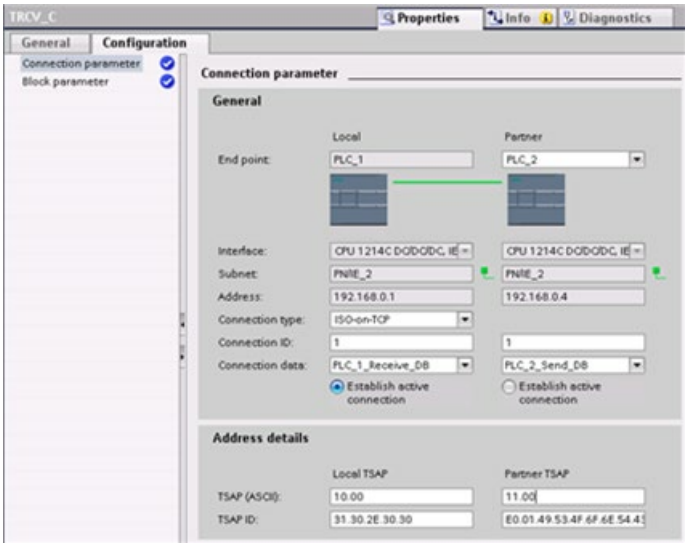
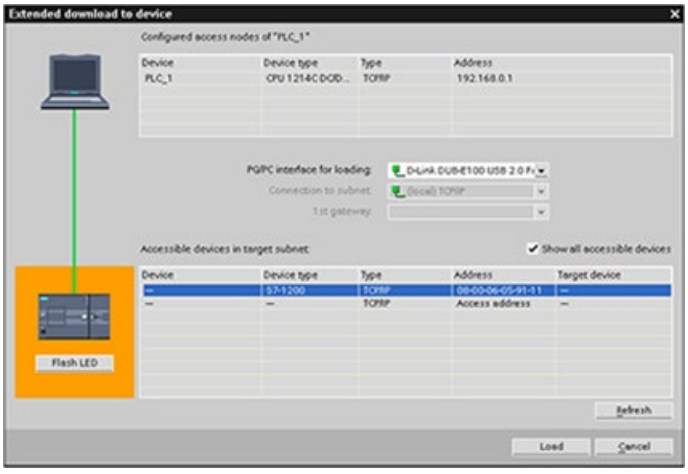
Depending on the type of communication interface, you configure the parameters for the network.



6.9 Configuring the CPU for communication

The S7-1200 is designed to solve your communications and networking needs by supporting not only the simplest of networks but also supporting more complex networks. The S7-1200 also provides tools that allow you to communicate with other devices, such as printers and weigh scales which use their own communications protocols.

	Use the "Network view" of Device configuration to create the network connections between the devices in your project. After creating the network connection, use the "Properties" tab of the inspector window to configure the parameters of the network. Refer to "Creating a network connection" (Page 787) for further information.
	In the Properties window, select the "Ethernet addresses" configuration entry. STEP 7 displays the Ethernet address configuration dialog, which associates the software project with the IP address of the CPU that will receive that project. Note: The S7-1200 CPU does not have a preconfigured IP address. You must manually assign an IP address for the CPU. Refer to "Assigning Internet Protocol (IP) addresses" (Page 791) for further information.

	For the TCP, ISO-on-TCP, and UDP Ethernet protocols, use the "Properties" of the instruction (TSEND_C, TRCV_C, or TCON) to configure the "Local/Partner" connections. The figure shows the "Connection properties" of the "Configuration tab" for an ISO-on-TCP connection. Refer to "Configuring the Local/Partner connection path" (Page 788) for further information.
	After completing the configuration, download the project to the CPU. All IP addresses are configured when you download the project. Refer to "Testing the PROFINET network" (Page 799) for further information.

Note

To make a connection to your CPU, your network interface card (NIC) and the CPU must be on the same class of network and on the same subnet. You can either set up your network interface card to match the default IP address of the CPU, or you can change the IP address of the CPU to match the network class and subnet of your network interface card.

Refer to "Assigning Internet Protocol (IP) addresses" (Page 791) for information about how to accomplish this.

6.10 Time synchronization

The objective of time synchronization of the time-of-day clocks is to have one master clock that synchronizes all other local clocks. The master clock synchronizes the local clocks initially and also periodically re-synchronizes the clocks to avoid the effects of drift over time.

In the case of the S7-1200 and its local base components, only the CPU and some of the CP modules have time-of-day clocks that might need to be synchronized. You can configure the CPU's time-of-day clock to be synchronized to an external master clock. The external master clock might supply the time of day using an NTP server or through a CP in the local rack of the S7-1200 that is connected to a SCADA system that includes a master clock.

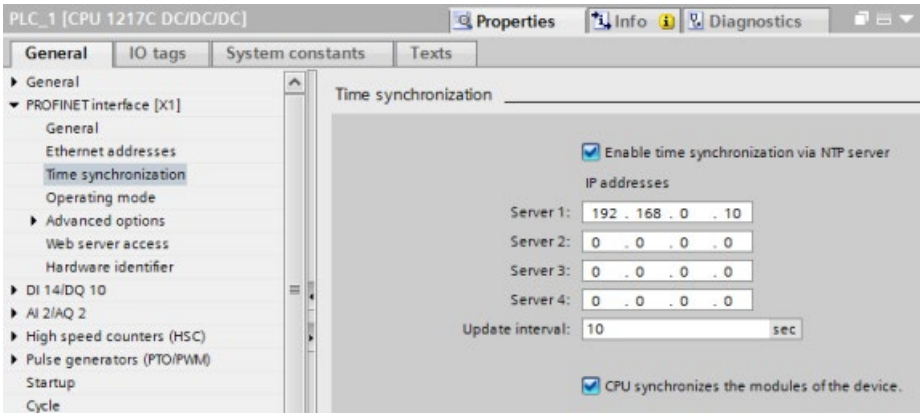
Refer to S7-1200 CPs (https://support.industry.siemens.com/cs/us/en/ps) at Siemens Industry Online Support, Product Support for further information on all S7-1200 CPs that support the Time sychronization function.

Setting the time-of-day clock

There are three ways to set the time-of-day clock in the S7-1200 CPU:

- Using the NTP server (Page 802)
- Using STEP 7
- From the user program
- Using an HMI panel

You configure time synchronization of the CP modules to the CPU's clock by selecting the "CPU synchronizes the modules of the device." check box as shown:



By default, neither time synchronization using the NTP server nor time synchronization of the CP clocks to the CPU's clock is enabled.

You configure time synchronization of the CPU's clock and time synchronization of the CP clocks independently. Consequently, you can enable time synchronization of the CP clocks by the CPU when the CPU's clock is set by any of the above-mentioned methods.

You can select the update interval using the NTP server. The update interval of the NTP server is set to 10 seconds by default.

When you activate time synchronization in a module, STEP 7 prompts you to select the "CPU synchronizes the modules of the device." if you have not already selected the check box in the CPU's "Time synchronization" dialog. STEP 7 also warns you if you configured more than one master clock source for time synchronization (for example, you activated time synchronization on more than one CP or on both the CPU and a module).

Note

Activating time synchronization on a CP causes the CP to set the CPU's clock.

If you select "CPU synchronizes the modules of the device" in the CPU "Time synchronization" dialog, then the CPU is the time master. The CP modules then synchronize to the CPU's clock.

Note

Only configure one time source for the CPU. Receiving time synchronizations for the CPU from more than one source (NTP server or CP module, for example) could cause conflicting time updates. Time synchronizations from multiple sources could adversely affect instructions and events based on time of day.

Programming concepts

7

7.1 Guidelines for designing a PLC system

When designing a PLC system, you can choose from a variety of methods and criteria. The following general guidelines can apply to many design projects. Of course, you must follow the directives of your own company's procedures and the accepted practices of your own training and location.

Table 7- 1 Guidelines for designing a PLC system

Recommended steps	Tasks
Partition your process or machine	Divide your process or machine into sections that have a level of independence from each other. These partitions determine the boundaries between controllers and influence the functional description specifications and the assignment of resources.
Create the functional specifications	Write the descriptions of operation for each section of the process or machine, such as the I/O points, the functional description of the operation, the states that must be achieved before allowing action for each actuator (such as a solenoid, a motor, or a drive), a description of the operator interface, and any interfaces with other sections of the process or machine.
Design the safety circuits	Identify any equipment that might require hard-wired logic for safety. Remember that control devices can fail in an unsafe manner, which can produce unexpected startup or change in the operation of machinery. Where unexpected or incorrect operation of the machinery could result in physical injury to people or significant property damage, consider the implementation of electromechanical overrides (which operate independently of the PLC) to prevent unsafe operations. The following tasks should be included in the design of safety circuits: • Identify any improper or unexpected operation of actuators that could be hazardous. • Identify the conditions that would assure the operation is not hazardous, and determine how to detect these conditions independently of the PLC. • Identify how the PLC affects the process when power is applied and removed, and also identify how and when errors are detected. Use this information only for designing the normal and expected abnormal operation. You should not rely on this "best case" scenario for safety purposes. • Design the manual or electromechanical safety overrides that block the hazardous operation independent of the PLC. • Provide the appropriate status information from the independent circuits to the PLC so that the program and any operator interfaces have necessary information. • Identify any other safety-related requirements for safe operation of the process.
Plan system security	Determine what level of protection (Page 204) you require for access to your process. You can password-protect CPUs and program blocks from unauthorized access.

Recommended steps	Tasks
Specify the operator stations	Based on the requirements of the functional specifications, create the following drawings of the operator stations: • Overview drawing that shows the location of each operator station in relation to the process or machine. • Mechanical layout drawing of the devices for the operator station, such as display, switches, and lights. • Electrical drawings with the associated I/O of the PLC and signal modules.
Create the configuration drawings	Based on the requirements of the functional specification, create configuration drawings of the control equipment: • Overview drawing that shows the location of each PLC in relation to the process or machine. • Mechanical layout drawing of each PLC and any I/O modules, including any cabinets and other equipment. • Electrical drawings for each PLC and any I/O modules, including the device model numbers, communications addresses, and I/O addresses.
Create a list of symbolic names	Create a list of symbolic names for the absolute addresses. Include not only the physical I/O signals, but also the other elements (such as tag names) to be used in your program.

7.2 Structuring your user program

When you create a user program for the automation tasks, you insert the instructions for the program into code blocks:

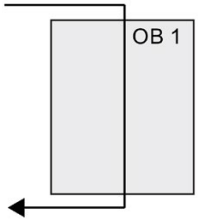
- An organization block (OB) responds to a specific event in the CPU and can interrupt the execution of the user program. The default for the cyclic execution of the user program (OB 1) provides the base structure for your user program. If you include other OBs in your program, these OBs interrupt the execution of OB 1. The other OBs perform specific functions, such as for startup tasks, for handling interrupts and errors, or for executing specific program code at specific time intervals.
- A function block (FB) is a subroutine that is executed when called from another code block (OB, FB, or FC). The calling block passes parameters to the FB and also identifies a specific data block (DB) that stores the data for the specific call or instance of that FB. Changing the instance DB allows a generic FB to control the operation of a set of devices. For example, one FB can control several pumps or valves, with different instance DBs containing the specific operational parameters for each pump or valve.
- A function (FC) is a subroutine that is executed when called from another code block (OB, FB, or FC). The FC does not have an associated instance DB. The calling block passes parameters to the FC. The output values from the FC must be written to a memory address or to a global DB.

Choosing the type of structure for your user program

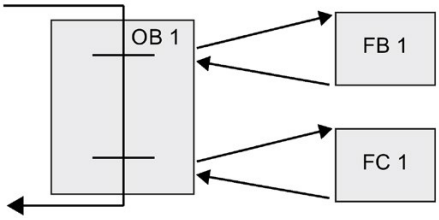
Based on the requirements of your application, you can choose either a linear structure or a modular structure for creating your user program:

- A linear program executes all of the instructions for your automation tasks in sequence, one after the other. Typically, the linear program puts all of the program instructions into the OB for the cyclic execution of the program (OB 1).
- A modular program calls specific code blocks that perform specific tasks. To create a modular structure, you divide the complex automation task into smaller subordinate tasks that correspond to the technological functions of the process. Each code block provides the program segment for each subordinate task. You structure your program by calling one of the code blocks from another block.

Linear structure:



Modular structure:



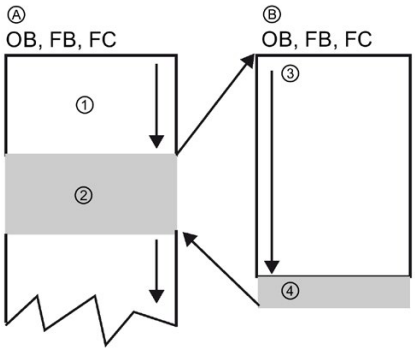
By creating generic code blocks that can be reused within the user program, you can simplify the design and implementation of the user program. Using generic code blocks has a number of benefits:

- You can create reusable blocks of code for standard tasks, such as for controlling a pump or a motor. You can also store these generic code blocks in a library that can be used by different applications or solutions.
- When you structure the user program into modular components that relate to functional tasks, the design of your program can be easier to understand and to manage. The modular components not only help to standardize the program design, but can also help to make updating or modifying the program code quicker and easier.
- Creating modular components simplifies the debugging of your program. By structuring the complete program as a set of modular program segments, you can test the functionality of each code block as it is developed.
- Creating modular components that relate to specific technological functions can help to simplify and reduce the time involved with commissioning the completed application.

7.3 Using blocks to structure your program

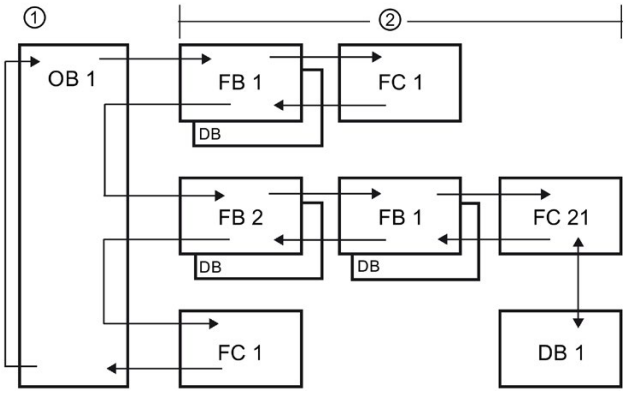
By designing FBs and FCs to perform generic tasks, you create modular code blocks. You then structure your program by having other code blocks call these reusable modules. The calling block passes device-specific parameters to the called block.

When a code block calls another code block, the CPU executes the program code in the called block. After execution of the called block is complete, the CPU resumes the execution of the calling block. Processing continues with execution of the instruction that follows after the block call.



A Calling block
B Called (or interrupting) block
① Program execution
② Instruction or event that initiates the execution of another block
③ Program execution
④ Block end (returns to calling block)

You can nest the block calls for a more modular structure. In the following example, the nesting depth is 3: the program cycle OB plus 3 layers of calls to code blocks.



① Start of cycle
② Nesting depth

Note: The maximum nesting depth is six. Safety programs use two nesting levels. The user program therefore has a nesting depth of four in safety programs.

7.3.1 Organization block (OB)

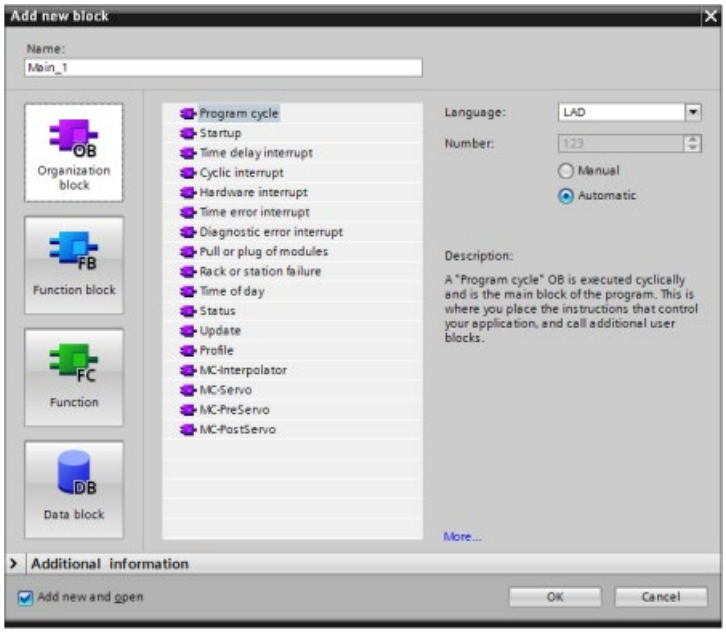
Organization blocks provide structure for your program. They serve as the interface between the operating system and the user program. OBs are event driven. An event, such as a diagnostic interrupt or a time interval, causes the CPU to execute an OB. Some OBs have predefined start events and behavior.

The program cycle OB contains your main program. You can include more than one program cycle OB in your user program. During RUN mode, the program cycle OBs execute at the lowest priority level and can be interrupted by all other event types. The startup OB does not interrupt the program cycle OB because the CPU executes the startup OB before going to RUN mode.

After finishing the processing of the program cycle OBs, the CPU immediately executes the program cycle OBs again. This cyclic processing is the "normal" type of processing used for programmable logic controllers. For many applications, the entire user program is located in a single program cycle OB.

You can create other OBs to perform specific functions, such as for handling interrupts and errors, or for executing specific program code at specific time intervals. These OBs interrupt the execution of the program cycle OBs.

Use the "Add new block" dialog to create new OBs in your user program.



Interrupt handling is always event-driven. When such an event occurs, the CPU interrupts the execution of the user program and calls the OB that was configured to handle that event. After finishing the execution of the interrupting OB, the CPU resumes the execution of the user program at the point of interruption.

The CPU determines the order for handling interrupt events by priority. You can assign multiple interrupt events to the same priority class. For more information, refer to the topics on organization blocks (Page 92) and execution of the user program (Page 83).

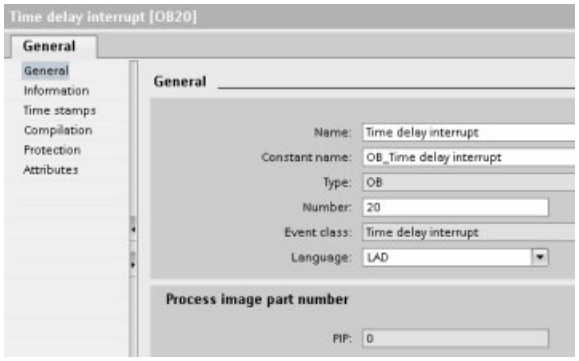
Creating additional OBs

You can create multiple OBs for your user program, even for the program cycle and startup OB events. Use the "Add new block" dialog to create an OB and enter a name for your OB.

If you create multiple program cycle OBs for your user program, the CPU executes each program cycle OB in numerical sequence, starting with the program cycle OB with the lowest number (such as OB 1). For example: after the first program cycle OB (such as OB 1) finishes, the CPU executes the program cycle OB with the next higher number.

Configuring the properties of an OB

You can modify the properties of an OB. For example, you can configure the OB number or programming language.



Note

Note that you can assign a process image part number to an OB that corresponds to PIP0, PIP1, PIP2, PIP3, or PIP4. If you enter a number for the process image part number, the CPU creates that process image partition. See the topic "Execution of the user program (Page 83)" for an explanation of the process image partitions.

7.3.2 Function (FC)

A function (FC) is a code block that typically performs a specific operation on a set of input values. The FC stores the results of this operation in memory locations. For example, use FCs to perform standard and reusable operations (such as for mathematical calculations) or technological functions (such as for individual controls using bit logic operations). An FC can also be called several times at different points in a program. This reuse simplifies the programming of frequently recurring tasks.

An FC does not have an associated instance data block (DB). The FC uses the local data stack for the temporary data used to calculate the operation. The temporary data is not saved. To store data permanently, assign the output value to a global memory location, such as M memory or to a global DB.

7.3.3 Function block (FB)

A function block (FB) is a code block that uses an instance data block for its parameters and static data. FBs have variable memory that is located in a data block (DB), or "instance" DB. The instance DB provides a block of memory that is associated with that instance (or call) of the FB and stores data after the FB finishes. You can associate different instance DBs with different calls of the FB. The instance DBs allow you to use one generic FB to control multiple devices. You structure your program by having one code block make a call to an FB and an instance DB. The CPU then executes the program code in that FB, and stores the block parameters and the static local data in the instance DB. When the execution of the FB finishes, the CPU returns to the code block that called the FB. The instance DB retains the values for that instance of the FB. These values are available to subsequent calls to the function block either in the same scan cycle or other scan cycles.

Reusable code blocks with associated memory

You typically use an FB to control the operation for tasks or devices that do not finish their operation within one scan cycle. To store the operating parameters so that they can be quickly accessed from one scan to the next, each FB in your user program has one or more instance DBs. When you call an FB, you also specify an instance DB that contains the block parameters and the static local data for that call or "instance" of the FB. The instance DB maintains these values after the FB finishes execution.

By designing the FB for generic control tasks, you can reuse the FB for multiple devices by selecting different instance DBs for different calls of the FB.

An FB stores the Input, Output, and InOut, and Static parameters in an instance DB.

You can also modify and download the function block interface in RUN mode (Page 1327).

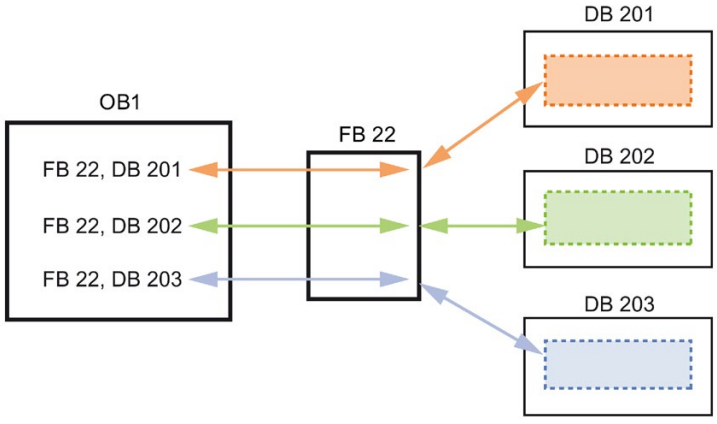
Assigning the start value in the instance DB

The instance DB stores both a default value and a start value for each parameter. The start value provides the value to be used when the FB is executed. The start value can then be modified during the execution of your user program.

The FB interface also provides a "Default value" column that allows you to assign a new start value for the parameter as you are writing the program code. This default value in the FB is then transferred to the start value in the associated instance DB. If you do not assign a new start value for a parameter in the FB interface, the default value from instance DB is copied to start value.

Using a single FB with DBs

The following figure shows an OB that calls one FB three times, using a different data block for each call. This structure allows one generic FB to control several similar devices, such as motors, by assigning a different instance data block for each call for the different devices. Each instance DB stores the data (such as speed, ramp-up time, and total operating time) for an individual device.



In this example, FB 22 controls three separate devices, with DB 201 storing the operational data for the first device, DB 202 storing the operational data for the second device, and DB 203 storing the operational data for the third device.

7.3.4 Data block (DB)

You create data blocks (DB) in your user program to store data for the code blocks. All of the program blocks in the user program can access the data in a global DB, but an instance DB stores data for a specific function block (FB).

The data stored in a DB is not deleted when the execution of the associated code block comes to an end. There are two types of DBs:

- A global DB stores data for the code blocks in your program. Any OB, FB, or FC can access the data in a global DB.
- An instance DB stores the data for a specific FB. The structure of the data in an instance DB reflects the parameters (Input, Output, and InOut) and the static data for the FB. (The Temp memory for the FB is not stored in the instance DB.)

Note

Although the instance DB reflects the data for a specific FB, any code block can access the data in an instance DB.

You can also modify and download data blocks in RUN mode (Page 1327).

Read-only data blocks

You can configure a DB as being read-only:

1. Right-click the DB in the project navigator and select "Properties" from the context menu.
2. In the "Properties" dialog, select "Attributes".
3. Select the "Data block write-protected in the device" option and click "OK".

Optimized and standard data blocks

You can also configure a data block to be either standard or optimized. A standard DB is compatible with STEP 7 Classic programming tools and the classic S7-300 and S7-400 CPUs. Data blocks with optimized access have no fixed defined structure. The data elements contain only a symbolic name in the declaration and no fixed address within the block. The CPU stores the elements automatically in the available memory area of the block so that there are no gaps in the memory. This makes for optimal use of the memory capacity.

To set optimized access for a data block, follow these steps:

1. Expand the program blocks folder in the STEP 7 project tree.
2. Right-click the data block and select "Properties" from the context menu.
3. For the attributes, select "Optimized block access".

Note that optimized block access is the default for new data blocks. If you deselect "Optimized block access", the block uses standard access.

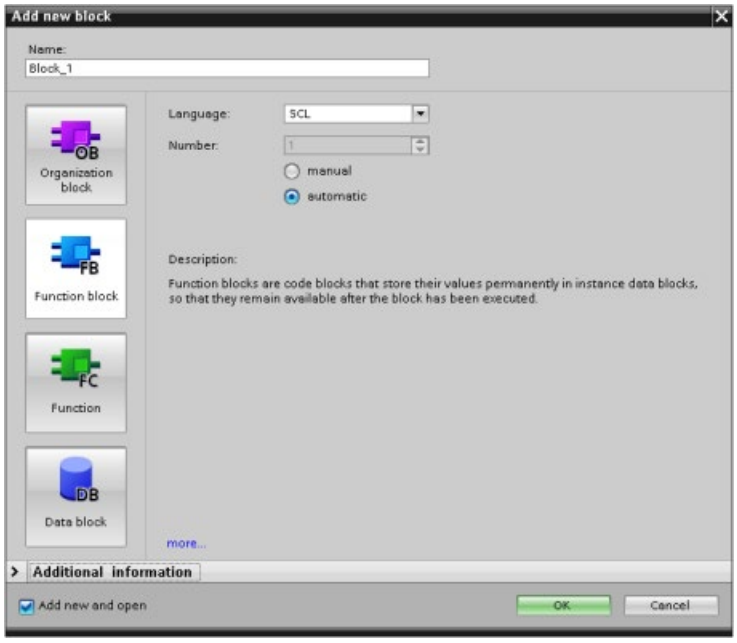
Note

Block access type for an FB and its instance DB

Be sure that if your FB setting is "Optimized block access" then the setting of the instance DB for that FB is also "Optimized block access". Similarly if you have not selected "Optimized block access" for the FB such that the FB is of type standard access, then be sure that the instance DB is also standard, or not optimized block access.

If you do not have compatible block access types, then changes to the IN/OUT parameter values of the FB from an HMI during execution of the FB could be lost.

7.3.5 Creating reusable code blocks



Use the "Add new block" dialog under "Program blocks" in the Project navigator to create OBs, FBs, FCs, and global DBs.

When you create a code block, you select the programming language for the block. You do not select a language for a DB because it only stores data.

Selecting the "Add new and open" check box (default) opens the code block in the Project view.

You can store objects you want to reuse in libraries. For each project, there is a project library that is connected to the project. In addition to the project library, you can create any number of global libraries that can be used over several projects. Since the libraries are compatible with each other, library elements can be copied and moved from one library to another.

Libraries are used, for example, to create templates for blocks that you first paste into the project library and then further develop there. Finally, you copy the blocks from the project library to a global library. You make the global library available to other colleagues working on your project. They use the blocks and further adapt them to their individual requirements, where necessary.

For details about library operations, refer to the STEP 7 online Help library topics.

7.3.6 Passing parameters to blocks

Function Blocks (FB) and Functions (FC) have three different interface types:

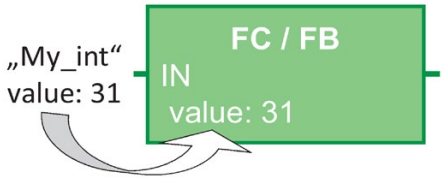
- IN
- IN/OUT
- OUT

FBs and FCs receive parameters through the IN and IN/OUT interface types. The blocks process the parameters and return values to the caller through the IN/OUT and OUT interface types.

The user program transfers parameters using one of two methods.

Call-by-value

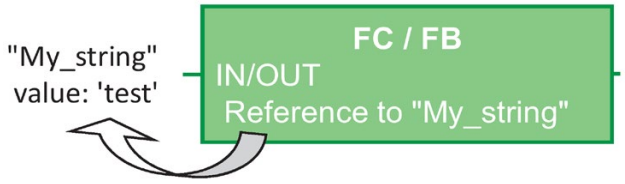
When the user program passes a parameter to a function as "call-by-value", the user program copies the actual parameter value into the input parameter of the block for the IN interface type. This operation requires additional memory for the copied value.



When the user program calls the block, it copies the values.

Call-by-reference

When the user program passes a parameter to a function as "call-by-reference", the user program references the address of the actual parameter for the IN/OUT interface type and does not copy the value. This operation does not require additional memory.



When the user program calls the block, it references the address of the actual parameters.

Note

Generally, use the IN/OUT interface type for structured tags (for example, ARRAY, STRUCT, and STRING) in order to avoid increasing the required data memory unnecessarily.

Block optimization and passing parameters

The user program passes FC parameters as "call-by-value" for simple data types (for example, INT, DINT, and REAL). It passes complex data types (for example, STRUCT, ARRAY, and STRING) as "call-by-reference".

The user program normally passes FB parameters in the instance Data block (DB) associated with the FB:

- The user program passes simple data types (for example, INT, DINT, and REAL) as "call-by-value" by copying the parameters to/from the instance DB.
- The user program copies complex data types (for example, STRUCT, ARRAY, and STRING) to and from the instance DB for IN and OUT parameter types.
- The user program passes complex data types as "call-by-reference" for the IN/OUT interface type.

DBs can be created as either "Optimized" or "Standard" (non-optimized). The optimized data blocks are more compact than the non-optimized data blocks. Also, the ordering of the data elements within the DB is different for optimized versus non-optimized DBs. Refer to the "Optimized blocks" section of the S7-Programming Guideline for S7-1200/1500, STEP 7 (TIA Portal), 03/2014 (http://support.automation.siemens.com/WW/view/en/81318674) for a discussion of optimized blocks.

You create FBs and FCs to process either optimized or non-optimized data. You can select the "Optimized block access" check box as one of the attributes for the block. The user program optimizes program blocks by default, and the program blocks expect data passed to the block to be in the optimized format.

When the user program passes a complex parameter (for example, a STRUCT) to a function, the system checks the optimization setting of the data block containing the structure and the optimization setting of the program block. If you optimize both the data block and the function, then the user program passes the STRUCT as a "call-by-reference". The same is true if you select non-optimized for both the data block and the function.

However, if you make the function and data block optimization different (meaning that you optimized one block and not the other block), the STRUCT must be converted to the format expected by the function. For example, if you select non-optimized for the data block and optimized for the function, then a STRUCT in the data block must be converted to an optimized format before the function can process the STRUCT. The system does this conversion by making a "copy" of the STRUCT and converting it to the optimized format that the function expects.

In summary, when the user program passes a complex data type (for example, a STRUCT) to a function as an IN/OUT parameter, the function expects the user program to pass the STRUCT as a "call-by-reference":

- If you select optimized or non-optimized for both the data block containing the STRUCT and the function, the user program passes the data as "call-by-reference".
- If you do not configure the data block and the function with the same optimization settings (one is optimized and the other is non-optimized), the system must make a copy of the STRUCT before passing it to the function. Because the system has to make this copy of the structure, this converts the "call-by-reference", effectively, into a "call-by-value".

Effect of optimization settings on user programs

The copying of the parameter can cause an issue in a user program if an HMI or interrupt OB modifies elements of the structure. For example, there is an IN/OUT parameter of a function (normally passed as "call-by-reference"), but the optimization settings of the data block and function are different:

1. When the user program is ready to call the function, the system must make a "copy" of the structure to change the format of the data to match the function.
2. The user program calls the function with a reference to the "copy" of the structure.
3. An interrupt OB occurs while the function is executing, and the interrupt OB changes a value in the original structure.
4. The function completes and, since the structure is an IN/OUT parameter, the system copies the values back to the original structure in the original format.

The effect of making the copy of the structure to change the format is that the data written by the interrupt OB is lost. The same can happen when writing a value with an HMI. The HMI can interrupt the user program and write a value in the same manner as an interrupt OB.

There are multiple ways to correct this issue:

- The best solution for this this issue is to match the optimization settings of the program block and the data block when using complex data types (for example, a STRUCT). This ensures that the user program always passes the parameters as "call-by-reference".
- Another solution is that an interrupt OB or HMI does not directly modify an element in the structure. The OB or HMI can modify another variable, and then you can copy this variable into the structure at a specific point in the user program.

7.4 Understanding data consistency

The CPU maintains the data consistency for all of the elementary data types (such as Words or DWords) and all of the system-defined structures (for example, IEC_TIMERS or DTL). The reading or writing of the value cannot be interrupted. (For example, the CPU protects the access to a DWord value until the four bytes of the DWord have been read or written.) To ensure that the program cycle OBs and the interrupt OBs cannot write to the same memory location at the same time, the CPU does not execute an interrupt OB until the read or write operation in the program cycle OB has been completed.

If your user program shares multiple values in memory between a program cycle OB and an interrupt OB, your user program must also ensure that these values are modified or read consistently. You can use the DIS_AIRT (disable alarm interrupt) and EN_AIRT (enable alarm interrupt) instructions in your program cycle OB to protect any access to the shared values.

- Insert a DIS_AIRT instruction in the code block to ensure that an interrupt OB cannot be executed during the read or write operation.
- Insert the instructions that read or write the values that could be altered by an interrupt OB.
- Insert an EN_AIRT instruction at the end of the sequence to cancel the DIS_AIRT and allow the execution of the interrupt OB.

A communication request from an HMI device or another CPU can also interrupt execution of the program cycle OB. The communication requests can also cause problems with data consistency. The CPU ensures that the elementary data types are always read and written consistently by the user program instructions. Because the user program is interrupted periodically by communications, it is not possible to guarantee that multiple values in the CPU will all be updated at the same time by the HMI. For example, the values displayed on a given HMI screen could be from different scan cycles of the CPU.

The PtP (Point-to-Point) instructions, PROFINET instructions (such as TSEND_C and TRCV_C), PROFINET Distributed I/O instructions (Page 374), and PROFIBUS Distributed I/O Instructions (Page 374) transfer buffers of data that could be interrupted. Ensure the data consistency for the buffers of data by avoiding any read or write operation to the buffers in both the program cycle OB and an interrupt OB. If it is necessary to modify the buffer values for these instructions in an interrupt OB, use a DIS_AIRT instruction to delay any interruption (an interrupt OB or a communication interrupt from an HMI or another CPU) until an EN_AIRT instruction is executed.

Note

The use of the DIS_AIRT instruction delays the processing of interrupt OBs until the EN_AIRT instruction is executed, affecting the interrupt latency (time from an event to the time when the interrupt OB is executed) of your user program.

7.5 Programming language

STEP 7 provides the following standard programming languages for S7-1200:

- LAD (ladder logic) is a graphical programming language. The representation is based on circuit diagrams (Page 193).
- FBD (Function Block Diagram) is a programming language that is based on the graphical logic symbols used in Boolean algebra (Page 194).
- SCL (structured control language) is a text-based, high-level programming language (Page 195).

When you create a code block, you select the programming language to be used by that block.

Your user program can utilize code blocks created in any or all of the programming languages.

7.5.1 Ladder logic (LAD)

The elements of a circuit diagram, such as normally closed and normally open contacts, and coils are linked to form networks.



To create the logic for complex operations, you can insert branches to create the logic for parallel circuits. Parallel branches are opened downwards or are connected directly to the power rail. You terminate the branches upwards.

LAD provides "box" instructions for a variety of functions, such as math, timer, counter, and move.

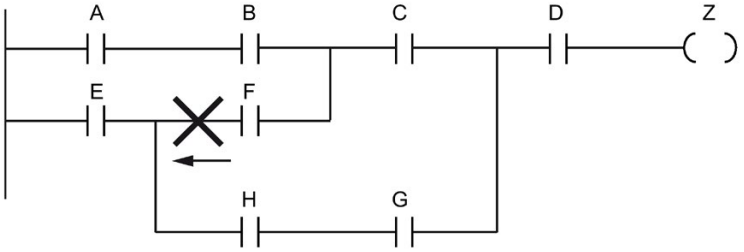
STEP 7 does not limit the number of instructions (rows and columns) in a LAD network.

Note

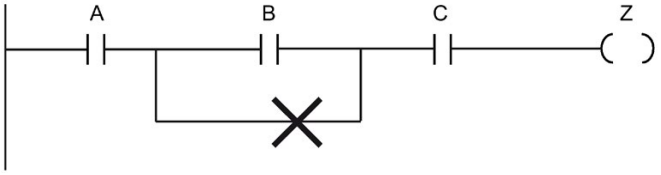
Every LAD network must terminate with a coil or a box instruction.

Consider the following rules when creating a LAD network:

- You cannot create a branch that could result in a power flow in the reverse direction.

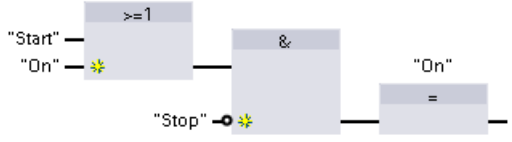


- You cannot create a branch that would cause a short circuit.



7.5.2 Function Block Diagram (FBD)

Like LAD, FBD is also a graphical programming language. The representation of the logic is based on the graphical logic symbols used in Boolean algebra.



To create the logic for complex operations, insert parallel branches between the boxes.

Mathematical functions and other complex functions can be represented directly in conjunction with the logic boxes.

STEP 7 does not limit the number of instructions (rows and columns) in an FBD network.

7.5.3 SCL

Structured Control Language (SCL) is a high-level, PASCAL-based programming language for the SIMATIC S7 CPUs. SCL supports the block structure of STEP 7 (Page 182). Your project can include program blocks in any of the three programming languages: SCL, LAD, and FBD.

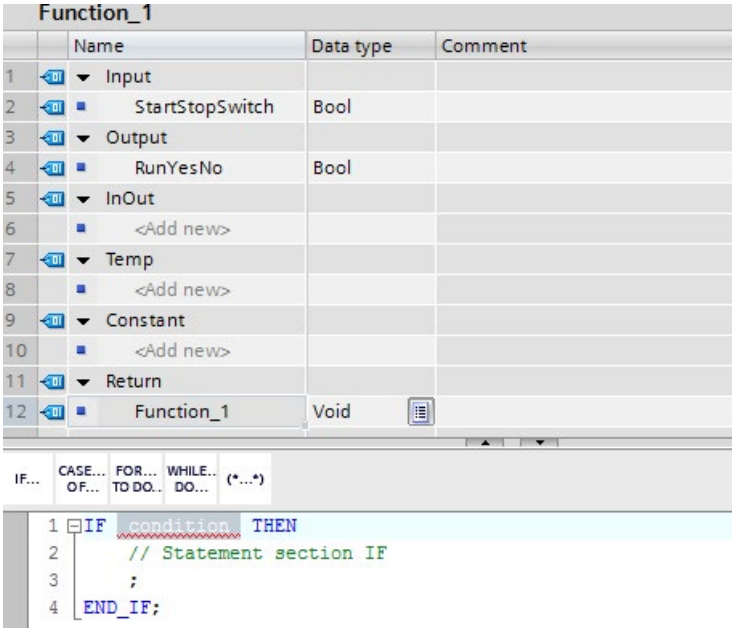
SCL instructions use standard programming operators, such as for assignment (:=), mathematical functions (+ for addition, - for subtraction, * for multiplication, and / for division). SCL also uses standard PASCAL program control operations, such as IF-THEN-ELSE, CASE, REPEAT-UNTIL, GOTO and RETURN. You can use any PASCAL reference for syntactical elements of the SCL programming language. Many of the other instructions for SCL, such as timers and counters, match the LAD and FBD instructions. For more information about specific instructions, refer to the specific instructions in the chapters for Basic instructions (Page 221) and Extended instructions (Page 329).

7.5.3.1 SCL program editor

You can designate any type of block (OB, FB, or FC) to use the SCL programming language at the time you create the block. STEP 7 provides an SCL program editor that includes the following elements:

- Interface section for defining the parameters of the code block
- Code section for the program code
- Instruction tree that contains the SCL instructions supported by the CPU

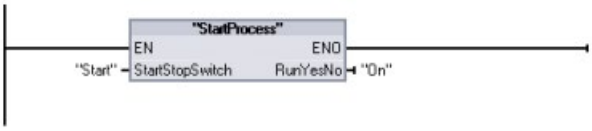
You enter the SCL code for your instruction directly in the code section. The editor includes buttons for common code constructs and comments. For more complex instructions, simply drag the SCL instructions from the instruction tree and drop them into your program. You can also use any text editor to create an SCL program and then import that file into STEP 7.



In the Interface section of the SCL code block you can declare the following types of parameters:

- Input, Output, InOut, and Ret_Val: These parameters define the input tags, output tags, and return value for the code block. The tag name that you enter here is used locally during the execution of the code block. You typically would not use the global tag name in the tag table.
- Static (FBs only; the illustration above is for an FC): The code block uses static tags for storage of static intermediate results in the instance data block. The block retains static data until overwritten, which can be after several cycles. The names of the blocks, which this block calls as multi-instance, are also stored in the static local data.
- Temp: These parameters are the temporary tags that are used during the execution of the code block.
- Constant: These are named constant values for your code block.

If you call the SCL code block from another code block, the parameters of the SCL code block appear as inputs or outputs.



In this example, the tags for "Start" and "On" (from the project tag table) correspond to "StartStopSwitch" and "RunYesNo" in the declaration table of the SCL program.

7.5.3.2 SCL expressions and operations

Constructing an SCL expression

An SCL expression is a formula for calculating a value. The expression consists of operands and operators (such as *, /, + or -). The operands can be tags, constants, or expressions.

The evaluation of the expression occurs in a certain order, which is defined by the following factors:

- Every operator has a pre-defined priority, with the highest-priority operation performed first.
- For operators with equal priority, the operators are processed in a left-to-right sequence.
- You use parentheses to designate a series of operators to be evaluated together.

The result of an expression can be used either for assigning a value to a tag used by your program, as a condition to be used by a control statement, or as parameters for another SCL instruction or for calling a code block.

Table 7- 2 Operators in SCL

Type	Operation	Operator	Priority
Parentheses	(*Expression*)	(,)	1
Math	Power	**	2
	Sign (unary plus)	+	3
	Sign (unary minus)	-	3
	Multiplication	*	4
	Division	/	4
	Modulo	MOD	4
	Addition	+	5
	Subtraction	-	5
Comparison	Less than	<	6
	Less than or equal to	<=	6
	Greater than	>	6
	Greater than or equal to	>=	6
	Equal to	=	7
	Not equal to	<>	7
Bit logic	Negation (unary)	NOT	3
	AND logic operation	AND or &	8
	Exclusive OR logic operation	XOR	9
	OR logic operation	OR	10
Assignment	Assignment	:=	11

As a high-level programming language, SCL uses standard statements for basic tasks:

- Assignment statement: :=
- Mathematical functions: +, -, *, and /
- Addressing of global variables (tags): "<tag name>" (Tag name or data block name enclosed in double quotes)
- Addressing of local variables: #<variable name> (Variable name preceded by "#" symbol)

The following examples show different expressions for different uses:

`"C" := #A+#B;`	Assigns the sum of two local variables to a tag
`"Data_block_1".Tag := #A;`	Assignment to a data block tag
`IF #A > #B THEN "C" := #A;`	Condition for the IF-THEN statement
`"C" := SQRT (SQR (#A) + SQR (#B));`	Parameters for the SQRT instruction

Arithmetic operators can process various numeric data types. The data type of the result is determined by the data type of the most-significant operands. For example, a multiplication operation that uses an INT operand and a REAL operand yields a REAL value for the result.

Control statements

A control statement is a specialized type of SCL expression that performs the following tasks:

- Program branching
- Repeating sections of the SCL program code
- Jumping to other parts of the SCL program
- Conditional execution

The SCL control statements include IF-THEN, CASE-OF, FOR-TO-DO, WHILE-DO, REPEAT-UNTIL, CONTINUE, GOTO, and RETURN.

A single statement typically occupies one line of code. You can enter multiple statements on one line, or you can break a statement into several lines of code to make the code easier to read. Separators (such as tabs, line breaks and extra spaces) are ignored during the syntax check. An END statement terminates the control statement.

The following examples show a FOR-TO-DO control statement. (Both forms of coding are syntactically valid.)

```
FOR x := 0 TO max DO sum := sum + value(x); END_FOR;
FOR x := 0 TO max DO
     sum := sum + value(x);
END_FOR;
```

A control statement can also be provided with a label. A label is set off by a colon at the beginning of the statement:

```
Label: <Statement>;
```

The STEP 7 online help provides a complete SCL programming language reference.

Conditions

A condition is a comparison expression or a logical expression whose result is of type BOOL (with the value of either TRUE or FALSE). The following example shows conditions of various types:

`#Temperature > 50`	Relational expression
`#Counter <= 100`	
`#CHAR1 < 'S'`	
`(#Alpha <> 12) AND NOT #Beta`	Comparison and logical expression
`5 + #Alpha`	Arithmetic expression

A condition can use arithmetic expressions:

- The condition of the expression is TRUE if the result is any value other than zero.
- The condition of the expression is FALSE if the result equals zero.

Calling other code blocks from your SCL program

To call another code block in your user program, simply enter the name (or absolute address) of the FB or FC with the parameters. For an FB, you must provide the instance DB to be called with the FB.

`<DB name> (Parameter list)`	Call as a single instance
`<#Instance name> (Parameter list)`	Call as multi-instance
`"MyDB"(MyInput:=10, MyInOut:="Tag1");`	
`<FC name> (Parameter list)`	Standard call
`<Operand>:=<FC name> (Parameter list)`	Call in an expression
`"MyFC"(MyInput:=10, MyInOut:="Tag1");`	

You can also drag blocks from the navigation tree to the SCL program editor, and complete the parameter assignment.

Adding block comments to SCL code

You can include a block comment in your SCL code by including the comment text between (* and *). You can have any number of comment lines between the (* and the *). Your SCL program block can include many block comments. For programming convenience, the SCL editor includes a block comment button along with common control statements:



Addressing

As with LAD and FBD, SCL allows you to use either tags (symbolic addressing) or absolute addresses in your user program. SCL also allows you to use a variable as an array index.

Absolute addressing

`%I0.0` `%MB100`	Precede absolute addresses with the "%" symbol. Without the "%", STEP 7 generates an undefined tag error at compile time.

Symbolic addressing

`"PLC_Tag_1"`	Tag in PLC tag table
`"Data_block_1".Tag_1`	Tag in a data block
`"Data_block_1".MyArray[#i]`	Array element in a data block array

7.5.3.3 Indexed addressing with PEEK and POKE instructions

SCL provides PEEK and POKE instructions that allow you to read from or write to data blocks, I/O, or memory. You provide parameters for specific byte offsets or bit offsets for the operation.

Note

To use the PEEK and POKE instructions with data blocks, you must use standard (not optimized) data blocks. Also note that the PEEK and POKE instructions merely transfer data. They have no knowledge of data types at the addresses.

`PEEK(area:=_in_, dbNumber:=_in_, byteOffset:=_in_);`	Reads the byte referenced by byteOffset of the referenced data block, I/O or memory area.
	Example referencing data block:
	`%MB100 := PEEK(area:=16#84, dbNumber:=1, byteOffset:=#i);`
	Example referencing IB3 input:
	`%MB100 := PEEK(area:=16#81, dbNumber:=0, byteOffset:=#i); // when #i = 3`

`PEEK_WORD(area:=_in_, dbNumber:=_in_, byteOffset:=_in_);`	Reads the word referenced by byteOffset of the referenced data block, I/O or memory area. Example: `%MW200 := PEEK_WORD(area:=16#84, dbNumber:=1, byteOffset:=#i);`
`PEEK_DWORD(area:=_in_, dbNumber:=_in_, byteOffset:=_in_);`	Reads the double word referenced by byteOffset of the referenced data block, I/O or memory area. Example: `%MD300 := PEEK_DWORD(area:=16#84, dbNumber:=1, byteOffset:=#i);`
`PEEK_BOOL(area:=_in_, dbNumber:=_in_, byteOffset:=_in_, bitOffset:=_in_);`	Reads a Boolean referenced by the bitOffset and byteOffset of the referenced data block, I/O or memory area Example: `%MB100.0 := PEEK_BOOL(area:=16#84, dbNumber:=1, byteOffset:=#ii, bitOffset:=#j);`

```
POKE(area:=_in_,
     dbNumber:=_in_,
     byteOffset:=_in_,
     value:=_in_);
```

Writes the value (Byte, Word, or DWord) to the referenced byteOffset of the referenced data block, I/O or memory area

Example referencing data block:

```
POKE(area:=16#84, dbNumber:=2,
byteOffset:=3, value:="Tag_1");
```

Example referencing QB3 output:

```
POKE(area:=16#82, dbNumber:=0,
byteOffset:=3, value:="Tag_1");
```

```
POKE_BOOL(area:=_in_,
     dbNumber:=_in_,
     byteOffset:=_in_,
     bitOffset:=_in_,
     value:=_in_);
```

Writes the Boolean value to the referenced bitOffset and byteOffset of the referenced data block, I/O or memory area

Example:

```
POKE_BOOL(area:=16#84, dbNumber:=2,
byteOffset:=3, bitOffset:=5, val-
ue:=0);
```

```
POKE_BLK(area_src:=_in_,
     dbNumber_src:=_in_,
     byteOffset_src:=_in_,
     area_dest:=_in_,
     dbNumber_dest:=_in_,
     byteOffset_dest:=_in_,
     count:=_in_);
```

Writes "count" number of bytes starting at the referenced byte Offset of the referenced source data block, I/O or memory area to the referenced byteOffset of the referenced destination data block, I/O or memory area

Example:

```
POKE_BLK(area_src:=16#84,
dbNumber_src:=#src_db, byteOff-
set_src:=#src_byte, area_dest:=16#84,
dbNumber_dest:=#src_db, byteOff-
set_dest:=#src_byte, count:=10);
```

For PEEK and POKE instructions, the following values for the "area", "area_src" and "area_dest" parameters are applicable. For areas other than data blocks, the dbNumber parameter must be 0.

16#81	I
16#82	Q
16#83	M
16#84	DB

7.5.4 EN and ENO for LAD, FBD and SCL

Determining "power flow" (EN and ENO) for an instruction

Certain instructions (such as the Math and the Move instructions) provide parameters for EN and ENO. These parameters relate to power flow in LAD or FBD and determine whether the instruction is executed during that scan. SCL also allows you to set the ENO parameter for a code block.

- EN (Enable In) is a Boolean input. Power flow (EN = 1) must be present at this input for the box instruction to be executed. If the EN input of a LAD box is connected directly to the left power rail, the instruction will always be executed.
- ENO (Enable Out) is a Boolean output. If the box has power flow at the EN input and the box executes its function without error, then the ENO output passes power flow (ENO = 1) to the next element. If an error is detected in the execution of the box instruction, then power flow is terminated (ENO = 0) at the box instruction that generated the error.

Table 7- 3 Operands for EN and ENO

Program editor	Inputs/outputs	Operands	Data type
LAD	EN, ENO	Power flow	Bool
FBD	EN	I, I:P, Q, M, DB, Temp, Power Flow	Bool
	ENO	Power Flow	Bool
SCL	EN[1]	TRUE, FALSE	Bool
	ENO[2]	TRUE, FALSE	Bool

[1] The use of EN is only available for FBs.

[2] The use of ENO with the SCL code block is optional. You must configure the SCL compiler to set ENO when the code block finishes.

Configuring SCL to set ENO

To configure the SCL compiler for setting ENO, follow these steps:

1. Select the "Settings" command from the "Options" menu.

2. Expand the "PLC programming" properties and select "SCL (Structured Control Language)".

3. Select the "Set ENO automatically" option.

Using ENO in program code

You can also use ENO in your program code, for example by assigning ENO to a PLC tag, or by evaluating ENO in a local block.

Examples:

```
"MyFunction"
  ( IN1 := … ,
    IN2 := … ,
    OUT1 => #myOut,
    ENO => #statusFlag ); // PLC tag statusFlag holds the value of E
NO

"MyFunction"
  ( IN1 := …
    IN2 := … ,
    OUT1 => #myOut,
    ENO => ENO );  // block status flag of "MyFunction"
                   // is stored in the local block

IF ENO = TRUE THEN
    // execute code only if MyFunction returns true ENO
```

Effect of Ret_Val or Status parameters on ENO

Some instructions, such as the communication instructions or the string conversion instructions, provide an output parameter that contains information about the processing of the instruction. For example, some instructions provide a Ret_Val (return value) parameter, which is typically an Int data type that contains status information in a range from -32768 to +32767. Other instructions provide a Status parameter, which is typically a Word data type that stores status information in a range of hexadecimal values from 16#0000 to 16#FFFF. The numerical value stored in a Ret_Val or a Status parameter determines the state of ENO for that instruction.

- Ret_Val: A value from 0 to 32767 typically sets ENO = 1 (or TRUE). A value from -32768 to -1 typically sets ENO = 0 (or FALSE). To evaluate Ret_Val, change the representation to hexadecimal.
- Status: A value from 16#0000 16#7FFF typically sets ENO = 1 (or TRUE). A value from 16#8000 to 16#FFFF typically sets ENO = 0 (or FALSE).

Instructions that take more than one scan to execute often provide a Busy parameter (Bool) to signal that the instruction is active but has not completed execution. These instructions often also provide a Done parameter (Bool) and an Error parameter (Bool). Done signals that the instruction was completed without error, and Error signals that the instruction was completed with an error condition.

- When Busy = 1 (or TRUE), ENO = 1 (or TRUE).
- When Done = 1 (or TRUE), ENO = 1 (or TRUE).
- When Error = 1 (or TRUE), ENO = 0 (or FALSE).

See also

OK (Check validity) and NOT_OK (Check invalidity) (Page 246)

7.6 Protection

7.6.1 Access protection for the CPU

The CPU provides four levels of security for restricting access to specific functions. When you configure the security level and password for a CPU, you limit the functions and memory areas that can be accessed without entering a password.

Each level allows certain functions to be accessible without a password. The default condition for the CPU is to have no restriction and no password-protection. To restrict access to a CPU, you configure the properties of the CPU and enter the password.

Entering the password over a network does not compromise the password protection for the CPU. Password protection does not apply to the execution of user program instructions including communication functions. Entering the correct password provides access to all of the functions at that level.

PLC-to-PLC communications (using communication instructions in the code blocks) are not restricted by the security level in the CPU.

Table 7- 4 Security levels for the CPU

Security level	Access restrictions
Full access (no protection)	Allows full access without password protection.
Read access	Allows HMI access, comparing Offline/Online code blocks, and all forms of PLC-to-PLC communications without password protection. Password is required for modifying (writing to) the CPU. Password is not required for changing the CPU mode (RUN/STOP).
HMI access	Allows HMI access and all forms of PLC-to-PLC communications without password protection. Password is required for reading the data in the CPU, for comparing Offline/Online code blocks, for modifying (writing to) the CPU, and for changing the CPU mode (RUN/STOP).
No access (complete protection)	Allows no access without password protection. Password is required for HMI access, reading the data in the CPU, comparing Offline/Online code blocks, and for modifying (writing to) the CPU.

Note that you can set an emergency (temporary) IP address (Page 980) for the CPU at any security level.

Passwords are case-sensitive. To configure the protection level and passwords, follow these steps:

1. In the "Device configuration", select the CPU.
2. In the inspector window, select the "Properties" tab.
3. Select the "Protection" property to select the protection level and to enter passwords.



When you download this configuration to the CPU, the user has HMI access and can access HMI functions without a password. To read data or compare Offline/Online code blocks, the user must enter the configured password for "Read access" or the password for "Full access (no protection)". To write data, the user must enter the configured password for "Full access (no protection)".

WARNING

Unauthorized access to a protected CPU

Users with CPU full access privileges have privileges to read and write PLC variables. Regardless of the access level for the CPU, Web server users can have privileges to read and write PLC variables. Unauthorized access to the CPU or changing PLC variables to invalid values could disrupt process operation and could result in death, severe personal injury and/or property damage.

Authorized users can perform operating mode changes, writes to PLC data, and firmware updates. Siemens recommends that you observe the following security practices:

- Password protect CPU access levels and Web server user IDs (Page 984) with strong passwords. Strong passwords are at least ten characters in length, mix letters, numbers, and special characters, are not words that can be found in a dictionary, and are not names or identifiers that can be derived from personal information. Keep the password secret and change it frequently.
- Enable access to the Web server only with the HTTPS protocol.
- Do not extend the default minimum privileges of the Web server "Everybody" user.
- Perform error-checking and range-checking on your variables in your program logic because Web page users can change PLC variables to invalid values.

Connection mechanisms

To access remote connection partners with PUT/GET instructions, the user must also have permission.

By default, the "Permit access with PUT/GET communication" option is not enabled. In this case, read and write access to CPU data is only possible for communication connections that require configuration or programming both for the local CPU and for the communication partner. Access through BSEND/BRCV instructions is possible, for example.

Connections for which the local CPU is only a server (meaning that no configuration/programming of the communication with the communication partner exists at the local CPU), are therefore not possible during operation of the CPU, for example:

- PUT/GET, FETCH/WRITE or FTP access through communication modules
- PUT/GET access from other S7 CPUs
- HMI access through PUT/GET communication

If you want to allow access to CPU data from the client side, that is, you do not want to restrict the communication services of the CPU, follow these steps:

1. Configure the protection access level to be any level other than "No access (complete protection)".
2. Select the "Permit access with PUT/GET communication" check box.



When you download this configuration to the CPU, the CPU permits PUT/GET communication from remote partners

7.6.2 External load memory

You can also prevent copies of internal load memory to external load memory (SIMATIC memory card). To prevent the copying of internal load memory to external load memory follow these steps:

1. From the device configuration of the CPU in STEP 7, select "Protection" from the General properties.
2. In the "External Load Memory" section, select "Disable copy from internal load memory to external load memory".

See also the topic Inserting a memory card in the CPU (Page 135) for a description of how this property affects the insertion of a memory card into the CPU.

7.6.3 Know-how protection

Know-how protection allows you to prevent one or more code blocks (OB, FB, FC, or DB) in your program from unauthorized access. You create a password to limit access to the code block. The password-protection prevents unauthorized reading or modification of the code block. Without the password, you can read only the following information about the code block:

- Block title, block comment, and block properties
- Transfer parameters (IN, OUT, IN_OUT, Return)
- Call structure of the program
- Global tags in the cross references (without information on the point of use), but local tags are hidden

When you configure a block for "know-how" protection, the code within the block cannot be accessed except after entering the password.

Use the "Properties" task card of the code block to configure the know-how protection for that block. After opening the code block, select "Protection" from Properties.



1. In the Properties for the code block, click the "Protection" button to display the "Know-how protection" dialog.
2. Click the "Define" button to enter the password.



After entering and confirming the password, click "OK".



7.6.4 Copy protection

An additional security feature allows you to bind program blocks for use with a specific memory card or CPU. This feature is especially useful for protecting your intellectual property. When you bind a program block to a specific device, you restrict the program or code block for use only with a specific memory card or CPU. This feature allows you to distribute a program or code block electronically (such as over the Internet or through email) or by sending a memory card. Copy protection is available for OBs (Page 183), FBs (Page 185), and FCs (Page 184). The S7-1200 CPU supports three types of block protection:

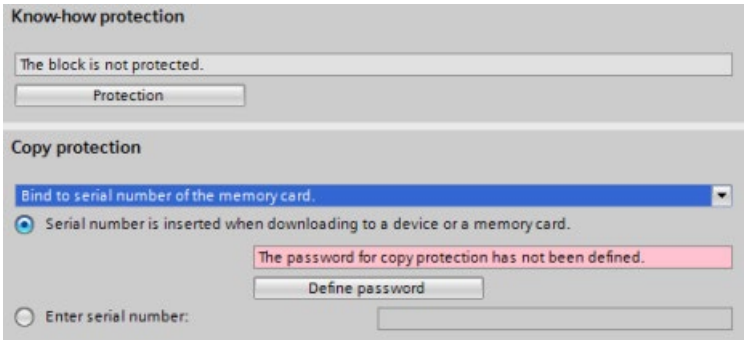
- Binding to the serial number of a CPU
- Binding to the serial number of a memory card
- Dynamic binding with mandatory password

Use the "Properties" task card of the code block to bind the block to a specific CPU or memory card.

1. After opening the code block, select "Protection".



2. From the drop-down list under "Copy protection" task, select the type of copy protection that you want to use.



3. For binding to the serial number of a CPU or memory card, select either to insert the serial number when downloading, or enter the serial number for the memory card or CPU.

Note

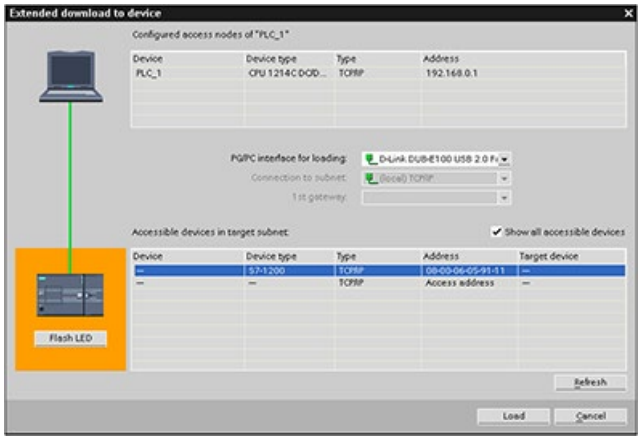
The serial number is case-sensitive.

For dynamic binding with mandatory password, define the password that you must use to download or copy the block.

When you subsequently download (Page 210) a block with dynamic binding, you must enter the password to be able to download the block. Note that the copy protection password and the know-how protection (Page 207) password are two separate passwords.

7.7 Downloading the elements of your program

You can download the elements of your project from the programming device to the CPU. When you download a project, the CPU stores the user program (OBs, FCs, FBs and DBs) in internal load memory or if a SIMATIC memory card is present in external load memory (the card).



You can download your project from the programming device to your CPU from any of the following locations:

- Project tree: Right-click the program element, and then click the context-sensitive "Download" selection.
- Online menu: Click the "Download to device" selection.
- Toolbar: Click the "Download to device" icon.
- Device configuration: Right-click the CPU and select the elements to download.

Note that if you have applied dynamic binding with mandatory password (Page 208) to any of the program blocks, you must enter the password for the protected blocks in order to download them. If you have configured this type of copy protection for multiple blocks, you must enter the password for each of the protected blocks in order to download them.

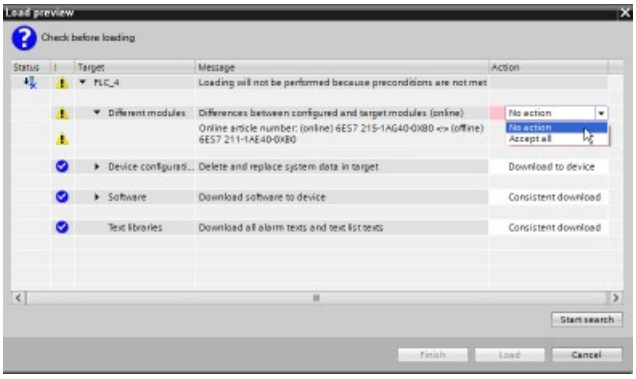
Note

Downloading a program does not clear or make any changes to existing values in retentive memory. If you want to clear retentive memory before a download, then reset your CPU to factory settings prior to downloading the program.

You can also download a panel project for the Basic HMI panels (Page 33) from the TIA Portal to a memory card in the S7-1200 CPU.

Downloading when the configured CPU is different from the connected CPU

STEP 7 and the S7-1200 permit a download if the connected CPU has the capacity to store a download from the configured CPU, based on the memory requirements of the project and the compatibility of the I/O. You can download the configuration and program from a CPU to a larger CPU, for example, from a CPU 1211C DC/DC/DC to a CPU 1215C DC/DC/DC because the I/O is compatible and the memory is sufficient. In this case, the download operation displays a warning, "Differences between configured and target modules (online)" along with the article numbers and firmware versions in the "Load preview" dialog. You must choose either "No action" if you do not want the download to proceed or "Accept all" if you do want the download to proceed:



Note

When you go online (Page 1299) after downloading the configured CPU to a different connected CPU, you see the project for the configured CPU with online status indicators in the project tree. In the online and diagnostics view, however, you see the actual connected CPU module type.

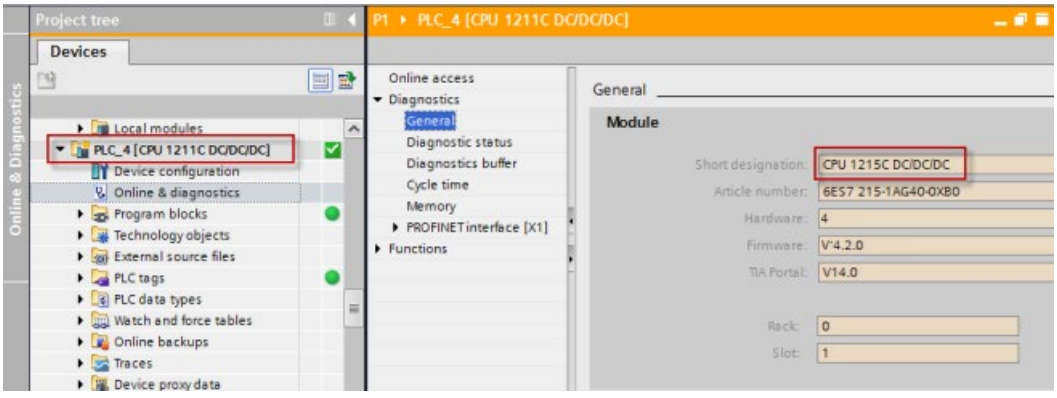


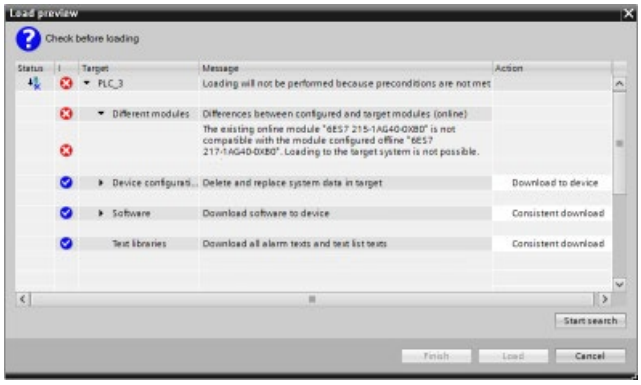
Figure 7-1 Online view when configured CPU is different from connected CPU

You can, of course, change your device (Page 164) in the device configuration so that the configured CPU is the same module type as the connected CPU. The "Change device" dialog provides complete compatibility details when you try to change a device.

STEP 7 and the S7-1200 prohibit a download if the connected CPU does not have the capacity to store a download from the configured CPU; for example, you cannot download the hardware configuration and program for the following cases:

- CPU 1215C DC/DC/DC to a CPU 1212C DC/DC/DC due to insufficient work memory
- CPU 1211C DC/DC/Relay to a CPU 1211C DC/DC/DC due to I/O differences
- CPU 1217C DC/DC/DC to any CPU 1211C, CPU 1212C, CPU 1214C, or CPU 1215C due to the 1.5 V DC outputs in the CPU 1217C
- CPU 1214C V4.2.x to CPU 1214C V4.0, due to downward firmware version incompatibility

The "Load preview" dialog displays an error in such cases:



Recovering from a failed download

If the download fails, the Info tab of the Inspector Window displays the reason. The diagnostic buffer also provides information. After a failed download, follow these steps to be able to download successfully:

1. Correct the problem as described in the error message.
2. Reattempt the download.

In rare cases, the download succeeds but a subsequent power cycle of the CPU fails. In this case you may see an error in the diagnostic buffer such as:

- 16# 02:4175 -- CPU error: Memory card evaluation error: Unknown or incompatible version of CPU configuration description current card type: No memory card Function finished/aborted, new startup inhibit set: ..- Memory card missing, wrong type, wrong content or protected

If this occurs and additional attempts to download fail, you must clear the internal load memory or external load memory:

1. If using internal load memory, reset the CPU to factory settings.
2. If using a SIMATIC memory card, remove it and delete the contents of the memory card (Page 141) before reinserting.
3. Download the hardware configuration and software.

See also

Synchronizing the online CPU and offline project (Page 213)

7.8 Synchronizing the online CPU and offline project

When you download project blocks to the CPU, the CPU can detect whether blocks or tags have changed in the online CPU since the last download. In such cases, the CPU offers you the choice to synchronize the changes. This means that you can upload the online CPU changes to the project before downloading the project to the CPU. Changes in the online CPU can be due to a variety of factors:

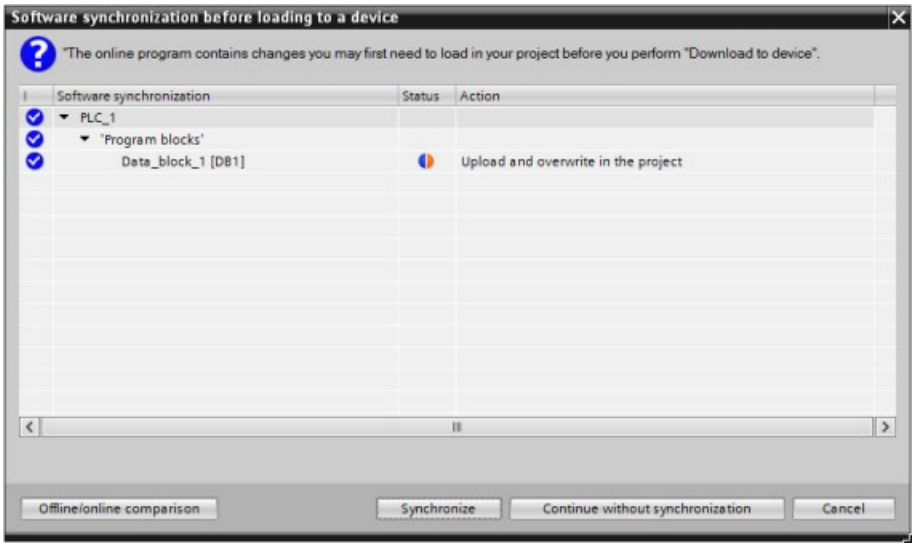
- Changes to the start values of data block tags during runtime, for example by the WRIT_DBL instruction (Page 525) or by loading a recipe
- A download from a "secondary" project (a project other than the one that originated the last download) where one or more of the following conditions exist:
  - The online CPU includes program blocks that do not exist in the project.
  - Data block tags or block attributes differ between the offline project and online CPU.
  - PLC tags exist in the online CPU that do not exist in the offline project.

Note

If you edit blocks or tags in the project that you used for the last download, you do not have to make any choices about synchronization. STEP 7 and the CPU detect that the offline project changes are newer than the online CPU and proceeds with a normal download operation.

Synchronization choices

When you download a project to the CPU, you see the synchronization dialog if STEP 7 detects that data blocks or tags in the online CPU are newer than the project values. For example, if the STEP 7 program has executed WRIT_DBL and changed a start value for a tag in Data_block_1, STEP 7 displays the following synchronization dialog when you initiate a download:



This dialog lists the program blocks where differences exist. From this dialog, you have the following choices:

- Online/offline comparison: If you click this button, STEP 7 displays the program blocks, system blocks, technology objects, PLC tags, and PLC data types for the project as compared to the online CPU (Page 1309). For each object, you can click to see a detailed analysis of the differences including time stamps. You can use this information to decide what to do about the differences between the online CPU and the project.
- Synchronize: If you click this button, STEP 7 uploads the data blocks, tags, and other objects from the online CPU to the project. You can then continue with the program download, unless program execution has again caused the project to be out of sync with the CPU.
- Continue without synchronization: If you click this button, STEP 7 downloads the project to the CPU.
- Cancel: If you click this button, you cancel the download operation.

7.9 Uploading from the online CPU

You can also copy the program blocks from an online CPU or a memory card attached to your programming device.

Prepare the offline project for the copied program blocks:

1. Add a CPU device that matches the online CPU.
2. Expand the CPU node once so that the "Program blocks" folder is visible.



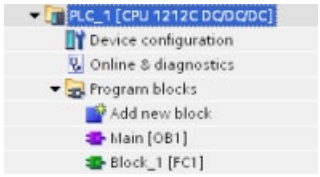
To upload the program blocks from the online CPU to the offline project, follow these steps:





1. Click the "Program blocks" folder in the offline project.
2. Click the "Go online" button.
3. Click the "Upload" button.
4. Confirm your decision from the Upload dialog (Page 1299).

When the upload is complete, STEP 7 displays all of the uploaded program blocks in the project.



7.9.1 Comparing the online CPU to the offline CPU

You can use the "Compare" editor (Page 1309) in STEP 7 to find differences between the online and offline projects. You might find this useful prior to uploading from the CPU.

7.10 Debugging and testing the program

7.10.1 Monitor and modify data in the CPU

As shown in the following table, you can monitor and modify values in the online CPU.

Table 7- 5 Monitoring and modifying data with STEP 7

Editor	Monitor	Modify	Force
Watch table	Yes	Yes	No
Force table	Yes	No	Yes
Program editor	Yes	Yes	No
Tag table	Yes	No	No
DB editor	Yes	No	No



Monitoring with a watch table



Monitoring with the LAD editor

Refer to the "Online and diagnostics" chapter for more information about monitoring and modifying data in the CPU (Page 1311).

7.10.2 Watch tables and force tables

You use "watch tables" for monitoring and modifying the values of a user program being executed by the online CPU. You can create and save different watch tables in your project to support a variety of test environments. This allows you to reproduce tests during commissioning or for service and maintenance purposes.

With a watch table, you can monitor and interact with the CPU as it executes the user program. You can display or change values not only for the tags of the code blocks and data blocks, but also for the memory areas of the CPU, including the inputs and outputs (I and Q), peripheral inputs (I:P), bit memory (M), and data blocks (DB).

With the watch table, you can enable the physical outputs (Q:P) of a CPU in STOP mode. For example, you can assign specific values to the outputs when testing the wiring for the CPU.

STEP 7 also provides a force table for "forcing" a tag to a specific value. For more information about forcing, see the section on forcing values in the CPU (Page 1319) in the "Online and Diagnostics" chapter.

Note

The force values are stored in the CPU and not in the watch table.

You cannot force an input (or "I" address). However, you can force a peripheral input. To force a peripheral input, append a ":P" to the address (for example: "On:P").

STEP 7 also provides the capability of tracing and recording program variables based on trigger conditions (Page 1332).

7.10.3 Cross reference to show usage

The Inspector window displays cross-reference information about how a selected object is used throughout the complete project, such as the user program, the CPU and any HMI devices. The "Cross-reference" tab displays the instances where a selected object is being used and the other objects using it. The Inspector window also includes blocks which are only available online in the cross-references. To display the cross-references, select the "Show cross-references" command. (In the Project view, find the cross references in the "Tools" menu.)

Note

You do not have to close the editor to see the cross-reference information.

You can sort the entries in the cross-reference. The cross-reference list provides an overview of the use of memory addresses and tags within the user program.

- When creating and changing a program, you retain an overview of the operands, tags and block calls you have used.
- From the cross-references, you can jump directly to the point of use of operands and tags.
- During a program test or when troubleshooting, you are notified about which memory location is being processed by which command in which block, which tag is being used in which screen, and which block is called by which other block.

Table 7- 6 Elements of the cross reference

Column	Description
Object	Name of the object that uses the lower-level objects or that is being used by the lower-level objects
Number	Number of uses
Point of use	Each location of use, for example, network
Property	Special properties of referenced objects, for example, the tag names in multi-instance declarations
as	Shows additional information about the object, such as whether an instance DB is used as template or as a multiple instance
Access	Type of access, whether access to the operand is read access (R) and/or write access (W)
Address	Address of the operand
Type	Information on the type and language used to create the object
Path	Path of object in project tree

Depending on the installed products, the cross-reference table displays additional or different columns.

7.10.4 Call structure to examine the calling hierarchy

The call structure describes the call hierarchy of the block within your user program. It provides an overview of the blocks used, calls to other blocks, the relationships between blocks, the data requirements for each block, and the status of the blocks. You can open the program editor and edit blocks from the call structure.

Displaying the call structure provides you with a list of the blocks used in the user program. STEP 7 highlights the first level of the call structure and displays any blocks that are not called by any other block in the program. The first level of the call structure displays the OBs and any FCs, FBs, and DBs that are not called by an OB. If a code block calls another block, the called block is shown as an indentation under the calling block. The call structure only displays those blocks that are called by a code block.

You can selectively display only the blocks causing conflicts within the call structure. The following conditions cause conflicts:

- Blocks that execute any calls with older or newer code time stamps
- Blocks that call a block with modified interface
- Blocks that use a tag with modified address and/or data type
- Blocks that are called neither directly nor indirectly by an OB
- Blocks that call a non-existent or missing block

You can group several block calls and data blocks as a group. You use a drop-down list to see the links to the various call locations.

You can also perform a consistency check to show time stamp conflicts. Changing the time stamp of a block during or after the program is generated can lead to time stamp conflicts, which in turn cause inconsistencies among the blocks that are calling and being called.

- Most time stamp and interface conflicts can be corrected by recompiling the code blocks.
- If compilation fails to clear up inconsistencies, use the link in the "Details" column to go to the source of the problem in the program editor. You can then manually eliminate any inconsistencies.
- Any blocks marked in red must be recompiled.

Basic instructions

8

8.1 Bit logic operations

8.1.1 Bit logic instructions

LAD and FBD are very effective for handling Boolean logic. While SCL is especially effective for complex mathematical computation and for project control structures, you can use SCL for Boolean logic.

LAD contacts

Table 8- 1 Normally open and normally closed contacts

LAD	SCL	Description

"IN" 	`IF in THEN`
	`  Statement;`
	`ELSE`
	`  Statement;`
	`END_IF;`
		Normally open and normally closed contacts: You can connect contacts to other contacts and create your own combination logic. If the input bit you specify uses memory identifier I (input) or Q (output), then the bit value is read from the process-image register. The physical contact signals in your control process are wired to I terminals on the PLC. The CPU scans the wired input signals and continuously updates the corresponding state values in the process-image input register.
		You can perform an immediate read of a physical input using ":P" following the I offset (example: "%I3.4:P"). For an immediate read, the bit data values are read directly from the physical input instead of the process image. An immediate read does not update the process image.

"IN" 	`IF NOT (in) THEN`
	`  Statement;`
	`ELSE`
	`  Statement;`
	`END_IF;`	

Table 8- 2 Data types for the parameters

Parameter	Data type	Description
IN	Bool	Assigned bit

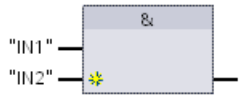
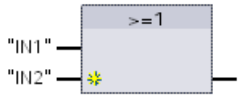
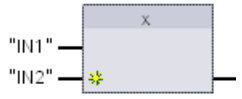
- The Normally Open contact is closed (ON) when the assigned bit value is equal to 1.
- The Normally Closed contact is closed (ON) when the assigned bit value is equal to 0.
- Contacts connected in series create AND logic networks.
- Contacts connected in parallel create OR logic networks.

FBD AND, OR, and XOR boxes

In FBD programming, LAD contact networks are transformed into AND (&), OR (>=1), and EXCLUSIVE OR (x) box networks where you can specify bit values for the box inputs and outputs. You may also connect to other logic boxes and create your own logic combinations. After the box is placed in your network, you can drag the "Insert input" tool from the "Favorites" toolbar or instruction tree and then drop it onto the input side of the box to add more inputs. You can also right-click on the box input connector and select "Insert input".

Box inputs and outputs can be connected to another logic box, or you can enter a bit address or bit symbol name for an unconnected input. When the box instruction is executed, the current input states are applied to the binary box logic and, if true, the box output will be true.

Table 8- 3 AND, OR, and XOR boxes

FBD	SCL[1]	Description
	`out := in1 AND in2;`	All inputs of an AND box must be TRUE for the output to be TRUE.
	`out := in1 OR in2;`	Any input of an OR box must be TRUE for the output to be TRUE.
	`out := in1 XOR in2;`	An odd number of the inputs of an XOR box must be TRUE for the output to be TRUE.

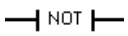
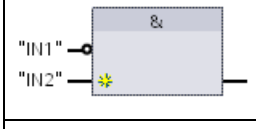
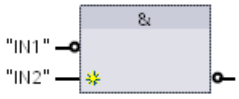
[1] For SCL: You must assign the result of the operation to a variable to be used for another statement.

Table 8- 4 Data types for the parameters

Parameter	Data type	Description
IN1, IN2	Bool	Input bit

NOT logic inverter

Table 8- 5 Invert RLO (Result of Logic Operation)

LAD	FBD	SCL	Description
	 	`NOT`	For FBD programming, you can drag the "Invert RLO" tool from the "Favorites" toolbar or instruction tree and then drop it on an input or output to create a logic inverter on that box connector. The LAD NOT contact inverts the logical state of power flow input. • If there is no power flow into the NOT contact, then there is power flow out. • If there is power flow into the NOT contact, then there is no power flow out.

Output coil and assignment box

The coil output instruction writes a value for an output bit. If the output bit you specify uses memory identifier Q, then the CPU turns the output bit in the process-image register on or off, setting the specified bit equal to power flow status. The output signals for your control actuators are wired to the Q terminals of the CPU. In RUN mode, the CPU system continuously scans your input signals, processes the input states according to your program logic, and then reacts by setting new output state values in the process-image output register. The CPU system transfers the new output state reaction that is stored in the process-image register, to the wired output terminals.

Table 8- 6 Assignment and negate assignment

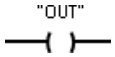
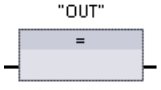
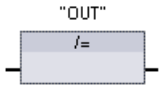
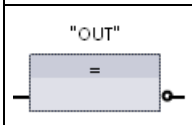
LAD	FBD	SCL	Description
		`out := <Boolean expression>;`	In FBD programming, LAD coils are transformed into assignment (= and /=) boxes where you specify a bit address for the box output. Box inputs and outputs can be connected to other box logic or you can enter a bit address. You can specify an immediate write of a physical output using ":P" following the Q offset (example: "%Q3.4:P"). For an immediate write, the bit data values are written to the process image output and directly to physical output.
	 	`out := NOT <Boolean expression>;`	

Table 8- 7 Data types for the parameters

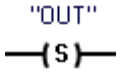
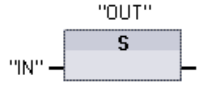
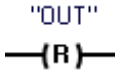
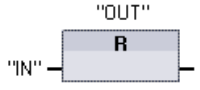
Parameter	Data type	Description
OUT	Bool	Assigned bit

- If there is power flow through an output coil or an FBD "=" box is enabled, then the output bit is set to 1.
- If there is no power flow through an output coil or an FBD "=" assignment box is not enabled, then the output bit is set to 0.
- If there is power flow through an inverted output coil or an FBD "/=" box is enabled, then the output bit is set to 0.
- If there is no power flow through an inverted output coil or an FBD "/=" box is not enabled, then the output bit is set to 1.

8.1.2 Set and reset instructions

Set and Reset 1 bit

Table 8- 8 S and R instructions

LAD	FBD	SCL	Description
		Not available	Set output: When S (Set) is activated, then the data value at the OUT address is set to 1. When S is not activated, OUT is not changed.
		Not available	Reset output: When R (Reset) is activated, then the data value at the OUT address is set to 0. When R is not activated, OUT is not changed.

1 For LAD and FBD: These instructions can be placed anywhere in the network.

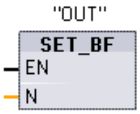
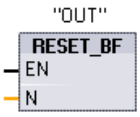
2 For SCL: You must write code to replicate this function within your application.

Table 8- 9 Data types for the parameters

Parameter	Data type	Description
IN (or connect to contact/gate logic)	Bool	Bit tag of location to be monitored
OUT	Bool	Bit tag of location to be set or reset

Set and Reset Bit Field

Table 8- 10 SET_BF and RESET_BF instructions

LAD[1]	FBD	SCL	Description
		Not available	Set bit field: When SET_BF is activated, a data value of 1 is assigned to "n" bits starting at address tag OUT. When SET_BF is not activated, OUT is not changed.
		Not available	Reset bit field: RESET_BF writes a data value of 0 to "n" bits starting at address tag OUT. When RESET_BF is not activated, OUT is not changed.

1 For LAD and FBD: These instructions must be the right-most instruction in a branch.

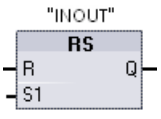
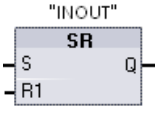
2 For SCL: You must write code to replicate this function within your application.

Table 8- 11 Data types for the parameters

Parameter	Data type	Description
OUT	Bool	Starting element of a bit field to be set or reset (Example: #MyArray[3])
n	Constant (UInt)	Number of bits to write

Set-dominant and Reset-dominant flip-flops

Table 8- 12 RS and SR instructions

LAD / FBD	SCL	Description
	Not available	Reset/set flip-flop: RS is a set dominant latch where the set dominates. If the set (S1) and reset (R) signals are both true, the value at address INOUT will be 1.
	Not available	Set/reset flip-flop: SR is a reset dominant latch where the reset dominates. If the set (S) and reset (R1) signals are both true, the value at address INOUT will be 0.

1 For LAD and FBD: These instructions must be the right-most instruction in a branch.

2 For SCL: You must write code to replicate this function within your application.

Table 8- 13 Data types for the parameters

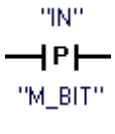
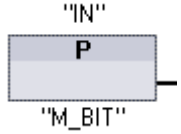
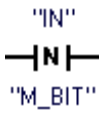
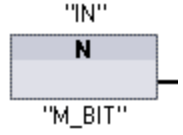
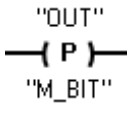
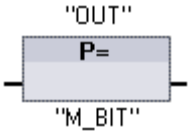
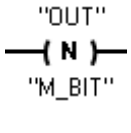
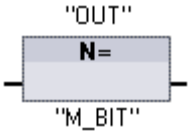
Parameter	Data type	Description
S, S1	Bool	Set input; 1 indicates dominance
R, R1	Bool	Reset input; 1 indicates dominance
INOUT	Bool	Assigned bit tag "INOUT"
Q	Bool	Follows state of "INOUT" bit

The "INOUT" tag assigns the bit address that is set or reset. The optional output Q follows the signal state of the "INOUT" address.

Instruction	S1	R	"INOUT" bit
RS	0	0	Previous state
	0	1	0
	1	0	1
	1	1	1
	S	**R1**	
SR	0	0	Previous state
	0	1	0
	1	0	1
	1	1	0

8.1.3 Positive and negative edge instructions

Table 8- 14 Positive and negative transition detection

LAD	FBD	SCL	Description
		Not available [1]	Scan operand for positive signal edge. LAD: The state of this contact is TRUE when a positive transition (OFF-to-ON) is detected on the assigned "IN" bit. The contact logic state is then combined with the power flow in state to set the power flow out state. The P contact can be located anywhere in the network except the end of a branch. FBD: The output logic state is TRUE when a positive transition (OFF-to-ON) is detected on the assigned input bit. The P box can only be located at the beginning of a branch.
		Not available [1]	Scan operand for negative signal edge. LAD: The state of this contact is TRUE when a negative transition (ON-to-OFF) is detected on the assigned input bit. The contact logic state is then combined with the power flow in state to set the power flow out state. The N contact can be located anywhere in the network except the end of a branch. FBD: The output logic state is TRUE when a negative transition (ON-to-OFF) is detected on the assigned input bit. The N box can only be located at the beginning of a branch.
		Not available [1]	Set operand on positve signal edge. LAD: The assigned bit "OUT" is TRUE when a positive transition (OFF-to-ON) is detected on the power flow entering the coil. The power flow in state always passes through the coil as the power flow out state. The P coil can be located anywhere in the network. FBD: The assigned bit "OUT" is TRUE when a positive transition (OFF-to-ON) is detected on the logic state at the box input connection or on the input bit assignment if the box is located at the start of a branch. The input logic state always passes through the box as the output logic state. The P= box can be located anywhere in the branch.
		Not available [1]	Set operand on negative signal edge. LAD: The assigned bit "OUT" is TRUE when a negative transition (ON-to-OFF) is detected on the power flow entering the coil. The power flow in state always passes through the coil as the power flow out state. The N coil can be located anywhere in the network. FBD: The assigned bit "OUT" is TRUE when a negative transition (ON-to-OFF) is detected on the logic state at the box input connection or on the input bit assignment if the box is located at the start of a branch. The input logic state always passes through the box as the output logic state. The N= box can be located anywhere in the branch.

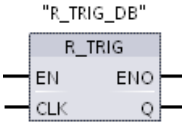
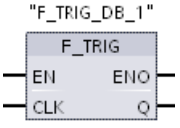
[1] For SCL: You must write code to replicate this function within your application.

Table 8- 15 P_TRIG and N_TRIG

LAD / FBD	SCL	Description
	Not available [1]	Scan RLO (result of logic operation) for positve signal edge. The Q output power flow or logic state is TRUE when a positive transition (OFF-to-ON) is detected on the CLK input state (FBD) or CLK power flow in (LAD). In LAD, the P_TRIG instruction cannot be located at the beginning or end of a network. In FBD, the P_TRIG instruction can be located anywhere except the end of a branch.
	Not available [1]	Scan RLO for negative signal edge. The Q output power flow or logic state is TRUE when a negative transition (ON-to-OFF) is detected on the CLK input state (FBD) or CLK power flow in (LAD). In LAD, the N_TRIG instruction cannot be located at the beginning or end of a network. In FBD, the N_TRIG instruction can be located anywhere except the end of a branch.

[1] For SCL: You must write code to replicate this function within your application.

Table 8- 16 R_TRIG and F_TRIG instructions

LAD / FBD	SCL	Description
	**"R_TRIG_DB"(CLK:=_in_, Q=> _bool_out_);**	Set tag on positive signal edge. The assigned instance DB is used to store the previous state of the CLK input. The Q output power flow or logic state is TRUE when a positive transition (OFF-to-ON) is detected on the CLK input state (FBD) or CLK power flow in (LAD). In LAD, the R_TRIG instruction cannot be located at the beginning or end of a network. In FBD, the R_TRIG instruction can be located anywhere except the end of a branch.
	"F_TRIG_DB"(CLK:=_in_, Q=> _bool_out_);	Set tag on negative signal edge. The assigned instance DB is used to store the previous state of the CLK input. The Q output power flow or logic state is TRUE when a negative transition (ON-to-OFF) is detected on the CLK input state (FBD) or CLK power flow in (LAD). In LAD, the F_TRIG instruction cannot be located at the beginning or end of a network. In FBD, the F_TRIG instruction can be located anywhere except the end of a branch.

For R_TRIG and F_TRIG, when you insert the instruction in the program, the "Call options" dialog opens automatically. In this dialog you can assign
whether the edge memory bit is stored in its own data block (single instance) or as a local tag (multiple instance) in the
block interface. If you create a separate data block, you will find it in the project tree in the "Program resources" folder
under "Program blocks > System blocks".

Table 8- 17 Data types for the parameters (P and N contacts/coils, P=, N=, P_TRIG and N_TRIG)

Parameter	Data type	Description
M_BIT	Bool	Memory bit in which the previous state of the input is saved
IN	Bool	Input bit whose transition edge is detected
OUT	Bool	Output bit which indicates a transition edge was detected
CLK	Bool	Power flow or input bit whose transition edge is detected
Q	Bool	Output which indicates an edge was detected

All edge instructions use a memory bit (M_BIT: P/N contacts/coils, P_TRIG/N_TRIG) or (instance DB bit: R_TRIG, F_TRIG) to store the previous state of the monitored input signal. An edge is detected by comparing the state of the input with the previous state. If the states indicate a change of the input in the direction of interest, then an edge is reported by writing the output TRUE. Otherwise, the output is written to FALSE.

Note

Edge instructions evaluate the input and memory-bit values each time they are executed, including the first execution. You must account for the initial states of the input and memory bit in your program design either to allow or to avoid edge detection on the first scan.

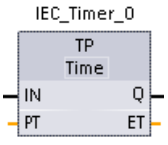
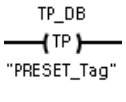
Because the memory bit must be maintained from one execution to the next, you should use a unique bit for each edge instruction, and you should not use this bit any other place in your program. You should also avoid temporary memory and memory that can be affected by other system functions, such as an I/O update. Use only M, global DB, or Static memory (in an instance DB) for M_BIT memory assignments.

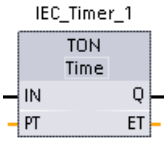
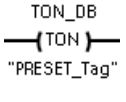
8.2 Timer operations

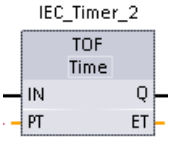
You use the timer instructions to create programmed time delays. The number of timers that you can use in your user program is limited only by the amount of memory in the CPU. Each timer uses a 16 byte IEC_Timer data type DB structure to store timer data that is specified at the top of the box or coil instruction. STEP 7 automatically creates the DB when you insert the instruction.

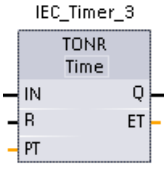
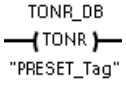
Table 8- 18 Timer instructions

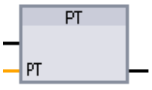
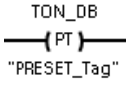
LAD / FBD boxes	LAD coils	SCL	Description

		`"IEC_Timer_0_DB".TP(`
		`IN:=_bool_in_,`
		`PT:=_time_in_,`
		`Q=>_bool_out_,`
		`ET=>_time_out_);`
			The TP timer generates a pulse with a preset width time.

		`"IEC_Timer_0_DB".TON (`
		`IN:=_bool_in_,`
		`PT:=_time_in_,`
		`Q=>_bool_out_,`
		`ET=>_time_out_);`
			The TON timer sets output Q to ON after a preset time delay.

		`"IEC_Timer_0_DB".TOF (`
		`IN:=_bool_in_,`
		`PT:=_time_in_,`
		`Q=>_bool_out_,`
		`ET=>_time_out_);`
			The TOF timer resets output Q to OFF after a preset time delay.

		`"IEC_Timer_0_DB".TONR (`
		`IN:=_bool_in_,`
		`R:=_bool_in_,`
		`PT:=_time_in_,`
		`Q=>_bool_out_,`
		`ET=>_time_out_);`
			The TONR timer sets output Q to ON after a preset time delay. Elapsed time is accumulated over multiple timing periods until the R input is used to reset the elapsed time.

FBD only:

		`PRESET_TIMER(`
		`PT:=_time_in_,`
		
		`TIMER:=_iec_timer_in_);`
			The PT (Preset timer) coil loads a new PRESET time value in the specified IEC_Timer.

FBD only: 		`RESET_TIMER(` `_iec_timer_in_);`	The RT (Reset timer) coil resets the specified IEC_Timer.

[1] STEP 7 automatically creates the DB when you insert the instruction.

[2] In the SCL examples, "IEC_Timer_0_DB" is the name of the instance DB.

Table 8- 19 Data types for the parameters

Parameter	Data type	Description
Box: IN Coil: Power flow	Bool	TP, TON, and TONR: Box: 0=Disable timer, 1=Enable timer Coil: No power flow=Disable timer, Power flow=Enable timer TOF: Box: 0=Enable timer, 1=Disable timer Coil: No power flow=Enable timer, Power flow=Disable timer
R	Bool	TONR box only: 0=No reset 1= Reset elapsed time and Q bit to 0
Box: PT Coil: "PRESET_Tag"	Time	Timer box or coil: Preset time input
Box: Q Coil: DBdata.Q	Bool	Timer box: Q box output or Q bit in the timer DB data Timer coil: you can only address the Q bit in the timer DB data
Box: ET Coil: DBdata.ET	Time	Timer box: ET (elapsed time) box output or ET time value in the timer DB data Timer coil: you can only address the ET time value in the timer DB data.

Table 8- 20 Effect of value changes in the PT and IN parameters

Timer	Changes in the PT and IN box parameters and the corresponding coil parameters
TP	• Changing PT has no effect while the timer runs. • Changing IN has no effect while the timer runs.
TON	• Changing PT has no effect while the timer runs. • Changing IN to FALSE, while the timer runs, resets and stops the timer.
TOF	• Changing PT has no effect while the timer runs. • Changing IN to TRUE, while the timer runs, resets and stops the timer.
TONR	• Changing PT has no effect while the timer runs, but has an effect when the timer resumes. • Changing IN to FALSE, while the timer runs, stops the timer but does not reset the timer. Changing IN back to TRUE will cause the timer to start timing from the accumulated time value.

PT (preset time) and ET (elapsed time) values are stored in the specified IEC_TIMER DB data as signed double integers that represent milliseconds of time. TIME data uses the T# identifier and can be entered as a simple time unit (T#200ms or 200) and as compound time units like T#2s_200ms.

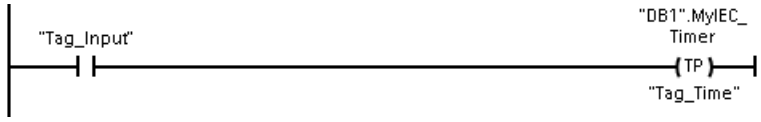
Table 8- 21 Size and range of the TIME data type

Data type	Size	Valid number ranges[1]
TIME	32 bits, stored as DInt data	T#-24d_20h_31m_23s_648ms to T#24d_20h_31m_23s_647ms Stored as -2,147,483,648 ms to +2,147,483,647 ms

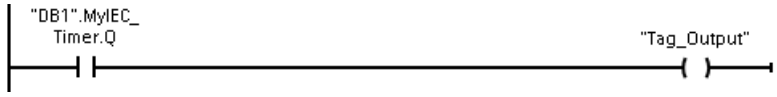
[1] The negative range of the TIME data type shown above cannot be used with the timer instructions. Negative PT (preset time) values are set to zero when the timer instruction is executed. ET (elapsed time) is always a positive value.

Timer coil example

The -(TP)-, -(TON)-, -(TOF)-, and -(TONR)- timer coils must be the last instruction in a LAD network. As shown in the timer example, a contact instruction in a subsequent network evaluates the Q bit in a timer coil's IEC_Timer DB data. Likewise, you must address the ELAPSED element in the IEC_timer DB data if you want to use the elapsed time value in your program.



The pulse timer is started on a 0 to 1 transition of the Tag_Input bit value. The timer runs for the time specified by Tag_Time time value.



As long as the timer runs, the state of DB1.MyIEC_Timer.Q=1 and the Tag_Output value=1. When the Tag_Time value has elapsed, then DB1.MyIEC_Timer.Q=0 and the Tag_Output value=0.

Reset timer -(RT)- and Preset timer -(PT)- coils

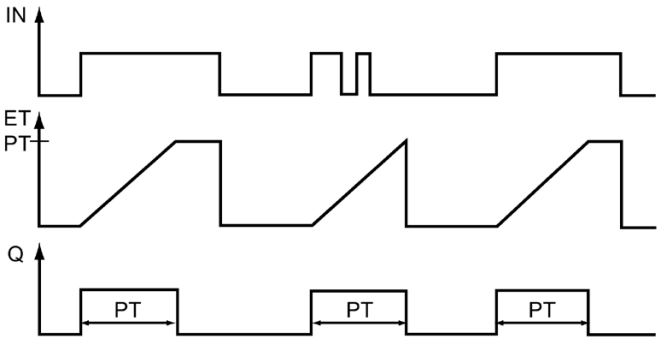
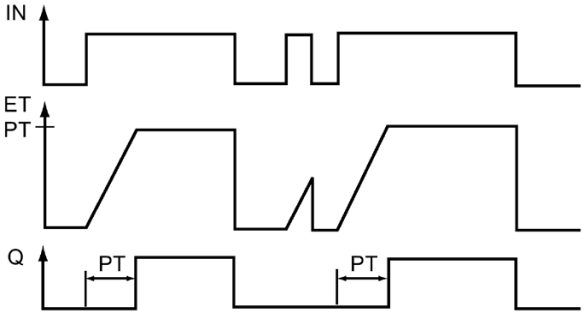
These coil instructions can be used with box or coil timers and can be placed in a mid-line position. The coil output power flow status is always the same as the coil input status. When the -(RT)- coil is activated, the ELAPSED time element of the specified IEC_Timer DB data is reset to 0. When the -(PT)- coil is activated, the PRESET time element of the specified IEC_Timer DB data is loaded with the assigned time-duration value..

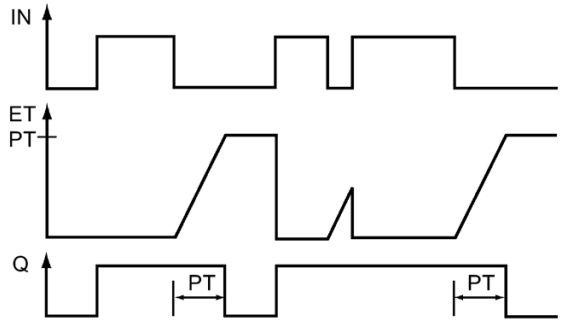
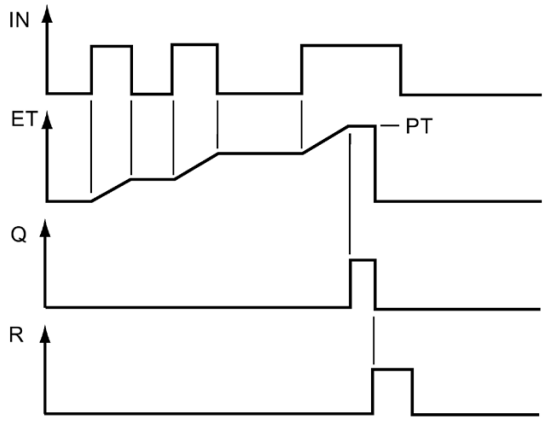
Note

When you place timer instructions in an FB, you can select the "Multi-instance data block" option. The timer structure names can be different with separate data structures, but the timer data is contained in a single data block and does not require a separate data block for each timer. This reduces the processing time and data storage necessary for handling the timers. There is no interaction between the timer data structures in the shared multi-instance DB.

Operation of the timers

Table 8- 22 Types of IEC timers

Timer	Timing diagram
TP: Generate pulse The TP timer generates a pulse with a preset width time.	
TON: Generate ON-delay The TON timer sets output Q to ON after a preset time delay.	

Timer	Timing diagram
TOF: Generate OFF-delay The TOF timer resets output Q to OFF after a preset time delay.	
TONR: Time accumulator The TONR timer sets output Q to ON after a preset time delay. Elapsed time is accumulated over multiple timing periods until the R input is used to reset the elapsed time.	

Note

In the CPU, no dedicated resource is allocated to any specific timer instruction. Instead, each timer utilizes its own timer structure in DB memory and a continuously-running internal CPU timer to perform timing.

When a timer is started due to an edge change on the input of a TP, TON, TOF, or TONR instruction, the value of the continuously-running internal CPU timer is copied into the START member of the DB structure allocated for this timer instruction. This start value remains unchanged while the timer continues to run, and is used later each time the timer is updated. Each time the timer is started, a new start value is loaded into the timer structure from the internal CPU timer.

When a timer is updated, the start value described above is subtracted from the current value of the internal CPU timer to determine the elapsed time. The elapsed time is then compared with the preset to determine the state of the timer Q bit. The ELAPSED and Q members are then updated in the DB structure allocated for this timer. Note that the elapsed time is clamped at the preset value (the timer does not continue to accumulate elapsed time after the preset is reached).

A timer update is performed when and only when:

- A timer instruction (TP, TON, TOF, or TONR) is executed
- The "ELAPSED" member of the timer structure in DB is referenced directly by an instruction
- The "Q" member of the timer structure in DB is referenced directly by an instruction

Timer programming

The following consequences of timer operation should be considered when planning and creating your user program:

- You can have multiple updates of a timer in the same scan. The timer is updated each time the timer instruction (TP, TON, TOF, TONR) is executed and each time the ELAPSED or Q member of the timer structure is used as a parameter of another executed instruction. This is an advantage if you want the latest time data (essentially an immediate read of the timer). However, if you desire to have consistent values throughout a program scan, then place your timer instruction prior to all other instructions that need these values, and use tags from the Q and ET outputs of the timer instruction instead of the ELAPSED and Q members of the timer DB structure.
- You can have scans during which no update of a timer occurs. It is possible to start your timer in a function, and then cease to call that function again for one or more scans. If no other instructions are executed which reference the ELAPSED or Q members of the timer structure, then the timer will not be updated. A new update will not occur until either the timer instruction is executed again or some other instruction is executed using ELAPSED or Q from the timer structure as a parameter.
- Although not typical, you can assign the same DB timer structure to multiple timer instructions. In general, to avoid unexpected interaction, you should only use one timer instruction (TP, TON, TOF, TONR) per DB timer structure.
- Self-resetting timers are useful to trigger actions that need to occur periodically. Typically, self-resetting timers are created by placing a normally-closed contact which references the timer bit in front of the timer instruction. This timer network is typically located above one or more dependent networks that use the timer bit to trigger actions. When the timer expires (elapsed time reaches preset value), the timer bit is ON for one scan, allowing the dependent network logic controlled by the timer bit to execute. Upon the next execution of the timer network, the normally closed contact is OFF, thus resetting the timer and clearing the timer bit. The next scan, the normally closed contact is ON, thus restarting the timer. When creating self-resetting timers such as this, do not use the "Q" member of the timer DB structure as the parameter for the normally-closed contact in front of the timer instruction. Instead, use the tag connected to the "Q" output of the timer instruction for this purpose. The reason to avoid accessing the Q member of the timer DB structure is because this causes an update to the timer and if the timer is updated due to the normally closed contact, then the contact will reset the timer instruction immediately. The Q output of the timer instruction will not be ON for the one scan and the dependent networks will not execute.

Time data retention after a RUN-STOP-RUN transition or a CPU power cycle

If a run mode session is ended with stop mode or a CPU power cycle and a new run mode session is started, then the timer data stored in the previous run mode session is lost, unless the timer data structure is specified as retentive (TP, TON, TOF, and TONR timers).

When you accept the defaults in the call options dialog after you place a timer instruction in the program editor, you are automatically assigned an instance DB which **cannot be made retentive**. To make your timer data retentive, you must either use a global DB or a Multi-instance DB.

Assign a global DB to store timer data as retentive data

This option works regardless of where the timer is placed (OB, FC, or FB).

1. Create a global DB:
   - Double-click "Add new block" from the Project tree
   - Click the data block (DB) icon
   - For the Type, choose global DB
   - If you want to be able to select individual data elements in this DB as retentive, be sure the DB type "Optimized" box is checked. The other DB type option "Standard - compatible with S7-300/400" only allows setting all DB data elements retentive or none retentive.
   - Click OK
2. Add timer structure(s) to the DB:
   - In the new global DB, add a new static tag using data type IEC_Timer.
   - In the "Retain" column, check the box so that this structure will be retentive.
   - Repeat this process to create structures for all the timers that you want to store in this DB. You can either place each timer structure in a unique global DB, or you can place multiple timer structures into the same global DB. You can also place other static tags besides timers in this global DB. Placing multiple timer structures into the same global DB allows you to reduce your overall number of blocks.
   - Rename the timer structures if desired.
3. Open the program block for editing where you want to place a retentive timer (OB, FC, or FB).
4. Place the timer instruction at the desired location.
5. When the call options dialog appears, click the cancel button.
6. On the top of the new timer instruction, type the name (do not use the helper to browse) of the global DB and timer structure that you created above (example: "Data_block_3.Static_1").

Assign a multi-instance DB to store timer data as retentive data

This option only works if you place the timer in an FB.

This option depends upon whether the FB properties specify "Optimized block access" (allows symbolic access only). To verify how the access attribute is configured for an existing FB, right-click on the FB in the Project tree, choose properties, and then choose Attributes.

If the FB specifies "Optimized block access" (allows symbolic access only):

1. Open the FB for edit.
2. Place the timer instruction at the desired location in the FB.
3. When the Call options dialog appears, click the Multi instance icon. The Multi Instance option is only available if the instruction is being placed into an FB.
4. In the Call options dialog, rename the timer if desired.
5. Click OK. The timer instruction appears in the editor, and the IEC_TIMER structure appears in the FB Interface under Static.
6. If necessary, open the FB interface editor (may have to click on the small arrow to expand the view).
7. Under Static, locate the timer structure that was just created for you.
8. In the Retain column for this timer structure, change the selection to "Retain". Whenever this FB is called later from another program block, an instance DB will be created with this interface definition which contains the timer structure marked as retentive.

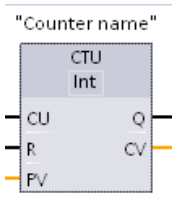
If the FB does not specify "Optimized block access", then the block access type is standard, which is compatible with S7-300/400 classic configurations and allows symbolic and direct access. To assign a multi-instance to a standard block access FB, follow these steps:

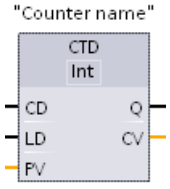
1. Open the FB for edit.
2. Place the timer instruction at the desired location in the FB.
3. When the Call options dialog appears, click on the multi instance icon. The multi instance option is only available if the instruction is being placed into an FB.
4. In the Call options dialog, rename the timer if desired.
5. Click OK. The timer instruction appears in the editor, and the IEC_TIMER structure appears in the FB Interface under Static.
6. Open the block that will use this FB.
7. Place this FB at the desired location. Doing so results in the creation of an instance data block for this FB.
8. Open the instance data block created when you placed the FB in the editor.
9. Under Static, locate the timer structure of interest. In the Retain column for this timer structure, check the box to make this structure retentive.

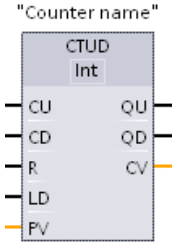
8.3 Counter operations

Table 8- 23 Counter instructions

LAD / FBD	SCL	Description

	`"IEC_Counter_0_DB".CTU (`
	`CU:=_bool_in,`
	`R:=_bool_in,`
	`PV:=_in,`
	`Q=>_bool_out,`
	`CV=>_out);`
		Use the counter instructions to count internal program events and external process events. Each counter uses a structure stored in a data block to maintain counter data. You assign the data block when the counter instruction is placed in the editor.
		• CTU is a count-up counter
		• CTD is a count-down counter
		• CTUD is a count-up-and-down counter

	`"IEC_Counter_0_DB".CTD (`
	`CD:=_bool_in,`
	`LD:=_bool_in,`
	`PV:=_in,`
	`Q=>_bool_out,`
	`CV=>_out);`	

	`"IEC_Counter_0_DB".CTUD(`
	`CU:=_bool_in,`
	`CD:=_bool_in,`
	`R:=_bool_in,`
	`LD:=_bool_in,`
	`PV:=_in_,`
	`QU=>_bool_out,`
	`QD=>_bool_out,`
	`CV=>_out_);`	

1 For LAD and FBD: Select the count value data type from the drop-down list below the instruction name.

2 STEP 7 automatically creates the DB when you insert the instruction.

3 In the SCL examples, "IEC_Counter_0_DB" is the name of the instance DB.

Table 8- 24 Data types for the parameters

Parameter	Data type[1]	Description
CU, CD	Bool	Count up or count down, by one count
R (CTU, CTUD)	Bool	Reset count value to zero
LD (CTD, CTUD)	Bool	Load control for preset value
PV	SInt, Int, DInt, USInt, UInt, UDInt	Preset count value
Q, QU	Bool	True if CV >= PV
QD	Bool	True if CV <= 0
CV	SInt, Int, DInt, USInt, UInt, UDInt	Current count value

1 The numerical range of count values depends on the data type you select. If the count value is an unsigned integer type, you can count down to zero or count up to the range limit. If the count value is a signed integer, you can count down to the negative integer limit and count up to the positive integer limit.

The number of counters that you can use in your user program is limited only by the amount of memory in the CPU. Counters use the following amount of memory:

- For SInt or USInt data types, the counter instruction uses 3 bytes.
- For Int or UInt data types, the counter instruction uses 6 bytes.
- For DInt or UDInt data types, the counter instruction uses 12 bytes.

These instructions use software counters whose maximum counting rate is limited by the execution rate of the OB in which they are placed. The OB that the instructions are placed in must be executed often enough to detect all transitions of the CU or CD inputs. For faster counting operations, see the CTRL_HSC instruction (Page 541).

Note

When you place counter instructions in an FB, you can select the multi-instance DB option, the counter structure names can be different with separate data structures, but the counter data is contained in a single DB and does not require a separate DB for each counter. This reduces the processing time and data storage necessary for the counters. There is no interaction between the counter data structures in the shared multi-instance DB.

Operation of the counters

Table 8- 25 Operation of CTU (count up)

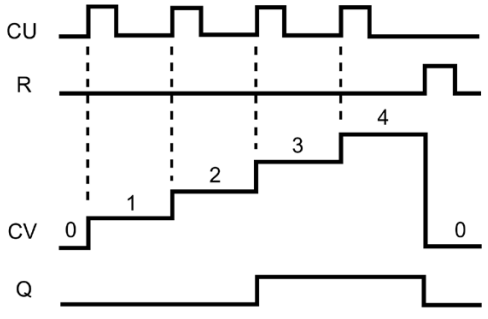
Counter	Operation
The CTU counter counts up by 1 when the value of parameter CU changes from 0 to 1. The CTU timing diagram shows the operation for an unsigned integer count value (where PV = 3). • If the value of parameter CV (current count value) is greater than or equal to the value of parameter PV (preset count value), then the counter output parameter Q = 1. • If the value of the reset parameter R changes from 0 to 1, then the current count value is reset to 0.	

Table 8- 26 Operation of CTD (count down)

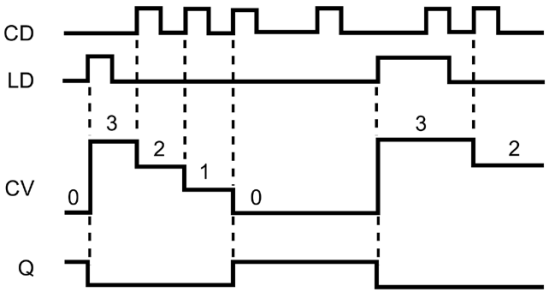
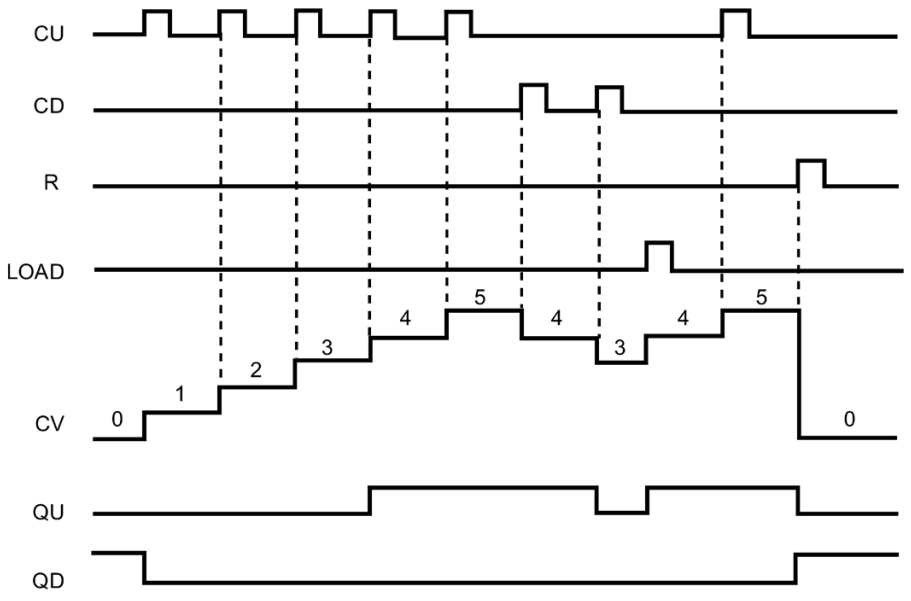
Counter	Operation
The CTD counter counts down by 1 when the value of parameter CD changes from 0 to 1. The CTD timing diagram shows the operation for an unsigned integer count value (where PV = 3). • If the value of parameter CV (current count value) is equal to or less than 0, the counter output parameter Q = 1. • If the value of parameter LOAD changes from 0 to 1, the value at parameter PV (preset value) is loaded to the counter as the new CV (current count value).	

Table 8- 27 Operation of CTUD (count up and down)

Counter	Operation
The CTUD counter counts up or down by 1 on the 0 to 1 transition of the count up (CU) or count down (CD) inputs. The CTUD timing diagram shows the operation for an unsigned integer count value (where PV = 4). • If the value of parameter CV is equal to or greater than the value of parameter PV, then the counter output parameter QU = 1. • If the value of parameter CV is less than or equal to zero, then the counter output parameter QD = 1. • If the value of parameter LOAD changes from 0 to 1, then the value at parameter PV is loaded to the counter as the new CV. • If the value of the reset parameter R is changes from 0 to 1, the current count value is reset to 0.	

Counter data retention after a RUN-STOP-RUN transition or a CPU power cycle

If a run mode session is ended with stop mode or a CPU power cycle and a new run mode session is started, then the counter data stored in the previous run mode session is lost, unless the counter data structure is specified as retentive (CTU, CTD, and CTUD counters).

When you accept the defaults in the call options dialog after you place a counter instruction in the program editor, you are automatically assigned an instance DB which **cannot be made retentive**. To make your counter data retentive, you must either use a global DB or a Multi-instance DB.

Assign a global DB to store counter data as retentive data

This option works regardless of where the counter is placed (OB, FC, or FB).

1. Create a global DB:
   - Double-click "Add new block" from the Project tree
   - Click the data block (DB) icon
   - For the Type, choose global DB
   - If you want to be able to select individual items in this DB as retentive, be sure the symbolic-access-only box is checked.
   - Click OK
2. Add counter structure(s) to the DB:
   - In the new global DB, add a new static tag using one of the counter data types. Be sure to consider the Type you want to use for your Preset and Count values.
   - In the "Retain" column, check the box so that this structure will be retentive.
   - Repeat this process to create structures for all the counters that you want to store in this DB. You can either place each counter structure in a unique global DB, or you can place multiple counter structures into the same global DB. You can also place other static tags besides counters in this global DB. Placing multiple counter structures into the same global DB allows you to reduce your overall number of blocks.
   - Rename the counter structures if desired.
3. Open the program block for editing where you want to place a retentive counter (OB, FC, or FB).
4. Place the counter instruction at the desired location.

5. When the call options dialog appears, click the cancel button. You should now see a new counter instruction which has "???" both just above and just below the instruction name.
6. On the top of the new counter instruction, type the name (do not use the helper to browse) of the global DB and counter structure that you created above (example: "Data_block_3.Static_1"). This causes the corresponding preset and count value type to be filled in (example: UInt for an IEC_UCounter structure).

Counter Data Type	Corresponding Type for the Preset and Count Values
IEC_Counter	INT
IEC_SCounter	SINT
IEC_DCounter	DINT
IEC_UCounter	UINT
IEC_USCounter	USINT
IEC_UDCounter	UDINT

Assign a multi-instance DB to store counter data as retentive data

This option only works if you place the counter in an FB.

This option depends upon whether the FB properties specify "Optimized block access" (allows symbolic access only). To verify how the access attribute is configured for an existing FB, right-click on the FB in the Project tree, choose properties, and then choose Attributes.

If the FB specifies "Optimized block access" (allows symbolic access only):

1. Open the FB for edit.
2. Place the counter instruction at the desired location in the FB.
3. When the Call options dialog appears, click on the Multi instance icon. The Multi Instance option is only available if the instruction is being placed into an FB.
4. In the Call options dialog, rename the counter if desired.
5. Click OK. The counter instruction appears in the editor with type INT for the preset and count values, and the IEC_COUNTER structure appears in the FB Interface under Static.
6. If desired, change the type in the counter instruction from INT to one of the other types. The counter structure will change correspondingly.
7. If necessary, open the FB interface editor (may have to click on the small arrow to expand the view).
8. Under Static, locate the counter structure that was just created for you.
9. In the Retain column for this counter structure, change the selection to "Retain". Whenever this FB is called later from another program block, an instance DB will be created with this interface definition which contains the counter structure marked as retentive.

If the FB does not specify "Optimized block access", then the block access type is standard, which is compatible with S7-300/400 classic configurations and allows symbolic and direct access. To assign a multi-instance to a standard block access FB, follow these steps:

1. Open the FB for edit.
2. Place the counter instruction at the desired location in the FB.
3. When the Call options dialog appears, click on the multi instance icon. The multi instance option is only available if the instruction is being placed into an FB.
4. In the Call options dialog, rename the counter if desired.
5. Click OK. The counter instruction appears in the editor with type INT for the preset and count value, and the IEC_COUNTER structure appears in the FB Interface under Static.
6. If desired, change the type in the counter instruction from INT to one of the other types. The counter structure will change correspondingly.
7. Open the block that will use this FB.
8. Place this FB at the desired location. Doing so results in the creation of an instance data block for this FB.
9. Open the instance data block created when you placed the FB in the editor.
10. Under Static, locate the counter structure of interest. In the Retain column for this counter structure, check the box to make this structure retentive.

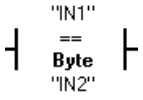
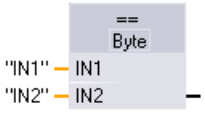
Type shown in counter instruction (for preset and count values)	Corresponding structure Type shown in FB interface
INT	IEC_Counter
SINT	IEC_SCounter
DINT	IEC_DCounter
UINT	IEC_UCounter
USINT	IEC_USCounter
UDINT	IEC_UDCounter

8.4 Comparator operations

8.4.1 Compare values instructions

Table 8- 28 Compare instructions

LAD	FBD	SCL	Description

		`out := in1 = in2;`
		or
		`IF in1 = in2`
		`THEN out := 1;`
		`ELSE out := 0;`
		`END_IF;`
			Compares two values of the same data type. When the LAD contact comparison is TRUE, then the contact is activated. When the FBD box comparison is TRUE, then the box output is TRUE.

[1] For LAD and FBD: Click the instruction name (such as "==") to change the comparison type from the drop-down list. Click the "???" and select data type from the drop-down list.

Table 8- 29 Data types for the parameters

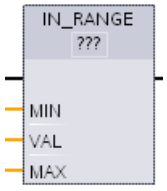
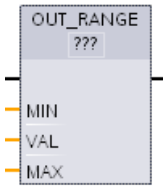
Parameter	Data type	Description
IN1, IN2	Byte, Word, DWord, SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, String, WString, Char, Char, Time, Date, TOD, DTL, Constant	Values to compare

Table 8- 30 Comparison descriptions

Relation type	The comparison is true if ...
=	IN1 is equal to IN2
<>	IN1 is not equal to IN2
>=	IN1 is greater than or equal to IN2
<=	IN1 is less than or equal to IN2
>	IN1 is greater than IN2
<	IN1 is less than IN2

8.4.2 IN_Range (Value within range) and OUT_Range (Value outside range)

Table 8- 31 Value within Range and value outside range instructions

LAD / FBD	SCL	Description
	`out := IN_RANGE(min, val, max);`	Tests whether an input value is in or out of a specified value range. If the comparison is TRUE, then the box output is TRUE.
	`out := OUT_RANGE(min, val, max);`	

1 For LAD and FBD: Click the "???" and select the data type from the drop-down list.

Table 8- 32 Data types for the parameters

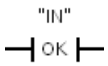
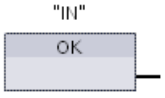
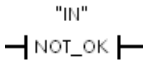
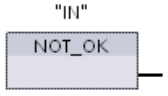
Parameter	Data type[1]	Description
MIN, VAL, MAX	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Constant	Comparator inputs

1 The input parameters MIN, VAL, and MAX must be the same data type.

- The IN_RANGE comparison is true if: MIN <= VAL <= MAX
- The OUT_RANGE comparison is true if: VAL < MIN or VAL > MAX

8.4.3 OK (Check validity) and NOT_OK (Check invalidity)

Table 8- 33 OK (check validity) and Not OK (check invalidity) instructions

LAD	FBD	SCL	Description
		Not available	Tests whether an input data reference is a valid real number according to IEEE specification 754.
		Not available	

[1] For LAD and FBD: When the LAD contact is TRUE, the contact is activated and passes power flow. When the FBD box is TRUE, then the box output is TRUE.

Table 8- 34 Data types for the parameter

Parameter	Data type	Description
IN	Real, LReal	Input data

Table 8- 35 Operation

Instruction	The Real number test is TRUE if:
OK	The input value is a valid real number [1]
NOT_OK	The input value is not a valid real number [1]

[1] A Real or LReal value is invalid if it is +/- INF (infinity), NaN (Not a Number), or if it is a denormalized value. A denormalized value is a number very close to zero. The CPU substitutes a zero for a denormalized value in calculations.

8.4.4 Variant and array comparison instructions

8.4.4.1 Equality and non-equality comparison instructions

The S7-1200 CPU provides instructions for querying the data type of a tag to which a Variant operand points for either equality or non-equality to the data type of the other operand.

In addition, the S7-1200 CPU provides instructions for querying the data type of an array element for either equality or non-equality to the data type of the other operand.

In these instructions, you are comparing <Operand1> to <Operand2>. <Operand1> must have the Variant data type. <Operand2> can be an elementary data type of a PLC data type. In LAD and FBD, <Operand1> is the operand above the instruction. In LAD, <Operand2> is the operand below the instruction.

For all instructions, the result of logic operation (RLO) is 1 (true) if the equality or non-equality test passes, and is 0 (false) if not.

The equality and non-equality type comparison instructions are as follows:

- EQ_Type (Compare data type for EQUAL with the data type of a tag)
- NE_Type (Compare data type for UNEQUAL with the data type of a tag)
- EQ_ElemType (Compare data type of an ARRAY element for EQUAL with the data type of a tag)
- NE_ElemType (Compare data type of an ARRAY element for UNEQUAL with the data type of a tag)

Table 8- 36 EQ and NE instructions

LAD	FBD	SCL	Description
#Operand1 EQ_Type "Operand2"	#Operand1 EQ_Type "Operand2" — IN2 OUT	Not available	Tests whether the tag pointed to by the Variant at Operand1 is of the same data type as the tag at Operand2.
#Operand1 NE_Type "Operand2"	#Operand1 NE_Type "Operand2" — IN2 OUT	Not available	Tests whether the tag pointed to by the Variant at Operand1 is of a different data type as the tag at Operand2.
#Operand1 EQ_ElemType "Operand2"	#Operand1 EQ_ElemType "Operand2" — IN2 OUT	Not available	Tests whether the array element pointed to by the Variant at Operand1 is of the same data type as the tag at Operand2.
#Operand1 NE_ElemType "Operand2"	#Operand1 NE_ElemType "Operand2" — IN2 OUT	Not available	Tests whether the array element pointed to by the Variant at Operand1 is of a different data type as the tag at Operand2.

Table 8- 37 Data types for the parameters

Parameter	Data type	Description
Operand1	Variant	First operand
Operand2	Bit strings, integers, floating-point numbers, timers, date and time, character strings, ARRAY, PLC data types	Second operand

8.4.4.2 Null comparsion instructions

You can use the instructions IS_NULL and NOT_NULL to determine whether or not the input actually points to an object or not.

For both instructions, <Operand> must have the Variant data type.

Table 8- 38 IS_NULL (Query for EQUALS ZERO pointer) and NOT_NULL (Query for EQUALS ZERO pointer) instructions

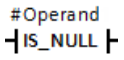
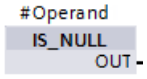
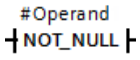
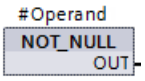
LAD	FBD	SCL	Description
		Not available	Tests whether the tag pointed to by the Variant at Operand is null and therefore not an object.
		Not available	Tests whether the tag pointed to by the Variant at Operand is not null and therefore does point to an object.

Table 8- 39 Data types for the parameters

Parameter	Data type	Description
Operand	Variant	Operand to evaluate for null or not null.

8.4.4.3 IS_ARRAY (Check for ARRAY)

You can use the "Check for ARRAY" instruction to query whether the Variant points to a tag of the Array data type.

The <Operand> must have the Variant data type.

The instructions returns 1 (true) if the operand is an array.

Table 8- 40 IS_ARRAY (Check for ARRAY)

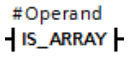
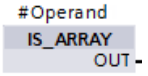
LAD	FBD	SCL	Description
		IS_ARRAY(_variant_in_)	Tests whether the tag pointed to by the Variant at Operand is an array.

Table 8- 41 Data types for the parameters

Parameter	Data type	Description
Operand	Variant	Operand to evaluate for whether it is an array.

8.5 Math functions

8.5.1 CALCULATE (Calculate)

Table 8- 42 CALCULATE instruction

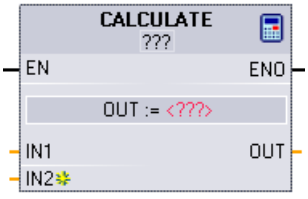
LAD / FBD	SCL	Description
	Use the standard SCL math expressions to create the equation.	The CALCULATE instruction lets you create a math function that operates on inputs (IN1, IN2, .. INn) and produces the result at OUT, according to the equation that you define. • Select a data type first. All inputs and the output must be the same data type. • To add another input, click the icon at the last input.

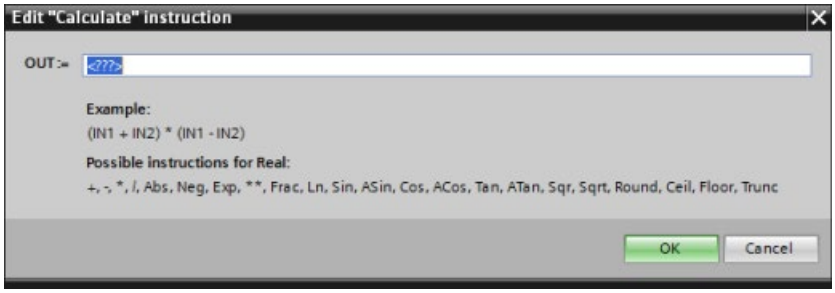
Table 8- 43 Data types for the parameters

Parameter	Data type[1]
IN1, IN2, ..INn	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord

[1] The IN and OUT parameters must be the same data type (with implicit conversions of the input parameters). For example: A SINT value for an input would be converted to an INT or a REAL value if OUT is an INT or REAL

Click the calculator icon to open the dialog and define your math function. You enter your equation as inputs (such as IN1 and IN2) and operations. When you click "OK" to save the function, the dialog automatically creates the inputs for the CALCULATE instruction.

The dialog shows an example and a list of possible instructions that you can include based on the data type of the OUT parameter:



Note

You also must create an input for any constants in your function. The constant value would then be entered in the associated input for the CALCULATE instruction.

By entering constants as inputs, you can copy the CALCULATE instruction to other locations in your user program without having to change the function. You then can change the values or tags of the inputs for the instruction without modifying the function.

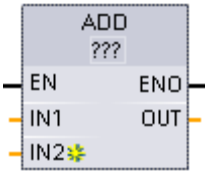
When CALCULATE is executed and all the individual operations in the calculation complete successfully, then the ENO = 1. Otherwise, ENO = 0.

For an example of the CALCULATE instruction, see "Creating a complex equation with a simple instruction (Page 42)".

8.5.2 Add, subtract, multiply and divide instructions

Table 8- 44 Add, subtract, multiply and divide instructions

LAD / FBD	SCL	Description

	`out := in1 + in2;`
	`out := in1 - in2;`
	`out := in1 * in2;`
	`out := in1 / in2;`
		• ADD: Addition (IN1 + IN2 = OUT)
		• SUB: Subtraction (IN1 - IN2 = OUT)
		• MUL: Multiplication (IN1 * IN2 = OUT)
		• DIV: Division (IN1 / IN2 = OUT)
		An Integer division operation truncates the fractional part of the quotient to produce an integer output.

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 45 Data types for the parameters (LAD and FBD)

Parameter	Data type[1]	Description
IN1, IN2	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Constant	Math operation inputs
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Math operation output

[1] Parameters IN1, IN2, and OUT must be the same data type.



To add an ADD or MUL input, click the "Create" icon or right-click on an input stub for one of the existing IN parameters and select the "Insert input" command.

To remove an input, right-click on an input stub for one of the existing IN parameters (when there are more than the original two inputs) and select the "Delete" command.

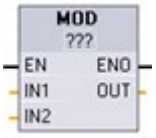
When enabled (EN = 1), the math instruction performs the specified operation on the input values (IN1 and IN2) and stores the result in the memory address specified by the output parameter (OUT). After the successful completion of the operation, the instruction sets ENO = 1.

Table 8- 46 ENO status

ENO	Description
1	No error
0	The Math operation result value would be outside the valid number range of the data type selected. The least significant part of the result that fits in the destination size is returned.
0	Division by 0 (IN2 = 0): The result is undefined and zero is returned.
0	Real/LReal: If one of the input values is NaN (not a number) then NaN is returned.
0	ADD Real/LReal: If both IN values are INF with different signs, this is an illegal operation and NaN is returned.
0	SUB Real/LReal: If both IN values are INF with the same sign, this is an illegal operation and NaN is returned.
0	MUL Real/LReal: If one IN value is zero and the other is INF, this is an illegal operation and NaN is returned.
0	DIV Real/LReal: If both IN values are zero or INF, this is an illegal operation and NaN is returned.

8.5.3 MOD (return remainder of division)

Table 8- 47 Modulo (return remainder of division) instruction

LAD / FBD	SCL	Description
	`out := in1 MOD in2;`	You can use the MOD instruction to return the remainder of an integer division operation. The value at the IN1 input is divided by the value at the IN2 input and the remainder is returned at the OUT output.

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 48 Data types for parameters

Parameter	Data type[1]	Description
IN1 and IN2	SInt, Int, DInt, USInt, UInt, UDInt, Constant	Modulo inputs
OUT	SInt, Int, DInt, USInt, UInt, UDInt	Modulo output

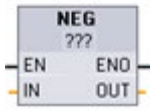
[1] The IN1, IN2, and OUT parameters must be the same data type.

Table 8- 49 ENO values

ENO	Description
1	No error
0	Value IN2 = 0, OUT is assigned the value zero

8.5.4 NEG (Create twos complement)

Table 8- 50 NEG (create twos complement) instruction

LAD / FBD	SCL	Description
	`-(in);`	The NEG instruction inverts the arithmetic sign of the value at parameter IN and stores the result in parameter OUT.

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 51 Data types for parameters

Parameter	Data type[1]	Description
IN	SInt, Int, DInt, Real, LReal, Constant	Math operation input
OUT	SInt, Int, DInt, Real, LReal	Math operation output

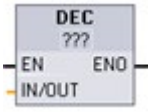
[1] The IN and OUT parameters must be the same data type.

Table 8- 52 ENO status

ENO	Description
1	No error
0	The resulting value is outside the valid number range of the selected data type. Example for SInt: NEG (-128) results in +128 which exceeds the data type maximum.

8.5.5 INC (Increment) and DEC (Decrement)

Table 8- 53 INC and DEC instructions

LAD / FBD	SCL	Description
	`in_out := in_out + 1;`	Increments a signed or unsigned integer number value: IN_OUT value +1 = IN_OUT value
	`in_out := in_out - 1;`	Decrements a signed or unsigned integer number value: IN_OUT value - 1 = IN_OUT value

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 54 Data types for parameters

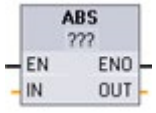
Parameter	Data type	Description
IN/OUT	SInt, Int, DInt, USInt, UInt, UDInt	Math operation input and output

Table 8- 55 ENO status

ENO	Description
1	No error
0	The resulting value is outside the valid number range of the selected data type. Example for SInt: INC (+127) results in +128, which exceeds the data type maximum.

8.5.6 ABS (Form absolute value)

Table 8- 56 ABS (absolute value) instruction

LAD / FBD	SCL	Description
	`out := ABS(in);`	Calculates the absolute value of a signed integer or real number at parameter IN and stores the result in parameter OUT.

1 For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 57 Data types for parameters

Parameter	Data type[1]	Description
IN	SInt, Int, DInt, Real, LReal	Math operation input
OUT	SInt, Int, DInt, Real, LReal	Math operation output

1 The IN and OUT parameters must be the same data type.

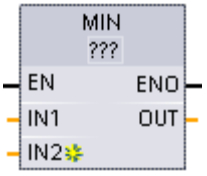
Table 8- 58 ENO status

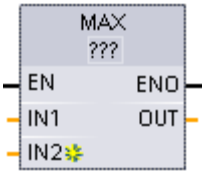
ENO	Description
1	No error
0	The math operation result value is outside the valid number range of the selected data type. Example for SInt: ABS (-128) results in +128 which exceeds the data type maximum.

8.5.7 MIN (Get minimum) and MAX (Get maximum)

Table 8- 59 MIN (get minimum) and MAX (get maximum) instructions

LAD / FBD	SCL	Description

	`out:= MIN(`
	`  in1:=_variant_in_,`
	`  in2:=_variant_in_`
	`[,...in32]);`
		The MIN instruction compares the value of two parameters IN1 and IN2 and assigns the minimum (lesser) value to parameter OUT.

	`out:= MAX(`
	`  in1:=_variant_in_,`
	`  in2:=_variant_in_`
	`[,...in32]);`
		The MAX instruction compares the value of two parameters IN1 and IN2 and assigns the maximum (greater) value to parameter OUT.

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 60 Data types for the parameters

Parameter	Data type[1]	Description
IN1, IN2 [...IN32]	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Time, Date, TOD, Constant	Math operation inputs (up to 32 inputs)
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Time, Date, TOD	Math operation output

[1] The IN1, IN2, and OUT parameters must be the same data type.



To add an input, click the "Create" icon or right-click on an input stub for one of the existing IN parameters and select the "Insert input" command.

To remove an input, right-click on an input stub for one of the existing IN parameters (when there are more than the original two inputs) and select the "Delete" command.

Table 8- 61 ENO status

ENO	Description
1	No error
0	For Real data type only: • At least one input is not a real number (NaN). • The resulting OUT is +/- INF (infinity).

8.5.8 LIMIT (Set limit value)

Table 8- 62 LIMIT (set limit value) instruction

LAD / FBD	SCL	Description

	`LIMIT(MN:=_variant_in_,`
	`IN:=_variant_in_,`
	`MX:=_variant_in_,`
	`OUT:=_variant_out_);`
		The Limit instruction tests if the value of parameter IN is inside the value range specified by parameters MIN and MAX and if not, clamps the value at MIN or MAX.

1 For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 63 Data types for the parameters

Parameter	Data type[1]	Description
MN, IN, and MX	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Time, Date, TOD·Constant	Math operation inputs
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Time, Date, TOD	Math operation output

1 The MN, IN, MX, and OUT parameters must be the same data type.

If the value of parameter IN is within the specified range, then the value of IN is stored in parameter OUT. If the value of parameter IN is outside of the specified range, then the OUT value is the value of parameter MIN (if the IN value is less than the MIN value) or the value of parameter MAX (if the IN value is greater than the MAX value).

Table 8- 64 ENO status

ENO	Description
1	No error
0	Real: If one or more of the values for MIN, IN and MAX is NaN (Not a Number), then NaN is returned.
0	If MIN is greater than MAX, the value IN is assigned to OUT.

SCL examples:

- MyVal := LIMIT(MN:=10,IN:=53, MX:=40); //Result: MyVal = 40
- MyVal := LIMIT(MN:=10,IN:=37, MX:=40); //Result: MyVal = 37
- MyVal := LIMIT(MN:=10,IN:=8, MX:=40); //Result: MyVal = 10

8.5.9 Exponent, logarithm, and trigonometry instructions

You use the floating point instructions to program mathematical operations using a Real or LReal data type:

- SQR: Form square (IN ^{2} = OUT)
- SQRT: Form square root ($\sqrt{}$IN = OUT)
- LN: Form natural logarithm (LN(IN) = OUT)
- EXP: Form exponential value (e ^{IN} =OUT), where base e = 2.71828182845904523536
- EXPT: exponentiate (IN1 ^{IN2} = OUT)

  EXPT parameters IN1 and OUT are always the same data type, for which you must select Real or LReal. You can select the data type for the exponent parameter IN2 from among many data types.
- FRAC: Return fraction (fractional part of floating point number IN = OUT)
- SIN: Form sine value (sin(IN radians) = OUT)
- ASIN: Form arcsine value (arcsine(IN) = OUT radians), where the sin(OUT radians) = IN
- COS: Form cosine (cos(IN radians) = OUT)
- ACOS: Form arccosine value (arccos(IN) = OUT radians), where the cos(OUT radians) = IN
- TAN: Form tangent value (tan(IN radians) = OUT)
- ATAN: Form arctangent value (arctan(IN) = OUT radians), where the tan(OUT radians) = IN

Table 8- 65 Examples of floating-point math instructions

LAD / FBD	SCL	Description

	`out := SQR(in);`
	or
	`out := in * in;`
		Square: IN ^{2} = OUT
		For example: If IN = 9, then OUT = 81.

	`out := in1 ** in2;`	General exponential: IN1 ^{IN2} = OUT For example: If IN1 = 3 and IN2 = 2, then OUT = 9.

[1] For LAD and FBD: Click the "???" (by the instruction name) and select a data type from the drop-down menu.

[2] For SCL: You can also use the basic SCL math operators to create the mathematical expressions.

Table 8- 66 Data types for parameters

Parameter	Data type	Description
IN, IN1	Real, LReal, Constant	Inputs
IN2	SInt, Int, DInt, USInt, UInt,UDInt, Real, LReal, Constant	EXPT exponent input
OUT	Real, LReal	Outputs

Table 8- 67 ENO status

ENO	Instruction	Condition	Result (OUT)
1	All	No error	Valid result
0	SQR	Result exceeds valid Real/LReal range	+INF
		IN is +/- NaN (not a number)	+NaN
	SQRT	IN is negative	-NaN
		IN is +/- INF (infinity) or +/- NaN	+/- INF or +/- NaN
	LN	IN is 0.0, negative, -INF, or -NaN	-NaN
		IN is +INF or +NaN	+INF or +NaN
	EXP	Result exceeds valid Real/LReal range	+INF
		IN is +/- NaN	+/- NaN
	SIN, COS, TAN	IN is +/- INF or +/- NaN	+/- INF or +/- NaN
	ASIN, ACOS	IN is outside valid range of -1.0 to +1.0	+NaN
		IN is +/- NaN	+/- NaN
	ATAN	IN is +/- NaN	+/- NaN
	FRAC	IN is +/- INF or +/- NaN	+NaN
	EXPT	IN1 is +INF and IN2 is not -INF	+INF
		IN1 is negative or -INF	+NaN if IN2 is Real/LReal, -INF otherwise
		IN1 or IN2 is +/- NaN	+NaN
		IN1 is 0.0 and IN2 is Real/LReal (only)	+NaN

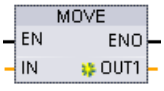
8.6 Move operations

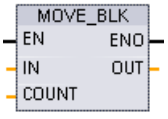
8.6.1 MOVE (Move value), MOVE_BLK (Move block), UMOVE_BLK (Move block uninterruptible), and MOVE_BLK_VARIANT (Move block)

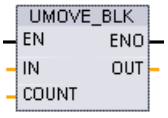
Use the Move instructions to copy data elements to a new memory address and convert from one data type to another. The source data is not changed by the move process.

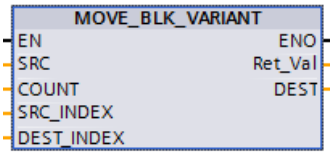
- The MOVE instruction copies a single data element from the source address specified by the IN parameter to the destination addresses specified by the OUT parameter.
- The MOVE_BLK and UMOVE_BLK instructions have an additional COUNT parameter. The COUNT specifies how many data elements are copied. The number of bytes per element copied depends on the data type assigned to the IN and OUT parameter tag names in the PLC tag table.

Table 8- 68 MOVE, MOVE_BLK, UMOVE_BLK, and MOVE_BLK_VARIANT instructions

LAD / FBD	SCL	Description
	`out1 := in;`	Copies a data element stored at a specified address to a new address or multiple addresses.[1]

	`MOVE_BLK(`
	`in:=_variant_in,`
	`count:=_uint_in,`
	`out=>_variant_out);`
		Interruptible move that copies a block of data elements to a new address.

	`UMOVE_BLK(`
	`in:=_variant_in,`
	`count:=_uint_in,`
	`out=>_variant_out);`
		Uninterruptible move that copies a block of data elements to a new address.

	`MOVE_BLK(`
	`SRC:=_variant_in,`
	`COUNT:=_udint_in,`
	`SRC_INDEX:=_dint_in,`
	
	`DEST_INDEX:=_dint_in,`
	`DEST=>_variant_out);`
		Moves the contents of a source memory area to a destination memory area.
		You can copy a complete array or elements of an array to another array of the same data type. The size (number of elements) of source and destination array may be different. You can copy multiple or single elements within an array. You use Variant data types to point to both the source and destination arrays.

[1] MOVE instruction: To add another output in LAD or FBD, click the "Create" icon by the output parameter. For SCL, use multiple assignment statements. You might also use one of the loop constructions.

Table 8- 69 Data types for the MOVE instruction

Parameter	Data type	Description
IN	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Char, WChar, Array, Struct, DTL, Time, Date, TOD, IEC data types, PLC data types	Source address
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Char, WChar, Array, Struct, DTL, Time, Date, TOD, IEC data types, PLC data types	Destination address



To add MOVE outputs, click the "Create" icon or right-click on an output stub for one of the existing OUT parameters and select the "Insert output" command.

To remove an output, right-click on an output stub for one of the existing OUT parameters (when there are more than the original two outputs) and select the "Delete" command.

Table 8- 70 Data types for the MOVE_BLK and UMOVE_BLK instructions

Parameter	Data type	Description
IN	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal Byte, Word, DWord, Time, Date, TOD, WChar	Source start address
COUNT	UInt	Number of data elements to copy
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, WChar	Destination start address

Table 8- 71 Data types for the MOVE_BLK_VARIANT instruction

Parameter	Data type	Description
SRC	Variant (which points to an array or individual array element)	Source block from which to copy
COUNT	UDInt	Number of data elements to copy
SRC_INDEX	DInt	Zero-based index into the SRC array
DEST_INDEX	DInt	Zero-based index into the DEST array
RET_VAL	Int	Error information
DEST	Variant (which points to an array or individualt array element)	Destination area into which to copy the contents of the source block

Note

Rules for data copy operations

- To copy the Bool data type, use SET_BF, RESET_BF, R, S, or output coil (LAD) (Page 224)
- To copy a single elementary data type, use MOVE
- To copy an array of an elementary data type, use MOVE_BLK or UMOVE_BLK
- To copy a structure, use MOVE
- To copy a string, use S_MOVE (Page 339)
- To copy a single character in a string, use MOVE
- The MOVE_BLK and UMOVE_BLK instructions cannot be used to copy arrays or structures to the I, Q, or M memory areas.

MOVE_BLK and UMOVE_BLK instructions differ in how interrupts are handled:

- Interrupt events are **queued and processed** during MOVE_BLK execution. Use the MOVE_BLK instruction when the data at the move destination address is not used within an interrupt OB subprogram or, if used, the destination data does not have to be consistent. If a MOVE_BLK operation is interrupted, then the last data element moved is complete and consistent at the destination address. The MOVE_BLK operation is resumed after the interrupt OB execution is complete.
- Interrupt events are **queued but not processed** until UMOVE_BLK execution is complete. Use the UMOVE_BLK instruction when the move operation must be completed and the destination data consistent, before the execution of an interrupt OB subprogram. For more information, see the section on data consistency (Page 192).

ENO is always true following execution of the MOVE instruction.

Table 8- 72 ENO status

ENO	Condition	Result
1	No error	All COUNT elements were successfully copied.
0	Either the source (IN) range or the destination (OUT) range exceeds the available memory area.	Elements that fit are copied. No partial elements are copied.

Table 8- 73 Condition codes for the MOVE_BLK_VARIANT instruction

RET_VAL (W#16#...)	Description
0000	No error
80B4	Data types do not correspond.
8151	Access to the SRC parameter is not possible.
8152	The operand at the SRC parameter is an invalid type.
8153	Code generation error at the SRC parameter
8154	The operand at the SRC parameter has the data type Bool.
8281	The COUNT parameter has an invalid value.
8382	The value at the SRC_INDEX parameter is outside the limits of the Variant.
8383	The value at parameter SRC_INDEX is outside the high limit of the array.
8482	The value at the DEST_INDEX parameter is outside the limits of the Variant.
8483	The value at parameter DEST_INDEX is outside the high limit of the array.
8534	The DEST parameter is write-protected.
8551	Access to the DEST parameter is not possible.
8552	The operand at the DEST parameter is an invalid type.
8553	Code generation error at the DEST parameter
8554	The operand at the DEST parameter has the data type Bool.
*You can display error codes in the program editor as integer or hexadecimal values.	

8.6.2 Deserialize

You can use the "Deserialize" instruction to convert the sequential representation of a PLC data type (UDT) back to a PLC data type and to fill its entire contents. If the comparison is TRUE, then the box output is TRUE.

The memory area which holds the sequential representation of a PLC data type must have the Array of Byte data type and you must declare the data block to have standard (not optimized) access. Make sure that there is enough memory space prior to the conversion.

The instruction enables you to convert multiple sequential representations of converted PLC data types back to their original data types.

Note

If you only want to convert back a single sequential representation of a PLC data type (UDT), you can also use the instruction "TRCV: Receive data via communication connection".

Table 8- 74 DESERIALIZE instruction

LAD / FBD	SCL	Description

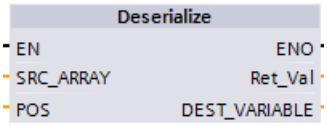
	`ret_val := Deserialize(`
	`  SRC_ARRAY:=_variant_in_,`
	`  DEST_VARIABLE=>_variant_out_,`
	`  POS:=_dint_inout_);`
		Converts the sequential representation of a PLC data type (UDT) back to a PLC data type and fills its entire contents

Table 8- 75 Parameters for the DESERIALIZE instruction

Parameter	Type	Data type	Description
SRC_ARRAY	IN	Variant	Global data block that contains the data stream
DEST_VARIABLE	INOUT	Variant	Tag in which to store the converted PLC data type (UDT)
POS	INOUT	DInt	Number of bytes that the converted PLC data type uses
RET_VAL	OUT	Int	Error information

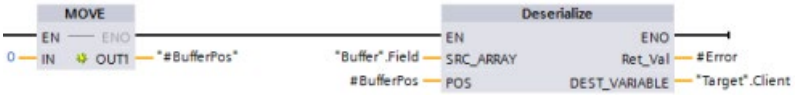
Table 8- 76 RET_VAL parameter

RET_VAL* (W#16#...)	Description
0000	No error
80B0	The memory areas for the SRC_ARRAY and DEST_VARIABLE parameters overlap.
8136	The data block at the DEST_VARIABLE parameter is not a block with standard access.
8150	The Variant data type at the SRC_ARRAY parameter contains no value.
8151	Code generation error at the SRC_ARRAY parameter.
8153	There is not enough free memory available at the SRC_ARRAY parameter.
8250	The Variant data type at the DEST_VARIABLE parameter contains no value.
8251	Code generation error at the DEST_VARIABLE parameter.
8254	Invalid data type at the DEST_VARIABLE parameter.
8382	The value at parameter POS is outside the limits of the array.
*You can view the error codes as either integer or hexadecimal in the program editor.	

Example: Deserialize instruction

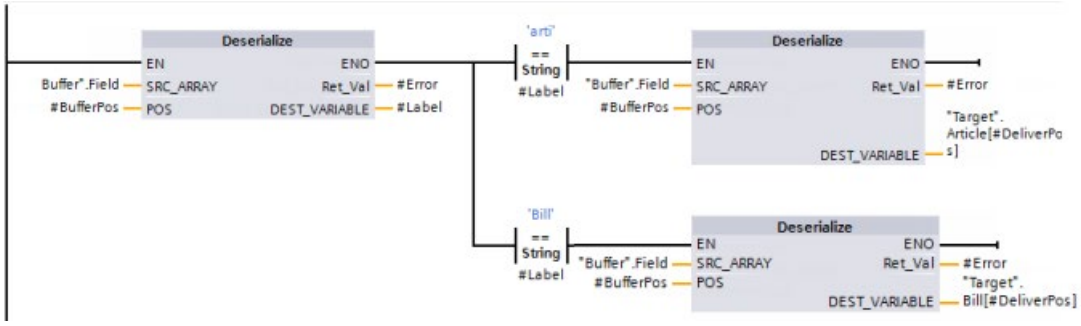
The following example shows how the instruction works:

Network 1:



The "MOVE" instruction moves the value "0" to the "#BufferPos" data block tag. The Deserialize instruction then deserializes the sequential representation of the customer data from the "Buffer" data block and writes it to the "Target" data block. The Deserialize instruction calculates the number of bytes that the converted data uses and stores it in the "#BufferPos" data block tag.

Network 2:



The "Deserialize" instruction deserializes the sequential representation of the data stream pointed to by "Buffer" and writes the characters to the "#Label" operand. The logic compares the characters using the comparison instructions "arti" and "Bill". If the comparison for "arti" = TRUE, the data is article data that is to be deserialized and written to the "Article" data structure of the "Target" data block. If the comparison for "Bill" = TRUE, the data is billing data that is to be deserialized and written to the "Bill" data structure of the "Target" data block.

Function block (or Function) interface:

Name	Data type
Input	
DeliverPos	Int
Output	
InOut	
Static	
Temp	
BufferPos	DInt
Error	Int
Label	String[4]

Custom PLC data types:

The structure of the two PLC data types (UDTs) for this example are as follows:

Article

	Name	Data type
1	Number	DInt
2	Declaration	String
3	Colli	Int

Client

	Name	Data type
1	Title	Int
2	Firstname	String[10]
3	Surname	String[10]

Data blocks:

The two data blocks for this example are as follows:

Target

	Name	Data type
1	Static	
2	Client	"Client"
3	Article	Array[0..10] of "Article"
4	Bill	Array[0..10] of Int

Buffer

	Name	Data type
1	Static	
2	Field	Array[0..294] of Byte

8.6.3 Serialize

You can use the "Serialize" instruction to convert several PLC data types (UDTs) to a sequential representation without any loss of structure.

You can use the instruction to temporarily save multiple structured data items from your program to a buffer, for example to a global data block, and send them to another CPU. The memory area in which the converted PLC data types are stored must have the ARRAY of BYTE data type and be declared with standard access. Make sure that there is enough memory space prior to the conversion.

The POS parameter contains information about the number of bytes that the converted PLC data types use.

Note

If you only want to send a single PLC data type (UDT), you can use the instruction "TSEND: Send data via communication connection".

Table 8- 77 SERIALIZE instruction

LAD / FBD	SCL	Description

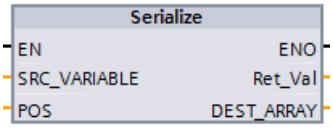
	`ret_val := Serialize(`
	`  SRC_VARIABLE=>_variant_in_,`
	`  DEST_ARRAY:=_variant_out_,`
	`  POS:=_dint_inout_);`
		Converts a PLC data type (UDT) to a sequential representation.

Table 8- 78 Parameters for the SERIALIZE instruction

Parameter	Type	Data type	Description
SRC_VARIABLE	IN	Variant	PLC data type (UDT) that is to be converted to a serial representation
DEST_ARRAY	INOUT	Variant	Data block in which the generated data stream is to be stored
POS	INOUT	DInt	Number of bytes that the converted PLC data types use. The calculated POS parameter is zero-based.
RET_VAL	OUT	Int	Error information

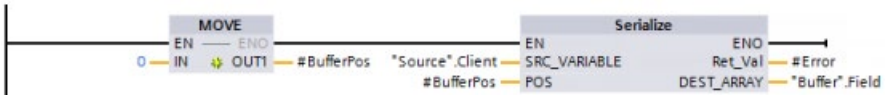
Table 8- 79 RET_VAL parameter

RET_VAL* (W#16#...)	Description
0000	No error
80B0	The memory areas for the SRC_VARIABLE and DEST_ARRAY parameters overlap.
8150	The Variant data type at the SRC_VARIABLE parameter contains no value.
8152	Code generation error at the SRC_VARIABLE parameter.
8236	The data block at the DEST_ARRAY parameter is not a block with standard access.
8250	The Variant data type at the DEST_ARRAY parameter contains no value.
8252	Code generation error at the DEST_ARRAY parameter.
8253	There is not enough free memory available at the DEST_ARRAY parameter.
8254	Invalid data type at the DEST_VARIABLE parameter.
8382	The value at parameter POS is outside the limits of the array.
*You can view the error codes as either integer or hexadecimal in the program editor.	

Example: Serialize instruction

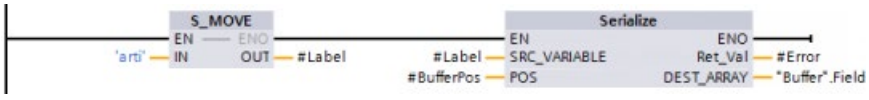
The following example shows how the instruction works:

Network 1:



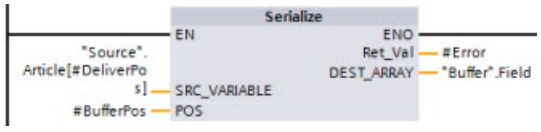
The "MOVE" instruction moves the value "0" to the "#BufferPos" parameter. The "Serialize" instruction serializes the customer data from the "Source" data block and writes it in sequential representation to the "Buffer" data block. The instruction stores the number of bytes used by the sequential representation in the "#BufferPos" parameter.

Network 2:



The logic now inserts some separator text to make it easier to deserialize the sequential representation later. The "S_MOVE" instruction moves the text string "arti" to the "#Label" parameter. The "Serialize" instruction writes these characters after the source client data to the "Buffer" data block. The instruction adds the number of bytes in the text string "arti" to the number already stored in the "#BufferPos" parameter.

Network 3:



The "Serialize" instruction serializes the data of a specific article, which is calculated in runtime, from the "Source" data block and writes it in sequential representation to the "Buffer" data block after the "arti" characters

Block Interface:

	Name	Data type
	Input	
	DeliverPos	Int
	Output	
	InOut	
	Static	
	Temp	
	BufferPos	DInt
	Error	Int
	Label	String[4]

Custom PLC data types:

The structure of the two PLC data types (UDTs) for this example are as follows:

Article

	Name	Data type
1	Number	DInt
2	Declaration	String
3	Colli	Int

Client

	Name	Data type
1	Title	Int
2	Firstname	String[10]
3	Surname	String[10]

Data blocks:

The two data blocks for this example are as follows:

Source

	Name	Data type
1	Static	
2	Client	"Client"
3	Article	Array[0..10] of "Article"

Buffer

	Name	Data type
1	Static	
2	Field	Array[0..294] of Byte

8.6.4 FILL_BLK (Fill block) and UFILL_BLK (Fill block uninterruptible)

Table 8- 80 FILL_BLK and UFILL_BLK instructions

LAD / FBD	SCL	Description

	`FILL_BLK(`
	`  in:=_variant_in,`
	`  count:=int,`
	`  out=>_variant_out);`
		Interruptible fill instruction: Fills an address range with copies of a specified data element

	`UFILL_BLK(`
	`  in:=_variant_in,`
	`  count:=int,`
	`  out=>_variant_out);`
		Uninterruptible fill instruction: Fills an address range with copies of a specified data element

Table 8- 81 Data types for parameters

Parameter	Data type	Description
IN	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Data source address
COUNT	UDint, USInt, UInt	Number of data elements to copy
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Data destination address

Note

Rules for data fill operations

- To fill with the BOOL data type, use SET_BF, RESET_BF, R, S, or output coil (LAD)
- To fill with a single elementary data type, use MOVE
- To fill an array with an elementary data type, use FILL_BLK or UFILL_BLK
- To fill a single character in a string, use MOVE
- The FILL_BLK and UFILL_BLK instructions cannot be used to fill arrays in the I, Q, or M memory areas.

The FILL_BLK and UFILL_BLK instructions copy the source data element IN to the destination where the initial address is specified by the parameter OUT. The copy process repeats and a block of adjacent addresses is filled until the number of copies is equal to the COUNT parameter.

FILL_BLK and UFILL_BLK instructions differ in how interrupts are handled:

- Interrupt events are **queued and processed** during FILL_BLK execution. Use the FILL_BLK instruction when the data at the move destination address is not used within an interrupt OB subprogram or, if used, the destination data does not have to be consistent.
- Interrupt events are **queued but not processed** until UFILL_BLK execution is complete. Use the UFILL_BLK instruction when the move operation must be completed and the destination data consistent, before the execution of an interrupt OB subprogram.

Table 8- 82 ENO status

ENO	Condition	Result
1	No error	The IN element was successfully copied to all COUNT destinations.
0	The destination (OUT) range exceeds the available memory area	Elements that fit are copied. No partial elements are copied.

8.6.5 SWAP (Swap bytes)

Table 8- 83 SWAP instruction

LAD / FBD	SCL	Description
	`out := SWAP(in);`	Reverses the byte order for two-byte and four-byte data elements. No change is made to the bit order within each byte. ENO is always TRUE following execution of the SWAP instruction.

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 84 Data types for the parameters

Parameter	Data type	Description
IN	Word, DWord	Ordered data bytes IN
OUT	Word, DWord	Reverse ordered data bytes OUT

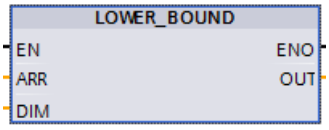
Example 1	Parameter IN = MB0 (before execution)		Parameter OUT = MB4, (after execution)	
Address	MW0	MB1	MW4	MB5
W#16#1234	12	34	34	12
WORD	MSB	LSB	MSB	LSB

Example 2	Parameter IN = MB0 (before execution)				Parameter OUT = MB4, (after execution)			
Address	MD0	MB1	MB2	MB3	MD4	MB5	MB6	MB7
DW#16#12345678	12	34	56	78	78	56	34	12
DWORD	MSB			LSB	MSB			LSB

8.6.6 LOWER_BOUND: (Read out ARRAY low limit)

Table 8- 85 LOWER_BOUND instruction

LAD / FBD	SCL	Description

	`out := LOWER_BOUND(`
	`  ARR:=_variant_in_,`
	`  DIM:=_udint_in_);`
		You can declare tags with ARRAY[*] in the block interface. For these local tags, you can read out the limits of the ARRAY. You will need to specify the required dimension at the DIM parameter.
		The LOWER_BOUND (Read out ARRAY low limit). instruction lets you read out the variable low limit of the ARRAY.

Parameters

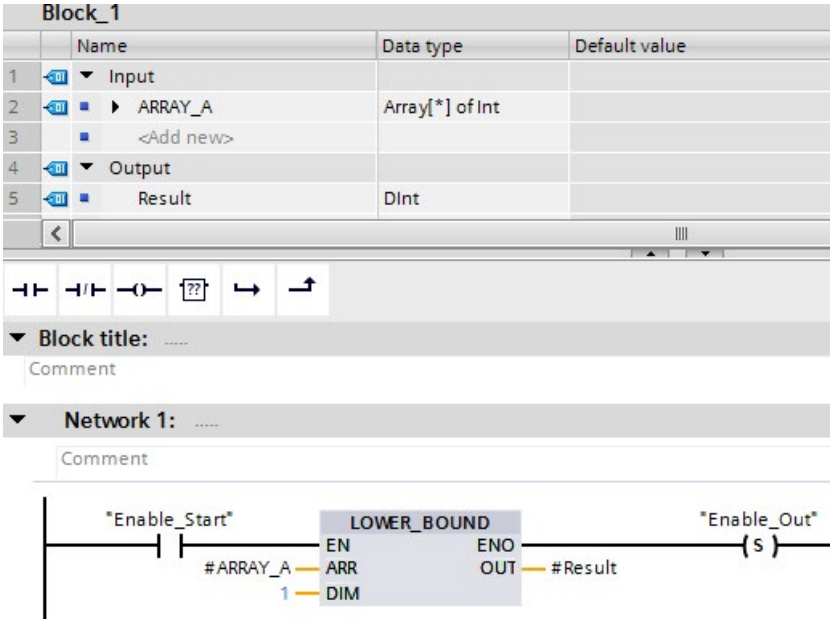
The following table shows the parameters of the instruction "LOWER_BOUND: Read out ARRAY low limit":

Parameters	Declaration	Data type	Memory area	Description
EN	Input	BOOL	I, Q, M, D, L	Enable input
ENO	Output	BOOL	I, Q, M, D, L	Enable output ENO has the signal state "0" if one of the following conditions applies: • The EN enable input has the signal state "0". • The dimension specified at input DIM does not exist.
ARR	Input	ARRAY [*]	FB: Section InOut FC: Sections Input and InOut	ARRAY of which the variable low limit is to be read.
DIM	Input	UDINT	I, Q, M, D, L or constant	Dimension of the ARRAY of which the variable low limit is to be read.
OUT	Output	DINT	I, Q, M, D, L	Result

You can find additional information on valid data types under "Data types (Page 122)":

Example

In the function (FC) block interface, the input parameter ARRAY_A is a one-dimensional array with variable dimensions.

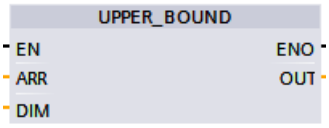


If the "Enable_Start" operand returns signal state "1", the CPU executes the LOWER_BOUND instruction. It reads out the variable low limit of the ARRAY #ARRAY_A from the one-dimensional array. If the instruction executes without errors, it sets operand "Enable_Out" and sets the "Result" operand to the low limit of the array.

8.6.7 UPPER_BOUND: (Read out ARRAY high limit)

Table 8- 86 LOWER_BOUND instruction

LAD / FBD	SCL	Description

	`out := UPPER_BOUND(`
	`  ARR:=_variant_in_,`
	`  DIM:=_udint_in_);`
		You can declare tags with ARRAY[*] in the block interface. For these local tags, you can read out the limits of the ARRAY. You will need to specify the required dimension at the DIM parameter.
		The UPPER_BOUND (Read out ARRAY high limit) instruction lets you read out the variable high limit of the ARRAY.

Parameters

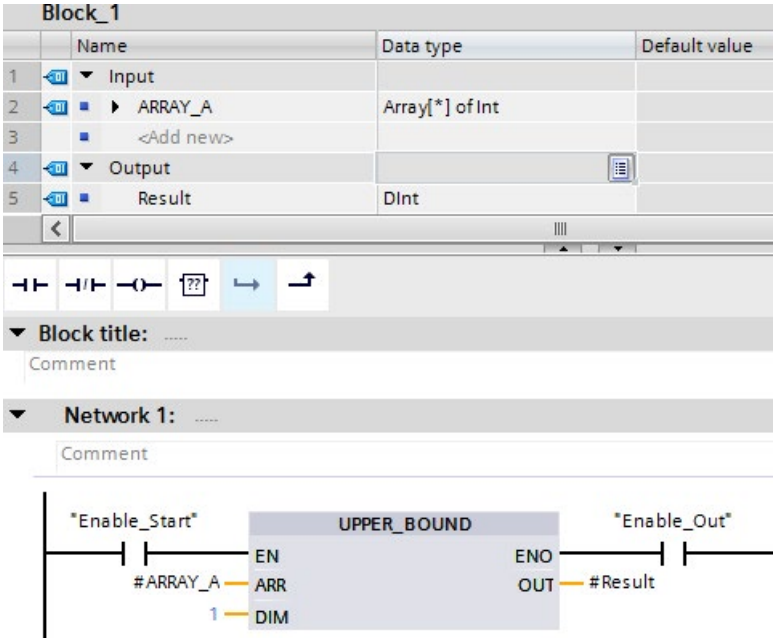
The following table shows the parameters of the instruction "UPPER_BOUND: Read out ARRAY high limit":

Parameters	Declaration	Data type	Memory area	Description
EN	Input	BOOL	I, Q, M, D, L	Enable input
ENO	Output	BOOL	I, Q, M, D, L	Enable output
ARR	Input	ARRAY [*]	FB: Section InOut FC: Sections Input and InOut	ARRAY of which the variable high limit is to be read.
DIM	Input	UDINT	I, Q, M, D, L or constant	Dimension of the ARRAY of which the variable high limit is to be read.
OUT	Output	DINT	I, Q, M, D, L	Result

You can find additional information on valid data types under "Data types (Page 122)":

Example

In the function (FC) block interface, the input parameter ARRAY_A is a one-dimensional array with variable dimensions.



If the "Enable_Start" operand returns signal state "1", the CPU executes the instruction. It reads out the variable high limit of the ARRAY #ARRAY_A from the one-dimensional array. If the instruction executes without errors, it sets operand "Enable_Out" and sets the "Result" operand.

8.6.8 Read / Write memory instructions

8.6.8.1 PEEK and POKE (SCL only)

SCL provides PEEK and POKE instructions that allow you to read from or write to data blocks, I/O, or memory. You provide parameters for specific byte offsets or bit offsets for the operation.

Note

To use the PEEK and POKE instructions with data blocks, you must use standard (not optimized) data blocks. Also note that the PEEK and POKE instructions merely transfer data. They have no knowledge of data types at the addresses.

```
PEEK(area:=_in_,
     dbNumber:=_in_,
     byteOffset:=_in_);
```

Reads the byte referenced by byteOffset of the referenced data block, I/O or memory area.

Example referencing data block:

```
%MB100 := PEEK(area:=16#84,
dbNumber:=1, byteOffset:=#i);
```

Example referencing IB3 input:

```
%MB100 := PEEK(area:=16#81,
dbNumber:=0, byteOffset:=#i); // when
#i = 3
```

```
PEEK_WORD(area:=_in_,
     dbNumber:=_in_,
     byteOffset:=_in_);
```

Reads the word referenced by byteOffset of the referenced data block, I/O or memory area.

Example:

```
%MW200 := PEEK_WORD(area:=16#84,
dbNumber:=1, byteOffset:=#i);
```

```
PEEK_DWORD(area:=_in_,
     dbNumber:=_in_,
     byteOffset:=_in_);
```

Reads the double word referenced by byteOffset of the referenced data block, I/O or memory area.

Example:

```
%MD300 := PEEK_DWORD(area:=16#84,
dbNumber:=1, byteOffset:=#i);
```

```
PEEK_BOOL(area:=_in_,
     dbNumber:=_in_,
     byteOffset:=_in_,
     bitOffset:=_in_);
```

Reads a Boolean referenced by the bitOffset and byteOffset of the referenced data block, I/O or memory area

Example:

```
%MB100.0 := PEEK_BOOL(area:=16#84,
dbNumber:=1, byteOffset:=#ii,
bitOffset:=#j);
```

```
POKE(area:=_in_,
     dbNumber:=_in_,
     byteOffset:=_in_,
     value:=_in_);
```

Writes the value (Byte, Word, or DWord) to the referenced byteOffset of the referenced data block, I/O or memory area

Example referencing data block:

```
POKE(area:=16#84, dbNumber:=2,
byteOffset:=3, value:="Tag_1");
```

Example referencing QB3 output:

```
POKE(area:=16#82, dbNumber:=0,
byteOffset:=3, value:="Tag_1");
```

```
POKE_BOOL(area:=_in_,
     dbNumber:=_in_,
     byteOffset:=_in_,
     bitOffset:=_in_,
     value:=_in_);
```

Writes the Boolean value to the referenced bitOffset and byteOffset of the referenced data block, I/O or memory area

Example:

```
POKE_BOOL(area:=16#84, dbNumber:=2,
byteOffset:=3, bitOffset:=5, val-
ue:=0);
```

```
POKE_BLK(area_src:=_in_,
     dbNumber_src:=_in_,
     byteOffset_src:=_in_,
     area_dest:=_in_,
     dbNumber_dest:=_in_,
     byteOffset_dest:=_in_,
     count:=_in_);
```

Writes "count" number of bytes starting at the referenced byte Offset of the referenced source data block, I/O or memory area to the referenced byteOffset of the referenced destination data block, I/O or memory area

Example:

```
POKE_BLK(area_src:=16#84,
dbNumber_src:=#src_db, byteOff-
set_src:=#src_byte, area_dest:=16#84,
dbNumber_dest:=#src_db, byteOff-
set_dest:=#src_byte, count:=10);
```

For PEEK and POKE instructions, the following values for the "area", "area_src" and "area_dest" parameters are applicable. For areas other than data blocks, the dbNumber parameter must be 0.

16#81	I
16#82	Q
16#83	M
16#84	DB

8.6.8.2 Read and write big and little Endian instructions (SCL)

The S7-1200 CPU provides SCL instructions for reading and writing data in little endian format and in big endian format. Little endian format means that the byte with the least significant bit is in the lowest memory address. Big endian format means that the byte with the most significant bit is in the lowest memory address.

The four SCL instructions for reading and writing data in little endian and big endian format are as follows:

- READ_LITTLE (Read data in little endian format)
- WRITE_LITTLE (Write data in little endian format)
- READ_BIG (Read data in big endian format)
- WRITE_BIG (Write data in big endian format)

Table 8- 87 Read and write big and little endian instructions

LAD / FBD	SCL	Description

Not available	`READ_LITTLE(`
	`  src_array:=_variant_in_,`
	`  dest_Variable =>_out_,`
	`  pos:=_dint_inout)`
		Reads data from a memory area and writes it to a single tag in little endian byte format.

Not available	`WRITE_LITTLE(`
	`  src_variable:=_in_,`
	`  dest_array =>_variant_inout_,`
	`  pos:=_dint_inout)`
		Writes data from a single tag to a memory area in little endian byte format.

Not available	`READ_BIG(`
	`  src_array:=_variant_in_,`
	`  dest_Variable =>_out_,`
	`  pos:=_dint_inout)`
		Reads data from a memory area and writes it to a single tag in big endian byte format.

Not available	`WRITE_BIG(`
	`  src_variable:=_in_,`
	`  dest_array =>_variant_inout_,`
	`  pos:=_dint_inout)`
		Writes data from a single tag to a memory area in big endian byte format.

Table 8- 88 Parameters for the READ_LITTLE and READ_BIG instructions

Parameter	Data type	Description
src_array	Array of Byte	Memory area from which to read data
dest_Variable	Bit strings, integers, floating-point numbers, timers, date and time, character strings	Destination variable at which to write data
pos	DINT	Zero-based position from which to start reading data from the src_array input.

Table 8- 89 Parameters for the WRITE_LITTLE and WRITE_BIG instructions

Parameter	Data type	Description
src_variable	Bit strings, integers, floating-point numbers, LDT, TOD, LTOD, DATA, Char, WChar	Source data from tag
dest_array	Array of Byte	Memory area at which to write data
pos	DINT	Zero-based position at which to start writing data into the dest_array output.

Table 8- 90 RET_VAL parameter

RET_VAL* (W#16#...)	Description
0000	No error
80B4	The SRC_ARRAY or DEST_ARRAY is not an Array of Byte
8382	The value at parameter POS is outside the limits of the array.
8383	The value at parameter POS is within the limits of the Array but the size of the memory area exceeds the high limit of the array.
*You can view the error codes as either integer or hexadecimal in the program editor.	

8.6.9 Variant instructions

8.6.9.1 VariantGet (Read VARIANT tag value)

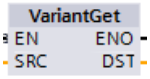
You can use the "Read out Variant tag value" instruction to read the value of the tag to which the Variant pointer at the SRC parameter points and write it in the tag at the DST parameter.

The SRC parameter has the Variant data type. Any data type except for Variant can be specified at the DST parameter.

The data type of the tag at the DST parameter must match the data type to which the Variant points.

Table 8- 91 VariantGet instruction

LAD / FBD	SCL	Description

	`VariantGet(`
	`  SRC:=_variant_in_,`
	`  DST=>_variant_out_);`
		Reads the tag pointed to by the SRC parameter and writes it to the tag at the DST parameter

Note

To copy structures and arrays, you can use the "MOVE_BLK_VARIANT: Move block" instruction.

Table 8- 92 Parameters for the VariantGet instruction

Parameter	Data type	Description
SRC	Variant	Pointer to source data
DST	Bit strings, integers, floating-point numbers, timers, date and time, character strings, ARRAY elements, PLC data types	Destination at which to write data

Table 8- 93 ENO status

ENO	Condition	Result
1	No error	Instruction copied the tag data pointed to by SRC to the DST tag.
0	Enable input EN has the signal state "0" or the data types do not correspond.	Instruction copied no data.

8.6.9.2 VariantPut (Write VARIANT tag value)

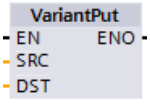
You can use the "Write VARIANT tag value" instruction to write the value of the tag at the SRC parameter to the tag at the DST parameter to which the VARIANT points.

The DST parameter has the VARIANT data type. Any data type except for VARIANT can be specified at the SRC parameter.

The data type of the tag at the SRC parameter must match the data type to which the VARIANT points.

Table 8- 94 VariantPut instruction

LAD / FBD	SCL	Description

	`VariantPut(`
	`  SRC:=_variant_in_,`
	`  DST=>_variant_in_);`
		Writes the tag referenced by the SRC parameter to the variant pointed to by the DST parameter

Note

To copy structures and ARRAYs, you can use the "MOVE_BLK_VARIANT: Move block" instruction.

Table 8- 95 Parameters for the VariantPut instruction

Parameter	Data type	Description
SRC	Bit strings, integers, floating-point numbers, timers, date and time, character strings, ARRAY elements, PLC data types	Pointer to source data
DST	Variant	Destination at which to write data

Table 8- 96 ENO status

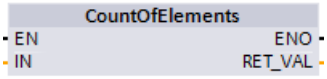
ENO	Condition	Result
1	No error	Instruction copied the SRC tag data to the DST tag.
0	Enable input EN has the signal state "0" or the data types do not correspond.	Instruction copied no data.

8.6.9.3 CountOfElements (Get number of ARRAY elements)

You can use the "Get number of ARRAY elements" instruction to query how many Array elements are in a tag pointed to by a Variant.

If it is a one-dimensional ARRAY, the instruction returns the difference between the high and low limit +1 is output. If it is a multi-dimensional ARRAY, the instruction returns the product of all dimensions.

Table 8- 97 CountOfElements instruction

LAD / FBD	SCL	Description
	`Result := CountOfElements( _variant_in_);`	Counts the number of array elements at the array pointed to by the IN parameter.

Note

If the Variant points to an Array of Bool, the instruction counts the fill elements to the nearest byte boundary. For example, the instruction returns 8 as the count for an Array[0..1] of Bool.

Table 8- 98 Parameters for the CountOfElements instruction

Parameter	Data type	Description
IN	Variant	Tag with array elements to be counted
RET_VAL	UDint	Instruction result

Table 8- 99 ENO status

ENO	Condition	Result
1	No error	Instruction returns the number of array elements.
0	Enable input EN has the signal state "0" or the Variant does not point to an array.	Instruction returns 0.

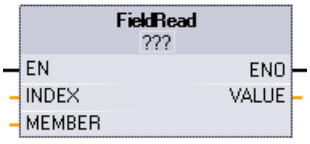
8.6.10 Legacy instructions

8.6.10.1 FieldRead (Read field) and FieldWrite (Write field) instructions

Note

STEP 7 V10.5 **did not support** a variable reference as an array index or multi-dimensional arrays. The FieldRead and FieldWrite instructions were used to provide variable array index operations for a one-dimensional array. STEP 7 V11 and greater **do support** a variable as an array index and multi-dimensional arrays. FieldRead and FieldWrite are included in STEP 7 V11 and greater for backward compatibility with programs that have used these instructions.

Table 8- 100 FieldRead and FieldWrite instructions

LAD / FBD	SCL	Description
	`value := member[index];`	FieldRead reads the array element with the index value INDEX from the array whose first element in specified by the MEMBER parameter. The value of the array element is transferred to the location specified at the VALUE parameter.
	`member[index] := value;`	WriteField transfers the value at the location specified by the VALUE parameter to the array whose first element is specified by the MEMBER parameter. The value is transferred to the array element whose array index is specified by the INDEX parameter.

1 For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 101 Data types for parameters

Parameter and type		Data type	Description
Index	Input	DInt	The index number of the array element to be read or written to
Member [1]	Input	Binary numbers, integers, floating-point numbers, timers, DATE, TOD, CHAR and WCHAR as components of an ARRAY tag	Location of the first element in a one- dimension array defined in a global data block or block interface. For example: If the array index is specified as [-2..4], then the index of the first element is -2 and not 0.
Value [1]	Out	Binary numbers, integers, floating-point numbers, timers, DATE, TOD, CHAR, WCHAR	Location to which the specified array element is copied (FieldRead) Location of the value that is copied to the specified array element (FieldWrite)

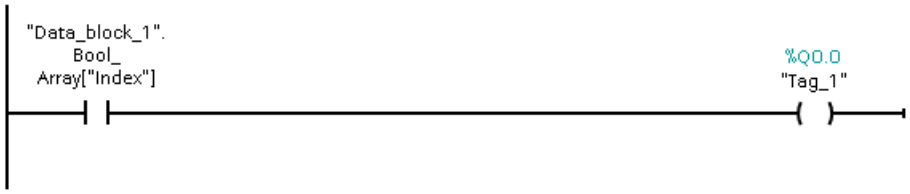
1 The data type of the array element specified by the MEMBER parameter and the VALUE parameter must have the same data type.

The enable output ENO = 0, if one of the following conditions applies:

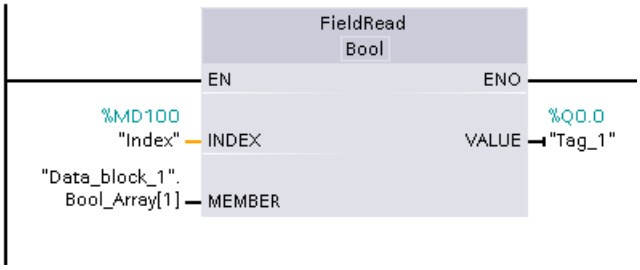
- The EN input has signal state "0"
- The array element specified at the INDEX parameter is not defined in the array referenced at MEMBER parameter
- Errors such as an overflow occur during processing

Example: Accessing data by array indexing

To access elements of an array with a variable, simply use the variable as an array index in your program logic. For example, the network below sets an output based on the Boolean value of an array of Booleans in "Data_block_1" referenced by the PLC tag "Index".



The logic with the variable array index is equivalent to the former method using the FieldRead instruction:



FieldWrite and FieldRead instructions can be replaced with variable array indexing logic.

SCL has no FieldRead or FieldWrite instructions, but supports indirect addressing of an array with a variable:

```
#Tag_1 := "Data_block_1".Bool_Array[#Index];
```

8.7 Conversion operations

8.7.1 CONV (Convert value)

Table 8- 102 Convert (CONV) instruction

LAD / FBD	SCL	Description
	`out := <data type in>_TO_<data type out>(in);`	Converts a data element from one data type to another data type.

1 For LAD and FBD: Click the "???" and select the data types from the drop-down menu.

2 For SCL: Construct the conversion instruction by identifying the data type for the input parameter (in) and output parameter (out). For example, DWORD_TO_REAL converts a DWord value to a Real value.

Table 8- 103 Data types for the parameters

Parameter	Data type	Description
IN	Bit string[1], SInt, USInt, Int, UInt, DInt, UDInt, Real, LReal, BCD16, BCD32, Char, WChar	Input value
OUT	Bit string[1], SInt, USInt, Int, UInt, DInt, UDInt, Real, LReal, BCD16, BCD32, Char, WChar	Input value converted to a new data type

1 The instruction does not allow you to select Bit strings (Byte, Word, DWord). To enter an operand of data type Byte, Word, or DWord for a parameter of the instruction, select an unsigned integer with the same bit length. For example, select USInt for a Byte, UInt for a Word, or UDInt for a DWord.

After you select the (convert from) data type, a list of possible conversions is shown in the (convert to) dropdown list. Conversions from and to BCD16 are restricted to the Int data type. Conversions from and to BCD32 are restricted to the DInt data type.

Table 8- 104 ENO status

ENO	Description	Result OUT
1	No error	Valid result
0	IN is +/- INF or +/- NaN	+/- INF or +/- NaN
0	Result exceeds valid range for OUT data type	OUT is set to the IN value

8.7.2 Conversion instructions for SCL

Conversion instructions for SCL

Table 8- 105 Conversion from a Bool, Byte, Word, or DWord

Data type	Instruction	Result
Bool	**BOOL_TO_BYTE, BOOL_TO_WORD, BOOL_TO_DWORD, BOOL_TO_INT, BOOL_TO_DINT**	The value is transferred to the least significant bit of the target data type.
Byte	**BYTE_TO_BOOL**	The least significant bit is transferred into the destination data type.
	BYTE_TO_WORD, BYTE_TO_DWORD	The value is transferred to the least significant byte of the target data type.
	BYTE_TO_SINT, BYTE_TO_USINT	The value is transferred to the target data type.
	BYTE_TO_INT, BYTE_TO_UINT, BYTE_TO_DINT, BYTE_TO_UDINT	The value is transferred to the least significant byte of the target data type.
Word	**WORD_TO_BOOL**	The least significant bit is transferred into the destination data type.
	WORD_TO_BYTE	The least significant byte of the source value is transferred to the target data type
	WORD_TO_DWORD	The value is transferred to the least significant word of the target data type.
	WORD_TO_SINT, WORD_TO_USINT	The least significant byte of the source value is transferred to the target data type.
	WORD_TO_INT, WORD_TO_UINT	The value is transferred to the target data type.
	WORD_TO_DINT, WORD_TO_UDINT	The value is transferred to the least significant word of the target data type.
DWord	**DWORD_TO_BOOL**	The least significant bit is transferred into the destination data type.
	DWORD_TO_BYTE, DWORD_TO_WORD, DWORD_TO_SINT	The least significant byte of the source value is transferred to the target data type.
	DWORD_TO_USINT, DWORD_TO_INT, DWORD_TO_UINT	The least significant word of the source value is transferred to the target data type.
	DWORD_TO_DINT, DWORD_TO_UDINT, DWORD_TO_REAL	The value is transferred to the target data type.

Table 8- 106 Conversion from a short integer (SInt or USInt)

Data type	Instruction	Result
SInt	SINT_TO_BOOL	The least significant bit is transferred into the destination data type.
	SINT_TO_BYTE	The value is transferred to the target data type
	SINT_TO_WORD, SINT_TO_DWORD	The value is transferred to the least significant byte of the target data type.
	SINT_TO_INT, SINT_TO_DINT, SINT_TO_USINT, SINT_TO_UINT, SINT_TO_UDINT, SINT_TO_REAL, SINT_TO_LREAL, SINT_TO_CHAR, SINT_TO_STRING	The value is converted.
USInt	USINT_TO_BOOL	The least significant bit is transferred into the destination data type.
	USINT_TO_BYTE	The value is transferred to the target data type
	USINT_TO_WORD, USINT_TO_DWORD, USINT_TO_INT, USINT_TO_UINT, USINT_TO_DINT, USINT_TO_UDINT	The value is transferred to the least significant byte of the target data type.
	USINT_TO_SINT, USINT_TO_REAL, USINT_TO_LREAL, USINT_TO_CHAR, USINT_TO_STRING	The value is converted.

Table 8- 107 Conversion from an integer (Int or UInt)

Data type	instruction	Result
Int	INT_TO_BOOL	The least significant bit is transferred into the destination data type.
	INT_TO_BYTE, INT_TO_DWORD, INT_TO_SINT, INT_TO_USINT, INT_TO_UINT, INT_TO_UDINT, INT_TO_REAL, INT_TO_LREAL, INT_TO_CHAR, INT_TO_STRING	The value is converted.
	INT_TO_WORD	The value is transferred to the target data type.
	INT_TO_DINT	The value is transferred to the least significant byte of the target data type.
UInt	UINT_TO_BOOL	The least significant bit is transferred into the destination data type.
	UINT_TO_BYTE, UINT_TO_SINT, UINT_TO_USINT, UINT_TO_INT, UINT_TO_REAL, UINT_TO_LREAL, UINT_TO_CHAR, UINT_TO_STRING	The value is converted.
	UINT_TO_WORD, UINT_TO_DATE	The value is transferred to the target data type.
	UINT_TO_DWORD, UINT_TO_DINT, UINT_TO_UDINT	The value is transferred to the least significant byte of the target data type.

Table 8- 108 Conversion from a double integer (Dint or UDInt)

Data type	Instruction	Result
DInt	**DINT_TO_BOOL**	The least significant bit is transferred into the destination data type.
	DINT_TO_BYTE, DINT_TO_WORD, DINT_TO_SINT, DINT_TO_USINT, DINT_TO_INT, DINT_TO_UINT, DINT_TO_UDINT, DINT_TO_REAL, DINT_TO_LREAL, DINT_TO_CHAR, DINT_TO_STRING	The value is converted.
	DINT_TO_DWORD, DINT_TO_TIME	The value is transferred to the target data type.
UDInt	**UDINT_TO_BOOL**	The least significant bit is transferred into the destination data type.
	UDINT_TO_BYTE, UDINT_TO_WORD, UDINT_TO_SINT, UDINT_TO_USINT, UDINT_TO_INT, UDINT_TO_UINT, UDINT_TO_DINT, UDINT_TO_REAL, UDINT_TO_LREAL, UDINT_TO_CHAR, UDINT_TO_STRING	The value is converted.
	UDINT_TO_DWORD, UDINT_TO_TOD	The value is transferred to the target data type.

Table 8- 109 Conversion from a Real number (Real or LReal)

Data type	Instruction	Result
Real	**REAL_TO_DWORD, REAL_TO_LREAL**	The value is transferred to the target data type.
	REAL_TO_SINT, REAL_TO_USINT, REAL_TO_INT, REAL_TO_UINT, REAL_TO_DINT, REAL_TO_UDINT, REAL_TO_STRING	The value is converted.
LReal	**LREAL_TO_SINT, LREAL_TO_USINT, LREAL_TO_INT, LREAL_TO_UINT, LREAL_TO_DINT, LREAL_TO_UDINT, LREAL_TO_REAL, LREAL_TO_STRING**	The value is converted.

Table 8- 110 Conversion from Time, DTL, TOD or Date

Data type	Instruction	Result
Time	**TIME_TO_DINT**	The value is transferred to the target data type.
DTL	**DTL_TO_DATE, DTL_TO_TOD**	The value is converted.
TOD	**TOD_TO_UDINT**	The value is converted.
Date	**DATE_TO_UINT**	The value is converted.

Table 8- 111 Conversion from a Char or String

Data type	Instruction	Result
Char	`CHAR_TO_SINT, CHAR_TO_USINT, CHAR_TO_INT, CHAR_TO_UINT, CHAR_TO_DINT, CHAR_TO_UDINT`	The value is converted.
	`CHAR_TO_STRING`	The value is transferred to the first character of the string.
String	`STRING_TO_SINT, STRING_TO_USINT, STRING_TO_INT, STRING_TO_UINT, STRING_TO_DINT, STRING_TO_UDINT, STRING_TO_REAL, STRING_TO_LREAL`	The value is converted.
	`STRING_TO_CHAR`	The first character of the string is copied to the Char.

8.7.3 ROUND (Round numerical value) and TRUNC (Truncate numerical value)

Table 8- 112 ROUND and TRUNC instructions

LAD / FBD	SCL	Description
	`out := ROUND (in);`	Converts a real number to an integer. For LAD/FBD, you click the "???" in the instruction box to select the data type for the output, for example "DInt". For SCL, the default data type for the output of the ROUND instruction is DINT. To round to another output data type, enter the instruction name with the explicit name of the data type, for example, ROUND_REAL or ROUND_LREAL. The real number fraction is rounded to the nearest integer value (IEEE - round to nearest). If the number is exactly one-half the span between two integers (for example, 10.5), then the number is rounded to the even integer. For example: • ROUND (10.5) = 10 • ROUND (11.5) = 12
	`out := TRUNC(in);`	TRUNC converts a real number to an integer. The fractional part of the real number is truncated to zero (IEEE - round to zero).

[1] For LAD and FBD: Click the "???" (by the instruction name) and select a data type from the drop-down menu.

Table 8- 113 Data types for the parameters

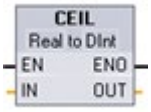
Parameter	Data type	Description
IN	Real, LReal	Floating point input
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Rounded or truncated output

Table 8- 114 ENO status

ENO	Description	Result OUT
1	No error	Valid result
0	IN is +/- INF or +/- NaN	+/- INF or +/- NaN

8.7.4 CEIL and FLOOR (Generate next higher and lower integer from floating-point number)

Table 8- 115 CEIL and FLOOR instructions

LAD / FBD	SCL	Description
	`out := CEIL(in);`	Converts a real number (Real or LReal) to the closest integer greater than or equal to the selected real number (IEEE "round to +infinity").
	`out := FLOOR(in);`	Converts a real number (Real or LReal) to the closest integer smaller than or equal to the selected real number (IEEE "round to -infinity").

[1] For LAD and FBD: Click the "???" (by the instruction name) and select a data type from the drop-down menu.

Table 8- 116 Data types for the parameters

Parameter	Data type	Description
IN	Real, LReal	Floating point input
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Converted output

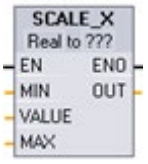
Table 8- 117 ENO status

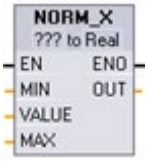
ENO	Description	Result OUT
1	No error	Valid result
0	IN is +/- INF or +/- NaN	+/- INF or +/- NaN

8.7.5 SCALE_X (Scale) and NORM_X (Normalize)

Table 8- 118 SCALE_X and NORM_X instructions

LAD / FBD	SCL	Description

	`out :=SCALE_X(min:=_in_,`
	`value:=_in_,`
	`max:=_in_);`
		Scales the normalized real parameter VALUE where (0.0 <= VALUE <= 1.0) in the data type and value range specified by the MIN and MAX parameters:
		OUT = VALUE (MAX - MIN) + MIN

	`out :=NORM_X(min:=_in_,`
	`value:=_in_,`
	`max:=_in_);`
		Normalizes the parameter VALUE inside the value range specified by the MIN and MAX parameters:
		OUT = (VALUE - MIN) / (MAX - MIN),
		where (0.0 <= OUT <= 1.0)

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 119 Data types for the parameters

Parameter	Data type[1]	Description
MIN	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Input minimum value for range
VALUE	SCALE_X: Real, LReal NORM_X: SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Input value to scale or normalize
MAX	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Input maximum value for range
OUT	SCALE_X: SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal NORM_X: Real, LReal	Scaled or normalized output value

[1] For SCALE_X: Parameters MIN, MAX, and OUT must be the same data type.
For NORM_X: Parameters MIN, VALUE, and MAX must be the same data type.

Note

SCALE_X parameter VALUE should be restricted to (0.0 <= VALUE <= 1.0)

If parameter VALUE is less than 0.0 or greater than 1.0:

- The linear scaling operation can produce OUT values that are less than the parameter MIN value or above the parameter MAX value for OUT values that fit within the value range of the OUT data type. SCALE_X execution sets ENO = TRUE for these cases.
- It is possible to generate scaled numbers that are not within the range of the OUT data type. For these cases, the parameter OUT value is set to an intermediate value equal to the least-significant portion of the scaled real number prior to final conversion to the OUT data type. SCALE_X execution sets ENO = FALSE in this case.

NORM_X parameter VALUE should be restricted to (MIN <= VALUE <= MAX)

If parameter VALUE is less than MIN or greater than MAX, the linear scaling operation can produce normalized OUT values that are less than 0.0 or greater than 1.0. NORM_X execution sets ENO = TRUE in this case.

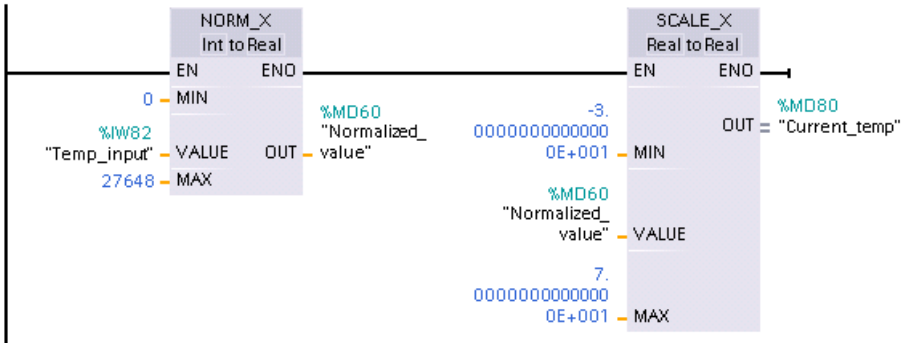
Table 8- 120 ENO status

ENO	Condition	Result OUT
1	No error	Valid result
0	Result exceeds valid range for the OUT data type	Intermediate result: The least-significant portion of a real number prior to final conversion to the OUT data type.
0	Parameters MAX <= MIN	SCALE_X: The least-significant portion of the Real number VALUE to fill up the OUT size. NORM_X: VALUE in VALUE data type extended to fill a double word size.
0	Parameter VALUE = +/- INF or +/- NaN	VALUE is written to OUT

Example (LAD): normalizing and scaling an analog input value

An analog input from an analog signal module or signal board using input in current is in the range 0 to 27648 for valid values. Suppose an analog input represents a temperature where the 0 value of the analog input represents -30.0 degrees C and 27648 represents 70.0 degrees C.

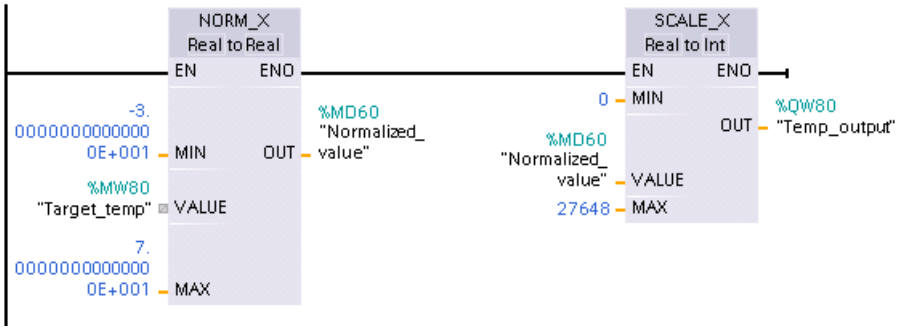
To transform the analog value to the corresponding engineering units, normalize the input to a value between 0.0 and 1.0, and then scale it between -30.0 and 70.0. The resulting value is the temperature represented by the analog input in degrees C:



Note that if the analog input was from an analog signal module or signal board using voltage, the MIN value for the NORM_X instruction would be -27648 instead of 0.

Example (LAD): normalizing and scaling an analog output value

An analog output to be set in an analog signal module or signal board using output in current must be in the range 0 to 27648 for valid values. Suppose an analog output represents a temperature setting where the 0 value of the analog input represents -30.0 degrees C and 27648 represents 70.0 degrees C. To convert a temperature value in memory that is between -30.0 and 70.0 to a value for the analog output in the range 0 to 27648, you must normalize the value in engineering units to a value between 0.0 and 1.0, and then scale it to the range of the analog output, 0 to 27648:



Note that if the analog output was for an analog signal module or signal board using voltage, the MIN value for the SCALE_X instruction would be -27648 instead of 0.

Additional information on analog input representations (Page 1458) and analog output representations (Page 1460) in both voltage and current can be found in the Technical Specifications.

8.7.6 Variant conversion instructions

8.7.6.1 VARIANT_TO_DB_ANY (Convert VARIANT to DB_ANY)

You use the "VARIANT to DB_ANY" instruction to read the operand at the IN parameter and convert it to the data type DB_ANY. The IN parameter is of the Variant data type and represents either an instance data block or an ARRAY data block. When you create the program, you do not need to know which data block corresponds to the IN parameter. The instruction reads the data block number during runtime and writes it to the operand at the RET_VAL parameter.

Table 8- 121 VARIANT_TO_DB_ANY instruction

LAD / FBD	SCL	Description
Not available	`RET_VAL := VARIANT_TO_DB_ANY( in := _variant_in_, err => _int_out_);`	Reads the operand from the Variant IN parameter and stores it in the function result, which is of the type DB_ANY

Table 8- 122 Parameters for the VARIANT_TO_DB_ANY instruction

Parameter	Data type	Description
IN	Variant	Variant that represents and instance data block or an array data block
RET_VAL	DB_ANY	Output DB_ANY data type that contains the converted data block number
ERR	Int	Error information

Table 8- 123 ENO status

ENO	Condition	Result
1	No error	Instruction converts the input Variant and stores it in the DB_ANY function output
0	Enable input EN has the signal state "0" or the IN parameter is invalid.	Instruction does nothing.

Table 8- 124 Error output codes for the VARIANT_TO_DB_ANY instruction

Err (W#16#...)	Description
0000	No error
252C	The Variant data type at IN parameter has the value 0. The CPU changes to STOP mode.
8131	The data block does not exist or is too short (first access).
8132	The data block is too short and not an Array data block (second access).
8134	The data block is write-protected
8150	The data type Variant at parameter IN provides the value "0". To receive this error message, the "Handle errors within block" block property must be activated. Otherwise the CPU changes to STOP mode and sends the error code 16#252C
8154	The data block has the incorrect data type.
*You can display error codes in the program editor as integer or hexadecimal values.	

8.7.6.2 DB_ANY_TO_VARIANT (Convert DB_ANY to VARIANT)

You use the "DB_ANY to VARIANT" instruction to read the number of a data block that meets the requirements listed below. The operand at the IN parameter has the data type DB_ANY, which means you do not need to know during program creation which data block is to be read. The instruction reads the data block number during runtime and writes it to the function result RET_VAL by means of a VARIANT pointer.

Table 8- 125 DB_ANY_TO_VARIANT instruction

LAD / FBD	SCL	Description
Not available	`RET_VAL := DB_ANY_TO_VARIANT( in := _db_any_in_, err => _int_out_);`	Reads the data block number from the Variant IN parameter and stores it in the function result, which is of the type Variant

Table 8- 126 Parameters for the DB_ANY_TO_VARIANT instruction

Parameter	Data type	Description
IN	DB_ANY	Variant that contains the data block number
RET_VAL	Variant	Output DB_ANY data type that contains the converted data block number
ERR	Int	Error information

Table 8- 127 ENO status

ENO	Condition	Result
1	No error	Instruction converts the data block number in the variant and stores it in the function DB_ANY output
0	Enable input EN has the signal state "0" or the IN parameter is invalid.	Instruction does nothing.

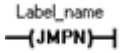
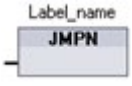
Table 8- 128 Error output codes for the DB_ANY_TO_VARIANT instruction

Err (W#16#...)	Description
0000	No error
8130	The number of the data block is 0.
8131	The data block does not exist or is too short.
8132	The data block is too short and not an Array data block.
8134	The data block is write-protected.
8154	The data block has the incorrect data type.
8155	Unknown type code
*You can display error codes in the program editor as integer or hexadecimal values.	

8.8 Program control operations

8.8.1 JMP (Jump if RLO = 1), JMPN (Jump if RLO = 0), and Label (Jump label) instructions

Table 8- 129 JMP, JMPN, and LABEL instruction

LAD	FBD	SCL	Description
		See the GOTO (Page 319) statement.	Jump if RLO (result of logic operation) = 1: If there is power flow to a JMP coil (LAD), or if the JMP box input is true (FBD), then program execution continues with the first instruction following the specified label.
			Jump if RLO = 0: If there is no power flow to a JMPN coil (LAD), or if the JMPN box input is false (FBD), then program execution continues with the first instruction following the specified label.
			Destination label for a JMP or JMPN jump instruction.

[1] You create your label names by typing in the LABEL instruction directly. Use the parameter helper icon to select the available label names for the JMP and JMPN label name field. You can also type a label name directly into the JMP or JMPN instruction.

Table 8- 130 Data types for the parameters

Parameter	Data type	Description
Label_name	Label identifier	Identifier for Jump instructions and the corresponding jump destination program label

- Each label must be unique within a code block.
- You can jump within a code block, but you cannot jump from one code block to another code block.
- You can jump forward or backward.
- You can jump to the same label from more than one place in the same code block.

8.8.2 JMP_LIST (Define jump list)

Table 8- 131 JMP_LIST instruction

LAD / FBD	SCL	Description

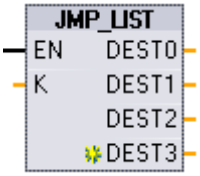
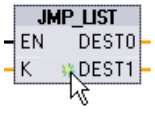
	`CASE k OF`
	`  0: GOTO dest0;`
	`  1: GOTO dest1;`
	`  2: GOTO dest2;`
	`  [n: GOTO destn;]`
	`END_CASE;`
		The JMP_LIST instruction acts as a program jump distributor to control the execution of program sections. Depending on the value of the K input, a jump occurs to the corresponding program label. Program execution continues with the program instructions that follow the destination jump label. If the value of the K input exceeds the number of labels - 1, then no jump occurs and processing continues with the next program network.

Table 8- 132 Data types for parameters

Parameter	Data type	Description
K	UInt	Jump distributor control value
DEST0, DEST1, .., DESTn.	Program Labels	Jump destination labels corresponding to specific K parameter values: If the value of K equals 0, then a jump occurs to the program label assigned to the DEST0 output. If the value of K equals 1, then a jump occurs to the program label assigned to the DEST1 output, and so on. If the value of the K input exceeds the (number of labels - 1), then no jump occurs and processing continues with the next program network.

For LAD and FBD: When the JMP_LIST box is first placed in your program, there are two jump label outputs. You can add or delete jump destinations.



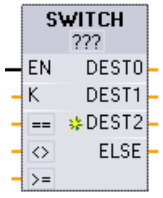
Click the create icon inside the box (on the left of the last DEST parameter) to add new outputs for jump labels.



- Right-click on an output stub and select the "Insert output" command.
- Right-click on an output stub and select the "Delete" command.

8.8.3 SWITCH (Jump distributor)

Table 8- 133 SWITCH instruction

LAD / FBD	SCL	Description
	`Not available`	The SWITCH instruction acts as a program jump distributor to control the execution of program sections. Depending on the result of comparisons between the value of the K input and the values assigned to the specified comparison inputs, a jump occurs to the program label that corresponds to the first comparison test that is true. If none of the comparisons is true, then a jump to the label assigned to ELSE occurs. Program execution continues with the program instructions that follow the destination jump label.

1 For LAD and FBD: Click below the box name and select a data type from the drop-down menu.

2 For SCL: Use an IF-THEN set of comparisons.

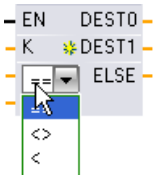
Table 8- 134 Data types for parameters

Parameter	Data type[1]	Description
K	UInt	Common comparison value input
==, <>, <, <=, >. >=	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, TOD, Date	Separate comparison value inputs for specific comparison types
DEST0, DEST1, .., DESTn, ELSE	Program Labels	Jump destination labels corresponding to specific comparisons: The comparison input below and next to the K input is processed first and causes a jump to the label assigned to DEST0, if the comparison between the K value and this input is true. The next comparison test uses the next input below and causes a jump to the label assigned to DEST1, if the comparison is true, The remaining comparisons are processed similarly and if none of the comparisons are true, then a jump to the label assigned to the ELSE output occurs.

1 The K input and comparison inputs (==, <>, <, <=, >, >=) must be the same data type.

Adding inputs, deleting inputs, and specifying comparison types

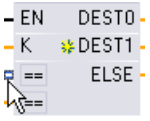
When the LAD or FBD SWITCH box is first placed in your program there are two comparison inputs. You can assign comparison types and add inputs/jump destinations, as shown below.



Click a comparison operator inside the box and select a new operator from the drop-down list.



Click the create icon inside the box (to the left of the last DEST parameter) to add new comparison-destination parameters.



- Right-click on an input stub and select the "Insert input" command.
- Right-click on an input stub and select the "Delete" command.

Table 8- 135 SWITCH box data type selection and allowed comparison operations

Data type	Comparison	Operator syntax
Byte, Word, DWord	Equal	==
	Not equal	<>
SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Time, TOD, Date	Equal	==
	Not equal	<>
	Greater than or equal	>=
	Less than or equal	<=
	Greater than	>
	Less than	<

SWITCH box placement rules

- No LAD/FBD instruction connection in front of the compare input is allowed.
- There is no ENO output, so only one SWITCH instruction is allowed in a network and the SWITCH instruction must be the last operation in a network.

8.8.4 RET (Return)

The optional RET instruction is used to terminate the execution of the current block. If and only if there is power flow to the RET coil (LAD) or if the RET box input is true (FBD), then program execution of the current block will end at that point and instructions beyond the RET instruction will not be executed. If the current block is an OB, the "Return_Value" parameter is ignored. If the current block is a FC or FB, the value of the "Return_Value" parameter is passed back to the calling routine as the ENO value of the called box.

You are not required to use a RET instruction as the last instruction in a block; this is done automatically for you. You can have multiple RET instructions within a single block.

For SCL, see the RETURN (Page 319) statement.

Table 8- 136 Return_Value (RET) execution control instruction

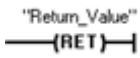
LAD	FBD	SCL	Description
		`RETURN;`	Terminates the execution of the current block

Table 8- 137 Data types for the parameters

Parameter	Data type	Description
Return_Value	Bool	The "Return_value" parameter of the RET instruction is assigned to the ENO output of the block call box in the calling block.

Sample steps for using the RET instruction inside an FC code block:

1. Create a new project and add an FC:
2. Edit the FC:
   - Add instructions from the instruction tree.
   - Add a RET instruction, including one of the following for the "Return_Value" parameter:

     TRUE, FALSE, or a memory location that specifies the required return value.
   - Add more instructions.
3. Call the FC from MAIN [OB1].

The EN input on the FC box in the MAIN code block must be true to begin execution of the FC.

The value specified by the RET instruction in the FC will be present on the ENO output of the FC box in the MAIN code block following execution of the FC for which power flow to the RET instruction is true.

8.8.5 ENDIS_PW (Enable/disable CPU passwords)

Table 8- 138 ENDIS_PW instruction

LAD / FBD	SCL	Description

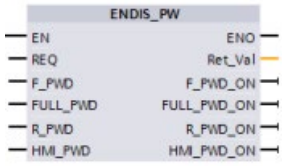
	`ENDIS_PW(`
	`  req:=_bool_in_,`
	`  f_pwd:=_bool_in_,`
	`  full_pwd:=_bool_in_,`
	`  r_pwd:=_bool_in_,`
	`  hmi_pwd:=_bool_in_,`
	`  f_pwd_on=>_bool_out_,`
	`  full_pwd_on=>_bool_out_,`
	`  r_pwd_on=>_bool_out_,`
	`  hmi_pwd_on=>_bool_out_);`
		The ENDIS_PW instruction can allow and disallow client connections to a S7-1200 CPU, even when the client can provide the correct password.
		This instruction does not disallow Web server passwords.

Table 8- 139 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Perform function if REQ=1
F_PWD	IN	Bool	Fail-safe password: Allow (=1) or disallow (=0)
FULL_PWD	IN	Bool	Full access password: Allow (=1) or disallow (=0) full access password
R_PWD	IN	Bool	Read access password: Allow (=1) or disallow (=0)
HMI_PWD	IN	Bool	HMI password: Allow (=1) or disallow (=0)
F_PWD_ON	OUT	Bool	Fail-safe password status: Allowed (=1) or disallowed (=0)
FULL_PWD_ON	OUT	Bool	Full access password status: Allowed (=1) or disallowed (=0)
R_PWD_ON	OUT	Bool	Read only password status: Allowed (=1) or disallowed (=0)
HMI_PWD_ON	OUT	Bool	HMI password status: Allowed (=1) or disallowed (=0)
Ret_Val	OUT	Word	Function result

Calling ENDIS_PW with REQ=1 disallows password types where the corresponding password input parameter is FALSE. Each password type can be allowed or disallowed independently. For example, if the fail-safe password is allowed and all other passwords disallowed, then you can restrict CPU access to a small group of employees.

ENDIS_PW is executed synchronously in a program scan and the password output parameters always show the current state of password allowance independent of the input parameter REQ. All passwords that you set to allow must be changeable to disallowed/allowed. Otherwise, an error is returned and all passwords are allowed that were allowed before ENDIS_PW execution. This means that in a standard CPU (where the fail-safe password is not configured) F_PWD must always be set to 1, to result in a return value of 0. In this case, F_PWD_ON is always 1.

Note

- ENDIS_PW execution can block the access of HMI devices, if the HMI password is disallowed.
- Client sessions that were authorized prior to ENDIS_PW execution remain unchanged by ENDIS_PW execution.

After a power-up, CPU access is restricted by passwords previously defined in the regular CPU protection configuration. The ability to disallow a valid password must be re-established with a new ENDIS_PW execution. However, if ENDIS_PW is immediately executed and necessary passwords are disallowed, then TIA portal access can be locked out. You can use a timer instruction to delay ENDIS_PW execution and allow time to enter passwords, before the passwords become disallowed.

Note

Restoring a CPU that locks out TIA portal communication

Refer to the "Recovery from a lost password (Page 147)" topic for details about how to erase the internal load memory of a PLC using a memory card.

An operating mode change to STOP caused by errors, STP execution or STEP 7 does not abolish the protection. The protection is valid until the CPU is power cycled. See the following table for details.

Action	Operating mode	ENDIS_PW password control
After memory reset from STEP 7	STOP	Active: Disallowed passwords remain disallowed.
After powering on, or changing a memory card	STOP	Off: No passwords are disallowed.
After ENDIS_PW execution in a program cycle or startup OB	STARTUP, RUN	Active: Passwords are disallowed according to ENDIS_PW parameters
After change of the operating mode from RUN or STARTUP to STOP through STP instruction, error, or STEP 7	STOP	Active: Disallowed passwords remain disallowed

Note

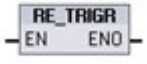
Password protect CPU access levels with strong passwords. Strong passwords are at least ten characters in length, mix letters, numbers, and special characters, are not words that can be found in a dictionary, and are not names or identifiers that can be derived from personal information. Keep the password secret and change it frequently.

Table 8- 140 Condition codes

RET_VAL (W#16#...)	Description
0000	No error
8090	The instruction is not supported.
80D0	The password for fail-safe is not configured.
80D1	The password for read/write access is not configured.
80D2	The password for read access is not configured.
80D3	The password for HMI access is not configured.

8.8.6 RE_TRIGR (Restart cycle monitoring time)

Table 8- 141 RE_TRIGR instruction

LAD / FBD	SCL	Description
	`RE_TRIGR();`	RE_TRIGR (Re-trigger scan time watchdog) is used to extend the maximum time allowed before the scan cycle watchdog timer generates an error.

Use the RE_TRIGR instruction to restart the scan cycle monitoring timer during a single scan cycle. This has the effect of extending the allowed maximum scan cycle time by one maximum cycle time period, from the last execution of the RE_TRIGR function.

Note

Prior to S7-1200 CPU firmware version 2.2, RE_TRIGR was restricted to execution from a program cycle OB and could be used to extend the PLC scan time indefinitely. ENO = FALSE and the watchdog timer is not reset when RE_TRIGR was executed from a start up OB, an interrupt OB, or an error OB.

For firmware version 2.2 and later, RE_TRIGR can be executed from any OB (including start up, interrupt, and error OBs). However, the PLC scan can only be extended by a maximum of 10x the configured maximum cycle time.

Setting the PLC maximum cycle time

Configure the value for maximum scan cycle time in the Device configuration for "Cycle time".

Table 8- 142 Cycle time values

Cycle time monitor	Minimum value	Maximum value	Default value
Maximum cycle time	1 ms	6000 ms	150 ms

Watchdog timeout

If the maximum scan cycle timer expires before the scan cycle has been completed, an error is generated. If the user program includes a time error interrupt OB (OB 80), the CPU executes the time error interrupt OB, which can include program logic to create a special reaction.

If the user program does not include a time error interrupt OB, the first timeout condition is ignored and the CPU remains in RUN mode. If a second maximum scan time timeout occurs in the same program scan (2 times the maximum cycle time value), then an error is triggered that causes a transition to STOP mode.

In STOP mode, your program execution stops while CPU system communications and system diagnostics continue.

8.8.7 STP (Exit program)

Table 8- 143 STP instruction

LAD / FBD	SCL	Description
	`STP();`	STP puts the CPU in STOP mode. When the CPU is in STOP mode, the execution of your program and physical updates from the process image are stopped.

For more information see: Configuring the outputs on a RUN-to-STOP transition (Page 113).

If EN = TRUE, then the CPU goes to STOP mode, the program execution stops, and the ENO state is meaningless. Otherwise, EN = ENO = 0.

8.8.8 GET_ERROR and GET_ERROR_ID (Get error and error ID locally) instructions

The get error instructions provide information about program block execution errors. If you add a GET_ERROR or GET_ERROR_ID instruction to your code block, you can handle program errors within your program block.

GET_ERROR

Table 8- 144 GET_ERROR instruction

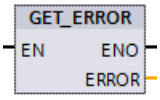
LAD / FBD	SCL	Description
	`GET_ERROR(_out_);`	Indicates that a local program block execution error has occurred and fills a predefined error data structure with detailed error information.

Table 8- 145 Data types for the parameters

Parameter	Data type	Description
ERROR	ErrorStruct	Error data structure: You can rename the structure, but not the members within the structure.

Table 8- 146 Elements of the ErrorStruct data structure

Structure components		Data type	Description
ERROR_ID		Word	Error ID
FLAGS		Byte	Shows if an error occurred during a block call. • 16#01: Error during a block call. • 16#00: No error during a block call.
REACTION		Byte	Default reaction: • 0: Ignore (write error), • 1: Continue with substitute value "0" (read error), • 2: Skip instruction (system error)
CODE_ADDRESS		CREF	Information about the address and type of block
	BLOCK_TYPE	Byte	Type of block where the error occurred: • 1: OB • 2: FC • 3: FB
	CB_NUMBER	UInt	Number of the code block
	OFFSET	UDInt	Reference to the internal memory

<table>
<tr><th>Structure components</th><th colspan="2">Data type</th><th>Description</th></tr>
<tr><td>MODE</td><td colspan="2">Byte</td><td>Access mode: Depending on the type of access, the following information can be output:
<table>
<tr><th>Mode</th><th>(A)</th><th>(B)</th><th>(C)</th><th>(D)</th><th>(E)</th></tr>
<tr><td>0</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1</td><td></td><td></td><td></td><td></td><td>Offset</td></tr>
<tr><td>2</td><td></td><td></td><td>Area</td><td></td><td></td></tr>
<tr><td>3</td><td>Location</td><td>Scope</td><td></td><td>Number</td><td></td></tr>
<tr><td>4</td><td></td><td></td><td>Area</td><td></td><td>Offset</td></tr>
<tr><td>5</td><td></td><td></td><td>Area</td><td>DB no.</td><td>Offset</td></tr>
<tr><td>6</td><td>PtrNo. /Acc</td><td></td><td>Area</td><td>DB no.</td><td>Offset</td></tr>
<tr><td>7</td><td>PtrNo. / Acc</td><td>Slot No. / Scope</td><td>Area</td><td>DB no.</td><td>Offset</td></tr>
</table></td></tr>
<tr><td>OPERAND_NUMBER</td><td colspan="2">UInt</td><td>Operand number of the machine command</td></tr>
<tr><td>POINTER_NUMBER_ LOCATION</td><td colspan="2">UInt</td><td>(A) Internal pointer</td></tr>
<tr><td>SLOT_NUMBER_SCOPE</td><td colspan="2">UInt</td><td>(B) Storage area in internal memory</td></tr>
<tr><td>DATA_ADDRESS</td><td colspan="2">NREF</td><td>Information about the address of an operand</td></tr>
<tr><td></td><td>AREA</td><td>Byte</td><td>(C) Memory area:
• L: 16#40 – 4E, 86, 87, 8E, 8F, C0 – CE
• I: 16#81
• Q: 16#82
• M: 16#83
• DB: 16#84, 85, 8A, 8B</td></tr>
<tr><td></td><td>DB_NUMBER</td><td>UInt</td><td>(D) Number of the data block</td></tr>
<tr><td></td><td>OFFSET</td><td>UDInt</td><td>(E) Relative address of the operand</td></tr>
</table>

GET_ERROR_ID

Table 8- 147 GetErrorID instruction

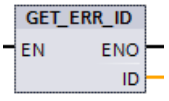
LAD / FBD	SCL	Description
	`GET_ERR_ID();`	Indicates that a program block execution error has occurred and reports the ID (identifier code) of the error.

Table 8- 148 Data types for the parameters

Parameter	Data type	Description
ID	Word	Error identifier values for the ErrorStruct ERROR_ID member

Table 8- 149 Error_ID values

ERROR_ID hexa-decimal	ERROR_ID decimal	Program block execution error
0	0	No error
2520	9504	Corrupted string
2522	9506	Operand out of range read error
2523	9507	Operand out of range write error
2524	9508	Invalid area read error
2525	9509	Invalid area write error
2528	9512	Data alignment read error (incorrect bit alignment)
2529	9513	Data alignment write error (incorrect bit alignment)
252C	9516	Uninitialized pointer error
2530	9520	DB write protected
2533	9523	Invalid pointer used
2538	9528	Access error: DB does not exist
2539	9529	Access error: Wrong DB used
253A	9530	Global DB does not exist
253C	9532	Wrong version or FC does not exist
253D	9533	Instruction does not exist
253E	9534	Wrong version or FB does not exist
253F	9535	Instruction does not exist
2550	9552	Access error: DB does not exist
2575	9589	Program nesting depth error
2576	9590	Local data allocation error
2942	10562	Physical input point does not exist
2943	10563	Physical output point does not exist

Operation

By default, the CPU responds to a block execution error by logging an error in the diagnostics buffer. However, if you place one or more GET_ERROR or GET_ERROR_ID instructions within a code block, this block is now set to handle errors within the block. In this case, the CPU does not log an error in the diagnostics buffer. Instead, the error information is reported in the output of the GET_ERROR or GET_ERROR_ID instruction. You can read the detailed error information with the GET_ERROR instruction, or read just the error identifier with GET_ERROR_ID instruction. Normally the first error is the most important, with the following errors only consequences of the first error.

The first execution of a GET_ERROR or GET_ERROR_ID instruction within a block returns the first error detected during block execution. This error could have occurred anywhere between the start of the block and the execution of either GET_ERROR or GET_ERROR_ID. Subsequent executions of either GET_ERROR or GET_ERROR_ID return the first error since the previous execution of GET_ERROR or GET_ERROR_ID. The history of errors is not saved, and execution of either instruction will re-arm the PLC system to catch the next error.

The ErrorStruct data type used by the GET_ERROR instruction can be added in the data block editor and block interface editors, so your program logic can access these values. Select ErrorStruct from the data type drop-down list to add this structure. You can create multiple ErrorStruct elements by using unique names. The members of an ErrorStruct cannot be renamed.

Error condition indicated by ENO

If EN = TRUE and GET_ERROR or GET_ERROR_ID executes, then:

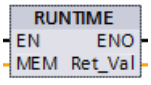
- ENO = TRUE indicates a code block execution error occurred and error data is present
- ENO = FALSE indicates no code block execution error occurred

You can connect error reaction program logic to ENO which activates after an error occurs. If an error exists, then the output parameter stores the error data where your program has access to it.

GET_ERROR and GET_ERROR_ID can be used to send error information from the currently executing block (called block) to a calling block. Place the instruction in the last network of the called block program to report the final execution status of the called block.

8.8.9 RUNTIME (Measure program runtime)

Table 8- 150 RUNTIME instruction

LAD / FBD	SCL	Description
	`Ret_Val := RUNTIME(` `  _lread_inout_);`	Measures the runtime of the entire program, individual blocks, or command sequences.

If you want to measure the runtime of your entire program, call the instruction "Measure program runtime" in OB 1. Measurement of the runtime is started with the first call and the output RET_VAL returns the runtime of the program after the second call. The measured runtime includes all CPU processes that can occur during the program execution, for example, interruptions caused by higher-level events or communication. The instruction "Measure program runtime" reads an internal counter of the CPU and write the value to the IN-OUT parameter MEM. The instruction calculates the current program runtime according to the internal counter frequency and writes it to output RET_VAL.

If you want to measure the runtime of individual blocks or individual command sequences, you need three separate networks. Call the instruction "Measure program runtime" in an individual network within your program. You set the starting point of the runtime measurement with this first call of the instruction. Then you call the required program block or the command sequence in the next network. In another network, call the "Measure program runtime" instruction a second time and assign the same memory to the IN-OUT parameter MEM as you did during the first call of the instruction. The "Measure program runtime" instruction in the third network reads an internal CPU counter and calculates the current runtime of the program block or the command sequence according to the internal counter frequency and writes it to the output RET_VAL.

The Measure program runtime" instruction uses an internal high-frequency counter to calculate the time. If the counter overruns, the instruction returns values <= 0.0. Ignore these runtime values.

Note

The CPU cannot exactly determine the runtime of a command sequence, because the sequence of instructions within a command sequence changes during optimized compilation of the program.

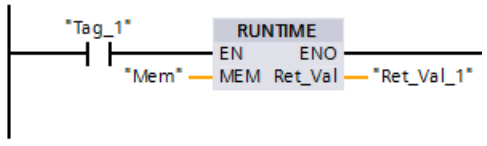
Table 8- 151 Data types for the parameters

Parameter	Data type	Description
MEM	LReal	Starting poing of the runtime measurement
RET_VAL	LReal	Measured runtime in seconds

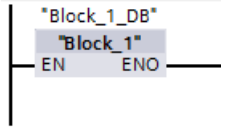
Example: RUNTIME instruction

The following example shows the use of the RUNTIME instruction to measure the execution time of a function block:

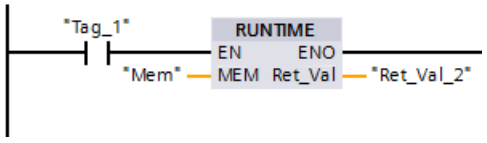
Network 1:



Network 2:



Network 3:



When the "Tag_1" operand in network 1 has the signal state "1", the RUNTIME instruction executes. The starting point for the runtime measurement is set with the first call of the instruction and buffered as reference for the second call of the instruction in the "Mem" operand.

The function block FB1 executes in network 2.

When the FB1 program block completes and the "Tag_1" operand has the signal state "1", the RUNTIME instruction in network 3 executes. The second call of the instruction calculates the runtime of the program block and writes the result to the output RET_VAL_2.

8.8.10 SCL program control statements

8.8.10.1 Overview of SCL program control statements

Structured Control Language (SCL) provides three types of program control statements for structuring your user program:

- Selective statements: A selective statement enables you to direct program execution into alternative sequences of statements.
- Loops: You can control loop execution using iteration statements. An iteration statement specifies which parts of a program should be iterated depending on certain conditions.
- Program jumps: A program jump means an immediate jump to a specified jump destination and therefore to a different statement within the same block.

These program control statements use the syntax of the PASCAL programming language.

Table 8- 152 Types of SCL program control statements

Program control statement		Description
Selective	IF-THEN statement (Page 312)	Enables you to direct program execution into one of two alternative branches, depending on a condition being TRUE or FALSE
	CASE statement (Page 313)	Enables the selective execution into 1 of *n* alternative branches, based on the value of a variable
Loop	FOR statement (Page 314)	Repeats a sequence of statements for as long as the control variable remains within the specified value range
	WHILE-DO statement (Page 315)	Repeats a sequence of statements while an execution condition continues to be satisfied
	REPEAT-UNTIL statement (Page 316)	Repeats a sequence of statements until a terminate condition is met
Program jump	CONTINUE statement (Page 317)	Stops the execution of the current loop iteration
	EXIT statement (Page 318)	Exits a loop at any point regardless of whether the terminate condition is satisfied or not
	GOTO statement (Page 319)	Causes the program to jump immediately to a specified label
	RETURN statement (Page 319)	Causes the program to exit the block currently being executed and to return to the calling block

8.8.10.2 IF-THEN statement

The IF-THEN statement is a conditional statement that controls program flow by executing a group of statements, based on the evaluation of a Bool value of a logical expression. You can also use brackets to nest or structure the execution of multiple IF-THEN statements.

Table 8- 153 Elements of the IF-THEN statement

SCL	Description

`IF "condition" THEN`
`  statement_A;`
`  statement_B;`
`  statement_C;`
`  ;`
	If "condition" is TRUE or 1, then execute the following statements until encountering the END_IF statement.
	If "condition" is FALSE or 0, then skip to END_IF statement (unless the program includes optional ELSIF or ELSE statements).

`[ELSIF "condition-n" THEN`
`  statement_N;`
`  ;]`
	The optional ELSEIF[1] statement provides additional conditions to be evaluated. For example: If "condition" in the IF-THEN statement is FALSE, then the program evaluates "condition-n". If "condition-n" is TRUE, then execute "statement_N".

`[ELSE`
`  statement_X;`
`  ;]`
	The optional ELSE statement provides statements to be executed when the "condition" of the IF-THEN statement is FALSE.

`END_IF;`	The END_IF statement terminates the IF-THEN instruction.

[1] You can include multiple ELSIF statements within one IF-THEN statement.

Table 8- 154 Variables for the IF-THEN statement

Variables	Description
"condition"	Required. The logical expression is either TRUE (1) or FALSE (0).
"statement_A"	Optional. One or more statements to be executed when "condition" is TRUE.
"condition-n"	Optional. The logical expression to be evaluated by the optional ELSIF statement.
"statement_N"	Optional. One or more statements to be executed when "condition-n" of the ELSIF statement is TRUE.
"statement_X"	Optional. One or more statements to be executed when "condition" of the IF-THEN statement is FALSE.

An IF statement is executed according to the following rules:

- The first sequence of statements whose logical expression = TRUE is executed. The remaining sequences of statements are not executed.
- If no Boolean expression = TRUE, the sequence of statements introduced by ELSE is executed (or no sequence of statements if the ELSE branch does not exist).
- Any number of ELSIF statements can exist.

Note

Using one or more ELSIF branches has the advantage that the logical expressions following a valid expression are no longer evaluated in contrast to a sequence of IF statements. The runtime of a program can therefore be reduced.

8.8.10.3 CASE statement

Table 8- 155 Elements of the CASE statement

SCL	Description

`CASE "Test_Value" OF`
`  "ValueList": Statement[; Statement, ...]`
`  "ValueList": Statement[; Statement, ...]`
`[ELSE`
`Else-statement[; Else-statement, ...]]`
`END_CASE;`
	The CASE statement executes one of several groups of statements, depending on the value of an expression.

Table 8- 156 Parameters

Parameter	Description
"Test_Value"	Required. Any numeric expression of data type Int
"ValueList"	Required. A single value or a comma-separated list of values or ranges of values. (Use two periods to define a range of values: 2..8) The following example illustrates the different variants of the value list: 1: Statement_A; 2, 4: Statement _B; 3, 5..7,9: Statement _C;
Statement	Required. One or more statements that are executed when "Test_Value" matches any value in the value list
Else-statement	Optional. One or more statements that are executed if no match with a value of the "ValueList" stated matches

The CASE statement is executed according to the following rules:

- The Test_value expression must return a value of the type Int.
- When a CASE statement is processed, the program checks whether the value of the Test_value expression is contained within a specified list of values. If a match is found, the statement component assigned to the list is executed.
- If no match is found, the program section following ELSE is executed or no statement is executed if the ELSE branch does not exist.

Example: Nested CASE statements

CASE statements can be nested. Each nested case statement must have an associated END_CASE statement.

```
CASE "var1" OF
       1 : #var2 := 'A';
       2 : #var2 := 'B';
ELSE
       CASE "var3" OF

          65..90: #var2 := 'UpperCase';
          97..122: #var2 := 'LowerCase';
       ELSE

          #var2:= 'SpecialCharacter';
       END_CASE;
END_CASE;
```

8.8.10.4 FOR statement

Table 8- 157 Elements of the FOR statement

SCL	Description

`FOR "control_variable" := "begin" TO "end"`
`[BY "increment"] DO`
`  statement;`
`  ;`
`END_FOR;`
	A FOR statement is used to repeat a sequence of statements as long as a control variable is within the specified range of values. The definition of a loop with FOR includes the specification of an initial and an end value. Both values must be the same type as the control variable.
	You can nest FOR loops. The END_FOR statement refers to the last executed FOR instruction.

Table 8- 158 Parameters

Parameter	Description
"control_variable"	Required. An integer (Int or DInt) that serves as a loop counter
"begin"	Required. Simple expression that specifies the initial value of the control variables
"end"	Required. Simple expression that determines the final value of the control variables
"increment"	Optional. Amount by which a "control variable" is changed after each loop. The "increment" has the same data type as "control variable". If the "increment" value is not specified, then the value of the run tags will be increased by 1 after each loop. You cannot change "increment" during the execution of the FOR statement.

The FOR statement executes as follows:

- At the start of the loop, the control variable is set to the initial value (initial assignment) and each time the loop iterates, it is incremented by the specified increment (positive increment) or decremented (negative increment) until the final value is reached.
- Following each run through of the loop, the condition is checked (final value reached) to establish whether or not it is satisfied. If the end condition is not satisfied, the sequence of statements is executed again, otherwise the loop terminates and execution continues with the statement immediately following the loop.

Rules for formulating FOR statements:

- The control variable may only be of the data type Int or DInt.
- You can omit the statement BY [increment]. If no increment is specified, it is automatically assumed to be +1.

To end the loop regardless of the state of the "condition" expression, use the EXIT statement (Page 318). The EXIT statement executes the statement immediately following the END_FOR statement.

Use the CONTINUE statement (Page 317) to skip the subsequent statements of a FOR loop and to continue the loop with the examination of whether the condition is met for termination.

8.8.10.5 WHILE-DO statement

Table 8- 159 WHILE statement

SCL	Description

`WHILE "condition" DO`
`  Statement;`
`  Statement;`
`  ...;`
`END_WHILE;`
	The WHILE statement performs a series of statements until a given condition is TRUE.
	You can nest WHILE loops. The END_WHILE statement refers to the last executed WHILE instruction.

Table 8- 160 Parameters

Parameter	Description
"condition"	Required. A logical expression that evaluates to TRUE or FALSE. (A "null" condition is interpreted as FALSE.)
Statement	Optional. One or more statements that are executed until the condition evaluates to TRUE.

Note

The WHILE statement evaluates the state of "condition" before executing any of the statements. To execute the statements at least one time regardless of the state of "condition", use the REPEAT statement (Page 316).

The WHILE statement executes according to the following rules:

- Prior to each iteration of the loop body, the execution condition is evaluated.
- The loop body following DO iterates as long as the execution condition has the value TRUE.
- Once the value FALSE occurs, the loop is skipped and the statement following the loop is executed.

To end the loop regardless of the state of the "condition" expression, use the EXIT statement (Page 318). The EXIT statement executes the statement immediately following the END_WHILE statement.

Use the CONTINUE statement to skip the subsequent statements of a WHILE loop and to continue the loop with the examination of whether the condition is met for termination.

8.8.10.6 REPEAT-UNTIL statement

Table 8- 161 REPEAT instruction

SCL	Description

`REPEAT`
`  Statement;`
`  ;`
`UNTIL "condition"`
`END_REPEAT;`
	The REPEAT statement executes a group of statements until a given condition is TRUE.
	You can nest REPEAT loops. The END_REPEAT statement always refers to the last executed Repeat instruction.

Table 8- 162 Parameters

Parameter	Description
Statement	Optional. One or more statements that are executed until the condition is TRUE.
"condition"	Required. One or more expressions of the two following ways: A numeric expression or string expression that evaluates to TRUE or FALSE. A "null" condition is interpreted as FALSE.

Note

Before evaluating the state of "condition", the REPEAT statement executes the statements during the first iteration of the loop (even if "condition" is FALSE). To review the state of "condition" before executing the statements, use the WHILE statement (Page 315).

To end the loop regardless of the state of the "condition" expression, use the EXIT statement (Page 318). The EXIT statement executes the statement immediately following the END_REPEAT statement.

Use the CONTINUE statement (Page 317) to skip the subsequent statements of a REPEAT loop and to continue the loop with the examination of whether the condition is met for termination.

8.8.10.7 CONTINUE statement

Table 8- 163 CONTINUE statement

SCL	Description

`CONTINUE`
`Statement;`
`;`
	The CONTINUE statement skips the subsequent statements of a program loop (FOR, WHILE, REPEAT) and continues the loop with the examination of whether the condition is met for termination. If this is not the case, the loop continues.

The CONTINUE statement executes according to the following rules:

- This statement immediately terminates execution of a loop body.
- Depending on whether the condition for repeating the loop is satisfied or not the body is executed again or the iteration statement is exited and the statement immediately following is executed.
- In a FOR statement, the control variable is incremented by the specified increment immediately after a CONTINUE statement.

Use the CONTINUE statement only within a loop. In nested loops CONTINUE always refers to the loop that includes it immediately. CONTINUE is typically used in conjunction with an IF statement.

If the loop is to exit regardless of the termination test, use the EXIT statement.

Example: CONTINUE statement

The following example shows the use of the CONTINUE statement to avoid a division-by-0 error when calculating the percentage of a value:

```
FOR i := 0 TO 10 DO
IF value[i] = 0 THEN CONTINUE; END_IF;
     p := part / value[i] * 100;
     s := INT_TO_STRING(p);
     percent := CONCAT(IN1:=s, IN2:="%");
END_FOR;
```

8.8.10.8 EXIT statement

Table 8- 164 EXIT instruction

SCL	Description
`EXIT;`	An EXIT statement is used to exit a loop (FOR, WHILE or REPEAT) at any point, regardless of whether the terminate condition is satisfied.

The EXIT statement executes according to the following rules:

- This statement causes the repetition statement immediately surrounding the exit statement to be exited immediately.
- Execution of the program is continued after the end of the loop (for example after END_FOR).

Use the EXIT statement within a loop. In nested loops, the EXIT statement returns the processing to the next higher nesting level.

Example: EXIT statement

```
FOR i := 0 TO 10 DO
CASE value[i, 0] OF
 1..10: value [i, 1]:="A";
 11..40: value [i, 1]:="B";
 41..100: value [i, 1]:="C";
ELSE
EXIT;
END_CASE;
END_FOR;
```

8.8.10.9 GOTO statement

Table 8- 165 GOTO statement

SCL	Description

`GOTO JumpLabel;`
`Statement;`
`... ;`
`JumpLabel: Statement;`
	The GOTO statement skips over statements by jumping to a label in the same block.
	The jump label ("JumpLabel") and the GOTO statement must be in the same block. The name of a jump label can only be assigned once within a block. Each jump label can be the target of several GOTO statements.

It is not possible to jump to a loop section (FOR, WHILE or REPEAT). It is possible to jump from within a loop.

Example: GOTO statement

In the following example: Depending on the value of the "Tag_value" operand, the execution of the program resumes at the point defined by the corresponding jump label. If "Tag_value" equals 2, the program execution resumes at the jump label "MyLabel2" and skips "MyLabel1".

```
CASE "Tag_value" OF
1 : GOTO MyLabel1;
2 : GOTO MyLabel2;
ELSE GOTO MyLabel3;
END_CASE;
MyLabel1: "Tag_1" := 1;
MyLabel2: "Tag_2" := 1;
MyLabel3: "Tag_4" := 1;
```

8.8.10.10 RETURN statement

Table 8- 166 RETURN instruction

SCL	Description
`RETURN;`	The Return instruction exits the code block being executed without conditions. Program execution returns to the calling block or to the operating system (when exiting an OB).

Example: RETURN instruction:

```
IF "Error" <> 0 THEN
RETURN;
END_IF;
```

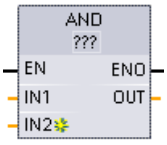
Note

After executing the last instruction, the code block automatically returns to the calling block. Do not insert a RETURN instruction at the end of the code block.

8.9 Word logic operations

8.9.1 AND, OR, and XOR logic operation instructions

Table 8- 167 AND, OR, and XOR logic operation instructions

LAD / FBD	SCL	Description
	`out := in1 AND in2;`	AND: Logical AND
	`out := in1 OR in2;`	OR: Logical OR
	`out := in1 XOR in2;`	XOR: Logical EXCLUSIVE OR

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.



To add an input, click the "Create" icon or right-click on an input stub for one of the existing IN parameters and select the "Insert input" command.

To remove an input, right-click on an input stub for one of the existing IN parameters (when there are more than the original two inputs) and select the "Delete" command.

Table 8- 168 Data types for the parameters

Parameter	Data type	Description
IN1, IN2	Byte, Word, DWord	Logical inputs
OUT	Byte, Word, DWord	Logical output

[1] The data type selection sets parameters IN1, IN2, and OUT to the same data type.

The corresponding bit values of IN1 and IN2 are combined to produce a binary logic result at parameter OUT. ENO is always TRUE following the execution of these instructions.

8.9.2 INV (Create ones complement)

Table 8- 169 INV instruction

LAD / FBD	SCL	Description
	`Not available`	Calculates the binary one's complement of the parameter IN. The one's complement is formed by inverting each bit value of the IN parameter (changing each 0 to 1 and each 1 to 0). ENO is always TRUE following the execution of this instruction.

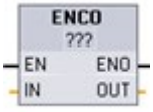
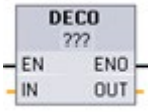
[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 170 Data types for the parameters

Parameter	Data type	Description
IN	SInt, Int, DInt, USInt, UInt, UDInt, Byte, Word, DWord	Data element to invert
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Byte, Word, DWord	Inverted output

8.9.3 DECO (Decode) and ENCO (Encode) instructions

Table 8- 171 ENCO and DECO instruction

LAD / FBD	SCL	Description
	`out := ENCO(_in_);`	Encodes a bit pattern to a binary number The ENCO instruction converts parameter IN to the binary number corresponding to the bit position of the least-significant set bit of parameter IN and returns the result to parameter OUT. If parameter IN is either 0000 0001 or 0000 0000, then a value of 0 is returned to parameter OUT. If the parameter IN value is 0000 0000, then ENO is set to FALSE.
	`out := DECO(_in_);`	Decodes a binary number to a bit pattern The DECO instruction decodes a binary number from parameter IN, by setting the corresponding bit position in parameter OUT to a 1 (all other bits are set to 0). ENO is always TRUE following execution of the DECO instruction. Note: The default data type for the DECO instruction is DWORD. In SCL, change the instruction name to DECO_BYTE or DECO_WORD to decode a byte or word value, and assign to a byte or word tag or address.

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 172 Data types for the parameters

Parameter	Data type	Description
IN	ENCO: Byte, Word, DWord DECO: UInt	ENCO: Bit pattern to encode DECO: Value to decode
OUT	ENCO: Int DECO: Byte, Word, DWord	ENCO: Encoded value DECO: Decoded bit pattern

Table 8- 173 ENO status

ENO	Condition	Result (OUT)
1	No error	Valid bit number
0	IN is zero	OUT is set to zero

The DECO parameter OUT data type selection of a Byte, Word, or DWord restricts the useful range of parameter IN. If the value of parameter IN exceeds the useful range, then a modulo operation is performed to extract the least significant bits shown below.

DECO parameter IN range:

- 3 bits (values 0-7) IN are used to set 1 bit position in a Byte OUT
- 4-bits (values 0-15) IN are used to set 1 bit position in a Word OUT
- 5 bits (values 0-31) IN are used to set 1 bit position in a DWord OUT

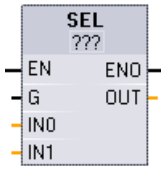
Table 8- 174 Examples

DECO IN value			DECO OUT value (Decode single bit position)
Byte OUT 8 bits	Min. IN	0	00000001
	Max. IN	7	10000000
Word OUT 16 bits	Min. IN	0	0000000000000001
	Max. IN	15	1000000000000000
DWord OUT 32 bits	Min. IN	0	00000000000000000000000000000001
	Max. IN	31	10000000000000000000000000000000

8.9.4 SEL (Select), MUX (Multiplex), and DEMUX (Demultiplex) instructions

Table 8- 175 SEL (select) instruction

LAD / FBD	SCL	Description

	`out := SEL(`
	`g:=_bool_in,`
	`in0:-_variant_in,`
	`in1:=_variant_in);`
		SEL assigns one of two input values to parameter OUT, depending on the parameter G value.

1 For LAD and FBD: Click the "???" and select a data type from the drop-down menu.

Table 8- 176 Data types for the SEL instruction

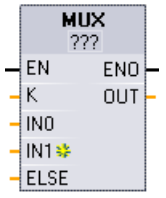
Parameter	Data type [1]	Description
G	Bool	• 0 selects IN0 • 1 selects IN1
IN0, IN1	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Inputs
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Output

1 Input variables and the output variable must be of the same data type.

Condition codes: ENO is always TRUE following execution of the SEL instruction.

Table 8- 177 MUX (multiplex) instruction

LAD / FBD	SCL	Description

	`out := MUX(`
	`k:=_unit_in,`
	`in1:=variant_in,`
	`in2:=variant_in,`
	
	`[...in32:=variant_in,]`
	`inelse:=variant_in);`
		MUX copies one of many input values to parameter OUT, depending on the parameter K value. If the parameter K value exceeds (IN*n* - 1), then the parameter ELSE value is copied to parameter OUT.

1 For LAD and FBD: Click the "???" and select a data type from the drop-down menu.



To add an input, click the "Create" icon or right-click on an input stub for one of the existing IN parameters and select the "Insert input" command.

To remove an input, right-click on an input stub for one of the existing IN parameters (when there are more than the original two inputs) and select the "Delete" command.

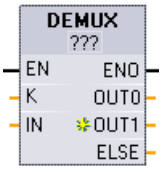
Table 8- 178 Data types for the MUX instruction

Parameter	Data type	Description
K	UInt	• 0 selects IN1 • 1 selects IN2 • *n* selects IN*n*
IN0, IN1, .. INn	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Inputs
ELSE	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Input substitute value (optional)
OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Output

[1] Input variables and the output variable must be of the same data type.

Table 8- 179 DEMUX (Demultiplex) instruction

LAD / FBD	SCL	Description

	`DEMUX(`
	`k:=_unit_in,`
	`in:=variant_in,`
	`out1:=variant_in,`
	`out2:=variant_in,`
	
	`[...out32:=variant_in,]`
	
	`outelse:=variant_in);`
		DEMUX copies the value of the location assigned to parameter IN to one of many outputs. The value of the K parameter selects which output selected as the destination of the IN value. If the value of K is greater than the number (OUT*n* - 1) then the IN value is copied to location assigned to the ELSE parameter.

[1] For LAD and FBD: Click the "???" and select a data type from the drop-down menu.



To add an output, click the "Create" icon or right-click on an output stub for one of the existing OUT parameters and select the "Insert output" command.

To remove an output, right-click on an output stub for one of the existing OUT parameters (when there are more than the original two outputs) and select the "Delete" command.

Table 8- 180 Data types for the DEMUX instruction

Parameter	Data type [1]	Description
K	UInt	Selector value: • 0 selects OUT1 • 1 selects OUT2 • n selects OUTn
IN	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Input
OUT0, OUT1, .. OUTn	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Outputs
ELSE	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal, Byte, Word, DWord, Time, Date, TOD, Char, WChar	Substitute output when K is greater than (OUTn - 1)

[1] The input variable and the output variables must be of the same data type.

Table 8- 181 ENO status for the MUX and DEMUX instructions

ENO	Condition	Result OUT
1	No error	MUX: Selected IN value is copied to OUT DEMUX: IN value is copied to selected OUT
0	MUX: K is greater than the number of inputs -1	• No ELSE provided: OUT is un-changed, • ELSE provided, ELSE value assigned to OUT
	DEMUX: K is greater than the number of outputs -1	• No ELSE provided: outputs are un-changed, • ELSE provided, IN value copied to ELSE

8.10 Shift and rotate

8.10.1 SHR (Shift right) and SHL (Shift left) instructions

Table 8- 182 SHR and SHL instructions

LAD / FBD	SCL	Description

	`out := SHR(`
	`  in:=_variant_in_,`
	`  n:=_uint_in);`
	`out := SHL(`
	`  in:=_variant_in_,`
	`  n:=_uint_in);`
		Use the shift instructions (SHL and SHR) to shift the bit pattern of parameter IN. The result is assigned to parameter OUT. Parameter N specifies the number of bit positions shifted:
		• SHR: Shift bit pattern right
		• SHL: Shift bit pattern left

[1] For LAD and FBD: Click the "???" and select the data types from the drop-down menu.

Table 8- 183 Data types for the parameters

Parameter	Data type	Description
IN	Integers	Bit pattern to shift
N	USInt, UDint	Number of bit positions to shift
OUT	Integers	Bit pattern after shift operation

- For N=0, no shift occurs. The IN value is assigned to OUT.
- Zeros are shifted into the bit positions emptied by the shift operation.
- If the number of positions to shift (N) exceeds the number of bits in the target value (8 for Byte, 16 for Word, 32 for DWord), then all original bit values will be shifted out and replaced with zeros (zero is assigned to OUT).
- ENO is always TRUE for the shift operations.

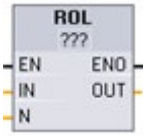
Table 8- 184 Example: SHL for Word data

Shift the bits of a Word to the left by inserting zeroes from the right (N = 1)			
IN	1110 0010 1010 1101	OUT value before first shift:	1110 0010 1010 1101
		After first shift left:	1100 0101 0101 1010
		After second shift left:	1000 1010 1011 0100
		After third shift left:	0001 0101 0110 1000

8.10.2 ROR (Rotate right) and ROL (Rotate left) instructions

Table 8- 185 ROR and ROL instructions

LAD / FBD	SCL	Description

	`out := ROL(`
	`  in:=_variant_in_,`
	`  n:=_uint_in);`
	`out := ROR(`
	`  in:=_variant_in_,`
	`  n:=_uint_in);`
		Use the rotate instructions (ROR and ROL) to rotate the bit pattern of parameter IN. The result is assigned to parameter OUT. Parameter N defines the number of bit positions rotated.
		• ROR: Rotate bit pattern right
		• ROL: Rotate bit pattern left

[1] For LAD and FBD: Click the "???" and select the data types from the drop-down menu.

Table 8- 186 Data types for the parameters

Parameter	Data type	Description
IN	Integers	Bit pattern to rotate
N	USInt, UDint	Number of bit positions to rotate
OUT	Integers	Bit pattern after rotate operation

- For N=0, no rotate occurs. The IN value is assigned to OUT.
- Bit data rotated out one side of the target value is rotated into the other side of the target value, so no original bit values are lost.
- If the number of bit positions to rotate (N) exceeds the number of bits in the target value (8 for Byte, 16 for Word, 32 for DWord), then the rotation is still performed.
- ENO is always TRUE following execution of the rotate instructions.

Table 8- 187 Example: ROR for Word data

Rotate bits out the right -side into the left -side (N = 1)			
IN	0100 0000 0000 0001	OUT value before first rotate:	0100 0000 0000 0001
		After first rotate right:	1010 0000 0000 0000
		After second rotate right:	0101 0000 0000 0000

Extended instructions

9

9.1 Date, time-of-day, and clock functions

9.1.1 Date and time-of-day instructions

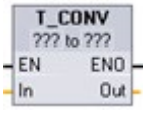
Use the date and time instructions for calendar and time calculations.

- T_CONV converts a value to or from (date and time data types) and (byte, word, and dword size data types)
- T_ADD adds Time and DTL values: (Time + Time = Time) or (DTL + Time = DTL)
- T_SUB subtracts Time and DTL values: (Time - Time = Time) or (DTL - Time = DTL)
- T_DIFF provides the difference between two DTL values as a Time value: DTL - DTL = Time
- T_COMBINE combines a Date value and a Time_and_Date value to create a DTL value

For information about the format of DTL and Time data, refer to the section on the Time and Date data types (Page 125).

Table 9- 1 T_CONV (Convert times and extract) instruction

LAD / FBD	SCL example	Description

	`out := DINT_TO_TIME( in:=_variant_in);`
	
	`out := TIME_TO_DINT( in:=_variant_in);`
		T_CONV converts a value to or from (date and time data types) and (byte, word, and dword size data types).

1 For LAD and FBD boxes: Click "???" and select the source/target data types from the drop-down menu.

2 For SCL: Drag T_CONV from instruction tree and drop into the program editor, then select the source/target data types.

Table 9- 2 Valid data types for T_CONV conversions

Data type IN (or OUT)	Data types OUT (or IN)
TIME (milliseconds)	DInt, Int, SInt, UDInt, UInt, USInt, TOD SCL only: Byte, Word, Dword
DATE (number of days since Jan. 1 1990)	DInt, Int, SInt, UDInt, UInt, USInt, DTL SCL only: Byte, Word, Dword
TOD (milliseconds since midnight- 24:00:00.000)	DInt, Int, SInt, UDInt, UInt, USInt, TIME, DTL SCL only: Byte, Word, Dword

Note

Using T_CONV to convert a larger data size to a smaller data size

Data values can be truncated when you convert a larger data type with more bytes to a smaller data type with less bytes. If this error occurs, then ENO is set to 0.

Conversion to/from DTL data type

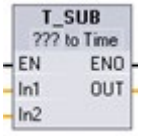
DTL (Date and Time Long) contains year, month, date, and time data. DTL data can be converted to/from DATE and TOD data types.
However, DTL conversion with DATE data only affects the year, month, and day values. DTL conversion with TOD data only affects the hour, minutes, and seconds values.

When T_CONV converts to DTL, the unaffected data elements in the DTL format are left unchanged.

Table 9- 3 T_ADD (Add times) and T_SUB (Subtract times) instructions

LAD / FBD	SCL	Description

	`out := T_ADD(`
	`  in1:=_variant_in,`
	`  in2:=_time_in);`
		T_ADD adds the input IN1 value (DTL or Time data types) with the input IN2 Time value. Parameter OUT provides the DTL or Time value result. Two data type operations are possible:
		• Time + Time = Time
		• DTL + Time = DTL

	`out := T_SUB(`
	`  in1:=_variant_in,`
	`  in2:=_time_in);`
		T_SUB subtracts the IN2 Time value from IN1 (DTL or Time value). Parameter OUT provides the difference value as a DTL or Time data type. Two data type operations are possible.
		• Time - Time = Time
		• DTL - Time = DTL

[1] For LAD and FBD: Click the "???" and select the data types from the drop-down menu.

Table 9- 4 Data types for the T_ADD and T_SUB parameters

Parameter and type		Data type	Description
IN1[1]	IN	DTL, Time	DTL or Time value
IN2	IN	Time	Time value to add or subtract
OUT	OUT	DTL, Time	DTL or Time sum or difference

[1] Select the IN1 data type from the drop-down list available below the instruction name. The IN1 data type selection also sets the data type of parameter OUT.

Table 9- 5 T_DIFF (Time difference) instruction

LAD / FBD	SCL	Description

	`out := T_DIFF(`
	`in1:=_DTL_in,`
	`in2:=_DTL_in);`
		T_DIFF subtracts the DTL value (IN2) from the DTL value (IN1). Parameter OUT provides the difference value as a Time data type.
		• DTL - DTL = Time

Table 9- 6 Data types for the T_DIFF parameters

Parameter and type		Data type	Description
IN1	IN	DTL	DTL value
IN2	IN	DTL	DTL value to subtract
OUT	OUT	Time	Time difference

Condition codes: ENO = 1 means no error occurred. ENO = 0 and parameter OUT = 0 errors:

- Invalid DTL value
- Invalid Time value

Table 9- 7 T_COMBINE (Combine times) instruction

LAD / FBD	SCL	Description

	`out :=`
	`CONCAT_DATE_TOD(`
	`In1 := _date_in,`
	`In2 := _tod_in);`
		T_COMBINE combines a Date value and a Time_of_Day value to create a DTL value.

[1] Note that the T_COMBINE instruction in the Extended Instructions equates to the CONCAT_DATE_TOD function in SCL.

Table 9- 8 Data types for the T_COMBINE parameters

Parameter and type		Data type	Description
IN1	IN	Date	Date value to be combined must be between DATE#1990-01-01 and DATE#2089-12-31
IN2	IN	Time_of_Day	Time_of_Day values to be combined
OUT	OUT	DTL	DTL value

9.1.2 Clock functions

WARNING

Risk of attacker accessing your networks through Network Time Protocol (NTP) synchronization

If an attacker can access your networks through Network Time Protocol (NTP) synchronization, the attacker can possibly disrupt control of your process by shifting the CPU system time. Disruptions to process control can possibly cause death, severe injury, or property damage.

The NTP client feature of the S7-1200 CPU is disabled by default, and, when enabled, only allows configured IP addresses to act as an NTP server. The CPU disables this feature by default, and you must configure this feature to allow remotely-controlled CPU system time corrections.

The S7-1200 CPU supports "time of day" interrupts and clock instructions that depend upon accurate CPU system time. If you configure NTP and accept time synchronization from a server, you must ensure that the server is a trusted source. Failure to do so can cause a security breach that allows an unknown user to disrupt control of your process by shifting the CPU system time.

For security information and recommendations, please see our "Operational Guidelines for Industrial Security" (http://www.industry.siemens.com/topics/global/en/industrial-security/Documents/operational_guidelines_industrial_security_en.pdf) on the Siemens Service and Support site.

Use the clock instructions to set and read the CPU system clock. The data type DTL (Page 125) is used to provide date and time values.

Table 9- 9 System time instructions

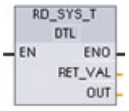
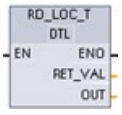
LAD / FBD	SCL	Description
	`ret_val := WR_SYS_T( in:=_DTL_in_);`	WR_SYS_T (Set time-of-day) sets the CPU time of day clock with a DTL value at parameter IN. This time value does not include local time zone or daylight saving time offsets.
	`ret_val := RD_SYS_T( out=>_DTL_out);`	RD_SYS_T (Read time-of-day) reads the current system time from the CPU. This time value does not include local time zone or daylight saving time offsets.
	`ret_val := RD_LOC_T( out=>_DTL_out);`	RD_LOC_T (Read local time) provides the current local time of the CPU as a DTL data type. This time value reflects the local time zone adjusted appropriately for daylight saving time (if configured).
	`ret_val := WR_LOC_T( LOCTIME:=DTL_in_, DST:_in_;`	WR_LOC_T (Write local time) sets the date and time of the CPU clock. You assign the date and time information as local time at LOCTIME with DTL data type. The instruction uses the "TimeTransformationRule (Page 335)" DB structure to calculate the system time. The granularity of the time information for local time and system time is product-specific and is at least one millisecond. Input values at the LOCTIME parameter which are less than those supported by the CPU are rounded up during system time calculation. **Note**: You must use the CPU device configuration to set the "Time of day" properties (time zone, DST activation, DST start, and DST stop). Otherwise, WR_LOC_T cannot interpret the DST time change.

Table 9- 10 Data types for the parameters

Parameter and type		Data type	Description
IN	IN	DTL	Time of day to set in the CPU system clock
OUT	OUT	DTL	RD_SYS_T: Current CPU system time RD_LOC_T: Current local time, including any adjustment for daylight saving time, if configured
LOCTIME	IN	DTL	WR_LOC_T: Local time
DST	IN	BOOL	WR_LOC_T: **D**aylight **S**aving **T**ime only evaluated during the "double hour" when the clocks change to daylight saving time. • TRUE = daylight saving time (first hour) • FALSE = standard time (second hour)
RET_VAL	OUT	Int	Execution condition code

- The local time is calculated by using the time zone and daylight saving time offsets that you set in the device configuration general tab "Time of day" parameters.
- Time zone configuration is an offset to UTC or GMT time.
- Daylight saving time configuration specifies the month, week, day, and hour when daylight saving time begins.

- Standard time configuration also specifies the month, week, day, and hour when standard time begins.
- The time zone offset is always applied to the system time value. The daylight saving time offset is only applied when daylight saving time is in effect.

Note

Daylight saving and standard start time configuration

The "Time of day" properties for "Start for daylight saving time" of the CPU device configuration must be your local time.

Condition codes: ENO = 1 means no error occurred. ENO = 0 means an execution error occurred, and a condition code is provided at the RET_VAL output.

RET_VAL (W#16#....)	Description
0000	The current local time is in standard time.
0001	Daylight saving time has been configured, and the current local time is in daylight saving time.
8080	Local time not available or LOCTIME value is invalid.
8081	Illegal year value or time value assigned by the LOCTIME parameter is invalid
8082	Illegal month value (byte 2 in DTL format)
8083	Illegal day value (byte 3 in DTL format)
8084	Illegal hour value (byte 5 in DTL format)
8085	Illegal minute value (byte 6 in DTL format)
8086	Illegal second value (byte 7 in DTL format)
8087	Illegal nanosecond value (bytes 8 to 11 in DTL format)
8089	Time value does not exist (hour already passed upon changeover to daylight saving time)
80B0	The real-time clock has failed
80B1	The "TimeTransformationRule" structure has not been defined.

9.1.3 TimeTransformationRule data structure

Description

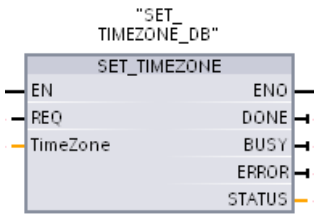
The changeover rules for standard and daylight saving time are defined in the TimeTransformationRule structure. The structure is as follows:

Name		Data type	Description
TimeTransformationRule		STRUCT	
	Bias	INT	Time difference between local time and UTC [minutes] Range: -1439 to 1439
	DaylightBias	INT	Time difference between daylight saving and standard time [minutes] Range: 0 to 60
	DaylightStartMonth	USINT	Month of conversion to daylight saving time Range: 1 to 12
	DaylightStartWeek	USINT	Week of conversion to daylight saving time 1 = First occurrence of the weekday in the month, ..., 5 = Last occurrence of the weekday in the month
	DaylightStartWeekday	USINT	Weekday of daylight saving time changeover: 1 = Sunday
	DaylightStartHour	USINT	Hour of daylight saving time changeover: Range: 0 to 23
	DaylightStartMinute	USINT	Minute of daylight saving time changeover Range: 0 to 59
	StandardStartMonth	USINT	Month of conversion to standard time Range: 1 to 12
	StandardStartWeek	USINT	Week of conversion to standard time 1 = First occurrence of the weekday in the month, ..., 5 = Last occurrence of the weekday in the month
	StandardStartWeekday	USINT	Weekday of standard time changeover: 1 = Sunday
	StandardStartHour	USINT	Hour of standard time changeover Range: 0 to 23
	StandardStartMinute	USINT	Minute of standard time changeover Range: 0 to 59
	TimeZoneName	STRING[80]	Name of time zone: "(GMT+01:00) Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna"

9.1.4 SET_TIMEZONE (Set timezone)

Table 9- 11 SET_TIMEZONE instruction

LAD / FBD	SCL	Description

	`"SET_TIMEZONE_DB"(`
	`REQ:=_bool_in,`
	`Timezone:=_struct_in,`
	`DONE=>_bool_out_,`
	`BUSY=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		Sets the local time zone and daylight saving parameters that are used to transform the CPU system time to local time.

[1] In the SCL example, "SET_TIMEZONE_DB" is the name of the instance DB.

Table 9- 12 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	REQ=1: execute function
Timezone	IN	TimeTransformationRule	Rules for the transformation from system time to local time
DONE	OUT	Bool	Function complete
BUSY	OUT	Bool	Function busy
ERROR	OUT	Bool	Error detected
STATUS	OUT	Word	Function result / error message

To manually configure the time zone parameters for the CPU, use the "Time of day" properties of the "General" tab of the device configuration.

Use the SET_TIMEZONE instruction to set the local time configuration. The parameters of the "TimeTransformationRule (Page 335)" structure assign the local time zone and timing for automatic switching between standard time and daylight saving time.

Condition codes: ENO = 1 means no error occurred. ENO = 0 means an execution error occurred, and a condition code is provided at the STATUS output.

STATUS (W#16#....)	Description
0	No error
7000	No job processing active
7001	Start of job processing. Parameter BUSY = 1, DONE = 0
7002	Intermediate call (REQ irrelevant): Instruction already active; BUSY has the value "1".
808x	Error at x-th component: For example 8084 indicates that DaylightStartWeekif is not a value from 1to 5.

9.1.5 RTM (Runtime meters)

Table 9- 13 RTM instruction

LAD / FBD	SCL	Description

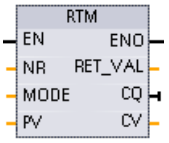
	`RTM(NR:=_uint_in_,`
	`MODE:=_byte_in_,`
	`PV:=_dint_in_,`
	`CQ=>_bool_out_,`
	`CV=>_dint_out_);`
		The RTM (Runtime Meters) instruction can set, start, stop, and read the runtime hour meters in the CPU.

Table 9- 14 Data types for the parameters

Parameter and type		Data type	Description
NR	IN	UInt	Runtime meter number: (possible values: 0..9)
MODE	IN	Byte	RTM Execution mode number: • 0 = Fetch values (the status is then written to CQ and the current value to CV) • 1 = Start (at the last counter value) • 2 = Stop • 4 = Set (to the value specified in PV) • 5 = Set (to the value specified in PV) and then start • 6 = Set (to the value specified in PV) and then stop • 7 = Save all RTM values in the CPU to the MC (memory card)
PV	IN	DInt	Preset hours value for the specified runtime meter
RET_VAL	OUT	Int	Function result / error message
CQ	OUT	Bool	Runtime meter status (1 = running)
CV	OUT	DInt	Current runtime hours value for the specified meter

The CPU operates up to 10 runtime hour meters to track the runtime hours of critical control subsystems. You must start the individual hour meters with one RTM execution for each timer. All runtime hour meters are stopped when the CPU makes a run-to-stop transition. You can also stop individual timers with RTM execution mode 2.

When a CPU makes a stop-to-run transition, you must restart the hour timers with one RTM execution for each timer that is started. After a runtime meter value is greater than 2147483647 hours, counting stops and the "Overflow" error is sent. You must execute the RTM instruction once for each timer to reset or modify the timer.

A CPU power failure or power cycle causes a power-down process that saves the current runtime meter values in retentive memory. Upon CPU power-up, the stored runtime meter values are reloaded to the timers and the previous runtime hour totals are not lost. The runtime meters must be restarted to accumulate additional runtime.

Your program can also use RTM execution mode 7 to save the runtime meter values in a memory card. The states of all timers at the instant RTM mode 7 is executed are stored in the memory card. These stored values can become incorrect over time as the hour timers are started and stopped during a program run session. You must periodically update the memory card values to capture important runtime events. The advantage that you get from storing the RTM values in the memory card is that you can insert the memory card in a substitute CPU where your program and saved RTM values will be available. If you did not save the RTM values in the memory card, then the timer values would be lost (in a substitute CPU).

Note

Avoid excessive program calls for memory card write operations

Minimize flash memory card write operations to extend the life of the memory card.

Table 9- 15 Condition codes

RET_VAL (W#16#....)	Description
0	No error
8080	Incorrect runtime meter number
8081	A negative value was passed to the parameter PV
8082	Overflow of the operating hours counter
8091	The input parameter MODE contains an illegal value
80B1	Value cannot be saved to MC (MODE=7)

9.2 String and character

9.2.1 String data overview

String data type

String data is stored as a 2-byte header followed by up to 254 character bytes of ASCII character codes. A String header contains two lengths. The first byte is the maximum length that is given in square brackets when you initialize a string, or 254 by default. The second header byte is the current length that is the number of valid characters in the string. The current length must be smaller than or equal to the maximum length. The number of stored bytes occupied by the String format is 2 bytes greater than the maximum length.

Initialize your String data

String input and output data must be initialized as valid strings in memory, before execution of any string instructions.

Valid String data

A valid string has a maximum length that must be greater than zero but less than 255. The current length must be less than or equal to the maximum length.

Strings cannot be assigned to I or Q memory areas.

For more information see: Format of the String data type (Page 127).

9.2.2 S_MOVE (Move character string)

Table 9- 16 String move instruction

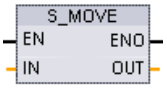
LAD / FBD	SCL	Description
	`out := in;`	Copy the source IN string to the OUT location. S_MOVE execution does not affect the contents of the source string.

Table 9- 17 Data types for the parameters

Parameter	Data type	Description
IN	String	Source string
OUT	String	Target address

If the actual length of the string at the input IN exceeds the maximum length of a string stored at output OUT, then the part of the IN string which can fit in the OUT string is copied.

9.2.3 String conversion instructions

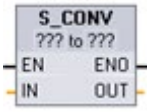
9.2.3.1 S_CONV, STRG_VAL, and VAL_STRG (Convert to/from character string and number) instructions

You can convert number character strings to number values or number values to number character strings with these instructions:

- S_CONV converts (number string to a number value) or (number value to a number string)
- STRG_VAL converts a number string to a number value with format options
- VAL_STRG converts a number value to a number string with format options

S_CONV (convert character string)

Table 9- 18 String conversion instruction

LAD / FBD	SCL	Description
	`out := <Type>_TO_<Type>(in);`	Converts a character string to the corresponding value, or a value to the corresponding character string. The S_CONV instruction has no output formatting options. This makes the S_CONV instruction simpler, but less flexible than the STRG_VAL and VAL_STRG instructions.

1 For LAD / FBD: Click the "???" and select the data type from the drop-down list.

2 For SCL: Select S_CONV from the Extended Instructions, and answer the prompts for the data types for the conversion. STEP 7 then provides the appropriate conversion instruction.

Table 9- 19 Data types (string to value)

Parameter and type		Data type	Description
IN	IN	String, WString	Input character string
OUT	OUT	String, WString, Char, WChar, SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Output number value

Conversion of the string parameter IN starts at the first character and continues until the end of the string, or until the first character is encountered that is not "0" through "9", "+", "-", or ".". The result value is provided at the location specified in parameter OUT. If the output number value does not fit in the range of the OUT data type, then parameter OUT is set to 0 and ENO is set to FALSE. Otherwise, parameter OUT contains a valid result and ENO is set to TRUE.

Input String format rules:

- If a decimal point is used in the IN string, you must use the "." character.
- Comma characters "," used as a thousands separator to the left of the decimal point are allowed and ignored.
- Leading spaces are ignored.

S_CONV (value to string conversion)

Table 9- 20 Data types (value to string)

Parameter and type		Data type	Description
IN	IN	String, WString, Char, WChar, SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Input number value
OUT	OUT	String, WString	Output character string

An integer, unsigned integer, or floating point value IN is converted to the corresponding character string at OUT. The parameter OUT must reference a valid string before the conversion is executed. A valid string consists of a maximum string length in the first byte, the current string length in the second byte, and the current string characters in the next bytes. The converted string replaces characters in the OUT string starting at the first character and adjusts the current length byte of the OUT string. The maximum length byte of the OUT string is not changed.

How many characters are replaced depends on the parameter IN data type and number value. The number of characters replaced must fit within the parameter OUT string length. The maximum string length (first byte) of the OUT string should be greater than or equal to the maximum expected number of converted characters. The following table shows S_CONV value to string conversion examples:

Output String format rules:

- Values written to parameter OUT do not use a leading "+" sign.
- Fixed-point representation is used (no exponential notation).
- The period character "." is used to represent the decimal point when parameter IN is the Real data type.
- Values are right-justified in the output string and are preceded by space characters that fill empty character positions.

Table 9- 21 Maximum string lengths for each data type

IN data type	Character positions allocated by S_CONV	Converted string example[1]	Total string length including maximum and current length bytes
USInt	4	"x255"	6
SInt	4	"-128"	6
UInt	6	"x65535"	8
Int	6	"-32768"	8
UDInt	11	"x4294967295"	13
DInt	11	"-2147483648"	13
Real	14	"x-3.402823E+38" "x-1.175495E-38" "x+1.175495E-38" "x+3.402823E+38"	16
LReal	21	"-1.7976931348623E+308" "-2.2250738585072E-308" "+2.2250738585072E-308" "+1.7976931348623E+308"	23

[1] The "x" characters represent space characters that fill empty positions in the right-justified field that is allocated for the converted value.

STRG_VAL (convert characer string to numerical value)

Table 9- 22 String-to-value instruction

LAD / FBD	SCL	Description

	`"STRG_VAL"(`
	`in:=_string_in,`
	`format:=_word_in,`
	`p:=uint_in,`
	`out=>_variant_out);`
		Converts a number character string to the corresponding integer or floating point representation.

[1] For LAD / FBD: Click the "???" and select the data type from the drop-down list.

Table 9- 23 Data types for the STRG_VAL instruction

Parameter and type		Data type	Description
IN	IN	String, WString	The ASCII character string to convert
FORMAT	IN	Word	Output format options
P	IN	UInt, Byte, USInt	IN: Index to the first character to be converted (first character = 1)
OUT	OUT	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Converted number value

Conversion begins in the string IN at character offset P and continues until the end of the string, or until the first character is encountered that is not "+", "-", ".", ",", "e", "E", or "0" to "9". The result is placed at the location specified in parameter OUT.

String data must be initialized before execution as a valid string in memory.

The FORMAT parameter for the STRG_VAL instruction is defined below. The unused bit positions must be set to zero.

Table 9- 24 Format of the STRG_VAL instruction

Bit 16							**Bit 8**	**Bit 7**							**Bit 0**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	f	r

f = Notation format
1= Exponential notation
0 = Fixed point notation

r = Decimal point format
1 = "," (comma character)
0 = "." (period character)

Table 9- 25 Values of the FORMAT parameter

FORMAT (W#16#)	Notation format	Decimal point representation
0000 (default)	Fixed point	"."
0001		","
0002	Exponential	"."
0003		","
0004 to FFFF	Illegal values	

Rules for STRG_VAL conversion:

- If the period character "." is used for the decimal point, then commas "," to the left of the decimal point are interpreted as thousands separator characters. The comma characters are allowed and ignored.
- If the comma character "," is used for the decimal point, then periods "." to the left of the decimal point are interpreted as thousands separator characters. These period characters are allowed and ignored.
- Leading spaces are ignored.

VAL_STRG (convert numerical value to string)

Table 9- 26 Value-to-string operation

LAD / FBD	SCL	Description

	`"VAL_STRG"(`
	`in:=_variant_in,`
	`size:=_usint_in,`
	`prec:=_usint_in,`
	`format:=_word_in,`
	`p:=uint_in,`
	`out=>_string_out);`
		Converts an integer, unsigned integer, or floating point value to the corresponding character string representation.

[1] For LAD / FBD: Click the "???" and select the data type from the drop-down list.

Table 9- 27 Data types for the VAL_STRG instruction

Parameter and type		Data type	Description
IN	IN	SInt, Int, DInt, USInt, UInt, UDInt, Real, LReal	Value to convert
SIZE	IN	USInt	Number of characters to be written to the OUT string
PREC	IN	USInt	The precision or size of the fractional portion. This does not include the decimal point.
FORMAT	IN	Word	Output format options
P	IN	UInt, Byte, USInt	IN: Index to the first OUT string character to be replaced (first character = 1)
OUT	OUT	String, WString	The converted string

This instruction converts the value represented by parameter IN to a string referenced by parameter OUT. The parameter OUT must be a valid string before the conversion is executed.

The converted string replaces characters in the OUT string starting at character offset count P to the number of characters specified by parameter SIZE. The number of characters in SIZE must fit within the OUT string length, counting from character position P. If the SIZE parameter is zero, then the characters overwrite at position P in the OUT string without limitation. This instruction is useful for embedding number characters into a text string. For example, you can put the numbers "120" into the string "Pump pressure = 120 psi".

Parameter PREC specifies the precision or number of digits for the fractional part of the string. If the parameter IN value is an integer, then PREC specifies the location of the decimal point. For example, if the data value is 123 and PREC = 1, then the result is "12.3". The maximum supported precision for the Real data type is 7 digits.

If parameter P is greater than the current size of the OUT string, then spaces are added, up to position P, and the result is appended to the end of the string. The conversion ends if the maximum OUT string length is reached.

The FORMAT parameter for the VAL_STRG instruction is defined below. The unused bit positions must be set to zero.

Table 9- 28 Format of the VAL_STRG instruction

Bit 16							**Bit 8**	**Bit 7**							**Bit 0**
0	0	0	0	0	0	0	0	0	0	0	0	0	s	f	r

s = Number sign character	1= use sign character "+" and "-" 0 = use sign character "-" only
f = Notation format	1= Exponential notation 0 = Fixed point notation
r = Decimal point format	1 = "," (comma character) 0 = "." (period character)

Table 9- 29 Values of the FORMAT parameter

FORMAT (WORD)	Number sign character	Notation format	Decimal point representation
W#16#0000	"-" only	Fixed point	"."
W#16#0001			","
W#16#0002		Exponential	"."
W#16#0003			","
W#16#0004	"+" and "-"	Fixed Point	"."
W#16#0005			","
W#16#0006		Exponential	"."
W#16#0007			","
W#16#0008 to W#16#FFFF	Illegal values		

Parameter OUT string format rules:

- Leading space characters are added to the leftmost part of the string when the converted string is smaller than the specified size.
- When the FORMAT parameter sign bit is FALSE, unsigned and signed integer data type values are written to the output buffer without the leading "+" sign. The "-" sign is used if required.
  <leading spaces><digits without leading zeroes>'.'<PREC digits>
- When the sign bit is TRUE, unsigned and signed integer data type values are written to the output buffer always with a leading sign character.

  <leading spaces><sign><digits without leading zeroes>'.'<PREC digits>
- When the FORMAT is set to exponential notation, Real data type values are written to the output buffer as:

  <leading spaces><sign><digit> '.' <PREC digits>'E' <sign><digits without leading zero>

- When the FORMAT is set to fixed point notation, integer, unsigned integer, and real data type values are written to the output buffer as:

  <leading spaces><sign><digits without leading zeroes>'.'<PREC digits>
- Leading zeros to the left of the decimal point (except the digit adjacent to the decimal point) are suppressed.
- Values to the right of the decimal point are rounded to fit in the number of digits to the right of the decimal point specified by the PREC parameter.
- The size of the output string must be a minimum of three bytes more than the number of digits to the right of the decimal point.
- Values are right-justified in the output string.

Conditions reported by ENO

When the conversion operation encounters an error, the instruction returns the following results:

- ENO is set to 0.
- OUT is set to 0, or as shown in the examples for string to value conversion.
- OUT is unchanged, or as shown in the examples when OUT is a string.

Table 9- 30 ENO status

ENO	Description
1	No error
0	Illegal or invalid parameter; for example, an access to a DB that does not exist
0	Illegal string where the maximum length of the string is 0 or 255
0	Illegal string where the current length is greater than the maximum length
0	The converted number value is too large for the specified OUT data type.
0	The OUT parameter maximum string size must be large enough to accept the number of characters specified by parameter SIZE, starting at the character position parameter P.
0	Illegal P value where P=0 or P is greater than the current string length
0	Parameter SIZE must be greater than parameter PREC.

Table 9- 31 Example of S_CONV string to value conversion

IN string	OUT data type	OUT value	ENO
"123"	Int or DInt	123	TRUE
"-00456"	Int or DInt	-456	TRUE
"123.45"	Int or DInt	123	TRUE
"+2345"	Int or DInt	2345	TRUE
"00123AB"	Int or DInt	123	TRUE
"123"	Real	123.0	TRUE
"123.45"	Real	123.45	TRUE
"1.23e-4"	Real	1.23	TRUE
"1.23E-4"	Real	1.23	TRUE
"12,345.67"	Real	12345.67	TRUE
"3.4e39"	Real	3.4	TRUE
"-3.4e39"	Real	-3.4	TRUE
"1.17549e-38"	Real	1.17549	TRUE
"12345"	SInt	0	FALSE
"A123"	N/A	0	FALSE
""	N/A	0	FALSE
"++123"	N/A	0	FALSE
"+-123"	N/A	0	FALSE

Table 9- 32 Examples of S_CONV value to string conversion

Data type	IN value	OUT string [1]	ENO
UInt	123	"xxx123"	TRUE
UInt	0	"xxxxx0"	TRUE
UDInt	12345678	"xxx12345678"	TRUE
Real	+9123.456	"xx+9.123456E+3"	TRUE
LReal	+9123.4567890123	"xx+9.1234567890123E+3"	TRUE
Real	-INF	"xxxxxxxxxxINF"	FALSE
Real	+INF	"xxxxxxxxxxINF"	FALSE
Real	NaN	"xxxxxxxxxxNaN"	FALSE

[1] The "x" characters represent space characters that fill empty positions in the right-justified field that is allocated for the converted value.

Table 9- 33 Example: STRG_VAL conversion

IN string	FORMAT (W#16#....)	OUT data type	OUT value	ENO
"123"	0000	Int or DInt	123	TRUE
"-00456"	0000	Int or DInt	-456	TRUE
"123.45"	0000	Int or DInt	123	TRUE
"+2345"	0000	Int or DInt	2345	TRUE
"00123AB"	0000	Int or DInt	123	TRUE
"123"	0000	Real	123.0	TRUE
"-00456"	0001	Real	-456.0	TRUE
"+00456"	0001	Real	456.0	TRUE
"123.45"	0000	Real	123.45	TRUE
"123.45"	0001	Real	12345.0	TRUE
"123.45"	0000	Real	12345.0	TRUE
"123.45"	0001	Real	123.45	TRUE
".00123AB"	0001	Real	123.0	TRUE
"1.23e-4"	0000	Real	1.23	TRUE
"1.23E-4"	0000	Real	1.23	TRUE
"1.23E-4"	0002	Real	1.23E-4	TRUE
"12,345.67"	0000	Real	12345.67	TRUE
"12,345.67"	0001	Real	12.345	TRUE
"3.4e39"	0002	Real	+INF	TRUE
"-3.4e39"	0002	Real	-INF	TRUE
"1.1754943e-38" (and smaller)	0002	Real	0.0	TRUE
"12345"	N/A	SInt	0	FALSE
"A123"	N/A	N/A	0	FALSE
""	N/A	N/A	0	FALSE
"++123"	N/A	N/A	0	FALSE
"+-123"	N/A	N/A	0	FALSE

The following examples of VAL_STRG conversions are based on an OUT string initialized as follows:

"`Current Temp = xxxxxxxxxx C`"
where the "`x`" character represents space characters allocated for the converted value.

Table 9- 34 Example: VAL_STRG conversion

Data type	IN value	P	SIZE	FORMAT (W#16#....)	PREC	OUT string	ENO
UInt	123	16	10	0000	0	`Current Temp = xxxxxxx123 C`	TRUE
UInt	0	16	10	0000	2	`Current Temp = xxxxxx0.00 C`	TRUE
UDInt	12345678	16	10	0000	3	`Current Temp = x12345.678 C`	TRUE
UDInt	12345678	16	10	0001	3	`Current Temp = x12345,678 C`	TRUE
Int	123	16	10	0004	0	`Current Temp = xxxxxx+123 C`	TRUE
Int	-123	16	10	0004	0	`Current Temp = xxxxxx-123 C`	TRUE
Real	-0.00123	16	10	0004	4	`Current Temp = xxx-0.0012 C`	TRUE
Real	-0.00123	16	10	0006	4	`Current Temp = -1.2300E-3 C`	TRUE
Real	-INF	16	10	N/A	4	`Current Temp = xxxxxx-INF C`	FALSE
Real	+INF	16	10	N/A	4	`Current Temp = xxxxxx+INF C`	FALSE
Real	NaN	16	10	N/A	4	`Current Temp = xxxxxxxNaN C`	FALSE
UDInt	12345678	16	6	N/A	3	`Current Temp = xxxxxxxxxx C`	FALSE

9.2.3.2 Strg_TO_Chars and Chars_TO_Strg (Convert to/from character string and array of CHAR) instructions

Strg_TO_Chars copies an ASCII character string into an array of character bytes.

Chars_TO_Strg copies an array of ASCII character bytes into a character string.

Note

Only the zero based array types (Array [0..n] of Char) or (Array [0..n] of Byte) are allowed as the input parameter Chars for the Chars_TO_Strg instruction, or as the IN_OUT parameter Chars for the Strg_TO_Chars instruction.

Table 9- 35 Strg_TO_Chars instruction

LAD / FBD	SCL	Description

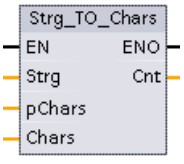
	`Strg_TO_Chars(`
	`  Strg:=_string_in_,`
	`  pChars:=_dint_in_,`
	`  Cnt=>_uint_out_,`
	
	`Chars:=_variant_inout_);`
		The complete input string Strg is copied to an array of characters at IN_OUT parameter Chars.
		The operation overwrites bytes starting at array element number specified by the pChars parameter.
		Strings of all supported max lengths (1..254) may be used.
		An end delimiter is not written; this is your responsibility. To set an end delimiter just after the last written array character, use the next array element number [pChars+Cnt].

Table 9- 36 Data types for the parameters (Strg_TO_Chars)

Parameter and type		Data type	Description
Strg	IN	String, WString	Source string
pChars	IN	DInt	Array element number for the first string character written to the target array
Chars	IN_OUT	Variant	The Chars parameter is a pointer to a zero-based array [0..n] of characters copied from the input string. The array can be declared in a DB or as local variables in the block interface. Example: "DB1".MyArray points to MyArray [0..10] of Char element values in DB1.
Cnt	OUT	UInt	Count of characters copied

Table 9- 37 Chars_TO_Strg instruction

LAD / FBD	SCL	Description

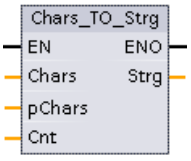
	`Chars_TO_Strg(`
	`  Chars:=_variant_in_,`
	`  pChars:=_dint_in_,`
	`  Cnt:=_uint_in_,`
	`  Strg=>_string_out_);`
		All or part of an array of characters is copied to a string.
		The output string must be declared before Chars_TO_Strg is executed. The string is then overwritten by the Chars_TO_Strg operation.
		Strings of all supported maximum lengths (1..254) may be used.
		The string maximum length value is not changed by Chars_TO_Strg operation. Copying from array to string stops when the maximum string length is reached.
		A nul character '$00' or 16#00 value in the character array works as a delimiter and ends copying of characters into the string.

Table 9- 38 Data types for the parameters (Chars_TO_Strg)

Parameter and type		Data type	Description
Chars	IN	Variant	The Chars parameter is a pointer to zero based array [0..n] of characters to be converted into a string. The array can be declared in a DB or as local variables in the block interface. Example: "DB1".MyArray points to MyArray [0..10] of Char element values in DB1.
pChars	IN	Dint	Element number for the first character in the array to copy. Array element [0] is the default value.
Cnt	IN	UInt	Count of characters to copy: 0 means all
Strg	OUT	String, WString	Target string

Table 9- 39 ENO status

ENO	Description
1	No error
0	Chars_TO_Strg: Attempt to copy more character bytes to the output string than allowed by the maximum length byte in the string declaration
0	Chars_TO_Strg: The nul character (16#00) value was found in the input character byte array.
0	Strg_TO_Chars: Attempt to copy more character bytes to the output array than are allowed by the element number limit

9.2.3.3 ATH and HTA (Convert to/from ASCII string and hexadecimal number) instructions

Use the ATH (ASCII to hexadecimal) and HTA (hexadecimal to ASCII) instructions for conversions between ASCII character bytes (characters 0 to 9 and uppercase A to F only) and the corresponding 4-bit hexadecimal nibbles.

Table 9- 40 ATH instruction

LAD / FBD	SCL	Description

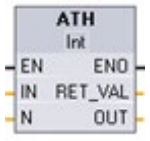
	`ret_val := ATH(`
	`in:=_variant_in_,`
	`n:=_int_in_,`
	
	`out=>_variant_out_);`
		Converts ASCII characters into packed hexadecimal digits.

Table 9- 41 Data types for the ATH instruction

Parameter type		Data Type	Description
IN	IN	Variant	Pointer to ASCII character byte array
N	IN	UInt	Number of ASCII character bytes to convert
RET_VAL	OUT	Word	Execution condition code
OUT	OUT	Variant	Pointer to the converted hexadecimal byte array

Conversion begins at the location specified by parameter IN and continues for N bytes. The result is placed at the location specified by OUT. Only valid ASCII characters 0 to 9, lower case a to f, and uppercase A to F can be converted. Any other character will be converted to zero.

8-bit ASCII coded characters are converted to 4-bit hexadecimal nibbles. Two ASCII characters can converted into a single byte containing two 4-bit hexadecimal nibbles.

The IN and OUT parameters specify byte arrays and not hexadecimal String data. ASCII characters are converted and placed in the hexadecimal output in the same order as they are read. If there are an odd number of ASCII characters, then zeros are put in the right-most nibble of the last converted hexadecimal digit.

Table 9- 42 Examples: ASCII-to-hexadecimal (ATH) conversion

IN character bytes	N	OUT value	ENO
'0a23'	4	W#16#0A23	TRUE
'123AFx1a23'	10	16#123AF01023	FALSE
'a23'	3	W#16#A230	TRUE

Table 9- 43 HTA instruction

LAD / FBD	SCL	Description

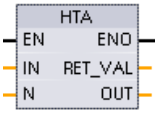
	`ret_val := HTA(`
	`  in:=_variant_in_,`
	`  n:=_uint_in_,`
	`  out=>_variant_out_);`
		Converts packed hexadecimal digits to their corresponding ASCII character bytes.

Table 9- 44 Data types for the HTA instruction

Parameter and type		Data Type	Description
IN	IN	Variant	Pointer to input byte array
N	IN	UInt	Number of bytes to convert (each input byte has two 4-bit nibbles and produces 2N ASCII characters)
RET_VAL	OUT	Word	Execution condition code
OUT	OUT	Variant	Pointer to ASCII character byte array

Conversion begins at the location specified by parameter IN and continues for N bytes. Each 4-bit nibble converts to a single 8-bit ASCII character and produces 2N ASCII character bytes of output. All 2N bytes of the output are written as ASCII characters 0 to 9 through uppercase A to F. The parameter OUT specifies a byte array and not a string.

Each nibble of the hexadecimal byte is converted into a character in the same order as they are read in (left-most nibble of a hexadecimal digit is converted first, followed by the right-most nibble of that same byte).

Table 9- 45 Examples: Hexadecimal -to- ASCII (HTA) conversion

IN value	N	OUT character bytes	ENO (ENO always TRUE after HTA execution)
W#16#0123	2	'0123'	TRUE
DW#16#123AF012	4	'123AF012'	TRUE

Table 9- 46 ATH and HTA condition codes

RET_VAL (W#16#....)	Description	ENO
0000	No error	TRUE
0007	Invalid ATH input character: A character was found that was not an ASCII character 0-9, lowercase a to f, or uppercase A to F	FALSE
8101	Illegal or invalid input pointer, for example, an access to a DB that does not exist.	FALSE
8120	Input string is an invalid format, i.e., max= 0, max=255, current>max, or grant length in pointer < max	FALSE
8182	Input buffer is too small for N	FALSE
8151	Data type not allowed for input buffer	FALSE
8301	Illegal or invalid output pointer, for example, an access to a DB that does not exist.	FALSE
8320	Output string is an invalid format, i.e., max= 0, max=255, current>max, or grant length in pointer < max	FALSE
8382	Output buffer is too small for N	FALSE
8351	Data type not allowed for output buffer	FALSE

9.2.4 String operation instructions

Your control program can use the following string and character instructions to create messages for operator display and process logs.

9.2.4.1 MAX_LEN (Maximum length of a character string)

Table 9- 47 Maximum length instruction

LAD / FBD	SCL	Description
	`out := MAX_LEN(in);`	MAX_LEN (Maximum length of string) provides the maximum length value assigned to string IN at output OUT. If errors occur during processing of the instruction, then an empty string length will be output. The String and WString data types contain two lengths: the first byte (or word) gives the maximum length and the second byte (or word) gives the current length (this is the current number of valid characters). • The maximum length of the character string is assigned for each String or WString declaration in square brackets. The number of bytes occupied by a String is 2 bytes greater than the maximum length. The number of words occupied by a WString is 2 words greater than the maximum length. • The current length represents the number of the characters actually used. The current length must be less than or equal to the maximum length. The current length is in bytes for a String and in words for a WString. Use the MAX_LEN instruction to get the maximum length of the character string and the LEN instruction to get the current length of a string.

Table 9- 48 Data types for the parameters

Parameter and type		Data type	Description
IN	IN	String, WString	Input string
OUT	OUT	DInt	Maximum number of characters allowed for IN string

9.2.4.2 LEN (Determine the length of a character string)

Table 9- 49 Length instruction

LAD / FBD	SCL	Description
	`out := LEN(in);`	LEN (length) provides the current length of the string IN at output OUT. An empty string has a length of zero.

Table 9- 50 Data types for the parameters

Parameter and type		Data type	Description
IN	IN	String, WString	Input string
OUT	OUT	Int, DInt, Real, LReal	Number of valid characters of IN string

Table 9- 51 ENO status

ENO	Condition	OUT
1	No invalid string condition	Valid string length
0	Current length of IN exceeds maximum length of IN	Current length is set to 0
	Maximum length of IN does not fit within allocated memory range	
	Maximum length of IN is 255 (illegal length)	

9.2.4.3 CONCAT (Combine character strings)

Table 9- 52 Concatenate strings instruction

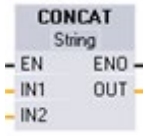
LAD / FBD	SCL	Description
	`out := CONCAT(in1, in2);`	CONCAT (concatenate strings) joins string parameters IN1 and IN2 to form one string provided at OUT. After concatenation, String IN1 is the left part and String IN2 is the right part of the combined string.

Table 9- 53 Data types for the parameters

Parameter and type		Data type	Description
IN1	IN	String, WString	Input string 1
IN2	IN	String, WString	Input string 2
OUT	OUT	String, WString	Combined string (string 1 + string 2)

Table 9- 54 ENO status

ENO	Condition	OUT
1	No errors detected	Valid characters
0	Resulting string after concatenation is larger than maximum length of OUT string	Resulting string characters are copied until the maximum length of the OUT is reached
	Current length of IN1 exceeds maximum length of IN1, current length of IN2 exceeds maximum length of IN2, or current length of OUT exceeds maximum length of OUT (invalid string)	Current length is set to 0
	Maximum length of IN1, IN2 or OUT does not fit within allocated memory range	
	Maximum length of IN1 or IN2 is 255, or the maximum length of OUT is 0 or 255 (String data type)	
	Maximum length of IN1 or IN2 is 65534, or the maximum length of OUT is 0 or 65534 (WString data type)	

9.2.4.4 LEFT, RIGHT, and MID (Read substrings in a character string) instructions

Table 9- 55 Left, right and middle substring operations

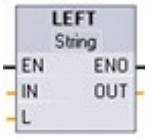
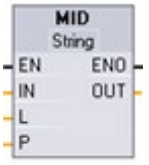
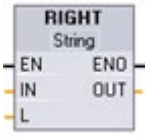
LAD / FBD	SCL	Description
	`out := LEFT(in, L);`	LEFT (Left substring) provides a substring made of the first L characters of string parameter IN. • If L is greater than the current length of the IN string, then the entire IN string is returned in OUT. • If an empty string is the input, then an empty string is returned in OUT.
	`out := MID(in, L, p);`	MID (Middle substring) provides the middle part of a string. The middle substring is L characters long and starts at character position P (inclusive) If the sum of L and P exceeds the current length of the string parameter IN, then a substring is returned that starts at character position P and continues to the end of the IN string.
	`out := RIGHT(in, L);`	RIGHT (Right substring) provides the last L characters of a string. • If L is greater than the current length of the IN string, then the entire IN string is returned in parameter OUT. • If an empty string is the input, then an empty string is returned in OUT.

Table 9- 56 Data types for the parameters

Parameter and type		Data type	Description
IN	IN	String, WString	Input string
L	IN	Int	Length of the substring to be created: • LEFT uses the left-most characters number of characters in the string • RIGHT uses the right-most number of characters in the string • MID uses the number of characters starting at position P within the string
P	IN	Int	MID only: Position of first substring character to be copied P= 1, for the initial character position of the IN string
OUT	OUT	String, WString	Output string

Table 9- 57 ENO status

ENO	Condition	OUT
1	No errors detected	Valid characters
0	• L or P is less than or equal to 0 • P is greater than maximum length of IN • Current length of IN exceeds maximum length of IN, or current length of OUT exceeds maximum length of OUT • Maximum length of IN or OUT does not fit within allocated memory • Maximum length of IN or OUT is 0 or 255 (String data type) or 0 or 65534 (WString data type)	Current length is set to 0
	Substring length (L) to be copied is larger than maximum length of OUT string.	Characters are copied until the maximum length of OUT is reached
	MID only: L or P is less than or equal to 0	Current length is set to 0
	MID only: P is greater than maximum length of IN	
	Current length of IN1 exceeds maximum length of IN1, or current length of IN2 exceeds maximum length of IN2 (invalid string)	Current length is set to 0
	Maximum length of IN1, IN2 or OUT does not fit within allocated memory range	
	Maximum length of IN1, IN2 or OUT is illegal length: 0 or 255 (String data type) or 0 or 65534 (WString data type)	

9.2.4.5 DELETE (Delete characters in a character string)

Table 9- 58 Delete substring instruction

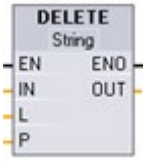
LAD / FBD	SCL	Description
	`out := DELETE(in, L, p);`	Deletes L characters from string IN. Character deletion starts at character position P (inclusive), and the remaining substring is provided at parameter OUT. • If L is equal to zero, then the input string is returned in OUT. • If the sum of L and P is greater than the length of the input string, then the string is deleted to the end.

Table 9- 59 Data types for the parameters

Parameter and type		Data type	Description
IN	IN	String, WString	Input string
L	IN	Int	Number of characters to be deleted
P	IN	Int	Position of the first character to be deleted: The first character of the IN string is position number 1
OUT	OUT	String, WString	Output string

Table 9- 60 ENO status

ENO	Condition	OUT
1	No errors detected	Valid characters
0	P is greater than current length of IN	IN is copied to OUT with no characters deleted
	Resulting string after characters are deleted is larger than maximum length of OUT string	Resulting string characters are copied until the maximum length of OUT is reached
	L is less than 0, or P is less than or equal to 0	Current length is set to 0
	Current length of IN exceeds maximum length of IN, or current length of OUT exceeds maximum length of OUT	
	Maximum length of IN or OUT does not fit within allocated memory	
	Maximum length of IN or OUT is 0 or 255	

9.2.4.6 INSERT (Insert characters in a character string)

Table 9- 61 Insert substring instruction

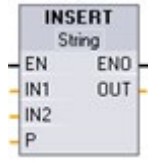
LAD / FBD	SCL	Description
	`out := INSERT(in1, in2, p);`	Inserts string IN2 into string IN1. Insertion begins after the character at position P.

Table 9- 62 Data types for the parameters

Parameter and type		Data type	Description
IN1	IN	String, WString	Input string 1
IN2	IN	String, WString	Input string 2
P	IN	Int	Last character position in string IN1 before the insertion point for string IN2 The first character of string IN1 is position number 1.
OUT	OUT	String, WString	Result string

Table 9- 63 ENO status

ENO	Condition	OUT
1	No errors detected	Valid characters
0	P is greater than length of IN1	IN2 is concatenated with IN1 immediately following the last IN1 character
	P is less than 0	Current length is set to 0
	Resulting string after insertion is larger than maximum length of OUT string	Resulting string characters are copied until the maximum length of OUT is reached
	Current length of IN1 exceeds maximum length of IN1, current length of IN2 exceeds maximum length of IN2, or current length of OUT exceeds maximum length of OUT (invalid string)	Current length is set to 0
	Maximum length of IN1, IN2 or OUT does not fit within allocated memory range	
	Maximum length of IN1 or IN2 is 255, or maximum length of OUT is 0 or 255 (String data type)	
	Maximum length of IN1 or IN2 is 65534, or maximum length of OUT is 0 or 65534 (WString data type)	

9.2.4.7 REPLACE (Replace characters in a character string)

Table 9- 64 Replace substring instruction

LAD / FBD	SCL	Description

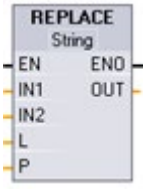
	`out := REPLACE(`
	`  in1:=_string_in_,`
	`  in2:=_string_in_,`
	`  L:=_int_in_,`
	`  p:=_int_in);`
		Replaces L characters in the string parameter IN1. Replacement starts at string IN1 character position P (inclusive), with replacement characters coming from the string parameter IN2.

Table 9- 65 Data types for the parameters

Parameter and type		Data type	Description
IN1	IN	String, WString	Input string
IN2	IN	String, WString	String of replacement characters
L	IN	Int	Number of characters to replace
P	IN	Int	Position of first character to be replaced
OUT	OUT	String, WString	Result string

If parameter L is equal to zero, then the string IN2 is inserted at position P of string IN1 without deleting any characters from string IN1.

If P is equal to one, then the first L characters of string IN1 are replaced with string IN2 characters.

Table 9- 66 ENO status

ENO	Condition	OUT
1	No errors detected	Valid characters
0	P is greater than length of IN1	IN2 is concatenated with IN1 immediately following the last IN1 character
	P points within IN1, but fewer than L characters remain in IN1	IN2 replaces the end characters of IN1 beginning at position P
	Resulting string after replacement is larger than maximum length of OUT string	Resulting string characters are copied until the maximum length of OUT is reached
	Maximum length of IN1 is 0	IN2 characters are copied to OUT
	L is less than 0, or P is less than or equal to 0	Current length is set to 0
	Current length of IN1 exceeds maximum length of IN1, current length of IN2 exceeds maximum length of IN2, or current length of OUT exceeds maximum length of OUT	
	Maximum length of IN1, IN2 or OUT does not fit within allocated memory range	
	Maximum length of IN1 or IN2 is 255, or maximum length of OUT is 0 or 255 (String data type)	
	Maximum length of IN1 or IN2 is 65534, or maximum length of OUT is 0 or 65534 (WString data type)	

9.2.4.8 FIND (Find characters in a character string)

Table 9- 67 Find substring instruction

LAD / FBD	SCL	Description

	`out := FIND(`
	`  in1:=_string_in_,`
	`  in2:=_string_in);`
		Provides the character position of the substring specified by IN2 within the string IN1. The search starts on the left. The character position of the first occurrence of IN2 string is returned at OUT. If the string IN2 is not found in the string IN1, then zero is returned.

Table 9- 68 Data types for the parameters

Parameter and type		Data type	Description
IN1	IN	String, WString	Search inside this string
IN2	IN	String, WString	Search for this string
OUT	OUT	Int	Character position in string IN1 of the first search match

Table 9- 69 ENO status

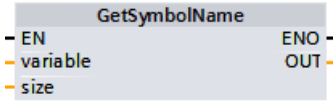
ENO	Condition	OUT
1	No errors detected	Valid character position
0	IN2 is larger than IN1	Character position is set to 0
	Current length of IN1 exceeds maximum length of IN1, or current length of IN2 exceeds maximum length of IN2 (invalid string)	
	Maximum length of IN1 or IN2 does not fit within allocated memory range	
	Maximum length of IN1 or IN2 is 255 (String data type) or 65535 (WString data type)	

9.2.5 Runtime information

9.2.5.1 GetSymbolName (Read out a tag on the input parameter)

Table 9- 70 GetSymbolName instruction

LAD / FBD	SCL	Description

	`OUT := GetSymbolName(`
	`  variable:=_parameter_in_,`
	`  size:=_dint_in_);`
		The GetSymbolName instruction returns a string corresponding to the name of a variable from the block interface.
		Your program can call the instruction multiple times with different tags. The process value of the tag is irrelevant.
		The instruction returns the name read at the OUT parameter.

Parameter

The following table shows the parameters of the GetSymbolName instruction:

Parameter	Declaration	Data type	Memory area	Description
VARIABLE	Input	PARAMETER	Parameter sections Input, Output, InOut	Variable from the local block interface for which you want a string value of the name returned
SIZE	Input	DINT	I, Q, M, D, L	Limits the number of characters output at the OUT parameter: • SIZE > 0: GetSymbolName returns the first SIZE characters of the name. • SIZE = 0: GetSymbolName returns the entire name. • SIZE < 0: GetSymbolName returns the last SIZE characters of the name.
OUT	Return	WSTRING	I, Q, M, D, L	Output of the tag name supplied by the input parameter

You specify the input parameters of the block interface at the VARIABLE parameter. Use only an interface parameter for this parameter and not a PLC or data block tag.

To limit the length of the read tag name, use the SIZE parameter. If the instruction truncates the name, it indicates the truncation by the characters "..." (Unicode character 16#2026) appears at the end of the name. Note that this character has the length 1.

You can find additional information on valid data types under "Data types (Page 122)".

Example: Meaning of SIZE parameter

The following example illustrates the meaning of the SIZE parameter. The following tag name is read from the block interface: "MyPLCTag" (The double quotes at the start and end belong to the name.)

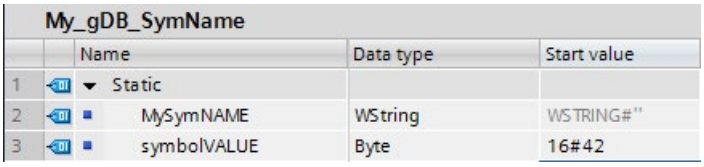
SIZE	GetSymbolName returns	Explanation
1	'...'	• First character of WSTRING:' • Identifier that the name was truncated: ... • Last character of WSTRING:'
2	'"...'	• First character of WSTRING:' • The first character of the name and identifier that the name was truncated:"... • Last character of WSTRING:'
3	'"M...'	• First character of WSTRING:' • The first two characters of the name and identifier that the name was truncated:"... "M... • Last character of WSTRING:'

SIZE	GetSymbolName returns	Explanation
6	'"MyPL...'	• First character of WSTRING:' • The first five characters of the name and identifier that the name was truncated: "MyPL... • Last character of WSTRING:'
0	'"MyPLCTag"'	• First character of WSTRING:' • All characters of the name: "MyPLCTag" • Last character of WSTRING:'

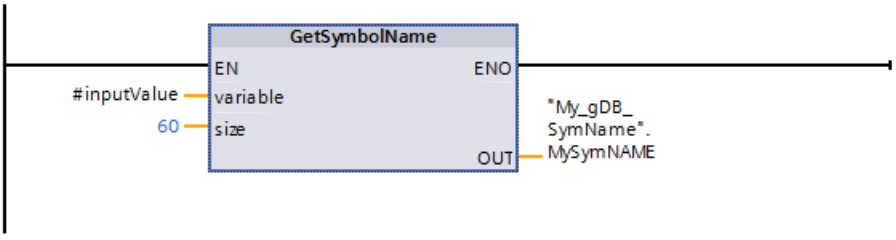
Example: Reading a symbol name

In the following example, you read out the name of a tag that is interconnected via the input parameter of a block.

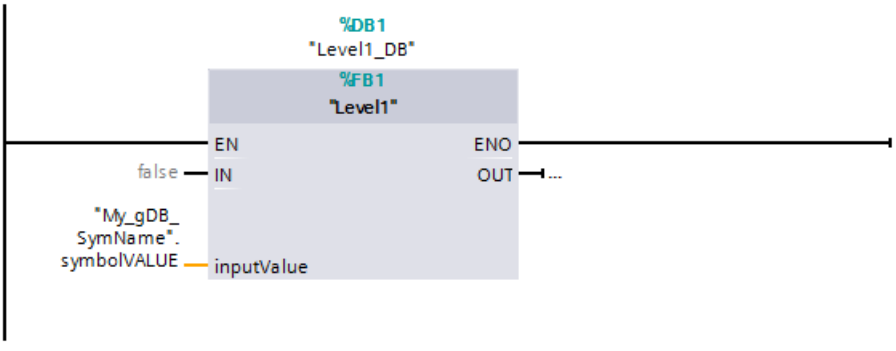
Create two tags in a global data block for storing the data.



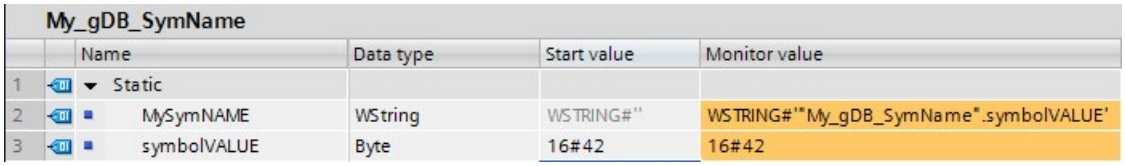
Create an input parameter inputValue with the BYTE data type in the Level1 block. Call the GetSymbolName instruction in the Level1 block. Interconnect the parameters of the instruction as follows.



Interconnect the inputValue parameter of the Level1 block as follows.



The GetSymbolName instruction is executed in the Level1 block. Input parameter inputValue of the Level1 block is examined for its interconnection using input parameter VARIABLE of the instruction. In doing so, the symbolVALUE tag is read out and output as a character string at output parameter OUT ("MySymNAME"). According to the value of input parameter SIZE, the length of the character string is limited to 60 characters.



My_gDB_SymName

	Name	Data type	Start value	Monitor value
1	Static			
2	MySymNAME	WString	WSTRING#''	WSTRING#'"My_gDB_SymName".symbolVALUE'
3	symbolVALUE	Byte	16#42	16#42

9.2.5.2 GetSymbolPath (Query composite global name of the input parameter assignment)

Table 9- 71 GetSymbolPath instruction

LAD / FBD	SCL	Description

GetSymbolPath
EN — ENO
variable — OUT
size
	`OUT := GetSymbolPath(`
	`  variable:=_parameter_in_,`
	`  size:=_dint_in_);`
		The GetSymbolPath instruction reads the composite global name of an input parameter at the local interface of a block (FB or FC). The name consists of the storage path and the tag name.
		Your program can call the instruction multiple times with different tags. The process value of the tag is irrelevant.
		The instruction returns the name read at the OUT parameter.

Parameter

The following table shows the parameters of the GetSymbolPath instruction:

Parameter	Declaration	Data type	Memory area	Description
VARIABLE	Input	PARAMETER	Parameter sections Input, Output, InOut	Selection of the local interface to which you want to read the global name of the input parameter supply.
SIZE	Input	DINT	I, Q, M, D, L or constant	Limits the number of characters output at the OUT parameter. • SIZE > 0: GetSymbolPath returns the first SIZE characters of the name. • SIZE = 0: GetSymbolPath returns the entire name. • SIZE < 0: GetSymbolPath returns the last SIZE characters of the name.
OUT	Output	WSTRING	I, Q, M, D, L	Output of the tag name of the input parameters supply.

You can find additional information on valid data types under "Data types (Page 122)".

Usage

Note the following tips on using the GetSymbolPath instruction:

- Specify the block interface through which the name of the input tag is read at the VARIABLE parameter of the instruction:
  - If a data block tag supplies the input parameter, GetSymbolPath outputs the name of the DB, contained structures and the name of the tag.
  - If a PLC tag supplies the input parameters GetSymbolPath outputs the name of the PLC tag.
  - If a constant supplies the input parameter, GetSymbolPath outputs the constant value.
- To limit the length of the read tag name, use the SIZE parameter. If the name has been truncated, this is indicated by the character "..." (Unicode character 16#2026) at the end of the name. Note that this character has the length 1.

Example: Meaning of the SIZE parameter

The following example illustrates the meaning of the SIZE parameter. GetSymbolPath has read out the following tag name is read out from the block interface: "MyPLCTag" (The double quotes at the start and end belong to the name.)

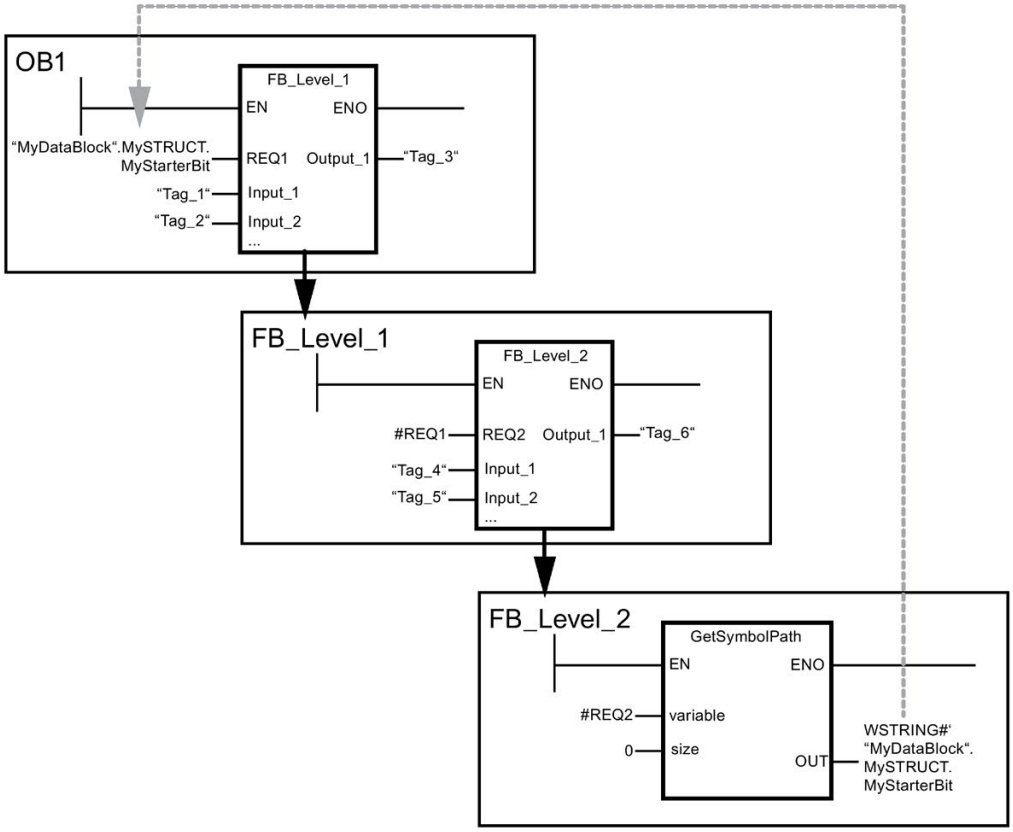
SIZE	GetSymbolPath returns	Explanation
1	'...'	• First character of WSTRING:' • Identifier that the name was truncated: ... • Last character of WSTRING:'
2	'"...'	• First character of WSTRING:' • The first character of the name and identifier that the name was truncated:"... • Last character of WSTRING:'
3	'"M...'	• First character of WSTRING:' • The first two characters of the name and identifier that the name was truncated:"... "M... • Last character of WSTRING:'
6	'"MyPL...'	• First character of WSTRING:' • The first five characters of the name and identifier that the name was truncated: "MyPL... • Last character of WSTRING:'
0	'"MyPLCTag"'	• First character of WSTRING:' • All characters of the name: "MyPLCTag" • Last character of WSTRING:'

Example: Calling GetSymbolPath over mutiple block call levels

The following example shows the use of GetSymbolPath over several call levels:

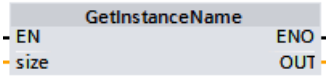
- Organization block OB1 calls the FB_Level_1 block, which in turn calls the FB_Level_2 block.
- The FB_Level_2 block executes GetSymbolPath to read the path of the parameter at the REQ2 interface.
- Since the REQ1 interface supplies REQ2, the instruction determines the path of the input parameter of REQ1.
- The MyStarterBit tag is the REQ1 input parameter. The bit is located in the MySTRUCT structure in the MyDatablock data block.

  GetSymbolPath reads this information and outputs the path ("MyDataBlock".MySTRUCT.MyStarterBit) at the OUT parameter.



9.2.5.3 GetInstanceName (Read out name of the block instance)

Table 9- 72 GetInstanceName instruction

LAD / FBD	SCL	Description
	`OUT := GetInstanceName(` `  size:=_dint_in_);`	You can use the GetInstanceName instruction to read the name of the instance data block within a function block.

Parameter

The following table shows the parameters of the GetInstanceName instruction:

Parameter	Declaration	Data type	Memory area	Description
SIZE	Input	DINT	I, Q, M, D, L or constant	Limits the number of characters output at the OUT parameter. • SIZE > 0: GetInstanceName returns the first SIZE characters of the name. • SIZE = 0: GetInstanceName returns the entire name. • SIZE < 0: GetInstanceName returns the last SIZE characters of the name.
OUT	Output	WSTRING	I, Q, M, D, L	Read name of the instance data block

You can find additional information on valid data types under "Data types (Page 122)".

Example: Meaning of SIZE parameter

To limit the length of the read instance name, use the SIZE parameter. If the instruction has truncated the name, it indicates the truncation by the character "..." (Unicode character 16#2026) at the end of the name. Note that this character has the length 1.

The following example illustrates the meaning of the SIZE parameter. GetInstanceName has read out the following instance name from the block interface: "Level1_DB" (The double quotes at the start and end belong to the name.)

SIZE	GetSymbolPath returns	Explanation
1	'...'	• First character of WSTRING:' • Identifier that the name was truncated: ... • Last character of WSTRING:'
2	'"...'	• First character of WSTRING:' • The first character of the name and identifier that the name was truncated:"... • Last character of WSTRING:'
3	'"L...'	• First character of WSTRING:' • The first two characters of the name and identifier that the name was truncated:"... "L... • Last character of WSTRING:'
6	'"Leve...'	• First character of WSTRING:' • The first five characters of the name and identifier that the name was truncated: "Leve... • Last character of WSTRING:'
0	'"Level1_DB"'	• First character of WSTRING:' • All characters of the name: "Level1_DB" • Last character of WSTRING:'

GetInstanceName writes out the name of the instance data block to the OUT parameter. The instruction truncates the name if the name of the instance data block is longer than the maximum length of WSTRING.

Example: Reading the name of an instance data block

The following example shows how to read out the name of an instance data block.

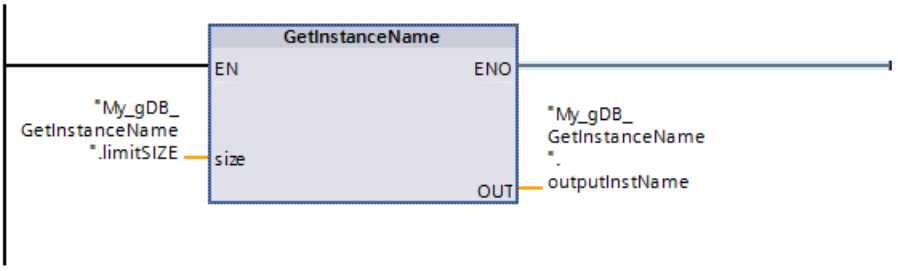
Create two tags in a global data block for storing the data.

Define the parameters of the instruction as follows.

My_gDB_GetInstanceName

		Name	Datentyp	Startwert
1		Static		
2		limitSIZE	DInt	0
3		outputInsName	WString	WSTRING#''

The Level1_gin block executes the GetInstanceName instruction, which determines the associated instance data block of the Level1_gin block and outputs the name as a character string at output parameter OUT (outputInstName). According to the value 0 of parameter SIZE (limitSIZE), the length of the character string is unlimited.

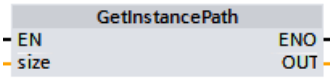


My_gDB_GetInstanceName

		Name	Data type	Start value	Monitor value
1		Static			
2		limitSIZE	DInt	0	0
3		outputInstName	WString	WSTRING#''	WSTRING#'"Level1_DB"'

9.2.5.4 GetInstancePath (Query composite global name of the block instance)

Table 9- 73 GetInstancePath instruction

LAD / FBD	SCL	Description
	`OUT := GetInstancePath(` `  size:=_dint_in_);`	You use the GetInstancePath instruction to read the composed global name of the block instance within a function block. The composed global name of the block instance is the path of the complete call hierarchy when the program calls multiple instances.

Parameter

The following table shows the parameters of the GetInstancePath instruction:

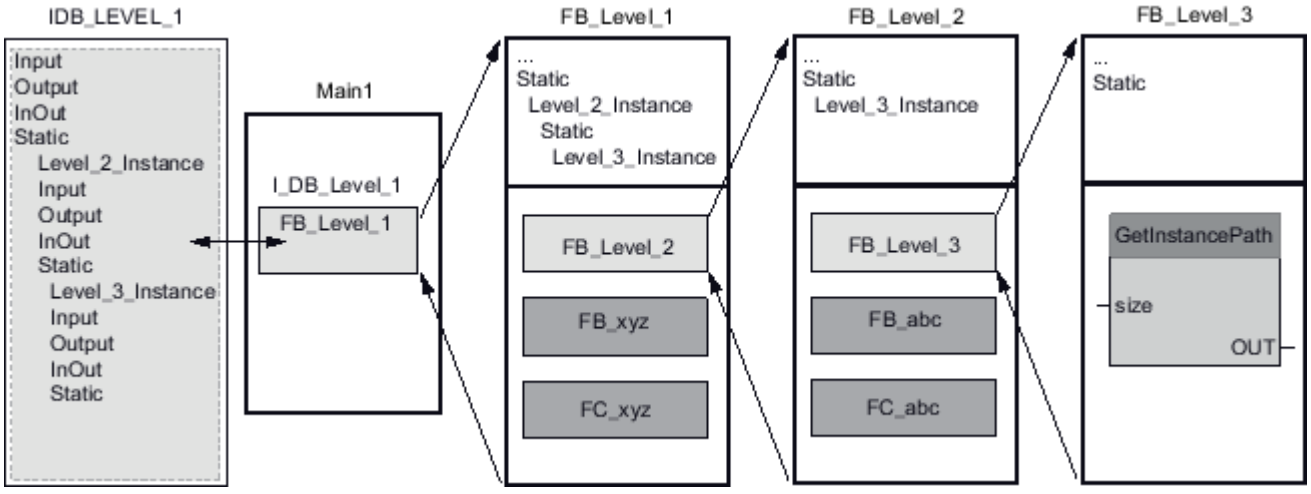
Parameter	Declaration	Data type	Memory area	Description
SIZE	Input	DINT	I, Q, M, D, L or constant	Limits the number of characters output at the OUT parameter. • SIZE > 0: GetInstancePath returns the first SIZE characters of the name. • SIZE = 0: GeInstancePath returns the entire name. • SIZE < 0: GetInstancePath returns the last SIZE characters of the name.
OUT	Output	WSTRING	I, Q, M, D, L	Read global name of the block instance. If the global name of the block instance is longer than the maximum length of WSTRING (254 characters), GetInstancePath truncates the name.

You can find additional information on valid data types under "Data types (Page 122)".

Example: Calling GetInstancePath to get the path of a multi-instance FB call

In the following example, the FB_Level_3 function block calls the GetInstancePath instruction.

- The FB_Level_3 function block stores its data in the calling FB_Level_2 function block.
- The FB_Level_2 function block in turn stores its data in the calling FB_Level_1 function block.
- The FB_Level_1 function block in turn stores its data in its instance data block IDB_LEVEL_1. Through the use of multi-instances, the instance data block of FB_Level_1 contains all data of the three function blocks.



The GetInstancePath instruction returns the following values for this example, depending on the value of the SIZE parameter:

SIZE	GetInstancePath returns	Explanation
1	'...'	• First character of WSTRING:' • Identifier that the name was truncated: ... • Last character of WSTRING:'
2	'"...'	• First character of WSTRING:' • The first character of the name and identifier that the name was truncated:"... • Last character of WSTRING:'
3	'"I...'	• First character of WSTRING:' • The first two characters of the name and identifier that the name was truncated:"... "I... • Last character of WSTRING:'
6	'"IDB_...'	• First character of WSTRING:' • The first five characters of the name and identifier that the name was truncated: "IDB_... • Last character of WSTRING:'
0	'"IDB_LEVEL_1".Level_2_Instance.Level_3_Instance'	• First character of WSTRING:' • All characters of the name: "IDB_LEVEL_1".Level_2_Instance.Level_3_Instance • Last character of WSTRING:'

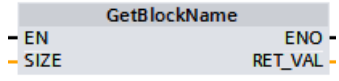
Note

Use of GetInstancePath in function blocks with single instance

If the function block in which you call GetInstancePath saves data in its own instance data block, GetInstancePath outputs the name of the single instance as the global name. The result at parameter OUT corresponds in this case to the GetInstanceName (Page 367) instruction.

9.2.5.5 GetBlockName (Read out name of the block)

Table 9- 74 GetBlockName instruction

LAD / FBD	SCL	Description
	`RET_VAL := GetBlockName(` `  size:=_dint_in_);`	You use the GetBlockName instruction to read the name of the block in which the instruction is called.

Parameter

The following table shows the parameters of the GetBlockName instruction:

Parameter	Declaration	Data type	Memory area	Description
SIZE	Input	UINT	I, Q, M, D, L or constant	Limits the number of characters output at the RET_VAL parameter. • SIZE > 0: GetBlockName returns the first SIZE characters of the name. • SIZE = 0: GetBlockName returns the entire name. • SIZE < 0: GetBlockName returns the last SIZE characters of the name.
RET_VAL	Output	WSTRING	I, Q, M, D, L	Read name of the instance data block

You can find additional information on valid data types under "Data types (Page 122)".

Example: Meaning of the SIZE parameter

To limit the length of the block name to a certain number of characters, specify the maximum length at the SIZE parameter. If GetBlockName truncates the name, it indicates the truncation by the character "..." (Unicode character 16#2026) at the end of the name. Note that this character has the length 1.

The following example illustrates the meaning of the SIZE parameter. GetBlockName has read out the following block name: Level1_gbn (The double quotes at the start and end belong to the name.)

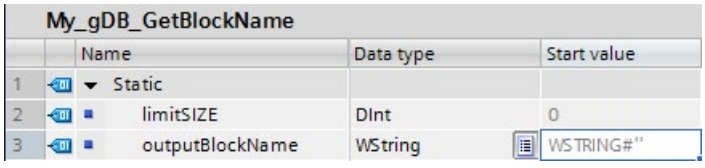
SIZE	GetBlockName returns	Explanation
1	'...'	• First character of WSTRING:' • Identifier that the name was truncated: ... • Last character of WSTRING:'
2	'"...'	• First character of WSTRING:' • The first character of the name and identifier that the name was truncated:"... • Last character of WSTRING:'
3	'"L...'	• First character of WSTRING:' • The first two characters of the name and identifier that the name was truncated:"... "L... • Last character of WSTRING:'
6	'"Leve...'	• First character of WSTRING:' • The first five characters of the name and identifier that the name was truncated: "Leve... • Last character of WSTRING:'
0	'"Level1_gbn"'	• First character of WSTRING:' • All characters of the name: "Level1_gbn" • Last character of WSTRING:'

GetBlockName writes the name of the block at the RET_VAL parameter. If the name of the block is longer than the maximum length of WSTRING, it truncates the name.

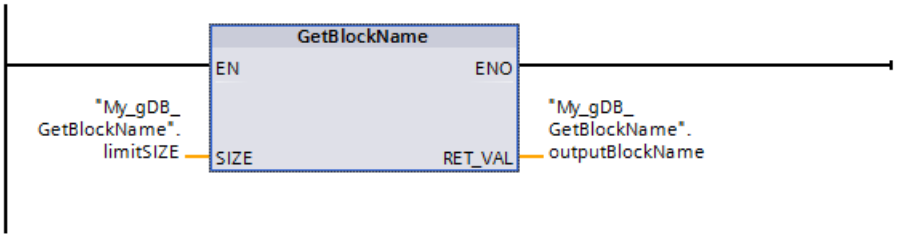
Example: Reading a block name

The following example shows how to read out a block name.

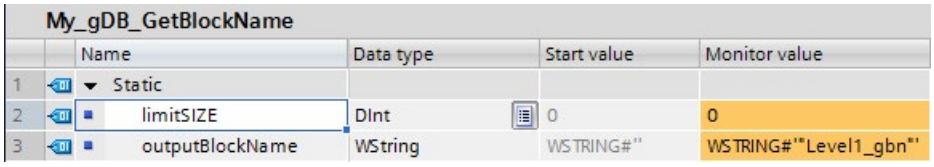
1. Create two tags in a global data block for storing the data.



2. Define the parameters of the instruction as follows:



The Level1_gbn block executes the GetBlockName instruction. GetBlockName reads out the name of the Level1_gbn block and outputs the name as a character string at output parameter RET_VAL(outputBlockName). Because the SIZE parameter is 0 (limitSIZE), the length of the character string is unlimited.



My_gDB_GetBlockName

	Name	Data type	Start value	Monitor value
1	Static			
2	limitSIZE	DInt	0	0
3	outputBlockName	WString	WSTRING#''	WSTRING#'"Level1_gbn"'

9.3 Distributed I/O (PROFINET, PROFIBUS, or AS-i)

9.3.1 Distributed I/O Instructions

The following Distributed I/O instructions can be used with PROFINET, PROFIBUS, or AS-i:

- RDREC instruction (Page 375): Reads a data record with the number INDEX from a module or device.
- WRREC instruction (Page 375): Transfers a data record with the number INDEX to a module or device defined by ID.
- GETIO instruction (Page 378): Consistently reads out all inputs of a DP standard slave / PROFINET IO device.
- SETIO instruction (Page 379): Consistently transfers data from the source range defined by the OUTPUTS parameter to the addressed DP standard slave / PROFINET IO device.
- GETIO_PART instruction (Page 380): Consistently reads out a related part of the inputs of an IO module.
- SETIO_PART instruction (Page 381): Consistently writes data from the source area spanned by the OUTPUTS parameter to the outputs of an IO module.
- RALRM instruction (Page 383): Allows you to receive an interrupt with all corresponding information from a module or device and supply this information to its output parameters.
- DPRD_DAT instruction (Page 396): Allows you to read consistent data areas greater than 64 bytes from a module or device with the DPRD_DAT instruction.
- DPWR_DAT instruction (Page 396): Allows you to write consistent data areas greater than 64 bytes to a module or device with the DPWR_DAT instruction.

The D_ACT_DP instruction (Page 387) allows you to disable and enable configured PROFINET IO devices in a targeted manner. You can also determine whether each assigned PROFINET IO device is currently activated or deactivated.

Note

Note: You can only use the D_ACT_DP instruction with PROFINET IO devices. You cannot use the instruction with PROFIBUS DP slaves.

The DPNRM_DG instruction (Page 404) allows you to read the current diagnostic data of a DP slave in the format specified by EN 50 170 Volume 2, PROFIBUS.

Note

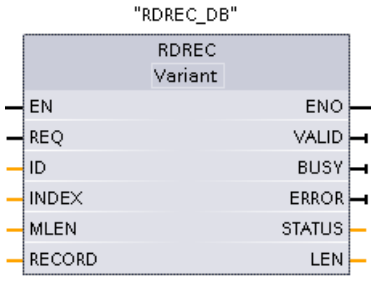
You can only use the DPNRM_DG instruction with PROFIBUS.

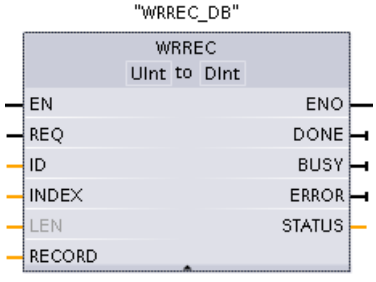
9.3.2 RDREC and WRREC (Read/write data record)

You can use the RDREC (Read data record) and WRREC (Write data record) instructions with PROFINET, PROFIBUS, and AS-i.

Table 9- 75 RDREC and WRREC instructions

LAD / FBD	SCL	Description

	`"RDREC_DB"(`
	`req:=_bool_in_,`
	`ID:=_word_in_,`
	`index:=_dint_in_,`
	`mlen:=_uint_in_,`
	`valid=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_dword_out_,`
	`len=>_uint_out_,`
	`rec-`
	`ord:=_variant_inout_);`
		Use the RDREC instruction to read a data record with the number INDEX from the component addressed by the ID, such as a central rack or a distributed component (PROFIBUS DP or PROFINET IO). Assign the maximum number of bytes to read in MLEN. The selected length of the target area RECORD should have at least the length of MLEN bytes.

	`"WRREC_DB"(`
	`req:=_bool_in_,`
	`ID:=_word_in_,`
	`index:=_dint_in_,`
	`len:=_uint_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_dword_out_,`
	`rec-`
	`ord:=_variant_inout_);`
		Use the WRREC instruction to transfer a data RECORD with the record number INDEX to a DP slave/PROFINET IO device component addressed by ID, such as a module in the central rack or a distributed component (PROFIBUS DP or PROFINET IO).
		Assign the byte length of the data record to be transmitted. The selected length of the source area RECORD should, therefore, have at least the length of LEN bytes.

[1] STEP 7 automatically creates the DB when you insert the instruction.

[2] In the SCL examples, "RDREC_DB" and "WRREC_DB" are the names of the instance DBs.

Table 9- 76 RDREC and WRREC data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	REQ = 1: Transfer data record
ID	IN	HW_IO (Word)	Logical address of the DP slave/PROFINET IO component (module or submodule): • For an output module, bit 15 must be set (for example, for address 5: ID:= DW#16#8005). • For a combination module, the smaller of the two addresses should be specified. Note: In V3.0, the device ID can be determined in one of two ways: • By making the following "Network view" selections: – Device (gray box) – "Properties" of the device – "Hardware identifier" Note: Not all devices display their Hardware identifiers, however. • By making the following "Project tree" menu selections: – PLC tags – Default tag table – System constants tab All configured device Hardware identifiers are displayed. Note: In V4.0, the device ID (hardware identifier) for the interface module is determined by going to the tag table and locating the "Device Name [HEAD]" parameter under System Constants.
INDEX	IN	Byte, Word, USInt, UInt, SInt, Int, DInt	Data record number
MLEN	IN	Byte, USInt, UInt	Maximum length in bytes of the data record information to be fetched (RDREC)
VALID	OUT	Bool	New data record was received and valid (RDREC). The VALID bit is TRUE for one scan, after the last request was completed with no error.
DONE	OUT	Bool	Data record was transferred (WRREC). The DONE bit is TRUE for one scan, after the last request was completed with no error.
BUSY	OUT	Bool	• BUSY = 1: The read (RDREC) or write (WRREC) process is not yet terminated. • BUSY = 0: Data record transmission is completed.
ERROR	OUT	Bool	ERROR = 1: A read (RDREC) or write (WRREC) error has occurred. The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	DWord	Block status (Page 391) or error information (Page 540)

Parameter and type		Data type	Description
LEN	OUT (RDREC) IN (WRREC)	UInt	• Length of the fetched data record information (RDREC) • Maximum byte length of the data record to be transferred (WRREC)
RECORD	IN_OUT	Variant	• Target area for the fetched data record (RDREC) • Data record (WRREC)

The RDREC and WRREC instructions operate asynchronously, that is, processing covers multiple instruction calls. Start the job by calling RDREC or WRREC with REQ = 1.

The job status is displayed via output parameter BUSY and the two central bytes of output parameter STATUS. The transfer of the data record is complete when the output parameter BUSY has been set to FALSE

A value of TRUE (only for one scan) on the output parameter VALID (RDREC) or DONE (WRREC) verifies that the data record has been successfully transferred into the target area RECORD (RDREC) or to the target device (WRREC). In the case of the RDREC, the output parameter LEN contains the length of the fetched data in bytes.

The output parameter ERROR (only for one scan when ERROR = TRUE) indicates that a data record transmission error has occurred. In this case, the output parameter STATUS (only for the one scan when ERROR = TRUE) contains the error information.

Data records are defined by the hardware device manufacturer. Refer to the hardware manufacturer's device documentation for details about a data record.

You can have up to four RDREC instructions and four WRREC instructions in use at the same time.

Note

If you configure a DPV1 slave with a GSD file (GSD rev. 3 and higher) and the DP interface of the DP master is set to "S7 compatible", then you might not read any data records from the I/O modules in the user program with "RDREC" or write to the I/O modules with "WRREC". In this case, the DP master addresses the wrong slot (configured slot + 3).

Remedy: set the interface of the DP master to "DPV1".

Note

The interfaces of the "RDREC" and "WRREC" instructions are identical to the "RDREC" and "WRREC" FBs defined in "PROFIBUS Guideline PROFIBUS Communication and Proxy Function Blocks according to IEC 61131-3".

Note

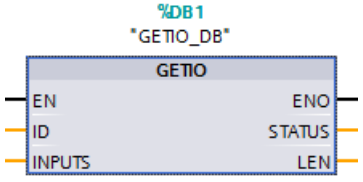
If you use "RDREC" or "WRREC" to read or write a data record for PROFINET IO, then the CPU interprets negative values in the INDEX, MLEN, and LEN parameters as unsigned 16-bit integers.

9.3.3 GETIO (Read process image)

You use the instruction "GETIO" to consistently read inputs of modules or submodules of DP slaves and PROFINET IO devices. The instruction "GETIO" calls the instruction "DPRD_DAT (Page 396)". If there is no error during the data transmission, the data that has been read is entered in the destination area indicated by INPUTS.

Table 9- 77 GETIO (Read process image) instruction

LAD / FBD	SCL	Description

	`"GETIO_DB"(`
	`id:=_uint_in_,`
	`status=>_dword_out_,`
	`len=>_int_out_,`
	`inputs:=_variant_inout_);`
		Use the instruction "GETIO" to consistently read out all inputs of a DP standard slave / PROFINET IO device.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "GETIO_DB" is the name of the instance DB.

The destination area must have a length that is greater than or equal to the length of the selected component.

If you read from a DP standard slave with a modular configuration or with several DP identifiers, you only access the data of one component / DP identifier at the configured start address with a "GETIO" call.

Parameters

The following table shows the parameters of the "GETIO" instruction:

Parameter	Declaration	Data type	Description
ID	IN	HW_SUBMODULE	Hardware ID of the DP standard slave / PROFINET IO device
STATUS[1]	OUT	DWord	Contains the error information of "DPRD_DAT (Page 396)" in the form DW#16#40xxxx00
LEN	OUT	Int	Amount of data read in bytes
INPUTS	IN_OUT	Variant	Destination area for the read data: The destination area must have a length that is greater than or equal to the length of the selected DP standard slave / PROFINET IO device. You can use the following data types: • System data types and array of system data types: BYTE, CHAR, SINT, USINT, WORD, INT, UINT, DWORD, DINT, UDINT, REAL, LREAL, LWORD, LINT, ULINT • User Defined Types (UDT) • Structures (STRUCT), but only in non-optimized data blocks (DB)

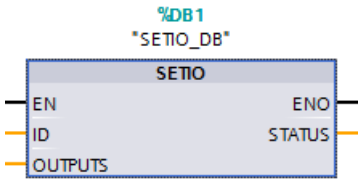
1 When displaying the "GETIO" error codes, use the DWord data type.

9.3.4 SETIO (Transfer process image)

You use the instruction "SETIO" to consistently transfer data from the source range defined by the OUTPUTS parameter to the addressed modules or submodules of DP slaves and PROFINET IO devices. If you have configured the relevant address area of the DP standard slave / PROFINET IO device as a consistent range in a process image, the data is transferred to the process image. "SETIO" calls the "DPWR_DAT (Page 396)" instruction during this transfer.

Table 9- 78 SETIO (Read process image) instruction

LAD / FBD	SCL	Description

	`"SETIO_DB"(`
	`  id:=_uint_in_,`
	`status=>_dword_out_,`
	`  outputs:=_variant_inout_);`
		Use the instruction "SETIO" to consistently transfer data from the source range defined by the parameter OUTPUTS to the addressed DP standard slave / PROFINET IO device.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "SETIO_DB" is the name of the instance DB.

The source range must have a length that is greater than or equal to the length of the selected component.

In the case of a DP standard slave / PROFINET IO device with modular configuration or with several DP identifiers, you can only access one DP identifier / component per "SETIO" call.

Parameters

The following table shows the parameters of the "SETIO" instruction:

Parameter	Declaration	Data type	Description
ID	IN	HW_SUBMODULE	Hardware ID of the DP standard slave / PROFINET IO device
STATUS[1]	OUT	DWord	Contains the error information of "DPWR_DAT (Page 396)" in the form DW#16#40xxxx00
OUTPUTS	IN_OUT	Variant	Source range for the data to be written: The source range must have a length that is greater than or equal to the length of the selected DP standard slave / PROFINET IO device. You can use the following data types: • System data types and array of system data types: BYTE, CHAR, SINT, USINT, WORD, INT, UINT, DWORD, DINT, UDINT, REAL, LREAL, LWORD, LINT, ULINT • User Defined Types (UDT) • Structures (STRUCT), but only in non-optimized data blocks (DB)

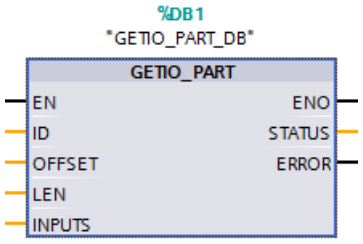
1 When displaying the "SETIO"error codes, use the DWord data type.

9.3.5 GETIO_PART (Read process image area)

You use the instruction "GETIO_PART" to consistently read a related part of the inputs of modules or submodules of DP slaves and PROFINET IO devices. GETIO_PART calls the instruction "DPRD_DAT (Page 396)".

Table 9- 79 GETIO_PART (Read process image area) instruction

LAD / FBD	SCL	Description

	`"GETIO_PART_DB"(`
	`id:=_uint_in_,`
	`offset:=_int_in_,`
	`len:=_int_in_,`
	`status=>_dword_out_,`
	`error=>_bool_out_,`
	`inputs:=_variant_inout_);`
		Use the instruction GETIO_PART to consistently read out a related part of the inputs of an IO module.

[1] STEP 7 automatically creates the DB when you insert the instruction.

[2] In the SCL example, "GETIO_PART_DB" is the name of the instance DB.

Use the ID input parameter to select the IO module by means of the hardware ID.

Use the OFFSET and LEN parameters to specify the portion of the process image area to be read. If the input area spanned by OFFSET and LEN is not completely covered by the module, the block returns the error code DW#16#40**80B7**00.

The length of the destination area must be larger than or equal to the amount of bytes to be read:

- If there is no error during the data transmission, ERROR receives the value FALSE. The data that is read is written to the destination area defined at the INPUTS parameter.
- If there is an error during the data transmission, ERROR receives the value TRUE. The STATUS parameter receives the error information from DPRD_DAT.
- If the destination area is greater than LEN, the instruction writes to the first LEN bytes of the destination area. ERROR receives the value FALSE.

Parameters

The following table shows the parameters of the GETIO_PART instruction:

Parameter	Declaration	Data type	Description
ID	IN	HW_SUBMODULE	Hardware identifier of the module
OFFSET	IN	Int	Number of the first byte to be read in the process image for the component (smallest possible value: 0)
LEN	IN	Int	Number of bytes to be read
STATUS[1]	OUT	DWord	Contains the error information of DPRD_DAT (Page 396) in the form DW#16#40xxxx00, if ERROR = TRUE
ERROR	OUT	Bool	Error display: ERROR = TRUE if an error occurs when DPRD_DAT (Page 396) is called
INPUTS	IN_OUT	Variant	Destination area for read data: If the destination area is greater than LEN, the instruction writes to the first LEN bytes of the destination area. You can use the following data types: • System data types and array of system data types: BYTE, CHAR, SINT, USINT, WORD, INT, UINT, DWORD, DINT, UDINT, REAL, LREAL, LWORD, LINT, ULINT • User Defined Types (UDT) • Structures (STRUCT), but only in non-optimized data blocks (DB)

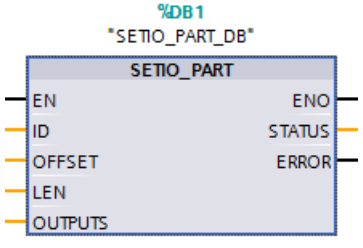
1 When displaying the GETIO_PART error codes, use the DWord data type.

9.3.6 SETIO_PART (Transfer process image area)

You can use the "SETIO_PART" instruction to consistently write data from the source area spanned by OUTPUTS to the outputs of modules or submodules of DP slaves and PROFINET IO devices. SETIO_PART calls the instruction "DPWR_DAT (Page 396)".

Table 9- 80 SETIO_PART (Transfer process image area) instruction

LAD / FBD	SCL	Description

	`"SETIO_PART_DB"(`
	`id:=_uint_in_,`
	`offset:=_int_in_,`
	`len:=_int_in_,`
	`status=>_dword_out_,`
	`error=>_bool_out_,`
	`outputs:=_variant_inout_);`
		Use the instruction SETIO_PART to consistently write data from the source area spanned by OUTPUTS to the outputs of an IO module.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "SETIO_PART_DB" is the name of the instance DB.

With the input parameter ID, you select the I/O module based on the hardware identified.

With the parameters OFFSET and LEN, you assign the portion of the process image area to be written for the component addressed by ID. If the output area spanned by OFFSET and LEN is not completely covered by the module, the block returns the error code DW#16#40**80B7**00.

The length of the destination area must be larger than or equal to the amount of bytes to be read:

- If there is no error during the data transmission, ERROR receives the value FALSE.
- If there is an error during the data transmission, ERROR receives the value TRUE, and STATUS receives the error information of DPWR_DAT.
- If the source area is greater than LEN, the instruction transfers the first LEN bytes from OUTPUTS. ERROR receives the value FALSE.

Parameters

The following table shows the parameters of the SETIO_PART instruction:

Parameter	Declaration	Data type	Description
ID	IN	HW_SUBMODULE	Hardware identifier of the IO module
OFFSET	IN	Int	Number of the first byte to be written in the process image for the component (smallest possible value: 0)
LEN	IN	Int	Number of bytes to be written
STATUS[1]	OUT	DWord	Contains the error information of DPWR_DAT (Page 396) in the form DW#16#40xxxx00, if ERROR = TRUE
ERROR	OUT	Bool	Error display: ERROR = TRUE if an error occurs when DPWR_DAT (Page 396) is called
OUTPUTS	IN_OUT	Variant	Source range for the data to be written: If the source area is greater than LEN, the first LEN bytes are transferred from OUTPUTS. You can use the following data types: • System data types and array of system data types: BYTE, CHAR, SINT, USINT, WORD, INT, UINT, DWORD, DINT, UDINT, REAL, LREAL, LWORD, LINT, ULINT • User Defined Types (UDT) • Structures (STRUCT), but only in non-optimized data blocks (DB)

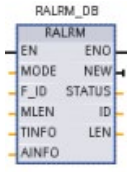
[1] When displaying the SETIO_PART error codes, use the DWord data type.

9.3.7 RALRM (Receive interrupt)

You can use the RALRM (Read alarm) instruction with PROFINET and PROFIBUS.

Table 9- 81 RALRM instruction

LAD / FBD	SCL	Description

	`"RALRM_DB"(`
	`mode:=_int_in_,`
	`f_ID:=_word_in_,`
	`mlen:=_uint_in_,`
	`new=>_bool_out_,`
	`status=>_dword_out_,`
	`ID=>_word_out_,`
	`len=>_uint_out_,`
	`tinfo:=_variant_inout_,`
	`ainfo:=_variant_inout_);`
		Use the RALRM (read alarm) instruction to read diagnostic interrupt information from PROFIBUS or PROFINET I/O modules/devices.
		The information in the output parameters contains the start information of the called OB as well as information of the interrupt source.
		Call RALRM in an interrupt OB to return information regarding the event(s) that caused the interrupt. In the S7-1200. The following Diagnostic OB interrupts are supported: Status, Update, Profile, Diagnostic error interrupt, Pull or plug of modules, Rack or station failure.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "RALRM_DB" is the name of the instance DB.

Table 9- 82 Data types for the parameters

Parameter and type		Data type	Description
MODE	IN	Byte, USInt, SInt, Int	Operating mode
F_ID	IN	HW_IO (Word)	Logical start address of the component (module) from which interrupts are to be received **Note**: The device ID can be determined in one of two ways: • By making the following "Network view" selections: – Device (gray box) – "Properties" of the device – "Hardware identifier" **Note**: Not all devices display their Hardware identifiers. • By making the following "Project tree" menu selections: – PLC tags – Default tag table – System constants tab – All configured device Hardware identifiers are displayed.
MLEN	IN	Byte, USInt, UInt	Maximum length in bytes of the data interrupt information to be received. MLEN of 0 will allow receipt of as much data interrupt information as is available in the AINFO Target Area.
NEW	OUT	Bool	A new interrupt was received.
STATUS	OUT	DWord	Status of the RALRM instruction. Refer to "STATUS parameter for RDREC, WRREC, and RALRM" (Page 391) for more information.

Parameter and type		Data type	Description
ID	OUT	HW_IO (Word)	Hardware identifier of the I/O module that caused the diagnostic interrupt **Note**: Refer to the F_ID parameter for an explanation of how to determine the device ID.
LEN	OUT	DWord, UInt, UDInt, DInt, Real, LReal	Length of the received AINFO interrupt information
TINFO	IN_OUT	Variant	Task information: Target range for OB start and management information. The TINFO length is always 32 bytes.
AINFO	IN_OUT	Variant	Interrupt information: Target area for header information and additional interrupt information. For AINFO, provide a length of at least the MLEN bytes, if MLEN is greater than 0. The AINFO length is variable.

Note

If you call "RALRM" in an OB whose start event is not an I/O interrupt, the instruction will provide correspondingly reduced information in its outputs.

Make sure to use different instance DBs when you call "RALRM" in different OBs. If you evaluate data from an "RALRM" call outside of the associated interrupt OB, use a separate instance DB per OB start event.

Note

The interface of the "RALRM" instruction is identical to the "RALRM" FB defined in "PROFIBUS Guideline PROFIBUS Communication and Proxy Function Blocks according to IEC 61131-3".

Calling RALRM

You can call the RALRM instruction in three different operating modes (MODE).

Table 9- 83 RALRM instruction operating modes

MODE	Description
0	• ID contains the hardware identifier of the I/O module that triggered the interrupt. • Output parameter NEW is set to TRUE. • LEN produces an output of 0. • AINFO and TINFO are not updated with any information.
1	• ID contains the hardware identifier of the I/O module that triggered the interrupt. • Output parameter NEW is set to TRUE. • LEN produces an output of the amount in bytes of AINFO data that is returned. • AINFO and TINFO are updated with interrupt-related information.
2	If the hardware identifier assigned to input parameter F_ID has triggered the interrupt then: • ID contains the hardware identifier of the I/O module that triggered the interrupt. Should be the same as the value at F_ID. • Output parameter NEW is set to TRUE. • LEN produces an output of the amount in bytes of AINFO data that is returned. • AINFO and TINFO are updated with interrupt-related information.

Note

If you assign a destination area for TINFO or AINFO that is too short, RALRM cannot return the full information.

MLEN can limit the amount of AINFO data that is returned.

Refer to the AINFO parameters and TINFO parameters of the online information system of STEP 7 for information on how to interpret the TINFO and AINFO data.

TInfo organization block data

The table below shows how the TInfo data is arranged for the RALRM instruction:

Same for OBs: Status, Update, Profile, Diagnostic error interrupt, Pull or plug of modules, Rack or station failure	0	SI_Format	OB_Class	OB_Nr	
	4	LADDR			
TI_Submodule - OBs: Status, Update, Profile	4			Slot	
	8	Specifier		0	
TI_DiagnosticInterrupt - OB: Diagnostic error interrupt	4			IO_State	
	8	Channel		MultiError	0
TI_PlugPullModule - OB: Pull or plug of modules	4			Event_Class	Fault_ID
	8	0		0	
TI_StationFailure - OB: Rack or station failure	4			Event_Class	Fault_ID
	8	0		0	
Same for OBs: Status, Update, Profile, Diagnostic error interrupt, Pull or plug of modules, Rack or station failure	12	0			
	16				
	20	address		slv_prfl	intr_type
	24	flags1	flags2	id	
	28[1]	manufacturer		instance	

[1] Bytes 28 - 31 (manufacturer and instance) are not used with PROFIBUS.

Note

Refer to the online information system of STEP 7 for more detailed information on TINFO data.

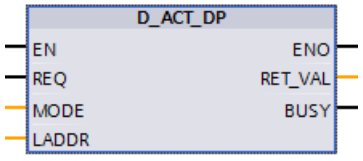
9.3.8 D_ACT_DP (Enable/disable PROFINET IO devices)

With the "D_ACT_DP" instruction, you can disable and enable configured PROFINET IO devices in a targeted manner. In addition, you can determine whether each assigned PROFINET IO device is currently activated or deactivated.

Note

You can only use the D_ACT_DP instruction with PROFINET IO devices. You cannot use the instruction with PROFIBUS DP slaves.

Table 9- 84 D_ACT_DP instruction

LAD / FBD	SCL	Description
	"D_ACT_DP_DB"(req:=_bool_in_, mode:=_usint_in_, laddr:=_uint_in_, ret_val=>_int_out_, busy=>_bool_out_);	Use the D_ACT_DP instruction to disable and enable configured PROFINET IO devices and determine whether each assigned PROFINET IO device is currently activated or deactivated.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "D_ACT_DP_SFB_DB" is the name of the instance DB.

You cannot disable/enable an IE/PB Link PN IO type of gateway using the D_ACT_DP instruction. If you nevertheless use D_ACT_DP on the gateway named, the CPU returns the value W#16#8093 (there is no hardware object that can be activated or deactivated for the address specified in LADDR).

Note

The disabling or enabling job requires several runs through the cycle control point. Therefore, you cannot wait for the end of such a job in a programmed loop.

Functional description

D_ACT_DP is an asynchronous instruction, which means that the job processing extends over multiple D_ACT_DP instruction executions. You start the job by calling D_ACT_DP with REQ = 1.

The output parameters RET_VAL and BUSY indicate the status of the job.

Application

If you configure PROFINET IO devices in a CPU which are not actually present or not currently required, the CPU nevertheless continues to access these PROFINET IO devices at regular intervals. After the devices are deactivated, further CPU accessing stops. The corresponding error events no longer occur.

Examples

From a machine OEM's point of view, there are numerous device options possible in series production of machines. However, each delivered machine includes only one combination of selected options.

The manufacturer configures every one of these possible machine options as a PROFINET IO device. The manufacturer does this in order to create and maintain a common user program having all possible options. Use D_ACT_DP to deactivate all PROFINET IO devices not present at machine startup.

A similar situation exists for machine tools having numerous tooling options available, but actually using only a few of them at any given time. These tools are implemented as PROFINET IO devices. With D_ACT_DP, the user program activates the tools currently needed and deactivates those required later.

Identification of a job

If you have started a deactivation or activation job and you call D_ACT_DP again before the job is complete, the behavior of the instruction depends on whether or not the new call involves the same job. If the input parameter LADDR matches, the call is interpreted as a follow-on call.

Deactivating PROFINET IO devices

When you deactivate a PROFINET IO device with D_ACT_DP, its process outputs are set to the configured substitute values or to "0" (safe state). The assigned PROFINET IO controller does not continue to address this component. The error LEDs on the PROFINET IO controller or CPU do not identify the deactivated PROFINET IO devices as faulty or missing.

The CPU updates the process image inputs of deactivated PROFINET IO devices with "0". Therefore, the CPU treats the deactivated PROFINET IO devices just like failed PROFINET IO devices.

If you directly access the user data of a previously deactivated PROFINET IO device from your program, the system behavior depends on the block’s error handling selection:

- If global error handling is enabled, the system enters an access error start event into the diagnostic buffer and stays in RUN.
- If block-local error handling is enabled, the system enters an error cause in the error structure. You can access the error cause using the GET_ERROR_ID (Page 306) instruction.

  An error for a read access returns "0". Refer to "Event execution priorities and queuing" (Page 103) for further information on error handling.

If you attempt to access a deactivated PROFINET IO device using an instruction (such as "RD_REC (Page 375)"), you receive the same error information in RET_VAL as for an unavailable PROFINET IO device.

If a PROFINET IO station fails after you have deactivated it with D_ACT_DP, the operating system does not detect the failure.

Activating PROFINET IO devices

When you reactivate a PROFINET IO device with D_ACT_DP, the associated PROFINET IO controller configures the component and assigns parameters (as with the return of a failed PROFINET IO station). This activation is complete when the component is able to transfer user data.

If you try to activate a PROFINET IO device that cannot be accessed (for example, because it was physically separated from the bus) with a D_ACT_DP instruction, the instruction returns the error code W#16#80A7 after expiration of the configured parameter assignment time for distributed I/O. The PROFINET IO device is activated and the fact that the activated PROFINET IO device cannot be accessed results in a corresponding display in the system diagnostics.

If the PROFINET IO device is accessible again afterwards, this results in standard system behavior.

Note

Activating a PROFINET IO device can be time-consuming. If you want to cancel a currently running activation job, start D_ACT_DP with the same value for LADDR and MODE = 2. You repeat the call for D_ACT_DP with MODE = 2 until the successful cancellation of the activation job is displayed with RET_VAL = 0.

Parameters

The following table shows the parameters of the D_ACT_DP instruction:

Parameter	Declaration	Data type	Description
REQ	IN	Bool	Level-triggered control parameter REQ = 1: Run activation or deactivation
MODE	IN	USInt	Job identifier Possible values: • 0: Request information on whether the addressed component is activated or deactivated (output using RET_VAL parameter) • 1: Activate the PROFINET IO device • 2: Deactivate the PROFINET IO device
LADDR	IN	HW_DEVICE	Hardware identifier of the PROFINET IO device (HW_Device) The number can be taken from the properties of the PROFINET IO device in the Network view or from the "System constants" tab of the standard tag table. If both the identifier for the device diagnostics as well as the ID for operating state transitions are specified there, you must use the code for the device diagnostics.

Parameter	Declaration	Data type	Description
RET_VAL	OUT	Int	If an error occurs while the program executes the instruction, the return value contains an error code.
BUSY	OUT	Bool	Active code: • BUSY = 1: The job is still active. • BUSY = 0: The job was terminated.

Parameter RET_VAL

Error code* (W#16#...)	Explanation
0000	Job completed without error.
0001	The PROFINET IO device is active (this error code is only possible with MODE = 0.)
0002	The PROFINET IO device is deactivated (this error code is only possible with MODE = 0.)
7000	First call with REQ = 0: The job specified in LADDR is not active; BUSY has the value "0".
7001	First call with REQ = 1. The program triggered the job specified in LADDR. BUSY has the value "1".
7002	Intermediate call (REQ irrelevant). The activated job is still active; BUSY has the value "1".
8090	• You have not configured a module with the address specified in LADDR. • You operate your CPU as I-slave / I-device, and you have specified an address of this I-slave/I-device in LADDR.
8092	The deactivation of the currently addressed PROFINET IO device (MODE = 2) cannot be canceled by being activated (MODE = 1). Activate the component at a later time.
8093	The address specified in LADDR does not belong to any PROFINET IO device that can be activated or deactivated, or the MODE parameter is unknown.
8094	You have attempted to activate a device which is a potential partner for a tool change port. However, another device is already activated on this tool change port at this time. The activated device remains activated.
80A0	Error during the communication between the CPU and the IO controller.
80A1	Parameters cannot be assigned for the addressed component. (This error code is only possible when MODE = 1.) Note: If this component fails again during parameter assignment of the activated device, the D_ACT_DP instruction supplies the error information. If the parameter assignment of a single module is unsuccessful, D_ACT_DP returns the error information W#16#0000.
80A3	The PROFINET IO controller concerned does not support this function.
80A4	The CPU does not support this function for an external PROFINET IO controller.

Error code* (W#16#...)	Explanation
80A6	Slot error in the PROFINET IO device; not all user data can be accessed (this error code is only available when MODE = 1). Note: D_ACT_DP returns this error information only if the activated component fails again after parameter assignment and before the end of the D_ACT_DP instruction execution. If only a single module is unavailable, D_ACT_DP returns the error information W#16#0000.
80A7	A timeout occurred during activation: The remote device is unreachable, or you have set the parameter assignment time for central and distributed I/O too short. The status of the remote device is "activated", but it is not accessible.
80AA	Activation with errors in the PROFINET IO device: Differences in the configuration
80AB	Activation with errors in the PROFINET IO device: Parameter assignment error
80AC	Activation with errors in the PROFINET IO device: Maintenance required
80C1	D_ACT_DP has started and is being continued with another address (this error code is possible when MODE = 1 and MODE = 2).
80C3	• Temporary resource error: The CPU is currently processing the maximum possible activation and deactivation jobs (8). (This error code is only possible when MODE = 1 and MODE = 2.) • The CPU is busy receiving a modified configuration. Currently, you cannot enable/disable PROFINET IO devices.
80C6	PROFINET: Jobs not collected by the user are discarded at restart.
General error information	See the GET_ERROR_ID (Page 306) instruction for information on how to access the error.
* The error codes in the program editor can be displayed as integer or hexadecimal values.	

9.3.9 STATUS parameter for RDREC, WRREC, and RALRM

The output parameter STATUS contains error information that is interpreted as ARRAY[1...4] OF BYTE, with the following structure:

Table 9- 85 STATUS output array

Array element	Name	Description
STATUS[1]	Function_Num	• B#16#00, if no error • Function ID from DPV1-PDU: If an error occurs, B#16#80 is OR'ed (for read data record: B#16#DE; for write data record: B#16#DF). If no DPV1 protocol element is used, then B#16#C0 will be output.
STATUS[2]	Error_Decode	Location of the error ID
STATUS[3]	Error_Code_1	Error ID
STATUS[4]	Error_Code_2	Manufacturer-specific error ID expansion

Table 9- 86 STATUS[2] values

Error_decode (B#16#....)	Source	Description
00 to 7F	CPU	No error or no warning
80	DPV1	Error according to IEC 61158-6
81 to 8F	CPU	B#16#8x shows an error in the "xth" call parameter of the instruction.
FE, FF	DP Profile	Profile-specific error

Table 9- 87 STATUS[3] values

Error_decode (B#16#....)	Error_code_1 (B#16#....)	Explanation (DVP1)	Description
00	00		No error, no warning
70	00	Reserved, reject	Initial call; no active data record transfer
	01	Reserved, reject	Initial call; data record transfer has started
	02	Reserved, reject	Intermediate call; data record transfer already active
80	90	Reserved, pass	Invalid logical start address
	92	Reserved, pass	Illegal type for Variant pointer
	93	Reserved, pass	The DP component addressed via ID or F_ID is not configured.
	96		The "RALRM (Page 383)" cannot supply the OB start information, management information, header information, or additional interrupt information. For the following OBs, you can use the "DPNRM_DG (Page 404)" instruction to read the current diagnostics message frame of the relevant DP slave asynchronously (address information from OB start information): • Hardware interrupt (Page 94) • Status (Page 100), Update (Page 101) or Profile (Page 101) • Diagnostic error interrupt (Page 96) • Pull or plug of modules (Page 98)
	A0	Read error	Negative acknowledgement while reading from the module
	A1	Write error	Negative acknowledgement while writing to the module
	A2	Module failure	DP protocol error at layer 2 (for example, slave failure or bus problems)
	A3	Reserved, pass	• PROFIBUS DP: DP protocol error with Direct-Data-Link-Mapper or User-Interface/User • PROFINET IO: General CM error
	A4	Reserved, pass	Communication on the communication bus disrupted
	A5	Reserved, pass	-
	A7	Reserved, pass	DP slave or modules is occupied (temporary error).
	A8	Version conflict	DP slave or module reports non-compatible versions.
	A9	Feature not supported	Feature not supported by DP slave or module

Error_decode (B#16#....)	Error_code_1 (B#16#....)	Explanation (DVP1)	Description
	AA to AF	User specific	DP slave or module reports a manufacturer-specific error in its application. Please check the documentation from the manufacturer of the DP slave or module.
	B0	Invalid index	Data record not known in module; illegal data record number ≥ 256
	B1	Write length error	The length information in the RECORD parameter is incorrect. • With "RALRM": Length error in AINFO **Note**: Refer to the online information system of STEP 7 for immediate access to information on how to interpret the "AINFO" returned buffers. • With "RDREC (Page 375)" and "WRREC (Page 375)": Length error in "MLEN"
	B2	Invalid slot	The configured slot is not occupied.
	B3	Type conflict	Actual module type does not match specified module type.
	B4	Invalid area	DP slave or module reports access to an invalid area.
	B5	Status conflict	DP slave or module not ready
	B6	Access denied	DP slave or module denies access.
	B7	Invalid range	DP slave or module reports an invalid range for a parameter or value.
	B8	Invalid parameter	DP slave or module reports an invalid parameter.
	B9	Invalid type	DP slave or module reports an invalid type: • With "RDREC (Page 375)": Buffer too small (subsets cannot be read) • With "WRREC (Page 375)": Buffer too small (subsets cannot be written)
	BA to BF	User specific	DP slave or module reports a manufacturer-specific error when accessing. Please check the documentation from the manufacturer of the DP slave or module.
	C0	Read constraint conflict	• With "WRREC (Page 375)": The data can only be written when the CPU is in STOP mode. **Note**: This means that data cannot be written by the user program. You can only write the data online with a PG/PC. • With "RDREC (Page 375)": The module routes the data record, but either no data is present or the data can only be read when the CPU is in STOP mode. **Note**: If data can only be read when the CPU is in STOP mode, no evaluation by the user program is possible. In this case, you can only read the data online with a PG/PC.
	C1	Write constraint conflict	The data of the previous write request to the module for the same data record has not yet been processed by the module.

Error_decode (B#16#....)	Error_code_1 (B#16#....)	Explanation (DVP1)	Description
	C2	Resource busy	The module is currently processing the maximum possible number of jobs for a CPU.
	C3	Resource unavailable	The required operating resources are currently occupied.
	C4		Internal temporary error. Job could not be carried out. Repeat the job. If this error occurs often, check your installation for sources of electrical interference.
	C5		DP slave or module not available
	C6		Data record transfer was cancelled due to priority class cancellation.
	C7		Job aborted due to warm or cold restart on the DP master.
	C8 to CF		DP slave or module reports a manufacturer-specific resource error. Please check the documentation from the manufacturer of the DP slave or module.
	Dx	User specific	DP Slave specific. Refer to the description of the DP Slave.
81	00 to FF		Error in the initial call parameter (with "RALRM (Page 383)": MODE)
	00		Illegal operating mode
82	00 to FF		Error in the second call parameter
88	00 to FF		Error in the eighth call parameter (with "RALRM (Page 383)": TINFO) **Note**: Refer to the online information system of STEP 7 for immediate access to information on how to interpret the "TINFO" returned buffers.
	01		Wrong syntax ID
	23		Quantity structure exceeded or destination area too small
	24		Wrong range ID
	32		DB/DI number out of user range
	3A		DB/DI number is NULL for area ID DB/DI, or specified DB/DI does not exist.
89	00 to FF		Error in the ninth call parameter (with "RALRM (Page 383)": AINFO) **Note**: Refer to the online information system of STEP 7 for immediate access to information on how to interpret the "AINFO" returned buffers.
	01		Wrong syntax ID
	23		Quantity structure exceeded or destination area too small
	24		Wrong range ID
	32		DB/DI number out of user range
	3A		DB/DI number is NULL for area ID DB/DI, or specified DB/DI does not exist.
8A	00 to FF		Error in the 10th call parameter
8F	00 to FF		Error in the 15th call parameter
FE, FF	00 to FF		Profile-specific error

Array element STATUS[4]

With DPV1 errors, the DP Master passes on STATUS[4] to the CPU and to the instruction. Without a DPV1 error, this value is set to 0, with the following exceptions for the RDREC:

- STATUS[4] contains the target area length from RECORD, if MLEN > the destination area length from RECORD.
- STATUS[4]=MLEN, if the actual data record length < MLEN < the destination area length from RECORD.
- STATUS[4]=0, if STATUS[4] > 255; would have to be set

In PROFINET IO, STATUS[4] has the value 0.

9.3.10 Others

9.3.10.1 DPRD_DAT and DPWR_DAT (Read/write consistent data)

Use the DPRD_DAT (Read consistent data) instruction to read one or more bytes of data consistently, and use the DPWR_DAT (Write consistent data) instruction to transfer one or more bytes of data consistently. You can use the DPRD_DAT and DPWR_DAT instructions with PROFINET and PROFIBUS.

Table 9- 88 DPRD_DAT and DPWR_DAT instructions

LAD / FBD	SCL	Description

	`ret_val := DPRD_DAT(`
	`laddr:=_word_in_,`
	`record=>_variant_out_);`
		Use the DPRD_DAT instruction to read one or more bytes of data from modules or submodules of one of the following locations:
		• Local base I/O
		• DP slave
		• PROFINET I/O device
		The CPU transfers the data read consistently. If no errors occur during the data transfer, the CPU enters the read data into the target area set up by the RECORD parameter. The target area must have the same length as you configured with STEP 7 for the selected module. When you execute the DPRD_DAT instruction, you can only access the data of one module or submodule. The transfer starts at the configured start address.

	`ret_val := DPWR_DAT(`
	`laddr:=_word_in_,`
	`record:=_variant_in_);`
		Use the DPWR_DAT instruction to transfer the data in RECORD consistently to the following locations:
		• Addressed module or submodule in the local base
		• DP standard slave
		• PROFINET I/O device
		The source area must have the same length as you configured with STEP 7 for the selected module or submodule.

- The S7-1200 CPU supports consistent peripheral I/O read or write of 1, 2, or 4 bytes. Use the DPRD_DAT instruction to consistently read and the DPWR_DAT instruction to consistently write data of lengths other than 1, 2, or 4 bytes.
- You can use these instructions for data areas of 1 or more bytes. If the access is rejected, error code W#16#8090 results.
- PROFINET supports up to 1024 bytes of consistent data. You do not need to use these instructions for consistent transfers between the S7-1200 and PROFINET devices.

Note

If you are using the DPRD_DAT and DPWR_DAT instructions with consistent data, you must remove this consistent data from the process-image automatic update. Refer to "PLC concepts: Execution of the user program" (Page 83) for more information.

Table 9- 89 Parameters

Parameter	Declaration	Data type	Description
LADDR	IN	HW_IO (Word)	Hardware ID of the module from which the data is to be read. (DPRD_DAT) Hardware ID of the module to which the data is to be written. (DPWR_DAT) The hardware ID can be found in the properties of the module in the device view or system constants.
RECORD	OUT	Variant	Destination area for the user data that were read (DPRD_DAT) or source area for the user data to be written (DPWR_DAT). This must be exactly as large as you configured for the selected module with STEP 7.
RET_VAL	OUT	Int	If an error occurs while the function is active, the return value contains an error code.

DPRD_DAT operations

Use the parameter LADDR to select the module of the DP standard slave / PROFINET IO device. If an access error occurs on the addressed module, the error code W#16#8090 is output.

Use the parameter RECORD to define the target range of the read data:

- The target range has to be at least as long as the inputs of the selected module. Only the inputs are transferred; the other bytes are not considered. If you read from a DP standard slave with a modular configuration or with several DP identifiers, you can only access the data of a module of the configured hardware identifier for each DPRD_DAT instruction call. If you select a target range that is too small, the error code W#16#80B1 is output at the RET_VAL parameter.
- The following data types can be used: Byte, Char, Word, DWord, Int, UInt, USInt, SInt, DInt, UDInt. The use of these data types in a User Defined Type (UDT) data structure of the type ARRAY or STRUCT is permissible.
- The data type STRING is not supported.
- If there was no error during the data transmission, the data that have been read are entered in the target range defined at the parameter RECORD.

DPWR_DAT operations

Use the parameter LADDR to select the module of the DP standard slave / PROFINET IO device. If an access error occurs on the addressed module, the error code W#16#8090 is output.

Use the parameter RECORD to define the source range of the data to be written:

- The source range has to be at least as long as the outputs of the selected module. Only the outputs are transferred; the other bytes are not considered. If the source range at the parameter RECORD is longer than the outputs of the configured module, only the data up to the maximum length of the outputs is transferred. If the source range at the parameter RECORD is shorter than the outputs of the configured module, the error code W#16#80B1 is output at the RET_VAL parameter.
- The following data types can be used: Byte, Char, Word, DWord, Int, UInt, USInt, SInt, DInt, UDInt. The use of these data types in a User Defined Type (UDT) data structure of the type ARRAY or STRUCT is permissible.
- The data type STRING is not supported.
- The data is transferred synchronously, that is, the write process is completed when the instruction is completed.

Error codes

Table 9- 90 DPRD_DAT and DPWR_DAT error codes

Error code [1]	Description
0000	No error occurred
8090	One of the following cases apply: • You have not configured a module for the specified logical base address. • You have ignored the restriction concerning the length of consistent data. • You have not entered the start address in the LADDR parameter in hexadecimal format.
8092	The RECORD parameter supports the following data types: Byte, Char, Word, DWord, Int, UInt, USInt, SInt, DInt, UDInt, and arrays of these types.
8093	No DP module/PROFINET IO device from which you can read (DPRD_DAT) or to which you can write (DPWR_DAT) consistent data exists at the logical address specified in LADDR.
80A0	Access error detected while the I/O devices were being accessed (DPRD_DAT).
80B1	The length of the specified destination (DPRD_DAT) or source (DPWR_DAT) area is not identical to the user data length configured with STEP 7 Basic.
80B2	System error with external DP interface module (DPRD_DAT) and (DPWR_DAT)

[1] When displaying the DPRD_DAT and DPWR_DAT error codes, use the Word data type.

Note

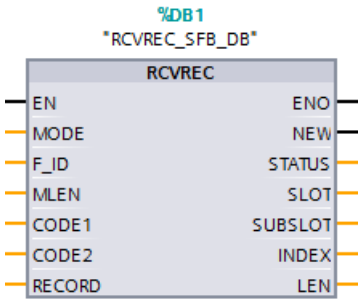
If you access DPV1 slaves, error information from these slaves can be forwarded from the DP master to the instruction.

9.3.10.2 RCVREC (I-device/I-slave receive data record)

An I-device can receive a data record from a higher-level controller. The receipt takes place in the user program with the RCVREC instruction (receive data record).

Table 9- 91 RCVREC instruction

LAD / FBD	SCL	Description

	`"RCVREC_SFB_DB"(`
	`mode:=_int_in_,`
	`F_ID:=_uint_in_,`
	`mlen:=_uint_in_,`
	`code1:=_byte_in_,`
	`code2:=_byte_in_,`
	`new=>_bool_out_,`
	`status=>_dword_out_,`
	`slot=>_uint_out_,`
	`subslot=>_uint_out_,`
	`index=>_uint_out_`
	`len=>_uint_out_,`
	`rec-`
	`ord:=_variant_inout_);`
		Use the RCVREC instruction to receive a data record from a higher-level controller.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "RCVREC_SFB_DB" is the name of the instance DB.

The instruction has the following operating modes:

- Check whether the I-device has a request for a data record receipt
- Make the data record available to the output parameters
- Send an answer to the higher-level controller

You can determine the operating mode executed by the instruction using the input parameter MODE (see below).

The I-device must be in the RUN or STARTUP mode.

With MLEN, you specify the maximum number of bytes you want to receive. The selected length of the target range RECORD should have at least the length of MLEN bytes.

If a data record is received (MODE = 1 or MODE = 2), the output parameter NEW indicates that the data record is stored in RECORD. Note that RECORD has a sufficient length. The output parameter LEN contains the actual length of the data record received in bytes.

Set CODE1 and CODE2 to zero for the positive answer to the higher-level controller. If the received data record is to be rejected, enter the negative answer to the higher-level controller in Error Code 1 of the CODE1 and in Error Code 2 of the CODE2.

Note

If the I-device has received a request for a data record receipt, you must recognize the delivery of this request within a certain duration. After recognition, you must send an answer to the higher-level controller within this time period. Otherwise, the I-device experiences a timeout error which causes the operating system of the I-device to send a negative answer to the higher-level controller. For information on the value for the time period, refer to the specifications of your CPU.

The STATUS output parameter receives the error information after the occurrence of an error.

Operating modes

You can determine the operating mode of the RCVREC instruction with the input parameter MODE. This step is explained in the following table:

MODE	Meaning
0	Check whether a request for a data record receipt exists If a data record from a higher-level controller exists on the I-device, the instruction only writes to the NEW, SLOT, SUBSLOT, INDEX, and LEN output parameters. If you call the instruction several times with MODE = 0, then the output parameter only refers to one and the same request.
1	Receiving a data record for any subslot of the I-device If a data record from a higher-level controller exists on the I-device for any subslot of the I-device, the instruction writes to the output parameter and transfers the data record to the parameter RECORD.
2	Receiving a data record for a specific subslot of the I-device If a data record from a higher-level controller exists on the I-device for a specific subslot of the I-device, the instruction writes to the output parameter and transfers the data record to the parameter RECORD.
3	Sending a positive answer to the higher-level controller The instruction checks the request of the higher-level controller to receive a data record, accepts the existing data record, and sends a positive acknowledgment to the higher-level controller.
4	Sending a negative answer to the higher-level controller The instruction checks the request of the higher-level controller to receive a data record, rejects the existing data record, and sends a negative acknowledgment to the higher-level controller. Enter the reason for the rejection in the input parameters CODE1 and CODE2.

Note

After the receipt of a data record (NEW = 1), you must call the RCVREC instruction twice to ensure complete processing. You must do this in the following order:

- First call with MODE = 1 or MODE = 2
- Second call with MODE = 3 or MODE = 4

Parameters

The following table shows the parameters of the RCVREC instruction:

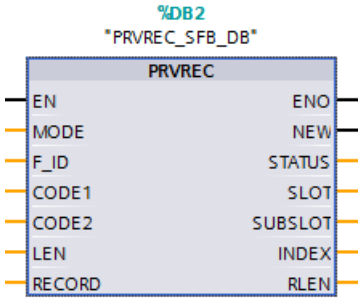
Parameter	Declaration	Data type	Description
MODE	IN	Int	Mode
F_ID	IN	HW_SUBMODULE	Subslot in the transfer area of the I-device for the data record to be received (only relevant for MODE = 2). The high word is always set to zero.
MLEN	IN	Int	Maximum length of the data record to be received in bytes
CODE1	IN	Byte	Zero (for MODE = 3) and/or Error Code 1 (for MODE = 4)
CODE2	IN	Byte	Zero (for MODE = 3) and/or Error Code 2 (for MODE = 4)
NEW	OUT	Bool	• MODE = 0: New data record was received • MODE = 1 or 2: Data record was transferred to RECORD
STATUS	OUT	DWord	Error information. Refer to "STATUS parameter" (Page 391) for more information.
SLOT	OUT	HW_SUBMODULE	Identical to F_ID
SUBSLOT	OUT	HW_SUBMODULE	Identical to F_ID
INDEX	OUT	UInt	Number of the data record received
LEN	OUT	UInt	Length of the data record received
RECORD	IN_OUT	Variant	Target range for the data record received

9.3.10.3 PRVREC (I-device/I-slave make data record available)

An I-device can receive a request from a higher-level controller to make a data record available. The I-device makes the data record available in the user program with the PRVREC instruction (make data record available).

Table 9- 92 PRVREC instruction

LAD / FBD	SCL	Description

	`"PRVREC_SFB_DB"(`
	`mode:=_int_in_,`
	`F_ID:=_uint_in_,`
	`code1:=_byte_in_,`
	`code2:=_byte_in_,`
	`len:=_uint_in_,`
	`new=>_bool_out_,`
	`status=>_dword_out_,`
	`slot=>_uint_out_,`
	`subslot=>_uint_out_,`
	`index=>_uint_out_`
	`rlen=>_uint_out_,`
	`rec-`
	`ord:=_variant_inout_);`
		Use the PRVREC instruction to receive a request from a higher-level controller to make a data record available.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "PRVREC_SFB_DB" is the name of the instance DB.

The instruction has the following operating modes:

- Check whether the I-device has a request for making a data record available
- Transfer the requested data record to the higher-level controller
- Sending an answer to the higher-level controller

You can determine the operating mode executed by the instruction using the input parameter MODE (see below).

The I-device must be in the RUN or STARTUP mode.

Enter the maximum number of bytes the data record to be sent should have with LEN. The selected length of the target range RECORD should have at least the length of LEN bytes.

If a request to make a data record available exists, (MODE = 0), the output parameter NEW is set to TRUE.

If the request for making a data record available is accepted, write RECORD for the positive answer to the higher-level controller with the requested data record and write zero for CODE1 and CODE2. If the request for making a data record available is to be rejected, enter the negative answer to the higher-level controller in Error Code 1 of the CODE1 and in Error Code 2 of the CODE2.

Note

If the I-device has received a request for making a data record available, you must recognize the delivery of this request within a certain time period. After recognition, you must send an answer to the higher-level controller within this time period. Otherwise, the I-device experiences a timeout error which causes the operating system of the I-device to send a negative answer to the higher-level controller. For information on the value for the time period, refer to the specifications of your CPU.

The STATUS output parameter receives the error information after the occurrence of an error.

Operating modes

You can determine the operating mode of the PRVREC instruction with the input parameter MODE. This step is explained in the following table:

MODE	Meaning
0	Check whether a request for making a data record available exists If a request from a higher-level controller for making a data record available exists on the I-device, the instruction only writes to the NEW, SLOT, SUBSLOT, INDEX, and RLEN output parameters. If you call the instruction several times with MODE = 0, then the output parameter only refers to one and the same request.
1	Receiving a request for making a data record available for any subslot of the I-device If such a request from a higher-level controller for any subslot of the I-device exists on the I-device, the instruction writes to the output parameter.
2	Receiving a request for making a data record available for a specific subslot of the I-device If such a request from a higher-level controller for a specific subslot of the I-device exists on the I-device, the instruction writes to the output parameter.
3	Make the data record available and send a positive answer to the higher-level controller The instruction checks the request of the higher-level controller to make a data record available, makes the request data record available to RECORD, and sends a positive acknowledgement to the higher-level controller.
4	Sending a negative answer to the higher-level controller The instruction checks the request of the higher-level controller to make a data record available, rejects this request, and sends a negative acknowledgement to the higher-level controller. Enter the reason for the rejection in the input parameters CODE1 and CODE2.

Note

After the receipt of a request (NEW = 1), you must call the PRVREC instruction twice to ensure complete processing. You must do this in the following order:

- First call with MODE = 1 or MODE = 2
- Second call with MODE = 3 or MODE = 4

Parameters

The following table shows the parameters of the PRVREC instruction:

Parameter	Declaration	Data type	Description
MODE	IN	Int	Mode
F_ID	IN	HW_SUBMODULE	Subslot in the transfer area of the I-device for the data record to be sent (only relevant for MODE = 2). The high word is always set to zero.
CODE1	IN	Byte	Zero (for MODE = 3) and/or Error Code 1 (for MODE = 4)
CODE2	IN	Byte	Zero (for MODE = 3) and/or Error Code 2 (for MODE = 4)
LEN	IN	UInt	Maximum length of the data record to be sent in bytes
NEW	OUT	Bool	The new data record was requested by the higher-level controller.
STATUS	OUT	DWord	Error information. Refer to "STATUS parameter" (Page 391) for more information.
SLOT	OUT	HW_SUBMODULE	Identical to F_ID
SUBSLOT	OUT	HW_SUBMODULE	Identical to F_ID
INDEX	OUT	UInt	Number of the data record to be sent
RLEN	OUT	UInt	Length of the data record to be sent
RECORD	IN_OUT	Variant	Data record made available

9.3.10.4 DPNRM_DG (Read diagnostic data from a PROFIBUS DP slave)

You can use the DPNRM_DG (Read diagnostic data) instruction with PROFIBUS.

Table 9- 93 DPNRM_DG instruction

LAD / FBD	SCL	Description

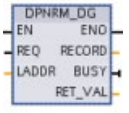
	`ret_val := DPNRM_DG(`
	`req:=_bool_in_,`
	`laddr:=_word_in_,`
	`record=>_variant_out_,`
	`busy=>_bool_out_);`
		Use the DPNRM_DG instruction to read the current diagnostic data of a DP slave in the format specified by EN 50 170 Volume 2, PROFIBUS. The data that has been read is entered in the destination area indicated by RECORD following error-free data transfer.

Table 9- 94 DPNRM_DG instruction data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	REQ=1: Read request
LADDR	IN	HW_DPSLAVE	Configured diagnostic address of the DP slave: Must be the address of the station and not for the I/O device. Select the station (and not the image of the device) in the "Network" view of the "Device configuration" to determine the diagnostic address. Enter the addresses in hexadecimal format. For example, diagnostic address 1022 means LADDR:=W#16#3FE.
RET_VAL	OUT	Int	If an error occurs while the function is active, the return value contains an error code. If no error occurs, the length of the data actually transferred is entered in RET_VAL.
RECORD	OUT	Variant	Destination area for the diagnostic data that were read. The minimum length of the data record to be read (or the destination area) is 6 bytes. The maximum length of the data record to be sent is 240 bytes. Standard slaves can provide more than 240 bytes of diagnostic data up to a maximum of 244 bytes. In this case, the first 240 bytes are transferred to the destination area, and the overflow bit is set in the data.
BUSY	OUT	Bool	BUSY=1: The read job is not yet completed

You start the read job by assigning 1 to the input parameter REQ in the DPNRM_DG instruction call. The read job is executed asynchronously, in other words, it requires several DPNRM_DG instruction calls. The status of the job is indicated by the output parameters RET_VAL and BUSY.

Table 9- 95 Slave diagnostic data structure

Byte	Description
0	Station status 1
1	Station status 2
2	Station status 3
3	Master station number
4	Vendor ID (high byte)
5	Vendor ID (low byte)
6 ...	Additional slave-specific diagnostic information

Table 9- 96 DPNRM_DG instruction error codes

Error code	Description	Restriction
0000	No error	-
7000	First call with REQ=0: No data transfer active; BUSY has the value 0.	-
7001	First call with REQ =1: No data transfer active; BUSY has the value 1.	Distributed I/Os
7002	Interim call (REQ irrelevant): Data transfer already active; BUSY has the value 1.	Distributed I/Os
8090	Specified logical base address invalid: There is no base address.	-
8092	The RECORD parameter supports the following data types: Byte, Char, Word, DWord, Int, UInt, USInt, SInt, DInt, UDInt, and arrays of these types.	-
8093	• This instruction is not permitted for the module specified by LADDR (S7-DP modules for S7-1200 are permitted). • LADDR specifies the I/O device instead of specifying the station. Select the station (and not the image of the device) in the "Network" view of the "Device configuration" to determine the diagnostic address for LADDR.	-
80A2	• DP protocol error at layer 2 (for example, slave failure or bus problems) • For ET200S, data record cannot be read in DPV0 mode.	Distributed I/Os
80A3	DP protocol error with user interface/user	Distributed I/Os
80A4	Communication problem on the communication bus	The error occurs between the CPU and the external DP interface module.
80B0	• The instruction is not possible for module type. • The module does not recognize the data record. • Data record number 241 is not permitted.	-
80B1	The length specified in the RECORD parameter is incorrect.	Specified length > record length
80B2	The configured slot is not occupied.	-
80B3	Actual module type does not match the required module type.	-
80C0	There is no diagnostic information.	-
80C1	The data of the previous write job for the same data record on the module have not yet been processed by the module.	-
80C2	The module is currently processing the maximum possible number of jobs for a CPU.	-
80C3	The required resources (memory, etc.) are currently occupied.	-
80C4	Internal temporary error. The job could not be processed. Repeat the job. If this error occurs frequently, check your system for electrical disturbance sources.	-
80C5	Distributed I/Os not available	Distributed I/Os
80C6	Data record transfer was stopped due to a priority class abort (restart or background)	Distributed I/Os
8xyy[1]	General error codes	

Refer to "Extended instructions, Distributed I/O: Error information for RDREC, WRREC, and RALRM" (Page 391) for more information on general error codes.

9.4 PROFIenergy

PROFIenergy is a manufacturer- and device-neutral profile for energy management with PROFINET. To reduce electricity consumption during breaks in production and unplanned interruptions, it is possible to shut down equipment in a coordinated and centralized manner using PROFIenergy.

The PROFINET IO controller switches off the PROFINET devices/power modules using special commands in the user program. You require no additional hardware. The PROFINET devices interpret the PROFIenergy commands directly.

The S7-1200 CPU does not support the PE controller functionality. The S7-1200 CPU can only act as a PROFIenergy entity (with I-device functionality).

PROFIenergy controller (PE controller)

The PE controller is a higher-level CPU (for example, an S7-1500) that activates or deactivates the idle state of lower-level devices. The PE controller deactivates and reactivates specific production components or complete production lines using the user program. Lower-level devices receive commands from the user program through corresponding instructions (function blocks).

The user program sends the commands using the PROFINET communication protocol. The PE command can be either a control command to switch a PE entity to the energy-saving mode, or a command to read a status or measured value.

You use the PE_I_DEV instruction to request data from a module. The user program has to determine what information is being requested by the PE controller and retrieve it from the energy module using data records. The module itself does not directly support the PE commands. The module stores the energy measurement information in a shared area, and the lower-level CPU (for example, an S7-1200) triggers the PE_I_DEV instruction to return it to the PE controller.

PROFIenergy entity (PE entity)

The PE entity (for example, an S7-1200) receives the PROFIenergy commands of the PE controller (for example, an S7-1500) and executes these accordingly (for example, by returning a measured value or activating an energy saving mode). Implementation of the PE entity in a PROFIenergy-capable device is device- and manufacturer-specific.

Reference information

You can find further information on PROFIenergy in the TIA Portal STEP 7 online help. You can find examples that use the PROFIenergy instructions in the Industry Online Support in the entry "PROFIenergy - Saving Energy with SIMATIC S7 (http://support.automation.siemens.com/WW/view/en/41986454)".

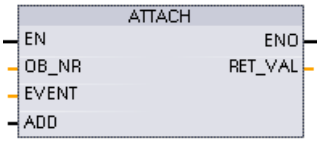
9.5 Interrupts

9.5.1 ATTACH and DETACH (Attach/detach an OB and an interrupt event) instructions

You can activate and deactivate interrupt event-driven subprograms with the ATTACH and DETACH instructions.

Table 9- 97 ATTACH and DETACH instructions

LAD / FBD	SCL	Description

	`ret_val := ATTACH(`
	`ob_nr:=_int_in_,`
	`event:=_event_att_in_,`
	`add:=_bool_in_);`
		ATTACH enables interrupt OB subprogram execution for a hardware interrupt event.

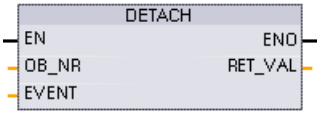
	`ret_val := DETACH(`
	`ob_nr:=_int_in_,`
	`event:=_event_att_ in);`
		DETACH disables interrupt OB subprogram execution for a hardware interrupt event.

Table 9- 98 Data types for the parameters

Parameter and type		Data type	Description
OB_NR	IN	OB_ATT	Organization block identifier: Select from the available hardware interrupt OBs that were created using the "Add new block" feature. Double-click on the parameter field, then click on the helper icon to see the available OBs.
EVENT	IN	EVENT_ATT	Event identifier: Select from the available hardware interrupt events that were enabled in PLC device configuration for digital inputs or high-speed counters. Double-click on the parameter field, then click on the helper icon to see the available events.
ADD (ATTACH only)	IN	Bool	• ADD = 0 (default): This event replaces all previous event attachments for this OB. • ADD = 1: This event is added to previous event attachments for this OB.
RET_VAL	OUT	Int	Execution condition code

Hardware interrupt events

The following hardware interrupt events are supported by the CPU:

- Rising edge events: first 12 built-in CPU digital inputs (DIa.0 to DIb.3) and all SB digital inputs
  - A rising edge occurs when the digital input transitions from OFF to ON as a response to a change in the signal from a field device connected to the input.
- Falling edge events: first 12 built-in CPU digital inputs (DIa.0 to DIb.3) and all SB digital inputs
  - A falling edge occurs when the digital input transitions from ON to OFF.
- High-speed counter (HSC) current value = reference value (CV = RV) events (HSC 1 through 6)
  - A CV = RV interrupt for a HSC is generated when the current count transitions from an adjacent value to the value that exactly matches a reference value that was previously established.
- HSC direction changed events (HSC 1 through 6)
  - A direction changed event occurs when the HSC is detected to change from increasing to decreasing, or from decreasing to increasing.
- HSC external reset events (HSC 1 through 6)
  - Certain HSC modes allow the assignment of a digital input as an external reset that is used to reset the HSC count value to zero. An external reset event occurs for such a HSC, when this input transitions from OFF to ON.

Enabling hardware interrupt events in the device configuration

Hardware interrupts must be enabled during the device configuration. You must check the enable-event box in the device configuration for a digital input channel or a HSC, if you want to attach this event during configuration or run time.

Check box options within the PLC device configuration:

- Digital input
  - Enable rising edge detection
  - Enable falling edge detection
- High-speed counter (HSC)
  - Enable this high-speed counter for use
  - Generate interrupt for counter value equals reference value count
  - Generate interrupt for external reset event
  - Generate interrupt for direction change event

Adding new hardware interrupt OB code blocks to your program

By default, no OB is attached to an event when the event is first enabled. This is indicated by the "HW interrupt:" device configuration "<not connected>" label. Only hardware-interrupt OBs can be attached to a hardware interrupt event. All existing hardware-interrupt OBs appear in the "HW interrupt:" drop-down list. If no OB is listed, then you must create an OB of type "Hardware interrupt" as follows. Under the project tree "Program blocks" branch:

1. Double-click "Add new block", select "Organization block (OB)" and choose "Hardware interrupt".
2. Optionally, you can rename the OB, select the programming language (LAD, FBD or SCL), and select the block number (switch to manual and choose a different block number than that suggested).
3. Edit the OB and add the programmed reaction that you want to execute when the event occurs. You can call FCs and FBs from this OB, up to the maximum nesting depth. The maximum nesting depth is four for safety progams. For other programs, the maximum nesting depth is six.

OB_NR parameter

All existing hardware-interrupt OB names appear in the device configuration "HW interrupt:" drop-down list and in the ATTACH / DETACH parameter OB_NR drop-list.

EVENT parameter

When a hardware interrupt event is enabled, a unique default event name is assigned to this particular event. You can change this event name by editing the "Event name:" edit box, but it must be a unique name. These event names become tag names in the "Constants" tag table, and appear on the EVENT parameter drop-down list for the ATTACH and DETACH instruction boxes. The value of the tag is an internal number used to identify the event.

General operation

Each hardware event can be attached to a hardware-interrupt OB which will be queued for execution when the hardware interrupt event occurs. The OB-event attachment can occur at configuration time or at run time.

You have the option to attach or detach an OB to an enabled event at configuration time. To attach an OB to an event at configuration time, you must use the "HW interrupt:" drop-down list (click on the down arrow on the right) and select an OB from the list of available hardware-interrupt OBs. Select the appropriate OB name from this list, or select "<not connected>" to remove the attachment.

You can also attach or detach an enabled hardware interrupt event during run time. Use the ATTACH or DETACH program instructions during run time (multiple times if you wish) to attach or detach an enabled interrupt event to the appropriate OB. If no OB is currently attached (either from a "<not connected>" selection in device configuration, or as a result of executing a DETACH instruction), the enabled hardware interrupt event is ignored.

DETACH operation

Use the DETACH instruction to detach either a particular event or all events from a particular OB. If an EVENT is specified, then only this one event is detached from the specified OB_NR; any other events currently attached to this OB_NR will remain attached. If no EVENT is specified, then all events currently attached to OB_NR will be detached.

Condition codes

Table 9- 99 Condition codes

RET_VAL (W#16#....)	ENO	Description
0000	1	No error
0001	1	Nothing to Detach (DETACH only)
8090	0	OB does not exist
8091	0	OB is wrong type
8093	0	Event does not exist

9.5.2 Cyclic interrupts

9.5.2.1 SET_CINT (Set cyclic interrupt parameters)

Table 9- 100 SET_CINT (Set cyclic interrupt parameters)

LAD / FBD	SCL	Description

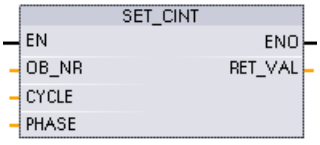
	`ret_val := SET_CINT(`
	`  ob_nr:=_int_in_,`
	`  cycle:=_udint_in_,`
	`  phase:=_udint_in_);`
		Set the specified interrupt OB to begin cyclic execution that interrupts the program scan.

Table 9- 101 Data types for the parameters

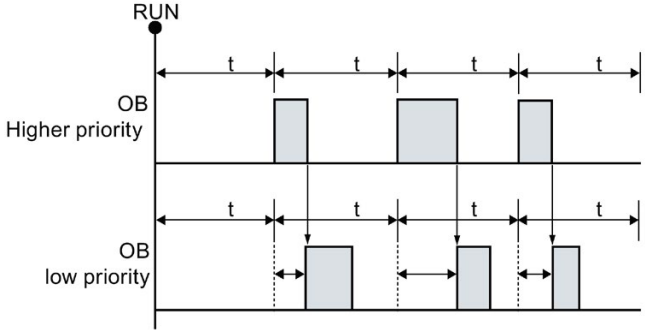
Parameter and type		Data type	Description
OB_NR	IN	OB_CYCLIC	OB number (accepts symbolic name)
CYCLE	IN	UDInt	Time interval, in microseconds
PHASE	IN	UDInt	Phase shift, in microseconds
RET_VAL	OUT	Int	Execution condition code

Examples: time parameter

- If the CYCLE time = 100 us, then the interrupt OB referenced by OB_NR interrupts the cyclic program scan every 100 us. The interrupt OB executes and then returns execution control to the program scan, at the point of interruption.
- If the CYCLE time = 0, then the interrupt event is deactivated and the interrupt OB is not executed.
- The PHASE (phase shift) time is a specified delay time that occurs before the CYCLE time interval begins. You can use the phase shift to control the execution timing of lower priority OBs.

If lower and higher priority OBs are called in the same time interval, the lower priority OB is only called after the higher priority OB has finished processing. The execution start time for the low priority OB can shift depending on the processing time of higher priority OBs.

OB call without phase shift



If you want to start the execution of a lower priority OB on a fixed time cycle, then phase shift time should be greater then the processing time of higher priority OBs.

OB-call with phase shift

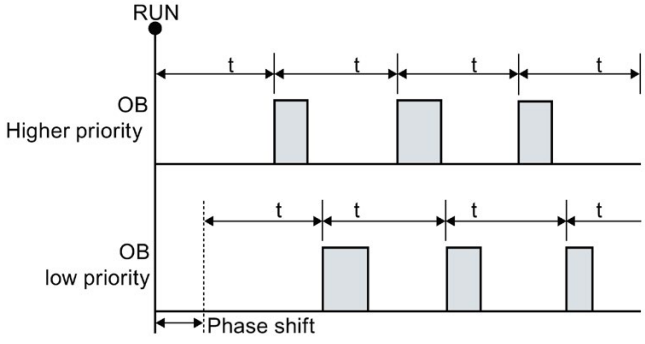


Table 9- 102 Condition codes

RET_VAL (W#16#....)	Description
0000	No error
8090	OB does not exist or is of wrong type
8091	Invalid cycle time
8092	Invalid phase shift time
80B2	OB has no attached event

9.5.2.2 QRY_CINT (Query cyclic interrupt parameters)

Table 9- 103 **QRY_CINT (Query cyclic interrupt)**

LAD / FBD	SCL	Description

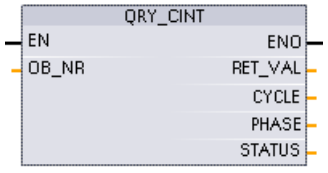
	`ret_val := QRY_CINT(`
	`ob_nr:=_int_in_,`
	`cycle=>_udint_out_,`
	`phase=>_udint_out__,`
	`status=>_word_out_);`
		Get parameter and execution status from a cyclic interrupt OB. The values that are returned existed at the time QRY_CINT was executed.

Table 9- 104 Data types for the parameters

Parameter and type		Data type	Description
OB_NR	IN	OB_CYCLIC	OB number (accepts symbolic name like OB_MyOBName)
RET_VAL	OUT	Int	Execution condition code
CYCLE	OUT	UDInt	Time interval, in microseconds
PHASE	OUT	UDInt	Phase shift, in microseconds
STATUS	OUT	Word	Cyclic interrupt status code: • Bits 0 to 4, see the STATUS table below • Other bits, always 0

Table 9- 105 STATUS parameter

Bit	Value	Description
0	0	During CPU RUN
	1	During startup
1	0	The interrupt is enabled.
	1	Interrupt is disabled via the DIS_IRT instruction.
2	0	The interrupt is not active or has elapsed.
	1	The interrupt is active.
4	0	The OB identified by OB_NR does not exist.
	1	The OB identified by OB_NR exists.
Other Bits		Always 0

If an error occurs, RET_VAL displays the appropriate error code and the parameter STATUS = 0.

Table 9- 106 RET_VAL parameter

RET_VAL (W#16#....)	Description
0000	No error
8090	OB does not exist or is of wrong type.
80B2	OB has no attached event.

9.5.3 Time of day interrupts

WARNING

Risk of attacker accessing your networks through Network Time Protocol (NTP) synchronization

If an attacker can access your networks through Network Time Protocol (NTP) synchronization, the attacker can possibly disrupt control of your process by shifting the CPU system time. Disruptions to process control can possibly cause death, severe injury, or property damage.

The NTP client feature of the S7-1200 CPU is disabled by default, and, when enabled, only allows configured IP addresses to act as an NTP server. The CPU disables this feature by default, and you must configure this feature to allow remotely-controlled CPU system time corrections.

The S7-1200 CPU supports "time of day" interrupts and clock instructions that depend upon accurate CPU system time. If you configure NTP and accept time synchronization from a server, you must ensure that the server is a trusted source. Failure to do so can cause a security breach that allows an unknown user to take limited control of your process by shifting the CPU system time.

For security information and recommendations, please see "Operational Guidelines for Industrial Security" (http://www.industry.siemens.com/topics/global/en/industrial-security/Documents/operational_guidelines_industrial_security_en.pdf) on the Siemens Service and Support site.

9.5.3.1 SET_TINTL (Set time of day interrupt)

Table 9- 107 SET_TINTL (Set date and time of day interrupt with DTL data type)

LAD / FBD	SCL	Description

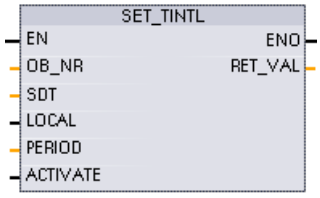
	`ret_val := SET_TINTL(`
	`OB_NR:=_int_in_,`
	`SDT:=_dtl_in_,`
	`LOCAL:=_bool_in_`
	`PERIOD:=_word_in_`
	`ACTIVATE:=_bool_in_);`
		Set a date and time of day interrupt. The program interrupt OB can be set for one execution, or for recurring execution with an assigned time period.

Table 9- 108 Data types for the parameters

Parameter and type		Data type	Description
OB_NR	IN	OB_TOD (INT)	OB number (accepts symbolic name)
SDT	IN	DTL	Start date and time: Seconds and milliseconds are ignored and can be set to 0.
LOCAL	IN	Bool	0 = Use system time 1 = Use local time (if the CPU is configured for local time, otherwise use system time)
PERIOD	IN	Word	The period from the starting date and time for recurring interrupt event. • W#16#0000 = Once • W#16#0201 = Every minute • W#16#0401 = Every hour • W#16#1001 = Daily • W#16#1201 = Weekly • W#16#1401 = Monthly • W#16#1801 = yearly • W#16#2001 = End of month
ACTIVATE	IN	Bool	0 = ACT_TINT must be executed to activate the interrupt event. 1 = The interrupt event is activated.
RET_VAL	OUT	Int	Execution condition code

Your program can use SET_TINTL to set a date and time of day interrupt event that will execute the assigned interrupt OB. The start date and time is set by parameter SDT and the time period for recurring interrupts (for example, daily or weekly) is set by parameter PERIOD. If you set the repetition period to monthly, then you must set the start date to a day from 1 to 28. The days 29 to 31 may not be used because they do not occur in February. If you want an interrupt event at the end of each month, then use end of month for parameter PERIOD.

The DTL data weekday value in parameter SDT is ignored. Set a CPU's current date and time using the "Set time of day" function in the "Online & diagnostics" view of an online CPU. You must set the month, day of month, and year. STEP 7 calculates the interrupt period based on the CPU date and time clock.

Note

The first hour of the day does not exist when changing from summer to winter (daylight saving time). Use a start time within the second hour or use an additional time delay interrupt within the first hour.

Table 9- 109 Condition code

RET_VAL (W#16#....)	Description
0000	No error
8090	Invalid OB_NR parameter
8091	Invalid SDT start time parameter: (for example, a start time within the skipped hour at the start of daylight savings time)
8092	Invalid PERIOD parameter
80A1	The start time is in the past. (This error code only occurs with PERIOD = W #16#0000.)

9.5.3.2 CAN_TINT (Cancel time of day interrupt)

Table 9- 110 CAN_TINT (Cancel date and time of day interrupt)

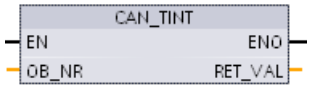
LAD / FBD	SCL	Description
	`ret_val:=CAN_TINT(_int_in);`	Cancels the start date and time of day interrupt event for the specified interrupt OB.

Table 9- 111 Data types for the parameters

Parameter and type		Data type	Description
OB_NR	IN	OB_TOD (INT)	OB number (accepts symbolic name)
RET_VAL	OUT	Int	Execution condition code

Table 9- 112 Condition codes

RET_VAL (W#16#....)	Description
0000	No error
8090	Invalid OB_NR parameter
80A0	No start date / time set for that interrupt OB

9.5.3.3 ACT_TINT (Activate time of day interrupt)

Table 9- 113 ACT_TINT (Activate date and time of day interrupt)

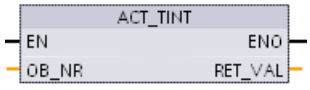
LAD / FBD	SCL	Description
	`ret_val:=ACT_TINT(_int_in_);`	Activates the start date and time of day interrupt event for the specified interrupt OB.

Table 9- 114 Data types for the parameters

Parameter and type		Data type	Description
OB_NR	IN	OB_TOD (INT)	OB number (accepts symbolic name)
RET_VAL	OUT	Int	Execution condition code

Table 9- 115 Condition codes

RET_VAL (W#16#....)	Description
0000	No error
8090	Invalid OB_NR parameter
80A0	Start date and time-of day not set, for the relevant time-of-day interrupt OB
80A1	The activated time is in the past. The error only occurs when the interrupt OB is set to execute once only.

9.5.3.4 QRY_TINT (Query status of time of day interrupt)

Table 9- 116 QRY_TINT (Query date and time of day interrupt)

LAD / FBD	SCL	Description

	`ret_val:=QRY_TINT(`
	`  OB_NR:=_int_in_,`
	`  STATUS=>_word_out_);`
		Queries the date and time of day interrupt status for the specified interrupt OB.

Table 9- 117 Data types for the parameters

Parameter and type		Data type	Description
OB_NR	IN	OB_TOD (INT)	OB number (accepts symbolic name) of the interrupt OB to query
RET_VAL	OUT	Int	Execution condition code
STATUS	OUT	Word	Status of the specified interrupt OB

Table 9- 118 STATUS parameter

Bit	Value	Description
0	0	In Run
	1	In Startup
1	0	The interrupt is enabled.
	1	The interrupt is disabled.
2	0	The interrupt is not active or has expired.
	1	The interrupt is active.
4	0	The assigned OB_NR does not exist.
	1	An OB with the assigned OB_NR exists.
6	1	The date and time of day interrupt uses local time.
	0	The date and time of day interrupt uses system time.
Others		Always 0

Table 9- 119 Condition code

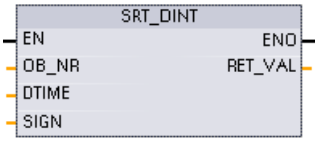
RET_VAL (W#16#....)	Description
0000	No error
8090	Invalid OB_NR parameter

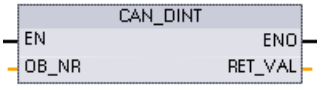
9.5.4 Time delay interrupts

You can start and cancel time delay interrupt processing with the SRT_DINT and CAN_DINT instructions, or query the interrupt status with the QRY_DINT instruction. Each time delay interrupt is a one-time event that occurs after the specified delay time. If the time delay event is cancelled before the time delay expires, the program interrupt does not occur.

Table 9- 120 SRT_DINT, CAN_DINT, and QRY_DINT instructions

LAD / FBD	SCL	Description

	`ret_val := SRT_DINT(`
	`ob_nr:=_int_in_,`
	`dtime:=_time_in_,`
	`sign:=_word_in_);`
		SRT_DINT starts a time delay interrupt that executes an OB when the delay time specified by parameter DTIME has elapsed.

	`ret_val := CAN_DINT(` `ob_nr:=_int_in_);`	CAN_DINT cancels a time delay interrupt that has already started. The time delay interrupt OB is not executed in this case.

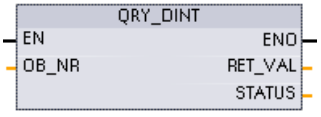
	`ret_val := QRY_DINT(`
	`ob_nr:=_int_in_,`
	`sta-`
	`tus=>_word_out_);`
		QRY_DINT queries the status of the time delay interrupt specified by the OB_NR parameter.

Table 9- 121 Data types for the parameters

Parameter and type		Data type	Description
OB_NR	IN	OB_DELAY	Organization block (OB) to be started after a time-delay: Select from the available time-delay interrupt OBs that were created using the "Add new block" project tree feature. Double-click on the parameter field, then click on the helper icon to see the available OBs.
DTIME [1]	IN	Time	Time delay value (1 to 60000 ms)
SIGN [1]	IN	Word	Not used by the S7-1200: Any value is accepted. A value must be assigned to prevent errors.
RET_VAL	OUT	Int	Execution condition code
STATUS	OUT	Word	QRY_DINT instruction: Status of the specified time-delay interrupt OB, see the table below

[1] Only for SRT_DINT

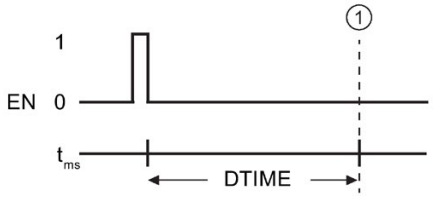
Operation

When EN=1, the SRT_DINT instruction starts the internal time delay timer (DTIME). When the time delay elapses, the CPU generates a program interrupt that triggers the execution of the associated time delay interrupt OB. You can cancel an in-process time delay interrupt before the specified time delay occurs by executing the CAN_DINT instruction. The total number of active time delay interrupt events must not exceed four.

Note

The SRT_DINT starts the time delay timer on every scan when EN=1. Assert EN=1 as a one-shot rather than just setting EN=1 to begin your time delay.

Timing diagram for the SRT_DINT instruction:



① Time delay interrupt executes

Adding time delay interrupt OBs to your project

You can only assign time delay interrupt OBs to the SRT_DINT and CAN_DINT instructions. No time delay interrupt OB exists in a new project. You must add time delay interrupt OBs to your project. To create a time-delay interrupt OB, follow these steps:

1. Double-click the "Add new block" item in the "Program blocks" branch of the project tree, select "Organization block (OB)", and choose "Time delay interrupt".
2. You have the option to rename the OB, select the programming language, or select the block number. Switch to manual numbering if you want to assign a different block number than the number that was assigned automatically.
3. Edit the time delay interrupt OB subprogram and create programmed reaction that you want to execute when the time delay timeout event occurs. You can call other FC and FB code blocks from the time delay interrupt OB. The maximum nesting depth is four for safety progams. For other programs, the maximum nesting depth is six.
4. The newly assigned time delay interrupt OB names will be available when you edit the OB_NR parameter of the SRT_DINT and CAN_DINT instructions.

QRY_DINT parameter STATUS

Table 9- 122 If there is an error (REL_VAL <> 0), then STATUS = 0.

Bit	Value	Description
0	0	In RUN
	1	In startup
1	0	The interrupt is enabled.
	1	The interrupt is disabled.
2	0	The interrupt is not active or has elapsed.
	1	The interrupt is active.
4	0	An OB with an OB number given in OB_NR does not exist.
	1	An OB with an OB number given in OB_NR exists.
Other bits		Always 0

Condition codes

Table 9- 123 Condition codes for SRT_DINT, CAN_DINT, and QRY_DINT

RET_VAL (W#16#...)	Description
0000	No error occurred
8090	Incorrect parameter OB_NR
8091	Incorrect parameter DTIME
80A0	Time delay interrupt has not started.

9.5.5 DIS_AIRT and EN_AIRT (Delay/enable execution of higher priority interrupts and asynchronous error events) instructions

Use the DIS_AIRT and EN_AIRT instructions to disable and enable alarm interrupt processing.

Table 9- 124 DIS_AIRT and EN_AIRT instructions

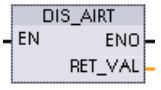
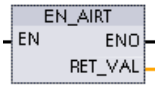
LAD / FBD	SCL	Description
	`DIS_AIRT();`	DIS_AIRT delays the processing of new interrupt events. You can execute DIS_AIRT more than once in an OB.
	`EN_AIRT();`	EN_AIRT enables the processing of interrupt events that you previously disabled with the DIS_AIRT instruction. Each DIS_AIRT execution must be cancelled by an EN_AIRT execution. The EN_AIRT executions must occur within the same OB, or any FC or FB called from the same OB, before interrupts are enabled again for this OB.

Table 9- 125 Data types for the parameters

Parameter and type		Data type	Description
RET_VAL	OUT	Int	Number of delays = number of DIS_AIRT executions in the queue.

The DIS_AIRT executions are counted by the operating system. Each of these remains in effect until it is cancelled again specifically by an EN_AIRT instruction, or until the current OB has been completely processed. For example: if you disabled interrupts five times with five DIS_AIRT executions, you must cancel these with five EN_AIRT executions before interrupts become enabled again.

After the interrupt events are enabled again, the interrupts that occurred while DIS_AIRT was in effect are processed, or the interrupts are processed as soon as the current OB has been executed.

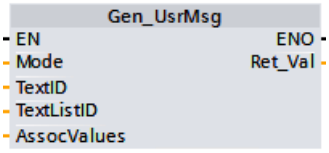
Parameter RET_VAL indicates the number of times that interrupt processing was disabled, which is the number of queued DIS_AIRT executions. Interrupt processing is only enabled again when parameter RET_VAL = 0.

9.6 Alarms

9.6.1 Gen_UsrMsg (Generate user diagnostic alarms)

Table 9- 126 Gen_UsrMsg instruction

LAD / FBD	SCL	Description

	`ret_val :=Gen_UsrMsg(`
	`Mode:=_uint_in_,`
	`TextID:=_uint_in_,`
	`TextListID:=_uint_in_,`
	`As-`
	`socValues:=_struct_inout_);`
		You use the "Gen_UsrMsg" instruction to generate a user diagnostic alarm that can be either an incoming or outgoing alarm. By means of user diagnostic alarms, you can write a user entry to the diagnostics buffer and send a corresponding alarm.
		The entry in the diagnostic buffer is created synchronously. Alarm transmission is asynchronous.
		If an error occurs during the execution of an instruction, it is output via the parameter RET_VAL.

Content of the alarm

A text list defines the content of the alarm:

- Define the text list you want to use with the parameter TextListID. For this purpose open the dialog "Text lists" in the project navigation. Show the column "ID" in the dialog "Text lists". Apply the ID at the parameter TextListID.
- Use the parameter TextID to select the text list entry you want to write in the diagnostic buffer. For this purpose select an entry from the "Text lists entries" dialog by applying a number from the columns "Range from / range to" at the parameter TextID. You must use the same number from both the "Range from" and "Range to" columns for the text list entry.

Refer to the STEP 7 Information System for detailed information about text lists.

Defining associated values

The text list entry defines new associated values to be added to the alarm:

- Add the following information to the text list entry to define associated values:

  @<No. of the associated value><Element type><Format specification>@
- Use the system data type AssocValues to specify which associated value to add when generating the alarm.

Refer to the STEP 7 Information System for detailed information about the structure of associated values.

Parameters

The following table shows the parameters of the "Gen_UsrMsg" instruction:

Parameter	Declaration	Data type	Memory area	Description
Mode	Input	UInt	I, Q, M, D, L or constant	Parameters for selecting the status of the alarm: • 1: incoming alarm • 2: outgoing alarm
TextID	Input	UInt	I, Q, M, D, L or constant	ID of the text list entry that should be used for the alarm text.
TextListID	Input	UInt	I, Q, M, D, L or constant	ID of the text list that contains text list entry.
Ret_Val	Return	Int	I, Q, M, D, L	Error code of the instruction.
AssocValues	InOut	VARIANT	D, L	Pointer to the system data type AssocValues that allows you to define the associated values.

For additional information on valid data types, refer to "Data types (Page 122)".

Parameter AssocValues

Use the system data type AssocValues to define which associated values will be sent. A maximum of eight associated values are possible. Enter the data type "AssocValues" as a data block to create the structure.

You select associated values by entering the numbers of the associated values for the parameters Value[x]. Note the following:

- The Gen_UsrMsg instruction treats the values for TextID and TextListID as associated values to be sent. As a result, "1" and "2" are pre-assigned as numbers for addressing associated values. Do not use the numbers "1" or "2" to address associated values.
- Address the associated value at parameter Value [1] as number "3", at parameter Value [2] as number "4", and so forth.

Byte	Parameter	Data type	Start value	Description	Number of the associated value
0..1	Value[1]	UINT	0	First associated value of the alarm.	3
2..3	Value[2]	UINT	0	Second associated value of the alarm.	4
4..5	Value[3]	UINT	0	...	5
6..7	Value[4]	UINT	0	...	6
8..9	Value[5]	UINT	0	...	7
10..11	Value[6]	UINT	0	...	8
12..13	Value[7]	UINT	0	...	9
14..15	Value[8]	UINT	0	Eighth associated value of the alarm.	10

Parameter RET_VAL

The following table defines output values for the RET_VAL parameter. See also Common error codes for the Extended instructions (Page 540).

Error code* (W#16#...)	Explanation
0000	No error
8080	Value in the MODE parameter is not supported.
80C1	Resource bottleneck due to too many parallel calls.
8528	Parameter 5 (AssocValues) is not byte-aligned.
853A	Parameter 5 (AssocValues) references an invalid point.
* You can display the error code as either integer or hexadecimal in the program editor.	

9.7 Diagnostics (PROFINET or PROFIBUS)

9.7.1 Diagnostic instructions

The following diagnostic instructions can be used with either PROFINET or PROFIBUS:

- RD_SINFO instruction (Page 428): Reads the current OB's start information
- LED instruction (Page 438): Reads the state of the LEDs for a distributed I/O device.
- Get_IM_Data instruction (Page 439): Checks the identification and maintenance (I&M) data for a specified module or sub-module.
- Get_Name instruction (Page 440): Reads the name of a PROFINET IO device, PROFIBUS slave, or AS-i slave.
- GetStationInfo instruction (Page 447): Reads the IP or MAC address of a PROFINET IO device in the local IO system or a PROFINET IO device located in a lower-level IO system (connected using CP/CM modules).
- DeviceStates instruction (Page 455): Retrieves the operational states for a distributed I/O device within an I/O subsystem.
- ModuleStates instruction (Page 460): Retrieves the operational states for the modules in a distributed I/O device.
- GET_DIAG instruction (Page 466): Reads the diagnostic information from a specified device.

Note

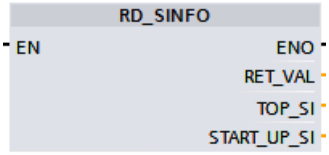
You can only use the GetStationInfo instruction with PROFINET IO devices. You cannot use the instruction with PROFIBUS DP slaves.

9.7.2 RD_SINFO (Read current OB start information)

Description

Table 9- 127 RD_SINFO instruction

LAD / FBD	SCL	Description

	`ret_val := RD_SINFO(`
	`TOP_SI=>_variant_out_,`
	
	`START_UP_SI=>_variant_out_)`
	`;`
		You use the instruction "RD_SINFO" to read the start information of the following OBs:
		• Last OB called that has not yet been completely executed
		• Last startup OB that the CPU started
		There is no time stamp in either case. If the call is in OB 100, OB 101 or OB 102, two identical start information messages will be returned.

Parameter

The following table shows the parameters of the "RD_SINFO" instruction:

Parameter	Declaration	Data type	Memory area	Description
RET_VAL	Return	INT	I, Q, M, D, L	Error information
TOP_SI	Output	VARIANT	D, L	Start information of the current OB
START_UP_SI	Output	VARIANT	D, L	Start information of the startup OB last started

You will find more detailed information on valid data types in "Data types (Page 122)".

SDTs of the TOP_SI parameter

The following table shows the possible SDTs for the TOP_SI parameter:

Organization blocks (OB)	System data types (SDT)	System data type numbers
Any	SI_classic*	592*
	SI_none	593
ProgramCycleOB	SI_ProgramCycle	594
TimeOfDayOB	SI_TimeOfDay	595
TimeDelayOB	SI_Delay	596
CyclicOB	SI_Cyclic	597
ProcessEventOB	SI_HWInterrupt	598
ProfileEventOB StatusEventOB UpdateEventOB	SI_Submodule	601
SynchronousCycleOB	SI_SynchCycle	602
IOredundancyErrorOB	SI_IORedundancyError	604
CPUredundancyErrorOB	SI_CPURedundancyError	605
TimeErrorOB	SI_TimeError	606
DiagnosticErrorOB	SI_DiagnosticInterrupt	607
PullPlugEventOB	SI_PlugPullModule	608
PeripheralAccessErrorOB	SI_AccessError	609
RackStationFailureOB	SI_StationFailure	610
ServoOB	SI_Servo	611
IpoOB	SI_Ipo	612
StartupOB	SI_Startup	613
ProgrammingErrorOB IOaccessErrorOB	SI_ProgIOAccessError	614

*The SI_classic SDT is not applicable for the S7-1200. The S7-1200 CPU returns a RET_VAL of #16#8081 if the TOP_SI parameter is of type SI_classic.

SDTs of the START_UP_SI parameter

The following table shows the possible SDTs for the START_UP_SI parameter:

System data types (SDT)	System data type numbers
SI_classic*	592
SI_none	593
SI_Startup	613

*The SI_classic SDT is not applicable for the S7-1200. The S7-1200 CPU returns a RET_VAL of #16#8083 if the START_UP_SI parameter is of type SI_classic.

Structures

The following tables define the structure elements of the individual structures:

Table 9- 128 SI_classic structure

Structure element	Data type	Description
EV_CLASS	BYTE	• Bits 0 to 3: Event ID • Bits 4 to 7: Event class
EV_NUM	BYTE	Event number
PRIORITY	BYTE	Priority class number (Meaning of B#16#FE: OB not available or disabled or cannot be started in current operating mode)
NUM	BYTE	OB number
TYP2_3	BYTE	Data ID 2_3: Identifies the information entered in ZI2_3
TYP1	BYTE	Data ID 1: Identifies the information entered in ZI1
ZI1	WORD	Additional information 1
ZI2_3	DWORD	Additional information 2_3

Table 9- 129 SI_none structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)

Table 9- 130 SI_ProgramCycle structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 1	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
Initial_Call	BOOL	For OB_Class = 1, 30, 52, 61, 65
Remanence	BOOL	For OB_Class = 1

Table 9- 131 SI_TimeOfDay structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 10	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
CaughtUp	BOOL	For OB_Class = 10
SecondTime	BOOL	For OB_Class = 10

Table 9- 132 SI_Delay structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 20	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
Sign	WORD	For OB_Class = 20

Table 9- 133 SI_Cyclic structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 30	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
Initial_Call	BOOL	For OB_Class = 1, 30, 52, 61, 65
Event_Count	INT	For OB_Class = 30, 51, 52, 61, 65, 91, 92

Table 9- 134 SI_HWInterrupt structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 40	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
LADDR	HW_IO	For OB_Class = 40, 51, 55, 56, 57, 70, 82, 83, 85, 86, 91, 92
USI	WORD	For OB_Class = 40
IChannel	USINT	For OB_Class = 40
EventType	BYTE	For OB_Class = 40

Table 9- 135 SI_Submodule structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
LADDR	HW_IO	For OB_Class = 40, 51, 55, 56, 57, 70, 82, 83, 85, 86, 91, 92
Slot	UINT	For OB_Class = 55, 56, 57
Specifier	WORD	For OB_Class = 55, 56, 57

Table 9- 136 SI_SynchCycle structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 61	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
Initial_Call	BOOL	For OB_Class = 1, 30, 52, 61, 65
PIP_Input	BOOL	For OB_Class = 61, 91, 92
PIP_Output	BOOL	For OB_Class = 61, 91, 92
IO_System	USINT	For OB_Class = 61, 91, 92
Event_Count	INT	For OB_Class = 30, 51, 52, 61, 65, 91, 92
SyncCycleTime	LTIME	Calculated cycle time

Table 9- 137 SI_IORedundancyError structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 70	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
LADDR	HW_ANY	For OB_Class = 40, 51, 55, 56, 57, 70, 82, 83, 85, 86, 91, 92
Event_Class	BYTE	For OB_Class = 70, 83, 85, 86
Fault_ID	BYTE	For OB_Class = 70, 80, 83, 85, 86

Table 9- 138 SI_CPURedundancyError structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 72	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
Switch_Over	BOOL	For OB_Class = 72

Table 9- 139 SI_TimeError structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 80	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
Fault_ID	BYTE	For OB_Class = 70, 80, 83, 85, 86
Csg_OBnr	OB_ANY	For OB_Class = 80
Csg_Prio	UINT	For OB_Class = 80

Table 9- 140 SI_DiagnosticInterrupt structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 82	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
IO_State	WORD	For OB_Class = 82
LADDR	HW_ANY	For OB_Class = 40, 51, 55, 56, 57, 70, 82, 83, 85, 86, 91, 92
Channel	UINT	For OB_Class = 82
MultiError	BOOL	For OB_Class = 82

Table 9- 141 SI_PlugPullModule structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 83	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
LADDR	HW_IO	For OB_Class = 40, 51, 55, 56, 57, 70, 82, 83, 85, 86, 91, 92
Event_Class	BYTE	For OB_Class = 70, 83, 85, 86
Fault_ID	BYTE	For OB_Class = 70, 80, 83, 85, 86

Table 9- 142 SI_AccessError structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 85	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
LADDR	HW_IO	For OB_Class = 40, 51, 55, 56, 57, 70, 82, 83, 85, 86, 91, 92
Event_Class	BYTE	For OB_Class = 70, 83, 85, 86
Fault_ID	BYTE	For OB_Class = 70, 80, 83, 85, 86
IO_Addr	UINT	For OB_Class = 85
IO_LEN	UINT	For OB_Class = 85

Table 9- 143 SI_StationFailure structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 86	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
LADDR	HW_IO	For OB_Class = 40, 51, 55, 56, 57, 70, 82, 83, 85, 86, 91, 92
Event_Class	BYTE	For OB_Class = 70, 83, 85, 86
Fault_ID	BYTE	For OB_Class = 70, 80, 83, 85, 86

Table 9- 144 SI_Servo structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 91	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
Initial_Call	BOOL	For OB_Class = 1, 30, 52, 61, 65
PIP_Input	BOOL	For OB_Class = 61, 91, 92
PIP_Output	BOOL	For OB_Class = 61, 91, 92
IO_System	USINT	For OB_Class = 61, 91, 92
Event_Count	INT	For OB_Class = 30, 51, 52, 61, 65, 91, 92
Synchronous	BOOL	

Table 9- 145 SI_Ipo structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 92	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
Initial_Call	BOOL	For OB_Class = 1, 30, 52, 61, 65
PIP_Input	BOOL	For OB_Class = 61, 91, 92
PIP_Output	BOOL	For OB_Class = 61, 91, 92
IO_System	USINT	For OB_Class = 61, 91, 92
Event_Count	INT	For OB_Class = 30, 51, 52, 61, 65, 91, 92
Reduction	UINT	For OB_Class = 92

Table 9- 146 SI_Startup structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT := 100	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
LostRetentive	BOOL	For OB_Class = 100
LostRTC	BOOL	For OB_Class = 100

Table 9- 147 SI_ProgIOAcessError structure

Structure element	Data type	Description
SI_Format	USINT	• 16#FF = No information • 16#FE = Optimized start information
OB_Class	USINT	OB class for "No information" or "Optimized start information"
OB_Nr	UINT	OB number (1 ... 32767)
BlockNr	UINT	For OB_Class = 121, 122
Reaction	USINT	For OB_Class = 121, 122
Fault_ID	BYTE	For OB_Class = 121, 122
BlockType	USINT	For OB_Class = 121, 122
Area	USINT	For OB_Class = 121, 122
DBNr	DB_ANY	For OB_Class = 121, 122
Csg_OBNr	OB_ANY	For OB_Class = 121, 122
Csg_Prio	USINT	For OB_Class = 121, 122
Width	USINT	For OB_Class = 121, 122

Note

If this was created with the block property "Standard", the structure elements specified for the SI_classic structure are identical in content to the temporary tags of an OB.

Note, however, that temporary tags of the individual OBs can have different names and different data types. Also note that the call interface of each OB includes additional information regarding the date and the time of the OB request.

Bits 4 to 7 of the EV_CLASS structure element contain the event class. The following values are possible here:

- 1: Start events from standard OBs
- 2: Start events from synchronous error OBs
- 3: Start events from asynchronous error OBs

The PRIORITY structure element supplies the priority class belonging to the current OB.

Apart from these two elements, NUM is also relevant. NUM contains the number of the current OB or the startup OB that was started last.

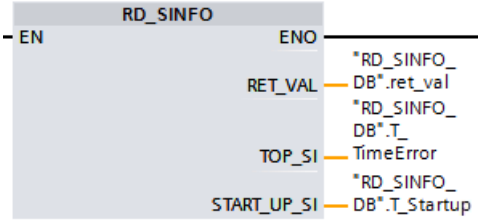
RET_VAL parameter

The following table shows the meaning of the values of the RET_VAL parameter:

Error code* (W#16#...)	Explanation
8081	Start information of the current OB does not correspond to the specified system data type
8083	Start information of the last startup OB started does not correspond to the specified system data type
* You can display the error code as either integer or hexadecimal values in the program editor.	

Example

A time error interrupt OB (OB 80) is the OB that was called last and that has not yet been completely processed. Startup OB (OB 100) is the startup OB that was started last. The instruction call to read the startup information is as follows, where RD_SINFO_DB is the data block that contains tags of the SDTs for types of OBs:



The following table shows the assignment between the structure elements of the TOP_SI parameter of the "RD_SINFO" instruction and the associated local tags of OB 80.

TOP_SI structure element	Data type	OB 80 - Associated local tag	Data type
EV_CLASS	BYTE	OB80_EV_CLASS	BYTE
EV_NUM	BYTE	OB80_FLT_ID	BYTE
PRIORITY	BYTE	OB80_PRIORITY	BYTE
NUM	BYTE	OB80_OB_NUMBR	BYTE
TYP2_3	BYTE	OB80_RESERVED_1	BYTE
TYP1	BYTE	OB80_RESERVED_2	BYTE
ZI1	WORD	OB80_ERROR_INFO	WORD
ZI2_3	DWORD	OB80_ERR_EV_CLASS	BYTE
		OB80_ERR_EV_NUM	BYTE
		OB80_OB_PRIORITY	BYTE
		OB80_OB_NUM	BYTE

The following table shows the assignment between the structure elements of the START_UP_SI parameter of the "RD_SINFO" instruction and the associated local tags of OB 100.

START_UP_SI structure element	Data type	OB 100 - Local tag	Data type
EV_CLASS	BYTE	OB100_EV_CLASS	BYTE
EV_NUM	BYTE	OB100_STRTUP	BYTE
PRIORITY	BYTE	OB100_PRIORITY	BYTE
NUM	BYTE	OB100_OB_NUMBR	BYTE
TYP2_3	BYTE	OB100_RESERVED_1	BYTE
TYP1	BYTE	OB100_RESERVED_2	BYTE
ZI1	WORD	OB100_STOP	WORD
ZI2_3	DWORD	OB100_STRT_INFO	DWORD

9.7.3 LED (Read LED status)

Table 9- 148 LED instruction

LAD / FBD	SCL	Description

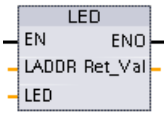
	`ret_val := LED(`
	`  laddr:=_word_in_,`
	`  LED:=_uint_in_);`
		Use the LED instruction to read the state of the LEDs on the CPU (Page 1295). The specified LED state is returned by the RET_VAL output.

Table 9- 149 Data types for the parameters

Parameter and type		Data type	Description		
LADDR	IN	HW_IO	Identifier of the CPU[1]		
LED	IN	UInt	LED identifier number		
			1	RUN/STOP	Color 1 = green, color 2 = yellow
			2	Error	Color 1 = red
			3	Maintenance	Color 1 = yellow
RET_VAL	OUT	Int	Status of the LED		

[1] For the identifier of the connected CPU, select Local~Common from the drop-down list of the parameter.

Table 9- 150 Status of RET_VAL

RET_VAL (W#16#...)	Description	
0 to 9 LED state	0	LED does not exist
	1	Off
	2	Color 1 On (solid)
	3	Color 2 On (Solid)
	4	Color 1 flashing at 2 Hz
	5	Color 2 flashing 2 Hz
	6	Color 1 & 2 flashing alternatively at 2 Hz
	9	State of the LED is not available
8091	Device identified by LADDR does not exist	
8092	Device identified by LADDR does not support LEDs	
8093	LED identifier not defined	
80Bx	CPU identified by LADDR does not support the LED instruction	

9.7.4 Get_IM_Data (Read the identification and maintenance data)

You use the Get_IM_Data instruction to check the identification and maintenance (I&M) data for the specified module or sub-module.

Table 9- 151 Get_IM_Data instruction

LAD / FBD	SCL	Description

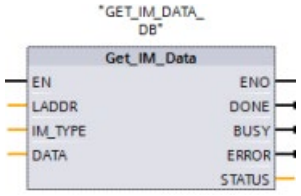
	`"GET_IM_DATA_DB"(LADDR:=16#0 ,`
	`IM_TYPE:=0,`
	`DONE=>_bool_out_,`
	`BUSY=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	
	`DATA:=_variant_inout_);`
		Use the Get_IM_Data instruction to check the identification and maintenance (I&M) data for the specified module or sub-module.

Table 9- 152 Data types for the parameters

Parameter and type		Data type	Description
LADDR	Input	HW_IO	Identifier of the module
IM_TYPE	Input	UInt	Identification and maintenance (I&M) data number: • 0: I&M0 (MLFB, serial number, version, and other information) • 1: I&M1 (Designators) • 2: I&M2 (Installation date) • 3: I&M3 (Descriptor) • 4: I&M4 (Signature)
RET_VAL	Output	Int	Status (condition code)
DATA	InOut	Variant	I&M data (STRING or an array of BYTE); recommend use of the SDT "IM0_Data" for IM_TYPE = 0.

Identification and maintenance (I&M) data can help you to check the system configuration, detect hardware changes, or view maintenance data. Module identification data (I data) is read only. Module maintenance data (M data) depends on system information, such as the installation date. M data are created during maintenance planning and written to the module:

- If the data type used at the parameter DATA is a string, then the current length of the string is set according to the length of the I&M data.
- If the data type used at the parameter DATA is an array of Byte or Char, then the I&M data are copied in as a sequence of bytes.
- If the data type used at the parameter DATA is a structure, then the I&M data are copied in as a sequence of bytes.
- If the given array of byte/char at DATA is longer than the requested I&M data, then the byte value 16#00 is appended.
- Other data types are not supported and error 8093 is returned.

Table 9- 153 Condition codes

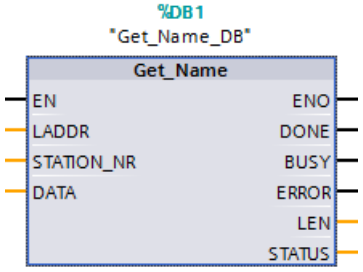
RET_VAL (W#16#...)	Description
0	No error
8091	LADDR does not exist
8092	LADDR does not address a HW object which supports I&M data
8093	Data type given at parameter DATA is not supported
80B1	DATA instruction not supported by the CPU for this LADDR
80B2	IM_TYPE not supported by the CPU
8452	The complete I&M information does not fit into the variable given at the DATA parameter. A partial result up to the byte length of the variable is returned.

9.7.5 Get_Name (Read the name of a PROFINET IO device)

The "Get_Name" instruction reads the name of a PROFINET IO device, PROFIBUS slave, or AS-i slave. The name is displayed in the network view and in the properties of the IO device.

Table 9- 154 Get_Name instruction

LAD / FBD	SCL	Description

	`"Get_Name_DB"(`
	`  LADDR:=_uint_in_,`
	`STATION_NR:=_uint_in_,`
	`DONE=>_bool_out_,`
	`  BUSY=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`  LEN=>_dint_out_,`
	`STATUS=>_word_out_,`
	`DATA:=_variant_inout_);`
		Use the Get_Name instruction to read the name of a PROFINET IO device or PROFIBUS slave.

[1] STEP 7 automatically creates the DB when you insert the instruction.

[2] In the SCL example, "Get_Name_DB" is the name of the instance DB.

You select the IO device by using the hardware identifier of the distributed IO system (at the LADDR parameter) and the device number of the PROFINET IO device or the PROFIBUS address of the PROFIBUS slave (at the STATION_NR parameter).

Once the instruction has been executed, the program writes the name of the IO device to the area addressed with the DATA parameter.

The name that is read depends on the type of IO device:

- DP slave or IO device: Name of the head module
- I-slave or I-device: Name of the interface module
- HMI panel: Name of the interface
- PC station: Name of the interface module
- GSD devices: Displays the name of the Device Access Point (DAP) (name of the interface or head module)

The instruction writes the length of the name at the LEN parameter. If the name is longer than the area specified at the DATA parameter, the program writes only that section which corresponds to the maximum length of the addressed area.

The maximum length for a name is 128 characters.

Note

Name of the CPU readout (Version 1.1)

If you assign a "0" at each of the parameters LADDR and STATION_NR, the instruction writes the name of the CPU.

Parameters

The following table shows the parameters of the Get_Name instruction:

Parameter	Declaration	Data type	Description
LADDR	IN	HW_IOSYSTEM	Hardware identifier (HW-IoSystem) of the distributed IO system. The number is taken from the system constants or the properties of the IO system.
STATION_NR	IN	UInt	• PROFINET IO device: Device number is applied in the Network view from the properties of the IO device under "Ethernet addresses". • PROFIBUS slave: PROFIBUS address is applied in the Network view from the properties of the PROFIBUS slave under "PROFIBUS address".
DATA	IN_OUT	Variant	Pointer to the area where the name is written.
DONE	OUT	Bool	The instruction executes successfully. Name of the module transfers to the area at the DATA parameter.
BUSY	OUT	Bool	Status parameter: • 0: Execution of the instruction complete. • 1: Execution of the instruction not yet complete.
ERROR	OUT	Bool	Status parameter: • 0: No error • 1: An error occurred during execution of the instruction. The STATUS parameter contains detailed information.

Parameter	Declaration	Data type	Description
LEN	OUT	DInt	Length of the name of the IO device (number of characters).
STATUS	OUT	Word	Status parameter: The parameter is only set for the duration of one call. To display the status, you should therefore copy STATUS to a free data area.

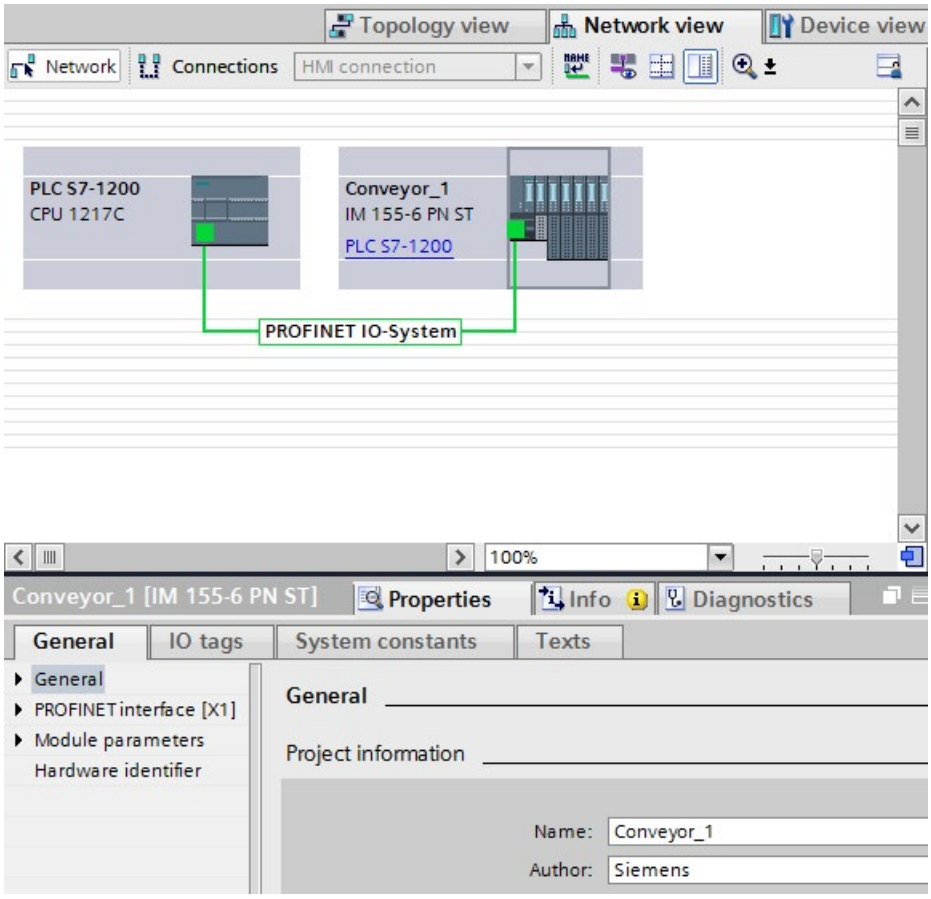
STATUS parameter

Error code* (W#16#...)	Explanation
0	No error
7000	No job in progress
7001	First call of the asynchronous Get_Name instruction. Execution of the instruction not yet complete (BUSY = 1, DONE = 0).
7002	Additional call of the asynchronous Get_Name instruction. Execution of the instruction not yet complete (BUSY = 1, DONE = 0).
8090	The hardware identifier specified at the LADDR parameter does not exist in the project.
8092	The value at the LADDR parameter does not address a PROFINET IO system.
8093	Instruction does not support data type at the DATA parameter.
8095	Device number (STATION_NR parameter) does not exist in the selected PROFINET IO system or does not address an IO device.
80B1	The CPU used does not support the instruction.
80C3	Temporary resource error: The CPU is currently processing the maximum possible number of simultaneous block calls. Get_Name cannot be executed until at least one of the block calls is finished.
8852	The area specified at the DATA parameter is too short for the full name of the IO device. The name can be written up to the maximum possible length. To read the full name, use a longer data area at the DATA parameter. The area must have at least as many characters as there are at the LEN parameter.
* The error codes in the program editor can be displayed as integer or hexadecimal values.	

Example

The following example shows how you can read the station name of an ET 200SP PROFINET IO device:

1. Configuring the ET 200SP:
   - Create the ET 200SP with the station name "Conveyor_1" in the network view and assign it to the same PROFINET IO system as the CPU.
   - Assign the CPU as the IO controller for the ET 200SP.
   - Use the default device number "1" located in the Properties under "Ethernet addresses".

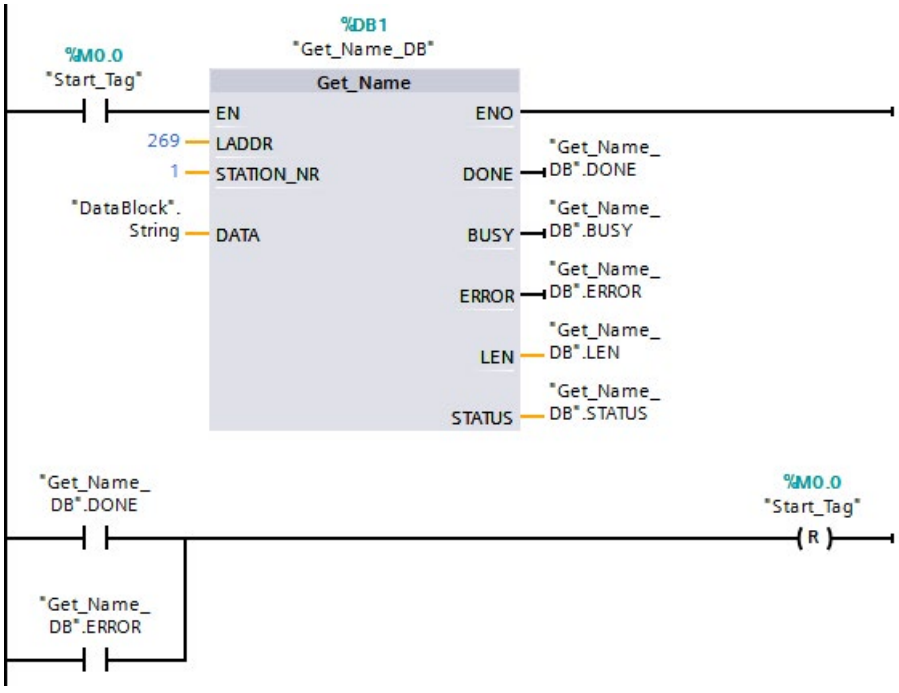


2. Assigning parameters for the Get_Name instruction:
   - Enter the hardware ID of the IO system at the LADDR parameter. In this example, the hardware ID is "269". You can find the hardware ID at the following location: PLC tags > Show all tags > System constants tab > Local-PROFINET_IO-System
   - Enter the device number of the ET 200SP at the STATION_NR parameter. In this example, the device number is "1".
   - Connect a tag with the data type STRING of a data block at the DATA parameter.

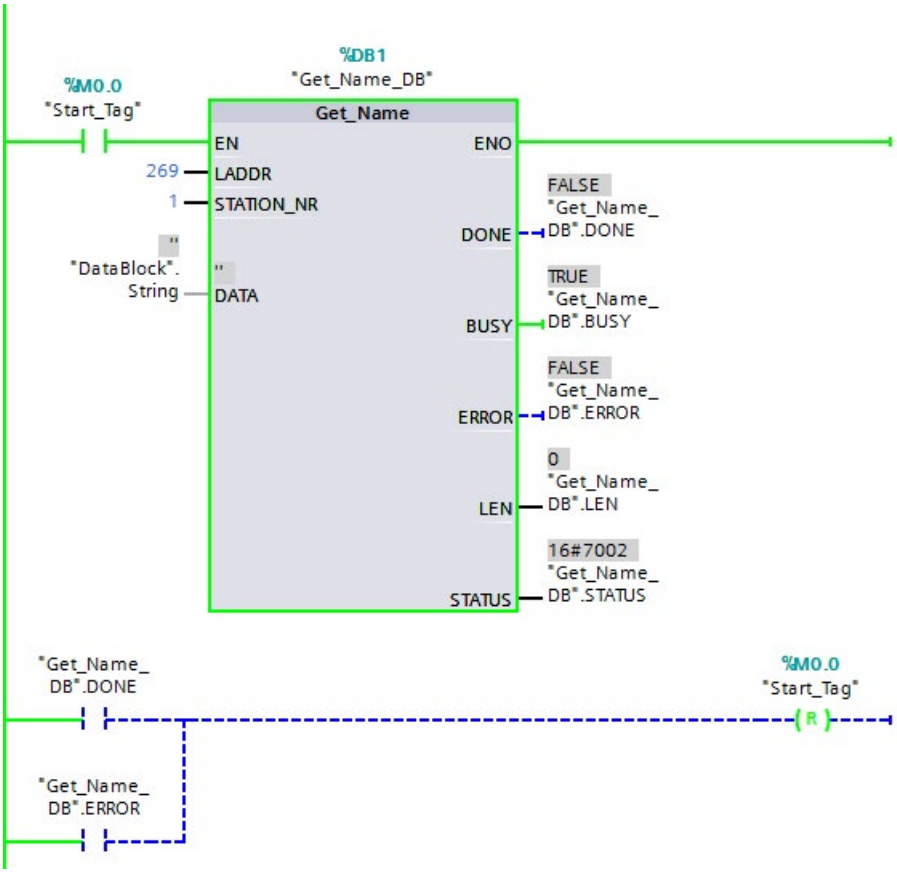
Note

When using the dropdown to make your selections for configuring the tag to the DATA parameter, select the DB (in the example, "Datablock") and the tag (in the example, "String[ ]"). In order to read the entire String data type, you must delete the brackets so that the final result is: "Datablock".String

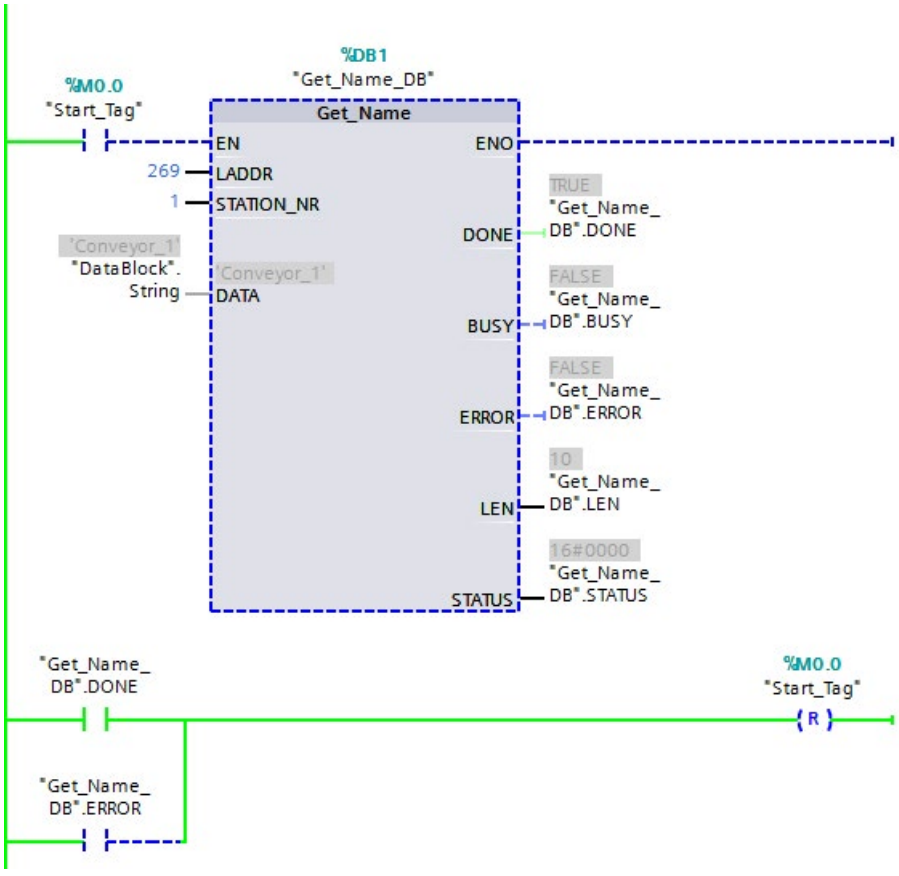
– Define PLC tags (memory area, flags) for the output parameters of the instruction.



3. Executing the Get_Name instruction:
   - As the instruction executes, the BUSY output parameter may get set to "1", and the DONE parameter is then set to "0".
   - Error code information is displayed at the STATUS output parameter.



4. Completing execution of the Get_Name instruction:
   - After execution of the instruction, the program writes "Conveyor_1", the station name of the ET 200SP, into the data block at the DATA parameter.
   - The program writes "10", the number of characters in the station name, to the LEN parameter.



9.7.6 GetStationInfo (Read the IP or MAC address of a PROFINET IO device)

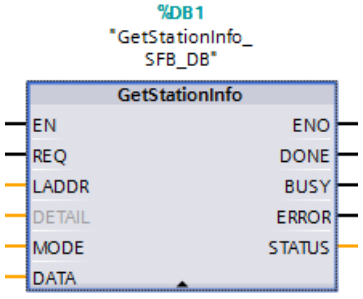
The "GetStationInfo" instruction reads the IP or MAC address of a PROFINET IO device in the local IO system or a PROFINET IO device located in a lower-level IO system (connected using CP/CM modules).

Note

You can only use the GetStationInfo instruction with PROFINET IO devices. You cannot use the instruction with PROFIBUS DP slaves.

Table 9- 155 GetStationInfo instruction

LAD / FBD	SCL	Description

	`"GetStationInfo_SFB_DB"(`
	`  REQ:=_bool_in_,`
	`LADDR:=_uint_in_,`
	`DETAIL:=_uint_in_,`
	`MODE:=_uint_in_,`
	`  DONE=>_bool_out_,`
	`BUSY=>_bool_out_,`
	`  ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`DATA:=_variant_inout_);`
		Use the GetStationInfo instruction to read the IP or MAC address of a PROFINET IO device. The instruction also enables you to read the IP or MAC address of an IO device located in a lower-level IO system (connected using CP/CM modules).

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "GetStationInfo_SFB_DB" is the name of the instance DB.

You address the IO device using the hardware identifier of the station at the LADDR parameter. You can find the hardware ID at the following location:
PLC tags > Show all tags > System constants tab. Search for the "IODevice" in the Name column and for "Hw_Device" in the Data type column.

Use the MODE parameter to select the information to be read.

At the DATA parameter, assign the data area to which the instruction writes the read address data. For storing the IP address, use the "IF_CONF_v4" structure. For storing the MAC address, use the "IF_CONF_MAC" structure.

Enable reading of the address data using the REQ control parameter. This requires the IO device to be accessible.

The instruction displays the execution status of the read job using the BUSY, DONE, and ERROR output parameters and the STATUS output parameter.

Note

Address the IO device using only the hardware identifier of the station

The station, the IO device, and PROFINET interface have their own hardware identifier. Use only the hardware identifier of the station for the GetStationInfo instruction.

If a PROFINET interface is addressed using the LADDR parameter, for example, the address data is not read and the CPU generates a "8092" error code.

To read the address data of an integrated PROFINET interface or a CM/CP module in the central configuration, use the "RDREC" instruction.

Parameters

The following table shows the parameters of the GetStationInfo instruction:

Parameter	Declaration	Data type	Description
REQ	IN	Bool	Control parameter request Activates the reading of the information with REQ = "1".
LADDR	IN	HW_DEVICE	Hardware identifier of the station of the IO device The number is taken from the properties of the station in the Network view or from the "System constants" tab of the default tag table.
DETAIL	IN	HW_SUBMODULE	The DETAIL parameter is not used. Leave the parameter unconnected.
MODE	IN	UNIT	Selection of address data to be read: • MODE = 1: Address parameter according to IPv4 (S7-1200 CPUs as of firmware version V4.2) • MODE = 2: MAC address (S7-1200 CPUs as of firmware version V4.2)
DATA	IN_OUT	Variant	Pointer to the area to which the program writes the address data of the IO device. Use the "IF_CONF_v4" structure for MODE = 1, and the "IF_CONF_MAC" structure for MODE = 2.
DONE	OUT	Bool	The program executed the instruction successfully. The program transferred the address data to the DATA parameter.
BUSY	OUT	Bool	STATUS parameter: • 0: Execution of the instruction complete. • 1: Execution of the instruction not yet complete.

Parameter	Declaration	Data type	Description
ERROR	OUT	Bool	STATUS parameter: • 0: No error. • 1: An error occurred during execution of the instruction. Detailed information is output using the STATUS parameter.
STATUS	OUT	Word	STATUS parameter: The parameter is only set for the duration of one call. To display the status, you should therefore copy STATUS to a free data area.

DATA parameter

- Use the "IF_CONF_v4" structure at the DATA parameter to store the address parameter according to IPv4:

Byte	Parameter	Data type	Start value	Description
0 … 1	Id	UINT	30	ID of the "IF_CONF_v4" structure
2 … 3	Length	UNIT	18	Length of data read in BYTE
4 ... 5	Mode	UNIT	0	Not relevant for the "GetStationInfo" instruction (left at "0")
6 ... 9	InterfaceAddress	ARRAY [1..4] of BYTE	-	IP address of the IO device in the format IP_V4 (for example, 192.168.3.10): • addr[1] = 192 • addr[2] = 168 • addr[3] = 3 • addr[4] = 10
10 … 13	SubnetMask	ARRAY [1..4] of BYTE	-	Subnet mask of the IO device in the format IP_V4 (for example, 255.255.255.0): • addr[1] = 255 • addr[2] = 255 • addr[3] = 255 • addr[4] = 0
14 ... 17	DefaultRouter	ARRAY [1..4] of BYTE	-	IP address of the router in the format IP_V4 (for example, 192.168.3.1): • addr[1] = 192 • addr[2] = 168 • addr[3] = 3 • addr[4] = 1

- Use the "IF_CONF_MAC" structure at parameter DATA for storing the MAC address:

Byte	Parameter	Data type	Start value	Description
0 … 1	Id	UINT	3	ID of the "IF_CONF_MAC" structure
2 … 3	Length	UNIT	12	Length of data read in BYTE
4 ... 5	Mode	UNIT	0	Not relevant for the "GetStationInfo" instruction (left at "0")
6 ... 11	MACAddress	ARRAY [1..6] of BYTE	-	MAC address of the IO device (for example, 08-00-06-12-34-56): • Mac[1] = 8 • Mac[2] = 0 • Mac[3] = 6 • Mac[4] = 12 • Mac[5] = 34 • Mac[6] = 56

STATUS parameter

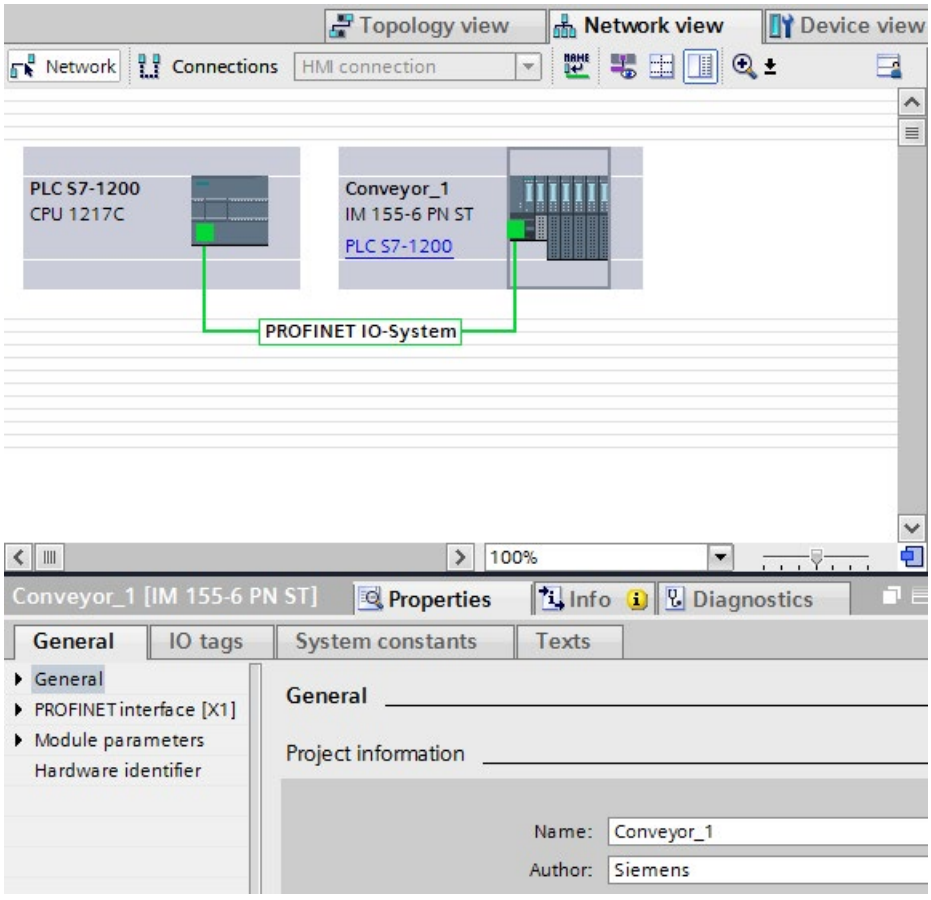
Error code* (W#16#...)	Explanation
0	No error
7000	No job in progress
7001	First call of the asynchronous instruction GetStationInfo. Execution of the instruction not yet complete (BUSY = 1, DONE = 0).
7002	Additional call of the asynchronous instruction GetStationInfo. Execution of the instruction not yet complete (BUSY = 1, DONE = 0).
8080	Value at the MODE parameter is not supported.
8090	The hardware identifier specified at the LADDR parameter is not configured.
8092	The LADDR parameter does not address a PROFINET IO device.
8093	Invalid data type at the DATA parameter.
80A0	Requested information is not read.
80C0	Addressed IO device is not reachable.
80C3	The maximum number of simultaneous calls of the GetStationInfo instruction (10 instances) has been reached.
* The error codes in the program editor are displayed as integer or hexadecimal values.	

Example

In the example below, you use the GetStationInfo instruction to read the IP address data of an IO device and write the information to a data block. The IP address data includes the IP address, subnet mask, and (if used) the address data of the router.

The IO controller executes the GetStationInfo instruction, and the instruction reads the IP address information of a lower-level IO device (in this example, an ET200SP):

1. Configuring the ET 200SP:
   - Create the ET 200SP with the station name "Conveyor_1" in the network view, and assign it to the same PROFINET IO system as the CPU.
   - Assign the CPU as the IO controller for the ET 200SP.



2. Assigning parameters for the GetStationInfo instruction:
   – Create five tags and a structure with the IF_CONF_v4 data type in a global data block for storing the IP address data. Assign any name to the structure. (In the example, the structure name is "IP_Address".)

GetStationInfo_Global_DB

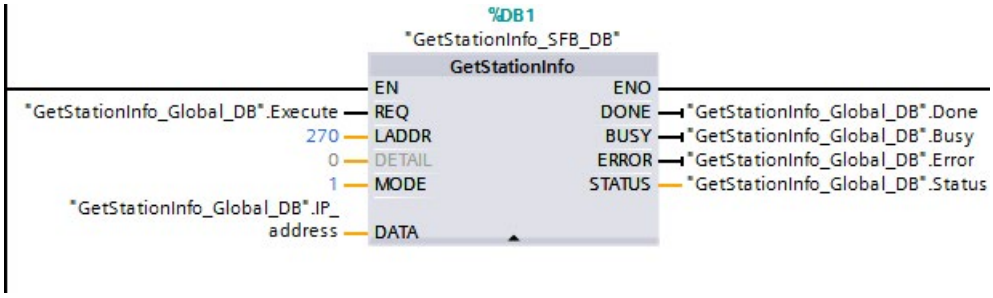
	Name	Data type	Start value
1	Static		
2	Execute	Bool	false
3	IP_address	IF_CONF_v4	
4	Id	UInt	30
5	Length	UInt	18
6	Mode	UInt	0
7	InterfaceAddress	IP_V4	
8	ADDR	Array[1..4] of Byte	
9	ADDR[1]	Byte	16#0
10	ADDR[2]	Byte	16#0
11	ADDR[3]	Byte	16#0
12	ADDR[4]	Byte	16#0
13	SubnetMask	IP_V4	
14	DefaultRouter	IP_V4	
15	Done	Bool	false
16	Busy	Bool	false
17	Error	Bool	false
18	Status	Word	16#0

3. Assigning parameters for the GetStationInfo instruction:
   - Enter the hardware ID of the IO device at the LADDR parameter. The hardware identifier uniquely identifies the product, and, in this example, the hardware ID is "270". You can find the hardware ID at the following location: PLC tags > Show all tags > System constants tab

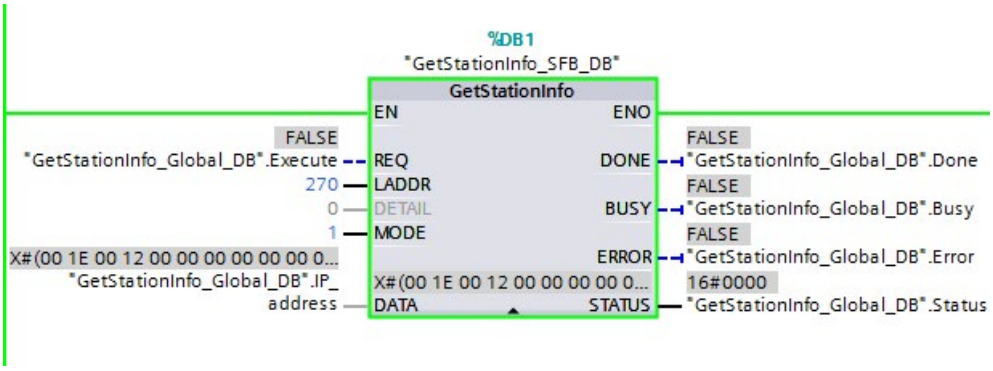
     Search for the IO device in the Name column and for the "Hw_Device" in the Data type column. The associated value is the hardware ID that you enter at the LADDR parameter.
   - Select "1" (read address parameters according to IPv4) for the MODE parameter.
   - Connect the IF_CONF_v4 structure at the DATA parameter.

     Note

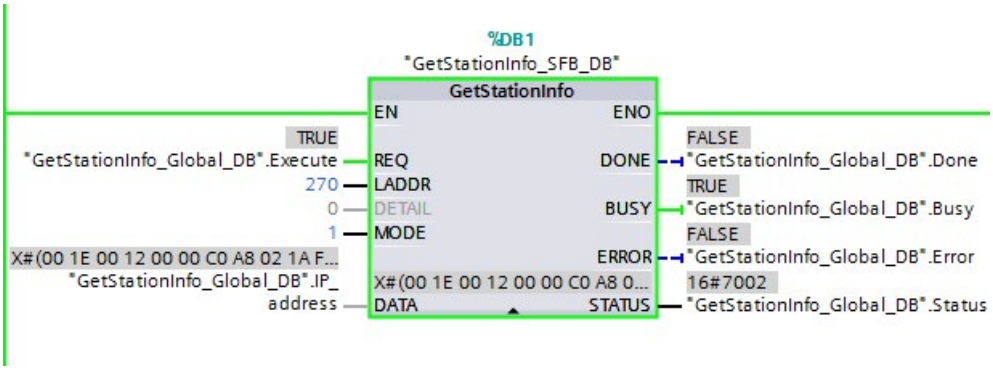
     When using the dropdown list to make your selections for configuring the tag to the DATA parameter, select the DB (in the example, "GetStationInfo_Global_DB") and the tag (in the example, "IP address"). In order to read the entire IF_CONF_v4 data type, you must delete the period that appears following "IP address" so that the final result is: "GetStationInfo_Global_DB".IP address
   - Define PLC tags from your global DB for the output parameters of the instruction.



4. Executing the GetStationInfo instruction:
   – When the REQ input = 1 (FALSE), the instruction displays no IP address information at the DATA input/output parameter or error code information at the STATUS output parameter.



5. Completing execution of the GetStationInfo instruction:
   – When the REQ input = 1 (TRUE), the program executes the instruction and writes the IP address to the data block. The program writes the IP address, "C0 A8 02 1A" (decimal value of "192.168.2.26"), to the DATA input/output parameter.



GetStationInfo_Global_DB

	Name	Data type	Start value	Monitor value
1	Static			
2	Execute	Bool	false	TRUE
3	IP_address	IF_CONF_v4		
4	Id	UInt	30	30
5	Length	UInt	18	18
6	Mode	UInt	0	0
7	InterfaceAddress	IP_V4		
8	ADDR	Array[1..4] of Byte		
9	ADDR[1]	Byte	16#0	16#C0
10	ADDR[2]	Byte	16#0	16#A8
11	ADDR[3]	Byte	16#0	16#02
12	ADDR[4]	Byte	16#0	16#1A
13	SubnetMask	IP_V4		
14	DefaultRouter	IP_V4		
15	Done	Bool	false	TRUE
16	Busy	Bool	false	FALSE
17	Error	Bool	false	FALSE
18	Status	Word	16#0	16#0000

9.7.7 DeviceStates instruction

You can use the DeviceStates instruction to return the states of all distributed I/O slave devices connected to a specified distributed I/O Master.

Table 9- 156 DeviceStates instruction

LAD / FBD	SCL	Description

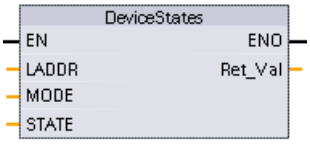
	`ret_val := DeviceStates(`
	`laddr:=_word_in_,`
	`mode:=_uint_in_,`
	`state:=_variant_inout_);`
		DeviceStates retrieves the I/O device operational states of an I/O subsystem. After execution, the STATE parameter contains the error state of each I/O device in a bit list (for the assigned LADDR and MODE). This information corresponds with the device status seen in the STEP 7 diagnostics view.
		The LADDR input of DeviceStates uses the hardware identifier of a distributed I/O interface. In the TIA portal, the hardware identifiers for a PLC can be found by looking for "HW_IOSYSTEM" data types in the system constants tab in the PLC tag table.

Table 9- 157 Data types for the parameters

Parameter and type		Data type	Description
LADDR	IN	HW_IOSYSTEM	Logical address: (Identifier for the I/O system)
MODE	IN	UInt	Supports five modes of operation. The MODE input determines which data will be returned to the location specified for STATE information. The modes are as follows: • 1: Device configuration active • 2: Device defective • 3: Device disabled • 4: Device exists • 5: Problem in Device
RET_VAL	OUT	Int	Execution condition code
STATE[1]	InOut	Variant	Buffer that receives the error status of each device: The data type that you choose for the STATE parameter can be any bit type (Bool, Byte, Word, or DWord) or an array of a bit type • Bit 0 of the first byte of the returned STATE data is a summary bit. When it is set to TRUE, it indicates that other data is available. • The data returned by the STATE parameter shows a one-to-one correlation between a bit location and a distributed I/O address. This device addressing is TRUE for PROFIBUS and PROFINET. For example, Bit 4 in the first Byte correlates to PROFIBUS address 4 or PROFINET device number 4.

[1] For PROFIBUS-DP, the length of the status information is 128 bits. For PROFINET I/O, the length is 1024 bits.

After execution, the STATE parameter contains the error state of each I/O device as a bit list (for the assigned LADDR and MODE).

Table 9- 158 Condition codes

RET_VAL (W#16#...)	Description
0	No error
8091	LADDR does not exist.
8092	LADDR does not address an I/O system.
8093	Invalid data type assigned for STATE parameter: Valid data types are (Bool, Byte, Word, or Dword), or an array of (Bools, Bytes, Words, or Dwords)
80Bx	DeviceStates instruction not supported by the CPU for this LADDR.
8452	The complete state data is too large for the assigned STATE parameter. The STATE buffer contains a partial result.

9.7.7.1 DeviceStates example configurations

PROFIBUS example

The PROFIBUS example consists of the following:

- 16 PROFIBUS devices named "DPSlave_10" through "DPSlave_25"
- The 16 PROFIBUS devices use PROFIBUS addresses 10 through 25, respectively.
- Each slave device is configured with multiple I/O modules.
- The first four bytes of the returned STATE parameter information is displayed.

MODE	Example 1: Normal operation with no errors	Example 2: PROFIBUS slave device DPSlave_12 with single module pulled	Example 3: PROFIBUS slave device DPSlave_12 disconnected
1: Device configuration active	0x01FC_FF03	0x01FC_FF03	0x01FC_FF03
2: Device defective	0x0000_0000	0x0110_0000	0x0110_0000
3: Device disabled	0x0000_0000	0x0000_0000	0x0000_0000
4: Device exists	0x01FC_FF03	0x01FC_FF03	0x01EC_FF03
5: Problem in device	0x0000_0000	0x0110_0000	0x0110_0000

The following four tables show a binary breakdown of the four bytes of data that are being analyzed:

Table 9- 159 Example 1: No errors: A value of 0x01FC_FF03 is returned for MODE 1 (Device configuration active).

Byte with value	Bit pattern with value	Notes
Byte 1 0x01	Bit 7 0000-0001 Bit 0	Bit 0 is true; data is available.
Byte 2 0xFC	Bit 15 1111-1100 Bit 8	
Byte 3 0xFF	Bit 23 1111-1111 Bit 16	
Byte 4 0x03	Bit 31 0000-0011 Bit 24	

The devices are configured in addresses 10 (Bit 10) through 25 (Bit 25).
No devices are configured in addresses 1 through 9.
MODE 4 (Device exists) data matches MODE 1 (Device configuration active), so the configured devices match the existing devices.

Table 9- 160 Example 2: A module has been pulled from PROFIBUS slave device "DPSlave_12". A value of 0x0110_0000 is returned for MODE 2 (Device defective).

Byte with value	Bit pattern with value	Notes
Byte 1 0x01	Bit 7 0000-0001 Bit 0	Bit 0 is true; data is available.
Byte 2 0x10	Bit 15 0001-0000 Bit 8	
Byte 3 0x00	Bit 23 0000-0000 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Device 12 (Bit 12) is marked as defective.
MODE 5 (Problem in device) returns the same information as MODE 2 (Device defective).

Table 9- 161 Example 2 (continued): A module has been pulled from PROFIBUS slave device "DPSlave_12". A value of 0x01FC_FF03 is returned for MODE 4 (Device exists).

Byte with value	Bit pattern with value	Notes
Byte 1 0x01	Bit 7 0000-0001 Bit 0	Bit 0 is true; data is available.
Byte 2 0xFC	Bit 15 1111-1100 Bit 8	
Byte 3 0xFF	Bit 23 1111-1111 Bit 16	
Byte 4 0x03	Bit 31 0000-0011 Bit 24	

Even though device 12 (Bit 12) has an error as shown in MODE 2 (Device defective) above, the device is still functioning on the network which causes MODE 4 (Device exists) to show the device as an "existing device".

Table 9- 162 Example 3: PROFIBUS slave device "DPSlave_12" is disconnected (cable disconnected or power loss) from the PROFIBUS network. "DPSlave_12" is still detected as a defective device as well as an error in the device. The difference is that "DPSlave_12" is no longer detected as a device that exists. A value of 0x01EC_FF03 is returned for MODE 4 (Device exists).

Byte with value	Bit pattern with value	Notes
Byte 1 0x01	Bit 7 0000-0001 Bit 0	Bit 0 is true; data is available.
Byte 2 0xEC	Bit 15 111**0**-1100 Bit 8	
Byte 3 0xFF	Bit 23 1111-1111 Bit 16	
Byte 4 0x03	Bit 31 0000-0011 Bit 24	

Device 12 (Bit 12) is marked as not existing. With this exception, devices 10 through 25 still report as existing.

PROFINET example

The PROFINET example consists of the following:

- 16 PROFINET slave devices named "et200s_1" through "et200s_16"
- The 16 PROFINET devices use PROFINET device numbers 1 through 16, respectively.
- Each slave device is configured with multiple I/O modules.
- The first four bytes of the returned STATE parameter information is displayed.

MODE	Example 1: Normal operation with no errors	Example 2: PROFINET slave et200s_1 module pulled	Example 3: PROFINET slave et200s_1 disconnected
1: Device configuration active	0xFFFF_0100	0xFFFF_0100	0xFFFF_0100
2 - Device defective	0x0000_0000	0x0300_0000	0x0300_0000
3 - Device disabled	0x0000_0000	0x0000_0000	0x0000_0000
4 - Device exists	0xFFFF_0100	0xFFFF_0100	0xFDFF_0100
5 - Problem in device	0x0000_0000	0x0300_0000	0x0300_0000

The following four tables show a binary breakdown of the four bytes of data that are being analyzed:

Table 9- 163 Example 1: No errors: A value of 0xFFFF_0100 is returned for MODE 1 (Device configuration active).

Byte with value	Bit pattern with value	Notes
Byte 1 0xFF	Bit 7 1111-1111 Bit 0	Bit 0 is true; data is available.
Byte 2 0xFF	Bit 15 1111-1111 Bit 8	
Byte 3 0x01	Bit 23 0000-0001 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

The devices are configured in addresses 1 (Bit 1) through 16 (Bit 16).
No devices are configured in addresses 1 through 9.
MODE 4 (Device exists) data matches MODE 1 (Device configuration active), so the configured devices match the existing devices.

Table 9- 164 Example 2: A module has been pulled from PROFINET slave device "et200s_1". A value of 0x0300_0000 is returned for MODE 2 (Device defective).

Byte with value	Bit pattern with value	Notes
Byte 1 0x03	Bit 7 0000-0011 Bit 0	Bit 0 is true; data is available.
Byte 2 0x00	Bit 15 0000-0000 Bit 8	
Byte 3 0x00	Bit 23 0000-0000 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Device 1 (Bit 1) is marked as defective. Since the device still exists, MODE 4 (Device exists) shows the same data as when operating normally.
MODE 5 (Problem in device) returns the same information as MODE 2 (Device defective).

Table 9- 165 Example 2 (continued): A module has been pulled from PROFIBUS slave device "et200s_1". A value of 0xFFFF_0100 is returned for MODE 4 (Device exists).

Byte with value	Bit pattern with value	Notes
Byte 1 0xFF	Bit 7 1111-1111 Bit 0	Bit 0 is true; data is available.
Byte 2 0xFF	Bit 15 1111-1111 Bit 8	
Byte 3 0x01	Bit 23 0000-0001 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Even though device 1 (Bit 1) has an error as shown in MODE 2 (Device defective) above, the device is still functioning on the network which causes MODE 4 (Device exists) to show the device as an "existing device".

Table 9- 166 Example 3: PROFINET slave device "et200s_1" is disconnected (cable disconnected or power loss) from the PROFINET network. A value of 0xFDFF_0100 is returned for MODE 4 (Device exists).

Byte with value	Bit pattern with value	Notes
Byte 1 0xFD	Bit 7 1111-1101 Bit 0	Bit 0 is true; data is available.
Byte 2 0xFF	Bit 15 1111-1111 Bit 8	
Byte 3 0x01	Bit 23 0000-0001 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Device 1 (Bit 1) does not exist. Devices 2 (Bit 2) through 16 (Bit 16) do exist.

9.7.8 ModuleStates instruction

You can use the ModuleStates instruction to return the status of all of the modules in a PROFIBUS or PROFINET station.

Table 9- 167 ModuleStates instruction

LAD / FBD	SCL	Description

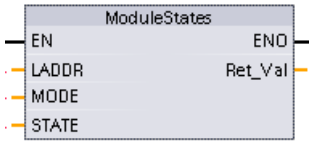
	`ret_val := ModuleStates(`
	`  laddr:=_word_in_,`
	`  mode:=_uint_in,`
	`  state:=_variant_inout);`
		ModuleStates retrieves the operational states of I/O modules. After execution, the STATE parameter contains the error state of each I/O module in a bit list (for the assigned LADDR and MODE). This information corresponds with the module status seen in the STEP 7 diagnostics view.
		The LADDR input of ModuleStates uses is a hardware identifier of a distributed I/O station and not of the head module itself. The hardware identifier can be found by selecting the entire station in the network view and then looking in the hardware identifier section under properties. It can also be found by looking for "Hw_Device" and "Hw_DpSlave" data types in the system constants tab in the PLC tag table.

Table 9- 168 Data types for the parameters

Parameter and type		Data type	Description
LADDR	IN	HW_DEVICE	Logical address (Identifier for the I/O modules)
MODE	IN	UInt	Supports five modes of operation. The MODE input determines which data will be returned to the location specified for STATE information. The modes are as follows: • 1: Module configuration active • 2: Module defective • 3: Module disabled • 4: Module exists • 5: Problem in Module
RET_VAL	OUT	Int	Status (condition code)
STATE[1]	InOut	Variant	Buffer that receives the error status of each module: The data type you use for the STATE parameter can be any bit type (Bool, Byte, Word, or DWord) or an array of a bit type. • Bit 0 of the first byte of the returned STATE data is a summary bit. When it is set to TRUE, it indicates that other data is available. • The data returned by the STATE parameter shows a one-to-one correlation between a bit location and a module position. This slot addressing is TRUE for PROFIBUS and PROFINET. For example, for an ET 200SP with a head module, power module, and a pair of I/O modules, Bit 1 in the first Byte correlates to the head module, Bit 2 to the power module, and Bits 3 and 4 to the I/O modules, respectively.

[1] A maximum of 128 bits can be assigned. The number of bits required is dependent on your I/O module usage.

Table 9- 169 Condition codes

RET_VAL (W#16#...)	Description
0	No error
8091	Module identified by LADDR does not exist.
8092	Module identified by LADDR does not address an I/O device.
8093	Invalid data type for STATE parameter: Valid data types are (Bool, Byte, Word, or Dword), or an array of (Bools, Bytes, Words, or Dwords).
80Bx	ModuleStates instruction not supported by this CPU for this LADDR.
8452	The complete state data is too large for the assigned STATE parameter. The STATE buffer contains a partial result.

9.7.8.1 ModuleStates example configurations

PROFIBUS example

The PROFIBUS example consists of the following:

- 16 PROFIBUS devices named "DPSlave_10" through "DPSlave_25"
- The 16 PROFIBUS devices use PROFIBUS addresses 10 through 25, respectively.
- Each slave device is configured with multiple I/O modules.
- The example uses the LADDR parameter of PROFIBUS slave "DPSlave_12" which contains a head module, a power module, and two I/O modules.
- The first four bytes of the returned STATE parameter information is displayed.

MODE	Example 1: Normal operation with no errors	Example 2: PROFIBUS slave device DPSlave_12 module pulled	Example 3: PROFIBUS slave device DPSlave_12 disconnected
1: Module configuration active	0x1F00_0000	0x1F00_0000	0x1F00_0000
2: Module defective	0x0000_0000	0x0900_0000	0x1F00_0000
3: Module disabled	0x0000_0000	0x0000_0000	0x0000_0000
4: Module exists	0x1F00_0000	0x1700_0000	0x0000_0000
5: Problem in module	0x0000_0000	0x0900_0000	0x1F00_0000

The following four tables show a binary breakdown of the four bytes of data that are being analyzed:

Table 9- 170 Example 1: No errors: A value of 0x1F00_0000 is returned for MODE 1 (Module configuration active).

Byte with value	Bit pattern with value	Notes
Byte 1 0x1F	Bit 7 0001-1111 Bit 0	Bit 0 is true; data is available.
Byte 2 0x00	Bit 15 0000-0000 Bit 8	
Byte 3 0x00	Bit 23 0000-0000 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Slots 1 (Bit 1) through 4 (Bit 4) contain modules. Slots 5 (Bit 5) and beyond do not contain modules. MODE 4 (Module exists) data matches MODE 1 (Module configuration active), so the configured modules match the existing modules.

Table 9- 171 Example 2: A module has been pulled from PROFIBUS slave device "DPSlave_12". A value of 0x0900_0000 is returned for MODE 2 (Module defective).

Byte with value	Bit pattern with value	Notes
Byte 1 0x09	Bit 7 0000-**1**001 Bit 0	Bit 0 is true; data is available.
Byte 2 0x00	Bit 15 0000-0000 Bit 8	
Byte 3 0x00	Bit 23 0000-0000 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Only module 3 (Bit 3) is marked as defective. All other modules are functional.

Table 9- 172 Example 2 (continued): A module has been pulled from PROFIBUS slave device "DPSlave_12". A value of 0x1700_0000 is returned for MODE 4 (Module exists).

Byte with value	Bit pattern with value	Notes
Byte 1 0x17	Bit 7 0001-**0**111 Bit 0	Bit 0 is true; data is available.
Byte 2 0x00	Bit 15 0000-0000 Bit 8	
Byte 3 0x00	Bit 23 0000-0000 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Module 3 (Bit 3) is shown as missing. Modules 1, 2, and 4 (Bits 1, 2, and 4) are shown as existing.

Table 9- 173 Example 3: PROFIBUS slave device "DPSlave_12" is disconnected (cable disconnected or power loss) from the PROFIBUS network. A value of 0x1F00_0000 is returned for MODE 2 (Module defective).

Byte with value	Bit pattern with value	Notes
Byte 1 0x1F	Bit 7 000**1**-1111 Bit 0	Bit 0 is true; data is available.
Byte 2 0x00	Bit 15 0000-0000 Bit 8	
Byte 3 0x00	Bit 23 0000-0000 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

The modules in slots 1 through 4 (Bits 1 through 4) are all marked as defective since the device is missing.

MODE 5 (Problem in module) shows the same information as MODE 2 (Module defective).

PROFINET example

The PROFINET example consists of the following:

- 16 PROFINET slave devices named "et200s_1" through "et200s_16"
- The 16 PROFINET devices use PROFINET device numbers 1 through 16, respectively.
- Each slave device is configured with multiple I/O modules.
- The example uses PROFINET slave "et200s_1" which contains a head module, a power module, and 18 I/O modules.
- The first four bytes of the returned STATE parameter information is displayed.

MODE	Example 1: Normal operation with no errors	Example 2: PROFINET et200s_1 slave module pulled	Example 3: PROFINET et200s_1 slave disconnected
1: Module configuration active	0xFFFF_1F00	0xFFFF_1F00	0xFFFF_1F00
2: Module defective	0x0000_0000	0x0180_0000	0xFFFF_1F00
3: Module disabled	0x0000_0000	0x0000_0000	0x0000_0000
4: Module exists	0xFFFF_1F00	0xFF7F_1F00	0x0000_0000
5: Problem in module	0x0000_0000	0x0180_0000	0xFFFF_1F00

The following four tables show a binary breakdown of the four bytes of data that are being analyzed:

Table 9- 174 Example 1: No errors: A value of 0xFFFF_1F00 is returned for MODE 1 (Module configuration active).

Byte with value	Bit pattern with value	Notes
Byte 1 0xFF	Bit 7 1111-1111 Bit 0	Bit 0 is true; data is available.
Byte 2 0xFF	Bit 15 1111-1111 Bit 8	
Byte 3 0x1F	Bit 23 0001-1111 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Slots 1 (Bit 1) through 20 (Bit 20) contain modules. Slot 21 (Bit 21) and beyond do not contain modules.

MODE 4 (Module exists) data matches MODE 1 (Module configuration active), so the configured modules match the existing modules.

Table 9- 175 Example 2: A module has been pulled from PROFINET slave device "et200s_1". A value of 0x0180_0000 is returned for MODE 2 (Module defective).

Byte with value	Bit pattern with value	Notes
Byte 1 0x01	Bit 7 0000-0001 Bit 0	Bit 0 is true; data is available.
Byte 2 0x80	Bit 15 1000-0000 Bit 8	
Byte 3 0x00	Bit 23 0000-0000 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Only module 15 (Bit 15) is marked as defective. All other modules are functional.

Table 9- 176 Example 2 (continued): A module has been pulled from PROFIBUS slave device "et200s_1". A value of 0xFF7F_1F00 is returned for MODE 4 (Module exists).

Byte with value	Bit pattern with value	Notes
Byte 1 0xFF	Bit 7 1111-1111 Bit 0	Bit 0 is true; data is available.
Byte 2 0x7F	Bit 15 **0**111-1111 Bit 8	
Byte 3 0x1F	Bit 23 0001-1111 Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

Module 15 (Bit 15) is shown as missing. Modules 1 through 14 (Bits 1 through 14) and 16 through 20 (Bits 16 through 20) are shown as existing.

Table 9- 177 Example 3: PROFINET slave device "et200s_1" is disconnected (cable disconnected or power loss) from the PROFINET network. A value of 0xFFFF_1F00 is returned for MODE 2 (Module defective).

Byte with value	Bit pattern with value	Notes
Byte 1 0xFF	Bit 7 **1111-1111** Bit 0	Bit 0 is true; data is available.
Byte 2 0xFF	Bit 15 **1111-1111** Bit 8	
Byte 3 0x1F	Bit 23 000**1**-**1111** Bit 16	
Byte 4 0x00	Bit 31 0000-0000 Bit 24	

The modules in slots 1 through 20 (Bits 1 through 20) are all marked as defective since the device is missing.
MODE 5 (Problem in module) shows the same information as MODE 2 (Module defective).

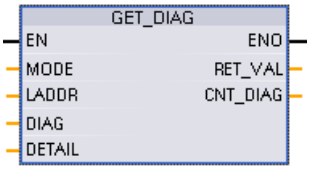
9.7.9 GET_DIAG (Read diagnostic information)

Description

You can use the "GET_DIAG" instruction to read out the diagnostic information of a hardware device. The hardware device is selected with the LADDR parameter. With the MODE parameter, you select which diagnostic information to read.

Table 9- 178 GET_DIAG instruction

LAD / FBD	SCL	Description

	`ret_val := GET_DIAG(`
	`  mode:=_uint_in_,`
	`  laddr:=_word_in_,`
	`  cnt_diag=>_uint_out_,`
	`  diag:=_variant_inout_,`
	`  detail:=_variant_inout_);`
		Reads the diagnostic information from an assigned hardware device.

Parameters

The following table shows the parameters of the "GET_DIAG" instruction:

Table 9- 179 Data types for the parameters

Parameter and type		Data type	Description
MODE	IN	UInt	Use the MODE parameter to select which diagnostic data is to be output.
LADDR	IN	HW_ANY (Word)	Hardware ID of the device
RET_VAL	OUT	Int	Status of the instruction
CNT_DIAG	OUT	UInt	Number of output diagnostic details
DIAG	InOut	Variant	Pointer to data area for storage of diagnostic information of the selected mode
DETAILS	InOut	Variant	Pointer to data area for storage of diagnostic details in accordance with the selected mode

MODE parameter

Depending on the value at the MODE parameter, different diagnostics data is output at the DIAG, CNT_DIAG and DETAILS output parameters:

Table 9- 180 MODE parameter

MODE	Description	DIAG	CNT_DIAG	DETAILS
0	Output of all supported diagnostic information for a module as DWord, where Bit X=1 indicates that mode X is supported.	Bit string of the supported modes as DWord, where Bit X=1 indicates that mode X is supported. The S7-1200 CPU ignores the LADDR parameter when the MODE parameter is 0.	0	-
1	Output of the inherent status of the addressed hardware object.	Diagnostics status: Output in accordance with the DIS structure. (Note: Refer to the "DIS structure" information below and GET_DIAG instruction example at the end of the section.)	0	-
2	Output of the status of all subordinate modules of the addressed hardware object.	Output of diagnostics data in accordance with the DNN structure. (Note: Refer to the "DNN structure" information below and GET_DIAG instruction example at the end of the section.)	0	-

DIS structure

With the MODE parameter = 1, the diagnostics information is output in accordance with the DIS structure. The following table shows the meaning of the individual parameter values:

Table 9- 181 Structure of the Diagnostic Information Source (DIS)

Parameter	Data type	Value	Description
MaintenanceState	DWord	Enum	
		0	No maintenance required
		1	The module or device is disabled.
		2	-
		3	-
		4	-
		5	Maintenance required
		6	Maintenance demanded
		7	Error
		8	Status unknown / error in subordinate module
		9	-
		10	Inputs/outputs are not available.
Componentstate Detail	DWord	Bit array	Status of the module submodules: • Bit 0 to 15: Status message of the module • Bit 16 to 31: Status message of the CPU
		0 to 2 (enum)	Additional information: • Bit 0: No additional information • Bit 1: Transfer not permitted
		3	Bit 3 = 1: At least one channel supports qualifiers for diagnostics.
		4	Bit 4 = 1: Maintenance required for at least one channel or one component
		5	Bit 5 = 1: Maintenance demanded for at least one channel or one component
		6	Bit 6 = 1: Error in at least one channel or one component
		7 to 10	Reserved (always = 0)
		11 to 14	Bit 11 = 1: PNIO - submodule correct Bit 12 = 1: PNIO - replacement module Bit 13 = 1: PNIO - incorrect module Bit 14 = 1: PNIO - module disconnected
		15	Reserved (always = 0)

Parameter	Data type	Value	Description
		16 to 31	Status information for modules generated by the CPU: Bit 16 = 1: Module disabled Bit 17 = 1: CiR operation active Bit 18 = 1: Input not available Bit 19 = 1: Output not available Bit 20 = 1: Overflow diagnostics buffer Bit 21 = 1: Diagnostics not available Bit 22 - 31: Reserved (always 0)
OwnState	Uint16	Enum	The value of the OwnState parameter describes the maintenance status of the module.
		0	No fault
		1	The module or device is disabled.
		2	Maintenance required
		3	Maintenance demanded
		4	Error
		5	The module or the device cannot be reached from the CPU (valid for modules and devices below a CPU).
		6	Inputs/outputs are not available.
		7	-
IO State	Uint16	Bit array	I/O status of the module
		0	Bit 0 = 1: No maintenance required
		1	Bit 1 = 1: The module or device is disabled.
		2	Bit 2 = 1: Maintenance required
		3	Bit 3 = 1: Maintenance demanded
		4	Bit 4 = 1: Error
		5	Bit 5 = 1: The module or the device cannot be reached from the CPU (valid for modules and devices below a CPU).
		6	Qualifier; bit 7 = 1, if bit 0, 2, or 3 are set
		7	Inputs/outputs are not available.
		8 to 15	Reserved (always = 0)
OperatingState	UInt16	Enum	
		0	-
		1	In STOP / firmware update
		2	In STOP / reset memory
		3	In STOP / self start
		4	In STOP
		5	Memory reset
		6	In START
		7	In RUN
		8	-
		9	In HOLD
		10	-
		11	-

Parameter	Data type	Value	Description
		12	Module defective
		13	-
		14	No power
		15	CiR
		16	In STOP / without DIS
		17	In
		18	
		19	
		20	

DNN structure

With the MODE parameter = 2, the diagnostics information details are output in accordance with the DNN structure. The following table shows the meaning of the individual parameter values:

Table 9- 182 Structure of the Diagnostic Navigation Node (DNN)

Parameter	Data type	Value	Description
SubordinateState	UINT	Enum	Status of the subordinate module (See parameter OwnState of the DIS structure.)
SubordinateIOState	WORD	Bitarray	Status of the inputs and outputs of the subordinate module (See parameter IO State of the DIS structure.)
DNNmode	WORD	Bitarray	• Bit 0 = 0: Diagnostics enabled • Bit 0 = 1: Diagnostics disabled • Bit 1 to 15: Reserved

RET_VAL parameter

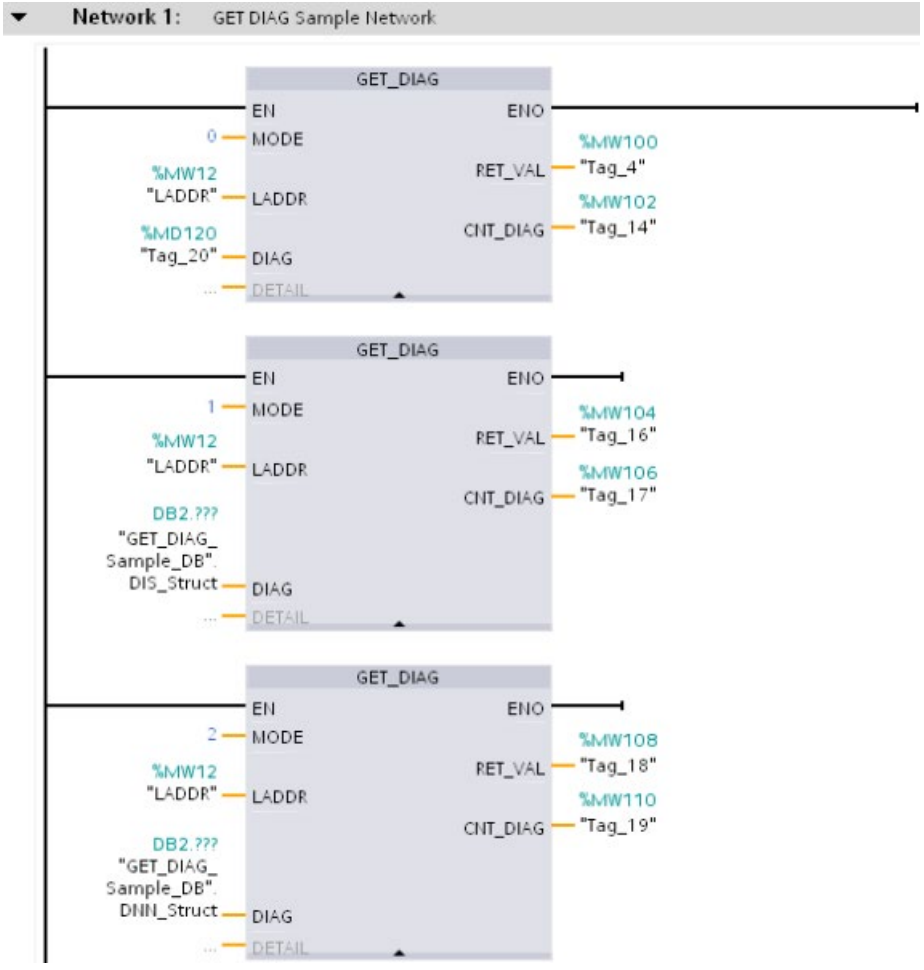
Table 9- 183 Error codes of the RET_VAL parameter

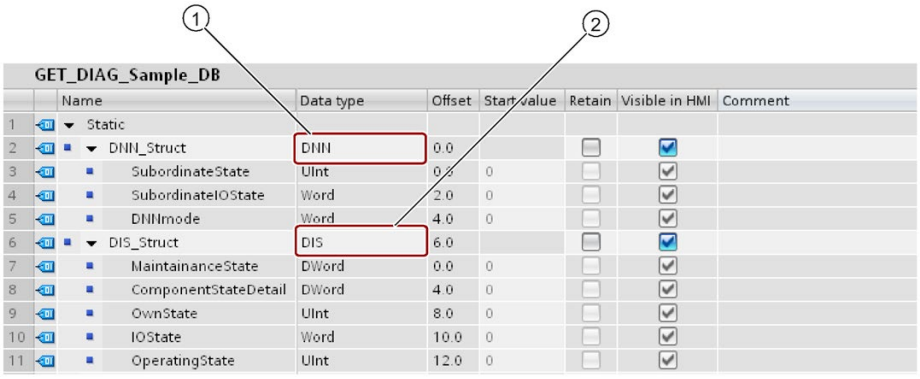
Error code (W#16#...)	Description
0	No error
8080	Value in the MODE parameter is not supported.
8081	Type in the DIAG parameter is not supported with the selected mode (parameter MODE).
8082	Type in the DETAILS parameter is not supported with the selected mode (parameter MODE).
8090	LADDR does not exist.
8091	The selected channel in the CHANNEL parameter does not exist.
80C1	Insufficient resources for parallel execution

Example

The following ladder logic network and DB show how to use the three modes with the three structures:

- DIS
- DNN





① DNN
② DIS

Note

In the DB, you must manually type in the data type to access each of the three structures; there is no dropdown list selection. Type in the data types exactly as shown below:

- DNN
- DIS

9.7.10 Diagnostic events for distributed I/O

Note

With a PROFIBUS IO system, after a download or power cycle, the CPU will go to RUN mode unless the hardware compatibility is set to allow acceptable substitute modules (Page 165) and one or more modules is missing or is not an acceptable substitute for the configured module.

As shown in the following table, the CPU supports diagnostics that can be configured for the components of the distributed I/O system. Each of these errors generates a log entry in the diagnostic buffer.

Table 9- 184 Handling of diagnostic events for PROFINET and PROFIBUS

Type of error	Diagnostic information for the station?	Entry in the diagnostic buffer?	CPU operating mode
Diagnostic error	Yes	Yes	Stays in RUN mode
Rack or station failure	Yes	Yes	Stays in RUN mode
I/O access error [1]	No	Yes	Stays in RUN mode
Peripheral access error [2]	No	Yes	Stays in RUN mode
Pull / plug event	Yes	Yes	Stays in RUN mode

[1] I/O access error example cause: A module that has been removed.

[2] Peripheral access error example cause: Acyclic communication to a submodule that is not communicating.

Use the GET_DIAG instruction (Page 466) for each station to obtain the diagnostic information. This will allow you to programmatically handle the errors encountered on the device and if desired take the CPU to STOP mode. This method requires you to specify the hardware device from which to read the status information.

The GET_DIAG instruction uses the "L address" (LADDR) of the station to obtain the health of the entire station. This L Address can be found within the Network Configuration view and by selecting the entire station rack (entire gray area), the L Address is shown in the Properties Tab of the station. You can find the LADDR for each individual module either in the properties for the module (in the device configuration) or in the default tag table for the CPU.

9.8 Pulse

9.8.1 CTRL_PWM (Pulse width modulation)

Table 9- 185 CTRL_PWM (Pulse Width Modulation) instruction

LAD / FBD	SCL	Description

	`"CTRL_PWM_DB"(`
	`PWM:=_uint_in_,`
	`ENABLE:=_bool_in_,`
	`BUSY=>_bool_out_,`
	`STATUS=>_word_out_);`
		Provides a fixed cycle time output with a variable duty cycle. The PWM output runs continuously after being started at the specified frequency (cycle time). The pulse width is varied as required to affect the desired control.

1 When you insert the instruction, STEP 7 displays the "Call Options" dialog for creating the associated DB.

2 In the SCL example, "CTRL_PWM_DB" is the name of the instance DB.

Table 9- 186 Data types for the parameters

Parameter and type		Data type	Description
PWM	IN	HW_PWM (Word)	PWM identifier: Names of enabled pulse generators will become tags in the "constant" tag table, and will be available for use as the PWM parameter. (Default value: 0)
ENABLE	IN	Bool	1=start pulse generator 0 = stop pulse generator
BUSY	OUT	Bool	Function busy (Default value: 0)
STATUS	OUT	Word	Execution condition code (Default value: 0)

The CTRL_PWM instruction stores the parameter information in the DB. The data block parameters are not separately changed by the user, but are controlled by the CTRL_PWM instruction.

Specify the enabled pulse generator to use, by using its tag name for the PWM parameter.

When the EN input is TRUE, the PWM_CTRL instruction starts or stops the identified PWM based on the value at the ENABLE input. Pulse width is specified by the value in the associated Q word output address.

Because the CPU processes the request when the CTRL_PWM instruction is executed, parameter BUSY will always report FALSE. If an error is detected, then ENO is set to FALSE, and parameter STATUS contains a condition code.

The pulse width will be set to the initial value configured in device configuration when the CPU first enters RUN mode. You write values to the Q-word location specified in device configuration ("Output addresses" / "Start address:") as needed to change the pulse width. You use an instruction such as a move, convert, math, or PID box to write the desired pulse width to the appropriate Q word. You must use the valid range for the Q-word value (percent, thousandths, ten-thousandths, or S7 analog format).

Note

Digital I/O points assigned to PWM and PTO cannot be forced

The digital I/O points used by the pulse-width modulation (PWM) and pulse-train output (PTO) devices are assigned during device configuration. When digital I/O point addresses are assigned to these devices, the values of the assigned I/O point addresses cannot be modified by the Watch table force function.

Table 9- 187 Value of the STATUS parameter

STATUS	Description
0	No error
80A1	PWM identifier does not address a valid PWM.

9.8.2 CTRL_PTO (Pulse train output)

The PTO instruction provides a square wave with a 50% duty cycle output at a specified frequency. You can use the CTRL_PTO instruction to assign the frequency without a Technology objects (TO) axis data block (DB).

This instruction requires a pulse generator. You must activate the pulse generator and select a signal type in the hardware configuration. Refer to "Configuring a pulse channel for PWM or PTO" (Page 480) for further information.

You can access the CTRL_PTO instruction in the Task Cards, Extended instructions.

Table 9- 188 CTRL_PTO (Pulse Train Output) instruction

LAD / FBD[1]	SCL[2]	Description

	`"CTRL_PTO_DB"(`
	`REQ:=_bool_in_,`
	`PTO:=_uint_in_,`
	`FREQUENCY:=_udint_in_,`
	`DONE=>_bool_out_,`
	`BUSY=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		The PTO instruction allows the user to control the frequency for a square wave (50% duty cycle) output.

1 When you insert the instruction, STEP 7 displays the "Call Options" dialog for creating the associated DB.

2 In the SCL example, "CTRL_PTO_DB" is the name of the instance DB.

Table 9- 189 Data types for the parameters

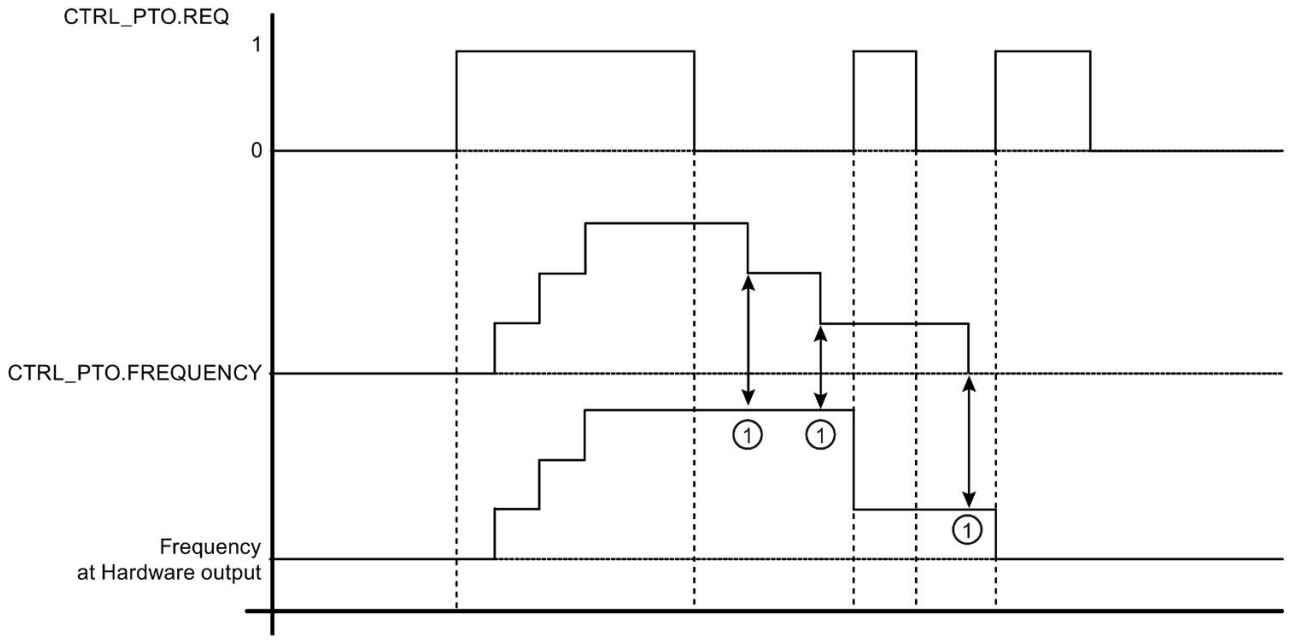
Parameter and type		Data type	Description
EN	IN	Bool	1 = Instruction enabled 0 = Instruction disabled
REQ	IN	Bool	1 = Set PTO output frequency to value in FREQUENCY input 0 = No change to PTO
PTO	IN	HW_PTO (Word)	PTO identifier: Hardware ID of the pulse generator: • Names of the enabled pulse generators become tags in the "constant" tag table, and are available for use as the PTO parameter. (Default value = 0) • You can find the hardware ID in the Properties of the pulse generator in the Device view. The system constants also list the hardware IDs of the pulse generators. (Default value = 0)
FREQUENCY	IN	UDInt	Desired frequency (in Hz) of the PTO. This value is applied only when REQ = 1 (Default value is 0 Hz)
DONE	OUT	Bool	Function completed without error (Default value: 0)
BUSY	OUT	Bool	Function busy (Default value: 0)
ERROR	OUT	Word	Error detected (Default value: 0)
STATUS	OUT	Word	Execution condition code (Default value: 0)

The CTRL_PTO instruction stores the parameter information in the DB. The data block parameters are not separately changed by the user, but are controlled by the CTRL_PTO instruction.

Specify the enabled pulse generator to use, by using its tag name or hardware identifier for the PTO parameter.

When the EN input is TRUE, the CTRL_PTO instruction starts or stops the identified PTO. When the EN input is FALSE, the CTRL_PTO instruction does not execute and the PTO maintains its current state.

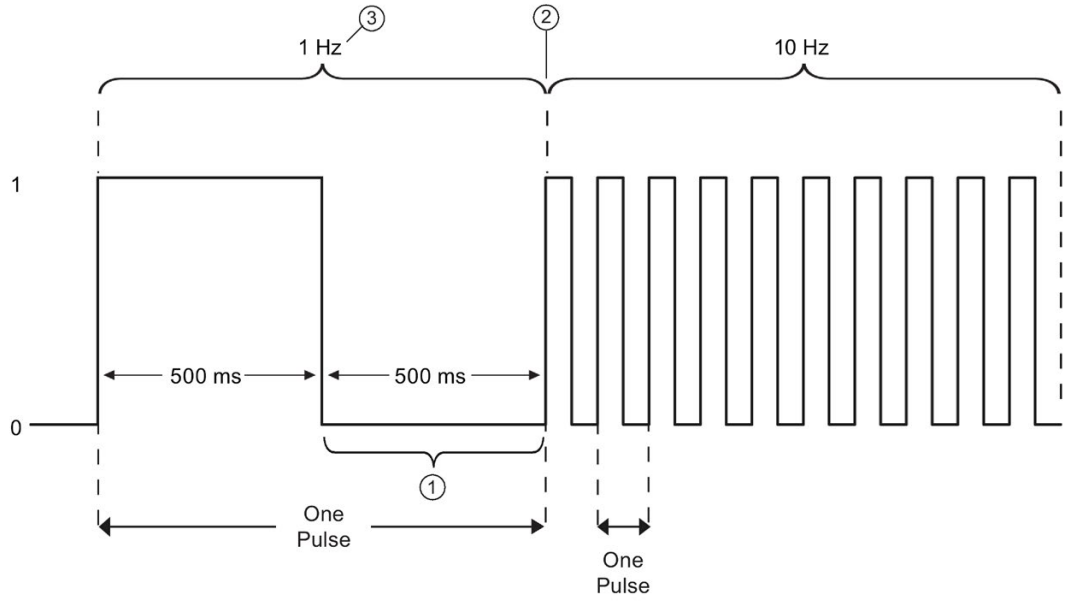
When you set the REQ input to TRUE, the FREQUENCY value takes effect. If REQ is FALSE, the PTO's output frequency cannot be changed, and the PTO continues to output pulses.



① No change in output frequency while REQ = 0

Since the CTRL_PTO instruction only starts the PTO, the CTRL_PTO instruction finishes immediately. As a result, the BUSY output never turns on. The DONE output comes on as long as no error occurs. If an error is detected, the ERROR parameter is set to TRUE, and the STATUS parameter contains a condition code.

When the user enables the CTRL_PTO instruction with a given frequency, the S7-1200 outputs a pulse train at that given frequency. The user can change the desired frequency at any time. When the frequency is changed, the S7-1200 finishes the current pulse prior to changing frequency to the new desired frequency. For example, if the desired frequency is 1 Hz (which takes 1000ms to complete) and the user changes the frequency to 10 Hz after 500ms, the frequency changes at the end of the 1000ms time period.



① The user changes the frequency to 10 Hz after 500 ms.

② The 1 Hz pulse must finish before the frequency can change to the new 10 Hz frequency.

③ 1 Hz corresponds to 1000 ms

The pulse generator hardware object has the following restriction: Only one instruction can use the pulse generator as PTO, and the hardware configuration editor manages the use of the pulse generator. Other instructions that try to access that PTO return an error: "0x8090" (Pulse generator with the specified hardware ID is in use).

Note

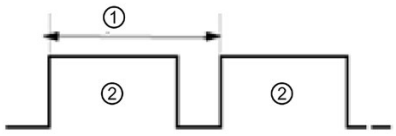
Digital I/O points assigned to PWM and PTO cannot be forced

The digital I/O points used by the pulse width modulation (PWM) and pulse train output (PTO) devices are assigned during device configuration. When digital I/O point addresses are assigned to these devices, the values of the assigned I/O point addresses cannot be modified by the Watch table force function.

Table 9- 190 STATUS parameter error code value

Error code (W#16#...)	Description
0	No errors
0x8090	Pulse generator with the specified hardware ID is in use.
0x8091	Frequency out-of-range. The desired frequency exceeds the maximum frequency of the pulse output selected.
0x80A1	PTO identifier (hardware ID) does not address a valid PTO.
0x80D0	Pulse generator with the specified hardware ID is not activated. Activate the pulse generator in the CPU properties under "Pulse generators (PTO/PWM)".
0x80D1	Pulse generator with the specified hardware ID has no PTO selection. Select PTO in Hardware Configuration.

9.8.3 Operation of the pulse outputs



Pulse width can be expressed as hundredths of the cycle time (0 to 100), as thousandths (0 to 1000), as ten thousandths (0 to 10000), or as S7 analog format.

The pulse width can vary from 0 (no pulse, always off) to full scale (no pulse, always on).

① Cycle time

② Pulse width

Since the PWM output can be varied from 0 to full scale, it provides a digital output that in many ways is the same as an analog output. For example, the PWM output can be used to control the speed of a motor from stop to full speed, or it can be used to control position of a valve from closed to fully opened.

You configure frequency in the hardware configuration (Page 480). You control pulse width from the user program.

Four pulse generators are available for controlling high-speed pulse output functions: PWM and Pulse train output (PTO). PTO is used by the motion control instructions. You can assign each pulse generator to either PWM or PTO, but not both at the same time.

You can use onboard CPU outputs, or you can use the optional signal board outputs. The output point numbers are shown in the following table (assuming the default output configuration). If you have changed the output point numbering, then the output point numbers will be those you assigned. Note that PWM requires only one output, while PTO can optionally use two outputs per channel. If an output is not required for a pulse function, it is available for other uses. Refer to the table below for I/O assignment.

The table below shows the default I/O assignments; however, the four pulse generators can be configured to any CPU built-in or SB digital output. Different output points support different voltages and speeds, so take that into account when assigning PWM/PTO locations.

Note

Pulse-train outputs cannot be used by other instructions in the user program.

When you configure the outputs of the CPU or signal board as pulse generators (for use with the PWM or motion control PTO instructions), the corresponding outputs addresses are removed from the Q memory and cannot be used for other purposes in your user program. If your user program writes a value to an output used as a pulse generator, the CPU does not write that value to the physical output.

Note

PTO direction outputs can be freed for use elsewhere in your program.

Each PTO requires the assignment of two outputs: one as a pulse output and one as a direction output. You can use just the pulse output and not the direction output. You can then free the direction output for other purposes in your user program.

Table 9- 191 Default output assignments for the pulse generators[3]

Description	Pulse	Direction
PTO1		
Built-in I/O	Q0.0	Q0.1
SB I/O	Q4.0	Q4.1
PWM1		
Built-in outputs	Q0.0	-
SB outputs	Q4.0	-
PTO2		
Built-in I/O	Q0.2	Q0.3
SB I/O	Q4.2	Q4.3
PWM2		
Built-in outputs	Q0.2	-
SB outputs	Q4.2	-
PTO3		
Built-in I/O	Q0.4[1]	Q0.5[1]
SB I/O	Q4.0	Q4.1
PWM3		
Built-in outputs	Q0.4[1]	-
SB outputs	Q4.1	-
PTO4		
Built-in I/O	Q0.6[2]	Q0.7[2]
SB I/O	Q4.2	Q4.3
PWM4		
Built-in outputs	Q0.6[2]	-
SB outputs	Q4.3	-

1 The CPU 1211C does not have outputs Q0.4, Q0.5, Q0.6, or Q0.7. Therefore, these outputs cannot be used in the CPU 1211C.

2 The CPU 1212C does not have outputs Q0.6 or Q0.7. Therefore, these outputs cannot be used in the CPU 1212C.

3 This table applies to the CPU 1211C, CPU 1212C, CPU 1214C, CPU 1215C, and CPU 1217C PTO/PWM functions.

9.8.4 Configuring a pulse channel for PWM or PTO

To prepare for PWM or PTO operation, first configure a pulse channel in the device configuration by selecting the CPU, then Pulse Generator (PTO/PWM), and choose PWM1/PTO1 through PWM4/PTO4. Enable the pulse generator (check box). If a pulse generator is enabled, a unique default name is assigned to this particular pulse generator. You can change this name by editing it in the "Name:" edit box, but it must be a unique name. Names of enabled pulse generators will become tags in the "constant" tag table and will be available for use as one of the following:

- PWM parameter of the CTRL_PWM instruction
- PTO parameter of the CTRL_PTO instruction

You can also write a comment about this specific pulse generator in the "Comment:" edit box.

Table 9- 192 CPU output: Maximum frequency (PTO) and minimum cycle time (PWM)

CPU	CPU output channel	PTO maximum frequency	PWM minimum cycle time
1211C	Qa.0 to Qa.3	100 kHz	10 µs
1212C	Qa.0 to Qa.3	100 kHz	10 µs
	Qa.4, Qa.5	20 kHz	50 µs
1214C and 1215C	Qa.0 to Qa.3	100kHz	10 µs
	Qa.4 to Qb.1	20 kHz	50 µs
1217C	DQa.0 to DQa.3 (.0+, .0- to .3+, .3-)	1 MHz	1 µs
	DQa.4 to DQb.1	100 kHz	10 µs

Table 9- 193 SB signal board output: Maximum frequency (PTO) and minimum cycle time (PWM)

SB signal board	SB output channel	PTO maximum frequency	PWM minimum cycle time
SB 1222, 200 kHz	DQe.0 to DQe.3	200kHz	5 µs
SB 1223, 200 kHz	DQe.0, DQe.1	200kHz	5 µs
SB 1223	DQe.0, DQe.1	20 kHz	50 µs

Note

The minimum cycle time of each of the CPU and Signal Board outputs is given in the tables above. However, the TIA Portal does not alert you when you configure a PWM pulse generator with a cycle time that falls below the minimum cycle time of the hardware. Problems can result with your application, so always ensure that the cycle time lies within the hardware limits.

Note

When you set the Pulse duration of a PWM signal, the actual Pulse duration time (time that the pulse is high) must be greater than or equal to 1 millisecond if the Time base is "Milliseconds". If the Time base is "Microseconds", the actual Pulse duration time must be greater than or equal to 1 microsecond. The output turns off if the Pulse duration time is less than 1 "Time base".

For example, a Cycle time of 10 microseconds and a Pulse duration of 5 hundredths produces a Pulse duration time of 0.5 microseconds. Because this is less than 1 microsecond, the PWM signal is off.

Parameter assignment

The Parameter assignment section allows the user to configure the parameters of the output pulse. The following options are available, depending on whether PWM or PTO is selected:

- Signal type: Configure the pulse output as PWM or PTO. For PTO selections, refer to "Phasing" (Page 642) for further information:
  - PWM
  - PTO (pulse A and direction B)
  - PTO (pulse up A and pulse down B)
  - PTO (A/B phase-shifted)
  - PTO (A/B phase-shifted - fourfold)
- Time base (only applies to PWM): Select which units of time to use:
  - Milliseconds
  - Microseconds
- Pulse duration format (only applies to PWM): Assign the resolution of the pulse duration (width):
  - Hundredths (0 to 100)
  - Thousandths (0 to 1000)
  - Ten-thousandths (0 to 10000)
  - S7 analog format (0 to 27648)
- Cycle time (only applies to PWM): Assign the time duration it takes to complete one pulse (pulse high time plus pulse low time equals cycle time). You can change the cycle time at runtime by selecting the check box "Allow runtime modification of the cycle time". Refer to the "I/O addresses" section below for further information. Range is 1 to 16,777,215 units of time.
- Initial pulse duration (only applies to PWM): Assign the pulse duration of the first pulse. You can change this value at runtime using the Q word address configured in I/O addresses. Range is based upon the Pulse duration format.
- Allow runtime modification of the cycle time (only applies to PWM): Selecting this option allows your program to modify the cycle time of the PWM signal while the program is running. Refer to the "I/O addresses" section below for further information.

Note

When setting the pulse duration of a PWM signal, be sure to consider the switching delay of the output channel as specified in Appendix A. The actual pulse duration measured at the output may be greater than the selected pulse duration. The increase of the pulse duration is more pronounced for small pulse duration and higher frequencies. Be sure to verify that the pulse duration measured at the output matches your requirements.

Determining the Pulse duration value

"Pulse duration" is derived by multiplying the "Initial pulse duration" by the "Cycle time". When you select a "Time base", "Pulse duration format", "Cycle time", and "Initial pulse duration", you must keep in mind that the overall "Pulse duration" cannot be a fractional value. If your resulting "Pulse duration" is a fractional value, you should adjust your "Initial pulse duration" or change your "Time base" to generate an integer value.

Here are two examples:

- Example 1: If you select the following values:
  - Time base = Milliseconds (ms)
  - Pulse duration format = Hundredths (0 to 100)
  - Cycle time = 3 ms
  - Initial pulse duration = 75

  The resulting "Pulse duration" = .75 x 3 ms = 2.25 ms

  This "Pulse duration" value is fractional and causes an error when you operate the CTRL_PWM instruction. The "Pulse duration" value must be an integer value.
- Example 2: If you select the following values:
  - Time base = Microseconds (µs)
  - Pulse duration format = Hundredths (0 to 100)
  - Cycle time = 3000 µs
  - Initial pulse duration = 75

  The resulting "Pulse duration" = .75 x 3000 µs = 2250 µs

  This "Pulse duration" value is an integer value, and the CTRL_PWM instruction functions properly with this value.

Hardware outputs

In the hardware outputs section, select the output channel from the dropdown menu. Depending on the configuration, there may be one or two outputs to select. If you do assign an output channel to a pulse generator, the output channel cannot be used by another pulse generator, HSC, or the process image register.

Note

Pulse generator outputs cannot be used by other instructions in the user program

When you configure the outputs of the CPU or signal board as pulse generators (for use with the PWM, PTO, or motion control instructions), the corresponding outputs addresses are removed from the Q memory and cannot be used for other purposes in your program. If your program writes a value to an output used as a pulse generator, the CPU does not write that value to the physical output.

I/O addresses

The PWM has two bytes of Q memory designated for "Pulse duration". While the PWM is running, you can modify the value in the assigned Q memory and change the Pulse duration.

In the I/O Address section, enter the Q word address where you want to store the Pulse duration value.

The default addresses for the PWM Pulse duration values are as follows:

- PWM1: QW1000
- PWM2: QW1002
- PWM3: QW1004
- PWM4: QW1006

For the PWM, the value at this location controls the duration of the pulse and is initialized to the "Initial pulse duration:" value (assigned above) each time the CPU transitions from STOP to RUN mode. You change this Q-word value during runtime to cause a change in the pulse duration. The range of this value is dependent on the Pulse duration format configured under Parameter assignment.

You can also allocate an additional four bytes of Q memory for the "Cycle time" of the PWM signal. Refer to "Operation of the pulse outputs" (Page 478) for a diagram of the PWM signal. When you select the "Allow runtime modification of the cycle time" check box, the first two bytes hold the Pulse duration value and the last four bytes hold the Cycle time value.

While the PWM is running, you can modify the value of the double word at the end of the Q memory that is allocated to that PWM. This changes the Cycle time of the PWM signal. For example, you enable this option so that the CPU allocates six bytes for PWM1, and you decide to use QB1008 to QB1013. Once you download the program and start the PWM, you can modify the Pulse duration using QW1008 and the Cycle time using QD1010.

Each time the CPU transitions from STOP to RUN mode, the CPU initializes the Cycle time value in Q memory to the "Cycle time" value assigned above in the "Parameter assignment" section. The units and range of values for the Cycle time value in Q memory are the same as the configuration in the "Parameter assignment" section.

When you select the "Allow runtime modification of the cycle time" check box, the TIA Portal automatically selects a new address for the output address. The new output address cannot be the same as the default address for that pulse generator. The TIA Portal uses the next available block of six consecutive bytes. If the search does not find an available block of Q memory before it reaches the end of Q memory, the search starts over at address "0" of Q memory and continues searching for an available block.

A pulse generator configured for PTO does not use the Q-word address.

9.9 Recipes and Data logs

9.9.1 Recipes

9.9.1.1 Recipe overview

Recipe data storage

- A recipe data block that you create in your project must be stored in CPU **load** memory. Internal CPU memory or an external memory "Program" card can be used.
- Another DB that you must create is the active recipe data block. This DB must be in **work** memory, where one active recipe record is read or written with your program logic.

Recipe data management

The recipe DB uses an array of product recipe records. Each element of the recipe array represents a different recipe flavor that is based on a common set of components.

- You create a PLC data type or struct that defines all the components in one recipe record. This data type template is reused for all recipe records. Product recipes vary according to the start values that are assigned to the recipe components.
- One of the recipes can be transferred at any time from the recipe DB (all recipes in load memory) to the active recipe DB (one recipe in work memory) using the READ_DBL instruction. After a recipe record is moved to work memory, then your program logic can read the component values and begin a production run. This transfer minimizes the amount of CPU work memory that is required for recipe data.
- If the active recipe component values are adjusted by an HMI device during a production run, you can write the modified values back to the recipe DB, using the WRIT_DBL instruction.

Recipe export (from recipe DB to CSV file)

The complete set of recipe records can be generated as a CSV file using the RecipeExport instruction. Unused recipe records are also exported.

Recipe import (from CSV file to recipe DB)

Once a recipe export operation is completed, then you can use the generated CSV file as a data structure template.

1. Use the file browser page in the CPU web server to download an existing recipe CSV file from the CPU to a PC
2. Modify the recipe CSV with an ASCII text editor. You can modify the start values assigned to components, but not the data types or data structure
3. Upload the modified CSV file from PC back to the CPU. However, the old CSV file in CPU load memory (with the same name) must be deleted or renamed before the CPU Web server allows the upload operation.
4. After the modified CSV file is uploaded to the CPU, then you can use the RecipeImport instruction to transfer the new start values from the modified CSV file (in CPU load memory) to the recipe DB (in CPU load memory).

9.9.1.2 Recipe example

Example recipes

The table below shows how to prepare recipe information for use in a recipe DB. The example recipe DB stores five records, three of which are used. The fourth and fifth records are free for later expansions. Each table row represents one record that stores the recipe name, component data types, and component values.

productname	water	barley	wheat	hops	yeast	waterTmp	mashTmp	mashTime	QTest
Pils	10	9	3	280	39	40	30	100	0
Lager	10	9	3	150	33	50	30	120	0
BlackBeer	10	9	3	410	47	60	30	90	1
Not_used	0	0	0	0	0	0	0	0	0
Not_used	0	0	0	0	0	0	0	0	0

Creating a recipe data block

Note

Rules for recipe data blocks

- The recipe DB must contain a single dimension array of either a PLC data type or a struct. The recipe example shows how to create a recipe DB with a PLC data type.
- In the example, the data type of the component ingredients are all the UINT data type. The component data types may also be a mix of any data type except for structs. In a recipe DB array element, a struct in a PLC data type or a struct in a struct is not allowed.

First, create a new PLC data type

Add a new PLC data type whose name is the recipe type. In the following image, "Beer_Recipe" is the new complex PLC data type that stores a sequence of simple data types. The "Beer_Recipe" PLC data type is a data template that is reused in each recipe DB record and also in the active recipe DB. Enter the component names and data types that are common to all the example recipes. The individual component values are added later in the recipe DB.

Beer_Recipe

	Name	Data type	Default value
1	productname	String[20]	'Beer_Recipe'
2	water	UInt	0
3	barley	UInt	0
4	wheat	UInt	0
5	hops	UInt	0
6	yeast	UInt	0
7	waterTmp	UInt	0
8	mashTmp	UInt	0
9	mashTime	UInt	0
10	QTest	UInt	0

Second, create a recipe data block

- Create your recipe DB as a global data block with the DB property "Only store in load memory" enabled.
- The name of a recipe data block is used as file name of the corresponding CSV file. The DB name characters you assign must follow the Windows file system naming restrictions. Characters \ / : * ? " < > | and the space character are not allowed.
- The recipe array assignment is "Products" as Array [1.. 5] of "Beer_Recipe". The array size 5 is the maximum number of recipe flavors that are possible.
- The values for recipe components are added as DB start values.

In the following image, the "BlackBeer" recipe is expanded to show all the components of a recipe record.

Recipe_DB

	Name	Data type	Offset	Start value
1	Static			
2	Products	Array [1 .. 5] of "Beer_Recipe"	...	
3	Products[1]	"Beer_Recipe"	...	
4	Products[2]	"Beer_Recipe"	...	
5	Products[3]	"Beer_Recipe"	...	
6	productname	String[20]	...	'BlackBeer'
7	water	UInt	...	10
8	barley	UInt	...	9
9	wheat	UInt	...	3
10	hops	UInt	...	410
11	yeast	UInt	...	47
12	waterTmp	UInt	...	60
13	mashTmp	UInt	...	30
14	mashTime	UInt	...	90
15	QTest	UInt	...	1
16	Products[4]	"Beer_Recipe"	...	
17	Products[5]	"Beer_Recipe"	...	

Recipe export (from recipe DB to CSV file)

"RecipeExport (Page 488)" execution transfers recipe DB data to a CSV file, as shown in the following text file.

```
Recipe_DB.csv
index,productname,water,barley,wheat,hops,yeast,waterTmp,
mashTmp,mashTime,QTest
1,”Pils”,10,9,3,280,39,40,30,100,0
2,”Lager”,10,9,3,150,33,50,30,120,0
3,”BlackBeer”,10,9,3,410,47,60,30,90,1
4 ”Not_used”,0,0,0,0,0,0,0,0,0
5 ”Not_used”,0,0,0,0,0,0,0,0,0
```

Recipe import (from CSV file to recipe DB)

1. Use the file browser page (Page 1017) in the Web server to download an existing recipe CSV file from CPU load memory to a PC
2. Modify the recipe CSV with an ASCII text editor. You can modify the start values assigned to components, but not the data types or data structure
3. Upload the modified CSV file from the PC back to the CPU. You must, however, delete or rename the old CSV file in CPU load memory (of the same name) before the Web server allows the upload operation.
4. After you upload the modified CSV file to the CPU, then you can use the RecipeImport instruction to transfer the new start values from the modified CSV file (in CPU load memory) to the recipe DB (in CPU load memory).

CSV files must exactly match the corresponding recipe DB structure

- The values in the CSV file can be changed, but changing the structure is not allowed. The RecipeImport instruction requires that the exact number of records and components matches the destination recipe DB structure. Otherwise, RecipeImport execution fails. For example, if 10 recipes are defined in the recipe DB but only 6 are in use, then line 7 to 10 in the CSV file are also transferred to the DB. You must coordinate whether this data is valid or not. For example, you can assign a variable “Not_used” for the product name in unused recipe records.
- If you add data records to the text file and import the modified file, make sure the recipe DB array limit you assign has enough elements for all the recipe records.
- An index number is automatically generated during export to the CSV file. If you create additional data records, add consecutive index numbers accordingly.
- RecipeImport execution checks the CSV file data for correct structure and whether the values fit in the data types assigned in the associated recipe DB. For example, a Bool data type cannot store an integer value and the RecipeImport execution fails.

Display CSV recipe data in Excel

You can open the CSV file in Excel for easy reading and editing. If the commas are not recognized as decimal separators, use the Excel import function to output the data in structured form.

	A	B	C	D	E	F	G	H	I	J	K
1	index	product	water	barley	wheat	hops	yeast	waterTmp	mashTmp	mashTime	QTest
2	1	"Pils"	10	9	3	280	39	40	30	100	0
3	2	"Lager"	10	9	3	150	33	50	30	120	0
4	3	"BlackBeer"	10	9	3	410	47	60	30	90	1
5	4	"Not_used"	0	0	0	0	0	0	0	0	0
6	5	"Not_used"	0	0	0	0	0	0	0	0	0

Note

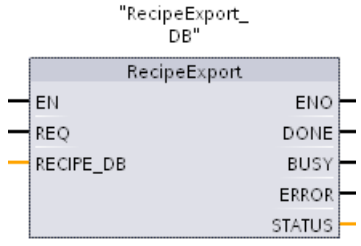
Commas in the name field of the PLC data type element

Do not place commas in the name field of the PLC data type element(s) used in a recipe. If you place commas in the name field, Excel inserts extra columns in the displayed .csv file. These extra columns can introduce errors when you edit the recipe record file start values.

9.9.1.3 Program instructions that transfer recipe data

RecipeExport (Recipe export)

Table 9- 194 RecipeExport instruction

LAD/FBD	SCL	Description
	`"RecipeExport_DB"( req:=_bool_in_, done=>_bool_out_, busy=>_bool_out_, error=>_bool_out_, status=>_word_out_, Reci- pe_DB:=_variant_inout_);`	The "RecipeExport" instruction exports all recipe records from a recipe data block to the CSV file format. The CSV file contains product names, component names, and start values. The CSV file is stored in internal load memory or external load memory, if an optional external "program" memory card is installed. The export operation is triggered by the "REQ" parameter. The BUSY parameter is set to "1" during export processing. After the execution of RecipeExport stops, BUSY is reset to "0" and the completion of the operation is indicated with "1" at the DONE parameter. If an error occurs during execution, then parameters ERROR and STATUS indicate the result.

A recipe DB must be created before a recipe export is possible. The name of a recipe data block is used as the file name of the new CSV file. If a CSV file with an identical name already exists, then it is overwritten during the export operation.

You can use the File Browser page (Page 1017) of the CPU's built-in Web server to access the recipe CSV file. The file is put in the recipe folder in the root directory of CPU load memory.

Table 9- 195 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Control parameter REQUEST: Activates the export on a positive edge.
RECIPE_DB	In/Out	Variant	Pointer to the recipe data block. Refer to the "Recipe DB example (Page 485)" for details. The DB name characters must follow the Windows file system naming restrictions. Characters \ / : * ? " < > | and the space character are not allowed.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error. (Default value: False)
BUSY	OUT	Bool	RecipeExport execution • 0: No operation in progress • 1: Operation on progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE. • 0: No warning or error • 1: An error has occurred. The STATUS parameter provides information on the type of error.
STATUS	OUT	Word	Execution condition code

Table 9- 196 Values of ERROR and STATUS

ERROR	STATUS (W#16#....)	Description
0	0000	No error
0	7000	Call with no REQ edge: BUSY = 0, DONE = 0
0	7001	First call with REQ edge (working): BUSY = 1, DONE = 0
0	7002	N^{th} call (working): BUSY = 1, DONE = 0
1	8070	All instance memory is in use.
1	8090	File name contains invalid characters
1	8091	The data structure referenced with RECIPE_DB cannot be processed.
1	8092	Data structure specified in RECIPE_DB exceeds 5000 bytes
1	80B3	Not enough space in on MC or in internal load memory
1	80B4	MC is write protected
1	80B6	Recipe DB attribute "Only store in load memory" is not enabled.
1	80C0	CSV file is temporarily locked
1	80C1	DB is temporarily locked

RecipeImport (Recipe import)

Table 9- 197 RecipeImport instruction

LAD/FBD	SCL	Description

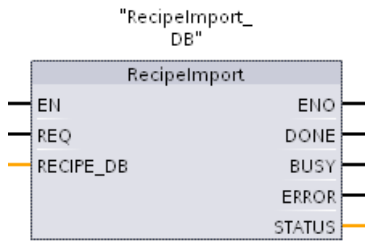
	`"RecipeImport_DB"(`
	`req:=_bool_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`Reci-`
	`pe_DB:=_variant_inout_);`
		The "RecipeImport" instruction imports recipe data from a CSV file, in CPU load memory, to a recipe data block referenced by the RECIPE_DB parameter. Start values in the recipe data block are overwritten by the import process. The import operation is triggered by the "REQ" parameter. The BUSY parameter is set to "1" during import processing. After the execution of RecipeImport stops, BUSY is reset to "0" and the completion of the operation is indicated with "1" at the DONE parameter. If an error occurs during execution, then parameters ERROR and STATUS indicate the result.

Table 9- 198 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Control parameter REQUEST: Activates the import on a positive edge.
RECIPE_DB	In/Out	Variant	Pointer to the recipe data block. Refer to "Recipe DB example (Page 485)" for details. The DB name characters must follow the Windows file system naming restrictions. Characters \ / : * ? " < > | and the space character are not allowed.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error. (Default value: False)
BUSY	OUT	Bool	• 0 - No operation in progress • 1 - Operation on progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code (Default value: 0)

A recipe DB that contains a structure which is consistent with the CSV file data structure must exist, before a recipe import operation is possible.

CSV file rules:

- The CSV file must be located in the root directory "Recipes" folder of internal load memory or external load memory, if an optional external "program" memory card is installed.
- The name of the CSV file must match the name of the data block at the RECIPE_DB parameter.

- The first line (header) of the CSV file contains the name of the recipe components. The first line is ignored during import. The names of the recipe components in the CSV file and the data block are not reconciled during the import process.
- In each case the first value in each line of the CSV file is the index number of the recipe. The individual recipes are imported in the order of the index. For this, the index in the CSV file has to be in ascending order and may contain no gaps (if this is not the case, the error message 80B0 is output at the STATUS parameter).
- The CSV file may not contain more recipe data records than provided for in the recipe data block. The maximum number of data records is indicated by the array limits in the data block.

Table 9- 199 Values of ERROR and STATUS

ERROR	STATUS (W#16#....)	Description
0	0000	No error
0	7000	Call with no REQ edge: BUSY = 0, DONE = 0
0	7001	First call with REQ edge (working): BUSY = 1, DONE = 0
0	7002	N^{th} call (working): BUSY = 1, DONE = 0
1	8070	All instance memory is in use.
1	8090	The file name contains invalid characters.
1	8092	No matching CSV file found for the import. Possible cause: The name of the CSV file does not match the name of the recipe DB.
1	80C0	CSV file is temporarily locked.
1	80C1	Data block is temporarily locked.
1	80B0	Numbering in the index of the CSV file is not continuous, not ascending or exceeds the maximum number (array limit) in the data block.
1	80B1	Structure of the recipe data block and the CSV file do not match: The CSV file contains too many fields.
1	80B2	Structure of the recipe data block and the CSV file do not match: The CSV file contains too few fields.
1	80B6	Recipe DB attribute "Only store in load memory" is not enabled.
1	80D0 +n	Structure of the recipe data block and the CSV file do not match: Data type in field n does not match (n<=46).
1	80FF	Structure of the recipe data block and the CSV file do not match: Data type in field n does not match (n>46).

9.9.1.4 Recipe example program

Prerequisites for the recipe example program

The prerequisites for the recipe example program are as follows:

- A recipe DB that stores all recipe records. The recipe DB is stored in load memory.
- An active recipe DB that stores a copy of one recipe in work memory.

Refer to the "Recipe DB example (Page 485)" for details about the recipe DB and the corresponding CSV file.

Create the active recipe DB

On the "Add new block" window:

- Select the "Data block" button on the "Add new block" window
- On the "Type" drop-down menu, select the "Beer_recipe" PLC data type that you created previously.

Start values are not required. The DB data values are set when one recipe is transferred from the recipe DB to the active recipe DB. In the example, the active recipe DB is the destination for READ_DBL data and provides source data for WRITE_DBL. The following image shows the Active_Recipe DB.

Active_Recipe

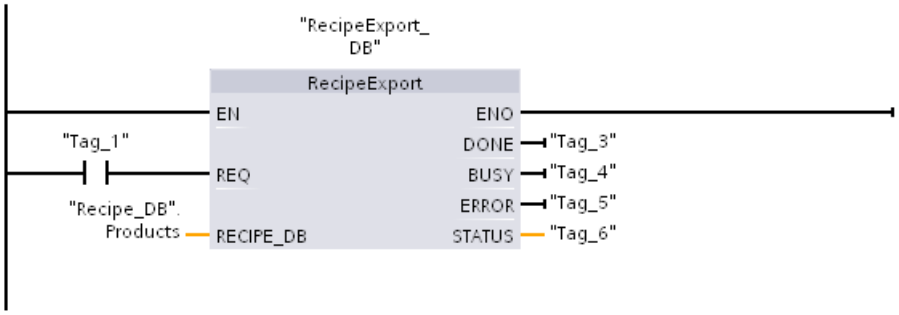
	Name	Data type	Start value
1	Static		
2	productname	String[20]	'Beer_Recipe'
3	water	UInt	0
4	barley	UInt	0
5	wheat	UInt	0
6	hops	UInt	0
7	yeast	UInt	0
8	waterTmp	UInt	0
9	mashTmp	UInt	0
10	mashTime	UInt	0
11	QTest	UInt	0

Instance DBs

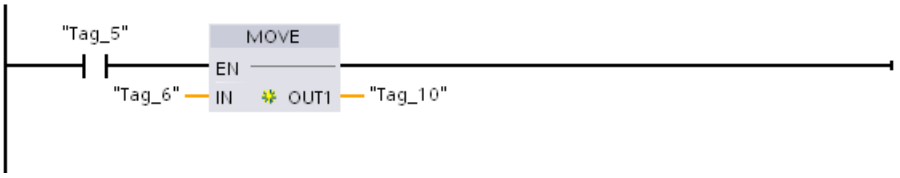
The instance DBs used by instructions RecipeExport ("RecipeExport_DB") and RecipeImport ("RecipeImport_DB") are created automatically when you place the instructions in your program. The instance DBs are used to control instruction execution and are not referenced in the program logic.

Example recipe program

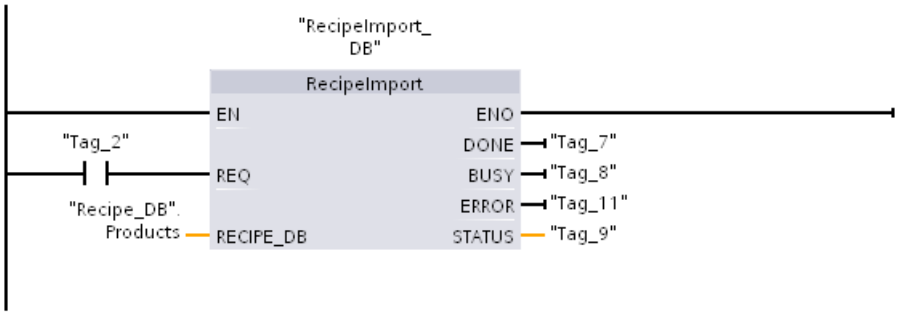
Network 1 A rising edge on REQ starts the export process. A CSV file is generated from the recipe DB data and placed in the CPU memory recipes folder.



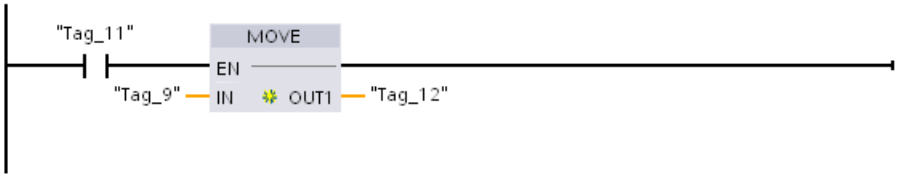
Network 2 Capture the STATUS output from RecipeExport execution, because it is only valid for one scan.



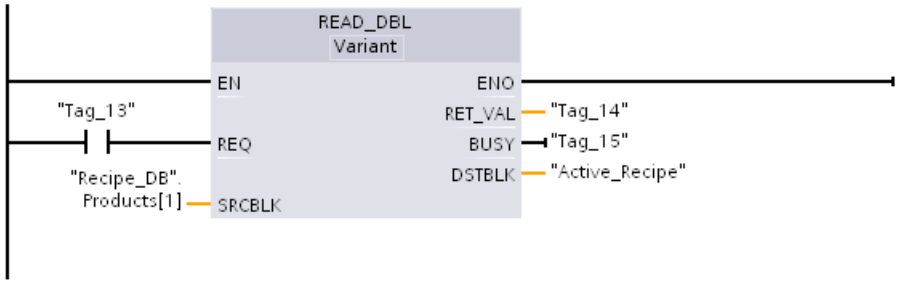
Network 3 A rising edge on REQ starts the import process. The existing recipe DB is loaded with all recipe data read from the corresponding CSV file that is located in the CPU memory recipes folder.



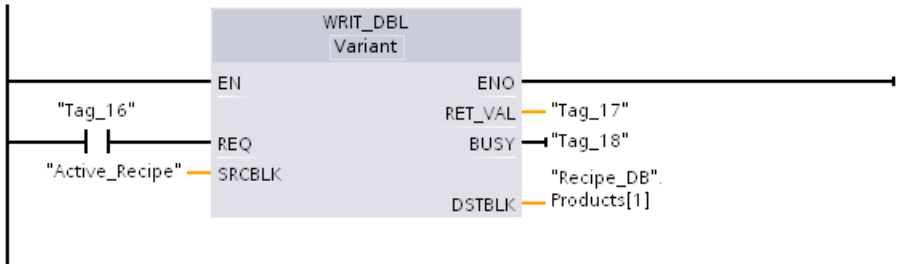
Network 4 Capture the STATUS output from RecipeImport execution, because it is only valid for one scan.



Network 5 READ_DBL copies the start values from one recipe "Recipe_DB". Products[1] (in CPU load memory) to the Active_Recipe DB current values (in CPU work memory). After READ_DBL execution, your program logic can access the recipe component values by addressing locations in the Active_Recipe DB. For example, the symbolic addresses ("Active_Recipe".productname) and ("Active_Recipe.water) provide your program logic with the current recipe name and quantity of water.



Network 6 During run time, An HMI device could modify a component value stored in the Active_Recipe DB. Improved recipe data can be stored by executing WRIT_DBL. In the example, all Recipe_DB start values for the single recipe "Recipe_DB". Products[1] are overwritten by the current values from the "Active_Recipe" DB.



9.9.2 Data logs

Your control program can use the Data log instructions to store run-time data values in persistent log files. The CPU stores data log files in flash memory (CPU or memory card) in standard CSV (Comma Separated Value) format. The CPU organizes the data records as a circular log file of a pre-determined size.

You use the Data log instructions in your program to create, open, write a record to, and close the log files. You decide which program values to log by creating a data buffer that defines a single log record. The CPU uses your data buffer as temporary storage for a new log record. Your control program moves new current values into the buffer during runtime. When the program has updated all of the current data values, it can then execute the DataLogWrite instruction to transfer data from the buffer to a data log record.

You can open, edit, save, rename, and delete data log files from the File Browser page of the Web Server. You must have read privileges to view the file browser and you must have modify privileges to edit, delete, or rename data log files.

9.9.2.1 Data log record structure

The DATA and HEADER parameters of the DataLogCreate instruction assign the data type and the column header description of all data elements in a log record.

DATA parameter for the DataLogCreate instruction

The DATA parameter points to memory used as a temporary buffer for a new log record and must be assigned to an M or DB location.

You can assign an entire DB (derived from a PLC data type that you assign when the DB is created) or part of a DB (the specified DB element can be any data type, data type structure, PLC data type, or data array).

Structure data types are limited to a single nesting level. The total number of data elements declared should correspond to the number of columns specified in the header parameter. The maximum number of data elements you can assign is 253 (with a timestamp) or 255 (without a timestamp). This restriction keeps your record inside the 256 column limit of an Excel sheet.

The DATA parameter can assign either retentive or non-retentive data elements in a "Standard" (compatible with S7-300/400) or "Optimized" DB type.

In order to write a Data log record you must first load the temporary DATA record with new process values and then execute the DataLogWrite instruction that saves new record values in the Datalog file.

HEADER parameter for the DataLogCreate instruction

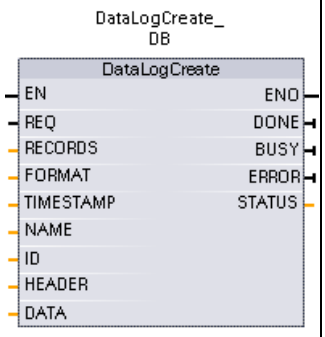
The HEADER parameter points to column header names for the top row of the data matrix encoded in the CSV file. HEADER data must be located in DB or M memory and the characters must follow standard CSV format rules with commas separating each column name. The data type may be a string, byte array, or character array. Character/byte arrays allow increased size, where strings are limited to a maximum of 255 bytes. The HEADER parameter is optional. If the HEADER is not assigned, then no header row is created in the Data log file.

9.9.2.2 Program instructions that control data logs

DataLogCreate (Create data log)

Table 9- 200 DataLogCreate instruction

LAD/FBD	SCL	Description

	`"DataLogCreate_DB"(`
	`req:=_bool_in_,`
	`records:=_udint_in_,`
	`format:=_uint_in_,`
	`timestamp:=_uint_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`name:=_string_inout_,`
	`ID:=_dword_inout_,`
	`header:=_variant_inout_,`
	`data:=_variant_inout_);`
		Creates and initializes a data log file. The CPU creates the file in the \DataLogs folder, using the name in the NAME parameter, and implicitly opens the file for write operations. You can use the Data log instructions in your program to store runtime process data in the flash memory of the CPU or on the memory card.
		STEP 7 automatically creates the associated instance DB when you insert the instruction.

[1] In the SCL example, "DataLogCreate_DB" is the name of the instance DB.

Table 9- 201 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	A low to high (positive edge) signal starts the operation. (Default value: False)
RECORDS	IN	UDint	The maximum number of data records the circular data log can contain before overwriting the oldest entry: The header record is not included. Sufficient available PLC load memory must exist in order to successfully create the data log. (Default value - 1)
FORMAT	IN	UInt	Data log format: • 0 - Internal format (not supported) • 1 - Comma separated values "csv-eng" (Default value)
TIMESTAMP	IN	UInt	Data time stamp format: Column headers for date and time fields are optional. The time stamp can use either the system time (Coordinated Universal Time - UTC) or the local time. • 0 - No time stamp • 1 - Date and time stamp, system time (Default value) • 2 - Date and time stamp, local time

Parameter and type		Data type	Description
NAME	IN	Variant	Data log name: You provide the name. This variant only supports a String data type and must be located in DB, or local memory. (Default value: ' ') The string reference is the name of the data log file. Use characters from the ASCII character set, with the exception of the characters \ / : * ? " < > | and the space character.
ID	In/Out	DWord	Data log numeric identifier: You store this generated value for use with other Data log instructions. The ID parameter is only used as an output with the DataLogCreate instruction. (Default value: 0) Symbolic name access for this parameter is not allowed.
HEADER	In/Out	Variant	Pointer to data log column header names for the top row of the data matrix encoded in the CSV file. (Default value: null). HEADER data must be located in DB or M memory. The characters must follow standard CSV format rules with commas separating each column name. The data type may be a string, byte array, or character array. Character/byte arrays allow increased size, where strings are limited to a maximum of 255 bytes. The HEADER parameter is optional. If the HEADER is not parameterized, then no header row is created in the Data log file.
DATA	In/Out	Variant	Pointer to the record data structure, user defined type (UDT), or array. Record data must be located in DB or M memory. The DATA parameter specifies the individual data elements (columns) of a data log record and their data type. Structure data types are limited to a single nesting level. The number of data elements declared should correspond to the number of columns specified in the header parameter. The maximum number of data elements you can assign is 253 (with a timestamp) or 255 (without a timestamp). This restriction keeps your record inside the 256 column limit of an Excel sheet.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error. (Default value: False)
BUSY	OUT	Bool	• 0 - No operation in progress • 1 - Operation on progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code (Default value: 0)

The CPU creates a data log file with a pre-determined fixed sized based on the RECORDS and DATA parameters and organizes the data records as a circular log file. The DataLogCreate instruction allocates persistent CPU memory for the entire data log when the instruction returns DONE = TRUE. The required memory in the CPU is greater than the size of the file due to file system management and related values. The persistent memory for the data log remains allocated until the CPU deallocates the memory in one of the following ways:

- The user program calls the DataLogDelete instruction
- A Web server user deletes the data log from the Web server
- A SIMATIC Automation Tool user deletes the data log from the SIMATIC Automation Tool

Deleting the data log file by other means, such as using a card reader, does not deallocate the CPU persistent memory for the data log.

The DataLogWrite instruction appends new records to the data log file until it stores the maximum number of records that is specified by the RECORDS parameter. The next record written will overwrite the oldest record. Another DataLogWrite operation will overwrite the next oldest data record and so on.

Memory resource usage:

- The data logs consume only load memory.
- The size of all data logs combined is limited by the available resources of load memory. Only eight data logs can be open at one time. You can manage your data logs from the File Browser (Page 1017) standard Web page. See the description of this standard Web page for guidelines on how many data logs to maintain at a time.
- The maximum possible number for the RECORDS parameter is the limit for an UDint number (4,294,967,295). The actual limit for the RECORD parameter depends on the size of a single record, the size of other data logs, and the available resources of load memory. In addition, Excel limits the number of rows allowed in an Excel sheet.

Note

Data log creation execution must be complete before starting a data log write operation

- DataLogCreate and DataLogNewFile log file creation operations extend over many program scan cycles. The actual time required for the log file creation depends on the record structure and number of records. Your program logic must monitor and catch the DONE bit's transition to the TRUE state that signals the completion of a log file creation. If the user program executes a DataLogWrite instruction before a data log creation operation is complete, then the write operation will fail to write a new data log record as expected.
- In certain situations when a very fast program scan is running, data log creation can take an extended time. If the long creation time is too slow, you should ensure that the checkbox for the Enable minimum cycle time for cyclic OBs is active, and the minimum cycle time is set to one ms or greater. Refer to Configuring the cycle time and communication load (Page 107) for more information.

Note

The DataLogNewFile instruction copies an existing data log's record structure

If you want to prevent overwriting any data records, then you can use the DataLogNewFile instruction to create a new data log based on the current data log, after the current data log has stored the maximum number of records. New data records are stored in the new data log file. The old data log file and record data remain stored in flash memory.

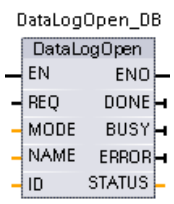
Table 9- 202 Values of ERROR and STATUS

ERROR	STATUS (W#16#....)	Description
0	0000	No error
0	7000	Call with no REQ edge: BUSY = 0, DONE = 0
0	7001	First call with REQ edge (working): BUSY = 1, DONE = 0
0	7002	N^{th} call (working): BUSY = 1, DONE = 0
1	8070	All internal instance memory is in use.
1	807F	Internal error
1	8090	Invalid file name
1	8091	Name parameter is not a String reference.
1	8093	A data log already exists with that name. Use a different name, make sure the existing data log's .csv file is not open, and then use the File Browser (Page 1017) page of the Web Server to delete the existing data log.
1	8097	Requested file length exceeds file system maximum.
1	80B2	Out of resource IDs Note: Delete some existing data logs or decrease the number of columns in the data record structure to avoid this error.
1	80B3	Insufficient load memory available.
1	80B4	MC (memory card) is write-protected.
1	80C0	Archive file is locked
1	80C1	Too many open files: No more than eight opened data log files are allowed.
1	8253	Invalid record count
1	8353	Invalid format selection
1	8453	Invalid timestamp selection
1	8B24	Invalid HEADER area assignment: For example, pointing to local memory
1	8B51	Invalid HEADER parameter data type
1	8B52	Too many HEADER parameter data elements
1	8C24	Invalid DATA area assignment: For example, pointing to local memory
1	8C51	Invalid DATA parameter data type
1	8C52	Too many DATA parameter data elements

DataLogOpen (Open data log)

Table 9- 203 DataLogOpen instruction

LAD / FBD	SCL	Description

	`"DataLogOpen_DB"(`
	`req:=_bool_in_,`
	`mode:=_uint_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`name:=_string_inout_,`
	`ID:=_dword_inout_);`
		Opens a pre-existing data log file. You must open a data log before you can write (Page 501) new records to the log. You can open and close data logs individually. A maximum of eight data logs can be open at the same time.
		STEP 7 automatically creates the associated instance DB when you insert the instruction.

[2] In the SCL example, "DataLogOpen_DB" is the name of the instance DB.

Table 9- 204 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	A low to high (positive edge) signal starts the operation. (Default value: False)
MODE	IN	UInt	Operation mode: • 0 - Append to existing data (Default value) • 1 - Clear all existing records
NAME	IN	Variant	Name of an existing data log: This variant only supports a String data type and can only be located in local, DB, or M memory. (Default value: ' ')
ID	In/Out	DWord	Numeric identifier of a data log. (Default value: 0) **Note:** Symbolic name access for this parameter is not allowed.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error. (Default value: False)
BUSY	OUT	Bool	• 0 - No operation in progress • 1 - Operation in progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code (Default value: 0)

You can provide either the NAME or an ID (ID parameter as an input) of a pre-existing data log. If you provide both parameters and a valid ID does correspond to the NAME data log, then the ID is used, and the NAME ignored.

The NAME must be the name of a data log created by the DataLogCreate instruction. If only the NAME is provided and the NAME specifies a valid data log, then the corresponding ID will be returned (ID parameter as an output).

Note

General usage of data log files

- Data log files are automatically opened after the DataLogCreate and DataLogNewFile operations.
- Data log files are automatically closed after a PLC run to stop transition or a PLC power cycle.
- A Data log file must be open before a new DataLogWrite operation is possible.
- A maximum of eight data log files may be open at one time. More than eight data log files may exist, but some of them must be closed so no more than eight are open.

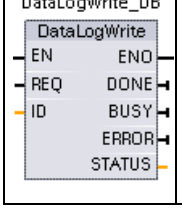
Table 9- 205 Values of ERROR and STATUS

ERROR	STATUS (W#16#)	Description
0	0000	No error
0	0002	Warning: Data log file already open by this application program
0	7000	Call with no REQ edge: BUSY = 0, DONE = 0
0	7001	First call with REQ edge (working): BUSY = 1, DONE = 0
0	7002	N^{th} call (working): BUSY = 1, DONE = 0
1	8070	All internal instance memory is in use.
1	8090	Data log definition is inconsistent with existing data log file.
1	8091	Name parameter is not a String reference.
1	8092	Data log does not exist.
1	80C0	Data log file is locked.
1	80C1	Too many open files: No more than eight opened data log files are allowed.

DataLogWrite (Write data log)

Table 9- 206 DataLogWrite instruction

LAD / FBD	SCL	Description

	`"DataLogWrite_DB"(`
	`req:=_bool_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`ID:=_dword_inout_);`
		Writes a data record into the specified data log. The pre-existing target data log must be open (Page 500) before you can write to it with a DataLogWrite instruction.
		STEP 7 automatically creates the associated instance DB when you insert the instruction.

[2] In the SCL example, "DataLogWrite_DB" is the name of the instance DB.

Table 9- 207 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	A low to high (positive edge) signal starts the operation. (Default value: False)
ID	In/Out	DWord	Numeric data log identifier. Only used as an input for the DataLogWrite instruction. (Default value: 0) **Note:** Symbolic name access for this parameter is not allowed.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error.
BUSY	OUT	Bool	• 0 - No operation in progress • 1 - Operation on progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code (Default value: 0)

The DATA parameter of a DataLogCreate instruction defines the memory address and data structure of the record buffer. The control program must load the record buffer with current runtime process values and then execute the DataLogWrite instruction to move new record data from the buffer to the data log.

The ID parameter identifies a data log and data record configuration. The DataLogCreate instruction generates the ID number.

If there are empty records in the circular data log file, then the DataLogWrite instruction writes the next available empty record. If all records are full, then the DataLogWrite instruction overwrites the oldest record.

NOTICE

Data log creation operations must be complete, before starting a data log write operation

DataLogCreate and DataLogNewFile log file creation operations extend over many program scan cycles. The actual time required for the log file creation depends on the record structure and number of records. Your program logic must monitor and catch the DONE bit's transition to the TRUE state that signals the completion of a log file creation. If a DataLogWrite instruction executes before a data log creation operation is complete, then the write operation does not write a new data log record.

Note

Effect of data logs on internal CPU memory

Each data log write consumes at a minimum 2 KB of memory. If your program writes small amounts of data frequently, it is consuming at least 2 KB of memory on each write. A better implementation would be to accumulate the small data items in a data block (DB), and to write the data block to the data log at less frequent intervals.

If your program writes many data log entries at a high frequency, consider using a replaceable SD memory card.

NOTICE
Potential for data log data loss during a CPU power failure If there is a power failure during an incomplete DataLogWrite operation, then the data record being transferred to the data log could be lost.

Table 9- 208 Values of ERROR and STATUS

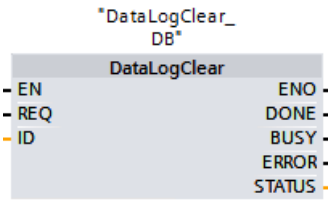
ERROR	STATUS (W#16#)	Description
0	0000	No error
0	0001	Indicates that the data log is full: Each data log is created with a specified maximum number of records. The last record of the maximum number has been written. The next write operation will overwrite the oldest record.
0	7000	Call with no REQ edge: BUSY = 0, DONE = 0
0	7001	First call with REQ edge (working): BUSY = 1, DONE = 0
0	7002	N^{th} call (working): BUSY = 1, DONE = 0
1	8070	All internal instance memory is in use.
1	8092	Data log does not exist.
1	80B0	Data log file is not open (for explicit open mode only).

DataLogClear (Empty data log)

Description

Table 9- 209 DataLogClear instruction

LAD / FBD	SCL	Description

	`"DataLogClear_DB"(`
	`REQ:=_bool_in_,`
	`DONE=>_bool_out_,`
	`BUSY=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`ID:=_dword_inout_);`
		The "DataLogClear" instruction deletes all data records in an existing data log. The instruction does not delete the optional header of the CSV file (see the description of the HEADER parameter of the instruction "DataLogCreate (Page 496)").
		You use the ID parameter to select the data log whose data records are to be deleted.

"DataLogClear_DB" is the name of the instance DB.

Requirement

Before you can delete data records, the data log must be open (see "DataLogOpen (Page 500) instruction").

Parameters

The following table shows the parameters of the "DataLogClear" instruction:

Parameter	Declaration	Data type	Memory area	Description
REQ	Input	BOOL	I, Q, M, L, D, T, C or constant (T and C are only available in LAD and FBD with S7-1500)	Execution of the instruction upon a rising edge.
ID	InOut	DWORD	I, Q, M, D, L	Numeric data log identifier
DONE	Output	BOOL	I, Q, M, D, L	Instruction was executed successfully.
BUSY	Output	BOOL	I, Q, M, D, L	Execution of the instruction not yet complete.
ERROR	Output	BOOL	I, Q, M, D, L	• 0: No error. • 1: An error occurred during execution of the instruction. Detailed information is output at the STATUS parameter.
STATUS	Output	WORD	I, Q, M, D, L	Status parameter The parameter is only set for the duration of one call. To display the status, you should therefore copy the STATUS parameter to a free data area.

You can find additional information on valid data types under "Data types (Page 122)".

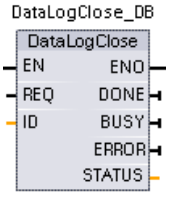
Parameter STATUS

Error code* (W#16#...)	Explanation
0000	No error.
7000	No job processing active.
7001	Start of job processing. Parameter BUSY = 1, DONE = 0
7002	Intermediate call (REQ irrelevant): Instruction already active; BUSY has the value "1".
8080	The data log file selected with the ID parameter cannot be processed with the "DataLogClear" instruction.
8092	Data log does not exist.
80A2	Write error signaled back by the file system.
80B0	Data log is not open.
80B4	The memory card is write-protected.
* The error codes can be displayed as integer or hexadecimal values in the program editor. For information on switching the display formats, refer to "See also".	

DataLogClose (Close data log)

Table 9- 210 DataLogClose instruction

LAD / FBD	SCL	Description

	`"DataLogClose_DB"(`
	`req:=_bool_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`ID:=_dword_inout_);`
		Closes an open data log file. DataLogWrite operations to a closed data log result in an error. No write operations are allowed to this data log until another DataLogOpen operation is performed.
		A transition to STOP mode will close all open data log files.
		STEP 7 automatically creates the associated instance DB when you insert the instruction.

[2] In the SCL example, "DataLogClose_DB" is the name of the instance DB.

Table 9- 211 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	A low to high (positive edge) signal starts the operation. (Default value: False)
ID	In/Out	DWord	Numeric identifier of a data log. Only used as an input for the DataLogClose instruction. (Default value: 0) **Note:** Symbolic name access for this parameter is not allowed.
DONE	OUT	Bool	The DONE bit is TRUE for one scan after the last request was completed with no error.
BUSY	OUT	Bool	• 0 - No operation in progress • 1- Operation in progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code (Default value: 0)

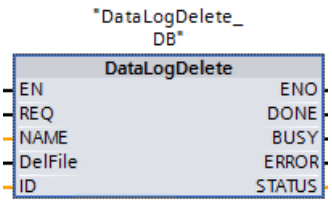
Table 9- 212 Values of ERROR and STATUS

ERROR	STATUS (W#16#)	Description
0	0000	No error
0	0001	Data log not open
0	7000	Call with no REQ edge: BUSY = 0, DONE = 0
0	7001	First call with REQ edge (working): BUSY = 1, DONE = 0
0	7002	N^{th} call (working): BUSY = 1, DONE = 0
1	8092	Data log does not exist.

DataLogDelete (Delete data log)

Table 9- 213 DataLogDelete instruction

LAD / FBD	SCL	Description

	`"DataLogDelete_DB"(`
	`REQ:=_bool_in_,`
	`NAME:=_variant_in_,`
	`DelFile:=_bool_in_,`
	`DONE=>_bool_out_,`
	`BUSY=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`ID:=_dword_inout_);`
		You use the "DataLogDelete" instruction to delete a data log file. The data log and the data records it contains can only be deleted if it was created with the "DataLogCreate" or "DataLogNewFile" instruction.

"DataLogDelete_DB" is the name of the instance DB.

Parameters

The following table shows the parameters of the "DataLogDelete" instruction:

Parameter	Declaration	Data type	Memory area	Description
REQ	Input	BOOL	I, Q, M, L, D, T, C or constant (T and C are only available in LAD and FBD with S7-1500)	Execution of the instruction upon a rising edge.
NAME	Input	VARIANT	L, D	File name of the data log
DELFILE	Input	BOOL	I, Q, M, D, L or constant	• 0: Data log is retained. • 1: Data log is deleted.
ID	InOut	DWORD	I, Q, M, D, L	Numeric data log identifier
DONE	Output	BOOL	I, Q, M, D, L	Instruction executed successfully.
BUSY	Output	BOOL	I, Q, M, D, L	Deletion of the data log is not yet complete.
ERROR	Output	BOOL	I, Q, M, D, L	• 0: No error. • 1: An error occurred during execution of the instruction. Detailed information is output at the STATUS parameter.
STATUS	Output	WORD	I, Q, M, D, L	Status parameter The parameter is only set for the duration of one call. To display the status, you should therefore copy the STATUS parameter to a free data area.

You can find additional information on valid data types under "Data types (Page 122)".

Parameters NAME and ID

Select the data log to be deleted using the NAME and ID parameters. The ID parameter is evaluated first. If there is a data log with the relevant ID, the NAME parameter will not be evaluated. If the value "0" is used at the ID parameter, a value with the data type STRING must be used at the NAME parameter.

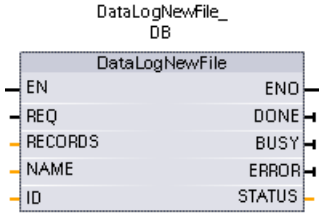
Parameter RET_VAL

Error code* (W#16#...)	Explanation
0	No error.
7000	No job processing active.
7001	Start of job processing. Parameter BUSY = 1, DONE = 0
7002	Intermediate call (REQ irrelevant): Instruction already active; BUSY has the value "1".
8091	A data type other than STRING is being used at the NAME parameter.
8092	Data log does not exist.
80A2	Write error signaled back by the file system.
80B4	The memory card is write-protected.
* The error codes can be displayed as integer or hexadecimal values in the program editor. For information on switching the display formats, refer to "See also".	

DataLogNewFile (Data log in new file)

Table 9- 214 DataLogNewFile instruction

LAD / FBD	SCL	Description

	`"DataLogNewFile_DB"(`
	`req:=_bool_in_,`
	`records=:_udint_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`name=:_DataLog_out_,`
	`ID:=_dword_inout_);`
		Allows your program to create a new data log file based upon an existing data log file.
		STEP 7 automatically creates the associated instance DB when you insert the instruction.

[2] In the SCL example, "DataLogNewFile_DB" is the name of the instance DB.

Table 9- 215 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	A low to high (positive edge) signal starts the operation. (Default value: False)
RECORDS	IN	UDInt	The maximum number of data records the circular data log can contain before overwriting the oldest entry. (Default value: 1) The header record is not included. Sufficient available CPU load memory must exist in order to successfully create the data log.
NAME	IN	Variant	Data log name: You provide the name. This variant only supports a String data type and can only be located in local, DB, or M memory. (Default value: ' ') The string reference is also used as the name of the data log file. The name characters must follow the Windows file system naming restrictions. Characters \ / : * ? " < > | and the space character are not allowed.)
ID	In/Out	DWord	Numeric data log identifier(Default value: 0): • At execution, the ID input identifies a valid data log. The new data log configuration is copied from this data log. • After execution, the ID parameter becomes an output that returns the ID of the newly created data log file. **Note:** Symbolic name access for this parameter is not allowed.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error.
BUSY	OUT	Bool	• 0 - No operation in progress • 1 - Operation in progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code (Default value: 0)

You can execute the DataLogNewFile instruction when a data log becomes full or is deemed completed and you do not want to lose any data that is stored in the data log. A new empty data log file can be created based on the structure of the full Data log file. The header record will be duplicated from the original data log with the original data log properties (DATA record buffer, data format, and timestamp settings). The original Data log file is implicitly closed and the new Data log file is implicitly opened.

DataLogWrite parameter trigger: Your program must monitor the ERROR and STATUS parameters of each DataLogWrite operation. When the final record is written and a data log is full, the DataLogWrite ERROR bit = 1 and the DataLogWrite STATUS word = 1. These ERROR and STATUS values are valid for one scan only, so your monitoring logic must use ERROR = 1 as a time gate to capture the STATUS value and then test for STATUS = 1 (the data log is full).

DataLogNewFile operation: When your program logic gets the data log is full signal, this state is used to activate a DataLogNewFile operation. You must execute DataLogNewFile with the ID of an existing (usually full) and open data log, but a new unique NAME parameter. After the DataLogNewFile operation is done, a new data log ID value is returned (as an output parameter) that corresponds to the new data log name. The new data log file is implicitly opened and is ready to store new records. New DataLogWrite operations that are directed to the new data log file, must use the ID value returned by the DataLogNewFile operation.

NOTICE
Data log creation operations must be complete, before starting a data log write operation DataLogCreate and DataLogNewFile log file creation operations extend over many program scan cycles. The actual time required for the log file creation depends on the record structure and number of records. Your program logic must monitor and catch the DONE bit's transition to the TRUE state that signals the completion of a log file creation. If a DataLogWrite instruction is executed before a data log creation operation is complete, then the write operation will fail to write a new data log record as expected.

Table 9- 216 Values of ERROR and STATUS

ERROR	STATUS (W#16#)	Description
0	0000	No error
0	7000	Call with no REQ edge: BUSY = 0, DONE = 0
0	7001	First call with REQ edge (working): BUSY = 1, DONE = 0
0	7002	N^{th} call (working): BUSY = 1, DONE = 0
1	8070	All internal instance memory is in use.
1	8090	Invalid file name
1	8091	Name parameter is not a String reference.
1	8092	Data log does not exist.
1	8093	Data log already exists.
1	8097	Requested file length exceeds file system maximum.
1	80B2	Out of resource IDs Note: Delete some existing data logs to create resources for a new data log.
1	80B3	Insufficient load memory available.
1	80B4	MC is write-protected.
1	80C1	Too many open files.

9.9.2.3 Working with data logs

The data log files are stored as comma separated value format (*.csv) in persistent flash memory. You can view the data logs by using the PLC Web server feature or by removing the PLC memory card and inserting it in a standard PC card reader.

Viewing data logs with the PLC Web server feature

If the PLC PROFINET port and a PC are connected to a network, then you can use a PC web browser like Microsoft Internet Explorer or Mozilla Firefox to access the built-in PLC Web server. The PLC may be in run mode or stop mode when you operate the PLC Web server. If the PLC is in run mode, then your control program continues to execute while the PLC Web server is transferring log data through the network.

Web server access:

1. Enable the Web server in the Device Configuration for the target CPU (Page 983).
2. Connect your PC to the PLC through the PROFINET network (Page 987).
3. Access the CPU through the built-in Web server (Page 991).
4. Download, edit, and delete data log files with the "File Browser" standard Web page (Page 1017).
5. Open the .csv file with a spreadsheet application like Microsoft Excel.

Note

Data log management

Keep no more than 1000 data logs in a file system. Exceeding this number can prevent the Web server from having enough CPU resources to display the data logs.

If you find that the File Browser Web page is not able to display the data logs, then you must place the CPU in STOP mode in order to display and delete data logs.

Manage your data logs to ensure that you only keep the number that you need to maintain, and do not exceed 1000 data logs.

Viewing data logs on a PLC memory card

If the S7-1200 CPU has a "Program" type S7-1200 memory card inserted, then you can remove the memory card and insert the card into a standard SD (Secure Digital) or MMC (MultiMediaCard) card slot on a PC or PG. The PLC is in stop mode when the memory card is removed and your control program is not executed.

Use the Windows file explorer and navigate to the \DataLog directory on the memory card. All your *.csv data log files are located in this directory.

Make a copy of the data log files and put the copies on a local drive of your PC. Then, you can use Excel to open a local copy of a *.csv file and not the original file that is stored on the memory card.

NOTICE
You can copy, but do not modify or delete data log files on a S7-1200 memory card using a PC card reader The standard Web server File Browser page is the recommended tool for viewing, downloading (copying), and deleting data log files. Direct browsing of the memory card file system by the Windows Explorer has the risk that you can accidentally delete/modify data log or other system files which can corrupt a file or make the memory card unusable.

NOTICE
Effect of data logs on memory cards To ensure the overall performance and robustness of your system, limit the data log rate to no faster than every 200 ms.

9.9.2.4 Limit to the size of data log files

Data log files share PLC load memory space with the program, program data, configuration data, user-defined Web pages, and PLC system data. A large program using internal load memory requires a large amount of load memory. There might be insufficient free space for data log files. In this case, you can use a "Program card" (Page 141) to increase the size of load memory. S7-1200 CPUs can use either internal or external load memory, but not both at once.

Maximum size rule for Data log files

The maximum size of one data log file cannot exceed the free load memory size or 500 megabytes, whichever is smaller. The size of 500 megabytes in this case refers to the decimal definition of megabyte, such that the maximum data log file size is 500,000,000 bytes or 500 x 1000^2 bytes.

Table 9- 217 Load memory size

Data area	CPU 1211C	CPU 1212C	CPU 1214C	CPU 1215C, CPU 1217C	Data storage
Internal load memory flash memory	1 MB	2 MB	4 MB	4 MB	User program and program data, configuration data, Data logs, user-defined Web pages, and PLC system data
External load memory Optional "Program card" flash memory	4 MB, 12 MB, 24 MB, 256 MB, 2 GB, or 32 GB depending on the SD card size				

Determining load memory free space

The amount of load memory free space varies during normal operations as the operating system uses and releases memory. Use the following steps to view the load memory memory size.

1. Establish an online connection between STEP 7 and the target S7-1200 PLC.
2. Download the program that controls your data log operations.
3. Create any optional user-defined Web pages that you need. The standard Web pages that access data logs are stored in PLC firmware and do not use load memory.
4. Use the Online and diagnostic tools (Page 1295) or the Web server Diagnostics page (Page 999)to view total load memory size and free space.

Calculating the size of a data log file (all data records)

When the data log file is created the CPU allocates the maximum memory size. In addition to the size required for all the data records, you must include storage space for a data log header (if used), time stamp header (if used), record index header, and the minimum block size for memory allocation.

Use the following formula to determine the size of your data log files and ensure you do not violate the maximum size rule.

Data log data bytes = ((data bytes in one record + time stamp bytes + 12 bytes) * number of records)

Header

Data log header bytes = header character bytes + 2 bytes

Header character bytes

- No data header and no timestamps = 7 bytes
- No data header and timestamps (has a timestamp header) = 21 bytes
- Data headers and no timestamps = number of character bytes in all column head text including separator commas
- Data headers and timestamps (has a timestamp header) = number of character bytes in all column head text including separator commas +21 bytes

Data

Data log data bytes = ((data bytes in one record + time stamp bytes + 12 bytes) * number of records)

Data bytes in one data record

The DataLogCreate DATA parameter points to a structure that assigns the number of data fields and the data type of each data field for one data log record.

Multiply the number of occurrences for a given data type by the number of bytes required. Repeat the process for each data type in a record and sum all the data bytes to get the total of all data elements in one record.

Size of individual data elements

Log data is stored as character bytes in the CSV (comma separated values) file format. The following table shows the number of bytes that are required to store each data element.

Data type	Number of bytes (includes data plus one comma byte)
Bool	2
Byte	5
Word	7
DWord	12
Char	4

String	**Example 1**: MyString String[10] The maximum string size is assigned as 10 characters. Text characters + automatic padding with blank characters = 10 bytes Opening and closing double quote + comma characters = 3 bytes 10 + 3 = 13 total bytes **Example 2**: Mystring2 String If no size is assigned with square brackets, then 254 bytes is allocated by default. Text characters + automatic padding with blank characters = 254 bytes Opening and closing double quote + comma characters = 3 bytes 254 + 3 = 257 total bytes
USInt	5
UInt	7
UDInt	12
SInt	5
Int	7
DInt	12
Real	16
LReal	25
Time	15
DTL	24

Number of records in a data log file

The RECORDS parameter of the DataLogCreate instruction sets the maximum number of records in a data log file.

Time stamp bytes in one data record

- No time stamp = 0 bytes
- Time stamp = 20 bytes

9.9.2.5 Data log example program

This Data log example program does not show all the program logic necessary to get sample values from a dynamic process, but does show the key operations of the Data log instructions. The structure and number of log files that you use depends on your process control requirements.

Note

General usage of Data log files

- Data log files are automatically opened after the DataLogCreate and DataLogNew File operations.
- Data log files are automatically closed after a PLC run to stop transition or a PLC power cycle.
- A Data log file must be open before a DataLogWrite operation is possible.
- A maximum of eight data log files may be open at one time. More than eight data log files may exist, but some of them must be closed so no more than eight are open.

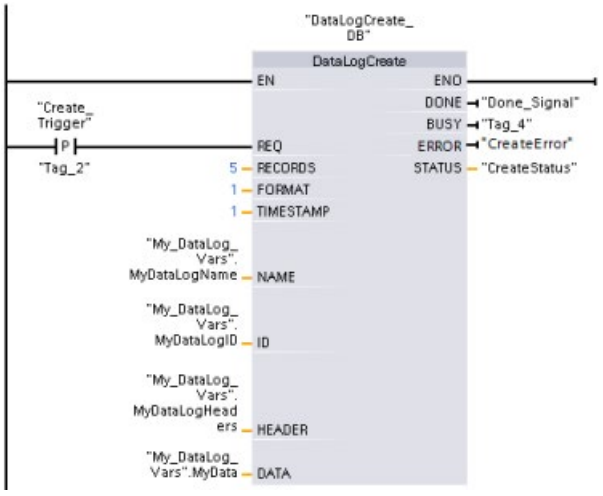
Example Data log program

Example data log names, header text, and the MyData structure are created in a data block. The three MyData variables temporarily store new sample values. The process sample values at these DB locations are transferred to a data log file by executing the DataLogWrite instruction.

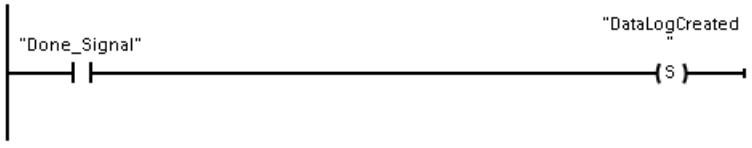
My_Datalog_Vars

	Name	Data type	Start value
1	Static		
2	MyNewDataLogName	String	'MyNEWDataLog'
3	MyDataLogName	String	'MyDataLog'
4	MyDataLogID	DWord	0
5	MyDataLogHeaders	String	'Count,Temperature,Pressure'
6	MyData	Struct	
7	MyCount	Int	0
8	MyTemperature	Real	0.0
9	MyPressure	Real	0.0

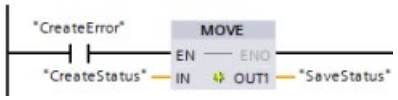
Network 1 REQ rising edge starts the data log creation process.



Network 2 Capture the DONE output from DataLogCreate because it is only valid for one scan.



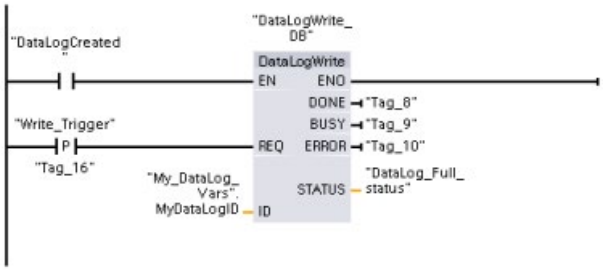
Network 3 If an error exists save the status output



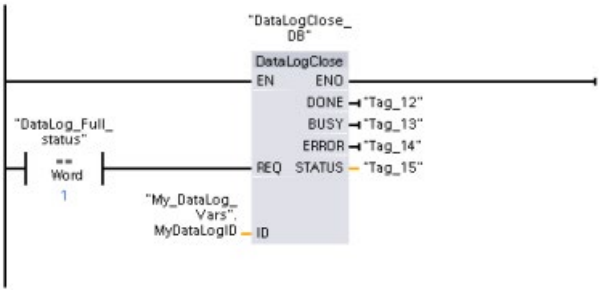
Network 4 A positive edge signal triggers when to store new process values in the MyData structure.



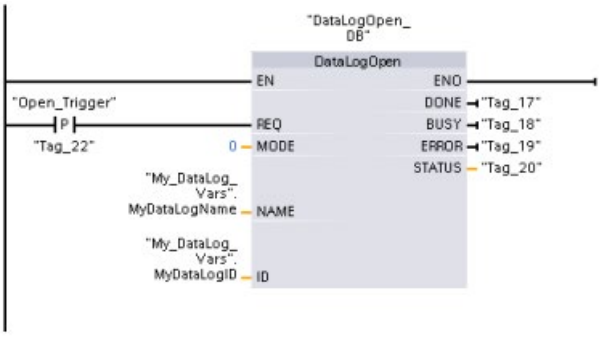
Network 5 The EN input state is based upon when the DataLogCreate operation is complete. A create operation extends over many scan cycles and must be complete before executing a write operation. The positive edge signal on the REQ input is the event that triggers an enabled write operation.



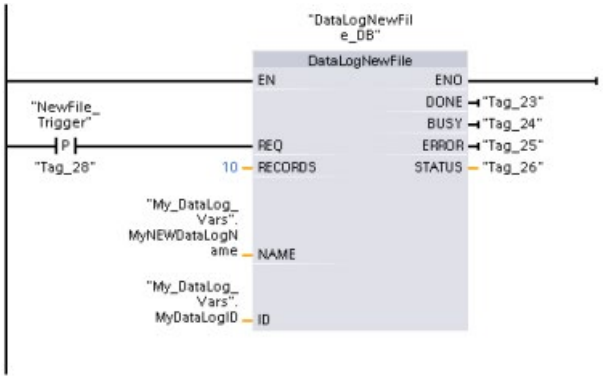
Network 6 Close the data log once the last record has been written. After executing the DataLogWrite operation that writes the last record, the log file full status is signaled when DataLogWrite STATUS output = 1.



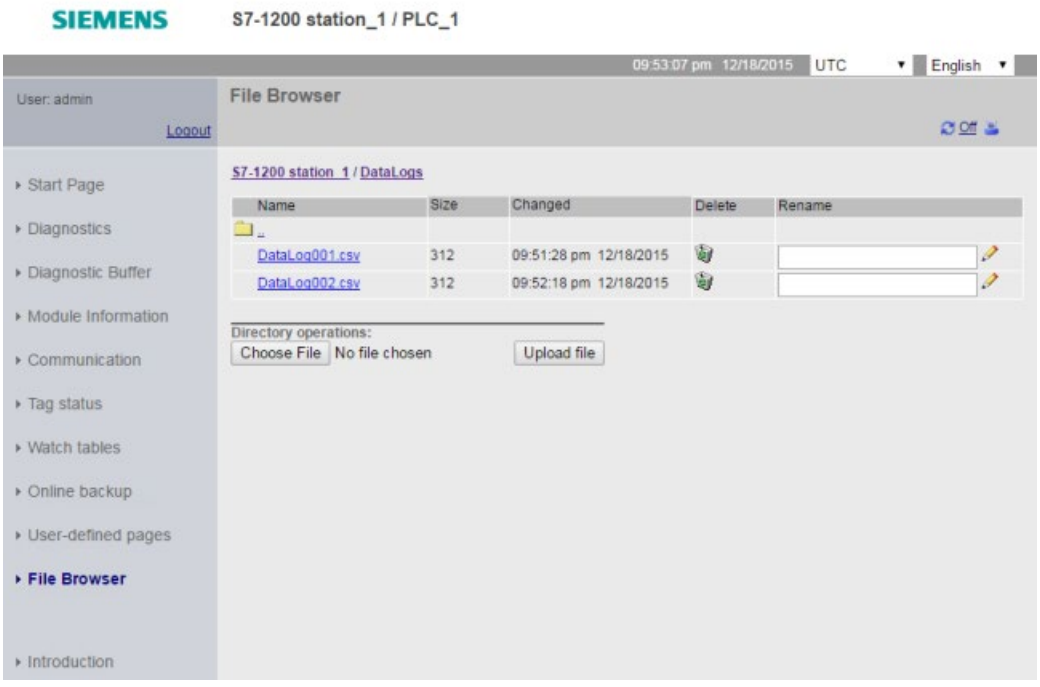
Network 7 A positive signal edge DataLogOpen REQ input simulates the user pushing a button on an HMI that opens a data log file. If you open a Data log file that has all records filled with process data, then the next DataLogWrite operation will overwrite the oldest record. You may want to preserve the old Data log and instead create a new data log, as shown in network 7.



Network 8 The ID parameter is an IN/OUT type. First, you supply the ID value of the existing Data log whose structure you want to copy. After the DataLogNewFile operation is complete, a new and unique ID value for the new Data log is written back to the ID reference location. The required DONE bit = TRUE capture is not shown, refer to networks 1, 2, and 4 for an example of DONE bit logic.



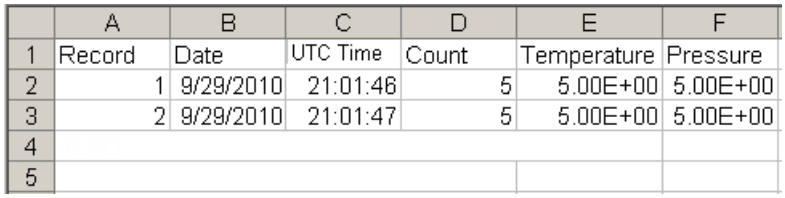
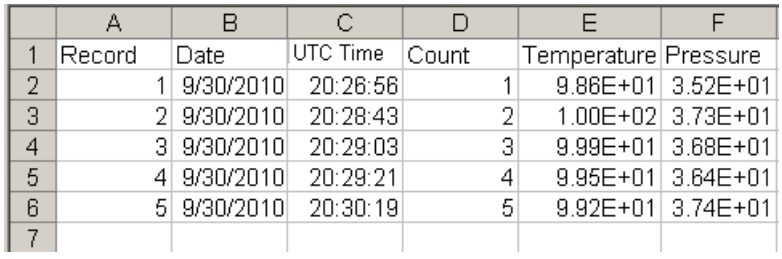
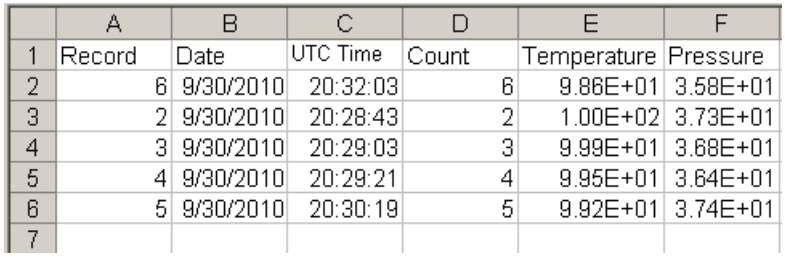
Data log files created by the example program viewed with the S7-1200 CPU Web server



① The "Delete" option is not available if you are not logged in with modify privileges.

② The "Rename" option is not available if you are not logged in with modify privileges.

Table 9- 218 Downloaded .csv file examples viewed with Excel

Two records written in a five record maximum file	
Five records in a Data log file with a five record maximum	
After one additional record is written to the file above which is full, the sixth write operation overwrites the oldest record one with record six. Another write operation will overwrite record two with record seven and so on.	

	A	B	C	D	E	F
1	Record	Date	UTC Time	Count	Temperature	Pressure
2	1	9/29/2010	21:01:46	5	5.00E+00	5.00E+00
3	2	9/29/2010	21:01:47	5	5.00E+00	5.00E+00
4						
5						

	A	B	C	D	E	F
1	Record	Date	UTC Time	Count	Temperature	Pressure
2	1	9/30/2010	20:26:56	1	9.86E+01	3.52E+01
3	2	9/30/2010	20:28:43	2	1.00E+02	3.73E+01
4	3	9/30/2010	20:29:03	3	9.99E+01	3.68E+01
5	4	9/30/2010	20:29:21	4	9.95E+01	3.64E+01
6	5	9/30/2010	20:30:19	5	9.92E+01	3.74E+01
7						

	A	B	C	D	E	F
1	Record	Date	UTC Time	Count	Temperature	Pressure
2	6	9/30/2010	20:32:03	6	9.86E+01	3.58E+01
3	2	9/30/2010	20:28:43	2	1.00E+02	3.73E+01
4	3	9/30/2010	20:29:03	3	9.99E+01	3.68E+01
5	4	9/30/2010	20:29:21	4	9.95E+01	3.64E+01
6	5	9/30/2010	20:30:19	5	9.92E+01	3.74E+01
7						

Note

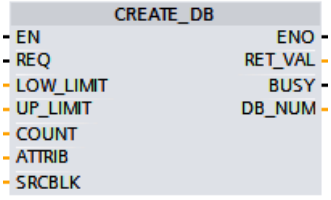
Data logs no longer use an //END marker to mark the end of a data log file that is not full. Prior to V4.1 of the S7-1200 CPU, data logs that were not full included an //END marker.

9.10 Data block control

9.10.1 CREATE_DB (Create data block)

Table 9- 219 CREATE_DB instruction

LAD / FBD	SCL	Description

	`ret_val := CREATE_DB(`
	`REQ:=_bool_in_,`
	`LOW_LIMIT:=_uint_in_,`
	`UP_LIMIT:=_uint_in_,`
	`COUNT:=_udint_in_,`
	`ATTRIB:=_byte_in_,`
	`BUSY=>_bool_out_,`
	`DB_NUM=>_uint_out_);`
		Use the instruction "CREATE_DB" to create a new data block in the load and/or work memory.
		The instruction "CREATE_DB" does not change the checksum of the user program.
		A data block that you create only in work memory has the following properties:
		• After a memory reset or POWER OFF / POWER ON this block no longer exists.
		• When loading or when there is a STOP-RUN transition, its content remains unchanged.

Number of the data block

The data block created is assigned a number from the range defined at the LOW_LIMIT (low limit) and UP_LIMIT (high limit) parameters. "CREATE_DB" assigns the smallest possible number from the specified range to the DB. You cannot assign the numbers of the DBs already contained in the user program.

To create a DB with a specific number, enter the same number for the high and low limit of the range to be specified. If a DB with the same number already exists in the work memory and/or load memory, or if the DB exists as a copied version, the instruction will be terminated and an error message will be generated at the RET_VAL parameter.

Start values of the data block

The SRCBLK parameter is used to define start values for the DB that is to be created. The SRCBLK parameter is a pointer to a DB or a DB area from which you apply the start values. The DB addressed at the SRCBLK parameter must have been generated with standard access ("Optimized block access" attribute disabled).

- If the area specified at the SRCBLK parameter is larger than the DB generated, the values up to the length of the DB generated will be applied as start values.
- If the area specified at the SRCBLK parameter is smaller than the DB generated, the remaining values will be filled with "0".

To ensure data consistency, you must not change this data area while "CREATE_DB" is being executed (which means as long as the BUSY parameter has the value TRUE).

Functional description

The "CREATE_DB" instruction works asynchronously. Processing takes place across several calls. You start the job by calling "CREATE_DB" with REQ = 1.

The output parameters RET_VAL and BUSY indicate the status of the job.

See also: DELETE_DB (Delete data block) (Page 530)

Parameters

The following table shows the parameters of the "CREATE_DB" instruction:

Parameter	Declaration	Data type	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L or constant	Level-triggered control parameter "request to activate" REQ = 1: Request to generate the data block
LOW_LIMIT	Input	UINT	I, Q, M, D, L or constant	Low limit of the range for the assignment of a DB number. The smallest possible number is 60000.
UP_LIMIT	Input	UINT	I, Q, M, D, L or constant	High limit of the area used by "CREATE_DB" to assign a number to your DB (largest possible DB number: 60999)
COUNT	Input	UDINT	I, Q, M, D, L or constant	The count value specifies the number of bytes which you want to reserve for the DB generated. The number of bytes must be an even number. The maximum length is 65534 bytes.

<table>
<tr><th>Parameter</th><th>Declaration</th><th>Data type</th><th>Memory area</th><th>Description</th></tr>
<tr><td rowspan="8">ATTRIB</td><td rowspan="8">Input</td><td rowspan="8">BYTE</td><td rowspan="8">I, Q, M, D, L or constant</td><td>You use the first 4 bits of the byte at parameter ATTRIB to define the properties of the data block *:</td></tr>
<tr><td>• Bit 0 = 0: Attribute "Only store in load memory" is not set.
• Bit 0 = 1: Attribute "Only store in load memory" is set. With this setting, the DB takes up no space in the work memory and is not included in the program. The DB cannot be accessed with bit commands. When bit 0 = 1, the selection for bit 2 is irrelevant.
To ensure compatibility with STEP 7 V5.x, bits 0 and 3 must be considered together (see below).</td></tr>
<tr><td>• Bit 1 = 0: Attribute "Data block write-protected in the device" is not set.
• Bit 1 = 1: Attribute "Data block write-protected in the device" is set.</td></tr>
<tr><td>• Bit 2 = 0: DB is retentive (only for DBs generated in the load and in the work memory). The DB is regarded as retentive if at least one value has been set as retentive.
• Bit 2 = 1: DB is not retentive
Retentivity is not supported with DBs that are only stored in load memory or only in the work memory. If you call the "CREATE_DB" instruction with one of the two combinations "retentive and only load memory" or "retentive and only work memory" the DB to be generated will not be marked as retentive.</td></tr>
<tr><td>• Bit 3 = 0: Creation of the DB either in the load memory or in the work memory (selection using bit 0, see above)
• Bit 3 = 1: Creation of the DB both in the load memory and in the work memory (bit 0 irrelevant)
To ensure compatibility with STEP 7 V5.x, bits 0 and 3 must be used in combination. When bit 3 = 1, bit 0 is irrelevant.</td></tr>
<tr><td><table>
<tr><th>Bit 0</th><th>Bit 3</th><th>DB generation</th></tr>
<tr><td>0</td><td>0</td><td>In work memory only</td></tr>
<tr><td>1</td><td>0</td><td>In load memory only</td></tr>
<tr><td>Irrelevant</td><td>1</td><td>Work and load memory</td></tr>
</table></td></tr>
<tr><td>• Bit 4 = 0 - No start values specified (input values at the SRCBLK parameter will be ignored).
• Bit 4 = 1 - Specify start values (values correspond to the DB addressed by the SRCBLK parameter).</td></tr>
<tr><td>SRCBLK</td><td>Input</td><td>VARIANT</td><td>D</td><td>Pointer to the data block whose values will be used to initialize the data block to be generated.</td></tr>
<tr><td>RET_VAL</td><td>Return</td><td>INT</td><td>I, Q, M, D, L</td><td>Error information</td></tr>
<tr><td>BUSY</td><td>Output</td><td>BOOL</td><td>I, Q, M, D, L</td><td>BUSY = 1: The process is not yet complete.</td></tr>
</table>

Parameter	Declaration	Data type	Memory area	Description
DB_NUM	Output	DB_DYN (UINT)	I, Q, M, D, L	Number of the DB created.
* The properties selected here correspond to the attributes in the properties of a data block.				

You can find additional information on valid data types under "Data types (Page 122)".

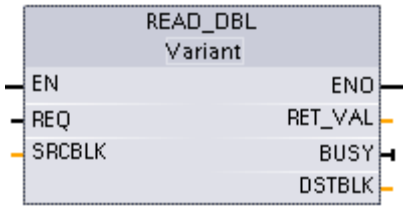
Parameter RET_VAL

Error code* (W#16#...)	Description
0000	No error
0081	The destination area is greater than the source area. The source area is written completely to the destination area. The remaining bytes of the destination area remain unchanged.
7000	First call with REQ = 0: No data transfer active; BUSY has the value "0".
7001	First call with REQ = 1: Data transfer triggered; BUSY has the value "1".
7002	Intermediate call (REQ irrelevant): Data transfer already active; BUSY has the value "1".
8081	The source area is larger than the destination area. The complete destination area is written. The remaining bytes of the source area are ignored.
8092	The "Create data block" function is currently unavailable because • The "Compress user memory" function is currently active. • The maximum number of blocks on your CPU has already been reached.
8093	No data block or a data block that is not in the work memory is specified for the SRCBLK parameter.
8094	An invalid value was specified at parameter ATTRIB.
80A1	DB number error: • The number is "0" • The number exceeds the CPU-specific high limit for DB numbers • Low limit > high limit
80A2	DB length error: • The length is "0" • The length is an odd number • The length is greater than permitted by the CPU
80A3	The data block at the SRCBLK parameter was not created with standard access.
80B1	There is no DB number free.
80B2	Not enough work memory.
80B4	The memory card is write-protected.
80BB	Not enough load memory.
80C3	The maximum number of simultaneously active "CREATE_DB" instructions has already been reached.
General error information	See also: Common error codes for the Extended instructions (Page 540)
* You can display the error code as either integer or hexadecimal values in the program editor.	

9.10.2 READ_DBL and WRIT_DBL (Read/write a data block in load memory) instructions

Table 9- 220 READ_DBL and WRIT_DBL instructions

LAD / FBD	SCL	Description

	`READ_DBL(`
	`req:=_bool_in_,`
	`srcblk:=_variant_in_,`
	`busy=>_bool_out_,`
	`dstblk=>_variant_out_);`
		Copies DB start values or part of the values, from load memory to a target DB in the work memory.
		The content of load memory is not changed during the copy process.

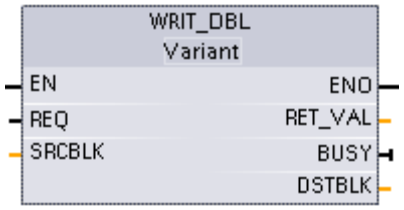
	`WRIT_DBL(`
	`req:=_bool_in_,`
	`srcblk:=_variant_in_,`
	`busy=>_bool_out_,`
	`dstblk=>_variant_out_);`
		Copies DB current values or part of the values from work memory to a target DB in load memory.
		The content of work memory is not changed during the copy process.

Table 9- 221 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	BOOL	A high signal starts the operation, if BUSY = 0.
SRCBLK	IN	VARIANT	READ_DBL: Pointer to the source data block in load memory WRIT_DBL: Pointer to the source data block in work memory
RET_VAL	OUT	INT	Execution condition code
BUSY	OUT	BOOL	BUSY = 1 signals that the reading/writing process is not complete.
DSTBLK	OUT	VARIANT	READ_DBL: Pointer to the destination data block in work memory WRIT_DBL: Pointer to the destination data block in load memory

Typically, a DB is stored in both load memory (flash) and work memory (RAM). The start values (initial values) are always stored in load memory, and the current values are always stored in work memory. READ_DBL can be used to copy a set of start values from load memory to the current values of a DB in work memory that is referenced by your program. You can use WRIT_DBL to update the start values stored in internal load memory or memory card from current values in work memory.

Note

Effect of WRIT_DBL and READ_DBL instruction on flash memory

The WRIT_DBL instruction performs write operations in flash memory (internal load memory or memory card). To avoid reducing the lifetime of the flash memory, use the WRIT_DBL instruction for infrequent updates such as recording changes to a production process. For similar reasons, avoid frequent calls to READ_DBL for read operations.

You must create the data blocks for READ_DBL and WRIT_DBL prior to calling these instructions in the STEP 7 program. If you created the source DB as a "standard" type then the destination DB must also be the "standard" type. If you created the source data block as an "optimized" type then the destination data block must also be the "optimized" type.

If the DBs are standard, then you can specify either a tag name or a P# value. The P# value allows you to specify and copy any number of elements of the specified size (Byte, Word, or DWord). Thus, you can copy part or all of a DB. If the DBs are optimized, you can only specify a tag name; you cannot use the P# operator. If you specify a tag name for either standard or optimized DBs (or for other work-memory types), then the instruction copies the data that this tag name references. This could be a user-defined type, an array, or a basic element. You can only use type Struct with these instructions if the DB is standard, not optimized. You must use a user-defined type (UDT) if it is a structure in optimized memory. Only a user-defined type ensures that the "data types" are exactly the same for both the source and destination structures.

Note

Using a structure (data type Struct) in an "optimized" DB

When using a Struct data type with "optimized" DBs, you must first create a user-defined data type (UDT) for the Struct. You then configure both the source and destination DBs with the UDT. The UDT ensures that the data types within the Struct remain consistent for both DBs.

For "standard" DBs, you use the Struct without creating a UDT.

READ_DBL and WRIT_DBL execute asynchronously to the cyclic program scan. The processing extends over multiple READ_DBL and WRIT_DBL calls. You start the DB transfer job by calling with REQ = 1 and then monitor the BUSY and RET_VAL outputs to determine when the data transfer is complete and correct.

Note

Effect of WRIT_DBL and READ_DBL instruction on communication load

When the WRIT_DBL or READ_DBL instruction is continually active, it can consume communication resources to the point that STEP 7 loses communication with the CPU. For this reason, use a positive edge input (Page 227) for the REQ parameter rather than a normally open or closed input (Page 221) that would remain on (signal level high) for multiple scans.

To ensure data consistency, do not modify the destination area during the processing of READ_DBL or the source area during the processing of WRIT_DBL (that is, as long as the BUSY parameter is TRUE).

SRCBLK and DSTBLK parameter restrictions:

- A data block must have been previously created before it can be referenced.
- The length of a VARIANT pointer of type BOOL must be divisible by 8.
- The length of a VARIANT pointer of type STRING must be the same in the source and destination pointers.

Recipes and machine setup information

You can use the READ_DBL and WRIT_DBL instructions to manage recipes or machine setup information. This essentially becomes another method of achieving retentive data for values that do not change often, although you would want to limit the number of writes to prevent wearing out the flash prematurely. This effectively allows you to increase the amount of retentive memory beyond that supported for the normal power-down retentive data, at least for values that do not change often. You could save recipe information or machine-setup information from work memory to load memory using the WRIT_DBL instruction, and you could retrieve such information from load memory into work memory using the READ_DBL instruction.

Table 9- 222 Condition codes

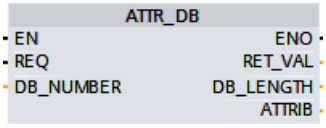
RET_VAL (W#16#...)	Description
0000	No error
0081	Warning: that the source area is smaller than the destination area. The source data is copied completely with the extra bytes in the destination area unchanged.
7000	Call with REQ = 0: BUSY = 0
7001	First call with REQ = 1 (working): BUSY = 1
7002	N^{th} call (working): BUSY = 1
8051	Data block type error
8081	The source area is larger than the destination area. The destination area is completely filled and the remaining bytes of the source are ignored.
8251	Source data block type error
82B1	Missing source data block
82C0	The source DB is being edited by another statement or a communication function.
8551	Destination data block type error
85B1	Missing destination data block
85C0	The destination DB is being edited by another statement or a communication function.
80C3	More than 50 READ_DBL or 50 WRIT_DBL statements are currently queued for execution.

See also Recipes (Page 484)

9.10.3 ATTR_DB (Read data block attribute)

Table 9- 223 ATTR_DB instruction

LAD / FBD	SCL	Description

	`ret_val := ATTR_DB(`
	`REQ:=_bool_in_,`
	`DB_NUMBER:=_uint_in_,`
	`DB_LENGTH=>_udint_out_,`
	`ATTRIB=>_byte_out_);`
		You use the instruction "ATTR_DB" to obtain information about a data block (DB) located in the work memory of the CPU. The instruction determines the attributes set at the ATTRIB parameter for the DB selected.
		The length cannot be read out for data blocks with optimized access and data blocks that are only in load memory. In these cases, the DB_LENGH parameter has the value "0".
		Do not apply ATTR_DB to data blocks with optimized access and activated memory reserve.
		Do not read out the data blocks for motion control with the "ATTR_DB" instruction. The error code 80B2 is output for this.

Parameters

The following table shows the parameters of the "ATTR_DB" instruction:

Parameter	Declaration	Data type	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L or constant	REQ = 1: Request to read block attributes
DB_NUMBER	Input	DB_ANY	I, Q, M, D, L or constant	Number of the DB to be tested
RET_VAL	Output	INT	I, Q, M, D, L	Error information
DB_LENGTH	Output	UDINT	I, Q, M, D, L	• Number of data bytes that the selected DB contains. • "0" for data blocks with optimized access and data blocks that are only in load memory.
ATTRIB	Output	BYTE	I, Q, M, D, L	DB properties:
				• Bit 0*= 0: Attribute "Only store in load memory" is not set. • Bit 0*= 1: Attribute "Only store in load memory" is set.
				• Bit 1 = 0: Attribute "Data block write-protected in the device" is not set. • Bit 1 = 1: Attribute "Data block write-protected in the device" is set.
				If bit 0 = 1, then bit 2 is irrelevant and gets the value 1. • Bit 2 = 0: Retentive - The DB is regarded as retentive if at least one value has been set as retentive. • Bit 2 = 1: Not retentive - The complete DB is not retentive.
				• Bit 3*= 0: The DB is either in the load memory (bit 0 = 1) or in the work memory (bit 0 = 0). • Bit 3*= 1: The DB is generated in both the load and the work memory
* The relationship between bit 0 and bit 3 is explained in the parameters of the instruction "CREATE_DB (Create data block) (Page 520)".				

You can find additional information on valid data types under "Data types (Page 122)".

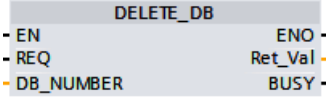
Parameter RET_VAL

Error code* (W#16#...)	Explanation
0000	No error occurred.
80A1	Error in input parameter DB_NUMBER: the actual parameter selected • Is "0" • Is greater than the maximum permitted DB number for the CPU used.
80B1	The DB with the specified number does not exist on the CPU.
80B2	Data blocks of motion control technology objects cannot be read with the "ATTR_DB" instruction.
General error information	See also: Common error codes for the Extended instructions (Page 540)
* You can display the error code as either integer or hexadecimal values in the program editor.	

9.10.4 DELETE_DB (Delete data block)

Table 9- 224 DELETE_DB instruction

LAD / FBD	SCL	Description

	`ret_val := DELETE_DB(`
	`  REQ := _bool_in_,`
	`  DB_NUMBER := _uint_in_,`
	`  BUSY => _bool_out_);`
		You use the instruction "DELETE_DB" to delete a data block (DB) that the user program created by calling the instruction "CREATE_DB (Page 520)".
		If the data block was not created with "CREATE_DB", DELETE_DB returns the error code W#16#80B5 at the RET_VAL parameter.
		The DELETE_DB call does not delete the selected data block immediately, but rather at the cycle control point after execution of the cycle OB.

Functional description

The "DELETE_DB" instruction works asynchronously, that is, its execution extends over multiple calls. You start the interrupt transfer by calling the instruction with REQ = 1.

Output parameter BUSY and bytes 2 and 3 of output parameter RET_VAL show the status of the job.

The deletion of the data block is complete when output parameter BUSY has the value FALSE.

Parameters

The following table shows the parameters of the "DELETE_DB" instruction:

Parameter	Declaration	Data type	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L or constant	REQ =1: Request to delete the DB with the number in parameter DB_NUMBER
DB_NUMBER	Input	UINT	I, Q, M, D, L or constant	Number of the DB to be deleted
RET_VAL	Output	INT	I, Q, M, D, L	Error information (see "RET_VAL parameter")
BUSY	Output	BOOL	I, Q, M, D, L	BUSY= 1: The process is not yet complete.

You can find additional information on valid data types under "Data types (Page 122)".

Parameter RET_VAL

Error code* (W#16#...)	Explanation
0000	No error occurred.
7000	First call with REQ = 0: No data transfer active; BUSY has the value "0".
7001	First call with REQ = 1: Data transfer triggered; BUSY has the value "1".
7002	Intermediate call (REQ irrelevant): Data transfer already active; BUSY has the value "1".
80A1	Error in input parameter DB_NUMBER: • The value at the parameter is "0". • The value at the parameter is greater than the maximum permitted DB number for the CPU used.
80B1	The DB with the specified number does not exist on the CPU.
80B4	The DB cannot be deleted because the memory card of the CPU is write-protected.
80B5	The DB was not created using "CREATE_DB".
80BB	Not enough load memory.
80C3	The "Delete a DB" function cannot be executed at this time due to a temporary resource bottleneck.
General error information	See also: Common error codes for the Extended instructions (Page 540)
* You can display the error code as either integer or hexadecimal values in the program editor.	

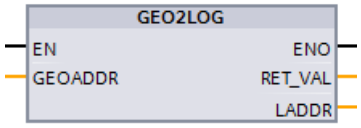
9.11 Address handling

9.11.1 GEO2LOG (Determine the hardware identifier from the slot)

You use the GEO2LOG instruction to determine the hardware identifier based upon slot information.

Table 9- 225 GEO2LOG instruction

LAD / FBD	SCL	Description

	`ret_val := GEO2LOG(`
	`  GEOADDR:=_variant_in_out_,`
	`  laddr:=_word_out_);`
		You use the GEO2LOG instruction to determine the hardware identifier based upon slot information.

The GEO2LOG instruction determines the hardware identifier based upon slot information that you define using the GEOADDR system data type:

Depending on the type of hardware you define at the parameter HWTYPE, the following information is evaluated from the other GEOADDR parameters:

- With HWTYPE = 1 (PROFINET IO system):
  - Only IOSYSTEM is evaluated. The other parameters of GEOADDR are not taken into consideration.
  - The hardware identifier of the PROFINET IO system is output.
- With HWTYPE = 2 (PROFINET IO device):
  - IOSYSTEM and STATION are evaluated. The other parameters of GEOADDR are not taken into consideration.
  - The hardware identifier of the PROFINET IO device is output.
- With HWTYPE = 3 (rack):
  - Only IOSYSTEM and STATION are evaluated. The other parameters of GEOADDR are not taken into consideration.
  - The hardware identifier of the rack is output.
- With HWTYPE = 4 (module):
  - IOSYSTEM, STATION, and SLOT are evaluated. The SUBSLOT parameter of GEOADDR is not taken into consideration.
  - The hardware identifier of the module is output.
- With HWTYPE = 5 (submodule):
  - All parameters of GEOADDR are evaluated.
  - The hardware identifier of the submodule is output.

The AREA parameter of the GEOADDR system data type is not evaluated.

Table 9- 226 Data types for the parameters

Parameter and type		Data type	Description
GEOADDR	IN/OUT or IN ?	Variant	Pointer to the structure of the GEOADDR system data type. The GEOADDR system data type contains the slot information from which the hardware ID is determined. Refer to the "GEOADDR system data type (Page 538)" for further information.
RET_VAL	OUT or RETURN ?	Int	Output of error information.
LADDR	OUT	HW_ANY	Hardware identifier of the assembly or the module. The number is automatically assigned and is stored in the properties in the hardware configuration.

For further information on valid data types, refer to "Overview of the valid data types" in the STEP 7 online help.

Table 9- 227 Condition codes

RET_VAL* (W#16#...)	Explanation
0	No error occurred.
8091	Invalid value for in GEOADDR for HWTYPE.
8094	Invalid value for in GEOADDR for IOSYSTEM.
8095	Invalid value for in GEOADDR for STATION.
8096	Invalid value for in GEOADDR for SLOT.
8097	Invalid value for in GEOADDR for SUBSLOT.
* The error codes can be displayed as integer or hexadecimal values in the program editor.	

9.11.2 LOG2GEO (Determine the slot from the hardware identifier)

You use the LOG2GEO instruction to determine the geographical address (module slot) from the logical address belonging to a hardware identifier.

Table 9- 228 LOG2GEO instruction

LAD / FBD	SCL	Description

	`ret_val := LOG2GEO(`
	`  laddr:=_word_in_,`
	
	`GEOADDR:=_variant_in_out_);`
		You use the LOG2GEO instruction to determine the module slot belonging to a hardware identifier.

The LOG2GEO instruction determines the geographic address of a logical address based upon the hardware identifier:

- Use the LADDR parameter to select the logical address based upon the hardware identifier.
- The GEOADDR contains the geographic address of the logical address given at the LADDR input.

Note

In the cases where the HW type does not support a component, a subslot number for a module 0 is returned.

An error is provided if the LADDR input does not address a HW object.

Table 9- 229 Data types for the parameters

Parameter and type		Data type	Description
LADDR	IN	HW_ANY	Hardware identifier of the IO system or the module. The number is assigned automatically and is stored in the properties of the CPU or the interface of the hardware configuration.
RET_VAL	OUT	Int	Error code of the instruction
GEOADDR	IN_OUT	Variant	Pointer to the GEOADDR system data type. The GEOADDR system data type contains the slot information. Refer to the "GEOADDR system data type (Page 538)" for further information.

For further information on valid data types, refer to "Overview of the valid data types" in the STEP 7 online help.

Table 9- 230 Condition codes

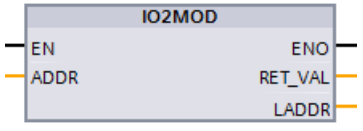
RET_VAL (W#16#...)	Description
0000	No error
8090	The address specified at the LADDR parameter is invalid.
* The error codes can be displayed as integer or hexadecimal values in the program editor.	

9.11.3 IO2MOD (Determine the hardware identifier from an I/O address)

You use the IO2MOD instruction to determine the hardware identifier of the module from an I/O address of a (sub)module.

Table 9- 231 IO2MOD instruction

LAD / FBD	SCL	Description

	`ret_val := IO2MOD(`
	`  ADDR:=_word_in_,`
	`  LADDR:=_word_out_);`
		You use the IO2MOD instruction to determine the module slot belonging to a hardware identifier.

The IO2MOD instruction determines the hardware identifier of the module from an IO address (I, Q, PI, PQ) of a (sub)module.

Enter the IO address at the ADDR parameter. If a series of IO addresses is used at this parameter, only the first address is evaluated to determine the hardware identifier. If the first address is correctly specified, the length for the address specification at the ADDR is of no significance. If an address area is used that encompasses several modules or non-used addresses, the hardware identifier of the first module can also be determined.

If no IO address of a (sub)module is specified at the ADDR parameter, the error code "8090" is output at the RET_VAL parameter.

Note

Input of IO address in SCL

You cannot program using the IO access ID "%QWx:P" in SCL. In this case, use the symbolic tag name or the absolute address in the process image.

Table 9- 232 Data types for the parameters

Parameter	Declaration	Data type	Memory area	Description
ADDR	IN or IN/OUT ?	Variant	I, Q, M, D, L	IO address (I, Q, PI, PQ) within a (sub)module. Make sure that slice access is not used for the parameter ADDR. If this is the case, incorrect values are output at the LADDR parameter.
RET_VAL	OUT or RETURN ?	Int	I, Q, M, D, L	Error code of the instruction.
LADDR	OUT	HW_IO	I, Q, M, D, L	Determined hardware identifier (logical address) of the IO (sub)module.

For further information on valid data types, refer to "Overview of the valid data types" in the STEP 7 online help.

Table 9- 233 Condition codes

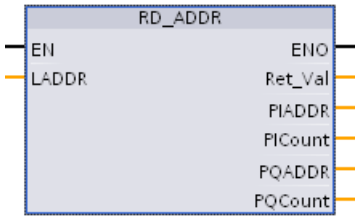
RET_VAL* (W#16#...)	Explanation
0	No error occurred.
8090	IO address specified at ADDR parameter is not used by any hardware component.
* The error codes can be displayed as integer or hexadecimal values in the program editor.	

9.11.4 RD_ADDR (Determine the IO addresses from the hardware identifier)

You use the RD_ADDR instruction to get the I/O addresses of a submodule.

Table 9- 234 RD_ADDR instruction

LAD / FBD	SCL	Description

	`ret_val := RD_ADDR(`
	`laddr:=_word_in_,`
	`PIADDR=>_udint_out_,`
	`PICount=>_uint_out_,`
	`PQADDR=>_udint_out_,`
	`PQCount=>_uint_out_,);`
		You use the RD_ADDR instruction to get the I/O addresses of a submodule.

The RD_ADDR instruction determines the length and the start address of the inputs or outputs based on the hardware identifier of a submodule:

- Use the LADDR parameter to select the input or output module based upon the hardware identifier.
- The following output parameters are used depending on whether it is an input module or output module:
  - In the case of an input module, the determined values are output at the PIADDR and PICOUNT parameters.
  - In the case of an output module, the determined values are output at the PQADDR and PQCOUNT parameters.
- The PIADDR and PQADDR parameters each contain the start address of the I/O addresses of the module.
- The PICOUNT and PQCOUNT parameters each contain the number of bytes of the inputs or outputs (1 byte for 8 inputs/outputs, 2 bytes for 16 inputs/outputs).

Table 9- 235 Data types for the parameters

Parameter and type		Data type	Description
LADDR	IN	HW_IO	Hardware identifier of the (sub)module
RET_VAL	OUT	Int	Error code of the instruction
PIADDR	OUT	UDInt	Start address of the input module
PICOUNT	OUT	UInt	Number of bytes of the inputs
PQADDR	OUT	UDInt	Start address of the output module
PQCOUNT	OUT	UInt	Number of bytes of the outputs

For further information on valid data types, refer to "Overview of the valid data types" in the STEP 7 online help.

Table 9- 236 Condition codes

RET_VAL (W#16#...)	Description
0000	No error
8090	Hardware identifier of the module at the LADDR parameter is invalid.
* The error codes can be displayed as integer or hexadecimal values in the program editor.	

9.11.5 GEOADDR system data type

Geographical address

The system data type GEOADDR contains the geographical address of a module (or the slot information).

- Geographical address for PROFINET IO:

  For PROFINET IO, the geographical address is composed of the ID of the PROFINET IO system, the device number, the slot number, and the submodule (if a sub-module is used).

- Geographical address for PROFIBUS DP:

  For PROFIBUS DP, the geographical address consists of the ID of the DP master system, the station number, and the slot number.

The slot information of the modules can be found in the hardware configuration of each module.

Structure of the GEOADDR system data type

The structure GEOADDR is automatically created if you enter "GEOADDR" as the data type in a data block.

Parameter name	Data type	Description
GEOADDR	STRUCT	
HWTYPE	UINT	Hardware type: • 1: IO system (PROFINET/PROFIBUS) • 2: IO device/DP slave • 3: Rack • 4: Module • 5: Submodule If a hardware type is not supported by the instruction, a HWTYPE "0" is output.
AREA	UINT	Area ID: • 0 = CPU • 1 = PROFINET IO • 2 = PROFIBUS DP • 3 = AS-i
IOSYSTEM	UINT	PROFINET IO system (0=central unit in the rack)
STATION	UINT	• Number of the rack if area identifier AREA = 0 (central module). • Station number if area identifier AREA > 0.
SLOT	UINT	Slot number
SUBSLOT	UINT	Number of the submodule. This parameter has the value "0" if no submodule is available or can be plugged.

9.12 Common error codes for the Extended instructions

Table 9- 237 Common condition codes for the extended instructions

Condition code (W#16#....)[1]	Description
8x22[2]	Area too small for input
8x23	Area too small for output
8x24	Illegal input area
8x25	Illegal output area
8x28	Illegal input bit assignment
8x29	Illegal output bit assignment
8x30	Output area is a read-only DB.
8x3A	DB does not exist.

[1] If one of these errors occurs when a code block is executed, then the CPU remains in RUN (default) or can be configured to go to STOP. Optionally, you can use the GetError or GetErorID instructions within that code block to handle the error locally (CPU remains in RUN), and create a programmed reaction to the error.

[2] The "x" represents the parameter number with the error. Parameter numbers start with 1.

Technology instructions 10

10.1 Counting (High-speed counters)

The basic counter instructions, described in "Counter operations" (Page 238), are limited to counting events that occur at a rate slower than the scan cycle of the S7-1200 CPU. The High-speed counter (HSC) function provides the ability to count pulses occurring at a higher rate than the PLC scan cycle. In addition, you can configure the HSC to measure the frequency and period of the occurring pulses, or be setup such that motion control can use the HSC to read a motor encoder signal.

To use the HSC function, the HSC must first be enabled and configured using the CPU's Properties tab in the Device Configuration screen. To get started configuring the HSC, refer to "Configuring a high-speed counter" (Page 558).

After you download the hardware configuration, the HSC can count pulses or measure frequency without the need for any instructions to be called. When the HSC is in Count or Period mode, the count value is automatically captured and updated in the process image (I memory) each scan cycle. If the HSC is in Frequency mode, the process image value is the frequency in Hz.

In addition to counting and measuring, the HSC can generate hardware interrupt events, operate dependent on the state of physical input points, and produce an output pulse according to a specified counter event (V4.2 or above CPUs only). Technology instruction CTRL_HSC_EXT allows the user program to control the HSC programmatically. CTRL_HSC_EXT updates HSC parameters and returns the most up-to-date values when executed. You can use the CTRL_HSC_EXT instruction while the HSC is in Count, Period, or Frequency mode.

Note

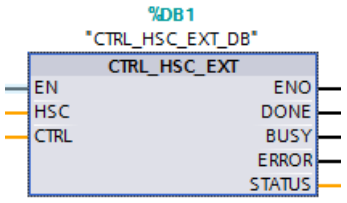
The CTRL_HSC_EXT instruction replaces the legacy CTRL_HSC instruction for projects targeting V4.2 CPUs and later. All of the functionality of the CTRL_HSC instruction, plus several additional features, is available with the CTRL_HSC_EXT instruction. The legacy CTRL_HSC instruction is only available for compatibility with older S7-1200 projects and should not be used in new projects.

10.1.1 CTRL_HSC_EXT (Control high-speed counter) instruction

10.1.1.1 Instruction overview

Table 10- 1 CTRL_HSC_EXT instruction

LAD / FBD	SCL	Description

	`"CTRL_HSC_1_DB" (`
	`hsc:=_hw_hsc_in_,`
	`done:=_done_out_,`
	`busy:=_busy_ out_,`
	`error:=_error_out_,`
	`status:=_status_out_,`
	`ctrl:=_variant_in_);`
		Each CTRL_HSC_EXT (Control high-speed counter (extended)) instruction uses a system-defined data structure stored in a user-defined Global DB to store counter data. You assign the HSC_Count, HSC_Period, or HSC_Frequency data types as an input parameter to the CTRL_HSC_EXT instruction.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "CTRL_HSC_1_DB" is the name of the instance DB.

Table 10- 2 Data types for the parameters

Parameter	Declaration	Data type	Description
HSC	IN	HW_HSC	HSC identifier
CTRL	IN_OUT	Variant	SFB input and return data. Note: Refer to "CTRL_HSC_EXT instruction System Data Types (SDT) (Page 546)" for further information.
DONE	OUT	Bool	1= Indicates SFB is finished. Always 1 because SFB is synchronous
BUSY	OUT	Bool	Always 0, function is never busy
ERROR	OUT	Bool	1 = Indicates an error
STATUS	OUT	Word	Execution condition code Note: Refer to the "Execution condition codes" table below for further information.

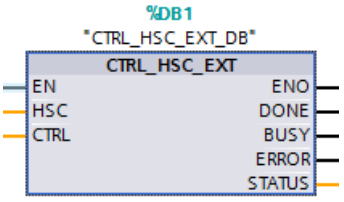
Table 10- 3 Execution condition codes

STATUS (W#16#)	Description
0	No error
80A1	HSC identifier does not address an HSC
80B1	Illegal value in NewDirection
80B4	Illegal value in NewPeriod
80B5	Illegal value in NewOpModeBehavior
80B6	Illegal value in NewLimitBehavior
80D0	SFB 124 not available

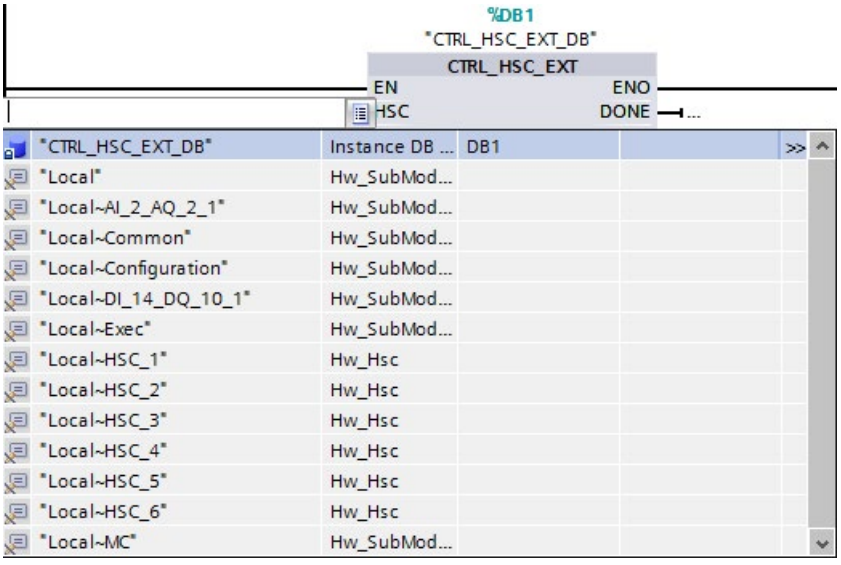
10.1.1.2 Example

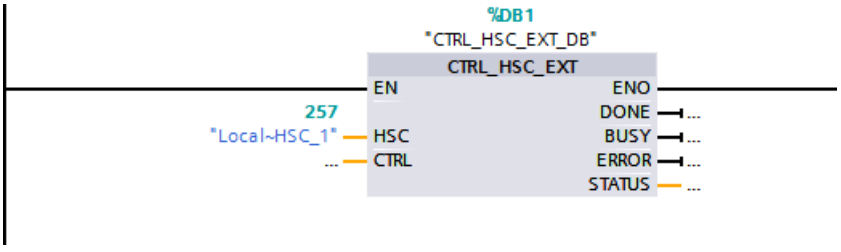
To use the CTRL_HSC_EXT instruction, follow the steps below:

1. Place the CTRL_HSC_EXT instruction in the ladder network, which also creates the following instance data block: "CTRL_HSC_EXT_DB":



2. Attach the HSC's hardware identifier, found in the HSC's properties, to the "HSC" pin of the ladder instruction. You can also select one of the six "Hw_Hsc" objects from the dropdown menu of this input pin. The default tag name for HSC1 is "Local~HSC_1":



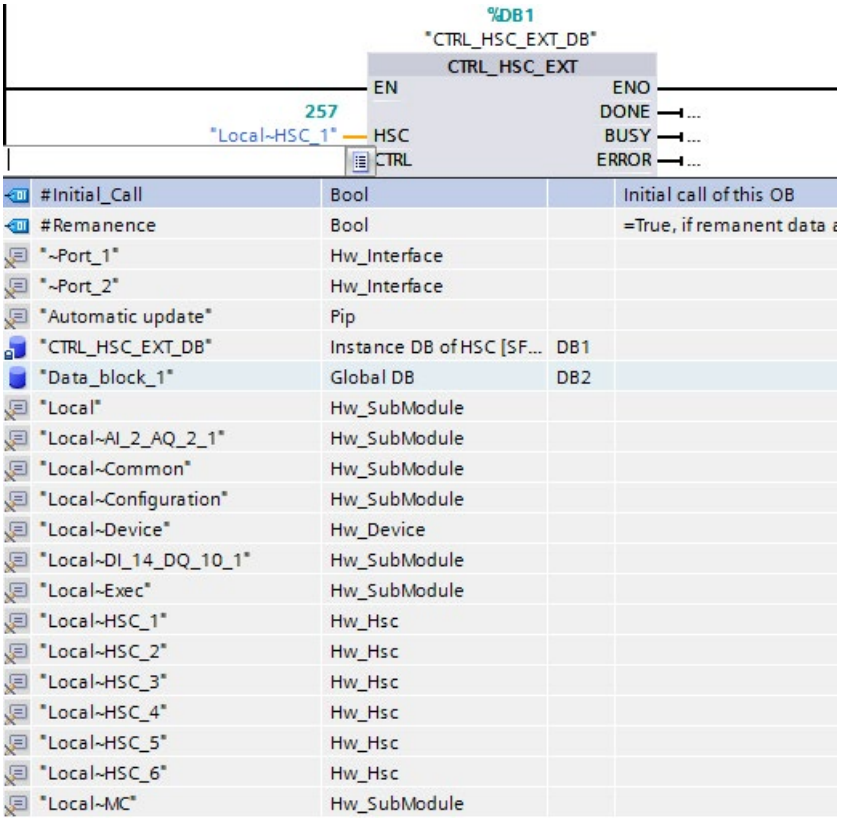


3. Create a global data block named "Data_block_1" (You can also use an existing global data block.):
   - Within "Data_block_1", locate an empty row and add a variable named "MyHSC".
   - In the "Data type" column, add one of the following System Data Types (SDT). Select the SDT that corresponds to the HSC's configured type of counting. More HSC SDT information can be found later in this section. The dropdown list does not contain these types so ensure that you enter the SDT name exactly as shown: HSC_Count, HSC_Period, or HSC_Frequency
   - After you enter the data type, you can expand the "MyHSC" variable to see all the fields contained in the data structure. Here, you can find the data type of each of the fields and change the default starting values:

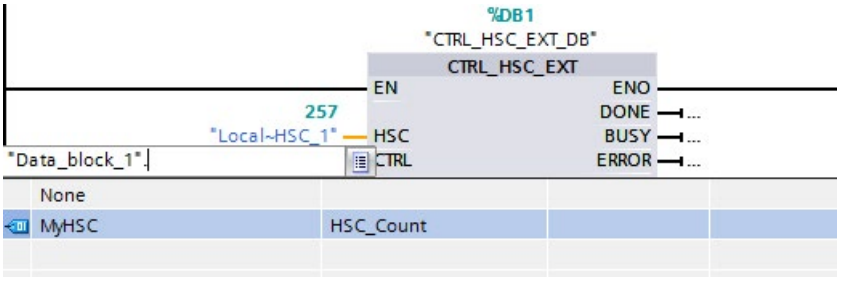
Data_block_1

	Name	Data type	Start value
1	Static		
2	MyHSC	HSC_Count	
3	CurrentCount	DInt	0
4	CapturedCount	DInt	0
5	SyncActive	Bool	false
6	DirChange	Bool	false
7	CmpResult_1	Bool	false
8	CmpResult_2	Bool	false
9	OverflowNeg	Bool	false
10	OverflowPos	Bool	false
11	EnHSC	Bool	false
12	EnCapture	Bool	false
13	EnSync	Bool	false
14	EnDir	Bool	false
15	EnCV	Bool	false
16	EnSV	Bool	false
17	EnReference1	Bool	false
18	EnReference2	Bool	false
19	EnUpperLmt	Bool	false
20	EnLowerLmt	Bool	false
21	EnOpMode	Bool	false
22	EnLmtBehavior	Bool	false
23	EnSyncBehavior	Bool	false
24	NewDirection	Int	0
25	NewOpModeBeha...	Int	0
26	NewLimitBehavior	Int	0
27	NewSyncBehavior	Int	0
28	NewCurrentCount	DInt	0
29	NewStartValue	DInt	0
30	NewReference1	DInt	0
31	NewReference2	DInt	0
32	NewUpperLimit	DInt	0
33	New_Lower_Limit	DInt	0

4. Assign the variable "'Data_block_1'. MyHSC" to the CTRL input pin of the CTRL_HSC_EXT instruction:
   – Select "Data_Block_1".



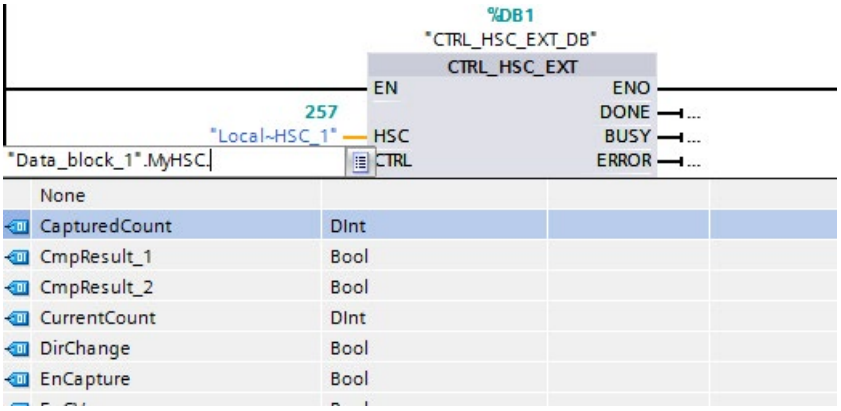
   – Select "MyHSC".



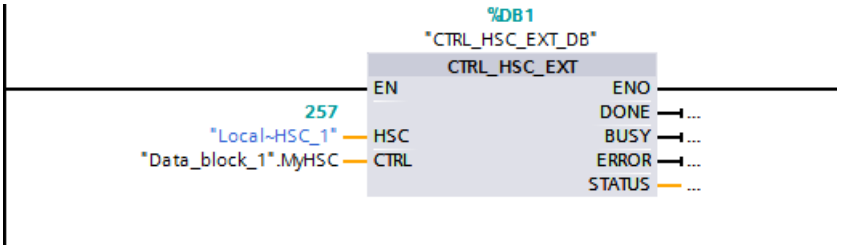
   – Delete the period (".") following: "'Data_Block_1'.MyHSC". Then, either click outside the box or press the ESC key once and then press the Enter key.

Note

After deleting the period (".") following: "'Data_Block_1'.MyHSC", do not press only the Enter key. This action places the period (".") back into the box.



– The completed CTRL input is shown below.



After you configure the HSC in the PLC, you can execute the CTRL_HSC_EXT instruction. If an error occurs, ENO is set to "0" and the STATUS output indicates the condition code.

See also

CTRL_HSC_EXT Instruction System Data Types (SDT) (Page 546)

10.1.1.3 CTRL_HSC_EXT Instruction System Data Types (SDT)

The following System Data Types (SDTs) are only used with the CTRL_HSC_EXT instruction's CTRL pin. To use them, create a user data block and add an object with the data type of the SDT that corresponds to the HSC's configured mode (type of counting). STEP 7 does not show these data types in the dropdown menu. Type the name of the SDT exactly as shown.

Inputs of the HSC's SDT are denoted by the prefix "En" or "New". Inputs prefixed with "En" either enables an HSC function or updates the corresponding parameter. The prefix "New" identifies the update value. In order for the new value to take effect, the corresponding "En" bit must be true, and the "New" value must be valid. When the CTRL_HSC_EXT instruction is executed, the program applies input changes and updates the outputs with the appropriate SDT reference attached.

SDT: HSC_Count

The "HSC_Count" data type corresponds to an HSC configured for "Count" mode. The Count mode provides the following capabilities:

- Access the current pulse count
- Latch the current pulse count on an input event
- Reset the current pulse count to the starting value on an input event
- Access status bits, indicating certain HSC events have occurred
- Disable the HSC using a software or hardware input
- Change the counting direction using a software or hardware input
- Change the current pulse count
- Change the starting value (used when CPU transitions to RUN state or when Sync function is triggered)
- Changing two independent reference (or preset) values used for comparison
- Change the upper and lower counting limits
- Change how the HSC operates when the pulse count reaches those limits
- Generate a hardware interrupt event when the current pulse count reaches a reference (preset) value
- Generate a hardware interrupt event when the Synchronization (reset) input activates
- Generate a hardware interrupt event when the counting direction changes based upon an external input
- Generate a single output pulse on a specified counting event

When an event occurs and the CTRL_HSC_EXT instruction executes, the instruction sets a status bit. On the following CTRL_HSC_EXT instruction execution, the instruction clears the status bit, unless the event occurs again before the instruction executes.

Table 10- 4 HSC_Count structure

Structure element	Declaration	Data type	Description
CurrentCount	OUT	Dint	Returns the HSC's current count value
CapturedCount	OUT	Dint	Returns the counter value captured on the specified input event
SyncActive	OUT	Bool	Status bit: Sync input was activated
DirChange	OUT	Bool	Status bit: Counting direction has changed
CmpResult1	OUT	Bool	Status bit: CurrentCount equals Reference1 event occured
CmpResult2	OUT	Bool	Status bit: CurrentCount equals Reference2 event occured
OverflowNeg	OUT	Bool	Status bit: CurrentCount reached the LowerLimit
OverflowPos	OUT	Bool	Status bit: CurrentCount reached the UpperLimit
EnHSC	IN	Bool	Enables the HSC to count pulses when true; disables counting when false
EnCapture	IN	Bool	Enables the Capture input when true, Capture input has no effect when false
EnSync	IN	Bool	Enables the Sync input when true; Sync input has no effect when false
EnDir	IN	Bool	Enables the NewDirection value to take effect
EnCV	IN	Bool	Enables the NewCurrentCount value to take effect
EnSV	IN	Bool	Enables the NewStartValue value to take effect
EnReference1	IN	Bool	Enables the NewReference1 value to take effect
EnReference2	IN	Bool	Enables the NewReference2 value to take effect
EnUpperLmt	IN	Bool	Enables the NewUpperLimit value to take effect
EnLowerLmt	IN	Bool	Enables the New_Lower_Limit value to take effect
EnOpMode	IN	Bool	Enables the NewOpModeBehavior value to take effect
EnLmtBehavior	IN	Bool	Enables the NewLimitBehavior value to take effect
EnSyncBehavior	IN	Bool	This value is not used.
NewDirection	IN	Int	Counting direction: 1 = count up; -1 = count down; all other values are reserved.
NewOpModeBehavior	IN	Int	HSC's operation on overflow: 1 = HSC stops counting (HSC must be disabled and re-enabled to continue counting); 2 = HSC continues to operate; all other values are reserved.
NewLimitBehavior	IN	Int	Result of the CurrentCount value on overflow: 1 = set CurrentCount to opposite limit; 2 = set CurrentCount to StartValue; all other values are reserved.
NewSyncBehavior	IN	Int	This value is not used.
NewCurrentCount	IN	Dint	CurrentCount Value
NewStartValue	IN	Dint	StartValue: Initial value of the HSC
NewReference1	IN	Dint	Reference1 Value
NewReference2	IN	Dint	Reference2 Value
NewUpperLimit	IN	Dint	Upper counting limit value
New_Lower_Limit	IN	Dint	Lower counting limit value

SDT: HSC_Period

The "HSC_Period" data type corresponds to an HSC configured for "Period" mode. The CTRL_HSC_EXT instruction provides program access to the number of input pulses over a specified measurement interval. This instruction allows for the time period between input pulses to be calculated with a fine nanosecond resolution.

Table 10- 5 HSC_Period structure

Structure element	Declaration	Data type	Description
ElapsedTime	OUT	UDInt	See description below.
EdgeCount	OUT	UDInt	See description below.
EnHSC	IN	Bool	Enables the HSC for Period measurement when true; disables Period measurement when false.
EnPeriod	IN	Bool	Enables NewPeriod value to take effect.
NewPeriod	IN	Int	Specifies the measurement interval time in milliseconds. The only allowed values are 10, 100 or 1000 ms.

ElapsedTime returns the time, in nanoseconds, between the last counting events of sequential measurement intervals. If no counting events occurred during a measurement interval, ElapsedTime returns the cumulative time since the last counting event. ElapsedTime has a range from "0" to 4,294,967,280 nanoseconds (0x0000 0000 to 0xFFFF FFF0). The return value 4,294,967,295 (0xFFFF FFFF) indicates that period overflow has occurred. Overflow indicates that the time between pulse edges is greater than 4.295 seconds and the period cannot be calculated using this instruction. The values from 0xFFFF FFF1 to 0xFFFF FFFE are reserved.

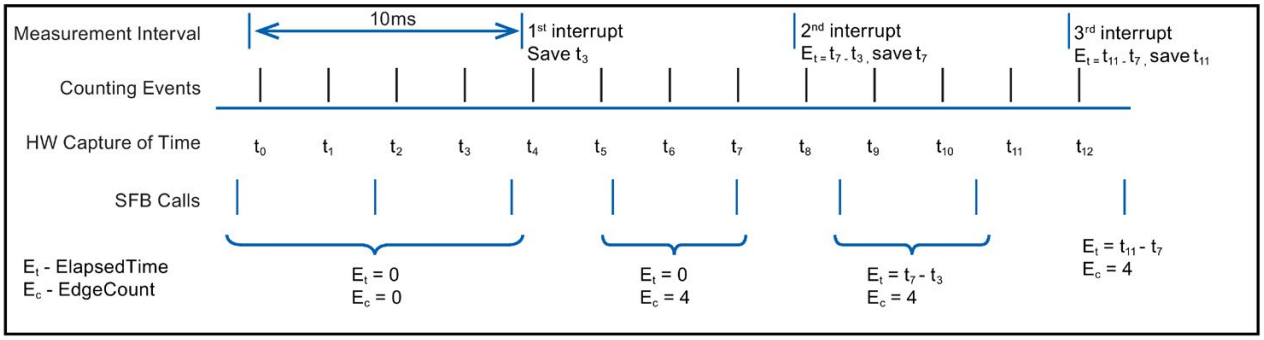
EdgeCount returns the number of counting events received during the measurement interval. The period can only be calculated when the value of EdgeCount is greater than zero. If ElapsedTime is either "0" (no input pulses received) or 0xFFFF FFFF (Period overflow), then EdgeCount is not valid.

When EdgeCount is valid, use the following formula to calculate the period in nanoseconds: Period = ElapsedTime/EdgeCount

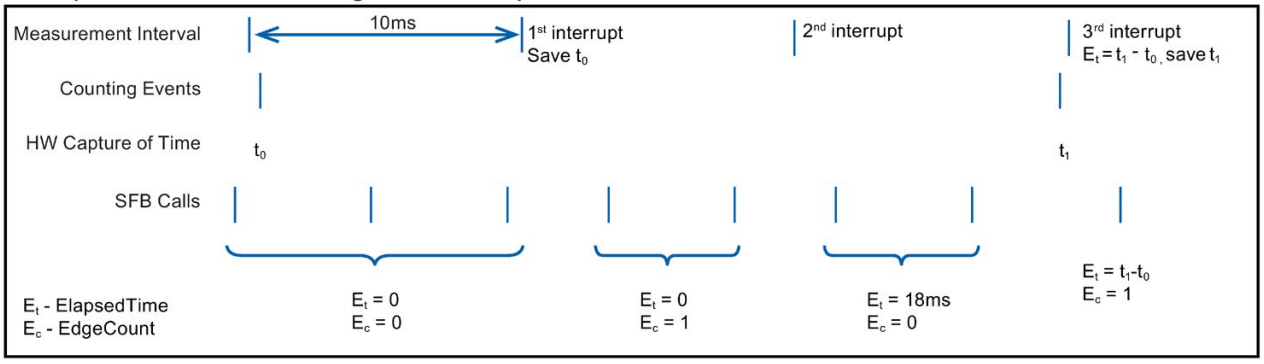
The calculated time period value is an average of the time periods of all of the pulses that occur during the measurement interval. If the period of an incoming pulse is greater than the measurement interval (10, 100, or 1000 ms), then the period calculation requires multiple measurement intervals.

The following examples show how the instruction makes period measurements:

Example 1: Multiple Counting Events in a Measurement Interval



Example 2: Zero and One Counting Events in Multiple Measurement Intervals



Rules:
1. If $E1_t = 0$, the period is invalid
2. Else, Period = E_t / E_c

SDT: HSC_Frequency

The "HSC_Frequency" data type corresponds to an HSC configured for "Frequency" mode. The instruction CTRL_HSC_EXT provides program access to the frequency of input pulses, measured over a specified time period.

Using the CTRL_HSC_EXT instruction in Frequency mode provides the following capabilities:

Table 10- 6 HSC_Frequency structure

Structure element	Declaration	Data type	Description
Frequency	OUT	DInt	Returns a frequency in Hz, measured over the measurement interval time. When the HSC counts down, the instruction returns a negative frequency.
EnHSC	IN	Bool	Enables the HSC for Frequency measurement when true; disables Frequency measurement when false.
EnPeriod	IN	Bool	Enables NewPeriod value to take effect.
NewPeriod	IN	Int	Specifies the measurement interval time in milliseconds. The only allowed values are 10, 100, or 1000 ms.

The CTRL_HSC_EXT instruction measures the Frequency using the same measurement technique as Period mode to find the ElapsedTime and EdgeCount. The instruction calculates the frequency as a signed integer value in Hz using the formula: Frequency = EdgeCount/ElapsedTime

If you require a floating-point value for frequency, you can use the above formula for frequency when the HSC is in Period mode. Note that in Period mode, ElapsedTime is returned in nanoseconds and can require scaling of the value.

10.1.2 Operating the high-speed counter

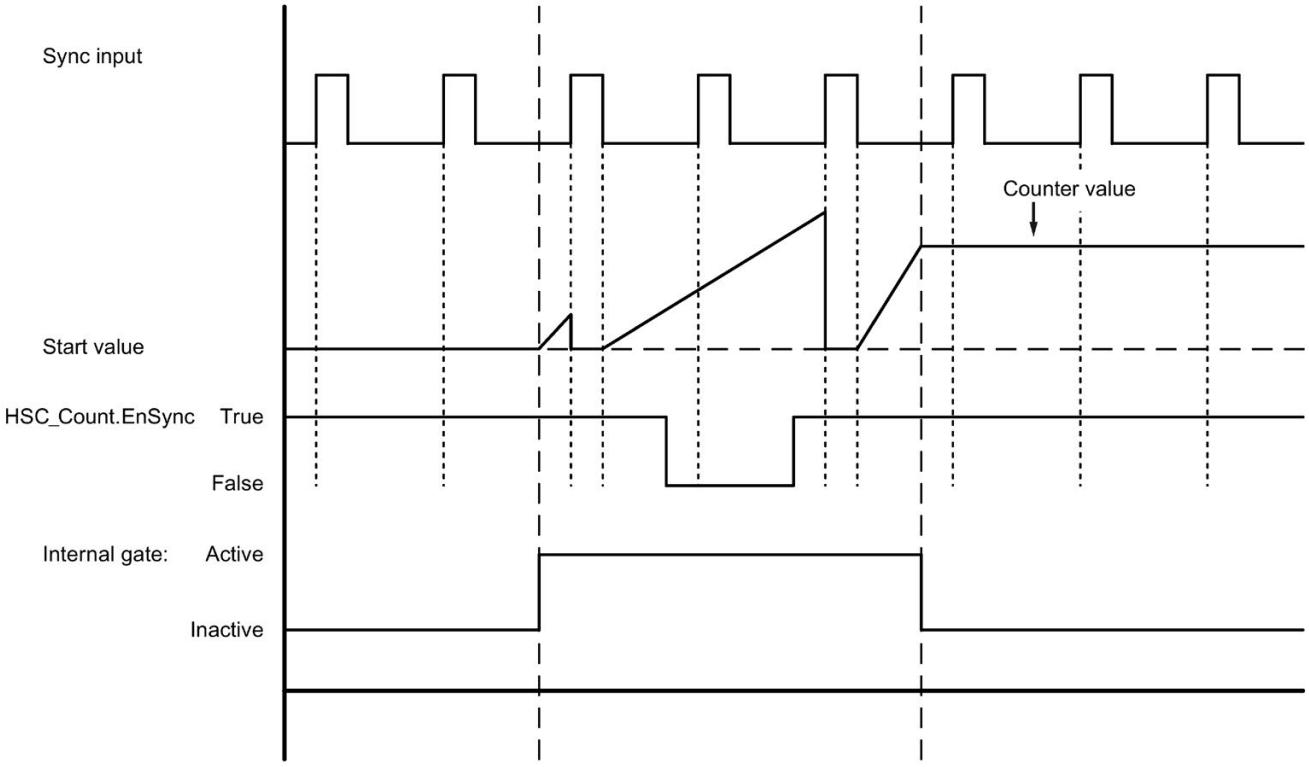
10.1.2.1 Synchronization function

You use the Sync (synchronization) function to set the counter to the start value with an external input signal. You can modify the start value by executing the CTRL_HSC_EXT instruction. This allows the user to synchronize the current count value to a desired value on occurrence of an external input signal.

Synchronization always takes place at the occurrence of the input signal and is effective regardless of the status of the internal gate. You must set the "HSC_Count.EnSync" bit to true in order to enable the Sync function.

The CTRL_HSC_EXT instruction sets the HSC_Count.SyncActive status bit to true after completion of synchronization. The CTRL_HSC_EXT instruction sets the HSC_Count.SyncActive status bit to false if synchronization has not occurred since the last instruction execution.

The figure below shows an example of synchronization when the input signal is configured for an active high level:



Note

The configured input filters delay the control signal of the digital input.

This input function is only available to be used when the HSC is configured for Count mode.

Refer to Input functions (Page 564) for information on how to configure the Synchronization function.

10.1.2.2 Gate function

Many applications require counting processes to be started or stopped in accordance with other events. In such cases, counting is started and stopped using the internal gate function. Each HSC channel has two gates: a software gate and a hardware gate. The state of these gates determines the state of the internal gate. See the table below.

The internal gate is open if the software gate is open and the hardware gate is open or has not been configured. If the internal gate is open, counting is started. If the internal gate is closed, all other count pulses are ignored and counting is stopped.

Table 10- 7 Gate function states

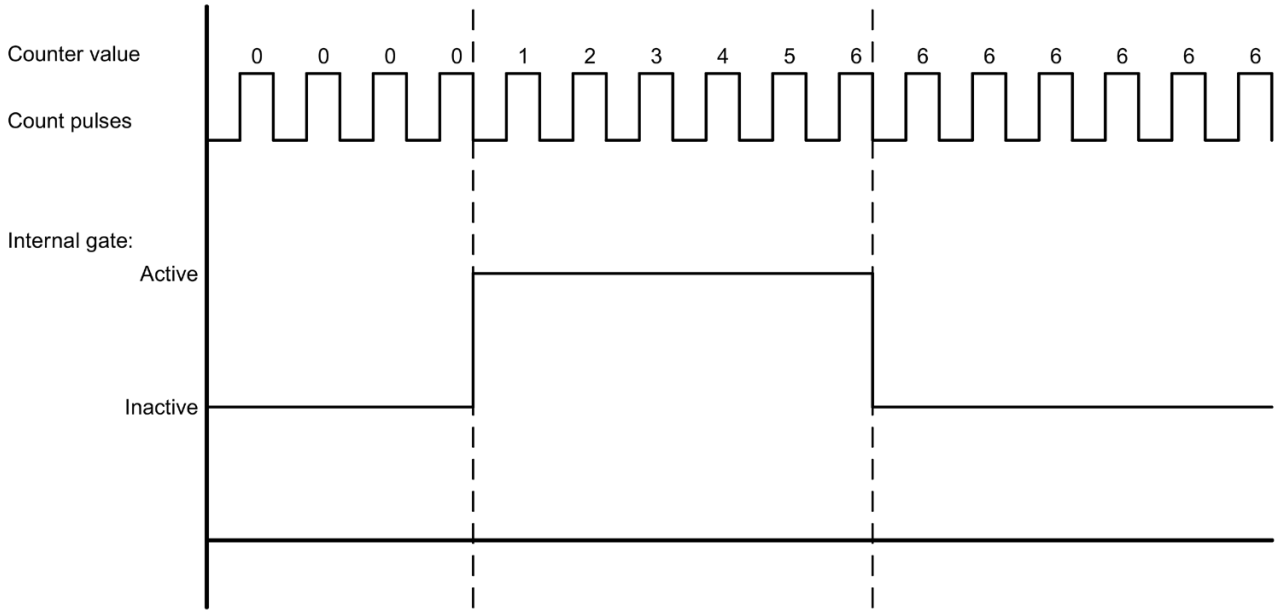
Hardware gate	Software gate	Internal gate
Open/not configured	Open	Open
Open/not configured	Closed	Closed
Closed	Open	Closed
Closed	Closed	Closed

The term "open" is defined to be the active state of the gate. Similarly, the term "closed" is defined to be the inactive state of the gate.

You control the software gate with the "HSC_Count.EnHSC" enable bit in the SDT attached to the CTRL_HSC_EXT instruction. To open the software gate, set the "HSC_Count.EnHSC" bit true; to close the software gate, set the "HSC_Count.EnHSC" bit false. Execute the CTRL_HSC_EXT instruction to update the software gate's state.

The hardware gate is optional, and you can enable or disable it in the HSC properties section. To control a counting process with only the hardware gate, the software gate must remain open. If you do not configure a hardware gate, the hardware gate is considered to be always open and the internal gate state is the same as the software gate state.

The figure below shows an example of the hardware gate opening and closing with a digital input. The digital input is configured for an active high level:



Note

The configured input filters delay the control signal of the digital input.

The hardware gate function is only available to be used when the HSC is configured for Count mode. In Period and Frequency modes, the internal gate state is the same as the software gate state.

In Period mode, the software gate is controlled by "HSC_Period.EnHSC".

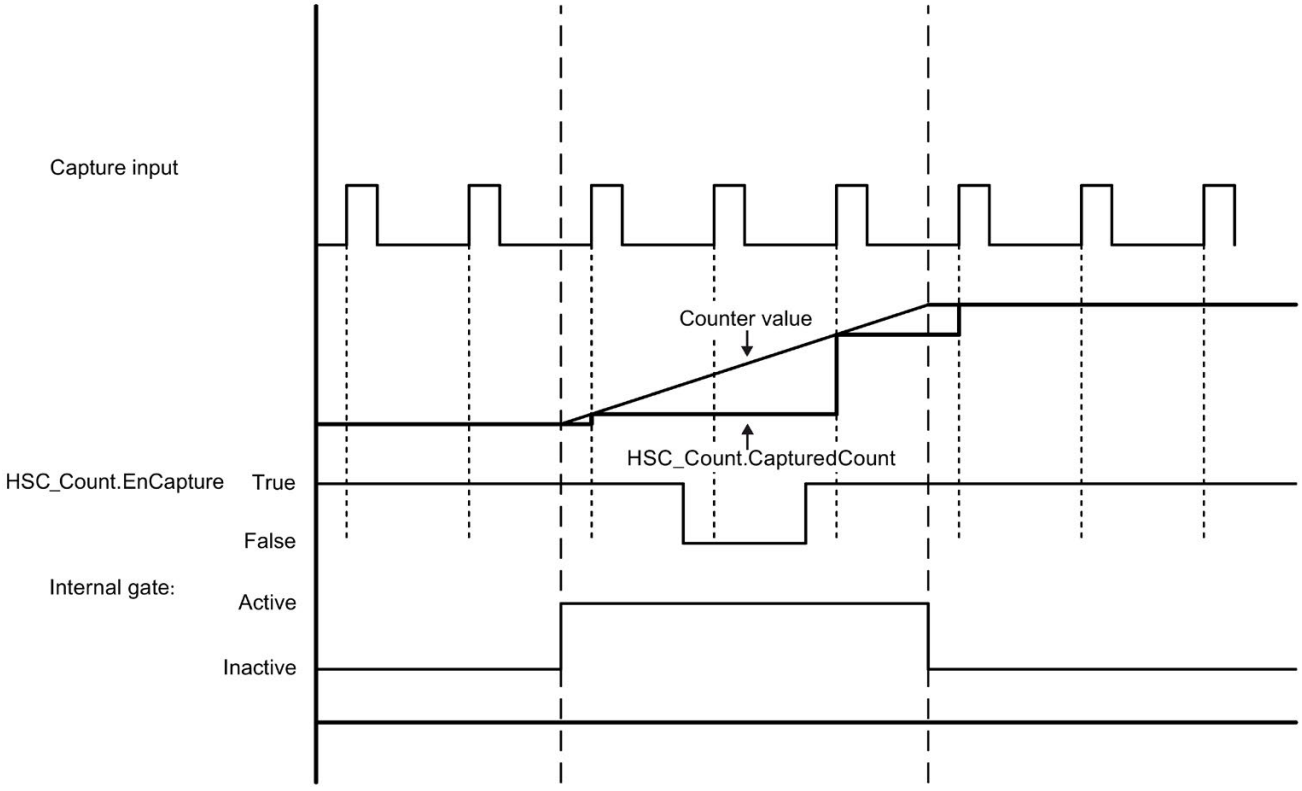
In Frequency mode, the software gate is controlled by "HSC_Frequency.EnHSC".

Refer to Input functions (Page 564) for information on how to configure the Gate function.

10.1.2.3 Capture function

You use the Capture function to save the current counter value with an external reference signal. When configured and enabled by the "HSC_Count.EnCapture" bit, the Capture function causes the current count to be captured on the occurrence of an external input edge. The Capture function is effective regardless of the status of the internal gate. The program saves the unchanged counter value when the gate is closed. After executing the CTRL_HSC_EXT instruction, the program stores the captured value in "HSC_Count.CapturedCount".

The figure below shows an example of the Capture function configured to capture on a rising edge. The Capture input does not trigger a capture of the current count when the "HSC_Count.EnCapture" bit is set false through the CTRL_HSC_EXT instruction.



Note

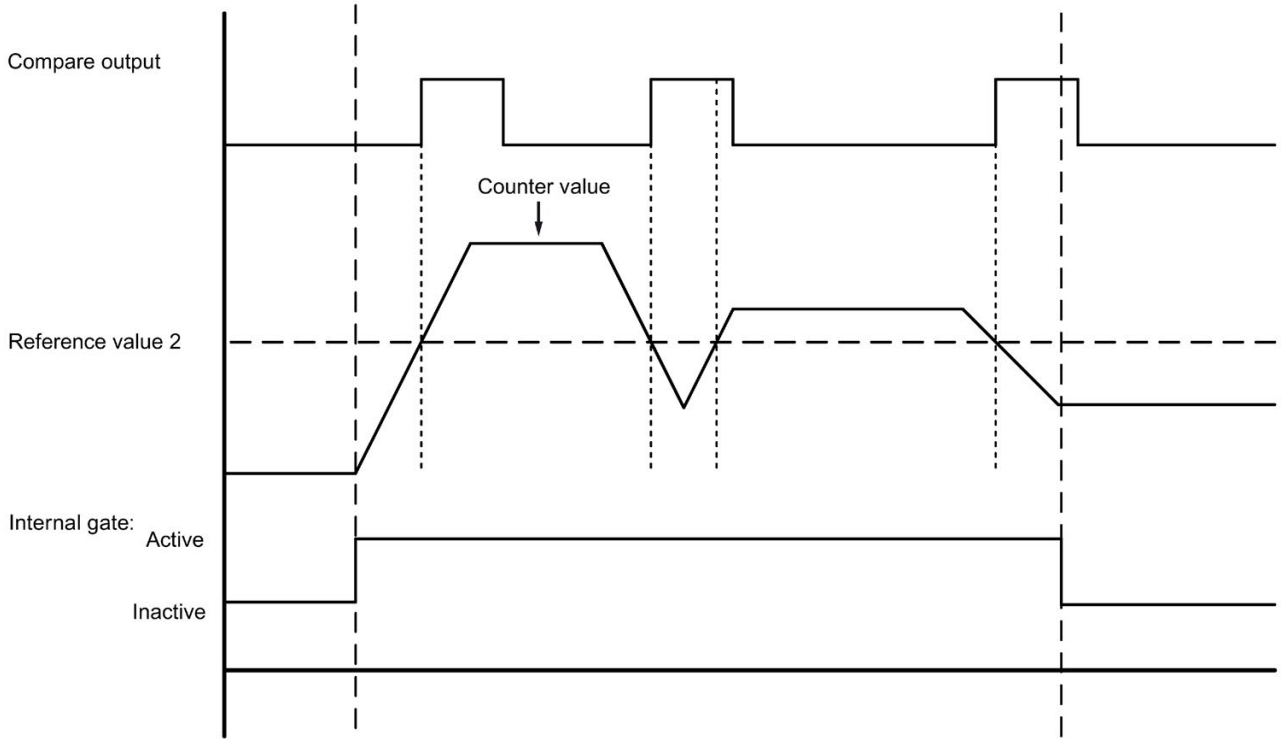
The configured input filters delay the control signal of the digital input.

This input function can only be used when the HSC is configured for Count mode.

Refer to Input functions (Page 564) for information on how to configure the Capture function.

10.1.2.4 Compare function

When enabled, the Compare output function generates a single, configurable pulse that occurs every time the configured event occurs. The events include count equal to one of the reference values or the counter overflows. If a pulse is in progress and the event occurs again, a pulse is not produced for that event.



Note

This output function can only be used when the HSC is configured for Count mode.

Refer to Output function (Page 565) for information on how to configure the Compare function.

10.1.2.5 Applications

A typical application uses the HSC to monitor feedback from an incremental shaft encoder. The shaft encoder provides a specified number of counts per revolution that you can use as the clock generator input to the HSC. There is also a reset pulse that occurs once per revolution that you can use as the sync input to the HSC.

To start, the program loads the first reference value into the HSC and sets the outputs to their initial states. The outputs remain in this state for the time period that the current count is less than the reference value. The HSC provides an interrupt when the current count is equal to the reference value, when the sync event (reset) occurs, and also when there is a direction change.

As each counter value equals the reference value, an interrupt event occurs, and the program loads a new reference value into the HSC and sets the outputs to their next state. When the sync interrupt event occurs, the program sets the first reference value and the first output states and repeats the cycle.

Since the interrupts occur at a much slower rate than the counting rate of the HSC, you can implement precise control of high-speed operations with relatively minor impact to the scan cycle of the CPU. The method of interrupt attachment allows each load of a new preset to be performed in a separate interrupt routine for easy state control. Alternatively, you can process all interrupt events in a single interrupt routine.

The Gate function, triggered either by the user program or an external input signal, can disable counting of the encoder pulses. You can ignore any movement of the shaft by deactivating the gate. This means that while the encoder continues to send pulses to the HSC, the count value is held at the last value before the gate goes inactive. When the gate goes active, counting resumes from the last value before the gate went inactive.

When enabled, the Capture function causes the current count to be captured on the occurrence of an external input. A process (for example, a calibration routine) can use this function to determine how many pulses occur between events.

When enabled, the Compare output function generates a single, configurable pulse that occurs every time the current count reaches one of the reference values or overflows (exceeds the counting limits). You can use this pulse as a signal to start another process whenever a certain HSC event occurs.

The counting direction is controlled by either the user program or an external input signal.

To obtain the speed of the rotating shaft, you can configure the HSC for Frequency mode. This function provides a signed integer value in units of Hz. Because the reset signal occurs once per revolution, measuring the frequency of the reset signal provides a quick indication of the shaft's speed, in revolutions per second.

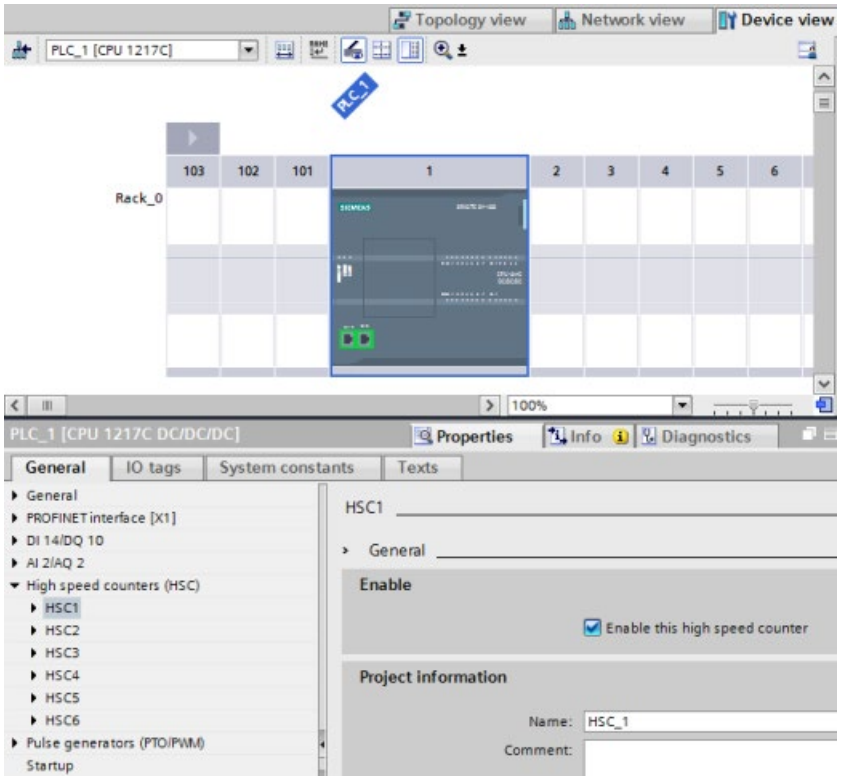
If you desire a floating point value of the frequency, configure the HSC for Period mode. You can use the ElapsedTime and EdgeCount values returned in Period mode to calculate the frequency.

10.1.3 Configuring a high-speed counter

To setup the high-speed counter (HSC):

- Select Device Configuration from the Project navigator.
- Select the CPU you wish to configure.
- Click the Properties tab, located in the Inspector window (see figure below).
- Select the HSC you want to enable from the list shown under the General tab (see figure below).

You may configure up to six high-speed counters (HSC1 through HSC6). Enable an HSC by selecting the "Enable this high speed counter" option. If enabled, STEP 7 assigns a unique default name to this HSC. You can change this name by editing it in the "Name:" edit field; however, it must be a unique name. Names of enabled HSCs become tags with the Data type "HW_Hsc" in the "System constant" tag table and are available for use as the "HSC" parameter of the CTRL_HSC_EXT instructions. Refer to "Configuring the operation of the CPU (Page 165)" for further information:



After enabling the HSC, STEP 7 sets single phase counting as the default configuration. Once you set the digital input filter for the HSC clock generator input, the program can be downloaded to the PLC, and the CPU is ready to count. To change the HSC's configuration, proceed to the next section, "Type of Counting".

The following table provides an overview of what inputs and outputs are available for each configuration:

Table 10- 8 Counting modes for HSC

Type	Input 1	Input 2	Input 3	Input 4	Input 5	Output 1	Function
Single-phase with internal direction control	Clock	-	-	-	-	-	Count, Frequency, or Period
			Sync	Gate	Capture	Compare	Count
Single-phase with external direction control	Clock	Direction	-	-	-	-	Count, Frequency, or Period
			Sync	Gate	Capture	Compare	Count
Two-phase	Clock up	Clock down	-	-	-	-	Count, Frequency, or Period
			Sync	Gate	Capture	Compare	Count
A/B counter	Phase A	Phase B	-	-	-	-	Count, Frequency, or Period
			Sync[1]	Gate	Capture	Compare	Count
A/B counter fourfold	Phase A	Phase B	-	-	-	-	Count, Frequency, or Period
			Sync[1]	Gate	Capture	Compare	Count

[1] For an encoder: Phase Z, Home

10.1.3.1 Type of Counting

There are four types of counting or modes. When you change the mode, the available configuration options for that HSC also change:

- Count: Counts the number of pulses and increments or decrements the count value, depending on the state of the direction control. External I/O can reset the count, disable counting, initiate a capture of the current count, and produce a single pulse on a specified event. The output values are the current count value and the count value at the moment a capture event occurs.
- Period: Counts the number of input pulses over a specified time period. Returns the pulse count and time duration in nanoseconds (ns). Values are captured and calculated at the end of the time period specified by Frequency measuring period. Period mode is available for the CTRL_HSC_EXT instruction but not the CTRL_HSC instruction.
- Frequency: Measures the input pulses and time duration and calculates the frequency of the pulses. The program returns the frequency as a signed double integer in units of Hz. The value is negative if the counting direction is down. Values are captured and calculated at the end of the time period specified by the Frequency measuring period.
- Motion control: Used by the motion control technology object and not available to the HSC instructions. Refer to "Motion control (Page 637)" for further information.

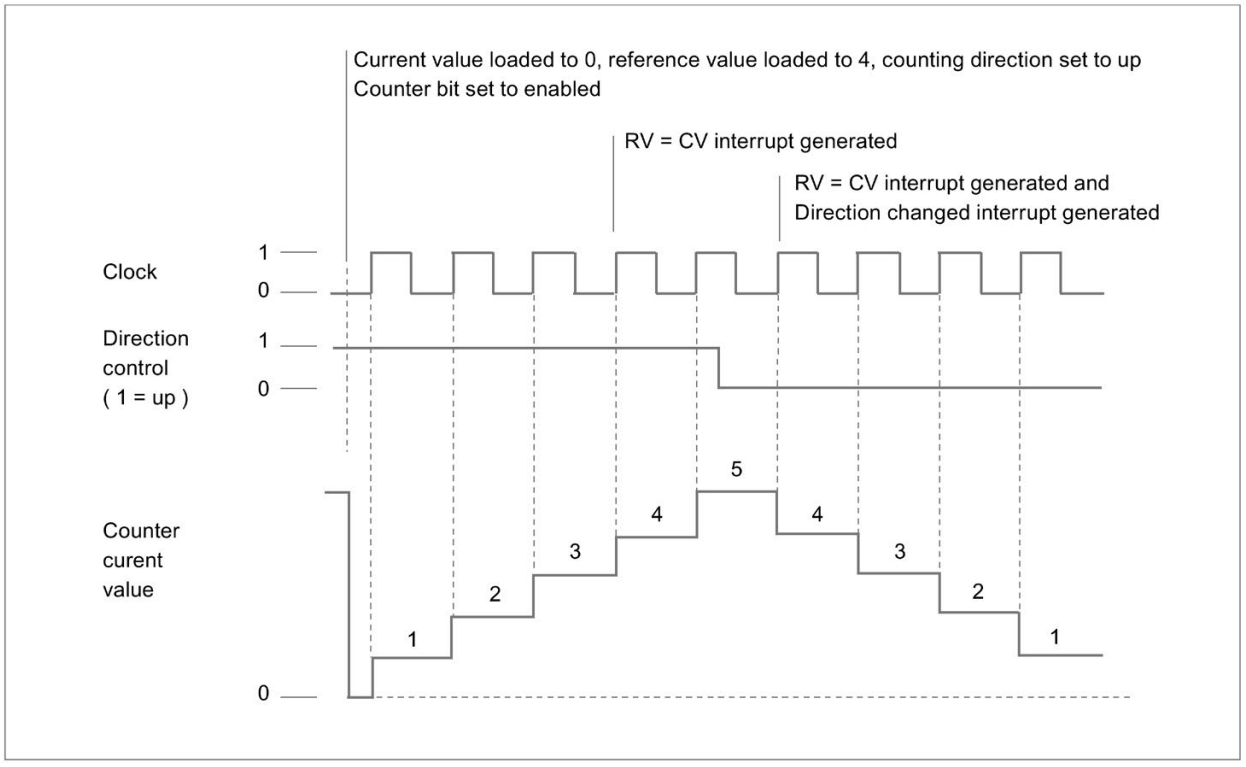
10.1.3.2 Operating phase

Select the desired operating phase of the HSC. The four figures below show when the counter value changes, when the current value (CV) equals the reference value (RV) event occurs, and when the direction change event occurs.

Single phase

Single-phase (not available with motion control) counts pulses:

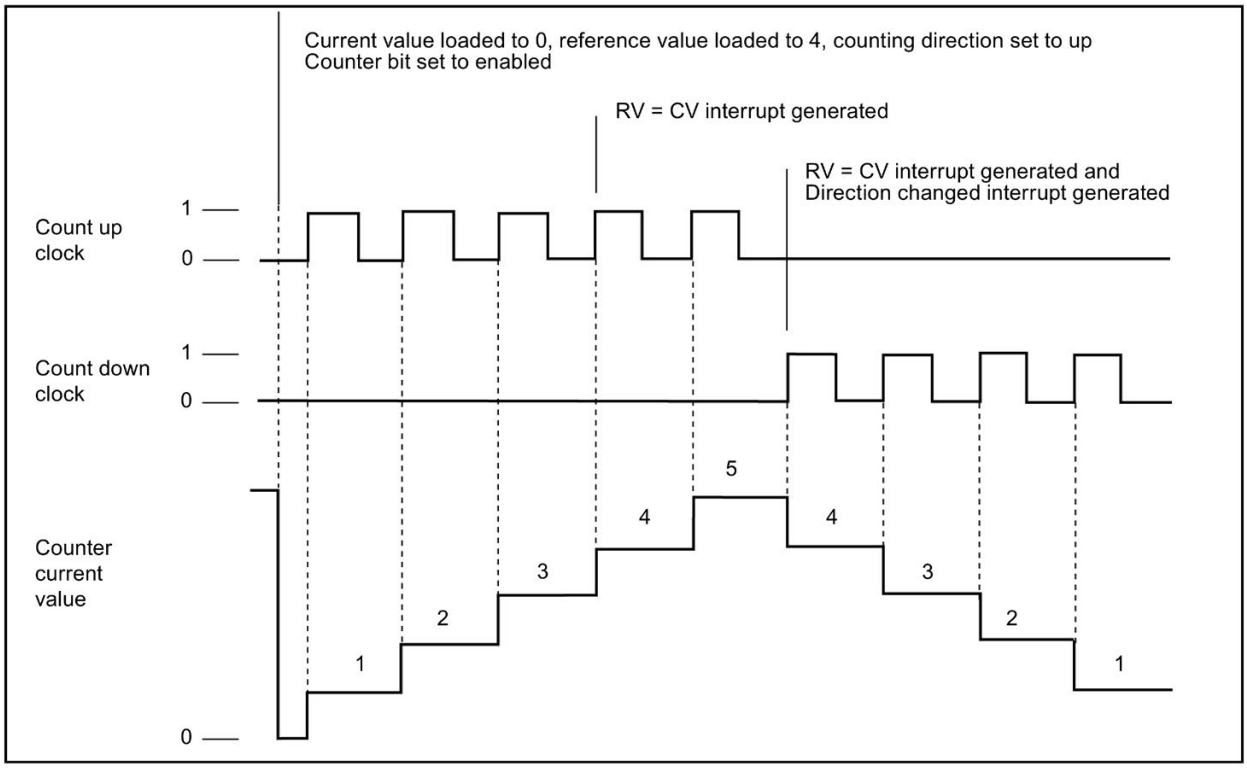
- User program (internal direction control):
  - 1 is up
  - -1 is down
- Hardware input (external direction control):
  - High level is up.
  - Low level is down.



Two phase

Two phase counts:

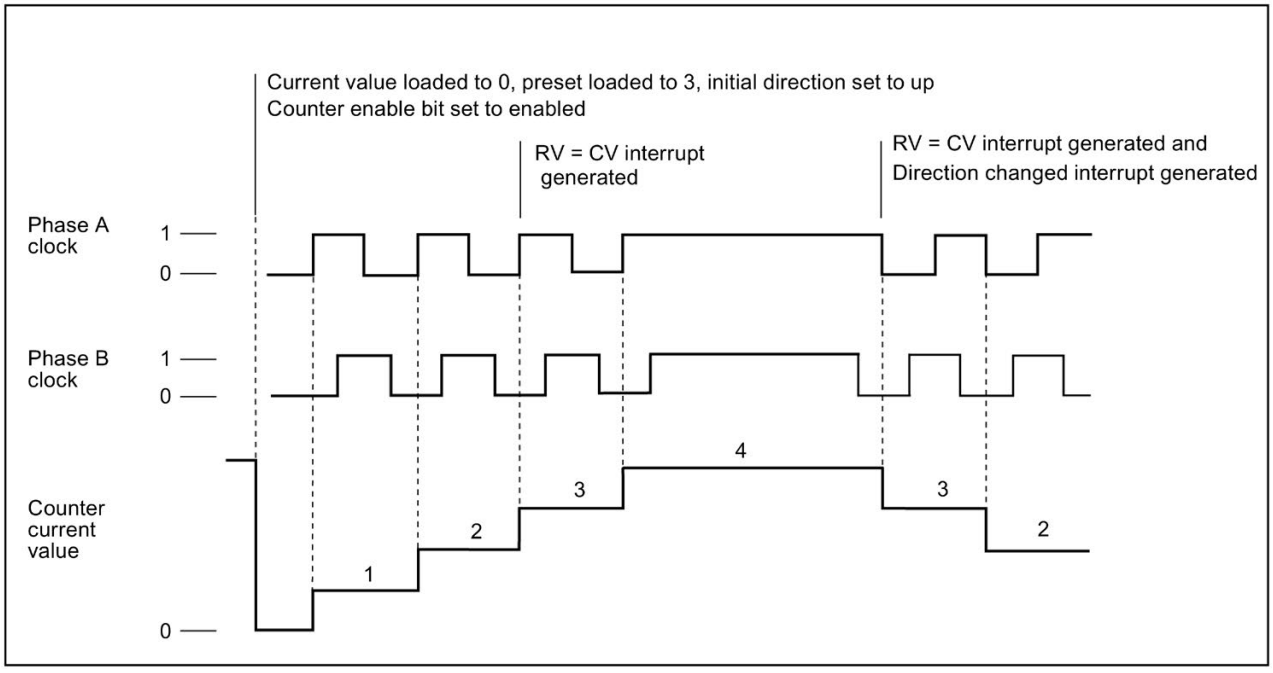
- Up on the clock up input
- Down on the clock down input



A/B counter

A/B phase quadrature counts:

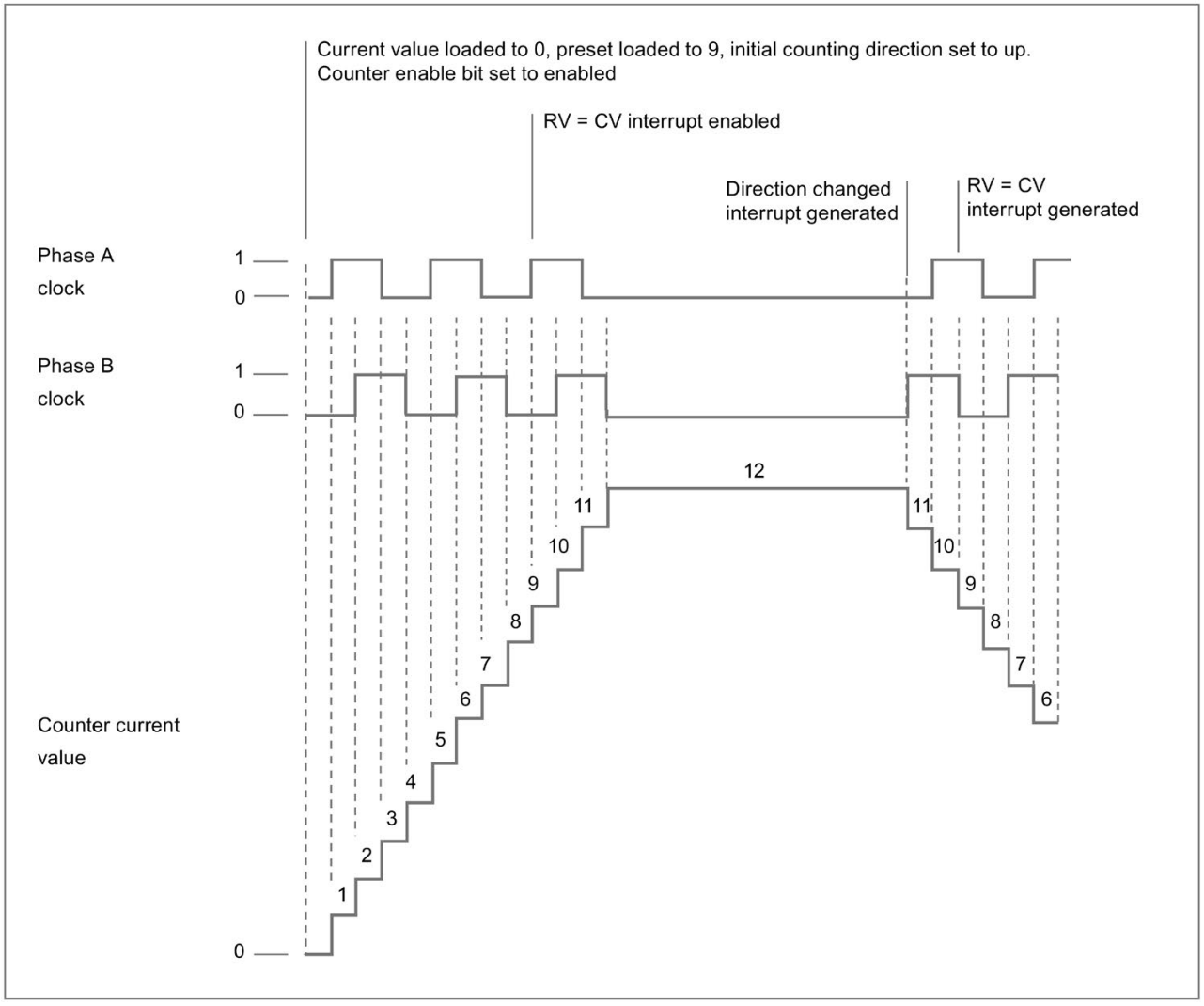
- Up on the rising edge of the clock A input when the clock B input is low
- Down on the falling edge of the clock A input when the clock B input is low



A/B counter fourfold

A/B phase quadrature fourfold counts:

- Up on the rising edge of the clock A input when the clock B input is low
- Up on the falling edge of the clock A input when the clock B input is high
- Up on the rising edge of the clock B input when the clock A input is high
- Up on the falling edge of the clock B input when the clock A input is low
- Down on the rising edge of the clock B input when the clock A input is low
- Down on the falling edge of the clock B input when the clock A input is high
- Down on the rising edge of the clock A input when the clock B input is high
- Down on the falling edge of the clock A input when the clock B input is low



10.1.3.3 Initial values

Each time the CPU goes to RUN, it loads initial values. The initial values are only used in count mode:

- Initial counter value: The program sets the current count value to the initial counter value when the CPU goes from STOP to RUN mode or when the program triggers the sync input.
- Initial reference value: When the current count reaches the reference value, if the respective functions are set up, the program generates an interrupt and/or an output pulse.
- Initial reference value 2: When the current count reaches the reference value 2, if the function is set up, the program generates an output pulse.
- Initial upper limit value: Maximum counting value. The default is the largest possible value of +2,147,483,647 pulses.
- Initial lower limit value: Minimum counting value. The default is the smallest possible value of -2,147,483,648 pulses.

The values above and the behavior of the counter when it reaches a limit are only available in Count mode. You can adjust the values and the behavior with the CTRL_HSC_EXT instruction using the HSC_Count SDT.

10.1.3.4 Input functions

The Clock and direction inputs determine count events and direction, based upon the operating phase. You can only use the Sync, Capture, and Gate inputs in Count mode and can individually enable and configure the inputs for different types of triggers.

Synchronization input

The Sync (synchronization) input sets the current count value to the starting (or initial counter) value. You typically use the Sync input to reset the counter to "0". You can trigger the Sync when the input pin is in one of the following states:

- High
- Low
- Goes from low to high
- Goes from high to low
- Goes from high to low or from low to high

Capture input

The Capture input sets the captured count value to the count value saved at the moment you triggered the Capture input. You can trigger the capture when the input pin is in one of the following states:

- Goes from low to high
- Goes from high to low
- Goes from high to low or from low to high

Gate input

The Gate input stops HSC counting. You can trigger the Gate when the input pin is in one of the following states:

- High
- Low

10.1.3.5 Output function

The compare output function is the only output for the HSC and is only available in Count mode.

Compare output

You can configure the Compare output to generate a single pulse on the occurrence of one of the following events:

- Counter equals reference value (count direction is up)
- Counter equals reference value (count direction is down)
- Counter equals reference value (count direction is up or down)
- Counter equals reference value 2 (count direction is up)
- Counter equals reference value 2 (count direction is down)
- Counter equals reference value 2 (count direction is up or down)
- Positive overflow
- Negative overflow

You can configure the output pulse with a cycle time ranging from 1 to 500 ms; the default cycle time is 10 ms. You can set the pulse width, or duty cycle, anywhere from 1 to 100%; the default pulse width is 50%.

If multiple compare output events occur within the specified cycle time, the output pulses from those events are lost due to the fact that the current pulse has not completed its cycle yet. Once the pulse has finished (the configured cycle time has passed), the pulse generator is available to produce a new pulse.

10.1.3.6 Interrupt events

Under the Event configuration section, you can select a hardware interrupt OB from the dropdown menu (or you can create a new OB) and attach it to an HSC event. The priority of the interrupt is in a range from 2 to 26, where 2 is the lowest priority and 26 is the highest priority. Depending on the HSC's configuration, the following events are available:

- Counter value equals reference value event: A counter value equals reference value event occurs when the HSC's count value reaches the reference value. You can set the reference value during configuration under the Initial reference value section, or by updating "NewReference1" using the CTRL_HSC_EXT instruction. Refer to the "Operating phase (Page 560)" section for further information.
- Synchronization event: A Sync (synchronization) occurs whenever you enable and trigger the Sync input.
- Change of direction event: A change of direction event occurs when the counting direction changes. Refer to the "Operating phase (Page 560)" section for further information.

10.1.3.7 Hardware input pin assignment

For each HSC input that you enable, select the desired input point, located either on the CPU or optional signal board (communication and signal modules do not support HSC inputs). When you select a point, STEP 7 displays the maximum frequency value next to the selection. The digital input filter settings may need to be adjusted so that all valid signal frequencies can pass through the filter. To set up the HSC input filters, refer to "Configuring digital input filter times (Page 167)".

Note

CPU and SB input channels (V4 or later firmware) have configurable input filter times

Earlier firmware versions had fixed HSC input channels and fixed filter times that you could not change.

With V4 or later versions, you can assign input channels and filter times. The default input filter setting is 6.4 ms, which limits the maximum counting rate to 78 Hz. You can change the filter settings to count higher or lower frequencies depending on the design of your system.

WARNING

Risks with changes to filter time setting for digital input channels

If the filter time for a digital input channel is changed from a previous setting, a new "0" level input value might need to be presented for up to a 20.0 ms accumulated duration before the filter becomes fully responsive to new inputs. During this time, short "0" pulse events of duration less than 20.0 ms may not be detected or counted.

The changing of filter times can result in unexpected machine or process operation, which can cause death or serious injury to personnel, and/or damage to equipment.

To ensure that a new filter time goes immediately into effect, power cycle the CPU.

Use the following table and ensure that the CPU and SB input channels that you connect can support the maximum pulse rates in your process signals:

Table 10- 9 CPU input: maximum frequency

CPU	CPU Input channel	Operating phase: Single phase or Two phase	Operating phase: A/B counter or A/B Counter fourfold
1211C	Ia.0 to Ia.5	100 kHz	80 kHz
1212C	Ia.0 to Ia.5	100 kHz	80 kHz
	Ia.6, Ia.7	30 kHz	20 kHz
1214C and 1215C	Ia.0 to Ia.5	100kHz	80kHz
	Ia.6 to Ib.5	30 kHz	20 kHz
1217C	Ia.0 to Ia.5	100 kHz	80 kHz
	Ia.6 to Ib.1	30 kHz	20 kHz
	Ib.2 to Ib.5 (.2+, .2- to .5+, .5-)	1 MHz	1 MHz

Table 10- 10 SB signal board input: maximum frequency (optional board)

SB signal board	SB input channel	Operating phase: Single phase or Two phase	Operating phase: A/B counter or A/B Counter fourfold
SB 1221, 200 kHz	Ie.0 to Ie.3	200kHz	160 kHz
SB 1223, 200 kHz	Ie.0, Ie.1	200kHz	160 kHz
SB 1223	Ie.0, Ie.1	30 kHz	20 kHz

When assigning an input point to an HSC function, you can assign the same input point to multiple HSC functions. For example, assigning I0.3 to the Sync input of HSC1 and the Sync input of HSC2 to synchronize the count of both HSCs at the same time is a valid configuration; however, it generates a compiler warning.

When possible, avoid assigning multiple input functions of the same HSC to the same input point. For example, assigning I0.3 to the Sync input and the Gate input of HSC 1 to synchronize the count and disable counting at the same time is also a valid configuration. You can make this configuration, but it could produce unintended results.

WARNING

Risks with assigning multiple functions to a single digital input channel

Assigning multiple input functions of the same HSC to a common input point may produce unpredictable results. When a trigger occurs on a point with multiple functions assigned to that trigger, the order in which the functions are executed by the PLC cannot be known. This is known as a race condition and is often an undesirable situation.

This race condition can result in unexpected machine or process operation, which can cause death or serious injury to personnel, and/or damage to equipment.

To avoid a race condition, do not assign more than two input functions, of the same HSC, to the same input pin. If an HSC has two input functions assigned to the same pin, set the triggers such that they could never occur at the same time. Remember that a falling edge occurs at the same instance that a low level begins and that a rising edge occurs at the same instance that a high level begins.

Note

You assign the digital input and output points used by high-speed counter (HSC) devices during CPU device configuration. When you assign input and output points to HSC devices, you cannot modify the values of these points using the force function in a watch table. The HSC has full control of these input and output points.

10.1.3.8 Hardware output pin assignment

If you enable the Compare output, select an available output point. Once you configure an output point for use by an HSC (or other technology objects such as a pulse generator), that output point is owned exclusively by that object. No other component can use the output point, and the output point cannot be forced to a value. If you configure a single output channel for multiple HSCs or for use in an HSC and a pulse output, the program generates a compile error.

10.1.3.9 HSC input memory addresses

Each HSC uses a double word section of I-memory that stores the current count. If you configure the HSC for frequency, then the frequency is stored in that input memory location. The available input address range is I0.0 to I1023.7 (maximum start address is I1020.0). The HSC cannot use an input address that overlaps with an input address mapped to another component. For further information on the process image, refer to "Execution of the user program (Page 83)".

The following table shows the default addresses assigned for each HSC:

Table 10- 11 HSC default addresses

High-speed counter (HSC)	Current value data type	Default current value address
HSC1	DInt	ID 1000
HSC2	DInt	ID 1004
HSC3	DInt	ID 1008
HSC4	DInt	ID 1012
HSC5	DInt	ID 1016
HSC6	DInt	ID 1020

10.1.3.10 Hardware identifier

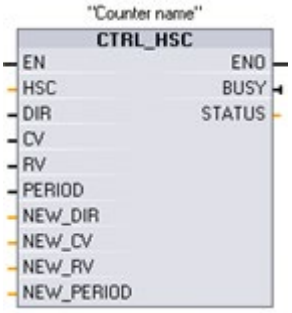
Each HSC has a unique hardware identifier, which is used by the HSC_CTRL and HSC_CTRL_EXT instructions. You can find the PLC tag for the hardware identifier under "System Constants". An HSC with the name "HSC_1" has the tag "Local~HSC_1" and data type "Hw_Hsc". This tag is also shown in the dropdown menu when selecting the HSC input of the CTRL_HSC_EXT instructions.

10.1.4 Legacy CTRL_HSC (Control high-speed counter) instruction

10.1.4.1 Instruction overview

Table 10- 12 CTRL_HSC instruction (For general purpose counting)

LAD / FBD	SCL	Description

	`"CTRL_HSC_1_DB" (`
	`hsc:=W#16#0,`
	`dir:=False,`
	`cv:=False,`
	`rv:=False,`
	`period:=False,`
	`new_dir:=0,`
	`new_cv:=L#0,`
	`new_rv:=L#0,`
	`new_period:=0,`
	`busy=>_bool_out_,`
	`status=>_word_out_);`
		Each CTRL_HSC (Control high-speed counter) instruction uses a structure stored in a DB to maintain counter data. You assign the DB when the CTRL_HSC instruction is placed in the editor.

1 When you insert the instruction, STEP 7 displays the "Call Options" dialog for creating the associated DB.

2 In the SCL example, "CTRL_HSC_1_DB" is the name of the instance DB.

Table 10- 13 Data types for the parameters

Parameter	Declaration	Data type	Description
HSC	IN	HW_HSC	HSC identifier
DIR[1, 2]	IN	Bool	1 = Request new direction
CV[1]	IN	Bool	1 = Request to set new counter value
RV[1]	IN	Bool	1= Request to set new reference value
PERIOD[1]	IN	Bool	1 = Request to set new period value (only for frequency measurement mode)
NEW_DIR	IN	Int	New direction: 1= forward, -1= backward
NEW_CV	IN	DInt	New counter value
NEW_RV	IN	DInt	New reference value
NEW_PERIOD	IN	Int	New period value is in milliseconds (only for frequency measurement mode). The only allowed values are 10, 100, or 1000 milliseconds: 1000 = 1 second 100 = 0.1 second 10 = 0.01 second
BUSY[3]	OUT	Bool	Function is busy
STATUS	OUT	Word	Execution condition code

1 If an update of a parameter value is not requested, then the corresponding input values are ignored.

2 The DIR parameter is only valid if the configured counting direction is set to "User program (internal direction control)". You determine how to use this parameter in the HSC device configuration.

3 For an HSC on the CPU or on the SB, the BUSY parameter always has a value of 0.

You configure the parameters for each HSC in the device configuration for the CPU for counting/frequency function, reset options, interrupt event configuration, hardware I/O, and count value address.

Some of the parameters for the HSC can be modified by your user program to provide program control of the counting process:

- Set the counting direction to a NEW_DIR value
- Set the current count value to a NEW_CV value
- Set the reference value to a NEW_RV value
- Set the period value (for frequency measurement mode) to a NEW_PERIOD value

If the following Boolean flag values are set to 1 when the CTRL_HSC instruction is executed, the corresponding NEW_xxx value is loaded to the counter. Multiple requests (more than one flag is set at the same time) are processed in a single execution of the CTRL_HSC instruction.

- DIR = 1 is a request to load a NEW_DIR value, 0 = no change
- CV = 1 is a request to load a NEW_CV value, 0 = no change
- RV = 1 is a request to load a NEW_RV value, 0 = no change
- PERIOD = 1 is a request to load a NEW_PERIOD value, 0 = no change

If an error occurs, ENO is set to "0" and the STATUS output indicates a condition code:

Table 10- 14 Execution condition codes

STATUS (W#16#)	Description
0	No error
80A1	HSC identifier does not address a HSC
80B1	Illegal value in NEW_DIR
80B2	Illegal value in NEW_CV
80B3	Illegal value in NEW_RV
80B4	Illegal value in NEW_PERIOD
80C0	Multiple access to the high-speed counter This error can occur if the type of counting (Page 559) is set to "Period" or "Motion control". These types are invalid for the CTRL_HSC instruction and are only supported by the CTRL_HSC_EXT instruction.
80D0	High-speed counter (HSC) not enabled in CPU hardware configuration

10.1.4.2 Using CTRL_HSC

The CTRL_HSC instruction is typically placed in a hardware interrupt OB that is executed when the counter hardware interrupt event is triggered. For example, if a CV=RV event triggers the counter interrupt, then a hardware interrupt OB code block executes the CTRL_HSC instruction and can change the reference value by loading a NEW_RV value.

The current count value is not available in the CTRL_HSC parameters. The process image address that stores the current count value is assigned during the hardware configuration of the high-speed counter. You may use program logic to directly read the count value. The value returned to your program will be a correct count for the instant in which the counter was read. The counter will continue to count high-speed events. Therefore, the actual count value could change before your program completes a process using an old count value.

10.1.4.3 HSC current count value

The CPU stores the current value of each HSC in an input (I) address. The following table shows the default addresses assigned to the current value for each HSC. You can change the I address for the current value by modifying the properties of the CPU in the Device Configuration.

High-speed counters use a DInt value to store the current count value. A DInt count value has a range of -2147483648 to +2147483647. As of CPU firmware V4.2, you can configure the range limits. Refer to "Initial values (Page 564)" for further information.

The counter rolls over from the maximum positive value to the maximum negative value when counting up, and from the maximum negative value to the maximum positive value when counting down. Frequency is returned in units of Hertz (for example, 123.4 Hz is returned as 123).

Table 10- 15 HSC default addresses

HSC	Current value data type	Default current value address
HSC1	DInt	ID1000
HSC2	DInt	ID1004
HSC3	DInt	ID1008
HSC4	DInt	ID1012
HSC5	DInt	ID1016
HSC6	DInt	ID1020

10.2 PID control

STEP 7 provides the following PID instructions for the S7-1200 CPU:

- The PID_Compact instruction is used to control technical processes with continuous input- and output variables.
- The PID_3Step instruction is used to control motor-actuated devices, such as valves that require discrete signals for open- and close actuation.
- The PID_Temp instruction provides a universal PID controller that allows handling of the specific requirements of temperature control.

Note

Changes that you make to the PID configuration and download in RUN do not take effect until the CPU transitions from STOP to RUN mode. Changes that you make in the "PID parameters" dialog using the "Start value control" take effect immediately.

All three PID instructions (PID_Compact, PID_3Step, and PID_Temp) can calculate the P-, I-, and D-components during startup (if configured for "pre-tuning"). You can also configure the instruction for "fine tuning" to allow you to optimize the parameters. You do not need to manually determine the parameters.

Note

Execute the PID instruction at constant intervals of the sampling time (preferably in a cyclic OB).

Because the PID loop needs a certain time to respond to changes of the control value, do not calculate the output value in every cycle. Do not execute the PID instruction in the main program cycle OB (such as OB 1).

The sampling time of the PID algorithm represents the time between two calculations of the output value (control value). The output value is calculated during self-tuning and rounded to a multiple of the cycle time. All other functions of PID instruction are executed at every call.

PID algorithm

The PID (Proportional/Integral/Derivative) controller measures the time interval between two calls and then evaluates the results for monitoring the sampling time. A mean value of the sampling time is generated at each mode changeover and during initial startup. This value is used as reference for the monitoring function and is used for calculation. Monitoring includes the current measuring time between two calls and the mean value of the defined controller sampling time.

The output value for the PID controller consists of three components:

- P (proportional): When calculated with the "P" component, the output value is proportional to the difference between the setpoint and the process value (input value).
- I (integral): When calculated with the "I" component, the output value increases in proportion to the duration of the difference between the setpoint and the process value (input value) to finally correct the difference.
- D (derivative): When calculated with the "D" component, the output value increases as a function of the increasing rate of change of the difference between the setpoint and the process value (input value). The output value is corrected to the setpoint as quickly as possible.

The PID controller uses the following formula to calculate the output value for the PID_Compact instruction.

$$y = K_p \left[(b \cdot w - x) + \frac{1}{T_I \cdot s} (w - x) + \frac{T_D \cdot s}{a \cdot T_D \cdot s + 1} (c \cdot w - x) \right]$$

y	Output value	x	Process value
w	Setpoint value	s	Laplace operator
K_p	Proportional gain (P component)	a	Derivative delay coefficient (D component)
T_1	Integral action time (I component)	b	Proportional action weighting (P component)
T_D	Derivative action time (D component)	c	Derivative action weighting (D component)

The PID controller uses the following formula to calculate the output value for the PID_3Step instruction.

$$\Delta y = K_p \cdot s \cdot \left[(b \cdot w - x) + \frac{1}{T_I \cdot s} (w - x) + \frac{T_D \cdot s}{a \cdot T_D \cdot s + 1} (c \cdot w - x) \right]$$

y	Output value	x	Process value
w	Setpoint value	s	Laplace operator
K_p	Proportional gain (P component)	a	Derivative delay coefficient (D component)
T_1	Integral action time (I component)	b	Proportional action weighting (P component)
T_D	Derivative action time (D component)	c	Derivative action weighting (D component)

10.2.1 Inserting the PID instruction and technology object

STEP 7 provides two instructions for PID control:

- The PID_Compact instruction and its associated technology object provide a universal PID controller with tuning. The technology object contains all of the settings for the control loop.
- The PID_3Step instruction and its associated technology object provide a PID controller with specific settings for motor-activated valves. The technology object contains all of the settings for the control loop. The PID_3Step controller provides two additional Boolean outputs.

After creating the technology object, you must configure the parameters (Page 608). You also adjust the autotuning parameters ("pre-tuning" during startup or manual "fine tuning") to commission the operation of the PID controller (Page 625).

Table 10- 16 Inserting the PID instruction and the technology object

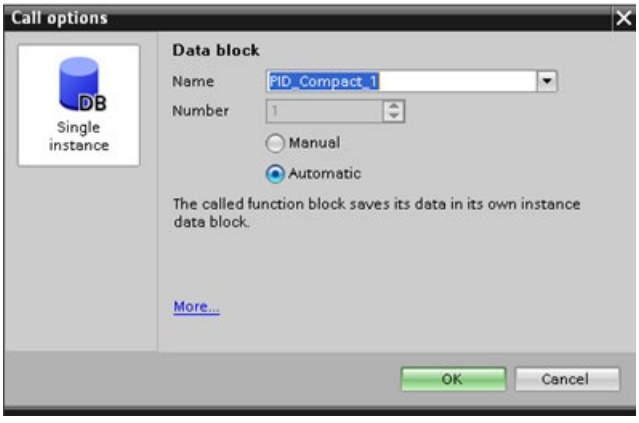
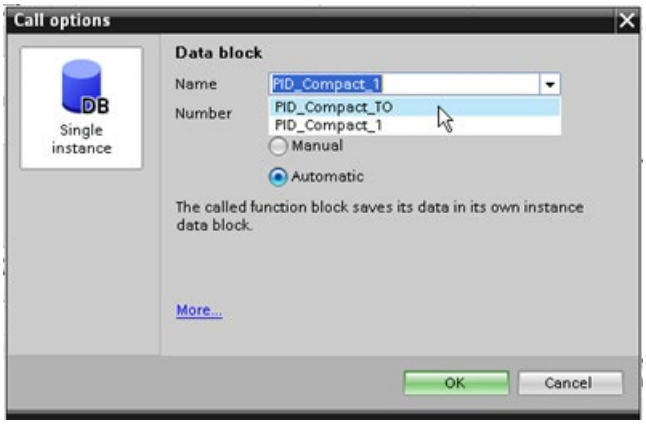
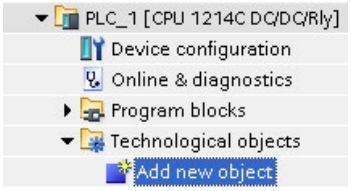
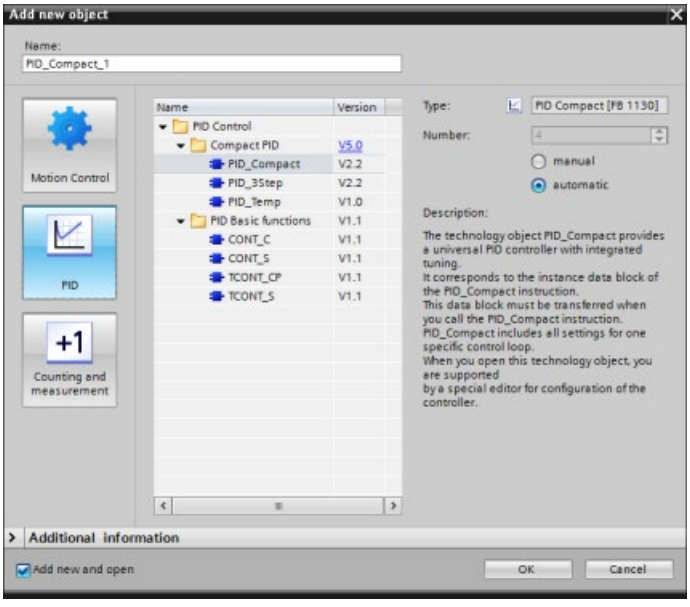
When you insert a PID instruction into your user program, STEP 7 automatically creates a technology object and an instance DB for the instruction. The instance DB contains all of the parameters that are used by the PID instruction. Each PID instruction must have its own unique instance DB to operate properly. After inserting the PID instruction and creating the technology object and instance DB, you configure the parameters for the technology object (Page 608).	

Table 10- 17 (Optional) Creating a technology object from the project navigator

You can also create technology objects for your project **before** inserting the PID instruction. By creating the technology object before inserting a PID instruction into your user program, you can then select the technology object when you insert the PID instruction.	
To create a technology object, double-click the "Add new object" icon in the project navigator.	
Click the "Control" icon and select the technology object for the type of PID controller (PID_Compact or PID_3Step). You can create an optional name for the technology object. Click "OK" to create the technology object.	

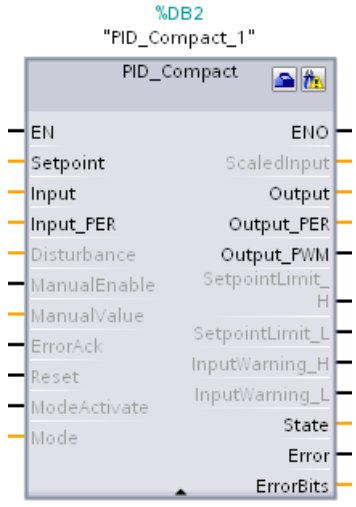
10.2.2 PID_Compact

10.2.2.1 PID_Compact instruction

The PID_Compact instruction provides a universal PID controller with integrated self-tuning for automatic and manual mode.

Table 10- 18 PID_Compact instruction

LAD / FBD	SCL	Description

	`"PID_Compact_1"(`
	`  Setpoint:=_real_in_,`
	`  Input:=_real_in_,`
	`  Input_PER:=_word_in_,`
	`  Disturbance:=_real_in_,`
	`  ManualEnable:=_bool_in_,`
	`  ManualValue:=_real_in_,`
	`  ErrorAck:=_bool_in_,`
	`  Reset:=_bool_in_,`
	`  ModeActivate:=_bool_in_,`
	`  Mode:=_int_in_,`
	`  ScaledInput=>_real_out_,`
	`  Output=>_real_out_,`
	`  Output_PER=>_word_out_,`
	`  Output_PWM=>_bool_out_,`
	`  SetpointLimit_H=>_bool_out_,`
	`  SetpointLimit_L=>_bool_out_,`
	`  InputWarn-`
	`ing_H=>_bool_out_,`
	`  InputWarn-`
	`ing_L=>_bool_out_,`
	`  State=>_int_out_,`
	`  Error=>_bool_out_,`
	`  ErrorBits=>_dword_out_);`
		PID_Compact provides a PID controller with self-tuning for automatic and manual mode. PID_Compact is a PID T1 controller with anti-windup and weighting of the P- and D-component.

1 STEP 7 automatically creates the technology object and instance DB when you insert the instruction. The instance DB contains the parameters of the technology object.

2 In the SCL example, "PID_Compact_1" is the name of the instance DB.

Table 10- 19 Data types for the parameters

Parameter and type		Data type	Description
Setpoint	IN	Real	Setpoint of the PID controller in automatic mode. (Default value: 0.0)
Input	IN	Real	A tag of the user program is used as the source of the process value. (Default value: 0.0) If you are using the Input parameter, you must set Config.InputPerOn = FALSE.
Input_PER	IN	Word	An Analog input is used as the source of the process value. (Default value: W#16#0) If you are using the Input_PER parameter, you must set Config.InputPerOn = TRUE.
Disturbance	IN	Real	Disturbance variable or pre-control value
ManualEnable	IN	Bool	Enables or disables the manual operation mode. (Default value: FALSE): • A FALSE to TRUE edge activates "manual mode", while State = 4, Mode remains unchanged. As long as ManualEnable = TRUE, you cannot change the operating mode using a rising edge at ModeActivate or use the commissioning dialog. • A TRUE to FALSE edge activates the operating mode that is assigned by Mode. Note: We recommend that you change the operating mode using ModeActivate only.
ManualValue	IN	Real	Output value for manual operation. (Default value: 0.0) You can use values from Config.OutputLowerLimit to Config.OutputUpperLimit.
ErrorAck	IN	Bool	Resets the ErrorBits and warning outputs. FALSE to TRUE edge
Reset	IN	Bool	Restarts the controller. (Default value: FALSE): • FALSE to TRUE edge: – Switches to "inactive" mode – Resets the ErrorBits and warning outputs – Clears Integral action – Maintains PID parameters • As long as Reset = TRUE, PID_Compact remains in "Inactive" mode (State = 0). • TRUE to FALSE edge: – PID_Compact switches to the operating mode that is saved in the Mode parameter.
ModeActivate	IN	Bool	The PID_Compact switches to the operating mode that is saved in the Mode parameter. FALSE to TRUE edge:
Mode	IN	Int	The desired PID mode; Activated on the leading edge of the Mode Activate input.
ScaledInput	OUT	Real	Scaled process value. (Default value: 0.0)
Output[1]	OUT	Real	Output value in REAL format. (Default value: 0.0)
Output_PER[1]	OUT	Word	Analog output value. (Default value: W#16#0)

Parameter and type		Data type	Description
Output_PWM[1]	OUT	Bool	Output value for pulse width modulation. (Default value: FALSE) On and Off times form the output value.
SetpointLimit_H	OUT	Bool	Setpoint high limit. (Default value: FALSE) If SetpointLimit_H = TRUE, the absolute setpoint upper limit is reached (Setpoint ≥ Config.SetpointUpperLimit). The setpoint is limited to Config.SetpointUpperLimit.
SetpointLimit_L	OUT	Bool	Setpoint low limit. (Default value: FALSE) If SetpointLimit_L = TRUE, the absolute setpoint lower limit is reached (Setpoint ≤ Config.SetpointLowerLimit). The setpoint is limited to Config.SetpointLowerLimit.
InputWarning_H	OUT	Bool	If InputWarning_H = TRUE, the process value has reached or exceeded the warning high limit. (Default value: FALSE)
InputWarning_L	OUT	Bool	If InputWarning_L = TRUE, the process value has reached or fallen below the warning low limit. (Default value: FALSE)
State	OUT	Int	Current operating mode of the PID controller. (Default value: 0) You can change the operating mode using the Mode input parameter and a rising edge at ModeActivate: • State = 0: Inactive • State = 1: Pre-tuning • State = 2: Manual fine tuning • State = 3: Automatic mode • State = 4: Manual mode • State = 5: Substitute output value with error monitoring
Error	OUT	Bool	If Error = TRUE, at least one error message is pending in this cycle. (Default value: FALSE) Note: The Error parameter in V1.x PID was the ErrorBits field that contained the error codes. It is now a Boolean flag indicating that an error has occurred.
ErrorBits	OUT	DWord	The PID_Compact instruction ErrorBits parameters table (Page 583) defines the error messages that are pending. (Default value: DW#16#0000 (no error)). ErrorBits is retentive and is reset upon a rising edge at Reset or ErrorAck. Note: In V1.x, the ErrorBits parameter was defined as the Error parameter and did not exist.

[1] You can use the outputs of the Output, Output_PER, and Output_PWM parameters in parallel.

Operation of the PID_Compact controller

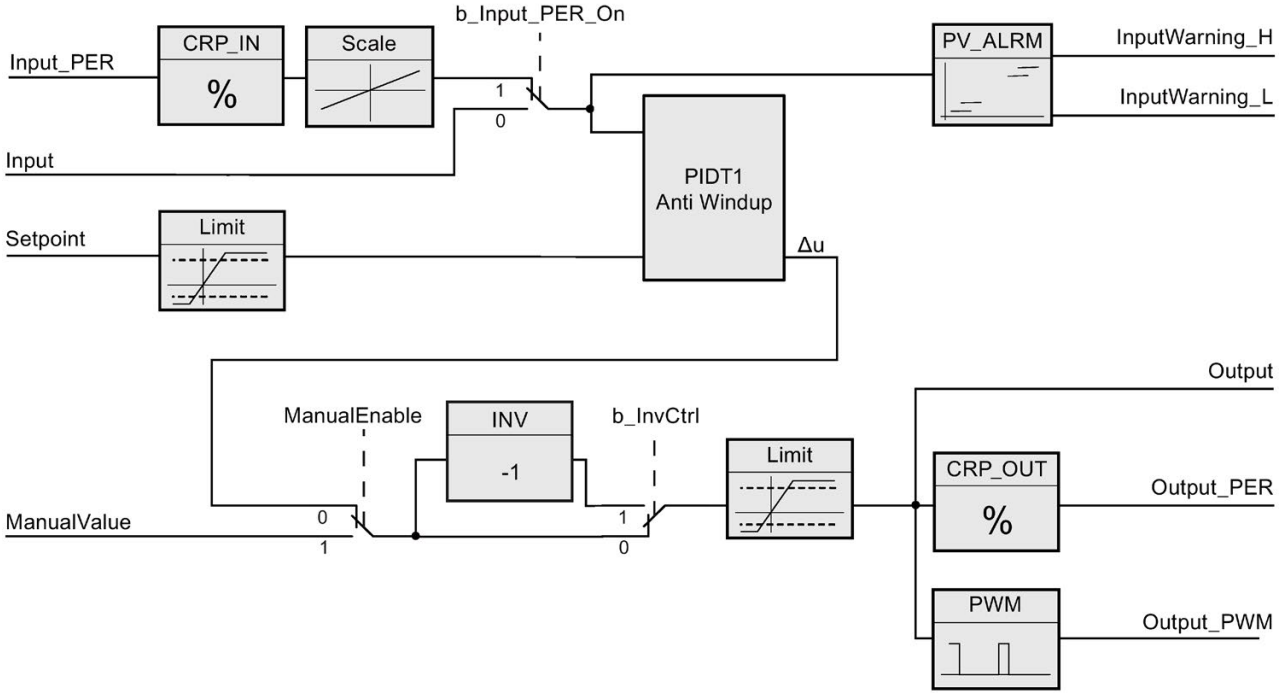


Figure 10-1 Operation of the PID_Compact controller

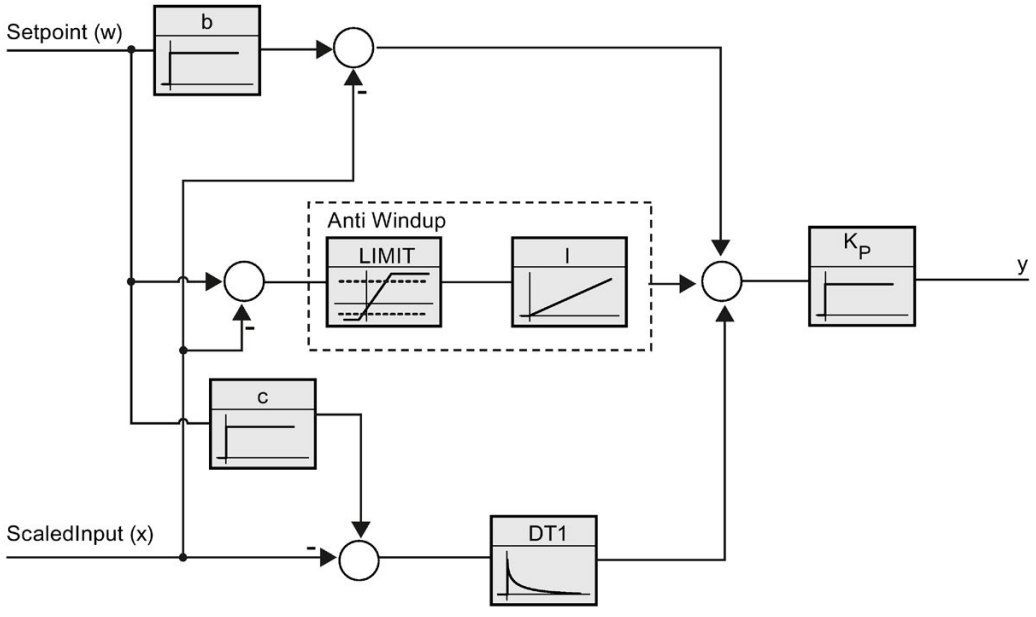


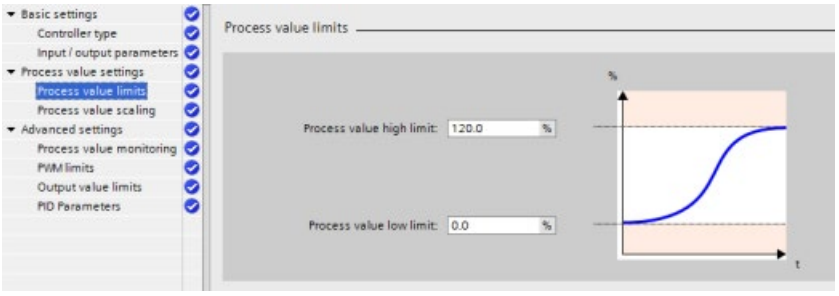
Figure 10-2 Operation of the PID_Compact controller as a PIDT1 controller with anti-windup

10.2.2.2 PID_Compact instruction Process value limits

"Process value limits" are normally used in conjunction with the analog input; however, you can use them for other purposes.

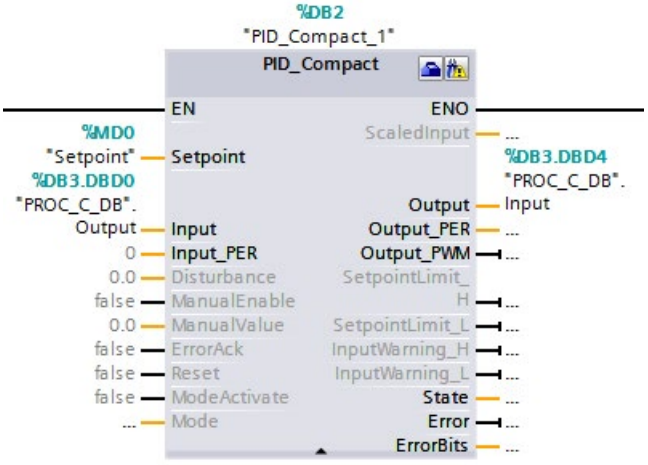
The Process value limits configuration serves two functions:

- Sets the upper and lower limits for the Setpoint High/Low alarm outputs on the PID block
- Sets a limit so that the process variable cannot exceed or go below those limits regardless of the setpoint. This configuration defines fixed limits for the process.



On the PID block, you can use four alarm outputs:

- SetpointLimit_H: Setpoint exceeds the High Limit.
- SetpointLimit_L: Setpoint exceeds the Low Limit.
- InputWarning_H: Process Variable exceeds the input high limit.
- InputWarning_L: Process Variable exceeds the input low limit.



When you set the Process value limits, the points that trigger the Setpoint high and low alarm outputs to go true are set to the same value. For example, with the settings shown above, if you enter a setpoint that is greater than 120%, the "SetpointLimit_H" output goes true. This action is the same for the low limit. If you enter a setpoint that is lower than 0%, then the "SetpointLimit_L" goes true. This gives your program an indication that the entered setpoint is out-of-range. This alarm can prompt you to re-enter the setpoint.

If you enter a setpoint that is out-of-range, the Compact_PID automatically limits the process variable to the configured range. For example, if the Process value high limit is set to 120% (as shown in the figure above), you can still enter a setpoint higher than 120%. As the process variable approaches 120%, the PID reduces the output and controls the process at the high limit of 120%. Conversely, the same action occurs if the setpoint is lower than the Process value low limit. The PID does not let the process variable go below the low limit. This feature allows you to define the acceptable process operation during normal automatic PID control. However, this feature does not apply to startup and shutdown unless the PID is in automatic mode. If the PID is in automatic mode and the setpoint and process variable are less than the lower limit, the PID tries to control the process at the configured lower limit.

10.2.2.3 PID_Compact instruction ErrorBit parameters

If several errors are pending, the values of the error codes are displayed by means of binary addition. The display of error code 0003, for example, indicates that the errors 0001 and 0002 are also pending.

Table 10- 20 PID_Compact instruction ErrorBit parameters

ErrorBit (DW#16#...)	Description
0000	No error
0001 [1, 2]	The Input parameter is outside the process value limits. Input > Config.InputUpperLimit Input < Config.InputLowerLimit
0002 [2, 3]	Invalid value at the Input_PER parameter. Check whether an error is pending at the analog input.
0004 [4]	Error during fine tuning. Oscillation of the process value could not be maintained.
0008 [4]	Error at start of pre-tuning. The process value is too close to the setpoint. Start fine tuning.
0010 [4]	The setpoint was changed during tuning. Note: You can set the permitted fluctuation on the setpoint at the CancelTuningLevel tag.
0020	Pre-tuning is not permitted during fine tuning. Note: If ActivateRecoverMode = TRUE before the error occurred, PID_Compact remains in fine tuning mode.
0080 [4]	Error during pre-tuning. Incorrect configuration of output value limits. Check whether the limits of the output value are configured correctly and match the control logic.
0100 [4]	Error during fine tuning resulted in invalid parameters.
0200 [2, 3]	Invalid value at the Input parameter: Value has an invalid number format.
0400 [2, 3]	Calculation of the output value failed. Check the PID parameters.
0800 [1, 2]	Sampling time error: PID_Compact is not called within the sampling time of the cyclic interrupt OB.
1000 [2, 3]	Invalid value at the Setpoint parameter: Value has an invalid number format.

ErrorBit (DW#16#...)	Description
10000	Invalid value at the ManualValue parameter: Value has an invalid number format. Note: If ActivateRecoverMode = TRUE before the error occurred, PID_Compact uses SubstituteOutput as the output value. As soon as you assign a valid value in the ManualValue parameter, PID_Compact uses it as the output value.
20000	Invalid value at the SubstituteValue tag: Value has an invalid number format. PID_Compact uses the output value low limit as the output value. Note: If automatic mode was active before the error occurred, ActivateRecoverMode = TRUE, and the error is no longer pending, PID_Compact switches back to automatic mode.
40000	Invalid value at the Disturbance parameter: Value has an invalid number format. Note: If automatic mode was active and ActivateRecoverMode = FALSE before the error occurred, Disturbance is set to zero. PID_Compact remains in automatic mode. Note: If pre-tuning or fine tuning mode was active and ActivateRecoverMode = TRUE before the error occurred, PID_Compact switches to the operating mode that is saved in the Mode parameter. If Disturbance in the current phase has no effect on the output value, tuning is not canceled.

[1] Note: If automatic mode was active before the error occurred and ActivateRecoverMode = TRUE, PID_Compact remains in automatic mode.

[2] Note: If pre-tuning or fine tuning mode was active before the error occurred and ActivateRecoverMode = TRUE, PID_Compact switches to the operating mode that is saved in the Mode parameter.

[3] Note: If automatic mode was active before the error occurred and ActivateRecoverMode = TRUE, PID_Compact outputs the configured substitute output value. As soon as the error is no longer pending, PID_Compact switches back to automatic mode.

[4] Note: If ActivateRecoverMode = TRUE before the error occurred, PID_Compact cancels the tuning and switches to the operating mode that is saved in the Mode parameter.

10.2.2.4 PID_Compact instruction Warning parameters

If the PID controller has several warnings pending, it displays the values of the error codes by means of binary addition. The display of error code 0003, for example, indicates that the errors 0001 and 0002 are pending.

Table 10- 21 PID_Compact instruction Warning parameters

Warning (DW#16#...)	Description
0000	No warning pending.
0001 [1]	The point of inflection was not found during pretuning.
0002	Oscillation was enforced during “tuning in run”. (The "Warning" parameter suppresses this warning and is only visible in the “WarningInternal” parameter for diagnostic purposes.)
0004 [1]	The setpoint was limited to the configured limits.
0008 [1]	Not all the necessary controlled system properties were defined for the selected method of calculation. Instead, the PID parameters were calculated using the TIR.TuneRuleHeat / TIR.TuneRuleCool = 3 method.
0010	The operating mode could not be changed because Reset = TRUE or ManualEnable = TRUE.
0020	The cycle time of the calling OB limits the sampling time of the PID algorithm. Improve results by using shorter OB cycle times.
0040 [1]	The process value exceeded one of its warning limits.
0080	Invalid value at Mode. The operating mode is not switched.
0100 [1]	The manual value was limited to the limits of the controller output.
0200	The specified rule for tuning is not supported. No PID parameters are calculated.
1000	The substitute output value cannot be reached because it is outside the output value limits.

[1] Note: The PID controller deleted the following warnings automatically as soon as the cause is eliminated or the user action repeated with valid parameters: 0001, 0004, 0008, 0040, and 0100.

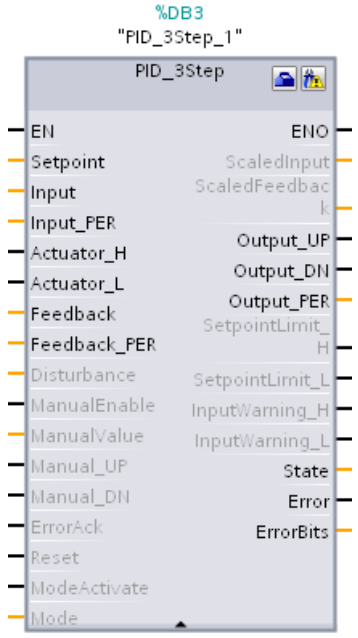
10.2.3 PID_3Step

10.2.3.1 PID_3Step instruction

The PID_3Step instruction configures a PID controller with self-tuning capabilities that has been optimized for motor-controlled valves and actuators.

Table 10- 22 PID_3Step instruction

LAD / FBD	SCL	Description

	`"PID_3Step_1"(`
	`  SetpoInt:=_real_in_,`
	`  Input:=_real_in_,`
	`  ManualValue:=_real_in_,`
	`  Feedback:=_real_in_,`
	`  InputPer:=_word_in_,`
	`  FeedbackPer:=_word_in_,`
	`Disturbance:=_real_in_,`
	`ManualEnable:=_bool_in_,`
	`  ManualUP:=_bool_in_,`
	`  ManualDN:=_bool_in_,`
	`  ActuatorH:=_bool_in_,`
	`  ActuatorL:=_bool_in_,`
	`  ErrorAck:=_bool_in_,`
	`Reset:=_bool_in_,`
	`  ModeActivate:=_bool_in_,`
	`Mode:=_int_in_,`
	`ScaledInput=>_real_out_,`
	`  ScaledFeedback=>_real_out_,`
	`  ErrorBits=>_dword_out_,`
	`  OutputPer=>_word_out_,`
	`  State=>_int_out_,`
	`  OutputUP=>_bool_out_,`
	`  OutputDN=>_bool_out_,`
	`  SetpoIntLimitH=>_bool_out_,`
	`  SetpoIntLimitL=>_bool_out_,`
	`  InputWarningH=>_bool_out_,`
	`  InputWarningL=>_bool_out_,`
	`  Error=>_bool_out_,`
	`ErrorBits=>_dword_out_);`
		PID_3Step configures a PID controller with self-tuning capabilities that has been optimized for motor-controlled valves and actuators. It provides two Boolean outputs.
		PID_3Step is a PID T1controller with anti-windup and weighting of the P- and D-components.

[1] STEP 7 automatically creates the technology object and instance DB when you insert the instruction. The instance DB contains the parameters of the technology object.

[2] In the SCL example, "PID_3Step_1" is the name of the instance DB.

Table 10- 23 Data types for the parameters

Parameter and type		Data type	Description
Setpoint	IN	Real	Setpoint of the PID controller in automatic mode. (Default value: 0.0)
Input	IN	Real	A tag of the user program is used as the source of the process value. (Default value: 0.0) If you are using the Input parameter, you must set Config.InputPerOn = FALSE.
Input_PER	IN	Word	An Analog input is used as the source of the process value. (Default value: W#16#0) If you are using the Input_PER parameter, you must set Config.InputPerOn = TRUE.
Actuator_H	IN	Bool	Digital position feedback of the valve for the high end stop If Actuator_H = TRUE, the valve is at the high end stop and is no longer moved in this direction. (Default value: FALSE)
Actuator_L	IN	Bool	Digital position feedback of the valve for the low end stop If Actuator_L = TRUE, the valve is at the low end stop and is no longer moved in this direction. (Default value: FALSE)
Feedback	IN	Real	Position feedback of the valve. (Default value: 0.0) If you are using the Feedback parameter, you must set Config.FeedbackPerOn = FALSE.
Feedback_PER	IN	Int	Analog feedback of the valve position. (Default value: W#16#0) If you are using the Feedback_PER parameter, you must set Config.FeedbackPerOn = TRUE. Feedback_PER is scaled, based upon the following tags: • Config.FeedbackScaling.LowerPointIn • Config.FeedbackScaling.UpperPointIn • Config.FeedbackScaling.LowerPointOut • Config.FeedbackScaling.UpperPointOut
Disturbance	IN	Real	Disturbance variable or pre-control value
ManualEnable	IN	Bool	Enables or disables the manual operation mode. (Default value: FALSE): • A FALSE to TRUE edge activates "manual mode", while State = 4, Mode remains unchanged. As long as ManualEnable = TRUE, you cannot change the operating mode using a rising edge at ModeActivate or use the commissioning dialog. • A TRUE to FALSE edge activates the operating mode that is assigned by Mode. Note: We recommend that you change the operating mode using ModeActivate only.
ManualValue	IN	Real	Process value for manual operation. (Default value: 0.0) In manual mode, you specify the absolute position of the valve. ManualValue is evaluated only if you are using OutputPer, **or** if position feedback is available.

Parameter and type		Data type	Description
ManualUP	IN	Bool	• Manual_UP = TRUE: – The valve is opened even if you use Output_PER or a position feedback. The valve is no longer moved if the high end stop has been reached. – See also Config.VirtualActuatorLimit • Manual_UP = FALSE: – If you use Output_PER or a position feedback, the valve is moved to ManualValue. Otherwise, the valve is no longer moved. Note: If Manual_UP and Manual_DN are set to TRUE simultaneously, the valve is not moved.
ManualDN	IN	Bool	• Manual_DN = TRUE: – The valve is opened even if you use Output_PER or a position feedback. The valve is no longer moved if the high end stop has been reached. – See also Config.VirtualActuatorLimit • Manual_DN = FALSE: – If you use Output_PER or a position feedback, the valve is moved to ManualValue. Otherwise, the valve is no longer moved.
ErrorAck	IN	Bool	Resets the ErrorBits and warning outputs. FALSE to TRUE edge
Reset	IN	Bool	Restarts the controller. (Default value: FALSE): • FALSE to TRUE edge: – Switches to "inactive" mode – Resets the ErrorBits and warning outputs – Clears Integral action – Maintains PID parameters • As long as Reset = TRUE, PID_3Step remains in "Inactive" mode (State = 0). • TRUE to FALSE edge: – PID_3Step switches to the operating mode that is saved in the Mode parameter.
ModeActivate	IN	Bool	The PID_3Step switches to the mode that is saved in the Mode parameter. FALSE to TRUE edge:
Mode	IN	Int	The desired PID mode; Activated on the leading edge of the Mode Activate input.
ScaledInput	OUT	Real	Scaled process value
ScaledFeedback	OUT	Real	Scaled valve position feedback Note: For an actuator without position feedback, the position of the actuator indicated by ScaledFeedback is very imprecise. ScaledFeedback can only be used for rough estimation of the current position in this case.
Output_UP	OUT	Bool	Digital output value for opening the valve. (Default value: FALSE) If Config.OutputPerOn = FALSE, the parameter Output_UP is used.
Output_DN	OUT	Bool	Digital output value for closing the valve. (Default value: FALSE) If Config.OutputPerOn = FALSE, the parameter Output_DN is used.

Parameter and type		Data type	Description
Output_PER	OUT	Word	Analog output value. If Config.OutputPerOn = TRUE, the parameter Output_PER is used.
SetpointLimitH	OUT	Bool	Setpoint high limit. (Default value: FALSE) If SetpointLimitH = TRUE, the absolute upper limit of the setpoint is reached (Setpoint ≥ Config.SetpointUpperLimit). Note: The setpoint is limited to (Setpoint ≥ Config.SetpointUpperLimit).
SetpointLimitL	OUT	Bool	Setpoint low limit. (Default value: FALSE) If SetpointLimitL = TRUE, the absolute lower limit of the setpoint is reached (Setpoint ≥ Config.SetpointLowerLimit). Note: The setpoint is limited to (Setpoint ≥ Config.SetpointLowerLimit).
InputWarningH	OUT	Bool	If InputWarningH = TRUE, the input value has reached or exceeded the warning high limit. (Default value: FALSE)
InputWarningL	OUT	Bool	If InputWarningL = TRUE, the input value has reached or exceeded the warning low limit. (Default value: FALSE)
State	OUT	Int	Current operating mode of the PID controller. (Default value: 0) You can change the operating mode using the Mode input parameter and a rising edge at ModeActivate: • State = 0: Inactive • State = 1: Pre-tuning • State = 2: Manual fine tuning • State = 3: Automatic mode • State = 4: Manual mode • State = 5: Substitute output value approach • State = 6: Transition time measurement • State = 7: Error monitoring • State = 8: Substitute output value approach with error monitoring\ • State = 10: Manual mode without end stop signals
Error	OUT	Bool	If Error = TRUE, at least one error message is pending. (Default value: FALSE) Note: The Error parameter in V1.x PID was the ErrorBits field that contained the error codes. It is now a Boolean flag indicating that an error has occurred.
ErrorBits	OUT	DWord	The PID_3Step instruction ErrorBits parameters table (Page 593) defines the error messages that are pending. (Default value: DW#16#0000 (no error)). ErrorBits is retentive and is reset upon a rising edge at Reset or ErrorAck. Note: In V1.x, the ErrorBits parameter was defined as the Error parameter and did not exist.

Operation of the PID_3Step controller

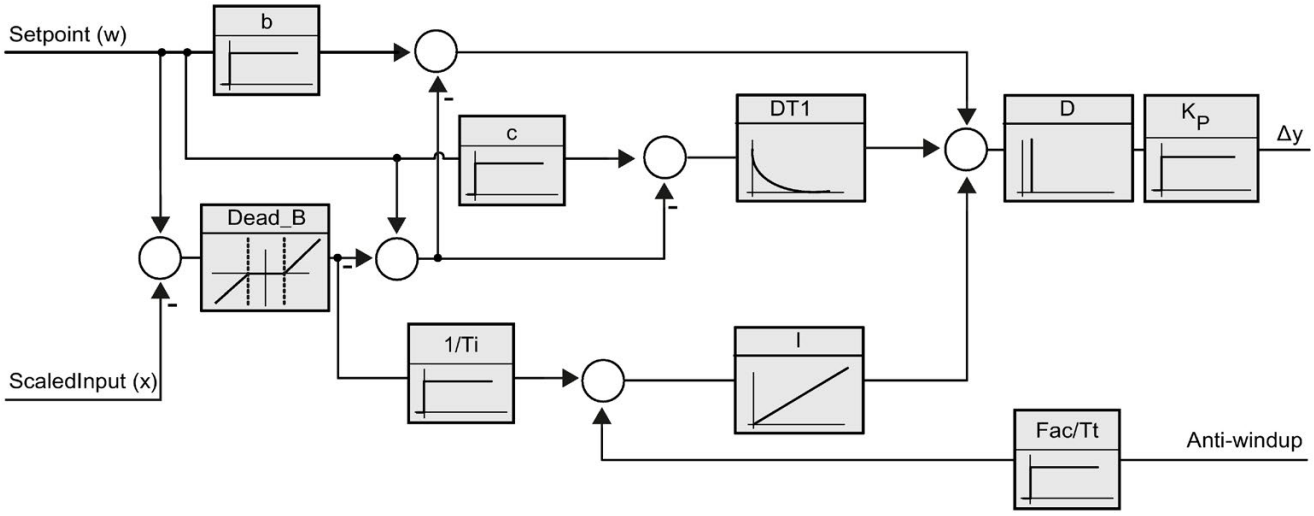


Figure 10-3 Operation of the PID_3Step controller as a PID T1 controller with anti-windup

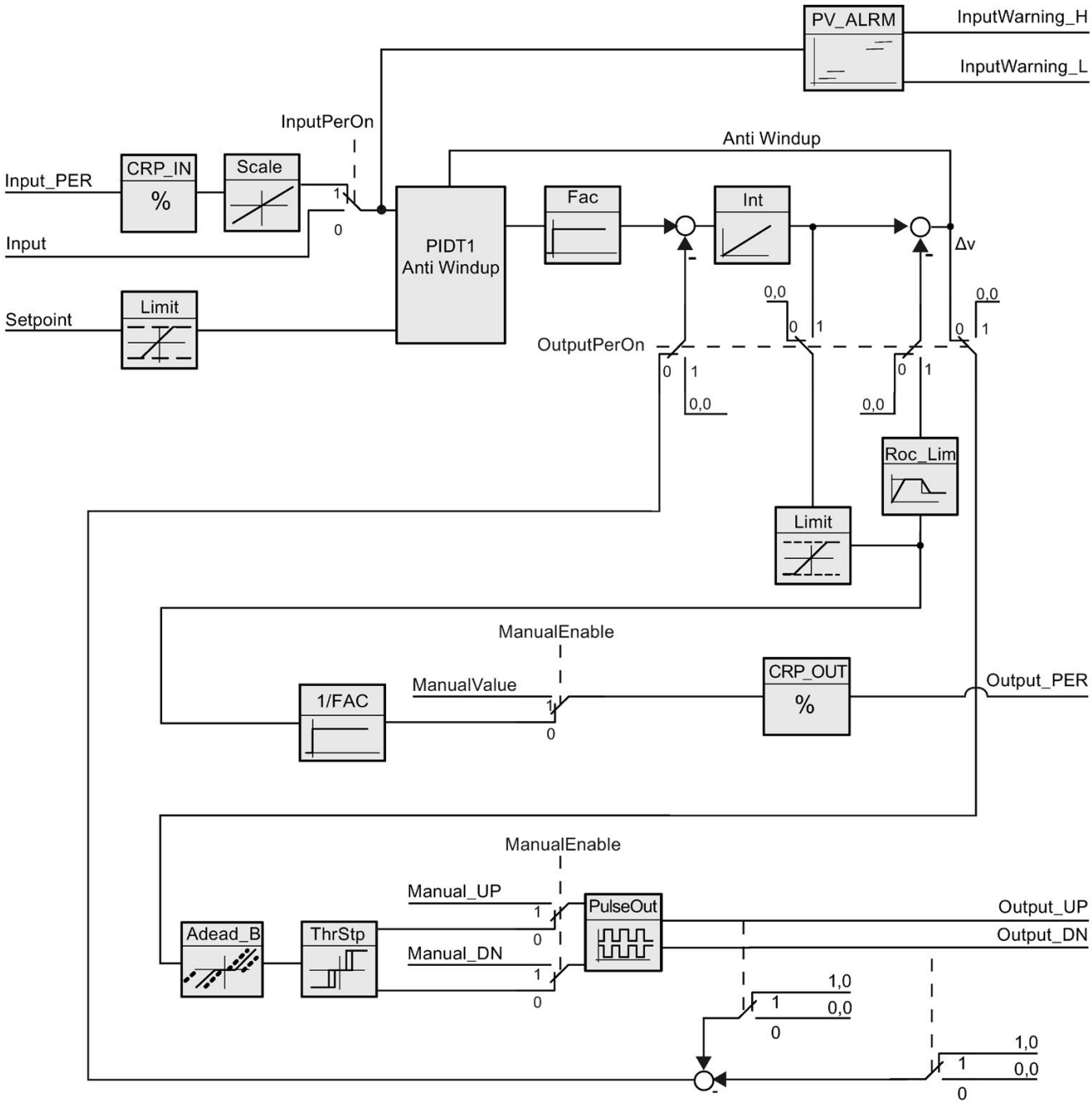


Figure 10-4 Operation of the PID_3Step controller without position feedback

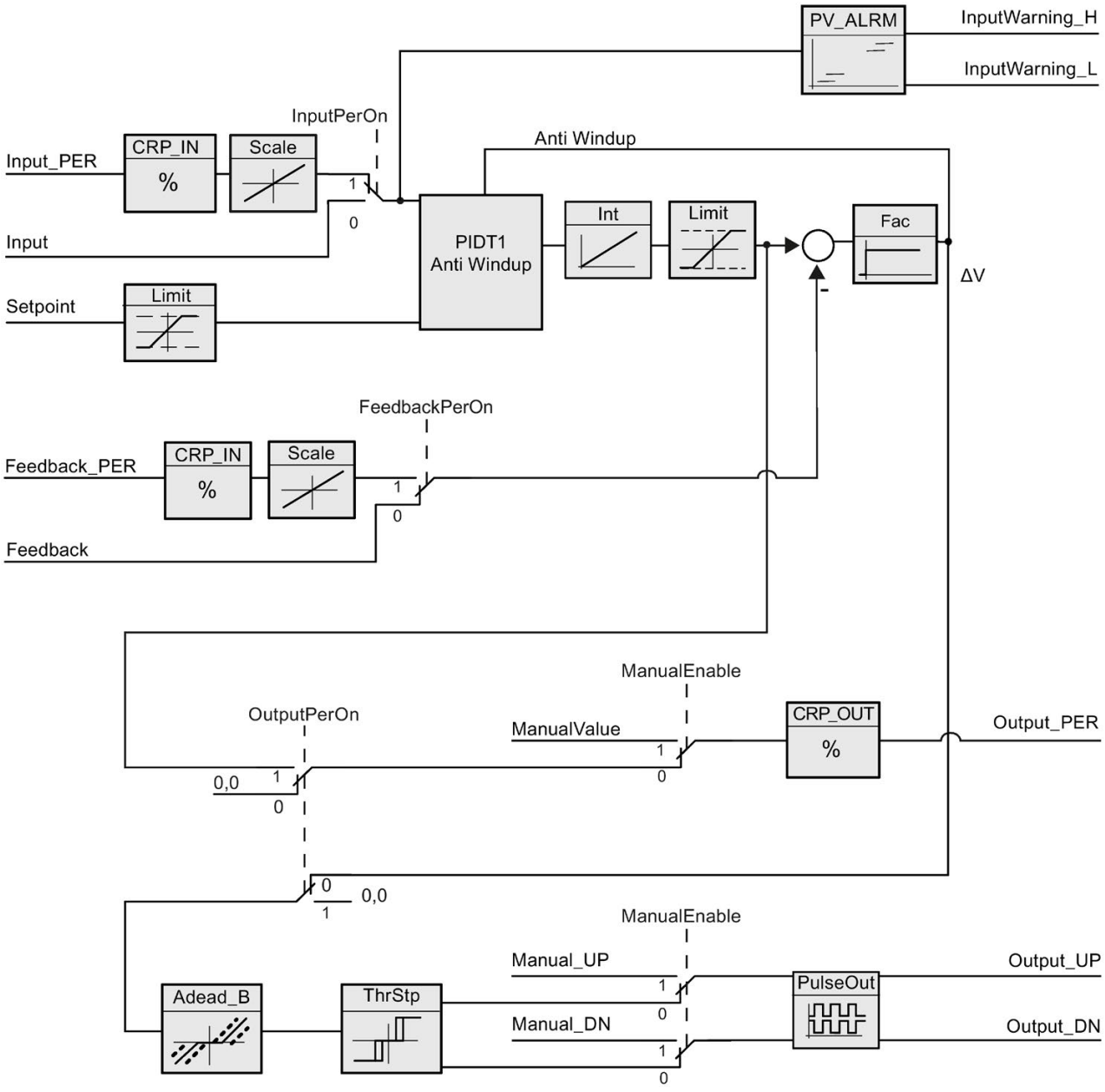


Figure 10-5 Operation of the PID_3Step controller with position feedback enabled

10.2.3.2 PID_3Step instruction ErrorBit parameters

If several errors are pending, the values of the error codes are displayed by means of binary addition. The display of error code 0003, for example, indicates that the errors 0001 and 0002 are also pending.

Table 10- 24 PID_3STEP instruction ErrorBit parameters

ErrorBit (DW#16#...)	Description
0000	No error
0001 [1, 2]	The Input parameter is outside the process value limits. Input > Config.InputUpperLimit Input < Config.InputLowerLimit
0002 [2, 3]	Invalid value at the Input_PER parameter. Check whether an error is pending at the analog input.
0004 [4]	Error during fine tuning. Oscillation of the process value could not be maintained.
0010 [4]	The setpoint was changed during tuning. Note: You can set the permitted fluctuation on the setpoint at the CancelTuningLevel tag.
0020	Pre-tuning is not permitted during fine tuning. Note: If ActivateRecoverMode = TRUE before the error occurred, PID_3Step remains in fine tuning mode.
0080 [4]	Error during pre-tuning. Incorrect configuration of output value limits. Check whether the limits of the output value are configured correctly and match the control logic.
0100 [4]	Error during fine tuning resulted in invalid parameters.
0200 [2, 3]	Invalid value at the Input parameter: Value has an invalid number format.
0400 [2, 3]	Calculating the output value failed. Check the PID parameters.
0800 [1, 2]	Sampling time error: PID_3Step is not called within the sampling time of the cyclic interrupt OB.
1000 [2, 3]	Invalid value at the Setpoint parameter: Value has an invalid number format.
2000 [1, 2, 5]	Invalid value at the Feedback_PER parameter. Check whether an error is pending at the analog input.
4000 [1, 2, 5]	Invalid value at the Feedback parameter: Value has an invalid number format.
8000 [1, 2]	Error during digital position feedback. Actuator_H = TRUE and Actuator_L = TRUE. The actuator cannot be moved to the substitute output value and remains in its current position. Manual mode is not possible in this state. In order to move the actuator from this state, you must deactivate the "Actuator end stop" (Config.ActuatorEndStopOn = FALSE) or switch to manual mode without end stop signals (Mode = 10).

ErrorBit (DW#16#...)	Description
10000	Invalid value at the ManualValue parameter: Value has an invalid number format. The actuator cannot be moved to the manual value and remains in its current position. Assign a valid value in ManualValue or move the actuator in manual mode with Manual_UP and Manual_DN.
20000	Invalid value at the SavePosition tag: Value has an invalid number format. The actuator cannot be moved to the substitute output value and remains in its current position.
40000	Invalid value at the Disturbance parameter: Value has an invalid number format. Note: If automatic mode was active and ActivateRecoverMode = FALSE before the error occurred, Disturbance is set to zero. PID_3Step remains in automatic mode. Note: If pre-tuning or fine tuning mode was active and ActivateRecoverMode = TRUE before the error occurred, PID_3Step switches to the operating mode that is saved in the Mode parameter. If Disturbance in the current phase has no effect on the output value, tuning is not canceled. The error has no effect during transition time measurement.

[1] Note: If automatic mode was active before the error occurred and ActivateRecoverMode = TRUE, PID_3Step remains in automatic mode.

[2] Note: If pre-tuning, fine tuning, or transition time measurement mode were active and ActivateRecoverMode = TRUE before the error occurred, PID_3Step switches to the operating mode that is saved in the Mode parameter.

[3] Note: If automatic mode was active before the error occurred and ActivateRecoverMode = TRUE, PID_3Step switches to "Approach substitute output value with error monitoring" or "Error monitoring" mode. As soon as the error is no longer pending, PID_3Step switches back to automatic mode.

[4] Note: If ActivateRecoverMode = TRUE before the error occurred, PID_3Step cancels the tuning and switches to the operating mode that is saved in the Mode parameter.

[5] The actuator cannot be moved to the substitute output value and remains in its current position. In manual mode, you can change the position of the actuator only with Manual_UP and Manual_DN, and not with ManualValue.

10.2.3.3 PID_3Step instruction Warning parameters

If the PID controller has several warnings pending, it displays the values of the error codes by means of binary addition. The display of error code 0003, for example, indicates that the errors 0001 and 0002 are pending.

Table 10- 25 PID_Compact instruction Warning parameters

Warning (DW#16#...)	Description
0000	No warning pending.
0001 [1]	The point of inflection was not found during pretuning.
0002	Oscillation was enforced during “tuning in run”. (The "Warning" parameter suppresses this warning and is only visible in the “WarningInternal” parameter for diagnostic purposes.)
0004 [1]	The setpoint was limited to the configured limits.
0008 [1]	Not all the necessary controlled system properties were defined for the selected method of calculation. Instead, the PID parameters were calculated using the TIR.TuneRuleHeat / TIR.TuneRuleCool = 3 method.
0010	The operating mode could not be changed because Reset = TRUE or ManualEnable = TRUE.
0020	The cycle time of the calling OB limits the sampling time of the PID algorithm. Improve results by using shorter OB cycle times.
0040 [1]	The process value exceeded one of its warning limits.
0080	Invalid value at Mode. The operating mode is not switched.
0100 [1]	The manual value was limited to the limits of the controller output.
0200	The specified rule for tuning is not supported. No PID parameters are calculated.
1000	The substitute output value cannot be reached because it is outside the output value limits.

[1] Note: The PID controller deleted the following warnings automatically as soon as the cause is eliminated or the user action repeated with valid parameters: 0001, 0004, 0008, 0040, and 0100.

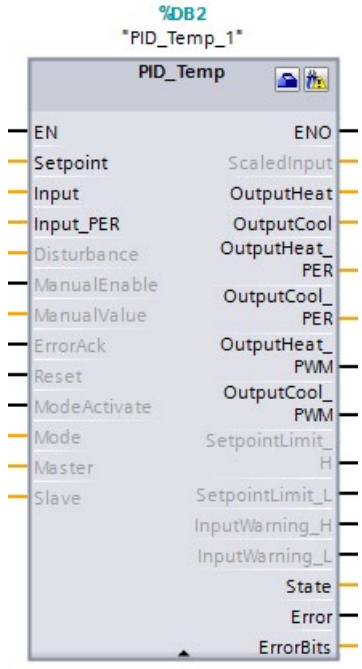
10.2.4 PID_Temp

10.2.4.1 PID_Temp instruction

The PID_Temp instruction provides a universal PID controller that allows handling of the specific requirements of temperature control.

Table 10- 26 PID_Temp instruction

LAD / FBD	SCL	Description

	`"PID_Temp_1"(`
	`  Setpoint:=_real_in_,`
	`  Input:=_real_in_,`
	`  Input_PER:=_int_in_,`
	`  Disturbance:=_real_in_,`
	`ManualEnable:=_bool_in_,`
	`  ManualValue:=_real_in_,`
	`  ErrorAck:=_bool_in_,`
	`Reset:=_bool_in_,`
	`  ModeActivate:=_bool_in_,`
	`Mode:=_int_in_,`
	`Master:=_dword_in`
	`Save:=_dword_in`
	`ScaledInput=>_real_out_,`
	`  OutputHeat=>_real_out_,`
	`  OutputCool=>_real_out_,`
	`  OutputHeat_PER=>_int_out_,`
	`  OutputCool_PER=>_int_out_,`
	`  Out-`
	`putHeat_PWM=>_bool_out_,`
	`  Out-`
	`putCool_PWM=>_bool_out_,`
	`SetpointLimit_H=>_bool_out_,`
	`SetpointLimit_L=>_bool_out_,`
	`  InputWarn-`
	`ing_H=>_bool_out_,`
	`  InputWarn-`
	`ing_L=>_bool_out_,`
	`  State=>_int_out_,`
	`  Error=>_bool_out_,`
	`ErrorBits=>_dword_out_);`
		PID_Temp provides these capabilities:
		• Heating and cooling of the process with different actuators
		• Integrated autotuning to handle temperature processes
		• Cascading to process more than one temperature that depends on the same actuator

[1] STEP 7 automatically creates the technology object and instance DB when you insert the instruction. The instance DB contains the parameters of the technology object.

[2] In the SCL example, "PID_Temp_1" is the name of the instance DB.

Table 10- 27 Data types for the parameters

Parameter and type		Data type	Description
Setpoint	IN	Real	Setpoint of the PID controller in automatic mode. (Default value: 0.0)
Input	IN	Real	A tag of the user program is used as the source of the process value. (Default value: 0.0) If you are using the Input parameter, you must set Config.InputPerOn = FALSE.
Input_PER	IN	Int	An Analog input is used as the source of the process value. (Default value: 0) If you are using the Input_PER parameter, you must set Config.InputPerOn = TRUE.
Disturbance	IN	Real	Disturbance variable or pre-control value
ManualEnable	IN	Bool	Enables or disables the manual operation mode. (Default value: FALSE): • A FALSE to TRUE edge activates Manual mode, while State = 4, Mode remains unchanged. As long as ManualEnable = TRUE, you cannot change the operating mode using a rising edge at ModeActivate or use the commissioning dialog. • A TRUE to FALSE edge activates the operating mode that is assigned by Mode. Note: We recommend that you change the operating mode using ModeActivate only.
ManualValue	IN	Real	Output value for manual operation. (Default value: 0.0) You can use values from Config.OutputLowerLimit to Config.OutputUpperLimit.
ErrorAck	IN	Bool	Resets the ErrorBits and warning outputs with a FALSE to TRUE edge. (Default value: FALSE)
Reset	IN	Bool	Restarts the controller. (Default value: FALSE): • FALSE to TRUE edge: – Switches to "inactive" mode – Resets the ErrorBits and warning outputs – Clears Integral action – Maintains PID parameters • As long as Reset = TRUE, PID_Temp remains in Inactive mode (State = 0). • TRUE to FALSE edge: – PID_Temp switches to the operating mode that is saved in the Mode parameter.
ModeActivate	IN	Bool	The PID_Temp switches to the operating mode that is saved in the Mode parameter with a FALSE to TRUE edge. (Default value: FALSE)

Parameter and type		Data type	Description
Mode	IN/OUT	Int	Activated on the leading edge of the Mode Activate input. Operating mode selection (Default value: 0.0): • Mode = 0: Inactive • Mode = 1: Pretuning • Mode = 2: Fine tuning • Mode = 3: Automatic mode • Mode = 4: Manual mode “Substitute output value with error monitoring” (State = 5). This cannot be activated by the user; it is only an automatic error reaction.
Master	IN/OUT	DWord	Cascade connection to master (AntiWindUp and tuning conditions). (Default value: DW#16#0000) • Bits 0 - 15: Not used in PID_Temp instruction • Bits 16 - 23: Limit counter: A slave increments this value if it reaches its limitation. The number of slaves in limitation is processed for Anti-Windup-functionality (Refer to the Config.Cascade.AntiWindUpMode parameter. • Bit 24: IsAutomatic: This bit is set to "1" if all slaves of this controller are in Automatic mode and are processed to check conditions for tuning in a cascade. This bit is identical to the AllSlaveAutomaticState parameter. • Bit 25: "IsReplacement-Setpoint": This bit is set to "1" if a slave of this controller has the "Replacement Setpoint" activated and is processed to check conditions for tuning in a cascade. The inverted value is stored in the NoSlaveReplacementSetpoint parameter.
Slave	IN/OUT	DWord	
ScaledInput	OUT	Real	Scaled process value. (Default value: 0.0)
OutputHeat[1]	OUT	Real	Output value for heating in REAL format. (Default value: 0.0) This output value is calculated, independent from the output selection, using the Config.Output.Heat.Select parameter.
OutputCool[1]	OUT	Real	Output value for cooling in REAL format. (Default value: 0.0) This output value is calculated, independent from the output selection, using the Config.Output.Cool.Select parameter.
OutputHeat_PER[1]	OUT	Int	Output value for heating in peripheral format (Default value: 0) This output value is only calculated if selected using the Config.Output.Heat.Select = 2 parameter. If not selected, this output is always "0".
OutputCool_PER[1]	OUT	Int	Output value for cooling in peripheral format (Default value: 0) This output value is only calculated if selected using the Config.Output.Cool.Select = 2 parameter. If not selected, this output is always "0".
OutputHeat_PWM[1]	OUT	Bool	Pulse-width-modulated output value for heating. (Default value: FALSE) This output value is only calculated if selected using the Config.Output.Heat.Select = 1 (default value) parameter. If not selected, this output is always FALSE.

Parameter and type		Data type	Description
OutputCool_PWM[1]	OUT	Bool	Pulse-width-modulated output value for cooling. (Default value: FALSE) This output value is only calculated if selected using the Config.Output.Cool.Select = 1 (default value) parameter. If not selected, this output is always FALSE.
SetpointLimit_H	OUT	Bool	Setpoint high limit. (Default value: FALSE) If SetpointLimit_H = TRUE, the absolute setpoint upper limit is reached (Setpoint ≥ Config.SetpointUpperLimit). The setpoint is limited to Config.SetpointUpperLimit.
SetpointLimit_L	OUT	Bool	Setpoint low limit. (Default value: FALSE) If SetpointLimit_L = TRUE, the absolute setpoint lower limit is reached (Setpoint ≤ Config.SetpointLowerLimit). The setpoint is limited to Config.SetpointLowerLimit.
InputWarning_H	OUT	Bool	If InputWarning_H = TRUE, the process value has reached or exceeded the warning high limit. (Default value: FALSE)
InputWarning_L	OUT	Bool	If InputWarning_L = TRUE, the process value has reached or fallen below the warning low limit. (Default value: FALSE)
State	OUT	Int	Current operating mode of the PID controller. (Default value: 0) You can change the operating mode using the Mode input parameter and a rising edge at ModeActivate: • State = 0: Inactive • State = 1: Pre-tuning • State = 2: Fine tuning • State = 3: Automatic mode • State = 4: Manual mode • State = 5: Substitute output value with error monitoring
Error	OUT	Bool	If Error = TRUE, at least one error message is pending in this cycle. (Default value: FALSE) Note: The Error parameter in V1.x PID was the ErrorBits field that contained the error codes. It is now a Boolean flag indicating that an error has occurred.
ErrorBits	OUT	DWord	The PID_Temp instruction, ErrorBits parameters table (Page 605)defines the error messages that are pending. (Default value: DW#16#0000 (no error)). ErrorBits is retentive and is reset upon a rising edge at Reset or ErrorAck. Note: In V1.x, the ErrorBits parameter was defined as the Error parameter and did not exist.
Warning	OUT	DWord	The PID_Temp instruction, Warning parameters table (Page 607) defines the user-relevant warning messages that are pending. (Default value: DW#16#0000 (no warning)).
WarningInternal	OUT	DWord	The PID_Temp instruction, WarningInternal parameters table defines the warning internal messages that are pending (includes all warnings). (Default value: DW#16#0000 (no warning internal)).

[1] You can use the outputs of the Output, Output_PER, and Output_PWM parameters in parallel.

Operation of the PID_Temp controller

Selecting heating and/or cooling control

You must first select if you need a cooling device in addition to the heating output at parameter "ActivateCooling". Afterwards, you must define if you want to use two PID-parameter-sets (advanced mode) or only one PID-parameter-set with an additional heating/cooling-factor at parameter "AdvancedCooling".

Using CoolFactor

In case you want to apply a heating/cooling-factor, you must define the value manually. You have to identify the value from the technical data of your application (ratio of proportional gain of the actuators (for example, the ratio of maximum heating- and cooling-power of the actuators) and assign it to parameter "CoolFactor". A heating/cooling-factor of 2.0 means that the heating device is two times more effective than the cooling device. If you use cooling factor, PID_Temp calculates the output signal and, depending on its sign, multiply the output signal with the heating/cooling-factor (when sign is negative) or not (when sign is positive).

Using two PID-parameter-sets

Different PID-parameter-sets for heating and cooling can be automatically detected during commissioning. You can expect a better control performance compared to heating/cooling-factor because, in addition to different proportional gains, you can consider different delay times with two parameters-sets. However, the disadvantage is that this can take more time for the tuning process. If PID-parameter switchover is activated (Config.AdvancedCooling = TRUE), the PID_Temp controller detects in "Automatic mode" (controlling is active) if heating or cooling is necessary at that time and uses PID-parameter-sets for control.

ControlZone

With the PID_Temp controller, you can define a control zone for each parameter-set at parameter "ControlZone". If the control deviation (setpoint – input) is within the control zone, PID_Temp uses the PID-algorithm to calculate the output signals. However, if the control deviation leaves the defined range, the output is set to the maximum heating or maximum cooling output value (cooling output activated) / minimum heating output value (cooling output deactivated). You can use this functionality to reach the desired setpoint faster, especially for initial heating-up of slow temperature processes.

DeadZone

In the "DeadZone" parameter, you can define a width of control deviation for heating and cooling that is neglected by the PID-algorithm. This means a control deviation within this range is suppressed, and the PID_Temp controller behaves like the setpoint and process values are identical. Thus, you can reduce unnecessary intervention by the controller around the setpoint and conserve the actuator. If you want to apply a DeadZone, you must define the value manually. Auto tuning does not automatically set the DeadZone value. DeadZone is symmetric (between -Retain.CtrlParams.Heat.DeadZone and +Retain.CtrlParams.Heat.DeadZone) for heating controllers without cooling or heating/cooling controllers using CoolFactor. DeadZone can be asymmetric (between -Retain.CtrlParams.Cool.DeadZone and +Retain.CtrlParams.Heat.DeadZone) for heating/cooling controllers using two PID-parameter sets.

PID_Temp controller operations

The following block diagrams illustrate the PID_Temp instruction standard and cascade operations:

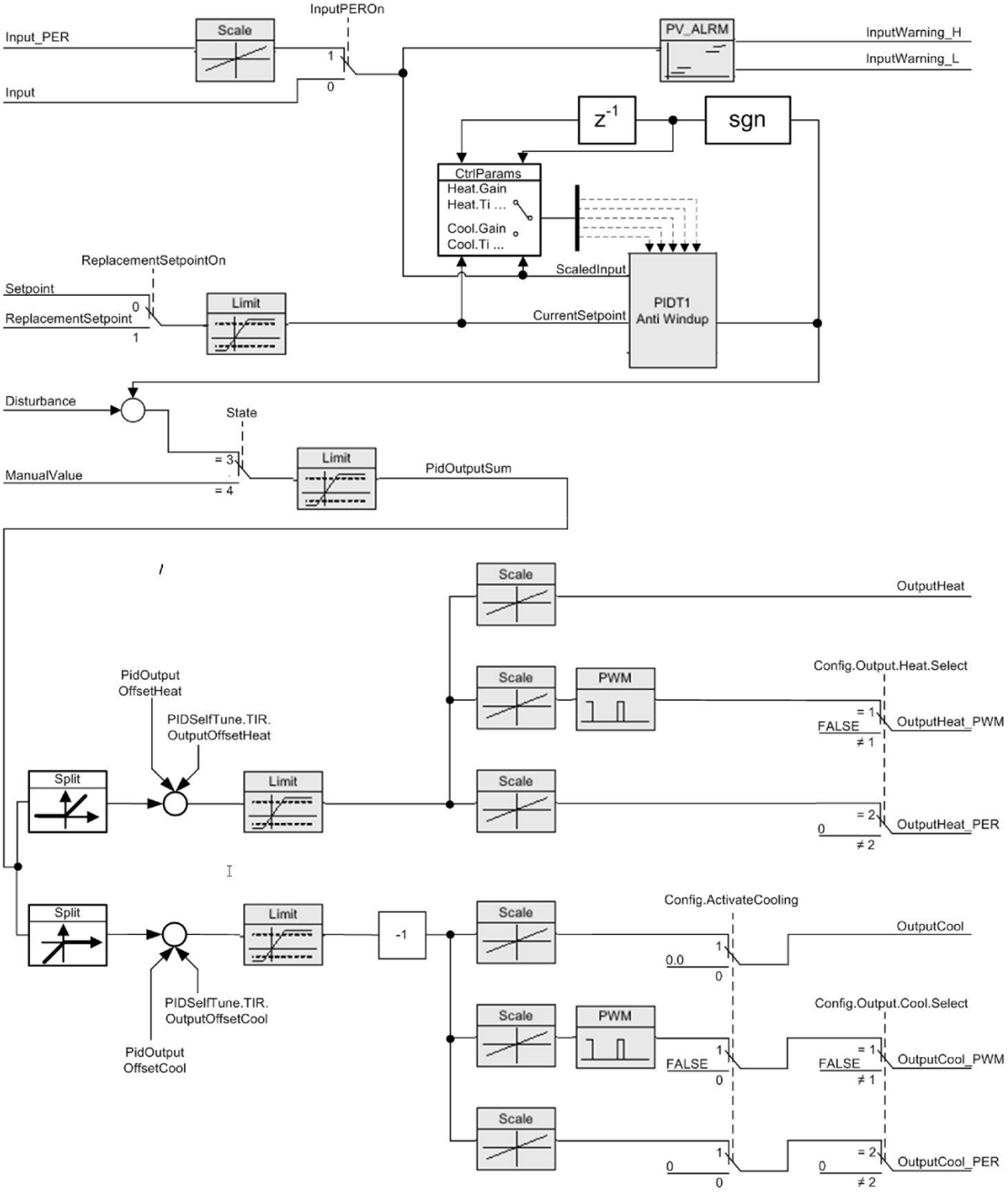


Figure 10-6 PID_Temp_Operation_Block_Diagram

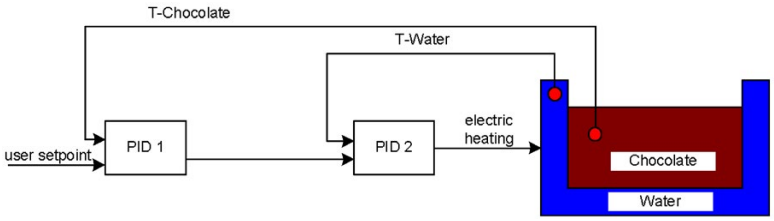


Figure 10-7 PID_Temp_Cascade_Operation_Block_Diagram

Cascading controllers

You can cascade temperature PID controllers to process more than one temperature that depend on the same actuator.

Call order

You must call cascaded PID controllers in the same OB cycle. First, you must call the master, then, the next slave(s) in the control signal flow, and finally on to the last slave in the cascade. The PID_Temp instruction does not make an automatic check of call order.

Communication connections

When cascading controllers, you must connect the master and slave so that they can share information with each other. You must connect a slave's "Master" IN/OUT parameter to its master's "Slave" IN/OUT parameter in the signal flow direction.

This shows a connection of PID_Temp controllers in a cascade with two sub-cascades: "PID_Temp1" provides the setpoint. The configuration connects the outputs of "PID_Temp2", "PID_Temp3", "PID_Temp5", "PID_Temp6", and "PID_Temp8" to the process:

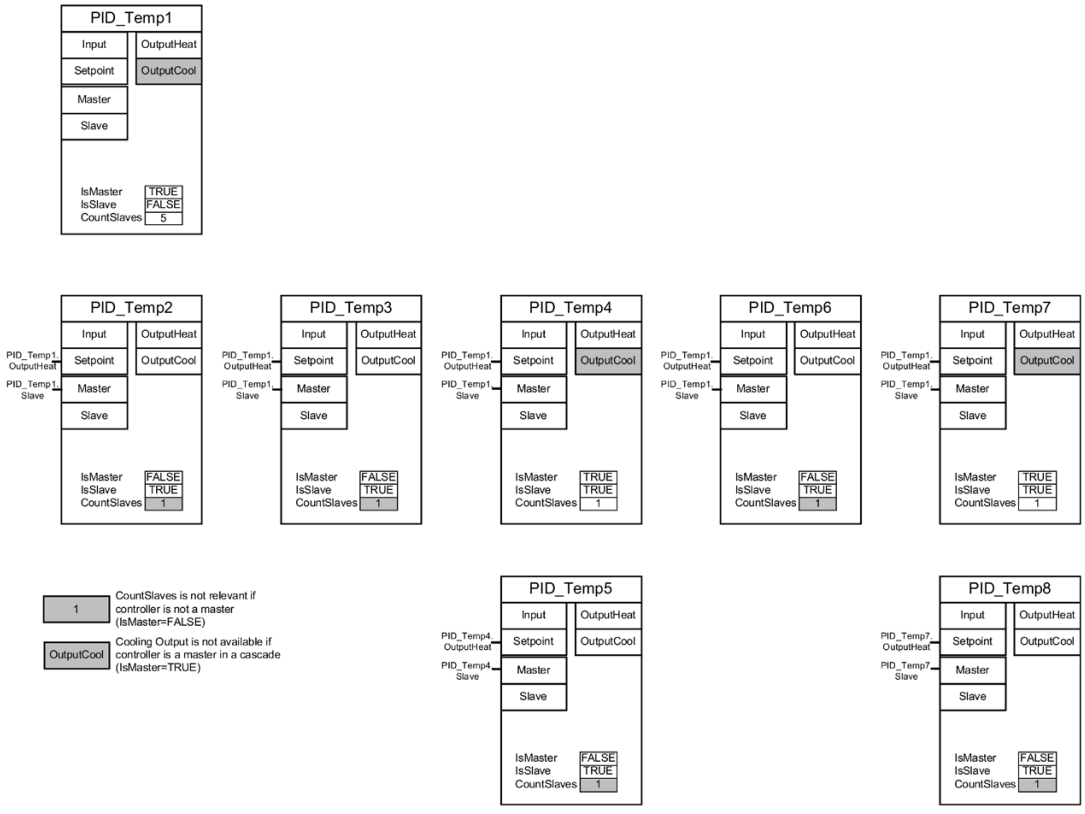


Figure 10-8 PID_Temp_Cascading_communication_connection

Replacement setpoint

The PID_Temp instruction provides a second setpoint input at the "ReplacementSetpoint" parameter that you can activate by setting the parameter "ReplacementSetpointOn" = TRUE. You can use "ReplacementSetpoint" as your setpoint input during commissioning or tuning of a slave controller without having to disconnect the output-to-setpoint connection between master and slave. This connection is necessary for normal operation of the cascade.

In this way, you do not have to change your program and download it if you want to temporarily separate a slave from its master. You only have to activate the "ReplacementSetpoint" and deactivate it again when you finish.The setpoint value is effective for the PID algorithm when you can see the value at the "CurrentSetpoint" parameter.

Autotuning

An autotuning for a cascaded master controller must meet these requirements:

- Be commissioned from its inner slave to the first master.
- All slaves of the master have to be in “Automatic mode".
- The output of the master must be the setpoint for the slaves.

PID_Temp instruction will provide the following support for autotuning in the cascade:

- If you start autotuning for a master controller, the master checks to see if all slaves are in “Automatic mode” and for the deactivation of the Replacement-Setpoint-functionality for all slaves (“ReplacementSetpointOn” = FALSE). If you do not meet these conditions, you cannot autotune the master. The master cancels the tuning, goes to “Inactive” mode" (if “ActivateRecoverMode” = FALSE), or back to the mode stored in the “Mode” parameter (if “ActivateRecoverMode” = TRUE). The master displays the error message 200000hex ("Error with master in the cascade. Slaves are not in automatic mode or have a substitute setpoint enabled and are preventing tuning of the master.").
- When all slaves are in “Automatic mode”, the system sets the parameter “AllSlaveAutomaticState” = TRUE. You can apply this parameter in your programs or localize the cause of error 200000hex.
- When the "ReplacementSetpoint" is deactivated for all slaves, the system sets the parameter “NoSlaveReplacementSetpoint” = TRUE. You can apply this parameter in their programs or localize the cause of error 200000hex.

When the PID_Temp instruction commissioning dialog is used, you have further support for cascade tuning (Page 627).

Operation modes and error handling

The PID_Temp controller does not allow switching of the operating mode by its master or slaves. This means that a master inside the cascade stays in its current mode when a slave raises an error. This is an advantage if two or more parallel slaves operate with this master controller; an error in one chain does not shut down the parallel chain.

Similarly, a slave inside the cascade stays in its current operation mode, if its master has an error. However, further operation of the slave then depends on the configuration of the master because the slave’s setpoint is the master’s output. This means that if you configure the master with “ActivateRecoverMode” = TRUE and an error occurs, the master outputs the last valid or a substitute output value as setpoint for the slave. If you configure the master with “ActivateRecoverMode” = FALSE, the master switchs to “Inactive mode" and sets all outputs to "0.0" so that the slave uses "0.0" as its setpoint.

Because only the slave controllers have direct access to the actuators and these stay in their operating mode in case of a master error, you can avoid damage to the process. For example, for plastics processing devices, it is fatal for the slaves to stop working, shut down the actuators, and allow the plastic to harden inside the device solely because the master controller had an error.

Anti-windup

A slave in a cascade gets its setpoint from the output of his master. If the slave reaches its own output limits while the master still sees a control deviation (setpoint – input), the master freezes or reduces its integration contribution to prevent a so-called "WindUp". In case of a "WindUp", the master increases its integration contribution to a very large value and must reduce it first, before the controller can again have a normal reaction. Such a "WindUp" affects the dynamic of the control negatively. The PID_Temp provides ways to prevent this effect in a cascade by configuring the parameter “Config.Cascade.AntiWindUpMode” of the master controller:

Value	Description
0	Deactivates Anti-Windup functionality.
1	Reduces the integration contribution of the master controller at the ratio “slaves in limitation” to “existing slaves” (parameter “CountSlaves”).
2	Freezes the integration contribution of the master as soon as one slave reaches its limitation. Only relevant if "Config.Cascade.IsMaster" = TRUE.

10.2.4.2 PID_Temp ErrorBit parameters

If the PID controller has several warnings pending, it displays the values of the error codes by means of binary addition. The display of error code 0003, for example, indicates that the errors 0001 and 0002 are pending.

Table 10- 28 PID_Temp instruction ErrorBit parameters

ErrorBit (DW#16#...)	Description
0000	No error
0001 [1, 2]	The Input parameter is outside the process value limits. Input > Config.InputUpperLimit Input < Config.InputLowerLimit
0002 [2, 3]	Invalid value at the Input_PER parameter. Check whether an error is pending at the analog input.
0004 [4]	Error during fine tuning. Oscillation of the process value could not be maintained.
0008 [4]	Error at start of pre-tuning. The process value is too close to the setpoint. Start fine tuning.
0010 [4]	The setpoint was changed during tuning. Note: You can set the permitted fluctuation on the setpoint at the CancelTuningLevel tag.
0020	Pre-tuning is not permitted during fine tuning. Note: If ActivateRecoverMode = TRUE before the error occurred, PID_Temp remains in fine tuning mode.
0040 [4]	Error during pretuning. The cooling could not reduce the process value.
0080 [4]	Error during pre-tuning. Incorrect configuration of output value limits. Check whether the limits of the output value are configured correctly and match the control logic.
0100 [4]	Error during fine tuning resulted in invalid parameters.

ErrorBit (DW#16#...)	Description
0200 [2, 3]	Invalid value at the Input parameter: Value has an invalid number format.
0400 [2, 3]	Calculation of the output value failed. Check the PID parameters.
0800 [1, 2]	Sampling time error: PID_Temp is not called within the sampling time of the cyclic interrupt OB.
1000 [2, 3]	Invalid value at the Setpoint parameter: Value has an invalid number format.
10000	Invalid value at the ManualValue parameter: Value has an invalid number format. Note: If ActivateRecoverMode = TRUE before the error occurred, PID_Temp uses SubstituteOutput as the output value. As soon as you assign a valid value in the ManualValue parameter, PID_Temp uses it as the output value.
20000	Invalid value at the SubstituteValue tag: Value has an invalid number format. PID_Temp uses the output value low limit as the output value. Note: If automatic mode was active before the error occurred, ActivateRecoverMode = TRUE, and the error is no longer pending, PID_Temp switches back to automatic mode.
40000	Invalid value at the Disturbance parameter: Value has an invalid number format. Note: If automatic mode was active and ActivateRecoverMode = FALSE before the error occurred, Disturbance is set to zero. PID_Temp remains in automatic mode. Note: If pre-tuning or fine tuning mode was active and ActivateRecoverMode = TRUE before the error occurred, PID_Temp switches to the operating mode that is saved in the Mode parameter. If Disturbance in the current phase has no effect on the output value, tuning is not canceled.
200000	Error with master in the cascade. Slaves are not in automatic mode or have a substitute setpoint enabled, preventing tuning of the master.
400000	The PID controller does not permit pretuning for heating while cooling is active.
800000	The process value must be close to the setpoint in order to start pretuning for cooling.
1000000	Error starting tuning. “Heat.EnableTuning” and “Cool.EnableTuning” are not set or do not match the configuration.
2000000	Pretuning for cooling requires successful pretuning for heating.

ErrorBit (DW#16#...)	Description
4000000	Error starting fine tuning. “Heat.EnableTuning” and “Cool.EnableTuning” cannot be set at the same time.
8000000	Error during PID parameter calculation resulted in invalid parameters (for example, negative Gain; the current PID parameters remain unchanged and tuning has no effect).

[1] Note: If automatic mode was active before the error occurred and ActivateRecoverMode = TRUE, PID_Temp remains in automatic mode.

[2] Note: If pre-tuning or fine tuning mode was active before the error occurred and ActivateRecover-Mode = TRUE, PID_Temp switches to the operating mode that is saved in the Mode parameter.

[3] Note: If automatic mode was active before the error occurred and ActivateRecoverMode = TRUE, PID_Compact outputs the configured substitute output value. As soon as the error is no longer pending, PID_Temp switches back to automatic mode.

[4] Note: If ActivateRecoverMode = TRUE before the error occurred, PID_Temp cancels the tuning and switches to the operating mode that is saved in the Mode parameter.

10.2.4.3 PID_Temp Warning parameters

If the PID controller has several warnings pending, it displays the values of the error codes by means of binary addition. The display of error code 0003, for example, indicates that the errors 0001 and 0002 are pending.

Table 10- 29 PID_Temp instruction Warning parameters

Warning (DW#16#...)	Description
0000	No warning pending.
0001 [1]	The point of inflection was not found during pretuning.
0002	Oscillation was enforced during “tuning in run”. (The "Warning" parameter suppresses this warning and is only visible in the “WarningInternal” parameter for diagnostic purposes.)
0004 [1]	The setpoint was limited to the configured limits.
0008 [1]	Not all the necessary controlled system properties were defined for the selected method of calculation. Instead, the PID parameters were calculated using the TIR.TuneRuleHeat / TIR.TuneRuleCool = 3 method.
0010	The operating mode could not be changed because Reset = TRUE or ManualEnable = TRUE.
0020	The cycle time of the calling OB limits the sampling time of the PID algorithm. Improve results by using shorter OB cycle times.
0040 [1]	The process value exceeded one of its warning limits.
0080	Invalid value at Mode. The operating mode is not switched.
0100 [1]	The manual value was limited to the limits of the controller output.
0200	The specified rule for tuning is not supported. No PID parameters are calculated.
1000	The substitute output value cannot be reached because it is outside the output value limits.
4000	The specified output selection for heating and/or cooling is not supported. Only OutputHeat and OutputCool are active.

Warning (DW#16#...)	Description
8000	The specified value for the PIDSelfTune.SUT.AdaptDelayTime parameter is not supported, so the default value "0" is used.
10000	The specified value for the PIDSelfTune.SUT.CoolingMode parameter is not supported, so the default value "0" is used.

[1] Note: The PID controller deleted the following warnings automatically as soon as the cause is eliminated or the user action repeated with valid parameters: 0001, 0004, 0008, 0040, and 0100.

10.2.5 Configuring the PID_Compact and PID_3Step controllers

The parameters of the technology object determine the operation of the PID controller. Use the icon to open the configuration editor.

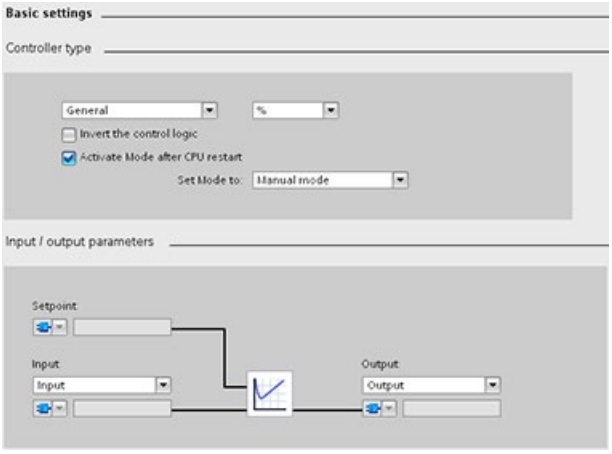


Table 10- 30 Example configuration settings for the PID_Compact instruction

Settings		Description
Basic	Controller type	Selects the engineering units.
	Invert the control logic	Allows selection of a reverse-acting PID loop. • If not selected, the PID loop is in direct-acting mode and the output of PID loop increases if input value < setpoint. • If selected, the output of the PID loop increases if the input value > setpoint.
	Enable last mode after CPU restart	Restarts the PID loop after it is reset or if an input limit has been exceeded and returned to the valid range.
	Input	Selects either the Input parameter or the Input_PER parameter (for analog) for the process value. Input_PER can come directly from an analog input module.
	Output	Selects either the Output parameter or the Output_PER parameter (for analog) for the output value. Output_PER can go directly to an analog output module.
Process value	Scales both the range and the limits for the process value. If the process value goes below the low limit or above the high limit, the PID loop goes to inactive mode and sets the output value to 0. To use Input_PER, you **must** scale the analog process value (input value).	

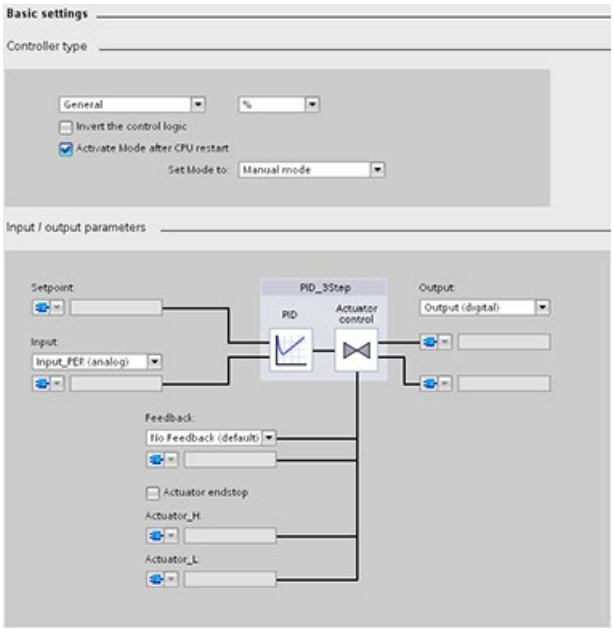


Table 10- 31 Example configuration settings for the PID_3Step instruction

Settings		Description
Basic	Controller type	Selects the engineering units.
	Invert the control logic	Allows selection of a reverse-acting PID loop. • If not selected, the PID loop is in direct-acting mode, and the output of PID loop increases if the input value < setpoint). • If selected, the output of the PID loop increases if the input value > setpoint.
	Activate mode after CPU restart	Restarts the PID loop after it is reset or if an input limit has been exceeded and returned to the valid range. Set Mode to: Defines the mode that the user wants the PID to go to after restart.
	Input	Selects either the Input parameter or the Input_PER parameter (for analog) for the process value. Input_PER can come directly from an analog input module.
	Output	Selects either to use the digital outputs (Output_UP and Output_DN) or to use the analog output (Output_PER) for the output value.
	Feedback	Selects the type of device status returned to the PID loop: • No feedback (default) • Feedback • Feedback_PER
Process value	Scales both the range and the limits for the process value. If the process value goes below the low limit or above the high limit, the PID loop goes to inactive mode and sets the output value to 0. To use Input_PER, you **must** scale the analog process value (input value).	

Settings		Description
Actuator	Motor transition time	Sets the time from open to close for the valve. (Locate this value on the data sheet or the faceplate of the valve.)
	Minimum ON time	Sets the minimum movement time for the valve. (Locate this value on the data sheet or the faceplate of the valve.)
	Minimum OFF time	Sets the minimum pause time for the valve. (Locate this value on the data sheet or the faceplate of the valve.)
	Reaction to error	Defines the behavior of the valve when an error is detected or when the PID loop is reset. If you select to use a substitute position, enter the "Safety position". For analog feedback or analog output, select a value between the upper or lower limit for the output. For digital outputs, you can choose only 0% (off) or 100% (on).
	Scale Position Feedback[1]	• "High end stop" and "Lower end stop" define the maximum positive position (full-open) and the maximum negative position (full-closed). "High end stop" must be greater than "Lower end stop". • "High limit process value" and "Low limit process value" define the upper and lower positions of the valve during tuning and automatic mode. • "FeedbackPER" ("Low" and "High") defines the analog feedback of the valve position. "FeedbackPER High" must be greater than "FeedbackPER Low".
Advanced	Monitoring process value	Sets the warning high and low limits for the process value.
	PID parameters	If the user wishes, he can enter his own PID tuning parameters in this window. The “Enable Manual Entry” check box must be checked to allow this.

[1] "Scale Position Feedback" is editable only if you enabled "Feedback" in the "Basic" settings.

10.2.6 Configuring the PID_Temp controller

The parameters of the technology object determine the operation of the PID controller. Use the icon to open the configuration editor.

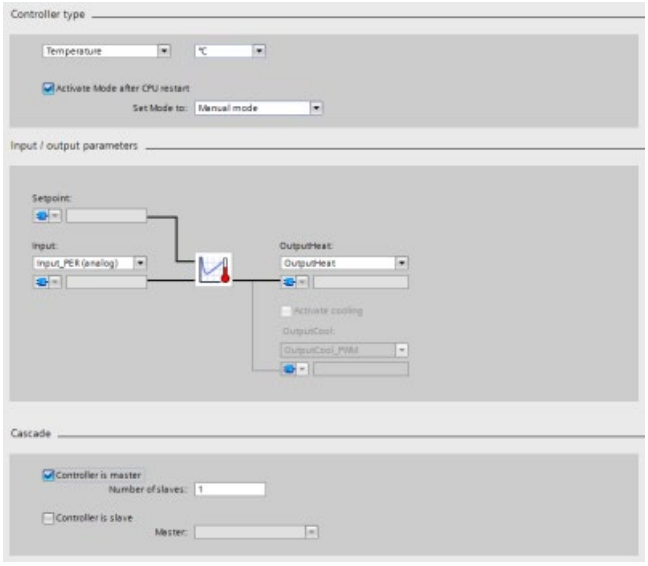


Table 10- 32 Example configuration settings for the PID_Temp instruction

Settings		Description
Basic	Controller type	Selects the engineering units.
	Activate mode after CPU restart	Restarts the PID loop after it is reset or if an input limit has been exceeded and returned to the valid range. Set Mode to: Defines the mode that the user wants the PID to go to after restart.
	Input	Selects either the Input parameter or the Input_PER parameter (for analog) for the process value. Input_PER can come directly from an analog input module.
	Output Heat	Selects either to use the digital outputs (OutputHeat and OutputHeat_PWM) or to use the analog output (OutputHeat_PER (analog)) for the output value.
	Output Cool	Selects either to use the digital outputs (OutputCool and OutputCool_PWM) or to use the analog output (OutputCool_PER (analog)) for the output value.
Process value	Scales both the range and the limits for the process value. If the process value goes below the low limit or above the high limit, the PID loop goes to inactive mode and sets the output value to 0. To use Input_PER, you **must** scale the analog process value (input value).	
Cascade	Controller is master	Sets the controller as a master and selects the number of slaves.
	Controller is slave	Sets the controller as a slave and selects the number of masters.

Controller type

Setting	TO-DB parameter	Data type	Value range	Description
Physical quantity	"PhysicalQuantity"	Int (Enum)	• General • Temperature (=default)	Pre-selection for physical unit value No multi-value control and not editable in online mode of functional view.
Unit of meas-urement	"PhysicalUnit	Int (Enum)	• General: Units = % • Temperature: Units (possible selections) = – °C (=default) – °F – K	User unit selection is set back to “0” if you change the physical quantity.
Activate mode after CPU restart	"RunModeByStartup"	Bool	Checkbox	If set to TRUE (=default), the controller switches to the state that is stored in the “Mode” variable after a powercycle (Power on - off - on) or PLC STOP-to-RUN transition. Other-wise, the PID_Temp remains in “Inactive” mode.
Set mode to	"Mode"	Int (Enum)	Modes (possible selections): • 0: Inactive • 1: Pretuning • 2: Fine tuning • 3: Automatic mode • 4: Manual mode (=default)	The engineering station (ES) sets the start value of the“Mode” variable according to user selec-tion.The default value of Mode (stored inTO-DB) is Manual Mode.

Input / output parameters

Setting	TO-DB parameter	Data type	Value range	Description
Setpoint	Setpoint	Real)	Real	Only accessible in Property Page. No multi value control in online mode of functional view.
Selection input	"Config.InputPerOn"	Bool (Enum)	Bool	Selects which kind of input to use. Possible selections: • FALSE: “Input” (Real) • TRUE: “Input_PER (analog)”
Input	Input or Input_PER	Real or Int	Real or Int	Only accessible in Properties page. No multi value control in online mode of functional view.
Selection Output (heating)	"Config.Output.Heat.Select"	Int (Enum)	2 >= Config.Output.Heat.Select >= 0	Selects which kind of output to use for heating. Possible selections: • “OutputHeat” (Real) • “OutputHeat_PWM” (Bool) (=default) • “OutputHeat_PER (analog)” (Word) Is set to “OutputHeat” once, if “This controller is a master” checkbox in the “Cascade” section is activated by user.
Output (heating)	OutputHeat, OutputHeat_PER, or OutputHeat_PWM	Real or Int or Bool	Real, Int, or Bool	Only accessible in Properties page. No multi value control in online mode of functional view.

Setting	TO-DB parameter	Data type	Value range	Description
Activate output (cooling)	"Config.ActivateCooling"	Bool	Bool	Checking this checkbox: • Sets the "Config.Output.Heat.PidLowerLimit = 0.0 once. • Sets the "Config.ActivateCooling" parameter to TRUE, instead of FALSE if unchecked (=default). • Activates all other “Output (cooling)” controls (in “Basic settings” and other views). • Changes the line from the PID symbol to the controls from gray to black. • “This controller is a master” checkbox in the “Cascade” section is disabled. Note: Only available if you do not configure the controller as a master for a cascade (“This controller is a master”checkbox in the “Cascade” section is deactivated; "Config.Cascade.IsMaster" = FALSE).

Setting	TO-DB parameter	Data type	Value range	Description
Selection Output (cooling)	"Config.Output.Cool.Select"	Int (Enum)	2 >= Config.Output.Heat.Select >= 0	Selects which kind of output to use for cooling. Possible selections: • “OutputCool” (Real) • “OutputCool_PWM” (Bool) (=default) • “OutputCool_PER (analog)” (Word) Only available if you check “Activate output (cooling)”; (Config.ActivateCooling = TRUE).
Output (cooling)	OutputCool, OutputCool_PER, or OutputCool_PWM	Real or Int or Bool	Real, Int, or Bool	Only accessible in Properties page. No multi value control in online mode of functional view.

Cascade parameters

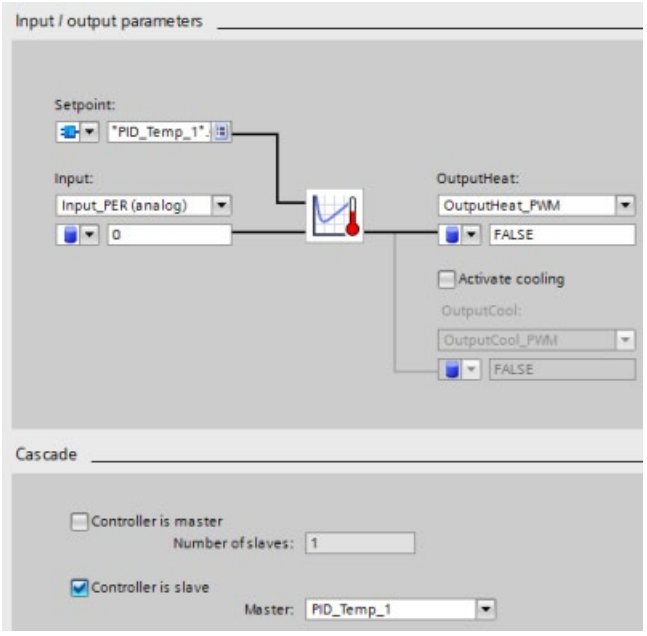
The following parameters enable you to select controllers as masters or slaves and to determine the number of slave copntrollers that receive their setpoint directly from the master controller:

Setting	TO-DB parameter	Data type	Value range	Description
This controller is a master	"Config.Cascade.IsMaster"	Bool	Bool	Shows if this controller is a master in a cascade. When you check this checkbox, you perform the following: • Set the parameter "Config.Cascade.IsMaster" to TRUE, instead of FALSE if unchecked (=default). • Set “Selection Output (heating)” in “Input / output parameters” section to “OutputHeat” once (Config.Output.Heat.Select = 0). • Enable “Number of Slaves” input field. • Disable “Activate output (cooling)” checkbox in “Input / output parameters” section. Note: Only available if cooling output of this controller is deactivated (“Activate output (cooling)” checkbox in “Input / output parameters” section deactivated (Config.ActivateCooling = FALSE).

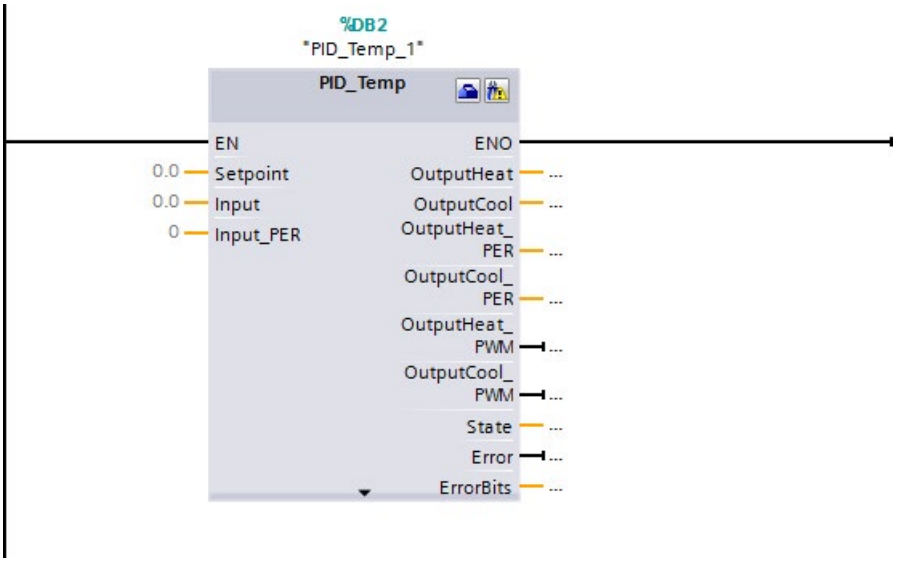
Setting	TO-DB parameter	Data type	Value range	Description
Number of slaves	"Config.Cascade.CountSlaves"	Int	255 >= Config.Cascade.CountSlaves >= 1	Number of slave controllers that get their setpoint directly from this master controller. The PID_Temp instruction processes this value, along with others, for anti-windup-handling."Number of slaves is only available if “This controller is a master” checkbox is activated (Con-(Config.Cascade.IsMaster = TRUE).
This controller is a slave	"Config.Cascade.IsSlave"	Bool	Bool	Shows if this controller is a slave in a cascade. When you check this checkbox, you set the parameter "Config.Cascade.IsSlave" to TRUE, instead of FALSE if unchecked (=default). You must check this checkbox in the property page to enable the “SelectionMaster” dropdown list.

Example: Cascading controllers

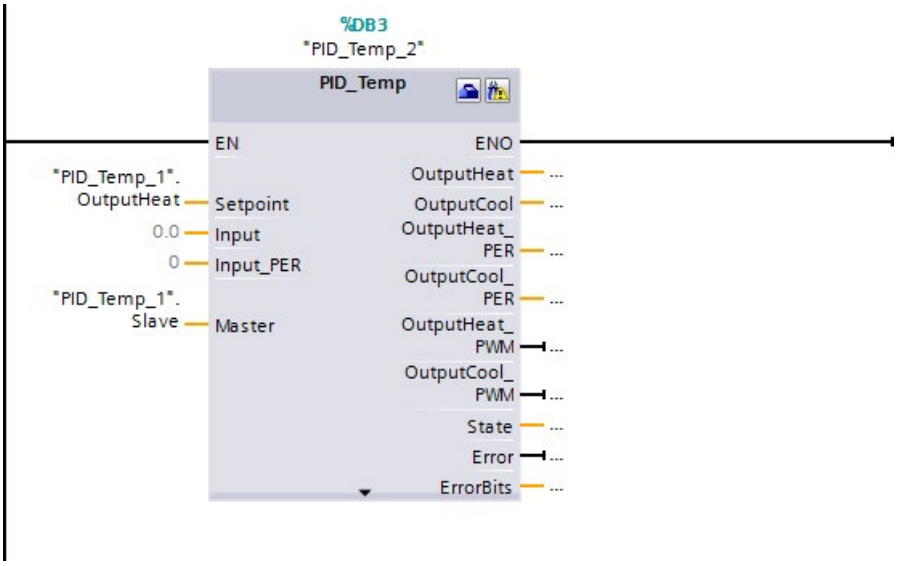
In the “Basic settings” dialog below, you see the “Input / output parameters” section and the “Cascade” section for slave controller "PID_Temp_2" after selecting "PID_Temp_1" as master. You make the connections between master and slave controller:



Network 1: In these networks, you make the connection between the "PID_Temp_1" master and the "PID_Temp_2" slave in the programming editor:



Network 2: You make the connection between the "PID_Temp_1" master's "OutputHeat" and "Slave" parameters to the "PID_Temp_2" slave's "Setpoint" and "Master" parameters, respectively:



Autotuning of temperature processes

The PID_Temp instruction provides two modes for auto tuning:

- "Pretuning" (parameter "Mode" = 1)
- "Finetuning" (parameter "Mode" = 2)

Depending on the controller configuration, different variants of these tuning methods are available:

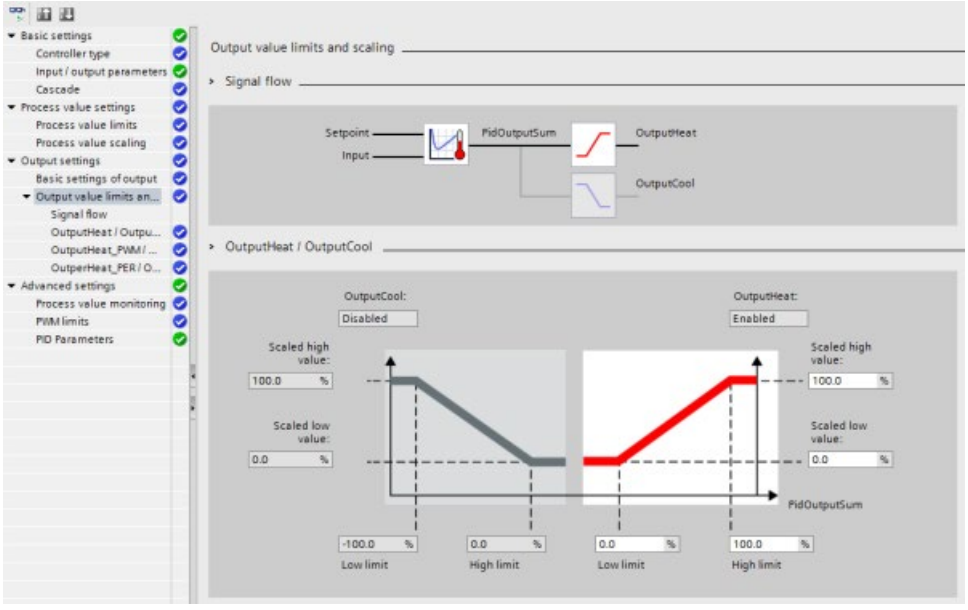
Configuration	Controller with heating output	Controller with heating and cooling output using cooling factor	Controller with heating and cooling output using two sets of PID parameters
Associated TO-DB values	• Config.ActivateCooling = FALSE • Config.AdvancedCooling = irrelevant	• Config.ActivateCooling = TRUE • Config.AdvancedCooling = FALSE	• Config.ActivateCooling = TRUE • Config.AdvancedCooling = TRUE
Available tuning methods	• “Pretuning heating” • “Fine tuning heating" (cooling offset cannot be used)	• “Pretuning heating” • “Fine tuning heating" (cooling offset can be used)	• “Pretuning heating and cooling” • "Pretuning heating” • “Pretuning cooling” • “Fine tuning heating” (cooling offset can be used) • “Fine tuning cooling” (heating offset can be used)

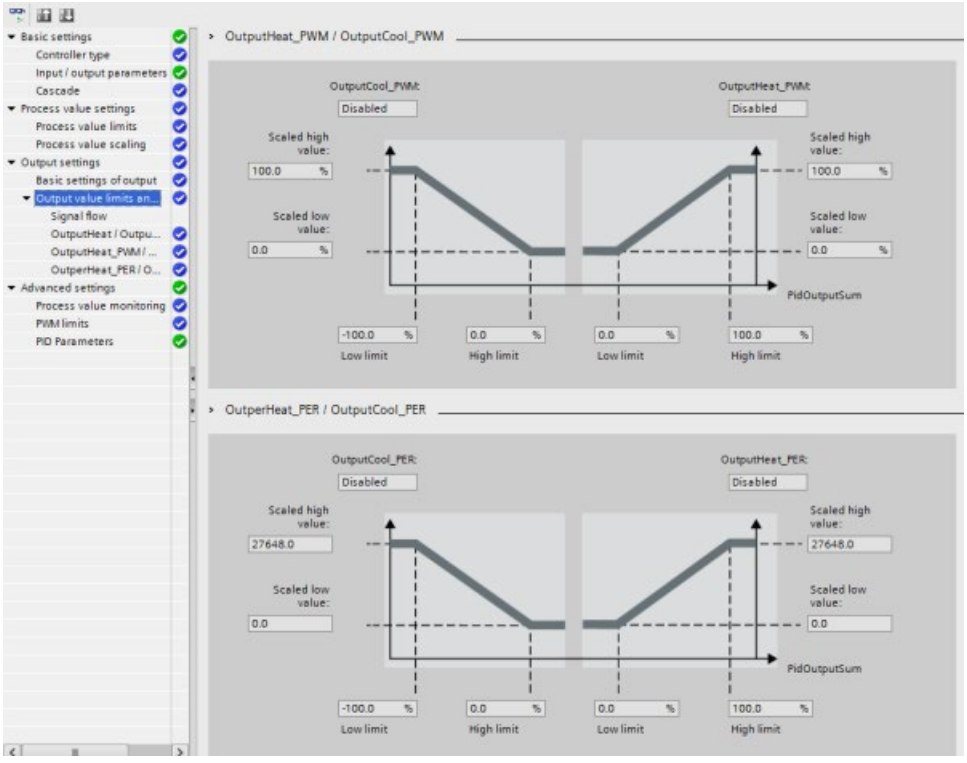
Output value limits and scaling

Cooling activation disabled

If you configure the PID_Temp instruction as master for a cascade “Activate output (cooling)” checkbox in “Basic settings” view is unchecked and disabled, all settings in the “Output settings” view that depend on cooling activation are disabled, too.

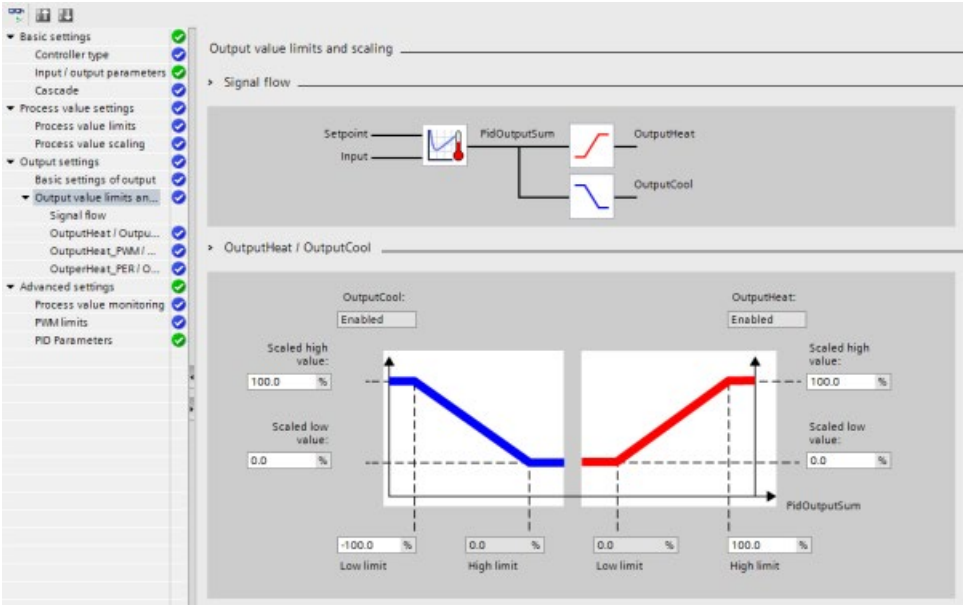
The figure below shows the "Output value limits and scaling” section in the “Output settings” view with cooling deactivated (OutputHeat_PWM selected in “Input / output parameters” view and OutputHeat always enabled):

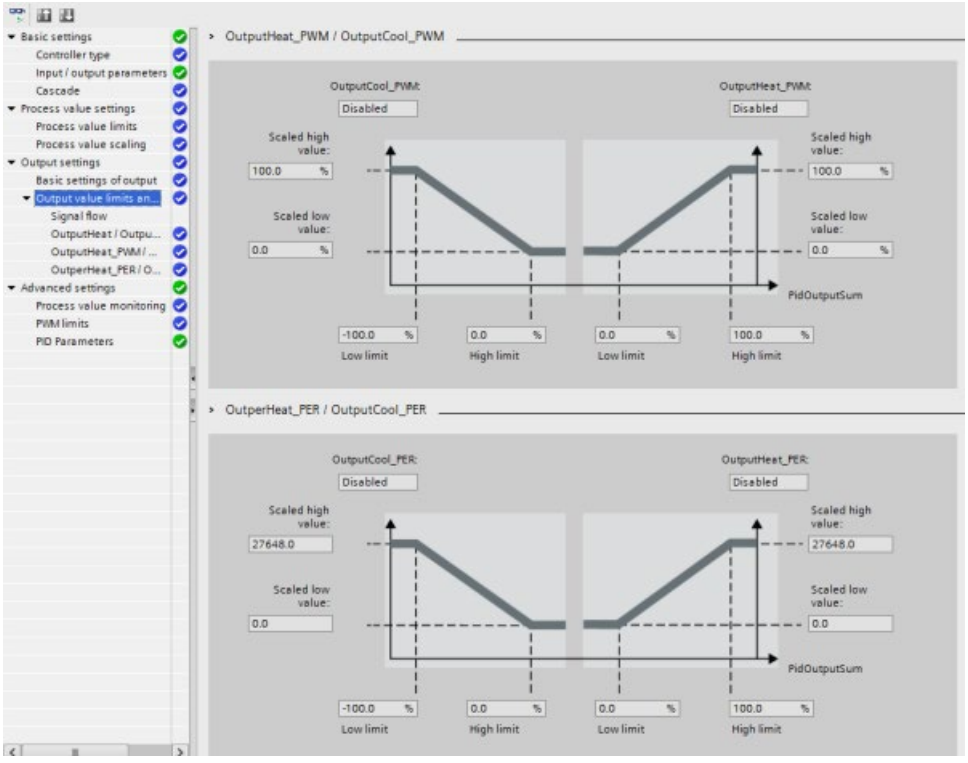




Cooling activation enabled

The figure below shows the ”Output value limits and scaling” section in “Output settings” view with cooling activated (OutputCool_PER and OutputHeat_PWM selected in “Input / output parameters” view; OutputCool and OutputHeat always enabled):





Operation modes

To change the mode of operation manually, the user needs to set the “Mode” in-out parameter of the controller and activate it by setting “ModeActivate” from FALSE to TRUE (rising edge triggered). You must reset “ModeActivate” before the next mode change; it does not reset automatically.

Output parameter “State” shows the current operating mode and is set to the requested “Mode” if possible. The “State” parameter cannot be changed directly; it is only changed through the “Mode” parameter or automatic operating mode changes by the controller.

"Mode" / "State"	Name	Description
0	Inactive	The PID_Temp instruction: • Deactivates the PID-algorithm and pulse width modulation • Sets to "0" (FALSE) all controller outputs (OutputHeat, OutputCool, OutputHeat_PWM,OutputCool_PWM, OutputHeat_PER, OutputCool_PER), regardless of configured output limits or offsets. You can reach this mode by setting “Mode” = 0, “Reset” = TRUE, or by error.
1	Pretuning (startup tuning / SUT)	This mode determines the parameters during first start up of the controller. Unlike the PID_Compact, for the PID_Temp, you must select if you require heating tuning, cooling tuning, or both with the “Heat.EnableTuning” and “Cool.EnableTuning” parameters. You can activate "Pretuning" from Inactive, Automatic mode, or Manual mode. If tuning is successful, PID_Temp switches to Automatic mode. If tuning is unsuccessful, the switchover of the operating mode depends on “ActivateRecoverMode”.

"Mode" / "State"	Name	Description
2	Fine tuning (tuning in run / TIR)	This mode determines the optimum parameterization of the PID controller at the setpoint. Unlike the PID_Compact, for the PID_Temp, you must select if you require heating tuning or cooling tuning with the “Heat.EnableTuning” and “Cool.EnableTuning” parameters. You can activate "Finetuning" from Inactive, Automatic mode, or Manual mode. If tuning is successful, PID_Temp switches to Automatic mode. If tuning is not successful, the switchover of the operating mode depends on “ActivateRecoverMode”.
3	Automatic mode	In Automatic mode (the standard PID control mode), the result of the PID-algorithm determines the output values. PID_Temp switches to Inactive if an error occurs and “ActivateRecoverMode” = FALSE. If an error occurs and “ActivateRecoverMode” = TRUE, the switchover of the operating mode depends on the error. Refer to PID_Temp instruction ErrorBit parameters (Page 605) for further information.
4	Manual mode	In this mode, the PID controller scales, limits, and transfers the value of parameter “ManualValue” to the outputs. The PID controller assigns “ManualValue” in the scaling of the PID-algorithm (like“PidOutputSum”), so its value decides if it is effective at the heating or cooling outputs. You can reach this mode by setting “Mode” = 4 or “ManualEnable”= TRUE.
5	Substitute output value with error monitoring (Recover mode)	You can activate this mode by setting "Mode" = 5. The mode is an automatic error reaction of the controller if Automatic mode is active at the moment the error occurs: • SetSubstituteOutput = FALSE (Last valid output value) • SetSubstituteOutput = TRUE (Value stored in parameter "SubstituteOutput") When PID_Temp is in “Automatic mode” and the “ActivateRecoverMode” parameter = TRUE, PID_Temp changes to this mode in the case of the following errors: • “Invalid value at "Input_PER" parameter. Check for an error at the analog input (for example, wire broken)." (ErrorBits = DW#16#0002) • “Invalid value at "Input" parameter. Value is not a number.” (ErrorBits = DW#16#0200) • “Calculation of output value failed. Check the PID parameters.” (ErrorBits = DW#16#0400) • “Invalid value at "Setpoint" parameter. Value is not a number.” (ErrorBits = DW#16#1000) If the error is no longer pending, PID_Temp will switch back to Automatic mode automatically.

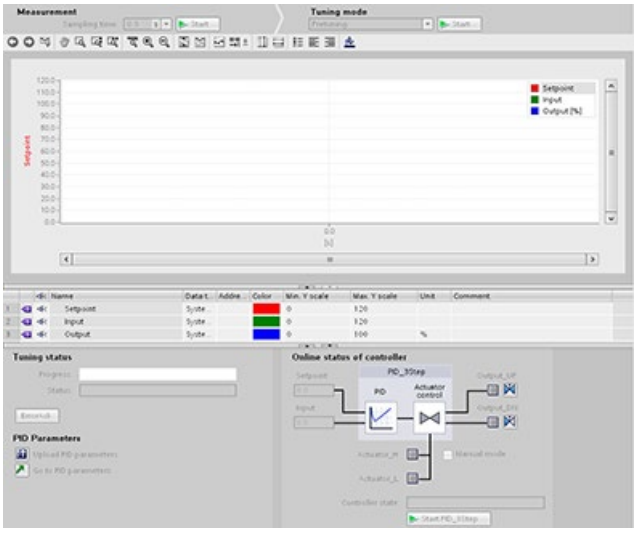
10.2.7 Commissioning the PID_Compact and PID_3Step controllers

Use the commissioning editor to configure the PID controller for autotuning at startup and for autotuning during operation. To open the commissioning editor, click the icon on either the instruction or the project navigator.





Table 10- 33 Sample commissioning screen (PID_3Step)

	• Measurement: To display the setpoint, the process value (input value) and the output value in a real-time trend, enter the sample time and click the "Start" button. • Tuning mode: To tune the PID loop, select either "Pre-tuning" or "Fine tuning" (manual) and click the "Start" button. The PID controller runs through multiple phases to calculate system response and update times. The appropriate tuning parameters are calculated from these values. After the completion of the tuning process, you can store the new parameters by clicking the "Upload PID parameters" button in the "PID Parameters" section of the commissioning editor. If an error occurs during tuning, the output value of the PID goes to 0. The PID mode then is set to "inactive" mode. The status indicates the error.

PID start value control

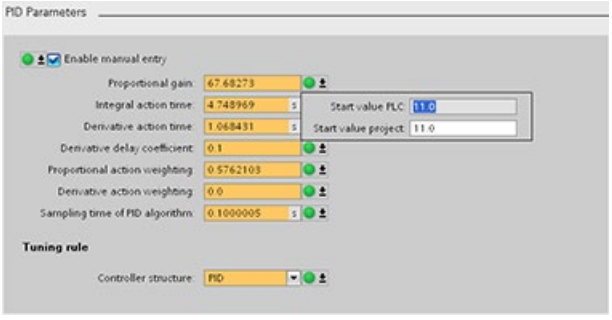
You can edit the actual values of the PID configuration parameters so that the behavior of the PID controller can be optimized in online mode.

Open the "Technology objects" for your PID controller and its "Configuration" object. To access the start value control, click the "eyeglasses icon" in the upper left corner of the dialog:



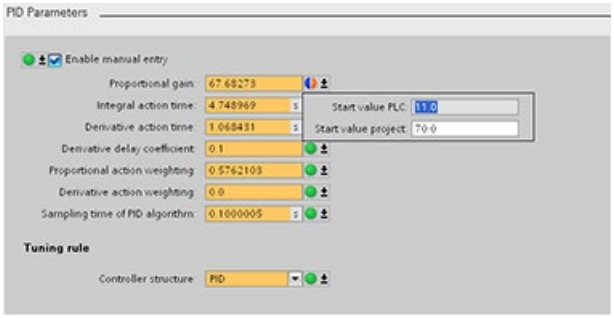
You can now change the value of any of your PID controller configuration parameters as shown in the figure below.

You can compare the actual value to the project (offline) start value and the PLC (online) start value of each parameter. This is necessary to compare online/offline differences of the Technology object data block (TO-DB) and to be informed about the values that will be used as current values on the next Stop-to-Start transition of the PLC. In addition, a compare icon gives a visual indication to help easily identify online/offline differences:



The figure above shows the PID parameter screen with compare icons showing which values are different between online and offline projects. A green icon indicates that the values are the same; a blue/orange icon indicates that the values are different.

Additionally, click the parameter button with the downward arrow to open a small window that shows the project (offline) start value and the PLC (online) start value of each parameter:



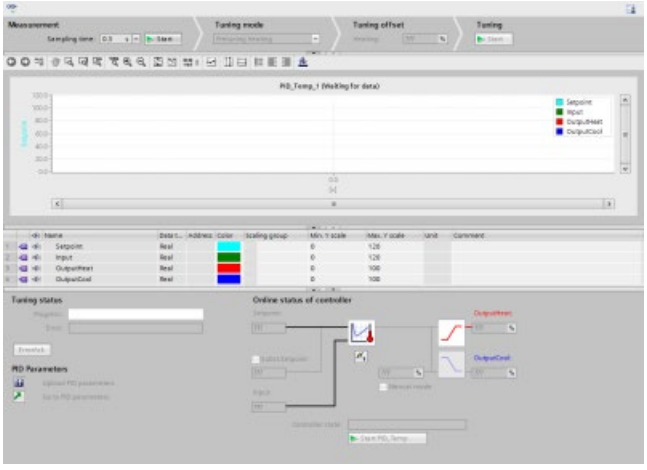
10.2.8 Commissioning the PID_Temp controller

Use the commissioning editor to configure the PID controller for autotuning at startup and for autotuning during operation. To open the commissioning editor, click the icon on either the instruction or the project navigator.





Table 10- 34 Sample commissioning screen (PID_Temp)

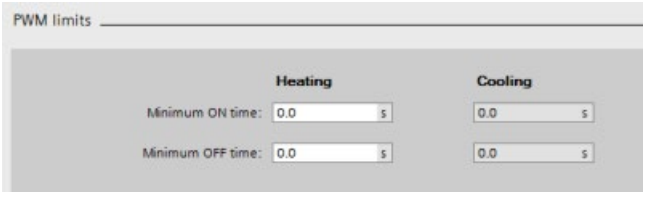
	Measurement: To display the setpoint, the process value (input value) and the output value in a real-time trend, enter the sample time and click the "Start" button. Tuning mode: To tune the PID_Temp loop, select either "Pretuning" or "Finetuning" (manual) and click the "Start" button. The PID controller runs through multiple phases to calculate system response and update times. The appropriate tuning parameters are calculated from these values. After the completion of the tuning process, you can store the new parameters by clicking the "Upload PID parameters" button in the "PID Parameters" section of the commissioning editor. If an error occurs during tuning, the output value of the PID goes to "0". The PID mode then is set to "inactive" mode. The status indicates the error.

PWM limits

Actuators that are controlled with the software PWM function of the PID_Temp may need to be protected from too short pulse durations (for example, a thyristor relay needs to be turned on for more than 20 ms before it can react at all); you assign a minimum on time. The actuator can also neglect short impulses and therefore corrupt the control quality. A minimum off time can be necessary (for example, to prevent overheating).

To show up the PWM limits view, you must open the functional view in the Technology objects (TO) configuration and select “PWM limits” from the “Advanced settings” node in the navigation tree.

If you open the “PWM limits” view in the functional view and activate monitoring (“glasses” button), all controls show the online monitor value from TO-DB with orange background color and multi-value control, and you can edit the values (if configuration conditions are fulfilled; refer to the table below).



Setting	TO-DB parameter	Data type	Value range	Description
Minimum on time (heating) [1,2]	"Config.Output.Heat. MinimumOnTime"	Real	100000.0 >= "Config.Output. Heat. MinimumOnTime >= 0.0	A pulse at OutputHeat_PWM" is never shorter than this value.
Minimum off time (heating) [1,2]	"Config.Output.Heat. MinimumOffTime"	Real	100000.0 >= "Config.Output. Heat. MinimumOffTime >= 0.0	A break at OutputHeat_PWM is never shorter than this value.

Setting	TO-DB parameter	Data type	Value range	Description
Minimum on time (cooling) [1,3,4]	"Config.Output.Cool. MinimumOnTime"	Real	100000.0 >= Config.Output. Cool. MinimumOnTime >= 0.0	A pulse at OutputCool_PWM is never shorter than this value.
Minimum off time (cooling) [1,3,4]	"Config.Output.Cool. MinimumOffTime"	Real	100000.0 >= Config.Output. Cool. MinimumOffTime >= 0.0	A break at OutputCool_PWM is never shorter than this value.

1 The field displays "s" (seconds) as the time units.

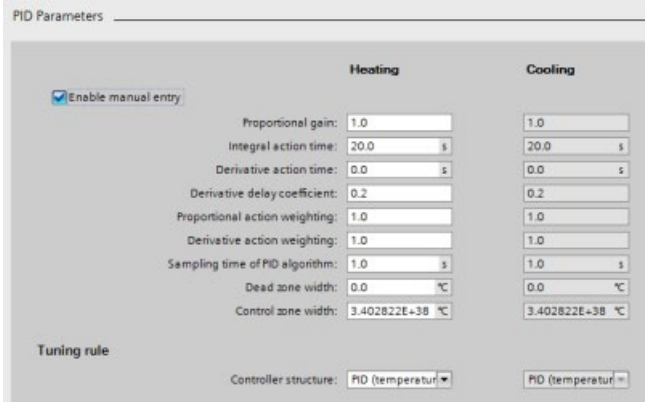
2 If the·selection Output (heating) in “Basic settings” view is not “OutputHeat_PWM” (Config.Output.Heat.Select = TRUE), you should set this value to "0.0".

3 If selection Output (cooling) in “Basic settings” view is not “OutputCool_PWM” (Config.Output.Cool.Select = TRUE), you should set this value to "0.0".

4 Only available if you check “Activate output (cooling)” in “Basic settings” view (Config.ActivateCooling = TRUE).

PID parameters

The “Advanced settings” view, "PID Parameters” section is shown below with the cooling and/or “PID parameterswitchover” feature deactivated.



Setting	TO-DB parameter	Data type	Value range	Description
Enable manual entry	"Retain.CtrlParams. SetByUser"	Bool	Bool	You must check this checkbox to enter PID parameters manually.
Proportional gain (heating) [2]	"Retain.CtrlParams. Heat.Gain"	Real	Gain >= 0.0	PID proportional gain for heating

Setting	TO-DB parameter	Data type	Value range	Description
Integral action time (heating) [1,2]	"Retain.CtrlParams. Heat.Ti"	Real	100000.0 >= Ti >= 0.0	PID integral action for heating.
Derivative action time (heating) [1,2]	"Retain.CtrlParams. Heat.Td"	Real	100000.0 >= Td >= 0.0	PID derivative action time for heating.
Derivative delay coefficient(heating) [2]	"Retain.CtrlParams. Heat.TdFiltRatio"	Real	TdFiltRatio >= 0.0	PID derivative delay coefficient for heating that defines the derivative lag time as coefficient from the PID derivative time.
Proportional action weighting(heating) [2]	"Retain.CtrlParams. Heat.PWeighting"	Real	1.0 >=PWeighting >= 0.0	Weighting of the PID proportional gain for heating in either direct- or loopback- control path.
Derivative action weighting (heating) [2]	"Retain.CtrlParams. Heat.DWeighting"	Real	1.0 >=DWeighting >= 0.0	Weighting of the PID derivative part for heating in either direct- or loopback- control path.
Sampling time of PID algorithm (heating) [1,2]	"Retain.CtrlParams. Heat.Cycle"	Real	100000.0 >=Cycle > 0.0	Internal call cycle of the PID controller for heating. Rounded to an integer multiple of the FB call cycle time.
Deadband width(heating) [2,3]	"Retain.CtrlParams. Heat.DeadZone"	Real	DeadZone>= 0.0	Width of the deadband for heating control deviation.
Control Zone (heating)[2,3]	"Retain.CtrlParams. Heat.ControlZone"	Real	ControlZone> 0.0	Width of the control deviation zone for heating where PID control is active. If control deviation leaves this range, output is switched to maximum output values. Default value is "MaxReal" so control zone is deactivated as long as autotuning is not executed. Value "0.0" is prohibited for Control Zone; with the value "0.0", PID_Temp behaves like a two-position controller that is always heating or cooling at full power.

Setting	TO-DB parameter	Data type	Value range	Description
Controller structure (heating)	"PIDSelfTune.SUT. TuneRuleHeat", "PIDSelfTune.TIR. TuneRuleHeat"	Int	"PIDSelf-Tune.SUT. TuneRuleHeat" = 0..2, "PIDSelf-Tune.TIR. TuneRuleHeat" = 0..5	You can select the tuning algorithm for heating. Possible selections: • PID (Temperature) (=default) ("PIDSelfTune.SUT. TuneRuleHeat" = 2) ("PIDSelfTune.TIR. TuneRuleHeat" = 0) • PID ("PIDSelfTune.SUT. TuneRuleHeat" = 0) ("PIDSelfTune.TIR. TuneRuleHeat" = 0) • PI ("PIDSelfTune.SUT. TuneRuleHeat" = 1) ("PIDSelfTune.TIR. TuneRuleHeat" = 4) Any other combination shows “User defined”, but “User defined” is not provided by default. “PID (Temperature)” is new for PID_Temp, with a specific pretuning (SUT) method for temperature processes.
Proportional gain (cooling) [4]	"Retain.CtrlParams. Cool.Gain"	Real	Gain >= 0.0	PID proportional gain for cooling
Integral action time (cooling) [1,4]	"Retain.CtrlParams. Cool.Ti"	Real	100000.0 >=Ti >= 0.0	PID integral action for cooling
Derivative action time (cooling) [1,4]	"Retain.CtrlParams. Cool.Td"	Real	100000.0 >=Td >= 0.0	PID derivative action time for cooling
Derivative delay coefficient (cooling) [4]	Retain.CtrlParams. Cool.TdFiltRatio"	Real	TdFiltRatio>= 0.0	PID derivative delay coefficient for cooling that defines the derivative lag time as a coefficient from the PID derivative time.

Setting	TO-DB parameter	Data type	Value range	Description
Proportional action weighting (cooling) [4]	"Retain.CtrlParams. Cool.PWeighting"	Real	1.0 >=PWeighting >= 0.0	Weighting of the PID proportional gain for cooling in either the direct- or loopback-control path.
Derivative action weighting (cooling) [4]	Retain.CtrlParams. Cool.DWeighting"	Real	1.0 >=DWeighting >= 0.0	Weighting of the PID derivative part for cooling in either the direct- or loopback- control path.
Sampling time of PID algorithm (cooling) [1,4]	"Retain.CtrlParams. Cool.Cycle"	Real	100000.0 >=Cycle > 0.0	Internal call cycle of the PID controller for cooling. Rounded to an integer multiple of the FB call cycle time.
Deadband width (cooling) [3,4]	"Retain.CtrlParams. Cool.DeadZone"	Real	DeadZone>= 0.0	Width of the deadband for cooling control deviation

Setting	TO-DB parameter	Data type	Value range	Description
Control Zone (cooling) [3,4]	"Retain.CtrlParams. Cool.ControlZone"	Real	ControlZone> 0.0	Width of the control deviation zone for cooling where PID control is active. If control deviation leaves this range, output is switched to maximum output values. Default value is "MaxReal" so control zone is deactivated as long as autotuning is not executed. Value "0.0" is prohibited for Control Zone; with the value "0.0", PID_Temp behaves like a two-position controller that is always heating or cooling at full power.

Setting	TO-DB parameter	Data type	Value range	Description
Controller structure (cooling)	"PIDSelfTune.SUT. TuneRuleCool", "PIDSelfTune.TIR. TuneRuleCool"	Int	"PIDSelf-Tune.SUT. TuneRuleHeat" = 0..2, "PIDSelf-Tune.TIR. TuneRuleHeat" = 0..5	You can select the tuning algorithm for cooling. Possible selections: • PID (Temperature) (=default) ("PIDSelfTune.SUT. TuneRuleCool" = 2) ("PIDSelfTune.TIR. TuneRuleCool = 0) • PID ("PIDSelfTune.SUT. TuneRuleCool" = 0) ("PIDSelfTune.TIR. TuneRuleCool" = 0) • PI ("PIDSelfTune.SUT. TuneRuleCool" = 1) ("PIDSelfTune.TIR. TuneRuleCool" = 4) Any other combination shows “User defined”, but “User defined” is not provided by default. “PID (Temperature)” is new for PID_Temp, with a specific pretuning (SUT) method for temperature processes. Only available if you check/select the following items: “Activate output (cooling)” in “Basic settings” view ("Config.ActivateCooling" = TRUE), and “PID parameter switchover” in “Output settings” view (Config.AdvancedCooling = TRUE).

Setting	TO-DB parameter	Data type	Value range	Description

1 The field displays "s" (seconds) as the time units.

2 Only available if you check "Enable manual entry" in PID parameters ("Retain.CtrlParams.SetByUser" = TRUE).

3 Unit of measurement is displayed at the end of the field as selected in "Basic settings" view.

4 Only available if you check/select the following items: "Enable manual entry" in PID parameters ("Retain.CtrlParams.SetByUser" = TRUE), "Activate output (cooling)" in "Basic settings" view ("Config.ActivateCooling" = TRUE), and "PID parameter switchover" in "Output settings" view (Config.AdvancedCooling = TRUE).

PID start value control

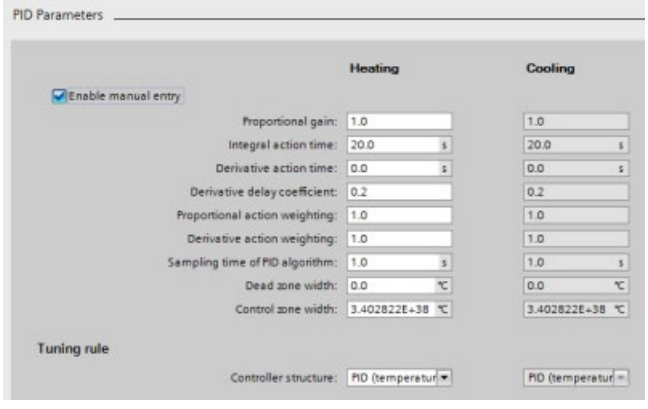
You can edit the actual values of the PID configuration parameters so that the behavior of the PID controller can be optimized in online mode.

Open the "Technology objects" for your PID controller and its "Configuration" object. To access the start value control, click the "eyeglasses icon" in the upper left corner of the dialog:



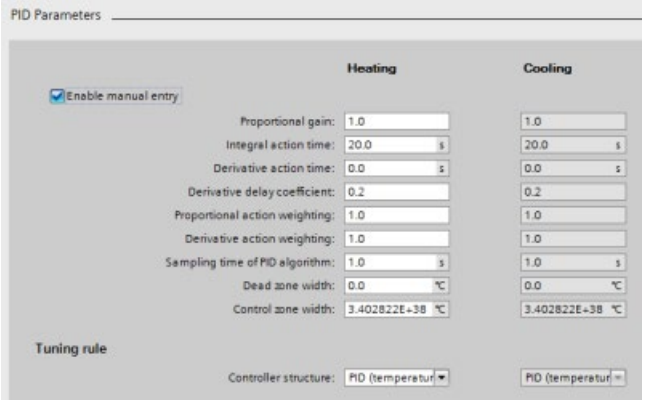
You can now change the value of any of your PID controller configuration parameters as shown in the figure below.

You can compare the actual value to the project (offline) start value and the PLC (online) start value of each parameter. This is necessary to compare online/offline differences of the Technology object data block (TO-DB) and to be informed about the values that will be used as current values on the next Stop-to-Start transition of the PLC. In addition, a compare icon gives a visual indication to help easily identify online/offline differences:



The figure above shows the PID parameter screen with compare icons showing which values are different between online and offline projects. A green icon indicates that the values are the same; a blue/orange icon indicates that the values are different.

Additionally, click the parameter button with the downward arrow to open a small window that shows the project (offline) start value and the PLC (online) start value of each parameter:



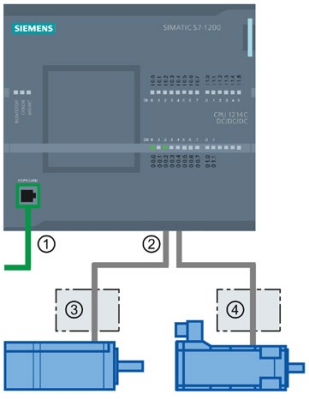
10.3 Motion control

The CPU provides motion control functionality for the operation of stepper motors and servo motors with pulse interface. The motion control functionality takes over the control and monitoring of the drives.

- The "Axis" technology object configures the mechanical drive data, drive interface, dynamic parameters, and other drive properties.
- You configure the pulse and direction outputs of the CPU for controlling the drive.
- Your user program uses the motion control instructions to control the axis and to initiate motion tasks.
- Use the PROFINET interface to establish the online connection between the CPU and the programming device. In addition to the online functions of the CPU, additional commissioning and diagnostic functions are available for motion control.

Note

Changes that you make to the motion control configuration and download in RUN mode do not take effect until the CPU transitions from STOP to RUN mode.



① PROFINET

② Pulse and direction outputs

③ Power section for stepper motor

④ Power section for servo motor

The DC/DC/DC variants of the CPU S7-1200 have onboard outputs for direct control of drives. The relay variants of the CPU require the signal board with DC outputs for drive control.

A signal board (SB) expands the onboard I/O to include a few additional I/O points. An SB with two digital outputs can be used as pulse and direction outputs to control one motor. An SB with four digital outputs can be used as pulse and direction outputs to control two motors. Built-in relay outputs cannot be used as pulse outputs to control motors. Whether you use onboard I/O or SB I/O or a combination of both, you can have a maximum number of four pulse generators.

The four pulse generators have default I/O assignments; however, they can be configured to any digital output on the CPU or SB. Pulse generators on the CPU cannot be assigned to SMs or to distributed I/O.

Note

Pulse-train outputs cannot be used by other instructions in the user program

When you configure the outputs of the CPU or signal board as pulse generators (for use with the PWM or motion control instructions), the corresponding output addresses no longer control the outputs. If your user program writes a value to an output used as a pulse generator, the CPU does not write that value to the physical output.

Table 10- 35 Maximum number of controllable drives

Type of CPU		Onboard I/O; No SB installed		With an SB (2 x DC outputs)		With an SB (4 x DC outputs)	
		With direction	Without direction	With direction	Without direction	With direction	Without direction
CPU 1211C	DC/DC/DC	2	4	3	4	4	4
	AC/DC/Relay	0	0	1	2	2	4
	DC/DC/Relay	0	0	1	2	2	4
CPU 1212C	DC/DC/DC	3	4	3	4	4	4
	AC/DC/Relay	0	0	1	2	2	4
	DC/DC/Relay	0	0	1	2	2	4
CPU 1214C	DC/DC/DC	4	4	4	4	4	4
	AC/DC/Relay	0	0	1	2	2	4
	DC/DC/Relay	0	0	1	2	2	4
CPU 1215C	DC/DC/DC	4	4	4	4	4	4
	AC/DC/Relay	0	0	1	2	2	4
	DC/DC/Relay	0	0	1	2	2	4
CPU 1217C	DC/DC/DC	4	4	4	4	4	4

Note

The maximum number of pulse generators is four.

Whether you use onboard I/O, SB I/O, or a combination of both, you can have a maximum number of four pulse generators.

Table 10- 36 CPU output: maximum frequency

CPU	CPU output channel	Pulse and direction output	A/B, quadrature, up/down, and pulse/direction
1211C	Qa.0 to Qa.3	100 kHz	100 kHz
1212C	Qa.0 to Qa.3	100 kHz	100 kHz
	Qa.4, Qa.5	20 kHz	20 kHz
1214C and 1215C	Qa.0 to Qa.3	100kHz	100kHz
	Qa.4 to Qb.1	20 kHz	20 kHz
1217C	DQa.0 to DQa.3 (.0+, .0- to .3+, .3-)	1 MHz	1 MHz
	DQa.4 to DQb.1	100 kHz	100 kHz

Table 10- 37 SB signal board output: maximum frequency (optional board)

SB signal board	SB output channel	Pulse and direction output	A/B, quadrature, up/down, and pulse/direction
SB 1222, 200 kHz	DQe.0 to DQe.3	200kHz	200 kHz
SB 1223, 200 kHz	DQe.0, DQe.1	200kHz	200 kHz
SB 1223	DQe.0, DQe.1	20 kHz	20 kHz

Table 10- 38 Limit frequencies of pulse outputs

Pulse output	Frequency
Onboard	4 PTO: 2 Hz ≤ f ≤ 1 MHz, 4 PTO: 2 Hz ≤ f ≤ 100 kHz, or any combination of these values for 4 PTOs.[1] [2]
Standard SB	2 Hz ≤ f ≤ 20 kHz
High-speed SBs	2 Hz ≤ f ≤ 200 kHz

[1] See the table below for four possible CPU 1217C output speed combinations.

[2] See the table below for four possible CPU 1211C, CPU 1212C, CPU 1214C, or CPU 1215C output speed combinations.

Example: CPU 1217C pulse output speed configurations

Note

The CPU 1217C can generate pulse outputs up to 1 MHz, using the onboard differential outputs.

The examples below show four possible output speed combinations:

- Example 1: 4 - 1 MHz PTOs, no direction output
- Example 2: 1 - 1 MHz, 2 - 100 kHz, and 1 - 20 kHz PTOs, all with direction output
- Example 3: 4 - 200 kHz PTOs, no direction output
- Example 4: 2 - 100 kHz PTOs and 2 - 200 kHz PTOs, all with direction output

P = Pulse **D = Direction**		**CPU onboard outputs**										**High-speed SB outputs**				**Standard SB outputs**	
		1 MHz Outputs (Q)				100 kHz Outputs (Q)						200 kHz Outputs (Q)				20 kHz Outputs (Q)	
		0.0+	0.1+	0.2+	0.3+	0.4	0.5	0.6	0.7	1.0	1.1	4.0	4.1	4.2	4.3	4.0	4.1
		0.0-	0.1-	0.2-	0.3-												
Ex. 1: 4 - 1 MHz (no direction output)	PTO1	P															
	PTO2		P														
	PTO3			P													
	PTO4				P												
Ex. 2: 1 - 1 MHz; 2 - 100 and 1 - 20 kHz (all with direction output)	PTO1	P	D														
	PTO2					P	D										
	PTO3							P	D								
	PTO4															P	D
Ex. 3: 4 - 200 kHz (no direction output)	PTO1											P					
	PTO2												P				
	PTO3													P			
	PTO4														P		
Ex. 4: 2 - 100 kHz; 2 - 200 kHz (all with direction output)	PTO1					P	D										
	PTO2							P	D								
	PTO3											P	D				
	PTO4													P	D		

Example: CPU 1211C, CPU 1212C, CPU 1214C, and CPU 1215C pulse output speed configurations

The examples below show four possible output speed combinations:

- Example 1: 4 - 100 kHz PTOs, no direction output
- Example 2: 2 - 100 kHz PTOs and 2 - 20 kHz PTOs, all with direction output
- Example 3: 4 - 200 kHz PTOs, no direction output
- Example 4: 2 - 100 kHz PTOs and 2 - 200 kHz PTOs, all with direction output

P = Pulse **D = Direction**		**CPU onboard outputs**										**High-speed SB outputs**				**Low-speed SB outputs**	
		100 kHz Outputs (Q)				20 kHz Outputs (Q)						200 kHz Outputs (Q)				20 kHz Outputs (Q)	
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	1.0	1.1	4.0	4.1	4.2	4.3	4.0	4.1
		CPU 1211C															
		CPU 1212C				CPU 1212C											
		CPU 1214C				CPU 1214C		CPU 1214C									
		CPU 1215C				CPU 1215C		CPU 1215C									
Ex. 1: 4 - 100 kHz (no direction output)	PTO1	P															
	PTO2		P														
	PTO3			P													
	PTO4				P												
Ex. 2: 2 - 100 kHz; 2 - 20 kHz (all with direction output)	PTO1	P	D														
	PTO2			P	D												
	PTO3					P	D										
	PTO4							P	D								
Ex. 3: 4 - 200 kHz (no direction output)	PTO1											P					
	PTO2												P				
	PTO3													P			
	PTO4														P		
Ex. 4: 2 - 100 kHz; 2 - 200 kHz (all with direction output)	PTO1	P	D														
	PTO2			P	D												
	PTO3											P	D				
	PTO4													P	D		

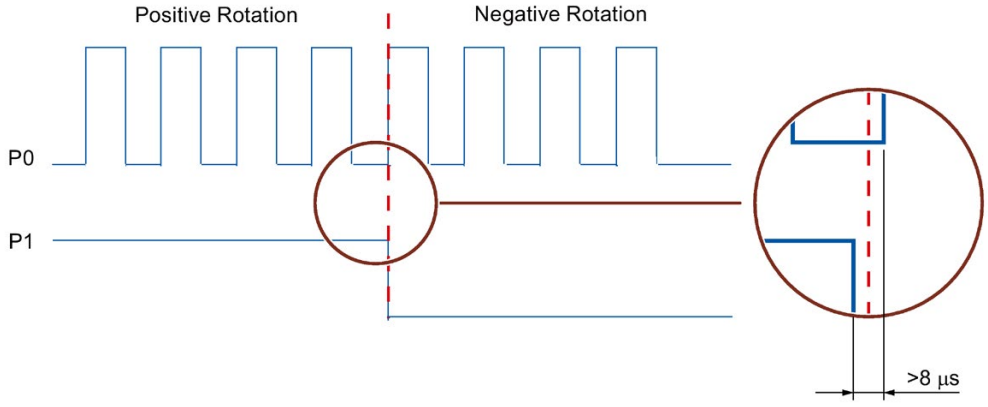
Note

Refer to the *SIMATIC STEP 7 S7-1200 Motion Control V14 Function Manual* for further information.

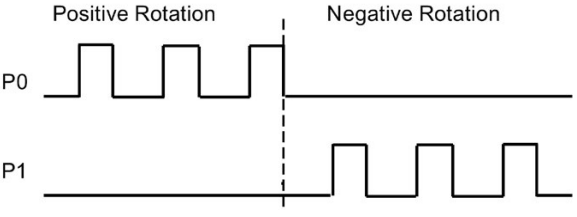
10.3.1 Phasing

You have four options for the "Phasing" interface to the stepper/servo drive. These options are as follows:

- PTO (pulse A and direction B): If you select a PTO (pulse A and direction B) option, then one output (P0) controls the pulsing and one output (P1) controls the direction. P1 is high (active) if pulsing is in the positive direction. P1 is low (inactive) if pulsing is in the negative direction:

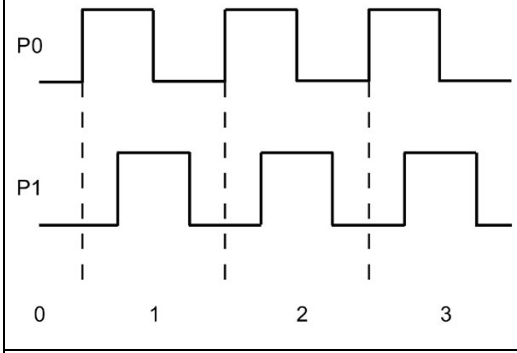
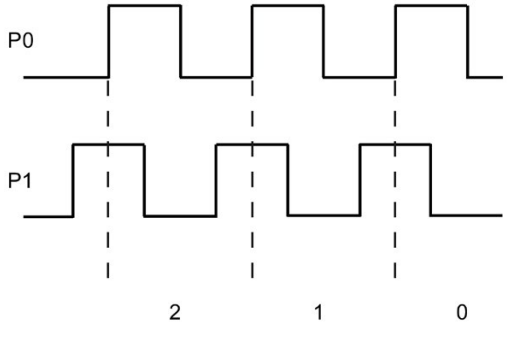


- PTO (pulse up A and pulse down B): If you select a PTO (pulse up A and pulse down B) option, then one output (P0) pulses for positive directions and a different output (P1) pulses for negative directions:



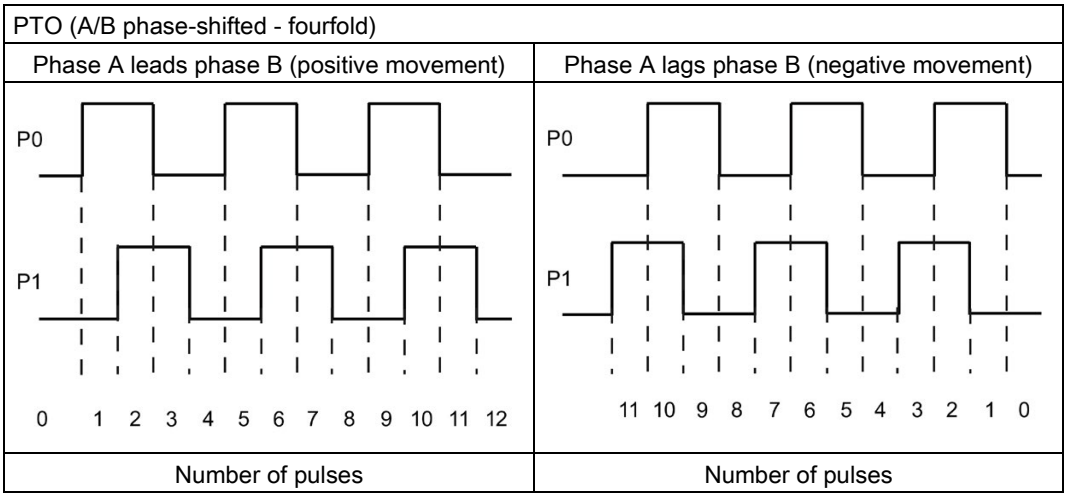
- PTO (A/B phase-shifted): If you select a PTO (A/B phase-shifted) option, then both outputs pulse at the speed specified, but 90 degrees out-of-phase. It is a 1X configuration, meaning one pulse is the amount of time between positive transitions of P0. In this case, the direction is determined by which output transitions high first. P0 leads P1 for the positive direction. P1 leads P0 for the negative direction.

  The number of pulses generated is based upon the number of 0 to 1 transitions of Phase A. The phase relationship determines the direction of movement:

<table>
<tr><td colspan="2">PTO (A/B phase-shifted)</td></tr>
<tr><td>Phase A leads phase B (positive movement)</td><td>Phase A lags phase B (negative movement)</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Number of pulses</td><td>Number of pulses</td></tr>
</table>

- PTO (A/B phase-shifted - fourfold): If you select a PTO (A/B phase-shifted - fourfold) option, then both outputs pulse at the speed specified, but 90 degrees out-of-phase. The fourfold is a 4X configuration, meaning one pulse is the transition of each output (both positive and negative). In this case, the direction is determined by which output transitions high first. P0 leads P1 for the positive direction. P1 leads P0 for the negative direction.

Fourfold is based upon positive and negative transitions of both Phase A and Phase B. You configure the number of transitions. The phase relationship (A leading B or B leading A) determines the direction of movement.



- PTO (pulse and direction (direction de-selected)): If you de-select the direction output in a PTO (pulse and direction (direction de-selected)), then output (P0) controls the pulsing. Output P1 is not used and is available for other program uses. Only positive motion commands are accepted by the CPU in this mode. Motion control restricts you from making illegal negative configurations when you select this mode. You can save an output if your motion application is in one direction only. Single phase (one output) is shown in the figure below (assuming positive polarity):



10.3.2 Configuring a pulse generator

1. Add a Technology object:
   - In the Project tree, expand the node "Technology Objects" and select "Add new object".
   - Select the "Axis" icon (rename if required) and click "OK" to open the configuration editor for the axis object.

     Note

     To ensure the consistency of your project after you rename the technology objects, download the project to the CPU while it is in STOP. A name change occurs when you delete a technolology object and create a new technology object with a new name and data block number.

   - Display the "Select PTO for Axis Control" properties under the "Basic parameters" and select the desired pulse.

     Note

     If the PTO has not been previously configured in the CPU Properties, the PTO is configured to use one of the onboard outputs.

     If you use an output signal board, then select the "Device configuration" button to go to the CPU Properties. Under "Parameter assignment", in the "Pulse options", configure the output source to a signal board output.

   - Configure the remaining Basic and Extended parameters.
2. Program your application: Insert the MC_Power instruction in a code block.
   - For the Axis input, select the axis technology object that you created and configured.
   - Setting the Enable input to TRUE allows the other motion instructions to function.
   - Setting the Enable input FALSE cancels the other motion instructions.

     Note

     Include only one MC_Power instruction per axis.

3. Insert the other motion instructions to produce the required motion.

Note

Configuring a pulse generator to signal board outputs: Select the "Pulse generators (PTO/PWM)" properties for a CPU (in Device configuration) and enable a pulse generator. Two pulse generators are available for each S7-1200 CPU V1.0, V2.0, V2.1, and V2.2. S7-1200 CPU V3.0 and V4.0 CPUs have four pulse generators available. In this same configuration area under "Pulse options", select Pulse generator used as: "PTO".

Note

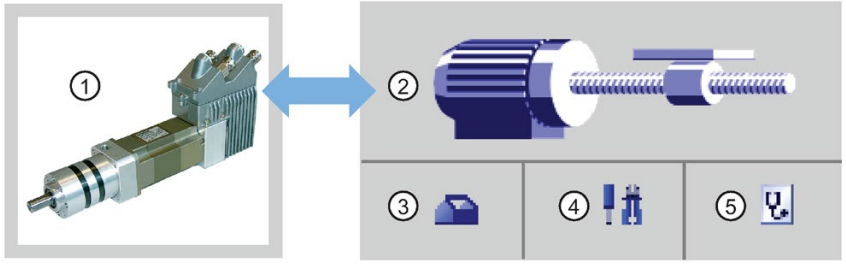
The CPU calculates motion tasks in "slices" or segments of 10 ms. As one slice is being executed, the next slice is waiting in the queue to be executed. If you interrupt the motion task on an axis (by executing another new motion task for that axis), the new motion task cannot be executed for a maximum of 20 ms (the remainder of the current slice plus the queued slice).

10.3.3 Open loop motion control

10.3.3.1 Configuring the axis

You connect the open loop axis on the PLC and the drive through a PTO (Pulse Train Output). For motion applications using PTO, the CPU requires onboard or signal board (SB) digital I/O. This limits the number of axes that are available on the smaller PLCs.

STEP 7 provides the configuration tools, the commissioning tools, and the diagnostic tools for the "Axis" technology object.



① Drive
② Technology object
③ Configuration
④ Commissioning
⑤ Diagnostics

Note

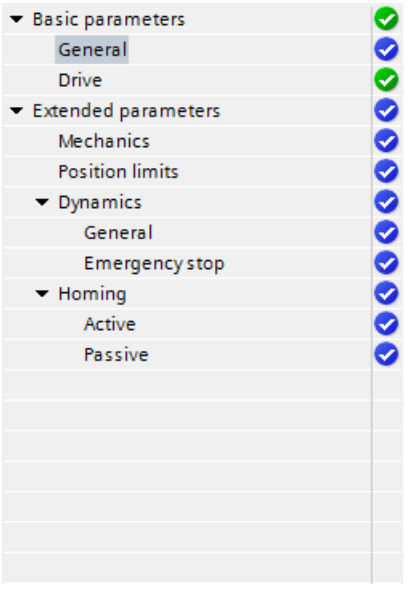
For CPU firmware releases V2.2 and earlier, the PTO requires the internal functionality of a high-speed counter (HSC). This means the corresponding HSC cannot be used elsewhere.

The assignment between PTO and HSC is fixed. If PTO1 is activated, it will be connected to HSC1. If PTO2 is activated, it will be connected to HSC2. You cannot monitor the current value (for example, in ID1000) when pulses are occurring.

S7-1200 V3.0 and later CPUs do not have this restriction; all HSCs remain available for program use when pulse outputs are configured in these CPUs.

Table 10- 39 STEP 7 tools for motion control

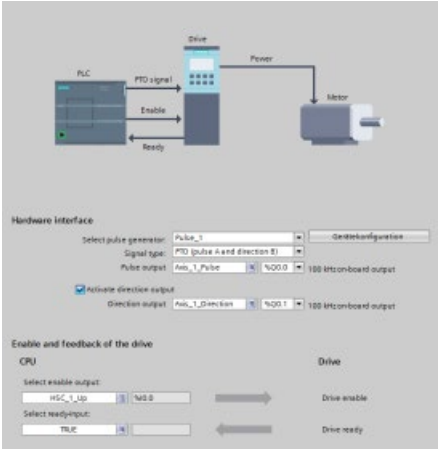
Tool	Description
Configuration	Configures the following properties of the "Axis" technology object: • Selection of the PTO to be used and configuration of the drive interface • Properties of the mechanics and the transmission ratio of the drive (or machine or system) • Properties for position limits, dynamics, and homing Save the configuration in the data block of the technology object.
Commissioning	Tests the function of your axis without having to create a user program. When the tool is started, the control panel will be displayed. The following commands are available on the control panel: • Enable and disable axis • Move axis in jog mode • Position axis in absolute and relative terms • Home axis • Acknowledge errors The velocity and the acceleration / deceleration can be specified for the motion commands. The control panel also shows the current axis status.
Diagnostics	Monitors of the current status and error information for the axis and drive.



The tree selector for the PTO axis does not include the Encoder, Modulo, Position monitoring, and Control loop configuration menus.

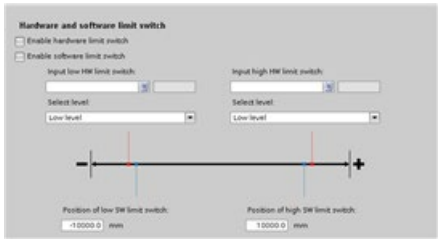


After you create the technology object for the axis, you configure the axis by defining the basic parameters, such as the PTO and the configuration of the drive interface. You also configure the other properties of the axis, such as position limits, dynamics, and homing.

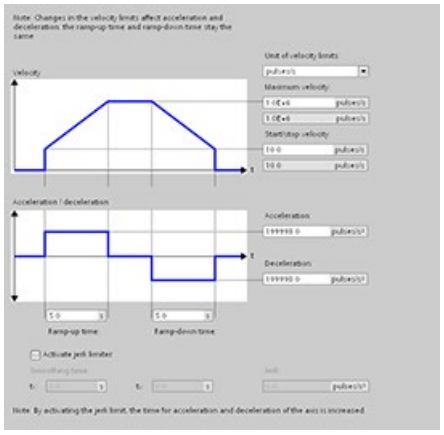


Note

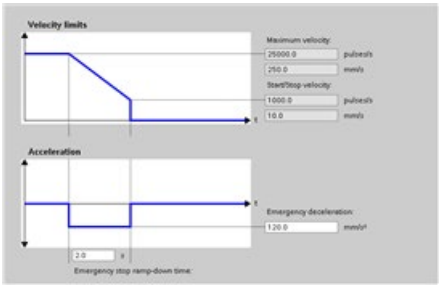
You may have to adapt the values of the input parameters of motion control instructions to the new dimension unit in the user program.



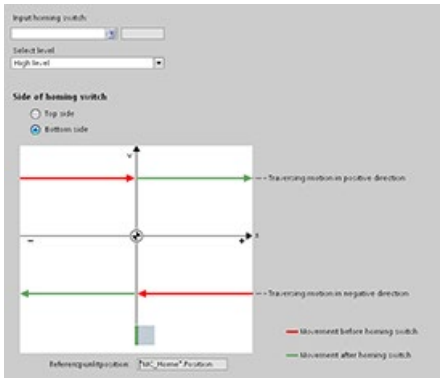
Configure the properties for the drive signals, drive mechanics, and position monitoring (hardware and software limit switches).

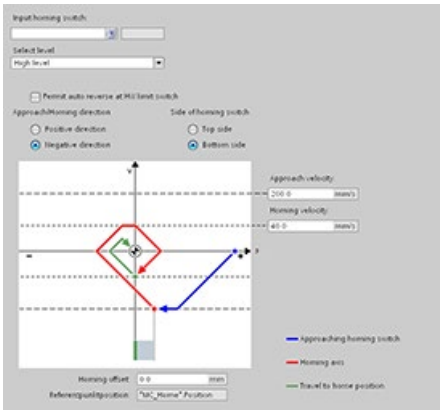


You configure the motion dynamics and the behavior of the emergency stop command.



You also configure the homing behavior (passive and active).





Use the "Commissioning" control panel to test the functionality independently from your user program.



Click the "Startup" icon to commission the axis.

The control panel shows the current status of the axis. Not only can you enable and disable the axis, but you can also test the positioning of the axis (both in absolute and relative terms) and can specify the velocity, acceleration and deceleration. You can also test the homing and jogging tasks. The control panel also allows you to acknowledge errors.

10.3.3.2 Commissioning

"Status and error bits" diagnostic function

Use the "Status and error bits" diagnostic function to monitor the most important status and error messages for the axis. The diagnostic function display is available in online mode in "Manual control" mode and in "Automatic control" when the axis is active.

Table 10- 40 Status of the axis

Status	Description
Enabled	The axis is enabled and ready to be controlled via motion control tasks. (Tag of technology object: <Axis name>.StatusBits.Enable)
Homed	The axis is homed and is capable of executing absolute positioning tasks of motion control instruction "MC_MoveAbsolute". The axis does not have to be homed for relative homing. Special situations: • During active homing, the status is FALSE. • If a homed axis undergoes passive homing, the status is set to TRUE during passive homing. (Tag of technology object: <Axis name>.StatusBits.HomingDone)
Error	An error has occurred in the "Axis" technology object. More information about the error is available in automatic control at the ErrorID and ErrorInfo parameters of the motion control instructions. In manual mode, the "Last error" field of the control panel displays detailed information about the cause of error. (Tag of technology object: <Axis name>.StatusBits.Error)
Control panel active	The "Manual control" mode was enabled in the control panel. The control panel has control priority over the "Axis" technology object. The axis cannot be controlled from the user program. (Tag of technology object: <Axis name>.StatusBits.ControlPanelActive)

Table 10- 41 Drive status

Status	Description
Drive ready	The drive is ready for operation. (Tag of technology object: <Axis name>.StatusBits.DriveReady)
Error	The drive has reported an error after failure of its ready signal. (Tag of technology object: <Axis name>.ErrorBits.DriveFault)

Table 10- 42 Status of the axis motion

Status	Description
Standstill	The axis is at a standstill. (Tag of technology object: <Axis name>.StatusBits.StandStill)
Accelerating	The axis accelerates. (Tag of technology object: <Axis name>.StatusBits.Acceleration)
Constant velocity	The axis travels at constant velocity. (Tag of technology object: <Axis name>.StatusBits.ConstantVelocity)
Decelerating	The axis decelerates (slows down). (Tag of technology object: <Axis name>.StatusBits.Deceleration)

Table 10- 43 Status of the motion mode

Status	Description
Positioning	The axis executes a positioning task of motion control instruction "MC_MoveAbsolute" or "MC_MoveRelative" or of the control panel. (Tag of technology object: <Axis name>.StatusBits.PositioningCommand)
Speed Command	The axis executes a task at set speed of motion control instruction "MC_MoveVelocity" or "MC_MoveJog" or of the control panel. (Tag of technology object: <Axis name>.StatusBits.SpeedCommand)
Homing	The axis executes a homing task of motion control instruction "MC_Home" or the control panel. (Tag of technology object: <Axis name>.StatusBits.Homing)

Table 10- 44 Error bits

Error	Description
Min software limit reached	The lower software limit switch has been reached. (Tag of technology object: <Axis name>.ErrorBits.SwLimitMinReached)
Min software limit exceeded	The lower software limit switch has been exceeded. (Tag of technology object: <Axis name>.ErrorBits.SwLimitMinExceeded)
Max software limit reached	The upper software limit switch has been reached. (Tag of technology object: <Axis name>.ErrorBits.SwLimitMaxReached)
Max software limit exceeded	The upper software limit switch has been exceeded. (Tag of technology object: <Axis name>.ErrorBits.SwLimitMaxExceeded)
Negative hardware limit	The lower hardware limit switch has been approached. (Tag of technology object: <Axis name>.ErrorBits.HwLimitMin)
Positive hardware limit	The upper hardware limit switch has been approached. (Tag of technology object: <Axis name>.ErrorBits.HwLimitMax)
PTO already used	A second axis is using the same PTO and is enabled with "MC_Power". (Tag of technology object: <Axis name>.ErrorBits.HwUsed)
Configuration error	The "Axis" technology object was incorrectly configured or editable configuration data were modified incorrectly during runtime of the user program. (Tag of technology object: <Axis name>.ErrorBits.ConfigFault)
General Error	An internal error has occurred. (Tag of technology object: <Axis name>.ErrorBits.SystemFault)

"Motion status" diagnostic function

Use the "Motion status" diagnostic function to monitor the motion status of the axis. The diagnostic function display is available in online mode in "Manual control" mode and in "Automatic control" when the axis is active.

Table 10- 45 Motion status

Status	Description
Target position	The "Target position" field indicates the current target position of an active positioning task of motion control instruction "MC_MoveAbsolute" or "MC_MoveRelative" or of the control panel. The value of the "Target position" is only valid during execution of a positioning task. (Tag of technology object: <Axis name>.MotionStatus.TargetPosition)
Current position	The "Current position" field indicates the current axis position. If the axis is not homed, the value indicates the position value relative to the enable position of the axis. (Tag of technology object: <Axis name>.MotionStatus.Position)
Current velocity	The "Current velocity" field indicates the actual axis velocity. (Tag of technology object: <Axis name>.MotionStatus.Velocity)

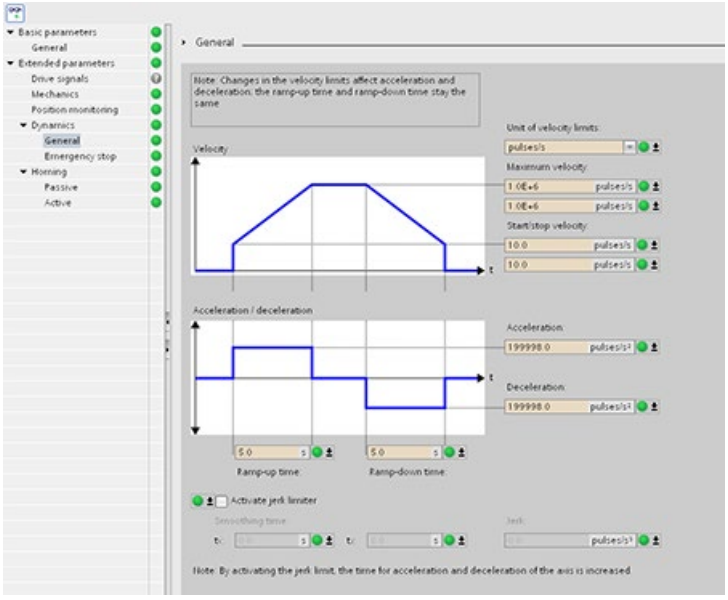
Table 10- 46 Dynamic limits

Dynamic limit	Description
Velocity	The "Velocity" field indicates the configured maximum velocity of the axis. (Tag of technology object: <Axis name>.Config.DynamicLimits.MaxVelocity)
Acceleration	The "Acceleration" field indicates the currently configured acceleration of the axis. (Tag of technology object: <Axis name>.Config.DynamicDefaults.Acceleration)
Deceleration	The "Deceleration" field indicates the currently configured deceleration of the axis. (Tag of technology object: <Axis name>.Config.DynamicDefaults.Deceleration)

Motion start value control

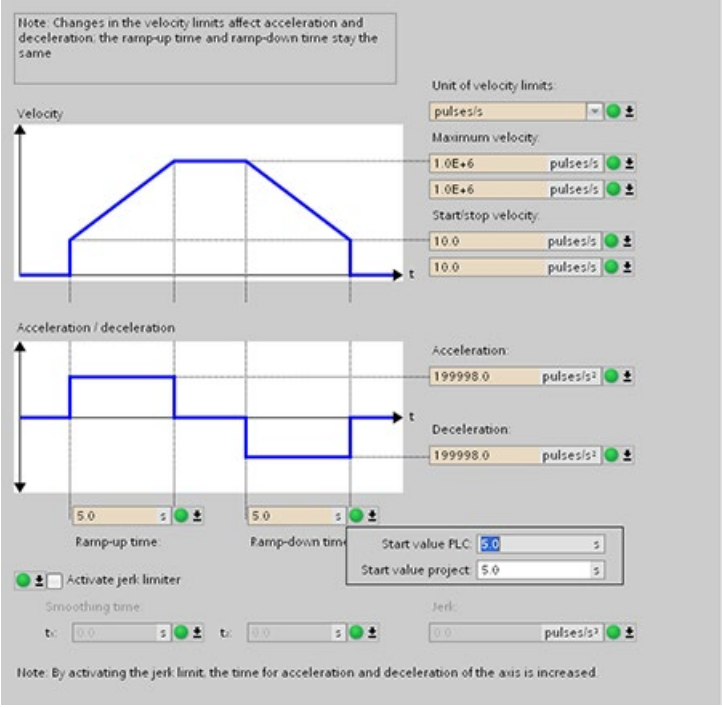
You can edit the actual values of the Motion configuration parameters so that the behavior of the process can be optimized in online mode.

Open the "Technology objects" for your motion control and its "Configuration" object. To access the start value control, click the "eyeglasses icon" in the upper left corner of the dialog:



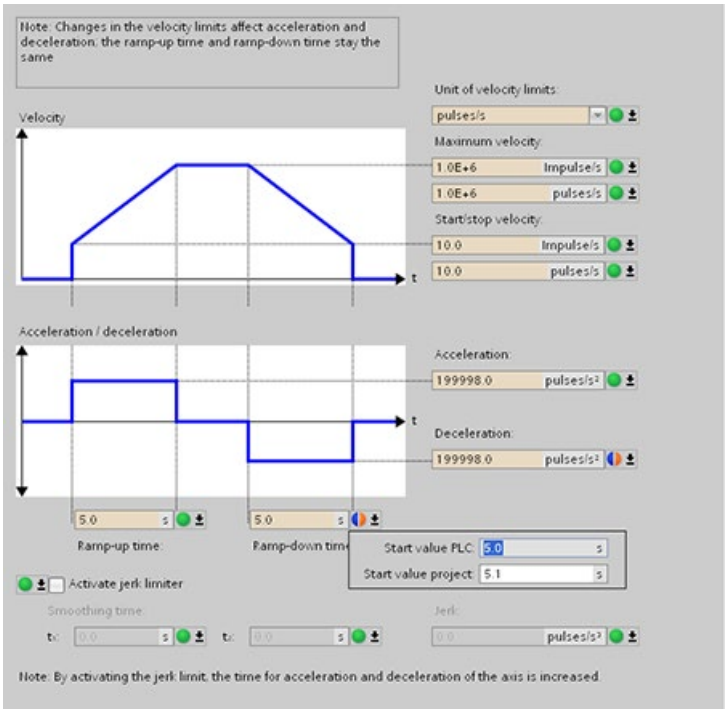
You can now change the value of any of your motion control configuration parameters as shown in the figure below.

You can compare the actual value to the project (offline) start value and the PLC (online) start value of each parameter. This is necessary to compare online/offline differences of the Technology object data block (TO-DB) and to be informed about the values that will be used as current values on the next Stop-to-Start transition of the PLC. In addition, a compare icon gives a visual indication to help easily identify online/offline differences.



The figure above shows the Motion parameter screen with compare icons showing which values are different between online and offline projects. A green icon indicates that the values are the same; a blue/orange icon indicates that the values are different.

Additionally, click the parameter button with the downward arrow to open a small window that shows the project (offline) start value and the PLC (online) start value of each parameter.



10.3.4 Closed loop motion control

10.3.4.1 Configuring the axis

You connect the closed loop axis on the PLC and the drive through one of two connections:

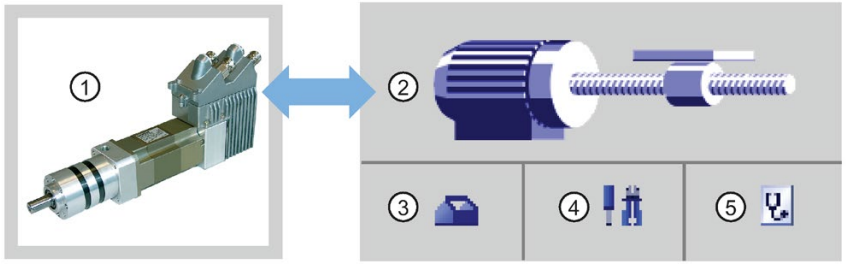
- Analog drive: This connection can use onboard, SB, or signal module (SM) analog I/O; it does not use PTOs. You have the following analog I/O resolution available for your application:
  - Onboard I/O: 10 bit (lowest I/O resolution)
  - Signal board (SB) I/O: 12 bit
  - SM I/O: 14 bit (highest I/O resolution)
- PROFIdrive: This connection is a network solution and does not use PTOs.

The closed loop axis requires an encoder as well. You can connect encoders to the following items:

- Encoder interface on the drive
- High-speed counters (HSC)
- Technology modules (TM)
- PROFIdrive encoder on PROFINET / PROFIBUS

You can have a maximum number of eight drives (or axes) for the PROFIdrive or analog drive connection.

STEP 7 provides the configuration tools, the commissioning tools, and the diagnostic tools for the "Axis" technology object.



① Drive
② Technology object
③ Configuration
④ Commissioning
⑤ Diagnostics

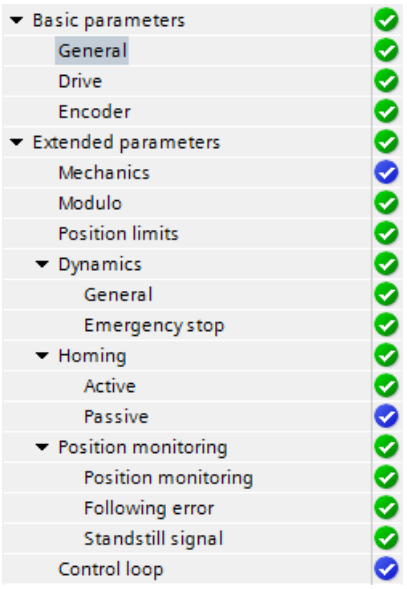
Table 10- 47 STEP 7 tools for closed loop motion control

Tool	Description
Configuration	Configures the following properties of the "Axis" technology object: • Selection of the analog drive connection or PROFIdrive to be used and configuration of the drive and encoder interface • Properties of the mechanics and the transmission ratio of the drive and encoder (or machine or system) • Properties for position limits, dynamics, and homing Save the configuration in the data block of the technology object.
Commissioning	Tests the function of your axis without having to create a user program. When the tool is started, the control panel will be displayed. The following commands are available on the control panel: • Enable and disable axis • Move axis in jog mode • Position axis in absolute and relative terms • Home axis • Acknowledge errors The velocity and the acceleration / deceleration can be specified for the motion commands. The control panel also shows the current axis status.
Diagnostics	Monitors of the current status and error information for the axis and drive.

Note

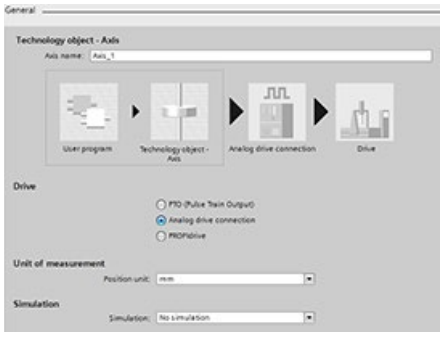
You may have to adapt the values of the input parameters of motion control instructions to the new dimension unit in the user program.

After you create the technology object for the axis, you configure the axis by defining the basic parameters, either the Analog drive or the PROFIdrive connection and the configuration of the drive and encoder.



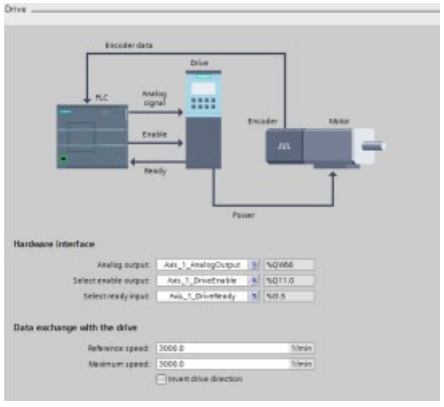
The tree selector for the analog drive or PROFIdrive connection includes the Encoder, Modulo, Position monitoring, and Control loop configuration menus.

Analog drive connection configuration



In the General configuration dialog, you select the following parameters:

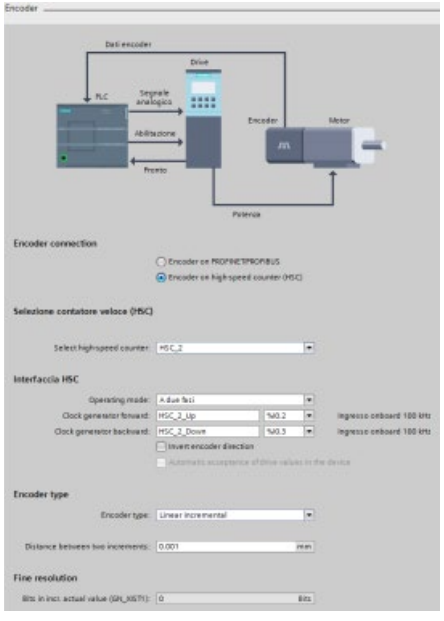
- "Analog drive connection" radio button
- Unit of measurement



In the Drive configuration dialog, you select the following parameters:

- Analog drive hardware outputs
- Data exchange drive velocities

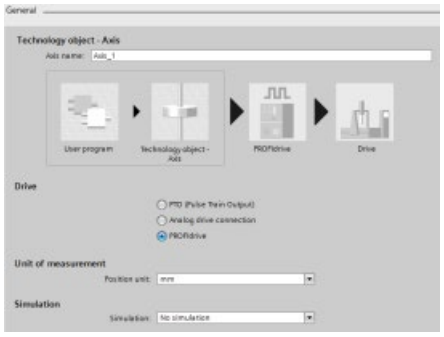
Note: The Maximum speed must be greater than or equal to the Reference (nominal) speed.



In the Encoder configuration dialog, you select the following parameters:

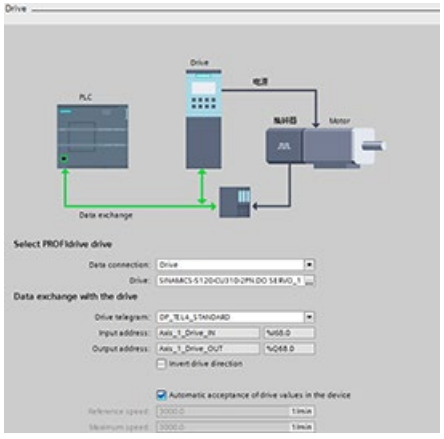
- Analog drive encoder coupling (for example, a high-speed counter (HSC))
- HSC interface
- Encoder type
- Fine resolution

PROFIdrive configuration



In the General configuration dialog, you select the following parameters:

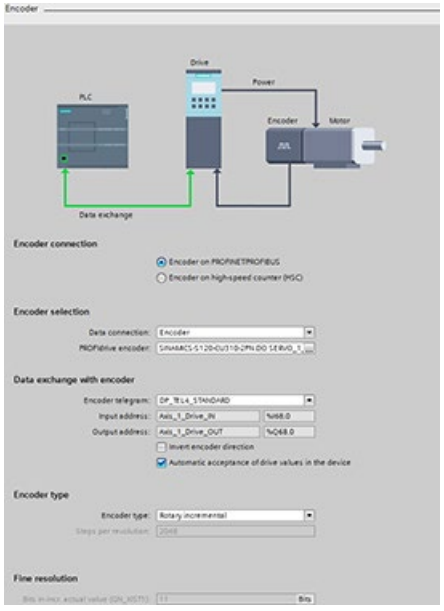
- "PROFIdrive" radio button
- Unit of measurement



In the Drive configuration dialog, you select the following parameters:

- PROFIdrive drive
- Data exchange with the drive

  Note: The Maximum speed must be greater than or equal to the Reference (nominal) speed.



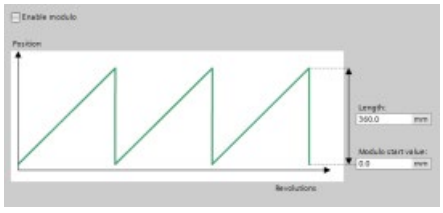
In the Encoder configuration dialog, you select the following parameters:

- PROFIdrive encoder coupling (for example, a PROFIdrive encoder on PROFINET)
- PROFIdrive encoder
- Data exchange with the encoder
- Encoder type
- Fine resolution

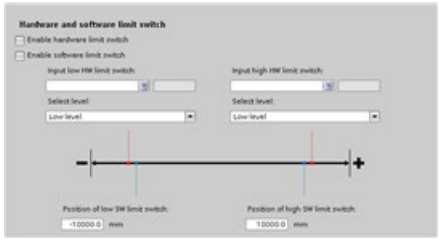
Extended parameters

You can also configure the following properties of the closed loop axis:

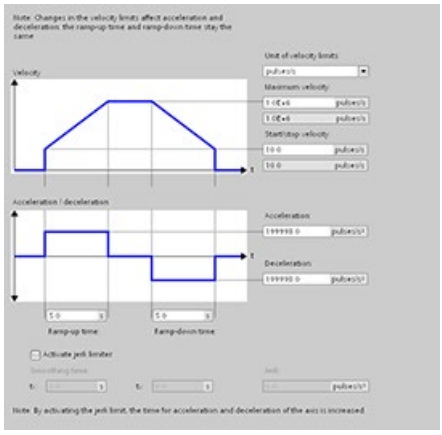
- Modulo
- Position limits
- Dynamics
- Homing
- Position monitoring
- Following error
- Standstill signal
- Control loop



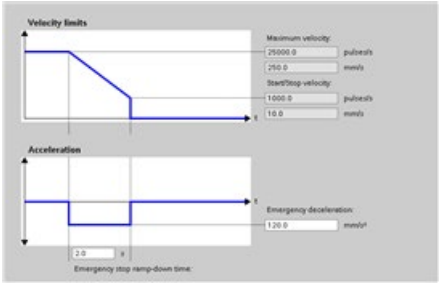
Modulo: You can configure a "Modulo" axis to move the load in a cyclic area which has a start value/start position and a given length. If the position of the load reaches the end of this area, it is automatically set to the start value again. You enable the "Length" and "Modulo start value" fields when you check the "Enable Modulo" check box.



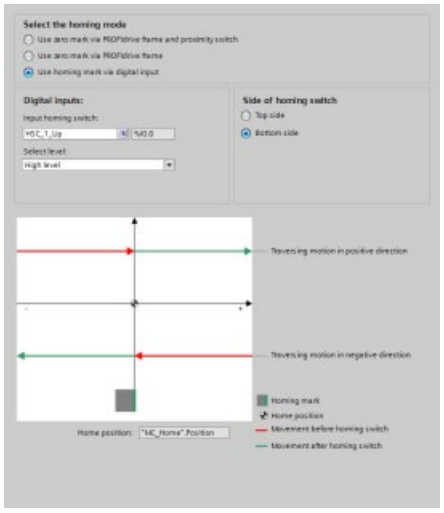
Position limits: You can configure the properties for the drive signals, drive mechanics, and position monitoring (hardware and software limit switches).

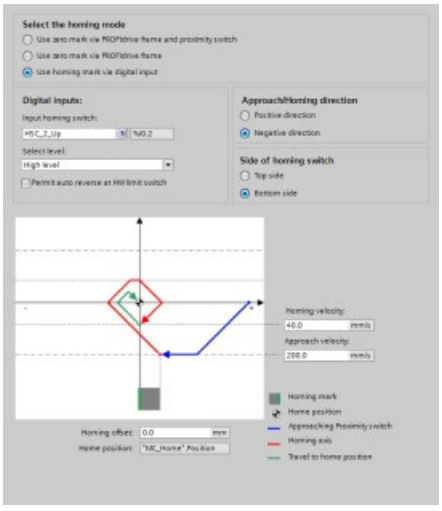


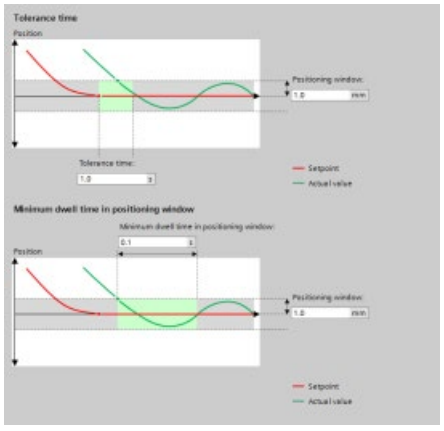
Dynamics: You can configure the motion dynamics and the behavior of the emergency stop command.



Homing: You can configure the homing behavior (passive and active).





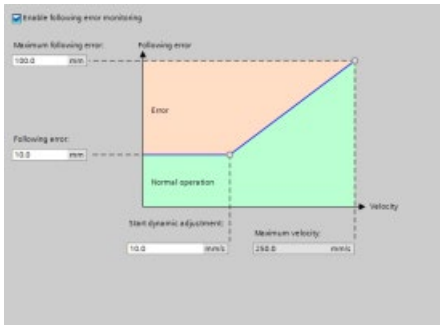


"Positioning monitoring": You can configure tolerance time as well as minimum dwell time for the positioning window.

The system connects the following three parameters directly with the axis TO-DB:

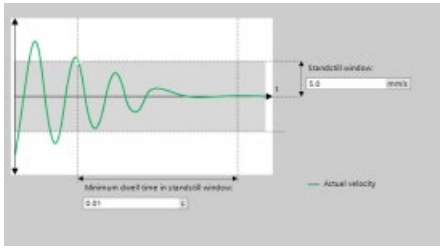
- Positioning window
- Tolerance time
- Minimum dwell time in positioning window

Note: The "Positioning window" field's minimum value is "0.001" and its maximum value is "1 E+12".



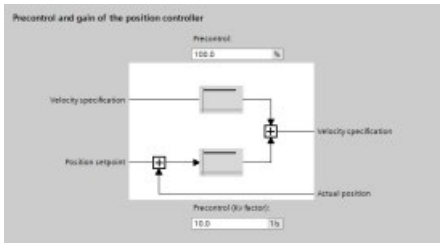
"Following error": You can configure the difference of the allowed error distance over a velocity range. You check the "Enable following error monitoring" check box to activate following error. You can configure the following parameters:

- Maximum following error
- Following error
- Start dynamic adjustment
- Maximum velocity



"Standstill signal": You can configure the following parameters:

- Minimum dwell time in standstill window
- Standstill window.



"Control loop": You can configure the velocity gain known as "Precontrol (Kv factor)".

Use the "Commissioning" control panel to test the functionality independently from your user program.

Click the "Startup" icon to commission the axis.

The control panel shows the current status of the axis. Not only can you enable and disable the axis, but you can also test the positioning of the axis (both in absolute and relative terms) and can specify the velocity, acceleration and deceleration. You can also test the homing and jogging tasks. The control panel also allows you to acknowledge errors.

10.3.4.2 ServoOBs

When you create a technology object for S7-1200 motion control, the CPU automatically creates the organization block "MC-Servo (OB 91)" for processing the technology objects. The motion control functionality of the technology objects creates its own priority class, and the SIMATIC S7-1200 execution system calls the OB according to the application cycle.

The MC-Servo OB is write-protected. You cannot change the contents.

The position control algorithms of all technology objects configured for motion control on the CPU are calculated within the MC-Servo OB.

You can set the application cycle and the priority of the organization block in accordance with your requirements for control quality and system load. Multiple ServoOBs can link to a "CyclicServoEvent". The Property page of the MC-Servo OB shows the two changeable values of the CyclicServoEvent:

- Priority number
- Cycle time

The MC-PreServo OB and MC-PostServo OB are instances of the ServoOB, and they are of type ServoOB. These OBs are optional, can only exist if MC-Servo OB is present, and contain user code. All three OBs (MC-PreServo, MC-Servo, and MC-PostServo) have to run in the same runtime level, and the same CyclicServoEvent triggers them. The PLC firmware executes the OBs sequencially, based upon their block number:

OB instance	OB number	Automation System Object Model (ASOM) event	Engineering System Object Model (ESOM) event
MC-PreServo	67	ServoOB	-
MC-Servo	91	ServoOB	ServoOB
MC-PostServo	95	ServoOB	-

Compared to the ASOM, the Engineering System Object Model (ESOM) only links the event to the MC-Servo OB. The ESOM does not link the event to the MC-PreServo OB or MC-PostServo OB.

Configuring the axis with an application cycle MC-Servo (OB 91)

Application cycle MC-Servo (OB 91)

You can set the application cycle in which the MC-Servo OB is called in the properties of the organization block:

- Synchronous to the BUS: You call the MC-Servo OB synchronously with a bus system. You set the send clock in the properties of the selected bus system.
- Cyclical: You call the MC-Servo OB cyclically with the assigned application cycle.

To avoid disruptions in the program execution on the CPU, set the application cycle depending on the number of used axes as follows:

Application cycle = number of axes x 2 ms

Number of axes	Application cycle
1	2 ms
2	4 ms
4	8 ms
8	16 ms

The SINAMICS G120 drive updates the drive process image every 4 ms. To improve control, set the application cycle of the MC-Servo (OB 91) to 4 ms or to a multiple of 4 ms.

Overflow MC-Servo (OB 91)

The selected application cycle must be long enough to allow all the technology objects for motion control to be processed in one cycle. If the application cycle is not observed, overflows occur.

The CPU does not go into STOP at overflow of the MC-Servo (OB 91). (The TIA Portal online help statement concerning STOP at overflow of the MC-Servo (OB 91) is incorrect.)

If necessary, you can set the CPU to STOP at overflow of the MC-Servo (OB 91) using a time-error OB (OB 80).

Process image partition OB Servo PIP

For optimal control of all I/O modules (for example, hardware limit switches) used by motion control, assign them to the process image partition "OB Servo PIP". The assignment causes the I/O modules to be processed simultaneously with the technology object.

When motion control uses a high-speed counter (HSC), motion control automatically assigns the HSC to the process image partition "OB Servo PIP".

10.3.4.3 Speed controlled operation

With speed controlled operation, you can move a positioning axis with "speed controlled". Using the MC_Power instruction, you can enable the axis. With the MC_MoveVelocity and MC_MoveJog instructions, you can move the axis with velocity setpoints. You can move the axis in spite of a sensor error even if no valid actual values are available. "Speed controlled" mode sets the following conditions:

- Disables the positioning controller of the axis
- Sets velocity setpoints to the drive directly
- Sets the axis position setpoint to zero
- Updates the actual position of the axis in case of valid sensor values
- Does not define the following error and controller error and sets them to zero

You can activate and deactivate the "speed controlled" mode with the following three instructions and these parameters:

- MC_Power.StartMode (Int)
- MC_MoveVelocity.PositionControlled (Bool)
- MC_MoveJog.PositionControlled (Bool)

MC_Power

With the MC_Power instruction, you can enable the axis with the "speed controlled" mode. You can do this if no valid sensor values are available or the axis cannot change to "position controlled" mode.

You can only use StartModes "0" and "1". Other values show an error:

StartMode	PTO axis	Servo axis
0	Ignored	Speed controlled
1	Ignored	Positioning controlled
Other	Invalid mode MC_Power.ErrorID = 0x8412 MC_Power.ErrorID = 0x0011	Invalid mode MC_Power.ErrorID = 0x8412 MC_Power.ErrorID = 0x0011

During disabling of the TO axis with "MC_Power.Enable = FALSE", you obtain the operation mode. Depending on the operation mode, the axis reacts with a different behavior:

StartMode	Mode: Position controlled	Mode: Speed controlled
0: Emergency stop	The axis decelerates positioning controlled with "DynamicDefaults.EmergencyDeceleration" based upon the ActualPosition and ActualVelocity.	The axis decelerates speed controlled with "DynamicDefaults.EmergencyDeceleration" based upon the ActualVelocity if available.
1: Immediate stop	The drive stops with the "AUS3" ramp within the connected drive.	The drive stops with the "AUS3" ramp within the connected drive.
2: Emergency stop with jerk control	Axis brakes are positioning controlled at the configured emergency deceleration based upon the setpoint position. If the jerk control is activated, the configured jerk is taken into account.	Axis brakes are speed controlled at the configured emergency deceleration based upon the setpoint velocity. If the jerk control is activated, the configured jerk is taken into account.

During drive switch off, the operation mode cannot be changed because new motion commands are not accepted until the drive is stopped. After standstill of the drive, the axis can be enabled again.

MC_MoveVelocity/MC_MoveJog

Independent of operation mode (Speed controlled / Positioning controlled), the blocks change the axis to the configured mode. This can happen during closed loop motion or during standstill.

MC_Halt

The MC_Halt instruction does not change the operation mode. In speed controlled mode, the calculated deceleration ramp depends on the setpoint velocity with the configured deceleration.

If the Standstill window is reached, the command is finished and shows "Done = TRUE".

Other motion commands

The speed controlled mode remains active until one of the following commands becomes active:

- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity (PositionControlled = TRUE)
- MC_MoveJog (PositionControlled = TRUE)
- MC_Home:
  - Active homing (Mode 3)
  - Other modes (passive, direct, adjustment of absolute value sensor) are refused with ErrorId:

    ErrorId 8207: "Command rejected" / "Auftrag abgewiesen"

    ErrorInfo 006B: "Aufruf im Speed controlled Mode unzulässig".

Axis TODB

The axis TODB displays the operation mode if one of the three motion instructions, MC_Power, MC_MoveVelocity, or MC_MoveJog, are executed with the speed controlled operation mode:

- Axis.Statusbit.NonPositionControlled = TRUE
- Axis.Position = 0.0

Calculation of new setpoint position

The setpoint position must be recalculated after a mode change from speed-controlled to closed loop during motion:

- With Precontrol (kpc > 0): Position = ActualPosition + ActualVelocity * vtc
- Without Precontrol (kpc = 0): Position = ActualPosition + ActualVelocity / kv (vtc = substitute time constate of precontrol; kv = gain of position control)

Software limit switches

During speed controlled mode, the software limit switches are not active.

Hardware limit switches

Hardware limit switches are supported during speed controlled mode.

10.3.4.4 Telegram 4 support

The PROFdrive Telegram 4 contains actor values and two values from different encoders. The first sensor value comes from the encoder on the motor. The second sensor value is provided by an additional encoder on the machine.

The machine encoder is connected directly to a SINAMICS CU, and the CU provides both sensor values within the Telegram 4.

Axis Drive configuration dialog

You configure Telegram 4 in the hardware configuration, and you can select it in the axis Drive configuration dialog.

Axis Encoder configuration dialog

In the axis Encoder configuration dialog, you have two options:

- Encoder on PROFINET/PROFIBUS
- Encoder on high-speed counter (HSC)

"Encoder on PROFINET/PROFIBUS" is the default selection; however, both options are available.

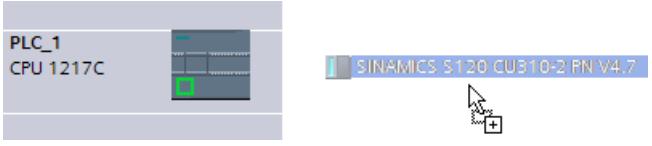
Example: Configuring the SINAMICS S120 and encoder with Telegram 4

1. Selecting the SINAMICS drive:

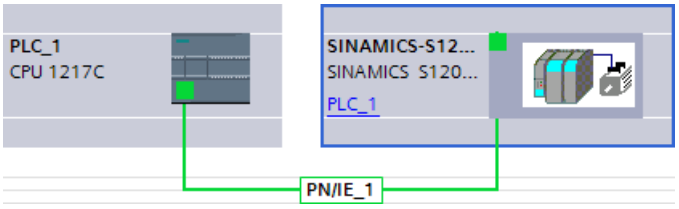
   Use the hardware catalog to add a SINAMICS S120 CU310-2 PN V4.7 drive. To do so, expand the following containers:

   – Other field devices
   – PROFINET IO
   – Drives
   – SIEMENS AG
   – SINAMICS

   Insert the drive as shown in the figures below:

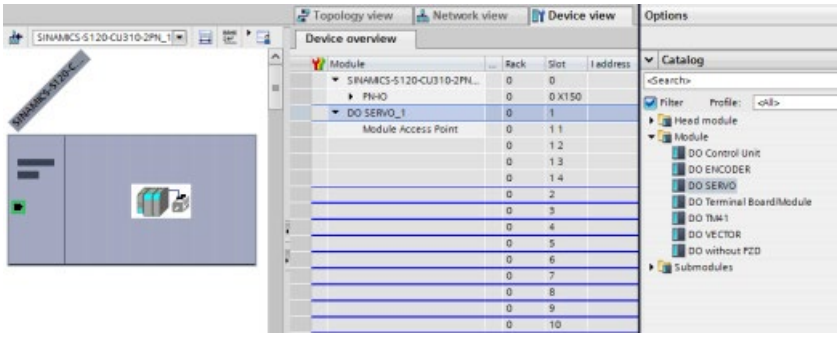


   Configure your PROFINET network.

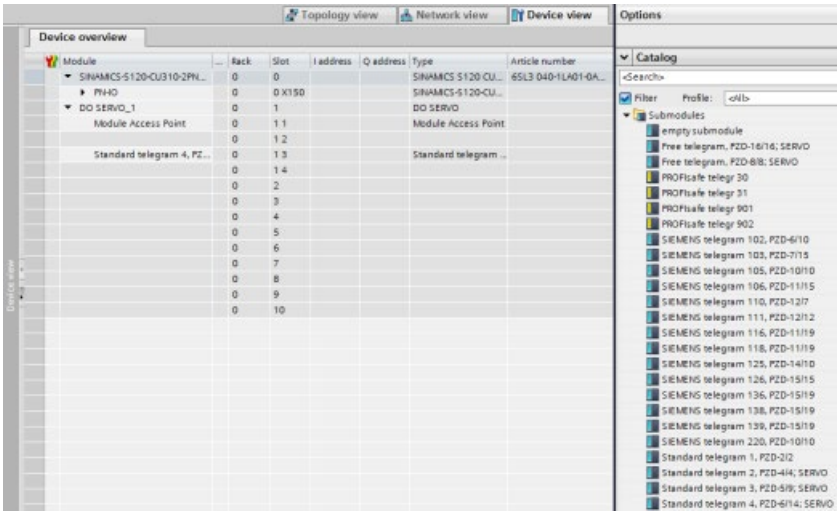


2. Selecting the DO SERVO:

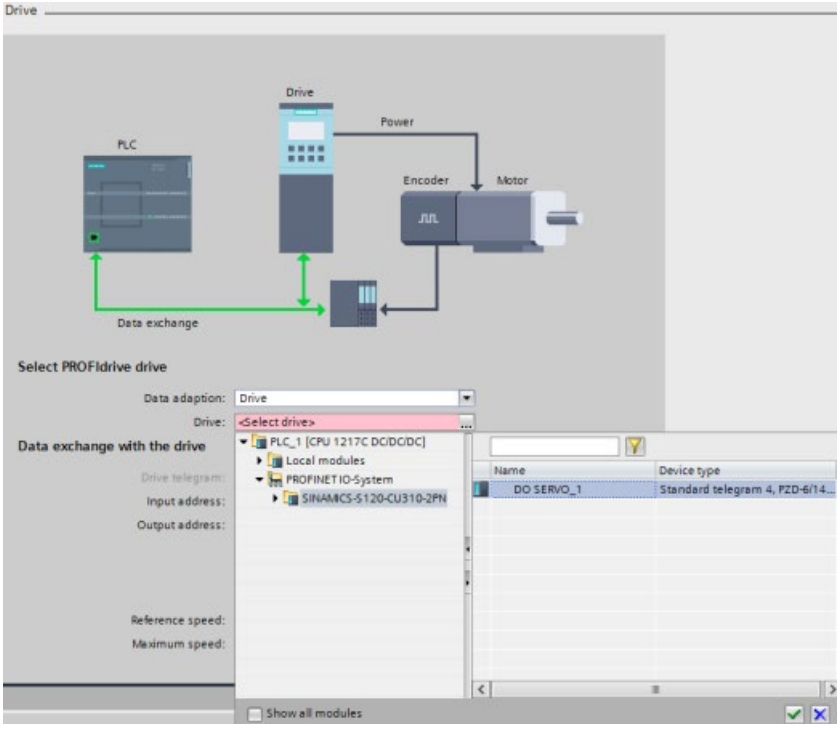
   – From the Network view, double-click the SINAMICS S120 CU310-2 PN V4.7 drive.
   – Open the Device overview.
   – In the hardware catalog, expand the Module container.
   – Double-click or drag the DO SERVO drive object to insert it in the first blank row:



3. Selecting the Telegram 4:
   - In the hardware catalog, expand the Submodules container.
   - Double-click or drag the "Standard telegram 4, PZD-6/15;SERVO" to insert it in the second blank row.
   - You must skip a blank row to insert the Telegram 4, as shown in the figure below:

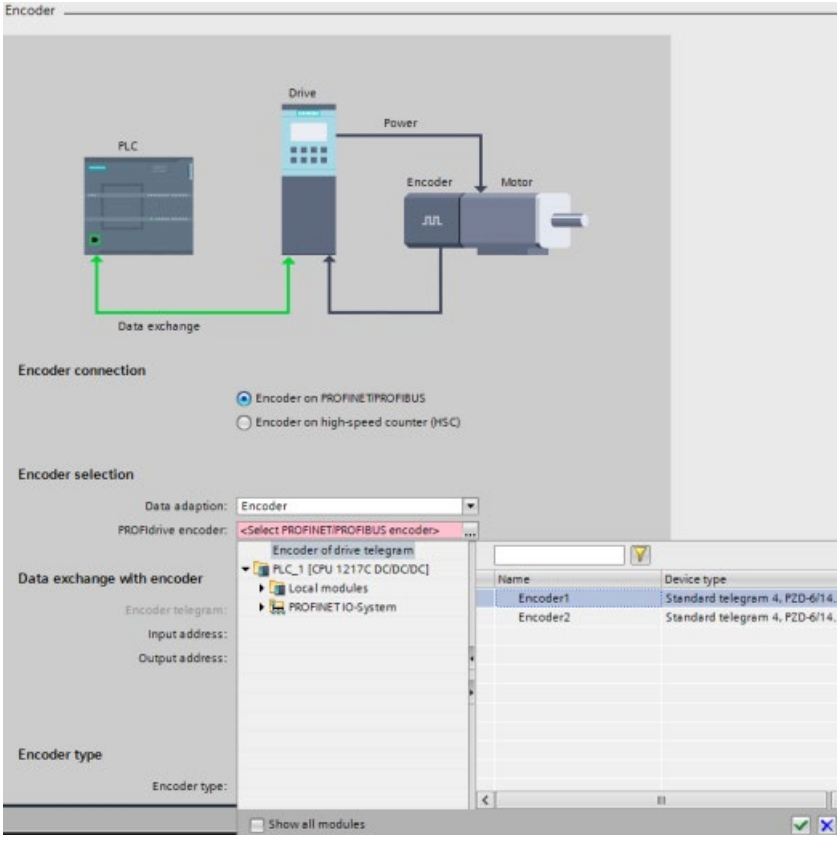


4. Selecting the encoder in the Drive configuration dialog:
   - Navigate to the axis configuration dialog, and the Basic parameters, Drive configuration dialog.
   - Move to the Select PROFIdrive drive, Drive: field.
   - Click the ellipsis button.
   - Double-click "PROFINET IO-System" to open its folder.
   - Click "SINAMICS-S120-CU310-2PN".
   - In the right pane, "DO SERVO_1: Standard telegam 4, PZD-6/14; SERVO" displays.
   - Click the green check mark button to enter the configuration.



5. Configuring the encoder:
   - Since you selected Telegram 4 in the axis Drive configuration dialog, the Encoder drive configuration dialog provides a new "Encoder in telegram" entry in the navigation tree. When you select the "Encoder in telegram" entry, the right pane displays two entries, Encoder 1 and Encoder 2, with encoder values.
   - Motion control assigns one of the encoders as the drive encoder and the other encoder as the machine encoder. When you select either Encoder 1 or Encoder 2, you determine which encoder is assigned as the drive encoder. The encoder that you do not select is assigned as the machine encoder.

– After you select the drive encoder, click the green check mark button to enter the configuration:



10.3.4.5 Simulation axis

You use Simulation Mode when you want to work with the PROFIdrive or the Analog drive axis on a PLC without a connected drive.

Simulation Mode is required when you want to do one of the following tasks:

- Commisioning of program sequence without a drive
- Testing of user program without moving an axis
- Simulation of behavior of the axis using a process model without a real movement.
- Drive and encoder must not be connected: Testing is also possible without a projected drive; drive will be added and configured later.

Configuring Simulation Mode

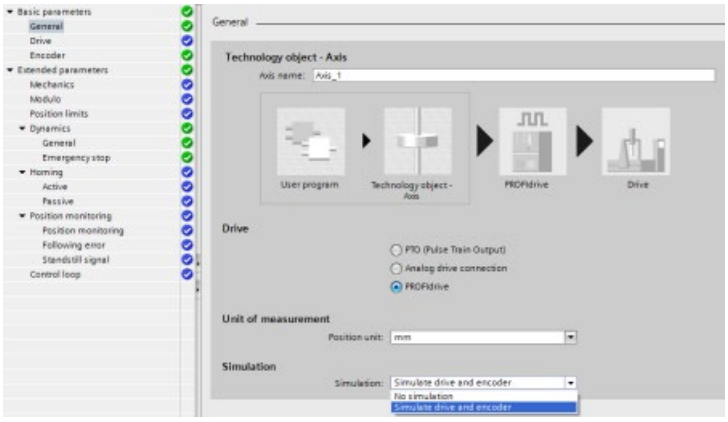
The following options are available:

TODB value	Dialog entries	Comment
0	No simulation	No simulation
1	Simulate drive and encoder	Simulation with and without correct configured addresses of the axis and configured I/O in hardware configuration

You can only use Simulation Mode with Servo Axis, and, therefore, only with PROFIdrive and Analog drive. In the case of a PTO axis, the simulation mode is "0".

The TIA Portal has to implement the remainder of the Simulation Mode in case of switching the type of the axis to PTO. Also, with "Data adaptation", check that in the case of PTO that simulation mode is "0", and, if not, it is set automatically.

The user selects the different simulation modes in the Basic parameters dialog > General section > Simulation field as shown in the following figure:



Mode 1: "Simulate drive and encoder":

- In this mode, the axis in your program executes and works on a PLC without real connected hardware regarding a PROFIdrive drive and sensor.
- You do not require the logical I/O addresses in the Technology Objects data block (TODB). This means that you do not have to configure the sensor and drive configuration and additional digital signals (hardware limit switches and reference point switches) in the TO and in hardware configuration. The axis does not supply data to the logical addresses of sensor and drive.
- Simulates TODB ActualSpeed.
- Does not use the PROFIdrive telegram in the case of PROFIdrive.
- In the case of PROFIdrive, the PLC shows a diagnostic error that the configured hardware (peripheral devices or drives) is missing, but this has no influence on the applicability of the axis.
- Creates homing reports in all homing modes directly. Sets positions and status, accordingly. Does not detect hardware inputs.
- All connections can be empty.

- Axis Control Panel \ Tuning Panel works as usual.
- Supports Speed Controlled axis.
- Does not support a virtual axis (like defined by SMC); however, you can use a simulated axis with no hardware connections like a virtual axis.

Download case:

You can download the axis with changed simulation mode during PLC in RUN. In this case, the PLC sets the StatusBit RestartRequired". After restart of the axis, the PLC transfers the changes to the working memory. The following table shows all axis parameters that are connected to hardware configuration (Actor, Sensor, and PositionLimits) and required or optional for simulation:

TODB parameter	Mode 1: Simulate PROFIdrive
Actor.Interface.AddressIn	Optional
Actor.Interface.AddressOut	Optional
Actor.Interface.EnableDriveOutput	Optional
Actor.Interface.DriveReadyInput	Optional
Sensor.Interface.AddressIn	Optional
Sensor.Interface.AddressOut	Optional
Sensor.ActiveHoming.DigitalInputAddress	Optional
Sensor.PassiveHoming.DigitalInputAddress	Optional
PositionLimits_HW.MinSwitchAddress	Optional
PositionLimits_HW.MaxSwitchAddress	Optional

10.3.4.6 Data adaptation

Overview

You can adapt actor and sensor data that are readable from the drive or sensor module and have been configured the same in both the PLC and the drive/sensor device.

Configuring Adaptation RT

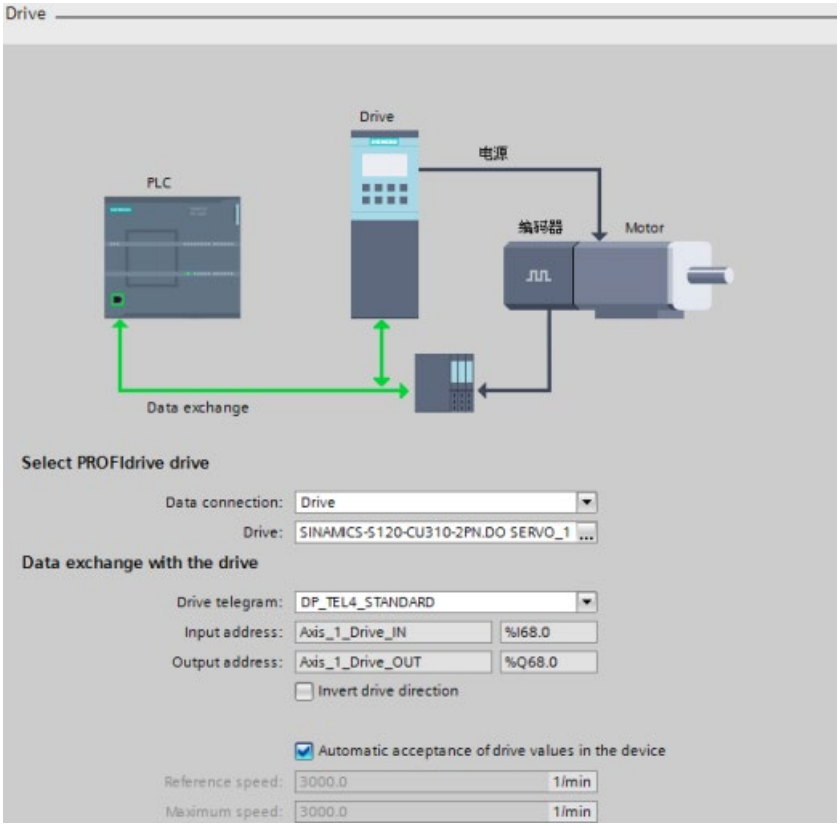
The CPU configures the Adaptation RT in the TO-DB for the specific actor and sensor:

- <axis>.Sensor[i].DataAdaptation: DINT [0:NO | 1:YES]
- <axis>.Actor.DataAdaptation: DINT [0:NO | 1:YES]

You can change the Adaptation RT configuration during run with the axis configuration dialog, Basic parameters, Drive and Encoder configuration dialogs. The adaptation is effective with TO startup or restart or loss of communication to the drive.

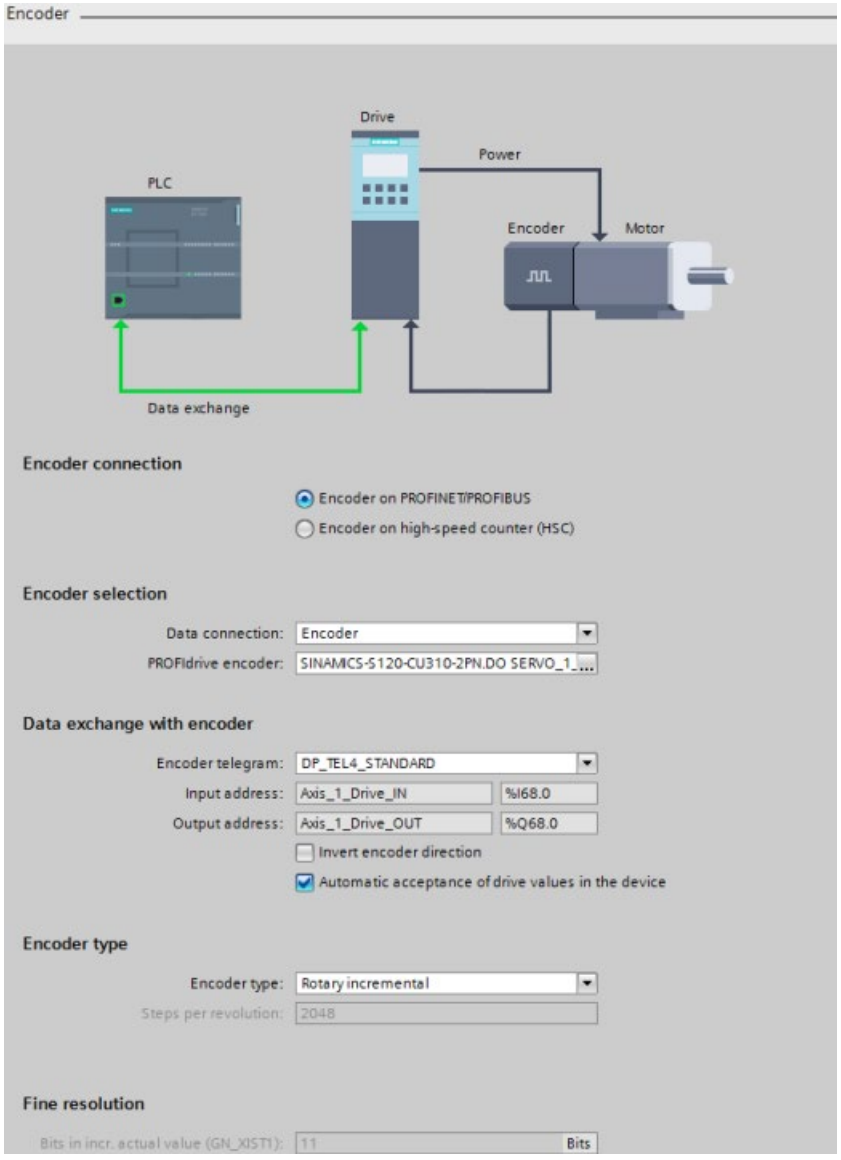
In the TIA Portal, you select "Data adaptation" using the "Automatic acceptance of drive values in the device" check box found in both of the axis configuration dialog, Basic parameters, Drive and Encoder dialogs.

The following figure shows the axis configuration Drive dialog:



- If a SINAMICS drive is connected:
  - The check box is selected by default.
  - The controls following the check box, "Reference speed' and "Maximum speed", are grayed out.
  - Adaptation RT for actor data is activated.
  - If you manually deselect the check box, you can change the values of both of the controls following the check box.
- If no SINAMICS drive or another drive is connected:
  - The check box is deselected and grayed out by default.
  - The controls following the check box, "Reference speed' and "Maximum speed", are active and editable.
  - Adaptation RT for actor data is not activated.

The following figure shows the axis configuration Encoder dialog:



- If a PROFIdrive encoder is connected:
  - The check box is selected by default.
  - The controls following the check box, "Encoder type" ("Steps per revolution" only) and "Fine resolution", are grayed out.
  - Adaptation RT for encoder data is activated.
  - If you manually deselect the check box, you can change the values of both of the controls following the check box.
- If no PROFIdrive encoder is connected (HSC or TM modules):
  - The check box is deselected and grayed out by default.
  - The controls following the check box, "Encoder type" and "Fine resolution", are active and editable.
  - Adaptation RT for actor data is not activated.

Executing Adaptation RT

You execute the adaptation with Adaptation RT activated:

- During startup of the Technology objects (TO) (or PLC startup) or creation of the TO (on download of the TO-DB)
- After the drive or encoder blackout (or communication loss) and startup again
- Restart of TO (after every restart data are adapted)

During active communication of Adaptation RT, motion control refuses communication orders from the user program regarding this drive and displays a resource error in the user program.

A drop out of the drive breaks the adaptation during communication of Adaptation RT. If the drive answers again, the adaptation starts again.

If the device makes a negative confirmation, motion control does not overwrite the TO axis configuration. If Adaptation RT is selected, but the system does not operate an adaptation successfully, motion control displays an error and the device cannot be enabled.

Displaying adaptation status and adaption errors

Motion control displays the Adaptation RT status and errors in parameters and ErrorIDs/ErrorInfos:

- Motion control displays the adaptation status at the axis: If the adaptation does not operate or operates with errors, motion control displays an error at the axis and the ErrorID / ErrorInfo of the MC_Power instruction.
- General adaptation parameter: Manufacturer, device, version, and date are readout from the P964[7] parameter. The P964 parameter is a PROFIdrive parameter and available at the actor and encoder.
- Performance: Motion control executes the Adaptation RT after startup or restart. If the configuration does not change afterwards, it is reasonable to deactivate the data adaptation because of performance reasons. There are two solutions:
  - Save the values by application in the RT after adaptation and deactivate the adaptation.
  - Upload of the values after adaptation, transfer these values to the project, and deactivate the adaptation.
- Adaptation behavior:
  - During startup / restart all configured devices (actor and sensor) to be adapted are adapted.
  - If a device is not adaptable during this step, motion control displays an error and the status changes to "ADAPTATION_ERROR".
  - With errors of an encoder, an enabling of the axis in the speed controlled mode is possible because this mode usually works without an encoder.

Refer to "ErrorIDs and ErrorInfos for motion control" for a listing of the data adaptation ErrorIDs and ErrorInfos.

Adapting actor data

The adaptation of actor data is device specific and supported only for SINAMICS drives. SINAMICS drives support data adaptation and show an error if Adaptation RT is activated.

Units

Adaptation of actor data considers the configured units in the drive. Values and units depend on the DO-Type, DO-Function module, and units system.

Adaptation of actor data only supports rotary drives (no linear drives) and units of 1/min.

The following parameters are read and evaluated:

- p107 (DO-Typ)
- p108 (DO-Function module)
- p505 (SI units or US units)

Selected current data record from the drive

A SINAMICS drive supports different data sets for the encoder and actor. The SINAMICS drive adapts the current data record at the moment of adaptation. Therefore, "p51" (current data record of drive) is readout:

- The reference speed is equal to all data records: "p2000" (reference speed) is independent of the data record.
- The maximum speed is independent of the data record: "p1082"
- The SINAMICS drive does not check the different maximum values of the different data records if they are consistent regarding their control value in the current data record. For example, this happens after a data adaptation to another data record.

Motor type

SINAMICS supports two motor types:

- Linear motor
- Default motor (rotary motor)

With Basic Motion Control (BMC), SINAMICS only supports rotary motors.

If the SINAMICS drive has a linear motor configured (parameter "r108, bit 12"), motion control displays an ErrorID after a consistency check or a data adaptation abort.

Parameters

Motion control supports "DO-Servo" and "DO-Vector". The following parameters of the drive are adapted:

TO-DB actor parameter	SINAMICS parameter
Actor.DriveParameter.ReferenceSpeed	p2000
Actor.DriveParameter.MaxSpeed	p1082

Three TO DB parameters of the actor are not adapted but checked on plausibility:

TO-DB sensor parameter	SINAMICS/PROFIdrive parameter
Actor.type	r108, bit12
Actor.Interface.AddressIn.RID	p922 or p2079
Actor.Interface.AddressOut.RID	p922 or p2079

The values of each parameter are listed in the following tables:

TO-DB actor parameter	Value
Actor.type	• 0 = Analog • 1 = PROFIdrive • 2 = PTO Note: The TIA Portal only supports the rotary drive. This means that only a "1" value is valid.
Actor.Interface.AddressIn.RID	• 0208_0708 = Telegram 1 • 0208_070A = Telegram 2 • 0208_070C = Telegram 3 • 0208_0720 = Telegram 4 • 0208_070E = Telegram 81 • 0208_0710 = Telegram 83
Actor.Interface.AddressOut.RID	• 0208_0709 = Telegram 1 • 0208_070B = Telegram 2 • 0208_070D = Telegram 3 • 0208_0721 = Telegram 4 • 0208_070F = Telegram 81 • 0208_0711 = Telegram 83

SINAMICS/PROFIdrive parameter	Value
r108, bit12	• 0 = Linear drive • 1 = Rotary drive Note: The TIA Portal only supports the rotary drive.
p922 or p2079	• 1 = Telegram 1 • 2 = Telegram 2 • 3 = Telegram 3 • 4 = Telegram 4 • 81 = Telegram 81 • 83 = Telegram 83

Check of the maximum velocity

The TIA Portal verifies the validity of the TO-DB "DynamicLimits.MaxVelocity" parameter. However, with data adaptation, the check is only possible when the system is in RUN and does not perform the TIA Portal verification.

Consistency check

Motion control executes a consistency check during the first startup or restart of the TO axis. Motion control also displays an ErrorID if the data adaptation of the actor is activated. A consistency check involves the telegram, motor type, and maximum speed:

- Telegram in "p922" or "p2079": If there is an inconsistency between the TO and drive configuration, motion control displays an error.
- Motor type in "r108, bit12" of DO-Servo: If there is an inconsistency between the TO and drive configuration, motion control displays an error.
- The maximum speed is not reachable with the configured axis parameters, and motion control displays an error. (Note: Motion control does not display this error again after confirmation if the axis configuration is not changed.)

Special case:

- Maximum speed (p1082) > 2 x reference speed (p2000)
- Motion control reduces the maximum speed to "2x" reference speed internally. The entry in the axis configuration is not limited. However, motion control adapts the value of "p1082" and displays an error.

Adapting sensor data

Only data adaptation with an active encoder is supported (p0979).

Amount of adapted data

Motion control adapts the actual value description of "p0979" (including the rotary or linear encoder configuration) and checks the TIA Portal encoder type parameter, "incremental or absolute". Motion control does not adapt or evaluate the NIST reference value in Telegram 83.

Correlating the encoder in the telegram to the encoder in the PLC and drive

- Motion control configures the mapping of an encoder in the PLC to the actual value in the telegram (actual value 1 or actual value 2) in the VREF.RID of two TO-DB parameters:
  - <axis>.Sensor[i].Interface.AddressIn
  - <axis>.Sensor[i].Interface.AddressOut
- The mapping in the drive occurs with the index setting in "p979" (encoder modeling in SINAMICS).

Parameters

Motion control adapts the following prarmeters:

TO-DB sensor parameter	SINAMICS/PROFIdrive parameter
Sensor[i].System	• P979.[1] or P979.[11] • Bit 0 = 0: rotary encoder • Bit 0 = 1: linear encoder
Incremental rotary sensor	
Sensor[i].Parameter.StepsPerRevolution	P979.[2] or P979.[12]
Sensor[i].Parameter.FineResolutionXist1	P979.[3] or P979.[13]
Incremental linear sensor	
Sensor[i].Parameter.Resolution	P979.[2] or P979.[12]
Sensor[i].Parameter.FineResolutionXist1	P979.[3] or P979.[13]
Absolute rotary sensor	
Sensor[i].Parameter.StepsPerRevolution	P979.[2] or P979.[12]
Sensor[i].Parameter.FineResolutionXist1	P979.[3] or P979.[13]
Sensor[i].Parameter.DeterminableRevolutions	P979.[5] or P979.[15]
Sensor[i].Parameter.FineResolutionXist2	P979.[4], bzw.P979.[14]
Absolute linear sensor	
Sensor[i].Parameter.Resolution	P979.[2] or P979.[12]
Sensor[i].Parameter.FineResolutionXist1	P979.[3] or P979.[13]
Sensor[i].Parameter.FineResolutionXist2	P979.[4], bzw. P979.[14]

Motion control does not adapt one TO-DB sensor parameter, but checks it on consistency:

TO-DB sensor parameter	SINAMICS/PROFIdrive parameter
Sensor[i].Type	• P979.[5], bzw. P979.[15] • Bit 0 = 0: incremental encoder • Bit 0 > 1: absolute encoder
Sensor[i].Interface.AddressIn Sensor[i].Interface.AddressOut	p922 or p2079

You can use an absolute encoder as an incremental encoder, but not an incremental encoder as an absolute encoder. Motion control displays an incompatibility of the encoder type at the TO and its related actual value in the PROFIdrive telegram in an error. Note: With SINAMICS FW V2.6, the PROFIdrive interface has a sensor zero mark.

Consistency check

Motion control executes a consistency check during the first startup or restart of the TO axis. Motion control also displays an ErrorID if the data adaptation of the sensor is activated. A consistency check involves the telegram and sensor type:

- Telegram in "p922" or "p2079": If there is an inconsistency between the TO and sensor configuration, motion control displays an error.
- Sensor type in "P979.[5]" or "P979.[15]": You can use an absolute encoder as an incremental encoder, but not an incremental encoder as an absolute encoder. If there is no consistency, motion control displays an error.

Parameters that must be uploaded

The following list shows all the parameters that you have to upload from the drive into the TIA portal. To manage this data adaptation, you must expand the TO-DB. You use the following structs of the TO-DB to perform this expansion:

Actor	Type	Default	Changeable	Comment
Actor.DataAdaptation	DINT	0	R (with restart)	Adaptation activate: • 0: NO • 1: YES

StatusDrive	Type	Comment
StatusDrive.AdaptationState	DINT	Adaptation status: • 0: NOT_ADAPTED: Cannot take over data. • 1: IN_ADAPTATION: Data adaptation has just started. • 2: ADAPTED: Data are adapted • 3:NOT_APPLICABLE: Adaptation not selected or not available for this drive • 4:ADAPTATION_ERROR: Error during adaptation: – Axis cannot be enabled. – Motion control displays a configuration error.

Sensor	Type	Default	Changeable	Comment
Sensor.DataAdaptation	DINT	0	R (with restart)	Adaptation activate: • 0: NO • 1: YES

StatusSensor	Type	Comment
StatusSensor.AdaptationState	DINT	Adaptation status: • 0: NOT_ADAPTED: Cannot take over data. • 1: IN_ADAPTATION: Data adaptation has just started. • 2: ADAPTED: Data are adapted. • 3: NOT_APPLICABLE: Adaptation not selected or not available for this drive. • 4: ADAPTATION_ERROR: Error during adaptation: – Axis cannot be enabled. – Motion control displays a configuration error.

ErrorWord	Type	Comment
...	Bool	
Bit 15: Adaptation Error	Bool	ErrorID:
...	Bool	

10.3.4.7 Axis control using the TM Pulse module

The TM Pulse Module is an ET 200SP two-channel pulse output module for use with valves and motors. The module can support either two 24 V DC channels at 2 A or one 24 V DC channel at 4 A.

Using the "DC motor" operating mode of the TM Pulse 2x24V output module, you can drive a motor in both directions with a bipolar PWM output. You can assign a digital input as an "External stop" signal for the motor.

The TM Pulse module can perform the following functions to support motion control:

- Programmable output response to CPU/master STOP condition
- Error detection and diagnostics:
  - Missing or under voltage L+ supply voltage
  - Short-circuit/overload of a digital output
  - Short-circuit/under voltage of a sensor power supply
  - Over temperature error
  - Parameterization fault
  - Module/firmware error

Example

Some applications require the ability to move easily to a specific location, but do not require the absolute accuracy and adherence to a specific profile. The use of a common DC motor in conjunction with the Closed Loop Servo control is possible using the ET 200SP TM Pulse module to control the motor. This application example covers one mode of the ET 200SP TM Pulse module: "PWM with DC Motor". Refer to the *ET 200SP Technology module TM Pulse 2x24V Manual* for further information on the other ET 200SP TM Pulse modes.

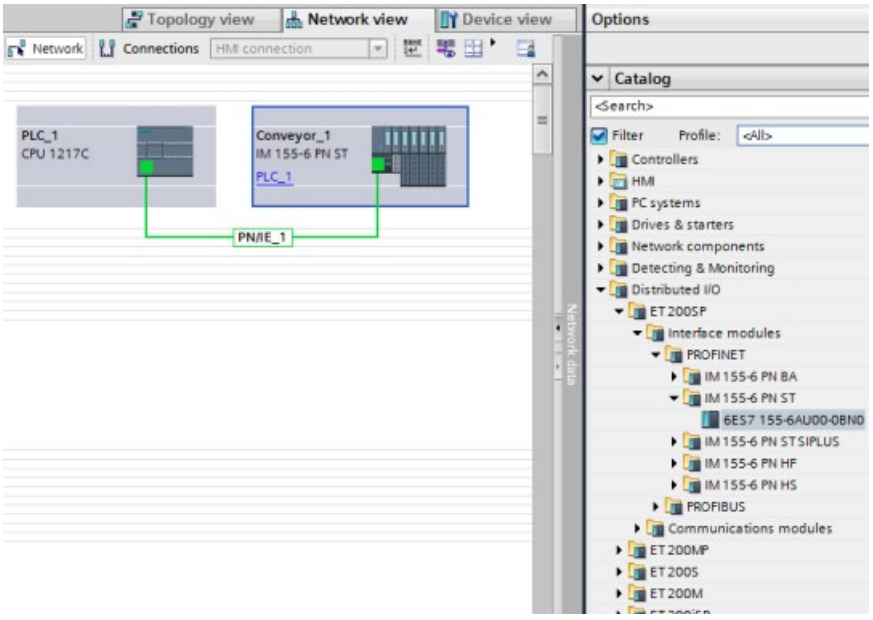
In order to use true closed loop control, you require a method of position feedback. You must connect an encoder to the motor to provide feedback to the control system. This example shows three methods of achieving this:

- High Speed Counter (HSC) that is built into the S7-1200
- ET 200SP TM Count Module
- ET 200SP TM PosInput module

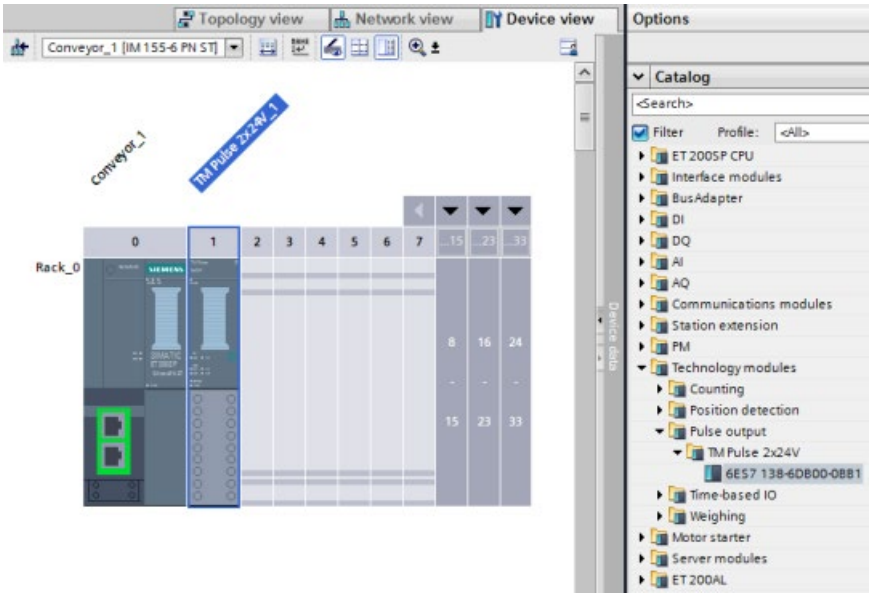
In some cases, where moving at various velocities is a requirement, the Closed Loop control can operate in Speed Control mode. If you use this mode, you do not require position feedback.

Follow these steps to configure the TM Pulse module:

1. Configure your S7-1200 CPU.
2. Select the required ET 200SP Interface module and place it in the Device View:



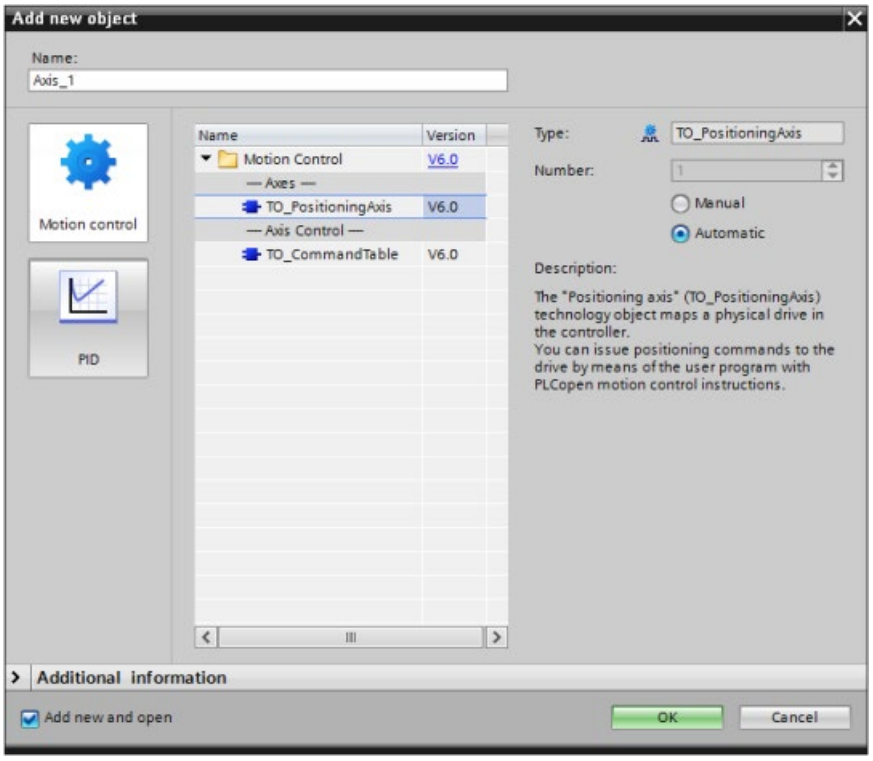
3. Add the ET 200SP TM Pulse module:



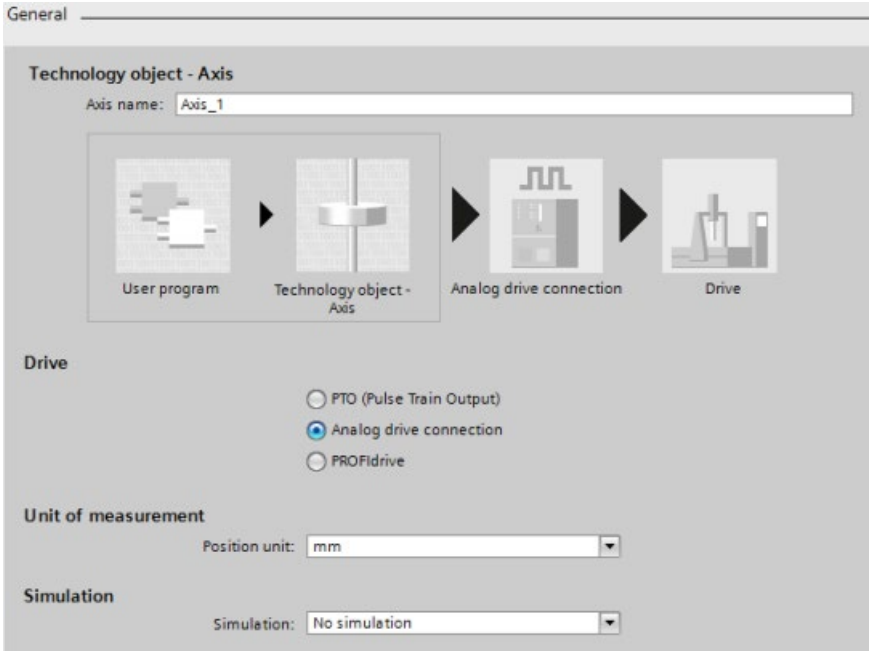
4. In the Channel configuration, select "2 channels (2A)".
5. Set the Operating mode to "PWM with DC Motor".
6. Set the Diagnostics and Channel parameters as required.

Follow these steps to configure the Axis of Motion with position feedback:

1. When configuring your interface with a Closed Loop Motion Control System, you use analog control, not PROFIdrive or PTO. You configure the axis to be controlled in the same way that you configure an axis that uses an analog output as the input to a servo drive. Add a "TO PositioningAxis" as shown in the figure below:



2. In the General configuration dialog for the axis configuration, select "Analog drive connection":



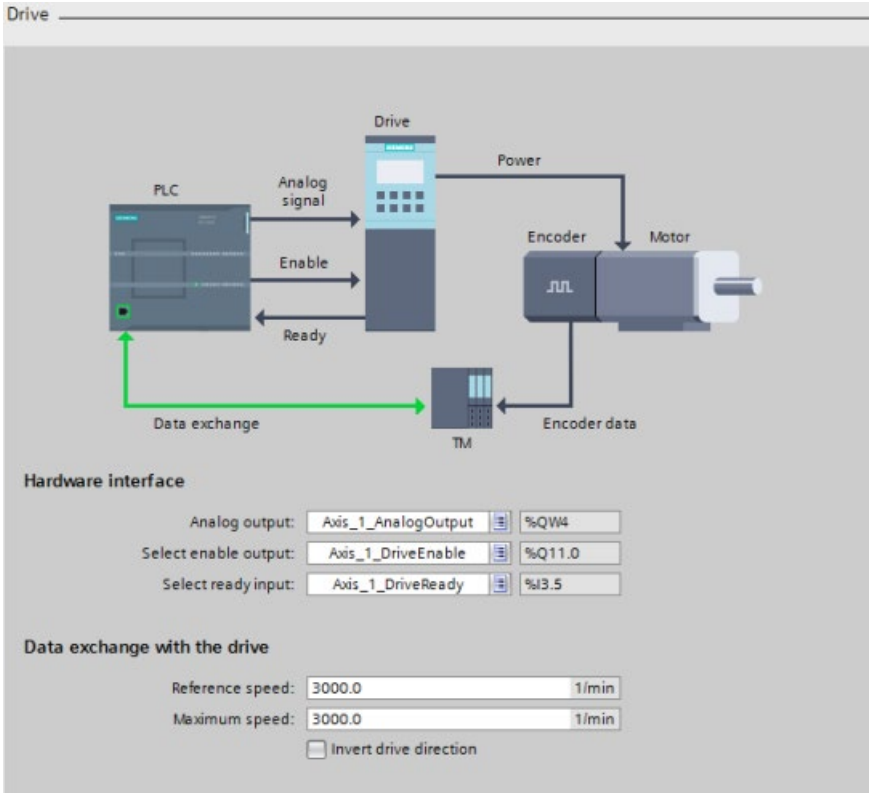
3. You now need analog outputs and a drive enable for your drive configuration. Go to the Device View of the ET 200SP interface module and the Device Overview entry for the TM Pulse module. Using the starting Q address for the TM Pulse module and the Control interface and Feedback interface tables in the *SIMATIC ET 200SP Technology module TM Pulse 2x24V (6ES7138-6DB00-0BB1) Manual*, you can determine the following analog outputs and drive enable required for your drive:

   – Analog output

   – Select enable output

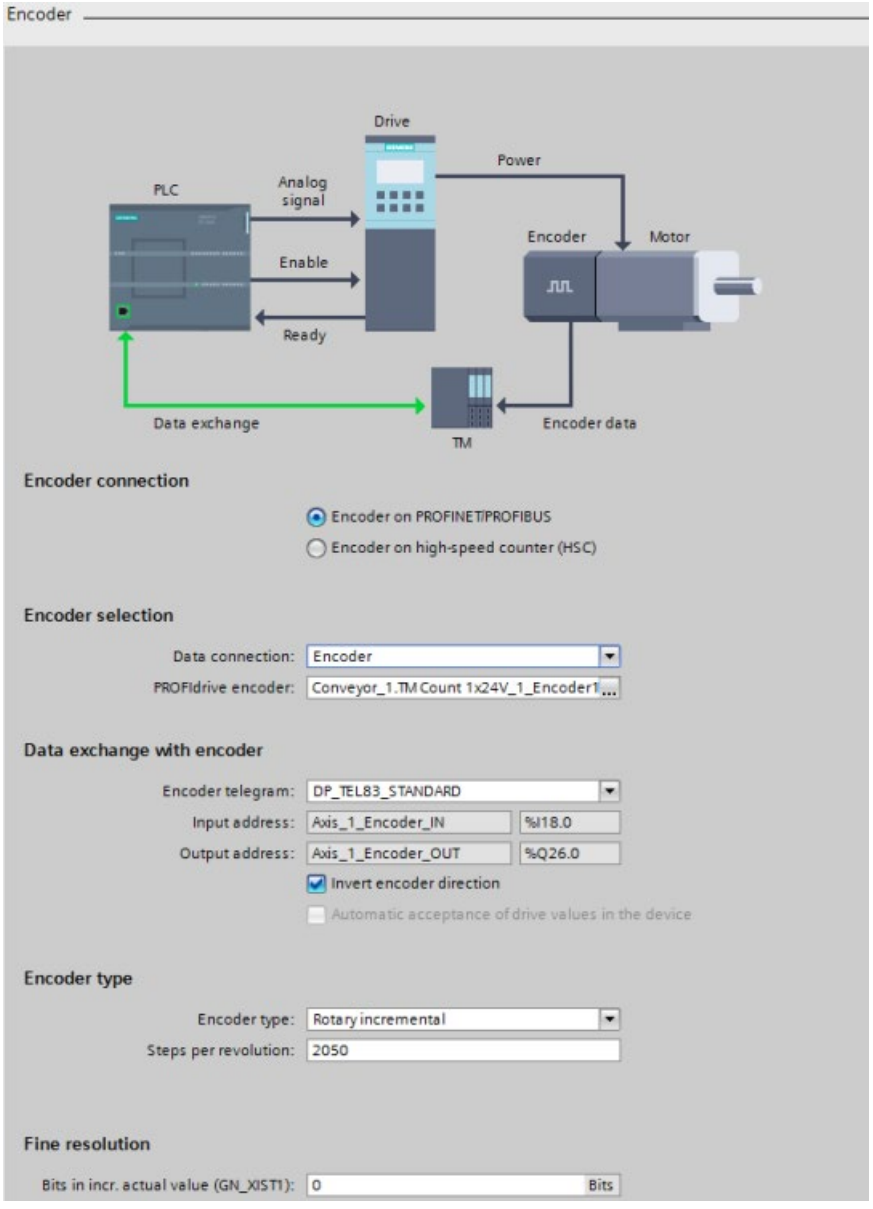
   – Select ready input

   In the Drive configuration dialog for the axis configuration, select your hardware interface I/O and data exchange values:



4. In the Encoder configuration dialog for the axis configuration, complete the configuration by selecting one of the following encoders:

- TM Count module
- TM PosInput module
- High-Speed Counter (HSC)

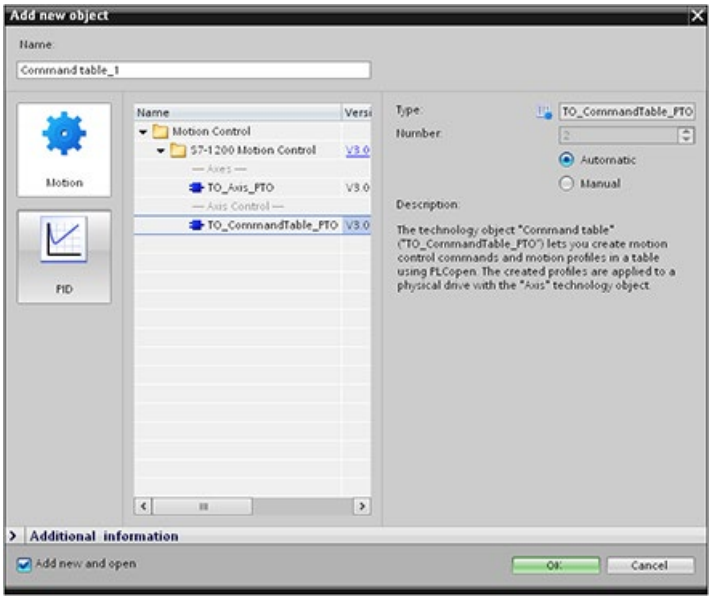


10.3.5 Configuring the TO_CommandTable_PTO

You can configure a MC_CommandTable instruction using the Technology objects. The following example demonstrates how this is done.

Adding a Technology object

1. In the Project tree, expand the node "Technology Objects" and select "Add new object".
2. Select the "CommandTable" icon (rename if required), and click "OK" to open the configuration editor for the CommandTable object.



Planning the steps for your application

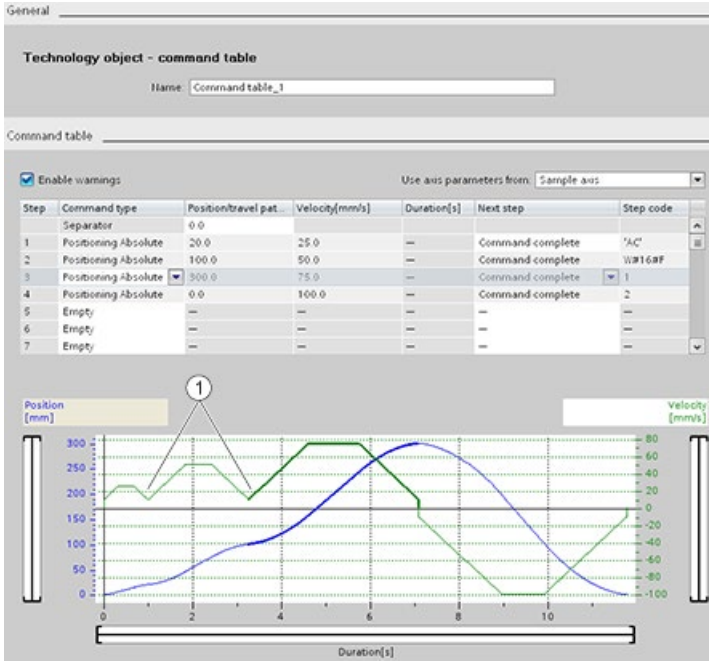
You can create the desired movement sequence in the "Command Table" configuration window, and check the result against the graphic view in the trend diagram.

You can select the command types that are to be used for processing the command table. Up to 32 steps can be entered. The commands are processed in sequence, easily producing a complex motion profile.

Table 10- 48 MC_CommandTable command types

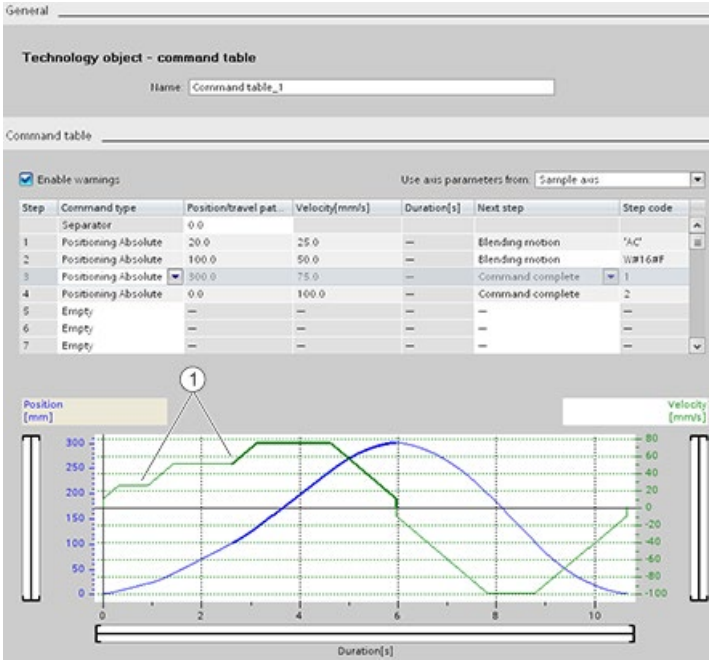
Command type	Description
Empty	The empty serves as a placeholder for any commands to be added. The empty entry is ignored when the command table is processed
Halt	Pause axis. Note: The command only takes place after a "Velocity setpoint" command.
Positioning Relative	Positions the axis based upon distance. The command moves the axis by the given distance and velocity.
Positioning Absolute	Positions the axis based upon location. The command moves the axis to the given location, using the velocity specified.
Velocity setpoint	Moves the axis at the given velocity.
Wait	Waits until the given period is over. "Wait" does not stop an active traversing motion.
Separator	Adds a "Separator" line above the selected line. The separator line allows more than one profile to be defined in a single command table.

In the figure below, "Command complete" is used as the transition to the next step. This type of transition allows your device to decelerate to the start/stop speed and then accelerate once again at the start of the next step.



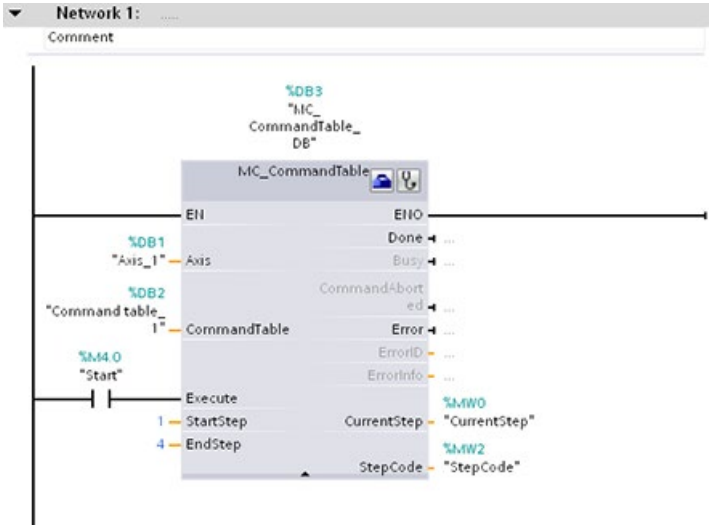
① Axis decelerates to the start/stop speed between steps.

In the figure below, "Blending motion" is used as the transition to the next step. This type of transition allows your device to maintain its velocity into the start of the next step, resulting in a smooth transition for the device from one step to the next. Using blending can shorten the total time required for a profile to execute completely. Without blending, this example takes seven seconds to run. With blending, the execution time is reduced by one second to a total of six seconds.



① Axis continues to move and accelerates or decelerates to the next step velocity, saving time and mechanical wear.

The operation of your CommandTable is controlled by an MC_CommandTable instruction, as shown below:



10.3.6 Operation of motion control for S7-1200

10.3.6.1 CPU outputs used for motion control

The CPU provides four pulse output generators. Each pulse output generator provides one pulse output and one direction output for controlling a stepper motor drive or a servo motor drive with pulse interface. The pulse output provides the drive with the pulses required for motor motion. The direction output controls the travel direction of the drive.

The PTO output generates a square wave output of variable frequency. Pulse generation is controlled by configuration and execution information supplied through H/W configuration and/or SFCs/SFBs.

Based upon the user's selection while the CPU is in RUN mode, either the values stored in the image register or the pulse generator outputs drive the digital outputs. In STOP mode, the PTO generator does not control the outputs.

Onboard CPU outputs and outputs of a signal board can be used as pulse and direction outputs. You select between onboard CPU outputs and outputs of the signal board during device configuration under Pulse generators (PTO/PWM) on the "Properties" tab. Only PTO (Pulse Train Output) applies to motion control.

The table below shows the default I/O assignments; however, the four pulse generators can be configured to any digital output.

Note

Pulse-train outputs cannot be used by other instructions in the user program.

When you configure the outputs of the CPU or signal board as pulse generators (for use with the PWM or motion control instructions), the corresponding output addresses no longer control the outputs. If your user program writes a value to an output used as a pulse generator, the CPU does not write that value to the physical output.

Note

PTO direction outputs can be freed for use elsewhere in your program.

Each PTO requires the assignment of two outputs: one as a pulse output and one as a direction output. You can use just the pulse output and not the direction output. You can then free the direction output for other purposes in your user program. The output cannot be used for both the PTO direction output and in the user program, simultaneously.

Table 10- 49 Default address assignments of the pulse and direction outputs

Usage of outputs for motion control		
	Pulse	Direction
PTO1		
Built-in I/O	Q0.0	Q0.1
SB I/O	Q4.0	Q4.1
PTO2		
Built-in I/O	Q0.2	Q0.3
SB I/O	Q4.2 [1]	Q4.3 [1]
PTO3		
Built-in I/O	Q0.4 [2]	Q0.5 [2]
SB I/O	Q4.0	Q4.1
PTO4		
Built-in I/O	Q0.6 [3]	Q0.7 [3]
SB I/O	Q4.2	Q4.3

1 Outputs Q4.2 and Q4.3 are only available on the SB 1222 DQ4.

2 The CPU 1211C does not have outputs Q0.4, Q0.5, Q0.6, or Q0.7. Therefore, these outputs cannot be used in the CPU 1211C.

3 The CPU 1212C does not have outputs Q0.6 or Q0.7. Therefore, these outputs cannot be used in the CPU 1212C.

4 This table applies to the CPU 1211C, CPU 1212C, CPU 1214C, CPU 1215C, and CPU 1217C PTO functions.

Drive interface

For motion control, you can optionally configure a drive interface for "Drive enabled" and "Drive ready". When using the drive interface, the digital output for the drive enable and the digital input for "drive ready" can be freely selected.

Note

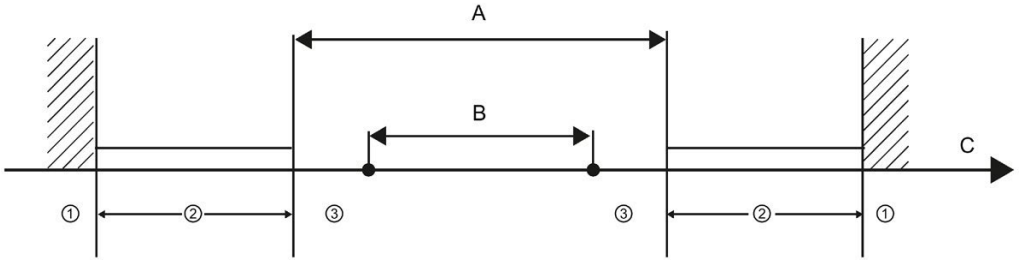
The firmware will take control through the corresponding pulse and direction outputs if the PTO (Pulse Train Output) has been selected and assigned to an axis.

With this takeover of the control function, the connection between the process image and I/O output is also disconnected. While the user has the possibility of writing the process image of pulse and direction outputs via the user program or watch table, this is never transferred to the I/O output. Accordingly, it is also not possible to monitor the I/O output via the user program or watch table. The information read merely reflects the value of the process image and does not match the actual status of the I/O output in any respect.

For all other CPU outputs that are not used permanently by the CPU firmware, the status of the I/O output can be controlled or monitored via the process image, as usual.

10.3.6.2 Hardware and software limit switches for motion control

Use the hardware and software limit switches to limit the "allowed travel range" and the "working range" of your axis.



①	Mechanical stop	A	Allowed travel range for the axis
②	Lower and upper hardware limits	B	Working range of the axis
③	Lower and upper software limits	C	Distance

Hardware and software limit switches must be activated prior to use in the configuration or in the user program. Software limit switches are only active after homing the axis.

Hardware limit switches

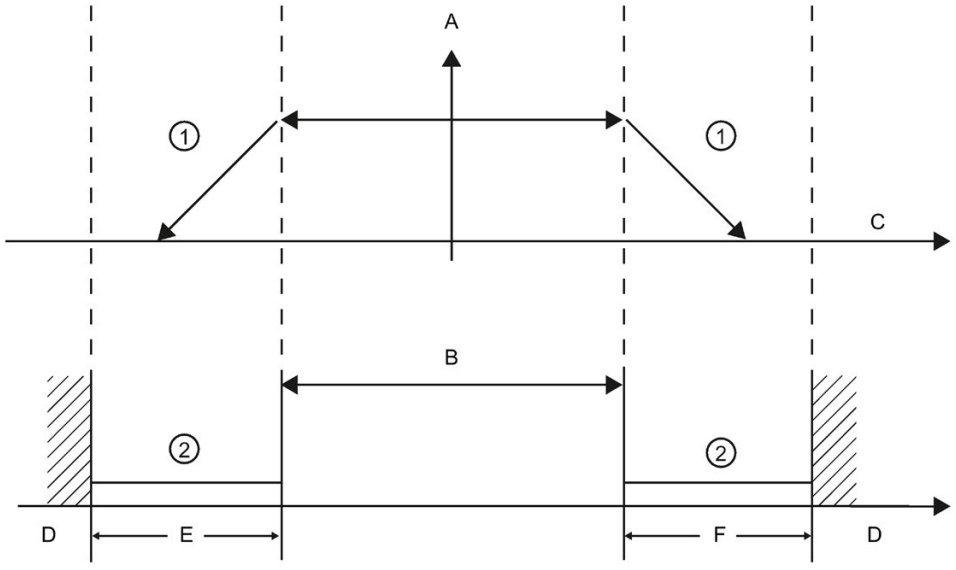
Hardware limit switches determine the maximum travel range of the axis. Hardware limit switches are physical switching elements that must be connected to interrupt-capable inputs of the CPU. Use only hardware limit switches that remain permanently switched after being approached. This switching status can only be revoked after a return to the allowed travel range.

Table 10- 50 Available inputs for hardware limits

Description	CPU	RPS, LIM-, and LIM+ [1]
Built-in I/O	CPU 1211C	I0.0 - I0.5
	CPU 1212C	I0.0 - I0.7
	CPU 1214C, CPU 1215C, and CPU 1217C	I0.0 - I01.3
SB I/O	All S7-1200 CPUs	I4.0 - I4.3

[1] Reference Point Switch input (RPS), Negative Travel Limit input (LIM-), and Positive Travel Limit input (LIM+)

When the hardware limit switches are approached, the axis brakes to a standstill at the configured emergency deceleration. The specified emergency deceleration must be sufficient to reliably stop the axis before the mechanical stop. The following diagram presents the behavior of the axis after it approaches the hardware limit switches.



① The axis brakes to a standstill at the configured emergency deceleration.
② Range in which the hardware limit switches signal the stats "approached".
A [Velocity]
B Allowed travel range
C Distance
D Mechanical stop
E Lower hardware limit switch
F Upper hardware limit switch

WARNING

Risks with changes to filter time for digital input channel

If the filter time for a digital input channel is changed from a previous setting, a new "0" level input value needs to be presented for up to 20.0 ms accumulated duration before the filter becomes fully responsive to new inputs. During this time, short "0" pulse events of duration less than 20.0 ms cannot be detected or counted.

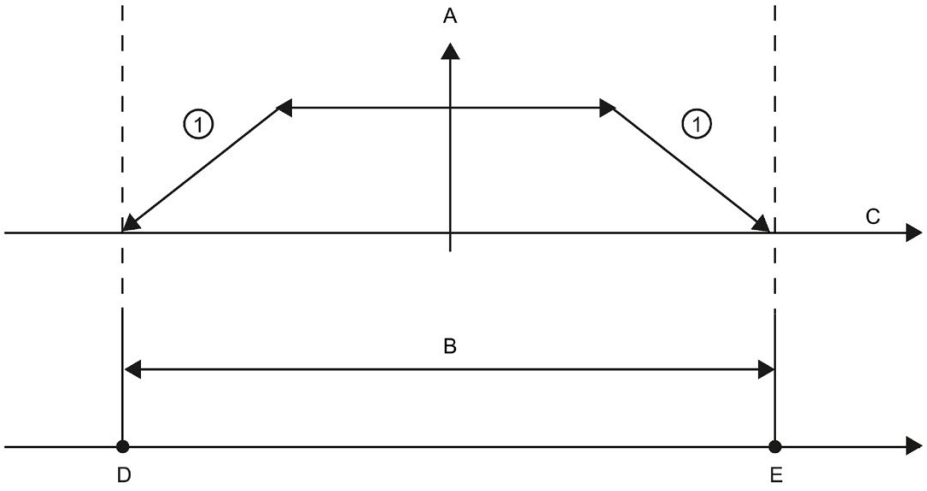
This changing of filter times can result in unexpected machine or process operation, which can cause death or serious injury to personnel, and/or damage to equipment.

To ensure that a new filter time goes immediately into effect, a power cycle of the CPU must be applied.

Software limit switches

Software limit switches limit the "working range" of the axis. They must fall inside the hardware limit switches relative to the travel range. Because the positions of the software limit switches can be set flexibly, the working range of the axis can be restricted on an individual basis depending on the current traversing profile. In contrast to hardware limit switches, software limit switches are implemented exclusively by means of the software and do not require their own switching elements.

If software limit switches are activated, an active motion is stopped at the position of the software limit switch. The axis is braked at the configured deceleration. The following diagram presents the behavior of the axis until it reaches the software limit switches.



① The axis brakes to a standstill at the configured deceleration.
A [Velocity]
B Working range
C Distance
D Lower software limit switch
E Upper software limit switch

Use additional hardware limit switches if a mechanical endstop is located after the software limit switches and there is a risk of mechanical damage.

Edge detection configuration on address change

If you configure a position limit or input homing switch to an input address in a TO PositionAxis, motion control configures it with edge interrupts automatically. If, then, you change the position limit or input homing switch to another address, the configuration with edge detection for the old address remains active.

In the axis configuration, Extended parameters, Position limits dialog, you can add hardware and software limit switches. When you add a hardware limit switch input, an edge detection is automatically activated. Later, if you decide to change an input address, an edge detection dialog displays which offers the following choices:

- Yes: Changes to the new address, activates edge detection on the new address, and deactivates edge detection on the old address (default selection)
- No: Changes to the new address, activates edge detection on the new address, and maintains edge detection on the old address
- Cancel: Does not change to a new address and maintains current edge detection state

Edge detection dialog selection	Changes to new address	Activates edge dectection on new address	Deactivates edge detection on old address
Yes (default)	Yes	Yes	Yes
No	Yes	Yes	No
Cancel	No	N/A	No

Note

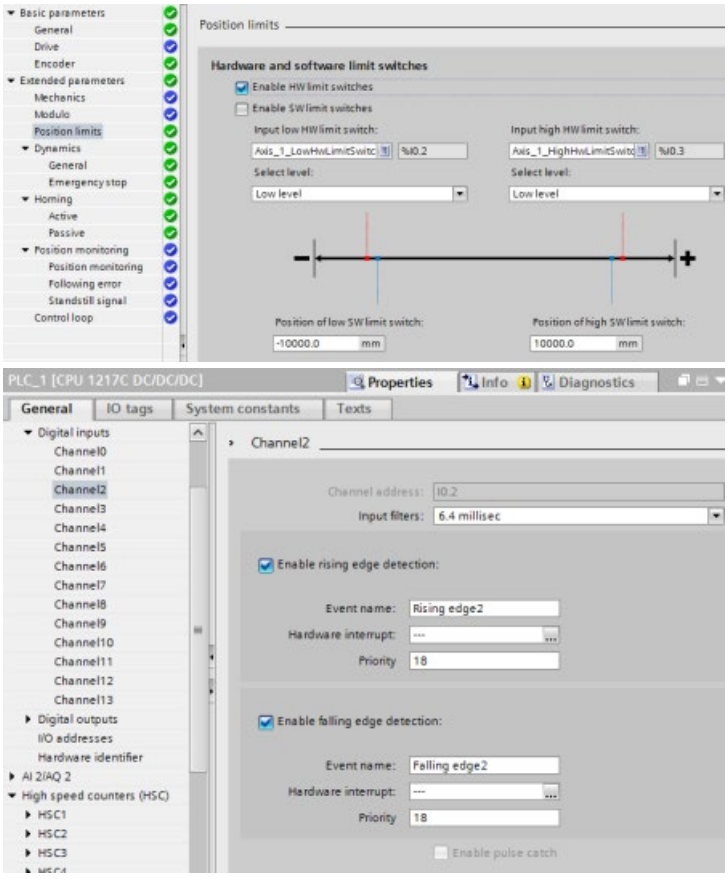
For Servo configurations that require no edge detection, no dialog displays.

Note

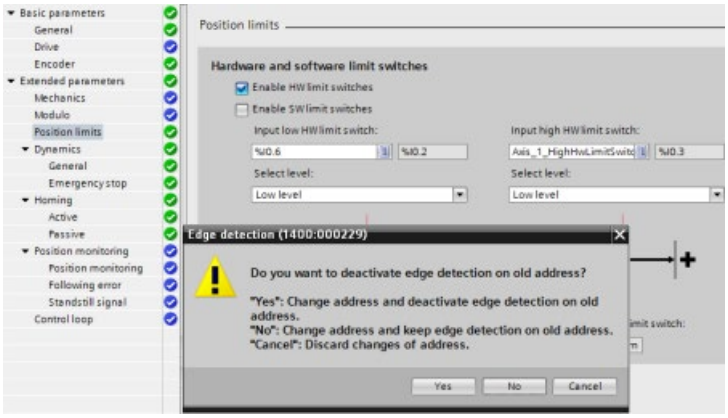
If an OB is linked to the input, motion control does not perform operations with edge detection as described above.

Example: Changing to a new HW limit switch address with edge detection and deactivating edge detection on the old address

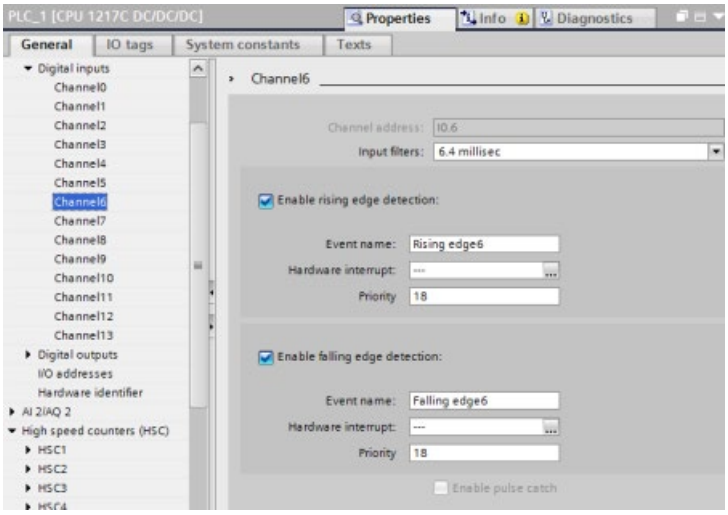
1. Current state: You have connected an "Input low HW limit switch" to I0.2. This configuration automatically enabled edge detection on I0.2. This configuration is also shown in the CPU Properties, Digital Inputs:

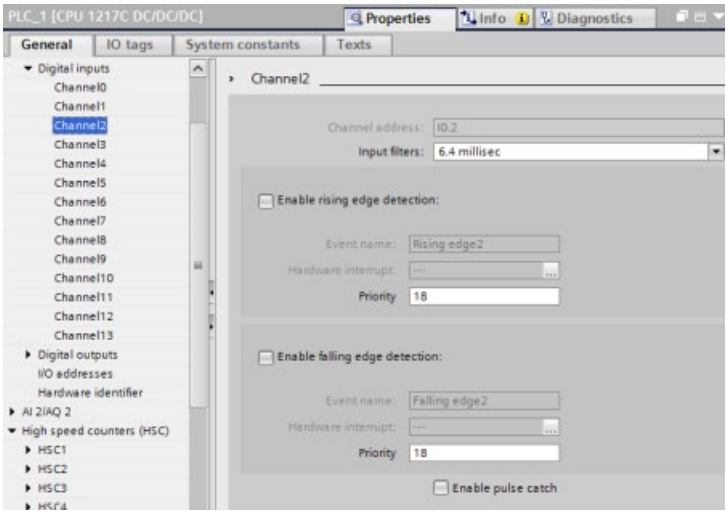


2. You change "Input low HW limit switch" to I0.6 and confirm. The edge detection dialog displays. You select: "Yes: Change address and deactivate edge detection on old address.":



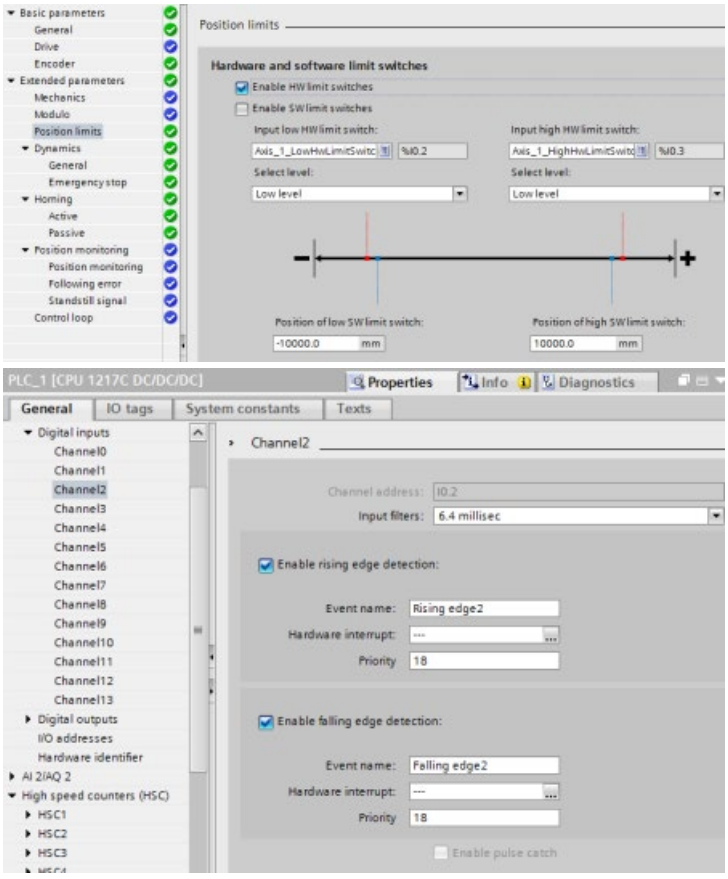
3. The CPU accepts the new I0.6 address and activates edge detection on the I0.6. The edge detection of I0.2 in the CPU Properties, Digital Inputs is automatically deactivated:



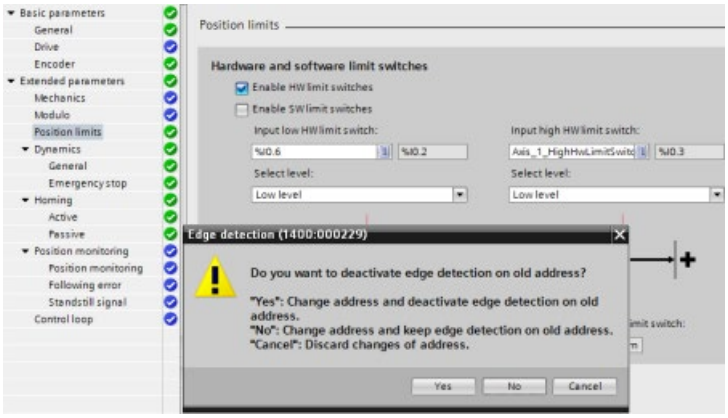


Example: Changing to a new HW limit switch address with edge detection and maintaining edge detection on the old address

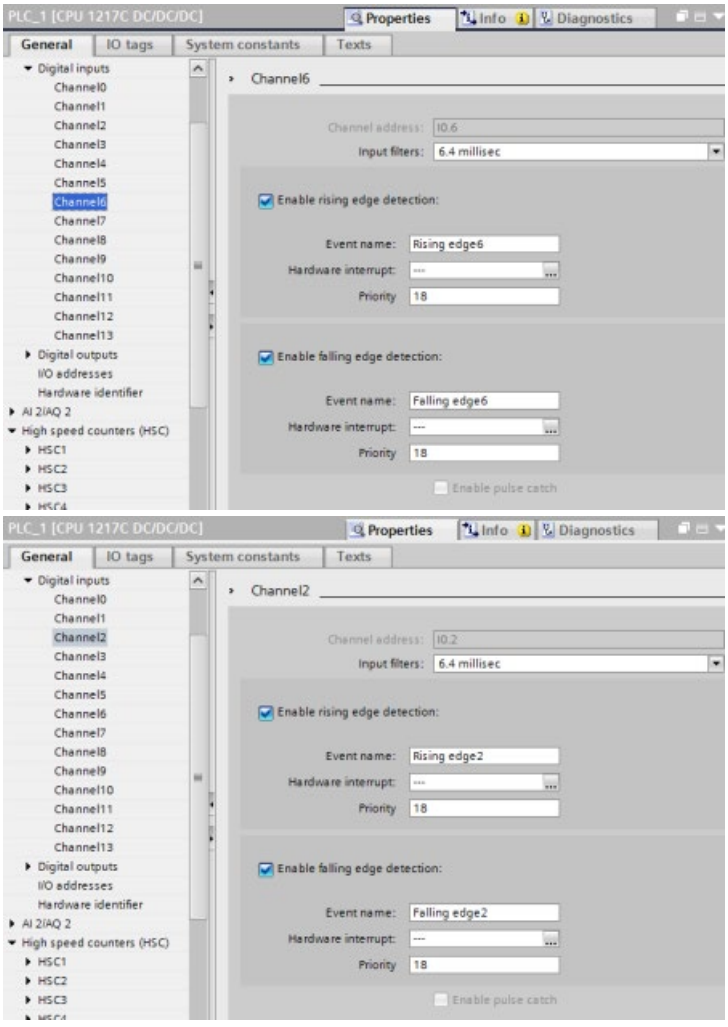
1. Current state: You have connected an "Input low HW limit switch" to I0.2. This configuration automatically enabled edge detection on I0.2. This configuration is also shown in the CPU Properties, Digital Inputs:



2. You change "Input low HW limit switch" to I0.6 and confirm. The edge detection dialog displays. You select: "No: Change address and keep edge detection on old address.":

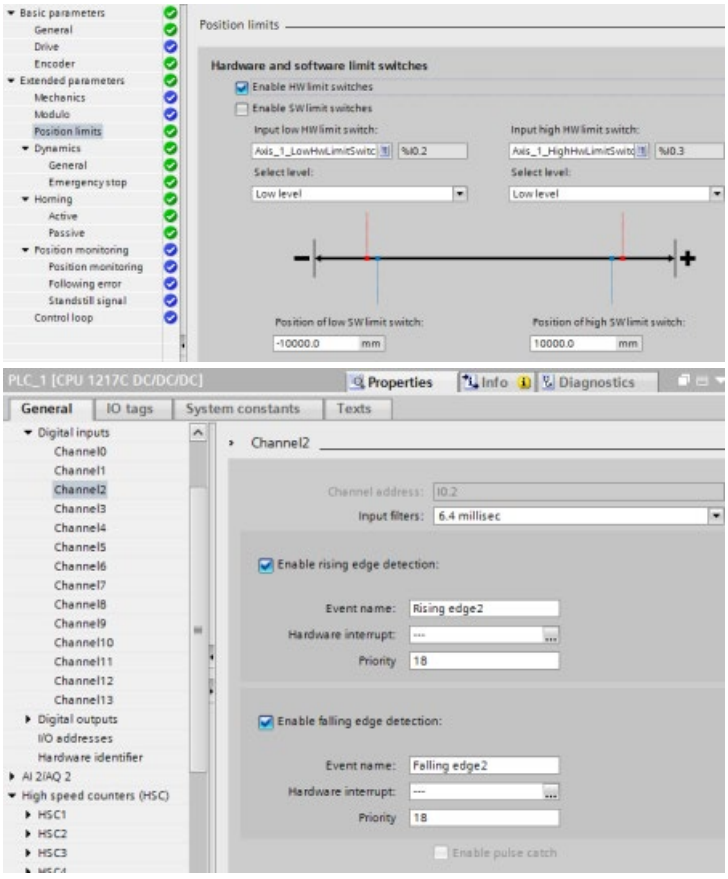


3. The CPU accepts the new I0.6 address and activates edge detection on the I0.6. The edge detection of I0.2 in the CPU Properties, Digital Inputs is kept activated:

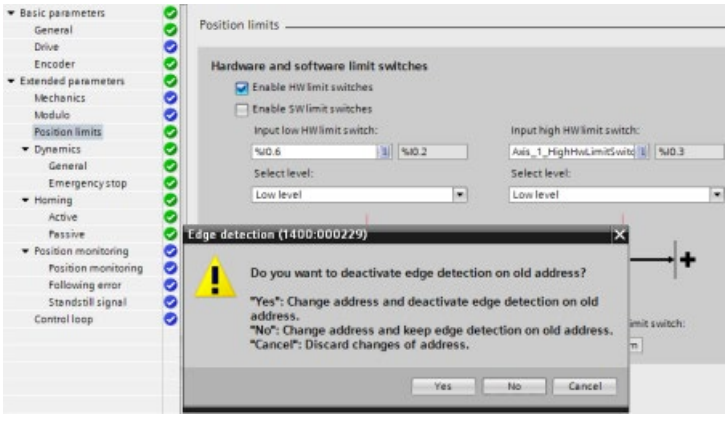


Example: Canceling change to a new HW limit switch address with edge detection

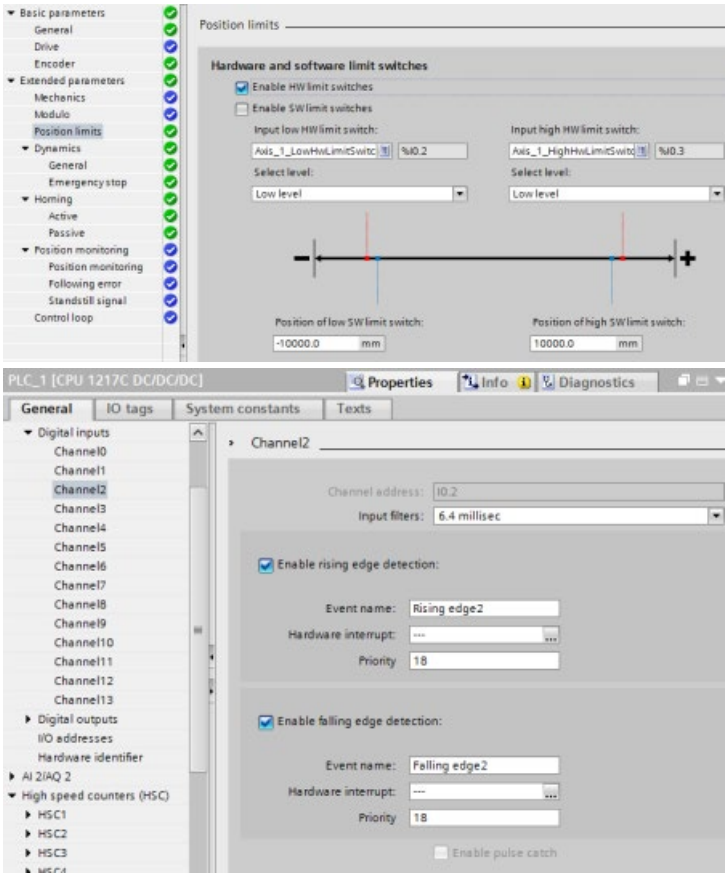
1. Current state: You have connected an "Input low HW limit switch" to I0.2. This configuration automatically enabled edge detection on I0.2. This configuration is also shown in the CPU Properties, Digital Inputs:



2. You change "Input low HW limit switch" to I0.6 and confirm. The edge detection dialog displays. You select: "Cancel.":



3. The "Input low HW limit switch" remains configured to I0.2 and edge detection on I0.2 remains activated:



Additional information

Your user program can override the hardware or software position limits by enabling or disabling both hardware and software limits functionality. The selection is made from the Axis DB.

- To enable or disable the hardware limit functionality, access the "Active" tag (Bool) in the DB path "<axis name>/Config/**PositonLimits_HW**". The state of the "Active" tag enables or disables the use of hardware position limits.
- To enable or disable software position limit functionality, access "Active" tag (Bool) in the DB path "<axis name>/Config/**Position Limits_SW**". The state of this "Active" tag enables or disables the software position limits.

You can also modify the software position limits with your user program (for example, to add flexibility for machine setup or to shorten machine change-over time). Your user program can write new values to the " MinPosition " and " MaxPosition " tags (engineering units in Real format) in the DB "<axis name>/Config/**PositionLimits_SW**".

10.3.6.3 Homing

Homing refers to the matching of the axis coordinates to the real, physical drive position. (If the drive is currently at position x, the axis will be adjusted to be in position x.) For position-controlled axes, the entries and displays for the position refer exactly to these axis coordinates.

Note

The agreement between the axis coordinates and the real situation is extremely important. This step is necessary to ensure that the absolute target position of the axis is also achieved exactly with the drive.

The MC_Home instruction initiates the homing of the axis.

There are 4 different homing functions. The first two functions allow the user to set the current position of the axis and the second two position the axis with respect to a Home reference Sensor.

- Mode 0 - Direct Referencing Absolute: When executed this mode tells the axis exactly where it is. It sets the internal position variable to the value of the Position input of the Homing instruction. This is used for machine calibration and setup.

  The axis position is set regardless of the reference point switch. Active traversing motions are not aborted. The value of the Position input parameter of the MC_Home instruction is set immediately as the reference point of the axis. To assign the reference point to an exact mechanical position, the axis must be at a standstill at this position at the time of the homing operation.

- Mode 1 - Direct Referencing Relative: When executed this mode uses the internal position variable and adds the value of the Position input on the Homing instruction to it. This is typically used to account for machine offset.

  The axis position is set regardless of the reference point switch. Active traversing motions are not aborted. The following statement applies to the axis position after homing: New axis position = current axis position + value of the Position parameter of the MC_Home instruction.

- Mode 2 - Passive Referencing: When the axis is moving and passes the Reference Point Switch the current position is set as the home position. This feature will help account for normal machine wear and gear backlash and prevent the need for manual compensation for wear. The Position input on the Homing instruction, as before, adds to the location indicated by the Reference Point Switch allowing easy offset of the Home position.

  During passive homing, the MC_Home instruction does not carry out any homing motion. The traversing motion required for this step must be implemented by the user via other motion control instructions. When the reference point switch is detected, the axis is homed according to the configuration. Active traversing motions are not aborted upon start of passive homing.

- Mode 3 - Active Referencing: This mode is the most precise method of Homing the Axis. The initial direction and velocity of movement is configured in the Technology Object Configuration Extended Parameters-Homing. This is dependent upon machine configuration. There is also the ability to determine if the leading edge or falling edge of the Reference Point Switch signal is the Home position. Virtually all sensors have an active range and if the Steady State On position was used as the Home signal then there would be a possibility for error in the Homing position since the On signal active range would cover a range of distance. By using either the leading or falling edge of that signal a much more precise Home position results. As with all other modes the value of the Position input on the Homing instruction is added to the Hardware referenced position.

  In active homing mode, the MC_Home instruction performs the required reference point approach. When the reference point switch is detected, the axis is homed according to the configuration. Active traversing motions are aborted.

Modes 0 and 1 do not require that the axis be moved at all. They are typically used in setup and calibration. Modes 2 and 3 require that the axis move and pass a sensor that is configured in the "Axis" technology object as the Reference Point Switch. The reference point can be placed in the work area of the axis or outside of the normal work area but within movement range.

Configuration of homing parameters

You configure the parameters for active and passive homing in the "Homing" configuration window. The homing method is set using the "Mode" input parameter of the motion control instruction. Here, Mode = 2 means passive homing and Mode = 3 means active homing.

Note

Use one of the following measures to ensure that the machine does not travel to a mechanical endstop in the event of a direction reversal:

- Keep the approach velocity low
- Increase the configured acceleration/deceleration
- Increase the distance between hardware limit switch and mechanical stop

Table 10- 51 Configuration parameters for homing the axis

Parameter	Description
Input reference point switch (Active and passive homing)	Select the digital input for the reference point switch from the drop-down list box. The input must be interrupt-capable. The onboard CPU inputs and inputs of an inserted signal board can be selected as inputs for the reference point switch. The default filter time for the digital inputs is 6.4 ms. When the digital inputs are used as a reference point switch, this can result in undesired decelerations and thus inaccuracies. Depending on the homing velocity and extent of the reference point switch, the reference point may not be detected. The filter time can be set under "Input filter" in the device configuration of the digital inputs. The specified filter time must be less than the duration of the input signal at the reference point switch.
Reference point switch (Active and passive homing)	• Active homing: Select whether the axis is to be referenced on the bottom or top side of the reference point switch. Depending on the start position of the axis and the configuration of the homing parameters, the reference point approach sequence can differ from the diagram in the configuration window. • Passive homing: With passive homing, the traversing motions for purposes of homing must be implemented by the user via motion commands. The side of the reference point switch on which homing occurs depends on the following factors: – "Reference point switch" configuration – Current travel direction during passive homing
Auto reverse after reaching the hardware limit switches (Active homing only)	Activate the check box to use the hardware limit switch as a reversing cam for the reference point approach. The hardware limit switches must be configured and activated for direction reversal. If the hardware limit switch is reached during active homing, the axis brakes at the configured deceleration (not with the emergency deceleration) and reverses direction. The reference point switch is then sensed in reverse direction. If the direction reversal is not active and the axis reaches the hardware limit switch during active homing, the reference point approach is aborted with an error and the axis is braked at the emergency deceleration.
Approach direction (Active and passive homing)	With the direction selection, you determine the "approach direction" used during active homing to search for the reference point switch, as well as the homing direction. The homing direction specifies the travel direction the axis uses to approach the configured side of the reference point switch to carry out the homing operation.
Approach velocity (Active homing only)	Specify the velocity at which the reference point switch is to be searched for during the reference point approach. Limit values (independent of the selected user unit): Start/stop velocity ≤ approach velocity ≤ maximum velocity

Parameter	Description
Homing velocity (Active homing only)	Specify the velocity at which the axis approaches the reference point switch for homing. Limit values (independent of the selected user unit): Start/stop velocity ≤ homing velocity ≤ maximum velocity
Home position offset (Active homing only)	If the desired reference position deviates from the position of the reference point switch, the home position offset can be specified in this field. If the value does not equal 0, the axis executes the following actions following homing at the reference point switch: 1. Move the axis at homing velocity by the value of the home position offset. 2. When the position of the home position offset is reached, the axis position is set to the absolute reference position. The absolute reference position is specified via parameter "Position" of motion control instruction "MC_Home". Limit values (independent of the selected user unit): -1.0e12 ≤ home position offset ≤ 1.0e12

Table 10- 52 Factors that affect homing

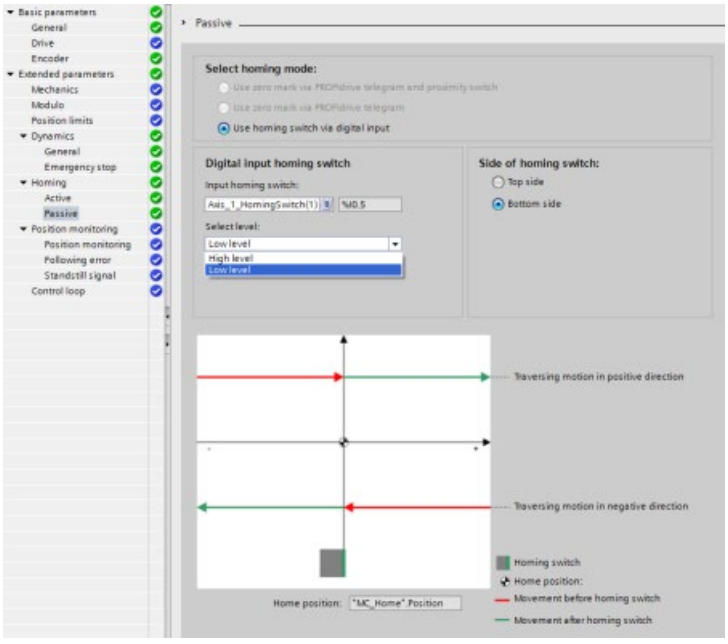
Influencing factors:			Result:
Configuration Approach direction	Configuration Reference point switch	Current travel direction	Homing on Reference point switch
Positive	"Bottom (negative) side"	Positive direction	Bottom
		Negative direction	Top
Positive	"Top (positive) side"	Positive direction	Top
		Negative direction	Bottom
Negative	"Bottom (negative) side"	Positive direction	Top
		Negative direction	Bottom
Negative	"Top (positive) side"	Positive direction	Bottom
		Negative direction	Top

Homing reference point switch level

In the axis configuration Homing dialog, Passive or Active, you configure your "Digital input homing switch". As part of this configuration, you can also change the levels (high or low) of the closed loop axes (PROFIdrive and analog) reference point switches. The default value is high level.

Example: Selecting the passive reference point switch level

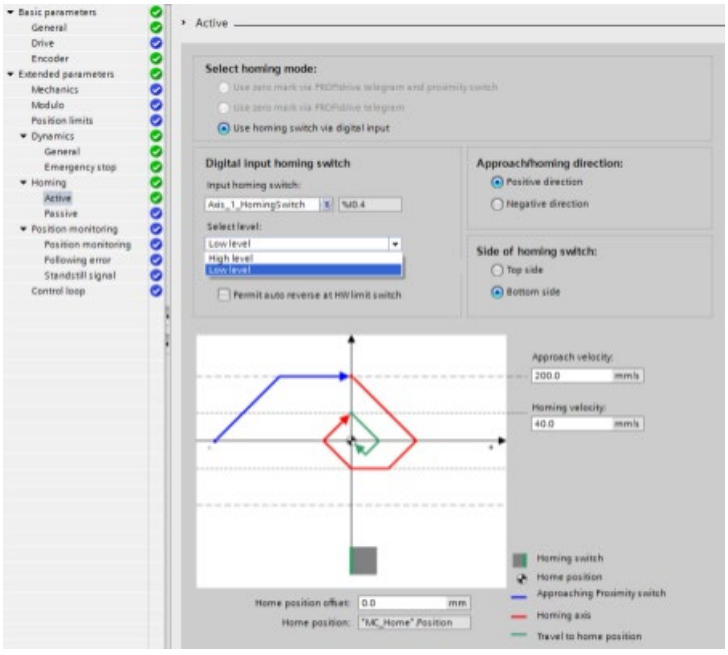
1. You have configured an S7-1200 project with an Analog/PROFIdrive axis using passive homing. Depending on your application, you select "High level" or "Low level" for the passive homing switch level:



2. The program executes a passive homing.
3. After finishing the passive homing, the axis is homed.

Example: Selecting the active reference point switch level

1. You have configured an S7-1200 project with an Analog/PROFIdrive axis using active homing. Depending on your application, you select "High level" or "Low level" for the active homing switch level:



2. The program executes an active homing.
3. After finishing the active homing, the axis is homed.

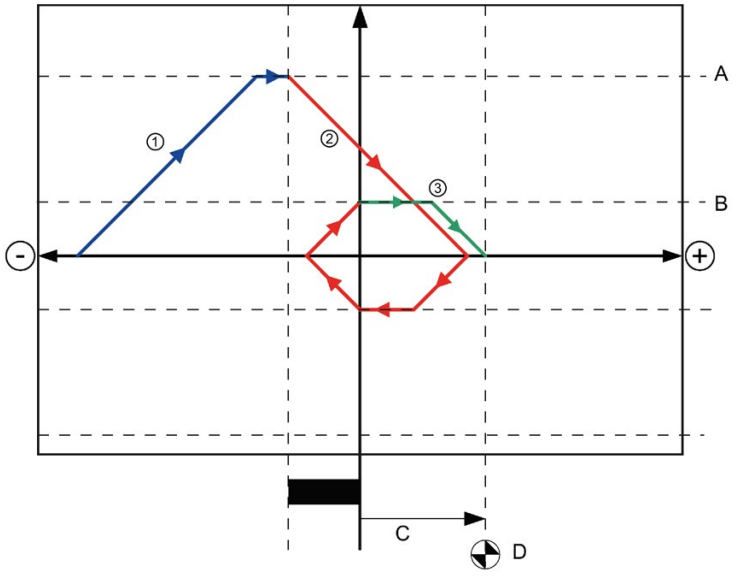
Sequence for active homing

You start active homing with motion control instruction "MC_Home" (input parameter Mode = 3). Input parameter "Position" specifies the absolute reference point coordinates in this case. Alternatively, you can start active homing on the control panel for test purposes.

The following diagram shows an example of a characteristic curve for an active reference point approach with the following configuration parameters:

- "Approach direction" = "Positive approach direction"
- "Reference point switch" = "Top (positive) side"
- Value of "home position offset" > 0

Table 10- 53 Velocity characteristics of MC homing

Operation	Notes	
	A	Approach velocity
	B	Homing velocity
	C	Home position coordinate
	D	Home position offset

①	Search phase (blue curve segment): When active homing starts, the axis accelerates to the configured "approach velocity" and searches at this velocity for the reference point switch.
②	Reference point approach (red curve section): When the reference point switch is detected, the axis in this example brakes and reverses, to be homed on the configured side of the reference point switch at the configured "homing velocity".
③	Travel to reference point position (green curve segment): After homing at the reference point switch, the axis travels to the "Reference point coordinates" at the "homing velocity". On reaching the "Reference point coordinates", the axis is stopped at the position value that was specified in the Position input parameter of the MC_Home instruction".

Note

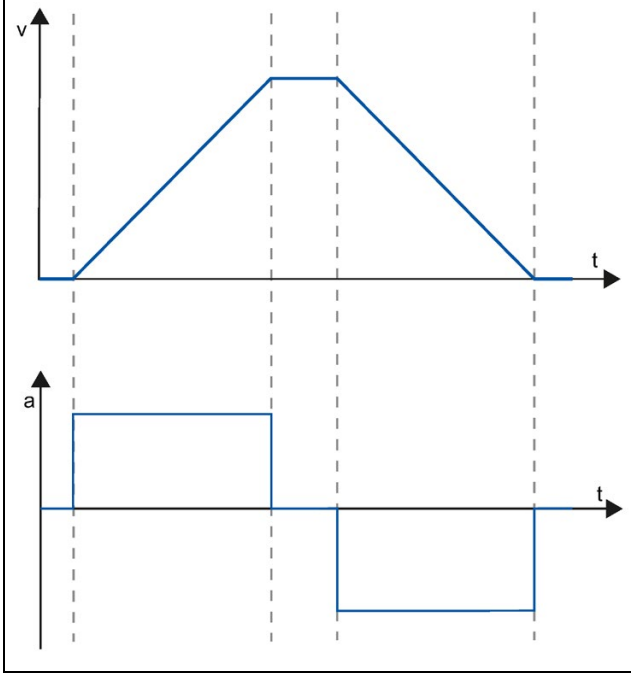
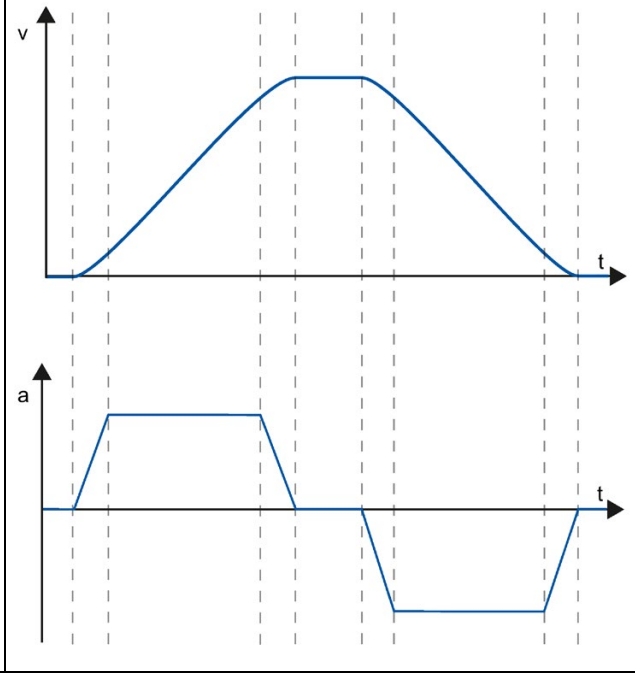
If the homing search does not function as you expected, check the inputs assigned to the hardware limits or to the reference point. These inputs may have had their edge interrupts disabled in device configuration.

Examine the configuration data for the axis technology object of concern to see which inputs (if any) are assigned for "HW Low Limit Switch Input", "HW High Limit Switch Input", and "Input reference point switch". Then open the Device configuration for the CPU and examine each of the assigned inputs. Verify the "Enable rising edge detection" and "Enable falling edge detection" are both selected. If these properties are not selected, delete the specified inputs in the axis configuration and select them again.

10.3.6.4 Jerk limit

With the jerk limit you can reduce the stresses on your mechanics during an acceleration and deceleration ramp. The value for the acceleration and deceleration is not changed abruptly when the step limiter is active; it is adapted in a transition phase. The figure below shows the velocity and acceleration curve without and with jerk limit.

Table 10- 54 Jerk limit

Travel without step limiter	Travel with step limiter
	

The jerk limit gives a "smoothed" velocity profile of the axis motion. This ensures soft starting and braking of a conveyor belt for example.

10.3.7 Motion control instructions

10.3.7.1 MC instruction overview

The motion control instructions use an associated technology data block and the dedicated PTO (pulse train outputs) of the CPU to control the motion on an axis.

- MC_Power (Page 716) enables and disables a motion control axis.
- MC_Reset (Page 719) resets all motion control errors. All motion control errors that can be acknowledged are acknowledged.
- MC_Home (Page 720) establishes the relationship between the axis control program and the axis mechanical positioning system.
- MC_Halt (Page 723) cancels all motion processes and causes the axis motion to stop. The stop position is not defined.
- MC_MoveAbsolute (Page 725) starts motion to an absolute position. The job ends when the target position is reached.
- MC_MoveRelative (Page 728) starts a positioning motion relative to the start position.
- MC_MoveVelocity (Page 730) causes the axis to travel with the specified speed.
- MC_MoveJog (Page 732) executes jog mode for testing and startup purposes.
- MC_CommandTable (Page 734) runs axis commands as a movement sequence.
- MC_ChangeDynamic (Page 737) changes Dynamics settings for the axis.
- MC_WriteParam (Page 739) writes a select number of parameters to change the functionality of the axis from the user program.
- MC_ReadParam (Page 741) reads a select number of parameters that indicate the current position, velocity, and so forth of the axis defined in the Axis input.

CPU firmware levels

If you have an S7-1200 CPU with V4.1 or later firmware, select the V5.0 version of each motion instruction.

If you have an S7-1200 CPU with V4.0 or earlier firmware, select the applicable V4.0, V3.0, V2.0, or V1.0 version of each motion instruction.

Note

Instructions in motion control V1.0 to V3.0 actively control the ENO output of the instruction. When an error occurs within the block, the ENO output is turned to the OFF state. An error is indicated by the ERROR, ErrorID, and ErrorInfo outputs on the block. Using the ENO output, it is possible to evaluate the status of the instruction and execute subsequent instructions after it in a serial manner.

With instructions in motion control V4.0 and V5.0, the ENO output stays true as long as the instruction executes regardless of its error state. This could cause a program that used V3.0 or earlier motion control that depends on the ENO status to function incorrectly. To remedy this situation, use the DONE and ERROR outputs to evaluate the status of the instruction rather than the ENO output when using motion control V4.0 or later.

Note

The CPU calculates motion tasks in "slices" or segments of 10 ms. As one slice is being executed, the next slice is waiting in the queue to be executed. If you interrupt the motion task on an axis (by executing another new motion task for that axis), the new motion task cannot be executed for a maximum of 20 ms (the remainder of the current slice plus the queued slice).

10.3.7.2 MC_Power (Release/block axis)

Note

If the axis is switched off due to an error, it will be enabled again automatically after the error has been eliminated and acknowledged. This requires that the Enable input parameter has retained the value TRUE during this process.

Table 10- 55 MC_Power instruction

LAD / FBD	SCL	Description

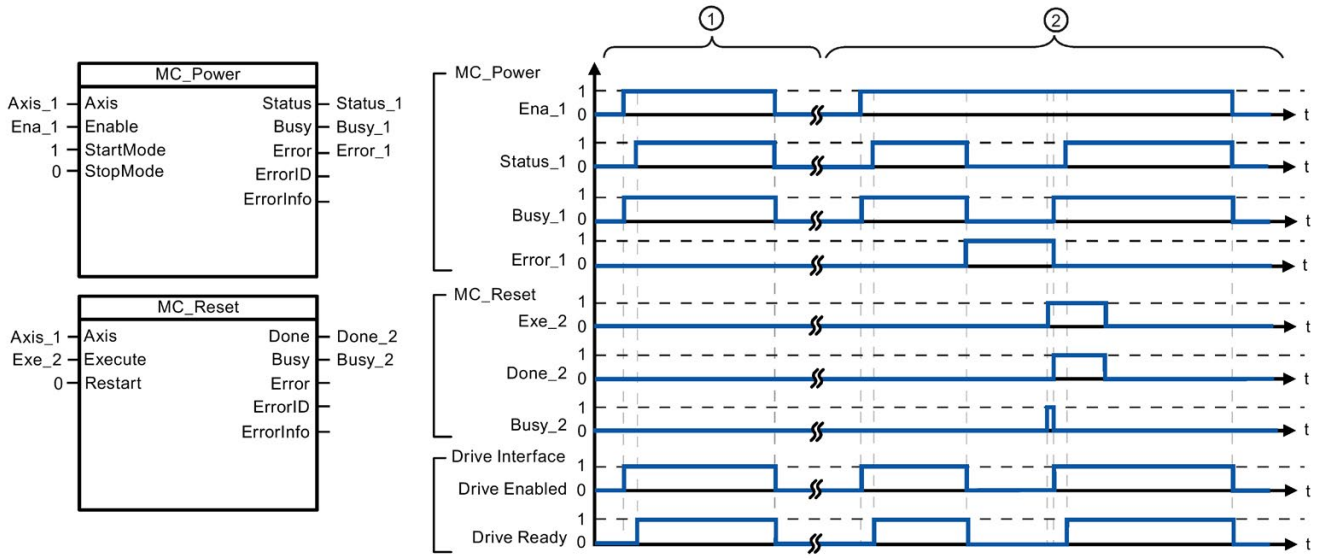
	`"MC_Power_DB"(`
	`Axis:=_multi_fb_in_,`
	`Enable:=_bool_in_,`
	`StartMode:=_int_in_,`
	`StopMode:=_int_in_,`
	`Status=>_bool_out_,`
	`Busy=>_bool_out_,`
	`Error=>_bool_out_,`
	`ErrorID=>_word_out_,`
	`ErrorIn-`
	`fo=>_word_out_);`
		The MC_Power motion control instruction enables or disables an axis. Before you can enable or disable the axis, ensure the following conditions:
		• The technology object has been configured correctly.
		• There is no pending enable-inhibiting error.
		The execution of MC_Power cannot be aborted by a motion control task. Disabling the axis (input parameter Enable = FALSE) aborts all motion control tasks for the associated technology object.

[1] STEP 7 automatically creates the DB when you insert the instruction.

[2] In the SCL example, "MC_Power_DB" is the name of the instance DB.

Table 10- 56 Parameters for the MC_Power instruction

Parameter and type		Data type	Description
Axis	IN_OUT	TO_Axis	Axis technology object
Enable	IN	Bool	• FALSE (default): All active tasks are aborted according to the parameterized "StopMode" and the axis is stopped. • TRUE: Motion control attempts to enable the axis.
StartMode	IN	Int	• 0: Speed controlled Note: The StartMode parameter is only evaluated during edge detection (false to true). • 1: Position controlled (default)
StopMode	IN	Int	• 0: Emergency stop: If a request to disable the axis is pending, the axis brakes at the configured emergency deceleration. The axis is disabled after reaching standstill. • 1: Immediate stop: If a request to disable the axis is pending, this axis is disabled without deceleration. Pulse output is stopped immediately. • 2: Emergency stop with jerk control: If a request to disable the axis is pending, the axis brakes at the configured emergency stop deceleration. If the jerk control is activated, the configured jerk is taken into account. The axis is disabled after reaching standstill.
Status	OUT	Bool	Status of axis enable: • FALSE: The axis is disabled: – The axis does not execute motion control tasks and does not accept any new tasks (exception: MC_Reset task). – The axis is not homed. – Upon disabling, the status does not change to FALSE until the axis reaches a standstill. • TRUE: The axis is enabled: – The axis is ready to execute motion control tasks. – Upon axis enabling, the status does not change to TRUE until the signal "Drive ready" is pending. If the "Drive ready" drive interface was not configured in the axis configuration, the status changes to TRUE immediately.
Busy	OUT	Bool	FALSE: MC_Power is not active. TRUE: MC_Power is active.
Error	OUT	Bool	FALSE: No error TRUE: An error has occurred in motion control instruction "MC_Power" or in the associated technology object. The cause of the error can be found in parameters "ErrorID" and "ErrorInfo".
ErrorID	OUT	Word	Error ID for parameter "Error""
ErrorInfo	OUT	Word	Error info ID for parameter "ErrorID"



① An axis is enabled and then disabled again. After the drive has signaled "Drive ready" back to the CPU, the successful enable can be read out via "Status_1".

② Following an axis enable, an error has occurred that caused the axis to be disabled. The error is eliminated and acknowledged with "MC_Reset". The axis is then enabled again.

To enable an axis with configured drive interface, follow these steps:

1. Check the requirements indicated above.
2. Initialize input parameter "StopMode" with the desired value. Set input parameter "Enable" to TRUE.

   The enable output for "Drive enabled" changes to TRUE to enable the power to the drive. The CPU waits for the "Drive ready" signal of the drive.

   When the "Drive ready" signal is available at the configured ready input of the CPU, the axis becomes enabled. Output parameter "Status" and technology object tag <Axis name>.StatusBits.Enable indicates the value TRUE.

To enable an axis without configured drive interface, follow these steps:

1. Check the requirements indicated above.
2. Initialize input parameter "StopMode" with the desired value. Set input parameter "Enable" to TRUE. The axis is enabled. Output parameter "Status" and technology object tag <Axis name>.StatusBits.Enable indicate the value TRUE.

To disable an axis, follow these steps:

1. Bring the axis to a standstill.

   You can identify when the axis is at a standstill in technology object tag <Axis name>.StatusBits.StandStill.
2. Set input parameter "Enable" to FALSE after standstill is reached.
3. If output parameters "Busy" and "Status" and technology object tag <Axis name>.StatusBits.Enable indicate the value FALSE, disabling of the axis is complete.

10.3.7.3 MC_Reset (Confirm error)

Table 10- 57 MC_Reset instruction

LAD / FBD	SCL	Description

	`"MC_Reset_DB"(`
	`Axis:=_multi_fb_in_,`
	`Execute:=_bool_in_,`
	`Restart:=_bool_in_,`
	`Done=>_bool_out_,`
	`Busy=>_bool_out_,`
	`Error=>_bool_out_,`
	`ErrorID=>_word_out_,`
	`ErrorInfo=>_word_out_);`
		Use the MC_Reset instruction to acknowledge "Operating error with axis stop" and "Configuration error". The errors that require acknowledgement can be found in the "List of ErrorIDs and ErrorInfos" under "Remedy".
		Before using the MC_Reset instruction, you must have eliminated the cause of a pending configuration error requiring acknowledgement (for example, by changing an invalid acceleration value in "Axis" technology object to a valid value).
		As of V3.0 and later, the Restart command allows the axis configuration to be downloaded to the work memory in the RUN operating mode.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_Reset_DB" is the name of the instance DB.

The MC_Reset task cannot be aborted by any other motion control task. The new MC_Reset task does not abort any other active motion control tasks.

Table 10- 58 Parameters of the MC_Reset instruction

Parameter and type		Data type	Description
Axis	IN	TO_Axis_1	Axis technology object
Execute	IN	Bool	Start of the task with a positive edge
Restart	IN	Bool	TRUE = Download the axis configuration from the load memory to the work memory. The command can only be executed when the axis is disabled.
			FALSE = Acknowledges pending errors
Done	OUT	Bool	TRUE = Error has been acknowledged.
Busy	OUT	Bool	TRUE = The task is being executed.
Error	OUT	Bool	TRUE = An error has occurred during execution of the task. The cause of the error can be found in parameters "ErrorID" and "ErrorInfo".
ErrorID	OUTP	Word	Error ID for parameter "Error""
ErrorInfo	OUT	Word	Error info ID for parameter "ErrorID"

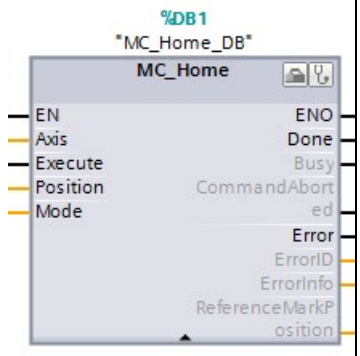
To acknowledge an error with MC_Reset, follow these steps:

1. Check the requirements indicated above.
2. Start the acknowledgement of the error with a rising edge at the Execute input parameter.
3. The error has been acknowledged when Done equals TRUE and the technology object tag <Axis name>.StatusBits.Error equals FALSE.

10.3.7.4 MC_Home (Home axis)

Table 10- 59 MC_Home instruction

LAD / FBD	SCL	Description

	`"MC_Home_DB"(`
	`Axis:=_multi_fb_in_,`
	`Execute:=_bool_in_,`
	`Position:=_real_in_,`
	`Mode:=_int_in_,`
	`Done=>_bool_out_,`
	`Busy=>_bool_out_,`
	`CommandAborted=>_bool_out_,`
	`Error=>_bool_out_,`
	`ErrorID=>_word_out_,`
	`ErrorInfo=>_word_out_,`
	`ReferenceMarkPosi-`
	`tion=>_real_out_);`
		Use the MC_Home instruction to match the axis coordinates to the real, physical drive position. Homing is required for absolute positioning of the axis:
		In order to use the MC_Home instruction, the axis must first be enabled.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_Home_DB" is the name of the instance DB.

The following types of homing are available:

- Direct homing absolute (Mode = 0): The current axis position is set to the value of parameter "Position".
- Direct homing relative (Mode = 1): The current axis position is offset by the value of parameter "Position".
- Passive homing (Mode = 2): During passive homing, the MC_Home instruction does not carry out any homing motion. The traversing motion required for this step must be implemented by the user via other motion control instructions. When the reference point switch is detected, the axis is homed.
- Active homing (Mode = 3): The homing procedure is executed automatically.
- Absolute encoder adjustment (relative) (Mode = 6): The current position is shifted by the value of the parameter "MC_Home.Position".
- Absolute encoder adjustment (absolute) (Mode = 7): The current position is set to the value of the parameter "MC_Home.Position".

Table 10- 60 Parameters for the MC_Home instruction

Parameter and type		Data type	Description
Axis	IN_OUT	TO_Axis	Axis technology object
Execute	IN	Bool	Start of the task with a positive edge
Position	IN	Real	• Mode = 0, 2, and 3 (Absolute position of axis after completion of the homing operation) • Mode = 1 (Correction value for the current axis position) • Mode = 6 (The current position is shifted by the value of the parameter "MC_Home.Position".) • Mode = 7 (The current position is set to the value of the parameter "MC_Home.Position".) Limit values: $-1.0e^{12} \leq$ Position $\leq 1.0e^{12}$
Mode	IN	Int	Homing mode: • 0: Direct homing absolute New axis position is the position value of parameter "Position". • 1: Direct homing relative New axis position is the current axis position + position value of parameter "Position". • 2: Passive homing Homing according to the axis configuration. Following homing, the value of parameter "Position" is set as the new axis position. • 3: Active homing Reference point approach in accordance with the axis configuration. Following homing, the value of parameter "Position" is set as the new axis position. • 6: The current position is shifted by the value of the parameter "MC_Home.Position". The calculated absolute value offset is stored retentively in the CPU. (<Axis name>.StatusSensor.AbsEncoderOffset) • 7: The current position is set to the value of the parameter "MC_Home.Position". The calculated absolute value offset is stored retentively in the CPU. (<Axis name>.StatusSensor.AbsEncoderOffset)
Done	OUT	Bool	TRUE = Task completed
Busy	OUT	Bool	TRUE = The task is being executed.
CommandAborted	OUT	Bool	TRUE = During execution, the task was aborted by another task.
Error	OUT	Bool	TRUE = An error has occurred during execution of the task. The cause of the error can be found in parameters "ErrorID" and "ErrorInfo".
ErrorID	OUT	Word	Error ID for parameter "Error""

Parameter and type		Data type	Description
ErrorInfo	OUT	Word	Error info ID for parameter "ErrorID"
ReferenceMarkPosition	OUT	Real	Position of the axis at the reference mark in the previous coordinate system.

"ReferenceMarkPosition" output parameter: The homing function saves the old position before execution and provides this value in the ReferenceMarkPosition output parameter. The output displays the following values during the different homing modes:

- Active/Passive homing: Displays the position of the axis at the zero/reference mark of the previous coordinate system during and after active/passive homing.
- Absolute encoder adjustment: Displays the previous axis position during and after absolute encoder adjustment.
- Direct homing: Displays the previous axis position during and after direct homing.

During homing, motion control sets the axis position to the new value of input "MC_Home.Position". The values of "MC_Home.ReferenceMarkPosition" are valid when "MC_Home.Done" = TRUE.

Note

Axis homing is lost under the following conditions

- Disabling of axis by the MC_Power instruction
- Switchover between automatic control and manual control
- Upon start of active homing (After successful completion of the homing operation, axis homing is available again.)
- After power-cycling the CPU
- After CPU restart (RUN-to-STOP or STOP-to-RUN)

To home the axis, follow these steps:

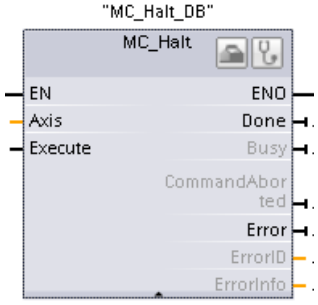
1. Check the requirements indicated above.
2. Initialize the necessary input parameters with values, and start the homing operation with a rising edge at input parameter "Execute".
3. If output parameter "Done" and technology object tag <Axis name>.StatusBits.HomingDone indicate the value TRUE, homing is complete.

Table 10- 61 Override response

Mode	Description	
0 or 1	The MC_Home task cannot be aborted by any other motion control task. The new MC_Home task does not abort any active motion control tasks. Position-related motion tasks are resumed after homing according to the new homing position (value at the Position input parameter).	
2	The MC_Home task can be aborted by the following motion control tasks: MC_Home task Mode = 2, 3: The new MC_Home task aborts the following active motion control task. MC_Home task Mode = 2: Position-related motion tasks are resumed after homing according to the new homing position (value at the Position input parameter).	
3	The MC_Home task can be aborted by the following motion control tasks: • MC_Home Mode = 3 • MC_Halt • MC_MoveAbsolute • MC_MoveRelative • MC_MoveVelocity • MC_MoveJog	The new MC_Home task aborts the following active motion control tasks: • MC_Home Mode = 2, 3 • MC_Halt • MC_MoveAbsolute • MC_MoveRelative • MC_MoveVelocity • MC_MoveJog

10.3.7.5 MC_Halt (Pause axis)

Table 10- 62 MC_Halt instruction

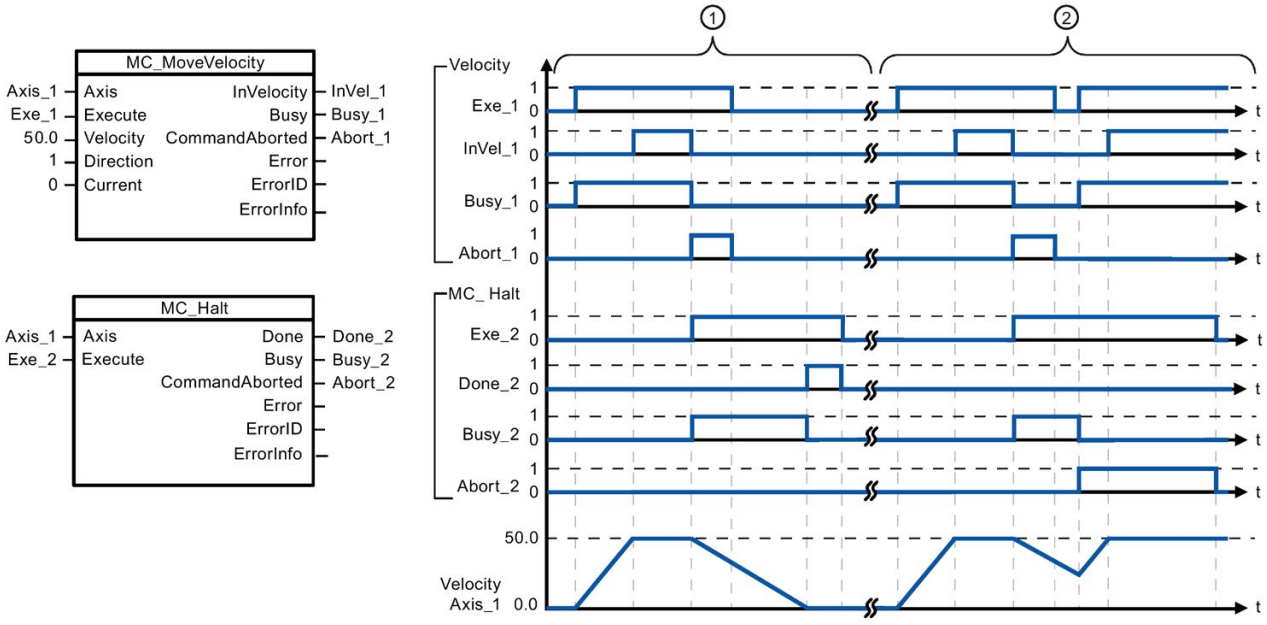
LAD / FBD	SCL	Description
	"MC_Halt_DB"(Axis:=_multi_fb_in_, Execute:=_bool_in_, Done=>_bool_out_, Busy=>_bool_out_, CommandAborted=>_bool_out_, Error=>_bool_out_, ErrorID=>_word_out_, ErrorInfo=>_word_out_);	Use the MC_Halt instruction to stop all motion and to bring the axis to a stand-still. The stand-still position is not defined. In order to use the MC_Halt instruction, the axis must first be enabled.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_Halt_DB" is the name of the instance DB.

Table 10- 63 Parameters for the MC_Halt instruction

Parameter and type		Data type	Description
Axis	IN	TO_Axis_1	Axis technology object
Execute	IN	Bool	Start of the task with a positive edge
Done	OUT	Bool	TRUE = Zero velocity reached
Busy	OUT	Bool	TRUE = The task is being executed.
CommandAborted	OUT	Bool	TRUE = During execution the task was aborted by another task.
Error	OUT	Bool	TRUE = An error has occurred during execution of the task. The cause of the error can be found in parameters "ErrorID" and "ErrorInfo".
ErrorID	OUT	Word	Error ID for parameter "Error"
ErrorInfo	OUT	Word	Error info ID for parameter "ErrorID"



The following values were configured in the "Dynamics > General" configuration window: Acceleration = 10.0 and Deceleration = 5.0

① The axis is braked by an MC_Halt task until it comes to a standstill. The axis standstill is signaled via "Done_2".

② While an MC_Halt task is braking the axis, this task is aborted by another motion task. The abort is signaled via "Abort_2".

Override response

The MC_Halt task can be aborted by the following motion control tasks:

- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog

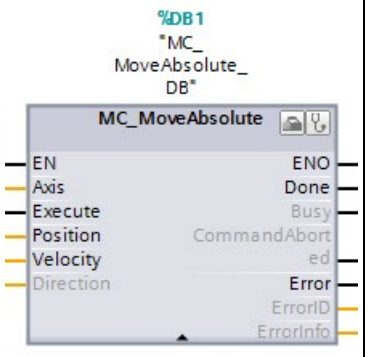
The new MC_Halt task aborts the following active motion control tasks:

- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog

10.3.7.6 MC_MoveAbsolute (Position axis absolutely)

Table 10- 64 MC_MoveAbsolute instruction

LAD / FBD	SCL	Description

	`"MC_MoveAbsolute_DB"(`
	`  Axis:=_multi_fb_in_,`
	`  Execute:=_bool_in_,`
	`  Position:=_real_in_,`
	`  Velocity:=_real_in_,`
	`  Direction:=_int_in_,`
	`  Done=>_bool_out_,`
	`  Busy=>_bool_out_,`
	`  CommandAborted=>_bool_out_,`
	`  Error=>_bool_out_,`
	`  ErrorID=>_word_out_,`
	`  ErrorInfo=>_word_out_);`
		Use the MC_MoveAbsolute instruction to start a positioning motion of the axis to an absolute position.
		In order to use the MC_MoveAbsolute instruction, the axis must first be enabled and also must be homed.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_MoveAbsolute_DB" is the name of the instance DB.

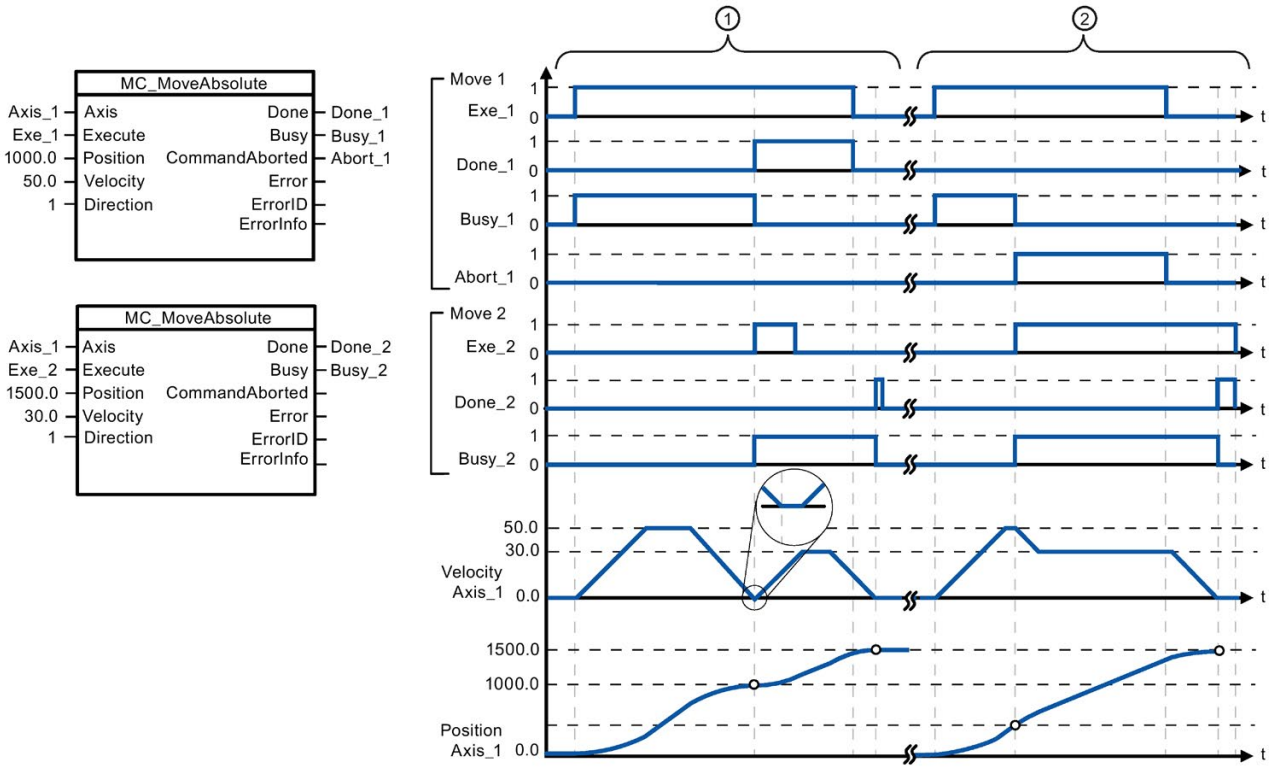
Table 10- 65 Parameters for the MC_MoveAbsolute instruction

Parameter and type		Data type	Description
Axis	IN	TO_Axis_1	Axis technology object
Execute	IN	Bool	Start of the task with a positive edge (Default value: False)
Position	IN	Real	Absolute target position (Default value: 0.0) Limit values: $-1.0e^{12} \leq$ Position $\leq 1.0e^{12}$
Velocity	IN	Real	Velocity of axis (Default value: 10.0) This velocity is not always reached because of the configured acceleration and deceleration and the target position to be approached. Limit values: Start/stop velocity ≤ Velocity ≤ maximum velocity
Direction	IN	Int	Direction of rotation (Default value: 0)
Done	OUT	Bool	TRUE = Absolute target position reached
Busy	OUT	Bool	TRUE = The task is being executed.
CommandAborted	OUT	Bool	TRUE = During execution the task was aborted by another task.
Error	OUT	Bool	TRUE = An error has occurred during execution of the task. The cause of the error can be found in parameters "ErrorID" and "ErrorInfo".
ErrorID	OUT	Word	Error ID for parameter "Error" (Default value: 0000)
ErrorInfo	OUT	Word	Error info ID for parameter "ErrorID" (Default value: 0000)

You can configure the positioning axis as a Modulo axis. When using a modulo axis, you can select the motion direction with the "Direction" input parameter. Motion control ignores the "Direction" input if the axis is not a Modulo axis.

The following table shows the valid values for the Direction input:

Value	Enumeration	Comment
0	SIGN_OF_VELOCITY	Sign of velocity defines the motion direction
1	POSITIVE	Motion with positive velocity
2	NEGATIVE	Motion with negative velocity
3	SHORTEST_WAY	Motion with shortest distance to the destination



The following values were configured in the "Dynamics > General" configuration window: Acceleration = 10.0 and Deceleration = 10.0

① An axis is moved to absolute position 1000.0 with a MC_MoveAbsolute task. When the axis reaches the target position, this is signaled via "Done_1". When "Done_1" = TRUE, another MC_MoveAbsolute task, with target position 1500.0, is started. Because of the response times (e.g., cycle time of user program, etc.), the axis comes to a standstill briefly (see zoomed-in detail). When the axis reaches the new target position, this is signaled via "Done_2".

② An active MC_MoveAbsolute task is aborted by another MC_MoveAbsolute task. The abort is signaled via "Abort_1". The axis is then moved at the new velocity to the new target position 1500.0. When the new target position is reached, this is signaled via "Done_2".

Override response

The MC_MoveAbsolute task can be aborted by the following motion control tasks:

- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog

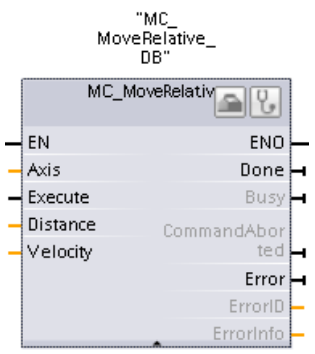
The new MC_MoveAbsolute task aborts the following active motion control tasks:

- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog

10.3.7.7 MC_MoveRelative (Position axis relatively)

Table 10- 66 MC_MoveRelative instruction

LAD / FBD	SCL	Description

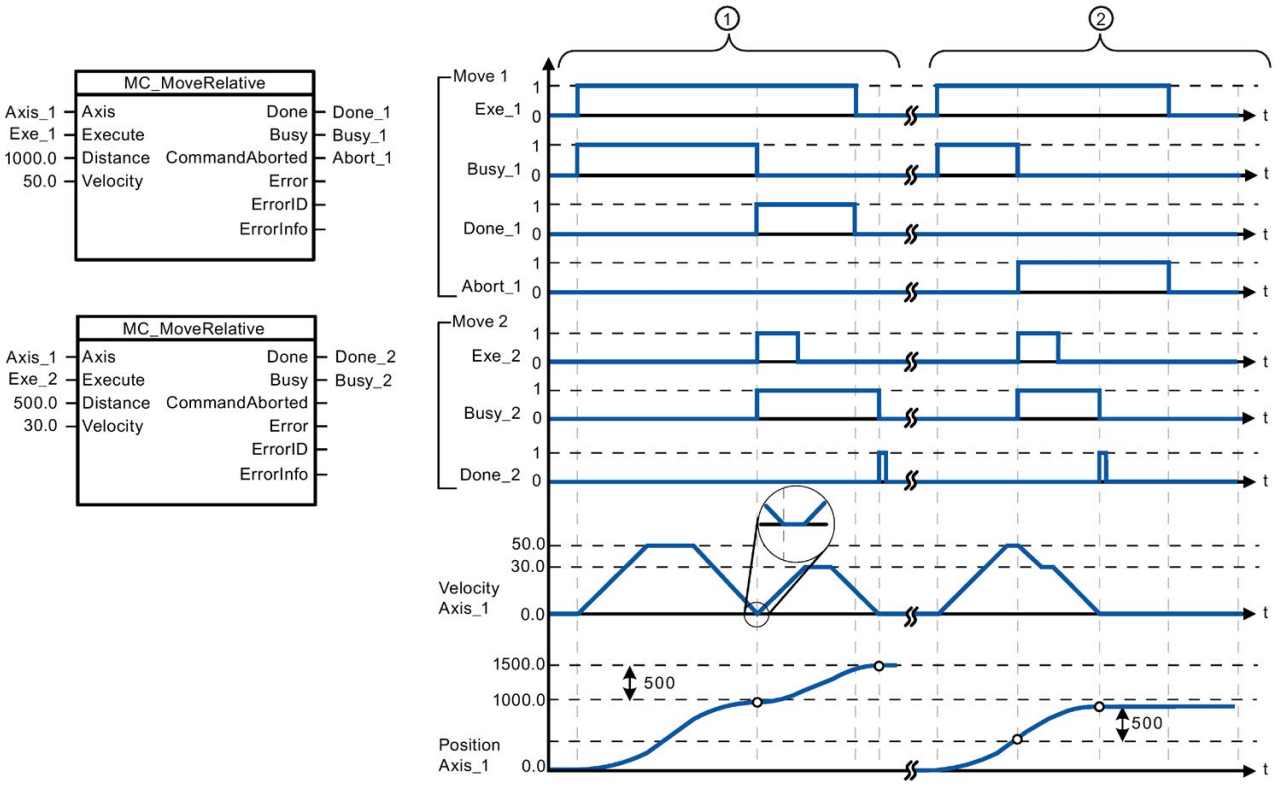
	`"MC_MoveRelative_DB"(`
	`Axis:=_multi_fb_in_,`
	`Execute:=_bool_in_,`
	`Distance:=_real_in_,`
	`Velocity:=_real_in_,`
	`Done=>_bool_out_,`
	`Busy=>_bool_out_,`
	`CommandAborted=>_bool_out_,`
	`Error=>_bool_out_,`
	`ErrorID=>_word_out_,`
	`ErrorInfo=>_word_out_);`
		Use the MC_MoveRelative instruction to start a positioning motion relative to the start position.
		In order to use the MC_MoveRelative instruction, the axis must first be enabled.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_MoveRelative_DB " is the name of the instance DB.

Table 10- 67 Parameters for the MC_MoveRelative instruction

Parameter and type		Data type	Description
Axis	IN	TO_Axis_1	Axis technology object
Execute	IN	Bool	Start of the task with a positive edge (Default value: False)
Distance	IN	Real	Travel distance for the positioning operation (Default value: 0.0) Limit values: $-1.0e^{12} \leq$ Distance $\leq 1.0e^{12}$
Velocity	IN	Real	Velocity of axis (Default value: 10.0) This velocity is not always reached on account of the configured acceleration and deceleration and the distance to be traveled. Limit values: Start/stop velocity ≤ Velocity ≤ maximum velocity
Done	OUT	Bool	TRUE = Target position reached
Busy	OUT	Bool	TRUE = The task is being executed.
CommandAborted	OUT	Bool	TRUE = During execution the task was aborted by another task.
Error	OUT	Bool	TRUE = An error has occurred during execution of the task. The cause of the error can be found in parameters "ErrorID" and "ErrorInfo".
ErrorID	OUT	Word	Error ID for parameter "Error" (Default value: 0000)
ErrorInfo	OUT	Word	Error info ID for parameter "ErrorID" (Default value: 0000)



The following values were configured in the "Dynamics > General" configuration window: Acceleration = 10.0 and Deceleration = 10.0

① The axis is moved by an MC_MoveRelative task by the distance ("Distance") 1000.0. When the axis reaches the target position, this is signaled via "Done_1". When "Done_1" = TRUE, another MC_MoveRelative task, with travel distance 500.0, is started. Because of the response times (for example, cycle time of user program), the axis comes to a standstill briefly (see zoomed-in detail). When the axis reaches the new target position, this is signaled via "Done_2".

② An active MC_MoveRelative task is aborted by another MC_MoveRelative task. The abort is signaled via "Abort_1". The axis is then moved at the new velocity by the new distance ("Distance") 500.0. When the new target position is reached, this is signaled via "Done_2".

Override response

The MC_MoveRelative task can be aborted by the following motion control tasks:

- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog

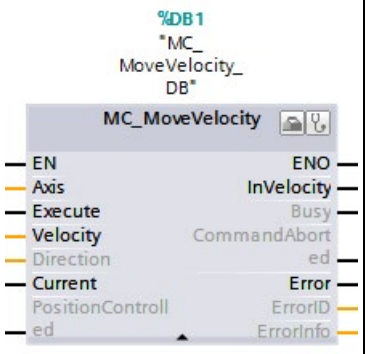
The new MC_MoveRelative task aborts the following active motion control tasks:

- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog

10.3.7.8 MC_MoveVelocity (Move axis at predefined velocity)

Table 10- 68 MC_MoveVelocity instruction

LAD / FBD	SCL	Description

	`"MC_MoveVelocity_DB"(`
	`Axis:=_multi_fb_in_,`
	`Execute:=_bool_in_,`
	`Velocity:=_real_in_,`
	`Direction:=_int_in_,`
	`Current:=_bool_in_,`
	`PositionControlled:=_bool_in_,`
	`InVelocity=>_bool_out_,`
	`Busy=>_bool_out_,`
	`CommandAborted=>_bool_out_,`
	`Error=>_bool_out_,`
	`ErrorID=>_word_out_,`
	`ErrorInfo=>_word_out_);`
		Use the MC_MoveVelocity instruction to move the axis constantly at the specified velocity.
		In order to use the MC_MoveVelocity instruction, the axis must first be enabled.

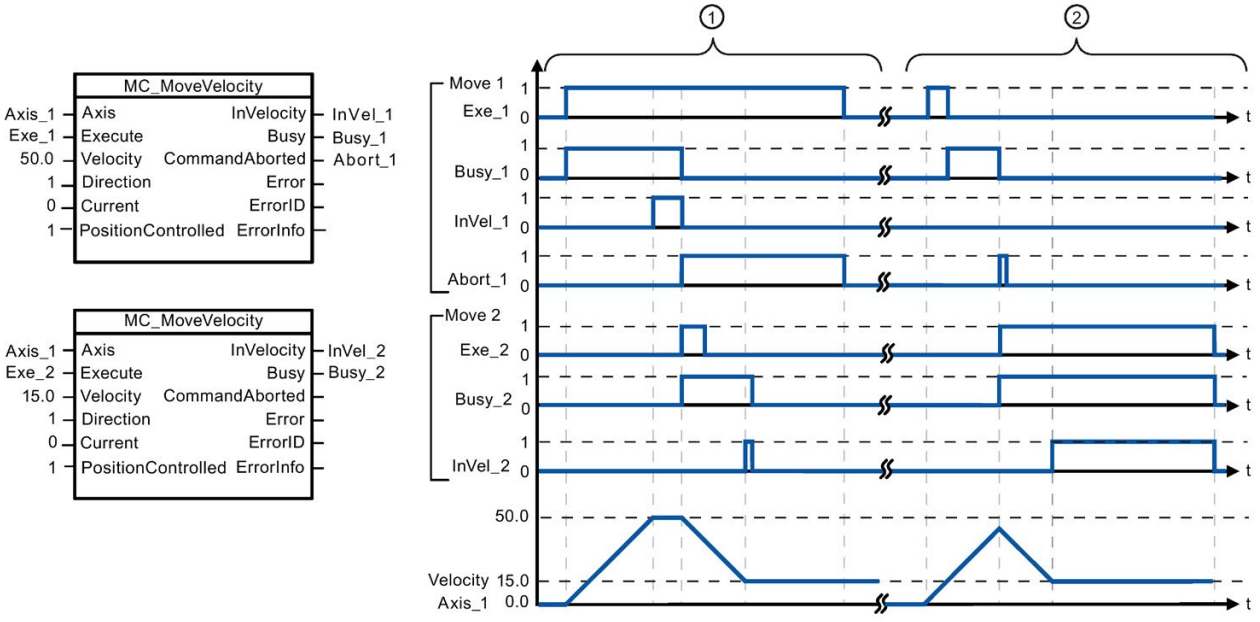
1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_MoveVelocity_DB " is the name of the instance DB.

Table 10- 69 Parameters for the MC_MoveVelocity instruction

Parameter and type		Data type	Description
Axis	IN	TO_SpeedAxis	Axis technology object
Execute	IN	Bool	Start of the task with a positive edge (Default value: False)
Velocity	IN	Real	Velocity specification for axis motion (Default value: 100.0) Limit values: Start/stop velocity ≤ |Velocity| ≤ maximum velocity (Velocity = 0.0 is allowed)
Direction	IN	Int	Direction specification: • 0: Direction of rotation corresponds to the sign of the value in parameter "Velocity" (Default value) • 1: Positive direction of rotation (The sign of the value in parameter "Velocity" is ignored.) • 2: Negative direction of rotation (The sign of the value in parameter "Velocity" is ignored.)
Current	IN	Bool	Maintain current velocity: • FALSE: "Maintain current velocity" is deactivated. The values of parameters "Velocity" and "Direction" are used. (Default value) • TRUE: "Maintain current velocity" is activated. The values in parameters "Velocity" and "Direction" are not taken into account. When the axis resumes motion at the current velocity, the "InVelocity" parameter returns the value TRUE.

Parameter and type		Data type	Description
PositionControlled	IN	Bool	• 0: speed controlled • 1: position controlled (Default value: True)
InVelocity	OUT	Bool	TRUE: • If "Current" = FALSE: The velocity specified in parameter "Velocity" was reached. • If "Current" = TRUE: The axis travels at the current velocity at the start time.
Busy	OUT	Bool	TRUE = The task is being executed.
CommandAborted	OUT	Bool	TRUE = During execution the task was aborted by another task.
Error	OUT	Bool	TRUE = An error has occurred during execution of the task. The cause of the error can be found in parameters "ErrorID" and "ErrorInfo".
ErrorID	OUT	Word	Error ID for parameter "Error" (Default value: 0000)
ErrorInfo	OUT	Word	Error info ID for parameter "ErrorID" (Default value: 0000)



The following values were configured in the "Dynamics > General" configuration window: Acceleration = 10.0 and Deceleration = 10.0

① An active MC_MoveVelocity task signals via "InVel_1" that its target velocity has been reached. It is then aborted by another MC_MoveVelocity task. The abort is signaled via "Abort_1". When the new target velocity 15.0 is reached, this is signaled via "InVel_2". The axis then continues moving at the new constant velocity.

② An active MC_MoveVelocity task is aborted by another MC_MoveVelocity task prior to reaching its target velocity. The abort is signaled via "Abort_1". When the new target velocity 15.0 is reached, this is signaled via "InVel_2". The axis then continues moving at the new constant velocity.

Override response

The MC_MoveVelocity task can be aborted by the following motion control tasks:

- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog

The new MC_MoveVelocity task aborts the following active motion control tasks:

- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog

Note

Behavior with zero set velocity (Velocity = 0.0)

An MC_MoveVelocity task with "Velocity" = 0.0 (such as an MC_Halt task) aborts active motion tasks and stops the axis with the configured deceleration. When the axis comes to a standstill, output parameter "InVelocity" indicates TRUE for at least one program cycle.

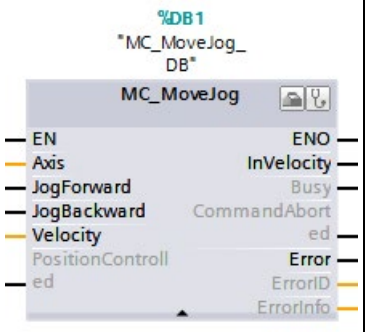
"Busy" indicates the value TRUE during the deceleration operation and changes to FALSE together with "InVelocity". If parameter "Execute" = TRUE is set, "InVelocity" and "Busy" are latched.

When the MC_MoveVelocity task is started, status bit "SpeedCommand" is set in the technology object. Status bit "ConstantVelocity" is set upon axis standstill. Both bits are adapted to the new situation when a new motion task is started.

10.3.7.9 MC_MoveJog (Move axis in jog mode)

Table 10- 70 MC_MoveJog instruction

LAD / FBD	SCL	Description

	`"MC_MoveJog_DB"(`
	`Axis:=_multi_fb_in_,`
	`JogForward:=_bool_in_,`
	`JogBackward:=_bool_in_,`
	`Velocity:=_real_in_,`
	`PositionControlled:=_bool_in_,`
	`InVelocity=>_bool_out_,`
	`Busy=>_bool_out_,`
	`CommandAborted=>_bool_out_,`
	`Error=>_bool_out_,`
	`ErrorID=>_word_out_,`
	`ErrorInfo=>_word_out_);`
		Use the MC_MoveJog instruction to move the axis constantly at the specified velocity in jog mode. This instruction is typically used for testing and commissioning purposes.
		In order to use the MC_MoveJog instruction, the axis must first be enabled.

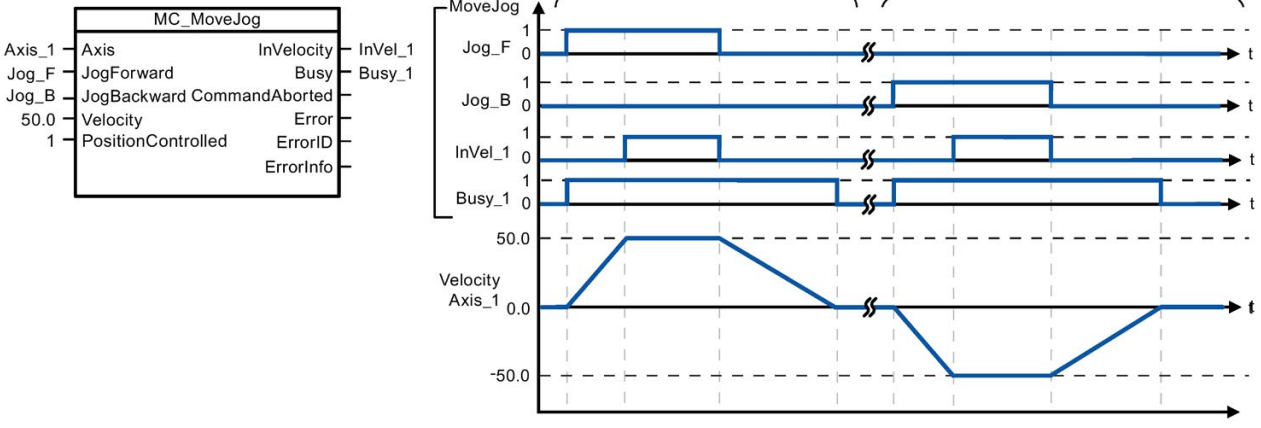
1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_MoveJog_DB " is the name of the instance DB.

Table 10- 71 Parameters for the MC_MoveJog instruction

Parameter and type		Data type	Description
Axis	IN	TO_SpeedAxis	Axis technology object
JogForward[1]	IN	Bool	As long as the parameter is TRUE, the axis moves in the positive direction at the velocity specified in parameter "Velocity". The sign of the value in parameter "Velocity" is ignored. (Default value: False)
JogBackward[1]	IN	Bool	As long as the parameter is TRUE, the axis moves in the negative direction at the velocity specified in parameter "Velocity". The sign of the value in parameter "Velocity" is ignored. (Default value: False)
Velocity	IN	Real	Preset velocity for jog mode (Default value: 100.0) Limit values: Start/stop velocity ≤ |Velocity| ≤ maximum velocity
PositionControlled	IN	Bool	• 0: speed controlled • 1: position controlled (Default value: True)
InVelocity	OUT	Bool	TRUE = The velocity specified in parameter "Velocity" was reached.
Busy	OUT	Bool	TRUE = The task is being executed.
CommandAborted	OUT	Bool	TRUE = During execution the task was aborted by another task.
Error	OUT	Bool	TRUE = An error has occurred during execution of the task. The cause of the error can be found in parameters "ErrorID" and "ErrorInfo".
ErrorID	OUT	Word	Error ID for parameter "Error" (Default value: 0000)
ErrorInfo	OUT	Word	Error info ID for parameter "ErrorID" (Default value: 0000)

[1] If both the JogForward and JogBackward parameters are simultaneously TRUE, the axis stops with the configured deceleration. An error is indicated in parameters "Error", "ErrorID", and "ErrorInfo".



The following values were configured in the "Dynamics > General" configuration window: Acceleration = 10.0 and Deceleration = 5.0

① The axis is moved in the positive direction in jog mode via "Jog_F". When the target velocity 50.0 is reached, this is signaled via "InVelo_1". The axis brakes to a standstill again after Jog_F is reset.

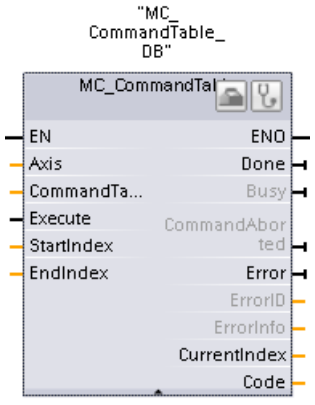
② The axis is moved in the negative direction in jog mode via "Jog_B". When the target velocity 50.0 is reached, this is signaled via "InVelo_1". The axis brakes to a standstill again after Jog_B is reset.

Override response

The MC_MoveJog task can be aborted by the following motion control tasks:	The new MC_MoveJog task aborts the following active motion control tasks:
• MC_Home Mode = 3 • MC_Halt • MC_MoveAbsolute • MC_MoveRelative • MC_MoveVelocity • MC_MoveJog	• MC_Home Mode = 3 • MC_Halt • MC_MoveAbsolute • MC_MoveRelative • MC_MoveVelocity • MC_MoveJog

10.3.7.10 MC_CommandTable (Run axis commans as movement sequence)

Table 10- 72 MC_CommandTable instruction

LAD / FBD	SCL	Description
	"MC_CommandTable_DB"(Axis:=_multi_fb_in_, CommandTable:=_multi_fb_in_, Execute:=_bool_in_, StartIndex:=_uint_in_, EndIndex:=_uint_in_, Done=>_bool_out_, Busy=>_bool_out_, CommandAborted=>_bool_out_, Error=>_bool_out_, ErrorID=>_word_out_, ErrorInfo=>_word_out_, CurrentIndex=>_uint_out_, Code=>_word_out_);	Executes a series of individual motions for a motor control axis that can combine into a movement sequence. Individual motions are configured in a technology object command table for pulse train output (TO_CommandTable_PTO).

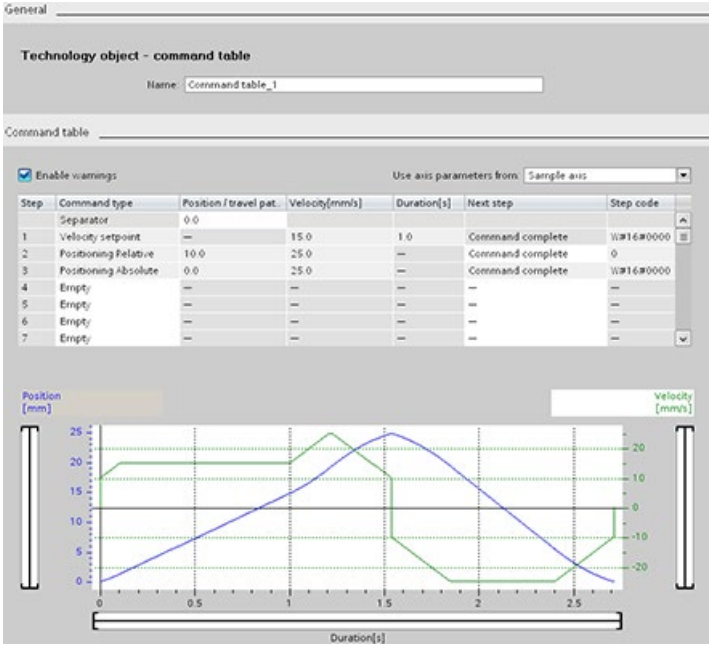
[1] STEP 7 automatically creates the DB when you insert the instruction.

[2] In the SCL example, "MC_CommandTable_DB " is the name of the instance DB.

Table 10- 73 Parameters for the MC_CommandTable instruction

Parameter and type		Data type	Initial value	Description
Axis	IN	TO_Axis_1	-	Axis technology object
Table	IN	TO_CommandTable_1	-	Command table technology object
Execute	IN	Bool	FALSE	Start job with rising edge
StartIndex	IN	Int	1	Start command table processing with this step Limits: 1 ≤ **StartIndex** ≤ EndIndex
EndIndex	IN	Int	32	End command table processing with this step Limits: StartIndex ≤ **EndIndex** ≤ 32
Done	OUT	Bool	FALSE	MC_CommandTable processing completed successfully
Busy	OUT	Bool	FALSE	Operation in progress
CommandAborted	OUT	Bool	FALSE	The task was aborted during processing by another task.
Error	OUT	Bool	FALSE	An error occurred during processing. The cause is indicated by the parameters ErrorID and ErrorInfo.
ErrorID	OUT	Word	16#0000	Error identifier
ErrorInfo	OUT	Word	16#0000	Error information
Step	OUT	Int	0	Step currently in process
Code	OUT	Word	16#0000	User defined identifier of the step currently in process

You can create the desired movement sequence in the "Command Table" configuration window and check the result against the graphic view in the trend diagram.



You can select the command types that are to be used for processing the command table. Up to 32 jobs can be entered. The commands are processed in sequence.

Table 10- 74 MC_CommandTable command types

Command type	Description
Empty	The empty serves as a placeholder for any commands to be added. The empty entry is ignored when the command table is processed
Halt	Pause axis. Note: The command only takes place after a "Velocity setpoint" command.
Positioning Relative	Positions the axis based upon distance. The command moves the axis by the given distance and velocity.
Positioning Absolute	Positions the axis based upon location. The command moves the axis to the given location, using the velocity specified.
Velocity setpoint	Moves the axis at the given velocity.
Wait	Waits until the given period is over. "Wait" does not stop an active traversing motion.
Separator	Adds a "Separator" line above the selected line. The separator line allows more than one profile to be defined in a single command table.

Prerequisites for MC_CommandTable execution:

- The technology object TO_Axis_PTO V2.0 must be correctly configured.
- The technology object TO_CommandTable_PTO must be correctly configured.
- The axis must be released.

Override response

The MC_CommandTable task can be aborted by the following motion control tasks:

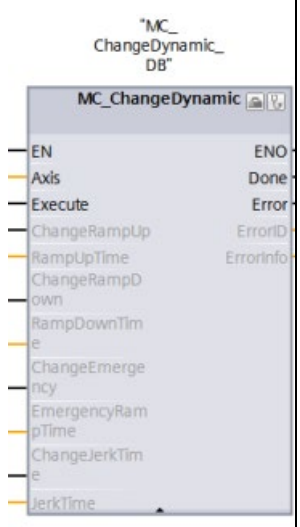
- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog
- MC_CommandTable

The new MC_CommandTable task aborts the following active motion control tasks:

- MC_Home Mode = 3
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveVelocity
- MC_MoveJog
- MC_CommandTable
- The current motion control job with the launch of the first "Positioning Relative", "Positioning Absolute", "Velocity setpoint" or "Halt" command

10.3.7.11 MC_ChangeDynamic (Change dynamc settings for the axis)

Table 10- 75 MC_ChangeDynamic instruction

LAD / FBD	SCL	Description
	**"MC_ChangeDynamic_DB"(** **Execute:=_bool_in_,** **ChangeRampUp:=_bool_in_,** **RampUpTime:=_real_in_,** **ChangeRampDown:=_bool_in_,** **RampDownTime:=_real_in_,** **ChangeEmergency:=_bool_in_,** **EmergencyRampTime:=_real_in_,** **ChangeJerkTime:=_bool_in_,** **JerkTime:=_real_in_,** **Done=>_bool_out_,** **Error=>_bool_out_,** **ErrorID=>_word_out_,** **ErrorInfo=>_word_out_);**	Changes the dynamic settings of a motion control axis: • Change the ramp-up time (acceleration) value • Change the ramp-down time (deceleration) value • Change the emergency stop ramp-down time (emergency stop deceleration) value • Change the smoothing time (jerk) value

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_ChangeDynamic_DB " is the name of the instance DB.

Table 10- 76 Parameters for the MC_ChangeDynamic instruction

Parameter and type		Data type	Description
Axis	IN	TO_Axis_1	Axis technology object
Execute	IN	Bool	Start of the command with a positive edge. Default value: FALSE
ChangeRampUp	IN	Bool	TRUE = Change ramp-up time in line with input parameter "RampUpTime". Default value: FALSE
RampUpTime	IN	Real	Time (in seconds) to accelerate from standstill to the configured maximum velocity without jerk limit. Default value: 5.00 The change will influence the tag <Axis name>. Config.DynamicDefaults.Acceleration. The effectiveness of the change is shown in the description of this tag.
ChangeRampDown	IN	Bool	TRUE = Change ramp-down time in line with input parameter "RampDownTime". Default value: FALSE
RampDownTime	IN	Real	Time (in seconds) to decelerate axis from the configured maximum velocity to standstill without jerk limiter. Default value: 5.00 The change will influence the tag <Axis name>. Config.DynamicDefaults.Deceleration. The effectiveness of the change is shown in the description of this tag.
ChangeEmergency	IN	Bool	TRUE = Change emergency stop ramp-down time in line with input parameter "EmergencyRampTime" Default value: FALSE
EmergencyRampTime	IN	Real	Time (in seconds) to decelerate the axis from configured maximum velocity to standstill without jerk limiter in emergency stop mode. Default value: 2.00 The change will influence the tag <Axis name>. Config.DynamicDefaults.EmergencyDeceleration. The effectiveness of the change is shown in the description of this tag.
ChangeJerkTime	IN	Bool	TRUE = Change smoothing time according to the input parameter "JerkTime". Default value: FALSE
JerkTime	IN	Real	Smoothing time (in seconds) used for the axis acceleration and deceleration ramps. Default value: 0.25 The change will influence the tag <Axis name>. Config.DynamicDefaults.Jerk. The effectiveness of the change is shown in the description of this tag.
Done	OUT	Bool	TRUE = The changed values have been written to the technology data block. The description of the tags will show when the change becomes effective. Default value: FALSE
Error	OUT	Bool	TRUE = An error occurred during execution of the command. The cause of the error can be found in parameters "ErrorID" and "ErrorInfo". Default value: FALSE
ErrorID	OUT	Word	Error identifier. Default value: 16#0000
ErrorInfo	IN	Word	Error information. Default value: 16#0000

Prerequisites for MC_ ChangeDynamic execution:

- The technology object TO_Axis_PTO V2.0 must be correctly configured.
- The axis must be released.

Note

You can only use the MC_ChangeDynamic instruction for a drive connection using PTO (Pulse Train Output).

Override response

An MC_ChangeDynamic command cannot be aborted by any other motion control command.

A new MC_ChangeDynamic command does not abort any active motion control jobs.

Note

The input parameters "RampUpTime", "RampDownTime", "EmergencyRampTime" and "RoundingOffTime" can be specified with values that makes the resultant axis parameters "acceleration", "delay", "emergency stop-delay" and "jerk" outside the permissible limits.

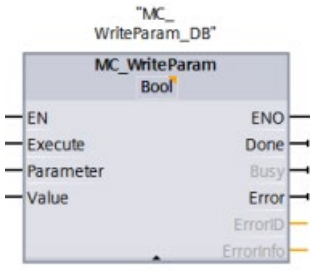
Make sure you keep the MC_ChangeDynamic parameters within the limits of the dynamic configuration settings for the axis technology object.

10.3.7.12 MC_WriteParam (write parameters of a technology object)

You use the MC_WriteParam instruction to write a select number of parameters to change the functionality of the axis from the user program.

Table 10- 77 MC_WriteParam instruction

LAD / FBD	SCL	Description

	`"MC_WriteParam_DB"(`
	`Parameter:=_variant_in_,`
	`Value:=_variant_in_,`
	`Execute:=_bool_in_,`
	`Done:=_bool_out_,`
	`Error:=_real_out_,`
	`ErrorID:=_word_out_,`
	`ErrorInfo:=_word_out_);`
		You use the MC_WriteParam instruction to write to public parameters (for example, acceleration and user DB values).

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_WriteParam_DB" is the name of the instance DB.

You can write to the parameters that are public. You cannot write to "MotionStatus" and "StatusBits". The valid parameters are listed in the table below:

Writeable parameter name	Writeable parameter name
Actor.InverseDirection	DynamicDefaults.Acceleration
Actor.DirectionMode	DynamicDefaults.Deceleration
Actor.DriveParameter.PulsesPerDriveRevolution	DynamicDefaults.Jerk
Sensor[1].ActiveHoming.Mode	DynamicDefaults.EmergencyDeceleration
Sensor[1].ActiveHoming.SideInput	PositionLimitsHW.Active
Sensor[1].ActiveHoming.Offset	PositionLimitsHW.MaxSwitchedLevel
Sensor[1].ActiveHoming.SwitchedLevel	PositionLimitsHW.MinSwitchedLevel
Sensor[1].PassiveHoming.Mode	PositionLimitsSW.Active
Sensor[1].PassiveHoming.SideInput	PositionLimitsSW.MinPosition
Sensor[1].PassiveHoming.SwitchedLevel	PositionLimitsSW.MaxPosition
Units.LengthUnit	Homing.AutoReversal
Mechanics.LeadScrew	Homing.ApproachDirection
DynamicLimits.MinVelocity	Homing.ApproachVelocity
DynamicLimits.MaxVelocity	Homing.ReferencingVelocity

Table 10- 78 Parameters for the MC_WriteParam instruction

Parameter and type		Data type	Description
PARAMNAME	IN	Variant	Name of parameter where value is written
VALUE	IN	Variant	Value to write to assigned parameter
EXECUTE	IN	Bool	Start the instruction. Default value: FALSE
DONE	OUT	Bool	Value has been written. Default value: FALSE
BUSY	OUT	Bool	If TRUE, the instruction is operating. Default value: FALSE
ERROR	OUT	Real	If TRUE, an error occurred. Default value: FALSE
ERRORID	OUT	Word	ID of the error
ERRORINFO	OUT	Word	Related information to the ERRORID

Table 10- 79 Condition codes for ERRORID and ERRORINFO

ERRORID (W#16#...)	ERRORINFO (W#16#...)	Description
0	0	Successful change of an Axis TO-DB parameter
8410[1]	0028[1]	Set an invalid parameter (Axis TO-DB parameter with incorrect length)
8410[1]	0029[1]	Set an invalid parameter (no Axis TO-DB parameter)
8410[1]	002B[1]	Set an Invalid parameter (read-only Axis TO-DB parameter)
8410[1]	002C[1]	Set a valid parameter, but axis is not disabled
Config Error[2]	Config Error[2]	Set a valid parameter (public read-only Axis TO-DB parameter) out-of-range
Config Error[3]	Config Error[3]	Set a valid parameter (public Axis TO-DB parameter) out-of-range

[1] Error at MC_WriteParam

[2] Error at MC_Power

[3] Error at MC_Power and MC_MoveXXX or MC_CommandTable

Note

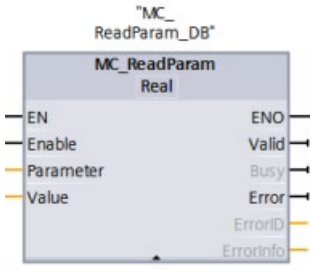
For a drive connection using a PROFIdrive/analog output, you cannot write parameters with MC_WriteParam that require a restart of the technology object. The TIA Portal online help statement concerning this instruction is incorrect.

10.3.7.13 MC_ReadParam instruction (read parameters of a technology object)

You use the MC_ReadParam instruction to read a select number of parameters that indicate the current position, velocity, and so forth of the axis defined in the Axis input.

Table 10- 80 MC_ReadParam instruction

LAD / FBD	SCL	Description

	`"MC_ReadParam_DB"(`
	`Enable:=_bool_in_,`
	`Parameter:=_variant_in_,`
	`Value:=_variant_in_out_,`
	`Valid:=_bool_out_,`
	`Busy:=_bool_out_,`
	`Error:=_real_out_,`
	`ErrorID:=_word_out_,`
	`ErrorInfo:=_word_out_);`
		You use the MC_ReadParam instruction to read single status values, independent of the cycle control point.

1 STEP 7 automatically creates the DB when you insert the instruction.

2 In the SCL example, "MC_ReadParam_DB " is the name of the instance DB.

The MC_ReadParam instruction works on an enable behavior. As long as the input "Enable" is true the instruction reads the specified "Parameter" to the "Value" storage location.

The "MotionStatus" "Position" value updates at each Cycle Control Point (CCP) based upon the current HSC value.

The "MotionStatus" "Velocity" value is the command velocity at the end of the current segment (updated ~10ms). The MC_ReadParam can also read this value.

If an error occurs, the instruction switches to an error state that can only be reset by a new rising edge at the input "Enable".

Table 10- 81 Parameters for the MC_ReadParam instruction

Parameter and type		Data type	Description
ENABLE	IN	Bool	Start the instruction. Default value: FALSE
PARAMETER	IN	Variant	Pointer to the TO-parameter that is to be read
VALID	OUT	Bool	If TRUE, the value has been read. Default value: FALSE
BUSY	OUT	Bool	If TRUE, the instruction is operating. Default value: FALSE
ERROR	OUT	Real	If TRUE, an error occurred. Default value: FALSE
ERRORID	OUT	Word	ID of the error. Default value: 0
ERRORINFO	OUT	Word	Related information to the ERRORID. Default value: 0
VALUE	INOUT	Variant	Pointer to the location where the read value is stored

Table 10- 82 Condition codes for ERRORID and ERRORINFO

ERRORID (W#16#...)	ERRORINFO (W#16#...)	Description
0	0	Successful read of a parameter
8410	0028	Invalid parameter (incorrect length)
8410	0029	Invalid parameter (no TO-DB)
8410	0030	Invalid parameter (not readable)
8411	0032	Invalid parameter (wrong value)

TO parameters

The axis "MotionStatus" consists of four values. You will want to monitor changes in these values, which can be read while the program is running:

Variable name	Data type	Readable through MC_ReadParam
MotionStatus:	Structure	No
• Position	REAL	Yes
• Velocity	REAL	Yes
• Distance	REAL	Yes
• TargetPosition	REAL	Yes

10.3.8 Monitoring active commands

10.3.8.1 Monitoring MC instructions with a "Done" output parameter

Motion control instructions with the output parameter "Done" are started by the input parameter "Execute" and have a defined conclusion (for example, with motion control instruction "MC_Home": Homing was successful). The task is complete and the axis is at a standstill.

- The output parameter "Done" indicates the value TRUE, if the task has been successfully completed.
- The output parameters "Busy", "CommandAborted", and "Error" signal that the task is still being processed, has been aborted or an error is pending. The motion control instruction "MC_Reset" cannot be aborted and thus has no "CommandAborted" output parameter.
  - During processing of the motion control task, the output parameter "Busy" indicates the value TRUE. If the task has been completed, aborted, or stopped by an error, the output parameter "Busy" changes its value to FALSE. This change occurs regardless of the signal at input parameter "Execute".
  - Output parameters "Done", "CommandAborted", and "Error" indicate the value TRUE for at least one cycle. These status messages are latched while input parameter "Execute" is set to TRUE.

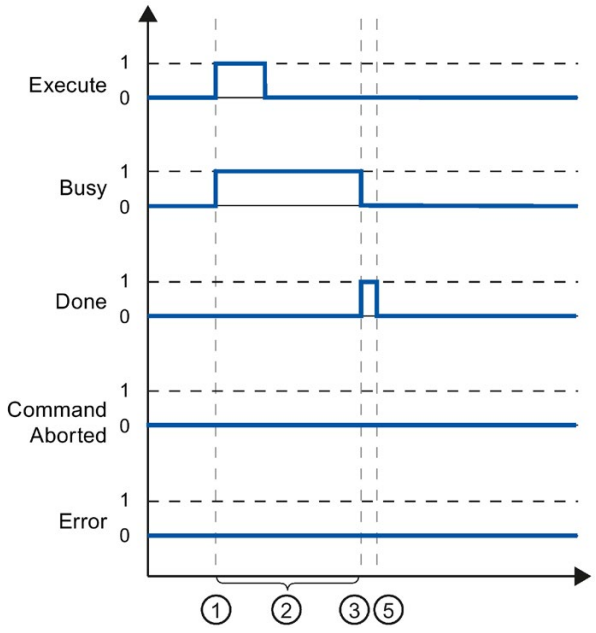
The tasks of the following motion control instructions have a defined conclusion:

- MC_Reset
- MC_Home
- MC_Halt
- MC_MoveAbsolute
- MC_MoveRelative

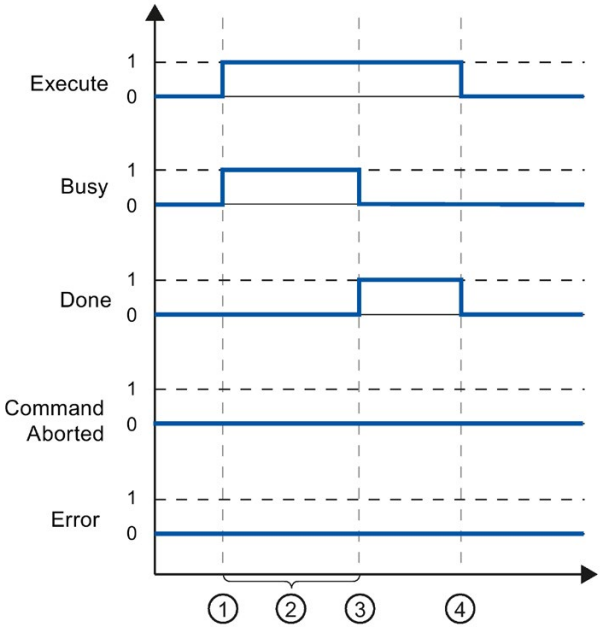
The behavior of the status bits is presented below for various example situations.

- The first example shows the behavior of the axis for a completed task. If the motion control task has been completely executed by the time of its conclusion, this is indicated by the value TRUE in output parameter "Done". The signal status of input parameter "Execute" influences the display duration in the output parameter "Done".
- The second example shows the behavior of the axis for an aborted task. If the motion control task is aborted during execution, this is indicated by the value TRUE in output parameter "CommandAborted". The signal status of the input parameter "Execute" influences the display duration in the output parameter "CommandAborted".
- The third example shows the behavior of the axis if an error occurs. If an error occurs during execution of the motion control task, this is indicated by the value TRUE in the output parameter "Error". The signal status of the input parameter "Execute" influences the display duration in the output parameter "Error".

Table 10- 83 Example 1 - Complete execution of task



If "Execute" = FALSE during the processing of the task



If "Execute" = FALSE after completion of the task

① The task is started with a positive edge at the input parameter "Execute". Depending on the programming, "Execute" can still be reset to the value FALSE during the task, or the value TRUE can be retained until after completion of the task.

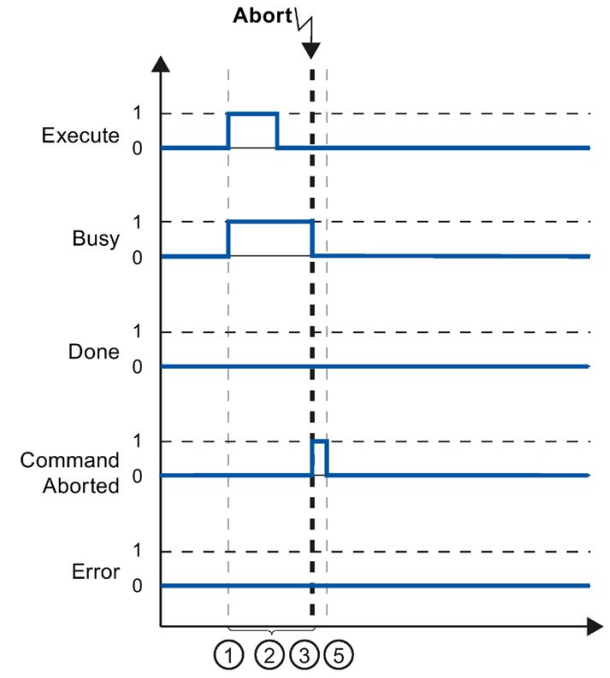
② While the task is active, the output parameter "Busy" indicates the value TRUE.

③ With conclusion of the task (for example, for motion control instruction "MC_Home": Homing was successful), output parameter "Busy" changes to FALSE and "Done" to TRUE.

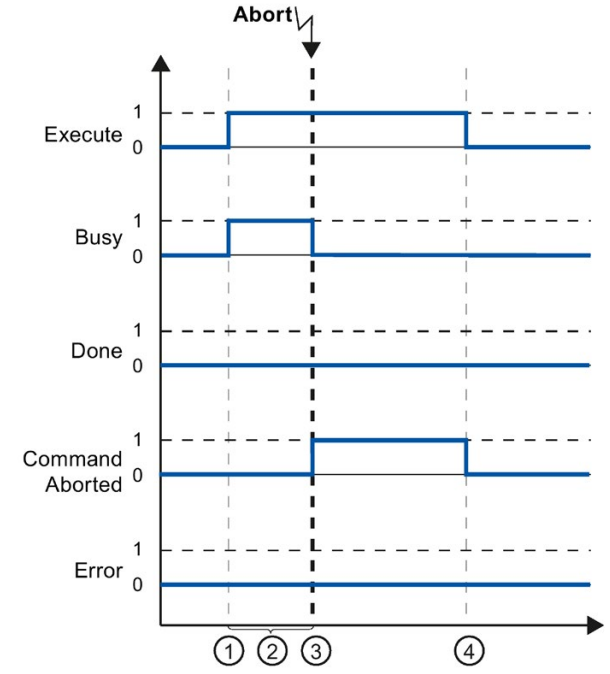
④ If "Execute" retains the value TRUE until after completion of the task, then "Done" also remains TRUE and changes its value to FALSE together with "Execute".

⑤ If "Execute" has been set to FALSE before the task is complete, "Done" indicates the value TRUE for only one execution cycle.

Table 10- 84 Example 2 - Aborting the task



If "Execute" = FALSE before the task is aborted



If "Execute" = FALSE after the task is aborted

① The task is started with a positive edge at the input parameter "Execute". Depending on the programming, "Execute" can still be reset to the value FALSE during the task, or the value TRUE can be retained until after completion of the task.

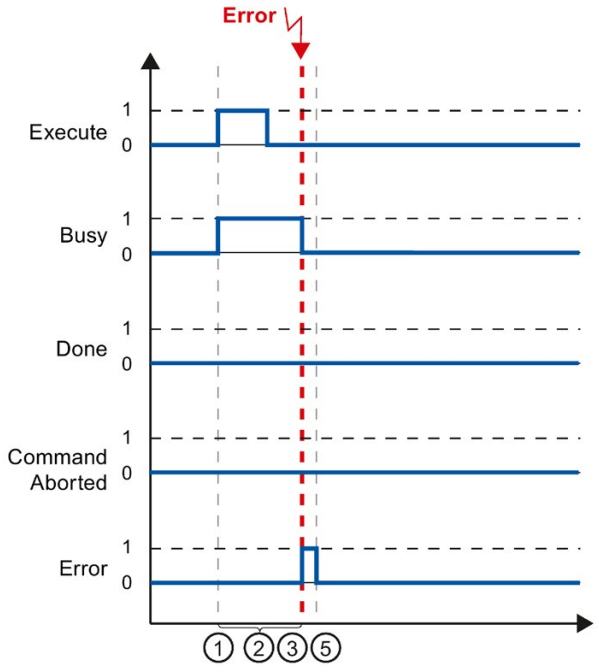
② While the task is active, the output parameter "Busy" indicates the value TRUE.

③ During task execution, the task is aborted by another motion control task. If the task is aborted, output parameter "Busy" changes to FALSE and "CommandAborted" to TRUE.

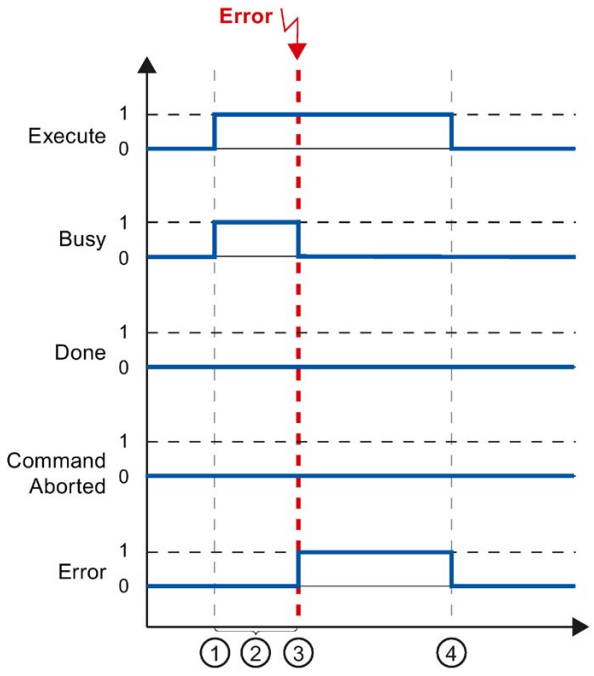
④ If "Execute" retains the value TRUE until after the task is aborted, then "CommandAborted" also remains TRUE and changes its value to FALSE together with "Execute".

⑤ If "Execute" has been set to FALSE before the task is aborted, "CommandAborted" indicates the value TRUE for only one execution cycle.

Table 10- 85 Example 3 - Error during task execution



If "Execute" = FALSE before the error occurs



If "Execute" = FALSE after the error occurs

① The task is started with a positive edge at the input parameter "Execute". Depending on the programming, "Execute" can still be reset to the value FALSE during the task, or the value TRUE can be retained until after completion of the task.

② While the task is active, the output parameter "Busy" indicates the value TRUE.

③ An error occurred during task execution. When the error occurs, the output parameter "Busy" changes to FALSE and "Error" to TRUE.

④ If "Execute" retains the value TRUE until after the error occurs, then "Error" also remains TRUE and only changes its value to FALSE together with "Execute".

⑤ If "Execute" has been set to FALSE before the error occurs, "Error" indicates the value TRUE for only one execution cycle.

10.3.8.2 Monitoring the MC_Velocity

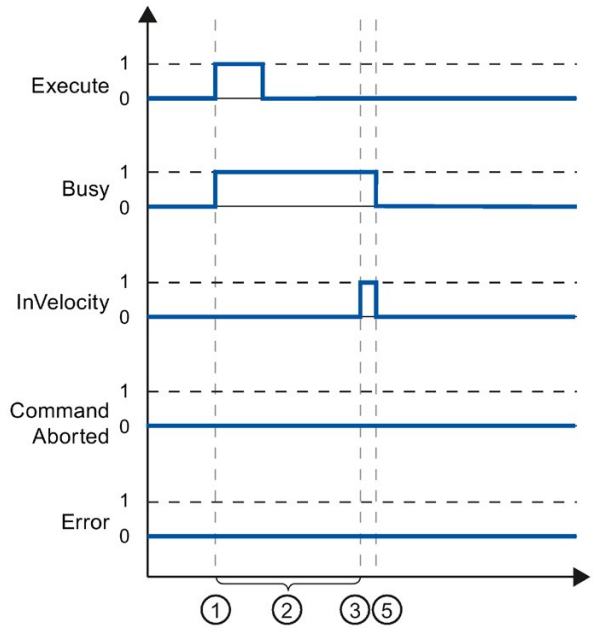
The tasks of the motion control instruction "MC_MoveVelocity" implement a move at the specified velocity:

- The tasks of motion control instruction "MC_MoveVelocity" do not have a defined end. The task objective is fulfilled when the parameterized velocity is reached for the first time and the axis travels at constant velocity. When the parameterized velocity is reached, this is indicated by the value TRUE in output parameter "InVelocity".
- The task is complete when the parameterized velocity has been reached and input parameter "Execute" has been set to the value FALSE. However, the axis motion is not yet complete upon completion of the task. For example, the axis motion can be stopped with motion control task "MC_Halt".
- The output parameters "Busy", "CommandAborted", and "Error" signal that the task is still being processed, has been aborted or an error is pending.
  - During execution of the motion control task, output parameter "Busy" indicates the value TRUE. If the task has been completed, aborted, or stopped by an error, the output parameter "Busy" changes its value to FALSE. This change occurs regardless of the signal at input parameter "Execute".
  - The output parameters "InVelocity", "CommandAborted", and "Error" indicate the value TRUE for at least one cycle, when their conditions are met. These status messages are latched while input parameter "Execute" is set to TRUE.

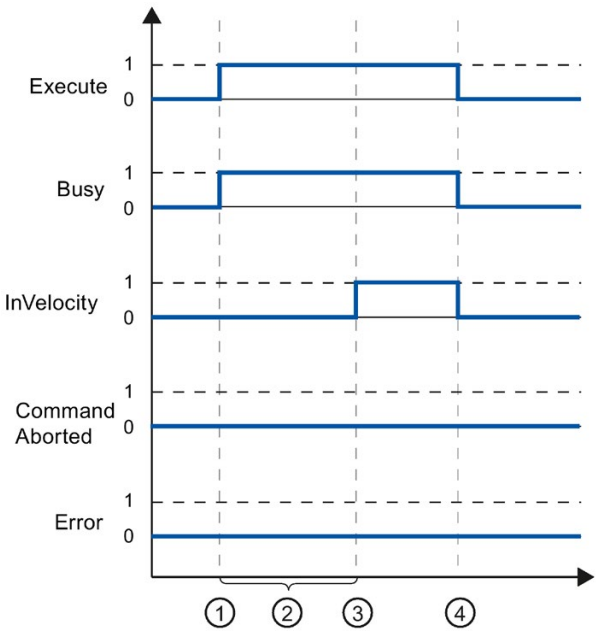
The behavior of the status bits is presented below for various example situations:

- The first example shows the behavior when the axis reaches the parameterized velocity. If the motion control task has been executed by the time the parameterized velocity is reached, this is indicated by the value TRUE in output parameter "InVelocity". The signal status of the input parameter "Execute" influences the display duration in the output parameter "InVelocity".
- The second example shows the behavior if the task is aborted before achieving the parameterized velocity. If the motion control task is aborted before the parameterized velocity is reached, this is indicated by the value TRUE in output parameter "CommandAborted". The signal status of input parameter "Execute" influences the display duration in output parameter "CommandAborted".
- The third example shows the behavior of the axis if an error occurs before achieving the parameterized velocity. If an error occurs during execution of the motion control task before the parameterized velocity has been reached, this is indicated by the value TRUE in the output parameter "Error". The signal status of the input parameter "Execute" influences the display duration in the output parameter "Error".

Table 10- 86 Example 1 - If the parameterized velocity is reached



If "Execute" = FALSE before the configured velocity is reached



If "Execute" = FALSE after the configured velocity is reached

① The task is started with a positive edge at the input parameter "Execute". Depending on the programming, "Execute" can be reset to the value FALSE event before the parameterized velocity is reached, or alternatively only after it has been reached.

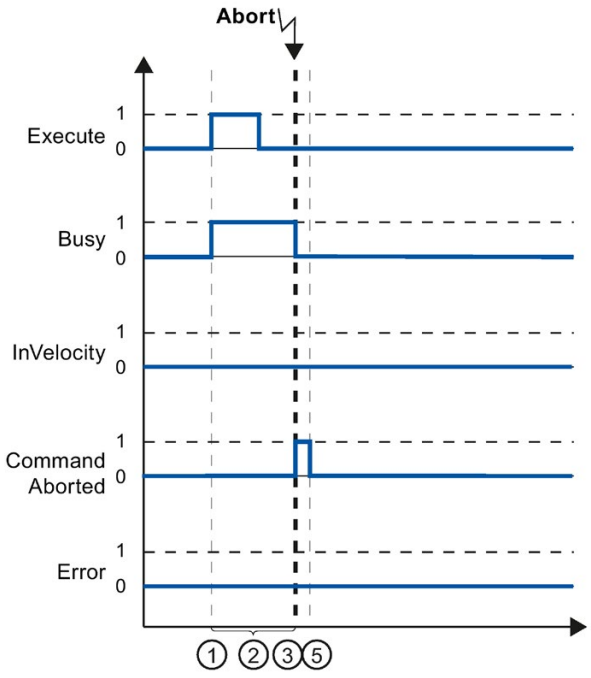
② While the task is active, the output parameter "Busy" indicates the value TRUE.

③ When the parameterized velocity is reached, the output parameter "InVelocity" changes to TRUE.

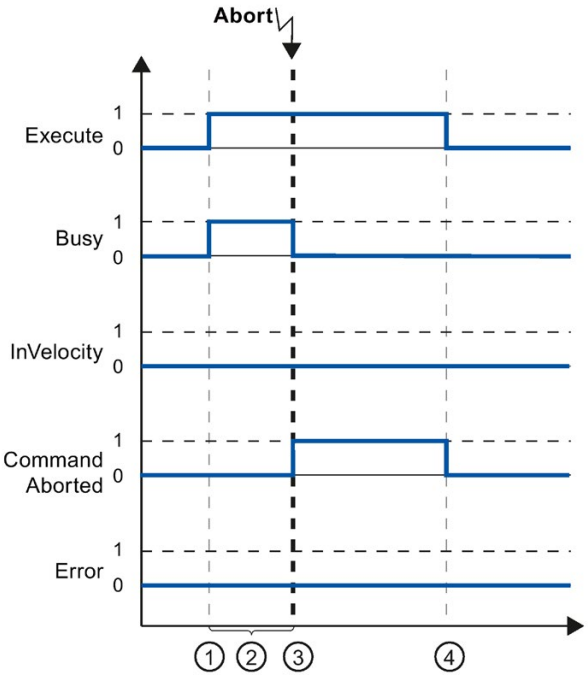
④ If "Execute" retains the value TRUE even after the parameterized velocity has been reached, the task remains active. "InVelocity" and "Busy" retain the value TRUE and only change their status to FALSE together with "Execute".

⑤ If "Execute" has been reset to FALSE before the parameterized velocity is reached, the task is complete when the parameterized velocity is reached. "InVelocity" indicates the value TRUE for one execution cycle and changes to FALSE together with "Busy".

Table 10- 87 Example 2 - If the task is aborted prior to reaching the parameterized velocity



If "Execute" = FALSE before the task is aborted



If "Execute" = FALSE after the task is aborted

① The task is started with a positive edge at the input parameter "Execute". Depending on the programming, "Execute" can still be reset to the value FALSE during the task, or the value TRUE can be retained until after the task is aborted.

② While the task is active, the output parameter "Busy" indicates the value TRUE.

③ During task execution, the task is aborted by another motion control task. If the task is aborted, output parameter "Busy" changes to FALSE and "CommandAborted" to TRUE.

④ If "Execute" retains the value TRUE until after the task is aborted, then "CommandAborted" also remains TRUE and changes its status to FALSE together with "Execute".

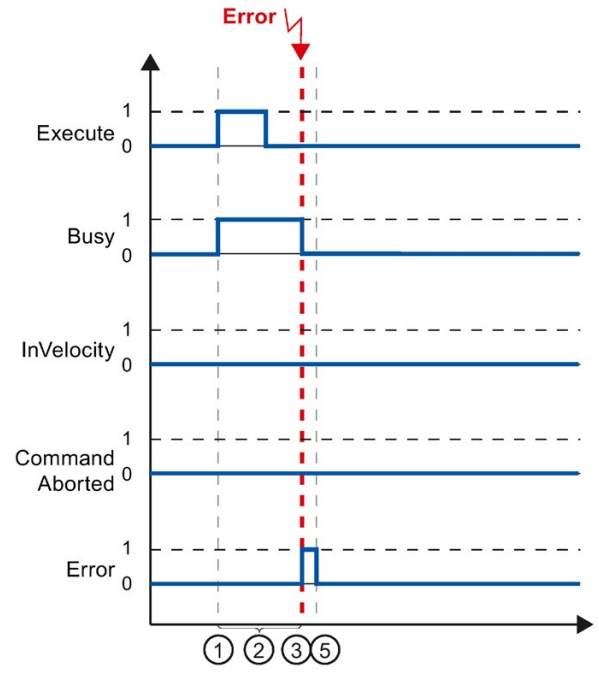
⑤ If "Execute" has been reset to FALSE before the task is aborted, "CommandAborted" indicates the value TRUE for only one execution cycle.

Note

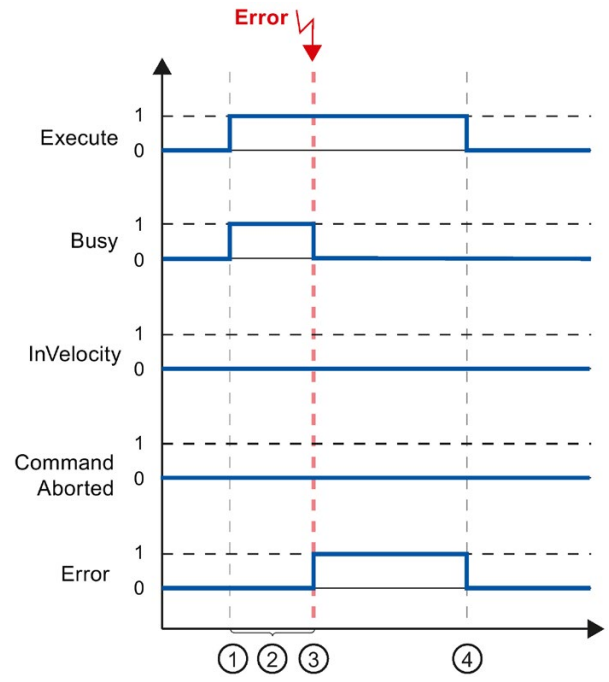
Under the following conditions, an abort is not indicated in output parameter "CommandAborted":

- The parameterized velocity has been reached, input parameter "Execute" has the value FALSE, and a new motion control task is initiated.
- When the parameterized velocity is reached and input parameter "Execute" has the value FALSE, the task is complete. Therefore, the start of a new task is not indicated as an abort.

Table 10- 88 Example 3 - If an error occurs prior to reaching the parameterized velocity



If "Execute" = FALSE before the error occurs



If "Execute" = FALSE after the error occurs

① The task is started with a positive edge at the input parameter "Execute". Depending on the programming, "Execute" can still be reset to the value FALSE during the task, or the value TRUE can be retained until after the error has occurred.

② While the task is active, the output parameter "Busy" indicates the value TRUE.

③ An error occurred during task execution. When the error occurs, the output parameter "Busy" changes to FALSE and "Error" to TRUE.

④ If "Execute" retains the value TRUE until after the error has occurred, then "Error" also remains TRUE and only changes its status to FALSE together with "Execute".

⑤ If "Execute" has been reset to FALSE before the error occurs, "Error" indicates the value TRUE for only one execution cycle.

Note

Under the following conditions, an error is not indicated in output parameter "Error":

- The parameterized velocity has been reached, input parameter "Execute" has the value FALSE, and an axis error occurs (software limit switch is approached, for example).
- When the parameterized velocity is reached and input parameter "Execute" has the value FALSE, the task is complete. After completion of the task, the axis error is only indicated in the motion control instruction "MC_Power".

10.3.8.3 Monitoring the MC_MoveJog

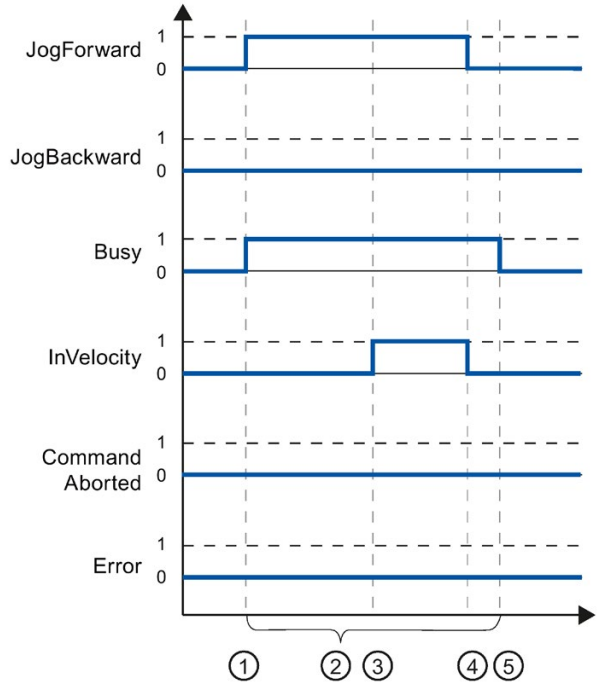
The tasks of motion control instruction "MC_MoveJog" implement a jog operation.

- The motion control tasks "MC_MoveJog" do not have a defined end. The task objective is fulfilled when the parameterized velocity is reached for the first time and the axis travels at constant velocity. When the parameterized velocity is reached, this is indicated by the value TRUE in output parameter "InVelocity".
- The order is complete when input parameter "JogForward" or "JogBackward" has been set to the value FALSE and the axis has come to a standstill.
- The output parameters "Busy", "CommandAborted", and "Error" signal that the task is still being processed, has been aborted or an error is pending.
  - During processing of the motion control task, the output parameter "Busy" indicates the value TRUE. If the task has been completed, aborted, or stopped by an error, the output parameter "Busy" changes its value to FALSE.
  - The output parameter "InVelocity" indicates the status TRUE, as long as the axis is moving at the parameterized velocity. The output parameters "CommandAborted" and "Error" indicate the status for at least one cycle. These status messages are latched as long as either input parameter "JogForward" or "JogBackward" is set to TRUE.

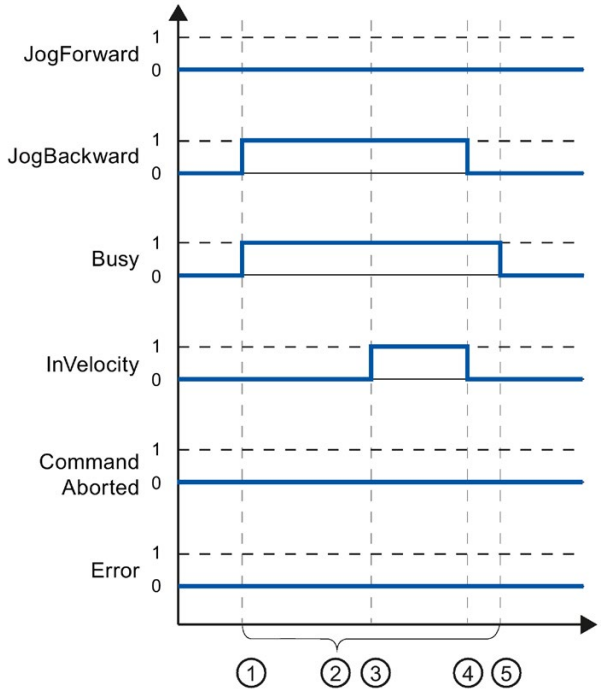
The behavior of the status bits is presented below for various example situations.

- The first example shows the behavior or the axis if the parameterized velocity is reached and maintained. If the motion control task has been executed by the time the parameterized velocity is reached, this is indicated by the value TRUE in output parameter "InVelocity".
- The second example shows the behavior of the axis if the task is aborted. If the motion control task is aborted during execution, this is indicated by the value TRUE in output parameter "CommandAborted". The behavior is independent of whether or not the parameterized velocity has been reached.
- The third example shows the behavior of the axis if an error occurs. If an error occurs during execution of the motion control task, this is indicated by the value TRUE in output parameter "Error". The behavior is independent of whether or not the parameterized velocity has been reached.

Table 10- 89 Example 1 - If the parameterized velocity is reached and maintained



JogForward



JogBackward

① The task is started with a positive edge at the input parameter "JogForward" or "JogBackward".

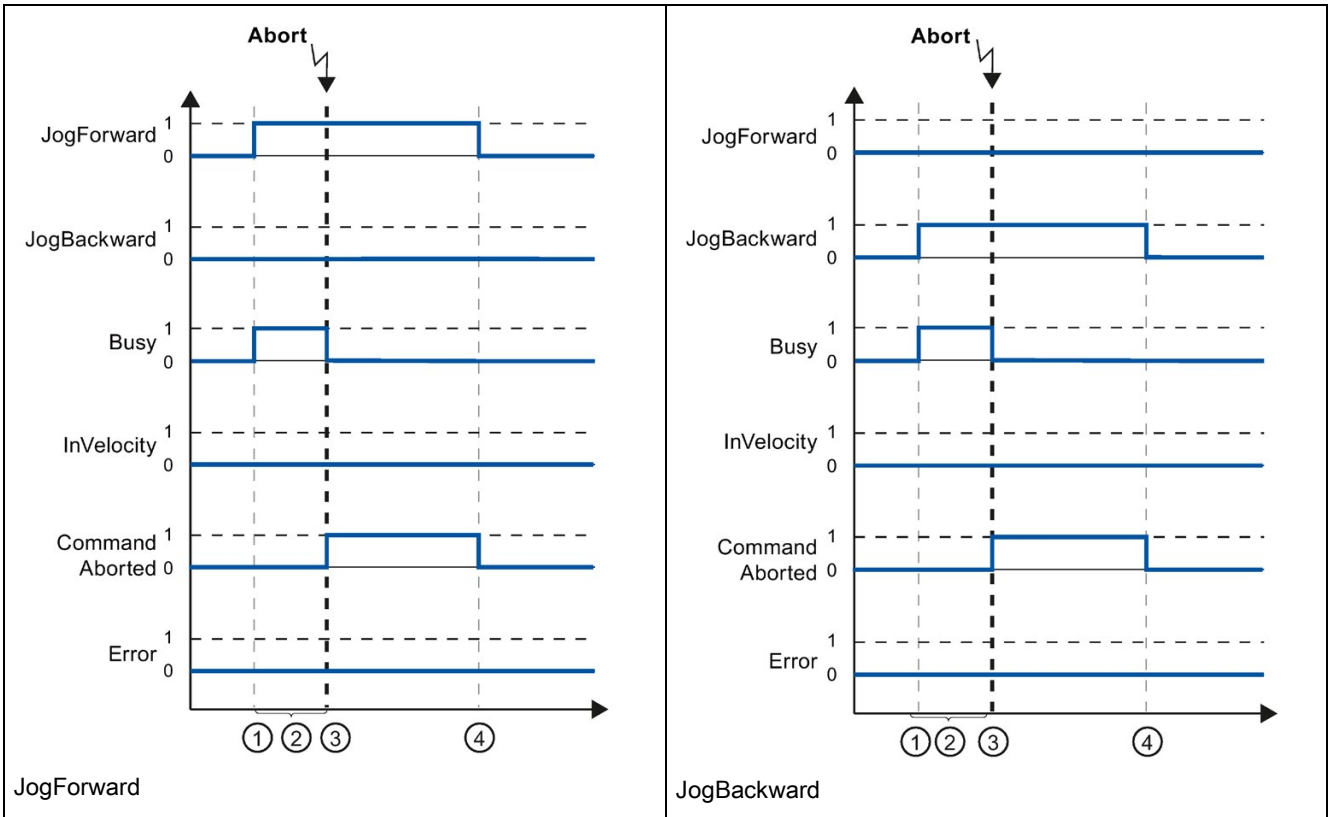
② While the task is active, the output parameter "Busy" indicates the value TRUE.

③ When the parameterized velocity is reached, the output parameter "InVelocity" changes to TRUE.

④ When the input parameter "JogForward" or "JogBackward" is reset to the value FALSE, the axis motion ends. The axis starts to decelerate. As a result, the axis no longer moves at constant velocity and the output parameter "InVelocity" changes its status to FALSE.

⑤ If the axis has come to a standstill, the motion control task is complete and the output parameter "Busy" changes its value to FALSE.

Table 10- 90 Example 2 - If the task is aborted during execution



① The task is started with a positive edge at the input parameter "JogForward" or "JogBackward".

② While the task is active, the output parameter "Busy" indicates the value TRUE.

③ During task execution, the task is aborted by another motion control task. If the task is aborted, output parameter "Busy" changes to FALSE and "CommandAborted" to TRUE.

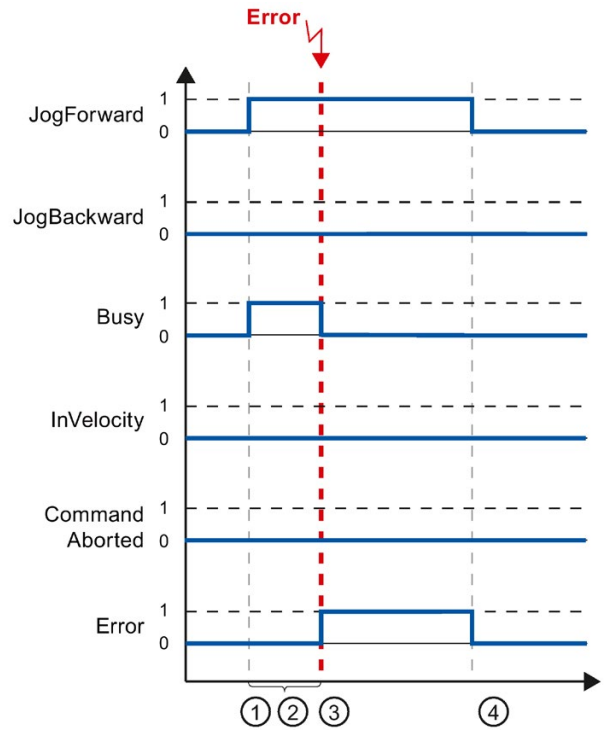
④ When the input parameter "JogForward" or "JogBackward" is reset to the value FALSE, the output parameter "CommandAborted" changes its value to FALSE.

Note

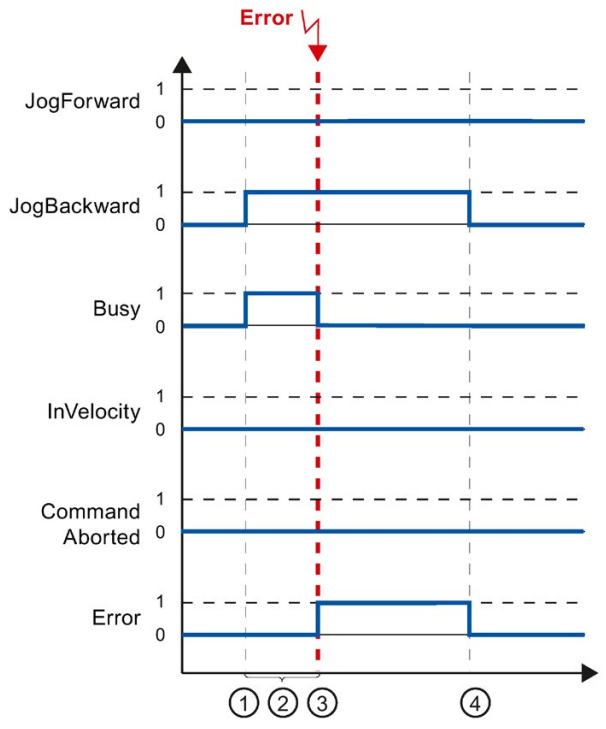
The task abort is indicated in the output parameter "CommandAborted" for only one execution cycle, if all conditions below are met:

The input parameters "JogForward" and "JogBackward" have the value FALSE (but the axis is still decelerating) and a new motion control task is initiated.

Table 10- 91 Example 3 - If an error has occurred during task execution



JogForward



JogBackward

① The task is started with a positive edge at the input parameter "JogForward" or "JogBackward".

② While the task is active, the output parameter "Busy" indicates the value TRUE.

③ An error occurred during task execution. When the error occurs, the output parameter "Busy" changes to FALSE and "Error" to TRUE.

④ When the input parameter "JogForward" or "JogBackward" is reset to the value FALSE, the output parameter "Error" changes its value to FALSE.

Note

An error occurrence is indicated in the output parameter "Error" for only one execution cycle, if all the conditions below are met:

The input parameters "JogForward" and "JogBackward" have the value FALSE (but the axis is still decelerating) and a new error occurs (software limit switch is approached, for example).

10.3.9 ErrorIDs and ErrorInfos for motion control

The following table lists all ErrorIDs and ErrorInfos that can be indicated in motion control instructions and data adaptation. In addition to the cause of the error, remedies for eliminating the error are also listed.

Depending on the error reaction, the axis is stopped in the case of operating errors with stop of axis. The following error reactions are possible:

- **Remove enable**

  The setpoint zero is output and the enable is removed. The axis is braked depending on the configuration in the drive, and is brought to a standstill.

- **Stop with emergency stop ramp**

  Active motion commands are aborted. The axis is braked with the emergency stop deceleration configured under "Technology object > Extended parameters > Dynamics > Emergency stop ramp" without any jerk limit and brought to a standstill.

Operating error with axis stop

ErrorID	ErrorInfo	Description	Remedy	Error reaction
16#8000		**Drive error, loss of "Drive ready"**		-
	16#0001	-	Acknowledge error with instruction "MC_Reset"; provide drive signal; re-start command, if necessary	
16#8001		**Low SW limit switch has been tripped**		Stop with emergency stop ramp.
	16#000E	The position of the low SW limit switch was reached with the currently configured deceleration	Acknowledge the error with instruction "MC_Reset"; use a motion command to move the axis in the positive direction out of the range of the SW limit switch	
	16#000F	The position of the low SW limit switch was reached with the emergency stop deceleration		
	16#0010	The position of the low SW limit switch was exceeded with the emergency stop deceleration		
16#8002		**High SW limit switch has been tripped**		Stop with emergency stop ramp.
	16#000E	The position of the high SW limit switch was reached with the currently configured deceleration	Acknowledge the error with instruction "MC_Reset"; use a motion command to move the axis in the negative direction out of the range of the SW limit switch	
	16#000F	The position of the high SW limit switch was reached with the emergency stop deceleration		
	16#0010	The position of the high SW limit switch was exceeded with the emergency stop deceleration		

ErrorID	ErrorInfo	Description	Remedy	Error reaction
16#8003		**Low HW limit switch was reached**		For drive connection via PTO (Pulse Train Output): Stop with emergency stop ramp. For drive connection via PROFIdrive/analog output: Remove enable.
	16#000E	The low HW limit switch was reached. The axis was stopped with the emergency stop deceleration. (During an active homing procedure, the homing switch was not found)	Acknowledge the error for an enabled axis with instruction "MC_Reset"; use a motion command to move the axis in the positive direction out of the range of the HW limit switch.	
16#8004		**High HW limit switch was reached**		For drive connection via PTO (Pulse Train Output): Stop with emergency stop ramp. For drive connection via PROFIdrive/analog output: Remove enable.
	16#000E	The high HW limit switch has been reached. The axis was stopped with the emergency stop deceleration. (During an active homing procedure, the homing switch was not found)	Acknowledge the error for an enabled axis with instruction "MC_Reset"; use a motion command to move the axis in the negative direction out of the range of the HW limit switch.	
16#8005		**PTO/HSC are already being used by another axis**		-
	16#0001	-	**The axis was configured incorrectly:** Correct the configuration of the PTO (Pulse Train Output) / HSC (High Speed Counter) and download it to the controller	
			More than one axis is to run with one PTO: Another axis is using the PTO / HSC. If the current axis is to assume the control, the other axis must be disabled with "MC_Power" Enable = FALSE.	
16#8006		**A communication error in the control panel has occurred**		Remove enable.
	16#0012	A timeout has occurred	Check the cable connection and press the "Manual control" button again	
16#8007		**The axis cannot be enabled**		-
	16#0025	Restarting	Wait until the axis restart is complete.	
	16#0026	Executing loading process in RUN mode	Wait until the loading process is complete.	

ErrorID	ErrorInfo	Description	Remedy	Error reaction
16#8008		**Invalid direction of motion**		-
	16#002E	The selected motion direction is not allowed.	• Adjust the motion direction and restart the command. • Adjust the allowed direction of rotation in the technology object configuration under "Extended parameters > Mechanics". Restart the command.	
	16#002F	A reversing motion is not possible with the selected motion direction.		
16#8009		**Reference switch/encoder zero mark not found**		Stop with emergency stop ramp.
	16#0033	Error in the configuration, hardware or installation of the encoder or at the homing switch.	• Connect a suitable device. • Check the device (I/Os). • Compare the configuration of HW Config and the technology object.	
16#800A		**Alarm message from encoder**		Remove enable.
	16#0001	-	Check the device with regard to function, connections and I/Os.	
	16#0034	Hardware error at encoder		
	16#0035	Encoder dirty		
	16#0036	Error during reading of encoder absolute value	Compare the encoder type in the drive or encoder parameter P979 with the configuration data of the technology object.	
	16#0037	Zero mark monitoring of the encoder	Encoder reports error in zero mark monitoring (fault code 0x0002 in Gx_XIST2, see PROFIdrive profile). Check the plant for electromagnetic compatibility (EMC).	
	16#0038	Encoder is in "Parking" state	• Search for the cause of the error in the connected drive or encoder. • Check whether the error message was possibly triggered by a commissioning action at the drive or encoder.	
	16#0040	PROFIdrive: Encoder at bus failed (station failure)	Check the device with regard to function, connections and I/Os.	
	16#0041	PROFIdrive: Signs of life of encoder faulty		
16#800B		**Range violation of the position**		Remove enable.
	16#0039	Range violation in positive direction	Home the axis to a valid actual value range.	
	16#003A	Range violation in negative direction		
	16#003B	The change of the actual position in a position control clock cycle is greater than the modulo length.	Adjust the modulo length of the employed encoder.	

ErrorID	ErrorInfo	Description	Remedy	Error reaction
16#800C		**Alarm message from drive**		Remove enable.
	16#0001	-	Check the device with regard to function, connections and I/Os.	
	16#003C	PROFIdrive: Drive signal "Control requested" failed		
	16#003D	PROFIdrive: Drive has shut down		
	16#003E	PROFIdrive: Drive at bus failed (station failure)		
	16#003F	PROFIdrive: Signs of life of drive faulty	• Check the device with regard to function, connections and I/Os. • Compare the clock parameters of HW Config (PROFIBUS line, slave OM for drive or encoder) and the execution system. Tmapc and servo must be configured with the same clock cycle time.	
16#800D		**The permitted following error was exceeded**		Remove enable.
	16#0001	-	• Check the configuration of the control loop. • Check the direction signal of the encoder. • Check the configuration of following error monitoring.	
16#800E		**Error at the hardware limit switch**		Remove enable.
	16#0042	Illegal free travel direction with active hardware limit switch	The programmed direction of movement is disabled due to the active hardware limit switch. Retract the axis in the opposite direction.	
	16#0043	Hardware limit switch polarity is reversed, axis cannot be freed	Check the mechanical configuration of the hardware limit switch.	
	16#0044	Both hardware limit switches are active, axis cannot be freed		
16#800F		**Error in target range**		Remove enable.
	16#0045	Target range not reached	Target range was not reached within the positioning tolerance time. • Check the configuration of the position monitoring. • Check the configuration of the control loop.	
	16#0046	Exit target range again	The target range was exited within the minimum dwell time. • Check the configuration of the position monitoring. • Check the configuration of the control loop.	

ErrorID	ErrorInfo	Description	Remedy	Error reaction
16#8010		Position of the low SW limit switch is greater than that of the high SW limit switch when the axis is not a modulo axis		Remove enable.
	16#0001	-	Change the position of the software limit switches.	

Operating error without axis stop

ErrorID	ErrorInfo	Description	Remedy
16#8200		Axis is not enabled	
	16#0001	-	Enable the axis; restart the command.
	16#003D	Displayed if a drive with an analog drive connection has turned off.	Enable the axis; restart the command.
16#8201		Axis has already been enabled by another "MC_Power" instance	
	16#0001	-	Enable the axis with only one "MC_Power" instance.
16#8202		The maximum number of simultaneous motion control commands has been exceeded (max. 200 commands for drive connection via PTO (Pulse Train Output), max. 100 commands for drive connection via PROFIdrive/analog output)	
	16#0001	-	Reduce the number of simultaneously active commands; restart the command A command is active if parameter "Busy" = TRUE in the motion control instruction.
16#8203		Axis is currently operated in "Manual control" (axis control panel)	
	16#0001	-	Exit "Manual control"; restart the command.
16#8204		Axis is not homed	
	16#0001	-	Home the axis with instruction "MC_Home"; restart the command.
16#8205		The axis is currently controlled by the user program (the error is only displayed in the axis control panel)	
	16#0013	The axis is enabled in the user program	Disable axis with instruction "MC_Power" and select "Manual control" again in the axis control panel
16#8206		Technology object not activated yet	
	16#0001	-	Enable the axis with instruction "MC_Power" Enable = TRUE or enable the axis in the axis control panel.

ErrorID	ErrorInfo	Description	Remedy
16#8207		**Command rejected**	
	16#0016	Active homing is running; another homing method cannot be started.	Wait for active homing to finish or abort the active homing with a motion command, for example, "MC_Halt".
	16#0018	The axis cannot be moved with a command table while it is being actively or passively homed.	Wait until direct or passive homing is complete.
	16#0019	The axis cannot be actively or passively homed while a command table is being processed.	Wait for command table to finish or abort the command table with a motion command, for example, "MC_Halt".
	16#0052	The specified position exceeds the numerical limit.	Enter a valid position value at the motion control instruction.
	16#0053	The axis is ramping up.	Wait until the axis is ready for operation.
	16#0054	Actual value is invalid	To execute a "MC_Home" command, the actual values must be valid. Check the status of the actual values. The tag of the technology object <Axis name>."StatusSensor.State" must show the value 2 (valid).
16#8208		**Difference between maximum and start/stop velocity is invalid**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#000A	Value is less than or equal to 0.	
16#8209		**Invalid acceleration for technology object "Axis"**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#000A	Value is less than or equal to 0.	
16#820A		**It is not possible to restart the axis**	
	16#0013	The axis is enabled in the user program	Disable the axis with the "MC_Power" instruction; restart again.
	16#0027	The axis is currently being operated in "Manual control" (axis control panel)	Exit "Manual control"; restart again.
	16#002C	The axis is not disabled.	Disable the axis; restart the command.
	16#0047	The technology object is not ready for restart.	Download the project again.
	16#0048	Condition for restart of the technology object is not satisfied.	Disable the technology object.
16#820B		**It is not possible to execute the command table**	
	16#0026	Executing loading process in RUN mode	Wait until the loading process is complete.
16#820C		**No configuration available**	
	16#0001	-	Internal error Contact the hotline.

Block parameter error

ErrorID	ErrorInfo	Description	Remedy
16#8400		**Invalid value at parameter "Position" of the motion control instruction**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#0005	Value is outside the number range (greater than 1E+12)	
	16#0006	Value is outside the number range (less than 1E+12)	
16#8401		**Invalid value at parameter "Distance" of the motion control instruction**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#0005	Value is outside the number range (greater than 1E+12)	
	16#0006	Value is outside the number range (less than 1E+12)	
16#8402		**Invalid value at parameter "Velocity" of the motion control instruction**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#0008	Value is greater than the configured maximum velocity	
	16#0009	Value is less than the configured start/stop velocity	
	16#0024	Value is less than 0	
16#8403		**Invalid value at parameter "Direction" of the motion control instruction**	
	16#0011	The selection value is invalid	Correct the selection value; restart the command.
16#8404		**Invalid value at parameter "Mode" of the motion control instruction**	
	16#0011	The selection value is invalid	Correct the selection value; restart the command.
	16#0015	Active/passive homing is not configured	Correct the configuration and download it to the controller; enable the axis and restart the command.
	16#0017	The direction reversal is activated at the hardware limit switch, despite the fact that the hardware limit switches are disabled	• Activate the HW limit switch using the tag <Axis name>.PositionLimitsHW.Active = TRUE, restart the command. • Correct the configuration and download it to the controller; enable the axis and restart the command.
	16#0055	Invalid mode at incremental encoder	Start a homing process for an incremental encoder using parameter "Mode" = 0, 1, 2, 3.
	16#0056	Invalid mode at absolute encoder	Passive and active homing ("Mode" = 2, 3) are not possible for an absolute value encoder. Start a homing process for an absolute encoder using parameter "Mode" = 0, 1.
16#8405		**Invalid value at parameter "StopMode" of the motion control instruction**	
	16#0011	The selection value is invalid	Correct the selection value; enable the axis again.

ErrorID	ErrorInfo	Description	Remedy
16#8406		**Simultaneous forward and backward jogging is not allowed**	
	16#0001	-	Take steps to ensure that parameters "JogForward" and "JogBackward" do not have signal status TRUE simultaneously; restart the command.
16#8407		**Switching to another axis with instruction "MC_Power" is only permitted after disabling the active axis.**	
	16#0001	-	Disable the active axis; it is then possible to switch to the other axis and enable it.
16#8408		**Invalid value at parameter "Axis" of the motion control instruction**	
	16#001A	The specified value does not match the required technology object version	Correct the value; restart the command.
	16#001B	The specified value does not match the required technology object type	
	16#001C	The specified value is not a motion control technology data block	
16#8409		**Invalid value at parameter "CommandTable" of the motion control instruction**	
	16#001A	The specified value does not match the required technology object version	Correct the value; restart the command.
	16#001B	The specified value does not match the required technology object type	
	16#001C	The specified value is not a motion control technology data block	
16#840A		**Invalid value at parameter "StartStep" of the motion control instruction**	
	16#000A	Value is less than or equal to 0.	Correct the value; restart the command.
	16#001D	The start step is greater than the end step	
	16#001E	Value is greater than 32	
16#840B		**Invalid value at parameter "EndStep" of the motion control instruction**	
	16#000A	Value is less than or equal to 0.	Correct the value; restart the command.
	16#001E	Value is greater than 32	
16#840C		**Invalid value at parameter "RampUpTime" of the motion control instruction**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#000A	Value is less than or equal to 0.	
16#840D		**Invalid value at parameter "RampDownTime" of the motion control instruction**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#000A	Value is less than or equal to 0.	
16#840E		**Invalid value at parameter "EmergencyRampTime" of the motion control instruction**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#000A	Value is less than or equal to 0.	
16#840F		**Invalid value at parameter "JerkTime" of the motion control instruction**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#000A	Value is less than or equal to 0.	

ErrorID	ErrorInfo	Description	Remedy
16#8410		**Invalid value at parameter "Parameter" of the motion control instruction**	
	16#0002	Value is not a valid number	Correct the value; restart the command.
	16#000B	Address is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#0028	Data type of VARIANT pointer "Parameter" and "Value" do not match.	Use a suitable data type; restart command.
	16#0029	VARIANT pointer "Parameter" does not point to a data block of the technology object.	Correct the VARIANT pointer; restart the command.
	16#002A	The value at the VARIANT pointer "Parameter" cannot be read.	Correct the VARIANT pointer; restart the command.
	16#002B	The value at the VARIANT pointer "Parameter" cannot be written.	Correct the VARIANT pointer or value; restart the command.
	16#002C	The axis is not disabled.	Disable the axis; restart the command.
16#8411		**Invalid value at parameter "Value" of the motion control instruction**	
	16#0002	Value is not a valid number.	Correct the value; restart the command.
	16#0005	Value is outside the number range (greater than 1E+12).	
	16#0006	Value is outside the number range (less than 1E+12).	

Configuration error of the axis

ErrorID	ErrorInfo	Description	Remedy
16#8600		**Parameter assignment of pulse generator (PTO is invalid**	
	16#000B	The address is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#0014	The selected hardware is used by another application	
16#8601		**Parameter assignment of the high-speed counter (HSC) is invalid**	
	16#000B	The address is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#0014	The selected hardware is used by another application	
16#8602		**Invalid parameter assignment of "Enable output"**	
	16#000B	The address is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#8603		**Invalid parameter assignment of "Ready input"**	
	16#000B	The address is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#8604		**Invalid "Pulses per motor revolution" value**	
	16#000A	Value is less than or equal to zero	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".

ErrorID	ErrorInfo	Description	Remedy
16#8605		**Invalid "Distance per revolution" value**	
	16#0002	Value is not a valid number	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#0005	Value is outside the number range (greater than 1E+12)	
	16#000A	Value is less than or equal to zero	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8606		**Invalid "Start/stop velocity" value**	
	16#0002	Value is not a valid number	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#0003	Value is higher than the high hardware limit	
	16#0004	Value is lower than the low hardware limit	
	16#0007	The start/stop velocity is greater than the maximum velocity	
16#8607		**Invalid "maximum velocity" value**	
	16#0002	Value is not a valid number	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#0003	Value is higher than the high hardware limit	
	16#0004	Value is lower than the low hardware limit	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8608		**Invalid "Acceleration" value**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0003	Value is higher than the high hardware limit	
	16#0004	Value is lower than the low hardware limit	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.

ErrorID	ErrorInfo	Description	Remedy
16#8609		**Invalid "Deceleration" value**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0003	Value is higher than the high hardware limit	
	16#0004	Value is lower than the low hardware limit	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#860A		**Invalid "Emergency stop deceleration" value**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0003	Value is higher than the high hardware limit	
	16#0004	Value is lower than the low hardware limit	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#860B		**Value for position of the low SW limit switch is invalid**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0005	Value is outside the number range (greater than 1E+12)	
	16#0006	Value is outside the number range (less than 1E+12)	
	16#0030	The position value of the low software limit switch is greater than that of the high software limit switch	

ErrorID	ErrorInfo	Description	Remedy
16#860C		**Value for position of the high SW limit switch is invalid**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0005	Value is outside the number range (greater than 1E+12)	
	16#0006	Value is outside the number range (less than 1E+12)	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#860D		**Invalid address of the low HW limit switch**	
	16#000B	Invalid address	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#000C	The address of the falling edge is invalid	
	16#000D	The address of the rising edge is invalid	
16#860E		**Invalid address of the high HW limit switch**	
	16#000B	Invalid address	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#000C	The address of the falling edge is invalid	
	16#000D	The address of the rising edge is invalid	
16#860F		**Invalid "home position offset" value**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0005	Value is outside the number range (greater than 1E+12)	
	16#0006	Value is outside the number range (less than 1E+12)	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.

ErrorID	ErrorInfo	Description	Remedy
16#8610		**Invalid "approach velocity" value**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0008	The velocity is greater than the maximum velocity	
	16#0009	The velocity is less than the start/stop velocity	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8611		**Invalid "Homing velocity" value**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0008	The velocity is greater than the maximum velocity	
	16#0009	The velocity is less than the start/stop velocity	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8612		**Invalid address of the homing switch**	
	16#000B	Invalid address	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#000C	The address of the falling edge is invalid	
	16#000D	The address of the rising edge is invalid	
16#8613		**During active homing, direction reversal at the hardware limit switch is activated although the hardware limit switches are not configured**	
	16#0001	-	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.

ErrorID	ErrorInfo	Description	Remedy
16#8614		**Invalid "Jerk" value**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#001F	Value is greater than the maximum jerk	
	16#0020	Value is less than the minimum jerk	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8615		**Value for "Unit of measurement" is invalid**	
	16#0011	The selection value is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#8616		**Address of homing switch is invalid (passive homing as of V4)**	
	16#0011	The selection value is invalid	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8617		**Value of tag <Axis name>.Sensor.Sensor[1].ActiveHoming.Mode is invalid**	
	16#0011	The selection value is invalid (Valid value: 2 = Homing via digital input)	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8618		**Value of tag <Axis name>.Sensor.Sensor[1].PassiveHoming.Mode is invalid**	
	16#0011	The selection value is invalid (Valid value: 2 = Homing via digital input)	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.

ErrorID	ErrorInfo	Description	Remedy
16#8619		**Value of tag <Axis name>.Actor.Type is invalid**	
	16#0011	The selection value is invalid (Valid value: 2 = Connection via pulse interface)	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#861A		**Value for "Permitted direction of rotation" is invalid**	
	16#0011	The selection value is invalid	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#002D	"Both directions" not allowed when direction output is deactivated	
16#861B		**Faulty load gear factors**	
	16#0031	Value is invalid.	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#861C		**Illegal combination of data for homing with incremental encoder**	
	16#0031	Value is invalid.	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#861D		**The set encoder mounting type is invalid. Invalid value in <Axis name>.Sensor.Sensor[1].MountingMode**	
	16#0011	The selection value is invalid	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#861E		**The configuration of the measuring wheel circumference of the encoder is invalid. Invalid value in <Axis name>.Sensor.Sensor[1].Parameter.DistancePerRevolution**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.

ErrorID	ErrorInfo	Description	Remedy
16#861F		**The configuration for the resolution of the linear encoder is faulty. Invalid value in <Axis name>.Sensor.Sensor[1].Parameter.Resolution**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8620		**The set fine resolution for Gn_XIST1 is invalid. Invalid value in <Axis name>.Sensor.Sensor[1].Parameter.FineResolutionXist1**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8621		**The set fine resolution for Gn_XIST1 in <Axis name>.Sensor.Sensor[1].Parameter.FineResolutionXist1 is not consistent with the setting in PROFIdrive parameter P979**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8622		**Invalid value for the configuration date <Axis name>.Actor.Interface.AddressIn or <Axis name>.Actor.Interface.AddressOut**	
	16#0011	The selection value is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#8623		**The value set in the tag <Axis name>.Sensor.Sensor[1].Type is invalid.**	
	16#0011	The selection value is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#8624		**The set encoder system is invalid. Invalid value in <Axis name>.Sensor.Sensor[1].System**	
	16#0011	The selection value is invalid	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.

ErrorID	ErrorInfo	Description	Remedy
16#8625		**Parameter of position monitoring is faulty. Invalid value in <Axis name>.PositioningMonitoring.MinDwellTime**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8626		**Parameter of position monitoring is faulty. Invalid value in <Axis name>.PositioningMonitoring.Window**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8627		**The configuration of the PROFIdrive interface of the actual value is faulty. Invalid value in <Axis name>.Sensor.Sensor[1].Interface.AddressIn or <Axis name>.Sensor.Sensor[1].Interface.AddressOut**	
	16#0011	The selection value is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#8628		**Faulty controller factors**	
	16#0030	Value has an incorrect number format or is outside the valid number range	The value for the gain or the precontrol of the control loop is faulty. • Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary. (<Axis name>.PositionControl.Kv, <Axis name>.PositionControl.Kpc)
16#8629		**Limit for standstill signal is faulty. Invalid value in <Axis name>.StandStillSignal.VelocityThreshold**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.

ErrorID	ErrorInfo	Description	Remedy
16#862A		**Parameter of position monitoring is faulty. Invalid value in <Axis name>.PositioningMonitoring.ToleranceTime**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#862B		**Inconsistent PROFIBUS parameterization; the sum of Ti and To is greater than one DP cycle**	
	16#0030	Value has an incorrect number format or is outside the valid number range	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#862C		**Parameter of standstill monitoring is faulty. Invalid value in <Axis name>.StandStillSignal.MinDwellTime**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#862D		**Parameter of following error monitoring is faulty. Invalid value in <Axis name>.FollowingError.MinValue**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#862E		**Invalid value for the configuration date <Axis name>.Modulo.Length**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#862F		**Invalid value for the configuration date <Axis name>.Modulo.StartValue**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.

ErrorID	ErrorInfo	Description	Remedy
16#8630		**Invalid value for the configuration date <Axis name>.Actor.DriveParameter.ReferenceSpeed**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8631		**The set fine resolution for Gn_XIST2 is invalid. Invalid value in <Axis name>.Sensor.Sensor[1].Parameter.FineResolutionXist2**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8632		**The number of determinable encoder revolutions is invalid. Invalid value in <Axis name>.Sensor.Sensor[1].Parameter.DeterminableRevolutions**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8633		**The specified approach direction of the homing switch for passive homing is invalid. Invalid value in <Axis name>.Sensor.Sensor[1].PassiveHoming.Direction**	
16#8634		**Parameter of the following error monitoring is faulty. Invalid value in <Axis name>.FollowingError.MaxValue**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8635		**Parameter of the following error monitoring is faulty. Invalid value in <Axis name>.FollowingError.MinVelocity**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.

ErrorID	ErrorInfo	Description	Remedy
16#8636		**Controller factor is incorrect. Invalid value of the precontrol factor <Axis name>.PositionControl.Kpc**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
16#8637		**Invalid value for the configuration date <Axis name>.Sensor.Sensor[1].Interface.Type**	
	16#0011	The selection value is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#8638		**Invalid value for the configuration date <Axis name>.Sensor.Sensor[1].Interface.HSC**	
	16#0011	The selection value is invalid	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
16#8639		**Error at the drive**	
	16#0049	Configuration error at device	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#004A	The technology needs a smaller servo clock.	Internal system error. Check the project for consistency and reload it into the controller.
	16#004B	Device driver not initialized during ramp-up.	To enable a technology object, the actuator driver must be initialized. Execute the command again later.
16#863A		**Communication to the drive is faulty**	
	16#004C	Configuration error at device	• Connect a suitable device. • Check the device (I/Os). • Compare the configuration of HW Config and the technology object.
	16#004D	The device driver needs a smaller servo clock.	• Connect a suitable device. • Check the device (I/Os). • Compare the configuration of HW Config and the technology object.
	16#004E	Error in internal communication with the device	Check the project for consistency and reload it into the controller.

ErrorID	ErrorInfo	Description	Remedy
16#863B		**Error at encoder**	
	16#0049	Configuration error at device	Download error-free configuration to the controller; enable the axis again with instruction "MC_Power".
	16#004A	The technology needs a smaller servo clock.	Internal system error. Check the project for consistency and reload it into the controller.
	16#004B	Device driver not initialized during ramp-up.	To enable a technology object, the actuator driver must be initialized. Execute the command again later.
16#863C		**Communication with encoder is faulty**	
	16#004C	Configuration error at device	• Connect a suitable device. • Check the device (I/Os). • Compare the configuration of HW Config and the technology object.
	16#004D	The device driver needs a smaller servo clock.	• Connect a suitable device. • Check the device (I/Os). • Compare the configuration of HW Config and the technology object.
	16#004E	Error in internal communication with the device	Check the project for consistency and reload it into the controller.
16#863D		**Communication to the device (drive or encoder) is faulty**	
	16#0030	Value has an incorrect number format or is outside the valid number range	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online; acknowledge error with instruction "MC_Reset" and restart the command, if necessary.
	16#0055	The requested logical address is invalid.	• Connect a suitable device. • Check the device (I/Os). • Check the topological configuration in HW Config. • Compare the configuration of HW Config and the technology object.
	16#0056	The requested logical output address is invalid.	
	16#0057	The requested logical output address is invalid.	
16#863E		**Value of tag "ControlPanel.Input.TimeOut" is invalid (axis control panel)**	
	16#0030	Value has an incorrect number format or is outside the valid number range	Correct the value in the tags of the technology object <Axis name>.ControlPanel.Input.TimeOut. The value is specified in milliseconds (ms).
16#863F		**Invalid value for the configuration date <Axis name>.Actor.DriveParameter.MaxSpeed**	
	16#0030	Value has an incorrect number format or is outside the valid number range	Correct the reference value in the drive and in the configuration of the technology object to Actuator.MaxSpeed/2. With analog drive connection, correct the reference value in the drive and in the configuration of the technology object to Actuator.MaxSpeed/1.17.

Data adaptation errors

ErrorID	ErrorInfo	Description	Remedy	Error reaction
16#8640		Errors when adapting actuator configuration		
	16#0030	Value has the wrong numerical format or is outside the valid number range.	Restart	Adaptation Error
	16#0059	The device is not assigned to any SINAMICS drive unit or does not support the services necessary for adaptation.	Restart	Adaptation Error
	16#005A	Adaptation was cancelled because of the lack of resources.	Restart	Adaptation Error
	16#005B	Adaptation is possible only if the device was wired directly to an IO area.	Restart	Adaptation Error
	16#005C	Maximum speed (p1082): Parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error
	16#005D	Maximum torque/force (p1520): Parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error
	16#005E	Maximum torque/force (p1521): Parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error
	16#005F	Fine resolution torque/force limit (p1544): Parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error
	16#0060	Basic speed/rated speed (p2000): Parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error
	16#0061	Rated torque/rated force (p2003): Parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error

ErrorID	ErrorInfo	Description	Remedy	Error reaction
16#8041		**Errors when adapting the encoder configuration**		
	16#0030	Value has the wrong numerical format or is outside the valid number range.	Restart	Adaptation Error
	16#005A	Adaptation was cancelled because of a lack of resources.	Restart	Adaptation Error
	16#005B	Adaptation is possible only if the device was wired directly to an IO area.	Restart	Adaptation Error
	16#0059	The device is not assigned to any SINAMICS drive unit or does not support the services necessary for adaptation.	Restart	Adaptation Error
	16#0062	Encoder System (r0979[1/11].0): A parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error
	16#0063	Encoder resolution (r0979[2/12]): A parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error
	16#0064	Encoder resolution Gx_XIST1 (r0979[3/13]): A parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error
	16#0065	Encoder resolution Gx_XIST2 (r0979[4/14]): A parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error
	16#0066	Number of resolvable encoder revolutions (r0979[5/15]): A parameter does not exist or its value cannot be read or is outside the permitted limits. Reading the parameters was cancelled because of an error indicated by the hardware.	Restart	Adaptation Error

ErrorID	ErrorInfo	Description	Remedy	Error reaction
16#8642		**Configuration is adapted internally**		
	16#0067	1: Impermissible value for Actor.MaxSpeed (Actor.MaxSpeed larger than 2*Actor.ReferenceSpeed); Remedy: in drive, set P2000 = P1082 for example.	Reset	Configuration error
16#8643		**Inconsistency between TO and drive configuration**		
	16#0068	The configured telegram type is not compatible with the device's telegram type (P922 or P2079).	Reset	Configuration error
	16#0069	The torque resolution is not compatible.	Reset	Configuration error
	16#006A	The elementary period time of the master application cycle is not identical with that of the servo clock.	Reset	Configuration error
	16#006B	The processing clock of the technology object is not identical with the drive's application cycle.	Reset	Configuration error
	16#006C	In the drive, a function module with linear motor is set.	Reset	Configuration error
16#8644		**Inconsistency between TO and encoder configuration**		
	16#0068	The configured telegram type is not compatible with the device's telegram type (P922 or P2079).	Reset	Configuration error
	16#006A	The elementary period time of the master application cycle is not identical with that of the servo clock.	Reset	Configuration error
	16#006B	The processing clock of the technology object is not identical with the drive's application cycle.	Reset	Configuration error
	16#006D	The encoder at the drive is not an absolute value encoder (P979).	Reset	Configuration error
16#8645		**Maximum velocity cannot be attained with the drive and axis parameters that were set**		
	16#0001	General	Reset	Configuration error

Configuration error of the command table

ErrorID	ErrorInfo	Description	Remedy
16#8700		**Value for "Command type" in the command table is invalid**	
	16#0001	-	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online and restart the command, if necessary.
16#8701		**Value for "Position / travel path" in the command table is invalid**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online and restart the command, if necessary.
	16#0005	Value is outside the number range (greater than 1E+12)	
	16#0006	Value is outside the number range (less than 1E+12)	
16#8702		**Value for "Velocity" in the command table is invalid**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online and restart the command, if necessary.
	16#0008	Value is greater than the configured maximum velocity	
	16#0009	Value is less than the configured start/stop velocity	
16#8703		**Value for "Duration" in the command table is invalid**	
	16#0002	Value is not a valid number	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online and restart the command, if necessary.
	16#0021	Value is greater than 64800 s	
	16#0022	Value is less than 0.001 s	
16#8704		**Value for "Next step" in the command table is invalid**	
	16#0011	The selection value is invalid	• Download error-free configuration to the controller; enable the axis again with instruction "MC_Power". • Correct the incorrect value online and restart the command, if necessary.
	16#0023	The command transition is not permitted for this command	

Internal errors

ErrorID	ErrorInfo	Description	Remedy
16#8FFF		**Internal error**	
	16#F0**	-	POWER OFF and POWER ON the CPU If this does not work, contact Customer Support. Have the following information ready: • ErrorID • ErrorInfo • Diagnostic buffer entries

Communication

11

The S7-1200 offers several types of communication between CPUs and programming devices, HMIs, and other CPUs.

⚠ WARNING

If an attacker can physically access your networks, the attacker can possibly read and write data.

The TIA Portal, the CPU, and HMIs (except HMIs using GET/PUT) use secure communication that protects against replay and "man-in-the-middle" attacks. Once communication is enabled, the exchange of signed messages takes place in clear text which allows an attacker to read data, but protects against unauthorized writing of data. The TIA Portal, not the communication process, encrypts the data of know-how protected blocks.

All other forms of communication (I/O exchange through PROFIBUS, PROFINET, AS-i, or other I/O bus, GET/PUT, T-Block, and communication modules (CM)) have no security features. You must protect these forms of communication by limiting physical access. If an attacker can physically access your networks utilizing these forms of communication, the attacker can possibly read and write data.

For security information and recommendations, please see our "Operational Guidelines for Industrial Security" (http://www.industry.siemens.com/topics/global/en/industrial-security/Documents/operational_guidelines_industrial_security_en.pdf) on the Siemens Service and Support site.

PROFINET

PROFINET is used for exchanging data through the user program with other communications partners through Ethernet:

- In the S7-1200, PROFINET supports 16 IO devices with a maximum of 256 submodules, and PROFIBUS allows 3 independent PROFIBUS DP Masters, supporting 32 slaves per DP master, with a maximum of 512 modules per DP master.
- S7 communication
- User Datagram Protocol (UDP) protocol
- ISO on TCP (RFC 1006)
- Transport Control Protocol (TCP)

PROFINET IO controller

As an IO controller using PROFINET IO, the CPU communicates with up to 16 PN devices on the local PN network or through a PN/PN coupler (link). Refer to PROFIBUS and PROFINET International, PI (www.us.profinet.com) for more information.

PROFIBUS

PROFIBUS is used for exchanging data through the user program with other communications partners through the PROFIBUS network:

- With CM 1242-5, the CPU operates as a PROFIBUS DP slave.
- With CM 1243-5, the CPU operates as a PROFIBUS DP master class1.
- PROFIBUS DP Slaves, PROFIBUS DP Masters, and AS-i (the 3 left-side communication modules) and PROFINET are separate communications networks that do not limit each other.

AS-i

The S7-1200 CM 1243-2 AS-i Master allows the attachment of an AS-i network to an S7-1200 CPU.

CPU-to-CPU S7 communication

You can create a communication connection to a partner station and use the GET and PUT instructions to communicate with S7 CPUs.

TeleService communication

In TeleService via GPRS, an engineering station on which STEP 7 is installed communicates via the GSM network and the Internet with a SIMATIC S7-1200 station with a CP 1242-7. The connection runs via a telecontrol server that serves as an intermediary and is connected to the Internet.

IO-Link

The S7-1200 SM 1278 4xIO-Link Master enables IO-Link devices to connect to an S7-1200 CPU.

11.1 Asynchronous communication connections

Overview of communication services

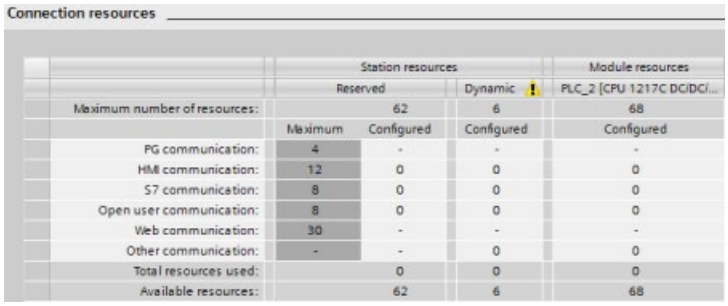
The CPU supports the following communication services:

Communication service	Functionality	Using PROFIBUS DP		Using Ethernet
		CM 1243-5 DP master module	CM 1242-5 DP slave module	
PG communication	Commissioning, testing, diagnostics	Yes	No	Yes
HMI communication	Operator control and monitoring	Yes	No	Yes
S7 communication	Data exchange using configured connections	Yes	No	Yes
Routing of PG functions	For example, testing and diagnostics beyond network boundaries	No	No	No
PROFIBUS DP	Data exchange between master and slave	Yes	Yes	No
PROFINET IO	Data exchange between I/O controllers and I/O devices	No	No	Yes
Web server	Diagnostics	No	No	Yes
SNMP [1] (Simple Network Management Protocol)	Standard protocol for network diagnostics and parameterization	No	No	Yes
S7 routing	Using routing tables, communication partners can communicate with each device even though the devices are on different S7 subnets.	No	No	Yes
Open communication over TCP/IP	Data exchange over Industrial Ethernet with TCP/IP protocol (with loadable FBs)	No	No	Yes
Open communication over ISO on TCP	Data exchange over Industrial Ethernet with ISO on TCP protocol (with loadable FBs)	No	No	Yes
Open communication over UDP	Data exchange over Industrial Ethernet with UDP protocol (with loadable FBs)	No	No	Yes

[1] The CPU supports SNMP V1 without TRAPs.

Available connections

The CPU supports the following number of maximum simultaneous, asynchronous communication connections for PROFINET and PROFIBUS. The maximum number of connection resources allocated to each category are fixed; you cannot change these values. However, you can configure the 6 "Free available connections" to increase the number of any category as required by your application.



Note

The total number of S7-1200 communication connections does not increase when you add CM/CP modules.

Based upon the allocated connection resources, the following number of connections per device are available:

	Programming terminal (PG)	Human Machine Interface (HMI)	GET/PUT client/server	Open User Communications	Web browser
Maximum number of connection resources	4 (guaranteed to support 1 PG device)	12 (guaranteed to support 4 HMI devices)	8	8	30 (guaranteed to support 3 web browsers)

For an example, the CPU has four available PG connection resources. Depending on the current PG functions in use, the PG might actually use one, two, three, or four of its available connection resources. If one PG uses one connection resource and another PG uses three connection resources for their current functions, it is possible to use two PGs at one time. You are always guaranteed at least one PG.

Another example is the number of HMIs, as shown in the figure below. HMIs have 12 available connection resources. Depending on what HMI type or model that you have and the HMI functions that you use, each HMI might actually use one, two, or three of its available connection resources. Given the number of available connection resources being used, it might be possible to use more than four HMIs at one time. However, you are always guaranteed at least four HMIs. An HMI can use its available connection resources (one each for a total of three) for the following functions:

- Reading
- Writing
- Alarming plus diagnostics

This is only an example. The actual number of connections used can vary by HMI type and version.

Example	HMI 1	HMI 2	HMI 3	HMI 4	HMI 5	Total connection resources available
Connection resources used	2	2	2	3	3	12

Note

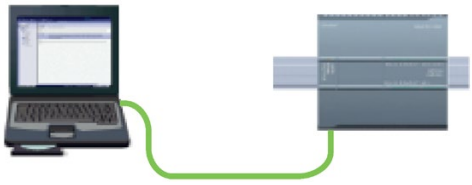
Web server (HTTP) connections: The CPU provides connections for multiple web browsers. The number of browsers that the CPU can simultaneously support depends upon how many connections a given web browser requests/utilizes.

Note

The Open User Communications, S7 connection, HMI, programming device, and Web server (HTTP) communication connections may utilize multiple connection resources based upon the features currently being used.

11.2 PROFINET

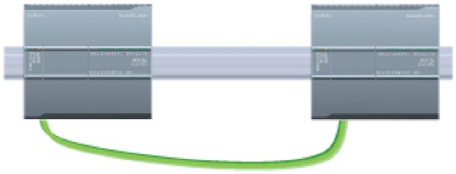
The CPU can communicate with other CPUs, with programming devices, with HMI devices, and with non-Siemens devices using standard TCP communications protocols.



Programming device connected to the CPU



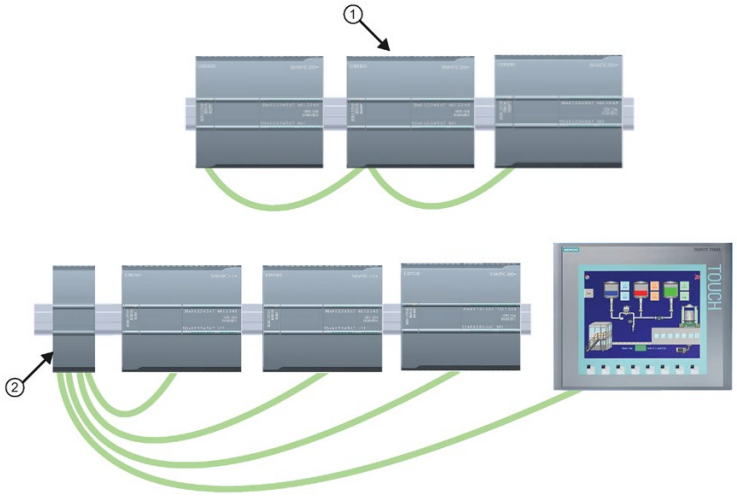
HMI connected to the CPU



A CPU connected to another CPU

Ethernet switching

The CPU 1211C, 1212C, and 1214C have a single Ethernet port and do not include a integrated Ethernet Switch. A direct connection between a programming device or HMI and a CPU does not require an Ethernet switch. However, a network with more than two CPUs or HMI devices requires an Ethernet switch.



① CPU 1215C

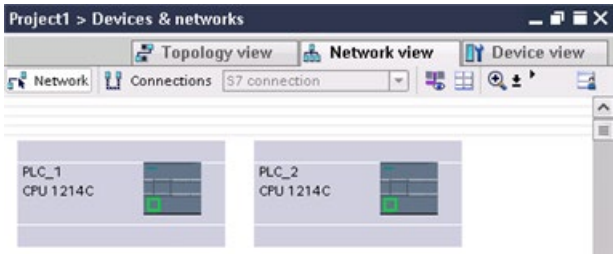
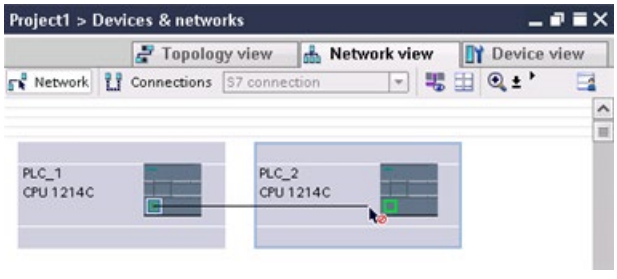
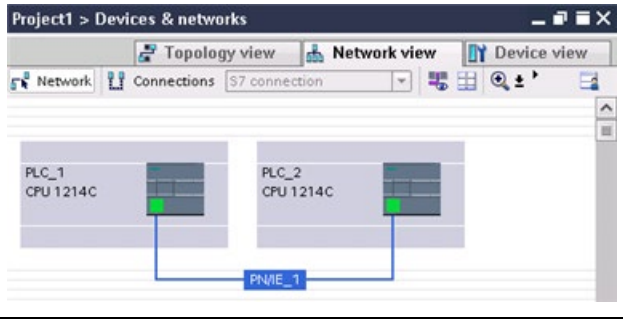
② CSM1277 Ethernet switch

The CPU 1215C and the CPU 1217C have a built-in 2-port Ethernet switch. You can have a network with a CPU 1215C and two other S7-1200 CPUs. You can also use the rack-mounted CSM1277 4-port Ethernet switch for connecting multiple CPUs and HMI devices.

11.2.1 Creating a network connection

Use the "Network view" of Device configuration to create the network connections between the devices in your project. After creating the network connection, use the "Properties" tab of the inspector window to configure the parameters of the network.

Table 11- 1 Creating a network connection

Action	Result
Select "Network view" to display the devices to be connected.	
Select the port on one device and drag the connection to the port on the second device.	
Release the mouse button to create the network connection.	

11.2.2 Configuring the Local/Partner connection path

A Local / Partner (remote) connection defines a logical assignment of two communication partners to establish communication services. A connection defines the following:

- Communication partners involved (One active, one passive)
- Type of connection (for example, a PLC, HMI, or device connection)
- Connection path

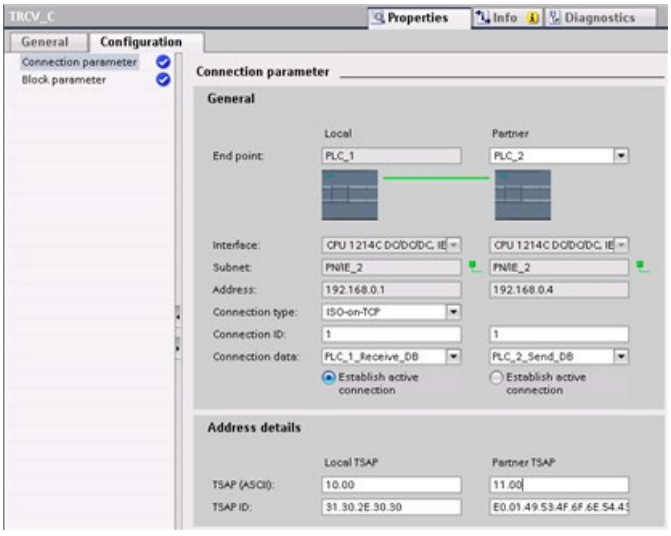
Communication partners execute the instructions to set up and establish the communication connection. You use parameters to specify the active and passive communication end point partners. After the connection is set up and established, it is automatically maintained and monitored by the CPU.

If the connection is terminated (for example, due to a line break), the active partner attempts to re-establish the configured connection. You do not have to execute the communication instruction again.

Connection paths

After inserting a TSEND_C, TRCV_C or TCON instruction into the user program, the inspector window displays the properties of the connection whenever you have selected any part of the instruction. Specify the communication parameters in the "Configuration" tab of the "Properties" for the communication instruction.

Table 11- 2 Configuring the connection path (using the properties of the instruction)

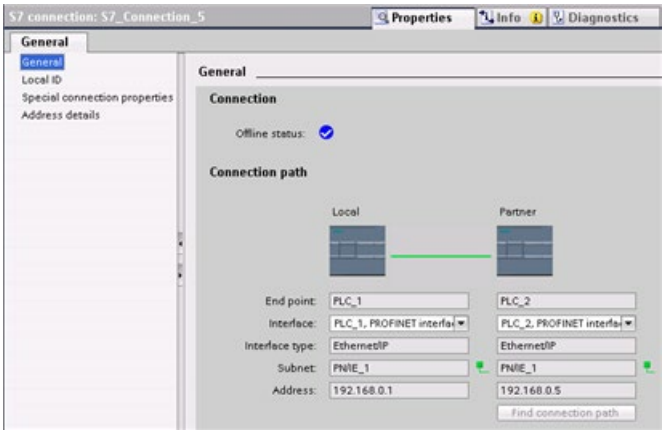
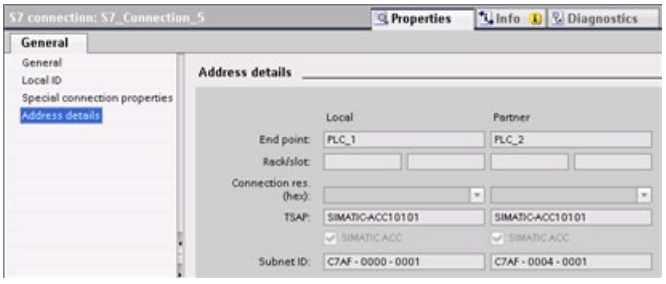
TCP, ISO-on-TCP, and UDP	Connection properties
For the TCP, ISO-on-TCP, and UDP Ethernet protocols, use the "Properties" of the instruction (TSEND_C, TRCV_C, or TCON) to configure the "Local/Partner" connections. The illustration shows the "Connection properties" of the "Configuration tab" for an ISO-on-TCP connection.	

Note

When you configure the connection properties for one CPU, STEP 7 allows you either to select a specific connection DB in the partner CPU (if one exists), or to create the connection DB for the partner CPU. The partner CPU must already have been created for the project and cannot be an "unspecified" CPU.

You must still insert a TSEND_C, TRCV_C or TCON instruction into the user program of the partner CPU. When you insert the instruction, select the connection DB that was created by the configuration.

Table 11- 3 Configuring the connection path for S7 communication (Device configuration)

S7 communication (GET and PUT)	Connection properties
For S7 communication, use the "Devices & networks" editor of the network to configure the Local/Partner connections. You can click the "Highlighted: Connection" button to access the "Properties". The "General" tab provides several properties: • "General" (shown) • "Local ID" • "Special connection properties" • "Address details" (shown)	 

Refer to "Protocols" (Page 805) in the "PROFINET" section or to "Creating an S7 connection" (Page 970) in the "S7 communication" section for more information and a list of available communication instructions.

Table 11- 4 Parameters for the multiple CPU connection

Parameter		Definition
Address		Assigned IP addresses
General	End point	Name assigned to the partner (receiving) CPU
	Interface	Name assigned to the interfaces
	Subnet	Name assigned to the subnets
	Interface type	*S7 communication only*: Type of interface
	Connection type	Type of Ethernet protocol
	Connection ID	ID number
	Connection data	Local and Partner CPU data storage location
	Establish active connection	Radio button to select Local or Partner CPU as the active connection
Address details	End point	*S7 communication only*: Name assigned to the partner (receiving) CPU
	Rack/slot	*S7 communication only*: Rack and slot location
	Connection resource	*S7 communication only*: Component of the TSAP used when configuring an S7 connection with an S7-300 or S7-400 CPU
	Port (decimal):	TCP and UPD: Partner CPU port in decimal format
	TSAP [1] and Subnet ID:	ISO on TCP (RFC 1006) and S7 communication: Local and partner CPU TSAPs in ASCII and hexadecimal formats

[1] When configuring a connection with an S7-1200 CPU for ISO-on-TCP, use only ASCII characters in the TSAP extension for the passive communication partners.

Transport Service Access Points (TSAPs)

Using TSAPs, ISO on TCP protocol and S7 communication allows multiple connections to a single IP address. TSAPs uniquely identify these communication end point connections to an IP address.

In the "Address Details" section of the Connection Parameters dialog, you define the TSAPs to be used. The TSAP of a connection in the CPU is entered in the "Local TSAP" field. The TSAP assigned for the connection in your partner CPU is entered under the "Partner TSAP" field.

Port Numbers

With TCP and UDP protocols, the connection parameter configuration of the Local (active) connection CPU must specify the remote IP address and port number of the Partner (passive) connection CPU.

In the "Address Details" section of the Connection Parameters dialog, you define the ports to be used. The port of a connection in the CPU is entered in the "Local Port" field. The port assigned for the connection in your partner CPU is entered under the "Partner Port" field.

11.2.3 Assigning Internet Protocol (IP) addresses

11.2.3.1 Assigning IP addresses to programming and network devices

If your programming device is using an onboard adapter card connected to your plant LAN, both the programming device and the CPU must exist on the same subnet. You assign the subnet as a combination of the IP address and subnet mask for the device. See your local network administrator for help.

The Network ID is the first three octets of the IP address, for example, **211.154.184**.16. This network ID uniquely identifes your IP network. The subnet mask normally has a value of **255.255.255.0**. Because your computer is on a plant LAN, however, the subnet mask might have various values, for example, **255.255.254.0**, to set up unique subnets. The subnet mask, when combined with the device IP address in a logical AND operation, defines the boundaries of an IP subnet.

Note

In a World Wide Web scenario, where your programming devices, network devices, and IP routers communicate with the world, you must assign unique IP addresses to avoid conflict with other network users. Contact your company IT department personnel, who are familiar with your plant networks, for assignment of your IP addresses.

WARNING

Unauthorized access to the CPU through the Web server

Unauthorized access to the CPU or changing PLC variables to invalid values could disrupt process operation and could result in death, severe personal injury and/or property damage.

Enabling the Web server allows authorized users to perform operating mode changes, writes to PLC data, and firmware updates, Siemens recommends that you observe the following security practices:

- Enable access to the Web server only with the HTTPS protocol.
- Password-protect Web server user IDs (Page 984) with a strong password. Strong passwords are at least ten characters in length, mix letters, numbers, and special characters, are not words that can be found in a dictionary, and are not names or identifiers that can be derived from personal information. Keep the password secret and change it frequently.
- Do not extend the default minimum privileges of the "Everybody" user.
- Perform error-checking and range-checking on your variables in your program logic because Web page users can change PLC variables to invalid values.

Note

A secondary network adapter card is useful when you do not want your CPU on your company LAN. During initial testing or commissioning tests, this arrangement is particularly useful.

Assigning or checking the IP address of your programming device using "My Network Places" (on your desktop)

To assign or check your programming device's IP address, follow these steps:

1. Open the Control Panel from the Start menu.
2. Open the "Network and Sharing Center" and elect "Local Area Connection" for the network adapter connected to your CPU
3. Click "Properties" on the "Local Area Connection Status" dialog.
4. In the "Local Area Connection Properties" dialog, select "Internet Protocol Version 4 (TCP/IPv4)" for the "This connection uses the following items:" field.
5. Click the "Properties" button.
6. Select "Obtain an IP address automatically" or to enter a static IP address select "Use the following IP address".
7. If you selected "Use the following IP address", set the IP address and subnet mask:
   - Set the IP address to use the same Network ID and same subnet as the CPU. For example, if the CPU IP address is **192.168.0**.1, you could set the IP address to **192.168.0**.200.
   - Select a subnet mask of **255.255.255**.0.
   - Leave the default gateway blank.

You can now connect to the CPU.

Note

The Network Interface Card and the CPU must be on the same subnet to allow STEP 7 to find and communicate with the CPU.

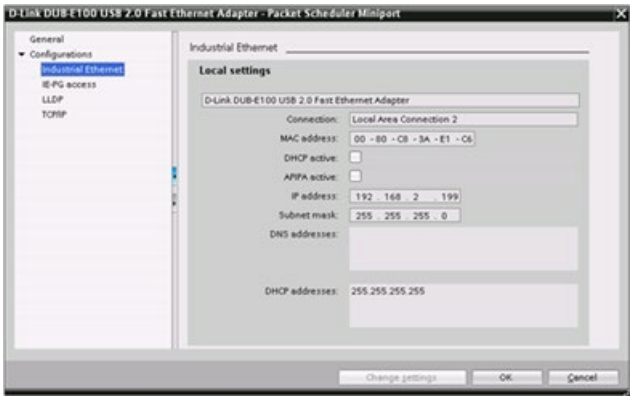
Consult your IT personnel to help you set up a network configuration to allow you to connect to the S7-1200 CPU.

11.2.3.2 Checking the IP address of your programming device

You can check the MAC and IP addresses of your programming device with the following menu selections:

1. In the "Project tree", expand "Online access".
2. Right-click the required network, and select "Properties".
3. In the network dialog, expand "Configurations", and select "Industrial Ethernet".

The MAC and IP addresses of the programming device are displayed.

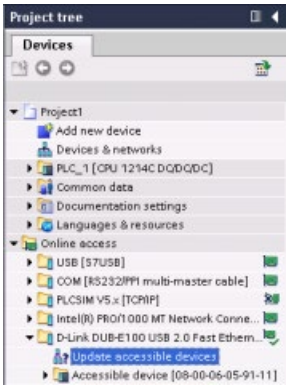


11.2.3.3 Assigning an IP address to a CPU online

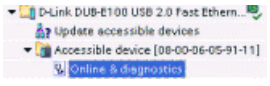
You can assign an IP address to a network device online. This is particularly useful in an initial device configuration.

1. In the "Project tree," verify that the CPU does not have a configured IP address. Expand "Online access" > <Adapter card for the network in which the device is located and double-click "Update accessible devices".

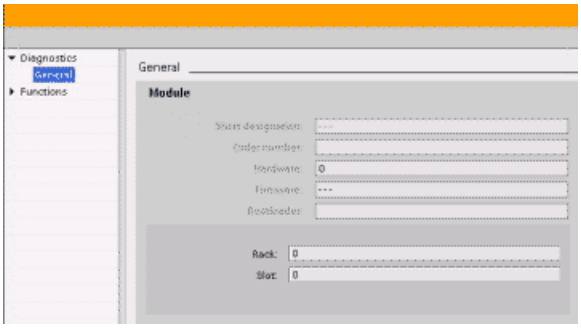
If STEP 7 displays a MAC address instead of an IP address, then no IP address has been assigned.



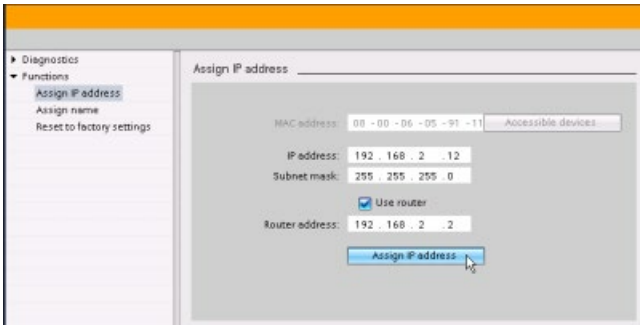
2. Under the required accessible device, double-click "Online & diagnostics".



3. In the "Online & diagnostics" dialog, select "Functions" > "Assign IP address".

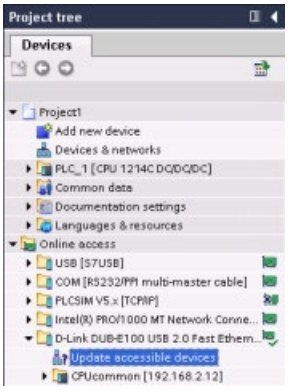


4. In the "IP address" field, enter your new IP address, and click the "Assign IP address" button.



5. In the "Project tree," verify that STEP 7 has assigned your new IP address to the CPU.

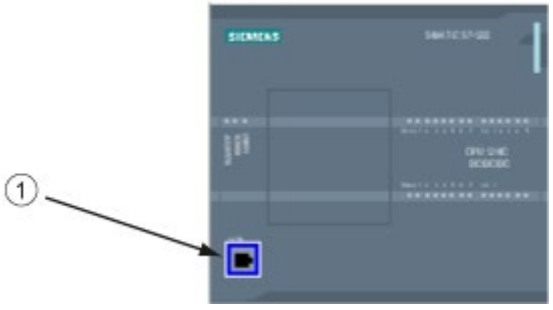
Double-click "Update accessible devices" to display the IP address that you configured.



11.2.3.4 Configuring an IP address for a CPU in your project

Configuring the PROFINET interface

To configure parameters for the PROFINET interface, select the green PROFINET box on the CPU. The "Properties" tab in the inspector window displays the PROFINET port.



① PROFINET port

Configuring the IP address

Ethernet (MAC) address: In a PROFINET network, each device is assigned a Media Access Control address (MAC address) by the manufacturer for identification. A MAC address consists of six groups of two hexadecimal digits, separated by hyphens (-) or colons (:), in transmission order, (for example, 01-23-45-67-89-AB or 01:23:45:67:89:AB).

IP address: Each device must also have an Internet Protocol (IP) address. This address allows the device to deliver data on a more complex, routed network.

Each IP address is divided into four 8-bit segments and is expressed in a dotted, decimal format (for example, 211.154.184.16). The first part of the IP address is used for the Network ID (What network are you on?), and the second part of the address is for the Host ID (unique for each device on the network). An IP address of 192.168.x.y is a standard designation recognized as part of a private network that is not routed on the Internet.

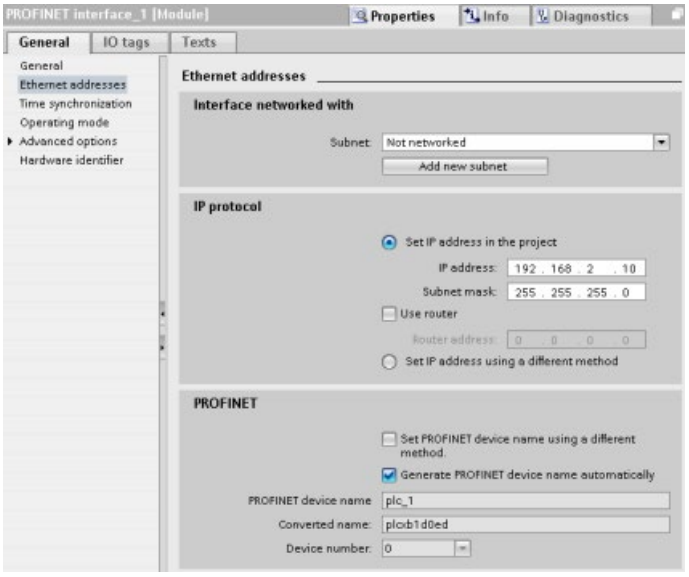
Subnet mask: A subnet is a logical grouping of connected network devices. Nodes on a subnet tend to be located in close physical proximity to each other on a Local Area Network (LAN). A mask (known as the subnet mask or network mask) defines the boundaries of an IP subnet.

A subnet mask of 255.255.255.0 is generally suitable for a small local network. This means that all IP addresses on this network should have the same first 3 octets, and the various devices on this network are identified by the last octet (8-bit field). An example of this is to assign a subnet mask of 255.255.255.0 and an IP addresses of 192.168.2.0 through 192.168.2.255 to the devices on a small local network.

The only connection between different subnets is via a router. If subnets are used, an IP router must be employed.

IP router: Routers are the link between LANs. Using a router, a computer in a LAN can send messages to any other networks, which might have other LANs behind them. If the destination of the data is not within the LAN, the router forwards the data to another network or group of networks where it can be delivered to its destination.

Routers rely on IP addresses to deliver and receive data packets.



IP addresses properties: In the Properties window, select the "Ethernet addresses" configuration entry. STEP 7 displays the Ethernet address configuration dialog, which associates the software project with the IP address of the CPU that will receive that project.

Table 11- 5 Parameters for the IP address

Parameter		Description
Subnet	Name of the Subnet to which the device is connected. Click the "Add new subnet" button to create a new subnet. "Not connected" is the default. Two connection types are possible: • The "Not connected" default provides a local connection. • A subnet is required when your network has two or more devices.	
IP protocol	IP address	Assigned IP address for the CPU
	Subnet mask	Assigned subnet mask
	Use IP router	Click the checkbox to indicate the use of an IP router
	Router address	Assigned IP address for the router, if applicable

Note

All IP addresses are configured when you download the project. If the CPU does not have a pre-configured IP address, you must associate the project with the MAC address of the target device. If your CPU is connected to a router on a network, you must also enter the IP address of the router.

The "Set IP address using a different method" radio button allows you to change the IP address online or by using the "T_CONFIG (Page 880)" instruction after the program is downloaded. This IP address assignment method is for the CPU only.

WARNING

Downloading a hardware configuration with "Set IP address using different method"

After downloading a hardware configuration with the "Set IP address using a different method" option enabled, it is not possible to transition the CPU operating mode from RUN to STOP or from STOP to RUN.

User equipment continues to run under these conditions and can result in unexpected machine or process operations, which could cause death, severe personal injury, or property damage if proper precautions are not taken.

Ensure that your CPU IP address(es) are set before using the CPU in an actual automation environment. This can be done by using your STEP 7 programming package, the SIMATIC Automation Tool, or an attached HMI device in conjunction with the T_CONFIG instruction.

WARNING

Condition in which PROFINET network might stop

When changing the IP address of a CPU online or from the user program, it is possible to create a condition in which the PROFINET network might stop.

If the IP address of a CPU is changed to an IP address outside the subnet, the PROFINET network will lose communication, and all data exchange will stop. User equipment may be configured to keep running under these conditions. Loss of PROFINET communication may result in unexpected machine or process operations, causing death, severe personal injury, or property damage if proper precautions are not taken.

If an IP address must be changed manually, ensure that the new IP address lies within the subnet.

Configuring the PROFINET port

By default, the CPU configures port(s) of the PROFINET interface for autonegotiation. For autonegotiation to function properly, you must configure both stations to autonegotiate. If one station has a fixed configuration (for example, full-duplex at 100 Mbps) and the other station is set to autonegotiate, then autonegotiation fails, resulting in half-duplex operation.

To overcome this limitation of autonegotiation, the S7-1200 provides an option to disable autonegotiation. When you disable autonegotiation, the S7-1200 is automatically configured for full-duplex operation at 100 Mbps.

You can set the transmission rate and duplex to a fixed value for each port:

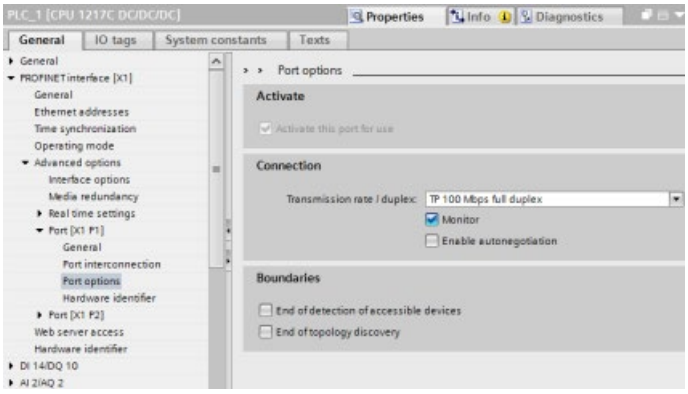
1. Select Advanced options and the port you need to configure. Then, select Port options.
2. In the Connection, Transmission rate / duplex field, select one of the following:
   - Automatic: The CPU and the peer device determine the port's transmission rate and duplex by autonegotiation.

– TP 100 Mbps full-duplex: If you disable autonegotiation, the port operates at 100 Mbps full-duplex. If you enable autonegotiation, the port can operate at 100 Mbps full-duplex or another transmission rate / duplex that is autonegotiated between the CPU and the peer device (which places a message in the diagnostic buffer if "Monitor" is selected (see below)).

3. Monitor: When you select this check box, a message is placed in the diagnostic buffer if any of the following occur at the port:
   – A link cannot be established at the port
   – An established link fails
   – You select "TP 100 Mbps full-duplex" as the Transmission rate / duplex, and the CPU establishes a link using autonegotiation with the negotiated transmission rate not equal to 100 Mbps or the negotiated duplex equal to half-duplex.
4. Enable autonegotiation: Once you set the Transmission rate / duplex field to full-duplex at 100 Mbps, you can then disable autonegotiation. Deselect the "Enable autonegotiation" check box to disable autonegotiation.

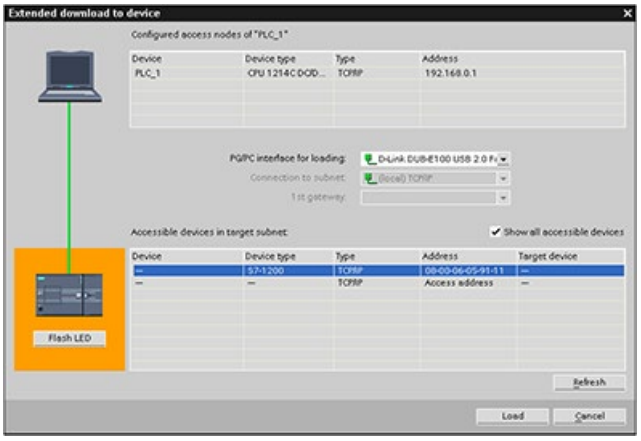
Note

If you do not disable autonegotiation, the CPU and the peer device negotiate the port's transmission rate and duplex.



11.2.4 Testing the PROFINET network

After completing the configuration, download the project (Page 210) to the CPU. All IP addresses are configured when you download the project.



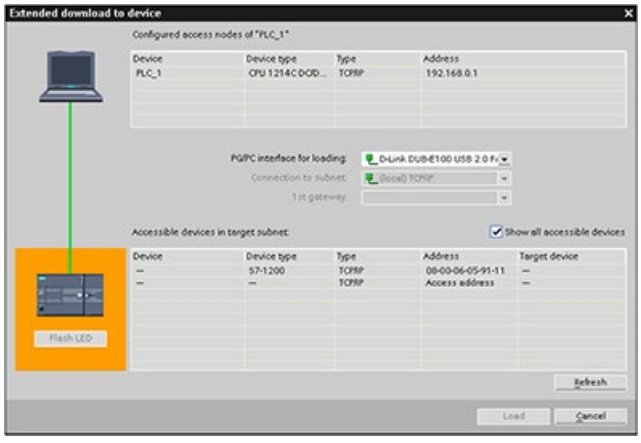
Assigning an IP address to a device online

The S7-1200 CPU does not have a pre-configured IP address. You must manually assign an IP address for the CPU:

- To assign an IP address to a device online, refer to "Device configuration: Assigning an IP address to a CPU online" (Page 793) for this step-by-step procedure.
- To assign an IP address in your project, you must configure the IP address in the Device configuration, save the configuration, and download it to the PLC. Refer to "Device configuration: Configuring an IP address for a CPU in your project" (Page 795) for more information.

Using the "Extended download to device" dialog to test for connected network devices

The S7-1200 CPU "Download to device" function and its "Extended download to device" dialog can show all accessible network devices and whether or not unique IP addresses have been assigned to all devices. To display all accessible and available devices with their assigned MAC or IP addresses, check the "Show all accessible devices" checkbox.



If the required network device is not in this list, communications to that device have been interrupted for some reason. The device and network must be investigated for hardware and/or configuration errors.

11.2.5 Locating the Ethernet (MAC) address on the CPU

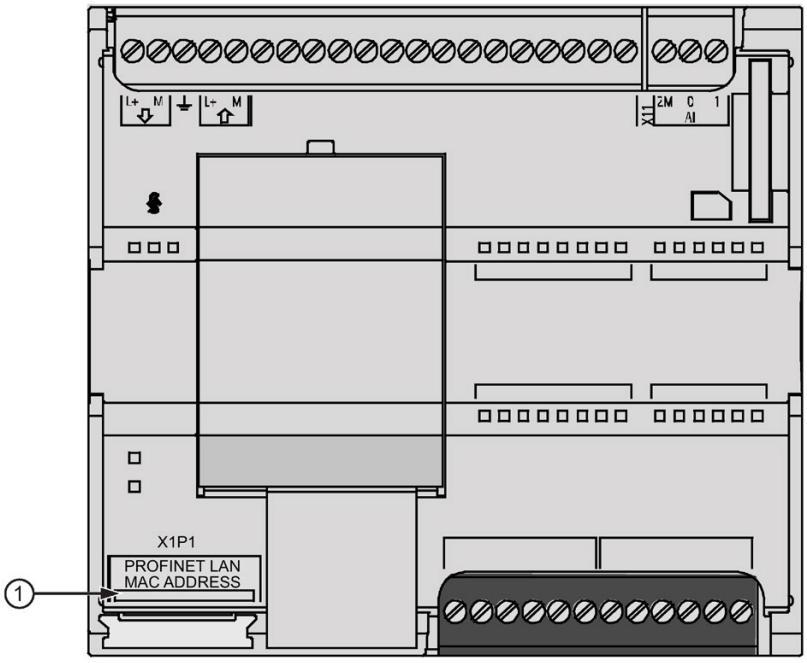
In PROFINET networking, a Media Access Control address (MAC address) is an identifier assigned to the network interface by the manufacturer for identification. A MAC address usually encodes the manufacturer's registered identification number.

The standard (IEEE 802.3) format for printing MAC addresses in human-friendly form is six groups of two hexadecimal digits, separated by hyphens (-) or colons (:), in transmission order, (for example, 01-23-45-67-89-ab or 01:23:45:67:89:ab).

Note

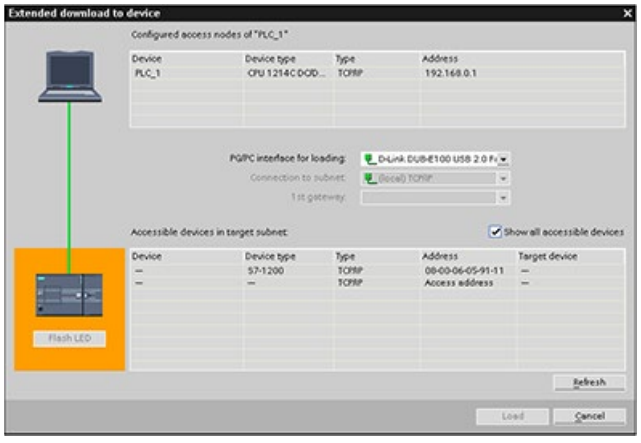
Each CPU is loaded at the factory with a permanent, unique MAC address. You cannot change the MAC address of a CPU.

The MAC address is printed on the front, lower-left corner of the CPU. Note that you have to lift the lower door to see the MAC address information.



① MAC address

Initially, the CPU has no IP address, only a factory-installed MAC address. PROFINET communications requires that all devices be assigned a unique IP address.



Use the CPU "Download to device" function and the "Extended download to device" dialog to show all accessible network devices and ensure that unique IP addresses have been assigned to all devices. This dialog displays all accessible and available devices with their assigned MAC or IP addresses. MAC addresses are all-important in identifying devices that are missing the required unique IP address.

11.2.6 Configuring Network Time Protocol (NTP) synchronization

WARNING

Risk of attacker accessing your networks through Network Time Protocol (NTP) synchronization

If an attacker can access your networks through Network Time Protocol (NTP) synchronization, the attacker can possibly disrupt control of your process by shifting the CPU system time. Disruptions to process control can possibly cause death, severe injury, or property damage.

The S7-1200 CPU disables the NTP client feature by default. When you enable the NTP feature, then only the IP addresses that you configure can act as NTP servers. You must configure the NTP feature to allow CPU system time corrections from remote servers.

The S7-1200 CPU supports "time of day" interrupts and clock instructions that depend upon accurate CPU system time. If you configure NTP and accept time synchronization from a server, you must ensure that the server is a trusted source. Failure to do so can cause a security breach that allows an unknown user to take disrupt control of your process by shifting the CPU system time.

For security information and recommendations, please see our "Operational Guidelines for Industrial Security" (http://www.industry.siemens.com/topics/global/en/industrial-security/Documents/operational_guidelines_industrial_security_en.pdf) on the Siemens Service and Support site.

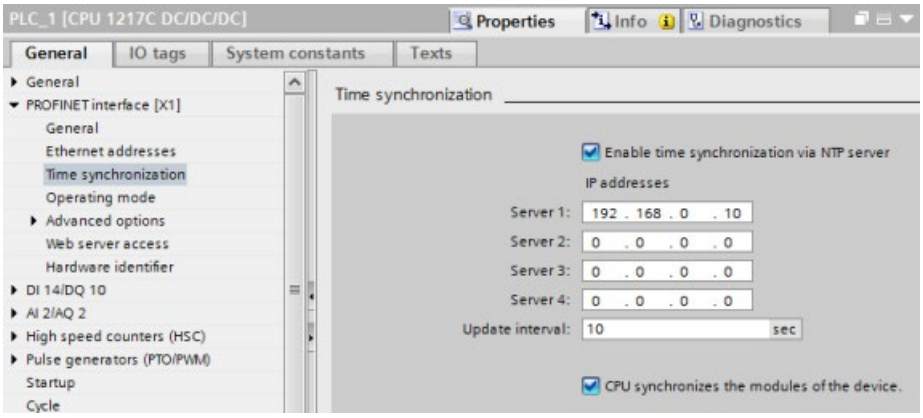
The Network Time Protocol (NTP) is widely used to synchronize the clocks of computer systems to Internet time servers. In NTP mode, the CPU sends time-of-day queries at regular intervals (in the client mode) to the NTP server in the subnet (LAN). Based on the replies from the server, the most reliable and most accurate time is calculated and the time of day on the station is synchronized.

The advantage of this mode is that it allows the time to be synchronized across subnets.

You configure the IP addresses of up to four NTP servers. The update interval defines the interval between the time queries (in seconds). The value of the interval ranges between 10 seconds and one day.

In NTP mode, the servers generally transfer UTC (Universal Time Coordinated), which corresponds to GMT (Greenwich Mean Time).

In the Properties window of the CPU's device configuration, select the "Time synchronization" configuration entry. STEP 7 displays the Time synchronization configuration dialog:



Note

The CPU receives all the IP addresses when you download the project.

Table 11- 6 Parameters for time synchronization

Parameter	Definition
Enable time synchronization via NTP server	Select the checkbox to enable time synchronization via NTP server.
Server 1	Assigned IP Address for network time server 1
Server 2	Assigned IP Address for network time server 2
Server 3	Assigned IP Address for network time server 3
Server 4	Assigned IP Address for network time server 4
Time synchronization update interval	Interval value (sec)
CPU synchronizes the modules of the device.	Select the checkbox to synchronize the CP clock with the CPU clock.

11.2.7 PROFINET device start-up time, naming, and address assignment

PROFINET IO can extend the start-up time for your system (configurable time-out). More devices and slow devices impact the amount of time it takes to switch to RUN.

In V4.0 and later, you can have a maximum of 16 PROFINET IO devices on your S7-1200 PROFINET network.

Each station (or IO device) starts up independently on start-up, and this affects the overall CPU start-up time. If you set the configurable time-out too low, there may not be a sufficient overall CPU start-up time for all stations to complete start-up. If this situation occurs, false station errors will result.

In the CPU Properties under "Startup", you can find the "Parameter assignment time for distributed I/O" (time-out). The default configurable time-out is 60,000 ms (1 minute); the user can configure this time.

PROFINET device naming and addressing in STEP 7

All PROFINET devices **must** have a Device Name and an IP Address. Use STEP 7 to define the Device Names and to configure the IP addresses. Device names are downloaded to the IO devices using PROFINET DCP (Discovery and Configuration Protocol).

PROFINET address assignment at system start-up

The controller broadcasts the names of the devices to the network, and the devices respond with their MAC addresses. The controller then assigns an IP address to the device using PROFINET DCP protocol:

- If the MAC address has a configured IP address, then the station performs start-up.
- If the MAC address does not have a configured IP address, STEP 7 assigns the address that is configured in the project, and the station then performs start-up.
- If there is a problem with this process, a station error occurs and no start-up takes place. This situation causes the configurable time-out value to be exceeded.

11.2.8 Open user communication

11.2.8.1 Protocols

The integrated PROFINET port of the CPU supports multiple communications standards over an Ethernet network:

- Transport Control Protocol (TCP)
- ISO on TCP (RFC 1006)
- User Datagram Protocol (UDP)

Table 11- 7 Protocols and communication instructions for each

Protocol	Usage examples	Entering data in the receive area	Communication instructions	Addressing type
TCP	CPU-to-CPU communication Transport of frames	Ad hoc mode	Only TRCV_C and TRCV	Assigns port numbers to the Local (active) and Partner (passive) devices
		Data reception with specified length	TSEND_C, TRCV_C, TCON, TDISCON, TSEND, and TRCV	
ISO on TCP	CPU-to-CPU communication Message fragmentation and re-assembly	Ad hoc mode	Only TRCV_C and TRCV	Assigns TSAPs to the Local (active) and Partner (passive) devices
		Protocol-controlled	TSEND_C, TRCV_C, TCON, TDISCON, TSEND, and TRCV	
UDP	CPU-to-CPU communication User program communications	User Datagram Protocol	TUSEND and TURCV	Assigns port numbers to the Local (active) and Partner (passive) devices, but is not a dedicated connection
S7 communication	CPU-to-CPU communication Read/write data from/to a CPU	Data transmission and reception with specified length	GET and PUT	Assigns TSAPs to the Local (active) and Partner (passive) devices
PROFINET IO	CPU-to-PROFINET IO device communication	Data transmission and reception with specified length	Built-in	Built-in

11.2.8.2 TCP and ISO on TCP

Transport Control Protocol (TCP) is a standard protocol described by RFC 793: Transmission Control Protocol. The primary purpose of TCP is to provide reliable, secure connection service between pairs of processes. This protocol has the following features:

- An efficient communications protocol since it is closely tied to the hardware
- Suitable for medium-sized to large data amounts (up to 8192 bytes)
- Provides considerably more facilities for applications, notably error recovery, flow control, and reliability
- A connection-oriented protocol
- Can be used very flexibly with third-party systems which exclusively support TCP
- Routing-capable
- Only static data lengths are applicable.
- Messages are acknowledged.
- Applications are addressed using port numbers.
- Most of the user application protocols, such as TELNET and FTP, use TCP.
- Programming effort is required for data management due to the SEND / RECEIVE programming interface.

International Standards Organization (ISO) on Transport Control Protocol (TCP) (RFC 1006) (ISO on TCP) is a mechanism that enables ISO applications to be ported to the TCP/IP network. This protocol has the following features:

- An efficient communications protocol closely tied to the hardware
- Suitable for medium-sized to large data amounts (up to 8192 bytes)
- In contrast to TCP, the messages feature an end-of-data identification and are message-oriented.
- Routing-capable; can be used in WAN
- Dynamic data lengths are possible.
- Programming effort is required for data management due to the SEND / RECEIVE programming interface.

Using Transport Service Access Points (TSAPs), TCP protocol allows multiple connections to a single IP address (up to 64K connections). With RFC 1006, TSAPs uniquely identify these communication end point connections to an IP address.

11.2.8.3 Communication services and used port numbers

The S7-1200 CPU supports the protocols listed in the table below. For each protocol, the CPU assigns the address parameters, the respective communications layer as well as the communications role, and the communications direction.

This information makes it possible to match the security measures for protection of the automation system to the used protocols (for example, firewall). Only the Ethernet or PROFINET networks have security measures. Since PROFIBUS does not have any security measures, the table does not include any PROFIBUS protocols.

The table below shows the different layers and protocols that the CPU uses:

Protocol	Port number	(2) Link layer (4) Transport layer	Function	Description
PROFINET protocols				
DCP (Discovery and Configuration Protocol)	Not relevant	(2) Ethernet II and IEEE 802.1Q and Ethertype 0x8892 (PROFINET)	Accessible devices PROFINET Discovery and configuration	PROFINET uses DCP to discover devices and provide basic settings. DCP uses the special multicast MAC address: xx-xx-xx-01-0E-CF, xx-xx-xx = Organizationally Unique Indentifier
LLDP (Link Layer Discovery Protocol)	Not relevant	(2) Ethernet II and IEEE 802.1Q and Ethertype 0x88CC (PROFINET)	PROFINET Link Layer Discovery protocol	PROFINET uses LLDP to discover and manage neighbor relationships between PROFINET devices. LLDP uses the special multicast MAC address: 01-80-C2-00-00-0E

11.2.8.4 Ad hoc mode

Typically, TCP and ISO-on-TCP receive data packets of a specified length, ranging from 1 to 8192 bytes. However, the TRCV_C and TRCV communication instructions also provide an "ad hoc" communications mode that can receive data packets of a variable length from 1 to 1472 bytes.

Note

If you store the data in an "optimized" DB (symbolic only), you can receive data only in arrays of Byte, Char, USInt, and SInt data types.

To configure the TRCV_C or TRCV instruction for ad hoc mode, set the ADHOC instruction input parameter.

If you do not call the TRCV_C or TRCV instruction in ad hoc mode frequently, you could receive more than one packet in one call. For example: If you were to receive five 100-byte packets with one call, TCP would deliver these five packets as one 500-byte packet, while ISO-on-TCP would restructure the packets into five 100-byte packets.

11.2.8.5 Connection IDs for the Open user communication instructions

When you insert the TSEND_C, TRCV_C or TCON PROFINET instructions into your user program, STEP 7 creates an instance DB to configure the communications channel (or connection) between the devices. Use the "Properties" (Page 788) of the instruction to configure the parameters for the connection. Among the parameters is the connection ID for that connection.

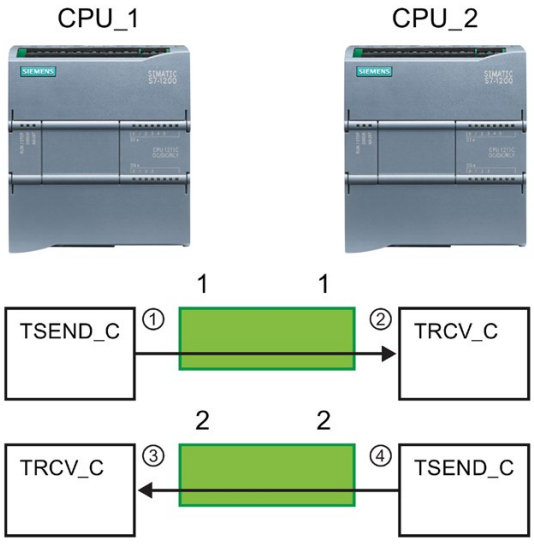
- The connection ID must be unique for the CPU. Each connection that you create must have a different DB and connection ID.
- Both the local CPU and the partner CPU can use the same connection ID number for the same connection, but the connection ID numbers are not required to match. The connection ID number is relevant only for the PROFINET instructions within the user program of the individual CPU.
- You can use any number for the connection ID of the CPU. However, configuring the connection IDs sequentially from "1" provides an easy method for tracking the number of connections in use for a specific CPU.

Note

Each TSEND_C, TRCV_C or TCON instruction in your user program creates a new connection. It is important to use the correct connection ID for each connection.

The following example shows the communication between two CPUs that utilize two separate connections for sending and receiving the data.

- The TSEND_C instruction in CPU_1 links to the TRCV_C in CPU_2 over the first connection ("connection ID 1" on both CPU_1 and CPU_2).
- The TRCV_C instruction in CPU_1 links to the TSEND_C in CPU_2 over the second connection ("connection ID 2" on both CPU_1 and CPU_2).



① TSEND_C on CPU_1 creates a connection and assigns a connection ID to that connection (connection ID 1 for CPU_1).

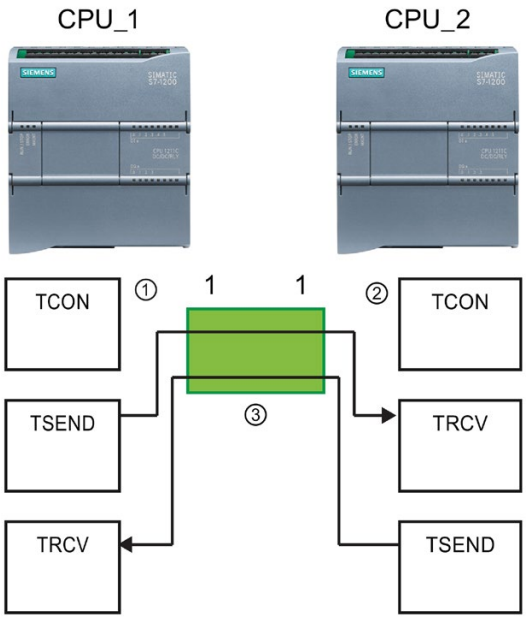
② TRCV_C on CPU_2 creates the connection for CPU_2 and assigns the connection ID (connection ID 1 for CPU_2).

③ TRCV_C on CPU_1 creates a second connection for CPU_1 and assigns a different connection ID for that connection (connection ID 2 for CPU_1).

④ TSEND_C on CPU_2 creates a second connection and assigns a different connection ID for that connection (connection ID 2 for CPU_2).

The following example shows the communication between two CPUs that utilize 1 connection for both sending and receiving the data.

- Each CPU uses a TCON instruction to configure the connection between the two CPUs.
- The TSEND instruction in CPU_1 links to the TRCV instruction in CPU_2 by using the connection ID ("connection ID 1") that was configured by the TCON instruction in CPU_1. The TRCV instruction in CPU_2 links to the TSEND instruction in CPU_1 by using the connection ID ("connection ID 1") that was configured by the TCON instruction in CPU_2.
- The TSEND instruction in CPU_2 links to the TRCV instruction in CPU_1 by using the connection ID ("connection ID 1") that was configured by the TCON instruction in CPU_2. The TRCV instruction in CPU_1 links to the TSEND instruction in CPU_2 by using the connection ID ("connection ID 1") that was configured by the TCON instruction in CPU_1.



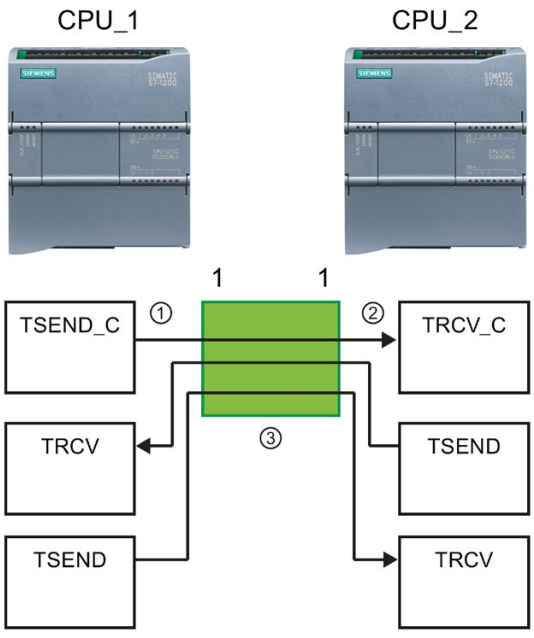
① TCON on CPU_1 creates a connection and assigns a connection ID for that connection on CPU_1 (ID=1).

② TCON on CPU_2 creates a connection and assigns a connection ID for that connection on CPU_2 (ID=1).

③ TSEND and TRCV on CPU_1 use the connection ID created by the TCON on CPU_1 (ID=1).

TSEND and TRCV on CPU_2 use the connection ID created by the TCON on CPU_2 (ID=1).

As shown in the following example, you can also use individual TSEND and TRCV instruction to communication over a connection created by a TSEND_C or TRCV_C instruction. The TSEND and TRCV instructions do not themselves create a new connection, so you must use the DB and connection ID that was created by a TSEND_C, TRCV_C or TCON instruction.



① TSEND_C on CPU_1 creates a connection and assigns a connection ID to that connection (ID=1).

② TRCV_C on CPU_2 creates a connection and assigns the connection ID to that connection on CPU_2 (ID=1).

③ TSEND and TRCV on CPU_1 use the connection ID created by the TSEND_C on CPU_1 (ID=1).

TSEND and TRCV on CPU_2 use the connection ID created by the TRCV_C on CPU_2 (ID=1).

11.2.8.6 Parameters for the PROFINET connection

The TSEND_C, TRCV_C and TCON instructions require connection-related parameters in order to connect to the partner device. The TCON_Param structure assigns these parameters for the TCP, ISO-on-TCP, and UDP protocols. Typically, you use the "Configuration" (Page 788) tab of the "Properties" of the instruction to specify these parameters. If the "Configuration" tab is not accessible, then you must provide the TCON_Param structure in the instruction parameters.

With V4.1, the TCON_IP_V4 structure assigns parameters for the TCP protocol, and the TCON_IP_RFC structure assigns parameters for the ISO-on-TCP protocol.

TCON_Param

Table 11- 8 Structure of the connection description (TCON_Param)

Byte	Parameter and data type		Description
0 … 1	block_length	UInt	Length: 64 bytes (fixed)
2 … 3	id	CONN_OUC (Word)	Reference to this connection: Range of values: 1 (default) to 4095. Specify the value of this parameter for the TSEND_C, TRCV_C or TCON instruction under ID.
4	connection_type	USInt	Connection type: • 17: TCP (default) • 18: ISO-on-TCP • 19: UDP
5	active_est	Bool	ID for the type of connection: • TCP and ISO-on-TCP: – FALSE: Passive connection – TRUE: Active connection (default) • UDP: FALSE
6	local_device_id	USInt	ID for the local PROFINET or Industrial Ethernet interface: 1 (default)
7	local_tsap_id_len	USInt	Length of parameter local_tsap_id used, in bytes; possible values: • TCP: 0 (active, default) or 2 (passive) • ISO-on-TCP: 2 to 16 • UDP: 2
8	rem_subnet_id_len	USInt	This parameter is not used.
9	rem_staddr_len	USInt	Length of address of partner end point, in bytes: • 0: unspecified (parameter rem_staddr is irrelevant) • 4 (default): Valid IP address in parameter rem_staddr (only for TCP and ISO-on-TCP)
10	rem_tsap_id_len	USInt	Length of parameter rem_tsap_id used, in bytes; possible values: • TCP: 0 (passive) or 2 (active, default) • ISO-on-TCP: 2 to 16 • UDP: 0
11	next_staddr_len	USInt	This parameter is not used.

Byte	Parameter and data type		Description
12 … 27	local_tsap_id	Array [1..16] of Byte	Local address component of connection: • TCP and ISO-on-TCP: local port no. (possible values: 1 to 49151; recommended values: 2000...5000): – local_tsap_id[1] = high byte of port number in hexadecimal notation; – local_tsap_id[2] = low byte of port number in hexadecimal notation; – local_tsap_id[3-16] = irrelevant • ISO-on-TCP: local TSAP-ID: – local_tsap_id[1] = B#16#E0; – local_tsap_id[2] = rack and slot of local end points (bits 0 to 4: slot number, bits 5 to 7: rack number); – local_tsap_id[3-16] = TSAP extension, optional • UDP: This parameter is not used. Note: Make sure that every value of local_tsap_id is unique within the CPU.
28 … 33	rem_subnet_id	Array [1..6] of USInt	This parameter is not used.
34 … 39	rem_staddr	Array [1..6] of USInt	TCP and ISO-on-TCP only: IP address of the partner end point. (Not relevant for passive connections.) For example, IP address 192.168.002.003 is stored in the following elements of the array: rem_staddr[1] = 192 rem_staddr[2] = 168 rem_staddr[3] = 002 rem_staddr[4] = 003 rem_staddr[5-6]= irrelevant
40 … 55	rem_tsap_id	Array [1..16] of Byte	Partner address component of connection • TCP: partner port number. Range: 1 to 49151; Recommended values: 2000 to 5000): – rem_tsap_id[1] = high byte of the port number in hexadecimal notation – rem_tsap_id[2] = low byte of the port number in hexadecimal notation; – rem_tsap_id[3-16] = irrelevant • ISO-on-TCP: partner TSAP-ID: – rem_tsap_id[1] = B#16#E0 – rem_tsap_id[2] = rack and slot of partner end point (bits 0 to 4: Slot number, bits 5 to 7: rack number) – rem_tsap_id[3-16] = TSAP extension, optional • UDP: This parameter is not used.
56 … 61	next_staddr	Array [1..6] of Byte	This parameter is not used.
62 … 63	spare	Word	Reserved: W#16#0000

TCON_IP_V4

Table 11- 9 Structure of the connection description (TCON_IP_V4): For use with TCP

Byte	Parameter and data type		Description
0 … 1	InterfaceId	HW_ANY	HW-identifier of the IE-interface submodule
2 … 3	ID	CONN_OUC (Word)	Reference to this connection: Range of values: 1 (default) to 4095. Specify the value of this parameter for the TSEND_C, TRCV_C, or TCON instruction under ID.
4	ConnectionType	Byte	Connection type: • 11: TCP/IP (default) • 17: TCP/IP (This connection type is included for legacy reasons. It is recommended that you use "11: TCP/IP (default)".) • 19: UDP
5	ActiveEstablished	Bool	Active/passive connection establishment: • TRUE: Active connection (default) • FALSE: Passive connection
	V4 IP address		
6	ADDR[1]	Byte	Octet 1
7	ADDR[1]	Byte	Octet 2
8	ADDR[1]	Byte	Octet 3
9	ADDR[1]	Byte	Octet 4
10 ... 11	RemotePort	UInt	Remote UDP/TCP port number
12 ... 13	LocalPort	UInt	Local UDP/TCP port number

TCON_IP_RFC

Table 11- 10 Structure of the connection description (TCON_IP_RFC): For use with ISO on TCP

Byte	Parameter and data type		Description
0 … 1	InterfaceId	HW_ANY	HW-identifier of the IE-interface submodule
2 … 3	ID	CONN_OUC (Word)	Reference to this connection: Range of values: 1 (default) to 4095. Specify the value of this parameter for the TSEND_C, TRCV_C, or TCON instruction under ID.
4	ConnectionType	Byte	Connection type: • 12: ISO-on-TCP (default) • 17: ISO-on-TCP (This connection type is included for legacy reasons. It is recommended that you use "12: ISO-on-TCP (default)".)
5	ActiveEstablished	Bool	Active/passive connection establishment: • TRUE: Active connection (default) • FALSE: Passive connection
6 ... 7	Spare		Not used
	V4 IP address		
8	ADDR[1]	Byte	Octet 1
9	ADDR[1]	Byte	Octet 2
10	ADDR[1]	Byte	Octet 3
11	ADDR[1]	Byte	Octet 4
	Remote transport selector		
12 ... 13	TSelLength	UInt	Length of TSelector
14 ... 45	TSel	array [1..32] of Byte	Character array for TSAP name
	Local transport selector		
46 ... 47	TSelLength	UInt	Length of TSelector
48 ... 79	TSel	array [1..32] of Byte	Character array for TSAP name

See also

S7-1200 CM/CPs (https://support.industry.siemens.com/cs/us/en/ps)

11.2.8.7 TSEND_C and TRCV_C instructions

As of version V4.1 of the S7-1200 CPU together with STEP 7 V13 SP1, the CPU extends the capability of the TSEND_C and TRCV_C instructions to use connection parameters with structures according to "TCON_IP_v4" and "TCON_IP_RFC".

For this reason, the S7-1200 supports two sets of TSEND_C and TRCV_C instructions:

- Legacy TSEND_C and TRCV_C instructions (Page 828): These TSEND_C and TRCV_C instructions existed prior to version V4.0 of the S7-1200 and only work with connection parameters with structures according to "TCON_Param".
- TSEND_C and TRCV_C instructions (Page 817): These TSEND_C and TRCV_C instructions provide all of the functionality of the legacy instructions, plus the ability to use connection parameters with structures according to "TCON_IP_v4" and "TCON_IP_RFC".

Selecting the version of the TSEND_C and TRCV_C instructions

There are two versions of the TSEND_C and TRCV_C instructions available in STEP 7:

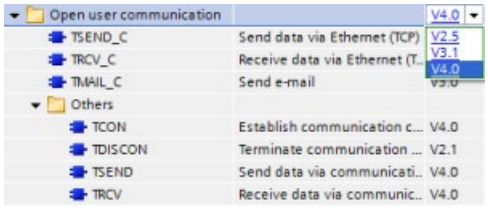
- Versions 2.5 and 3.1 were available in STEP 7 Basic/Professional V13 or earlier.
- Version 4.0 is available in STEP 7 Basic/Professional V13 SP1 or later.

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

Do not use different instruction versions in the same CPU program.



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



To change the version of the TSEND_C and TRCV_C instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a TSEND_C or TRCV_C instruction in your program, a new FB or FC instance, depending on the TSEND_C or TRCV_C instruction selected, is created in the project tree. You can see new FB or FC instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a TSEND_C or TRCV_C instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree TSEND_C or TRCV_C FB or FC instance, right-click, select "Properties", and select the "Information" page to see the TSEND_C or TRCV_C instruction version number.

TSEND_C and TRCV_C (Send and receive data using Ethernet)

The TSEND_C instruction combines the functions of the TCON, TDISCON and TSEND instructions. The TRCV_C instruction combines the functions of the TCON, TDISCON, and TRCV instructions. (Refer to "TCON, TDISCON, TSEND, AND TRCV (Page 837)" for more information on these instructions.)

The minimum size of data that you can transmit (TSEND_C) or receive (TRCV_C) is one byte; the maximum size is 8192 bytes. TSEND_C does not support the transmission of data from Boolean locations, and TRCV_C will not receive data into Boolean locations. For information on transferring data with these instructions, see the section on data consistency (Page 192).

Note

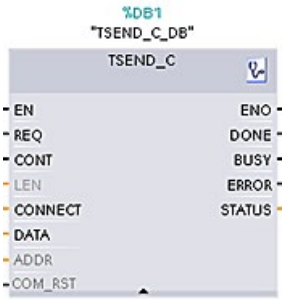
Initializing the communication parameters

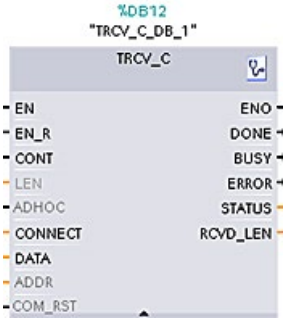
After you insert the TSEND_C or TRCV_C instruction, use the "Properties" of the instruction (Page 788) to configure the communication parameters (Page 811). As you enter the parameters for the communication partners in the inspector window, STEP 7 enters the corresponding data in the DB for the instruction.

If you want to use a multi-instance DB, you must manually configure the DB on both CPUs.

Table 11- 11 TSEND_C and TRCV_C instructions

LAD / FBD	SCL	Description

	`"TSEND_C_DB"(`
	`req:=_bool_in_,`
	`cont:=_bool_in_,`
	`len:=_uint_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`connect:=_struct_inout_,`
	`data:=_variant_inout_,`
	`com_rst:=_bool_inout_);`
		TSEND_C establishes a TCP or ISO on TCP communication connection to a partner station, sends data, and can terminate the connection. After the connection is set up and established, it is automatically maintained and monitored by the CPU.

	`"TRCV_C_DB"(`
	`en_r:=_bool_in_,`
	`cont:=_bool_in_,`
	`len:=_uint_in_,`
	`adhoc:=_bool_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`rcvd_len=>_uint_out_,`
	`connect:=_struct_inout_,`
	`data:=_variant_inout_,`
	`com_rst:=_bool_inout_);`
		TRCV_C establishes a TCP or ISO on TCP communication connection to a partner CPU, receives data, and can terminate the connection. After the connection is set up and established, it is automatically maintained and monitored by the CPU.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 11- 12 TSEND_C and TRCV_C data types for the parameters

Parameter and type		Data type	Description
REQ (TSEND_C)	IN	Bool	Starts the send job on a rising edge
EN_R (TRCV_C)	IN	Bool	Receive enable
CONT	IN	Bool	Controls the communication connection: • 0: Disconnect the communication connection after data is sent. • 1: Establish and maintain the communication connection. When sending data (TSEND_C) (rising edge at the REQ parameter) or receiving data (TRCV_C) (rising edge at the EN_R parameter), the CONT parameter must have the value TRUE in order to establish or maintain a connection.
LEN	IN	UDInt	Optional parameter (hidden) Maximum number of bytes to be sent (TSEND_C) or received (TRCV_C) with the job. If you use purely symbolic values at the DATA parameter, the LEN parameter must have the value "0".
ADHOC (TRCV_C)	IN	Bool	Optional parameter (hidden) Ad hoc mode request for connection type TCP.
CONNECT	IN_OUT	TCON_Param	Pointer to the connection description corresponding to the structure of connection to be described: • For TCP or UDP, use the structure TCON_IP_v4 • For further information on TCON_IP_v4, refer to: "Parameters for the PROFINET connection" (Page 811). • For ISO-on-TCP, use the structure TCON_IP_RFC • For further information on TCON_IP_RFC, refer to: "Parameters for the PROFINET connection" (Page 811). The CONNECT parameter is only evaluated upon a positive edge at REQ (TSEND_C), when connection establishment starts (TRCV_C), or when COM_RST = 1.
DATA	IN_OUT	Variant	Pointer to the send area containing: • Address and length of data to be sent (TSEND_C) • Address and maximum length of received data (TRCV_C)
ADDR	IN_OUT	Variant	Optional parameter (hidden) Pointer to the address of the recipient with the connection type UDP. The address information is mapped in the structure TADDR_Param ###.

Parameter and type		Data type	Description
COM_RST	IN_OUT	Bool	Optional parameter (hidden) Restarts the instruction: • 0: Irrelevant • 1: Completely restarts the instruction; the existing connection is either terminated or reset and established again in accordance with CONT. The COM_RST parameter is reset after evaluation by the TSEND_C or TRCV_C instruction and should not, therefore, be switched statically.
DONE	OUT	Bool	Status parameter with the following values: • 0: Send job not yet started or is still executing. • 1: Send job executed without errors. This state is only displayed for one cycle.
BUSY	OUT	Bool	Status parameter with the following values: • 0: Send job not yet started or already completed. • 1: Send job not yet completed. A new send job cannot be started.
ERROR	OUT	Bool	Status parameters with the following values: • 0: No error • 1: Error occurred during connection establishment, data transmission, or connection termination.
STATUS	OUT	Word	Status of instruction (see the ERROR and STATUS parameters description).
RCVD_LEN (TRCV_C)	OUT	Int	Amount of data actually received (in bytes).

Note

The TSEND_C instruction requires a low-to-high transition at the REQ input parameter to start a send job. The BUSY parameter is then set to 1 during processing. Completion of the send job is indicated by either the DONE or ERROR parameters being set to 1 for one scan. During this time, any low-to-high transition at the REQ input parameter is ignored.

Note

The default setting of the LEN parameter (LEN = 0) uses the DATA parameter to determine the length of the data being transmitted. It is recommended that the data transmitted by the TSEND_C instruction be the same size as the DATA parameter of the TRCV_C instruction.

If using the default setting of the LEN parameter and it is necessary to send the data in segments smaller than the DATA parameter size, the following applies. If the size of the data transmitted from TSEND_C does not equal the TRCV_C DATA parameter size, TRCV_C remains in a busy status (status code: 7006) until the overall size of the data transmitted from TSEND_C equals the TRCV_C DATA parameter size.

The TRCV_C DATA parameter buffer does not display the new data received until the data size equals the DATA parameter buffer size.

TSEND_C operations

The TSEND_C instruction is executed asynchronously and implements the following functions in sequence:

1. Setting up and establishing a communications connection:

   TSEND_C sets up a communication connection and establishes this connection if a rising edge is detected at the REQ parameter and no communication connection is in place yet. Once the connection has been set up and established, it is automatically maintained and monitored by the CPU. The connection description specified at the CONNECT parameter is used to set up the communications connection. The following connection types can be used:

   – TCON_Param structure for the TCP, ISO-on-TCP, and UDP protocols
   – WIth V4.1, TCP/UDP: Connection description using the structure TCON_IP_v4 at the parameter CONNECT
   – WIth V4.1, ISO-on-TCP: Connection description using the structure TCON_IP_RFC at the parameter CONNECT

   An existing connection is terminated and the connection which has been set up is removed when the CPU goes into STOP mode. To set up and establish the connection again, you must execute TSEND_C again. For information on the number of possible communication connections, please refer to the technical specifications for your CPU.

2. Sending data via an existing communications connection:

   The send job is executed when a rising edge is detected at the REQ parameter. As described above, the communications connection is established first. You specify the send area with the DATA parameter. This includes the address and the length of the data to be sent. Do not use a data area with the data type BOOL or Array of BOOL at the DATA parameter. With the LEN parameter, you specify the maximum number of bytes sent with a send job. If using a symbolic name at the DATA parameter, the LEN parameter should have the value "0".

   The data to be sent must not be edited until the send job is completed.

3. Terminating the communications connection:

   The communications connection is terminated after the data has been sent if the CONT parameter had the value "0" at the time of the rising edge at the REQ parameter. Otherwise, the communications connection will be maintained.

If the send job executes successfully, the DONE parameter is set to "1". The communications connection may be terminated before this (see the above description of the dependency on the CONT parameter). Signal state "1" at the DONE parameter is not confirmation that the data sent has already been read by the communications partner.

TSEND_C is reset when the COM_RST parameter is set to "1". Data loss may occur if data is being transferred at this point.

The following scenarios are possible depending on the CONT parameter:

- CONT = "0":

  An existing communications connection is established.

- CONT = "1" and a communications connection was established:

  An existing communications connection is reset and established again.

- CONT = "1" and no communications connection was established.

  No communications connection is established.

The COM_RST parameter is reset following evaluation by the instruction T_SEND. To enable TSEND_C again after the execution (DONE = 1), call the instruction once with REQ = 0

TRCV_C operations

The TRCV_C instruction is executed asynchronously and implements the following functions in sequence:

1. Setting up and establishing a communications connection:

   TRCV_C sets up a communication connection and establishes this connection if the EN_R parameter = "1" and there is no communication connection. Once the connection has been set up and established, it is automatically maintained and monitored by the CPU.

   The connection description specified at the CONNECT parameter is used to set up the communications connection. The following connection types can be used:

   – TCON_Param structure for the TCP, ISO-on-TCP, and UDP protocols
   – With V4.1, TCP / UDP: Connection description via the structure TCON_IP_v4 at the parameter CONNECT
   – With V4.1, ISO-on-TCP: Connection description via the structure TCON_IP_RFC at the parameter CONNECT

   An existing connection is terminated and the connection which has been set up is removed when the CPU goes into STOP mode. To set up and establish the connection again, you must execute TRCV_C again with EN_R = "1".

   If EN_R is set to "0" before the communications connection has been established, the connection will be established and remain in place even if CONT = "0". However, no data will be received (DONE will remain "0").

   For information on the number of possible communication connections, please refer to the technical specifications for your CPU.

2. Receiving data via an existing communications connection:

   Receipt of data is enabled when the EN_R parameter is set to the value "1". As described above, the communications connection is established first. The received data is entered in a receive area. You specify the length of the receive area either with the LEN parameter (if LEN <> 0) or with the length information of the DATA parameter (if LEN = 0), depending on the protocol variant being used. If you use purely symbolic values at the DATA parameter, the LEN parameter must have the value "0".

   If EN_R is set to "0" before data is received for the first time, the communication connection will remain in place even if CONT = 0. However, no data will be received (DONE will remain "0").

3. Terminating the communications connection:

   The communications connection is terminated after data has been received if the CONT parameter had the value "0" when connection established was started. Otherwise, the communications connection will be maintained.

If the receive job executes successfully, the DONE parameter is set to "1". The communications connection may be terminated before this (see the above description of the dependency on the CONT parameter).

TRCV_C is reset when the COM_RST parameter is set. If data is being received when it executes again, this can lead to a loss of data. The following scenarios are possible depending on the CONT parameter:

- CONT = "0":

  An existing communications connection is established.

- CONT = "1" and a communications connection was established:

  An existing communications connection is reset and established again.

- CONT = "1" and no communications connection was established:

  No communications connection is established.

The COM_RST parameter is reset following evaluation by the instruction TRCV_".

TRCV_C handles the same receive modes as the TRCV instruction. The following table shows how data is entered in the receive area:

Protocol variant	Availability of data in the receive area	Connection_type parameter of the connection description	LEN parameter	RCVD_LEN parameter
TCP (Ad hoc mode)	The data is immediately available.	B#16#11	Selected with the TRCV_C instruction ADHOC input	1 to 1472
TCP (data receipt with specified length)	The data is available as soon as the data length specified at the LEN parameter has been fully received.	B#16#11	1 to 8192	Identical to the value at the LEN parameter
ISO on TCP (protocol-controlled data transfer)	The data is available as soon as the data length specified at the LEN parameter has been fully received.	B#16#12	1 to 8192	Identical to the value at the LEN parameter

Note

Ad hoc mode

The "ad hoc mode" is only available with the TCP protocol variant. To configure the TRCV_C instruction for ad hoc mode, set the ADHOC instruction input parameter. The length of the receive area is defined by the pointer at the DATA parameter. The data length actually received is output at the RCVD_LEN parameter. A maximum of 1460 bytes can be received.

Note

Importing of S7-300/400 STEP 7 projects containing "ad hoc mode" into the S7-1200

In S7-300/400 STEP 7 projects, "ad hoc mode" is selected by assigning "0" to the LEN parameter. In the S7-1200, you configure the TRCV_C instruction for ad hoc mode by setting the ADHOC instruction input parameter..

If you import an S7-300/400 STEP 7 project containing "ad hoc mode" into the S7-1200, you must change the LEN parameter to "65535".

Note

TCP (data receipt with specified length)

You use the value of the LEN parameter to specify the length for the data receipt. The data specified at the DATA parameter is available in the receive area as soon as the length specified at the LEN parameter has been completely received.

Note

ISO on TCP (protocol-controlled data transfer)

With the ISO on TCP protocol variant, data is transferred protocol-controlled. The receive area is defined by the LEN and DATA parameters.

BUSY, DONE, and ERROR parameters

Note

Due to the asynchronous processing of TSEND_C, you must keep the data in the sender area consistent until the DONE parameter or the ERROR parameter assumes the value TRUE.

For TSEND_C, a TRUE state at the parameter DONE means that the data was sent successfully. It does not mean that the connection partner CPU actually read the receive buffer.

Due to the asynchronous processing of TRCV_C, the data in the receiver area are only consistent when parameter DONE = 1.

Table 11- 13 TSEND_C and TRCV_C instructions BUSY, DONE, and ERROR parameters

BUSY	DONE	ERROR	Description
1	0	0	The send job is being processed.
0	1	0	The send job was completed successfully.
0	0	1	The connection establishment or the send job was completed with an error. The cause of the error is specified in the STATUS parameter.
0	0	0	No new send job was assigned.

You can check the status of the execution with the BUSY, DONE, ERROR, and STATUS parameters. The BUSY parameter indicates the processing status. With the DONE parameter, you can check whether or not a send job executed successfully. The ERROR parameter is set when errors occurred during execution of TSEND_C or TRCV_C. The error information is output at the STATUS parameter.

Error and Status parameters

Table 11- 14 TSEND_C and TRCV_C condition codes for ERROR and STATUS

ERROR	STATUS (W#16#...)	Description
0	0000	Send (TSEND_C) or receive (TRCV_C) job executed without errors.
0	7000	No active send job execution; no communications connection established.
0	7001	• Start send (TSEND_C) or receive (TRCV_C) job execution. • Establish connection. • Wait for connection partner.
0	7002	Data is being sent (TSEND_C) or received (TRCV_C).
0	7003	Communications connection is being terminated.
0	7004	Communications connection established and monitored; no send (TSEND_C) or receive (TRCV_C) job execution active.
0	7005	Communications connection is being reset.
1	80A0	Group error for error codes W#16#80A1 and W#16#80A2.
1	80A1	• Connection or port already being used by user. • Communication error: – The specified connection has not yet been established. – The specified connection is being terminated. Transfer through this connection is not possible. – The interface is being re-initialized.
1	80A2	Local or remote port is being used by the system.
1	80A3	• Attempt being made to re-establish an existing connection. • Attempt being made to terminate a non-existent connection.
1	80A4	IP address of the remote endpoint of the connection is invalid, which means it corresponds to the IP address of the local partner.
1	80A7	Communication error: You called the instruction with COM_RST = 1 before the send job was complete.
1	80B2	The CONNECT parameter points to a data block that was generated with the attribute "Only store in load memory".
1	80B3	Inconsistent parameter assignment: Group error for error codes W#16#80A0 to W#16#80A2, W#16#80A4, W#16#80B4 to W#16#80B9.
1	80B4	You have violated one or both of the following conditions for passive connection establishment (active_est = FALSE) when using the ISO on TCP protocol variant (connection_type = B#16#12): • local_tsap_id_len >= B#16#02 • local_tsap_id[1] = B#16#E0
1	80B5	Only passive connection establishment is permitted for connection type 13 = UDP.
1	80B6	Parameter assignment error in the connection_type parameter of the data block for connection description.
1	80B7	Error in one of the following parameters of the data block for connection description: block_length, local_tsap_id_len, rem_subnet_id_len, rem_staddr_len, rem_tsap_id_len, next_staddr_len.

ERROR	STATUS (W#16#...)	Description
1	8085	• The LEN parameter is larger than the highest permitted value. • The value at the LEN or DATA parameter was changed after the first call.
1	8086	The ID parameter within the CONNECT parameter is outside the permitted range.
1	8087	Maximum number of connections reached; no additional connection possible.
1	8088	The value at the LEN parameter does not correspond to the receive area set at the DATA parameter.
1	8089	The CONNECT parameter does not point to a data block.
1	8091	Maximum nesting depth exceeded.
1	809A	The CONNECT parameter points to a field that does not correspond to the length of the connection description.
1	809B	The ID of the local device in the connection description does not correspond to the CPU.
1	80C3	• All connection (Page 808) resources are in use. • A block with this ID is already being processed in a different priority group.
1	80C4	Temporary communication error: • The connection cannot be established at this time. • The interface is receiving new parameters or the connection is being established. • The configured connection is being removed by a "TDISCON (Page 837)" instruction. • The connection used is being terminated by a call with COM_RST = 1.
1	8722	Error in the CONNECT parameter: Invalid source area (area not declared in data block).
1	873A	Error in the CONNECT parameter: Access to connection description is not possible (no access to data block).
1	877F	Error in the CONNECT parameter: Internal error
1	8822	TSEND_C: DATA parameter: Invalid source area, the area does not exist in the DB.
1	8824	TSEND_C: DATA parameter: Area error in the VARIANT pointer.
1	8832	TSEND_C: DATA parameter: The DB number is too high.
1	883A	TSEND_C: CONNECT parameter: Access to specified connection data not possible (for example, because the DB does not exist).
1	887F	TSEND_C: DATA parameter: Internal error (for example, invalid VARIANT reference)
1	893A	TSEND_C: DATA parameter: Access to send area not possible (for example, because the DB does not exist).
1	8922	TRCV_C: DATA parameter: Invalid target area; the area does not exist in the DB.
1	8924	TRCV_C: DATA parameter: Area error in the VARIANT pointer.
1	8932	TRCV_C: DATA parameter: The DB number is too high.
1	893A	TRCV_C: CONNECT parameter: Access to specified connection data not possible (for example, because the DB does not exist).
1	897F	TRCV_C: DATA parameter: Internal error (for example, invalid VARIANT reference).
1	8A3A	TRCV_C: DATA parameter: No access to the data area (for example because the data block does not exist).

Note

Error messages of the instructions TCON, TSEND, TRCV, and TDISCON

Internally, the TSEND_C instruction uses the TCON, TSEND, and TDISCON instructions; and the TRCV_C instruction uses the TCON, TRCV, and TDISCON instructions. Refer to "TCON, TDISCON, TSEND, AND TRCV (Page 837)" for more information on error messages of these instructions.

Connection Ethernet protocols

Every CPU has an integrated PROFINET port, which supports standard PROFINET communications. The TSEND_C and TRCV_C and TSEND and TRCV instructions all support the TCP and ISO on TCP Ethernet protocols.

Refer to "Device Configuration: Configuring the Local/Partner connection path (Page 788)" for more information.

11.2.8.8 Legacy TSEND_C and TRCV_C instructions

Prior to the release of STEP 7 V13 SP1 and the S7-1200 V4.1 CPUs, the TSEND_C and TRCV_C instructions could only work with connection parameters with structures according to "TCON_Param". The general concepts apply to both sets of instructions. Refer to the individual legacy TSEND_C and TRCV_C instructions for programming information.

Selecting the version of the TSEND_C and TRCV_C instructions

There are two versions of the TSEND_C and TRCV_C instructions available in STEP 7:

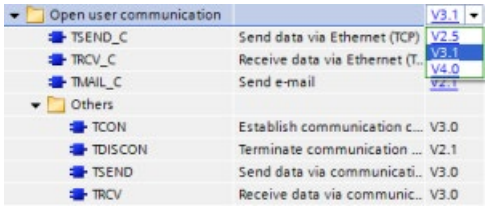
- Versions 2.5 and 3.1 were available in STEP 7 Basic/Professional V13 or earlier.
- Version 4.0 is available in STEP 7 Basic/Professional V13 SP1 or later.

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

Do not use different instruction versions in the same CPU program.



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



To change the version of the TSEND_C and TRCV_C instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a TSEND_C or TRCV_C instruction in your program, a new FB or FC instance, depending on the TSEND_C or TRCV_C instruction selected, is created in the project tree. You can see new FB or FC instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a TSEND_C or TRCV_C instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree TSEND_C or TRCV_C FB or FC instance, right-click, select "Properties", and select the "Information" page to see the TSEND_C or TRCV_C instruction version number.

Legacy TSEND_C and TRCV_C (Send and receive data using Ethernet)

The legacy TSEND_C instruction combines the functions of the legacy TCON, TDISCON and TSEND instructions. The TRCV_C instruction combines the functions of the TCON, TDISCON, and TRCV instructions. (Refer to "Legacy TCON, TDISCON, TSEND, and TRCV (TCP communication) instructions (Page 848)" for more information on these instructions.)

The minimum size of data that you can transmit (TSEND_C) or receive (TRCV_C) is one byte; the maximum size is 8192 bytes. TSEND_C does not support the transmission of data from Boolean locations, and TRCV_C will not receive data into Boolean locations. For information on transferring data with these instructions, see the section on data consistency (Page 192).

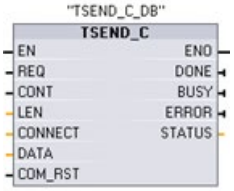
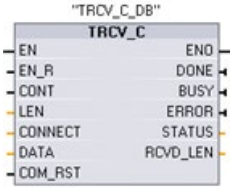
Note

Initializing the communication parameters

After you insert the TSEND_C or TRCV_C instruction, use the "Properties" of the instruction (Page 788) to configure the communication parameters (Page 811). As you enter the parameters for the communication partners in the inspector window, STEP 7 enters the corresponding data in the DB for the instruction.

If you want to use a multi-instance DB, you must manually configure the DB on both CPUs.

Table 11- 15 TSEND_C and TRCV_C instructions

LAD / FBD	SCL	Description
	**"TSEND_C_DB"(** **req:=_bool_in_,** **cont:=_bool_in_,** **len:=_uint_in_,** **done=>_bool_out_,** **busy=>_bool_out_,** **error=>_bool_out_,** **status=>_word_out_,** **connect:=_struct_inout_,** **data:=_variant_inout_,** **com_rst:=_bool_inout_);**	TSEND_C establishes a TCP or ISO on TCP communication connection to a partner station, sends data, and can terminate the connection. After the connection is set up and established, it is automatically maintained and monitored by the CPU.
	**"TRCV_C_DB"(** **en_r:=_bool_in_,** **cont:=_bool_in_,** **len:=_uint_in_,** **adhoc:=_bool_in_,** **done=>_bool_out_,** **busy=>_bool_out_,** **error=>_bool_out_,** **status=>_word_out_,** **rcvd_len=>_uint_out_,** **connect:=_struct_inout_,** **data:=_variant_inout_,** **com_rst:=_bool_inout_);**	TRCV_C establishes a TCP or ISO on TCP communication connection to a partner CPU, receives data, and can terminate the connection. After the connection is set up and established, it is automatically maintained and monitored by the CPU.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 11- 16 TSEND_C and TRCV_C data types for the parameters

Parameter and type		Data type	Description
REQ (TSEND_C)	IN	Bool	REQ = 1 starts the TSEND_C send job on a rising edge with the connection descricribed in CONNECT parameter. (CONT = 1 is also required to establish and maintain the communication connection.
EN_R (TRCV_C)	IN	Bool	When EN_R = 1, TRCV_C is ready to receive. The receive job is processed. (CONT = 1 is also required to establish and maintain the communication connection.)
CONT	IN	Bool	Controls the communication connection: • 0: Disconnect the communication connection • 1: Establish and maintain the communication connection When sending data (TSEND_C) (rising edge at the REQ parameter), the CONT parameter must have the value TRUE in order to establish or maintain a connection. When receiving data (TRCV_C) (rising edge at the EN_R parameter), the CONT parameter must have the value TRUE in order to establish or maintain a connection.
LEN	IN	UInt	Maximum number of bytes to be sent (TSEND_C) or received (TRCV_C): • Default = 0: The DATA parameter determines the length of the data to be sent (TSEND_C) or received (TRCV_C). • Ad hoc mode = 65535: A variable length of data is set for reception (TRCV_C).
CONNECT	IN_OUT	TCON_Param	Pointer to the connection description (Page 811)
DATA	IN_OUT	Variant	• Contains address and length of data to be sent (TSEND_C) • Contains start address and maximum length of received data (TRCV_C).
COM_RST	IN_OUT	Bool	Allows restart of the instruction: • 0: Irrelevant • 1: Complete restart of the function block, existing connection will be terminated.
DONE	OUT	Bool	• 0: Job is not yet started or still running. • 1: Job completed without error.
BUSY	OUT	Bool	• 0: Job is completed. • 1: Job is not yet completed. A new job cannot be triggered.
ERROR	OUT	Bool	Status parameters with the following values: • 0: No error • 1: Error occurred during processing. STATUS provides detailed information on the type of error.
STATUS	OUT	Word	Status information including error information. (Refer to the "Error and Status Parameters" table below.)
RCVD_LEN (TRCV_C)	OUT	Int	Amount of data actually received, in bytes

Note

The TSEND_C instruction requires a low-to-high transition at the REQ input parameter to start a send job. The BUSY parameter is then set to 1 during processing. Completion of the send job is indicated by either the DONE or ERROR parameters being set to 1 for one scan. During this time, any low-to-high transition at the REQ input parameter is ignored.

Note

The default setting of the LEN parameter (LEN = 0) uses the DATA parameter to determine the length of the data being transmitted. It is recommended that the data transmitted by the TSEND_C instruction be the same size as the DATA parameter of the TRCV_C instruction.

If using the default setting of the LEN parameter and it is necessary to send the data in segments smaller than the DATA parameter size, the following applies. If the size of the data transmitted from TSEND_C does not equal the TRCV_C DATA parameter size, TRCV_C remains in a busy status (status code: 7006) until the overall size of the data transmitted from TSEND_C equals the TRCV_C DATA parameter size.

The TRCV_C DATA parameter buffer does not display the new data received until the data size equals the DATA parameter buffer size.

TSEND_C operations

The following functions describe the operation of the TSEND_C instruction:

- To establish a connection, execute TSEND_C with CONT = 1.
- After successful establishing of the connection, TSEND_C sets the DONE parameter for one cycle.
- To terminate the communication connection, execute TSEND_C with CONT = 0. The connection will be aborted immediately. This also affects the receiving station. The connection will be closed there and data inside the receive buffer could be lost.
- To send data over an established connection, execute TSEND_C with a rising edge on REQ. After a successful send operation, TSEND_C sets the DONE parameter for one cycle.
- To establish a connection and send data, execute TSEND_C with CONT =1 and REQ = 1. After a successful send operation, TSEND_C sets the DONE parameter for one cycle.

TRCV_C operations

The following functions describe the operation of the TRCV_C instruction:

- To establish a connection, execute TRCV_C with parameter CONT = 1.
- To receive data, execute TRCV_C with parameter EN_R = 1. TRCV_C receives the data continuously when parameters EN_R = 1 and CONT = 1.
- To terminate the connection, execute TRCV_C with parameter CONT = 0. The connection will be aborted immediately, and data could be lost.

TRCV_C handles the same receive modes as the TRCV instruction. The following table shows how data is entered in the receive area:

Table 11- 17 Entering the data into the receive area

Protocol variant	Entering the data in the receive area	Parameter "connection_type"	Value of the LEN parameter	Value of the RCVD_LEN parameter (bytes)
TCP	Ad hoc mode	B#16#11	65535	1 to 1472
TCP	Data reception with specified length	B#16#11	0 (recommended) or 1 to 8192, except 65535	1 to 8192
ISO on TCP	Ad hoc mode	B#16#12	65535	1 to 1472
ISO on TCP	Protocol-controlled	B#16#12	0 (recommended) or 1 to 8192, except 65535	1 to 8192

Note

Ad hoc mode

The "ad hoc mode" exists with the TCP and ISO on TCP protocol variants. You set "ad hoc mode" by assigning "65535" to the LEN parameter. The receive area is identical to the area formed by DATA. The length of the received data will be output to the parameter RCVD_LEN.

If you store the data in an "optimized" DB (symbolic only), you can receive data only in arrays of Byte, Char, USInt, and SInt data types.

Note

Importing of S7-300/400 STEP 7 projects containing "ad hoc mode" into the S7-1200

In S7-300/400 STEP 7 projects, "ad hoc mode" is selected by assigning "0" to the LEN parameter. In the S7-1200, you set "ad hoc mode" by assigning "65535" to the LEN parameter.

If you import an S7-300/400 STEP 7 project containing "ad hoc mode" into the S7-1200, you must change the LEN parameter to "65535".

Note

Must keep the data in the sender area consistent until the DONE parameter or the ERROR parameter assumes the value TRUE

Due to the asynchronous processing of TSEND_C, you must keep the data in the sender area consistent until the DONE parameter or the ERROR parameter assumes the value TRUE.

For TSEND_C, a TRUE state at the parameter DONE means that the data was sent successfully. It does not mean that the connection partner CPU actually read the receive buffer.

Due to the asynchronous processing of TRCV_C, the data in the receiver area are only consistent when parameter DONE = 1.

Table 11- 18 TSEND_C and TRCV_C instructions BUSY, DONE, and ERROR parameters

BUSY	DONE	ERROR	Description
TRUE	irrelevant	irrelevant	The job is being processed.
FALSE	TRUE	FALSE	The job is successfully completed.
FALSE	FALSE	TRUE	The job was ended with an error. The cause of the error can be found in the STATUS parameter.
FALSE	FALSE	FALSE	A new job was not assigned.

TSEND_C and TRCV_C Error and Status condition codes

ERROR	STATUS	Description
0	0000	Job executed without error
0	7000	No job processing active
0	7001	Start job processing, establishing connection, waiting for connection partner
0	7002	Data being sent or received
0	7003	Connection being terminated
0	7004	Connection established and monitored, no job processing active
1	8085	LEN parameter is greater than the largest permitted value.
1	8086	The CONNECT parameter is outside the permitted range.
1	8087	Maximum number of connections reached; no additional connection possible.
1	8088	LEN parameter is not valid for the memory area specified in DATA.
1	8089	The CONNECT parameter does not point to a data block.
1	8091	Maximum nesting depth exceeded.
1	809A	The CONNECT parameter points to a field that does not match the length of the connection description.
1	809B	The local_device_id in the connection description does not match the CPU.

ERROR	STATUS	Description
1	80A1	Communications error: • The specified connection was not yet established • The specified connection is currently being terminated; transmission over this connection is not possible • The interface is being reinitialized
1	80A3	Attempt being made to terminate a nonexistent connection
1	80A4	IP address of the remote partner connection is invalid. For example, the remote partner IP address is the same as the local partner IP address.
1	80A5	Connection ID (Page 808) is already in use.
1	80A7	Communications error: You called TDISCON before TSEND_C was complete.
1	80B2	The CONNECT parameter points to a data block that was generated with the keyword UNLINKED.
1	80B3	Inconsistent parameters: • Error in the connection description • Local port (parameter local_tsap_id) is already present in another connection description. • ID in the connection description different from the ID specified as parameter
1	80B4	When using the ISO on TCP (connection_type = B#16#12) to establish a passive connection, condition code 80B4 alerts you that the TSAP entered did not conform to one of the following address requirements: • For a local TSAP length of 2 and a TSAP ID value of either E0 or E1 (hexadecimal) for the first byte, the second byte must be either 00 or 01. • For a local TSAP length of 3 or greater and a TSAP ID value of either E0 or E1 (hexadecimal) for the first byte, the second byte must be either 00 or 01 and all other bytes must be valid ASCII characters. • For a local TSAP length of 3 or greater and the first byte of the TSAP ID does not have a value of either E0 or E1 (hexadecimal), then all bytes of the TSAP ID must be valid ASCII characters. Valid ASCII characters are byte values from 20 to 7E (hexadecimal).
1	80B7	Data type and/or length of the transmitted data does not fit in the area in the partner CPU in which it is to be written.
1	80C3	All connection resources are in use.
1	80C4	Temporary communications error: • The connection cannot be established at this time • The interface is receiving new parameters • The configured connection is currently being removed by a TDISCON.
1	8722	CONNECT parameter: Source area invalid: area does not exist in DB.
1	873A	CONNECT parameter: Access to connection description is not possible (for example, DB not available)
1	877F	CONNECT parameter: Internal error such as an invalid ANY reference
1	893A	Parameter contains the number of a DB that is not loaded.

Connection Ethernet protocols

Every CPU has an integrated PROFINET port, which supports standard PROFINET communications. The TSEND_C and TRCV_C and TSEND and TRCV instructions all support the TCP and ISO on TCP Ethernet protocols.

Refer to "Device Configuration: Configuring the Local/Partner connection path (Page 788)" for more information.

11.2.8.9 TCON, TDISCON, TSEND, and TRCV instructions

As of version V4.1 of the S7-1200 CPU together with STEP 7 V13 SP1, the CPU extends the capability of the TCON, TDISCON, TSEND, and TRCV instructions to use connection parameters with structures according to "TCON_IP_v4" and "TCON_IP_RFC".

For this reason, the S7-1200 supports two sets of TCON, TDISCON, TSEND, and TRCV instructions:

- Legacy TCON, TDISCON, TSEND, and TRCV instructions (Page 848): These TCON, TDISCON, TSEND, and TRCV instructions existed prior to version V4.0 of the S7-1200 and only work with connection parameters with structures according to "TCON_Param".
- TCON, TDISCON, TSEND, and TRCV instructions (Page 837): These TCON, TDISCON, TSEND, and TRCV instructions provide all of the functionality of the legacy instructions, plus the ability to use connection parameters with structures according to "TCON_IP_v4" and "TCON_IP_RFC".

Selecting the version of the TCON, TDISCON, TSEND, and TRCV instructions

There are two versions of the TCON, TDISCON, TSEND, or TRCV instructions available in STEP 7:

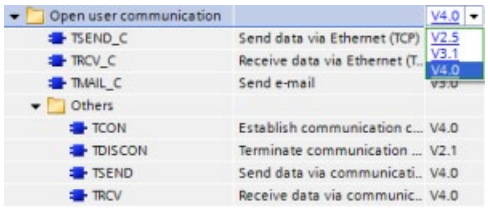
- Versions 2.5 and 3.1 were available in STEP 7 Basic/Professional V13 or earlier.
- Version 4.0 is available in STEP 7 Basic/Professional V13 SP1 or later.

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

Do not use different instruction versions in the same CPU program.



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



To change the version of the TCON, TDISCON, TSEND, or TRCV instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a TCON, TDISCON, TSEND, or TRCV instruction in your program, a new FB or FC instance, depending on the TCON, TDISCON, TSEND, or TRCV instruction selected, is created in the project tree. You can see new FB or FC instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a TCON, TDISCON, TSEND, or TRCV instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree TCON, TDISCON, TSEND, or TRCV FB or FC instance, right-click, select "Properties", and select the "Information" page to see the TCON, TDISCON, TSEND, or TRCV instruction version number.

TCON, TDISCON, TSEND, and TRCV (TCP communication) instructions

Ethernet communication using TCP and ISO on TCP protocols

Note

TSEND_C and TRCV_C instructions

To help simplify the programming of PROFINET/Ethernet communication, the TSEND_C instruction and the TRCV_C instruction combine the functionality of the TCON, TDISCON. TSEND and TRCV instructions:

- TSEND_C combines the TCON, TDISCON and TSEND instructions.
- TRCV_C combines the TCON, TDISCON and TRCV instructions.

The following instructions control the communication process:

- TCON establishes the TCP/IP connection between the client and server (CPU) PC.
- TSEND and TRCV send and receive data.
- TDISCON breaks the connection.

The minimum size of data that you can transmit (TSEND) or receive (TRCV) is one byte; the maximum size is 8192 bytes. TSEND does not support the transmission of data from Boolean locations, and TRCV will not receive data into Boolean locations. For information transferring data with these instructions, see the section on data consistency (Page 192).

TCON, TDISCON, TSEND, and TRCV operate asynchronously, which means that the job processing extends over multiple instruction executions. For example, you start a job for setting up and establishing a connection by executing an instruction TCON with parameter REQ = 1. Then you use additional TCON executions to monitor the job progress and test for job completion with parameter DONE.

The following table shows the relationships between BUSY, DONE, and ERROR. Use the table to determine the current job status:

Table 11- 19 Interactions between the BUSY, DONE, and ERROR parameters

BUSY	DONE	ERROR	Description
1	0	0	The job is being processed.
0	1	0	The job successfully completed.
0	0	1	The job ended with an error. The cause of the error is output at the STATUS parameter.
0	0	0	No new job assigned.

TCON and TDISCON

Note

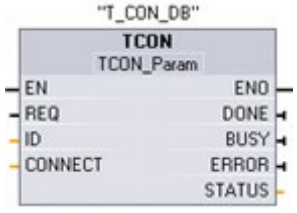
Initializing the communication parameters

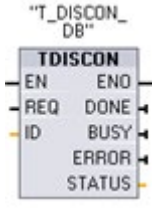
After you insert the TCON instruction, use the "Properties" of the instruction (Page 788) to configure the communication parameters (Page 811). As you enter the parameters for the communication partners in the inspector window, STEP 7 enters the corresponding data in the instance DB for the instruction.

If you want to use a multi-instance DB, you must manually configure the DB on both CPUs.

Table 11- 20 TCON and TDISCON instructions

LAD / FBD		Description

	`"TCON_DB"(`
	`req:=_bool_in_,`
	`ID:=_undef_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`connect:=_struct_inout_);`
		TCP and ISO on TCP: TCON initiates a communications connection from the CPU to a communication partner.

	`"TDISCON_DB"(`
	`req:=_bool_in_,`
	`ID:=_word_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_);`
		TCP and ISO on TCP: TDISCON terminates a communications connection from the CPU to a communication partner.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 11- 21 Data types for the parameters of TCON and TDISCON

Parameter	Declaration	Data type	Description
REQ	IN	Bool	Starts the job to establish the connection specified in the ID upon a rising edge.
ID	IN	CONN_OUC (Word)	Reference to the assigned connection. Range of values: W#16#0001 to W#16#0FFF
CONNECT (TCON)	IN_OUT	VARIANT	Pointer to the connection description • For TCP or UDP, use the structure TCON_IP_v4 For further information on TCON_IP_v4, refer to: "Parameters for the PROFINET connection" (Page 811). • For ISO-on-TCP, use the structure TCON_IP_RFC For further information on TCON_IP_RFC, refer to: "Parameters for the PROFINET connection" (Page 811).
DONE	OUT	Bool	Status parameter with the following values: • 0: Job not yet started or still in progress • 1: Job executed without errors
BUSY	OUT	Bool	Status parameter with the following values: • 0: Job not yet started or already completed • 1: Job not yet completed. A new job cannot be started
ERROR	OUT	Bool	Status parameter ERROR: • 0: No error • 1: Error occurred
STATUS	OUT	Word	Status of the instruction

Both communication partners execute the TCON instruction to set up and establish the communication connection. You use parameters to specify the active and passive communication end point partners. After the connection is set up and established, it is automatically maintained and monitored by the CPU.

If the connection is terminated due to a line break or due to the remote communications partner, for example, the active partner attempts to re-establish the configured connection. You do not have to execute TCON again.

An existing connection is terminated and the set-up connection is removed when the TDISCON instruction is executed or when the CPU has gone into STOP mode. To set up and re-establish the connection, you must execute TCON again.

Table 11- 22 ERROR and STATUS condition codes for TCON and TDISCON

ERROR	STATUS (W#16#...)	Explanation
0	0000	Connection successfully established.
0	7000	No job processing active
0	7001	Start job execution; establish connection (TCON) or terminate connection (TDISCON).
0	7002	Connection is being established (REQ irrelevant); establish connection (TCON) or terminate connection (TDISCON).
1	8085	TCON: Connection ID is already in use.
1	8086	TCON: The ID parameter is outside the valid range.
1	8087	TCON: Maximum number of connections reached; no additional connection possible
1	8089	TCON: The CONNECT parameter does not point to a connection description or the connection description was created manually.
1	809A	TCON: The structure at the CONNECT parameter is not supported or the length is invalid.
1	809B	TCON: The ID of the local device in the connection description does not correspond to the CPU or the CP, or it is "0".
1	80A0	Group error for error codes W#16#80A1 and W#16#80A2.
1	80A1	TCON: For TCP/UDP (TCON_IP_v4): Connection or port is already in use.
1	80A2	TCON: Local or remote port is being used by the system.
1	80A3	TCON: Value at the ID parameter is already being used by a connection (TCON) that was created using the user program. The connection uses the identical ID, but different connection settings at the parameter CONNECT.
1	80A4	TCON: IP address of the remote endpoint of the connection is invalid or it corresponds to the IP address of the local partner.
1	80A5	TCON: Connection ID is already in use.
1	80A7	TCON: Communication error: You executed "TDISCON" before "TCON" had completed.
1	80B2	TCON: The CONNECT parameter points to a data block that was generated with the attribute "Only store in load memory".
1	80B3	Inconsistent parameter assignment: Group error for error codes W#16#80A0 to W#16#80A2, W#16#80A4, W#16#80B4 to W#16#80B9.
1	80B4	TCON: Only with TCON_IP_RFC The local T selector was not specified or the first byte does not contain the value 0x0E or the local T selector starts with "SIMATIC-".
1	80B5	TCON: Only passive connection establishment is permitted for connection type 13 = UDP (Parameter active_est of the structure TCON_IP_v4 has the value TRUE)..
1	80B6	TCON: Parameter assignment error in the connection_type parameter of the data block for connection description. • Only valid with TCON_IP_v4: 0x11, 0x0B and 0x13. • Only valid with TCON_IP_RFC: 0x0C and 0x12

ERROR	STATUS (W#16#...)	Explanation
1	80B7	TCON: With TCON_IP_v4: • TCP (active connection establishment): Remote port is "0". • TCP (passive connection establishment): Local port is "0". • UDP: Local port is "0". TCON: With TCON_IP_RFC: • Local (local_tselector) or remote (remote_tselector) T selector was specified with a length of more than 32 bytes. • For TSelLength of the T selector (local or remote), a length greater than 32 was entered. • Error in the length of the IP address of the specific connection partner.
1	80B8	TCON: Parameter ID in the local connection description (structure at parameter CONNECT) and parameter ID of the instruction are different.
1	80C3	TCON: All connection (Page 808) resources are in use.
1	80C4	Temporary communication error: • The connection cannot be established at this time (TCON). • The interface is currently receiving new parameters (TCON and TDISCON). • The configured connection is currently being removed by a "TDISCON" instruction (TCON).
1	80C5	TCON: The remote partner refuses to establish the connection, has terminated the connection or actively ended it.
1	80C6	TCON: The remote partner cannot be reached (network error).
1	80C7	TCON: Execution timeout.
1	80C8	TCON: ID is used by a connection created by the user program, which uses the same connection description at the CONNECT parameter.
1	80C9	TCON: Validation of the remote partner failed. The remote partner that wants to establish the connection does not match the defined partner of the structure at the CONNECT parameter.
1	80CE	TCON: The IP address of the local interface is 0.0.0.0.

TSEND and TRCV

Note

When using PROFINET Open User communication, if you execute a TSEND instruction without a corresponding TRCV instruction executing on the remote device, then the TSEND instruction may reside indefinitely in a "Busy State", waiting for the TRCV instruction to receive the data. In this state, the TSEND instruction "Busy" output is set, and the "Status" output has a value of "0x7002". This condition may occur if you are transferring more than 4096 bytes of data. The issue is resolved at the next execution of the TRCV instruction.

Table 11- 23 TSEND and TRCV instructions

LAD / FBD	SCL	Description
	"TSEND_DB"(req:=_bool_in_, ID:=_word_in_, len:=_udint_in_, done=>_bool_out_, busy=>_bool_out_, error=>_bool_out_, status=>_word_out_, data:=_variant_inout_);	TCP and ISO on TCP: TSEND sends data through a communication connection from the CPU to a partner station.
	"TRCV_DB"(en_r:=_bool_in_, ID:=_word_in_, len:=_udint_in_, adhoc:=_bool_in_, ndr=>_bool_out_, busy=>_bool_out_, error=>_bool_out_, status=>_word_out_, rcvd_len=>_udint_out_, data:=_variant_inout_);	TCP and ISO on TCP: TRCV receives data through a communication connection from a partner station to the CPU.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 11- 24 Data types for the parameters of TSEND and TRCV

Parameter and type		Data type	Description
REQ	IN	Bool	TSEND: Starts the send job on a rising edge. The data is transferred from the area specified by DATA and LEN.
EN_R	IN	Bool	TRCV: Enables the CPU to receive; with EN_R = 1, the TRCV is ready to receive. The receive job is processed.
ID	IN	CONN_OUC (Word)	Reference to the associated connection. ID must be identical to the associated parameter ID in the local connection description. Value range: W#16#0001 to W#16#0FFF
LEN	IN	UDInt	Maximum number of bytes to be sent (TSEND) or received (TRCV): • Default = 0: The DATA parameter determines the length of the data to be sent (TSEND) or received (TRCV). • Ad hoc mode = 65535: A variable length of data is set for reception (TRCV).
ADHOC	IN	Bool	TRCV: Optional parameter (hidden) Ad hoc mode request for connection type TCP.
DATA	IN_OUT	Variant	Pointer to send (TSEND) or receive (TRCV) data area; data area contains the address and length. The address refers to I memory, Q memory, M memory, or a DB.
DONE	OUT	Bool	TSEND: • 0: Job not yet started or still running. • 1: Job executed without error.
NDR	OUT	Bool	TRCV: • NDR = 0: Job not yet started or still running. • NDR = 1: Job successfully completed.
BUSY	OUT	Bool	• BUSY = 1: The job is not yet complete. A new job cannot be triggered. • BUSY = 0: Job is complete.
ERROR	OUT	Bool	ERROR = 1: Error occurred during processing. STATUS provides detailed information on the type of error
STATUS	OUT	Word	Status information including error information. (Refer to the Error and Status condition codes in the table below.)
RCVD_LEN	OUT	UDInt	TRCV: Amount of data actually received in bytes

Note

The TSEND instruction requires a low-to-high transition at the REQ input parameter to start a send job. The BUSY parameter is then set to 1 during processing. Completion of the send job is indicated by either the DONE or ERROR parameters being set to 1 for one scan. During this time, any low-to-high transition at the REQ input parameter is ignored.

TRCV Operations

The TRCV instruction writes the received data to a receive area that is specified by the following two variables:

- Pointer to the start of the area
- Length of the area or the value supplied at the LEN input if not 0

Note

The default setting of the LEN parameter (LEN = 0) uses the DATA parameter to determine the length of the data being transmitted. It is recommended that the data transmitted by the TSEND instruction be the same size as the DATA parameter of the TRCV instruction.

If using the default setting of the LEN parameter and it is necessary to send the data in segments smaller than the DATA parameter size, the following applies. It is recommended to keep the EN_R bit high until the corresponding TSEND transfers the appropriate amount of data to fill the TRCV DATA parameter. If the size of the data transmitted from TSEND does not equal the TRCV DATA parameter size, TRCV remains in a busy status (status code: 7002) while the EN_R bit is high until the overall size of the data transmitted from TSEND equals the TRCV DATA parameter size. If the EN_R bit of TRCV is pulsed, it needs to be pulsed the same number of times as TSEND is executed to receive the data.

The TRCV DATA parameter buffer does not display the new data received until the data size equals the DATA parameter buffer size.

As soon as all the job data has been received, TRCV transfers it to the receive area and sets NDR to 1.

Table 11- 25 Entering the data into the receive area

Protocol variant	Entering the data in the receive area	Parameter "connection_type"	Value of the LEN parameter	Value of the RCVD_LEN parameter (bytes)
TCP	Ad hoc mode	B#16#11	Selected with the TRCV instruction ADHOC input	1 to 1472
TCP	Data reception with specified length	B#16#11	0 (recommended) or 1 to 8192, except 65535	1 to 8192
ISO on TCP	Ad hoc mode	B#16#12	65535	1 to 1472
ISO on TCP	protocol-controlled	B#16#12	0 (recommended) or 1 to 8192, except 65535	1 to 8192

Note

Ad hoc mode

The "ad hoc mode" exists with the TCP and ISO on TCP protocol variants. To configure the TRCV instruction for ad hoc mode, set the ADHOC instruction input parameter. The receive area is identical to the area formed by DATA. The length of the received data will be output to the parameter RCVD_LEN. Immediately after receiving a block of data, TRCV enters the data in the receive area and sets NDR to 1.

If you store the data in an "optimized" DB (symbolic only), you can receive data only in arrays of Byte, Char, USInt, and SInt data types.

Note

Importing of S7-300/400 STEP 7 projects containing "ad hoc mode" into the S7-1200

In S7-300/400 STEP 7 projects, "ad hoc mode" is selected by assigning "0" to the LEN parameter. In the S7-1200, you configure the TRCV instruction for ad hoc mode by setting the ADHOC instruction input parameter.

If you import an S7-300/400 STEP 7 project containing "ad hoc mode" into the S7-1200, you must change the LEN parameter to "65535".

Table 11- 26 ERROR and STATUS condition codes for TSEND and TRCV

ERROR	STATUS	Description
0	0000	• Send job completed without error (TSEND) • New data accepted: The current length of the received data is shown in RCVD_LEN (TRCV).
0	7000	• No job processing active (TSEND) • Block not ready to receive (TRCV)
0	7001	• Start of job processing, data being sent: During this processing the operating system accesses the data in the DATA send area (TSEND). • Block is ready to receive, receive job was activated (TRCV).
0	7002	• Follow-on instruction execution (REQ irrelevant), job being processed: The operating system accesses the data in the DATA send area during this processing (TSEND). • Follow-on instruction execution, receive job being processed: Data is written to the receive area during this processing. For this reason, an error could result in inconsistent data in the receive area (TRCV).
1	8085	• LEN parameter is greater than the largest permitted value (TSEND) and (TRCV). • LEN or DATA parameter changed since the first instruction execution (TRCV).
1	8086	The ID parameter is not in the permitted address range.
1	8088	The LEN parameter is larger than the memory area specified in DATA.
1	80A1	Communications error: • The specified connection has not yet established (TSEND and TRCV). • The specified connection is currently being terminated. Transmission or a receive job over this connection is not possible (TSEND and TRCV). • The interface is being reinitialized (TSEND). • The interface is receiving new parameters (TRCV).
1	80C3	Internal lack of connection (Page 808) resources: A block with this ID is already being processed in a different priority class.
1	80C4	Temporary communications error: • The connection to the communications partner cannot be established at this time. • The interface is receiving new parameter settings, or the connection is currently being established.

Connection Ethernet protocols

Every CPU has an integrated PROFINET port, which supports standard PROFINET communications. The TSEND_C, TRCV_C, TSEND and TRCV instructions all support the TCP and ISO on TCP Ethernet protocols.

Refer to "Device Configuration: Configuring the Local/Partner connection path (Page 788)" for more information.

11.2.8.10 Legacy TCON, TDISCON, TSEND, and TRCV instructions

Prior to the release of STEP 7 V13 SP1 and the S7-1200 V4.1 CPUs, the TCON, TDISCON, TSEND, and TRCV instructions could only work with connection parameters with structures according to "TCON_Param". The general concepts apply to both sets of instructions. Refer to the individual legacy TCON, TDISCON, TSEND, and TRCV instructions for programming information.

Selecting the version of the TCON, TDISCON, TSEND, and TRCV instructions

There are two versions of the TCON, TDISCON, TSEND, or TRCV instructions available in STEP 7:

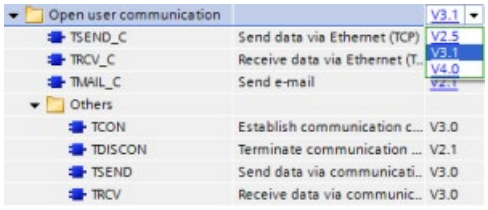
- Versions 2.5 and 3.1 were available in STEP 7 Basic/Professional V13 or earlier.
- Version 4.0 is available in STEP 7 Basic/Professional V13 SP1 or later.

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

Do not use different instruction versions in the same CPU program.



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



To change the version of the TCON, TDISCON, TSEND, or TRCV instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a TCON, TDISCON, TSEND, or TRCV instruction in your program, a new FB or FC instance, depending on the TCON, TDISCON, TSEND, or TRCV instruction selected, is created in the project tree. You can see new FB or FC instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a TCON, TDISCON, TSEND, or TRCV instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree TCON, TDISCON, TSEND, or TRCV FB or FC instance, right-click, select "Properties", and select the "Information" page to see the TCON, TDISCON, TSEND, or TRCV instruction version number.

Legacy TCON, TDISCON, TSEND, and TRCV (TCP communication) instructions

Ethernet communication using TCP and ISO on TCP protocols

Note

TSEND_C and TRCV_C instructions

To help simplify the programming of PROFINET/Ethernet communication, the TSEND_C instruction and the TRCV_C instruction combine the functionality of the TCON, TDISCON. TSEND and TRCV instructions:

- TSEND_C combines the TCON, TDISCON and TSEND instructions.
- TRCV_C combines the TCON, TDISCON and TRCV instructions.

The following instructions control the communication process:

- TCON establishes the TCP/IP connection between the client and server (CPU) PC.
- TSEND and TRCV send and receive data.
- TDISCON breaks the connection.

The minimum size of data that you can transmit (TSEND) or receive (TRCV) is one byte; the maximum size is 8192 bytes. TSEND does not support the transmission of data from Boolean locations, and TRCV will not receive data into Boolean locations. For information transferring data with these instructions, see the section on data consistency (Page 192).

TCON, TDISCON, TSEND, and TRCV operate asynchronously, which means that the job processing extends over multiple instruction executions. For example, you start a job for setting up and establishing a connection by executing an instruction TCON with parameter REQ = 1. Then you use additional TCON executions to monitor the job progress and test for job completion with parameter DONE.

The following table shows the relationships between BUSY, DONE, and ERROR. Use the table to determine the current job status:

Table 11- 27 Interactions between the BUSY, DONE, and ERROR parameters

BUSY	DONE	ERROR	Description
TRUE	irrelevant	irrelevant	The job is being processed.
FALSE	TRUE	FALSE	The job successfully completed.
FALSE	FALSE	TRUE	The job was ended with an error. The cause of the error can be found in the STATUS parameter.
FALSE	FALSE	FALSE	A new job was not assigned.

TCON and TDISCON

Note

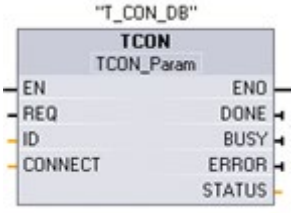
Initializing the communication parameters

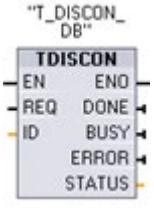
After you insert the TCON instruction, use the "Properties" of the instruction (Page 788) to configure the communication parameters (Page 811). As you enter the parameters for the communication partners in the inspector window, STEP 7 enters the corresponding data in the instance DB for the instruction.

If you want to use a multi-instance DB, you must manually configure the DB on both CPUs.

Table 11- 28 TCON and TDISCON instructions

LAD / FBD		Description

	`"TCON_DB"(`
	`req:=_bool_in_,`
	`ID:=_undef_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`connect:=_struct_inout_);`
		TCP and ISO on TCP: TCON initiates a communications connection from the CPU to a communication partner.

	`"TDISCON_DB"(`
	`req:=_bool_in_,`
	`ID:=_word_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_);`
		TCP and ISO on TCP: TDISCON terminates a communications connection from the CPU to a communication partner.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 11- 29 Data types for the parameters of TCON and TDISCON

Parameter and type		Data type	Description
REQ	IN	Bool	Control parameter REQ starts the job by establishing the connection specified by ID. The job starts at rising edge.
ID	IN	CONN_OUC (Word)	Reference to the connection to be established (TCON) or terminated (TDISCON) to the remote partner, or between the user program and the communication layer of the operating system. The ID must be identical to the associated parameter ID in the local connection description. Value range: W#16#0001 to W#16#0FFF
CONNECT (TCON)	IN_OUT	TCON_Param	Pointer to the connection description (Page 811)
DONE	OUT	Bool	• 0: Job is not yet started or still running. • 1: Job completed without error.
BUSY	OUT	Bool	• 0: Job is completed. • 1: Job is not yet completed. A new job cannot be triggered.
ERROR	OUT	Bool	Status parameters with the following values: • 0: No error • 1: Error occurred during processing. STATUS provides detailed information on the type of error.
STATUS	OUT	Word	Status information including error information. (Refer to the Error and Status condition codes in the table below.)

Both communication partners execute the TCON instruction to set up and establish the communication connection. You use parameters to specify the active and passive communication end point partners. After the connection is set up and established, it is automatically maintained and monitored by the CPU.

If the connection is terminated due to a line break or due to the remote communications partner, for example, the active partner attempts to re-establish the configured connection. You do not have to execute TCON again.

An existing connection is terminated and the set-up connection is removed when the TDISCON instruction is executed or when the CPU has gone into STOP mode. To set up and re-establish the connection, you must execute TCON again.

Table 11- 30 ERROR and STATUS condition codes for TCON and TDISCON

ERROR	STATUS	Description
0	0000	Connection was established successfully.
0	7000	No job processing active
0	7001	Start job processing; establishing connection (TCON) or terminating connection (TDISCON)
0	7002	Follow-on call (REQ irrelevant); establishing connection (TCON) or terminating connection (TDISCON)
1	8086	The ID parameter is outside the permitted address range.
1	8087	TCON: Maximum number of connections reached; no additional connection possible.
1	809B	TCON: The local_device_id in the connection description does not match the CPU.
1	80A1	TCON: Connection or port is already occupied by user.
1	80A2	TCON: Local or remote port is occupied by the system.
1	80A3	Attempt being made to re-establish an existing connection (TCON) or terminate a non-existent connection (TDISCON).
1	80A4	TCON: IP address of the remote connection end point is invalid; it matches the local partner IP address.
1	80A5	TCON: Connection ID (Page 808) is already in use.
1	80A7	TCON: Communications error: You executed a TDISCON before the TCON completed.The TDISCON must first completely terminate the connection referenced by the ID.
1	80B2	TCON: The CONNECT parameter points to a data block that was generated with the attribute "Only store in load memory".
1	80B4	TCON: When using the ISO on TCP (connection_type = B#16#12) to establish a passive connection, condition code 80B4 alerts you that the TSAP entered did not conform to one of the following address requirements: • For a local TSAP length of 2 and a TSAP ID value of either E0 or E1 (hexadecimal) for the first byte, the second byte must be either 00 or 01. • For a local TSAP length of 3 or greater and a TSAP ID value of either E0 or E1 (hexadecimal) for the first byte, the second byte must be either 00 or 01 and all other bytes must be valid ASCII characters. • For a local TSAP length of 3 or greater and the first byte of the TSAP ID does not have a value of either E0 or E1 (hexadecimal), then all bytes of the TSAP ID must be valid ASCII characters. Valid ASCII characters are byte values from 20 to 7E (hexadecimal).
1	80B5	TCON: Connection type "13 = UDP" permits only passive connection establishment.
1	80B6	TCON: Parameter assignment error in CONNECTION_TYPE parameter of the SDT TCON_Param.

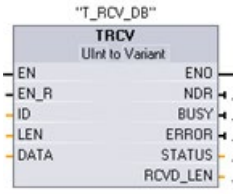
ERROR	STATUS	Description
1	80B7	TCON: Error in one of the following parameters of the data block for connection description: • block_length • local_tsap_id_len • rem_subnet_id_len • rem_staddr_len • rem_tsap_id_len • next_staddr_len Note: When operating TCON in TCP passive mode, the LOCAL_TSAP_ID_LEN must be "2" and the REM_TSAP_ID_LEN must be "0".
1	80B8	TCON: Parameter in the local connection description and Parameter ID are different.
1	80C3	TCON: All connection resources are in use.
1	80C4	Temporary communications error: • The connection cannot be established at this time (TCON). • The configured connection is currently being removed by TDISCON (TCON). • The connection is currently being established (TDISCON). • The interface is receiving new parameters (TCON and TDISCON).

TSEND and TRCV

Note

When using PROFINET Open User communication, if you execute a TSEND instruction without a corresponding TRCV instruction executing on the remote device, then the TSEND instruction may reside indefinitely in a "Busy State", waiting for the TRCV instruction to receive the data. In this state, the TSEND instruction "Busy" output is set, and the "Status" output has a value of "0x7002". This condition may occur if you are transferring more than 4096 bytes of data. The issue is resolved at the next execution of the TRCV instruction.

Table 11- 31 TSEND and TRCV instructions

LAD / FBD	SCL	Description
	"TSEND_DB"(req:=_bool_in_, ID:=_word_in_, len:=_udint_in_, done=>_bool_out_, busy=>_bool_out_, error=>_bool_out_, status=>_word_out_, data:=_variant_inout_);	TCP and ISO on TCP: TSEND sends data through a communication connection from the CPU to a partner station.
	"TRCV_DB"(en_r:=_bool_in_, ID:=_word_in_, len:=_udint_in_, ndr=>_bool_out_, busy=>_bool_out_, error=>_bool_out_, status=>_word_out_, rcvd_len=>_udint_out_, data:=_variant_inout_);	TCP and ISO on TCP: TRCV receives data through a communication connection from a partner station to the CPU.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 11- 32 Data types for the parameters of TSEND and TRCV

Parameter and type		Data type	Description
REQ	IN	Bool	TSEND: Starts the send job on a rising edge. The data is transferred from the area specified by DATA and LEN.
EN_R	IN	Bool	TRCV: Enables the CPU to receive; with EN_R = 1, the TRCV is ready to receive. The receive job is processed.
ID	IN	CONN_OUC (Word)	Reference to the associated connection. ID must be identical to the associated parameter ID in the local connection description. Value range: W#16#0001 to W#16#0FFF
LEN	IN	UInt	Maximum number of bytes to be sent (TSEND) or received (TRCV): • Default = 0: The DATA parameter determines the length of the data to be sent (TSEND) or received (TRCV). • Ad hoc mode = 65535: A variable length of data is set for reception (TRCV).
DATA	IN_OUT	Variant	Pointer to send (TSEND) or receive (TRCV) data area; data area contains the address and length. The address refers to I memory, Q memory, M memory, or a DB.
DONE	OUT	Bool	TSEND: • 0: Job not yet started or still running. • 1: Job executed without error.

Parameter and type		Data type	Description
NDR	OUT	Bool	TRCV: • NDR = 0: Job not yet started or still running. • NDR = 1: Job successfully completed.
BUSY	OUT	Bool	• BUSY = 1: The job is not yet complete. A new job cannot be triggered. • BUSY = 0: Job is complete.
ERROR	OUT	Bool	ERROR = 1: Error occurred during processing. STATUS provides detailed information on the type of error
STATUS	OUT	Word	Status information including error information. (Refer to the Error and Status condition codes in the table below.)
RCVD_LEN	OUT	Int	TRCV: Amount of data actually received in bytes

Note

The TSEND instruction requires a low-to-high transition at the REQ input parameter to start a send job. The BUSY parameter is then set to 1 during processing. Completion of the send job is indicated by either the DONE or ERROR parameters being set to 1 for one scan. During this time, any low-to-high transition at the REQ input parameter is ignored.

TRCV Operations

The TRCV instruction writes the received data to a receive area that is specified by the following two variables:

- Pointer to the start of the area
- Length of the area or the value supplied at the LEN input if not 0

Note

The default setting of the LEN parameter (LEN = 0) uses the DATA parameter to determine the length of the data being transmitted. It is recommended that the data transmitted by the TSEND instruction be the same size as the DATA parameter of the TRCV instruction.

If using the default setting of the LEN parameter and it is necessary to send the data in segments smaller than the DATA parameter size, the following applies. It is recommended to keep the EN_R bit high until the corresponding TSEND transfers the appropriate amount of data to fill the TRCV DATA parameter. If the size of the data transmitted from TSEND does not equal the TRCV DATA parameter size, TRCV remains in a busy status (status code: 7002) while the EN_R bit is high until the overall size of the data transmitted from TSEND equals the TRCV DATA parameter size. If the EN_R bit of TRCV is pulsed, it needs to be pulsed the same number of times as TSEND is executed to receive the data.

The TRCV DATA parameter buffer does not display the new data received until the data size equals the DATA parameter buffer size.

As soon as all the job data has been received, TRCV transfers it to the receive area and sets NDR to 1.

Table 11- 33 Entering the data into the receive area

Protocol variant	Entering the data in the receive area	Parameter "connection_type"	Value of the LEN parameter	Value of the RCVD_LEN parameter (bytes)
TCP	Ad hoc mode	B#16#11	65535	1 to 1472
TCP	Data reception with specified length	B#16#11	0 (recommended) or 1 to 8192, except 65535	1 to 8192
ISO on TCP	Ad hoc mode	B#16#12	65535	1 to 1472
ISO on TCP	protocol-controlled	B#16#12	0 (recommended) or 1 to 8192, except 65535	1 to 8192

Note

Ad hoc mode

The "ad hoc mode" exists with the TCP and ISO on TCP protocol variants. You set "ad hoc mode" by assigning "65535" to the LEN parameter. The receive area is identical to the area formed by DATA. The length of the received data will be output to the parameter RCVD_LEN. Immediately after receiving a block of data, TRCV enters the data in the receive area and sets NDR to 1.

If you store the data in an "optimized" DB (symbolic only), you can receive data only in arrays of Byte, Char, USInt, and SInt data types.

Note

Importing of S7-300/400 STEP 7 projects containing "ad hoc mode" into the S7-1200

In S7-300/400 STEP 7 projects, "ad hoc mode" is selected by assigning "0" to the LEN parameter. In the S7-1200, you set "ad hoc mode" by assigning "65535" to the LEN parameter.

If you import an S7-300/400 STEP 7 project containing "ad hoc mode" into the S7-1200, you must change the LEN parameter to "65535".

TSEND and TRCV Error and Status condition codes

ERROR	STATUS	Description
0	0000	• Send job completed without error (TSEND) • New data accepted: The current length of the received data is shown in RCVD_LEN (TRCV).
0	7000	• No job processing active (TSEND) • Block not ready to receive (TRCV)
0	7001	• Start of job processing, data being sent: During this processing the operating system accesses the data in the DATA send area (TSEND). • Block is ready to receive, receive job was activated (TRCV).
0	7002	• Follow-on instruction execution (REQ irrelevant), job being processed: The operating system accesses the data in the DATA send area during this processing (TSEND). • Follow-on instruction execution, receive job being processed: Data is written to the receive area during this processing. For this reason, an error could result in inconsistent data in the receive area (TRCV).
1	8085	• LEN parameter is greater than the largest permitted value (TSEND) and (TRCV). • LEN or DATA parameter changed since the first instruction execution (TRCV).
1	8086	The ID parameter is not in the permitted address range.
1	8088	The LEN parameter is larger than the memory area specified in DATA.
1	80A1	Communications error: • The specified connection has not yet established (TSEND and TRCV). • The specified connection is currently being terminated. Transmission or a receive job over this connection is not possible (TSEND and TRCV). • The interface is being reinitialized (TSEND). • The interface is receiving new parameters (TRCV).
1	80C3	Internal lack of resources: A block with this ID is already being processed in a different priority class.
1	80C4	Temporary communications error: • The connection to the communications partner cannot be established at this time. • The interface is receiving new parameter settings, or the connection is currently being established.

Connection Ethernet protocols

Every CPU has an integrated PROFINET port, which supports standard PROFINET communications. The TSEND_C, TRCV_C, TSEND and TRCV instructions all support the TCP and ISO on TCP Ethernet protocols.

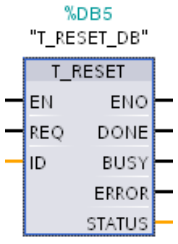
Refer to "Device Configuration: Configuring the Local/Partner connection path (Page 788)" for more information.

11.2.8.11 T_RESET (Terminate and re-establish an existing connection) instruction

The "T_RESET" instruction terminates and then re-establishes an existing connection:

Table 11- 34 T_RESET instruction

LAD / FBD	SCL	Description

	`"T_RESET_DB"(`
	`req:=_bool_in_,`
	`id:=_word_in_,`
	`done=>_bool_out_,`
	`error=>_bool_out_,`
	`sta-`
	`tus=>_word_out_);`
		Use the T_RESET instruction to terminate and then re-establish an existing connection.

The local end points of the connection are retained. They are generated automatically:

- If a connection has been configured and loaded to the CPU.
- If a connection has been generated by the user program, for example, by calling the instruction "TCON (Page 837)".

The "T_RESET" instruction can be executed for all connection types regardless of whether the local interface of the CPU or the interface of a CM/CP was used for the connection. An exception to this is connections for data transfer in ad-hoc mode with TCP, as such connections cannot be referenced with a connection ID.

Once the instruction "T_RESET" has been called using the REQ parameter, the connection specified with the ID parameter is terminated and, if necessary, the data send and receive buffer cleared. Canceling the connection also cancels any data transfer in progress. There is therefore a risk of losing data if data transfer is in progress. The CPU defined as the active connection partner will then automatically attempt to restore the interrupted communication connection. You therefore do not need to call the "TCON (Page 837)" instruction to re-establish the communication connection.

The output parameters DONE, BUSY, and STATUS indicate the status of the job.

Data types for the parameters

The following table shows the parameters of the "T_RESET" instruction:

Parameter	Declaration	Data type	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L, T, C or constant	Control parameter REQUEST starts the job for terminating the connection specified by ID. The job starts on a rising edge.
ID	Input	CONN_OUC (WORD)	L, D or constant	Reference to the connection to the passive partner which is to be terminated. ID must be identical to the corresponding parameter ID in the local connection description. Range of values: W#16#0001 to W#16#0FFF
DONE	Output	BOOL	I, Q, M, D, L	Status parameter DONE • 0: Job not yet started or still executing. • 1: Job executed without errors.
BUSY	Output	BOOL	I, Q, M, D, L	Status parameter BUSY • 0: Job is complete. • 1: Job is not yet complete.
ERROR	Output	BOOL	I, Q, M, D, L	Status parameter ERROR • 0: No error occurred. • 1: Error occurred during processing. The STATUS parameter supplies detailed information on the type of error
STATUS	Output	WORD	I, Q, M, D, L	Status parameter STATUS Error information (see "STATUS parameter" table).

STATUS parameter

Error bit	STATUS* (W#16#...)	Description
0	0000	No error.
0	0001	Connection has not been established.
0	7001	Connection termination launched.
0	7002	Connection being terminated.
1	8081	Unknown connection specified at the ID parameter.

11.2.8.12 T_DIAG (Checks the status of connection and reads information) instruction

The "T_DIAG" instruction checks the status of a connection and reads further information on the local end point of this connection:

Table 11- 35 T_DIAG instruction

LAD / FBD	SCL	Description

	`"T_DIAG_DB"(`
	`req:=_bool_in_,`
	`id:=_word_in_,`
	`done=>_bool_out_,`
	`error=>_bool_out_,`
	`sta-`
	`tus=>_dword_out_);`
		Use the T_DIAG instruction to check the status of a connection and read further information on the local end point of this connection.

The "T_DIAG" instruction operates as follows:

- The connection is referenced by the ID parameter. You can read both connection end points configured in the connection editor and programmed connection end points (e.g. with the "TCON" instruction).

  Temporary connection end points (for example end points created when you connect to an engineering station) cannot be diagnosed, as no connection ID is generated in this process.
- The connection information read is stored in a structure referenced by the RESULT parameter.
- The output parameter STATUS indicates whether it was possible to read the connection information. The connection information in the structure at the RESULT parameter is only valid if the "T_DIAG" instruction has been completed with STATUS = W#16#0000 and ERROR = FALSE.

  Connection information cannot be evaluated if an error occurs.

Possible connection information

The "TDiag_Status" structure can be used to read the connection information at the RESULT parameter. The TDiag_Status structure only contains the most important information about a connection end point (for example, the protocol used, the connection status, and the number of data bytes sent or received).

The structure and parameters of the TDiag_Status structure are described below (see the "TDIAG_Status structure" table).

Data types for the parameters

The following table shows the parameters of the "T_DIAG" instruction:

Parameter	Declaration	Data type	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L, T, C or constant	Starts the instruction to check the connection specified in the ID parameter when there is a positive edge.
ID	Input	CONN_OUC (WORD)	L, D or constant	Reference to the assigned connection. Range of values: W#16#0001 to W#16#0FFF
RESULT	InOut	VARIANT	D	Pointer to the structure in which the connection information is stored. The structure TDiag_Status can be used at the RESULT parameter (for a description, see the "TDIAG_Status structure" table).
DONE	Output	BOOL	I, Q, M, D, L	Status parameter: • 0: Instruction not yet started or still in progress. • 1: Instruction executed without errors.
BUSY	Output	BOOL	I, Q, M, D, L	Status parameter: • 0: Instruction not yet started or already completed. • 1: Instruction not yet completed. A new job cannot be started.
ERROR	Output	BOOL	I, Q, M, D, L	Status parameter: • 0: No error. • 1: Error occurred.
STATUS	Output	WORD	I, Q, M, D, L	Status of the instruction

Parameters BUSY, DONE, and ERROR

You can check the status of "T_DIAG" instruction execution with the BUSY, DONE, ERROR and STATUS parameters. The BUSY parameter indicates the processing status. You use the DONE parameter to check whether or not an instruction has been executed successfully. The ERROR parameter is set if errors occur during execution of "T_DIAG".

The following table shows the relationship between the BUSY, DONE, and ERROR parameters:

BUSY	DONE	ERROR	Description
1	-	-	The instruction is being processed.
0	1	0	The instruction has been executed successfully. The data in the structure referenced by RESULT are only valid if this is the case.
0	0	1	Instruction completed with an error. The cause of the error is output at the STATUS parameter.
0	0	0	No new instruction has been assigned.

STATUS parameter

The following table shows the meaning of the values at the STATUS parameter:

Error bit	STATUS* (W#16#...)	Description
0	0000	The instruction "T_DIAG" has been executed successfully. The data in the structure referenced at the RESULT parameter can be evaluated.
0	7000	No instruction processing active.
0	7001	Instruction processing launched.
0	7002	Connection information is being read (REQ parameter irrelevant).
1	8086	The value at the ID parameter is outside the valid range (W#16#0001 ... W#16#0FFF).
1	8089	The RESULT parameter points to an invalid data type (structures TDIAG_Status and TDIAG_StatusExt only).
1	80A3	The ID parameter references a connection end point which does not exist. With programmed connections, this error can also occur after the "TDISCON" instruction is called.
1	80C4	Internal error. Access to the connection end point is temporarily unavailable.

TDIAG_Status Structure

The table below details the form of the TDIAG_Status structure. The value of each element is only valid if the instruction has been executed without errors. If an error occurs, the content of the parameters will not change:

Name	Data type	Description
The following parameters are in the TDIAG_Status structure:		
InterfaceID	HW_ANY	Interface ID (LADDR) of the CPU or the CM/CP.
ID	CONN_OUC	ID of the connection diagnosed. Following a successful call, the value of this element is identical to the parameter ID of the "T_DIAG" instruction.
ConnectionType	BYTE	Protocol type used for connection: • 0x01: Not used. • ... • 0x0B: TCP protocol (IP_v4) • 0x0C: ISO-on-TCP protocol (RFC1006) • 0x0D: TCP protocol (DNS) • 0x0E: Dial-in protocol • 0x0F: WDC protocol • 0x10: SMTP protocol • 0x11: TCP protocol • 0x12: TCP and ISO-on-TCP protocol (RFC1006) • 0x13: UDP protocol • 0x14: Reserved • 0x15: PROFIBUS bus access protocol (FDL) • 0x16: ISO 8073 transport protocol (ISO native) • ... • 0x20: SMTP or SMTPS protocol - based on IPv4 • 0x21: SMTP or SMTPS protocol - based on IPv6 • 0x22: SMTP or SMTPS protocol - based on FQDN (**F**ully **Q**ualified **D**omain **N**ame) • ... • 0x70: S7 connection • Other: Reserved
ActiveEstablished	BOOL	• FALSE: Locally, the passive connection end point • TRUE: Locally, the active connection end point

Name	Data type	Description
State	BYTE	Current status of the connection end point • 0x00: Not used. • 0x01: Connection terminated. Temporary status, for example, after the "T_RESET" instruction is called. The system then automatically attempts to re-establish the connection. • 0x02: The active connection end point is attempting to establish a connection to the remote communication partner. • 0x03: The passive connection end point is waiting for establishment of the connection to the remote communication partner. • 0x04: Connection established. • 0x05: The connection is being terminated. This may be because the "T_RESET" or "T_DISCON" instruction has been called. Other possible reasons are protocol errors and line breaks. • 0x06..0xFF: Not used.
Kind	BYTE	Mode of the connection end point: • 0x00: Not used. • 0x01: Configured, static connection which has been configured and loaded to the CPU. • 0x02: Configured, dynamic connection which has been configured and loaded to the CPU (not currently supported). • 0x03: Programmed connection generated in the user program with the instruction "TCON". A call of the instruction "TDISCON" or a transition to CPU STOP status has destroyed the connection end point. • 0x04: Temporary, dynamic connection established by the engineering station (ES) or operator station (OS), for example. (this connection type cannot currently be diagnosed as there is no ID). • 0x05..0xFF: Not used.
SentBytes	UDINT	Number of data bytes sent.
ReceivedBytes	UDINT	Number of data bytes received.

11.2.8.13 TMAIL_C (Send an email using the Ethernet interface of the CPU) instruction

Overview

You use the "TMAIL_C" instruction to send an e-mail using the Ethernet interface of the S7-1200 CPU.

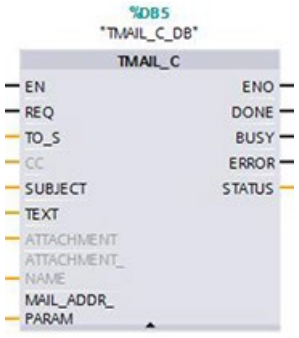
The TMAIL_C instruction has two functionalities:

- Email over the CPU Interface (only SMTP without SSL)
- Email over a CP Interface (either SMTP without SSL or SMTP with SSL) If you want to use the SSL functionality, you must set the TMAIL_C input parameter CERTINDEX = 1 and use the CP Interface. Also, the correct certificate must be stored in CP cert storage.

The instruction can only be used once the hardware has been configured and if the network infrastructure allows for a communication connection to the mail server.

Table 11- 36 TMAIL_C instruction

LAD / FBD	SCL	Description

	`"TMAIL_C_DB"(`
	`req:=_bool_in_,`
	`to_s:=_string_in_,`
	`cc:=_string_in_,`
	`subject:=_string_in_,`
	`text:=_string_in_,`
	`attachment:=_variant_in_,`
	`attachment_name:=_string_in_,`
	`mail_addr_param:=_string_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_);`
		The TMAIL_C instruction sends an e-mail using the Ethernet interface of the S7-1200 CPU.

[1] STEP 7 automatically creates the DB when you insert the instruction.

You define the content of the e-mail, and the connection data, using the following parameters:

- You define the recipient addresses with the parameters TO_S and CC.
- You define the content of the e-mail with the parameters SUBJECT and TEXT.
- You can define an attachment using VARIANT pointers at the ATTACHMENT and ATTACHMENT_NAME parameters.
- The connection data are defined, and addressing and authentication for the mail server executed, using the system data type Tmail_v4 or Tmail_FQDN at the MAIL_ADDR_PARAM parameter. If you are using the interface of the S7-1200 CPU, the system data type Tmail_v4 must be used. In this case, the e-mail can only be sent using SMTP.
- You start the sending of an e-mail with an edge change from "0" to "1" for the REQ parameter.
- The job status is indicated by the output parameters "BUSY", "DONE", "ERROR" and "STATUS".

You cannot send an SMS directly with the "TMAIL_C" instruction. Whether or not the e-mail can be forwarded by the mail server as an SMS depends on your telecommunications provider.

Operation of the instruction

The "TMAIL_C" instruction works asynchronously, which means its execution extends over multiple calls. You must specify an instance when you call the instruction "TMAIL_C".

In the following cases, the connection to the mail server will be lost:

- If the CPU switches to STOP while "TMAIL_C" is active.
- If communication problems occur at the Industrial Ethernet bus. In this case, the transfer of the e-mail will be interrupted and it will not reach its recipient.

The connection is also canceled once the instruction has been successfully executed and the e-mail sent.

NOTICE
Changing user programs You can change the parts of your user program that directly affect calls of "TMAIL_C" only when: • The CPU is in "STOP" mode. • No e-mail is being sent (REQ = 0 and BUSY = 0). This relates, in particular, to deleting and replacing program blocks that contain "TMAIL_C" calls or calls for the instance of "TMAIL_C". Ignoring this restriction can tie up connection resources. The automation system can change to an undefined status with the TCP/IP communication functions via Industrial Ethernet. A warm or cold restart of the CPU is required after the changes are transferred.

Data consistency

The TO_S, CC, SUBJECT, TEXT, ATTACHMENT and MAIL_ADDR_PARAM parameters are applied by the "TMAIL_C" instruction while it is running, which means that they may only be changed after the job has been completed (BUSY = 0).

SMTP authentication

Authentication refers here to a procedure for verifying identity, for example, with a password query.

If you are using the S7-1200 CPU interface, the instruction "TMAIL_C" supports the SMTP authentication procedure AUTH-LOGIN which is required by most mail servers. For information about the authentication procedure of your mail server, please refer to your mail server manual or the website of your Internet service provider.

- Before you can use the AUTH-LOGIN authentication procedure, the "TMAIL_C" instruction requires the user name with which it is to log on to the mail server. This user name corresponds to the user name with which you set up a mail account on your mail server. It is transferred via the UserName parameter to the structure at parameter MAIL_ADDR_PARAM.

  If no user name is specified at the MAIL_ADDR_PARAM parameter, the AUTH-LOGIN authentication procedure is not used. The e-mail is then sent without authentication.
- To log on, the "TMAIL_C" instruction also requires the associated password. This password corresponds to the password you specified when you set up your mail account. It is transferred via the PassWord parameter to the structure at parameter MAIL_ADDR_PARAM.

Data types for the parameters

The following table shows the parameters of the "TMAIL_C" instruction:

Parameter	Declaration	Data type	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L, T, C or constant	Control parameter REQUEST: Activates the sending of an e-mail upon a rising edge.
TO_S (Page 870)	Input	STRING	D	Recipient addresses STRING with a maximum length of 180 characters (bytes). For the e-mail address format, please see the example in the parameter description.
CC (Page 870)	Input	STRING	D	CC recipient addresses (optional) STRING with a maximum length of 180 characters (bytes). Same e-mail address format as for the TO_S parameter. If an empty string is assigned here, the e-mail is not sent to a CC recipient.
SUBJECT	Input	STRING	D	Subject of the e-mail STRING with a maximum length of 180 characters (bytes).

Parameter	Declaration	Data type	Memory area	Description
TEXT	Input	STRING	D	Text of the e-mail (optional) STRING with a maximum length of 180 characters (bytes). If an empty string is assigned at this parameter, the e-mail is sent without text.
ATTACHMENT	Input	VARIANT	D	E-mail attachment (optional) Reference to a byte/word/double word field (ArrayOfByte, ArrayOfWord or ArrayOfDWord) with a maximum length of 64 KB. If no value is assigned, the e-mail is sent without an attachment.
ATTACHMENT_NAME	Input	VARIANT	D	E-mail attachment name (optional) Reference to a character string with a maximum length of 50 characters (bytes) to define the file name of the attachment. If an empty string is assigned at this parameter, the e-mail attachment will be sent with the file name "attachment.bin".
MAIL_ADDR_PARAM (Page 868)	Input	VARIANT	D	Connection parameter and address of the e-mail server To define the connection parameters, use the structure Tmail_v4 or Tmail_FQDN (see parameter description).
DONE (Page 870)	Output	BOOL	I, Q, M, D, L	Status parameter • DONE = 0: Job not yet started or still executing. • DONE = 1: Job was executed without errors.
BUSY (Page 870)	Output	BOOL	I, Q, M, D, L	Status parameter • BUSY=0: The processing of "TMAIL_C" was stopped. • BUSY = 1: E-mail transmission is not yet complete.
ERROR (Page 870)	Output	BOOL	I, Q, M, D, L	Status parameter • ERROR = 0: No error has occurred. • ERROR = 1: An error occurred during processing. STATUS supplies detailed information on the type of error.
STATUS (Page 871)	Output	WORD	I, Q, M, D, L	Status parameter Return value or error information of the "TMAIL_C" instruction (see parameter description).

You will find more detailed information on valid data types in "Overview of valid data types".

Note

Optional parameters

The optional parameters CC, TEXT, and ATTACHMENT are only sent with the e-mail if the corresponding parameters contain a string of length > 0.

MAIL_ADDR_PARAM parameter

At the MAIL_ADDR_PARAM parameter, you define the connection for sending the e-mail in the structure Tmail_v4 or Tmail_FQDN, and save the e-mail server address and login details.

The structure you use at the MAIL_ADDR_PARAM parameter depends on the format in which the e-mail server is to be addressed:

- Tmail_v4: Addressing by IP address (IPv4).
- Tmail_FQDN: Addressing by fully qualified domain name (FQDN).

Which structure you can use depends on the interface addressed at the InterfaceId parameter. If you want to use the "TMAIL_C" instruction with the internal interface, the structure Tmail_v4 must be used at the MAIL_ADDR_PARAM parameter.

Table 11- 37 **Tmail_v4: Addressing the mail server by IP address (IPv4)**

Parameter	Data type	Description
Tmail_v4	Struct	
InterfaceId	LADDR	Hardware identifier of the interface
ID	CONN_OUC	Connection ID
ConnectionType	BYTE	Connection type. Select 16#20 as the connection type for IPv4.
ActiveEstablished	BOOL	Status bit. Set to "1" once the connection is established.
CertIndex	BYTE	=0: SMTP used (**S**imple **M**ail **T**ransfer **P**rotocol). SMTP must be used if the e-mail is being sent via the interface of an S7-1200 CPU.
WatchDogTime	TIME	Execution watchdog. Use this parameter to define the maximum execution time for the send operation. Note: Connection establishment can take longer (approx. one minute) if the connection is slow. When you specify the WATCH_DOG_TIME parameter, remember to allow for the time required to establish the connection. The connection is terminated once the specified time has elapsed.
MailServerAddress	IP_v4	IP address of the mail server. IPv4 in the following format: XXX.XXX.XXX.XXX (decimal). Example: 192.142.131.237.
UserName	STRING[254]	Mail server login name
PassWord	STRING[254]	Mail server password

Parameter			Data type	Description
	From		EMAIL_ADDR	E-mail sender address, which is defined using the following two STRING parameters. For example: "myname@mymailserver.com".
		Local-PartPlusAtSign	STRING[64]	Local part of sender address, including @ sign. Example: "myname@".
		FullQualified-DomainName	STRING[254]	Fully Qualified Domain Name (FQDN for short) of the mail server. Example: "mymailserver.com".

Table 11- 38 **Tmail_FQDN: Addressing the mail server by FQDN**

Parameter			Data type	Description
Tmail_v6			Struct	
	Tmail_FQDN		LADDR	Hardware identifier of the interface
	ID		CONN_OUC	Connection ID
	ConnectionType		BYTE	Connection type. Select 16#22 as the connection type for FQDN.
	ActiveEstablished		BOOL	Status bit. Set to "1" once the connection is established.
	CertIndex		BYTE	=0: SMTP used (**S**imple **M**ail **T**ransfer **P**rotocol). SMTP must be used if the e-mail is being sent via the interface of an S7-1200 CPU.
	WatchDogTime		TIME	Execution watchdog. Use this parameter to define the maximum execution time for the send operation. Note: Connection establishment can take longer (approx. one minute) if the connection is slow. When you specify the WATCH_DOG_TIME parameter, remember to allow for the time required to establish the connection. The connection is terminated once the specified time has elapsed.
	MailServerAddress		STRING[254]	FQDN (**F**ully **Q**ualified **D**omain **N**ame) of the mail server. The mail server is addressed using the fully qualified domain name. Example: "www.mymailserver.com.".
	UserName		STRING[254]	Mail server login name
	PassWord		STRING[254]	Mail server password
	From		Struct	E-mail sender address, which is defined using the following two STRING parameters. For example: "myname@mymailserver.com".
		Local-PartPlusAtSign	STRING[64]	Local part of sender address, including @ sign. Example: "myname@".
		FullQualified-DomainName	STRING[254]	Fully Qualified Domain Name (FQDN for short) of the mail server. Example: "mymailserver.com".

TO_S and CC parameters

The TO_S and CC parameters are strings, for example, with the following content:

- <wenna@mydomain.com>, <ruby@mydomain.com>
- <admin@mydomain.com>, <judy@mydomain.com>

Note the following rules when entering the parameters:

- A space and an opening pointed bracket "<" must be entered before each address.
- A closing pointed bracket ">" must be entered after each address.
- A comma must be entered between the addresses in TO and CC.

For runtime and memory space reasons, the "TMAIL_C" instruction does not perform a syntax check of parameter TO_S or CC

DONE, BUSY and ERROR parameters

The output parameters DONE, BUSY and ERROR are each displayed for only one cycle if the status of the BUSY output parameter changes from "1" to "0".

The following table shows the relationship between DONE, BUSY, and ERROR. Using this table, you can determine the current status of the instruction "TMAIL_C and when the sending of the e-mail is complete.

DONE	BUSY	ERROR	Description
0	1	0	The job is being processed.
1	0	0	Job successfully completed.
0	0	1	The job ended with an error. The cause of the error can be found in the STATUS (Page 871) parameter.
0	0	0	The "TMAIL_C" instruction was not assigned a (new) job.

STATUS parameter

The following table shows the return values of TMAIL_C at the STATUS parameter:

Return value STATUS* (W#16#...):	Explanation	Notes
0000	The processing of TMAIL_C was completed without errors.	Error-free completion of TMAIL_C does not mean that the e-mail sent will necessarily arrive. Incorrectly entering the recipient addresses does not generate a status error of the TMAIL_C instruction. In this case, there is no guarantee that the e-mail will be sent to other recipients, even if these were entered correctly.
7001	TMAIL_C is active (BUSY = 1).	First call: Job triggered.
7002	TMAIL_C is active (BUSY = 1).	Intermediate call: Job already active.
8xxx	The processing of TMAIL_C was completed with an error code of the communication instructions called internally.	For detailed information, refer to the STATUS parameter descriptions for the TCON, TDISCON, TSEND and TRCV (Page 837) communication instructions.
8010	Error during connection establishment	You will find further information on evaluation in the SFB_STATUS parameter of the instance data block. The error code displayed at the SFB_STATUS parameter is explained in the STATUS parameter description for the TCON (Page 837) instruction.
8011	Error sending the data	You will find further information on evaluation in the SFB_STATUS parameter of the instance data block. The error code displayed at the SFB_STATUS parameter is explained in the STATUS parameter description for the TSEND (Page 837) instruction.
8012	Error receiving the data	You will find further information on evaluation in the SFB_STATUS parameter of the instance data block. The error code displayed at the SFB_STATUS parameter is explained in the STATUS parameter description for the TRCV (Page 837) instruction.
8013	Error during connection establishment	You will find further information on evaluation in the SFB_STATUS parameter of the instance data block. The error code displayed at the SFB_STATUS parameter is explained in the STATUS parameter description for the TCON (Page 837) and TDISCON (Page 837) instructions.

Return value STATUS* (W#16#...):	Explanation	Notes
8014	Establishment of a connection is not possible.	You may have entered an incorrect mail server IP address (MailServerAddress (Page 868)) or too short a time span (WatchDogTime (Page 868)) for connection establishment. It is also possible that the CPU has no connection to the network or that the CPU configuration is incorrect.
8015	Incorrect data type for MAIL_ADDR_PARAM	The only valid data types are the system data types (structures) Tmail_v4 and TMail_FQDN.
8016	Incorrect data type for the ATTACHMENT parameter	The only valid data types are ArrayOfByte, ArrayOfWord and ArrayOfDWord.
8017	Incorrect data length for the ATTACHMENT parameter	Data length must be <= 65534 bytes.
82xx, 84xx, or 85xx	The error message originates from the mail server and corresponds, except for the "8", to the error number of the SMTP protocol. The following lines list several error codes that can occur.	You will find more detailed information on the SMTP error code and other error codes in the SMTP protocol on the Internet or in the error documentation of the mail server. You can also view the most recent error message from the mail server in your instance DB in the BUFFER1 parameter. You will find the last data sent by the TMAIL_C instruction under DATEN in the instance DB.
8450	Action not executed: Mailbox not available/cannot be reached	Try again later.
8451	Action aborted: Local processing error	Try again later.
8500	Syntax error: Error not recognized. This also includes the error when a command string is too long. This can also occur when the e-mail server does not support the LOGIN authentication procedure.	Check the parameters of TMAIL_C. Try to send an e-mail without authentication. To do this, replace the content of the UserName parameter with an empty string. If no user name is specified, the LOGIN authentication procedure is not used.
8501	Syntax error: Incorrect input at a parameter	Possible cause: Incorrect address at the TO_S or CC parameter (see also: TO_S and CC parameters (Page 870)).
8502	Command unknown or not implemented	Check your entries, in particular the FROM parameter. It may be incomplete and you may have forgotten the "@" or "." (see also: TO_S and CC parameters (Page 870)).
8535	SMTP authentication incomplete	You have possibly entered an incorrect user name or incorrect password.
8550	Mail server cannot be reached. You have no access rights.	You may have entered an incorrect user name or password, or the mail server may not support your login. Another cause of error could be a mistake in the domain name after the "@" at the TO_S or CC parameter (see also: TO_S and CC parameters (Page 870)).

Return value STATUS* (W#16#...):	Explanation	Notes
8552	Action aborted: Assigned memory size has been exceeded	Try again later.
8554	Transfer failed	Try again later.
* You can display error codes as integer or hexadecimal values in the program editor.		

11.2.8.14 UDP

UDP is a standard protocol described by RFC 768: User Datagram Protocol. UDP provides a mechanism for one application to send a datagram to another; however, delivery of data is not guaranteed. This protocol has the following features:

- A quick communications protocol
- Suitable for small-sized to medium data amounts (up to 1472 bytes)
- UDP is a simpler transport control protocol than TCP, with a thin layer that yields low overheads
- Can be used very flexibly with many third-party systems
- Routing-capable
- Uses port numbers to direct the datagrams
- Messages are unacknowledged: The application is required to take responsibility for error recovery and security
- Programming effort is required for data management due to the SEND / RECEIVE programming interface

UDP supports broadcast communication. To use broadcast, you must configure the IP address portion of the ADDR configuration. For example: A CPU with an IP address of 192.168.2.10 and subnet mask of 255.255.255.0 would use a broadcast address of 192.168.2.255.

11.2.8.15 TUSEND and TURCV

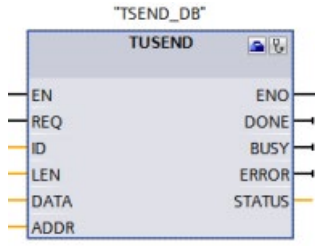
The following instructions control the UDP communication process:

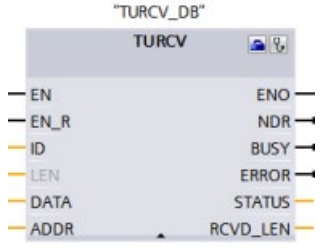
- TCON establishes the communication between the client and server (CPU) PC.
- TUSEND and TURCV send and receive data.
- TDISCON disconnects the communication between the client and server.

Refer to TCON, TDISCON, TSEND, and TRCV (Page 837) in the "TCP and ISO-on-TCP" section for more information on the TCON and TDISCON communication instructions.

Table 11- 39 TUSEND and TURCV instructions

LAD / FBD	SCL	Description

	`"TUSEND_DB"(`
	`req:=_bool_in_,`
	`ID:=_word_in_,`
	`len:=_udint_in_,`
	`done=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`data:=_variant_inout_);`
		The TUSEND instruction sends data via UDP to the remote partner specified by the parameter ADDR.
		To start the job for sending data, call the TUSEND instruction with REQ = 1.

	`"TURCV_DB"(`
	`en_r:=_bool_in_,`
	`ID:=_word_in_,`
	`len:=_udint_in_,`
	`ndr=>_bool_out_,`
	`busy=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`rcvd_len=>_udint_out_,`
	`data:=_variant_inout_);`
		The TURCV instruction receives data via UDP. The parameter ADDR shows the address of the sender. After successful completion of TURCV, the parameter ADDR contains the address of the remote partner (the sender).
		TURCV does not support ad hoc mode.
		To start the job for receiving data, call the TURCV instruction with EN_R = 1.

[1] STEP 7 automatically creates the DB when you insert the instruction.

TCON, TDISCON, TUSEND, and TURCV operate asynchronously, which means that the job processing extends over multiple instruction executions.

Table 11- 40 TUSEND and TURCV data types for the parameters

Parameter and type		Data type	Description
REQ (TUSEND)	IN	Bool	Starts the send job on a rising edge. The data is transferred from the area specified by DATA and LEN.
EN_R (TURCV)	IN	Bool	• 0: CPU cannot receive. • 1: Enables the CPU to receive. The TURCV instruction is ready to receive, and the receive job is processed.
ID	IN	Word	Reference to the associated connection between the user program and the communication level of the operating system. ID must be identical to the associated parameter ID in the local connection description. Range of values: W#16#0001 to W#16#0FFF.
LEN	IN	UDInt	Number of bytes to be sent (TUSEND) or received (TURCV). • Default = 0. The DATA parameter determines the length of the data to be sent or received. • Otherwise, range of values: 1 to 1472
DONE (TUSEND)	IN	Bool	Status parameter DONE (TUSEND): • 0: Job is not yet started or still running. • 1: Job completed without error.
NDR (TURCV)	OUT	Bool	Status parameter NDR (TURCV): • 0: Job not yet started or still running. • 1: Job has successfully completed.
BUSY	OUT	Bool	• 1: Job is not yet completed. A new job cannot be triggered. • 0: Job has completed.
ERROR	OUT	Bool	Status parameters with the following values: • 0: No error • 1: Error occurred during processing. STATUS provides detailed information on the type of error.
STATUS	OUT	Word	Status information including error information. (Refer to the Error and Status condition codes in the table below.)
RCVD_LEN	OUT	UDInt	Number of bytes received (TURCV)

Parameter and type		Data type	Description
DATA	IN_OUT	Variant	Address of the sender area (TUSEND) or receive area (TURCV): • The process image input table • The process image output table • A memory bit • A data block
ADDR	IN_OUT	Variant	Pointer to the address of the receiver (for TUSEND) or sender (for TURCV) (for example, P#DB100.DBX0.0 byte 8). The pointer may point to any memory area. A structure of 8 bytes is required as follows: • First 4 bytes contain the remote IP address. • Next 2 bytes specify the remote port number. • Last 2 bytes are reserved.

The job status is indicated at the output parameters BUSY and STATUS. STATUS corresponds to the RET_VAL output parameter of asynchronously functioning instructions.

The following table shows the relationships between BUSY, DONE (TUSEND), NDR (TURCV), and ERROR. Using this table, you can determine the current status of the instruction (TUSEND or TURCV) or when the sending (transmission) / receiving process is complete.

Table 11- 41 Status of BUSY, DONE (TUSEND) / NDR (TURCV), and ERROR parameters

BUSY	DONE / NDR	ERROR	Description
TRUE	irrelevant	irrelevant	The job is being processed.
FALSE	TRUE	FALSE	The job was completed successfully.
FALSE	FALSE	TRUE	The job was ended with an error. The cause of the error can be found in the STATUS parameter.
FALSE	FALSE	FALSE	The instruction was not assigned a (new) job.

[1] Due to the asynchronous function of the instructions: For TUSEND, you must keep the data in the sender area consistent until the DONE parameter or the ERROR parameter assumes the value TRUE. For TURCV, the data in the receiver area are only consistent when the NDR parameter assumes the value TRUE.

Table 11- 42 TUSEND and TURCV condition codes for ERROR and STATUS

ERROR	STATUS	Description
0	0000	• Send job completed without error (TUSEND). • New data were accepted. The current length of the received data is shown in RCVD_LEN (TURCV).
0	7000	• No job processing active (TUSEND) • Block not ready to receive (TURCV)
0	7001	• Start of job processing, data being sent (TUSEND): During this processing, the operating system accesses the data in the DATA send area. • Block is ready to receive, receive job was activated (TURCV).
0	7002	• Follow-on instruction execution (REQ irrelevant), job being processed (TUSEND): During this processing, the operating system accesses the data in the DATA send area. • Follow-on instruction execution, job being processed: During this processing, the TURCV instruction writes data to the receive area. For this reason, an error could result in inconsistent data in the receive area.
1	8085	LEN parameter is greater than the largest permitted value, has the value 0 (TUSEND), or you changed the value of the LEN or DATA parameter since the first instruction execution (TURCV).
1	8086	The ID parameter is not in the permitted address range.
1	8088	• LEN parameter is larger than the memory area (TUSEND) or receive area (TURCV) specified in DATA. • Receive area is too small (TURCV).
1	8089	ADDR parameter does not point to a data block.
1	80A1	Communications error: • The specified connection between user program and communications layer of the operating system has not yet been established. • The specified connection between the user program and the communication layer of the operating system is currently being terminated. Transmission (TUSEND) or a receive job (TURCV) over this connection is not possible. • The interface is being reinitialized.
1	80A4	IP address of the remote connection end point is invalid; it is possible that it matches the local IP address (TUSEND).
1	80B3	• The set protocol variant (connection_type parameter in the connection description) is not UDP. Please use the TSEND or TRCV instruction. • ADDR parameter: Invalid settings for port number (TUSEND)
1	80C3	• A block with this ID is already being processed in a different priority class. • Internal lack of resources
1	80C4	Temporary communications error: • The connection between the user program and the communication level of the operating system cannot be established at this time (TUSEND). • The interface is receiving new parameters (TUSEND). • The connection is currently being reinitiated (TURCV).

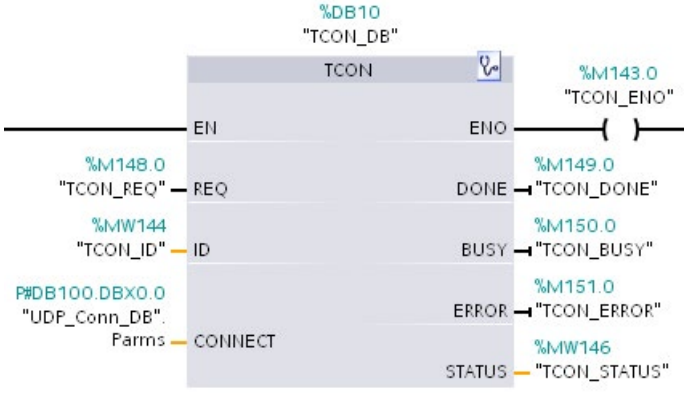
Connection Ethernet protocols

Every CPU has an integrated PROFINET port, which supports standard PROFINET communications. The TUSEND and TURCV instructions support the UDP Ethernet protocol.

Refer to "Configuring the Local/Partner connection path" (Page 788)" in the "Device configuration" chapter for more information.

Operations

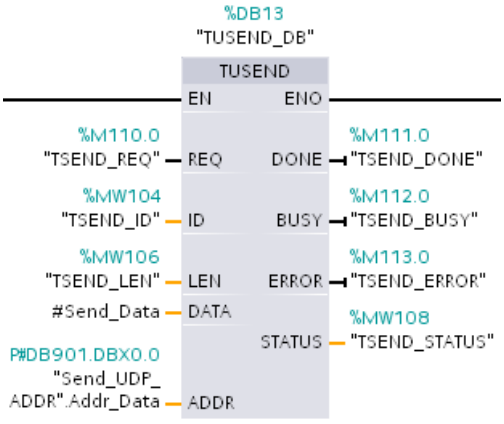
Both partners are passive in UDP communication. Typical parameter start values for the "TCON_Param" data type are shown in the following figures. Port numbers (LOCAL_TSAP_ID) are written in a 2-byte format. All ports except for 161, 34962, 34963, and 34964 are allowed.



UDP_Conn_DB

	Name	Data type	Offset	Initial value	Comment
1	Static				
2	Parms	TCON_Param	0.0		
3	BLOCK_LENGTH	UInt	0.0	64	byte length of SDT
4	ID	CONN_OUC	2.0	1	reference to the connection
5	CONNECTION_TYPE	USInt	4.0	19	17: TCP/IP, 18: ISO on TCP
6	ACTIVE_EST	Bool	5.0	false	active/passive connection establishment
7	LOCAL_DEVICE_ID	USInt	6.0	1	1: local IE interface
8	LOCAL_TSAP_ID_L...	USInt	7.0	2	byte length of local TSAP id/port number
9	REM_SUBNET_ID_...	USInt	8.0	0	byte length of remote subnet id
10	REM_STADDR_LEN	USInt	9.0	0	byte length of remote IP address
11	REM_TSAP_ID_LEN	USInt	10.0	0	byte length of remote port/TSAP id
12	NEXT_STADDR_LEN	USInt	11.0	0	byte length of next station address
13	LOCAL_TSAP_ID	Array[1..16] of Byte	12.0		TSAP id/local port number
14	LOCAL_TSAP_I...	Byte		B#16#07	
15	LOCAL_TSAP_I...	Byte		B#16#D0	

The TUSEND instruction sends data through UDP to the remote partner specified in the "TADDR_Param" data type. The TURCV instruction receives data through UDP. After a successful execution of the TURCV instruction, the "TADDR_Param" data type shows the address of the remote partner (the sender), as shown in the figures below.



Send_UDP_ADDR

	Name	Data type	Offset	Initial value	Comment
1	Static				
2	Addr_Data	TADDR_Param	0.0		
3	REM_IP_ADDR	Array[1..4] of USint	0.0		remote station address
4	REM_IP_ADDR[1]	USInt		192	
5	REM_IP_ADDR[2]	USInt		168	
6	REM_IP_ADDR[3]	USInt		2	
7	REM_IP_ADDR[4]	USInt		10	
8	REM_PORT_NR	UInt	4.0	2000	remote port number
9	RESERVED	Word	6.0	0	ununsed; has to be 0

11.2.8.16 T_CONFIG

The T_CONFIG instruction can change the Ethernet address, the PROFINET device name, or the IP addresses of the NTP servers for time-of-day synchronization from within the user program. The following features can be adjusted permanently or temporarily:

- IP address
- Subnet mask
- Router address
- Station name
- IP addresses of up to four NTP servers

Note

Located in the CPU "Properties", "Ethernet address" page, the "IP address is set directly at the device" (Page 887) radio button allows you to change the IP address online or by using the "T_CONFIG" instruction after the program is downloaded.

Located in the CPU "Properties", "Ethernet address" page, the "PROFINET device name is set directly at the device" (Page 888) radio button allows you to change the PROFINET device name online or by using the "T_CONFIG" instruction after the program is downloaded.

Located in the CPU "Properties", "Time synchronization" page, the "Enable time synchronization via NTP server" (Page 889) box allows you to change the IP addresses of up to four NTP servers.

Note

You cannot execute more than one T_CONFIG instruction at a time.

Note

Changes to the IP address or name of station of the CPU can be temporary or permanent. Changes to the NTP server IP addresses can only be temporary:

- A permanent change indicates that the change is retentive, meaning that the change persists through a power failure.
- A temporary change indicates that the change is volatile and reverts to the original value after a power loss.

Table 11- 43 T_CONFIG instruction

LAD / FBD	SCL	Description

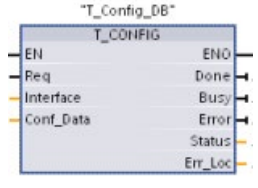
	`"T_CONFIG_DB"(`
	`Req:=_bool_in_,`
	`Interface:=_uint_in_,`
	`Conf_Data:=_variant_in_,`
	`Done=>_bool_out_,`
	`Busy=>_bool_out_,`
	`Error=>_bool_out_,`
	`Status=>_dword_out_,`
	`Err_Loc=>_dword_out_);`
		Use the T_CONFIG instruction to change the IP configuration parameters from your user program.
		T_CONFIG works asynchronously. The execution extends over multiple calls.

Table 11- 44 T_CONFIG data types for the parameters

Parameter and type		Data type	Description
REQ	Input	Bool	Starts the instruction on the rising edge.
INTERFACE	Input	HW_Interface	ID of network interface
CONF_DATA	Input	Variant	Reference to the structure of the configuration data; CONF_DATA is defined by a struct containing up to four System Data Types (SDT).
DONE	Output	Bool	• 0: Job has not yet started or is still running. • 1: Job was executed without error.
BUSY	Output	Bool	• 0: The job is complete. • 1: The job is not yet complete. A new job cannot be triggered.
ERROR	Output	Bool	Status parameters with the following values: • 0: No error • 1: Error occurred during processing. STATUS provides detailed information on the type of error.
STATUS	Output	DWord	Status information including error information. (Refer to the Error and Status condition codes in the table below.)
ERR_LOC	Output	DWord	Fault location (field ID and subfield location within the CONF_DATA structure)

The IP configuration information is placed in the CONF_DATA data block, along with a Variant pointer on parameter CONF_DATA referenced above. The successful execution of the T_CONFIG instruction ends with the handover of the IP configuration data to the network interface.

The status and error messages of the instruction "T_CONFIG" are output at the parameters STATUS and ERR_LOC:

- The cause of the error is output at the parameter STATUS.
- The location of the error that occurred is output at the parameter ERR_LOC. The following options are available here:
  - 16#0000_0000: No error or error when calling the instruction (for example, errors when assigning parameters to the instruction or in communication with the PROFINET interface).
  - 16#0001_0000: Error with the configuration data in the parameters of the system data type IF_CONF_HEADER.
  - 16#0001_000x: Error in the configuration data in the parameters of system data type IF_CONF_V4 or IF_CONF_NOS or IF_CONF_NTP (x specifies the position of the bad sub-block in the T_CONFIG structure. If the T_CONFIG structure contains, for example, a sub-block for the IP address and a sub-block for the station name, and the error is located in the sub-block for the station name, ERR_LOC has the value 0001_0002.)

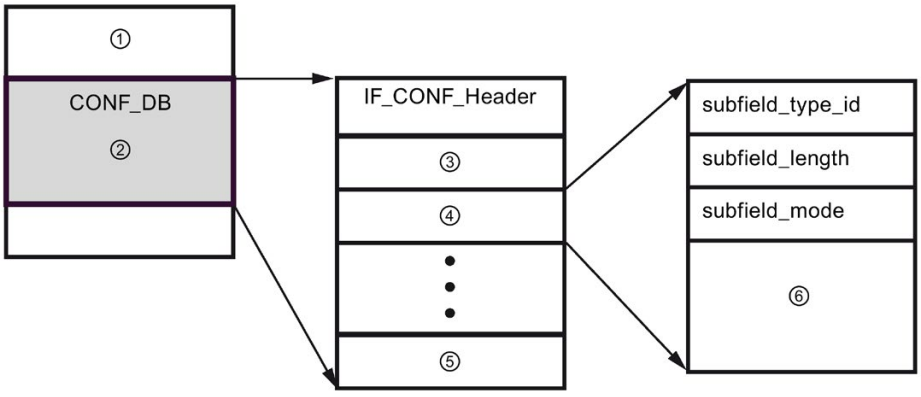
The following table shows the possible values for the parameters STATUS and ERR_LOC:

STATUS*	ERR_LOC*	Explanation
0000_0000	0000_0000	Order processing completed without errors.
0070_0000	0000_0000	No job processing active.
0070_0100	0000_0000	Start of the order processing.
0070_0200	0000_0000	Intermediate call (REQ irrelevant).
C08x_yy00	0000_0000	General error information.
C080_8000	0000_0000	Error at call of the instruction: The hardware ID at the parameter Interface is invalid.
C080_8100	0000_0000	Error at call of the instruction: The hardware ID at the parameter Interface does not address a PROFINET interface.
C080_8700	0000_0000	Error at call of the instruction: Incorrect length of the data block at the parameter CONF_DATA.
C080_8800	0001_0000	Error in the system data type IF_CONF_HEADER: The parameter FieldType has an invalid value. Use the value "0" for FieldType.
C080_8900	0001_0000	Error in the system data type IF_CONF_HEADER: The parameter FieldId has an invalid value or was used several times. Use the value "0" for FieldId.
C080_8A00	0001_0000	Error in the system data type IF_CONF_HEADER: Incorrect number at the parameter SubfieldCount. Enter the correct number of system data types IF_CONF_V4, IF_CONF_NOS, or IF_CONF_NTP being used.
C080_8B00	0001_000x	Error in the system data type IF_CONF_V4, IF_CONF_NOS, or IF_CONF_NTP: The parameter Id has an invalid value. For IF_CONF_V4 use "30", for IF_CONF_NOS "40", for IF_CONF_NTP "17".
C080_8C00	0001_000x	Error in the system data type IF_CONF_V4, IF_CONF_NOS, or IF_CONF_NTP: Incorrect data type system used, wrong order or multiple use of a system data type.
C080_8D00	0001_000x	Error in the system data type IF_CONF_V4, IF_CONF_NOS, or IF_CONF_NTP: The parameter Length has an incorrect or invalid value.
C080_8E00	0001_000x	Error in the system data type IF_CONF_V4, IF_CONF_NOS, or IF_CONF_NTP: The parameter Mode has an incorrect or invalid value. • With IF_CONF_V4 and IF_CONF_NOS only the values "1" (permanent) or "2" (temporary) are permitted. • With IF_CONF_NTP only the value "2" (temporary) is permitted.
C080_9000	0001_000x	Error in the system data type IF_CONF_V4, IF_CONF_NOS, or IF_CONF_NTP: Configuration data cannot be applied. Possible cause: • With IF_CONF_V4: In the hardware configuration, the setting "Set IP address on the device" was not selected.. • With IF_CONF_NOS: In the hardware configuration, the setting "Set PROFINET device name on the device" was not selected.. • With IF_CONF_NTP: In the hardware configuration, the setting "Enable time synchronization via NTP server " was not selected and no IP address was set for NTP servers..
C080_9400	0001_000x	Error in the system data type IF_CONF_V4, IF_CONF_NOS, or IF_CONF_NTP: A parameter value is undefined or invalid.

STATUS*	ERR_LOC*	Explanation
C080_9500	0001_000x	Error in the system data type IF_CONF_V4, IF_CONF_NOS, or IF_CONF_NTP: The values of two parameters are inconsistent.
C080_C200	0000_0000	Error at call of the instruction: The configuration data cannot be transferred. Possible cause: The PROFINET interface is not accessible.
C080_C300	0000_0000	Error at call of the instruction: Insufficient resources (for example, multiple calling of "T_CONFIG" with different parameters).
C080_C400	0000_0000	Error at call of the instruction: Temporary communication error. Time indication for change to daylight saving time.
C080_D200	0000_0000	Error at call of the instruction: Call not possible. Instruction is not supported by the selected PROFINET interface.

CONF_DATA Data block

The following diagram shows how the configuration data to be transferred is stored in the configuration DB.



① Configuration DB
② Configuration data
③ Subfield 1
④ Subfield 2
⑤ Subfield *n*
⑥ Subfield-specific parameters

The configuration data of CONF_DB consists of a field that contains a header (IF_CONF_Header) and several subfields. IF_CONF_Header provides the following elements:

- field_type_id (data type UInt): Zero
- field_id (data type UInt): Zero
- subfield_cnt (data type UInt): Number of subfields

Each subfield consists of a header (subfield_type_id, subfield_length, subfield_mode) and the subfield-specific parameters. Each subfield must consist of an even number of bytes. The subfield_mode can support a value of 1 or 2. Please refer to the tables below.

Note

Only one field (IF_CONF_Header) is currently allowed. Its parameters field_type_id and field_id must have the value zero. Other fields with different values for field_type_id and field_id are subject to future extensions.

Table 11- 45 Subfields supported

subfield_type_id	Data type	Explanation
30	IF_CONF_V4	IP parameters: IP address, subnet mask, router address
40	IF_CONF_NOS	PROFINET IO device name (Name of station)
17	IF_CONF_NTP	Network Time Protocol (NTP)

Table 11- 46 Elements of the IF_CONF_V4 data type

Name		Data type	Start value	Description
Id		UInt	30	subfield_type_id
Length		UInt	18	subfield_length
Mode		UInt	0	subfield_mode (1: permanent or 2: temporary)
InterfaceAddress		IP_V4	-	Interface address
ADDR		Array [1..4] of Byte		
	ADDR[1]	Byte	0	IP address high byte: 200
	ADDR[2]	Byte	0	IP address high byte: 12
	ADDR[3]	Byte	0	IP address low byte: 1
	ADDR[4]	Byte	0	IP address low byte: 144
SubnetMask		IP_V4	-	Subnet mask
ADDR		Array [1..4] of Byte		
	ADDR[1]	Byte	0	Subnet mask high byte: 255
	ADDR[2]	Byte	0	Subnet mask high byte: 255
	ADDR[3]	Byte	0	Subnet mask low byte: 255
	ADDR[4]	Byte	0	Subnet mask low byte: 0
DefaultRouter		IP_V4	-	Default router
ADDR		Array [1..4] of Byte		
	ADDR[1]	Byte	0	Router high byte: 200
	ADDR[2]	Byte	0	Router high byte: 12
	ADDR[3]	Byte	0	Router low byte: 1
	ADDR[4]	Byte	0	Router low byte: 1

Table 11- 47 Elements of the IF_CONF_NOS data type

Name	Data type	Start value	Description
Id	UInt	40	subfield_type_id
Length	UInt	246	subfield_length
Mode	UInt	0	subfield_mode (1: permanent or 2: temporary)
NOS (Name of station)	Array[1..240] of Byte	0	Station name: You must occupy the ARRAY from the first byte. If the ARRAY is longer than the station name to be assigned, you must enter a zero byte after the actual station name (in conformity with IEC 61158-6-10). Otherwise, NOS is rejected and the "T_CONFIG (Page 880)" instruction enters the error code DW#16#C0809400 in STATUS. If you occupy the first byte with zero, the station name is deleted.

The station name is subject to the following limitations:

- A name component within the station name, i.e., a character string between two dots, must not exceed 63 characters.
- No special characters such as umlauts, brackets, underscore, slash, blank space, etc. The only special character permitted is the dash.
- The station name must not begin or end with the "-" character.
- The station name must not begin with a number.
- The station name form n.n.n.n (n = 0, ... 999) is not permitted.
- The station name must not begin with the string "port-xyz" or "port-xyz-abcde" (a, b, c, d, e, x, y, z = 0, ... 9).

Note

You can also create an ARRAY "NOS" that is shorter then 240 bytes, but not less than 2 bytes. In this case, you must adjust the "Length" (length of subfield) tag accordingly.

Table 11- 48 Elements of the IF_CONF_NTP data type

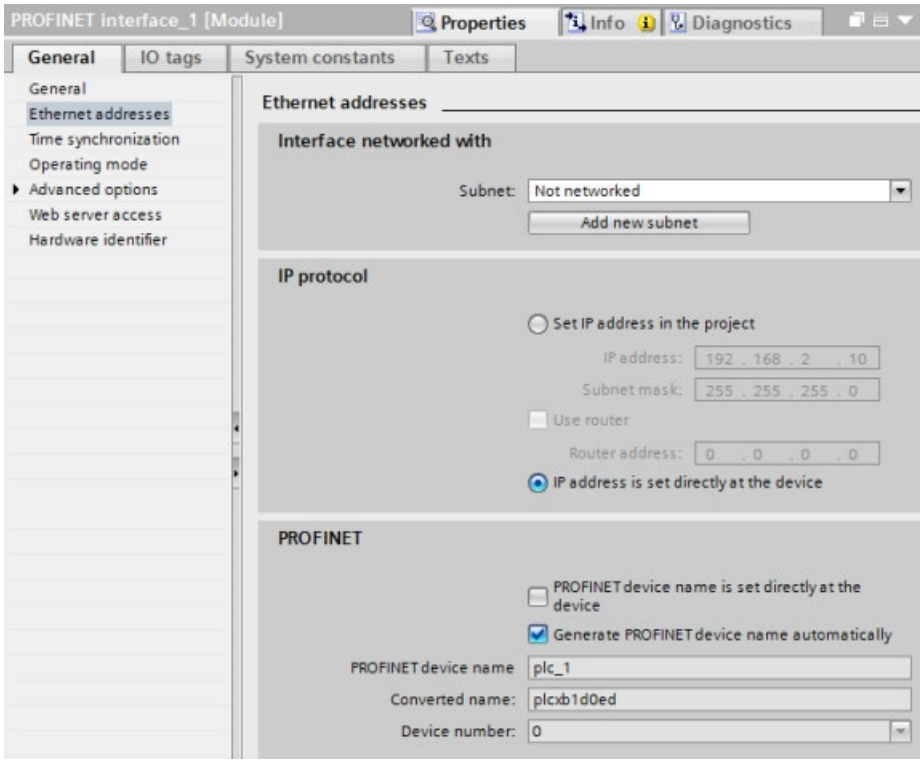
Name	Data type	Start value	Description
Id	UInt	17	subfield_type_id
Length	UInt	22	subfield_length
Mode	UInt	0	subfield_mode (2: temporary)
NTP_IP	Array[1...4] of IP_V4	-	IP addresses of NTP servers
NTP_IP[1]	IP_V4		IP addresses of NTP server 1
ADDR	Array[1...4] of Byte	0	
ADDR[1]	Byte	0	IP address high byte
ADDR[2]	Byte	0	IP address high byte
ADDR[3]	Byte	0	IP address low byte
ADDR[4]	Byte	0	IP address low byte
NTP_IP[2]	IP_V4		IP addresses of NTP server 2
ADDR	Array[1...4] of Byte	0	
ADDR[1]	Byte	0	IP address high byte
ADDR[2]	Byte	0	IP address high byte
ADDR[3]	Byte	0	IP address low byte
ADDR[4]	Byte	0	IP address low byte
NTP_IP[3]	IP_V4		IP addresses of NTP server 3
ADDR	Array[1...4] of Byte	0	
ADDR[1]	Byte	0	IP address high byte
ADDR[2]	Byte	0	IP address high byte
ADDR[3]	Byte	0	IP address low byte
ADDR[4]	Byte	0	IP address low byte
NTP_IP[4]	IP_V4		IP addresses of NTP server 4
ADDR	Array[1...4] of Byte	0	
ADDR[1]	Byte	0	IP address high byte
ADDR[2]	Byte	0	IP address high byte
ADDR[3]	Byte	0	IP address low byte
ADDR[4]	Byte	0	IP address low byte

Example: Using the T_CONFIG instruction to change IP parameters

In the following example, in the "addr" subfield, the "InterfaceAddress" (IP address), "SubnetMask", and "DefaultRouter" (IP router) are changed. In the CPU "Properties", "Ethernet address" page, you must select the "IP address is set directly at the device" radio button to enable you to change the IP parameters using the "T_CONFIG" instruction after the program is downloaded.

CONF_DATA_1

	Name	Data type	Start value
1	Static		
2	Conf_data	Struct	
3	header	IF_CONF_Header	
4	FieldType	UInt	0
5	FieldId	UInt	0
6	SubfieldCount	UInt	1
7	addr	IF_CONF_v4	
8	Id	UInt	30
9	Length	UInt	18
10	Mode	UInt	1
11	InterfaceAddress	IP_V4	
12	ADDR	array [1..4] of Byte	
13	ADDR[1]	Byte	192
14	ADDR[2]	Byte	168
15	ADDR[3]	Byte	2
16	ADDR[4]	Byte	30
17	SubnetMask	IP_V4	
18	ADDR	array [1..4] of Byte	
19	ADDR[1]	Byte	255
20	ADDR[2]	Byte	255
21	ADDR[3]	Byte	255
22	ADDR[4]	Byte	0
23	DefaultRouter	IP_V4	
24	ADDR	array [1..4] of Byte	
25	ADDR[1]	Byte	192
26	ADDR[2]	Byte	168
27	ADDR[3]	Byte	2
28	ADDR[4]	Byte	1

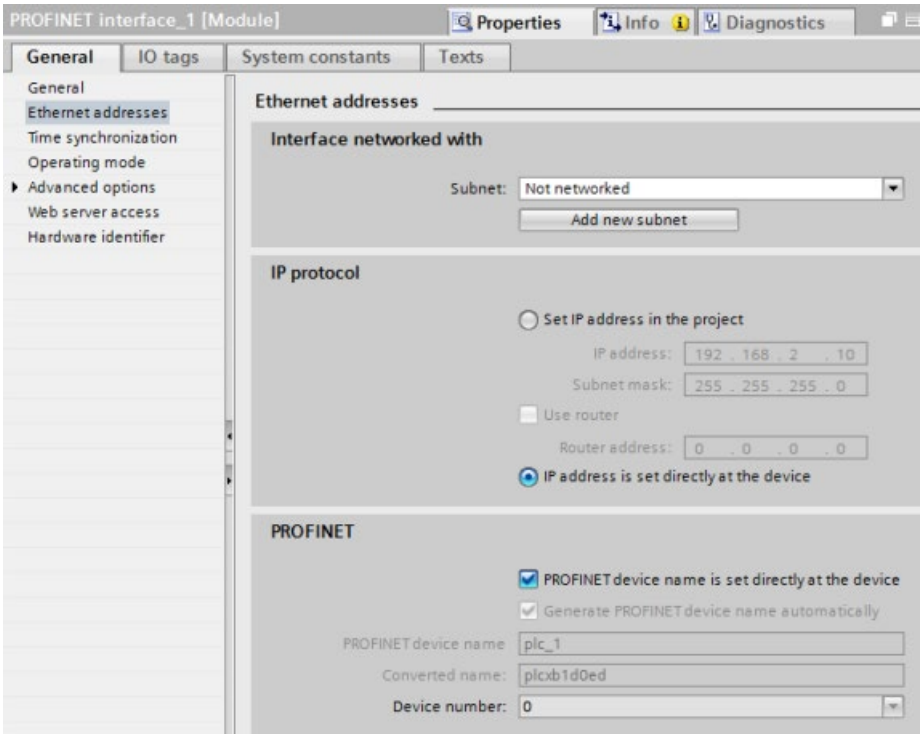


Example: Using the T_CONFIG instruction to change IP parameters and PROFINET IO device names

In the following example, both the "addr" and "nos" (Name of station) subfields are changed. In the CPU "Properties", "Ethernet address" page, you must select the "PROFINET device name is set directly at the device" check box to enable you to change the PROFINET device name using the "T_CONFIG" instruction after the program is downloaded.

CONF_DATA_2

	Name	Data type	Start value
1	Static		
2	Conf_data	Struct	
3	header	IF_CONF_Header	
4	FieldType	UInt	0
5	FieldId	UInt	0
6	SubfieldCount	UInt	2
7	addr	IF_CONF_v4	
8	Id	UInt	30
9	Length	UInt	18
10	Mode	UInt	1
11	InterfaceAddress	IP_V4	
12	ADDR	array [1..4] of Byte	
13	SubnetMask	IP_V4	
14	ADDR	array [1..4] of Byte	
15	DefaultRouter	IP_V4	
16	ADDR	array [1..4] of Byte	
17	nos	IF_CONF_NOS	
18	Id	UInt	40
19	Length	UInt	246
20	Mode	UInt	1
21	NOS	array [1..240] of Byte	



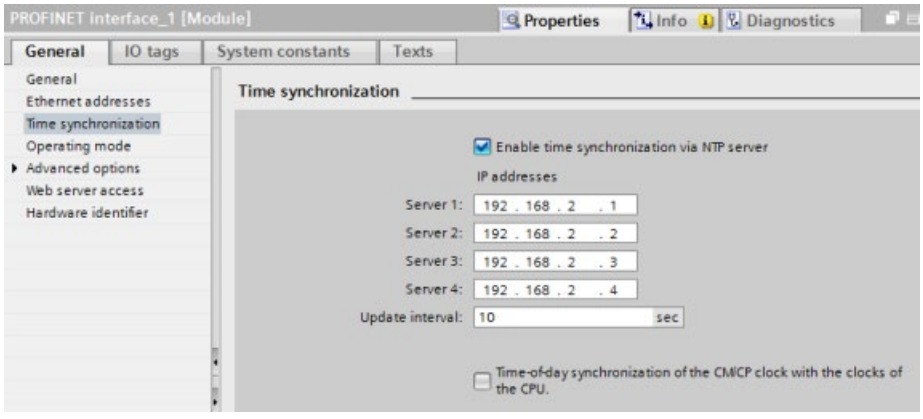
Example: Using the T_CONFIG instruction to change IP addresses in the NTP servers

In the following example, in the "ntp" (Network Time Protocol (NTP) server) subfield, the T_CONFIG instruction changes the IP addresses of up to four NTP servers.

In the CPU Properties, PROFINET interface [X1], Time synchronization page, you configure NTP synchronization by selecting the "Enable time synchronization via NTP server" check box as shown in the figure below. You can then change the IP addresses in the NTP servers using the "T_CONFIG" instruction after the program is downloaded.

CONF_DATA_3

	Name	Data type	Start value
1	Static		
2	Conf_Data	Struct	
3	header	IF_CONF_Header	
4	FieldType	UInt	0
5	FieldId	UInt	0
6	SubfieldCount	UInt	1
7	ntp	IF_CONF_NTP	
8	Id	UInt	17
9	Length	UInt	22
10	Mode	UInt	2
11	NTP_IP	Array[1..4] of IP_V4	
12	NTP_IP[1]	IP_V4	
13	ADDR	Array[1..4] of Byte	
14	ADDR[1]	Byte	192
15	ADDR[2]	Byte	168
16	ADDR[3]	Byte	2
17	ADDR[4]	Byte	5
18	NTP_IP[2]	IP_V4	
19	ADDR	Array[1..4] of Byte	
20	ADDR[1]	Byte	192
21	ADDR[2]	Byte	168
22	ADDR[3]	Byte	2
23	ADDR[4]	Byte	6
24	NTP_IP[3]	IP_V4	
25	ADDR	Array[1..4] of Byte	
26	ADDR[1]	Byte	192
27	ADDR[2]	Byte	168
28	ADDR[3]	Byte	2
29	ADDR[4]	Byte	7
30	NTP_IP[4]	IP_V4	
31	ADDR	Array[1..4] of Byte	
32	ADDR[1]	Byte	192
33	ADDR[2]	Byte	168
34	ADDR[3]	Byte	2
35	ADDR[4]	Byte	8



11.2.8.17 Common parameters for instructions

REQ input parameter

Many of the Open User Communication instructions use the REQ input to initiate the operation on a low to high transition. The REQ input must be high (TRUE) for one execution of an instruction, but the REQ input can remain TRUE for as long as desired. The instruction does not initiate another operation until it has been executed with the REQ input FALSE so that the instruction can reset the history state of the REQ input. This is required so that the instruction can detect the low to high transition to initiate the next operation.

When you place one of these instructions in your program, STEP 7 prompts you to identify the instance DB. Use a unique DB for each instruction call. This ensures that each instruction properly handles inputs such as REQ.

ID input parameter

This is a reference to the "Local ID (hex)" on the "Network view" of "Devices and networks" in STEP 7 and is the ID of the network that you want to use for this communication block. The ID must be identical to the associated parameter ID in the local connection description.

DONE, NDR, ERROR, and STATUS output parameters

These instructions provide outputs describing the completion status:

Table 11- 49 Open User Communication instruction output parameters

Parameter	Data type	Default	Description
DONE	Bool	FALSE	Is set TRUE for one execution to indicate that the last request completed without errors; otherwise, FALSE.
NDR	Bool	FALSE	Is set TRUE for one execution to indicate that the requested action has completed without error and new data has been received; otherwise, FALSE.
BUSY	Bool	FALSE	Is set TRUE when active to indicate that: • The job is not yet complete. • A new job cannot be triggered. Is set FALSE when job is complete.
ERROR	Bool	FALSE	Is set TRUE for one execution to indicate that the last request completed with errors, with the applicable error code in STATUS; otherwise, FALSE.
STATUS	Word	0	Result status: • If the DONE or NDR bit is set, then STATUS is set to 0 or to an informational code. • If the ERROR bit is set, then STATUS is set to an error code. • If none of the above bits are set, then the instruction returns status results that describe the current state of the function. STATUS retains its value for the duration of the execution of the function.

Note

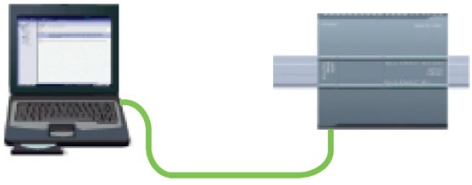
Note that DONE, NDR, and ERROR are set for one execution only.

Restricted TSAPs and port numbers for passive ISO and TCP communication

If you use the "TCON" instruction to set up and establish a passive communications connection, the following port addresses are restricted and should not be used:

- ISO TSAP (passive):
  - 01.00, 01.01, 02.00, 02.01, 03.00, 03.01
  - 10.00, 10.01, 11.00, 11.01, ... BF.00, BF.01
- TCP port (passive): 5001, 102, 123, 20, 21, 25, 34962, 34963, 34964, 80
- UDP port (passive): 161, 34962, 34963, 34964

11.2.9 Communication with a programming device



A CPU can communicate with a STEP 7 programming device on a network.

Consider the following when setting up communications between a CPU and a programming device:

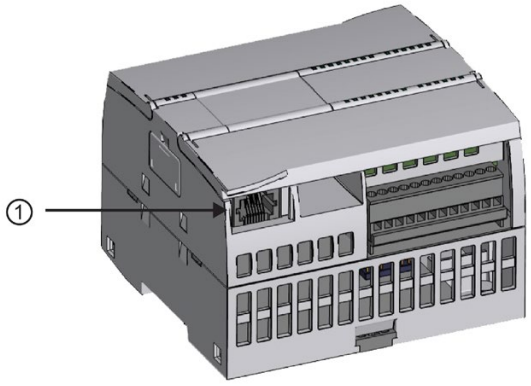
- Configuration/Setup: Hardware configuration is required.
- No Ethernet switch is required for one-to-one communications; an Ethernet switch is required for more than two devices in a network.

11.2.9.1 Establishing the hardware communications connection

The PROFINET interfaces establish the physical connections between a programming device and a CPU. Since Auto-Cross-Over functionality is built into the CPU, either a standard or crossover Ethernet cable can be used for the interface. An Ethernet switch is not required to connect a programming device directly to a CPU.

Follow the steps below to create the hardware connection between a programming device and a CPU:

1. Install the CPU (Page 60).
2. Plug the Ethernet cable into the PROFINET port shown below.
3. Connect the Ethernet cable to the programming device.



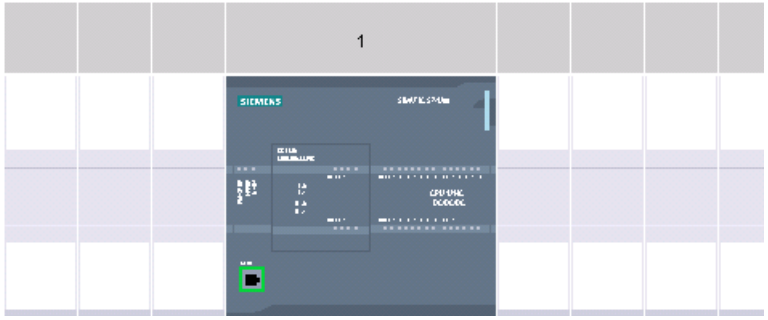
① PROFINET port

An optional strain relief is available to strengthen the PROFINET connection. For ordering information, see Spare parts and other hardware (Page 1554).

11.2.9.2 Configuring the devices

If you have already created a project with a CPU, open your project in STEP 7.

If not, create a project and insert a CPU (Page 150) into the rack. In the project below, a CPU is shown in the "Device View".



11.2.9.3 Assigning Internet Protocol (IP) addresses

Assigning the IP addresses

In a PROFINET network, each device must also have an Internet Protocol (IP) address. This address allows the device to deliver data on a more complex, routed network:

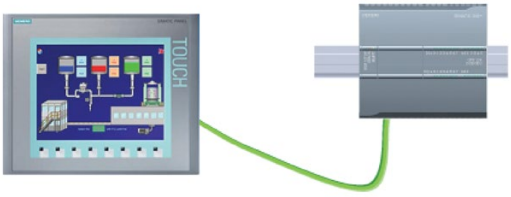
- If you have programming or other network devices that use an onboard adapter card connected to your plant LAN or an Ethernet-to-USB adapter card connected to an isolated network, you must assign IP addresses to them. Refer to "Assigning IP addresses to programming and network devices" (Page 791) for more information.
- You can also assign an IP address to a CPU or network device online. This is particularly useful in an initial device configuration. Refer to "Assigning an IP address to a CPU online" (Page 791) for more information.
- After you have configured your CPU or network device in your project, you can configure parameters for the PROFINET interface, to include its IP address. Refer to "Configuring an IP address for a CPU in your project" (Page 793) for more information.

11.2.9.4 Testing your PROFINET network

After completing the configuration, you must download your project to the CPU. All IP addresses are configured when you download the project.

The CPU "Download to device" function and its "Extended download to device" dialog can show all accessible network devices and whether or not unique IP addresses have been assigned to all devices. Refer to "Testing the PROFINET network" (Page 799) for more information.

11.2.10 HMI-to-PLC communication



The CPU supports PROFINET communications connections to HMIs (Page 33). The following requirements must be considered when setting up communications between CPUs and HMIs:

Configuration/Setup:

- The PROFINET port of the CPU must be configured to connect with the HMI.
- The HMI must be setup and configured.
- The HMI configuration information is part of the CPU project and can be configured and downloaded from within the project.
- No Ethernet switch is required for one-to-one communications; an Ethernet switch is required for more than two devices in a network.

Note

The rack-mounted CSM1277 4-port Ethernet switch can be used to connect your CPUs and HMI devices. The PROFINET port on the CPU does not contain an Ethernet switching device.

Supported functions:

- The HMI can read/write data to the CPU.
- Messages can be triggered, based upon information retrieved from the CPU.
- System diagnostics

Table 11- 50 Required steps in configuring communications between an HMI and a CPU

Step	Task
1	Establishing the hardware communications connection A PROFINET interface establishes the physical connection between an HMI and a CPU. Since Auto-Cross-Over functionality is built into the CPU, you can use either a standard or crossover Ethernet cable for the interface. An Ethernet switch is not required to connect an HMI and a CPU. Refer to "Communication with a programming device: Establishing the hardware communications connection" (Page 893) for more information.
2	Configuring the devices Refer to "Communication with a programming device: Configuring the devices" (Page 893) for more information.
3	Configuring the logical network connections between an HMI and a CPU Refer to "HMI-to-PLC communication: Configuring the logical network connections between two devices" (Page 896) for more information.

Step	Task
4	Configuring an IP address in your project Use the same configuration process; however, you must configure IP addresses for the HMI and the CPU. Refer to "Device configuration: Configuring an IP address for a CPU in your project" (Page 795) for more information.
5	Testing the PROFINET network You must download the configuration for each CPU and HMI device. Refer to "Device configuration: Testing the PROFINET network" (Page 799) for more information.

11.2.10.1 Configuring logical network connections between two devices

After you configure the rack with the CPU, you are now ready to configure your network connections.

In the Devices and Networks portal, use the "Network view" to create the network connections between the devices in your project. First, click the "Connections" tab, and then select the connection type with the dropdown, just to the right (for example, an ISO on TCP connection).

To create a PROFINET connection, click the green (PROFINET) box on the first device, and drag a line to the PROFINET box on the second device. Release the mouse button and your PROFINET connection is joined.

Refer to "Device Configuration: Creating a network connection" (Page 787) for more information.

11.2.11 PLC-to-PLC communication



A CPU can communicate with another CPU on a network by using the TSEND_C and TRCV_C instructions.

Consider the following when setting up communications between two CPUs:

- Configuration/Setup: Hardware configuration is required.
- Supported functions: Reading/Writing data to a peer CPU
- No Ethernet switch is required for one-to-one communications; an Ethernet switch is required for more than two devices in a network.

Table 11- 51 Required steps in configuring communications between two CPUs

Step	Task
1	Establishing the hardware communications connection A PROFINET interface establishes the physical connection between two CPUs. Since Auto-Cross-Over functionality is built into the CPU, you can use either a standard or crossover Ethernet cable for the interface. An Ethernet switch is not required to connect the two CPUs. Refer to "Communication with a programming device: Establishing the hardware communications connection" (Page 893) for more information.
2	Configuring the devices You must configure two CPUs in your project. Refer to "Communication with a programming device: Configuring the devices" (Page 893) for more information.
3	Configuring the logical network connections between two CPUs Refer to "PLC-to-PLC communication: Configuring logical network connections between two devices" (Page 897) for more information.
4	Configuring an IP address in your project Use the same configuration process; however, you must configure IP addresses for two CPUs (for example, PLC_1 and PLC_2). Refer to "Device configuration: Configuring an IP address for a CPU in your project" (Page 795) for more information.
5	Configuring transmit (send) and receive parameters You must configure TSEND_C and TRCV_C instructions in both CPUs to enable communications between them. Refer to "Configuring communications between two CPUs: Configuring transmit (send) and receive parameters" (Page 898) for more information.
6	Testing the PROFINET network You must download the configuration for each CPU. Refer to "Device configuration: Testing the PROFINET network" (Page 799) for more information.

11.2.11.1 Configuring logical network connections between two devices

After you configure the rack with the CPU, you are now ready to configure your network connections.

In the Devices and Networks portal, use the "Network view" to create the network connections between the devices in your project. First, click the "Connections" tab, and then select the connection type with the dropdown, just to the right (for example, an ISO on TCP connection).

To create a PROFINET connection, click the green (PROFINET) box on the first device, and drag a line to the PROFINET box on the second device. Release the mouse button and your PROFINET connection is joined.

Refer to "Device Configuration: Creating a network connection" (Page 787) for more information.

11.2.11.2 Configuring the Local/Partner connection path between two devices

Configuring General parameters

You specify the communication parameters in the "Properties" configuration dialog of the communication instruction. This dialog appears near the bottom of the page whenever you have selected any part of the instruction.

Refer to "Device configuration: Configuring the Local/Partner connection path (Page 788)" for more information.

In the "Address Details" section of the Connection parameters dialog, you define the TSAPs or ports to be used. The TSAP or port of a connection in the CPU is entered in the "Local TSAP" field. The TSAP or port assigned for the connection in your partner CPU is entered under the "Partner TSAP" field.

11.2.11.3 Configuring transmit (send) and receive parameters

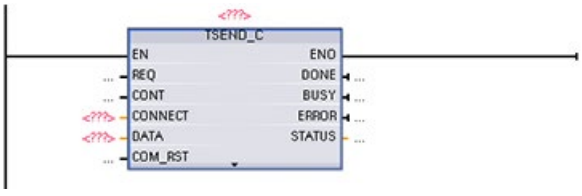
Communication blocks (for example, TSEND_C and TRCV_C) are used to establish connections between two CPUs. Before the CPUs can engage in PROFINET communications, you must configure parameters for transmitting (or sending) messages and receiving messages. These parameters dictate how communications operate when messages are being transmitted to or received from a target device.

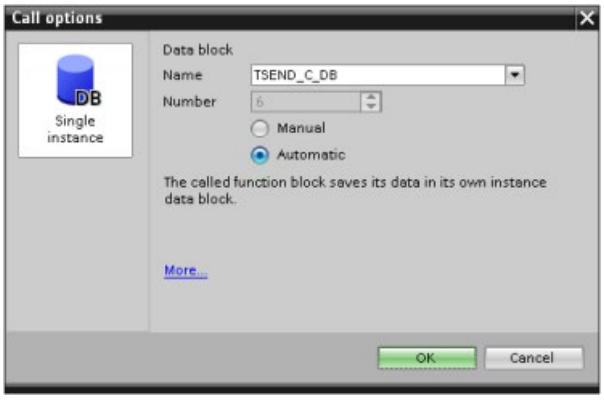
Configuring the TSEND_C instruction transmit (send) parameters

TSEND_C instruction

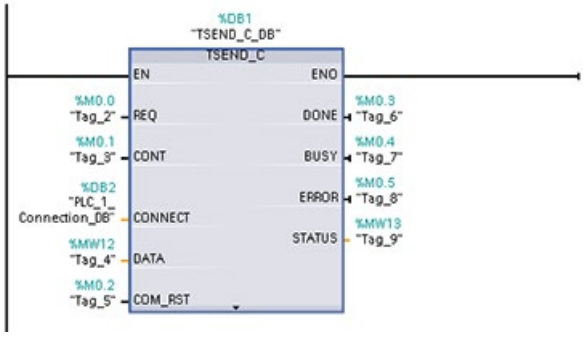
The TSEND_C instruction (Page 817) creates a communications connection to a partner station. The connection is set up, established, and automatically monitored until it is commanded to disconnect by the instruction. The TSEND_C instruction combines the functions of the TCON, TDISCON and TSEND instructions.

From the Device configuration in STEP 7, you can configure how a TSEND_C instruction transmits data. To begin, you insert the instruction into the program from the "Communications" folder in the "Instructions" task card. The TSEND_C instruction is displayed, along with the Call options dialog where you assign a DB for storing the parameters of the instruction.





You can assign tag memory locations to the inputs and outputs, as shown in the following figure:



Configuring General parameters

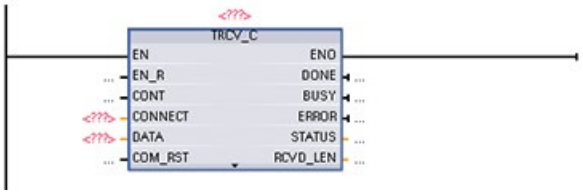
You specify the parameters in the Properties configuration dialog of the TSEND_C instruction. This dialog appears near the bottom of the page whenever you have selected any part of the TSEND_C instruction.

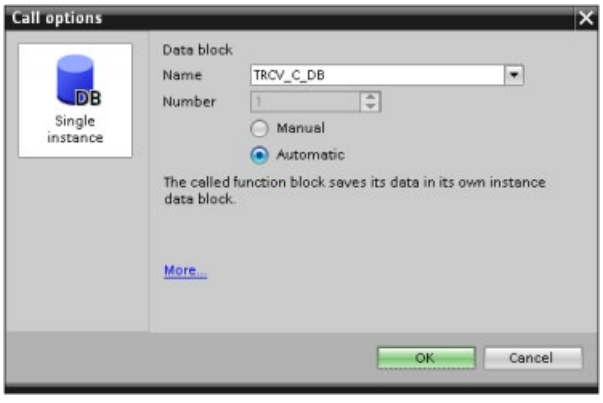
Configuring the TRCV_C instruction receive parameters

TRCV_C instruction

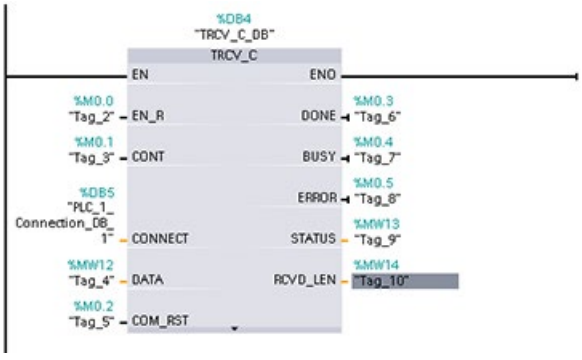
The TRCV_C instruction (Page 817) creates a communications connection to a partner station. The connection is set up, established, and automatically monitored until it is commanded to disconnect by the instruction. The TRCV_C instruction combines the functions of the TCON, TDISCON, and TRCV instructions.

From the CPU configuration in STEP 7, you can configure how a TRCV_C instruction receives data. To begin, insert the instruction into the program from the "Communications" folder in the "Instructions" task card. The TRCV_C instruction is displayed, along with the Call options dialog where you assign a DB for storing the parameters of the instruction.





You can assign tag memory locations to the inputs and outputs, as shown in the following figure:



Configuring the General parameters

You specify the parameters in the Properties configuration dialog of the TRCV_C instruction. This dialog appears near the bottom of the page whenever you have selected any part of the TRCV_C instruction.

11.2.12 Configuring a CPU and PROFINET IO device

11.2.12.1 Adding a PROFINET IO device

Adding a PROFINET IO device

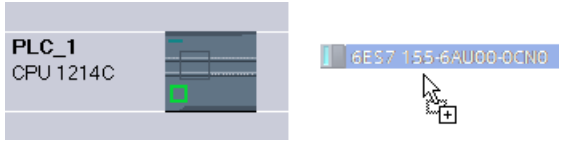
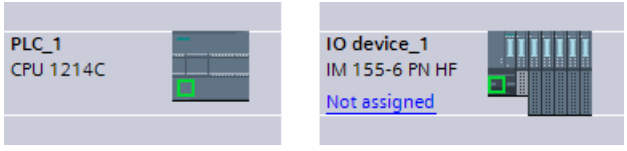
In the "Devices and networks" portal, use the hardware catalog to add PROFINET IO devices.

Note

To add a PROFINET IO device, you can use STEP 7 Professional or Basic, V11 or greater.

For example, expand the following containers in the hardware catalog to add an ET 200SP IO device: Distributed I/O, ET 200SP, Interface modules, and PROFINET. You can then select the interface module from the list of ET 200SP devices (sorted by part number) and add the ET 200SP IO device.

Table 11- 52 Adding an ET 200SP IO device to the device configuration

Insert the IO device	Result
	

You can now connect the PROFINET IO device to the CPU:

1. Right-click the "Not assigned" link on the device and select "Assign new IO controller" from the context menu to display the "Select IO controller" dialog.
2. Select your S7-1200 CPU (in this example, "PLC_1") from the list of IO controllers in the project.
3. Click "OK" to create the network connection.

You can also go to the "Devices and networks" portal and use the "Network view" to create the network connections between the devices in your project:

1. To create a PROFINET connection, click the green (PROFINET) box on the first device, and drag a line to the PROFINET box on the second device.
2. Release the mouse button and your PROFINET connection is joined.

Refer to "Device Configuration: Configuring the CPU for communication" (Page 175) for more information.

11.2.12.2 Assigning CPUs and device names

Assigning CPUs and device names

Network connections between the devices also assign the PROFINET IO device to the CPU, which is required for that CPU to control the device. To change this assignment, click the PLC Name shown on the PROFINET IO device. A dialog box opens that allows the PROFINET IO device to be disconnected from the current CPU and reassigned or left unassigned, if desired.

The devices on your PROFINET network must have an assigned name before you can connect with the CPU. Use the "Network view" to assign names to your PROFINET devices if the devices have not already been assigned a name or if the name of the device is to be changed. Right-click the PROFINET IO device and select "Assign device name" to do this.

For each PROFINET IO device, you must assign the same name to that device in both the STEP 7 project and to the PROFINET IO device in the PROFINET network. (You can use either the STEP 7 "Online & diagnostics" tool or the PRONETA commissioning, configuration, and diagnostics tool to assign the device name in the PROFINET network.) If a name is missing or does not match in either location, the PROFINET IO data exchange mode will not run. Refer to "Online and diagnostic tools: Assigning a name to a PROFINET device online (Page 1300)" for more information.

11.2.12.3 Assigning Internet Protocol (IP) addresses

Assigning the IP addresses

In a PROFINET network, each device must also have an Internet Protocol (IP) address. This address allows the device to deliver data on a more complex, routed network:

- If you have programming or other network devices that use an onboard adapter card connected to your plant LAN or an Ethernet-to-USB adapter card connected to an isolated network, you must assign IP addresses to them. Refer to "Assigning IP addresses to programming and network devices" (Page 791) for more information.
- You can also assign an IP address to a CPU or network device online. This is particularly useful in an initial device configuration. Refer to "Assigning an IP address to a CPU online" (Page 793) for more information.
- After you have configured your CPU or network device in your project, you can configure parameters for the PROFINET interface, to include its IP address. Refer to "Configuring an IP address for a CPU in your project" (Page 795) for more information.

11.2.12.4 Configuring the IO cycle time

Configuring the IO cycle time

A PROFINET IO device is supplied with new data from the CPU within an "IO cycle" time period. The update time can be separately configured for each device and determines the time interval in which data is transmitted from the CPU to and from the device.

STEP 7 calculates the "IO cycle" update time automatically in the default setting for each device of the PROFINET network, taking into account the volume of data to be exchanged and the number of devices assigned to this controller. If you do not want to have the update time calculated automatically, you can change this setting.

You specify the "IO cycle" parameters in the "Properties" configuration dialog of the PROFINET IO device. This dialog appears near the bottom of the page whenever you have selected any part of the instruction.

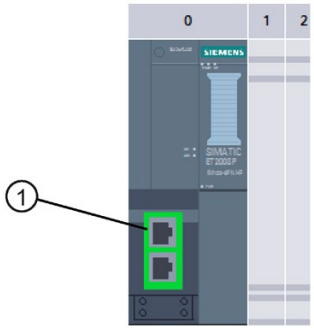
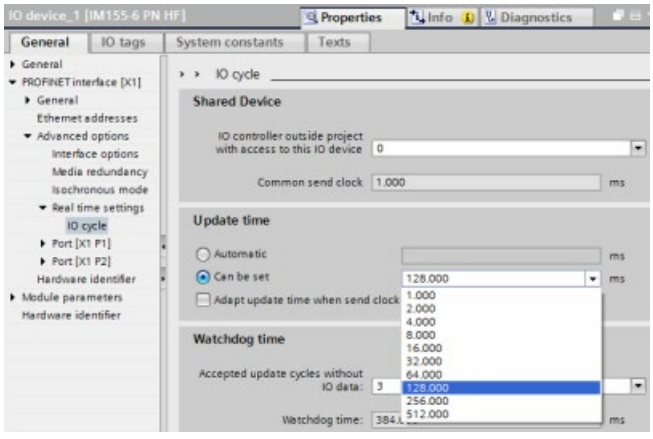
In the "Device view" of the PROFINET IO device, click the PROFINET port. In the "PROFINET Interface" dialog, access the "IO cycle" parameters with the following menu selections:

- "Advanced options"
- "Realtime settings"
- "IO cycle"

Define the IO cycle "Update time" with the following selections:

- To have a suitable update time calculated automatically, select "Automatic".
- To set the update yourself, select "Can be set" and enter the required update time in ms.

Table 11- 53 Configuring the ET 200SP PROFINET IO cycle time

ET 200SP PROFINET IO device	ET 200SP PROFINET IO cycle dialog
	

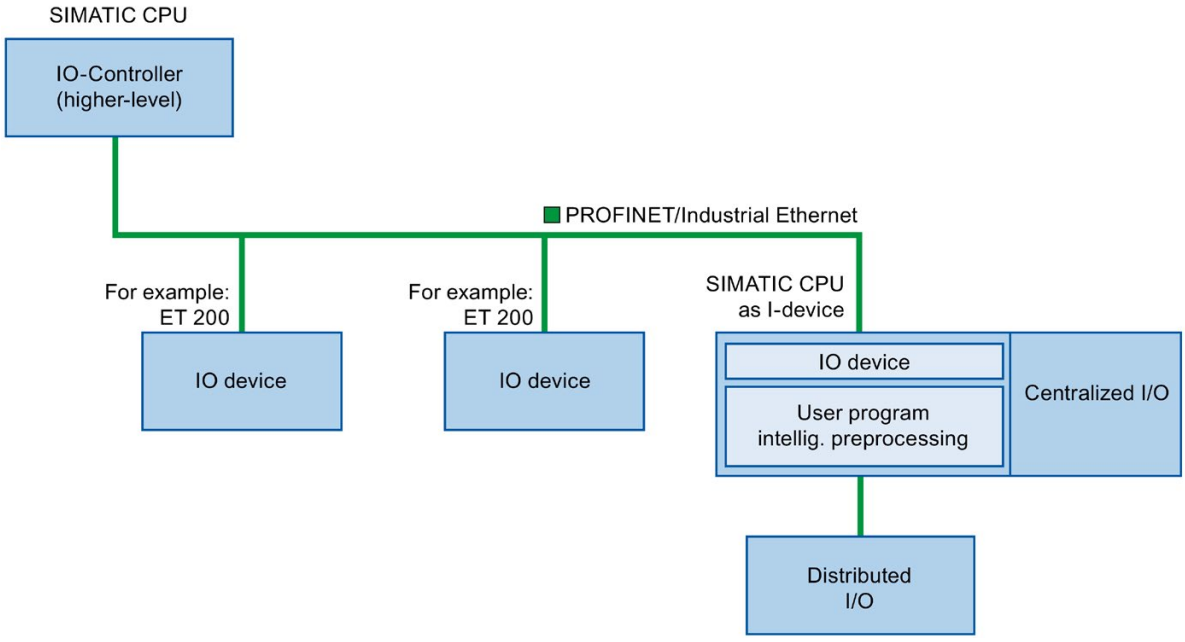
① PROFINET port

11.2.13 Configuring a CPU and PROFINET I-device

11.2.13.1 I-device functionality

The "I-device" (intelligent IO device) functionality of a CPU facilitates data exchange with an IO controller and operation of the CPU as intelligent preprocessing unit of sub processes, for example. The I-device is linked as an IO device to a "higher-level" IO controller.

The pre-processing is handled by the user program on the CPU. The process values acquired in the centralized or distributed (PROFINET IO or PROFIBUS DP) I/O are pre-processed by the user program and made available through a PROFINET IO interface to the CPU of a higher-level station.



"I-device" naming conventions

In the remainder of this description, a CPU or a CP with I-device functionality is simply called an "I-device".

11.2.13.2 Properties and advantages of the I-device

Fields of application

Fields of application of the I-device:

- Distributed processing:

  A complex automation task can be divided into smaller units/subprocesses. This results in manageable processes which lead to simplified subtasks.

- Separating subprocesses:

  Complicated, widely distributed and extensive processes can be subdivided into several subprocesses with manageable interfaces by using I-devices. These subprocesses can be stored in individual STEP 7 projects if necessary, which can later be merged to form one master project.

- Know-how protection:

  Components can only be delivered with a GSD file for the I-device interface description instead of with a STEP 7 project. The user can protect his program since it no longer has to be published.

Properties

Properties of the I-device:

- Unlinking STEP 7 projects:

  Creators and users of an I-device can have completely separated STEP 7 automation projects. The GSD file forms the interface between the STEP 7 projects. This allows a link to standard IO controllers through a standardized interface.

- Real-time communication:

  The I-device is provided with a deterministic PROFINET IO system through a PROFINET IO interface.

Advantages

The I-device has the following advantages:

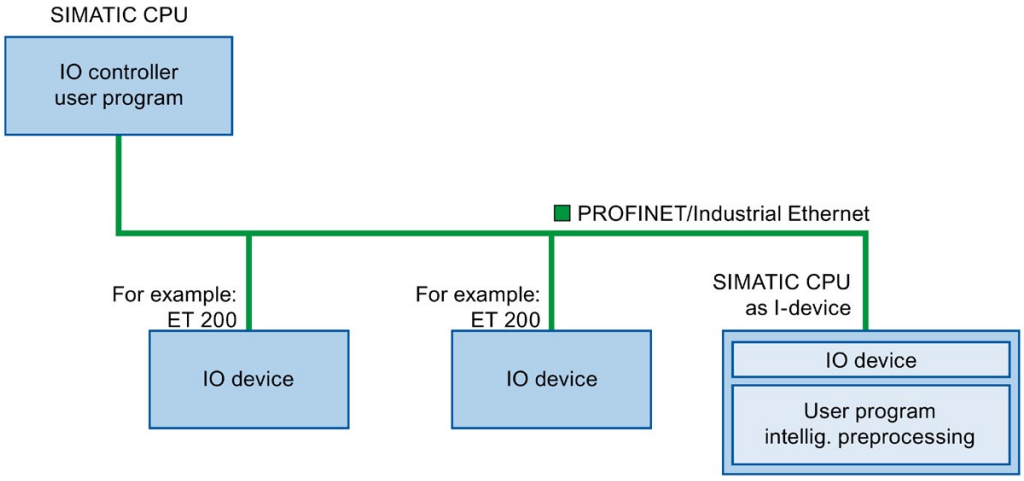
- Simple linking of IO controllers
- Real-time communication between IO controllers
- Relieving the IO controller by distributing the computing capacity to I-devices.
- Lower communications load by processing process data locally.
- Manageable, due to processing of subtasks in separate STEP 7 projects

11.2.13.3 Characteristics of an I-device

An I-device is included in an IO system like a standard IO device.

I-device without lower-level PROFINET IO system

The I-device does not have its own distributed I/O. The configuration and parameter assignment of the I-devices in the role of an IO device is the same as for a distributed I/O system (for example, ET 200).



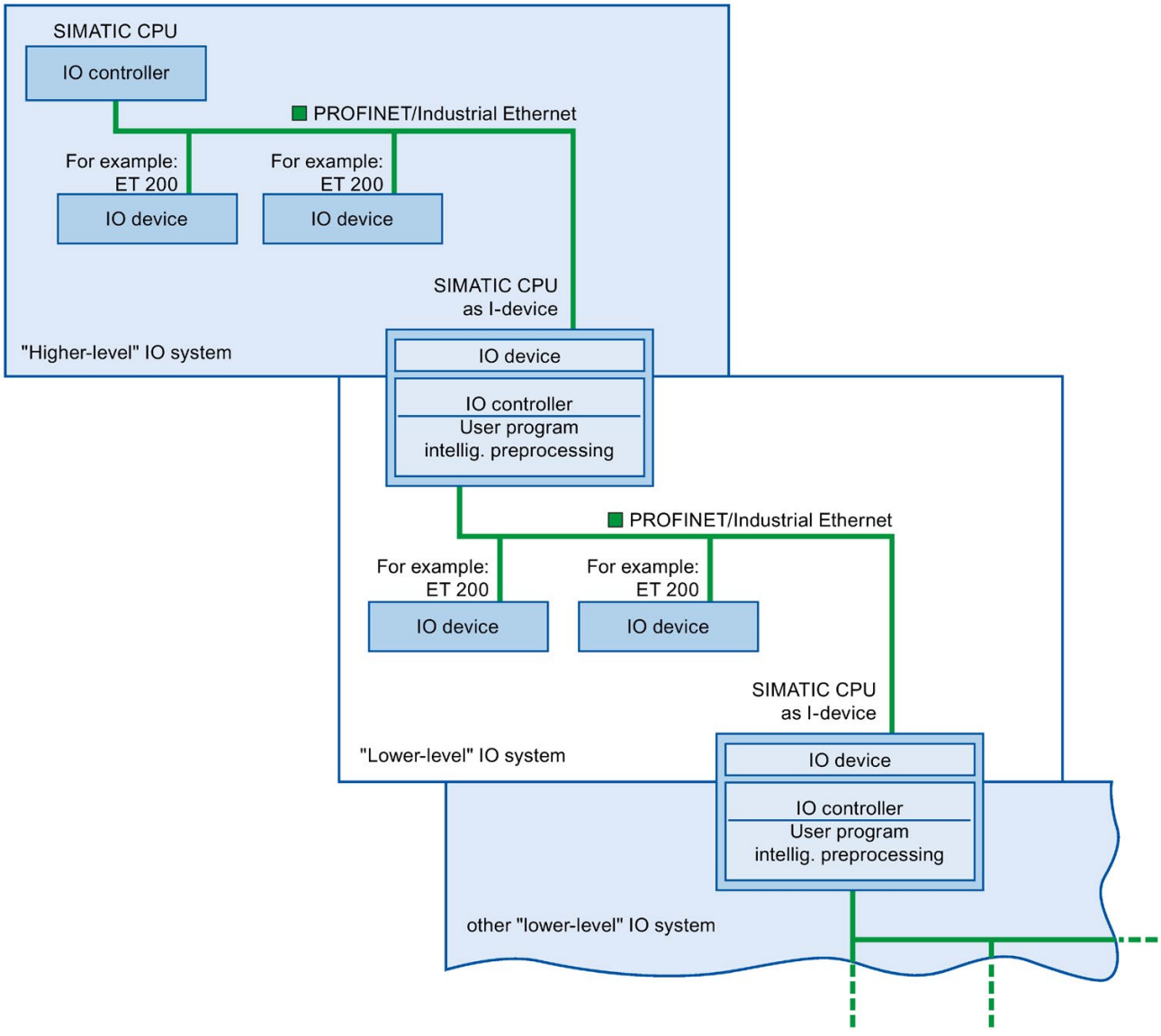
I-device with lower-level PROFINET IO system

Depending on the configuration, an I-device can also be an IO controller on a PROFINET interface in addition to having the role of an IO device.

This means that the I-device can be part of a higher-level IO system through its PROFINET interface and as an IO controller can support its own lower-level IO system.

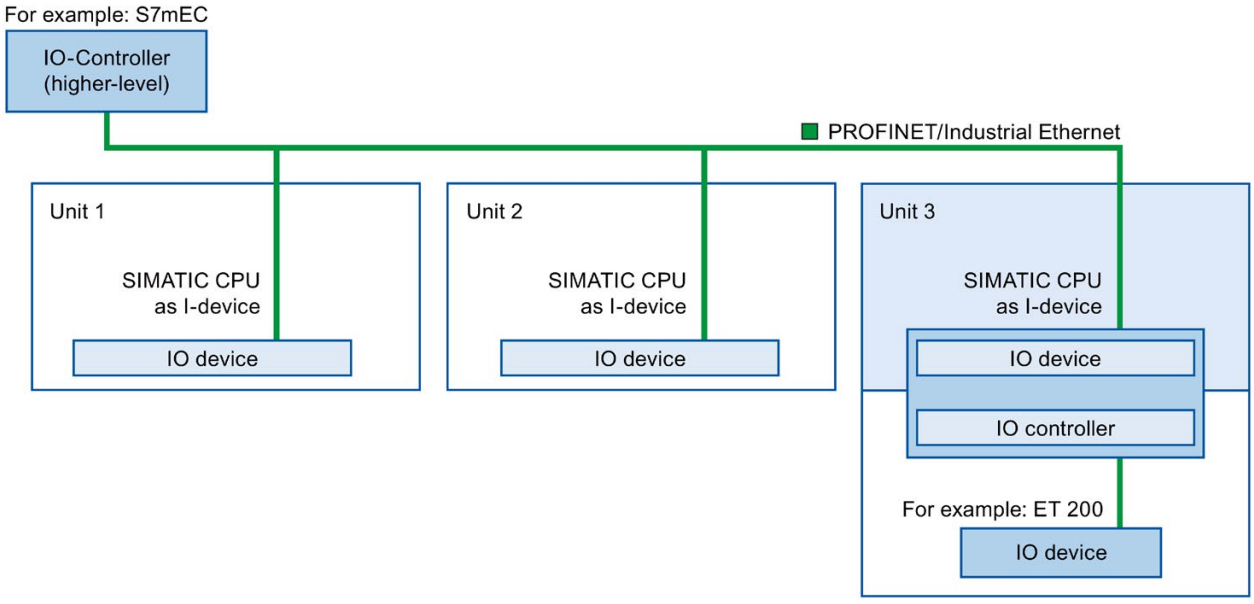
The lower-level IO system can, in turn, contain I-devices (see figure below). This makes hierarchically structured IO systems possible.

In addition to its role as IO controller, an I-device can also be used through a PROFIBUS interface as DP master for a lower-level PROFIBUS system.



Example: I-device as IO device and IO controller

The I-device as IO device and IO controller is explained based on the example of a print process. The I-device controls a unit (a subprocess). One unit is used, for example, to insert additional sheets such as flyers or brochures in a package of printed material.



Unit 1 and unit 2 each consist of an I-device with centralized I/O. The I-device along with the distributed I/O system (for example, ET 200) forms unit 3.

The user program on the I-device is responsible for preprocessing the process data. For this task, the user program of the I-device requires default settings (for example, control data) from the higher-level IO controller. The I-device provides the higher-level IO controller with the results (for example, status of its subtask).

11.2.13.4 Data exchange between higher- and lower-level IO system

Transfer areas are an interface to the user program of the I-device CPU. Inputs are processed in the user program and outputs are the result of the processing in the user program.

The data for communication between IO controller and I-device is made available in the transfer areas. A transfer area contains an information unit that is exchanged consistently between IO controller and I-device. You can find more information on configuration and use of transfer areas in "Configuring the I-device" (Page 911).

Input transfer areas behave differently upon network loss between controller and I-device

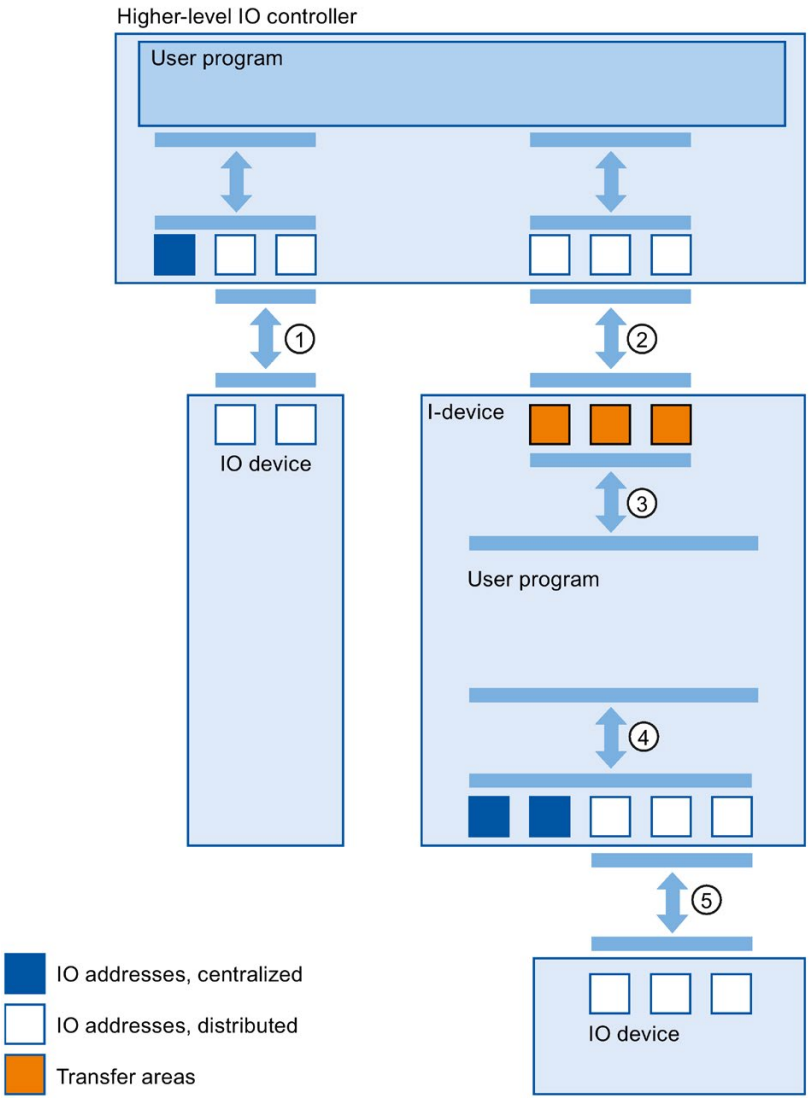
On the controller, the CPU writes zero to the input transfer areas upon network loss. On the I-device, the input transfer areas retain their last values.

You can configure your system to avoid this condition for the general I-device case (non-shared I-device). To do this, clear the input transfer areas for the I-device in a "Rack or Station Failure OB" for a coming event. Follow these steps:

1. Add a "Rack or Station Failure OB" to your project. (This OB defaults to the number OB 86).
2. Add logic to the OB to write the values of the inputs for the I-device to zero when the startup variable of LADDR indicates the value of the I-device hardware ID and the startup variable of Event_Class indicates a "coming" event:
   - You can find the I-device hardware ID in the Default tag table in the "System constants" tab. The hardware ID is a type of "HW_Device", and the name of the tag indicates that it is an I-device (for example, "Local~PROFINET_interface_1~IODevice").
   - A value of "16#39" in the Event_Class indicates a "coming" event. If the "Event_Class" input variable contains the value of "16#39", this indicates that the "Rack or Station Failure OB" is now active (as opposed to being cleared).

Data exchange flow

The next figure shows the data exchange between the higher- and lower-level IO system. The individual communication relations are explained below based upon the numbers:



① **Data exchange between higher-level IO controller and normal IO-device**

In this way, the IO controller and IO devices exchange data throughPROFINET.

② **Data exchange between higher-level IO controller and I-device**

In this way, the IO controller and the I-device exchange data throughPROFINET.

The data exchange between a higher-level IO controller and an I-device is based upon the conventional IO controller / IO device relationship.

For the higher-level IO controller, the transfer areas of the I-devices represent submodules of a pre-configured station.

The output data of the IO controller is the input data of the I-device. Analogously, the input data of the IO controller is the output data of the I-device.

③ **Transfer relationship between the user program and the transfer area**

In this way, the user program and the transfer area exchange input and output data.

④ **Data exchange between the user program and the I/O of the I-device**
In this way, the user program and the centralized / distributed I/O exchange input and output data.

⑤ **Data exchange between the I-device and a lower-level IO device**
In this way, the I-device and its IO devices exchange data. The data transfer is through-PROFINET.

11.2.13.5 Configuring the I-device

There are basically two possibilities for configuration:

- Configuration of an I-device within a project
- Configuration of an I-device that is used in another project or in another engineering system.

STEP 7 allows you to configure an I-device for another project or for another engineering system by exporting a configured I-device to a GSD file. You import the GSD file in other projects or engineering systems as with other GSD files. The transfer areas for the data exchange, among other data, are stored in this GSD file.

Note

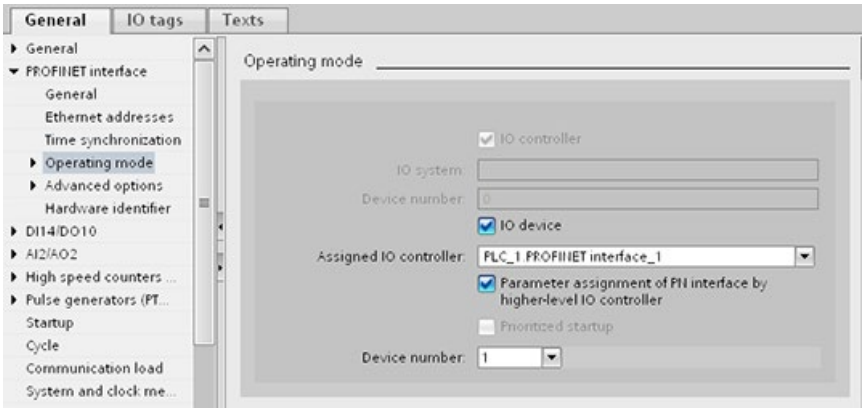
When you use the S7-1200 as a shared I-device and as a controller, ensure that you increase the PROFINET I-device and PROFINET IO Update times to alleviate the communications performance impact. The system is very stable and works well when you select 2 ms for the Update time of a single PROFINET I-device time and you select 2 ms for the Update time of a single PROFINET IO time.

Configuration of an I-device within a project

1. Drag-and-drop a PROFINET CPU from the hardware catalog into the network view.
2. Drag-and-drop a PROFINET CPU, which can also be configured as an IO device, from the hardware catalog into the network view. This device is configured as an I-device (for example, CPU 1215C).
3. Select the PROFINET interface for the I-device.
4. In the Inspector window in the area navigation choose "Operating mode" and select the check box "IO device".

5. Now you have the option of choosing the IO controller in the "Assigned IO controller" drop-down list.

   Once you have chosen the IO controller, the networking and the IO system between both devices are displayed in the network view.



6. With the "Parameter assignment of PN interface by higher-level IO controller" check box, you specify whether the interface parameters will be assigned by the I-device itself or by a higher-level IO controller.

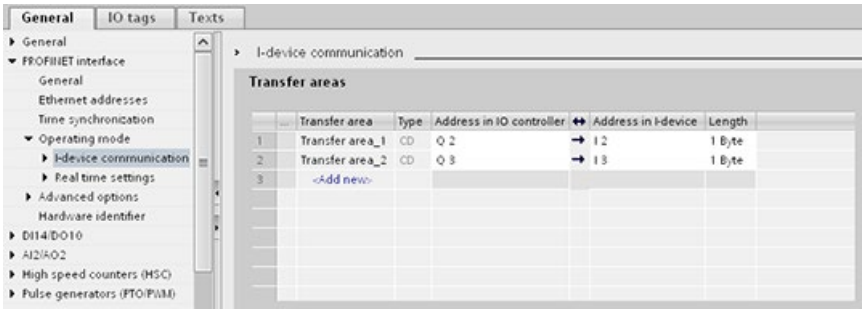
   If you operate the I-device with a lower-level IO system, then the parameters of the I-device PROFINET interface (for example, port parameter) cannot be assigned with the higher-level IO controller.

7. Configure the transfer areas. The transfer areas are found in the area navigation section "I-device communication":

   – Click in the first field of the "Transfer area" column. STEP 7 assigns a default name which you can change.

   – Select the type of communication relation: you can currently only select CD or F-CD.

   – Addresses are automatically preset; you can correct addresses if necessary, and determine the length of the transfer area which is to be consistently transferred.



8. A separate entry is created in the area navigation for each transfer area. If you select one of these entries, you can adjust the details of the transfer area, or correct them and comment on them.

Note

If you configure an S7-1200 as an I-device, the maximum size of a transfer area is 1024 input or output bytes. There are possible constraining factors depending on local I/O as well as address space limitations on the controlling device.

Configuring an I-device with a GSD file

If you use an I-device in another project, or if the I-device is used in another engineering system, then configure the higher-level IO controller and the I-device as described above.

However, click on the "Export" button after configuring the transfer areas so a new GSD file is created from the I-device. This GSD file represents the configured I-device in other projects.

The "Export" button is found in the "I-device communication" section of the Inspector window.

The hardware configuration is compiled and the export dialog opened.

Assign a name for the I-device proxy as well as a description in the fields provided. Click the "Export" button to complete your process.

Finally, import the GSD file, for example, in another project.

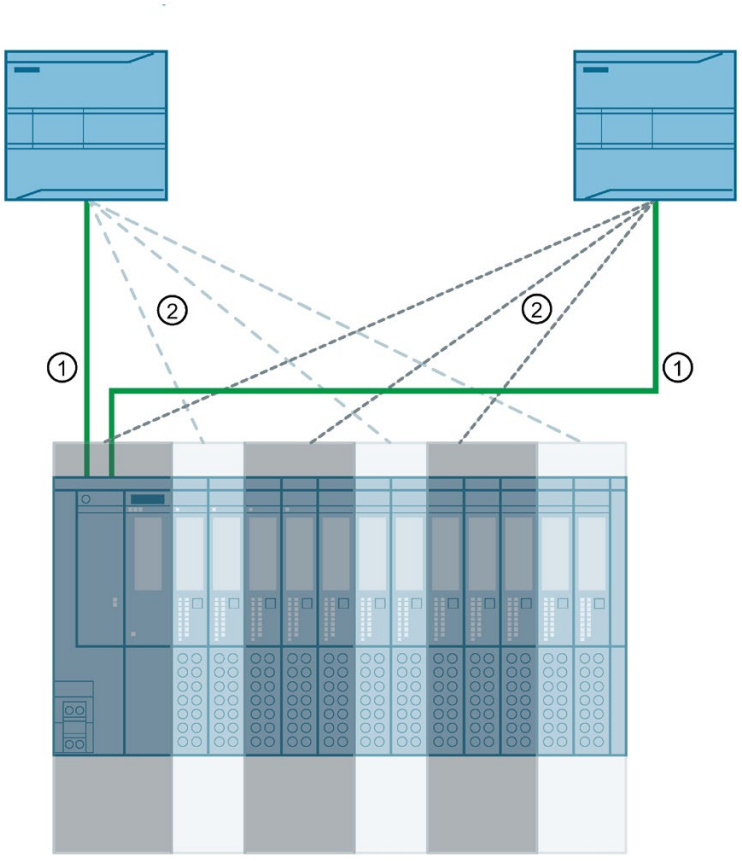
11.2.14 Shared devices

11.2.14.1 Shared device functionality

Numerous IO controllers are often used in larger or widely distributed systems.

Without the "Shared Device" function, each I/O module of an IO device is assigned to the same IO controller. If sensors that are physically close to each other must provide data to different IO controllers, several IO devices are required.

The "Shared Device" function allows the modules or submodules of an IO device to be divided up among different IO controllers. This allows flexible automation concepts. You have, for example, the possibility of combining I/O modules lying near each other into an IO device.



① PROFINET
② Logical assignment

Principle

Access to the submodules of the shared device is then divided up among the individual IO controllers. Each submodule of the shared device is assigned exclusively to one IO controller.

Requirement (GSD configuration)

- STEP 7 V12 Service Pack 1 or higher
- S7-1200 CPU with firmware of V4.1 or later as IO controller
- IO device supports the shared device function, e.g. interface module IM 155-5 PN ST
- GSD file for configuring the IO device is installed
- An S7-1200 CPU configured as an I-device supports the Shared Device functionality. You must export the PROFINET GSD file for the I-device from STEP 7 (as of V5.5) and then import it into STEP 7 (TIA Portal).

Configuring the access

The IO device must be present in several projects so that the modules or submodules of an IO device can be assigned to different IO controllers. A separate project is required for each IO controller.

You use the "Shared device" parameter of the interface module to determine the modules or submodules to which the IO controller has access:

- If the local IO controller has access to the configured module, select the name of the IO controller from the list.
- If the IO controller from a different project and not the local IO controller is to have access to the configured module, select the entry "---".

The configuration is consistent regarding access if each module or submodule in exactly one project is assigned to an IO controller.

Module or submodule is assigned to another IO controller

The paragraph below describes the consequences of the "---" setting of the "Shared device" parameter from the point of view of the local IO controller.

In this case, the local IO controller does not have access to the module configured in this way. Specifically, this means:

- No data exchange with the module or submodule
- No reception of alarms or diagnostics, which means no display of the diagnostics status in the online view
- No parameter assignment of the module or submodule

Setting of the real-time properties

STEP 7 calculates the communication load and thus the resulting update times. You must enter the number of project-external IO controllers in the project in which the PROFINET interface of the shared device is assigned to the IO controller so that a calculation is possible with shared device configurations.

The maximum possible number of IO controllers for the shared device depends on the device. This number is stored in the GSD file of the shared device.

You can set a very short send clock (minimum of 1 ms) with an S7-1200 CPU as IO controller. The send clock can be shorter than the shortest send clock supported by the shared device. In this case, the shared device is operated by the IO controller with a send clock that it supports (send clock adaptation).

Example: A CPU supports send clocks starting from 1 ms. A configured IO device supports send clocks starting at 1.25 ms; another IO device supports send clocks starting at 1 ms. In this case, you have the option of setting the short send clock of 1 ms for the CPU. The CPU operates the "slow" IO device with the send clock of 1.25 ms.

Rules for the configuration

- IO controllers that use the shared device are created in different projects. In each project, care must be taken that the shared device is configured identically in each station. Only one IO controller may ever have full access to a submodule. Inconsistencies in the configuration result in a failure of the shared device.
- I/O addresses of a module or submodule can only be edited if a module or submodule is assigned to the IO controller in the same project.
- The shared device must have the same IP parameters and the same device name in each project.
- The send clock must be identical for all IO controllers that have access to the shared device.
- The S7 subnet ID of the subnet to which the shared device is connected must be identical in all projects.
- The following functions are only available if the PROFINET interface of the shared device is assigned to the local IO controller:
  - Prioritized startup
  - Parameter assignment of the port properties

Boundary conditions

The following boundary conditions result because a shared device configuration is distributed across several projects:

- The addresses of modules or submodules that are not assigned to this IO controller are missing in the address overview of each IO controller that has access to a shared device.
- The modules or submodules that are not assigned are not taken into consideration in the configuration limit calculation for the shared device during the consistency check. For this reason, you must verify for yourself that the maximum number of submodules or the maximum amount of cyclic IO data for the shared device will not be exceeded. For information on the maximum quantities, refer to the documentation for the devices you are using.
- Configuration errors such as the assignment of a module or submodule to several IO controllers are not detected in STEP 7.
- CPUs that are loaded with a shared device configuration do not have any information on whether the IO device is a shared device. Modules or submodules that are assigned to other IO controllers and therefore other CPUs are missing in the loaded configuration. These modules or submodules are therefore displayed neither in the CPU web server nor in the CPU display.

11.2.14.2 Example: Configuring a shared device (GSD configuration)

This example describes how to configure a distributed I/O system as a shared device with STEP 7 V13 SP1 or higher.

A "distributed" configuration with different engineering tools for different IO controller families is possible. The procedure described below is based on STEP 7 as of V13 SP1 and is limited to configuration with two IO controllers of the S7-1200 series that share one shared device.

The example creates two projects with one IO controller each:

- Controller1
- Controller2

You must create the shared device in both projects, even though it is physically one and the same IO device.

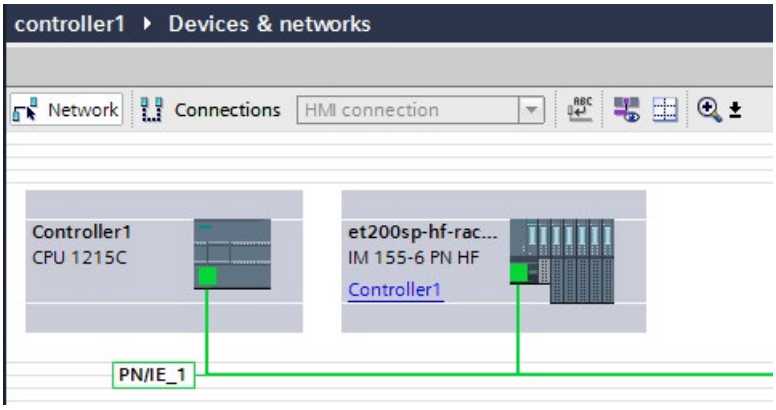
Requirements

- STEP 7 V13 SP1 or higher
- IO device supports shared device functionality (for example, ET 200SP IM 155-6 PN HF V3.1).
- GSD file for configuring the IO device as a shared device is installed.

Procedure: Creating project 1

To create the first project with a shared device, follow these steps:

1. Start STEP 7.
2. Create a new project with the name "Controller1".
3. Insert a CPU 1215C from the hardware catalog in the network view. Name it "Controller1".
4. Insert an IO device with the "Shared Device" function (for example, an ET 200SP) from the hardware catalog (hardware catalog: Other field devices > PROFINET IO > I/O).
5. Assign the IO controller "Controller1" to the IO device.



6. Double-click the IO device and insert all required modules and submodules from the hardware catalog in the device overview table.
7. Assign the module parameters.
8. Save the project.

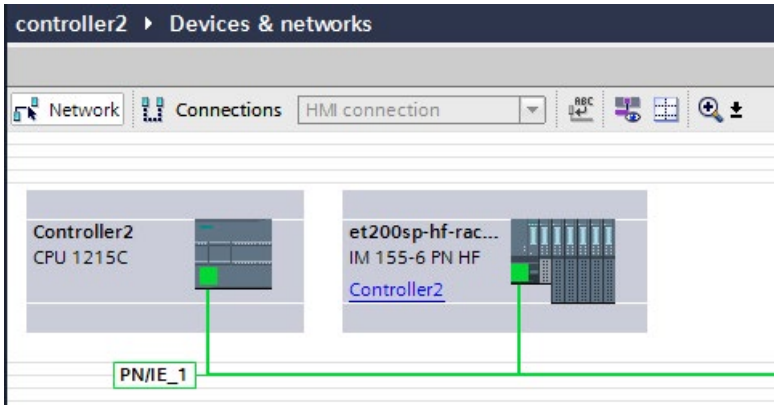
Procedure: Creating project 2

To create the second project with a shared device, follow these steps:

1. Start STEP 7 once again.

   A new instance of STEP 7 opens.

2. In the new instance, create a new project with the name "Controller2".
3. Insert a CPU 1215C in the network view. Name it "Controller2".
4. Copy the IO device from the project "Controller1" and insert it in the network view of project "Controller2".
5. Assign the IO controller "Controller2" to the IO device.



6. Save the project.

Both projects now have an identically structured IO device that must be configured in the next step for the different types of IO controller access.

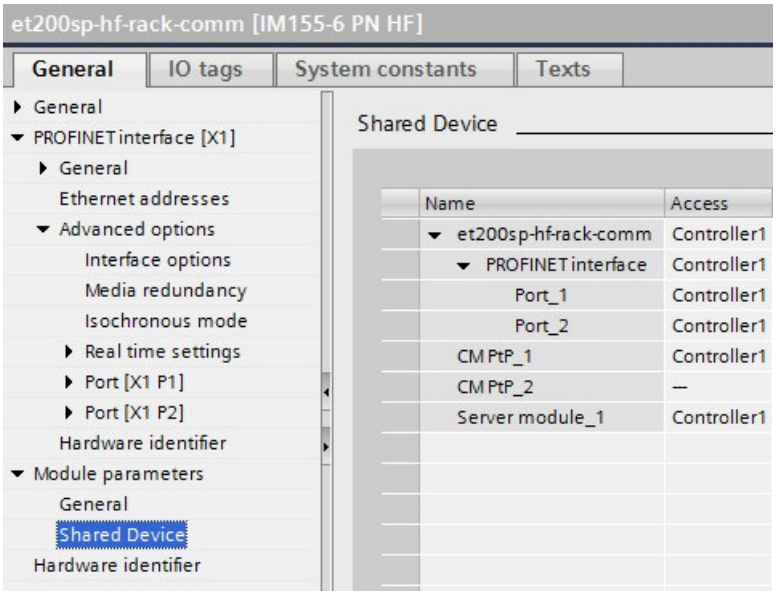
Procedure: Configuring access to the shared device

The modules and submodules you insert in the shared device are automatically assigned to the local CPU. To change the assignment, follow these steps:

1. Select the interface module in the network or device view of project "Controller1".
2. Select the "Shared Device" area in the Inspector window.

   A table shows which CPU has access to the respective module or submodule for all configured modules. The default setting is that the local CPU has access to all modules and submodules.
3. Keep the "Controller1" setting for all modules and submodules that are to remain in the address range of the local CPU.

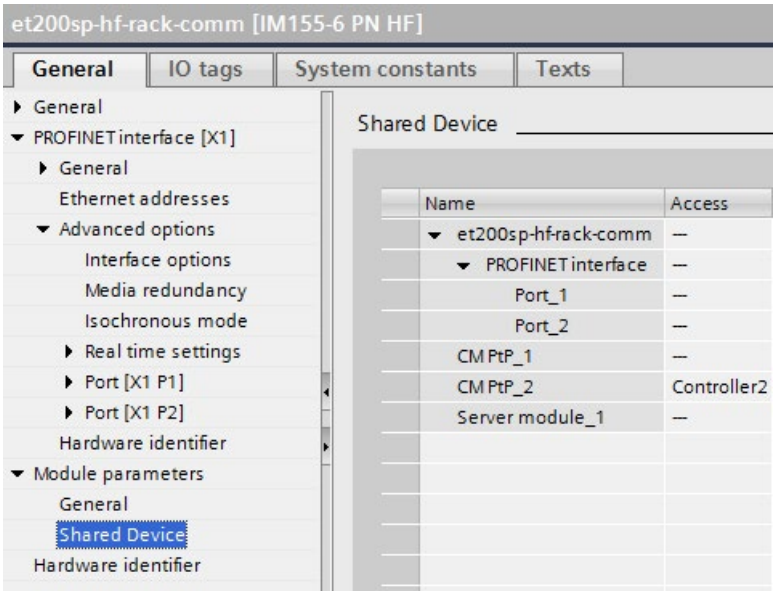
   Select the setting "---" for all modules and submodules that are to be located in the address range of the CPU from the "Controller2" project (Controller2). This means that an IO controller outside the project is to have access to the module or submodule.



4. Select the interface module in the network or device view of project "Controller2".
5. Select the "Shared Device" area in the Inspector window.

   A table shows which CPU has access to the respective module or submodule for all configured modules.

6. Select the setting "---" for all modules and submodules that are to be located in the address range of the CPU from the "Controller1" project (Controller1).



7. Finally, check whether the settings for access are "complementary" for each module or submodule in both projects. This means that if the local CPU has access in one project, the option "---" must be set in the other project and vice versa.

   Note: The option "---" for the PROFINET interface and therefore for the ports makes the associated parameters read-only and not changeable. Parameters of the PROFINET interface and port parameters can only be edited in the project in which the PROFINET interface is assigned to the local CPU. The ports can be interconnected in both projects regardless of this.

8. Check whether the same IP address parameters and device name are set for the shared device in all projects.

   Check whether the same S7 subnet ID is set in all projects for the subnet to which the shared device is connected (subnet properties, "General" area in the Inspector window).

Note

If you make changes to the shared device: Make the same changes in each project on the shared device. Make sure that only one IO controller has access to a module or submodule.

Procedure: Adjusting the real-time settings

To ensure that all IO controllers and shared devices are operated with the appropriate send clock and that the update times are calculated correctly based on the communication load, you must adjust and check the following settings:

1. Select the project whose IO controllers have access to the PROFINET interface and the ports of the shared device.
2. Select the interface module of the shared device in the network view.
3. In the Inspector window, navigate to the "PROFINET interface > Advanced options > Real time settings > IO cycle" area.
4. In the "Shared device" area, set the number of project-external IO controllers. The maximum number depends on the IO device (specification in GSD file).
5. You must set the same send clock for each IO controller that has access to modules and submodules of the shared device:

- If you configure the IO controller with STEP 7 (TIA Portal):
  - Open the corresponding project.
  - Select the PROFINET interface of the IO controller.
  - Select the "Advanced options > Real time settings > IO communication" area in the Inspector window and set the shared send clock.
- If you configure the IO controller with a different engineering tool:
  - Select the PROFINET interface of the shared device in STEP 7 (TIA Portal) and read out the send clock on the shared device ("Advanced options > Real time settings" area).
  - Enter the read send clock in the engineering tool.

Note

If you configure all IO controllers that have access to the shared device in STEP 7 (TIA Portal), you can set shorter send clocks on the IO controller than supported by the shared device (send clock adaptation).

Compiling and loading

You must compile the configurations for the different IO controllers and load them to the CPUs one after the other.

Due to the distributed configuration with separate projects, STEP 7 does not output consistency errors in the case of incorrect access parameter assignment. These are examples of incorrect access parameter assignment:

- Several IO controllers have access to the same module
- IP address parameters or send clocks are not identical

These errors do not show up until controller operation and are output as configuration errors.

11.2.14.3 Example: Configuring an I-device as a shared device

This example describes how to configure an S7-1200 as an I-device with STEP 7 Version V13 SP1 or higher and then use it in two projects as a shared device.

A "distributed" configuration with different engineering tools for different IO controller families is possible. The procedure described below is based on STEP 7 V13 SP1 and is limited to a configuration with two IO controllers of the S7-1200 family that share the transfer areas of an I-device as a shared device. The I-device itself is a CPU 1215C.

The example creates three projects with one IO controller each:

- S7-1200-I-Device
- Controller1
- Controller2

You use the S7-1200-I-Device project to configure the I-device. You use the PROFINET GSD variant of S7-1200-I-Device in the Controller1 and Controller2 projects in order to assign the transfer areas in the respective higher-level IO controller.

Shared I-device concept

The shared I-device concept requires a minimum of three separate projects:

- I-device project: You configure and program an I-device to perform a particular automation task. You define transfer areas as the I/O interface for the higher level controllers and assign these transfer areas to different IO controllers. For the connection to higher-level IO controllers, you provide a PROFINET GSD file and use the transfer areas to access the I-device.
- Controllers that share the I-device (two projects): You use the I-device as a PROFINET GSD variant during configuration of the PROFINET IO system and, in this process, specify the I/O addresses under which the IO controllers access the transfer areas.

Note

If you configure an S7-1200 as an I-device, the maximum size of a transfer area is 1024 input or output bytes. There are possible constraining factors depending on local I/O as well as address space limitations on the controlling device.

I-device

You assign the following parameters for an S7-1200 CPU as an I-device:

- Centralized and distributed I/O
- Desired transfer areas
- Number of IO controllers having access to this I-device (always greater than 1 for a shared device)

Note

You configure the I-device without a higher-level IO controller. As a result, you can only use the local I/O addresses of the transfer area (corresponds with the "Address in the I-device") to create the user program for editing the addresses from the transfer area. You download the I-device, completely configured except for the connection to the higher-level IO controller, to the S7-1200 CPU.

You export a PROFINET GSD file from the I-device configuration.

Controllers that share the I-device

You must install the PROFINET GSD file created from the I-device configuration in all engineering systems that you use in configuring a PROFINET IO system with this shared I-device. If you configure all uses of this I-device with STEP 7 V13 SP1, it is sufficient to install the GSD file in STEP 7.

You configure the I-device as a GSD variant on the PROFINET IO system in the projects involved. In STEP 7 V13 SP1, you find this I-device under "Other field devices > PROFINET IO > PLCs & CPs" following installation.

In each of the projects involved, you assign transfer areas exclusively to the higher-level IO controllers (default setting: all). You set the other transfer areas to "---" (not assigned). When you do so, the local IO controller cannot access this transfer area, and you can assign the transfer area to another IO controller in another project.

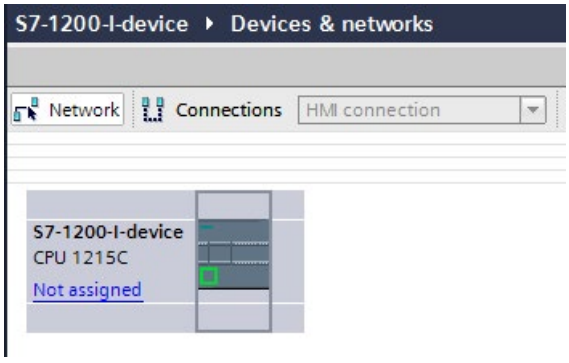
Requirements

- STEP 7 V13 SP1 or higher
- IO device supports shared device functionality (for example, ET 200SP IM 155-6 PN HF V3.1).
- GSD file for configuring the IO device as a shared device is installed.

Procedure: Creating the S7-1200-I-device project

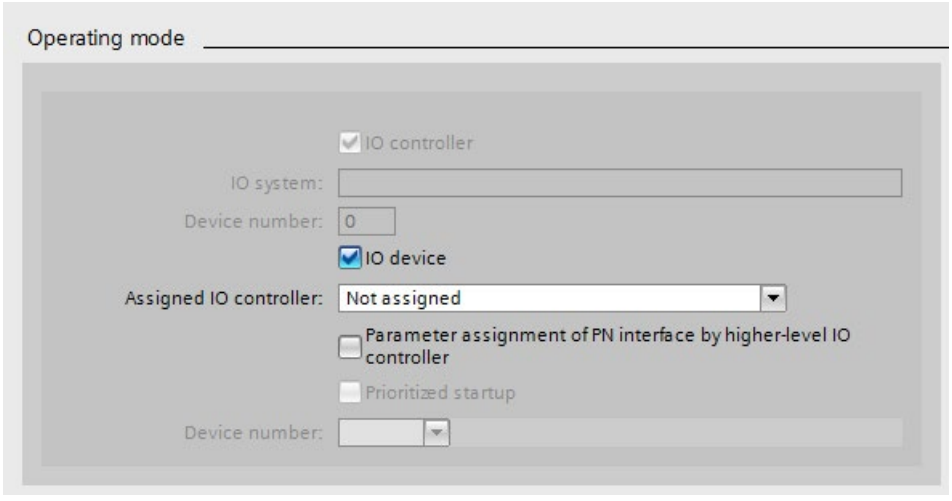
To create the project with a shared I-device, follow these steps:

1. Start STEP 7.
2. Create a new project with the name "S7-1200-I-device".
3. Insert a CPU 1215C from the hardware catalog in the network view. Assign the name "S7-1200-I-device".

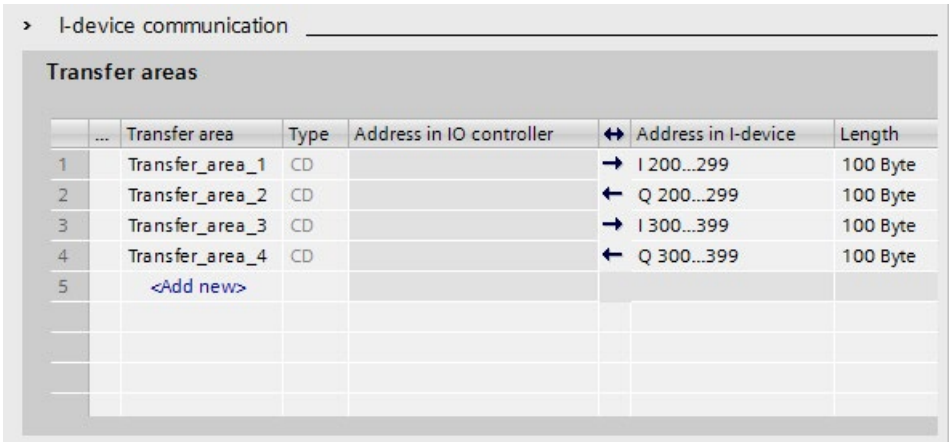


4. Double-click the IO device and configure all required modules and submodules.

5. Assign the module parameters. In particular, you must configure the following settings for the CPU in the area of the PROFINET interface [X1]:
   - Enable the "IO device" option in the "Operating mode" area.

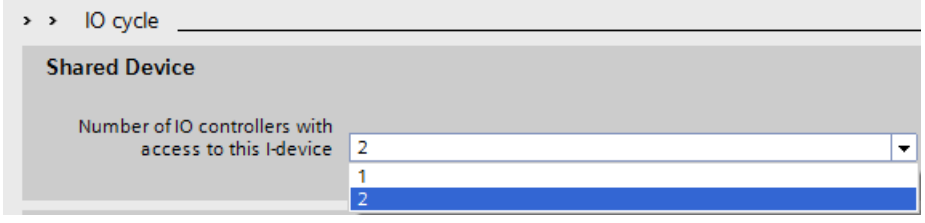


   - Configure the transfer areas in the "Operating mode" > "I-device configuration" area. The "Address in IO controller" column remains empty because no IO controller is assigned.



     Note: To change an input area to an output area, and vice versa, you must navigate to the area of the corresponding transfer area.

   - Select the number of IO controllers (at least two) that will access the shared I-device during operation ("Operating mode" > "Real time settings" area, "Shared Device" area).



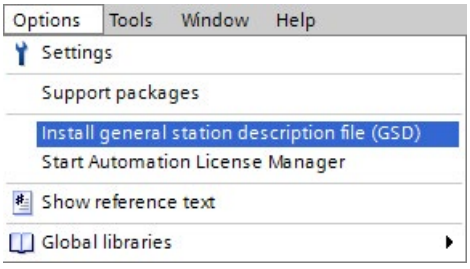
6. Save the project.
7. Click the "Export" button ("Mode" > "I-device configuration" area, "Export general station description file (GSD)" section). If you do not change the name in the Export dialog, the GSD file uses an assigned format name (for example, "GSDML-V2.31-#Siemens-PreConf_S7-1200-I-Device-20130925-123456").



Procedure: Creating the Controller1 project

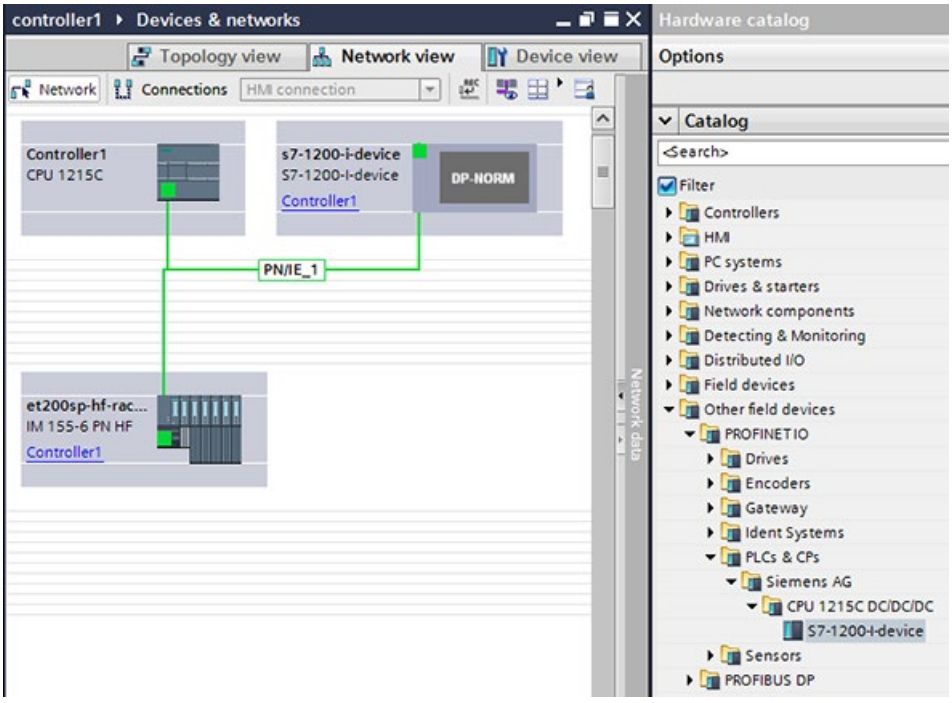
To create the first project with a shared I-device, follow these steps:

1. Start STEP 7.
2. Install the PROFINET GSD file from the export of the I-device CPU (S7-1200-I-Device).

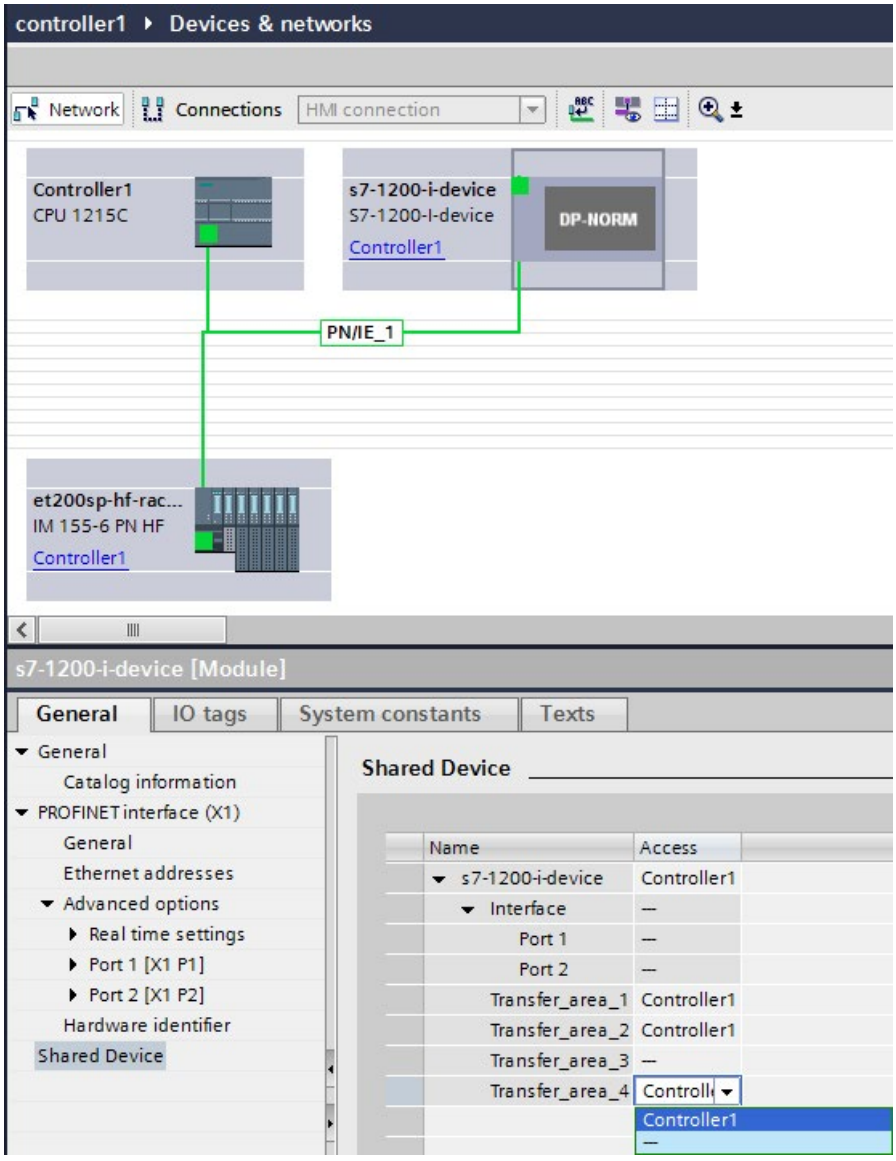


3. Create a new project with the name "Controller1".
4. Insert the CPU 1215C in the network view. The name of the CPU should be "Controller1".
5. Insert the I-device from the hardware catalog (Hardware catalog: Other field devices > PROFINET IO > PLCs & CPs).

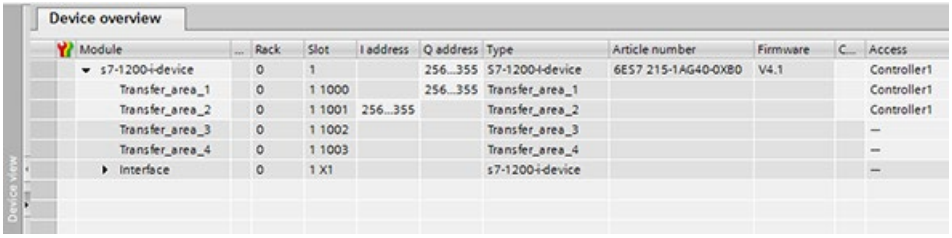
6. Assign the IO controller "Controller1" to the I-device.



7. Select the "Shared device" area in the properties of the I-device:
   - In the table, all transfer areas and the PROFINET interface are assigned to the local IO controller (Controller1).
   - Define the transfer areas to which the Controller1 CPU should **not** have access. Select the "---" entry for these areas. These transfer areas are provided for Controller2.



8. You can adapt the addresses from the Device view of the IO controller in the Device overview. To open the device overview, double-click the I-device.



9. Save the project.

Procedure - Creating the Controller2 project

To create the second project with a shared device, follow these steps:

1. Start STEP 7 once again.

   A new instance of STEP 7 opens.

2. In the new instance, create a new project with the name "Controller2".
3. Insert the CPU 1215C in the network view. Assign the name "Controller2".
4. Insert the I-device from the hardware catalog (Hardware catalog: Other field devices > PROFINET IO > PLCs & CPs).
5. Assign the IO controller "Controller2" to the I-device.
6. Adapt the access to the transfer areas as in the Controller1 project. Ensure that no duplicate assignments result.
7. Adapt the parameters of the subnet and PROFINET interface. Because the shared I-device involves the same device in different projects, these data must match.
8. Save the project.

Both projects now have an identically configured shared I-device. The IO controller access and the parameters of the PROFINET interface should still be checked in the different projects during the next step.

Summary - Assigning parameters for access to the shared device

The transfer areas are automatically assigned to the local IO controller. To change the assignment, follow these steps:

1. Click the "S7-1200-I-Device" device in the network view of the "Controller1" project, and select the "Shared device" area.
2. A table shows which CPU has access to each of the configured transfer areas. The default setting is that the local CPU has access to all modules and submodules.
3. Keep the setting "Controller1" for all transfer areas that are to remain in the address range of the local CPU.

   Select the setting "---" for all transfer areas that are to be located in the address range of the "Controller2" CPU from the "Controller2" project. This means that an IO controller outside the project is to have access to the transfer area.
4. Follow the same procedure for the remaining projects.
5. Finally, check whether the settings for access are "complementary" for each module or submodule in both projects. This means that if the local CPU has access in one project, the option "---" must be set in the other project and vice versa.

   Note: The option "---" for the PROFINET interface and therefore for the ports makes the associated parameters read-only and not changeable. Parameters of the PROFINET interface and port parameters can only be edited in the project in which the PROFINET interface is assigned to the local CPU. The ports can be interconnected in both projects regardless of this.
6. Check whether the same IP address parameters and device name are set for the shared device in all projects.

   Check whether the same S7 subnet ID is set in all projects for the subnet to which the shared device is connected (subnet properties, "General" area in the Inspector window).

Note

If you make changes to the I-device (for example, change the number or length of the transfer areas), export the I-device as a GSD file again. Re-install the GSD file in each project that uses the I-device as a shared device. Make sure that only one IO controller has access to a transfer area.

Note

When you use the S7-1200 as a shared I-device and as a controller, ensure that you increase the PROFINET I-device and PROFINET IO Update times to alleviate the communications performance impact. The system is very stable and works well when you select 2 ms for the Update time of a single PROFINET I-device time and you select 2 ms for the Update time of a single PROFINET IO time.

You specify the "IO cycle" parameters in the "Properties" configuration dialog of the PROFINET I-device or IO. Refer to "Configuring the IO cycle time" (Page 903) for further information.

Procedure - Adjusting the real-time settings

To ensure that all IO controllers and shared devices are operated with the appropriate send clock and that the update times are calculated correctly based on the communication load, you must adjust and check the following settings:

1. You must set the same send clock for each IO controller that has access to modules and submodules of the shared device:

- If you configure the IO controller with STEP 7 (TIA Portal), perform these steps:
  - Open the corresponding project.
  - Select the PROFINET interface of the IO controller.
  - Select the "Advanced options > Real time settings > IO communication" area in the Inspector window and set the shared send clock.
- If you configure the IO controller with a different engineering tool, perform these steps:
  - Select the PROFINET interface of the shared device in STEP 7 (TIA Portal) and read out the send clock on the shared device ("Advanced options > Real time settings" area)
  - Enter the read send clock in the engineering tool.

Note

If you configure **all** IO controllers that have access to the shared I-device in STEP 7 (TIA Portal), you can set shorter send clocks on the IO controller than supported by the shared device (send clock adaptation).

Compiling and downloading

You must compile the configurations for the different IO controllers and download them to the CPUs one after the other.

Due to the distributed configuration with separate projects, STEP 7 does not output consistency errors in the case of incorrect access parameter assignment. These are examples of incorrect access parameter assignment:

- Several IO controllers have access to the same module.
- IP address parameters or send clocks are not identical.

These errors do not show up until controller operation and are output as configuration errors.

11.2.15 Media Redundancy Protocol (MRP)

The following V4.2.x S7-1200 CPUs support operations as an MRP client, but do not fulfill the MRP manager role:

- CPU 1215C
- CPU 1217C
- CPU 1215FC

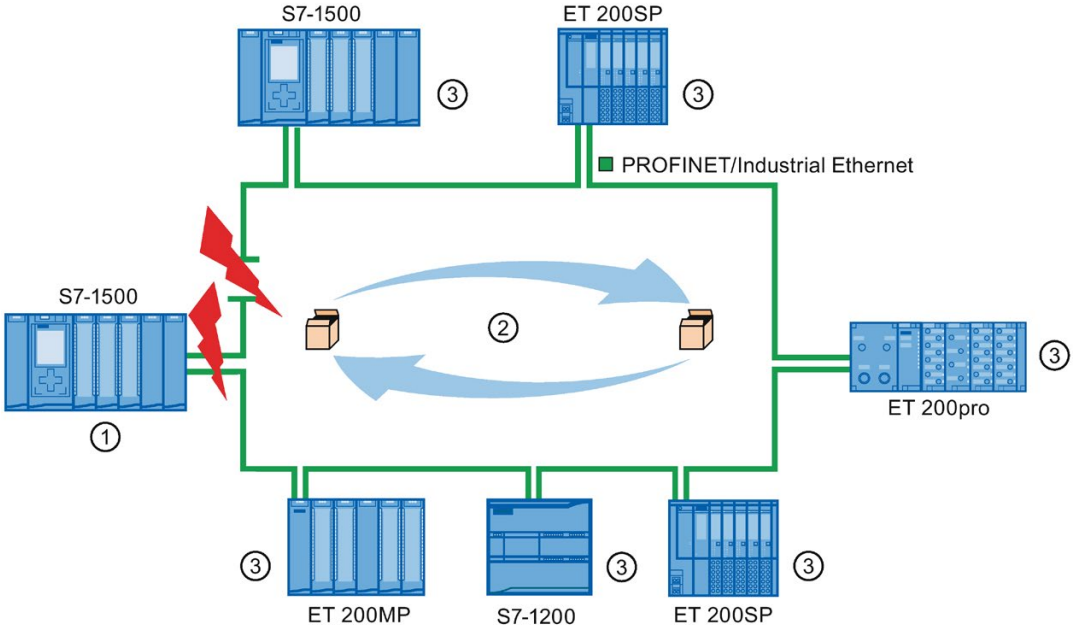
The three S7-1200 CPUs all have two PN ports which are required to support the MRP protocol and the configuration parameters used to initialize MRP client operation.

11.2.15.1 Media redundancy with ring topologies

In order to increase the network availability of an Industrial Ethernet network with optical or electrical linear bus topologies, you can convert a linear bus topology to a ring topology by joining the ends together.

Devices in a ring topology can be IO devices, IO controllers, external switches, and/or the integrated switches of communication modules.

To set up a ring topology with media redundancy, you need to bring together the two free ends of a linear bus topology in one device. Closing the linear bus topology to form a ring is achieved with two ports (ring ports) of a device in the ring. One device of the resulting ring then takes over the role of the MRP manager. All other devices in the ring are MRP clients.



① MRP manager
② Test frames
③ MRP clients

The ring ports of a device are the ports that establish the connection to the two neighboring devices in the ring topology. The ring ports are selected and set in the configuration of the relevant device (is also preset, if applicable).

How media redundancy works in a ring topology

The data paths between the individual devices are automatically reconfigured if the ring is interrupted at any point. The devices are available again after reconfiguration.

In the MRP manager, one of the two ring ports is blocked in uninterrupted network operation for normal communication so that no data frames are circulated. In terms of data transmission, the ring topology is a linear bus topology. The MRP manager monitors the ring for interruptions. It does this by sending test frames both from ring port 1 and ring port 2. The test frames run round the ring in both directions until they arrive at the other ring port of the MRP manager.

An interruption of the ring can be caused by loss of the connection between two devices or by failure of a device in the ring.

If the test frames of the MRP manager no longer arrive at the other ring port during an interruption of the ring, the MRP manager connects its two ring ports. This substitute path once again restores a functioning connection between all remaining devices in the form of a linear bus topology.

The time between the ring interruption and restoration of a functional linear topology is known as the reconfiguration time.

As soon as the interruption is eliminated, the original transmission paths are established again, the two ring ports of the MRP manager are disconnected, and the MRP clients informed of the change. The MRP clients then use the original paths again to the other devices.

Media redundancy method

The standard method of media redundancy in SIMATIC is Media Redundancy Protocol (MRP) with a typical reconfiguration time of 200 ms. Up to 50 devices can participate per ring.

11.2.15.2 Using Media Redundancy Protocol (MRP)

The "MRP" process works in conformity with Media Redundancy Protocol (MRP), which is specified in IEC 61158 Type 10 "PROFINET".

Requirements

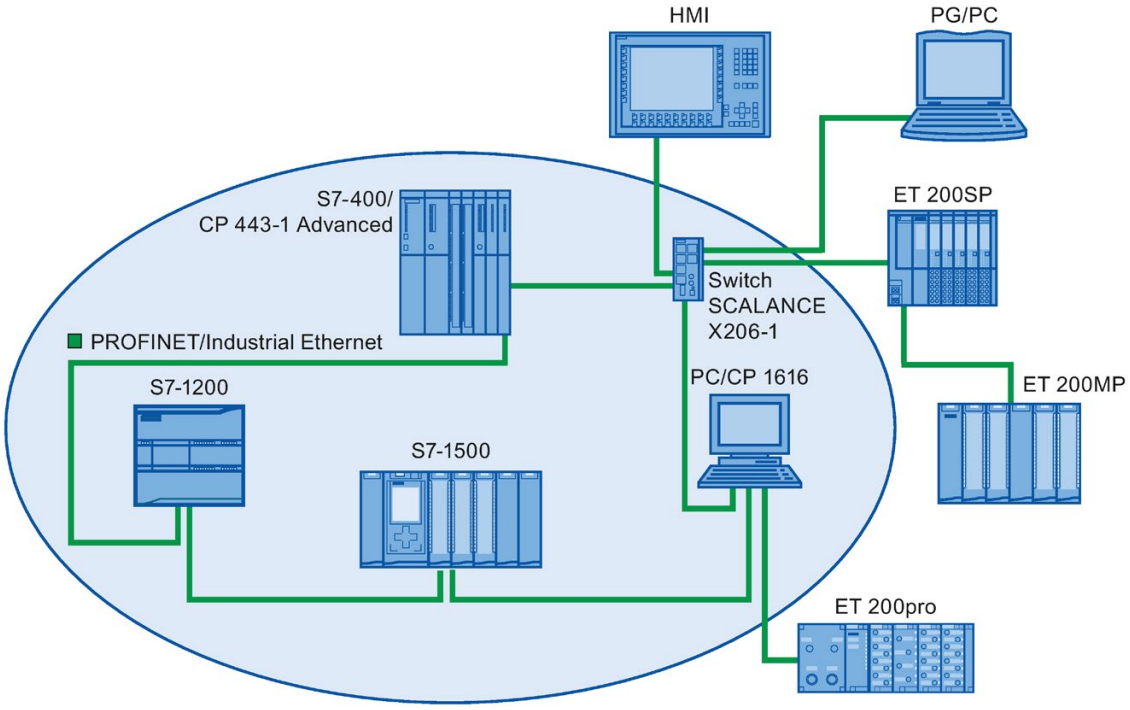
The following requirements must be met for error-free operation with MRP:

- The ring in which you want to use MRP may only consist of devices that support this function.
- "MRP" must be activated for all devices in the ring.
- All devices must be interconnected using their ring ports.
- At least one MRP manager (role "Manager (Auto)") must be available.
- The ring must contain not more than 50 devices. Otherwise, reconfiguration times of greater than or equal to 200 ms can occur.
- All partner ports within the rings must have the identical settings.

Topology

The following schematic shows a possible topology for devices in a ring with MRP. The devices inside the shaded oval are in the redundancy domain.

This is an example of a ring topology with MRP:



The following rules apply to a ring topology with media redundancy using MRP:

- All devices in the ring belong to the same redundancy domain.
- One device in the ring has the role of a MRP manager.
- All other devices in the ring are MRP clients.

You can connect non MRP-compliant devices to the network through ports not configured as ring ports. You can only do this with devices that have more than two ports (for example, a SCALANCE X switch or a PC with a CP1616).

Boundary conditions

You can have the following communication possibilities:

- MRP and RT: RT operation is possible with the use of MRP.

  Note

  The RT communication is disrupted (station failure) if the reconfiguration time of the ring is greater than the selected watchdog time of the IO device. You must select a watchdog time greater than 200 ms for your IO devices. Refer to the "Watchdog time" section below for further information.

- MRP and TCP/IP (TSEND, HTTP, ...): The TCP/IP communication with MRP is possible because lost data packages are resent, if applicable.
- MRP and prioritized startup:
  - If you configure MRP in a ring, you cannot use the "prioritized startup" function in PROFINET applications on the devices involved.
  - If you want to use the "prioritized startup" function, then you must disable MRP in the configuration (the device cannot be part of the ring).
- MRP on PROFINET devices with more than two ports: If you operate a PROFINET device with more than two ports in a ring, you should set a sync boundary on the ports that are not in the ring. By setting the sync boundary, you define a boundary for a sync domain. You cannot forward sync frames transmitted to synchronize devices within a sync domain.

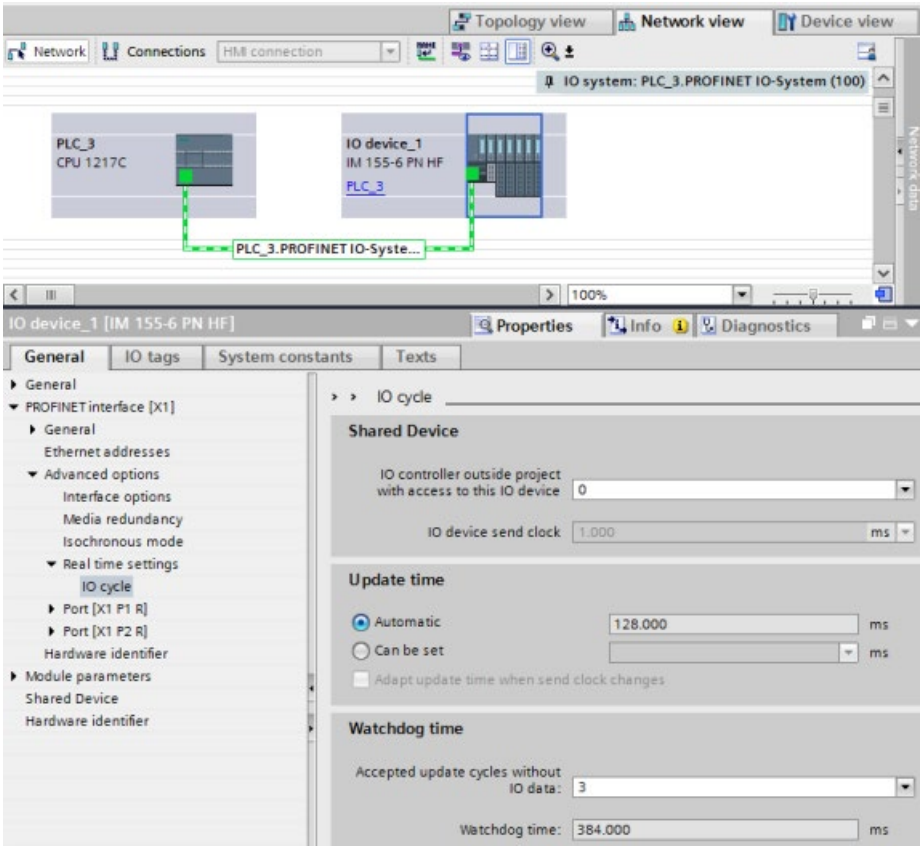
Watchdog time

The watchdog time is the time interval that an IO controller or IO device permits, without receiving IO data. If the IO device is not supplied by the IO controller with data within the watchdog time, the device detects the missing frames and outputs substitute values. This is reported in the IO controller as a station failure.

You can configure the watchdog time for PROFINET IO devices. Do not enter the watchdog time directly, but as "Accepted number of update cycles when IO data is missing". The resulting watchdog time is automatically calculated from the number of update cycles.

To assign the watchdog time, follow these steps:

1. Select the PROFINET interface of the IO device in the Network or Device view.
2. In the properties of the interface, navigate to: Advanced options > Realtime settings > IO cycle
3. Select the required number of cycles from the drop-down list.



11.2.15.3 Configuring media redundancy

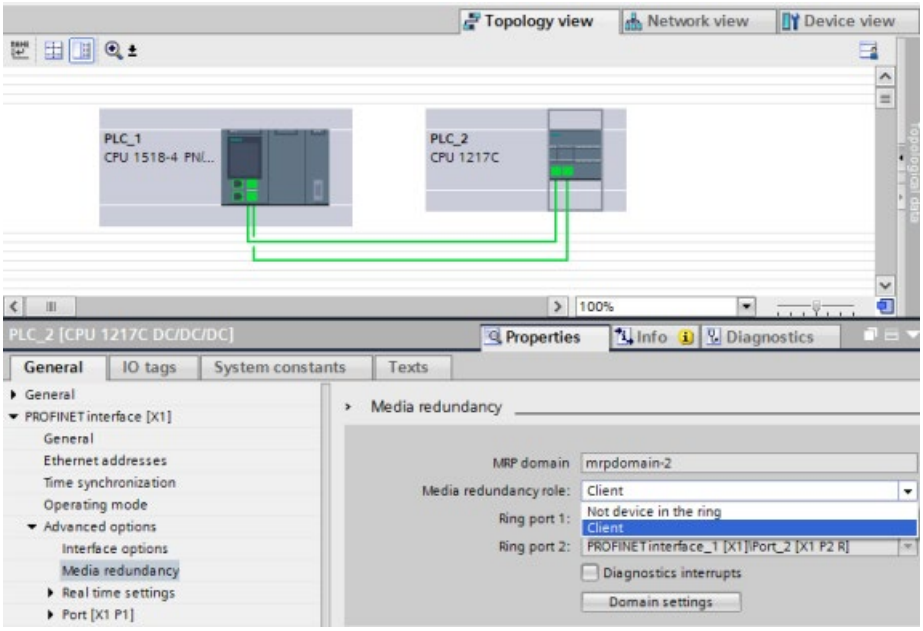
All of the components in your application must support Media Redundancy Protocol (MRP).

Procedure

To configure media redundancy, proceed as follows:

1. Establish a ring by means of appropriate port interconnections (for example, in the topology view).
2. Select a PROFINET device for which you want to configure media redundancy.

3. In the Inspector window, navigate to "PROFINET" interface [X1]">"Advanced options">"Media redundancy".



4. Under "Media redundancy role", assign the "Manager (Auto)", "Client", or "Not device in the ring" role to the device.

   When you configure a ring in the TIA Portal Topology view, the TIA Portal automatically sets the Media Redundancy role for you. If a device can be a Manager, the TIA Portal sets the Media redundancy role as "Manager (Auto)". For the S7-1200, the Media Redundancy role is automatically set to "Client".

   Note

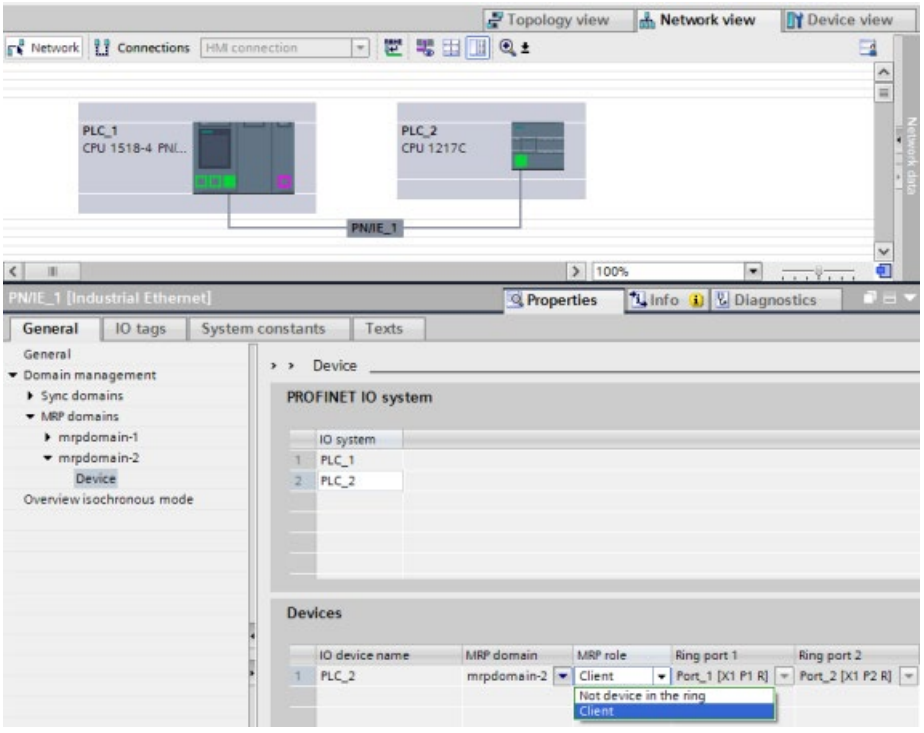
   You cannot assign the "Manager (Auto)" media redundancy role to the S7-1200 CPU.

5. Repeat steps 2 to 4 for all PROFINET devices in the ring.

Or:

1. Highlight the PROFINET IO system in the network view.
2. Click on the PROFINET IO system.

3. Navigate to the device of the required MRP domain in the inspector window.



4. For the PROFINET devices, set the "Manager (Auto)", "Client", or "Not device in the ring" role.

Note

You cannot assign the "Manager (Auto)" MRP role to the S7-1200 CPU.

"Media redundancy" setting option: MRP role

Depending on the device used, the roles "Manager", "Manager (Auto)", "Client", and "Not device in the ring" are available.

Rules:

- A ring can have only one device with the role of "Manager". No additional devices with the role of "Manager" or "Manager (Auto)" are permissible. All other devices in the ring can only have the role of "Client". Devices not in the ring can have the role "Not device in the ring".
- If a ring has no device with the "Manager" role, the ring must at least have one device with the role "Manager (Auto)". A ring can have any number of devices with the roles "Client" and "Manager (Auto)".

Note

You cannot assign the "Manager" or "Manager (Auto)" MRP roles to the S7-1200 CPU.

"Media redundancy" setting option: Ring port 1 and Ring port 2

Select one at a time those ports you want to configure as ring port 1 or ring port 2. The drop-down list box shows the selection of possible ports for each device type. If the ports are set at the factory, then the fields are unavailable.

Note

Ring port configuration is not necessary in the S7-1200 because the S7-1200 CPU has only two ports.

Diagnostic interrupts

If diagnostic interrupts to the MRP state are to be output in the local CPU, select the "Diagnostic interrupts" check box. The following diagnostic interrupts can be configured:

- Wiring or port error:

  The CPU generates diagnostic interrupts for the following errors in the ring ports:

  – A neighbor of the ring port does not support MRP.

  – A ring port is connected to a non-ring port.

  – A ring port is connected to the ring port of another MRP domain.

- Interruption / return (MRP manager only):

  If the ring is interrupted and the original configuration is returned, the CPU generates diagnostic interrupts. If both of these interrupts occur within 0.2 seconds, this indicates an interruption of the ring.

You can respond to these events in the user program by programming the appropriate response in the diagnostic error interrupt OB (OB 82).

Note

Third-party devices as MRP manager

To assure error-free operation when a third party device is used as MRP manager in a ring, you must assign the fixed role of "Client" to all other devices in the ring before you close the ring. Otherwise, circulating data frames and network failure could occur.

11.2.16 S7 routing

From the STEP 7 Network view, you can create a complex communication topology by connecting devices in different S7 subnets. You can connect classic CPUs and CPs as well as the latest S7 CPUs and CPs and can include HMIs and PC stations such as an OPC server.

Once you decide which devices must communicate and establish the necessary connections using STEP 7, the Engineering System (ES) can download the corresponding routing tables to the various S7 routers as part of the hardware configuration. After you download the routing tables to the various S7 routers, the ES or other communication partners can communicate with each device even though the devices are on different S7 subnets. This is possible because the CPUs and/or CPs, in between, act as S7 routers. The CPUs and/or CPs forward incoming connection requests to the next S7 router until the connection request reaches the targeted device, and the devices establish the S7 connection.

The CPU uses the write record mechanism to transfer the routing tables required by the CP devices in the local base. The routing tables establish the route from one device to another at the time of a connection request, which includes a remote S7 Subnet_ID. The device receiving the connection request interrogates its routing table, finds the next station in the path to the target S7 subnet, and forwards the connection request. Eventually, the connection request reaches the intended target and the response traverses the route in the reverse direction.

The S7-1200 CPUs have a single PN interface and up to three CP devices connected to the local communication bus. Therefore, you have two options for routing within the S7-1200 station:

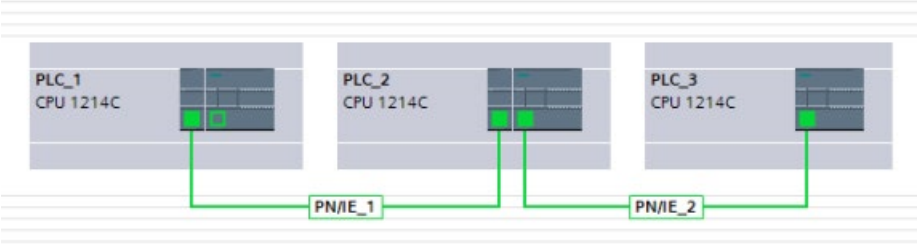
- Routing between the CPU and a CP
- Routing from one CP to another CP

Refer to S7-1200 CPs at Siemens Industry Online Support, Product Support for further information on all S7-1200 CPs that support the S7 routing function. The CP 1243-1 (https://support.industry.siemens.com/cs/us/en/view/584459) is shown as an example CP module search for S7 routing capabilities.

11.2.16.1 S7 routing between CPU and CP interfaces

Since the S7-1200 CPUs are limited to a single PN interface, a stand-alone CPU cannot serve the function of a router. You can never connect a stand-alone CPU to more than one S7 subnet at a time. When you install CP modules in the local base of the CPU, you can connect to multiple S7 subnets and utilize routing.

In the example system below, in order for PLC_1 to communicate with PLC_3, the Engineering System (ES) must rout messages through PLC_2. The ES must download the routing table for PLC_2, and PLC_2 must provide the routing table for the CP module in its local base. With these routing tables in place, PLC_1 and PLC_3 can communicate with each other, even though not directly connected.

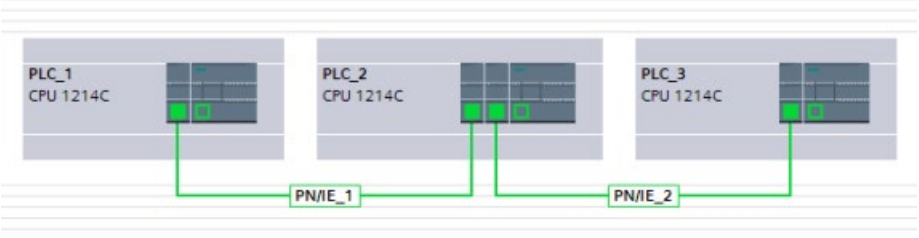


In order to check routing from either S7 subnet to the other S7 subnet, PLC_1 must establish a transport connection to PLC_3, and PLC_3 must establish a connection to PLC_1. Doing so, makes sure that routing from the PLC's PN/IE interface to a CP module is possible as well as routing from a CP module to the PLC's PN/IE interface.

11.2.16.2 S7 routing between two CP interfaces

Since the S7-1200 CPUs support up to three CP modules, you can connect all three modules to different S7 subnets. When you install at least two CP modules in the local base of the CPU and connect to different S7 subnets, you can utilize routing.

In the example system below, in order for PLC_1 to communicate with PLC_3, the Engineering System (ES) must rout messages by PLC_2 from the CP module to the CP module in its local base. The ES must download the routing table for PLC_2, and PLC_2 must provide the routing table for the two CP modules. With these routing tables in place, PLC_1 and PLC_3 can communicate with each other, even though not directly connected. Also, you should note that routing takes place from CP module to CP module without messages being sent over the PN/IE interface of PLC_2.



11.2.17 Disabling SNMP

Simple Network Management Protocol (SNMP) is an Internet-standard protocol for collecting and organizing information about managed devices on IP networks and for modifying that information to change device behavior. Devices that typically support SNMP include routers, switches, servers, workstations, printers, modem racks, and more.

SNMP is widely used in network management systems to monitor network-attached devices for conditions that warrant administrative attention. SNMP uses various services and tools for detection and diagnostics of the network topology. Information about the properties of devices capable of SNMP is contained in Management Information Base (MIB) files for which the user needs to have the appropriate rights. SNMP exposes management data in the form of variables on the managed systems, which describe the system configuration. These variables can then be queried (and sometimes set) by managing applications.

SNMP uses the UDP transport protocol and has two network components:

- SNMP manager: Monitors the network nodes
- SNMP client: Collects the various network-specific information in the individual network nodes and stores it in a structured form in the Management Information Base (MIB). With this data, detailed network diagnostics can be performed.

Under certain conditions, your application may require you to disable SNMP. Examples of these conditions include the following:

- The security settings in your network do not allow the use of SNMP.
- You use your own SNMP solution (for example, with your own communications instructions).

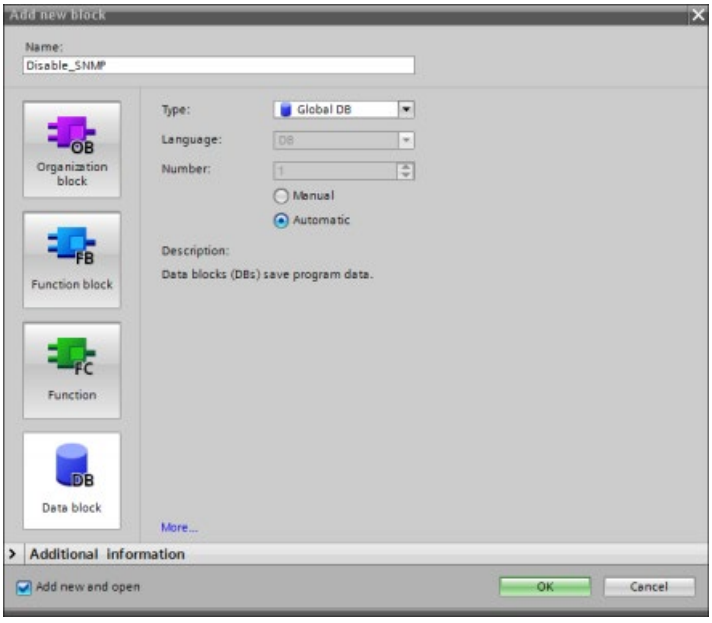
If you disable SNMP for a device, you no longer have some options for diagnostics of the network topology (for example, using the PRONETA tool or the web server of the CPU).

11.2.17.1 Disabling SNMP

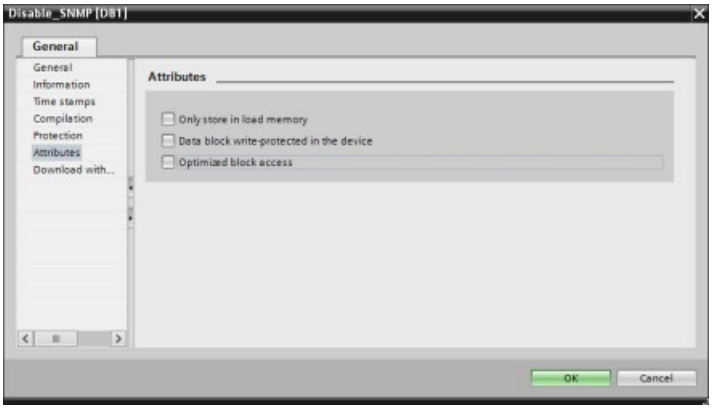
Disabling SNMP

Follow these steps to disable SNMP in the S7-1200 CPU:

1. Create a classic data block (DB):



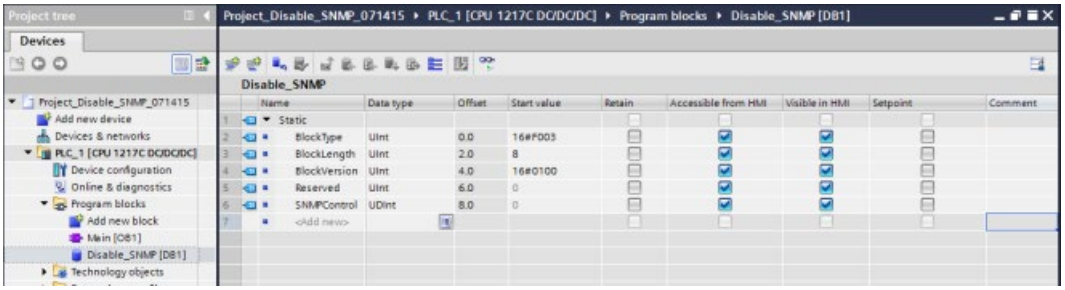
2. Select the Properties of the newly-created DB.
3. Select the Attributes tab. Deselect the check box for "Optimized block access":



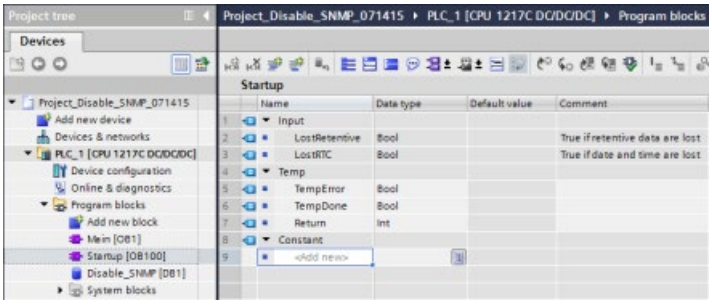
4. Click the OK button.

   A message displays advising you to recompile your program. Recompile your program at this time.

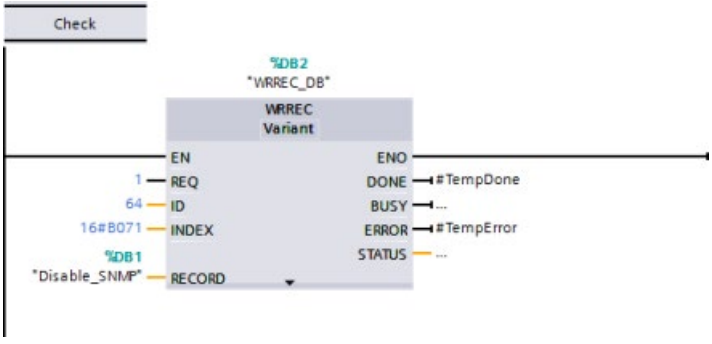
5. In the classic DB block interface, create the following static tags with the values shown. You will use these tags in your program to disable the internal SNMP implementation:



6. In the Startup OB (OB100), add the Temporary variables as shown:



7. Using the LAD editor, in the Startup OB (OB100), in Network 1, insert a Label (Jump label) (in the example below, the Label is named "Check") and a WRREC (Write Record) instruction with the inputs and outputs shown:



8. Insert the following loop and check code with the Jump to Label (JMP) output. This code ensures that the call completes and that you disable SNMP before leaving the Startup OB:



11.2.18 Diagnostics

Refer to "Organization blocks (OBs)" (Page 92) for information on how to use organization blocks (OBs) for diagnostics with these communication networks.

11.2.19 Distributed I/O instructions

Refer to "Distributed I/O (PROFINET, PROFIBUS, or AS-i)" (Page 374) for information on how to use the distributed I/O instructions with these communication networks.

11.2.20 Diagnostic instructions

Refer to the "Diagnostics (PROFINET or PROFIBUS)": "Diagnostics instructions" (Page 427) for information on how to use these instructions with these communication networks.

11.2.21 Diagnostic events for distributed I/O

Refer to the "Diagnostics (PROFINET or PROFIBUS)": "Diagnostics events for distributed I/O" (Page 472) for information on how to use this diagnostic information with these communication networks.

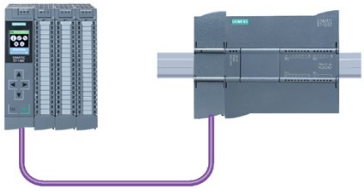
11.3 PROFIBUS

A PROFIBUS system uses a bus master to poll slave devices distributed in a multi-drop fashion on an RS485 serial bus. A PROFIBUS slave is any peripheral device (I/O transducer, valve, motor drive, or other measuring device) which processes information and sends its output to the master. The slave forms a passive station on the network since it does not have bus access rights, and can only acknowledge received messages, or send response messages to the master upon request. All PROFIBUS slaves have the same priority, and all network communication originates from the master.

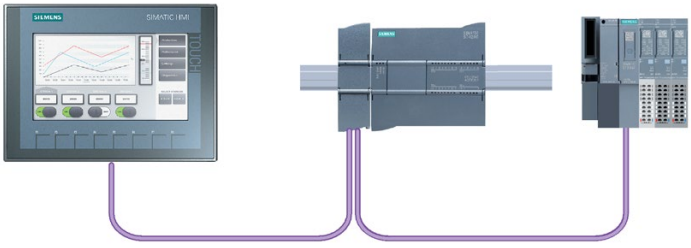
A PROFIBUS master forms an "active station" on the network. PROFIBUS DP defines two classes of masters. A class 1 master (normally a central programmable controller (PLC) or a PC running special software) handles the normal communication or exchange of data with the slaves assigned to it. A class 2 master (usually a configuration device, such as a laptop or programming console used for commissioning, maintenance, or diagnostics purposes) is a special device primarily used for commissioning slaves and for diagnostic purposes.

The S7-1200 is connected to a PROFIBUS network as a DP slave with the CM 1242-5 communication module. The CM 1242-5 (DP slave) module can be the communications partner of DP V0/V1 masters. If you want to configure the module in a third-party system, there is a GSD file available for the CM 1242-5 (DP slave) on the CD that ships with the module and on Siemens Automation Customer Support (https://support.industry.siemens.com/cs/ww/en/ps/6GK7242-5DX30-0XE0) pages on the Internet.

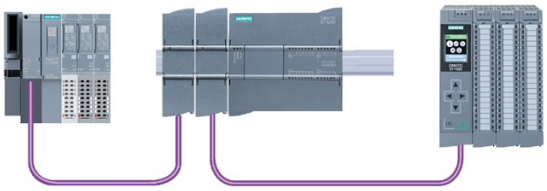
In the figure below, the S7-1200 is a DP slave to an S7-300 controller:



The S7-1200 is connected to a PROFIBUS network as a DP master with the CM 1243-5 communication module. The CM 1243-5 (DP master) module can be the communications partner of DP V0/V1 slaves. In the figure below, the S7-1200 is a master controlling an ET 200SP DP slave:



If a CM 1242-5 and a CM 1243-5 are installed together, an S7-1200 can perform as both a slave of a higher-level DP master system and a master of a lower-level DP slave system, simultaneously:



As of V3.0, you can configure a maximum of three PROFIBUS CMs per station, in which there can be any combination of DP master or DP slave CMs. DP masters in a V3.0 or greater CPU firmware implementation can each control a maximum of 32 slaves.

The configuration data of the PROFIBUS CMs is stored on the local CPU. This allows simple replacement of these communications modules when necessary.

To use PROFIBUS with S7-1200 V4.0 or later CPUs, you must upgrade the PROFIBUS Master CM firmware to at least V1.3.

Note

Always update the PROFIBUS CM firmware to the latest version available (http://support.automation.siemens.com/WW/view/en/42131407). You can perform a firmware update by any of these methods:

- Using the online and diagnostic tools of STEP 7 (Page 1304)
- Using a SIMATIC memory card (Page 144)
- Using the Web server "Module Information" standard Web page (Page 1002)
- Using the SIMATIC Automation Tool (https://support.industry.siemens.com/cs/ww/en/view/98161300)

11.3.1 Communications services of the PROFIBUS CMs

The PROFIBUS CMs use the PROFIBUS DP-V1 protocol.

Types of communication with DP-V1

The following types of communication are available with DP-V1:

- Cyclic communication (CM 1242-5 and CM 1243-5)

  Both PROFIBUS modules support cyclic communication for the transfer of process data between DP slave and DP master.

  Cyclic communication is handled by the operating system of the CPU. No software blocks are required for this. The I/O data is read or written directly from/to the process image of the CPU.

- Acyclic communication (CM 1243-5 only)

  The DP master module also supports acyclic communication using software blocks:

  – The "RALRM" instruction is available for interrupt handling.

  – The "RDREC" and "WRREC" instructions are available for transferring configuration and diagnostics data.

Functions not supported by the CM 1243-5: SYNC/FREEZE and Get_Master_Diag

Other communications services of the CM 1243-5

The CM 1243-5 DP master module supports the following additional communications services:

- S7 communication

  – PUT/GET services

    The DP master functions as a client and server for queries from other S7 controllers or PCs via PROFIBUS.

  – PG/OP communication

    The PG functions allow the downloading of configuration data and user programs from a PG and the transfer of diagnostics data to a PG.

    Possible communications partners for OP communication are HMI panels, SIMATIC panel PCs with WinCC flexible or SCADA systems that support S7 communication.

11.3.2 Reference to the PROFIBUS CM user manuals

Further information

You can find detailed information on the PROFIBUS CMs in the manuals for the devices. You can find these on the Internet in the pages of Siemens Industrial Automation Customer Support under the following entry IDs:

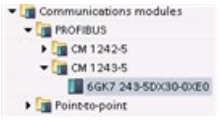
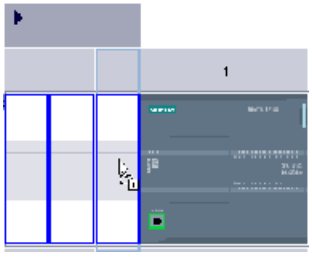
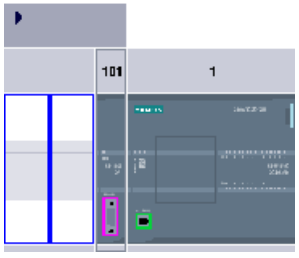
- CM 1242-5 (https://support.industry.siemens.com/cs/ww/en/ps/15667)
- CM 1243-5 (https://support.industry.siemens.com/cs/ww/en/ps/15669)

11.3.3 Configuring a DP master and slave device

11.3.3.1 Adding the CM 1243-5 (DP master) module and a DP slave

In the "Devices and networks" portal, use the hardware catalog to add PROFIBUS modules to the CPU. These modules are connected to the left side of the CPU. To insert a module into the hardware configuration, select the module in the hardware catalog and either double-click or drag the module to the highlighted slot.

Table 11- 54 Adding a PROFIBUS CM 1243-5 (DP master) module to the device configuration

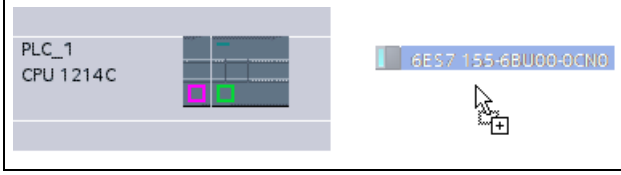
Module	Select the module	Insert the module	Result
CM 1243-5 (DP master)			

Use the hardware catalog to add DP slaves as well. For example, to add an ET 200SP DP slave, in the Hardware Catalog, expand the following containers:

- Distributed I/O
- ET 200SP
- Interface modules
- PROFIBUS

Next, select "6ES7 155-6BU00-0CN0" (IM155-6 DP HF) from the list of part numbers, and add the ET 200SP DP slave as shown in the figure below.

Table 11- 55 Adding an ET 200SP DP slave to the device configuration

Insert the DP slave	Result
	

11.3.3.2 Configuring logical network connections between two PROFIBUS devices

After you configure the CM 1243-5 (DP master) module, you are now ready to configure your network connections.

In the Devices and Networks portal, use the "Network view" to create the network connections between the devices in your project. To create the PROFIBUS connection, select the purple (PROFIBUS) box on the first device. Drag a line to the PROFIBUS box on the second device. Release the mouse button and your PROFIBUS connection is joined.

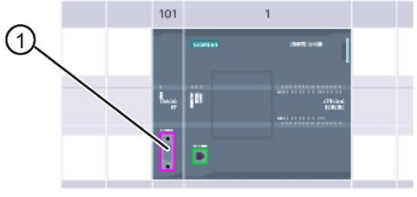
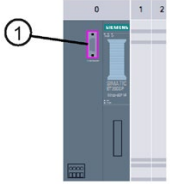
Refer to "Device Configuration: Creating a network connection" (Page 787) for more information.

11.3.3.3 Assigning PROFIBUS addresses to the CM 1243-5 module and DP slave

Configuring the PROFIBUS interface

After you configure logical network connections between two PROFIBUS devices, you can configure parameters for the PROFIBUS interfaces. To do so, click the purple PROFIBUS box on the CM 1243-5 module, and the "Properties" tab in the inspector window displays the PROFIBUS interface. The DP slave PROFIBUS interface is configured in the same manner.

Table 11- 56 Configuring the CM 1243-5 (DP master) module and ET 200SP DP slave PROFIBUS interfaces

CM 1243-5 (DP master) module	ET 200SP DP slave
	

① PROFIBUS port

Assigning the PROFIBUS address

In a PROFIBUS network, each device is assigned a PROFIBUS address. This address can range from 0 through 127, with the following exceptions:

- Address 0: Reserved for network configuration and/or programming tools attached to the bus
- Address 1: Reserved by Siemens for the first master
- Address 126: Reserved for devices from the factory that do not have a switch setting and must be re-addressed through the network
- Address 127: Reserved for broadcast messages to all devices on the network and may not be assigned to operational devices

Thus, the addresses that may be used for PROFIBUS operational devices are 2 through 125.

In the Properties window, select the "PROFIBUS address" configuration entry. STEP 7 displays the PROFIBUS address configuration dialog, which is used to assign the PROFIBUS address of the device.

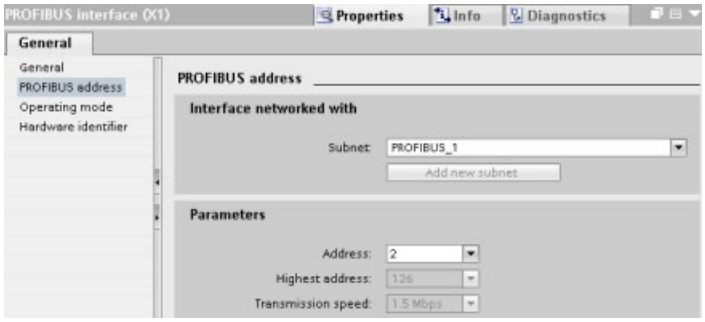


Table 11- 57 Parameters for the PROFIBUS address

Parameter		Description
Subnet	Name of the Subnet to which the device is connected. Click the "Add new subnet" button to create a new subnet. "Not connected" is the default. Two connection types are possible: • The "Not connected" default provides a local connection. • A subnet is required when your network has two or more devices.	
Parameters	Address	Assigned PROFIBUS address for the device
	Highest address	The highest PROFIBUS address is based on the active stations on the PROFIBUS (for example, DP master). Passive DP slaves independently have PROFIBUS addresses from 1 to 125 even if the highest PROFIBUS address is set to 15, for example. The highest PROFIBUS address is relevant for token forwarding (forwarding of the send rights), and the token is only forwarded to active stations. Specifying the highest PROFIBUS address optimizes the bus.
	Transmission rate	Transmission rate of the configured PROFIBUS network: The PROFIBUS transmission rates range from 9.6 Kbits/sec to 12 Mbits/sec. The transmission rate setting depends on the properties of the PROFIBUS nodes being used. The transmission rate should not be greater than the rate supported by the slowest node. The transmission rate is normally set for the master on the PROFIBUS network, with all DP slaves automatically using that same transmission rate (auto-baud).

11.3.4 Distributed I/O instructions

Refer to "Distributed I/O (PROFINET, PROFIBUS, or AS-i)" (Page 374) for information on how to use the distributed I/O instructions with these communication networks.

11.3.5 Diagnostic instructions

Refer to the "Diagnostics (PROFINET or PROFIBUS)": "Diagnostics instructions" (Page 427) for information on how to use these instructions with these communication networks.

11.3.6 Diagnostic events for distributed

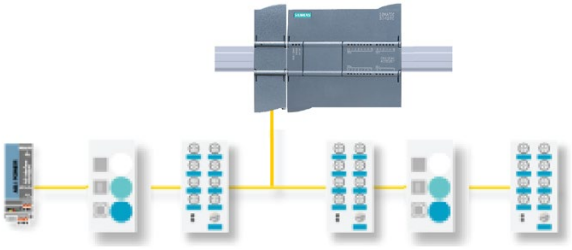
Refer to the "Diagnostics (PROFINET or PROFIBUS)": "Diagnostics events for distributed I/O" (Page 472) for information on how to use this diagnostic information with these communication networks.

11.4 AS-i

The S7-1200 AS-i master CM 1243-2 allows the attachment of an AS-i network to an S7-1200 CPU.

The actuator/sensor interface, or AS-i, is a single master network connection system for the lowest level in automation systems. The CM 1243-2 serves as the AS-i master for the network. Using a single AS-i cable, sensors and actuators (AS-i slave devices) can be connected to the CPU through the CM 1243-2. The CM 1243-2 handles all AS-i network coordination and relays data and status information from the actuators and sensors to the CPU through the I/O addresses assigned to the CM 1243-2. You can access binary or analog values depending on the slave type. The AS-i slaves are the input and output channels of the AS-i system and are only active when called by the CM 1243-2.

In the figure below, the S7-1200 is an AS-i master controlling AS-i I/O module digital/analog slave devices.



To use AS-i with S7-1200 V4.0 CPUs, you must upgrade the AS-i Master CM firmware to V1.1.

You can make this upgrade using the webserver or a SIMATIC memory card.

Note

For V4.0 S7-1200 CPUs, if using the web server or a SIMATIC memory card to upgrade from V1.0 to V1.1 AS-i firmware, you must update the AS-i firmware in the AS-i Master CM 1243-2 according to the following procedure:

1. Download the firmware upgrade to the AS-i Master CM 1243-2.
2. When the download is complete, power cycle the S7-1200 CPU to complete the firmware upgrade process in the AS-i Master CM 1243-2.
3. Repeat steps 1 and 2 for each additional AS-i Master CM 1243-2. The S7-1200 PLC allows a maximum of three AS-i Master CM 1243-2.

Note

It is recommended that you always update the AS-i CM firmware to the latest version available (http://support.automation.siemens.com/WW/view/en/43416171)at the Siemens Service and Support web site.

11.4.1 Configuring an AS-i master and slave device

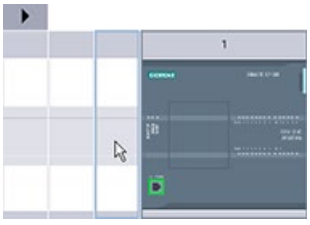
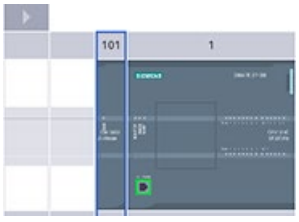
The AS-i master CM 1243-2 is integrated into the S7-1200 automation system as a communication module.

You can find detailed information on the AS-i master CM 1243-2 in the "AS-i master CM 1243-2 and AS-i data decoupling unit DCM 1271 for SIMATIC S7-1200" Manual (https://support.industry.siemens.com/cs/ww/en/ps/15750/man).

11.4.1.1 Adding the AS-i master CM 1243-2 and AS-i slave

Use the hardware catalog to add AS-i master CM1243-2 modules to the CPU. These modules are connected to the left side of the CPU, and a maximum of three AS-i master CM1243-2 modules can be used. To insert a module into the hardware configuration, select the module in the hardware catalog and either double-click or drag the module to the highlighted slot.

Table 11- 58 Adding an AS-i master CM1243-2 module to the device configuration

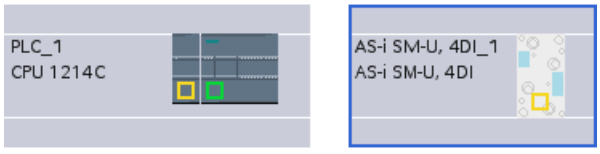
Module	Select the module	Insert the module	Result
CM 1243-2 AS-i Mas-ter			

Use the hardware catalog to add AS-i slaves as well. For example, to add an "I/O module, compact, digital, input" slave, in the Hardware Catalog, expand the following containers:

- Field devices
- AS-Interface slaves

Next, select "3RG9 001-0AA00" (AS-i SM-U, 4DI) from the list of part numbers, and add the "I/O module, compact, digital, input" slave as shown in the figure below.

Table 11- 59 Adding an AS-i slave to the device configuration

Insert the AS-i slave	Result
	

11.4.1.2 Configuring logical network connections between two AS-i devices

After you configure the AS-i master CM1243-2, you are now ready to configure your network connections.

In the Devices and Networks portal, use the "Network view" to create the network connections between the devices in your project. To create the AS-i connection, select the yellow (AS-i) box on the first device. Drag a line to the AS-i box on the second device. Release the mouse button and your AS-i connection is joined.

Refer to "Device Configuration: Creating a network connection" (Page 787) for more information.

11.4.1.3 Configuring the properties of the AS-i master CM1243-2

To configure parameters for the AS-i interface, click the yellow AS-i box on the AS-i master CM1243-2 module, and the "Properties" tab in the inspector window displays the AS-i interface.

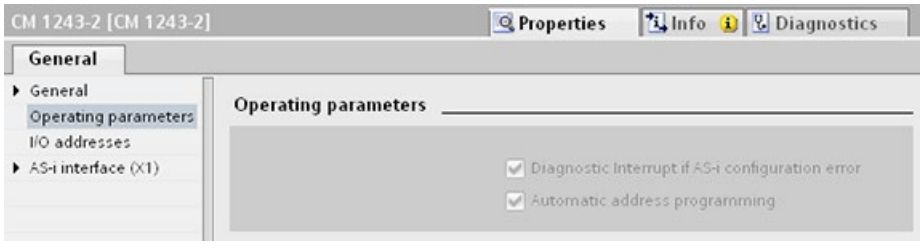
In the STEP 7 inspector window, you can view, configure, and change general information, addresses and operating parameters:

Table 11- 60 AS-i master CM1243-2 module properties

Property	Description
General	Name of the AS-i master CM 1243-2
Operating parameters	Parameters for the response of the AS-i master
I/O addresses	Address area for the slave I/O addresses
AS-i interface (X1)	Assigned AS-i network

Note

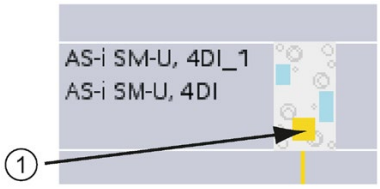
"Diagnostic interrupt for faults in the AS-i configuration" and "Automatic address programming" are always active and are therefore shown in gray.



11.4.1.4 Assigning an AS-i address to an AS-i slave

Configuring the AS-i slave interface

To configure parameters for the AS-i interface, click the yellow AS-i box on the AS-i slave, and the "Properties" tab in the inspector window displays the AS-i interface.



① AS-i port

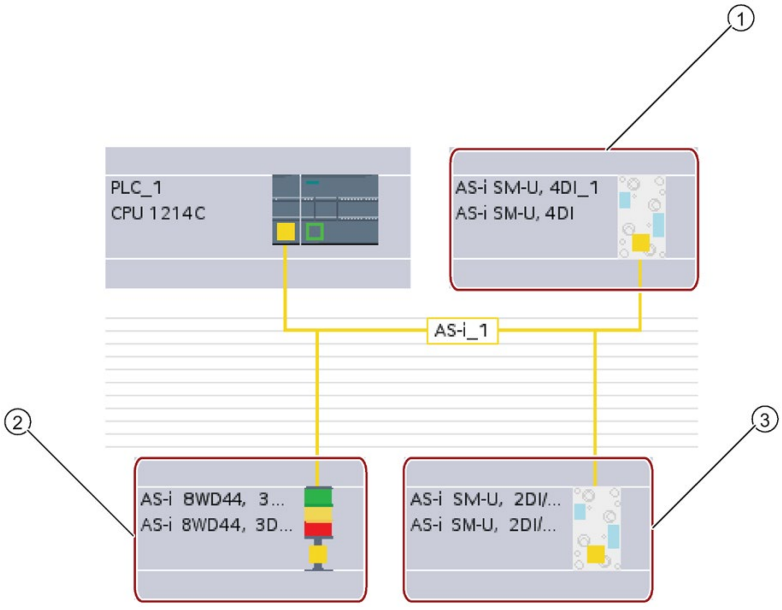
Assigning the AS-i slave address

In an AS-i network, each device is assigned an AS-i slave address. This address can range from 0 through 31; however, address 0 is reserved only for new slave devices. The slave addresses are 1(A or B) to 31(A or B) for a total of up to 62 slave devices.

"Standard" AS-i devices use the entire address, having a number address without the A or B designation. "A/B node" AS-i devices use the A or B portion of each address, enabling each of the 31 addresses to be used twice. The address space range is 1A to 31A plus 1B to 31B.

Any address in the range of 1 - 31 can be assigned to an AS-i slave device; in other words, it does not matter whether the slaves begin with address 21 or whether the first slave is actually given the address 1.

In the example below, three AS-i devices have been addressed as "1" (a standard type device), "2A" (an A/B node type device), and "3" (a standard type device):



① AS-i slave address 1; Device: AS-i SM-U, 4DI; article number: 3RG9 001-0AA00
② AS-i slave address 2A; Device: AS-i 8WD44, 3DO, A/B; article number: 8WD4 428-0BD
③ AS-i slave address 3; Device: AS-i SM-U, 2DI/2DO; article number: 3RG9 001-0AC00

Enter the AS-i slave address here:

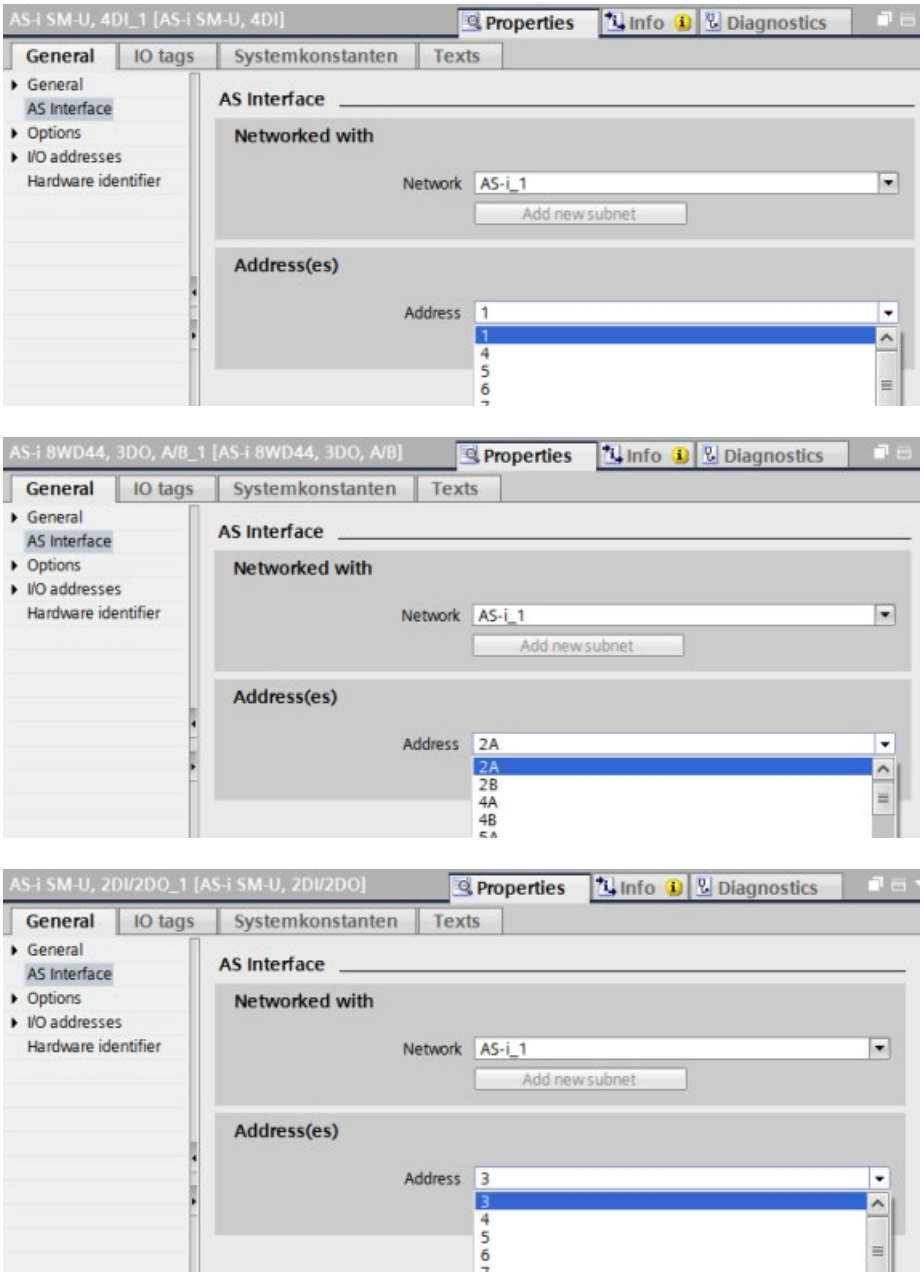


Table 11- 61 Parameters for the AS-i interface

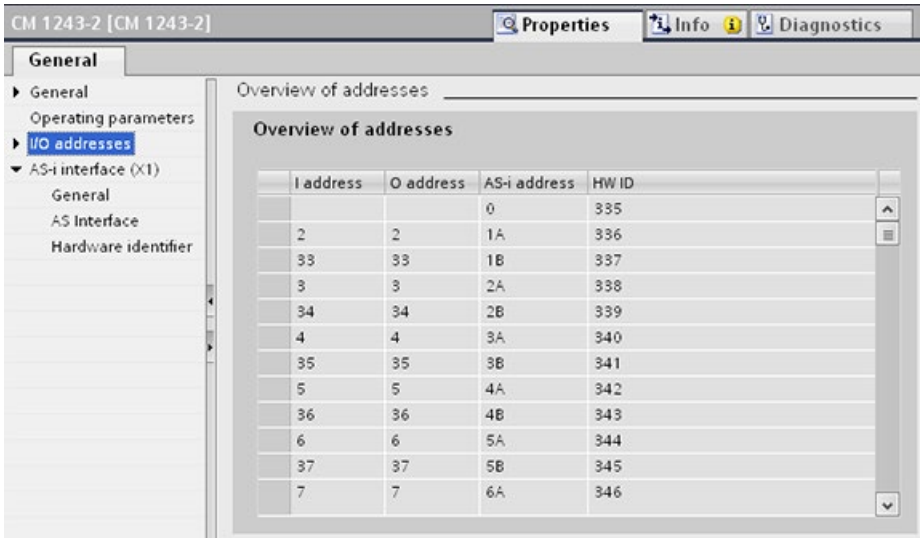
Parameter	Description
Network	Name of the network to which the device is connected
Address(es)	Assigned AS-i address for the slave device in range of 1(A or B) to 31(A or B) for a total of up to 62 slave devices

11.4.2 Exchanging data between the user program and AS-i slaves

11.4.2.1 STEP 7 basic configuration

The AS-i master reserves a 62-byte data area in the I/O area of the CPU. Access to the digital data is performed here in bytes; for each slave, there is one byte of input and one byte of output data.

The assignment of the AS-i connections of the AS-i digital slaves to the data bits of the assigned byte is indicated in the inspection window of the AS-i master CM 1243-2.



You can access the data of the AS-i slaves in the user program by using the displayed I/O addresses with the appropriate bit logic operations (for example, "AND") or bit assignments.

Note

"System assignment" is automatically activated if you do not configure the AS-i slaves with STEP 7.

If you do not configure any slaves, you must inform the AS-i master CM1243-2 about the actual bus configuration using the online function "ACTUAL > EXPECTED".

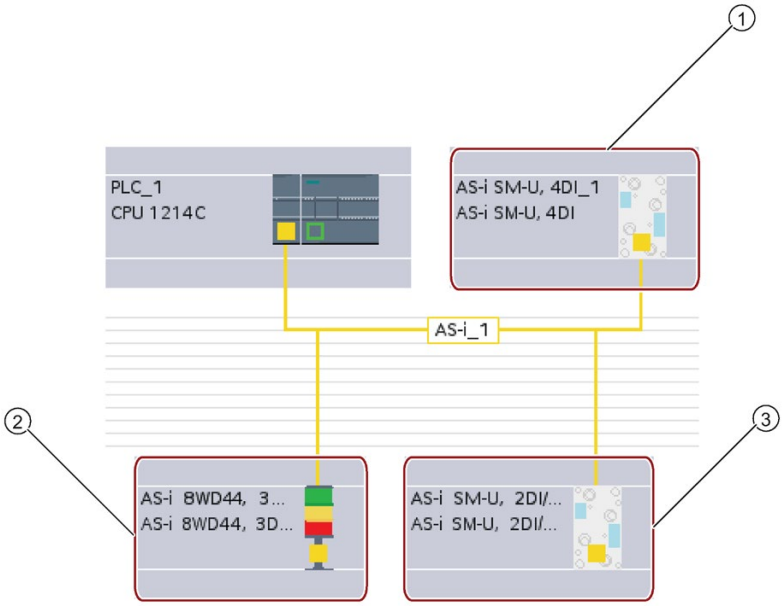
Further information

You can find detailed information on the AS-i master CM 1243-2 in the "AS-i master CM 1243-2 and AS-i data decoupling unit DCM 1271 for SIMATIC S7-1200" Manual (https://support.industry.siemens.com/cs/ww/en/ps/15750/man).

11.4.2.2 Configuring slaves with STEP 7

Transferring AS-i digital values

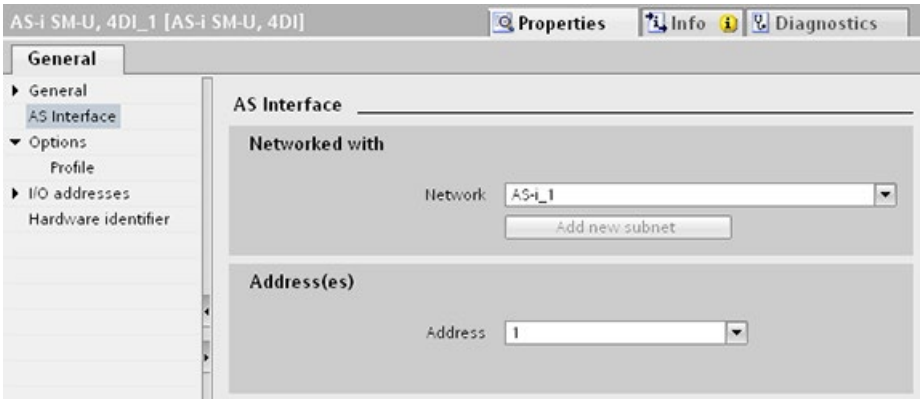
The CPU accesses the digital inputs and outputs of the AS-i slaves through the AS-i master CM1243-2 in cyclic operation. The data is accessed through I/O addresses or by means of a data record transfer.



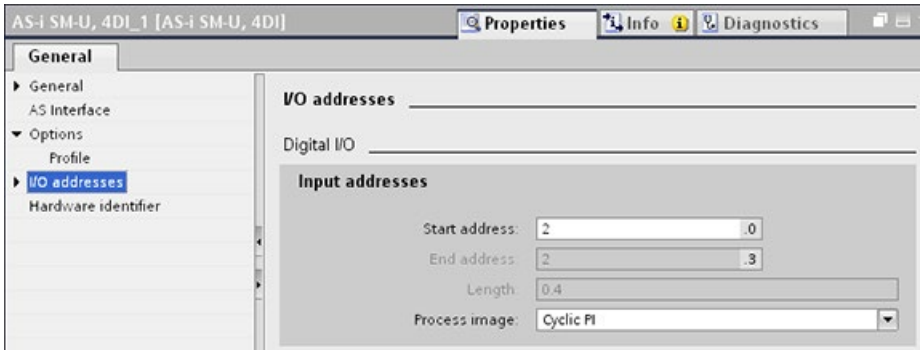
① AS-i slave address 1
② AS-i slave address 2A
③ AS-i slave address 3

Access to the digital data is performed here in bytes (in other words, one byte is assigned to each AS-i digital slave). When you configure the AS-i slaves in STEP 7, the I/O address for accessing the data from the user program is displayed in the inspection window for the respective AS-i slave.

The digital input module (AS-i SM-U, 4DI) in the AS-i network above has been assigned slave address 1. By clicking on the digital input module, the "AS interface" tab in the device "Properties" displays the slave address, as shown below:

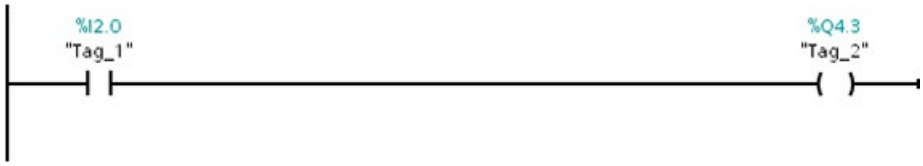


The digital input module (AS-i SM-U, 4DI) in the AS-i network above has been assigned I/O address 2. By clicking on the digital input module, the "I/O addresses" tab in the device "Properties" displays the I/O address, as shown below:



You can access the data of the AS-i slaves in the user program by using their I/O addresses with the appropriate bit logic operations (for example, "AND") or bit assignments. The following simple program illustrates how the assignment works:

Input 2.0 is polled in this program. In the AS-i system, this input belongs to slave1 (Input byte 2, bit 0). Output 4.3, which is then set, corresponds to AS-i slave 3 (Output byte 4, bit 3)



Transferring AS-i analog values

You can access analog data of an AS-i slave through the process image of the CPU if you have configured this AS-i slave in STEP 7 as an analog slave.

If you did not configure the analog slave in STEP 7, you can only access the data of the AS-i slave through the acyclic functions (data record interface). In the user program of the CPU, AS-i calls are read and written using the RDREC (read data record) and WRREC (write data record) distributed I/O instructions.

Note

A configuration of the AS-i slaves specified through STEP 7 and downloaded into the S7 station is transferred by the CPU on the AS-i master CM1243-2 during S7 station start-up. Any existing configuration that was determined through the "System assignment" online function (Page 960) ("ACTUAL -> EXPECTED") will be overwritten.

Further information

You can find detailed information on the AS-i master CM 1243-2 in the "AS-i master CM 1243-2 and AS-i data decoupling unit DCM 1271 for SIMATIC S7-1200" Manual (http://support.automation.siemens.com/WW/view/en/50414115/133300).

11.4.3 Distributed I/O instructions

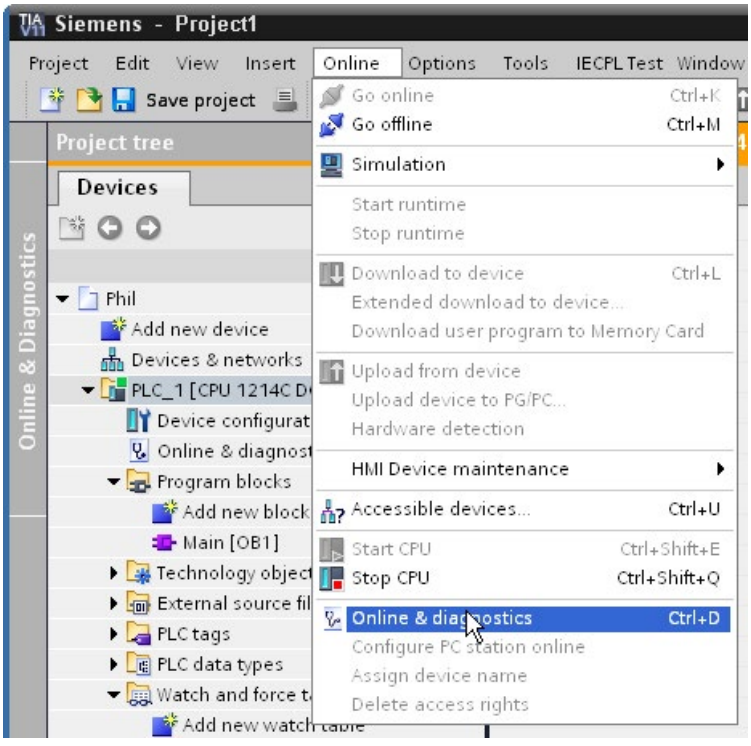
Refer to "Distributed I/O (PROFINET, PROFIBUS, or AS-i)" (Page 374) for information on how to use the distributed I/O instructions with these communication networks.

11.4.4 Working with AS-i online tools

Changing AS-i operational modes online

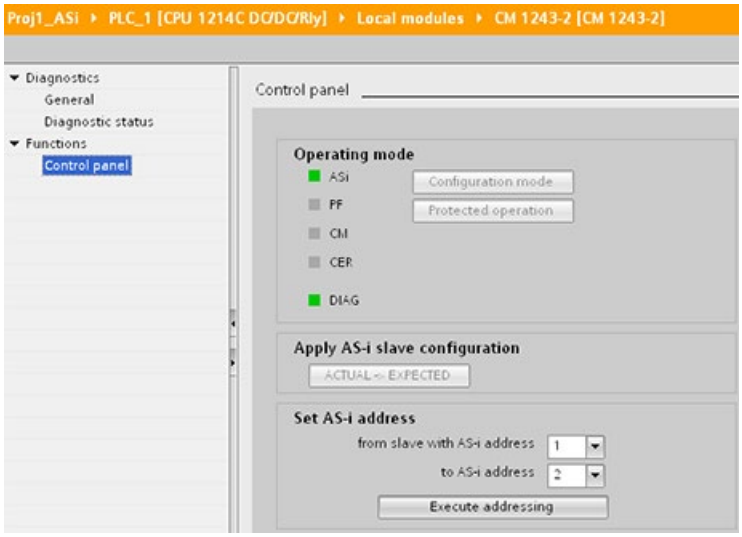
You must go online to view and change the AS-i operational modes.

In order to go online, your must first be in "Device configuration" with the AS-i master CM1243-2 module selected, and then click the "Go online" button in the toolbar. Next, select the "Online and diagnostics" command from the "Online" menu.



There are two AS-i operational modes:

- Protection mode:
  - You cannot change AS-i slave device and CPU I/O addresses.
  - The green "CM" LED is OFF.
- Configuration mode:
  - You can make required changes in your AS-i slave device and CPU I/O addresses.
  - The green "CM" LED is ON.



In the "Set AS-i address" field, you can change the AS-i slave address. A new slave that has not been assigned an address always has address 0. It is detected by the master as a new slave without an address assignment and is not included in normal communication until assigned an address.

Configuration error

When the yellow "CER" LED is ON, there is an error in the AS-i slave device configuration. Select the "ACTUAL > EXPECTED" button to overwrite the AS-i master CM1243-2 module slave device configuration with the AS-i field network slave device configuration.

11.5 S7 communication

11.5.1 GET and PUT (Read and write from a remote CPU)

You can use the GET and PUT instructions to communicate with S7 CPUs through PROFINET and PROFIBUS connections. This is only possible if the "Permit access with PUT/GET communication" function is activated for the partner CPU in the "Protection" property of the local CPU properties:

- Accessing data in a remote CPU: An S7-1200 CPU can only use absolute addresses in the ADDR_x input field to address variables of remote CPUs (S7-200/300/400/1200).
- Accessing data in a standard DB: An S7-1200 CPU can only use absolute addresses in the ADDR_x input field to address DB variables in a standard DB of a remote S7 CPU.
- Accessing data in an optimized DB: An S7-1200 CPU cannot access DB variables in an optimized DB of a remote S7-1200 CPU.
- Accessing data in a local CPU: An S7-1200 CPU can use either absolute or symbolic addresses as inputs to the RD_x or SD_x input fields of the GET or PUT instruction, respectively.

Note

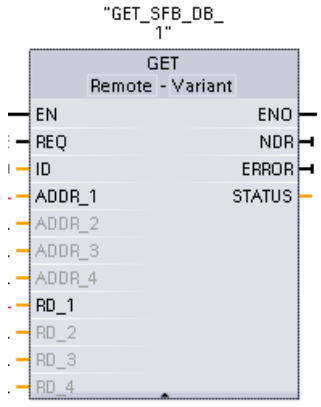
V4.0 CPU program GET/PUT operation is not automatically enabled

A V3.0 CPU program GET/PUT operation is automatically enabled in a V4.0 CPU.

However, a V4.0 CPU program GET/PUT operation in a V4.0 CPU is not automatically enabled. You must go to the CPU "Device configuration", inspector window "Properties"tab, "Protection" property to enable GET/PUT access (Page 204).

Table 11- 62 GET and PUT instructions

LAD / FBD	SCL	Description

	`"GET_DB"(`
	`req:=_bool_in_,`
	`ID:=_word_in_,`
	`ndr=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`addr_1:=_remote_inout_,`
	`[...addr_4:=_remote_inout_,]`
	`rd_1:=_variant_inout_`
	`[,...rd_4:=_variant_inout_]);`
		Use the GET instruction to read data from a remote S7 CPU. The remote CPU can be in either RUN or STOP mode.
		STEP 7 automatically creates the DB when you insert the instruction.

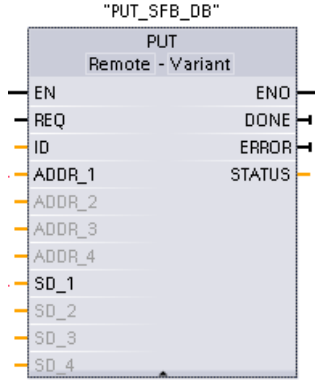
	`"PUT_DB"(`
	`req:=_bool_in_,`
	`ID:=_word_in_,`
	`done=>_bool_out_,`
	`error=>_bool_out_,`
	`status=>_word_out_,`
	`addr_1:=_remote_inout_,`
	`[...addr_4:=_remote_inout_,]`
	`sd_1:=_variant_inout_,`
	`[....sd_4:=_variant_inout_]);`
		Use the PUT instruction to write data to a remote S7 CPU. The remote CPU can be in either RUN or STOP mode.
		STEP 7 automatically creates the DB when you insert the instruction.

Table 11- 63 Data types for the parameters

Parameter and type		Data type	Description
REQ	Input	Bool	A low to high (positive edge) signal starts the operation.
ID	Input	CONN_PRG (Word)	S7 connection ID (Hex)
NDR (GET)	Output	Bool	New Data Ready: • 0: request has not yet started or is still running • 1: task was completed successfully
DONE (PUT)	Output	Bool	DONE: • 0: request has not yet started or is still running • 1: task was completed successfully
ERROR STATUS	Output Output	Bool Word	• ERROR=0 STATUS value: – 0000H: neither warning nor error – <> 0000H: Warning, STATUS supplies detailed information • ERROR=1 There is an error. STATUS supplies detailed information about the nature of the error.
ADDR_1	InOut	Remote	Pointer to the memory areas in the remote CPU that stores the data to be read (GET) or that is sent (PUT).
ADDR_2	InOut	Remote	
ADDR_3	InOut	Remote	
ADDR_4	InOut	Remote	
RD_1 (GET) SD_1 (PUT)	InOut	Variant	Pointer to the memory areas in the local CPU that stores the data to be read (GET) or sent (PUT). Data types allowed: Bool (only a single bit allowed), Byte, Char, Word, Int, DWord, DInt, or Real. Note: If the pointer accesses a DB, you must specify the absolute address, such as: P# DB10.DBX5.0 Byte 10 In this case, 10 represents the number of bytes to GET or PUT.
RD_2 (GET) SD_2 (PUT)	InOut	Variant	
RD_3 (GET) SD_3 (PUT)	InOut	Variant	
RD_4 (GET) SD_4 (PUT)	InOut	Variant	

You must ensure that the length (number of bytes) and data types for the ADDR_x (remote CPU) and RD_x or SD_x (local CPU) parameters match. The number after the identifier "Byte" is the number of bytes referenced by the ADDR_x, RD_x, or SD_x parameter.

Note

The total number of bytes received on a GET instruction or the total number of bytes sent on a PUT instruction is limited. The limitations are based on how many of the four possible address and memory areas you use:

- If you use only ADDR_1 and RD_1/SD_1, a GET instruction can get 222 bytes and a PUT instruction can send 212 bytes.
- If you use ADDR_1, RD_1/SD_1, ADDR_2, and RD_2/SD_2, a GET instruction can get a total of 218 bytes and a PUT instruction can send a total of 196 bytes.
- If you use ADDR_1, RD_1/SD_1, ADDR_2, RD_2/SD_2, ADDR_3, and RD_3/SD_3 a GET instruction can get a total of 214 bytes and a PUT instruction can send a total of 180 bytes.
- If you use ADDR_1, RD_1/SD_1, ADDR_2, RD_2/SD_2, ADDR_3, RD_3/SD_3, ADDR_4, RD_4/SD_4 a GET instruction can get a total of 210 bytes and a PUT instruction can send a total of 164 bytes.

The sum of the number of bytes of each of your address and memory area parameters must be less than or equal to the defined limits. If you exceed these limits, the GET or PUT instruction returns an error.

On the rising edge of the REQ parameter, the read operation (GET) or write operation (PUT) loads the ID, ADDR_1, and RD_1 (GET) or SD_1 (PUT) parameters.

- For GET: The remote CPU returns the requested data to the receive areas (RD_x), starting with the next scan. When the read operation has completed without error, the NDR parameter is set to 1. A new operation can only be started after the previous operation has completed.
- For PUT: The local CPU starts sending the data (SD_x) to the memory location (ADDR_x) in the remote CPU. When the write operation has completed without error, the remote CPU returns an execution acknowledgement. The DONE parameter of the PUT instruction is then set to 1. A new write operation can only be started after the previous operation has completed.

Note

To ensure data consistency, always evaluate when the operation has been completed (NDR = 1 for GET, or DONE = 1 for PUT) before accessing the data or initiating another read or write operation.

The ERROR and STATUS parameters provide information about the status of the read (GET) or write (PUT) operation.

Table 11- 64 Error information

ERROR	STATUS (decimal)	Description
0	11	• New job cannot take effect since previous job is not yet completed. • The job is now being processed in a priority class having lower priority.
0	25	Communication has started. The job is being processed.
1	1	Communications problems, such as: • Connection description not loaded (local or remote) • Connection interrupted (for example: cable, CPU is turned off, or CM/CB/CP is in STOP mode) • Connection to partner not yet established
1	2	Negative acknowledgement from the partner device. The task cannot be executed.
1	4	Errors in the send area pointers (RD_x for GET, or SD_x for PUT) involving the data length or the data type.
1	8	Access error on the partner CPU
1	10	Access to the local user memory not possible (for example, attempting to access a deleted DB)
1	12	When the SFB was called: • An instance DB was specified that does not belong to GET or PUT • No instance DB was specified, but rather a shared DB • No instance DB found (loading a new instance DB)
1	20	• Exceeded the maximum number of parallel jobs/instances • The instances were overloaded at CPU-RUN This status is possible for first execution of the GET or PUT instruction
1	27	There is no corresponding GET or PUT instruction in the CPU.

11.5.2 Creating an S7 connection

Connection mechanisms

To access remote connection partners with PUT/GET instructions, the user must also have permission.

By default, the "Permit access with PUT/GET communication" option is not enabled. In this case, read and write access to CPU data is only possible for communication connections that require configuration or programming both for the local CPU and for the communication partner. Access through BSEND/BRCV instructions is possible, for example.

Connections for which the local CPU is only a server (meaning that no configuration/programming of the communication with the communication partner exists at the local CPU), are therefore not possible during operation of the CPU, for example:

- PUT/GET, FETCH/WRITE or FTP access through communication modules
- PUT/GET access from other S7 CPUs
- HMI access through PUT/GET communication

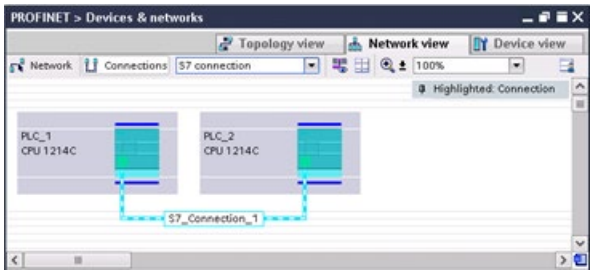
If you want to allow access to CPU data from the client side, that is, you do not want to restrict the communication services of the CPU, you can configure the access protection for the S7-1200 CPU (Page 204) for this level of security.

Connection types

The connection type that you select creates a communication connection to a partner station. The connection is set up, established, and automatically monitored.

In the Devices and Networks portal, use the "Network view" to create the network connections between the devices in your project. First, click the "Connections" tab, and then select the connection type with the dropdown, just to the right (for example, an S7 connection). Click the green (PROFINET) box on the first device, and drag a line to the PROFINET box on the second device. Release the mouse button and your PROFINET connection is joined.

Refer to "Creating a network connection" (Page 787) for more information.



Click the "Highlighted: Connection" button to access the "Properties" configuration dialog of the communication instruction.

11.5.3 Configuring the Local/Partner connection path between two devices

Configuring General parameters

You specify the communication parameters in the "Properties" configuration dialog of the communication instruction. This dialog appears near the bottom of the page whenever you have selected any part of the instruction.

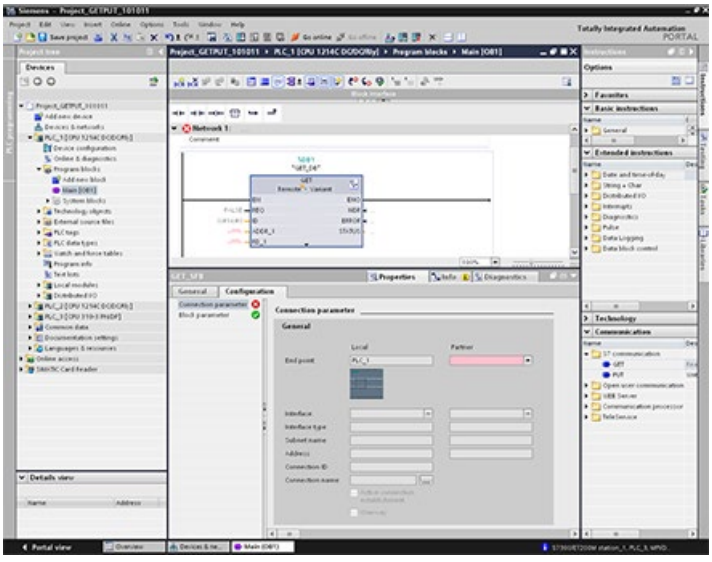
Refer to "Device configuration: Configuring the Local/Partner connection path (Page 788)" for more information.

In the "Address Details" section of the Connection parameters dialog, you define the TSAPs or ports to be used. The TSAP or port of a connection in the CPU is entered in the "Local TSAP" field. The TSAP or port assigned for the connection in your partner CPU is entered under the "Partner TSAP" field.

11.5.4 GET/PUT connection parameter assignment

The GET/PUT instructions connection parameter assignment is a user aid for configuring CPU-to-CPU S7 communication connections.

After inserting a GET or PUT block, STEP 7 displays the connection parameter assignment dialog for the GET/PUT instructions:



The inspector window displays the properties of the connection whenever you have selected any part of the instruction. You can configure the communication parameters in the "Configuration" tab of the "Properties" for the communication instruction.

Note

V4.1 and later CPU program GET/PUT operation is not automatically enabled

A V3.0 CPU program GET/PUT operation is automatically enabled in a V4.1 and later CPU.

However, a V4.1 and later CPU program GET/PUT operation in a V4.1 and later CPU is not automatically enabled. You must go to the CPU "Device configuration", inspector window "Properties"tab, "Protection" property to enable GET/PUT access (Page 204).

11.5.4.1 Connection parameters

The "Connection parameters" page allows you to configure the necessary S7 connection and to configure the parameter "Connection ID" that is referenced by the GET/PUT block parameter "ID". The page's content has information about the local endpoint and allows you to define the local interface. You can also define the partner end point.

The "Block parameters" page allows you to configure the additional block parameters.

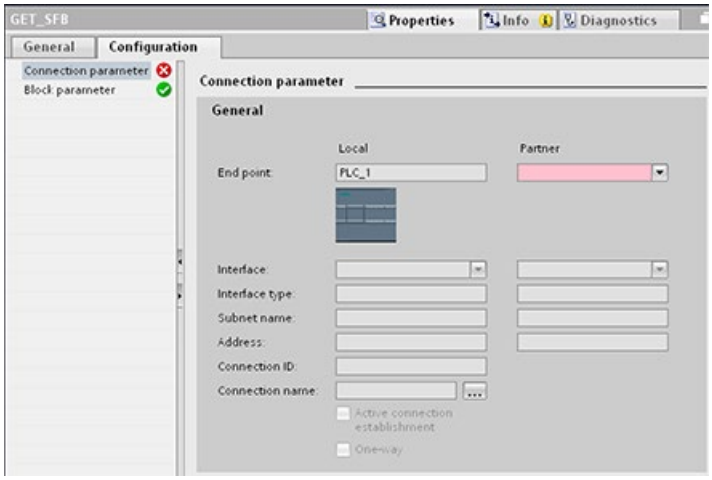


Table 11- 65 Connection parameter: General definitions

Parameter		Definition
Connection parameter: General	End point	"Local End point": Name assigned to the Local CPU "Partner End point": Name assigned to the Partner (remote) CPU Note: In the "Partner End point" dropdown list, the system displays all potential S7 connection partners of the current project as well as the option "unspecified". An unspecified partner represents a communication partner which is not currently in the STEP 7 project (for example, a third party device communication partner).
	Interface	Name assigned to the interfaces Note: You can change the connection by changing the Local and Partner interfaces
	Interface type	Type of interface
	Subnet name	Name assigned to the subnets
	Address	Assigned IP addresses Note: You can specify the remote address of a third party device for an "unspecified" communication partner.
	Connection ID	ID number: Automatically generated by the GET/PUT connection parameter assignment
	Connection name	Local and Partner CPU data storage location: Automatically generated by the GET/PUT connection parameter assignment
	Active connection establishment	Checkbox to select Local CPU as the active connection
	One-way	Checkbox to specify a one-way or two-way connection; read-only Note: In a PROFINET GET/PUT connection, both the local and partner devices can act as a server or a client. This allows a two-way connection, and the "One-way" checkbox is unchecked. In a PROFIBUS GET/PUT connection, in some cases, the Partner device can only act as a server (for example, an S7-300), and the "One-way" checkbox is checked.

Connection ID parameter

There are three ways to change the system-defined connection IDs:

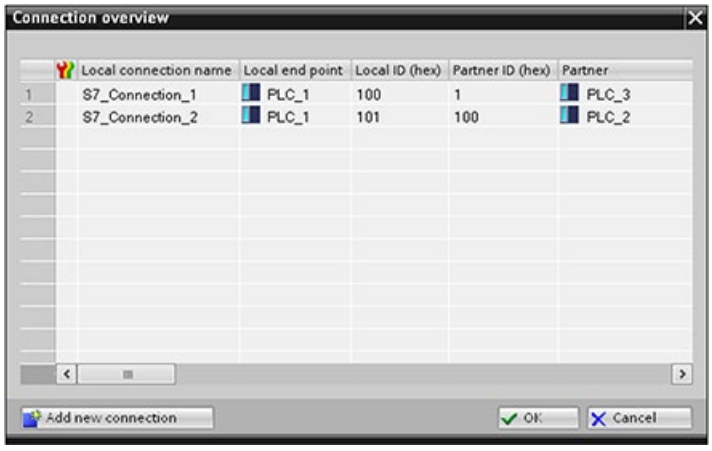
1. The user can change the current ID directly on the GET/PUT block. If the new ID belongs to an already existing connection, the connection is changed.
2. The user can change the current ID directly on the GET/PUT block, but the new ID does not already exist. A new S7 connection is created by the system.
3. The user can change the current ID through the "Connection overview" dialog: The user-input is synchronized with the ID-parameter on the corresponding GET/PUT block.

Note

The parameter "ID" of the GET/PUT block is not a connection name, but a numerical expression which is written like the following example: W#16#1

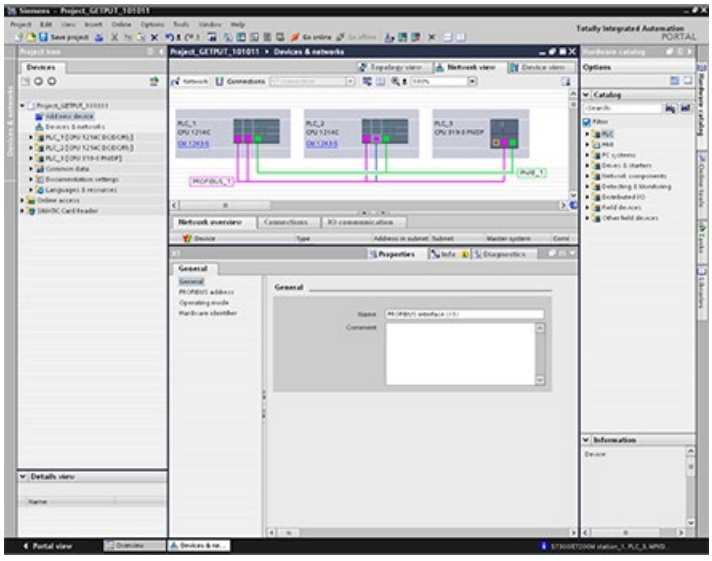
Connection name parameter

The connection name is editable through a special user control, the "Connection overview" dialog. This dialog offers all the available S7 connections which could be selected as an alternative for the current GET/PUT communication. The user can create a completely new connection in this table. Click the button to the right of the "Connection name" field to start the "Connection overview" dialog.



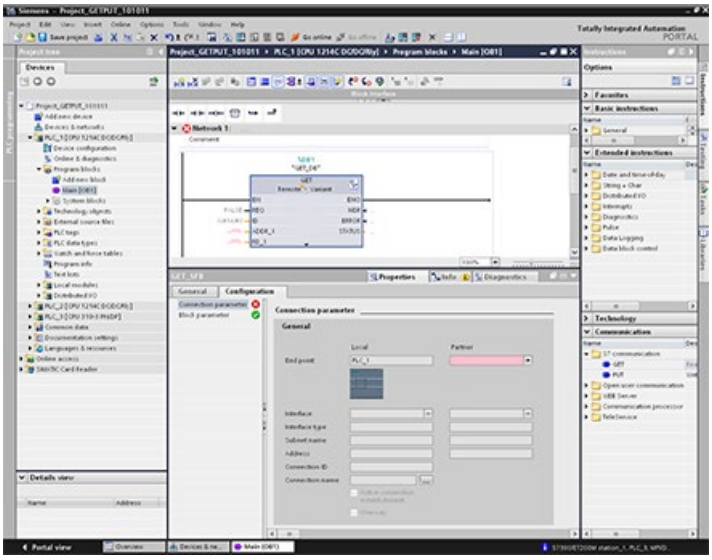
11.5.4.2 Configuring a CPU-to-CPU S7 connection

Given the configuration of PLC_1, PLC_2, and PLC_3 as shown in the figure below, insert GET or PUT blocks for "PLC_1".



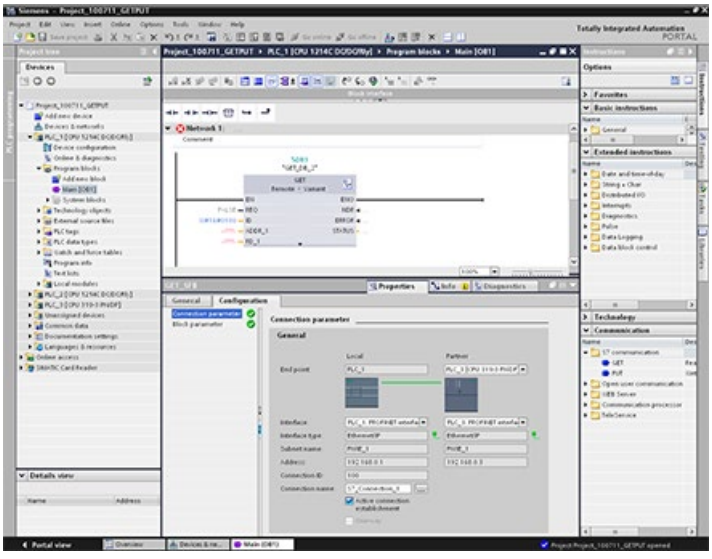
For the GET or PUT instruction, the "Properties" tab is automatically displayed in the inspector window with the following menu selections:

- "Configuration"
- "Connection parameters"



Configuring a PROFINET S7 connection

For the "Partner End point", select "PLC_3".



The system reacts with the following changes:

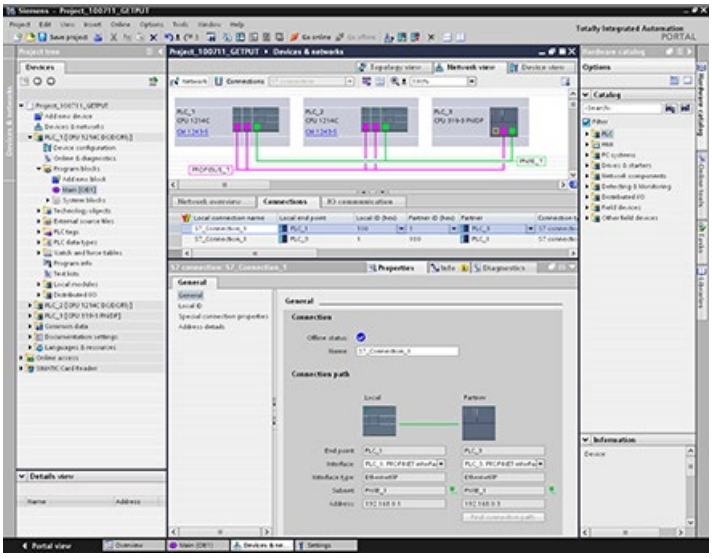
Table 11- 66 Connection parameter: General values

Parameter		Definition
Connection parameter: General	End point	"Local End point" contains "PLC_1" as read-only. "Partner End point" field contains "PLC_3[CPU319-3PN/DP]": • The color switches from red to white • The "Partner" device image is shown. • A connection line appears between the PLC_1- and PLC_3 device images (green Ethernet line).
	Interface	"Local Interface" contains "CPU1214C DC/DC/DC, PROFINET interface (R0/S1)". "Partner Interface" contains: "CPU319-3PN/DP, PROFINET interface (R0/S2)".
	Interface type	"Local Interface type" contains "Ethernet/IP"; control is read-only. "Partner Interface type" contains "Ethernet/IP"; control is read-only. Interface type images are shown at the right beside the Local and Partner "Interface type" (green Ethernet icon).
	Subnet name	"Local Subnet name" contains "PN/IE_1"; control is read only. "Partner Subnet name" contains "PN/IE_1"; control is read only.
	Address	"Local Address" contains the Local IP address; control is read only. "Partner Address" contains the Partner IP address; control is read only.
	Connection ID	"Connection ID" contains "100". In the Program editor, in the Main [OB1], the GET/PUT block "Connection ID" value also contains "100".
	Connection name	"Connection name" contains the default connection name (for example, "S7_Connection_1"); control is enabled.
	Active connection establishment	Checked and enabled to select the Local CPU as the active connection.
	One-way	Read-only and unchecked. Note: "PLC_1" (an S7-1200 CPU 1214CDC/DC/Relay) and "PLC_3" (an S7-300 CPU 319-3PN/DP) can both act as a server and a client in a PROFINET GET/PUT connection, allowing a two-way connection.

The GET/PUT icon in the Property View tree also changes from red to green.

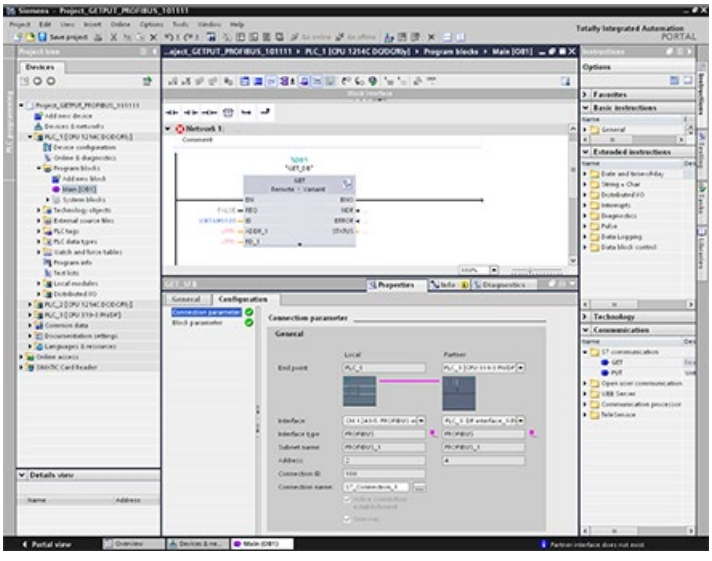
Completed PROFINET S7 connection

In the "Network view", a two-way S7 connection is shown in the "Connections" table between "PLC_1" and "PLC_3".



Configuring a PROFIBUS S7 connection

For the "Partner End point", select "PLC_3".



The system reacts with the following changes:

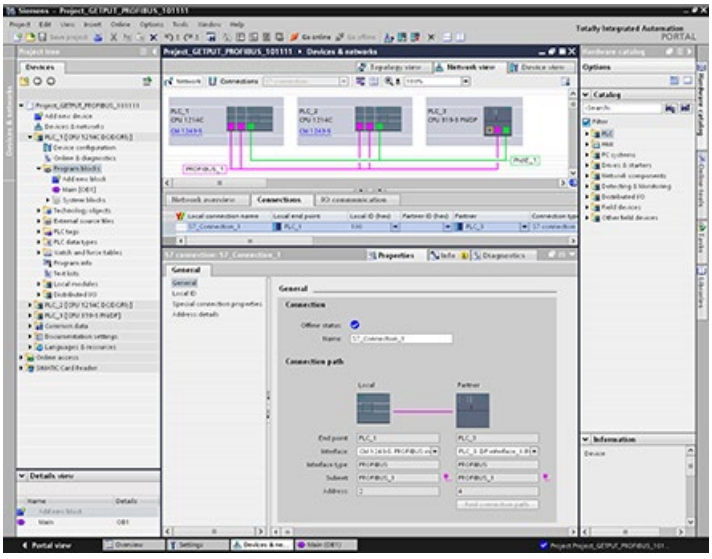
Table 11- 67 Connection parameter: General values

Parameter		Definition
Connection parameter: General	End point	"Local End point" contains "PLC_1" as read-only. "Partner End point" field contains "PLC_3[CPU319-3PN/DP]": • The color switches from red to white • The "Partner" device image is shown. • A connection line appears between the PLC_1- and PLC_3 device images (purple PROFIBUS line).
	Interface	"Local Interface" contains "CPU1214C DC/DC/DC, PROFIBUS interface (R0/S1)". "Partner Interface" contains: "CPU319-3PN/DP, PROFIBUS interface (R0/S2)".
	Interface type	"Local Interface type" contains "PROFIBUS"; control is read-only. "Partner Interface type" contains " PROFIBUS "; control is read-only. Interface type images are shown at the right beside the Local and Partner "Interface type" (purple PROFIBUS icon).
	Subnet name	"Local Subnet name" contains " PROFIBUS _1"; control is read only. "Partner Subnet name" contains " PROFIBUS _1"; control is read only.
	Address	"Local Address" contains the Local IP address; control is read only. "Partner Address" contains the Partner IP address; control is read only.
	Connection ID	"Connection ID" contains "100". In the Program editor, in the Main [OB1], the GET/PUT block "Connection ID" value also contains "100".
	Connection name	"Connection name" contains the default connection name (for example, "S7_Connection_1"); control is enabled.
	Active connection establishment	Read-only, checked, and enabled to select the Local CPU as the active connection.
	One-way	Read-only and checked. Note: "PLC_3" (an S7-300 CPU319-3PN/DP) can act only as a server (cannot also be a client) in a PROFIBUS GET/PUT connection, allowing only a one-way connection.

The GET/PUT icon in the Property View tree also changes from red to green.

Completed PROFIBUS S7 connection

In the "Network view", a one-way S7 connection is shown in the "Connections" table between "PLC_1" and "PLC_3".



11.6 What to do when you cannot access the CPU by the IP address

In case you cannot reach a CPU by the IP address, you can set an emergency (temporary) IP address for the CPU. The emergency IP address enables you to re-establish communication with the CPU in order to download a device configuration with a valid IP address.

Reasons why you might need an emergency IP address

Your CPU might be inaccessbile if someone downloaded a project with one of the follwing problems:

- The IP address of the PROFINET interface of the CPU is a duplicate of another device on the network.
- The subnet is incorrect for the CPU.
- The subnet mask makes the CPU unreachable.

In these cases, the CPU is no longer accessible from STEP 7.

Assigning an emergency IP address

You can assign an emergency IP address under the following conditions:

- The device configuration in STEP 7 has "Set IP address in the project" for the IP protocol.
- The CPU is in STOP mode.

Under these conditions, you can use a DCP tool to set the IP address of the device to an emergency IP address. The SIMATIC Automation Tool, for example, has a DCP Set IP address command. You can set an emergency IP address regardless of the protection level (Page 204) of the CPU. After you set a temporary IP address with a DCP tool, the Maintenence LED on the CPU turns on. The Diagnostic Buffer also includes an entry indicating that you enabled an emergency address of an Ethernet interface.

Restoring an IP address after assigning an emergency IP address

The diagnostic buffer informs you when you have enabled or disabled an emergency IP address. You can reset the emergency IP address by powering the CPU off and on.

After you have assigned an emergency IP address, you can then download a STEP 7 project with a valid IP address for the CPU. After you download the project, power cycle the CPU.

Web server

12

The Web server for the S7-1200 provides Web page access to data about your CPU and process data.

You can access the S7-1200 Web pages from a PC or from a mobile device. For devices with small screens, the Web server supports a collection of basic pages (Page 992).

You use a Web browser to access the IP address of the S7-1200 CPU or the IP address of a Web server-enabled CP (communications processor) module (Page 990) in the local rack with the CPU to establish the connection. The S7-1200 supports multiple concurrent connections.



Standard Web pages

The S7-1200 includes standard Web pages (Page 991) that you can access from the Web browser of your PC (Page 987) or from a mobile device (Page 989):

- Introduction (Page 997) - entry point to the standard Web pages
- Start Page (Page 998) - general information about the CPU
- Diagnostics (Page 999) - detailed information about the CPU including serial, order, and version numbers, program protection, and memory usage
- Module Information (Page 1002) - information about the local and remote modules and the ability to update firmware for local modules
- Communication (Page 1007) - information about the network addresses, physical properties of the communication interfaces, statistics, parameters, as well as a connection summary and diagnostic information
- Diagnostic Buffer (Page 1002) - the diagnostic buffer
- Tag status (Page 1011) - CPU variables and I/O, accessible by address or PLC tag name
- Watch tables (Page 1012) - watch tables that you configured in STEP 7
- Online backup (Page 1015) - ability to backup an online CPU or restore a previously-made online backup
- File Browser (Page 1017) - browser for files stored internally in the CPU or on a memory card, for example, data logs and recipes
- Login (Page 993) - log in as a different user, or log out.

These pages are included in the S7-1200 CPU, and are available in English, German, French, Spanish, Italian, and Simplified Chinese. All pages except for the Introduction and Start page require additional user privileges (Page 984) that you configure in STEP 7 to view the page.

User-defined Web pages

The S7-1200 also provides support for you to create user-defined Web pages that can access CPU data. You can develop these pages with the HTML authoring software of your choice, and include pre-defined "AWP" (Automation Web Programming) commands in your HTML code to access CPU data. Refer to the User-defined Web pages (Page 1020) chapter for specific information on the development of user-defined Web pages, and the associated configuration and programming in STEP 7.

You can access the user-defined pages from either a PC or mobile device from the standard or basic Web pages. You can also configure one of your user-defined Web pages to be the entry page (Page 1037) for the Web server.

Web browser requirement

Siemens has tested the Web server standard pages and verifies support of the following Web browsers:

- Internet Explorer 8 to 11
- Microsoft Edge
- Mozilla Firefox V22 to V32, V42 to V47
- Google Chrome V33 to V38, V46 to V47
- Mobile Safari and Mobile Chrome for iOS 9 devices
- Android browser for the following versions:
  - Jellybean v4.3
  - Kitkat v4.4
  - Lollipop V5.0 to v5.1
  - Marshmellow v6.0
- Mobile Chrome for Google Android

When using the HTML Browser control in a WinCC project, the Web server supports the following Siemens HMI Panels for the standard pages:

- Basic Panels
  - Gen 2 KTP400 to KTP1200
- Comfort Panels
  - TP700 to TP2200
  - KP400 to KP1500
  - KTP400
  - TP700 Comfort Outdoor

- Mobile Panels
  - Gen 2 KTP700[F], KTP900[F]

For browser-related restrictions that can interfere with the display of standard or user-defined Web pages, see the Constraints (Page 1061) section.

12.1 Enabling the Web server

You enable the Web server in STEP 7 from Device Configuration for the CPU to which you intend to connect.

To enable the Web server, follow these steps:

1. Select the CPU in the Device Configuration view.
2. In the inspector window, select "Web server" from the CPU properties.
3. Select the check box for "Activate web server on all modules of this device".
4. For increased security, ensure that "Permit access only with HTTPS" is selected to require secure access to the Web server.
5. If you select "Enable automatic update" for "Automatic update", standard Web pages will refresh by default every ten seconds. You you can also enter a custom refresh time period in seconds for the "Update interval" field.

WARNING

Unauthorized access to the CPU through the Web server

Unauthorized access to the CPU or changing PLC variables to invalid values could disrupt process operation and could result in death, severe personal injury and/or property damage.

Because enabling the Web server allows authorized users to perform operating mode changes, writes to PLC data, and firmware updates, Siemens recommends that you observe the following security practices:

- Enable access to the Web server only with the HTTPS protocol.
- Password-protect Web server user IDs (Page 984) with a strong password. Strong passwords are at least ten characters in length, mix letters, numbers, and special characters, are not words that can be found in a dictionary, and are not names or identifiers that can be derived from personal information. Keep the password secret and change it frequently.
- Do not extend the default minimum privileges of the "Everybody" user.
- Perform error-checking and range-checking on your variables in your program logic because Web page users can change PLC variables to invalid values.
- Use a secure Virtual Private Network (VPN) to connect to the S7-1200 PLC Web server from a location outside your protected network.

After you download the device configuration, you can use the standard Web pages to access the Introduction and Start page of the CPU. To access additional pages, you must configure one or more Web server users (Page 984).

If you created and enabled user-defined Web pages (Page 1020), you can access them from the standard or basic Web page navigation menu.

Note

Device exchange: Replacing a V3.0 CPU with a V4.x CPU

If you replace an existing V3.0 CPU with a V4.x CPU (Page 1561) and convert your V3.0 project to a V4.x project, note that STEP 7 and the V4.x CPU retain the Web server settings for

- "Activate web server on all modules of this device"
- "Permit access only with HTTPS"

Note

If a "Download in RUN" (Page 1321) is in progress, standard and user-defined Web pages do not update data values or permit you to write data values until the download is complete. The Web server discards any attempts to write data values while a download is in progress.

12.2 Configuring Web server users

You can configure users with various privilege levels for accessing the CPU through the Web server.

To configure Web server users and their associated privileges, follow these steps:

1. Select the CPU in the Device Configuration view.
2. In the inspector window, select "Web server" from the CPU properties and enable the Web server (Page 983).
3. Select "User management" in the Web server properties.
4. Enter user names, access levels, and passwords for the user logins that you want to provide.

After you download the configuration to the CPU, only authorized users can access Web server functions for which they have privileges.

Web server access levels

STEP 7 provides a default user named "Everybody" with no password. By default, this user has no additional privileges and can only view the Start (Page 998) and Introduction (Page 997) standard Web pages. You can, however, configure additional privileges for the "Everybody" user as well as other users:

- Query diagnostics
- Read tags
- Write tags
- Read tag status
- Write tag status
- Open user-defined web pages
- Write in user-defined web pages
- Read files
- Write/delete files
- Change operating mode
- Flash LEDs
- Perform a firmware update
- Backup CPU
- Restore CPU
- Change system parameter
- Change application parameter

If you have set a user-defined Web page to be the entry page (Page 1037) for the Web server, the Everybody user must have the "Open user-defined web pages" privilege.

WARNING

Access to Web server

Granting privileges to the "Everybody" user makes it possible to log in to the Web server with no password. Unauthorized access to the CPU or changing PLC variables to invalid values could disrupt process operation and could result in death, severe personal injury and/or property damage.

Because the "Everybody" user when granted sufficient privileges can perform operating mode changes, writes to PLC data, and firmware updates with no password, Siemens recommends that you observe the following security practices

- Enable access to the Web server only with the HTTPS protocol.
- Password-protect Web server user IDs with a strong password. Strong passwords are at least ten characters in length, mix letters, numbers, and special characters, are not words that can be found in a dictionary, and are not names or identifiers that can be derived from personal information. Keep the password secret and change it frequently.
- Do not extend the default minimum privileges of the "Everybody" user.
- Perform error-checking and range-checking on your variables in your program logic because Web page users can change PLC variables to invalid values.
- Use a secure Virtual Private Network (VPN) to connect to the S7-1200 PLC Web server from a location outside your protected network.

12.3 Accessing the Web pages from a PC

You can access the S7-1200 standard Web pages from a PC or from a mobile device through the IP address of the S7-1200 CPU or the IP address of any Web server-enabled CP (Page 990) in the local rack.

To access the S7-1200 standard Web pages from a PC, follow these steps:

1. Ensure that the S7-1200 and the PC are on a common Ethernet network or are connected directly to each other with a standard Ethernet cable.
2. Open a Web browser and enter the URL "https://ww.xx.yy.zz", where "ww.xx.yy.zz" corresponds to the IP address of the S7-1200 CPU or the IP address of a CP in the local rack.

The Web browser opens the Introduction standard Web page (Page 997) or the Default HTML page of your user-defined Web pages if you configured it to be the entry page (Page 1037).

Note

Use a secure Virtual Private Network (VPN) to connect to the S7-1200 PLC Web server from a location outside your protected network. Be aware also of any constraints (Page 1061) that your Web environment or operating system might impose.

Accessing standard Web pages by entering the page URL

You can access a specific standard Web page from the URL of the page. To do so, enter the URL in the form "https://ww.xx.yy.zz/<page>.html", where "ww.xx.yy.zz" corresponds to the IP address of the S7-1200 CPU or the IP address of a CP in the local rack:

- https://ww.xx.yy.zz/start.html - start (Page 998) page with general information about the CPU
- https://ww.xx.yy.zz/identification.html - identifying information (Page 999) about the CPU including serial, order, and version numbers, now called the Diagnostics page
- https://ww.xx.yy.zz/module.html - information about the modules in the local rack and the ability to update firmware (Page 1002)
- https://ww.xx.yy.zz/communication.html - communication information (Page 1007) about the network addresses, physical properties of the communication interfaces, and communication statistics
- https://ww.xx.yy.zz/diagnostic.html - the diagnostic buffer (Page 1002)
- https://ww.xx.yy.zz/variable.html - CPU variables (tags) and I/O (Page 1011), accessible by address, PLC tag name, or data block tag name
- https://ww.xx.yy.zz/watch.html - watch tables (Page 1012)
- https://ww.xx.yy.zz/filebrowser.html - browser for accessing data log files or recipe files (Page 1017) stored internally in the CPU or on a memory card
- https://ww.xx.yy.zz/index.html - introduction page to enter the standard Web pages
- https://ww.xx.yy.zz/login.html - page to log in (Page 993) if no user is currently logged in; otherwise, the page is blank.

For example, if you enter "https://ww.xx.yy.zz/communication.html", the browser displays the communication page.

Note

Note that any standard Web page that is not listed specifically above (for example, the Online backup page (Page 1015)) does not have a direct access URL.

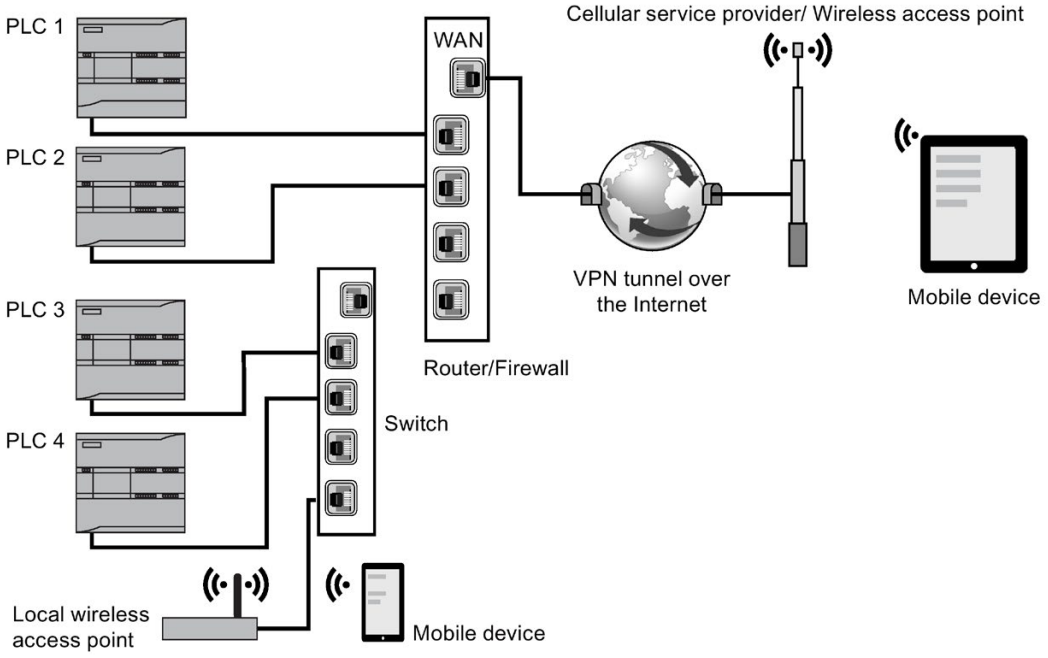
Secure access

Use a secure Virtual Private Network (VPN) to connect to the S7-1200 PLC Web server from a location outside your protected network. Require and use https:// instead of http:// for secure access (Page 983) to the standard Web pages. When you connect to the S7-1200 with https://, the Web site encrypts the session with a digital certificate. The Web server transmits the data securely and it is not accessible for anyone to view. You typically get a security warning that you can confirm with "Yes" to proceed to the standard Web pages. To avoid the security warning with each secure access, you can import the Siemens software certificate to your Web browser (Page 1063).

12.4 Accessing the Web pages from a mobile device

To access an S7-1200 from a mobile device, you must connect your PLC to a network that connects to the Internet or to a local wireless access point. Use a secure Virtual Private Network (VPN) to connect a mobile device to the S7-1200 PLC Web server. You can use port forwarding in the wireless router to map the IP address of the PLC to an address by which a mobile device can access it from the Internet. To configure port forwarding, follow the instructions for the software configuration of your router. You can connect as many PLCs and switching devices as your router supports.

Without port forwarding, you can connect to a PLC, but only locally within range of the wireless signal.



In this example, a mobile device that is within range of the local wireless access point can connect to PLC 3 and PLC 4 by their IP addresses. From the Internet outside the local wireless range, a mobile device can connect to PLC 1 and PLC 2 using the port forwarded address for each PLC.

To access the standard Web pages, you must have access to a cellular service or wireless access point. To access a PLC from the Internet, enter the port forwarded address in the Web browser of your mobile device to access the PLC, for example http://ww.xx.yy.zz:pppp or https://ww.xx.yy.zz:pppp, where ww.xx.yy.zz is the address of the router and pppp is the port assignment for a specific PLC.

For local access through a local wireless access point, enter the IP address of the S7-1200 CPU or a Web server-enabled CP (Page 990) in the local rack:

- http://ww.xx.yy.zz or https://ww.xx.yy.zz to access the standard Web pages (Page 991)
- http://ww.xx.yy.zz/basic or https://ww.xx.yy.zz/basic to access the basic Web pages (Page 992)

For increased security, configure the Web server to be accessible only by secure access (HTTPS) (Page 983).

12.5 Using a CP module to access Web pages

Regardless of whether you access the Web server from a PC or a mobile device, you can connect to standard Web pages through one of the following CP modules when you have configured it in STEP 7 and installed it in the local rack with the S7-1200 CPU:

- CP 1242-7 GPRS V2
- CP 1243-1
- CP 1243-1 PCC
- CP 1243-7 LTE-EU
- CP 1243-7 LTE-US
- CP 1243-8 IRC

You use the Start standard Web page (Page 998) to access the Web pages through these CP modules. The Start page displays all configured and installed CP modules that you have in your local rack, but you can only access Web pages from the ones listed above.

Note

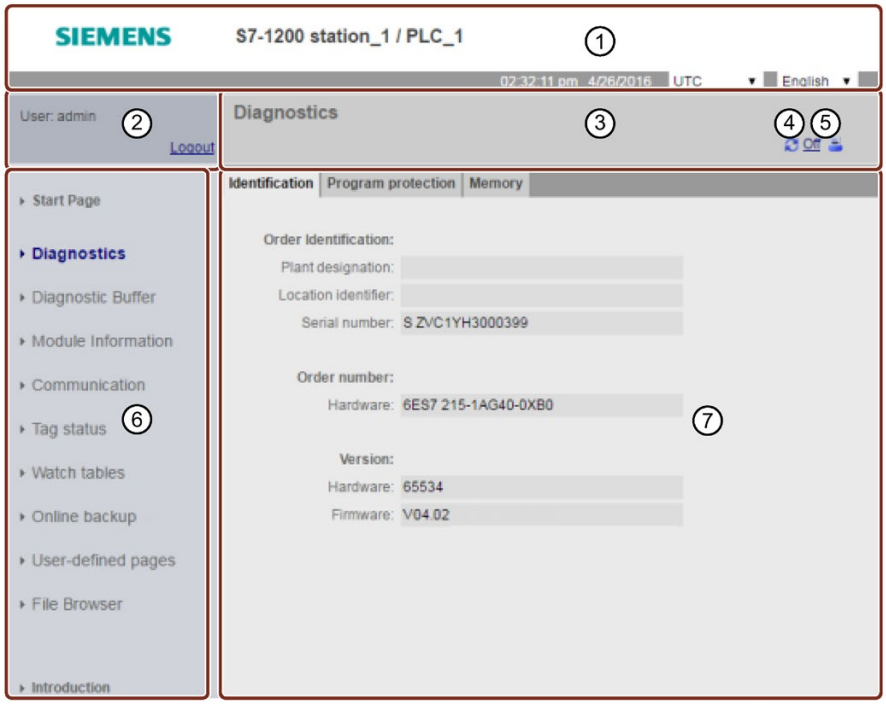
Access to standard Web pages when Web server-enabled CPs are in the local rack

You might observe delays up to one or two minutes when connecting to the S7-1200 standard Web pages when Web server-enabled CPs are in the local rack. If the pages do not appear to be available, or you get errors, just wait one or two minutes and refresh the page.

12.6 Standard Web pages

12.6.1 Layout of the standard Web pages

Each of the S7-1200 standard Web pages has a common layout with navigational links and page controls. Regardless of whether you are viewing the page on a PC or on a mobile device, each page has the same content area, but the layout and navigation controls vary based on the screen size and resolution of the device. On a standard PC or large mobile device the layout of a standard Web page appears as follows:



① Web server header with selector to display PLC Local time or UTC time, and a selector for the display language (Page 165)

② Log in or log out

③ Standard Web page header with name of the page that you are viewing. This example is the CPU Identification page. Some of the standard Web pages, such as module information, also display a navigation path here if multiple screens of that type can be accessed.

④ Refresh icon: for pages with automatic refresh, enables or disables the automatic refresh function; for pages without automatic refresh, causes the page to update with current data

⑤ Print icon: prepares and displays a printable version of the information available from the displayed page

⑥ Navigation area to switch to another page

⑦ Content area for specific standard Web page that you are viewing. This example is the Diagnostics page.

Note

CP module standard Web pages

Certain CP modules (Page 990) provide standard Web pages that are similar in appearance and functionality to the S7-1200 CPU standard Web pages. Refer to your CP documentation for descriptions of the CP standard Web pages.

12.6.2 Basic pages

The Web server provides basic pages intended for use on mobile devices. You access the basic pages using the IP address of the device and appending "basic" to the URL: http://ww.xx.yy.zz/basic or https://ww.xx.yy.zz/basic

The basic pages look similar to the standard pages, but with some differences. The page omits the navigation area, login area, and the header area, and includes buttons for advancing backward and forward through the Web pages. Basic pages also include a Home page button that takes you to a Navigation page. You can also use the navigation controls provided with your mobile device for navigation. For example, the basic Diagnostics page appears as follows in the vertical orientation:

The minimum resolution for displaying a basic page is 240 x 240 pixels.



Note that the standard Web page illustrations in this chapter represent the standard PC Web page appearance. Most of the standard Web pages have equivalent basic pages.

12.6.3 Logging in and user privileges

Each of the PC standard Web pages provides a login window above the navigation pane. Due to space considerations, the basic Web pages provide a separate Login page. The S7-1200 supports multiple user logins with various access levels (privileges):

- Query diagnostics
- Read tags
- Write tags
- Read tag status
- Write tag status
- Open user-defined pages
- Write in user-defined pages
- Read files
- Write/delete files
- Change operating mode
- Flash LEDs
- Perform firmware update
- Backup CPU
- Restore CPU
- Change system parameter
- Change application parameter

You configure user roles, associated access levels (privileges), and passwords (Page 984) in the Web server user management properties of the STEP 7 device configuration of the CPU.

Logging in

STEP 7 provides a default user named "Everybody" with no password. By default, this user has no additional privileges and can only view the Start (Page 998) and Introduction (Page 997) standard Web pages. You can, however, grant additional privileges to the "Everybody" user as well as other users that you configure:

WARNING

Access to Web server

Granting privileges to the "Everybody" user makes it possible to log in to the Web server with no password. Unauthorized access to the CPU or changing PLC variables to invalid values could disrupt process operation and could result in death, severe personal injury and/or property damage.

Because the "Everybody" user when granted sufficient privileges can perform operating mode changes, writes to PLC data, and firmware updates with no password, Siemens recommends that you observe the following security practices

- Enable access to the Web server only with the HTTPS protocol.
- Password-protect Web server user IDs (Page 984) with a strong password. Strong passwords are at least ten characters in length, mix letters, numbers, and special characters, are not words that can be found in a dictionary, and are not names or identifiers that can be derived from personal information. Keep the password secret and change it frequently.
- Do not extend the default minimum privileges of the "Everybody" user.
- Perform error-checking and range-checking on your variables in your program logic because Web page users can change PLC variables to invalid values.
- Use a secure Virtual Private Network (VPN) to connect to the S7-1200 PLC Web server from a location outside your protected network.

To perform certain actions such as changing the operating mode of the controller, writing values to memory, and updating the CPU firmware you must have the required privileges. Note that if you have set the protection level of the CPU (Page 204) to "Complete protection (no access)", then the "Everybody" user has no permission to access the Web server, regardless of the Web server user permission settings.





The log in frame is near the upper left corner on each standard Web page when displayed from a PC or a wide mobile device.

The Log In page is a separate page on small mobile devices that display the basic pages. It is selectable from the Home page.

To log in, follow these steps:

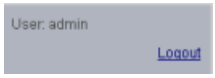
1. Enter the user name for the Username field.
2. Enter the user password in the Password field.

Your login session expires after thirty minutes of inactivity. If the currently-loaded page is continually refreshing, the login session timeout resets, preventing the session from expiring.

Note

If you encounter any problems logging in, download the Siemens security certificate (Page 1063) from the Introduction page (Page 997). You can then log in with no errors.

Logging out





To log out, simply click the "Logout" link from any page when viewing from a PC or wide mobile device.

From the basic pages, navigate to the Login/Logout page from the Home page and tap the "Logout" button.

After you log out, you can only access and view standard Web pages according to the privileges of the "Everybody" user. Each of the standard Web page descriptions defines the required privileges for that page.

Note

Log off prior to closing Web server

If you have logged in to the Web server, be sure to log off prior to closing your Web browser. The Web server supports a maximum of seven concurrent logins.

12.6.4 Introduction

The Introduction page is the welcome screen for entry into the S7-1200 standard Web pages.



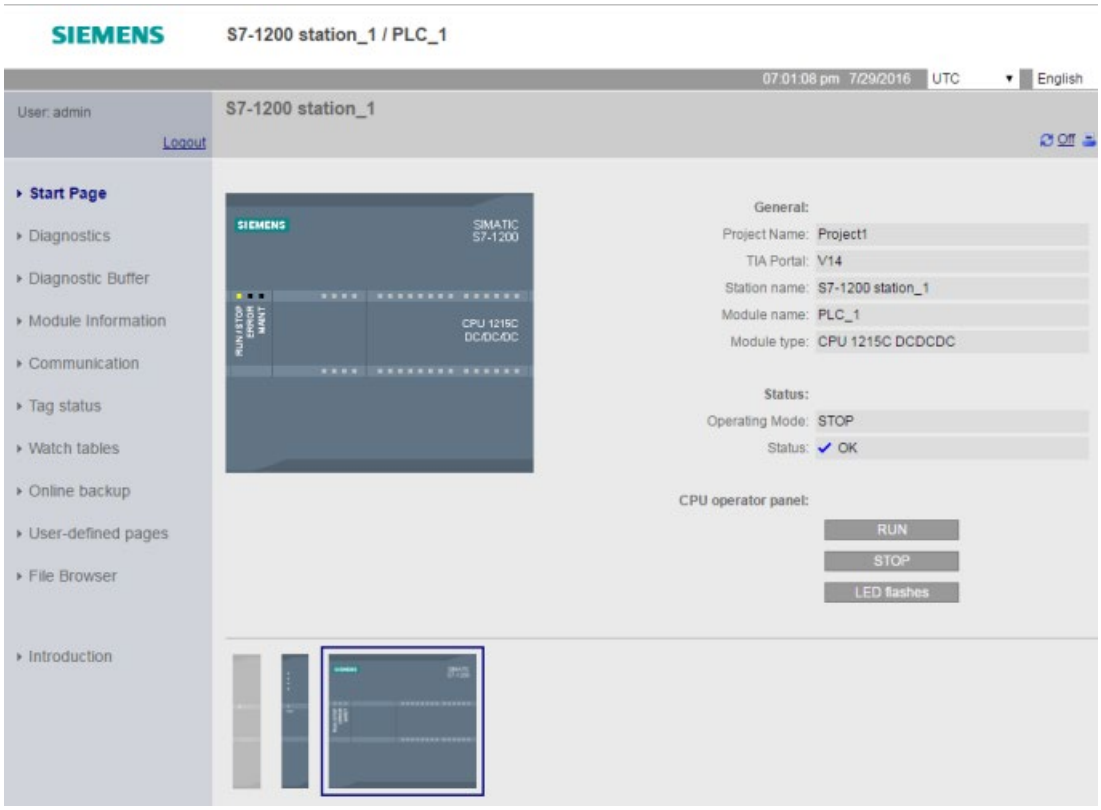
From this page, you click "Enter" to access the S7-1200 standard Web pages. At the top of the screen are links to useful Siemens Web sites, as well as a link to download the Siemens security certificate (Page 1063). You can also choose to skip the introduction page on future accesses to the Web server.

12.6.5 Start

The Start page displays a representation of the CPU or CP to which you are connected and lists general information about the device and the TIA Portal version you used to download the project to the CPU. For the CPU, you can use the buttons to change the operating mode and flash the LEDs, if you have logged in (Page 993) with the "change operating mode" privilege (Page 984).

The bottom portion of the screen is visible if you have configured and installed Web server-enabled CP modules (Page 990) in the local rack with the S7-1200 CPU. You can hover over and click a Web server-enabled CP module to access the standard Web pages. Refer to the documentation for your CP module for information about the CP module Web pages. You see the name of the CP module when you hover over it.

The Web server also displays any other CM and CP modules in the local rack, but you cannot click them as they do not contain Web pages. The module appearance for these CMs and CPs are light gray (desensitized) to indicate that they are display-only and not clickable modules.



Note that the S7-1200 fail-safe CPUs display additional data on this page related to functional safety.

12.6.6 Diagnostics

The Diagnostics page displays identifying characteristics of the CPU, configuration settings for know-how protection and memory usage for load memory, work memory, and retentive memory:

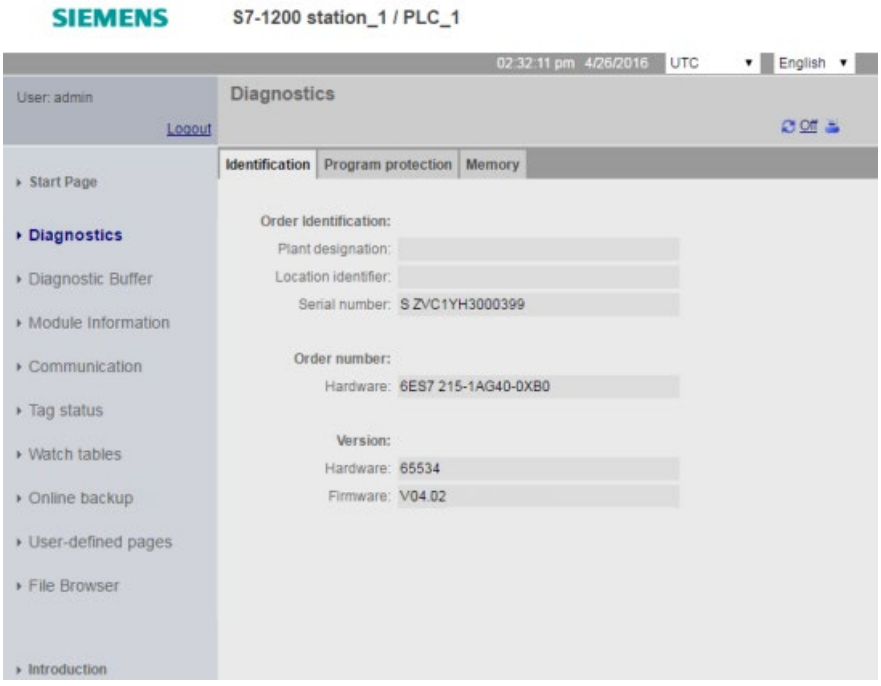
The page consists of three tabs:

- Identification: identifying characteristics of the module and plant and location information from STEP 7
- Program protection: status of know-how protection and CPU binding, which can be useful in planning for spare parts as well as STEP 7 configuration setting for allowing or preventing the copy of internal load memory to external load memory (SIMATIC memory card).
- Memory: load, work, and retentive memory usage

For F-CPUs, there is an additional Fail-safe tab.

Viewing the Identification page requires the "query diagnostics" privilege (Page 984).

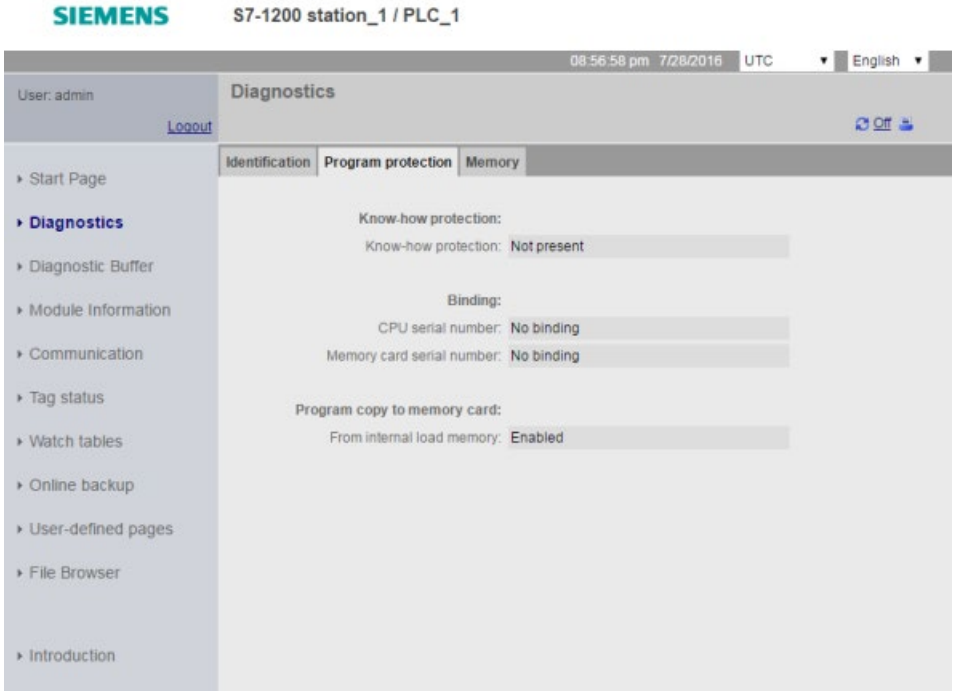
Identification tab



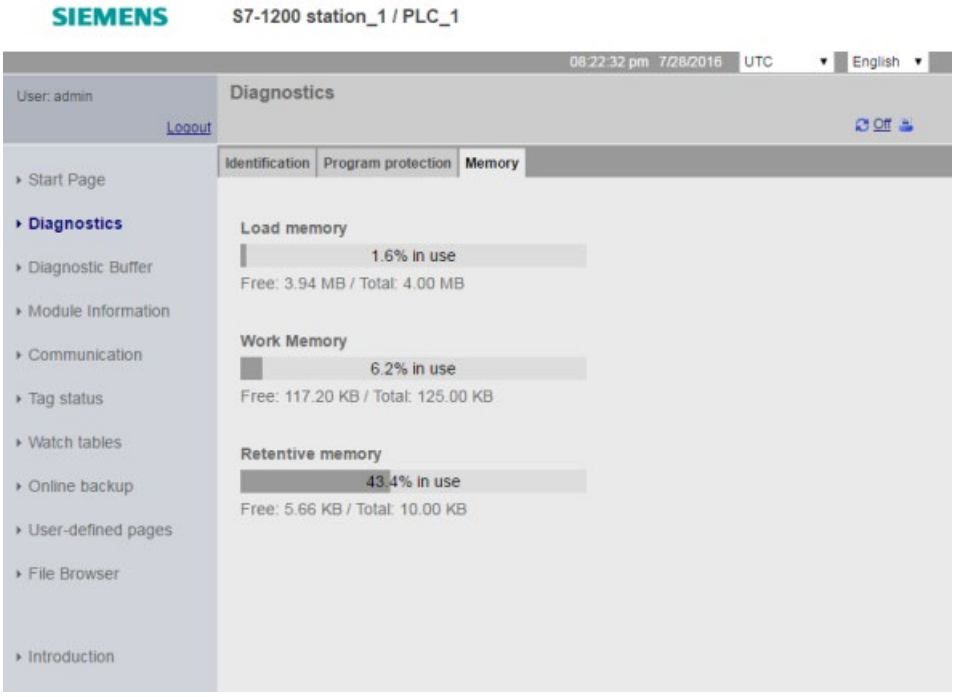
Program protection tab

The program protection tab includes the following information:

- Know-how protection (Page 207): Displays whether you have configured know-how protection for any of the program blocks in STEP 7
- Binding (Page 208): Displays whether you have bound the program to either the CPU or to the SIMATIC memory card
- Program copy to memory card (Page 206): DIsplays whether you have enabled the ability to copy the program from internal load memory to external load memory (SIMATIC memory card)



Memory tab



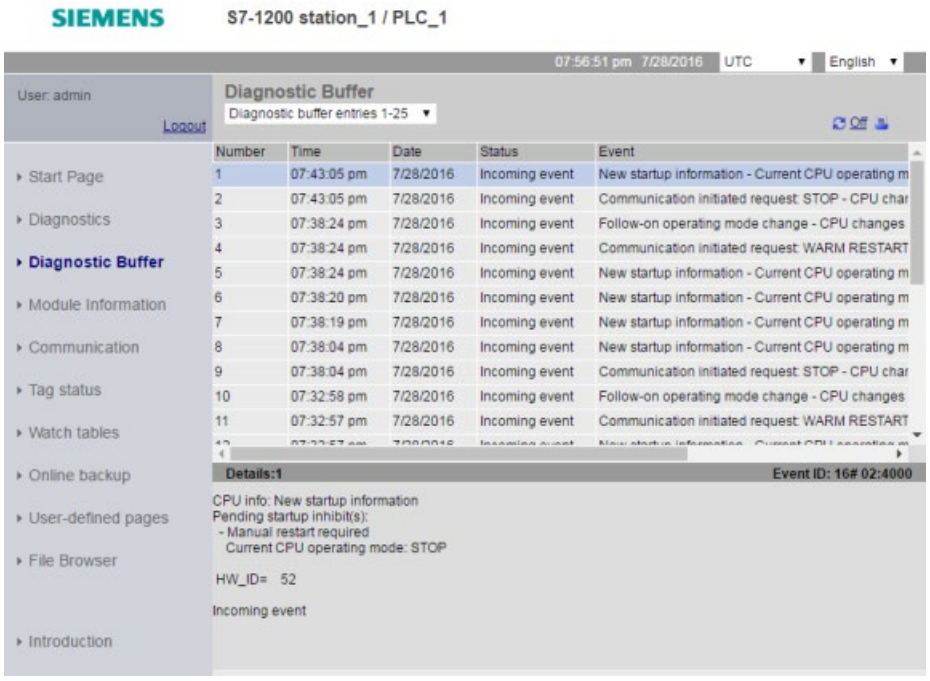
Fail-safe tab

Refer to the S7-1200 Functional Safety Manual (https://support.industry.siemens.com/cs/ww/en/view/104547552) for information about the Diagnostics page Fail-safe tab.

12.6.7 Diagnostic Buffer

The diagnostic buffer page displays diagnostic events. The newest event is Number 1 at the top and the oldest event is Number 50. From the selector on the left, you can choose what range of diagnostic buffer entries to display, either 1 to 25 or 26 to 50. From the selector on the right, you can choose whether to display the times in UTC times or PLC local times. The top part of the page displays the diagnostic entries with the time and date of when the event occurred.

From the top part of the page, you can select any individual entry to show detailed information about that entry in the bottom part of the page. Note that the display language of the diagnostic buffer entries depends upon your device configuration setting for multilingual support (Page 171).



Viewing the Diagnostic Buffer page requires the "query diagnostics" privilege (Page 984).

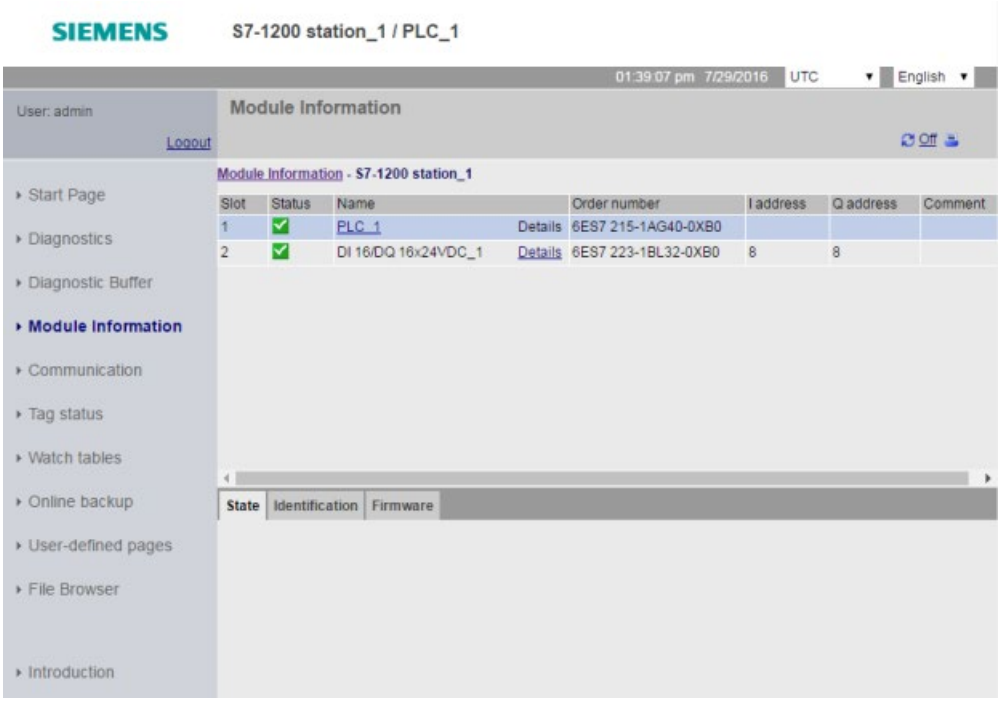
12.6.8 Module Information

The module information page provides information about all the modules in the local rack. The top section of the screen shows a summary of the modules based on the device configuration in STEP 7, and the bottom section shows status, identification and firmware information for the selected module based on the corresponding connected module. The module information page also provides the capability to perform a firmware update.

Viewing the Module Information page requires the "query diagnostics" privilege (Page 984).

Module information: Status tab

The status tab in the bottom section of the module information page displays a description of the current status of the module that is selected in the top section. If the section is empty, then the module has no pending diagnostic state.



Status icons for the modules

For each module, the status column of the top section displays an icon that indicates the status of that module:

Icon	Meaning
	No fault
	Deactivated
	Maintenance required
	Maintenance demanded
	Error
	The CPU cannot reach the module or device (for devices other than the CPU)
	The CPU has established a connection to the device, but the module status is unknown (for devices other than the CPU)
	Input and output data are unavailable because the submodule has blocked its I/O channels (for devices other than the CPU)

Drilling down

You can select a link in the top section to drill down to the module information for that particular module. Modules with submodules have links for each submodule. The type of information that is displayed varies with the module selected. For example, the module information dialog initially displays the name of the S7-1200 station, a status indicator, and a comment. If you drill down to the CPU, the module information displays the name of the digital and analog inputs and outputs that the CPU model provides, addressing information for the I/O, status indicators, slot numbers, and comments.

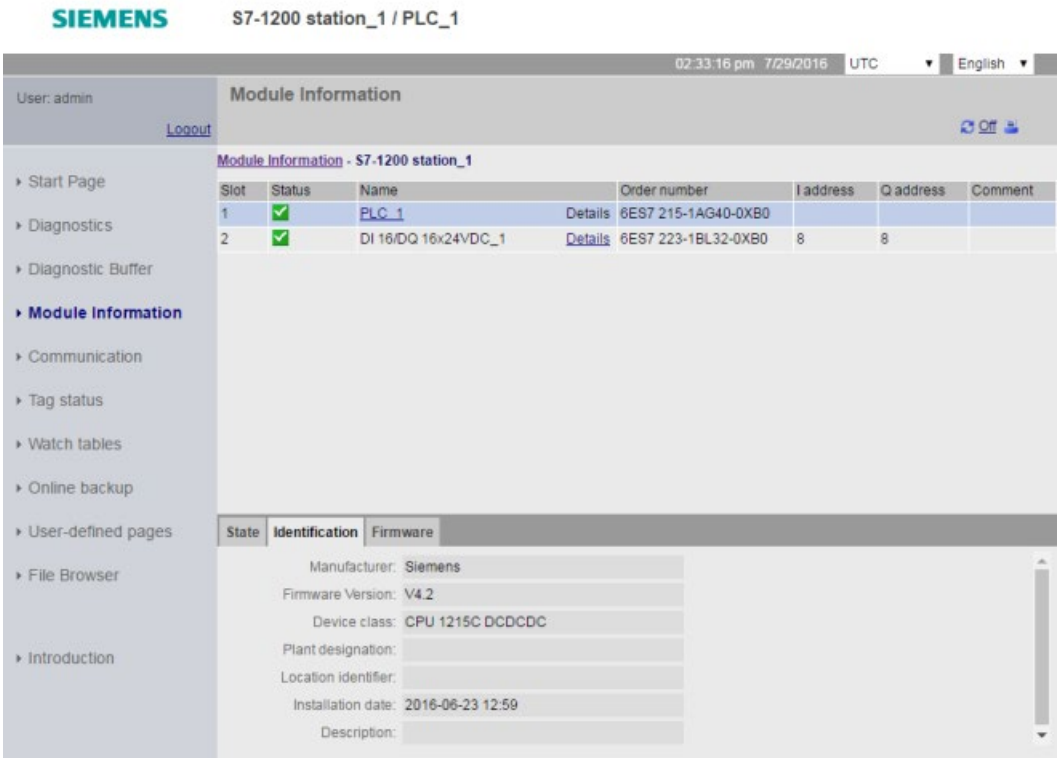
Slot	Status	Name		Order number	I address	Q address	Comment
1.16	✔	HSC_1	Details	6ES7 214-1AG40-0XB0	1000	---	
1.17	✔	HSC_2	Details	6ES7 214-1AG40-0XB0	1004	---	
1.18	✔	HSC_3	Details	6ES7 214-1AG40-0XB0	1008	---	
1.19	✔	HSC_4	Details	6ES7 214-1AG40-0XB0	1012	---	
1.20	✔	HSC_5	Details	6ES7 214-1AG40-0XB0	1016	---	
1.21	✔	HSC_6	Details	6ES7 214-1AG40-0XB0	1020	---	
1.2	✔	AI2_1	Details	6ES7 214-1AG40-0XB0	64	---	
1.1	✔	DI14/DQ10_1	Details	6ES7 214-1AG40-0XB0	0	0	
1.32	✔	Pulse_1	Details	6ES7 214-1AG40-0XB0	---	1000	

As you drill down, the module information page shows the path you have followed. You can click any link in this path to return to a higher level.



Module information: Identification tab

The identification tab displays the Identification and Maintenance (I&M) information of the selected module.



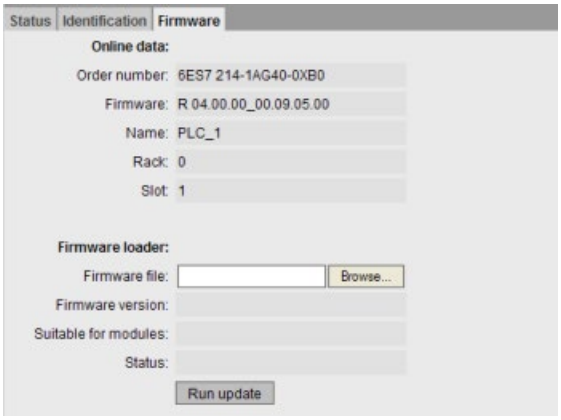
Note that if you click an F-I/O module in the top section, then the bottom section has a Safety tab. On this tab, you can see specific data related to the selected module as described in the S7-1200 Functional Safety Manual (https://support.industry.siemens.com/cs/ww/en/view/104547552).

Module information: Firmware tab

The firmware tab of the module information page displays information about the firmware of the selected module. If you have the "perform firmware update" privilege (Page 984), you can also perform a firmware update of the CPU or other modules in the local rack that support firmware update. For remote modules, you can view the firmware information, but not perform a firmware update.

Note

For updating CPU firmware, you can only update S7-1200 CPUs of version 3.0 and higher.



Performing a firmware update

The CPU must be in STOP mode to perform a firmware update. When the CPU is in STOP mode, click the Browse button to navigate to and select a firmware file. Firmware updates are available on the Siemens Industry Online Support Web site (http://support.industry.siemens.com).

During the update, the page displays a message showing that the update is in progress. After the update completes, the page displays the article number and version number of the updated firmware. If you updated the firmware for the CPU or a signal board, the Web server restarts the CPU.

You can also perform a firmware update by one of these methods:

- Using the online and diagnostic tools of STEP 7 (Page 1304)
- Using a SIMATIC memory card (Page 144)
- Using the SIMATIC Automation Tool (https://support.industry.siemens.com/cs/ww/en/view/98161300)

Note

Potential problems with performing a firmware update from the Web server

In the event of a communications disruption during a firmware update from the Web server, your Web browser could display a message asking whether you want to leave or stay on the current page. To avoid potential problems, select the option to stay on the current page.

If you close the Web browser while in the process of performing a firmware update from the Web server, you will be unable to change the operating mode of the CPU to RUN mode. If this situation happens, you must cycle power to the CPU to be able to change the CPU to RUN mode.

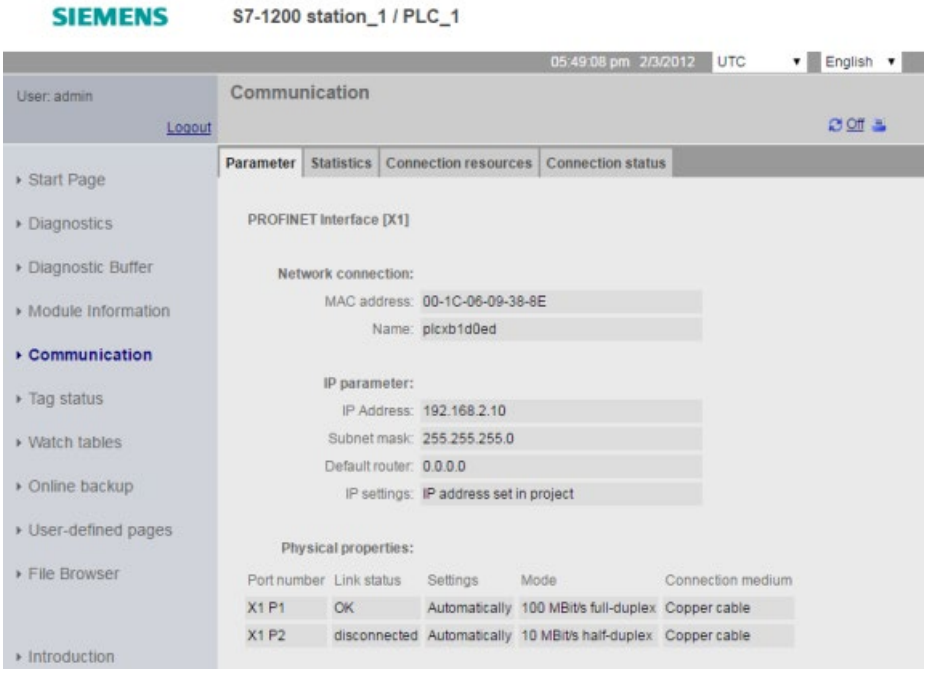
12.6.9 Communication

The communication page displays the parameters of the connected CPU, communications statistics, resources and information about connections.

Viewing the Communication page requires the "query diagnostics" privilege.

Parameter tab

The Parameter tab shows the MAC address of the CPU, the IP address and IP settings of the CPU, and physical properties:



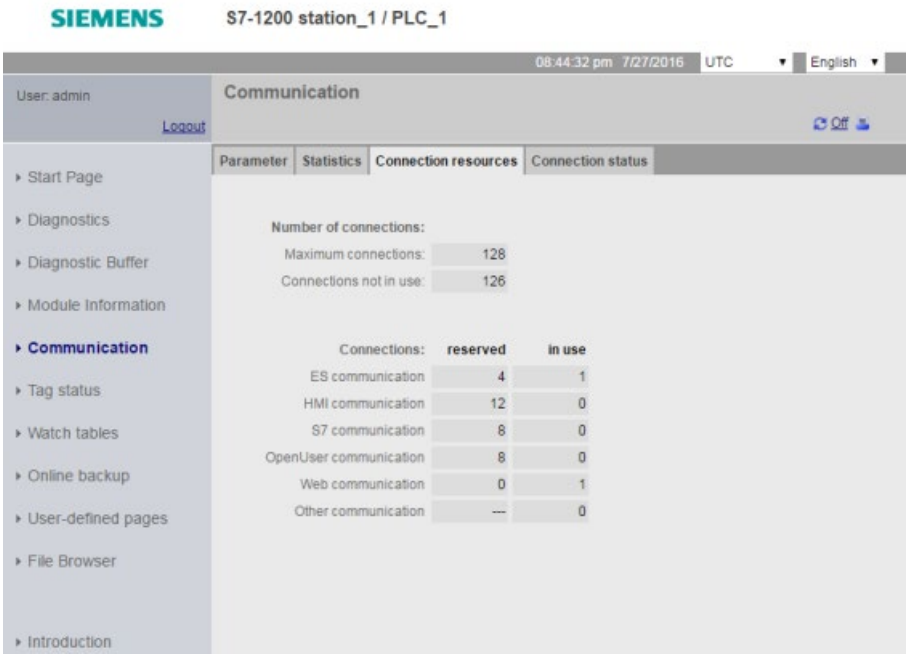
Statistics tab

The Statistics tab shows send and receive communication statistics:



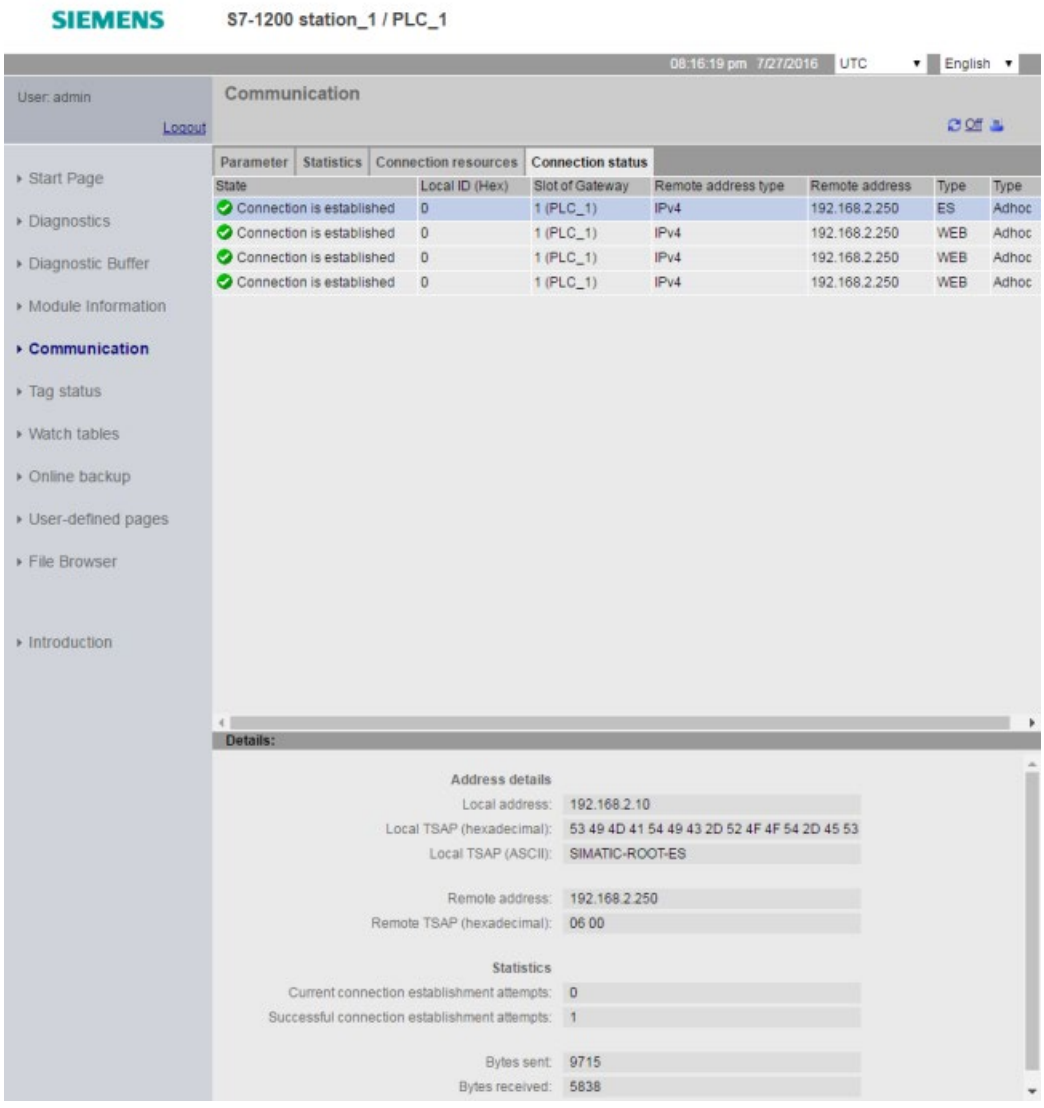
Connection resources tab

The Resources tab shows information about the total number of connection resources and how they are allocated for different types of communication:



Connection status tab

The Connections tab shows the connections for the CPU, and connection details for the selected connection.

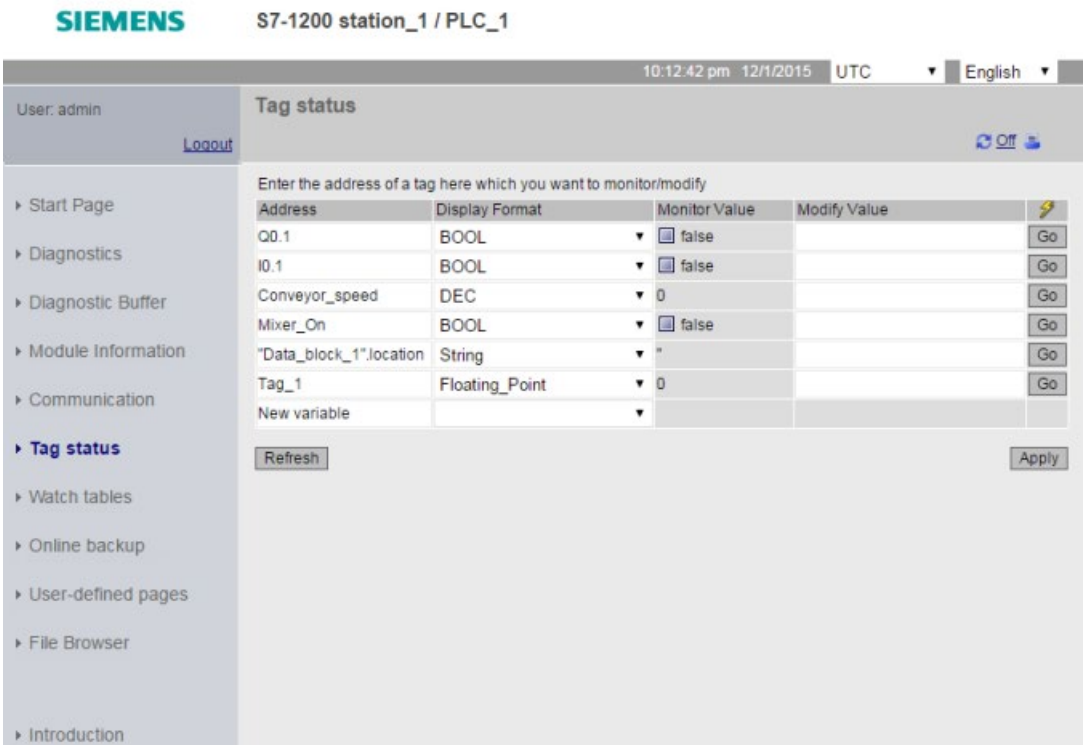


12.6.10 Tag status

The Tag status page allows you to view any of the I/O or memory data in your CPU. You can enter a direct address (such as %I0.0), a PLC tag name, or a tag from a specific data block. For data block tags, you enclose the data block name in double quotation marks. For each monitor value you can select a display format for the data. You can continue entering and specifying values until you have as many as you want within the limitations for the page. The monitor values show up automatically. You can click the "Refresh" button at any time to refresh all of the monitor values. If you have enabled automatic update in STEP 7 (Page 983), you can click the "Off" icon in the upper right area of the page to disable it. When automatic update is disabled, you can click "On" to re-enable it.

Viewing the Tag status page requires the "read tag status" privilege.

If you login as a user with the "write tag status" privilege (Page 993), you can also modify data values. Enter any values that you wish to set in the appropriate "Modify Value" field. Click the "Go" button beside a value to write that value to the CPU. You can also enter multiple values and click "Apply" to write all of the values to the CPU. The buttons and column labels for modifying only appear if you have the "write tag status" privilege.



If you leave the Tag status page and return, the Tag status page does not retain your entries. You can bookmark the page and return to the bookmark to see the same entries. If you do not bookmark the page, you must re-enter the variables.

For values you frequently monitor or modify, consider using a Watch table (Page 1012) instead.

Note

Be aware of the following issues when using the standard Tag status page:

- Enclose all string modifications in single quotes.
- The Tag status page can monitor and modify tags that contain any of the following characters: &, <, (, +, ,(comma), ., [,], $, or %, providing you enclose the tag name in double quotation marks, for example, "Clock_2.5Hz".
- To monitor or modify just one field of a DTL tag, include the field in the Address, for example, "Data_block_1".DTL_tag.Year. Enter an integer value for the modify value according to the data type of the specific field of the DTL. For example, the Year field is a UInt.
- The maximum number of variable entries per page is 50.
- If a tag name displays special characters such that it is rejected as an entry on the Tag status page, you can enclose the tag name in double quotation marks. In most cases, the page will then recognize the tag name.

See also

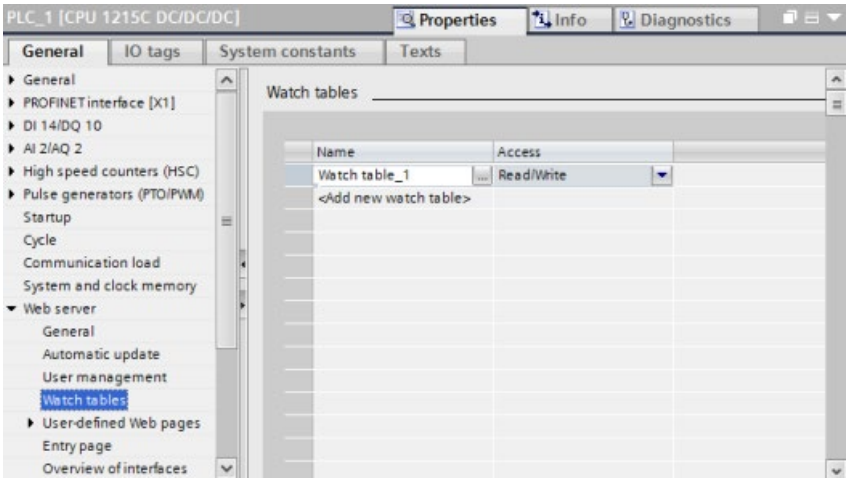
Rules for entering tag names and values (Page 1062)

12.6.11 Watch tables

The Web server allows you to access watch tables that you have configured in STEP 7 and which you have downloaded to the CPU. Watch tables with 50 or fewer entries offer the best performance in the Web server.

STEP 7 configuration to select watch tables for the Web server

From the Device Configuration of the CPU in STEP 7, you can add the watch tables that you want the Web server to be able to display. For each watch table that you select from the list of existing watch tables, you select Read or Read/Write privileges for it. When downloaded to the CPU, you can only view the watch tables that have the Read privilege but you can view and modify watch table tags when you select the Read/Write privilege.



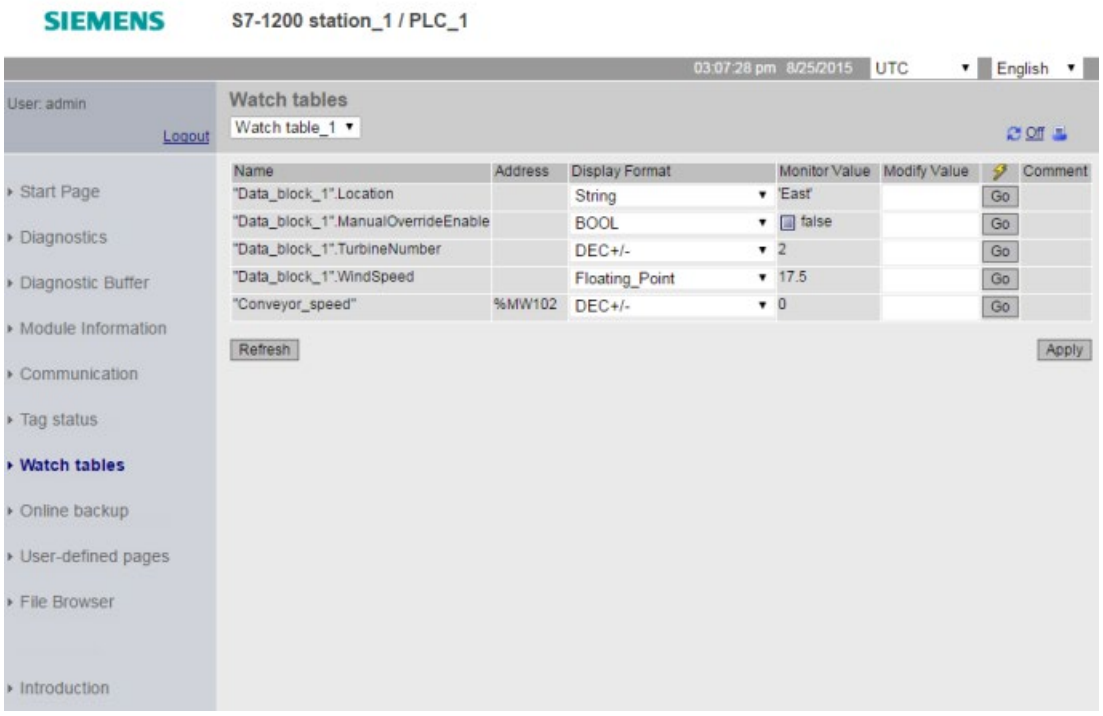
After you complete the watch table configuration in the Web server section of the device configuration, download your hardware configuration to the CPU.

Viewing watch tables from the Web server

From the Web server, if you have the "read tags" privilege (Page 984) you can select "Watch tables" from the navigation menu to access the watch tables that you have configured and downloaded to the CPU. If you have downloaded more than one watch table, you can select the one you want to display from the drop-down list. The Web server displays the watch table that you created in STEP 7 and the current values according to the display format. You can change the display format if you choose, but when you return to the watch table page the Web server defaults to the display formats in the STEP 7 watch table.

Modifying watch table tags from the Web server

If you downloaded a watch table with the "Read/Write" access level, and you have logged in to the Web server with the "write tags" privilege (Page 984) you can also modify tag values just like you do in a watch table in STEP 7. You can modify individual tag values and click "Go" to modify only the one value, or you can enter several values and click "Apply" to modify them all at once.



Note

Advantages of watch tables for modifying tags

In order for a user to modify tags and data block tags in the CPU from a watch table, you must configure the watch table in the Web server properties in the STEP 7 device configuration, and you must make it have Read/Write access. By so doing, you can restrict the tags to which a user with the "write tags" privilege can modify to only those tags in the configured Web server watch tables.

The Tag Status (Page 1011) page on the other hand allows any user with the "write tag status" privilege to write to any tag or data block tag in the CPU.

By careful configuration of the Web server user management privileges (Page 984), you can help safeguard access to your PLC data.

See also

Rules for entering tag names and values (Page 1062)

12.6.12 Online backup

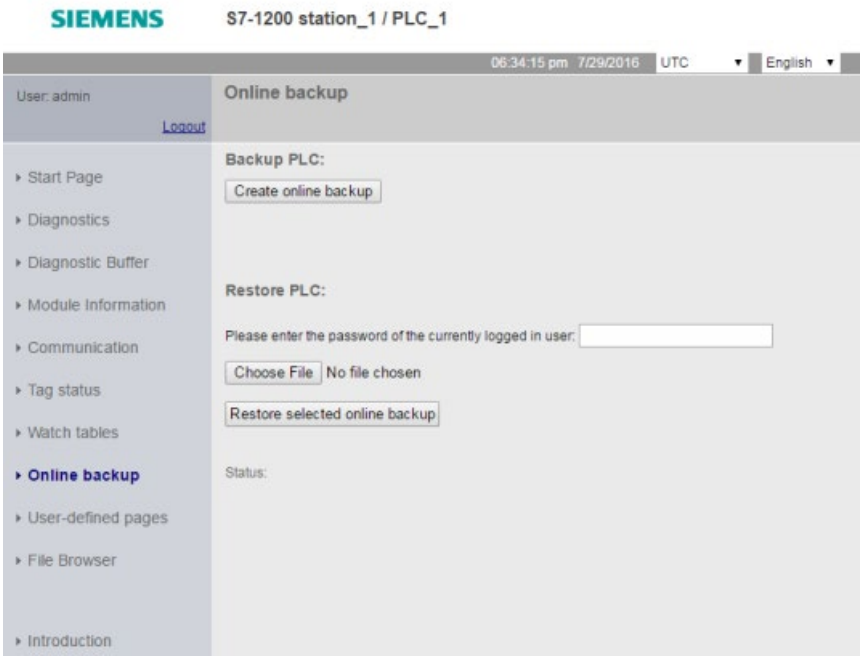
The Online backup standard Web page allows you to make a backup of the STEP 7 project for the online PLC as well as to restore a previously-made backup of the PLC. Before creating a backup or restoring a backup, place the PLC in STOP mode and cease all communication with the PLC such as HMI access and Web server access. If your CPU is not in STOP mode, the backup and restore functions prompt for confirmation to place the CPU in STOP mode before continuing.

If you have accessed the Online backup page through one of the Web-enabled CP modules, you can perform a backup but you cannot restore.

Note

You can also perform backup and restore operations from STEP 7 (Page 1337). Refer to these topics for a full description of what data you can back up and restore. The SIMATIC Automation Tool (SAT) also provides backup and restore capability.

When you back files up from the Web server, your PC or device saves the backup files in the default folder for downloads. When you back files up from STEP 7, STEP 7 stores the files within the STEP 7 project. You cannot restore STEP 7 backup files from the Web server and you cannot restore Web server backup files from STEP 7. You can, however, save STEP 7 backup files directly to the download folder of your PC or device. If you do so, then you can restore these files from the Web server.



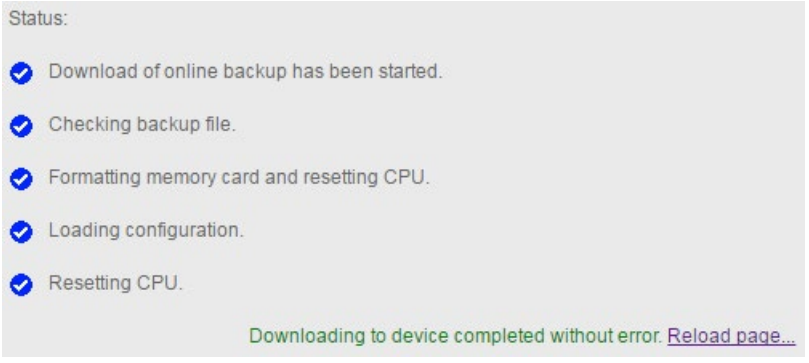
Backup PLC

From the Backup PLC section of the page, click the "Create online backup" button to make a backup of the project that is currently stored in the PLC. This function requires the "Backup CPU" user privilege (Page 984). If the CPU is in RUN mode and you have to change it to STOP mode, you also need the "Change operating mode" privilege. The PC or device will store the backup file at the default location for downloads. Depending on your browser and device settings, you might be prompted about saving the file.

Restore PLC

From the Restore PLC section of the page, enter the Web server user password and click the "Browse" or "Choose File" button (depending on your browser) to select a previously-saved backup file. Click the "Load online backup" button and confirm the prompt to load this file in the connected PLC. This page requires the "Restore CPU" user privilege (Page 984). If the CPU is in RUN mode and you have to change it to STOP mode, you also need the "Change operating mode" privilege.

As the restore operation proceeds, you see a series of progress messages and you must reenter your user login and password. After each step of the process completes successfuly, you see the following completion indicators and a link to reload the page:



WARNING

Restoring backups with unknown content

If you restore a backup with unknown content, you can cause serious damage or injuries in case of malfunctions or program errors.

In addition, if you restore a backup that does not have the Web server enabled in the device configuration of the CPU, you will not be able to access the CPU from the Web server.

Make sure that the backup consists of a configuration with known content.

Note

Restoring a backup where the CPU IP address is different

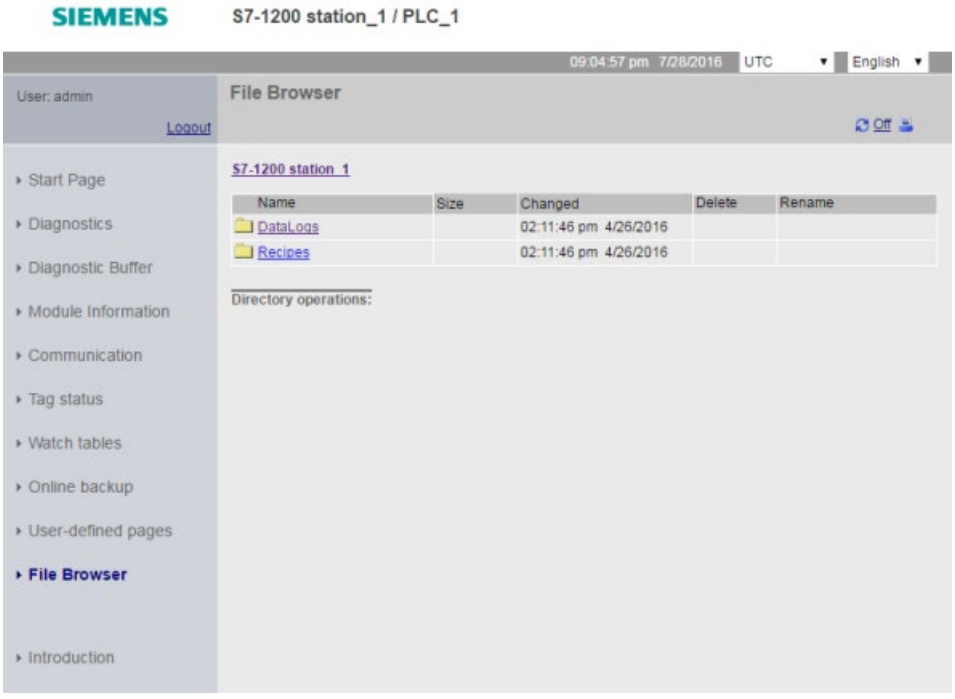
If you attempt to restore a backup where the CPU IP address in the backup is different from the IP address of the current CPU, the Web server cannot display the message that the restore is complete. After you see the "Reset CPU" message for greater than five minutes, enter the new IP address that corresponds to the address in the backup file. The CPU now has this address and you can resume Web server access.

12.6.13 File Browser

The File Browser page provides access to files in the internal load memory of the CPU or on the memory card (external load memory). The file browser page initially displays the root folder of the load memory, which contains the "DataLogs" and "Recipes" folders, but also displays any other folders that you might have created, if using a memory card.

The type of file access you have to the files and folders depends on your user privileges (Page 984). Any user with "read files" privileges can view the files and folders with the file browser. You cannot delete the DataLogs folder or Recipes folder regardless of your login privileges, but if you had made custom folders on the memory card, you can delete those folders if you have logged in as a user with "write/delete files" privileges.

Click a folder to access the individual files in the folder.



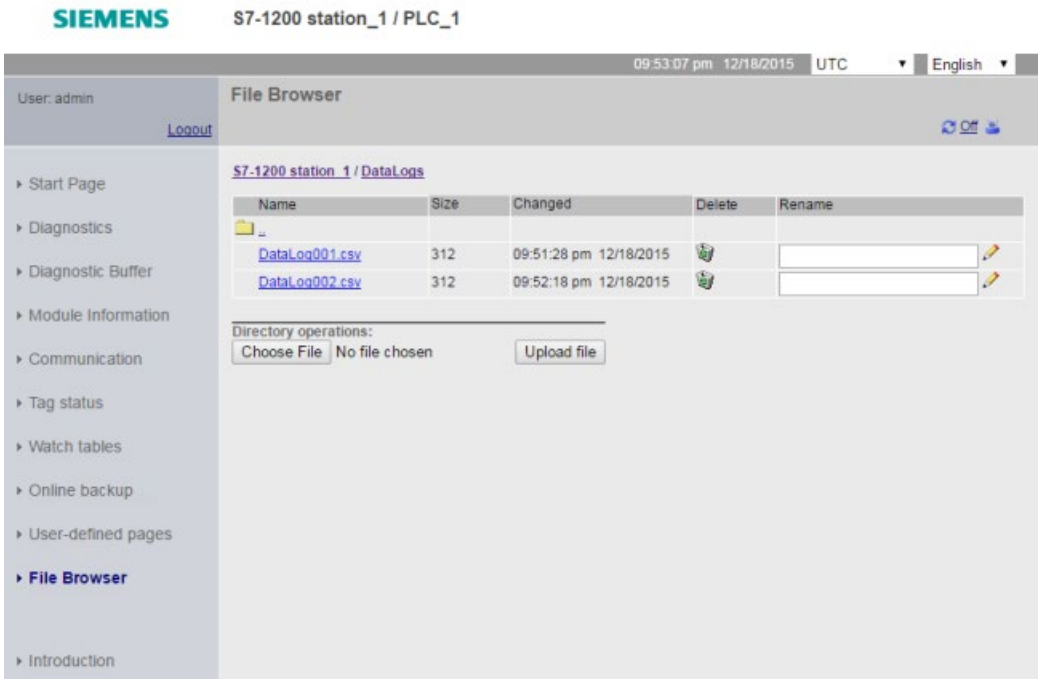
Data logs

From the "Data Logs" folder, you can open any of the data log files. If you have logged in with the "write/delete files" privilege (Page 984), you can also delete, rename, and upload files. The data log files are in comma-separated values (CSV) file format. You can save them to your computer or open them in Microsoft Excel (default) or another program.

Note

Time stamps for data logs

The Web server displays the time stamps for the data logs in either UTC time or PLC local time depending upon your selection at the top of the page.



Note: The "Delete" and "Rename" options are not available if you are not logged in with the "write/delete files" privilege.

Note

Data log management

Keep no more than 1000 data logs in a file system. Exceeding this number can prevent the Web server from having enough CPU resources to display the data logs.

If you find that the File Browser Web page is not able to display the data logs, then you must place the CPU in STOP mode in order to display and delete data logs.

Manage your data logs to ensure that you only keep the number that you need to maintain, and do not exceed 1000 data logs.

Working with a data log in Excel

The data log file is in USA/UK comma-separated values format (CSV). To open it in Excel on non-USA/UK systems, you must import it into Excel with specific settings (Page 1065).

Recipe files

Like the data logs folder, the recipe folder displays any recipe files that are present in load memory. Recipe files are also in CSV format, and you can open them in Microsoft Excel, or another program. Like data logs, you must have modify privileges in order to delete, modify and save, rename or upload recipe files.

Uploading files and automatic page refresh

If you begin a file upload, the upload operation continues as long as you remain on the File Browser Web page. If you enabled automatic update to refresh the Web server pages every ten seconds, then whenever a page refresh occurs you see the incremental progress of the file upload operation. For example, if you are uploading a 2 MB file, you might see updates that show the file size in bytes at 2500, 5000, 10000, 15000, and 20000 as the file upload progresses.

If you navigate away from the File Browser page before the upload completes, the Web server deletes the incomplete file.

Additional information

Note

File name conventions

In order for the Web server to work with data log and recipe files, the characters in the file names must be from the ASCII character set with the exception of the characters \ / : * ? " < > | and the space character.

If your files are not compliant with this naming convention, the Web server can have errors in operations such as file upload, deletion or renaming. In this case, you might need to use a card reader and the Windows file explore to rename files that were on external load memory.

For information on programming with the data log instructions, and importing (Page 490) and exporting (Page 488) recipes, see the Recipes and Data logs (Page 484) chapter.

12.7 User-defined Web pages

The S7-1200 Web server also provides the means for you to create your own application-specific HTML pages that incorporate data from the PLC.

WARNING

Unauthorized access to the CPU through user-defined Web pages

Unauthorized access to the CPU through user-defined Web pages could disrupt process operation, which could result in death, severe personal injury and/or property damage.

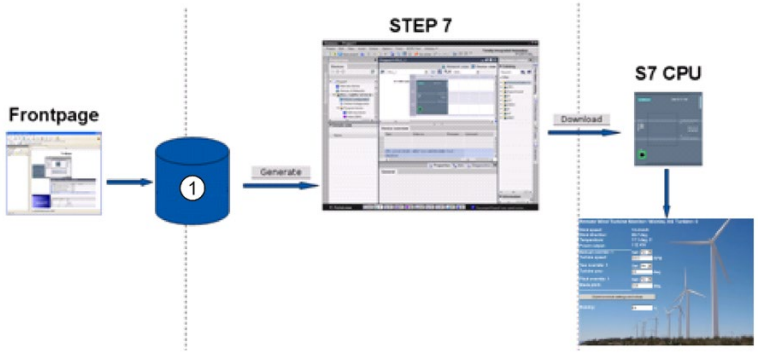
Insecure coding of user-defined Web pages introduces security vulnerabilites such as cross-site scripting (XSS), code injection, and others.

Protect your S7-1200 CPU from unauthorized access by installing it in a secure fashion as outlined in the Operational Guidelines found on the Industrial Security Web site (http://www.siemens.com/industrialsecurity).

You create user-defined Web pages using the HTML editor of your choice and download them to the CPU where they are accessible from the standard Web page menu. This process involves several tasks:

- Creating HTML pages with an HTML editor, such as Microsoft Frontpage (Page 1021)
- Including AWP commands in HTML comments in the HTML code (Page 1022):The AWP commands are a fixed set of commands that Siemens provides for accessing CPU information.
- Configuring STEP 7 to read and process the HTML pages (Page 1036)
- Generating blocks from the HTML pages (Page 1036)
- Programming STEP 7 to control the use of the HTML pages (Page 1038)
- Compiling and downloading the blocks to the CPU (Page 1039)
- Accessing the user-defined Web pages from your PC (Page 1040)

This process is illustrated below:



① HTML files with embedded AWP commands

12.7.1 Creating HTML pages

You can use the software package of your choice to create your own HTML pages for use with the Web server. Be sure that your HTML code is compliant to the HTML standards of the W3C (World Wide Web Consortium). STEP 7 does not perform any verification of your HTML syntax.

You can use a software package that lets you design in WYSIWYG or design layout mode, but you need to be able to edit your HTML code in pure HTML form. Most Web authoring tools provide this type of editing; otherwise, you can always use a simple text editor to edit the HTML code. Include the following line in your HTML page to set the charset for the page to UTF-8:

```
<meta http-equiv="content-type" content="text/html; charset=utf-8">
```

Also be sure to save the file from the editor in UTF-8 character encoding.

You use STEP 7 to compile everything in your HTML pages into STEP 7 data blocks. These data blocks consist of one control data block that directs the display of the Web pages and one or more fragment data blocks that contain the compiled Web pages. Be aware that extensive sets of HTML pages, particularly those with lots of images, require a significant amount of load memory space (Page 1041) for the fragment DBs. If the internal load memory of your CPU is not sufficient for your user-defined Web pages, use a memory card (Page 134) to provide external load memory.

To program your HTML code to use data from the S7-1200, you include AWP commands (Page 1022) as HTML comments. When finished, save your HTML pages to your PC and note the folder path where you save them.

Note

The file size limit for HTML files containing AWP commands is 64 kilobytes. You must keep your file size below this limit for STEP 7 to be able to successfully compile your pages.

Refreshing user-defined Web pages

User-defined Web pages do not automatically refresh. It is your choice whether to program the HTML to refresh the page or not. For pages that display PLC data, refreshing periodically keeps the data current. For HTML pages that serve as forms for data entry, refreshing can interfere with the user entering data. If you want your entire page to automatically refresh, you can add this line to your HTML header, where "10" is the number of seconds between refreshes:

```
<meta http-equiv="Refresh" content="10">
```

You can also use JavaScript or other HTML techniques to control page or data refreshing. For this, refer to documentation on HTML and JavaScript.

12.7.2 AWP commands supported by the S7-1200 Web server

The S7-1200 Web server provides AWP commands that you embed in your user-defined Web pages as HTML comments for the following purposes:

- Reading variables (Page 1023)
- Writing variables (Page 1024)
- Reading special variables (Page 1026)
- Writing special variables (Page 1028)
- Defining enum types (Page 1030)
- Assigning variables to enum types (Page 1030)
- Creating fragment data blocks (Page 1032)

General syntax

Except for the command to read a variable, the AWP commands are of the following syntax:
<!-- AWP_ <command name and parameters> -->

You use the AWP commands in conjunction with typical HTML form commands to write to variables in the CPU.

The descriptions of the AWP commands in the following pages use the following conventions:

- Items enclosed in brackets [ ] are optional.
- Items enclosed in angle brackets **< >** are parameter values to be specified.
- Quotation marks are a literal part of the command. They must be present as indicated.
- Special characters in tag or data block names, depending on usage, must be escaped or enclosed in quotation marks (Page 1034).

Use a text editor or HTML editing mode to insert AWP commands into your pages.

Note

Expected syntax of AWP commands

The space after "<!--" and the space before "-->" in the formulation of an AWP command are essential to proper compiling of the command. Omission of the space characters can cause the compiler to be unable to generate the proper code. The compiler does not display an error in this case.

AWP command summary

The details for using each AWP command are in the topics to follow, but here is a brief summary of the commands:

Reading variables

```
:=<Varname>:
```

Writing variables

```
<!-- AWP_In_Variable Name='<Varname1>' [Use='<Varname2>'] ... -->
```

This AWP command merely declares the variable in the Name clause to be writable. Your HTML code performs writes to the variable by name from <input>, <select>, or other HTML statements within an HTML form.

Reading special variables

```
<!-- AWP_Out_Variable Name='<Type>:<Name>' [Use='<Varname>'] -->
```

Writing special variables

```
<!-- AWP_In_Variable Name='<Type>:<Name>' [Use='<Varname>']-->
```

Defining enum types

```
<!--
 AWP_Enum_Def Name='<Enum type name>' Values='<Value>, <Value>,... '
 -->
```

Referencing enum types

```
<!-- AWP_In_Variable Name='<Varname>' Enum="<Enum type name>" -->
<!-- AWP_Out_Variable Name='<Varname>' Enum="<Enum type name>" -->
```

Creating fragments

```
<!-- AWP_Start_Fragment Name='<Name>' [Type=<Type>][ID=<id>] -->
```

Importing fragments

```
<!-- AWP_Import_Fragment Name='<Name>' -->
```

12.7.2.1 Reading variables

User-defined Web pages can read variables (PLC tags) and data block tags from the CPU, provided that you have configured the tags to be accessible from an HMI.

Syntax

```
:=<Varname>:
```

Parameters

<Varname>	The variable to be read, which can be a PLC tag name from your STEP 7 program, a data block tag, I/O, or addressable memory. For memory or I/O addresses or alias names (Page 1034), do not use quotation marks around the tag name. For PLC tags, use double quotation marks around the tag name. For data block tags, enclose the block name only in double quotation marks. The tag name is outside of the quotation marks. Note that you use the data block name and not a data block number. Reference array elements using array element syntax.

Examples

```
:="Conveyor_speed":
:="My_Data_Block".flag1:
:=I0.0:
:=MW100:
:="My_Data_Block".Array_Dim1[0]:
:="My_Data_Block".Array_Dim2[0,0]:
```

Example reading an aliased variable

```
<!-- AWP_Out_Variable Name='flag1' Use='"My_Data_Block".flag1' -->
:=flag1:
```

Note

Defining alias names for PLC tags and data block tags is described in the topic Using an alias for a variable reference (Page 1029).

If a tag name or data block name includes special characters, you must use additional quotation marks or escape characters as described in the topic Handling tag names that contain special characters (Page 1034).

12.7.2.2 Writing variables

User-defined pages can write data to the CPU. This is accomplished by using an AWP command to identify a variable in the CPU to be writable from the HTML page. The variable must be specified by PLC tag name or data block tag name. You can declare multiple variable names in one statement. To write the data to the CPU, you use standard HTTP POST commands.

A typical usage is to design a form in your HTML page with text input fields or select list choices that correspond to writable CPU variables. As with all user-defined pages, you then generate the blocks from STEP 7 such that they are included in your STEP 7 program. When a user with privileges to modify variables subsequently accesses this page and types data into the input fields or selects a choice from a select list, the Web server converts the input to the appropriate data type for the variable, and writes the value to the variable in the CPU. Note that the name clause for HTML input fields and HTML select lists uses syntax typical for the name clause of the AWP_In_Variable command. Typically enclose the name in single quotation marks and if you reference a data block, enclose the data block name in double quotation marks.

For form management details, refer to documentation for HTML.

Syntax

```
<!-- AWP_In_Variable Name='<Varname1>' [Use='<Varname2>'] ... -->
```

Parameters

<Varname1>	If no Use clause is provided, Varname1 is the variable to be written. It can be a PLC tag name from your STEP 7 program, a tag from a specific data block, or a data block name. If a Use clause is provided, Varname1 is an alternate name for the variable referenced in <Varname2> (Page 1029). It is a local name within the HTML page.
<Varname2>	If a Use clause is provided, Varname2 is the variable to be written. It can be a PLC tag name from your STEP 7 program or a tag from a specific data block.

For both Name clauses and Use clauses, the complete name must be enclosed in single quotation marks. Within the single quotes, use double quotation marks around a PLC tag and double quotation marks around a data block name. The data block name is within the double quotes but not the data block tag name. Note that for data block tags, you use the name of the block and not a data block number. Reference array elements using array element syntax.

If you use an AWP_In_Variable command to make a data block writable, then every tag in the data block is writable.

Examples using HTML input field

```
<!-- AWP_In_Variable Name='"Target_Level"' -->
<form method="post">
<p>Input Target Level: <input name='"Target_Level"' type="text" />
</p>
</form>

<!-- AWP_In_Variable Name='"Data_block_1".Braking' -->
<form method="post">
<p>Braking: <input name='"Data_block_1".Braking' type="text" />
%</p>
</form>

<!-- AWP_In_Variable Name='"Data_block_1".Array_Dim2' -->
<form method="post">
<p>Two-dimensional array value [2,1]: <input
name='"Data_block_1".Array_Dim2[2,1]' type="text" /> %</p>
</form>
```

Example using Use clause

```
<!-- AWP_In_Variable Name='"Braking"' Use='"Data_block_1".Braking' -
->
<form method="post">
<p>Braking: <input name='"Braking"' type="text" /> %</p>
</form>
```

Example using writable data block

```
<!-- AWP_In_Variable Name='"Data_block_1"' -->
<form method="post">
<p>Braking: <input name='"Data_block_1".Braking' type="text" /> %
</p>
<p>Turbine Speed: <input name='"Data_block_1".TurbineSpeed'
size="10" value='"Data_block_1".TurbineSpeed' type="text" />
</p>
</form>
```

Example using HTML select list

```
<!-- AWP_In_Variable Name='"Data_block_1".ManualOverrideEnable'-->
<form method="post">
<select name='"Data_block_1".ManualOverrideEnable'>
<option value=:"Data_block_1".ManualOverrideEnable:> </option>
<option value=1>Yes</option>
<option value=0>No</option>
</select><input type="submit" value="Submit setting" /></form>
```

Note

Only a user with the "Write in user-defined pages" privilege (Page 984) can write data to the CPU. The Web server ignores the commands if the user does not have modify privileges.

If a tag name or data block name includes special characters, you must use additional quotation marks or escape characters as described in the topic "Handling tag names that contain special characters (Page 1034)".

12.7.2.3 Reading special variables

The Web server provides the ability to read values from the PLC to store in special variables in the HTTP response header. You might, for example, want to read a pathname from a PLC tag to redirect the URL to another location using the HEADER:Location special variable.

Syntax

```
<!-- AWP_Out_Variable Name='<Type>:<Name>' [Use='<Varname>'] -->
```

Parameters

<Type>	The type of special variable, which is one of the following: HEADER COOKIE_VALUE COOKIE_EXPIRES
<Name>	Refer to HTTP documentation for a list of all the names of HEADER variables. A few examples are listed below: Status: response code Location: path for redirection Retry-After: how long service is expected to be unavailable to the requesting client For types COOKIE_VALUE and COOKIE_EXPIRES, <Name> is the name of a specific cookie. COOKIE_VALUE:name: value of the named cookie COOKIE_EXPIRES:name: expiration time in seconds of named cookie The Name clause must be enclosed in single or double quotation marks. If no Use clause is specified, the special variable name corresponds to a PLC tag name. Enclose the complete Name clause within single quotation marks and the PLC tag in double quotation marks. The special variable name and PLC tag name must match exactly.
<Varname>	Name of the PLC tag or data block tag into which the variable is to be read The Varname must be enclosed in single quotation marks. Within the single quotes, use double quotation marks around a PLC tag or data block name. The data block name is within the double quotes but not the data block tag name. Note that for data block tags, you use the name of the block and not a data block number.

If a tag name or data block name includes special characters, you must use additional quotation marks or escape characters as described in the topic Handling tag names that contain special characters (Page 1034).

Example: Reading a special variable with no Use clause

```
<!-- AWP_Out_Variable Name='"HEADER:Status"' -->
```

In this example, the HTTP special variable "HEADER:Status" receives the value of the PLC tag "HEADER:Status". The name in the PLC tag table must match the name of the special variable exactly if no Use clause is specified.

Example: Reading a special variable with a Use clause

```
<!-- AWP_Out_Variable Name='HEADER:Status' Use='"Status"' -->
```

In this example, the special variable "HEADER:Status" receives the value of the PLC tag "Status".

12.7.2.4 Writing special variables

The Web server provides the ability to write values to the CPU from special variables in the HTTP request header. For example, you can store information in STEP 7 about the cookie associated with a user-defined Web page, the user that is accessing a page, or header information. The Web server provides access to specific special variables that you can write to the CPU when logged in as a user with privileges to modify variables.

Syntax

```
<!-- AWP_In_Variable Name='<Type>:<Name>' [Use='<Varname>']-->
```

Parameters

<Type>	The type of special variable and is one of the following: HEADER SERVER COOKIE_VALUE
<Name>	Specific variable within the types defined above, as shown in these examples: HEADER:Accept: content types that are acceptable HEADER:User-Agent: information about the user agent originating the request. SERVER:current_user_id: id of the current user; 0 if no user logged in SERVER:current_user_name: name of the current user COOKIE_VALUE:<name>: value of the named cookie Enclose the Name clause in single quotation marks. If no Use clause is specified, the special variable name corresponds to a PLC variable name. Enclose the complete Name clause within single quotation marks and the PLC tag in double quotation marks. The special variable name must match the PLC tag name exactly. Refer to HTTP documentation for a list of all the names of HEADER variables.
<Varname>	The variable name in your STEP 7 program into which you want to write the special variable, which can be a PLC tag name, or a data block tag. The Varname must be enclosed in single quotation marks. Within the single quotes, use double quotation marks around a PLC tag or data block name. The data block name is within the double quotes but not the data block tag name. Note that for data block tags, you use the name of the block and not a data block number.

Examples

```
<!-- AWP_In_Variable Name='"SERVER:current_user_id"' -->
```

In this example, the Web page writes the value of the HTTP special variable "SERVER:current_user_id" to the PLC tag named "SERVER:current_user_id ".

```
<!-- AWP_In_Variable Name=SERVER:current_user_id' Use='"my_userid"'
-->
```

In this example, the Web page writes the value of the HTTP special variable "SERVER:current_user_id" to the PLC tag named "my_userid".

Note

Only a user with privileges to modify variables can write data to the CPU. The Web server ignores the commands if the user does not have modify privileges.

If a tag name or data block name includes special characters, you must use additional quotation marks or escape characters as described in the topic "Handling tag names that contain special characters (Page 1034)".

12.7.2.5 Using an alias for a variable reference

You can use an alias in your user-defined Web page for an In_Variable or an Out_Variable. For example, you can use a different symbolic name in your HTML page than the one used in the CPU, or you can equate a variable in the CPU with a special variable. The AWP Use clause provides this capability.

Syntax

```
<-- AWP_In_Variable Name='<Varname1>' Use='<Varname2>' -->
<-- AWP_Out_Variable Name='<Varname1>' Use='<Varname2>' -->
```

Parameters

<Varname1>	The alias name or special variable name Varname1 must be enclosed in single or double quotation marks.
<Varname2>	Name of the PLC variable for which you want to assign an alias name. The variable can be a PLC tag, a data block tag, or a special variable. Varname2 must be enclosed in single quotation marks. Within the single quotes, use double quotation marks around a PLC tag, special variable, or data block name. The data block name is within the double quotes but not the data block tag name. Note that for data block tags, you use the name of the block and not a data block number.

Examples

```
<-- AWP_In_Variable Name='SERVER:current_user_id'
Use='"Data_Block_10".server_user' -->
```

In this example, the special variable SERVER:current_user_id is written to the tag "server_user" in data block "Data_Block_10".

```
<-- AWP_Out_Variable Name='Weight'
Use='"Data_Block_10".Tank_data.Weight' -->
```

In this example, the value in data block structure member Data_Block_10.Tank_data.Weight can be referenced simply by "Weight" throughout the rest of the user-defined Web page.

```
<-- AWP_Out_Variable Name='Weight' Use='"Raw_Milk_Tank_Weight"' -->
```

In this example, the value in the PLC tag "Raw_Milk_Tank_Weight" can be referenced simply by "Weight" throughout the rest of the user-defined Web page.

If a tag name or data block name includes special characters, you must use additional quotation marks or escape characters as described in the topic Handling tag names that contain special characters (Page 1034).

12.7.2.6 Defining enum types

You can define enum types in your user-defined pages and assign the elements in an AWP command.

Syntax

```
<!-- AWP_Enum_Def Name='<Enum type name>' Values='<Value>,
<Value>,... ' -->
```

Parameters

<Enum type name>	Name of the enumerated type, enclosed in single or double quotation marks.
<Value>	<constant>:<name> The constant indicates the numerical value for the enum type assignment. The total number is unbounded. The name is the value assigned to the enum element.

Note that the entire string of enum value assignments is enclosed in single quotation marks, and each individual enum type element assignment is enclosed in double quotation marks. The scope of an enum type definition is global for the user-defined Web pages. If you have set up your user-defined Web pages in language folders (Page 1053), the enum type definition is global for all pages in the language folder.

Example

```
<!-- AWP_Enum_Def Name='AlarmEnum' Values='0:"No alarms", 1:"Tank is
full", 2:"Tank is empty"' -->
```

12.7.2.7 Referencing CPU variables with an enum type

You can assign a variable in the CPU to an enum type. This variable can be used elsewhere in your user-defined Web page in a read operation (Page 1023) or a write operation (Page 1024). On a read operation, the Web server will replace the numerical value that is read from the CPU with the corresponding enum text value. On a write operation, the Web server will replace the text value with the integer value of the enumeration that corresponds to the text before writing the value to the CPU.

Syntax

```
<!-- AWP_In_Variable Name='<Varname>' Enum="<EnumType>" -->
<!-- AWP_Out_Variable Name='<Varname>' Enum="<EnumType>" -->
```

Parameters

<Varname>	Name of PLC tag or data block tag to associate with the enum type, or the name of the alias name for a PLC tag (Page 1029) if declared. Varname must be enclosed in single quotation marks. Within the single quotes, use double quotation marks around a PLC tag or data block name. Note that for data block tags, you use the name of the block and not a data block number. The data block name is within the double quotes but not the data block tag name.
<EnumType>	Name of the enumerated type, which must be enclosed in single or double quotation marks

The scope of an enum type reference is the current fragment.

Example usage in a variable read

```
<!-- AWP_Out_Variable Name='"Alarm"' Enum="AlarmEnum" -->...
<p>The current value of "Alarm" is :="Alarm":</p>
```

If the value of "Alarm" in the CPU is 2, the HTML page displays 'The current value of "Alarm" is Tank is empty' because the enum type definition (Page 1030) assigns the text string "Tank is empty" to the numerical value 2.

Example usage in a variable write

```
<!-- AWP_Enum_Def Name='AlarmEnum' Values='0:"No alarms", 1:"Tank is
full", 2:"Tank is empty"' -->
<!-- AWP_In_Variable Name='"Alarm"' Enum='AlarmEnum' -->...
<form method="POST">
<p><input type="hidden" name='"Alarm"' value="Tank is full" /></p>
<p><input type="submit" value='Set Tank is full' /><p>
</form>
```

Because the enum type definition (Page 1030) assigns "Tank is full" to the numerical value 1, the value 1 is written to the PLC tag named "Alarm" in the CPU.

Note that the Enum clause in the AWP_In_Variable declaration must correspond exactly to the Name clause in the AWP_Enum_Def declaration.

Example usage in a variable write with use of an alias

```
<!-- AWP_Enum_Def Name='AlarmEnum' Values='0:"No alarms", 1:"Tank is
full", 2:"Tank is empty"' -->
<!-- AWP_In_Variable Name='"Alarm"' Enum='AlarmEnum'
Use='"Data_block_4".Motor1.Alarm'-->...
<form method="POST">
<p><input type="hidden" name='"Alarm"' value="Tank is full" /></p>
<p><input type="submit" value='Set Tank is full' /><p>
</form>
```

Because the enum type definition (Page 1030) assigns "Tank is full" to the numerical value 1, the value 1 is written to the alias "Alarm" which corresponds to the PLC tag named "Motor1.Alarm" in data block "Data_Block_4" in the CPU.

If a tag name or data block name includes special characters, you must use additional quotation marks or escape characters as described in the topic Handling tag names that contain special characters (Page 1034).

Note

Previous releases required a separate AWP_Enum_Ref declaration to associate a variable with a defined enum type. STEP 7 and the S7-1200 support existing code with AWP_Enum_Ref declarations; however, this command is no longer needed.

12.7.2.8 Creating fragments

STEP 7 converts and stores user-defined Web pages as a control DB and fragment DBs when you click "Generate blocks" in the CPU Properties for the Web server. You can set up specific fragments for specific pages or for sections of specific pages. You can identify these fragments by a name and number with the "Start_Fragment" AWP command. Everything in the page following the AWP_Start_Fragment command belongs to that fragment until another AWP_Start_Command is issued or until end of file is reached.

Syntax

```
<!-- AWP_Start_Fragment Name='<Name>'
[Type=<Type>][ID=<id>][Mode=<Mode>] -->
```

Parameters

<Name>	Text string: name of fragment DB Fragment names must begin with a letter or underscore and be comprised of letters, numeric digits, and underscores. The fragment name is a regular expression of the form: [a-zA-Z_][a-zA-Z_0-9]*
<Type>	"manual" or "automatic" manual: The STEP 7 program must request this fragment and can respond accordingly. Operation of the fragment must be controlled with STEP 7 and the control DB variables. automatic: The Web server processes the fragment automatically. If you do not specify the type parameter, the default is "automatic".
<id>	Integer identification number. If you do not specify the ID parameter, the Web server assigns a number by default. For manual fragments, set the ID to a low number. The ID is the means by which the STEP 7 program controls a manual fragment.
<Mode>	"visible" or "hidden" visible: Contents of the fragment will display on the user-defined Web page. hidden: Contents of the fragment will not display on the user-defined Web page. If you do not specify the type parameter, the default is "visible".

Manual fragments

If you create a manual fragment for a user-defined Web page or portion of a page, then your STEP 7 program must control when the fragment is sent. The STEP 7 program must set appropriate parameters in the control DB for a user-defined page under manual control and then call the WWW instruction with the control DB as modified. For understanding the structure of the control DB and how to manipulate individual pages and fragments, see the topic Advanced user-defined Web page control (Page 1057).

12.7.2.9 Importing fragments

You can create a named fragment from a portion of your HTML code and then import that fragment elsewhere in your set of user-defined Web pages. For example, consider a set of user-defined Web pages that has a start page and then several other HTML pages accessible from links on the start page. Suppose each of the separate pages is to display the company logo on the page. You could implement this by creating a fragment (Page 1032) that loads the image of the company logo. Each individual HTML page could then import this fragment to display the company logo. You use the AWP Import_Fragment command for this purpose. The HTML code for the fragment only exists in one fragment, but you can import this fragment DB as many times as necessary in as many Web pages as you choose.

Syntax

```
<!-- AWP_Import_Fragment Name='<Name>' -->
```

Parameters

<Name>	Text string: name of the fragment DB to be imported

Example

Excerpt from HTML code that creates a fragment to display an image:

```
<!-- AWP_Start_Fragment Name='My_company_logo' --><p><img
src="company_logo.jpg"></p>
```

Excerpt from HTML code in another .html file that imports the fragment that displays the logo image:

```
<!-- AWP_Import_Fragment Name='My_company_logo' -->
```

Both .html files (the one that creates the fragment and the one that imports it) are in the folder structure that you define when you configure the user-defined pages in STEP 7 (Page 1036).

12.7.2.10 Combining definitions

When declaring variables for use in your user-defined Web pages, you can combine a variable declaration and an alias for the variable (Page 1029). You can also declare multiple In_Variables in one statement and multiple Out_Variables in one statement.

Examples

```
<!-- AWP_In_Variable Name='"Level"', Name='"Weight"', Name='"Temp"'
-->
<--! AWP_Out_Variable Name='HEADER:Status', Use='"Status"',
         Name='HEADER:Location', Use="Location",
         Name='COOKIE_VALUE:name', Use="my_cookie" -->
<!-- AWP_In_Variable Name='Alarm' Use='"Data_block_10".Alarm' -->
```

12.7.2.11 Handling tag names that contain special characters

When specifying variable names in user-defined Web pages, you must take special care if tag names contain characters that have special meanings.

Reading variables

You use the following syntax to read a variable (Page 1023):
:=<Varname>:

The following rules apply to reading variables:

- For variable names from the PLC tag table, enclose the tag name in double quotation marks.
- For variable names that are data block tags, enclose the data block name in double quotation marks. The tag is outside of the quotation marks.
- For variable names that are direct I/O addresses, memory addresses, or alias names, do not use quotation marks around the read variable.
- For tag names or data block tag names that contain a backslash, precede the backslash with another backslash.
- If a tag name or data block tag name contains a colon, less than sign, greater than sign, or ampersand define an alias that has no special characters for the read variable, and read the variable using the alias. Precede colons in tag names in a Use clause with a backslash.

Table 12- 1 Examples of Read variables

Data block name	Tag name	Read command
n/a	ABC:DEF	`<!--AWP_Out_Variable Name='special_tag' Use ='"ABC:DEF"' --> :=special_tag:`
n/a	T\	`:="T\\":`
n/a	A \B 'C :D	`<!--AWP_Out_Variable Name='another_special_tag' Use='"A \\B \'C :D"' --> :=another_special_tag:`
n/a	a<b	`<!--AWP_Out_Variable Name='a_less_than_b' Use='"a<b"' --> :=a_less_than_b:`
Data_block_1	Tag_1	`:="Data_block_1".Tag_1:`
Data_block_1	ABC:DEF	`<!-- AWP_Out_Variable Name='special_tag' Use='"Data_block_1".ABC\:DEF'--> :=special_tag:`
DB A' B C D$ E	Tag	`:="DB A' B C D$ E".Tag:`
DB:DB	Tag:Tag	`<!--AWP_Out_Variable Name='my_tag' Use ='"DB:DB".Tag\:Tag' --> :=my_tag:`

Name and Use clauses

The AWP commands AWP_In_Variable, AWP_Out_Variable, AWP_Enum_Def, AWP_Enum_Ref, AWP_Start_Fragment and AWP_Import_Fragment have Name clauses. HTML form commands such as <input> and <select> also have name clauses. AWP_In_Variable and AWP_Out_Variable can additionally have Use clauses. Regardless of the command, the syntax for Name and Use clauses regarding the handling of special characters is the same:

- The text you provide for a Name or Use clause must be enclosed within single quotation marks. If the enclosed name is a PLC tag or Data block name, use single quotation marks for the full clause.
- Within a Name or Use clause, data block names and PLC tag names must be enclosed within double quotation marks.
- If a tag name or Data block name includes a single quote character or backslash, escape that character with a backslash. The backslash is the escape character in the AWP command compiler.

Table 12- 2 Examples of Name clauses

Data block name	Tag name	Name clause options
n/a	ABC'DEF	`Name='"ABC\'DEF"'`
n/a	A \B 'C :D	`Name='"A \\B \'C :D"'`
Data_block_1	Tag_1	`Name='"Data_block_1".Tag_1'`
Data_block_1	ABC'DEF	`Name='"Data_block_1".ABC\'DEF'`
Data_block_1	A \B 'C :D	`Name='"Data_block_1".A \\B \'C :D'`
DB A' B C D$ E	Tag	`Name='"DB A\' B C D$ E".Tag'`

Use clauses follow the same conventions as Name clauses.

Note

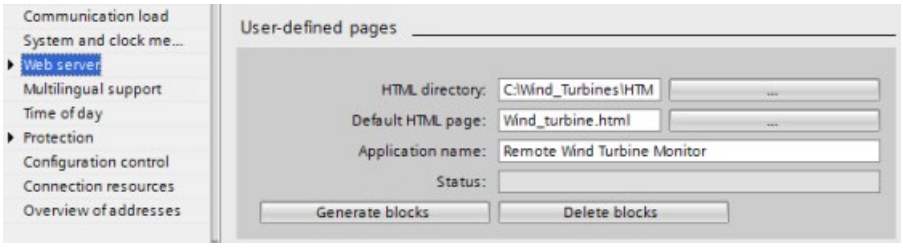
Regardless of what characters you use in your HTML page, set the charset of the HTML page to UTF-8 and save it from the editor with UTF-8 character encoding.

12.7.3 Configuring use of user-defined Web pages

To configure user-defined Web pages from STEP 7, follow these steps:

1. Select the CPU in the Device Configuration view.
2. Display the "Web server" properties in the inspector window for the CPU.
3. If not already selected, select the check box for "Activate Web server on this module".
4. Select "Permit access only with HTTPS" to ensure that the Web server uses encrypted communication and to increase the security of your Web-accessible CPU.
5. Enter or browse to the folder name on your PC where you saved the HTML default page (start page).
6. Enter the name of the default page.
7. Provide a name for your application (optional). The Web server uses the application name to further subcategorize or group web pages. When you provide an application name, the Web server creates an URL for your user-defined page in the following format: http[s]://ww.xx.yy.zz/awp/<application name>/<pagename>.html. If you do not provide an application name, the URL is http[s]://ww.xx.yy.zz/awp/<pagename>.html.

   Avoid special characters in the application name. Some characters can cause the Web server to be unable to display the user-defined pages.



8. In the Advanced section, enter filename extensions of files that include AWP commands. By default, STEP 7 analyzes files with .htm, .html, or .js extensions. If you have additional file extensions, append them. To save processing resources, do not enter file extensions if no files of that type include AWP commands.
9. Keep the default for the Web DB number, or enter a number of your choice. This is the DB number of the control DB that controls display of the Web pages.
10. Keep the default for the fragment DB start number, or enter a number of your choice. This is the first of the fragment DBs that contains the Web pages.

Generating program blocks

When you click the "Generate blocks" button, STEP 7 generates data blocks from the HTML pages in the HTML source directory that you specified and a control data block for the operation of your Web pages. You can set these attributes as needed for your application (Page 1038). STEP 7 also generates a set of fragment data blocks to hold the representation of all of your HTML pages. When you generate the data blocks, STEP 7 updates the properties to display the control data block number, and the number of the first of the fragment data blocks. After you generate the data blocks, your user-defined Web pages are a part of your STEP 7 program. The blocks corresponding to these pages appear in the Web server folder, which is in the System blocks folder under Program blocks in the project navigation tree.

Deleting program blocks

To delete data blocks that you have previously generated, click the "Delete data blocks" button. STEP 7 deletes the control data block and all of the fragment data blocks from your project that correspond to user-defined Web pages.

12.7.4 Configuring the entry page

In the Device Configuration of the CPU, you have the opportunity to designate a user-defined Web page to be the entry page when you access the Web server from either a PC or a mobile device. Otherwise, the entry page is the Introduction (Page 997) standard Web page.

To select a user-defined Web page to be the entry page, follow these steps:

1. Select the CPU in the Device Configuration view.
2. In the inspector window, select "Web server" from the CPU properties and enable the Web server (Page 983).
3. Select "Entry page" in the Web server properties.
4. Select "UP1" from the drop-down list to configure the Web server to display a user-defined page upon access. (The other selection, "Intro page", sets the Web server to display the standard Introduction Web page upon access.)

You must also configure the Everybody user to have the "open user-defined Web pages" privilege (Page 984) and include a call to the WWW instruction (Page 1038) in your program.

After you have completed configuration and downloaded the project to the CPU, the Web server can use the "Default HTML page" that you selected when you configured your user-defined Web pages (Page 1036) as the entry page.

Note

The CPU must be in RUN mode to display a user-defined entry page.

12.7.5 Programming the WWW instruction for user-defined web pages

Your STEP 7 user program must include and execute the WWW instruction in order for the user-defined Web pages to be accessible from the standard Web pages. The control data block is the input parameter to the WWW instruction and specifies the content of the pages as represented in the fragment data blocks, as well as state and control information. STEP 7 creates the control data block when you click the "Create blocks" button in the configuration of user-defined Web pages (Page 1036).

Programming the WWW instruction

The STEP 7 program must execute the WWW instruction for the user-defined Web pages to be accessible from the standard Web pages. You might want the user-defined Web pages available only under certain circumstances as dictated by your application requirements and preferences. In this case, your program logic can control when to call the WWW instruction.

Table 12- 3 WWW instruction

LAD / FBD	SCL	Description
	`ret_val := WWW(` `  ctrl_db:=_uint_in_);`	Provides access to user-defined Web pages from standard Web pages

You must provide the control data block input parameter (CTRL_DB) which corresponds to the integer DB number of the control DB. You can find this control DB block number (called Web DB Number) in the Web Server properties of the CPU after you create the blocks for the user-defined Web pages. Enter the integer DB number as the CTRL_DB parameter of the WWW instruction. The return value (RET_VAL) contains the function result. Note that the WWW instruction executes asynchronously and that the RET_VAL output might have an initial value of 0 although an error can occur later. The program can check the state of the control DB to ensure that the application started successfully, or check RET_VAL with a subsequent call to WWW.

Table 12- 4 Return value

RET_VAL	Description
0	No error
16#00yx	x: The request represented by the respective bit is in the waiting state: x=1: request 0 x=2: request 1 x=4: request 2 x=8: request 3 The x values can be logically OR-ed to represent waiting states of multiple requests. If x = 6, for example, requests 1 and 2 are waiting. y: 0: no error; 1: error exists and "last_error" has been set in the control DB (Page 1057)
16#803a	The control DB is not loaded.
16#8081	The control DB is of the wrong type, format, or version.
16#80C1	No resources are available to initialize the web application.

Usage of the Control DB

STEP 7 creates the control data block when you click "Generate blocks" and displays the control DB number in the User-defined Web pages properties. You can find the control DB as well in the Program blocks folder in the project navigation tree.

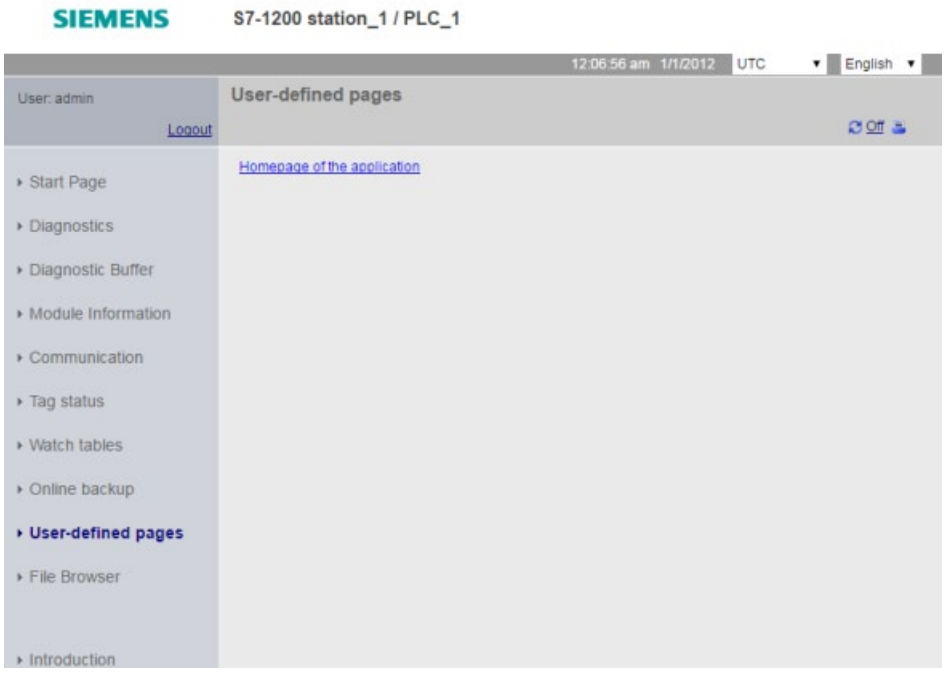
Typically, your STEP 7 program uses the control DB directly as created by the "Generate blocks" process with no additional manipulation. However, the STEP 7 user program can set global commands in the control DB to deactivate the web server or to subsequently re-enable it. Also, for user-defined pages that you create as manual fragment DBs (Page 1036), the STEP 7 user program must control the behavior of these pages through a request table in the control DB. For information on these advanced tasks, see the topic Advanced user-defined Web page control (Page 1057).

12.7.6 Downloading the program blocks to the CPU

After you have generated the blocks for user-defined Web pages, they are part of your STEP 7 program just like any other program blocks. You follow the normal process to download the program blocks to the CPU. Note that you can only download user-defined Web page program blocks when the CPU is in STOP mode.

12.7.7 Accessing the user-defined Web pages

You access your user-defined Web pages from the standard Web pages (Page 987). The standard Web pages display a link for "User-defined pages" on the left side navigation menu. The basic page navigation also provides a link to "User-defined pages". When you click the "User-defined pages" link, your Web browser goes to the page that provides a link to your default page. From within the user-defined pages, navigation is according to how you designed your specific pages.



Note

You can also define a user-defined page as the entry page (Page 1037) for the Web server.

12.7.8 Constraints specific to user-defined Web pages

The constraints for standard Web pages (Page 1061) also apply to user-defined Web pages. In addition, user-defined Web pages have some specific considerations.

Load memory space

Your user-defined Web pages become data blocks when you click "Generate blocks", which require load memory space. If you have a memory card installed, you have up to the capacity of your memory card as external load memory space for the user-defined Web pages.

If you do not have a memory card installed, these blocks take up internal load memory space, which is limited according to your CPU model.

You can check the amount of load memory space that is used and the amount that is available from the Online and Diagnostic tools in STEP 7. You can also look at the properties for the individual blocks that STEP 7 generates from your user-defined Web pages and see the load memory consumption.

Note

If you need to reduce the space required for your user-defined Web pages, reduce your use of images if applicable.

Quotation marks in text strings

Avoid using text strings that contain embedded single or double quotation marks in data block tags that you use for any purpose in user-defined Web pages. Because HTML syntax often uses single quotes or double quotes as delimiters, quotation marks within text strings can break the display of user-defined Web pages.

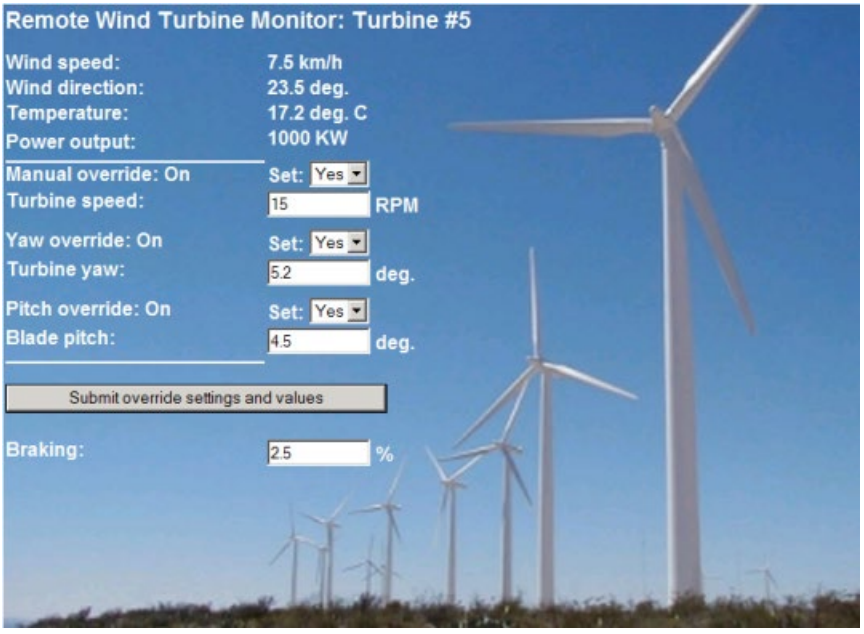
For data block tags of type String that you use in user-defined Web pages, observe the following rules:

- Do not enter single or double quotation marks in the data block tag string value in STEP 7.
- Do not let the user program make assignments of strings containing quotes to these data block tags.

12.7.9 Example of a user-defined web page

12.7.9.1 Web page for monitoring and controlling a wind turbine

As an example of a user-defined Web page, consider a Web page that is used to remotely monitor and control a wind turbine:



Description

In this application, each wind turbine in a wind turbine farm is equipped with an S7-1200 for control of the turbine. Within the STEP 7 program, each wind turbine has a data block with data specific to that wind turbine.

The user-defined Web page provides remote turbine access from a PC. A user can connect to standard web pages of the CPU of a particular wind turbine and access the user-defined "Remote Wind Turbine Monitor" Web page to see the data for that turbine. A user with privileges to modify variables can also put the turbine in manual mode and control the variables for turbine speed, yaw, and pitch from the Web page. A user with privileges to modify variables can also set a braking value regardless of whether the turbine is under manual or automatic control.

The STEP 7 program would check the Boolean values for overriding automatic control, and if set, would use the user-entered values for turbine speed, yaw, and pitch. Otherwise, the program would ignore these values.

Files used

This user-defined Web page example consists of three files:

- **Wind_turbine.html**: This is the HTML page that implements the display shown above, using AWP commands to access controller data.
- **Wind_turbine.css**: This is the cascading style sheet that contains formatting styles for the HTML page. Use of a cascading style sheet is optional, but it can simplify the HTML page development.
- **Wind_turbine.jpg**: This is the background image that the HTML page uses. Use of images in user-defined Web pages is, of course, optional, and does require additional space in the CPU.

These files are not provided with your installation, but are described as an example.

Implementation

The HTML page uses AWP commands to read values from the PLC (Page 1023) for the display fields and to write values to the PLC (Page 1024) for data coming from user input. This page also uses AWP commands for enum type definition (Page 1030) and reference (Page 1030) for handling ON/OFF settings.

The first part of the page displays a header line that includes the wind turbine number.



The next part of the page displays atmospheric conditions at the wind turbine. I/O at the turbine site provide the wind speed, wind direction, and current temperature.

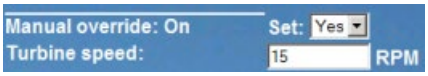


Next, the page displays the power output of the turbine as read from the S7-1200.



The following sections allow for manual control of the turbine, overriding the normal automatic control by the S7-1200. These types are as follows:

- Manual override: enables manual override of the turbine. The STEP 7 user program requires that the manual override setting be true before enabling the use of any of the manual settings for turbine speed, or yaw or pitch.



- Yaw override: enables manual override of the yaw setting, and a manual setting for the yaw. The STEP 7 user program requires that both manual override and yaw override be true in order to apply the yaw setting.



- Pitch override: enables manual override of the pitch of the blades. The STEP 7 user program requires that both manual override and pitch override be true in order to apply the blade pitch setting.



The HTML page includes a submit button to post the override settings to the controller.



The braking user input field provides a manual setting for a braking percentage. The STEP 7 user program does not require manual override to accept a braking value.



In addition, the HTML page uses an AWP command to write the special variable (Page 1028) that contains the user ID of the user that is accessing the page to a tag in the PLC tag table.

12.7.9.2 Reading and displaying controller data

The "Remote Wind Turbine Monitor" HTML page uses numerous AWP commands for reading data from the controller (Page 1023) and displaying it on the page. For example, consider the HTML code for displaying the power output as shown in this portion of the example Web page:



Example HTML code

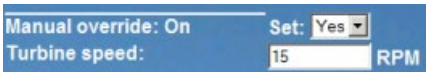
The following excerpt from the "Remote Wind Turbine Monitor" HTML page displays the text "Power Output:" in the left cell of a table row and reads the variable for the power output and displays it in the right cell of the table row along with the text abbreviation for kilowatts, kW.

The AWP command :="Data_block_1".PowerOutput: performs the read operation. Note that data blocks are referenced by name, not by data block number (that is, "Data_block_1" and not "DB1").

```
<tr style="height:2%;">
<td>
<p>Power output:</p>
</td>
<td>
<p style="margin-bottom:5px;"> :="Data_block_1".PowerOutput: kW</p>
</td>
</tr>
```

12.7.9.3 Using an enum type

The "Remote Wind Turbine Monitor" HTML page uses enum types for the three instances where HTML page displays "ON" or "OFF" for a Boolean value, and for where the user sets a Boolean value. The enum type for "ON" results in a value of 1, and the enum type for "OFF" results in a value of 0. For example, consider the HTML code for reading and writing the Manual Override Enable setting in "Data_block_1".ManualOverrideEnable value using an enum type:



Example HTML code

The following excerpts from the "Remote Wind Turbine Monitor" HTML page show how to declare an enum type called "OverrideStatus" with values of "Off" and "On" for 0 and 1, and then setting an enum type reference to OverrideStatus for the ManualOverrideEnable Boolean tag in the data block named "Data_block_1".

```
<!-- AWP_In_Variable Name='"Data_block_1".ManualOverrideEnable'
Enum="OverrideStatus" -->

<!-- AWP_Enum_Def Name="OverrideStatus" Values='0:"Off",1:"On"' -->
```

Where the HTML page includes a display field in a table cell for the current state of ManualOverrideEnable, it uses just a normal read variable command, but with the use of the previously declared and referenced enum type, the page displays "Off" or "On" rather than 0 or 1.

```
<td style="width:24%; border-top-style: Solid; border-top-width:
2px; border-top-color: #ffffff;">
<p>Manual override: :="Data_block_1".ManualOverrideEnable:</p>
</td>
```

The HTML page includes a drop-down select list for the user to change the value of ManualOverrideEnable. The select list uses the text "Yes" and "No" to display in the select lists. With the use of the enum type, "Yes" is correlated to the value "On" of the enum type, and "No" is correlated to the value "Off". The empty selection leaves the value of ManualOverrideEnable as it is.

```
<select name='"Data_block_1".ManualOverrideEnable'>
<option value=':"Data_block_1".ManualOverrideEnable:'> </option>
<option value="On">Yes</option>
<option selected value="Off">No</option>
</select>
```

The select list is included within a form on the HTML page. When the user clicks the submit button, the page posts the form, which writes a value of "1" to the Boolean ManualOverrideEnable in Data_block_1 if the user had selected "Yes", or "0" if the user had selected "No".

12.7.9.4 Writing user input to the controller

The "Remote Wind Turbine Monitor" HTML page includes several AWP commands for writing data to the controller (Page 1024). The HTML page declares AWP_In_Variables for Boolean variables so that a user with privileges to modify variables can put the wind turbine under manual control and enable manual override for the turbine speed, yaw override, and/or blade pitch override. The page also uses AWP_In_Variables to allow a user with privileges to modify variables to subsequently set floating-point values for the turbine speed, yaw, pitch, and braking percentage. The page uses an HTTP form post command to write the AWP_In_Variables to the controller.

For example, consider the HTML code for manually setting the braking value:



Example HTML code

The following excerpt from the "Remote Wind Turbine Monitor" HTML page first declares an AWP_In_Variable for "Data_block_1" that enables the HTML page to write to any tags in the data block "Data_block_1". The page displays the text "Braking:" in the left cell of a table row. In the right cell of the table row is the field that accepts user input for the "Braking" tag of "Data_block_1". This user input value is within an HTML form that uses the HTTP method "POST" to post the entered text data to the CPU. The page then reads the actual braking value from the controller and displays it in the data entry field.

A user with privileges to modify variables can subsequently use this page to write a braking value to the data block in the CPU that controls braking.

```
<!-- AWP_In_Variable Name='"Data_block_1"' -->
...
<tr style="vertical-align: top; height: 2%;">
<td style="width: 22%;"><p>Braking:</p></td>
<td>
<form method="POST">
<p><input name='"Data_block_1".Braking' size="10" type="text"> %</p>
</form>
</td>
</tr>
```

Note

Note that if a user-defined page has a data entry field for a writable data block tag that is a string data type, the user must enclose the string in single quotation marks when entering the string value in the field.

Note

Note that if you declare an entire data block in an AWP_In_Variable declaration such as <!-- AWP_In_Variable Name='"Data_block_1"' -->, then every tag within that data block can be written from the user-defined Web page. Use this when you intend for all of the tags in a data block to be writable. Otherwise, if you only want specific data block tags to be writable from the user-defined Web page, declare it specifically with a declaration such as <!-- AWP_In_Variable Name='"Data_block_1".Braking' -->

12.7.9.5 Writing a special variable

The "Remote Wind Turbine Monitor" Web page writes the special variable SERVER:current_user_id to a PLC tag in the CPU, providing that the user has modify privileges. In this case, the PLC tag value contains the user ID of the user who is accessing the "Remote Wind Turbine Monitor" Web page.

The Web page writes the special variable to the PLC and requires no user interface.

Example HTML code

```
<!-- AWP_In_Variable Name="SERVER:current_user_id" Use="User_ID"-->
```

12.7.9.6 Reference: HTML listing of remote wind turbine monitor Web page

Wind_turbine.html

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">
<!--
This test program simulates a Web page to monitor and control a Wind
Turbine
Required PLC tags and Data Block Tags in STEP 7:

PLC Tag:
User_ID: Int

Data Blocks:
Data_block_1

Tags in Data_Block_1:

TurbineNumber: Int
WindSpeed: Real
WindDirection: Real
```

```
Temperature: Real
PowerOutput: Real
ManualOverrideEnable: Bool
TurbineSpeed: Real
YawOverride: Bool
Yaw: Real
PitchOverride: Bool
Pitch: Real
Braking: Real
The user-defined Web page displays current values for the PLC data,
and provides a select list to set the three Booleans using an
enumerated type assignment. The "Submit" button posts the selected
Boolean values as well as the data entry fields for TurbineSpeed,
Yaw, and Pitch. The value for Braking can be set without use of the
"Submit" button.

No actual STEP 7 program is required to use this page.
Theoretically, the STEP 7 program would only act on the values of
TurbineSpeed, Yaw, and Pitch, if the associated Booleans were set.
The only STEP 7 requirement is to call the WWW instruction with the
DB number of the generated data blocks for this page.
-->
<!-- AWP_In_Variable Name='"Data_block_1"' -->
<!-- AWP_In_Variable Name='"Data_block_1".ManualOverrideEnable'
Enum="OverrideStatus" -->
<!-- AWP_In_Variable Name='"Data_block_1".PitchOverride'
Enum="OverrideStatus" -->
<!-- AWP_In_Variable Name='"Data_block_1".YawOverride'
Enum="OverrideStatus" -->
<!-- AWP_In_Variable Name="SERVER:current_user_id" Use="User_ID"-->
<!-- AWP_Enum_Def Name="OverrideStatus" Values='0:"Off",1:"On"' -->

<html>
<head>
<meta http-equiv="content-type" content="text/html; charset=utf-
8"><link rel="stylesheet" href="Wind_turbine.css">
<title>Remote Wind Turbine Monitor</title>
</head>
<body>
<table cellpadding="0" cellspacing="2">
<tr style="height: 2%;">
<td colspan="2">
<h2>Remote Wind Turbine Monitor: Turbine
#:="Data_block_1".TurbineNumber:</h2>
</td>

<tr style="height: 2%;"><td style="width: 25%;"><p>Wind
speed:</p></td>
<td><p> :="Data_block_1".WindSpeed: km/h</p></td>
</tr>

<tr style="height: 2%;">
<td style="width: 25%;"><p>Wind direction:</p></td>
<td><p> :="Data_block_1".WindDirection: deg.</p></td>
</tr>
```

```
<tr style="height: 2%;"><td style="width:
25%;"><p>Temperature:</p></td>
<td><p> :="Data_block_1".Temperature: deg. C</p></td>
</tr>

<tr style="height: 2%;">
<td style="width: 25%;"><p>Power output:</p></td>
<td><p style="margin-bottom:5px;"> :="Data_block_1".PowerOutput:
kW</p>
</td>
</tr>

<form method="POST" action="">
<tr style="height: 2%;" >
<td style="width=25%; border-top-style: Solid; border-top-width:
2px; border-top-color: #ffffff;">
<p>Manual override: :="Data_block_1".ManualOverrideEnable:</p>
</td>
<td class="Text">Set:

<select name='"Data_block_1".ManualOverrideEnable'>
<option value=':="Data_block_1".ManualOverrideEnable:'> </option>
<option value="On">Yes</option>
<option value="Off">No</option>
</select>

</td>
</tr>

<tr style="vertical-align: top; height: 2%;"><td style="width:
25%;"><p>Turbine speed:</p></td>
<td>
<p style="margin-bottom:5px;"><input
name='"Data_block_1".TurbineSpeed' size="10"
value=':="Data_block_1".TurbineSpeed:' type="text"> RPM</p>
</td>
</tr>

<tr style="vertical-align: top; height: 2%;">
<td style="width: 25%;">
<p>Yaw override: :="Data_block_1".YawOverride: </p>
</td>
<td class="Text">Set:

<select name='"Data_block_1".YawOverride'>
<option value=':="Data_block_1".YawOverride:'> </option>
<option value="On">Yes</option>
<option value="Off">No</option>
</select>

</td>
</tr>

<tr style="vertical-align: top; height: 2%;">
```

```
<td style="width: 25%;">
<p>Turbine yaw:</p>
</td>
<td>
<p style="margin-bottom:5px;"><input name='"Data_block_1".Yaw'
size="10" value=':="Data_block_1".Yaw:' type="text"> deg.</p>
</td>
</tr>

<tr style="vertical-align: top; height: 2%;">
<td style="width: 25%;">
<p>Pitch override: :="Data_block_1".PitchOverride: </p>
</td>
<td class="Text">Set:

<select name='"Data_block_1".PitchOverride'>
<option value=':="Data_block_1".PitchOverride:'> </option>
<option value="On">Yes</option>
<option value="Off">No</option>
</select>

</td>
</tr>

<tr style="vertical-align: top; height: 2%;">
<td style="width=25%; border-bottom-style: Solid; border-bottom-
width: 2px; border-bottom-color: #ffffff;">
<p>Blade pitch:</p>
</td>
<td>
<p style="margin-bottom:5px;"><input name='"Data_block_1".Pitch'
size="10" value=':="Data_block_1".Pitch:' type="text"> deg.</p>
</td>

</tr>
<tr style="height: 2%;">
<td colspan="2">
<input type="submit" value="Submit override settings and values">
</td>
</tr>
</form>

<tr style="vertical-align: top; height: 2%;">
<td style="width: 25%;"><p>Braking:</p></td>
<td>
<form method="POST" action="">
<p> <input name='"Data_block_1".Braking' size="10"
value=':="Data_block_1".Braking:' type="text"> %</p>
</form>
</td>
</tr>
<tr><td></td></tr>
```

```
</table>
</body>
</html>
```

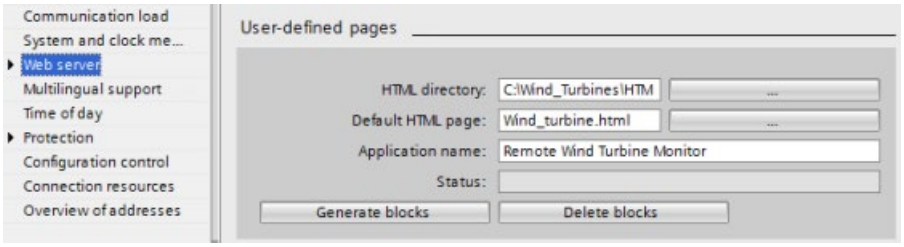
Wind_turbine.css

```
BODY {
 background-image: url('./Wind_turbine.jpg');
 background-position: 0% 0%;
 background-repeat: no-repeat;
 background-size: cover;
}
H2 {
 font-family: Arial;
 font-weight: bold;
 font-size: 14.0pt;
 color: #FFFFFF;
 margin-top:0px;
 margin-bottom:10px;
}
P {
 font-family: Arial;
 font-weight: bold;
 color: #FFFFFF;
 font-size: 12.0pt;
 margin-top:0px;
 margin-bottom:0px;
}
TD.Text {
 font-family: Arial;
 font-weight: bold;
 color: #FFFFFF;
 font-size: 12.0pt;
 margin-top:0px;
 margin-bottom:0px;
}
```

12.7.9.7 Configuration in STEP 7 of the example Web page

To include the "Remote Wind Turbine Monitor" HTML page as a user-defined Web page for the S7-1200, you configure the data about the HTML page in STEP 7 and create data blocks from the HTML page.

Access the CPU Properties for the S7-1200 that controls the wind turbine, and enter the configuration information in the User-defined pages properties of the Web Server:



Configuration fields

- HTML directory: This field specifies the fully-qualified pathname to the folder where the default page (home page or start page) is located on the computer. The "..." button allows you to browse to the folder that you need.
- Default HTML page: This field specifies the filename of the default page or home page of the HTML application. The "..." button allows you to select the file that you need. For this example, WindTurbine.html is the default HTML page. The Remote Wind Turbine Monitor example only consists of a single page, but in other user-defined applications the default page can call up additional pages from links on the default page. Within the HTML code, the default page must reference other pages relative to the HTML source folder.
- Application name: This optional field contains the name that the Web browser includes in the address field when displaying the page. For this example, it is "Remote Wind Turbine Monitor", but you can use any name.

No other fields require configuration.

Final steps

To use the Remote Wind Turbine Monitor as configured, generate the blocks, program the WWW instruction (Page 1038) with the number of the generated control DB as an input parameter, download the program blocks, and put the CPU in run mode.

When an operator subsequently accesses the standard Web pages for the S7-1200 that controls the wind turbine, the "Remote Wind Turbine Monitor" Web page is accessible from the "User-defined pages" link on the navigation bar. This page now provides the means to monitor and control the wind turbine.

12.7.10 Setting up user-defined Web pages in multiple languages

The Web server provides the means for you to provide user-defined Web pages in the following languages:

- German (de)
- English (en)
- Spanish (es)
- French (fr)
- Italian (it)
- Simplified Chinese (zh)

You do this by setting up your HTML pages in a folder structure (Page 1053) that corresponds to the languages and by setting a specific cookie named "siemens_automation_language" from your pages (Page 1053). The Web server responds to this cookie, and switches to the default page in the corresponding language folder.

12.7.10.1 Creating the folder structure

To provide user-defined Web pages in multiple languages, you set up a folder structure under your HTML directory. The two-letter folder names are specific and must be named as shown below:



de: German
en: English
es: Spanish
fr: French
it: Italian
zh: Simplified Chinese

At the same level, you can also include any other folders that your pages need, for example, folders for images or scripts.

You can include any subset of the language folders. You do not have to include all six languages. Within the language folders, you create and program your HTML pages in the appropriate language.

12.7.10.2 Programming the language switch

The Web server performs switching between languages through the use of a cookie named "siemens_automation_language". This is a cookie defined and set in the HTML pages, and interpreted by the Web server to display a page in the appropriate language from the language folder of the same name. The HTML page must include a JavaScript to set this cookie to one of the pre-defined language identifiers: "de", "en", "es", "fr", "it', or "zh".

For example, if the HTML page sets the cookie to "de", the Web server switches to the "de" folder and displays the page with the default HTML page name as defined in the STEP 7 configuration (Page 1057).

Example

The following example uses a default HTML page named "langswitch.html" in each of the language folders. Also in the HTML directory is a folder named "script". The script folder includes a JavaScript file named "lang.js". Each langswitch.html page uses this JavaScript to set the language cookie, "siemens_automation_language".

HTML for "langswitch.html" in "en" folder

The header of the HTML page sets the language to English, sets the character set to UTF-8, and sets the path to the JavaScript file lang.js.

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head>
<meta http-equiv="Content-Language" content="en">
<meta http-equiv="Content-Type" content="text/html; charset=utf-8">
<title>Language switching english page</title>
<script type="text/javascript" src="script/lang.js" ></script>
```

The body of the file uses a select list for the user to select between German and English. English ("en") is pre-selected for the language. When the user changes the language, the page calls the DoLocalLanguageChange() JavaScript function with the value of the selected option.

```
<!-- Language Selection -->
<table>
   <tr>
      <td align="right" valign="top" nowrap>
       <!-- change language immediately on selection change -->
          <select name="Language"
                    onchange="DoLocalLanguageChange(this)"
                    size="1">
            <option value="de" >German</option>
            <option value="en" selected >English</option>
           </select>
      </td>
   </tr>
</table><!-- Language Selection End-->
```

HTML for "langswitch.html" in "de" folder

The header for the German langswitch.html page is the same as English, except the language is set to German.

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head>
<meta http-equiv="Content-Language" content="de"><meta http-
equiv="Content-Type" content="text/html; charset=utf-8">
<title>Sprachumschaltung Deutsche Seite</title>
<script type="text/javascript" src="script/lang.js" ></script>
</head>
```

The HTML in the German page is identical to that of the English page, except that the default value of the selected language is German ("de").

```
<!-- Language Selection -->
<table>
   <tr>
     <td align="right" valign="top" nowrap>
       <!-- change language immediately on change of the selection -
->
       <select name="Language"
               onchange="DoLocalLanguageChange(this)"
               <size="1">
            <option value="de" selected >Deutsch</option>
            <option value="en" >Englisch</option>
       </select>
      </td>
   </tr>
</table><!-- Language Selection End-->
```

JavaScript "lang.js" in "script" folder

The function "DoLocalLanguageChange()" is in the lang.js file. This function calls the "SetLangCookie()" function and then reloads the window that is displaying the HTML page.

The function "SetLangCookie()" constructs an assignment that assigns the value from the select list to the "siemens_automation_language" cookie of the document. It also sets the path to the application so that the switched page, and not the requesting page, receives the value of the cookie.

Optionally, in the commented section, the page could set an expiration value for the cookie.

```
function DoLocalLanguageChange(oSelect) {
        SetLangCookie(oSelect.value);
        top.window.location.reload();
    }
function SetLangCookie(value) {
        var strval = "siemens_automation_language=";
        // This is the cookie by which the Web server
        // detects the desired language
        // This name is required by the Web server.
        strval = strval + value;
        strval = strval + "; path=/ ;";
        // Set path to the application, since otherwise
        // path would be set to the requesting page
        // and this page would not get the cookie.
        /* OPTIONAL
           use expiration if this cookie should live longer
           than the current browser session:
           var now = new Date();
           var endttime = new Date(now.getTime() + expiration);
           strval = strval + "; expires=" +
                    endttime.toGMTString() + ";";
        */
        document.cookie = strval;
    }
```

Note

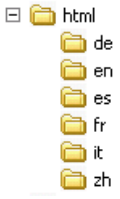
If your user-defined Web page implementation includes HTML files within language-specific folders (en, de, for example) and also HTML files that are not in the language-specific folders, note that you cannot define enum types with the AWP_Enum_Def command in files in both locations. If you use enums, you must define them either within files in the language - specific folders or within files outside of the language-specific folders. You cannot make enum declarations in files in both places.

12.7.10.3 Configuring STEP 7 to use a multi-language page structure

The procedure for configuring multi-language user-defined Web pages is similar to the general process for configuring user-defined Web pages (Page 1036). When you have folders set up for languages, however, you set your HTML directory setting to the folder that contains the individual language folders. You do not set the HTML directory to be one of the language folders.

When you select the default HTML page, you navigate into the language folder and select the HTML page that is to be the start page. When you subsequently generate blocks and download the blocks to the CPU, the Web server displays the start page in the language folder that you configured.

For example, if the folder structure shown here was at C:\, the setting for HTML directory would be C:\html, and if English were to be the initial page display, you would navigate to en\langswitch.html for the default HTML page setting.



12.7.11 Advanced user-defined Web page control

When you generate data blocks for your user-defined Web pages, STEP 7 creates a control DB that it uses to control display of and interaction with the user-defined pages. STEP 7 also creates a set of fragment DBs that represent the individual pages. Under normal circumstances, you do not need to know the structure of the control DB or how to manipulate it.

If you want to turn a web application on and off, for example, or manipulate individual manual fragments, you use the control DB tags and the WWW instruction to do so.

Structure of the control DB

The control DB is an extensive data structure, and is accessible when programming your STEP 7 user program. Only some of the control data block tags are described here.

Commandstate structure

"Commandstate" is a structure that contains global commands and global states for the Web server.

Global commands in the "Commandstate" structure

The global commands apply to the Web server in general. You can deactivate the Web server or restart it from the control DB parameters.

Block tag	Data type	Description
init	BOOL	Evaluate the control DB and initialize the Web application
deactivate	BOOL	Deactivate the Web application

Global states in the Commandstate structure

The global states apply to the Web server in general and contain status information about the Web application.

Block tag	Data type	Description
initializing	BOOL	Web application is reading control DB
error	BOOL	Web application could not be initialized
deactivating	BOOL	Web application is terminating
deactivated	BOOL	Web application is terminated
initialized	BOOL	Web application is initialized
last_error	INT	Last error returned from a WWW instruction call (Page 1038) when the return code of WWW is 16#0010: 16#0001: fragment DB structure is inconsistent 16#0002: the application name already exists 16#0003: no resources (memory) 16#0004: control DB structure is inconsistent 16#0005: fragment DB not available 16#0006: fragment DB not for AWP 16#0007: enumeration data is inconsistent 16#000D: conflicting size of the control DB

Request table

The request table is an array of structures containing commands and states that apply to individual fragment DBs. If you created fragments with the AWP_Start_Fragment (Page 1032) command of type "manual", the STEP 7 user program must control these pages through the control DB. The request states are read-only and provide information about the current fragment. You use the request commands to control the current fragment.

Block tag	Data type	Description
requesttab	ARRAY [1 .. 4] OF STRUCT	Array of structures for individual fragment DB control. The Web server can process up to four fragments at a time. The array index for a particular fragment is arbitrary when the Web server is processing multiple fragments or fragments from multiple browser sessions.

Struct members of requesttab struct

Block tag	Data type	Description
page_index	UINT	Number of the current web page
fragment_index	UINT	Number of the current fragment - can be set to a different fragment
// Request Commands		
continue	BOOL	Enables current page/fragment for sending and continues with the next fragment
repeat	BOOL	Enables current page/fragment for resending and continues with the same fragment
abort	BOOL	Close http connection without sending
finish	BOOL	Send this fragment; page is complete - do not process any additional fragments
// Request states		The request states are read-only
idle	BOOL	Nothing to do, but active
waiting	BOOL	Fragment is waiting to be enabled
sending	BOOL	Fragment is sending
aborting	BOOL	User has aborted current request

Operation

Whenever your program makes changes to the control DB, it must call the WWW instruction with the number of the modified control DB as its parameter. The global commands and request commands take effect when the STEP 7 user program executes the WWW instruction (Page 1038).

The STEP 7 user program can set the fragment_index explicitly, thus causing the Web server to process the specified fragment with a request command. Otherwise, the Web server processes the current fragment for the current page when the WWW instruction executes.

Possible techniques for using the fragment_index include:

- Processing the current fragment: Leave fragment_index unchanged and set the continue command.
- Skip the current fragment: Set fragment_index to 0 and set the continue command.
- Replace current fragment with a different fragment: Set the fragment_index to the new fragment ID and set the continue command.

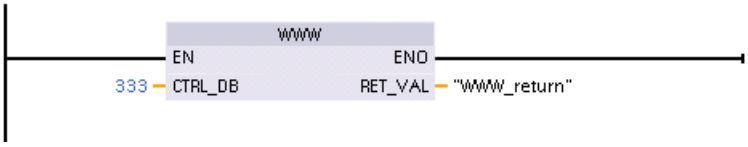
To check global states or request states that might be changing, the STEP 7 user program must call the WWW instruction to evaluate the current values of these states. A typical usage might be to call the WWW instruction periodically until a specific state occurs.

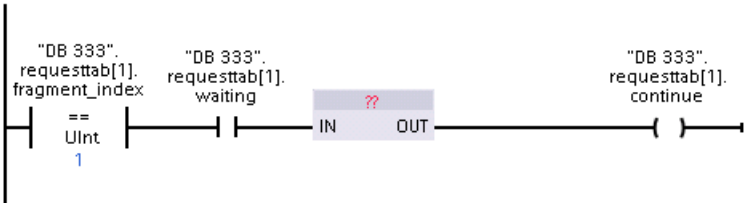
Note

If the STEP 7 user program sets more than one request command, the WWW instruction processes only one in this order of precedence: abort, finish, repeat, continue. The WWW instruction clears all of the request commands after processing.

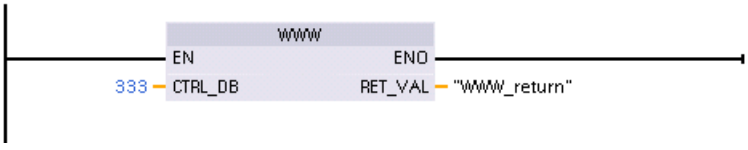
Examples

The following example shows a STEP 7 user program that is checking for a fragment with an ID of 1 to be in the waiting state, following a prior call to the WWW instruction. It might also wait for other application-specific conditions to occur. Then it performs whatever processing is necessary for the fragment, such as setting data block tags, performing calculations, or other application-specific tasks. Afterwards, it sets the continue flag so that the Web server will execute this fragment.





When the program calls the WWW instruction with this modified control DB, the user-defined Web page with this fragment can be displayed from the Web browser.



Note that this is a simplified example; the fragment to check could be in any one of the four requesttab structs in the array. Your program must handle all four requesttab structs.

12.8 Constraints

The following IT considerations can affect your use of the Web server:

- Typically, you must use the IP address of the CPU to access the standard Web pages or user-defined Web pages, or the IP address of a wireless router with a port number. If your Web browser does not allow connecting directly to an IP address, see your IT administrator. If your local policies support DNS, you can connect to the IP address through a DNS entry to that address.
- Firewalls, proxy settings, and other site-specific restrictions can also restrict access to the CPU. See your IT administrator to resolve these issues.
- The standard Web pages use JavaScript and cookies. If your Web browser settings disable JavaScript or cookies, enable them. If you cannot enable them, some features are restricted (Page 1062). Use of JavaScript and cookies in user-defined Web pages is optional. If used, you must enable them in your browser.
- The Web server supports Secure Sockets Layer (SSL). You can access the standard Web pages and user-defined Web pages with an URL of either http://ww.xx.yy.zz or https://ww.xx.yy.zz, where "ww.xx.yy.zz" represents the IP address of the CPU.
- Siemens provides a security certificate for secure access to the Web server. From the Introduction standard Web page (Page 997), you can download and import the certificate into the Internet options of your Web browser (Page 1063). If you choose to not import the certificate, you will get a security verification prompt every time you access the Web server with https://.

Number of connections

The Web server supports a maximum of 30 active connections. Various actions consume the 30 connections, depending on the Web browser that you use and the number of different objects per page (.css files, images, additional .html files). Some connections persist while the Web server is displaying a page; other connections do not persist after the initial connection.

If, for example, you are using certain versions of Mozilla Firefox, which support a maximum of six persistent connections, you could use five browser or browser tab instances before the Web server starts dropping connections. In the case where a page is not using all six connections, you could have additional browser or browser tab instances.

Also be aware that the number of active connections can affect page performance.

Note

Log off prior to closing Web server

If you have logged in to the Web server, be sure to log off prior to closing your Web browser. The Web server supports a maximum of seven concurrent logins.

12.8.1 Use of JavaScript

The standard Web pages use HTML, JavaScript, and cookies. If your site restricts the use of JavaScript and cookies, then enable them for the pages to function properly. If you cannot enable JavaScript for your Web browser, the standard Web pages cannot run. Consider using the basic pages, which do not use JavaScript.

See also

Layout of the standard Web pages (Page 991)

12.8.2 Feature restrictions when the Internet options do not allow cookies

If you disable cookies in your Web browser, the following restrictions apply:

- You cannot log in.
- You cannot change the language setting.
- You cannot switch from UTC time to PLC time. Without cookies, all times are in UTC time.

12.8.3 Rules for entering tag names and values

Be aware of the following conventions when using the Tag status (Page 1011) and Watch tables (Page 1012) standard pages:

- If modifying the entire value of a DTL tag, for example, "Data_block_1_.DTL_tag, use the following DTL syntax for the modify value: DTL#YYYY-MM-DD-HH-MM-SS[.sssssssss]
- When using exponential notation to enter a value for a Real or LReal data type:
  - To enter a real-number value (Real or LReal) with a positive exponent (such as +3.402823e+25), enter the value in either of the following formats:

    +3.402823e25

    +3.402823e+25
  - To enter real-number value (Real or LReal) with a negative exponent (such as +3.402823e-25), enter the value as follows:

    +3.402823e-25
  - Be sure that the mantissa portion of the real value in exponential notation includes a decimal point. Failure to include a decimal point results in the modification of the value to an unexpected integer value. For example, enter -1.0e8 rather than -1e8.
- LReal values can be only 15 digits (regardless of the location of the decimal point). Entering more than 15 digits creates a rounding error.

Limitations on the Tag status and Watch Table page:

- The maximum number of characters for the URL is 2083. You can see the URL that represents your current page in the address bar of your browser.
- For the character display format, if the actual CPU values are not valid ASCII characters as interpreted by the browser then the page displays the character preceded by a dollar sign: $.

12.8.4 Importing the Siemens security certificate

You can download the Siemens security certificate to your Internet options. With the certificate, you do not have to provide security verification when you enter https://ww.xx.yy.zz in your Web browser, where "ww.xx.yy.zz" is the device IP address. If you use an http:// URL and not an https:// URL, then you do not need to download and install the certificate.

Downloading the certificate

You use the "download certificate" link from the Introduction page (Page 997) to download the Siemens security certificate to your PC. The procedure varies according to which Web browser you use:

Importing the certificate to Internet Explorer

1. Click the "download certificate" link from the Introduction page.
2. From the next dialog, click "Open" to open the file.
3. From the "Certificate" dialog, click the "Install Certificate" button to launch the Certificate Import Wizard.
4. Click "Next" in the "Certificate Import Wizard" dialog to set the certificate store.
5. Select "Place all certificates in the following store" and click the "Browse" button.
6. From the "Select Certificate Store" dialog, select "Third-Party Root Certification Authorities" and click OK.
7. Click "Next" then "Finish" to complete the Certificate Import Wizard.

Importing the certificate to Mozilla Firefox

1. Click the "download certificate" link from the Intro page.
2. When prompted, click OK to trust the S7-1200 Controller Family.

On older versions of Mozilla Firefox, after you click "download certificate", you must save the file and execute the wizard:

1. Click "Save file" from the "Opening MiniWebCA_Cer.crt" dialog. A "Downloads" dialog appears.
2. From the "Downloads" dialog, double-click "MiniWebCA_Cer.crt". If you have attempted the download more than once, multiple copies show up. Just double-click any one of the "MiniWebCA_Cer.crt" entries.
3. Click "OK" if prompted to open an executable file.
4. Click "Open" on the "Open File - Security Warning" dialog if it appears. A "Certificate" dialog appears.
5. On the "Certificate" dialog, click the "Install Certificate" button.
6. Follow the dialogs of the "Certificate Import Wizard" to import the certificate, letting the operating system automatically select the certificate store.
7. If the "Security Warning" dialog appears, click "Yes" to confirm installation of the certificate.

Other browsers

Follow the conventions of your Web browser to import and install the Siemens certificate.

After you install the Siemens security certificate "S7-1200 Controller Family" in the Internet options for your Web browser content, you do not have to verify a security prompt when you access the Web server with https:// ww.xx.yy.zz.

Note

The security certificate remains constant through reboots of the CPU; however, if you change the IP address of the device you must download a new certificate if you are using a browser other than Internet Explorer or Mozilla Firefox.

12.8.5 Importing CSV format data logs to non-USA/UK versions of Microsoft Excel

Data log files are in the comma-separated values (CSV) file format. You can open these files directly in Excel from the Data Logs page when your system is running the USA or UK version of Excel. In other countries, however, this format is not widely used because commas occur frequently in numerical notation.

To open a data log file that you have saved, follow these steps for non USA/UK versions of Excel:

1. Open Excel and create an empty workbook.
2. From the "Data > Import External Data" menu, select the "Import Data" command.
3. Navigate to and select the data log file you want to open. The Text Import Wizard starts.
4. From the Text Import Wizard, change the default option for "Original data type" from "Fixed width" to "Delimited".
5. Click the Next button.
6. From the Step 2 dialog, select the "Comma" check box to change the delimiter type from "Tab" to "Comma".
7. Click the Next button.
8. From the Step 3 dialog, you can optionally change the Date format from MDY (month/day/year) to another format.
9. Complete the remaining steps of the Text Import Wizard to import the file.

Communication processor and Modbus TCP 13

13.1 Using the serial communication interfaces

Two communication modules (CMs) and one communication board (CB) provide the interface for PtP communications:

- CM 1241 RS232 (Page 1535)
- CM 1241 RS422/485 (Page 1536)
- CB 1241 RS485 (Page 1532)

You can connect up to three CMs (of any type) plus a CB for a total of four communication interfaces. Install the CM to the left of the CPU or another CM. Install the CB on the front of the CPU. Refer to the installation guidelines (Page 65)for information on module installation and removal.

The serial communication interfaces have the following characteristics:

- Have an isolated port
- Support Point-to-Point protocols
- Are configured and programmed through the point-to-point communication processor instructions
- Display transmit and receive activity by means of LEDs
- Display a diagnostic LED (CMs only)
- Are powered by the CPU: No external power connection is needed.

Refer to the technical specifications for communication interfaces (Page 1522).

LED indicators

The communication modules have three LED indicators:

- Diagnostic LED (DIAG): This LED flashes red until it is addressed by the CPU. After the CPU powers up, it checks for CMs and addresses them. The diagnostic LED begins to flash green. This means that the CPU has addressed the CM, but has not yet provided the configuration to it. The CPU downloads the configuration to the configured CMs when the program is downloaded to the CPU. After a download to the CPU, the diagnostic LED on the communication module should be a steady green.
- Transmit LED (Tx): The transmit LED illuminates when data is being transmitted out the communication port.
- Receive LED (Rx): This LED illuminates when data is being received by the communication port.

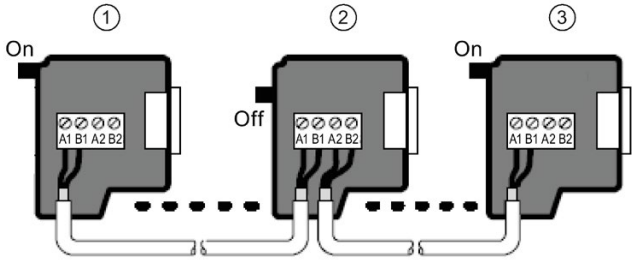
The communication board provides transmit (TxD) and receive (RxD) LEDs. It has no diagnostic LED.

13.2 Biasing and terminating an RS485 network connector

Siemens provides an RS485 network connector (Page 1551) that you can use to easily connect multiple devices to an RS485 network. The connector has two sets of terminals that allow you to attach the incoming and outgoing network cables. The connector also includes switches for selectively biasing and terminating the network.

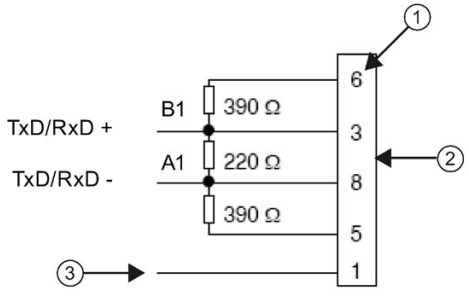
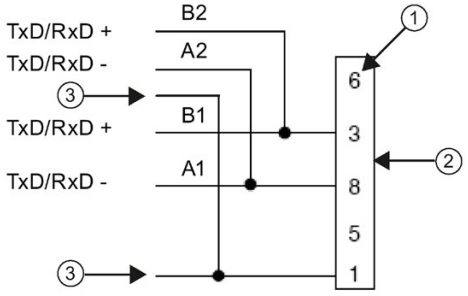
Note

You terminate and bias only the two ends of the RS485 network. The devices in between the two end devices are not terminated or biased. Bare cable shielding: Approximately 12 mm (1/2 in) must contact the metal guides of all locations.



① Switch position = On: Terminated and biased
② Switch position = Off: No termination or bias
③ Switch position = On: Terminated and biased

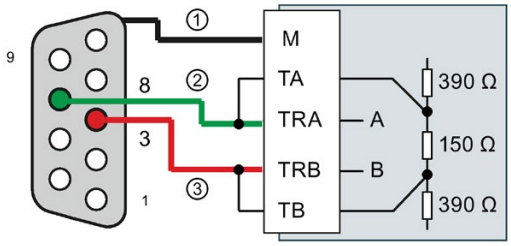
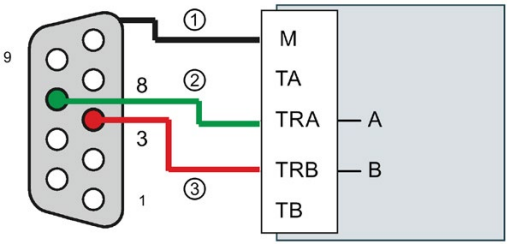
Table 13- 1 Termination and bias for the RS485 connector

Terminating device (bias ON)	Non-terminating device (bias OFF)
	

① Pin number
② Network connector
③ Cable shield

The CB 1241 provides internal resistors for terminating and biasing the network. To terminate and bias the connection, connect TRA to TA and connect TRB to TB to include the internal resistors to the circuit. CB 1241 does not have a 9-pin connector. The following table shows the connections to a 9-pin connector on the communications partner.

Table 13- 2 Termination and bias for the CB 1241

Terminating device (bias ON)	Non-terminating device (bias OFF)
	

① Connect M to the cable shield

② A = TxD/RxD - (Green wire / Pin 8)

③ B = TxD/RxD + (Red wire / Pin 3)

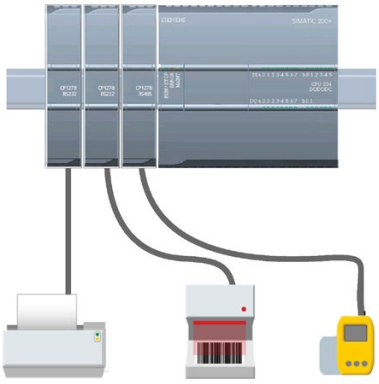
13.3 Point-to-point (PtP) communication

The CPU supports the following Point-to-Point communication (PtP) for character-based serial protocols:

- PtP, Freeport (Page 1070)
- PtP, 3964(R) (Page 1072)
- USS (Page 1127)
- Modbus (Page 1147)

13.3.1 PtP, Freeport communication

PtP with a Freeport, or freely constructed, protocol provides maximum freedom and flexibility, but requires extensive implementation in the user program.



PtP enables a wide variety of possibilities:

- The ability to send information directly to an external device such as a printer
- The ability to receive information from other devices such as barcode readers, RFID readers, third-party camera or vision systems, and many other types of devices
- The ability to exchange information, sending and receiving data, with other devices such as GPS devices, third-party camera or vision systems, radio modems, and many more

This type of PtP communication is serial communication that uses standard UARTs to support a variety of baud rates and parity options. The RS232 and RS422/485 communication modules (CM 1241) and the RS485 communication board (CB 1241) provide the electrical interfaces for performing the PtP communications.

PtP Freeport over PROFIBUS or PROFINET

PtP enables you to use a PROFINET or PROFIBUS distributed I/O rack to communicate to various devices (RFID readers, GPS device, and others):

- PROFINET (Page 786): You connect the Ethernet interface of the S7-1200 CPU to a PROFINET interface module. PtP communication modules in the rack with the interface module can then provide serial communications to the PtP devices.
- PROFIBUS (Page 947): You insert a PROFIBUS communication module in the left side of the rack with the S7-1200 CPU. You connect the PROFIBUS communication module to a rack containing a PROFIBUS interface module. PtP communication modules in the rack with the interface module can then provide serial communications to the PtP devices.

For this reason, the S7-1200 supports two sets of PtP instructions:

- Legacy point-to-point instructions (Page 1204): These instructions existed prior to version V4.0 of the S7-1200 and only work with serial communications using a CM 1241 communication module or CB 1241 communication board.
- Point-to-point instructions (Page 1088): These instructions provide all of the functionality of the legacy instructions, plus the ability to support PtP communication modules over PROFINET and PROFIBUS distributed I/O. The point-to-point instructions allow you to access the communication modules over the distributed I/O rack.

  The S7-1200 CM 1241 modules must have a minimum firmware version of V2.1 to use the point-to-point instructions. These modules are limited to the local rack to the left side of the S7-1200 CPU. You can also use the point-to-point instructions with a CB 1241.

  Communications over distributed I/O use the following modules:

Station	Module	Article number	Interface
ET 200MP	CM PtP RS232 BA	6ES7540-1AD00-0AA0	RS232
	CM PtP RS232 HF	6ES7541-1AD00-0AB0	RS232
	CM PtP RS422/485 BA	6ES7540-1AB00-0AA0	RS422/RS485
	CM PtP RS422/485 HF	6ES7541-1AB00-0AB0	RS422/RS485
ET 200SP	CM PtP	6ES7137-6AA00-0BA0	RS232 and RS422/RS485

Note

You can use the point-to-point instructions to access a communication board, local (or left side) serial modules, serial modules over PROFINET, and serial modules over PROFIBUS. STEP 7 provides the legacy point-to-point instructions only to support existing programs. The legacy instructions still function, however, with the current S7-1200 CPUs. You do not have to convert prior programs from one set of instructions to the other.

Note

CM module firmware version requirement for Time synchronization and PtP communication

If you have enabled "CPU synchronizes the modules of the device" in the Time synchronization (Page 177) properties for the Profinet interface in the device configuration, update the firmware versions of the connected communication modules to the latest available versions. Enabling module time synchronization for communication modules with old firmware versions can cause communication issues or errors.

13.3.2 3964(R) communication

The S7-1200 CPU supports the 3964(R) protocol to enable communication between a CM 1241 RS232 module or a CM 1241 (RS422/485) module and a communication partner that uses the 3964(R) protocol. Unlike the PtP communication described above where you define specific send (transmit) and receive characteristics for the messages, the 3964(R) protocol proscribes a strict protocol using the following control characters:

- STX Start of text
  Start of character string to be transmitted
- DLE Data Link Escape
  Data transmission switchover
- ETX End of Text
  End of character string to be transmitted
- BCC Block check character
- NAK Negative Acknowledge

Refer to the chapter describing serial data transmission principles in the S7-300 CP 341 Point-to-Point Communication, Installation, and Parameter Assignment Manual. (https://support.industry.siemens.com/cs/us/en/view/1117397) manual for a complete description of the protocol.

Configuring the communication module

To communicate to a partner using the 3964(R) protocol, you must include one of the following communication modules in your device configuration in STEP 7:

- CM 1241 (RS232)
- CM 1241 (RS422/485)

The firmware version of the CM module must be V2.2.0 or later.

For the communication module, you then configure the communication ports (Page 1073), priority, and protocol parameters (Page 1086).

Communication to a partner with the 3964(R) protocol

When you configure a CM for 3964(R) protocol, you use the standard point-to-point send and receive instructions to transfer data between the CPU and its communication partner.

The CM embeds your data from the BUFFER parameter of the send instruction into the 3964(R) protocol and sends the data to the communication partner.

The CM receives data from the communication partner by means of the 3964(R) protocol, removes the protocol information, and returns the data in the BUFFER parameter of the receive instruction.

Refer to the following point-to-point instructions:

- Send_P2P (Transmit send buffer data) (Page 1103)
- Receive_P2P (Enable receive messages) (Page 1108)

You can also use the legacy point-to-point send and receive instructions:

- SEND_PTP (Transmit send buffer data) (Page 1212)
- RCV_PTP (Enable receive messages) (Page 1215)

13.3.3 Configuring the PtP Freeport communication

You can use either of the following methods to configure the communication interfaces for PtP Freeport communication:

- Use the device configuration in STEP 7 to configure the port parameters (baud and parity), the send parameters and the receive parameters. The CPU stores the device configuration settings and applies the settings after a power cycle and a RUN to STOP transition.
- Use the Port_Config (Page 1090), Send_Config (Page 1093), and Receive_Config (Page 1095) instructions to set the parameters. The port settings set by the instructions are valid while the CPU is in RUN mode. The port settings revert to the device configuration settings after a STOP transition or power cycle.

After configuring the hardware devices (Page 149), you configure parameters for the communication interfaces by selecting one of the CMs in your rack or the CB, if configured.





The "Properties" tab of the inspector window displays the parameters of the selected CM or CB. Select "Port configuration" to edit the following parameters:

- Baud rate
- Parity
- Data bits per character
- Number of stop bits
- Flow control (RS232 only)
- Wait time

For the CM 1241 RS232 and CB RS485 (except for flow control (Page 1075), which only the CM 1241 RS232 supports), the port configuration parameters are the same regardless of whether you are configuring an RS232 or an RS485 communication module or the RS485 communication board. The parameter values can differ.

For the CM 1241 RS422/485, you have additional options for port configuration as shown below. The 422 mode of the CM 1241 RS422/485 module also supports software flow control.



Select "Port configuration" to edit the following RS422/485 parameters:

- "Operating mode":
  - Full duplex (RS422) four wire mode (point-to-point connection)
  - Full duplex (RS422) four wire mode (multipoint master)
  - Full duplex (RS422) four wire mode (multipoint slave)
  - Half duplex (RS485) two wire mode
- "Receive line initial state":
  - None
  - Forward bias (Signal R(A) 0V, signal R(B) 5V)

The STEP 7 user program can also configure the port or change the existing configuration with the Port_Config instruction (Page 1090). The instruction topic provides more detail about the operational mode and initial line state as well as other parameters.

Parameter	Definition
Baud rate	The default value for the baud rate is 9.6 Kbits per second. Valid choices are: 300 baud, 600 baud, 1.2 Kbits, 2.4 Kbits, 4.8 Kbits, 9.6 Kbits, 19.2 Kbits, 38.4 Kbits, 57.6 Kbits, 76.8 Kbits, and 115.2 Kbits.
Parity	The default value for parity is no parity. Valid choices are: No parity, even, odd, mark (parity bit always set to 1), and space (parity bit always set to 0).
Data bits per character	The number of data bits in a character. Valid choices are 7 or 8.
Number of stop bits	The number of stop bits can be either one or two. The default is one.
Flow control	For the RS232 communication module, you can select either hardware or software flow control (Page 1075). If you select hardware flow control, you can select whether the RTS signal is always on, or RTS is switched. If you select software flow control, you can define the XON and XOFF characters. The RS485 communication interfaces do not support flow control. The 422 mode of the CM 1241 RS422/485 module supports software flow control.
Wait time	Wait time specifies the time that the CM or CB waits to receive CTS after asserting RTS, or for receiving an XON after receiving an XOFF, depending on the type of flow control. If the wait time expires before the communication interface receives an expected CTS or XON, the CM or CB aborts the transmit operation and returns an error to the user program. You specify the wait time in milliseconds. The range is 0 to 65535 milliseconds.
Operating mode	This selects the operating mode RS422 or RS485 and network configurations.
Receive line initial state	This selects the bias options. Valid values are none, forward bias and reverse bias. Reverse bias is used to allow cable break detection.

13.3.3.1 Managing flow control

Flow control refers to a mechanism for balancing the sending and receiving of data transmissions so that no data is lost. Flow control ensures that a transmitting device is not sending more information than a receiving device can handle. Flow control can be accomplished through either hardware or software. The RS232 CM supports both hardware and software flow control. The RS485 CM and CB do not support flow control. The 422 mode of the CM 1241 RS422/485 module supports software flow control. You specify the type of flow control either when you configure the port (Page 1073) or with the PORT_CFG instruction (Page 1204).

Hardware flow control works through the Request-to-send (RTS) and Clear-to-send (CTS) communication signals. With the RS232 CM, the RTS signal is output from pin 7 and the CTS signal is received through pin 8. The RS232 CM is a DTE (Data Terminal Equipment) device which asserts RTS as an output and monitors CTS as an input.

Hardware flow control: RTS switched

If you enable RTS switched hardware flow control for an RS232 CM, the module sets the RTS signal active to send data. It monitors the CTS signal to determine whether the receiving device can accept data. When the CTS signal is active, the module can transmit data as long as the CTS signal remains active. If the CTS signal goes inactive, then the transmission must stop.

Transmission resumes when the CTS signal becomes active. If the CTS signal does not become active within the configured wait time, the module aborts the transmission and returns an error to the user program. You specify the wait time in the port configuration (Page 1073).

The RTS switched flow control is useful for devices that require a signal that the transmit is active. An example would be a radio modem that uses RTS as a "Key" signal to energize the radio transmitter. The RTS switched flow control will not function with standard telephone modems. Use the RTS always on selection for telephone modems.

Hardware flow control: RTS always on

In RTS always on mode, the CM 1241 sets RTS active by default. A device such as a telephone modem monitors the RTS signal from the CM and utilizes this signal as a clear-to-send. The modem only transmits to the CM when RTS is active, that is, when the telephone modem sees an active CTS. If RTS is inactive, the telephone module does not transmit to the CM.

To allow the modem to send data to the CM at any time, configure "RTS always on" hardware flow control. The CM thus sets the RTS signal active all the time. The CM will not set RTS inactive even if the module cannot accept characters. The transmitting device must ensure that it does not overrun the receive buffer of the CM.

Data Terminal Ready (DTR) and Data Set Ready (DSR) signal utilization

The CM sets DTR active for either type of hardware flow control. The module transmits only when the DSR signal becomes active. The state of DSR is only evaluated at the start of the send operation. If DSR becomes inactive after transmission has started, the transmission will not be paused.

Software flow control

Software flow control uses special characters in the messages to provide flow control. You configure Hex characters that represent XON and XOFF.

XOFF indicates that a transmission must stop. XON indicates that a transmission can resume. XOFF and XON must not be the same character.

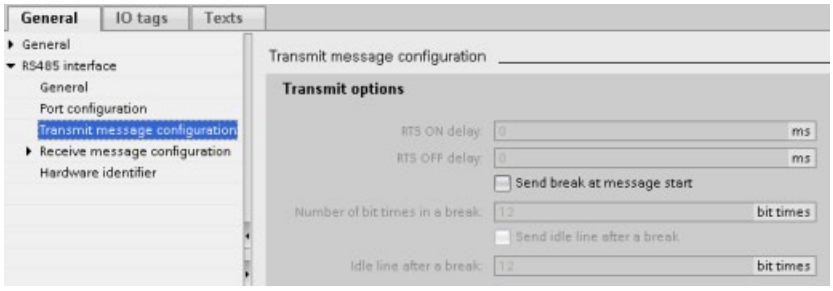
When the transmitting device receives an XOFF character from the receiving device, it stops transmitting. Transmitting resumes when the transmitting device receives an XON character. If it does not receive an XON character within the wait time that is specified in the port configuration (Page 1073), the CM aborts the transmission and returns an error to the user program.

Software flow control requires full-duplex communication, as the receiving partner must be able to send XOFF to the transmitting partner while a transmission is in progress. Software flow control is only possible with messages that contain only ASCII characters. Binary protocols cannot utilize software flow control.

Before the CPU can engage in PtP Freeport communications, you must configure parameters for transmitting (or sending) messages and receiving messages. These parameters dictate how communications operate when messages are being transmitted to or received from a target device.

13.3.3.2 Configuring transmit (send) parameters

From the device configuration of the CPU, you configure how a communication interface transmits data by setting the "Transmit message configuration" properties for the selected interface.



You can also dynamically configure or change the transmit message parameters from the user program by using the Send_Config (Page 1093) instruction.

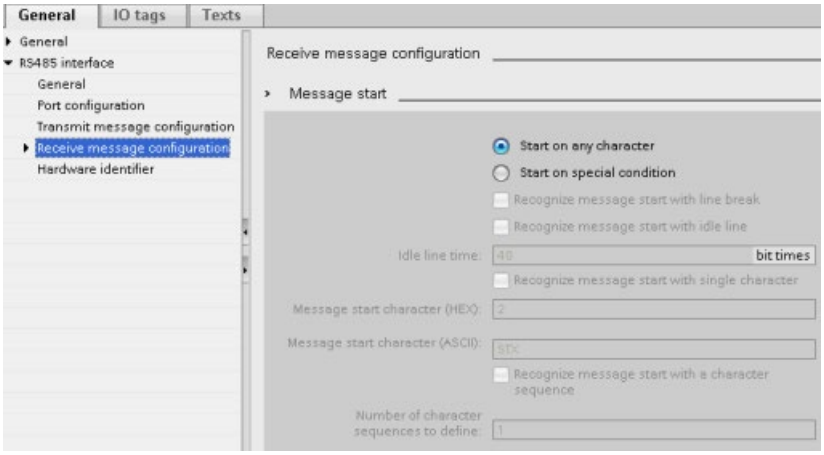
Note

Parameter values set from the Send_Config instruction in the user program override the "Transmit message configuration" properties. Note that the CPU does not retain parameters set from the Send_Config instruction in the event of power down.

Parameter	Definition
RTS On delay	Specifies the amount of time to wait after activating RTS before transmission is initiated. The range is 0 to 65535 ms, with a default value of 0. This parameter is valid only when the port configuration (Page 1073) specifies hardware flow control. CTS is evaluated after the RTS On delay time has expired. This parameter is applicable for RS232 modules only.
RTS Off delay	Specifies the amount of time to wait before de-activating RTS after completion of transmission. The range is 0 to 65535 ms, with a default value of 0. This parameter is valid only when the port configuration (Page 1073) specifies hardware flow control. This parameter is applicable for RS232 modules only.
Send break at message start Number of bit times in a break	Specifies that upon the start of each message, a break will be sent after the RTS On delay (if configured) has expired and CTS is active. You specify how many bit times constitute a break where the line is held in a spacing condition. The default is 12 and the maximum is 65535, up to a limit of eight seconds.
Send idle line after a break Idle line after a break	Specifies that an idle line will be sent before message start. It is sent after the break, if a break is configured. The "Idle line after a break" parameter specifies how many bit times constitute an idle line where the line is held in a marking condition. The default is 12 and the maximum is 65535, up to a limit of eight seconds.

13.3.3.3 Configuring receive parameters

From the device configuration of the CPU, you configure how a communication interface receives data, and how it recognizes both the start of and the end of a message. You set these parameters in the "Receive message configuration" properties for the selected interface.



You can also dynamically configure or change the receive message parameters from the user program by using the Receive_Config instruction (Page 1095).

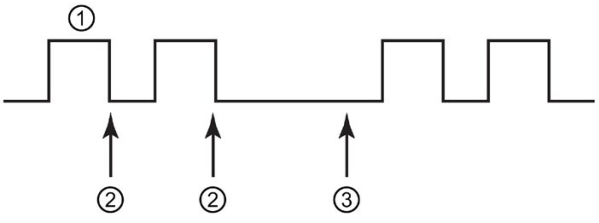
Note

Parameter values set from the Receive_Config instruction in the user program override the "Receive message configuration" properties. Note that the CPU does not retain parameters set from the RCV_CFG instruction in the event of power down or transition to STOP.

Message start conditions

You can determine how the communication interface recognizes the start of a message. The start characters and the characters comprising the message go into the receive buffer until a configured end condition is met.

You can specify multiple start conditions. If you specify more than one start condition, all of the start conditions must be met before the message is considered started. For example, if you configure an idle line time and a specific start character, the CM or CB will first look for the idle line time requirement to be met and then the CM will look for the specified start character. If some other character is received (not the specified start character), the CM or CB will restart the start of message search by again looking for an idle line time.

Parameter	Definition
Start on Any Character	The Any Character condition specifies that any successfully received character indicates the start of a message. This character is the first character within a message.
Line Break	The Line Break condition specifies that a message receive operation starts after a break character is received.
Idle Line	The Idle Line condition specifies that a message reception starts once the receive line has been idle or quiet for the number of specified bit times. Once this condition occurs, the start of a message begins.  ① Characters ② Restarts the idle line timer ③ Idle line is detected and message receive is started
Special condition: Recognize message start with single character	Specifies that a particular character indicates the start of a message. This character is then the first character within a message. Any character that is received before this specific character is discarded. The default character is STX.
Special condition: Recognize message start with a character sequence	Specifies that a particular character sequence from up to four configured sequences indicates the start of a message. For each sequence, you can specify up to five characters. For each character position, you specify either a specific hex character, or that the character is ignored in sequence matching (wild-card character). The last specific character of a character sequence terminates that start condition sequence. Incoming sequences are evaluated against the configured start conditions until a start condition has been satisfied. Once the start sequence has been satisfied, evaluation of end conditions begins. You can configure up to four specific character sequences. You use a multiple-sequence start condition when different sequences of characters can indicate the start of a message. If any one of the character sequences is matched, the message is started.

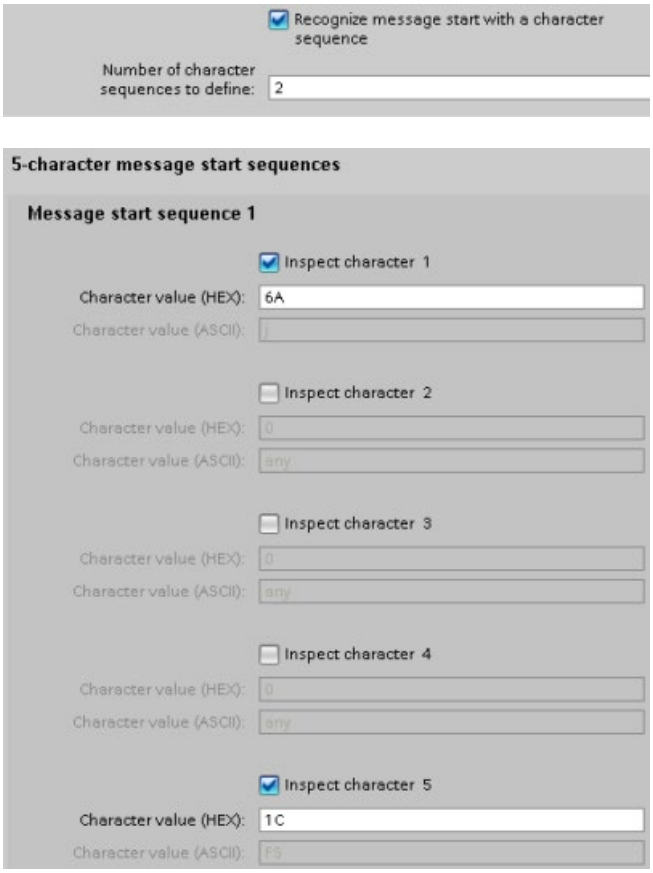
The order of checking start conditions is:

- Idle line
- Line break
- Characters or character sequences

While checking for multiple start conditions, if one of the conditions is not met, the CM or CB will restart the checking with the first required condition. After the CM or CB establishes that the start conditions have been met, it begins evaluating end conditions.

Example configuration: Start message on one of two character sequences

Consider the following start message condition configuration:





With this configuration, the start condition is satisfied when either pattern occurs:

- When a five-character sequence is received where the first character is 0x6A and the fifth character is 0x1C. The characters at positions 2, 3, and 4 can be any character with this configuration. After the fifth character is received, evaluation of end conditions begins.
- When two consecutive 0x6A characters are received, preceded by any character. In this case, evaluation of end conditions begins after the second 0x6A is received (3 characters). The character preceding the first 0x6A is included in the start condition.

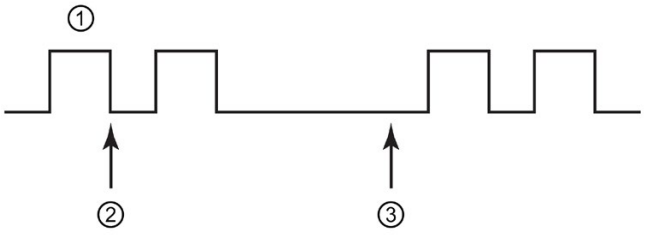
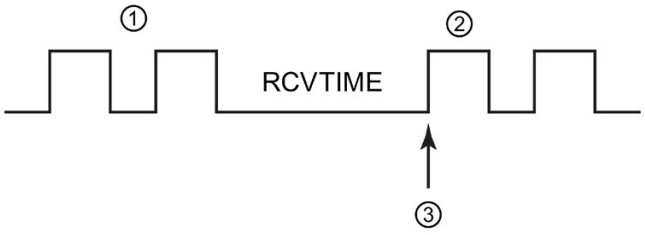
Example sequences that would satisfy this start condition are:

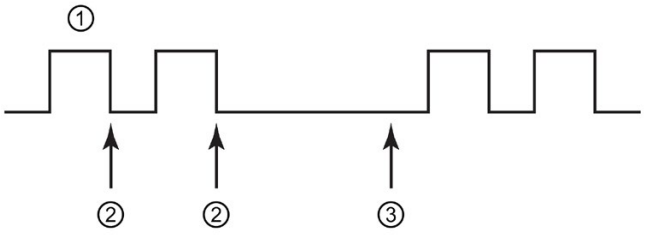
- <any character> 6A 6A
- 6A 12 14 18 1C
- 6A 44 A5 D2 1C

Message end conditions

You also configure how the communication interface recognizes the end of a message. You can configure multiple message end conditions. If any one of the configured conditions occurs, the message ends.

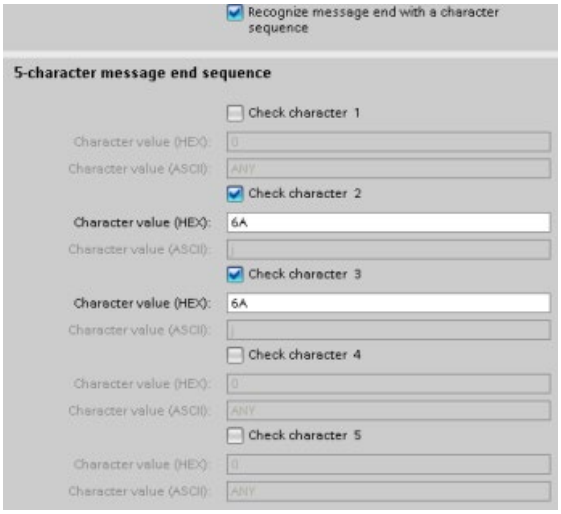
For example, you could specify an end condition with an end of message timeout of 300 milliseconds, an inter-character timeout of 40 bit times, and a maximum length of 50 bytes. The message will end if the message takes longer than 300 milliseconds to receive, or if the gap between any two characters exceeds 40 bit times, or if 50 bytes are received.

Parameter	Definition
Recognize message end by message timeout	The message end occurs when the configured amount of time to wait for the message end has expired. The message timeout period begins when a start condition has been satisfied. The default is 200 ms and the range is 0 to 65535 ms.  ① Received characters ②Start Message condition satisfied: message timer starts ③ Message timer expires and terminates the message
Recognize message end by response timeout	The message end occurs when the configured amount of time to wait for a response expires before a valid start sequence is received. The response timeout period begins when a transmission ends and the CM or CB begins the receive operation. The default response timeout is 200 ms and the range is 0 to 65535 ms. If a character is not received within the response time period, RCVTIME, then an error is returned to the corresponding RCV_PTP instruction. The response timeout does not define a specific end condition. It only specifies that a character must be successfully received within the specified time. You must configure another end condition to indicate the actual end of a message.  ① Transmitted characters ② Received characters ③ First character must be successfully received by this time.

Parameter	Definition
Recognize message end by inter-character gap	The message end occurs when the maximum configured timeout between any two consecutive characters of a message has expired. The default value for the inter-character gap is 12 bit times and the maximum number is 65535 bit times, up to a maximum of eight seconds.  ① Received characters ② Restarts the intercharacter timer ③ The intercharacter timer expires and terminates the message.
Recognize message end by receiving a fixed number of characters	The message end occurs when the specified number of characters has been received. The valid range for the fixed length is 1 to 4096. Note that for the S7-1200, this end condition is only valid for V4.0 CPUs or higher.
Recognize message end by max length	The message end occurs when the configured maximum number of characters has been received. The valid range for maximum length is 1 to 1024. This condition can be used to prevent a message buffer overrun error. When this end condition is combined with timeout end conditions and the timeout condition occurs, any valid received characters are provided even if the maximum length is not reached. This allows support for varying length protocols when only the maximum length is known.
Read message length from message	The message itself specifies the length of the message. The message end occurs when a message of the specified length has been received. The method for specifying and interpreting the message length is described below.
Recognize message end with a character	The message end occurs when a specified character is received.
Recognize message end with a character sequence	The message end occurs when a specified character sequence is received. You can specify a sequence of up to five characters. For each character position, you specify either a specific hex character, or that the character is ignored in sequence matching. Leading characters that are ignored characters are not part of the end condition. Trailing characters that are ignored characters are part of the end condition.

Example configuration: End message with a character sequence

Consider the following end message condition configuration:



In this case, the end condition is satisfied when two consecutive 0x6A characters are received, followed by any two characters. The character preceding the 0x6A 0x6A pattern is not part of the end character sequence. Two characters following the 0x6A 0x6A pattern are required to terminate the end character sequence. The values received at character positions 4 and 5 are irrelevant, but they must be received to satisfy the end condition.

Note

If you want your character sequence to indicate the end of the message, put the sequence in the last character positions. In the example above, if you wanted 0x6A 0x6A to end the message with no trailing characters, you would configure 0x6A in character positions 4 and 5.

Specification of message length within the message

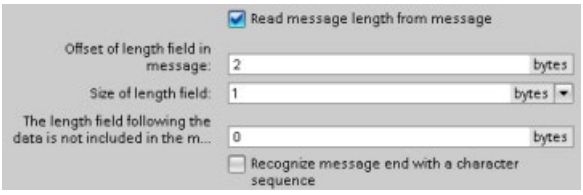
When you select the special condition where the message length is included in the message, you must provide three parameters that define information about the message length.

The actual message structure varies according to the protocol in use. The three parameters are as follows:

- n: the character position (1-based) within the message that starts the length specifier
- Length size: The number of bytes (one, two, or four) of the length specifier
- Length m: the number of characters following the length specifier that are not included in the length count

The ending characters do not need to be contiguous. The "Length m" value can be used to specify the length of a checksum field whose size is not included in the length field.

These fields appear in the Receive message configuration of the device properties:



Example 1: Consider a message structured according to the following protocol:

STX	Len (n)	Characters 3 to 14 counted by the length												
		ADR	PKE		INDEX		PWD		STW		HSW		BCC
1	2	3	4	5	6	7	8	9	10	11	12	13	14
STX	0x0C	xx	xxxx		xxxx		xxxx		xxxx		xxxx		xx

Configure the receive message length parameters for this message as follows:

- n = 2 (The message length starts with byte 2.)
- Length size = 1 (The message length is defined in one byte.)
- Length m = 0 (There are no additional characters following the length specifier that are not counted in the length count. Twelve characters follow the length specifier.)

In this example, the characters from 3 to 14 inclusive are the characters counted by Len (n).

Example 2: Consider another message structured according to the following protocol:

SD1	Len (n)	Len (n)	SD2	Characters 5 to 10 counted by length						FCS	ED
				DA	SA	FA	Data unit=3 bytes				
1	2	3	4	5	6	7	8	9	10	11	12
xx	0x06	0x06	xx	xx	xx	xx	xx	xx	xx	xx	xx

Configure the receive message length parameters for this message as follows:

- n = 3 (The message length starts at byte 3.)
- Length size = 1 (The message length is defined in one byte.)
- Length m = 3 (There are three characters following the length specifier that are not counted in the length. In the protocol of this example, the characters SD2, FCS, and ED are not counted in the length count. The other six characters are counted in the length count; therefore the total number of characters following the length specifier is nine.)

In this example, the characters from 5 to 10 inclusive are the characters counted by Len (n).

13.3.4 Configuring 3964(R) communication

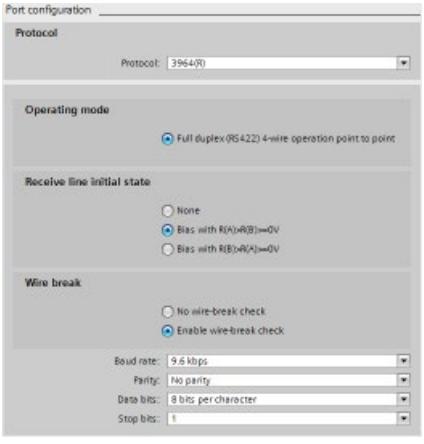
13.3.4.1 Configuring the 3964(R) communication ports

You can use either of the following methods to configure the communication interfaces for 3964(R) communication:

- Use the device configuration in STEP 7 to configure the port parameters. The CPU stores the device configuration settings and applies the settings after a power cycle.
- Use the Port_Config (Page 1090) instruction to set the port parameters. The port settings set by the instructions are valid while the CPU is in RUN mode. The port settings revert to the device configuration settings after a power cycle.

After adding the communication interfaces to the device configuration (Page 154), you configure parameters for the communication interfaces by selecting one of the CMs in your rack.





The "Properties" tab of the inspector window displays the parameters of the selected CM. Select "Port configuration" to edit the following parameters:

- Protocol: 3964(R)
- Operating mode
  (CM 1241 (RS422/485) module only)
- Receive line initial state
  (CM 1241 (RS422/485) module only)
- Wire break
  (CM 1241 (RS422/485) module only)
- Baud rate
- Parity
- Data bits
- Stop bits

Parameter	Definition
Protocol	3964R or Freeport. Select 3964R to configure port for 3964(R) communication
Operating mode*	Full duplex (RS422) four-wire operation point-to-point. (Enabled)
Receive line initial state*	Enable one of the following choices: • None • Bias with R(A)>R(B)>=0V • Bias with R(B)>R(A)>=0V
Wire break*	Enable one of the following choices: • No wire-break check • Enable wire-break check
Baud rate	The default value for the baud rate is 9.6 Kbits per second. Valid choices are: 300 baud, 600 baud, 1.2 Kbits, 2.4 Kbits, 4.8 Kbits, 9.6 Kbits, 19.2 Kbits, 38.4 Kbits, 57.6 Kbits, 76.8 Kbits, and 115.2 Kbits.
Parity	The default value for parity is no parity. Valid choices are: No parity, even, odd, mark (parity bit always set to 1), space (parity bit always set to 0), and any parity (set parity bit to 0 for transmission; ignore parity error when receiving).
Data bits per character	The number of data bits in a character. Valid choices are 7 or 8.
Number of stop bits	The number of stop bits can be either one or two. The default is one.

* CM 1241 (RS422/485) module only

13.3.4.2 Configuring the 3964(R) priority and protocol parameters

You can use either of the following methods to configure the communication interfaces for 3964(R) communication:

- In the device configuration of the communication interface, click "3964(R) configuration" to set the priority and configure the protocol parameters. The CPU stores the device configuration settings and applies the settings after a power cycle.
- Use the P3964_Config (Page 1101) instruction to set the priority and protocol configuration parameters. The values set by the instructions are valid while the CPU is in RUN mode. The values revert to the device configuration settings after a power cycle.



The "Properties" tab of the inspector window displays the parameters of the selected CM. Select "3964(R) configuration" to edit the following parameters:

- Priority (high or low)
- Protocol parameters
  - With block check (3964R)
  - Use default values

    Connection attempts

    Transmission attempts

    Character delay time

    Acknowledgement delay

Parameter	Definition
Priority	High or low: The CM will be either high or low and the communication partner must be the opposite.
With block check (3964)	If selected, 3964(R) communication employs transmission security by including a block check character (BCC). If not selected transmission security does not include a block check character.
Use default values	If selected, 3964(R) uses default values for the following protocol parameters: • Connection attempts • Transmission attempts • Character delay time • Acknowledgement delay If not selected, you can configure values for each of these parameters.
Connection attempts	Number of connection attempts (default value: 6 connection attempts) 1 to 255
Transmission attempts	Number of transmission attempts (default value: 6 connection attempts) 1 to 255
Character delay time	Character delay time setting (depending on the set data transmission rate) (default value: 220 ms) 1 ms to 65535 ms
Acknowledgement delay	Acknowledgment delay time setting (depending on the set data transmission rate) (default value: 2000 ms when block check is enabled; 550 ms when block check is not enabled) 1 ms to 65535 ms

Note

With the exception of Priority, the protocol settings must be the same for the CM module and the communication partner.

13.3.5 Point-to-point instructions

13.3.5.1 Common parameters for Point-to-Point instructions

Table 13- 3 Common input parameters for the PTP instructions

Parameter	Description
REQ	Many of the PtP instructions use the REQ input to initiate the operation on a low to high transition. The REQ input must be high (TRUE) for one execution of an instruction, but the REQ input can remain TRUE for as long as desired. The instruction does not initiate another operation until it has been called with the REQ input FALSE so that the instruction can reset the history state of the REQ input. This is required so that the instruction can detect the low to high transition to initiate the next operation. When you place a PtP instruction in your program, STEP 7 prompts you to identify the instance DB. Use a unique DB for each PtP instruction call. This ensures that each instruction properly handles inputs such as REQ.
PORT	A port address is assigned during communication device configuration. After configuration, a default port symbolic name can be selected from the parameter assistant drop-list. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "Constants" tab of the PLC tag table.
Bit time resolution	Several parameters are specified in a number of bit times at the configured baud rate. Specifying the parameter in bit times allows the parameter to be independent of baud rate. All parameters that are in units of bit times can be specified to a maximum number of 65535. However, the maximum amount of time that a CM or CB can measure is eight seconds.

The DONE, NDR, ERROR, and STATUS output parameters of the PtP instructions provide execution completion status for the PtP operations.

Table 13- 4 DONE, NDR, ERROR, and STATUS output parameters

Parameter	Data type	Default	Description
DONE	Bool	FALSE	Set TRUE for one execution to indicate that the last request completed without errors; otherwise, FALSE.
NDR	Bool	FALSE	Set TRUE for one execution to indicate that the requested action has completed without error and that the new data has been received; otherwise, FALSE.
ERROR	Bool	FALSE	Set TRUE for one execution to indicate that the last request completed with errors, with the applicable error code in STATUS; otherwise, FALSE.
STATUS	Word	0	Result status: • If the DONE or NDR bit is set, then STATUS is set to 0 or to an informational code. • If the ERROR bit is set, then STATUS is set to an error code. • If none of the above bits are set, then the instruction returns status results that describe the current state of the function. STATUS retains its value for the duration of the execution of the function.

Note

The DONE, NDR, and ERROR parameters are set for one execution only. Your program logic must save temporary output state values in data latches, so you can detect state changes in subsequent program scans.

Table 13- 5 Common condition codes

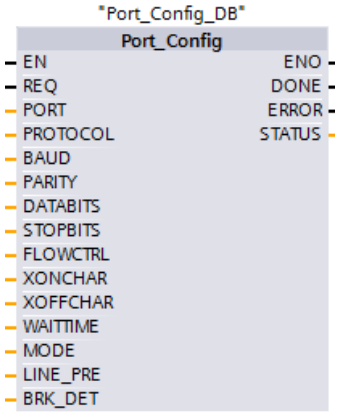
STATUS (W#16#....)	Description
0000	No error
7000	Function is not busy
7001	Function is busy with the first call.
7002	Function is busy with subsequent calls (polls after the first call).
8x3A	Illegal pointer in parameter x
8070	All internal instance memory in use, too many concurrent instructions in progress
8080	Port number is illegal.
8081	Timeout, module error, or other internal error
8082	Parameterization failed because parameterization is in progress in background.
8083	Buffer overflow: The CM or CB returned a received message with a length greater than the length parameter allowed.
8090	Internal error: Wrong message length, wrong sub-module, or illegal message Contact customer support.
8091	Internal error: Wrong version in parameterization message Contact customer support.
8092	Internal error: Wrong record length in parameterization message Contact customer support.

Table 13- 6 Common error classes

Class description	Error classes	Description
Port configuration	16#81Ax	Used to define common port configuration errors
Transmit configuration	16#81Bx	Used to define common transmit configuration errors
Receive configuration	16#81Cx 16#82Cx	Used to define common receive configuration errors
Transmission runtime	16#81Dx	Used to define common transmission runtime errors
Reception runtime	16#81Ex	Used to define common reception runtime errors
Signal handling	16#81Fx	Used to define common errors associated with all signal handling
Pointer errors	16#8p01 to 16#8p51	Used for ANY pointer errors where "p" is the parameter number of the instruction
Embedded protocol errors	16#848x 16#858x	Used for embedded protocol errors

13.3.5.2 Port_Config (Configure communication parameters dynamically)

Table 13- 7 Port_Config (Port Configuration) instruction

LAD / FBD	SCL	Description
	"Port_Config_DB"(REQ:=_bool_in_, PORT:=_word_in_, PROTOCOL:=_uint_in_, BAUD:=_uint_in_, PARITY:=_uint_in_, DATABITS:=_uint_in_, STOPBITS:=_uint_in_, FLOWCTRL:=_uint_in_, XONCHAR:=_char_in_, XOFFCHAR:=_char_in_, WAITTIME:=_uint_in_, MODE:=_uint_in_, LINE_PRE:=_uint_in_, BRK_DET:=_uint_in_, DONE=>_bool_out_, ERROR=>_bool_out_, STATUS=>_word_out_);	Port_Config allows you to change port parameters such as baud rate from your program. You can set up the initial static configuration of the port in the device configuration properties, or just use the default values. You can execute the Port_Config instruction in your program to change the configuration.

[1] STEP 7 automatically creates the DB when you insert the instruction.

The CPU does not permanently store the values you set with the Port_Config instruction. The CPU restores the parameters configured in the device configuration when the CPU transitions from RUN to STOP mode and after a power cycle. See Configuring the communication ports (Page 1073) and Managing flow control (Page 1075) for more information.

Table 13- 8 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activate the configuration change on rising edge of this input. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
PROTOCOL	IN	UInt	0 - Freeport protocol (Default value) 1. 3964(R) protocol
BAUD	IN	UInt	Port baud rate (Default value: 6): 1 = 300 baud, 2 = 600 baud, 3 = 1200 baud, 4 = 2400 baud, 5 = 4800 baud, 6 = 9600 baud, 7 = 19200 baud, 8 = 38400 baud, 9 = 57600 baud, 10 = 76800 baud, 11 = 115200 baud
PARITY	IN	UInt	Port parity (Default value: 1): 1 = No parity, 2 = Even parity, 3 = Odd parity, 4 = Mark parity, 5 = Space parity
DATABITS	IN	UInt	Bits per character (Default value: 1): 1 = 8 data bits, 2 = 7 data bits
STOPBITS	IN	UInt	Stop bits (Default value: 1): 1 = 1 stop bit, 2 = 2 stop bits
FLOWCTRL*	IN	UInt	Flow control (Default value: 1): 1 = No flow control, 2 = XON/XOFF, 3 = Hardware RTS always ON, 4 = Hardware RTS switched
XONCHAR[1]	IN	Char	Specifies the character that is used as the XON character. This is typically a DC1 character (16#11). This parameter is only evaluated if flow control is enabled. (Default value: 16#11)
XOFFCHAR[1]	IN	Char	Specifies the character that is used as the XOFF character. This is typically a DC3 character (16#13). This parameter is only evaluated if flow control is enabled. (Default value: 16#13)
WAITTIME[1]	IN	UInt	Specifies how long to wait for a XON character after receiving a XOFF character, or how long to wait for the CTS signal after enabling RTS (0 to 65535 ms). This parameter is only evaluated if flow control is enabled. (Default value: 2000)
MODE[2]	IN	UInt	Specifies the selection of the module's operating mode. • 0 = Full duplex (RS232) • 1 = Full duplex (RS422) four-wire mode (point-to-point), transmitter always enabled • 2 = Full duplex (RS422) four-wire mode (multipoint master), transmitter always enabled • 3 = Full duplex (RS422) four-wire modemultipoint slave, transmitter enabled while sending • 4 = Half dubplex (RS485) two-wire mode

Parameter and type		Data type	Description
LINE_PRE	IN	UInt	Specifies the inactive (idle) line condition. For RS422 and RS485 modules the idle line condition is established by applying a bias voltage to the R(A) and R(B) signals. The following selections are possible: • 0 = Not biased (No Presetting) (default) • 1 = Biased with R(A) > R(B) ≥ 0V; RS422 only • 2 = Biased with R(B) > R(A) ≥ 0V; RS422 and RS485
BRK_DET	IN	UInt	Enables/disables communications cable break detection. Enabling cable break detection causes the module to indicate a fault when the communications cable is not connected to the module. In RS422 Point-to-Point mode cable break detection is only possible when Receive Line Presetting is used with bias applied so that R(A) > R(B) ≥ 0V. • 0 -= No Cable Break Detection (default) • 1 = Cable Break Detection enabled
DONE	OUT	Bool	TRUE for one execution after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one execution after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

[1] Not applicable when Protocol=1 (3964(R) protocol)

[2] Only modes 0 and 1 are valid when Protocol=1 (3964(R) protocol) depending on whether your CM module is an RS232 module or RS422 module.

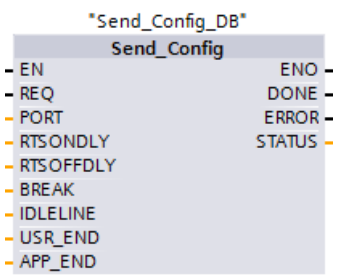
Table 13- 9 Condition codes

STATUS (W#16#....)	Description
81A0	Specific protocol does not exist.
81A1	Specific baud rate does not exist.
81A2	Specific parity option does not exist.
81A3	Specific number of data bits does not exist.
81A4	Specific number of stop bits does not exist.
80A5	Specific type of flow control does not exist.
81A6	Wait time is 0 and flow control enabled
81A7	XON and XOFF are illegal values (for example, the same value)
81A8	Error in the block header (for example, wrong block type or wrong block length)
81A9	Reconfiguration rejected because a configuration is in progress
81AA	Invalid RS422/RS485 mode of operation
81AB	Invalid presetting of the receive line for break detection
81AC	Invalid RS232 break handling
8280	Negative acknowledgement while reading the module
8281	Negative acknowledgement while writing the module
8282	DP slave or module not available

13.3.5.3 Send_Config (Configure serial transmission parameters dynamically)

Table 13- 10 Send_Config (Send Configuration) instruction

LAD / FBD	SCL	Description

	`"Send_Config_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_word_in_,`
	`RTSONDLY:=_uint_in_,`
	`RTSOFFDLY:=_uint_in_,`
	`BREAK:=_uint_in_,`
	`IDLELINE:=_uint_in_,`
	`USR_END:=_string_in_,`
	`APP_END:=_string_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		Send_Config allows the dynamic configuration of serial transmission parameters for a PtP communication port. Any queued messages within a CM or CB are discarded when Send_Config is executed.

[1] STEP 7 automatically creates the DB when you insert the instruction.

You can set up the initial static configuration of the port in the device configuration properties, or just use the default values. You can execute the Send_Config instruction in your program to change the configuration.

The CPU does not permanently store the values you set with the Send_Config instruction. The CPU restores the parameters configured in the device configuration when the CPU transitions from RUN to STOP mode and after a power cycle. See Configuring transmit (send) parameters (Page 1076).

Table 13- 11 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activate the configuration change on the rising edge of this input. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
RTSONDLY	IN	UInt	Number of milliseconds to wait after enabling RTS before any Tx data transmission occurs. This parameter is only valid when hardware flow control is enabled. The valid range is 0 - 65535 ms. A value of 0 disables the feature. (Default value: 0)
RTSOFFDLY	IN	UInt	Number of milliseconds to wait after the Tx data transmission occurs before RTS is disabled: This parameter is only valid when hardware flow control is enabled. The valid range is 0 - 65535 ms. A value of 0 disables the feature. (Default value: 0)
BREAK	IN	UInt	This parameter specifies that a break will be sent upon the start of each message for the specified number of bit times. The maximum is 65535 bit times up to an eight second maximum. A value of 0 disables the feature. (Default value: 12)
IDLELINE	IN	UInt	This parameter specifies that the line will remain idle for the specified number of bit times before the start of each message. The maximum is 65535 bit times up to an eight second maximum. A value of 0 disables the feature. (Default value: 0)
USR_END*	IN	STRING[2]	Specifies the number and the characters in the end delimiter. The end delimiter is embedded in the transmit buffer (characters only) and marks the end of the transmitted message (characters are transmitted until the end delimiter is encountered). The end delimiter is appended to the end of the message. • STRING[2,0,xx,yy] – End delimiter is not used (default) • STRING[2,1,xx,yy] – End delimiter is a single character • STRING[2,2,xx,yy] – End delimiter is two characters Either USR_END or APP_END must have a length of zero.
APP_END*	IN	STRING[5]	Specifies the number and the characters to be appended to the transmitted message (only the characters are appended). STRING[5,0,aa,bb,cc,dd,ee] – End char is not used (default) • STRING[5,1,aa,bb,cc,dd,ee] – Transmit one end character • STRING[5,2,aa,bb,cc,dd,ee] – Transmit two end characters • STRING[5,3,aa,bb,cc,dd,ee]– Transmit three end characters • STRING[5,4,aa,bb,cc,dd,ee] – Transmit four end characters • STRING[5,5,aa,bb,cc,dd,ee] – Transmit five end characters
DONE	OUT	Bool	TRUE for one execution after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one execution after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

* Not supported for the CM and CB 1241s; you must use an empty string ("") for the parameter.

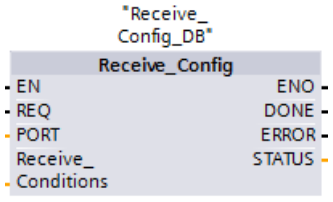
Table 13- 12 Condition codes

STATUS (W#16#....)	Description
81B0	Transmit interrupt configuration is not allowed. Contact customer suport.
81B1	Break time is greater than the maximum allowed value.
81B2	Idle time is greater than the maximum allowed value.
81B3	Error in the block header, for example, wrong block type or wrong block length
81B4	Reconfiguration rejected because a configuration is in progress
81B5	The number of end delimiters specified is greater than two or the number of end characters is greater than five
81B6	Send configuration rejected when configured for firmware embedded protocols
8280	Negative acknowledgement while reading the module
8281	Negative acknowledgement while writing the module
8282	DP slave or module not available

13.3.5.4 Receive_Config (Configure serial receive parameters dynamically)

Table 13- 13 Receive_Config (Receive Configuration) instruction

LAD / FBD	SCL	Description

	`"Receive_Config_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_uint_in_,`
	`Re-`
	`ceive_Conditions:=_struct_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		Receive_Config performs dynamic configuration of serial receiver parameters for a PtP communication port. This instruction configures the conditions that signal the start and end of a received message. Any queued messages within a CM or CB are discarded when Receive_Config is executed.

1 STEP 7 automatically creates the DB when you insert the instruction.

You can set up the initial static configuration of the communication port in the device configuration properties, or just use the default values. You can execute the Receive_Config instruction in your program to change the configuration.

The CPU does not permanently store the values you set with the Receive_Config instruction. The CPU restores the parameters configured in the device configuration when the CPU transitions from RUN to STOP mode and after a power cycle. See the topic "Configuring receive parameters (Page 1077)" for more information.

Table 13- 14 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activate the configuration change on the rising edge of this input. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
CONDITIONS	IN	CONDITIONS	The Conditions data structure specifies the starting and ending message conditions as described below.
DONE	OUT	Bool	TRUE for one scan, after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one scan, after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

Start conditions for the Receive_P2P instruction

The Receive_P2P instruction uses the configuration specified by the Receive_Config instruction to determine the beginning and ending of point-to-point communication messages. The start of a message is determined by the start conditions. The start of a message can be determined by one or a combination of start conditions. If more than one start condition is specified, all the conditions must be satisfied before the message is started.

See the topic "Configuring receive parameters (Page 1077)" for a description of the message start conditions.

Parameter CONDITIONS data type structure part 1 (start conditions)

Table 13- 15 CONDITIONS structure for start conditions

Parameter and type		Data type	Description
STARTCOND	IN	UInt	Specifies the start condition (Default value: 1) • 01H - Start Char • 02H - Any Char • 04H - Line Break • 08H - Idle Line • 10H - Sequence 1 • 20H - Sequence 2 • 40H - Sequence 3 • 80H - Sequence 4
IDLETIME	IN	UInt	The number of bit times required for idle line timeout. (Default value: 40). Only used with an idle line condition. 0 to 65535
STARTCHAR	IN	Byte	The start character used with the start character condition. (Default value: B#16#2)
STRSEQ1CTL	IN	Byte	Sequence 1 ignore/compare control for each character: (Default value: B#16#0) These are the enabling bits for each character in start sequence • 01H - Character 1 • 02H - Character 2 • 04H - Character 3 • 08H - Character 4 • 10H - Character 5 Disabling the bit associated with a character means any character will match, in this sequence position.
STRSEQ1	IN	Char[5]	Sequence 1 start characters (5 characters). Default value: 0
STRSEQ2CTL	IN	Byte	Sequence 2 ignore/compare control for each character. Default value: B#16#0)
STRSEQ2	IN	Char[5]	Sequence 2 start characters (5 characters). Default value: 0
STRSEQ3CTL	IN	Byte	Sequence 3 ignore/compare control for each character. Default value: B#16#0
STRSEQ3	IN	Char[5]	Sequence 3 start characters (5 characters). Default value: 0
STRSEQ4CTL	IN	Byte	Sequence 4 ignore/compare control for each character. Default value: B#16#0
STRSEQ4	IN	Char[5]	Sequence 4 start characters (5 characters), Default value: 0

Example

Consider the following received hexadecimal coded message: "**68** 10 aa **68** bb 10 aa 16" and the configured start sequences shown in the table below. Start sequences begin to be evaluated when the first 68H character is successfully received. Upon successfully receiving the fourth character (the second 68H), then start condition 1 is satisfied. Once the start conditions are satisfied, the evaluation of the end conditions begins.

The start sequence processing can be terminated due to various parity, framing, or inter-character timing errors. These errors result in no received message, because the start condition was not satisfied.

Table 13- 16 Start conditions

Start condition	First Character	First Character +1	First Character +2	First Character +3	First Character +4
1	**68**H	xx	xx	**68**H	xx
2	10H	aaH	xx	xx	xx
3	dcH	aaH	xx	xx	xx
4	e5H	xx	xx	xx	xx

End conditions for the Receive_P2P instruction

The end of a message is determined by the specification of end conditions. The end of a message is determined by the first occurrence of one or more configured end conditions. The section "Message end conditions" in the topic "Configuring receive parameters (Page 1077)" describes the end conditions that you can configure in the Receive_Config instruction.

You can configure the end conditions in either the properties of the communication interface in the device configuration, or from the Receive_Config instruction. Whenever the CPU transitions from STOP to RUN, the receive parameters (both start and end conditions) return to the device configuration settings. If the STEP 7 user program executes Receive_Config, then the settings are changed to the Receive_Config conditions.

Parameter CONDITIONS data type structure part 2 (end conditions)

Table 13- 17 CONDITIONS structure for end conditions

Parameter	Parameter type	Data type	Description
ENDCOND	IN	UInt 0	This parameter specifies message end condition: • 01H - Response time • 02H - Message time • 04H - Inter-character gap • 08H - Maximum length • 10H - N + LEN + M • 20H - Sequence
MAXLEN	IN	UInt 1	Maximum message length: Only used when the maximum length end condition is selected. 1 to 1024 bytes
N	IN	UInt 0	Byte position within the message of the length field. Only used with the N + LEN + M end condition. 1 to 1022 bytes
LENGTHSIZE	IN	UInt 0	Size of the byte field (1, 2, or 4 bytes). Only used with the N + LEN + M end condition.
LENGTHM	IN	UInt 0	Specify the number of characters following the length field that are not included in the value of the length field. This is only used with the N + LEN + M end condition. 0 to 255 bytes
RCVTIME	IN	UInt 200	Specify how long to wait for the first character to be received. The receive operation will be terminated with an error if a character is not successfully received within the specified time. This is only used with the response time condition. (0 to 65535 bit times with an 8 second maximum) This parameter is not a message end condition since evaluation terminates when the first character of a response is received. It is an end condition only in the sense that it terminates a receiver operation because no response is received when a response is expected. You must select a separate end condition.
MSGTIME	IN	UInt 200	Specify how long to wait for the entire message to be completely received once the first character has been received. This parameter is only used when the message timeout condition is selected. (0 to 65535 milliseconds)
CHARGAP	IN	UInt 12	Specify the number of bit times between characters. If the number of bit times between characters exceeds the specified value, then the end condition will be satisfied. This is only used with the inter-character gap condition. (0 to 65535 bit times up to 8 second maximum)

Parameter	Parameter type	Data type	Description
ENDSEQ1CTL	IN	Byte B#16#0	Sequence 1 ignore/compare control for each character: These are the enabling bits for each character for the end sequence. Character 1 is bit 0, character 2 is bit 1, …, character 5 is bit 4. Disabling the bit associated with a character means any character will match, in this sequence position.
ENDSEQ1	IN	Char[5] 0	Sequence 1 start characters (5 characters)

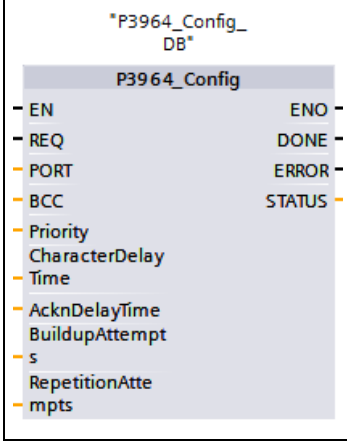
Table 13- 18 Condition codes

STATUS (W#16#....)	Description
81C0	Illegal start condition selected
81C1	Illegal end condition selected, no end condition selected
81C2	Receive interrupt enabled and this is not possible.
81C3	Maximum length end condition is enabled and max length is 0 or > 1024.
81C4	Calculated length is enabled and N is >= 1023.
81C5	Calculated length is enabled and length is not 1, 2 or 4.
81C6	Calculated length is enabled and M value is > 255.
81C7	Calculated length is enabled and calculated length is > 1024.
81C8	Response timeout is enabled and response timeout is zero.
81C9	Inter-character gap timeout is enabled and it is zero.
81CA	Idle line timeout is enabled and it is zero.
81CB	End sequence is enabled but all chars are "don't care".
81CC	Start sequence (any one of 4) is enabled but all characters are "don't care".
81CD	Invalid receive message overwrite protection selection error
81CE	Invalid receive message buffer handling on STOP to RUN transition selection error
81CF	Error in the block header, for example, wrong block type or wrong block length
8281	Negative acknowledgement while writing the module
8282	DP slave or module not available
82C0	Reconfiguration rejected because a configuration is in progress
82C1	The specified value for the number of messages that the module can buffer is greater than the maximum permitted value.
82C2	Receive configuration rejected when configured for firmware embedded protocols
8351	Data type not allowed at this Variant pointer

13.3.5.5 P3964_Config (Configuring the 3964(R) protocol)

Table 13- 19 P3964_Config (Configuring the 3964(R) protocol) instruction

LAD / FBD	SCL	Description

	`"P3964_Config_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_uint_in_,`
	`BCC:=_usint_in,`
	`Priority:= _usint_in,`
	`CharacterDelayTime:=_uint_in,`
	`AcknDelayTime:= _uint_in,`
	`BuildupAttempts:=_usint_in_,`
	`RepetitionAttempts:=_usint_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		P3964_Config allows you to change priority and protocol parameters during runtime.
		You can set up the initial static configuration of the port in the device configuration properties, or just use the default values. You can execute the P3964_Config instruction in your program to change the configuration.

[1] STEP 7 automatically creates the DB when you insert the instruction.

The CPU does not permanently store the values you set with the P3964_Config instruction. The CPU restores the parameters configured in the device configuration after a power cycle of the CPU. See Configuring the 3964(R) communication priority and protocol parameters (Page 1086) for more information.

Table 13- 20 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activate the configuration change on rising edge of this input. (Default value: False)
PORT	IN	UInt	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
BCC	IN	USInt	Activates/deactivates the use of the block check • 0 = without block check • 1 = with block check
Priority	IN	UInt	Selection of the priority • 0 = low priority • 1 = high priority The priority of the CM must be the opposite of the priority of the communication partner.
CharacterDelayTime	IN	UInt	Character delay time setting (depending on the set data transmission rate) (default value: 220 ms) 1 ms to 65535 ms
AcknDelayTime	IN	UInt	Acknowledgment delay time setting (depending on the set data transmission rate) (default value: 2000 ms) 1 ms to 65535 ms
BuildupAttempts	IN	UInt	Number of connection attempts (default value: 6 connection attempts) 1 to 255
RepetitionAttempts	IN	UInt	Number of transmission attempts (default value: 6 connection attempts) 1 to 255
DONE	OUT	Bool	TRUE for one execution after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one execution after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

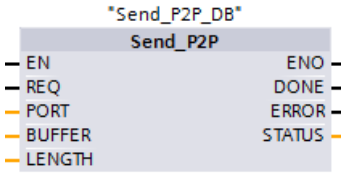
Table 13- 21 Condition codes

STATUS (W#16#....)	Description
16#8380	Parameter assignment error: Invalid value for "Character delay time".
16#8381	Parameter assignment error: Invalid value for "Response timeout".
16#8382	Parameter assignment error: Invalid value for "Priority".
16#8383	Parameter assignment error: Invalid value for "Block check"
16#8384	Parameter assignment error: Invalid value for "Connection attempts".
16#8385	Parameter assignment error: Invalid value for "Transmission attempts".
16#8386	Runtime error: Number of connection attempts exceeded
16#8387	Runtime error: Number of transmission attempts exceeded
16#8388	Runtime error: Error at the "Block check character" The internally calculated value of the block check character does not correspond to the block check character received by the partner at the connection end.
16#8389	Runtime error: Invalid character received while waiting for free receive buffer
16#838A	Runtime error: Logical error during receiving. After DLE was received, a further random character (other than DLE or ETX) was received.
16#838B	Runtime error: Character delay time exceeded
16#838C	Runtime error: Wait time for free receive buffer has started
16#838D	Runtime error: frame repetition does not start within 4 s after NAK
16#838E	Runtime error: In idle mode, one or several characters (other than NAK or STX) were received.
16#838F	Runtime error: Initialization conflict - Both partners have set high priority
16#8391	Parameter assignment error: 3964 configuration data rejected because Freeport is set

13.3.5.6 Send_P2P (Transmit send buffer data)

Table 13- 22 Send_P2P (Send Point-to-Point data) instruction

LAD / FBD	SCL	Description

	`"Send_P2P_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_word_in_,`
	`BUFFER:=_variant_in_,`
	`LENGTH:=_uint_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		Send_P2P initiates the transmission of the data and transfers the assigned buffer to the communication interface. The CPU program continues while the CM or CB sends the data at the assigned baud rate. Only one send operation can be pending at a given time. The CM or CB returns an error if a second Send_P2P is executed while the CM or CB is already transmitting a message.

[1] STEP 7 automatically creates the DB when you insert the instruction.

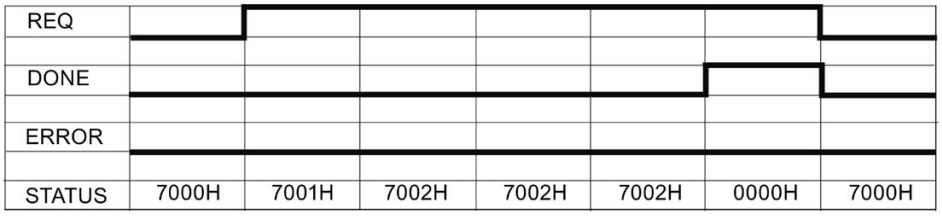
Table 13- 23 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activates the requested transmission on the rising edge of this transmission enable input. This initiates transfer of the contents of the buffer to the Point-to-Point communication interface. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
BUFFER	IN	Variant	This parameter points to the starting location of the transmit buffer. (Default value: 0) **Note:** Boolean data or Boolean arrays are not supported.
LENGTH	IN	UInt	Transmitted frame length in bytes (Default value: 0) When transmitting a complex structure, always use a length of 0. When the length is 0, the instruction transmits the entire frame.
DONE	OUT	Bool	TRUE for one scan, after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one scan, after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

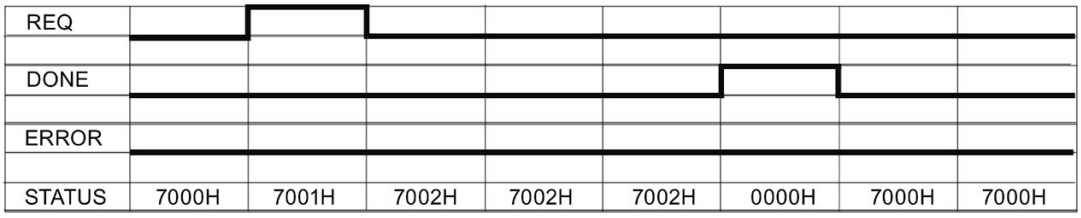
While a transmit operation is in progress, the DONE and ERROR outputs are FALSE. When a transmit operation is complete, either the DONE or the ERROR output will be set TRUE to show the status of the transmit operation. While DONE or ERROR is TRUE, the STATUS output is valid.

The instruction returns a status of 16#7001 if the communication interface accepts the transmit data. Subsequent Send_P2P executions return 16#7002, if the CM or CB is still busy transmitting. When the transmit operation is complete, the CM or CB returns the status of the transmit operation as 16#0000 (if no errors occurred). Subsequent executions of Send_P2P with REQ low return a status of 16#7000 (not busy).

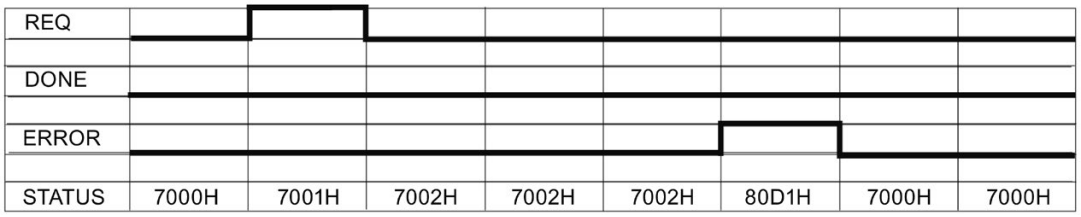
The following diagrams show the relationship of the output values to REQ. This assumes that the instruction is called periodically to check for the status of the transmission process. In the diagram below, it is assumed that the instruction is called every scan (represented by the STATUS values).



The following diagram shows how the DONE and STATUS parameters are valid for only one scan if the REQ line is pulsed (for one scan) to initiate the transmit operation.



The following diagram shows the relationship of DONE, ERROR and STATUS parameters when there is an error.



The DONE, ERROR and STATUS values are only valid until Send_P2P executes again with the same instance DB.

Table 13- 24 Condition codes

STATUS (W#16#....)	Description
81D0	New request while transmitter active
81D1	Transmit aborted because of no CTS within wait time
81D2	Transmit aborted because of no DSR from the DCE device
81D3	Transmit aborted because of queue overflow (transmit more than 1024 bytes)
81D5	Reverse bias signal (wire break condition)
81D6	Transmission request rejected because end delimiter was not found in the transmit buffer
81D7	Internal error / error in synchronization between FB and CM
81D8	Transmission attempt rejected because the port has not been configured
81DF	CM has reset the interface to the FB due to one of the following reasons • The module has restarted (Power cycle) • The CPU has reached a breakpoint • The module has been reparameterized In each case the module indicates this code in the Status parameter. The module resets Status and Error to zero after the first received record for SEND_P2P.
8281	Negative acknowledgement while writing the module
8282	DP slave or module not available
8301	Illegal syntax ID at an ANY pointer
8322	Range length error when reading a parameter
8324	Range error when reading a parameter
8328	Alignment error when reading a parameter
8332	The parameter contains a DB number that is higher than the highest permitted number (DB number error).
833A	The DB for the BUFFER parameter does not exist.

Note

Setting the maximum record length for Profibus communication

When using a CM1243-5 Profibus Master module to control an ET 200SP or ET 200MP Profibus device that uses an RS232, RS422, or RS485 point-to-point module, you need to explicitly set the "max_record_len" data block tag to 240 as defined below:

Set "max_record_len" in the instance DB (for example, "Send_P2P_DB".max_record_len) to 240 after running any configuration instruction such as Port_Config, Send_Config, or Receive_Config.

Explicitly assigning max_record_len is only necessary with Profibus communication; Profinet communication already uses a valid max_record_len value.

Interaction of the LENGTH and BUFFER parameters

The minimum size of data that can be transmitted by the SEND_P2P instruction is one byte. The BUFFER parameter determines the size of the data to be transmitted. You cannot use the data type Bool or arrays of Bool for the BUFFER parameter.

You can always set the LENGTH parameter to 0 and ensure that SEND_P2P sends the entire data structure represented by the BUFFER parameter. If you only want to send part of a data structure in the BUFFER parameter, you can set LENGTH as follows:

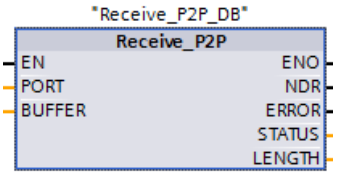
Table 13- 25 LENGTH and BUFFER parameters

LENGTH	BUFFER	Description
= 0	Not used	The complete data is sent as defined at the BUFFER parameter. You do not need to specify the number of transmitted bytes when LENGTH = 0.
> 0	Elementary data type	The LENGTH value must contain the byte count of this data type. For example, for a Word value, the LENGTH must be two. For a Dword or Real, the LENGTH must be four. Otherwise, nothing is transferred and the error 8088H is returned.
	Structure	The LENGTH value can contain a byte count less than the complete byte length of the structure, in which case the instruction sends only the first n bytes of the structure from the BUFFER, where n = LENGTH. Since the internal byte organization of a structure cannot always be determined, you might get unexpected results. In this case, use a LENGTH of 0 to send the complete structure.
	Array	The LENGTH value must contain a byte count that is less than or equal to the complete byte length of the array and which must be a multiple of the data element byte count. For example, the LENGTH parameter for an array of Words must be a multiple of two and for an array of Reals, a multiple of four. When LENGTH is specified, the instruction transfers the number of array elements that correspond to the LENGTH value in bytes. If your BUFFER, for example, contains an array of 15 Dwords (60 total bytes), and you specify a LENGTH of 20, then the first five Dwords in the array are transferred. The LENGTH value must be a multiple of the data element byte count. Otherwise, STATUS = 8088H, ERROR = 1, and no transmission occurs.
	String	The LENGTH parameter contains the number of characters to be transmitted. Only the characters of the String are transmitted. The maximum and actual length bytes of the String are not transmitted.

13.3.5.7 Receive_P2P (Enable receive messages)

Table 13- 26 Receive_P2P (Receive Point-to-Point) instruction

LAD / FBD	SCL	Description

	`"Receive_P2P_DB"(`
	`PORT:=_word_in_,`
	`BUFFER:=_variant_in_,`
	`NDR=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`LENGTH=>_uint_out_);`
		Receive_P2P checks for messages that have been received in the CM or CB. If a message is available, it will be transferred from the CM or CB to the CPU. An error returns the appropriate STATUS value.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 13- 27 Data types for the parameters

Parameter and type		Data type	Description
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
BUFFER	IN	Variant	This parameter points to the starting location of the receive buffer. This buffer should be large enough to receive the maximum length message. Boolean data or Boolean arrays are not supported. (Default value: 0)
NDR	OUT	Bool	TRUE for one execution when new data is ready and operation is complete with no errors.
ERROR	OUT	Bool	TRUE for one execution after the operation was completed with an error.
STATUS	OUT	Word	Execution condition code (Default value: 0)
LENGTH	OUT	UInt	Length of the returned message in bytes (Default value: 0)

The STATUS value is valid when either NDR or ERROR is TRUE. The STATUS value provides the reason for termination of the receive operation in the CM or CB. This is typically a positive value, indicating that the receive operation was successful and that the receive process terminated normally. If the STATUS value is negative (the Most Significant Bit of the hexadecimal value is set), the receive operation was terminated for an error condition such as parity, framing, or overrun errors.

Each PtP communication interface can buffer up to a maximum of 1024 bytes. This could be one large message or several smaller messages. If more than one message is available in the CM or CB, the Receive_P2P instruction returns the oldest message available. A subsequent Receive_P2P instruction execution returns the next oldest message available.

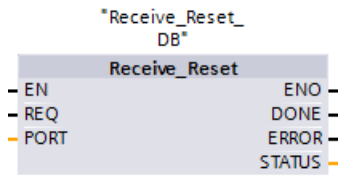
Table 13- 28 Condition codes

STATUS (W#16#...)	Description
0000	No buffer present
0094	Message terminated due to received maximum character length
0095	Message terminated because of message timeout
0096	Message terminated because of inter-character timeout
0097	Message terminated because of response timeout
0098	Message terminated because the "N+LEN+M" length condition was satisfied
0099	Message terminated because of end sequence was satisfied
8085	LENGTH parameter has a value of 0 or is greater than 1KB.
8088	The LENGTH parameter or the received length is longer than the area specified in BUFFER or the received length is longer than the area specified in BUFFER.
8090	Incorrect configuration message, wrong message length, wrong submodule, illegal message
81E0	Message terminated because the receive buffer is full
81E1	Message terminated due to parity error
81E2	Message terminated due to framing error
81E3	Message terminated due to overrun error
81E4	Message terminated because calculated length exceeds buffer size
81E5	Reverse bias signal (wire break condition)
81E6	The message queue is full. This error is reported without data. If it occurs, the module toggles between an error free data transfer and this error.
81E7	Internal error, error in synchronization between instruction and CM: set wehn a sequence error is detected
81E8	Message terminated, inter-character timeout expired before the end of message criteria was satisfied
81E9	Modbus CRC error detected (Only used by modules that support CRC generation/checking for the Modbus protocol)
81EA	Modbus telegram is too short (Only used by modules that support CRC generation/checking for the Modbus protocol)
81EB	Message terminated, because maximum message size exceeded
8201	Illegal syntax ID at an ANY pointer
8223	Range length error when writing a parameter. The parameter is located either entirely or partly outside the range of an address or that the length of a bit range is not a multiple of 8 with an ANY pointer.
8225	Range error when writing a parameter. The parameter is located in a range that is illegal for the system function.
8229	Alignment error when writing a parameter. The referenced parameter is located at bit address that is not equal to 0.
8230	Parameter is located in a read-only global DB
8231	Parameter is located in a read-only instance DB.
8232	Parameter contains a DB number that is higher than the highest block number allowed (DB number error).
823A	The DB for the BUFFER parameter does not exist.
8280	Negative acknowledgement while reading the module
8282	DP slave or module not available

13.3.5.8 Receive_Reset (Delete receive buffer)

Table 13- 29 Receive_Reset (Receiver Reset) instruction

LAD / FBD	SCL	Description

	`"Receive_Reset_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_word_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		Receive_Reset clears the receive buffers in the CM or CB.

[1] STEP 7 automatically creates the DB when you insert the instruction.

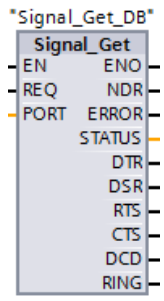
Table 13- 30 Data types for parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activates the receiver reset on the rising edge of this enable input (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
DONE	OUT	Bool	When TRUE for one scan, indicates that the last request was completed without errors.
ERROR	OUT	Bool	When TRUE, shows that the last request was completed with errors. Also, when this output is TRUE, the STATUS output will contain related error codes.
STATUS	OUT	Word	Error code (Default value: 0)

13.3.5.9 Signal_Get (Query RS-232 signals)

Table 13- 31 Signal_Get (Get RS232 signals) instruction

LAD / FBD	SCL	Description

	`"Signal_Get_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_uint_in_,`
	`NDR=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`DTR=>_bool_out_,`
	`DSR=>_bool_out_,`
	`RTS=>_bool_out_,`
	`CTS=>_bool_out_,`
	`DCD=>_bool_out_,`
	`RING=>_bool_out_);`
		Signal_Get reads the current states of RS232 communication signals.
		This function is valid only for the RS232 CM.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 13- 32 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Get RS232 signal state values on the rising edge of this input (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table.
NDR	OUT	Bool	TRUE for one scan, when new data is ready and the operation is complete with no errors
ERROR	OUT	Bool	TRUE for one scan, after the operation was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)
DTR	OUT	Bool	Data terminal ready, module ready (output). Default value: False
DSR	OUT	Bool	Data set ready, communication partner ready (input). Default value: False
RTS	OUT	Bool	Request to send, module ready to send (output). Default value: False
CTS	OUT	Bool	Clear to send, communication partner can receive data (input). Default value: False
DCD	OUT	Bool	Data carrier detect, receive signal level (always False, not supported)
RING	OUT	Bool	Ring indicator, indication of incoming call (always False, not supported)

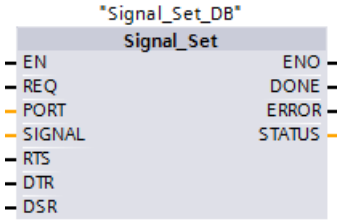
Table 13- 33 Condition codes

STATUS (W#16#....)	Description
81F0	CM or CB is RS485 and no signals are available
81F4	Error in the block header, for example, wrong block type or wrong block length
8280	Negative acknowledgement while reading the module
8282	DP slave or module not available

13.3.5.10 Signal_Set (Set RS-232 signals)

Table 13- 34 Signal_Set (Set RS232 signals) instruction

LAD / FBD	SCL	Description

	`"Signal_Set_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_word_in_,`
	`SIGNAL:=_byte_in_,`
	`RTS:=_bool_in_,`
	`DTR:=_bool_in_,`
	`DSR:=_bool_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		Signal_Set sets the states of RS232 communication signals.
		This function is valid only for the RS232 CM.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 13- 35 Data types for parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Start the set RS232 signals operation, on the rising edge of this input (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
SIGNAL	IN	Byte	Selects which signal to set: (multiple allowed). Default value: 0 • 01H = Set RTS • 02H = Set DTR • 04H = Set DSR
RTS	IN	Bool	Request to send, module ready to send value to set (true or false), Default value: False
DTR	IN	Bool	Data terminal ready, module ready to send value to set (true or false). Default value: False
DSR	IN	Bool	Data set ready (only applies to DCE type interfaces), not used.
DONE	OUT	Bool	TRUE for one execution after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one execution after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

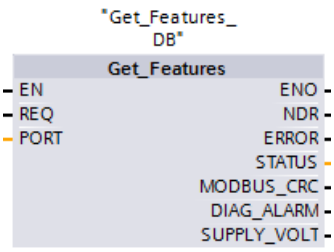
Table 13- 36 Condition codes

STATUS (W#16#....)	Description
81F0	CM or CB is RS485 and no signals can be set
81F1	Signals cannot be set because of Hardware flow control
81F2	Cannot set DSR because module is DTE
81F3	Cannot set DTR because module is DCE
81F4	Error in the block header, for example, wrong block type or wrong block length
8280	Negative acknowledgement while reading the module
8281	Negative acknowledgement while writing the module
8282	DP slave or module not available

13.3.5.11 Get_Features

Table 13- 37 Get_Features (Get advanced features) instruction

LAD / FBD	SCL	Description

	`"Get_Features_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_word_in_,`
	`NDR:=_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`MODBUS_CRC=>_bool_out_,`
	`DIAG_ALARM=>_bool_out_,`
	`SUPPLY_VOLT=>_bool_out);`
		Get_Features reads the advanced feature capabilities of a module.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Use the Get_Features instruction to read the advanced feature capabilites of a module.

Table 13- 38 Data types for the parameters

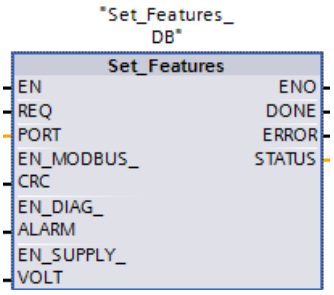
Parameter and type		Data type	Description
REQ	IN	Bool	Activate the configuration change on the rising edge of this input. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
NDR	OUT	Bool	Indicates that new data is ready.
ERROR	OUT	Bool	TRUE for one scan, after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)
MODBUS_CRC*	OUT	Bool	MODBUS CRC generation and checking
DIAG_ALARM*	OUT	Bool	Diagnostic alarm generation
SUPPLY_VOLT*	OUT	Bool	Diagnostics for missing supply voltage L+ is available

*Get_Features returns TRUE (1) if the feature is available, FALSE (0) if the feature is not available

13.3.5.12 Set_Features

Table 13- 39 Set_Features (Set advanced features) instruction

LAD / FBD	SCL	Description

	`"Set_Features_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_word_in_,`
	`EN_MODBUS_CRC:=_bool_in_,`
	`EN_DIAG_ALARM:=_bool_in_,`
	`EN_SUPPLY_VOLT:=_bool_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		Set_Features enables the advanced features that a module supports.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Use the Set_Features instruction to read the advanced feature capabilites of a module.

Table 13- 40 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activate the configuration change on the rising edge of this input. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
EN_MODBUS_CRC	IN	Bool	Enable MODBUS CRC generation and checking: • 0: CRC calculation tuned OFF (default) • 1: CRC calculation turned ON Note: Only V2.1 CMs, V4.1 CPUs with CBs, and CM PtP modules for distributed I/O support this parameter.
EN_DIAG_ALARM	IN	Bool	Enable diagnostic alarm generation: • 0: Diagnostic alarm turned OFF • 1: Diagnostic alarm turned ON (default)
EN_SUPPLY_VOLT	IN	Bool	Enable diagnostics for missing supply voltage L+: • 0: Supply voltage diagnostic disabled (default) • 1: Supply voltage diagnostic enabled
DONE	OUT	Bool	Indicates that set features is done
ERROR	OUT	Bool	TRUE for one scan, after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

13.3.6 Programming the PtP communications

STEP 7 provides extended instructions that enable the user program to perform Point-to-Point communications with a protocol designed and implemented in the user program. These instructions fall into two categories:

- Configuration instructions
- Communication instructions

Configuration instructions

Before your user program can engage in PtP communication, you must configure the communication interface port and the parameters for sending data and receiving data.

You can perform the port configuration and message configuration for each CM or CB through the device configuration or through these instructions in your user program:

- Port_Config (Page 1090)
- Send_Config (Page 1093)
- Receive_Config (Page 1095)

Communication instructions

The PtP communication instructions enable the user program to send messages to and receive messages from the communication interfaces. For information about transferring data with these instructions, see the section on data consistency (Page 192).

All of the PtP functions operate asynchronously. The user program can use a polling architecture to determine the status of transmissions and receptions. Send_P2P and Receive_P2P can execute concurrently. The communication modules and communication board buffer the transmit and receive messages as necessary up to a maximum buffer size of 1024 bytes.

The CMs and CB send messages to and receive messages from the actual point-to-point devices. The message protocol is in a buffer that is either received from or sent to a specific communication port. The buffer and port are parameters of the send and receive instructions:

- Send_P2P (Page 1103)
- Receive_P2P (Page 1108)

Additional instructions provide the capability to reset the receive buffer, and to get and set specific RS232 signals:

- Receive_Reset (Page 1110)
- Signal_Get (Page 1110)
- Signal_Set (Page 1112)

13.3.6.1 Polling architecture

The STEP 7 user program must call the S7-1200 point-to-point instructions cyclically/periodically to check for received messages. Polling the send tells the user program when the transmit has completed.

Polling architecture: master

The typical sequence for a master is as follows:

1. A Send_P2P (Page 1103) instruction initiates a transmission to the CM or CB.
2. The Send_P2P instruction executes on subsequent scans to poll for the transmit complete status.
3. When the Send_P2P instruction indicates that the transmission is complete, the user code can prepare to receive the response.
4. The Receive_P2P (Page 1108) instruction executes repeatedly to check for a response. When the CM or CB has collected a response message, the Receive_P2P instruction copies the response to the CPU and indicates that new data has been received.
5. The user program can process the response.
6. Go to step 1 and repeat the cycle.

Polling architecture: slave

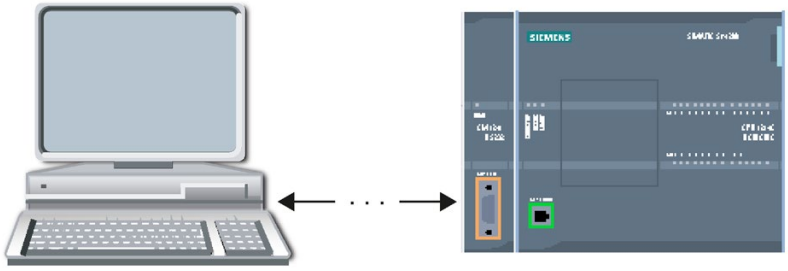
The typical sequence for a slave is as follows:

1. The user program executes the Receive_P2P instruction every scan.
2. When the CM or CB has received a request, the Receive_P2P instruction indicates that new data is ready and the request is copied into the CPU.
3. The user program services the request and generates a response.
4. Use a Send_P2P instruction to send the response back to the master.
5. Repeatedly execute Send_P2P to be sure the transmit occurs.
6. Go to step 1 and repeat the cycle.

The slave must be responsible for calling Receive_P2P frequently enough to receive a transmission from the master before the master times out while waiting for a response. To accomplish this task, the user program can call RCV_PTP from a cyclic OB, where the cycle time is sufficient to receive a transmission from the master before the timeout period expires. If you set the cycle time for the OB to provide for two executions within the timeout period of the master, the user program can receive transmissions without missing any.

13.3.7 Example: Point-to-Point communication

In this example, an S7-1200 CPU communicates to a PC with a terminal emulator through a CM 1241 RS232 module. The point-to-point configuration and STEP 7 program in this example illustrate how the CPU can receive a message from the PC and echo the message back to the PC.



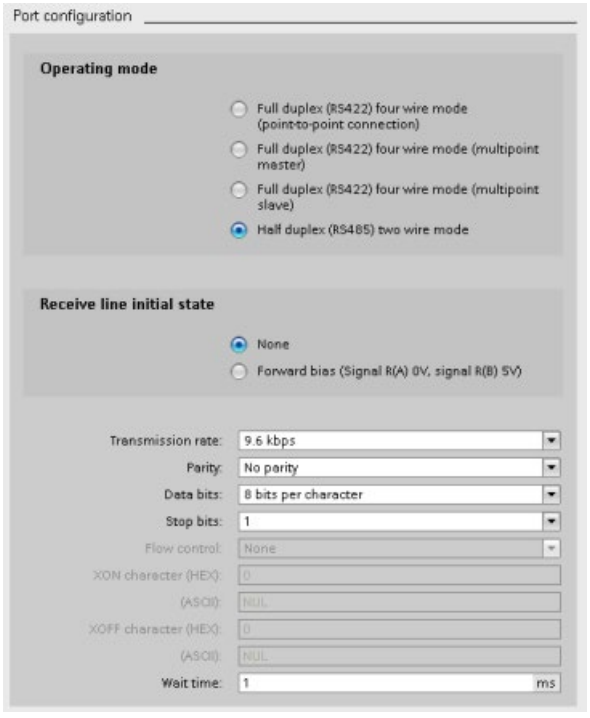
You must connect the communication interface of the CM 1241 RS232 module to the RS232 interface of the PC, which is normally COM1. Because both of these ports are Data Terminal Equipment (DTE), you must switch the receive and transmit pins (2 and 3) when connecting the two ports, which you can accomplish by either of the following methods:

- Use a NULL modem adapter to swap pins 2 and 3 together with a standard RS232 cable.
- Use a NULL modem cable, which already has pins 2 and 3 swapped. You can usually identify a NULL modem cable as one with two female 9-pin D connector ends.

13.3.7.1 Configuring the communication module

You can configure the CM 1241 from the Device configuration in STEP 7 or with user program instructions. This example uses the Device configuration method.

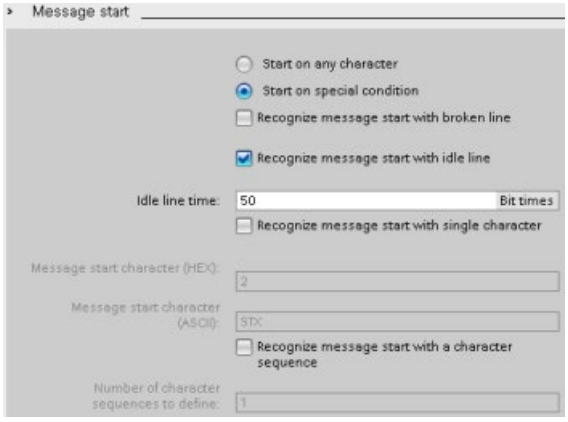
- Port configuration: Click the communication port of the CM module from the Device configuration, and configure the port as shown:



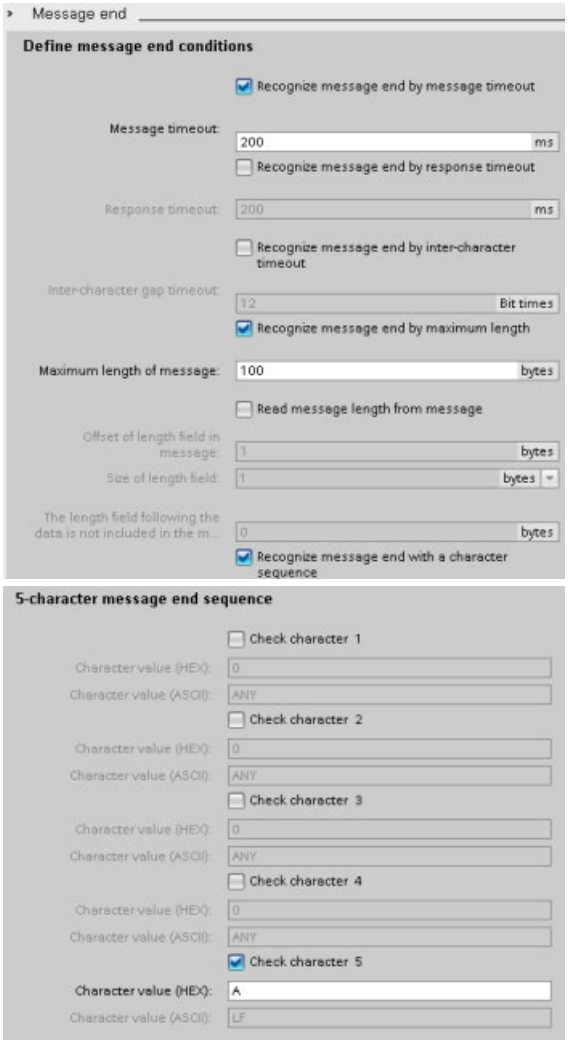
Note

The configuration settings for "Operating mode" and "Receive line initial state" are only applicable for the CM 1241 (RS422/RS485) module. The other CM 1241 modules do not have these port configuration settings. Refer to Configuring the RS422 and RS485 (Page 1122).

- Transmit message configuration: Accept the default for transmit message configuration. No break is to be sent at message start.
- Receive message start configuration: Configure the CM 1241 to start receiving a message when the communication line is inactive for at least 50 bit times (about 5 milliseconds at 9600 baud = 50 * 1/9600):



- Receive message end configuration: Configure the CM 1241 to end a message when it receives a maximum of 100 bytes or a linefeed character (10 decimal or a hexadecimal). The end sequence allows up to five end characters in sequence. The fifth character in the sequence is the linefeed character. The preceding four end sequence characters are "don't care" or unselected characters. The CM 1241 does not evaluate the "don't care" characters but looks for a linefeed character preceded by zero or more "don't care" characters to indicate the message end.



13.3.7.2 RS422 and RS485 operating modes

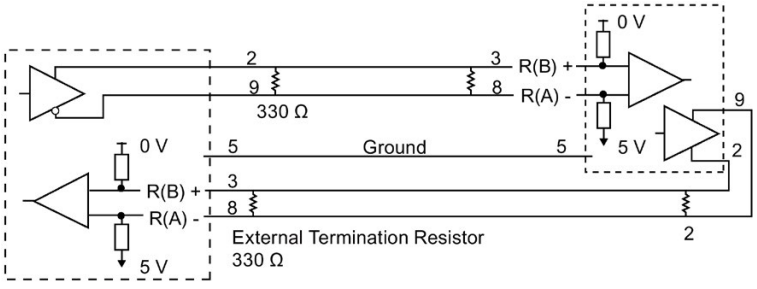
Configuring the RS422

For RS422 mode, there are three operating modes depending on your network configuration. Select one of these operating modes based on the devices in your network. The different selections for Receive line initial state reference the cases shown below for more details.

- Full duplex (RS422) four wire mode (point-to-point connection): select this option when there are two devices on your network. In the Receive line initial state:
  - Select none when you supply the bias and termination (Case 3).
  - Select forward bias to use internal bias and termination (Case 2).
  - Select reverse bias to use internal bias and termination, and enable cable break detection for both devices (Case 1).
- Full duplex (RS422) four wire mode (multipoint master): select this option for the master device when you have a network with one master and multiple slaves. In the Receive line initial state:
  - Select none when you supply the bias and termination (Case 3).
  - Select forward bias to use internal bias and termination (Case 2).
  - Cable break detection is not possible in this mode.
- Full duplex (RS422) four wire mode (multipoint slave): Select this option for all the slave devices when you have a network with one master and multiple slaves. In the Receive line initial state:
  - Select none when you supply the bias and termination (Case 3).
  - Select forward bias to use internal bias and termination (Case 2).
  - Select reverse bias to use internal bias and termination, and enable cable break detection for the slaves (Case 1).

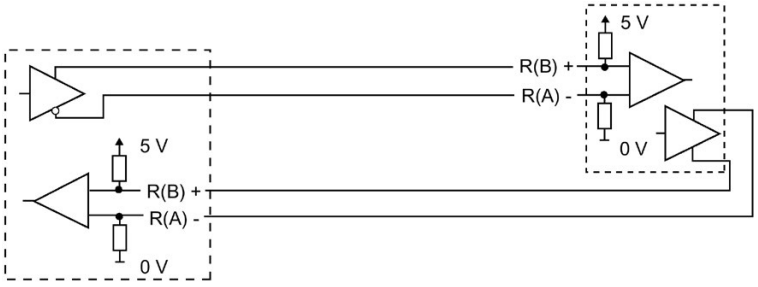
Case 1: RS422 with cable break detection

- Mode of operation: RS422
- Receive line initial state: Reverse bias (biased with R(A) > R(B) > 0V)
- Cable break: Cable break detection enabled (transmitter always active)



Case 2: RS422 No cable break detection, forward bias

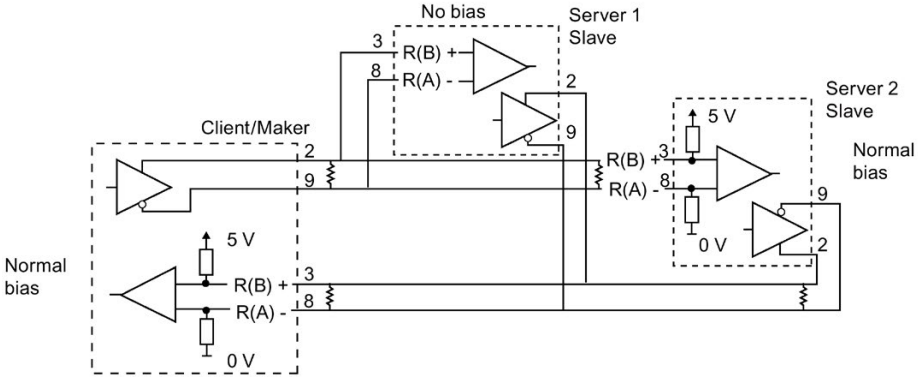
- Mode of operation: RS422
- Receive line initial state: Forward bias (biased with R(B) > R(A) > 0 V)
- Cable break: No cable break detection (transmitter enabled only while transmitting)



Case 3: RS422: No cable break detection, no bias

- Mode of operation: RS422
- Receive line initial state: no bias
- Cable break: No cable break detection (transmitter enabled only while transmitting)

Bias and termination are added by the user at the end nodes of the network.



Configuring the RS485

For RS485 mode, there is only one operating mode. The different selections for Receive line initial state reference the cases shown below for more details.

- Half duplex (RS485) two wire mode. In the Receive line initial state:
  - Select none when you supply the bias and termination (Case 5).
  - Select forward bias to use internal bias and termination (Case 4).

Case 4: RS485: Forward bias

- Mode of operation: RS485
- Receive line initial state: Forward bias (biased with R(B) > R(A) > 0 V)



Case 5: RS485: No bias (external bias)

- Mode of operation: RS485
- Receive line initial state: No bias (external bias required)

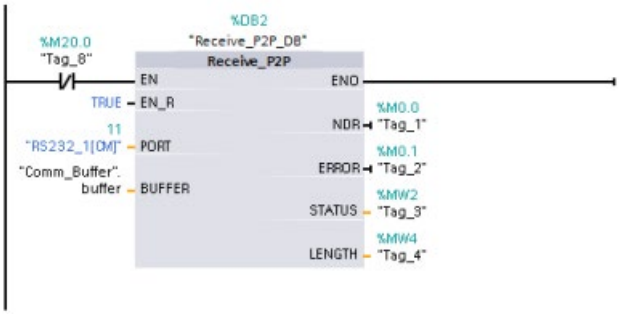


13.3.7.3 Programming the STEP 7 program

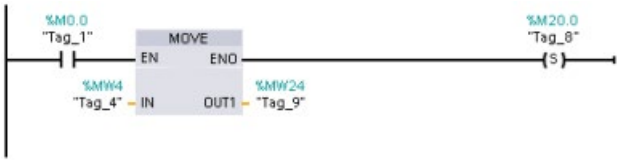
The example program uses a global data block for the communication buffer, a RCV_PTP instruction (Page 1215) to receive data from the terminal emulator, and a SEND_PTP instruction (Page 1212) to echo the buffer back to the terminal emulator. To program the example, add the data block configuration and Main program block OB 1 as described below.

Global data block "Comm_Buffer": Create a global data block (DB) and name it "Comm_Buffer". Create one value in the data block called "buffer" with a data type of "array [0 .. 99] of byte".

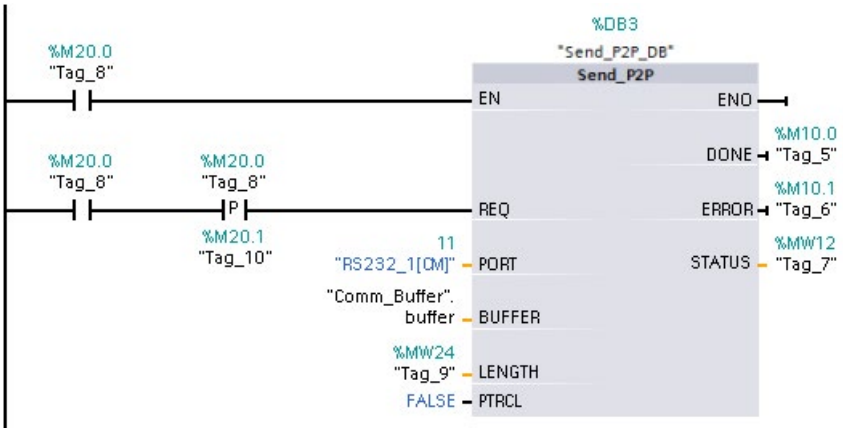
Network 1: Enable the RCV_PTP instruction whenever SEND_PTP is not active. Tag_8 at MW20.0 indicates when sending is complete in Network 4, and when the communication module is thus ready to receive a message.



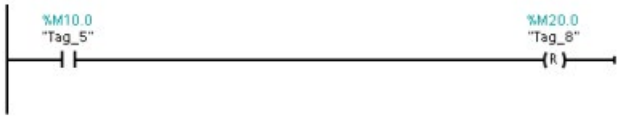
Network 2: Use the NDR value (Tag_1 at M0.0) set by the RCV_PTP instruction to make a copy of the number of bytes received and to set a flag (Tag_8 at M20.0) to trigger the SEND_PTP instruction.



Network 3: Enable the SEND_PTP instruction when the M20.0 flag is set. Also use this flag to set the REQ input to TRUE for one scan. The REQ input tells the SEND_PTP instruction that a new request is to be transmitted. The REQ input must only be set to TRUE for one execution of SEND_PTP. The SEND_PTP instruction is executed every scan until the transmit completes. The transmit is complete when the last byte of the message has been transmitted from the CM 1241. When the transmit is complete, the DONE output (Tag_5 at M10.0) is set TRUE for one execution of SEND_PTP.



Network 4: monitor the DONE output of SEND_PTP and reset the transmit flag (Tag_8 at M20.0) when the transmit operation is complete. When the transmit flag is reset, the RCV_PTP instruction in Network 1 is enabled to receive the next message.



13.3.7.4 Configuring the terminal emulator

You must set up the terminal emulator to support the example program. You can use most any terminal emulator on your PC, such as HyperTerminal. Make sure that the terminal emulator is in the disconnected mode before editing the settings as follows:

1. Set the terminal emulator to use the RS232 port on the PC (normally COM1).
2. Configure the port for 9600 baud, 8 data bits, no parity (none), 1 stop bit and no flow control.
3. Change the settings of the terminal emulator to emulate an ANSI terminal.
4. Configure the terminal emulator ASCII setup to send a line feed after every line (after the user presses the Enter key).
5. Echo the characters locally so that the terminal emulator displays what is typed.

13.3.7.5 Running the example program

To exercise the example program, follow these steps:

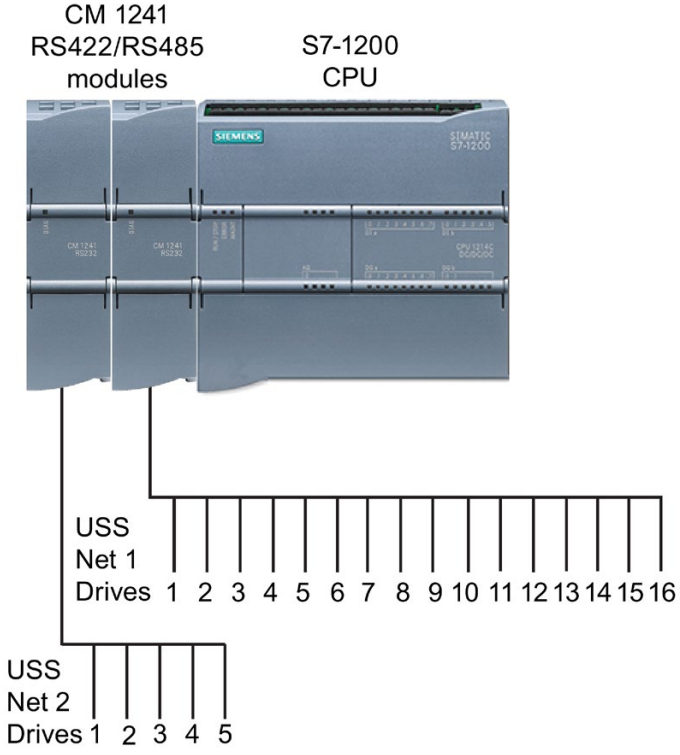
1. Download the STEP 7 program to the CPU and ensure that it is in RUN mode.
2. Click the "connect" button on the terminal emulator to apply the configuration changes and open a terminal session to the CM 1241.
3. Type characters at the PC and press Enter.

The terminal emulator sends the characters to the CM 1241 and to the CPU. The CPU program then echoes the characters back to the terminal emulator.

13.4 Universal serial interface (USS) communication

The USS instructions control the operation of motor drives which support the universal serial interface (USS) protocol. You can use the USS instructions to communicate with multiple drives through RS485 connections to CM 1241 RS485 communication modules or a CB 1241 RS485 communication board. Up to three CM 1241 RS422/RS485 modules and one CB 1241 RS485 board can be installed in a S7-1200 CPU. Each RS485 port can operate up to sixteen drives.

The USS protocol uses a master-slave network for communications over a serial bus. The master uses an address parameter to send a message to a selected slave. A slave itself can never transmit without first receiving a request to do so. Direct message transfer between the individual slaves is not possible. USS communication operates in half-duplex mode. The following USS illustration shows a network diagram for an example drive application.



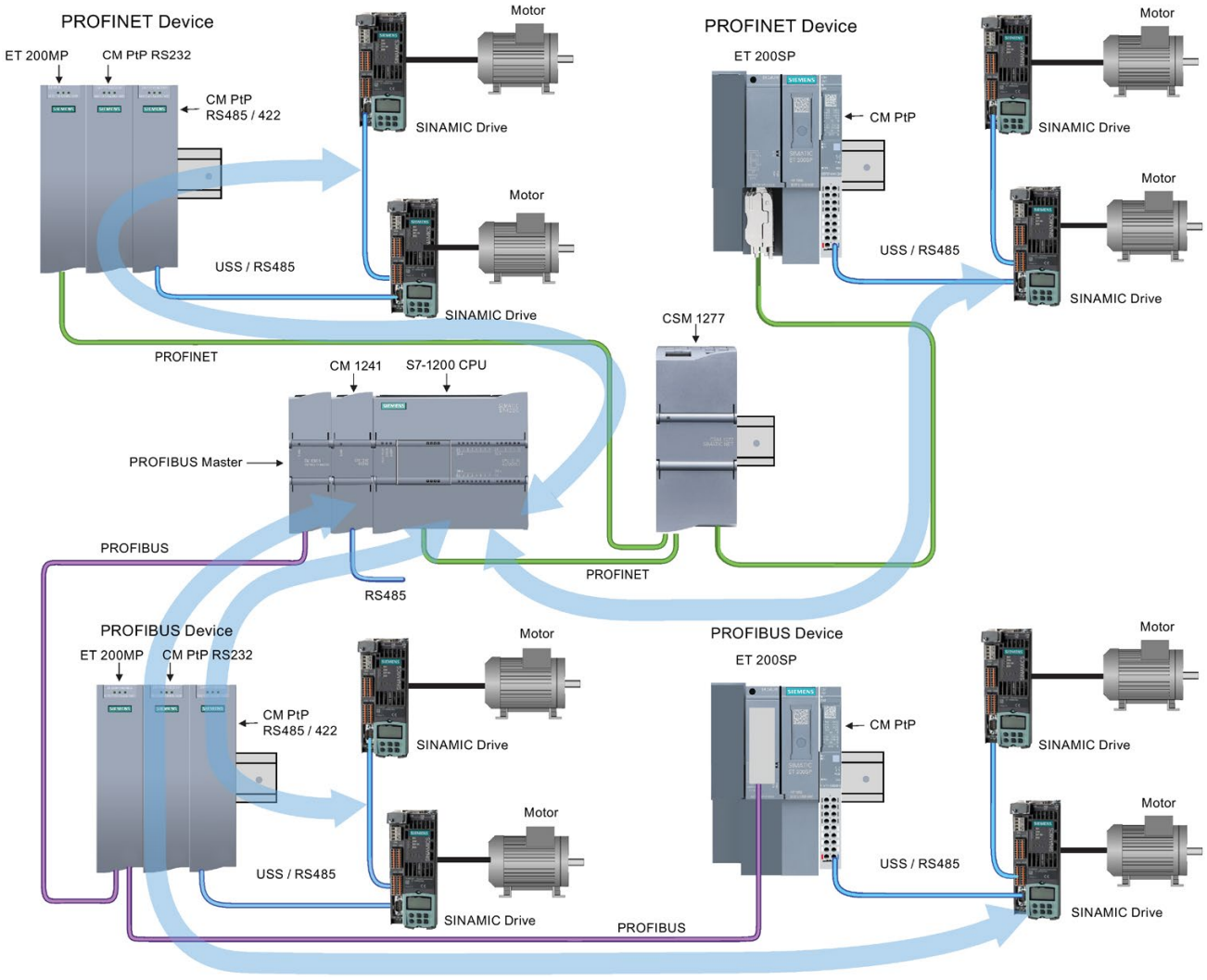
USS communications through PROFIBUS or PROFINET

As of version V4.1 of the S7-1200 CPU together with STEP 7 V13 SP1, the CPU extends the capability of USS to use a PROFINET or PROFIBUS distributed I/O rack to communicate to various devices (RFID readers, GPS device, and others):

- PROFINET (Page 786): You connect the Ethernet interface of the S7-1200 CPU to a PROFINET interface module. PtP communication modules in the rack with the interface module can then provide serial communications to the PtP devices.
- PROFIBUS (Page 947): You insert a PROFIBUS communication module in the left side of the rack with the S7-1200 CPU. You connect the PROFIBUS communication module to a rack containing a PROFIBUS interface module. PtP communication modules in the rack with the interface module can then provide serial communications to the PtP devices.

For this reason, the S7-1200 supports two sets of PtP instructions:

- Legacy USS instructions (Page 1225): These USS instructions existed prior to version V4.0 of the S7-1200 and only work with serial communications using a CM 1241 communication module or CB 1241 communication board.
- USS instructions (Page 1134): These USS instructions provide all of the functionality of the legacy instructions, plus the ability to connect to PROFINET and PROFIBUS distributed I/O. These USS instructions allow you to configure the communications between the PtP communication modules in the distributed I/O rack and the PtP devices. S7-1200 CM 1241 modules must have a minimum firmware version of V2.1 to use these USS instructions.



The blue arrows indicate the flow of bidirectional communication between devices.

Note

With version V4.1 of the S7-1200, you can use the point-to-point instructions for all types of point-to-point communication: serial, serial over PROFINET, and serial over PROFIBUS. STEP 7 provides the legacy point-to-point instructions only to support existing programs. The legacy instructions still function with all S7-1200 CPUs. You do not have to convert prior programs from one set of instructions to the other.

13.4.1 Selecting the version of the USS instructions

There are two versions of USS instructions available in STEP 7:

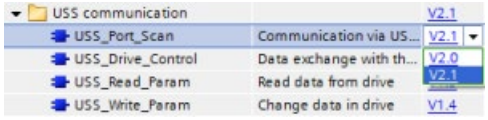
- Version 2.0 (legacy instructions) was initially available in STEP 7 Basic/Professional V13.
- Version 2.1 is available in STEP 7 Basic/Professional V13 SP1 or later.

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

You cannot use both versions of the instructions with the same module, but two different modules can use different versions of the instructions.



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



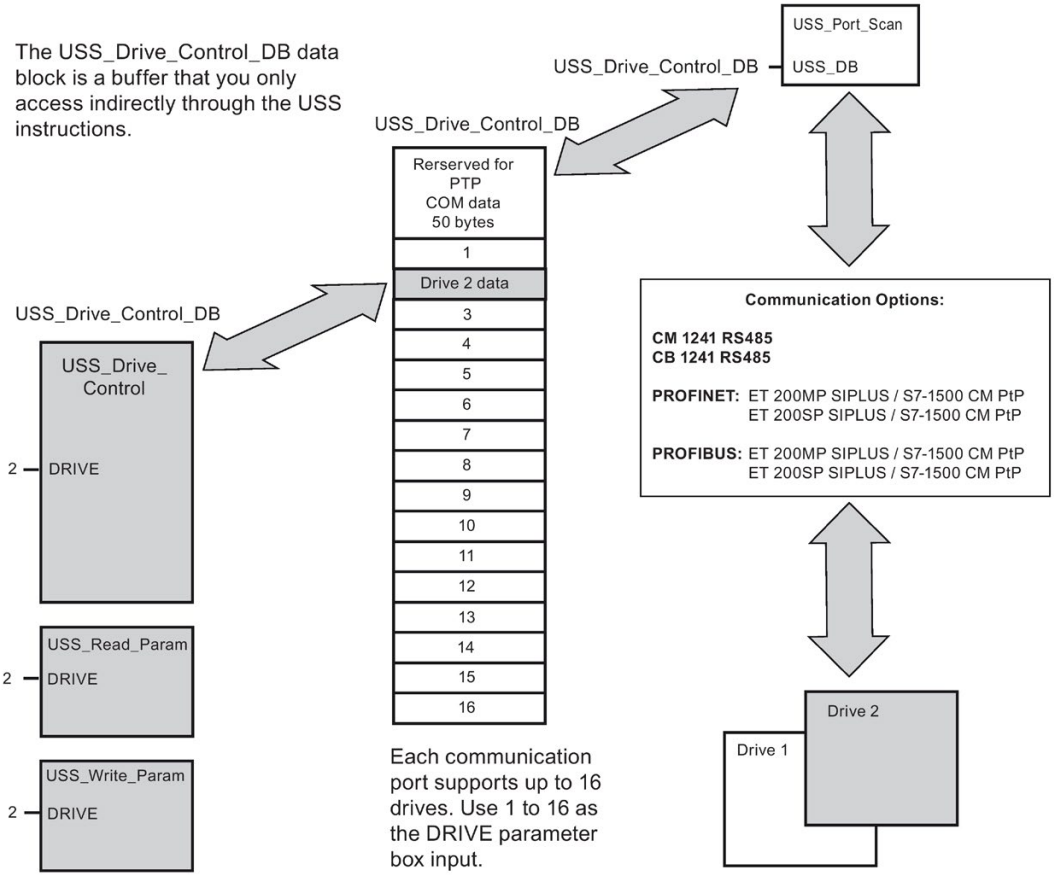
To change the version of the USS instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a USS instruction in your program, a new FB or FC instance, depending on the USS instruction selected, is created in the project tree. You can see new FB or FC instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a USS instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree USS FB or FC instance, right-click, select "Properties", and select the "Information" page to see the USS instruction version number.

13.4.2 Requirements for using the USS protocol

The four USS instructions use two function blocks (FBs) and two functions (FCs) to support the USS protocol. One USS_Port_Scan instance data block (DB) is used for each USS network. The USS_Port_Scan instance data block contains temporary storage and buffers for all drives on that USS network. The USS instructions share the information in this data block.



All drives (up to 16) connected to a single RS485 port are part of the same USS network. All drives connected to a different RS485 port are part of a different USS network. Each USS network is managed using a unique data block. All instructions associated with a single USS network must share this data block. This includes all USS_Drive_Control, USS_Port_Scan, USS_Read_Param, and USS_Write_Param instructions used to control all drives on a single USS network.

The USS_Drive_Control instruction is a Function Block (FB). When you place the USS_Drive_Control instruction into the program editor, you will be prompted by the "Call options" dialog to assign a DB for this FB. If this is the first USS_Drive_Control instruction in this program for this USS network, then you can accept the default DB assignment (or change the name if you wish) and the new DB is created for you. If however this is not the first USS_Drive_Control instruction for this channel, then you must use the drop-down list in the "Call options" dialog to select the DB name that was previously assigned for this USS network.

The USS_Port_Scan instruction is a Function Block (FB) and handles the actual communication between the CPU and the drives through the Point-to-Point (PtP) RS485 communication port. Each call to this FB handles one communication with one drive. Your program must call this FB fast enough to prevent a communication timeout by the drives. You may call this function FB in a main program cycle OB or any interrupt OB.

The USS_Read_Param, and USS_Write_Param instructions are both Functions (FCs). No DB is assigned when you place these FCs in the editor. Instead, you must assign the appropriate DB reference to the "USS_DB" input of these instructions. Double-click on the parameter field and then click on the parameter helper icon to see the available DB names).

Typically, you should call the USS_Port_Scan FB from a cyclic interrupt OB. The cycle time of the cyclic interrupt OB should be set to about half of the minimum call interval (As an example, 1200 baud communication should use a cyclic time of 350 ms or less).

The USS_Drive_Control FB provides your program access to a specified drive on the USS network. Its inputs and outputs are the status and controls for the drive. If there are 16 drives on the network, your program must have at least 16 USS_Drive_Control calls, one for each drive. These blocks should be called at the rate that is required to control the operation of the drive.

You may only call the USS_Drive_Control FB from a main program cycle OB.

CAUTION

Considerations in calling USS instructions from OBs

Only call USS_Drive_Control, USS_Read_Param, and USS_Write_Param from a main program cycle OB. The USS_Port_Scan FB can be called from any OB, usually from a cyclic interrupt OB.

Do not use instructions USS_Drive_Control, USS_Read_Param, and USS_Write_Param in a higher priority OB than the corresponding USS_Port_Scan instruction. For example, do not place the USS_Port_Scan in the main OB and a USS_Read_Param in a cyclic interrupt OB. Failure to prevent interruption of USS_Port_Scan execution can produce unexpected errors, which could result in personal injury.

The USS_Read_Param, and USS_Write_Param FCs read and write the remote drive operating parameters. These parameters control the internal operation of the drive. See the drive manual for the definition of these parameters. Your program can contain as many of these functions as necessary, but only one read or write request can be active per drive, at any given time. You may only call the USS_Read_Param, and USS_Write_Param FCs from a main program cycle OB.

Calculating the time required for communicating with the drive

Communications with the drive are asynchronous to the S7-1200 scan cycle. The S7-1200 typically completes several scans before one drive communications transaction is completed.

The USS_Port_Scan interval is the time required for one drive transaction. The table below shows the minimum USS_Port_Scan interval for each communication baud rate. Calling the USS_Port_Scan FB more frequently than the USS_Port_Scan interval will not increase the number of transactions. The drive timeout interval is the amount of time that might be taken for a transaction, if communications errors caused 3 tries to complete the transaction. By default, the USS protocol library automatically does up to 2 retries on each transaction.

Table 13- 41 Calculating the time requirements

Baud rate	Calculated minimum USS_Port_Scan call Interval (milliseconds)	Drive message interval timeout per drive (milliseconds)
1200	790	2370
2400	405	1215
4800	212.5	638
9600	116.3	349
19200	68.2	205
38400	44.1	133
57600	36.1	109
115200	28.1	85

13.4.3 USS instructions

13.4.3.1 USS_Port_Scan (Edit communication using USS network)

Table 13- 42 USS_Port_Scan instruction

LAD / FBD	SCL	Description

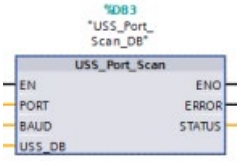
	`USS_Port_Scan(`
	`  PORT:=_uint_in_,`
	`  BAUD:=_dint_in_,`
	`  ERROR=>_bool_out_,`
	`  STATUS=>_word_out_,`
	`  USS_DB:=_fbtref_inout_);`
		The USS_Port_Scan instruction handles communication over a USS network.

Table 13- 43 Data types for the parameters

Parameter and type		Data type	Description
PORT	IN	Port	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table.
BAUD	IN	DInt	The baud rate used for USS communication.
USS_DB	INOUT	USS_BASE	The name of the instance DB that is created and initialized when a USS_Drive_Control instruction is placed in your program.
ERROR	OUT	Bool	When true, this output indicates that an error has occurred and the STATUS output is valid.
STATUS	OUT	Word	The status value of the request indicates the result of the scan or initialization. Additional information is available in the "USS_Extended_Error" variable for some status codes.

Typically, there is only one USS_Port_Scan instruction per PtP communication port in the program, and each call of this Function Block (FB) handles a transmission to or from a single drive. All USS functions associated with one USS network and PtP communication port must use the same instance DB.

Your program must execute the USS_Port_Scan instruction often enough to prevent drive timeouts. USS_Port_Scan is usually called from a cyclic interrupt OB to prevent drive timeouts and keep the most recent USS data updates available for USS_Drive_Control calls.

Note

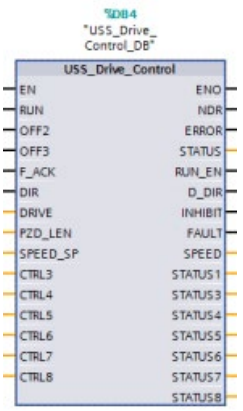
When using the USS protocol library and the USS_Port_Scan instruction with a CB 1241, you must set the LINE_PRE data block tag to a value of 0 (No initial state). The default value of 2 for the LINE_PRE data block tag results in an error value of 16#81AB being returned by the USS_Port_Scan instruction. The LINE_PRE data block tag is found in the data block associated with the USS_Port_Scan instruction (usually named USS_Port_Scan_DB).

Ensure the start value of LINE_PRE is changed to a 0 (zero).

13.4.3.2 USS_Drive_Control (Swap data with drive)

Table 13- 44 USS_Drive_Control instruction

LAD / FBD	SCL	Description

	`"USS_Drive_Control_DB"(`
	`RUN:=_bool_in_,`
	`OFF2:=_bool_in_,`
	`OFF3:=_bool_in_,`
	`F_ACK:=_bool_in_,`
	`DIR:=_bool_in_,`
	`DRIVE:=_usint_in_,`
	`PZD_LEN:=_usint_in_,`
	`SPEED_SP:=_real_in_,`
	`CTRL3:=_word_in_,`
	`CTRL4:=_word_in_,`
	`CTRL5:=_word_in_,`
	`CTRL6:=_word_in_,`
	`CTRL7:=_word_in_,`
	`CTRL8:=_word_in_,`
	`NDR=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`RUN_EN=>_bool_out_,`
	`D_DIR=>_bool_out_,`
	`INHIBIT=>_bool_out_,`
	`FAULT=>_bool_out_,`
	`SPEED=>_real_out_,`
	`STATUS1=>_word_out_,`
	`STATUS3=>_word_out_,`
	`STATUS4=>_word_out_,`
	`STATUS5=>_word_out_,`
	`STATUS6=>_word_out_,`
	`STATUS7=>_word_out_,`
	`STATUS8=>_word_out_);`
		The USS_Drive_Control instruction exchanges data with a drive by creating request messages and interpreting the drive response messages. A separate function block should be used for each drive, but all USS functions associated with one USS network and PtP communication port must use the same instance data block. You must create the DB name when you place the first USS_Drive_Control instruction and then reference the DB that was created by the initial instruction usage.
		STEP 7 automatically creates the DB when you insert the instruction.

[1] LAD and FBD: Expand the box to reveal all the parameters by clicking the bottom of the box. The parameter pins that are grayed are optional and parameter assignment is not required.

Table 13- 45 Data types for the parameters

Parameter and type		Data type	Description
RUN	IN	Bool	Drive start bit: When true, this input enables the drive to run at the preset speed. When RUN goes to false while a drive is running, the motor will be ramped down to a stop. This behavior differs from the dropping power (OFF2) or braking the motor (OFF3).
OFF2	IN	Bool	Electrical stop bit: When false, this bit causes the drive to coast to a stop with no braking.
OFF3	IN	Bool	Fast stop bit: When false, this bit causes a fast stop by braking the drive rather than just allowing the drive to coast to a stop.
F_ACK	IN	Bool	Fault acknowledge bit: This bit is set to reset the fault bit on a drive. The bit is set after the fault is cleared to indicate to the drive it no longer needs to indicate the previous fault.
DIR	IN	Bool	Drive direction control: This bit is set to indicate that the direction is forward (for positive SPEED_SP).
DRIVE	IN	USInt	Drive address: This input is the address of the USS drive. The valid range is drive 1 to drive 16.
PZD_LEN	IN	USInt	Word length: This is the number of words of PZD data. The valid values are 2, 4, 6, or 8 words. The default value is 2.
SPEED_SP	IN	Real	Speed set point: This is the speed of the drive as a percentage of configured frequency. A positive value specifies forward direction (when DIR is true). Valid range is 200.00 to -200.00.
CTRL3	IN	Word	Control word 3: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL4	IN	Word	Control word 4: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL5	IN	Word	Control word 5: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL6	IN	Word	Control word 6: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL7	IN	Word	Control word 7: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL8	IN	Word	Control word 8: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
NDR	OUT	Bool	New data ready: When true, the bit indicates that the outputs contain data from a new communication request.
ERROR	OUT	Bool	Error occurred: When true, this indicates that an error has occurred and the STATUS output is valid. All other outputs are set to zero on an error. Communication errors are only reported on the USS_Port_Scan instruction ERROR and STATUS outputs.
STATUS	OUT	Word	The status value of the request indicates the result of the scan. This is not a status word returned from the drive.
RUN_EN	OUT	Bool	Run enabled: This bit indicates whether the drive is running.
D_DIR	OUT	Bool	Drive direction: This bit indicates whether the drive is running forward.
INHIBIT	OUT	Bool	Drive inhibited: This bit indicates the state of the inhibit bit on the drive.
FAULT	OUT	Bool	Drive fault: This bit indicates that the drive has registered a fault. You must fix the problem and then set the F_ACK bit to clear this bit when set.

Parameter and type		Data type	Description
SPEED	OUT	Real	Drive Current Speed (scaled value of drive status word 2): The value of the speed of the drive as a percentage of configured speed.
STATUS1	OUT	Word	Drive Status Word 1: This value contains fixed status bits of a drive.
STATUS3	OUT	Word	Drive Status Word 3: This value contains a user-configurable status word on the drive.
STATUS4	OUT	Word	Drive Status Word 4: This value contains a user-configurable status word on the drive.
STATUS5	OUT	Word	Drive Status Word 5: This value contains a user-configurable status word on the drive.
STATUS6	OUT	Word	Drive Status Word 6: This value contains a user-configurable status word on the drive.
STATUS7	OUT	Word	Drive Status Word 7: This value contains a user-configurable status word on the drive.
STATUS8	OUT	Word	Drive Status Word 8: This value contains a user-configurable status word on the drive.

When the initial USS_Drive_Control execution occurs, the drive indicated by the USS address (parameter DRIVE) is initialized in the Instance DB. After this initialization, subsequent executions of USS_Port_Scan can begin communication to the drive at this drive number.

Changing the drive number requires a CPU STOP-to-RUN mode transition that initializes the instance DB. Input parameters are configured into the USS TX message buffer and outputs are read from a "previous" valid response buffer if any exists. There is no data transmission during USS_Drive_Control execution. Drives communicate when USS_Port_Scan is executed. USS_Drive_Control only configures the messages to be sent and interprets data that might have been received from a previous request.

You can control the drive direction of rotation using either the DIR input (Bool) or using the sign (positive or negative) with the SPEED_SP input (Real). The following table indicates how these inputs work together to determine the drive direction, assuming the motor is wired for forward rotation.

Table 13- 46 Interaction of the SPEED_SP and DIR parameters

SPEED_SP	DIR	Drive rotation direction
Value > 0	0	Reverse
Value > 0	1	Forward
Value < 0	0	Forward
Value < 0	1	Reverse

13.4.3.3 USS_Read_Param (Readout parameters from the drive)

Table 13- 47 USS_Read_Param instruction

LAD / FBD	SCL	Description

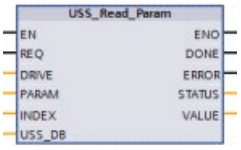
	`USS_Read_Param(REQ:=_bool_in_,`
	`DRIVE:=_usint_in_,`
	`PARAM:=_uint_in_,`
	`INDEX:=_uint_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`VALUE=>_variant_out_,`
	`USS_DB:=_fbtref_inout_);`
		The USS_Read_Param instruction reads a parameter from a drive. All USS functions associated with one USS network and PtP communication port must use the same data block. USS_Read_Param must be called from a main program cycle OB.

Table 13- 48 Data types for the parameters

Parameter type		Data type	Description
REQ	IN	Bool	Send request: When true, REQ indicates that a new read request is desired. This is ignored if the request for this parameter is already pending.
DRIVE	IN	USInt	Drive address: DRIVE is the address of the USS drive. The valid range is drive 1 to drive 16.
PARAM	IN	UInt	Parameter number: PARAM designates which drive parameter is written. The range of this parameter is 0 to 2047. On some drives, the most significant byte can access PARAM values greater than 2047. See your drive manual for details on how to access an extended range.
INDEX	IN	UInt	Parameter index: INDEX designates which Drive Parameter index is to be written. A 16-bit value where the Least Significant Byte is the actual index value with a range of (0 to 255). The Most Significant Byte may also be used by the drive and is drive-specific. See your drive manual for details.
USS_DB	INOUT	USS_BASE	The name of the instance DB that is created and initialized when a USS_Drive_Control instruction is placed in your program.
VALUE	IN	Word, Int, UInt, DWord, DInt, UDInt, Real	This is the value of the parameter that was read and is valid only when the DONE bit is true.
DONE[1]	OUT	Bool	When true, indicates that the VALUE output holds the previously requested read parameter value. This bit is set when USS_Drive_Control sees the read response data from the drive. This bit is reset when either: you request the response data using another USS_Read_Param poll, or on the second of the next two calls to USS_Drive_Control.

Parameter type		Data type	Description
ERROR	OUT	Bool	Error occurred: When true, ERROR indicates that an error has occurred and the STATUS output is valid. All other outputs are set to zero on an error. Communication errors are only reported on the USS_Port_Scan instruction ERROR and STATUS outputs.
STATUS	OUT	Word	STATUS indicates the result of the read request. Additional information is available in the "USS_Extended_Error" variable for some status codes.

[1] The DONE bit indicates that valid data has been read from the referenced motor drive and delivered to the CPU. It does not indicate that the USS library is capable of immediately reading another parameter. A blank PKW request must be sent to the motor drive and must also be acknowledged by the instruction before the parameter channel for the specific drive becomes available for use. Immediately calling a USS_Read_Param or USS_Write_Param FC for the specified motor drive will result in a "0x818A" error.

13.4.3.4 USS_Write_Param (Change parameters in the drive)

Note

EEPROM write operations (for the EEPROM inside a USS drive)

Do not overuse the EEPROM permanent write operation. Minimize the number of EEPROM write operations to extend the EEPROM life.

Table 13- 49 USS_Write_Param instruction

LAD / FBD	SCL	Description

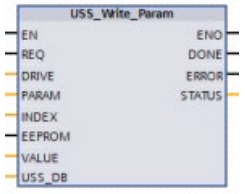
	`USS_Write_Param(REQ:=_bool_in_,`
	`DRIVE:=_usint_in_,`
	`PARAM:=_uint_in_,`
	`INDEX:=_uint_in_,`
	`EEPROM:=_bool_in_,`
	`VALUE:=_variant_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`USS_DB:=_fbtref_inout_);`
		The USS_Write_Param instruction modifies a parameter in the drive. All USS functions associated with one USS network and PtP communication port must use the same data block.
		USS_Write_Param must be called from a main program cycle OB.

Table 13- 50 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Send request: When true, REQ indicates that a new write request is desired. This is ignored if the request for this parameter is already pending.
DRIVE	IN	USInt	Drive address: DRIVE is the address of the USS drive. The valid range is drive 1 to drive 16.
PARAM	IN	UInt	Parameter number: PARAM designates which drive parameter is written. The range of this parameter is 0 to 2047. On some drives, the most significant byte can access PARAM values greater than 2047. See your drive manual for details on how to access an extended range.
INDEX	IN	UInt	Parameter index: INDEX designates which Drive Parameter index is to be written. A 16-bit value where the least significant byte is the actual index value with a range of (0 to 255). The most significant byte may also be used by the drive and is drive-specific. See your drive manual for details.
EEPROM	IN	Bool	Store To Drive EEPROM: When true, a write drive parameter transaction will be stored in the drive EEPROM. If false, the write is temporary and will not be retained if the drive is power cycled.
VALUE	IN	Word, Int, UInt, DWord, DInt, UDInt, Real	The value of the parameter that is to be written. It must be valid on the transition of REQ.
USS_DB	INOUT	USS_BASE	The name of the instance DB that is created and initialized when a USS_Drive_Control instruction is placed in your program.
DONE[1]	OUT	Bool	When true, DONE indicates that the input VALUE has been written to the drive. This bit is set when USS_Drive_Control sees the write response data from the drive. This bit is reset when either you request the response data using another USS_Drive_Control poll, or on the second of the next two calls to USS_Drive_Control.
ERROR	OUT	Bool	When true, ERROR indicates that an error has occurred and the STATUS output is valid. All other outputs are set to zero on an error. Communication errors are only reported on the USS_Port_Scan instruction ERROR and STATUS outputs.
STATUS	OUT	Word	STATUS indicates the result of the write request. Additional information is available in the "USS_Extended_Error" variable for some status codes.

[1] The DONE bit indicates that valid data has been read from the referenced motor drive and delivered to the CPU. It does not indicate that the USS library is capable of immediately reading another parameter. A blank PKW request must be sent to the motor drive and must also be acknowledged by the instruction before the parameter channel for the specific drive becomes available for use. Immediately calling a USS_Read_Param or USS_Write_Param FC for the specified motor drive will result in a "0x818A" error.

13.4.4 USS status codes

USS instruction status codes are returned at the STATUS output of the USS functions.

Table 13- 51 STATUS codes [1]

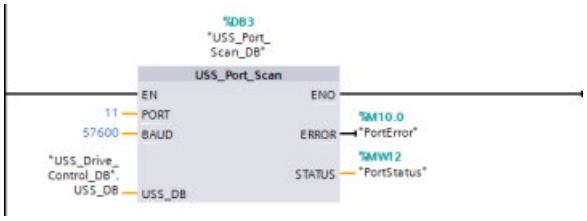
STATUS (W#16#....)	Description
0000	No error
8180	The length of the drive response did not match the characters received from the drive. The drive number where the error occurred is returned in the "USS_Extended_Error" variable. See the extended error description below this table.
8181	VALUE parameter was not a Word, Real or DWord data type.
8182	The user supplied a Word for a parameter value and received a DWord or Real from the drive in the response.
8183	The user supplied a DWord or Real for a parameter value and received a Word from the drive in the response.
8184	The response telegram from drive had a bad checksum. The drive number where the error occurred is returned in the "USS_Extended_Error" variable. See the extended error description below this table.
8185	Illegal drive address (valid drive address range: 1 to16)
8186	The speed set point is out of the valid range (valid speed SP range: -200% to 200%).
8187	The wrong drive number responded to the request sent. The drive number where the error occurred is returned in the "USS_Extended_Error" variable. See the extended error description below this table.
8188	Illegal PZD word length specified (valid range = 2, 4, 6 or 8 words)
8189	Illegal Baud Rate was specified.
818A	The parameter request channel is in use by another request for this drive.
818B	The drive has not responded to requests and retries. The drive number where the error occurred is returned in the "USS_Extended_Error" variable. See the extended error description below this table.
818C	The drive returned an extended error on a parameter request operation. See the extended error description below this table.
818D	The drive returned an illegal access error on a parameter request operation. See your drive manual for information of why parameter access may be limited.
818E	The drive has not been initialized. This error code is returned to USS_Read_Param or USS_Write_Param when USS_Drive_Control, for that drive, has not been called at least once. This keeps the initialization on first scan of USS_Drive_Control from overwriting a pending parameter read or write request, since it initializes the drive as a new entry. To fix this error, call USS_Drive_Control for this drive number.
80Ax-80Fx	Specific errors returned from PtP communication FBs called by the USS Library - These error code values are not modified by the USS library and are defined in the PtP instruction descriptions.

[1] In addition to the USS instruction errors listed above, errors can be returned from the underlying PtP communication instructions (Page 1088).

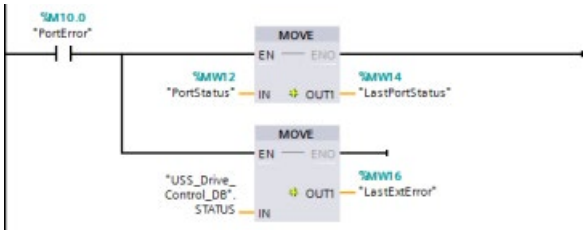
For several STATUS codes, additional information is provided in the "USS_Extended_Error" variable of the USS_Drive_Control Instance DB. For STATUS codes hexadecimal 8180, 8184, 8187, and 818B, USS_Extended_Error contains the drive number where the communication error occurred. For STATUS code hexadecimal 818C, USS_Extended_Error contains a drive error code returned from the drive when using a USS_Read_Param or USS_Write_Param instruction.

Example: Communication errors reporting

Communication errors (STATUS = 16#818B) are only reported on the USS_Port_Scan instruction and not on the USS_Drive_Control instruction. For example, if the network is not properly terminated, then it is possible for a drive to go to RUN but the USS_Drive_Control instruction will show all "0's' for the output parameters. In this case, you can only detect the communication error on the USS_Port_Scan instruction. Since this error is only visible for one scan, you will need to add some capture logic as illustrated in the following example. In this example, when the error bit of the USS_Port_Scan instruction is TRUE, then the STATUS and the USS_Extended_Error values are saved into M memory. The drive number is placed in the USS_Extended_Error variable when the STATUS code value is hexadecimal 8180, 8184, 8187, or 818B.



Network 1"PortStatus"port status and"USS_Drive_Control_DB".USS_Extended_Error
extended error code values are only valid for
one program scan. The values must be
captured for later processing.



Network 2 The "PortError" contact triggers the storage of the "PortStatus" value in "LastPortStatus" and the"USS_Drive_Control_DB".USS_Extended_Error
value in "LastExtError".

Read and write access to a drive's internal parameters

USS drives support read and write access to a drive's internal parameters. This feature allows remote control and configuration of the drive. Drive parameter access operations can fail due to errors such as values out of range or illegal requests for a drive's current mode. The drive generates an error code value that is returned in the "USS_Extended_Error" variable. This error code value is only valid for the last execution of a USS_Read_Param or USS_Write_Param instruction. The drive error code is put into USS_Extended_Error variable when the STATUS code value is hexadecimal 818C. The error code value of USS_Extended_Error depends on the drive model. See the drive's manual for a description of the extended error codes for read and write parameter operations.

13.4.5 USS general drive setup requirements

USS general drive setup requirements consist of the following points:

- The drives must be set to use 4 PKW words.
- The drives can be configured for 2, 4, 6, or 8 PZD words.
- The number of PZD word's in the drive must match PZD_LEN input on the USS_Drive_Control instruction for that drive.
- The baud rate in all the drives must match the BAUD input on the USS_Port_Scan instruction.
- The drive must be set for remote control.
- The drive must be set for frequency set-point to USS on COM Link.
- The drive address must be set to 1 to 16 and match the DRIVE input on the USS_Drive_Control block for that drive.
- The drive direction control must be set to use the polarity of the drive set-point.
- The RS485 network must be terminated properly.

13.4.6 Example: USS general drive connection and setup

Connecting a MicroMaster drive

This information about SIEMENS MicroMaster drives is provided as an example. For other drives, refer to the drive's manual for setup instructions.

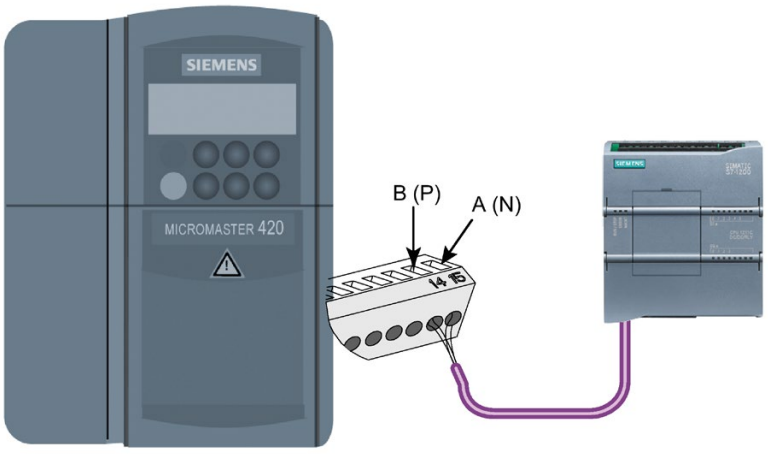
To make the connection to a MicroMaster Series 4 (MM4) drive, insert the ends of the RS485 cable into the two caged-clamp, screw-less terminals provided for USS operation. Standard PROFIBUS cable and connectors can be used to connect the S7-1200.

⚠ CAUTION

Interconnecting equipment with different reference potentials can cause unwanted currents to flow through the interconnecting cable

These unwanted currents can cause communications errors or damage equipment. Be sure all equipment that you are about to connect with a communications cable either shares a common circuit reference or is isolated to prevent unwanted current flows. The shield must be tied to chassis ground or pin 1 on the 9-pin connector. It is recommended that you tie wiring terminal 2-0 V on the MicroMaster drive to chassis ground.

The two wires at the opposite end of the RS485 cable must be inserted into the MM4 drive terminal blocks. To make the cable connection on a MM4 drive, remove the drive cover(s) to access the terminal blocks. See the MM4 user manual for details about how to remove the covers(s) of your specific drive.

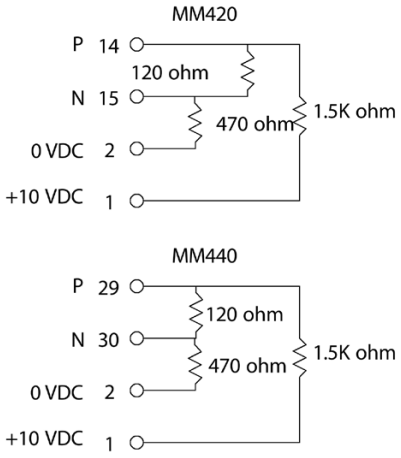


The terminal block connections are labeled numerically. Using a PROFIBUS connector on the S7-1200 side, connect the A terminal of the cable to the drive terminal 15 (for an MM420) or terminal 30 (MM440). Connect the B terminal of B (P) A (N) the cable connector to terminal 14 (MM420) or terminal 29 (MM440).

If the S7-1200 is a terminating node in the network, or if the connection is point-to-point, it is necessary to use terminals A1 and B1 (not A2 and B2) of the connector since they allow the termination settings to be set (for example, with DP connector type 6ES7972-0BA40-0X40).

CAUTION
Replace drive covers properly before supplying power Make sure the drive covers are replaced properly before supplying power to the unit.

If the drive is configured as the terminating node in the network, then termination and bias resistors must also be wired to the appropriate terminal connections. This diagram shows examples of the MM4 drive connections necessary for termination and bias.



Setting up the MM4 drive

Before you connect a drive to the S7-1200, you must ensure that the drive has the following system parameters. Use the keypad on the drive to set the parameters:

1. Reset the drive to factory settings (optional).	P0010=30 P0970=1
If you skip step 1, then ensure that these parameters are set to the indicated values.	USS PZD length = P2012 Index 0=(2, 4, 6, or 8) USS PKW length = P2013 Index 0=4
2. Enable the read/write access to all parameters (Expert mode).	P0003=3
3. Check the motor settings for your drive. The settings will vary according to the motor(s) being used. To set the parameters P304, P305, P307, P310, and P311, you must first set parameter P010 to 1 (quick commissioning mode). When you are finished setting the parameters, set parameter P010 to 0. Parameters P304, P305, P307, P310, and P311 can only be changed in the quick commissioning mode.	P0304 = Rated motor voltage (V) P0305 = Rated motor current (A) P0307 = Rated motor power (W) P0310 = Rated motor frequency (Hz) P0311 = Rated motor speed
4. Set the local/remote control mode.	P0700 Index 0=5
5. Set selection of frequency set-point to USS on COM link.	P1000 Index 0=5
6. Ramp up time (optional) This is the time in seconds that it takes the motor to accelerate to maximum frequency.	P1120=(0 to 650.00)
7. Ramp down time (optional) This the time in seconds that it takes the motor to decelerate to a complete stop.	P1121=(0 to 650.00)
8. Set the serial link reference frequency:	P2000=(1 to 650 Hz)
9. Set the USS normalization:	P2009 Index 0=0

10. Set the baud rate of the RS485 serial interface:	P2010 Index 0= 4 (2400 baud) 5 (4800 baud) 6 (9600 baud) 7 (19200 baud 8 (38400 baud) 9 (57600 baud) 12 (115200 baud)
11. Enter the Slave address. Each drive (a maximum of 31) can be operated over the bus.	P2011 Index 0=(0 to 31)
12. Set the serial link timeout. This is the maximum permissible period between two incoming data telegrams. This feature is used to turn off the inverter in the event of a communications failure. Timing starts after a valid data telegram has been received. If a further data telegram is not received within the specified time period, the inverter will trip and display fault code F0070. Setting the value to zero switches off the control.	P2014 Index 0=(0 to 65,535 ms) 0=timeout disabled
13. Transfer the data from RAM to EEPROM:	P0971=1 (Start transfer) Save the changes to the parameter settings to EEPROM

13.5 Modbus communication

13.5.1 Overview of Modbus RTU and Modbus TCP communication

Modbus function codes

- A CPU operating as a Modbus RTU master (or Modbus TCP client) can read/write both data and I/O states in a remote Modbus RTU slave (or Modbus TCP server). Remote data can be read and then processed in your program logic.
- A CPU operating as a Modbus RTU slave (or Modbus TCP server) allows a supervisory device to read/write both data and I/O states in CPU memory. An RTU master (or Modbus TCP client) can write new values into slave/server CPU memory that is available to your program logic.

WARNING

If an attacker can physically access your networks, the attacker can possibly read and write data.

The TIA Portal, the CPU, and HMIs (except HMIs using GET/PUT) use secure communication that protects against replay and "man-in-the-middle" attacks. Once communication is enabled, the exchange of signed messages takes place in clear text which allows an attacker to read data, but protects against unauthorized writing of data. The TIA Portal, not the communication process, encrypts the data of know-how protected blocks.

All other forms of communication (I/O exchange through PROFIBUS, PROFINET, AS-i, or other I/O bus, GET/PUT, T-Block, and communication modules (CM)) have no security features. You must protect these forms of communication by limiting physical access. If an attacker can physically access your networks utilizing these forms of communication, the attacker can possibly read and write data.

For security information and recommendations, refer to the "Operational Guidelines for Industrial Security" (http://www.industry.siemens.com/topics/global/en/industrial-security/Documents/operational_guidelines_industrial_security_en.pdf).

Table 13- 52 Read data functions: Read remote I/O and program data

Modbus function code	Read slave (server) functions - standard addressing
01	Read output bits: 1 to 2000 bits per request
02	Read input bits: 1 to 2000 bits per request
03	Read Holding registers: 1 to 125 words per request
04	Read input words: 1 to 125 words per request

Table 13- 53 Write data functions: Write remote I/O and modify program data

Modbus function code	Write slave (server) functions - standard addressing
05	Write one output bit: 1 bit per request
06	Write one holding register: 1 word per request
15	Write one or more output bits: 1 to 1968 bits per request
16	Write one or more holding registers: 1 to 123 words per request

- Modbus function codes 08 and 11 provide slave device communication diagnostic information.
- Modbus function code 0 broadcasts a message to all slaves (with no slave response). The broadcast function is not available for Modbus TCP, because communication is connection based.

Table 13- 54 Modbus network station addresses

Station		Address
RTU station	Standard station address	1 to 247
	Extended station address	1 to 65535
TCP station	Station address	IP address and port number

Modbus memory addresses

The actual number of Modbus memory addresses available depends on the CPU model, how much work memory exists, and how much CPU memory is used by other program data. The table below gives the nominal value of the address range.

Table 13- 55 Modbus memory addresses

Station		Address range
RTU station	Standard memory address	10K
	Extended memory address	64K
TCP station	Standard memory address	10K

Modbus RTU communication

Modbus RTU (Remote Terminal Unit) is a standard network communication protocol that uses the RS232 or RS485 electrical connection for serial data transfer between Modbus network devices. You can add PtP (Point to Point) network ports to a CPU with a RS232 or RS485 CM or a RS485 CB.

Modbus RTU uses a master/slave network where all communications are initiated by a single Master device and slaves can only respond to a master's request. The master sends a request to one slave address and only that slave address responds to the command.

Modbus TCP communication

Modbus TCP (Transmission Control Protocol) is a standard network communication protocol that uses the PROFINET connector on the CPU for TCP/IP communication. No additional communication hardware module is required.

Modbus TCP uses Open User Communications (OUC) connections as a Modbus communication path. Multiple client-server connections may exist, in addition to the connection between STEP 7 and the CPU. Mixed client and server connections are supported up to the maximum number of connections allowed by the CPU model (Page 783).

Each MB_SERVER connection must use a unique instance DB and IP port number. Only 1 connection per IP port is supported. Each MB_SERVER (with its unique instance DB and IP port) must be executed individually for each connection.

A Modbus TCP client (master) must control the client-server connection with the DISCONNECT parameter. The basic Modbus client actions are shown below.

1. Initiate a connection to a particular server (slave) IP address and IP port number
2. Initiate client transmission of a Modbus message and receive the server responses
3. When desired, initiate the disconnection of client and server to enable connection with a different server.

Modbus RTU instructions in your program

- Modbus_Comm_Load: One execution of Modbus_Comm_Load is used to set up PtP port parameters like baud rate, parity, and flow control. After a CPU port is configured for the Modbus RTU protocol, it can only be used by either the Modbus_Master or Modbus_Slave instructions.
- Modbus_Master: The Modbus_Master instruction enables the CPU to act as a Modbus RTU master device and communicate with one or more Modbus slave devices.
- Modbus_Slave: The Modbus_Slave instruction enables the CPU to act as a Modbus RTU slave device and communicate with a Modbus master device.

Modbus TCP instructions in your program

- MB_CLIENT: Make client-server TCP connection, send command message, receive response, and control the disconnection from the server
- MB_SERVER: Connect to a Modbus TCP client upon request, receive Modbus message, and send response

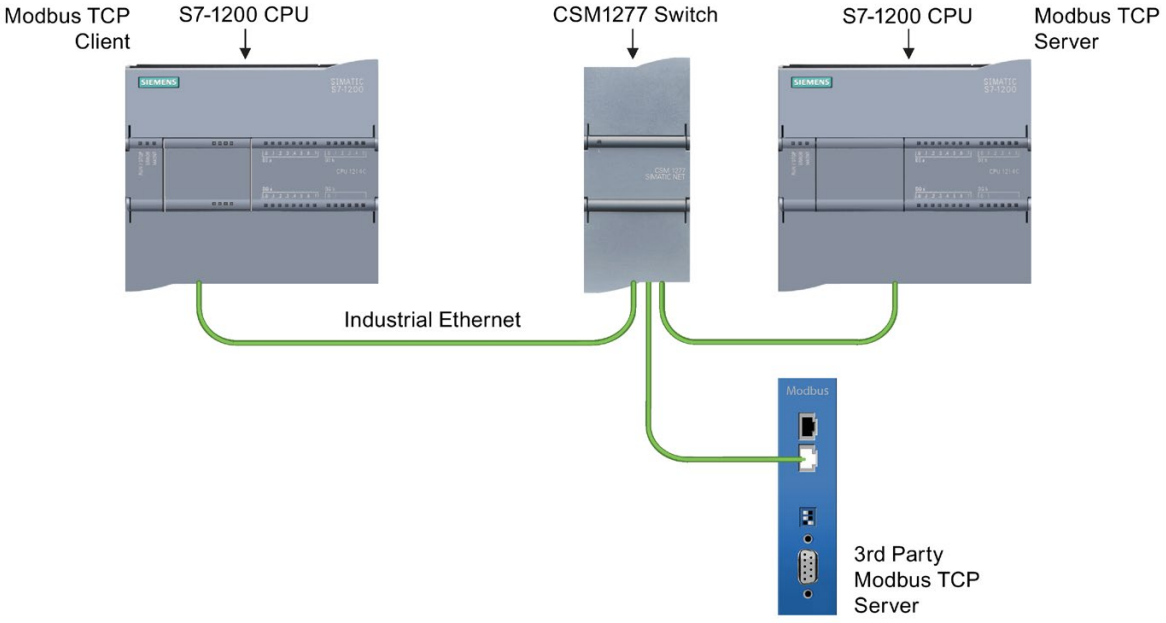
13.5.2 Modbus TCP

13.5.2.1 Overview

As of version V4.1 of the S7-1200 CPU together with STEP 7 V13 SP1, the CPU extends the capability of Modbus TCP to use enhanced T-block instructions.

For this reason, the S7-1200 supports two sets of PtP instructions:

- Legacy Modbus TCP instructions (Page 1236): These Modbus TCP instructions existed prior to version V4.0 of the S7-1200.
- Modbus TCP instructions (Page 1151): These Modbus TCP instructions provide all of the functionality of the legacy instructions.



13.5.2.2 Selecting the version of the Modbus TCP instructions

There are three versions of the Modbus TCP instructions available in STEP 7:

- Legacy version 3.0: Compatible with all CPU and CP versions
- Legacy version 3.1: Compatible with all CPU and CP versions
- Version 4.1: Compatible with V4.0 and later CPUs and V2.1 and later CMs

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

Do not use both 3.0 and 3.1 instruction versions in the same CPU program. Your program's Modbus TCP instructions must have the same major version number (**1**.x, **2**.y, or **V**.z). The individual instructions within a major version group may have different minor versions (1.**x**).



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



To change the version of the Modbus TCP instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a Modbus TCP instruction in your program, a new FB instance is created in the project tree. You can see new FB instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a Modbus TCP instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree Modbus TCP FB instance, right-click, select "Properties", and select the "Information" page to see the Modbus TCP instruction version number.

13.5.2.3 Modbus TCP instructions

MB_CLIENT (Communicate using PROFINET as Modbus TCP client) instruction

Table 13- 56 MB_CLIENT instruction

LAD / FBD	SCL	Description

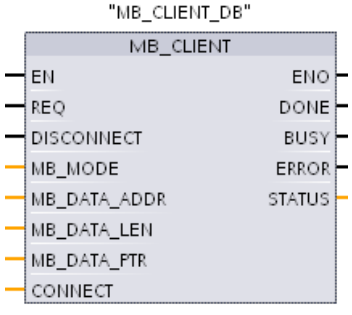
	`"MB_CLIENT_DB"(`
	`REQ:=_bool_in_,`
	`DISCONNECT:=_bool_in_,`
	`MB_MODE:=_usint_in_,`
	`MB_DATA_ADDR:=_udint_in_,`
	`MB_DATA_LEN:=_uint_in_,`
	`DONE=>_bool_out_,`
	`BUSY=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`MB_DATA_PTR:=_variant_inout_,`
	`CONNECT:=_variant_inout_);`
		MB_CLIENT communicates as a Modbus TCP client through the PROFINET port on the S7-1200 CPU. No additional communication hardware module is required.
		MB_CLIENT can make a client-server connection, send a Modbus function request, receive a response, and control the disconnection from a Modbus TCP server.

Table 13- 57 Data types for the parameters

Parameter and type		Data type	Description
REQ	In	Bool	FALSE = No Modbus communication request TRUE = Request to communicate with a Modbus TCP server
DISCONNECT	IN	Bool	The DISCONNECT parameter allows your program to control connection and disconnection with a Modbus server device. If DISCONNECT = 0 and a connection does not exist, then MB_CLIENT attempts to make a connection to the assigned IP address and port number. If DISCONNECT = 1 and a connection exists, then a disconnect operation is attempted. Whenever this input is enabled, no other operation will be attempted.
MB_MODE	IN	USInt	Mode selection: Assigns the type of request (read, write, or diagnostic). See the Modbus functions table below for details.
MB_DATA_ADDR	IN	UDInt	Modbus starting Address: Assigns the starting address of the data to be accessed by MB_CLIENT. See the following Modbus functions table for valid addresses.
MB_DATA_LEN	IN	UInt	Modbus data Length: Assigns the number of bits or words to be accessed in this request. See the following Modbus functions table for valid lengths
MB_DATA_PTR	IN_OUT	Variant	Pointer to the Modbus data register: The register buffers data going to or coming from a Modbus server. The pointer must assign a non-optimized global DB or an M memory address.
CONNECT	IN_OUT	Variant	Reference to a Data block structure that contains connection parameters in the system data type "TCON_IP_v4".
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error.
BUSY	OUT	Bool	• 0 - No MB_CLIENT operation in progress • 1 - MB_CLIENT operation in progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the MB_CLIENT execution ended with an error. The error code at the STATUS parameter is valid only during the single cycle where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code

Note

CPU firmware version requirement

The Modbus TCP instructions described in this section of the manual require firmware release V4.1 or later.

REQ parameter

FALSE = No Modbus communication request
TRUE = Request to communicate with a Modbus TCP server

If no instance of MB_CLIENT is active and parameter DISCONNECT=0, when REQ=1 a new Modbus request starts. If the connection is not already established, then a new connection is made.

If the same instance of MB_CLIENT is executed again with DISCONNECT=0 and REQ=1, before the completion of the current request, then no subsequent Modbus transmission will be made. However, as soon as the current request is completed, a new request can be processed if MB_CLIENT is executed with REQ=1.

When the current MB_CLIENT communication request is complete, the DONE bit is TRUE for one cycle. The DONE bit can be used as a time gate to sequence multiple MB_CLIENT requests.

Note

Input data consistency during MB_CLIENT processing

Once a Modbus client initiates a Modbus operation, all the input states are saved internally and are then compared on each successive call. The comparison is used to determine if this particular call was the originator of the active client request. More than one MB_CLIENT call can be performed using a common instance DB.

It is important that the inputs are not changed during the period of time that an MB_CLIENT operation is actively being processed. If this rule is not followed, then an MB_CLIENT cannot determine the active instance.

MB_MODE and MB_DATA_ADDR parameters select the Modbus communication function

The MB_CLIENT instruction uses an MB_MODE input rather than a function code. MB_DATA_ADDR assigns the starting Modbus address of the remote data.

The combination of MB_MODE and MB_DATA_ADDR determines the function code that is used in the actual Modbus message. The following table shows the correspondence between parameter MB_MODE, MB_DATA_ADDR, and Modbus function:

Table 13- 58 Modbus functions

MB_MODE	Modbus function	Data length	Operation and data	MB_DATA_ADDR
0	01	1 to 2000	Read output bits: 1 to 2000 bits per request	1 to 9999
101	01	1 to 2000	Read output bits: 1 to 2000 bits per request	00000 to 65535
0	02	1 to 2000	Read input bits: 1 to 2000 bits per request	10001 to 19999
102	02	1 to 2000	Read input bits: 1 to 2000 bits per request	00000 to 65535
0	03	1 to 125	Read Holding registers: 1 to 125 words per request	40001 to 49999 or 400001 to 465535
103	03	1 to 125	Read Holding registers: 1 to 125 words per request	00000 to 65535
0	04	1 to 125	Read input words: 1 to 125 words per request	30001 to 39999
104	04	1 to 125	Read input words: 1 to 125 words per request	00000 to 65535
1	05	1	Write one output bit: One bit per request	1 to 9999
105	05	1	Write one output bit: One bit per request	00000 to 65535
1	06	1	Write one holding register: 1 word per request	40001 to 49999 or 400001 to 465535
106	06	1	Write one holding register: 1 word per request	00000 to 65535
1	15	2 to 1968	Write multiple output bits: 2 to 1968 bits per request	1 to 9999
1	16	2 to 123	Write multiple holding registers: 2 to 123 words per request	40001 to 49999 or 400001 to 465535
2	15	1 to 1968	Write one or more output bits: 1 to 1968 bits per request	1 to 9999
2	15	1 to 1968	Write one or more output bits: 1 to 1968 bits per request	1 to 9999
2	15	1 to 1968	Write one or more output bits: 1 to 1968 bits per request	1 to 9999
115	15	1 to 1968	Write one or more output bits: 1 to 1968 bits per request	00000 to 65535

MB_MODE	Modbus function	Data length	Operation and data	MB_DATA_ADDR
2	16	1 to 123	Write one or more holding registers: 1 to 123 words per request	40001 to 49999 or 400001 to 465535
116	16	1 to 123	Write one or more holding registers: 1 to 123 words per request	00000 to 65535
11	11	0	Read the server communication status word and event counter. The status word indicates busy (0 = not busy, 0xFFFF = busy). The event counter is incremented for each successful completion of a message. Both the MB_DATA_ADDR and MB_DATA_LEN parameters of MB_CLIENT are ignored for this function.	
80	08	1	Check server status with diagnostic code 0x0000 (Loopback test, server echoes the request) 1 word per request	
81	08	1	Reset server event counter with diagnostic code 0x000A 1 word per request	
3 to 10, 12 to 79, 82 to 100, 107 to 114, 117 to 255			Reserved	

Note

MB_DATA_PTR assigns a buffer to store data read/written to/from a Modbus TCP server

The data buffer can be located in a non-optimized global DB or M memory address.

For a buffer in M memory, use the Any Pointer format. This is in the format P#"Bit Address" "Data Type" "Length", an example would be P#M1000.0 WORD 500.

MB_DATA_PTR parameter assigns a communication buffer

- MB_CLIENT communication functions:
  - Read and write 1-bit data from Modbus server addresses (00001 to 09999)
  - Read 1-bit data from Modbus server addresses (10001 to 19999)
  - Read 16-bit word data from Modbus server addresses (30001 to 39999) and (40001 to 49999)
  - Write 16-bit word data to Modbus server addresses (40001 to 49999)
- Word or bit sized data is transferred to/from the DB or M memory buffer assigned by MB_DATA_PTR.
- If a DB is assigned as the buffer by MB_DATA_PTR, then you must assign data types to all DB data elements.
  - The 1-bit Bool data type represents one Modbus bit address
  - 16-bit single word data types like WORD, UInt, and Int represent one Modbus word address
  - 32-bit double word data types like DWORD, DInt, and Real represent two Modbus word addresses
- Complex DB elements can be assigned by MB_DATA_PTR, such as
  - Arrays
  - Named structures where each element is unique.
  - Named complex structures where each element has a unique name and a 16 or 32 bit data type.
- No requirement that the MB_DATA_PTR data areas be in the same global data block (or M memory area). You can assign one data block for Modbus reads, another data block for Modbus writes, or one data block for each MB_CLIENT.

CONNECT parameter assigns data used to establish a PROFINET connection

You must use a global data block and store the required connection data before you can reference this DB at the CONNECT parameter.

1. Create a new global DB or use an existing global DB to store the CONNECT data. You can use one DB to store multiple TCON_IP_v4 data structures. Each Modbus TCP client or server connection uses a TCON_IP_v4 data structure. You reference the connection data at the CONNECT parameter.
2. Name the DB and a static variable with a helpful name. For example, name the data block "Modbus connections" and a static variable "TCPactive_1" (for Modbus TCP client connection 1).
3. In the DB editor, assign the system data type "TCON_IP_v4" in the Data Type column, for the example static variable "TCPactive_1".
4. Expand the TCON_IP_v4 structure so you can modify the connection parameters, as shown in the following image.
5. Modify data in the TCON_IP_v4 structure for an MB_CLIENT connection.
6. Enter the DB structure reference for the CONNECT parameter of MB_CLIENT. For the example, this would be "Modbus connections".TCPactive_1.

Modbus connections

		Name	Data type	Start value	Comment
1		Static			
2		TCPactive_1	TCON_IP_v4		
3		InterfaceId	HW_ANY	64	HW-identifier of IE-interface submodule
4		ID	CONN_OUC	1	connection reference / identifier
5		ConnectionType	Byte	16#0B	type of connetion: 11=TCP/IP, 19=UDP (17=TC...
6		ActiveEstablished	Bool	True	active/passive connection establishment
7		RemoteAddress	IP_V4		remote IP address (IPv4)
8		ADDR	array [1..4] of Byte		IPv4 address
9		ADDR[1]	Byte	192	
10		ADDR[2]	Byte	168	
11		ADDR[3]	Byte	2	
12		ADDR[4]	Byte	241	
13		RemotePort	UInt	502	remote UDP/TCP port number
14		LocalPort	UInt	0	local UDP/TCP port number

Modify TCP_IP_v4 DB data for each MB_CLIENT connection

- **InterfaceID**: Using the Device configuration window, click on the CPU PROFINET port image. Then click on the General properties tab and use the Hardware identifier that you see there.
- **ID**: Enter a connection ID number between 1 and 4095. Modbus TCP communication is made using underlying TCON, TDISCON, TSEND, and TRCV instructions, for OUC (Open User Communication).
- **ConnectionType**: For TCP/IP, use the default 16#0B (decimal number = 11).
- **ActiveEstablished**: This value must be 1 or TRUE. The connection is active in that MB_CLIENT initiates Modbus communication.
- **RemoteAddress**: Enter the IP address of the target Modbus TCP server into the four ADDR array elements. For example, enter 192.168.2.241, as in the previous image.

- **RemotePort**: The default is 502. This number is the IP port number of the Modbus server that MB_CLIENT attempts to connect and communicate with. Some third-party Modbus servers require that you use another port number.
- **LocalPort**: This value must be 0, for an MB_CLIENT connection.

Multiple client connections

A Modbus TCP client can support concurrent connections up to the maximum number of Open User Communications connections allowed by the PLC. The total number of connections for a PLC, including Modbus TCP Clients and Servers, must not exceed the maximum number of supported Open User Communications connections (Page 783).

Individual concurrent client connections must follow these rules:

- Each MB_CLIENT connection must use a unique instance DB
- Each MB_CLIENT connection must assign a unique server IP address
- Each MB_CLIENT connection must assign a unique connection ID
- Unique IP port numbers may or may not be required depending upon the server configuration

A different connection ID must be used with each instance DB. In summary, the instance DB and the connection ID are paired together and must be unique for each connection.

Table 13- 59 MB_CLIENT instance data block: User accessible static variables

Variable	Data type	Default	description
Blocked_Proc_Timeout	Real	3.0	Amount of time (in seconds) to wait upon a blocked Modbus client instance before removing this instance as being ACTIVE. This can occur, for example, when a client request has been issued and then application stops executing the client function before completely finishing the request. The maximum S7-1200 limit is 55 seconds.
MB_Unit_ID	Word	255	Modbus unit identifier: A Modbus TCP server is addressed using its IP address. As a result, the MB_UNIT_ID parameter is not used for Modbus TCP addressing. The MB_UNIT_ID parameter corresponds to the slave address in the Modbus RTU protocol. If a Modbus TCP server is used for a gateway to a Modbus RTU protocol, the MB_UNIT_ID can be used to identify the slave device connected on the serial network. The MB_UNIT_ID would be used to forward the request to the correct Modbus RTU slave address. Some Modbus TCP devices may require the MB_UNIT_ID parameter to be within a restricted range.
RCV_TIMEOUT	Real	2.0	Time in seconds that the MB_CLIENT waits for a server to respond to a request.
Connected	Bool	0	Indicates whether the connection to the assigned server is connected or disconnected: 1=connected, 0=disconnected

Table 13- 60 MB_CLIENT protocol errors

STATUS (W#16#)	Response code to Modbus client (B#16#)	Modbus protocol errors
8381	01	Function code not supported
8382	03	Data length error
8383	02	Data address error or access outside the bounds of the MB_HOLD_REG address area
8384	03	Data value error
8385	03	Data diagnostic code not supported (function code 08)

Table 13- 61 MB_CLIENT execution condition codes [1]

STATUS (W#16#)	MB_CLIENT parameter errors
7001	MB_CLIENT is waiting for a Modbus server response to a connect or disconnect request, on the assigned TCP port. This code is only returned for the first execution of a connect or disconnect operation.
7002	MB_CLIENT is waiting for a Modbus server response to a connect or disconnect request, for the assigned TCP port. This will be returned for any subsequent executions, while waiting for completion of a connect or disconnect operation.
7003	A disconnect operation has successfully completed (Only valid for one PLC scan).
80C8	The server has not responded in the assigned time. MB_CLIENT must receive a response using the transaction ID that was originally transmitted within the assigned time or this error is returned. Check the connection to the Modbus server device. This error is only returned after retries (if applicable) have been attempted.
8188	Invalid mode
8189	Invalid data address
818A	Invalid data length
818B	Invalid pointer to the DATA_PTR area. This can be the combination of MB_DATA_ADDRESS + MB_DATA_LEN.
818C	Pointer DATA_PTR points to an non-optimized DB area (must be a non-optimized DB area or M memory area)
8200	The port is busy processing an existing Modbus request.
8380	Received Modbus frame is incorrect or too few bytes have been received.
8387	The assigned Connection ID parameter is different from the ID used for previous requests. There can only be a single Connection ID used within each MB_CLIENT instance DB. This code is also returned as an internal error if the Modbus TCP protocol ID received from a server is not 0.
8388	A Modbus server returned a quantity of data that is different than what was requested. This code applies to Modbus functions 15 or 16 only.

[1] In addition to the MB_CLIENT errors listed above, errors can be returned from the underlying T block communication instructions (TCON, TDISCON, TSEND, and TRCV).

MB_SERVER (Communicate using PROFINET as Modbus TCP server) instruction

Table 13- 62 MB_SERVER instruction

LAD / FBD	SCL	Description

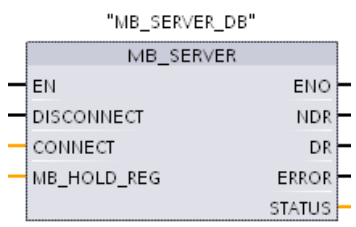
	`"MB_SERVER_DB"(`
	`DISCONNECT:=_bool_in_,`
	`CONNECT:=_variant_in_,`
	`NDR=>_bool_out_,`
	`DR=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	
	`MB_HOLD_REG:=_variant_inout_);`
		MB_SERVER communicates as a Modbus TCP server through the PROFINET port on the S7-1200 CPU. No additional communication hardware module is required.
		MB_SERVER can accept a request to connect with Modbus TCP client, receive a Modbus function request, and send a response message.

Table 13- 63 Data types for the parameters

Parameter and type		Data type	Description
DISCONNECT	IN	Bool	MB_SERVER attempts to make a "passive" connection with a partner device. This means that the server is passively listening for a TCP connection request from any requesting IP address. If DISCONNECT = 0 and a connection does not exist, then a passive connection can be initiated. If DISCONNECT = 1 and a connection exists, then a disconnect operation is initiated. This parameter allows your program to control when a connection is accepted. Whenever this input is enabled, no other operation will be attempted.
CONNECT	IN	Variant	Reference to a Data block structure that contains connection parameters in the system data type "TCON_IP_v4".
MB_HOLD_REG	IN_OUT	Variant	Pointer to the MB_SERVER Modbus holding register: The holding register must either be a non-optimized global DB or an M memory address. This memory area is used to hold the data a Modbus client is allowed to access using Modbus register functions 3 (read), 6 (write), 16 (write), and 23 (write/read).
NDR	OUT	Bool	New Data Ready: 0 = No new data, 1 = Indicates that new data has been written by a Modbus client
DR	OUT	Bool	Data Read: 0 = No data read, 1 = Indicates that data has been read by a Modbus client.
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after MB_SERVER execution ended with an error. The error code at the STATUS parameter is valid only during the single cycle where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code

Note

CPU firmware version requirement

The Modbus TCP instructions described in this section of the manual require firmware release V4.1 or later.

Note

Using Function 23 with the MB_SERVER instruction

The MB_SERVER instruction supports the use of function code 23 for writing to and reading from a holding register in a single request; however, the MB_CLIENT instruction does NOT support this function and returns an error code. You should also note that while the request contains both the read and write, the instruction processes the write before the read.

CONNECT parameter assigns data used to establish a PROFINET connection

You must use a global data block and store the required connection data before you can reference this DB at the CONNECT parameter.

1. Create a new global DB or use an existing global DB to store the CONNECT data. You can use one DB to store multiple TCON_IP_v4 data structures. Each Modbus TCP client or server connection uses a TCON_IP_v4 data structure. You reference the connection data at the CONNECT parameter.
2. Name the DB and a static variable with a helpful name. For example, name the data block "Modbus connections" and a static variable "TCPpassive_1" (for Modbus TCP server connection 1).
3. In the DB editor, assign the system data type "TCON_IP_v4" in the Data Type column, for the example static variable "TCPactive_1".
4. Expand the TCON_IP_v4 structure so you can modify the connection parameters, as shown in the following image.
5. Modify data in the TCON_IP_v4 structure for an MB_SERVER connection.
6. Enter the DB structure reference for the CONNECT parameter of MB_SEVER. For the example, this would be "Modbus connections".TCPpassive_1.

Modbus connections

	Name	Data type	Start value	Comment
1	Static			
2	TCPpassive_1	TCON_IP_v4		
3	InterfaceId	HW_ANY	64	HW-identifier of IE-interface submodule
4	ID	CONN_OUC	1	connection reference / identifier
5	ConnectionType	Byte	16#0B	type of connetion: 11=TCP/IP, 19=UDP (17=TC...
6	ActiveEstablished	Bool	False	active/passive connection establishment
7	RemoteAddress	IP_V4		remote IP address (IPv4)
8	ADDR	array [1..4] of Byte		IPv4 address
9	ADDR[1]	Byte	192	
10	ADDR[2]	Byte	168	
11	ADDR[3]	Byte	2	
12	ADDR[4]	Byte	241	
13	RemotePort	UInt	0	remote UDP/TCP port number
14	LocalPort	UInt	502	local UDP/TCP port number

Modify TCP_IP_v4 DB data for each MB_SERVER connection

- **InterfaceID**: Using the Device configuration window, click on the CPU PROFINET port image. Then click on the General properties tab and use the Hardware identifier that you see there.
- **ID**: Enter a number between 1 and 4095 that is unique for this connection. Modbus TCP communication is made using underlying TCON, TDISCON, TSEND, and TRCV instructions, for OUC (Open User Communication). Up to eight simultaneous OUC connections are allowed.
- **ConnectionType**: For TCP/IP, use the default 16#0B (decimal value = 11).
- **ActiveEstablished**: This value must be 0 or FALSE. The connection is passive in that MB_SERVER is waiting for a communication request from a Modbus client.
- **RemoteAddress**: There are two options.
  - Use 0.0.0.0 and MB_CLIENT will respond to a Modbus request from any TCP client
  - Enter the IP address of a target Modbus TCP client and MB_CLIENT only responds to a request originating from this client's IP address. For example, enter 192.168.2.241, as in the previous image.
- **RemotePort**: This value must be 0, for an MB_SERVER connection.
- **LocalPort**: The default is 502. This number is the IP port number of the Modbus client that MB_SERVER attempts to connect and communicate with. Some third-party Modbus clients require another port number.

Modbus and process image addresses

MB_SERVER allows incoming Modbus function codes (1, 2, 4, 5, and 15) to read/write bits/words directly in the input/output process image. For data transfer function codes (3, 6, and 16), the MB_HOLD_REG parameter must be defined as a data type larger than a byte. The following table shows the mapping of Modbus addresses to the process image in the CPU.

Table 13- 64 Mapping of Modbus addresses to the process image

Modbus functions						S7-1200	
Codes	Function	Data area	Address range			Data area	CPU address
01	Read bits	Output	1	To	8192	Output Process Image	Q0.0 to Q1023.7
02	Read bits	Input	10001	To	18192	Input Process Image	I0.0 to I1023.7
04	Read words	Input	30001	To	30512	Input Process Image	IW0 to IW1022
05	Write bit	Output	1	To	8192	Output Process Image	Q0.0 to Q1023.7
15	Write bits	Output	1	To	8192	Output Process Image	Q0.0 to Q1023.7

Incoming Modbus message function codes function codes (3, 6, and 16) read/write words in a Modbus holding register, which can be in M memory or a data block. The type of holding register is specified by the MB_HOLD_REG parameter.

Note

MB_HOLD_REG parameter assignment

Modbus holding registers defined as arrays of word, integer, wide character, unsigned integer, byte, short integer, unsigned short integer, character, double word, double integer, unsigned double integer, or real can be placed in any memory area.

You must place Modbus holding registers that you defined as structures in non-optimized DBs.

For a Modbus holding register in M memory, use the Any Pointer format. This is in the format P#"Bit Address" "Data Type" "Length". An example would be P#M1000.0 WORD 500.

The following table shows examples of Modbus addresses to holding register mapping used for Modbus function codes 03 (read words), 06 (write word), and 16 (write words). The actual upper limit of DB addresses is determined by the maximum work memory limit and M memory limit, for each CPU model.

Table 13- 65 Mapping examples of Modbus address to CPU memory address

Modbus Address	MB_HOLD_REG parameter examples		
	P#M100.0 Word 5	P#DB10.DBx0.0 Word 5	"Recipe".ingredient
40001	MW100	DB10.DBW0	"Recipe".ingredient[1]
40002	MW102	DB10.DBW2	"Recipe".ingredient[2]
40003	MW104	DB10.DBW4	"Recipe".ingredient[3]
40004	MW106	DB10.DBW6	"Recipe".ingredient[4]
40005	MW108	DB10.DBW8	"Recipe".ingredient[5]

Multiple server connections

Multiple server connections may be created. A single PLC can establish concurrent connections to multiple Modbus TCP clients.

A Modbus TCP server can support concurrent connections up to the maximum number of Open User Communications connections allowed by the PLC. The total number of connections for a PLC, including Modbus TCP Clients and Servers, must not exceed the maximum number of supported Open User Communications connections (Page 783). The Modbus TCP connections may be shared between Client and Server type connections.

Individual concurrent server connection must follow these rules:

- Each MB_SERVER connection must use a unique instance DB.
- Each MB_SERVER connection must assign a unique IP port number. Only 1 connection per port is supported.
- Each MB_SERVER connection must assign a unique connection ID.
- The MB_SERVER must be called individually for each connection (with its respective instance DB).

The connection ID must be unique for each individual connection. A single, connection ID must be used with each individual instance DB. The instance DB and the connection ID are paired together and must be unique for every connection.

Table 13- 66 Modbus diagnostic function codes

MB_SERVER Modbus diagnostic functions		
Codes	Sub-function	Description
08	0x0000	Return query data echo test: The MB_SERVER will echo back to a Modbus client a data word that is received.
08	0x000A	Clear communication event counter: The MB_SEVER will clear the communication event counter that is used for Modbus function 11.
11		Get communication event counter: The MB_SERVER uses an internal communication event counter for recording the number of successful Modbus read and write requests that are sent to the Modbus server. The counter does not increment on any request for Function 8, Function 11, or any request that results in a communication error. The broadcast function is not available for Modbus TCP, because only one client-server connection exists at any one time.

MB_SERVER instruction data block (DB) variables

This table shows the public static variables that are stored in the MB_SERVER instance data block and can be used in your program

Table 13- 67 MB_SERVER public static variables

Variable	Data type	Default	Description
HR_Start_Offset	Word	0	Assigns the starting address of the Modbus Holding register
Request_Count	Word	0	The number of all requests received by this server.
Server_Message_Count	Word	0	The number of requests received for this specific server.
Xmt_Rcv_Count	Word	0	The number of transmissions or receptions that have encountered an error. Also, incremented if a message is received that is an invalid Modbus message.
Exception_Count	Word	0	Modbus specific errors that require a returned exception
Success_Count	Word	0	The number of requests received for this specific server that has no protocol errors.
Connected	Bool	0	Indicates whether the connection to the assigned client is connected or disconnected: 1=connected, 0=disconnected
QB_Start	UInt	0	The starting address of the output bytes to which the CPU can write (QB0 to QB65535)
QB_Count	UInt	65535	The number of bytes to which a remote device can write. If QB_Count = 0, a remote device cannot write to the outputs. Example: To allow only QB10 through QB17 to be writable, QB_Start = 10 and QB_Count = 8.
QB_Read_Start	UInt	0	The starting address of the output bytes to which the CPU can read (QB0 to QB65535)
QB_Read_Count	UInt	65535	The number of output bytes from which a remote device can read. If QB_Count = 0, a remote device cannot read from the outputs. Example: To allow only QB10 through QB17 to be readable, QB_Start = 10 and QB_Count = 8.
IB_Read_Start	UInt	0	The starting address of the input bytes to which the CPU can read (IB0 to IB65535)
IB_Read_Count	UInt	65535	The number of input bytes from which a remote device can read. If IB_Count = 0, a remote device cannot read from the inputs. Example: To allow only IB10 through IB17 to be readable, IB_Start = 10 and IB_Count = 8.
NDR_immediate	Bool	FALSE	Identical meaning as the parameter NDR (New Data Ready). The MB_SERVER updates the "NDR_immediate" in the same call that processes a Modbus TCP write request.
DR_immediate	Bool	FALSE	Identical meaning as the parameter DR (Data Read). The MB_SERVER updates the "DR_immediate" in the same call that processes a Modbus TCP write request.

Your program can write data to the HR_Start_Offset and control Modbus server operations. The other variables can be read to monitor Modbus status.

Version requirements for MB_SERVER instruction data block (DB) variables availability are as follows:

Table 13- 68 MB_SERVER instruction data block (DB) variables availability version requirements: Instruction, TIA Portal, and S7-1200 CPU

MB_SERVER instruction version	TIA Portal version	S7-1200 CPU firmware (FW) version	Data block variables
4.0	V14 SP1	CPU FW V4.0 or later	QB_Start
			QB_Count
5.0	V15.1	CPU FW V4.2 or later	QB_Start
			QB_Count
			QB_Read_Start
			QB_Read_Count
			IB_Read_Start
			IB_Read_Count
			NDR_immediate
			DR_immediate

HR_Start_Offset

Modbus holding register addresses begin at 40001. These addresses correspond to the beginning PLC memory address of the holding register. However, you can use the "HR_Start_Offset" variable to start the beginning Modbus holding register address at another number instead of 40001.

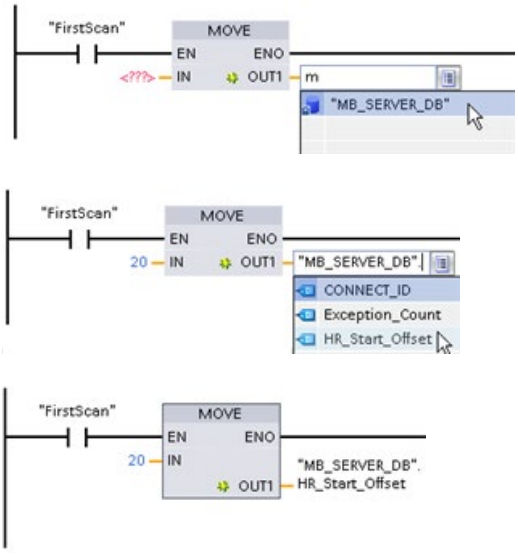
For example, if the holding register starts at MW100 and is 100 words long. An offset of 20 specifies a beginning holding register address of 40021 instead of 40001. Any address less than 40021 or greater than 40119 results in an addressing error.

Table 13- 69 Example of Modbus holding register addressing

HR_Start_Offset	Address	Minimum	Maximum
0	Modbus address (Word)	40001	40099
	S7-1200 address	MW100	MW298
20	Modbus address (Word)	40021	40119
	S7-1200 address	MW100	MW298

HR_Start_Offset is word data in the MB_SERVER instance data block that assigns the starting address of the Modbus holding register. You can set this public static variable by using the parameter helper drop list, after MB_SERVER is placed in your program.

For example, after you place MB_SERVER in a LAD network, you can go to a previous network and assign HR_Start_Offset. The start address must be assigned prior to execution of MB_SERVER.



Entering a Modbus server variable using the default DB name:

1. Set the cursor in the parameter field and type an m character.
2. Select "MB_SERVER_DB" from the drop list of DB names.
3. Select "MB_SERVER_DB.HR_Start_Offset" from the drop list of DB variables.

Access to data areas in data blocks (DB) instead of direct access to Modbus addresses

As of version V5.0 of the MB_SERVER instruction and firmware (FW) version V4.2 of the S7-1200 CPU, you can access data areas in DBs instead of directly accessing process images and holding registers. In order to do this, in the global DB "Attributes" Property page, you must deselect the "Only store in load memory" and "Optimized block access" check boxes.

If a Modbus request arrives and you did not define a data area for the Modbus data type of the corresponding function code, the CPU treats the request as in previous instruction versions: You access process images and holding registers directly.

If you have defined a data area for the Modbus data type of the function code, the MB_SERVER instruction reads from or writes to that data area. Whether it reads or writes depends on the job type.

For one individual Modbus request, you can only read from or write to one data area. If, for example, you want to read holding registers that extend over multiple data areas, you require multiple Modbus requests.

These are the rules for defining data areas:

- You can define up to eight data areas in different DBs; each DB must only contain one data area. An individual MODBUS request can only read from precisely one data area or write to precisely one data area. Each data area corresponds to one MODBUS address area. You define the data areas in the "Data_Area_Array" static tag of the instance DB.
- If you want to use less than eight data areas, you must place the required data areas one behind the other, without any gaps. The first blank entry in the data areas ends the data area search during processing. If, for example, you define the field elements 1, 2, 4, and 5, the "Data_Area_Array" only recognizes field elements 1 and 2. as field element 3 is empty.
- The Data_Area_Array field consists of eight elements: Data_Area_Array[1] to Data_Area_Array[8]
- Each field element Data_Area_Array[x], 1 <= x <= 8, is a UDT of the type MB_DataArea and is structured as follows:

Parameter	Data type	Meaning
data_ type	UInt	Identifier for the MODBUS data type that is mapped to this data area: • 0: Identifier for an empty field element or an unused data area. In this case, the values of db, start and length are irrelevant. • 1: Process image output (used with function codes 1, 5, and 15) • 2: Process image input (used with function code 2) • 3: Holding register (used with function codes 3, 6, and 16) • 4: Input register (used with function code 4) Note: If you have defined a data area for a MODBUS data type, the instruction MB_SERVER can no longer access this MODBUS data type directly. If the address of a MODBUS request for such a data type does not correspond to a defined data area, a value of W#16#8383 is returned in STATUS.
db	UInt	Number of the data block to which the MODBUS register or bits subsequently defined are mapped The DB number must be unique in the data areas. The same DB number must not be defined in multiple data areas. Inthe global DB "Attributes" Property page, you must deselect the "Only store in load memory" and "Optimized block access" check boxes. Data areas also start with the byte address 0 of the DB. Permitted values: 1 to 60999
start	UInt	First MODBUS address that is mapped to the data block starting from address 0.0 Permitted values: 0 to 65535
length	UInt	Number of bits (for the values 1 and 2 of data_type) or number of registers (for the values 3 and 4 of data_type) The MODBUS address areas of one and the same MODBUS data type must not overlap. Permitted values: 1 to 65535

Examples of the definition of data areas:

- First example: data_type = 3, db = 1, start = 10, length = 6

  The CPU maps the holding registers (data_type = 3) in data block 1 (db = 1), placing the Modbus address 10 (start = 10) at data word 0 and the last valid Modbus address 15 (length = 6) at data word 5.

- Second example: data_type = 2, db = 15, start = 1700, length = 112

  The CPU maps the inputs (data_type = 2) in data block 15 (db = 15), placing the Modbus address 1700 (start = 1700) at data word 0 and the last valid Modbus address 1811 (length = 112) at data word 111.

Condition codes

Table 13- 70 MB_SERVER execution condition codes [1]

STATUS (W#16#)	Response code to Modbus server (B#16#)	Modbus protocol errors
7001		MB_SERVER is waiting for a Modbus client to connect to the assigned TCP port. This code is returned on the first execution of a connect or disconnect operation.
7002		MB_SERVER is waiting for a Modbus client to connect to the assigned TCP port. This code is returned for any subsequent executions, while waiting for completion of a connect or disconnect operation.
7003		A disconnect operation has successfully completed (Only valid for one PLC scan).
8187		MB_HOLD_REG is not valid, could be pointing into an optimized DB, or is pointing to an area of less than 2 bytes.
818C		Pointer MB_HOLD_REG points to a non-optimized DB area (must be a non-optimized global DB area or M memory area) or Blocked process timeout exceeds the limit of 55 seconds. (S7-1200 specific)
8381	01	Function code not supported
8382	03	Data length error
8383	02	Data address error or access outside the bounds of the MB_HOLD_REG address area
8384	03	Data value error
8385	03	Data diagnostic code not supported (function code 08)

[1] In addition to the MB_SERVER errors listed above, errors can be returned from the underlying T block communication instructions (TCON, TDISCON, TSEND, and TRCV).

13.5.2.4 Modbus TCP examples

Example: MB_SERVER Multiple TCP connections

You can have multiple Modbus TCP server connections. To accomplish this, MB_SERVER must be independently executed for each connection. Each connection must use an independent instance DB, connection ID, and IP port. The S7-1200 allows only one connection per IP port.

For best performance, MB_SERVER should be executed every program cycle, for each connection.

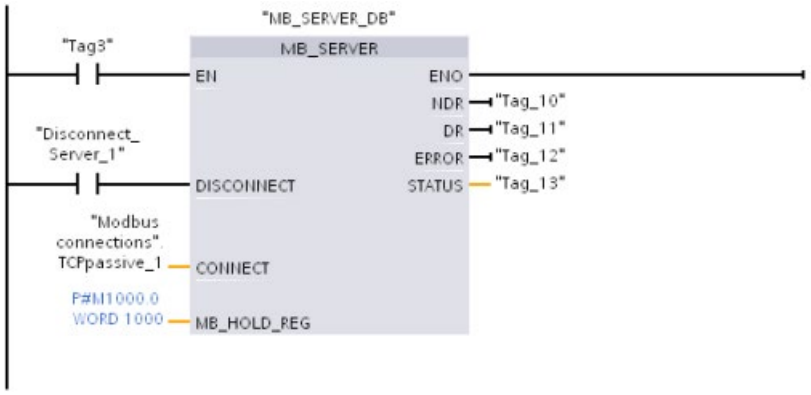
The CONNECT parameter uses system data type TCP_IP_v4.For the example, these data structures are in a DB named "Modbus connections". The "Modbus connections" DB contains two TCP_IP_v4 structures "TCPpassive_1" (for connection 1) and "TCP_passive_2" (for connection 2).The connection properties ID and LocalPort described in the network comments are data elements stored in the CONNECT data structure.

The TCP_IP_v4 CONNECT data also contains an IP address in the RemoteAddress ADDR array. IP address assignments within TCPpassive_1 and TCP_passive_2 do not affect the establishment of TCP server connections, but determine which Modbus TCP clients are allowed to communicate though the connections to each MB_SERVER. MB_SERVER passively listens for a modbus client message and compares the incoming message IP address with the IP address stored in the corresponding RemoteAddress ADDR array.

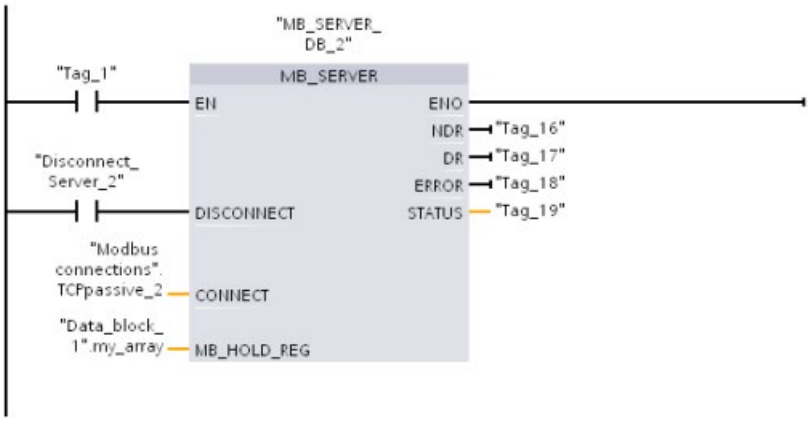
Three MB_SERVER IP address variations are possible for the two MB_SERVER instructions:

- **IP address = 0.0.0.0**
  Each MB_SERVER will respond to all Modbus TCP clients using any IP address.
- **IP address = Same IP address in TCPpassive_1 and TCPpassive_2**
  Both MB_SERVER connections only respond to Modbus clients originating from this IP address.
- **IP address = Different IP number in TCP_passive_1 and TCP_passive_2**
  Each MB_SERVER only responds to Modbus clients that originate from the IP address stored in their TCP_IP_v4 data.

Network 1: Connection #1, Instance DB = "MB_SERVER_DB", within "Modbus connections.TCPpassive_1" (ID = 1 and LocalPort = 502)



Network 2: Connection #2, Instance DB = "MB_SERVER_DB_1, within "Modbus connections.TCPpassive_2" (ID = 2 and LocalPort = 503)



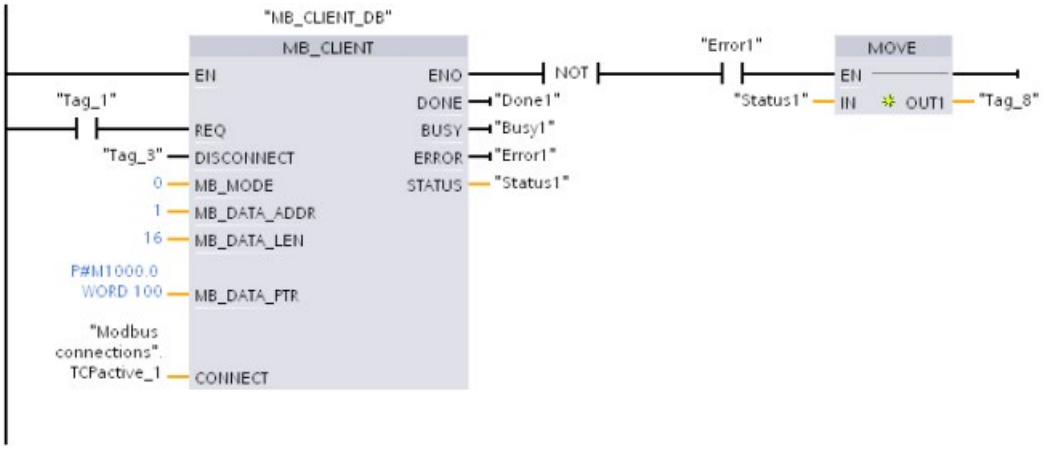
Example: MB_CLIENT 1: Multiple requests with common TCP connection

Multiple Modbus client requests can be sent over the same connection. To accomplish this, use the same instance DB, connection ID, and port number.

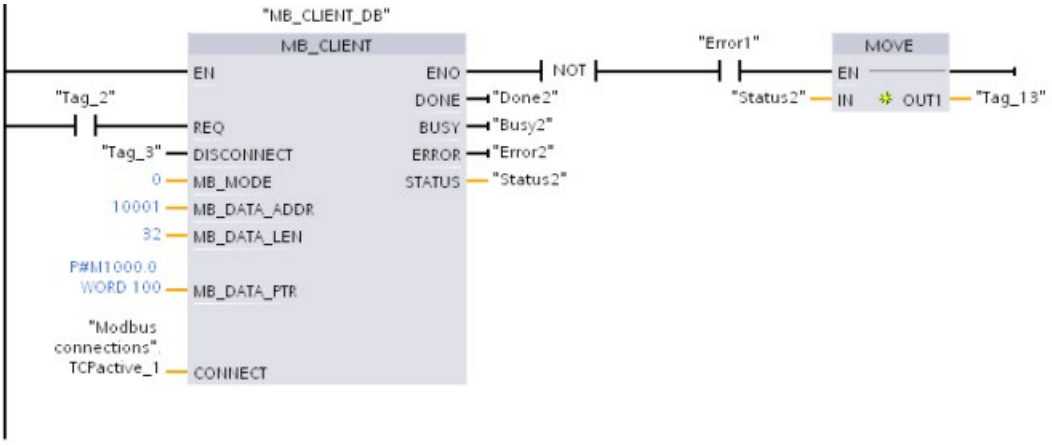
Because both MB_CLIENT boxes use the same CONNECT parameter TCON_IP_v4 data structure ("Modbus_connections".TCPactive_1), the connection ID, port number, and IP address are identical. The CONNECT IP address data assigns the IP address, of the target Modbus TCP server.

Only one MB_CLIENT can be active at any given time. Once a client completes its execution, the next client can begin execution. Your program logic is responsible for the execution sequence logic. The example shows both clients reading remote data from a single Modbus client and transferring the data to the Modbus client's CPU (M memory starting at M1000.0). A returned error is captured, which is optional.

Network 1: Modbus function 1 - Read 16 output bits from a Modbus TCP server with the IP address assigned in "Modbus connections".TCPactive_1.



Network 2: Modbus function 2 - Read 32 input bits from a Modbus TCP server with the IP address assigned in "Modbus connections".TCPactive_1.



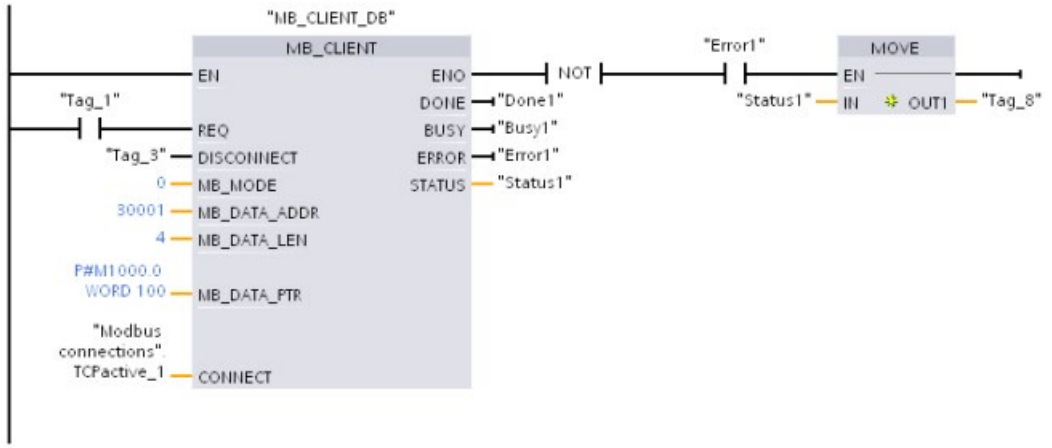
Example: MB_CLIENT 2: Multiple requests with different TCP connections

Modbus TCP client requests can be sent over different connections. To accomplish this, different instance DBs and connection IDs must be used.

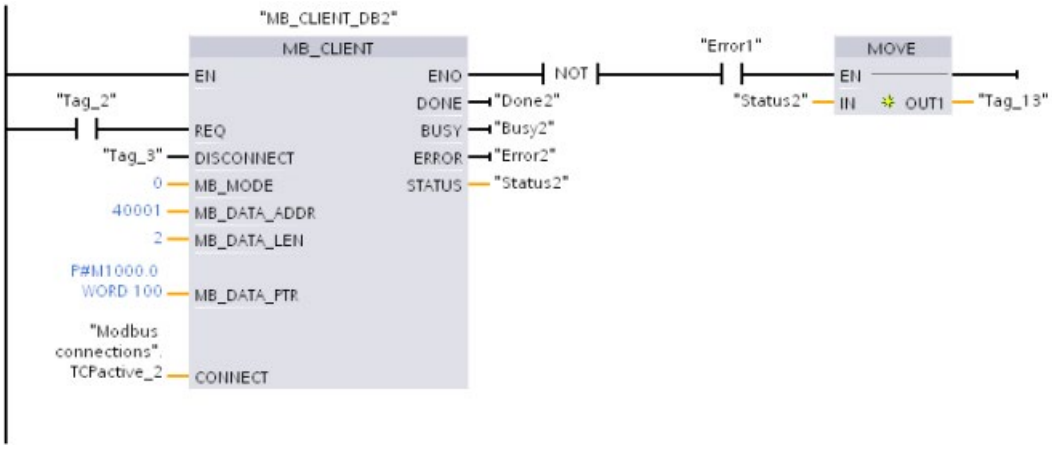
The RemotePort (IP port) number must be different, if the connections are established to the same Modbus server. If the connections are on different servers, there is no IP port number restriction.

The example shows two Modbus TCP clients transferring remote data from two different Modbus TCP servers to the same local CPU memory area, starting at address M1000.0. Also, a returned error is captured which is optional.

Network 1: Modbus function 4 - Read input process image words from a Modbus TCP server CONNECT parameter = "Modbus connections".TCPactive_1: Connection **ID** = 1, **RemoteAddress** = 192.168.2.241, **RemotePort** = 502



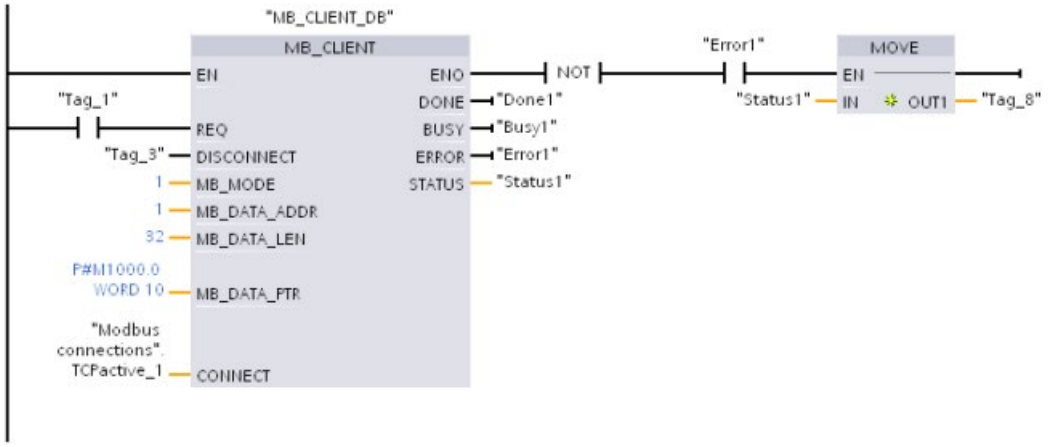
Network 2: Modbus function 3 - Read holding register words from a Modbus TCP server
CONNECT parameter = "Modbus connections".TCPactive_2: Connection **ID** = 2, **RemoteAddress** = 192.168.2.242, **RemotePort** = 502



Example: MB_CLIENT 3: Output image write request

This example shows a Modbus client request that transfers bit data from local CPU memory (starting at M1000.0) to a remote Modbus TCP server.

Network 1: Modbus function 15 - Write output bits in a Modbus server

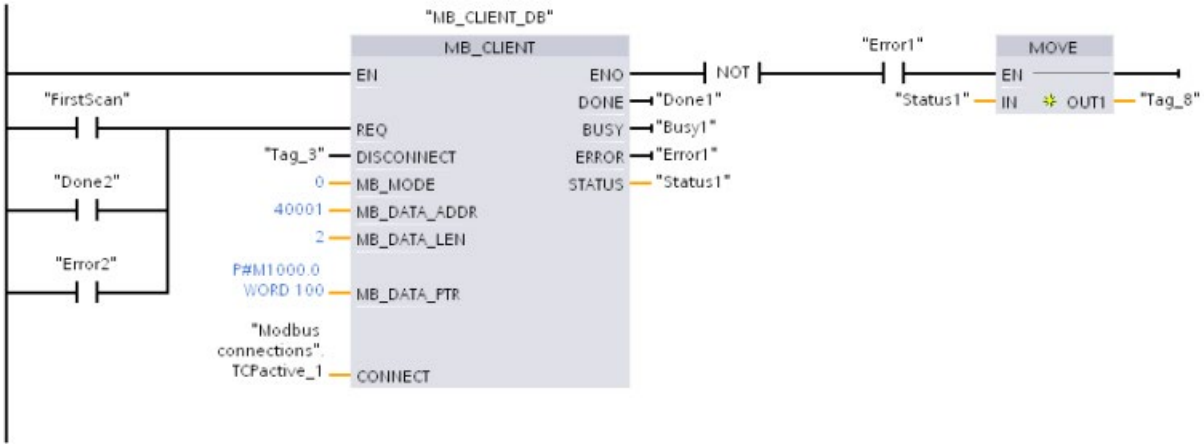


Example: MB_CLIENT 4: Coordinating multiple requests

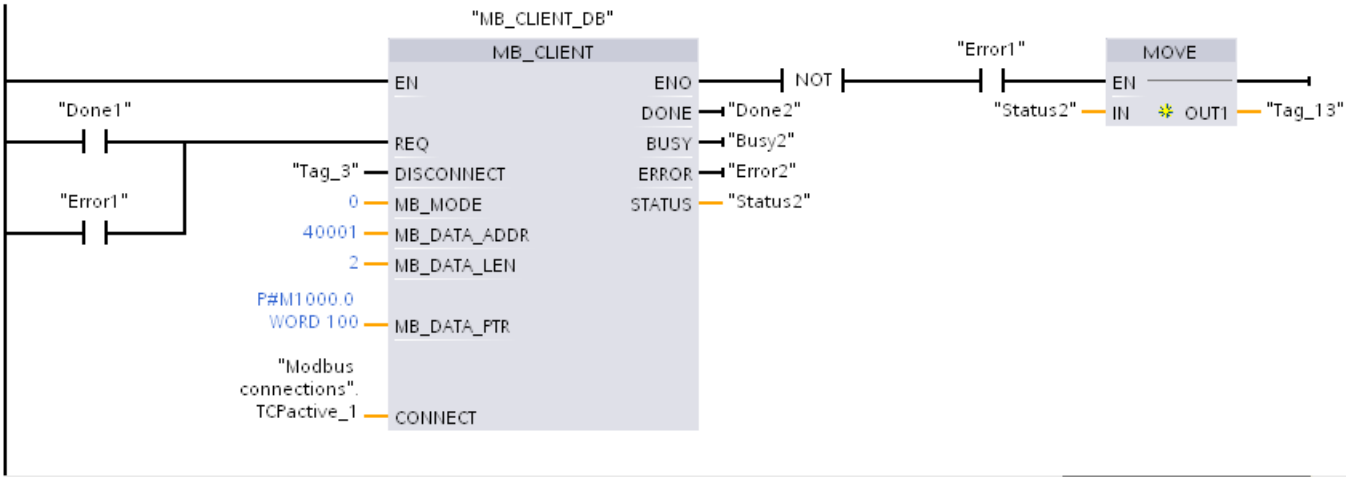
You must ensure that each individual Modbus TCP request finishes execution. The execution sequence must be controlled by your program logic. The example below shows how the outputs of the first and second client requests can control the execution sequence.

The example shows both clients using the same CONNECT connection data (used at different times). The clients transfer holding register data from the same remote Modbus TCP server to the same local CPU memory M address. Also, a returned error is captured which is optional.

Network 1: Modbus function 3 - Read Modbus TCP server holding register words



Network 2: Modbus function 3 - Read Modbus TCP server holding register words



13.5.3 Modbus RTU

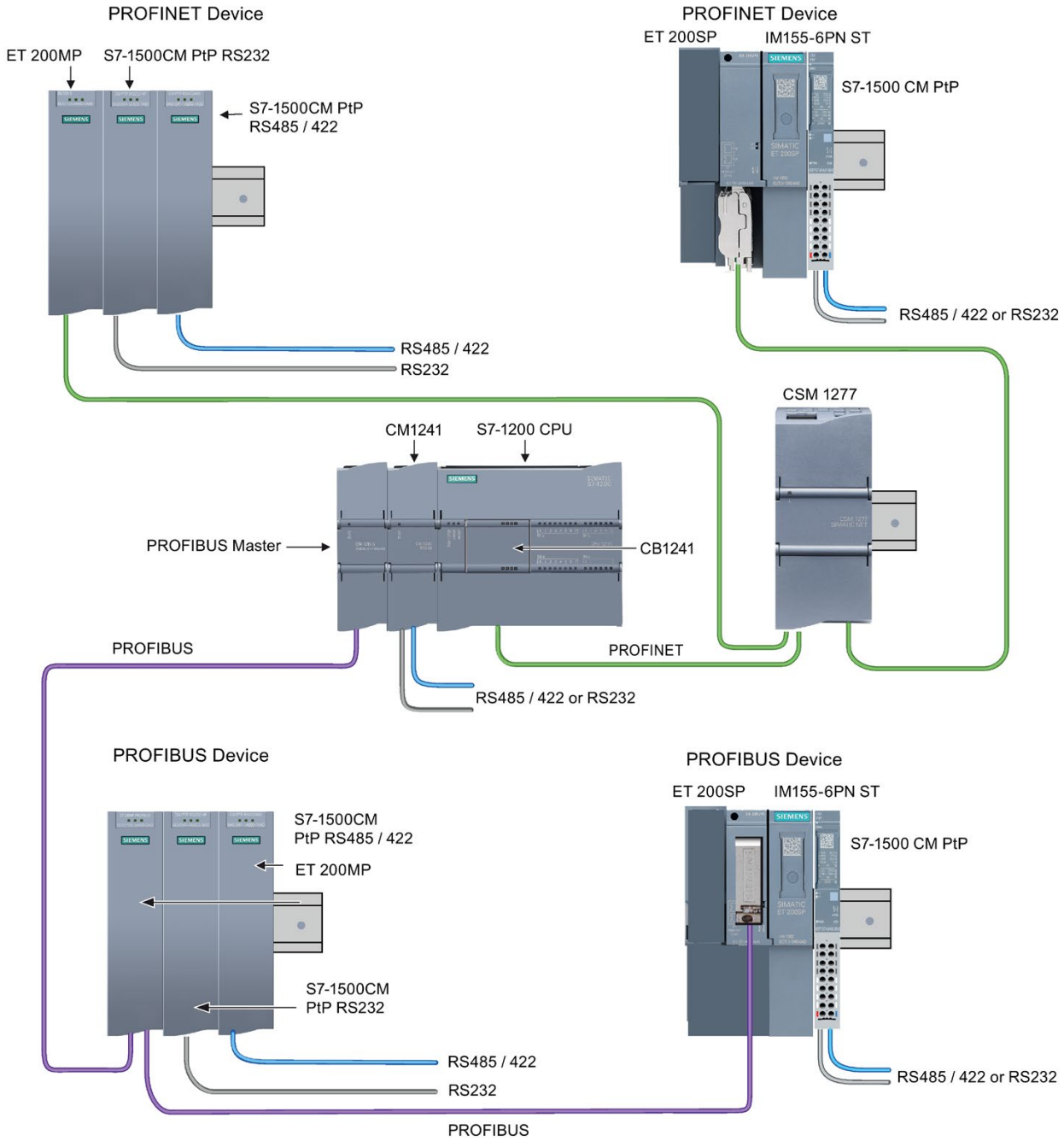
13.5.3.1 Overview

As of version V4.1 of the S7-1200 CPU together with STEP 7 V13 SP1, the CPU extends the capability of Modbus RTU to use a PROFINET or PROFIBUS distributed I/O rack to communicate to various devices (RFID readers, GPS device, and others):

- PROFINET (Page 786): You connect the Ethernet interface of the S7-1200 CPU to a PROFINET interface module. PtP communication modules in the rack with the interface module can then provide serial communications to the PtP devices.
- PROFIBUS (Page 947): You insert a PROFIBUS communication module in the left side of the rack with the S7-1200 CPU. You connect the PROFIBUS communication module to a rack containing a PROFIBUS interface module. PtP communication modules in the rack with the interface module can then provide serial communications to the PtP devices.

For this reason, the S7-1200 supports two sets of PtP instructions:

- Legacy Modbus RTU instructions (Page 1254): These Modbus RTU instructions existed prior to version V4.0 of the S7-1200 and only work with serial communications using a CM 1241 communication module or CB 1241 communication board.
- Modbus RTU instructions (Page 1178): These Modbus RTU instructions provide all of the functionality of the legacy instructions, plus the ability to connect to PROFINET and PROFIBUS distributed I/O. These Modbus RTU instructions allow you to configure the communications between the PtP communication modules in the distributed I/O rack and the PtP devices. S7-1200 CM 1241 modules must have a minimum firmware version of V2.1 to use these Modbus RTU instructions.



Note

With version V4.1 of the S7-1200, you can use the point-to-point instructions for all types of point-to-point communication: serial, serial over PROFINET, and serial over PROFIBUS. STEP 7 provides the legacy point-to-point instructions only to support existing programs. The legacy instructions still function, however, with V4.1 CPUs as well as V4.0 and earlier CPUs. You do not have to convert prior programs from one set of instructions to the other.

13.5.3.2 Selecting the version of the Modbus RTU instructions

There are three versions of the Modbus RTU instructions available in STEP 7:

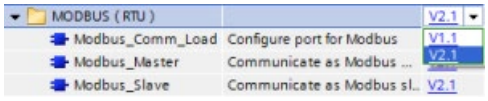
- Version 1.1: Compatible with V4.0 and later CPUs and V2.1 and later CMs
- Version 2.1: Compatible with V4.0 and later CPUs and V2.1 and later CMs
- Version 3.0: Compatible with V4.0 and later CPUs and V2.1 and later CMs

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

You cannot use both versions of the instructions with the same module, but two different modules can use different versions of the instructions. Do not use both 1.x and 2.y instruction versions in the same CPU program. Your program's Modbus RTU instructions must have the same major version number (**1**.x, **2**.y, or **V**.z). The individual instructions within a major version group may have different minor versions (1.**x**).



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



To change the version of the Modbus RTU instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a Modbus RTU instruction in your program, a new FB instance is created in the project tree. You can see new FB instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a Modbus RTU instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree Modbus RTU FB instance, right-click, select "Properties", and select the "Information" page to see the Modbus RTU instruction version number.

13.5.3.3 Maximum number of supported Modbus slaves

Modbus addressing supports a maximum of 247 slaves (slave numbers 1 through 247). Each Modbus network segment can have a maximum of 32 devices, based upon the loading and drive capabilities of the RS485 interface. When you reach the 32-device limit, you must use a repeater to expand to the next segment. You need seven repeaters to support the 247 slaves connected to one master for RS485.

Siemens repeaters work only with PROFIBUS; their function is to monitor PROFIBUS token passing. You cannot use Siemens repeaters with other protocols. Therefore, you require third party repeaters for Modbus.

Modbus timeouts are long by default; the use of multiple repeaters does not create a time-delay problem. The Modbus master does not care if a slave is slow to respond or if multiple repeaters delay the response.

13.5.3.4 Modbus RTU instructions

Modbus_Comm_Load (Configure SIPLUS I/O or port on the PtP module for Modbus RTU) instruction

Table 13- 71 Modbus_Comm_Load instruction

LAD / FBD	SCL	Description

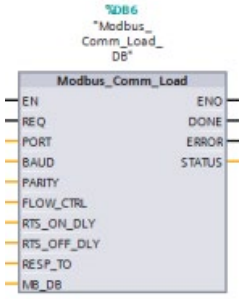
	`"Modbus_Comm_Load_DB"(`
	`REQ:=_bool_in,`
	`PORT:=_uint_in_,`
	`BAUD:=_udint_in_,`
	`PARITY:=_uint_in_,`
	`FLOW_CTRL:=_uint_in_,`
	`RTS_ON_DLY:=_uint_in_,`
	`RTS_OFF_DLY:=_uint_in_,`
	`RESP_TO:=_uint_in_,`
	`DONE=>_bool_out,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`MB_DB:=_fbtref_inout_);`
		The Modbus_Comm_Load instruction configures SIPLUS I/O or a PtP port for Modbus RTU protocol communications.
		Modbus RTU port hardware options: Install up to three CMs (RS485 or RS232), plus one CB (R4845).
		Modbus RTU SIPLUS I/O options: Install ET 200MP S7-1500CM PtP (RS485 / 422 or RS232) or ET 200SP S7-1500 CM PtP (RS485 / 422 or RS232)
		An instance data block is assigned automatically when you place the Modbus_Comm_Load instruction in your program.

Table 13- 72 Data types for the parameters

Parameter and type		Data type	Description
EN	IN	Bool	Note: The Modbus RTU, Modbus_Comm_Load instruction uses the RDREC and WRREC instructions to initialize the PTP module. However, the RDREC/WRREC instruction works asynchronously, which means that it takes several scans for the instruction to complete. Therefore, you must hold the EN parameter of the Modbus_Comm_Load instruction true until completion of the RDREC/WRREC instruction.
REQ	IN	Bool	A low to high (positive edge) signal starts the operation. (Version 2.0 only)
PORT	IN	Port	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table.
BAUD	IN	UDInt	Baud rate selection: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, all other values are invalid
PARITY	IN	UInt	Parity selection: • 0 – None • 1 – Odd • 2 – Even
FLOW_CTRL [1]	IN	UInt	Flow control selection: • 0 – (default) no flow control • 1 – Hardware flow control with RTS always ON (does not apply to RS485 ports) • 2 – Hardware flow control with RTS switched
RTS_ON_DLY [1]	IN	UInt	RTS ON delay selection: • 0 – (default) No delay from RTS active until the first character of the message is transmitted • 1 to 65535 – Delay in milliseconds from RTS active until the first character of the message is transmitted (does not apply to RS485 ports). RTS delays shall be applied independent of the FLOW_CTRL selection.
RTS_OFF_DLY [1]	IN	UInt	RTS OFF delay selection: • 0 – (default) No delay from the last character transmitted until RTS goes inactive • 1 to 65535 – Delay in milliseconds from the last character transmitted until RTS goes inactive (does not apply to RS485 ports). RTS delays shall be applied independent of the FLOW_CTRL selection.
RESP_TO [1]	IN	UInt	Response timeout: Time in milliseconds allowed by the Modbus_Master for the slave to respond. If the slave does not respond in this time period, the Modbus_Master will retry the request or terminate the request with an error when the specified number of retries has been sent. 5 ms to 65535 ms (default value = 1000 ms).

Parameter and type		Data type	Description
MB_DB	IN	Variant	A reference to the instance data block used by the Modbus_Master or Modbus_Slave instructions. After Modbus_Master or Modbus_Slave is placed in your program, the DB identifier appears in the parameter helper drop-list available at the MB_DB box connection.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error. (Version 2.0 only)
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code

[1] Optional parameters for Modbus_Comm_Load (V 2.x or later). Click the arrow at the bottom of a LAD/FBD box to expand the box and include these parameters.

Modbus_Comm_Load is executed to configure a port for the Modbus RTU protocol. Once a port is configured for the Modbus RTU protocol, it can only be used by either the Modbus_Master or Modbus_Slave instructions.

One execution of Modbus_Comm_Load must be used to configure each communication port that is used for Modbus communication. Assign a unique Modbus_Comm_Load instance DB for each port that you use. You can install up to three communication modules (RS232 or RS485) and one communication board (RS485) in the CPU. Call Modbus_Comm_Load from a startup OB and execute it one time or use the first scan system flag (Page 108) to initiate the call to execute it one time. Only execute Modbus_Comm_Load again if communication parameters like baud rate or parity must change.

If you use the Modbus library with a module in a distributed rack, the Modbus_Comm_Load instruction must be executed in a cyclical interrupt routine (for example, once per second or once every 10 seconds). If power is lost to the distributed rack or the module is pulled, upon restoration of module operation, only the HWConfig parameter set is sent to the PtP module. All requests initiated by the Modbus_Master timeout, and the Modbus_Slave goes silent (no response to any message). Cyclic execution of the Modbus_Comm_Load instruction resolves these issues.

An instance data block is assigned for Modbus_Master or Modbus_Slave when you place these instructions in your program. This instance data block is referenced when you specify the MB_DB parameter for the Modbus_Comm_Load instruction.

Modbus_Comm_Load instance data block (DB) tags

The following table shows the public static tags stored in the Modbus_Comm_Load instance DB that can be used in your program:

Table 13- 73 Modbus_Comm_Load instance DB static tags

Tag	Data type	Default	Description
ICHAR_GAP	Word	0	Maximum character delay time between characters. This parameter is specified in milliseconds and increases the anticipated period between the received characters. The corresponding number of bit times for this parameter is added to the Modbus default value of 35 bit times (3.5 character times).
RETRIES	Word	2	Number of retries that the master executes before the error code 0x80C8 for "No response" is returned.
EN_SUPPLY_VOLT	Bool	0	Enable diagnostics for missing supply voltage L+.
MODE	USInt	0	Operating mode Valid operating modes are as follows: • 0 = Full duplex (RS232) • 1 = Full duplex (RS422) four-wire mode (point-to-point) • 2 = Full duplex (RS422) four-wire mode (multipoint master, CM PtP (ET 200SP)) • 3 = Full duplex (RS422) four-wire mode (multipoint slave, CM PtP (ET 200SP)) • 4 = Half duplex (RS485) two-wire mode (See Note below.)
LINE_PRE	USInt	0	Receive line initial state Valid initial states are as follows: • 0 = "No" initial state (See Note below.) • 1 = signal R(A) = 5 V DC, signal R(B) = 0 V DC (break detection): Break detection is possible with this initial state. Can only be selected with: "Full duplex (RS422) four-wire mode (point-to-point connection)" and "Full duplex (RS422) four-wire mode (multipoint slave)". • 2 = signal R(A) = 0 V DC, signal R(B) = 5 V DC: This default setting corresponds to the idle state (no active send operation). No break detection is possible with this initial state.
BRK_DET	USInt	0	Break detection The following selections are valid: • 0 = break detection deactivated • 1 = break detection activated

Tag	Data type	Default	Description
EN_DIAG_ALARM	Bool	0	Activate diagnostics interrupt: • 0 = not activated • 1 = activated
STOP_BITS	USInt	1	Number of stop bits: • 1 = 1 stop bit • 2 = 2 stop bits • 0, 3 to 255 = reserved

Note

Required setting for the use of PROFIBUS cables with CM 1241 for RS485

Table 13- 74 Modbus_Comm_Load execution condition codes [1]

STATUS (W#16#)	Description
0000	No error
8180	Invalid port ID value (wrong port/hardware identifier for communication module)
8181	Invalid baud rate value
8182	Invalid parity value
8183	Invalid flow control value
8184	Invalid response timeout value (response timeout less than the 5 ms minimum)
8185	MB_DB parameter is not an instance data block of a Modbus_Master or Modbus_Slave instruction.

[1] In addition to the Modbus_Comm_Load errors listed above, errors can be returned from the underlying PtP communication instructions.

Modbus_Master (Communicate using SIPLUS I/O or the PtP port as Modbus RTU master) instruction

Table 13- 75 Modbus_Master instruction

LAD / FBD	SCL	Description

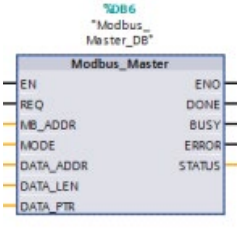
	`"Modbus_Master_DB"(`
	`REQ:=_bool_in_,`
	`MB_ADDR:=_uint_in_,`
	`MODE:=_usint_in_,`
	`DATA_ADDR:=_udint_in_,`
	`DATA_LEN:=_uint_in_,`
	`DONE=>_bool_out_,`
	`BUSY=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`DATA_PTR:=_variant_inout_);`
		The Modbus_Master instruction communicates as a Modbus master using a port that was configured by a previous execution of the Modbus_Comm_Load instruction. An instance data block is assigned automatically when you place the Modbus_Master instruction in your program. This Modbus_Master instance data block is used when you specify the MB_DB parameter for the Modbus_Comm_Load instruction.

Table 13- 76 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	0=No request 1= Request to transmit data to Modbus slave
MB_ADDR	IN	V1.0: USInt V2.0: UInt	Modbus RTU station address: Standard addressing range (1 to 247) Extended addressing range (1 to 65535) The value of 0 is reserved for broadcasting a message to all Modbus slaves. Modbus function codes 05, 06, 15 and 16 are the only function codes supported for broadcast.
MODE	IN	USInt	Mode Selection: Specifies the type of request (read, write, or diagnostic). See the Modbus functions table below for details.
DATA_ADDR	IN	UDInt	Starting Address in the slave: Specifies the starting address of the data to be accessed in the Modbus slave. See the Modbus functions table below for valid addresses.
DATA_LEN	IN	UInt	Data Length: Specifies the number of bits or words to be accessed in this request. See the Modbus functions table below for valid lengths.
DATA_PTR	IN_OUT	Variant	Data Pointer: Points to the M or DB address (non-optimized DB type) for the data being written or read.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error.
BUSY	OUT	Bool	• 0 – No Modbus_Master operation in progress • 1 – Modbus_Master operation in progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code

Modbus_Master communication rules

- Modbus_Comm_Load must be executed to configure a port before a Modbus_Master instruction can communicate with that port.
- If a port is to be used to initiate Modbus master requests, that port should not be used by a Modbus_Slave. One or more instances of Modbus_Master execution can be used with that port, but all Modbus_Master execution must use the same Modbus_Master instance DB for that port.
- The Modbus instructions do not use communication interrupt events to control the communication process. Your program must poll the Modbus_Master instruction for transmit and receive complete conditions.
- It is recommended that you call all Modbus_Master execution for a given port from a program cycle OB. Modbus_Master instructions may execute in only one of the program cycle or cyclic/time delay execution levels. They must not execute in both execution priority levels. Pre-emption of a Modbus_Master instruction by another Modbus_Master instruction in a higher priority execution priority level will result in improper operation. Modbus_Master instructions must not execute in the startup, diagnostic or time error execution priority levels.
- Once a Modbus_Master instruction initiates a transmission, this instance must be continually executed with the EN input enabled until a DONE=1 state or ERROR=1 state is returned. A particular Modbus_Master instance is considered active until one of these two events occurs. While the original instance is active, any call to any other instance with the REQ input enabled will result in an error. If the continuous execution of the original instance stops, the request state remains active for a period of time specified by the static variable "Blocked_Proc_Timeout". Once this period of time expires, the next Modbus_Master instruction called with an enabled REQ input will become the active instance. This prevents a single Modbus_Master instance from monopolizing or locking access to a port. If the original active instance is not enabled within the period of time specified by the static variable "Blocked_Proc_Timeout", then the next execution by this instance (with REQ not set) will clear the active state. If (REQ is set), then this execution initiates a new Modbus_Master request as if no other instance was active.

REQ parameter

0 = No request; 1 = Request to transmit data to Modbus Slave

You may control this input either through the use of a level or edge triggered contact. Whenever this input is enabled, a state machine is started to ensure that no other Modbus_Master using the same instance DB is allowed to issue a request, until the current request is completed. All other input states are captured and held internally for the current request, until the response is received or an error detected.

If the same instance of Modbus_Master is executed again with REQ input = 1 before the completion of the current request, then no subsequent transmissions are made. However, when the request is completed, a new request is issued whenever a Modbus_Master is executed again with REQ input = 1.

DATA_ADDR and MODE parameters select the Modbus function type

DATA_ADDR (starting Modbus address in the slave): Specifies the starting address of the data to be accessed in the Modbus slave.

The Modbus_Master instruction uses a MODE input rather than a Function Code input. The combination of MODE and Modbus address determine the Function Code that is used in the actual Modbus message. The following table shows the correspondence between parameter MODE, Modbus function code, and Modbus address range.

Table 13- 77 Modbus functions

MODE	Modbus function	Data length	Operation and data	Modbus address
0	01	1 to 2000 1 to 1992 [1]	Read output bits: 1 to (1992 or 2000) bits per request	1 to 9999
0	02	1 to 2000 1 to 1992 [1]	Read input bits: 1 to (1992 or 2000) bits per request	10001 to 19999
0	03	1 to 125 1 to 124 [1]	Read Holding registers: 1 to (124 or 125) words per request	40001 to 49999 or 400001 to 465535
0	04	1 to 125 1 to 124 [1]	Read input words: 1 to (124 or 125) words per request	30001 to 39999
104	04	1 to 125 1 to 124 1	Read input words: 1 to (124 or 125) words per request	00000 to 65535
1	05	1	Write one output bit: One bit per request	1 to 9999
1	06	1	Write one holding register: 1 word per request	40001 to 49999 or 400001 to 465535
1	15	2 to 1968 2 to 1960 [1]	Write multiple output bits: 2 to (1960 or 1968) bits per request	1 to 9999
1	16	2 to 123 2 to 122 [1]	Write multiple holding registers: 2 to (122 or 123) words per request	40001 to 49999 or 400001 to 465535
2	15	1 to 1968 2 to 1960 [1]	Write one or more output bits: 1 to (1960 or 1968) bits per request	1 to 9999
2	16	1 to 123 1 to 122 [1]	Write one or more holding registers: 1 to (122 or 123) words per request	40001 to 49999 or 400001 to 465535
11	11	0	Read the slave communication status word and event counter. The status word indicates busy (0 – not busy, 0xFFFF - busy). The event counter is incremented for each successful completion of a message. Both the DATA_ADDR and DATA_LEN operands of the Modbus_Master instruction are ignored for this function.	
80	08	1	Check slave status using data diagnostic code 0x0000 (Loopback test – slave echoes the request) 1 word per request	

MODE	Modbus function	Data length	Operation and data	Modbus address
81	08	1	Reset slave event counter using data diagnostic code 0x000A 1 word per request	
3 to 10, 12 to 79, 82 to 255			Reserved	

[1] For "Extended Addressing" mode the maximum data lengths are reduced by 1 byte or 1 word depending upon the data type used by the function.

DATA_PTR parameter

The DATA_PTR parameter points to the DB or M address that is written to or read from. If you use a data block, then you must create a global data block that provides data storage for reads and writes to Modbus slaves.

Note

The DATA_PTR data block type must allow direct addressing

The data block must allow both direct (absolute) and symbolic addressing. When you create the data block the "Standard" access attribute must be selected.

As of Modbus_Master instruction version V4.0 or later, you can enable the data block attribute "Optimized block access". You can only use a single element, or an array of elements, in optimized memory with the following data types: Bool, Byte, Char, Word, Int, DWord, Dint, Real, USInt, UInt, UDInt, SInt, or WChar.

Data block structures for the DATA_PTR parameter

- These data types are valid for **word reads** of Modbus addresses 30001 to 39999, 40001 to 49999, and 400001 to 465536 and also for **word writes** to Modbus addresses 40001 to 49999 and 400001 to 465536.
  - Standard array of WORD, UINT, or INT data types
  - Named WORD, UINT, or INT structure where each element has a unique name and 16 bit data type.
  - Named complex structure where each element has a unique name and a 16 or 32 bit data type.
- For **bit reads** and writes of Modbus addresses 00001 to 09999 and bit reads of 10001 to 19999.
  - Standard array of Boolean data types.
  - Named Boolean structure of uniquely named Boolean variables.

- Although not required, it is recommended that each Modbus_Master instruction have its own separate memory area. The reason for this recommendation is that there is a greater possibility of data corruption if multiple Modbus_Master instructions are reading and writing to the same memory area.
- There is no requirement that the DATA_PTR data areas be in the same global data block. You can create one data block with multiple areas for Modbus reads, one data block for Modbus writes, or one data block for each slave station.

Modbus_Master instruction data block (DB) variables

The following table shows the public static tags stored in the Modbus_Master instance DB that you can use in your program:

Table 13- 78 Modbus_Master instance DB static variables

Tag	Data type	Default	Description
Blocked_Proc_Timeout	Real	3.0	Duration (in seconds) for which to wait for a blocked Modbus_Master instance before this instance is removed as ACTIVE. This can occur, for example, if a Modbus_Master request is issued and the program then stops to call the Modbus_Master function before it has completely finished the request. The time value must be greater than 0 and less than 55 seconds, or an error occurs.
Extended_Addressing	Bool	FALSE	Configures single or double-byte slave station addressing: • FALSE = One-byte address; 0 to 247 • TRUE = Two-byte address (corresponds to extended addressing); 0 to 65535
MB_DB	MB_BASE	-	The MB_DB parameter of the Modbus_Comm_Load instruction must be connected to the MB_DB parameter of the Modbus_Master instruction.

Your program can write values to the Blocked_Proc_Timeout and Extended_Addressing variables to control the Modbus_Master operations. See the Modbus_Slave topic description of HR_Start_Offset (Page 1190) and Extended_Addressing (Page 1190) for an example of how to use these variables in the program editor and details about Modbus extended addressing.

Condition codes

Table 13- 79 Modbus_Master execution condition codes (communication and configuration errors) [1]

STATUS (W#16#)	Description
0000	No error
80C8	Slave timeout. The specified slave did not respond in the specified time. Please check the baud rate, parity, and wiring of the slave device. This error is only reported after any configured retries have been attempted.
80C9	The Modbus_Master instruction has timed out for one of the following reasons: • The instruction is waiting for a response from the module that is being used for communications. • The Blocked_Proc_Timeout value is set too small. This error is reported if a PROFIBUS or PROFINET distributed I/O device returns from one of the following: • An interruption to power or communication • A communication module pull/plug event In these instances, the hardware configuration from the PLC is reloaded, and Modbus_Comm_Load must be executed again to properly configure the communication module.
80D1	The receiver issued a flow control request to suspend an active transmission and never re-enabled the transmission during the specified wait time. This error is also generated during hardware flow control when the receiver does not assert CTS within the specified wait time.
80D2	The transmit request was aborted because no DSR signal is received from the DCE.
80E0	The message was terminated because the receive buffer is full.
80E1	The message was terminated as a result of a parity error.
80E2	The message was terminated as a result of a framing error.
80E3	The message was terminated as a result of an overrun error.
80E4	The message was terminated as a result of the specified length exceeding the total buffer size.
8180	Invalid port ID value or error with Modbus_Comm_Load instruction
8186	Invalid Modbus station address
8188	Invalid Mode specified for broadcast request
8189	Invalid Data Address value
818A	Invalid Data Length value
818B	Invalid pointer to the local data source/destination: Size not correct
818C	Invalid pointer for DATA_PTR or invalid Blocked_Proc_Timeout. The data area must be one of the following: • Classic DB • Array of elemental data types in a symbolic or retentive DB • M memory
8200	Port is busy processing a transmit request.

STATUS (W#16#)	Description
8280	Negative acknowledgement when reading module. Check the input at the PORT parameter. This can be caused by the loss of a PROFIBUS or PROFINET distributed I/O module, either by a station power or communication loss or a module pull.
8281	Negative acknowledgement when writing to module. Check the input at the PORT parameter. This can be caused by the loss of a PROFIBUS or PROFINET distributed I/O module, either by a station power or communication loss or a module pull.

Table 13- 80 Modbus_Master execution condition codes (Modbus protocol errors) [1]

STATUS (W#16#)	Response code from slave	Modbus protocol errors
8380	-	CRC error
8381	01	Function code not supported
8382	03	Data length error
8383	02	Data address error or address outside the valid range of the DATA_PTR area
8384	Greater than 03	Data value error
8385	03	Data diagnostic code value not supported (function code 08)
8386	-	Function code in the response does not match the code in the request.
8387	-	Wrong slave responded
8388	-	The slave response to a write request is incorrect. The write request returned by the slave does not match what the master actually sent.

[1] In addition to the Modbus_Master errors listed above, errors can be returned from the underlying PtP communication instructions.

Note

Setting the maximum record length for Profibus communication

When using a CM1243-5 Profibus Master module to control an ET 200SP or ET 200MP Profibus device that uses an RS232, RS422, or RS485 point-to-point module, you need to explicitly set the "max_record_len" data block tag to 240 as defined below:

Set "max_record_len" in the Send_P2P section of the instance DB (for example, "Modbus_Master_DB".Send_P2P.max_record_len) to 240 after running Modbus_Comm_Load.

Explicitly assigning max_record_len is only necessary with Profibus communication; Profinet communication already uses a valid max_record_len value.

Modbus_Slave (Communicate using SIPLUS I/O or the PtP port as Modbus RTU slave) instruction

Table 13- 81 Modbus_Slave instruction

LAD / FBD	SCL	Description

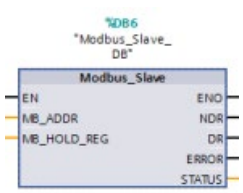
	`"Modbus_Slave_DB"(`
	`MB_ADDR:=_uint_in_,`
	`NDR=>_bool_out_,`
	`DR=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`MB_HOLD_REG:=_variant_inout_);`
		The Modbus_Slave instruction allows your program to communicate in one of two ways:
		• As a Modbus RTU slave through a PtP port on the CM (RS485 or RS232) and CB (RS485)
		• As a Modbus RTU slave through Modbus RTU SIPLUS I/O options:
		– Install ET 200MP S7-1500CM PtP (RS485 / 422 or RS232).
		– Install ET 200SP S7-1500 CM PtP (RS485 / 422 or RS232).
		When a remote Modbus RTU master issues a request, your user program responds to the request by Modbus_Slave execution. STEP 7 automatically creates an instance DB when you insert the instruction. Use this Modbus_Slave_DB name when you specify the MB_DB parameter for the Modbus_Comm_Load instruction.

Table 13- 82 Data types for the parameters

Parameter and type		Data type	Description
MB_ADDR	IN	V1.0: USInt V2.0: UInt	The station address of the Modbus slave: Standard addressing range (1 to 247) Extended addressing range (0 to 65535)
MB_HOLD_REG	IN_OUT	Variant	Pointer to the Modbus Holding Register DB: The Modbus holding register can be M memory or a data block.
NDR	OUT	Bool	New Data Ready: • 0 – No new data • 1 – Indicates that new data has been written by the Modbus master
DR	OUT	Bool	Data Read: • 0 – No data read • 1 – Indicates that data has been read by the Modbus master
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. If execution is terminated with an error, then the error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution error code

Modbus communication function codes (1, 2, 4, 5, and 15) can read and write bits and words directly in the input process image and output process image of the CPU. For these function codes, the MB_HOLD_REG parameter must be defined as a data type larger than a byte. The following table shows the example mapping of Modbus addresses to the process image in the CPU.

Table 13- 83 Mapping of Modbus addresses to the process image

Modbus functions						S7-1200	
Codes	Function	Data area	Address range			Data area	CPU address
01	Read bits	Output	1	to	8192	Output Process Image	Q0.0 to Q1023.7
02	Read bits	Input	10001	to	18192	Input Process Image	I0.0 to I1023.7
04	Read words	Input	30001	to	30512	Input Process Image	IW0 to IW1022
05	Write bit	Output	1	to	8192	Output Process Image	Q0.0 to Q1023.7
15	Write bits	Output	1	to	8192	Output Process Image	Q0.0 to Q1023.7

Modbus communication function codes (3, 6, 16) use a Modbus holding register which can be an M memory address range or a data block. The type of holding register is specified by the MB_HOLD_REG parameter on the Modbus_Slave instruction.

Note

MB_HOLD_REG data block type

A Modbus holding register data block must allow both direct (absolute) and symbolic addressing. When you create the data block the "Standard" access attribute must be selected.

As of Modbus_Slave instruction version V4.0 or later, you can enable the data block attribute "Optimized block access". You can only use a single element, or an array of elements, in optimized memory with the following data types: Bool, Byte, Char, Word, Int, DWord, Dint, Real, USInt, UInt, UDInt, SInt, or WChar.

The following table shows examples of Modbus address to holding register mapping that is used for Modbus function codes 03 (read words), 06 (write word), and 16 (write words). The actual upper limit of DB addresses is determined by the maximum work memory limit and M memory limit, for each CPU model.

Table 13- 84 Mapping of Modbus addresses to CPU memory

Modbus master address	MB_HOLD_REG parameter examples				
	MW100	DB10.DBw0	MW120	DB10.DBW50	"Recipe".ingredient
40001	MW100	DB10.DBW0	MW120	DB10.DBW50	"Recipe".ingredient[1]
40002	MW102	DB10.DBW2	MW122	DB10.DBW52	"Recipe".ingredient[2]
40003	MW104	DB10.DBW4	MW124	DB10.DBW54	"Recipe".ingredient[3]
40004	MW106	DB10.DBW6	MW126	DB10.DBW56	"Recipe".ingredient[4]
40005	MW108	DB10.DBW8	MW128	DB10.DBW58	"Recipe".ingredient[5]

Table 13- 85 Diagnostic functions

S7-1200 Modbus_Slave Modbus diagnostic functions		
Codes	Sub-function	Description
08	0000H	Return query data echo test: • Prior to STEP 7 V15.1, the Modbus_Slave echos back to a Modbus master a word of data that is received. • As of STEP 7 V15.1 or later, the Modbus_Slave instruction V4.1 or later echos back one or more words of data that is received.
08	000AH	Clear communication event counter: The Modbus_Slave will clear out the communication event counter that is used for Modbus function 11.
11		Get communication event counter: The Modbus_Slave uses an internal communication event counter for recording the number of successful Modbus read and write requests that are sent to the Modbus_Slave. The counter does not increment on any Function 8, Function 11, or broadcast requests. It is also not incremented on any requests that result in a communication error (for example, parity or CRC errors).

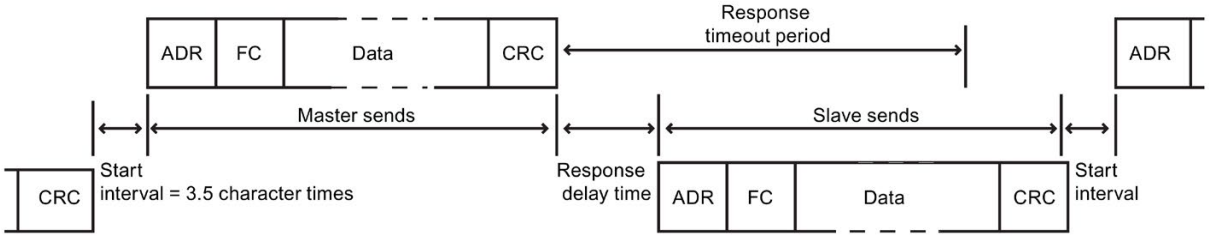
The Modbus_Slave instruction supports broadcast write requests from any Modbus master as long as the request is for accessing valid addresses. Modbus_Slave will produce error code "0x8188" for function codes not supported in broadcast.

Modbus_Slave communication rules

- Modbus_Comm_Load must be executed to configure a port, before a Modbus_Slave instruction can communicate through that port.
- If a port is to respond as a slave to a Modbus_Master, then do not program that port with the Modbus_Master instruction.
- Only one instance of Modbus_Slave can be used with a given port, otherwise erratic behavior may occur.
- The Modbus instructions do not use communication interrupt events to control the communication process. Your program must control the communication process by polling the Modbus_Slave instruction for transmit and receive complete conditions.
- The Modbus_Slaveinstruction must execute periodically at a rate that allows it to make a timely response to incoming requests from a Modbus_Master. It is recommended that you execute Modbus_Slave every scan from a program cycle OB. Executing Modbus_Slave from a cyclic interrupt OB is possible, but is not recommended because of the potential for excessive time delays in the interrupt routine to temporarily block the execution of other interrupt routines.

Modbus signal timing

Modbus_Slave must be executed periodically to receive each request from the Modbus_Master and then respond as required. The frequency of execution for Modbus_Slave is dependent upon the response timeout period of the Modbus_Master. This is illustrated in the following diagram.



The response timeout period RESP_TO is the amount of time a Modbus_Master waits for the start of a response from a Modbus_Slave. This time period is not defined by the Modbus protocol, but is a parameter of each Modbus_Master. The frequency of execution (the time between one execution and the next execution) of Modbus_Slave must be based upon the particular parameters of your Modbus_Master. At a minimum, you should execute Modbus_Slave twice within the response timeout period of the Modbus_Master.

Modbus_Slave instruction data block (DB) variables

The following table shows the public static tags stored in the Modbus_Slave instance DB that you can use in your program:

Table 13- 86 Modbus_Slave instance DB static variables

Variable	Data type	Default	Description
HR_Start_Offset	Word	0	Assigns the starting address of the Modbus holding register (default = 0)
Extended_Addressing	Bool	FALSE	Configures single or double-byte slave addressing: • FALSE = single byte address • TRUE = double-byte address
Request_Count	Word	0	Total of all requests received by this slave
Slave_Message_Count	Word	0	Number of requests received for this specific slave
Bad_CRC_Count	Word	0	Number of requests received that have a CRC error
Broadcast_Count	Word	0	Number of broadcast requests received
Exception_Count	Word	0	Modbus-specific errors that require an acknowledgement with a returned exception to the master
Success_Count	Word	0	Number of requests received for this specific slave that have no protocol errors
MB_DB	MB_BASE	-	The MB_DB parameter of the Modbus_Comm_Load instruction must be connected to the MB_DB parameter of the Modbus_Slave instruction.
QB_Start	UInt	0	The starting address of the output bytes to which the CPU can write (QB0 to QB65535)
QB_Count	UInt	65535	The number of bytes to which a remote device can write. If QB_Count = 0, a remote device cannot write to the outputs. Example: To allow only QB10 through QB17 to be writable, QB_Start = 10 and QB_Count = 8.
QB_Read_Start	UInt	0	The starting address of the output bytes to which the CPU can read (QB0 to QB65535)
QB_Read_Count	UInt	65535	The number of output bytes from which a remote device can read. If QB_Count = 0, a remote device cannot read from the outputs. Example: To allow only QB10 through QB17 to be readable, QB_Start = 10 and QB_Count = 8.
IB_Read_Start	UInt	0	The starting address of the input bytes to which the CPU can read (IB0 to IB65535)
IB_Read_Count	UInt	65535	The number of input bytes from which a remote device can read. If IB_Count = 0, a remote device cannot read from the inputs. Example: To allow only IB10 through IB17 to be readable, IB_Start = 10 and IB_Count = 8.

Your program can write values to the HR_Start_Offset and Extended_Addressing tags and control the Modbus slave operations. You can read the other tags to monitor the Modbus status.

Version requirements for Modbus_Slave instruction data block (DB) variables availability are as follows:

Table 13- 87 Modbus_Slave instruction data block (DB) variables availability version requirements: Instruction, TIA Portal, and S7-1200 CPU

Modbus_Slave instruction version	TIA Portal version	S7-1200 CPU firmware (FW) version	Data block variables
3.0	V14 SP1	CPU FW V4.0 or later	QB_Start
			QB_Count
4.0	V15.1	CPU FW V4.2 or later	QB_Start
			QB_Count
			QB_Read_Start
			QB_Read_Count
			IB_Read_Start
			IB_Read_Count

HR_Start_Offset

Modbus holding register addresses begin at 40001 or 400001. These addresses correspond to the beginning PLC memory address of the holding register. However, you can configure the "HR_Start_Offset" variable to start the beginning Modbus holding register address at another value instead of 40001 or 400001.

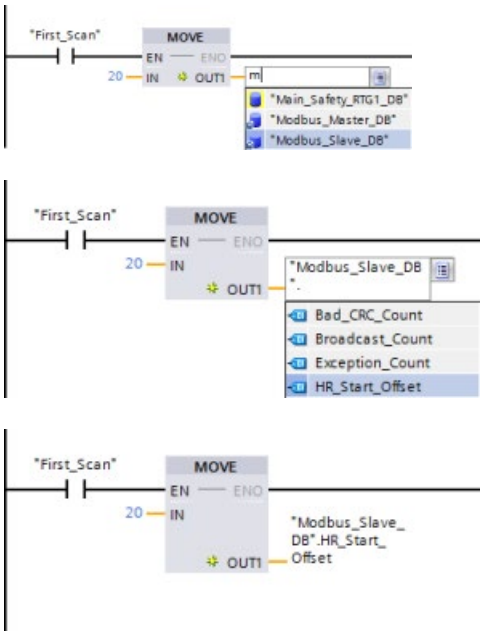
For example, if the holding register is configured to start at MW100 and is 100 words long. An offset of 20 specifies a beginning holding register address of 40021 instead of 40001. Any address below 40021 and above 400119 will result in an addressing error.

Table 13- 88 Example of Modbus holding register addressing

HR_Start_Offset	Address	Minimum	Maximum
0	Modbus address (Word)	40001	40099
	S7-1200 address	MW100	MW298
20	Modbus address (Word)	40021	40119
	S7-1200 address	MW100	MW298

HR_Start_Offset is a word value that specifies the starting address of the Modbus holding register and is stored in the Modbus_Slave instance data block. You can set this public static variable value by using the parameter helper drop-list, after Modbus_Slave is placed in your program.

For example, after Modbus_Slave is placed in a LAD network, you can go to a previous network and assign the HR_Start_Offset value. The value must be assigned prior to execution of Modbus_Slave.



Entering a Modbus slave variable using the default DB name:

1. Set the cursor in the parameter field and type an m character.
2. Select "Modbus_Slave_DB" from the drop-list.
3. Set the cursor at the right side of the DB name (after the quote character) and enter a period character.
4. Select "Modbus_Slave_DB.HR_Start_Offset" from the drop list.

Extended_Addressing

The Extended_Addressing variable is accessed in a similar way as the HR_Start_Offset reference discussed above except that the Extended_Addressing variable is a Boolean value. The Boolean value must be written by an output coil and not a move box.

Modbus slave addressing can be configured to be either a single byte (which is the Modbus standard) or double byte. Extended addressing is used to address more than 247 devices within a single network. Selecting extended addressing allows you to address a maximum of 64000 addresses. A Modbus function 1 frame is shown below as an example.

Table 13- 89 Single-byte slave address (byte 0)

Function 1	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	
Request	Slave addr.	F code	Start address		Length of coils		
Valid Response	Slave addr.	F code	Length	Coil data			
Error response	Slave addr.	0x81	E code				

Table 13- 90 Double-byte slave address (byte 0 and byte 1)

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Request	Slave address		F code	Start address		Length of coils	
Valid Response	Slave address		F code	Length	Coil data		
Error response	Slave address		0x81	E code			

Access to data areas in data blocks (DB) instead of direct access to Modbus addresses

As of version V4.0 of the Modbus_Slave instruction and firmware (FW) version V4.2 of the S7-1200 CPU, you can access data areas in DBs instead of directly accessing process images and holding registers. In order to do this, in the global DB "Attributes" Property page, you must deselect the "Only store in load memory" and "Optimized block access" check boxes.

If a Modbus request arrives and you did not define a data area for the Modbus data type of the corresponding function code, the CPU treats the request as in previous instruction versions: You access process images and holding registers directly.

If you have defined a data area for the Modbus data type of the function code, the Modbus_Slave instruction reads from or writes to that data area. Whether it reads or writes depends on the job type.

For one individual Modbus request, you can only read from or write to one data area. If, for example, you want to read holding registers that extend over multiple data areas, you require multiple Modbus requests.

These are the rules for defining data areas:

- You can define up to eight data areas in different DBs; each DB must only contain one data area. An individual MODBUS request can only read from precisely one data area or write to precisely one data area. Each data area corresponds to one MODBUS address area. You define the data areas in the "Data_Area_Array" static tag of the instance DB.
- If you want to use less than eight data areas, you must place the required data areas one behind the other, without any gaps. The first blank entry in the data areas ends the data area search during processing. If, for example, you define the field elements 1, 2, 4, and 5, the "Data_Area_Array" only recognizes field elements 1 and 2. as field element 3 is empty.
- The Data_Area_Array field consists of eight elements: Data_Area_Array[1] to Data_Area_Array[8]
- Each field element Data_Area_Array[x], 1 <= x <= 8, is a UDT of the type MB_DataArea and is structured as follows:

Parameter	Data type	Meaning
data_ type	UInt	Identifier for the MODBUS data type that is mapped to this data area: • 0: Identifier for an empty field element or an unused data area. In this case, the values of db, start and length are irrelevant. • 1: Process image output (used with function codes 1, 5, and 15) • 2: Process image input (used with function code 2) • 3: Holding register (used with function codes 3, 6, and 16) • 4: Input register (used with function code 4) Note: If you have defined a data area for a MODBUS data type, the instruction Modbus_Slave can no longer access this MODBUS data type directly. If the address of a MODBUS request for such a data type does not correspond to a defined data area, a value of W#16#8383 is returned in STATUS.
db	UInt	Number of the data block to which the MODBUS register or bits subsequently defined are mapped The DB number must be unique in the data areas. The same DB number must not be defined in multiple data areas. Inthe global DB "Attributes" Property page, you must deselect the "Only store in load memory" and "Optimized block access" check boxes. Data areas also start with the byte address 0 of the DB. Permitted values: 1 to 60999
start	UInt	First MODBUS address that is mapped to the data block starting from address 0.0 Permitted values: 0 to 65535
length	UInt	Number of bits (for the values 1 and 2 of data_type) or number of registers (for the values 3 and 4 of data_type) The MODBUS address areas of one and the same MODBUS data type must not overlap. Permitted values: 1 to 65535

- First example: data_type = 3, db = 1, start = 10, length = 6

  The CPU maps the holding registers (data_type = 3) in data block 1 (db = 1), placing the Modbus address 10 (start = 10) at data word 0 and the last valid Modbus address 15 (length = 6) at data word 5.

- Second example: data_type = 2, db = 15, start = 1700, length = 112

  The CPU maps the inputs (data_type = 2) in data block 15 (db = 15), placing the Modbus address 1700 (start = 1700) at data word 0 and the last valid Modbus address 1811 (length = 112) at data word 111.

Condition codes

Table 13- 91 Modbus_Slave execution condition codes (communication and configuration errors) [1]

STATUS (W#16#)	Description
80D1	The receiver issued a flow control request to suspend an active transmission and never re-enabled the transmission during the specified wait time. This error is also generated during hardware flow control when the receiver does not assert CTS within the specified wait time.
80D2	The transmit request was aborted because no DSR signal is received from the DCE.
80E0	The message was terminated because the receive buffer is full.
80E1	The message was terminated as a result of a parity error.
80E2	The message was terminated as a result of a framing error.
80E3	The message was terminated as a result of an overrun error.
80E4	The message was terminated as a result of the specified length exceeding the total buffer size.
8180	Invalid port ID value or error with Modbus_Comm_Load instruction
8186	Invalid Modbus station address
8187	Invalid pointer to MB_HOLD_REG DB: Area is too small
818C	Invalid MB_HOLD_REG pointer. The data area must be one of the following: • Classic DB • Array of elemental data types in a symbolic or retentive DB • M memory

Table 13- 92 Modbus_Slave execution condition codes (Modbus protocol errors) [1]

STATUS (W#16#)	Response code from slave	Modbus protocol errors
8380	No response	CRC error
8381	01	Function code not supported or not supported within broadcasts
8382	03	Data length error
8383	02	Data address error or address outside the valid range of the DATA_PTR area
8384	03	Data value error
8385	03	Data diagnostic code value not supported (function code 08)

[1] In addition to the Modbus_Slave errors listed above, errors can be returned from the underlying PtP communication instructions.

Note

Setting the maximum record length for PROFIBUS communication

When using a CM1243-5 PROFIBUS Master module to control an ET 200SP or ET 200MP PROFIBUS device that uses an RS232, RS422, or RS485 point-to-point module, you need to explicitly set the "max_record_len" data block tag to 240 as defined below:

Set "max_record_len" in the Send_P2P section of the instance DB (for example, "Modbus_Slave_DB".Send_P2P.max_record_len) to 240 after running Modbus_Comm_Load.

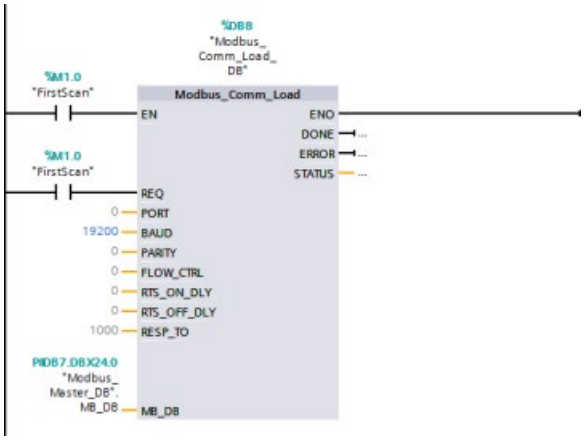
Explicitly assigning max_record_len is only necessary with PROFIBUS communication; PROFINET communication already uses a valid max_record_len value.

13.5.3.5 Modbus RTU examples

Example: Modbus RTU master program

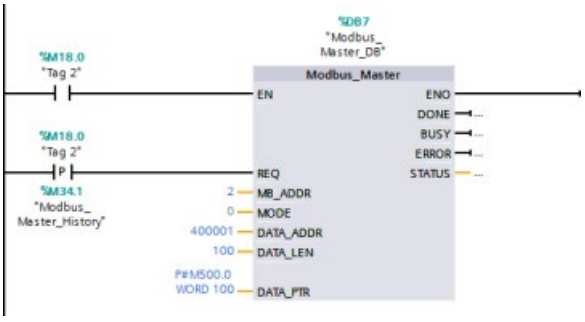
Modbus_Comm_Load is initialized during start-up by using the first scan flag. Execution of Modbus_Comm_Load in this manner should only be done when the serial port configuration will not change at runtime.

Network 1: Configure/initialize the RS485 module communications port only once during the first scan.

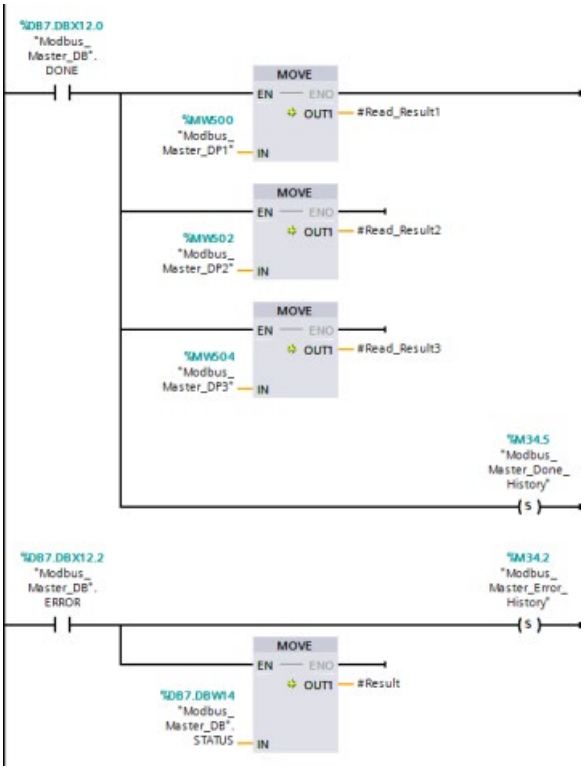


One Modbus_Master instruction is used in the program cycle OB to communicate with a single slave. Additional Modbus_Master instructions can be used in the program cycle OB to communicate with other slaves, or one Modbus_Master FB could be re-used to communicate with additional slaves.

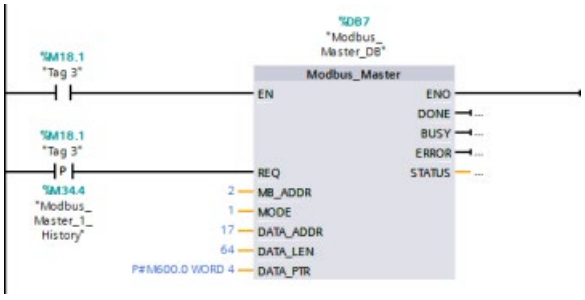
Network 2: Read 100 words of holding register data from location 400001 on slave #2 to memory location MW500-MW698.



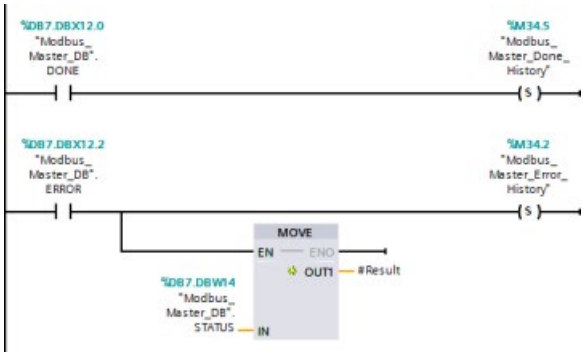
Network 3: Move the first 3 words of the holding register data that has been read to some other location, and set a DONE history bit. This network also sets an ERROR history bit and saves the STATUS word to another location in the event of an error.



Network 4: Write 64 bits of data from MW600-MW607 to output bit locations 00017 to 00081 on slave #2.



Network 5: Set a DONE history bit when the write is complete. If an error occurs, the program sets an ERROR history bit and saves the STATUS code.

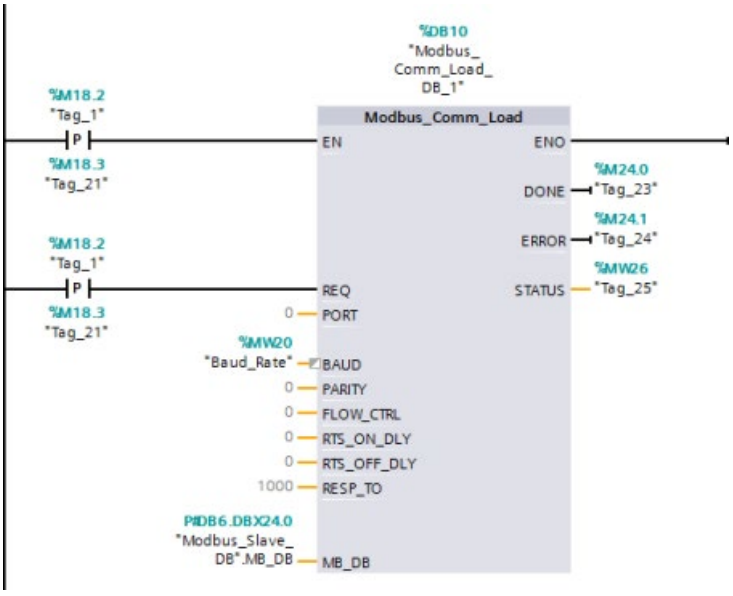


Example: Modbus RTU slave program

MB_COMM_LOAD shown below is initialized each time "Tag_1" is enabled.

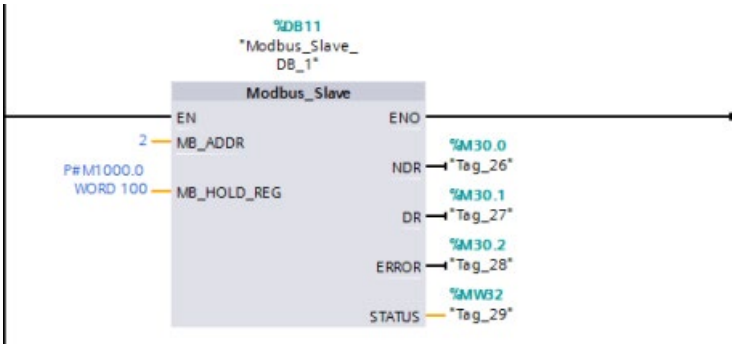
Execution of MB_COMM_LOAD in this manner should only be done when the serial port configuration will change at runtime, as a result of HMI configuration.

Network 1: Initialize the RS485 module parameters each time they are changed by an HMI device.



MB_SLAVE shown below is placed in a cyclic OB that is executed every 10 ms. While this does not give the absolute fastest response by the slave, it does provide good performance at 9600 baud for short messages (20 bytes or less in the request).

Network 2: Check for Modbus master requests during each scan. The Modbus holding register is configured for 100 words starting at MW1000.



13.6 Legacy PtP communication (CM/CB 1241 only)

Prior to the release of STEP 7 V13 SP1 and the S7-1200 V4.1 CPUs, the point-to-point communication instructions existed with different names, and in some cases, slightly different interfaces. The general concepts about point-to-point communication (Page 1070), as well as port (Page 1073) and parameter configuration (Page 1088) apply to both sets of instructions. Refer to the individual legacy point-to-point instructions for programming information.

Table 13- 93 Common error classes

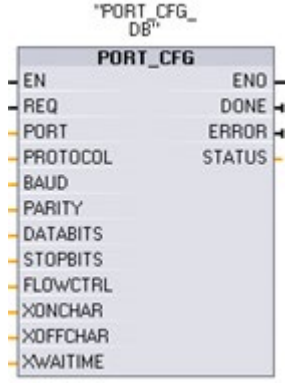
Class description	Error classes	Description
Port configuration	80Ax	Used to define common port configuration errors
Transmit configuration	80Bx	Used to define common transmit configuration errors
Receive configuration	80Cx	Used to define common receive configuration errors
Transmission runtime	80Dx	Used to define common transmission runtime errors
Reception runtime	80Ex	Used to define common reception runtime errors
Signal handling	80Fx	Used to define common errors associated with all signal handling

13.6.1 Legacy point-to-point instructions

13.6.1.1 PORT_CFG (Configure communication parameters dynamically)

Table 13- 94 PORT_CFG (Port Configuration) instruction

LAD / FBD	SCL	Description

	`"PORT_CFG_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_uint_in_,`
	`PROTOCOL:=_uint_in_,`
	`BAUD:=_uint_in_,`
	`PARITY:=_uint_in_,`
	`DATABITS:=_uint_in_,`
	`STOPBITS:=_uint_in_,`
	`FLOWCTRL:=_uint_in_,`
	`XONCHAR:=_char_in_,`
	`XOFFCHAR:=_char_in_,`
	`WAITTIME:=_uint_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		PORT_CFG allows you to change port parameters such as baud rate from your program.
		You can set up the initial static configuration of the port in the device configuration properties, or just use the default values. You can execute the PORT_CFG instruction in your program to change the configuration.

[1] STEP 7 automatically creates the DB when you insert the instruction.

The PORT_CFG configuration changes are not permanently stored in the CPU. The parameters configured in the device configuration are restored when the CPU transitions from RUN to STOP mode and after a power cycle. See Configuring the communication ports (Page 1073) and Managing flow control (Page 1075) for more information.

Table 13- 95 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activate the configuration change on rising edge of this input. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
PROTOCOL	IN	UInt	0 - Point-to-Point communication protocol (Default value) 1..n - future definition for specific protocols
BAUD	IN	UInt	Port baud rate (Default value: 6): 1 = 300 baud, 2 = 600 baud, 3 = 1200 baud, 4 = 2400 baud, 5 = 4800 baud, 6 = 9600 baud, 7 = 19200 baud, 8 = 38400 baud, 9 = 57600 baud, 10 = 76800 baud, 11 = 115200 baud
PARITY	IN	UInt	Port parity (Default value: 1): 1 = No parity, 2 = Even parity, 3 = Odd parity, 4 = Mark parity, 5 = Space parity
DATABITS	IN	UInt	Bits per character (Default value:1): 1 = 8 data bits, 2 = 7 data bits
STOPBITS	IN	UInt	Stop bits (Default value: 1): 1 = 1 stop bit, 2 = 2 stop bits
FLOWCTRL	IN	UInt	Flow control (Default value: 1): 1 = No flow control, 2 = XON/XOFF, 3 = Hardware RTS always ON, 4 = Hardware RTS switched
XONCHAR	IN	Char	Specifies the character that is used as the XON character. This is typically a DC1 character (16#11). This parameter is only evaluated if flow control is enabled. (Default value: 16#11)
XOFFCHAR	IN	Char	Specifies the character that is used as the XOFF character. This is typically a DC3 character (116#3). This parameter is only evaluated if flow control is enabled. (Default value: 16#13)
XWAITIME	IN	UInt	Specifies how long to wait for a XON character after receiving a XOFF character, or how long to wait for the CTS signal after enabling RTS (0 to 65535 ms). This parameter is only evaluated if flow control is enabled. (Default value: 2000)
DONE	OUT	Bool	TRUE for one execution after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one execution after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

Table 13- 96 Condition codes

STATUS (W#16#....)	Description
80A0	Specific protocol does not exist.
80A1	Specific baud rate does not exist.
80A2	Specific parity option does not exist.
80A3	Specific number of data bits does not exist.
80A4	Specific number of stop bits does not exist.
80A5	Specific type of flow control does not exist.
80A6	Wait time is 0 and flow control enabled
80A7	XON and XOFF are illegal values (for example, the same value)

13.6.1.2 SEND_CFG (Configure serial transmission parameters dynamically)

Table 13- 97 SEND_CFG (Send Configuration) instruction

LAD / FBD	SCL	Description

	`"SEND_CFG_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_uint_in_,`
	`RTSONDLY:=_uint_in_,`
	`RTSOFFDLY:=_uint_in_,`
	`BREAK:=_uint_in_,`
	`IDLELINE:=_uint_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		SEND_CFG allows the dynamic configuration of serial transmission parameters for a PtP communication port. Any queued messages within a CM or CB are discarded when SEND_CFG is executed.

[1] STEP 7 automatically creates the DB when you insert the instruction.

You can set up the initial static configuration of the port in the device configuration properties, or just use the default values. You can execute the SEND_CFG instruction in your program to change the configuration.

The SEND_CFG configuration changes are not permanently stored in the CPU. The parameters configured in the device configuration are restored when the CPU transitions from RUN to STOP mode and after a power cycle. See Configuring transmit (send) parameters.

Table 13- 98 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activate the configuration change on the rising edge of this input.. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
RTSONDLY	IN	UInt	Number of milliseconds to wait after enabling RTS before any Tx data transmission occurs. This parameter is only valid when hardware flow control is enabled. The valid range is 0 - 65535 ms. A value of 0 disables the feature. (Default value: 0)
RTSOFFDLY	IN	UInt	Number of milliseconds to wait after the Tx data transmission occurs before RTS is disabled: This parameter is only valid when hardware flow control is enabled. The valid range is 0 - 65535 ms. A value of 0 disables the feature. (Default value: 0)
BREAK	IN	UInt	This parameter specifies that a break will be sent upon the start of each message for the specified number of bit times. The maximum is 65535 bit times up to an eight second maximum. A value of 0 disables the feature. (Default value: 12)
IDLELINE	IN	UInt	This parameter specifies that the line will remain idle for the specified number of bit times before the start of each message. The maximum is 65535 bit times up to an eight second maximum. A value of 0 disables the feature. (Default value: 12)
DONE	OUT	Bool	TRUE for one execution after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one execution after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

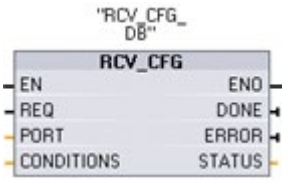
Table 13- 99 Condition codes

STATUS (W#16#....)	Description
80B0	Transmit interrupt configuration is not allowed.
80B1	Break time is greater than the maximum allowed value.
80B2	Idle time is greater than the maximum allowed value.

13.6.1.3 RCV_CFG (Configure serial receive parameters dynamically)

Table 13- 100 RCV_CFG (Receive Configuration) instruction

LAD / FBD	SCL	Description

	`"RCV_CFG_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_uint_in_,`
	`CONDITIONS:=_struct_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		RCV_CFG performs dynamic configuration of serial receiver parameters for a PtP communication port. This instruction configures the conditions that signal the start and end of a received message. Any queued messages within a CM or CB are discarded when RCV_CFG is executed.

[1] STEP 7 automatically creates the DB when you insert the instruction.

You can set up the initial static configuration of the communication port in the device configuration properties, or just use the default values. You can execute the RCV_CFG instruction in your program to change the configuration.

The RCV_CFG configuration changes are not permanently stored in the CPU. The parameters configured in the device configuration are restored when the CPU transitions from RUN to STOP mode and after a power cycle. See Configuring receive parameters (Page 1077) for more information.

Table 13- 101 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activate the configuration change on the rising edge of this input. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
CONDITIONS	IN	CONDITIONS	The Conditions data structure specifies the starting and ending message conditions as described below.
DONE	OUT	Bool	TRUE for one scan, after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one scan, after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

Start conditions for the RCV_PTP instruction

The RCV_PTP instruction uses the configuration specified by the RCV_CFG instruction to determine the beginning and ending of point-to-point communication messages. The start of a message is determined by the start conditions. The start of a message can be determined by one or a combination of start conditions. If more than one start condition is specified, all the conditions must be satisfied before the message is started.

See the topic "Configuring receive parameters (Page 1077)" for a description of the message start conditions.

Parameter CONDITIONS data type structure part 1 (start conditions)

Table 13- 102 CONDITIONS structure for START conditions

Parameter and type		Data type	Description
STARTCOND	IN	UInt	Specifies the start condition (Default value: 1) • 01H - Start Char • 02H - Any Char • 04H - Line Break • 08H - Idle Line • 10H - Sequence 1 • 20H - Sequence 2 • 40H - Sequence 3 • 80H - Sequence 4
IDLETIME	IN	UInt	The number of bit times required for idle line timeout. (Default value: 40). Only used with an idle line condition. 0 to 65535
STARTCHAR	IN	Byte	The start character used with the start character condition. (Default value: B#16#2)
SEQ[1].CTL	IN	Byte	Sequence 1 ignore/compare control for each character: (Default value: B#16#0) These are the enabling bits for each character in start sequence • 01H - Character 1 • 02H - Character 2 • 04H - Character 3 • 08H - Character 4 • 10H - Character 5 Disabling the bit associated with a character means any character will match, in this sequence position.
SEQ[1].STR	IN	Char[5]	Sequence 1 start characters (5 characters). Default value: 0
SEQ[2].CTL	IN	Byte	Sequence 2 ignore/compare control for each character. Default value: B#16#0)
SEQ[2].STR	IN	Char[5]	Sequence 2 start characters (5 characters). Default value: 0
SEQ[3].CTL	IN	Byte	Sequence 3 ignore/compare control for each character. Default value: B#16#0
SEQ[3].STR	IN	Char[5]	Sequence 3 start characters (5 characters). Default value: 0

Parameter and type		Data type	Description
SEQ[4].CTL	IN	Byte	Sequence 4 ignore/compare control for each character. Default value: B#16#0
SEQ[4].STR	IN	Char[5]	Sequence 4 start characters (5 characters), Default value: 0

Example

Consider the following received hexadecimal coded message: "**68** 10 aa **68** bb 10 aa 16" and the configured start sequences shown in the table below. Start sequences begin to be evaluated when the first 68H character is successfully received. Upon successfully receiving the fourth character (the second 68H), then start condition 1 is satisfied. Once the start conditions are satisfied, the evaluation of the end conditions begins.

The start sequence processing can be terminated due to various parity, framing, or inter-character timing errors. These errors result in no received message, because the start condition was not satisfied.

Table 13- 103 Start conditions

Start condition	First Character	First Character +1	First Character +2	First Character +3	First Character +4
1	**68**H	xx	xx	**68**H	xx
2	10H	aaH	xx	xx	xx
3	dcH	aaH	xx	xx	xx
4	e5H	xx	xx	xx	xx

End conditions for the RCV_PTP instruction

The end of a message is determined by the specification of end conditions. The end of a message is determined by the first occurrence of one or more configured end conditions. The section "Message end conditions" in the topic "Configuring receive parameters (Page 1077)" describes the end conditions that you can configure in the RCV_CFG instruction.

You can configure the end conditions in either the properties of the communication interface in the device configuration, or from the RCV_CFG instruction. Whenever the CPU transitions from STOP to RUN, the receive parameters (both start and end conditions) return to the device configuration settings. If the STEP 7 user program executes RCV_CFG, then the settings are changed to the RCV_CFG conditions.

Parameter CONDITIONS data type structure part 2 (end conditions)

Table 13- 104 CONDITIONS structure for END conditions

Parameter	Parameter type	Data type	Description
ENDCOND	IN	UInt 0	This parameter specifies message end condition: • 01H - Response time • 02H - Message time • 04H - Inter-character gap • 08H - Maximum length • 10H - N + LEN + M • 20H - Sequence
MAXLEN	IN	UInt 1	Maximum message length: Only used when the maximum length end condition is selected. 1 to 1024 bytes
N	IN	UInt 0	Byte position within the message of the length field. Only used with the N + LEN + M end condition. 1 to 1022 bytes
LENGTHSIZE	IN	UInt 0	Size of the length field (1, 2, or 4 bytes). Only used with the N + LEN + M end condition.
LENGTHM	IN	UInt 0	Specify the number of characters following the length field that are not included in the value of the length field. This is only used with the N + LEN + M end condition. 0 to 255 bytes
RCVTIME	IN	UInt 200	Specify how long to wait for the first character to be received. The receive operation will be terminated with an error if a character is not successfully received within the specified time. This is only used with the response time condition. (0 to 65535 bit times with an 8 second maximum) This parameter is not a message end condition since evaluation terminates when the first character of a response is received. It is an end condition only in the sense that it terminates a receiver operation because no response is received when a response is expected. You must select a separate end condition.
MSGTIME	IN	UInt 200	Specify how long to wait for the entire message to be completely received once the first character has been received. This parameter is only used when the message timeout condition is selected. (0 to 65535 milliseconds)
CHARGAP	IN	UInt 12	Specify the number of bit times between characters. If the number of bit times between characters exceeds the specified value, then the end condition will be satisfied. This is only used with the inter-character gap condition. (0 to 65535 bit times up to 8 second maximum)

Parameter	Parameter type	Data type	Description
SEQ.CTL	IN	Byte B#16#0	Sequence 1 ignore/compare control for each character: These are the enabling bits for each character for the end sequence. Character 1 is bit 0, character 2 is bit 1, …, character 5 is bit 4. Disabling the bit associated with a character means any character will match, in this sequence position.
SEQ.STR	IN	Char[5] 0	Sequence 1 start characters (5 characters)

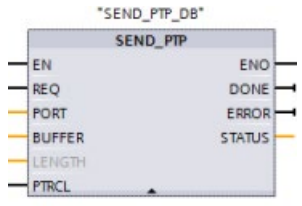
Table 13- 105 Condition codes

STATUS (W#16#....)	Description
80C0	Illegal start condition selected
80C1	Illegal end condition selected, no end condition selected
80C2	Receive interrupt enabled and this is not possible.
80C3	Maximum length end condition is enabled and max length is 0 or > 1024.
80C4	Calculated length is enabled and N is >= 1023.
80C5	Calculated length is enabled and length is not 1, 2 or 4.
80C6	Calculated length is enabled and M value is > 255.
80C7	Calculated length is enabled and calculated length is > 1024.
80C8	Response timeout is enabled and response timeout is zero.
80C9	Inter-character gap timeout is enabled and it is zero.
80CA	Idle line timeout is enabled and it is zero.
80CB	End sequence is enabled but all chars are "don't care".
80CC	Start sequence (any one of 4) is enabled but all characters are "don't care".

13.6.1.4 SEND_PTP (Transmit send buffer data)

Table 13- 106 SEND_PTP (Send Point-to-Point data) instruction

LAD / FBD	SCL	Description

	`"SEND_PTP_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_uint_in_,`
	
	`BUFFER:=_variant_in_,`
	`LENGTH:=_uint_in_,`
	`PTRCL:=_bool_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		SEND_PTP initiates the transmission of the data and transfers the assigned buffer to the communication interface. The CPU program continues while the CM or CB sends the data at the assigned baud rate. Only one send operation can be pending at a given time. The CM or CB returns an error if a second SEND_PTP is executed while the CM or CB is already transmitting a message.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 13- 107 Data types for the parameters

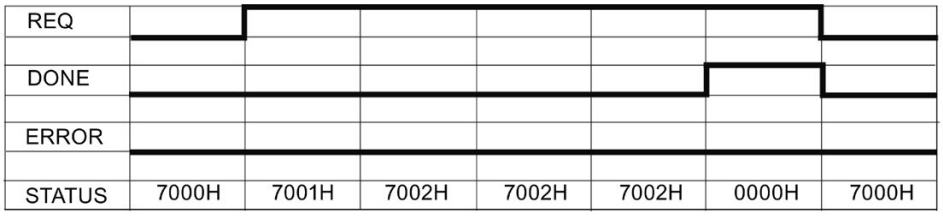
Parameter and type		Data type	Description
REQ	IN	Bool	Activates the requested transmission on the rising edge of this transmission enable input. This initiates transfer of the contents of the buffer to the Point-to-Point communication interface. (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
BUFFER	IN	Variant	This parameter points to the starting location of the transmit buffer. (Default value: 0) **Note:** Boolean data or Boolean arrays are not supported.
LENGTH [1]	IN	UInt	Transmitted frame length in bytes (Default value: 0) When transmitting a complex structure, always use a length of 0.
PTRCL	IN	Bool	Reserved for future use
DONE	OUT	Bool	TRUE for one scan, after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one scan, after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

[1] Optional parameter: Click the arrow at the bottom of a LAD/FBD box to expand the box and include this parameter.

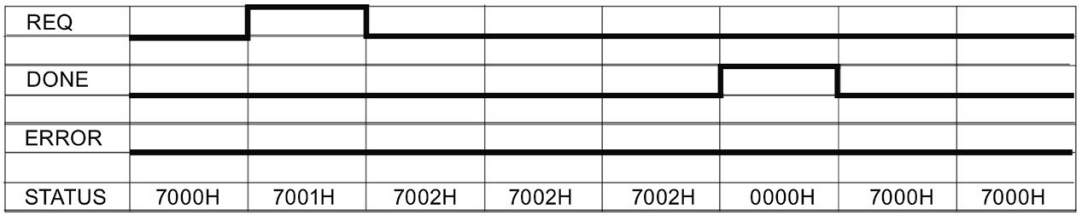
While a transmit operation is in progress, the DONE and ERROR outputs are FALSE. When a transmit operation is complete, either the DONE or the ERROR output will be set TRUE to show the status of the transmit operation. While DONE or ERROR is TRUE, the STATUS output is valid.

The instruction returns a status of 16#7001 if the communication interface accepts the transmit data. Subsequent SEND_PTP executions return 16#7002, if the CM or CB is still busy transmitting. When the transmit operation is complete, the CM or CB returns the status of the transmit operation as 16#0000 (if no errors occurred). Subsequent executions of SEND_PTP with REQ low return a status of 16#7000 (not busy).

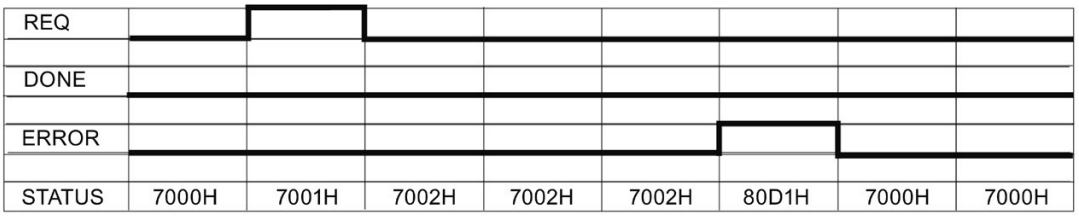
The following diagrams show the relationship of the output values to REQ. This assumes that the instruction is called periodically to check for the status of the transmission process. In the diagram below, it is assumed that the instruction is called every scan (represented by the STATUS values).



The following diagram shows how the DONE and STATUS parameters are valid for only one scan if the REQ line is pulsed (for one scan) to initiate the transmit operation.



The following diagram shows the relationship of DONE, ERROR and STATUS parameters when there is an error.



The DONE, ERROR and STATUS values are only valid until SEND_PTP executes again with the same instance DB.

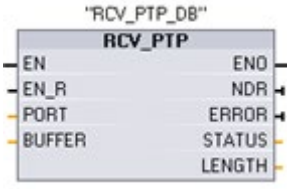
Table 13- 108 Condition codes

STATUS (W#16#....)	Description
80D0	New request while transmitter active
80D1	Transmit aborted because of no CTS within wait time
80D2	Transmit aborted because of no DSR from the DCE device
80D3	Transmit aborted because of queue overflow (transmit more than 1024 bytes)
80D5	Reverse bias signal (wire break condition)
833A	The DB for the BUFFER parameter does not exist.

13.6.1.5 RCV_PTP (Enable receive messages)

Table 13- 109 RCV_PTP (Receive Point-to-Point) instruction

LAD / FBD	SCL	Description

	`"RCV_PTP_DB"(`
	`EN_R:=_bool_in_,`
	`PORT:=_uint_in_,`
	`BUFFER:=_variant_in_,`
	`NDR=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`LENGTH=>_uint_out_);`
		RCV_PTP checks for messages that have been received in the CM or CB. If a message is available, it will be transferred from the CM or CB to the CPU. An error returns the appropriate STATUS value.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 13- 110 Data types for the parameters

Parameter and type		Data type	Description
EN_R	IN	Bool	When this input is TRUE and a message is available, the message is transferred from the CM or CB to the BUFFER. When EN_R is FALSE, the CM or CB is checked for messages and NDR, ERROR and STATUS output are updated, but the message is not transferred to the BUFFER. (Default value: 0)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
BUFFER	IN	Variant	This parameter points to the starting location of the receive buffer. This buffer should be large enough to receive the maximum length message. Boolean data or Boolean arrays are not supported. (Default value: 0)
NDR	OUT	Bool	TRUE for one execution when new data is ready and operation is complete with no errors.
ERROR	OUT	Bool	TRUE for one execution after the operation was completed with an error.
STATUS	OUT	Word	Execution condition code (Default value: 0)
LENGTH	OUT	UInt	Length of the returned message in bytes (Default value: 0)

Note the following correlation between the EN_R input and the message buffer of the RCV_PTP instruction:

Input EN_R controls the copy of a received message to the BUFFER.

When the EN_R input is TRUE and a message is available, the CPU transfers the message from the CM or CB to the BUFFER and updates the NDR, ERROR, STATUS, and LENGTH outputs.

When EN_R is FALSE, the CPU checks the CM or CB for messages and updates the NDR, ERROR, and STATUS outputs, but does not transfer the message to the BUFFER. (Note that the default value of EN_R is FALSE.)

The recommended practice is to set EN_R to TRUE and control execution of the RCV_PTP instruction with the EN input.

The STATUS value is valid when either NDR or ERROR is TRUE. The STATUS value provides the reason for termination of the receive operation in the CM or CB. This is typically a positive value, indicating that the receive operation was successful and that the receive process terminated normally. If the STATUS value is negative (the Most Significant Bit of the hexadecimal value is set), the receive operation was terminated for an error condition such as parity, framing, or overrun errors.

Each PtP communication interface can buffer up to a maximum of 1024 bytes. This could be one large message or several smaller messages. If more than one message is available in the CM or CB, the RCV_PTP instruction returns the oldest message available. A subsequent RCV_PTP instruction execution returns the next oldest message available.

Table 13- 111 Condition codes

STATUS (W#16#...)	Description
0000	No buffer present
0094	Message terminated due to received maximum character length
0095	Message terminated because of message timeout
0096	Message terminated because of inter-character timeout
0097	Message terminated because of response timeout
0098	Message terminated because the "N+LEN+M" length condition was satisfied
0099	Message terminated because of end sequence was satisfied
80E0	Message terminated because the receive buffer is full
80E1	Message terminated due to parity error
80E2	Message terminated due to framing error
80E3	Message terminated due to overrun error
80E4	Message terminated because calculated length exceeds buffer size
80E5	Reverse bias signal (wire break condition)
833A	The DB for the BUFFER parameter does not exist.

13.6.1.6 RCV_RST (Delete receive buffer)

Table 13- 112 RCV_RST (Receiver Reset) instruction

LAD / FBD	SCL	Description

	`"RCV_RST_DB"(`
	`  REQ:=_bool_in_,`
	`  PORT:=_uint_in_,`
	`  DONE=>_bool_out_,`
	`  ERROR=>_bool_out_,`
	`  STATUS=>_word_out_);`
		RCV_RST clears the receive buffers in the CM or CB.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 13- 113 Data types for parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Activates the receiver reset on the rising edge of this enable input (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
DONE	OUT	Bool	When TRUE for one scan, indicates that the last request was completed without errors.
ERROR	OUT	Bool	When TRUE, shows that the last request was completed with errors. Also, when this output is TRUE, the STATUS output will contain related error codes.
STATUS	OUT	Word	Error code (Default value: 0) See Common parameters for Point-to-Point instructions (Page 1088) for communication status codes.

Note

You might want to use the RCV_RST instruction to be sure the message buffers are clear following a communications error, or after changing a communication parameter such as the baud rate. Executing RCV_RST causes the module to clear all of the internal message buffers. After clearing the message buffers, you can be assured that when your program executes a subsequent receive instruction, the messages it returns are new messages and not old messages from some time prior to the RCV_RST call.

13.6.1.7 SGN_GET (Query RS-232 signals)

Table 13- 114 SGN_GET (Get RS232 signals) instruction

LAD / FBD	SCL	Description

	`"SGN_GET_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_uint_in_,`
	`NDR=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`DTR=>_bool_out_,`
	`DSR=>_bool_out_,`
	`RTS=>_bool_out_,`
	`CTS=>_bool_out_,`
	`DCD=>_bool_out_,`
	`RING=>_bool_out_);`
		SGN_GET reads the current states of RS232 communication signals.
		This function is valid only for the RS232 CM.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 13- 115 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Get RS232 signal state values on the rising edge of this input (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table.
NDR	OUT	Bool	TRUE for one scan, when new data is ready and the operation is complete with no errors
ERROR	OUT	Bool	TRUE for one scan, after the operation was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)
DTR	OUT	Bool	Data terminal ready, module ready (output). Default value: False
DSR	OUT	Bool	Data set ready, communication partner ready (input). Default value: False
RTS	OUT	Bool	Request to send, module ready to send (output). Default value: False
CTS	OUT	Bool	Clear to send, communication partner can receive data (input). Default value: False
DCD	OUT	Bool	Data carrier detect, receive signal level (always False, not supported)
RING	OUT	Bool	Ring indicator, indication of incoming call (always False, not supported)

Table 13- 116 Condition codes

STATUS (W#16#....)	Description
80F0	CM or CB is RS485 and no signals are available

13.6.1.8 SGN_SET (Set RS-232 signals)

Table 13- 117 SGN_SET (Set RS232 signals) instruction

LAD / FBD	SCL	Description

	`"SGN_SET_DB"(`
	`REQ:=_bool_in_,`
	`PORT:=_uint_in_,`
	`SIGNAL:=_byte_in_,`
	`RTS:=_bool_in_,`
	`DTR:=_bool_in_,`
	`DSR:=_bool_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_);`
		SGN_SET sets the states of RS232 communication signals.
		This function is valid only for the RS232 CM.

[1] STEP 7 automatically creates the DB when you insert the instruction.

Table 13- 118 Data types for parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Start the set RS232 signals operation, on the rising edge of this input (Default value: False)
PORT	IN	PORT	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table. (Default value: 0)
SIGNAL	IN	Byte	Selects which signal to set: (multiple allowed). Default value: 0 • 01H = Set RTS • 02H = Set DTR • 04H = Set DSR
RTS	IN	Bool	Request to send, module ready to send value to set (true or false), Default value: False
DTR	IN	Bool	Data terminal ready, module ready to send value to set (true or false). Default value: False
DSR	IN	Bool	Data set ready (only applies to DCE type interfaces), not used.
DONE	OUT	Bool	TRUE for one execution after the last request was completed with no error
ERROR	OUT	Bool	TRUE for one execution after the last request was completed with an error
STATUS	OUT	Word	Execution condition code (Default value: 0)

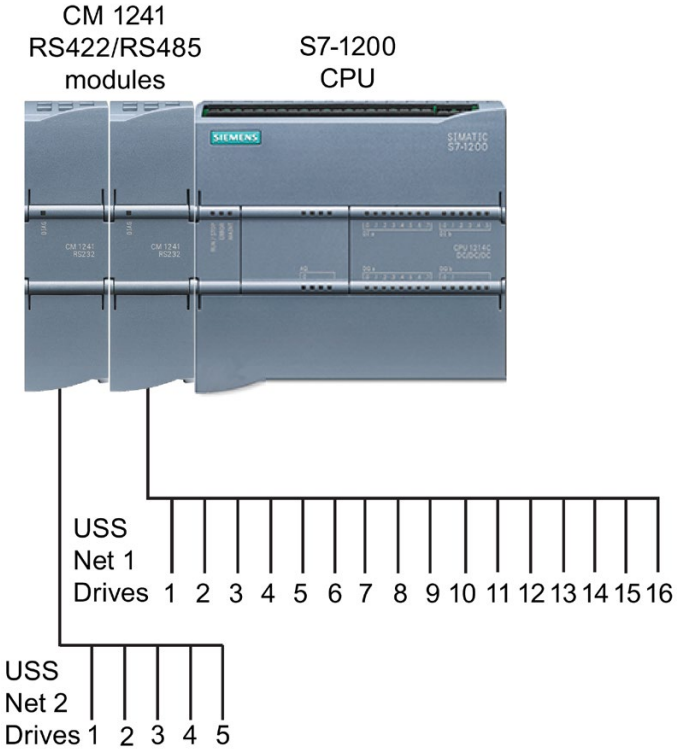
Table 13- 119 Condition codes

STATUS (W#16#....)	Description
80F0	CM or CB is RS485 and no signals can be set
80F1	Signals cannot be set because of Hardware flow control
80F2	Cannot set DSR because module is DTE
80F3	Cannot set DTR because module is DCE

13.7 Legacy USS communication (CM/CB 1241 only)

The USS instructions control the operation of motor drives which support the universal serial interface (USS) protocol. You can use the USS instructions to communicate with multiple drives through RS485 connections to CM 1241 RS485 communication modules or a CB 1241 RS485 communication board. Up to three CM 1241 RS422/RS485 modules and one CB 1241 RS485 board can be installed in a S7-1200 CPU. Each RS485 port can operate up to sixteen drives.

The USS protocol uses a master-slave network for communications over a serial bus. The master uses an address parameter to send a message to a selected slave. A slave itself can never transmit without first receiving a request to do so. Direct message transfer between the individual slaves is not possible. USS communication operates in half-duplex mode. The following USS illustration shows a network diagram for an example drive application.



Prior to the release of STEP 7 V13 SP1 and the S7-1200 V4.1 CPUs, the USS communication instructions existed with different names, and in some cases, slightly different interfaces. The general concepts apply to both sets of instructions. Refer to the individual legacy USS instructions for programming information.

13.7.1 Selecting the version of the USS instructions

There are two versions of USS instructions available in STEP 7:

- Version 2.0 was initially available in STEP 7 Basic/Professional V13.
- Version 2.1 is available in STEP 7 Basic/Professional V13 SP1 or later.

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

You cannot use both versions of the instructions with the same module, but two different modules can use different versions of the instructions.



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



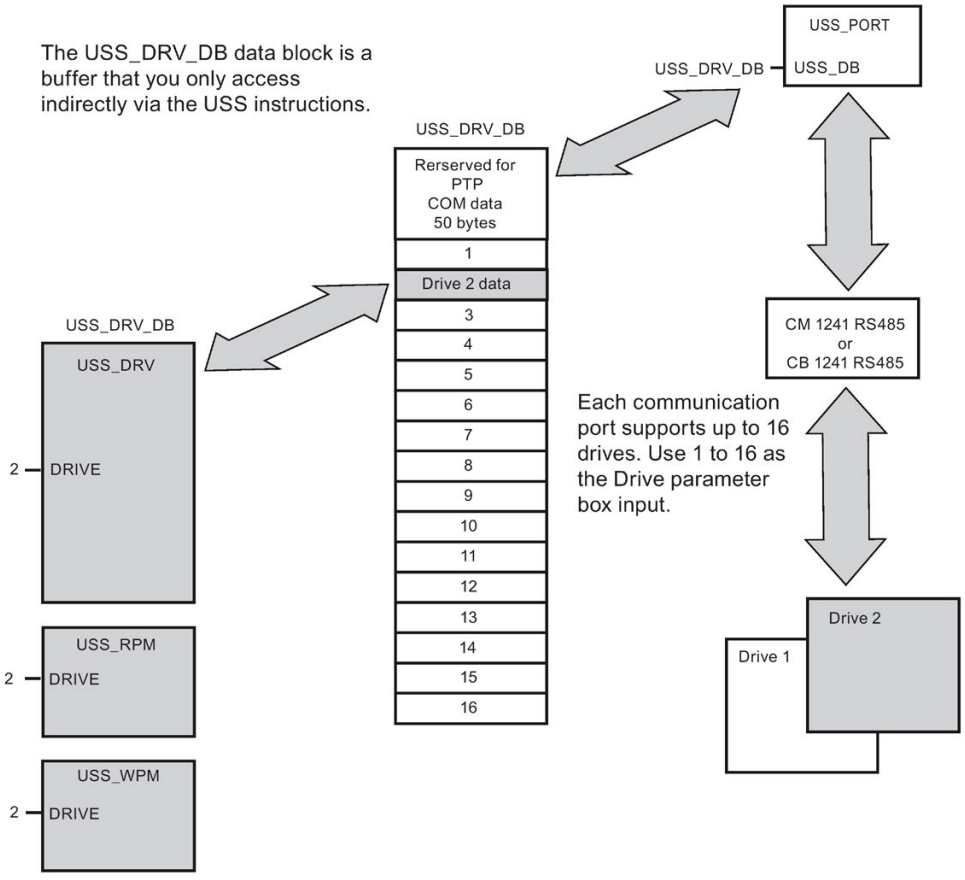
To change the version of the USS instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a USS instruction in your program, a new FB or FC instance, depending on the USS instruction selected, is created in the project tree. You can see new FB or FC instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a USS instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree USS FB or FC instance, right-click, select "Properties", and select the "Information" page to see the USS instruction version number.

13.7.2 Requirements for using the USS protocol

The four USS instructions use 1 FB and 3 FCs to support the USS protocol. One USS_PORT instance data block (DB) is used for each USS network. The USS_PORT instance data block contains temporary storage and buffers for all drives on that USS network. The USS instructions share the information in this data block.



All drives (up to 16) connected to a single RS485 port are part of the same USS network. All drives connected to a different RS485 port are part of a different USS network. Each USS network is managed using a unique data block. All instructions associated with a single USS network must share this data block. This includes all USS_DRV, USS_PORT, USS_RPM, and USS_WPM instructions used to control all drives on a single USS network.

The USS_DRV instruction is a Function Block (FB). When you place the USS_DRV instruction into the program editor, you will be prompted by the "Call options" dialog to assign a DB for this FB. If this is the first USS_DRV instruction in this program for this USS network, then you can accept the default DB assignment (or change the name if you wish) and the new DB is created for you. If however this is not the first USS_DRV instruction for this channel, then you must use the drop-down list in the "Call options" dialog to select the DB name that was previously assigned for this USS network.

Instructions USS_PORT, USS_RPM, and USS_WPM are all Functions (FCs). No DB is assigned when you place these FCs in the editor. Instead, you must assign the appropriate DB reference to the "USS_DB" input of these instructions. Double-click on the parameter field and then click on the parameter helper icon to see the available DB names).

The USS_PORT function handles the actual communication between the CPU and the drives via the Point-to-Point (PtP) RS485 communication port. Each call to this function handles one communication with one drive. Your program must call this function fast enough to prevent a communication timeout by the drives. You may call this function in a main program cycle OB or any interrupt OB.

Typically, you should call the USS_PORT function from a cyclic interrupt OB. The cycle time of the cyclic interrupt OB should be set to about half of the minimum call interval (As an example, 1200 baud communication should use a cyclic time of 350 ms or less).

The USS_DRV function block provides your program access to a specified drive on the USS network. Its inputs and outputs are the status and controls for the drive. If there are 16 drives on the network, your program must have at least 16 USS_DRV calls, one for each drive. These blocks should be called at the rate that is required to control the operation of the drive.

You may only call the USS_DRV function block from a main program cycle OB.

CAUTION

Considerations in calling USS instructions from OBs

Only call USS_DRV, USS_RPM, and USS_WPM from a main program cycle OB. The USS_PORT function can be called from any OB, usually from a cyclic interrupt OB.

Do not use instructions USS_DRV, USS_RPM, or USS_WPM in a higher priority OB than the corresponding USS_PORT instruction. For example, do not place the USS_PORT in the main and a USS_RPM in a cyclic interrupt OB. Failure to prevent interruption of USS_PORT execution can produce unexpected errors, which could result in personal injury.

The USS_RPM and USS_WPM functions read and write the remote drive operating parameters. These parameters control the internal operation of the drive. See the drive manual for the definition of these parameters. Your program can contain as many of these functions as necessary, but only one read or write request can be active per drive, at any given time. You may only call the USS_RPM and USS_WPM functions from a main program cycle OB.

Calculating the time required for communicating with the drive

Communications with the drive are asynchronous to the S7-1200 scan cycle. The S7-1200 typically completes several scans before one drive communications transaction is completed.

The USS_PORT interval is the time required for one drive transaction. The table below shows the minimum USS_PORT interval for each communication baud rate. Calling the USS_PORT function more frequently than the USS_PORT interval will not increase the number of transactions. The drive timeout interval is the amount of time that might be taken for a transaction, if communications errors caused 3 tries to complete the transaction. By default, the USS protocol library automatically does up to 2 retries on each transaction.

Table 13- 120 Calculating the time requirements

Baud rate	Calculated minimum USS_PORT call Interval (milliseconds)	Drive message interval timeout per drive (milliseconds)
1200	790	2370
2400	405	1215
4800	212.5	638
9600	116.3	349
19200	68.2	205
38400	44.1	133
57600	36.1	109
115200	28.1	85

13.7.3 Legacy USS instructions

13.7.3.1 USS_PORT (Edit communication using USS network) instruction

Table 13- 121 USS_PORT instruction

LAD / FBD	SCL	Description

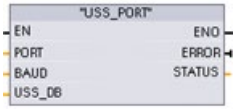
	`USS_PORT(`
	`  PORT:=_uint_in_,`
	`  BAUD:=_dint_in_,`
	`  ERROR=>_bool_out_,`
	`  STATUS=>_word_out_,`
	`  USS_DB:=_fbtref_inout_);`
		The USS_PORT instruction handles communication over a USS network.

Table 13- 122 Data types for the parameters

Parameter and type		Data type	Description
PORT	IN	Port	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table.
BAUD	IN	DInt	The baud rate used for USS communication.
USS_DB	INOUT	USS_BASE	The name of the instance DB that is created and initialized when a USS_DRV instruction is placed in your program.
ERROR	OUT	Bool	When true, this output indicates that an error has occurred and the STATUS output is valid.
STATUS	OUT	Word	The status value of the request indicates the result of the scan or initialization. Additional information is available in the "USS_Extended_Error" variable for some status codes.

Typically, there is only one USS_PORT instruction per PtP communication port in the program, and each call of this function handles a transmission to or from a single drive. All USS functions associated with one USS network and PtP communication port must use the same instance DB.

Your program must execute the USS_PORT instruction often enough to prevent drive timeouts. USS_PORT is usually called from a cyclic interrupt OB to prevent drive timeouts and keep the most recent USS data updates available for USS_DRV calls.

13.7.3.2 USS_DRV (Swap data with drive) instruction

Table 13- 123 USS_DRV instruction

LAD / FBD	SCL	Description
Default view  Expanded view  	"USS_DRV_DB"(RUN:=_bool_in_, OFF2:=_bool_in_, OFF3:=_bool_in_, F_ACK:=_bool_in_, DIR:=_bool_in_, DRIVE:=_usint_in_, PZD_LEN:=_usint_in_, SPEED_SP:=_real_in_, CTRL3:=_word_in_, CTRL4:=_word_in_, CTRL5:=_word_in_, CTRL6:=_word_in_, CTRL7:=_word_in_, CTRL8:=_word_in_, NDR=>_bool_out_, ERROR=>_bool_out_, STATUS=>_word_out_, RUN_EN=>_bool_out_, D_DIR=>_bool_out_, INHIBIT=>_bool_out_, FAULT=>_bool_out_, SPEED=>_real_out_, STATUS1=>_word_out_, STATUS3=>_word_out_, STATUS4=>_word_out_, STATUS5=>_word_out_, STATUS6=>_word_out_, STATUS7=>_word_out_, STATUS8=>_word_out_);	The USS_DRV instruction exchanges data with a drive by creating request messages and interpreting the drive response messages. A separate function block should be used for each drive, but all USS functions associated with one USS network and PtP communication port must use the same instance data block. You must create the DB name when you place the first USS_DRV instruction and then reference the DB that was created by the initial instruction usage. STEP 7 automatically creates the DB when you insert the instruction.

[1] LAD and FBD: Expand the box to reveal all the parameters by clicking the bottom of the box. The parameter pins that are grayed are optional and parameter assignment is not required.

Table 13- 124 Data types for the parameters

Parameter and type		Data type	Description
RUN	IN	Bool	Drive start bit: When true, this input enables the drive to run at the preset speed. When RUN goes to false while a drive is running, the motor will be ramped down to a stop. This behavior differs from the dropping power (OFF2) or braking the motor (OFF3).
OFF2	IN	Bool	Electrical stop bit: When false, this bit causes the drive to coast to a stop with no braking.
OFF3	IN	Bool	Fast stop bit: When false, this bit causes a fast stop by braking the drive rather than just allowing the drive to coast to a stop.
F_ACK	IN	Bool	Fault acknowledge bit: This bit is set to reset the fault bit on a drive. The bit is set after the fault is cleared to indicate to the drive it no longer needs to indicate the previous fault.
DIR	IN	Bool	Drive direction control: This bit is set to indicate that the direction is forward (for positive SPEED_SP).
DRIVE	IN	USInt	Drive address: This input is the address of the USS drive. The valid range is drive 1 to drive 16.
PZD_LEN	IN	USInt	Word length: This is the number of words of PZD data. The valid values are 2, 4, 6, or 8 words. The default value is 2.
SPEED_SP	IN	Real	Speed set point: This is the speed of the drive as a percentage of configured frequency. A positive value specifies forward direction (when DIR is true). Valid range is 200.00 to -200.00.
CTRL3	IN	Word	Control word 3: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL4	IN	Word	Control word 4: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL5	IN	Word	Control word 5: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL6	IN	Word	Control word 6: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL7	IN	Word	Control word 7: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
CTRL8	IN	Word	Control word 8: A value written to a user-configurable parameter on the drive. You must configure this on the drive. (optional parameter)
NDR	OUT	Bool	New data ready: When true, the bit indicates that the outputs contain data from a new communication request.
ERROR	OUT	Bool	Error occurred: When true, this indicates that an error has occurred and the STATUS output is valid. All other outputs are set to zero on an error. Communication errors are only reported on the USS_PORT instruction ERROR and STATUS outputs.
STATUS	OUT	Word	The status value of the request indicates the result of the scan. This is not a status word returned from the drive.
RUN_EN	OUT	Bool	Run enabled: This bit indicates whether the drive is running.
D_DIR	OUT	Bool	Drive direction: This bit indicates whether the drive is running forward.
INHIBIT	OUT	Bool	Drive inhibited: This bit indicates the state of the inhibit bit on the drive.
FAULT	OUT	Bool	Drive fault: This bit indicates that the drive has registered a fault. You must fix the problem and then set the F_ACK bit to clear this bit when set.

Parameter and type		Data type	Description
SPEED	OUT	Real	Drive Current Speed (scaled value of drive status word 2): The value of the speed of the drive as a percentage of configured speed.
STATUS1	OUT	Word	Drive Status Word 1: This value contains fixed status bits of a drive.
STATUS3	OUT	Word	Drive Status Word 3: This value contains a user-configurable status word on the drive.
STATUS4	OUT	Word	Drive Status Word 4: This value contains a user-configurable status word on the drive.
STATUS5	OUT	Word	Drive Status Word 5: This value contains a user-configurable status word on the drive.
STATUS6	OUT	Word	Drive Status Word 6: This value contains a user-configurable status word on the drive.
STATUS7	OUT	Word	Drive Status Word 7: This value contains a user-configurable status word on the drive.
STATUS8	OUT	Word	Drive Status Word 8: This value contains a user-configurable status word on the drive.

When the initial USS_DRV execution occurs, the drive indicated by the USS address (parameter DRIVE) is initialized in the Instance DB. After this initialization, subsequent executions of USS_PORT can begin communication to the drive at this drive number.

Changing the drive number requires a CPU STOP-to-RUN mode transition that initializes the instance DB. Input parameters are configured into the USS TX message buffer and outputs are read from a "previous" valid response buffer if any exists. There is no data transmission during USS_DRV execution. Drives communicate when USS_PORT is executed. USS_DRV only configures the messages to be sent and interprets data that might have been received from a previous request.

You can control the drive direction of rotation using either the DIR input (Bool) or using the sign (positive or negative) with the SPEED_SP input (Real). The following table indicates how these inputs work together to determine the drive direction, assuming the motor is wired for forward rotation.

Table 13- 125 Interaction of the SPEED_SP and DIR parameters

SPEED_SP	DIR	Drive rotation direction
Value > 0	0	Reverse
Value > 0	1	Forward
Value < 0	0	Forward
Value < 0	1	Reverse

13.7.3.3 USS_RPM (Readout parameters from the drive) instruction

Table 13- 126 USS_RPM instruction

LAD / FBD	SCL	Description

	`USS_RPM(REQ:=_bool_in_,`
	`DRIVE:=_usint_in_,`
	`PARAM:=_uint_in_,`
	`INDEX:=_uint_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`VALUE=>_variant_out_,`
	`USS_DB:=_fbtref_inout_);`
		The USS_RPM instruction reads a parameter from a drive. All USS functions associated with one USS network and PtP communication port must use the same data block. USS_RPM must be called from a main program cycle OB.

Table 13- 127 Data types for the parameters

Parameter type		Data type	Description
REQ	IN	Bool	Send request: When true, REQ indicates that a new read request is desired. This is ignored if the request for this parameter is already pending.
DRIVE	IN	USInt	Drive address: DRIVE is the address of the USS drive. The valid range is drive 1 to drive 16.
PARAM	IN	UInt	Parameter number: PARAM designates which drive parameter is written. The range of this parameter is 0 to 2047. On some drives, the most significant byte can access PARAM values greater than 2047. See your drive manual for details on how to access an extended range.
INDEX	IN	UInt	Parameter index: INDEX designates which Drive Parameter index is to be written. A 16-bit value where the Least Significant Byte is the actual index value with a range of (0 to 255). The Most Significant Byte may also be used by the drive and is drive-specific. See your drive manual for details.
USS_DB	INOUT	USS_BASE	The name of the instance DB that is created and initialized when a USS_DRV instruction is placed in your program.
VALUE	IN	Word, Int, UInt, DWord, DInt, UDInt, Real	This is the value of the parameter that was read and is valid only when the DONE bit is true.
DONE[1]	OUT	Bool	When true, indicates that the VALUE output holds the previously requested read parameter value. This bit is set when USS_DRV sees the read response data from the drive. This bit is reset when either: you request the response data via another USS_RPM poll, or on the second of the next two calls to USS_DRV

Parameter type		Data type	Description
ERROR	OUT	Bool	Error occurred: When true, ERROR indicates that an error has occurred and the STATUS output is valid. All other outputs are set to zero on an error. Communication errors are only reported on the USS_PORT instruction ERROR and STATUS outputs.
STATUS	OUT	Word	STATUS indicates the result of the read request. Additional information is available in the "USS_Extended_Error" variable for some status codes.

[1] The DONE bit indicates that valid data has been read from the referenced motor drive and delivered to the CPU. It does not indicate that the USS library is capable of immediately reading another parameter. A blank PKW request must be sent to the motor drive and must also be acknowledged by the instruction before the parameter channel for the specific drive becomes available for use. Immediately calling a USS_RPM or USS_WPM FC for the specified motor drive will result in a 0x818A error.

13.7.3.4 USS_WPM (Change parameters in the drive) instruction

Note

EEPROM write operations (for the EEPROM inside a USS drive)

Do not overuse the EEPROM permanent write operation. Minimize the number of EEPROM write operations to extend the EEPROM life.

Table 13- 128 USS_WPM instruction

LAD / FBD	SCL	Description

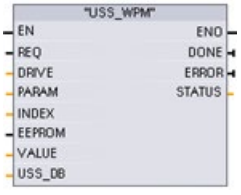
	`USS_WPM(REQ:=_bool_in_,`
	`DRIVE:=_usint_in_,`
	`PARAM:=_uint_in_,`
	`INDEX:=_uint_in_,`
	`EEPROM:=_bool_in_,`
	`VALUE:=_variant_in_,`
	`DONE=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`USS_DB:=_fbtref_inout_);`
		The USS_WPM instruction modifies a parameter in the drive. All USS functions associated with one USS network and PtP communication port must use the same data block.
		USS_WPM must be called from a main program cycle OB.

Table 13- 129 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	Send request: When true, REQ indicates that a new write request is desired. This is ignored if the request for this parameter is already pending.
DRIVE	IN	USInt	Drive address: DRIVE is the address of the USS drive. The valid range is drive 1 to drive 16.
PARAM	IN	UInt	Parameter number: PARAM designates which drive parameter is written. The range of this parameter is 0 to 2047. On some drives, the most significant byte can access PARAM values greater than 2047. See your drive manual for details on how to access an extended range.
INDEX	IN	UInt	Parameter index: INDEX designates which Drive Parameter index is to be written. A 16-bit value where the least significant byte is the actual index value with a range of (0 to 255). The most significant byte may also be used by the drive and is drive-specific. See your drive manual for details.
EEPROM	IN	Bool	Store To Drive EEPROM: When true, a write drive parameter transaction will be stored in the drive EEPROM. If false, the write is temporary and will not be retained if the drive is power cycled.
VALUE	IN	Word, Int, UInt, DWord, DInt, UDInt, Real	The value of the parameter that is to be written. It must be valid on the transition of REQ.
USS_DB	INOUT	USS_BASE	The name of the instance DB that is created and initialized when a USS_DRV instruction is placed in your program.
DONE[1]	OUT	Bool	When true, DONE indicates that the input VALUE has been written to the drive. This bit is set when USS_DRV sees the write response data from the drive. This bit is reset when either you request the response data via another USS_WPM poll, or on the second of the next two calls to USS_DRV
ERROR	OUT	Bool	When true, ERROR indicates that an error has occurred and the STATUS output is valid. All other outputs are set to zero on an error. Communication errors are only reported on the USS_PORT instruction ERROR and STATUS outputs.
STATUS	OUT	Word	STATUS indicates the result of the write request. Additional information is available in the "USS_Extended_Error" variable for some status codes.

[1] The DONE bit indicates that valid data has been read from the referenced motor drive and delivered to the CPU. It does not indicate that the USS library is capable of immediately reading another parameter. A blank PKW request must be sent to the motor drive and must also be acknowledged by the instruction before the parameter channel for the specific drive becomes available for use. Immediately calling a USS_RPM or USS_WPM FC for the specified motor drive will result in a 0x818A error.

13.7.4 Legacy USS status codes

USS instruction status codes are returned at the STATUS output of the USS functions.

Table 13- 130 STATUS codes [1]

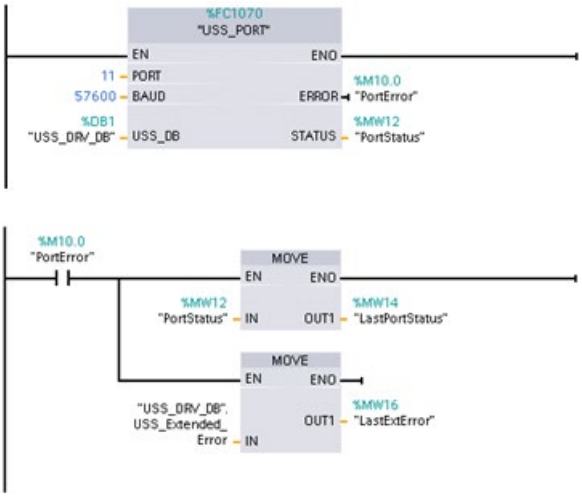
STATUS (W#16#....)	Description
0000	No error
8180	The length of the drive response did not match the characters received from the drive. The drive number where the error occurred is returned in the "USS_Extended_Error" variable. See the extended error description below this table.
8181	VALUE parameter was not a Word, Real or DWord data type.
8182	The user supplied a Word for a parameter value and received a DWord or Real from the drive in the response.
8183	The user supplied a DWord or Real for a parameter value and received a Word from the drive in the response.
8184	The response telegram from drive had a bad checksum. The drive number where the error occurred is returned in the "USS_Extended_Error" variable. See the extended error description below this table.
8185	Illegal drive address (valid drive address range: 1 to16)
8186	The speed set point is out of the valid range (valid speed SP range: -200% to 200%).
8187	The wrong drive number responded to the request sent. The drive number where the error occurred is returned in the "USS_Extended_Error" variable. See the extended error description below this table.
8188	Illegal PZD word length specified (valid range = 2, 4, 6 or 8 words)
8189	Illegal Baud Rate was specified.
818A	The parameter request channel is in use by another request for this drive.
818B	The drive has not responded to requests and retries. The drive number where the error occurred is returned in the "USS_Extended_Error" variable. See the extended error description below this table.
818C	The drive returned an extended error on a parameter request operation. See the extended error description below this table.
818D	The drive returned an illegal access error on a parameter request operation. See your drive manual for information of why parameter access may be limited.
818E	The drive has not been initialized. This error code is returned to USS_RPM or USS_WPM when USS_DRV, for that drive, has not been called at least once. This keeps the initialization on first scan of USS_DRV from overwriting a pending parameter read or write request, since it initializes the drive as a new entry. To fix this error, call USS_DRV for this drive number.
80Ax-80Fx	Specific errors returned from PtP communication FBs called by the USS Library - These error code values are not modified by the USS library and are defined in the PtP instruction descriptions.

[1] In addition to the USS instruction errors listed above, errors can be returned from the underlying PtP communication instructions.

For several STATUS codes, additional information is provided in the "USS_Extended_Error" variable of the USS_DRV Instance DB. For STATUS codes hexadecimal 8180, 8184, 8187, and 818B, USS_Extended_Error contains the drive number where the communication error occurred. For STATUS code hexadecimal 818C, USS_Extended_Error contains a drive error code returned from the drive when using a USS_RPM or USS_WPM instruction.

Example: communication errors reporting

Communication errors (STATUS = 16#818B) are only reported on the USS_PORT instruction and not on the USS_DRV instruction. For example, if the network is not properly terminated then it is possible for a drive to go to RUN but the USS_DRV instruction will show all 0's for the output parameters. In this case, you can only detect the communication error on the USS_PORT instruction. Since this error is only visible for one scan, you will need to add some capture logic as illustrated in the following example. In this example, when the error bit of the USS_PORT instruction is TRUE, then the STATUS and the USS_Extended_Error values are saved into M memory. The drive number is placed in USS_Extended_Error variable when the STATUS code value is hexadecimal 8180, 8184, 8187, or 818B.



Network 1"PortStatus"port status and"USS_DRV_DB".USS_Extended_ Errorextended error code values are only valid for one program scan. The values must be captured for later processing.

Network 2 The "PortError" contact triggers the storage of the "PortStatus" value in "LastPortStatus" and the"USS_DRV_DB".USS_Extended_Errorvalue in "LastExtError".

Read and write access to drive internal parameters

USS drives support read and write access to a drive's internal parameters. This feature allows remote control and configuration of the drive. Drive parameter access operations can fail due to errors such as values out of range or illegal requests for a drive's current mode. The drive generates an error code value that is returned in the "USS_Extended_Error" variable. This error code value is only valid for the last execution of a USS_RPM or USS_WPM instruction. The drive error code is put into USS_Extended_Error variable when the STATUS code value is hexadecimal 818C. The error code value of "USS_Extended_Error" depends on the drive model. See the drive's manual for a description of the extended error codes for read and write parameter operations.

13.7.5 Legacy USS general drive setup requirements

Legacy USS general drive setup requirements consist of the following points:

- The drives must be set to use 4 PKW words.
- The drives can be configured for 2, 4, 6, or 8 PZD words.
- The number of PZD word's in the drive must match PZD_LEN input on the USS_DRV instruction for that drive.
- The baud rate in all the drives must match the BAUD input on the USS_PORT instruction.
- The drive must be set for remote control.
- The drive must be set for frequency set-point to USS on COM Link.
- The drive address must be set to 1 to 16 and match the DRIVE input on the USS_DRV block for that drive.
- The drive direction control must be set to use the polarity of the drive set-point.
- The RS485 network must be terminated properly.

USS general drive connection and setup is the same for USS instructions (V4.1) and legacy USS instructions (V4.0 and earlier). Refer to the Example: USS general drive connection and setup (Page 1143) for further information.

13.8 Legacy Modbus TCP communication

13.8.1 Overview

Prior to the release of STEP 7 V13 SP1 and the S7-1200 V4.1 CPUs, the Modbus TCP communication instructions existed with different names, and in some cases, slightly different interfaces. The general concepts apply to both sets of instructions. Refer to the individual legacy Modbus TCP instructions for programming information.

13.8.2 Selecting the version of the Modbus TCP instructions

There are three versions of the Modbus TCP instructions available in STEP 7:

- Legacy version 3.0: Compatible with all CPU and CP versions
- Legacy version 3.1: Compatible with all CPU and CP versions
- Version 4.1: Compatible with V4.0 and later CPUs and V2.1 and later CMs

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

Do not use both 3.0 and 3.1 instruction versions in the same CPU program. Your program's Modbus TCP instructions must have the same major version number (**1**.x, **2**.y, or **V**.z). The individual instructions within a major version group may have different minor versions (1.**x**).



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



To change the version of the Modbus TCP instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a Modbus TCP instruction in your program, a new FB instance is created in the project tree. You can see new FB instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a Modbus TCP instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree Modbus TCP FB instance, right-click, select "Properties", and select the "Information" page to see the Modbus TCP instruction version number.

13.8.3 Legacy Modbus TCP instructions

13.8.3.1 MB_CLIENT (Communicate using PROFINET as Modbus TCP client)

Table 13- 131 MB_CLIENT instruction

LAD / FBD	SCL	Description

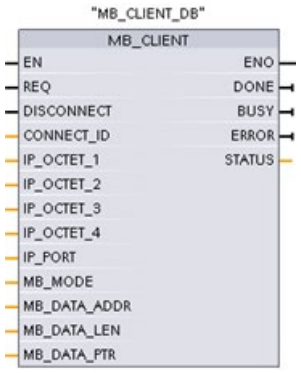
	`"MB_CLIENT_DB"(`
	`REQ:=_bool_in_,`
	`DISCONNECT:=_bool_in_,`
	`CONNECT_ID=_uint_in_,`
	`IP_OCTET_1:=_byte_in_,`
	`IP_OCTET_2:=_byte_in_,`
	`IP_OCTET_3:=_byte_in_,`
	`IP_OCTET_4:=_byte_in_,`
	`IP_PORT:=_uint_in_,`
	`MB_MODE:=_usint_in_,`
	`MB_DATA_ADDR:=_udint_in_,`
	`MB_DATA_LEN:=_uint_in_,`
	`DONE=>_bool_out_,`
	`BUSY=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`MB_DATA_PTR:=_variant_inout_);`
		MB_CLIENT communicates as a Modbus TCP client through the PROFINET connector on the S7-1200 CPU. No additional communication hardware module is required.
		MB_CLIENT can make a client-server connection, send a Modbus function request, receive a response, and control the disconnection from a Modbus TCP server.

Table 13- 132 Data types for the parameters

Parameter and type		Data type	Description
REQ	In	Bool	FALSE = No Modbus communication request TRUE = Request to communicate with a Modbus TCP server
DISCONNECT	IN	Bool	The DISCONNECT parameter allows your program to control connection and disconnection with a Modbus server device. If DISCONNECT = 0 and a connection does not exist, then MB_CLIENT attempts to make a connection to the assigned IP address and port number. If DISCONNECT = 1 and a connection exists, then a disconnect operation is attempted. Whenever this input is enabled, no other operation will be attempted.
CONNECT_ID	IN	UInt	The CONNECT_ID parameter must uniquely identify each connection within the PLC. Each unique instance of the MB_CLIENT or MB_SERVER instruction must contain a unique CONNECT_ID parameter.
IP_OCTET_1	IN	USInt	Modbus TCP server IP address: Octet 1 8-bit part of the 32-bit IPv4 IP address of the Modbus TCPserver to which the client will connect and communicate using the Modbus TCP protocol.
IP_OCTET_2	IN	USInt	Modbus TCP server IP address: Octet 2
IP_OCTET_3	IN	USInt	Modbus TCP server IP address: Octet 3
IP_OCTET_4	IN	USInt	Modbus TCP server IP address: Octet 4
IP_PORT	IN	UInt	Default value = 502: The IP port number of the server to which the client will attempt to connect and ultimately communicate using the TCP/IP protocol.

Parameter and type		Data type	Description
MB_MODE	IN	USInt	Mode Selection: Assigns the type of request (read, write, or diagnostic). See the Modbus functions table below for details.
MB_DATA_ADDR	IN	UDInt	Modbus starting Address: Assigns the starting address of the data to be accessed by MB_CLIENT. See the Modbus functions table below for valid addresses.
MB_DATA_LEN	IN	UInt	Modbus data Length: Assigns the number of bits or words to be accessed in this request. See the Modbus functions table below for valid lengths
MB_DATA_PTR	IN_OUT	Variant	Pointer to the Modbus data register: The register buffers data going to or coming from a Modbus server. The pointer must assign a non-optimized global DB or a M memory address.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error.
BUSY	OUT	Bool	• 0 - No MB_CLIENT operation in progress • 1 - MB_CLIENT operation in progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the MB_CLIENT execution was terminated with an error. The error code value at the STATUS parameter is valid only during the single cycle where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code

REQ parameter

FALSE = No Modbus communication request
TRUE = Request to communicate with a Modbus TCP server

If no instance of MB_CLIENT is active and parameter DISCONNECT=0, when REQ=1 a new Modbus request will start. If the connection is not already established then a new connection will be made.

If the same instance of MB_CLIENT is executed again with DISCONNECT=0 and REQ=1, before the completion of the current request, then no subsequent Modbus transmission will be made. However, as soon as the current request is completed, a new request can be processed if MB_CLIENT is executed with REQ=1.

When the current MB_CLIENT communication request is complete, the DONE bit is TRUE for one cycle. The DONE bit can be used as a time gate to sequence multiple MB_CLIENT requests.

Note

Input data consistency during MB_CLIENT processing

Once a Modbus client initiates a Modbus operation, all the input states are saved internally and are then compared on each successive call. The comparison is used to determine if this particular call was the originator of the active client request. More than one MB_CLIENT call can be performed using a common instance DB.

As a result, it is important that the inputs are not changed during the period of time that a MB_CLIENT operation is actively being processed. If this rule is not followed, then a MB_CLIENT cannot determine that it is the active instance.

MB_MODE and MB_DATA_ADDR parameters select the Modbus communication function

MB_DATA_ADDR assigns the starting Modbus address of the data to be accessed. The MB_CLIENT instruction uses a MB_MODE input rather than a function code input.

The combination of MB_MODE and MB_DATA_ADDR values determine the function code that is used in the actual Modbus message. The following table shows the correspondence between parameter MB_MODE, Modbus function, and Modbus address range.

Table 13- 133 Modbus functions

MB_MODE	Modbus function	Data length	Operation and data	MB_DATA_ADDR
0	01	1 to 2000	Read output bits: 1 to 2000 bits per request	1 to 9999
0	02	1 to 2000	Read input bits: 1 to 2000 bits per request	10001 to 19999
0	03	1 to 125	Read Holding registers: 1 to 125 words per request	40001 to 49999 or 400001 to 465535
0	04	1 to 125	Read input words: 1 to 125 words per request	30001 to 39999
1	05	1	Write one output bit: One bit per request	1 to 9999
1	06	1	Write one holding register: 1 word per request	40001 to 49999 or 400001 to 465535
1	15	2 to 1968	Write multiple output bits: 2 to 1968 bits per request	1 to 9999
1	16	2 to 123	Write multiple holding registers: 2 to 123 words per request	40001 to 49999 or 400001 to 465535
2	15	1 to 1968	Write one or more output bits: 1 to 1968 bits per request	1 to 9999
2	16	1 to 123	Write one or more holding registers: 1 to 123 words per request	40001 to 49999 or 400001 to 465535
11	11	0	Read the server communication status word and event counter. The status word indicates busy (0 – not busy, 0xFFFF - busy). The event counter is incremented for each successful completion of a message. Both the MB_DATA_ADDR and MB_DATA_LEN parameters of MB_CLIENT are ignored for this function.	
80	08	1	Check server status using data diagnostic code 0x0000 (Loopback test – server echoes the request) 1 word per request	

MB_MODE	Modbus function	Data length	Operation and data	MB_DATA_ADDR
81	08	1	Reset server event counter using data diagnostic code 0x000A 1 word per request	
3 to 10, 12 to 79, 82 to 255			Reserved	

Note

MB_DATA_PTR assigns a buffer to store data read/written to/from a Modbus TCP server

The data buffer can be in a non-optimized global DB or M memory address.

For a buffer in M memory, use the standard Any Pointer format. This is in the format P#"Bit Address" "Data Type" "Length", an example would be P#M1000.0 WORD 500.

MB_DATA_PTR assigns a communication buffer

- MB_CLIENT communication functions:
  - Read and write 1-bit data from Modbus server addresses (00001 to 09999)
  - Read 1-bit data from Modbus server addresses (10001 to 19999)
  - Read 16-bit word data from Modbus server addresses (30001 to 39999) and (40001 to 49999)
  - Write 16-bit word data to Modbus server addresses (40001 to 49999)
- Word or bit sized data is transferred to/from the DB or M memory buffer assigned by MB_DATA_PTR.
- If a DB is assigned as the buffer by MB_DATA_PTR, then you must assign data types to all DB data elements.
  - The 1-bit Bool data type represents one Modbus bit address
  - 16-bit single word data types like WORD, UInt, and Int represent one Modbus word address
  - 32-bit double word data types like DWORD, DInt, and Real represent two Modbus word addresses

- Complex DB elements can be assigned by MB_DATA_PTR, such as
  - Standard arrays
  - Named structures where each element is unique.
  - Named complex structures where each element has a unique name and a 16 or 32 bit data type.
- There is no requirement that the MB_DATA_PTR data areas be in the same global data block (or M memory area). You can assign one data block for Modbus reads, another data block for Modbus writes, or one data block for each MB_CLIENT station.

Multiple client connections

A Modbus TCP client can support concurrent connections up to the maximum number of Open User Communications connections allowed by the PLC. The total number of connections for a PLC, including Modbus TCP Clients and Servers, must not exceed the maximum number of supported Open User Communications connections (Page 783). The Modbus TCP connections may be shared between Client and/or Server type connections.

Individual client connections must follow these rules:

- Each MB_CLIENT connection must use a distinct instance DB
- Each MB_CLIENT connection must specify a unique server IP address
- Each MB_CLIENT connection must specify a unique connection ID
- Unique IP port numbers may or may not be required depending upon the server configuration

The Connection ID must be unique for each individual connection. This means a single, unique Connection ID must only be used with each individual instance DB. In summary, the instance DB and the Connection ID are paired together and must be unique for every connection.

Table 13- 134 MB_CLIENT instance data block user accessible static variables

Variable	Data type	Default	description
Blocked_Proc_Timeout	Real	3.0	Amount of time (in seconds) to wait upon a blocked Modbus client instance before removing this instance as being ACTIVE. This can occur, for example, when a client request has been issued and then application stops executing the client function before it has completely finished the request. The maximum S7-1200 limit is 55 seconds.
MB_Unit_ID	Word	255	Modbus unit identifier: A Modbus TCP server is addressed using its IP address. As a result, the MB_UNIT_ID parameter is not used for Modbus TCP addressing. The MB_UNIT_ID parameter corresponds to the slave address in the Modbus RTU protocol. If a Modbus TCP server is used for a gateway to a Modbus RTU protocol, the MB_UNIT_ID can be used to identify the slave device connected on the serial network. The MB_UNIT_ID would be used to forward the request to the correct Modbus RTU slave address. Some Modbus TCP devices may require the MB_UNIT_ID parameter to be initialized within a restricted range of values.
RCV_TIMEOUT	Real	2.0	Time in seconds that the MB_CLIENT waits for a server to respond to a request.
Connected	Bool	0	Indicates whether the connection to the assigned server is connected or disconnected: 1=connected, 0=disconnected

Table 13- 135 MB_CLIENT protocol errors

STATUS (W#16#)	Response code to Modbus client (B#16#)	Modbus protocol errors
8381	01	Function code not supported
8382	03	Data length error
8383	02	Data address error or access outside the bounds of the MB_HOLD_REG address area
8384	03	Data value error
8385	03	Data diagnostic code value not supported (function code 08)

Table 13- 136 MB_CLIENT execution condition codes [1]

STATUS (W#16#)	MB_CLIENT parameter errors
7001	MB_CLIENT is waiting for a Modbus server response to a connect or disconnect request, on the assigned TCP port. This is only reported for the first execution of a connect or disconnect operation.
7002	MB_CLIENT is waiting for a Modbus server response to a connect or disconnect request, for the assigned TCP port. This will be reported for any subsequent executions, while waiting for completion of a connect or disconnect operation.
7003	A disconnect operation has successfully completed (Only valid for one PLC scan).
80C8	The server did not respond in the assigned time. MB_CLIENT must receive a response using the transaction ID that was originally transmitted within the assigned time or this error is returned. Check the connection to the Modbus server device. This error is only reported after any configured retries (if applicable) have been attempted.
8188	Invalid mode value
8189	Invalid data address value
818A	Invalid data length value
818B	Invalid pointer to the DATA_PTR area. This can be the combination of MB_DATA_ADDRESS + MB_DATA_LEN.
818C	Pointer to a optimized DATA_PTR area (must be a non-optimized DB area or M memory area)
8200	The port is busy processing an existing Modbus request.
8380	Received Modbus frame is malformed or too few bytes have been received.
8387	The assigned Connection ID parameter is different from the ID used for previous requests. There can only be a single Connection ID used within each MB_CLIENT instance DB. This is also used as an internal error if the Modbus TCP protocol ID received from a server is not 0.
8388	A Modbus server returned a quantity of data that is different than what was requested. This applies to Modbus functions 15 or 16 only.

[1] In addition to the MB_CLIENT errors listed above, errors can be returned from the underlying T block communication instructions (TCON, TDISCON, TSEND, and TRCV (Page 837)).

13.8.3.2 MB_SERVER (Communicate using PROFINET as Modbus TCP server)

The "MB_SERVER" instruction communicates as Modbus TCP server through the PROFINET connector on the S7-1200 CPU. The "MB_SERVER" instruction processes connection requests of a Modbus TCP client, receives and processes Modbus requests, and sends responses.

To use the instruction, you do not require an additional hardware module.

NOTICE
Security information Note that each client of the network is given read and write access to the process image inputs and outputs and to the data block or bit memory area defined by the Modbus holding register. The option is available to restrict access to an IP address to prevent unauthorized read and write operations. Note, however, that the shared address can also be used for unauthorized access.

Table 13- 137 MB_SERVER instruction

LAD / FBD	SCL	Description

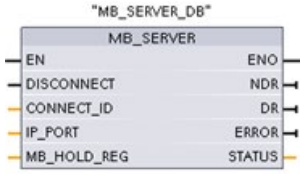
	`"MB_SERVER_DB"(`
	`DISCONNECT:=_bool_in_,`
	`CONNECT_ID:=_uint_in_,`
	`IP_PORT:=_uint_in_,`
	`NDR=>_bool_out_,`
	`DR=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`MB_HOLD_REG:=_variant_inout_);`
		MB_SERVER communicates as a Modbus TCP server through the PROFINET connector on the S7-1200 CPU. No additional communication hardware module is required.
		MB_SERVER can accept a request to connect with Modbus TCP client, receive a Modbus function request, and send a response message.

Table 13- 138 Data types for the parameters

Parameter and type		Data type	Description
DISCONNECT	IN	Bool	MB_SERVER attempts to make a "passive" connection with a partner device. This means that the server is passively listening for a TCP connection request from any requesting IP address. If DISCONNECT = 0 and a connection does not exist, then a passive connection can be initiated. If DISCONNECT = 1 and a connection exists, then a disconnect operation is initiated. This allows your program to control when a connection is accepted. Whenever this input is enabled, no other operation will be attempted.
CONNECT_ID	IN	UInt	CONNECT_ID uniquely identifies each connection within the PLC. Each unique instance of the MB_CLIENT or MB_SERVER instruction must contain a unique CONNECT_ID parameter.
IP_PORT	IN	UInt	Default value = 502: The IP port number that identifies the IP port that will be monitored for a connection request from a Modbus client. These TCP port numbers are not allowed for a MB_SERVER passive connection: 20, 21, 25, 80, 102, 123, 5001, 34962, 34963, and 34964.
MB_HOLD_REG	IN_OUT	Variant	Pointer to the MB_SERVER Modbus holding register: The holding register must either be a non-optimized global DB or a M memory address. This memory area is used to hold the values a Modbus client is allowed to access using Modbus register functions 3 (read), 6 (write), and 16 (write).
NDR	OUT	Bool	New Data Ready: 0 = No new data, 1 = Indicates that new data has been written by a Modbus client
DR	OUT	Bool	Data Read: 0 = No data read, 1 = Indicates that data has been read by a Modbus client.
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after MB_SERVER execution was terminated with an error. The error code value at the STATUS parameter is valid only during the single cycle where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code

MB_SERVER allows incoming Modbus function codes (1, 2, 4, 5, and 15) to read or write bits and words directly in the input process image and output process image of the S7-1200 CPU. For data transfer function codes (3, 6, and 16), the MB_HOLD_REG parameter must be defined as a data type larger than a byte. The following table shows the mapping of Modbus addresses to the process image in the CPU.

Table 13- 139 Mapping of Modbus addresses to the process image

Modbus functions						S7-1200	
Codes	Function	Data area	Address range			Data area	CPU address
01	Read bits	Output	1	To	8192	Output Process Image	Q0.0 to Q1023.7
02	Read bits	Input	10001	To	18192	Input Process Image	I0.0 to I1023.7
04	Read words	Input	30001	To	30512	Input Process Image	IW0 to IW1022
05	Write bit	Output	1	To	8192	Output Process Image	Q0.0 to Q1023.7
15	Write bits	Output	1	To	8192	Output Process Image	Q0.0 to Q1023.7

Incoming Modbus message function codes function codes (3, 6, and 16) read or write words in a Modbus holding register which can be an M memory address range or a data block. The type of holding register is specified by the MB_HOLD_REG parameter.

Note

MB_HOLD_REG parameter assignment

The Modbus Holding Register can be in a non-optimized global DB or an M memory address.

For A Modbus holding register in M memory, use the standard Any Pointer format. This is in the format P#"Bit Address" "Data Type" "Length". An example would be P#M1000.0 WORD 500

The following table shows examples of Modbus address to holding register mapping used for Modbus function codes 03 (read words), 06 (write word), and 16 (write words). The actual upper limit of DB addresses is determined by the maximum work memory limit and M memory limit, for each CPU model.

Table 13- 140 Mapping examples of Modbus address to CPU memory address

Modbus Address	MB_HOLD_REG parameter examples		
	P#M100.0 Word 5	P#DB10.DBx0.0 Word 5	"Recipe".ingredient
40001	MW100	DB10.DBW0	"Recipe".ingredient[1]
40002	MW102	DB10.DBW2	"Recipe".ingredient[2]
40003	MW104	DB10.DBW4	"Recipe".ingredient[3]
40004	MW106	DB10.DBW6	"Recipe".ingredient[4]
40005	MW108	DB10.DBW8	"Recipe".ingredient[5]

Multiple server connections

Multiple server connections may be created. This permits a single PLC to establish concurrent connections to multiple Modbus TCP clients.

A Modbus TCP server can support concurrent connections up to the maximum number of Open User Communications connections allowed by the PLC. The total number of connections for a PLC, including Modbus TCP Clients and Servers, must not exceed the maximum number of supported Open User Communications connections (Page 783). The Modbus TCP connections may be shared between Client and/or Server type connections.

Individual server connection must follow these rules:

- Each MB_SERVER connection must use a distinct instance DB.
- Each MB_SERVER connection must be established with a unique IP port number. Only 1 connection per port is supported.
- Each MB_SERVER connection must use a unique connection ID.
- The MB_SERVER must be called individually for each connection (with its respective instance DB).

The Connection ID must be unique for each individual connection. This means a single, unique Connection ID must only be used with each individual instance DB. In summary, the instance DB and the Connection ID are paired together and must be unique for every connection.

Table 13- 141 Modbus diagnostic function codes

MB_SERVER Modbus diagnostic functions		
Codes	Sub-function	Description
08	0x0000	Return query data echo test: The MB_SERVER will echo back to a Modbus client a word of data that is received.
08	0x000A	Clear communication event counter: The MB_SEVER will clear out the communication event counter that is used for Modbus function 11.
11		Get communication event counter: The MB_SERVER uses an internal communication event counter for recording the number of successful Modbus read and write requests that are sent to the Modbus server. The counter does not increment on any Function 8 or Function 11 requests. It is also not incremented on any requests that result in a communication error. The broadcast function is not available for Modbus TCP, because only one client-server connection exists at any one time.

MB_SERVER variables

This table shows the public static variables stored in the MB_SERVER instance data block that can be used in your program

Table 13- 142 MB_SERVER public static variables

Variable	Data type	Default value	Description
HR_Start_Offset	Word	0	Assigns the starting address of the Modbus Holding register
Request_Count	Word	0	The number of all requests received by this server.
Server_Message_Count	Word	0	The number of requests received for this specific server.
Xmt_Rcv_Count	Word	0	The number of transmissions or receptions that have encountered an error. Also, incremented if a message is received that is an invalid Modbus message.
Exception_Count	Word	0	Modbus specific errors that require a returned exception
Success_Count	Word	0	The number of requests received for this specific server that has no protocol errors.
Connected	Bool	0	Indicates whether the connection to the assigned client is connected or disconnected: 1=connected, 0=disconnected

Your program can write values to the HR_Start_Offset and control Modbus server operations. The other variables can be read to monitor Modbus status.

HR_Start_Offset

Modbus holding register addresses begin at 40001. These addresses correspond to the beginning PLC memory address of the holding register. However, you can configure the "HR_Start_Offset" variable to start the beginning Modbus holding register address at another value instead of 40001.

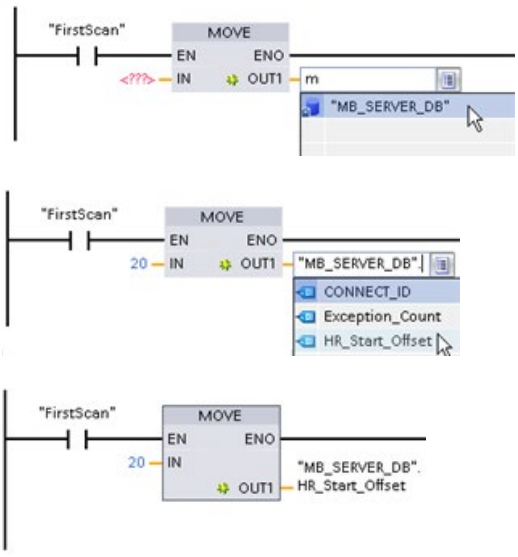
For example, if the holding register is configured to start at MW100 and is 100 words long. An offset of 20 specifies a beginning holding register address of 40021 instead of 40001. Any address below 40021 and above 40119 will result in an addressing error.

Table 13- 143 Example of Modbus holding register addressing

HR_Start_Offset	Address	Minimum	Maximum
0	Modbus address (Word)	40001	40099
	S7-1200 address	MW100	MW298
20	Modbus address (Word)	40021	40119
	S7-1200 address	MW100	MW298

HR_Start_Offset is a word value that specifies the starting address of the Modbus holding register and is stored in the MB_SERVER instance data block. You can set this public static variable value by using the parameter helper drop-list, after MB_SERVER is placed in your program.

For example, after MB_SERVER is placed in a LAD network, you can go to a previous network and assign the HR_Start_Offset value. The value must be assigned prior to execution of MB_SERVER.



Entering a Modbus server variable using the default DB name:

1. Set the cursor in the parameter field and type an m character.
2. Select "MB_SERVER_DB" from the drop-list of DB names.
3. Select "MB_SERVER_DB.HR_Start_Offset" from the drop-list of DB variables.

Table 13- 144 MB_SERVER execution condition codes [1]

STATUS (W#16#)	Response code to Modbus server (B#16#)	Modbus protocol errors
7001		MB_SERVER is waiting for a Modbus client to connect to the assigned TCP port. This code is reported on the first execution of a connect or disconnect operation.
7002		MB_SERVER is waiting for a Modbus client to connect to the assigned TCP port. This code is reported for any subsequent executions, while waiting for completion of a connect or disconnect operation.
7003		A disconnect operation has successfully completed (Only valid for one PLC scan).
8187		Invalid pointer to MB_HOLD_REG: area is too small
818C		Pointer to an optimized MB_HOLD_REG area (must be a non-optimized DB area or M memory area) or Blocked process timeout exceeds the limit of 55 seconds. (S7-1200 specific)
8381	01	Function code not supported
8382	03	Data length error
8383	02	Data address error or access outside the bounds of the MB_HOLD_REG address area
8384	03	Data value error
8385	03	Data diagnostic code value not supported (function code 08)

[1] In addition to the MB_SERVER errors listed above, errors can be returned from the underlying T block communication instructions (TCON, TDISCON, TSEND, and TRCV (Page 837)).

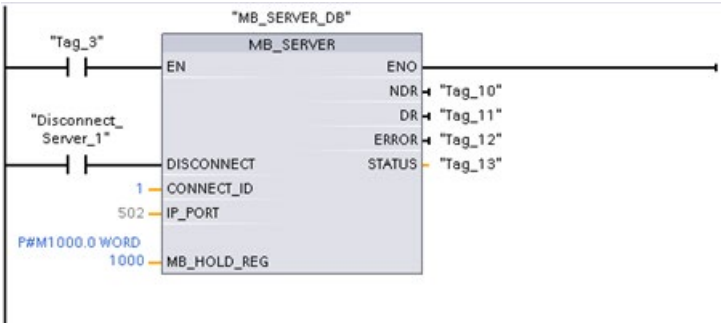
13.8.4 Legacy Modbus TCP examples

13.8.4.1 Example: Legacy MB_SERVER Multiple TCP connections

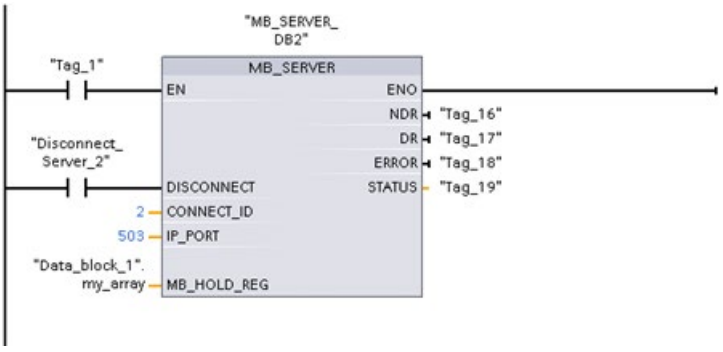
You can have multiple Modbus TCP server connections. To accomplish this, MB_SERVER must be independently executed for each connection. Each connection must use an independent instance DB, connection ID, and IP port. The S7-1200 allows only one connection per IP port.

For best performance, MB_SERVER should be executed every program cycle, for each connection.

Network 1: Connection #1 with independent IP_PORT, connection ID, and instance DB



Network 2: Connection #2 with independent IP_PORT, connection ID, and instance DB



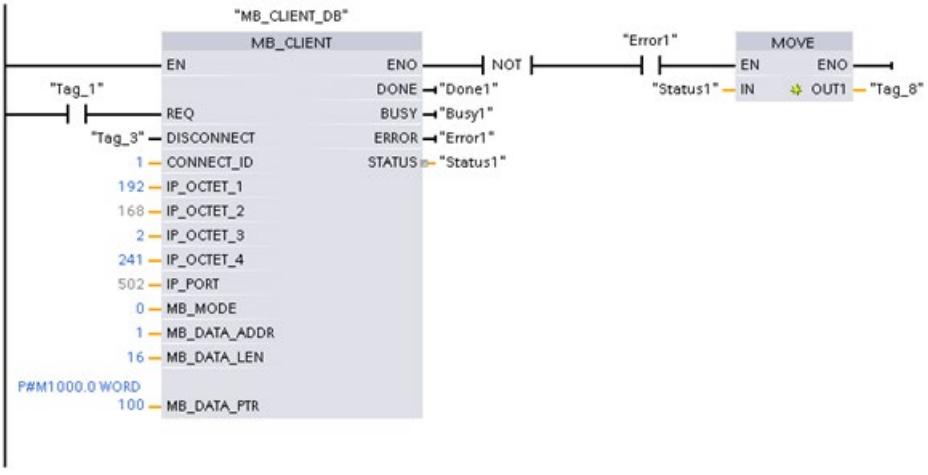
13.8.4.2 Example: Legacy MB_CLIENT 1: Multiple requests with common TCP connection

Multiple Modbus client requests can be sent over the same connection. To accomplish this, use the same instance DB, connection ID, and port number.

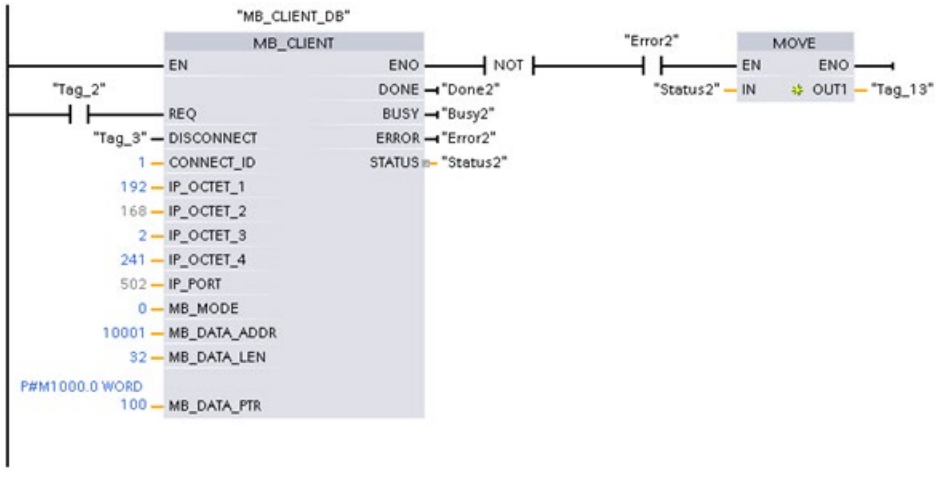
Only 1 client can be active at any given time. Once a client completes its execution, the next client begins execution. Your program is responsible for the order of execution.

The example shows both clients writing to the same memory area. Also, a returned error is captured which is optional.

Network 1: Modbus function 1 - Read 16 output image bits



Network 2: Modbus function 2 - Read 32 input image bits



13.8.4.3 Example: Legacy MB_CLIENT 2: Multiple requests with different TCP connections

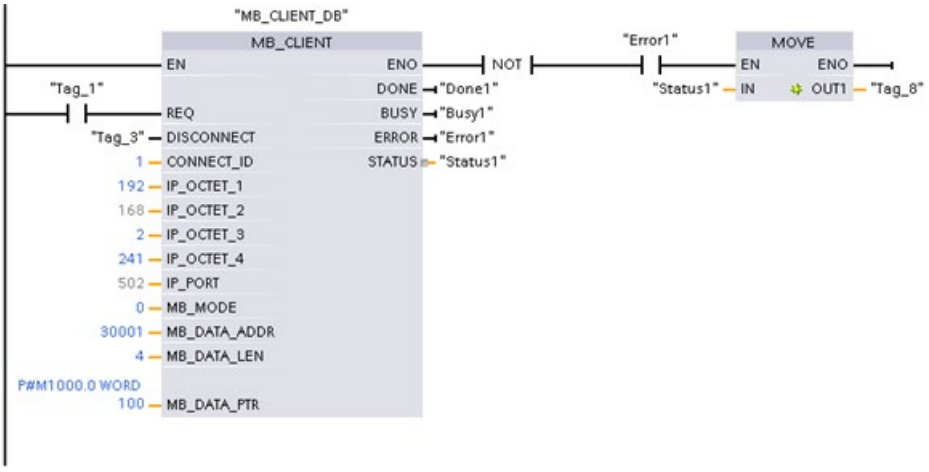
Modbus client requests can be sent over different connections. To accomplish this, different instance DBs, IP addresses, and connection IDs must be used.

The port number must be different if the connections are established to the same Modbus server. If the connections are on different servers, there is no port number restriction.

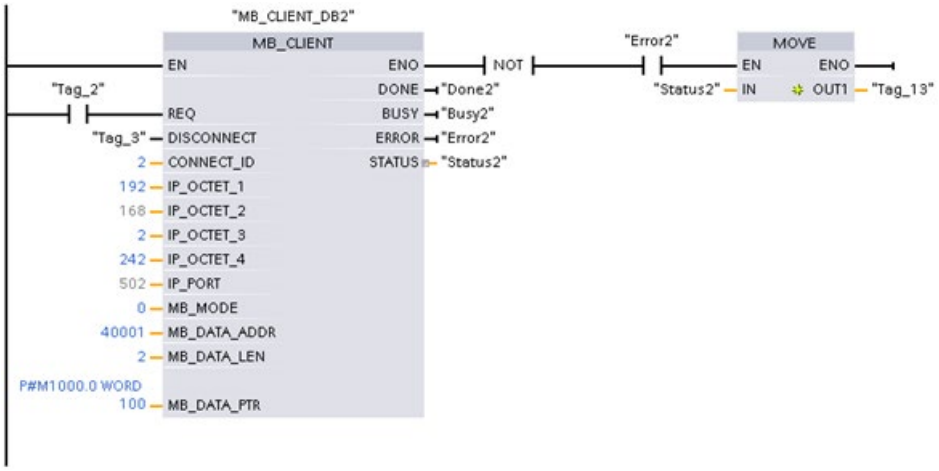
The example shows both clients writing to the same memory area. Also, a returned error is captured which is optional.

Network 1:

Modbus function 4 - Read input words (in S7-1200 memory)



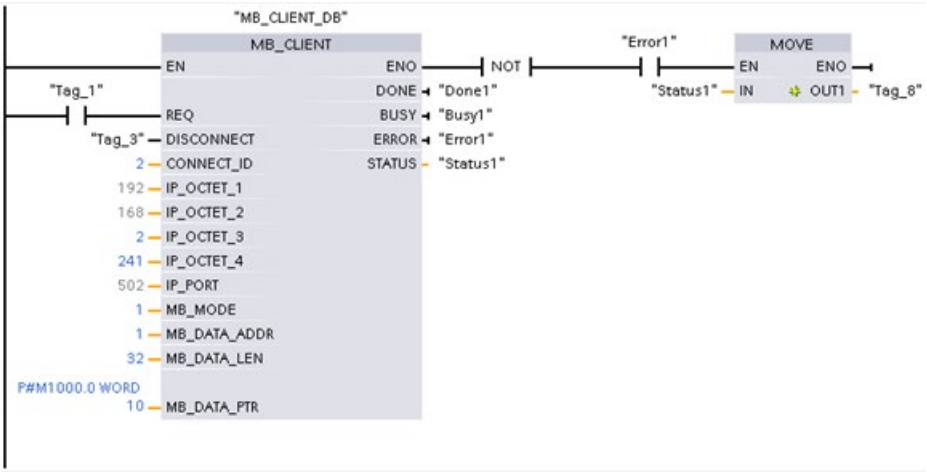
Network 2: Modbus function 3 - Read holding register words from a Modbus TCP server



13.8.4.4 Example: Legacy MB_CLIENT 3: Output image write request

This example shows a Modbus client request to write the S7-1200 output image.

Network 1: Modbus function 15 - Write S7-1200 output image bits

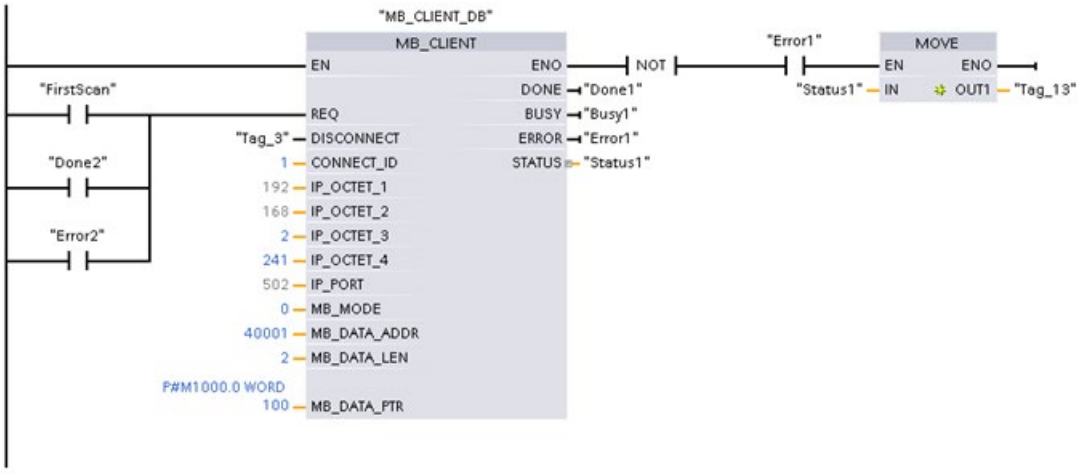


13.8.4.5 Example: Legacy MB_CLIENT 4: Coordinating multiple requests

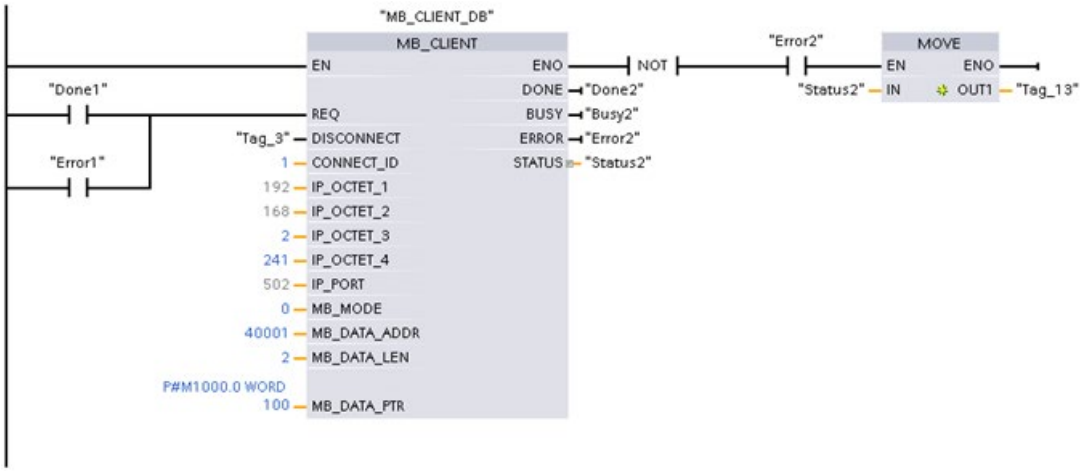
You must ensure that each individual Modbus TCP request finishes execution. This coordination must be provided by your program. The example below shows how the outputs of the first and second client requests can be used to coordinate execution.

The example shows both clients writing to the same memory area. Also, a returned error is captured which is optional.

Network 1: Modbus function 3 - Read holding register words



Network 2: Modbus function 3 - Read holding register words



13.9 Legacy Modbus RTU communication (CM/CB 1241 only)

13.9.1 Overview

Prior to the release of STEP 7 V13 SP1 and the S7-1200 V4.1 CPUs, the Modbus RTU communication instructions existed with different names, and in some cases, slightly different interfaces. The general concepts apply to both sets of instructions. Refer to the individual legacy Modbus RTU instructions for programming information.

13.9.2 Selecting the version of the Modbus RTU instructions

There are two versions of the legacy Modbus RTU instructions available in STEP 7:

- Legacy version 1.3: Compatible with all CPU and CP versions
- Legacy version 2.2: Compatible with all CPU and CP versions

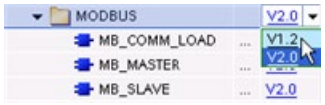
  (Note: The version 2.2 design adds REQ and DONE parameters to MB_COMM_LOAD. Also, the MB_ADDR parameter for MB_MASTER and MB_SLAVE now allows a UInt value for extended addressing.)

For compatibility and ease of migration, you can choose which instruction version to insert into your user program.

You cannot use both versions of the instructions with the same module, but two different modules can use different versions of the instructions. Your program's Modbus RTU instructions must have the same major version number (**1**.x, **2**.y, or **V**.z). The individual instructions within a major version group may have different minor versions (1.**x**).



Click the icon on the instruction tree task card to enable the headers and columns of the instruction tree.



To change the version of the Modbus instructions, select the version from the drop-down list. You can select the group or individual instructions.

When you use the instruction tree to place a Modbus instruction in your program, a new FB instance is created in the project tree. You can see new FB instance in the project tree under PLC_x > Program blocks > System blocks > Program resources.

To verify the version of a Modbus instruction in a program, you must inspect project tree properties and not the properties of a box displayed in the program editor. Select a project tree Modbus FB instance, right-click, select "Properties", and select the "Information" page to see the Modbus instruction version number.

13.9.3 Legacy Modbus RTU instructions

13.9.3.1 MB_COMM_LOAD (Configure port on the PtP module for Modbus RTU)

Table 13- 145 MB_COMM_LOAD instruction

LAD / FBD	SCL	Description

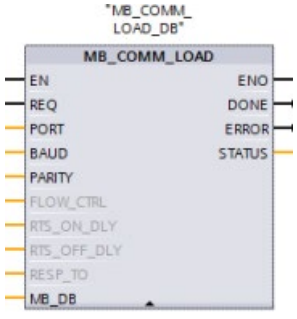
	`"MB_COMM_LOAD_DB"(`
	`REQ:=_bool_in,`
	`PORT:=_uint_in_,`
	`BAUD:=_udint_in_,`
	`PARITY:=_uint_in_,`
	`FLOW_CTRL:=_uint_in_,`
	`RTS_ON_DLY:=_uint_in_,`
	`RTS_OFF_DLY:=_uint_in_,`
	`RESP_TO:=_uint_in_,`
	`DONE=>_bool_out,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`MB_DB:=_fbtref_inout_);`
		The MB_COMM_LOAD instruction configures a PtP port for Modbus RTU protocol communications. Modbus port hardware options: Install up to three CMs (RS485 or RS232), plus one CB (R4845). An instance data block is assigned automatically when you place the MB_COMM_LOAD instruction in your program.

Table 13- 146 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	A low to high (positive edge) signal starts the operation. (Version 2.0 only)
PORT	IN	Port	After you install and configure a CM or CB communication device, the port identifier appears in the parameter helper drop-list available at the PORT box connection. The assigned CM or CB port value is the device configuration property "hardware identifier". The port symbolic name is assigned in the "System constants" tab of the PLC tag table.
BAUD	IN	UDInt	Baud rate selection: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, all other values are invalid
PARITY	IN	UInt	Parity selection: • 0 – None • 1 – Odd • 2 – Even
FLOW_CTRL [1]	IN	UInt	Flow control selection: • 0 – (default) no flow control • 1 – Hardware flow control with RTS always ON (does not apply to RS485 ports) • 2 – Hardware flow control with RTS switched
RTS_ON_DLY [1]	IN	UInt	RTS ON delay selection: • 0 – (default) No delay from RTS active until the first character of the message is transmitted • 1 to 65535 – Delay in milliseconds from RTS active until the first character of the message is transmitted (does not apply to RS485 ports). RTS delays shall be applied independent of the FLOW_CTRL selection.
RTS_OFF_DLY [1]	IN	UInt	RTS OFF delay selection: • 0 – (default) No delay from the last character transmitted until RTS goes inactive • 1 to 65535 – Delay in milliseconds from the last character transmitted until RTS goes inactive (does not apply to RS485 ports). RTS delays shall be applied independent of the FLOW_CTRL selection.
RESP_TO [1]	IN	UInt	Response timeout: Time in milliseconds allowed by MB_MASTER for the slave to respond. If the slave does not respond in this time period, MB_MASTER will retry the request or terminate the request with an error when the specified number of retries has been sent. 5 ms to 65535 ms (default value = 1000 ms).
MB_DB	IN	Variant	A reference to the instance data block used by the MB_MASTER or MB_SLAVE instructions. After MB_SLAVE or MB_MASTER is placed in your program, the DB identifier appears in the parameter helper drop-list available at the MB_DB box connection.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error. (Version 2.0 only)

Parameter and type		Data type	Description
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code

[1] Optional parameters for MB_COMM_LOAD (V 2.x or later). Click the arrow at the bottom of a LAD/FBD box to expand the box and include these parameters.

MB_COMM_LOAD is executed to configure a port for the Modbus RTU protocol. Once a port is configured for the Modbus RTU protocol, it can only be used by either the MB_MASTER or MB_SLAVE instructions.

One execution of MB_COMM_LOAD must be used to configure each communication port that is used for Modbus communication. Assign a unique MB_COMM_LOAD instance DB for each port that you use. You can install up to three communication modules (RS232 or RS485) and one communication board (RS485) in the CPU. Call MB_COMM_LOAD from a startup OB and execute it one time or use the first scan system flag (Page 108) to initiate the call to execute it one time. Only execute MB_COMM_LOAD again if communication parameters like baud rate or parity must change.

An instance data block is assigned for MB_MASTER or MB_SLAVE when you place these instructions in your program. This instance data block is referenced when you specify the MB_DB parameter for the MB_COMM_LOAD instruction.

MB_COMM_LOAD data block variables

The following table shows the public static variables stored in the instance DB for the MB_COMM_LOAD that can be used in your program.

Table 13- 147 Static variables in the instance DB

Variable	Data type	Description
ICHAR_GAP	UInt	Delay for Inter-character gap between characters. This parameter is specified in milliseconds and is used to increase the expected amount of time between received characters. The corresponding number of bit times for this parameter is added to the Modbus default of 35 bit times (3.5 character times).
RETRIES	UInt	Number of retries that the master will attempt before returning the no response error code 0x80C8.
STOP_BITS	USInt	Number of stop bits used in framing each character. Valid values are 1 and 2.

Table 13- 148 MB_COMM_LOAD execution condition codes [1]

STATUS (W#16#)	Description
0000	No error
8180	Invalid port ID value (wrong port/hardware identifier for communication module)
8181	Invalid baud rate value
8182	Invalid parity value
8183	Invalid flow control value
8184	Invalid response timeout value (response timeout less than the 5 ms minimum)
8185	MB_DB parameter is not an instance data block of a MB_MASTER or MB_SLAVE instruction.

[1] In addition to the MB_COMM_LOAD errors listed above, errors can be returned from the underlying PtP communication instructions.

13.9.3.2 MB_MASTER (Communicate using the PtP port as Modbus RTU master)

Table 13- 149 MB_MASTER instruction

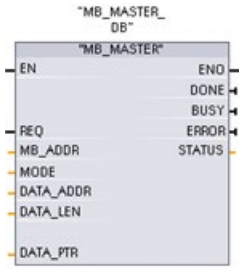
LAD / FBD	SCL	Description
	"MB_MASTER_DB"(REQ:=_bool_in_, MB_ADDR:=_uint_in_, MODE:=_usint_in_, DATA_ADDR:=_udint_in_, DATA_LEN:=_uint_in_, DONE=>_bool_out_, BUSY=>_bool_out_, ERROR=>_bool_out_, STATUS=>_word_out_, DATA_PTR:=_variant_inout_);	The MB_MASTER instruction communicates as a Modbus master using a port that was configured by a previous execution of the MB_COMM_LOAD instruction. An instance data block is assigned automatically when you place the MB_MASTER instruction in your program. This MB_MASTER instance data block is used when you specify the MB_DB parameter for the MB_COMM_LOAD instruction.

Table 13- 150 Data types for the parameters

Parameter and type		Data type	Description
REQ	IN	Bool	0=No request 1= Request to transmit data to Modbus slave
MB_ADDR	IN	V1.0: USInt V2.0: UInt	Modbus RTU station address: Standard addressing range (1 to 247) Extended addressing range (1 to 65535) The value of 0 is reserved for broadcasting a message to all Modbus slaves. Modbus function codes 05, 06, 15 and 16 are the only function codes supported for broadcast.
MODE	IN	USInt	Mode Selection: Specifies the type of request (read, write, or diagnostic). See the Modbus functions table below for details.
DATA_ADDR	IN	UDInt	Starting Address in the slave: Specifies the starting address of the data to be accessed in the Modbus slave. See the Modbus functions table below for valid addresses.
DATA_LEN	IN	UInt	Data Length: Specifies the number of bits or words to be accessed in this request. See the Modbus functions table below for valid lengths.
DATA_PTR	IN	Variant	Data Pointer: Points to the M or DB address (non-optimized DB type) for the data being written or read.
DONE	OUT	Bool	The DONE bit is TRUE for one scan, after the last request was completed with no error.
BUSY	OUT	Bool	• 0 – No MB_MASTER operation in progress • 1 – MB_MASTER operation in progress
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. The error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution condition code

Modbus master communication rules

- MB_COMM_LOAD must be executed to configure a port before a MB_MASTER instruction can communicate with that port.
- If a port is to be used to initiate Modbus master requests, that port should not be used by MB_SLAVE. One or more instances of MB_MASTER execution can be used with that port, but all MB_MASTER execution must use the same MB_MASTER instance DB for that port.
- The Modbus instructions do not use communication interrupt events to control the communication process. Your program must poll the MB_MASTER instruction for transmit and receive complete conditions.
- It is recommended that you call all MB_MASTER execution for a given port from a program cycle OB. Modbus master instructions may execute in only one of the program cycle or cyclic/time delay execution levels. They must not execute in both execution priority levels. Pre-emption of a Modbus Master instruction by another Modbus master instruction in a higher priority execution priority level will result in improper operation. Modbus master instructions must not execute in the startup, diagnostic or time error execution priority levels.
- Once a master instruction initiates a transmission, this instance must be continually executed with the EN input enabled until a DONE=1 state or ERROR=1 state is returned. A particular MB_MASTER instance is considered active until one of these two events occurs. While the original instance is active, any call to any other instance with the REQ input enabled will result in an error. If the continuous execution of the original instance stops, the request state remains active for a period of time specified by the static variable Blocked_Proc_Timeout. Once this period of time expires, the next master instruction called with an enabled REQ input will become the active instance. This prevents a single Modbus master instance from monopolizing or locking access to a port. If the original active instance is not enabled within the period of time specified by the static variable "Blocked_Proc_Timeout", then the next execution by this instance (with REQ not set) will clear the active state. If (REQ is set), then this execution initiates a new master request as if no other instance was active.

REQ parameter

0 = No request; 1 = Request to transmit data to Modbus Slave

You may control this input either through the use of a level or edge triggered contact. Whenever this input is enabled, a state machine is started to ensure that no other MB_MASTER using the same instance DB is allowed to issue a request, until the current request is completed. All other input states are captured and held internally for the current request, until the response is received or an error detected.

If the same instance of MB_MASTER is executed again with REQ input = 1 before the completion of the current request, then no subsequent transmissions are made. However, when the request is completed, a new request is issued whenever MB_MASTER is executed again with REQ input = 1.

DATA_ADDR and MODE parameters select the Modbus function type

DATA_ADDR (starting Modbus address in the slave): Specifies the starting address of the data to be accessed in the Modbus slave.

The MB_MASTER instruction uses a MODE input rather than a Function Code input. The combination of MODE and Modbus address determine the Function Code that is used in the actual Modbus message. The following table shows the correspondence between parameter MODE, Modbus function code, and Modbus address range.

Table 13- 151 Modbus functions

MODE	Modbus Function	Data length	Operation and data	Modbus Address
0	01	1 to 2000 1 to 1992 [1]	Read output bits: 1 to (1992 or 2000) bits per request	1 to 9999
0	02	1 to 2000 1 to 1992 [1]	Read input bits: 1 to (1992 or 2000) bits per request	10001 to 19999
0	03	1 to 125 1 to 124 [1]	Read Holding registers: 1 to (124 or 125) words per request	40001 to 49999 or 400001 to 465535
0	04	1 to 125 1 to 124 [1]	Read input words: 1 to (124 or 125) words per request	30001 to 39999
1	05	1	Write one output bit: One bit per request	1 to 9999
1	06	1	Write one holding register: 1 word per request	40001 to 49999 or 400001 to 465535
1	15	2 to 1968 2 to 1960 [1]	Write multiple output bits: 2 to (1960 or 1968) bits per request	1 to 9999
1	16	2 to 123 2 to 122 [1]	Write multiple holding registers: 2 to (122 or 123) words per request	40001 to 49999 or 400001 to 465535
2	15	1 to 1968 2 to 1960 [1]	Write one or more output bits: 1 to (1960 or 1968) bits per request	1 to 9999
2	16	1 to 123 1 to 122 [1]	Write one or more holding registers: 1 to (122 or 123) words per request	40001 to 49999 or 400001 to 465535
11	11	0	Read the slave communication status word and event counter. The status word indicates busy (0 – not busy, 0xFFFF - busy). The event counter is incremented for each successful completion of a message. Both the DATA_ADDR and DATA_LEN operands of MB_MASTER are ignored for this function.	
80	08	1	Check slave status using data diagnostic code 0x0000 (Loopback test – slave echoes the request) 1 word per request	

MODE	Modbus Function	Data length	Operation and data	Modbus Address
81	08	1	Reset slave event counter using data diagnostic code 0x000A 1 word per request	
3 to 10, 12 to 79, 82 to 255			Reserved	

[1] For "Extended Addressing" mode the maximum data lengths are reduced by 1 byte or 1 word depending upon the data type used by the function.

DATA_PTR parameter

The DATA_PTR parameter points to the DB or M address that is written to or read from. If you use a data block, then you must create a global data block that provides data storage for reads and writes to Modbus slaves.

Note

The DATA_PTR data block type must allow direct addressing

The data block must allow both direct (absolute) and symbolic addressing. When you create the data block the "Standard" access attribute must be selected.

Data block structures for the DATA_PTR parameter

- These data types are valid for **word reads** of Modbus addresses 30001 to 39999, 40001 to 49999, and 400001 to 465536 and also for **word writes** to Modbus addresses 40001 to 49999 and 400001 to 465536.
  - Standard array of WORD, UINT, or INT data types
  - Named WORD, UINT, or INT structure where each element has a unique name and 16 bit data type.
  - Named complex structure where each element has a unique name and a 16 or 32 bit data type.
- For **bit reads** and writes of Modbus addresses 00001 to 09999 and bit reads of 10001 to 19999.
  - Standard array of Boolean data types.
  - Named Boolean structure of uniquely named Boolean variables.
- Although not required, it is recommended that each MB_MASTER instruction have its own separate memory area. The reason for this recommendation is that there is a greater possibility of data corruption if multiple MB_MASTER instructions are reading and writing to the same memory area.
- There is no requirement that the DATA_PTR data areas be in the same global data block. You can create one data block with multiple areas for Modbus reads, one data block for Modbus writes, or one data block for each slave station.

Modbus master data block variables

The following table shows the public static variables stored in the instance DB for MB_MASTER that can be used in your program.

Table 13- 152 Static variables in the instance DB

Variable	Data type	Initial value	Description
Blocked_Proc_Timeout	Real	3.0	Amount of time (in seconds) to wait for a blocked Modbus Master instance before removing this instance as being ACTIVE. This can occur, for example, when a Master request has been issued and then the program stops calling the Master function before it has completely finished the request. The time value must be greater than 0 and less than 55 seconds, or an error occurs. The default value is .5 seconds.
Extended_Addressing	Bool	False	Configures single or double-byte slave addressing. The default value = 0. (0=single byte address, 1=double-byte address)

Your program can write values to the Blocked_Proc_Timeout and Extended_Addressing variables to control Modbus master operations. See the MB_SLAVE topic description of HR_Start_Offset and Extended_Addressing for an example of how to use these variables in the program editor and details about Modbus extended addressing (Page 1263).

Condition codes

Table 13- 153 MB_MASTER execution condition codes (communication and configuration errors) [1]

STATUS (W#16#)	Description
0000	No error
80C8	Slave timeout. Check baud rate, parity, and wiring of slave.
80D1	The receiver issued a flow control request to suspend an active transmission and never re-enabled the transmission during the specified wait time. This error is also generated during hardware flow control when the receiver does not assert CTS within the specified wait time.
80D2	The transmit request was aborted because no DSR signal is received from the DCE.
80E0	The message was terminated because the receive buffer is full.
80E1	The message was terminated as a result of a parity error.
80E2	The message was terminated as a result of a framing error.
80E3	The message was terminated as a result of an overrun error.
80E4	The message was terminated as a result of the specified length exceeding the total buffer size.
8180	Invalid port ID value or error with MB_COMM_LOAD instruction
8186	Invalid Modbus station address
8188	Invalid Mode specified for broadcast request
8189	Invalid Data Address value
818A	Invalid Data Length value
818B	Invalid pointer to the local data source/destination: Size not correct
818C	Invalid pointer for DATA_PTR or invalid Blocked_Proc_Timeout: The data area must be a DB (that allows both symbolic and direct access) or M memory.
8200	Port is busy processing a transmit request.

Table 13- 154 MB_MASTER execution condition codes (Modbus protocol errors) [1]

STATUS (W#16#)	Response code from slave	Modbus protocol errors
8380	-	CRC error
8381	01	Function code not supported
8382	03	Data length error
8383	02	Data address error or address outside the valid range of the DATA_PTR area
8384	Greater than 03	Data value error
8385	03	Data diagnostic code value not supported (function code 08)
8386	-	Function code in the response does not match the code in the request.
8387	-	Wrong slave responded
8388	-	The slave response to a write request is incorrect. The write request returned by the slave does not match what the master actually sent.

[1] In addition to the MB_MASTER errors listed above, errors can be returned from the underlying PtP communication instructions.

13.9.3.3 MB_SLAVE (Communicate using the PtP port as Modbus RTU slave)

Table 13- 155 MB_SLAVE instruction

LAD / FBD	SCL	Description

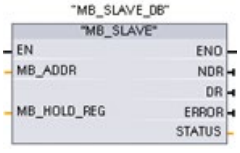
	`"MB_SLAVE_DB"(`
	`MB_ADDR:=_uint_in_,`
	`NDR=>_bool_out_,`
	`DR=>_bool_out_,`
	`ERROR=>_bool_out_,`
	`STATUS=>_word_out_,`
	`MB_HOLD_REG:=_variant_inout_);`
		The MB_SLAVE instruction allows your program to communicate as a Modbus slave through a PtP port on the CM (RS485 or RS232) and CB (RS485). When a remote Modbus RTU master issues a request, your user program responds to the request by MB_SLAVE execution. STEP 7 automatically creates an instance DB when you insert the instruction. Use this MB_SLAVE_DB name when you specify the MB_DB parameter for the MB_COMM_LOAD instruction.

Table 13- 156 Data types for the parameters

Parameter and type		Data type	Description
MB_ADDR	IN	V1.0: USInt V2.0: UInt	The station address of the Modbus slave: Standard addressing range (1 to 247) Extended addressing range (0 to 65535)
MB_HOLD_REG	IN	Variant	Pointer to the Modbus Holding Register DB: The Modbus holding register can be M memory or a data block.
NDR	OUT	Bool	New Data Ready: • 0 – No new data • 1 – Indicates that new data has been written by the Modbus master
DR	OUT	Bool	Data Read: • 0 – No data read • 1 – Indicates that data has been read by the Modbus master
ERROR	OUT	Bool	The ERROR bit is TRUE for one scan, after the last request was terminated with an error. If execution is terminated with an error, then the error code value at the STATUS parameter is valid only during the single scan where ERROR = TRUE.
STATUS	OUT	Word	Execution error code

Modbus communication function codes (1, 2, 4, 5, and 15) can read and write bits and words directly in the input process image and output process image of the CPU. For these function codes, the MB_HOLD_REG parameter must be defined as a data type larger than a byte. The following table shows the example mapping of Modbus addresses to the process image in the CPU.

Table 13- 157 Mapping of Modbus addresses to the process image

Modbus functions						S7-1200	
Codes	Function	Data area	Address range			Data area	CPU address
01	Read bits	Output	1	to	8192	Output Process Image	Q0.0 to Q1023.7
02	Read bits	Input	10001	to	18192	Input Process Image	I0.0 to I1023.7
04	Read words	Input	30001	to	30512	Input Process Image	IW0 to IW1022
05	Write bit	Output	1	to	8192	Output Process Image	Q0.0 to Q1023.7
15	Write bits	Output	1	to	8192	Output Process Image	Q0.0 to Q1023.7

Modbus communication function codes (3, 6, 16) use a Modbus holding register which can be an M memory address range or a data block. The type of holding register is specified by the MB_HOLD_REG parameter on the MB_SLAVE instruction.

Note

MB_HOLD_REG data block type

A Modbus holding register data block must allow both direct (absolute) and symbolic addressing. When you create the data block the "Standard" access attribute must be selected.

The following table shows examples of Modbus address to holding register mapping that is used for Modbus function codes 03 (read words), 06 (write word), and 16 (write words). The actual upper limit of DB addresses is determined by the maximum work memory limit and M memory limit, for each CPU model.

Table 13- 158 Mapping of Modbus addresses to CPU memory

Modbus Master Address	MB_HOLD_REG parameter examples				
	MW100	DB10.DBw0	MW120	DB10.DBW50	"Recipe".ingredient
40001	MW100	DB10.DBW0	MW120	DB10.DBW50	"Recipe".ingredient[1]
40002	MW102	DB10.DBW2	MW122	DB10.DBW52	"Recipe".ingredient[2]
40003	MW104	DB10.DBW4	MW124	DB10.DBW54	"Recipe".ingredient[3]
40004	MW106	DB10.DBW6	MW126	DB10.DBW56	"Recipe".ingredient[4]
40005	MW108	DB10.DBW8	MW128	DB10.DBW58	"Recipe".ingredient[5]

Table 13- 159 Diagnostic functions

S7-1200 MB_SLAVE Modbus diagnostic functions		
Codes	Sub-function	Description
08	0000H	Return query data echo test: The MB_SLAVE will echo back to a Modbus master a word of data that is received.
08	000AH	Clear communication event counter: The MB_SLAVE will clear out the communication event counter that is used for Modbus function 11.
11		Get communication event counter: The MB_SLAVE uses an internal communication event counter for recording the number of successful Modbus read and write requests that are sent to the Modbus slave. The counter does not increment on any Function 8, Function 11, or broadcast requests. It is also not incremented on any requests that result in a communication error (for example, parity or CRC errors).

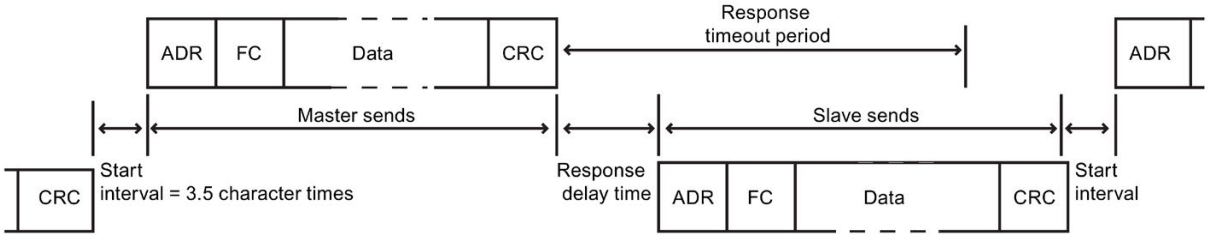
The MB_SLAVE instruction supports broadcast write requests from any Modbus master as long as the request is for accessing valid addresses. MB_SLAVE will produce error code 0x8188 for function codes not supported in broadcast.

Modbus slave communication rules

- MB_COMM_LOAD must be executed to configure a port, before a MB_SLAVE instruction can communicate through that port.
- If a port is to respond as a slave to a Modbus master, then do not program that port with the MB_MASTER instruction.
- Only one instance of MB_SLAVE can be used with a given port, otherwise erratic behavior may occur.
- The Modbus instructions do not use communication interrupt events to control the communication process. Your program must control the communication process by polling the MB_SLAVE instruction for transmit and receive complete conditions.
- The MB_SLAVE instruction must execute periodically at a rate that allows it to make a timely response to incoming requests from a Modbus master. It is recommended that you execute MB_SLAVE every scan from a program cycle OB. Executing MB_SLAVE from a cyclic interrupt OB is possible, but is not recommended because of the potential for excessive time delays in the interrupt routine to temporarily block the execution of other interrupt routines.

Modbus signal timing

MB_SLAVE must be executed periodically to receive each request from the Modbus master and then respond as required. The frequency of execution for MB_SLAVE is dependent upon the response timeout period of the Modbus master. This is illustrated in the following diagram.



The response timeout period RESP_TO is the amount of time a Modbus master waits for the start of a response from a Modbus slave. This time period is not defined by the Modbus protocol, but is a parameter of each Modbus master. The frequency of execution (the time between one execution and the next execution) of MB_SLAVE must be based on the particular parameters of your Modbus master. At a minimum, you should execute MB_SLAVE twice within the response timeout period of the Modbus master.

Modbus slave variables

This table shows the public static variables stored in the MB_SLAVE instance data block that can be used in your program

Table 13- 160 Modbus slave variables

Variable	Data type	Description
Request_Count	Word	The number of all requests received by this slave
Slave_Message_Count	Word	The number of requests received for this specific slave
Bad_CRC_Count	Word	The number of requests received that have a CRC error
Broadcast_Count	Word	The number of broadcast requests received
Exception_Count	Word	Modbus specific errors that require a returned exception
Success_Count	Word	The number of requests received for this specific slave that have no protocol errors
HR_Start_Offset	Word	Specifies the starting address of the Modbus Holding register (default = 0)
Extended_Addressing	Bool	Configures single or double-byte slave addressing (0=single byte address, 1=double-byte address, default = 0)

Your program can write values to the HR_Start_Offset and Extended_Addressing variables and control Modbus slave operations. The other variables can be read to monitor Modbus status.

HR_Start_Offset

Modbus holding register addresses begin at 40001 or 400001. These addresses correspond to the beginning PLC memory address of the holding register. However, you can configure the "HR_Start_Offset" variable to start the beginning Modbus holding register address at another value instead of 40001 or 400001.

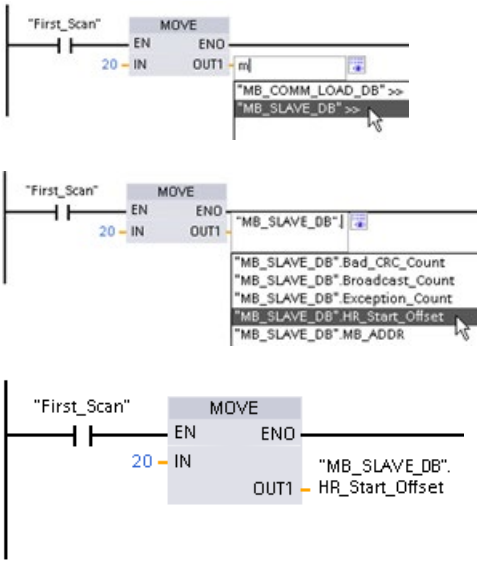
For example, if the holding register is configured to start at MW100 and is 100 words long. An offset of 20 specifies a beginning holding register address of 40021 instead of 40001. Any address below 40021 and above 400119 will result in an addressing error.

Table 13- 161 Example of Modbus holding register addressing

HR_Start_Offset	Address	Minimum	Maximum
0	Modbus address (Word)	40001	40099
	S7-1200 address	MW100	MW298
20	Modbus address (Word)	40021	40119
	S7-1200 address	MW100	MW298

HR_Start_Offset is a word value that specifies the starting address of the Modbus holding register and is stored in the MB_SLAVE instance data block. You can set this public static variable value by using the parameter helper drop-list, after MB_SLAVE is placed in your program.

For example, after MB_SLAVE is placed in a LAD network, you can go to a previous network and assign the HR_Start_Offset value. The value must be assigned prior to execution of MB_SLAVE.



Entering a Modbus slave variable using the default DB name:

1. Set the cursor in the parameter field and type an m character.
2. Select "MB_SLAVE_DB" from the drop-list.
3. Set the cursor at the right side of the DB name (after the quote character) and enter a period character.
4. Select "MB_SLAVE_DB.HR_Start_Offset" from the drop list.

Extended_Addressing

The Extended_Addressing variable is accessed in a similar way as the HR_Start_Offset reference discussed above except that the Extended_Addressing variable is a Boolean value. The Boolean value must be written by an output coil and not a move box.

Modbus slave addressing can be configured to be either a single byte (which is the Modbus standard) or double byte. Extended addressing is used to address more than 247 devices within a single network. Selecting extended addressing allows you to address a maximum of 64000 addresses. A Modbus function 1 frame is shown below as an example.

Table 13- 162 Single-byte slave address (byte 0)

Function 1	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	
Request	Slave addr.	F code	Start address		Length of coils		
Valid Response	Slave addr.	F code	Length	Coil data			
Error response	Slave addr.	0x81	E code				

Table 13- 163 Double-byte slave address (byte 0 and byte 1)

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Request	Slave address		F code	Start address		Length of coils	
Valid Response	Slave address		F code	Length	Coil data		
Error response	Slave address		0x81	E code			

Condition codes

Table 13- 164 MB_SLAVE execution condition codes (communication and configuration errors) [1]

STATUS (W#16#)	Description
80D1	The receiver issued a flow control request to suspend an active transmission and never re-enabled the transmission during the specified wait time. This error is also generated during hardware flow control when the receiver does not assert CTS within the specified wait time.
80D2	The transmit request was aborted because no DSR signal is received from the DCE.
80E0	The message was terminated because the receive buffer is full.
80E1	The message was terminated as a result of a parity error.
80E2	The message was terminated as a result of a framing error.
80E3	The message was terminated as a result of an overrun error.
80E4	The message was terminated as a result of the specified length exceeding the total buffer size.
8180	Invalid port ID value or error with MB_COMM_LOAD instruction
8186	Invalid Modbus station address
8187	Invalid pointer to MB_HOLD_REG DB: Area is too small
818C	Invalid MB_HOLD_REG pointer to M memory or DB (DB area must allow both symbolic and direct address)

Table 13- 165 MB_SLAVE execution condition codes (Modbus protocol errors) [1]

STATUS (W#16#)	Response code from slave	Modbus protocol errors
8380	No response	CRC error
8381	01	Function code not supported or not supported within broadcasts
8382	03	Data length error
8383	02	Data address error or address outside the valid range of the DATA_PTR area
8384	03	Data value error
8385	03	Data diagnostic code value not supported (function code 08)

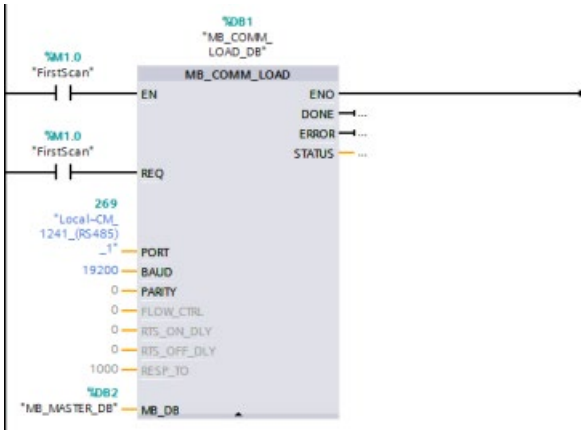
[1] In addition to the MB_SLAVE errors listed above, errors can be returned from the underlying PtP communication instructions.

13.9.4 Legacy Modbus RTU examples

13.9.4.1 Example: Legacy Modbus RTU master program

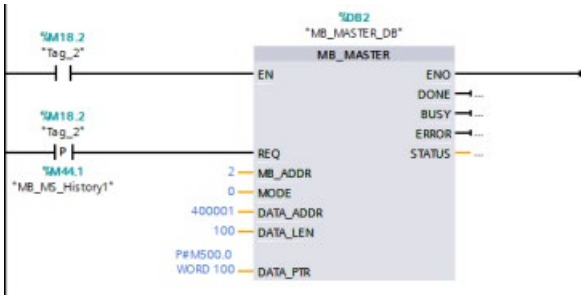
MB_COMM_LOAD is initialized during start-up by using the first scan flag. Execution of MB_COMM_LOAD in this manner should only be done when the serial port configuration will not change at runtime.

Network 1: Configure/initialize the RS485 module communications port only once during the first scan.

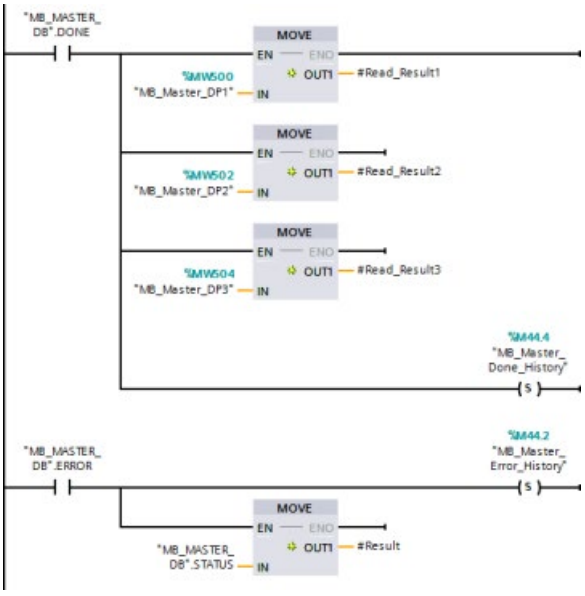


One MB_MASTER instruction is used in the program cycle OB to communicate with a single slave. Additional MB_MASTER instructions can be used in the program cycle OB to communicate with other slaves, or one MB_MASTER FB could be re-used to communicate with additional slaves.

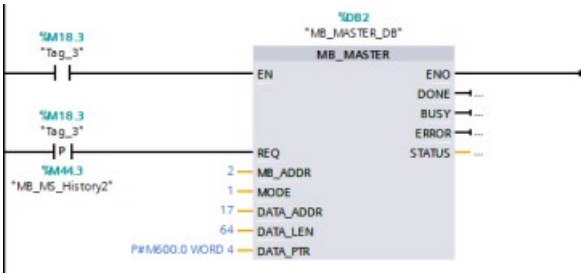
Network 2: Read 100 words of holding register data from location 400001 on slave #2 to memory location MW500-MW698.



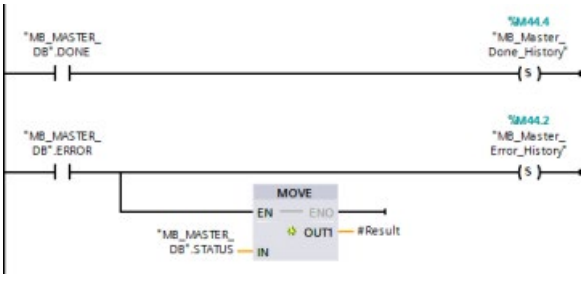
Network 3: Move the first 3 words of the holding register data that has been read to some other location, and set a DONE history bit. This network also sets an ERROR history bit and saves the STATUS word to another location in the event of an error.



Network 4: Write 64 bits of data from MW600-MW607 to output bit locations 00017 to 00081 on slave #2.



Network 5: Set a DONE history bit when the write is complete. If an error occurs, the program sets an ERROR history bit and saves the STATUS code.

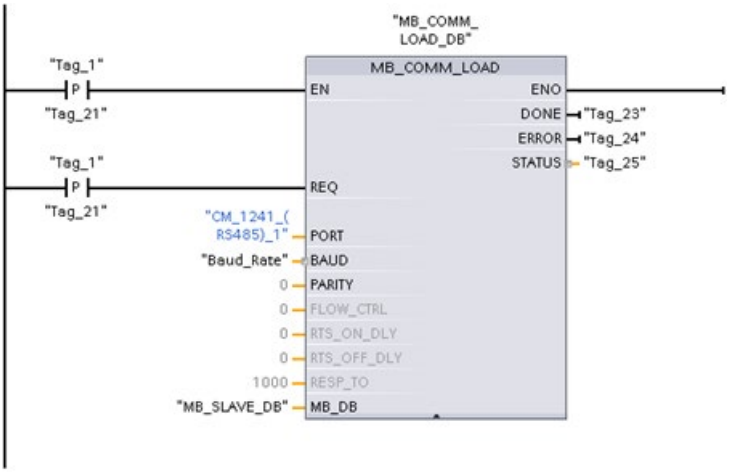


13.9.4.2 Example: Legacy Modbus RTU slave program

MB_COMM_LOAD shown below is initialized each time "Tag_1" is enabled.

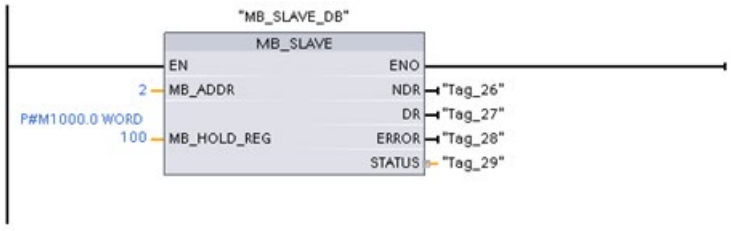
Execution of MB_COMM_LOAD in this manner should only be done when the serial port configuration will change at runtime, as a result of HMI configuration.

Network 1: Initialize the RS485 module parameters each time they are changed by an HMI device.



MB_SLAVE shown below is placed in a cyclic OB that is executed every 10ms. While this does not give the absolute fastest response by the slave, it does provide good performance at 9600 baud for short messages (20 bytes or less in the request).

Network 2: Check for Modbus master requests during each scan. The Modbus holding register is configured for 100 words starting at MW1000.



13.10 Industrial Remote Communication (IRC)

13.10.1 Telecontrol CPs overview

Industrial Remote Communication provides access to widely distributed machines, plants, and applications of different sizes securely and economically. Industrial Remote Communications includes the following means of communication through CP modules:

- TeleControl: Telecontrol is the connection of process stations (Remote Terminal Units/RTUs) that are distributed over a wide geographical area to one or more central process control systems for the purpose of monitoring and control. Various different transmission components in the Remote Networks product spectrum support remote communication over a range of public and private networks. Special telecontrol protocols perform event-driven or cyclic exchange of process data, which permits efficient control of the overall process.
- TeleService: Teleservice involves data exchange with distant technical systems (machines, plants, computers, etc.) for the purpose of error detection, diagnostics, maintenance, repair or optimization.
- Additional applications for remote communication, for example surveillance, smart grid applications, and condition monitoring.

TeleControl CPs for the S7-1200

For TeleControl applications, the following communications processors, many of which also provide access to the S7-1200 Web server (Page 990), are available:

- **CP 1243-1:**
  - Article number: 6GK7 243-1BX30-0XE0
  - Communications processor for connecting the SIMATIC S7-1200 using the public infrastructure (for example, DSL) to a control center with TeleControl Server Basic (TCSB version V3)
  - With the help of VPN technology and the firewall, the CP allows protected access to the S7-1200.
  - You can use the CP as an additional Ethernet interface of the CPU for S7 communication.
  - You communicate between the CP and CPU using configurable data points that access PLC tags.
- **CP 1243-1 DNP3:**
  - Article number: 6GK7 243-1JX30-0XE0
  - Communications processor for connecting the SIMATIC S7-1200 to control centers using the DNP3 protocol
  - You communicate between the CP and CPU using configurable data points that access PLC tags.

- **CP 1243-1 IEC:**
  - Article number: 6GK7 243-1PX30-0XE0
  - Communications processor for connecting SIMATIC S7-1200 to control centers using the IEC 60870-5 protocol
  - You communicate between the CP and CPU using configurable data points that access PLC tags.
- **CP 1243-1 PCC:**
  - Article number: 6GK7 243-1HX30-0XE0
  - Communications processor for connecting SIMATIC S7-1200 to control centers using Plant Cloud Communication (PCC)
  - You communicate between the CP and CPU using configurable data points that access PLC tags.
- **CP 1242-7:**
  - Article number: 6GK7 242-7KX31-0XE0
  - Communications processor for connecting the SIMATIC S7-1200 to a control center with TeleControl Server Basic using mobile wireless (GPRS) and the public infrastructure (DSL)
- **CP 1242-7 GPRS V2:**
  - Article number: 6GK7 242-7KX31-0XE0
  - Communications processor for connecting the SIMATIC S7-1200 to a control center with TeleControl Server Basic (TCSB version v3) using mobile wireless (GPRS) and the public infrastructure (DSL)
  - With the help of VPN technology and the firewall, the CP allows protected access to the S7-1200.
  - You can use the CP as an additional Ethernet interface of the CPU for S7 communication.
  - You communicate between the CP and CPU using configurable data points that access PLC tags.

- **CP 1243-7 LTE-xx:**
  - Communications processor for connecting the SIMATIC S7-1200 to a control center with TeleControl Server Basic (TCSB version v3) using mobile wireless (GPRS) and the public infrastructure (DSL)
  - Support of the following mobile wireless specifications: GSM/GPRS, UMTS (G3), LTE
  - To cover countries with different mobile wireless specifications, the CP is available in two variants:

    - CP 1243-7 LTE-US:

     - North American standard

     - Article number: 6GK7 243-7SX30-0XE0

    - CP 1243-7 LTE-EU:

     - Western European standard

     - Article number: 6GK7 243-7KX30-0XE0
  - With the help of VPN technology and the firewall, the CP allows protected access to the S7-1200.
  - You can use the CP as an additional Ethernet interface of the CPU for S7 communication.
  - You communicate between the CP and CPU using configurable data points that access PLC tags.
- **CP 1243-8 IRC:**
  - Article number: 6GK7 242-8RX30-0XE0
  - Communications processor for connecting the SIMATIC S7-1200 to an ST7 network, data point configuration, and VPN

Note

You must have TeleControl Server Basic software for TeleControl applications for CPs other than the CP 1243-1.

Secure communication

The well-proven SINAUT ST7 protocol or the standardized DNP3 or IEC 60870-5 protocol adds security to Industrial Remote Communication (http://w3app.siemens.com/mcms/infocenter/dokumentencenter/sc/ic/InfocenterLanguagePacks/Netzwerksicherheit/6ZB5530-1AP02-0BA4_BR_Network_Security_en_112015.pdf). The TeleControl solution provides comprehensive measures to prevent data falsification and loss. Each transmission module has a large memory for several thousand data frames, which offers the ability to bridge downtimes in the transmission link. Dedicated VPN solutions protect special IP-based networks.

The CP 1243-1 communications processor securely connects the SIMATIC S7-1200 controller to Ethernet networks. With its integrated firewall (Stateful Inspection) and VPN protocol (IPsec) security functions, the communications processor helps protect S7-1200 stations and lower-level networks against unauthorized access and helps protect data transmission against manipulation and espionage by encryption. Furthermore, the CP can also be used for integrating the S7-1200 station into the TeleControl Server Basic control center software using IP-based remote networks.

13.10.2 Connection to a GSM network

IP-based WAN communication via GPRS

Using the CP 1242-7 communications processor, the S7-1200 can be connected to GSM networks. The CP 1242-7 allows WAN communication from remote stations with a control center and inter-station communication.

Inter-station communication is possible only via a GSM network. For communication between a remote station and a control room, the control center must have a PC with Internet access.

The CP 1242-7 supports the following services for communication via the GSM network:

- GPRS (General Packet Radio Service)

  The packet-oriented service for data transmission "GPRS" is handled via the GSM network.

- SMS (Short Message Service)

  The CP 1242-7 can receive and send SMS messages. The communications partner can be a mobile phone or an S7-1200.

The CP 1242-7 is suitable for use in industry worldwide and supports the following frequency bands:

- 850 MHz
- 900 MHz
- 1,800 MHz
- 1,900 MHz

Requirements

The equipment used in the stations or the control center depends on the particular application.

- For communication with or via a central control room, the control center requires a PC with Internet access.
- Apart from the station equipment, a remote S7-1200 station with a CP 1242-7 must meet the following requirements to be able to communicate via the GSM network:
  - A contract with a suitable GSM network provider

    If GPRS is used, the contract must allow the use of the GPRS service.

    If there is to be direct communication between stations only via the GSM network, the GSM network provider must assign a fixed IP address to the CPs. In this case, communication between stations is not via the control center.
  - The SIM card belonging to the contract

    The SIM card is inserted in the CP 1242-7.
  - Local availability of a GSM network in the range of the station

13.10.3 Applications of the CP 1242-7

The CP 1242-7 can be used for the following applications:

Telecontrol applications

- Sending messages by SMS

  Via the CP 1242-7, the CPU of a remote S7-1200 station can receive SMS messages from the GSM network or send messages by SMS to a configured mobile phone or an S7-1200.

- Communication with a control center

  Remote S7-1200 stations communicate via the GSM network and the Internet with a telecontrol server in the master station. For data transfer using GPRS, the "TELECONTROL SERVER BASIC" application is installed on the telecontrol server in the master station. The telecontrol server communicates with a higher-level central control system using the integrated OPC server function.

- Communication between S7-1200 stations via a GSM network

  Communication between remote stations with a CP 1242-7 can be handled in two different ways:

  – Inter-station communication via a master station

    In this configuration, a permanent secure connection between S7-1200 stations that communicate with each other and the telecontrol server is established in the master station. Communication between the stations is via the telecontrol server. The CP 1242-7 operates in "Telecontrol" mode.

  – Direct communication between the stations

    For direct communication between stations without the detour via the master station, SIM cards with a fixed IP address are used that allow the stations to address each other directly. The possible communications services and security functions (for example VPN) depend on what is offered by the network provider. The CP 1242-7 operates in "GPRS direct" mode.

TeleService via GPRS

A TeleService connection can be established between an engineering station with STEP 7 and a remote S7-1200 station with a CP 1242-7 via the GSM network and the Internet. The connection runs from the engineering station via a telecontrol server or a TeleService gateway that acts as an intermediary forwarding frames and establishing the authorization. These PCs use the functions of the "TELECONTROL SERVER BASIC" application.

You can use the TeleService connection for the following purposes:

- Downloading configuration or program data from the STEP 7 project to the station
- Querying diagnostics data on the station

13.10.4 Other properties of the CP 1242-7

Other services and functions of the CP 1242-7

- Time-of-day synchronization of the CP via the Internet

  You can set the time on the CP as follows:

  – In "Telecontrol" mode, the time of day is transferred by the telecontrol server. The CP uses this to set its time.

  – In "GPRS direct" mode, the CP can request the time using SNTP.

  To synchronize the CPU time, you can read out the current time from the CP using a block.
- Interim buffering of messages to be sent if there are connection problems
- Increased availability thanks to the option of connecting to a substitute telecontrol server
- Logging the volume of data

  The volumes of data transferred are logged and can be evaluated for specific purposes.

13.10.5 Further information

The CP manuals, associated documentation, and product information documents provide detailed information:

- CP 1242-7 (http://support.automation.siemens.com/WW/view/en/45605894)
- CP 1243-7 LTE (https://support.industry.siemens.com/cs/ww/en/ps/15924)
- CP 1243-1 DNP3 (https://support.industry.siemens.com/cs/ww/en/ps/15938)
- CP 1243-8 IRC (https://support.industry.siemens.com/cs/ww/en/ps/21162)
- CP 1243-1 IEC (https://support.industry.siemens.com/cs/ww/en/ps/15942)
- Firmware updates as available (https://support.industry.siemens.com/cs/ww/en/view/109482530)

13.10.6 Accessories

The ANT794-4MR GSM/GPRS antenna

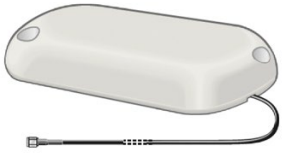
The following antennas are available for use in GSM/GPRS networks and can be installed both indoors and outdoors:

- Quadband antenna ANT794-4MR (http://support.automation.siemens.com/WW/view/en/23119005)



Short name	Order no.	Explanation
ANT794-4MR	6NH9 860-1AA00	Quadband antenna (900, 1800/1900 MHz, UMTS); weatherproof for indoor and outdoor areas; 5 m connecting cable connected permanently to the antenna; SMA connector, including installation bracket, screws, wall plugs

- Flat antenna ANT794-3M



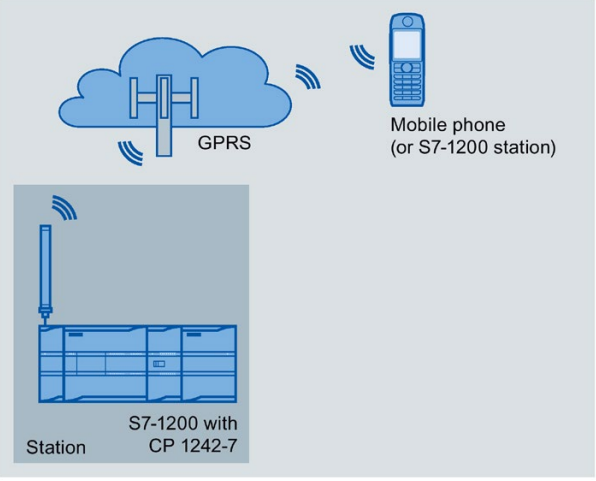
Short name	Order no.	Explanation
ANT794-3M	6NH9 870-1AA00	Flat antenna (900, 1800/1900 MHz); weatherproof for indoor and outdoor areas; 1.2 m connecting cable connected permanently to the antenna; SMA connector, including adhesive pad, screws mounting possible

The antennas must be ordered separately.

13.10.7 Configuration examples for telecontrol

Below, you will find several configuration examples for stations with a CP 1242-7.

Sending messages by SMS



A SIMATIC S7-1200 with a CP 1242-7 can send messages by SMS to a mobile phone or a configured S7-1200 station.

Telecontrol by a control center

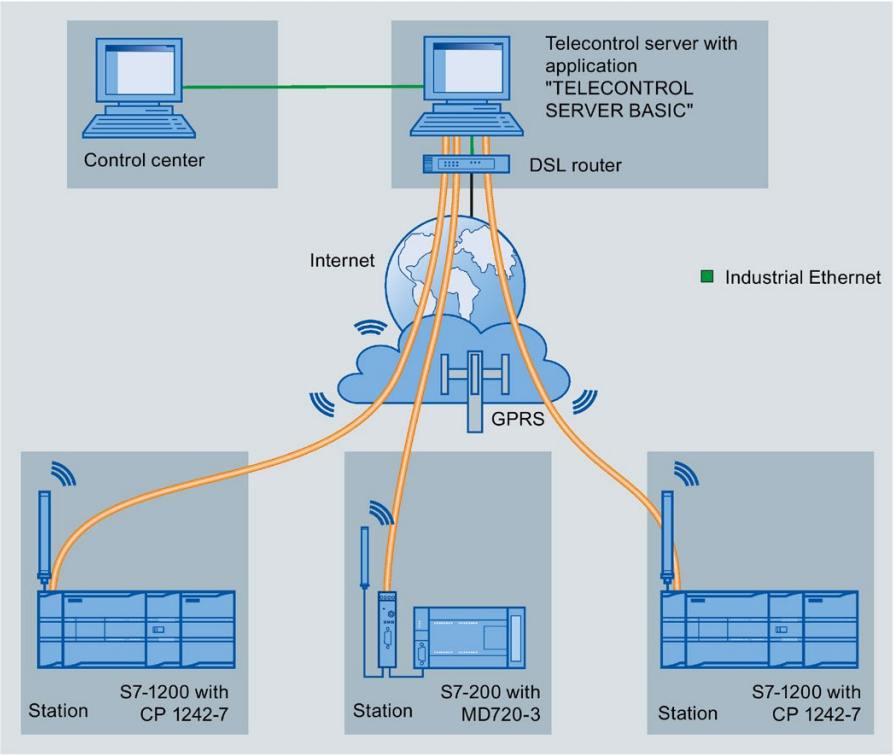


Figure 13-1 Communication between S7-1200 stations and a control center

In telecontrol applications, SIMATIC S7-1200 stations with a CP 1242-7 communicate with a control center via the GSM network and the Internet. The "TELECONTROL SERVER BASIC" (TCSB) application is installed on the telecontrol server in the master station. This results in the following use cases:

- Telecontrol communication between station and control center

  In this use case, data from the field is sent by the stations to the telecontrol server in the master station via the GSM network and Internet. The telecontrol server is used to monitor remote stations.

- Communication between a station and a control room with OPC client

  As in the first case, the stations communicate with the telecontrol server. Using its integrated OPC server, the telecontrol server exchanges data with the OPC client of the control room.

  The OPC client and telecontrol server can be located on a single computer, for example when TCSB is installed on a control center computer with WinCC.

- Inter-station communication via a control center

  Inter-station communication is possible with S7 stations equipped with a CP 1242-7.

  To allow inter-station communication, the telecontrol server forwards the messages of the sending station to the receiving station.

Direct communication between stations

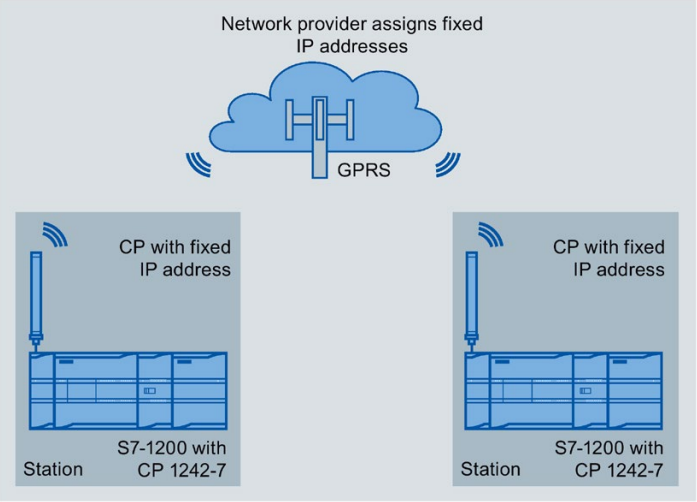


Figure 13-2 Direct communication between two S7-1200 stations

In this configuration, two SIMATIC S7-1200 stations communicate directly with each other using the CP 1242-7 via the GSM network. Each CP 1242-7 has a fixed IP address. The relevant service of the GSM network provider must allow this.

TeleService via GPRS

In TeleService via GPRS, an engineering station on which STEP 7 is installed communicates via the GSM network and the Internet with the CP 1242-7 in the S7-1200.

Since a firewall is normally closed for connection requests from the outside, a switching station between the remote station and the engineering station is required. This switching station can be a telecontrol server or, if there is no telecontrol server in the configuration, a TeleService gateway.

TeleService with telecontrol server

The connection runs via the telecontrol server.

- The engineering station and telecontrol server are connected via the Intranet (LAN) or Internet.
- The telecontrol server and remote station are connected via the Internet and via the GSM network.

The engineering station and telecontrol server can also be the same computer; in other words, STEP 7 and TCSB are installed on the same computer.

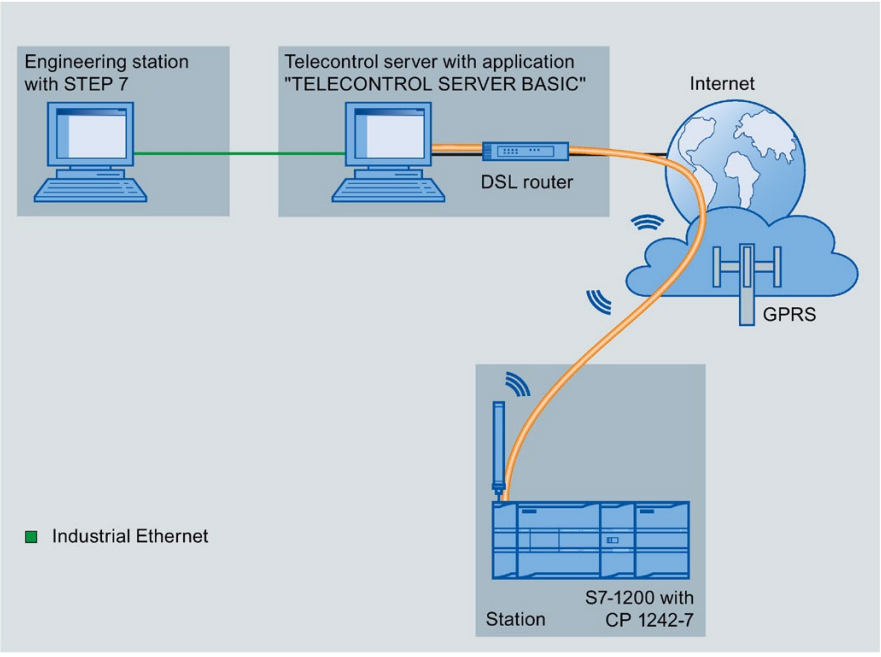


Figure 13-3 TeleService via GPRS in a configuration with telecontrol server

TeleService without a telecontrol server

The connection runs via the TeleService gateway.

The connection between the engineering station and the TeleService gateway can be local via a LAN or via the Internet.

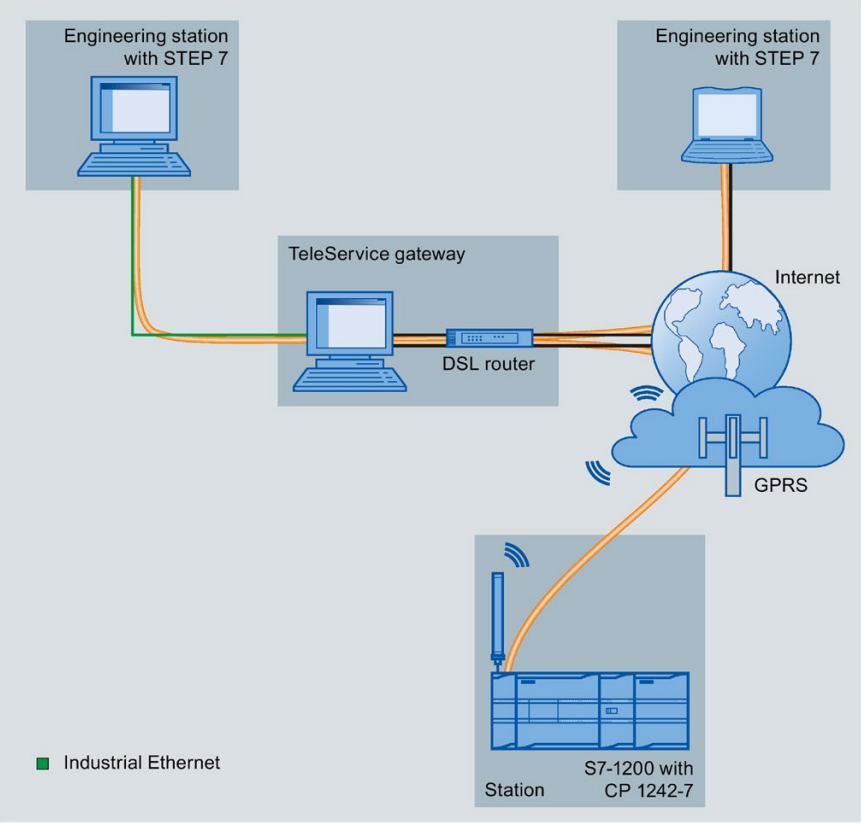
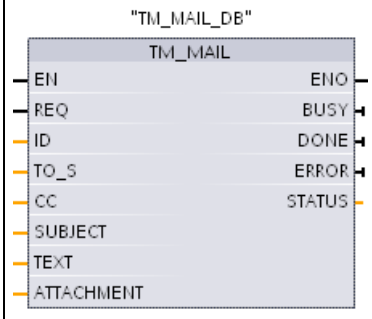


Figure 13-4 TeleService via GPRS in a configuration with TeleService gateway

TeleService communication (SMTP email) 14

14.1 TM_Mail (Send email) instruction

Table 14- 1 TM_MAIL instruction

LAD / FBD	SCL	Description
	**"TM_MAIL_DB"(** **REQ:=_bool_in_,** **ID:=_int_in_,** **TO_S:=_string_in_,** **CC:=_string_in_,** **SUBJECT:=_string_in_,** **TEXT:= _string_in_,** **ATTACHMENT:=_variant_in_,** **BUSY=>_bool_out_,** **DONE=>_bool_out_,** **ERROR=>_bool_out_,** **STATUS=>_word_out_,);**	The TM_MAIL instruction sends an email message using the SMTP (Simple Mail Transfer Protocol) over TCP/IP via the CPU Industrial Ethernet connection. Where Ethernet-based Internet connectivity is not available, an optional Teleservice adapter can be used for connection with telephone land lines. TM_MAIL executes asynchronously and the job extends over multiple TM_MAIL calls. When you call TM_MAIL, you must assign an instance DB. **The instance DB retentive attribute must not be set**. This ensures that the instance DB is initialized in the transition of the CPU from STOP to RUN and that a new TM_MAIL operation can be triggered.

[1] STEP 7 automatically creates the instance DB when you insert the instruction.

You start sending an email with a positive edge change from 0 to 1, at input parameter REQ. The following table shows the relationship between BUSY, DONE and ERROR. You can monitor the progress of TM_MAIL execution and detect completion, by evaluating these parameters in successive calls.

The output parameters DONE, ERROR, STATUS, and SFC_STATUS are valid for only one cycle, when the state of the output parameter BUSY changes from 1 to 0. Your program logic must save temporary output state values, so you can detect state changes in subsequent program execution cycles.

Note

TM_MAIL sends a mail message over TCP/IP using the Ethernet interface of the CPU. To send a mail message over a CP interface (with or without SSL) use the instruction TMAIL_C (Send an email using the Ethernet interface of the CPU) instruction (Page 863).

Table 14- 2 Interaction of the Done, Busy and Error parameters

DONE	BUSY	ERROR	Description
Irrelevant	1	Irrelevant	Job is in progress.
1	0	0	The job was completed successfully.
0	0	1	The job was terminated with an error. For the cause of the error, refer to the STATUS parameter.
0	0	0	No job in progress

If the CPU is changed to STOP mode while TM_MAIL is active, then the communication connection to the email server is terminated. The communication connection to the email server is also lost if problems occur in CPU communication on the Industrial Ethernet bus. In these cases, the send process is suspended and the email does not reach the recipient.

NOTICE

Modifying user programs

Deletion and replacement of program blocks, the calls to TM_MAIL, or calls to the instance DBs of TM_MAIL can break the linking of program blocks. If you fail to maintain linked program blocks, then the TPC/IP communication functions can enter an undefined state, possibly resulting in property damage. After transferring a modified program block, you would have to perform a CPU restart (warm) or cold start.

To avoid breaking the linking of program blocks, only change the parts of your user program that directly affect the TM_MAIL calls in the following cases:

- The CPU in the STOP mode
- No email is sent (REQ and BUSY = 0)

Data consistency

The input parameter ADDR_MAIL_SERVER is read when the operation is started. A new value does not take effect until the current operation is complete and a new TM_MAIL operation is initiated.

In contrast, the parameters WATCH_DOG_TIME, TO_S, CC, FROM, SUBJECT, TEXT, ATTACHMENT, USERNAME and PASSWORD are read during the execution of TM_MAIL and may be changed only when the job is finished (BUSY = 0)

Dial-up connection: Configuring the TS adapter IE parameters

You must configure the Teleservice adapter IE parameters for outgoing calls to connect with the dial-up server of your Internet Service Provider. If you set the call "on demand" attribute, then the connection is established only when an e-mail will be sent. For an analog modem connection, more time is required for the connection process (approx. a minute longer). You must include the extra time, in the WATCH_DOG_TIME value.

Table 14- 3 Data types for the parameters

Parameter and type		Data types	Description
REQ	IN	Bool	A low to high (positive edge) signal starts the operation.
ID	IN	Int	Connection identifier: See the ID parameter of the instructions TCON, TDISCON, TSEND and TRCV. A number that is not used for any additional instances of this instruction in the user program must be used.
TO_S	IN	String	Recipient addresses: STRING data with a maximum length of 240 characters
CC	IN	String	CC copy to recipient addresses (optional): STRING data with a maximum length of 240 characters
SUBJECT	IN	String	Subject name of the email: STRING data with a maximum length 240 characters.
TEXT	IN	String	Text message of the email (optional): STRING data with a maximum length of 240 characters. If this parameter is an empty string, then the email will be sent without message text.
ATTACHMENT	IN	Variant	Pointer to email attachment data: Byte, word, or double word data with a maximum length of 65534 bytes. If no value is assigned, then the email sent without an attachment.
DONE	OUT	Bool	• 0 - Job not yet started or still executing. • 1 - Job was executed error-free.
BUSY	OUT	Bool	• 0 - No operation in progress • 1- Operation in progress
ERROR	OUT	Bool	The ERROR bit =1 for one scan, after the last request was terminated with an error. The error code value at the STATUS output is valid only during the single scan where ERROR = 1.
STATUS	OUT	Word	Return value or error information of the TM_MAIL instruction.

Parameter and type		Data types	Description
ADDR_MAIL_SERVER	[1] Static	DWord	IP address of the mail server: You must assign each IP address fragment as an octet of two 4-bit hexadecimal characters. If the IP address fragment = decimal value 10 which equals hexadecimal value A, then you must enter "0A" for that octet. For example: IP address = 192.168.0.10 ADDR_MAIL_SERVER = DW#16#C0A8000A, where: • 192 = 16#C0, • 168 =16#A8 • 0 = 16#00 • 10 = 16#0A
WATCH_DOG_TIME	[1] Static	Time	The maximum time allowed for TM_MAIL to complete the entire SMTP process, from the initiation of the connection to the SMTP to the end of the SMTP transmission. If this time is exceeded, then TM_MAIL execution ends with an error. The actual time delay until TM_MAIL ends and the error is issued may exceed the WATCH_DOG_TIME, because of the additional time required for the disconnect operation. At first you should set a time of 2 minutes. This time can be much smaller for an ISDN phone connection.
USERNAME	[1] Static	String	Mail account user name: STRING data with a maximum length 180 characters.
PASSWORD	[1] Static	String	Mail server password: STRING data with a maximum length 180 characters.
FROM	[1] Static	String	Sender address: STRING with a maximum length of 240 characters
SFC_STATUS	[1] Static	Word	Execution condition code of the called communication blocks

[1] The values of these parameters are not modified at every call of TM_MAIL. The values are assigned in the TM_MAIL instance data block and are only referenced once, on the first call of TM_MAIL.

SMTP authentication

TM_MAIL supports the SMTP AUTH LOGIN authentication method. For information on this authentication method, please refer to the manual of the mail server or the website of your internet service provider.

The AUTH LOGIN authentication method uses the TM_MAIL USERNAME and PASSWORD parameters to connect with the mail server. The user name and password must be previously set up on an email account at an email server.

If no value is assigned for the USERNAME parameter, then the AUTH LOGIN authentication method is not used and the email is sent without authentication.

TO_S:, CC:, and FROM: parameters

The parameters TO_S:, CC: and FROM: are strings, as shown in the following examples:

TO: <wenna@mydomain.com>, <ruby@mydomain.com>,

CC: <admin@mydomain.com>, <judy@mydomain.com>,

FROM: <admin@mydomain.com>

The following rules must be used when entering these character strings:

- The characters "TO:", "CC:" and "FROM:" must be entered, including the colon character.
- A space character and an opening angle bracket "<" must precede each address. For example, there must be a space character between "TO:" and <email address>.
- A closing angle bracket ">" must be entered after each address.
- A comma character "," must be entered after each email address for the TO_S: and CC: addresses. For example, the comma after the single email address is required in "TO: <email address>,".
- Only one email address may be used for the FROM: entry, with no comma at the end.

Because of run-time mode and memory usage, a syntax check is not performed on the TM_MAIL TO_S:, CC: and FROM: data. If the format rules above are not followed exactly. The SMTP email server transaction will fail.

STATUS and SFC_STATUS parameters

The execution condition codes returned by TM_MAIL can be classified as follows:

- W#16#0000: Operation of TM_MAIL was completed successfully
- W#16#7xxx: Status of TM_MAIL operation
- W#16#8xxx: An error in an internal call to a communication device or the mail server

The following table shows the execution condition codes of TM_MAIL with the exception of the error codes from internally called communication modules.

Note

Email server requirements

TM_MAIL can only communicate with an email server using SMTP via port 25. The assigned port number cannot be changed.

Most IT departments and external email servers now block port 25 to prevent a PC infected with a virus from becoming a rogue email generator.

You can connect to an internal mail server via SMTP and let the internal server manage the current security enhancements that are required to relay email through the Internet to an external mail server.

Example: Internal email server configuration

If you use Microsoft Exchange as an internal mail server, then you can configure the server to allow SMTP access from the IP address assigned the S7-1200 PLC. Configure the Exchange management console: Server configuration > Hub transport > Receive connectors > IP relay. On the Network tab, there is a box named "Receive mail from remote servers that have these IP addresses". This is where you put the IP address of the PLC that is executing the TM_MAIL instruction. No authentication is required for this type of connection with an internal Microsoft Exchange server.

Email server configuration

TM_MAIL can only use an email server that allows port 25 communication, SMTP, and AUTH LOGIN authentication (optional).

Configure a compatible email server account to accept remote SMTP log in. Then edit the instance DB for TM_MAIL to put in the TM_MAIL USERNAME and PASSWORD character strings that are used to authenticate the connection with your email account.

Table 14- 4 Condition codes

STATUS (W#16#...):	SFC_STATUS (W#16#...):	Description
0000	-	The TM_MAIL operation completed without error. This zero STATUS code does not guarantee that an email was actually sent (See the first item in the note following this table).
7001	-	TM_MAIL is active (BUSY = 1).
7002	7002	TM_MAIL is active (BUSY = 1).
8xxx	xxxx	The TM_MAIL operation was completed with an error in the internal communication instruction calls. For more information about the SFC_STATUS parameter, see the descriptions of the STATUS parameter of the underlying PROFINET open user communication instructions.
8010	xxxx	Failed to connect: For more information about the SFC_STATUS parameter, see the STATUS parameter of the TCON instruction.
8011	xxxx	Error sending data: For more information about SFC_STATUS parameter, see the STATUS parameter of the TSEND instruction.
8012	xxxx	Error while receiving data: For more information about the SFC_STATUS parameter, see the STATUS parameter descriptions of the TRCV instruction.
8013	xxxx	Failed to connect: For more information for evaluating the SFC_STATUS parameter, see the STATUS parameter descriptions of the TCON and TDISCON instructions.
8014	-	Failed to connect: You may have entered an incorrect mail server IP address (ADDR_MAIL_SERVER) or too little time (WATCH_DOG_TIME) for the connection. It is also possible that the CPU has no connection to the network or the CPU configuration is incorrect.
8015	-	Invalid pointer for ATTACHMENT parameter: Use a variant pointer with a data type and length assignment. For example, "P#DB.DBX0.0" is incorrect and "P#DB.DBX0.0 byte 256" is correct.
82xx, 84xx, 85xx	-	The error message comes from the mail server and corresponds to error number "8" of the SMTP protocol. See the second item in the note following this table.
8450	-	Operation does not run: Mailbox is not available; try again later.

STATUS (W#16#...):	SFC_STATUS (W#16#...):	Description
8451	-	Operation aborted: Local error in processing, try again later.
8500	-	Command syntax error: The cause may be that the email server does not support the LOGIN authentication process. Check the parameters of TM_MAIL. Try to send an email without authentication. Try replacing the parameter USERNAME with an empty string.
8501	-	Syntax error: Incorrect parameter or argument; you may have typed an incorrect address in the TO_S or CC parameters.
8502	-	Command is unknown or not implemented: Check your entries, especially the parameter FROM. Perhaps this is incomplete and you have omitted the "@" or "." characters.
8535	-	SMTP authentication is incomplete. You may have entered an incorrect username or password.
8550	-	The mail server cannot be reached, or you have no access rights. You may have entered an incorrect username or password or your mail server does not support log in access. Another cause of this error could be an erroneous entry of the domain name after the "@" character in the TO_S or CC parameters.
8552	-	Operation aborted: Exceeded the allocated memory size; try again later.
8554	-	Transmission failed: Try again later.

Note

Possible unreported email transmission errors

- Incorrect entry of a recipient address does not generate a STATUS error for TM_MAIL. In this case, there is no guarantee that additional recipients (with correct email addresses), will receive the email.
- More information on SMTP error codes can be found on the internet or in the error documentation for the mail server. You can also read the last error message from the mail server. The error message is stored in buffer1parameter of the instance DB for TM_MAIL.

Online and diagnostic tools 15

15.1 Status LEDs

The CPU and the I/O modules use LEDs to provide information about either the operating state of the module or the I/O.

Status LEDs on a CPU

The CPU provides the following status indicators:

- STOP/RUN
  - Solid yellow indicates STOP mode
  - Solid green indicates RUN mode
  - Flashing (alternating green and yellow) indicates that the CPU is in the STARTUP operating state
- ERROR
  - Flashing red indicates an error, such as an internal error in the CPU, an error with the memory card, or a configuration error (mismatched modules)
  - Flashing red for three seconds indicates an error that is not ongoing. An example is if the real time clock (RTC) resets to the default time due to a power loss.
  - Defective state:

    - Solid red indicates defective hardware

    - All LEDs flash if the firmware detects a defect
- MAINT (Maintenance) flashes whenever you insert a memory card. The CPU then changes to STOP mode. After the CPU has changed to STOP mode, perform one of the following functions to initiate the evaluation of the memory card:
  - Change the CPU to RUN mode
  - Perform a memory reset (MRES)
  - Power-cycle the CPU

You can also use the LED instruction (Page 438) to determine the status of the LEDs.

Table 15- 1 Status LEDs for a CPU

Description	STOP/RUN Yellow / Green	ERROR Red	MAINT Yellow
Power is off	Off	Off	Off
Startup, self-test, or firmware update	Flashing (alternating yellow and green)	-	Off
Stop mode	On (yellow)	-	-
Run mode	On (green)	-	-
Remove the memory card	On (yellow)	-	Flashing
Error	On (either yellow or green)	Flashing	-
Maintenance requested • Forced I/O • Battery replacement required (if battery board installed)	On (either yellow or green)	-	On
Defective hardware	On (yellow)	On	Off
LED test or defective CPU firmware	Flashing (alternating yellow and green)	Flashing	Flashing
Unknown or incompatible version of CPU configuration	On (yellow)	Flashing	Flashing

Note

"Unknown or incompatible version of CPU configuration" error

Attempting to download an S7-1200 V3.0 program to an S7-1200 V4.0 CPU causes a CPU error, and the CPU displays a corresponding error message in the diagnostic buffer. If you reached this state by using an invalid version program transfer card (Page 138), then remove the card, perform a STOP to RUN transition, a memory reset (MRES) or cycle power. If you reach this state by an invalid program download, reset the CPU to factory settings (Page 1303). After you recover the CPU from the error condition, you can download a valid V4.0 CPU program.

The CPU also provides two LEDs that indicate the status of the PROFINET communications. Open the bottom terminal block cover to view the PROFINET LEDs.

- Link (green) turns on to indicate a successful connection
- Rx/Tx (yellow) turns on to indicate transmission activity

The CPU and each digital signal module (SM) provide an I/O Channel LED for each of the digital inputs and outputs. The I/O Channel (green) turns on or off to indicate the state of the individual input or output.

S7-1200 behavior following a fatal error

If the CPU firmware detects a fatal error it attempts a defect-mode restart, and if successful, signals the defective mode by continually flashing the STOP/RUN, ERROR and MAINT LEDs. The user program and hardware configuration are not loaded following the defect-mode restart.

If the CPU successfully completes the defect-mode restart, the CPU performs these actions:

- Sets the CPU and signal board outputs are to 0
- Sets the outputs of central rack signal modules and distributed I/O to the selection for "Reaction to CPU STOP" in the device configuration of the digital outputs of the module

If the defect-mode restart fails, (for example, due to a hardware fault), the STOP and ERROR LEDs are ON and the MAINT LED is OFF.

⚠ WARNING

Operation in defect state cannot be guaranteed

Control devices can fail in an unsafe condition, resulting in unexpected operation of controlled equipment. Such unexpected operations could result in death or serious injury to personnel, and/or damage to equipment.

Use an emergency stop function, electromechanical overrides or other redundant safeguards that are independent of the PLC.

Status LEDs on an SM

In addition, each digital SM provides a DIAG LED that indicates the status of the module:

- Green indicates that the module is operational
- Red indicates that the module is defective or non-operational

Each analog SM provides an I/O Channel LED for each of the analog inputs and outputs.

- Green indicates that the channel has been configured and is active
- Red indicates an error condition of the individual analog input or output

In addition, each analog SM provides a DIAG LED that indicates the status of the module:

- Green indicates that the module is operational
- Red indicates that the module is defective or non-operational

The SM detects the presence or absence of power to the module (field-side power, if required).

Table 15- 2 Status LEDs for a signal module (SM)

Description	DIAG (Red / Green)	I/O Channel (Red / Green)
Field-side power is off *	Flashing red	Flashing red
Not configured or update in progress	Flashing green	Off
Module configured with no errors	On (green)	On (green)
Error condition	Flashing red	-
I/O error (with diagnostics enabled)	-	Flashing red
I/O error (with diagnostics disabled)	-	On (green)

* Status is only supported on analog signal modules.

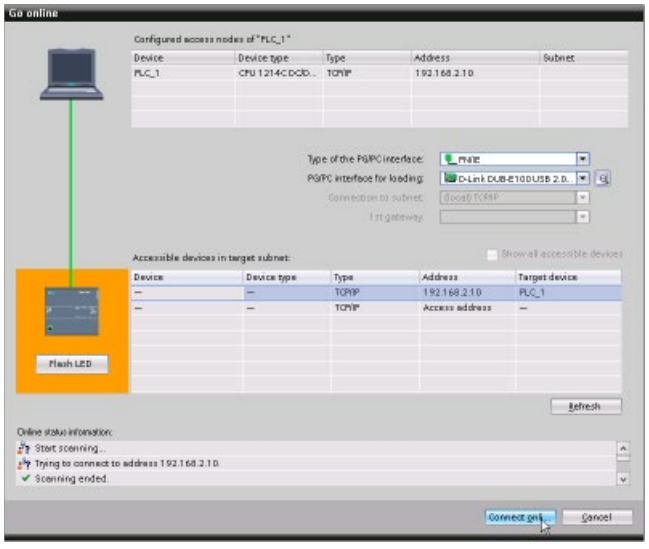
15.2 Going online and connecting to a CPU

You must establish an online connection between the programming device and CPU for loading programs and project engineering data as well as for activities such as the following:

- Testing user programs
- Displaying and changing the operating mode of the CPU (Page 1306)
- Displaying and setting the date and time of day of the CPU (Page 1302)
- Displaying the module information
- Comparing and synchronizing (Page 1309) offline to online program blocks
- Uploading and downloading program blocks
- Displaying diagnostics and the diagnostics buffer (Page 1308)
- Using a watch table (Page 1315) to test the user program by monitoring and modifying values
- Using a force table to force values in the CPU (Page 1318)

To establish an online connection to a configured CPU, click the CPU from the Project Navigation tree and click the "Go online" button from the Project View:





If this is the first time to go online with this CPU, you must select the type of PG/PC interface and the specific PG/PC interface from the Go Online dialog before establishing an online connection to a CPU found on that interface.

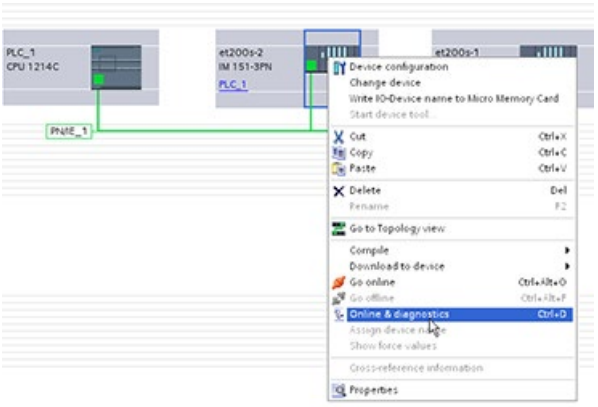
You have now connected your programming device to the CPU. The orange color frames indicate an online connection. You can now use the Online & diagnostics tools from the Project tree and the Online tools task card.

15.3 Assigning a name to a PROFINET IO device online

The devices on your PROFINET network must have an assigned name before you can connect with the CPU. Use the "Devices & networks" editor to assign names to your PROFINET devices if the devices have not already been assigned a name or if the name of the device is to be changed.

For each PROFINET IO device, you must assign the same name to that device in both the STEP 7 project and, using the "Online & diagnostics" tool, to the PROFINET IO device configuration memory (for example, an ET200 S interface module configuration memory). If a name is missing or does not match in either location, the PROFINET IO data exchange mode will not run.

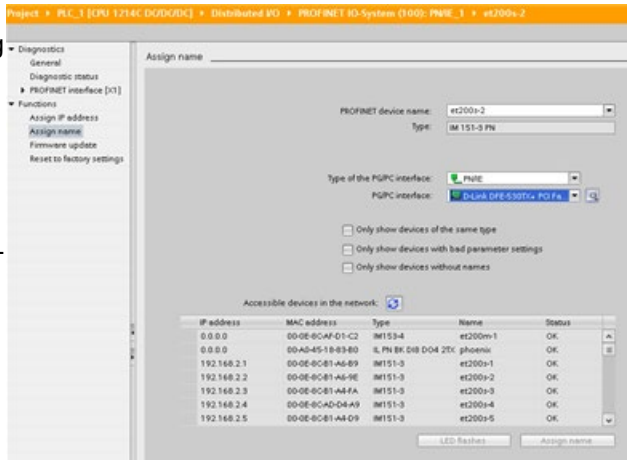
1. In the "Devices & networks" editor, right-click on the required PROFINET IO device, and select "Online & diagnostics".



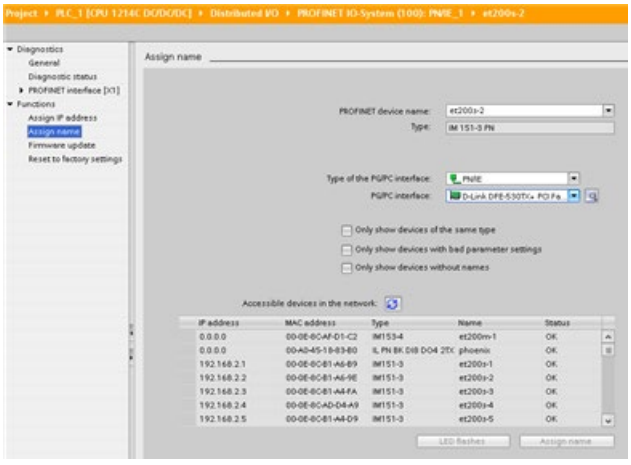
2. In the "Online & diagnostics" dialog, make the following menu selections:

- "Functions"
- "Assign PROFINET device name"

Click the "Update list" button to display all of the PROFINET IO devices on the network.

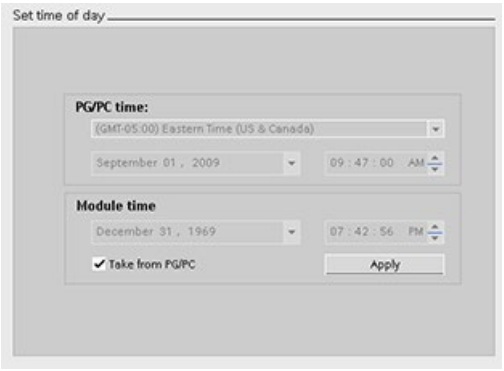


3. In the list that is displayed, click the required PROFINET IO device, and click the "Assign name" button to write the name to the PROFINET IO device configuration memory.



15.4 Setting the IP address and time of day

You can set the IP address (Page 793) and time of day in the online CPU. After accessing "Online & diagnostics" from the Project tree for an online CPU, you can display or change the IP address. You can also display or set the time and date parameters of the online CPU.





Note

This feature is available only for a CPU that either has only a MAC address (has not yet been assigned an IP address) or has been reset to factory settings.

15.5 Resetting to factory settings

You can reset an S7-1200 to its original factory settings under the following conditions:

- The CPU has an online connection.
- The CPU is in STOP mode.

Note

If the CPU is in RUN mode and you start the reset operation, you can place it in STOP mode after acknowledging a confirmation prompt.

Procedure

To reset a CPU to its factory settings, follow these steps:

1. Open the Online and Diagnostics view of the CPU.
2. Select "Reset to factory settings" from the "Functions" folder.
3. Select the "Retain IP address" check box if you want to retain the IP address or the "Delete IP address" check box if you want to delete the IP address.
4. Click the "Reset" button.
5. Acknowledge the confirmation prompt with "OK".

Result

The module switches to STOP mode if necessary, and it resets the factory settings. The CPU performs the following actions:

With memory card installed in CPU	Without memory card installed in CPU
• Clears the diagnostics buffer • Resets the time of day • Restores work memory from the memory card • Sets all operand areas to configured initial values • Sets all parameters to their configured values • Retains or deletes the IP address based on the selection you made. (The MAC address is fixed and is never changed.)[1] • Deletes the control data record (Page 155), if present	• Clears the diagnostics buffer • Resets the time of day • Clears the work memory and internal load memory • Sets all operand areas to configured initial values • Sets all parameters to their configured values • Retains or deletes the IP address based on the selection you made. (The MAC address is fixed and is never changed.)[1] • Deletes the control data record, if present

[1] If you selected "Retain IP address", the CPU sets the IP address, subnet mask, and router address (if used) to the settings in your hardware configuration, unless you have modified these values from the user program or another tool, in which case the CPU restores the modified values.

15.6 Updating firmware

You can update the firmware of a connected CPU from the STEP 7 online and diagnostics tools, by one of two methods:

- Updating from the CPU in the project
- Updating from the accessible devices in the project tree

Updating the firmware of a CPU in your project

To perform a firmware update, follow these steps:

1. Open the CPU in the Project Tree that corresponds to the connected CPU.
2. Open the Online and Diagnostics view of the connected CPU.
3. Select "Firmware update" from the "Functions" folder.
4. From the "Firmware loader" section, click the Browse button and navigate to the location that contains the firmware update file. This could be a location on your hard drive to which you have downloaded an S7-1200 (http://support.automation.siemens.com/WW/view/en/34612486/133100) firmware update file from the Siemens Industry Online Support Web site (http://support.industry.siemens.com).
5. Select a file that is compatible with your module. For a selected file, the table displays the compatible modules.
6. Click the "Run update" button. Follow the dialogs, if necessary, to change the operating mode of your CPU.

STEP 7 displays progress dialogs as it loads the firmware update. When it finishes, it prompts you to start the module with the new firmware.

Note

If you do not choose to start the module with the new firmware, the previous firmware remains active until you reset the module, for example by cycling power. The new firmware becomes active only after you reset the module.

Updating the firmware from the accessible devices

To perform a firmware update for one or more accessible devices, follow these steps:

1. Open "Online access" from the project tree.
2. Open the communications interface to which your CPU is connected.
3. Double-click "Update accessible devices" and wait for STEP 7 to display the online devices.
4. Expand the CPU that you want to update and double-click "Online & diagnostics".
5. Expand "Firmware update" from the "Functions" folder. You will see the PLC as well as local modules for the PLC. From either the "PLC" or "Local modules" selection, you can proceed with updating firmware from the "Firmware loader" section as described above.

You can also perform a firmware update by one of the following methods:

- Using a SIMATIC memory card (Page 144)
- Using the Web server "Module Information" standard Web page (Page 1002)
- Using the SIMATIC Automation Tool (https://support.industry.siemens.com/cs/ww/en/view/98161300)

15.7 Formatting a SIMATIC memory card from STEP 7

You can format the memory card in a connected CPU from the STEP 7 online and diagnostic tools. To do so, follow these steps:

1. Ensure the CPU is in STOP mode. Note that if the CPU is in RUN mode and you start a formatting operation, STEP 7 prompts you to allow STEP 7 to put the CPU in STOP mode.
2. Insert a memory card into the connected CPU.
3. Open Online & diagnostics for the connected CPU from either the CPU in the project or from the accessible devices in Online access in the project tree.
4. If the CPU is not online, select "Go online" for the connected CPU.
5. Select "Format memory card" from the "Functions" menu.
6. Click "Format".
7. Confirm the prompt with "Yes".

STEP 7 then formats the memory card and displays a message in the Info window when complete. The CPU is in STOP at the completion of the format operation with the STOP and MAINT lights blinking. You cannot go to RUN mode at this point; you must take one of the following actions:

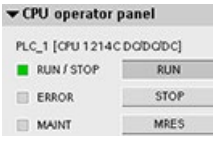
- Remove the memory card and restart the CPU: If the internal load memory of the CPU contains a program, the CPU starts with the program.
- Restart the CPU without removing the memory card: If the internal load memory of the CPU contains a program, the CPU copies it to the memory card and starts with that program. If the internal load memory has no program, the CPU changes the memory card to a Program card (Page 141) and waits for a download.

Note

Formatting a memory card has no effect on the contents of internal load memory.

If the CPU was using internal load memory when you inserted the memory card and you did not restart the CPU between inserting the card and executing the format operation, the CPU retains the contents of internal load memory.

15.8 CPU operator panel for the online CPU



The "CPU operator panel" displays the operating mode (STOP or RUN) of the online CPU. The panel also shows whether the CPU has an error or if values are being forced.

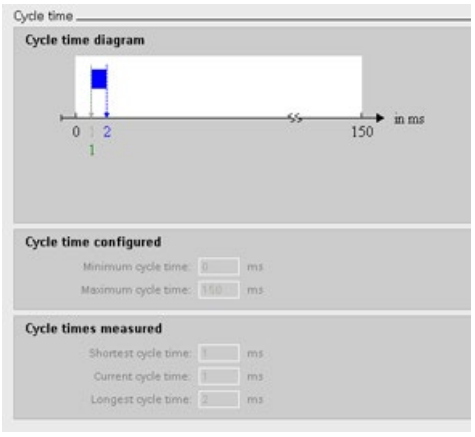
Use the CPU operating panel of the Online Tools task card to change the operating mode of an online CPU. The Online Tools task card is accessible whenever the CPU is online.

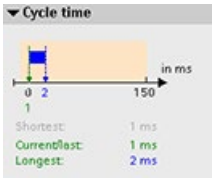
15.9 Monitoring the cycle time and memory usage

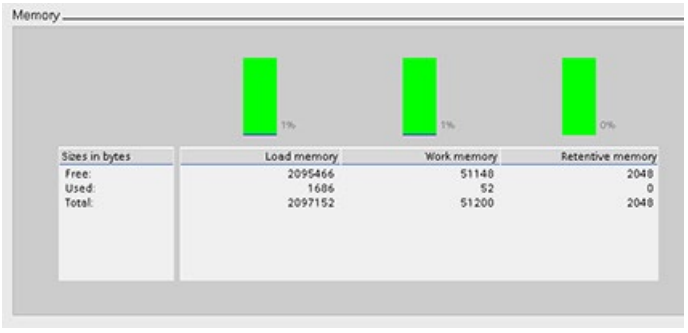
You can monitor the cycle time and memory usage of an online CPU.

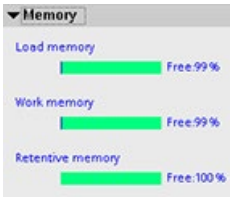
After connecting to the online CPU, open the Online tools task card to view the following measurements:

- Cycle time
- Memory usage





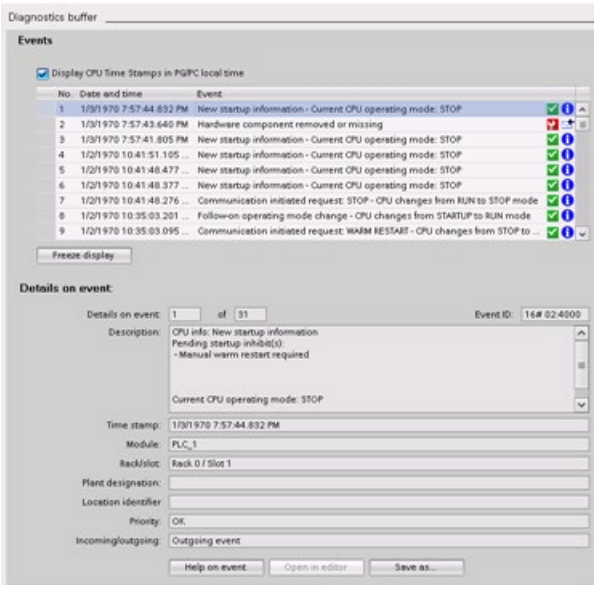




15.10 Displaying diagnostic events in the CPU

Use the diagnostics buffer to review the recent activity in the CPU. The diagnostics buffer is accessible from "Online & Diagnostics" for an online CPU in the Project tree. It contains the following entries:

- Diagnostic events
- Changes in the CPU operating mode (transitions to STOP or RUN mode)



The first entry contains the latest event. Each entry in the diagnostic buffer contains the date and time the event was logged, and a description.

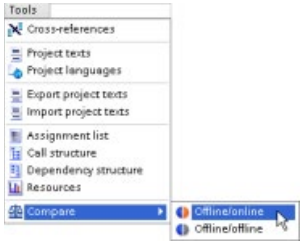
The maximum number of entries is dependent on the CPU. A maximum of 50 entries is supported.

Only the 10 most recent events in the diagnostic buffer are stored permanently. Resetting the CPU to the factory settings resets the diagnostic buffer by deleting the entries.

You can also use the GET_DIAG instruction (Page 466) to collect the diagnostic information.

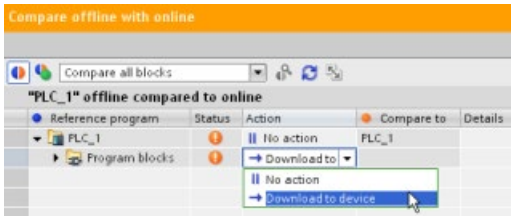
15.11 Comparing offline and online CPUs

You can compare the code blocks in an online CPU with the code blocks in your project. If the code blocks of your project do not match the code blocks of the online CPU, the "Compare" editor allows you to synchronize your project with the online CPU by downloading the code blocks of your project to the CPU, or by deleting blocks from the project that do not exist in the online CPU.



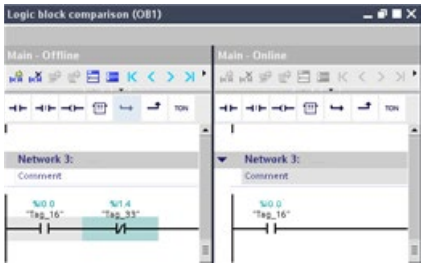
Select the CPU in your project.

Use the "Compare Offline/online" command to open the "Compare" editor. (Access the command either from the "Tools" menu or by right-clicking the CPU in your project.)



Click in the "Action" column for an object to select whether to delete the object, take no action, or download the object to the device.

Click the "Synchronize" button to load the code blocks.



Right-click an object in the "Compare to" column and select "Start detailed comparison" button to show the code blocks side-by-side.

The detailed comparison highlights the differences between the code blocks of online CPU and the code blocks of the CPU in your project.

Note

Read access required on protected CPU for the Offline/Online compare operations

For STEP 7 V14 or later versions, the "HMI access" security level is insufficient to perform the Offline/Online compare operations. You must have "Read access" or "Full access", to do Offline/Online compare operations.

See also Access protection for the CPU (Page 204)

15.12 Performing an online/offline topology comparison

From the topology overview in STEP 7, you can compare the configured offline topology with the actual online topology.

Procedure

To find the differences between the configured and thee actual topology, follow these steps:

1. Display the topology overview table of the topology view.
2. Click the "Offline/online comparison" button in the toolbar of the topology overview: 

Result

STEP 7 removes the "Partner station, "Partner interface" and "Cable data" columns in the topology overview table and inserts comparison columns for "Status", and "Action". For each device or port in the topology overview, the Status column displays the comparison status as follows:

Icon	Meaning
	Differing topology in at least one lower-level component
	Identical topology
	Topology information is only available offline, or device is disabled
	Topology information is only available online
	Differing topology
	Device does not support topology functions

For each compared port or device, the Action column provides these possible choices:

Icon	Meaning
	No action possible
	Adopt the online interconnection

To repeat the comparison, click the  toolbar button on the topology overview.

For additional information on the topology view, the topology overview, and online/offline topology comparisons, refer to the STEP 7 Information System. Also you can find additional information in the PROFINET with STEP 7 V13 manual (https://support.industry.siemens.com/cs/ww/en/view/49948856).

15.13 Monitoring and modifying values in the CPU

STEP 7 provides online tools for monitoring the CPU:

- You can display or monitor the current values of the tags. The monitoring function does not change the program sequence. It presents you with information about the program sequence and the data of the program in the CPU.
- You can also use other functions to control the sequence and the data of the user program:
  - You can modify the value for the tags in the online CPU to see how the user program responds.
  - You can force a peripheral output (such as Q0.1:P or "Start":P) to a specific value.
  - You can enable outputs in STOP mode.

Note

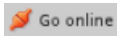
Always exercise caution when using control functions. These functions can seriously influence the execution of the user/system program.

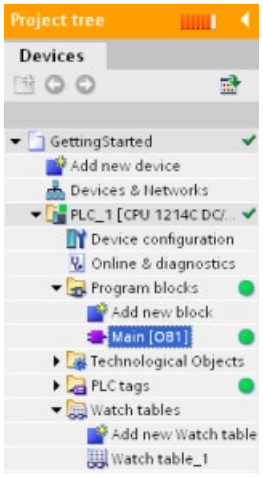
Table 15- 3 Online capabilities of the STEP 7 editors

Editor	Monitor	Modify	Force
Watch table	Yes	Yes	No
Force table	Yes	No	Yes
Program editor	Yes	Yes	No
Tag table	Yes	No	No
DB editor	Yes	No	No

15.13.1 Going online to monitor the values in the CPU

To monitor the tags, you must have an online connection to the CPU. Simply click the "Go online" button in the toolbar.

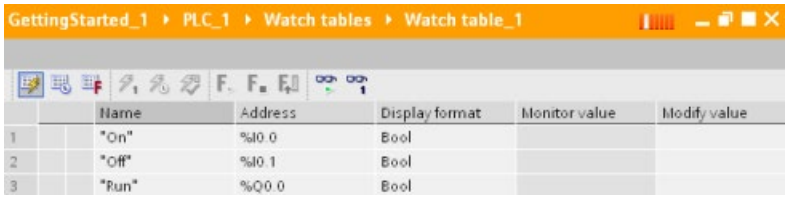




When you have connected to the CPU, STEP 7 turns the headers of the work areas orange.

The project tree displays a comparison of the offline project and the online CPU. A green circle means that the CPU and the project are synchronized, meaning that both have the same configuration and user program.

Tag tables show the tags. Watch tables can also show the tags, as well as direct addresses.





To monitor the execution of the user program and to display the values of the tags, click the "Monitor all" button in the toolbar.



The "Monitor value" field shows the value for each tag.

15.13.2 Displaying status in the program editor

You can monitor the status of up to 50 tags in the LAD and FBD program editors. Use the editor bar to display the LAD editor. The editor bar allows you to change the view between the open editors without having to open or close the editors.

In the toolbar of the program editor, click the "Monitoring on/off" button to display the status of your user program.



The network in the program editor displays power flow in green.

You can also right-click on the instruction or parameter to modify the value for the instruction.

15.13.3 Capturing a snapshot of the online values of a DB for restoring values

You can capture a snapshot of the actual values of data block tags from an online CPU for later use.

Note the following prerequisites:

- You must have an online connection to the CPU.
- You must have the DB open in STEP 7.

Capturing a snapshot

To capture a snapshot, follow these steps:

1. In the DB editor, click the "Monitor all tags" button: The "Monitor value" column displays the actual data values.
2. Click the button to capture a snapshot of the actual values and display them in the "Snapshot" column.

You can use this snapshot at a later time to update the actual CPU values or to replace the start values.

Copying the snapshot values to the CPU

To copy the snapshot values to the actual values of the data block tags in the CPU, click the following button: 

The online CPU loads the snapshot values into the actual values. The Monitor value column shows the actual values in the CPU. The scan cycle might subsequently change the values in the CPU from the snapshot values, but at the time you make the copy, the CPU loads the snapshot values in a consistent download.

Note

Be aware that if your snapshot contains state information, timer values, or calculated information, the CPU restores those values as of the time you made the snapshot.

Copying the snapshot values to the start values

To copy the snapshot values to the start values of the data block tags, click the following button: 

After you compile the DB and download it to the CPU, the DB uses the new start values when the CPU goes to RUN mode.

Copying individual snapshot or monitor values to start values

The data block editor also lets you copy individual values and paste them over start values. Simply right-click a value in any value column and select Copy to place it in the Windows clipboard. Then, you can right-click on any start value and select paste to replace that value with the value in the clipboard.

After you compile the DB and download it to the CPU, the DB uses the new start values when the CPU goes to RUN mode.

15.13.4 Using a watch table to monitor and modify values in the CPU

A watch table allows you to perform monitoring and control functions on data points as the CPU executes your program. These data points can be process image (I or Q), M, DB or physical inputs (I_:P), depending on the monitor or control function. You cannot accurately monitor the physical outputs (Q_:P) because the monitor function can only display the last value written from Q memory and does not read the actual value from the physical outputs.

The monitoring function does not change the program sequence. It presents you with information about the program sequence and the data of the program in the CPU.

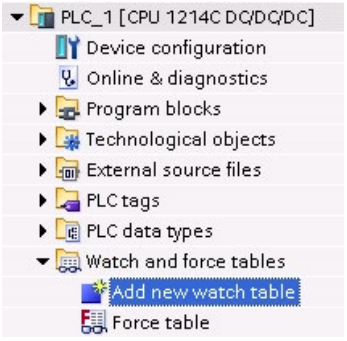
Control functions enable the user to control the sequence and the data of the program. You must exercise caution when using control functions. These functions can seriously influence the execution of the user/system program. The three control functions are Modify, Force and Enable Outputs in STOP.

With the watch table, you can perform the following online functions:

- Monitoring the status of the tags
- Modifying values for the individual tags

You select when to monitor or modify the tag:

- Beginning of scan cycle: Reads or writes the value at the beginning of the scan cycle
- End of scan cycle: Reads or writes the value at the end of the scan cycle
- Switch to stop



To create a watch table:

1. Double-click "Add new watch table" to open a new watch table.
2. Enter the tag name to add a tag to the watch table.

The following options are available for monitoring tags:

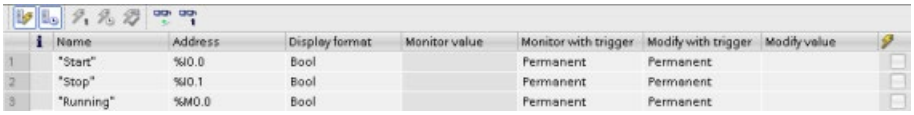
- Monitor all: This command starts the monitoring of the visible tags in the active watch table.
- Monitor now: This command starts the monitoring of the visible tags in the active watch table. The watch table monitors the tags immediately and once only.

The following options are available for modifying tags:

- "Modify to 0" sets the value of a selected address to "0".
- "Modify to 1" sets the value of a selected address to "1".
- "Modify now" immediately changes the value for the selected addresses for one scan cycle.
- "Modify with trigger" changes the values for the selected addresses.

  This function does not provide feedback to indicate that the selected addresses were actually modified. If feedback of the change is required, use the "Modify now" function.
- "Enable peripheral outputs" disables the command output disable and is available only when the CPU is in STOP mode.

To monitor the tags, you must have an online connection to the CPU.



	Name	Address	Display format	Monitor value	Monitor with trigger	Modify with trigger	Modify value
1	"Start"	%I0.0	Bool		Permanent	Permanent	
2	"Stop"	%I0.1	Bool		Permanent	Permanent	
3	"Running"	%M0.0	Bool		Permanent	Permanent	

You use the buttons at the top of the watch table to select the various functions.

Enter the tag name to monitor and select a display format from the dropdown selection. With an online connection to the CPU, click the "Monitor" button to display the actual value of the data point in the "Monitor value" field.

15.13.4.1 Using a trigger when monitoring or modifying PLC tags

Triggering determines at what point in the scan cycle the selected address will be monitored or modified.

Table 15- 4 Types of triggers

Trigger	Description
Permanent	Continuously collects the data
At scan cycle start	Permanent: Continuously collects the data at the start of the scan cycle, after the CPU reads the inputs
	Once: Collects the data at the start of the scan cycle, after the CPU reads the inputs
At scan cycle end	Permanent: Continuously collects the data at the end of the scan cycle, before the CPU writes the outputs
	Once: Collects the data once at the end of the scan cycle, before the CPU writes the outputs
At transition to STOP	Permanent: Continuously collects data when the CPU transitions to STOP
	Once: Collects the data once after the CPU transitions to STOP

For modifying a PLC tag at a given trigger, select either the start or the end of cycle.

- Modifying an output: The best trigger event for modifying an output is at the end of the scan cycle, immediately before the CPU writes the outputs.

  Monitor the value of the outputs at the beginning of the scan cycle to determine what value is written to the physical outputs. Also, monitor the outputs before the CPU writes the values to the physical outputs in order to check program logic and to compare to the actual I/O behavior.

- Modifying an input: The best trigger event for modifying an input is at the start of the cycle, immediately after the CPU reads the inputs and before the user program uses the input values.

  If you suspect values are changing during the scan, you might want to monitor the value of the inputs at the end of the scan cycle to ensure that the value of the input at the end the scan cycle has not changed from the start of the scan cycle. If there is a difference in the values, your user program might be erroneously writing to inputs.

To diagnose why the CPU might have gone to STOP, use the "Transition to STOP" trigger to capture the last process values.

15.13.4.2 Enabling outputs in STOP mode

The watch table allows you to write to the outputs when the CPU is in STOP mode. This functionality allows you to check the wiring of the outputs and verify that the wire connected to an output pin initiates a high or low signal to the terminal of the process device to which it is connected.

⚠ WARNING

Risks in writing to physical outputs in STOP mode

Even though the CPU is in STOP mode, enabling a physical output can activate the process point to which it is connected, possibly resulting in unexpected equipment operation. Unexpected equipment operation can cause death or severe personal injury.

Before writing to an output from the watch table, ensure that changing the physical output cannot cause unexpected equipment operation. Always observe safety precautions for your process equipment.

You can change the state of the outputs in STOP mode when the outputs are enabled. If the outputs are disabled, you cannot modify the outputs in STOP mode. To enable the modification in STOP mode of the outputs from the watch table, follow these steps:

1. Select the "Expanded mode" menu command from the "Online" menu.
2. Select the "Enable peripheral outputs" option of the "Modify" command of the "Online" menu, or from the context menu after right-clicking the row of the Watch table.

You cannot enable outputs in STOP mode if you have configured distributed I/O. An error is returned when you try to do this.

Setting the CPU to RUN mode disables "Enable peripheral outputs" option.

If any inputs or outputs are forced, the CPU is not allowed to enable outputs while in STOP mode. The force function must first be cancelled.

15.13.5 Forcing values in the CPU

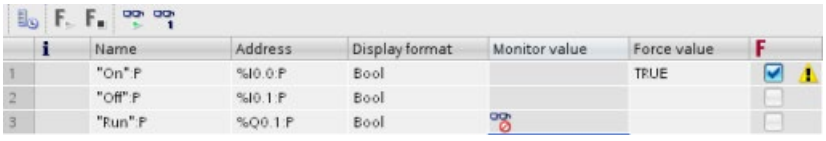
15.13.5.1 Using the force table

A force table provides a "force" function that overwrites the value for an input or output point to a specified value for the peripheral input or peripheral output address. The CPU applies this forced value to the input process image prior to the execution of the user program and to the output process image before the outputs are written to the modules.

Note

The force values are stored in the CPU and not in the force table.

You cannot force an input (or "I" address) or an output (or "Q" address). However, you can force a peripheral input or peripheral output. The force table automatically appends a ":P" to the address (for example: "On":P or "Run":P).



	i	Name	Address	Display format	Monitor value	Force value	F
1		"On":P	%I0.0:P	Bool		TRUE	
2		"Off":P	%I0.1:P	Bool			
3		"Run":P	%Q0.1:P	Bool			

In the "Force value" cell, enter the value for the input or output to be forced. You can then use the check box in the "Force" column to enable forcing of the input or output.



Use the "Start or replace forcing" button to force the value of the tags in the force table. Click the "Stop forcing" button to reset the value of the tags.

In the force table, you can monitor the status of the forced value for an input. However, you cannot monitor the forced value of an output.

You can also view the status of the forced value in the program editor.



Note

When an input or output is forced in a force table, the force actions become part of the project configuration. If you close STEP 7, the forced elements remain active in the CPU program until they are cleared. To clear these forced elements, you must use STEP 7 to connect with the online CPU and then use the force table to turn off or stop the force function for those elements.

15.13.5.2 Operation of the Force function

The CPU allows you to force input and output point(s) by specifying the physical input or output address (I_:P or Q_:P) in the force table and then starting the force function.

In the program, reads of physical inputs are overwritten by the forced value. The program uses the forced value in processing. When the program writes a physical output, the output value is overwritten by the force value. The forced value appears at the physical output and is used by the process.

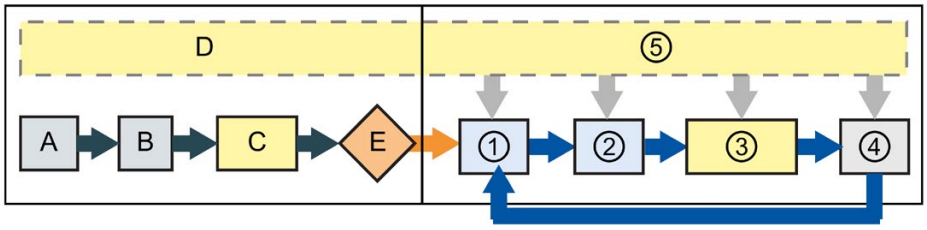
When an input or output is forced in the force table, the force actions become part of the user program. Even though the programming software has been closed, the force selections remain active in the operating CPU program until they are cleared by going online with the programming software and stopping the force function. Programs with forced points loaded on another CPU from a memory card will continue to force the points selected in the program.

If the CPU is executing the user program from a write-protected memory card, you cannot initiate or change the forcing of I/O from a watch table because you cannot override the values in the write-protected user program. Any attempt to force the write-protected values generates an error. If you use a memory card to transfer a user program, any forced elements on that memory card will be transferred to the CPU.

Note

Digital I/O points assigned to HSC, PWM, and PTO cannot be forced

The digital I/O points used by the high-speed counter (HSC), pulse-width modulation (PWM), and pulse-train output (PTO) devices are assigned during device configuration. When digital I/O point addresses are assigned to these devices, the values of the assigned I/O point addresses cannot be modified by the force function of the force table.



Startup

A	The clearing of the I memory area is not affected by the Force function.
B	The initialization of the outputs values is not affected by the Force function.
C	During the execution of the startup OBs, the CPU applies the force value when the user program accesses the physical input.
D	The storing of interrupt events into the queue is not affected.
E	The enabling of the writing to the outputs is not affected.

RUN

①	While writing Q memory to the physical outputs, the CPU applies the force value as the outputs are updated.
②	When reading the physical inputs, the CPU applies the force values just prior to copying the inputs into I memory.
③	During the execution of the user program (program cycle OBs), the CPU applies the force value when the user program accesses the physical input or writes the physical output.
④	Handling of communication requests and self-test diagnostics are not affected by the Force function.
⑤	The processing of interrupts during any part of the scan cycle is not affected.

15.14 Downloading in RUN mode

The CPU supports "Download in RUN mode". This capability is intended to allow you to make small changes to a user program with minimal disturbance to the process being controlled by the program. However, implementing this capability also allows massive program changes that could be disruptive or even dangerous.

WARNING

Risks with downloading in RUN mode

When you download changes to the CPU in RUN mode, the changes immediately affect process operation. Changing the program in RUN mode can result in unexpected system operation, which could cause death or serious injury to personnel, and/or damage to equipment.

Only authorized personnel who understand the effects of RUN mode changes on system operation should perform a download in RUN mode.

The "Download in RUN mode" feature allows you to make changes to a program and download them to your CPU without switching to STOP mode:

- You can make minor changes to your current process without having to shut down (for example, change a parameter value).
- You can debug a program more quickly with this feature (for example, invert the logic for a normally open or normally closed switch).

You can make the following program block and tag changes and download them in RUN mode:

- Create, overwrite, and delete Functions (FC), Function Blocks (FB), and Tag tables.
- Create, delete, and overwrite Data Blocks (DB) and instance data blocks for Function Blocks (FB). You can add to DB structures and download them in RUN mode. The CPU can maintain the values of existing block tags and initialize the new data block tags to their initial values, or the CPU can set all data block tags to initial values, depending on your configuration settings (Page 1327). You cannot download a web server DB (control or fragment) in RUN mode.
- Overwrite Organization Blocks (OB); however, you cannot create or delete OBs.

You can download a maximum number of twenty blocks in RUN mode at one time. If you must download more than twenty blocks, you must place the CPU in STOP mode.

If you download changes to a real process (as opposed to a simulated process, which you might do in the course of debugging a program), it is vital to think through the possible safety consequences to machines and machine operators before you download.

Note

If the CPU is in RUN mode and program changes have been made, STEP 7 always tries to download in RUN first. If you do not want this to happen, you must put the CPU into STOP.

If the changes made are not supported in "Download in RUN", STEP 7 prompts the user that the CPU must go to STOP.

15.14.1 Prerequisites for "Download in RUN mode"

To be able to download your program changes to a CPU that is in RUN mode, you must meet these prerequisites:

- Your CPU version is V3.0 or later

  Note

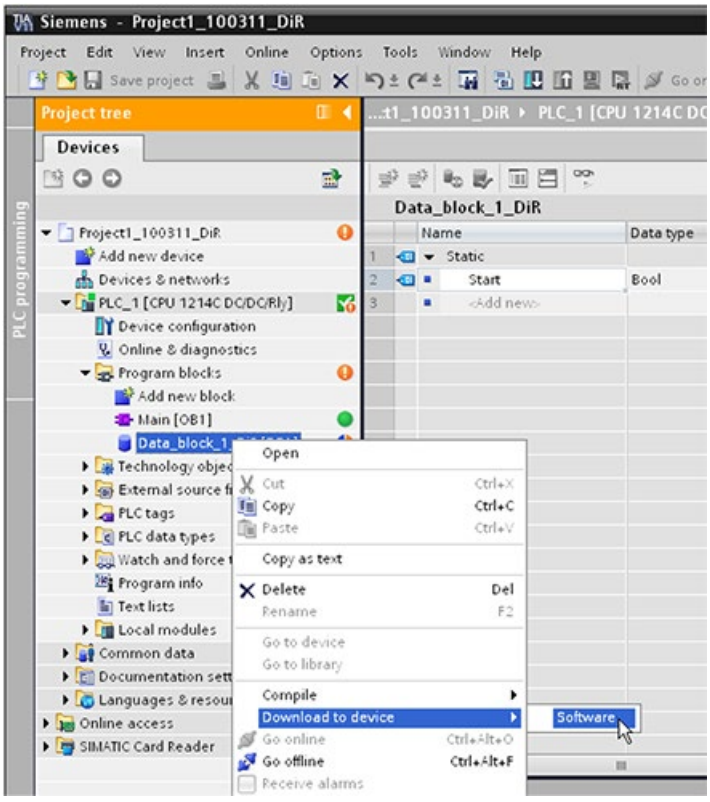
  Your CPU version must be V4.0 or later to modify the extended block interface in RUN mode. (Page 1327)

- Your program must compile successfully.
- You must have successfully established communication between the programming device where you are running STEP 7 and the CPU.

15.14.2 Changing your program in RUN mode

To change the program in RUN mode, you must first ensure that the CPU and program meet the prerequisites (Page 1322), and then follow these steps:

1. To download your program in RUN mode, select one of the following methods:
   - Select the "Download to device" command from the "Online" menu.
   - Click the "Download to device" button in the toolbar.
   - In the "Project tree", right-click "Program blocks" and select the "Download to device > Software" command.



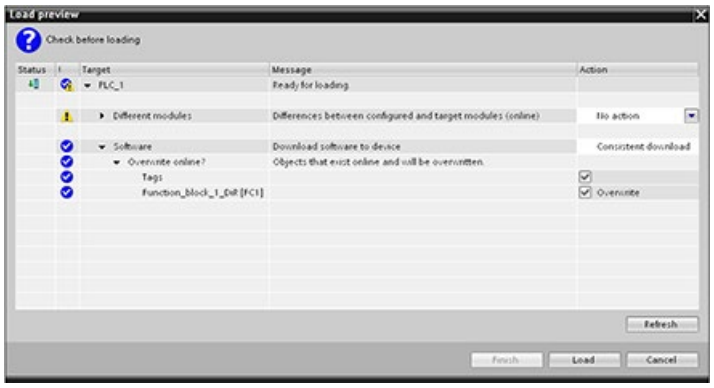
   If the program compiles successfully, STEP 7 starts to download the program to the CPU.

2. When STEP 7 prompts you to load your program or cancel the operation, click "Load" to download the program to the CPU.

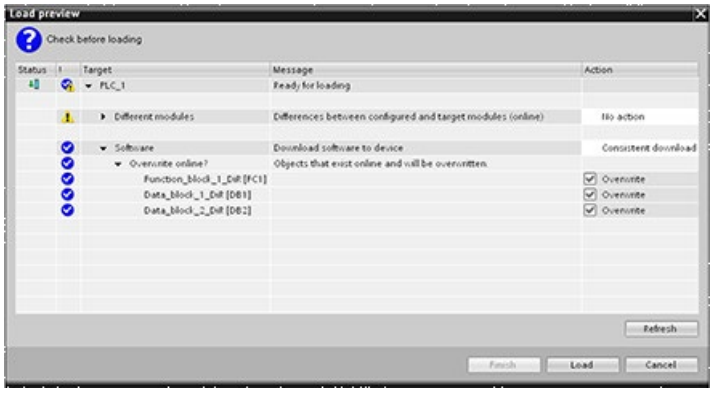
15.14.3 Downloading selected blocks

From the Program blocks folder, you can select a single block or a selection of blocks for downloading.

If you select a single block for downloading, then the only option in the "Action" column is "Consistent download". You can expand the category line to be sure what blocks are to be loaded. In this example, a small change was made to the offline block, and no other blocks need to be loaded.



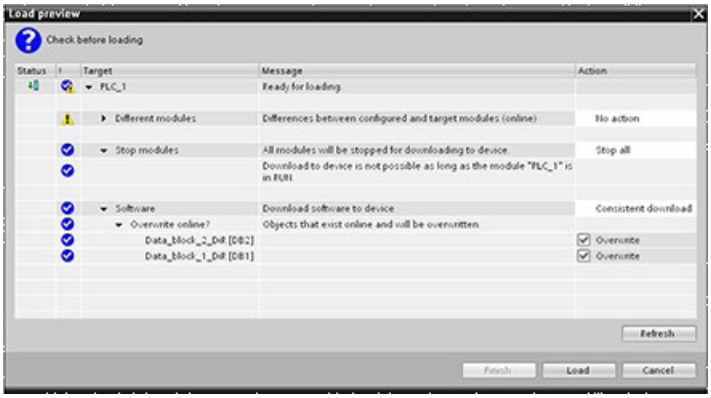
In this example, more than one block is needed for downloading.



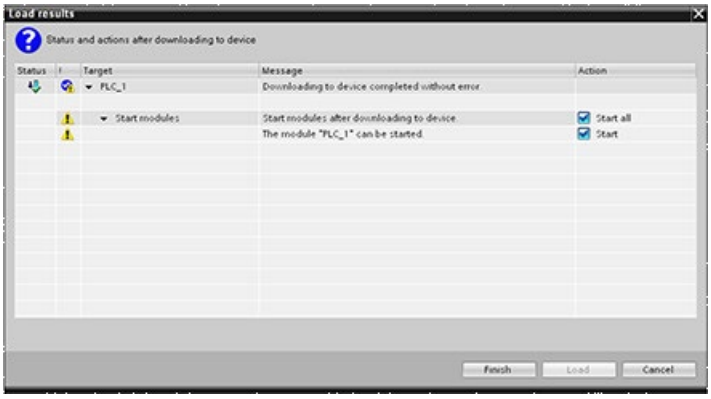
Note

You can download a maximum number of twenty blocks in RUN mode at one time. If you must download more than twenty blocks, you must place the CPU in STOP mode.

If you attempt to download in RUN, but the system detects that this is not possible prior to the actual download, then the Stop modules category line appears in the dialog.

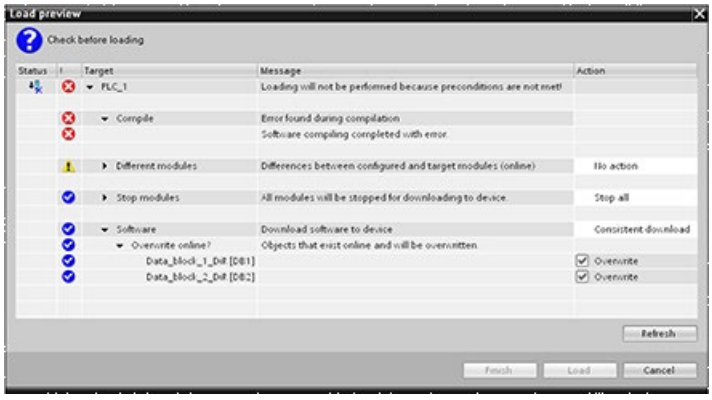


Click the "Load" button, and the "Load results" dialog appears. Click the "Finish" button to complete the download.



15.14.4 Downloading a single selected block with a compile error in another block

If you attempt a consistent download with a compile error in another block, then the dialog indicates an error, and the load button is disabled.



You must correct the compile error in the other block. Then, the "Load" button becomes active.



15.14.5 Modifying and downloading existing blocks in RUN mode

The Download in Run feature allows you to add and modify tags in data blocks and function blocks and then download the changed block to the CPU in RUN mode.

Download without reinitialization

Each DB and FB has an amount of reserved memory, which you can use for adding tags to the block that you can subsequently download in RUN mode. By default, the initial size of the memory reserve is 100 bytes. You can add additional tags to your data up to the size of the memory reserve and download the extended block to the CPU in RUN mode. You can also increase the memory reserve if you need more memory for additional tags in your block. If you add more tags than the amount of memory you have allocated, you cannot download the extended block to the CPU in RUN mode.



The "Download without reinitialization" feature allows you to extend a data block by adding more data block tags and download the extended data block in RUN mode. In this way, you can add tags to a data block and download it without reinitializing your program. The CPU retains the values of the existing data block tags and initializes the newly-added tags to their start values.

To enable this function for an online project with a CPU in RUN mode, follow these steps:

1. From the Program blocks folder in the STEP 7 project tree, open the block.
2. Click the "Download without reinitialization" toggle button in the block editor to enable the function. (The icon has a box around it when you have enabled it:)
3. Click OK on the prompt to confirm your choice.
4. Add tags to the block interface and download the block in RUN mode. You can add and download as many new tags as your memory reserve allows.

If you have added more bytes to your block than you have configured for the memory reserve, STEP 7 displays an error when you attempt to download the block in RUN mode. You must edit the block properties to increase the amount. You cannot delete existing entries or modify the “Memory reserve” of the block while the “Download without reinitialization” function is enabled. To disable the "Download without reinitialization" function, follow these steps:

1. Click the "Download without reinitialization" toggle button in the block editor to disable the function. (The icon does not have a box around it when you have disabled it:)
2. Click OK on the prompt to confirm your choice.
3. Download the block. On the download dialog, you must select "reinitialize" in order to download the extended block.

The download then reinitializes all existing and new block tags to their start values.

Downloading retentive block tags

Downloading retentive block tags in RUN mode requires the allocation of a retentive memory reserve. To configure this retentive memory reserve, follow these steps:

1. From the Program blocks folder in the STEP 7 project tree, right-click the block and select "Properties" from the context menu.
2. Select the "Download without reinitialization" property.
3. Select the check box for "Enable download without reinitialization for retentive tags".
4. Configure the number of bytes available for the retentive memory reserve.
5. Click OK to save your changes.
6. Add retentive data block tags to the data block and download the data block in RUN mode. You can add and download as many new retentive data block tags as your retentive memory reserve allows.

If you have added more retentive bytes to your data block than you have configured for the retentive memory reserve, STEP 7 displays an error when you attempt to download the block in RUN mode. You can only add retentive block tags up to the retentive memory reserve in order to be able to download them in RUN mode.

When you download the extended retentive block tags, the tags contain their current values.

Configuring amount of reserved memory for new blocks

The default memory reserve size for new data blocks is 100 bytes. When you create a new block, it has 100 bytes available in reserve. If you want the memory reserve size to be different for new blocks, you can change the setting in the PLC programming settings:

1. From STEP 7, select the **Options > Settings** menu command.
2. From the Settings dialog, expand "PLC programming" and select "General".
3. In the "Download without reinitialization" section, enter the number of bytes for the memory reserve.

When you create new blocks, STEP 7 uses the memory reserve configuration that you entered for the new blocks.

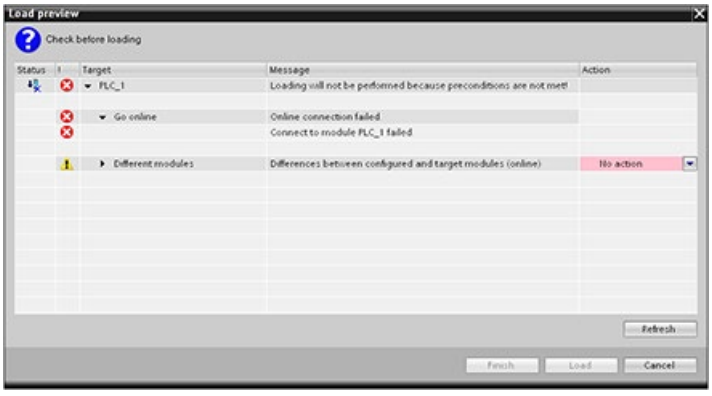
Restrictions

The following restrictions apply to editing and downloading blocks in RUN mode:

- Extending the block interface by adding new tags and downloading in RUN mode is only available for optimized blocks (Page 186).
- You cannot change the structure of a block and download the changed block in RUN mode without reinitializing. Adding new members to a Struct (Page 130) tag, changing tag names, array sizes, data types, or retentive status all require that you reinitialize the block if you download it in RUN mode. The only modifications to existing block tags that you can perform and still download the block in RUN mode without reinitialization are changes to start values (data blocks), default values (function blocks) or comments.
- You cannot download more new block tags in RUN mode than the memory reserve can accommodate.
- You cannot download more new retentive block tags in RUN mode than the retentive memory reserve can accommodate.

15.14.6 System reaction if the download process fails

During the initial Download in RUN operation, if a network connection failure occurs, STEP 7 displays the following "Load preview" dialog:



15.14.7 Considerations when downloading in RUN mode

Before downloading the program in RUN mode, consider the effect of a RUN-mode modification on the operation of the CPU for the following situations:

- If you deleted the control logic for an output, the CPU maintains the last state of the output until the next power cycle or transition to STOP mode.
- If you deleted a high-speed counter or pulse output functions which were running, the high-speed counter or pulse output continues to run until the next power cycle or transition to STOP mode.
- Any logic that is conditional on the state of the first scan bit will not be executed until the next power cycle or transition from STOP to RUN mode. The first scan bit is set only by the transition to RUN mode and is not affected by a download in RUN mode.
- The current values of data blocks (DB) and/or tags can be overwritten.

Note

Before you can download your program in RUN mode, the CPU must support changes in RUN mode, the program must compile with no errors, and the communication between STEP 7, and the CPU must be error-free.

You can make the following changes in program blocks and tags and download them in RUN mode:

- Create, overwrite, and delete Functions (FC), Function Blocks (FB), and Tag tables.
- Create and delete Data Blocks (DB); however, DB structure changes cannot be overwritten. Initial DB values can be overwritten. You cannot download a web server DB (control or fragment) in RUN mode.
- Overwrite Organization Blocks (OB); however, you cannot create or delete OBs.

You can download a maximum number of twenty blocks in RUN mode at one time. If you must download more than twenty blocks, you must place the CPU in STOP mode.

Once you initiate a download, you cannot perform other tasks in STEP 7 until the download completes.

Instructions that might fail due to "Download in RUN mode"

The following instructions might experience a temporary error when download in run changes are being activated in the CPU. The error occurs when the instruction is initiated while the CPU is preparing to activate the downloaded changes. During this time, the CPU suspends initiation of user-program access to the Load Memory, while it completes in-progress user-program access to Load Memory. This is done so that downloaded changes can be activated consistently.

Instruction	Response while Activation is Pending
DataLogCreate	STATUS = W#16#80C0, ERROR = TRUE
DataLogOpen	STATUS = W#16#80C0, ERROR = TRUE
DataLogWrite	STATUS = W#16#80C0, ERROR = TRUE
DataLogClose	STATUS = W#16#80C0, ERROR = TRUE
DataLogNewFile	STATUS = W#16#80C0, ERROR = TRUE
DataLogClear	STATUS = W#16#80C0, ERROR = TRUE
DataLogDelete	STATUS = W#16#80C0, ERROR = TRUE
READ_DBL	RET_VAL = W#16#82C0
WRIT_DBL	RET_VAL = W#16#82C0
Create_DB	RET_VAL = W#16#80C0
Delete_DB	RET_VAL = W#16#80C0
RTM	RET_VAL = 0x80C0

In all cases the RLO output from the instruction will be false when the error occurs. The error is temporary. If it occurs, the instruction should be retried later.

Note

You must not retry the operation in the current execution of the OB.

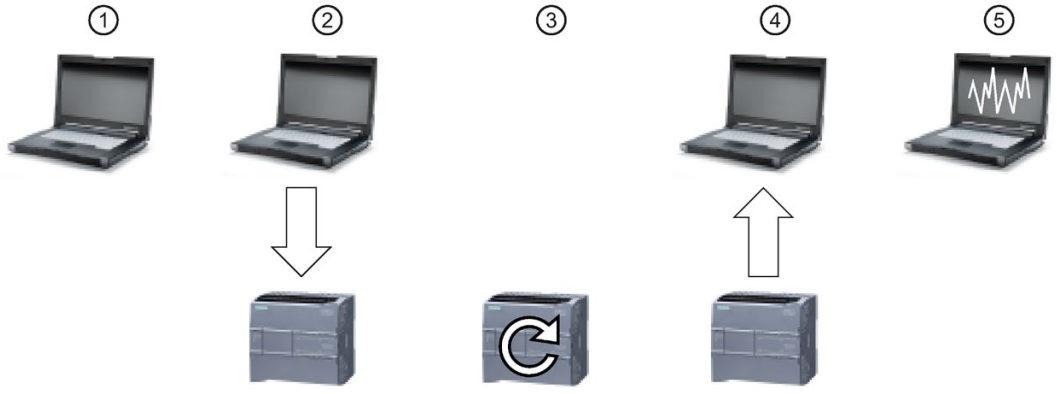
15.15 Tracing and recording CPU data on trigger conditions

STEP 7 provides trace and logic analyzer functions with which you can configure variables for the PLC to trace and record. You can then upload the recorded trace measurement data to your programming device and use STEP 7 tools to analyze, manage, and graph your data. You use the Traces folder in the STEP 7 project tree to create and manage traces.

Note

The trace measurement data is available only within the STEP 7 project and is not available for processing by other tools.

The following figure shows the various steps of the trace feature:



① Configure the trace in the trace editor of STEP 7. You can configure the following options:
- Data values to record
- Recording duration
- Recording frequency
- Trigger condition

② Transfer the trace configuration from STEP 7 to the PLC.

③ The PLC executes the program, and when the trigger condition occurs, begins recording the trace data.

④ Transfer the recorded values from the PLC to STEP 7.

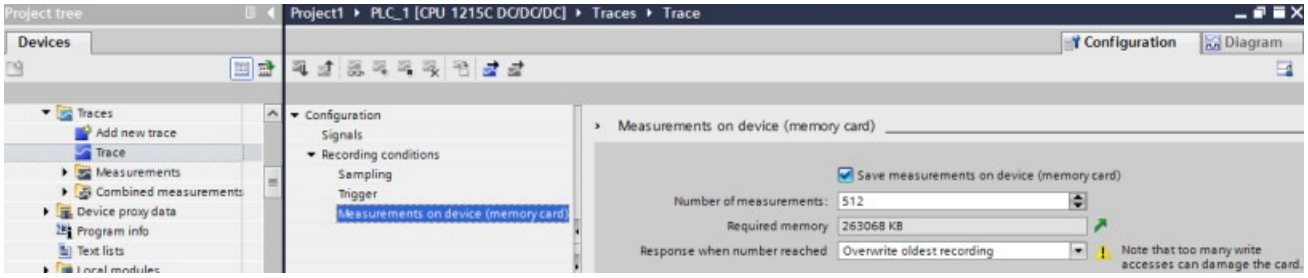
⑤ Use the tools in STEP 7 to analyze, graphically display, and save the data.

The S7-1200 supports two trace jobs with a maximum of 16 variables captured per trigger event. Each trace job provides 524288 bytes of RAM for the recording of trace values and associated overhead, for example variable addresses and time stamps.

Saving trace measurements to the memory card

The S7-1200 CPU can only save trace measurements to the SIMATIC memory card. If you do not have a memory card in your CPU, the CPU will log a diagnostic buffer entry if the program attempts to save trace measurements. The CPU limits the space allocated to trace measurements such that 1 MB of external load memory must always be available. If a trace measument would require more memory than the maximum allowance, the CPU will not save the measurement and will log a diagnostic buffer entry.

In addition, if you select "Overwrite oldest recording" in STEP 7, the continual writing can reduce the lifetime of load memory. When you select "Overwrite oldest recording", the CPU replaces the oldest measurement with the newest measurement after it has stored the configured number of trace measurements, and continues tracing and saving measurements. Overwriting the oldest measurements is useful in capturing intermittent problems.



The CPU supports a maximum of 999 trace measurement results. During the time that the CPU is saving the trace measurements to external load memory, the CPU does not check the trigger condition for the trace job. Once the CPU finishes saving the trace measurements, the CPU resumes checking for trigger conditions.

Access to examples

See the STEP 7 information system for details about how to program a trace, how to download the configuration, upload the trace data, and display the data in the logic analyzer. You can find detailed examples there in the "Using online and diagnostics functions > Using the trace and logic analyzer function" chapter.

In addition, the online manual "Industry Automation SINAMICS/SIMATIC Using the trace and logic analyzer function" (https://support.industry.siemens.com/cs/ww/en/view/64897128) is an excellent reference.

15.16 Determining the type of wire break condition from an SM 1231 module

As described in the topic Measurement ranges of the analog inputs for voltage and current (SB and SM) (Page 1458), the SM 1231 module returns an analog input value of 32767 (16#7FFF) for both a wire break condition or an overflow condition. If you want to determine which of these two conditions occurred, you can include logic in your STEP 7 program to make the determination. The method to determine the condition type consists of these tasks:

- Create a Diagnostic error interrupt OB to be called whenever there is an incoming or outgoing diagnostic event.
- Include a call to the RALRM instruction.
- Set up an array of bytes for the AINFO parameter, which includes the information about the condition type.
- Evaluate bytes 32 and 33 of the AINFO structure of the RALRM_DB when the CPU triggers the Diagnostic Interrupt OB..

Creating a Diagnostic error interrupt OB

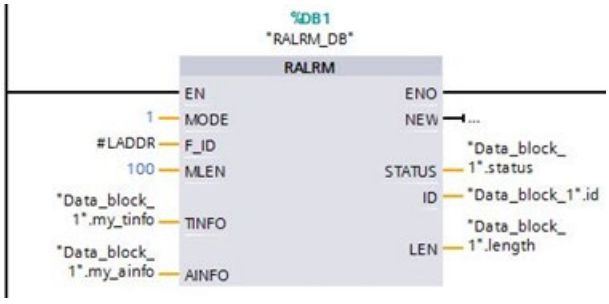
To be able to determine when a wire break condition occurs, create a Diagnostic error interrupt OB. The CPU will call this OB whenever an incoming or outgoing diagnostic event occurs.

When the CPU calls the Diagnostic error interrupt OB, the input parameter LADDR will contain the hardware identifier for the module with the error. You can find the hardware identifier for the SM 1231 module in the STEP 7 device configuration for the SM 1231 module.

Calling the RALRM instruction

To program the RALRM instruction call, follow these steps:

1. Add a call to RALRM in your STEP 7 program.
2. Set the F_ID input parameter to the hardware identifier in the LADDR parameter of the Diagnostic error interrupt OB.
3. Use an array of bytes for the TINFO and AINFO input parameters. Use an array size of 34 bytes or greater.



Interpreting AINFO after a diagnostic interrupt has occurred

The AINFO byte array will contain the information about the module diagnostics after the Diagnostic error interrupt OB executes.

Bytes 0 - 25 are header information. The bytes pertaining to the module diagnostic are as follows:

Byte	Description	
26 and 27	Word value 16#8000 - indicates the diagnostic is a Profinet style diagnostic	
28 and 29	Word containing channel number responsible for this diagnostic	
30	Bit pattern aaabb000 that indicates the type of channel (aaa) and type of error (bb)	
	aaa	bb
	000: reserved	00: reserved
	001: input channel	01: incoming error
	010: output channel	10: outgoing error
	011: input/output channel	11: outgoing error, other errors present
31	Indication of data format 0: Free data format 1: Bit 2: Two bits 3: Four bits 4: Byte 5: Word (two bytes) 6: Double word (four bytes) 7: Two double words (eight bytes)	
32 and 33	Word that defines the type of error: 16#0000: reserved 16#0001: short circuit 16#0002: undervoltage 16#0003: overvoltage 16#0004: overload 16#0005: over temperature 16#0006: wire break 16#0007: high limit exceeded 16#0008: low limit exceeded 16#0009: error	

For example, consider bytes 26 - 33 of this AINFO structure:

29		my_ainfo[26]	Byte	16#0	16#80
30		my_ainfo[27]	Byte	16#0	16#00
31		my_ainfo[28]	Byte	16#0	16#00
32		my_ainfo[29]	Byte	16#0	16#00
33		my_ainfo[30]	Byte	16#0	16#28
34		my_ainfo[31]	Byte	16#0	16#05
35		my_ainfo[32]	Byte	16#0	16#00
36		my_ainfo[33]	Byte	16#0	16#07

- The Word at bytes 26 and 27 is 16#8000, which indicates that this is a Profinet style diagnostic.
- The Word at bytes 28 and 29 indicates this is a diagnostic for channel 0 or the module.
- Byte 30 is 16#28, which when interpreted as the bit pattern aaa bb 00 is 001 01 000. This value indicates that this diagnostic is for an input channel and is an incoming error.
- Byte 31 is 5, which indicates a Word value
- The word value at bytes 32 and 33 is 16#0007, which indicates high limit exceeded.

By caputuring the AINFO information from a Diagnostic error interrupt event, you can thus determine the nature of the diagnostic event.

15.17 Backing up and restoring a CPU

15.17.1 Backup and restore options

You will make a number of changes to your automation system over time, for example, add new devices, replace existing devices or adapt the user program. If these changes were to result in undesirable behavior, you can restore the automation plant to an earlier version if you have a backup. STEP 7 and the S7-1200 CPU offer different options for backing up and restoring the hardware configuration and software.

Backup options

The table below provides an overview of the backup and restoration options of S7 CPUs:

	Snapshot of the monitored values	**Upload from device (software)**	**Upload device as new station (hardware and software)**	**Download backup from online device**
Use case	Restoring a specific status of a data block. The actual values of data blocks including time stamp are accepted in the project.	Upload blocks from a CPU to the project.	Upload of hardware configuration and software from a device to the project.	Create a complete backup of a CPU as a restore point. The backup copy is consistent and cannot be changed or opened.
Requirement	The CPU exists in a project. The data blocks must be identical online and offline.	The CPU exists in the project.	The device is available in the hardware catalog of TIA Portal. Any necessary HSPs or GSD files are installed.	-
Possible in mode	RUN, STOP	RUN, STOP	RUN, STOP	STOP
Possible for F-CPUs	Yes	Yes	No	Yes
Backup can be edited	Yes	Yes	Yes	No

Backup contents

The table below shows which data you can download and back up with which options:

	Snapshot of the monitored values	Upload from device (software)	Upload device as new station (hardware and software)	Download backup from online device
Actual values of the data blocks	Snapshot is possible	Download is possible	Download is possible	Backup is possible
Software blocks	-	Download is possible	Download is possible	Backup is possible
PLC tags (names of tags and constants)	-	Download is possible	Download is possible	Backup is possible
Technology objects	-	Download is possible	Download is possible	Backup is possible
Hardware configuration	-	-	Download is possible	Backup is possible
Monitoring tables (Web server)	-	-	Download is not possible	Backup is possible
Local data, bit memories, timers, counters and process picture	Snapshot is not possible	Download is not possible	Download is not possible	Backup is possible
Archives and recipes (PLC)	-	-	-	Backup is possible
General data on the SIMATIC memory card, for example, help for program blocks or GSD files	-	-	-	Backup is possible

Special considerations during backup of actual values

The "Backup from online device" type of backup backs up the actual values of the tags that are set as retentive. To ensure consistency of the retentive data, disable all write access to retentive data during the backup.

A transition from STOP to RUN mode sets actual values of the non-retentive data to their start values. A CPU backup contains only the start values of non-retentive data.

15.17.2 Backing up an online CPU

Making a backup of your configuration can be useful if you want to return to a specific configuration. You can restore the current configuration at a later time.

Prerequisites

You can create as many backups as you want and store a variety of configurations for a CPU. To make a backup, you must meet the following prerequisites:

- You have already created the CPU in the STEP 7 project.
- You have connected the CPU to the programming device/PC directly using the PROFINET interface of the CPU. Backup and restore operations do not support the PROFIBUS interfaces of the CMs.
- The CPU is online. (If there is no online connection, the backup process establishes an online connection.)
- The CPU is in "STOP" mode. (If the CPU is not in STOP mode, the backup process prompts you to allow the CPU to go to STOP mode.)

Procedure

To create a backup of the current configuration of a CPU, follow these steps:

1. Select the CPU in the project tree.
2. Select the "Backup from online device" command in the "Online" menu.

   If necessary, you must enter the password for read access to the CPU and confirm that the CPU should enter "STOP" mode.

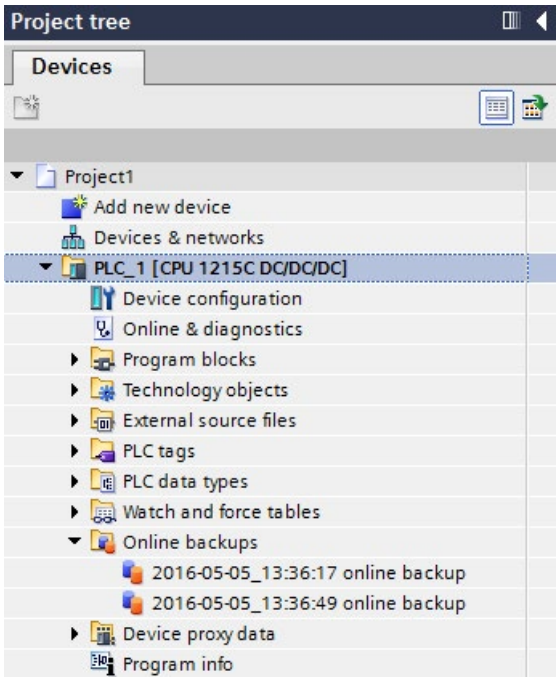
Result

The backups are named with the name of the CPU and the time and date of the backup. The backup includes all data that are needed to restore a particular configuration of a CPU. The CPU backs up the following data:

- Contents of the memory card if one is present
- Retentive memory areas of data blocks, counters, and bit memory
- Other retentive memory contents, such as IP address parameters

The backup contains the current values of the CPU but does not include the diagnostic buffer.

You can find the backup in the project tree under the CPU in the "Online backups" folder.The following figure shows an S7-1200 CPU for which two backups have been created:



Note

Note that you can also back up the online CPU from the SIMATIC Automation Tool (SAT) or the Web server Online backup standard Web page (Page 1015).

When you back files up from STEP 7, STEP 7 stores the files within the STEP 7 project. When you back files up from the Web server, your PC or device saves the backup files in the default folder for downloads. You cannot restore STEP 7 backup files from the Web server and you cannot restore Web server backup files from STEP 7. You can, however, save STEP 7 backup files directly to the download folder of your PC or device. If you do so, then you can restore these files from the Web server.

Saving backup files to your PC or device

To save a backup file to your PC or device, follow these steps:

1. Right-click a file from the Online backups folder in the project tree.
2. Select "Save as" from the context menu.
3. Navigate to the folder where you want to save the file, for example the default folder for downloads on your PC or device.
4. Click Save.

15.17.3 Restoring a CPU

If you have backed up the configuration of a CPU at an earlier point in time, you can transfer the backup to the CPU. The CPU goes to STOP while restoring a backup. If an access level is configured for the CPU, you must supply the password for read access to the CPU.

WARNING

Restoring backups with unknown content

If you restore a backup with unknown content, you can cause serious damage or injuries in case of malfunctions or program errors.

Make sure that the backup consists of a configuration with known content.

Prerequisites

To restore a backup, you must meet the following prerequisites:

- The STEP 7 project includes a configuration for the CPU and a previously-made backup.
- The CPU is connected to the programming device/PC directly through the PROFINET interface of the CPU.
- The CPU is in "STOP" mode.
- You know the password for full access to the CPU, if an access level was configured.

Procedure

To restore a backup, follow these steps:

1. Open the CPU in the project tree to display the lower-level objects.
2. Select the backup you want to restore from the "Online backups" folder.
3. From the "Online" menu, select the "Download to device" command.
   - If you had previously established an online connection (Page 1299), the "Load preview" dialog opens. This dialog displays alarms and recommends actions needed for the loading operation.
   - If you had not previously established an online connection, the "Extended download to device" dialog opens, and you must first select the interface from which you want to establish the online connection to the CPU.
4. Check the alarms in the "Load preview" dialog, and select the actions in the "Action" column, if necessary.
5. Click the "Load" button (The "Load" button is selectable as soon as downloading is possible.)

6. STEP 7 restores the backup to the CPU. From the "Load results" dialog, you can check whether or not the loading operation was successful and take any further action that might be necessary.
7. After reviewing the "Load results" dialog, click the "Finish" button.

   If prompted, enter the password for full access to the CPU and confirm that the CPU can enter "STOP" mode.

   STEP 7 restores the contents of the backup to the CPU and restarts the CPU.

Note

Note that you can also restore a CPU backup from the Web server Online backup standard Web page (Page 1015).

Technical specifications

A

A.1 Siemens Online Support website

Technical information for these products is available at the Siemens Industry Online Support website (https://support.industry.siemens.com/cs/us/en/).

A.2 General technical specifications

Standards compliance

The S7-1200 automation system design conforms with the following standards and test specifications. The test criteria for the S7-1200 automation system are based on these standards and test specifications.

Note that not all S7-1200 models may be certified to these standards, and certification status may change without notification. It is your responsibility to determine applicable certifications by referring to the ratings marked on the product. Consult your local Siemens representative if you need additional information related to the latest listing of exact approvals by part number.

CE approval

The S7-1200 Automation System satisfies requirements and safety related objectives according to the EC directives listed below, and conforms to the harmonized European standards (EN) for the programmable controllers listed in the Official Journals of the European Community.

- EC Directive 2006/95/EC (Low Voltage Directive) "Electrical Equipment Designed for Use within Certain Voltage Limits"
  - EN 61131-2 Programmable controllers - Equipment requirements and tests
- EC Directive 2004/108/EC (EMC Directive) "Electromagnetic Compatibility"
  - Emission standard
    EN 61000-6:+A1: Industrial Environment
  - Immunity standard
    EN 61000-6-2: Industrial Environment
- EC Directive 94/9/EC (ATEX) "Equipment and Protective Systems Intended for Use in Potentially Explosive Atmosphere"
  - EN 60079-0:+A11
  - EN 60079-15: Type of Protection 'n'

The CE Declaration of Conformity is held on file available to competent authorities at:

Siemens AG
Sector Industry
DF FA AS DH AMB
Postfach 1963
D-92209 Amberg
Germany

cULus approval

Underwriters Laboratories Inc. complying with:

- Underwriters Laboratories, Inc.: UL 508 Listed (Industrial Control Equipment)
- Canadian Standards Association: CSA C22.2 Number 142 (Process Control Equipment)

Note

The SIMATIC S7-1200 series meets the CSA standard.

The cULus logo indicates that the S7-1200 has been examined and certified by Underwriters Laboratories (UL) to standards UL 508 and CSA 22.2 No. 142.

FM approval



Factory Mutual Research (FM)
Approval Standard Class Number 3600 and 3611
Approved for use in:
Class I, Division 2, Gas Group A, B, C, D, Temperature Class T3C Ta = 60 °C
Class I, Zone 2, IIC, Temperature Class T3 Ta = 60 °C
Canadian Class I, Zone 2 Installation per CEC 18-150

IMPORTANT EXCEPTION: See Technical Specifications for the number of inputs or outputs allowed on simultaneously. Some models are de-rated for Ta = 60 °C.

WARNING
Substitution of components can impair the suitability for Class I, Division 2 and Zone 2.
Repair of units should only be performed by an authorized Siemens Service Center.

IECEx approval

EN 60079-0: Explosive Atmospheres – General Requirements

EN60079-15: Electrical Apparatus for Potentially Explosive Atmospheres
Type of protection 'nA'
US/FMG/ExTR14.0013
Ex nA IIC Gc T3

IECEx rating information may appear on the product with the FM Hazardous Location information.

Only products marked with an IECEx rating are approved. Consult your local Siemens representative if you need additional information related to the latest listing of exact approvals by part number.

Relay models are not included in IECEx approvals.

Refer to specific product marking for temperature rating.

Install modules in a suitable enclosure providing a minimum degree of protection of IP54 according to IEC 60079-15.

ATEX approval



ATEX approval applies to DC models only. ATEX approval does not apply to AC and Relay models.

EN 60079-0: Explosive Atmospheres - General Requirements

EN 60079-15: Electrical Apparatus for Potentially Explosive Atmospheres;
Type of protection 'nA'
II 3 G Ex nA IIC T4 or T3 Gc

Special conditions for safe use:

Install modules in a suitable enclosure providing a minimum degree of protection of IP54 according to EN 60529, or in a location providing an equivalent degree of protection.

Attached cables and conductors should be rated for the actual temperature measured under rated conditions.

Provisions should be made to prevent the rated voltage at the power supply terminals from being exceeded by transient disturbances of more than 119 V.

Australia and New Zealand - RCM Mark (Regulatory Compliance Mark)



The S7-1200 automation system satisfies requirements of standards to AS/NZS 61000.6.4 and IEC 610000-6-4 (Class A).

Korea Certification



The S7-1200 automation system satisfies the requirements of the Korean Certification (KC Mark). It has been defined as Class A Equipment and is intended for industrial applications and has not been considered for home use.

Eurasian Customs Union approval (Belarus, Kazakhstan, Russian Federation)



EAC (Eurasion Conformity): Declaration of Conformity according to Technical Regulation of Customs Union (TR CU)

Maritime approval

The S7-1200 products are periodically submitted for special agency approvals related to specific markets and applications. Consult your local Siemens representative if you need additional information related to the latest listing of exact approvals by part number.

Classification societies:

- ABS (American Bureau of Shipping): U.S.A.
- BV (Bureau Veritas): France
- DNV (Det Norske Veritas): Norway
- GL (Germanischer Lloyd): German
- LRS (Lloyds Register of Shipping): England
- Class NK (Nippon Kaiji Kyokai): Japan
- Korean Register of Shipping: Korea
- CSS (China Classification Society): China

Industrial environments

The S7-1200 automation system is designed for use in industrial environments.

Table A- 1 Industrial environments

Application field	Emission requirements	Immunity requirements
Industrial	EN 61000-6-4:2007+A1	EN 61000-6-2:2005

Note

The S7-1200 automation system is intended for use in industrial areas; use in residential areas can have an impact on radio or TV reception. If you use the S7-1200 in residential areas, you must ensure that its radio interference emission complies with the limit value Class B in accordance with EN 55011.

Examples of suitable measures for achieving RF interference, level Class B include:

- Installation of the S7-1200 in a grounded control cabinet

- Use of noise filters in the supply lines

Ensure that the radio interference emission complies with Class B in accordance with EN 55011.

Individual acceptance is required (final installation must meet all safety and EMC requirements of a residential installation).

Electromagnetic compatibility

Electromagnetic Compatibility (EMC) is the ability of an electrical device to operate as intended in an electromagnetic environment and to operate without emitting levels of electromagnetic interference (EMI) that may disturb other electrical devices in the vicinity.

Table A- 2 Immunity per EN 61000-6-2

Electromagnetic compatibility - Immunity per EN 61000-6-2	
EN 61000-4-2 Electrostatic discharge	8 kV air discharge to all surfaces 6 kV contact discharge to exposed conductive surfaces
EN 61000-4-3 Radiated, radio-frequency, electromagnetic field immunity test	80 to 1000 MHz, 10 V/m, 80% AM at 1 kHz 1.4 to 2.0 GHz, 3 V/m, 80% AM at 1 kHz 2.0 to 2.7 GHz, 1 V/m, 80% AM at 1 kHz
EN 61000-4-4 Fast transient bursts	2 kV, 5 kHz with coupling network to AC and DC system power 2 kV, 5 kHz with coupling clamp to I/O
EN 6100-4-5 Surge immunity	AC systems - 2 kV common mode, 1 kV differential mode DC systems - 2 kV common mode, 1 kV differential mode For DC systems, refer to Surge immunity below
EN 61000-4-6 Conducted disturbances	150 kHz to 80 MHz, 10 V RMS, 80% AM at 1kHz
EN 61000-4-11 Voltage dips	AC systems 0% for 1 cycle, 40% for 12 cycles and 70% for 30 cycles at 60 Hz

Table A- 3 Conducted and radiated emissions per EN 61000-6-4

Electromagnetic compatibility - Conducted and radiated emissions per EN 61000-6-4		
Conducted Emissions EN 55016, Class A, Group 1	0.15 MHz to 0.5 MHz	<79dB (µV) quasi-peak; <66 dB (µV) average
	0.5 MHz to 5 MHz	<73dB (µV) quasi-peak; <60 dB (µV) average
	5 MHz to 30 MHz	<73dB (µV) quasi-peak; <60 dB (µV) average
Radiated Emissions EN 55016, Class A, Group 1	30 MHz to 230 MHz	<40dB (µV/m) quasi-peak; measured at 10m
	230 MHz to 1 GHz	<47dB (µV/m) quasi-peak; measured at 10m
	1 GHz to 3 GHz	< 76dB (uV/m) quasi peak, measured at 10m

Surge immunity

Wiring systems subject to surges from lightning strike coupling must be equipped with external protection. One specification for evaluation of protection from lightning type surges is found in EN 61000-4-5, with operational limits established by EN 61000-6-2. S7-1200 DC CPUs and signal modules require external protection to maintain safe operation when subject to surge voltages defined by this standard.

Listed below are some devices that support the needed surge immunity protection. These devices only provide the protection if they are properly installed according to the manufacturer's recommendations. Devices manufactured by other vendors with the same or better specifications can also be used:

Table A- 4 Devices that support surge immunity protection

Sub-system	Protection device
+24 V DC power	BLITZDUCTOR VT, BVT AVD 24, Part Number 918 422
Industrial Ethernet	DEHNpatch DPA M CLE RJ45B 48, Part Number 929 121
RS-485	BLITZDUCTOR XT, Basic Unit BXT BAS, Part Number 920 300
	BLITZDUCTOR XT, Module BXT ML2 BD HFS 5, Part Number 920 271
RS-232	BLITZDUCTOR XT, Basic Unit BXT BAS, Part Number 920 300
	BLITZDUCTOR XT, Module BXT ML2 BE S 12, Part Number 920 222
+24 V DC digital inputs	DEHN, Inc., Type DCO SD2 E 24, Part Number 917 988
+24 V DC digital outputs and sensor supply	DEHN, Inc., Type DCO SD2 E 24, Part Number 917 988
Analog IO	DEHN, Inc., Type DCO SD2 E 12, Part Number 917 987
Relay outputs	None required

Environmental conditions

Table A- 5 Shipping and storage

Environmental conditions - Shipping and storage	
EN 60068-2-2, Test Bb, Dry heat and EN 60068-2-1, Test Ab, Cold	-40 °C to +70 °C
EN 60068-2-30, Test Db, Damp heat	25 °C to 55 °C, 95% humidity
EN 60068-2-14, Test Na, temperature shock	-40 °C to +70 °C, dwell time 3 hours, 2 cycles
EN 60068-2-32, Free fall	0.3 m, 5 times, product packaging
Atmospheric pressure	1139 to 660 hPa (corresponding to an altitude of -1000 to 3500 m)

Table A- 6 Climatic ambient conditions

Environmental conditions - Climatic ambient conditions	
The S7-1200 automation system is suitable for use in weather-proof, fixed locations. The operating conditions are based on requirements according to DIN IEC 60721-3-3: • Class 3M3 (mechanical requirements) • Class 3K3 (climatic requirements)	
Ambient temperature range (Inlet Air 25 mm below unit)	-20 °C to 60 °C horizontal mounting -20 °C to 50 °C vertical mounting 95% non-condensing humidity Unless otherwise specified
Atmospheric pressure	1139 to 795 hPa (corresponding to an altitude of -1000 to 2000 m)
Concentration of contaminants	SO_2: < 0.5 ppm; H_2S: < 0.1 ppm; RH < 60% non-condensing
	ISA-S71.04 severity level G1, G2, G3
EN 60068-2-14, Test Nb, temperature change	0 °C to 60 °C
EN 60068-2-27 Mechanical shock	15 g, 11 ms pulse, 6 shocks in each of 3 axis
EN 60068-2-6 Sinusoidal vibration	DIN rail mount: 3.5 mm from 5-9 Hz, 1G from 8.4 - 150 Hz Panel Mount: 7.0 mm from 5-8.4 Hz, 2G from 8.4 to 150 Hz 10 sweeps each axis, 1 octave per minute

Contamination level/overvoltage category according to IEC 61131-2

- Polution degree 2
- Overvoltage category: II

Protection class

- Protection Class II according to EN 61131-2 (Protective conductor not required)

Degree of protection

- IP20 Mechanical Protection, EN 60529
- Protects against finger contact with high voltage as tested by standard probe. External protection required for dust, dirt, water and foreign objects of < 12.5mm in diameter.

Rated voltages

Table A- 7 Rated voltages

Rated voltage	Tolerance
24 V DC	20.4 V DC to 28.8 V DC
120/230 V AC	85 V AC to 264 V AC, 47 to 63 Hz

Note

When a mechanical contact turns on output power to the S7-1200 CPU, or any digital expansion module, it sends a "1" signal to the digital outputs for approximately 50 microseconds. This could cause unexpected machine or process operation which could result in death or serious injury to personnel and/or damage to equipment. You must plan for this, especially if you are using devices which respond to short duration pulses.

Reverse voltage protection

Reverse voltage protection circuitry is provided on each terminal pair of +24 V DC power or user input power for CPUs, signal modules (SMs), and signal boards (SBs). It is still possible to damage the system by wiring different terminal pairs in opposite polarities.

Some of the 24 V DC power input ports in the S7-1200 system are interconnected, with a common logic circuit connecting multiple M terminals. For example, the following circuits are interconnected when designated as "not isolated" in the data sheets: the 24 V DC power supply of the CPU, the sensor power of the CPU, the power input for the relay coil of an SM, and the power supply for a non-isolated analog input. All non-isolated M terminals must connect to the same external reference potential.

WARNING

Connecting non-isolated M terminals to different reference potentials will cause unintended current flows that may cause damage or unpredictable operation in the PLC and any connected equipment.

Failure to comply with these guidelines could cause damage or unpredictable operation which could result in death or severe personal injury and/or property damage.

Always ensure that all non-isolated M terminals in an S7-1200 system are connected to the same reference potential.

DC Outputs

Short -circuit protection circuitry is not provided for DC outputs on CPUs, signal modules (SMs) and signal boards (SBs).

Relay electrical service life

The typical performance data estimated from sample tests is shown below. Actual performance may vary depending upon your specific application. An external protection circuit that is adapted to the load will enhance the service life of the contacts. N.C. contacts have a typical service life of about one-third that of the N.O. contact under inductive and lamp load conditions.

An external protective circuit will increase the service life of the contacts.

Table A- 8 Typical performance data

Data for selecting an actuator				
Continuous thermal current		2 A max.		
Switching capacity and life of the contacts				
	For ohmic load	Voltage	Current	Number of operating cycles (typical)
		24 V DC	2.0 A	0.1 million
		24 V DC	1.0 A	0.2 million
		24 V DC	0.5 A	1.0 million
		48 V AC	1.5 A	1.5 million
		60 V AC	1.5 A	1.5 million
		120 V AC	2.0 A	1.0 million
		120 V AC	1.0 A	1.5 million
		120 V AC	0.5 A	2.0 million
		230 V AC	2.0 A	1.0 million
		230 V AC	1.0 A	1.5 million
		230 V AC	0.5 A	2.0 million

Data for selecting an actuator				
	For inductive load (according to IEC 947-5-1 DC13/AC15)	Voltage	Current	Number of operating cycles (typical)
		24 V DC	2.0 A	0.05 million
		24 V DC	1.0 A	0.1 million
		24 V DC	0.5 A	0.5 million
		24 V AC	1.5 A	1.0 million
		48 V AC	1.5 A	1.0 million
		60 V AC	1.5 A	1.0 million
		120 V AC	2.0 A	0.7 million
		120 V AC	1.0 A	1.0 million
		120 V AC	0.5 A	1.5 million
		230 V AC	2.0 A	0.7 million
		230 V AC	1.0 A	1.0 million
		230 V AC	0.5 A	1.5 million
Activating a digital input		Possible		
Switching frequency				
	Mechanical	Max. 10 Hz		
	At ohmic load	Max. 1 Hz		
	At inductive load (according to IEC 947-5-1 DC13/AC15)	Max. 0.5 Hz		
	At lamp load	Max. 1Hz		

Internal CPU memory retention

- Lifetime of retentive data and data log data: 10 years
- Power down retentive data, Write cycle endurance: 2 million cycles
- Data log data: write cycle endurance: 500 million data log entries

Note

Effect of data logs on internal CPU memory

Each data log write consumes at a minimum 2 KB of memory. If your program writes small amounts of data frequently, it is consuming at least 2 KB of memory on each write. A better implementation would be to accumulate the small data items in a data block (DB), and to write the data block to the data log at less frequent intervals.

If your program writes many data log entries at a high frequency, consider using a replaceable SD memory card.

A.3 PROFINET interface X1 port pinouts

The S7-1200 CPU connects to the PROFINET network using a standard female RJ45 jack. The connector pinout depends on the CPU type.

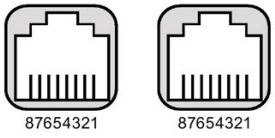
Single-port CPUs

Single-port CPUs (CPU 1211C, CPU 1212C and CPU 1214C) have a standard Ethernet MDI pin configuration as follows:

Pin	Signal name	Description	RJ45 female jack pinout
1	TD+	Transmit data	 X1P1
2	TD-		
3	RD+	Receive data	
4	GND	Ground	
5	GND		
6	RD-	Receive data	
7	GND	Ground	
8	GND		

Dual-port CPUs

The ports of a dual-port CPU (CPU 1215C and CPU1217C) have a standard Ethernet MDI-X pin configuration as follows:

Pin	Signal name	Description	RJ45 female jack pinout
1	RD+	Receive data	 X1P1 X1P2
2	RD-		
3	TD+	Transmit data	
4	GND	Ground	
5	GND		
6	TD-	Transmit data	
7	GND	Ground	
8	GND		

Autonegotiation

If the port's configuration enables autonegotiation, the S7-1200 CPU automatically detects the cable type and swaps the transmit/receive lines, if needed. If the port's configuration disables autonegotiation, the CPU also disables this automatic swap. You configure a port's autonegotiation setting in the TIA Portal's port options dialog. This is a port-specific advanced option for the PROFINET interface (X1) of the CPU's properties. Refer to "Configuring the PROFINET port" in Section 11.2.3.4: "Configuring an IP address for a CPU in your project" (Page 795) for further information.

A.4 CPU 1211C

A.4.1 General specifications and features

Table A- 9 General specifications

Technical data	CPU 1211C AC/DC/Relay	CPU 1211C DC/DC/Relay	CPU 1211C DC/DC/DC
Article number	6ES7211-1BE40-0XB0	6ES7211-1HE40-0XB0	6ES7211-1AE40-0XB0
Dimensions W x H x D (mm)	90 x 100 x 75		
Shipping weight	420 grams	380 grams	370 grams
Power dissipation	10 W	8 W	
Current available (CM bus)	750 mA max. (5 V DC)		
Current available (24 V DC)	300 mA max. (sensor power)		
Digital input current consumption (24 V DC)	4 mA/input used		

Table A- 10 CPU features

Technical data		Description
User memory (Refer to "General technical specifications" (Page 1343), "Internal CPU memory retention".)	Work	50 Kbytes
	Load	1 Mbyte internal, expandable up to SD card size
	Retentive	10 Kbytes
Onboard digital I/O		6 inputs/4 outputs
Onboard analog I/O		2 inputs
Process image size		1024 bytes of inputs (I) /1024 bytes of outputs (Q)
Bit memory (M)		4096 bytes
Temporary (local) memory		• 16 Kbytes for startup and program cycle (including associated FBs and FCs) • 6 Kbytes for each of the other interrupt priority levels (including FBs and FCs)
Signal modules expansion		none
SB, CB, BB expansion		1 max.
Communication module expansion		3 CMs max.
High-speed counters		Up to 6 configured to use any built-in or SB inputs. Refer to "Hardware input pin assignment" (Page 566) for CPU 1211C: HSC default address assignments. 100/180 kHz (Ia.0 to Ia.5)

Technical data	Description
Pulse outputs[2]	Up to 4 configured to use any built-in or SB outputs 100 kHz (Qa.0 to Qa.3)
Pulse catch inputs	6
Time delay interrupts	4 total with 1 ms resolution
Cyclic interrupts	4 total with 1 ms resolution
Edge interrupts	6 rising and 6 falling (10 and 10 with optional signal board)
Memory card	SIMATIC memory card (optional)
Real time clock accuracy	+/- 60 seconds/month
Real time clock retention time	20 days typ./12 days min. at 40 °C (maintenance-free Super Capacitor)

1 The slower speed is applicable when the HSC is configured for quadrature mode of operation.

2 For CPU models with relay outputs, you must install a digital signal board (SB) to use the pulse outputs.

Table A- 11 Performance

Type of instruction		Execution speed	
		Direct addressing (I, Q and M)	DB accesses
Boolean		0.08 µs/instruction	
Move	Move_Bool	0.3 µs/instruction	1.17 µs/instruction
	Move_Word	0.137 µs/instruction	1.0 µs/instruction
	Move_Real	0.72 µs/instruction	1.0 µs/instruction
Real Math	Add Real	1.48 µs/instruction	1.78 µs/instruction

Note

Many variables affect measured times. The above performance times are for the fastest instructions in this category and error-free programs.

A.4.2 Timers, counters, and code blocks supported by CPU 1211C

Table A- 12 Blocks, timers and counters supported by CPU 1211C

Element		Description
Blocks	Type	OB, FB, FC, DB
	Size	30 Kbytes
	Quantity	Up to 1024 blocks total (OBs + FBs + FCs + DBs)
	Address range for FBs, FCs, and DBs	FB and FC: 1 to 65535 (such as FB 1 to FB 65535) DB: 1 to 59999
	Nesting depth	16 from the program cycle or startup OB 6 from any interrupt event OB[1]
	Monitoring	Status of 2 code blocks can be monitored simultaneously
OBs	Program cycle	Multiple
	Startup	Multiple
	Time-delay interrupt	4 (1 per event)
	Cyclic interrupts	4 (1 per event)
	Hardware interrupts	50 (1 per event)
	Time error interrupts	1
	Diagnostic error interrupts	1
	Pull or plug of modules	1
	Rack or station failure	1
	Time of day	Multiple
	Status	1
	Update	1
	Profile	1
	MC-Interpolator	1
	MC-Servo	1
	MC-PreServo	1
	MC-PostServo	1
Timers	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, 16 bytes per timer
Counters	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, size dependent upon count type • SInt, USInt: 3 bytes • Int, UInt: 6 bytes • DInt, UDInt: 12 bytes

[1] Safety programs use two nesting levels. The user program therefore has a nesting depth of four in safety programs.

Table A- 13 Communication

Technical data	Description
Number of ports	1
Type	Ethernet
HMI device	4
Programming device (PG)	1
Connections	• 8 connections for Open User Communication (active or passive): TSEND_C, TRCV_C, TCON, TDISCON, TSEND, and TRCV • 8 CPU-to-CPU connections (client or server) for GET/PUT data • 6 connections for dynamic allocation to either GET/PUT or Open User Communication
Data rates	10/100 Mb/s
Isolation (external signal to logic)	Transformer isolated, 1500 V AC (type test)[1]
Cable type	CAT5e shielded
Interfaces	
Number of PROFINET interfaces	1
Number of interfaces PROFIBUS	0
Interface	
Interface Hardware	
Number of ports	1
Integrated switch	No
RJ-45 (Ethernet)	Yes; X1
Protocols	
PROFINET IO controller	Yes
PROFINET IO device	Yes
SIMATIC communication	Yes
Open IE communication	Yes
Web server	Yes
Media redundancy	No
PROFINET IO controller	
Services	
PG/OP communication	Yes
S7 routing	Yes
Isochronous mode	No
Open IE communication	Yes
IRT	No
MRP	No
PROFIenergy	Yes. The S7-1200 CPU only supports the PROFIenergy entity (with I-device functionality).
Prioritized startup	Yes (max. 16 PROFINET devices)
Number of connectable I/O devices max.	16

Technical data		Description
Number of IO devices that you can connect for RT, max.		16
Of which are in line, max.		16
Number of IO devices that can be activated/ deactivated simultaneously, max.		8
Update times		The minimum value of the update time also depends on the communication component set for PROFINET IO, on the number of IO devices, and the quantity of configured user data.
With RT		
Send clock of 1 ms		1 ms to 512 ms
PROFINET IO device		
Services		
PG/OP communication		Yes
S7 routing		Yes
Isochronous mode		No
Open IE communication		Yes
IRT, supported		No
MRP, supported		No
PROFIenergy		Yes
Shared device		Yes
Number of IO controllers with shared device, max.		2
SIMATIC communication		
S7 communication, as server		Yes
S7 communication, as client		Yes
User data per job, max.		See online help (S7 communication, user data size)
Open IE communication		
TCP/IP:		Yes
	Data length, max.	8 KB
	Several passive connections per port, supported	Yes
ISO-on-TCP (RFC1006):		Yes
	Data length, max.	8 KB
UDP		Yes
	Data length, max.	1472 bytes
DHCP		No
SNMP		Yes
DCP		Yes
LLDP		Yes

[1] Ethernet port isolation is designed to limit hazard during short term network faults to hazardous voltages. It does not conform to safety requirements for routine AC line voltage isolation.

Table A- 14 Power supply

Technical data		**CPU 1211C AC/DC/Relay**	**CPU 1211C DC/DC/Relay**	**CPU 1211C DC/DC/DC**
Voltage range		85 to 264 V AC	20.4 V DC to 28.8 V DC	
Line frequency		47 to 63 Hz	--	
Input current	CPU only at max. load	60 mA at 120 V AC 30 mA at 240 V AC	300 mA at 24 V DC	300 mA at 24 V DC
	CPU with all expansion accessories at max. load	180 mA at 120 V AC 90 mA at 240 V AC	900 mA at 24 V DC	
Inrush current (max.)		20 A at 264 V AC	12 A at 28.8 V DC	
I^2t		0.8 A^2 s	0.5 A^2 s	
Isolation (input power to logic)		1500 V AC	Not isolated	
Ground leakage, AC line to functional earth		0.5 mA max.	--	
Hold up time (loss of power)		20 ms at 120 V AC 80 ms at 240 V AC	10 ms at 24 V DC	
Internal fuse, not user replaceable		3 A, 250 V, slow blow		

Table A- 15 Sensor power

Technical data	**CPU 1211C AC/DC/Relay**	**CPU 1211C DC/DC/Relay**	**CPU 1211C DC/DC/DC**
Voltage range	20.4 to 28.8 V DC	L+ minus 4 V DC min.	
Output current rating (max.)	300 mA (short-circuit protected)		
Maximum ripple noise (<10 MHz)	< 1 V peak to peak	Same as input line	
Isolation (CPU logic to sensor power)	Not isolated		

A.4.3 Digital inputs and outputs

Table A- 16 Digital inputs

Technical data	CPU 1211C AC/DC/Relay, CPU 1211C DC/DC/Relay, and CPU 1211C DC/DC/DC
Number of inputs	6
Type	Sink/Source (IEC Type 1 sink)
Rated voltage	24 V DC at 4 mA, nominal
Continuous permissible voltage	30 V DC, max.
Surge voltage	35 V DC for 0.5 sec.
Logic 1 signal (min.)	15 V DC at 2.5 mA
Logic 0 signal (max.)	5 V DC at 1 mA
Isolation (field side to logic)	707 V DC (type test)
Isolation groups	1
Filter times	us settings: 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0 ms settings: 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0
HSC clock input rates (max.) (Logic 1 Level = 15 to 26 V DC)	100/80 kHz (Ia.0 to Ia.5)
Number of inputs on simultaneously	6 at 60 °C horizontal, 50 °C vertical
Cable length (meters)	500 m shielded, 300 m unshielded, 50 m shielded for HSC inputs

Table A- 17 Digital outputs

Technical data	CPU 1211C AC/DC/Relay and CPU 1211C DC/DC/Relay	CPU 1211C DC/DC/DC
Number of outputs	4	
Type	Relay, mechanical	Solid state - MOSFET (sourcing)
Voltage range	5 to 30 V DC or 5 to 250 V AC	20.4 to 28.8 V DC
Logic 1 signal at max. current	--	20 V DC min.
Logic 0 signal with 10 KΩ load	--	0.1 V DC max.
Current (max.)	2.0 A	0.5 A
Lamp load	30 W DC / 200 W AC	5 W
ON state resistance	0.2 Ω max. when new	0.6 Ω max.
Leakage current per point	--	10 µA max.
Surge current	7 A with contacts closed	8 A for 100 ms max.
Overload protection	No	
Isolation (field side to logic)	1500 V AC (coil to contact) None (coil to logic)	707 V DC (type test)
Isolation groups	1	
Inductive clamp voltage	--	L+ minus 48 V DC, 1 W dissipation
Maximum relay switching frequency	1 Hz	--

Technical data	CPU 1211C AC/DC/Relay and CPU 1211C DC/DC/Relay	CPU 1211C DC/DC/DC
Switching delay (Qa.0 to Qa.3)	10 ms max.	1.0 µs max., off to on 3.0 µs max., on to off
Pulse Train Output rate	Not recommended [1]	100 kHz (Qa.0 to Qa.3)[2], 2 Hz min.
Lifetime mechanical (no load)	10,000,000 open/close cycles	--
Lifetime contacts at rated load	100,000 open/close cycles	--
Behavior on RUN to STOP	Last value or substitute value (default value 0)	
Number of outputs on simultaneously	4 at 60 °C horizontal, 50 °C vertical	
Cable length (meters)	500 m shielded, 150 m unshielded	

1 For CPU models with relay outputs, you must install a digital signal board (SB) to use the pulse outputs.

2 Depending on your pulse receiver and cable, an additional load resistor (at least 10% of rated current) may improve pulse signal quality and noise immunity.

A.4.4 Analog inputs

Table A- 18 Analog inputs

Technical data	Description
Number of inputs	2
Type	Voltage (single-ended)
Full-scale range	0 to 10 V
Full-scale range (data word)	0 to 27648
Overshoot range	10.001 to 11.759 V
Overshoot range (data word)	27649 to 32511
Overflow range	11.760 to 11.852 V
Overflow range (data word)	32512 to 32767
Resolution	10 bits
Maximum withstand voltage	35 V DC
Smoothing	None, Weak, Medium, or Strong See the table for Step response (ms) for the analog inputs of the CPU (Page 1364).
Noise rejection	10, 50, or 60 Hz
Impedance	≥100 KΩ
Isolation (field side to logic)	None
Accuracy (25 °C / -20 to 60 °C)	3.0% / 3.5% of full-scale
Cable length (meters)	100 m, shielded twisted pair

A.4.4.1 Step response of the built-in analog inputs of the CPU

Table A- 19 Step Response (ms), 0 V to 10 V measured at 95%

Smoothing selection (sample averaging)	Rejection frequency (Integration time)		
	60 Hz	50 Hz	10 Hz
None (1 cycle): No averaging	50 ms	50 ms	100 ms
Weak (4 cycles): 4 samples	60ms	70 ms	200 ms
Medium (16 cycles): 16 samples	200 ms	240 ms	1150 ms
Strong (32 cycles): 32 samples	400 ms	480 ms	2300 ms
Sample time	**4.17 ms**	**5 ms**	**25 ms**

A.4.4.2 Sample time for the built-in analog ports of the CPU

Table A- 20 Sample time for built-in analog inputs of the CPU

Rejection frequency (Integration time selection)	Sample time
60 Hz (16.6 ms)	4.17 ms
50 Hz (20 ms)	5 ms
10 Hz (100 ms)	25 ms

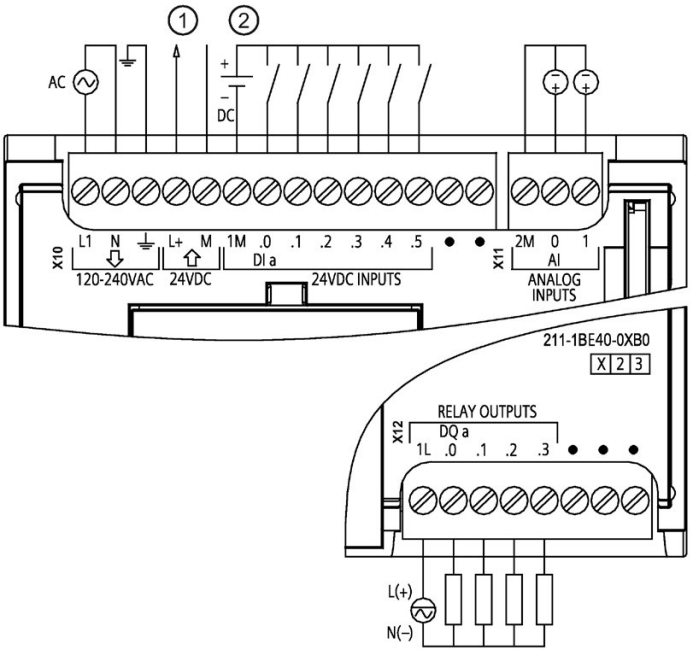
A.4.4.3 Measurement ranges of the analog inputs for voltage (CPUs)

Table A- 21 Analog input representation for voltage (CPUs)

System		Voltage Measuring Range	
Decimal	Hexadecimal	0 to 10 V	
32767	7FFF	11.852 V	Overflow
32512	7F00		
32511	7EFF	11.759 V	Overshoot range
27649	6C01		
27648	6C00	10 V	Rated range
20736	5100	7.5 V	
34	22	12 mV	
0	0	0 V	
Negative values		Negative values are not supported	

A.4.5 CPU 1211C wiring diagrams

Table A- 22 CPU 1211C AC/DC/Relay (6ES7211-1BE40-0XB0)

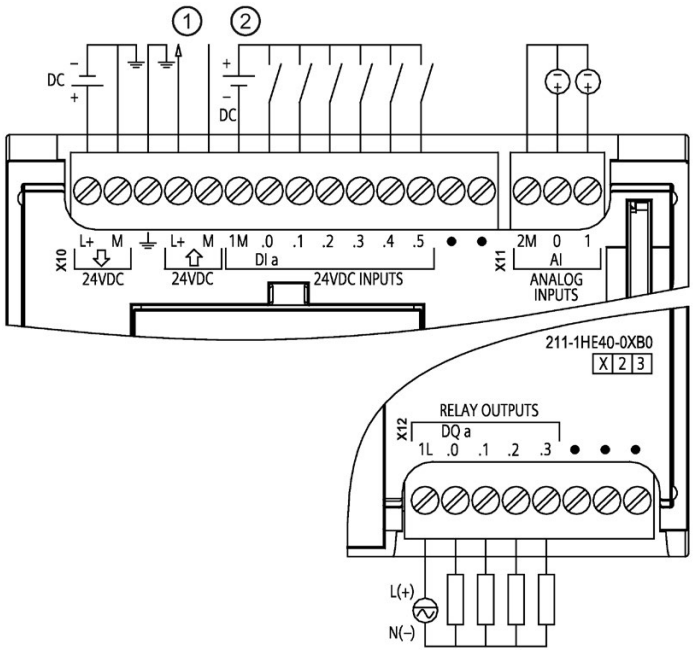


①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: Either the L1 or N (L2) terminal can be connected to a voltage source up to 240 V AC. The N terminal can be considered L2 and is not required to be grounded. No polarization is required for L1 and N (L2) terminals.	
Note 3: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 23 Connector pin locations for CPU 1211C AC/DC/Relay (6ES7211-1BE40-0XB0)

Pin	X10	X11 (gold)	X12
1	L1 / 120-240 V AC	2 M	1L
2	N / 120-240 V AC	AI 0	DQ a.0
3	Functional Earth	AI 1	DQ a.1
4	L+ / 24 V DC Sensor Out	--	DQ a.2
5	M / 24 V DC Sensor Out	--	DQ a.3
6	1M	--	No connection
7	DI a.0	--	No connection
8	DI a.1	--	No connection
9	DI a.2	--	--
10	DI a.3	--	--
11	DI a.4	--	--
12	DI a.5	--	--
13	No connection	--	--
14	No connection	--	--

Table A- 24 CPU 1211C DC/DC/Relay (6ES7211-1HE40-0XB0)

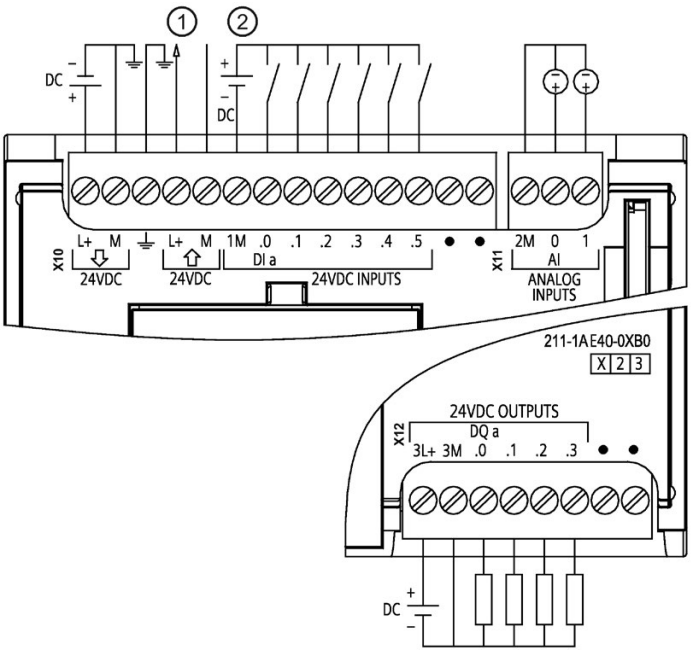


①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 25 Connector pin locations for CPU 1211C DC/DC/Relay (6ES7211-1HE40-0XB0)

Pin	X10	X11 (gold)	X12
1	L+ / 24 V DC	2 M	1L
2	M / 24 V DC	AI 0	DQ a.0
3	Functional Earth	AI 1	DQ a.1
4	L+ / 24 V DC Sensor Out	--	DQ a.2
5	M / 24 V DC Sensor Out	--	DQ a.3
6	1M	--	No connection
7	DI a.0	--	No connection
8	DI a.1	--	No connection
9	DI a.2	--	--
10	DI a.3	--	--
11	DI a.4	--	--
12	DI a.5	--	--
13	No connection	--	--
14	No connection	--	--

Table A- 26 CPU 1211C DC/DC/DC (6ES7211-1AE40-0XB0)



①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 27 Connector pin locations for CPU 1211C DC/DC/DC (6ES7211-1AE40-0XB0)

Pin	X10	X11 (gold)	X12
1	L+ / 24 V DC	2 M	3L+
2	M / 24 V DC	AI 0	3M
3	Functional Earth	AI 1	DQ a.0
4	L+ / 24 V DC Sensor Out	--	DQ a.1
5	M / 24 V DC Sensor Out	--	DQ a.2
6	1M	--	DQ a.3
7	DI a.0	--	No connection
8	DI a.1	--	No connection
9	DI a.2	--	--
10	DI a.3	--	--
11	DI a.4	--	--
12	DI a.5	--	--
13	No connection	--	--
14	No connection	--	--

Note

Unused analog inputs should be shorted.

A.5 CPU 1212C

A.5.1 General specifications and features

Table A- 28 General

Technical data	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/Relay	CPU 1212C DC/DC/DC
Article number	6ES7212-1BE40-0XB0	6ES7212-1HE40-0XB0	6ES7212-1AE40-0XB0
Dimensions W x H x D (mm)	90 x 100 x 75		
Shipping weight	425 grams	385 grams	370 grams
Power dissipation	11 W	9 W	
Current available (SM and CM bus)	1000 mA max. (5 V DC)		
Current available (24 V DC)	300 mA max. (sensor power)		
Digital input current consumption (24 V DC)	4 mA/input used		

Table A- 29 CPU features

Technical data		Description
User memory (Refer to "General technical specifications (Page 1343)", "Internal CPU memory retention".)	Work	75 Kbytes
	Load	2 Mbytes internal, expandable up to SD card size
	Retentive	10 Kbytes
Onboard digital I/O		8 inputs/6 outputs
Onboard analog I/O		2 inputs
Process image size		1024 bytes of inputs (I)/1024 bytes of outputs (Q)
Bit memory (M)		4096 bytes
Temporary (local) memory		• 16 Kbytes for startup and program cycle (including associated FBs and FCs) • 6 Kbytes for each of the other interrupt priority levels (including FBs and FCs)
Signal modules expansion		2 SMs max.
SB, CB, BB expansion		1 max.
Communication module expansion		3 CMs max.
High-speed counters		Up to 6 configured to use any built-in or SB inputs. Refer to "Hardware input pin assignment" (Page 566) for CPU 1212C: HSC default address assignments. • 100/180 kHz (Ia.0 to Ia.5) • 30 /120 kHz (Ia.6 to Ia.7)

Technical data	Description
Pulse outputs[2]	Up to 4 configured to use any built-in or SB outputs • 100 kHz (Qa.0 to Qa.3) • 20 kHz (Qa.4 to Qa.5)
Pulse catch inputs	8
Time delay interrupts	4 total with 1 ms resolution
Cyclic interrupts	4 total with 1 ms resolution
Edge interrupts	8 rising and 8 falling (12 and 12 with optional signal board)
Memory card	SIMATIC memory card (optional)
Real time clock accuracy	+/- 60 seconds/month
Real time clock retention time	20 days typ./12 days min. at 40 °C (maintenance-free Super Capacitor)

1 The slower speed is applicable when the HSC is configured for quadrature mode of operation.

2 For CPU models with relay outputs, you must install a digital signal board (SB) to use the pulse outputs.

Table A- 30 Performance

Type of instruction		Execution speed	
		Direct addressing (I, Q and M)	DB accesses
Boolean		0.08 µs/instruction	
Move	Move_Bool	0.3 µs/instruction	1.17 µs/instruction
	Move_Word	0.137 µs/instruction	1.0 µs/instruction
	Move_Real	0.72 µs/instruction	1.0 µs/instruction
Real Math	Add Real	1.48 µs/instruction	1.78 µs/instruction

Note

Many variables affect measured times. The above performance times are for the fastest instructions in this category and error-free programs.

A.5.2 Timers, counters, and code blocks supported by CPU 1212C

Table A- 31 Blocks, timers and counters supported by CPU 1212C

Element		Description
Blocks	Type	OB, FB, FC, DB
	Size	50 Kbytes
	Quantity	Up to 1024 blocks total (OBs + FBs + FCs + DBs)
	Address range for FBs, FCs, and DBs	FB and FC: 1 to 65535 (such as FB 1 to FB 65535) DB: 1 to 59999
	Nesting depth	16 from the program cycle or startup OB 6 from any interrupt event OB[1]
	Monitoring	Status of 2 code blocks can be monitored simultaneously
OBs	Program cycle	Multiple
	Startup	Multiple
	Time-delay interrupt	4 (1 per event)
	Cyclic interrupts	4 (1 per event)
	Hardware interrupts	50 (1 per event)
	Time error interrupts	1
	Diagnostic error interrupts	1
	Pull or plug of modules	1
	Rack or station failure	1
	Time of day	Multiple
	Status	1
	Update	1
	Profile	1
	MC-Interpolator	1
	MC-Servo	1
	MC-PreServo	1
	MC-PostServo	1
Timers	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, 16 bytes per timer
Counters	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, size dependent upon count type • SInt, USInt: 3 bytes • Int, UInt: 6 bytes • DInt, UDInt: 12 bytes

[1] Safety programs use two nesting levels. The user program therefore has a nesting depth of four in safety programs.

Table A- 32 Communication

Technical data	Description
Number of ports	1
Type	Ethernet
HMI device	4
Programming device (PG)	1
Connections	• 8 connections for Open User Communication (active or passive): TSEND_C, TRCV_C, TCON, TDISCON, TSEND, and TRCV • 8 CPU-to-CPU connections (client or server) for GET/PUT data • 6 connections for dynamic allocation to either GET/PUT or Open User Communication
Data rates	10/100 Mb/s
Isolation (external signal to logic)	Transformer isolated, 1500 V AC (type test)[1]
Cable type	CAT5e shielded
Interfaces	
Number of PROFINET interfaces	1
Number of interfaces PROFIBUS	0
Interface	
Interface Hardware	
Number of ports	1
Integrated switch	No
RJ-45 (Ethernet)	Yes; X1
Protocols	
PROFINET IO controller	Yes
PROFINET IO device	Yes
SIMATIC communication	Yes
Open IE communication	Yes
Web server	Yes
Media redundancy	No
PROFINET IO controller	
Services	
PG/OP communication	Yes
S7 routing	Yes
Isochronous mode	No
Open IE communication	Yes
IRT	No
MRP	No
PROFIenergy	Yes. The S7-1200 CPU only supports the PROFIenergy entity (with I-device functionality).
Prioritized startup	Yes (max. 16 PROFINET devices)
Number of connectable I/O devices max.	16
Number of IO devices that you can connect for RT, max.	16

Technical data		Description
Of which are in line, max.		16
Number of IO devices that can be activated/ deactivated simultaneously, max.		8
Update times		The minimum value of the update time also depends on the communication component set for PROFINET IO, on the number of IO devices, and the quantity of configured user data.
With RT		
Send clock of 1 ms		1 ms to 512 ms
PROFINET IO device		
Services		
PG/OP communication		Yes
S7 routing		Yes
Isochronous mode		No
Open IE communication		Yes
IRT, supported		No
MRP, supported		No
PROFIenergy		Yes
Shared device		Yes
Number of IO controllers with shared device, max.		2
SIMATIC communication		
S7 communication, as server		Yes
S7 communication, as client		Yes
User data per job, max.		See online help (S7 communication, user data size)
Open IE communication		
TCP/IP:		Yes
	Data length, max.	8 KB
	Several passive connections per port, supported	Yes
ISO-on-TCP (RFC1006):		Yes
	Data length, max.	8 KB
UDP		Yes
	Data length, max.	1472 bytes
DHCP		No
SNMP		Yes
DCP		Yes
LLDP		Yes

[1] Ethernet port isolation is designed to limit hazard during short term network faults to hazardous voltages. It does not conform to safety requirements for routine AC line voltage isolation.

Table A- 33 Power supply

Technical data		CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/Relay	CPU 1212C DC/DC/DC
Voltage range		85 to 264 V AC	20.4 V DC to 28.8 V DC	
Line frequency		47 to 63 Hz	--	
Input current (max. load)	CPU only	80 mA at 120 V AC 40 mA at 240 V AC	400 mA at 24 V DC	
	CPU with all expansion accessories	240 mA at 120 V AC 120 mA at 240 V AC	1200 mA at 24 V DC	
Inrush current (max.)		20 A at 264 V AC	12 A at 28.8 V DC	
I^2t		0.8 A^2 s	0.5 A^2 s	
Isolation (input power to logic)		1500 V AC	Not isolated	
Ground leakage, AC line to functional earth		0.5 mA max.	--	
Hold up time (loss of power)		20 ms at 120 V AC 80 ms at 240 V AC	10 ms at 24 V DC	
Internal fuse, not user replaceable		3 A, 250 V, slow blow		

Table A- 34 Sensor power

Technical data	CPU 1212C AC/DC/Relay	CPU 1212C DC/DC/Relay	CPU 1212C DC/DC/DC
Voltage range	20.4 to 28.8 V DC	L+ minus 4 V DC min.	
Output current rating (max.)	300 mA (short-circuit protected)		
Maximum ripple noise (<10 MHz)	< 1 V peak to peak	Same as input line	
Isolation (CPU logic to sensor power)	Not isolated		

A.5.3 Digital inputs and outputs

Table A- 35 Digital inputs

Technical data	CPU 1212C AC/DC/Relay, DC/DC/Relay, and DC/DC/DC
Number of inputs	8
Type	Sink/Source (IEC Type 1 sink)
Rated voltage	24 V DC at 4 mA, nominal
Continuous permissible voltage	30 V DC, max.
Surge voltage	35 V DC for 0.5 sec.
Logic 1 signal (min.)	15 V DC at 2.5 mA
Logic 0 signal (max.)	5 V DC at 1 mA
Isolation (field side to logic)	707 V DC (type test)
Isolation groups	1
Filter times	us settings: 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0 ms settings: 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0
HSC clock input rates (max.) (Logic 1 Level = 15 to 26 V DC)	100/80 kHz (Ia.0 to Ia.5) 30 /20 kHz (Ia.6 to Ia.7)
Number of inputs on simultaneously	4 (no adjacent points) at 60 °C horizontal or 50 °C vertical 8 at 55 °C horizontal or 45 °C vertical
Cable length (meters)	500 m shielded, 300 m unshielded, 50 m shielded for HSC inputs

Table A- 36 Digital outputs

Technical data	CPU 1212C AC/DC/Relay and DC/DC/Relay	CPU 1212C DC/DC/DC
Number of outputs	6	
Type	Relay, mechanical	Solid state - MOSFET (sourcing)
Voltage range	5 to 30 V DC or 5 to 250 V AC	20.4 to 28.8 V DC
Logic 1 signal at max. current	--	20 V DC min.
Logic 0 signal with 10 KΩ load	--	0.1 V DC max.
Current (max.)	2.0 A	0.5 A
Lamp load	30 W DC / 200 W AC	5 W
ON state resistance	0.2 Ω max. when new	0.6 Ω max.
Leakage current per point	--	10 µA max.
Surge current	7 A with contacts closed	8 A for 100 ms max.
Overload protection	No	
Isolation (field side to logic)	1500 V AC (coil to contact) None (coil to logic)	707 V DC (type test)
Isolation groups	2	1
Isolation (group-to-group)	1500 V AC[1]	--
Inductive clamp voltage	--	L+ minus 48 V DC, 1 W dissipation
Switching delay (Qa.0 to Qa.3)	10 ms max.	1.0 µs max., off to on 3.0 µs max., on to off

Technical data	CPU 1212C AC/DC/Relay and DC/DC/Relay	CPU 1212C DC/DC/DC
Switching delay (Qa.4 to Qa.5)	10 ms max.	5 µs max., off to on 20 µs max., on to off
Maximum relay switching frequency	1 Hz	--
Pulse Train Output rate	Not recommended[2]	100 kHz (Qa.0 to Qa.3)[3], 2 Hz min. 20 kHz (Qa.4 to Qa.5)[3]
Lifetime mechanical (no load)	10,000,000 open/close cycles	--
Lifetime contacts at rated load	100,000 open/close cycles	--
Behavior on RUN to STOP	Last value or substitute value (default value 0)	Last value or substitute value (default value 0)
Number of outputs on simultaneously	3 (no adjacent points) at 60 °C horizontal or 50 °C vertical 6 at 55 °C horizontal, or 45 °C vertical	
Cable length (meters)	500 m shielded, 150 m unshielded	

1 Relay group-to-group isolation separates line voltage from SELV/PELV and separates different phases up to 250 V AC line to ground.

2 For CPU models with relay outputs, you must install a digital signal board (SB) to use the pulse outputs.

3 Depending on your pulse receiver and cable, an additional load resistor (at least 10% of rated current) may improve pulse signal quality and noise immunity.

A.5.4 Analog inputs

Table A- 37 Analog inputs

Technical data	Description
Number of inputs	2
Type	Voltage (single-ended)
Full-scale range	0 to 10 V
Full-scale range (data word)	0 to 27648
Overshoot range	10.001 to 11.759 V
Overshoot range (data word)	27649 to 32511
Overflow range	11.760 to 11.852 V
Overflow range (data word)	32512 to 32767
Resolution	10 bits
Maximum withstand voltage	35 V DC
Smoothing	None, Weak, Medium, or Strong See the table for Step response (ms) for the analog inputs of the CPU (Page 1377).
Noise rejection	10, 50, or 60 Hz
Impedance	≥100 KΩ
Isolation (field side to logic)	None
Accuracy (25 °C / -20 to 60 °C)	3.0% / 3.5% of full-scale
Cable length (meters)	100 m, shielded twisted pair

A.5.4.1 Step response of the built-in analog inputs of the CPU

Table A- 38 Step Response (ms), 0 V to 10 V measured at 95%

Smoothing selection (sample averaging)	Rejection frequency (Integration time)		
	60 Hz	50 Hz	10 Hz
None (1 cycle): No averaging	50 ms	50 ms	100 ms
Weak (4 cycles): 4 samples	60ms	70 ms	200 ms
Medium (16 cycles): 16 samples	200 ms	240 ms	1150 ms
Strong (32 cycles): 32 samples	400 ms	480 ms	2300 ms
Sample time	**4.17 ms**	**5 ms**	**25 ms**

A.5.4.2 Sample time for the built-in analog ports of the CPU

Table A- 39 Sample time for built-in analog inputs of the CPU

Rejection frequency (Integration time selection)	Sample time
60 Hz (16.6 ms)	4.17 ms
50 Hz (20 ms)	5 ms
10 Hz (100 ms)	25 ms

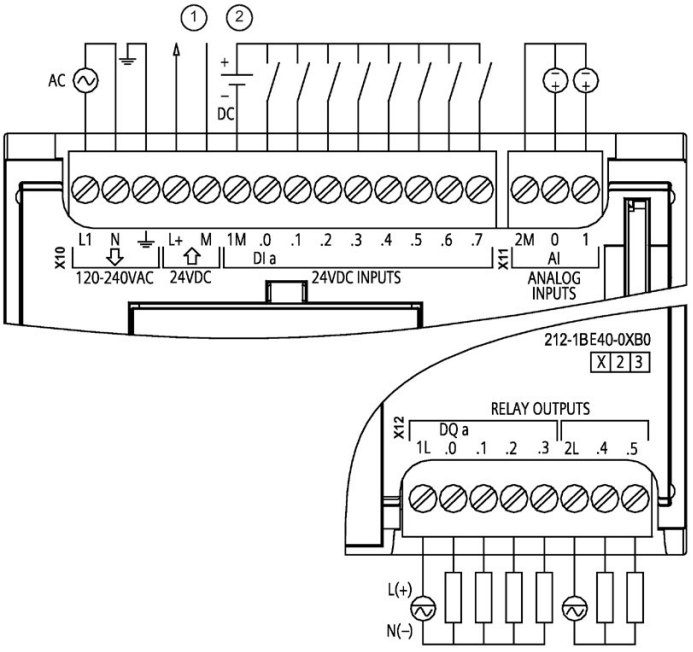
A.5.4.3 Measurement ranges of the analog inputs for voltage (CPUs)

Table A- 40 Analog input representation for voltage (CPUs)

System		Voltage Measuring Range	
Decimal	Hexadecimal	0 to 10 V	
32767	7FFF	11.852 V	Overflow
32512	7F00		
32511	7EFF	11.759 V	Overshoot range
27649	6C01		
27648	6C00	10 V	Rated range
20736	5100	7.5 V	
34	22	12 mV	
0	0	0 V	
Negative values		Negative values are not supported	

A.5.5 CPU 1212C wiring diagrams

Table A- 41 CPU 1212C AC/DC/Relay (6ES7212-1BE40-0XB0)

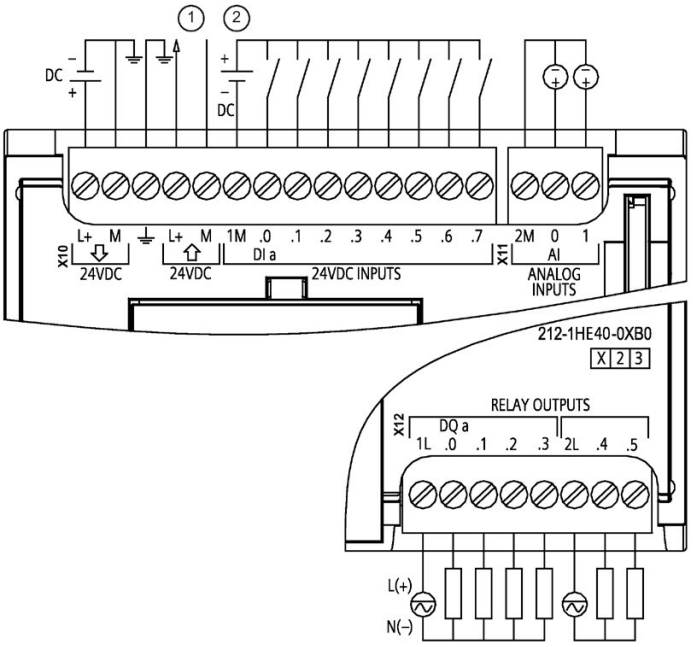


①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: Either the L1 or N (L2) terminal can be connected to a voltage source up to 240 V AC. The N terminal can be considered L2 and is not required to be grounded. No polarization is required for L1 and N (L2) terminals.	
Note 3: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 42 Connector pin locations for CPU 1212C AC/DC/Relay (6ES7212-1BE40-0XB0)

Pin	X10	X11 (gold)	X12
1	L1 / 120-240 V AC	2 M	1L
2	N / 120-240 V AC	AI 0	DQ a.0
3	Functional Earth	AI 1	DQ a.1
4	L+ / 24 V DC Sensor Out	--	DQ a.2
5	M / 24 V DC Sensor Out	--	DQ a.3
6	1M	--	2L
7	DI a.0	--	DQ a.4
8	DI a.1	--	DQ a.5
9	DI a.2	--	--
10	DI a.3	--	--
11	DI a.4	--	--
12	DI a.5	--	--
13	DI a.6	--	--
14	DI a.7	--	--

Table A- 43 CPU 1212C DC/DC/Relay (6ES7212-1HE40-0XB0)

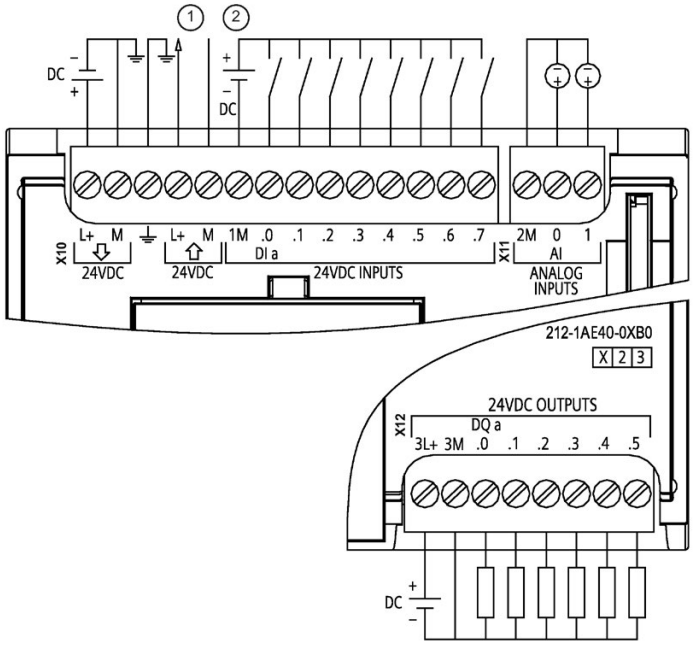


①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 44 Connector pin locations for CPU 1212C DC/DC/Relay (6ES7212-1HE40-0XB0)

Pin	X10	X11 (gold)	X12
1	L+ / 24 V DC	2 M	1L
2	M / 24 V DC	AI 0	DQ a.0
3	Functional Earth	AI 1	DQ a.1
4	L+ / 24 V DC Sensor Out	--	DQ a.2
5	M / 24 V DC Sensor Out	--	DQ a.3
6	1M	--	2L
7	DI a.0	--	DQ a.4
8	DI a.1	--	DQ a.5
9	DI a.2	--	--
10	DI a.3	--	--
11	DI a.4	--	--
12	DI a.5	--	--
13	DI a.6	--	--
14	DI a.7	--	--

Table A- 45 CPU 1212C DC/DC/DC (6ES7212-1AE40-0XB0)



①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 46 Connector pin locations for CPU 1212C DC/DC/DC (6ES7212-1AE40-0XB0)

Pin	X10	X11 (gold)	X12
1	L+ / 24 V DC	2 M	3L+
2	M / 24 V DC	AI 0	3M
3	Functional Earth	AI 1	DQ a.0
4	L+ / 24 V DC Sensor Out	--	DQ a.1
5	M / 24 V DC Sensor Out	--	DQ a.2
6	1M	--	DQ a.3
7	DI a.0	--	DQ a.4
8	DI a.1	--	DQ a.5
9	DI a.2	--	--
10	DI a.3	--	--
11	DI a.4	--	--
12	DI a.5	--	--
13	DI a.6	--	--
14	DI a.7	--	--

Note

Unused analog inputs should be shorted.

A.6 CPU 1214C

A.6.1 General specifications and features

Table A- 47 General

Technical data	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/Relay	CPU 1214C DC/DC/DC
Article number	6ES7214-1BG40-0XB0	6ES7214-1HG40-0XB0	6ES7214-1AG40-0XB0
Dimensions W x H x D (mm)	110 x 100 x 75		
Shipping weight	475 grams	435 grams	415 grams
Power dissipation	14 W	12 W	
Current available (SM and CM bus)	1600 mA max. (5 V DC)		
Current available (24 V DC)	400 mA max. (sensor power)		
Digital input current consumption (24 V DC)	4 mA/input used		

Table A- 48 CPU features

Technical data		Description
User memory (Refer to "General technical specifications", (Page 1343) "Internal CPU memory retention".)	Work	100 Kbytes
	Load	4 Mbytes internal, expandable up to SD card size
	Retentive	10 Kbytes
Onboard digital I/O		14 inputs/10 outputs
Onboard analog I/O		2 inputs
Process image size		1024 bytes of inputs (I)/1024 bytes of outputs (Q)
Bit memory (M)		8192 bytes
Temporary (local) memory		• 16 Kbytes for startup and program cycle (including associated FBs and FCs) • 6 Kbytes for each of the other interrupt priority levels (including FBs and FCs)
Signal modules expansion		8 SMs max.
SB, CB, BB expansion		1 max.
Communication module expansion		3 CMs max.
High-speed counters		Up to 6 configured to use any built-in or SB inputs. Refer to "Hardware input pin assignment" (Page 566) for CPU 1214C: HSC default address assignments. • 100/180 kHz (Ia.0 to Ia.5) • 30/120 kHz (Ia.6 to Ib.5)

Technical data	Description
Pulse outputs[2]	Up to 4 configured to use any built-in or SB outputs • 100 kHz (Qa.0 to Qa.3) • 20 kHz (Qa.4 to Qb.1)
Pulse catch inputs	14
Time delay interrupts	4 total with 1 ms resolution
Cyclic interrupts	4 total with 1 ms resolution
Edge interrupts	12 rising and 12 falling (16 and 16 with optional signal board)
Memory card	SIMATIC memory card (optional)
Real time clock accuracy	+/- 60 seconds/month
Real time clock retention time	20 days typ./12 days min. at 40 °C (maintenance-free Super Capacitor)

1 The slower speed is applicable when the HSC is configured for quadrature mode of operation.

2 For CPU models with relay outputs, you must install a digital signal board (SB) to use the pulse outputs.

Table A- 49 Performance

Type of instruction		Execution speed	
		Direct addressing (I, Q and M)	DB accesses
Boolean		0.08 µs/instruction	
Move	Move_Bool	0.3 µs/instruction	1.17 µs/instruction
	Move_Word	0.137 µs/instruction	1.0 µs/instruction
	Move_Real	0.72 µs/instruction	1.0 µs/instruction
Real Math	Add Real	1.48 µs/instruction	1.78 µs/instruction

Note

Many variables affect measured times. The above performance times are for the fastest instructions in this category and error-free programs.

A.6.2 Timers, counters and code blocks supported by CPU 1214C

Table A- 50 Blocks, timers and counters supported by CPU 1214C

Element		Description
Blocks	Type	OB, FB, FC, DB
	Size	64 Kbytes
	Quantity	Up to 1024 blocks total (OBs + FBs + FCs + DBs)
	Address range for FBs, FCs, and DBs	FB and FC: 1 to 65535 (such as FB 1 to FB 65535) DB: 1 to 59999
	Nesting depth	16 from the program cycle or startup OB 6 from any interrupt event OB[1]
	Monitoring	Status of 2 code blocks can be monitored simultaneously
OBs	Program cycle	Multiple
	Startup	Multiple
	Time-delay interrupts	4 (1 per event)
	Cyclic interrupts	4 (1 per event)
	Hardware interrupts	50 (1 per event)
	Time error interrupts	1
	Diagnostic error interrupts	1
	Pull or plug of modules	1
	Rack or station failure	1
	Time of day	Multiple
	Status	1
	Update	1
	Profile	1
	MC-Interpolator	1
	MC-Servo	1
	MC-PreServo	1
	MC-PostServo	1
Timers	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, 16 bytes per timer
Counters	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, size dependent upon count type • SInt, USInt: 3 bytes • Int, UInt: 6 bytes • DInt, UDInt: 12 bytes

[1] Safety programs use two nesting levels. The user program therefore has a nesting depth of four in safety programs.

Table A- 51 Communication

Technical data	Description
Number of ports	1
Type	Ethernet
HMI device	4
Programming device (PG)	1
Connections	• 8 connections for Open User Communication (active or passive): TSEND_C, TRCV_C, TCON, TDISCON, TSEND, and TRCV • 8 CPU-to-CPU connections (client or server) for GET/PUT data • 6 connections for dynamic allocation to either GET/PUT or Open User Communication
Data rates	10/100 Mb/s
Isolation (external signal to logic)	Transformer isolated, 1500 V AC (type test)[1]
Cable type	CAT5e shielded
Interfaces	
Number of PROFINET interfaces	1
Number of interfaces PROFIBUS	0
Interface	
Interface Hardware	
Number of ports	1
Integrated switch	No
RJ-45 (Ethernet)	Yes; X1
Protocols	
PROFINET IO controller	Yes
PROFINET IO device	Yes
SIMATIC communication	Yes
Open IE communication	Yes
Web server	Yes
Media redundancy	No
PROFINET IO controller	
Services	
PG/OP communication	Yes
S7 routing	Yes
Isochronous mode	No
Open IE communication	Yes
IRT	No
MRP	No
PROFIenergy	Yes. The S7-1200 CPU only supports the PROFIenergy entity (with I-device functionality).
Prioritized startup	Yes (max. 16 PROFINET devices)
Number of connectable I/O devices max.	16
Number of IO devices that you can connect for RT, max.	16

Technical data		Description
Of which are in line, max.		16
Number of IO devices that can be activated/ deactivated simultaneously, max.		8
Update times		The minimum value of the update time also depends on the communication component set for PROFINET IO, on the number of IO devices, and the quantity of configured user data.
With RT		
Send clock of 1 ms		1 ms to 512 ms
PROFINET IO device		
Services		
PG/OP communication		Yes
S7 routing		Yes
Isochronous mode		No
Open IE communication		Yes
IRT, supported		No
MRP, supported		No
PROFIenergy		Yes
Shared device		Yes
Number of IO controllers with shared device, max.		2
SIMATIC communication		
S7 communication, as server		Yes
S7 communication, as client		Yes
User data per job, max.		See online help (S7 communication, user data size)
Open IE communication		
TCP/IP:		Yes
	Data length, max.	8 KB
	Several passive connections per port, supported	Yes
ISO-on-TCP (RFC1006):		Yes
	Data length, max.	8 KB
UDP		Yes
	Data length, max.	1472 bytes
DHCP		No
SNMP		Yes
DCP		Yes
LLDP		Yes

[1] Ethernet port isolation is designed to limit hazard during short term network faults to hazardous voltages. It does not conform to safety requirements for routine AC line voltage isolation.

Table A- 52 Power supply

Technical data		CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/Relay	CPU 1214C DC/DC/DC
Voltage range		85 to 264 V AC	20.4 V DC to 28.8 V DC	
Line frequency		47 to 63 Hz	--	
Input current (max. load)	CPU only	100 mA at 120 V AC 50 mA at 240 V AC	500 mA at 24 V DC	
	CPU with all expansion accessories	300 mA at 120 V AC 150 mA at 240 V AC	1500 mA at 24 V DC	
Inrush current (max.)		20 A at 264 V AC	12 A at 28.8 V DC	
I^2t		0.8 A^2 s	0.5 A^2 s	
Isolation (input power to logic)		1500 V AC	Not isolated	
Ground leakage, AC line to functional earth		0.5 mA max.	-	
Hold up time (loss of power)		20 ms at 120 V AC 80 ms at 240 V AC	10 ms at 24 V DC	
Internal fuse, not user replaceable		3 A, 250 V, slow blow		

Table A- 53 Sensor power

Technical data	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/Relay	CPU 1214C DC/DC/DC
Voltage range	20.4 to 28.8 V DC	L+ minus 4 V DC min.	
Output current rating (max.)	400 mA (short-circuit protected)		
Maximum ripple noise (<10 MHz)	< 1 V peak to peak	Same as input line	
Isolation (CPU logic to sensor power)	Not isolated		

A.6.3 Digital inputs and outputs

Table A- 54 Digital inputs

Technical data	CPU 1214C AC/DC/Relay	CPU 1214C DC/DC/Relay	CPU 1214C DC/DC/DC
Number of inputs	14		
Type	Sink/Source (IEC Type 1 sink)		
Rated voltage	24 V DC at 4 mA, nominal		
Continuous permissible voltage	30 V DC, max.		
Surge voltage	35 V DC for 0.5 sec.		
Logic 1 signal (min.)	15 V DC at 2.5 mA		
Logic 0 signal (max.)	5 V DC at 1 mA		
Isolation (field side to logic)	707 V DC (type test)		
Isolation groups	1		
Filter times	us settings: 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0 ms settings: 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0		
HSC clock input rates (max.) (Logic 1 Level = 15 to 26 V DC)	100/80 kHz (Ia.0 to Ia.5) 30/20 kHz (Ia.6 to Ib.5		
Number of inputs on simultaneously	• 7 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 14 at 55 °C horizontal or 45 °C vertical		
Cable length (meters)	500 m shielded, 300 m unshielded, 50 m shielded for HSC inputs		

Table A- 55 Digital outputs

Technical data	CPU 1214C AC/DC/Relay and DC/DC/Relay	CPU 1214C DC/DC/DC
Number of outputs	10	
Type	Relay, mechanical	Solid state - MOSFET (sourcing)
Voltage range	5 to 30 V DC or 5 to 250 V AC	20.4 to 28.8 V DC
Logic 1 signal at max. current	--	20 V DC min.
Logic 0 signal with 10 KΩ load	--	0.1 V DC max.
Current (max.)	2.0 A	0.5 A
Lamp load	30 W DC / 200 W AC	5 W
ON state resistance	0.2 Ω max. when new	0.6 Ω max.
Leakage current per point	--	10 µA max.
Surge current	7 A with contacts closed	8 A for 100 ms max.
Overload protection	No	
Isolation (field side to logic)	1500 V AC (coil to contact) None (coil to logic)	707 V DC (type test)
Isolation groups	2	1
Isolation (group-to-group)	1500 V AC[1]	--
Inductive clamp voltage	--	L+ minus 48 V DC, 1 W dissipation
Switching delay (Qa.0 to Qa.3)	10 ms max.	1.0 µs max., off to on 3.0 µs max., on to off
Switching delay (Qa.4 to Qb.1)	10 ms max.	5 µs max., off to on 20 µs max., on to off
Maximum relay switching frequency	1 Hz	--
Pulse Train Output rate	Not recommended [2]	100 kHz (Qa.0 to Qa.3)[3], 2 Hz min. 20 kHz (Qa.4 to Qb.1)[3]
Lifetime mechanical (no load)	10,000,000 open/close cycles	--
Lifetime contacts at rated load	100,000 open/close cycles	--
Behavior on RUN to STOP	Last value or substitute value (default value 0)	
Number of outputs on simultaneously	• 5 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 10 at 55 °C horizontal or 45 °C vertical	
Cable length (meters)	500 m shielded, 150 m unshielded	

1 Relay group-to-group isolation separates line voltage from SELV/PELV and separates different phases up to 250 V AC line to ground.

2 For CPU models with relay outputs, you must install a digital signal board (SB) to use the pulse outputs.

3 Depending on your pulse receiver and cable, an additional load resistor (at least 10% of rated current) may improve pulse signal quality and noise immunity.

A.6.4 Analog inputs

Table A- 56 Analog inputs

Technical data	Description
Number of inputs	2
Type	Voltage (single-ended)
Full-scale range	0 to 10 V
Full-scale range (data word)	0 to 27648
Overshoot range	10.001 to 11.759 V
Overshoot range (data word)	27649 to 32511
Overflow range	11.760 to 11.852 V
Overflow range (data word)	32512 to 32767
Resolution	10 bits
Maximum withstand voltage	35 V DC
Smoothing	None, Weak, Medium, or Strong See the table for Step response (ms) for the analog inputs of the CPU (Page 1390).
Noise rejection	10, 50, or 60 Hz
Impedance	≥100 KΩ
Isolation (field side to logic)	None
Accuracy (25 °C / -20 to 60 °C)	3.0% / 3.5% of full-scale
Cable length (meters)	100 m, shielded twisted pair

A.6.4.1 Step response of the built-in analog inputs of the CPU

Table A- 57 Step Response (ms), 0 V to 10 V measured at 95%

Smoothing selection (sample averaging)	Rejection frequency (Integration time)		
	60 Hz	50 Hz	10 Hz
None (1 cycle): No averaging	50 ms	50 ms	100 ms
Weak (4 cycles): 4 samples	60ms	70 ms	200 ms
Medium (16 cycles): 16 samples	200 ms	240 ms	1150 ms
Strong (32 cycles): 32 samples	400 ms	480 ms	2300 ms
Sample time	**4.17 ms**	**5 ms**	**25 ms**

A.6.4.2 Sample time for the built-in analog ports of the CPU

Table A- 58 Sample time for built-in analog inputs of the CPU

Rejection frequency (Integration time selection)	Sample time
60 Hz (16.6 ms)	4.17 ms
50 Hz (20 ms)	5 ms
10 Hz (100 ms)	25 ms

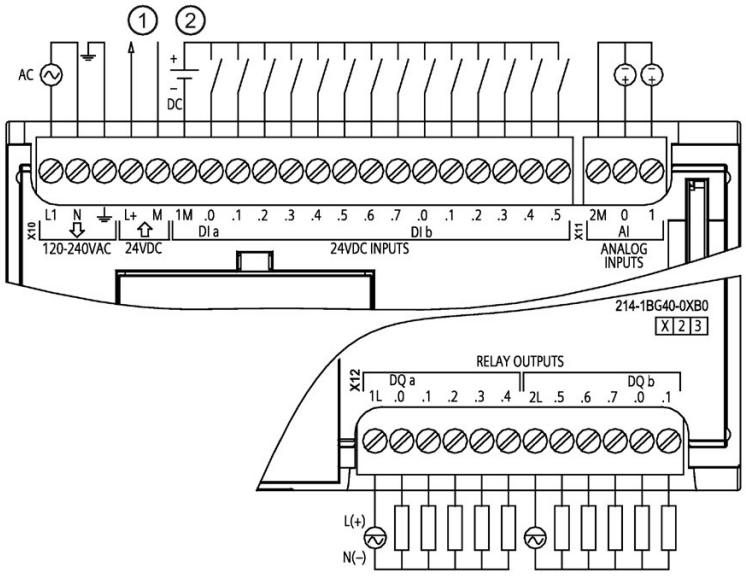
A.6.4.3 Measurement ranges of the analog inputs for voltage (CPUs)

Table A- 59 Analog input representation for voltage (CPUs)

System		Voltage Measuring Range	
Decimal	Hexadecimal	0 to 10 V	
32767	7FFF	11.852 V	Overflow
32512	7F00		
32511	7EFF	11.759 V	Overshoot range
27649	6C01		
27648	6C00	10 V	Rated range
20736	5100	7.5 V	
34	22	12 mV	
0	0	0 V	
Negative values		Negative values are not supported	

A.6.5 CPU 1214C wiring diagrams

Table A- 60 CPU 1214C AC/DC/Relay (6ES7214-1BG40-0XB0)



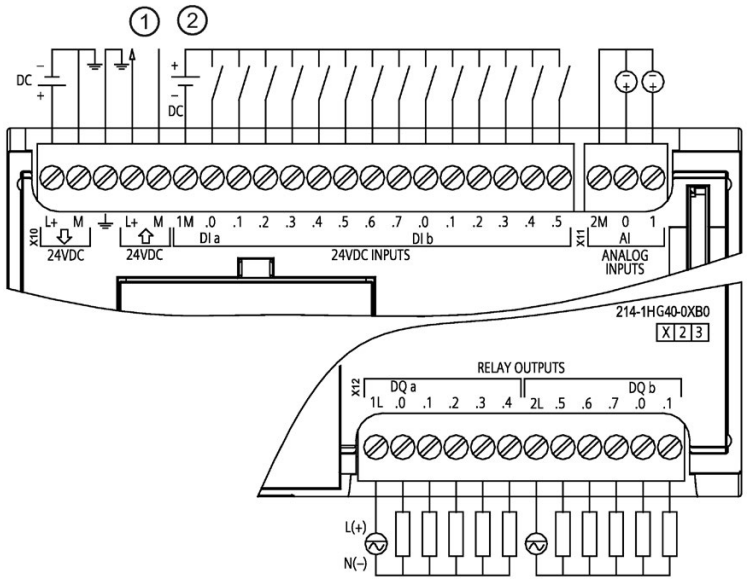
①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: Either the L1 or N (L2) terminal can be connected to a voltage source up to 240 V AC. The N terminal can be considered L2 and is not required to be grounded. No polarization is required for L1 and N (L2) terminals.	
Note 3: See Device Configuratio (Page 149)n for information about the Ethernet port of the CPU.	

Table A- 61 Connector pin locations for CPU 1214C AC/DC/Relay (6ES7214-1BG40-0XB0)

Pin	X10	X11 (gold)	X12
1	L1 / 120-240 V AC	2 M	1L
2	N / 120-240 V AC	AI 0	DQ a.0
3	Functional Earth	AI 1	DQ a.1
4	L+ / 24 V DC Sensor Out	--	DQ a.2
5	M / 24 V DC Sensor Out	--	DQ a.3
6	1M	--	DQ a.4
7	DI a.0	--	2L
8	DI a.1	--	DQ a.5
9	DI a.2	--	DQ a.6
10	DI a.3	--	DQ a.7
11	DI a.4	--	DQ b.0
12	DI a.5	--	DQ b.1
13	DI a.6	--	--

Pin	X10	X11 (gold)	X12
14	DI a.7	--	--
15	DI b.0	--	--
16	DI b.1	--	--
17	DI b.2	--	--
18	DI b.3	--	--
19	DI b.4	--	--
20	DI b.5	--	--

Table A- 62 CPU 1214C DC/DC/Relay (6ES7214-1HG40-0XB0)



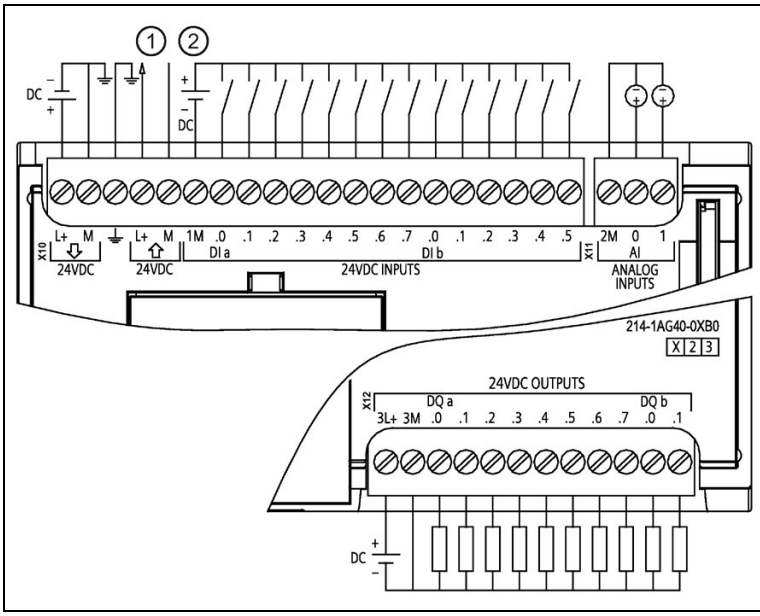
①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 63 Connector pin locations for CPU 1214C DC/DC/Relay (6ES7214-1HG40-0XB0)

Pin	X10	X11 (gold)	X12
1	L+ / 24 V DC	2 M	1L
2	M / 24 V DC	AI 0	DQ a.0
3	Functional Earth	AI 1	DQ a.1
4	L+ / 24 V DC Sensor Out	--	DQ a.2
5	M / 24 V DC Sensor Out	--	DQ a.3
6	1M	--	DQ a.4
7	DI a.0	--	2L
8	DI a.1	--	DQ a.5
9	DI a.2	--	DQ a.6
10	DI a.3	--	DQ a.7
11	DI a.4	--	DQ b.0

Pin	X10	X11 (gold)	X12
12	DI a.5	--	DQ b.1
13	DI a.6	--	--
14	DI a.7	--	--
15	DI b.0	--	--
16	DI b.1	--	--
17	DI b.2	--	--
18	DI b.3	--	--
19	DI b.4	--	--
20	DI b.5	--	--

Table A- 64 CPU 1214C DC/DC/DC (6ES7214-1AG40-0XB0)



①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 65 Connector pin locations for CPU 1214C DC/DC/DC (6ES7214-1AG40-0XB0)

Pin	X10	X11 (gold)	X12
1	L+ / 24 V DC	2 M	3L+
2	M / 24 V DC	AI 0	3M
3	Functional Earth	AI 1	DQ a.0
4	L+ / 24 V DC Sensor Out	--	DQ a.1
5	M / 24 V DC Sensor Out	--	DQ a.2
6	1M	--	DQ a.3
7	DI a.0	--	DQ a.4
8	DI a.1	--	DQ a.5
9	DI a.2	--	DQ a.6
10	DI a.3	--	DQ a.7

Pin	X10	X11 (gold)	X12
11	DI a.4	--	DQ b.0
12	DI a.5	--	DQ b.1
13	DI a.6	--	--
14	DI a.7	--	-
15	DI b.0	--	--
16	DI b.1	--	--
17	DI b.2	--	--
18	DI b.3	--	--
19	DI b.4	--	--
20	DI b.5	--	--

Note

Unused analog inputs should be shorted.

A.7 CPU 1215C

A.7.1 General specifications and features

Table A- 66 General

Technical data	CPU 1215C AC/DC/Relay	CPU 1215C DC/DC/Relay	CPU 1215C DC/DC/DC
Article number	6ES7215-1BG40-0XB0	6ES7215-1HG40-0XB0	6ES7215-1AG40-0XB0
Dimensions W x H x D (mm)	130 x 100 x 75		
Shipping weight	585 grams	550 grams	520 grams
Power dissipation	14 W	12 W	
Current available (SM and CM bus)	1600 mA max. (5 V DC)		
Current available (24 V DC)	400 mA max. (sensor power)		
Digital input current consumption (24 V DC)	4 mA/input used		

Table A- 67 CPU features

Technical data		Description
User memory (Refer to "General technical specifications (Page 1343)", "Internal CPU memory retention".)	Work	125 Kbytes
	Load	4 Mbytes, internal, expandable up to SD card size
	Retentive	10 Kbytes
Onboard digital I/O		14 inputs/10 outputs
Onboard analog I/O		2 inputs/2 outputs
Process image size		1024 bytes of inputs (I)/1024 bytes of outputs (Q)
Bit memory (M)		8192 bytes
Temporary (local) memory		• 16 Kbytes for startup and program cycle (including associated FBs and FCs) • 6 Kbytes for each of the other interrupt priority levels (including FBs and FCs)
Signal modules expansion		8 SMs max.
SB, CB, BB expansion		1 max.
Communication module expansion		3 CMs max.
High-speed counters		Up to 6 configured to use any built-in or SB inputs. Refer to "Hardware input pin assignment" (Page 566) for CPU 1215C: HSC default address assignments. • 100/180 kHz (Ia.0 to Ia.5) • 30/120 kHz (Ia.6 to Ib.5)

Technical data	Description
Pulse outputs[2]	Up to 4 configured to use any built-in or SB outputs • 100 kHz (Qa.0 to Qa.3) • 20 kHz (Qa.4 to Qb.1)
Pulse catch inputs	14
Time delay interrupts	4 total with 1 ms resolution
Cyclic interrupts	4 total with 1 ms resolution
Edge interrupts	12 rising and 12 falling (16 and 16 with optional signal board)
Memory card	SIMATIC memory card (optional)
Real time clock accuracy	+/- 60 seconds/month
Real time clock retention time	20 days typ./12 days min. at 40 °C (maintenance-free Super Capacitor)

1 The slower speed is applicable when the HSC is configured for quadrature mode of operation.

2 For CPU models with relay outputs, you must install a digital signal board (SB) to use the pulse outputs.

Table A- 68 Performance

Type of instruction		Execution speed	
		Direct addressing (I, Q and M)	DB accesses
Boolean		0.08 µs/instruction	
Move	Move_Bool	0.3 µs/instruction	1.17 µs/instruction
	Move_Word	0.137 µs/instruction	1.0 µs/instruction
	Move_Real	0.72 µs/instruction	1.0 µs/instruction
Real Math	Add Real	1.48 µs/instruction	1.78 µs/instruction

Note

Many variables affect measured times. The above performance times are for the fastest instructions in this category and error-free programs.

A.7.2 Timers, counters and code blocks supported by CPU 1215C

Table A- 69 Blocks, timers and counters supported by CPU 1215C

Element		Description
Blocks	Type	OB, FB, FC, DB
	Size	64 Kbytes
	Quantity	Up to 1024 blocks total (OBs + FBs + FCs + DBs)
	Address range for FBs, FCs, and DBs	FB and FC: 1 to 65535 (such as FB 1 to FB 65535) DB: 1 to 59999
	Nesting depth	16 from the program cycle or startup OB 6 from any interrupt event OB[1]
	Monitoring	Status of 2 code blocks can be monitored simultaneously
OBs	Program cycle	Multiple
	Startup	Multiple
	Time-delay interrupts	4 (1 per event)
	Cyclic interrupts	4 (1 per event)
	Hardware interrupts	50 (1 per event)
	Time error interrupts	1
	Diagnostic error interrupts	1
	Pull or plug of modules	1
	Rack or station failure	1
	Time of day	Multiple
	Status	1
	Update	1
	Profile	1
	MC-Interpolator	1
	MC-Servo	1
	MC-PreServo	1
	MC-PostServo	1
Timers	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, 16 bytes per timer
Counters	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, size dependent upon count type • SInt, USInt: 3 bytes • Int, UInt: 6 bytes • DInt, UDInt: 12 bytes

[1] Safety programs use two nesting levels. The user program therefore has a nesting depth of four in safety programs.

Table A- 70 Communication

Technical data	Description
Number of ports	2
Type	Ethernet
HMI device	4
Programming device (PG)	1
Connections	• 8 connections for Open User Communication (active or passive): TSEND_C, TRCV_C, TCON, TDISCON, TSEND, and TRCV • 8 CPU-to-CPU connections (client or server) for GET/PUT data • 6 connections for dynamic allocation to either GET/PUT or Open User Communication
Data rates	10/100 Mb/s
Isolation (external signal to logic)	Transformer isolated, 1500 V AC (type test)[1]
Cable type	CAT5e shielded
Interfaces	
Number of PROFINET interfaces	1
Number of interfaces PROFIBUS	0
Interface	
Interface hardware	
Number of ports	2
Integrated switch	Yes
RJ-45 (Ethernet)	Yes; X1
Protocols	
PROFINET IO controller	Yes
PROFINET IO device	Yes
SIMATIC communication	Yes
Open IE communication	Yes
Web server	Yes
Media redundancy	Yes
PROFINET IO controller	
Services	
PG/OP communication	Yes
S7 routing	Yes
Isochronous mode	No
Open IE communication	Yes
IRT	No
MRP	Yes as MRP client
PROFIenergy	Yes. The S7-1200 CPU only supports the PROFIenergy entity (with I-device functionality).
Prioritized startup	Yes (max. 16 PROFINET devices)
Number of connectable I/O devices max.	16
Number of IO devices that you can connect for RT, max.	16

Technical data		Description
Of which are in line, max.		16
Number of IO devices that can be activated/ deactivated simultaneously, max.		8
Update times		The minimum value of the update time also depends on the communication component set for PROFINET IO, on the number of IO devices, and the quantity of configured user data.
With RT		
Send clock of 1 ms		1 ms to 512 ms
PROFINET IO device		
Services		
PG/OP communication		Yes
S7 routing		Yes
Isochronous mode		No
Open IE communication		Yes
IRT, supported		No
MRP, supported		Yes
PROFIenergy		Yes
Shared device		Yes
Number of IO controllers with shared device, max.		2
SIMATIC communication		
S7 communication, as server		Yes
S7 communication, as client		Yes
User data per job, max.		See online help (S7 communication, user data size)
Open IE communication		
TCP/IP:		Yes
	Data length, max.	8 KB
	Several passive connections per port, supported	Yes
ISO-on-TCP (RFC1006):		Yes
	Data length, max.	8 KB
UDP:		Yes
	Data length, max.	1472 bytes
DHCP		No
SNMP		Yes
DCP		Yes
LLDP		Yes

[1] Ethernet port isolation is designed to limit hazard during short term network faults to hazardous voltages. It does not conform to safety requirements for routine AC line voltage isolation.

Table A- 71 Power supply

Technical data		CPU 1215C AC/DC/Relay	CPU 1215C DC/DC/Relay	CPU 1215C DC/DC/DC
Voltage range		85 to 264 V AC	20.4 V DC to 28.8 V DC	
Line frequency		47 to 63 Hz	--	
Input current (max. load)	CPU only	100 mA at 120 V AC 50 mA at 240 V AC	500 mA at 24 V DC	
	CPU with all expansion accessories	300 mA at 120 V AC 150 mA at 240 V AC	1500 mA at 24 V DC	
Inrush current (max.)		20 A at 264 V AC	12 A at 28.8 V DC	
I^2t		0.8 A^2 s	0.5 A^2 s	
Isolation (input power to logic)		1500 V AC	Not isolated	
Ground leakage, AC line to functional earth		0.5 mA max.	-	
Hold up time (loss of power)		20 ms at 120 V AC 80 ms at 240 V AC	10 ms at 24 V DC	
Internal fuse, not user replaceable		3 A, 250 V, slow blow		

Table A- 72 Sensor power

Technical data	CPU 1215C AC/DC/Relay	CPU 1215C DC/DC/Relay	CPU 1215C DC/DC/DC
Voltage range	20.4 to 28.8 V DC	L+ minus 4 V DC min.	
Output current rating (max.)	400 mA (short-circuit protected)		
Maximum ripple noise (<10 MHz)	< 1 V peak to peak	Same as input line	
Isolation (CPU logic to sensor power)	Not isolated		

A.7.3 Digital inputs and outputs

Table A- 73 Digital inputs

Technical data	CPU 1215C AC/DC/Relay	CPU 1215C DC/DC/Relay	CPU 1215C DC/DC/DC
Number of inputs	14		
Type	Sink/Source (IEC Type 1 sink)		
Rated voltage	24 V DC at 4 mA, nominal		
Continuous permissible voltage	30 V DC, max.		
Surge voltage	35 V DC for 0.5 sec.		
Logic 1 signal (min.)	15 V DC at 2.5 mA		
Logic 0 signal (max.)	5 V DC at 1 mA		
Isolation (field side to logic)	707 V DC (type test)		
Isolation groups	1		
Filter times	us settings: 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0 ms settings: 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0		
HSC clock input rates (max.) (Logic 1 Level = 15 to 26 V DC)	100/80 kHz (Ia.0 to Ia.5) 30/20 kHz (Ia.6 to Ib.5)		
Number of inputs on simultaneously	• 7 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 14 at 55 °C horizontal or 45 °C vertical		
Cable length (meters)	500 m shielded, 300 m unshielded, 50 m shielded for HSC inputs		

Table A- 74 Digital outputs

Technical data	CPU 1215C AC/DC/Relay and CPU 1215C DC/DC/Relay	CPU 1215C DC/DC/DC
Number of outputs	10	
Type	Relay, mechanical	Solid state - MOSFET (sourcing)
Voltage range	5 to 30 V DC or 5 to 250 V AC	20.4 to 28.8 V DC
Logic 1 signal at max. current	--	20 V DC min.
Logic 0 signal with 10 KΩ load	--	0.1 V DC max.
Current (max.)	2.0 A	0.5 A
Lamp load	30 W DC / 200 W AC	5 W
ON state resistance	0.2 Ω max. when new	0.6 Ω max.
Leakage current per point	--	10 µA max.
Surge current	7 A with contacts closed	8 A for 100 ms max.
Overload protection	No	
Isolation (field side to logic)	1500 V AC (coil to contact) None (coil to logic)	707 V DC (type test)
Isolation groups	2	1
Isolation (group-to-group)	1500 V AC[1]	--
Inductive clamp voltage	--	L+ minus 48 V DC, 1 W dissipation
Switching delay (Qa.0 to Qa.3)	10 ms max.	1.0 µs max., off to on 3.0 µs max., on to off
Switching delay (Qa.4 to Qb.1)	10 ms max.	5 µs max., off to on 20 µs max., on to off
Maximum relay switching frequency	1 Hz	--
Pulse Train Output rate	Not recommended [2]	100 kHz (Qa.0 to Qa.3)[3], 2 Hz min. 20 kHz (Qa.4 to Qb.1)[3]
Lifetime mechanical (no load)	10,000,000 open/close cycles	--
Lifetime contacts at rated load	100,000 open/close cycles	--
Behavior on RUN to STOP	Last value or substitute value (default value 0)	
Number of outputs on simultaneously	• 5 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 10 at 55 °C horizontal or 45 °C vertical	
Cable length (meters)	500 m shielded, 150 m unshielded	

1 Relay group-to-group isolation separates line voltage from SELV/PELV and separates different phases up to 250 V AC line to ground.

2 For CPU models with relay outputs, you must install a digital signal board (SB) to use the pulse outputs.

3 Depending on your pulse receiver and cable, an additional load resistor (at least 10% of rated current) may improve pulse signal quality and noise immunity.

A.7.4 Analog inputs and outputs

Table A- 75 Analog inputs

Technical data	Description
Number of inputs	2
Type	Voltage (single-ended)
Full-scale range	0 to 10 V
Full-scale range (data word)	0 to 27648
Overshoot range	10.001 to 11.759 V
Overshoot range (data word)	27649 to 32511
Overflow range	11.760 to 11.852 V
Overflow range (data word)	32512 to 32767
Resolution	10 bits
Maximum withstand voltage	35 V DC
Smoothing	None, Weak, Medium, or Strong See the table for Step response (ms) for the analog inputs of the CPU (Page 1404).
Noise rejection	10, 50, or 60 Hz
Impedance	≥100 KΩ
Isolation (field side to logic)	None
Accuracy (25 °C / -20 to 60 °C)	3.0% / 3.5% of full-scale
Cable length (meters)	100 m, shielded twisted pair

A.7.4.1 Step response of built-in analog inputs of the CPU

Table A- 76 Step Response (ms), 0 V to 10 V measured at 95%

Smoothing selection (sample averaging)	Rejection frequency (Integration time)		
	60 Hz	50 Hz	10 Hz
None (1 cycle): No averaging	50 ms	50 ms	100 ms
Weak (4 cycles): 4 samples	60ms	70 ms	200 ms
Medium (16 cycles): 16 samples	200 ms	240 ms	1150 ms
Strong (32 cycles): 32 samples	400 ms	480 ms	2300 ms
Sample time	**4.17 ms**	**5 ms**	**25 ms**

A.7.4.2 Sample time for the built-in analog ports of the CPU

Table A- 77 Sample time for built-in analog inputs of the CPU

Rejection frequency (Integration time selection)	Sample time
60 Hz (16.6 ms)	4.17 ms
50 Hz (20 ms)	5 ms
10 Hz (100 ms)	25 ms

A.7.4.3 Measurement ranges of the analog inputs for voltage (CPUs)

Table A- 78 Analog input representation for voltage (CPUs)

System		Voltage Measuring Range	
Decimal	Hexadecimal	0 to 10 V	
32767	7FFF	11.852 V	Overflow
32512	7F00		
32511	7EFF	11.759 V	Overshoot range
27649	6C01		
27648	6C00	10 V	Rated range
20736	5100	7.5 V	
34	22	12 mV	
0	0	0 V	
Negative values		Negative values are not supported	

A.7.4.4 Analog output specifications

Table A- 79 Analog outputs

Technical data	Description
Number of outputs	2
Type	Current
Full-scale range	0 to 20 mA
Full-scale range (data word)	0 to 27648
Overshoot range	20.01 to 23.52 mA
Overshoot range (data word)	27649 to 32511
Overflow range	see footnote [1]
Overflow range data word	32512 to 32767
Resolution	10 bits
Output drive impedance	≤500 Ω max.
Isolation (field side to logic)	None
Accuracy (25 °C / -20 to 60 °C)	3.0% / 3.5% of full-scale
Settling time	2 ms
Cable length (meters)	100 m, shielded twisted pair

[1] In an overflow condition, analog outputs will behave according to the device configuration properties settings. In the "Reaction to CPU STOP" parameter, select either: "Use substitute value" or "Keep last value".

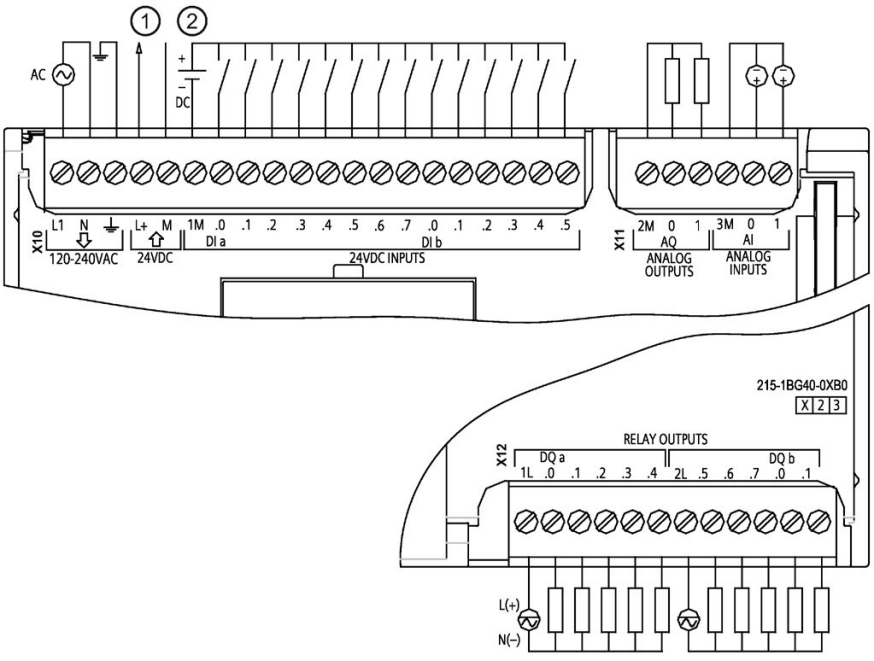
Table A- 80 Analog output representation for current (CPU 1215C and CPU 1217C)

System		Current output range	
Decimal	Hexadecimal	0 mA to 20 mA	
32767	7FFF	See note 1	Overflow
32512	7F00	See note 1	
32511	7EFF	23.52 mA	Overshoot range
27649	6C01		
27648	6C00	20 mA	Rated range
20736	5100	15 mA	
34	22	0.0247 mA	
0	0	0 mA	
Negative values		Negative values are not supported	

[1] In an overflow condition, analog outputs will behave according to the device configuration properties settings. In the "Reaction to CPU STOP" parameter, select either: "Use substitute value" or "Keep last value".

A.7.5 CPU 1215C wiring diagrams

Table A- 81 CPU 1215C AC/DC/Relay (6ES7215-1BG40-0XB0)

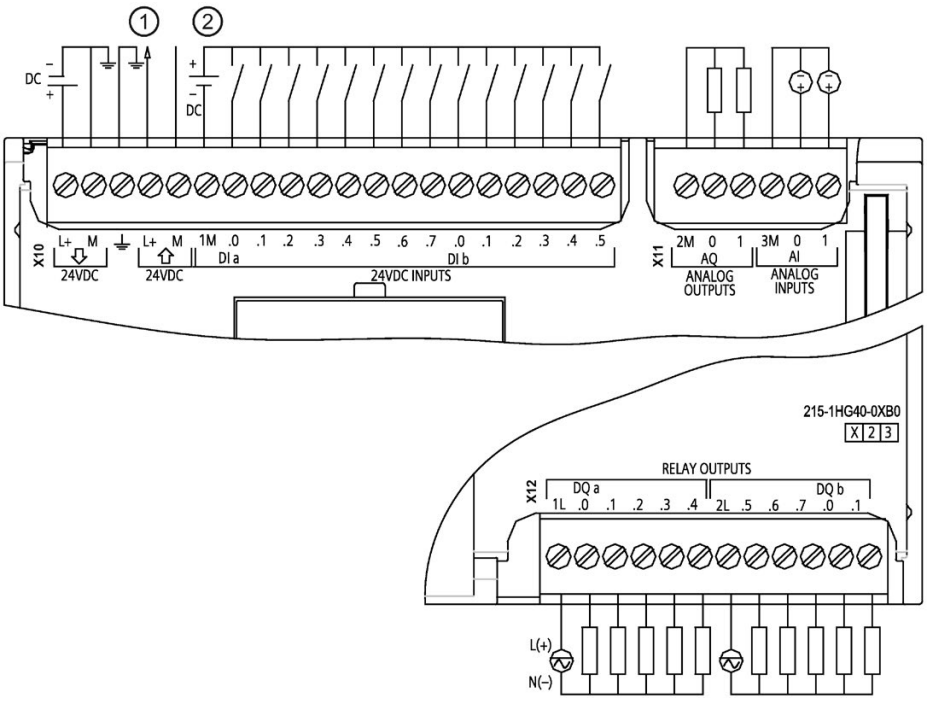


①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: Either the L1 or N (L2) terminal can be connected to a voltage source up to 240 V AC. The N terminal can be considered L2 and is not required to be grounded. No polarization is required for L1 and N (L2) terminals.	
Note 3: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 82 Connector pin locations for CPU 1215C AC/DC/Relay (6ES7215-1BG40-0XB0)

Pin	X10	X11 (gold)	X12
1	L1 /120-240 V AC	2 M	1L
2	N / 120 - 240 V AC	AQ 0	DQ a.0
3	Functional Earth	AQ 1	DQ a.1
4	L+ / 24 V DC Sensor Out	3M	DQ a.2
5	M / 24 V DC Sensor Out	AI 0	DQ a.3
6	1M	AI 1	DQ a.4
7	DI a.0	--	2L
8	DI a.1	--	DQ a.5
9	DI a.2	--	DQ a.6
10	DI a.3	--	DQ a.7
11	DI a.4	--	DQ b.0
12	DI a.5	--	DQ b.1
13	DI a.6	--	--
14	DI a.7	--	--
15	DI b.0	--	--
16	DI b.1	--	--
17	DI b.2	--	--
18	DI b.3	--	--
19	DI b.4	--	--
20	DI b.5	--	--

Table A- 83 CPU 1215C DC/DC/Relay (6ES7215-1HG40-0XB0)



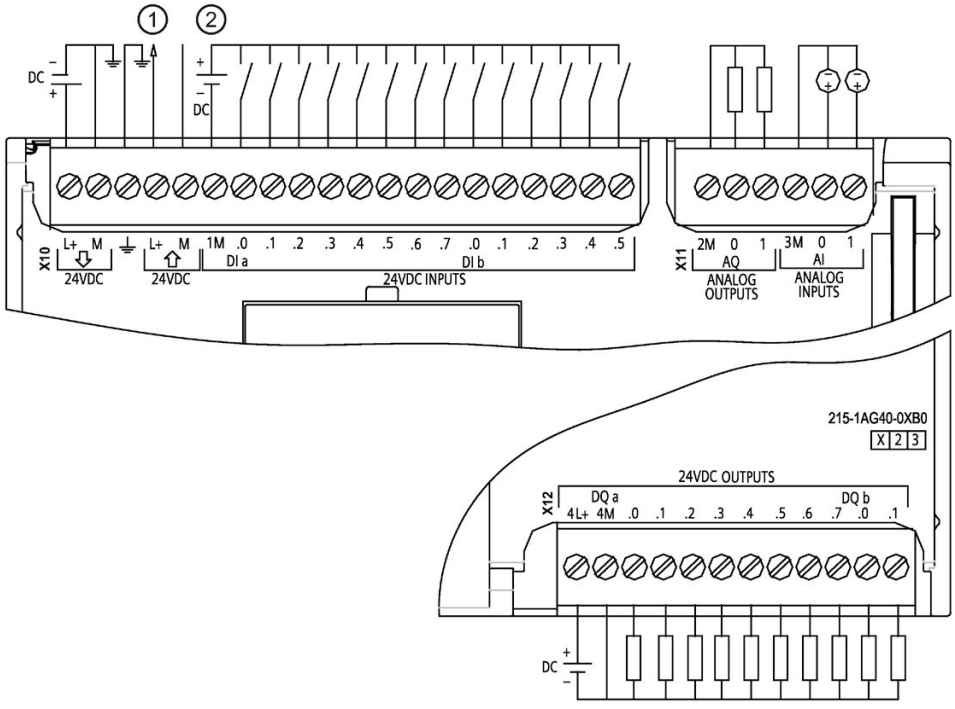
①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 84 Connector pin locations for CPU 1215C DC/DC/Relay (6ES7215-1HG40-0XB0)

Pin	X10	X11 (gold)	X12
1	L+ / 24 V DC	2 M	1L
2	M / 24 V DC	AQ 0	DQ a.0
3	Functional Earth	AQ 1	DQ a.1
4	L+ / 24 V DC Sensor Out	3M	DQ a.2
5	M / 24 V DC Sensor Out	AI 0	DQ a.3
6	1M	AI 1	DQ a.4
7	DI a.0	--	2L
8	DI a.1	--	DQ a.5
9	DI a.2	--	DQ a.6
10	DI a.3	--	DQ a.7
11	DI a.4	--	DQ b.0
12	DI a.5	--	DQ b.1
13	DI a.6	--	--
14	DI a.7	--	--

Pin	X10	X11 (gold)	X12
15	DI b.0	--	--
16	DI b.1	--	--
17	DI b.2	--	--
18	DI b.3	--	--
19	DI b.4	--	--
20	DI b.5	--	--

Table A- 85 CPU 1215C DC/DC/DC (6ES7215-1AG40-0XB0)



①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
Note 1: X11 connectors must be gold. See Appendix C, Spare Parts for article number.	
Note 2: See Device Configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 86 Connector pin locations for CPU 1215C DC/DC/DC (6ES7215-1AG40-0XB0)

Pin	X10	X11 (gold)	X12
1	L1 / 24 V DC	2 M	4L+
2	M / 24 V DC	AQ 0	4M
3	Functional Earth	AQ 1	DQ a.0
4	L+ / 24 V DC Sensor Out	3M	DQ a.1
5	M / 24 V DC Sensor Out	AI 0	DQ a.2
6	1M	AI 1	DQ a.3
7	DI a.0	--	DQ a.4
8	DI a.1	--	DQ a.5
9	DI a.2	--	DQ a.6
10	DI a.3	--	DQ a.7
11	DI a.4	--	DQ b.0
12	DI a.5	--	DQ b.1
13	DI a.6	--	--
14	DI a.7	--	--
15	DI b.0	--	--
16	DI b.1	--	--
17	DI b.2	--	--
18	DI b.3	--	--
19	DI b.4	--	--
20	DI b.5	--	--

Note

Unused analog inputs should be shorted.

A.8 CPU 1217C

A.8.1 General specifications and features

Table A- 87 General

Technical data	CPU 1217C DC/DC/DC
Article number	6ES7217-1AG40-0XB0
Dimensions W x H x D (mm)	150 x 100 x 75
Shipping weight	530 grams
Power dissipation	12 W
Current available (SM and CM bus)	1600 mA max. (5 V DC)
Current available (24 V DC)	400 mA max. (sensor power)
Digital input current consumption (24 V DC)	4 mA/input used

Table A- 88 CPU features

Technical data		Description
User memory (Refer to "General technical specifications (Page 1343)", Internal CPU memory retention".)	Work	150 Kbytes
	Load	4 Mbytes, internal, expandable up to SD card size
	Retentive	10 Kbytes
Onboard digital I/O		14 inputs/ 10 outputs
Onboard analog I/O		2 inputs/ 2 outputs
Process image size		1024 bytes of inputs (I) / 1024 bytes of outputs (Q)
Bit memory (M)		8192 bytes
Temporary (local) memory		• 16 Kbytes for startup and program cycle (including associated FBs and FCs) • 6 Kbytes for each of the other interrupt priority levels (including FBs and FCs)
Signal modules expansion		8 SMs max.
SB, CB, BB expansion		1 max.
Communication module expansion		3 CMs max.
High-speed counters		Up to 6 configured to use any built-in or SB inputs (refer to CPU 1217C Digital input (DI) H/W configuration table) (Page 1417) • 1 MHz (Ib.2 to Ib.5) • 100/180 kHz (Ia.0 to Ia.5) • 30/120 kHz (Ia.6 to Ib.1)

Technical data	Description
Pulse outputs	Up to 4 configured to use any built-in or SB outputs (refer to CPU 1217C Digital output (DQ) H/W configuration table) (Page 1417) • 1 MHz (Qa.0 to Qa.3) • 100 kHz (Qa.4 to Qb.1)
Pulse catch inputs	14
Time delay interrupts	4 total with 1 ms resolution
Cyclic interrupts	4 total with 1 ms resolution
Edge interrupts	12 rising and 12 falling (16 and 16 with optional signal board)
Memory card	SIMATIC memory card (optional)
Real time clock accuracy	+/- 60 seconds/month
Real time clock retention time	20 days typ./12 days min. at 40 °C (maintenance-free Super Capacitor)

[1] The slower speed is applicable when the HSC is configured for quadrature mode of operation.

Table A- 89 Performance

Type of instruction		Execution speed	
		Direct addressing (I, Q and M)	DB accesses
Boolean		0.08 µs/instruction	
Move	Move_Bool	0.3 µs/instruction	1.17 µs/instruction
	Move_Word	0.137 µs/instruction	1.0 µs/instruction
	Move_Real	0.72 µs/instruction	1.0 µs/instruction
Real Math	Add Real	1.48 µs/instruction	1.78 µs/instruction

Note

Many variables affect measured times. The above performance times are for the fastest instructions in this category and error-free programs.

A.8.2 Timers, counters and code blocks supported by CPU 1217C

Table A- 90 Blocks, timers and counters supported by CPU 1217C

Element		Description
Blocks	Type	OB, FB, FC, DB
	Size	64 Kbytes
	Quantity	Up to 1024 blocks total (OBs + FBs + FCs + DBs)
	Address range for FBs, FCs, and DBs	FB and FC: 1 to 65535 (such as FB 1 to FB 65535) DB: 1 to 59999
	Nesting depth	16 from the program cycle or startup OB 6 from any interrupt event OB[1]
	Monitoring	Status of 2 code blocks can be monitored simultaneously
OBs	Program cycle	Multiple
	Startup	Multiple
	Time-delay interrupts	4 (1 per event)
	Cyclic interrupts	4 (1 per event)
	Hardware interrupts	50 (1 per event)
	Time error interrupts	1
	Diagnostic error interrupts	1
	Pull or plug of modules	1
	Rack or station failure	1
	Time of day	Multiple
	Status	1
	Update	1
	Profile	1
	MC-Interpolator	1
	MC-Servo	1
	MC-PreServo	1
	MC-PostServo	1
Timers	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, 16 bytes per timer
Counters	Type	IEC
	Quantity	Limited only by memory size
	Storage	Structure in DB, size dependent upon count type • SInt, USInt: 3 bytes • Int, UInt: 6 bytes • DInt, UDInt: 12 bytes

[1] Safety programs use two nesting levels. The user program therefore has a nesting depth of four in safety programs.

Table A- 91 Communication

Technical data	Description
Number of ports	2
Type	Ethernet
HMI device	4
Programming device (PG)	1
Connections	• 8 connections for Open User Communication (active or passive): TSEND_C, TRCV_C, TCON, TDISCON, TSEND, and TRC • 8 CPU-to-CPU connections (client or server) for GET/PUT data • 6 connections for dynamic allocation to either GET/PUT or Open User Communication
Data rates	10/100 Mb/s
Isolation (external signal logic)	Transformer isolated, 1500 V AC (type test)[1]
Cable type	CAT5e shielded
Interfaces	
Number of PROFINET interfaces	1
Number of interfaces PROFIBUS	0
Interface	
Interface hardware	
Number of ports	2
Integrated switch	Yes
RJ-45 (Ethernet)	Yes; X1
Protocols	
PROFINET IO controller	Yes
PROFINET IO device	Yes
SIMATIC communication	Yes
Open IE communication	Yes
Web server	Yes
Media redundancy	Yes
PROFINET IO controller	
Services	
PG/OP communication	Yes
S7 routing	Yes
Isochronous mode	No
Open IE communication	Yes
IRT	No
MRP	Yes as MRP client
PROFIenergy	Yes. The S7-1200 CPU only supports the PROFIenergy entity (with I-device functionality).
Prioritized startup	Yes (max. 16 PROFINET devices)
Number of connectable I/O devices max.	16
Number of IO devices that you can connect for RT, max.	16

Technical data		Description
Of which are in line, max.		16
Number of IO devices that can be activated/ deactivated simultaneously, max.		8
Update times		The minimum value of the update time also depends on the communication component set for PROFINET IO, on the number of IO devices, and the quantity of configured user data.
With RT		
Send clock of 1 ms		1 ms to 512 ms
PROFINET IO device		
Services		
PG/OP communication		Yes
S7 routing		Yes
Isochronous mode		No
Open IE communication		Yes
IRT, supported		No
MRP, supported		Yes
PROFIenergy		Yes
Shared device		Yes
Number of IO controllers with shared device, max.		2
SIMATIC communication		
S7 communication, as server		Yes
S7 communication, as client		Yes
User data per job, max.		See online help (S7 communication, user data size)
Open IE communication		
TCP/IP:		Yes
	Data length, max.	8 KB
	Several passive connections per port, supported	Yes
ISO-on-TCP (RFC1006):		Yes
	Data length, max.	8 KB
UDP:		Yes
	Data length, max.	1472 bytes
DHCP		No
SNMP		Yes
DCP		Yes
LLDP		Yes

[1] Ethernet port isolation is designed to limit hazard during short term network faults to hazardous voltages. It does not conform to safety requirements for routine AC line voltage isolation.

Table A- 92 Power supply

Technical data		**CPU 1217C DC/DC/DC**
Voltage range		20.4 V DC to 28.8 V DC
Line frequency		--
Input current (max. load)	CPU only	600 mA at 24 V DC
	CPU with all expansion accessories	1600 mA at 24 V DC
Inrush current (max.)		12 A at 28.8 V DC
I^2t		0.5 A^2s
Isolation (input power to logic)		Not isolated
Hold up time (from loss of power)		10 ms at 24 V DC
Internal fuse, not user replaceable		3 A, 250 V, slow blow

Table A- 93 Sensor power

Technical data	**CPU 1217C DC/DC/DC**
Voltage range	L+ minus 4 V DC min.
Output current rating (max.)	400 mA (short-circuit protected)
Maximum ripple noise (<10 MHz)	Same as input line
Isolation (CPU logic to sensor power)	Not isolated

A.8.3 Digital inputs and outputs

Table A- 94 Digital inputs

Technical data	**CPU 1217C DC/DC/DC**
Number of inputs	14: total: 10: Sink/source (IEC Type 1 sink) 4: Differential (RS422/RS485)
Type: Sink/source (IEC Type 1 sink)	Ia.0 to Ia.7, Ib.0 to Ib.1
Rated voltage	24 V DC at 4 mA, nominal
Continuous permissible voltage	30 V DC, max.
Surge voltage	35 V DC for 0.5 sec.
Logic 1 signal (min.)	15 V DC at 2.5 mA
Logic 0 signal (max.)	5 V DC at 1 mA
Isolation (field side to logic)	707 V DC (type test)
Isolation groups	1
Filter times	us settings: 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0 ms settings: 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0

Technical data	**CPU 1217C DC/DC/DC**
HSC clock input rates (max.) (Logic 1 Level = 15 to 26 V DC)	100/80 kHz (Ia.0 to Ia.5) 30/20 kHz (Ia.6 to Ib.1)
Type: Differential input (RS422/RS485)	Ib.2 to Ib.5 (.2+ .2- to .5+ .5-)
Common mode voltage range	-7 V to +12 V, 1 second, 3 VRMS continuous (RS422/RS485 characteristics)
Built-in termination and bias	390 Ω to 2M on Ib'-', 390 Ω to +5 V on Ib'-', (biased OFF when T/B open-circuit) 220 Ω between Ib'+' and Ib'-'
Receiver input impedance	100 Ω including bias and termination
Differential receiver threshold/sensitivity	+/- 0.2 V min., 60 mV typical hysteresis (RS422/RS485 characteristics)
Isolation (field side to logic)	707 V DC (type test)
Isolation groups	1
Filter times	us settings: 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0 ms settings: 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0
HSC clock input rates (max.)	Single phase: 1 MHz (Ib.2 to Ib.5) Quadrature phase: 1 MHz (Ib.2 to Ib.5)
Differential input channel-to-channel skew	40 ns max.
General specifications (all digital inputs)	
Number of inputs on simultaneously	5 Sink/source inputs (no adjacent points) and 4 differential inputs at 60 °C horizontal or 50 °C vertical 14 at 55 °C horizontal or 45 °C vertical
Cable length (meters)	500 m shielded, 300 m unshielded 50 m shielded for HSC inputs (sink/source) 50 m shielded, twisted pair for all differential inputs

Table A- 95 CPU 1217C Digital input (DI) H/W configuration table

Input	Type and rate
DIa.0	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 100 kHz max.
DIa.1	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 100 kHz max.
DIa.2	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 100 kHz max.
DIa.3	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 100 kHz max.
DIa.4	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 100 kHz max.
DIa.5	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 100 kHz max.
DIa.6	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 30 kHz max.
DIa.7	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 30 kHz max.
DIb.0	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 30 kHz max.
DIb.1	Type: 24 V, source-sink Type 1 input High-speed counter input rate: 30 kHz max.
DIb.2+ .2-	Type: RS422/RS485 differential input High-speed counter input rate: 1 MHz max.
DIb.3+ .3-	Type: RS422/RS485 differential input High-speed counter input rate: 1 MHz max.
DIb.4+ .4-	Type: RS422/RS485 differential input High-speed counter input rate: 1 MHz max.
DIb.5+ .5-	Type: RS422/RS485 differential input High-speed counter input rate: 1 MHz max.

Table A- 96 Digital outputs

Technical data	**CPU 1217C DC/DC/DC**
Number of outputs	10 total 6: Solid state - MOSFET (sourcing) 4: Differential (RS422/RS485)
Type: Solid state - MOSFET (sourcing output)	Qa.4 to Qb.1
Voltage range	20.4 to 28.8 V DC
Logic 1 signal at max. current	20 V DC min.
Logic 0 signal with 10 KΩ load	0.1 V DC max.
Current (max.)	0.5 A
Lamp load	5 W
ON state resistance	0.6 Ω max.
Leakage current per point	10 µA max.
Surge current	8 A for 100 ms max.
Overload protection	No
Isolation (field side to logic)	707 V DC (type test)
Isolation groups	1
Inductive clamp voltage	L+ minus 48 V DC, 1 W dissipation
Switching delay (Qa.4 to Qb.1)	1.0 µs max., off to on 3.0 µs max., on to off
Maximum relay switching frequency	--
Pulse Train Output rate	100 kHz max. (Qa.4 to Qb.1)[1], 2 Hz min.
Type: Differential output (RS422/RS485)	Qa.0 to Qa.3 (.0+ 0- to .3+ .3-)
Common mode voltage range	-7 V to +12 V, 1 second, 3 VRMS continuous (RS422/RS485 characteristics)
Transmitter differential output voltage	2 V min. at RL = 100 Ω, 1.5 V min. at RL = 54 Ω (RS422/RS485 characteristics)
Built-in termination	100 Ω between Qa'+' and Qa'-'
Driver output impedance	100 Ω including termination
Isolation (field side to logic)	707 V DC (type test)
Isolation groups	1
Switching delay (DQa.0 to DQa.3)	100 ns max.
Differential output channel-to-channel skew	40 ns max.
Pulse train output rate	1 MHz (Qa.0 to Qa.3), 2 Hz min.
General specifications (all digital outputs)	
Behavior on RUN to STOP	Last value or substitute value (default value 0)

Technical data	CPU 1217C DC/DC/DC
Number of outputs on simultaneously	3 Solid state - MOSFET (sourcing) outputs (no adjacent points) and 4 differential outputs at 60 °C horizontal or 50 °C vertical 10 at 55 °C horizontal or 45 °C vertical
Cable length (meters)	500 m shielded, 150 m unshielded

[1] Depending on your pulse receiver and cable, an additional load resistor (at least 10% of rated current) may improve pulse signal quality and noise immunity.

Table A- 97 CPU 1217C Digital output (DQ) H/W configuration table

Output	Type and rate
DQa.0+ .0-	Type: RS422/RS485 differential output Pulse train output rate: 1 MHz max., 2 Hz min.
DQa.1+ .1-	Type: RS422/RS485 differential output Pulse train output rate: 1 MHz max., 2 Hz min.
DQa.2+ .2-	Type: RS422/RS485 differential output Pulse train output rate: 1 MHz max., 2 Hz min.
DQa.3+ .3-	Type: RS422/RS485 differential output Pulse train output rate: 1 MHz max., 2 Hz min.
DQa.4	Type: 24 V Sourcing output Pulse train output rate: 100 kHz max., 2 Hz min.
DQa.5	Type: 24 V Sourcing output Pulse train output rate: 100 kHz max., 2 Hz min.
DQa.6	Type: 24 V Sourcing output Pulse train output rate: 100 kHz max., 2 Hz min.
DQa.7	Type: 24 V Sourcing output Pulse train output rate: 100 kHz max., 2 Hz min.
DQb.0	Type: 24 V Sourcing output Pulse train output rate: 100 kHz max., 2 Hz min.
DQb.1	Type: 24 V Sourcing output Pulse train output rate: 100 kHz max., 2 Hz min.

A.8.4 Analog inputs and outputs

A.8.4.1 Analog input specifications

Table A- 98 Analog inputs

Technical data	Description
Number of inputs	2
Type	Voltage (single-ended)
Full-scale range	0 to 10 V
Full-scale range (data word)	0 to 27648
Overshoot range	10.001 to 11.759 V
Overshoot range (data word)	27649 to 32511
Overflow range	11.760 to 11.852 V
Overflow range (data word)	32512 to 32767
Resolution	10 bits
Maximum withstand voltage	35 V DC
Smoothing	None, Weak, Medium, or Strong See the table for Step response (ms) for the analog inputs of the CPU (Page 1422).
Noise rejection	10, 50, or 60 Hz
Impedance	≥100 KΩ
Isolation (field side to logic)	None
Accuracy (25 °C / -20 to 60 °C)	3.0% / 3.5% of full-scale
Cable length (meters)	100 m, shielded twisted pair

A.8.4.2 Step response of built-in analog inputs of the CPU

Table A- 99 Step Response (ms), 0 V to 10 V measured at 95%

Smoothing selection (sample averaging)	Rejection frequency (Integration time)		
	60 Hz	50 Hz	10 Hz
None (1 cycle): No averaging	50 ms	50 ms	100 ms
Weak (4 cycles): 4 samples	60ms	70 ms	200 ms
Medium (16 cycles): 16 samples	200 ms	240 ms	1150 ms
Strong (32 cycles): 32 samples	400 ms	480 ms	2300 ms
Sample time	**4.17 ms**	**5 ms**	**25 ms**

A.8.4.3 Sample time for the built-in analog ports of the CPU

Table A- 100 Sample time for built-in analog inputs of the CPU

Rejection frequency (Integration time selection)	Sample time
60 Hz (16.6 ms)	4.17 ms
50 Hz (20 ms)	5 ms
10 Hz (100 ms)	25 ms

A.8.4.4 Measurement ranges of the analog inputs for voltage (CPUs)

Table A- 101 Analog input representation for voltage (CPUs)

System		Voltage Measuring Range	
Decimal	Hexadecimal	0 to 10 V	
32767	7FFF	11.852 V	Overflow
32512	7F00		
32511	7EFF	11.759 V	Overshoot range
27649	6C01		
27648	6C00	10 V	Rated range
20736	5100	7.5 V	
34	22	12 mV	
0	0	0 V	
Negative values		Negative values are not supported	

A.8.4.5 Analog output specifications

Table A- 102 Analog outputs

Technical data	Description
Number of outputs	2
Type	Current
Full-scale range	0 to 20 mA
Full-scale range (data word)	0 to 27648
Overshoot range	20.01 to 23.52 mA
Overshoot range (data word)	27649 to 32511
Overflow range	see footnote [1]
Overflow range data word	32512 to 32767
Resolution	10 bits
Output drive impedance	≤500 Ω max.
Isolation (field side to logic)	None
Accuracy (25 °C / -20 to 60 °C)	3.0% / 3.5% of full-scale
Settling time	2 ms
Cable length (meters)	100 m, shielded twisted pair

[1] In an overflow condition, analog outputs will behave according to the device configuration properties settings. In the "Reaction to CPU STOP" parameter, select either: "Use substitute value" or "Keep last value".

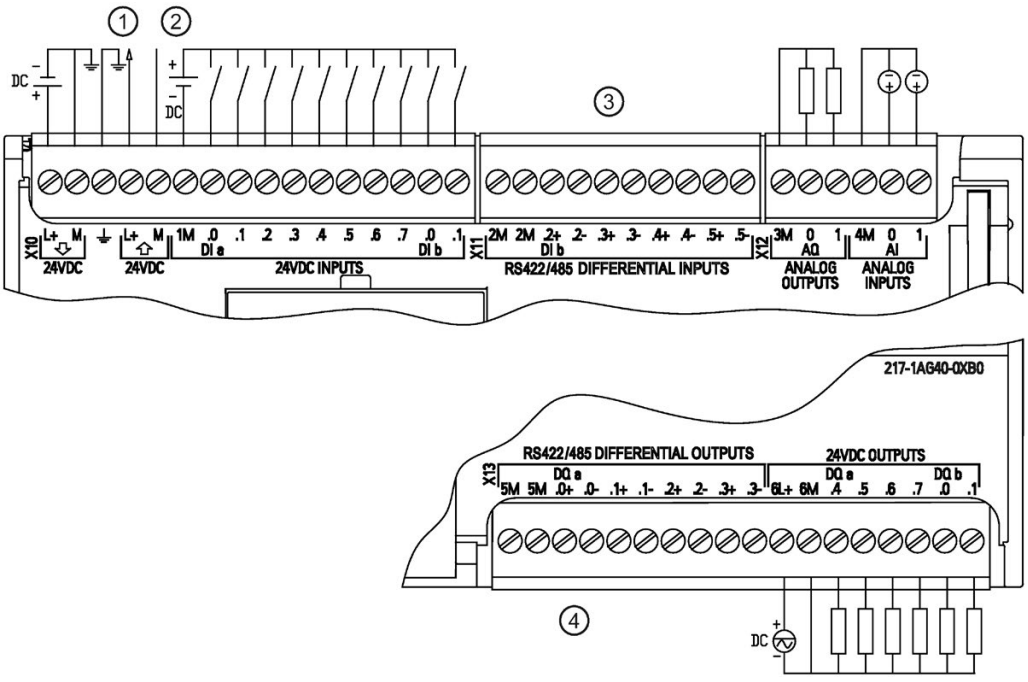
Table A- 103 Analog output representation for current (CPU 1215C and CPU 1217C)

System		Current output range	
Decimal	Hexadecimal	0 mA to 20 mA	
32767	7FFF	See note 1	Overflow
32512	7F00	See note 1	
32511	7EFF	23.52 mA	Overshoot range
27649	6C01		
27648	6C00	20 mA	Rated range
20736	5100	15 mA	
34	22	0.0247 mA	
0	0	0 mA	
Negative values		Negative values are not supported	

[1] In an overflow condition, analog outputs will behave according to the device configuration properties settings. In the "Reaction to CPU STOP" parameter, select either: "Use substitute value" or "Keep last value".

A.8.5 CPU 1217C wiring diagrams

Table A- 104 CPU 1217C DC/DC/DC (6ES7217-1AG40-0XB0)



①	24 V DC Sensor Power Out For additional noise immunity, connect "M" to chassis ground even if not using sensor supply.
②	For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".
③	See CPU 1217C Differential input (DI) detail and application example (Page 1427).
④	See CPU 1217C Differential output (DQ) detail and application example (Page 1428).
Note 1: X12 connectors must be gold. See Appendix C, Spare Parts (Page 1554) for article number.	
Note 2: See Device configuration (Page 149) for information about the Ethernet port of the CPU.	

Table A- 105 Connector pin locations for CPU 1217C DC/DC/DC (6ES7217-1AG40-0XB0)

Pin	X10	X11	X12 (gold)	X13
1	L+ / 24 V DC	2M	3M	5M
2	M / 24 V DC	2M	AQ 0	5M
3	Functional Earth	DI b.2+	AQ 1	DQ a.0+
4	L+ / 24 V DC Sensor Out	DI b.2-	4M	DQ a.0-
5	M / 24 V DC Sensor Out	DI b.3+	AI 0	DQ a.1+
6	1M	DI b.3-	AI 1	DQ a.1-
7	DI a.0	DI b.4+	--	DQ a.2+
8	DI a.1	DI b.4-	--	DQ a.2-
9	DI a.2	DI b.5+	--	DQ a.3+

Pin	X10	X11	X12 (gold)	X13
10	DI a.3	DI b.5-	--	DQ a.3-
11	DI a.4	--	--	6L+
12	DI a.5	--	--	6M
13	DI a.6	--	--	DQ a.4
14	DI a.7	--	--	DQ a.5
15	DI b.0	--	--	DQ a.6
16	DI b.1	--	--	DQ a.7
17	--	--	--	DQ b.0
18	--	--	--	DQ b.1

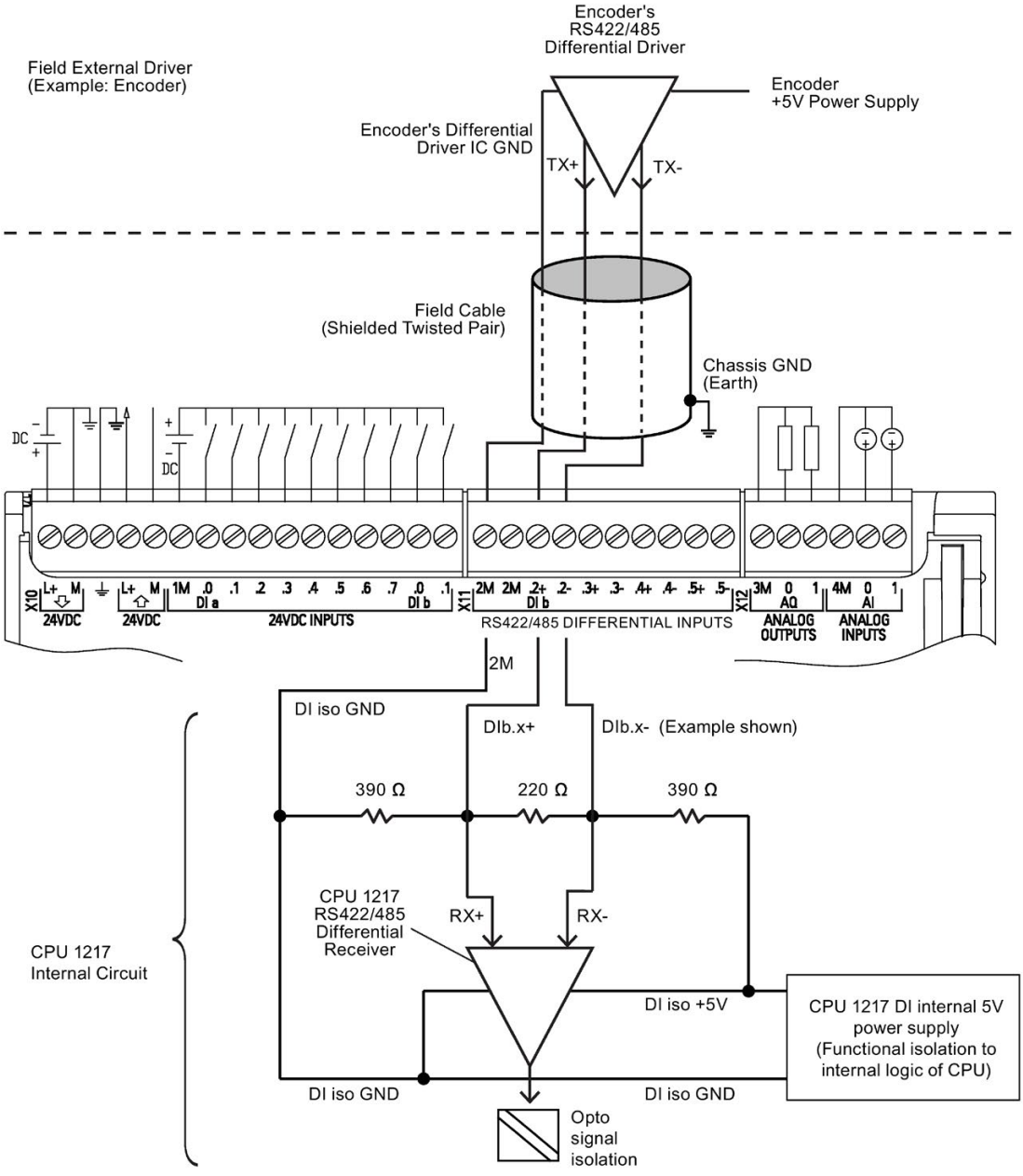
Note

Unused analog inputs should be shorted.

See also

Analog inputs and outputs (Page 1404)

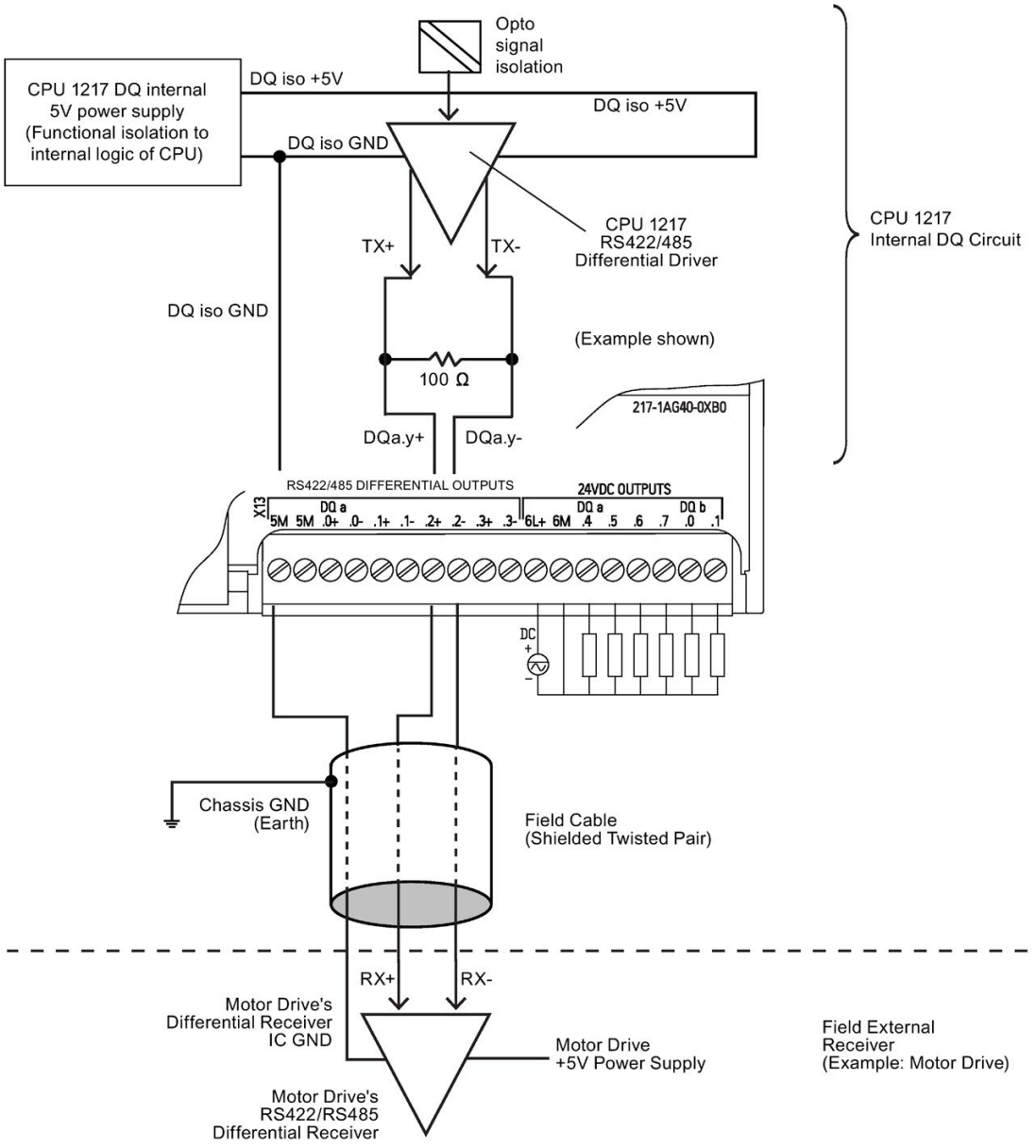
A.8.6 CPU 1217C Differential Input (DI) detail and application example



Notes

- Each differential DI is biased "OFF" when terminal block screws are open-circuit.
- Built-in DI Termination and Bias = 100 Ω equivalent impedance.
- Built-in DI Termination and Bias resistors limit the continuous common mode voltage range. See electrical specifications for detail.

A.8.7 CPU 1217C Differential Output (DQ) detail and application example



Note

- Built-in DQ Termination resistor limits the continuous common mode voltage range. See electrical specifications for detail.

A.9 Digital signal modules (SMs)

A.9.1 SM 1221 digital input specifications

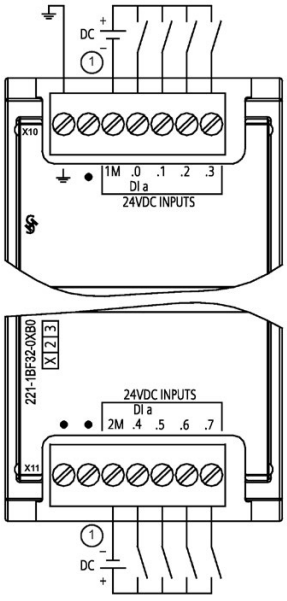
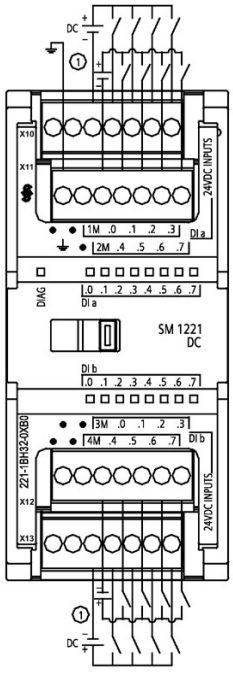
Table A- 106 General specifications

Model	SM 1221 DI 8 x 24 V DC	SM 1221 DI 16 x 24 V DC
Article number	6ES7221-1BF32-0XB0	6ES7221-1BH32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75	
Weight	170 grams	210 grams
Power dissipation	1.5 W	2.5 W
Current consumption (SM Bus)	105 mA	130 mA
Current consumption (24 V DC)	4 mA / input used	

Table A- 107 Digital inputs

Model	SM 1221 DI 8 x 24 V DC	SM 1221 DI 16 x 24 V DC
Number of inputs	8	16
Type	Sink/Source (IEC Type 1 sink)	
Rated voltage	24 V DC at 4 mA, nominal	
Continuous permissible voltage	30 V DC, max.	
Surge voltage	35 V DC for 0.5 sec.	
Logic 1 signal (min.)	15 V DC at 2.5 mA	
Logic 0 signal (max.)	5 V DC at 1 mA	
Isolation (field side to logic)	707 V DC (type test)	
Isolation groups	2	4
Filter times	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms (selectable in groups of 4)	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms (selectable in groups of 4)
Number of inputs on simultaneously	8	16
Cable length (meters)	500 m shielded, 300 unshielded	

Table A- 108 Wiring diagrams for the digital input SMs

SM 1221 DI 8 x 24 V DC (6ES7221-1BF32-0XB0)	SM 1221 DI 16 x 24 V DC (6ES7221-1BH32-0XB0)
	

① For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".

Table A- 109 Connector pin locations for SM 1221 DI 8 x 24 V DC (6ES7221-1BF32-0XB0)

Pin	X10	X11
1	Functional Earth	No connection
2	No connection	No connection
3	1M	2M
4	DI a.0	DI a.4
5	DI a.1	DI a.5
6	DI a.2	DI a.6
7	DI a.3	DI a.7

Table A- 110 Connector pin locations for SM 1221 DI 16 x 24 V DC (6ES7221-1BH32-0XB0)

Pin	X10	X11	X12	X13
1	No connection	Functional Earth	No connection	No connection
2	No connection	No connection	No connection	No connection
3	1M	2M	3 M	4 M
4	DI a.0	DI a.4	DI b.0	DI b.4
5	DI a.1	DI a.5	DI b.1	DI b.5
6	DI a.2	DI a.6	DI b.2	DI b.6
7	DI a.3	DI a.7	DI b.3	DI b.7

A.9.2 SM 1222 8-point digital output specifications

Table A- 111 General specifications

Model	SM 1222 DQ 8 x Relay	SM 1222 DQ 8 Relay Changeover	SM 1222 DQ 8 x 24 V DC
Article number	6ES7222-1HF32-0XB0	6ES7222-1XF32-0XB0	6ES7222-1BF32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75	70 x 100 x 75	45 x 100 x 75
Weight	190 grams	310 grams	180 grams
Power dissipation	4.5 W	5 W	1.5 W
Current consumption (SM Bus)	120 mA	140 mA	120 mA
Current consumption (24 V DC)	11 mA / Relay coil used	16.7 mA/Relay coil used	50 mA

Table A- 112 Digital outputs

Model	SM 1222 DQ 8 x Relay	SM 1222 DQ 8 Relay Changeover	SM 1222 DQ 8 x 24 V DC
Number of outputs	8	8	8
Type	Relay, mechanical	Relay change over contact	Solid state - MOSFET (sourcing)
Voltage range	5 to 30 V DC or 5 to 250 V AC	5 to 30 V DC or 5 to 250 V AC	20.4 to 28.8 V DC
Logic 1 signal at max. current	--	--	20 V DC min.
Logic 0 signal with 10K Ω load	--	--	0.1 V DC max
Current (max.)	2.0 A	2.0 A	0.5 A
Lamp load	30 W DC/200 W AC	30 W DC/200 W AC	5 W
ON state contact resistance	0.2 Ω max. when new	0.2 Ω max. when new	0.6 Ω max.
Leakage current per point	--	--	10 µA max.
Surge current	7 A with contacts closed	7 A with contacts closed	8 A for 100 ms max.
Overload protection	No	No	
Isolation (field side to logic)	1500 V AC (coil to contact) None (coil to logic)	1500 V AC (coil to contact)	707 V DC (type test)
Isolation groups	2	8	1
Current per common (max.)	10 A	2 A	4 A
Inductive clamp voltage	--	--	L+ minus 48 V, 1 W dissipation
Switching delay	10 ms max.	10 ms max.	50 µs max. off to on 200 µs max. on to off
Maximum relay switching frequency	1 Hz	1 Hz	--
Lifetime mechanical (no load)	10,000,000 open/close cycles	10,000,000 open/close cycles	--
Lifetime contacts at rated load (N.O. contact)	100,000 open/close cycles	100,000 open/close cycles	--
Behavior on RUN to STOP	Last value or substitute value (default value 0)	Last value or substitute value (default value 0)	Last value or substitute value (default value 0)
Number of outputs on simultaneously	8	• 4 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 8 at 55 °C horizontal or 45 °C vertical	8
Cable length (meters)	500 m shielded, 150 m unshielded	500 m shielded, 150 m unshielded	500 m shielded, 150 m unshielded

A.9.3 SM 1222 16-point digital output specifications

Table A- 113 General specifications

Model	SM 1222 DQ 16 x Relay	SM 1222 DQ 16 x 24 V DC
Article number	6ES7222-1HH32-0XB0	6ES7222-1BH32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75	45 x 100 x 75
Weight	260 grams	220 grams
Power dissipation	8.5 W	2.5 W
Current consumption (SM Bus)	135 mA	140 mA
Current consumption (24 V DC)	11 mA / Relay coil used	100 mA

Table A- 114 Digital outputs

Model	SM 1222 DQ 16 x Relay	SM 1222 DQ 16 x 24 V DC
Number of outputs	16	16
Type	Relay, mechanical	Solid state - MOSFET (sourcing)
Voltage range	5 to 30 V DC or 5 to 250 V AC	20.4 to 28.8 V DC
Logic 1 signal at max. current	-	20 V DC min.
Logic 0 signal with 10K Ω load	-	0.1 V DC max.
Current (max.)	2.0 A	0.5 A
Lamp load	30 W DC/200 W AC	5 W
ON state contact resistance	0.2 Ω max. when new	0.6 Ω max.
Leakage current per point	--	10 µA max.
Surge current	7 A with contacts closed	8 A for 100 ms max.
Overload protection	No	
Isolation (field side to logic)	1500 V AC (coil to contact) None (coil to logic)	707 V DC (type test)
Isolation groups	4	1
Current per common (max.)	10 A	8 A
Inductive clamp voltage	-	L+ minus 48 V, 1 W dissipation
Switching delay	10 ms max.	50 µs max. off to on 200 µs max. on to off
Maximum relay switching frequency	1 Hz	-
Lifetime mechanical (no load)	10,000,000 open/close cycles	-
Lifetime contacts at rated load (N.O. contact)	100,000 open/close cycles	-
Behavior on RUN to STOP	Last value or substitute value (default value 0)	Last value or substitute value (default value 0)

Model	SM 1222 DQ 16 x Relay	SM 1222 DQ 16 x 24 V DC
Number of outputs on simultaneously	• 8 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 16 at 55 °C horizontal or 45 °C vertical	16
Cable length (meters)	500 m shielded, 150 m unshielded	

Table A- 115 Wiring diagrams for the 8-point digital output SMs

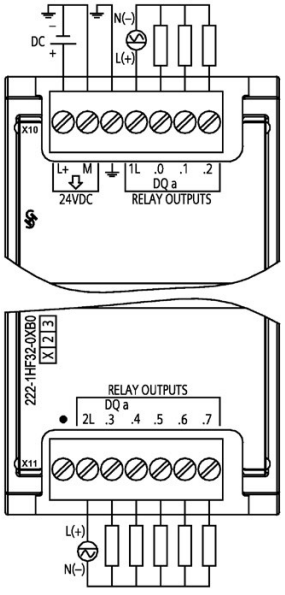
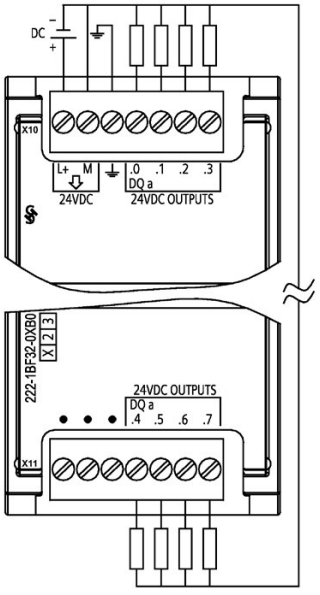
SM 1222 DQ 8 x Relay (6ES7222-1HF32-0XB0)	SM 1222 DQ 8 x 24 V DC (6ES7222-1BF32-0XB0)
	

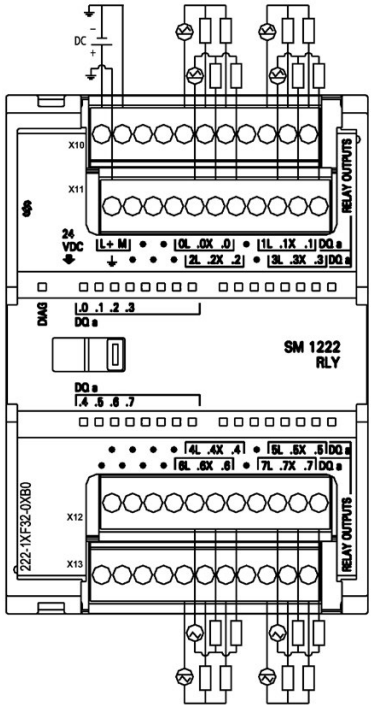
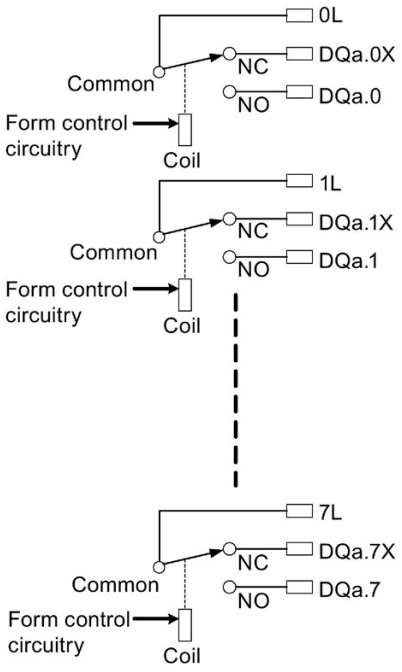
Table A- 116 Connector pin locations for SM 1222 DQ 8 x Relay (6ES7222-1HF32-0XB0)

Pin	X10	X11
1	L+ / 24 V DC	No connection
2	M / 24 V DC	2L
3	Functional Earth	DQ a.3
4	1L	DQ a.4
5	DQ a.0	DQ a.5
6	DQ a.1	DQ a.6
7	DQ a.2	DQ a.7

Table A- 117 Connector pin locations for SM 1222 DQ 8 x 24 V DC (6ES7222-1BF32-0XB0)

Pin	X10	X11
1	L+ / 24 V DC	No connection
2	M / 24 V DC	No connection
3	Functional Earth	No connection
4	DQ a.0	DQ a.4
5	DQ a.1	DQ a.5
6	DQ a.2	DQ a.6
7	DQ a.2	DQ a.7

Table A- 118 Wiring diagram for the 8-point digital output relay changeover SM

SM 1222 DQ 8 x Relay Changeover (6ES7222-1XF32-0XB0)	
	

A changeover relay output controls two circuits using a common terminal: one normally closed contact, and one normally open contact. Using output "0" as an example, when the output point is OFF, the common (0L) is connected to the normally closed contact (.0X) and disconnected from the normally open contact (.0). When the output point is ON, the common (0L) is disconnected from the normally closed contact (.0X) and connected to the normally open contact (.0).

Table A- 119 Connector pin locations for SM 1222 DQ 8 x Relay Changeover (6ES7222-1XF32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	Functional Earth	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	No connection	No connection	No connection	No connection
4	No connection	No connection	No connection	No connection
5	0L	2L	4L	6L
6	DQ a.0X	DQ a.2X	DQ a.4X	DQ a.6X
7	DQ a.0	DQ a.2	DQ a.4	DQ a.6
8	No connection	No connection	No connection	No connection
9	1L	3L	5L	7L
10	DQ a.1X	DQ a.3X	DQ a.5X	DQ a.7X
11	DQ a.1	DQ a.3	DQ a.5	DQ a.7

Table A- 120 Wiring diagrams for the 16-point digital output SMs

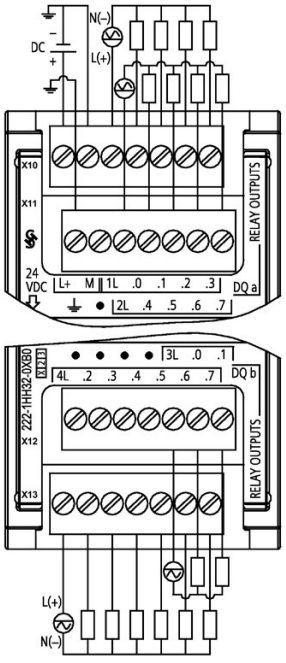
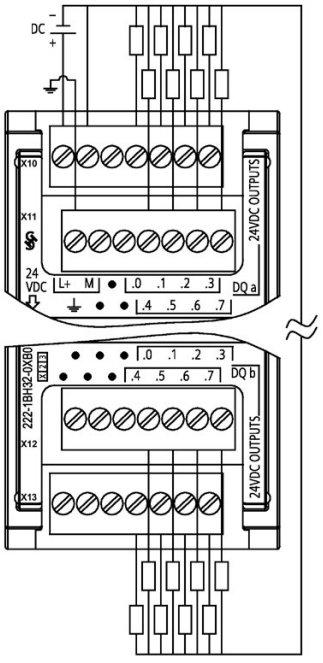
SM 1222 DQ 16 x Relay (6ES7222-1HH32-0XB0)	SM 1222 DQ 16 x 24 V DC (6ES7222-1BH32-0XB0)
	

Table A- 121 Connector pin locations for SM 1222 DQ 16 x Relay (6ES7222-1HH32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	Functional Earth	No connection	4L
2	M / 24 V DC	No connection	No connection	DQ b.2
3	1L	2L	No connection	DQ b.3
4	DQ a.0	DQ a.4	No connection	DQ b.4
5	DQ a.1	DQ a.5	3L	DQ b.5
6	DQ a.2	DQ a.6	DQ b.0	DQ b.6
7	DQ a.3	DQ a.7	DQ b.1	DQ b.7

Table A- 122 Connector pin locations for SM 1222 DQ 16 x 24 V DC (6ES7222-1BH32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	Functional Earth	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	No connection	No connection	No connection	No connection
4	DQ a.0	DQ a.4	DQ b.0	DQ b.4
5	DQ a.1	DQ a.5	DQ b.1	DQ b.5
6	DQ a.2	DQ a.6	DQ b.2	DQ b.6
7	DQ a.3	DQ a.7	DQ b.3	DQ b.7

A.9.4 SM 1223 digital input/output V DC specifications

Table A- 123 General specifications

Model	**SM 1223 DI 8 x 24 V DC, DQ 8 x Relay**	**SM 1223 DI 16 x 24 V DC, DQ 16 x Relay**	**SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC**	**SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC**
Article number	6ES7223-1PH32-0XB0	6ES7223-1PL32-0XB0	6ES7223-1BH32-0XB0	6ES7223-1BL32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75	70 x 100 x 75	45 x 100 x 75	70 x 100 x 75
Weight	230 grams	350 grams	210 grams	310 grams
Power dissipation	5.5 W	10 W	2.5 W	4.5 W
Current consumption (SM Bus)	145 mA	180 mA	145 mA	185 mA
Current consumption (24 V DC)	4 mA / Input used 11 mA / Relay coil used		150 mA	200 mA

Table A- 124 Digital inputs

Model	**SM 1223 DI 8 x 24 V DC, DQ 8 x Relay**	**SM 1223 DI 16 x 24 V DC, DQ 16 x Relay**	**SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC**	**SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC**
Number of inputs	8	16	8	16
Type	Sink/Source (IEC Type 1 sink)	Sink/Source (IEC Type 1 sink)	Sink/Source (IEC Type 1 sink)	Sink/Source (IEC Type 1 sink)
Rated voltage	24 V DC at 4 mA, nominal	24 V DC at 4 mA, nominal	24 V DC at 4 mA, nominal	24 V DC at 4 mA, nominal
Continuous permissible voltage	30 V DC max.	30 V DC max.	30 V DC max.	30 V DC max.
Surge voltage	35 V DC for 0.5 sec.	35 V DC for 0.5 sec.	35 V DC for 0.5 sec.	35 V DC for 0.5 sec.
Logic 1 signal (min.)	15 V DC at 2.5 mA	15 V DC at 2.5 mA	15 V DC at 2.5 mA	15 V DC at 2.5 mA
Logic 0 signal (max.)	5 V DC at 1 mA	5 V DC at 1 mA	5 V DC at 1 mA	5 V DC at 1 mA
Isolation (field side to logic)	707 V DC (type test)	707 V DC (type test)	707 V DC (type test)	707 V DC (type test)
Isolation groups	2	2	2	2
Filter times	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of 4	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of 4	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of 4	0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ms, selectable in groups of 4

Model	SM 1223 DI 8 x 24 V DC, DQ 8 x Relay	SM 1223 DI 16 x 24 V DC, DQ 16 x Relay	SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC	SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC
Number of inputs on simultaneously	8	• 8 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 16 at 55 °C horizontal or 45 °C vertical	8	16
Cable length (meters)	500 m shielded, 300 m unshielded	500 m shielded, 300 m unshielded	500 m shielded, 300 m un-shielded	500 m shielded, 300 m unshielded

Table A- 125 Digital outputs

Model	SM 1223 DI 8 x 24 V DC, DQ 8 x Relay	SM 1223 DI 16 x 24 V DC, DQ 16 x Relay	SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC	SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC
Number of outputs	8	16	8	16
Type	Relay, mechanical	Relay, mechanical	Solid state - MOSFET (sourc-ing)	Solid state - MOSFET (sourcing)
Voltage range	5 to 30 V DC or 5 to 250 V AC	5 to 30 V DC or 5 to 250 V AC	20.4 to 28.8 V DC	20.4 to 28.8 V DC
Logic 1 signal at max. current	--	--	20 V DC, min.	20 V DC, min.
Logic 0 signal with 10 KΩ load	--	--	0.1 V DC, max.	0.1 V DC, max.
Current (max.)	2.0 A	2.0 A	0.5 A	0.5 A
Lamp load	30 W DC / 200 W AC	30 W DC / 200 W AC	5 W	5 W
ON state contact resistance	0.2 Ω max. when new	0.2 Ω max. when new	0.6 Ω max.	0.6 Ω max.
Leakage current per point	--	--	10 µA max.	10 µA max.
Surge current	7 A with contacts closed	7 A with contacts closed	8 A for 100 ms max.	8 A for 100 ms max
Overload protection	No	No	No	No
Isolation (field side to logic)	1500 V AC (coil to contact) None (coil to logic)	1500 V AC (coil to contact) None (coil to logic)	707 V DC (type test)	707 V DC (type test)
Isolation groups	2	4	1	1
Current per common	10A	8 A	4 A	8 A
Inductive clamp voltage	--	--	L+ minus 48 V, 1 W dissipation	L+ minus 48 V, 1 W dissipation
Switching delay	10 ms max.	10 ms max.	50 µs max. off to on 200 µs max. on to off	50 µs max. off to on200 µs max. on to off

Model	SM 1223 DI 8 x 24 V DC, DQ 8 x Relay	SM 1223 DI 16 x 24 V DC, DQ 16 x Relay	SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC	SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC
Maximum relay switching frequency	1 Hz	1 Hz	--	--
Lifetime mechanical (no load)	10,000,000 open/close cycles	10,000,000 open/close cycles	--	--
Lifetime contacts at rated load (N.O. contact)	100,000 open/close cycles	100,000 open/close cycles	--	--
Behavior on RUN to STOP	Last value or substitute value (default value 0)	Last value or substitute value (default value 0)	Last value or substitute value (default value 0)	Last value or substitute value (default value 0)
Number of outputs on simultaneously	8	• 8 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 16 at 55 °C horizontal or 45 °C vertical	8	16
Cable length (meters)	500 m shielded, 150 m unshielded	500 m shielded, 150 m unshielded	500 m shielded, 150 m unshielded	500 m shielded, 150 m unshielded

Table A- 126 Wiring diagrams for the digital input V DC/output relay SMs

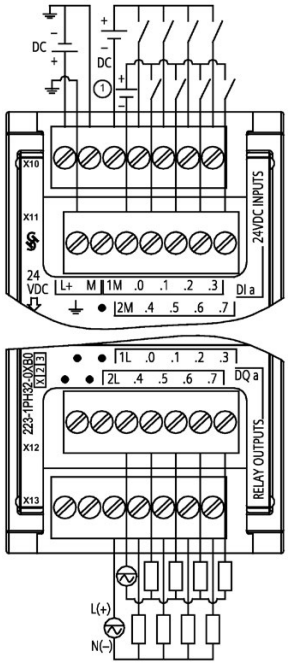
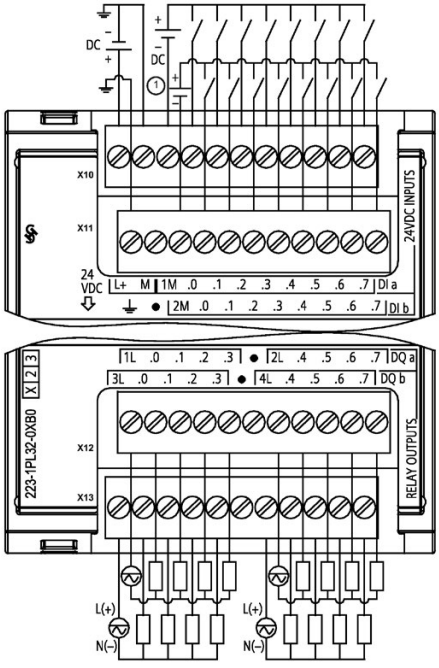
SM 1223 DI 8 x 24 V DC, DQ 8 x Relay (6ES7223-1PH32-0XB0)	SM 1223 DI 16 x 24 V DC, DQ 16 x Relay (6ES7223-1PL32-0XB0)	Notes
		① For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".

Table A- 127 Connector Pin Locations for SM 1223 DI 8 x 24 V DC, DQ 8 x Relay (6ES7223-1PH32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	Functional Earth	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	1M	2M	1L	2L
4	DI a.0	DI a.4	DQ a.0	DQ a.4
5	DI a.1	DI a.5	DQ a.1	DQ a.5
6	DI a.2	DI a.6	DQ a.2	DQ a.6
7	DI a.3	DI a.7	DQ a.3	DQ a.7

Table A- 128 Connector Pin Locations for SM 1223 DI 16 x 24 V DC, DQ 16 x Relay (6ES7223-1PL32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	Functional Earth	1L	3L
2	M / 24 V DC	No connection	DQ a.0	DQ b.0
3	1M	2M	DQ a.1	DQ b.1
4	DI a.0	DI b.0	DQ a.2	DQ b.2
5	DI a.1	DI b.1	DQ a.3	DQ b.3
6	DI a.2	DI b.2	No connection	No connection
7	DI a.3	DI b.3	2L	4L
8	DI a.4	DI b.4	DQ a.4	DQ b.4
9	DI a.5	DI b.5	DQ a.5	DQ b.5
10	DI a.6	DI b.6	DQ a.6	DQ b.6
11	DI a.7	DI b.7	DQ a.7	DQ b.7

Table A- 129 Wiring diagrams for the digital input V DC/output SMs

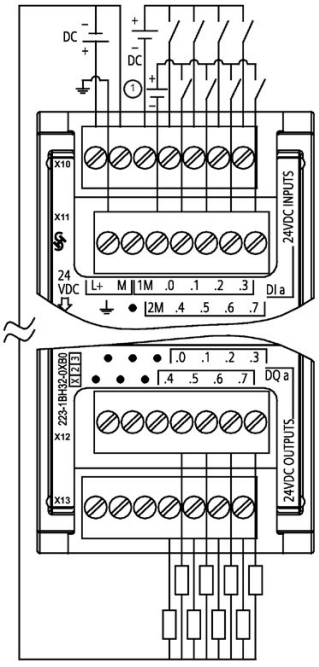
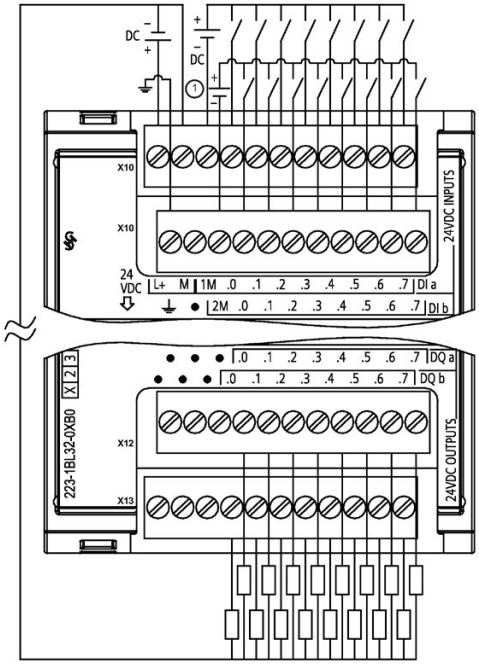
SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC (6ES7223-1BH32-0XB0)	SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC (6ES7223-1BL32-0XB0)	Notes
		① For sinking inputs, connect "-" to "M" (shown). For sourcing inputs, connect "+" to "M".

Table A- 130 Connector Pin Locations for SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC (6ES7223-1BH32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	Functional Earth	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	1M	2M	No connection	No connection
4	DI a.0	DI a.4	DQ a.0	DQ a.4
5	DI a.1	DI a.5	DQ a.1	DQ a.5
6	DI a.2	DI a.6	DQ a.2	DQ a.6
7	DI a.3	DI a.7	DQ a.3	DQ a.7

Table A- 131 Connector Pin Locations for SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC (6ES7223-1BL32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	Functional Earth	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	1M	2M	No connection	No connection
4	DI a.0	DI b.0	DQ a.0	DQ b.0
5	DI a.1	DI b.1	DQ a.1	DQ b.1
6	DI a.2	DI b.2	DQ a.2	DQ b.2
7	DI a.3	DI b.3	DQ a.3	DQ b.3
8	DI a.4	DI b.4	DQ a.4	DQ b.4
9	DI a.5	DI b.5	DQ a.5	DQ b.5
10	DI a.6	DI b.6	DQ a.6	DQ b.6
11	DI a.7	DI b.7	DQ a.7	DQ b.7

A.9.5 SM 1223 digital input/output V AC specifications

Table A- 132 General specifications

Model	SM 1223 DI 8 x120/230 V AC / DQ 8 x Relay
Article number	6ES7223-1QH32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75 mm
Weight	190 grams
Power dissipation	7.5 W
Current consumption (SM Bus)	120 mA
Current consumption (24 V DC)	11 mA per output when on

Table A- 133 Digital inputs

Model	SM 1223 DI 8 x 120/230 V AC / DQ 8 x Relay
Number of inputs	8
Type	IEC Type 1
Rated voltage	120 V AC at 6 mA, 230 V AC at 9 mA
Continuous permissible voltage	264 V AC
Surge voltage	--
Logic 1 signal (min.)	79 V AC at 2.5 mA
Logic 0 signal (max.)	20 V AC at 1 mA
Leakage current (max.)	1 mA
Isolation (field side to logic)	1500 V AC
Isolation groups[1]	4
Input delay times	Typical: 0.2 to 12.8 ms, user selectable Maximum: -
Connection of 2 wire proximity sensor (Bero) (max.)	1 mA
Cable length	Unshielded: 300 meters Shielded: 500 meters
Number of inputs on simultaneously	8

[1] Channels within a group must be of the same phase.

Table A- 134 Digital outputs

Model	**SM 1223 DI 8 x 120/230 V AC / DQ 8 x Relay**
Number of outputs	8
Type	Relay, mechanical
Voltage range	5 to 30 V DC or 5 to 250 V AC
Logic 1 signal at max. current	--
Logic 0 signal with 10K Ω load	--
Current (max.)	2.0 A
Lamp load	30 W DC / 200 W AC
ON state contact resistance	0.2 Ω max. when new
Leakage current per point	--
Surge current	7 A with contacts closed
Overload protection	No
Isolation (field side to logic)	1500 V AC (coil to contact) None (coil to logic)
Isolation groups	2
Current per common (max.)	10 A
Inductive clamp voltage	--
Switching delay (max.)	10 ms
Maximum relay switching frequency	1 Hz
Lifetime mechanical (no load)	10,000,000 open/close cycles
Lifetime contacts at rated load	100,000 open/close cycles
Behavior on RUN to STOP	Last value or substitute value (default value 0)
Number of outputs on simultaneously	• 4 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 8 at 55 °C horizontal or 45 °C vertical
Cable length (meters)	500 m shielded, 150 m unshielded

Table A- 135 SM 1223 DI 8 x 120/230 V AC, DQ 8 x Relay (6ES7223-1QH32-0XB0)

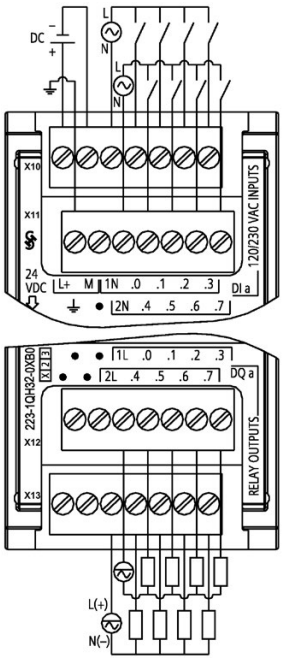


Table A- 136 Connector Pin Locations for SM 1223 DI 8 x 120/240 V AC, DQ 8 x Relay (6ES7223-1QH32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	Functional Earth	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	1N	2N	1L	2L
4	DI a.0	DI a.4	DQ a.0	DQ a.4
5	DI a.1	DI a.5	DQ a.1	DQ a.5
6	DI a.2	DI a.6	DQ a.2	DQ a.6
7	DI a.3	DI a.7	DQ a.3	DQ a.7

A.10 Analog signal modules (SMs)

A.10.1 SM 1231 analog input module specifications

Table A- 137 General specifications

Model	SM 1231 AI 4 x 13 bit	SM 1231 AI 8 x 13 bit	SM 1231 AI 4 x 16 bit
Article number	6ES7231-4HD32-0XB0	6ES7231-4HF32-0XB0	6ES7231-5ND32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75		
Weight	180 grams		
Power dissipation	2.2 W	2.3 W	2.0 W
Current consumption (SM Bus)	80 mA	90 mA	80 mA
Current consumption (24 V DC)	45 mA		65 mA

Table A- 138 Analog inputs

Model	SM 1231 AI 4 x 13 bit	SM 1231 AI 8 x 13 bit	SM 1231 AI 4 x 16 bit
Number of inputs	4	8	4
Type	Voltage or current (differential): Selectable in groups of 2		Voltage or current (differential)
Range	±10 V, ±5 V, ±2.5 V, 0 to 20 mA, or 4 mA to 20 mA		±10 V, ±5 V, ±2.5 V, ±1.25 V, 0 to 20 mA or 4 mA to 20 mA
Full scale range (data word)	-27648 to 27648 voltage / 0 to 27648 current		
Overshoot/undershoot range (data word) Refer to the section on analog input ranges for voltage and current (Page 1458).	Voltage: 32511 to 27649 / -27649 to -32,512 Current: 32511 to 27649 / 0 to -4864		
Overflow/underflow (data word) Refer to the section on input ranges for voltage and current (Page 1458).	Voltage: 32767 to 32512 / -32513 to -32768 Current 0 to 20 mA: 32767 to 32512 / -4865 to -32768 Current 4 to 20 mA: 32767 to 32512 (values below -4864 indicate open wire)		
Resolution1	12 bits + sign bit		15 bits + sign bit
Maximum withstand voltage/current	±35 V / ±40 mA		
Smoothing	None, weak, medium, or strong Refer to the section on step response times (Page 1457).		
Noise rejection	400, 60, 50, or 10 Hz Refer to the section on sample rates (Page 1457).		
Input impedance	≥ 9 MΩ (voltage) / ≥ 270 Ω, < 290 Ω (current)		≥ 1 MΩ (voltage) / < 315 Ω, > 280 Ω (current)

Model	SM 1231 AI 4 x 13 bit	SM 1231 AI 8 x 13 bit	SM 1231 AI 4 x 16 bit
Isolation Field side to logic Logic to 24 V DC Field side to 24 V DC Channel to channel	None		 707 V DC (type test) 707 V DC (type test) 500 V DC (type test) None
Accuracy (25 °C / -20 to 60 °C)	±0.1% / ±0.2% of full scale		±0.1% / ±0.3% of full scale
Measuring principle	Actual value conversion		
Common mode rejection	40 dB, DC to 60 Hz		
Operational signal range[1]	Signal plus common mode voltage must be less than +12 V and greater than -12 V		
Cable length (meters)	100 m, twisted and shielded		

[1] Voltages outside the operational range applied to one channel may cause interference on other channels.

Table A- 139 Diagnostics

Model	SM 1231 AI 4 x 13 bit	SM 1231 AI 8 x 13 bit	SM 1231 AI 4 x 16 bit
Overflow/underflow	Yes		
24 V DC low voltage	Yes		
Open wire	4 to 20 mA range only (if input is below -4864; 1.185 mA)		

SM 1231 current measurment

You can implement current measurement with either a 2-wire transducer or 4-wire transducer as shown in the following figure:

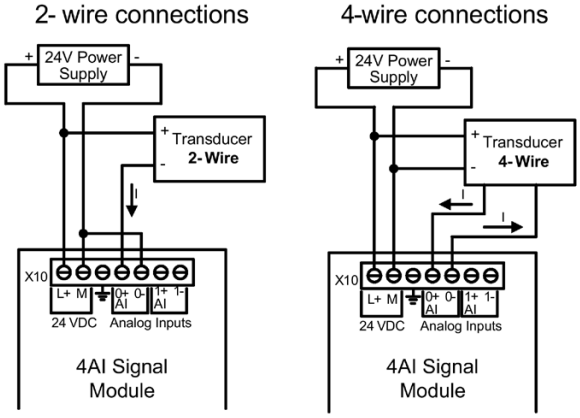


Table A- 140 Wiring diagrams for the analog input SMs

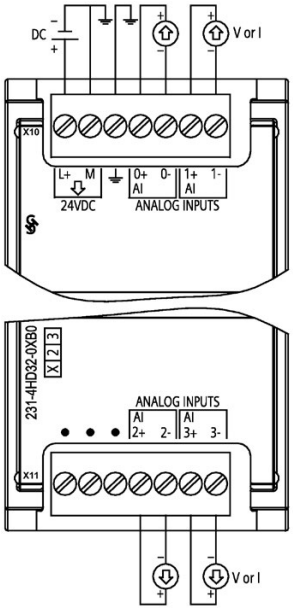
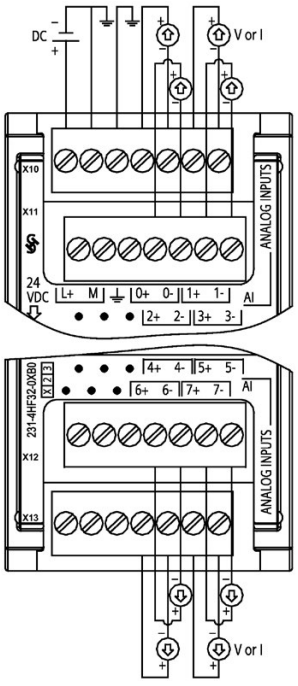
SM 1231 AI 4 x 13 bit (6ES7231-4HD32-0XB0)	SM 1231 AI 8 x 13 bit (6ES7231-4HF32-0XB0)
	
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

Table A- 141 Connector pin locations for SM 1231 AI 4 x 13 bit (6ES7231-4HD32-0XB0)

Pin	X10 (gold)	X11 (gold)
1	L+ / 24 V DC	No connection
2	M / 24 V DC	No connection
3	Functional Earth	No connection
4	AI 0+	AI 2+
5	AI 0-	AI 2-
6	AI 1+	AI 3+
7	AI 1-	AI 3-

Table A- 142 Connector pin locations for SM 1231 AI 8 x 13 bit (6ES7231-4HF32-0XB0)

Pin	X10 (gold)	X11 (gold)	X12 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	Functional Earth	No connection	No connection	No connection
4	AI 0+	AI 2+	AI 4+	AI 6+
5	AI 0-	AI 2-	AI 4-	AI 6-
6	AI 1+	AI 3+	AI 5+	AI 7+
7	AI 1-	AI 3-	AI 5-	AI 7-

Table A- 143 Wiring diagram for the analog input SM

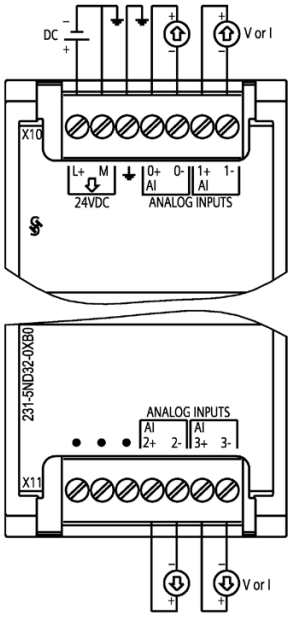
SM 1231 AI 4 x 16 bit (6ES7231-5ND32-0XB0)	
	
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

Table A- 144 Connector pin locations for SM 1231 AI 4 x 16 bit (6ES7231-5ND32-0XB0)

Pin	X10 (gold)	X11 (gold)
1	L+ / 24 V DC	No connection
2	M / 24 V DC	No connection
3	Functional Earth	No connection
4	AI 0+	AI 2+
5	AI 0-	AI 2-
6	AI 1+	AI 3+
7	AI 1-	AI 3-

Note

Unused voltage input channels should be shorted.

Unused current input channels should be set to the 0 to 20 mA range and/or disable broken wire error reporting.

Inputs configured for current mode will not conduct loop current unless the module is powered and configured.

Current input channels will not operate unless external power is supplied to the transmitter.

A.10.2 SM 1232 analog output module specifications

Table A- 145 General specifications

Technical data	SM 1232 AQ 2 x 14 bit	SM 1232 AQ 4 x 14 bit
Article number	6ES7232-4HB32-0XB0	6ES7232-4HD32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75	
Weight	180 grams	
Power dissipation	1.8 W	2.0 W
Current consumption (SM Bus)	80 mA	
Current consumption (24 V DC)	45 mA (no load)	

Table A- 146 Analog outputs

Technical data	SM 1232 AQ 2 x 14 bit	SM 1232 AQ 4 x 14 bit
Number of outputs	2	4
Type	Voltage or current	
Range	±10 V, 0 to 20 mA, or 4 mA to 20 mA	
Resolution	Voltage: 14 bits Current: 13 bits	
Full scale range (data word)	Voltage: -27,648 to 27,648 ; Current: 0 to 27,648 Refer to the output ranges for voltage and current (Page 1460).	
Accuracy (25 °C / -20 to 60 °C)	±0.3% / ±0.6% of full scale	
Settling time (95% of new value)	Voltage: 300 µs (R), 750 µs (1 uF) Current: 600 µs (1 mH), 2 ms (10 mH)	
Load impedance	Voltage: ≥ 1000 Ω Current: ≤ 600 Ω	
Maximum output short circuit current	Voltage mode: ≤ 24 mA Current mode: ≥ 38.5 mA	
Behavior on RUN to STOP	Last value or substitute value (default value 0)	
Isolation (field side to logic)	none	

Technical data	SM 1232 AQ 2 x 14 bit	SM 1232 AQ 4 x 14 bit
Isolation (24 V to output)	none	
Cable length (meters)	100 m twisted and shielded	

Table A- 147 Diagnostics

Technical data	SM 1232 AQ 2 x 14 bit	SM 1232 AQ 4 x 14 bit
Overflow/underflow	Yes	
Short to ground (voltage mode only)	Yes	
Wire break (current mode only)[1]	Yes	
24 V DC low voltage[2]	Yes	

1 Short circuit detection is only possible when the output voltage is less than -0.5 V or greater than +0.5 V.

2 Wire break detection is only possible when the output current is greater than 1 mA.

Table A- 148 Wiring diagrams for the analog output SMs

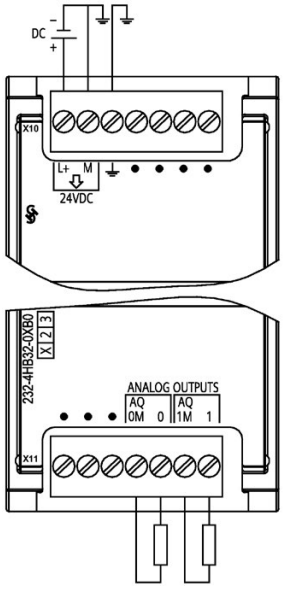
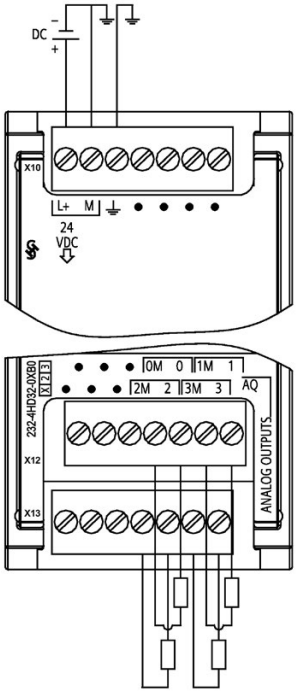
SM 1232 AQ 2 x 14 bit (6ES7232-4HB32-0XB0)	SM 1232 AQ 4 x 14 bit (6ES7232-4HD32-0XB0)
	
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

Table A- 149 Connector pin locations for SM 1232 AQ 2 x 14 bit (6ES7232-4HB32-0XB0)

Pin	X10 (gold)	X11 (gold)
1	L+ / 24 V DC	No connection
2	M / 24 V DC	No connection
3	Functional Earth	No connection
4	No connection	AQ 0M
5	No connection	AQ 0
6	No connection	AQ 1M
7	No connection	AQ 1

Table A- 150 Connector pin locations for SM 1232 AQ 4 x 14 bit (6ES7232-4HD32-0XB0)

Pin	X10 (gold)	X12 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection
2	M / 24 V DC	No connection	No connection
3	Functional Earth	No connection	No connection
4	No connection	AQ 0M	AQ 2M
5	No connection	AQ 0	AQ 2
6	No connection	AQ 1M	AQ 3M
7	No connection	AQ 1	AIQ 3

A.10.3 SM 1234 analog input/output module specifications

Table A- 151 General specifications

Technical data	SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit
Article number	6ES7234-4HE32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75
Weight	220 grams
Power dissipation	2.4 W
Current consumption (SM Bus)	80 mA
Current consumption (24 V DC)	60 mA (no load)

Table A- 152 Analog inputs

Model	SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit
Number of inputs	4
Type	Voltage or Current (differential): Selectable in groups of 2
Range	±10 V, ±5 V, ±2.5 V, 0 to 20 mA, or 4 mA to 20 mA
Full scale range (data word)	-27648 to 27648
Overshoot/undershoot range (data word)	Voltage: 32511 to 27649 / -27649 to -32512 Current: 32511 to 27649 / 0 to -4864 Refer to the section on input ranges for voltage and current (Page 1458).
Overflow/underflow (data word)	Voltage: 32767 to 32512 / -32513 to -32768 Current: 32767 to 32512 / -4865 to -32768 Refer to the section on input ranges for voltage and current (Page 1458).
Resolution	12 bits + sign bit
Maximum withstand voltage/current	±35 V / ±40 mA
Smoothing	None, weak, medium, or strong Refer to the section on step response times (Page 1457).
Noise rejection	400, 60, 50, or 10 Hz Refer to the section on sample rates (Page 1457).
Input impedance	≥ 9 MΩ (voltage) / ≥ 270 Ω, < 290 Ω (current)
Isolation (field side to logic)	None
Accuracy (25 °C / -20 to 60 °C)	±0.1% / ±0.2% of full scale
Analog to digital conversion time	625 µs (400 Hz rejection)
Common mode rejection	40 dB, DC to 60 Hz
Operational signal range[1]	Signal plus common mode voltage must be less than +12 V and greater than -12 V
Cable length (meters)	100 m, twisted and shielded

[1] Voltages outside the operational range applied to one channel may cause interference on other channels.

Table A- 153 Analog outputs

Technical data	SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit
Number of outputs	2
Type	Voltage or current
Range	±10 V or 0 to 20 mA or 4 mA to 20 mA
Resolution	Voltage: 14 bits ; Current: 13 bits
Full scale range (data word)	Voltage: -27648 to 27648; Current: 0 to 27648 Refer to the section on output ranges for voltage and current (Page 1460).
Accuracy (25 °C / -20 to 60 °C)	±0.3% / ±0.6% of full scale
Settling time (95% of new value)	Voltage: 300 µs (R), 750 µs (1 uF) Current: 600 µs (1 mH), 2 ms (10 mH)
Load impedance	Voltage: ≥ 1000 Ω Current: ≤ 600 Ω
Maximum output short circuit current	Voltage mode: ≤ 24 mA Current mode: ≥ 38.5 mA
Behavior on RUN to STOP	Last value or substitute value (default value 0)
Isolation (field side to logic)	none
Isolation (24 V to output)	none
Cable length (meters)	100 m twisted and shielded

Table A- 154 Diagnostics

Model	SM 1234 AI 4 x 13 bit / AQ 2 x 14 bit
Overflow/underflow	Yes
Short to ground (voltage mode only)[1]	Yes on outputs
Wire break (current mode only)[2]	Yes on outputs
24 V DC low voltage	Yes

1 Short circuit detection is only possible when the output voltage is less than -0.5 V or greater than +0.5 V.

2 Wire break detection is only possible when the output current is greater than 1 mA.

SM 1234 current measurement

You can implement current measurement with either a 2-wire transducer or 4-wire transducer as shown in the following figure:

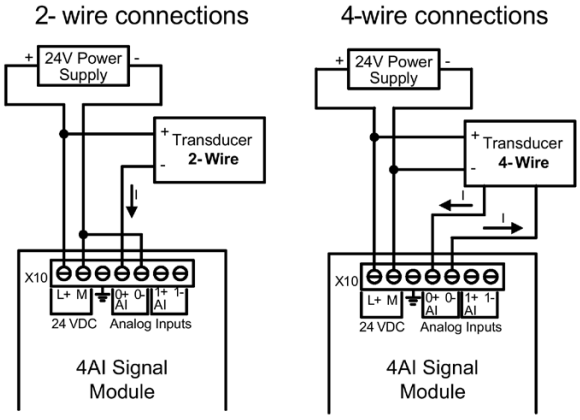


Table A- 155 Wiring diagrams for the analog input/output SM

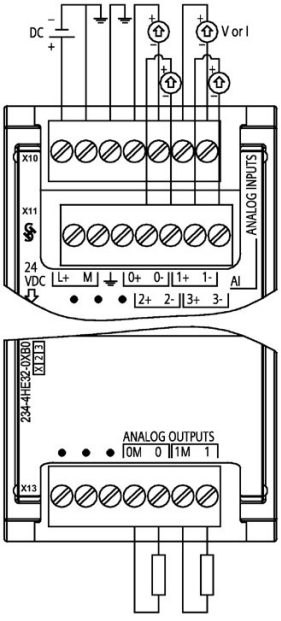
SM 1234 AI 4 x 13 Bit / AQ 2 x 14 bit (6ES7234-4HE32-0XB0)	
	
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

Table A- 156 Connector pin locations for SM 1234 AI 4 x 13 Bit / AQ 2 x 14 bit (6ES7234-4HE32-0XB0)

Pin	X10 (gold)	X11 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection
2	M / 24 V DC	No connection	No connection
3	Functional Earth	No connection	No connection
4	AI 0+	AI 2+	AQ 0M
5	AI 0-	AI 2-	AQ 0
6	AI 1+	AI 3+	AQ 1M
7	AI 1-	AI 3-	AQ 1

Note

Unused voltage input channels should be shorted.

Unused current input channels should be set to the 0 to 20 mA range and/or disable broken wire error reporting.

Inputs configured for current mode will not conduct loop current unless the module is powered and configured.

Current input channels will not operate unless external power is supplied to the transmitter.

A.10.4 Step response of the analog inputs

Table A- 157 Step response (ms), 0 to full-scale measured at 95%

Smoothing selection (sample averaging)	Noise reduction/rejection frequency (Integration time selection)			
	400 Hz (2.5 ms)	60 Hz (16.6 ms)	50 Hz (20 ms)	10 Hz (100 ms)
None (1 cycle): No averaging	4 ms	18 ms	22 ms	100 ms
Weak (4 cycles): 4 samples	9 ms	52 ms	63 ms	320 ms
Medium (16 cycles): 16 samples	32 ms	203 ms	241 ms	1200 ms
Strong (32 cycles): 32 samples	61 ms	400 ms	483 ms	2410 ms

A.10.5 Sample time and update times for the analog inputs

Table A- 158 Sample and module update times for all channels

Rejection frequency (Integration time)	Sample and module update times for all channels			
	400 Hz (2.5 ms)	60 Hz (16.6 ms)	50 Hz (20 ms)	10 Hz (100 ms)
4-channel x 13 bit SM	0.625 ms	4.17 ms	5 ms	25 ms
8-channel x 13 bit SM	1.25 ms	4.17 ms	5 ms	25 ms
4-channel x 16 bit SM	0.417 ms	0.397 ms	0.400 ms	0.400 ms

A.10.6 Measurement ranges of the analog inputs for voltage and current (SB and SM)

Table A- 159 Analog input representation for voltage (SB and SM)

System		Voltage Measuring Range				
Decimal	Hexadecimal	±10 V	±5 V	±2.5 V	±1.25 V	
32767	7FFF[1]	11.851 V	5.926 V	2.963 V	1.481 V	Overflow
32512	7F00					
32511	7EFF	11.759 V	5.879 V	2.940 V	1.470 V	Overshoot range
27649	6C01					
27648	6C00	10 V	5 V	2.5 V	1.250 V	Rated range
20736	5100	7.5 V	3.75 V	1.875 V	0.938 V	
1	1	361.7 µV	180.8 µV	90.4 µV	45.2 µV	
0	0	0 V	0 V	0 V	0 V	
-1	FFFF					
-20736	AF00	-7.5 V	-3.75 V	-1.875 V	-0.938 V	
-27648	9400	-10 V	-5 V	-2.5 V	-1.250 V	
-27649	93FF					Undershoot range
-32512	8100	-11.759 V	-5.879 V	-2.940 V	-1.470 V	
-32513	80FF					Underflow
-32768	8000	-11.851 V	-5.926 V	-2.963 V	-1.481 V	

[1] 7FFF can be returned for one of the following reasons: overflow (as noted in this table), before valid values are available (for example immediately upon a power up), or if a wire break is detected.

Table A- 160 Analog input representation for current (SB and SM)

System		Current measuring range		
Decimal	**Hexadecimal**	**0 mA to 20 mA**	**4 mA to 20 mA**	
32767	7FFF	> 23.52 mA	> 22.81 mA	Overflow
32511	7EFF	23.52 mA	22.81 mA	Overshoot range
27649	6C01			
27648	6C00	20 mA	20 mA	Nominal range
20736	5100	15 mA	16 mA	
1	1	723.4 nA	4 mA + 578.7 nA	
0	0	0 mA	4 mA	
-1	FFFF			Undershoot range
-4864	ED00	-3.52 mA	1.185 mA	
32767[1]	7FFF		< 1.185 mA	Wire break (4 to 20 mA)
-32768	8000	< -3.52 mA		Underflow (0 to 20 mA)

[1] The wire break value of 32767 (16#7FFF) is always returned regardless of the state of the wire break alarm.

See also

Determining the type of wire break condition from an SM 1231 module (Page 1334)

A.10.7 Measurement ranges of the analog outputs for voltage and current (SB and SM)

Table A- 161 Analog output representation for voltage (SB and SM)

System		Voltage Output Range	
Decimal	**Hexadecimal**	**± 10 V**	
32767	7FFF	See note 1	Overflow
32512	7F00	See note 1	
32511	7EFF	11.76 V	Overshoot range
27649	6C01		
27648	6C00	10 V	Rated range
20736	5100	7.5 V	
1	1	361.7 µ V	
0	0	0 V	
-1	FFFF	-361.7 µ V	
-20736	AF00	-7.5 V	
-27648	9400	-10 V	
-27649	93FF		Undershoot range
-32512	8100	-11.76 V	
-32513	80FF	See note 1	Underflow
-32768	8000	See note 1	

1 In an overflow or underflow condition, analog outputs will take on the substitute value of the STOP mode.

Table A- 162 Analog output representation for current (SB and SM)

System		Current output range		
Decimal	**Hexadecimal**	**0 mA to 20 mA**	**4 mA to 20 mA**	
32767	7FFF	See note 1	See note 1	Overflow
32512	7F00	See note 1	See note 1	
32511	7EFF	23.52 mA	22.81 mA	Overshoot range
27649	6C01			
27648	6C00	20 mA	20 mA	Rated range
20736	5100	15 mA	16 mA	
1	1	723.4 nA	4 mA + 578.7 nA	
0	0	0 mA	4mA	
-1	FFFF		4 mA to 578.7 nA	Undershoot range
-6912	E500		0 mA	
-6913	E4FF			Not possible. Output value limited to 0 mA.
-32512	8100			
-32513	80FF	See note 1	See note 1	Underflow
-32768	8000	See note 1	See note 1	

1 In an overflow or underflow condition, analog outputs will take on the substitute value of the STOP mode.

A.11 Thermocouple and RTD signal modules (SMs)

A.11.1 SM 1231 Thermocouple

Table A- 163 General specifications

Model		SM 1231 AI 4 x 16 bit TC	SM 1231 AI 8 x 16 bit TC
Article number		6ES7231-5QD32-0XB0	6ES7231-5QF32-0XB0
Dimensions W x H x D (mm)		45 x 100 x 75	
Weight		180 grams	190 grams
Power dissipation		1.5 W	
Current consumption (SM Bus)		80 mA	
Current consumption (24 V DC) [1]		40 mA	

[1] 20.4 to 28.8 V DC (Class 2, Limited Power, or sensor power from PLC)

Table A- 164 Analog inputs

Model		SM 1231 AI 4 x 16 bit TC	SM 1231 AI 8 x 16 bit TC
Number of inputs		4	8
Range Nominal range (data word) Overrange/underrange (data word) Overflow/underflow (data word)		See Thermocouple selection table (Page 1465).	
Resolution	Temperature	0.1 °C/0.1 °F	
	Voltage	15 bits plus sign	
Maximum withstand voltage		± 35 V	
Noise rejection		85 dB for selected filter setting (10 Hz, 50 Hz, 60 Hz or 400 Hz)	
Common mode rejection		> 120 dB at 120 V AC	
Impedance		≥ 10 MΩ	
Isolation	Field to logic	707 VDC (type test)	
	Field to 24 V DC	707 V DC (type test)	
	24 V DC to logic	707 V DC (type test)	
Channel to channel		120 V AC	
Accuracy		See Thermocouple selection table (Page 1465).	
Repeatability		±0.05% FS	
Measuring principle		Integrating	
Module update time		See Noise reduction selection table (Page 1465).	
Cold junction error		±1.5 °C	
Cable length (meters)		100 meters to sensor max.	
Wire resistance		100 Ω max.	

Table A- 165 Diagnostics

Model	SM 1231 AI 4 x 16 bit TC	SM 1231 AI 8 x 16 bit TC
Overflow/underflow [1]	Yes	
Wire break [2, 3]	Yes	
24 V DC low voltage [1]	Yes	

1 The overflow, underflow and low voltage diagnostic alarm information will be reported in the analog data values even if the alarms are disabled in the module configuration.

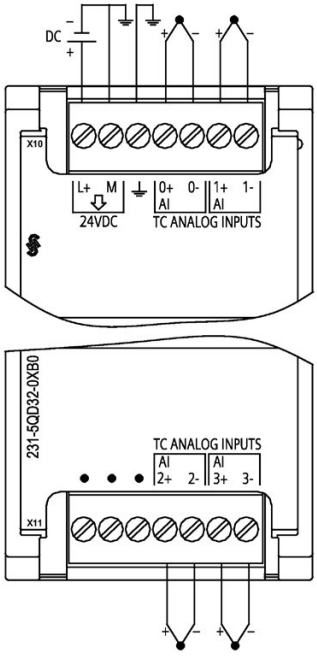
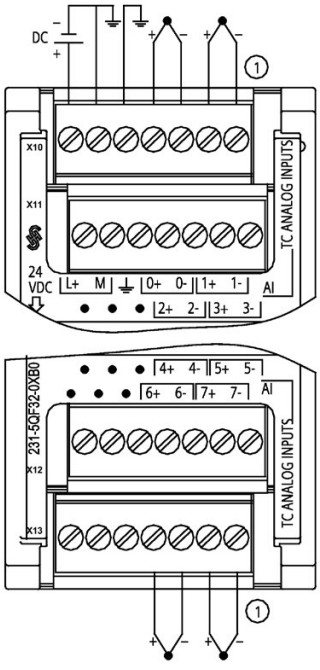
2 When wire break alarm is disabled and an open wire condition exists in the sensor wiring, the module may report random values.

3 The module performs wire break testing every 6 seconds, which extends the update time by 9 ms for each enable channel once every 6 seconds.

The SM 1231 Thermocouple (TC) analog signal module measures the value of voltage connected to the module inputs. The temperature measurement type can be either "Thermocouple" or "Voltage".

- "Thermocouple": The value will be reported in degrees multiplied by ten (for example, 25.3 degrees will be reported as decimal 253).
- "Voltage": The nominal range full scale value will be decimal 27648.

Table A- 166 Wiring diagrams for the thermocouple SMs

SM 1231 AI 4 x TC 16 bit (6ES7231-5QD32-0XB0)	SM 1231 AI 8 x TC bit (6ES7231-5QF32-0XB0)
	
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

① TC 2, 3, 4, and 5 not shown connected for clarity.

Table A- 167 Connector pin locations for SM 1231 AI 4 x TC 16 bit (6ES7231-5QD32-0XB0)

Pin	X10 (gold)	X11 (gold)
1	L+ / 24 V DC	No connection
2	M / 24 V DC	No connection
3	Functional Earth	No connection
4	AI 0+ /TC	AI 2+ /TC
5	AI 0- /TC	AI 2- /TC
6	AI 1+ /TC	AI 3+ /TC
7	AI 1- /TC	AI 3- /TC

Table A- 168 Connector Pin Locations for SM 1231 AI 8 x TC bit (6ES7231-5QF32-0XB0)

Pin	X10 (gold)	X11 (gold)	X12 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	Functional Earth	No connection	No connection	No connection
4	AI 0+ /TC	AI 2+ /TC	AI 4+ /TC	AI 6+ /TC
5	AI 0- /TC	AI 2- /TC	AI 4- /TC	AI 6- /TC
6	AI 1+ /TC	AI 3+ /TC	AI 5+ /TC	AI 7+ /TC
7	AI 1- /TC	AI 3- /TC	AI 5- /TC	AI 7- /TC

Note

Unused analog inputs should be shorted.

The thermocouple unused channels can be deactivated. No error will occur if an unused channel is deactivated.

A.11.1.1 Basic operation for a thermocouple

Thermocouples are formed whenever two dissimilar metals are electrically bonded to each other. A voltage is generated that is proportional to the junction temperature. This voltage is small; one microvolt could represent many degrees. Measuring the voltage from a thermocouple, compensating for extra junctions, and then linearizing the result forms the basis of temperature measurement using thermocouples.

When you connect a thermocouple to the SM 1231 Thermocouple module, the two dissimilar metal wires are attached to the module at the module signal connector. The place where the two dissimilar wires are attached to each other forms the sensor thermocouple.

Two more thermocouples are formed where the two dissimilar wires are attached to the signal connector. The connector temperature causes a voltage that adds to the voltage from the sensor thermocouple. If this voltage is not corrected, then the temperature reported will deviate from the sensor temperature.

Cold junction compensation is used to compensate for the connector thermocouple. Thermocouple tables are based on a reference junction temperature, usually zero degrees Celsius. The cold junction compensation compensates the connector to zero degrees Celsius. The cold junction compensation restores the voltage added by the connector thermocouples. The temperature of the module is measured internally, and then converted to a value to be added to the sensor conversion. The corrected sensor conversion is then linearized using the thermocouple tables.

For optimum operation of the cold junction compensation, the thermocouple module must be located in a thermally stable environment. Slow variation (less than 0.1 °C/minute) in ambient module temperature is correctly compensated within the module specifications. Air movement across the module will also cause cold junction compensation errors.

If better cold junction error compensation is needed, an external iso-thermal terminal block may be used. The thermocouple module provides for use of a 0 °C referenced or 50 °C referenced terminal block.

A.11.1.2 Selection tables for the SM 1231 thermocouple

The ranges and accuracy for the different thermocouple types supported by the SM 1231 Thermocouple signal module are shown in the table below.

Table A- 169 Thermocouple selection table

Type	Under-range minimum[1]	Nominal range low limit	Nominal range high limit	Over-range maximum[2]	Normal range [3, 4] accuracy @ 25 °C	Normal range [1, 2] accuracy -20 °C to 60 °C
J	-210.0 °C	-150.0 °C	1200.0 °C	1450.0 °C	±0.3 °C	±0.6 °C
	-346.0 °F	-238.0 °F	2192.0 °F	2642.0 °F	±0.5 °F	±1.1 °F
K	-270.0 °C	-200.0 °C	1372.0 °C	1622.0 °C	±0.4 °C	±1.0 °C
	-454.0 °F	-328.0 °F	2501.6 °F	2951.6 °F	±0.7 °F	±1.8 °F
T	-270.0 °C	-200.0 °C	400.0 °C	540.0 °C	±0.5 °C	±1.0 °C
	-454.0 °F	-328.0 °F	752.0 °F	1004.0 °F	±0.9 °F	±1.8 °F
E	-270.0 °C	-200.0 °C	1000.0 °C	1200.0 °C	±0.3 °C	±0.6 °C
	-454.0 °F	-328.0 °F	1832.0 °F	2192.0 °F	±0.5 °F	±1.1 °F
R & S	-50.0 °C	100.0 °C	1768.0 °C	2019.0 °C	±1.0 °C	±2.5 °C
	-58.0 °C	212.0 °F	3214.4 °F	3276.6 °F [5]	±1.8 °F	±4.5 °F
B	0.0 °C	200.0 °C	800.0 °C	--	±2.0 °C	±2.5 °C
	32.0 °F	392.0 °F	1472.0 °F	--	±3.6 °F	±4.5 °F
	--	800.0 °C	1820.0 °C	1820.0 °C	±1.0 °C	±2.3 °C
	--	1472.0 °F	3276.6 °F [5]	3276.6 °F [5]	±1.8 °F	±4.1 °F
N	-270.0 °C	-200.0 °C	1300.0 °C	1550.0 °C	±1.0 °C	±1.6 °C
	-454.0 °F	-328.0 °F	2372.0 °F	2822.0 °F	±1.8 °F	±2.9 °F
C	0.0 °C	100.0 °C	2315.0 °C	2500.0 °C	±0.7 °C	±2.7 °C
	32.0 °F	212.0 °F	3276.6 °F [5]	3276.6 °F [5]	±1.3 °F	±4.9 °F
TXK/XK(L)	-200.0 °C	-150.0 °C	800.0 °C	1050.0 °C	±0.6 °C	±1.2 °C
	-328.0 °F	302.0 °F	1472.0 °F	1922.0 °F	±1.1 °F	±2.2 °F
Voltage	-32512	-27648 -80mV	27648 80mV	32511	±0.05%	±0.1%

1 Thermocouple values below the under-range minimum value are reported as -32768.

2 Thermocouple values above the over-range maximum value are reported as 32767.

3 Internal cold junction error is ±1.5 °C for all ranges. This adds to the error in this table. The module requires at least 30 minutes of warm-up time to meet this specification.

4 In the presence of radiated radio frequency of 970 MHz to 990 MHz, the accuracy of the SM 1231 AI 4 x 16 bit TC may be degraded.

5 Lower limit of 3276.6 with °F reporting

Note

Thermocouple channel

Each channel on the Thermocouple signal module can be configured with a different thermocouple type (selectable in the software during configuration of the module).

Table A- 170 Noise reduction and update times for the SM 1231 Thermocouple

Rejection frequency selection	Integration time	4 Channel module update time (seconds)	8 Channel module update time (seconds)
400 Hz (2.5 ms)	10 ms [1]	0.143	0.285
60 Hz (16.6 ms)	16.67 ms	0.223	0.445
50 Hz (20 ms)	20 ms	0.263	0.525
10 Hz (100 ms)	100 ms	1.225	2.450

[1] To maintain module resolution and accuracy when 400 Hz rejection is selected, the integration time is 10 ms. This selection also rejects 100 Hz and 200 Hz noise.

It is recommended for measuring thermocouples that a 100 ms integration time be used. The use of smaller integration times will increase the repeatability error of the temperature readings.

Note

After power is applied, the module performs internal calibration for the analog-to-digital converter. During this time the module reports a value of 32767 on each channel until valid data is available on that channel. Your user program may need to allow for this initialization time. Because the configuration of the module can vary the length of the initialization time, you should verify the behavior of the module in your configuration. If required, you can include logic in your user program to accommodate the initialization time of the module.

Representation of analog values for Thermocouple Type J

A representation of the analog values of thermocouples type J is shown in the table below.

Table A- 171 Representation of analog values of thermocouples type J

Type J in °C	Units		Type J in °F	Units		Range
	Decimal	Hexadecimal		Decimal	Hexadecimal	
> 1450.0	32767	7FFF	> 2642.0	32767	7FFF	Overflow
1450.0 : 1200.1	14500 : 12001	38A4 : 2EE1	2642.0 : 2192.2	26420 : 21922	6734 : 55A2	Overrange
1200.0 : -150.0	12000 : -1500	2EE0 : FA24	2192.0 : -238.0	21920 : -2380	55A0 : F6B4	Rated range
< -150.0	-32768	8000	< -238.0	-32768	8000	Underflow[1]

[1] Faulty wiring (for example, polarity reversal, or open inputs) or sensor error in the negative range (for example, wrong type of thermocouple) may cause the thermocouple module to signal underflow.

A.11.2 SM 1231 RTD

SM 1231 RTD specifications

Table A- 172 General specifications

Technical data	SM 1231 AI 4 x RTD x 16 bit	SM 1231 AI 8 x RTD x 16 bit
Article number	6ES7231-5PD32-0XB0	6ES7231-5PF32-0XB0
Dimensions W x H x D (mm)	45 x 100 x 75	70 x 100 x 75
Weight	220 grams	270 grams
Power dissipation	1.5 W	
Current consumption (SM Bus)	80 mA	90 mA
Current consumption (24 V DC) [1]	40 mA	

[1] 20.4 to 28.8 V DC (Class 2, Limited Power, or sensor power from CPU)

Table A- 173 Analog inputs

Technical data		SM 1231 AI 4 x RTD x 16 bit	SM 1231 AI 8 x RTD x16 bit
Number of inputs		4	8
Type		Module referenced RTD and Ω	
Range Nominal range (data word) Overshoot/undershoot range (data word) Overflow/underflow (data word)		See RTD Sensor selection table (Page 1471).	
Resolution	Temperature	0.1 °C/0.1 °F	
	Resistance	15 bits plus sign	
Maximum withstand voltage		± 35 V	
Noise rejection		85 dB for the selected noise reduction (10 Hz, 50 Hz, 60 Hz or 400 Hz)	
Common mode rejection		> 120dB	
Impedance		≥ 10 MΩ	
Isolation	Field side to logic	707 V DC (type test)	
	Field to 24 V DC	707 V DC (type test)	
	24 V DC to logic	707 V DC (type test)	
Channel to channel isolation		none	
Accuracy		See RTD Sensor selection table (Page 1471).	
Repeatability		±0.05% FS	
Maximum sensor dissipation		0.5 m W	
Measuring principle		Integrating	
Module update time		See Noise reduction selection table (Page 1471).	
Cable length (meters)		100 meters to sensor max.	
Wire resistance		20 Ω, 2.7 Ω for 10 Ω RTD max.	

Table A- 174 Diagnostics

Technical data	SM 1231 AI 4 x RTD x 16 bit	SM 1231 AI 8 x RTD x16 bit
Overflow/underflow [1,2]	Yes	
Wire break [3]	Yes	
24 V DC low voltage [1]	Yes	

1 The overflow, underflow and low voltage diagnostic alarm information will be reported in the analog data values even if the alarms are disabled in the module configuration.

2 For resistance ranges underflow detection is never enabled.

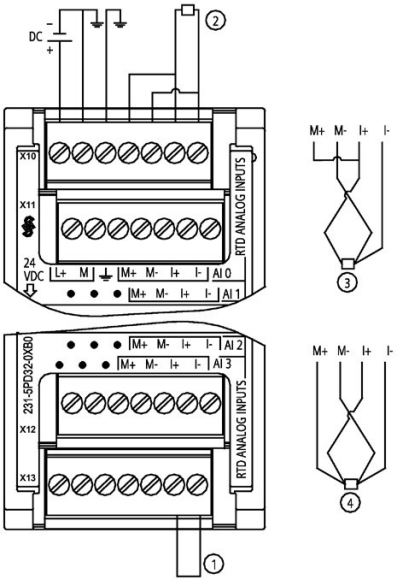
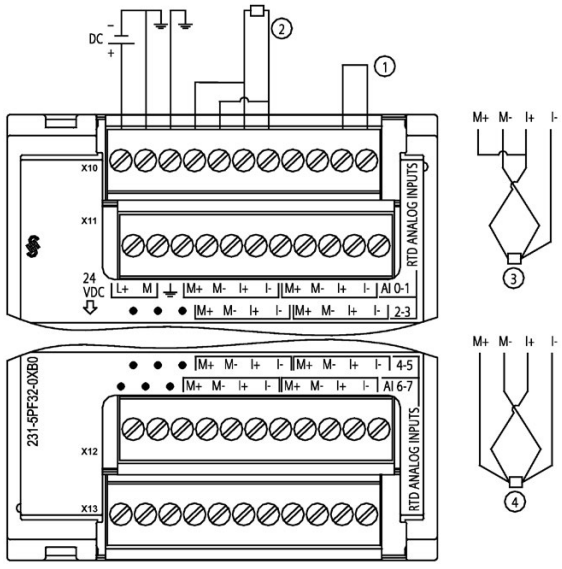
3 When wire break alarm is disabled and an open wire condition exists in the sensor wiring, the module may report random values.

The SM 1231 RTD analog signal module measures the value of resistance connected to the module inputs. The measurement type can be selected as either "Resistor" or "Thermal resistor".

- "Resistor": The nominal range full scale value will be decimal 27648.
- "Thermal resistor": The value will be reported in degrees multiplied by ten (for example, 25.3 degrees will be reported as decimal 253). The climatic range values will be reported in degrees multiplied by one hundred (for example, 25.34 degrees will be reported as decimal 2534).

The SM 1231 RTD module supports measurements with 2-wire, 3-wire and 4-wire connections to the sensor resistor.

Table A- 175 Wiring diagrams for the RTD SMs

SM 1231 RTD 4 x 16 bit (6ES7231-5PD32-0XB0)	SM 1231 RTD 8 x 16 bit (6ES7231-5PF32-0XB0)
	

① Loop-back unused RTD inputs

② 2-wire RTD ③ 3-wire RTD ④ 4-wire RTD

NOTE: Connectors must be gold. See Appendix C, Spare Parts for article number.

Table A- 176 Connector Pin Locations for SM 1231 RTD 4 x 16 bit (6ES7231-5PD32-0XB0)

Pin	X10 (gold)	X11 (gold)	X12 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	Functional Earth	No connection	No connection	No connection
4	AI 0 M+ /RTD	AI 1 M+ /RTD	AI 2 M+ /RTD	AI 3 M+ /RTD
5	AI 0 M- /RTD	AI 1 M- /RTD	AI 2 M- /RTD	AI 3 M- /RTD
6	AI 0 I+ /RTD	AI 1 I+ /RTD	AI 2 I+ /RTD	AI 3 I+ /RTD
7	AI 0 I- /RTD	AI 1 I- /RTD	AI 2 I- /RTD	AI 3 I- /RTD

Table A- 177 Connector Pin Locations for SM 1231 RTD 8 x 16 bit (6ES7231-5PF32-0XB0)

Pin	X10 (gold)	X11 (gold)	X12 (gold)	X13 (gold)
1	L+ / 24 V DC	No connection	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	Functional Earth	No connection	No connection	No connection
4	AI 0 M+ /RTD	AI 2 M+ /RTD	AI 4 M+ /RTD	AI 6 M+ /RTD
5	AI 0 M- /RTD	AI 2 M- /RTD	AI 4 M- /RTD	AI 6 M- /RTD
6	AI 0 I+ /RTD	AI 2 I+ /RTD	AI 4 I+ /RTD	AI 6 I+ /RTD
7	AI 0 I- /RTD	AI 2 I- /RTD	AI 4 I- /RTD	AI 6 I- /RTD
8	AI 1 M+ /RTD	AI 3 M+ /RTD	AI 5 M+ /RTD	A7 M+ /RTD
9	AI 1 M- /RTD	AI 3 M- /RTD	AI 5 M- /RTD	AI 7 M- /RTD
10	AI 1 I+ /RTD	AI 3 I+ /RTD	AI 5 I+ /RTD	AI 7 I+ /RTD
11	AI 1 I- /RTD	AI 3 I- /RTD	AI 5 I- /RTD	AI 7 I- /RTD

Note

The RTD unused channels can be deactivated. No error will occur if an unused channel is deactivated.

The RTD module needs to have the current loop continuous to eliminate extra stabilization time which is automatically added to an unused channel that is not deactivated. For consistency the RTD module should have a resistor connected (like the 2-wire RTD connection).

A.11.2.1 Selection tables for the SM 1231 RTD

Table A- 178 Ranges and accuracy for the different sensors supported by the RTD modules

Temperature coefficient	RTD type	Under range minimum[1]	Nominal range low limit	Nominal range high limit	Over range maximum[2]	Normal range accuracy @ 25 °C	Normal range accuracy -20 °C to 60 °C
Pt 0.003850 ITS90 DIN EN 60751	Pt 100 climatic	-145.00 °C	-120.00 °C	145.00 °C	155.00 °C	±0.20 °C	±0.40 °C
	Pt 10	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	±1.0 °C	±2.0 °C
	Pt 50	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	±0.5 °C	±1.0 °C
	Pt 100						
	Pt 200						
	Pt 500						
	Pt 1000						
Pt 0.003902 Pt 0.003916 Pt 0.003920	Pt 100	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	± 0.5 °C	±1.0 °C
	Pt 200	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	± 0.5 °C	±1.0 °C
	Pt 500						
	Pt 1000						
Pt 0.003910	Pt 10	-273.2 °C	-240.0 °C	1100.0 °C	1295 °C	±1.0 °C	±2.0 °C
	Pt 50	-273.2 °C	-240.0 °C	1100.0 °C	1295 °C	±0.8 °C	±1.6 °C
	Pt 100						
	Pt 500						
Ni 0.006720 Ni 0.006180	Ni 100	-105.0 °C	-60.0 °C	250.0 °C	295.0 °C	±0.5 °C	±1.0 °C
	Ni 120						
	Ni 200						
	Ni 500						
	Ni 1000						
LG-Ni 0.005000	LG-Ni 1000	-105.0 °C	-60.0 °C	250.0 °C	295.0 °C	±0.5 °C	±1.0 °C
Ni 0.006170	Ni 100	-105.0 °C	-60.0 °C	180.0 °C	212.4 °C	±0.5 °C	±1.0 °C
Cu 0.004270	Cu 10	-240.0 °C	-200.0 °C	260.0 °C	312.0 °C	±1.0 °C	±2.0 °C
Cu 0.004260	Cu 10	-60.0 °C	-50.0 °C	200.0 °C	240.0 °C	±1.0 °C	±2.0 °C
	Cu 50	-60.0 °C	-50.0 °C	200.0 °C	240.0 °C	±0.6 °C	±1.2 °C
	Cu 100						
Cu 0.004280	Cu 10	-240.0 °C	-200.0 °C	200.0 °C	240.0 °C	±1.0 °C	±2.0 °C
	Cu 50	-240.0 °C	-200.0 °C	200.0 °C	240.0 °C	±0.7 °C	±1.4 °C
	Cu 100						

1 RTD values below the under-range minimum value report -32768.

2 RTD values above the over-range maximum value report +32767.

Table A- 179 Resistance

Range	Under range minimum	Nominal range low limit	Nominal range high limit	Over range maximum[1]	Normal range accuracy @ 25 °C	Normal range accuracy -20 °C to 60 °C
150 Ω	n/a	0 (0 Ω)	27648 (150 Ω)	176.383 Ω	±0.05%	±0.1%
300 Ω	n/a	0 (0 Ω)	27648 (300 Ω)	352.767 Ω	±0.05%	±0.1%
600 Ω	n/a	0 (0 Ω)	27648 (600 Ω)	705.534 Ω	±0.05%	±0.1%

[1] Resistance values above the over-range minimum value are reported as +32767.

Note

The module reports 32767 on any activated channel with no sensor connected. If open wire detection is also enabled, the module flashes the appropriate red LEDs.

When 500 Ω and 1000 Ω RTD ranges are used with other lower value resistors, the error may increase to two times the specified error.

Best accuracy will be achieved for the 10 Ω RTD ranges if 4 wire connections are used.

The resistance of the connection wires in 2 wire mode will cause an error in the sensor reading and therefore accuracy is not guaranteed.

Table A- 180 Noise reduction and update times for the RTD modules

Rejection frequency selection	Integration time	Update time (seconds)	
		4-channel module	8-channel module
400 Hz (2.5 ms)	10 ms [1]	4-/2-wire: 0.142 3-wire: 0.285	4-/2-wire: 0.285 3-wire: 0.525
60 Hz (16.6 ms)	16.67 ms	4-/2-wire: 0.222 3-wire: 0.445	4-/2-wire: 0.445 3-wire: 0.845
50 Hz (20 ms)	20 ms	4-/2-wire: 0.262 3-wire: .505	4-/2-wire: 0.524 3-wire: 1.015
10 Hz (100 ms)	100 ms	4-/2-wire: 1.222 3-wire: 2.445	4-/2-wire: 2.425 3-wire: 4.845

[1] To maintain module resolution and accuracy when the 400 Hz filter is selected, the integration time is 10 ms. This selection also rejects 100 Hz and 200 Hz noise.

Note

After power is applied, the module performs internal calibration for the analog-to-digital converter. During this time the module reports a value of 32767 on each channel until valid data is available on that channel. Your user program may need to allow for this initialization time. Because the configuration of the module can vary the length of the initialization time, you should verify the behavior or the module in your configuration. If required, you can include logic in your user program to accommodate the initialization time of the module.

Representation of Analog values for RTDs

A representation of the digitized measured value for the RTD standard temperature range sensors are shown in the tables below.

Table A- 181 Representation of analog values for resistance thermometers PT 100, 200, 500, 1000 and PT 10, 50, 100, 500 GOST (0.003850) standard

Pt x00 standard in °C (1 digit = 0.1 °C)	Units		Pt x00 standard in °F (1 digit = 0.1 °F)	Units		Range
	Decimal	Hexadecimal		Decimal	Hexadecimal	
> 1000.0	32767	7FFF	> 1832.0	32767	7FFF	Overflow
1000.0 : 850.1	10000 : 8501	2710 : 2135	1832.0 : 1562.1	18320 : 15621	4790 : 3D05	Overrange
850.0 : -200.0	8500 : -2000	2134 : F830	1562.0 : -328.0	15620 : -3280	3D04 : F330	Rated range
-200.1 : -243.0	-2001 : -2430	F82F : F682	-328.1 : -405.4	-3281 : -4054	F32F : F02A	Underrange
< -243.0	-32768	8000	< -405.4	-32768	8000	Underflow

A.12 Technology modules

A.12.1 SM 1278 4xIO-Link Master SM

Table A- 182 General specifications

Technical data		SM 1278 4xIO-Link Master signal module
Article number		6ES7278-4BD32-0XB0
Dimensions W x H x D (mm)		45 x 100 x 75
Weight		150 grams
General information		
	I&M data	Yes; IM0 to IM3
Supply voltage		
	Rated voltage (DC)	24 V DC
	Valid range low limit (DC)	19.2 V; 20.5 V if IO-Link is used (the supply voltage for IO-Link devices on the master must be at least 20 V)
	Valid range high limit (DC)	28.8 V DC
	Polarity reversal protection	Yes
Input current		
	Current consumption	65 mA; without load
Encoder supply		
	Number of outputs	4
	Output current, rated value	200 mA
Power loss		
	Power loss, typ.	1 W, excluding port loading
Digital inputs/outputs		
	Cable length (meters)	20 m, unshielded, max.
SDLC		
	Cable length (meters)	20 m, unshielded, max.
IO-Link		
	Number of ports	4
	Number of ports which can be controlled at the same time	4
	IO-Link protocol 1.0	Yes
	IO-Link protocol 1.1	Yes
Operating mode		
	IO-Link	Yes
	DI	Yes
	DQ	Yes; max. 100 mA

Technical data			SM 1278 4xIO-Link Master signal module
Connection of IO-Link devices			
	Port type A		Yes
		Transmission rate	4.8 kBd (COM1)
			38.4 kBd (COM2)
			230.4 kBd (COM3)
	Cycle time, min.		2 ms, dynamic, dependent on the user data length
	Size of process data, input per port		32 bytes; max.
	Size of process data, input per module		32 bytes
	Size of process data, output per port		32 bytes; max.
	Size of process data, output per module		32 bytes
	Memory size for device parameters		2 Kbytes
	Cable length unshielded, max. (meters)		20 m
Interrupts/diagnostics/status information			
	Status display		Yes
Interrupts			
	Diagnostic interrupt		Yes; port diagnostics is only available in IO-Link mode
Diagnostic alarms			
	Diagnostics		
		Monitoring of supply voltage	Yes
		Short circuit	Yes
Diagostic indicator LED			
	Monitoring of supply voltage		Yes; flashing red DIAG LED
	Channel status display		Yes; per channel one green LED for channel status Qn (SIO mode) and PORT status Cn (IO-Link mode)
	For channel diagnostics		Yes; red Fn LED
	For module diagnostics		Yes; green/red DIAG LED
Electrical isolation			
	Electrical isolation channels		
		Between the channels	No
		Between the channels and the backplane bus	Yes
Insulation			
	Insulation tested with		707 V DC (type test)
Ambient conditions			
	Operating temperature		
		Min.	-20 °C
		Max.	60 °C
		Horizontal installation, min.	-20 °C
		Horizontal installation, max.	60 °C
		Vertical installation, min.	-20 °C
		Vertical installation, max.	50 °C

Overview of the response time

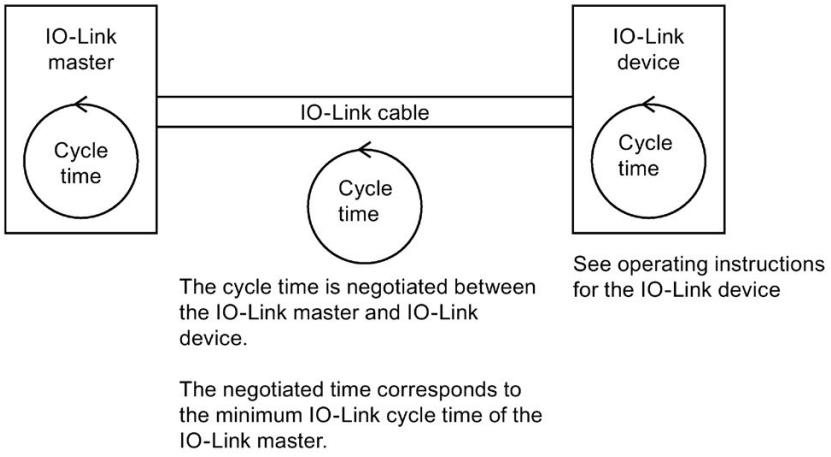


Table A- 183 Wiring diagram for the SM 1278 IO-Link Master

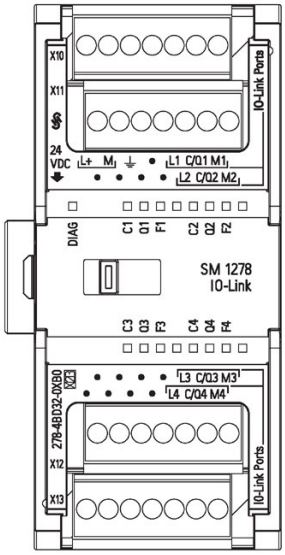
SM 1278 IO-Link Master (6ES7278-4BD32-0XB0)	
	

Table A- 184 Connector pin locations for SM 1278 IO-Link Master (6ES7278-4BD32-0XB0)

Pin	X10	X11	X12	X13
1	L+ / 24 V DC	No connection	No connection	No connection
2	M / 24 V DC	No connection	No connection	No connection
3	Functional Earth	No connection	No connection	No connection
4	No connection	No connection	No connection	No connection
5	L_1	L_2	L_3	L_4
6	C/Q_1	C/Q_2	C/Q_3	C/Q_4
7	M_1	M_2	M_3	M_4

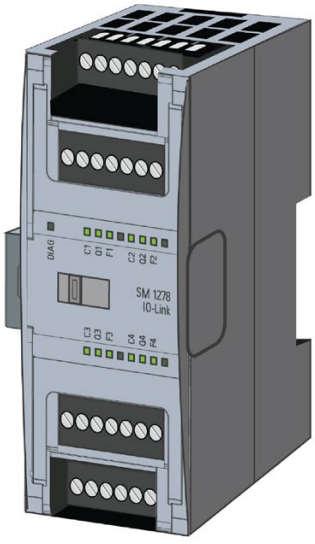
A.12.1.1 SM 1278 4xIO-Link Master overview

The SM 1278 4xIO-Link Master is a 4-port module that functions as both a signal module and a communication module. Each port can operate in the IO-Link mode, single 24 V DC digital input or 24 V DC digital output.

The IO-Link master programs acyclic communication with an IO-Link device using the IO_LINK_DEVICE function block (FB) in your STEP 7 S7-1200 controller program. The IO_LINK_DEVICE FB indicates the IO-Link master your program uses, and which ports the master uses for data exchange.

Visit the Siemens Industry Online Support website (http://support.industry.siemens.com) for details on working with the IO-Link library. Enter "IO-Link" in the website's search box to access information about IO-Link products and their use.

View of the module



Properties

Technical properties

- IO-Link Master according to IO-Link specification V1.1 (see the IO-Link Consortium website (http://io-link.com/en/index.php) for details)
- Serial communication module with four ports (channels)
- Data transmission rate COM1 (4.8 kbaud), COM2 (38.4 kbaud), COM3 (230.4 kbaud)
- SIO mode (standard IO mode)
- Connection of up to four IO-Link devices (3-wire connection) or four standard actuators or standard encoders
- Programmable diagnostics function by port

Supported functions

- I&M (installation and maintenance) identification data
- Firmware update
- IO-Link parameter assignment by means of the S7-PCT port configuration tool, STEP 7 Professional, and an S7-1200 V4.0 or later CPU. In STEP 7 Professional, V15 (with the use of V2.1 HSP), IO-Link parameter assignment can be done using the TIA Portal with limited functionality.
- Port Qualifier Information (PQI) bits
- Backup and Restore using IO-Link library FBs

IO-Link is a point-to-point connection between a master and a device. Both conventional and intelligent sensors/actuators can be used as devices at the IO-Link via unshielded standard cables using proven 3-wire technology. IO-Link is backward compatible with conventional digital sensors and actuators. The circuit state and data channel are designed in proven 24 V DC technology.

For additional information about the SIMATIC-IO-Link technology, refer to the "IO-Link system Function Manual" on the Siemens Industry Online Support website (http://support.automation.siemens.com).

Note

IO-Link parameter data

When you replace the SM 4xIO-Link Master, the parameter data is not automatically assigned to it.

CAUTION

Removal and insertion

If you insert the SM 4xIO-Link Master with the load switched on, this can lead to dangerous conditions in your plant.

Physical damage to the S7-1200 automation system may occur as a result.

Remove or insert the SM 4xIO-Link Master only when the load is switched off.

Effects of resetting to the factory settings

Use the function "Reset to factory settings" to restore the parameter assignments you made with S7-PCT to the delivery state.

After a "Reset to factory settings", the parameters of the SM 1278 4xIO-Link module are assigned as follows:

- The ports are in DI mode
- The ports are mapped to the relative addresses 0.0 to 0.3
- The PortQualifier is disabled
- Maintenance data 1 to 3 is deleted

Note

When you reset to factory settings, the device parameters are deleted and the delivery state is restored.

If you remove an SM 1278 4xIO-Link signal module, reset it to factory settings before you put it into storage.

Procedure

For "Reset to factory settings", proceed as described in the S7-PCT online help under "Master Configuration > 'Commands' tab".

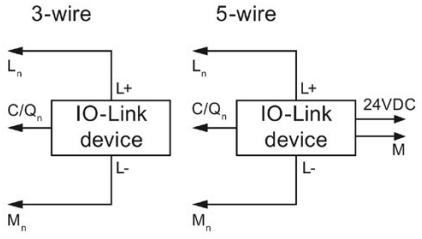
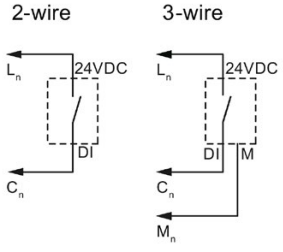
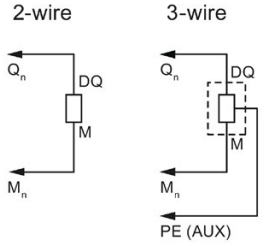
A.12.1.2 Connecting

For details about pin assignment, see table, Connector pin locations for SM 1278 I/O-Link Master (6ES 278-4BD32-0XB0). (Page 1474)

The following table shows the terminal assignments for the SM 1278 4xIO-Link Master:

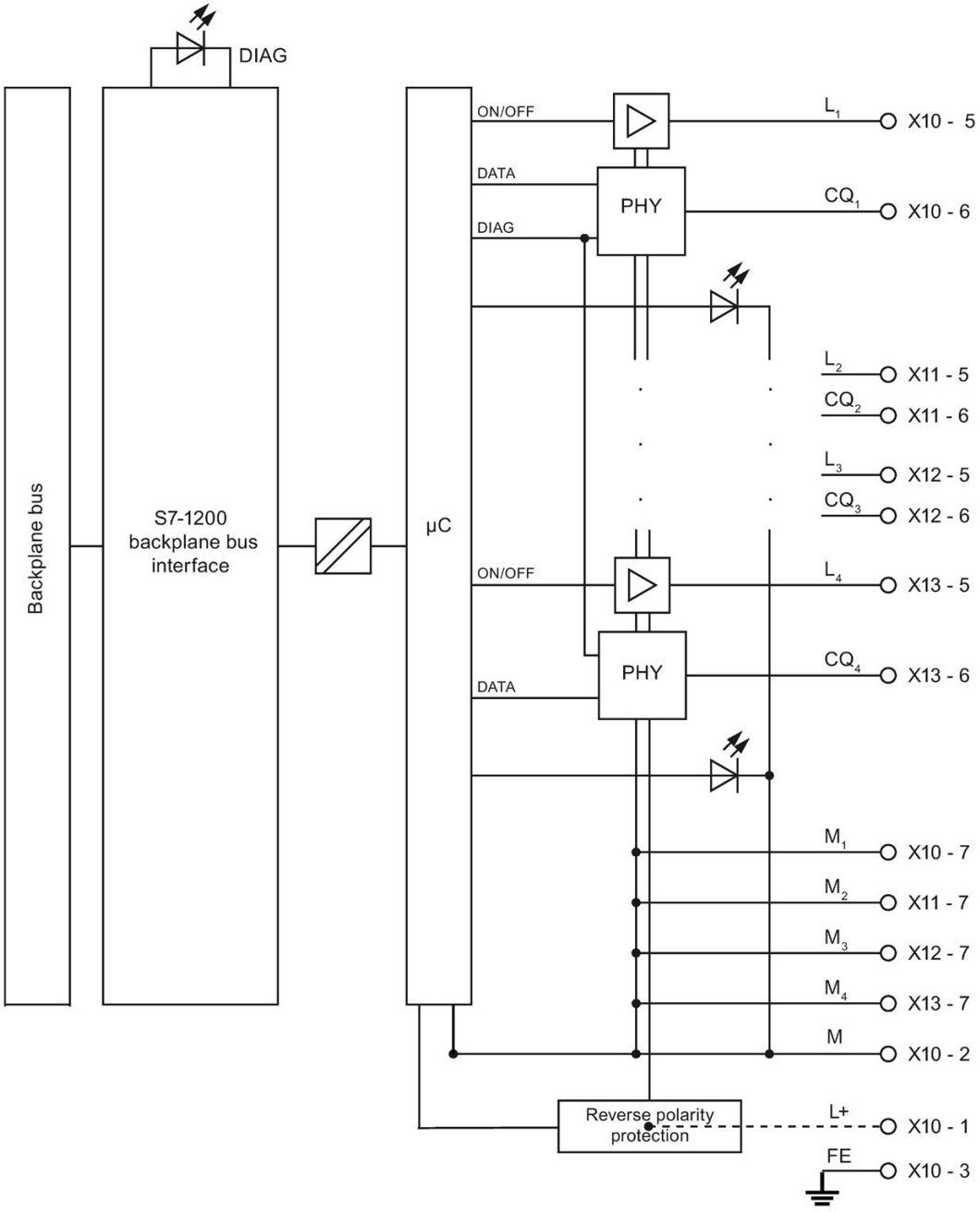
Pin	X10	X11	X12	X13	Notes	BaseUnits
7	M_1	M_2	M_3	M_4	• M_n: ground to slave • C/Q_n: SDLC, DI or DQ • L_n: 24 V DC to slave • M: ground • L+: 24 V DC to Master • RES: reserved; may not be assigned	A1
6	C/Q_1	C/Q_2	C/Q_3	C/Q_4		
5	L_1	L_2	L_3	L_4		
4	RES	RES	RES	RES		
3	⏚ (functional earth)	RES	RES	RES		
2	M	RES	RES	RES		
1	L+	RES	RES	RES		

The following table contains illustrations of connection examples, where n = port number:

IO-Link operating mode	Operating mode DI	Operating mode DQ
		

Note

Connected sensors must use the device supply provided by the Master module L_n connection.


DIAG
Backplane bus
S7-1200
backplane bus
interface
µC
ON/OFF
DATA
DIAG
PHY
L1
X10 - 5
CQ1
X10 - 6
L2
X11 - 5
CQ2
X11 - 6
L3
X12 - 5
CQ3
X12 - 6
ON/OFF
PHY
DATA
L4
X13 - 5
CQ4
X13 - 6
M1
X10 - 7
M2
X11 - 7
M3
X12 - 7
M4
X13 - 7
M
X10 - 2
Reverse polarity
protection
L+
X10 - 1
FE
X10 - 3

A.12.1.3 Parameters/address space

Configuring the SM 1278 4xIO-Link Master

For module integration, parameter assignment, and commissioning, you need STEP 7 V13 or later. For some features, you also need S7-PCT (Port Configuration Tool).

The table below shows the conditions when you need S7-PCT:

	SM 1278 V2.0 4xIO-Link Master	SM 1278 V2.1 4xIO-Link Master
STEP7 V13.x and STEP V14.x	S7-PCT required	S7-PCT required
STEP 7 15.x	S7-PCT required	S7-PCT not required for basic functions S7-PCT required for advanced functions.

For additional information, refer to the SIMATIC IO-Link system manual (https://support.industry.siemens.com/cs/ww/en/view/65949252).

The following table shows the parameters for the SM 1278 4xIO-Link Master:

Parameters	Value range	Default	Configuration in RUN	Efficiency range
Diagnostics port 1	• Disable • Enable	Disable	Yes	Port (channel)
Diagnostics port 2	• Disable • Enable	Disable	Yes	Port (channel)
Diagnostics port 3	• Disable • Enable	Disable	Yes	Port (channel)
Diagnostics port 4	• Disable • Enable	Disable	Yes	Port (channel)

Enable diagnostics for port 1 to port 4 parameter

This parameter allows diagnostics to be enabled for specific ports of the four IO-Link ports.

The port assignments are as follows:

Port 1 → channel 1

Port 2 → channel 2

Port 3 → channel 3

Port 4 → channel 4

The maximum size of the input and output addresses of the SM 4xIO-Link Master is 32 bytes in each case. You assign address spaces using the S7-PCT port configuration tool, or as of V15 V2.1 HSP, by using the TIA Portal hardware configuration.

Parameter data record

Parameter assignment in the user program

You can configure the device in runtime.

Changing parameters in runtime

The module parameters are included in data record 128. You can transmit the modifiable parameters to the module with the WRREC instruction.

When you reset (power cycle) the CPU, the CPU overwrites the parameters that were sent to the module by the WRREC instruction during the parameterization process.

Instruction for parameter assignment

The following instruction is provided for assigning parameters to the I/O module in the user program:

Instruction	Application
SFB 53 WRREC	Transfer of the alterable parameters to the module.

Error message

The following return value is reported in the event of an error:

Error code	Meaning
$80B1_H$	Error in data length
$80E0_H$	Error in header information
$80E1_H$	Parameter error

Data record structure

The following table shows the IO-Link parameters:

Offset	Label	Type	Default	Description
0	Version	1 byte	0x02	Shows the structure of the record 0x02 for the IO-Link Master in accordance with IO-Link V1.1
1	Parameter length	1 byte	0x02	Parameter length (2 bytes + 2 headers)
IO-Link start parameters				
2	Port diagnostics (Port1 1 to n)	1 byte	0x00	Activating the diagnostics for port 1 to n
3	IOL properties	1 byte	0x00	Module properties

The following table shows the data record version:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved		Major version (00)		Minor version (0010)			

The following table shows the data record port diagnostics:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved				EN_Port4	EN_Port3	EN_Port2	EN_Port1

EN_Portx:

0 = Diagnostics deactivated

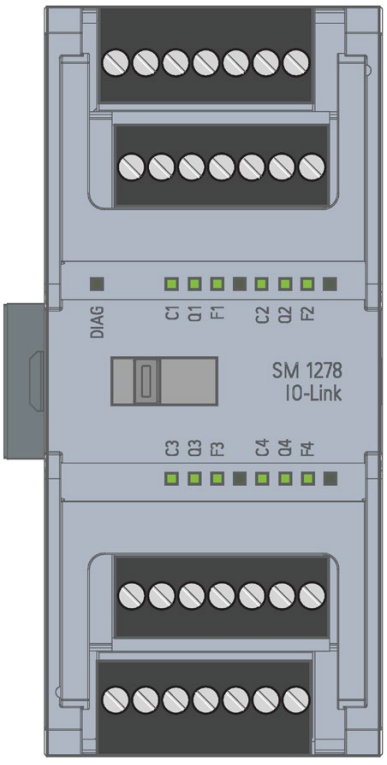
1 = Diagnostics activated

The following table shows the data record IOL properties:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved							

A.12.1.4 Interrupt, error, and system alarms

LED display



Meaning of the LED displays

The following table explains the meaning of the status and error displays. You can find remedial measures for diagnostic alarms in the "Diagnostic alarms" section.

LED DIAG

DIAG	Meaning
▫ Off	Backplane bus supply of the S7-1200 not OK
☼ Flashes	Module is not configured
■ On	Module parameterized and no module diagnostics
☼ Flashes	Module parameterized and module diagnostics OR L+ power not connected

LED port status

Valid for IO-Link port which is in IO-Link port mode.

COM/1 ... COM/4	Meaning
▫ Off	Port deactivated
☼ Flashes	Port activated, device not connected or Port is not connected to the configured device
■ On	Port activated, device connected

LED channel status

Valid for IO-Link port which is in DI/Q mode.

DI/Q1 ... DI/Q4	Meaning
▫ Off	Process signal = 0
■ On	Process signal = 1

LED port error

F1 ... F4	Meaning
▫ Off	No error
■ On	Error

Module errors are indicated as diagnostics (module status) only in IO-Link mode.

Diagnostic alarm	Error code (decimal)	STATUS (W#16#...)	Meaning (IO-Link error code)	IO-Link master	IO-Link device
Short-circuit	1	1804	Short-circuit at the process cables on the IO-Link device	X	
		7710	Short-circuit on IO device		X
Undervoltage	2	5111 5112	Supply voltage too low		X
Overvoltage	3	5110	Supply voltage too high		X
Overheating	5	1805	Temperature exceeded on master	X	
		4000 4210	Temperature exceeded on device		X
Wire break	6	1800	• No IO-Link device connected • There is a break on the signal line to the IO-Link device • IO-Link device cannot communicate due to a different error	X	
Overflow	7	8C10 8C20	Process tag range exceeded		X
		8C20	Measuring range exceeded		
Underflow	8	8C30	Process tag range too low		X
Error	9	---	All IO-Link error codes that are not listed here are mapped to this PROFIBUS DP error		X
Parameter assignment error	16	1882 1883	IO-Link master could not be configured	X	
		1802	Incorrect device		
		1886	Storage error		
		6320 6321 6350	Device was not configured correctly		X
Supply voltage missing	17	1806	L+ supply voltage for device missing	X	
		1807	L+ supply voltage for device too low (<20 V)		
Defective fuse	18	5101	Fuse on device is defective		X

Diagnostic alarm	Error code (decimal)	STATUS (W#16#...)	Meaning (IO-Link error code)	IO-Link master	IO-Link device
Safety shut-down	25	1880	Serious error (master has to be re-placed)	X	
External fault	26	1809 180A 180B 180C 180D	Error in data storage	X	
		1808	More than 6 errors are pending simul-taneously on the IO-Link device		

A.13 Digital signal boards (SBs)

A.13.1 SB 1221 200 kHz digital input specifications

Table A- 185 General specifications

Technical data	SB 1221 DI 4 x 24 V DC, 200 kHz	SB 1221 DI 4 x 5 V DC, 200 kHz
Article number	6ES7221-3BD30-0XB0	6ES7221-3AD30-0XB0
Dimensions W x H x D (mm)	38 x 62 x 21	
Weight	35 grams	
Power dissipation	1.5 W	1.0 W
Current consumption (SM Bus)	40 mA	
Current consumption (24 V DC)	7 mA / input + 20 mA	15 mA / input + 15 mA

Table A- 186 Digital inputs

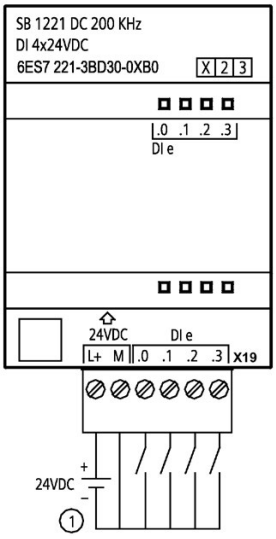
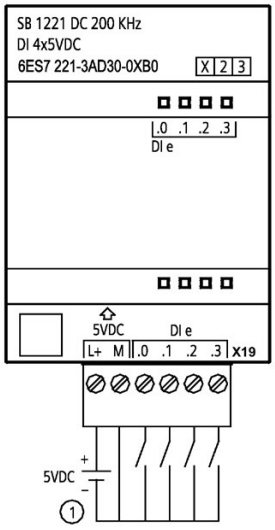
Technical data		SB 1221 DI 4 x 24 V DC, 200 kHz	SB 1221 DI 4 x 5 V DC, 200 kHz
Number of inputs		4	
Type		Source	
Rated voltage		24 V DC at 7 mA, nominal	5 V DC at 15 mA, nominal
Continuous permissible voltage		28.8 V DC	6 V DC
Surge voltage		35 V DC for 0.5 sec.	6 V
Logic 1 signal		0 V (10 mA) to L+ minus 10 V (2.9 mA)	0 V (20 mA) to L+ minus 2.0 V (5.1 mA)
Logic 0 signal		L+ minus 5 V (1.4 mA) to L+ (0 mA)	L+ minus 1.0 V (2.2 mA) to L + (0 mA)
HSC clock input rates (max.)		Single phase: 200 kHz Quadrature phase: 160 kHz	
Isolation (field side to logic)		707 V DC (type test)	
Isolation groups		1	
Filter times	us settings	0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0,12.8, 20.0	
	ms settings	0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0	
Number of inputs on simultaneously		• 2 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 4 at 55 °C horizontal or 45 °C vertical	4
Cable length (meters)		50 shielded twisted pair	

Note

When switching frequencies above 20 kHz, it is important that the digital inputs receive a square wave. Consider the following options to improve the signal quality to the inputs:

- Minimize the cable length
- Change a driver from a sink only driver to a sinking and sourcing driver
- Change to a higher quality cable
- Reduce the circuit/components from 24 V to 5 V
- Add an external load at the input

Table A- 187 Wiring diagrams for the 200 kHz digital input SBs

SB 1221 DI 4 x 24 V DC, 200 kHz (6ES7221-3BD30-0XB0)	SB 1221 DI 4 x 5 V DC, 200 kHz (6ES7221-3AD30-0XB0)
	

① Supports sourcing inputs only

Table A- 188 Connector pin locations for SB 1221 DI 4 x 24 V DC, 200 kHz (6ES7221-3BD30-0XB0)

Pin	X19
1	L+ / 24 V DC
2	M / 24 V DC
3	DI e.0
4	DI e.1
5	DI e.2
6	DI e.3

Table A- 189 Connector pin locations for SB 1221 DI 4 x 5 V DC, 200 kHz (6ES7221-3AD30-0XB0)

Pin	X19
1	L+ / 5 V DC
2	M / 5 V DC
3	DI e.0
4	DI e.1
5	DI e.2
6	DI e.3

A.13.2 SB 1222 200 kHz digital output specifications

Table A- 190 General specifications

Technical data	SB 1222 DQ 4 x 24 V DC, 200 kHz	SB 1222 DQ 4 x 5 V DC, 200 kHz
Article number	6ES7222-1BD30-0XB0	6ES7222-1AD30-0XB0
Dimensions W x H x D (mm)	38 x 62 x 21	
Weight	35 grams	
Power dissipation	0.5 W	
Current consumption (SM Bus)	35 mA	
Current consumption (24 V DC)	15 mA	

Table A- 191 Digital outputs

Technical data	SB 1222 DQ 4 x 24 V DC, 200 kHz	SB 1222 DQ 4 x 5 V DC, 200 kHz
Number of outputs	4	
Output type	Solid state - MOSFET sink and source[1]	
Voltage range	20.4 to 28.8 V DC	4.25 to 6.0 V DC
Logic 1 signal at max. current	L+ minus 1.5 V	L+ minus 0.7 V
Logic 0 signal at max. current	1.0 V DC, max.	0.2 V DC, max.
Current (max.)	0.1 A	
Lamp load	--	
On state contact resistance	11 Ω max.	7 Ω max.
Off state resistance	6 Ω max.	0.2 Ω max.
Leakage current per point	--	
Pulse Train Output rate	200 kHz max., 2 Hz min.	
Surge current	0.11 A	
Overload protection	No	
Isolation (field side to logic)	707 V DC (type test)	
Isolation groups	1	
Currents per common	0.4 A	
Inductive clamp voltage	Non	
Switching delay	1.5 µs + 300 ns rise 1.5 µs + 300 ns fall	200 ns + 300 ns rise 200 ns + 300 ns fall
Behavior on RUN to STOP	Last value or substitute value (default value 0)	

Technical data	SB 1222 DQ 4 x 24 V DC, 200 kHz	SB 1222 DQ 4 x 5 V DC, 200 kHz
Number of outputs on simultaneously	• 2 (no adjacent points) at 60 °C horizontal or 50 °C vertical • 4 at 55 °C horizontal or 45 °C vertical	4
Cable length (meters)	50 shielded twisted pair	

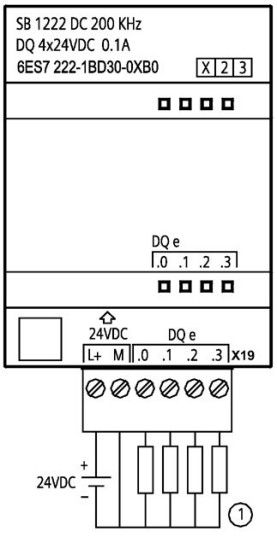
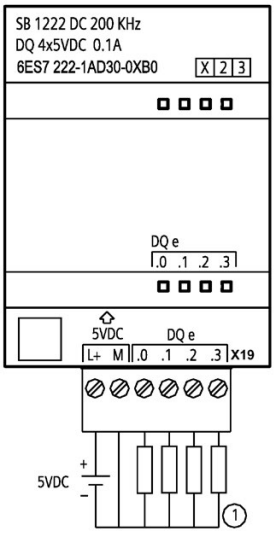
[1] Because both sinking and sourcing configurations are supported by the same circuitry, the active state of a sourcing load is opposite that of a sinking load. A source output exhibits positive logic (Q bit and LED are ON when the load has current flow), while a sink output exhibits negative logic (Q bit and LED are OFF when the load has current flow). If the module is plugged in with no user program, the default for this module is 0 V, which means that a sinking load will be turned ON.

Note

When switching frequencies above 20 kHz, it is important that the digital inputs receive a square wave. Consider the following options to improve the signal quality to the inputs:

- Minimize the cable length
- Change a driver from a sink only driver to a sinking and sourcing driver
- Change to a higher quality cable
- Reduce the circuit/components from 24 V to 5 V
- Add an external load at the input

Table A- 192 Wiring diagrams for the 200 kHz digital output SBs

SB 1222 DQ 4 x 24 V DC, 200 kHz (6ES7222-1BD30-0XB0)	SB 1222 DQ 4 x 5 V DC, 200 kHz (6ES7222-1AD30-0XB0)
	

① For sourcing outputs, connect "Load" to "-" (shown). For sinking outputs, connect "Load" to "+". Because both sinking and sourcing configurations are supported by the same circuitry, the active state of a sourcing load is opposite that of a sinking load. A source output exhibits positive logic (Q bit and LED are ON when the load has current flow), while a sink output exhibits negative logic (Q bit and LED are OFF when the load has current flow). If the module is plugged in with no user program, the default for this module is 0 V, which means that a sinking load will be turned ON.

Note

Ensure that the M connection wire is securely grounded. Loss of the ground wire connection to the high-speed DQ SBs may allow enough leakage current to activate a DC load. If the outputs are used for critical DC load applications, extra caution should be exercised by using a redundant ground wire to the SB.

Table A- 193 Connector pin locations for SB 1222 DQ 4 x 24 V DC, 200 kHz (6ES7222-1BD30-0XB0)

Pin	X19
1	L+ / 24 V DC
2	M / 24 V DC
3	DQ e.0
4	DQ e.1
5	DQ e.2
6	DQ e.3

Table A- 194 Connector pin locations for SB 1222 DQ 4 x 5 V DC, 200 kHz (6ES7222-1AD30-0XB0)

Pin	X19
1	L+ / 5 V DC
2	M / 5 V DC
3	DQ e.0
4	DQ e.1
5	DQ e.2
6	DQ e.3

A.13.3 SB 1223 200 kHz digital input / output specifications

Table A- 195 General specifications

Technical data	SB 1223 DI 2 x 24 V DC / DQ 2 x 24 V DC, 200 kHz	SB 1223 DI 2 x 5 V DC / DQ 2 x 5 V DC, 200 kHz
Article number	6ES7223-3BD30-0XB0	6ES7223-3AD30-0XB0
Dimensions W x H x D (mm)	38 x 62 x 21	
Weight	35 grams	
Power dissipation	1.0 W	0.5 W
Current consumption (SM Bus)	35 mA	
Current consumption (24 V DC)	7 mA / Input + 30 mA	15 mA / input + 15 mA

Table A- 196 Digital inputs

Technical data		SB 1223 DI 2 x 24 V DC / DQ 2 x 24 V DC, 200 kHz	SB 1223 DI 2 x 5 V DC / DQ 2 x 5 V DC, 200 kHz
Number of inputs		2	
Type		Source	
Rated voltage		24 V DC at 7 mA, nominal	5 V DC at 15 mA, nominal
Continuous permissible voltage		28.8 V DC	6 V DC
Surge voltage		35 V DC for 0.5 sec.	6 V
Logic 1 signal		0 V (10 mA) to L+ minus 10 V (2.9 mA)	0 V (20 mA) to L+ minus 2.0 V (5.1 mA)
Logic 0 signal		L+ minus 5 V (1.4 mA) to L+ (0 mA)	L+ minus 1.0 V (2.2 mA) to L + (0 mA)
HSC clock input rates (max.)		Single phase: 200 kHz Quadrature phase: 160 kHz	
Isolation (field side to logic)		707 V DC (type test)	
Isolation groups		1 (no isolation to outputs)	
Filter times	us settings	0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0	
	ms settings	0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0	
Number of inputs on simultaneously		2	
Cable length (meters)		50 shielded twisted pair	

Table A- 197 Digital outputs

Technical data	SB 1223 DI 2 x 24 V DC / DQ 2 x 24 V DC, 200 kHz	SB 1223 DI 2 x 5 V DC / DQ 2 x 5 V DC, 200 kHz
Number of outputs	2	
Output type	Solid state - MOSFET sink and source[1]	
Voltage range	20.4 to 28.8 V DC	4.25 to 6.0 V DC
Rated value	24 V DC	5 V DC
Logic 1 signal at max. current	L+ minus 1.5 V	L+ minus 0.7 V
Logic 0 signal at max. current	1.0 V DC, max.	0.2 V DC, max.
Current (max.)	0.1 A	
Lamp load	--	
On state contact resistance	11 Ω max.	7 Ω max.
Off state resistance	6 Ω max.	0.2 Ω max.
Leakage current per point	--	
Pulse Train Output rate	200 kHz max., 2 Hz min.	
Surge current	0.11 A	
Overload protection	No	
Isolation (field side to logic)	707 V DC (type test)	
Isolation groups	1 (no isolation to inputs)	
Currents per common	0.2 A	
Inductive clamp voltage	Non	
Switching delay	1.5 µs + 300 ns rise 1.5 µs + 300 ns fall	200 ns + 300 ns rise 200 ns + 300 ns fall

Technical data	SB 1223 DI 2 x 24 V DC / DQ 2 x 24 V DC, 200 kHz	SB 1223 DI 2 x 5 V DC / DQ 2 x 5 V DC, 200 kHz
Behavior on RUN to STOP	Last value or substitute (default value 0)	
Number of outputs on simultaneously	2	
Cable length (meters)	50 shielded twisted pair	

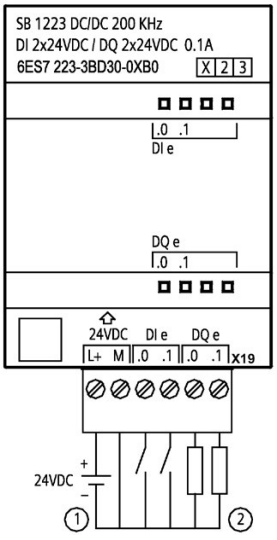
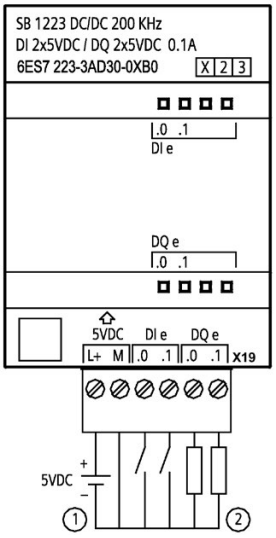
[1] Because both sinking and sourcing configurations are supported by the same circuitry, the active state of a sourcing load is opposite that of a sinking load. A source output exhibits positive logic (Q bit and LED are ON when the load has current flow), while a sink output exhibits negative logic (Q bit and LED are OFF when the load has current flow). If the module is plugged in with no user program, the default for this module is 0 V, which means that a sinking load will be turned ON.

Note

When switching frequencies above 20 kHz, it is important that the digital inputs receive a square wave. Consider the following options to improve the signal quality to the inputs:

- Minimize the cable length
- Change a driver from a sink only driver to a sinking and sourcing driver
- Change to a higher quality cable
- Reduce the circuit/components from 24 V to 5 V
- Add an external load at the input

Table A- 198 Wiring diagrams for the 200 kHz digital input/output SBs

SB 1223 DI 2 x 24 V DC/DQ 2 x 24 V DC, 200 kHz (6ES7223-3BD30-0XB0)	SB 1223 DI 2 x 5 V DC / DQ 2 x 5 V DC, 200 kHz (6ES7223-3AD30-0XB0)
	

① Supports sourcing inputs only

② For sourcing outputs, connect "Load" to "-" (shown). For sinking outputs, connect "Load" to "+". [1] Because both sinking and sourcing configurations are supported by the same circuitry, the active state of a sourcing load is opposite that of a sinking load. A source output exhibits positive logic (Q bit and LED are ON when the load has current flow), while a sink output exhibits negative logic (Q bit and LED are OFF when the load has current flow). If the module is plugged in with no user program, the default for this module is 0 V, which means that a sinking load will be turned ON.

Note

Ensure that the M connection wire is securely grounded. Loss of the ground wire connection to the high-speed DQ SBs may allow enough leakage current to activate a DC load. If the outputs are used for critical DC load applications, extra caution should be exercised by using a redundant ground wire to the SB.

Table A- 199 Connector pin locations for SB 1223 DI 2 x 24 V DC/DQ 2 x 24 V DC, 200 kHz (6ES7223-3BD30-0XB0)

Pin	X19
1	L+ / 24 V DC
2	M / 24 V DC
3	DI e.0
4	DI e.1
5	DQ e.0
6	DQ e.1

Table A- 200 Connector pin locations for SB 1223 DI 2 x 5 V DC / DQ 2 x 5 V DC, 200 kHz (6ES7223-3AD30-0XB0)

Pin	X19
1	L+ / 5 V DC
2	M / 5 V DC
3	DI e.0
4	DI e.1
5	DQ e.0
6	DQ e.1

A.13.4 SB 1223 2 X 24 V DC input / 2 X 24 V DC output specifications

Table A- 201 General specifications

Technical Data	SB 1223 DI 2 x 24 V DC, DQ 2 x 24 V DC
Article number	6ES7223-0BD30-0XB0
Dimensions W x H x D (mm)	38 x 62 x 21
Weight	40 grams
Power dissipation	1.0 W
Current consumption (SM Bus)	50 mA
Current consumption (24 V DC)	4 mA / Input used

Table A- 202 Digital inputs

Technical Data	SB 1223 DI 2 x 24 V DC, DQ 2 x 24 V DC
Number of inputs	2
Type	IEC Type 1 sink
Rated voltage	24 V DC at 4 mA, nominal
Continuous permissible voltage	30 V DC, max.
Surge voltage	35 V DC for 0.5 sec.

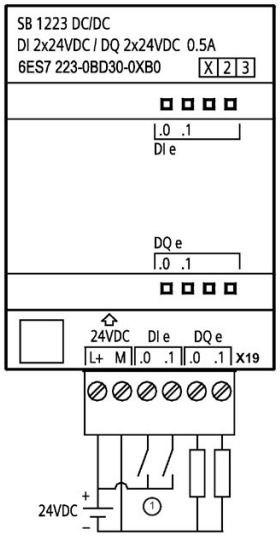
Technical Data		SB 1223 DI 2 x 24 V DC, DQ 2 x 24 V DC
Logic 1 signal (min.)		15 V DC at 2.5 mA
Logic 0 signal (max.)		5 V DC at 1 mA
HSC clock input rates (max.)		Single phase: 30 kHz (15 to 26 V DC) Quadrature phase: 20 kHz (15 to 26 V DC)
Isolation (field side to logic)		707 V DC (type test)
Isolation groups		1
Filter times	us settings	0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4,10.0, 12.8, 20.0
	ms settings	0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 10.0, 12.8, 20.0
Number of inputs on simultaneously		2
Cable length (meters)		500 shielded, 300 unshielded

Table A- 203 Digital outputs

Technical Data	SB 1223 DI 2 x 24 V DC, DQ 2 x 24 V DC
Number of outputs	2
Output type	Solid state - MOSFET (sourcing)
Voltage range	20.4 to 28.8 V DC
Logic 1 signal at max. current	20 V DC min.
Logic 0 signal with 10K Ω load	0.1 V DC max.
Current (max.)	0.5 A
Lamp load	5 W
On state contact resistance	0.6 Ω max.
Leakage current per point	10 µA max.
Pulse Train Output (PTO) rate	20 kHz max., 2 Hz min.[1]
Surge current	5 A for 100 ms max.
Overload protection	No
Isolation (field side to logic)	707 V DC (type test)
Isolation groups	1
Currents per common	1 A
Inductive clamp voltage	L+ minus 48 V, 1 W dissipation
Switching delay	2 µs max. off to on 10 µs max. on to off
Behavior on RUN to STOP	Last value or substitute value (default value 0)
Number of outputs on simultaneously	2
Cable length (meters)	500 m shielded, 150 m unshielded

[1] Depending on your pulse receiver and cable, an additional load resistor (at least 10% of rated current) may improve pulse signal quality and noise immunity.

Table A- 204 Wiring diagram for the digital input/output SB

SB 1223 DI 2 x 24 V DC, DQ 2 x 24 V DC (6ES7223-0BD30-0XB0)	
	

① Supports sinking inputs only

Table A- 205 Connector pin locations for SB 1223 DI 2 x 24 V DC, DQ 2 x 24 V DC (6ES7223-0BD30-0XB0)

Pin	X19
1	L+ / 24 V DC
2	M / 24 V DC
3	DI e.0
4	DI e.1
5	DQ e.0
6	DQ e.1

A.14 Analog signal boards (SBs)

A.14.1 SB 1231 1 analog input specifications

Note

To use this SB, your CPU firmware must be V2.0 or higher.

Table A- 206 General specifications

Technical data	SB 1231 AI 1 x 12 bit
Article number	6ES7231-4HA30-0XB0
Dimensions W x H x D (mm)	38 x 62 x 21
Weight	35 grams
Power dissipation	0.4 W
Current consumption (SM Bus)	55 mA
Current consumption (24 V DC)	none

Table A- 207 Analog inputs

Technical data	SB 1231 AI 1x12 bit
Number of inputs	1
Type	Voltage or current (differential)
Range	±10 V, ±5 V, ±2.5 or 0 to 20 mA
Resolution	11 bits + sign bit
Full scale range (data word)	-27648 to 27648
Over/Under range (data word)	Voltage: 32511 to 27649 / -27649 to -32512 Current: 32511 to 27649 / 0 to -4864 (Refer to Analog input representation for voltage and Analog input representation for current (Page 1506).)
Overflow/Underflow (data word)	Voltage: 32767 to 32512 / -32513 to -32768 Current: 32767 to 32512 / -4865 to -32768 (Refer to Analog input representation for voltage and Analog input representation for current (Page 1506).)
Maximum withstand voltage / current	±35 V / ±40 mA
Smoothing	None, weak, medium, or strong (refer to Analog input response times for step response time (Page 1505).)
Noise rejection	400, 60, 50, or 10 Hz (refer to Analog input response times for sample rates (Page 1506).)
Accuracy (25 °C / -20 to 60 °C)	±0.3% / ±0.6% of full scale
Input impedance	Voltage: 150 kΩ; Current: 250 Ω
Behavior on RUN to STOP	Last value or substitute value (default value 0)

Technical data	SB 1231 AI 1x12 bit
Measuring principle	Actual value conversion
Common mode rejection	40 dB, DC to 60 Hz
Operational signal range	Signal plus common mode voltage must be less than +35 V and greater than -35 V
Isolation (field side to logic)	None
Cable length (meters)	100 m, twisted and shielded

Table A- 208 Diagnostics

Technical data	SB 1231 AI 1 x 12 bit
Overflow/underflow	Yes
24 V DC low voltage	no

SB 1231 wiring current transducers

Wiring current transducers are available as 2-wire transducers and 4-wire transducers as shown below.

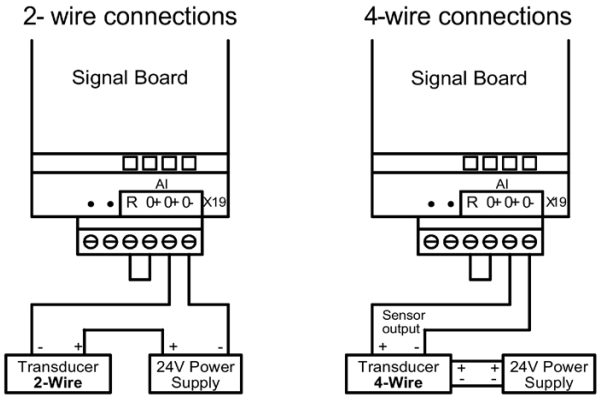


Table A- 209 Wiring diagram for the analog input SB

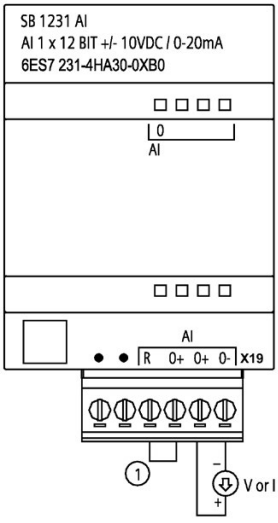
SB 1231 AI x 12 bit (6ES7231-4HA30-0XB0)	
	① Connect "R" and "0+" for current applications. Note: Connectors must be gold. See Appendic C, Spare Parts for article number.

Table A- 210 Connector pin locations for SB 1231 AI x 12 bit (6ES7231-4HA30-0XB0)

Pin	X19 (gold)
1	No connection
2	No connection
3	AI R
4	AI 0+
5	AI 0+
6	AI 0-

A.14.2 SB 1232 1 analog output specifications

Table A- 211 General specifications

Technical data	SB 1232 AQ 1 x 12 bit
Article number	6ES7232-4HA30-0XB0
Dimensions W x H x D (mm)	38 x 62 x 21
Weight	40 grams
Power dissipation	1.5 W
Current consumption (SM Bus)	15 mA
Current consumption (24 V DC)	40 mA (no load)

Table A- 212 Analog outputs

Technical data	SB 1232 AQ 1 x 12 bit
Number of outputs	1
Type	Voltage or current
Range	±10 V or 0 to 20 mA
Resolution	Voltage: 12 bits Current: 11 bits
Full scale range (data word) Refer to the output ranges for voltage and current (Page 1507).	Voltage: -27648 to 27648 Current: 0 to 27648
Accuracy (25 °C / -20 to 60 °C)	±0.5% / ±1% of full scale
Settling time (95% of new value)	Voltage: 300 µs (R), 750 µs (1 uF) Current: 600 µs (1 mH), 2 ms (10 mH)
Load impedance	Voltage: ≥ 1000 Ω Current: ≤ 600 Ω
Behavior on RUN to STOP	Last value or substitute value (default value 0)
Isolation (field side to logic)	None
Cable length (meters)	100 m, twisted and shielded

Table A- 213 Diagnostics

Technical data	SB 1232 AQ 1 x 12 bit
Overflow/underflow	Yes
Short to ground (voltage mode only)	Yes
Wire break (current mode only)	Yes

Table A- 214 Wiring diagram for the SB 1232 AQ 1 x 12 bit

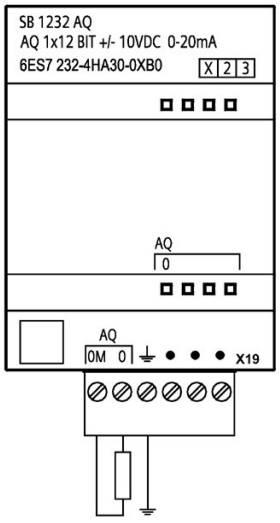
SB 1232 AQ 1 x 12 bit (6ES7232-4HA30-0XB0)	
	
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

Table A- 215 Connector pin locations for SB 1232 AQ 1 x 12 bit (6ES7232-4HA30-0XB0)

Pin	X19 (gold)
1	AQ 0M
2	AQ 0
3	Functional Earth
4	No connection
5	No connection
6	No connection

A.14.3 Measurement ranges for analog inputs and outputs

A.14.3.1 Step response of the analog inputs

Table A- 216 Step response (ms), 0 V to 10 V measured at 95%

Smoothing selection (sample averaging)	Integration time selection			
	400 Hz (2.5 ms)	60 Hz (16.6 ms)	50 Hz (20 ms)	10 Hz (100 ms)
None (1 cycle): No averaging	4.5 ms	18.7 ms	22.0 ms	102 ms
Weak (4 cycles): 4 samples	10.6 ms	59.3 ms	70.8 ms	346 ms
Medium (16 cycles): 16 samples	33.0 ms	208 ms	250 ms	1240 ms
Strong (32 cycles): 32 samples	63.0 ms	408 ms	490 ms	2440 ms
Sample time	**0.156 ms**	**1.042 ms**	**1.250 ms**	**6.250 ms**

A.14.3.2 Sample time and update times for the analog inputs

Table A- 217 Sample time and update time

Selection	Sample time	SB update time
400 Hz (2.5 ms)	0.156 ms	0.156 ms
60 Hz (16.6 ms)	1.042 ms	1.042 ms
50 Hz (20 ms)	1.250 ms	1.25 ms
10 Hz (100 ms)	6.250 ms	6.25 ms

A.14.3.3 Measurement ranges of the analog inputs for voltage and current (SB and SM)

Table A- 218 Analog input representation for voltage (SB and SM)

System		Voltage Measuring Range				
Decimal	Hexadecimal	±10 V	±5 V	±2.5 V	±1.25 V	
32767	7FFF[1]	11.851 V	5.926 V	2.963 V	1.481 V	Overflow
32512	7F00					
32511	7EFF	11.759 V	5.879 V	2.940 V	1.470 V	Overshoot range
27649	6C01					
27648	6C00	10 V	5 V	2.5 V	1.250 V	Rated range
20736	5100	7.5 V	3.75 V	1.875 V	0.938 V	
1	1	361.7 µV	180.8 µV	90.4 µV	45.2 µV	
0	0	0 V	0 V	0 V	0 V	
-1	FFFF					
-20736	AF00	-7.5 V	-3.75 V	-1.875 V	-0.938 V	
-27648	9400	-10 V	-5 V	-2.5 V	-1.250 V	
-27649	93FF					Undershoot range
-32512	8100	-11.759 V	-5.879 V	-2.940 V	-1.470 V	
-32513	80FF					Underflow
-32768	8000	-11.851 V	-5.926 V	-2.963 V	-1.481 V	

[1] 7FFF can be returned for one of the following reasons: overflow (as noted in this table), before valid values are available (for example immediately upon a power up), or if a wire break is detected.

Table A- 219 Analog input representation for current (SB and SM)

System		Current measuring range		
Decimal	**Hexadecimal**	**0 mA to 20 mA**	**4 mA to 20 mA**	
32767	7FFF	> 23.52 mA	> 22.81 mA	Overflow
32511	7EFF	23.52 mA	22.81 mA	Overshoot range
27649	6C01			
27648	6C00	20 mA	20 mA	Nominal range
20736	5100	15 mA	16 mA	
1	1	723.4 nA	4 mA + 578.7 nA	
0	0	0 mA	4 mA	
-1	FFFF			Undershoot range
-4864	ED00	-3.52 mA	1.185 mA	
32767[1]	7FFF		< 1.185 mA	Wire break (4 to 20 mA)
-32768	8000	< -3.52 mA		Underflow (0 to 20 mA)

[1] The wire break value of 32767 (16#7FFF) is always returned regardless of the state of the wire break alarm.

A.14.3.4 Measurement ranges of the analog outputs for voltage and current (SB and SM)

Table A- 220 Analog output representation for voltage (SB and SM)

System		Voltage Output Range	
Decimal	**Hexadecimal**	**± 10 V**	
32767	7FFF	See note 1	Overflow
32512	7F00	See note 1	
32511	7EFF	11.76 V	Overshoot range
27649	6C01		
27648	6C00	10 V	Rated range
20736	5100	7.5 V	
1	1	361.7 µ V	
0	0	0 V	
-1	FFFF	-361.7 µ V	
-20736	AF00	-7.5 V	
-27648	9400	-10 V	
-27649	93FF		Undershoot range
-32512	8100	-11.76 V	
-32513	80FF	See note 1	Underflow
-32768	8000	See note 1	

[1] In an overflow or underflow condition, analog outputs will take on the substitute value of the STOP mode.

Table A- 221 Analog output representation for current (SB and SM)

System		Current output range		
Decimal	**Hexadecimal**	**0 mA to 20 mA**	**4 mA to 20 mA**	
32767	7FFF	See note 1	See note 1	Overflow
32512	7F00	See note 1	See note 1	
32511	7EFF	23.52 mA	22.81 mA	Overshoot range
27649	6C01			
27648	6C00	20 mA	20 mA	Rated range
20736	5100	15 mA	16 mA	
1	1	723.4 nA	4 mA + 578.7 nA	
0	0	0 mA	4mA	
-1	FFFF		4 mA to 578.7 nA	Undershoot range
-6912	E500		0 mA	
-6913	E4FF			Not possible. Output value limited to 0 mA.
-32512	8100			
-32513	80FF	See note 1	See note 1	Underflow
-32768	8000	See note 1	See note 1	

[1] In an overflow or underflow condition, analog outputs will take on the substitute value of the STOP mode.

A.14.4 Thermocouple signal boards (SBs)

A.14.4.1 SB 1231 1 analog thermocouple input specifications

Note

To use this SB, your CPU firmware must be V2.0 or higher.

Table A- 222 General specifications

Technical data	SB 1231 AI 1 x 16 bit Thermocouple
Article number	6ES7231-5QA30-0XB0
Dimensions W x H x D (mm)	38 x 62 x 21
Weight	35 grams
Power dissipation	0.5 W
Current consumption (SM Bus)	5 mA
Current consumption (24 V DC)	20 mA

Table A- 223 Analog inputs

Technical data		SB 1231 AI 1x16 bit Thermocouple
Number of inputs		1
Type		Floating TC and mV
Range • Nominal range (data word) • Overrange/underrange (data word) • Overflow/underflow (data word)		See Thermocouple filter selection table (Page 1510).
Resolution	Temperature	0.1° C / 0.1° F
	Voltage	15 bits plus sign
Maximum withstand voltage		±35 V
Noise rejection		85 dB for the selected filter setting (10 Hz, 50 Hz, 60 Hz, 400 Hz)
Common mode rejection		> 120 dB at 120 V AC
Impedance		≥ 10 M Ω
Accuracy		See Thermocouple selection table (Page 1510).
Repeatability		±0.05% FS
Measuring principle		Integrating
Module update time		See Thermocouple filter selection table (Page 1510).
Cold junction error		±1.5° C
Isolation (field side to logic)		707 V DC (type test)
Cable length (meters)		100 m to sensor max.
Wire resistance		100 Ω max.

Table A- 224 Diagnostics

Technical data	SB 1231 AI 1 x 16 bit Thermocouple
Overflow/underflow[1]	Yes
Wire break[2, 3]	Yes

1 The overflow and underflow diagnostic alarm information will be reported in the analog data values even if the alarms are disabled in the module configuration.

2 When wire break alarm is disabled and an open wire condition exists in the sensor wiring, the module may report random values.

3 The module performs wire break testing every 6 seconds, which extends the update time by 9 ms for each enable channel once every 6 seconds.

The SM 1231 Thermocouple (TC) analog signal module measures the value of voltage connected to the module inputs.

The SB 1231 Thermocouple analog signal board measures the value of voltage connected to the signal board inputs. The temperature measurement type can be either "Thermocouple" or "Voltage".

- "Thermocouple": The value will be reported in degrees multiplied by ten (for example, 25.3 degrees will be reported as decimal 253).
- "Voltage": The nominal range full scale value will be decimal 27648.

A.14.4.2 Basic operation for a thermocouple

Thermocouples are formed whenever two dissimilar metals are electrically bonded to each other. A voltage is generated that is proportional to the junction temperature. This voltage is small; one microvolt could represent many degrees. Measuring the voltage from a thermocouple, compensating for extra junctions, and then linearizing the result forms the basis of temperature measurement using thermocouples.

When you connect a thermocouple to the SM 1231 Thermocouple module, the two dissimilar metal wires are attached to the module at the module signal connector. The place where the two dissimilar wires are attached to each other forms the sensor thermocouple.

Two more thermocouples are formed where the two dissimilar wires are attached to the signal connector. The connector temperature causes a voltage that adds to the voltage from the sensor thermocouple. If this voltage is not corrected, then the temperature reported will deviate from the sensor temperature.

Cold junction compensation is used to compensate for the connector thermocouple. Thermocouple tables are based on a reference junction temperature, usually zero degrees Celsius. The cold junction compensation compensates the connector to zero degrees Celsius. The cold junction compensation restores the voltage added by the connector thermocouples. The temperature of the module is measured internally, and then converted to a value to be added to the sensor conversion. The corrected sensor conversion is then linearized using the thermocouple tables.

For optimum operation of the cold junction compensation, the thermocouple module must be located in a thermally stable environment. Slow variation (less than 0.1 °C/minute) in ambient module temperature is correctly compensated within the module specifications. Air movement across the module will also cause cold junction compensation errors.

If better cold junction error compensation is needed, an external iso-thermal terminal block may be used. The thermocouple module provides for use of a 0 °C referenced or 50 °C referenced terminal block.

Selection table for the SB 1231 thermocouple

The ranges and accuracy for the different thermocouple types supported by the SB 1231 Thermocouple signal board are shown in the table below.

Table A- 225 Thermocouple selection table

Type	Under-range min-imum[1]	Nominal range low limit	Nominal range high limit	Over-range maxi-mum[2]	Normal range [3, 4] accuracy @ 25 °C	Normal range [1, 2] accuracy - 20 °C to 60 °C
J	-210.0 °C	-150.0 °C	1200.0 °C	1450.0 °C	±0.3 °C	±0.6 °C
	-346.0 °F	-238.0 °F	2192.0 °F	2642.0 °F	±0.5 °F	±1.1 °F
K	-270.0 °C	-200.0 °C	1372.0 °C	1622.0 °C	±0.4 °C	±1.0 °C
	-454.0 °F	-328.0 °F	2501.6 °F	2951.6 °F	±0.7 °F	±1.8 °F
T	-270.0 °C	-200.0 °C	400.0 °C	540.0 °C	±0.5 °C	±1.0 °C
	-454.0 °F	-328.0 °F	752.0 °F	1004.0 °F	±0.9 °F	±1.8 °F
E	-270.0 °C	-200.0 °C	1000.0 °C	1200.0 °C	±0.3 °C	±0.6 °C
	-454.0 °F	-328.0 °F	1832.0 °F	2192.0 °F	±0.5 °F	±1.1 °F
R & S	-50.0 °C	100.0 °C	1768.0 °C	2019.0 °C	±1.0 °C	±2.5 °C
	-58.0 °C	212.0 °F	3214.4 °F	3276.6 °F [5]	±1.8 °F	±4.5 °F
B	0.0 °C	200.0 °C	800.0 °C	--	±2.0 °C	±2.5 °C
	32.0 °F	392.0 °F	1472.0 °F	--	±3.6 °F	±4.5 °F
	--	800.0 °C	1820.0 °C	1820.0 °C	±1.0 °C	±2.3 °C
	--	1472.0 °F	3276.6 °F [5]	3276.6 °F [5]	±1.8 °F	±4.1 °F
N	-270.0 °C	-200.0 °C	1300.0 °C	1550.0 °C	±1.0 °C	±1.6 °C
	-454.0 °F	-328.0 °F	2372.0 °F	2822.0 °F	±1.8 °F	±2.9 °F
C	0.0 °C	100.0 °C	2315.0 °C	2500.0 °C	±0.7 °C	±2.7 °C
	32.0 °F	212.0 °F	3276.6 °F [5]	3276.6 °F [5]	±1.3 °F	±4.9 °F
TXK/XK(L)	-200.0 °C	-150.0 °C	800.0 °C	1050.0 °C	±0.6 °C	±1.2 °C
	-328.0 °F	302.0 °F	1472.0 °F	1922.0 °F	±1.1 °F	±2.2 °F

Type	Under-range min-imum[1]	Nominal range low limit	Nominal range high limit	Over-range maxi-mum[2]	Normal range [3, 4] accuracy @ 25 °C	Normal range [1, 2] accuracy - 20 °C to 60 °C
Voltage	-32512	-27648 -80mV	27648 80mV	32511	±0.05%	±0.1%

1 Thermocouple values below the under-range minimum value are reported as -32768.

2 Thermocouple values above the over-range maximum value are reported as 32767.

3 Internal cold junction error is ±1.5 °C for all ranges. This adds to the error in this table. The module requires at least 30 minutes of warm-up time to meet this specification.

4 In the presence of radiated radio frequency of 970 MHz to 990 MHz, the accuracy of the SM 1231 AI 4 x 16 bit TC may be degraded.

5 Lower limit of 3276.6 °F with °F reporting

Table A- 226 Filter selection table for the SB 1231 Thermocouple

Rejection frequency (Hz)	Integration time (ms)	Signal board update time (seconds)
10	100	0.306
50	20	0.066
60	16.67	0.056
400[1]	10	0.036

1 To maintain module resolution and accuracy when 400 Hz rejection is selected, the integration time is 10 ms. This selection also rejects 100 Hz and 200 Hz noise.

It is recommended for measuring thermocouples that a 100 ms integration time be used. The use of smaller integration times will increase the repeatability error of the temperature readings.

Note

After power is applied to the module, it performs internal calibration for the analog to digital converter. During this time, the module reports a value of 32767 on each channel until valid data is available on that channel. Your user program may need to allow for this initialization time.

Table A- 227 Wiring diagram for SB 1231 AI 1 x 16 thermocouple

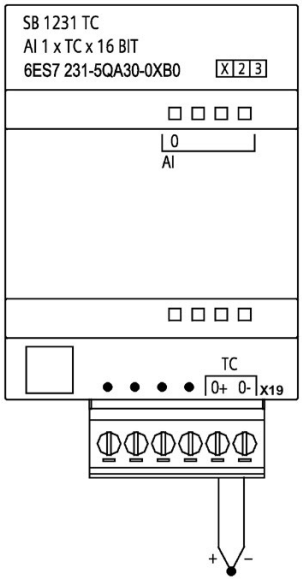
SB 1231 AI 1 x 16 bit thermocouple (6ES7231-5QA30-0XB0)	
	
Note: Connectors must be gold. See Appendix C, Spare Parts for article number.	

Table A- 228 Connector pin locations for SB 1231 AI 1 x 16 bit thermocouple (6ES7231-5QA30-0XB0)

Pin	X19 (gold)
1	No connection
2	No connection
3	No connection
4	No connection
5	AI 0- /TC
6	AI 0+ /TC

A.14.5 RTD signal boards (SBs)

A.14.5.1 SB 1231 1 analog RTD input specifications

Note

To use this SB, your CPU firmware must be V2.0 or higher.

Table A- 229 General specifications

Technical data	SB 1231 AI 1 x 16 bit RTD
Article number	6ES7231-5PA30-0XB0
Dimensions W x H x D (mm)	38 x 62 x 2
Weight	35 grams
Power dissipation	0.7 W
Current consumption (SM Bus)	5 mA
Current consumption (24 V DC)	25 mA

Table A- 230 Analog inputs

Technical data		SB 1231 AI 1 x 16 bit RTD
Number of inputs		1
Type		Module referenced RTD and Ohms
Range • Nominal range (data word) • Overrange/underrange (data word) • Overflow/underflow (data word)		See Selection tables (Page 1517).
Resolution	Temperature	0.1 °C/ 0.1 °F
	Voltage	15 bits plus sign
Maximum withstand voltage		±35 V
Noise rejection		85 dB (10 Hz, 50 Hz, 60 Hz, 400 Hz)
Common mode rejection		> 120 dB
Impedance		≥ 10 MΩ
Accuracy		See Selection tables (Page 1517).
Repeatability		±0.05% FS
Maximum sensor dissipation		0.5 m W
Measuring principle		Integrating
Module update time		See Selection table (Page 1517).
Isolation (field side to logic)		707 V DC (type test)
Cable length (meters)		100 m to sensor max.
Wire resistance		20 Ω, 2.7 for 10 Ω RTD max.

Table A- 231 Diagnostics

Technical data	SB 1231 AI 1 x 16 bit RTD
Overflow/underflow[1, 2]	Yes
Wire break [3]	Yes

1 The overflow and underflow diagnostic alarm information will be reported in the analog data values even if the alarms are disabled in the module configuration.

2 For resistance ranges underflow detection is never enabled.

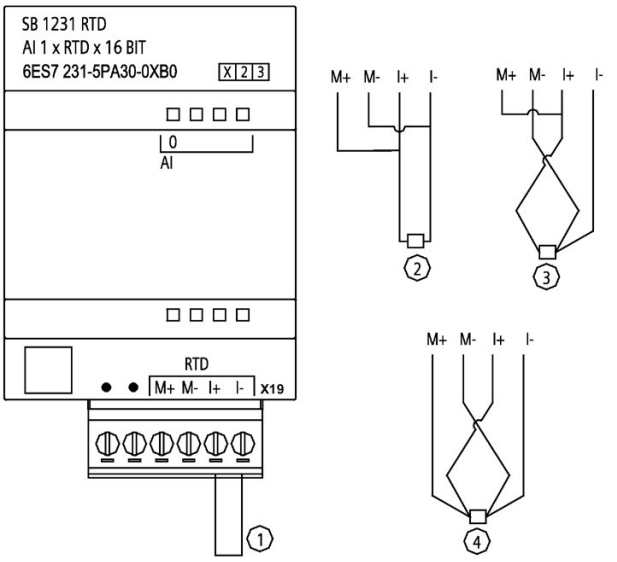
3 When wire break alarm is disabled and an open wire condition exists in the sensor wiring, the module may report random values.

The SM 1231 RTD analog signal board measures the value of resistance connected to the signal board inputs. The measurement type can be selected as either "Resistor" or "Thermal resistor".

- "Resistor": The nominal range full scale value will be decimal 27648.
- "Thermal resistor": The value will be reported in degrees multiplied by ten (for example, 25.3 degrees will be reported as decimal 253). The climatic range values will be reported in degrees multiplied by one hundred (for example, 25.34 degrees will be reported as decimal 2534).

The SB 1231 RTD signal board supports measurements with 2-wire, 3-wire and 4-wire connections to the sensor resistor.

Table A- 232 Wiring diagram for SB 1231 AI 1 x 16 bit RTD

SB 1231 AI 1 x 16 bit RTD (6ES7231-5PA30-0XB0)	
	

① Loop-back unused RTD input

② 2-wire RTD

③ 3-wire RTD

④ 4-wire RTD

Note: Connectors must be gold. See Appendix C, Spare Parts for article number.

Table A- 233 Connector pin locations for SB 1231 AI 1 x 16 bit RTD (6ES7231-5PA30-0XB0)

Pin	X19 (gold)
1	No connection
2	No connection
3	AI 0 M+ /RTD
4	AI 0 M- /RTD
5	AI 0 I+ /RTD
6	AI 0 I- /RTD

A.14.5.2 Selection tables for the SB 1231 RTD

Table A- 234 Ranges and accuracy for the different sensors supported by the RTD modules

Temperature coefficient	RTD type	Under range minimum[1]	Nominal range low limit	Nominal range high limit	Over range maximum[2]	Normal range accuracy @ 25 °C	Normal range accuracy -20 °C to 60 °C
Pt 0.003850	Pt 100 climatic	-145.00 °C	-120.00 °C	-145.00 °C	-155.00 °C	±0.20 °C	±0.40 °C
ITS90	Pt 10	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	±1.0 °C	±2.0 °C
DIN EN 60751	Pt 50	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	±0.5 °C	±1.0 °C
	Pt 100						
	Pt 200						
	Pt 500						
	Pt 1000						
Pt 0.003902	Pt 100	-243.0 °C	-200.0 °C	850.0 °C	1000.0 °C	± 0.5 °C	±1.0 °C
Pt 0.003916	Pt 200						
Pt 0.003920	Pt 500						
	Pt 1000						
Pt 0.003910	Pt 10	-273.2 °C	-240.0 °C	1100.0 °C	1295 °C	±1.0 °C	±2.0 °C
	Pt 50	-273.2 °C	-240.0 °C	1100.0 °C	1295 °C	±0.8 °C	±1.6 °C
	Pt 100						
	Pt 500						
Ni 0.006720	Ni 100	-105.0 °C	-60.0 °C	250.0 °C	295.0 °C	±0.5 °C	±1.0 °C
Ni 0.006180	Ni 120						
	Ni 200						
	Ni 500						
	Ni 1000						
LG-Ni 0.005000	LG-Ni 1000	-105.0 °C	-60.0 °C	250.0 °C	295.0 °C	±0.5 °C	±1.0 °C
Ni 0.006170	Ni 100	-105.0 °C	-60.0 °C	180.0 °C	212.4 °C	±0.5 °C	±1.0 °C
Cu 0.004270	Cu 10	-240.0 °C	-200.0 °C	260.0 °C	312.0 °C	±1.0 °	±2.0 °C
Cu 0.004260	Cu 10	-60.0 °C	-50.0 °C	200.0 °C	240.0 °C	±1.0 °C	±2.0 °C
	Cu 50	-60.0 °C	-50.0 °C	200.0 °C	240.0 °C	±0.6 °C	±1.2 °C
	Cu 100						
Cu 0.004280	Cu 10	-240.0 °C	-200.0 °C	200.0 °C	240.0 °C	±1.0 °C	±2.0 °C
	Cu 50	-240.0 °C	-200.0 °C	200.0 °C	240.0 °C	±0.7 °C	±1.4 °C
	Cu 100						

1 RTD values below the under-range minimum value are reported as -32768.

2 RTD values above the over-range maximum value are reported as +32768.

Table A- 235 Resistance

Range	Under range minimum	Nominal range low limit	Nominal range high limit	Over range maximum[1]	Normal range accuracy @ 25 °C	Normal range accuracy -20 °C to 60 °C
150 Ω	n/a	0 (0 Ω)	27648 (150 Ω)	176.383 Ω	±0.05%	±0.1%
300 Ω	n/a	0 (0 Ω)	27648 (300 Ω)	352.767 Ω	±0.05%	±0.1%
600 Ω	n/a	0 (0 Ω)	27648 (600 Ω)	705.534 Ω	±0.05%	±0.1%

[1] Resistance values above the over-range maximum value are reported as 32767.

Note

The module reports 32767 on any activated channel with no sensor connected. If open wire detection is also enabled, the module flashes the appropriate red LEDs.

Best accuracy will be achieved for the 10 Ω RTD ranges if 4 wire connections are used.

The resistance of the connection wires in 2 wire mode will cause an error in the sensor reading and therefore accuracy is not guaranteed.

Table A- 236 Noise reduction and update times for the RTD modules

Rejection frequency selection	Integration time	4-/2-wire, 1-channel module Update time (seconds)	3-wire, 1-channel module Update time (seconds)
400 Hz (2.5 ms)	10 ms [1]	0.036	0.071
60 Hz (16.6 ms)	16.67 ms	0.056	0.111
50 Hz (20 ms)	20 ms	0.066	1.086
10 Hz (100 ms)	100 ms	0.306	0.611

[1] To maintain module resolution and accuracy when the 400 Hz filter is selected, the integration time is 10 ms. This selection also rejects 100 Hz and 200 Hz noise.

Note

After power is applied, the module performs internal calibration for the analog-to-digital converter. During this time the module reports a value of 32767 on each channel until valid data is available on that channel. Your user program may need to allow for this initialization time. Because the configuration of the module can vary the length of the initialization time, you should verify the behavior or the module in your configuration. If required, you can include logic in your user program to accommodate the initialization time of the module.

A.15 BB 1297 Battery board

BB 1297 Battery Board

The S7-1200 BB 1297 Battery Board is designed for long-term backup of the Real-time clock. It is pluggable in the signal board slot of the S7-1200 CPU (firmware 3.0 and later versions). You must add the BB 1297 to the device configuration and download the hardware configuration to the CPU for the BB to be functional.

The battery (type CR1025) is not included with the BB 1297 and must be purchased by the user.

Note

The BB 1297 is mechanically designed to fit the CPUs with the firmware 3.0 and later versions.

Do not use the BB 1297 with earlier version CPUs as the BB 1297 connector will not plug into the CPU.

WARNING

Installing an unspecified battery in the BB 1297, or otherwise connecting an unspecified battery to the circuit can result in fire or component damage and unpredictable operation of machinery.

Fire or unpredictable operation of machinery can result in death, severe personal injury, or property damage.

Use only the specified CR1025 battery for backup of the Real-time clock.

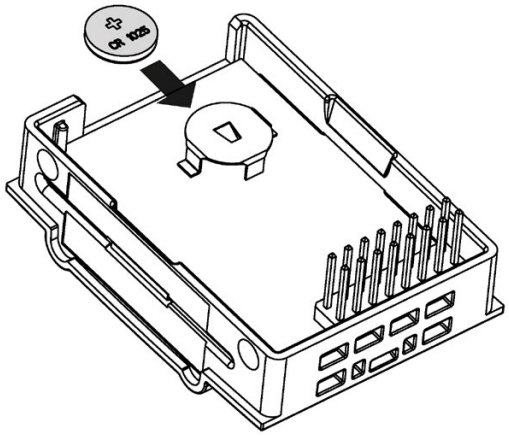
Table A- 237 General specifications

Technical data	BB 1297 Battery Board
Article number	6ES7297-0AX30-0XA0
Dimensions W x H x D (mm)	38 x 62 x 21
Weight	28 grams
Power dissipation	0.5 W
Current consumption (SM Bus)	11 mA
Current consumption (24 V DC)	none

Battery (not included)	BB 1297 Battery Board
Hold up time	Approximately 1 year
Battery type	CR1025 Refer to Installing or replacing a battery in the BB 1297 battery board (Page 62)
Nominal voltage	3 V
Nominal capacity	At least 30 mAH

Diagnostics	BB 1297 Battery Board
Critical battery level	< 2.5 V
Battery diagnostic	Low voltage indicator: • Low battery voltage causes the CPU MAINT LED to illuminate with the amber light continuously ON. • Diagnostic Buffer Event: 16#06:2700 "Submodule maintenance demanded: At least one battery exhausted (BATTF)"
Battery status	Battery status bit provided 0 = Battery OK 1 = Battery low
Battery status update	Battery status is updated at power up and then once per day while CPU is in RUN mode.

Table A- 238 Insertion diagram for the BB 1297 battery board

BB 1297 battery board (6ES7297-0AX30-0XA0)	
	

A.16 Communication interfaces

A.16.1 PROFIBUS

A.16.1.1 CM 1242-5 PROFIBUS DP SLAVE

Table A- 239 Technical specifications of the CM 1242-5

Technical specifications	
Article number	6GK7242-5DX30-0XE0
Interfaces	
Connection to PROFIBUS	9-pin D-sub female connector
Maximum current consumption on the PROFIBUS interface when connecting network components (for example optical network components)	15 mA at 5 V (only for bus termination) *)
Permitted ambient conditions	
Ambient temperature • during storage • during transportation • during operation with a vertical installation (DIN rail horizontal) • during operation with a horizontal installation (DIN rail vertical)	 • -40 °C to 70 °C • -40 °C to 70 °C • 0 °C to 55 °C • 0 °C to 45 °C
Relative humidity at 25 °C during operation, without condensation, maximum	95 %
Degree of protection	IP20
Power supply, current consumption and power loss	
Type of power supply	DC
Power supply from the backplane bus	5 V
Current consumption (typical)	150 mA
Effective power loss (typical)	0.75 W
Electrical isolation • PROFIBUS interface to ground • PROFIBUS interface to internal circuit	710 V DC for 1 minute
Dimensions and weights	
• Width • Height • Depth	• 30 mm • 100 mm • 75 mm

Technical specifications	
Weight	
• Net weight	• 115 g
• Weight including packaging	• 152 g

*)The current load of an external consumer connected between VP (pin 6) and DGND (pin 5) must not exceed a maximum of 15 mA (short-circuit proof) for bus termination.

A.16.1.2 Pinout of the D-sub socket of the CM 1242-5

PROFIBUS interface

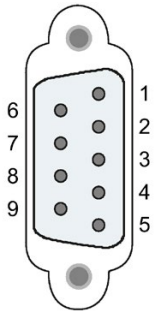


Table A- 240 Pinout of the D-sub socket

Pin	Description	Pin	Description
1	- not used -	6	P5V2: +5V power supply
2	- not used -	7	- not used -
3	RxD/TxD-P: Data line B	8	RxD/TxD-N: Data line A
4	RTS	9	- not used -
5	M5V2: Data reference potential (ground DGND)	Housing	Ground connector

A.16.1.3 CM 1243-5 PROFIBUS DP Master

Table A- 241 Technical specifications of the CM 1243-5

Technical specifications	
Article number	6GK7243-5DX30-0XE0
Interfaces	
Connection to PROFIBUS	9-pin D-sub female connector
Maximum current consumption on the PROFIBUS interface when connecting network components (for example optical network components)	15 mA at 5 V (only for bus termination) *)
Permitted ambient conditions	
Ambient temperature • during storage • during transportation • during operation with a vertical installation (DIN rail horizontal) • during operation with a horizontal installation (DIN rail vertical)	 • -40 °C to 70 °C • -40 °C to 70 °C • 0 °C to 55 °C • 0 °C to 45 °C
Relative humidity at 25 °C during operation, without condensation, maximum	95 %
Degree of protection	IP20
Power supply, current consumption and power loss	
Type of power supply	DC
Power supply / external • minimum • maximum	24 V • 19.2 V • 28.8 V
Current consumption (typical) • from 24 V DC • from the S7-1200 backplane bus	 • 100 mA • 0 mA
Effective power loss (typical) • from 24 V DC • from the S7-1200 backplane bus	 • 2.4 W • 0 W
Power supply 24 V DC / external • Min. cable cross section • Max. cable cross section • Tightening torque of the screw terminals	 • min.: 0.14 mm^2 (AWG 25) • max.: 1.5 mm^2 (AWG 15) • 0.45 Nm (4 lb-in)
Electrical isolation • PROFIBUS interface to ground • PROFIBUS interface to internal circuit	710 V DC for 1 minute

Technical specifications	
Dimensions and weights	
• Width • Height • Depth	• 30 mm • 100 mm • 75 mm
Weight • Net weight • Weight including packaging	 • 134 g • 171 g

*)The current load of an external consumer connected between VP (pin 6) and DGND (pin 5) must not exceed a maximum of 15 mA (short-circuit proof) for bus termination.

Note

The CM 1243-5 (PROFIBUS master module) must receive power from the 24 V DC sensor supply of the CPU.

A.16.1.4 Pinout of the D-sub socket of the CM 1243-5

PROFIBUS interface

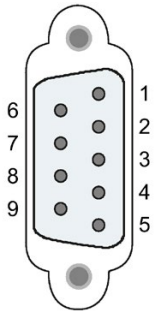


Table A- 242 Pinout of the D-sub socket

Pin	Description	Pin	Description
1	- not used -	6	VP: Power supply +5 V only for bus terminating resistors; not for supplying external devices
2	- not used -	7	- not used -
3	RxD/TxD-P: Data line B	8	RxD/TxD-N: Data line A
4	CNTR-P: RTS	9	- not used -
5	DGND: Ground for data signals and VP	Housing	Ground connector

PROFIBUS cable

Note

Contacting the shield of the PROFIBUS cable

The shield of the PROFIBUS cable must be contacted.

To do this, strip the insulation from the end of the PROFIBUS cable and connect the shield to functional earth.

A.16.2 CP 1242-7

Note

The CP 1242-7 is not approved for Maritime applications

The CP 1242-7 does not have Maritime approval.

Note

To use these modules, your CPU firmware must be V2.0 or higher.

A.16.2.1 CP 1242-7 GPRS

Table A- 243 Technical specifications of the CP 1242-7 GPRS V2

Technical specifications	
Article number	6GK7242-7KX3-0XE0
Wireless interface	
Antenna connector	SMA socket
Nominal impedance	50 ohms
Wireless connection	
Maximum transmit power	• GSM 850, class 4: +33 dBm ±2dBm • GSM 900, class 4: +33 dBm ±2dBm • GSM 1800, class 1: +30 dBm ±2dBm • GSM 1900, class 1: +30 dBm ±2dBm
GPRS	Multislot class 10 device class B coding scheme 1...4 (GMSK)
SMS	Mode outgoing: MO service: point-to-point

Technical specifications	
Permitted ambient conditions	
Ambient temperature	
• during storage	• -40 °C to 70 °C
• during transportation	• -40 °C to 70 °C
• during operation with a vertical installation (DIN rail horizontal)	• 0 °C to 55 °C
• during operation with a horizontal installation (DIN rail vertical)	• 0 °C to 45 °C
Relative humidity at 25 °C during operation, without condensation, maximum	95 %
Degree of protection	IP20
Power supply, current consumption and power loss	
Type of power supply	DC
Power supply / external	24 V
• minimum	• 19.2 V
• maximum	• 28.8 V
Current consumption (typical)	
• from 24 V DC	• 100 mA
• from the S7-1200 backplane bus	• 0 mA
Effective power loss (typical)	
• from 24 V DC	• 2.4 W
• from the S7-1200 backplane bus	• 0 W
24 V DC power supply	
• Min. cable cross section	• min.: 0.14 mm^2 (AWG 25)
• Max. cable cross section	• max.: 1.5 mm^2 (AWG 15)
• Tightening torque of the screw terminals	• 0.45 Nm (4 lb-in)
Electrical isolation Power supply unit to internal circuit	710 V DC for 1 minute
Dimensions and weights	
• Width	• 30 mm
• Height	• 100 mm
• Depth	• 75 mm
Weight	
• Net weight	• 133 g
• Weight including packaging	• 170 g

Note

Preventing CPU interference from antennas

CPU interference can occur if antenna proximity is too close, or if you do not use recommended antennas. For recommended antennas, refer to Antenna ANT794-4MR for LTE/UMTS/GSM Compact Operating Instructions (https://support.industry.siemens.com/cs/ww/en/view/23119005) (available in English and German only).

A.16.2.2 GSM/GPRS antenna ANT794-4MR

Technical specifications of the ANT794-4MR GSM/GPRS antenna

ANT794-4MR	
Article number	6NH9860-1AA00
Mobile wireless networks	GSM/GPRS
Frequency ranges	• 824 to 960 MHz (GSM 850, 900) • 1 710 to 1 880 MHz (GSM 1 800) • 1 900 to 2 200 MHz (GSM / UMTS)
Characteristics	omnidirectional
Antenna gain	0 dB
Impedance	50 ohms
Standing wave ratio (SWR)	< 2,0
Max. power	20 W
Polarity	linear vertical
Connector	SMA
Length of antenna cable	5 m
External material	Hard PVC, UV-resistant
Degree of protection	IP20
Permitted ambient conditions • Operating temperature • Transport/storage temperature • Relative humidity	 • -40 °C through +70 °C • -40 °C through +70 °C • 100 %
External material	Hard PVC, UV-resistant
Construction	Antenna with 5 m fixed cable and SMA male connector
Dimensions (D x H) in mm	25 x 193
Weight • Antenna incl. cable • Fittings	 • 310 g • 54 g
Installation	With supplied bracket

A.16.2.3 Flat antenna ANT794-3M

Technical specifications of the flat antenna ANT794-3M

ANT794-3M		
Article number	6NH9870-1AA00	
Mobile wireless networks	**GSM 900**	**GSM 1800/1900**
Frequency ranges	890 - 960 MHz	1710 - 1990 MHz
Standing wave ratio (VSWR)	≤ 2:1	≤ 1,5:1
Return loss (Tx)	≈ 10 dB	≈ 14 dB
Antenna gain	0 dB	
Impedance	50 ohms	
Max. power	10 W	
Antenna cable	HF cable RG 174 (fixed) with SMA male connector	
Cable length	1.2 m	
Degree of protection	IP64	
Permitted temperature range	-40 °C to +75 °C	
Flammability	UL 94 V2	
External material	ABS Polylac PA-765, light gray (RAL 7035)	
Dimensions (W x L x H) in mm	70.5 x 146.5 x 20.5	
Weight	130 g	

A.16.3 CM 1243-2 AS-i master

A.16.3.1 Technical data for the AS-i master CM 1243-2

Table A- 244 Technical data for the AS-i master CM 1243-2

Technical data	
Article number	3RK7243-2AA30-0XB0
Firmware version	V1.0
Date	01.12.2011
Interfaces	
Maximum current consumption From the S7-1200 backplane bus From the AS-i cable	 Max. 250 mA, supply voltage S7-1200 communication bus 5 V DC Max. 100 mA
Maximum current carrying capacity between the ASI+/ASI- terminals	8 A
Pin assignment	See section Electrical connections of the AS-i master (Page 1530)
Conductor cross-section	0.2 mm² (AWG 24) ... 3.3 mm² (AWG 12)

Technical data	
ASI connector tightening torque	0.56 Nm
Permissible ambient conditions	
Ambient temperature During storage During transport During the operating phase, with vertical installation (horizontal standard mounting rail) During the operating phase, with horizontal installation (vertical standard mounting rail)	 -40 °C ... 70 °C -40 °C ... 70 °C 0 °C ... 55 °C 0 °C ... 45 °C
Relative humidity at 25 °C during operating phase, no condensation, maximum	95 %
Degree of protection	IP20
Power supply, current consumption, power loss	
Type of power supply	DC
Current consumption (typically) From the S7-1200 backplane bus	 200 mA
Total power loss (typical): • From the S7-1200 backplane bus • From AS-i cable	 1 W 2.4 W
Dimensions and weights	
Width Height Depth	30 mm 100 mm 75 mm
Weight Net weight Weight including packaging	 122 g 159 g

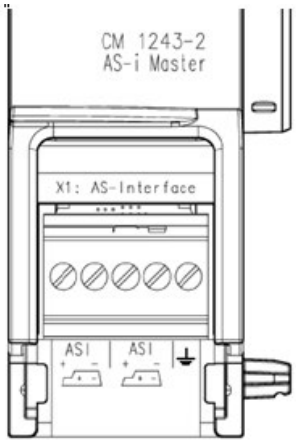
A.16.3.2 Electrical connections of the AS-i master

Power supply of the AS-i master CM 1243-2

The AS-i master CM 1243-2 is supplied over the communications bus of the S7-1200. This means that a diagnostics message can still be sent to the S7-1200 following failure of the AS-i supply voltage. The connection to the communications bus is on the right-hand side of the AS-i master CM 1243-2.

AS-Interface terminals

The removable terminal for connecting the AS-i cable is located behind the lower cover on the front of the AS-i master CM 1243-2.



If the AS-i shaped cable is used, you can recognize the correct polarity of the cable by means of the symbol



Information on how to remove and re-install the terminal block can be found in the Installation chapter (Page 67).

Note

Maximum current carrying capacity of the terminal contacts

The current carrying capacity of the connection contacts is max. 8 A. If this value is exceeded on the AS-i cable, the AS-i master CM 1243-2 must not be "looped in" to the AS-i cable, but must instead be connected via a spur line (only one connection pair assigned on the AS-i master CM 1243-2).
Please also ensure that the cables used are suitable for operating temperatures of at least 75 °C if current is being conducted via the AS-i master and currents of greater than 4 amperes are present.
You will find additional information on connecting the AS-i cable in the section "Installation, connection and commissioning of the modules" in the manual "AS-i Master CM 1243-2 and AS-i data decoupling unit DCM 1271 for SIMATIC S7-1200".

Terminal assignment

Label	Meaning
ASI+	AS-i connection – positive polarity
ASI–	AS-i connection – negative polarity
	Functional ground

A.16.4 RS232, RS422, and RS485

A.16.4.1 CB 1241 RS485 specifications

Note

To use this CB, your CPU firmware must be V2.0 or higher.

Table A- 245 General specifications

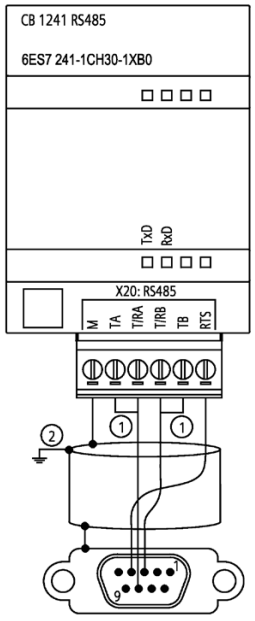
Technical data	CB 1241 RS485
Article number	6ES7241-1CH30-1XB0
Dimensions W x H x D (mm)	38 x 62 x 21
Weight	40 grams

Table A- 246 Transmitter and receiver

Technical data	CB 1241 RS485
Type	RS485 (2-wire half-duplex)
Common mode voltage range	-7 V to +12 V, 1 second, 3 VRMS continuous
Transmitter differential output voltage	2 V min. at R_L = 100 Ω 1.5 V min. at R_L = 54 Ω
Termination and bias	10K to +5 V on B, RS485 Pin 3 10K to GND on A, RS485 Pin 4
Optional termination	Short Pin TB to Pin T/RB, effective termination impedance is 127 Ω, connects to RS485 Pin 3 Short Pin TA to Pin T/RA, effective termination impedance is 127 Ω, connects to RS485 Pin 4
Receiver input impedance	5.4K Ω min. including termination
Receiver threshold/sensitivity	+/- 0.2 V min., 60 mV typical hysteresis
Isolation RS485 signal to chassis ground RS485 signal to CPU logic common	707 V DC (type test)
Cable length, shielded	1000 m max.
Baud rate	300 baud, 600 baud, 1.2 kbits, 2.4 kbits, 4.8 kbits, 9.6 kbits (default), 19.2 kbits, 38.4 kbits, 57.6 kbits, 76.8 kbits, 115.2 kbits
Parity	No parity (default), even, odd, Mark (parity bit always set to 1), Space (parity bit always set to 0)
Number of stop bits	1 (default), 2
Flow control	Not supported
Wait time	0 to 65535 ms

Table A- 247 Power supply

Technical data	CB 1241 RS485
Power loss (dissipation)	1.5 W
Current consumption (SM Bus), max.	50 mA
Current consumption (24 V DC) max.	80 mA

CB 1241 RS485 (6ES7241-1CH30-1XB0)	
	
① Connect "TA" and TB" as shown to terminate the network. (Terminate only the end devices on the RS485 network.)	
② Use shielded twisted pair cable and connect the cable shield to ground.	

You terminate only the two ends of the RS485 network. The devices in between the two end devices are not terminated or biased. See the topic "Biasing and terminating an RS485 network connector" (Page 1068)

Table A- 248 Connector pin locations for CB 1241 RS485 (6ES7241-1CH30-1XB0)

Pin	9-Pin connector	X20
1	RS485 / Logic GND	--
2	RS485 / Not Used	--
3	RS485 / TxD+	4 - T/RB
4	RS485 / RTS	6 - RTS
5	RS485 / Logic GND	--
6	RS485 / 5 V Power	--
7	RS485 / Not used	--
8	RS485 / TxD-	3 - T/RA
9	RS485 / Not Used	--
Shell		1 - M

A.16.4.2 CM 1241 RS232 specifications

Table A- 249 General specifications

Technical data	CM 1241 RS232
Article number	6ES7241-1AH32-0XB0
Dimensions (mm)	30 x 100 x 75
Weight	150 grams

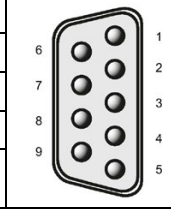
Table A- 250 Transmitter and receiver

Technical data	CM 1241 RS232
Type	RS232 (full-duplex)
Transmitter output voltage	+/- 5 V min. at R_L = 3K Ω
Transmit output voltage	+/- 15 V DC max.
Receiver input impedance	3 K Ω min.
Receiver threshold/sensitivity	0.8 V min. low, 2.4 max. high 0.5 V typical hysteresis
Receiver input voltage	+/- 30 V DC max.
Isolation RS 232 signal to chassis ground RS 232 signal to CPU logic common	707 V DC (type test)
Cable length, shielded	10 m max.
Baud rate	300 baud, 600 baud, 1.2 kbits, 2.4 kbits, 4.8 kbits, 9.6 kbits (default), 19.2 kbits, 38.4 kbits, 57.6 kbits, 76.8 kbits, 115.2 kbits
Parity	No parity (default), even, odd, Mark (parity bit always set to 1), Space (parity bit always set to 0)
Number of stop bits	1 (default), 2
Flow control	Hardware, software
Wait time	0 to 65535 ms

Table A- 251 Power supply

Technical data	CM 1241 RS232
Power loss (dissipation)	1 W
From +5 V DC	200 mA

Table A- 252 RS232 connector (male)

Pin	Description	Connector (male)	Pin	Description
1 DCD	Data carrier detect: Input		6 DSR	Data set ready: Input
2 RxD	Received data from DCE: Input		7 RTS	Request to send: Output
3 TxD	Transmitted data to DCE: Output		8 CTS	Clear to send: Input
4 DTR	Data terminal ready: Output		9 RI	Ring indicator (not used)
5 GND	Logic ground		SHELL	Chassis ground

A.16.4.3 CM 1241 RS422/485 specifications

CM 1241 RS422/485 Specifications

Table A- 253 General specifications

Technical data	CM 1241 RS422/485
Article number	6ES7241-1CH32-0XB0
Dimensions W x H x H (mm)	30 x 100 x 75
Weight	155 grams

Table A- 254 Transmitter and receiver

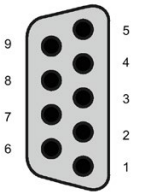
Technical data	CM 1241 RS422/485
Type	RS422 or RS485, 9-pin sub D female connector
Common mode voltage range	-7 V to +12 V, 1 second, 3 VRMS continuous
Transmitter differential output voltage	2 V min. at R_L = 100 Ω 1.5 V min. at R_L = 54 Ω
Termination and bias	10K Ω to +5 V on B, PROFIBUS Pin 3 10K Ω to GND on A, PROFIBUS Pin 8 Internal bias options provided, or no internal bias. In all cases, external termination is required, see Biasing and terminating an RS485 network connector (Page 1068) and Configuring the RS422 and RS485 in the S7-1200 Programmable Controller System Manual (Page 1122)
Receiver input impedance	5.4K Ω min. including termination
Receiver threshold/sensitivity	+/- 0.2 V min., 60 mV typical hysteresis
Isolation RS485 signal to chassis ground RS485 signal to CPU logic common	707 V DC (type test)
Cable length, shielded	1000 m max. (baud rate dependent)
Baud rate	300 baud, 600 baud, 1.2 kbits, 2.4 kbits, 4.8 kbits, 9.6 kbits (default), 19.2 kbits, 38.4 kbits, 57.6 kbits, 76.8 kbits, 115.2 kbits
Parity	No parity (default), even, odd, Mark (parity bit always set to 1), Space (parity bit always set to 0)

Technical data	CM 1241 RS422/485
Number of stop bits	1 (default), 2
Flow control	XON/XOFF supported for the RS422 mode
Wait time	0 to 65535 ms

Table A- 255 Power supply

Technical data	CM 1241 RS422/485
Power loss (dissipation)	1.1 W
From +5 V DC	220 mA

Table A- 256 RS485 or RS422 connector (female)

Pin	Description	Connector (female)	Pin	Description
1	Logic or communication ground		6 PWR	+5 V with 100 ohm series resistor: Output
2 TxD+ [1]	Connected for RS422 Not used for RS485: Output		7	Not connected
3 TxD+ [2]	Signal B (RxD/TxD+): Input/Output		8 TXD- [2]	Signal A (RxD/TxD-): Input/Output
4 RTS [3]	Request to send (TTL level) Output		9 TXD- [1]	Connected for RS422 Not used for RS485: Output
5 GND	Logic or communication ground		SHELL	Chassis ground

[1] Pin 2 (TxD+) and Pin 9 (TxD-) are the RS422 transmit signals.

[2] Pin 3 (RxD/Tx+) and Pin 8 (RxD/TxD-) are RS485 transmit and receive signals. For RS422, Pin 3 is RxD+ and Pin 8 is RxD-.

[3] The RTS is a TTL level signal and can be used to control another half duplex device based on this signal. It is active when you transmit and is inactive all other times.

A.17 TeleService (TS Adapter and TS Adapter modular)

The following manuals contain the technical specification for the TS Adapter IE Basic and the TS Adapter modular:

- Industrial Software Engineering Tools
  Modular TS Adapter
- Industrial Software Engineering Tools
  TS Adapter IE Basic

For more information about this product and for the product documentation, refer to the product catalog web site for the TS Adapter (https://eb.automation.siemens.com/mall/en/de/Catalog/Search?searchTerm=TS%20Adapter%20IE%20basic&tab=).

A.18 SIMATIC memory cards

Capacity	Article Number
32 GB	6ES7954-8LT02-0AA0
2 GB	6ES7954-8LP01-0AA0
256 MB	6ES7954-8LL02-0AA0
24 MB	6ES7954-8LF02-0AA0
12 MB	6ES7954-8LE02-0AA0
4 MB	6ES7954-8LC02-0AA0

A.19 Input simulators

Table A- 257 General specifications

Technical data	8 Position Simulator	14 Position Simulator	CPU 1217C Simulator
Article number	6ES7274-1XF30-0XA0	6ES7274-1XH30-0XA0	6ES7274-1XK30-0XA0
Dimensions W x H x D (mm)	43 x 35 x 23	67 x 35 x 23	93 x 40 x 23
Weight	20 grams	30 grams	43 grams
Points	8	14	14
Used with CPU	CPU 1211C, CPU 1212C	CPU 1214C, CPU 1215C	CPU 1217C

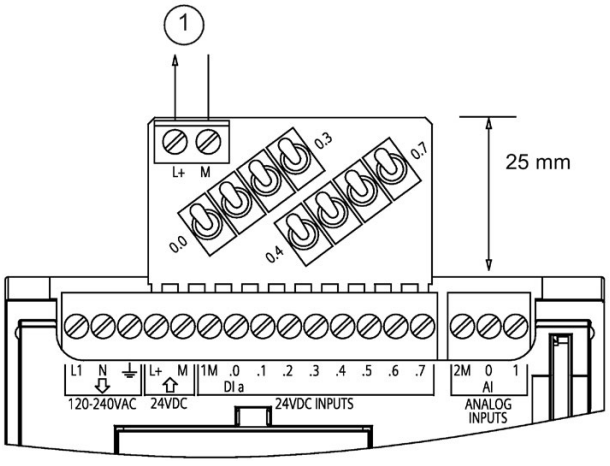
WARNING

Safe use of input simulators

These input simulators are not approved for use in Class I DIV 2 or Class I Zone 2 hazardous locations. The switches present a potential spark hazard/explosion hazard if used in a Class I DIV 2 or Class I Zone 2 location. Unapproved use could result in death or serious injury to personnel, and/or damage to equipment.

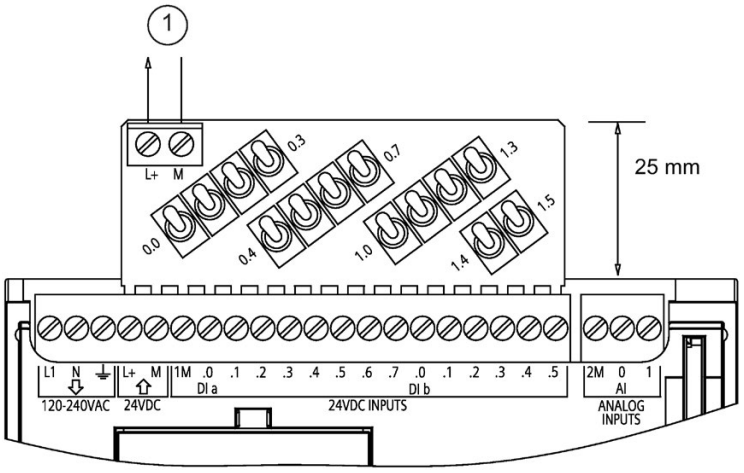
Use these input simulators only in non-hazardous locations. Do not use in Class I DIV 2 or Class I Zone 2 hazardous locations.

8 Position Simulator (6ES7274-1XF30-0XA0)



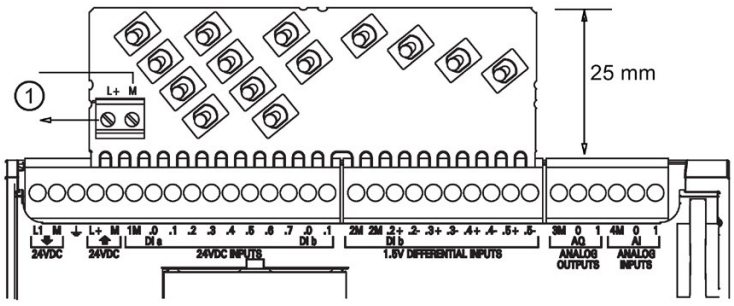
① 24 V DC sensor power out

14 Position Simulator (6ES7274-1XF30-0XA0)



① 24 V DC sensor power out

CPU 1217C Simulator (6ES7274-1XK30-0XA0)



① 24 V DC sensor power out

A.20 S7-1200 Potentiometer module

The S7-1200 Potentiometer module is an accessory for S7-1200 CPU. Each potentiometer creates an output voltage proportional to the position of the potentiometer to drive each of the two CPU analog inputs 0 V DC to 10 V DC. To install the potentiometer:

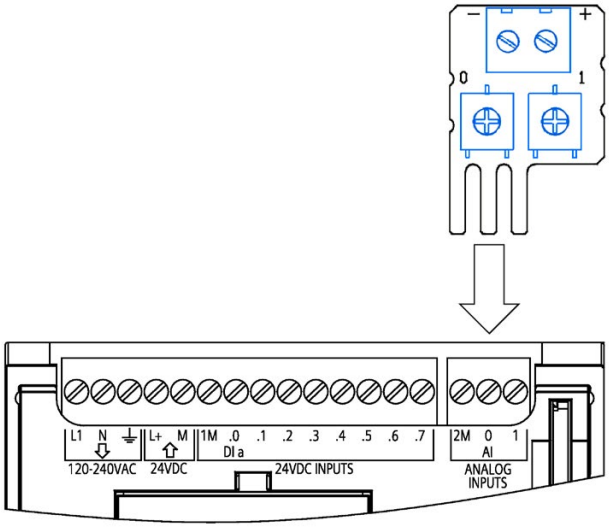
1. Insert the circuit board 'fingers' into any S7-1200 CPU analog input terminal block, and connect an external DC power supply to the 2-position connector on the potentiometer module.
2. Use a small screwdriver to make the adjustments: turn the potentiometer clockwise (to the right) to increase the voltage output, and counterclockwise (to the left) to decrease the voltage output.

Note

Follow ESD guidelines when handling the S7-1200 Potentiometer module.

Technical data	S7-1200 Potentiometer module
Article number	6ES7274-1XA30-0XA0
Used with CPU	All S7-1200 CPUs
Number of potentiometers	2
Dimensions W x H x D (mm)	20 x 33 x 14
Weight	26 grams
User-supplied voltage input at 2-position connector[1] (Class 2, Limited Power, or sensor power from PLC)	16.4 V DC to 28.8 V DC
Cable length (meters)/type	<30 m, shielded twisted pair
Input current consumption	10 mA max.
Potentiometer voltage output to S7-1200 CPU analog inputs[1]	0 V DC to 10.5 V DC min.
Isolation	Not isolated
Ambient temperature range	-20 °C to 60 °C

[1] Potentiometer module output voltage stability depends on the quality of the user-supplied voltage input at the 2-position connector - consider it as an analog input voltage.

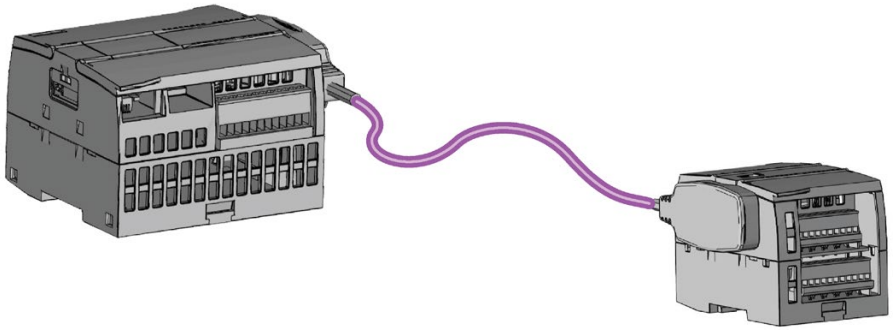


A.21 I/O expansion cable

Table A- 258 Expansion cables

Technical Data	
Article number	6ES7290-6AA30-0XA0
Cable length	2 m
Weight	200 g

Refer to the installation section (Page 68) for information about installing and removing the S7-1200 expansion cable.



A.22 Companion products

A.22.1 PM 1207 power module

The PM 1207 is a power supply module for the SIMATIC S7-1200. It provides the following features:

- Input 120/230 V AC, output 24 V DC/2.5A

For more information about this product and for the product documentation, refer to the product catalog web site for the PM 1207 (https://mall.industry.siemens.com/mall/en/de/Catalog/Product/6EP1332-1SH71).

A.22.2 CSM 1277 compact switch module

The CSM1277 is an Industrial Ethernet compact switch module. It can be used to multiply the Ethernet interface of the S7-1200 to allow simultaneous communication with operator panels, programming devices, or other controllers. It provides the following features:

- 4 x RJ45 sockets for connecting to Industrial Ethernet
- 3 pole plug in terminal strip for connection of the external 24 V DC supply on top
- LEDs for diagnostics and status display of Industrial Ethernet ports
- Article number 6GK7277-1AA00-0AA0

For more information about this product and for the product documentation, refer to the product catalog web site for the CSM 1277 (https://eb.automation.siemens.com/mall/en/de/Catalog/Search?searchTerm=csm%201277&tab=).

A.22.3 CM CANopen module

The CM CANopen module is a plug-in module between the SIMATIC S7-1200 PLC and any device running CANopen. The CM CANopen can be configured to be both master or slave. There are two CM CANopen modules: the CANopen module (article number 021620-B), and the CANopen (Ruggedized) module (article number 021730-B).

The CANopen module provides the following features:

- Able to connect 3 modules per CPU
- Connects up to 16 CANopen slave nodes
- 256 byte input and 256 byte output per module
- 3 LEDs provide diagnostic information on module, network, and I/O status
- Supports storage of CANopen network configuration in the PLC
- The module is integratable in the hardware catalogue of the TIA Portal configuration suite
- CANopen configuration via included CANopen Configuration Studio (included) or via any other externanal CANopen configuration tool
- Complies to the CANopen communication profiles CiA 301 rev. 4.2 and the CiA 302 rev. 4.1
- Supports transparent CAN 2.0A for custom protocol handling
- Pre-made function blocks available for each PLC programming in TIA portal
- CM CANopen modules include; DSUB with screw terminals for subnetwork. CM CANopen configuration studio CD, and USB configuration cable

For more information about this product and for the product documentation, refer to the product catalog web site for the CM CANopen.

A.22.4 RF120C communications module

The RF10C allows Siemens RFID and code reading systems to be connected directly and easily to an S7-1200. The reader is connected to the RF120C via a point-to-point connecton. Up to three communications modules can be connected to an S7-1200 to the left of the CPU. The RF120C comminications module is configured via the TIA Portal. The article number for the RF120C communications module is 6GT2002-0LA00.

For more information about this product and for the product documentation, refer to the product catalog web site for the RF120C.

A.22.5 SM 1238 Energy meter module

The SM 1238 Energy Meter 480 V AC is designed for machine-level deployment in an S7-1200 system. It records over 200 different electrical measurement and energy values. It lets you create transparency about the energy requirements of individual components of a production plant down to the machine level. Using the measured values provided by the SM 1238 Energy meter module, you can determine energy consumption and power demand.

For more information about this product and for the product documentation and specifications, refer to the product catalog web site for the SM 1238 Energy meter module (https://support.industry.siemens.com/cs/ww/en/view/109483435).

A.22.6 SIWAREX electronic weighing systems

SIWAREX WP231, WP241, and WP251

The SIWAREX WP231, WP241, and WP251 electronic weighing systems can be used in the S7-1200. These modules use all the features of a modern automation system, such as integrated communication, operation and monitoring, the dignostic system as well as the configuration tools in the TIA Portal.

- The SIWAREX WP231 (https://support.industry.siemens.com/cs/us/en/view/90229056), calibrater weighing electronic (1 channel) for strain guage load cells / full bridges (1-4 MV/V) for SIMATIC S7-1200, RS485 and Ethernet - interface, onboard I/O: 4 DI / 4 DO, 1 AO (0/4...20 MA)
- The SIWAREX WP241 (https://support.industry.siemens.com/cs/ww/en/view/90229063), belt weigher electronic (1 channel) for strain guage load cells / full bridges (1-4 M/V) for SIMATIC S7-1200, RS485 and Ethernet-interface, onboard I/O: 4 DI / 4 DO, 1 AO (0/4...20 MA)
- The SIWAREX WP251, weighing electronic for batching and filling processes (1 channel) for strain guage load cells / full bridges (1-4 MV/V) for SIMATIC S7-1200, RS485 and Ethernet - interface, onboard I/O: 4 DI / 4 DO, 1 AO (0/4...20 MA),

See also

SIWAREX WP251 (https://support.industry.siemens.com/cs/ww/en/view/109481751)

Calculating a power budget

B

The CPU has an internal power supply that provides power for the CPU itself, for any expansion modules, and for other 24 V DC user power requirements.

There are four types of expansion modules:

- Signal modules (SM) are installed on the right-side of the CPU. Each CPU allows a maximum number of signal modules possible without regard to the power budget.
  - CPU 1214C, CPU 1215C and CPU 1217C allows 8 signal modules
  - CPU 1212C allows 2 signal modules
  - CPU 1211C allows no signal modules
- Communication modules (CM) are installed on the left-side of the CPU. A maximum of 3 communication modules is allowed for any CPU without regard to the power budget.
- Signal boards (SB), communications boards (CB), and battery boards (BB) are installed on top of the CPU. A maximum of 1 signal board, communication board, or battery board is allowed for any CPU.

Use the following information as a guide for determining how much power (or current) the CPU can provide for your configuration.

Each CPU supplies both 5 V DC and 24 V DC power:

- The CPU provides 5 V DC power for the expansion modules when an expansion module is connected. If the 5 V DC power requirements for expansion modules exceed the power budget of the CPU, you must remove expansion modules until the requirement is within the power budget.
- Each CPU has a 24 V DC sensor supply that can supply 24 V DC for local input points or for relay coils on the expansion modules. If the power requirement for 24 V DC exceeds the power budget of the CPU, you can add an external 24 V DC power supply to provide 24 V DC to the expansion modules. You must manually connect the 24 V DC supply to the input points or relay coils.

WARNING

Connecting an external 24 V DC power supply in parallel with the DC sensor supply can result in a conflict between the two supplies as each seeks to establish its own preferred output voltage level.

The result of this conflict can be shortened lifetime or immediate failure of one or both power supplies, with consequent unpredictable operation of the PLC system. Unpredictable operation could result in death, severe personal injury and/or property damage.

The DC sensor supply on the CPU and any external power supply should provide power to different points. A single connection of the commons is allowed.

Some of the 24 V DC power input ports in the PLC system are interconnected, with a logic common circuit connecting multiple M terminals. The CPU 24 V DC power supply input, the SM relay coil power input, and a non-isolated analog power supply input are examples of circuits that are interconnected when designated as not isolated in the data sheets. All non-isolated M terminals must connect to the same external reference potential.

WARNING

Connecting non-isolated M terminals to different reference potentials will cause unintended current flows that may cause damage or unpredictable operation in the PLC and connected equipment.

Such damage or unpredictable operation could result in death, severe personal injury and/or property damage.

Always be sure that all non-isolated M terminals in a PLC system are connected to the same reference potential.

Information about the power budgets of the CPUs and the power requirements of the signal modules is provided in the technical specifications (Page 1343).

Note

Exceeding the power budget of the CPU may result in not being able to connect the maximum number of modules allowed for your CPU.

Example power budget

The following example shows a sample calculation of the power requirements for a configuration that includes one CPU 1214C AC/DC/Relay, one SB 1223 2 x 24 V DC Input/ 2 x 24 V DC Output, one CM 1241, three SM 1223 8 DC In/8 Relay Out, and one SM 1221 8 DC In. This example has a total of 48 inputs and 36 outputs.

Note

The CPU has already allocated the power required to drive the internal relay coils. You do not need to include the internal relay coil power requirements in a power budget calculation.

The CPU in this example provides sufficient 5 V DC current for the SMs, but does not provide enough 24 V DC current from the sensor supply for all of the inputs and expansion relay coils. The I/O requires 456 mA and the CPU provides only 400 mA. This installation requires an additional source of at least 56 mA at 24 V DC power to operate all the included 24 V DC inputs and outputs.

Table B- 1 Sample power budget

CPU power budget	**5 V DC**	**24 V DC**
CPU 1214C AC/DC/Relay	1600 mA	400 mA
Minus		
System requirements	**5 V DC**	**24 V DC**
CPU 1214C, 14 inputs	-	14 * 4 mA = 56 mA
1 SB 1223 2 x 24 V DC Input/ 2 x 24 V DC Output	50 mA	2 * 4 mA = 8 mA
1 CM 1241 RS422/485, 5 V power	220 mA	
3 SM 1223, 5 V power	3 * 145 mA = 435 mA	-
1 SM 1221, 5 V power	1 * 105 mA = 105 mA	-
3 SM 1223, 8 inputs each	-	3 * 8 * 4 mA = 96 mA
3 SM 1223, 8 relay coils each	-	3 * 8 * 11 mA = 264 mA
1 SM 1221, 8 inputs each	-	8 * 4 mA = 32 mA
Total requirements	810 mA	456 mA
Equals		
Current balance	**5 V DC**	**24 V DC**
Current balance total	790 mA	(56 mA)

Form for calculating your power budget

Use the following table to determine how much power (or current) the S7-1200 CPU can provide for your configuration. Refer to the technical specifications (Page 1343) for the power budgets of your CPU model and the power requirements of your signal modules.

Table B- 2 Calculations for a power budget

CPU power budget	**5 V DC**	**24 V DC**
Minus		
System requirements	**5 V DC**	**24 V DC**
Total requirements		
Equals		
Current balance	**5 V DC**	**24 V DC**
Current balance total		

Ordering Information

C

C.1 CPU modules

Table C- 1 S7-1200 CPUs

CPU models		Article number
CPU 1211C	CPU 1211C DC/DC/DC	6ES7211-1AE40-0XB0
	CPU 1211C AC/DC/Relay	6ES7211-1BE40-0XB0
	CPU 1211C DC/DC/Relay	6ES7211-1HE40-0XB0
CPU 1212C	CPU 1212C DC/DC/DC	6ES7212-1AE40-0XB0
	CPU 1212C AC/DC/Relay	6ES7212-1BE40-0XB0
	CPU 1212C DC/DC/Relay	6ES7212-1HE40-0XB0
CPU 1214C	CPU 1214C DC/DC/DC	6ES7214-1AG40-0XB0
	CPU 1214C AC/DC/Relay	6ES7214-1BG40-0XB0
	CPU 1214C DC/DC/Relay	6ES7214-1HG40-0XB0
CPU 1215C	CPU 1215C DC/DC/DC	6ES7215-1AG40-0XB0
	CPU 1215C AC/DC/Relay	6ES7215-1BG40-0XB0
	CPU 1215C DC/DC/Relay	6ES7215-1HG40-0XB0
CPU 1217C	CPU 1217C DC/DC/DC	6ES7217-1AG40-0XB0

C.2 Signal modules (SMs), signal boards (SBs), and battery boards (BBs)

Table C- 2 Signal modules (SMs)

Signal modules		Article number
Digital input	SM 1221 8 x 24 V DC Input (Sink/Source)	6ES7221-1BF32-0XB0
	SM 1221 16 x 24 V DC Input (Sink/Source)	6ES7221-1BH32-0XB0
Digital output	SM 1222 8 x 24 V DC Output (Source)	6ES7222-1BF32-0XB0
	SM 1222 16 x 24 V DC Output (Source)	6ES7222-1BH32-0XB0
	SM 1222 8 x Relay Output	6ES7222-1HF32-0XB0
	SM 1222 8 x Relay Output (Changeover)	6ES7222-1XF32-0XB0
	SM 1222 16 x Relay Output	6ES7222-1HH32-0XB0
Digital input / output	SM 1223 8 x 24 V DC Input (Sink/Source) / 8 x 24 V DC Output (Source)	6ES7223-1BH32-0XB0
	SM 1223 16 x 24 V DC Input (Sink/Source) / 16 x 24 V DC Output (Source)	6ES7223-1BL32-0XB0
	SM 1223 8 x 24 V DC Input (Sink/Source) / 8 x Relay Output	6ES7223-1PH32-0XB0
	SM 1223 16 x 24 V DC Input (Sink/Source) / 16 x Relay Output	6ES7223-1PL32-0XB0
	SM 1223 8 x 120/230 V AC Input (Sink/Source) / 8 x Relay Outputs	6ES7223-1QH32-0XB0
Analog input	SM 1231 4 x Analog Input	6ES7231-4HD32-0XB0
	SM 1231 8 x Analog Input	6ES7231-4HF32-0XB0
	SM 1231 4 x Analog Input x 16 bit (high feature)	6ES7231-5ND32-0XB0
	SM 1238 Energy Meter 480 V AC	6ES7238-5XA32-0XB0
Analog output	SM 1232 2 x Analog Output	6ES7232-4HB32-0XB0
	SM 1232 4 x Analog Output	6ES7232-4HD32-0XB0
Analog input / output	SM 1234 4 x Analog Input / 2 x Analog Output	6ES7234-4HE32-0XB0
RTD and thermocouple	SM 1231 TC 4 x 16 bit	6ES7231-5QD32-0XB0
	SM 1231 TC 8 x 16 bit	6ES7231-5QF32-0XB0
	SM 1231 RTD 4 x 16 bit	6ES7231-5PD32-0XB0
	SM 1231 RTD 8 x 16 bit	6ES7231-5PF32-0XB0
Technology modules	SM 1278 4xIO-Link Master	6ES7278-4BD32-0XB0
	SIWAREX WP231, calibrater weighing electronic (1 channel) for strain guage load cells / full bridges (1-4 MV/V) for SIMATIC S7-1200, RS485 and Ethernet - interface, onboard I/O: 4 DI / 4 DO, 1 AO (0/4...20 MA)	7MH4960-2AA01
	SIWAREX WP241, belt weigher electronic (1 channel) for strain guage load cells / full bridges (1-4 M/V) for SIMATIC S7-1200, RS485 and Ethernet-interface, onboard I/O: 4 DI / 4 DO, 1 AO (0/4...20 MA)	7MH4960-4AA01
	SIWAREX WP251, weighing electronic for batching and filling processes (1 channel) for strain guage load cells / full bridges (1-4 MV/V) for SIMATIC S7-1200, RS485 and Ethernet - interface, onboard I/O: 4 DI / 4 DO, 1 AO (0/4...20MA),	7MH4960-6AA01

Table C- 3 Signal boards (SB) and battery boards (BBs)

Signal and battery boards		Article number
Digital input	SB 1221 200 kHz 4 x 24 V DC Input (Source)	6ES7221-3BD30-0XB0
	SB 1221 200 kHz 4 x 5 V DC Input (Source)	6ES7221-3AD30-0XB0
Digital output	SB 1222 200 kHz 4 x 24 V DC Output (Sink/Source)	6ES7222-1BD30-0XB0
	SB 1222 200 kHz 4 x 5 V DC Output (Sink/Source)	6ES7222-1AD30-0XB0
Digital input / output	SB 1223 2 x 24 V DC Input (Sink) / 2 x 24 V DC Output (Source)	6ES7223-0BD30-0XB0
	SB 1223 200 kHz 2 x 24 V DC Input (Source) / 2 x 24 V DC Output (Sink/Source)	6ES7223-3BD30-0XB0
	SB 1223 200 kHz 2 x 5 V DC Input (Source) / 2 x 5 V DC Output (Sink/Source)	6ES7223-3AD30-0XB0
Analog	SB 1232 1 Analog Output	6ES7232-4HA30-0XB0
	SB 1231 1 Analog Input	6ES7231-4HA30-0XB0
	SB 1231 1 Analog Input Thermocouple	6ES7231-5QA30-0XB0
	SB 1231 1 Analog Input RTD	6ES7231-5PA30-0XB0
Battery	BB 1297 Battery Board (battery type CR1025 not included)	6ES7297-0AX30-0XA0

C.3 Communication

Table C- 4 Communication module (CM)

Communication module (CM)			Article number
RS232, RS422, and RS485	CM 1241 RS232	RS232	6ES7241-1AH32-0XB0
	CM 1241 RS422/485	RS422/485	6ES7241-1CH32-0XB0
PROFIBUS	CM 1243-5	PROFIBUS Master	6GK7243-5DX30-0XE0
	CM 1242-5	PROFIBUS Slave	6GK7242-5DX30-0XE0
AS-i Master	CM 1243-2	AS-i Master	3RK7243-2AA30-0XB0

Table C- 5 Communication board (CB)

Communication board (CB)			Article number
RS485	CB 1241 RS485	RS485	6ES7241-1CH30-1XB0

Table C- 6 Communication Processor (CP)

CP	Interface	Article number
CP 1242-7 GPRS V2	GPRS	6GK7242-7KX31-0XE0
CP 1243-7 LTE-US	LTE	6GK7243-7KX30-0XE0
CP 1243-7 LTE-EU	LTE	6GK7243-7KX30-0XE0
CP 1243-1	IE-interface	6GK7243-1BX30-0XE0
CP 1243-8 IRC	IE- and serial interface	6GK7243-8RX30-0XE0

Table C- 7 TeleService

TS Adapter	Article number
TS Adapter IE Basic	6ES7972-0EB00-0XA0
TS Adapter IE Advanced	6ES7972-0EA00-0XA0
TS Module GSM	6GK7972-0MG00-0XA0
TS Module RS232	6ES7792-0MS00-0XA0
TS Module Modem	6ES7972-0MM00-0XA0
TS Module ISDN	6ES7972-0MD00-0XA0

Table C- 8 Accessories

Accessory			Article number
Antenna	ANT794-4MR	GSM/GPRS antenna	6NH9860-1AA00
	ANT794-3M	Flat antenna	6NH9870-1AA00

Table C- 9 Connectors

Type of Connector		Article number
RS485	35-degree cable output, screw-terminal connection	6ES7972-0BA42-0XA0
	35-degree cable output, FastConnect connection	6ES7972-0BA60-0XA0

C.4 Fail-Safe CPUs and signal modules

Table C- 10 Fail-Safe CPUs

Fail-Safe CPU models		Article number
CPU 1212FC	CPU 1212FC DC/DC/DC	6ES7212-1AF40-0XB0
	CPU 1212FC DC/DC/Relay	6ES7212-1HF40-0XB0
CPU 1214FC	CPU 1214FC DC/DC/DC	6ES7214-1AF40-0XB0
	CPU 1214FC DC/DC/Relay	6ES7214-1HF40-0XB0
CPU 1215FC	CPU 1215FC DC/DC/DC	6ES7215-1AF40-0XB0
	CPU 1215FC DC/DC/Relay	6ES7215-1HF40-0XB0

Table C- 11 Fail-Safe signal modules

Functional Safety signal modules		Article number
Digital input	SM 1226 F-DI 16 x 24 V DC	6ES7226-6BA32-0XB0
Digital output	SM 1226 F-DQ 4 x 24 V DC	6ES7226-6DA32-0XB0
	SM 1226 F-DQ 2 x Relay	6ES7226-6RA32-0XB0

C.5 Other modules

Table C- 12 Companion products

Item		Article number
Power supply	PM 1207 power supply	6EP1332-1SH71
Ethernet switch	CSM 1277 Ethernet switch - 4 ports	6GK7277-1AA10-0AA0
CM CANopen	CANopen for SIMATIC S7-1200	021620-B
	CANopen (Ruggedized) for SIMATIC S7-1200	021730-B
RF120C	RF120C communications module	6GT2002-0LA00

C.6 Memory cards

Table C- 13 Memory cards

SIMATIC memory cards	Article number
SIMATIC MC 32 GB	6ES7954-8LT02-0AA0
SIMATIC MC 2 GB	6ES7954-8LP01-0AA0
SIMATIC MC 256 MB	6ES7954-8LL02-0AA0
SIMATIC MC 24 MB	6ES7954-8LF02-0AA0
SIMATIC MC 12 MB	6ES7954-8LE02-0AA0
SIMATIC MC 4 MB	6ES7954-8LC02-0AA0

C.7 Basic HMI devices

Table C- 14 HMI devices

HMI Basic Panels	Article number
KTP400 Basic (Mono, PN)	6AV2123-2DB03-0AX0
KTP700 Basic	6AV2123-2GB03-0AX0
KTP700 Basic DP	6AV2123-2GA03-0AX0
KTP900 Basic	6AV2123-2JB03-0AX0
KTP1200 Basic	6AV2123-2MB03-0AX0
KTP1200 Basic DP	6AV2123-2MA03-0AX0

C.8 Spare parts and other hardware

Table C- 15 Expansion cables, simulators, and end retainers

Item		Article number
I/O expansion cable	I/O Expansion cable, 2 m	6ES7290-6AA30-0XA0
I/O simulator	Simulator (1211C/1212C - 8 position)	6ES7274-1XF30-0XA0
	Simulator (1214C/1215C - 14 position)	6ES7274-1XH30-0XA0
	Simulator, CPU 1217C	6ES7274-1XK30-0XA0
Potentiometer module	S7-1200 Potentiometer module	6ES7274-1XA30-0XA0
Ethernet strain relief	Single port RJ45 strain relief, 10/100 Mbit/sec	6ES7290-3AA30-0XA0
	Dual port RJ45 strain relief, 10/100 Mbit/sec	6ES7290-3AB30-0XA0
Spare door kit	CPU 1211C/1212C	6ES7291-1AA30-0XA0
	CPU 1214C	6ES7291-1AB30-0XA0
	CPU 1215C	6ES7291-1AC30-0XA0
	CPU 1217C	6ES7291-1AD30-0XA0
	Signal module, 45 mm	6ES7291-1BA30-0XA0
	Signal module, 70 mm	6ES7291-1BB30-0XA0
	Communication module (for use with 6ES72xx-xxx32-0XB0 and 6ES72xx-xxx30-0XB0 modules)	6ES7291-1CC30-0XA0
End Retainer	End Retainer Thermoplastic, 10 MM	8WA1808
	End Retainer Steel, 10.3 MM	8WA1805

Replacing the terminal block connector

It is important to use the correct terminal block for your module. Refer to the tables below and your module specifications to determine the correct terminal block replacement.

Note

Keyed removable terminal blocks

PLCs always require correct wiring to ensure safety and proper operation.

When replacing the terminal block in your CPU or SM, it is important that you use the correct terminal block and correct wiring source for your module.

The keyed feature helps prevent you from accidentally placing a high voltage wired terminal block into a low voltage module, or from placing a special voltage wired terminal block into a normal voltage module. Some terminal blocks are specifically keyed at left, at right or at middle.

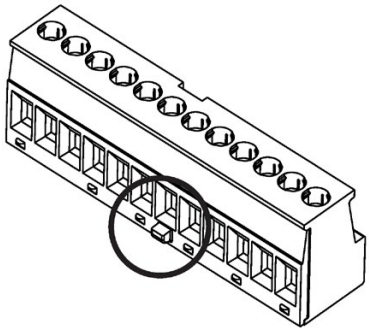
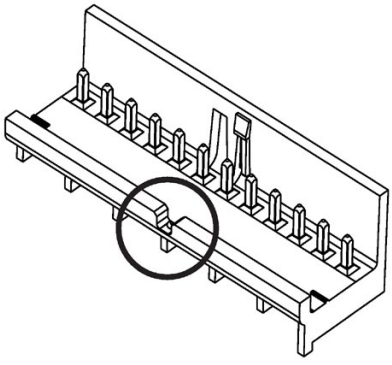
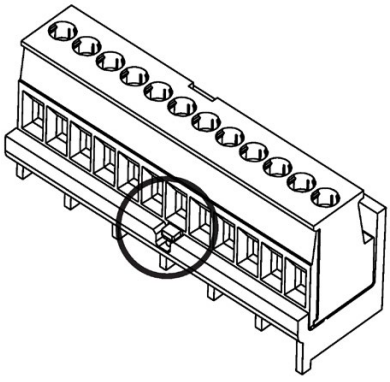
		
Removable terminal block (keyed example shown	Key on device	Key on device only fits appropriate removable terminal block

Table C- 16 S7-1200 CPU V4.0 and later - Terminal block spare kits

If you have S7-1200 CPU V4.0 and later (article number)	Use this terminal block spare kit (4/pk)	
	Terminal block article number	Terminal block description
CPU 1211C DC/DC/DC (6ES7211-1AE40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AH30-0XA0	8 pin, tin-plated
	6ES7292-1AP30-0XA0	14 pin, tin-plated
CPU 1211C DC/DC/Relay (6ES7211-1HE40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AH40-0XA0	8 pin, tin-plated, keyed
	6ES7292-1AP30-0XA0	14 pin, tin-plated
CPU 1211C AC/DC/Relay (6ES7211-1BE40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AH40-0XA0	8 pin, tin-plated, keyed
	6ES7292-1AP40-0XA0	14 pin, tin-plated, keyed
CPU 1212C DC/DC/DC (6ES7212-1AE40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AH30-0XA0	8 pin, tin-plated
	6ES7292-1AP30-0XA0	14 pin, tin-plated
CPU 1212C DC/DC/Relay (6ES7212-1HE40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AH40-0XA0	8 pin, tin-plated, keyed
	6ES7292-1AP30-0XA0	14 pin, tin-plated
CPU 1212C AC/DC/Relay (6ES7212-1BE40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AH40-0XA0	8 pin, tin-plated, keyed
	6ES7292-1AP40-0XA0	14 pin, tin-plated, keyed
CPU 1214C DC/DC/DC (6ES7214-1AG40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AM30-0XA0	12 pin, tin-plated
	6ES7292-1AV30-0XA0	20 pin, tin-plated
CPU 1214C DC/DC/Relay (6ES7214-1HG40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AM40-0XA0	12 pin, tin-plated, keyed
	6ES7292-1AV30-0XA0	20 pin, tin-plated
CPU 1214C AC/DC/Relay (6ES7214-1BG40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AM40-0XA0	12 pin, tin-plated, keyed
	6ES7292-1AV40-0XA0	20 pin, tin-plated, keyed
CPU 1215C DC/DC/DC (6ES7215-1AG40-0XB0)	6ES7292-1BF30-0XB0	6 pin, gold-plated
	6ES7292-1AM30-0XA0	12 pin, tin-plated
	6ES7292-1AV30-0XB0	20 pin, tin-plated
CPU 1215C DC/DC/Relay (6ES7215-1HG40-0XB0)	6ES7292-1BF30-0XB0	6 pin, gold-plated
	6ES7292-1AM40-0XA0	12 pin, tin-plated, keyed
	6ES7292-1AV30-0XA0	20 pin, tin-plated
CPU 1215C AC/DC/Relay (6ES7215-1BG40-0XB0)	6ES7292-1BF30-0XB0	6 pin, gold-plated
	6ES7292-1AM40-0XA0	12 pin, tin-plated, keyed
	6ES7292-1AV40-0XA0	20 pin, tin-plated, keyed
CPU 1217C DC/DC/DC (6ES7217-1AG40-0XB0)	6ES7292-1BF30-0XB0	6 pin, gold-plated
	6ES7292-1AK30-0XA0	10 pin, pin-plated
	6ES7292-1AR30-0XA0	16 pin, pin-plated

If you have S7-1200 CPU V4.0 and later (article number)	Use this terminal block spare kit (4/pk)	
	Terminal block article number	Terminal block description
	6ES7292-1AT30-0XA0	18 pin, tin-plated

Table C- 17 S7-1200 SMs V3.2 and later - Terminal block spare kits

If you have S7-1200 SMs V3.2 and later (article number)	Use this terminal block spare kit (4/pk)	
	Terminal block article number	Terminal block description
SM 1221 DI 8 x DC (6ES7221-1BF32-0XB0)	6ES7292-1AG30-0XA0	7 pin, tin-plated
SM 1222 DQ 8 x DC (6ES7222-1BF32-0XB0)	6ES7292-1AG30-0XA0	7 pin, tin-plated
SM 1222 DQ 8 x Relay (6ES7222-1HF32-0XB0)	6ES7292-1AG40-0XA1	7 pin, tin-plated, keyed-left
SM 1238 Energy Meter 480 V AC (6ES7238-5XA32-0XB0) for voltage input (top)	6ES7292-1AG40-0XA2	7-pin, tin-plated, keyed-middle
SM 1238 Energy Meter 480 V AC (6ES7238-5XA32-0XB0) for current input (bottom)	6ES7292-1AG30-0XA0	7-pin, tin-plated
SM 1231 AI 4 x 13 bit (6ES7231-4HD32-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1232 AQ 2 x 14 bit (6ES7232-4HB32-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1231 AI 4 x TC (6ES7231-5QD32-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1231 AI 4 x 16 bit (6ES7231-5ND32-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1221 DI 16 x DC (6ES7221-1BH32-0XB0)	6ES7292-1AG30-0XA0	7 pin, tin-plated
SM 1222 DQ 16 x DC (6ES7222-1BH32-0XB0)	6ES7292-1AG30-0XA0	7 pin, tin-plated
SM 1222 DQ 16 x Relay (6ES7222-1HH32-0XB0)	6ES7292-1AG40-0XA0	7 pin, tin-plated, keyed-right
SM 1223 DI 8 x DC/DQ 8 x DC (6ES7223-1BH32-0XB0)	6ES7292-1AG30-0XA0	7 pin, tin-plated
SM 1223 8 x DC/8 x Relay (6ES7223-1PH32-0XB0)	6ES7292-1AG30-0XA0	7 pin, tin-plated
	6ES7292-1AG40-0XA0	7 pin, tin-plated, keyed-right
SM 1223 8 x AC/8 x Relay (6ES7223-1QH32-0XB0)	6ES7292-1AG40-0XA0	7 pin, tin-plated, keyed-right
SM 1234 AI 4 / AQ 2 (6ES7234-4HE32-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1231 AI 8 x 13 BIT (6ES7231-4HF32-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1232 AQ 4 x 14 bit (6ES7232-4HD32-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1231 AI 4 x RTD (6ES7231-5PD32-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1231 AI 8 x TC (6ES7231-5QF32-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1278 IO LINK (6ES7278-4BD32 0XB0)	6ES7292-1AG30-0XA0	7 pin, tin-plated
SM 1222 DQ 8 x Relay (Changeover) (6ES7222-1XF32-0XB0)	6ES7292-1AL30-0XA0	11 pin, tin-plated
SM 1223 DI 16 x DC/DQ 16 x DC (6ES7223-1BL32-0XB0)	6ES7292-1AL30-0XA0	11 pin, tin-plated
SM 1223 DI 16 x DC/DQ 16 x Relay (6ES7223-1PL32-0XB0)	6ES7292-1AL30-0XA0	11 pin, tin-plated
	6ES7292-1AL40-0XA0	11 pin, tin-plated, keyed
SM 1231 AI 8 x RTD (6ES7231-5PF32-0XB0)	6ES7292-1BL30-0XA0	11 pin, gold-plated

Table C- 18 S7-1200 SBs, CBs, and BBs - Terminal block spare kits

If you have S7-1200 SB, CB, or BB (article number)	Use this terminal block spare kit (4/pk)	
	Terminal block article number	Terminal block description
SB 1221 DI 4 x 5 V DC (6ES7221-3AD30-0XB0)	6ES7292-1BF30-0XA0	6-pin
SB 1221 DI 4 x 5 V DC (6ES7221-3AD30-0XB0)		
SB 1221 DI 4 x 24 V DC (6ES7221-3BD30-0XB0)		
SB 1222 DQ 4 x 5 V DC (6ES7222-1AD30-0XB0)		
SB 1222 DQ 4 x 24 V DC (6ES7222-1BD30-0XB0)		
SB 1223 DI 2x24 V DC/DQ 2x24 V DC (6ES7223-0BD30-0XB0)		
SB 1223 DI 2x5 V DC / DQ 2x5 V DC (6ES7223-3AD30-0XB0)		
SB 1223 DI 2x24 V DC / DQ 2x24 V DC (6ES7223-3BD30-0XB0)		
SB 1231 AI 1 x 12 BIT (6ES7231-4HA30-0XB0)		
SB 1231 AI 1 x RTD (6ES7231-5PA30-0XB0)		
SB 1231 AI 1 x TC (6ES7231-5QA30-0XB0)		
SB 1232 AQ 1x12 BIT (6ES7232-4HA30-0XB0)		
CB 1231 RS485 (6ES7241-1CH30-1XB0)		
BB 1297 Battery (6ES7297-0AX30-0XA0)		

Table C- 19 Fail-Safe CPUs - Terminal block spare kit

If you have Fail-Safe CPU (article number)	Use this terminal block spare kit (4/pk)	
	Terminal block article number	Terminal block description
CPU 1214FC DC/DC/DC (6ES7214-1AF40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AM30-0XA0	12 pin, tin-plated
	6ES7292-1AV30-0XA0	20 pin, tin-plated
CPU 1214FC DC/DC/Relay (6ES7214-1HF40-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
	6ES7292-1AM40-0XA0	12 pin, tin-plated, keyed
	6ES7292-1AV30-0XA0	20 pin, tin-plated
CPU 1215FC DC/DC/DC (6ES7215-1AF40 0XB0)	6ES7292-1BF30-0XB0	6 pin, gold-plate
	6ES7292-1AM30-0XA0	12 pin, tin-plated
	6ES7292-1AV30-0XA0	20 pin, tin-plated
CPU 1215FC DC/DC/Relay (6ES7215-1HF40 0XB0)	6ES7292-1BF30-0XB0	6 pin, gold-plated
	6ES7292-1AM40-0XA0	2 pin, tin-plated, keyed
	6ES7292-1AV30-0XA0	20 pin, tin-plated

Table C- 20 Fail-Safe signal modules - Terminal block spare kit

If you have Fail-Safe signal module (article number)	Use this Terminal block spare kit (4/pk)	
	Terminal block article number	Terminal block description
SM 1226 F-DI (6ES7226-6BA32-0XB0)	6ES7292-1AL30-0XA0	11 pin, tin-plated
SM 1226 F-DQ (6ES7226-6DA32-0XB0)	6ES7292-1AL30-0XA0	11 pin, tin-plated
SM 1226 F-Relay (6ES7226-6RA32-0XB0)	6ES7292-1AL40-0XA0	11 pin, tin-plated, keyed

C.9 Programming software

Table C- 21 Programming software

SIMATIC software		Article number
Programming software	STEP 7 Basic V15	6ES7822-0AA05-0YA5
	STEP 7 Professional V15	6ES7822-1AA05-0YA5
Visualization software	WinCC Basic V15	6AV2100-0AA05-0AA5
	WinCC Comfort V15	6AV2101-0AA05-0AA5
	WinCC Advanced V15	6AV2102-0AA05-0AA5
	WinCC Professional 512 PowerTags V15	6AV2103-0DA05-0AA5
	WinCC Professional 4096 PowerTags V15	6AV2103-0HA05-0AA5
	WinCC Professional max. PowerTags V15	6AV2103-0XA05-0AA5

Device exchange and spare parts compatibility

D

D.1 Exchanging a V3.0 CPU for a V4.2.x CPU

To upgrade a V3.0 CPU to a V4.2.x CPU, you must replace the CPU hardware. You cannot upgrade a V3.0 CPU to a V4.2.x CPU by firmware update.

Then in your STEP 7 project, you can replace your V3.0 CPU with a V4.2.x CPU (Page 164) and use your existing STEP 7 project that you designed for the V3.0 CPU.

When you replace a V3.0 CPU with a V4.2.x CPU, you might also want to check for and apply firmware updates (Page 144) to your connected signal and communication modules.

Note

No device exchange possible in STEP 7 from V4.2.x to V3.0

You can exchange a V3.0 CPU for a V4.2.x CPU, but you cannot exchange a V4.2.x CPU for a V3.0 CPU after you download the configuration. If you want to view or otherwise use your existing STEP 7 V3.0 project, make an archive of your STEP 7 V3.0 project prior to the device exchange.

Note that if you have not downloaded the exchanged device configuration, you can undo it. After downloading, however, you cannot undo the exchange from V3.0 to V4.2.x.

You need to be aware of some configuration and operational changes between the two CPU versions:

Upgrading STEP 7 projects

You cannot upgrade STEP 7 V11 or V12 projects directly to STEP 7 V15. You must first upgrade these projects to STEP 7 V13 SP1 or STEP 7 V13 SP2 . Then use that project as a basis for upgrade to STEP 7 V15.

WARNING

Risks with copying and pasting program logic from older versions of STEP 7

Copying program logic from an older version of STEP 7 such as STEP 7 V12 into STEP 7 V15 can cause unpredictable behavior in program execution or failures to compile. Different versions of STEP 7 implement program elements differently. The compiler does not always detect the differences if you made the changes by pasting from an older version into STEP 7 V15. Executing unpredictable program logic could result in death or severe personal injury if you do not correct the program.

When using program logic from a release of STEP 7 earlier than STEP 7 V15, always upgrade the entire project to STEP 7 V15. Then you can copy, cut, paste, and edit program logic as necessary. In STEP 7 V15, you can open a project from STEP 7 V13 SP1 or later. STEP 7 then performs the necessary compatibility conversions and upgrades the program correctly. Such upgrade conversions and corrections are necessary for proper program compilation and execution. If your project is older than STEP 7 V13 SP1, you must upgrade the project incrementally to STEP 7 V15.

Organization blocks

With V4.2.x, you can configure OB execution to be interruptible or non-interruptible (Page 103). For projects from former V3.0 CPUs, STEP 7 sets all OBs by default to be non-interruptible.

STEP 7 sets all OB priorities (Page 103) to the values they were in the V3.0 CPU STEP 7 project.

You can subsequently change the interruptability or priority settings if you choose.

The Diagnostic error interrupt OB (Page 96) start information references the submodule as a whole if no diagnostics event is pending.

CPU password protection

STEP 7 sets the password protection level (Page 204) for the V4.2.x CPU to be the equivalent password protection level that was set for the V3.0 CPU, and assigns the V3.0 password to the "Full access (no protection)" password for the V4.2.x CPU:

V3.0 protection level	V4.2.x access level
No protection	Full access (no protection)
Write protection	Read access
Write/read protection	HMI access

Note that the V4.2.x access level "No access (complete protection)" did not exist for V3.0.

Web server

If you use user-defined Web pages in your V3.0 project, store them in your project installation folder under the subfolder "UserFiles\Webserver" prior to upgrading your project. If you store your user-defined pages at this location, saving the STEP 7 project will also save the user-defined Web pages.

If you exchange a V3.0 CPU for a V4.2.x CPU, your Web server project setting (Page 983) for activating the Web server and HTTPS setting will be the same as it was in V3.0. You can then configure users, privileges, passwords (Page 984), and languages (Page 983) as needed to use the Web server. If you do not configure users with additional privileges, then you are limited as to what you can view from the standard Web pages (Page 991). The S7-1200 V4.2.x CPU does not support the former pre-configured "admin" user and password.

The S7-1200 V3.0 Web server Data log page provided a "Download and Clear" operation. The V4.2.x Web server File browser page (Page 1017), from which you access data logs, no longer provides this feature. Instead, the Web server provides the ability to download, rename, and delete data log files.

Transfer card incompatibility

You cannot use a V3.0 transfer card (Page 135) to transfer a V3.0 program to a V4.2.x CPU. You must open the V3.0 project in STEP 7, change the device to a V4.2.x CPU (Page 164), and download the STEP 7 project to your V4.2.x CPU. After you have changed your project to a V4.2.x project, you can then make a V4.2.x transfer card for subsequent program transfers.

GET/PUT communication

By default, S7-1200 V3.0 CPUs enabled GET/PUT communication. When you replace your V3.0 CPU with a V4.2.x CPU (Page 164), you see a message in the compatibility information section stating that GET/PUT is enabled.

Motion control support

S7-1200 V4.2.x CPUs do not support the V1.0 and V2.0 motion libraries. If you perform a device exchange for a STEP 7 project with V1.0 or V2.0 motion libraries, the device exchange substitutes compatible V3.0 motion control instructions (Page 714) for the V1.0 or V2.0 motion library instructions at compile.

If you perform a device exchange from a V3.0 CPU to a V4.2.x CPU for a STEP 7 project that contains two different motion control instruction versions (V3.0 and V5.0), the device exchange substitutes compatible V5.0 motion control instructions (Page 714) at compile.

During a device exchange from a V3.0 CPU to a V4.2.x CPU, the motion control Technological Object (TO) version does not automatically change from V3.0 to V5.0. If you want to upgrade to the later versions, you must go to the Instruction tree and select the required S7-1200 Motion Control version for your project as shown in the table below:

CPU version	Allowed motion control versions
V4.2.x (motion control V5.0)	V5.0 or V4.0 or V3.0
V4.1 (motion control V5.0)	V5.0 or V4.0 or V3.0
V4.0 (motion control V4.0)	V4.0 or V3.0
V3.0 (motion control V3.0)	V3.0

The TO structure is different between motion control versions V3.0 and V5.0. All associated blocks change as well. Block interfaces, watch tables, and traces update to the new motion control V5.0 structure. You can find the differences between the V3.0 CPU and V4.2.x CPU motion control axis parameters in the following two tables:

V3.0 CPU (Motion control V3.0)	V4.2.x CPU (Motion control V5.0)
Config.General.LengthUnit	Units.LengthUnit
Config.Mechanics.PulsesPerDriveRevolution	Actor.DriveParameter.PulsesPerDriveRevolution
Config.Mechanics.LeadScrew	Mechanics.LeadScrew
Config.Mechanics.InverseDirection	Actor.InverseDirection
Config.DynamicLimits.MinVelocity	DynamicLimits.MinVelocity
Config.DynamicLimits.MaxVelocity	DynamicLimits.MaxVelocity
Config.DynamicDefaults.Acceleration	DynamicDefaults.Acceleration
Config.DynamicDefaults.Deceleration	DynamicDefaults.Deceleration
Config.DynamicDefaults.EmergencyDeceleration	DynamicDefaults.EmergencyDeceleration
Config.DynamicDefaults.Jerk	DynamicDefaults.Jerk
Config.PositionLimits_SW.Active	PositionLimitsSW.Active
Config.PositionLimits_SW.MinPosition	PositionLimitsSW.MinPosition
Config.PositionLimits_SW.MaxPosition	PositionLimitsSW.MaxPosition
Config.PositionLimits_HW.Active	PositionLimitsHW.Active
Config.PositionLimits_HW.MinSwitchedLevel	PositionLimitsHW.MinSwitchLevel
Config.PositionLimits_HW.MaxSwitchedLevel	PositionLimitsHW.MaxSwitchLevel
Config.Homing.AutoReversal	Homing.AutoReversal
Config.Homing.Direction	Homing.ApproachDirection
Config.Homing.SideActiveHoming	Sensor[1].ActiveHoming.SideInput
Config.Homing.SidePassiveHoming	Sensor[1].PassiveHoming.SideInput
Config.Homing.Offset	Sensor[1].ActiveHoming.HomePositionOffset
Config.Homing.FastVelocity	Homing.ApproachVelocity
Config.Homing.SlowVelocity	Homing.ReferencingVelocity
MotionStatus.Position	Position
MotionStatus.Velocity	Velocity
MotionStatus.Distance	StatusPositioning.Distance
MotionStatus.TargetPosition	StatusPositioning.TargetPosition

V3.0 CPU (Motion control V3.0)	V4.2.x CPU (Motion control V5.0)
StatusBits.SpeedCommand	StatusBits.VelocityCommand
StatusBits.Homing	StatusBits.HomingCommand

The only "commandtable" parameter that is renamed is the array with the commands:

V3.0	V4.2.x
Config.Command[]	Command[]

Note: The array "Command[]" is a UDT of the type "TO_CmdTab_Config_Command" in V3.0 and "TO_Struct_Command" in V4.2.x.

Instruction changes

The following instructions have changes in parameters or behavior:

- RDREC and WRREC (Page 375)
- CONV (Page 285)

HMI panel communication

If you had one or more HMI panels (Page 33) connected to your S7-1200 V3.0 CPU, the communication to the S7-1200 V4.2.x CPU depends on the type of communication you use and the firmware version of the HMI panel. Recompile and download your project to the CPU and the HMI and/or update your HMI firmware.

Requirement to recompile program blocks

After exchanging a V3.0 CPU for a V4.2.x CPU, you must recompile all program blocks before you can download them to the V4.2.x CPU. Additionally, if any of the blocks have know-how protection (Page 207) or copy protection bound to a PLC serial number (Page 208), you must remove the protection before you compile and download the blocks. (You do not, however, need to deactivate copy protection bound to a memory card.) After a successful compile, you can reconfigure the know-how protection and/or PLC serial number copy protection. Note that if your project includes any blocks with know-how protection that an OEM (Original Equipment Manufacturer) provided, you must contact the OEM to provide V4.2.x versions of those blocks.

In general, Siemens recommends that you recompile the hardware configuration and software in STEP 7 and download to all devices in your project after the device exchange. Correct any errors that compiling the project finds, and recompile until you have no errors. Then, you can download the project to the V4.2.x CPU.

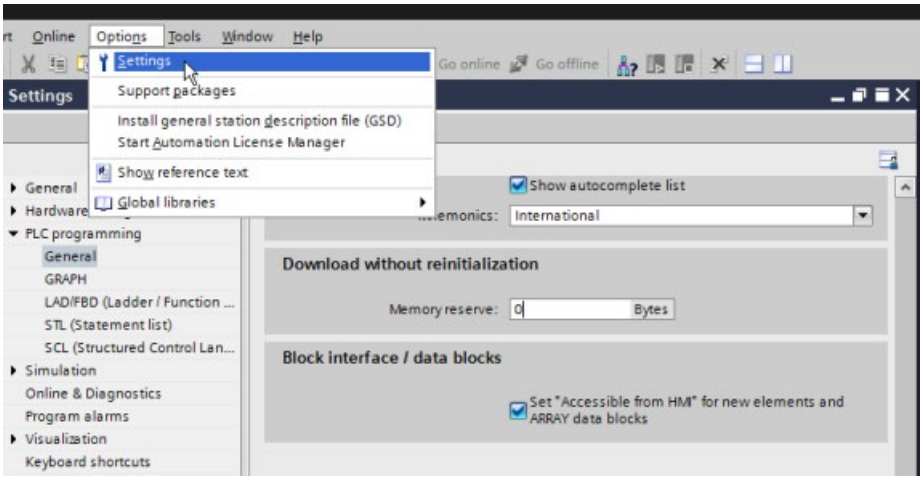
S7-1200 V3.0 projects might not fit in S7-1200 V4.2.x CPUs

S7-1200 V4.0 and later added a reserve area of 100 bytes to each DB to support download without reinitialization.

You can remove the 100-byte reserve area from DBs prior to attempting to download a V3.0 project to a V4.2.x CPU.

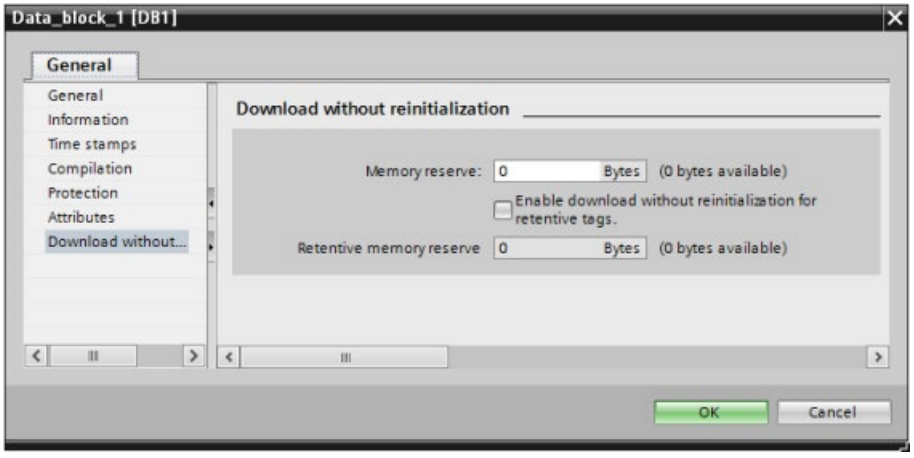
To remove the 100-byte reserve area, follow these steps before you perform the device exchange:

1. From the TIA Portal main menu, select the Options > Settings menu command.
2. From the navigation tree, open the PLC programming > General node.
3. In the "Download without reinitialization" area, set the memory reserve to 0 bytes.



If you have already performed the device exchange, you must remove the 100-byte reserve from each block individually:

1. From the project tree, right-click a data block from the Program blocks folder and select Properties from the shortcut menu.
2. In the Data block properties dialog, select the "Download without reinitialization" node.
3. Set the memory reserve to 0 bytes.
4. Repeat for each data block in your project.



Note

Projects for V4.0 and V4.1 CPUs can run without modification in V4.2.x CPUs.

D.2 S7-1200 V3.0 and earlier terminal block spare kits

Table D- 1 S7-1200 CPU V3.0 and earlier - Terminal Block spare kits

If you have	Use this terminal block spare kit (4/pk)	
S7-1200 CPU V3.0 and earlier (article number)	Terminal block article number	Terminal block description
CPU 1211C DC/DC/DC (6ES7211-1AE31-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
CPU 1211C AC/DC/Relay (6ES7211-1BE31-0XB0)	6ES7292-1AH30-0XA0	8 pin, gold-plated
CPU 1211C DC/DC/Relay (6ES7211-1HE31-0XB0)	6ES7292-1AP30-0XA0	14 pin, tin-plated
CPU 1212C DC/DC/DC (6ES7212-1AE31-0XB0)		
CPU 1212C AC/DC/Relay (6ES7212-1BE31-0XB0)		
CPU 1212C DC/DC/Relay (6ES7212-1HE31-0XB0)		
CPU 1214C DC/DC/DC (6ES7214-1AG31-0XB0)	6ES7292-1BC30-0XA0	3 pin, gold-plated
CPU 1214C AC/DC/Relay (6ES7214-1BG31-0XB0)	6ES7292-1AM30-0XA0	12 pin, tin-plated
CPU 1214C DC/DC/Relay (6ES7214-1HG31-0XB0)	6ES7292-1AV30-0XA0	20 pin, tin-plated
CPU 1215C DC/DC/DC (6ES7215-1AG31-0XB0)	6ES7292-1BF30-0XB0	6 pin, gold-plated
CPU 1215C AC/DC/Relay (6ES7215-1BG31-0XB0)	6ES7292-1AM30-0XA0	12 pin, tin-plated
CPU 1215C DC/DC/Relay (6ES7215-1HG31-0XB0)	6ES7292-1AV30-0XA0	20 pin, tin-plated

Table D- 2 S7-1200 SMs V3.0 and earlier - Terminal Block spare kits

If you have	Use this terminal block spare kit (4/pk)	
S7-1200 SM V3.0 and earlier (article number)	Terminal block article number	Terminal block description
SM 1221 DI 8 x DC (6ES7221-1BF30-0XB0)	6ES7292-1AG30-0XA0	7 pin, tin-plated
SM 1222 DQ 8 x DC (6ES7222-1BF30-0XB0)		
SM 1222 DQ 8 x Relay (6ES7222-1HF30-0XB0)		
SM 1231 AI 4 x 13 bit (6ES7231-4HD30-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1232 AQ 2 x 14 bit (6ES7232-4HB30-0XB0)		
SM 1231 AI 4 x TC (6ES7231-5QD30-0XB0)		
SM 1231 AI 4 x 16 bit (6ES7231-5ND30-0XB0)		
SM 1221 DI 16 x DC (6ES7221-1BH30-0XB0)	6ES7292-1AG30-0XA0	7 pin, tin-plated
SM 1222 DQ 16 x DC (6ES7222-1BH30-0XB0)		
SM 1222 DQ 16 x Relay (6ES7222-1HH30-0XB0)		
SM 1223 DI 8 x DC/DQ 8x DC (6ES7223-1BH30-0XB0)		
SM 1223 8 x DC/8 x Relay (6ES7223-1PH30-0XB0)		
SM 1223 8 x AC/8 x Relay (6ES7223-1QH30-0XB0)		
SM 1234 AI 4 / AQ 2 (6ES7234-4HE30-0XB0)	6ES7292-1BG30-0XA0	7 pin, gold-plated
SM 1231 AI 8 x 13 bit (6ES7231-4HF30-0XB0)		
SM 1232 AQ 4 x 14 bit (6ES7232-4HD30-0XB0)		
SM 1231 AI 4 x RTD (6ES7231-5PD30-0XB0)		
SM 1231 AI 8 x TC (6ES7231-5QF30-0XB0)		
SM 1222 DQ 8 x Relay (Changeover) (6ES7222-1XF30-0XB0)	6ES7292-1AL30-0XA0	11 pin, tin-plated
SM 1223 DI 16 x DC/DQ 16 x DC (6ES7223-1BL30-0XB0)		
SM 1223 16 x DC/16 x Relay (6ES7223-1PL30-0XB0)		
SM 1231 AI 8 x RTD (6ES7231-5PF30-0XB0)	6ES7292-1BL30-0XA0	11 pin, gold-plated

Index

&

& box (FBD AND logic operation), 222

/

/= box (FBD negate assignment), 223

=

= box (FBD assignment), 223

>

>=1 box (FBD OR logic operation), 222

A

ABS (form absolute value), 255
AC
  grounding, 76
  isolation guidelines, 76
  wiring guidelines, 75, 77
Access protection, CPU, 204
Accessible devices
  formatting a memory card, 1305
Accessible devices, updating firmware, 1305
Accessing
  data logs from PC, 1018
  user-defined Web pages, 1040
ACOS (form arccosine value), 258
ACT_TINT (activate time of day interrupt), 418
Active/passive communication
  configuring the partners, 788, 972
  connection IDs, 808
  parameters, 811
Active/Passive connection, 788
Ad hoc mode, TCP and ISO on TCP, 808
ADD (add), 250
Add new device
  CPU, 150
  detect existing hardware, 152
  unspecific CPU, 152
Adding inputs or outputs to LAD or FBD instructions, 44
Addresses
  Read station address with GetStationInfo, 447
  Reading out the MAC address with GetStationInfo, 447
Addressing
  Boolean or bit values, 115
  individual inputs (I) or outputs (Q), 115
  memory areas, 115
  process image, 115
Air flow, 55
Aliases in user-defined Web pages, 1029
Analog drive, 656
Analog I/O
  configuration, 173
  conversion to engineering units, 43, 120, 293
  input representation (current), 1459, 1507
  input representation (voltage), 1458, 1506
  output representation (current), 1460, 1508
  output representation (voltage), 1460, 1507
  status indicators, 1298
  step response times (CPU), 1364, 1377, 1390, 1404, 1422
  step response times (SB), 1505
  step response times (SM), 1457
Analog signal boards
  SB 1231, 1501
  SB 1231 RTD, 1514
  SB 1231 Thermocouple, 1508
  SB 1232, 1503
Analog signal modules
  SM 1231, 1447
  SM 1231 RTD, 1467
  SM 1231 Thermocouple, 1461
  SM 1232, 1451
  SM 1234, 1453
AND (logic operation), 320
Approvals
  ATEX, 1346
  Australia and New Zealand - RCM Mark, 1346
  CE, 1344
  cULus, 1344
  FM, 1345
  Korea Certification, 1346
  Maritime, 1347
Arrays, accessing members, 284
Article numbers
  communication interfaces (CM, CB and CP), 1551, 1551, 1552, 1552, 1552

connector blocks, 1554
connectors and terminal connections, 1552
CPU 1214FC, CPU 1215FC, 1553
CPUs, 1549
CSM 1277 Ethernet switch, 1553
end retainer, 1554
expansion cables, 1554
FS signal modules, 1553
HMI basic panels, 1554
memory cards, 1553
PM 1207 power supply, 1553
programming software, 1559
signal boards, battery boards, 1551
signal modules, 1550
simulators, 1554
STEP 7, 1559
visualization software, 1559
WinCC, 1559
AS-i
add AS-i master CM1243-2 module, 955
add AS-i slave, 955
address, 958
AS-i master CM 1243-2, 954
distributed I/O instructions, 374
network connection, 956
RDREC (read data record), 375
slave configuration with STEP 7, 961
slave configuration without STEP 7, 960
system assignment, 960
system assignment of slave addresses, 960
transferring analog values, 961
transferring digital values, 961
WRREC (write data record), 375
ASIN (form arcsinevalue), 258
Assigning enum types, user-defined Web pages, 1030
AT tag overlay, 132
ATEX approval, 1346
ATH (convert ASCII string to hexadecimal number), 351
ATTACH (attach an OB to an interrupt event), 408
ATTR_DB (Read data block attribute), 528
Australia and New Zealand - RCM Mark approval, 1346
Autonegotiation, 797
AWP commands, 1022
combining definitions, 1033
defining an enum type, 1030
generating fragments, 1032
importing fragments, 1033
reading special variables, 1026
referencing an enum type, 1030
using an alias, 1029
writing special variables, 1028
writing variables, 1024
AWP_Enum_Def, 1030
AWP_Import_Fragment, 1033
AWP_In_Variable, 1024, 1028
AWP_Out_Variable, 1026
AWP_Start_Fragment, 1032

B

Backing up a CPU, 1339
Basic panels (HMI), 33
Battery board (BB)
BB 1297, 1520
inserting battery, 1521
Baud rate, 1074
BB 1297, 1520
Binding to a CPU, memory card, or password, 208
Bit logic
AND, OR, and XOR instructions, 222
normally open and closed coils, 223
normally open and closed contacts, 221
NOT instruction (invert RLO), 223
positive and negative edge instructions, 227
set and reset instructions, 224
Blocks
block calls, 83
calling an FB or FC with SCL, 196
consistency check, 219
copying blocks from an online CPU, 215
counters (quantity and memory requirements), 30, 1358, 1371, 1384, 1398, 1414
data block (DB), 83
download, 210
events, 103
function (FC), 83, 184
function block (FB), 83, 185
initial value of an FB, 185
instance data block (DB), 185
interrupts, 30, 103, 1358, 1371, 1384, 1398, 1414
linear and structured programs, 180
monitoring, 30, 1358, 1371, 1384, 1398, 1414
nesting
depth, 30, 83, 1358, 1371, 1384, 1398, 1414
number of code
blocks, 30, 1358, 1371, 1384, 1398, 1414
number of
OBs, 30, 103, 1358, 1371, 1384, 1398, 1414
organization blocks
(OBs), 30, 83, 92, 103, 1358, 1371, 1384, 1398, 14
14
password protection, 207

single instance or multi-instance DB, 185
size of the user
program, 30, 83, 1358, 1371, 1384, 1398, 1414
start-up OBs, 103
timers (quantity and memory
requirements), 30, 1358, 1371, 1384, 1398, 1414
types of, 83
types of code blocks, 83
valid FC, FB, and DB numbers, 83
Boolean or bit values, 115
Break, 1077, 1078
Browsers supported for Web server, 982
BUFFER parameter, SEND_P2P, 1107
Bus connector, 32

C

Cable
expansion, 1542
Network communication, 1068
CALCULATE (calculate), 249
scaling analogs, 43
using for complex equations, 42
Calendar, 329
Call structure, 219
Call structure local memory allocation, 118
Calling code blocks within the user program, 182
CAN_DINT (cancel time-delay interrupt), 420
CAN_TINT (cancel time of day interrupt), 417
CANopen modules
021620-B, 021630-B, 1543
Capturing values from an online DB, 1313
Cascading PID controllers, 602
CB 1241
termination and bias, 1069
CB 1241 RS485, 1533
CE approval, 1344
CEIL (generate next higher integer from floating-point number), 290
Certificate Import Wizard, 1063
Change device, 164
Changing settings for STEP 7, 45
Char (character data type), 127
Character position, message length, 1084
Character sequence
message end, 1082
message start, 1078
Chars_TO_Strg (convert array of CHAR to character string), 349
Checking the connection, 859
Clearance, airflow and cooling, 55
Clock
RD_LOC_T (read local time), 332
RD_SYS_T (read time-of-day), 332
time-of-day clock, 113
WR_LOC_T (set local time), 332
WR_SYS_T (set time-of-day), 332
Clock memory byte, 111
Closed loop motion control
analog drive, 656
configuring the axis, 656
PROFIdrive, 656
Code block
binding to a CPU, memory card, or password, 208
block calls, 83
calling code blocks within the user program, 182
copy protection, 208
counters (quantity and memory
requirements), 30, 1358, 1371, 1384, 1398, 1414
DB (data block), 83, 186
FB (function block), 83, 185
FC (function), 83, 184
initial value of an FB, 185
instance data block (DB), 185
interrupts, 30, 1358, 1371, 1384, 1398, 1414
know-how protection, 207
linear and structured programs, 180
monitoring, 30, 1358, 1371, 1384, 1398, 1414
nesting depth, 30, 1358, 1371, 1384, 1398, 1414
number of code
blocks, 30, 1358, 1371, 1384, 1398, 1414
number of OBs, 30, 1358, 1371, 1384, 1398, 1414
organization blocks
(OBs), 30, 183, 1358, 1371, 1384, 1398, 1414
size of the user
program, 30, 1358, 1371, 1384, 1398, 1414
timers (quantity and memory
requirements), 30, 1358, 1371, 1384, 1398, 1414
types of code blocks, 83
valid FC, FB, and DB numbers, 83
Coils, (See Bit logic)
Cold junction compensation, thermocouple, 1464, 1510
Columns and headers in task cards, 45
Commissioning
PID_Compact and PID_3Step instructions, 625
PID_Temp instruction, 627
Communication
active/passive, 788, 811, 972
AS-i address, 958
communication load, 108
configuration, 788, 811, 972
connection IDs, 808
cycle time, 108

flow control, 1075
hardware connection, 893
IP address, 795
loss, pull or plug of modules, 98
MAC address, 795
network, 892
network connection, 787
number of connections (PROFINET/PROFIBUS), 784
polling architecture, 1117
PROFIBUS address, 952
PROFINET and PROFIBUS, 781
protocols, 807
send and receive parameters, 1076
TCON_Param, 811
time synchronization property (PROFINET), 803
Communication board (CB)
add modules, 154
CB 1241 RS485, 1533
comparison chart, 31
configuration of parameters, 173
device configuration, 149
installation, 62
LED indicators, 1067, 1295
overview, 32
programming, 1115
removal, 62
RS485, 1067
Communication interfaces
add modules, 154
CB 1241 RS485, 1533
CM 1241 RS232, 1535
comparison chart of the modules, 31
configuration, 1073
device configuration, 149
LED indicators, 1295
programming, 1115
RS232 and RS485, 1067
Communication interfaces, 3964(R), 1085
Communication module (CM)
add AS-i master CM1243-2 module, 955
add CM 1243-5 (DP master) module, 950
add modules, 154
CM 1241 RS232, 1535
CM 1241 RS422/RS485, 1536
comparison chart, 31
configuration for PtP example program, 1119
configuration of parameters, 173
data reception, 1108, 1215
device configuration, 149
installation, 65
LED indicators, 1067, 1295
overview, 32
power requirements, 1545
programming, 1115
removal, 65
RS232 and RS485, 1067
Communication processor (CP)
add modules, 154
comparison chart, 31
configuration of parameters, 173
device configuration, 149
overview, 32
Communication standard Web page, 1007
Compact switch module, CSM 1277, 1543
Compare values, 244
Comparing and synchronizing online/offline
CPUs, 1309
Comparison chart
CPU models, 28
HMI devices, 33
modules, 31
Compatibility, 51
Computer requirements, 38
CONCAT (combine character strings), 355
Configuration
add modules, 154
AS-i, 957
AS-i port, 956
communication interfaces, 1073
communication load, 108
CPU parameters, 165
cycle time, 107
discover, 152
download, 210
Ethernet port, 795
HSC (high-speed counter), 558
IP address, 795
MAC address, 795
modules, 173
network connection, 787
PID_Compact and PID_3Step instructions, 608
PID_Temp instructions, 611
PLC to PLC communication, 896
ports, 1073
PROFIBUS, 951
PROFIBUS address, 952
PROFINET port, 795
receive message, 1077
RS422, operating modes, 1122
RS485 operating modes, 1123
startup parameters, 138
time synchronization property (PROFINET), 803

Configuration control (option handling), 155
control data record, 159
example, 161
Configuration of transmitted message, 1076
Configuration, 3964(R)
communication interfaces, 1085
ports, 1085
priority and protocol parameters, 1086
Configuration, user-defined Web pages
setting up multiple languages, 1057
STEP 7 configuration, 1036
Connection contacts
Maximum current carrying capacity, 1531
Connections
configuration, 811
connection IDs, 808
Ethernet protocols, 970
number of connections (PROFINET/PROFIBUS), 784
partners, 788, 972
S7 connection, 970
types of communication, 781
types, multi-node connections, 970
Web server, 1061
Connector, installation and removal, 67
Consistency check, 219
Constraints
user-defined Web pages, 1041
Web server, 1061
Contact information, 3, 164
Contacts, (See Bit logic)
Contamination level/overvoltage category, 1350
CONTINUE, SCL, 317
Control DB for user-defined Web pages
global commands, 1057
parameter to WWW instruction, 1038
request commands and states, 1057
CONV (convert value), 285
Conversion (SCL instructions), 286
Cookie restrictions, standard Web pages, 1062
Cookie, siemens_automation_language, 1053
Cooling, 55
Copy protection
binding to a CPU, memory card, or password, 208
Copying blocks from an online CPU, 215
Copying, cutting, and pasting in STEP 7, 51
COS (form cosine value), 258
Counters
CTD (count down), 238
CTRL_HSC (control high-speed counter), 570
CTRL_HSC_EXT (Control high-speed counter (extended)), 542
CTU (count up), 238
CTUD (count up and down), 238
HSC configuration, 558
operation (standard counters), 239
quantity, 30, 1358, 1371, 1384, 1398, 1414
size, 30, 1358, 1371, 1384, 1398, 1414
Counting modes
high-speed counter, 559
CountOfElements (Get number of ARRAY elements), 282
CP module
access to Web server, 990
Web server Start page, 998
CPU
access protection by passwords, 204
add modules, 154
add new device, 150, 150
AS-i, 956
AS-i address, 958
AS-i port, 956
assigning an IP address to an online CPU, 793
backing up, 1339
capturing and resetting DB values, 1313
communication, 786
communication boards (CB), 32
communication load, 108
comparing and synchronizing blocks, 1309
comparison chart, 28
copying blocks from an online CPU, 215
cycle time configuration, 108
device configuration, 149, 149
displaying the MAC and IP addresses, 800
download, 210
download to device, 800
empty transfer card, 147
enable outputs in STOP mode, 1317
Ethernet port, 795
expansion cable, 68
force, 1318, 1319
going online, 1299
grounding, 76
HSC configuration, 558
inductive loads, 79
installation, 59, 60
IP address, 795
isolation guidelines, 76
know-how protection, 207
lamp loads, 78
LED indicators, 1295
lost password, 147
MAC address, 795, 795, 800
monitoring online, 1312

network connection, 787
number of communication connections, 784
online, 1302
operating modes, 87
operating panel (online CPU), 1306
operator panel, 47
oveload behavior, 104
overview, 27
power budget, 56
power requirements, 1545
processing the OBs, 183
PROFIBUS address, 952
PROFINET IO, 901
PROFINET port, 795
program execution, 83
pulse outputs, 478
recover from a lost password, 147
reset to factory settings, 1303
restoring a backup, 1341
RTM (runtime meters), 337
RUN/STOP buttons, 47
RUN/STOP modes, 1306
security levels, 204
signal boards (SB), 32
startup parameters, 138
startup processing, 90
terminal block connector, 67
thermal zone, 55, 58
time synchronization property, 803
types of communication, 781
unspecific CPU, 152
version compatibility, 51
watch table, 1315
wiring guidelines, 75, 77
CPU configuration
communication to HMI, 895
cycle time monitoring, 107
module properties, 173
multiple CPUs, 896
operational parameters, 165
pulse channels, 480
CPU memory card
inserting, 135
program card, 142
transfer card, 139
CPU properties, user-defined Web pages
setting up multiple languages, 1057
STEP 7 configuration, 1036
CPUs
CPU 1211C AC/DC/Relay, 1356
CPU 1211C DC/DC/DC, 1356
CPU 1211C DC/DC/Relay, 1356
CPU 1212C AC/DC/Relay, 1369
CPU 1212C DC/DC/DC, 1369
CPU 1212C DC/DC/Relay, 1369
CPU 1214C AC/DC/Relay, 1382
CPU 1214C DC/DC/DC, 1382
CPU 1214C DC/DC/Relay, 1382
CPU 1215C AC/DC/Relay, 1396
CPU 1215C DC/DC/DC, 1396
CPU 1215C DC/DC/Relay, 1396
CPU 1217C DC/DC/DC, 1412
step response times, 1364, 1377, 1390, 1404, 1422
CREATE_DB (Create data block), 520
Creating a network connection
between PLCs, 787
Creating user-defined Web page DBs, 1037
Creating user-defined Web pages, 1021
Cross-reference to show usage, 218
CSM 1277 compact switch module, 1543
CTD (count down), 238
CTRL_HSC (control high-speed counter), 570
CTRL_HSC_EXT (Control high-speed counter (extended)), 542
CTS (Hardware flow control, PtP), 1075
CTU (count up), 238
CTUD (count up and down), 238
cULus approval, 1344
current consumption, 56, 1545
Customer support, 3
Cycle time
configuration, 108
monitoring, 1307
overview, 107
Cyclic interrupt OB, 93

D

D_ACT_DP, 387
Data block
capturing and resetting values, 1313
CONF_DATA, 883
creating with CREATE_DB, 520
Deleting with DELETE_DB, 530
global data block, 114, 186
importing fragments in user-defined Web pages, 1033
instance data block, 114
optimized access, 187
organization blocks (OBs), 183
overview, 83, 186
READ_DBL (read from data block in load memory), 525
Reading attributes with ATTR_DB, 528

single FB with multiple instance DBs, 186
standard access, 187
structure, 83
WRIT_DBL (write to data block in load memory), 525
Data block
synchronizing online and offline start values, 213
Data exchange between IO systems, 909
Data handling block (DHB), 186
Data log
data log overview, 494
data record structure, 495
DataLogClose (close data log), 505
DataLogCreate (create data log), 496
DataLogNewFile (data log in new file), 507
DataLogOpen (open data log), 500
DataLogWrite (write data log), 501
Deleting with DataLogDelete, 506
Empty with DataLogClear, 503
example program, 515
size limit and calculating size, 512
viewing Data logs, 510
Data Logs standard Web page, 1018
Data transmission, initiating, 1103, 1212
Data types, 122
arrays, 129
Bool, Byte, Word, and DWord, 123
characters and strings, 127
PLC data type editor, 130
Real, LReal (floating-point real), 124
Struc, 130
Time, Date, TOD (time of day), DTL (date and time long), 125
USInt, SInt, UInt, Int, UDInt, Dint (integer), 124
Variant (pointer), 131
DataLogClear, 503
DataLogDelete, 506
Date
Date data type, 125
DTL (date and time long data type), 126
SET_TIMEZONE (set time zone), 336
T_ADD (add times), 330
T_COMBINE (combine times), 331
T_CONV (convert times and extract), 329
T_DIFF (time difference), 331
T_SUB (subtract times), 330
Daylight saving time TimeTransformationRule, 335
DB (data block), (Data block)
DB_ANY_TO_VARIANT (Convert DB_ANY to VARIANT, 295
DC
grounding, 76
inductive loads, 79
isolation guidelines, 76
outputs, 1352
wiring guidelines, 75, 77
Debugging in RUN mode, 1330
Debugging n RUN mode, 1321
DEC (decrement), 254
DECO (decode), 321
Defining enum types, user-defined Web pages, 1030
Degree of protection, 1351
DELETE (delete characters in a character string), 357
DELETE_DB (Delete data block), 530
DEMUX (demultiplex), 324
Deserialize, 263
Designing a PLC system, 179, 180
DETACH (detach an OB from an interrupt even)t, 408
Device
PROFINET IO, 901
PROFINET IO device names, 902
shared, 917
Device configuration, 149, 893
add modules, 154
add new device, 150
AS-i, 957
AS-i port, 957
changing a device type, 164
configuring the CPU, 165
configuring the modules, 173
discover, 152
download, 210
Ethernet port, 795
network connection, 787
PROFIBUS, 951
PROFINET port, 795
time synchronization property (PROFINET), 803
unplugged modules, 50
Device exchange
procedure, 164
V3.0 CPU for a V4.2.x CPU, 1561
DeviceStates (read module status of an I/O system), 455
DeviceStates, example, 456
Diagnostic error interrupt OB, 96
Diagnostic standard Web page, 1002
Diagnostics
buffer, 112
cycle time, 1307
DeviceStates (read module status of an I/O system), 455
diagnostics buffer, 1308
GET_DIAG (read diagnostic information), 466

Get_IM_Data (read the identification and maintenance data), 439
LED (read LED status), 438
LED indicators, 1295
memory usage, 1307
ModuleStates (read module status information of a module), 460
status indicator, 111
watch table, 1315
Diagnostics standard Web page, 999
Diagnostics, reducing security events, 112
Differences
in Modbus RTU instructions, 1175
in Modbus TCP instructions, 1150
in point-to-point instructions, 1070
in TCON, TDISCON, TSEND, and TRCV instructions, 836
in TSEND_C and TRCV_C instructions, 816
in USS instructions, 1128
Digital I/O
configuration, 173
pulse catch, 173
status indicators, 1296
Digital input filter time, 167
Digital signal boards
SB 1221, 1488
SB 1222, 1491
SB 1223, 1494, 1498
Digital signal modules
SM 1221, 1429
SM 1222, 1431, 1433
SM 1223, 1438, 1443
DIN rail, 59
Directories, languages for user-defined Web pages, 1053
DIS_AIRT (disable execution of higher priority interrupts and asynchronous error events), 423
Discover to upload an online CPU, 152
Displaying the MAC and IP addresses, 800
DIV (divide), 250
Documentation, 4
Download in RUN mode
compile errors, 1326
considerations, 1330
download without reinitialization, 1327
downloading selected blocks, 1324
extended block interface, 1327
failed download, 1329
global memory reserve settings, 1328
initiating from STEP 7, 1323
memory reserve and retentive memory reserve, 1327
overview, 1321
prerequisites, 1322
restrictions, 1329
Downloading
displaying the MAC and IP addresses, 800
firmware update, 144
project, 210
Siemens security certificate to PC, 997, 1063
user program, 210
user-defined Web page DBs, 1039
DP standard slaves
Reading a portion of the inputs with GETIO_PART, 380
Reading all inputs with GETIO, 378
Writing a part of the outputs with SETIO_PART, 381
Writing all outputs with SETIO, 379
DPNRM_DG, 404
DPRD_DAT (read consistent data of a DP standard slave), 396
DPWR_DAT (write consistent data of a DP standard slave), 396
Drag and drop between editors, 46
Drives, setting up MM4 drive, 1145
Dynamic binding, 208

E

Edge instructions, positive and negative, 227
Edit in RUN mode, (Download in RUN mode)
Electromagnetic compatibility, 1348
Electromagnetic compatibility (EMC), 1348
E-mail, sending with TMAIL_C, 863
EN and ENO (power flow), 202
EN_AIRT (enable execution of higher priority interrupts and asynchronous error events), 423
ENCO (encode), 321
End conditions, 1081
End message character, 1082
ENDIS_PW (enable disable passwords), 302
Enum types in user-defined Web pages, 1030, 1030
Environmental
operating conditions, 1350
transport and storage conditions, 1350
EQ_ElemType (Compare data type of an ARRAY element for UNEQUAL with the data type of a tag), 247
EQ_Type (Compare data type for EQUAL with the data type of a tag), 247
Errors
common errors for extended instructions, 540
diagnostic errors, 97
time errors, 95

Ethernet
ad hoc mode, 808
connection IDs, 808
CSM 1277 compact switch module, 1543
DPNRM_DG (read diagnostic data from a DP slave), 404
DPRD_DAT (read consistent data of a DP standard slave), 396
DPWR_DAT (write consistent data of a DP standard slave), 396
GET (read data from a remote CPU), 965
IP address, 795
legacy TCON, TDISCON, TSEND, and TRCV instructions, 848
legacy TRCV_C (receive data via Ethernet (TCP)), 829
legacy TSEND_C (send data via Ethernet (TCP)), 829
MAC address, 795
network connection, 787
number of communication connections, 784
overview, 805
PRVREC (make data record available), 401
PUT (write data to a remote CPU), 965
RALRM (receive interrupt), 383
RCVREC (receive data record), 399
RDREC (read data record), 375
T_CONFIG (configure interface), 880
TCON, 837
TDISCON, 837
TRCV, 837
TRCV_C, 817
TSEND, 837
TSEND_C, 817
TURCV (receive data via Ethernet (UDP)), 874
TUSEND (send data via Ethernet (UDP)), 874
types of communication, 781
WRREC (write data record), 375
Ethernet protocols, 805
multi-node connections, 970
Event execution and queueing, 103
Example
adding a SINAMICS S120 drive, 669
configuring edge detection on a position limit or input homing switch, 700
selecting a passive motion reference point switch level, 710
selecting an active motion reference point switch level, 711
Examples, communication
AS-i slave addressing, 958
configuring a PROFIBUS S7 connection, 977
configuring a PROFINET S7 connection, 975
CPU communication over TSEND_C or TRCV_C connections, 811
CPU communication with a common send and receive connection, 810
CPU communication with separate send and receive connections, 809
I-device as IO device and IO controller, 908
PROFINET communication protocols, 805
shared device, 917
shared I-device, 923
T_CONFIG, changing IP parameters, 887
T_CONFIG, changing IP parameters and PROFINET IO device names, 888
T_CONFIG, changing IP parameters of the NTP servers, 889
telecontrol, 1281
Examples, instructions
ATH (ASCII to hexadecimal), 352
CALCULATE, 42
CONTINUE, SCL, 317
CTRL_PWM, 482
DECO (Decode), 322
Deserialize, 265
DeviceStates, PROFIBUS and PROFINET, 456
EXIT, SCL, 318
GET_DIAG and modes, 471
GOTO (SCL), 319
HTA (Hexadecimal to ASCII), 352
LIMIT (set limit value), 257
ModuleStates, PROFIBUS and PROFINET, 462
PEEK and POKE variations, 200, 276
RETURN, SCL, 319
ROR (Rotate right), SCL, 327
RUNTIME (Measure program runtime), 310
S_CONV (convert character string), 347
Serialize, 268
SET_CINT cyclic interrupt execution and time parameter, 412
SHL (Shift left), SCL, 326
STRG_VAL (convert string to numerical value), 348
SWAP (swap bytes), 271
timer coils, 232
TM_MAIL, 1292
VAL_STRG (convert numerical value to string), 349
Examples, legacy Modbus
Legacy Modbus RTU, holding register addressing, 1267
Legacy Modbus RTU, MB_HOLD_REG parameter examples, 1265
Examples, legacy Modbus CP
MB_HOLD_REG parameter, 1245

Examples, legacy Modbus RTU
master program, 1270
slave program, 1272
Examples, legacy Modbus TCP
holding register addressing, 1247
MB_CLIENT coordinating multiple Modbus TCP requests, 1252
MB_CLIENT multiple requests with different Modbus TCP connections, 1251
MB_CLIENT output image write request, 1252
MB_CLIENT: multiple requests with common Modbus TCP connection,
MB_SERVER multiple Modbus TCP connections, 1249
Examples, Modbus
MB_CLIENT multiple requests with common Modbus TCP connection, 1171
MB_CLIENT multiple requests with different Modbus TCP connections, 1172
MB_SERVER multiple Modbus TCP connections, 1170
Modbus RTU master program, 1200
Modbus RTU slave program, 1203
Modbus TCP MB_CLIENT coordinating multiple requests, 1174
Modbus TCP MB_CLIENT ourput image write request, 1173
Modbus TCP, holding register addressing, 1166
Modbus TCP, MB_CLIENT connection parameters, 1157
Modbus TCP, MB_HOLD_REG parameter examples, 1163
Modbus TCP, MB_SERVER connection parameters, 1161
Examples, motion control
axis behavior, 743
Axis control with the TM Pulse module, 685
configuring a technology object motion command table, 691
CPU 1211C, CPU 1212C, CPU 1214C, and CPU 1215C pulse output speed configurations, 641
CPU 1217C pulse output speed configuration, 640
jerk limit, 713
jog behavior, 751
velocity, 747
velocity characteristics of MC homing, 712
Examples, PID
PID_3Step, configuration settings, 609
PID_Compact, configuration settings, 608
PID_Temp, configuration settings, 611
Examples, PtP communication
configuration, 1119
end message condition, 1083
Legacy PtP communication, RCV_CFG, 1210
message length within message, 1084
Receive_Config, 1098
running the terminal emulator example, 1127
start message condition, 1079
STEP 7 programming, 1125
terminal emulator, 1118, 1126
Examples, runtime string instructions
GetBlockName, 373
GetInstanceName, 369
GetInstancePath, 370
GetSymbolName, 363
GetSymbolPath, 366
Examples, USS communication
legacy USS communication errors reporting, 1233
USS communication error reporting, 1142
Examples, various
accessing array elements, 284
analog value processing, 120, 293
AT tag overlay, 133
configuration control (option handling), 161
CPU 1217C Differential input and application, 1427
CPU 1217C differential output and appplication, 1428
data log program, 515
downloading selected blocks in RUN mode, 1324
dragging and dropping between editors, 46
ENO evaluation in SCL, 203
nested CASE statements, SCL, 314
power budget calculation, 1546
recipe, 485, 492
S7-1200 IO-Link Master connection, 1480
slice of tagged data type, 132
trace and logic analyzer function, 1333
Examples, Web server
access from mobile device, 989
aliases, 1024, 1029
combining AWP declarations, 1034
enum types, 1030, 1031, 1045
fragment DBs, 1033
reading special variables, 1027
reading variables, 1024, 1045
special characters in AWP commands, 1035
STEP 7 program to check fragments, 1060
user-defined Web page, 1042, 1047
user-defined Web page to switch languages, 1053
writing special variables, 1028, 1047
writing variables, 1025, 1046
Exchanging a V3.0 CPU for a V4.2.x CPU, 1561
Execution speeds of instructions, 1357, 1370, 1383, 1397, 1413

EXIT, SCL, 318
EXP (form exponential value), 258
Expandable instructions, 44
Expanding the capabilities of the S7-1200, 31
Expansion cable, 1542
  installation, 68
  removal, 68
EXPT (exponentiate), 258
Extended block interface
  download in RUN mode, 1327

F

F_TRIG (set tag on negative signal edge), 228
Factory settings reset, 1303
FAQs, 4
Favorites toolbar, 41
FB (function block)
  overview, 83
FBD (function block diagram), 194
FC (function), 83, 184
Features, new, 35
FieldRead (read field), 283
FieldWrite (write field), 283
FILL_BLK (fill block), 269
Filter time, 167
FIND (find characters in a character string), 360
Firmware update
  from STEP 7, 1304
  from Web server, 1006
  with a memory card, 144
First scan indicator, 111
Fixed length, 1082
Flexible machines (configuration control), 155
FLOOR (generate next lower integer from floating-point number), 290
Flow control, 1074
  configuration, 1074
  managing, 1075
FM approval, 1345
Folders, languages for user-defined Web pages, 1053
FOR, SCL, 314
Force, 1318
  I memory, 1318, 1319
  inputs and outputs, 1319
  peripheral inputs, 1318, 1319
  scan cycle, 1319
  watch table, 1315
Force table
  addressing peripheral inputs, 1318
  force, 1318
  force operation, 1319
Formatting a memory card, 1305
FRAC (return fraction), 258
Fragment DBs (user-defined Web pages)
  creating from AWP command, 1032
  generating, 1037
  importing with AWP command, 1033
Freeport protocol, 1070
Frequency, clock bits, 111
Function (FC)
  calling code blocks within the user program, 182
  know-how protection, 207
  linear and structured programs, 180
  overview, 83, 184
  valid FC numbers, 83
Function block (FB)
  calling code blocks within the user program, 182
  initial value, 185
  instance data block, 185
  know-how protection, 207
  linear and structured programs, 180
  output parameters, 185
  overview, 83, 185
  single FB with multiple instance DBs, 186
  valid FB numbers, 83
Functionality, I-device, 904

G

Gen_UsrMsg (Generate user diagnostic alarms), 424
Generating user-defined Web page DBs, 1037
GEO2LOG (Determine the hardware identifier based upon slot information), 532
GEOADDR, 538
GET (read data from a remote CPU), 965
  configuring the connection, 789
GET_DIAG (read diagnostic information), 466
GET_ERROR (get error locally), 306
GET_ERROR_ID (get error ID locally), 307
Get_Features (get advanced features), 1113
Get_IM_Data (read the identification and maintenance data), 439
GetBlockName (Read out name of the block), 372
GetInstanceName (Read out name of block instance), 367
GetInstancePath (Query composite global name of the block instance), 370
GETIO, 378
GETIO_PART, 380
GetStationInfo, 447
GetSymbolName (Read out a tag on the input parameter), 361

GetSymbolPath (Query composite global name of the input parameter assignment), 364
Global data block, 114, 186
Global library
  legacy USS protocol overview, 1220
  USS protocol overview, 1127
GOTO, SCL, 319
GSD file, 913
Guidelines
  CPU installation, 60
  grounding, 76
  inductive loads, 79
  installation, 53
  installation procedures, 59
  isolation, 76
  lamp loads, 78
  wiring guidelines, 75, 77

H

Hardware configuration, 149
  add modules, 154
  add new device, 150
  AS-i, 957
  AS-i port, 957
  configuring the CPU, 165
  configuring the modules, 173
  discover, 152
  download, 210
  Ethernet port, 795
  network connection, 787
  PROFIBUS, 951
  PROFINET port, 795
Hardware flow control, 1075
Hardware interrupt OB, 94
High-speed counter, 542, 570
  cannot be forced, 1319
  configuration, 558
  counting modes, 559
  operating phase, 560
HMI devices
  configuring PROFINET communication, 895
  network connection, 787
  overview, 33
Hotline, 3
HSC (high-speed counter
  operating phase, 560
HSC (high-speed counter)
  configuration, 558
  counting modes, 559
HTA (convert hexadecimal number to ASCII string), 351
HTML pages
  listing, user-defined Web page example, 1047
  user-defined, 1020
HTML pages, user-defined
  accessing S7-1200 data, 1022
  developing, 1021
  language locations, 1057
  page locations, 1036
  refreshing, 1021
HTTP connections, Web server, 1061

I

I memory
  force, 1318
  force operation, 1319, 1319
  force table, 1318
  monitor, 1312
  monitor LAD, 1313
  peripheral input addresses (force table), 1318
  watch table, 1312
I/O
  addressing, 119
  analog input representation (current), 1459, 1507
  analog input representation (voltage), 1458, 1506
  analog output representation (current), 1460, 1508
  analog output representation (voltage), 1460, 1507
  analog status indicators, 1298
  digital status indicators, 1296
  force operation, 1319
  inductive loads, 79
  monitoring status in LAD, 1313
  monitoring with a watch table, 1315
  step response times
  (CPU), 1364, 1377, 1390, 1404, 1422
  step response times (SB), 1505
  step response times (SM), 1457
Identification of CPU, viewing with Web server, 999
I-device (intelligent IO device)
  configuring, 911
  configuring with GSD file, 913
  functionality, 904
  lower-level PN IO system, 906
  Properties, 905
  shared, 923
Idle line, 1077, 1078
IF-THEN, SCL, 312
Importing Siemens security certificate, 1063
IN_Range (value within range), 245
INC (increment), 254
Incompatible CPU version error, 1296
Indexing arrays with variables, 284

Inductive loads, 79
Industrial environments
  approvals, 1347
Information resources, 4
Input filter time, 167
Input simulators, 1538
Inputs
  pulse catch bits, 168
Inputs and outputs
  monitoring, 1312
INSERT (insert characters in a character string), 358
Inserting a device
  unspecific CPU, 152
Inserting instructions
  drag and drop, 40
  drag and drop between editors, 46
  favorites, 41
Inserting the memory card into CPU, 135
Installation
  air flow, 55
  clearance, 55
  communication board (CB), 62
  communication module (CM), 65
  cooling, 55
  CPU, 60
  expansion cable, 68
  grounding, 76
  guidelines, 53
  inductive loads, 79
  isolation guidelines, 76
  lamp loads, 78
  mounting dimensions, 58
  overview, 53, 59
  power budget, 56
  requirements, 38
  signal board (SB), 62
  signal module (SM), 64
  signal modules (SM), 32
  terminal block connector, 67
  thermal zone, 55, 58
  TS Adapter and TS module, 70
  TS Adapter on a DIN rail, 73
  TS Adapter on a wall, 74
  TS Adapter SIM card, 71
  wiring guidelines, 75, 77
Instance data block, 114
Instruction execution
speeds, 1357, 1370, 1383, 1397, 1413
Instructions
  & box (FBD AND logic operation), 222
  -( )- (normally open coil), 223
  -(/)- (normally closed coil), 223
  -(N)- (set operand on negative signal edge), 227
  -(P)- (set operand on positive signal edge), 227
  -(RESET_BF) (reset bit field), 225
  -(SET_BF) (set bit field), 225
  /= box (FBD negate assignment), 223
  -|/|- (normally closed contact), 221
  -||- (normally open contact), 221
  -|N|- (scan operand for negative signal edge), 227
  -|P|- (scan operand for positive signal edge), 227
  = box (FBD assignment), 223
  >=1 box (FBD OR logic operation), 222
  ABS (form absolute value), 255
  ACOS (form arccosine value), 258
  ACT_TINT (activate time of day interrupt), 418
  ADD (add), 250
  adding inputs or outputs to LAD or FBD instructions, 44
  AND (logic operation), 320
  AS-i distributed I/O, 374
  ASIN (form arcsine value), 258
  ATAN (form arctangent value), 258
  ATH (convert ASCII string to hexadecimal number), 351
  ATTACH (attach an OB to an interrupt event), 408
  ATTR_DB (Read data block attribute), 528
  CALCULATE, 42
  CALCULATE (calculate), 249
  calendar, 329
  CAN_DINT (cancel time-delay interrupt), 420
  CAN_TINT (cancel time of day interrupt), 417
  CASE (SCL), 313
  CEIL (generate next higher integer from floating-point number), 290
  Chars_TO_Strg (convert array of CHAR to character string), 349
  clock, 332
  columns and headers, 45, 816, 828, 836, 847, 1130, 1151, 1177, 1221, 1235, 1253
  common parameters, 891
  compare values, 244
  CONCAT (combine character strings), 355
  CONTINUE (SCL), 317
  CONV (convert value), 285
  COS (form cosine value), 258
  CountOfElements (Get number of ARRAY elements), 282
  CREATE_DB (Create data block), 520
  CTD (count down), 238
  CTRL_HSC (control high-speed counter), 570
  CTRL_HSC_EXT (Control high-speed counter (extended)), 542

CTRL_PTO (pulse train output), 474
CTRL_PWM (pulse width modulation), 473
CTU (count up), 238
CTUD (count up and down), 238
DataLogClose (close data log), 505
DataLogCreate (create data log), 496
DataLogNewFile (data log in new file), 507
DataLogOpen (open data log), 500
DataLogWrite (write data log), 501
date, 329
DB_ANY_TO_VARIANT (Convert DB_ANY to VARIANT, 295
DEC (decrement), 254
DECO (decode), 321
DELETE (delete characters in a character string), 357
DELETE_DB (Delete data block), 530
DEMUX (demultiplex), 324
Deserialize, 263
DETACH (detach an OB from an interrupt event), 408
DeviceStates (read module status of an I/O system), 455
DIS_AIRT (disable execution of higher priority interrupts and asynchronous error events), 423
DIV (divide), 250
DPNRM_DG (read diagnostic data from a DP slave), 404
DPRD_DAT (read consistent data of a DP standard slave), 396
DPWR_DAT (write consistent data of a DP standard slave), 396
drag and drop, 40
drag and drop between editors, 46
EN_AIRT (enable execution of higher priority interrupts and asynchronous error events)), 423
ENCO (encode), 321
ENDIS_PW (enable disable passwords), 302
EQ_ElemType (Compare data type of an ARRAY element for EQUAL with the data type of a tag), 247
EQ_Type (Compare data type for EQUAL with the data type of a tag), 247
EXIT (SCL), 318
EXP (form exponential value), 258
expandable instructions, 44
EXPT (exponentiate), 258
F_TRIG (set tag on negative signal edge), 228
favorites, 41
FieldRead (read field), 283
FieldWrite (write field), 283
FILL_BLK (fill block), 269
FIND (find characters in a character string), 360
FLOOR (generate next lower integer from floating-point number), 290
FOR (SCL), 314
force operation, 1319
FRAC (return fraction), 258
Gen_UsrMsg (Generate user diagnostic alarms), 424
GEO2LOG (Determine the hardware identifier based upon slot information), 532
GET (read data from a remote CPU), 965
GET_DIAG (read diagnostic information), 466
GET_ERROR (get error locally), 306
GET_ERROR_ID (get error ID locally), 307
Get_Features (get advanced features), 1113
Get_IM_Data (read the identification and maintenance data), 439
GetBlockName (Read out name of the block), 372
GetInstanceName (Read out name of block instance), 367
GetSInstancePath (Query composite global name of the block instance), 370
GetSymbolName (Read out a tag on the input parameter), 361
GetSymbolPath (Query composite global name of the input parameter assignment), 364
GOTO (SCL), 319
HTA (convert hexadecimal number to ASCII string), 351
IF-THEN (SCL), 312
IN_Range (value within range), 245
INC (increment), 254
INSERT (insert characters in a character string), 358
inserting, 40
INV (create ones complement), 321
IO2MOD (Determine the hardware identifier from an I/O address, 535
IS_ARRAY (Check for ARRAY), 249
IS_NULL (Query for EQUALS zero pointer), 248
JMP (jump if RLO = 1), 297
JMP_LIST (define jump list), 298
JMPN (jump if RLO = 0), 297
Label (jump label), 297
LED (read LED status), 438
LEFT (read the left characters of a character string), 356
legacy TCON, TDISCON, TSEND, and TRCV instructions, 848
legacy TRCV_C (receive data via Ethernet (TCP)), 829
legacy TSEND_C (send data via Ethernet (TCP)), 829

legacy USS status codes, 1232
LEN (determine the length of a character string), 354
LIMIT (set limit value), 257
LN (form natural logarithm), 258
LOG2GEO (Determine the slot from the hardware identifier), 534
LOWER_BOUND (read out ARRAY low limit), 272
MAX (get maximum), 256
MAX_LEN (maximum length of a character string), 353
MB_CLIENT, 1151
MC_ChangeDynamic (change dynamic settings for the axis), 737
MC_CommandTable, 734
MC_Halt (pause axis), 723
MC_Home (home axis), 720
MC_MoveAbsolute (position axis absolutely), 725
MC_MoveJog (move axis in jog mode), 732
MC_MoveRelative (position axis relatively), 728
MC_MoveVelocity (move axis at predefined velocity), 730
MC_Power (release/block axis), 716
MC_ReadParam (read parameters of a technology object), 741
MC_Reset (confirm error), 719
MC_WriteParam (write to parameters of a technology object), 739
MID (read the middle characters of a character string), 356
MIN (get minimum), 256
MOD (return remainder of division), 252
Modbus_Comm_Load (Configure SIPLUS I/O or port on the PtP module for Modbus RTU), 1178
Modbus_Master (Communicate using SIPLUS I/O or the PtP port as Modbus RTU master), 1182
Modbus_Slave (Communicate using SIPLUS I/O or the PtP port as Modbus RTU slave), 1190
ModuleStates (read module status information of a module), 460
monitor, 1313
monitoring status or value, 1312
motion control, 714
MOVE (move value), 260
MOVE_BLK (move block), 260
MUL (multiply), 250
MUX (multiplex), 323
N (scan operand for negative signal edge), 227
N_TRIG (scan RLO for negative signal edge), 228
N= box and N coil (set operand on negative signal edge), 227
NE_ElemType (Compare data type for UNEQUAL with the data type of a tag), 247
NE_Type (Compare data type for UNEQUAL with the data type of a tag), 247
NEG (create twos complement), 253
NORM_X (normalize), 291
NOT (invert RLO), 223
NOT_NULL (Query for UNEQUALS zero pointer), 248
NOT_OK (check invalidity), 246
OK (check validity), 246
OR (logic operation), 320
OUT_Range (value outside range), 245
P (scan operand for positive signal edge), 227
P_TRIG (scan RLO for positive signal edge), 228
P= box and P coil (set operand on positive signal edge), 227
P3964_Config (Configuring the 3964(R) protocol), 1101
PEEK and POKE variations, 200, 276
PID_Compact (universal PID controller with integrated tuning), 578
PID_Temp (universal PID controller that allows handling of temperature control), 596
Port_Config (port configuration), 1090
PROFIBUS distributed I/O, 374
PROFINET distributed I/O, 374
program control (SCL), 311
PRVREC (make data record available), 401
PUT (write data to a remote CPU), 965
QRY_CINT (query cyclic interrupt parameters), 413
QRY_DINT (query time-delay interrupt status), 420
QRY_TINT (query status of time of day interrupt), 419
R (reset output), 224
R_TRIG (set tag on positive signal edge), 228
RALRM (receive interupt), 383
RCVREC (receive data record), 399
RD_ADDR (determine the IO addresses from the hardware identifier), 537
RD_LOC_T (read local time), 332
RD_SYS_T (read time-of-day), 332
RDREC (read data record), 375
RE_TRIGR, 107
RE_TRIGR (restart cycle monitoring time), 304
READ_BIG (Read data in big little endian format), 278
READ_DBL (read from data block in load memory), 525
READ_LITTLE (Read data in little endian format), 278
Receive_Config (receive configuration), 1095

Receive_P2P (receive Point-to-Point), 1108
Receive_Reset (receiver reset), 1110
RecipeExport (recipe export), 488
RecipeImport (recipe import), 490
REPEAT (SCL), 316
REPLACE (replace characters in a character string), 359
reset output, 224
RESET_BF (reset bit field), 225
RET (return), 301
RETURN (SCL), 319
RIGHT (read the right characters of a character string), 356
ROL (rotate left) and ROR (rotate right), 327
ROUND (round numerical value), 289
RS (reset/set flip-flop), 225
RT (reset timer), 230
RTM (runtime meters), 337
RUNTIME (Measure program runtime), 309
S (set output), 224
S_CONV (convert character string), 340
S_MOV (move chracter string), 339
SCALE_X (scale), 291
scaling analog values, 43
SCL conversion instructions, 286
SEL (select), 323
Send_Config (send configuration), 1093
Send_P2P (send Point-to-Point data), 1103
Serialize, 266
set output, 224
SET_BF (set bit field), 225
SET_CINT (set cyclic interrupt parameters), 411
Set_Features (set advanced features), 1114
SET_TIMEZONE (set time zone), 336
SET_TINTL (set date and time of day interrupt), 415
SGN_GET (get RS232 signals), 1110
SHL (shift left) and SHR (shift right), 326
Signal_Set (set RS232 signals), 1112
SIN (form sine value), 258
SQR (form square), 258
SQRT (form square root), 258
SR (set/reset flip-flop), 225
SRT_DINT (start time-delay interrupt), 420
status, 1313
STP (exit program), 305
Strg_TO_Chars (convert character string to array of CHAR), 349
STRG_VAL (convert character string to numerical value), 340
SUB (subtract), 250
SWAP (swap bytes), 271
SWITCH (jump distributor), 299
T_ADD (add times), 330
T_COMBINE (combine times), 331
T_CONFIG (configure interface), 880
T_CONV (convert times and extract), 329
T_DIAG, 859
T_DIFF (time difference), 331
T_RESET, 857
T_SUB (subtract times), 330
TAN (form tangent value), 258
TCON, 837
TDISCON, 837
time, 329
timer, 230
TM_MAIL (send email), 1287
TOF (off-delay timer), 230
TON (on-delay timer), 230
TONR (on-delay retentive timer), 230
TP (pulse timer), 230
TRCV, 837
TRCV_C, 817, 900
TRUNC (truncate numerical value), 289
TSEND, 837
TSEND_C, 817, 898
TURCV (receive data via Ethernet (UDP)), 874
TUSEND (send data via Ethernet (UDP)), 874
UFILL_BLK (fill block uninterruptible), 269
UMOVE_BLK (move block uninterruptible), 260
UPPER_BOUND (read out ARRAY high limit), 274
USS status codes, 1141
USS_Drive_Control (Swap data with drive), 1135
USS_Port_Scan (Edit communication via USS network), 1134
USS_Read_Param (readout parameters from the drive), 1138
USS_Write_Param (change parameters in the drive), 1139
VAL_STRG (convert numerical value to character string), 340
VARIANT_TO_DB_ANY (Convert VARIANT to DB_ANY), 294
VariantGet (Read VARIANT tag value), 280
VariantPut (Write VARIANT tag value), 281
versions of
instructions, 45, 816, 828, 836, 847, 1130, 1151, 1177, 1221, 1235, 1253
WHILE (SCL), 315
WR_LOC_T (set local time), 332
WR_SYS_T (set time-of-day), 332
WRIT_DBL (write to data block in load memory), 525
WRITE_BIG (Write data in big endian format), 278

WRITE_LITTLE (Write data in little endian format), 278
WRREC (write data record), 375
WWW (synchronizing user-defined Web pages), 1038
x box (FBD XOR logic operation), 222
XOR (logic operation), 320
Instructions, legacy
MB_CLIENT (communicate via PROFINET as Modbus TCP client), 1236
MB_COMM_LOAD (configure port on the PtP module for Modbus RTU), 1254
MB_MASTER (communicate via the PtP port as Modbus master), 1257
MB_SERVER (communicate via PROFINET as Modbus TCP server), 1243
MB_SLAVE (communicate via the PtP port as Modbus slave), 1263
PORT_CFG (configure communication parameters dynamically), 1204
RCV_CFG (configure serial receive parameters dynamically), 1208
RCV_PTP (enable receive messages), 1215
RCV_RST (delete receive buffer), 1216
SEND_CFG (configure serial transmission parameters dynamically), 1206
SEND_PTP (transmit send buffer data), 1212
SGN_GET (Query RS232 signals), 1217
SGN_SET (set RS-232 signals), 1218
USS_DRV (Swap data with drive), 1226
USS_PORT (Edit communication via USS network), 1225
USS_RPM (readout parameters from the drive), 1229
USS_WPM (change parameters in the drive), 1230
Inter-character gap, 1082
Interrupts
ATTACH (attach an OB to an interrupt event), 408
CAN_DINT (cancel time-delay interrupt), 420
DETACH (detach an OB from an interrupt event, 408
interrupt latency, 103
overview, 92
QRY_DINT (query time-delay interrupt status), 420
SRT_DINT (start time-delay interrupt), 420
Intro standard Web page, 997
INV (create ones complement), 321
IO system, data exchange, 909
IO2MOD (Determine the hardware identifier from an I/O address, 535
IO-Link
address space, 1482
changing parameters in runtime, 1483
configuring, 1482
data record, 1483
device profile, 1477
device storage, 1479
diagnostics, 1487
diagram, 1481
error messages, 1483, 1485, 1487
functions, 1478
LED display, 1485
parameters, 1482
pin assignment, 1480
replacing, 1478
reset to factory settings, 1479
IO-Link Master signal module, 1474
IP address, 795, 796
assigning, 791, 799
assigning online, 793
configuring, 795
configuring the online CPU, 1302
device configuration, 165
MAC address, 795
IP address, emergency (temporary), 980
IP router, 795
IS_ARRAY (Check for ARRAY), 249
IS_NULL (Query for EQUALS ZERO pointer), 248
ISO on TCP
ad hoc mode, 808
ISO on TCP protocol, 805
Isolation guidelines, 76
ISO-on-TCP
connection configuration, 788
connection IDs, 808
parameters, 811

J

JavaScript, standard Web pages, 1062
Jerk limit, 713
JMP (jump if RLO = 1), 297
JMP_LIST (define jump list), 298
JMPN (jump if RLO = 0), 297

K

Know-how protection
password protection, 207
Know-how protection, viewing with Web server, 999
Korea Certification approval, 1346

L

Label (jump label), 297
LAD (ladder logic)
monitor, 1313
monitoring status or value, 1312
overview, 193
program editor, 1313
status, 1313, 1318
Lamp loads, 78
Languages, user-defined Web pages, 1052
Latency, 103
LED (read LED status), 438
LED indicators
communication interface, 1067, 1295
CPU status, 1295
LEFT (read the left characters of a character string), 356
Legacy TCON, TDISCON, TSEND, and TRCV instructions, 848
Legacy TRCV_C (receive data via Ethernet (TCP)), 829
Legacy TSEND_C (send data via Ethernet (TCP)), 829
Legacy USS protocol library
overview, 1220
requirements for using, 1222
status codes, 1232
USS_DRV (Swap data with drive), 1226
USS_PORT (Edit communication via USS network), 1225
USS_RPM (readout parameters from the drive), 1229
USS_WPM (change parameters in the drive), 1230
LEN (determine the length of a character string), 354
LENGTH parameter, SEND_P2P, 1107
Length, PtP message, 1084
LIMIT (set limit value), 257
Linear programming, 180
LN (form natural logarithm), 258
Load memory, 28
CPU 1211C, 1356
CPU 1212C, 1369
CPU 1214C, 1382
CPU 1215C, 1396
CPU 1217C, 1412
user-defined Web pages, 1041
Local memory
maximum per OB priority level, 118
usage by blocks, 118
Local time
RD_LOC_T (read local time), 332
WR_LOC_T (set local time), 332
Local/Partner connection, 788
LOG2GEO (Determine the slot from the hardware identifier), 534
Logging in/out, standard Web pages, 994
Logic analyzer, 1332
Loss of CPU communication to modules, 98
Lost password, 147
LOWER_BOUND (read out ARRAY low limit), 272

M

MAC address, 795, 800
Manual fragment DB control, 1057
Manuals, 4
Maritime approval, 1347
Master polling architecture, 1117
Math, 42, 249, 250
MAX (get maximum), 256
MAX_LEN (maximum length of a character string), 353
Maximum message length, 1082
Maximum Web server connections, 1061
MB_CLIENT, 1151
MB_CLIENT (communicate via PROFINET as Modbus TCP client), legacy, 1236
MB_COMM_LOAD (configure port on the PtP module for Modbus RTU), legacy, 1254
MB_MASTER (communicate via the PtP port as Modbus master), legacy, 1257
MB_SERVER, 1160
MB_SERVER (communicate via PROFINET as Modbus TCP server), legacy, 1243
MB_SLAVE (communicate via the PtP port as Modbus slave), legacy, 1263
MC_ChangeDynamic (change dynamic settings for the axis), 737
MC_CommandTable, 734
MC_Halt (pause axis), 723
MC_Home (home axis), 720
MC_MoveAbsolute (position axis absolutely), 725
MC_MoveJog (move axis in jog mode), 732
MC_MoveRelative (position axis relatively), 728
MC_MoveVelocity (move axis at predefined velocity), 730
MC_Power (release/block axis), 716
MC_ReadParam (read parameters of a technology object), 741
MC_Reset (confirm error), 719
MC_WriteParam (write to parameters of a technology object), 739
MC-PostServo OB, 102
MC-PreServo OB, 101
Measurements, trace jobs, 1333

Media redundancy
Configuring, 937
Functions in ring topology, 934
Memory
clock memory, 110
I (process image input), 116
L (local memory), 114
load memory, 108
M (bit memory), 118
monitoring memory usage, 1307
peripheral input addresses (force table), 1318
Q (process image output), 117
retentive memory, 108
system memory, 110
Temp memory, 118
work memory, 108
Memory areas
addressing Boolean or bit values, 115
immediate access, 115
process image, 115
Memory areas, viewing with Web server, 999
Memory card, 1538
configure the startup parameters, 138
empty transfer card for a lost password, 147
firmware update, 144
incompatibility error, 1296
inserting into CPU, 135
lost password, 147
overview, 134
program card, 142
transfer card, 139
Memory locations, 114, 116
Message
end, 1081
length, 1082
start, 1078
Message configuration
instructions, 1116
receive, 1077
transmit, 1076
MicroMaster drive, connecting, 1143
MID (read the middle characters of a character string), 356
MIN (get minimum), 256
Miscellaneous PtP parameter errors, 1089
Mobile device, accessing Web server, 989
Mobile devices
Web page layout, 992
MOD (return remainder of division), 252
Modbus
function codes, 1147
MB_CLIENT (communicate via PROFINET as Modbus TCP client), legacy, 1236
MB_COMM_LOAD (configure port on the PtP module for Modbus RTU), legacy, 1254
MB_MASTER (communicate via the PtP port as Modbus master), legacy, 1257
MB_SERVER (communicate via PROFINET as Modbus TCP server), legacy, 1243
MB_SLAVE (communicate via the PtP port as Modbus slave), legacy, 1263
memory addresses, 1148
Modbus_Comm_Load (Configure SIPLUS I/O or port on the PtP module for Modbus RTU), 1178
Modbus_Master (Communicate using SIPLUS I/O or the PtP port as Modbus RTU master), 1182
Modbus_Slave (Communicate using SIPLUS I/O or the PtP port as Modbus RTU slave), 1190
network station addresses, 1148
RTU communication, 1148
versions, 45, 1130, 1177, 1221, 1253
MODBUS
MB_CLIENT, 1151
MB_SERVER, 1160
Modbus RTU
master program, 1200
slave example, 1203
Modbus TCP
versions, 1151, 1235
Modbus_Comm_Load (Configure SIPLUS I/O or port on the PtP module for Modbus RTU) instruction, 1178
Modbus_Master (Communicate using SIPLUS I/O or the PtP port as Modbus RTU master), 1182
Modbus_Slave (Communicate using SIPLUS I/O or the PtP port as Modbus RTU slave), 1190
Modifying
program editor status, 1313
variables from Web server, 1011
watch table, 1315
Module information standard Web page, 1002
Modules
communication boards (CB), 32
communication module (CM), 32
communication processor (CP), 32
comparison chart, 31
configuring parameters, 173
signal board (SB), 32
signal modules (SM), 32
thermal zone, 55, 58
ModuleStates, 460
ModuleStates example, 462
Monitoring
capturing and resetting DB values, 1313

cycle time, 1307
force operation, 1319
force table, 1318
LAD status, 1313
LAD status and use of watch table, 1312
memory usage, 1307
watch table, 1315
Monitoring the program, 217
Monitoring variables from Web server, 1011
Motion
Telegram 4, 668
Motion control
hardware and software limit switches, 696
homing (sequence for active homing), 712
homing configuration parameters, 707
homing the axis, 706
List of ErrorIDs and ErrorInfo, 755
MC_ChangeDynamic (change dynamic settings for the axis), 737
MC_CommandTable, 734
MC_Halt (pause axis), 723
MC_Home (home axis), 720
MC_MoveAbsolute (position axis absolutely), 725
MC_MoveJog (move axis in jog mode), 732
MC_MoveRelative (position axis relatively), 728
MC_MoveVelocity (move axis at predefined velocity), 730
MC_Power (release/block axis), 716
MC_ReadParam (read parameters of a technology object), 741
MC_Reset (confirm error), 719
MC_WriteParam (write to parameters of a technology object), 739
overview, 637
phasing, 642
TM Pulse module, 684
Motion control instructions, 714
Mounting
airflow, 55
clearance, 55
communication board (CB), 62
communication module (CM), 65
cooling, 55
CPU, 60
dimensions, 58
expansion cable, 68
grounding, 76
guidelines, 53
inductive loads, 79
isolation, 76
lamp loads, 78
overview, 59
signal board (SB), 62
signal module (SM), 64
terminal block connector, 67
thermal zone, 55, 58
wiring guidelines, 75, 77
MOVE (move value), 260
MOVE_BLK (move block), 260
Movement sequence (MC_CommandTable), 734
MRES, operator panel, 47
MUL (multiply), 250
Multi-node connections
connection types, 970
Ethernet protocols, 970
Multiple AWP variable definitions, 1033
MUX (multiplex), 323

N

N (scan operand for negative signal edge), 227
N_TRIG (scan RLO for negative signal edge), 228
N= box and N coil (set operand on negative signal edge), 227
NE_ElemType (Compare data type for UNEQUAL with the data type of a tag), 247
NE_Type (Compare data type for UNEQUAL with the data type of a tag), 247
NEG (create twos complement), 253
Nesting depth, 83
Network communication, 892
bias and terminate cable, 1068
Network connection
connecting devices, 787
multiple CPUs, 896, 897, 901, 951, 956
Network time protocol (NTP), 802
New features, 35
No restart, 87
NORM_X (normalize), 291
Normalizing analog values, 293
Normally open/closed coil, 223
Normally open/closed contact, 221
NOT (invert RLO), 223
NOT_NULL (Query for UNEQUALS ZERO pointer), 248
NOT_OK (check invalidity), 246
Numbers
binary, 123
integer, 124
real, 124

O

OB, (Organization block)
Off-delay (TOF), 230
OK (check validity), 246
On-delay delay (TON), 230
On-delay retentive (TONR), 230
Online
  assigning an IP address, 793
  capturing and resetting DB values, 1313
  comparing and synchronizing, 1309
  cycle time, 1307
  diagnostics buffer, 1308
  force, 1318
  force operation, 1319
  going online, 1299
  IP address, 1302
  memory usage, 1307
  monitoring status or value, 1312
  operating panel, 1306
  operator panel, 47
  RUN/STOP buttons, 47
  status, 1313
  time of day, 1302
  tools, 1311
  watch table, 1312, 1313, 1315
Online and diagnostic tools
  downloading in RUN mode, 1321
Online device names
  PROFINET IO, 1300
OPC, configuration, 1282
Open loop motion control
  configuring the axis, 646
  PTO, 646
Open User Communication
  establishing a connection and reading data with legacy TRCV_C, 829
  establishing a connection and reading data with TRCV_C, 817
  establishing a connection and sending data with legacy TSEND_C, 829
  establishing a connection and sending data with TSEND_C, 817
Open User Communication instructions return values, 891
Operating mode, 47, 47
  changing STOP/RUN, 1306
  operating modes of the CPU, 87
Operating phase
  HSC (high-speed counter), 560
Operator panel, 47
Operator panels, 33
Optimized data blocks, 187
Option handling (configuration control), 155
OR (logic operation), 320
Organization block
  call, 92
  calling code blocks within the user program, 182
  configuring operation, 184
  creating, 184
  cyclic interrupt, 93
  function, 92
  know-how protection, 207
  linear and structured programming, 180
  multiple cyclic, 184
  overview, 83
  priority classes, 92
  processing, 183, 183
  startup processing, 90
  temp memory allocation, 118
Organization block (OB)
  Reading start information with RD_SINFO, 428
OUT_Range (value outside range), 245
Output parameters, 185
  configuring pulse channels, 480
  pulse outputs, 478
Overvoltage category, 1350

P

P (scan operand for positive signal edge), 227
P_TRIG (scan RLO for positive signal edge), 228
P= box and P coil (set operand on positive signal edge), 227
P3964_Config (Configuring the 3964(R) protocol), 1101
  errors, 1103
Panels (HMI), 33
Parameter assignment, 185
Parameters configuration
  LENGH and BUFFER for SEND_P2P, 1107
  receive, 901
  transmit, 899
Parity, 1074
Passive/active communication
  configuring the partners, 788, 972
  connection IDs, 808
  parameters, 811
Password protection
  access to the CPU, 204
  binding to a CPU, memory card, or password, 208
  code block, 207
  copy protection, 208
  empty transfer card, 147
  ENDIS_PW (enable disable passwords), 302
  lost password, 147

PEEK, PEEK_WORD, PEEK_BOOL, PEEK_DWORD, PEEK_BLK, 200, 276
Performance times, 1357, 1370, 1383, 1397, 1413
Phase shift, cyclic interrupt OBs, 93
Phasing, 642
PID
cascading controllers, 602
overview, 575
PID_3STEP (PID controller with tuning for valves), 586
PID_3Step algorithm, 575
PID_3Step ErrorBit parameters, 593
PID_Compact (universal PID controller with integrated tuning), 578
PID_Compact algorithm, 575
PID_Compact ErrorBit parameters, 583
PID_Compact process value limits, 582
PID_Temp (universal PID controller that allows handling of temperature control), 596
PID_Temp ErrorBit parameters, 605
PLC
add modules, 154
assigning an IP address to an online CPU, 793
communication load, 108
comparing and synchronizing, 1309
copying blocks from an online CPU, 215
cycle time, 107, 108
cycle time, 107, 108
device configuration, 149
download, 210
expansion cable, 68
force, 1318
force operation, 1319
HSC configuration, 558
installation, 59, 60
know-how protection, 207
monitoring, 1312
operating modes, 87
overview of the CPU, 27
power budget, 56
RTM (runtime meters), 337
startup processing, 90
system design, 179
tags, 114
terminal block connector, 67
time synchronization property, 803
using blocks, 180
watch table, 1315
PM 1207 power module, 1542
PN slave
Activating and deactivating with D_ACT_DP, 387
Pointers
Variant data type, 131
Point-to-Point communication, 1070
Point-to-Point programming, 1115
POKE, POKE_BOOL, POKE_BLK, 200, 276
Polling architecture, 1117
Polution degree, 1350
Port configuration, 1073
errors, 1092, 1206
instructions, 1116
PtP example program, 1119
Port configuration, 3964(R), 1085
Port numbers
assigning to communication partners, 805
restricted, 892
PORT_CFG (configure communication parameters dynamically), legacy, 1204
Port_Config (port configuration), 1090
Portal view, 39
Potentiometer module
specifications, 1541
Power budget, 56
example, 1546
form for calculations, 1547
overview, 1545
Power supply module
PM1207, 1542
Priority
priority class, 92
priority in processing, 103
Process image
force, 1318
force operation, 1319
monitor, 1313
monitoring status or value, 1312
Reading inputs with GETIO, 378
Reading the process image area with GETIO_PART, 380
status, 1313, 1318
Transferring the process image area with SETIO_PART, 381
Writing outputs with SETIO, 379
PROFIBUS
add CM 1243-5 (DP master) module, 950
add DP slave, 950
address, 952
address, configuring, 952
CM 1242-5 (DP slave) module, 947
CM 1243-5 (DP master) module, 947
distributed I/O instructions, 374
DPNRM_DG (read diagnostic data from a DP slave), 404

DPRD_DAT (read consistent data of a DP standard slave), 396
DPWR_DAT (write consistent data of a DP standard slave), 396
GET (read data from a remote CPU), 965
master, 947
network connection, 787, 951
number of communication connections, 784
PUT (write data to a remote CPU), 965
RALRM (receive interrupt), 383
RDREC (read data record), 375
S7 connection, 970
slave, 947
WRREC (write data record), 375
PROFIBUS and PROFINET
DeviceStates example, 456
ModuleStates example, 462
PROFIdrive, 656
PROFIenergy, 407
Profile OB, 101
PROFINET
ad hoc mode, 808
configuring communication between CPU and HMI device, 895
configuring the IP address, 165
connection IDs, 808
CPU-to-CPU communication, 896
device naming and addressing, 804
distributed I/O instructions, 374
DPRD_DAT (read consistent data of a standard DP slave), 396
DPWR_DAT (write consistent data of a DP standard slave), 396
Ethernet address properties, 796
GET (read data from a remote CPU), 965
IP address, 795
IP address assignment, 804
MAC address, 795
network connection, 787, 896, 897, 901
number of communication connections, 784
overview, 805
PLC-to-PLC communication, 896
PRVREC (make data record available), 401
PUT (write data to a remote CPU), 965
RALRM (receive interrupt), 383
RCVREC (receive data record), 399
RDREC (read data record), 375
resetting a connection, 857
S7 connection, 970
system start-up time, 804
testing a network, 799
time synchronization, 165
time synchronization property, 803
types of communication, 781
WRREC (write data record), 375
PROFINET instructions
legacy TCON, TDISCON, TSEND, and TRCV instructions, 848
legacy TRCV_C (receive data via Ethernet (TCP)), 829
legacy TSEND_C (send data via Ethernet (TCP)), 829
T_CONFIG (configure interface), 880
T_DIAG, 859
T_RESET, 857
TCON, 837
TDISCON, 837
TRCV, 837
TRCV_C, 817, 900
TSEND, 837
TSEND_C, 817
TURCV (receive data via Ethernet (UDP)), 874
TUSEND (send data via Ethernet (UDP)), 874
PROFINET IO
Adding a device, 901
Assigning a CPU, 902
Assigning device names, 902
Assigning device names online, 1300
device names, 902
Devices, 901
Online device names, 1300
PROFINET IO devices
Reading a portion of the inputs with GETIO_PART, 380
Writing a part of the outputs with SETIO_PART, 381
Writing all outputs with SETIO, 379
PROFINET port
autonegotiation, 797
PROFINET RT, 805
Program
binding to a CPU, memory card, or password, 208
calling code blocks within the user program, 182
copying blocks from an online CPU, 215
download, 210
linear and structured programs, 180
memory card, 134
organization blocks (OBs), 183
password protection, 207
priority class, 92
Program card
configure the startup parameters, 138
creating, 142
inserting into CPU, 135
overview, 134

Program control (SCL), 311
CASE, 313
CONTINUE, 317
EXIT, 318
FOR, 314
GO TO, 319
IF-THEN, 312
REPEAT, 316
RETURN, 319
WHILE, 315
Program cycle OB, 92
Program editor
monitor, 1313
status, 1313
Program execution, 83
Program information
In the call structure, 219
Program structure, 182
Programming
adding inputs or outputs to LAD or FBD instructions, 44
binding to a CPU, memory card, or password, 208
block calls, 83
calling code blocks within the user program, 182
comparing and synchronizing code blocks, 1309
data block (DB), 83
drag and drop between editors, 46
expandable instructions, 44
favorites, 41
FBD (function block diagram), 194
function (FC), 184
function block (FB), 83, 185
initial value of an FB, 185
inserting instructions, 40
instance data block (DB), 185
LAD (ladder), 193
linear program, 180
operating modes of the CPU, 87
PID overview, 575
PID_3STEP (PID controller with tuning for valves), 586
PID_3Step algorithm, 575
PID_Compact (universal PID controller with integrated tuning), 578
PID_Compact algorithm, 575
PID_Temp (universal PID controller that allows handling of temperature control), 596
power flow (EN and ENO), 202
priority class, 92
PtP instructions, 1115
RTM (runtime meters), 337
SCL (Structured Control Language), 195, 195, 196
structured program, 180
system time, 332
types of code blocks, 83
unplugged modules, 50
unspecific CPU, 152
valid FC, FB, and DB numbers, 83
Programming user-defined Web page language switch, 1053
Project
access protection by passwords, 204
binding to a CPU, memory card, or password, 208
comparing and synchronizing, 1309
download, 210
empty transfer card, 147
lost password, 147
program card, 142
protecting a code block, 207
transfer card, 139
Project view, 39, 39
Protection class, 1351
Protection level
binding to a CPU, memory card, or password, 208
code block, 207
CPU, 204
lost password, 147
Protocol
communication, 1070
freeport, 1070
ISO on TCP, 805
Modbus, 1070
PROFINET RT, 805
TCP, 805
UDP, 805
USS, 1070
Protocols, communication, 807
PRVREC (make data record available), 401
PTO, 646
PTO (pulse train output)
cannot be forced, 1319
configuring pulse channels, 480
CTRL_PTO (pulse train output), 474
CTRL_PWM (pulse width modulation), 473
operation, 478
PtP communication, 1070
configuring parameters, 1076
configuring ports, 1073
example program, 1118
example program configuration, 1119
example program, running, 1127
example program, STEP 7 programming, 1125
programming, 1115
terminal emulator for example program, 1126

PtP communication, 3964(R)
configuring ports, 1085
configuring priority and protocol parameters, 1086
PtP error classes, 1089, 1204
PtP instruction return values, 1088
Pull or plug of modules OB, 98
Pulse catch, 168, 173
Pulse catch bits, digital input configuration, 168
Pulse delay (TP), 230
Pulse outputs, 478
PUT (write data to a remote CPU), 965
configuring the connection, 789
PWM (pulse width modulation
Cycle time, 481
Pulse duration, 481
PWM (pulse width modulation)
cannot be forced, 1319
changing the Cycle time, 483
changing the Pulse duration, 483
configuring pulse channels, 480
CTRL_PTO (pulse train output), 474
CTRL_PWM (pulse width modulation), 473
I/O addresses, 483
operation, 478

Q

Q memory
configuring pulse channels, 480
pulse outputs, 478
QRY_CINT (query cyclic interrupt parameters), 413
QRY_DINT (query time-delay interrupt status), 420
QRY_TINT (query status of time of day interrupt), 419
Queueing, 103
Quotation mark conventions, Web server, 1034

R

R (reset ouput), 224
R_TRIG (set tag on positive signal edge), 228
Rack or station failure OB, 99
RALRM (receive interrupt), 383, 391
Rated voltages, 1351, 1351
RCV_CFG (configure serial receive parameters dynamically), legacy, 1208
RCV_PTP (enable receive messages), legacy, 1215
RCV_RST (delete receive buffer), legacy, 1216
RCVREC (receive data record), 399
RD_ADDR (determine the IO addresses from the hardware identifier), 537
RD_LOC_T (read local time), 332
RD_SINFO (Read current OB start information, 428
RD_SYS_T (read time-of-day), 332
RDREC (read data record), 375, 391
RE_TRIGR (restart cycle monitoring time), 304
READ_BIG (Read data in big endian format), 278
READ_DBL (read from data block in load memory), 525
READ_LITTLE (Read data in little endian format), 278
Reading from DBs, I/O, or memory, 200, 276
Reading HTTP variables, 1026
Receive configuration errors, 1100, 1212
Receive message configuration
PtP device configuration, 1077
PtP example program, 1120
Receive parameters configuration, 901
Receive runtime return values, 1108, 1215
Receive_Config (receive configuration), 1095
Receive_P2P (receive Point-to-Point), 1108
Receive_Reset (receiver reset), 1110
Recipe
DB structure, 485
example program, 492
overview, 484
RecipeExport (recipe export), 488
RecipeImport (recipe import), 490
Recipe program example, 492
Redundancy
Redundancy clients, 933
Redundancy domains, 935
Referencing enum types, user-defined Web pages, 1030
Refreshing user-defined Web pages, 1021
Relay electrical service life, 1353
REPEAT, SCL, 316
REPLACE (replace characters in a character string), 359
Replacing modules, 50
Requirements, installation, 38
Reset timer (RT), 230
Reset to factory settings, 1303
RESET_BF (reset bit field), 225
Resetting the values of a DB, 1313
Restoring a backup, 1341
Restricted TSAPs and port numbers, 892
RET (return), 301
Retentive block tags
download in RUN mode, 1328
Retentive memory, 28, 108
CPU 1211C, 1356
CPU 1212C, 1369
CPU 1214C, 1382

CPU 1215C, 1396
CPU 1217C, 1412
Return values
Open User Communication instructions, 891
PtP instructions, 1088
RETURN, SCL, 319
Reverse voltage protection, 1352
RIGHT (read the right characters of a character string), 356
Ring port, 940
Ring topology, 933
ROL (rotate left) and ROR (rotate right), 327
ROUND (round numerical value), 289
Router IP address, 796
RS (reset/set flip-flop), 225
RS232 and RS485 communication modules, 1067
RS485 connector
termination and bias, 1068
RT (reset timer), 230
RTS (Hardware flow control, PtP), 1075
RTS On delay, Off delay, 1077
Run axis commands as movement sequence (MC_CommandTable), 734
RUN mode, 87, 91, 1306
force operation, 1319
operator panel, 47
toolbar buttons, 47
RUN to STOP transition, 113
RUN/STOP buttons, 47
Runtime meters (RTM), 337
RUNTIME(Measure program runtime), 309

S

S (set ouput), 224
S_CONV (convert character string), 340
S_MOV (move chracter string), 339
S7 communication
configuring the connection, 789
S7 routing, 941
Saving backup files, 1340
SCALE_X (scale), 291
Scaling analog values, 293
Scaling analogs, 43
Scan cycle
force operation, 1319, 1319
overview, 107
SCL (Structured Control Language)
addressing, 196
bit logic, 221
calling an FB or FC, 196
calling blocks, 182
compare values, 244
conditions, 196
control statements, 196, 311
Conversion instructions, 286
EN and ENO (power flow), 202
expressions, 196
operators, 196
overview, 195
priority of operators, 196
program control, 311
program editor, 195
timers, 230
Var section, 195
Security
binding to a CPU, memory card, or password, 208
copy protection, 208
CPU access protection, 204
know-how protectionf for a code block, 207
lost password, 147
Security events in diagnostics buffer, 112
SEL (select), 323
Send message configuration, 1076
Send parameters configuration, 788, 899, 972
SEND_CFG (configure serial transmission parameters dynamically), legacy, 1206
Send_Config (send configuration), 1093
Send_P2P (send Point-to-Point data), 1103
SEND_P2P (send Point-to-Point data)
LENGH and BUFFER parameters, 1107
SEND_PTP (transmit send buffer data), legacy, 1212
Serial communication, 1070
Serialize, 266
Service and support, 3
SET_BF (set bit field), 225
SET_CINT (set cyclic interrupt parameters), 411
Set_Features (set advanced features), 1114
SET_TIMEZONE (set time zone), 336
SET_TINTL (set date and time of day interrupt), 415
SETIO, 379
SETIO_PART, 381
Settings, 45
SGN_GET (get RS232 signals), 1110
SGN_GET (Query RS232 signals), legacy, 1217
SGN_SET (set RS-232 signals), legacy, 1218
Shared device
concept, 914
configuration, 917
Shared I-device, configuration, 923
SHL (shift left) and SHR (shift right), 326
Siemens security certificate, Web pages, 997, 1063
Siemens technical support, 3
siemens_automation_language cookie, 1053

Signal boards (SB)
add modules, 154
analog output representation (current), 1460, 1508
analog output representation (voltage), 1460, 1507
configuration of parameters, 173
input representation (current), 1459, 1507
input representation (voltage), 1458, 1506
installation, 62
overview, 32
power requirements, 1545
removal, 62
SB 1221 DI 4 x 24 V DC, 200 kHz, 1488
SB 1221 DI 4 x 5 V DC, 200 kHz, 1488
SB 1222 DQ 4 x 24 V DC, 200 kHz, 1491
SB 1222 DQ 4 x 5 V DC, 200 kHz, 1491
SB 1223 DI 2 x 24 V DC, DQ 2 x 24 V DC, 1498
SB 1223 DI 2 x 24 V DC/DQ 2 x 24 V DC, 200 kHz, 1494
SB 1223 DI 2 x 5 V DC/DQ 2 x 5 V DC, 200 kHz, 1494
SB 1231 AI 1 x 12 bit, 1501
SB 1231 AI 1 x 16 bit RTD, 1514
SB 1231 AI 1 x 16 bit Thermocouple, 1508
SB 1232 AQ 1 x 12 bit, 1503
Signal handling errors, 1111, 1113, 1218, 1219
Signal modules (SM)
add modules, 154
analog input representation (current), 1459, 1507
analog input representation (voltage), 1458, 1506
analog output representation (current), 1460, 1508
analog output representation (voltage), 1460, 1507
configuration of parameters, 173
expansion cable, 68
installation, 64
overview, 32
power requirements, 1545
removal, 65
SM 1221 DI 16 x 24 V DC, 1429
SM 1221 DI 8 x 24 V DC, 1429
SM 1222 DQ 16 x 24 V DC, 1433
SM 1222 DQ 16 x Relay, 1433
SM 1222 DQ 8 Relay Changeover, 1431
SM 1222 DQ 8 x 24 V DC, 1431
SM 1222 DQ 8 x Relay, 1431
SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC, 1438
SM 1223 DI 16 x 24 V DC, DQ 16 x Relay, 1438
SM 1223 DI 8 x 120/230 V AC/DQ 8 x Relay, 1443
SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC, 1438
SM 1223 DI 8 x 24 V DC, DQ 8 x Relay, 1438
SM 1231 AI 4 x 13 bit, 1447
SM 1231 AI 4 x 16 bit, 1447
SM 1231 AI 4 x 16 bit TC, 1461
SM 1231 AI 4 x RTD x 16 bit, 1467
SM 1231 AI 8 x 13 bit, 1447
SM 1231 AI 8 x 16 bit TC, 1461
SM 1231 AI 8 x RTD x 16 bit, 1467
SM 1232 AQ 2 x 14 bit, 1451
SM 1232 AQ 4 x 14 bit, 1451
SM 1234 AI 4 x 13 bit/AQ 2 x 14 bit, 1453
SM 1278 4xIO-Link Master, 1474
step response times, 1457
Signal_Set (set RS232 signals), 1112
Simulators, 1538
SIN (form sine value), 258
Slave polling architecture, 1117
Slice (of a tagged data type), 131
SM 1231 RTD
selection tables, 1471, 1517
SM and SB
comparison chart, 31
device configuration, 149, 149
Smart phone, accessing Web server, 989
SMS, 1281
Snapshot of DB values, 1313
Snubber circuits for inductive loads, 79
Software flow control, 1076
Special characters
User-defined Web pages, 1034
Specifications
analog input representation (current), 1459, 1507
analog input representation (voltage), 1458, 1506
analog output representation (current), 1460, 1508
analog output representation (voltage), 1460, 1507
approvals, 1344
BB 1297, 1520
CB 1241 RS485, 1533
CM 1241 RS232, 1535
CM 1241 RS422/485, 1536
CPU 1211C AC/DC/Relay, 1356
CPU 1211C DC/DC/DC, 1356
CPU 1211C DC/DC/Relay, 1356
CPU 1212C AC/DC/Relay, 1369
CPU 1212C DC/DC/DC, 1369
CPU 1212C DC/DC/Relay, 1369
CPU 1214C AC/DC/Relay, 1382
CPU 1214C DC/DC/DC, 1382
CPU 1214C DC/DC/Relay, 1382
CPU 1215C AC/DC/Relay, 1396
CPU 1215C DC/DC/DC, 1396
CPU 1215C DC/DC/Relay, 1396
CPU 1217C DC/DC/DC, 1412
electromagnetic compatibility (EMC), 1348
environmental conditions, 1350
general technical specifications, 1343

industrial environments, 1347
input simulators, 1538
memory cards, 1538
potentiometer module, 1541
rated voltages, 1351
SB 1221 DI 4 x 24 V DC, 200 kHz, 1488
SB 1221 DI 4 x 5 V DC, 200 kHz, 1488
SB 1222 DQ 4 x 24 V DC, 200 kHz, 1491
SB 1222 DQ 4 x 5 V DC, 200 kHz, 1491
SB 1223 DI 2 x 24 V DC, DQ 2 x 24 V DC, 1498
SB 1223 DI 2 x 24 V DC/DQ 2 x 24 V DC, 200 kHz, 1494
SB 1223 DI 2 x 5 V DC/DQ 2 x 5 V DC, 200 kHz, 1494
SB 1231 AI 1 x 12 bit, 1501
SB 1231 AI 1 x 16 bit RTD, 1514
SB 1231 AI 1 x 16 bit Thermocouple, 1508
SB 1232 AQ 1 x 12 bit, 1503
SM 1221 DI 16 x 24 V DC, 1429
SM 1221 DI 8 x 24 V DC, 1429
SM 1222 DQ 16 x 24 V DC, 1433
SM 1222 DQ 16 x Relay, 1433
SM 1222 DQ 8 Relay Changeover, 1431
SM 1222 DQ 8 x 24 V DC, 1431
SM 1222 DQ 8 x Relay, 1431
SM 1223 DI 16 x 24 V DC, DQ 16 x 24 V DC, 1438
SM 1223 DI 16 x 24 V DC, DQ 16 x Relay, 1438
SM 1223 DI 8 24 V DC, DQ 8 x Relay, 1438
SM 1223 DI 8 x 120/230 V AC/DQ 8 x Relay, 1443
SM 1223 DI 8 x 24 V DC, DQ 8 x 24 V DC, 1438
SM 1231 AI 4 x 13 bit, 1447
SM 1231 AI 4 x 16 bit, 1447
SM 1231 AI 4 x 16 bit TC, 1461
SM 1231 AI 4 x RTD x 16 bit signal module, 1467
SM 1231 AI 8 x 13 bit, 1447
SM 1231 AI 8 x 16 bit TC, 1461
SM 1231 AI 8 x RTD x 16 bit signal module, 1467
SM 1232 AQ 2 x 14 bit, 1451
SM 1232 AQ 4 x 14 bit, 1451
SM 1234 AI 4 x 13 bit/AQ 2 x 14 bit, 1453
SM 1278 4xIO-Link Master, 1474
step response times (CPU), 1364, 1377, 1390, 1404, 1422
step response times (SB), 1505
step response times (SM), 1457
SQR (form square), 258
SQRT (form square root), 258
SR (set/reset flip-flop), 225
SRT_DINT (start time-delay interrupt), 420
Standard data blocks, 187
Standard machine projects (configuration control), 155
Standard Web pages, 981
accessing from PC, 987
changing operating mode, 998
communication, 1007
cookie restrictions, 1062
Data Logs, 1018
Diagnostic, 1002
Diagnostics, 999
Intro, 997
JavaScript, 1062
layout, 991
logging in and out, 994
Module information, 1002
secure access, 988
Start, 998
Tag status, 1011
Start conditions, 1078
Start message character, 1078
Start standard Web page, 998
Startup after POWER ON, 87
startup processing, 90
STARTUP mode
force operation, 1319
Startup OB, 93
Startup parameters, 138
Station
Read information with GetStationInfo, 447
Status
LED indicators, 1295
LED indicators (communication interface), 1067
Status OB, 100
STEP 7
add modules, 154
add new device, 150
Adding a PROFINET IO device, 901
adding inputs or outputs to a LAD or FBD instruction, 44
AS-i, 957
AS-i port, 956
assigning an IP address to an online CPU, 793
block calls, 83
calling code blocks within the user program, 182
changing the settings, 45
communication load, 108
comparing and synchronizing, 1309
configuring the CPU, 165
configuring the modules, 173
copying blocks from an online CPU, 215
cycle time, 107, 108
cycle time, 107, 108
data block (DB), 83
device configuration, 149

download, 210
drag and drop between editors, 46
Ethernet port, 795
expandable inputs or outputs, 44
favorites, 41
force, 1318
force operation, 1319
function (FC), 184
function block (FB), 83, 185
HSC configuration, 558
initial value of an FB, 185
inserting instructions, 40
instance data block (DB), 185
linear and structured programs, 180
monitoring, 1312, 1313
network connection, 787
operating modes, 87
operation, 1315
operator panel, 47
password protection, 207
Portal view and Project view, 39
priority class (OB), 92
PROFIBUS, 951
PROFINET port, 795
program card, 134
RTM (run time meters), 337
RUN/STOP buttons, 47
startup processing, 90
time synchronization property (PROFINET), 803
types of code blocks, 83
unplugged modules, 50
valid FC, FB, and DB numbers, 83
version compatibility, 51
STEP 7 programming
PtP example program, 1125
user-defined Web pages, 1038
STEP 7 web pages, 4
Stop bits, 1074
STOP mode, 87, 1306
enable outputs in STOP mode, 1317
force operation, 1319
operator panel, 47
toolbar buttons, 47
STP (exit program), 305
Strg_TO_Chars (convert character string to array of CHAR), 349
STRG_VAL (convert character string to numerical value), 340
String
S_MOVE (move character string), 339
string data overview, 339
String data type, 127
string operations overview, 353
Structured programming, block structure, 180
SUB (subtract), 250
Subnet mask, 795
Support, 3
Suppressor circuits for inductive loads, 79
Surge immunity, 1349
SWAP (swap bytes), 271
SWITCH (jump distributor), 299
Switching languages, user-defined Web pages, 1052
Synchonizing data block start values, 213
Synchronization
time synchronization property (PROFINET), 803
System clock
RD_SYS_T (read time-of-day), 332
WR_LOC_T (set local time), 332
WR_SYS_T (set time-of-day), 332
System memory byte, 111
System requirements, 38

T

T_ADD (add times), 330
T_COMBINE (combine times), 331
T_CONFIG (configure interface), 880
T_CONV (convert times and extract), 329
T_DIAG, 859
T_DIFF (time difference), 331
T_RESET, 857
T_SUB (subtract times), 330
Tablet, accessing Web server, 989
Tag
force operation, 1319
monitoring status or value, 1312
overlay, 132
slice, 131
Tag status standard Web page, 1011
TAN (form tangent value), 258
Task cards
columns and
headers, 45, 816, 828, 836, 847, 1130, 1151, 1177, 1221, 1235, 1253
TCON, 837
configuration, 788
connection IDs, 808
connection parameters, 811
TCON, TDISCON, TSEND, and TRCV
versions, 836, 847
TCON_Param, 811
TCP
ad hoc mode, 808

connection configuration, 788, 788
connection IDs, 808
parameters, 811
protocol, 805
TCP/IP communication, 805
TDISCON, 837
Technical specifications, 1343
Technical support, 3
Technology instructions, 542, 570
Technology module, SM 1278 4xIO-Link Master, 1474
Technology objects
motion control, 645
PID, 576
Telecontrol, 1278
TeleControl
communication processors, 1273
TeleService adapter and module, 70
Teleservice communication
TM_MAIL (send email), 1287
TeleService via GPRS, 1278
Temp memory
maximum per OB priority level, 118
usage by blocks, 118
Terminal block connector, 67
Terminal emulator for PtP example program, 1126
Testing the program, 217
Thermal zone, 55, 58
Thermocouple
basic operation, 1464, 1510
cold junction compensation, 1464, 1510
SB 1231 AI 1 x 16 bit, 1508
SB 1231 Filter selection table, 1512
SB 1231 Thermocouple filter selection table, 1511
SM 1231 Thermocouple filter selection table, 1465
SM 1231 Thermocouple selection table, 1465
TIA Portal, Portal view and Project view, 39
Time
DTL (date and time long data type), 126
RD_LOC_T (read local time), 332
RD_SYS_T (read time-of-day), 332
SET_TIMEZONE (set time zone), 336
T_ADD (add times), 330
T_COMBINE (combine times), 331
T_CONV (convert times and extract), 329
T_DIFF (time difference), 331
T_SUB (subtract times), 330
Time data type, 125
TOD (time of day data type), 125
WR_LOC_T (set local time), 332
WR_SYS_T (set time-of-day), 332
Time delay OB, 93
Time error interrupt OB, 95
Time of day
configuring the online CPU, 1302
Time of day OB, 100
Time synchronization, 177
Time synchronization property, 803
Time-delay interrupts, 420
Timers
operation, 233
quantity, 30, 1358, 1371, 1384, 1398, 1414
RT (reset timer), 230
size, 30, 1358, 1371, 1384, 1398, 1414
TOF (off-delay timer), 230
TON (on-delay delay timer), 230
TONR (on-delay retentive) timer, 230
TP (pulse delay timer), 230
TimeTransformationRule for daylight saving time, 335
TM_MAIL (send email), 1287
TMAIL_C, 863
Topology
Ring, 933
Topology view, 39
Trace feature, 1332
Transfer (program) cards, 1538
Transfer card, 139
configure the startup parameters, 138
empty transfer card for a lost password, 147
inserting into CPU, 135
lost password, 147
overview, 134
Transmission block (T-block), 898
Transmit configuration errors, 1095, 1207
Transmit message configuration
PtP device configuration, 1076
PtP example program, 1120
Transmit runtime errors, 1106, 1214
TRCV, 837
connection IDs, 808
TRCV (receive data via Ethernet (TCP))
ad hoc mode, 808
parameter configuration, 901
TRCV_C
ad hoc mode, 808
TRCV_C (receive data via Ethernet (TCP)), 817
connection IDs, 808
connection parameters, 811
TRCV_C (receive data via Ethernet (TCP))
configuration, 788
Triggering
trace, 1332
values in the watch table, 1316
Trigonometric instructions, 258

Troubleshooting
diagnostics buffer, 1308
LED indicators, 1295
TRUNC (truncate numerical value), 289
TS Adapter, 31
installing a TS module, 70
installing on a DIN rail, 73
installing on a wall, 74
SIM card, 71
TSAP (transport service access points), 790
configuring general parameters, 898, 971
definition, 806
instructions for assigning to devices, 805
restricted TSAPs and port numbers, 892
TSEND, 837
connection IDs, 808
TSEND_C (send data via Ethernet (TCP)), 817
configuration, 788
connection IDs, 808
connection parameters, 811
instruction configuration, 899
TSEND_C and TRCV_C
legacy versions, 828
versions, 816
TURCV (receive data via Ethernet (UDP)), 874
configuration, 788
connection parameters, 811
TUSEND (send data via Ethernet (UDP)), 874
configuration, 788
parameters, 811

U

UDP
connection configuration, 788
parameters, 811
UDP protocol, 805
UFILL_BLK (fill block uninterruptible), 269
UMOVE_BLK (move block uninterruptible), 260
Unknown CPU version error, 1296
Unplugged modules, 50
Unspecific CPU, 152
Update OB, 101
Updating firmware
from STEP 7, 1304
from Web server, 1006
with a memory card, 144
Updating user-defined Web pages, 1021
Upgrading a V3.0 CPU to V4.2.x, 1561
Uploading
copying blocks from an online CPU, 215
user program, 215
UPPER_BOUND (read out ARRAY high limit), 274
User configuration, Web server, 984
User interface
STEP 7 project and portal views, 39
User program
adding inputs or outputs to LAD or FBD instructions, 44
binding to a CPU, memory card, or password, 208
calling code blocks within the user program, 182
copying blocks from an online CPU, 215
download, 210
drag and drop between editors, 46
expandable instructions, 44
favorites, 41
inserting instructions, 40
linear and structured programs, 180
memory card, 134
organization blocks (OBs), 183
password protection, 207
program card, 134
transfer card, 134
User-defined Web pages, 982, 1020
accessing from PC, 1040
activating and deactivating from control DB, 1057
AWP commands for accessing S7-1200 data, 1022
configuring, 1036
creating fragments, 1032
creating with HTML editor, 1021
deleting program blocks, 1037
downloading corresponding DBs, 1039
enabling with WWW instruction, 1038
example, 1042
generating program blocks, 1037
handling special characters, 1034
HTML listing, 1047
importing fragments, 1033
load memory constraints, 1041
manual fragment DB control, 1057
multiple language configuration, 1057
multiple languages, 1052
programming in STEP 7, 1038
reading special variables, 1026
reading variables, 1023
refreshing, 1021
writing special variables, 1028
writing variables, 1024
USS protocol library
overview, 1127
requirements for using, 1131
status codes, 1141
USS_Drive_Control (Swap data with drive), 1135

USS_Port_Scan (Edit communication via USS network), 1134
USS_Read_Param (readout parameters from the drive), 1138
USS_Write_Param (change parameters in the drive), 1139

V

VAL_STRG (convert numerical value to character string), 340
Valve PID tuning, 586
Variable index for an array, 284
Variable status Web page (See Tag status), 1011
Variables, monitoring and modifying from Web server, 1011
VARIANT_TO_DB_ANY (Convert VARIANT to DB_ANY), 294
VariantGet (Read VARIANT tag value), 280
VariantPut (Write VARIANT tag value), 281
Versions of
instructions, 45, 816, 828, 836, 847, 1130, 1151, 1177, 1221, 1235, 1253
Visualization, HMI devices, 33

W

Wait time, 1074
Warm restart, 87
Watch table
enable outputs in STOP mode, 1317
force, 217
monitor, 1312
operation, 1315
trigger values, 1316
Watchdog timer (RE_TRIGR instruction), 304
WChar (word character data type), 127
Web pages
STEP 7 service, support, and documentation, 4
Web server
access through CP module, 990
appearance on mobile device, 992
browser support, 982
constraints, 1061
enabling, 983
maximum HTTP connections, 1061
mobile device access, 989
quotation mark conventions, 1034
standard Web pages, 987
update rate, 983
user configuration, 984
user-defined Web pages, 1020
WHILE, SCL, 315
Wireless connection to Web server, 989
Wiring diagrams
CB 1241 RS 485, 1534
CPU 1211C, 1365
CPU 1212C, 1378
CPU 1214C, 1392
CPU 1215C, 1407
CPU 1217C, 1425
SB 1221, 1490
SB 1222, 1493
SB 1223, 1497, 1500
SB 1231, 1503
SB 1231 RTD, 1516
SB 1231 thermocouple, 1513
SB 1232, 1505
SM 1221, 1430
SM 1222, 1434
SM 1223, 1440, 1446
SM 1231, 1449
SM 1231 RTD, 1469
SM 1231 thermocouple, 1462
SM 1232, 1452
SM 1234, 1456
SM 1278 IO-Link Master, 1476
Wiring guidelines, 77
clearance for airflow and cooling, 55
grounding, 76
prerequisites, 75
Work memory, 28
CPU 1211C, 1356
CPU 1212C, 1369
CPU 1214C, 1382
CPU 1215C, 1396
CPU 1217C, 1412
WR_LOC_T (set local time), 332
WR_SYS_T (set time-of-day), 332
WRIT_DBL (write to data block in load memory), 525
WRITE_BIG (Write data in big endian format), 278
WRITE_LITTLE (Write data in little endian format), 278
Writing to DBs, I/O, or memory, 200, 276
WRREC (write data record), 375, 391
WString (word string data type), 127
WWW (synchronizing user-defined Web pages), 1038

X

x box (FBD EXCLUSIVE OR logic operation), 222
XON / XOFF, 1076
XOR (logic operation), 320

SIEMENS

SIMOTION

SIMOTION P320-4 E / P320-4 S

Manual

Valid as of version V4.5

11/2016

Preface

Safety instructions 1

Industrial security 2

Description 3

Application planning 4

Interfaces 5

Installation/mounting 6

Connection 7

Troubleshooting/FAQs 8

Technical data 9

Dimension drawings 10

Spare parts 11

Standards and approvals A

ESD Guideline B

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Division Digital Factory
Postfach 48 48
90026 NÜRNBERG
GERMANY

℗ 10/2016 Subject to change

Copyright © Siemens AG 2016.
All rights reserved

Preface

Preface

This document is part of the **SIMOTION P documentation package**.

This documentation describes the SIMOTION P320-4 hardware platform which can be delivered in the SIMOTION P320-4 E and SIMOTION P320-4 S hardware versions:

- SIMOTION P320-4 E with the Windows Embedded Standard 7 32-bit operating system and real-time expansion for SIMOTION.
  Successor to SIMOTION P320-3.
- SIMOTION P320-4 E with the Windows 7 Ultimate 32-bit operating system and real-time expansion for SIMOTION.
  Successor to SIMOTION P350-3.

References

The following documents contain the descriptions for the SIMOTION P hardware platform:

- SIMOTION P320-4 E / P320-4 S, Manual, Edition 11/2016
- SIMOTION P320-4 E / P320-4 S, Commissioning and Hardware Installation Manual, Edition 11/2016

Validity range

This manual applies to the SIMOTION P320-4 E and SIMOTION P320-4 S devices as of product level SIMOTION V4.5.

Standards

The SIMOTION system was developed in accordance with ISO 9001 quality guidelines.

Chapters in this documentation

The following sections describe the purpose and the use of this documentation:

- Safety instructions
  Contains fundamental safety instructions for SIMOTION and specific safety instructions for SIMOTION P320-4.
- Description
  System overview and product description for SIMOTION P320-4. The communication versions are also described.
- Use planning
  Points to note in advance: upon delivery, the permitted installation positions, environmental and ambient conditions and electromagnetic compatibility.

- Interfaces
  Description of the interfaces and operator control and display elements for SIMOTION P320-4.
- Installation/mounting
  An overview of the installation of the SIMOTION P320-4 taking into account the mounting positions.
- Connecting
  This section provides general information and important notes that you must observe when connecting the SIMOTION P320-4.
- Troubleshooting/FAQs
  List of possible errors and their remedies.
- Technical specifications
  This section contains an overview of the technical data, which is listed in detail for the individual components.
- Dimension drawings
  In this section you can find dimension drawings and dimensions of the SIMOTION P320-4.
- Spare parts
  You can find information about the spare parts for the SIMOTION P320-4 here.
- Appendix
  In addition to the safety information, the annexes also contain information about the standards, approvals and EGB guideline.
- Index
  Alphabetical directory for locating information.

SIMOTION Documentation

An overview of the SIMOTION documentation can be found in the SIMOTION Documentation Overview document.

This documentation is included as electronic documentation in the scope of delivery of SIMOTION SCOUT. It comprises ten documentation packages.

The following documentation packages are available for SIMOTION V4.5:

- SIMOTION Engineering System Handling
- SIMOTION System and Function Descriptions
- SIMOTION Service and Diagnostics
- SIMOTION IT
- SIMOTION Programming
- SIMOTION Programming - References
- SIMOTION C
- SIMOTION P

- SIMOTION D
- SIMOTION Supplementary Documentation

Hotline and Internet addresses

SIMOTION at a glance

We have compiled an overview page from our range of information about SIMOTION with the most important information on frequently asked topics - which can be opened with only one click.

Whether beginner or experienced SIMOTION user – the most important downloads, manuals, tutorials, FAQs, application examples, etc. can be found at

https://support.industry.siemens.com/cs/ww/en/view/109480700

Additional information

Click the following link to find information on the following topics:

- Documentation overview
- Additional links to download documents
- Using documentation online (find and search manuals/information)

https://support.industry.siemens.com/cs/ww/en/view/109479653

My Documentation Manager

Click the following link for information on how to compile documentation individually on the basis of Siemens content and how to adapt it for the purpose of your own machine documentation:

https://support.industry.siemens.com/My/ww/en/documentation

Training

Click the following link for information on SITRAIN - Siemens training courses for automation products, systems and solutions:

http://www.siemens.com/sitrain

FAQs

Frequently Asked Questions can be found in SIMOTION Utilities & Applications, which are included in the scope of delivery of SIMOTION SCOUT, and in the Service&Support pages in **Product Support**:

https://support.industry.siemens.com/cs/de/en/ps/14505/faq

Technical support

Country-specific telephone numbers for technical support are provided on the Internet under **Contact**:

https://support.industry.siemens.com/cs/ww/en/sc/2090

Disposal and recycling of the device

The disposal of the products described in this manual must be performed in compliance with the valid national regulations.

To a great extent, the products can be recycled owing to their low pollutant content. To recycle and dispose of your old device in an environmentally friendly way, please contact a waste disposal service certified for electronic waste.

If you have any further questions about disposal and recycling, please contact your local Siemens contact person. Contact details can be found in our contacts database on the Internet at: http://www.automation.siemens.com/partner/index.asp

Table of contents

Preface **3**

1 Safety instructions **11**

1.1 Fundamental safety instructions 11
1.1.1 General safety instructions 11
1.1.2 Safety instructions for electromagnetic fields (EMF) 14
1.1.3 Handling electrostatic sensitive devices (ESD) 14
1.1.4 Industrial security 15
1.1.5 Danger to life due to software manipulation when using removable storage media 16
1.1.6 Residual risks of power drive systems 16

1.2 Specific safety instructions for the SIMOTION P320-4 17
1.2.1 General safety instructions for the SIMOTION P320-4 17
1.2.2 Notes on use 20

2 Industrial security **21**

2.1 Security concept for SIMOTION P320-4 21
2.1.1 Security 21

2.2 Why is industrial security so important? 23
2.2.1 Trends in the IT sector 24
2.2.2 Possible corporate security holes 24

2.3 General security measures 25
2.3.1 Overview 25
2.3.2 Plant security 27
2.3.2.1 Physical protection of critical production areas 27
2.3.3 Network security 28
2.3.3.1 Network segmentation 28
2.3.4 System integrity 31
2.3.4.1 System hardening 31
2.3.4.2 Patch management 32

2.4 Product-specific measures 33
2.4.1 Virus scanners, Windows security patches, SIMOTION P 33
2.4.2 Changing the Windows user password 34
2.4.3 Changing the AutoLogin 38
2.4.4 Deactivating the remote desktop connection 45

3 Description **49**

3.1 System overview 49

3.2 SIMOTION P320-4 product description 50
3.2.1 SIMOTION P320-4 overview 50
3.2.2 Features 51
3.2.3 SIMOTION P320-4 (hardware) structure 53
3.2.4 Interfaces and operating elements 54
3.2.5 SIMOTION P Runtime (software) structure 54
3.2.6 Components 55

3.3 HMI and SIMOTION SCOUT....57
3.3.1 HMI and SIMOTION SCOUT Overview....57
3.3.2 Local HMI or ES on SIMOTION P320-4....58
3.3.2.1 Setting up a network bridge - MAC bridge miniport....59
3.3.3 HMI or ES via PROFINET....70
3.3.4 HMI or ES via Ethernet....71
3.3.5 HMI or ES via IsoPROFIBUS (optional)....73
4 Application planning....75
4.1 Unpacking and checking the delivery....75
4.2 Identification data of the device....76
4.3 Permissible mounting positions....78
4.4 Environmental conditions....79
4.5 Electromagnetic compatibility....80
5 Interfaces....81
5.1 Hardware components of the SIMOTION P320-4....81
5.2 Overview of operator control and display elements....82
5.3 Control elements....84
5.4 Status displays....85
5.5 Overview of the SIMOTION P320-4 interfaces....86
5.6 PROFINET onboard....87
5.7 Ethernet....88
5.8 DVI-I....88
5.9 DisplayPort....90
5.10 USB 3.0....90
5.11 CFast card....91
5.12 COM1....92
5.13 IsoPROFIBUS board (optional)....92
6 Installation/mounting....95
6.1 Installing the device....95
6.2 Permissible mounting positions....95
6.2.1 Standard rail mounting and vertical mounting....97
6.2.1.1 Standard rail mounting....97
6.2.1.2 Vertical mounting....98
6.3 Installation notes....99
6.4 Overview of operating modes for the SIMOTION P320-4....100
6.5 Decentralized structure....101
7 Connection....103
7.1 Requirements....103

7.2 Overview of connections....104
7.3 Notes on connecting....106
7.4 Protective conductor connection and potential equalization....107
7.5 Connecting peripheral equipment....108
7.6 Connecting the power supply (24 VDC)....109
7.7 Connecting the device to networks....110
7.8 Installing the strain relief....111
8 Troubleshooting/FAQs....113
8.1 Error correction....113
8.2 Hotplug Enabled BIOS settings....115
9 Technical data....121
9.1 Overview of the technical specifications....121
9.2 General technical specifications....121
9.3 Ambient conditions....124
9.4 Technical data of the IsoPROFIBUS board....125
9.5 Power requirements of the components....126
9.6 Integrated DC power supply....127
9.7 Technical data for the SITOP smart 24 V/10 A....127
9.8 Typical power consumption....129
10 Dimension drawings....131
10.1 Overview of the dimensional drawings....131
10.2 Device dimension drawing for standard rail mounting....131
10.3 Device dimension drawing for vertical mounting....133
10.4 Dimension drawing of device with one expansion card....135
11 Spare parts....137
11.1 Available spare parts for SIMOTION P320-4....137
A Standards and approvals....139
A.1 General rules....139
B ESD Guideline....141
B.1 ESD definition....141
B.2 Electrostatic charging of individuals....141
B.3 Basic measures for protection against discharge of static electricity....142
Index....143

Safety instructions

1

1.1 Fundamental safety instructions

1.1.1 General safety instructions



⚠ DANGER

Danger to life due to live parts and other energy sources

Death or serious injury can result when live parts are touched.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
   - Switch off the machine.
   - Wait until the discharge time specified on the warning labels has elapsed.
   - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
   - Check whether the existing auxiliary supply circuits are de-energized.
   - Ensure that the motors cannot move.
3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water.
4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example.
5. Secure the energy sources against switching on again.
6. Ensure that the correct machine is completely interlocked.

After you have completed the work, restore the operational readiness in the inverse sequence.



⚠ WARNING

Danger to life from hazardous voltage when connecting an unsuitable power supply

Touching live components can result in death or severe injury.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.



⚠ WARNING

Danger to life from touching live parts on damaged devices

Improper handling of devices can result in damage.

For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Observe the limit values specified in the technical specifications during transport, storage, and operation.
- Do not use damaged devices.



⚠ WARNING

Danger to life through electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the cores of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.



⚠ WARNING

Danger to life due to electric shock when not grounded

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

⚠ WARNING

Danger to life due to fire spreading if housing is inadequate

Fire and smoke development can cause severe personal injury or material damage.

- Install devices without a protective housing in a metal control cabinet (or protect the device by another equivalent measure) in such a way that contact with fire inside and outside the device is prevented.
- Ensure that smoke can only escape via controlled and monitored paths.

⚠ WARNING

Danger to life from unexpected movement of machines when using mobile wireless devices or mobile phones

Using mobile radios or mobile phones with a transmit power > 1 W closer than approx. 2 m to the components may cause the devices to malfunction, influence the functional safety of machines therefore putting people at risk or causing material damage.

- Switch off wireless devices or mobile phones in the immediate vicinity of the components.

⚠ WARNING

Danger to life due to fire if overheating occurs because of insufficient ventilation clearances

Inadequate ventilation clearances can cause overheating of components followed by fire and smoke development. This can cause death or serious injury. This can also result in increased downtime and reduced service life for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

⚠ WARNING

Danger of an accident occurring due to missing or illegible warning labels

Missing or illegible warning labels can result in accidents involving death or serious injury.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, in the national language if necessary.
- Replace illegible warning labels.

⚠ WARNING

Danger to life when safety functions are inactive

Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety notices for safety functions

If you want to use safety functions, you must observe the safety notices in the safety manuals.

1.1.2 Safety instructions for electromagnetic fields (EMF)



⚠ WARNING

Danger to life from electromagnetic fields

Electromagnetic fields (EMF) are generated by the operation of electrical power equipment such as transformers, converters or motors.

People with pacemakers or implants are at a special risk in the immediate vicinity of these devices/systems.

- Ensure that the persons involved are the necessary distance away (minimum 2 m).

1.1.3 Handling electrostatic sensitive devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.



NOTICE

Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.1.4 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions only form one element of such a concept.

Customer is responsible to prevent unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the internet if and to the extent necessary and with appropriate security measures (e.g. use of firewalls and network segmentation) in place.

Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit http://www.siemens.com/industrialsecurity.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends to apply product updates as soon as available and to always use the latest product versions. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under http://www.siemens.com/industrialsecurity..

⚠ WARNING

Danger as a result of unsafe operating states resulting from software manipulation

Software manipulation (e.g. by viruses, Trojan horses, malware, worms) can cause unsafe operating states to develop in your installation which can lead to death, severe injuries and/or material damage.

- Keep the software up to date.
  Information and newsletters can be found at:
  http://support.automation.siemens.com
- Incorporate the automation and drive components into a state-of-the-art, integrated industrial security concept for the installation or machine.
  For more detailed information, go to:
  http://www.siemens.com/industrialsecurity
- Make sure that you include all installed products into the integrated industrial security concept.

1.1.5 Danger to life due to software manipulation when using removable storage media

⚠ WARNING

Danger to life due to software manipulation when using removable storage media

The storage of files on removable storage media involves a high risk of infection, e.g. via viruses or malware. Incorrect parameter assignment can cause machines to malfunction, which can lead to injuries or death.

- Protect the files on removable storage media against harmful software through appropriate protective measures, e.g. virus scanners.

1.1.6 Residual risks of power drive systems

When performing the risk assessment for a machine or plant in accordance with the respective local regulations (e.g. EC Machinery Directive), the machine manufacturer or plant constructor must take into account the following residual risks associated with the control and drive components of a drive system:

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance and repairs caused by, for example:
   - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
   - Response times of the control system and of the drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices / mobile phones in the immediate vicinity of electronic components
   - External influences/damage
   - X-rays, ionizing radiation and cosmic radiation
2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage

3. Hazardous shock voltages caused by, for example:
   - Component failure
   - Influence during electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly

For more information about the residual risks of the drive system components, see the relevant sections in the technical user documentation.

1.2 Specific safety instructions for the SIMOTION P320-4

1.2.1 General safety instructions for the SIMOTION P320-4

⚠ WARNING

Life-threatening voltages are present with an open control cabinet

When you install the device in a control cabinet, some areas or components in the open control cabinet may be carrying life-threatening voltages.

If you touch these areas or components, you may be killed by electric shock.

Switch off the power supply to the cabinet before opening it.

System expansions

NOTICE

Damage through system expansions

Device and system expansions may be faulty and can affect the entire machine or plant.

The installation of expansions can damage the device, machine or plant.

Device and system expansions may violate safety rules and regulations regarding radio interference suppression.

If you install or exchange system expansions and damage your device, the warranty becomes void.

Note the following for system expansions:

- Only install system expansion devices designed for this device. Contact your technical support team or where you purchased your PC to find out which system expansion devices may safely be installed.
- Observe the information on electromagnetic compatibility (Page 139).

NOTICE

"Open Type" UL508

Note that the device is classified as "Open Type" for use in the area of Industrial Control Equipment (UL508). Installation of the device in an enclosure according to UL508 is conditional for approval or operation according to UL508.

Battery and rechargeable battery

⚠ WARNING

Risk of explosion and release of harmful substances

Improper handling of lithium batteries can result in an explosion of the batteries.

Explosion of the batteries and the released pollutants can cause severe physical injury. Worn batteries jeopardize the function of the device.

Note the following when handling lithium batteries:

- Replace used batteries in good time, see the section "Replacing the backup battery" in the Commissioning and Hardware Installation Manual.
- Replace the lithium battery only with an identical battery or types recommended by the manufacturer (Article No.: A5E30314053).
- Do not throw lithium batteries into fire, do not solder on the cell body, do not recharge, do not open, do not short-circuit, do not reverse polarity, do not heat above 100°C and protect from direct sunlight, moisture and condensation.

High frequency radiation

NOTICE

Unintentional operating situations

High frequency radiation, e g. from a cellular phone, interferes with device functions and can result in malfunctioning of the device.

Persons are injured and the plant is damaged.

Avoid high-frequency radiation:

- Remove radiation sources from the environment of the device.
- Switch off radiating devices.
- Reduce the radio output of radiating devices.
- Observe the information on electromagnetic compatibility (Page 139).

ESD Guideline



Electrostatic sensitive devices can be labeled with an appropriate symbol.

NOTICE

Electrostatic sensitive devices (ESD)

When you touch electrostatic sensitive components, you can destroy them through voltages that are far below the human perception threshold.

If you work with components that can be destroyed by electrostatic discharge, observe the ESD Guideline.

Further information

You can find more detailed information about the **EGB Guideline** in Annex B in the section with the same name.

1.2.2 Notes on use

⚠ WARNING

Hazards on an unprotected machine or plant

According to the results of a risk analysis, hazards can occur on an unprotected machine. The hazards can result in personal injury.

According to the risk analysis, the risk of personal injury can be avoided with the following measures:

- Additional protective devices on the machine or plant. With this, especially the programming, configuration and wiring of the inserted I/O modules have to be executed, in accordance with the necessary risk analysis identified safety performance (SIL, PL or Cat.).
- The correct use of the device has to be verified with a function test on the system. This test can detect programming, configuration and wiring errors.
- Documentation of the test results that you can enter in the relevant safety records when required.

NOTICE

Ambient conditions

Ambient conditions for which the device is not suitable can cause faults or damage the device.

Note the following:

- Operate the device only in closed rooms. Failure to comply nullifies the warranty.
- Operate the device only in accordance with the ambient conditions specified in the technical specifications.
- Protect the device against dust, moisture and heat.
- Do not expose the device to direct sunlight or other strong sources of light.
- Without additional measures, such as a supply of clean air, the device may not be used in locations with harsh operating conditions caused by acidic vapors or gases.
- Observe the permissible mounting positions of the device.
- Do not obstruct the venting slots of the device.

Note

Use in an industrial environment without additional protective measures

This device was designed for use in a normal industrial environment according to IEC 60721-3-3.

Industrial security

2

2.1 Security concept for SIMOTION P320-4

2.1.1 Security

Note

Observe the general security information in this documentation for Industrial security (Page 15).

Regular change of the Windows password

Note

For security reasons, the Windows password should be changed regularly.

It is essential that the AutoLogin is also adapted for this purpose.

You can find instructions in the following sections:

- Changing the Windows user password (Page 34)
- AutoLogin for SIMOTION P (Page 38).

Unlocking Windows

Note

Windows locked

Windows may be accidentally locked, e.g. through shortcut key Windows + L.

If you do not know the password for the SIMOTION P320-4, please contact the Siemens Industry Online Support (https://support.industry.siemens.com/cs/?lc=en-DE).

Windows firewall

Note

Windows firewall

To allows the Windows IP to be accessed externally, this must be set as an exception in the Windows firewall **File and Printer Sharing**. Otherwise, there is only limited access to Windows from outside.

Security and networks

Note

You will find information on the security of networks in Section General security measures (Page 25).

Remote desktop connection

Note that for the SIMOTION P320-4 with Headless operation, you require a user name and password for a remote desktop connection. Per default, the remote desktop connection is already set up.

Note

Deactivating the remote desktop connection

If you do **not** use the remote desktop connection, it must be deactivated for security reasons.

See Section Deactivating the remote desktop connection (Page 45)

SIMOTION IT

Note

Security concept

Note the security concept of HTTP/S, FTP and Telnet access on the Web server when working with SIMOTION IT.

You will find information in the SIMOTION IT Diagnostics and Configuration Diagnostics Manual or the SIMOTION online help in Section Security concept.

Note

User administration

Note the information on the user administration when working with SIMOTION IT.

You will find information in the SIMOTION IT Diagnostics and Configuration Diagnostics Manual or the SIMOTION online help in Section User administration.

Information on industrial security

The following sections are taken from the Motion Control Industrial Security Configuration Manual:

- Why is industrial security so important? (Page 23)
- General security measures (Page 25)
- Product-specific measures (virus scanners) (Page 33)

You can view the entire document in the Industry Online Support (https://support.industry.siemens.com/cs/ww/en/view/108862708).

2.2 Why is industrial security so important?

The topic of data security and access protection (security) is becoming more and more important in industrial environments. The progressive networking of entire industrial plants, the vertical integration and networking of the individual levels of a company, and new technologies, such as remote maintenance and remote access, are leading to increased requirements for protecting industrial plants.

The threats are diverse and the consequences far-reaching.

Possible threats:

- Espionage of data, recipes, etc.
- Sabotage of production plants
- System stoppage, e.g. due to virus infection and malware
- Manipulation of data or application software
- Unauthorized use of system functions

Possible effects of a security incident

- Loss of intellectual property
- Loss of production or reduced product quality
- Company image and economic damage

- Catastrophic environmental influences
- Danger to persons and machines

2.2.1 Trends in the IT sector

Overview

There are many new trends which affect industrial security:

- Cloud computing in general
  The number of network connections across the world is constantly increasing. This enables innovations such as cloud computing and the applications that go hand in hand with it. In conjunction with cloud computing, there has been a massive increase in the number of mobile devices, such as mobile phones and tablet PCs.
- Wireless technology
  On the other hand, the increasing use of mobile devices has only become possible thanks to the ubiquitous availability of mobile networks. Wireless LAN is also becoming increasingly available.
- Smart Grid
  Networking is not only limited to data networks, it also influences our energy infrastructure.
- Worldwide remote access to plants, machines and mobile applications
- The "Internet of things"
  Millions of electronic devices are becoming network-capable and are communicating via the Internet, such as onboard computers in cars, which send warranty information to dealers, or water meter sensors that transmit water consumption data to municipal water suppliers via radio.

However, in order for everything from cloud computing to sensors to work without service disruptions, you need reliable network infrastructures that are well protected against attacks from malware and hackers.

2.2.2 Possible corporate security holes

Possible security holes or weak points

The security chain of a company is only as strong as its weakest link. Security holes can exist at numerous points. The following list gives only a few examples:

- Employees
- Production plants
- Network infrastructure
- Data centers
- PC workstations

- Laptops
- Tablet PCs
- Printers
- Smartphones
- Portable storage media
- Guidelines and regulations

For this reason, a holistic approach is required to deal with the issue of security. Coordinated guidelines and regulations are required that cover all areas: Devices, systems, processes and employees.

2.3 General security measures

2.3.1 Overview

In the following section you will learn about the general security measures you can take in order to protect your system from threats. All of the measures are recommended.

Additional specific security measures for SINUMERIK, SIMOTION and SINAMICS products can be found in Section Product-specific security measures (Page 33).

Basically, the measures should be coordinated with one another and correspond to the ring-shaped principle of the "Defense in Depth" strategy. The measures are structured according to the "onion" principle and each measure forms an additional protective layer around the core: the production plant.



Figure 2-1 Defense in depth strategy

- **Plant security**
  Plant security represents the outermost protective ring. Plant security includes comprehensive physical security measures, e.g. entry checks, which should be closely coordinated with protective measures for IT security.
- **Network security**
  The measures, grouped under the keyword "Network security", form the core of the protective measures. This refers to the segmentation of the plant network with limited and secure communication between subnetworks ("secure islands") and the interface check with the use of firewalls.
- **System integrity**
  "System integrity" represents the combination two major measures. PC-based systems and the control level must be protected against attacks. Steps include the following measures:
  - User authentication for machine or plant operators with individual authorization levels
  - Integrated access protection mechanisms in the automation components to prevent unauthorized changes via the engineering system or during maintenance
  - The use of antivirus and whitelisting software to protect PC systems against malware
  - Maintenance and update processes to keep the automation systems up-to-date (e.g. patch management, firmware updates, etc.)

2.3.2 Plant security

2.3.2.1 Physical protection of critical production areas

Unauthorized persons may be able to enter the production site/building and damage or alter production equipment as a result of gaps in a company's physical security. Confidential information can also be lost. This can be prevented if both the company's site and the production areas are protected accordingly.

Company security

The company's physical security can be ensured via the following measures:

- Closed off and monitored company premises
- Entry control, keys / card readers and/or security personnel
- Escorting of external personnel by company employees

Physical production security

The physical security of a production location can also be ensured via the following measures:

- Separate access control for production areas.
- Installation of critical components in securely lockable cabinets / switching rooms including monitoring and alarm signaling options
- Prohibited production areas with restricted access rights
- Configuration of the radio field to restrict the WLAN range so that it is not available outside the defined areas (e.g. factory building).
- Guidelines that prevent the use of third-party data storage media (e.g. USB sticks) and IT devices (e.g. notebooks) classified as insecure on the control.

Further information

Further information on integrated security solutions can be found on the Surveillance page (http://www.buildingtechnologies.siemens.com/bt/global/en/security-solution/Pages/security-solution.aspx).

2.3.3 Network security

2.3.3.1 Network segmentation

Separation between production and office networks

One important protective measure for your control is the strict separation of the production networks and the other company networks. This separation creates protection zones for your production networks.

Note

The products – drives, controllers, commissioning tools (e.g. STARTER or Startdrive) – described in this manual must only be operated in protection zones.

Separation by means of a firewall system

In the simplest scenario, separation is achieved by means of an individual firewall system which controls and regulates communication between networks.

Separation via a DMZ network

In the more secure version, the coupling is established via a separate DMZ network. In this case, direct communication between the production network and the company network is completely prevented by firewalls and only takes place indirectly via servers in the DMZ network.

Note

The production networks should also be divided into separate automation cells in order to protect critical communication mechanisms.

General security measures

Observe the general security measures even within protection zones, for example:

- Virus scanners (Page 31)
- Reduction of attack points (Page 31)

Network segmentation with SCALANCE S

Siemens provides SCALANCE S security modules to meet network protection and network segmentation requirements.

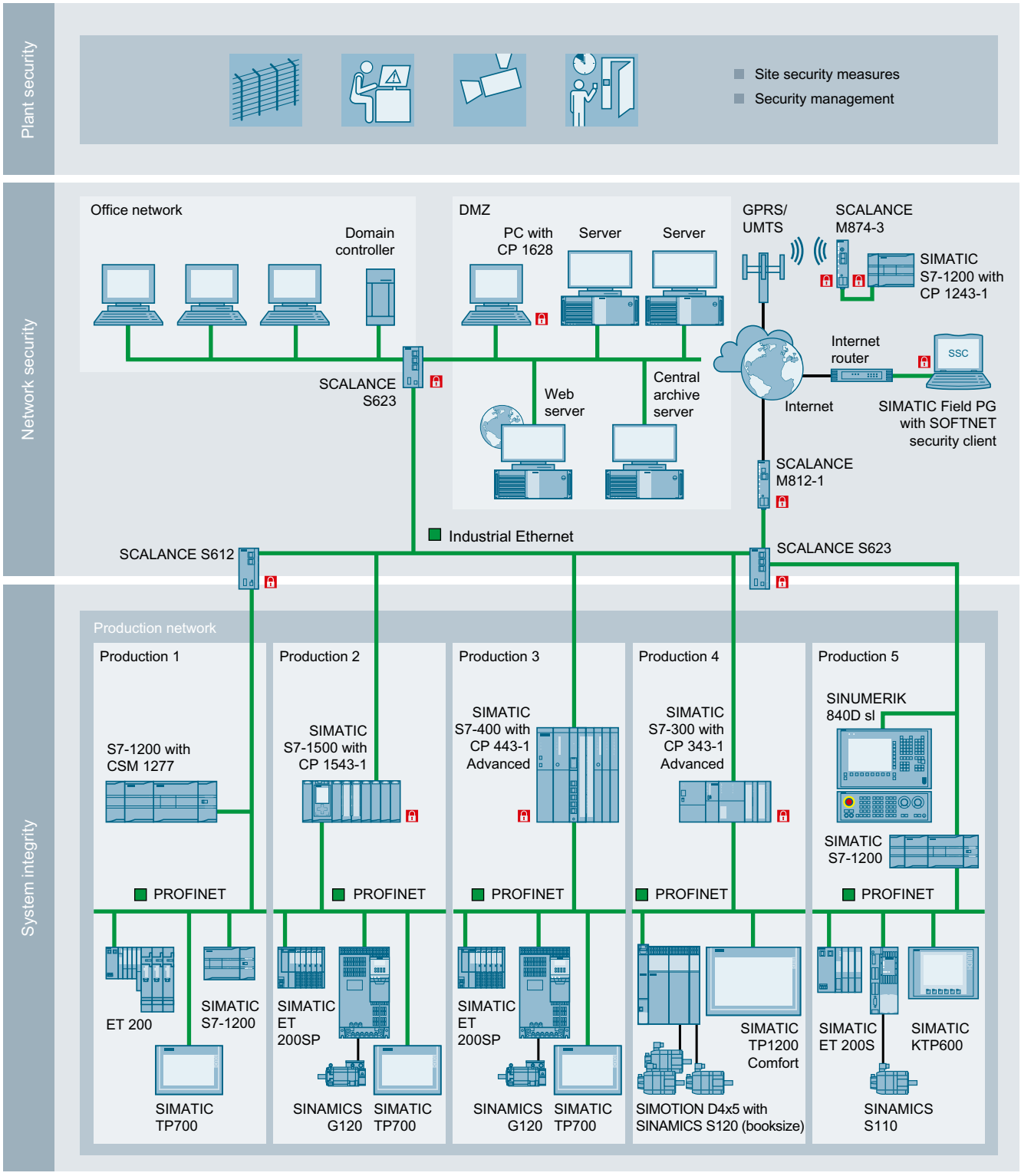
SCALANCE S security modules

SCALANCE S security modules with Security Integrated provide:

- Stateful inspection firewall
  In order to implement user-specific control and logging, firewall rules can also be specified that only apply to certain users.
- VPN via IPsec (data encryption and authentication)
  This establishes a secure tunnel between authenticated users whose data cannot be intercepted or manipulated. The most important aspect is the protection against external access via the Internet.
- NAT/NATP (address translation)
- Router functionality (PPPoE, DDNS) for broadband Internet access (DSL, cable)
- S623 with additional VPN port (DMZ) enables the secure connection of an additional network for service and remote maintenance purposes. S623 also permits the secure, redundant connection of subordinate networks by means of routers and firewall redundancy.

Principle

This application example shows cell segmentation by several SCALANCE S modules, each of which is upstream of the automation cell. The data traffic to and from the devices within automation cells can be filtered and controlled with the SCALANCE S firewall. If required, the traffic between the cells can be encrypted and authenticated. Secure channels and client access from the PCs to the cells can be established via SOFTNET Security Client, VPN client software for PCs.


Plant security
Site security measures
Security management
Network security
Office network
Domain controller
DMZ
PC with CP 1628
Server
Server
GPRS/ UMTS
SCALANCE M874-3
SIMATIC S7-1200 with CP 1243-1
Internet router
SSC
Internet
SIMATIC Field PG with SOFTNET security client
SCALANCE S623
Web server
Central archive server
SCALANCE M812-1
Industrial Ethernet
SCALANCE S612
SCALANCE S623
System integrity
Production network
Production 1
S7-1200 with CSM 1277
PROFINET
ET 200
SIMATIC S7-1200
SIMATIC TP700
Production 2
SIMATIC S7-1500 with CP 1543-1
PROFINET
SIMATIC ET 200SP
SINAMICS G120
SIMATIC TP700
Production 3
SIMATIC S7-400 with CP 443-1 Advanced
PROFINET
SIMATIC ET 200SP
SINAMICS G120
SIMATIC TP700
Production 4
SIMATIC S7-300 with CP 343-1 Advanced
PROFINET
SIMATIC TP1200 Comfort
SIMOTION D4x5 with SINAMICS S120 (booksize)
Production 5
SINUMERIK 840D sl
SIMATIC S7-1200
PROFINET
SIMATIC ET 200S
SIMATIC KTP600
SINAMICS S110

2.3.4 System integrity

2.3.4.1 System hardening

Reduction of attack points

Network services and ports

Activated services represent a risk. To minimize the risk, only the necessary services for all of the automation components should be activated. Ensure that all activated services are taken into account (especially web servers, FTP, remote maintenance, etc.) in the security concept.

A description of the ports used can be found in the Manuals and Function Manuals of the respective products.

User accounts

Any active user account allows access to the system is thus a potential risk. Therefore, take the following security measures:

- Reduction of configured/activated user accounts to the actually needed minimum
- Use of secure access data for existing accounts
- Regular checks, especially of the locally configured user accounts
- Regular change of passwords

Passwords

NOTICE
Changing default passwords The misuse of passwords can also represent a considerable security risk. We recommend that default passwords be changed during the commissioning and changed at regularly defined intervals as required.

Virus scanner

The use of a virus scanner must not impact the production operations of a plant. As the last consequence, this will lead to even a virus-infected computer not being permitted to immediately shut down if this would cause the control of the production process to be lost.

In order to be used on industrial control components, a virus scanner should therefore meet the following requirements:

Virus scanner requirements

- If a local firewall that has been adapted to the production operations is used, it must be possible to install the virus scanner without its own firewall.
- The virus scan clients can be divided into (product- and task-specific) groups and configured separately.
- It must be possible to deactivate the automatic distribution of the virus signatures and other updates.
- It must be possible to carry out the distribution of the virus signatures and updates manually and in groups.
- It must be possible to conduct a file scan and system scan manually and in groups.
- For the virus detection scenario, a message can be configured without a file action such as "Delete", "Clean", etc. being automatically carried out.
- It must be possible to log all of the messages on the virus scan server.
- On a virus scan client, it must be possible to suppress the local message window because it could obscure important messages from the production process.

Note

Installation of software

The installation of software is often a process which represents a serious and complicated change to the respective system. The storage location of the files to be installed must always be free of viruses (e.g. a file server with its own virus scanner or DVD checked for viruses).

2.3.4.2 Patch management

Microsoft security updates

The **WSUS** (Windows Server Update Service) system functionality provided by Microsoft is available for current Windows systems. WSUS supports administrators by providing Microsoft updates in large local networks. WSUS automatically downloads update packages from the Internet (Microsoft Update) and offers them to the Windows clients for installation.

The fully automatic update process ensures that Microsoft security updates are always available on Siemens clients.

2.4 Product-specific measures

2.4.1 Virus scanners, Windows security patches, SIMOTION P

General information on virus scanners

Once an industrial PC system is connected to the Internet, either directly or via an internal company network, there is a danger that it can become infected with a virus. However, malicious software is not only able to reach the system via the Intranet/Internet, but also, for example, via a removable storage device (such as a USB memory stick) attached to the system for backing up data.

SIMOTION P320-4 virus scanners

A virus scanner that runs on Microsoft Windows, as used in office or home computers, has a deep impact on a system's processes. There are, for example, processes such as real-time scans or regular system scans. Such interventions can cause performance issues for the system, and as a result, for the SIMOTION Runtime software. Although the SIMOTION Runtime software runs in a real-time environment, it still depends on the available system resources.

Note

Because of the resulting performance impairments, the installation and use of a standard virus scanner on a SIMOTION P320-4 during system runtime does not make sense and is not permitted.

Using a virus scanner

As a standard virus scanner cannot be used for SIMOTION P320-4, an alternative procedure is followed. The virus scanner is installed to a separately bootable Windows PE operating system. It is started, for example, from a CD or a USB storage device and then performs a virus scan.

Note

FAQ Service & Support portal

More information on using a virus scanner on a SIMOTION P320-4 can be found in the FAQ "How can a virus scanner be used on a SIMOTION P320-4?" (https://support.industry.siemens.com/cs/ww/en/view/59381507) which is available as a download from the Service & Support portal.

Windows security patches

A brief test is performed when a new SIMOTION version is released. During this brief test, a check is performed to establish whether the installation of the security update has affected any basic functions.

2.4.2 Changing the Windows user password

Permitting the Windows password to be changed

Before the Windows password can be changed, it must be permitted for the user.

If the following procedure is not observed, an error message is issued and the Windows password cannot be changed.

Note the following procedure:

1. Select the entry point **Control Panel** > **All Control Panel Items** > **Administrative Tools** > **Computer Management**.
   Double-click **Computer Management**.

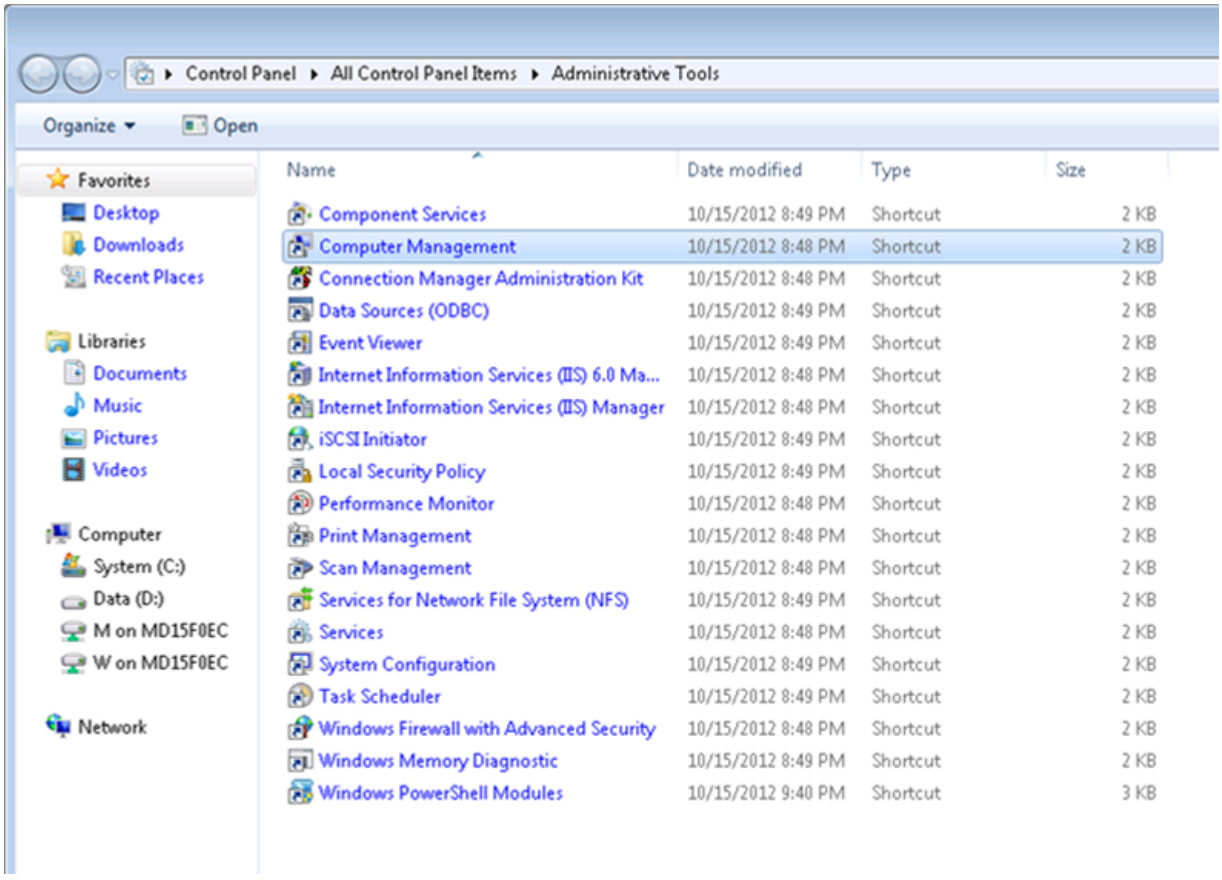


Figure 2-2 Homepage:

2. The **Users** folder is displayed at **Local Users and Groups** in the **Computer Management** window.
   Click the **Users** folder. The available user groups are displayed.

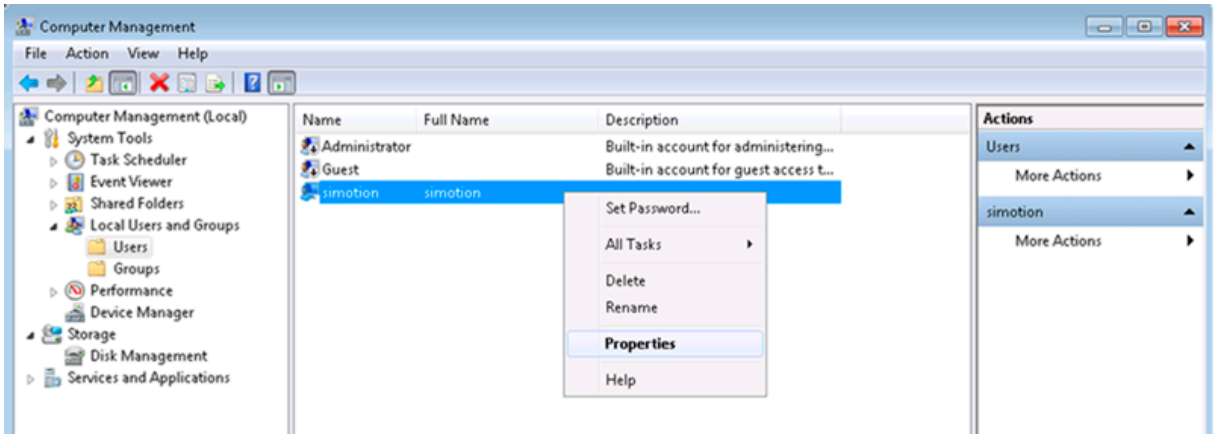


Figure 2-3 Computer management

3. With the selection of **Users simotion**, you can display the properties via **Properties**.
4. Deactivate the "**User cannot change password**" checkbox in the **General** tab on the **simotion Properties** dialog box.
   This checkbox must be deactivated for the user to change the Windows password.

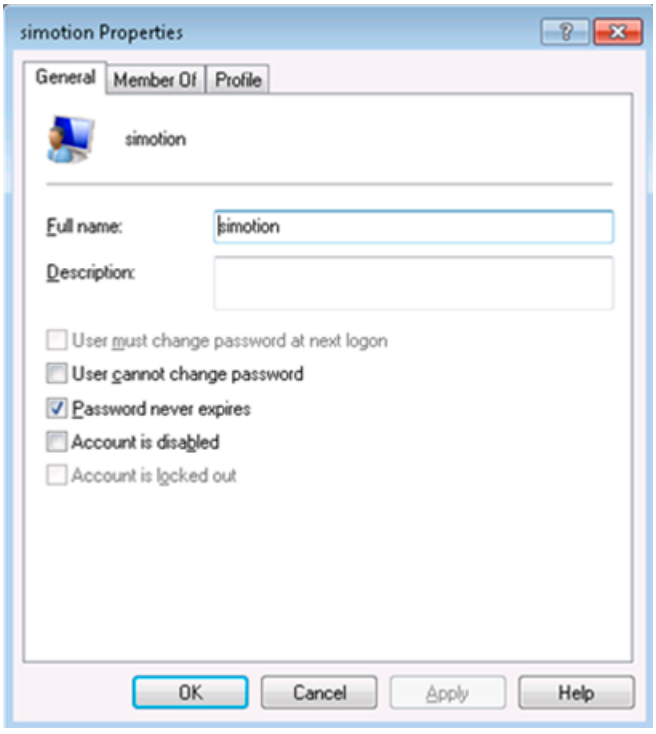


Figure 2-4 SIMOTION properties

Changing the Windows password

You can find general information on the Windows password on the website at Microsoft - Changing des Windows-password (http://windows.microsoft.com/en-us/windows/change-windows-password#change-windows-password=windows-7).

To change the Windows password, proceed as follows:

1. Press Ctrl+Alt+Del. The following Windows window opens.

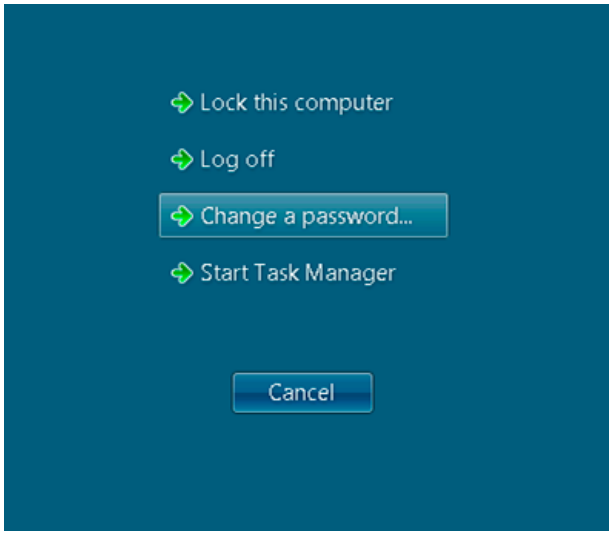


Figure 2-5 Changing the Windows password

2. After you have confirmed **Change a password...** , the Windows window to change the Windows password opens.
   First enter your current password and then the new Windows password. You must enter the new Windows password a second time for confirmation.

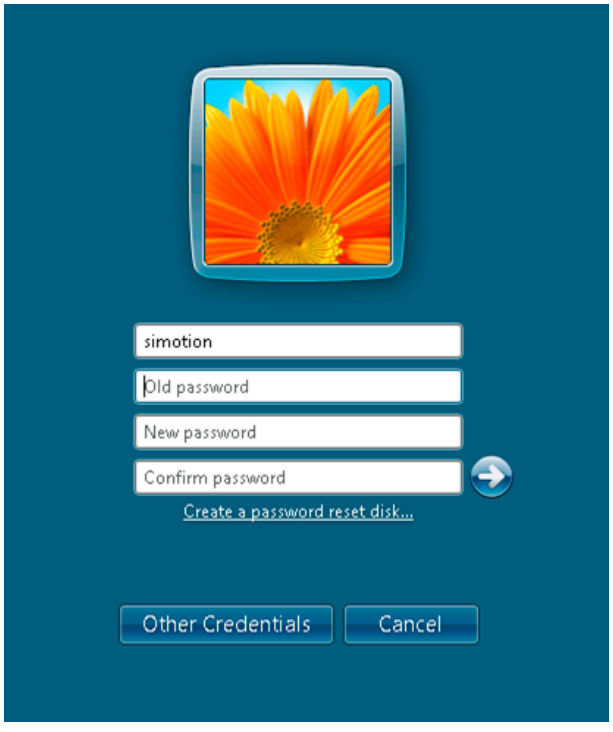


Figure 2-6 Entering the new Windows password

3. The password was changed successfully.

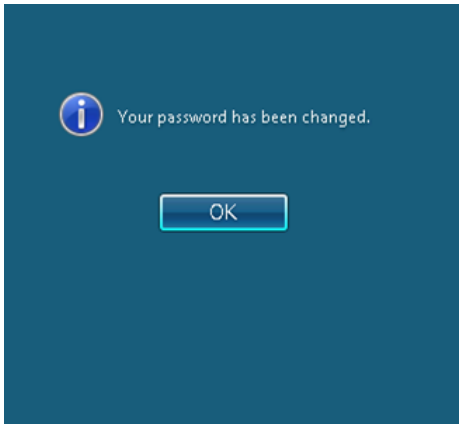


Figure 2-7 Confirmation of change

4. In the event of an error when the "User cannot change password" checkbox is activated, the following error message is displayed.
The Windows password has not been changed.

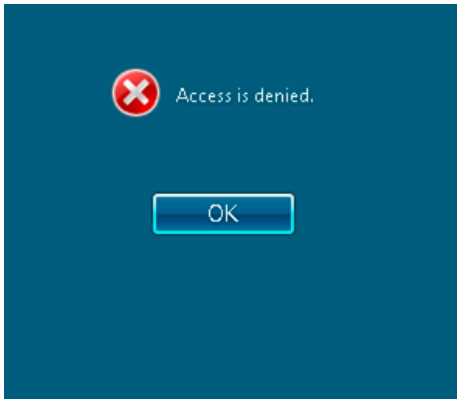


Figure 2-8 Error message when changing the Windows password has not been permitted.

2.4.3 Changing the AutoLogin

The password for the AutoLogin must be changed when the user has changed the Windows password.

The Windows user password is changed in the normal way, e.g. "Change Password" screen.
See also Section Changing the Windows user password (Page 34).

Automatically Log On

SIMOTION P320-4 is preset so that the user does not have to enter the user name and the password to log on.

Preparation for changing the AutoLogin

In order that an AutoLogin still functions after changing the Windows password, the password for the AutoLogin must be changed.

The required procedure is shown in the following so that the change of the AutoLogin for SIMOTION P320-4 can be prepared:

1. Open the **Computer Management** window via **Control Panel** > **All Control Panel Items** > **Administrative Tools** .

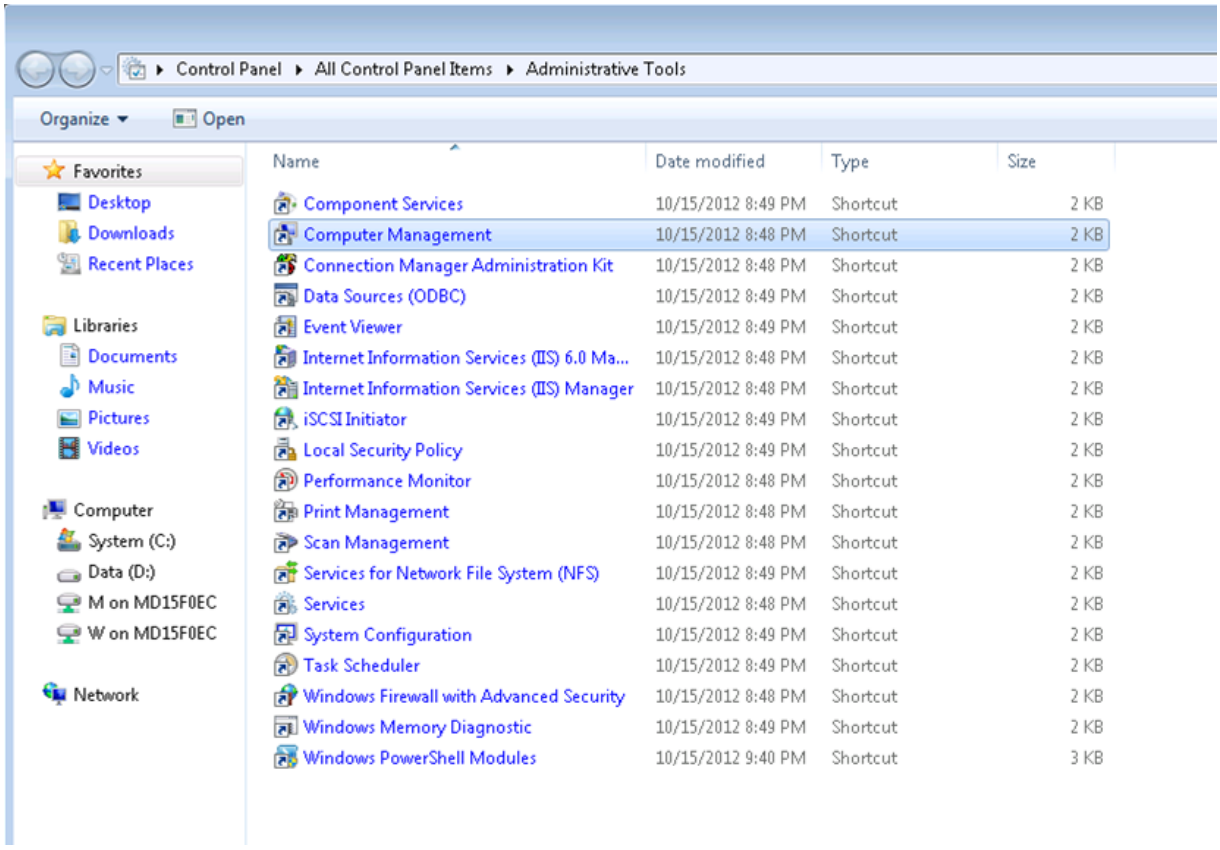


Figure 2-9 Computer Management entry point

2. The **Users** folder is displayed at **Local Users and Groups** in the **Computer Management** window.
   Click the **Users** folder. The available user groups are displayed.

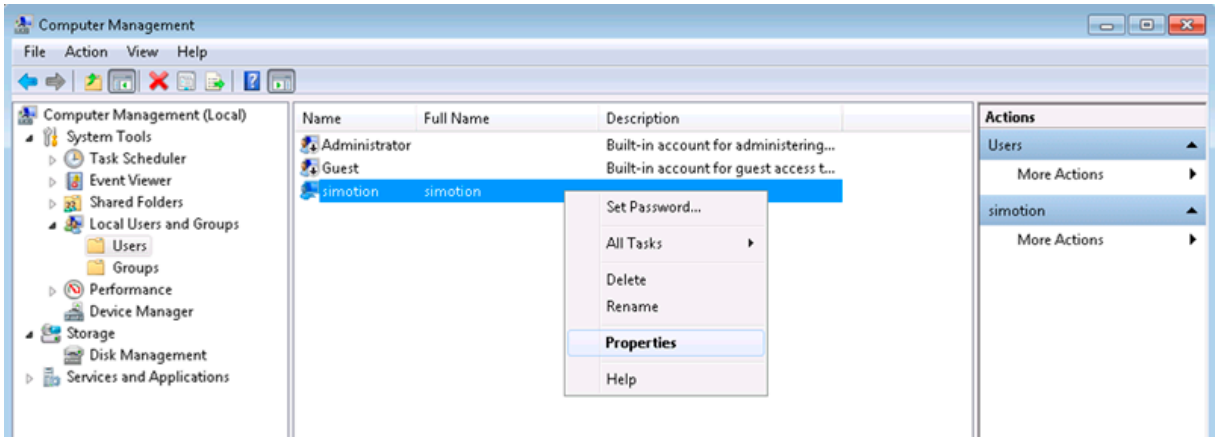


Figure 2-10 Computer Management - Users

3. With the selection of **Users> simotion**, you can display the properties via **Properties**.
4. Deactivate the **User cannot change password** checkbox in the **simotion Properties** dialog box.

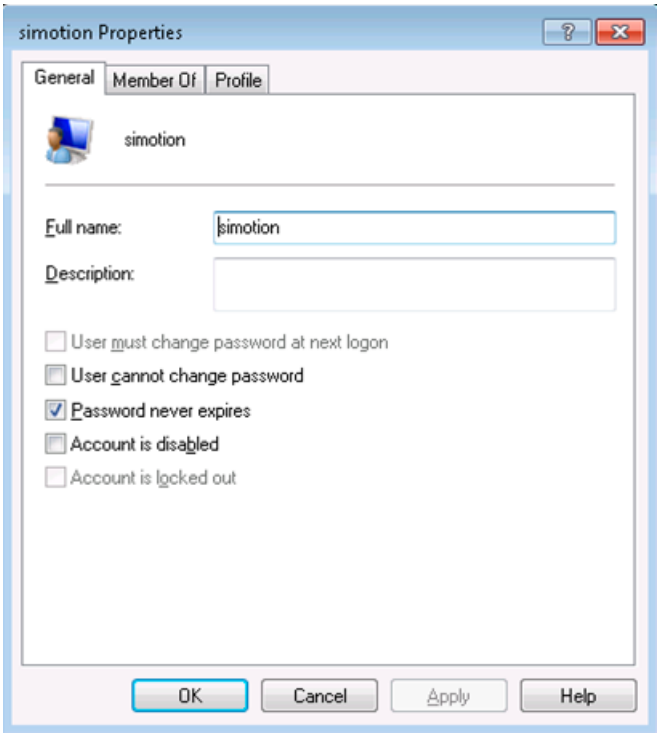


Figure 2-11 simotion Properties - General dialog box

5. Confirm with **OK.**

Changing the password for AutoLogin

To change the password for the AutoLogin, proceed as follows:

1. Open the search via **Windows-Start** and enter: **netplwiz**

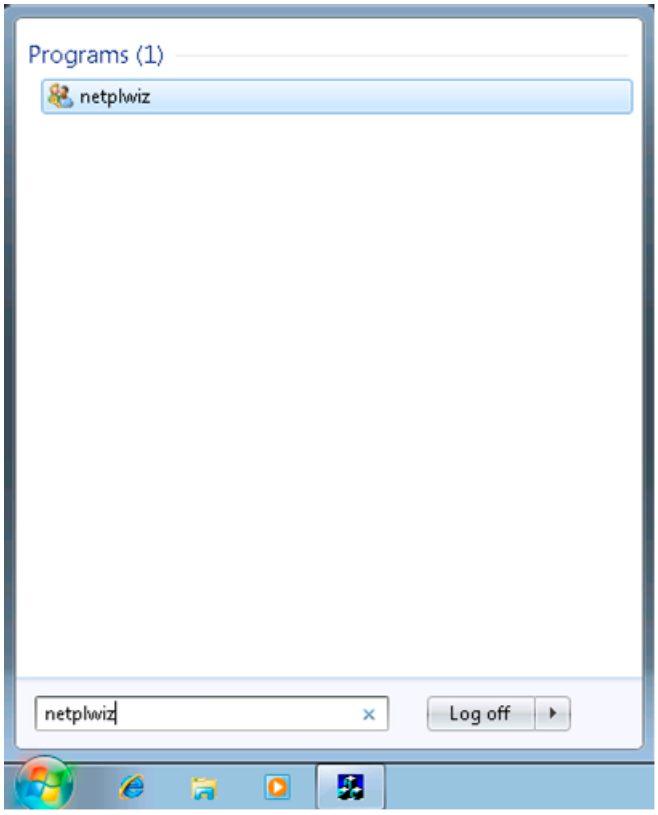


Figure 2-12 Programs netplwiz

2. The following **User Accounts** dialog box opens.

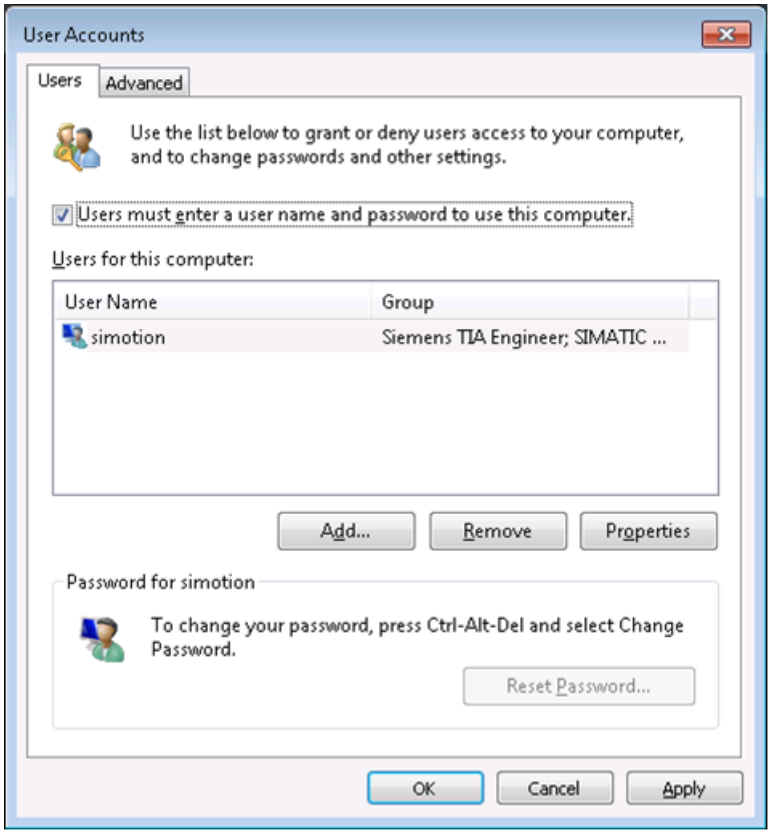


Figure 2-13 User Accounts

3. In the **Users** tab, activate the **Users must enter a user name and password to use this computer** checkbox.
   The **Apply** button is now active. Deactivate the checkbox and accept the changes now with the **OK** or **Apply** button.
   This is necessary so that the **Automatically Log On** dialog box is subsequently displayed.

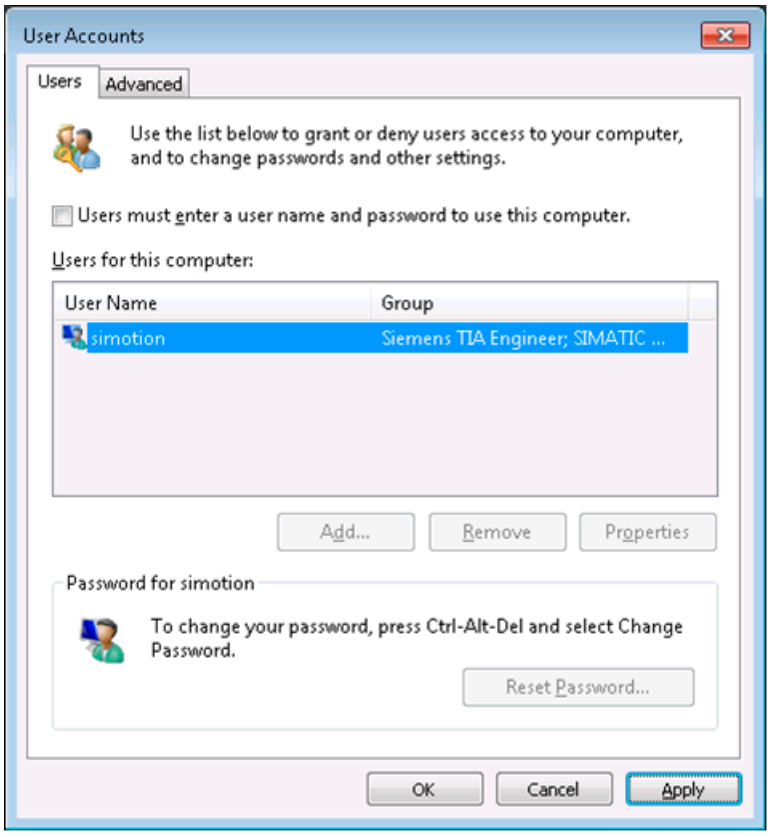


Figure 2-14 User accounts

4. Enter your changed Windows user password in the **Automatically Log On** dialog box and confirm it by entering it a second time.

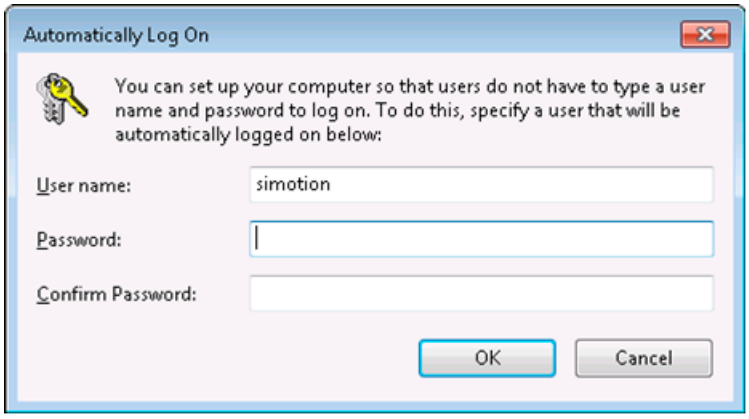


Figure 2-15 Automatically Log On dialog box

5. Confirm the password with **OK**.

2.4.4 Deactivating the remote desktop connection

Deactivating the remote desktop connection

NOTICE
Deactivating the remote desktop connection
To ensure that the remote desktop connection is not used, it must be explicitly deactivated.

Procedure for deactivating the remote desktop connection

1. Using the Control Panel, select **System** > **Remote settings**.

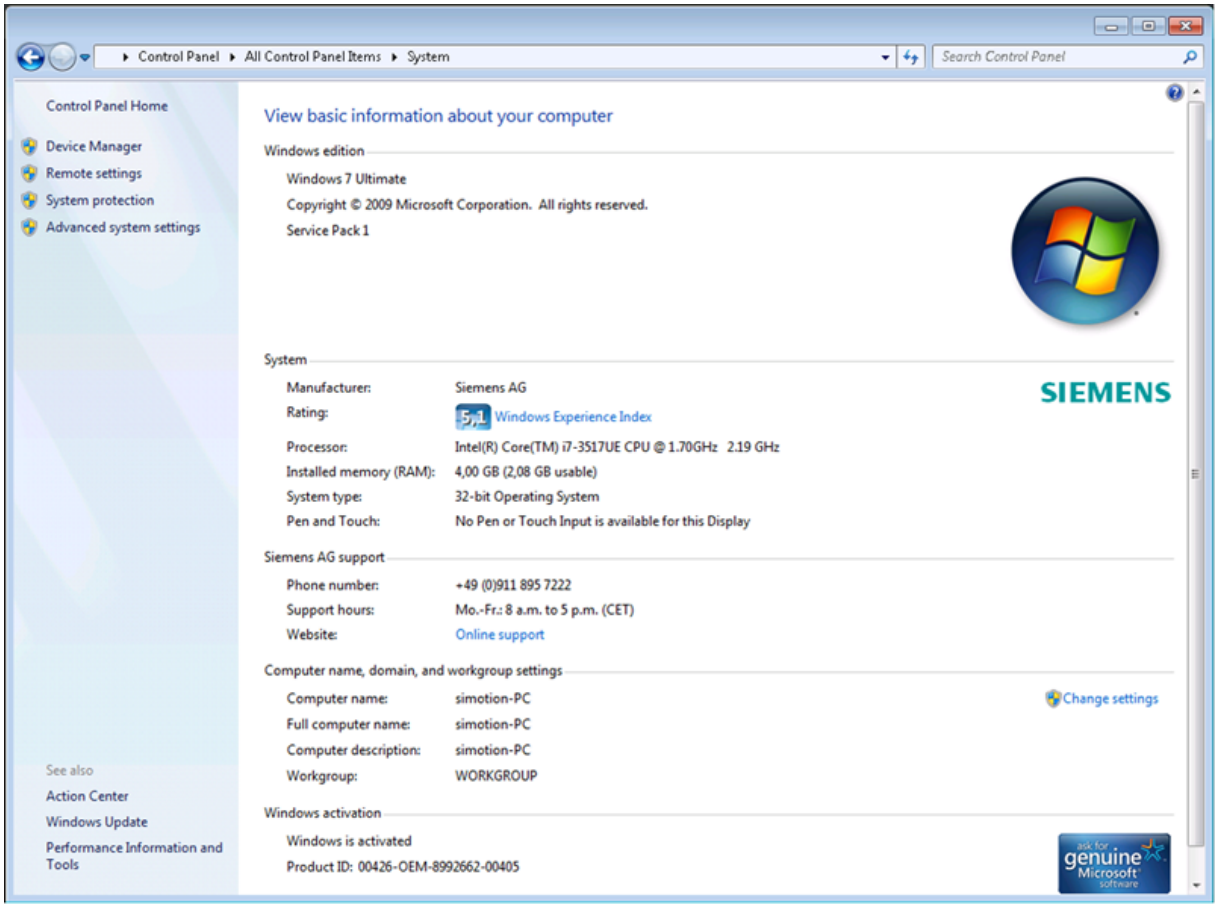


Figure 2-16 Remote settings

2. Select the **Remote** tab in the **System Properties** dialog box.

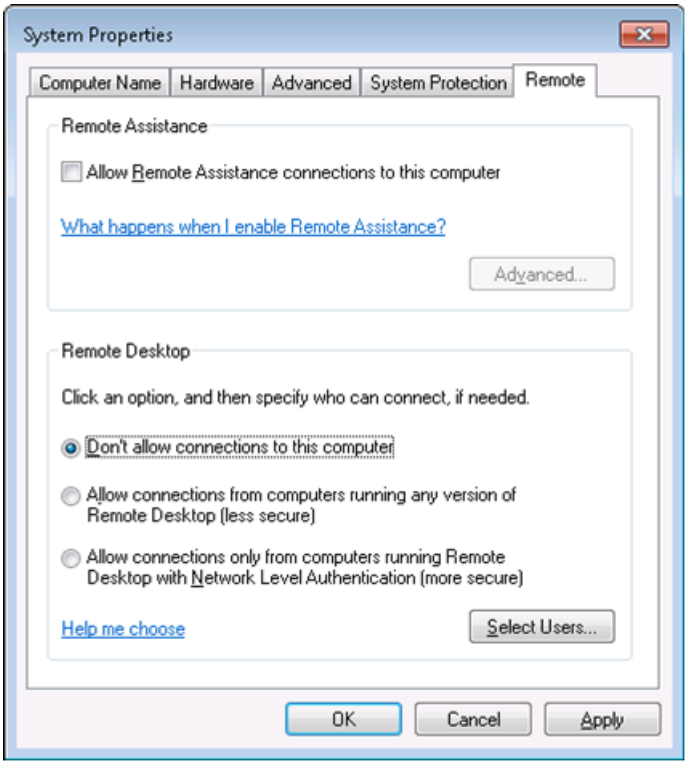


Figure 2-17 System Properties dialog box

3. Select the **Don't allow connections to this computer** option at **Remote Desktop**.
4. Confirm with **OK**.

Any remote desktop access is deactivated with this operation.

Description 3

3.1 System overview

Overview

SIMOTION P is a PC-based, open Motion Control System from SIMOTION.
Control, motion control, and HMI functions are executed together with standard PC applications on the SIMOTION P hardware platform. SIMOTION P combines the compatibility of the Windows operating system with real-time capability of SIMOTION P Runtime.

The fully independent SIMOTION P Runtime runs in parallel to Windows on SIMOTION P. This real-time expansion makes it possible to implement demanding motion control applications with high performance requirements on platforms of the SIMOTION P range. The hardware consists of a computing unit with innovative Intel technology, which is ready for operation at the time of delivery.

The drives and I/O devices are connected either via PROFINET onboard or IsoPROFIBUS board (optional).

The SIMATIC Flat Panel IFP1500, IFP1900 and IFP2200 can be used for the operation of the SIMOTION P320-4 hardware platform in a distributed configuration.

SIMOTION P320-4 versions

The SIMOTION P320-4 can control various I/O systems and HMI components via PROFINET onboard or the optional IsoPROFIBUS board.
If required, a USB DVD drive can be connected, for example.

The following versions of the SIMOTION P320-4 are available:

- SIMOTION P320-4 E
  with the Windows Embedded Standard 7 32-bit operating system and real-time expansion for SIMOTION.
- SIMOTION P320-4 S
  with the Windows 7 Ultimate 32-bit operating system and real-time expansion for SIMOTION.

Application

The SIMOTION P320-4 applications are directed at machines that require a high level of integration of PLC, motion control and technology functions on account of the increasing use of servo drives:

- Packaging machines
- Plastic and rubber processing machines
- Presses, wire-drawing machines
- Textile machines

- Printing machines
- Machines for processing wood, glass, ceramics, and stone
- Production lines in the renewable energy sector, e.g. solar technology, wind power installations

3.2 SIMOTION P320-4 product description

3.2.1 SIMOTION P320-4 overview

The SIMOTION P320-4 provides high-level industrial performance. It features:

- Compact design
- Maintenance-free operation
- High degree of ruggedness
- Long-term availability

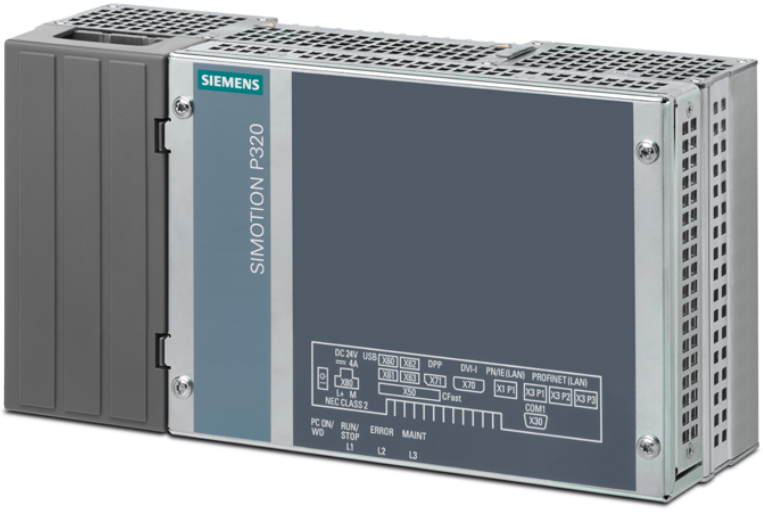


Figure 3-1 SIMOTION P320-4 view



Figure 3-2 SIMOTION P320-4 (open perspective) with plugged-in optional IsoPROFIBUS board

3.2.2 Features

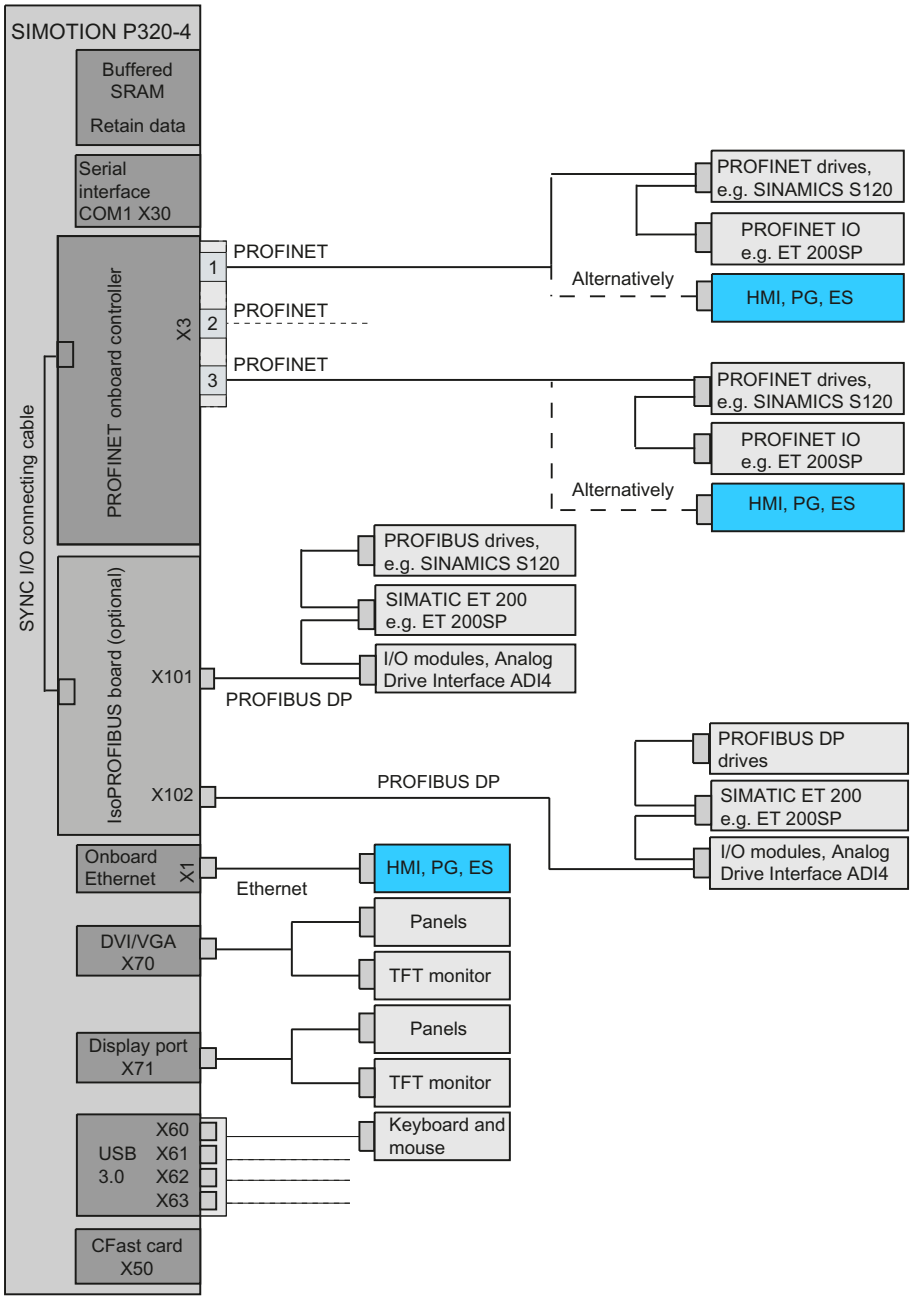
Basic data	
Installation	• Standard rail mounting • Vertical mounting
Processor	
P320-4 E **P320-4 S**	Intel Core i3-3217UE, 2 x 1.6 GHz, 3 MB cache Intel Core i7-3517UE, 2 x 1.7 GHz, 4 MB cache
Main memory	4 GB DDR3 RAM
Optional IsoPROFIBUS board (PROFIBUS DP)	2 x SUB-D socket with configurable baud rates (9.6 Kbit/s - 12 Mbps)
Graphics	• Integrated Intel HD2000 or HD4000 • DVI resolution of 640 × 480 pixels up to 1920 × 1200 pixels • Display port resolution max. 1920 × 1200 pixels • Graphics memory is occupied in the main memory (dynamic UMA)
Power supply	24 VDC (-20%/+20%) max. 4 A
Operating conditions	Operation without fan
Drives and storage media	
CFast card or SSD (Solid State Disk)	Depending on the hardware version of the SIMOTION P320-4

Basic data	
P320-4 E	**2 x CFast card** Internal interface: CFast External interface: CFast
P320-4 S	**SSD (Solid State Disk)** Internal interface: SSD **CFast card** External interface: CFast
USB stick	External, can be connected via USB interface
Interfaces	
Serial	COM (RS 232)
Graphics	DVI-I: Suitable for use as DVI or VGA DPP++: Display port, DVI via DPP-to-DVI adapter
USB	4 × USB 3.0, simultaneous operation of high current, backward compatible with USB 2.0/1.1
Ethernet	1 × RJ45 (10/100/1000 Mbps)
PROFINET I/O	3 × RJ45 (100 Mbps)
Keyboard, mouse	Can be connected via USB interface

Software	
Operating systems	
P320-4 E	Windows Embedded Standard 7 32-bit
P320-4 S	Windows 7 Ultimate 32-bit

3.2.3 SIMOTION P320-4 (hardware) structure

The following figure shows the integration of the SIMOTION P320-4 with integrated PROFINET onboard and optional IsoPROFIBUS board in a target system.

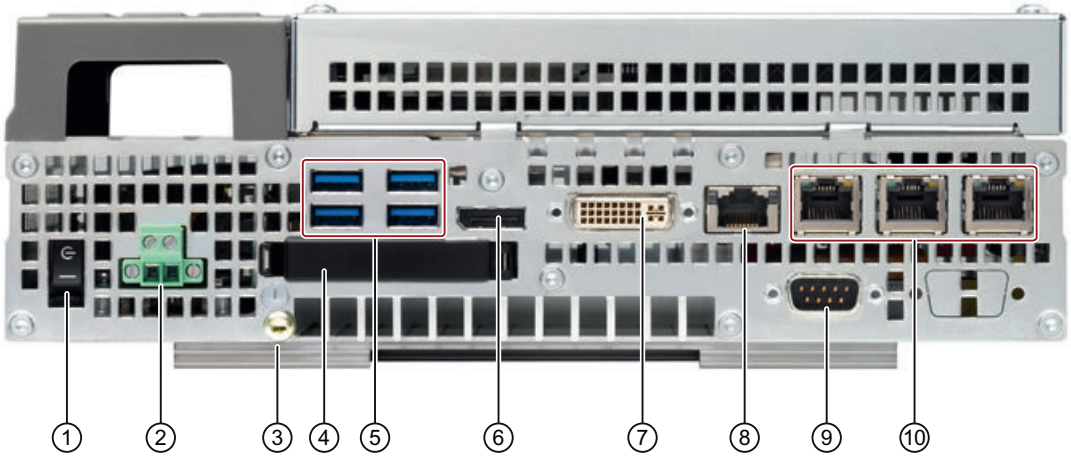


HMI Human Machine Interface
PG Programming device
ES Engineering system

Figure 3-3 SIMOTION P320-4 system overview

3.2.4 Interfaces and operating elements

SIMOTION P320-4



①	On/off switch	Position **OFF** is the delivery state. The on/off switch does not isolate the device from the power supply.
②	24 V DC	Power supply connection
③	Protective conductor	Protective conductor terminal
④	Memory card slot	Cover for the CFast card
⑤	4 × USB 3.0	USB 3.0 high current, backward compatible with USB 2.0/1.1
⑥	Display port	Display port connection for digital monitor
⑦	DVI-I	DVI connector for CRT or LCD monitor with DVI interface
⑧	Ethernet	RJ45 Ethernet connection for 10/100/1000 Mbps
⑨	COM1	Serial interface
⑩	3 × PROFINET	PROFINET ports with three RJ45 sockets

3.2.5 SIMOTION P Runtime (software) structure

SIMOTION P Runtime contains the SIMOTION P Kernel which performs the motion control and interface control.

A SIMOTION project is planned, configured, assigned parameters, commissioned and programmed via the SIMOTION SCOUT engineering system (ES).

The user data can be stored on the data media of the SIMOTION P320-4 .

Siemens WinCC flexible software can be used to visualize operational sequences or to operate the machine. Third-party systems can be linked via the OPC interface.

SIMOTION P Runtime

With the SIMOTION P320-4, the PLC and motion control functionality (starting from position controller upwards) is located centrally in a strictly deterministic task outside the Windows operating system.

Its main field of application is centralized motion control and control tasks requiring close coordination between multiple axes and/or input/output modules.

Functionality ranges from simple positioning to high-performance synchronous operation.

SIMOTION SCOUT

The SIMOTION SCOUT engineering system can be installed on the SIMOTION P320-4 S or connected via the interfaces integrated in SIMOTION P320-4 .

SIMOTION SCOUT TIA

As of version V4.5, the SIMOTION SCOUT TIA engineering system no longer supports the Windows 7 32-bit operating system and therefore cannot be installed.

HMI software

HMI/Runtime software can be operated on the same PC, e.g. the Siemens WinCC flexible software. Other software packages can be linked by means of the OPC interface.

The **HMI software** is used as the general term in the following.

Internal communication

A locally installed HMI can use the local communication to access the following:

- Variables in SIMOTION RT
- Drives on PROFINET IO or PROFIBUS DP
- Other SIMOTION devices on PROFINET IO or PROFIBUS DP

Scope of delivery

The system software supplied with the SIMOTION P320-4 is either already installed on the SIMOTION P320-4 storage medium or is ready to be installed:

- SIMOTION P Kernel
- SIMOTION IT
- SIMOTION IT VM Virtuell Machine (subject to license)

3.2.6 Components

The most important components of the SIMOTION P320-4 and their functions are listed below.

Distributed I/O systems (PROFINET)

Table 3-1 Components for distributed I/O

Component	Function
SIMATIC ET 200M	Modular I/O system for cabinet installation and high channel densities.
SIMATIC ET 200S	Finely modular I/O system for cabinet installation including motor starters, safety technology, and individual grouping of the load groups.
SIMATIC ET 200SP	Finely scalable I/O system for cabinet installation; SIMATIC ET 200SP features a single-cable and multi-cable connection with push-in terminals, compact dimensions, high performance, and low part variety.
SIMATIC ET 200MP	Modular I/O system for cabinet installation and high channel densities in the SIMATIC S7-1500 packaging system. SIMATIC ET 200MP permits the shortest bus cycle times and fastest response time even with large volumes of data.
SIMATIC ET 200eco	I/O system with IP67 degree of protection for machine-related, cabinet-free applications, featuring a flexible and fast connection system in ECOFAST or M12.
SIMATIC ET 200pro	Modular I/O system with IP65/67 degree of protection for machine-related, cabinet-free applications, including motor starters.

Note

Note that not all modules of the above-mentioned I/Os or I/O systems have been released for SIMOTION.

There may also be system-dependent functional differences with regard to the use on SIMOTION and on SIMATIC.
For example, special process-control functions (e.g. HART modules, etc.) are not supported by SIMOTION for the ET 200M distributed I/O system.

For a detailed and routinely updated list of I/O modules enabled with SIMOTION as well as application information, visit us online at:

SIEMENS Industry Online Support - Product support - Supplementary system components (https://support.industry.siemens.com/cs/de/en)

Further modules are integrated via the GSD file of the device's manufacturer.

Note

Note that in individual cases, additional supplementary conditions must be fulfilled.

Drive systems (via PROFINET IO)

Table 3-2 List of typically connected drive systems

Component	Function
SINAMICS S120	Servo drives, innovative single-axis and multi-axis solution

Optional components

Table 3-3 Optional components

Centralized I/O	Function
IsoPROFIBUS board	PROFIBUS connection
UPS	Uninterruptible Power Supply The drivers for the UPS are not pre-installed on the PC. Install the current drivers that are supplied with the UPS.

Note

An IsoPROFIBUS board may be inserted in addition to the PROFINET onboard.

3.3 HMI and SIMOTION SCOUT

3.3.1 HMI and SIMOTION SCOUT Overview

The operational sequences on the SIMOTION P320-4 are either monitored via the HMI system (Human Machine Interface) or the SIMOTION SCOUT engineering system.

The HMI or ES software can be connected using the following variants:

- Local (Page 58)
- via PROFINET (Page 70)
- via Ethernet (Page 71)
- via IsoPROFIBUS (optional) (Page 73)

Local communication of the HMI/ES

Only one local connection to the local SIMOTION Runtime is possible. If HMI or ES is also installed locally, **PC internal** can access other controllers/devices via PROFINET / PROFIBUS.

See Section Local HMI or ES on SIMOTION P320-4 (Page 58).

Communication of the HMI / ES via PROFINET / Ethernet / PROFIBUS

By using one of these communication variants, you can control and monitor several SIMOTION devices.

3.3.2 Local HMI or ES on SIMOTION P320-4

The model described below is used for the communication of the SIMOTION P320-4 with a local HMI or ES. The SIMOTION SCOUT engineering system or the HMI system can be installed directly on the **SIMOTION P320-4 S**.

For this model, you must set the communication (access point) to **TCP/IP** .

The SIMOTION P320-4 is already configured for this communication version at the time of delivery.

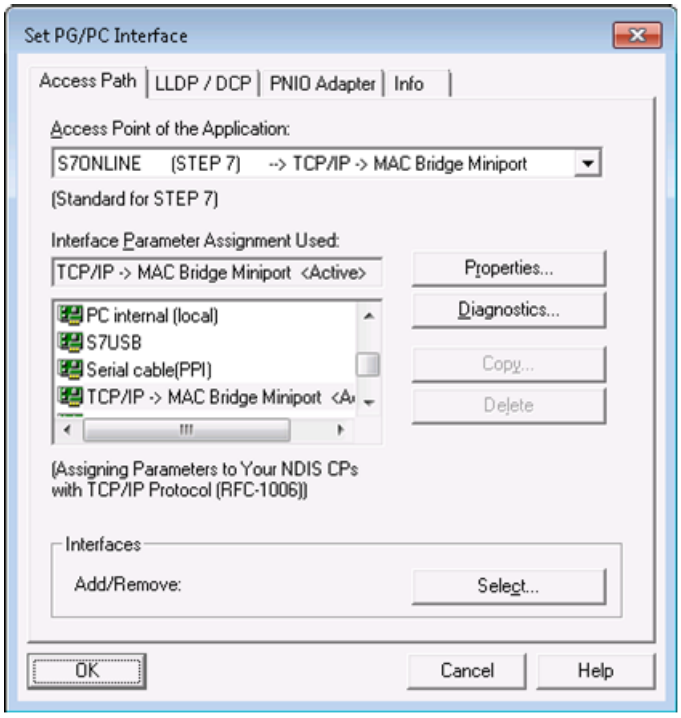


Figure 3-4 Set PG/PC Interface - TCP/IP -> MAC Bridge Miniport dialog box

Note

Local communication via Ethernet (TCP/IP)

For the communication via Ethernet (TCP/IP) to function locally, a link must be available to the Ethernet interface or a LAN cable must be connected **or** the MAC bridge set up.

Note

Setting up the MAC bridge miniport

See also Section Setting up a network bridge - MAC bridge miniport (Page 59)

Note

Only HMI-Runtime can be installed on the **SIMOTION P320-4 E** version.

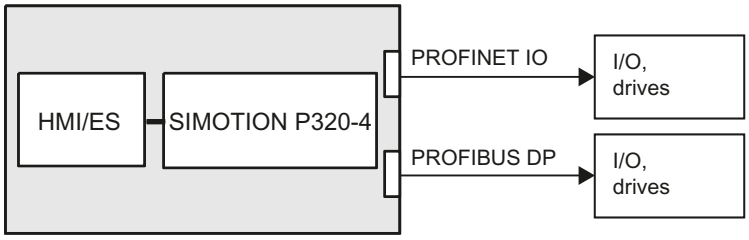


Figure 3-5 Model: Local HMI or ES

Alternatively to TCP/IP , SIMOTION SCOUT can also communicate locally via PC internal (local) .

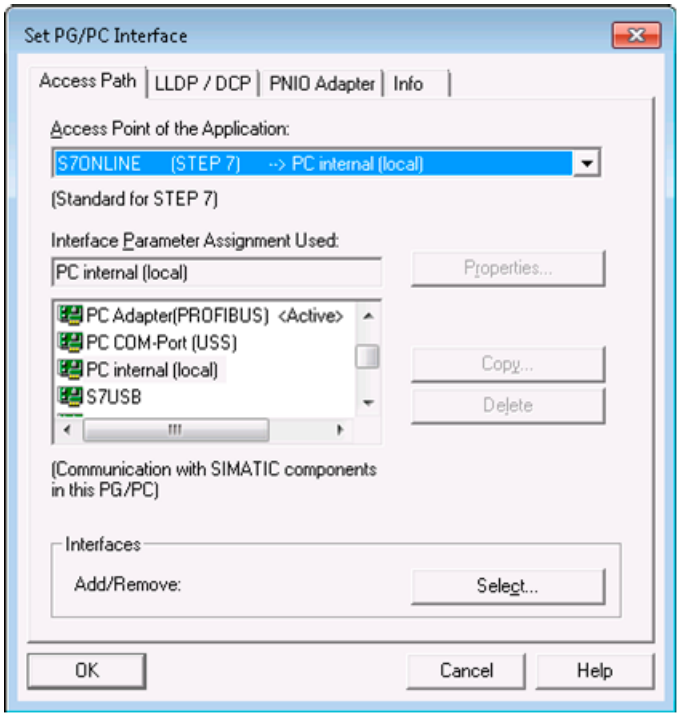


Figure 3-6 Set PG/PC Interface - PC internal (local) dialog box

3.3.2.1 Setting up a network bridge - MAC bridge miniport

Note

If you are working with SIMOTION P320-4 version V4.5, the Network Bridge is already preset.

The network bridge is not preset for version V4.4 and must be set up as described in the following.

The following is a step-by-step description of how the network bridge **MAC Bridge Miniport** is set up.

Network connections initial situation

Open the **Network and Internet** via the Control Panel.

- Select **Control Panel** > **All Control Panel Items** > **Network and Sharing Center** > **Change adapter settings**.
- Open the **Network and Internet** > **Network Connections** dialog box.
  The network connections of your PC are shown here.

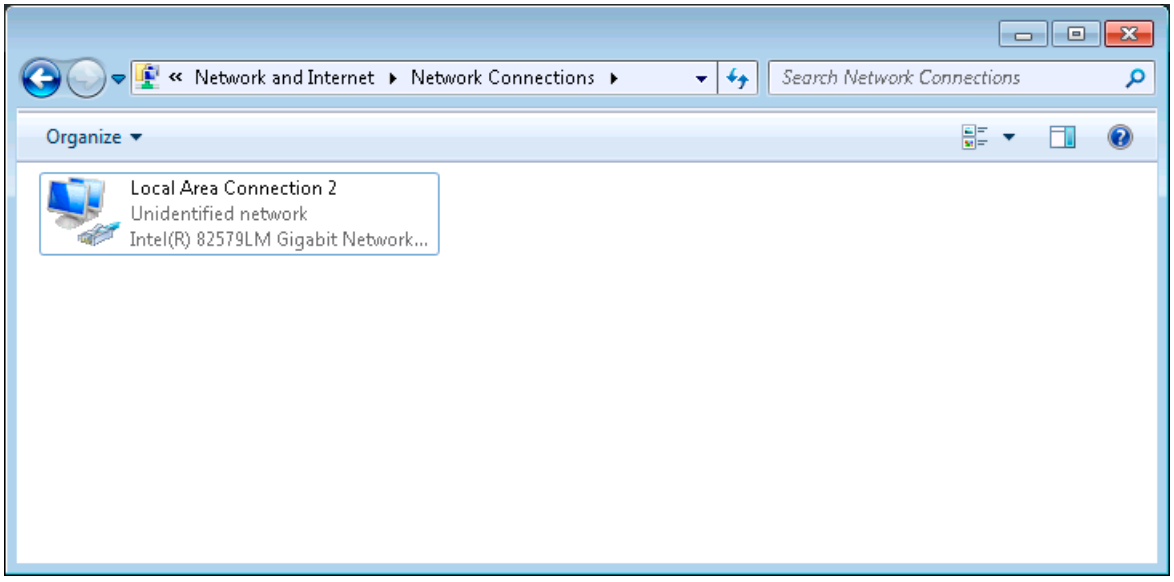


Figure 3-7 Initial situation - Network connections

Device Manager

Open the Device Manager via the Control Panel:

Control Panel > All Control Panel Items > System > Device Manager.

1. Select the **Network adapters** in the dialog box below the "SIMOTION PC".
   The available network connections are shown here.

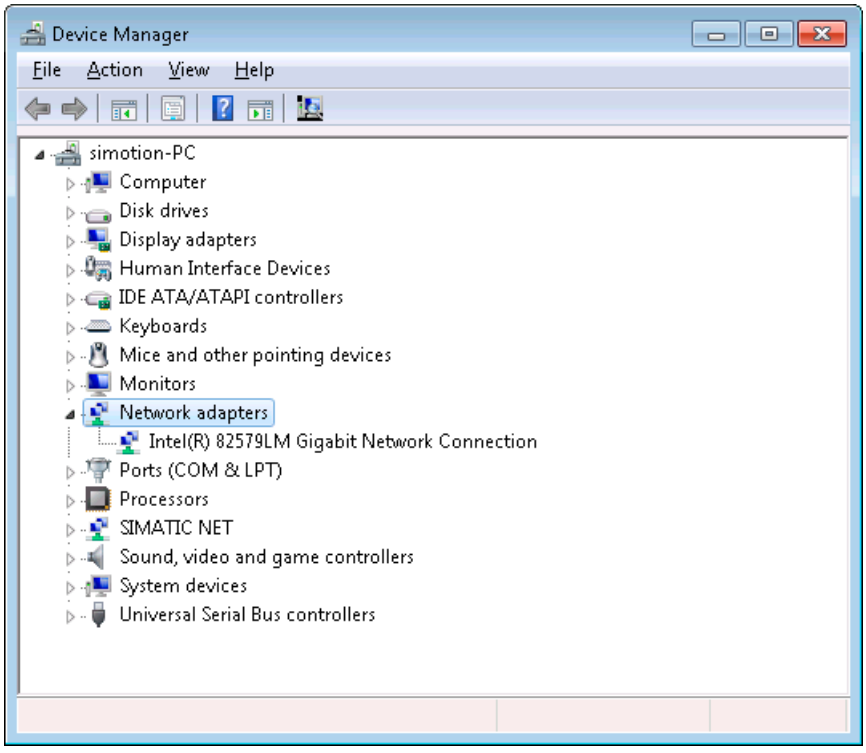


Figure 3-8 Opening the Device Manager

2. Install the **Microsoft Loopback Adapter** via the Device Manager.
3. To do this, select the menu **Action > Add legacy hardware**.
   The **Add Hardware Wizard** then opens.

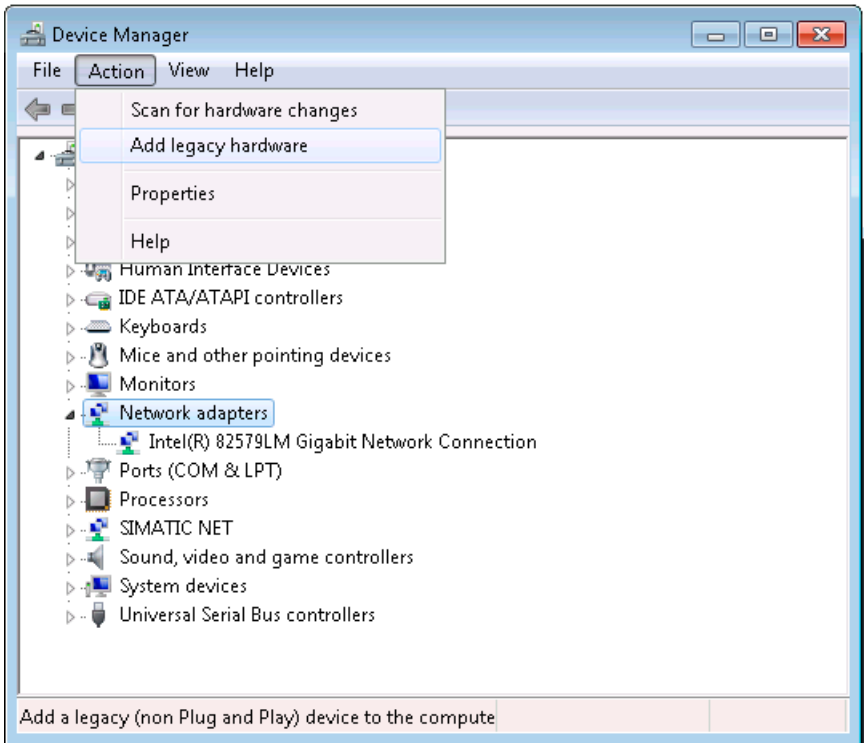


Figure 3-9 Device Manager - Action menu

Add Hardware Wizard

Use the **Add Hardware Wizard** to install the network bridge.

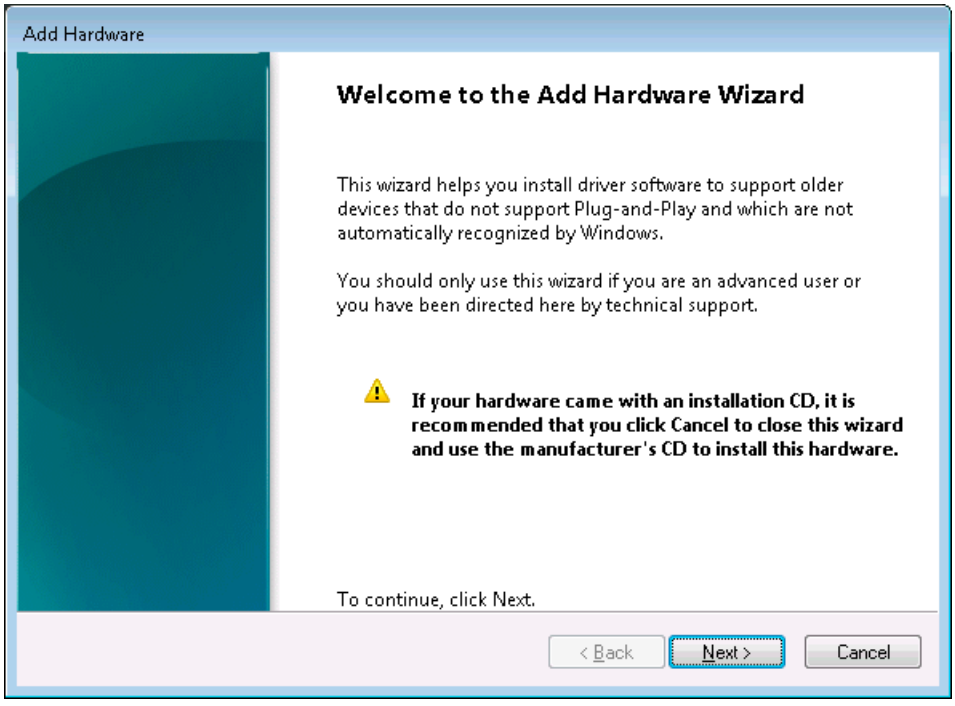


Figure 3-10 Add Hardware - Starting the wizard

1. Click **Next** to start the software wizard.
2. Select the option: **Install the hardware that I manually select from a list (Advanced)** and continue in the wizard with **Next**.

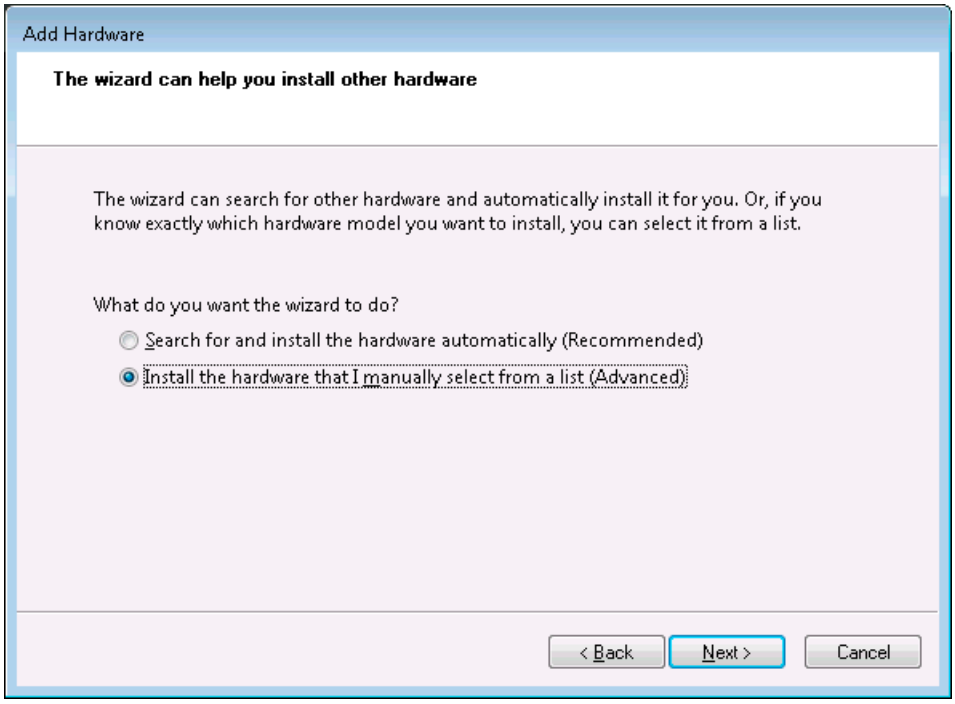


Figure 3-11 Add Hardware - Manual selection from a list

3. Select **Network adapters** in the dialog box now open and continue in the wizard with **Next**.

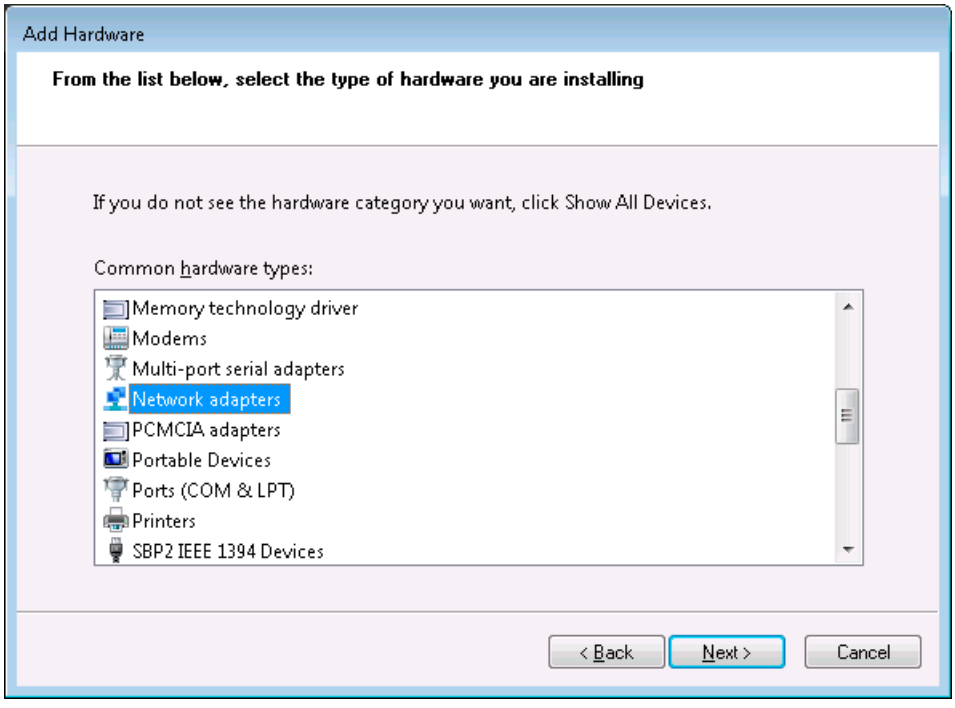


Figure 3-12 Select Add Hardware - Network adapters

4. In the following dialog box, select the **Microsoft Loopback Adapter**.
5. To do this, select Microsoft at **Manufacturer** and the Microsoft Loopback Adapter at **Network Adapter**.
6. Continue in the wizard with **Next**.

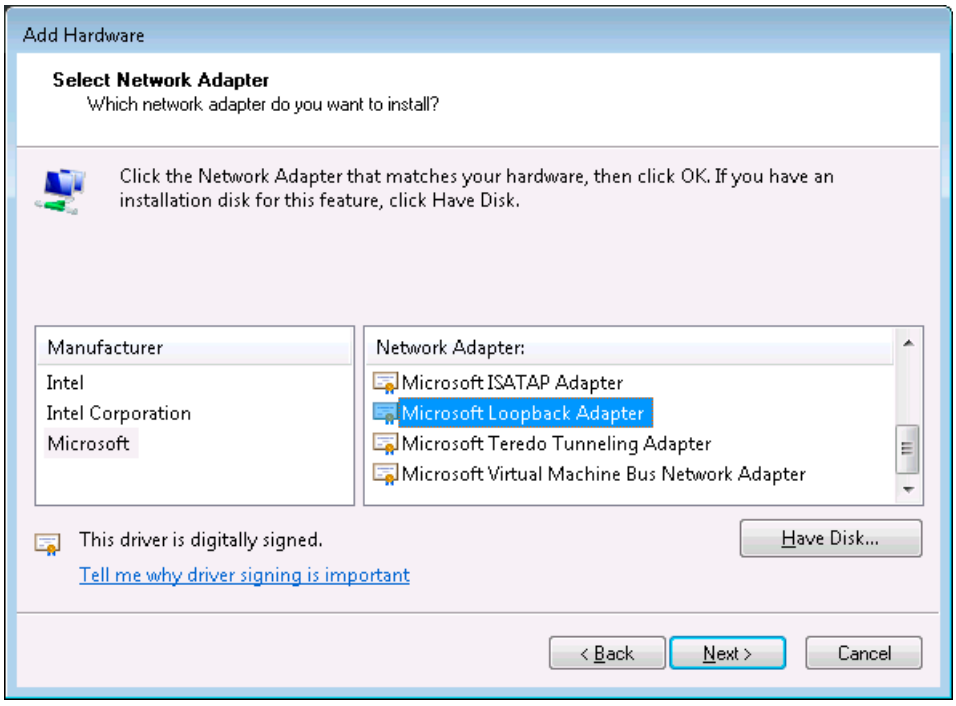


Figure 3-13 Add Hardware - Selecting the desired Network Adapter

7. The selected Network Adapter is shown in the following dialog box.
   Click **Next** to confirm and install.

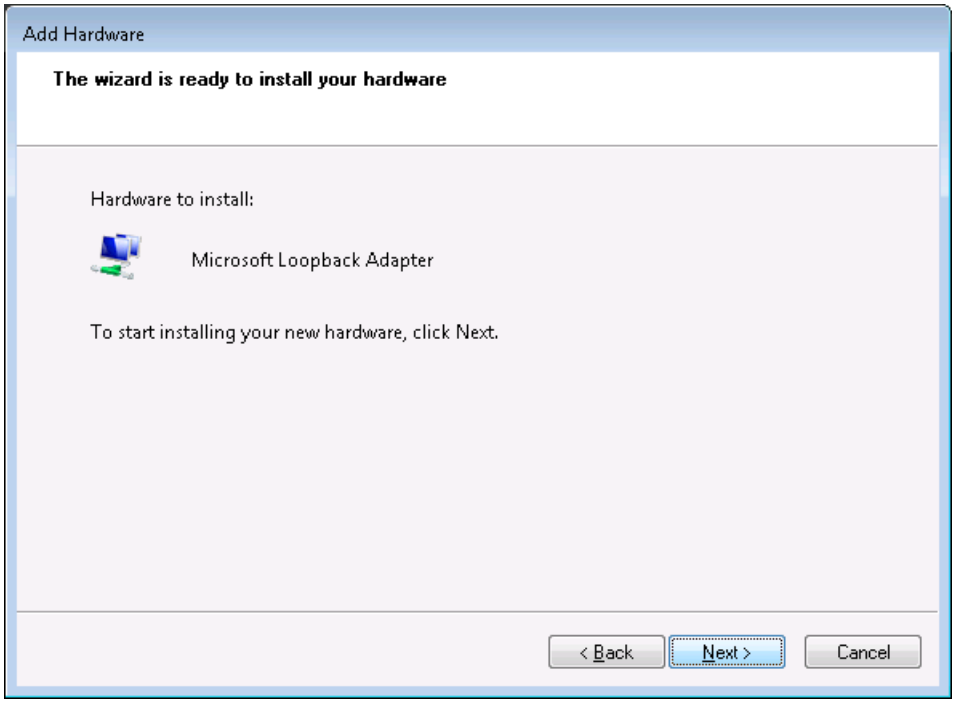


Figure 3-14 Add Hardware - Selected Network Adapter can be installed

8. After finishing the installation, the following dialog box is displayed.
   Exit the wizard with **Finish**.

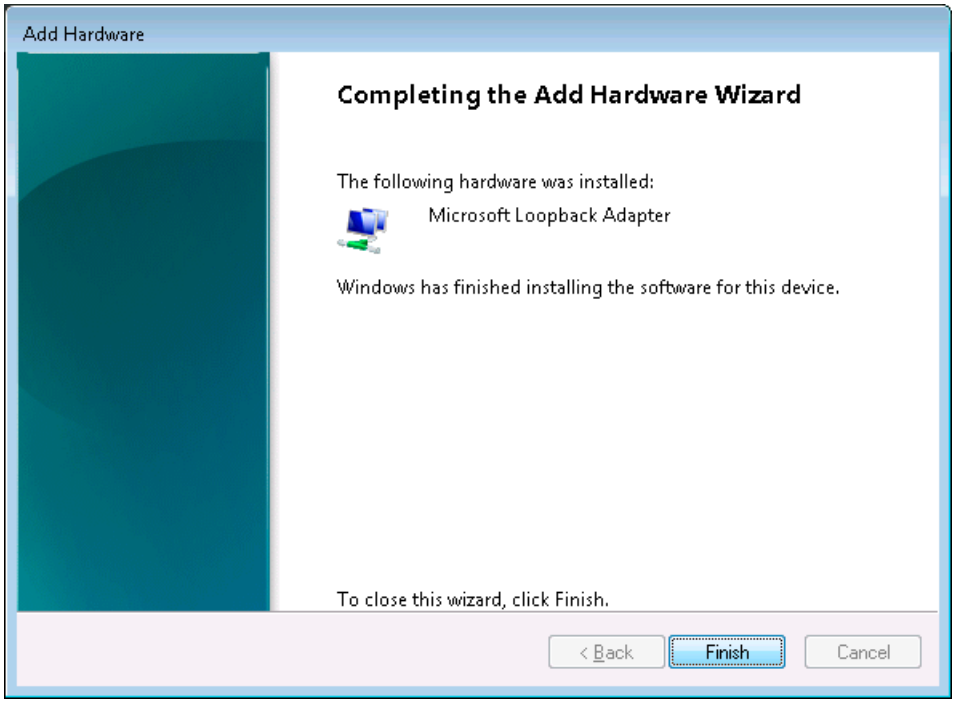


Figure 3-15 Add Hardware - Installation of the Microsoft Loopback Adapter is finished

Checking the installation of the network adapter

You can check the successful installation of the **Microsoft Loopback Adapters** in the

- Device Manager
- Internet connections

Device Manager

The Microsoft Loopback Adapter is displayed at **Network adapters** in the Device Manager.

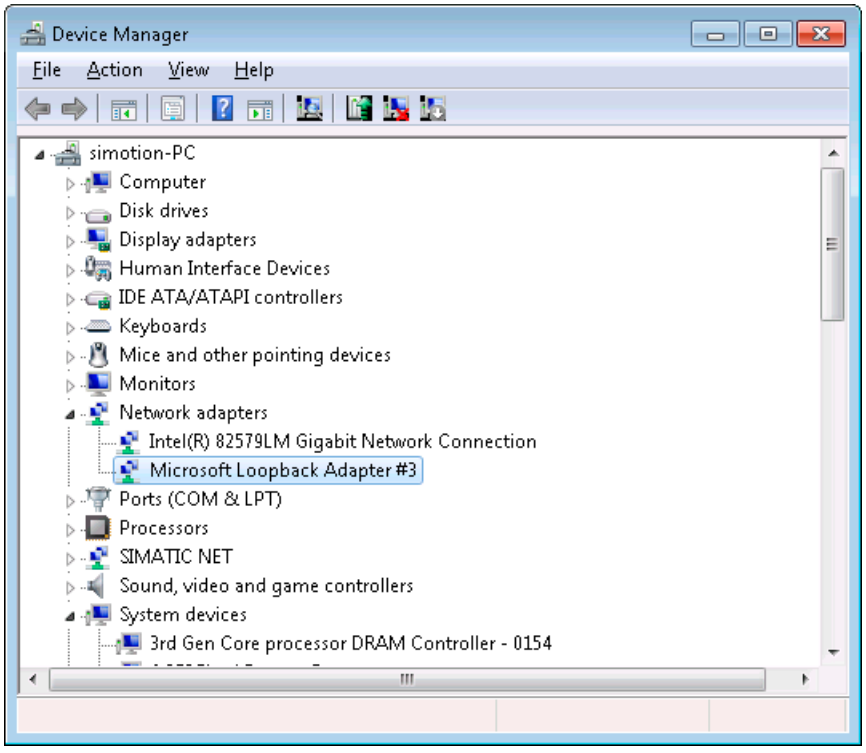


Figure 3-16 Device Manager - Microsoft loopback adapter

Network connections

The newly installed Microsoft Loopback Adapter is also displayed at **Network Connections**.

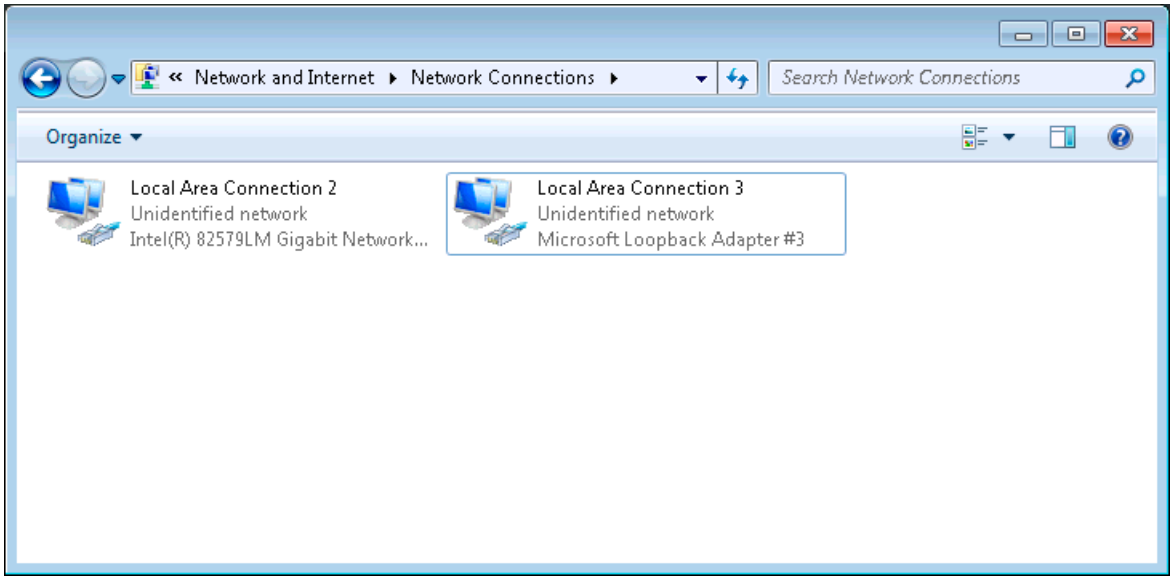


Figure 3-17 Network connections - Display of the newly installed Microsoft loopback adapter

Creating the network bridge

To activate the network bridge, proceed as follows:

1. Select both adapters at Network Connections
2. Select Bridge Connections via the context menu.

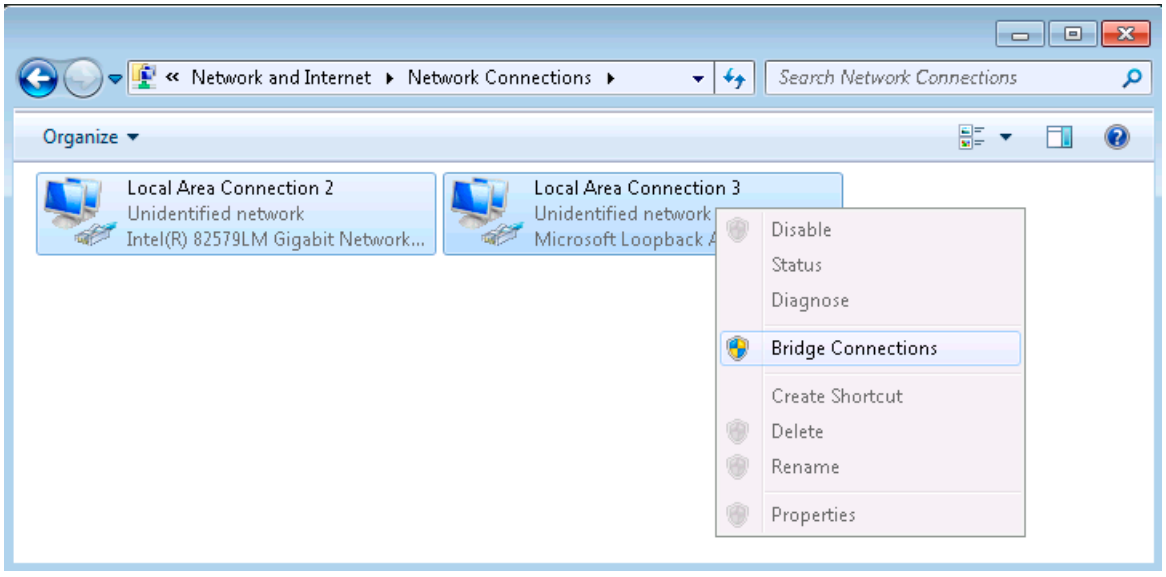


Figure 3-18 Network Connections - Setting the Bridge Connection

3. The Network Bridge MAC Bridge Miniport is displayed.

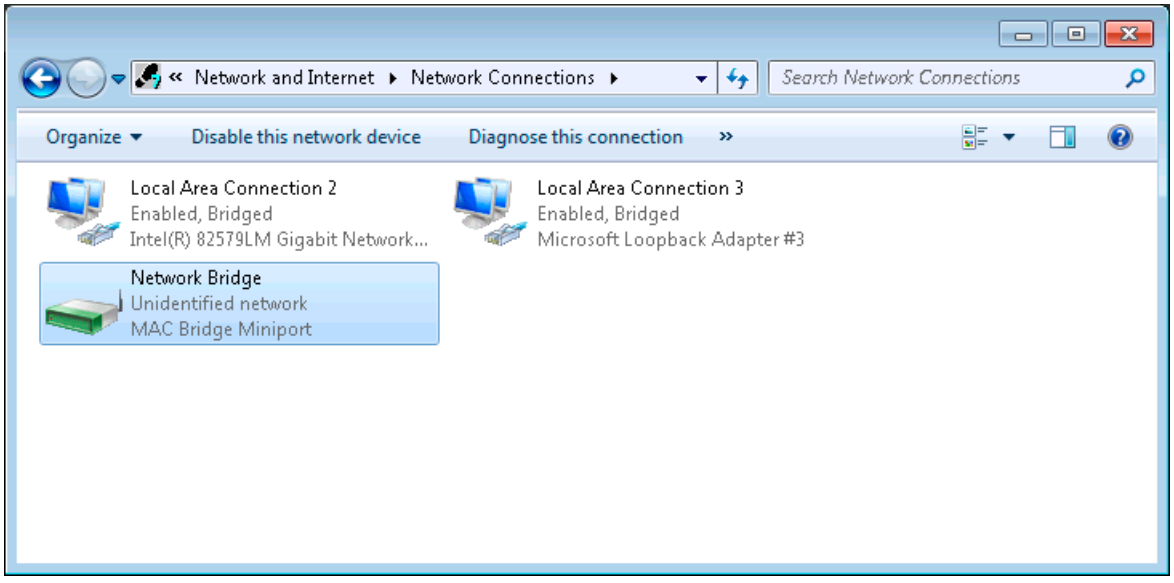


Figure 3-19 Network Connections - Display of the Network Bridge MAC Bridge Miniport

4. To initialize the network bridge, execute the **sp_bridge.cmd** Windows command script.
   The additional script can be found at C:\SiMotion\tools\sp_bridge.cmd
   After executing the batch file, the network bridge has been set up.

Setting "Set PG/PC interface"

Now open the PG/PC interface to complete the setting for the **Network Bridge** .

1. Open the **Set PG/PC Interface** dialog box via the **Control Panel** entry point.
2. Deactivate the **MAC Bridge Miniport DCP** checkbox in the **LLDP / DCP** tab.
   If you do not deactivate the MAC Bridge Miniport DCP, the SIMOTION P320-4 may not be found via Accessible nodes.

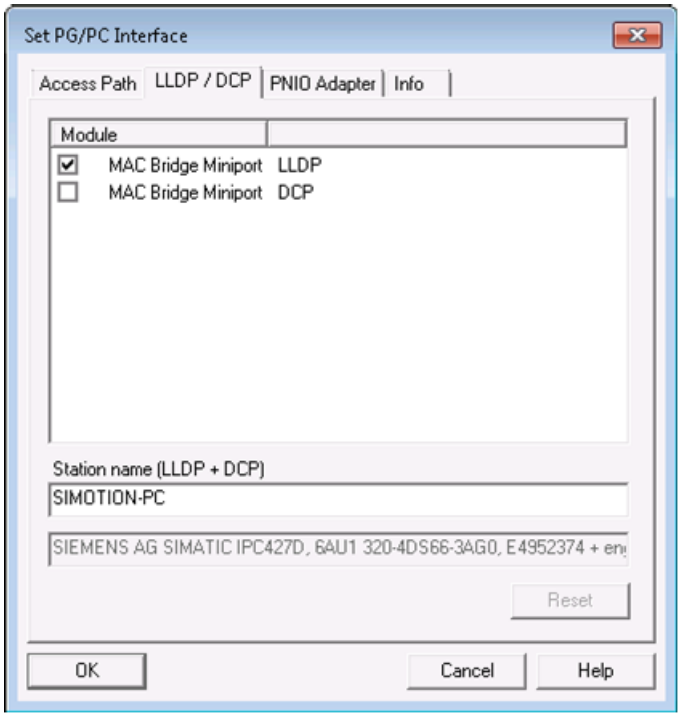


Figure 3-20 Set PG/PC interface

The settings for the network bridge have now been completed.

3.3.3 HMI or ES via PROFINET

Networking via PROFINET

PROFINET is the innovative and open Industrial Ethernet standard (EN 61158) for industrial automation. With PROFINET, devices can be linked up from the field level through to the management level.

With PROFINET, an external HMI or ES can also be integrated into the network and data can be exchanged directly with the SIMOTION P320-4 device.

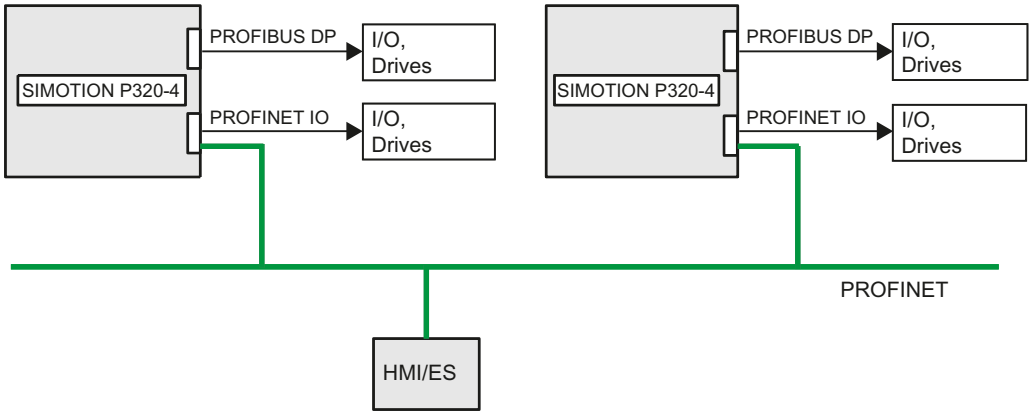


Figure 3-21 Model: Networking via PROFINET

References

You can find further information on the HMI in the documentation:

- SIMOTION Runtime Basic Functions, Section HMI (Human Machine Interface) coupling.
- SIMOTION SCOUT, Configuration Manual
- SIMOTION SCOUT TIA, Configuration Manual
- SIMOTION SCOUT TIA Device Proxy, Configuration Manual

3.3.4 HMI or ES via Ethernet

Networking via Ethernet

A complex interconnection with several HMIs or ESs is only possible using an Ethernet communication. This allows both an external HMI or ES to access several SIMOTION devices or one SIMOTION device to access another one, for example, to display the production data.

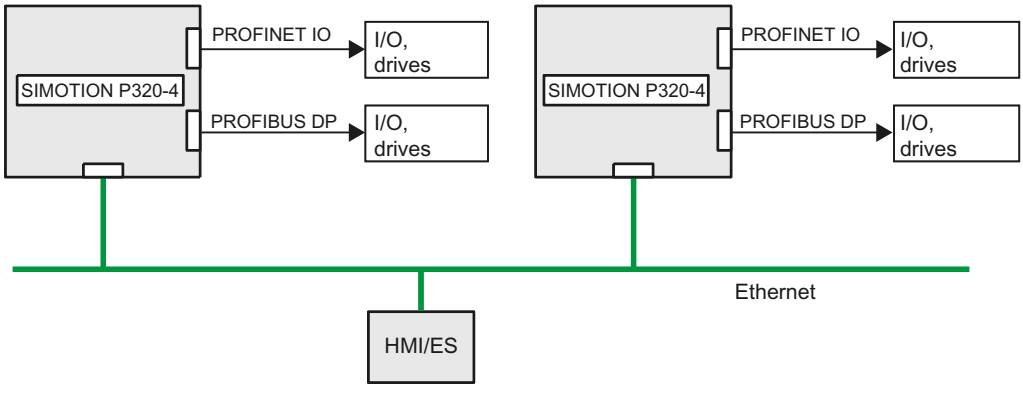


Figure 3-22 Model: Networking via Ethernet

The following services are possible on a SIMOTION device via Ethernet:

- HMI software
  WinCC flexible or the OPC server can use Ethernet to access one or more SIMOTION devices.
- SIMOTION SCOUT Engineering System
  SIMOTION SCOUT can also use Ethernet to access one or more SIMOTION devices.
- SIMOTION IT
  SIMOTION P320-4 offers communication with standard IT protocols (HTTP) over the integrated Ethernet interface.
  This makes it possible to access data or diagnostic information in the SIMOTION P320-4 from any location via intranet or the Internet.
- HTTP (browser, OPC XML)
  Setting in WebCFG.xml - default 80
- HTTPS (browser, OPC XML)
  Setting in WebCfg.xml - default 443
- FTP 21
- Telnet

Note

Information on the SIMOTION IT security concept

More detailed information on the SIMOTION IT security concept of HTTP/S, FTP and Telnet access on the Web server can be found in the following documentation:

- SIMOTION IT Diagnostics and Configuration, Diagnostics Manual, Section security concept

References

You can find further information in the documentation for SIMOTION IT:

- SIMOTION IT Diagnostics and Configuration
- SIMOTION IT Programming and Web Services
- SIMOTION IT Virtual Machine and Servlets

3.3.5 HMI or ES via IsoPROFIBUS (optional)

Networking via PROFIBUS DP

If you connect a central HMI via PROFIBUS DP, the X101 and X102 interfaces of the IsoPROFIBUS board are available.

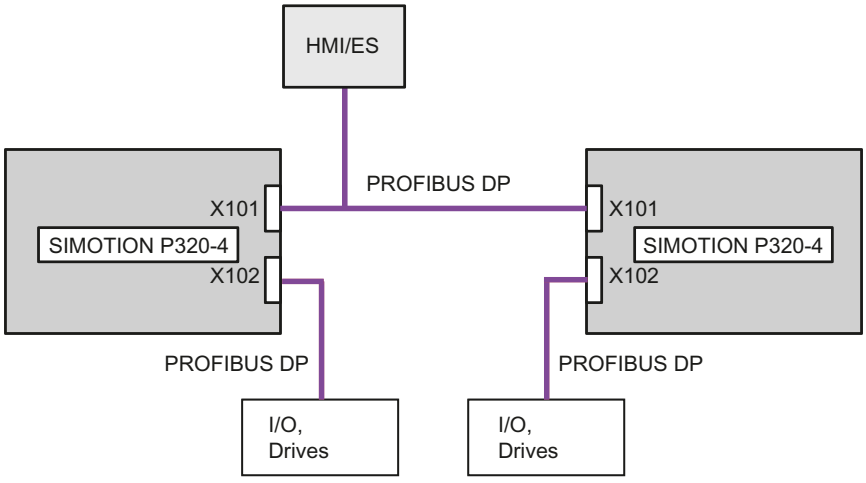


Figure 3-23 Model: Networking via PROFIBUS DP

References

You can find further information on the HMI in the documentation:

- SIMOTION Runtime Basic Functions, section HMI (Human Machine Interface) coupling.

Application planning

4

4.1 Unpacking and checking the delivery

Procedure

1. When accepting a delivery, please check the packaging for visible transport damage.
2. If any transport damage is present at the time of delivery, lodge a complaint at the shipping company in charge. Have the shipper confirm the transport damage immediately.
3. Unpack the device at its installation location.
4. Keep the **original packaging** in case you have to transport the device again.

   Note

   Damage to the device during transport and storage

   If a device is transported or stored without packaging, then shocks, vibrations, pressure and moisture may impact the unprotected device.
   A damaged packaging indicates that ambient conditions have already had a massive impact on the device.

   The device may be damaged.

   Do not dispose of the original packaging. Pack the device for transport and storage in the **original packaging**.

5. Check the contents of the packaging and any accessories you may have ordered for completeness and damage.

6. If the contents of the packaging are incomplete, damaged or do not match your order, inform the responsible delivery service **immediately**.

⚠ WARNING
Electric shock and fire hazard due to damaged device A damaged device can be under hazardous voltage and trigger a fire in the machine or plant. A damaged device has unpredictable properties and states. Death or serious injury could occur. Make sure that the damaged device is not inadvertently installed and put into operation. Label the damaged device and keep it locked away. Send off the device for immediate repair.

NOTICE
Damage from condensation If the device is subjected to low temperatures or extreme fluctuations in temperature during transportation, for example in cold weather, moisture could build up on or inside the HMI device. Moisture can result in short-circuits in electrical circuits and damage the device. In order to prevent damage to the device, proceed as follows: • Store the device in a dry place. • Bring the device to room temperature before starting it up. • Do not expose the device to direct heat radiation from a heating device. • If condensation develops, wait approximately 12 hours or until the device is completely dry before switching it on.

7. Please keep the enclosed documentation, it belongs to the device. You need the documentation when you commission the device for the first time.
8. Write down the identification data of the device.

4.2 Identification data of the device

Based on the identification data, the SIMOTION P320-4 device can be identified when service is required or in case of theft.

You also require the identification data in order to view further information on your SIMOTION P320-4 in the **Product Equipment Data** (PED) database.
All the important components of your SIMOTION P320-4 are stored in the PED. The entire history of the device is stored there, including the service reports.
To identify yourself in the PED database, enter the article number and the serial number of your device.

Link to the PED database

The Product Equipment Data database is available on the Internet via the following link (http://www.siemens.com/ped).

Identification data

Enter the identification data in the following table:

Identification data	Source	Value
Serial number	Rating plate	S VP ...
Article number of the device	Rating plate	6AU1320-...
Microsoft Windows Product Key Certificate of Authenticity (COA)	Rear of the device	Only devices with preinstalled Windows operating systems have COA labels
Ethernet address 1	BIOS setup, menu "Advanced", "Peripheral Configuration"	Input by the user.
PROFINET onboard MAC Address Layer 2		
PROFINET onboard MAC Address PROFINET		

SIMOTION P320-4 rating plate

Example of SIMOTION P320-4 S (standard)

You will find the following data on the rating plate of the SIMOTION P320-4:

- Device designation (here): SIMOTION P320-4 S
- Article number of the device (here): 6AU1320-4DS66-3AG0
- Serial number S VP<...>
  The computing unit is uniquely identifiable with the serial number at S VP <...>.
  <...> is an 8-digit character string.
- cULus Approval
- CE marking

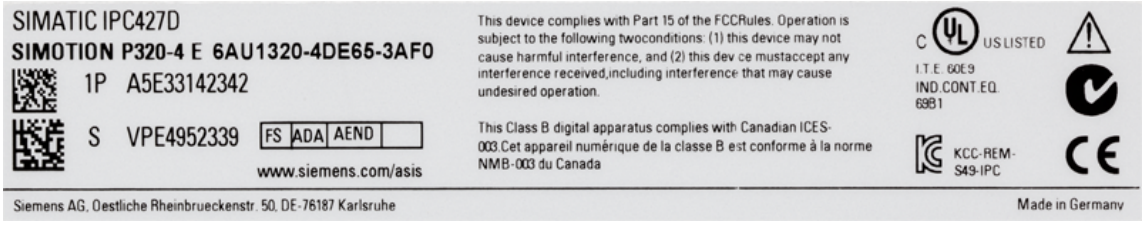


Figure 4-1 SIMOTION P320-4 rating plate

MAC addresses

Example of SIMOTION P320-4 S (standard)

In addition to the data that is found on the SIMOTION P320-4 rating plate, the MAC address plate also contains the **Onboard MAC addresses** for:

- ETHERNET (LAN) X1: VIPCTYSMAC1
- PROFINET (LAN) X3: VIPCTYSPROFINET

The data cited here is not real data.

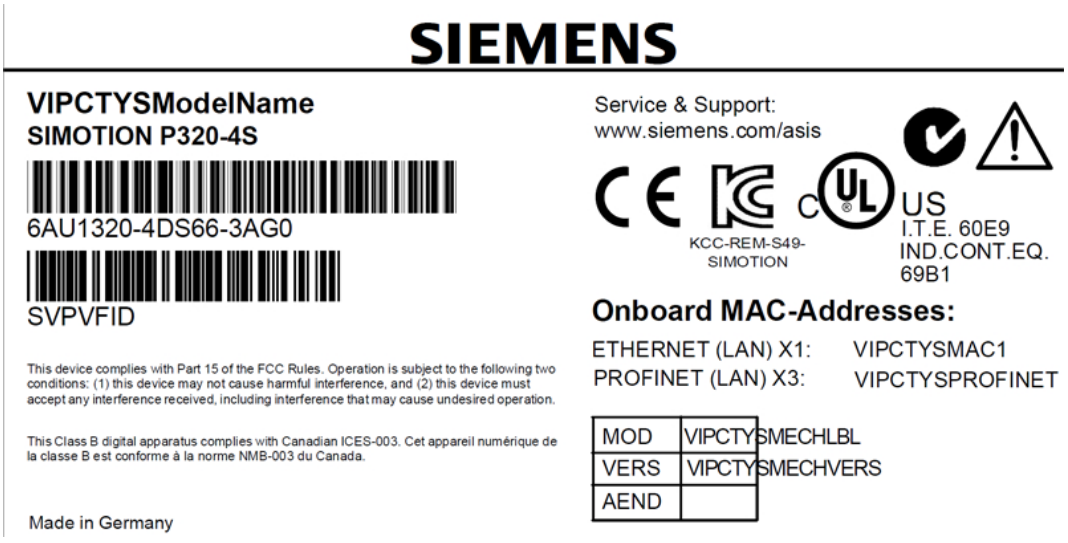


Figure 4-2 SIMOTION P320-4 S rating plate - MAC addresses

Example of a COA label

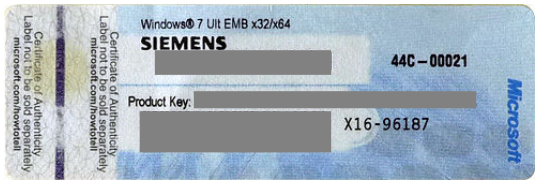
Microsoft Windows "Product Key" of the "Certificate of Authenticity" (COA):
The COA label is attached to the rear of all devices containing a Windows Embedded Standard 7 or Windows 7 operating system.

- COA label of a device with Windows Embedded Standard 7 32-bit operating system



Figure 4-3 ipc477d label coa 01

- COA label of a device with Windows 7 operating system



4.3 Permissible mounting positions

Information on the permissible mounting positions for the SIMOTION P320-4 can be found in the section Installation/mounting > Permissible mounting positions (Page 95).

4.4 Environmental conditions

Operating conditions

The SIMOTION P320-4 is designed for use in stationary, weather-protected locations.
The operating conditions exceed requirements according to EN 61131-2.

Observe the following points during installation:

- Note the climatic and mechanical environmental conditions specified in Section Technical specifications (Page 121).
- The device is designed for use in a normal industrial environment. Without additional protective measures (such as the provision of clean air), the SIMOTION P320-4 computing unit cannot be used in places with severe operating environments, for example, locations with corrosive vapors or gases.
- The clearance in the area of the ventilation slots must be at least 100 mm, so that the SIMOTION P320-4 receives sufficient ventilation.
- Do not cover the ventilation slots of the device.
- The DC power supply does not meet requirements according to EN 60950-1 in the area of the power unit connection. As such, SIMOTION P320-4 must be installed so that it is part of an operating area with restricted access (e.g. a locked control cabinet, console or server room).
- Always observe the mounting positions permitted for this device.
- The connected or installed I/O should not generate a reverse voltage greater than 0.5 V in the device.

⚠ WARNING

Invalidation of the approvals

Failure to adhere to these conditions when installing the system will invalidate approvals according to UL 60950-1, UL 508, and EN 60950-1!

Use prohibition

Without additional measures, the SIMOTION P320-4 should not be used in

- Locations with a high percentage of ionizing radiation
- Aggressive environments characterized, for example, by:
  - Dust accumulation
  - Corrosive vapors or gases
- at locations outside of the prescribed ambient conditions
- Installations requiring special monitoring such as:
  - Elevator installations
  - Electrical plants in particularly hazardous areas

An additional measure for using the SIMOTION P320-4 could be its installation in a cabinet.

Ambient conditions

For the mechanical and climatic environmental conditions, refer to the technical specifications in the section Ambient conditions (Page 124).

4.5 Electromagnetic compatibility

Definition

Standards for electromagnetic compatibility (EMC) are fulfilled if the EMC Installation Guideline is complied with.

See also:

Further information is provided in the Appendix, Section General regulations (Page 139).

Interfaces

5

5.1 Hardware components of the SIMOTION P320-4

Note

The article numbers of the components listed below can be obtained from the online catalog in the Siemens Industry Mall (http://www.siemens.com/industrymall).

SIMOTION P320-4 complete system

The SIMOTION P320-4 device is supplied with the integrated PROFINET onboard communication module.

An additional IsoPROFIBUS board can be inserted as required.

SIMOTION P320-4 spare parts

The SIMOTION P320-4 consists of the following hardware components:

- **SIMOTION P320-4** computing unit
- **Back-up battery** for the motherboard of the SIMOTION P320-4
- IsoPROFIBUS board (optional communication module for the SIMOTION P320-4)

Operation and display

The following hardware components for operation and display can be used:

- SIMATIC Industrial Flat Panel, in the variants IFP1500, IFP1900 or IFP2200.

Power supply of the SIMOTION P320-4

The power supply must satisfy the requirements as described in section Connecting the power supply (24 VDC) (Page 109). This can be ensured by using the following devices, for example:

- SITOP smart 24 V / 10 A
- 24 VDC UPS (optional)

Drives and I/O modules

The drives and I/O modules released for use with SIMOTION are specified on the website: www.siemens.com/simotion (www.siemens.com/simotion)

Note

Please note that not all modules of the I/O or I/O systems mentioned are approved for SIMOTION. Moreover, system-related functional differences can occur when these I/O or I/O systems are used on SIMOTION rather than SIMATIC. For example, special process-control functions (hot swapping, etc.) are not supported by SIMOTION for the ET 200M distributed I/O system.

A detailed and routinely updated list of I/O modules released for SIMOTION as well as instructions on their use is provided on the Internet at Siemens Product Support (https://support.industry.siemens.com/cs/ww/en/view/11886029).

In addition to the I/O modules approved for SIMOTION, all certified standard slaves can, in principle, be connected to SIMOTION provided that they support the following data traffic:

- Cyclic data traffic (DP V0)
- Acyclic data traffic (DP V1)
- Isochronous data traffic (DP V2)

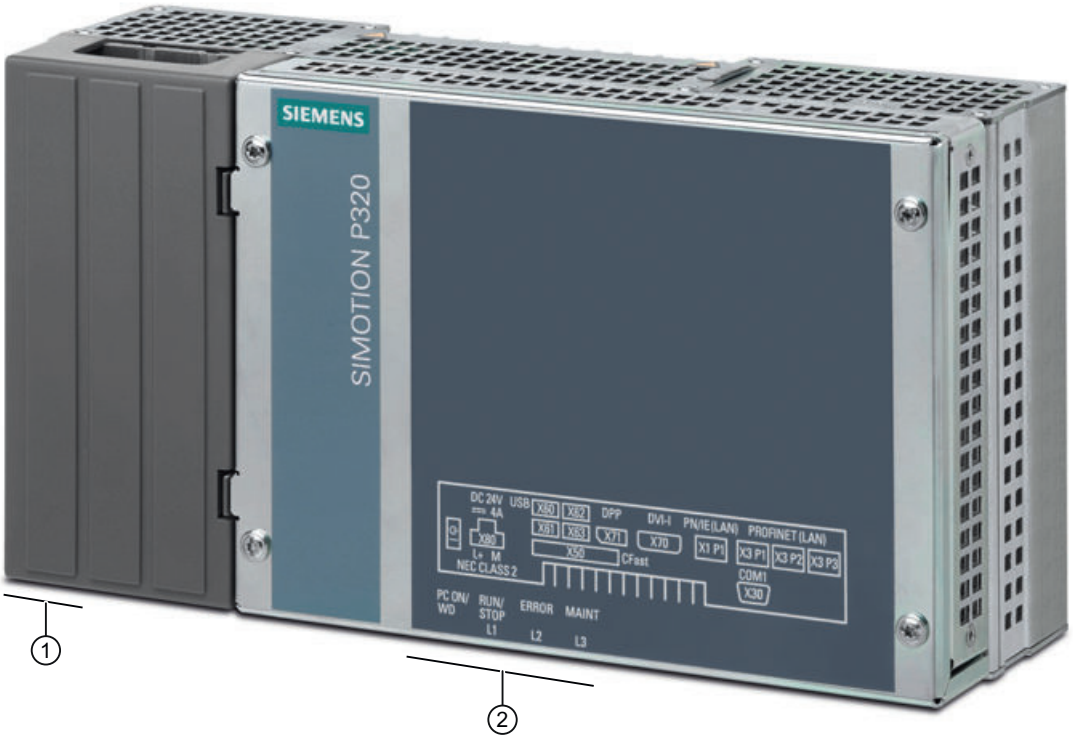
These modules are integrated via the GSD file of the device's manufacturer.

Note

Please note that in individual cases, additional boundary conditions must be fulfilled in order to integrate a standard slave into SIMOTION.

5.2 Overview of operator control and display elements

The following figure shows the arrangement of the indication and control elements of the SIMOTION P320-4.



① On/Off switch
② Operating displays (LEDs)

Figure 5-1 SIMOTION P320-4 control and display elements

5.3 Control elements

On/Off switch



① **Requirement**:
The BIOS setup entry **After Power Failure** is set to **Power on**.
The On/Off switch is used to switch the SIMOTION P320-4 on.

Figure 5-2 SIMOTION P320-4 - operator controls

⚠ WARNING

De-energize the SIMOTION P320-4!

The On/Off switch does not disconnect the device from the power supply system.
When the switch is in position **0** (Off), the device is still supplied with mains voltage.

To remove power from the device, the power supply plug must be removed.

NOTICE

Close down the operating system first

First close down the operating system before switching off the device with the on/off switch, otherwise data may get lost.

5.4 Status displays

The status indicators below the interfaces are described in the following table.

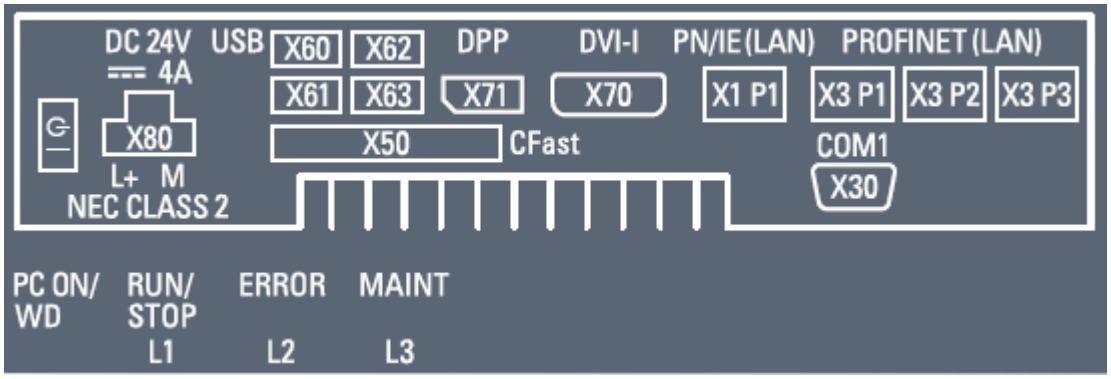


Figure 5-3 SIMOTION P320-4 status indicator

LED	Meaning	State	Description
PC ON/ WD	Power supply	Green	BIOS ready to boot. Indicates the correct supply voltage of 3.3 V, 5 V and 12 V from the integrated power unit.
		Off	Not relevant.
		Green/yellow flash-ing (1 Hz)	BIOS in POST, power switch on.
		Yellow	Idle state
RUN/STOP or L1	RUN STOP	Off	SIMOTION P Runtime is not running.
		Green	SIMOTION P320-4 in RUN.
		Yellow	SIMOTION P320-4 in STOP.
		Green/yellow: Flashes quickly (2 Hz)	DCP flashing
		Yellow: Flashes quickly (5 Hz)	FAULT state (only in combination with L2 and L3)

LED	Meaning	State	Description
ERROR or L2 (SF PROFINET LED)	-	Off	SIMOTION P320-4 is working error-free.
	Error	Red: Continuous light	Bus error at the PROFINET interface.
		Red: Flashes quickly (2 Hz)	Erroneous configuration.
		Red: Flashes quickly (5 Hz)	FAULT state (only in combination with L1 und L3)
	INIT	Red: Flashes slowly (0.5 Hz)	During the INIT process, the SF PROFINET LED is controlled by the boot loader. The precise flashing behavior therefore cannot be determined and displayed. In the INIT state, 0.5 Hz flashing is displayed in the SIMOTION P State. If no project has yet been loaded, 0.5 Hz flashing is also displayed for the INIT, which, in this case, is also retained in the Running state.
MAINT or L3 (SF LED)	-	Off	SIMOTION P320-4 works error-free.
	Error	Red	An event has occurred which needs to be acknowledged (alarm, message, notification). (See Diagnostics Guide)
		Red: Flashes slowly (0.5 Hz)	License missing for licensed technology objects. Carry out the licensing to correct the error. Further information on the licensing can be found in the SIMOTION P320-4 E / SIMOTION P320-4 S Commissioning and Hardware Installation Manual.
		Red: Flashes quickly (5 Hz)	FAULT state (only in combination with L1 and L2) A fault has occurred to which the user program cannot respond. The following actions may be required to rectify the fault: • Power OFF/ON • Recommissioning

5.5 Overview of the SIMOTION P320-4 interfaces

The following table provides an overview of the SIMOTION P320-4 interfaces.

Table 5-1 Overview of the interfaces

Interface	Description	Further information
PROFINET	Three PROFINET ports with RJ45 socket	PROFINET onboard interface (Page 87)
Ethernet	1 x 8-pole RJ45 interface	Ethernet RJ45 interface (Page 88)
DVI-I	26-pin socket for connection of a CRT or LCD monitor with DVI interface or VGA with DVI/VGA adapter	DVI-I interface (Page 88)

Interface	Description	Further information
Display port	20-pole DPP interface	Display port interface (Page 90)
USB 3.0	Lower USB channel 0, upper USB channel 1 Lower USB channel 2, upper USB channel 3	USB 3.0 interface (Page 90)
CFast card	Slot for CFast card 50-pin CF socket, types I/II	CFast card (Page 91)
COM1	Serial interface *V.24*	Serial interface COM1 (Page 92)
IsoPROFIBUS board (optional)	2 x 9-pin socket	IsoPROFIBUS board (optional) (Page 92)

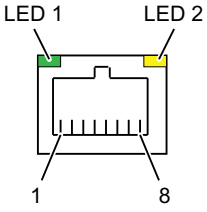
5.6 PROFINET onboard

Interface assignment

Designation: PROFINET LAN, X3, 3 ports: P1, P2, P3

Type: 8-pin RJ45 socket

PROFINET onboard LAN (X3) interface



Pin no.	Short description	Meaning	Input/output
1	RD+	Receive data [2]	Input
2	RD-	Receive data [2]	Input
3	TD+	Send data [2]	Output
4, 5 [1]	SYMR	Internal 75 Ohm terminating resistor	-
6	TD-	Receive data [2]	Output
7, 8 [1]	SYMT-	Internal 75 Ohm terminating resistor	-
S	-	Shield	-
-	LED 1	Lights up green: Link	-
-	LED 2	Lights up yellow: Activity	-

[1] Optional product feature

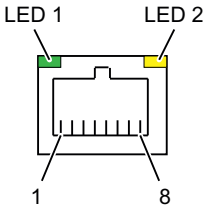
[2] Autonegotiation and autocrossover are supported.

5.7 Ethernet

Interface assignment

Designation: PN/IND. Ethernet (LAN), X1

Type: 8-pin RJ45 socket

Ethernet RJ45 interface			
			
Pin no.	**Short description**	**Meaning**	**Input/output**
1	BI_DA+	Bi-directional data A+	Input/output
2	BI_DA-	Bi-directional data A-	Input/output
3	BI_DB+	Bi-directional data B+	Input/output
4	BI_DC+	Bi-directional data C+	Input/output
5	BI_DC-	Bi-directional data C-	Input/output
6	BI_DB-	Bi-directional data B-	Input/output
7	BI_DD+	Bi-directional data D+	Input/output
8	BI_DD-	Bi-directional data D-	Input/output
S	–	Shield	–
	LED 1	Off: 10 Mbps Green light: 100 Mbps Orange light: 1000 Mbps	–
	LED 2	Lit: Active connection, e.g., to a hub Flashing: Activity	–

Note

The interfaces available on the device have been numbered for unique identification.

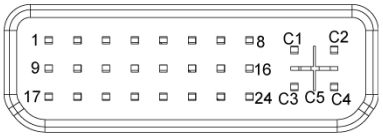
This numbering may deviate, however, from the numbering assigned by the operating system.

5.8 DVI-I

Interface assignment

Designation: DVI/VGA, X70

Type: 26-pin socket

DVI-I interface (standard socket)			
			
Pin no.	**Short description**	**Meaning**	**Input/output**

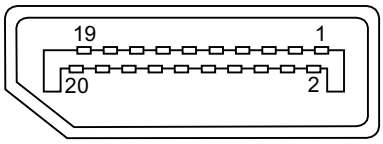
DVI-I interface (standard socket)			
1	TMDS Data2-	DVI data channel	Output
2	TMDS Data2+	DVI data channel	Output
3	TMDS Data2/4 shield	Cable shield	-
4	NC	-	-
5	NC	-	-
6	DDC clock (SCL)	Display Data Channel – Clock	Input/output
7	DDC data (SDA)	Display Data Channel – Data	Input/output
8	Analog vertical sync (VSYNC)	Analog Vertical Sync Signal	Output
9	TMDS Data1-	DVI data channel	Output
10	TMDS Data1+	DVI data channel	Output
11	TMDS Data1/3 shield	Cable shield	-
12	NC	-	-
13	NC	-	-
14	+5 V power (VCC)	+5 V power for DCC	Output
15	Ground (return for +5 V, Hsync and Vsync) (GND)	Analog ground	-
16	Hot Plug Detect	-	-
17	TMDS data 0-	DVI data channel	Output
18	TMDS data 0+	DVI data channel	Output
19	TMDS Data0/5 shield	Cable shield	-
20	NC	-	-
21	NC	-	-
22	TMDS clock shield	Cable shield	-
23	TMDS clock+	DVI clock channel	Output
24	TMDS clock-	DVI clock channel	Output
C1	Analog red (R)	Analog red signal	Output
C2	Analog green (G)	Analog green signal	Output
C3	Analog blue (B)	Analog blue signal	Output
C4	Analog horizontal sync (HSYNC)	Analog horizontal sSync signal	Output
C5	Analog ground (analog R, G, & return) (GND)	Analog ground	-

5.9 DisplayPort

Interface assignment

Designation: Display port interface, X71

Type: 20-pole DPP interface

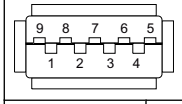
Display port interface			
			
Pin no.	**Short designation**	**Meaning**	**Input/output**
1	ML_Lane0+	DP data 0+	Output
2	GND	Ground	-
3	ML_Lane0-	DP data 0-	Output
4	ML_Lane1+	DP data 1+	Output
5	GND	Ground	-
6	ML_Lane1-	DP data 1-	Output
7	ML_Lane2+	DP data 2+	Output
8	GND	Ground	-
9	ML_Lane2-	DP data 2-	Output
10	ML_Lane3+	DP data 3+	Output
11	GND	Ground	-
12	ML_Lane3-	DP data 3-	Output
13	CONFIG1 CAD	Cable Adapter Detect	Input
14	CONFIG2	Ground (PullDown)	-
15	AUX_CH+	Auxiliary channel+	Bidirectional
16	GND	Ground	-
17	AUX_CH-	Auxiliary channel-	Bidirectional
18	HPD	Hot Plug Detect	Input
19	GND	Ground	-
20	DP_PWR	+3.3V (fused)	Output

5.10 USB 3.0

Interface assignment

Designation: USB X62, X61, X62, X63

Type: 9-channel *high current*

USB 3.0 interface			
			
Pin no.	**Short designation**	**Meaning**	**Input/output**
1	VBUS	+ 5 V (fused)	Output
2	D-	Data line	Input/output

USB 3.0 interface			
3	D+	Data line	Input/output
4	GND	Ground	–
5	RX-	Data line	Input
6	RX+	Data line	Input
7	GND	Ground	–
8	TX-	Data line	Output
9	TX+	Data line	Output

5.11 CFast card

Pin assignment of the interface

Designation: CFast X50

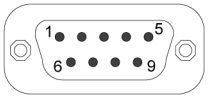
Pin no.	Short designation	Meaning
S1	SGND	Signal GND (ground for signal integrity)
S2	A+	SATA differential
S3	A-	SATA differential
S4	SGND	Signal GND (ground for signal integrity)
S5	B-	SATA differential
S6	B+	SATA differential
S7	SGND	Signal GND (ground for signal integrity)
PC1	CDI	Card Detect Out
PC2	GND	Device GND
PC3	TBD	TBD (not connected)
PC4	TBD	TBD (not connected)
PC5	TBD	TBD (not connected)
PC6	TBD	TBD (not connected)
PC7	GND	Device GND
PC8	LED1	LED Output (not connected)
PC9	LED2	LED Output (not connected)
PC10	IO1	Reserved Input/Output (not connected)
PC11	IO2	Reserved Input/Output (not connected)
PC12	IO3	Reserved Input/Output (not connected)
PC13	PWR	Device Power (3.3V)
PC14	PWR	Device Power (3.3V)
PC15	GND	Device GND
PC16	GND	Device GND
PC17	CDO	Card Detect In

5.12 COM1

Interface assignment

Designation: COM1, X30

Type: 9-pin (connector)

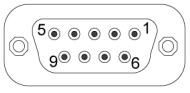
Serial interface COM1			
			
Pin no.	**Short designation**	**Meaning**	**Input/output**
1	DCD	Data carrier detect	Input
2	RxD	Receive data	Input
3	TxD	Transmit data	Output
4	DTR	Data terminal ready	Output
5	GND	Ground	-
6	DSR	Data set ready	Input
7	RTS	Request to send	Output
8	CTS	Clear to send	Input
9	RI	Incoming call	Input

5.13 IsoPROFIBUS board (optional)

Interface assignment

Designation: PROFIBUS, X101, X102

Type: 9-pin (socket)

PROFIBUS interface		
		
Pin no.	**Short designation**	**Meaning**
1-2	NC	Not connected
3	LTG_B	Data line (I/O)
4	RTS_AS	AS request to send (O)
5	GND	Ground electrically isolated
6	P5V_dp_fused	+5 V / max. 90 mA (fused) electrically isolated
7	NC	Not connected
8	LTG_A	Data line (I/O)
9	RTS_PG	PG request to send (O)

Installation/mounting

6

6.1 Installing the device

SIMOTION P320-4 is particularly suitable for installation in consoles, control cabinets and switchboards.

⚠ WARNING

Perform function test while installing the device in machines or plants

Following the results of a risk analysis, additional protection equipment on the machine or the system is necessary to avoid endangering persons. With this, especially the programming, configuration and wiring of the inserted I/O modules have to be executed, in accordance with the necessary risk analysis identified safety performance (SIL, PL or Cat.). The intended use of the device has to be secured.

The correct use of the device has to be verified with a function test on the system. This test can detect programming, configuration and wiring errors. The test results have to be documented and if necessary inserted into the relevant inputs.

6.2 Permissible mounting positions

Note

The SIMOTION P320-4 is approved for operation in closed rooms only.

Ensure the required minimum clearance to other components or enclosure panels:

- Below at least 100 mm
- Above at least 50 mm

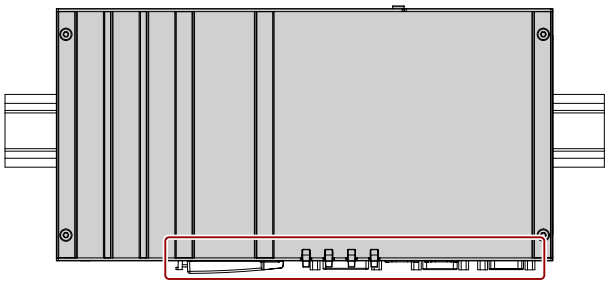
The permissible mounting positions for the SIMOTION P320-4 are standard rail mounting and vertical mounting.

Standard rail mounting

Horizontal mounting is the preferred position.

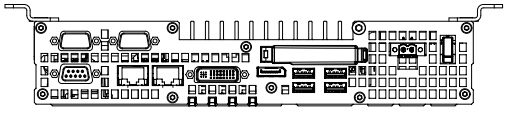
The following horizontal mounting option is permitted:

The interfaces are at the bottom.



The figure shows the interfaces on the front for representation purposes only.

For rail mounting, the interfaces always point downward.

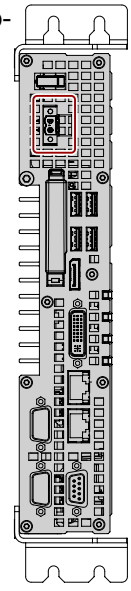


You can find mounting information under Standard rail mounting (Page 97).

Vertical mounting

The following vertical mounting option is permitted:

The interfaces are at the front. The power supply connection is at the top.



You can find information on mounting under Vertical mounting (Page 98).

Ambient conditions

Observe the permissible temperature range for operation in the respective mounting position as described in Section "Technical data > Ambient conditions (Page 124)".

6.2.1 Standard rail mounting and vertical mounting

6.2.1.1 Standard rail mounting

Requirement

- Standard mounting rail, 35 mm standard profile
  The standard mounting rail is installed at the installation site.
- The standard mounting rail clip is attached to the SIMOTION P320-4.

Note

Ensure that the wall or ceiling can hold four times the total weight of the SIMOTION P320-4 including the standard mounting rail and additional expansion cards. See section Notes on installation (Page 99).

Mounting the standard mounting rail clip

Before you can install the device on a standard mounting rail, you will need to attach the standard mounting rail clip included in the scope of delivery.

The fasteners and screws required are supplied with the device for mounting depending on the order number.

Requirement

- 1 standard mounting rail clip
- 2 screws
- 1 T20 screwdriver

Use the two screws to mount the standard mounting rail clip on the SIMOTION P320-4 enclosure.

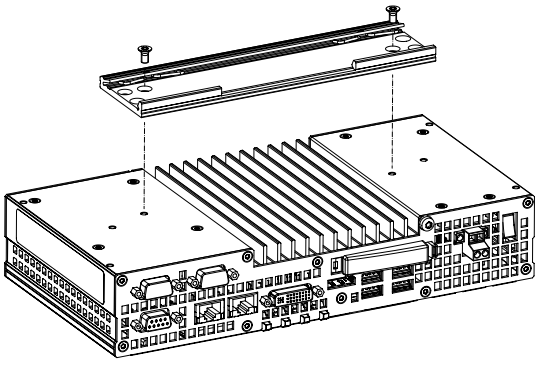
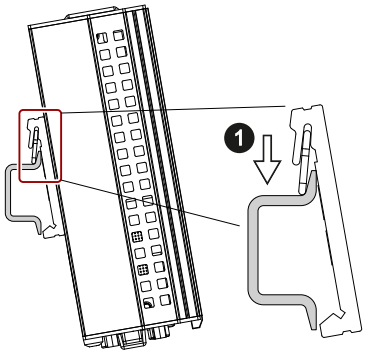


Figure 6-1 Mounting the standard mounting rail clip

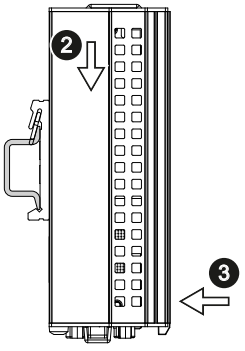
Mounting

1. Place the SIMOTION P320-4 and rail clip on the upper edge of the standard profile rail at the position shown.



2. Press the SIMOTION P320-4 slightly downward.
3. Once the rail clip slides over the bottom edge of the standard mounting rail, push the device onto the rail.

   Ensure that you hear the SIMOTION P320-4 snapping into place.



Note

To ensure secure vertical mounting on standard mounting rails, install a standard rail ground terminal beneath the device.

Removing

1. Press the SIMOTION P320-4 down until the rail clip releases the device.
2. Swing the SIMOTION P320-4 away from the standard mounting rail.
3. Lift the device up and off.

6.2.1.2 Vertical mounting

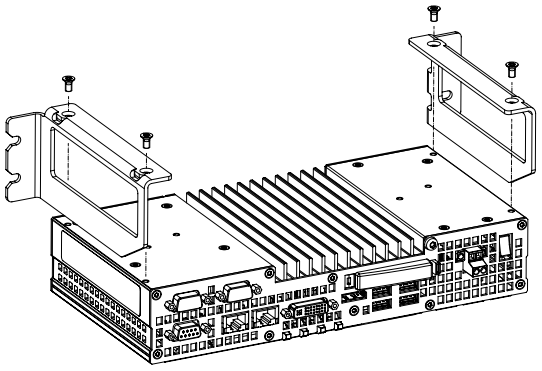
The fasteners and screws required are supplied with the device for the selected mounting option.

Requirement

- 2 mounting brackets
- 4 screws
- 1 T20 screwdriver

Procedure

1. Secure each mounting bracket with two screws.



6.3 Installation notes

Note the following:

- The SIMOTION P320-4 is approved for operation in closed rooms only.
- For installation in a control cabinet, observe the SIMATIC installation guidelines and applicable DIN/VDE requirements or other applicable country-specific regulations.
- When the device is used in the area of Industrial Control Equipment according to UL508, note that the device is classified as "Open Type". The installation of the device in a housing according to UL508 is therefore a mandatory requirement for approval or operation in according to UL508.

Securely fastening the SIMOTION P320-4

NOTICE
Insufficient load carrying capacity If the wall it is mounted on does not have a sufficient load-bearing capacity, the device may fall and be damaged. Ensure that the mounting surface on the wall can bear four times the total weight of the device, including fixing elements.

NOTICE
Incorrect fixing elements The device may not be securely fitted if you use dowels and screws other than those specified below for mounting. The device can fall and may be damaged. Use only the dowels and screws specified in the following table.

Connecting elements

The connecting elements for each mounting position are listed in the following:

- Standard rail mounting

Material	Bore diameter	Fastener
Metal, min. 2 mm thickness	5 mm	• 2 x M4 screws • 2 x M4 nuts
Concrete	6 mm, 40 mm depth	• 4 x dowels, ∅ 6 mm, 40 mm length • 4 x screws, ∅ 4 mm, 40 mm length
Plasterboard, min. 13 mm thickness	14 mm	4 x toggle bolts, ∅ 4 mm, 50 mm length

- Vertical mounting

Material	Bore diameter	Fastener
Concrete	6 mm, 40 mm depth	• 4 x dowels, ∅ 6 mm, 40 mm length • 4 x screws, ∅ 4 mm, 40 mm length
	8 mm, 40 mm depth	• Dowel, ∅ 8 mm, 40 mm length • Screw, ∅ 5 mm, 40 mm length
Plasterboard, min. 13 mm thickness	14 mm	Toggle bolt, ∅ 4 mm, 50 mm length

Mounting positions

The following mounting positions are permitted for the SIMOTION P320-4 and are described in detail in the following sections:

- Standard rail mounting (Page 95)
- Vertical mounting (Page 96)

6.4 Overview of operating modes for the SIMOTION P320-4

Overview

The following operating modes are available for mounting the SIMOTION P320-4.

The operating modes are:

- Decentralized structure
  The SIMOTION P320-4 is mounted separately from a panel in a decentralized structure.
- Headless operation
  The SIMOTION P320-4 is operated without panel.

Before mounting, the following must be noted:

Before you mount the SIMOTION P320-4 in a control cabinet or a rack, optional components are installed to expand the SIMOTION P320-4.

Example: installation of the optional IsoPROFIBUS board.

To do this, open the device and note the following procedure:

1. Open the cover of the SIMOTION P320-4.
2. Insert the optional IsoPROFIBUS board.
3. Plug in the SYNC I/O cable for synchronizing with PROFINET.
4. Close the cover.
5. Mount the SIMOTION P320-4.

Note

The installation and removal of components as well as the mounting of the SIMOTION P320-4 are described in detail in the SIMOTION P320-4 E / P320-4 S Commissioning and Hardware Installation Manual.

NOTICE
Avoid loss of warranty If you install or exchange system expansions and damage your device, the warranty becomes void.

6.5 Decentralized structure

Overview

The decentralized structure provides greater flexibility in terms of location and enables the SIMOTION P320-4 to be positioned in non-critical areas of the plant (e.g. control cabinet).

The decentralized structure of a panel with the SIMOTION P320-4 can be performed via the display port, USB or DVI connection. Please note the cable lengths that are supported for the panel.

For the use of an HMI system, the SIMATIC IFP, for example, can be connected by means of the described interfaces.

Connection

7

7.1 Requirements

General information

During the configuration of SIMOTION modules, you must pay attention to the "Electrical configuration design".

The following section provides information on wiring and networking the complete SIMOTION system.

Further information about the connection of the complete system and the individual components can be found in the SIMOTION P320-4 E / P320-4 S Commissioning and Hardware Installation Manual.

Open equipment

These modules are open equipment. This means they may only be installed in housings, cabinets, or in electrical equipment rooms that can only be entered or accessed with a key or tool. Housings, cabinets, or electrical equipment rooms may only be accessed by trained or authorized personnel. An external fire-protection housing is required.

Observe the following points during installation:

- The device should be connected only to **24 VDC** power supply networks that meet the requirements of **safety extra-low voltage** (**SELV**). The cable cross-section must be chosen large enough to ensure that no damage can result from cable overheating in the event of a short-circuit in the SIMOTION P320-4.
- Avoid extreme ambient conditions.
- Protect the device against dust, moisture, heat and severe vibration.
- Do not subject the SIMOTION P320-4 to direct sunlight.
- Install the device in such a way that it poses no danger, for example, by falling over.
- The clearance around the SIMOTION P320-4 must be at least 100 mm to ensure adequate ventilation.
- Do not cover the ventilation slots.

7.2 Overview of connections

The connection overview shows the SIMOTION P320-4 interfaces to which the appropriate I/O devices can be connected.

Note

The cabling for all elements and components of the complete system can only be carried out when disconnected from the mains.

It does not matter in which order connection takes place.

The connection of the individual components in the SIMOTION P320-4 E / P320-4 S Commissioning and Hardware Installation Manual.

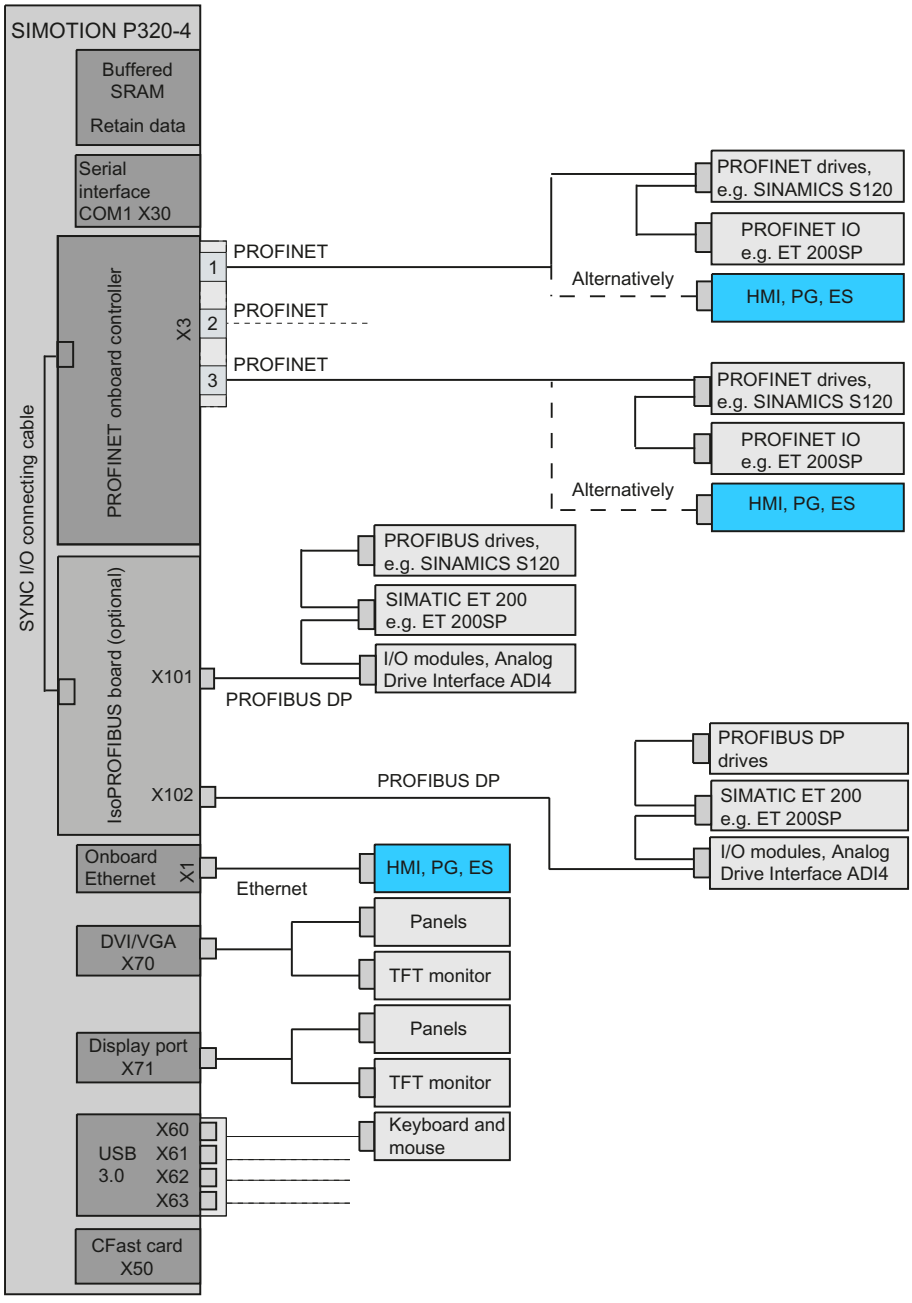


Figure 7-1 Hardware system overview - example with PROFINET onboard and optional IsoPROFIBUS board

7.3 Notes on connecting

⚠ WARNING

Risk of fire and electric shock

The On/Off switch does not isolate the device from the power supply. Risk of electric shock if the device is opened incorrectly or defective. There is also a risk of fire if the device or connecting lines are damaged.

You should therefore protect the device as follows:

- Always pull out the power plug when you are not using the device or if the device is defective. The power plug must be freely accessible.
- Connect the device to a protective conductor as instructed, see Section "Connecting the protective conductor".
- Use a central isolating switch in the case of cabinet installation.

⚠ WARNING

Risk of lightning strikes

A lightning strike may enter the mains cables and data transmission cables and reach to a person.

Death, serious injury and burns can be caused by lightning.

Take the following precautions:

- Disconnect the device from the power supply in good time when a thunderstorm is approaching.
- Do not touch mains cables and data transmission cables during a thunderstorm.
- Keep a sufficient distance from electric cables, distributors, systems, etc.

NOTICE

Fault caused by I/O devices

The connection of I/O devices can cause faults in the device.

The result may be personal injury and damage to the machine or plant.

Note the following when connecting I/O devices:

- Read the documentation of the I/O devices. Follow all instructions in the documentation.
- Only connect I/O devices which are approved for industrial applications in accordance with EN 61000-6-2 and IEC 61000-6-2.
- I/O devices that are not hotplug-capable may only be connected after the device has been disconnected from the power supply.

NOTICE

Damage through regenerative feedback

Regenerative feedback of voltage to ground by a connected or installed component can damage the device.

Connected or built-in I/Os, for example, a USB drive, are not permitted to supply any voltage to the device. Regenerative feedback is generally not permitted.

7.4 Protective conductor connection and potential equalization

The protective conductor connection is needed to protect the device and helps ensure that interference signals generated by power lines, signal lines or lines to I/O devices are safely discharged to earth.

The protective conductor connection on the device must be connected to the protective conductor of the control cabinet or system in which the device is installed.

⚠ WARNING

Electrical shock hazard and risk of fire

Internal components of a faulty device may carry dangerous voltages that pose the risk of fire or electrical shock. Risk of death and serious injury.

- Always connect the ground conductor before you commission the device.
- Never operate the device without protective conductor.
- Take a faulty device out of service immediately and mark it accordingly.

Requirement

- The device has been installed.
- 1 protective conductor, minimum cross section 2.5 mm^2
- 1 T20 screwdriver
- 1 x M4 cable lug

Procedure

1. Crimp the cable lug onto the protective conductor.
2. Screw the cable lug onto the protective conductor connection as shown.



① Protective conductor connection / potential equalization

3. Wire the protective conductor to the protective conductor connection of the control cabinet in which the device is installed.

7.5 Connecting peripheral equipment

Note

Observe suitability for industrial applications

Only connect I/O devices that are suitable for industrial applications in accordance with EN IEC 61000-6-2.

Note

I/O devices capable of hot-plugging (USB)

Hot-plug I/O devices (USB) may be connected while the PC is in operation.

NOTICE
Non-hot-plug I/O devices I/O devices that do not support hot-plugging may not be connected until the device is powered down. Strictly adhere to the specifications for peripheral equipment.

Note

Wait at least ten seconds before you reinsert USB devices.

Note that the EMC immunity of standard USB devices is designed only for office environments. These USB devices are appropriate for handling commissioning and service tasks. You may only use USB devices that are suitable for industrial applications. The USB devices are developed and marketed by the respective supplier. The respective product supplier provides support for the USB devices. The manufacturer's terms of liability shall apply.

Note

The connected or built-in I/Os, such as USB drives, should not introduce a counter EMF into the device.

Reverse voltages exceeding 0.5 V to ground that are generated by connected or installed components may prevent proper operation of the device or lead to its destruction.

7.6 Connecting the power supply (24 VDC)

Please note the following to ensure you operate the device safely and in accordance with regulations:

⚠ WARNING

Electrical shock hazard and risk of fire

Voltage exceeding SELV levels may cause fire or electric shock. Death or serious physical injury can result.

- Always wire the device to a 24 VDC power supply that is compliant with SELV requirements.
- You need a corresponding NEC Class 2 power source to comply with requirements to UL 50950-1 and UL 508 when operating the device on a wall, in an open frame, or at any other location.
- In all other cases (IEC / EN / DIN EN 60950-1), either a current source of limited output (LPS = Low Power Source), or a line-side fuse or a line-side circuit breaker is necessary. Current must be limited to 4.16 A. This requires a 4 A fuse max.

The device has reverse polarity protection.

Requirement

- The device has been installed.
- The protective conductor is connected.
- One wired terminal.
  The corresponding 24 VDC power supply is off.
- One 0.5 × 3 Philips screwdriver.

NOTICE
Damage to the device Do not turn the screws of the terminal when the terminal is inserted in the device. The device can be damaged through the pressure of the screwdriver on the terminal and consequently the connection socket. Only connect the wires to the terminal when it is unplugged.

Note

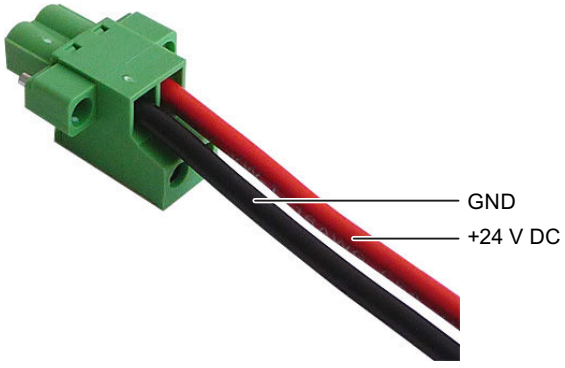
Make sure that the wires are not accidentally swapped over. Note the labeling for the contacts on the front cover of the device.

The terminal to connect the power supply is attached to the device. The terminal is designed for wires with a cross-section of 0.25 mm² to 2.5 mm². Only connect wires with a cross-section ≥ 0.5 mm².

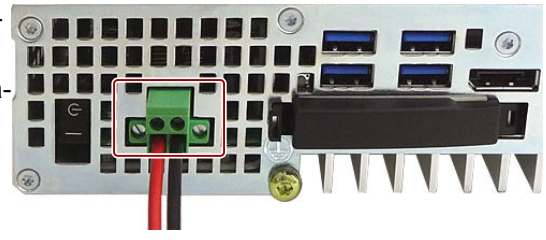
Solid or flexible cables can be used for the connection. Ferrules are not required.

Procedure

1. Connect the cables as shown.
   Note the position of the terminal.



2. Insert the terminal at the marked position.
3. Secure the terminal using the integrated screws.



7.7 Connecting the device to networks

Ethernet can be used for integrating the device into existing or planned networks.

Ethernet

The integrated Ethernet interface can be used for communication and for data exchange with automation devices such as SIMOTION SCOUT, SIMATIC S7.

Further information

Further information is available on the Internet at the Siemens Industry Mall (www.siemens.com/industrymall), the catalog and ordering system for automation and drives.

7.8 Installing the strain relief

Strain relief for the device is provided in the scope of delivery. The strain relief is designed to prevent the lines connected to the device from being accidentally pulled out.

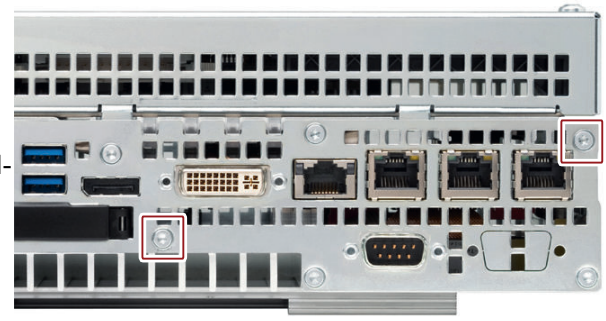
Attaching PROFINET strain relief

Requirement

- 1 strain relief
- 2 screws
- 1 T10 screwdriver

Mounting

1. Remove the marked countersunk screws.



2. Fasten the strain relief at the PROFINET interface(s).

   Use the oval head screws included with the strain relief.

Removing

Follow the mounting procedure in reverse to remove the strain relief.

Securing cables generally

Secure all cables connected to the device at the cable grip, each with a cable tie. The required cable ties are not part of the scope of delivery.

Requirement

- Maximum of 6 cable ties for USB, Ethernet, PROFIBUS
  Maximum cable tie width 3 mm.
- 1 cutting tool

Procedure

1. Place the cable tie around the attachment plate of the strain-relief assembly and secure the plugged-in cables.
2. Cut off the cable tie overhang.

Troubleshooting/FAQs

8

8.1 Error correction

This section provides you with tips on how to locate and troubleshoot common problems.

FAQs / error correction	Possible cause	Possible remedy
The device is not operational.	There is no power supply to the device.	• Check whether the 24 VDC power supply is connected. See Connecting the power supply (24 VDC) (Page 107). • Check whether the line side switch is activated. See Operator controls (Page 84).
SIMOTION P does not start after connecting the CFast card.	BIOS settings are not set to Hotplug Enabled.	You can find out how to check and correct the BIOS settings in Section Hotplug Enabled BIOS settings (Page 115).
SIMOTION P does not start after a reboot.	The user is not logged in automatically.	Set the password for the AutoLogin (Automatically Log On). See Section Changing the AutoLogin > SIMOTION P AutoLogin (Page 38).
The monitor remains dark.	The monitor is switched off.	Switch on the monitor.
	The monitor is in "power-save" mode.	Press any key on the connected keyboard.
	The brightness button has been set to dark.	Set the monitor brightness button to obtain more light. For detailed information, refer to the monitor operating instructions.
	The power cord or the monitor cable is not connected.	• Check whether the power cord has been properly connected to the monitor and to the system unit or to the grounded shockproof outlet. • Check whether the monitor cable has been properly connected to the system unit and to the monitor.
		If the monitor screen still remains dark after you have performed these checks, please contact your technical support team.
The mouse pointer does not appear on the screen.	The mouse driver is not loaded.	Check whether the mouse driver is properly installed and present when you start the application program. For more detailed information on the mouse driver, refer to the documentation for the mouse or application programs.
	The mouse is not connected.	Check whether the mouse is properly connected to the system unit. If you use an adapter or extension on the mouse cable, also check the connectors.
		If the cursor still does not appear on the screen after you have performed these checks and measures, please contact your technical support team.

FAQs / error correction	Possible cause	Possible remedy
Error message on the screen: Operating system not found	• No operating system present. • Incorrect active boot partition. • Incorrect drive entries in the SETUP.	Check whether one of the specified causes is present:
Wrong time and/or date on the PC.	-	• Press <ESC> during the boot sequence to open BIOS Setup. • Set the time and date in the setup menu.
Although the BIOS setting is OK, the time and date are still wrong.	The backup battery is empty.	Replace the backup battery. See SIMOTION P320-4 E / P320-4 S Commissioning and Hardware Installation Manual > Service and maintenances > Replacing the backup battery. If the problem cannot be resolved by replacing the battery, then contact your technical support team.
UPS does not function.	The operating system does not have a suitable driver for the UPS.	Install a suitable driver; the correct driver can often be downloaded from the homepage of the device's manufacturer. Note the SIMOTION P320-4 E / P320-4 S Commissioning and Hardware Installation Manual > Power on and software installation > Customer-specific software.
The display in the BIOS for the PROFINET MAC address is incorrect (00:00:00:00:00:00).	-	The correct MAC addresses can be taken from the rating plate on the housing. See also Device identification data (Page 76), Section MAC addresses.

8.2 Hotplug Enabled BIOS settings

Starting the BIOS setup

Proceed as follows:

1. Reset the SIMOTION P320-4 (warm or cold restart).
   Depending on the device version, the default settings may differ from the following figures.
2. After completing the startup test, you can start the program setup with BIOS.
   The following message is shown on the display:



Figure 8-1 SIEMENS Press Esc boot options

Press **Esc**.

3. After booting, the BIOS selection menu is displayed:



Figure 8-2 BIOS selection menu

4. The following buttons are available in the BIOS selection menu:

Button	Function
Continue	Exit BIOS menu, continue with the startup process
Boot Manager	Selection of the boot drive
Boot From File	Starting from a .EFI file
SCU	Device configurator (Setup Configuration Utility)
BIOS Update	BIOS update from USB stick
MEBx	Start the Intel Management Engine BIOS Extension

5. Select the **SCU** device configurator.

6. In the BIOS window, select the **Advanced** tab using the arrow keys and then select **IDE Configuration**.
   Press Enter to confirm the selection.

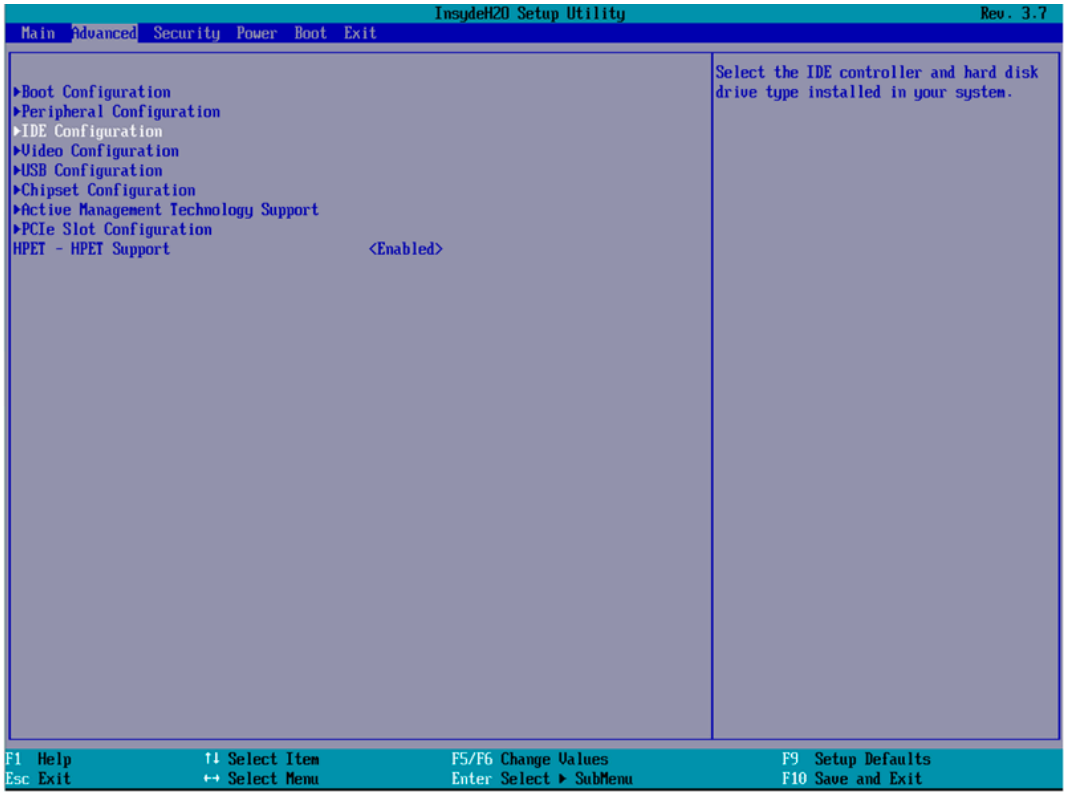


Figure 8-3 Advanced > IDE configuration

7. In the **IDE Configuration** window, select **SATA Port 2 HotPlug**.

8. Change the **Disabled** selection shown here to **Enabled**.

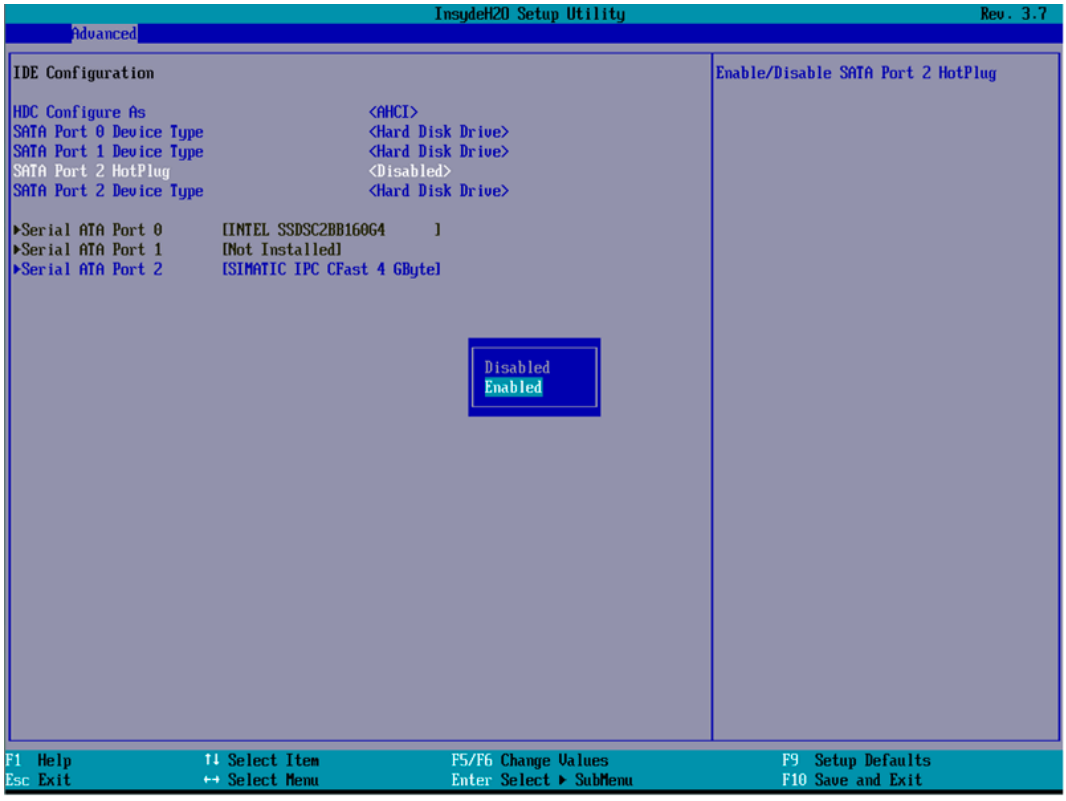


Figure 8-4 IDE Configuration > SATA Port 2 HotPlug

9. Press **F10** Save and Exit. The new entries are accepted.
10. Confirm the subsequent prompt to save the settings and exit the BIOS setup with **Yes**.

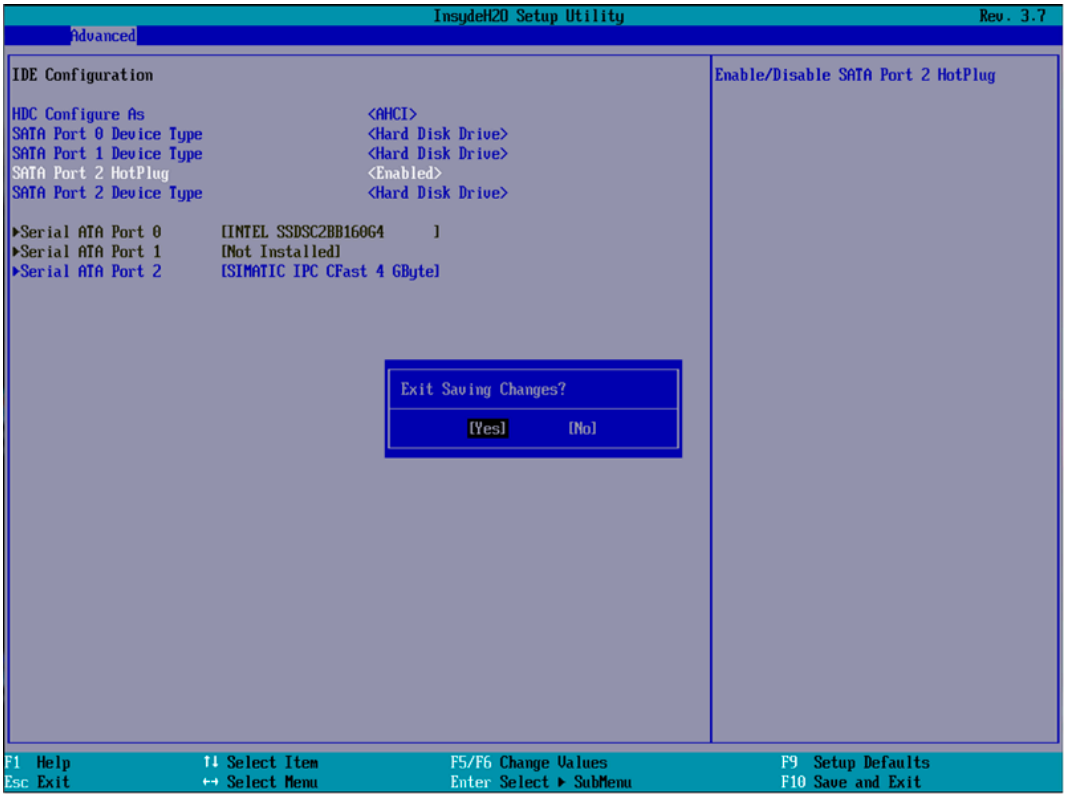


Figure 8-5 Confirming SATA Port 2 HotPlug > Enabled

Technical data

9

9.1 Overview of the technical specifications

Overview

The following technical specifications are available for SIMOTION P320-4 and the associated hardware components:

- General SIMOTION P320-4 technical specifications (Page 121)
- Ambient conditions (Page 124)
  - Climatic conditions
  - Mechanical conditions
- Technical specifications of the IsoPROFIBUS board (Page 125)
- Power requirement of the components (Page 126)
- Integrated DC voltage supply (Page 127)
- Technical specifications of the SITOP smart 24 V / 10 A (Page 127)
- Typical power consumption (Page 129)

9.2 General technical specifications

General technical specifications

General technical specifications for SIMOTION P320-4	
Article numbers	**SIMOTION P320-4 E** • 6AU1320-4DE65-3AF0 **SIMOTION P320-4 S** • 6AU1320-4DS66-3AG0
Dimensions	262 × 133 × 50.5 (W × H × D in mm)
Weight	Approximately 2 kg
Supply voltage (DC) [1]	24 VDC [1] (-20%/+20%)
Short-term voltage interruption in accordance with Namur	Min. 15 ms (at 20.4 V) Max. 10 events/h; recovery time min. 1 s
Max. power consumption	64.8 W (at 24 V)
Degree of protection	IP 20 according to IEC 60529
Protection class	Protection class I according to IEC 61140

General technical specifications for SIMOTION P320-4	
Safety regulations	EN 60950-1; UL 60950-1; UL 508;
Noise emission	<40dB (A) to DIN 45635-1
Quality assurance	In accordance with ISO 9001

[1] The upstream power supply must generate a safety extra-low voltage with safe electrical isolation according to IEC 60364-4-41 or an NEC Class 2 SELV and LPS according to IEC/ UL/EN/ DIN-EN 60950-1 (see the section "Connecting the power supply (24 V DC) (Page 107)").

Electromagnetic compatibility

Electromagnetic compatibility	
Interference emission	EN 61000-6-3, EN 61000-6-4, CISPR220 class B; FCC class A
Immunity with regard to conducted interference on the supply lines	± 2 kV according to IEC 61000-4-4; burst ± 1 kV according to IEC 61000-4-5; symmetrical surge ± 2 kV according to IEC 61000-4-5; asymmetrical surge
Noise immunity on signal lines	± 1 kV according to IEC 61000-4-4; burst; length < 3 m ± 2 kV according to IEC 61000-4-4; burst; length > 3 m ± 2 kV according to IEC 61000-4-5; surge; length > 30 m
Immunity to electrostatic discharge	± 6 kV contact discharge according to IEC 61000-4-2 ± 8 kV air discharge according to IEC 61000-4-2
Immunity to RF interference	10 V/m 80–1000 MHz and 1.4–2 GHz, 80% AM according to IEC 61000-4-3 1 V/m 2–2.7 GHz, 80% AM according to IEC 61000-4-3 10 V 10 kHz to 80 MHz, 80% AM according to IEC 61000-4-6
Immunity to magnetic fields	100 A/m, 50/60 Hz according to IEC 61000-4-8

Motherboard

Motherboard	
Processor	• Intel Core i3-3217UE 1.6 GHz, 3 MB SLC (SIMOTION P320-4 E) • Intel Core i7-3517UE 1.7 GHz, 4 MB SLC (SIMOTION P320-4 S)
Main memory	4 GB
Buffer memory	512 KB MRAM

Drive and memory media

Drive and memory media	
Solid State Disk (SSD)	≥ 80 GB Standard (SIMOTION P320-4 S)
CFast card	≥ 4 GB

Graphics

Graphics	
Graphics controller	Integrated Intel HD2000 or HD4000
Graphics memory	32 - 512 MB Shared Memory
Resolutions, frequencies, color depth	DVI-I: 640 × 480 to 1920 × 1200 / 60 Hz Display port: max. 1920 ×1200 / 60 Hz

Interfaces

Interfaces	
COM1	RS232, 115 kbps max., 9-pin SUB-D, male
DVI-I	Connection of display devices with DVI connector
Display port (DPP)	Connection of display devices with DPP connector
Keyboard	USB support
Mouse	USB support
USB	4 × USB 3.0
PROFINET	3 × RJ45 connector, onboard interface on ERTEC 400 basis, 100 Mbps electrically isolated
Ethernet	1 × Ethernet interface (RJ45) 10/100/1000 Mbps, electrically isolated, with teaming function

9.3 Ambient conditions

Climatic conditions

Temperature	Tested according to IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-14
- During operation	**Standard rail mounting (preferred mounting position)**:
	Operation with CFast card and/or SSD: • With max. 1 expansion card (max. load 10 W): 0 to +40° C • With max. 1 expansion card (max. load 10 W) in RAL [2]: 0 to +50° C [1] Operation with CFast card: • Without expansion cards in RAL [2]: 0 to +55° C [1]
	Vertical mounting:
	Operation with CFast card and/or SSD: • Without expansion cards: 0 to +40° C Operation with SSD: • With max. 1 expansion card (max. load 10 W) in RAL [2]: 0 to +45° C [1] Operation with CFast card: • Without expansion cards in RAL [2]: 0 to +50° C [1] • With max. 1 expansion card (max. load 10 W): 0 to +40° C • With max. 1 expansion card (max. load 10 W) in RAL [2]: 0 to +50° C [1]
- During storage/shipping	-40 °C to +70 °C (for devices with CFast or SSD)
- Gradient	Operating mode: Max. 10° C/h; Storage: 20° C/h; no condensation
Relative humidity	Tested according to IEC 60068-2-78, IEC 60068-2-30
- During operation	5% to 80% at 25° C (no condensation)
- During storage/shipping	5% to 95% at 25° C (no condensation)
Air pressure	
- During operation	1080 to 795 hPa (corresponds to an altitude of -1000 m to 2000 m)
- During storage/shipping	1080 to 660 hPa (corresponds to an altitude of -1000 m to 3500 m)

[1] For P320-4 S you must set "Turbo Mode Level" to "Temperature optimized" in the "Power" menu, selection "Advanced CPU Control", of the BIOS Setup; otherwise you have to reduce the maximum ambient temperature by 5 °C.

[2] RAL = Restricted Access Location
Installation of device in operating facilities with restricted access, for example, a locked control cabinet.

Mechanical conditions

Vibration	Tested according to DIN IEC 60068-2-6
- During operation	With CFast card or SSD: 5 to 9 Hz: 3.5 mm 9 to 500 Hz: 9.8 m/s2
- During storage/shipping	5 to 9 Hz: 3.5 mm 9 to 500 Hz: 9.8 m/s2
Resistance to shock	Tested according to DIN IEC 60068-2-27
- During storage/shipping	250 m/s^2, 6 ms

9.4 Technical data of the IsoPROFIBUS board

Technical specifications of the IsoPROFIBUS board (optional)

Table 9-1

IsoPROFIBUS board		
Power consumption for + 5 V PCI voltage		
Standard	2.5 W	
Maximum	3.5 W	
Permissible ambient conditions		
Heat dissipation	Open circuit ventilation	
Temperature	**Operation**	**Storage/transport**
• IsoPROFIBUS board in the SIMOTION P320-4	5° C to 45° C	-20° C to 60° C
Tested according to	EN 60068-2-1, EN 60068-2-2, EN 60068-2-14	
Relative atmospheric humidity	**Operation**	**Storage/transport**
• IsoPROFIBUS board in the SIMOTION P320-4	5 % … 80 %	5 % … 95 %
Tested according to	EN 60068-2-30	
Temperature change	Max. 10 K per hour in operation	
Moisture condensation and ice formation	Not permissible	
Design		
Module	Card (3.3 V/5 V, 32 bits)	
Dimensions (H x D) in mm	107 x 170	
Weight	150 g	
Space requirements	Short PCI slot	

Safety

Safety	
Degree of protection	IP20 in mounted state
Protection class	I complies with VDE 0106
Safety regulations	EN 60950
Approvals	CE, UL508, cULus

Quality assurance

Quality assurance complies with ISO 9001.

Note

The safety regulations, approvals, protection type and protection class specified are valid only if the module is inserted in a SIMOTION P320-4.

9.5 Power requirements of the components

Maximum power consumption of the auxiliary components

Auxiliary components		Maximum permitted power consumption			Max. total power
		+5 V	+3.3 V	+12 V	
USB device	High current	900 mA	-	-	10 W (for all USB devices)
Display port		-	500 mA	-	
DVI-I		500 mA	-	-	
PROFIBUS		500 mA	-	-	
PCI modules	Per slot	-	1.5 A	0.5 A	10 W (for entire device)
	Total	-	2 A	1 A	

[1] The total power of the PCI and USB cards may not exceed 15 W

Note

Device can overheat!

To avoid overheating, the power loss per PCI slot should not exceed 5 watts.

9.6 Integrated DC power supply

Technical specifications

DC power supply	
Input voltage	24 V DC (-20%/+20%)
Power consumption [1]	Max. 90 W
Power failure buffering	hold-up time = 20 ms at 20.4 V (DC_FAIL is active after > 5 ms)
Maximum continuous output power [1]	80 W
Degree of protection	IP 20
Protection class	Protection class I (a protective conductor must be connected to the device)

[1] The power specifications apply to the power supply component not to the device.

Note

Inrush current

The device requires an inrush current of at least 6.5 A for 50 ms.

The peak value of the startup current depends on the input voltage and the impedance of the 24 V power source. Peak currents greater than 6.5 A are possible. This will not have a negative impact on device functionality.

9.7 Technical data for the SITOP smart 24 V/10 A

Table 9-2 Technical specifications for the SITOP smart 24 V / 10 A

SITOP smart 24 V/10 A	
Input data	
Input voltage rated value	120/230 VAC
Input voltage range	85 to 132 VAC / 170 to 264 VAC
Power failure bridging	> 20 ms at V_{in} = 93/187 V
Mains frequency rated value	50/60 Hz
Mains frequency range	47 … 63 Hz
Input current rated value	4.1/2.4 A
Switch-on current (at +25° C)	< 65 A
Recommended miniature circuit breaker	10 A, Characteristic C
Output data	
Output voltage rated value	24 VDC
Output voltage tolerance	± 3 %
Residual ripple/spikes	< 150/240 mV_{pp}
Output voltage adjustment range	22.8 to 28 VDC

SITOP smart 24 V/10 A	
Output current rated value	10 A (12 A up to +45° C)
Efficiency	Typ. 90%
Electronic short-circuit protection	Yes; constant current approx. 1.3 × output current rated value; for 5 seconds extra power at 1.5 × output current rated value
Ambient conditions	
Ambient temperature during storage and transport	-40° … +85° C
Ambient temperature during operation	0° … +60° C
Humidity class	Climate class 3K3 according to EN 60721; relative atmospheric humidity 5 to 95%; no condensation
Degree of protection (EN 60529)	IP20
Radio suppression level (EN 55022)	Class B
Line harmonic limitation according to EN 61000-3-2	No
EMC immunity	EN 61000-6-2; EN 61000-4-2/-3/-4/-5/-6/-11
EMC interference emission	EN 61000-6-4
Safety	
Safety class (IEC 536; VDE 1006 T1)	Class I
Primary/secondary galvanic isolation	SELV output voltage according to EN 60950 and EN 50178; transformer according to EN 61558-2-17; overvoltage protection in the event of an internal error U_a < 60 V
Dimensions and weight	
Dimensions (W x H x D) in mm	70 x 125 x 125
Weight	Approximately. 0.75 kg
Certifications and approvals	
CE	CE conformity according to 98/336 EEC and 73/23 EEC
UL/CSA	UL 508 (Listed, File E197259); CSA C22.2 No 14, No 60950-1-03
Shipbuilding	Germanischer Lloyd
Directive 94/9/EC	Declaration of conformity according to EN 60079-15: ATEX94/9/EC Cat.3;Eex, nA, II, T4 U
C-Tick	AS/NZS 2064:1997
Article numbers	
	6EP1334-2AA01, 6EP1334-2BA01

9.8 Typical power consumption

Technical specifications

Typical current and power consumption of the device at a rated voltage of 24 V

Description	Current consumption	Power consumption
Device with core i3 or core i7 processor	950 mA	23 W
Fieldbus (PROFINET)	120 mA	3 W
USB expansion [1]	Max. 500 mA	Max. 12 W
PCI expansion [1]	Max. 500 mA	Max. 12 W

[1] The total power of the PCI and USB expansion may not exceed 15 W

Dimension drawings

10

10.1 Overview of the dimensional drawings

This section contains the dimension drawings for the SIMOTION P320-4:

- Standard rail mounting (Page 131)
- Vertical mounting (Page 133)
- SIMOTION P320-4 with an expansion card (Page 135)

10.2 Device dimension drawing for standard rail mounting

Various views of the standard rail mounting with dimensions are shown in the following:

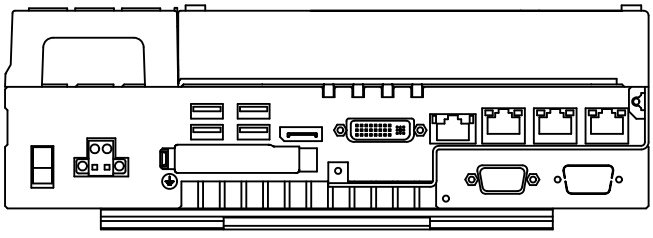


Figure 10-1 Standard rail mounting, bottom view

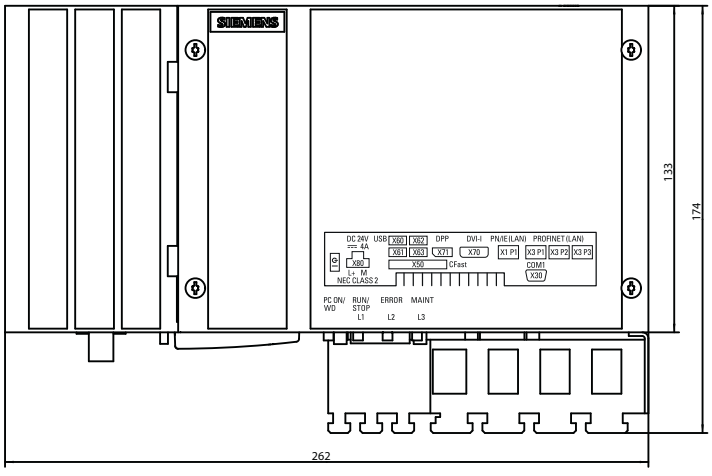


Figure 10-2 Standard rail mounting, front view

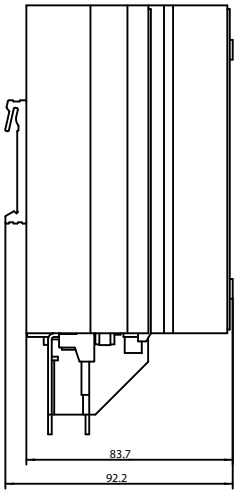


Figure 10-3 Standard rail mounting, side left view

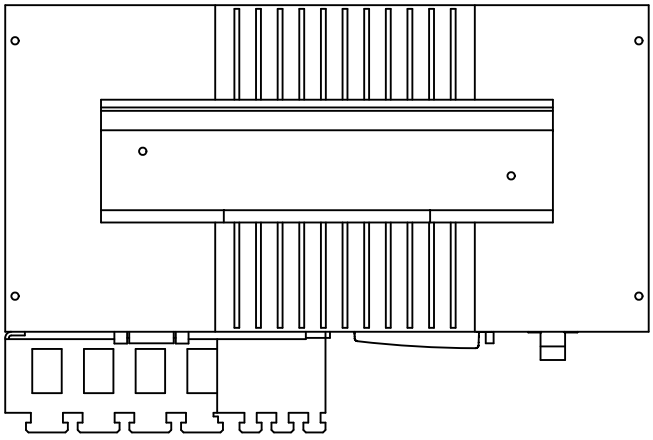


Figure 10-4 Standard rail mounting, rear view

All dimensions in mm.

10.3 Device dimension drawing for vertical mounting

Various views of the vertical mounting with dimensions are shown in the following:

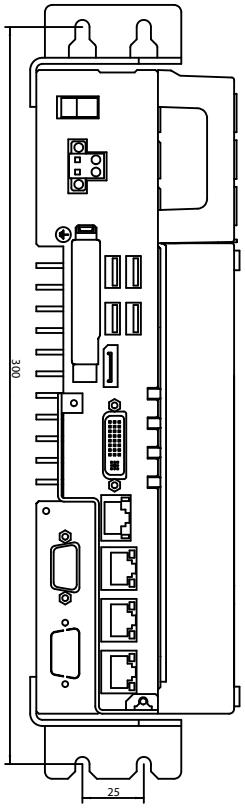


Figure 10-5 Vertical mounting, front view

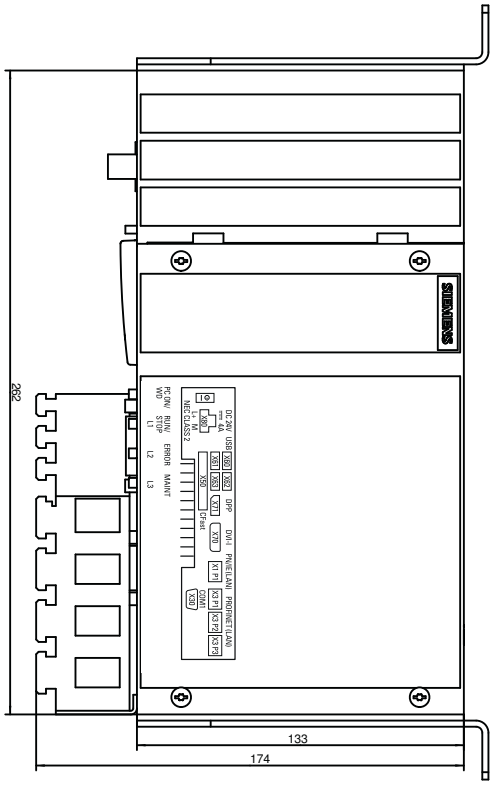


Figure 10-6 Vertical mounting, front side view

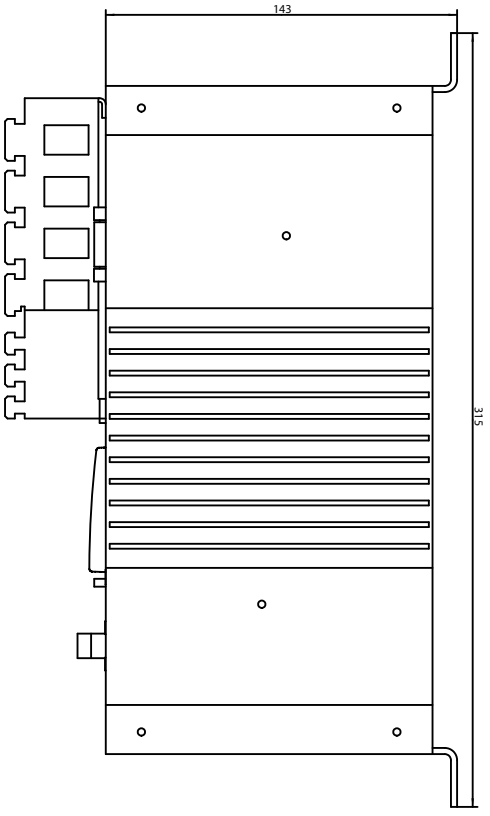


Figure 10-7 Vertical mounting, rear side view

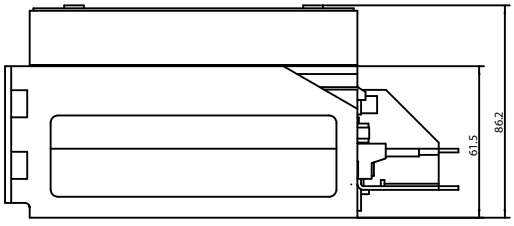


Figure 10-8 Vertical mounting, view from above

All dimensions in mm.

10.4 Dimension drawing of device with one expansion card

Device with one expansion card

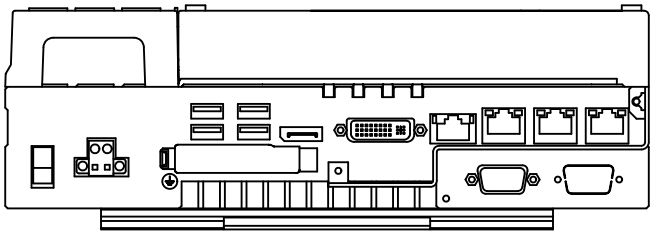
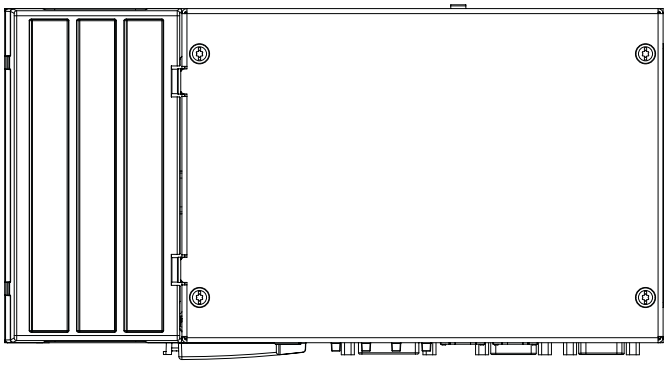
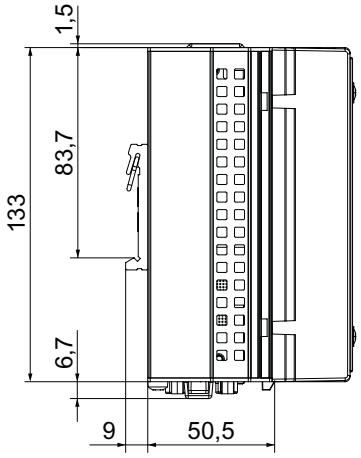


Figure 10-9 Standard rail mounting, bottom

SIMOTION P320-4 - Side views





Alle Angaben in mm

Spare parts

11

11.1 Available spare parts for SIMOTION P320-4

You can order the accessories via the Siemens Industry Mall (www.siemens.com/industrymall).

The following spare parts are available for SIMOTION P320-4:

Spare parts for SIMOTION P320-4			
Spare parts	**Article number**	**Scope of delivery**	**Accessories**
Lithium battery	A5E30314053	x	x
External CFast card The external CFast card contains user data. If a CFast card is used as a replacement for the external memory card, **no** Restore DVD or image is necessary.	6ES7648-2BF10-0XG0	x	x
IsoPROFIBUS board	6AU1390-0AA00-0AA1	-	x

Spares On Web

Spares On Web (http://support.automation.siemens.com/WW/view/en/16612315) is an information system that enables you to find out which spare parts are available for your device.

Standards and approvals

A

A.1 General rules

CE marking

CE	Our products satisfy the requirements and protection objectives of the EC Directives and comply with the harmonized European standards (EN).

Electromagnetic compatibility

Standards for EMC are satisfied if the EMC Installation Guideline is observed.

SIMOTION products are designed for industrial use in accordance with product standard DIN EN 61800-3, Category C2.

cULus approval

c UL us	Listed component mark for United States and the Canada Underwriters Laboratories (UL) according to Standard UL 508, File E164110, File E115352, File E85972.

You can find further information on the respective device on the Internet at http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm Enter the first seven characters of the article number at **Keyword**. Then click **Search**.

Korea certification

KC	KC registration number: KCC-REM-S49-SIMOTION Note that this device complies with limit class A with regard to the emission of radio frequency interference. This device can be used in all areas except residential areas. 이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

Declaration of conformity

The current Declaration of conformity is available on the Internet at Declaration of conformity (http://support.automation.siemens.com/WW/view/en/10805446/134200).

ESD Guideline

B

B.1 ESD definition

What does ESD mean?

Electrostatic sensitive devices (ESDs) are individual components, integrated circuits, modules or devices that may be damaged by either electrostatic fields or electrostatic discharge.



NOTICE

Damage caused by electric fields or electrostatic discharge

Electric fields or electrostatic discharge can result in malfunctions as a result of damaged individual parts, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber or aluminum foil.
- Only touch components, modules and devices if you are first grounded by applying one of the following measures:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

B.2 Electrostatic charging of individuals

Any person who is not conductively connected to the electrical potential of the environment can accumulate an electrostatic charge.

This figure indicates the maximum electrostatic charges that can accumulate on an operator when he comes into contact with the indicated materials. These values comply with the specifications in IEC 801-2.

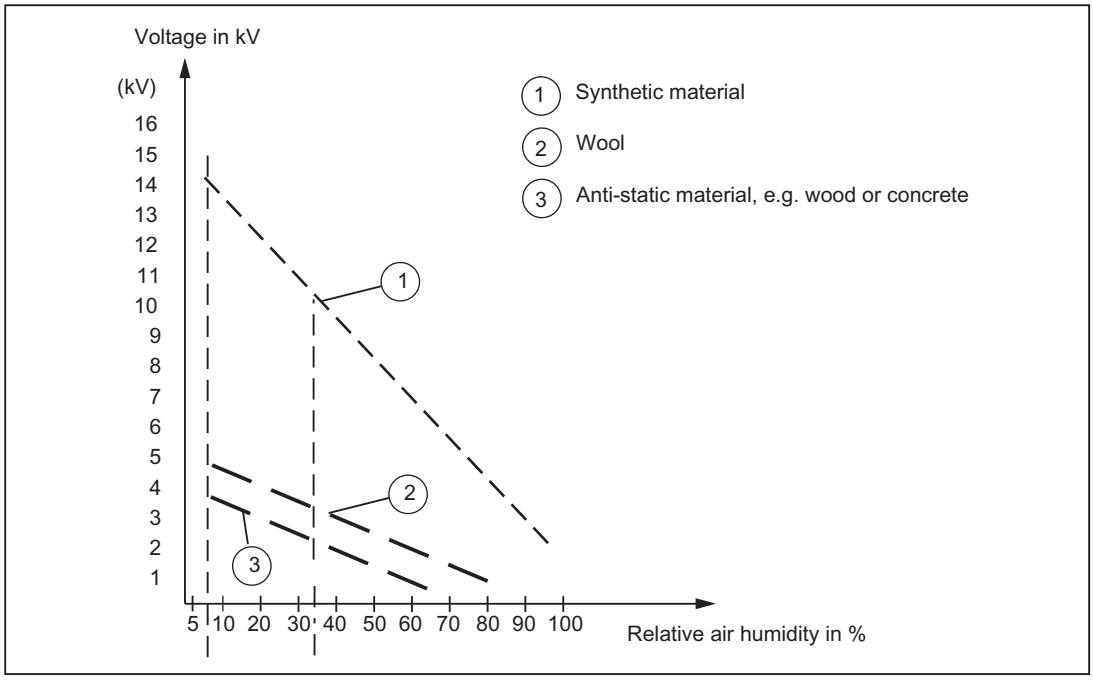


Figure B-1 Electrostatic voltage that can accumulate on operating personnel

B.3 Basic measures for protection against discharge of static electricity

Ensure sufficient grounding

When working with electrostatic sensitive devices, make sure that the you, your workstation, and the packaging are properly grounded. This prevents the accumulation of static electricity.

Avoid direct contact

You should only touch ESD components if unavoidable (for example, during maintenance work). When you touch modules, make sure that you do not touch either the pins on the modules or the printed conductors. If you follow these instructions, electrostatic discharge cannot reach or damage sensitive components.

If you have to take measurements on a module, make sure that you first discharge any static that may have accumulated in your body. To do this, touch a grounded metal object. Only use grounded measuring instruments.

Index

A

Add Hardware Wizard, 63
Ambient conditions, 79
    SIMOTION P320-4, 122
Approval, 79
Article number
    SIMOTION P320-4, 77
    SIMOTION P320-4 S, 119
    SIMOTION P320-4 E, 119
AutoLogin, 38
Automatically Log On, 38

B

Basic data
    P320-4, 51, 52
Battery
    SIMOTION P320-4, 135
BIOS settings, 113
Buffer memory, 120

C

CE marking, 137
CFast card
    Pin assignment of the interface, 91
    SIMOTION P320-4, 91
    SIMOTION P320-4, 135
Change
    Password, 31
Climatic conditions
    SIMOTION P320-4, 122
Cloud computing, 24
COA label, 78
COM1 - serial interface
    SIMOTION P320-4, 92
COM1 interface, 92
Company security, 27
Condensation, 76
Connecting I/Os
    Information, 106
    SIMOTION P320-4, 105
Connecting the power supply
    SIMOTION P320-4, 108
cULus approval, 137

D

DC power supply, 125
Decentralized structure
    SIMOTION P320-4, 99
Declaration of conformity, 137
Defense in depth strategy, 25
Degree of protection, 119
Device Manager, 60
Diagnostics
    SIMOTION P320-4, 111
Dimensions, 119
Display elements and operator controls, 82
Display port
    Interface, 90
    SIMOTION P320-4, 90
Displaying, 81
Distributed configuration
    SIMATIC Flat Panel, 49
Distributed I/O systems, 56
DMZ network, 28
DPP, (Display port)
Drive / storage media
    SIMOTION P320-4, 120
Drive systems
    For connection via PROFINET, 56
Duty types
    SIMOTION P320-4, 98
DVI-I interface, 88, 89
    SIMOTION P320-4, 88, 89

E

Effects, 23
Electromagnetic compatibility, 137
    SIMOTION P320-4, 80
    SIMOTION P320-4, 120
EMC directives, 80, 137
Environmental conditions
    SIMOTION P320-4, 79
Equipotential bonding
    SIMOTION P320-4, 106
Error correction
    SIMOTION P320-4, 111
ESD guideline, 139
ET 200, 56

Ethernet, 121
P320-4, 52
SIMOTION P320-4, 109
Ethernet interface
SIMOTION P320-4, 88

F

FAQs
SIMOTION P320-4, 111
Firewall, 28
Functional test
SIMOTION P320-4, 93

G

General technical specifications
SIMOTION P320-4, 119
Graphics
P320-4, 51
SIMOTION P320-4, 121
Guideline
ESD, 139

H

Hardware components
SIMOTION P320-4, 81
Hardware overview
SIMOTION P320-4, 53
HMI
Ethernet, 57
Local, 58
Local communication, 57
PROFIBUS, 57
PROFINET, 57
SIMOTION P320-4, 57
Via Ethernet, 71
Via IsoPROFIBUS (optional), 73
Via PROFINET, 70

I

I/O systems, 56
Identification data
SIMOTION P320-4, 77
Industrial security
Possible effects, 23
Industrial Security
Threats, 23
Info material
URL, 82
Information
Connecting I/Os, 106
Integration
Ethernet, 109
Interfaces
CFast card, 91
COM1, 92
Display port, 90
DVI-I, 88, 89
P320-4, 52
PROFIBUS, 92
PROFINET, 87
RJ45 Ethernet, 88
SIMOTION P320-4, 54, 121
USB 3.0, 90, 91
Interference emission, 120
Internet of things, 24
IsoPROFIBUS board
SIMOTION P320-4, 135
Technical specifications, 123

L

Local HMI / ES
SIMOTION P320-4, 58

M

MAC addresses
SIMOTION P320-4 S, 77
MAC bridge miniport, 58
Setting up, 59
Main memory, 120
P320-4, 51
Mechanical conditions
SIMOTION P320-4, 123
Memory modules, 120
Microsoft loopback adapter
Installing, 63
Mobile devices, 24
Mobile networks, 24
Motherboard
SIMOTION P320-4, 120
Mounting
SIMOTION P320-4, 99
SIMOTION P320-4 - decentralized structure, 99
Mounting positions
SIMOTION P320-4, 93

N

Network bridge
Setting up, 59
Network connections, 60
Checking, 67
Network security, 26
Network services and ports, 31
Notes about usage
SIMOTION P320-4, 20
Notes for
Connecting I/Os, 105

O

OPC interface, 54
Operating, 81
Operating conditions, 79
Operating system
P320-4 E, 52
P320-4 S, 52
Operator controls
SIMOTION P320-4, 54
Optional components
SIMOTION P320-4, 57
Overview of connections
SIMOTION P320-4, 103
Overview of the interfaces
SIMOTION P320-4, 86

P

P320-4 E
Operating system, 52
Processor, 51
Storage media, 52
P320-4 S
Operating system, 52
Processor, 51
Storage media, 52
Package contents, 75
Checking, 75
Packaging, 75
Checking, 75
Removing, 75
Password
Change, 31
PED
Database, 76
Physical production security, 27
Pin assignment
CFast card, 91
Plant security, 26
Power consumption, 119
Power supply
Connecting, 108
DC power supply, 125
P320-4, 51
Processor, 120
P320-4, 51
Product Equipment Data
Link, 76
PROFIBUS
Interface, 92
PROFIBUS interface
SIMOTION P320-4, 92
PROFINET, 121
Interface, 87
P320-4, 52
PROFINET interface
SIMOTION P320-4, 87
Protection zone, 28
Protective conductor connection
SIMOTION P320-4, 106

R

Radiation
High frequency radiation, 19
SIMOTION P320-4, 19
Rating plate
SIMOTION P320-4 S, 77
References, 4
Remote access, 24
Remote desktop connection
Deactivating, 45
Requirements
Virus scanner, 32

S

Safety information
Storage, 76
Transportation, 76
Safety instructions
SIMOTION P320-4, 18
SCALANCE S, 29
Scope of delivery
SIMOTION P320-4, 55
Security
AutoLogin for SIMOTION P, 21

Changing the Windows password, 21
Remote desktop connection, 22
SIMOTION IT, 22
Security holes, 24
Security module
SCALANCE S, 29
Serial number
SIMOTION P320-4, 77
Siemens Industry Mall
URL, 81, 109
Siemens Product Support
URL, 82
SIMATIC Flat Panel
Distributed configuration, 49
SIMOTION
Virus scanners, 33
SIMOTION P Runtime, 54
HMI software, 55
SIMOTION SCOUT, 55
Software, 54
SIMOTION P320-4
AutoLogin, 38
Automatically Log On, 38
BIOS settings, 113
CFast card, 91
COM1, 92
Connecting I/Os, 105
Display port, 90
Electromagnetic compatibility, 80
Functional test, 93
Hardware overview, 53
HMI, 57
Industrial security, 21
Notes about usage, 20
Optional components, 57
PROFIBUS interface, 92
Scope of delivery, 55
Status indicators, 85
Structure, 53
SIMOTION P320-4 E, 58
SIMOTION P320-4 S, 55, 58
SIMOTION SCOUT TIA, 55
SIMOTION P320-4
Ambient conditions, 122
Article number, 77
Battery, 135
CFast card, 135
Climatic conditions, 122
Connecting the power supply, 108
Decentralized structure, 99
Display elements and operator controls, 82
Drive / storage media, 120
Duty types, 98
DVI-I interface, 88, 89
Electromagnetic compatibility, 120
Environmental conditions, 79
Equipotential bonding, 106
Error correction, 111
Ethernet, 109
Ethernet interface, 88
FAQs, 111
General technical specifications, 119
Graphics, 121
Hardware components, 81
Identification data, 77
Interfaces, 54, 121
IsoPROFIBUS board, 123, 135
Local HMI / ES, 58
Mechanical conditions, 123
Motherboard, 120
Mounting positions, 93
Operator controls, 54
Overview of connections, 103
Overview of the interfaces, 86
PROFINET interface, 87
Protective conductor connection, 106
Radiation, 19
Rating plate, 77
Safety instructions, 18
Serial number, 77
SITOP smart 24 V/10 A, 125
Spare parts, 135
Standard rail mounting, 93
Versions, 49
Vertical mounting, 94
SIMOTION P320-4 S
Article number, 119
MAC addresses, 77
SIMOTION P320-4 E, 49
Article number, 119
SIMOTION P320-4 S, 49
SITOP smart 24 V/10 A
Technical specifications, 125
Smart Grid, 24
Spare parts
SIMOTION P320-4, 135
Spares On Web, 135
Standard rail mounting
Ambient conditions, 122
SIMOTION P320-4, 93
Status indicators
SIMOTION P320-4, 85

Storage media
P320-4 E, 52
P320-4 S, 52
Structure
SIMOTION P320-4, 53
Supply voltage, 119
System integrity, 26
System overview
SIMOTION P320-4, 53

T

Tablet PCs, 24
TCP/IP
Communication versions, 58
Technical specifications
Degree of protection, 119
Dimensions, 119
Drive / storage media, 120
Electromagnetic compatibility, 120
General information on SIMOTION P320-4, 119
Graphics, 121
IsoPROFIBUS board, 123
Motherboard, 120
Power consumption, 119
SITOP smart 24 V/10 A, 125
Supply voltage, 119
Weight, 119
Technical specifications interfaces, 121
Threats, 23
Troubleshooting/FAQs, 111

U

UL certification, 137
URL
Info material, 82
Siemens Industry Mall, 81
Siemens Product Support, 82
USB 3.0
Interface, 90, 91
User accounts, 31

V

Ventilation grid, 79
Vertical mounting
Ambient conditions, 122
SIMOTION P320-4, 94
Virus scanner
Requirements, 32

W

Warranty, 18
Weight, 119
Windows password
Changing, 36
Permitting changes, 34
Windows Server Update Service, 32
Windows user password
Changing, 34
Wireless technology, 24
WSUS, 32

Control Diagrams

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E07
Sequence Number: 001
Rev: 002
Document number: K559-2254-CWIWP4202201-E07-001
Document description: Control Diagrams

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Control Diagrams
E07

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E07
Document name	Control Diagrams
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	C. Palenzuela	First version
2.0	2024-12-19	M. Müller	First revised version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	C. Palenzuela
Checked by	2023-03-14	A. Fritz
Approved by	2023-03-14	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Other Applicable Documents 7
1.3 Generic Terms and Abbreviations Used 7
2 General 8

Identification

Product Version / Document Version

Product version
Prototype

Document release date
December 2024

Doc Code
K559-2254-CWIWP4202201-E07-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Deliverable C08 - Control Philosophy & Block Logic Diagrams	K559-2254-CWIWP4202201-C08-001

Table 1: Other applicable documents

1.3 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 2: Generic terms and abbreviations used

2 General

There are no complex/advanced control loops within the FREQCON system, therefore this document is not required according to KBR feedback to this document.

STATRON
NON STOP POWER

Electrical Termination & Hook Up Details

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E08
Sequence Number: 001
Rev: 002
Document number: K559-2254-CWIWP4202201-E08-001
Document description: Electrical Termination & Hook Up Details

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Electrical Termination & Hook Up Details
E08

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E08
Document name	Electrical Termination & Hook Up Details
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	C. Palenzuela	First version
2.0	2024-12-17	M. Müller	First revised version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	C. Palenzuela
Checked by	2023-03-14	A. Fritz
Approved by	2023-03-14	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
December 2024

Doc Code
K559-2254-CWIWP4202201-E08-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
BESS and PCS circuit diagram	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
Extract of BESS and PCS circuit diagram (Terminal list PCS)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Terminal List PCS
Extract of BESS and PCS circuit diagram (Terminal list Battery 1)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Terminal List Battery 1
Extract of BESS and PCS circuit diagram (Terminal list Battery 2)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Terminal List Battery 2

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The electrical termination and hook-up details of the respective containers can be found in the following documents (extracts of the BESS and PCS circuit diagram).
Also refer to section 1.3 “Other Applicable Documents”.

Container	Document Name
PCS	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Terminal List PCS
Battery 1	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Terminal List Battery 1
Battery 2	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Terminal List Battery 2

3 Appendix

1. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
2. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Terminal List PCS
3. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Terminal List Battery 1
4. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Terminal List Battery 2

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	CONVERTER CONTAINER	
Circuit diagram No:	10354_23A2007	20250805_V2.0

Producer (company):	Freqcon GmbH	53396
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	CT_Ausbau_1 53457 CT_Ausbau_2 53765
Type:	BESS MSC-1000-620-8	CONV 53399
Project manager:	Freqcon_CP	

created on:	17.09.2019			
edited on:	05.08.2025	edited by:	Freqcon_DG	total pages: 492

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	05.11.2024	Freqcon_DG
	3	INDEX	23.01.2025	Freqcon_DG
	4	INDEX	23.01.2025	Freqcon_DG
	5	INDEX	23.01.2025	Freqcon_DG
	6	INDEX	05.11.2024	Freqcon_DG
	7	INDEX	23.01.2025	Freqcon_DG
	8	INDEX	21.01.2025	Freqcon_DG
	9	INDEX	23.01.2025	Freqcon_DG
	10	INDEX	21.01.2025	Freqcon_DG
	11	INDEX	21.01.2025	Freqcon_DG
	12	INDEX	21.01.2025	Freqcon_DG
	13	INDEX	23.01.2025	Freqcon_DG
	14	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&ELU		Cabinet Overview		
	5a	CABINETS OVERVIEW	05.11.2024	Freqcon_DG
&EFS ++TRA		Circuit diagram medium voltage transformer		
	18	MV-TRANSFORMER UNIT_01+02	05.11.2024	Freqcon_DG
	18a	TEMPERATURE TRANSFORMER UNIT_01+02	05.11.2024	Freqcon_DG
&EFS ++CONV		Circuit diagram Converter		
	78	GRID CONNECTION	18.06.2024	Freqcon_JD
	80	BG CIRCUIT BREAKER 1000A AC GRID	18.06.2024	Freqcon_JD
	82	PI INDUCTORS GRID SIDE	18.06.2024	Freqcon_JD
	83	GRID AC FILTER 3* 600 µF + OVERVOLTAGE PROTECTOR	18.06.2024	Freqcon_JD
	99	BUSBARS N, PE	18.06.2024	Freqcon_JD
	200	POWER CIRCUITS COVER PAGE	14.06.2024	Freqcon_JD
	201	IGBT & INDUCTOR FOR GRID PHASE 1	18.06.2024	Freqcon_JD
	202	IGBT & INDUCTOR FOR GRID PHASE 2	18.06.2024	Freqcon_JD
	203	IGBT & INDUCTOR FOR GRID PHASE 3	18.06.2024	Freqcon_JD
	207	IGBT & INDUCTOR SUB 3_1 - 3_3	18.06.2024	Freqcon_JD
	211	IGBT & INDUCTOR SUB 2_1 -2_3	18.06.2024	Freqcon_JD
	217	IGBT & INDUCTOR SUB 4_1 -4_3	18.06.2024	Freqcon_JD
	227	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	18.06.2024	Freqcon_JD
	227.a	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	18.06.2024	Freqcon_JD
	228	DC SURGE ARRESTER 3_1 - 3_3	18.06.2024	Freqcon_JD
	231	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	231.a	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	237	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	18.06.2024	Freqcon_JD
	237.a	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	29.07.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CONV		Circuit diagram Converter		
	238a	DC SURGE ARRESTER 2_1 - 2_3	18.06.2024	Freqcon_JD
	238b	DC SURGE ARRESTER 4_1 - 4_3	18.06.2024	Freqcon_JD
	260	SMOKE DETECTOR	18.06.2024	Freqcon_JD
	279	CONVERTER CABINET CLIMATE	18.06.2024	Freqcon_JD
	281	CIRCUIT BREAKER CABINET CLIMATE	18.06.2024	Freqcon_JD
&EFS ++CT		Circuit diagram Control cabinets		
	84	FEEDING CONTROL CABINET (CTRL)	29.07.2024	Freqcon_DG
	85	SUPPLY UDC	29.07.2024	Freqcon_DG
	100	CONTROL CABINET COVER PAGE	18.06.2024	Freqcon_JD
	101	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	102	CONTROL VOLTAGE UPS	18.06.2024	Freqcon_JD
	103	CONTROL VOLTAGE FUSE	29.07.2024	Freqcon_DG
	110	MAIN PLC	20.06.2024	Freqcon_JD
	111	ETHERNET SWITCH	23.01.2025	Freqcon_DG
	112	PANEL PC HMI	18.06.2024	Freqcon_JD
	113a	ETHERNET / PROFINET ISOLATOR	18.06.2024	Freqcon_JD
	113b	ETHERNET / PROFINET ISOLATOR	18.06.2024	Freqcon_JD
	113c	PROFINET	25.11.2024	Freqcon_DG
	114	HELMHOLZ	23.01.2025	Freqcon_DG
	115	UMTS ROUTER	18.06.2024	Freqcon_JD
	120	ET200 24V DC	25.11.2024	Freqcon_DG
	121	ET200SP DIGITAL INPUTS DI_01 - DI_03	14.06.2024	Freqcon_JD
	122	ET200SP DIGITAL INPUTS DI_04 + DI_05	14.06.2024	Freqcon_JD
	123	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	14.06.2024	Freqcon_JD
	123.a	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	18.06.2024	Freqcon_JD
	124	ET200SP ANALOG INPUTS AI_01 - AI_03	14.06.2024	Freqcon_JD

previous page: 2

next page: 4

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram Control cabinets		
	125	ET200SP ANALOG INPUTS AI_04	14.06.2024	Freqcon_JD
	126	INPUTS CONTROL ELEMENTS	02.07.2024	Freqcon_JD
	127	DIGITAL INPUTS CB 1	18.06.2024	Freqcon_JD
	128	DIGITAL INPUTS CB 2	18.06.2024	Freqcon_JD
	129	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	18.06.2024	Freqcon_JD
	130	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	18.06.2024	Freqcon_JD
	131	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	29.07.2024	Freqcon_DG
	132	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	29.07.2024	Freqcon_DG
	133	DIGITAL INPUTS SPARE	05.11.2024	Freqcon_DG
	134	DIGITAL INPUTS SMOKE DETECTORS	18.06.2024	Freqcon_JD
	135	OUTPUTS FAN	19.06.2024	Freqcon_JD
	136	OUTPUTS COMMUNICATION	12.09.2024	Freqcon_DG
	137	OUTPUTS CIRCUIT BREAKER	18.06.2024	Freqcon_JD
	138	OUTPUTS CONTROL ELEMENTS	03.07.2024	Freqcon_JD
	139	OUTPUTS COOLING	14.06.2024	Freqcon_JD
	140	OUTPUTS CONTROL ELEMENTS	14.06.2024	Freqcon_JD
	145	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	14.06.2024	Freqcon_JD
	146	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	18.06.2024	Freqcon_JD
	147	ANALOG INPUTS CABINET TEMPERATURE	18.06.2024	Freqcon_JD
	148	ANALOG INPUTS COOLING WATER TEMPERATURE	18.06.2024	Freqcon_JD
	149	ANALOG INPUTS MEASURING VOLTAGE	18.06.2024	Freqcon_JD
	150	OUTPUTS DC CONTACTORS 2_1	18.06.2024	Freqcon_JD
	151	OUTPUTS DC CONTACTORS 2_2, 2_3	18.06.2024	Freqcon_JD
	160	INTERFACE HVIO 1	29.07.2024	Freqcon_DG
	161	INTERFACE HVIO 2	05.11.2024	Freqcon_DG
	162	INTERFACE HVIO 2 ANALOG	18.06.2024	Freqcon_JD
	163	INTERFACE HVIO 3	18.06.2024	Freqcon_JD

previous page: 3

next page: 5

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram Control cabinets		
	164	INTERFACE HVIO 4	18.06.2024	Freqcon_JD
	171	PRE-CHARGING UDC	18.06.2024	Freqcon_JD
	173	DISCHARGE UDC	18.06.2024	Freqcon_JD
	181	WATER SYSTEM	29.07.2024	Freqcon_DG
	182	HEAT EXCHANGER	18.06.2024	Freqcon_JD
	183	Supply for cabinet fan	29.07.2024	Freqcon_DG
	185	FAN / HEATING CONTROL CABINET	18.06.2024	Freqcon_JD
	186	THERMOSTAT	18.06.2024	Freqcon_JD
	187	24V DC SUPPLY CB	18.06.2024	Freqcon_JD
	188	24V DC SUPPLY CON / CB GRID	18.06.2024	Freqcon_JD
	189	TEST TERMINAL BLOCK	18.06.2024	Freqcon_JD
	190	CONTAINER COOLING, LIGHT 230V SUPPLY	29.07.2024	Freqcon_DG
	191	CONTAINER COOLING	29.07.2024	Freqcon_DG
	195	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	29.07.2024	Freqcon_DG
	278	CONTROL CABINET CLIMATE	29.07.2024	Freqcon_DG
	306	Feedback DC contactors 1_4 - 1_6	18.06.2024	Freqcon_JD
	307	Feedback DC contactors 2_1 - 2_3	18.06.2024	Freqcon_JD
	308	Feedback DC contactors 2_4 - 2_6	29.07.2024	Freqcon_DG
	350	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	18.06.2024	Freqcon_JD
	351	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	29.07.2024	Freqcon_DG
	352	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	29.07.2024	Freqcon_DG
	353	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	29.07.2024	Freqcon_DG
	440	PIII PROFINET IGBT IRT INTERFACE 1	18.06.2024	Freqcon_JD
	441	PIII PROFINET IGBT IRT INTERFACE 2	18.06.2024	Freqcon_JD
	442	PIII PROFINET IGBT IRT INTERFACE 3	18.06.2024	Freqcon_JD
	443	PIII PROFINET IGBT IRT INTERFACE 4	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
&EPC ++TRA		Parts List medium voltage transformer		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV		Parts List Converter		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +CON		Parts List Converter Converter cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +IND		Parts List Converter Inductor cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +CIR		Parts List Converter Circuit Breaker cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
	6	PARTS LIST	05.11.2024	Freqcon_DG
	7	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CONV +CIR		Parts List Converter Circuit Breaker cabinet		
	8	PARTS LIST	05.11.2024	Freqcon_DG
	9	PARTS LIST	05.11.2024	Freqcon_DG
	10	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CONV +AC_DC		Parts List Converter AC and DC connection cabinet		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT		Parts List Control cabinets		
	1	PARTS LIST	21.01.2025	Freqcon_DG
&EPC ++CT +CTRL_1.1		Parts List Control cabinets Control cabinet 1 Cabinet door		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.2		Parts List Control cabinets Control cabinet 1 Left side		
	1	PARTS LIST	23.01.2025	Freqcon_DG
&EPC ++CT +CTRL_1.3		Parts List Control cabinets Control cabinet 1 Main mounting plate		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
	6	PARTS LIST	05.11.2024	Freqcon_DG
	7	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL_1.3		Parts List Control cabinets Control cabinet 1 Main mounting plate		
	8	PARTS LIST	21.01.2025	Freqcon_DG
	9	PARTS LIST	21.01.2025	Freqcon_DG
	10	PARTS LIST	05.11.2024	Freqcon_DG
	11	PARTS LIST	05.11.2024	Freqcon_DG
	12	PARTS LIST	21.01.2025	Freqcon_DG
	13	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.4		Parts List Control cabinets Control cabinet 1 Right side		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	05.11.2024	Freqcon_DG
	4	PARTS LIST	05.11.2024	Freqcon_DG
	5	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1.5		Parts List Control cabinets Control cabinet 1 above		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_1		Parts List Control cabinets Control cabinet 1		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++CT +CTRL_2.1		Parts List Control cabinets Control cabinet 2 Cabinet door		
	1	PARTS LIST	05.11.2024	Freqcon_DG
	2	PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL.4		Parts List Control cabinets		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++FAN		Parts List FAN		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++TRA		Summarized part list medium voltage transformer		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++CONV		Summarized part list Converter		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
	2	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++CT		Summarized part list Control cabinets		
	1	SUMMARIZED PARTS LIST	23.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	23.01.2025	Freqcon_DG
&EMB ++TRA		Cable list medium voltage transformer		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CONV		Cable list Converter		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG

previous page: 8

next page: 10

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CONV		Cable list Converter		
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	05.11.2024	Freqcon_DG
	11	CABEL LIST	05.11.2024	Freqcon_DG
	12	CABEL LIST	05.11.2024	Freqcon_DG
	13	CABEL LIST	05.11.2024	Freqcon_DG
	14	CABEL LIST	05.11.2024	Freqcon_DG
	15	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CONV +CIR		Cable list Converter Circuit Breaker cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++CT		Cable list Control cabinets		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	21.01.2025	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CT		Cable list Control cabinets		
	10	CABEL LIST	05.11.2024	Freqcon_DG
	11	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++FAN		Cable list FAN		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++EXTERN		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
&EMZ ++CONV +IND		Terminals Converter Inductor cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+IND-207L1.1 - =UNIT_01++CONV+IND-217L1.3	05.11.2024	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+IND-207L1.1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+IND-207L1.2	05.11.2024	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+IND-207L1.3	05.11.2024	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+IND-211L1.1	05.11.2024	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+IND-211L1.2	05.11.2024	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+IND-211L1.3	05.11.2024	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CONV+IND-217L1.1	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_01++CONV+IND-217L1.2	05.11.2024	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CONV+IND-217L1.3	05.11.2024	Freqcon_DG
&EMZ ++CONV +CIR		Terminals Converter Circuit Breaker cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+CIR-227U1-X3.1 - =UNIT_01++CONV+CIR-237U1-X3.2	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.1	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CONV +CIR		Terminals Converter Circuit Breaker cabinet		
	2003	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.2	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.2	21.01.2025	Freqcon_DG
&EMZ ++CONV +AC_DC		Terminals Converter AC and DC connection cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+AC_DC-X3.43 - =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	21.01.2025	Freqcon_DG
&EMZ ++CT		Terminals Control cabinets		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+-XT1 - =UNIT_01++CT+-XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+-XT1	21.01.2025	Freqcon_DG
&EMZ ++CT +CTRL_1.3		Terminals Control cabinets Control cabinet 1 Main mounting plate		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.3-X1 - =UNIT_01++CT+CTRL_1.3-XV	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.11	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.12	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.13	21.01.2025	Freqcon_DG
	2007	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CT +CTRL_1.3		Terminals Control cabinets Control cabinet 1 Main mounting plate		
	2009	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5.1	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC3	23.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC4	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.1	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.2	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_01++CT+CTRL_1.3-XE	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_01++CT+CTRL_1.3-190XT1	21.01.2025	Freqcon_DG
	2024	Klemmenplan =UNIT_01++CT+CTRL_1.3-191XT1	21.01.2025	Freqcon_DG
	2025	Klemmenplan =UNIT_01++CT+CTRL_1.3-XV	21.01.2025	Freqcon_DG
&EMZ ++CT +CTRL_1.4		Terminals Control cabinets Control cabinet 1 Right side		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.4-350X1.21 - =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.4-XE2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CT +CTRL_2.1		Terminals Control cabinets Control cabinet 2 Cabinet door		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_2.1-149X1 - =UNIT_01++CT+CTRL_2.1-149X1	05.11.2024	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_2.1-149X1	05.11.2024	Freqcon_DG
&EMZ ++FAN		Terminals FAN		
	1000	Klemmenleistenübersicht : =UNIT_01++FAN+-52G1-181X1 - =UNIT_01++FAN+-52G1-181X3	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_01++FAN+-52G1-181X1	05.11.2024	Freqcon_DG
	2001	Klemmenplan =UNIT_01++FAN+-52G1-181X3	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/14

next page: 6a

SPECIFICATION of grounding

	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Editor	Freqcon_JD			Statron	FREQCON	Specification Earthing	20250805_V2.0	= UNIT_01	Converter Container 1
Date	14.06.2024	Norm						& EAC	Explanatory documents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 6a
Date								+	total: 492

Single line diagram

=UNIT_01++TRA

=UNIT_01++CONV

+AC_DC

+CIR

+IND

+CON

+IND

+CIR

+AC_DC

medium voltage transformer
-18T1
&EFS++TRA/18.2
1,25MVA
6,6kV/0,62 kV AC

Gehäuse Erdung

V1_L1 V1_L2 V1_L3

-78W1 - 78W3
GRID L1 -L3
&EFS++CONV/78.1

NSGAFöu 3x4x50mm²

3WL1112-2BB36-1BJ2-Z
A08+H07+M06+M21+R10

-80Q1
max.
1250 A
&EFS++CONV/80.0

-83U1
Filter Caps 3*600µF
Overvoltage protect
&EFS++CONV/83.2

PT100
201L1 - 203L1
Inductor
1*1000A
0,2mH
&EFS++CONV/201.1

PIII 1_1
-
PIII_1_3
201Q1 - 203Q1
1000A Stack x 3
AC
DC

V1_DC+ V1_DC-
UDC +
UDC N
UDC -

PIII 2_1
-
PIII_2_3
-211Q1
3X250A Stack
DC DC DC DC DC

PT100
-211L1
&EFS++CONV/211.1
0,6mH
3*250A

V3_L2 V3_L3 -231U1 VA_182
&EFS++CONV/231.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V3_L1 VA_186 VA_184

NSGAFöu 6x1x50mm²

-224W10 DC 1.4 + Pos.
-224W11 DC 1.4 - Pos.
-224W12 DC 1.5 + Pos.
-224W13 DC 1.5 - Pos.
-224W14 DC 1.6 + Pos.
-224W15 DC 1.6 - Pos.

HELUTHERM 2x1x70mm²

=UNIT_02++
BAT 1-3
BAT 4-5
BAT 6-8
LFP Battery Modul

V3_DC- V3_Ub -227U1 VA_188
&EFS++CONV/227.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V3_DC+ VA_192 VA_190

-231W10 DC 2.1 + Pos.
-231W11 DC 2.1 - Pos.
-231W12 DC 2.2 + Pos.
-231W13 DC 2.2 - Pos.
-231W14 DC 2.3 + Pos.
-231W15 DC 2.3 - Pos.

BAT 9-11
BAT 1-3

V4_L1 V4_L3 -237U1 V4_L2
&EFS++CONV/237.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -F1 1500V 300A 1250V 400A
-K7 -F2
-K2 -F5
-K8 -F6
-K3 -F9
-K9 -F10
-C1 -C7 -C13 340µF
V4_DC+ V4_DC- V4_Ub

-237W10 DC 2.4 + Pos.
-237W11 DC 2.4 - Pos.
-237W12 DC 2.5 + Pos.
-237W13 DC 2.5 - Pos.
-237W14 DC 2.6 + Pos.
-237W15 DC 2.6 - Pos.

BAT 4-6
BAT 7-8
BAT 9-11

PIII 3_1
-
PIII_3_3
-207Q1
3X250A Stack

PT100
-207L1
&EFS++CONV/207.1
0,6mH
3*250A

PIII 4_1
-
PIII_4_3
-217Q1
3X250A Stack

PT100
-217L1
&EFS++CONV/217.1
0,6mH
3*250A

N
78W4:N
&EFS++CONV/78.3
PEN
78W5:PE
&EFS++CONV/78.2

UDC_LINK_+ 2a.2 /
UDC_LINK_N 2a.5 /
UDC_LINK_- 2a.2 /

previous page: &EAC/6a

next page: 2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0
Date	18.06.2024	Norm		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Proved by							
Date							

=	UNIT_01	Converter Container 1	
&	EFA	Single line diagram	
++			page: 1a
+			total: 492

Single line diagram

Control circuit

++CONV

++CT
+CTRL_1

CTRL

UDC_LINK_+ / 1a.4

UDC_LINK_- / 1a.4

UDC_LINK_N / 1a.4

+4

-173F2 &EFS++CT/173.2 10A

-173F3 &EFS++CT/173.4 1A

-173K2 1500V 30A DC

-173R3 500 Ohm 150 W

-173R4 500 Ohm 150 W

-173K1 1500V 30A DC

-173R1 500 Ohm 150 W

-173R2 500 Ohm 150 W

V1_DC-

V1_DC+

+4

V1_L1 V1_L2 V1_L3

-85U1 &EFS++CT/85.6 L1 L2 L3 DC+ DC-

-171F1 &EFS++CT/171.2 10A

-171K1 &EFS++CT/171.7 1500V 50A DC

-171K2 &EFS++CT/171.8 1500V 50A DC

-171R1 &EFS++CT/171.1 15 Ohm 300W

-171R2 &EFS++CT/171.2 15 Ohm 300W

Precharge Resistors

Grid 400V
inc. overvotage fuse
& Fuse ??A(20A)

+3
Main mounting plate

1-6
-XE
1

-84F2

>+
CTRL_1.1
-84Q1

AC L1,L2,L3

101T1 &EFS++CT/101.2

24V DC supply unit

102G1 &EFS++CT/102.2
24V DC UPS

+24VDC
GND

+ 24V DC
24V GND

-102G2 &EFS++CT/102.6 Battery

-103F1 - 103F4 &EFS++CT/103.2 F2, 10A 60VDC

-103F5 &EFS++CT/103.9 F2, 10A 60VDC

-186K1 &EFS++CT/186.6

-186B1 &EFS++CT/186.6

24V Supply
Main PLC
ET200SP

+24V DC
for Control Cabinet

24V GND

400V AC
Control Cabinet

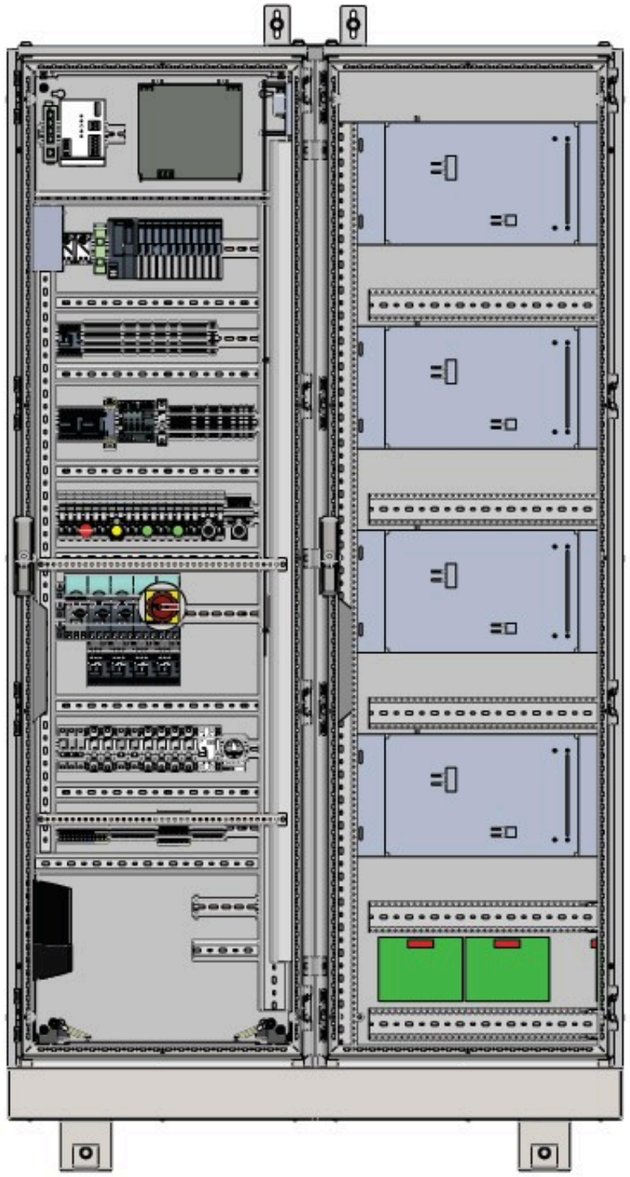
Thermostat
for start PLC

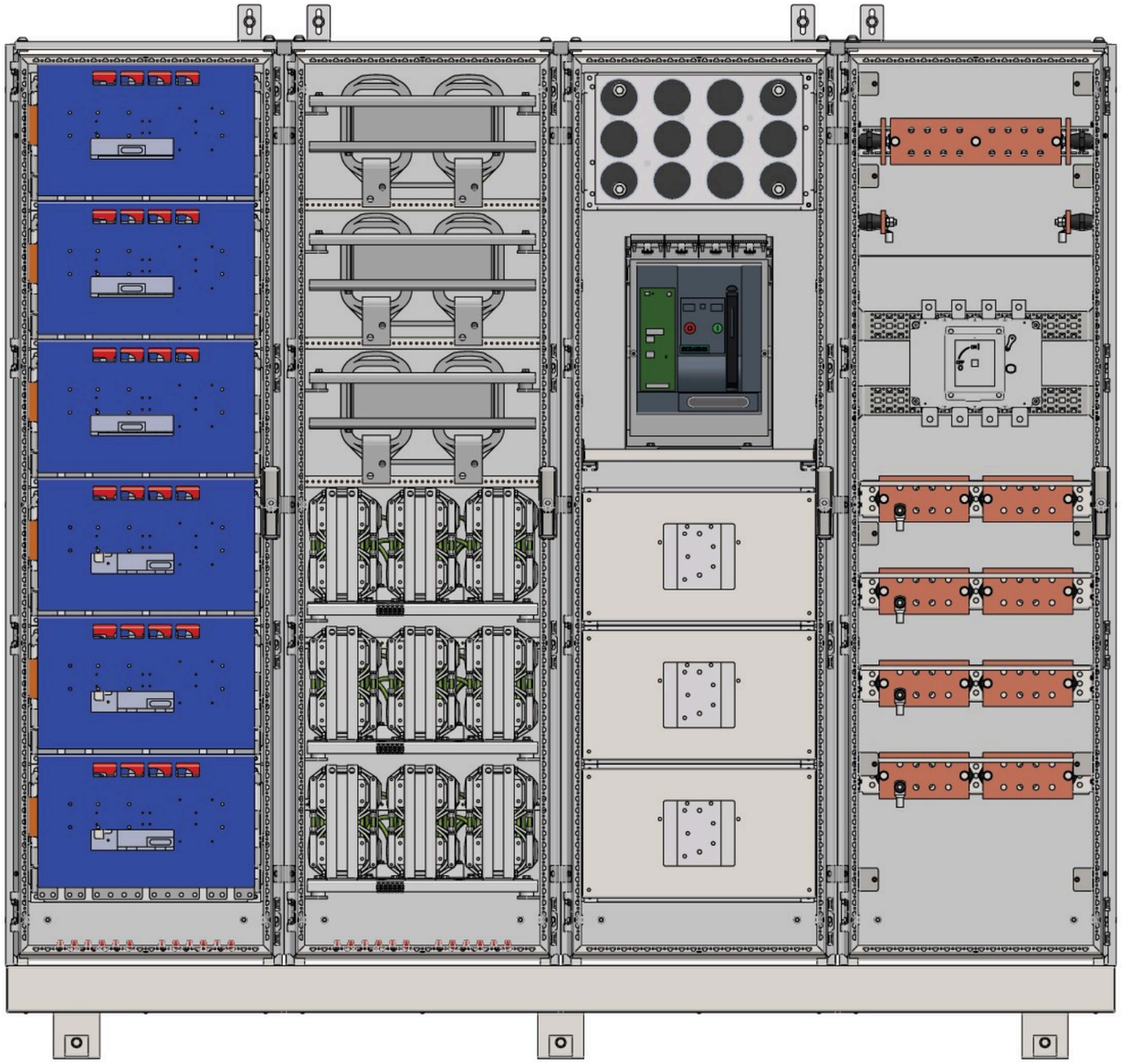
previous page: 1a

next page: &ELU/5a

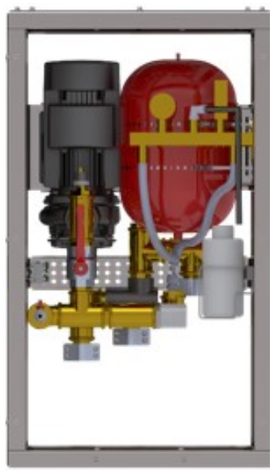
Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 2a
Date								+	total: 492

0	1	2	3	4	5	6	7	8	9









+CTRL_1
Control cabinet 1

+CTRL_2
Control cabinet 2

++CT Control cabinets

+CON
Converter cabinet

+IND
Inductor cabinet

+CIR
Circuit Breaker cabinet

+AC_DC
AC and DC connection cabinet

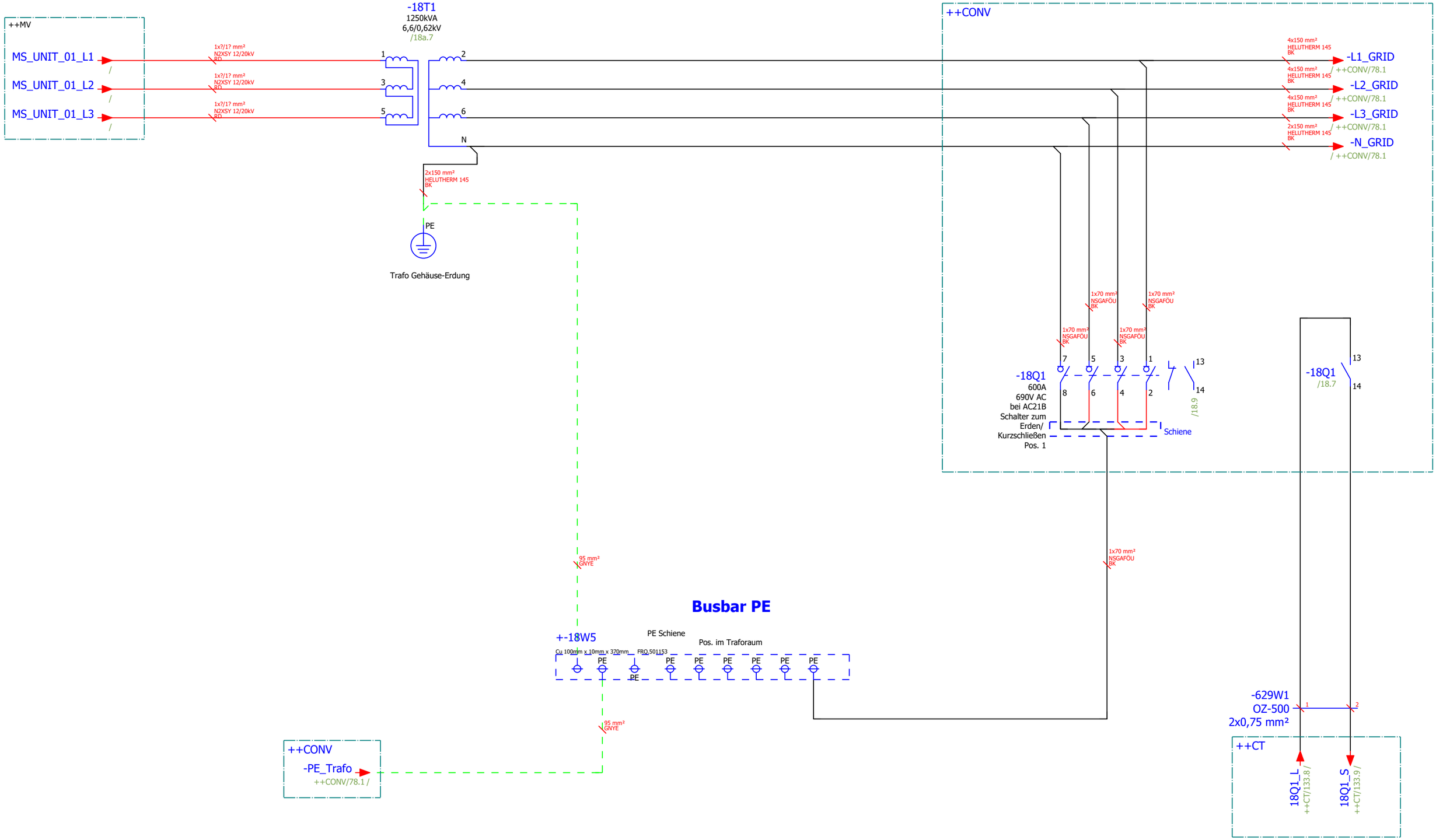
++CONV Converter

++FAN
FAN

previous page:
&EFA/2a

next page:
&EFS++TRA/18

Editor	Freqcon_DG			Statron	FREQCON	CABINETS OVERVIEW	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024	Norm						& ELU	Cabinet Overview
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
18a

Editor	Freqcon_DG			Statron	FREQCON	MV-TRANSFORMER UNIT_01+02	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer page: 18
Date								+ total: 492

++CT
+CTRL_1.2
-18B1
PWR07
Trafo-
Temperaturüberwachung
Pos: in Tür +ASC

SUPPLY
24-240V AC DC

ALARM

FAULT

FAN

PT100 SENSORS

CH 1

CH 2

CH 3

CH 4

40 41 42 4 5 6 7 8 9 1 2 3 4 5 6 13 14 15 16 17 18 19 20 21 22 23 24

0,75 mm² RT

-18W2
JZ-500
8G1,5 mm²

1 GNYE 2 3 4 5 6

-18W1
F-CY-OZ (LiY-CY)
10x1,5 mm²
500V
geschirmt

1 2 3 4 5 6 7 8 9

-18T1
/18.2

3x PT100 Fühler in NS-Wicklung Trafo

CH 3 CH 2 CH 1

3 2 1 3 2 1 3 2 1

++CT

-1L+3 ++CT/103.2/
-1PE5 ++CT/103.4/
-1M6 ++CT/103.3/
-PreAlarm ++CT/133.0/
-Trip ++CT/133.0/
-Fault ++CT/133.0/
-Fan ++CT/133.0/

previous page:
18

next page:
++CONV/78

Editor	Freqcon_DG			Statron	FREQCON	TEMPERATURE TRANSFORMER UNIT_01+02	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer	page: 18a
Date								+		total: 492

Grid Busbars L1, L2, L3

++TRA

-L1_GRID ++TRA/18.9 /
-L2_GRID ++TRA/18.9 /
-L3_GRID ++TRA/18.9 /

+AC_DC-78W1 GRID L1 Pos. 1/ Links
Cu 100mm x 10mm x 370mm FRQ.52163 &EFA++/1a.0
+AC_DC-78W2 GRID L2 Pos. 1/ Mitte
Cu 100mm x 10mm x 370mm FRQ.52163
+AC_DC-78W3 GRID L3 Pos. 1/ Rechts
Cu 100mm x 10mm x 370mm FRQ.52163

4x50 mm² NSGAFöu BK → -L1CON1 / 80.0
4x50 mm² NSGAFöu BK → -L2CON1 / 80.0
4x50 mm² NSGAFöu BK → -L3CON1 / 80.0

25 mm² NSGAFöu BK
+AC_DC -78F1 690Vac 100A gL/gG NH00 /78.8
1 3 5 13 21 / 2 4 6 14 22

-1F2 / ++CT/127.4
F3 / 238b.9

-238W7 OZ-500 2x0,75 mm² /238a.2
0,75 mm² BU
+AC_DC -X3.43 20 19

-78W7 OZ-500 2x0,75 mm²
1 2 / 13 14

25 mm² BK
+AC_DC -78F2 Typ 1 + Typ 2 400/690 V~
L1 L2 L3 / PE PE

+AC_DC -78F3 20A, aR
1 3 5 / 2 4 6

-78W6 OZ-600 3x2,5 mm² 0,6kV/1kV
1 2 3

+AC_DC -78F1 /78.6

-CHA_L1 ++CT/85.1 /
-CHA_L2 ++CT/85.1 /
-CHA_L3 ++CT/85.1 /

35 mm² GNYE

Busbars N

-N_GRID ++TRA/18.9 /

+AC_DC-78W4 GRID N &EFA++/1a.1 Pos. unten Links
Cu 50mm x 10mm x 370mm FRQ.50622
16 mm² NSGA Föu BK
-AC_F_N.1 83.3 /
-AC_F_N.2 83.3 /
-AC_F_N.3 83.3 /
2x50 mm² NSGAFöu BK → GRID_N / 99.5

Busbars PE

Einspeisung_IEC_Seite 78
Einbauort_Sicherung in Connection cabinet

-PE_Trafo ++TRA/18.2 /

+AC_DC-78W5 GRID PE &EFA++/1a.1 Pos. unten rechts
Cu 100mm x 10mm x 370mm FRQ.50070

95 mm² GNYE
35 mm² GNYE

PE_2_1 238a.1 /
PE_2_2 238a.4 /
PE_2_3 238a.8 /
PE_3_1 228.1 /
PE_3_2 228.4 /
PE_3_3 228.8 /
PE_4_1 238b.1 /
PE_4_2 238b.4 /
PE_4_3 238b.8 /

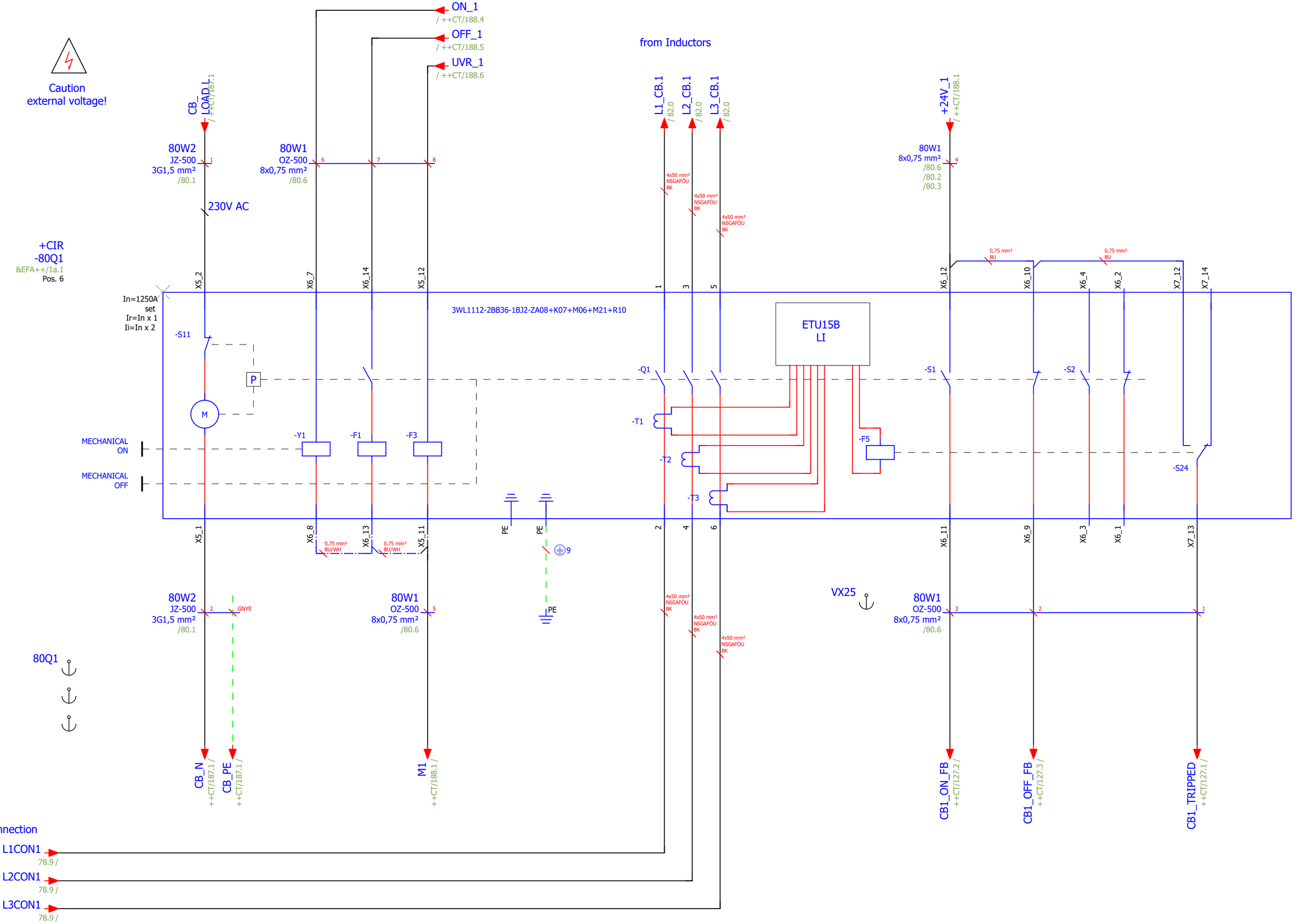
=UNIT_02 PE_BAT_CONV_1 =UNIT_02++Container/278.5 /
=UNIT_03 PE_BAT_CONV_2 =UNIT_03++Container/278.5 /

PE Container
PE Cabinet base frame front side
PE Cabinet base frame back side

400V TYP 1

previous page: ++TRA/18a
next page: 80

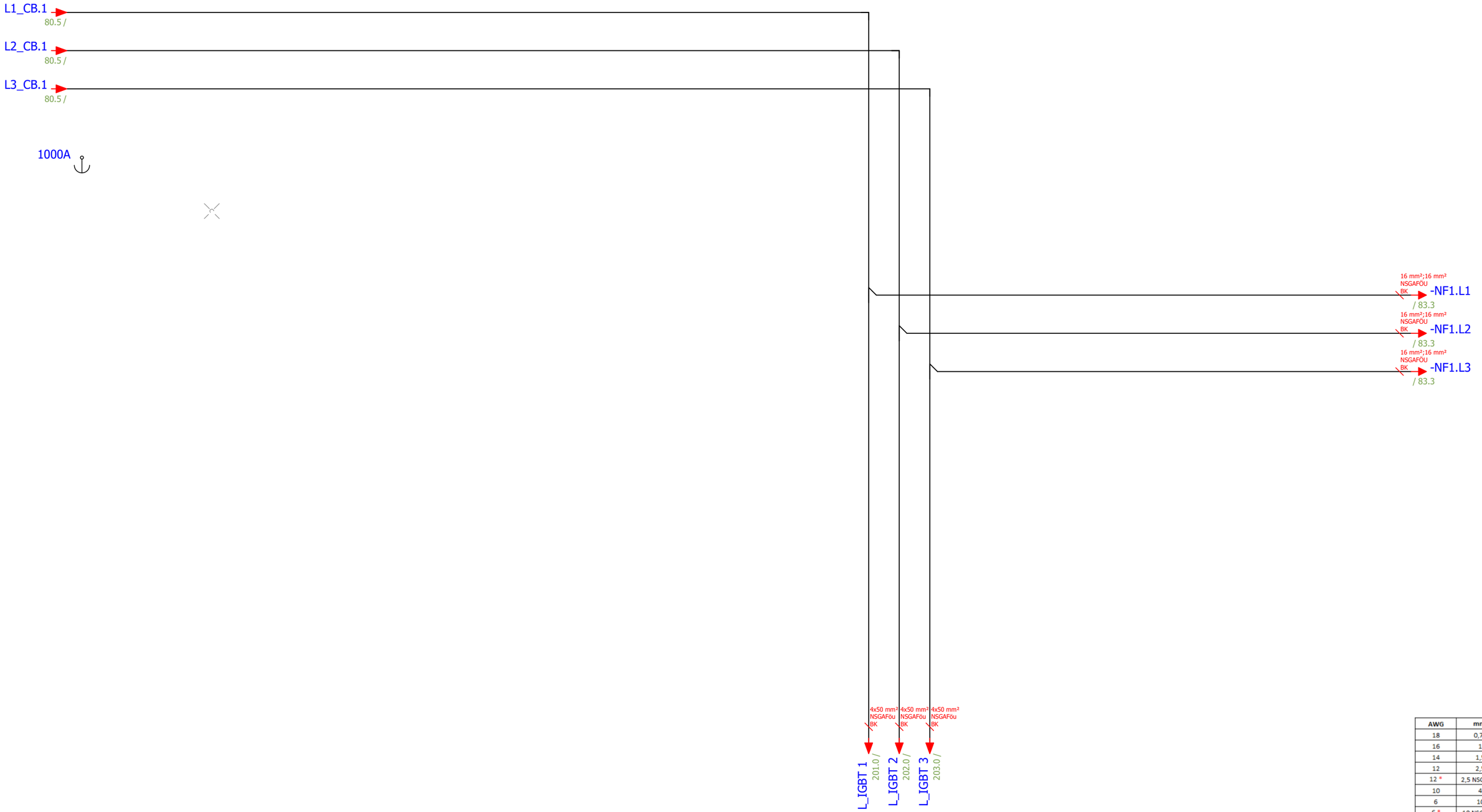
Editor	Freqcon_JD			Statron	FREQCON	GRID CONNECTION	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	



previous page: 78

next page: 82

Editor	Freqcon_JD			Statron		BG CIRCUIT BREAKER 1000A AC GRID	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024				FREQCON			& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 80
Date								+	total: 492



AWG	mm²
18	0,75
16	1
14	1,5
12	2,5
12 *	2,5 NSGAFÖu
10	4
6	10
6 *	10 NSGAFÖu
4	16
2	25
2 *	16 NSGAFÖu
1	35
250 kcmil	95 ALU
2x2	1x70 NSGAFÖu
2x4	2x70 NSGAFÖu
4x250 kcmil	4x70 NSGAFÖu
6x250 kcmil	6x70 NSGAFÖu

*cable into seperate UL protective tube

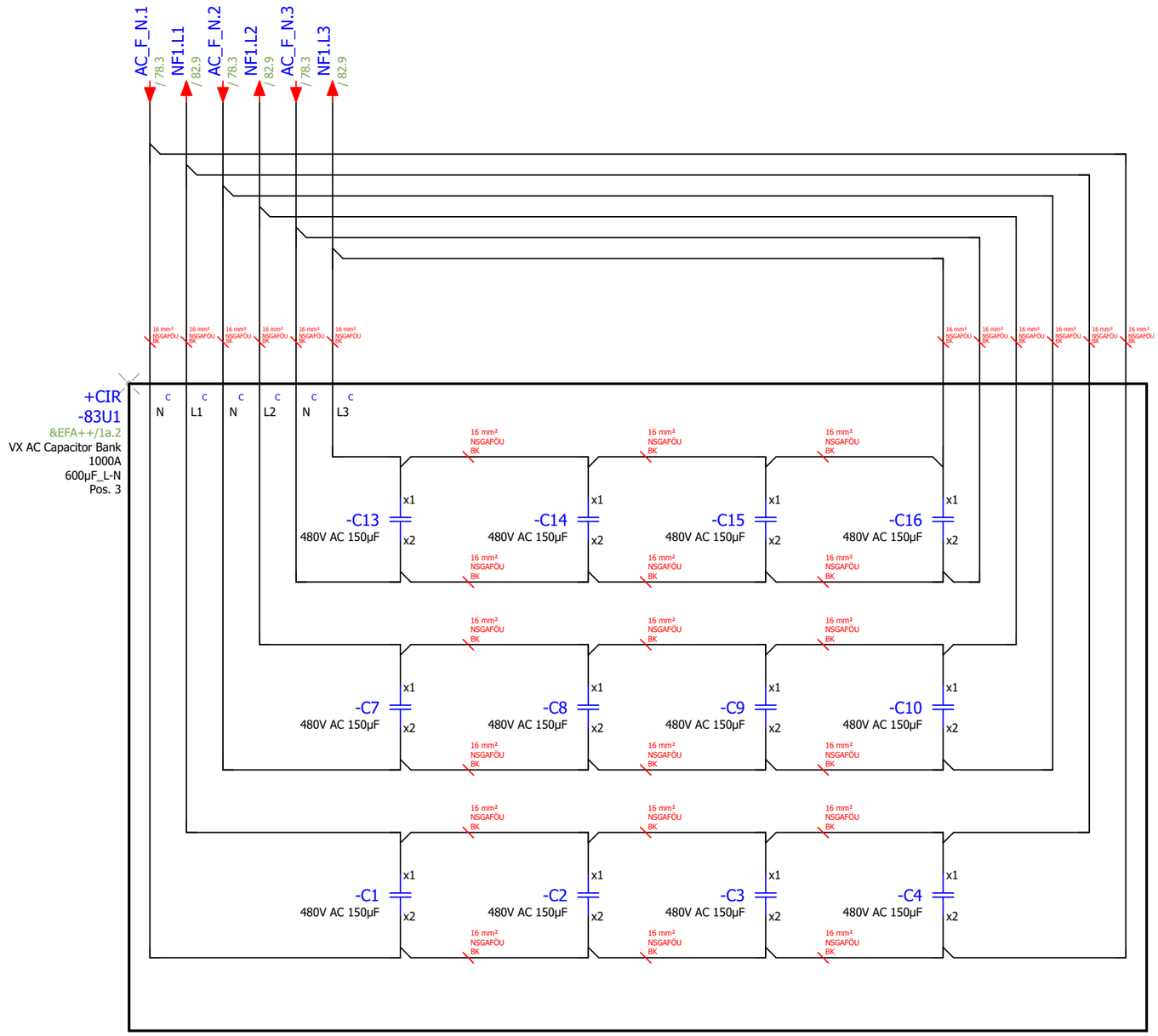
previous page:
80

next page:
83

Editor	Freqcon_JD			Statron	FREQCON	PI INDUCTORS GRID SIDE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 82
Date								+		total: 492

to polarity bar

behind main breaker



AWG	mm²	
18	0,75	
16	1	
14	1,5	
12	2,5	
12 *	2,5 NSGAFöu	
10	4	
6	10	
6 *	10 NSGAFöu	
4	16	
2	25	
2 *	16 NSGAFöu	
1	35	
250 kcmil	95 ALU	
2x2	1x70 NSGAFöu	
2x4	2x70 NSGAFöu	
4x250 kcmil	4x70 NSGAFöu	
6x250 kcmil	6x70 NSGAFöu	

*cable into seperate UL protective tube

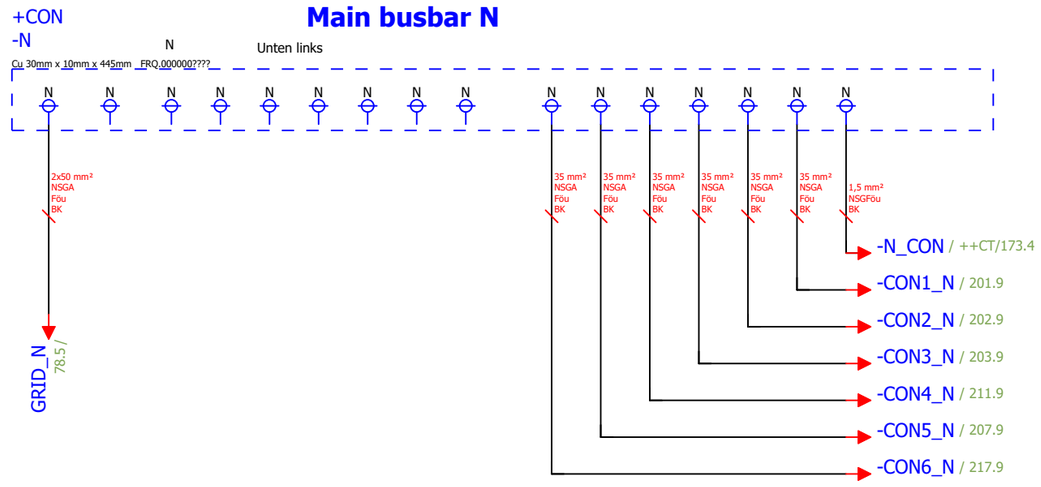
83U1

previous page: 82

next page: 99

Editor	Freqcon_JD			Statron	FREQCON	GRID AC FILTER 3* 600 µF + OVERVOLTAGE PROTECTOR	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 83
Date								+		total: 492

in converter cabinet



1000A

previous page: 83

next page: 200

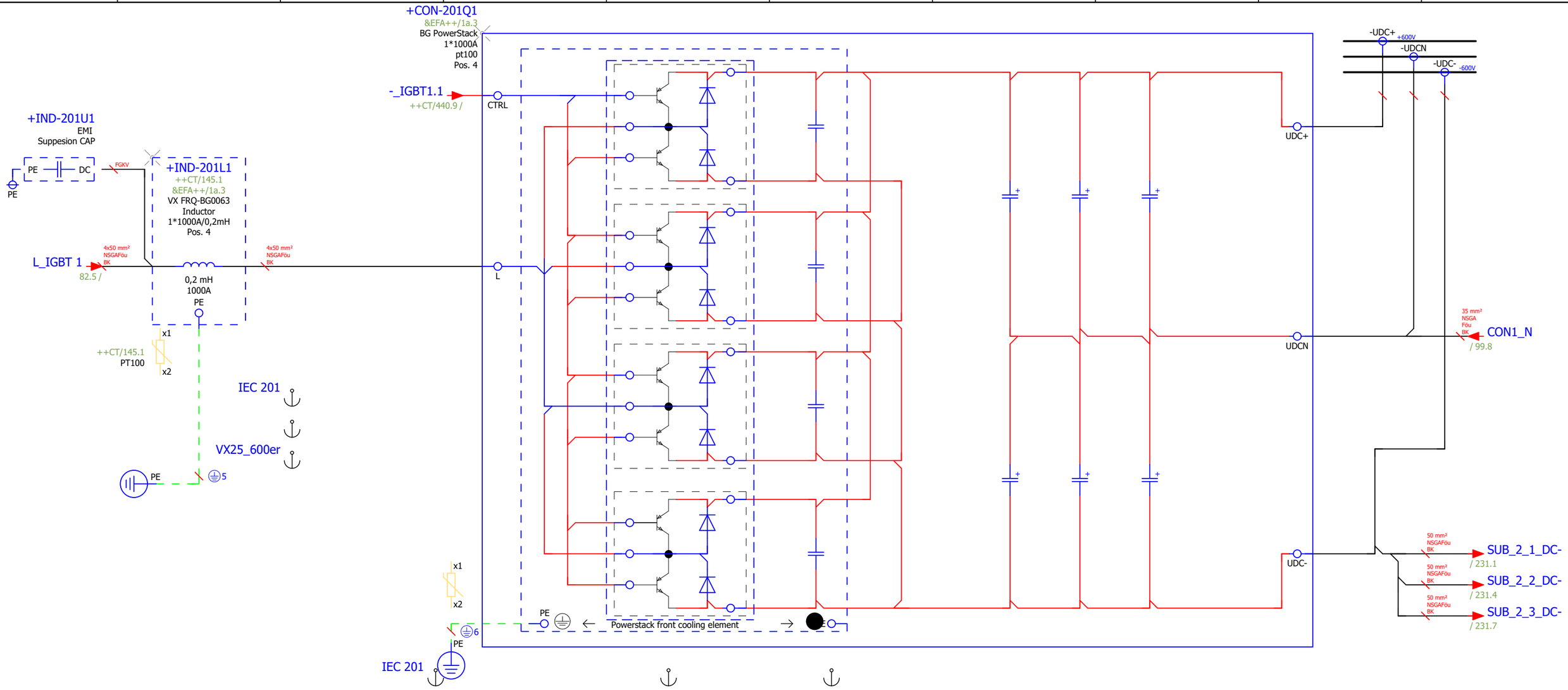
Editor	Freqcon_JD			Statron	FREQCON	BUSBARS N, PE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 99
Date								+	total: 492

Power Circuits

Pages 200 - 299

- Converter cabinet
- Inductor cabinet
- Circuit Breaker cabinet

Editor	Freqcon_JD			Statron	FREQCON	POWER CIRCUITS COVER PAGE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 200
Date								+	total: 492



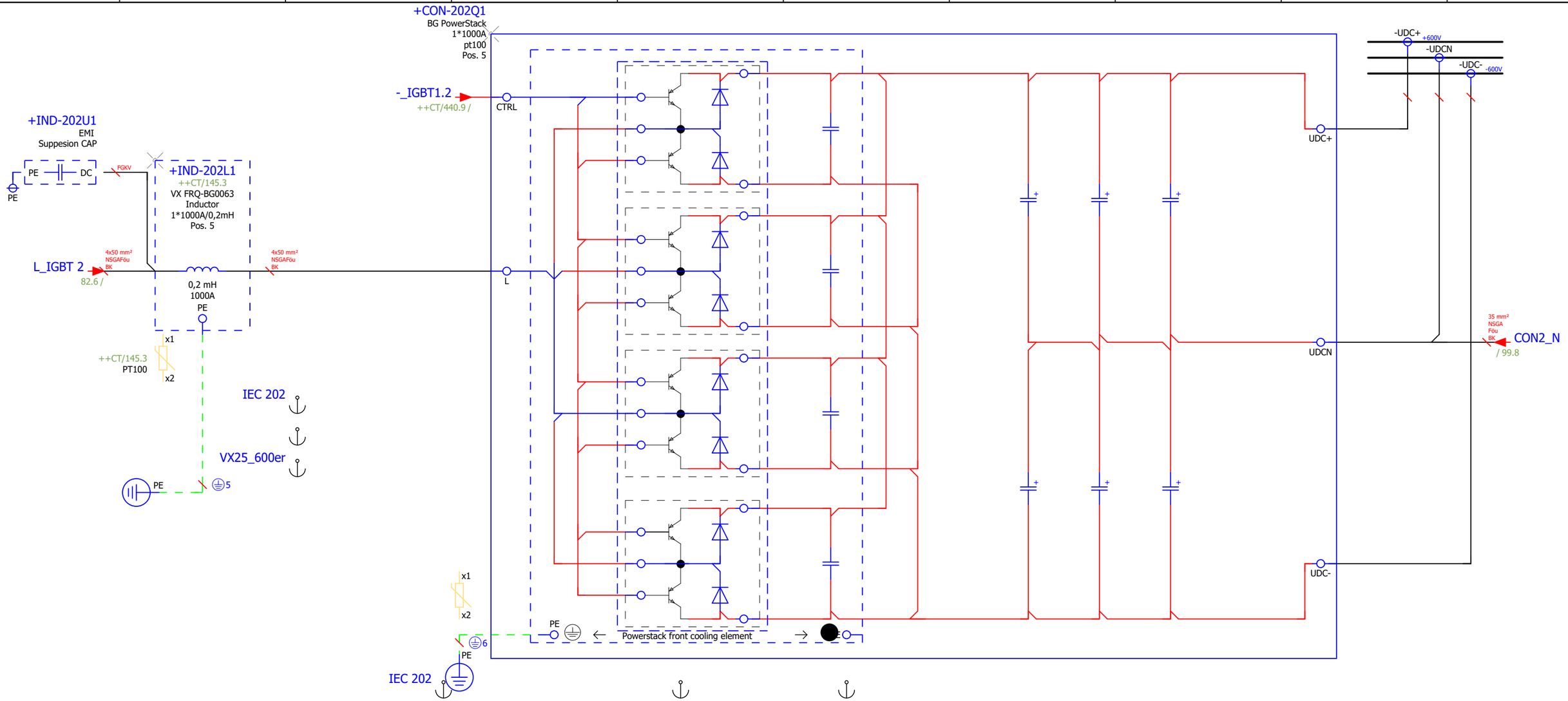
previous page: 200

next page: 202

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR FOR GRID PHASE 1	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 201

total: 492

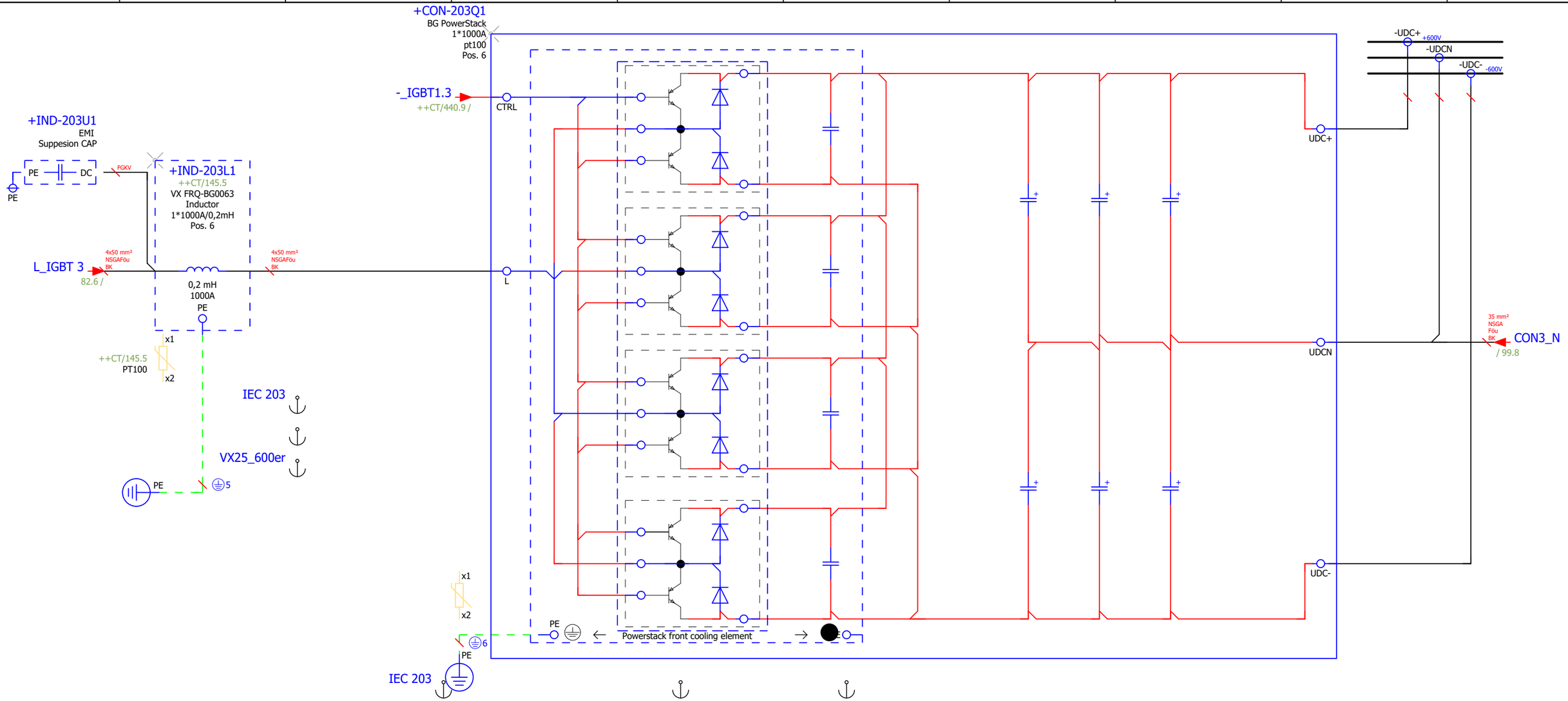


previous page:
201

next page:
203

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR FOR GRID PHASE 2	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 202
total: 492



previous page:
202

next page:
207

Editor	Freqcon_JD			Statron		IGBT & INDUCTOR FOR GRID PHASE 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 203
Date								+	total: 492

+CON-207Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 1

-_IGBT3.1_2
207.9 /
CTRL

+IND-207L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 1

L_IGBT 3_1
227.0 /
50 mm² NSGAFöu BK
0,6mH
L:1

L_IGBT 3_2
227.3 /
50 mm² NSGAFöu BK
0,6mH
L:2

L_IGBT 3_3
227.6 /
50 mm² NSGAFöu BK
0,6mH
L:3

PE.1 PE.2 PE.3

IEC 204 DC

++CT/146.5
PT100
x1 x2
++CT/146.7
x1 x2
++CT/147.1
x1 x2

VX25

PE
5

PE
5

PE
5

x1
x2
6
PE

IEC 204

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON5_N
/ 99.8

+CON-207Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT3.1
++CT/442.9 /
X1
25-POL SUB-D SOCKET

-_IGBT3.2
++CT/442.9 /
X2
25-POL SUB-D SOCKET

-_IGBT3.3
++CT/442.9 /
X3
25-POL SUB-D SOCKET

SKiiP 3 Adapter

FRQ-M00080
FREQCON

Shield connect by a ring cable lug
SH

X4
26-POL Stiftleiste (für Flachband) SOCKET
-_IGBT3.1_2
/ 207.3

previous page: 203
next page: 211

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 3_1 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 207
Date								+ total: 492

+CON-211Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 2

-_IGBT2.1_2
211.9 /

CTRL

+IND-211L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 2

L_IGBT 2_1
231.0 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:1

L_IGBT 2_2
231.3 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:2

L_IGBT 2_3
231.6 /
50 mm² NSGAFöu BK
0,6mH
50 mm² NSGAFöu BK
L:3

PE.1 PE.2 PE.3

IEC 211 DC

++CT/145.7
PT100
x1 x2
++CT/146.1
x1 x2
++CT/146.3
x1 x2

VX25

PE 5

PE 5

PE 5

x1 x2

6 PE

IEC 211

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON4_N
/ 99.8

+CON-211Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT2.1
++CT/441.9 /
X1
25-POL SUB-D SOCKET

-_IGBT2.2
++CT/441.9 /
X2
25-POL SUB-D SOCKET

-_IGBT2.3
++CT/441.9 /
X3
25-POL SUB-D SOCKET

Shield connect by a ring cable lug
SH

SKiiP 3 Adapter

FRQ-M00080
FREQCON

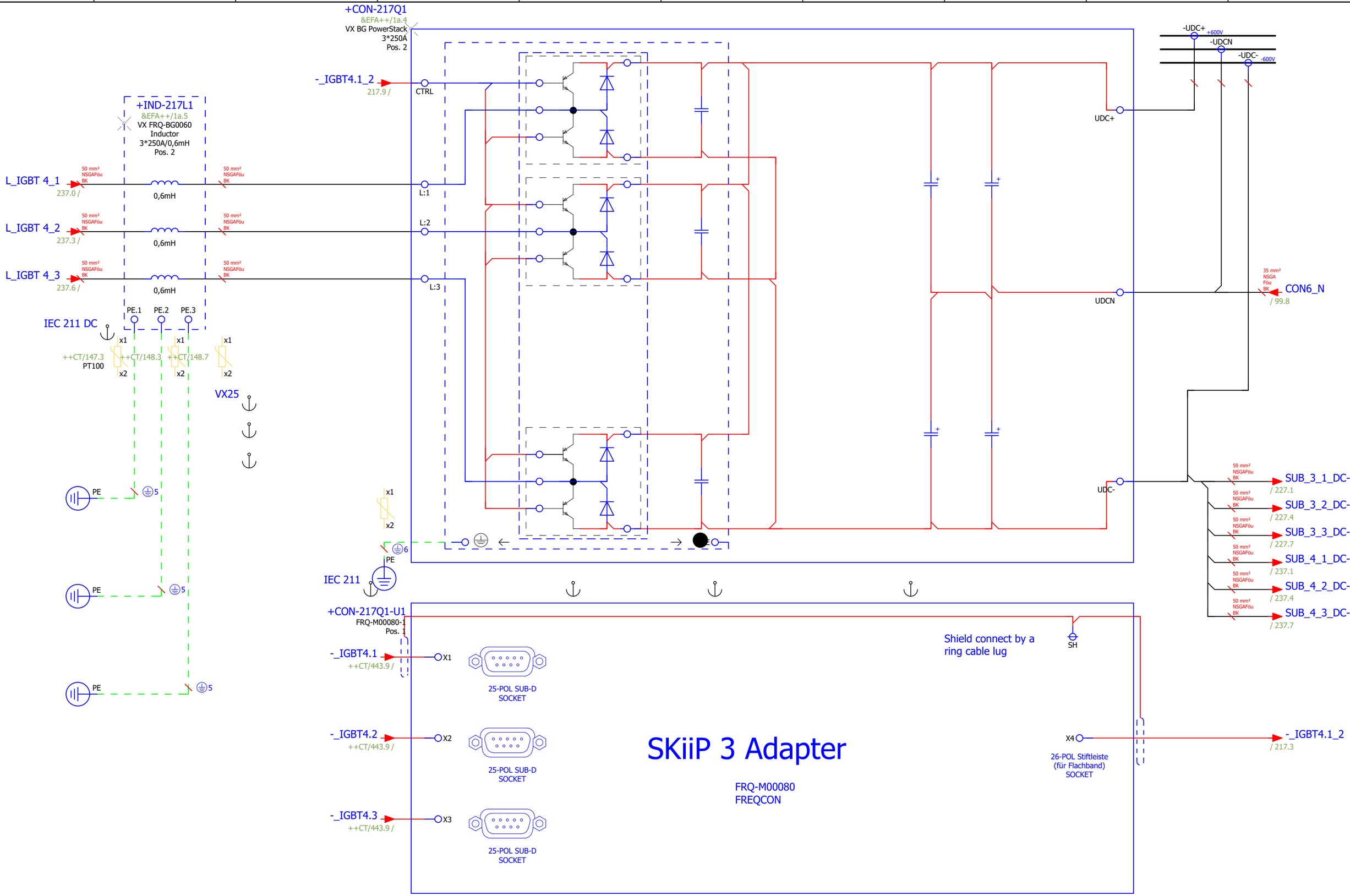
X4
26-POL Stiftleiste (für Flachband) SOCKET

-_IGBT2.1_2
/ 211.3

previous page: 207

next page: 217

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 2_1 -2_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	



previous page: 211

next page: 227

Editor	Freqcon_JD			Statron	FREQCON	IGBT & INDUCTOR SUB 4_1 -4_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 217

total: 492

VX25

224

Spare connections, if the BSU will be from here 20A supplied.

* cable intro seperate UL protrctive tube

L_IGBT 3_1 / 207.0 — SUB_3_1_V / ++CT/163.9 — SUB_3_1_DC- / 217.9 — SUB_3_1_V.1 / ++CT/162.9

L_IGBT 3_2 / 207.0 — SUB_3_2_V / ++CT/163.9 — SUB_3_2_DC- / 217.9 — SUB_3_2_V.1 / ++CT/162.9

L_IGBT 3_3 / 207.0 — SUB_3_3_V / ++CT/163.9 — SUB_3_3_DC- / 217.9 — SUB_3_3_V.1 / ++CT/162.9

227W1 OZ-600 2x0,75 mm² (1 / 2)

227W2 OZ-600 2x0,75 mm² (1 / 2)

227W3 OZ-600 2x0,75 mm² (1 / 2)

+CIR
-227U1
/227.a.0
&EFA++/1a.6
VX DC switch and Fuse
3*250A
1000V
Pos. 1

50 mm² NSGAFöu BK

PE

7

PE

Rear mounting plate

IGBT1 1+ — V_IGBT1 1+ — V_DC1 1+ — V_DC 1-

UDC [1]-

IGBT2 2+ — V_IGBT2 2+ — V_DC2 2+

UDC [2]-

IGBT3 3+ — V_IGBT3 3+ — V_DC3 3+

UDC [3]-

F3 1A — -C1 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F4 1A [20A, aR (BSU)] — F0 [20A, aR (BSU)]

F7 1A — -C7 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F8 1A

F11 1A — -C13 (x1 x2, 340µF, 1320V DC, Epcos) — 2,5 mm² NSGAFöu BK

F12 1A

16 mm² NSGAFöu BK

AWG	mm²	*cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

Front mounting plate — PE — -U1 EMI Suppesion CAP — PE — Front mounting plate — PE

16 mm² FGKV

PE

1 2 3 4 5 6

16 mm² in Shrin-kable Tube FGKV

-K1 /227.a.1 1500V 300A — -K7 /227.a.3 1500V 300A

-K2 /227.a.2 1500V 300A — -K8 /227.a.4 1500V 300A

-K3 /227.a.2 1500V 300A — -K9 /227.a.5 1500V 300A

A1 A2

70 mm² NSGAFöu BK

-F1 /227.a.7 1250V 400A 1KN/110 HLS Datenblatt

-F2 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F5 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F6 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F9 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

-F10 /227.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

IEC

DC1 + — DC1 -

DC2 + — DC2 -

DC3 + — DC3 -

*2

The single conductor must be placed in the protective tube

EEC

DC+ and DC- Busbars in Connection cabinet

+AC_DC-227W10 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_1 + Pos. =UNIT_02 — DC+3_1_BAT / =UNIT_02++ASC/678.7

+AC_DC-227W11 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_1 - Pos. — DC-3_1_BAT / =UNIT_02++ASC/678.7

DC+3_1 / 228.1

DC-3_1 / 228.1

+AC_DC-227W12 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_2 + Pos.

+AC_DC-227W13 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_2 - Pos.

DC+3_2 / 228.4

DC-3_2 / 228.4

+AC_DC-227W14 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_3 + Pos. =UNIT_03 — DC+3_3_BAT / =UNIT_03++ASC/678.0

+AC_DC-227W15 Cu 100mm x 10mm x 195mm FRQ.50604 — SUB 3_3 - Pos. — DC-3_3_BAT / =UNIT_03++ASC/678.0

DC+3_3 / 228.7

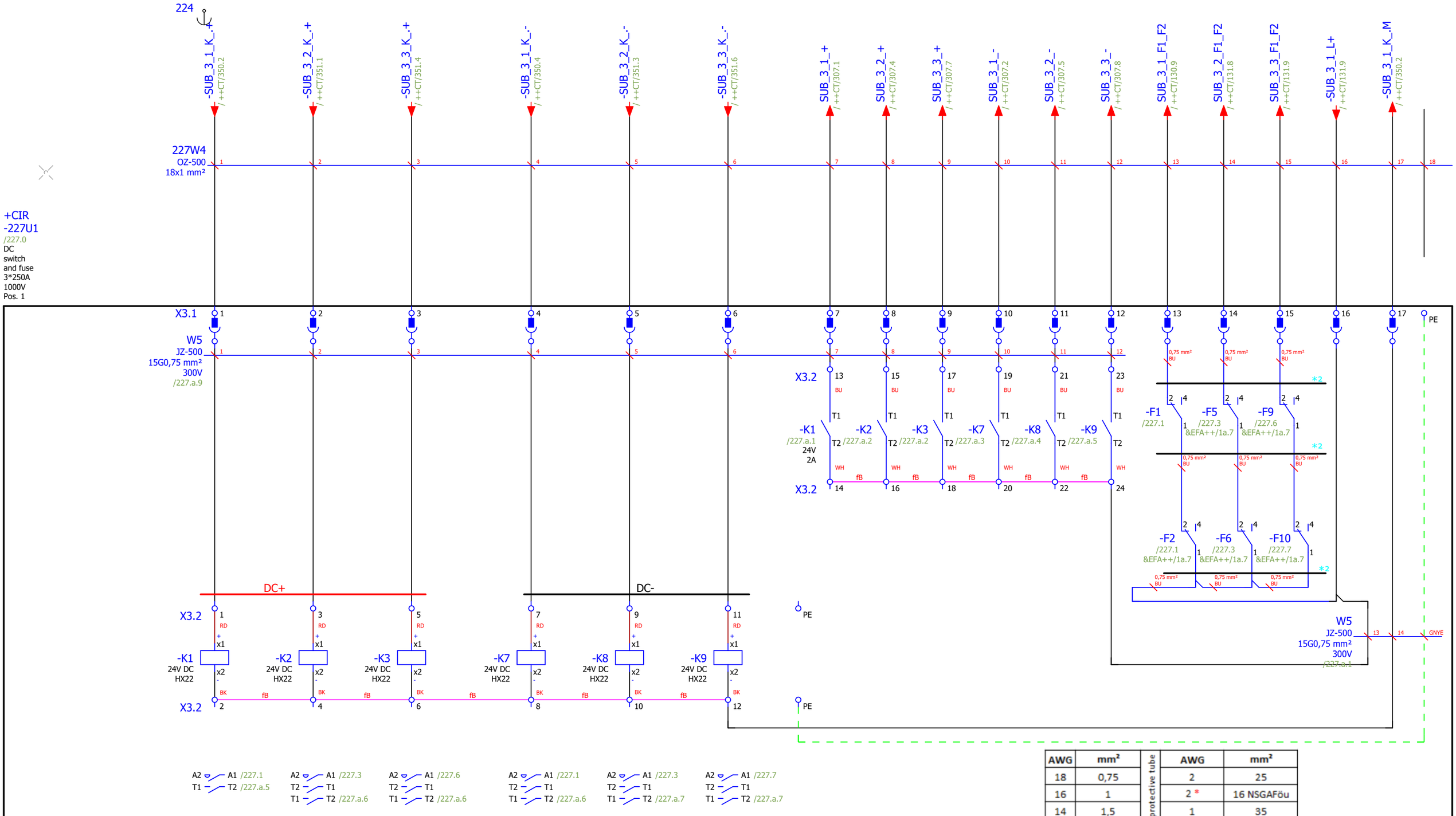
DC-3_3 / 228.8

previous page: 217

next page: 227.a

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 227
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 227

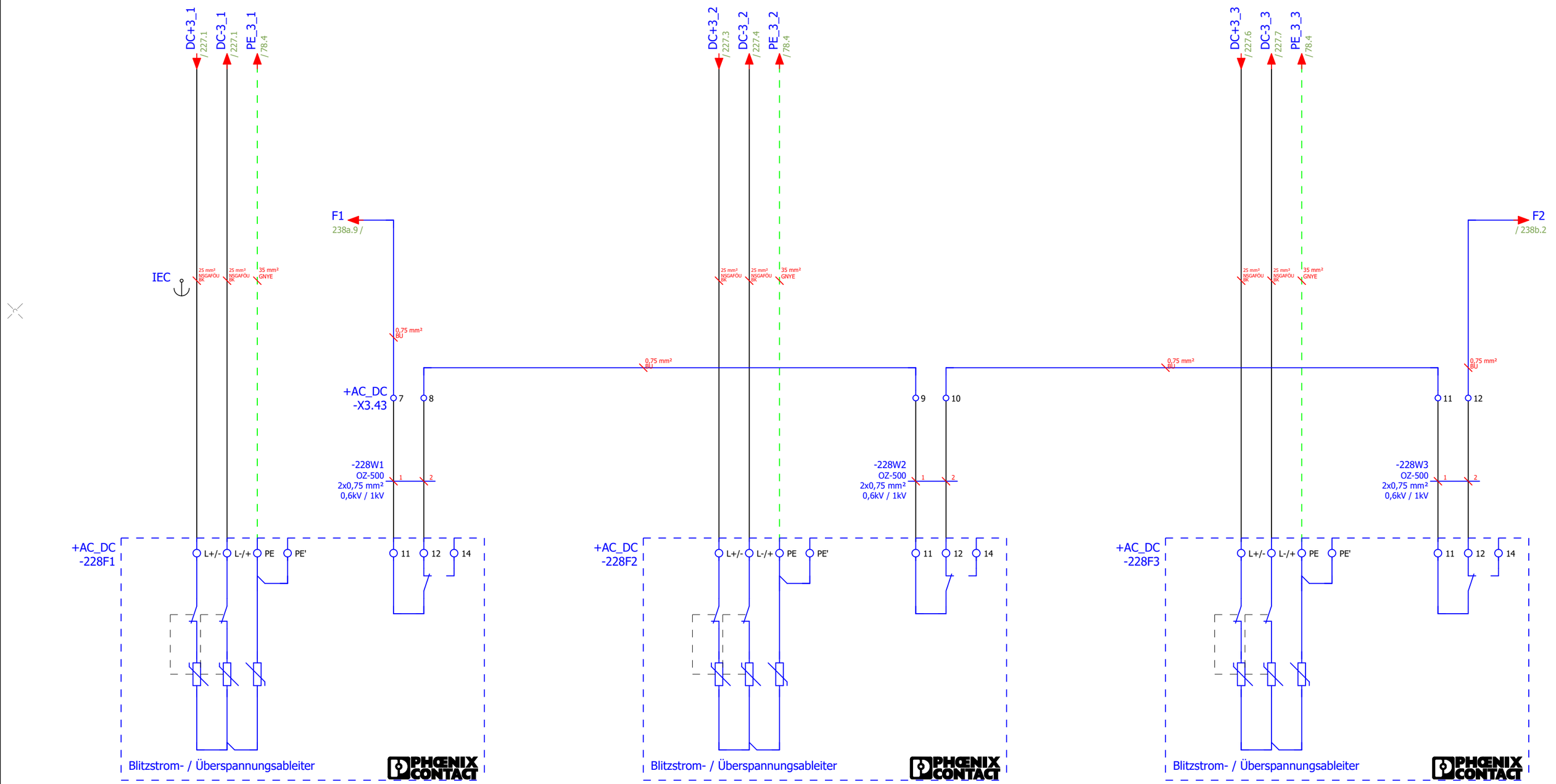
next page: 228

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 227.a
							+ total: 492

DC+ and DC- Busbars

DC+ and DC- Busbars

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 3_1

SURGE ARRESTER
DC SUBSYSTEM 3_2

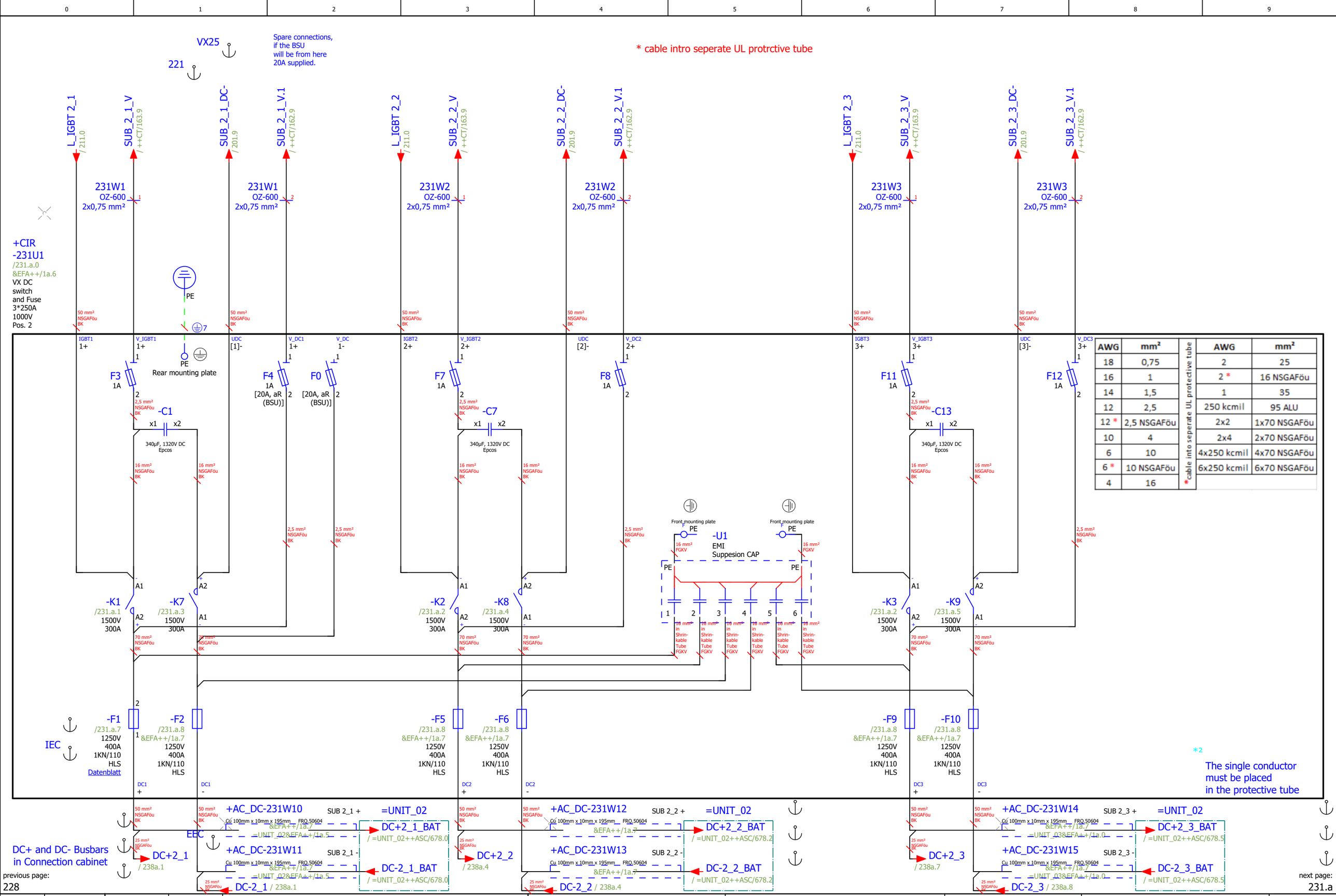
SURGE ARRESTER
DC SUBSYSTEM 3_3

in Connection cabinet

previous page:
227.a

next page:
231

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 3_1 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 228
Date								+	total: 492

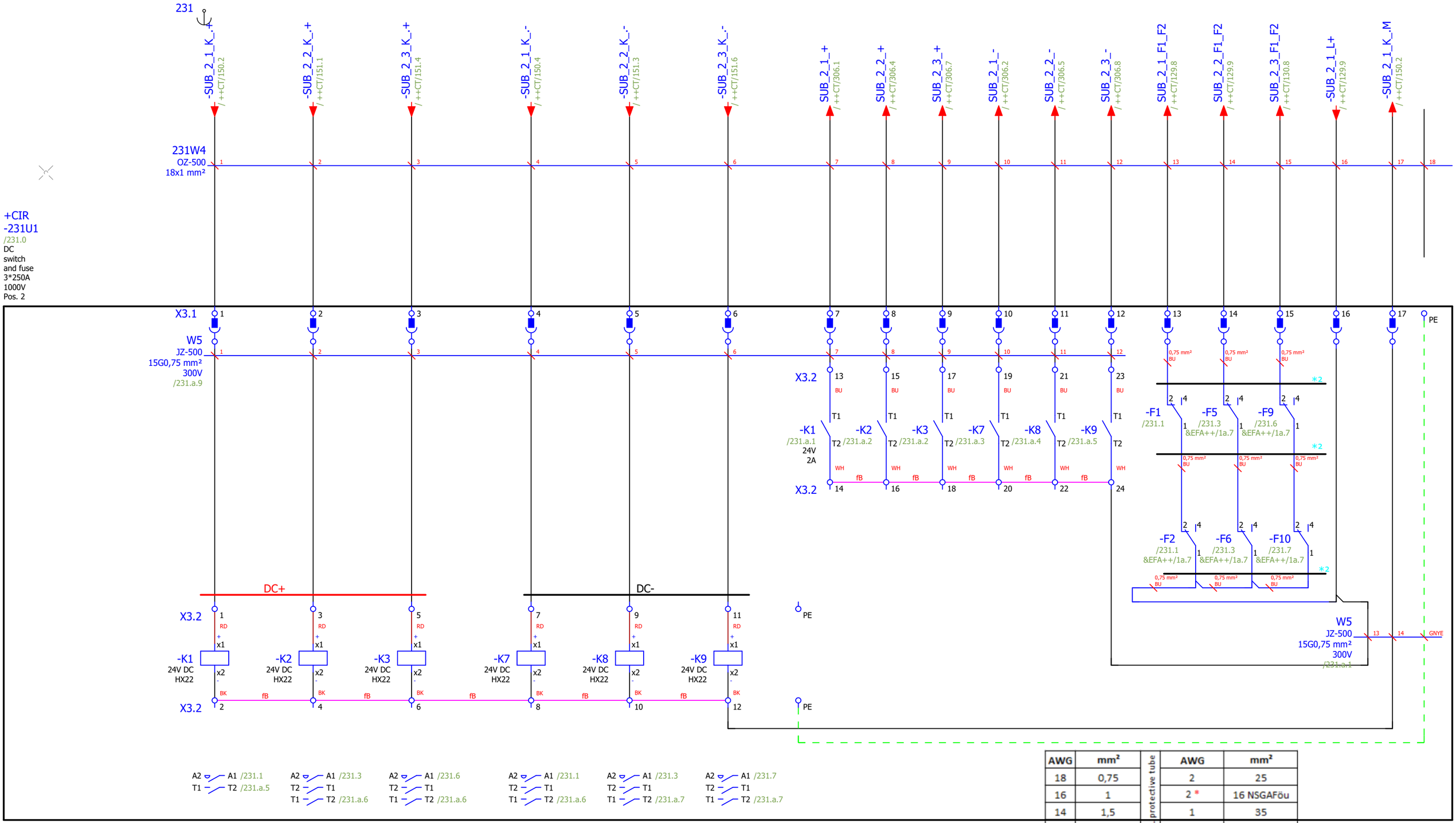


AWG	mm²	AWG	mm²
18	0,75	2	25
16	1	2 *	16 NSGAFöu
14	1,5	1	35
12	2,5	250 kcmil	95 ALU
12 *	2,5 NSGAFöu	2x2	1x70 NSGAFöu
10	4	2x4	2x70 NSGAFöu
6	10	4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu	6x250 kcmil	6x70 NSGAFöu
4	16		

*cable into seperate UL protective tube

Editor	Freqcon_JD			Statron		SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024			Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Proved by							
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 231
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 231

next page: 237

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 231.a
							+ total: 492

VX25
224

Spare connections,
if the BSU
will be from here
20A supplied.

* cable intro seperate UL protrctive tube

+CIR
-237U1
/237.a.0
&EFA++/1a.6
VX DC
switch
and Fuse
3*250A
1000V
Pos. 3

L_IGBT 4_1 / 217.0
SUB_4_1_V / ++CT/164.9
SUB_4_1_DC- / 217.9
SUB_4_1_V.1 / ++CT/164.9
L_IGBT 4_2 / 217.0
SUB_4_2_V / ++CT/164.9
SUB_4_2_DC- / 217.9
SUB_4_2_V.1 / ++CT/164.9
L_IGBT 4_3 / 217.0
SUB_4_3_V / ++CT/164.9
SUB_4_3_DC- / 217.9
SUB_4_3_V.1 / ++CT/164.9

237W1 OZ-600 2x0,75 mm²
237W1 OZ-600 2x0,75 mm²
237W2 OZ-600 2x0,75 mm²
237W2 OZ-600 2x0,75 mm²
237W3 OZ-600 2x0,75 mm²
237W3 OZ-600 2x0,75 mm²

50 mm² NSGAFöu BK

PE
PE
Rear mounting plate
7

IGBT1 1+ | V_IGBT1 1+ | V_DC1 1+ | V_DC 1-
UDC [1]-
IGBT2 2+ | V_IGBT2 2+ | V_DC2 2+
UDC [2]-
IGBT3 3+ | V_IGBT3 3+ | V_DC3 3+
UDC [3]-

F3 1A
F4 1A [20A, aR (BSU)]
F0 [20A, aR (BSU)]
F7 1A
F8 1A
F11 1A
F12 1A

2,5 mm² NSGAFöu BK

-C1
-C7
-C13
x1 x2
340µF, 1320V DC Epcos
16 mm² NSGAFöu BK

Front mounting plate
PE
-U1
EMI
Suppesion CAP
16 mm² FGKV
1 2 3 4 5 6
16 mm² in Shrin-kable Tube FGKV

-K1 /237.a.1 1500V 300A
-K7 /237.a.3 1500V 300A
-K2 /237.a.2 1500V 300A
-K8 /237.a.4 1500V 300A
-K3 /237.a.2 1500V 300A
-K9 /237.a.5 1500V 300A
A1 A2

70 mm² NSGAFöu BK

-F1 /237.a.7 1250V 400A 1KN/110 HLS Datenblatt
-F2 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F5 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F6 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F9 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F10 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
IEC

DC1 + / DC1 -
DC2 + / DC2 -
DC3 + / DC3 -

*2
The single conductor
must be placed
in the protective tube

AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

EEC

+AC_DC-237W10 SUB 4_1 + Pos. =UNIT_03 → DC+4_1_BAT / =UNIT_03++ASC/678.2
+AC_DC-237W11 SUB 4_1 - Pos. → DC-4_1_BAT / =UNIT_03++ASC/678.2
+AC_DC-237W12 SUB 4_2 + Pos. =UNIT_03 → DC+4_2_BAT / =UNIT_03++ASC/678.5
+AC_DC-237W13 SUB 4_2 - Pos. → DC-4_2_BAT / =UNIT_03++ASC/678.5
+AC_DC-237W14 SUB 4_3 + Pos. =UNIT_03 → DC+4_3_BAT / =UNIT_03++ASC/678.7
+AC_DC-237W15 SUB 4_3 - Pos. → DC-4_3_BAT / =UNIT_03++ASC/678.7

Cu 100mm x 10mm x 195mm FRQ.50604 &EFA++/1a.7 =UNIT_03&EFA++/1a.0
Cu 100mm x 10mm x 195mm FRQ.50604 &EFA++/1a.7 =UNIT_03&EFA++/1a.5

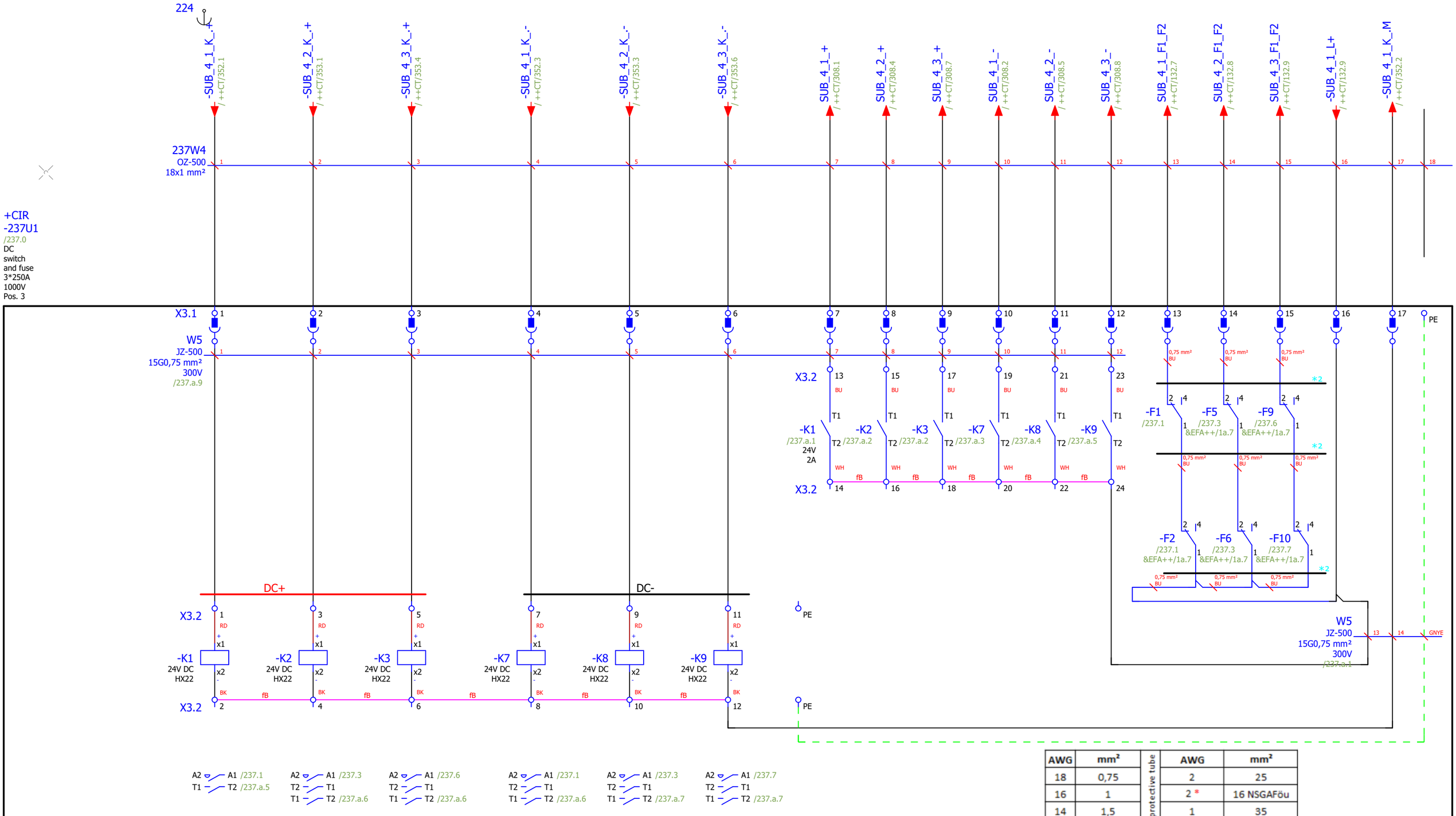
DC+4_1 / 238b.1
DC-4_1 / 238b.1
DC+4_2 / 238b.4
DC-4_2 / 238b.4
DC+4_3 / 238b.7
DC-4_3 / 238b.8

DC+ and DC- Busbars
in Connection cabinet

previous page: 231.a
next page: 237.a

Editor	Freqcon_JD			Statron	FREQCON	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	20250805_V2.0
Date	18.06.2024						10354_23A2007
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	Converter	page: 237
+			total: 492



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 237

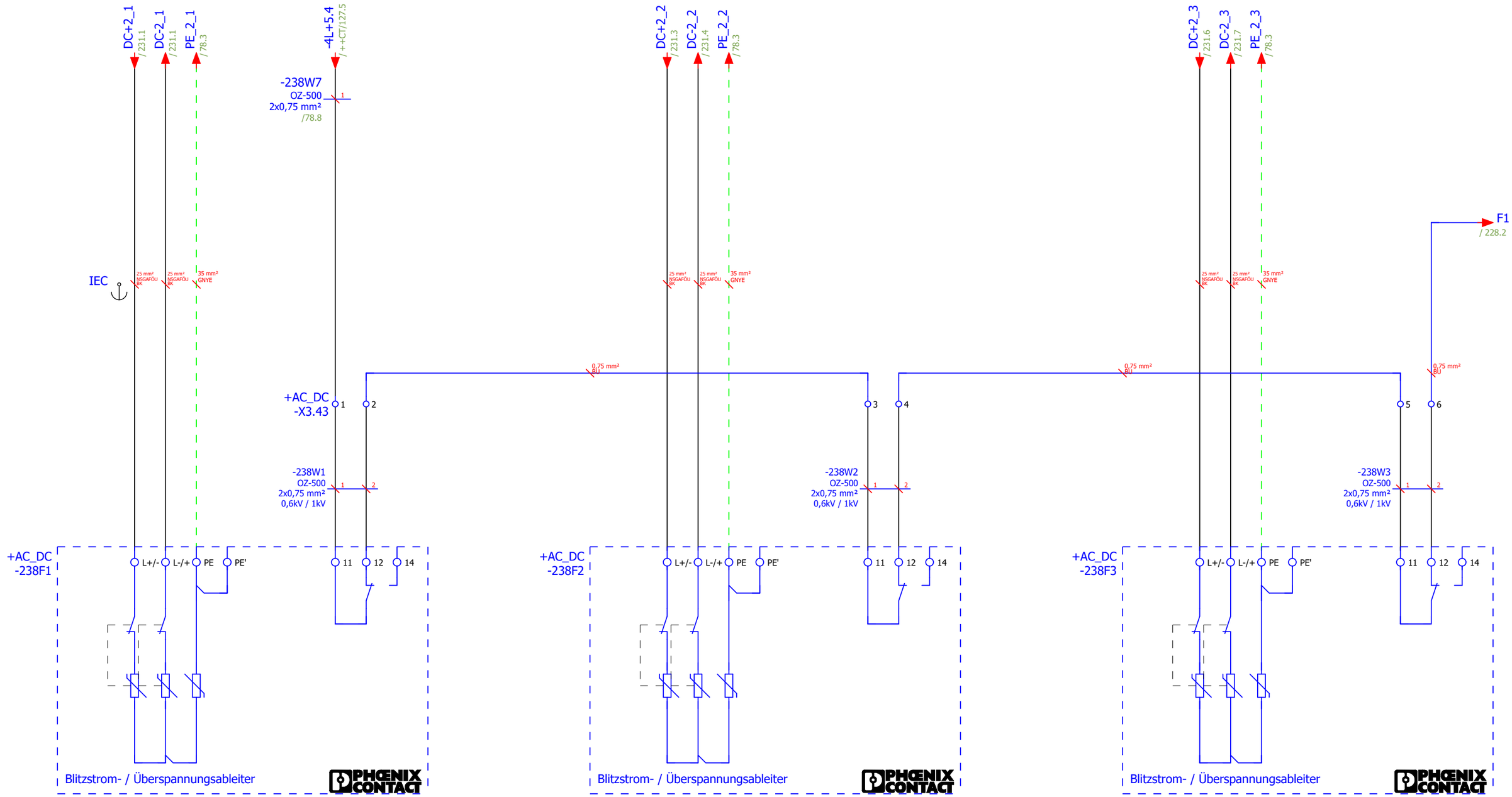
next page: 238a

Editor	Freqcon_DG			Statron	FREQCON	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	20250805_V2.0
Date	29.07.2024						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV Converter page: 237.a
							+ total: 492

DC+ and DC- Busbars

DC+ and DC- Busbars

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 2_1

SURGE ARRESTER
DC SUBSYSTEM 2_2

SURGE ARRESTER
DC SUBSYSTEM 2_3

in Connection cabinet

previous page:
237.a

next page:
238b

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 2_1 - 2_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 238a
Date								+ total: 492

DC+ and DC- Busbars

DC+4_1 / 237.1
DC-4_1 / 237.1
PE_4_1 / 78.4

IEC

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F2
228.9 /

0,75 mm² BU

+AC_DC
-X3.43
13 14

-238W4
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F4
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_1

DC+ and DC- Busbars

DC+4_2 / 237.3
DC-4_2 / 237.4
PE_4_2 / 78.4

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

0,75 mm² BU

15 16

-238W5
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F5
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_2

DC+ and DC- Busbars

DC+4_3 / 237.6
DC-4_3 / 237.7
PE_4_3 / 78.5

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F3
/ 78.9

0,75 mm² BU

17 18

-238W6
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F6
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

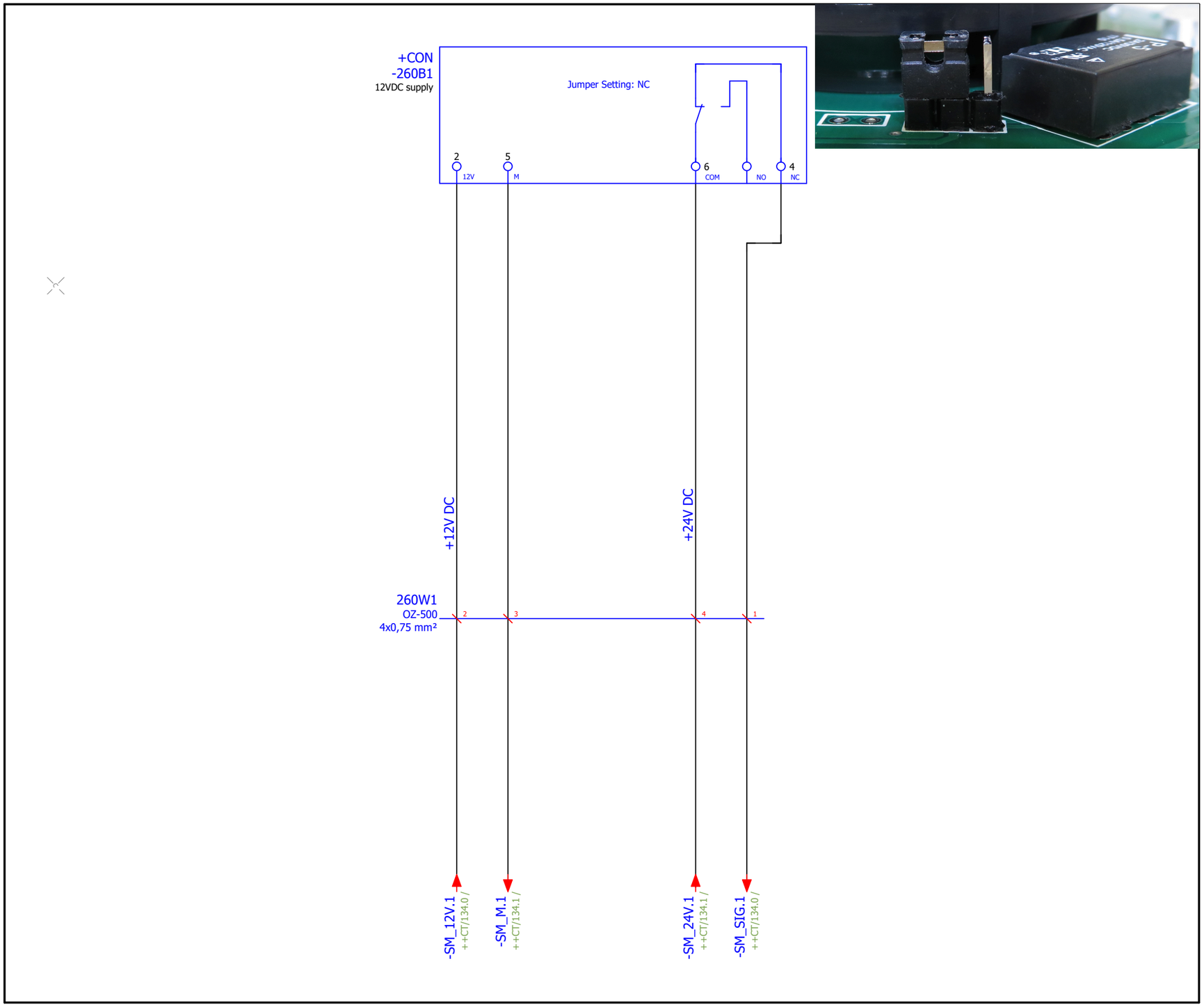
SURGE ARRESTER
DC SUBSYSTEM 4_3

in Connection cabinet

previous page: 238a

next page: 260

Editor	Freqcon_JD			Statron	FREQCON	DC SURGE ARRESTER 4_1 - 4_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 238b
Date								+	total: 492

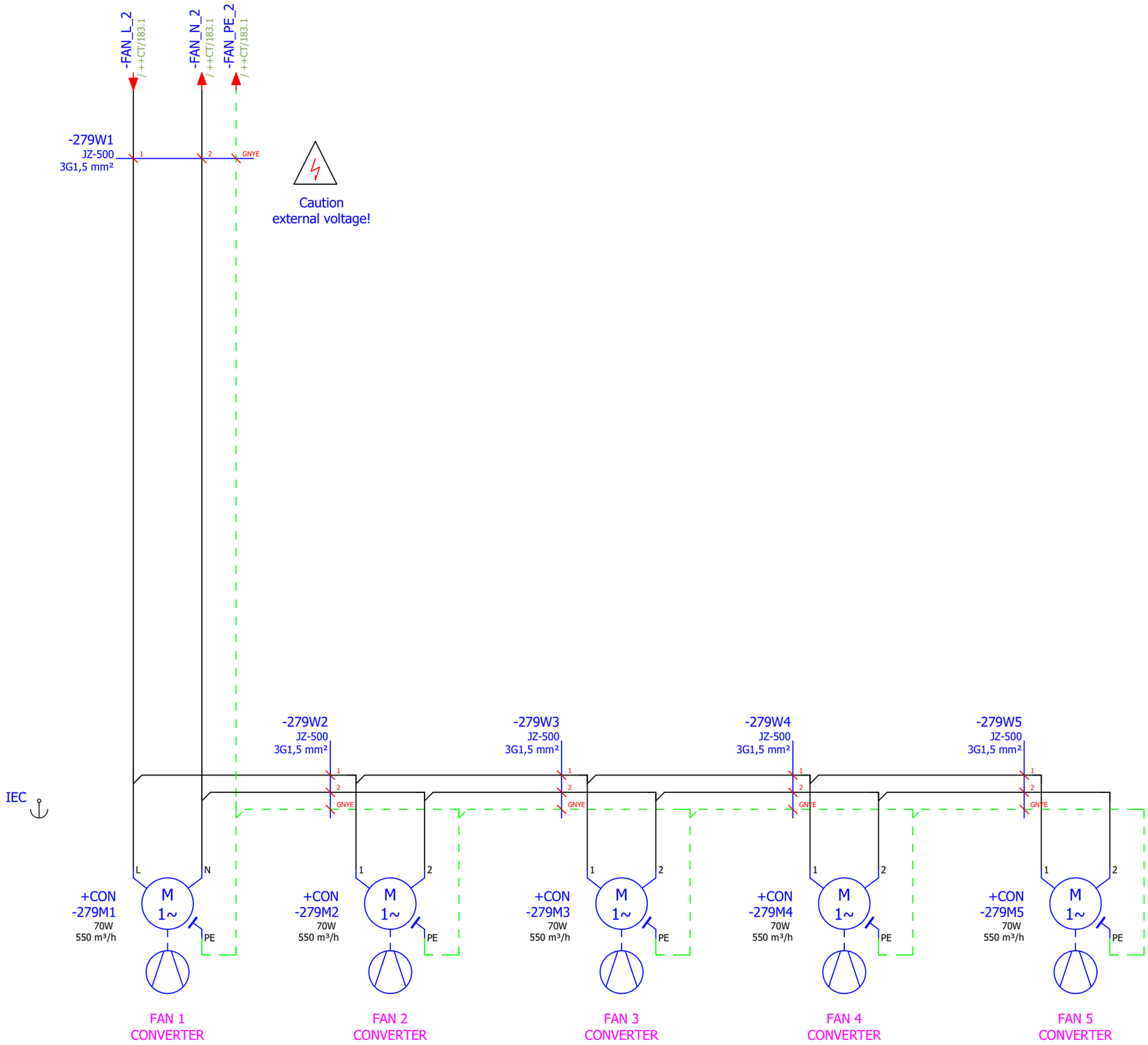


SMOKE DETECTOR
+CON CABINET

previous page:
238b

next page:
279

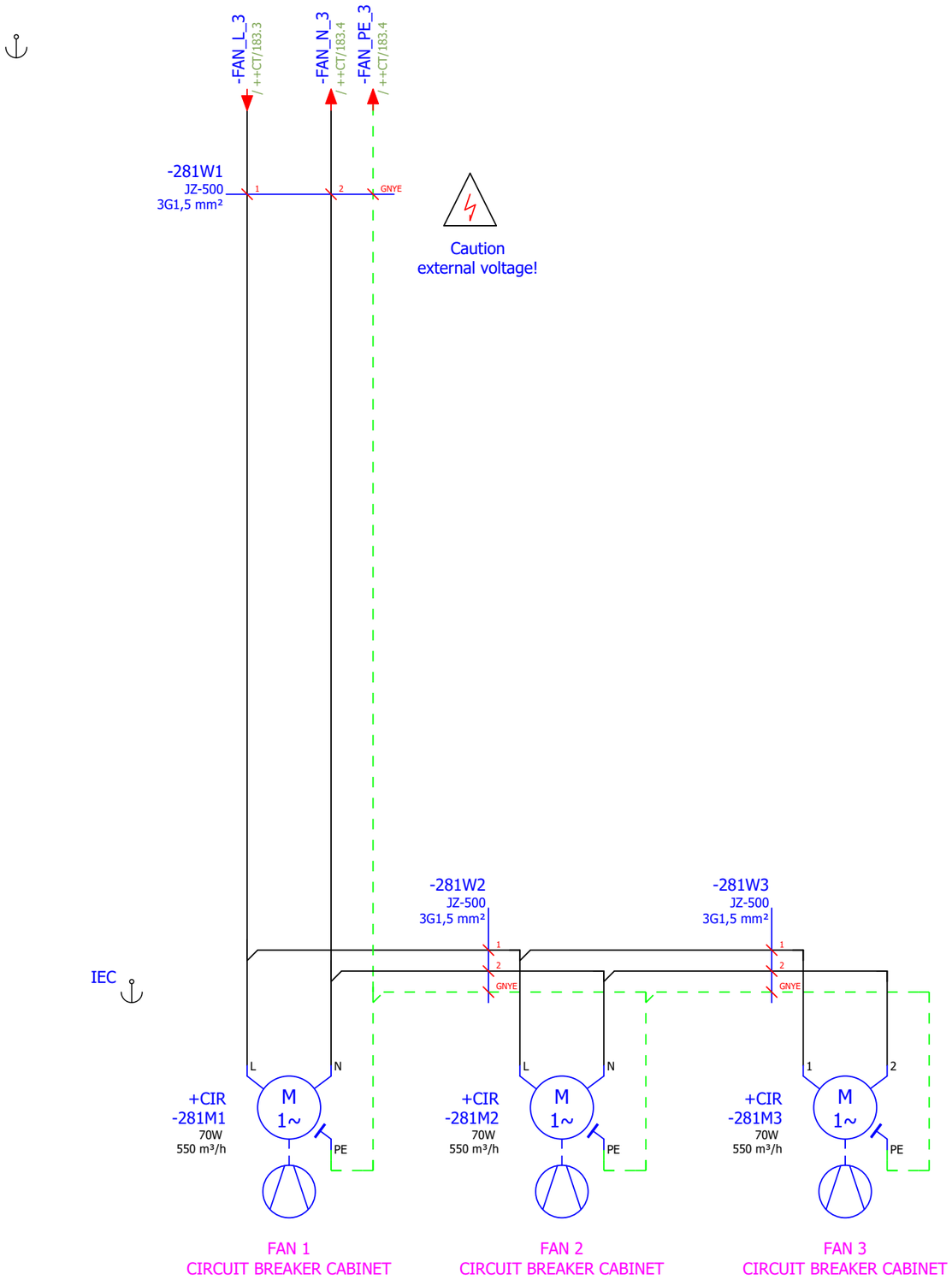
Editor	Freqcon_JD			Statron	FREQCON	SMOKE DETECTOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 260
Date								+	total: 492



previous page:
260

next page:
281

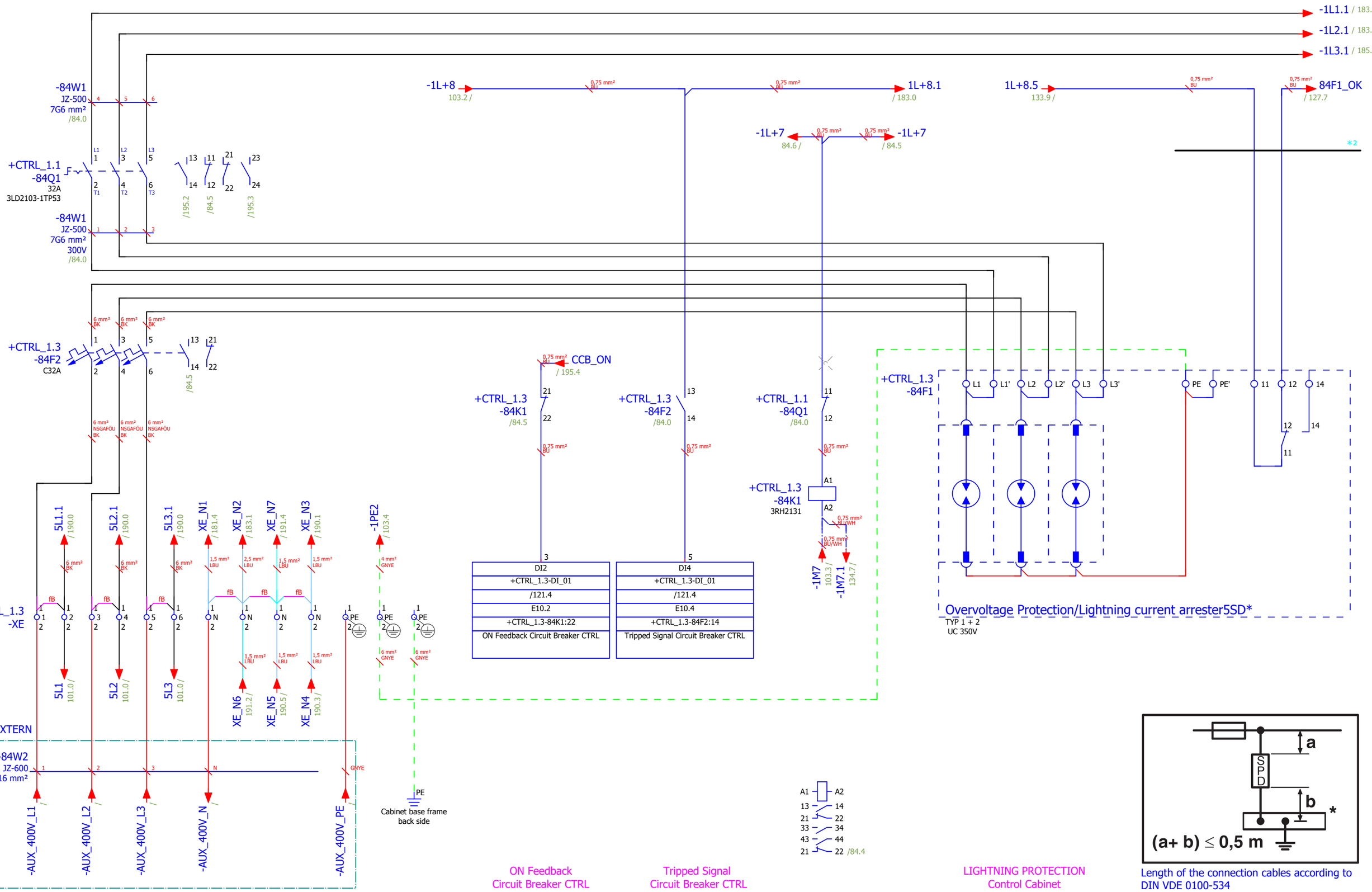
Editor	Freqcon_JD			Statron	FREQCON	CONVERTER CABINET CLIMATE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 279
Date								+	total: 492



previous page:
279

next page:
++CT/84

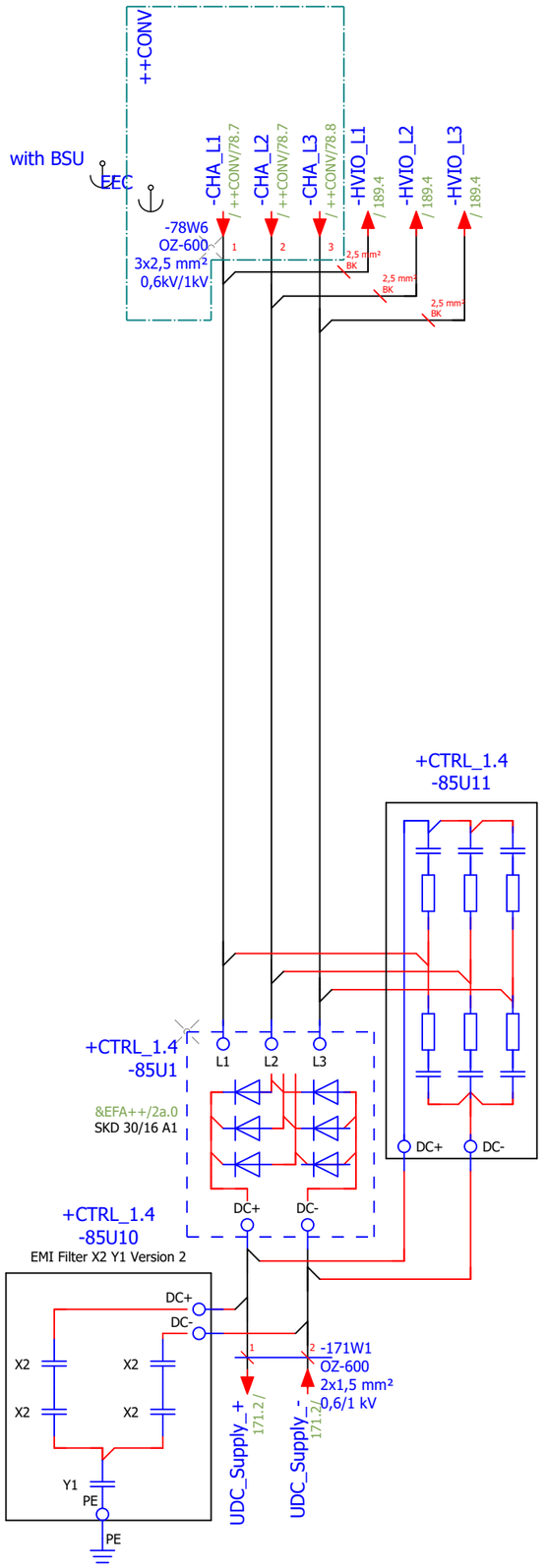
Editor	Freqcon_JD			Statron	FREQCON	CIRCUIT BREAKER CABINET CLIMATE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 281
Date								+	total: 492



previous page:
++CONV/281

next page:
85

Editor	Freqcon_DG			Statron	FREQCON	FEEDING CONTROL CABINET (CTRL)	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	



previous page: 84

earthing via cooling element

next page: 100

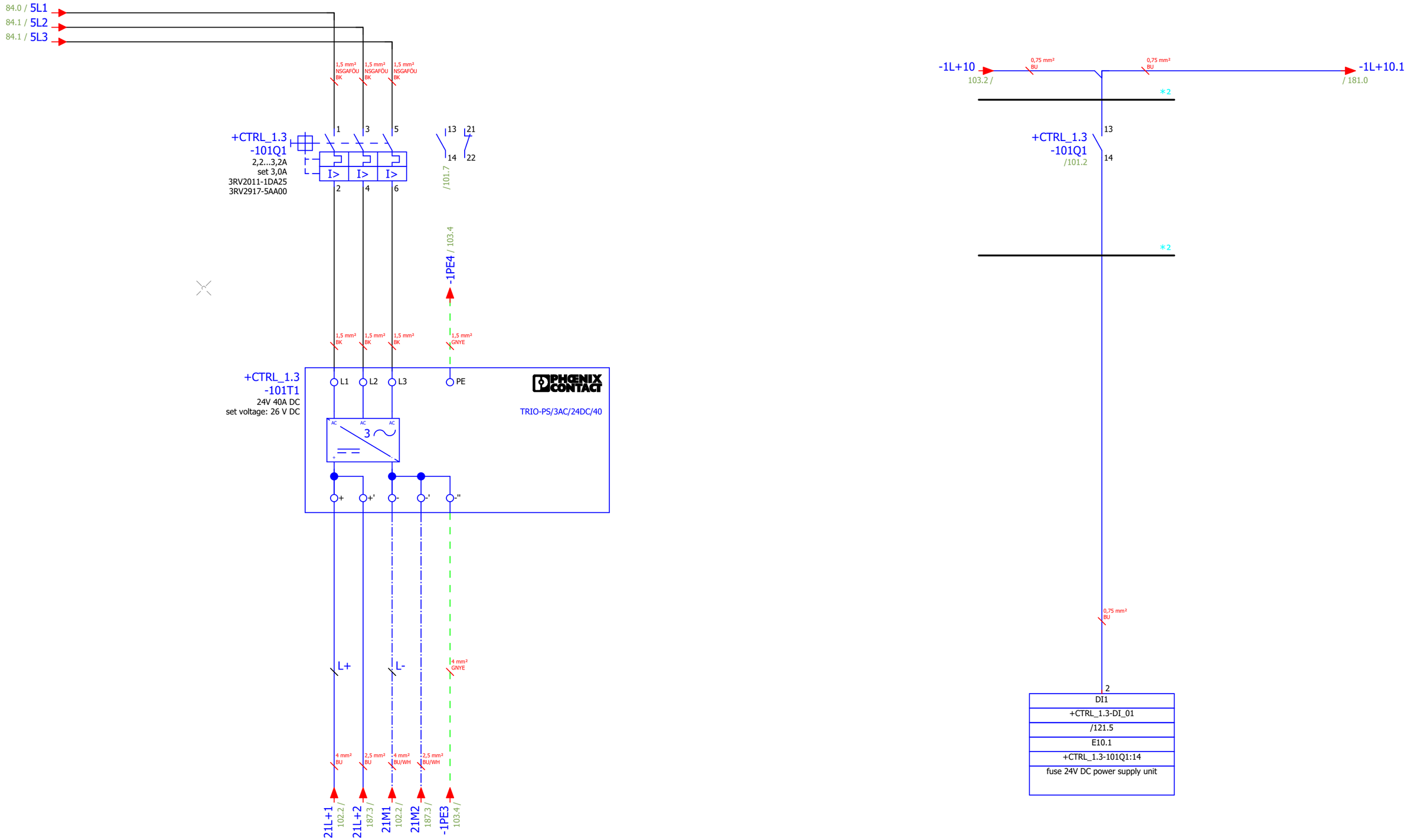
Editor	Freqcon_DG			Statron		SUPPLY UDC	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	29.07.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 85
Date								+		total: 492

Control Cabinet

Pages 100 - 199

previous page: 85

next page: 101

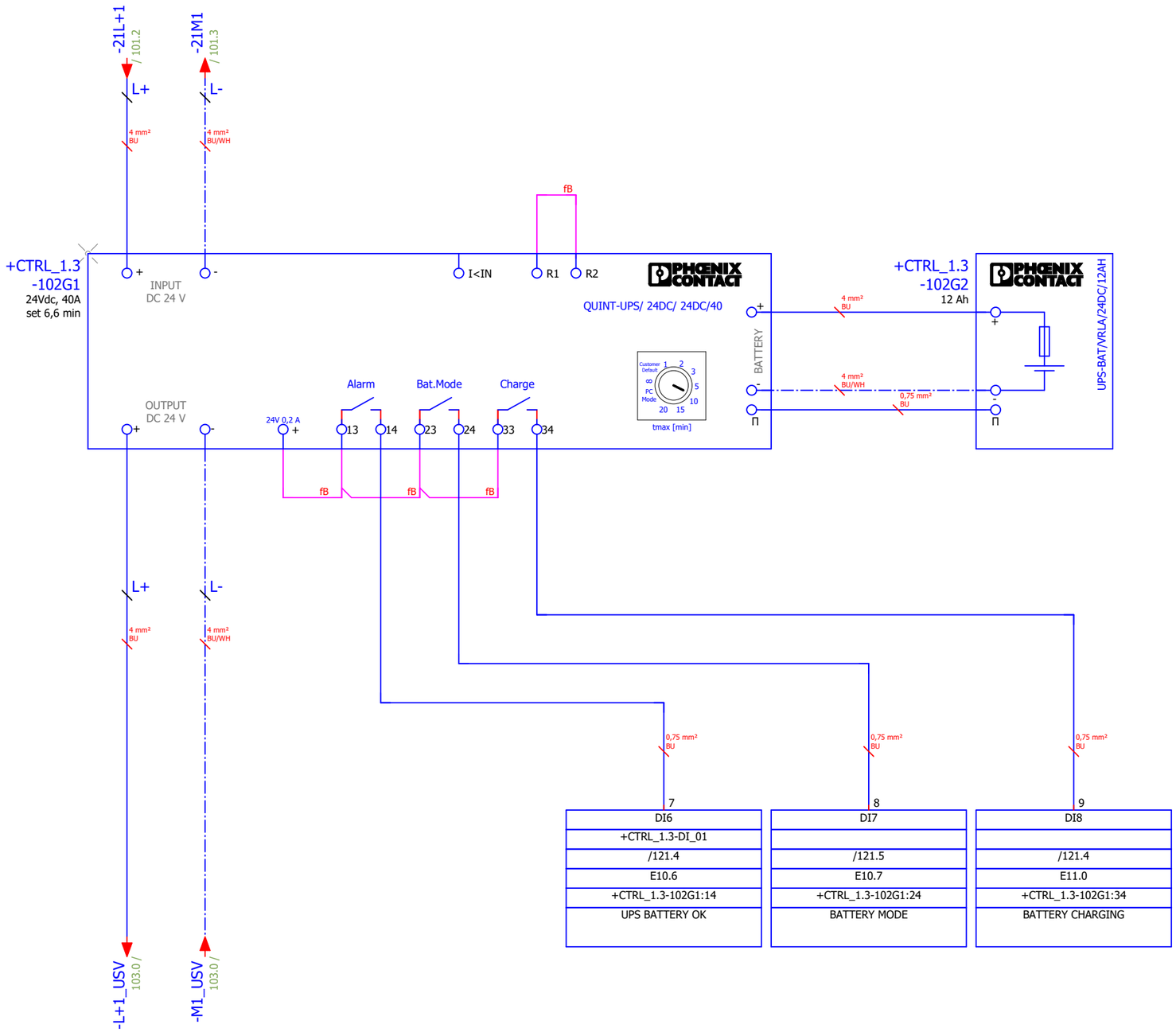


previous page: 100

Power supply unit from 400V AC

next page: 102

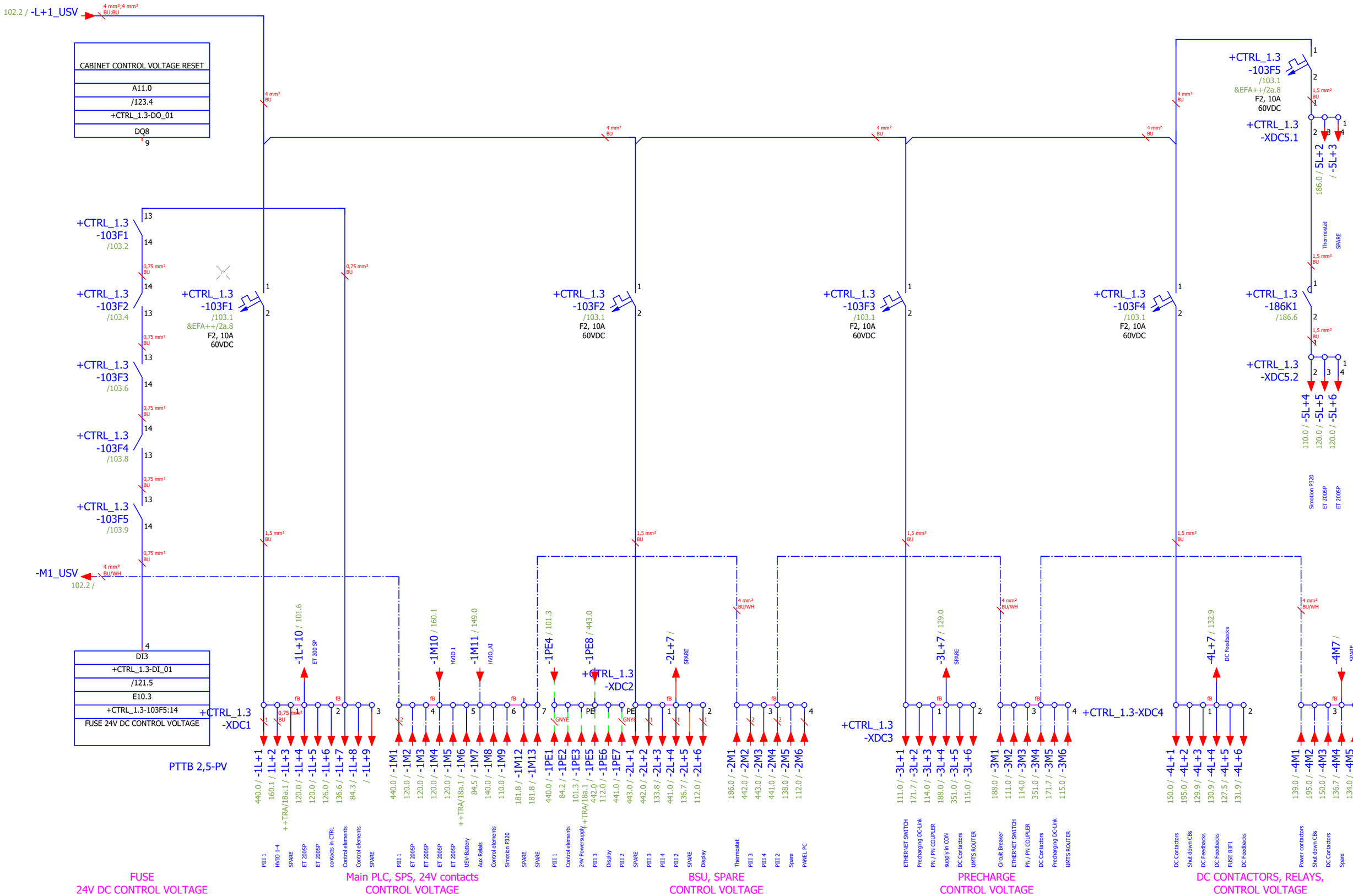
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 101
Date								+	total: 492



previous page:
101

next page:
103

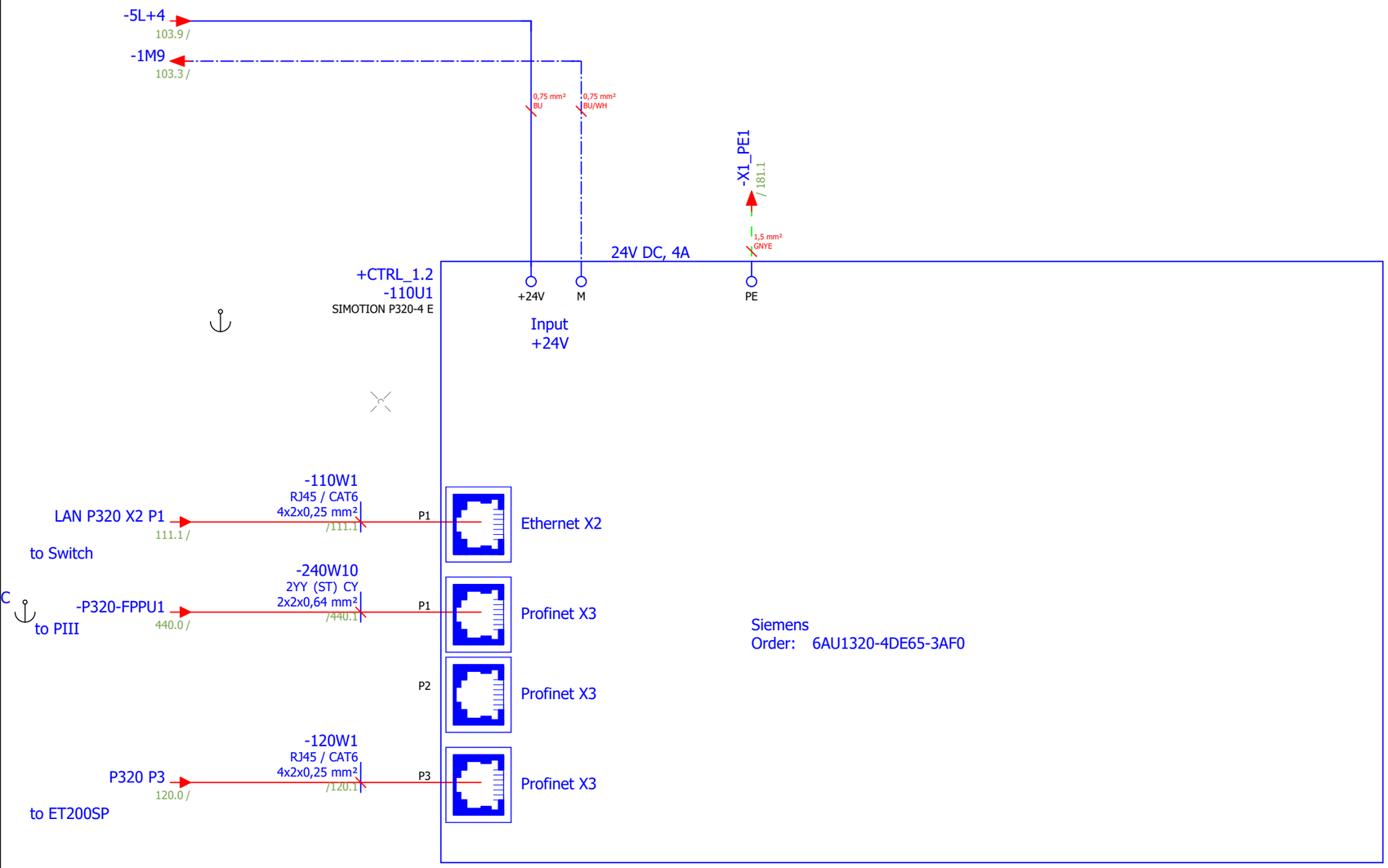
Editor	Freqcon_JD			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 102
Date								+ total: 492



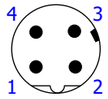
previous page: 102

next page: 110

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 103
Date								+	total: 492



Plug with D-coded



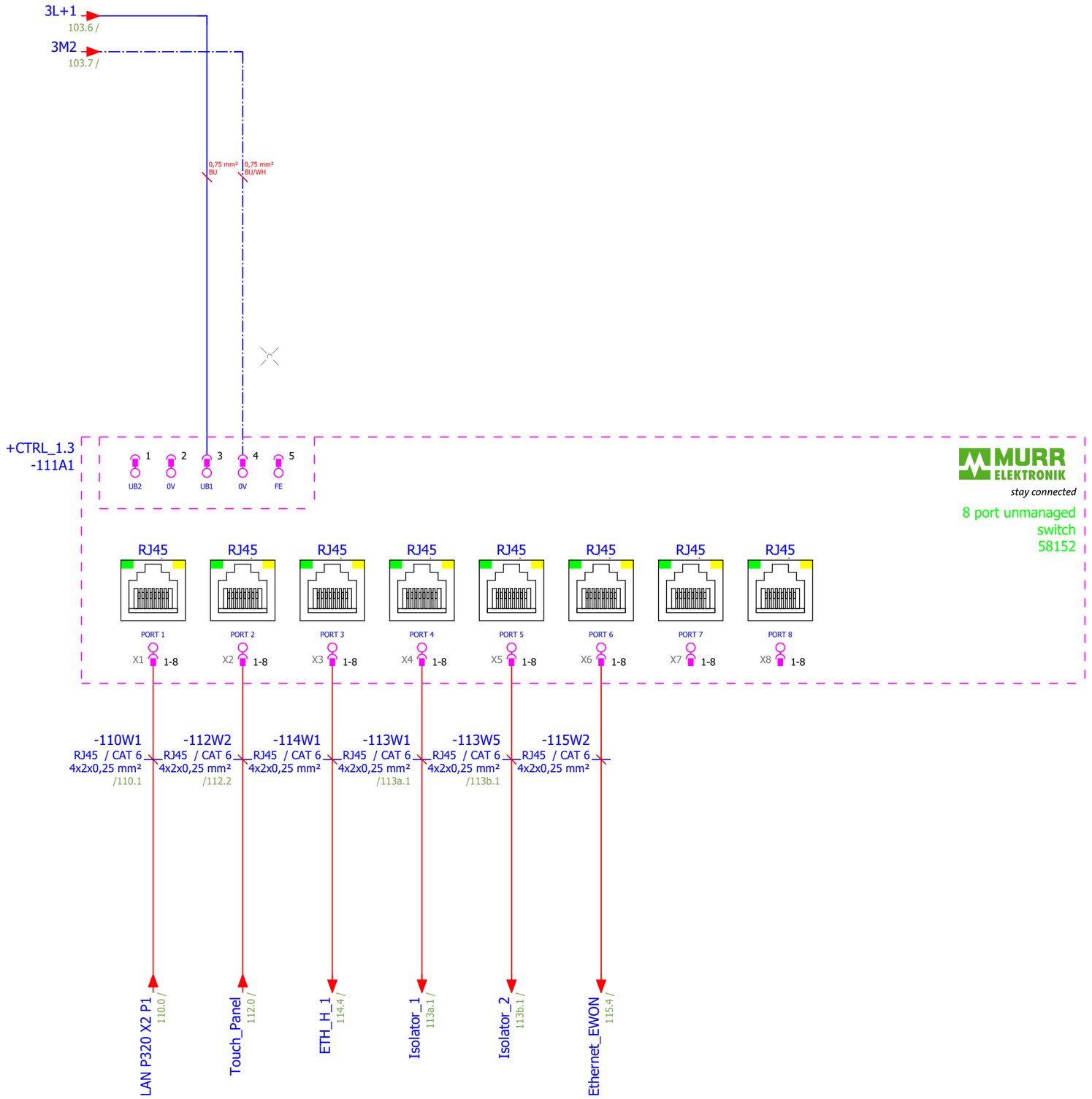
Top view of the pinheader

Signal	Colour	RJ45	M12 plug
TD+	yellow	1	1
TD-	orange	2	3
RD+	white	3	2
RD-	blue	6	4

Connection P320 -- PIII

previous page: 103

next page: 111

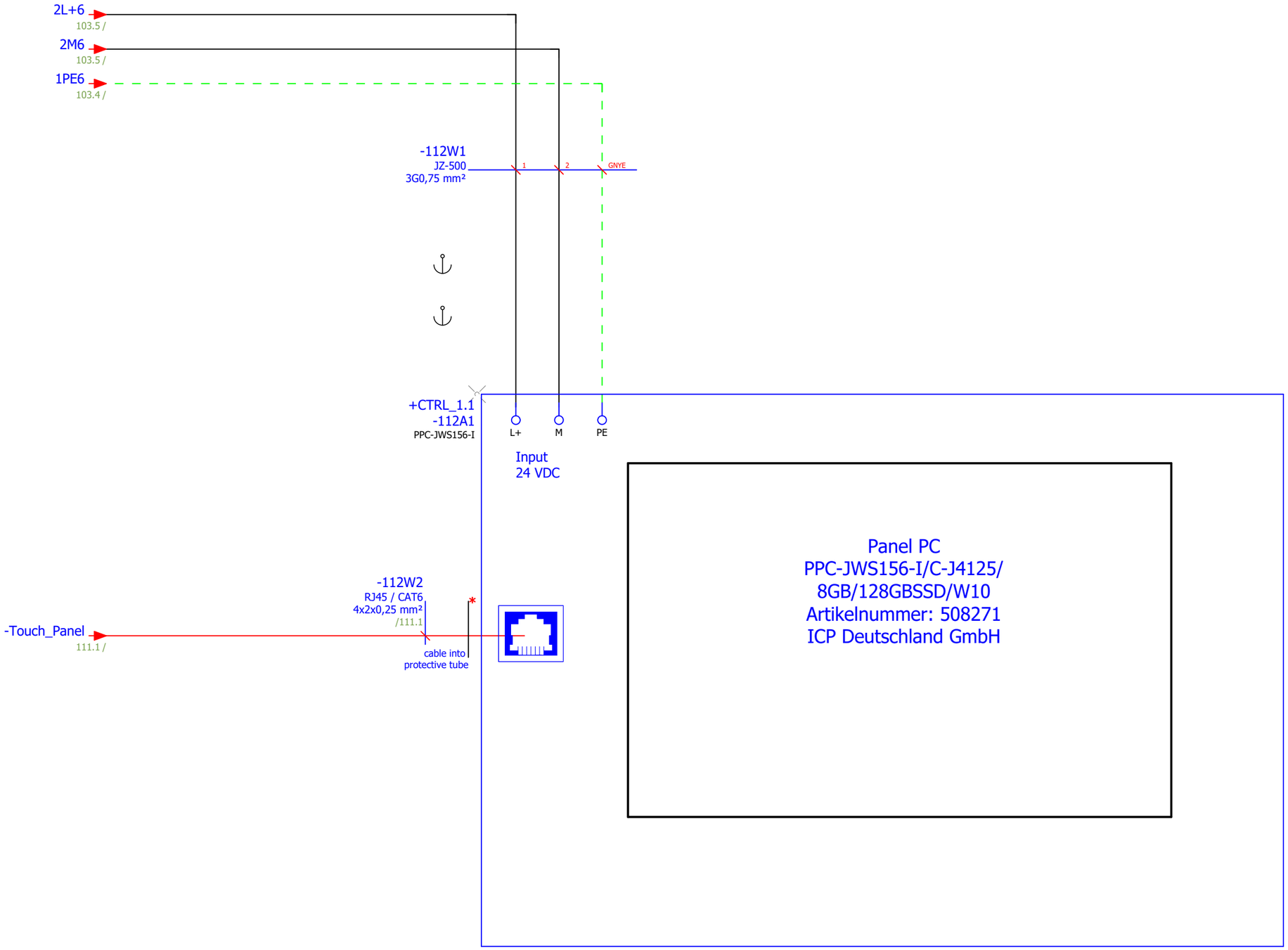


previous page:
110

next page:
112

Editor	Freqcon_DG			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_01	Converter Container 1
Date	23.01.2025							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

page: 111
total: 492



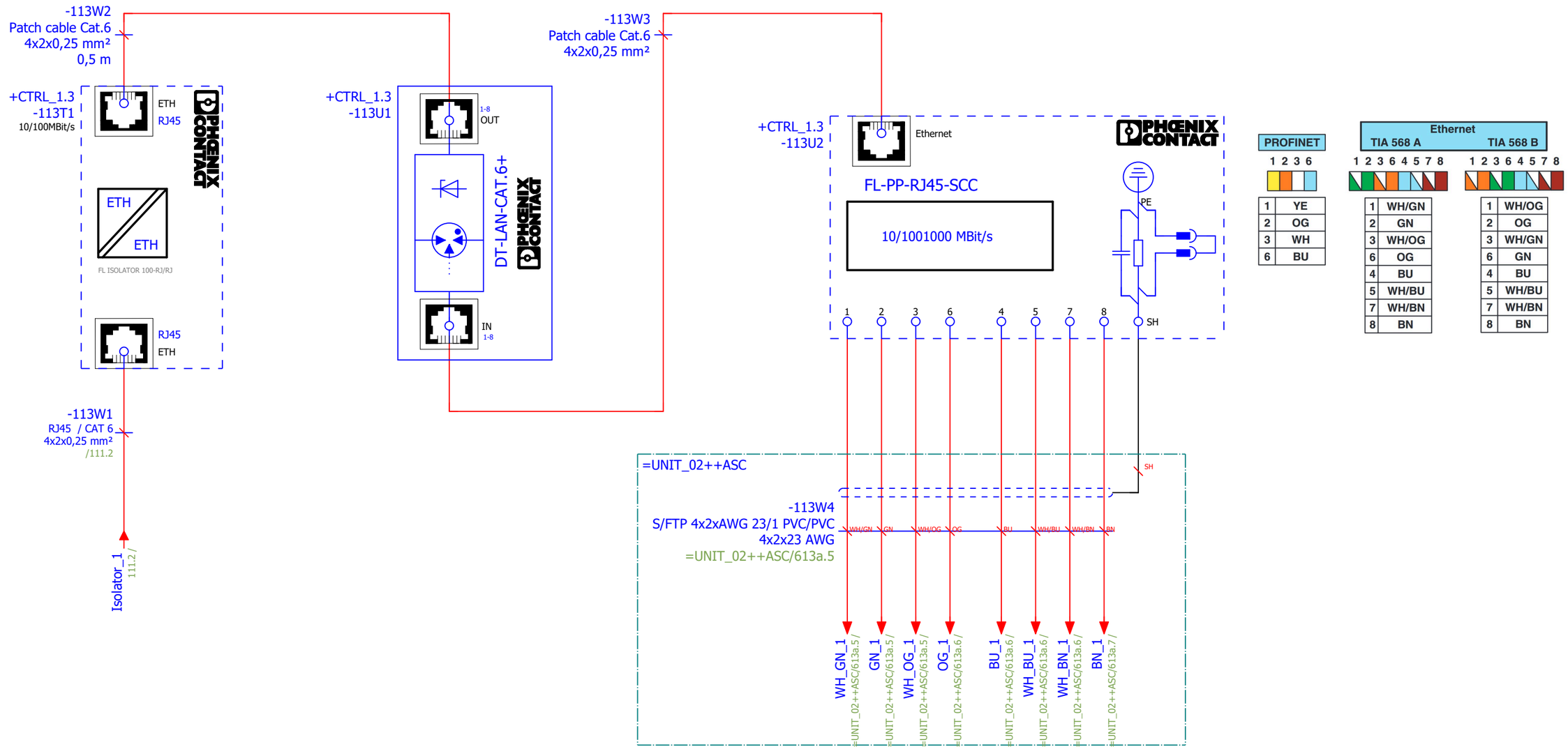
PANEL PC

previous page:
111

next page:
113a

Editor	Freqcon_JD			Statron	FREQCON	PANEL PC HMI	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

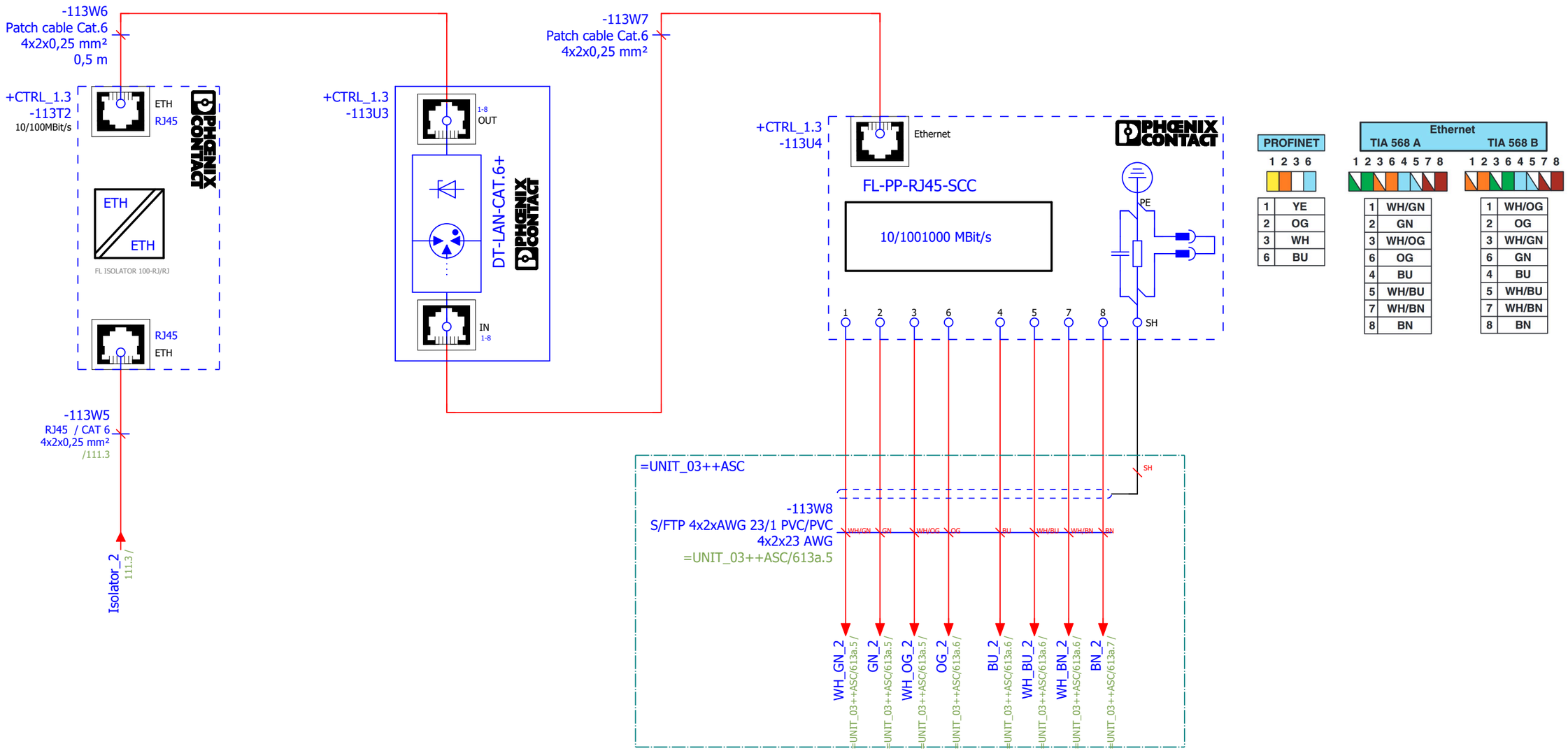
page: 112
total: 492



previous page:
112

next page:
113b

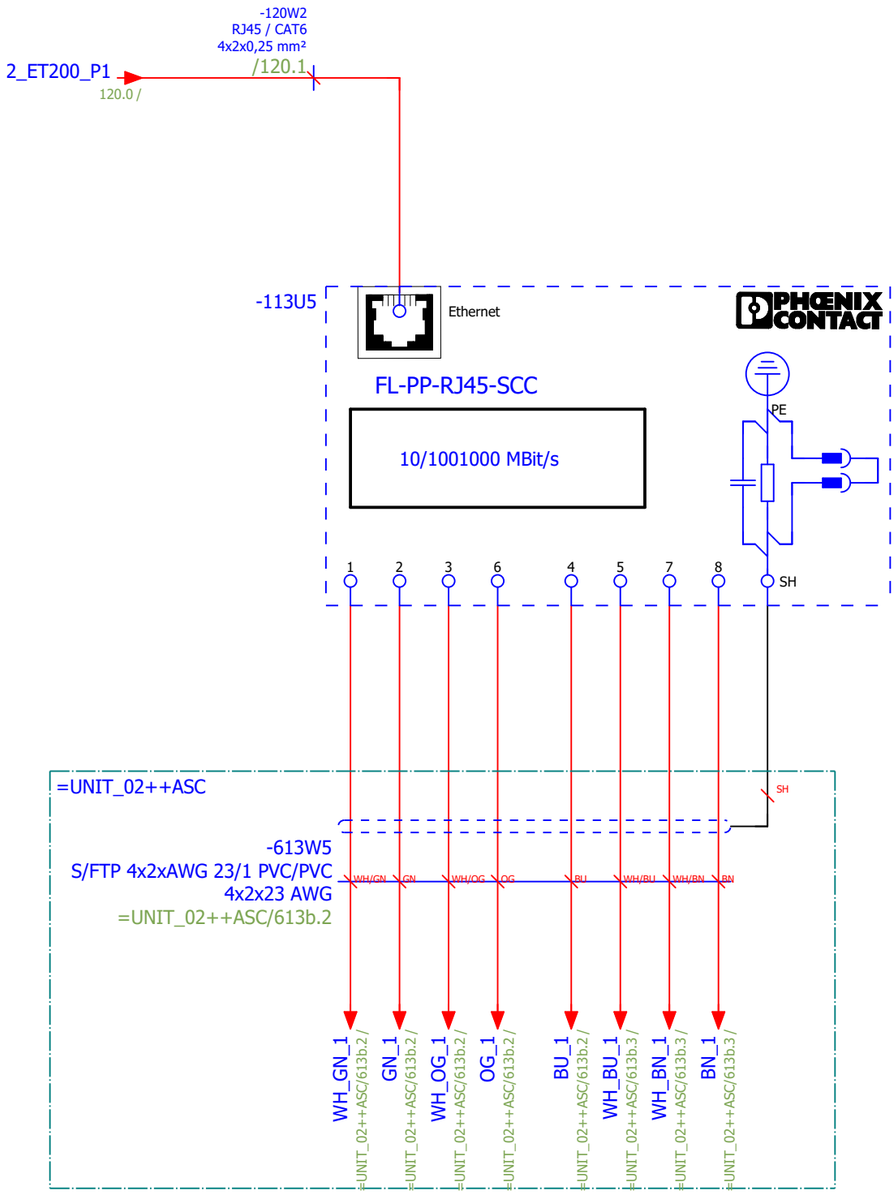
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 113a
Date								+	total: 492



previous page:
113a

next page:
113c

Editor	Freqcon_JD			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 113b
Date								+	total: 492



PROFINET

1 2 3 6

1	YE
2	OG
3	WH
6	BU

Ethernet

TIA 568 A

1 2 3 6 4 5 7 8

1	WH/GN
2	GN
3	WH/OG
6	OG
4	BU
5	WH/BU
7	WH/BN
8	BN

TIA 568 B

1 2 3 6 4 5 7 8

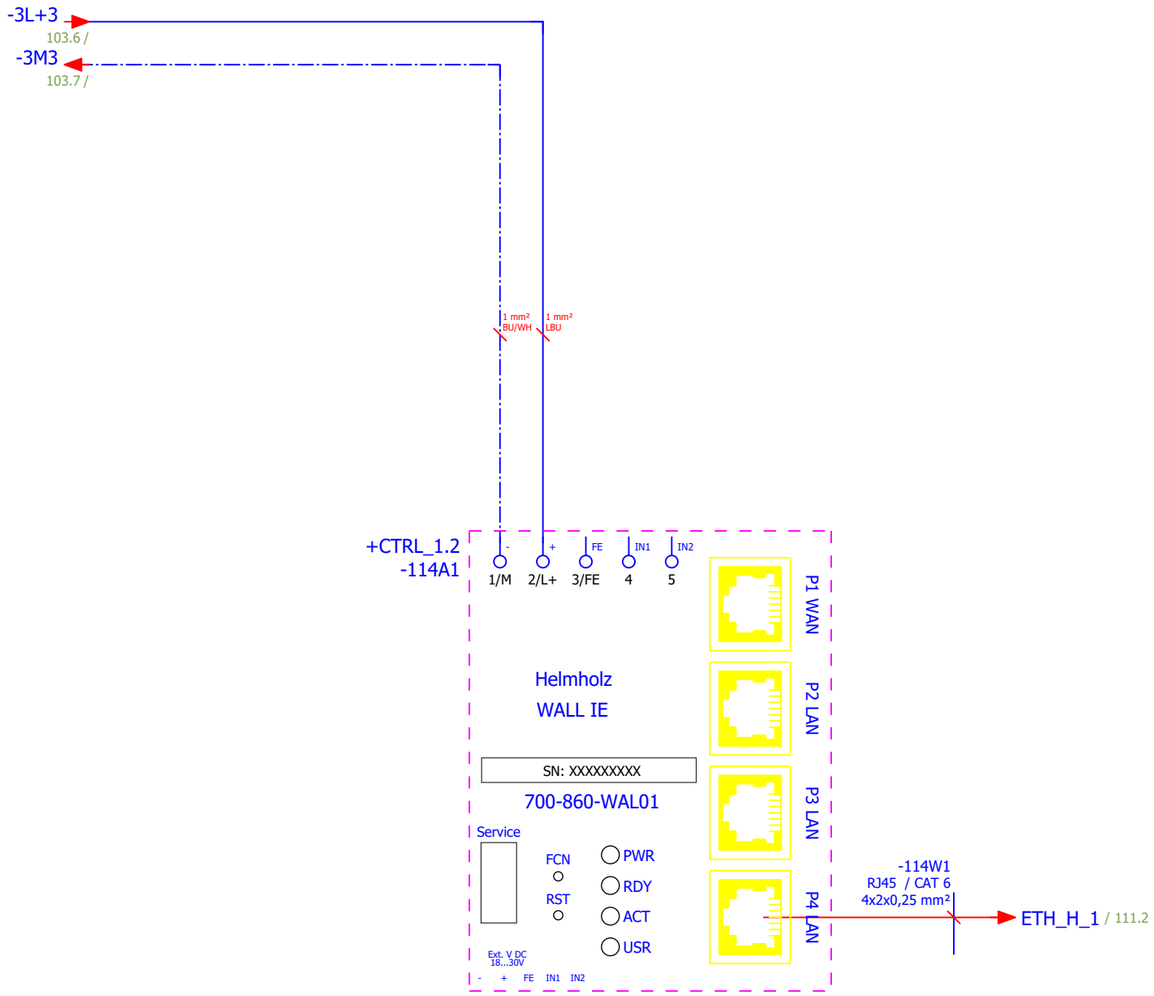
1	WH/OG
2	OG
3	WH/GN
6	GN
4	BU
5	WH/BU
7	WH/BN
8	BN

previous page: 113b

next page: 114

Editor	Freqcon_DG			Statron		PROFINET	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 113c
Date								+		total: 492

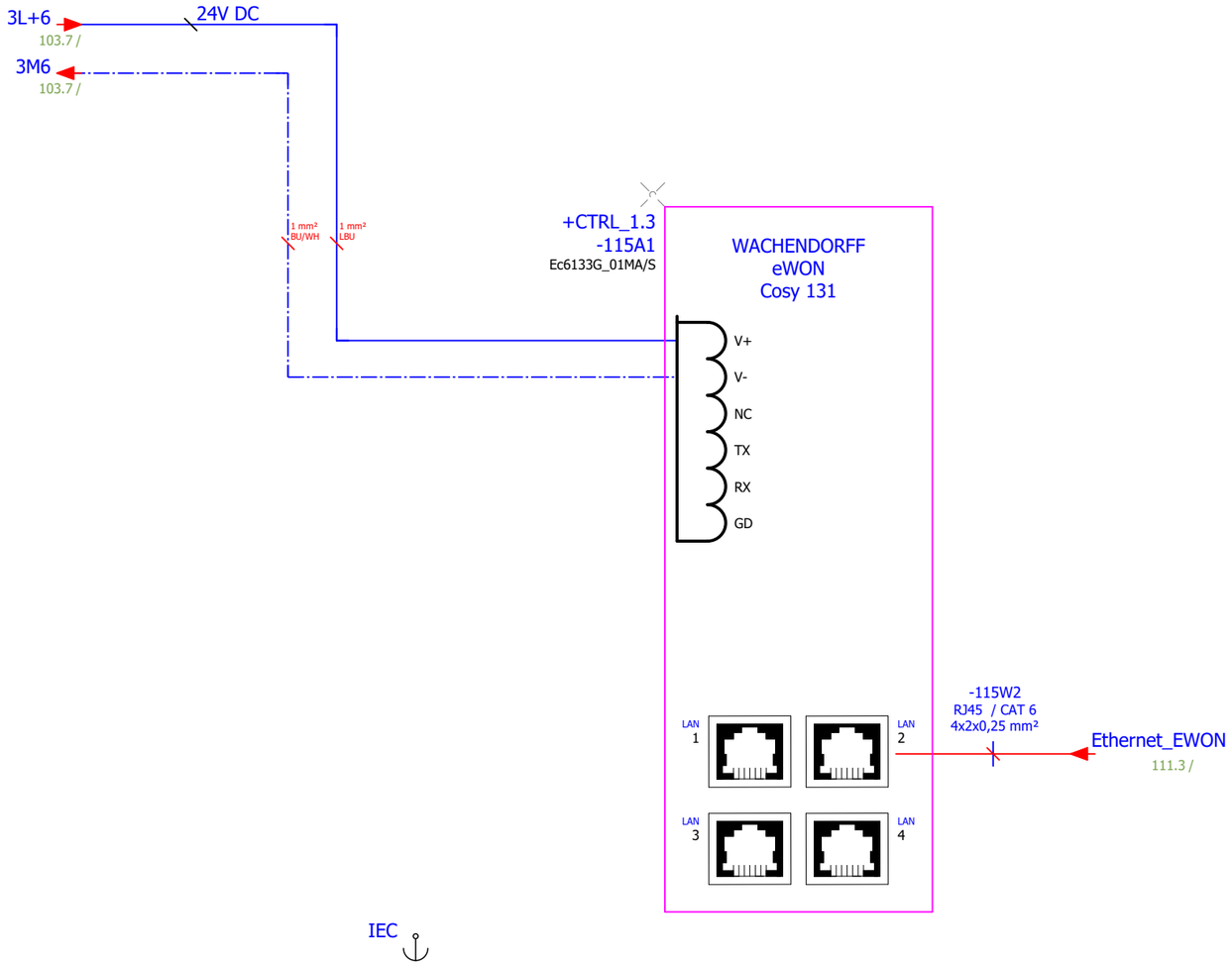
0	1	2	3	4	5	6	7	8	9



previous page:
113c

next page:
115

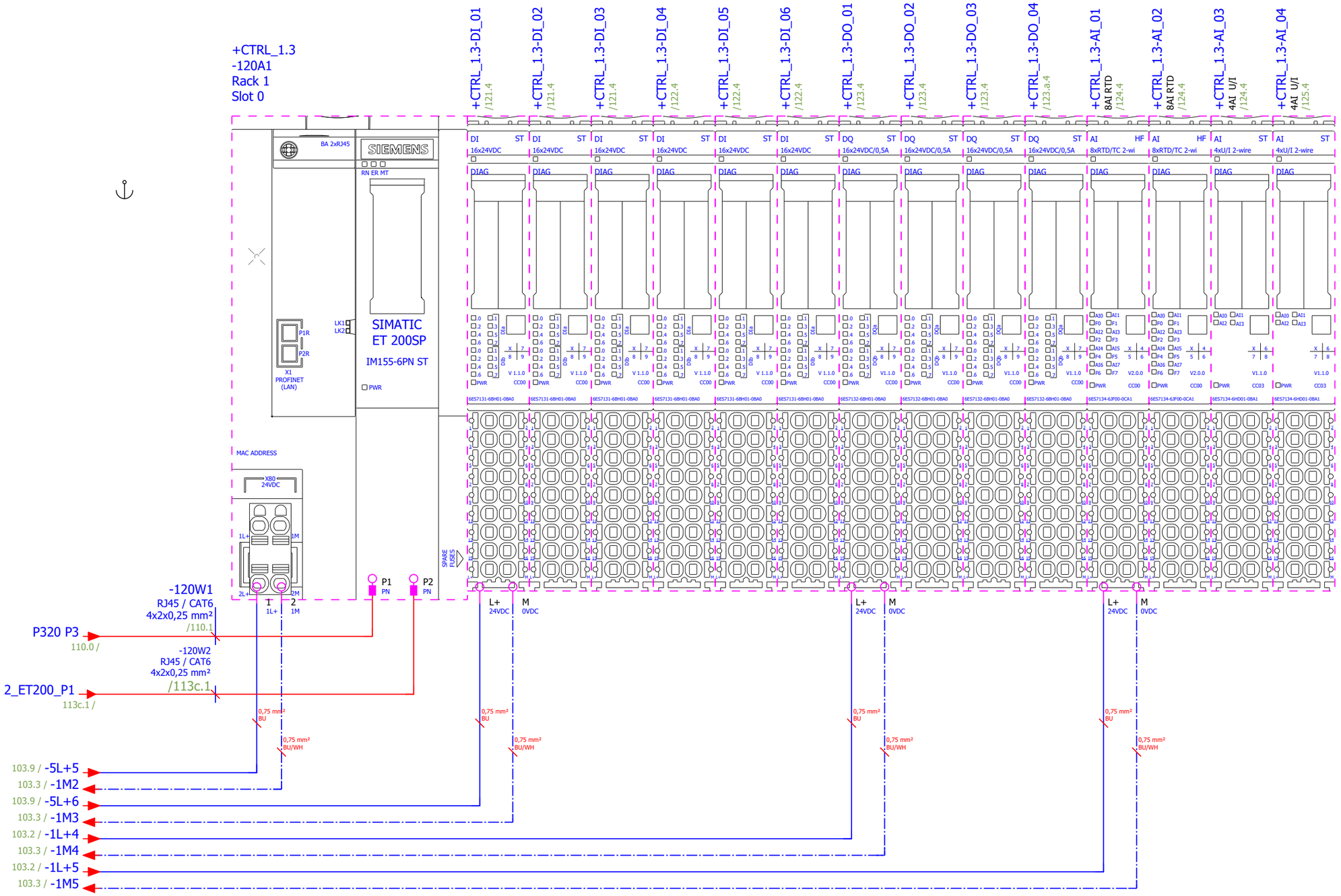
Editor	Freqcon_DG			Statron	FREQCON	HELMHOLZ	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	23.01.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 114
Date								+	total: 492



previous page:
114

next page:
120

Editor	Freqcon_JD			Statron	FREQCON	UMTS ROUTER	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 115
Date								+	total: 492



previous page: 115

next page: 121

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 120
Date								+		total: 492

+CTRL_1.3-DI_01

/120.3

		DI0 1	E10.0	E10.1 2 DI1	/101.7	fuse 24V DC power supply unit
ON Feedback Circuit Breaker CTRL	/84.4	DI2 3	E10.2	E10.3 4 DI3	/103.1	FUSE 24V DC CONTROL VOLTAGE
Tripped Signal Circuit Breaker CTRL	/84.5	DI4 5	E10.4	E10.5 6 DI5	/127.7	LIGHTNING PROTECTION in Control Cabinet OPTIONAL
UPS BATTERY OK	/102.5	DI6 7	E10.6	E10.7 8 DI7	/102.6	BATTERY MODE
BATTERY CHARGING	/102.7	DI8 9	E11.0	E11.1 10 DI9	/126.1	RESET -126S1
FUSE FOR PUMP	/181.2	DI10 11	E11.2	E11.3 12 DI11	/182.2	FAN 1 HEAT EXCHANGER
FUSE FOR HEATER	/181.5	DI12 13	E11.4	E11.5 14 DI13		
Fuse Fans CON, IND Cabinets	/183.6	DI14 15	E11.6	E11.7 16 DI15	/185.9	supply light, fan, heater, power unit in cabinet
	/120.3	24VDC L+		M 0VDC	/120.3	

+CTRL_1.3-DI_02

/120.3

FAULT SIGNAL SAFETY RELAY	/195.4	DI0 1	E12.0	E12.1 2 DI1	/187.6	FUSES SUPPLY FOR CIRCUIT BREAKER 1+2
CB 1 ON GRID	/127.2	DI2 3	E12.2	E12.3 4 DI3	/127.3	CB 1 OFF GRID
CB 1 Tripped GRID	/127.1	DI4 5	E12.4	E12.5 6 DI5	/127.4	FUSE AND LIGHTNING PROTECTION
Smoke detector CON	/134.0	DI6 7	E12.6	E12.7 8 DI7	/129.0	SUBSYSTEM 2_1_DC + Contactor K1 is on
SUBSYSTEM 2_1_DC -Contactor K7 is on	/129.1	DI8 9	E13.0	E13.1 10 DI9	/129.2	SUBSYSTEM 2_2_DC + Contactor K2 is on
SUBSYSTEM 2_2_DC -Contactor K8 is on	/129.3	DI10 11	E13.2	E13.3 12 DI11	/129.4	SUBSYSTEM 2_3_DC + Contactor K3 is on
SUBSYSTEM 2_3_DC -Contactor K9 is on	/129.5	DI12 13	E13.4	E13.5 14 DI13	/129.6	SUBSYSTEM 2_3_DC + SPARE
SUBSYSTEM 2_DC -SPARE	/129.7	DI14 15	E13.6	E13.7 16 DI15	/129.8	SUBSYSTEM 2_1_DC FUSE OK
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_03

/120.3

SUBSYSTEM 2_2_DC FUSE OK	/129.9	DI0 1	E14.0	E14.1 2 DI1	/130.0	SUBSYSTEM 3_1_DC + Contactor K1 is on
SUBSYSTEM 3_1_DC -Contactor K7 is on	/130.1	DI2 3	E14.2	E14.3 4 DI3	/130.2	SUBSYSTEM 3_2_DC + Contactor K2 is on
SUBSYSTEM 3_2_DC -Contactor K8 is on	/130.3	DI4 5	E14.4	E14.5 6 DI5	/130.4	SUBSYSTEM 3_3_DC + Contactor K3 is on
SUBSYSTEM 3_3_DC -Contactor K9 is on	/130.5	DI6 7	E14.6	E14.7 8 DI7	/130.6	SUBSYSTEM 3_DC + SPARE
SUBSYSTEM 3_DC -SPARE	/130.7	DI8 9	E15.0	E15.1 10 DI9	/130.8	SUBSYSTEM 2_DC FUSE OK
SUBSYSTEM 3_1_DC FUSE OK	/130.9	DI10 11	E15.2	E15.3 12 DI11	/131.0	SUBSYSTEM 4_1_DC + Contactor K1 is on
SUBSYSTEM 4_1_DC -Contactor K7 is on	/131.1	DI12 13	E15.4	E15.5 14 DI13	/131.2	SUBSYSTEM 4_2_DC + Contactor K2 is on
SUBSYSTEM 4_2_DC -Contactor K8 is on	/131.3	DI14 15	E15.6	E15.7 16 DI15	/131.4	SUBSYSTEM 4_3_DC + Contactor K3 is on
		24VDC L+		M 0VDC		

previous page: 120

next page: 122

+CTRL_1.3-DI_04

/120.4

SPARE	/133.1	DI0 1	E16.0	E16.1 2 DI1	/133.2	SPARE
SPARE	/133.3	DI2 3	E16.2	E16.3 4 DI3	/133.4	TRIP
Earthing switch in On Transformer 620V side	/133.9	DI4 5	E16.4	E16.5 6 DI5		
		DI6 7	E16.6	E16.7 8 DI7		
		DI8 9	E17.0	E17.1 10 DI9		
Fuse 230V AC for Container Air Conditioning	/133.6	DI10 11	E17.2	E17.3 12 DI11	/128.1	CB 2 Tripped ISLAND GRID
CB 2 ON ISLAND GRID	/128.2	DI12 13	E17.4	E17.5 14 DI13	/128.3	CB 2 OFF ISLAND GRID
FUSE AND LIGHTNING PROTECTION 2	/128.4	DI14 15	E17.6	E17.7 16 DI15	/182.5	FAN 2 HEAT EXCHANGER (OPTIONAL)
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_05

/120.4

SUBSYSTEM 4_3_DC -Contactor K9 is on	/131.5	DI0 1	E18.0	E18.1 2 DI1	/131.6	SUBSYSTEM 4_DC + SPARE
SUBSYSTEM 4_DC -SPARE	/131.7	DI2 3	E18.2	E18.3 4 DI3	/131.8	SUBSYSTEM 3_2_DC FUSE OK
SUBSYSTEM 3_3_DC FUSE OK	/131.9	DI4 5	E18.4	E18.5 6 DI5	/132.0	
	/132.1	DI6 7	E18.6	E18.7 8 DI7	/132.2	
	/132.3	DI8 9	E19.0	E19.1 10 DI9	/132.4	
	/132.5	DI10 11	E19.2	E19.3 12 DI11	/132.6	
SUBSYSTEM 4_1_DC FUSE OK	/132.7	DI12 13	E19.4	E19.5 14 DI13	/132.8	SUBSYSTEM 4_2_DC FUSE OK
SUBSYSTEM 4_3_DC FUSE OK	/132.9	DI14 15	E19.6	E19.7 16 DI15		
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_06

/120.4

Shut-down to BESS	/136.6	DI0 1	E20.0	E20.1 2 DI1		
		DI2 3	E20.2	E20.3 4 DI3		
		DI4 5	E20.4	E20.5 6 DI5		
		DI6 7	E20.6	E20.7 8 DI7		
incoming CB is open	/136.8	DI8 9	E21.0	E21.1 10 DI9	/136.9	cmd island mode
		DI10 11	E21.2	E21.3 12 DI11		
		DI12 13	E21.4	E21.5 14 DI13		
		DI14 15	E21.6	E21.7 16 DI15		
		24VDC L+		M 0VDC		

previous page: 121

next page: 123

+CTRL_1.3-DO_01

/120.5

CON Fans 1-5 in door	/135.1	DQ0 1	A10.0	A10.1 2 DQ1	/135.2	FAN 1 Control cabinet
CIR Fans 1-3 in door	/135.3	DQ2 3	A10.2	A10.3 4 DQ3	/135.4	SPARE 230V
CB2 ON ISLAND GRID OPTIONAL	/137.3	DQ4 5	A10.4	A10.5 6 DQ5	/137.4	CB 2 OFF ISLAND GRID OPTIONAL
Precharging DC-Link Capacitors	/171.5	DQ6 7	A10.6	A10.7 8 DQ7	/173.6	Discharge CON
CABINET CONTROL VOLTAGE RESET	/103.1	DQ8 9	A11.0	A11.1 10 DQ9	/137.1	CB1 ON GRID
CB 1 OFF GRID	/137.2	DQ10 11	A11.2	A11.3 12 DQ11	/189.1	GRID FAULT
FAULT 140H1	/140.1	DQ12 13	A11.4	A11.5 14 DQ13	/140.2	PREHEATING 140H2
READY FOR OPERATION 140H3	/140.3	DQ14 15	A11.6	A11.7 16 DQ15	/140.4	OPERATING 140H4
	/120.5	24VDC L+		M 0VDC	/120.5	

+CTRL_1.3-DO_02

/120.5

SUBSYSTEM 2_1 CONTACTOR DC+ ON	/150.1	DQ0 1	A12.0	A12.1 2 DQ1	/150.3	SUBSYSTEM 2_1 CONTACTOR DC-ON
SUBSYSTEM 2_2 CONTACTOR DC+ ON	/151.0	DQ2 3	A12.2	A12.3 4 DQ3	/151.2	SUBSYSTEM 2_2 CONTACTOR DC-ON
SUBSYSTEM 2_3 CONTACTOR DC+ ON	/151.3	DQ4 5	A12.4	A12.5 6 DQ5	/151.5	SUBSYSTEM 2_3 CONTACTOR DC-ON
		DQ6 7	A12.6	A12.7 8 DQ7	/135.5	SPARE
		DQ8 9	A13.0	A13.1 10 DQ9		
		DQ10 11	A13.2	A13.3 12 DQ11	/139.4	Fan 2 Heat exchanger optional
Heater On converter coolingsystem	/139.1	DQ12 13	A13.4	A13.5 14 DQ13	/139.2	Pump converter coolingsystem
Fan 1 Heat exchanger	/139.3	DQ14 15	A13.6	A13.7 16 DQ15	/134.8	Reset the smoke detectors
		24VDC L+		M 0VDC		

+CTRL_1.3-DO_03

/120.5

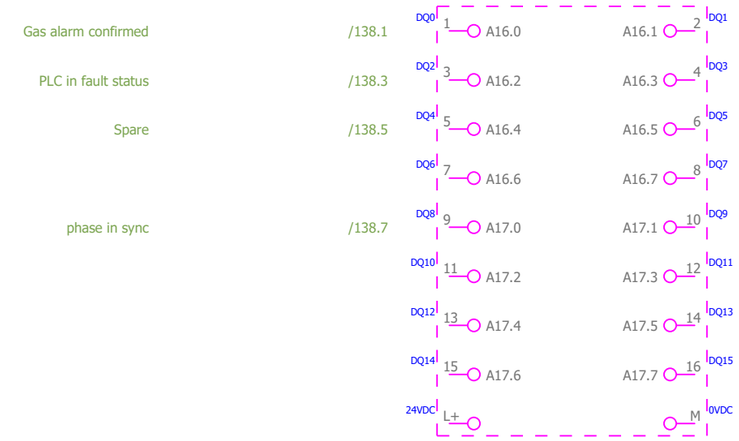
SUBSYSTEM 3_1 CONTACTOR DC+ ON	/350.1	DQ0 1	A14.0	A14.1 2 DQ1	/350.3	SUBSYSTEM 3_1 CONTACTOR DC-ON
		DQ2 3	A14.2	A14.3 4 DQ3		
SUBSYSTEM 3_3 CONTACTOR DC+ ON	/351.4	DQ4 5	A14.4	A14.5 6 DQ5	/351.5	SUBSYSTEM 3_3 CONTACTOR DC-ON
SUBSYSTEM 4_1 CONTACTOR DC+ ON	/352.0	DQ6 7	A14.6	A14.7 8 DQ7	/352.2	SUBSYSTEM 4_1 CONTACTOR DC-ON
SUBSYSTEM 4_2 CONTACTOR DC+ ON	/353.0	DQ8 9	A15.0	A15.1 10 DQ9	/353.2	SUBSYSTEM 4_2 CONTACTOR DC-ON
SUBSYSTEM 4_3 CONTACTOR DC+ ON	/353.3	DQ10 11	A15.2	A15.3 12 DQ11	/353.5	SUBSYSTEM 4_3 CONTACTOR DC-ON
		DQ12 13	A15.4	A15.5 14 DQ13		
		DQ14 15	A15.6	A15.7 16 DQ15		
		24VDC L+		M 0VDC		

previous page: 122

next page: 123.a

+CTRL_1.3-DO_04

/120.6



previous page: 123

next page: 124

Editor	Freqcon_JD			Statron	FREQCON	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 123.a
Date								+	total: 492

+CTRL_1.3-AI_01

/120.6

INDUCTOR GRID PHASE L1 TEMPERATURE 1_1	/145.1	M0+	1	PIW150	PIW152	2	M1+	/145.3	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3	/145.5	M2+	3	PIW154	PIW156	4	M3+	/145.7	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2	/146.1	M4+	5	PIW158	PIW160	6	M5+	/146.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1	/146.5	M6+	7	PIW162	PIW164	8	M7+	/146.7	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2
INDUCTOR GRID PHASE L1 TEMPERATURE 1_1	/145.1	M0-	9	PIW150	PIW152	10	M1-	/145.3	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3	/145.5	M2-	11	PIW154	PIW156	12	M3-	/145.7	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2	/146.1	M4-	13	PIW158	PIW160	14	M5-	/146.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1	/146.5	M6-	15	PIW162	PIW164	16	M7-	/146.7	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2
	/120.6	24VDC	L+		M	0VDC		/120.6	

+CTRL_1.3-AI_02

/120.6

INDUCTOR DC SUB 3_3 TEMPERATURE 3_3	/147.1	M0+	1	PIW166	PIW168	2	M1+	/147.3	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1
CONTROL CABINET TEMPERATURE	/147.5	M2+	3	PIW170	PIW172	4	M3+	/147.7	CONVERTER CABINET TEMPERATURE
COOLING WATER TEMPERATURE	/148.1	M4+	5	PIW174	PIW176	6	M5+	/148.3	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2
CIR CABINET TEMPERATURE	/148.5	M6+	7	PIW178	PIW180	8	M7+	/148.7	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3	/147.1	M0-	9	PIW166	PIW168	10	M1-	/147.3	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1
CONTROL CABINET TEMPERATURE	/147.5	M2-	11	PIW170	PIW172	12	M3-	/147.7	CONVERTER CABINET TEMPERATURE
COOLING WATER TEMPERATURE	/148.1	M4-	13	PIW174	PIW176	14	M5-	/148.3	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2
CIR CABINET TEMPERATURE	/148.5	M6-	15	PIW178	PIW180	16	M7-	/148.7	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3
		24VDC	L+		M	0VDC			

+CTRL_1.3-AI_03

/120.7

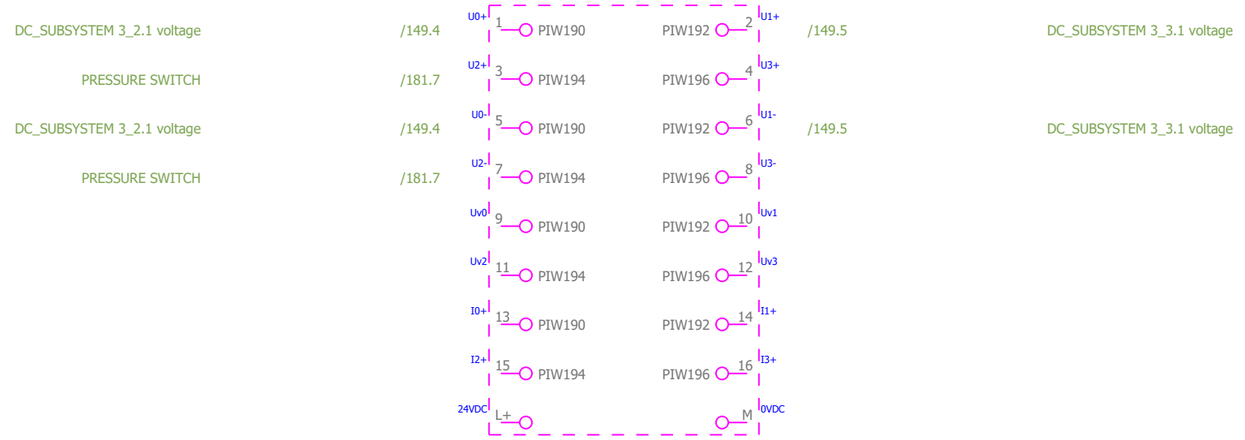
DC_SUBSYSTEM 2_1.1 voltage	/149.0	U0+	1	PIW182	PIW184	2	U1+	/149.1	DC_SUBSYSTEM 2_2.1 voltage
DC_SUBSYSTEM 2_3.1 voltage	/149.2	U2+	3	PIW186	PIW188	4	U3+	/149.3	DC_SUBSYSTEM 3_1.1 voltage
DC_SUBSYSTEM 2_1.1 voltage	/149.0	U0-	5	PIW182	PIW184	6	U1-	/149.1	DC_SUBSYSTEM 2_2.1 voltage
DC_SUBSYSTEM 2_3.1 voltage	/149.2	U2-	7	PIW186	PIW188	8	U3-	/149.3	DC_SUBSYSTEM 3_1.1 voltage
		Uv0	9	PIW182	PIW184	10	Uv1		
		Uv2	11	PIW186	PIW188	12	Uv3		
		I0+	13	PIW182	PIW184	14	I1+		
		I2+	15	PIW186	PIW188	16	I3+		
		24VDC	L+		M	0VDC			

previous page: 123.a

next page: 125

+CTRL_1.3-AI_04

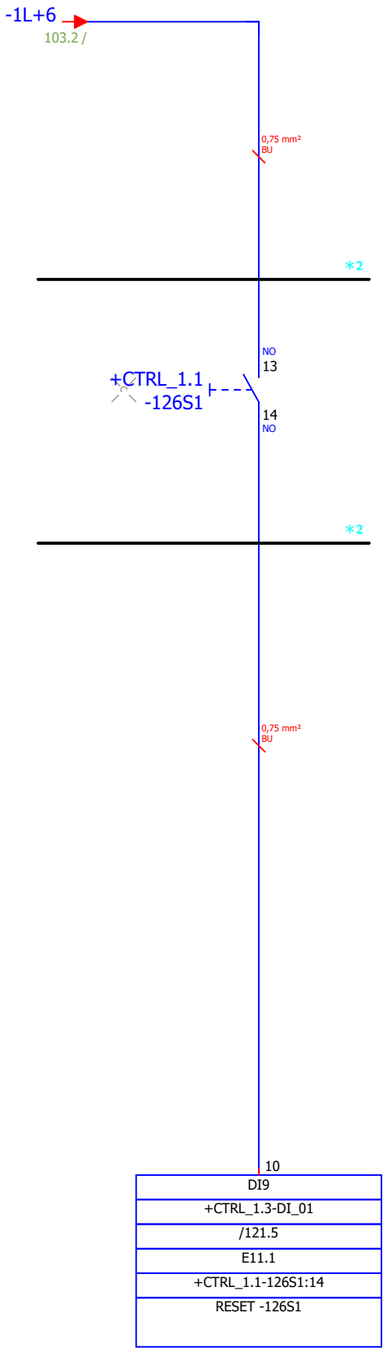
/120.7



previous page: 124

next page: 126

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_04	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 125
Date								+	total: 492



RESET
-126S1

*2
The single conductor
must be placed
in the protective tube

previous page:
125

next page:
127

Editor	Freqcon_JD			Statron	FREQCON	INPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	02.07.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 126
Date								+		total: 492

EC

3WL

++CONV

-CB1_TRIPPED / ++CONV/80.8

-CB1_ON_FB / ++CONV/80.7

-CB1_OFF_FB / ++CONV/80.7

-1F2 / ++CONV/78.9

-4L+5.4 / ++CONV/238a.2

-80W1
OZ-500
8x0,75 mm²

-238W7
OZ-500
2x0,75 mm²

-24V_Signal / 189.5

-4L+5.3 / 134.0

84F1_OK / 84.9

+CTRL_1.3
-X3

fB

bridge

0,75 mm² BU

-4L+5 / 103.8

-4L+5.1 / 128.5

DI14	DI2	DI3	DI5
+CTRL_1.3-DI_02	+CTRL_1.3-DI_02		
/121.4	/121.4	/121.5	/121.5
E12.4	E12.2	E12.3	E12.5
++CONV+CIR-80Q1:X7_13	++CONV+CIR-80Q1:X6_11	++CONV+CIR-80Q1:X6_9	++CONV+AC_DC-78F1:13
CB 1 Tripped GRID	CB 1 ON GRID	CB 1 OFF GRID	FUSE AND LIGHTNING PROTECTION

DI5
+CTRL_1.3-DI_01
/121.5
E10.5
+CTRL_1.3-84F1:12
LIGHTNING PROTECTION in Control Cabinet OPTIONAL

Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 1 Tripped GRID

CB 1 ON GRID

CB 1 OFF GRID

FUSE AND LIGHTNING PROTECTION

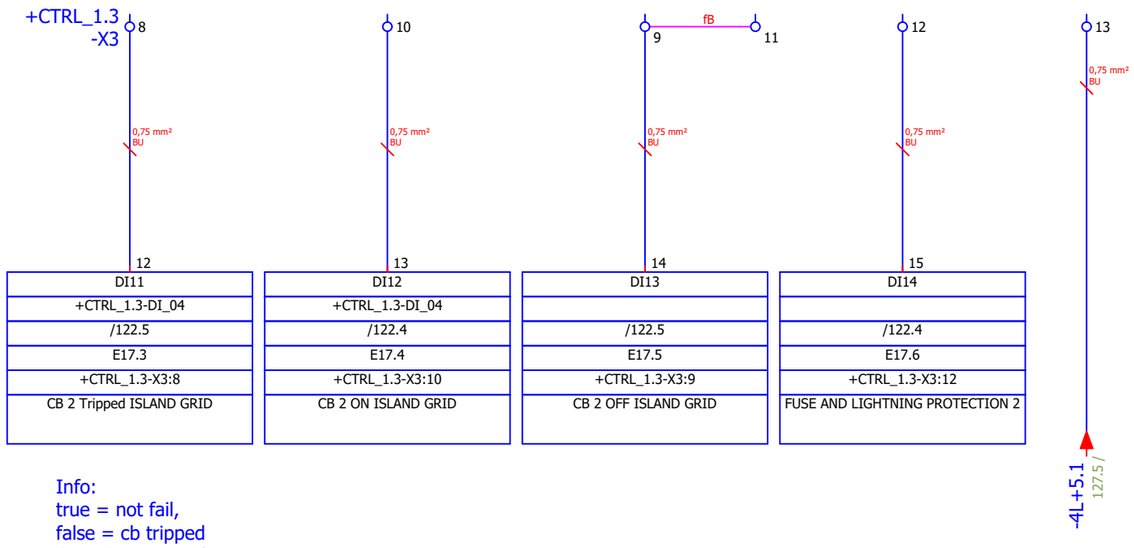
LIGHTNING PROTECTION in Control Cabinet OPTIONAL

previous page: 126

next page: 128

Editor	Freqcon_JD			Statron		DIGITAL INPUTS CB 1	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

0	1	2	3	4	5	6	7	8	9



Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 2 Tripped ISLAND GRID

CB 2 ON ISLAND GRID

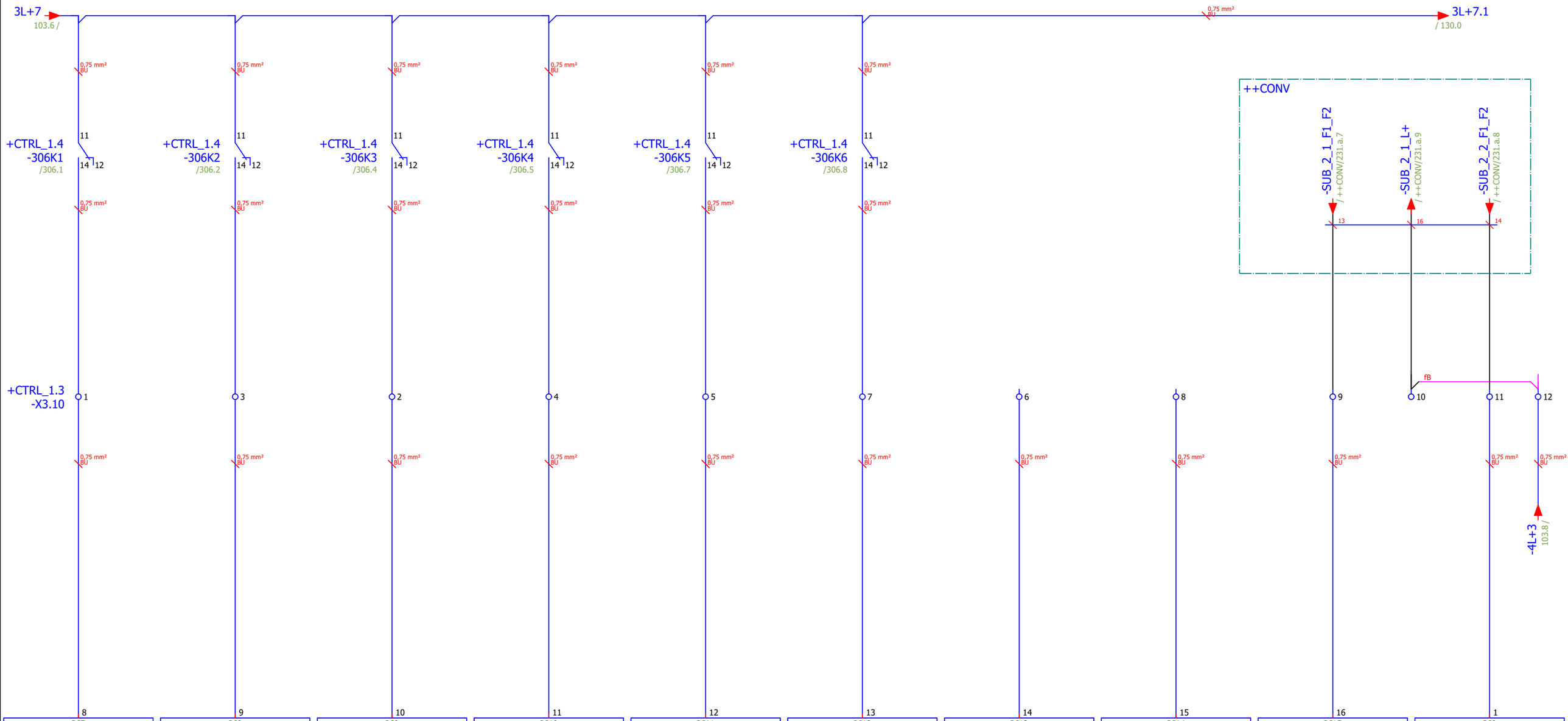
CB 2 OFF ISLAND GRID

FUSE AND LIGHTNING PROTECTION 2

previous page: 127

next page: 129

Editor	Freqcon_JD			Statron		DIGITAL INPUTS CB 2	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 128
Date								+	total: 492



8	9	10	11	12	13	14	15	16	1
DI7	DI8	DI9	DI10	DI11	DI12	DI13	DI14	DI15	DI0
+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_02	+CTRL_1.3-DI_03
/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4
E12.7	E13.0	E13.1	E13.2	E13.3	E13.4	E13.5	E13.6	E13.7	E14.0
+CTRL_1.4-306K1:14	+CTRL_1.4-306K2:14	+CTRL_1.4-306K3:14	+CTRL_1.4-306K4:14	+CTRL_1.4-306K5:14	+CTRL_1.4-306K6:14	+CTRL_1.3-X3.10:6	+CTRL_1.3-X3.10:8	++CONV+CIR-231U1-F1:2	++CONV+CIR-231U1-F5:2
SUBSYSTEM 2_1_DC + Contactor K1 is on	SUBSYSTEM 2_1_DC -Contactor K7 is on	SUBSYSTEM 2_2_DC + Contactor K2 is on	SUBSYSTEM 2_2_DC -Contactor K8 is on	SUBSYSTEM 2_3_DC + Contactor K3 is on	SUBSYSTEM 2_3_DC -Contactor K9 is on	SUBSYSTEM 2_3_DC + SPARE	SUBSYSTEM 2_DC -SPARE	SUBSYSTEM 2_1_DC FUSE OK	SUBSYSTEM 2_2_DC FUSE OK

Feedback of DC Contactors

SUBSYSTEM 2_1_DC + Contactor K1 is on

SUBSYSTEM 2_1_DC - Contactor K7 is on

SUBSYSTEM 2_2_DC + Contactor K2 is on

SUBSYSTEM 2_2_DC - Contactor K8 is on

SUBSYSTEM 2_3_DC + Contactor K3 is on

SUBSYSTEM 2_3_DC - Contactor K9 is on

SUBSYSTEM 2_3_DC + SPARE

SUBSYSTEM 2_DC - SPARE

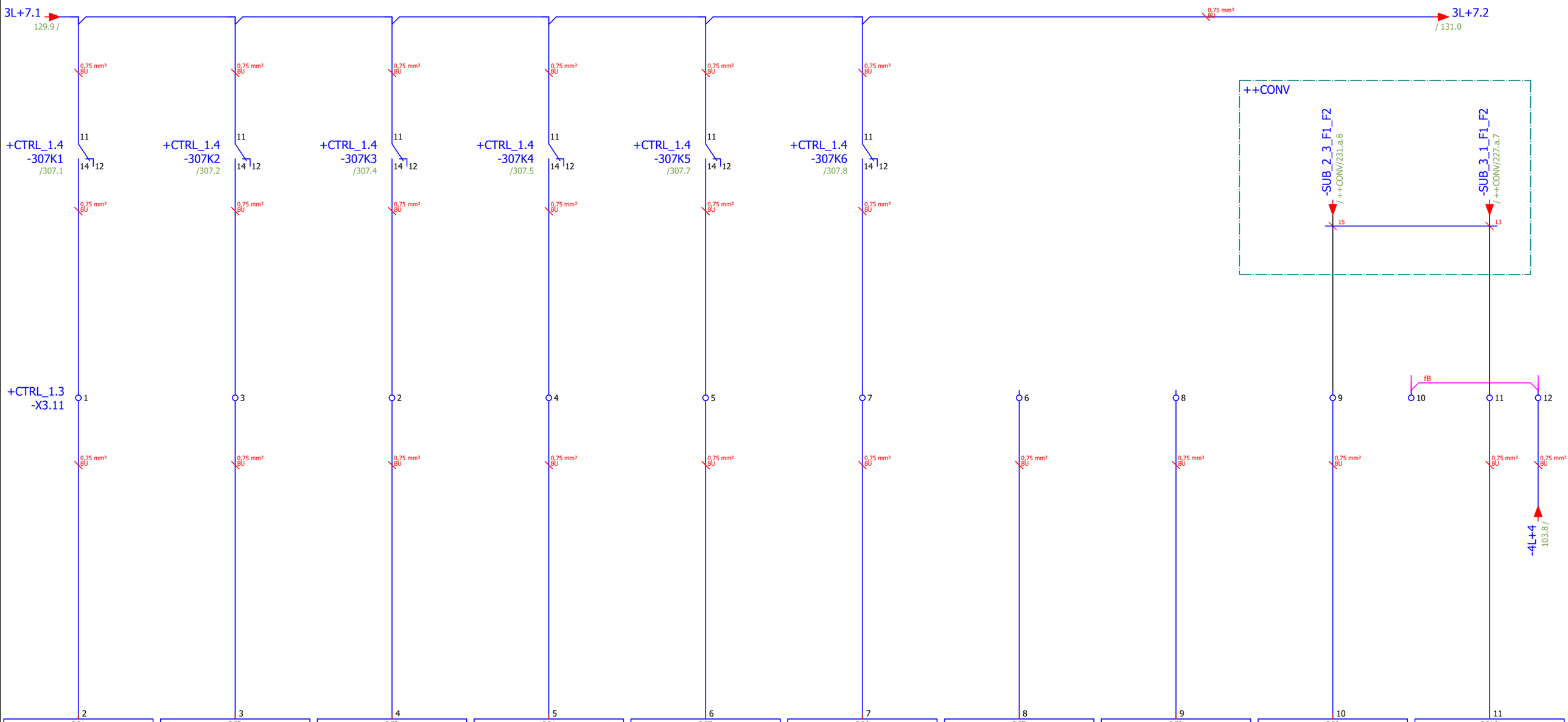
SUBSYSTEM 2_1_DC FUSE OK

SUBSYSTEM 2_2_DC FUSE OK

previous page: 128

next page: 130

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 129
Date								+ total: 492



2	3	4	5	6	7	8	9	10	11
DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	DI9	DI10
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03
/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4
E14.1	E14.2	E14.3	E14.4	E14.5	E14.6	E14.7	E15.0	E15.1	E15.2
+CTRL_1.4-307K1:14	+CTRL_1.4-307K2:14	+CTRL_1.4-307K3:14	+CTRL_1.4-307K4:14	+CTRL_1.4-307K5:14	+CTRL_1.4-307K6:14	+CTRL_1.3-X3.11:6	+CTRL_1.3-X3.11:8	++CONV+CIR-231U1-F9:2	++CONV+CIR-227U1-F1:2
SUBSYSTEM 3_1_DC + Contactor K1 is on	SUBSYSTEM 3_1_DC -Contactor K7 is on	SUBSYSTEM 3_2_DC + Contactor K2 is on	SUBSYSTEM 3_2_DC -Contactor K8 is on	SUBSYSTEM 3_3_DC + Contactor K3 is on	SUBSYSTEM 3_3_DC -Contactor K9 is on	SUBSYSTEM 3_DC + SPARE	SUBSYSTEM 3_DC -SPARE	SUBSYSTEM 2_DC FUSE OK	SUBSYSTEM 3_1_DC FUSE OK

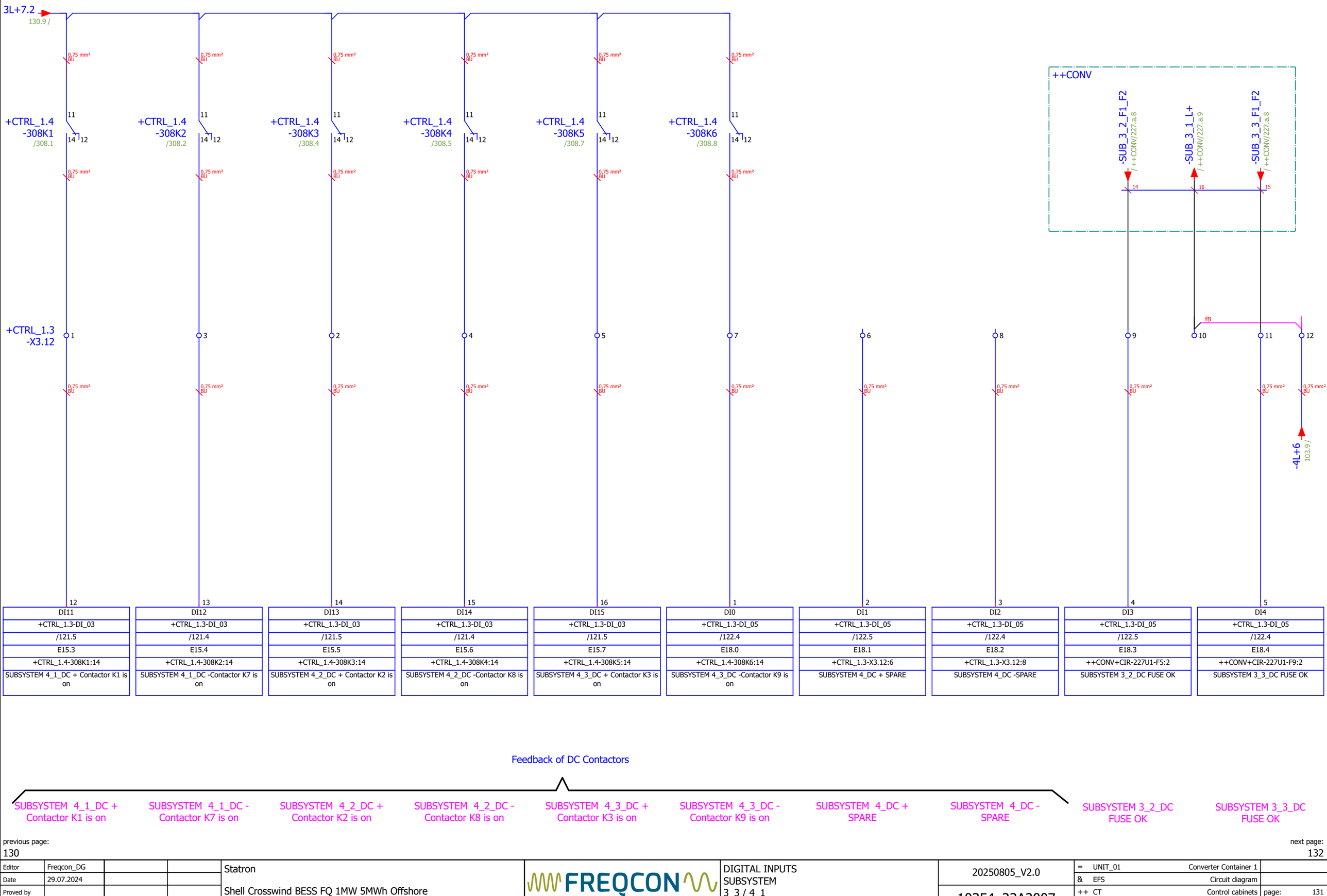
Feedback of DC Contactors

SUBSYSTEM 3_1_DC + Contactor K1 is on | SUBSYSTEM 3_1_DC - Contactor K7 is on | SUBSYSTEM 3_2_DC + Contactor K2 is on | SUBSYSTEM 3_2_DC - Contactor K8 is on | SUBSYSTEM 3_3_DC + Contactor K3 is on | SUBSYSTEM 3_3_DC - Contactor K9 is on | SUBSYSTEM 3_DC + SPARE | SUBSYSTEM 3_DC - SPARE | SUBSYSTEM 2_DC FUSE OK | SUBSYSTEM 3_1_DC FUSE OK

previous page: 129

next page: 131

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 130
Date								+ total: 492



12	13	14	15	16	1	2	3	4	5
DI11	DI12	DI13	DI14	DI15	DI0	DI1	DI2	DI3	DI4
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05
/121.5	/121.4	/121.5	/121.4	/121.5	/122.4	/122.5	/122.4	/122.5	/122.4
E15.3	E15.4	E15.5	E15.6	E15.7	E18.0	E18.1	E18.2	E18.3	E18.4
+CTRL_1.4-308K1:14	+CTRL_1.4-308K2:14	+CTRL_1.4-308K3:14	+CTRL_1.4-308K4:14	+CTRL_1.4-308K5:14	+CTRL_1.4-308K6:14	+CTRL_1.3-X3.12:6	+CTRL_1.3-X3.12:8	++CONV+CIR-227U1-F5:2	++CONV+CIR-227U1-F9:2
SUBSYSTEM 4_1_DC + Contactor K1 is on	SUBSYSTEM 4_1_DC -Contactor K7 is on	SUBSYSTEM 4_2_DC + Contactor K2 is on	SUBSYSTEM 4_2_DC -Contactor K8 is on	SUBSYSTEM 4_3_DC + Contactor K3 is on	SUBSYSTEM 4_3_DC -Contactor K9 is on	SUBSYSTEM 4_DC + SPARE	SUBSYSTEM 4_DC -SPARE	SUBSYSTEM 3_2_DC FUSE OK	SUBSYSTEM 3_3_DC FUSE OK

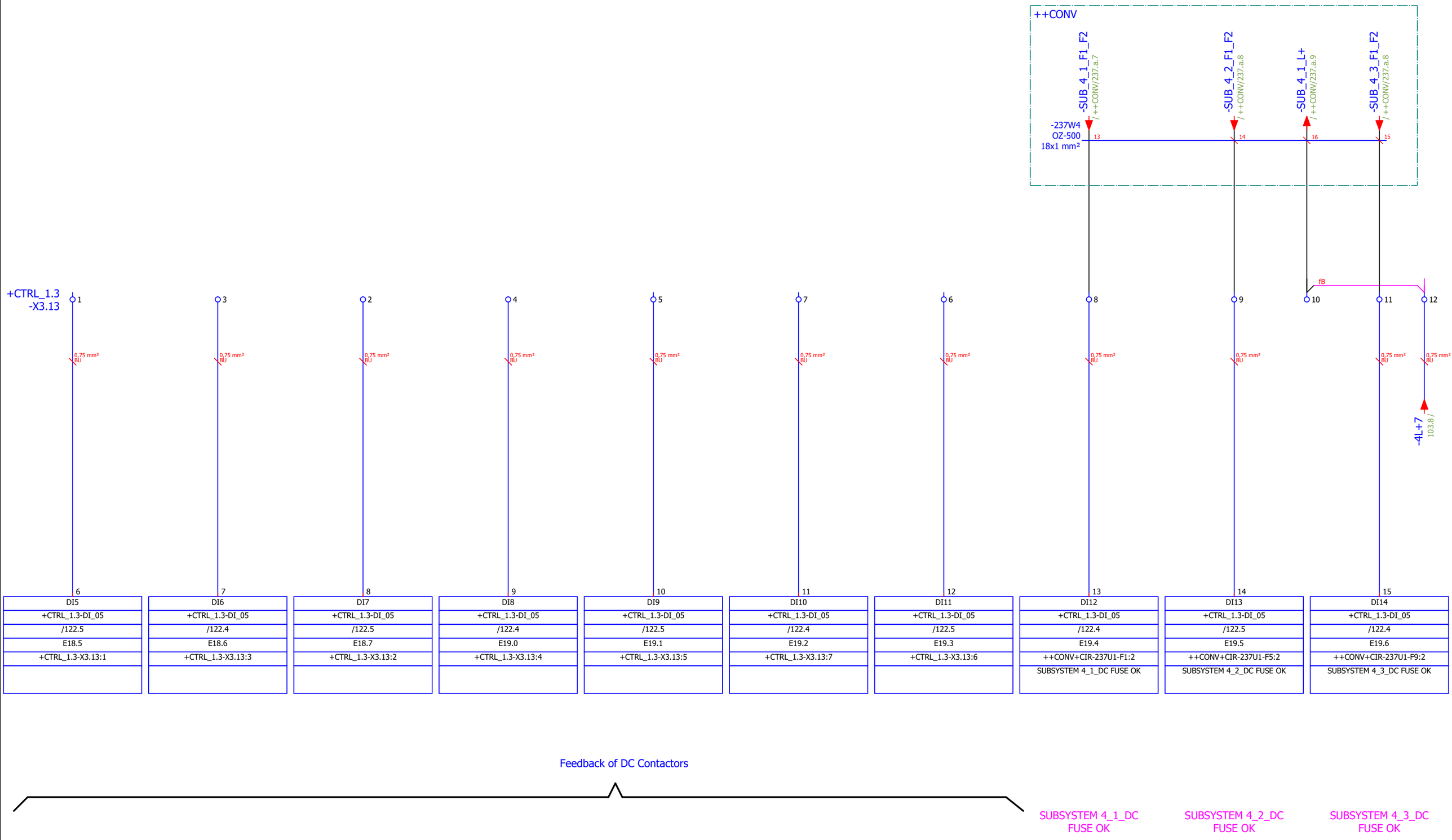
Feedback of DC Contactors

SUBSYSTEM 4_1_DC + Contactor K1 is on | SUBSYSTEM 4_1_DC - Contactor K7 is on | SUBSYSTEM 4_2_DC + Contactor K2 is on | SUBSYSTEM 4_2_DC - Contactor K8 is on | SUBSYSTEM 4_3_DC + Contactor K3 is on | SUBSYSTEM 4_3_DC - Contactor K9 is on | SUBSYSTEM 4_DC + SPARE | SUBSYSTEM 4_DC - SPARE | SUBSYSTEM 3_2_DC FUSE OK | SUBSYSTEM 3_3_DC FUSE OK

previous page: 130

next page: 132

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 131
Date								+ total: 492



Feedback of DC Contactors

SUBSYSTEM 4_1_DC FUSE OK

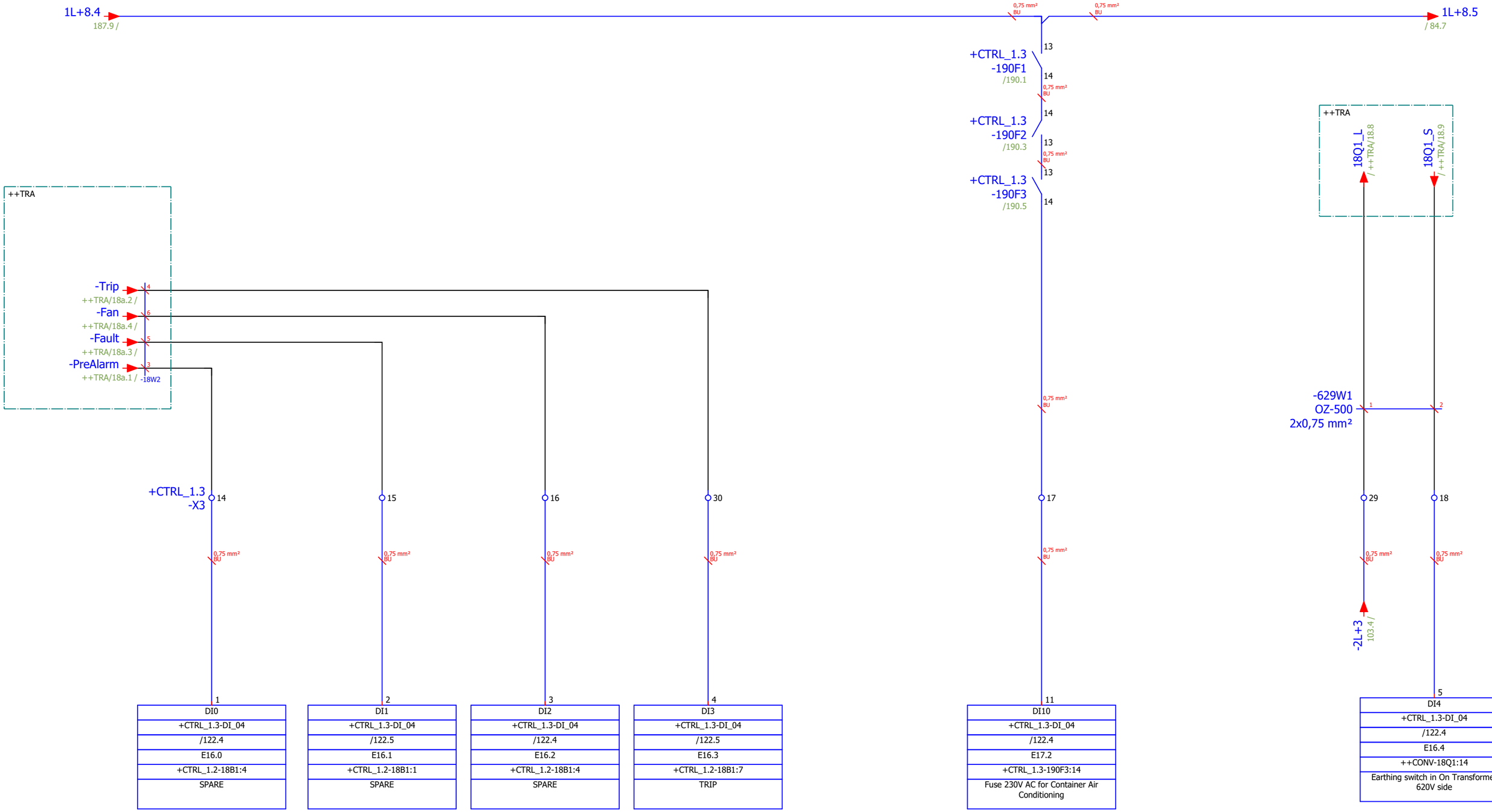
SUBSYSTEM 4_2_DC FUSE OK

SUBSYSTEM 4_3_DC FUSE OK

previous page: 131

next page: 133

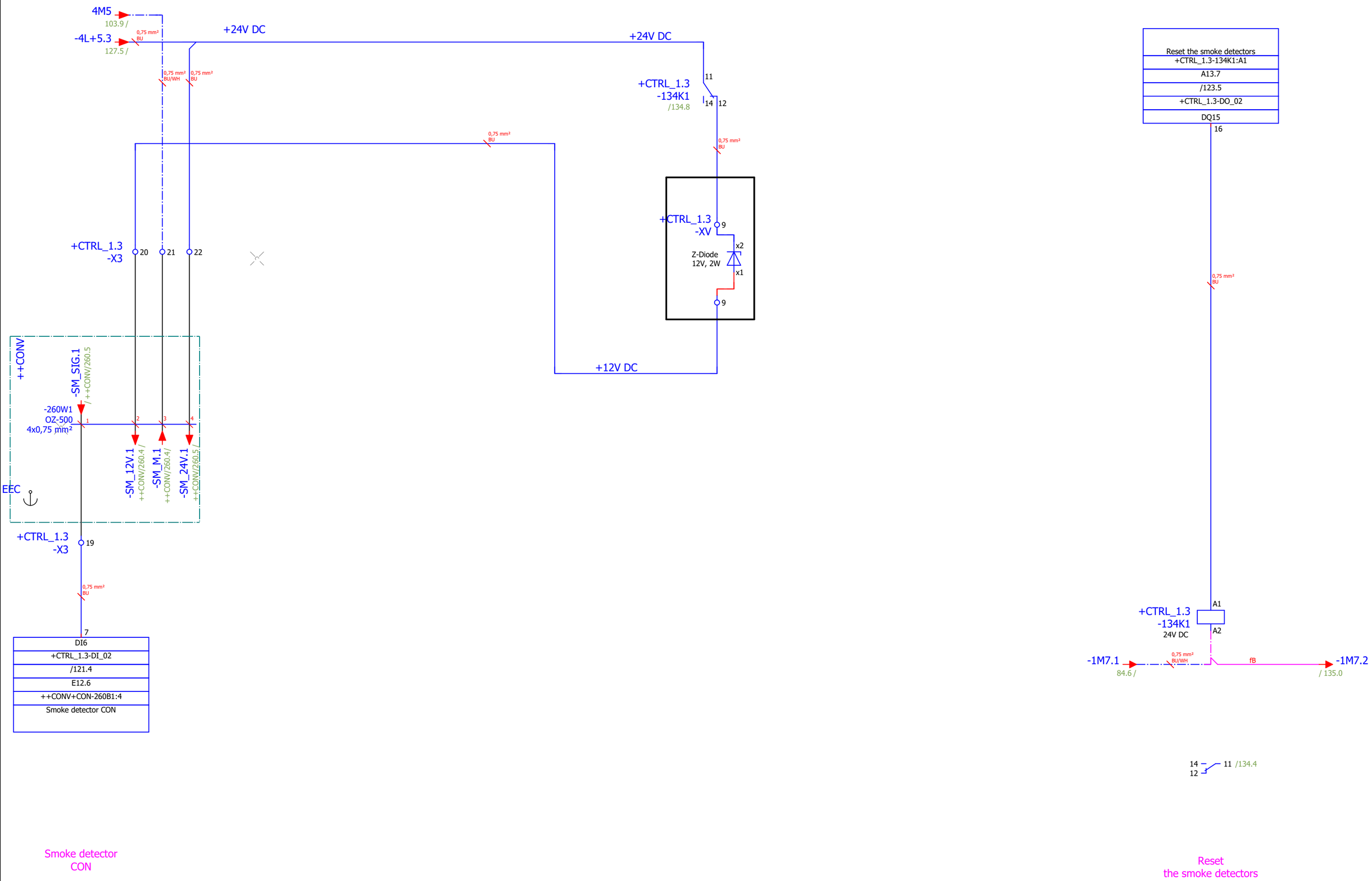
Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 132
Date								+	total: 492



previous page: 132

next page: 134

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SPARE	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 133
Date								+	total: 492



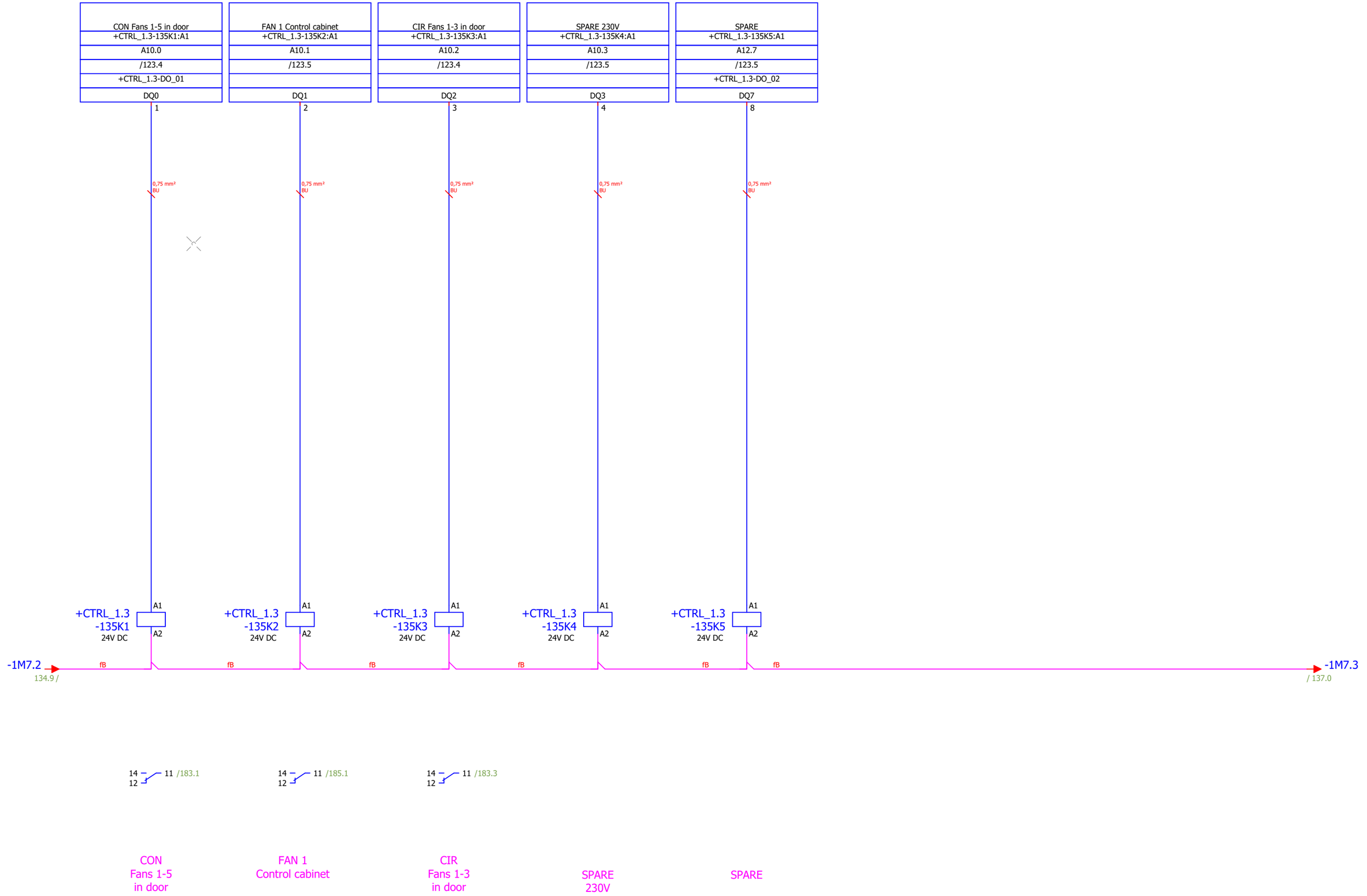
previous page:
133

next page:
135

Editor	Freqcon_JD			Statron	FREQCON	DIGITAL INPUTS SMOKE DETECTORS	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+	

page: 134
total: 492

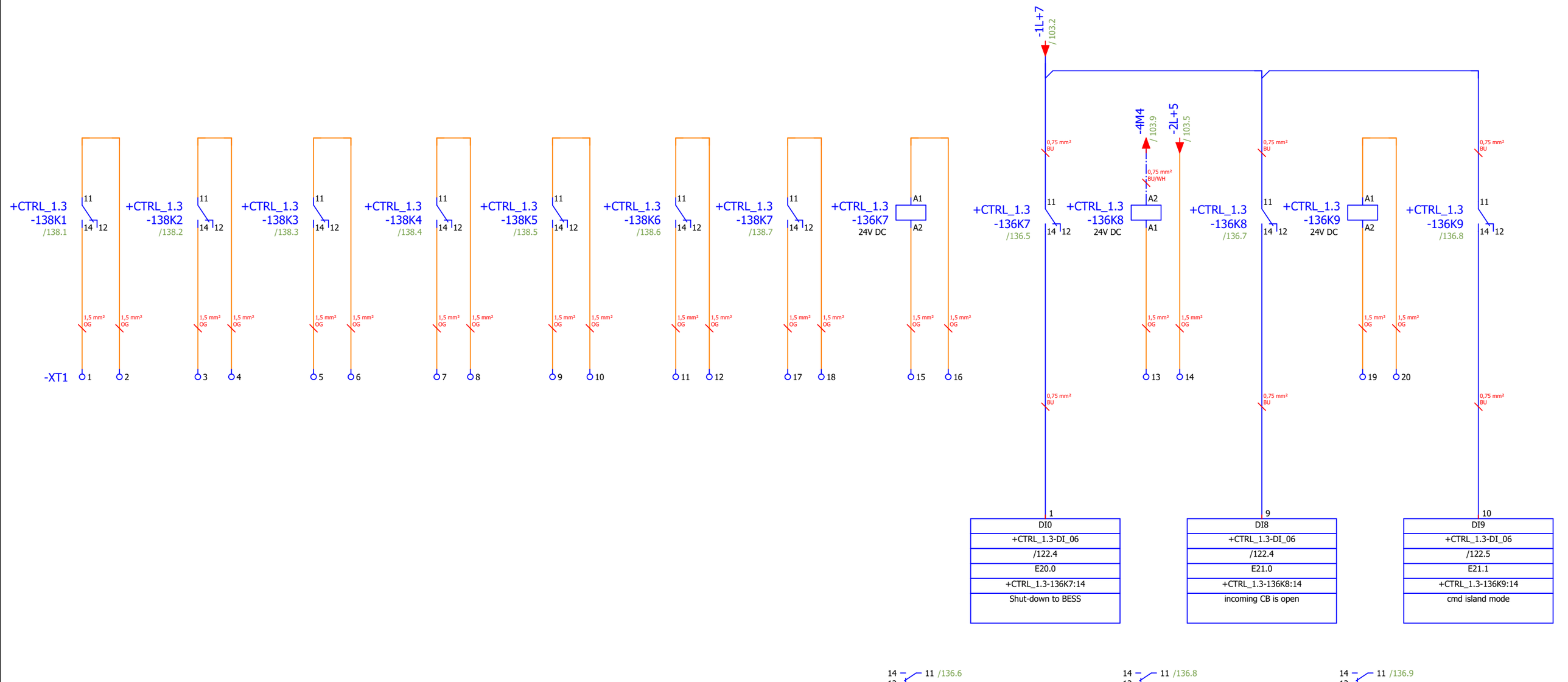
0	1	2	3	4	5	6	7	8	9



previous page: 134

next page: 136

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FAN	20250805_V2.0	= UNIT_01	Converter Container 1
Date	19.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 135
Date								+	total: 492

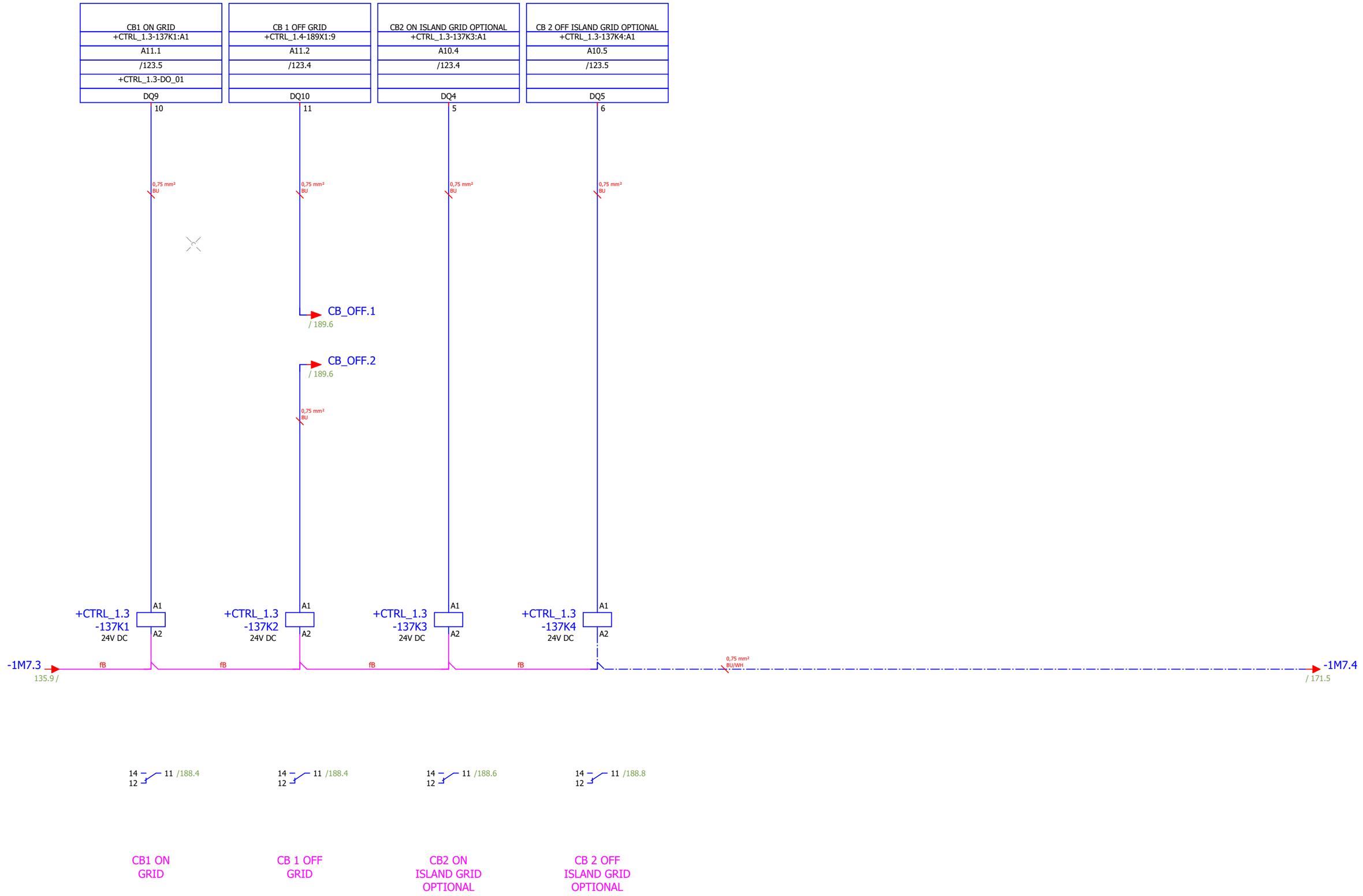


Gas confirmed FGS	Smoke confirmed FGS	PLC fault status SIS	Thermal runaway SIS	Spare	Spare	phase in sync	Shut-down to BESS	Shut-down to BESS	incoming CB is open	incoming CB is open	cmd island mode	cmd island mode

previous page: 135

next page: 137

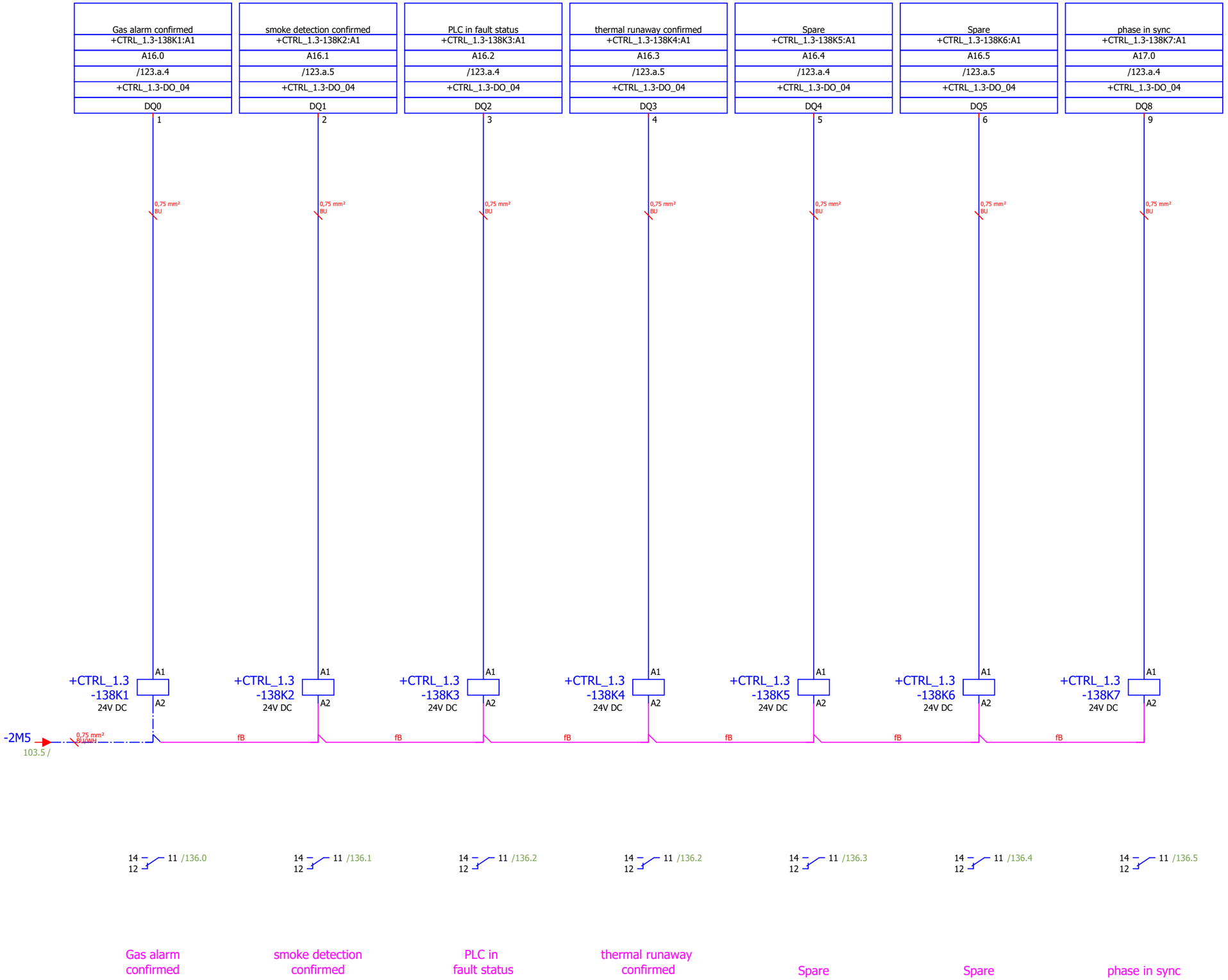
Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 136
Date								+	total: 492



previous page: 136

next page: 138

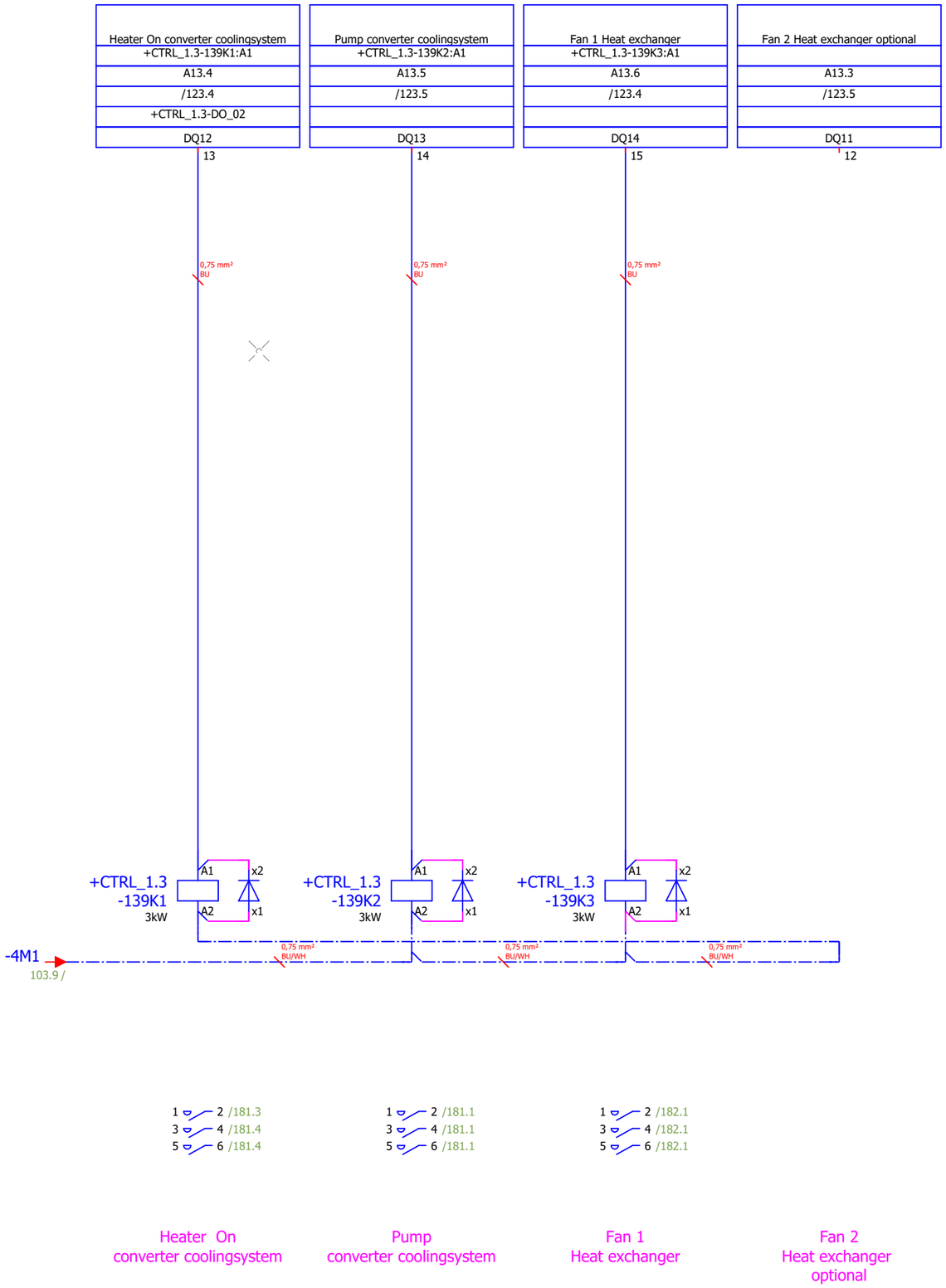
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CIRCUIT BREAKER	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 137
Date								+	total: 492



previous page: 137

next page: 139

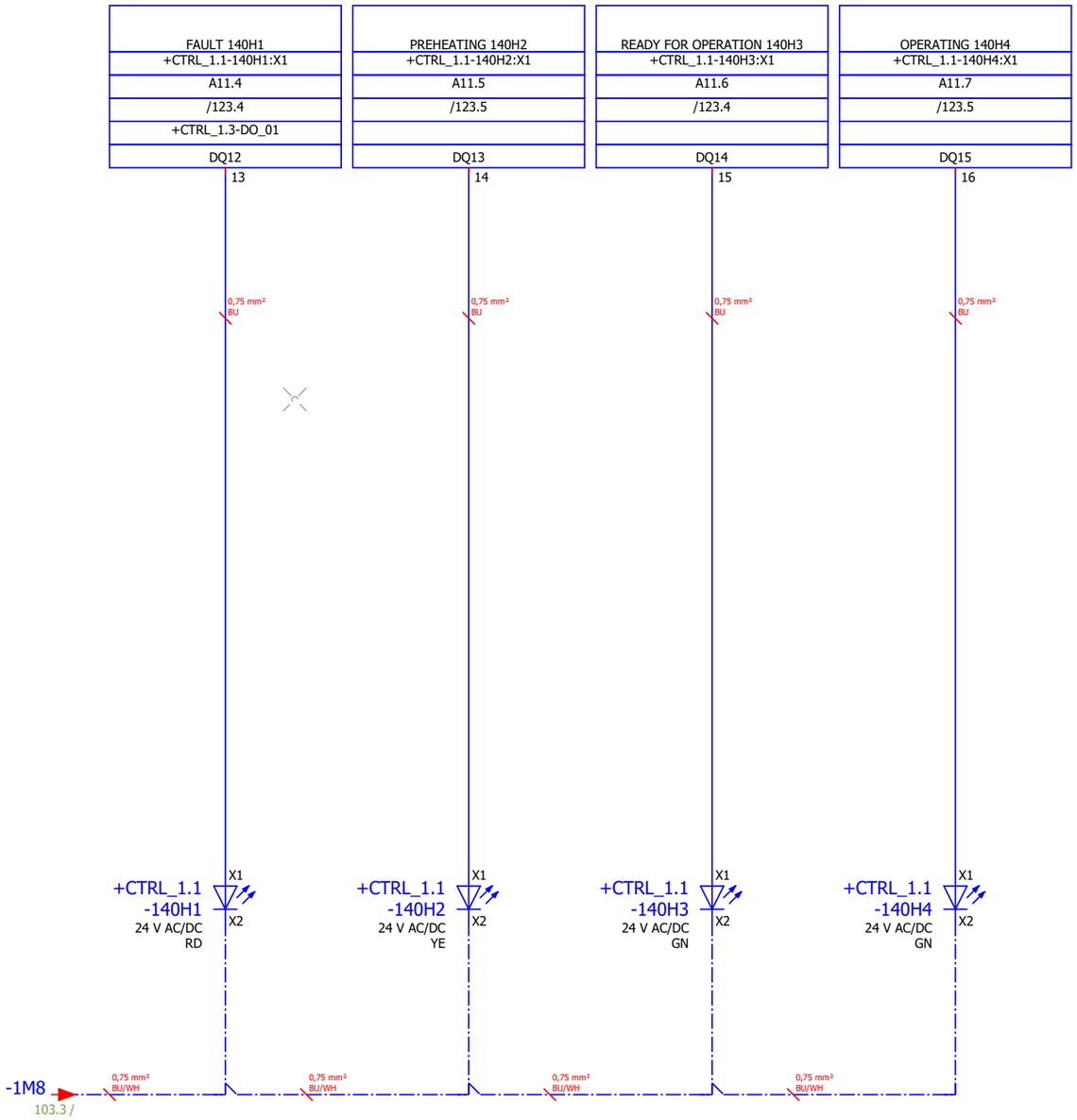
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	03.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 138
Date								+	total: 492



previous page:
138

next page:
140

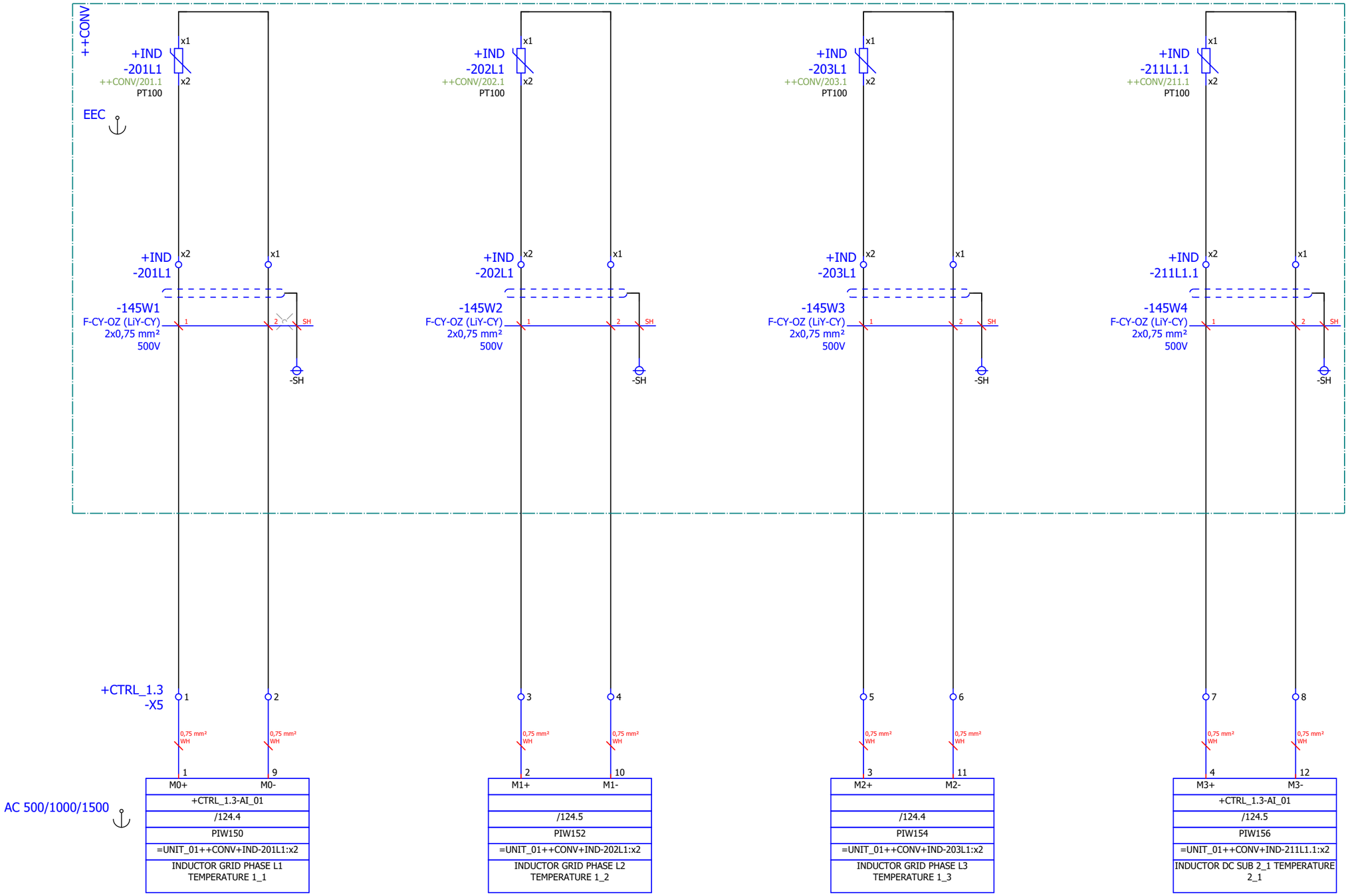
Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COOLING	20250805_V2.0	= UNIT_01	Converter Container 1
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 139
Date								+	total: 492



previous page: 139

next page: 145

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS CONTROL ELEMENTS	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	14.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 140
Date								+		total: 492



INDUCTOR
GRID PHASE L1
TEMPERATURE 1_1

INDUCTOR
GRID PHASE L2
TEMPERATURE 1_2

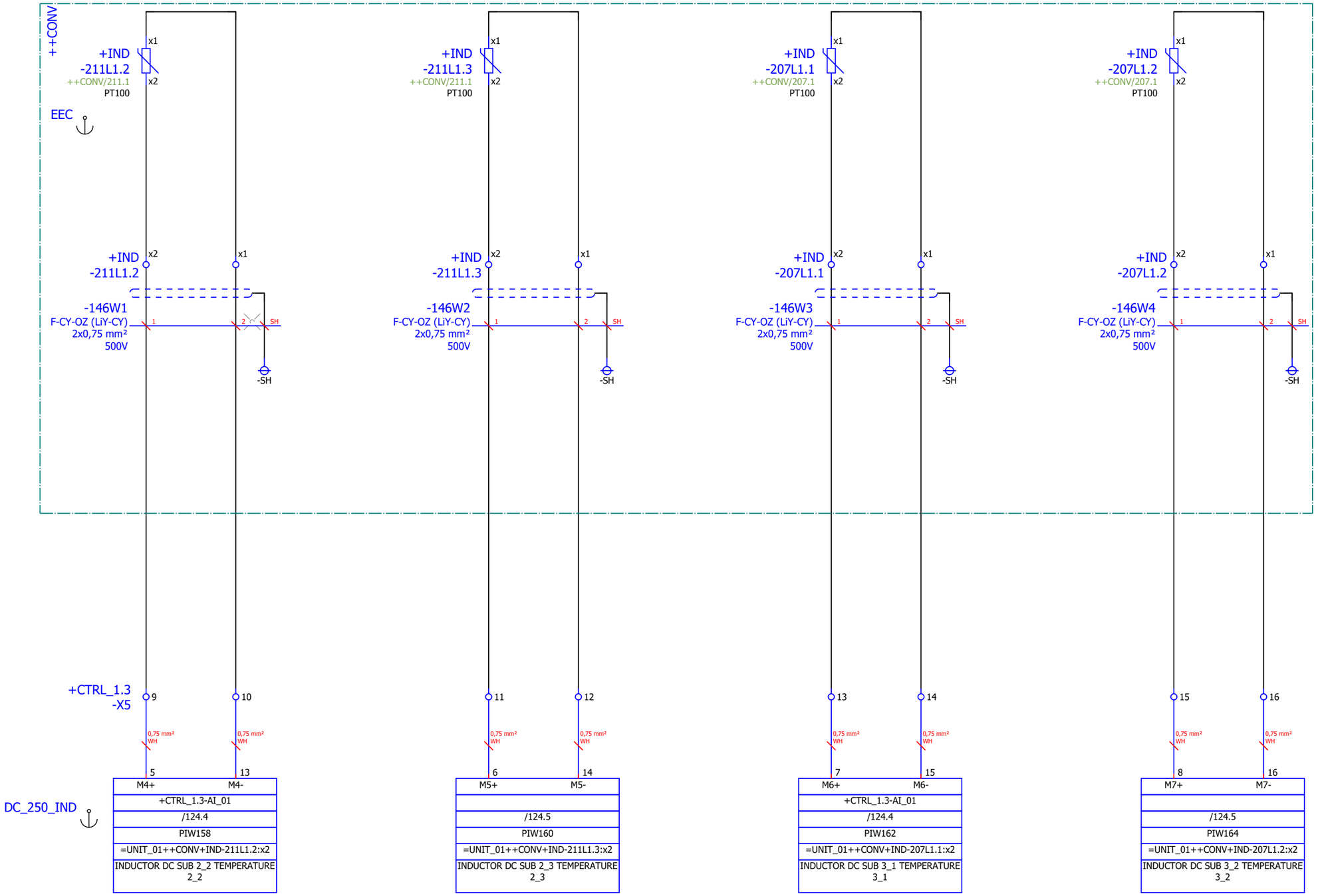
INDUCTOR
GRID PHASE L3
TEMPERATURE 1_3

INDUCTOR
DC SUB 2_1
TEMPERATURE 2_1

previous page:
140

next page:
146

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	14.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 145
Date								+		total: 492



INDUCTOR
DC SUB 2_2
TEMPERATURE 2_2

INDUCTOR
DC SUB 2_3
TEMPERATURE 2_3

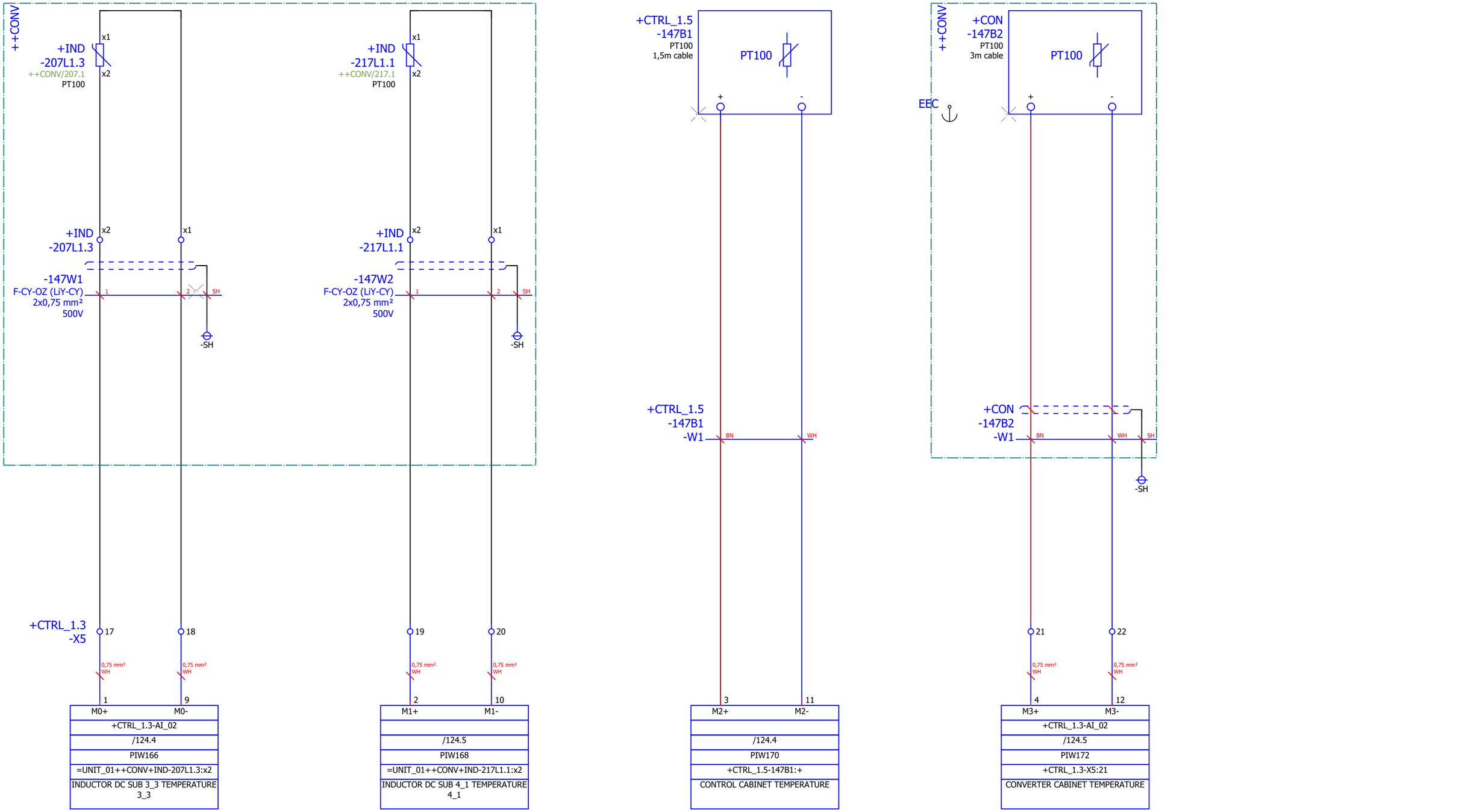
INDUCTOR
DC SUB 3_1
TEMPERATURE 3_1

INDUCTOR
DC SUB 3_2
TEMPERATURE 3_2

previous page: 145

next page: 147

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 146
Date								+		total: 492



INDUCTOR DC SUB 3_3 TEMPERATURE 3_3

INDUCTOR DC SUB 4_1 TEMPERATURE 4_1

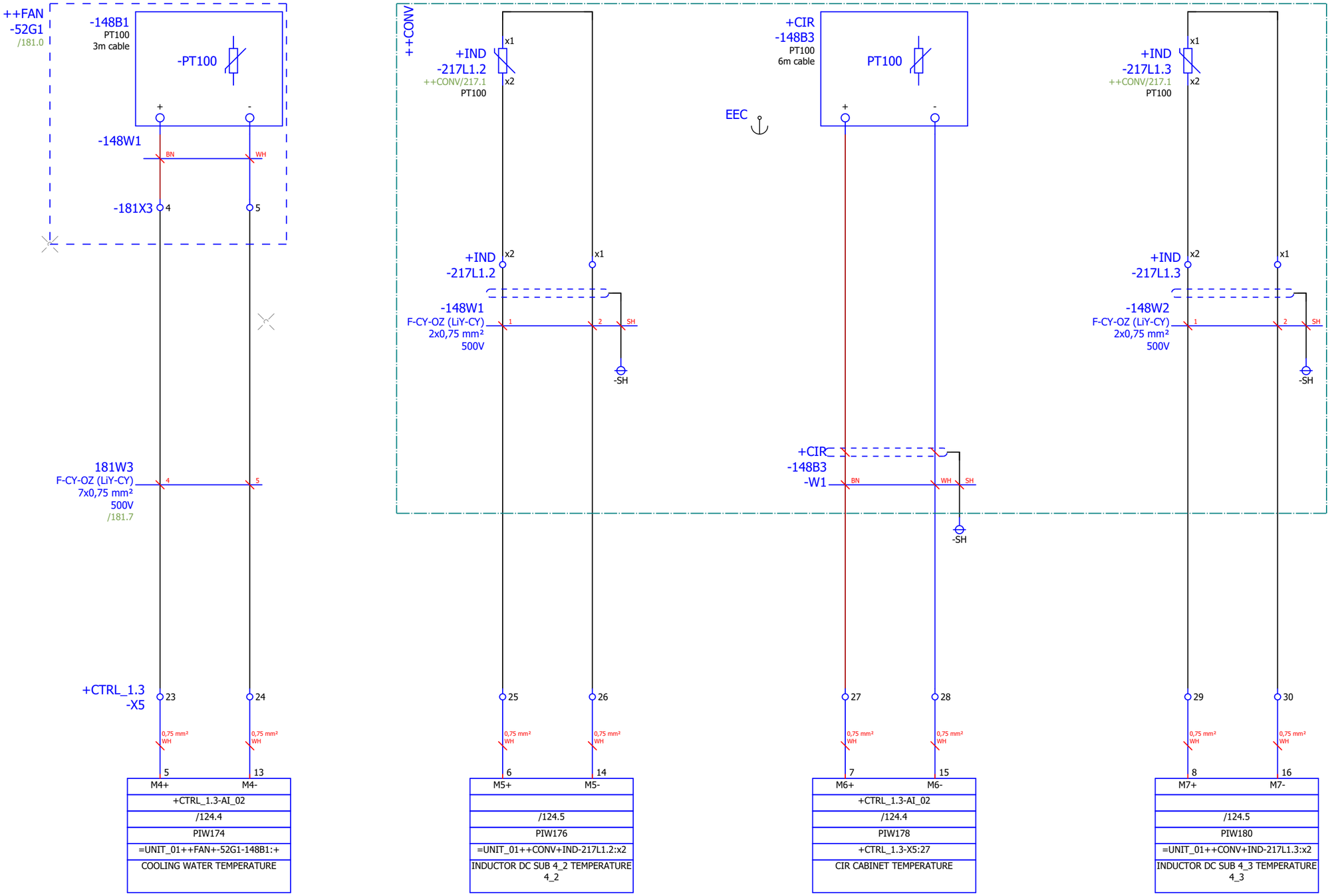
CONTROL CABINET TEMPERATURE

CONVERTER CABINET TEMPERATURE

previous page: 146

next page: 148

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS CABINET TEMPERATURE	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 147
Date								+	total: 492



COOLING WATER TEMPERATURE

INDUCTOR DC SUB 4_2 TEMPERATURE 4_2

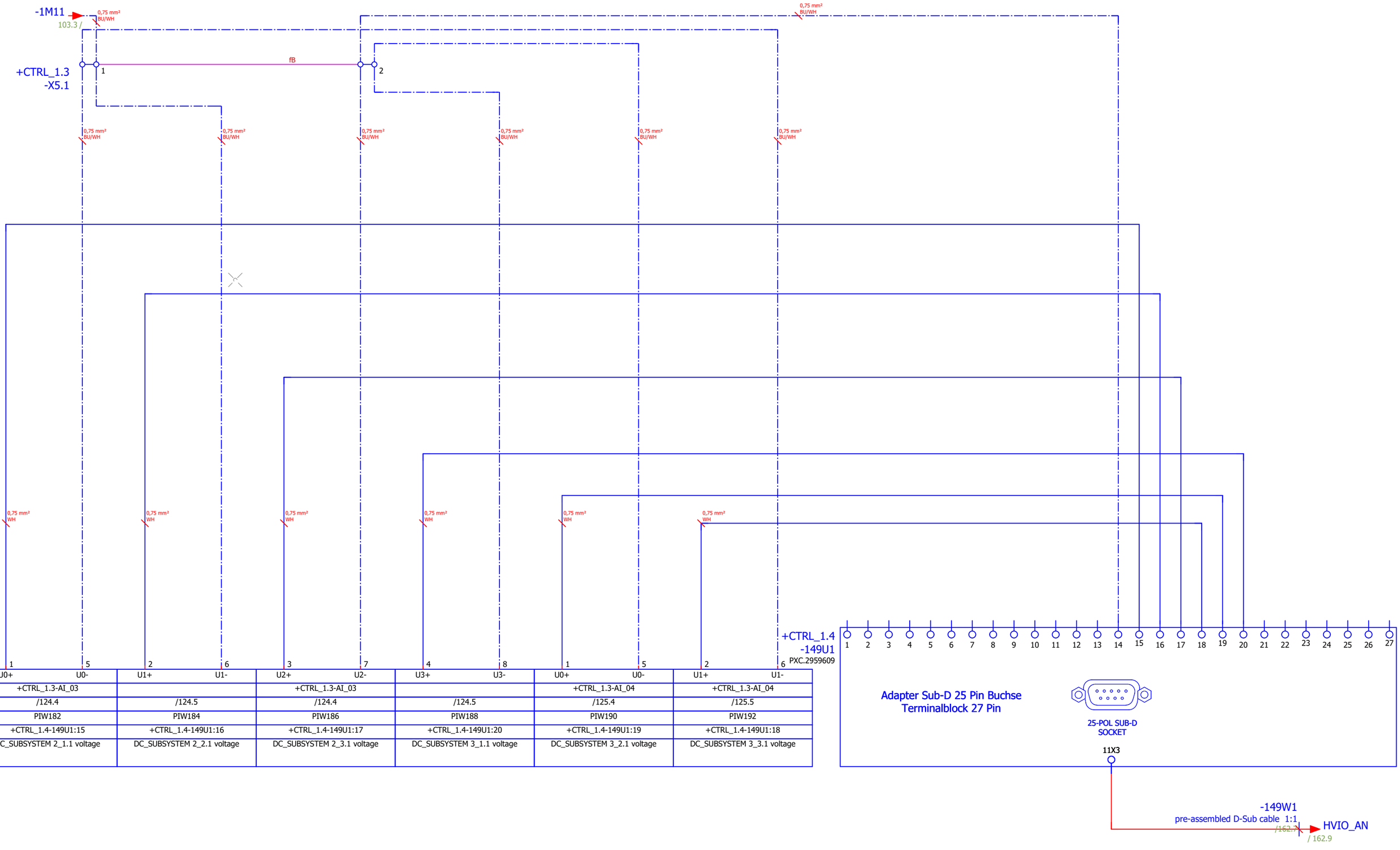
CIR CABINET TEMPERATURE

INDUCTOR DC SUB 4_3 TEMPERATURE 4_3

previous page: 147

next page: 149

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS COOLING WATER TEMPERATURE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 148
Date								+		total: 492

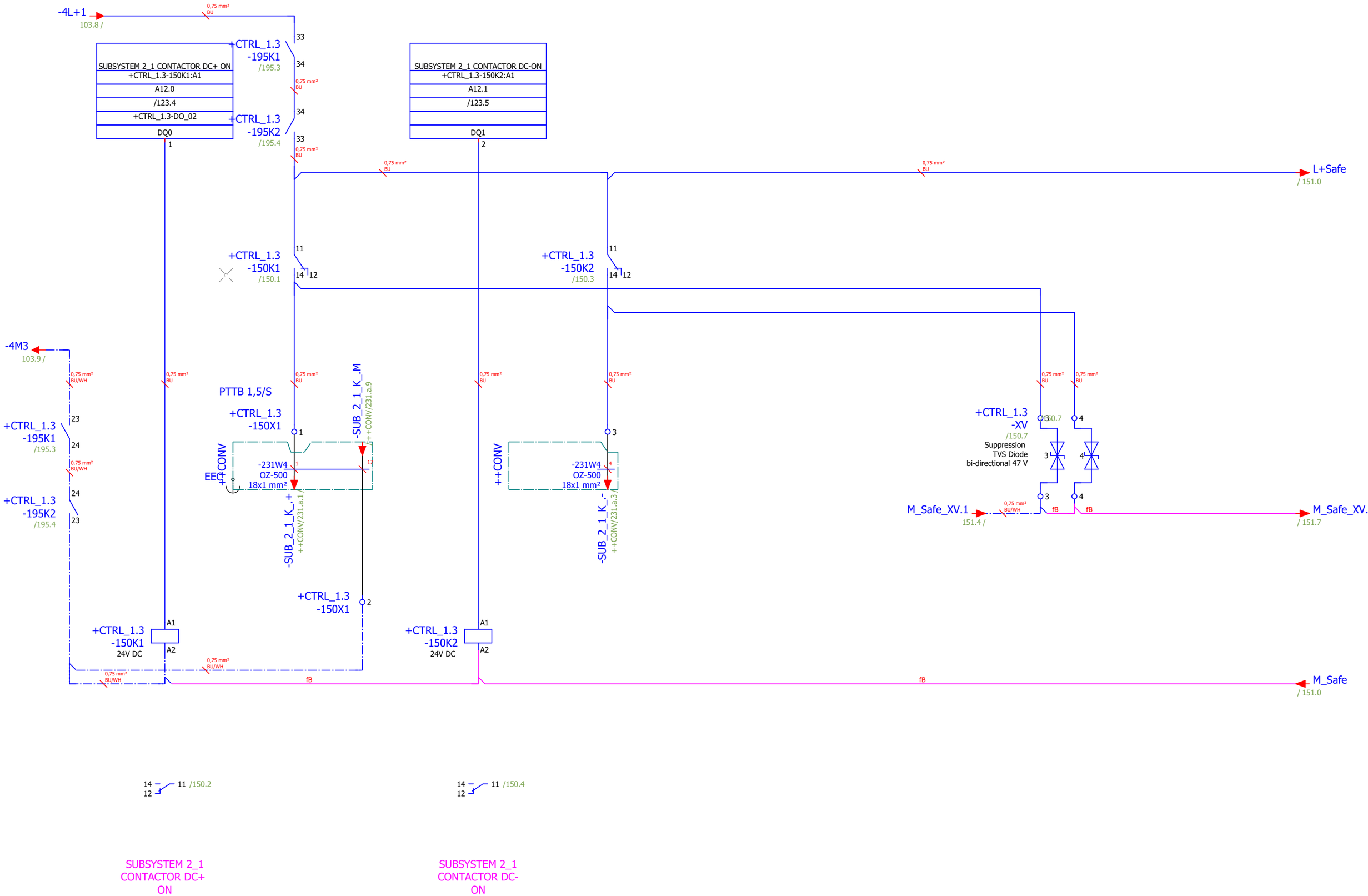


Voltage measurement

previous page: 148

next page: 150

Editor	Freqcon_JD			Statron	FREQCON	ANALOG INPUTS MEASURING VOLTAGE	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 149
Date							10354_23A2007	+		total: 492



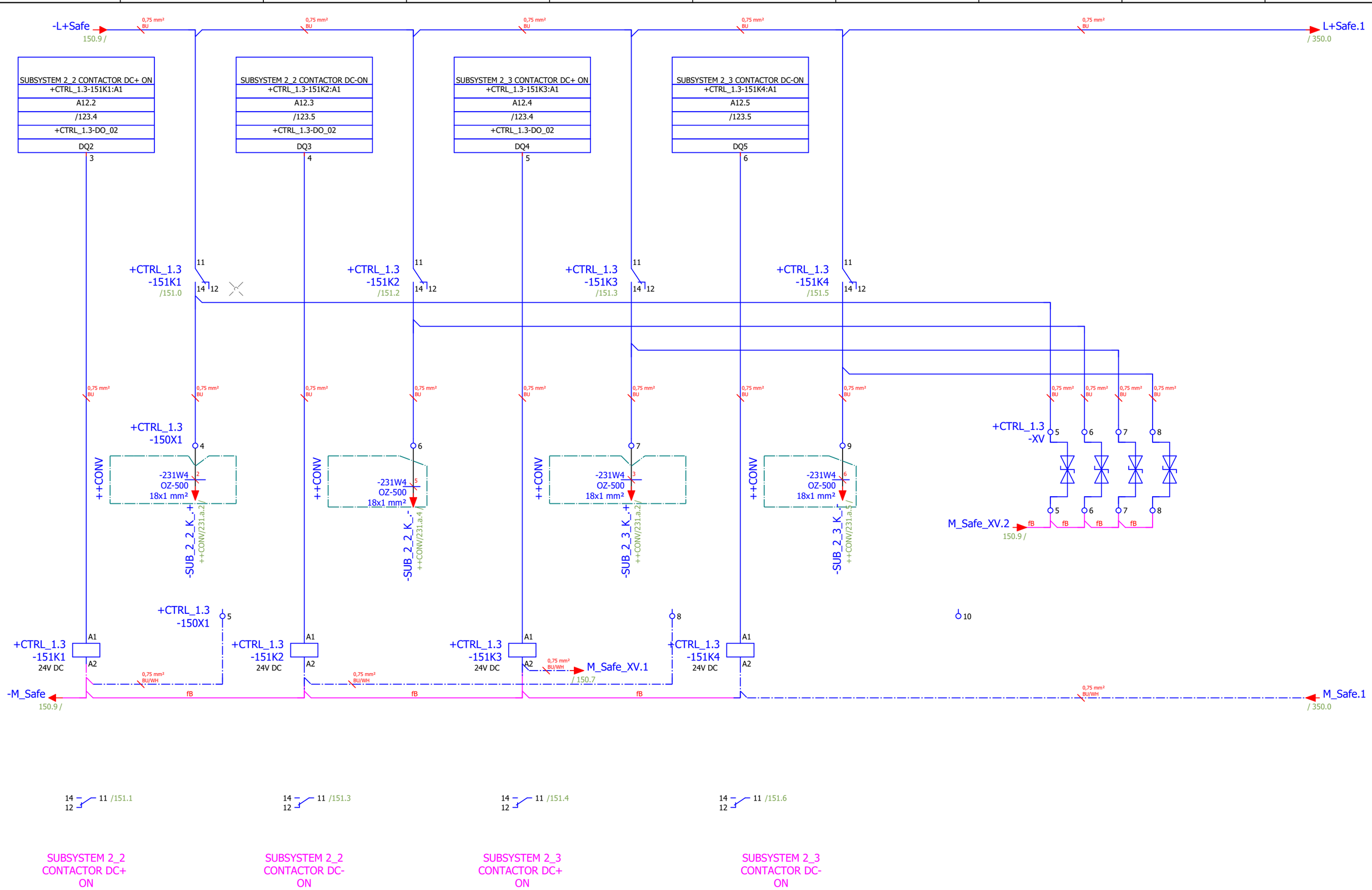
14 12 11 /150.2

14 12 11 /150.4

SUBSYSTEM 2_1 CONTACTOR DC+ ON

SUBSYSTEM 2_1 CONTACTOR DC- ON

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 150
Date								+	total: 492



14 12 11 /151.1

14 12 11 /151.3

14 12 11 /151.4

14 12 11 /151.6

SUBSYSTEM 2_2 CONTACTOR DC+ ON

SUBSYSTEM 2_2 CONTACTOR DC- ON

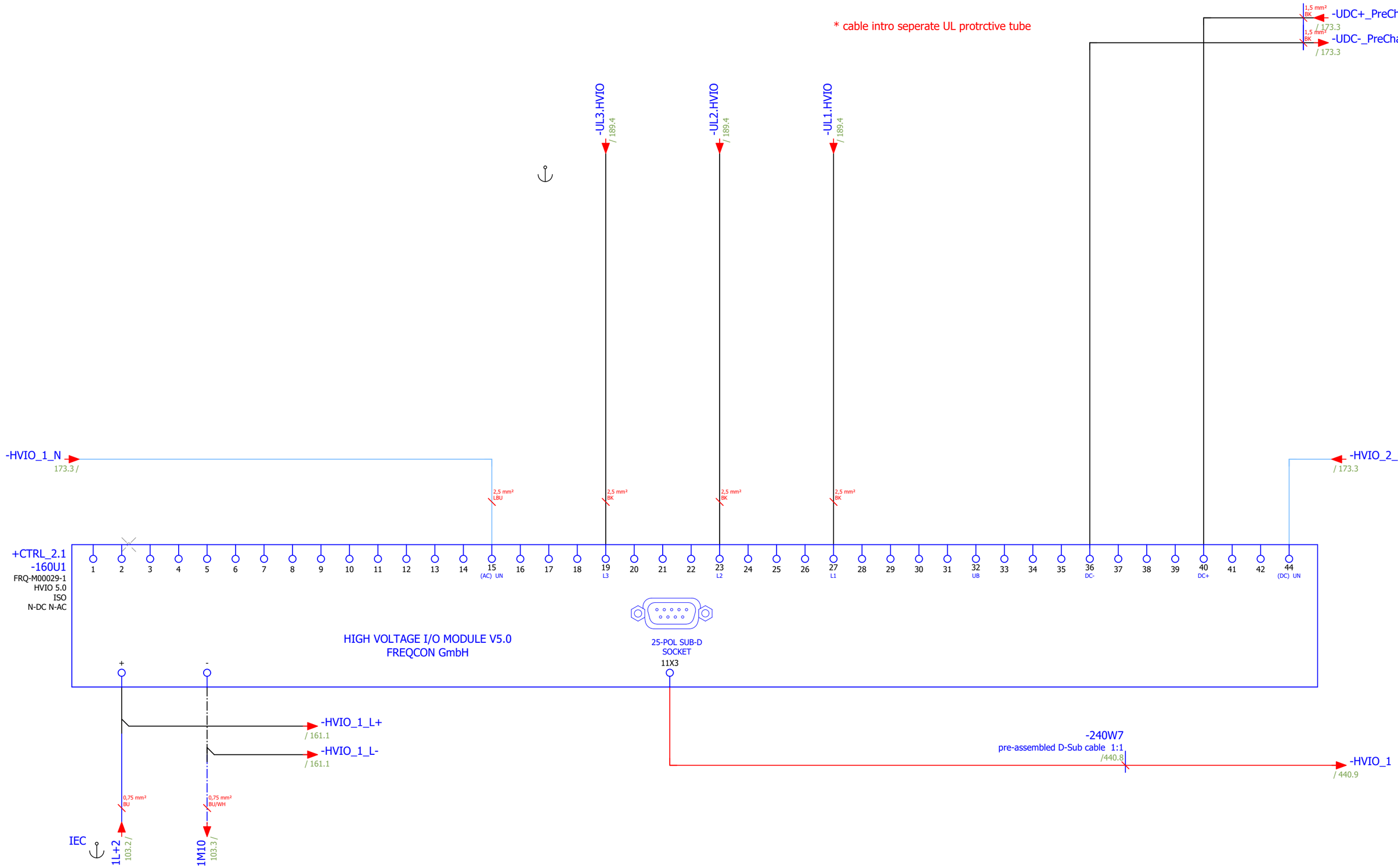
SUBSYSTEM 2_3 CONTACTOR DC+ ON

SUBSYSTEM 2_3 CONTACTOR DC- ON

previous page: 150

next page: 160

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_2, 2_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 151
Date								+	total: 492

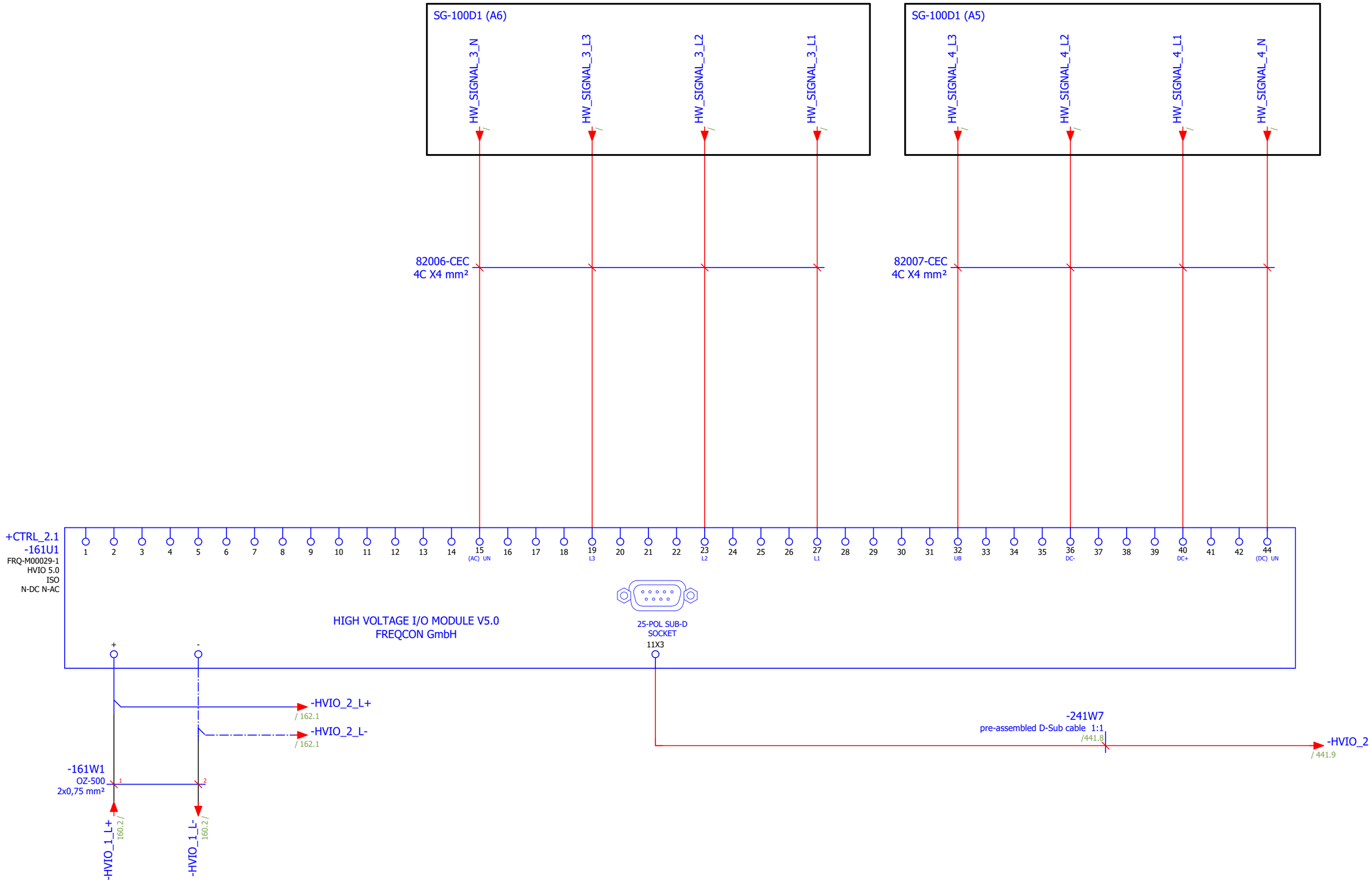


previous page: 151

Measuring: Grid side voltage / DC-Link

next page: 161

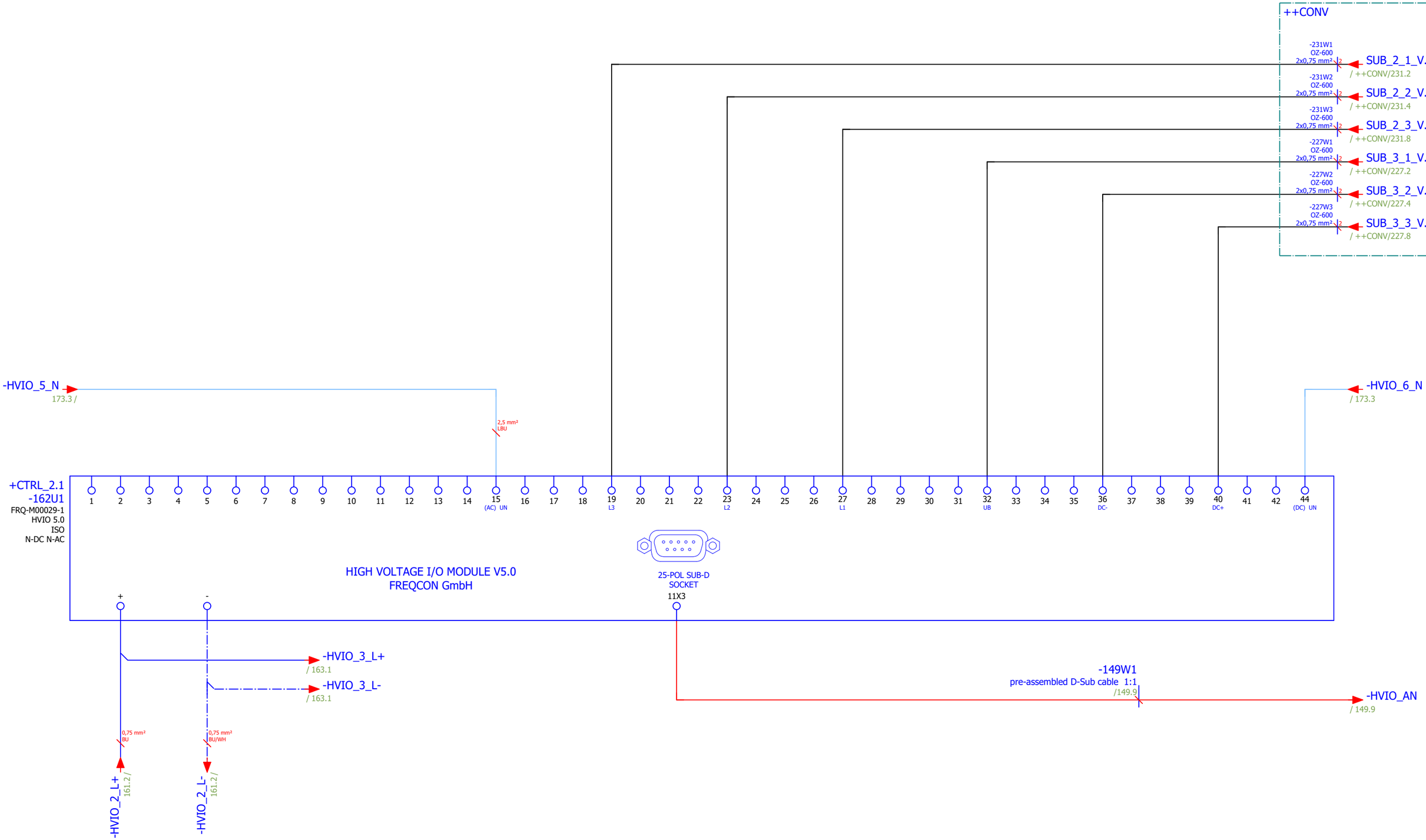
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 160
Date								+	total: 492



previous page:
160

next page:
162

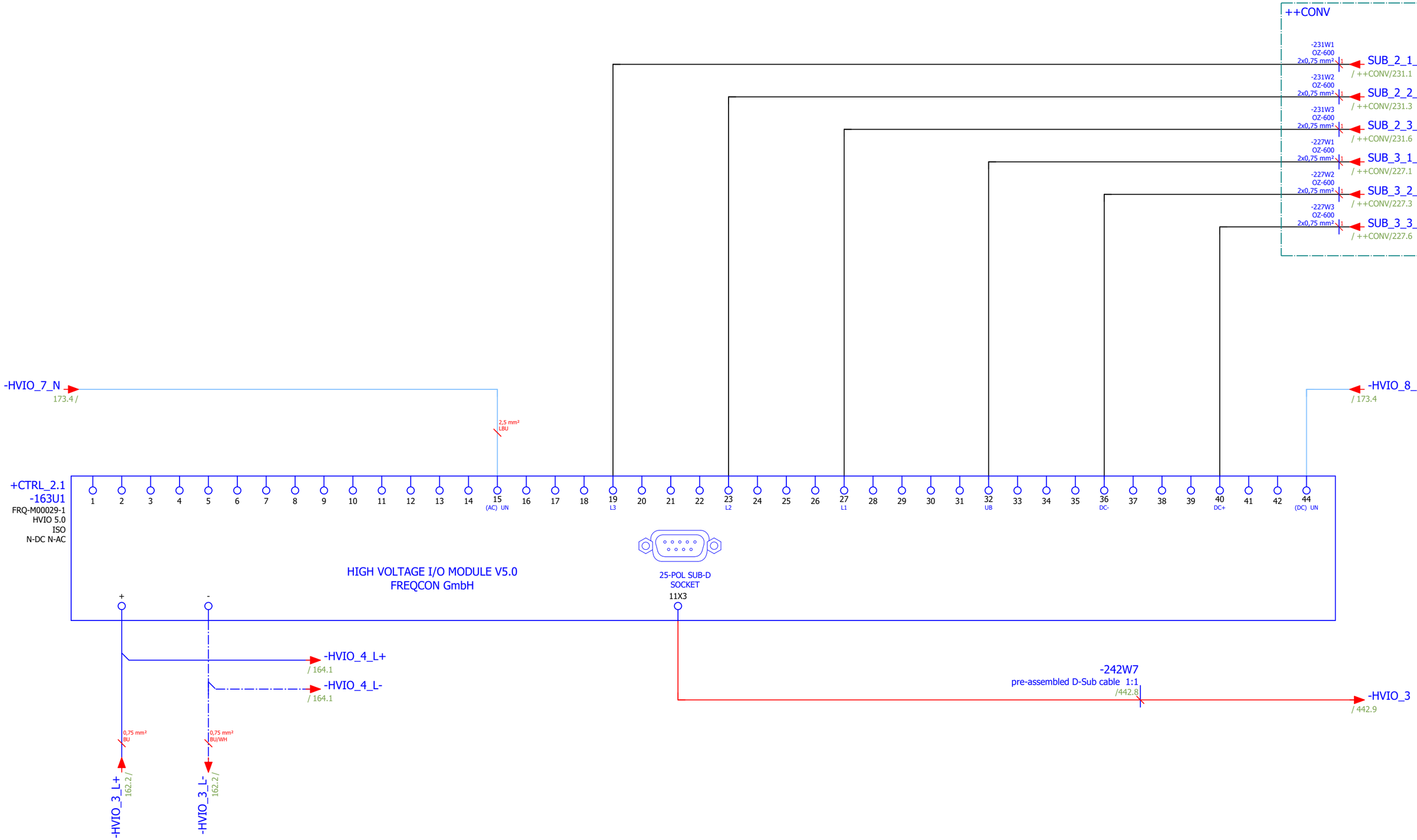
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 2	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.08.2025							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 161
Date								+		total: 492



previous page:
161

next page:
163

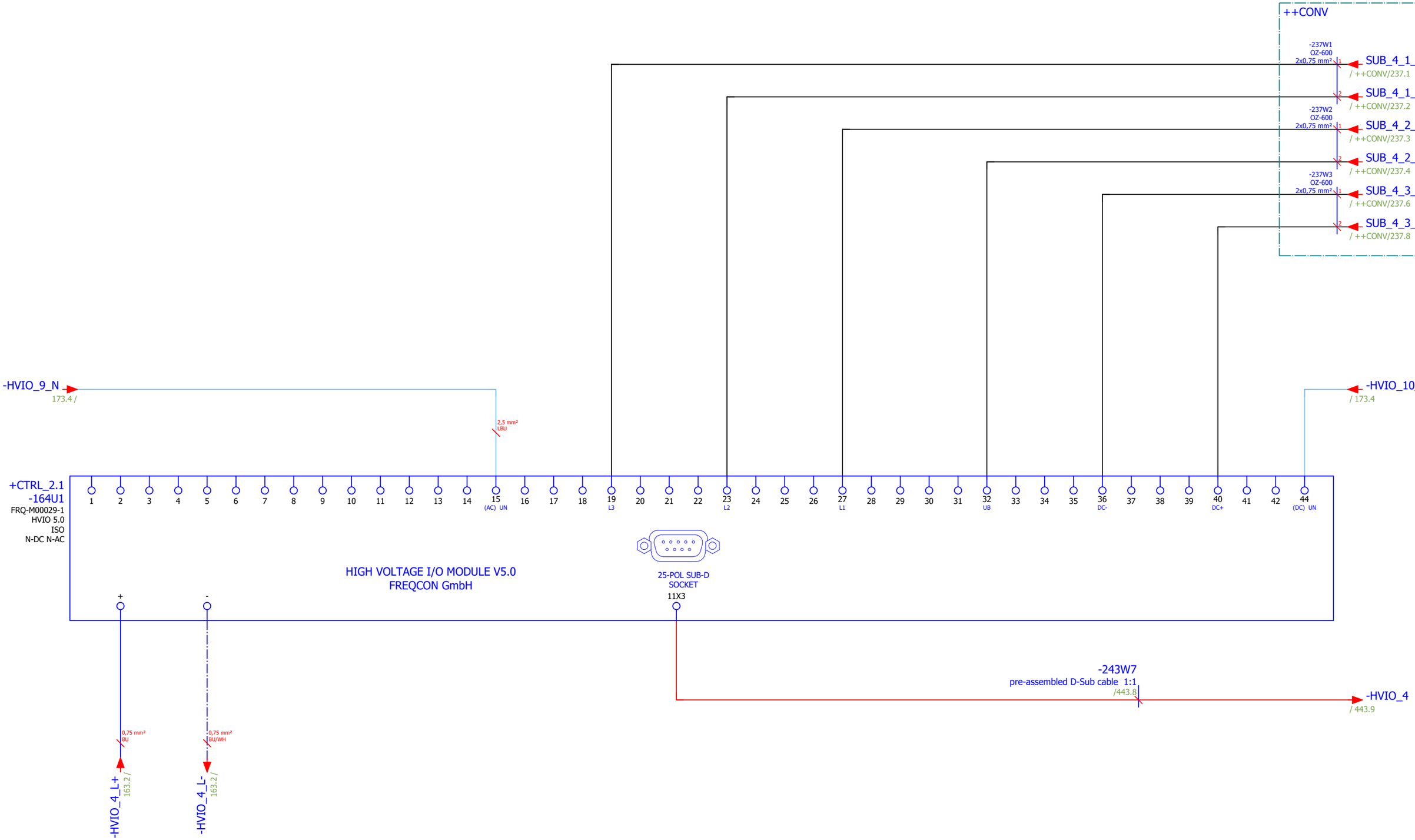
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 2 ANALOG	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 162
Date								+	total: 492



previous page:
162

next page:
164

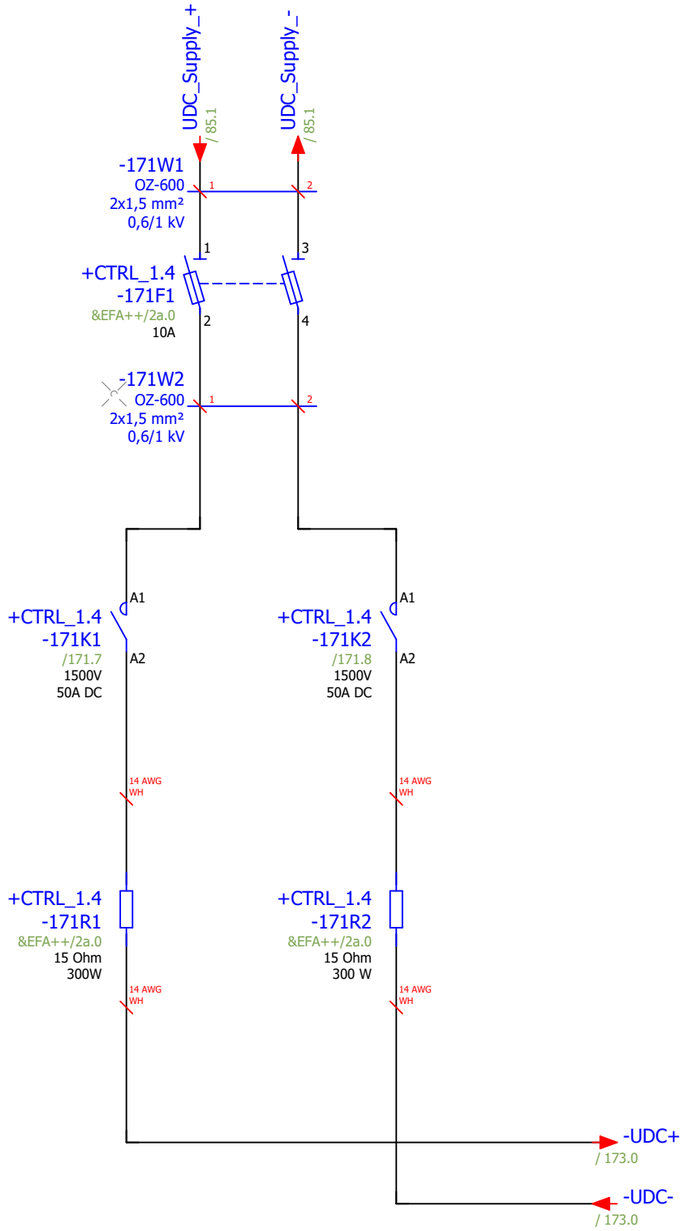
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 163
Date								+	total: 492



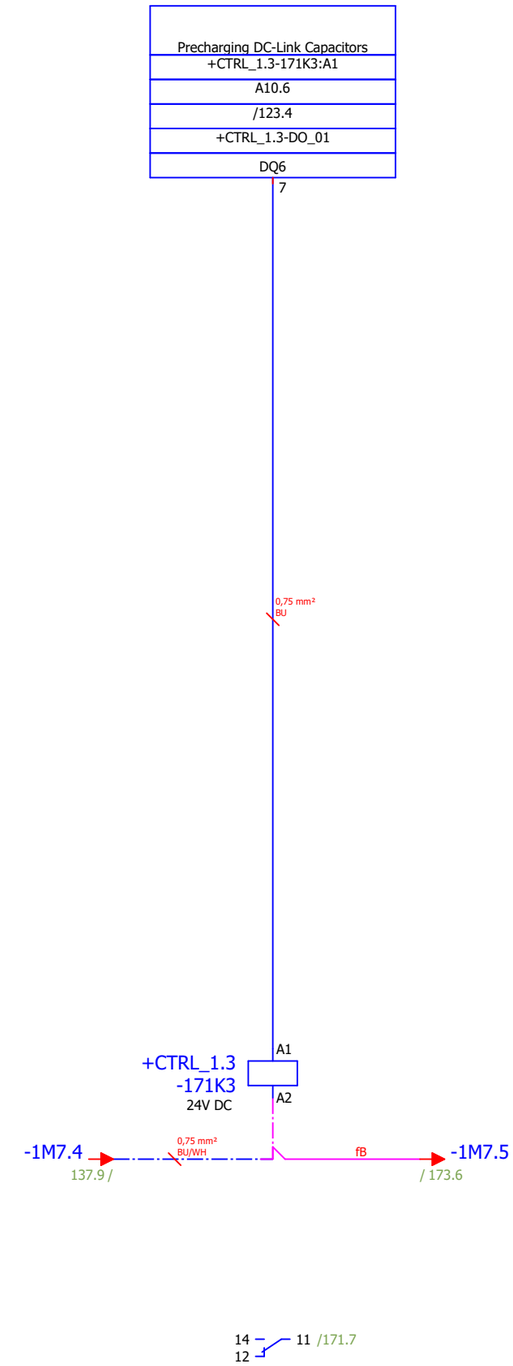
previous page:
163

next page:
171

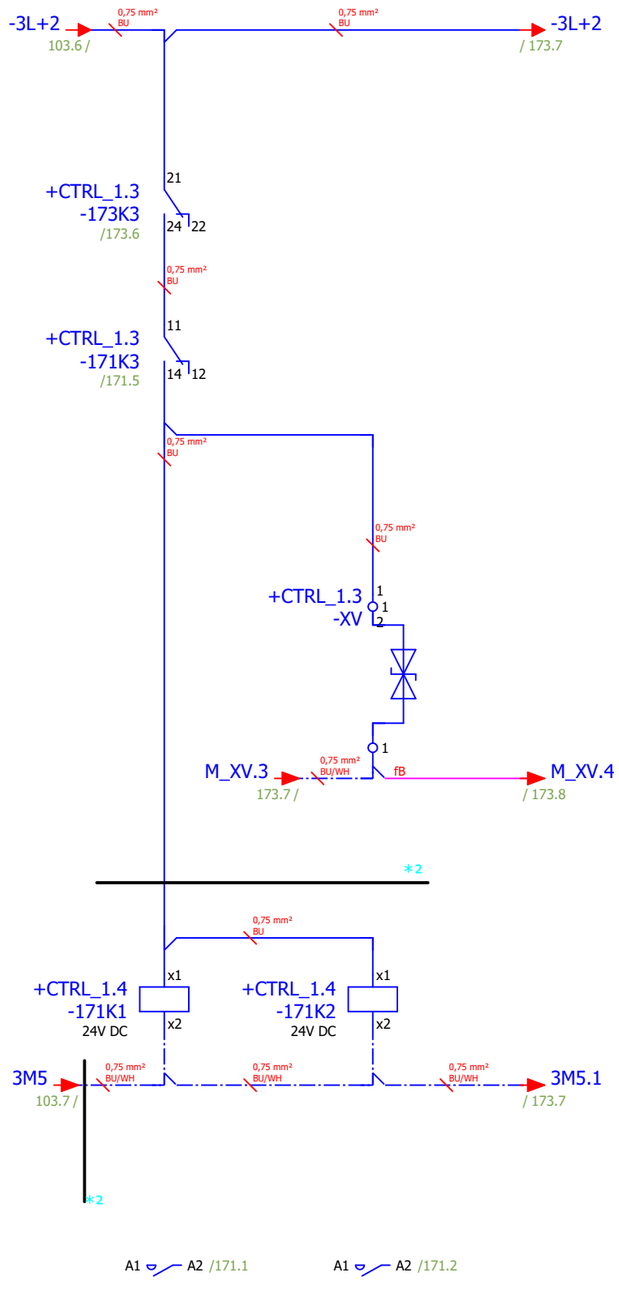
Editor	Freqcon_JD			Statron	FREQCON	INTERFACE HVIO 4	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 164
Date								+	total: 492



RESISTORS
FOR PRECHARGING
from Grid or Battery or DC-Link



Precharging
DC-Link Capacitors

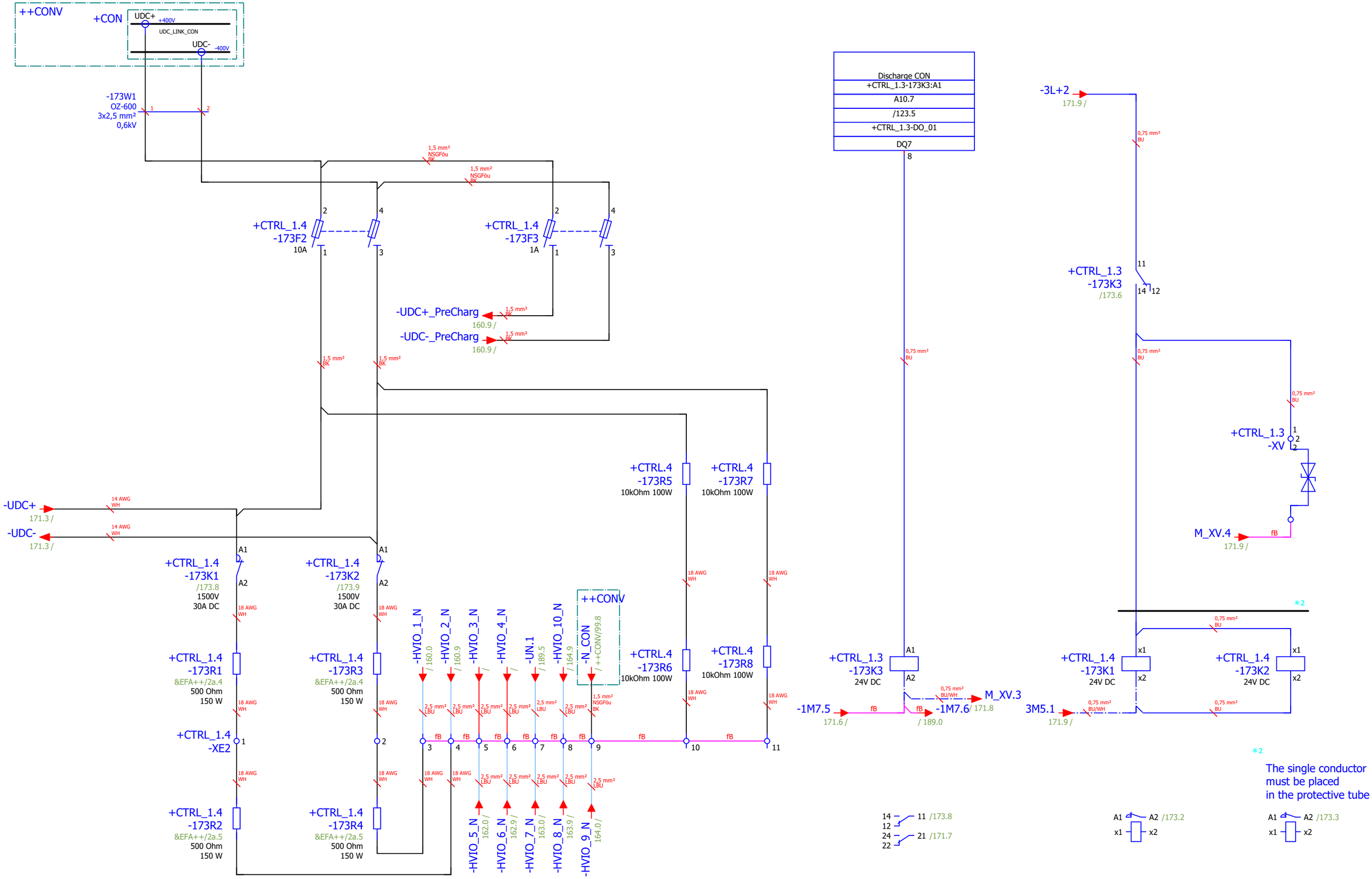


*2 The single conductor must be placed in the protective tube

previous page: 164

next page: 173

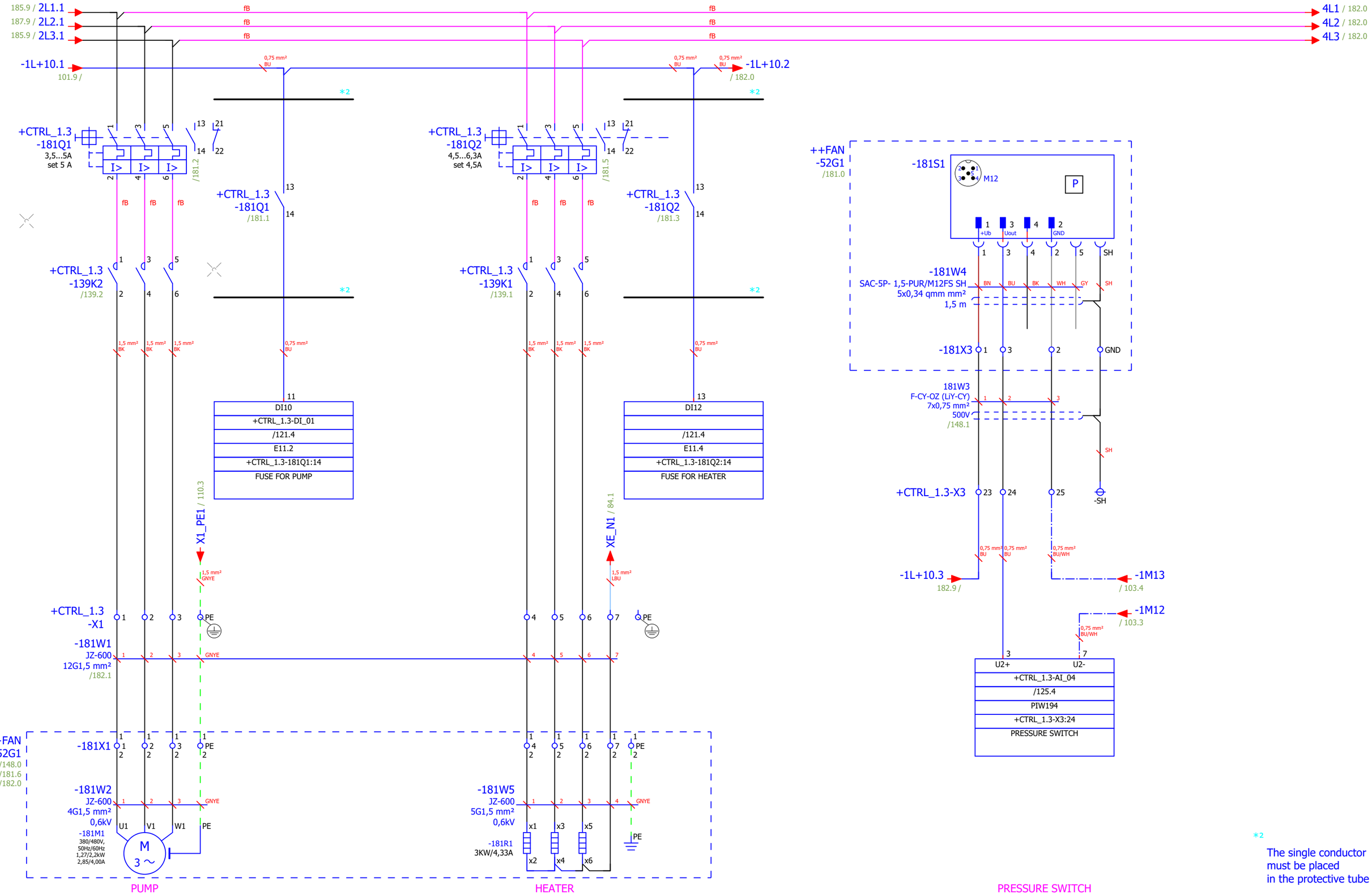
Editor	Freqcon_JD			Statron	FREQCON	PRE-CHARGING UDC	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 171
Date								+	total: 492



previous page: 171

next page: 181

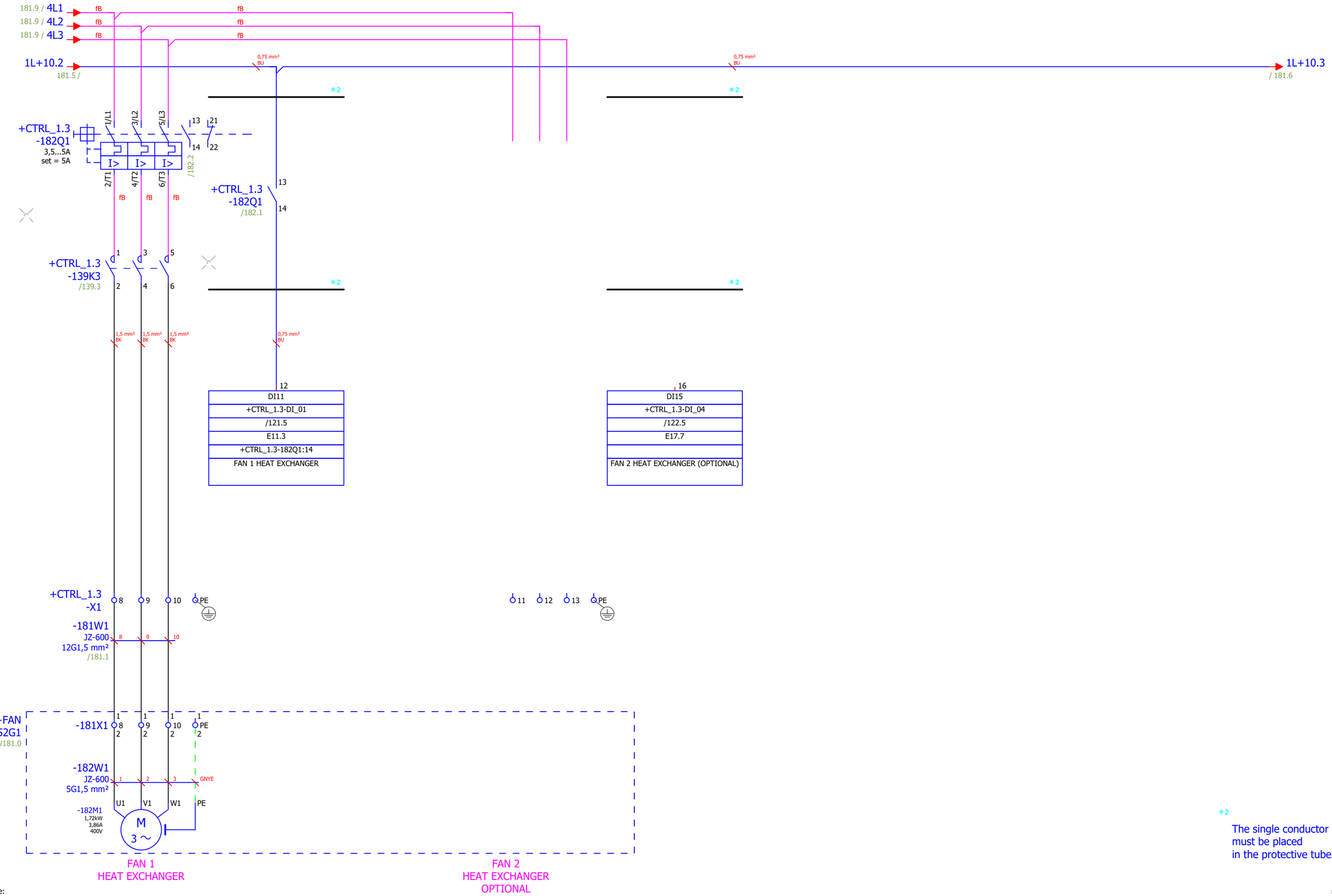
Editor	Freqcon_DG			Statron	FREQCON	DISCHARGE UDC	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.08.2025							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 173
Date								+	total: 492



previous page: 173

next page: 182

Editor	Freqcon_DG			Statron	FREQCON	WATER SYSTEM	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 181
Date								+	total: 492



*2 The single conductor must be placed in the protective tube

previous page: 181

next page: 183

Editor	Freqcon_JD			Statron	FREQCON	HEAT EXCHANGER	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 182
Date								+	total: 492

84.9 / 1L1.1
84.9 / 1L2.1
fB
1L1.2 / 185.0
1L2.2 / 187.0

-1L+8.1
84.6 /
0,75 mm² BU
-1L+8.2
/ 185.8

+CTRL_1.3
-183F1
C16A
/183.6
+CTRL_1.3
-183F2
C10A
/183.6

*2
+CTRL_1.3
-183F1
/183.1
0,75 mm² BU
*2
+CTRL_1.3
-183F2
/183.3
0,75 mm² BU
*2

1,5 mm² BK
1,5 mm² BK

+CTRL_1.3
-135K1
/135.1
XE_N2 / 84.1
+CTRL_1.3
-135K3
/135.3

1,5 mm² BK
2,5 mm² LBU
1,5 mm² BK

fB
fB
FB_XT.4-6
/ 185.1

PT 2,5 +CTRL_1.3
-XT
PE
PE

15
DI14
+CTRL_1.3-DI_01
/121.4
E11.6
+CTRL_1.3-183F2:13
Fuse Fans CON, IND Cabinets

++CONV
-279W1
JZ-500
3G1,5 mm²
GNYE
-FAN_L_2 ++CONV/279.1/
-FAN_N_2 ++CONV/279.1/
-FAN_PE_2 ++CONV/279.1/
EEC

++CONV
-281W1
JZ-500
3G1,5 mm²
GNYE
-FAN_L_3 ++CONV/281.1/
-FAN_N_3 ++CONV/281.1/
-FAN_PE_3 ++CONV/281.1/
EEC

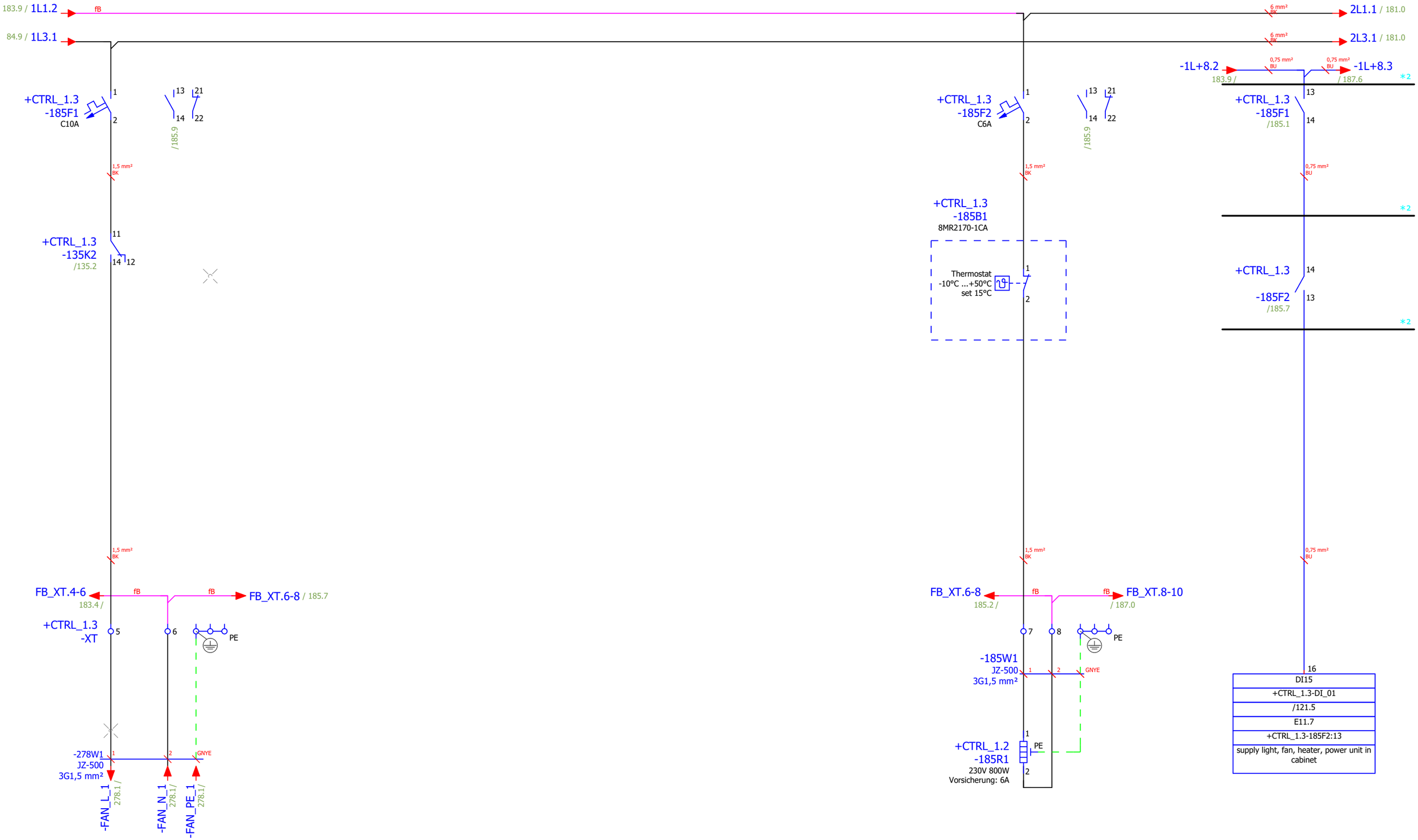
CON
Fans 1-5
in door

CIR
Fans 1-3
in door

*2
The single conductor
must be placed
in the protective tube

previous page: 182
next page: 185

Editor	Freqcon_DG			Statron	FREQCON	Supply for cabinet fan	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 183
Date								+	total: 492



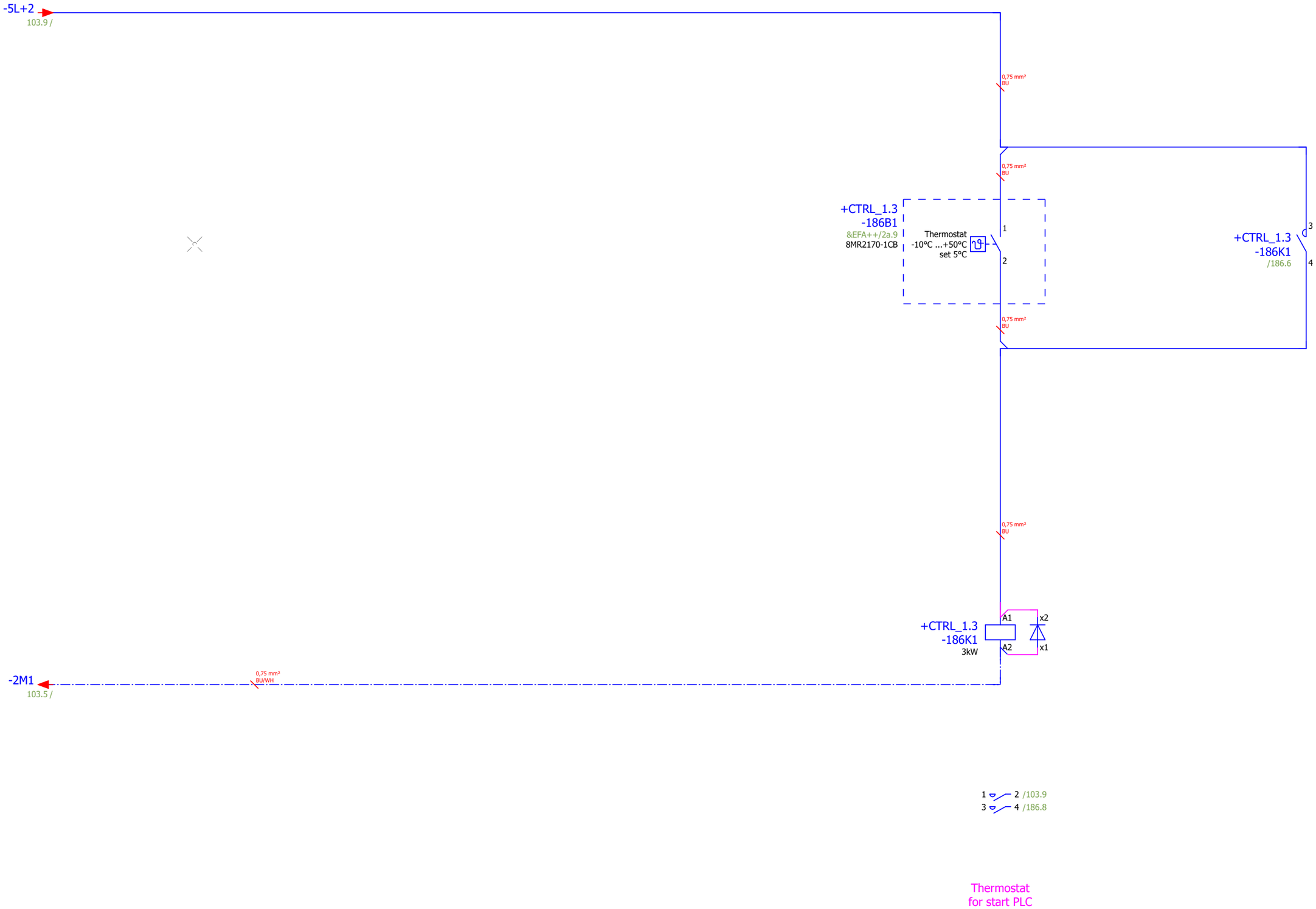
FAN 1
CONTROL CABINET

HEATING
CONTROL CABINET

previous page: 183

next page: 186

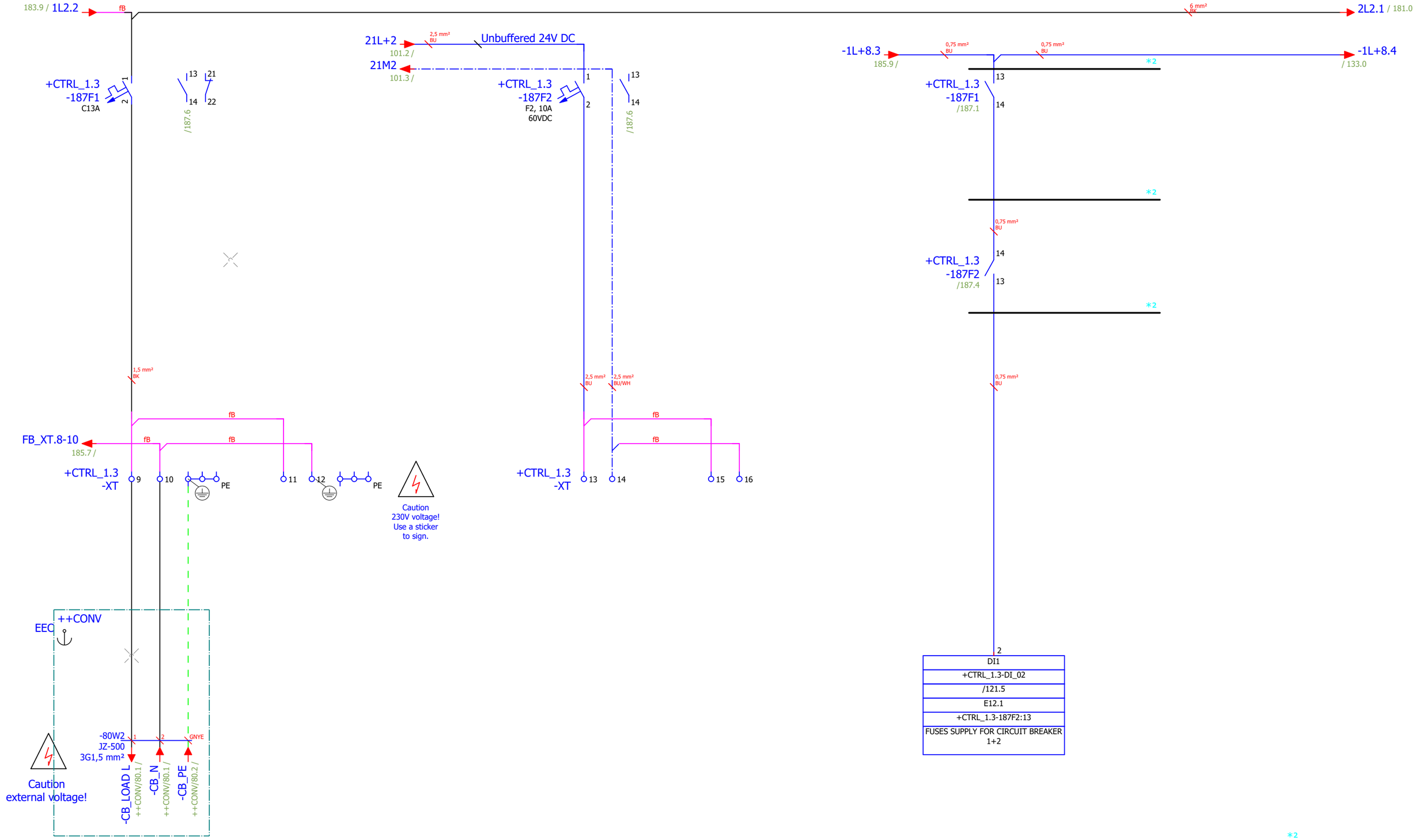
Editor	Freqcon_JD			Statron	FREQCON	FAN / HEATING CONTROL CABINET	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 185
Date								+	total: 492



previous page: 185

next page: 187

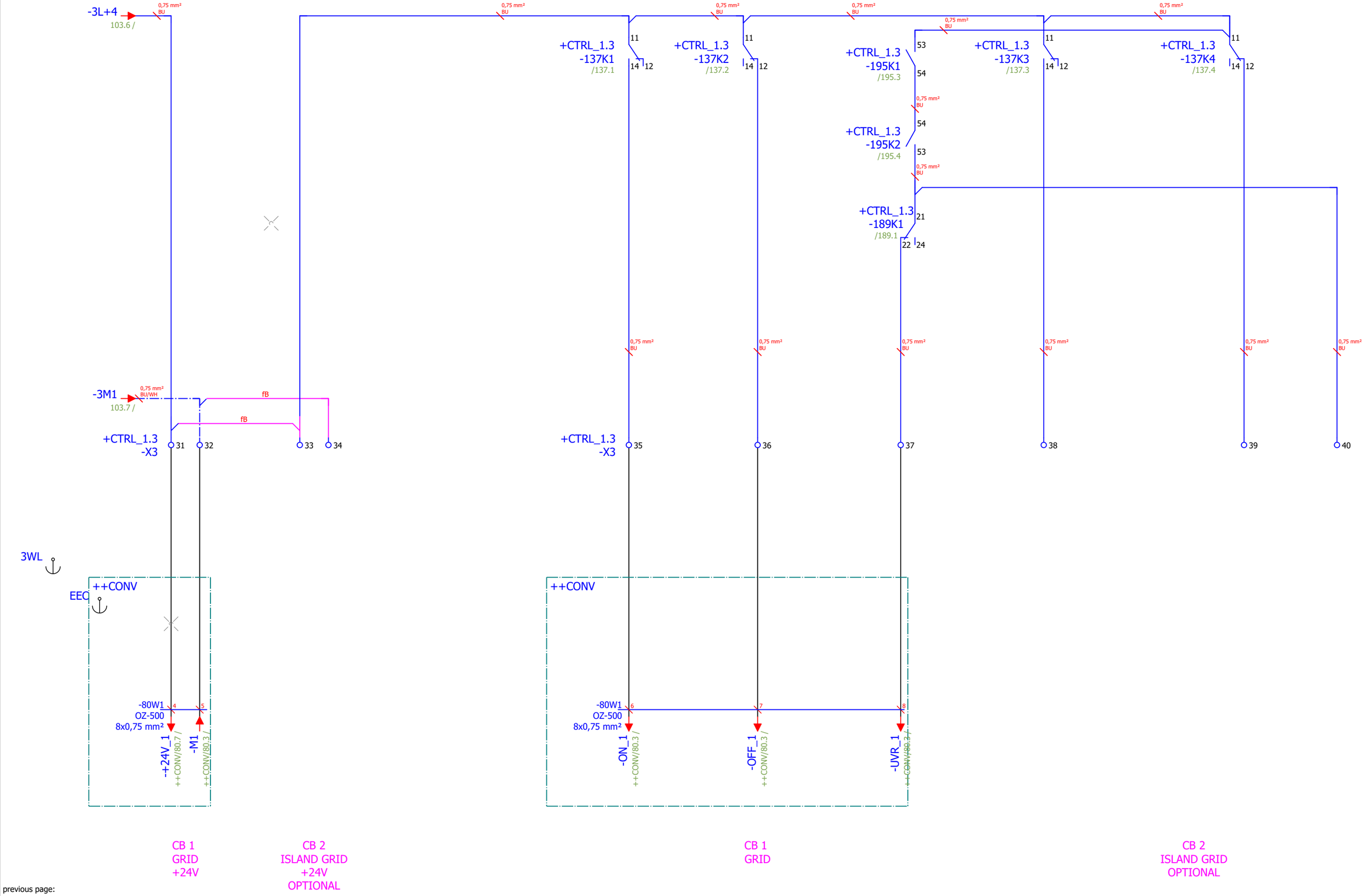
Editor	Freqcon_JD			Statron	FREQCON	THERMOSTAT	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 186
Date								+	total: 492



previous page: 186

next page: 188

Editor	Freqcon_JD			Statron	FREQCON	24V DC SUPPLY CB	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 187
Date								+	total: 492



previous page: 187

next page: 189

Editor	Freqcon_JD			Statron	FREQCON	24V DC SUPPLY CON / CB GRID	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 188
Date								+	total: 492

GRID FAULT
+CTRL_1.3-189K1:A1
A11.3
/123.5
+CTRL_1.3-DO_01
DQ11
12

0,75 mm² BU

+CTRL_1.3
-189K1
24V DC
A1
A2

-1M7.6 fB 0,75 mm² BU/WH -M_(GND)
173.6 / / 189.5

14 11 /189.6
12
24 21 /188.6
22

Voltage inputs
3 phases 620V AC

Grid Circuit Breaker:
if OFF then 24V;
if ON then 0V

Grid OK

-UL1.HVIO / 160.5 — 2,5 mm² BK
-UL2.HVIO / 160.5 — 2,5 mm² BK
-UL3.HVIO / 160.4 — 2,5 mm² BK
-UN.1 / 173.4 — 2,5 mm² LBU
-24V_Signal / 127.4 — 0,75 mm² BU
-M_(GND) / 189.1 — 0,75 mm² BU/WH
+CTRL_1.3 -189K1 /189.1 — 0,75 mm² BU (11 / 12 / 14)
CB_OFF.1 / 137.2 — 0,75 mm² BU

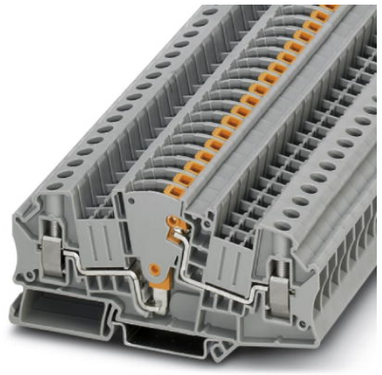
+CTRL_1.4
-189X1
Test disconnect
terminal block
Phoenix Contact
PTME 6

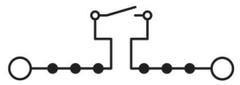
1 2 3 4 5 6 7 8 9

2,5 mm² BK
2,5 mm² BK
2,5 mm² BK
0,75 mm² BU

-HVIO_L1 / 85.1 /
-HVIO_L2 / 85.1 /
-HVIO_L3 / 85.2 /
CB_OFF.2 / 137.2 /

Relais
Circuit Breaker
OFF



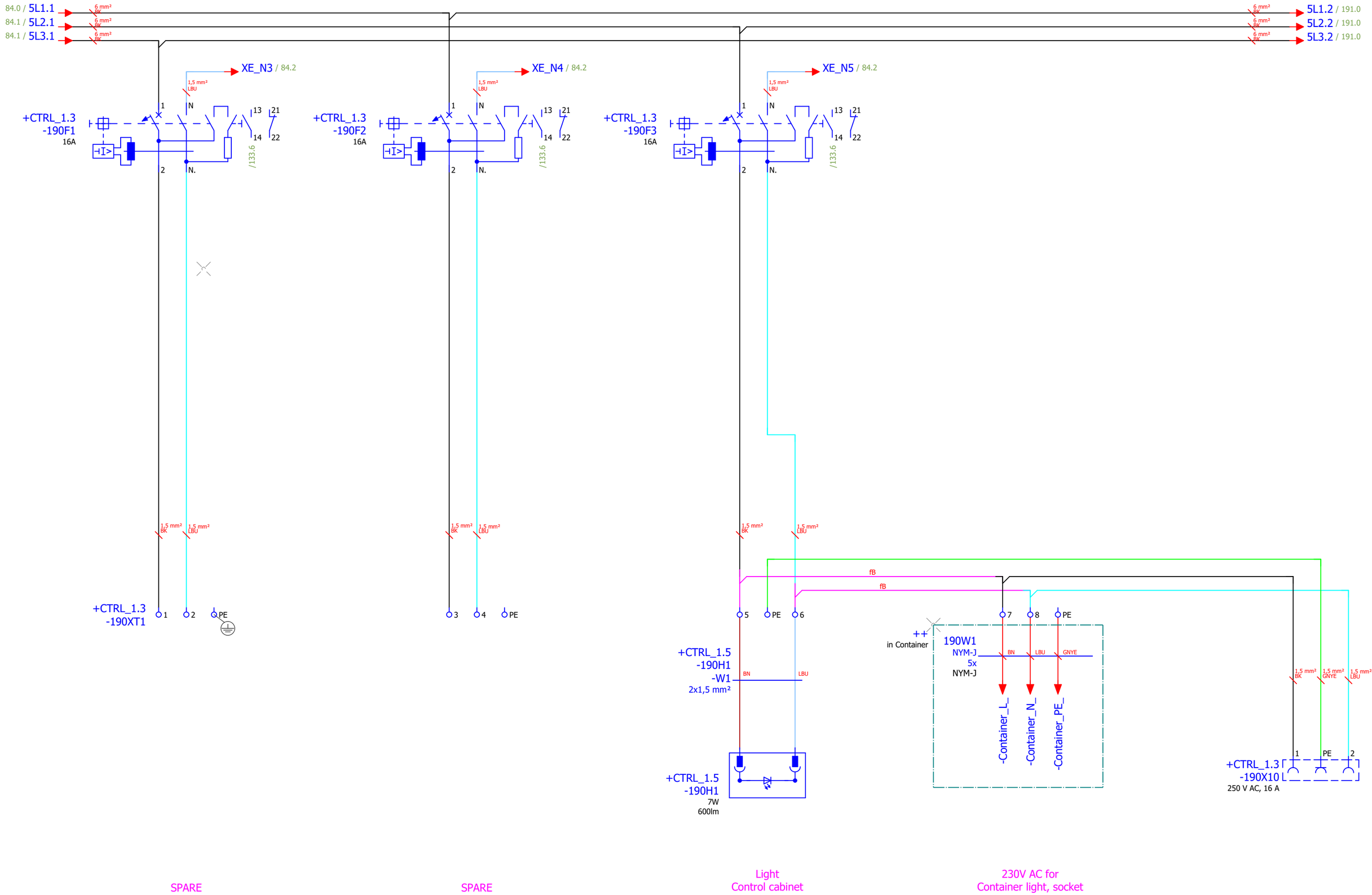


GRID FAULT

Test terminal block for protection tests

previous page: 188
next page: 190

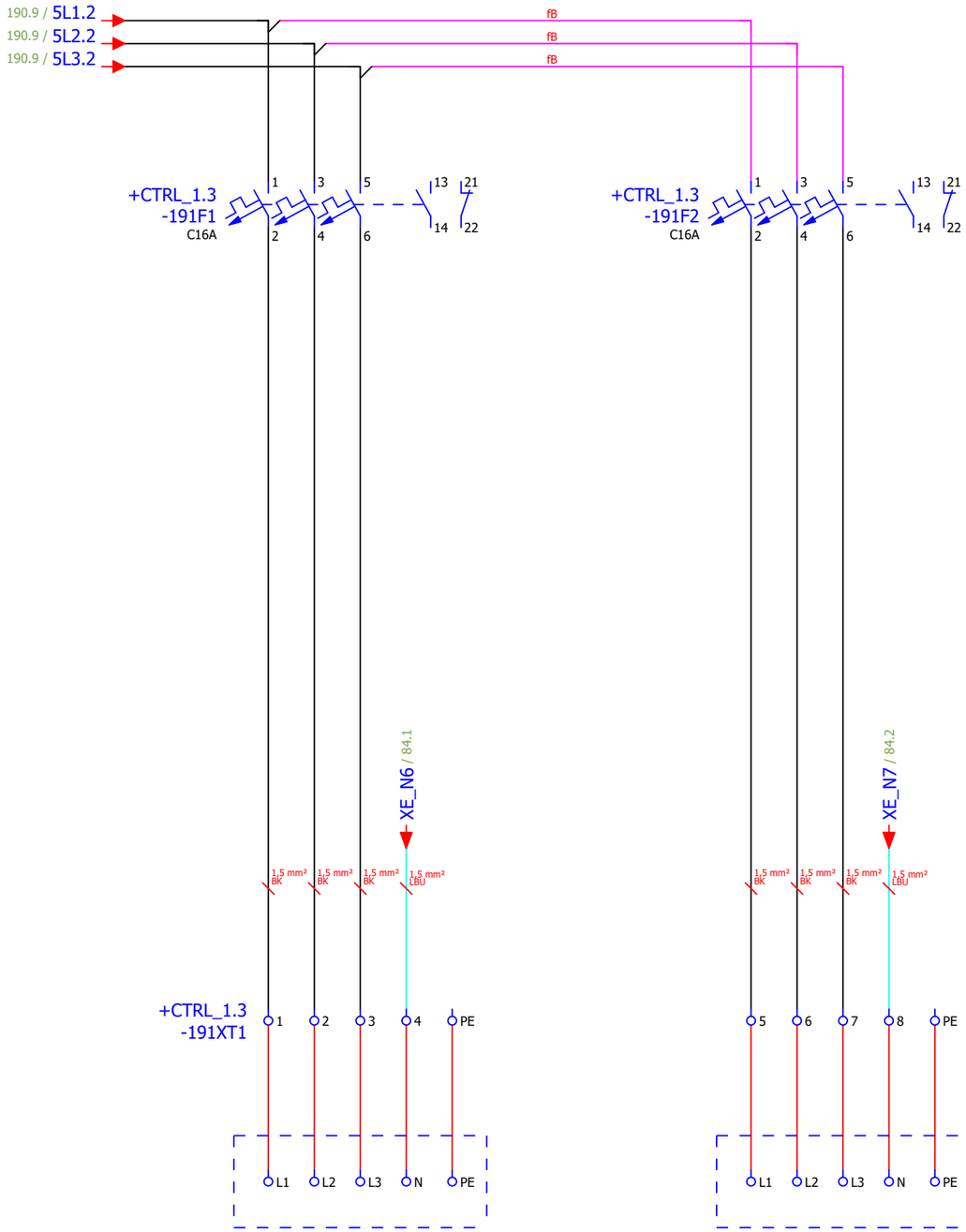
Editor	Freqcon_JD			Statron	FREQCON	TEST TERMINAL BLOCK	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 189
Date								+ total: 492



previous page: 189

next page: 191

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING, LIGHT 230V SUPPLY	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 190
Date								+	total: 492

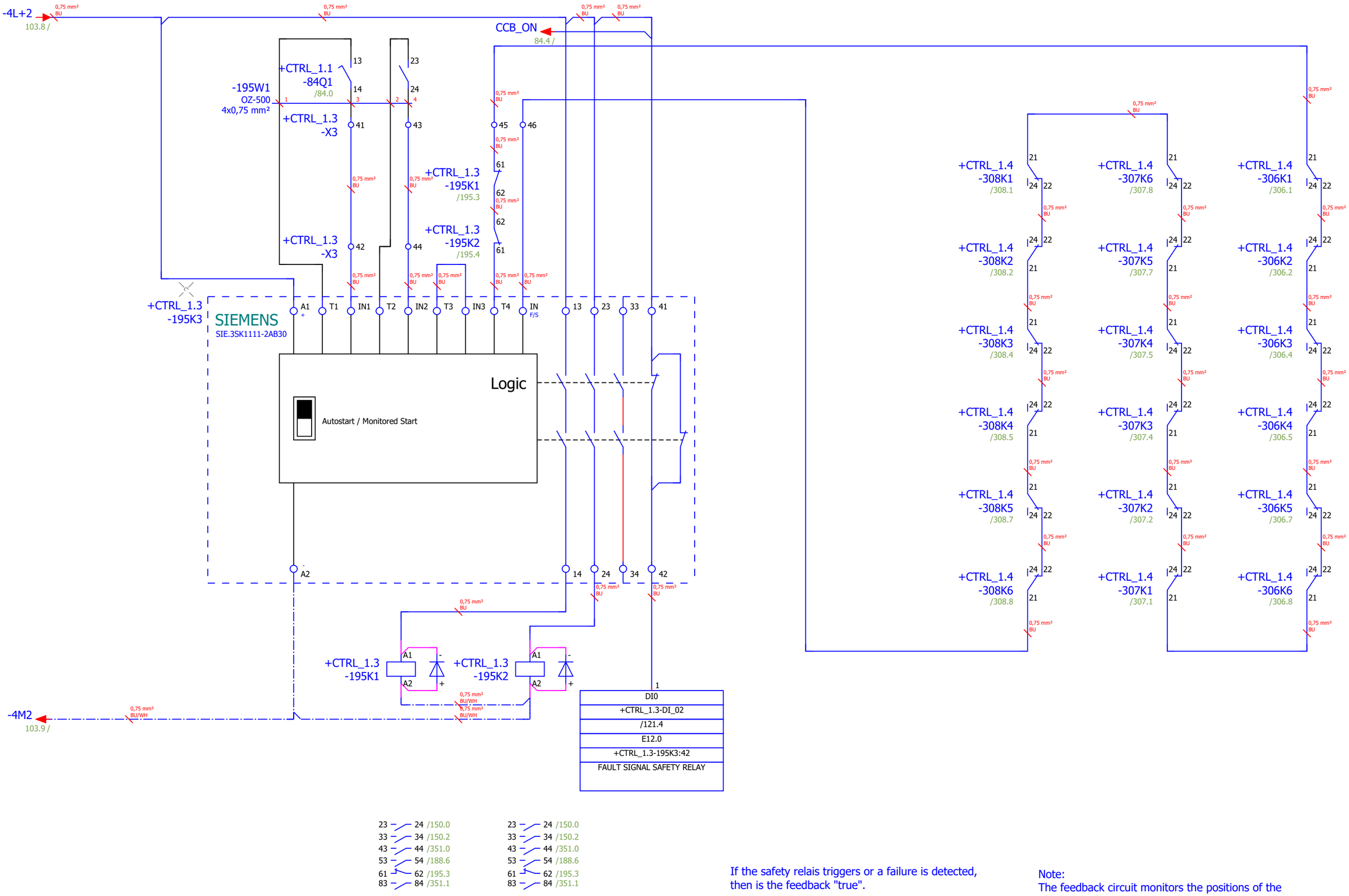


400V AC for
Container Air Conditioning 1

400V AC for
Container Air Conditioning 2

previous page: 190

next page: 195



23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
83 — 84 /351.1

23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
83 — 84 /351.1

SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS

FAULT SIGNAL SAFETY RELAY

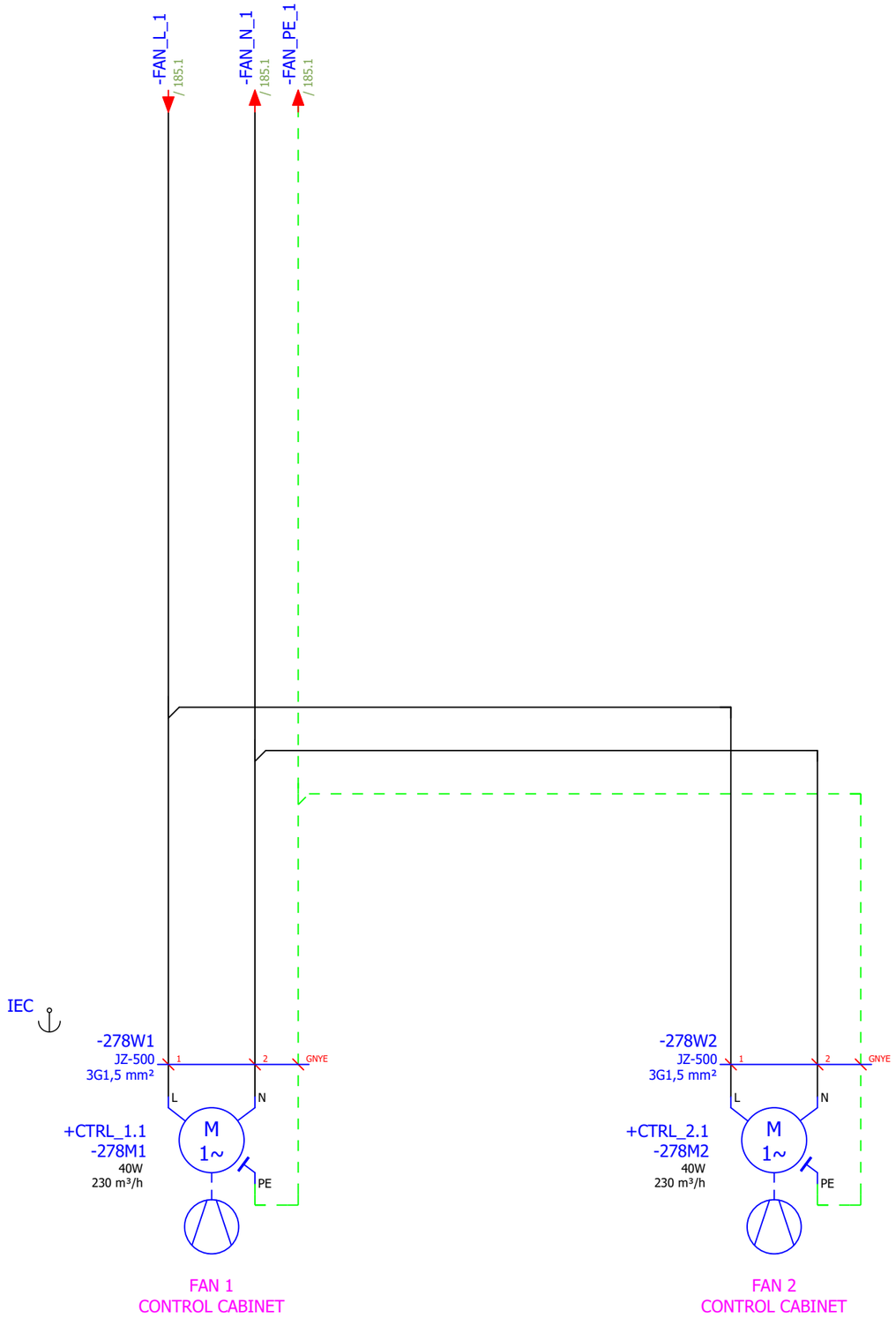
If the safety relais triggers or a failure is detected, then is the feedback "true".

Note:
The feedback circuit monitors the positions of the positive-guided NC contacts on the contactors 195K1 and 195K2. If one of their contacts latsches, then it is not possible to switch the contactors back on.

previous page: 191

next page: 278

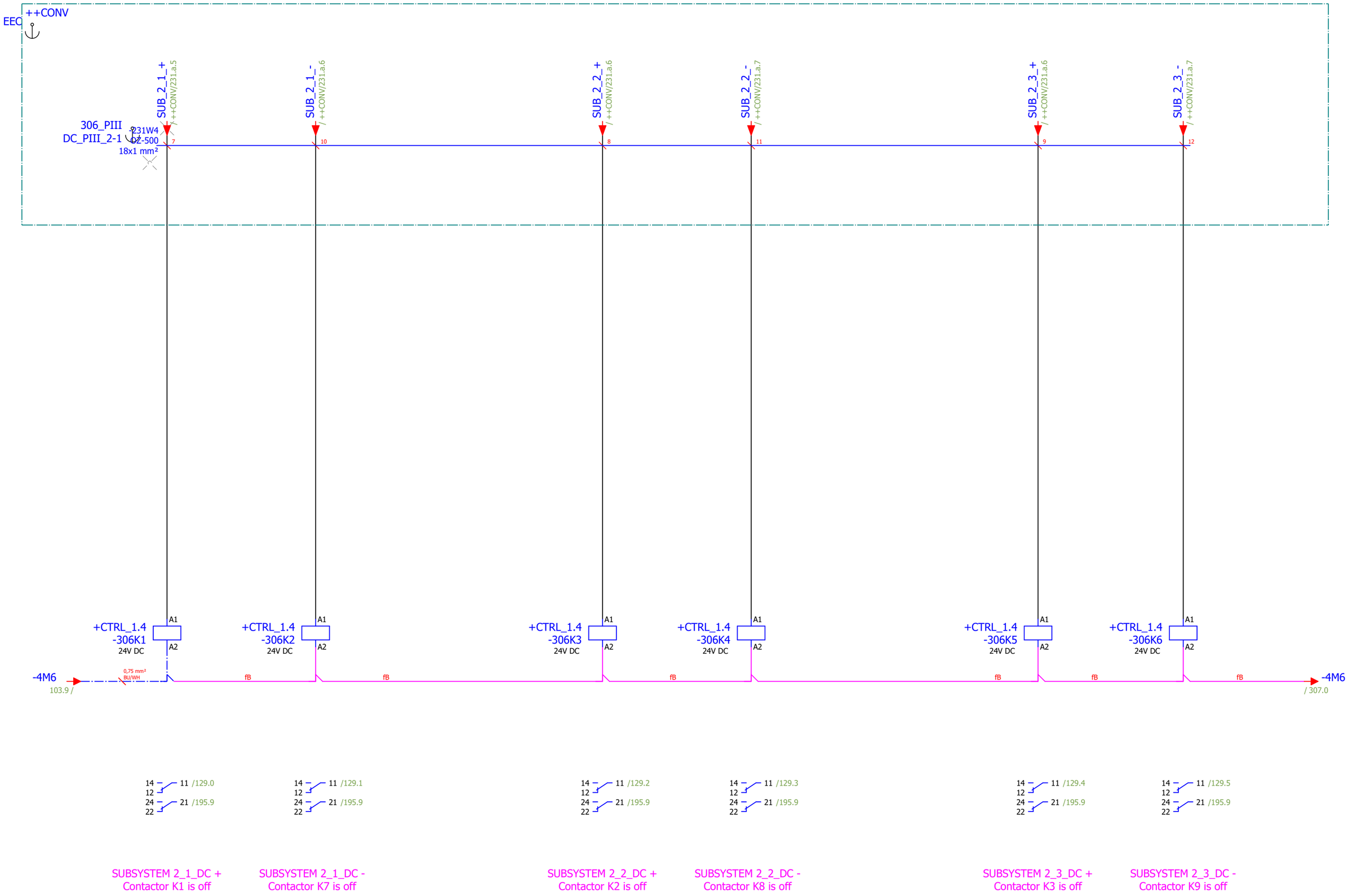
Editor	Freqcon_DG			Statron	FREQCON	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 195
Date								+ total: 492



previous page:
195

next page:
306

Editor	Freqcon_DG			Statron	FREQCON	CONTROL CABINET CLIMATE	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 278
Date								+	total: 492



previous page: 278

next page: 307

Editor	Freqcon_JD			Statron	FREQCON	Feedback DC contactors 1_4 - 1_6	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 306
Date								+	total: 492

EEC ++CONV

306_PIII
DC_PIII_3-1
227W4
D2-500
18x1 mm²

SUB_3_1_+ /++CONV/227.a.5 — 7
SUB_3_1_- /++CONV/227.a.6 — 10
SUB_3_2_+ /++CONV/227.a.6 — 8
SUB_3_2_- /++CONV/227.a.7 — 11
SUB_3_3_+ /++CONV/227.a.6 — 9
SUB_3_3_- /++CONV/227.a.7 — 12

+CTRL_1.4 -307K1 24V DC A1 A2
+CTRL_1.4 -307K2 24V DC A1 A2
+CTRL_1.4 -307K3 24V DC A1 A2
+CTRL_1.4 -307K4 24V DC A1 A2
+CTRL_1.4 -307K5 24V DC A1 A2
+CTRL_1.4 -307K6 24V DC A1 A2

-4M6 306.9 / — fB — fB — fB — fB — fB — fB — -4M6 / 308.0

14 12 11 /130.0 21 /195.8 22 24
14 12 11 /130.1 21 /195.8 22 24
14 12 11 /130.2 21 /195.8 22 24
14 12 11 /130.3 21 /195.8 22 24
14 12 11 /130.4 21 /195.8 22 24
14 12 11 /130.5 21 /195.8 22 24

SUBSYSTEM 3_1_DC +
Contactor K1 is off

SUBSYSTEM 3_1_DC -
Contactor K7 is off

SUBSYSTEM 3_2_DC +
Contactor K2 is off

SUBSYSTEM 3_2_DC -
Contactor K8 is off

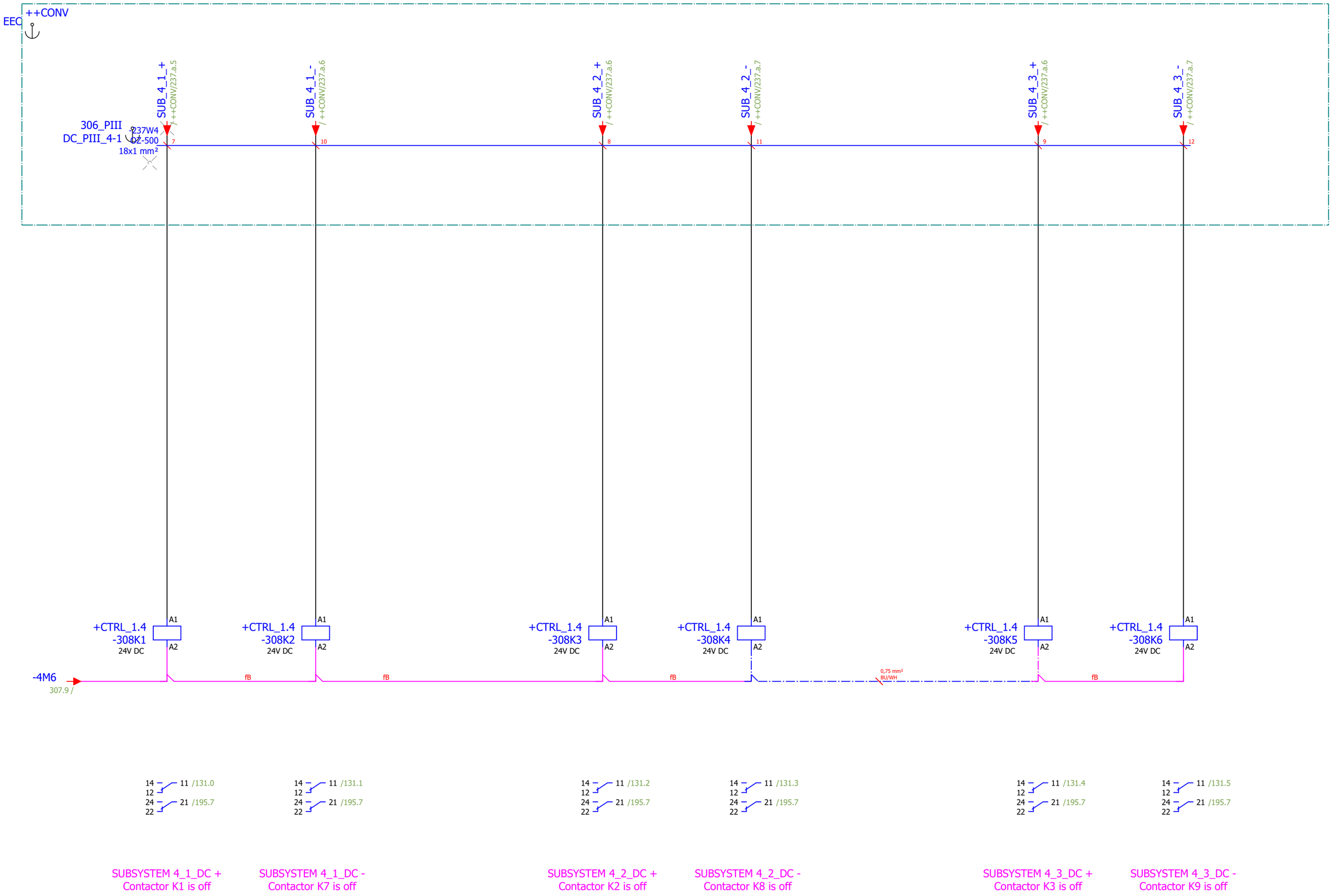
SUBSYSTEM 3_3_DC +
Contactor K3 is off

SUBSYSTEM 3_3_DC -
Contactor K9 is off

previous page: 306

next page: 308

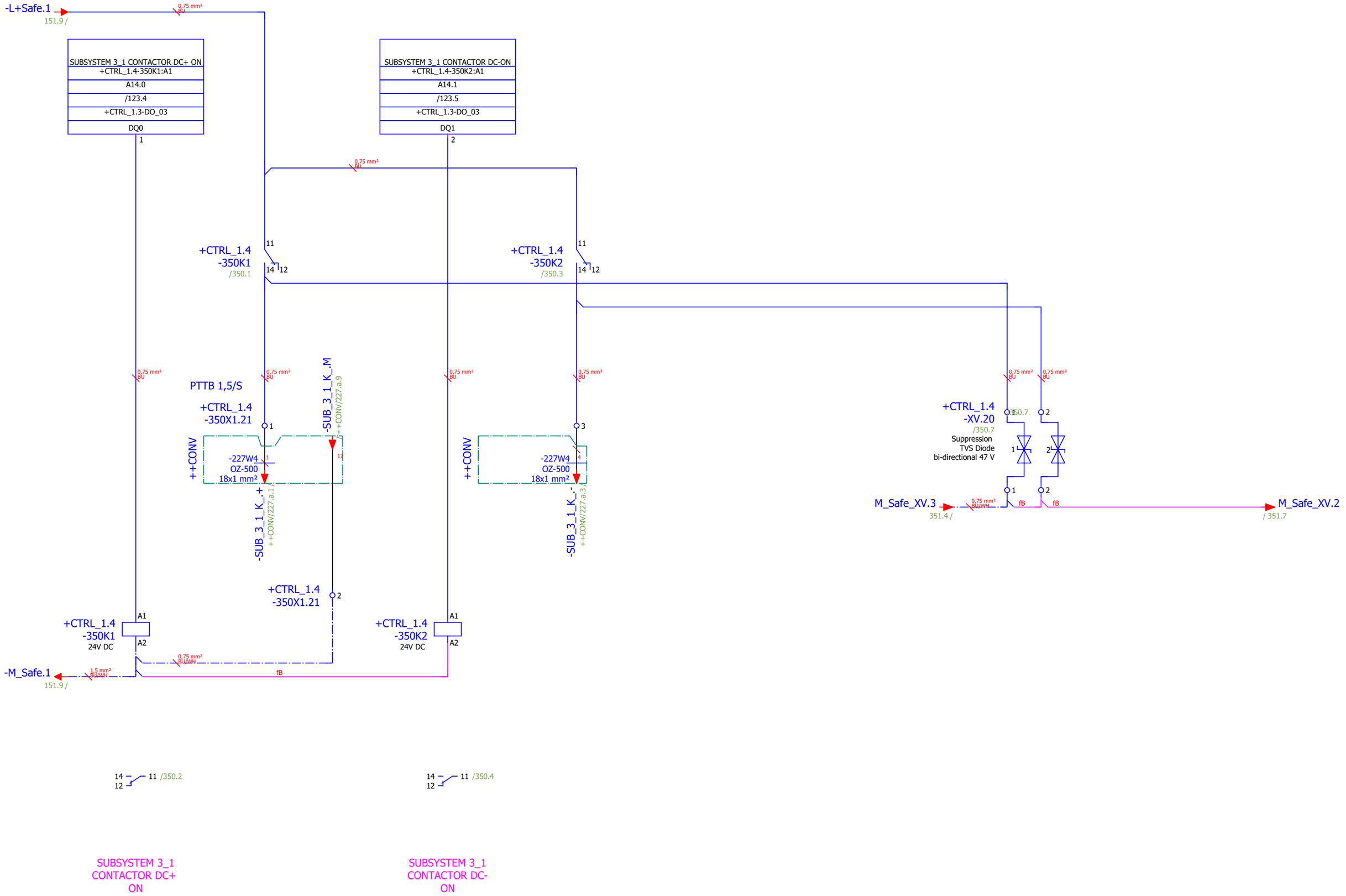
Editor	Freqcon_JD			Statron	FREQCON	Feedback DC contactors 2_1 - 2_3	20250805_V2.0	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 307
Date								+	total: 492



previous page: 307

next page: 350

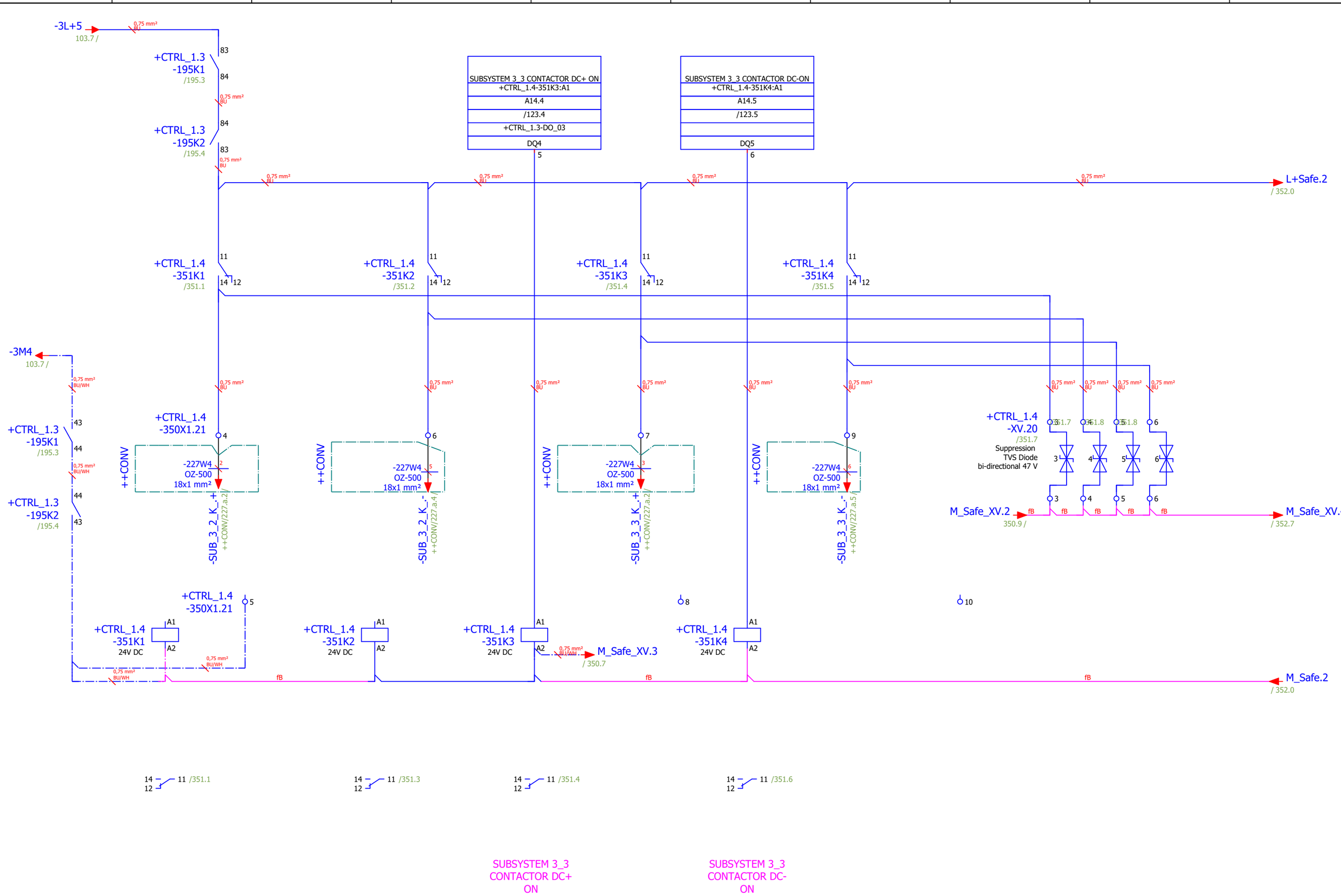
Editor	Freqcon_DG			Statron	FREQCON	Feedback DC contactors 2_4 - 2_6	20250805_V2.0	= UNIT_01	Converter Container 1
Date	29.07.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets page: 308
Date								+	total: 492



previous page: 308

next page: 351

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 350
Date								+	total: 492



previous page: 350

next page: 352

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 351
Date								+	total: 492

-L+Safe.2
351.9 /

SUBSYSTEM 4_1 CONTACTOR DC+ ON
+CTRL_1.4-352K1:A1
A14.6
/123.4
+CTRL_1.3-DO_03
DQ6
7

SUBSYSTEM 4_1 CONTACTOR DC-ON
+CTRL_1.4-352K2:A1
A14.7
/123.5
DQ7
8

L+Safe.3
/ 353.0

0,75 mm² BU

+CTRL_1.4
-352K1
/352.0
11 14 12

+CTRL_1.4
-352K2
/352.2
11 14 12

+CTRL_1.4
-350X1.21
11

-SUB_4_1_K_M
/++CONV/237.a.9

++CONV
-237W4
OZ-500
18x1 mm²
1 17

-SUB_4_1_K_+
/++CONV/237.a.1

13

++CONV
-237W4
OZ-500
18x1 mm²
4

-SUB_4_1_K_-
/++CONV/237.a.3

+CTRL_1.4
-XV.20
/352.7
Suppression
TVS Diode
bi-directional 47 V
7 8

M_Safe_XV.4
351.9 /
fB

M_Safe_XV.5
/ 353.7

+CTRL_1.4
-350X1.21
12

+CTRL_1.4
-352K1
24V DC
A1 A2

+CTRL_1.4
-352K2
24V DC
A1 A2

-M_Safe.2
351.9 /

M_Safe.3
/ 353.0

14 12 11 /352.1

14 12 11 /352.3

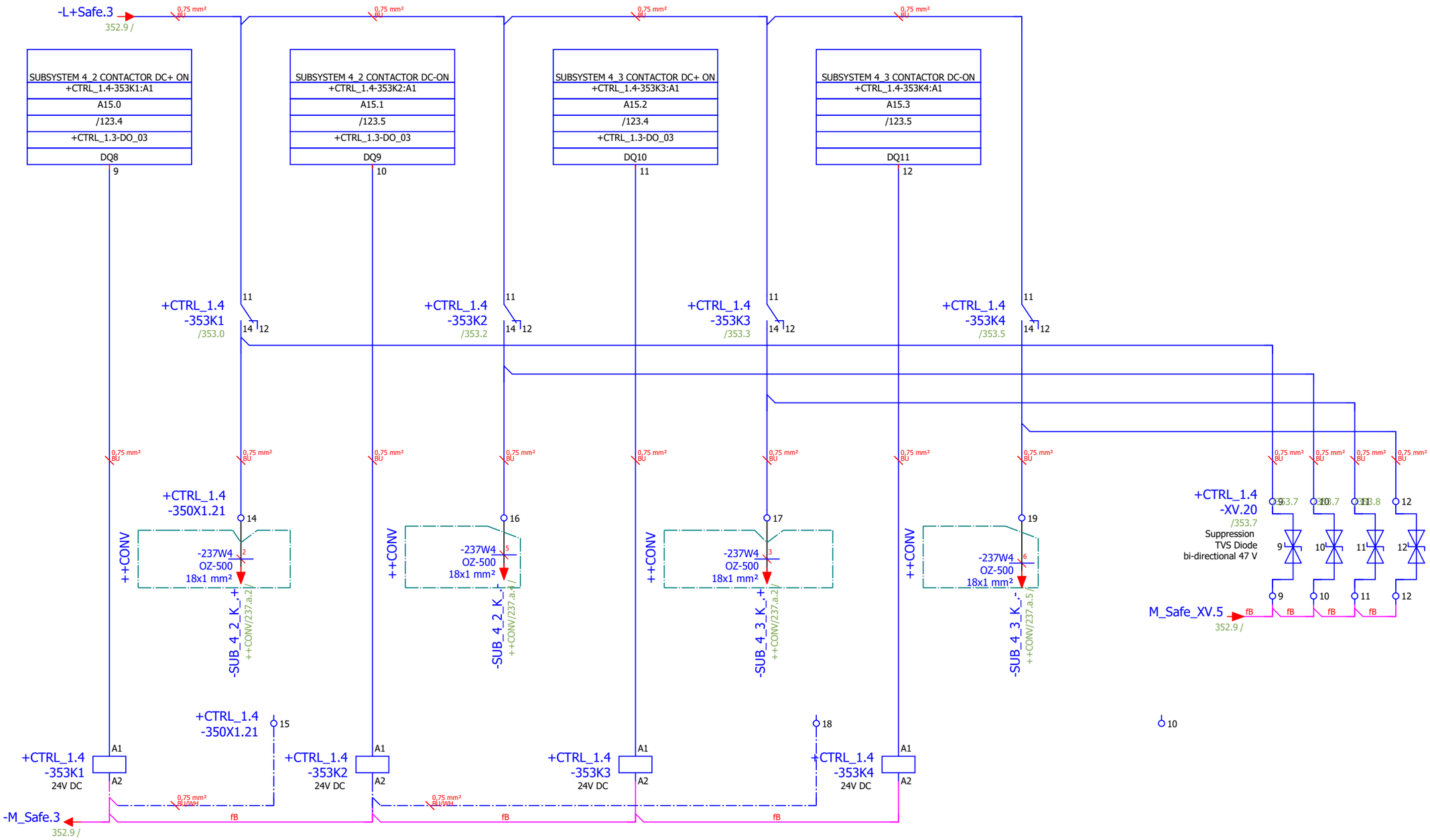
SUBSYSTEM 4_1
CONTACTOR DC+
ON

SUBSYSTEM 4_1
CONTACTOR DC-
ON

previous page:
351

next page:
353

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	29.07.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 352
Date								+	total: 492



14 12 — 11 /353.1

14 12 — 11 /353.3

14 12 — 11 /353.4

14 12 — 11 /353.6

SUBSYSTEM 4_2 CONTACTOR DC+ ON

SUBSYSTEM 4_2 CONTACTOR DC- ON

SUBSYSTEM 4_3 CONTACTOR DC+ ON

SUBSYSTEM 4_3 CONTACTOR DC- ON

previous page: 352

next page: 440

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	29.07.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 353
Date								+ total: 492

-1L+1
103.2 /
-1M1
103.3 /
-1PE1
103.4 /
240W9
JZ-500
3G0,75 mm²
1 2 GNYE

4 3
1 2
Stecker A-Codiert

PIII_1

+CTRL_2.1
-240U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
4 3
1 2
Ansicht
Stiftleiste
24 VDC
M12 System-
steckverbinder

Ansicht
Buchsenleiste
240W10
2YY (ST) CY
2x2x0,64 mm²
/110.1
-P320-FPPU1
110.0 /
P1
3 4
(IN)
2 1
M12 System-
steckverbinder

240W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU1-FPPU2
441.0 /
P2
3 4
(OUT)
2 1

Arc Detect
3 4
2 1

M6 Bolzen
-PE

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_1
CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1 X1
IGBT2 X2
IGBT3 X3
IGBT4 X4
25-POL SUB-D SOCKET

++CONV
240W1
pre-assembled D-Sub cable 1:1
-_IGBT1.1
/ ++CONV/201.3
240W2
pre-assembled D-Sub cable 1:1
-_IGBT1.2
/ ++CONV/202.3
240W3
pre-assembled D-Sub cable 1:1
-_IGBT1.3
/ ++CONV/203.3

IEC
PE
19

PIII_1
-240W7
pre-assembled D-Sub cable 1:1
/160.7
-HVIO_1
/ 160.9

PIII_Version
2_6_V_4

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

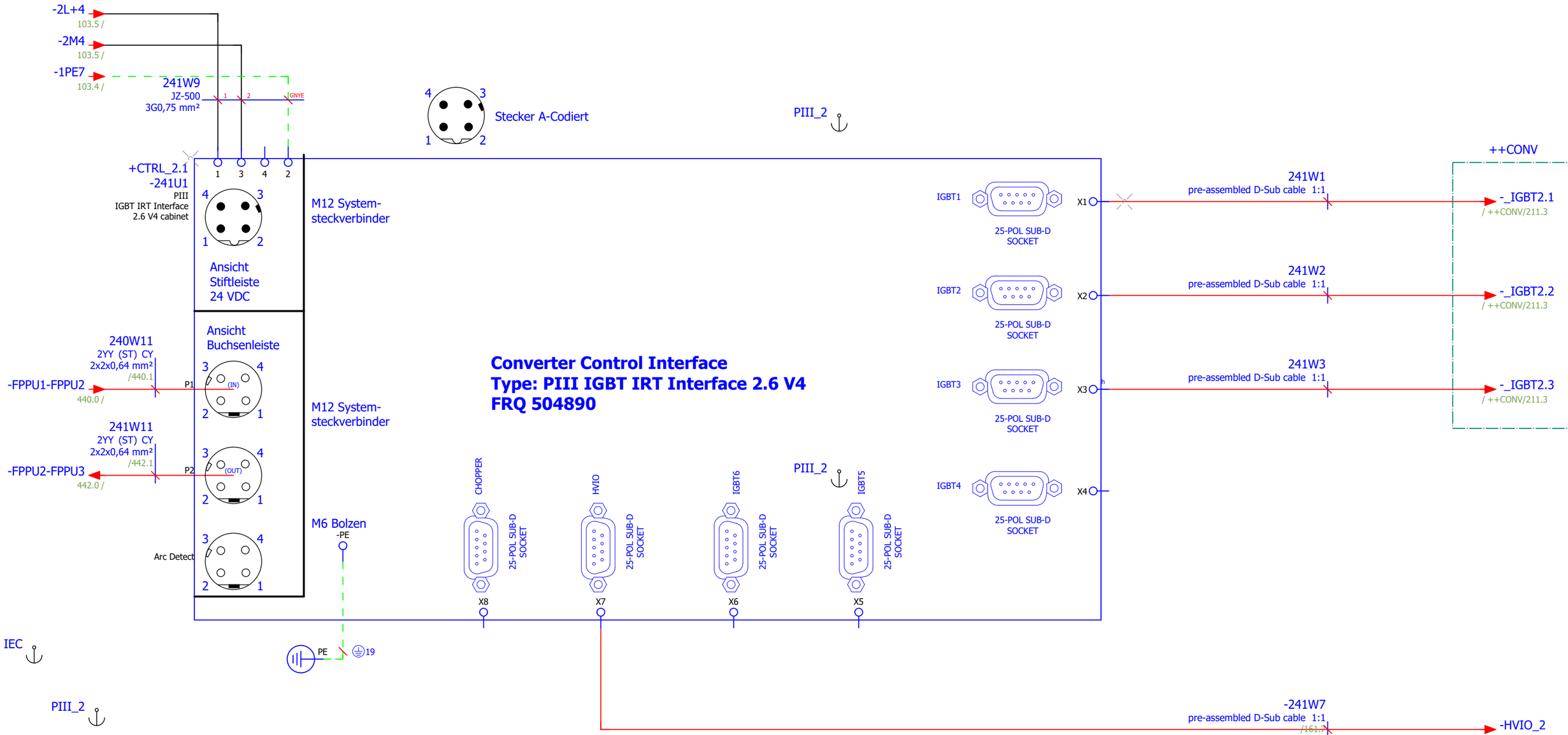
3 4
2 1
Plug D-coded

P2 LAN OUT
P1 LAN IN
Supply 24 V DC
Arc Detect
Fuse 6A F
IGBT6 IGBT4 IGBT2 HVIO
IGBT5 IGBT3 IGBT1 CHOPPER
25-POL SUB-D

connector view PIII

previous page: 353
next page: 441

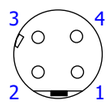
Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 1	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 440
Date								+	total: 492

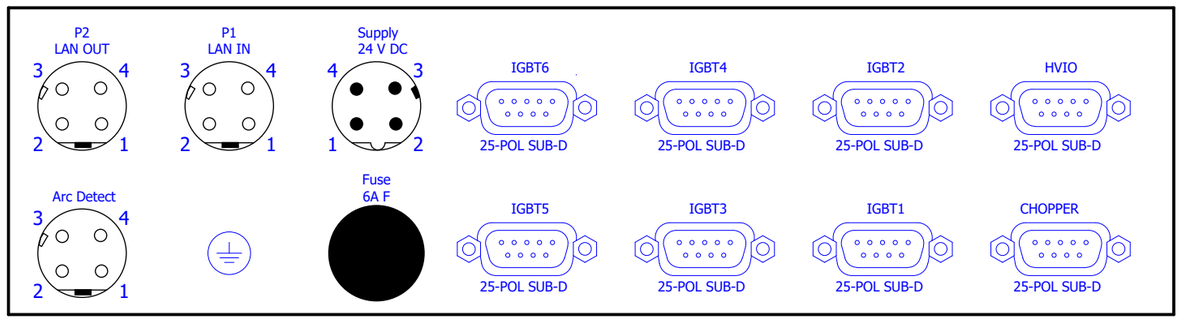


Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320





connector view PIII

previous page: 440
next page: 442

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 441
Date								+ total: 492

-2L+2
103.4 /
-2M2
103.5 /
-1PE5
103.4 /
242W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-242U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

241W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU2-FPPU3
441.0 /
P1 (IN)

242W11
2YY (ST) CY
2x2x0,64 mm²
/443.1
-FPPU3-FPPU4
443.0 /
P2 (OUT)

Arc Detect

M12 System-
steckverbinder

M6 Bolzen
-PE

PE
19

IEC

PIII_3

PIII_Version
2_6_V_4

Stecker A-Codiert

PIII_3

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1 X1
IGBT2 X2
IGBT3 X3
IGBT4 X4
25-POL SUB-D SOCKET

242W1
pre-assembled D-Sub cable 1:1
-_IGBT3.1
/ ++CONV/207.3

242W2
pre-assembled D-Sub cable 1:1
-_IGBT3.2
/ ++CONV/207.3

242W3
pre-assembled D-Sub cable 1:1
-_IGBT3.3
/ ++CONV/207.3

++CONV

-242W7
pre-assembled D-Sub cable 1:1
/163.7
-HVIO_3
/ 163.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

P2 LAN OUT
P1 LAN IN
Supply 24 V DC
Arc Detect
Fuse 6A F
IGBT6 IGBT4 IGBT2 HVIO
IGBT5 IGBT3 IGBT1 CHOPPER
25-POL SUB-D

connector view PIII

previous page: 441
next page: 443

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 3	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 442
Date								+	total: 492

-2L+1
103.4 /
-2M3
103.5 /
-1PE8
103.4 /
243W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-243U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2
Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

242W11
2YY (ST) CY
2x2x0,64 mm²
/442.1
-FPPU3-FPPU4
442.0 /
P1 (IN)
P2 (OUT)
Arc Detect

M12 System-
steckverbinder

M6 Bolzen
-PE
PE
19

Stecker A-Codiert

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_2

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8 X7 X6 X5

IGBT1
IGBT2
IGBT3
IGBT4
25-POL SUB-D SOCKET
X1 X2 X3 X4

243W1
pre-assembled D-Sub cable 1:1
-_IGBT4.1
/ ++CONV/217.3

243W2
pre-assembled D-Sub cable 1:1
-_IGBT4.2
/ ++CONV/217.3

243W3
pre-assembled D-Sub cable 1:1
-_IGBT4.3
/ ++CONV/217.3

++CONV

IEC

PIII_4

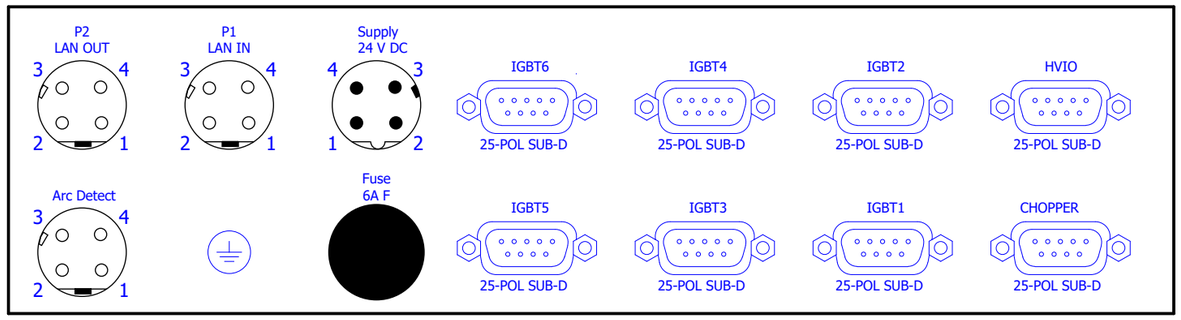
PIII_Version
2_6_V_4

-243W7
pre-assembled D-Sub cable 1:1
/164.7
-HVIO_4
/ 164.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

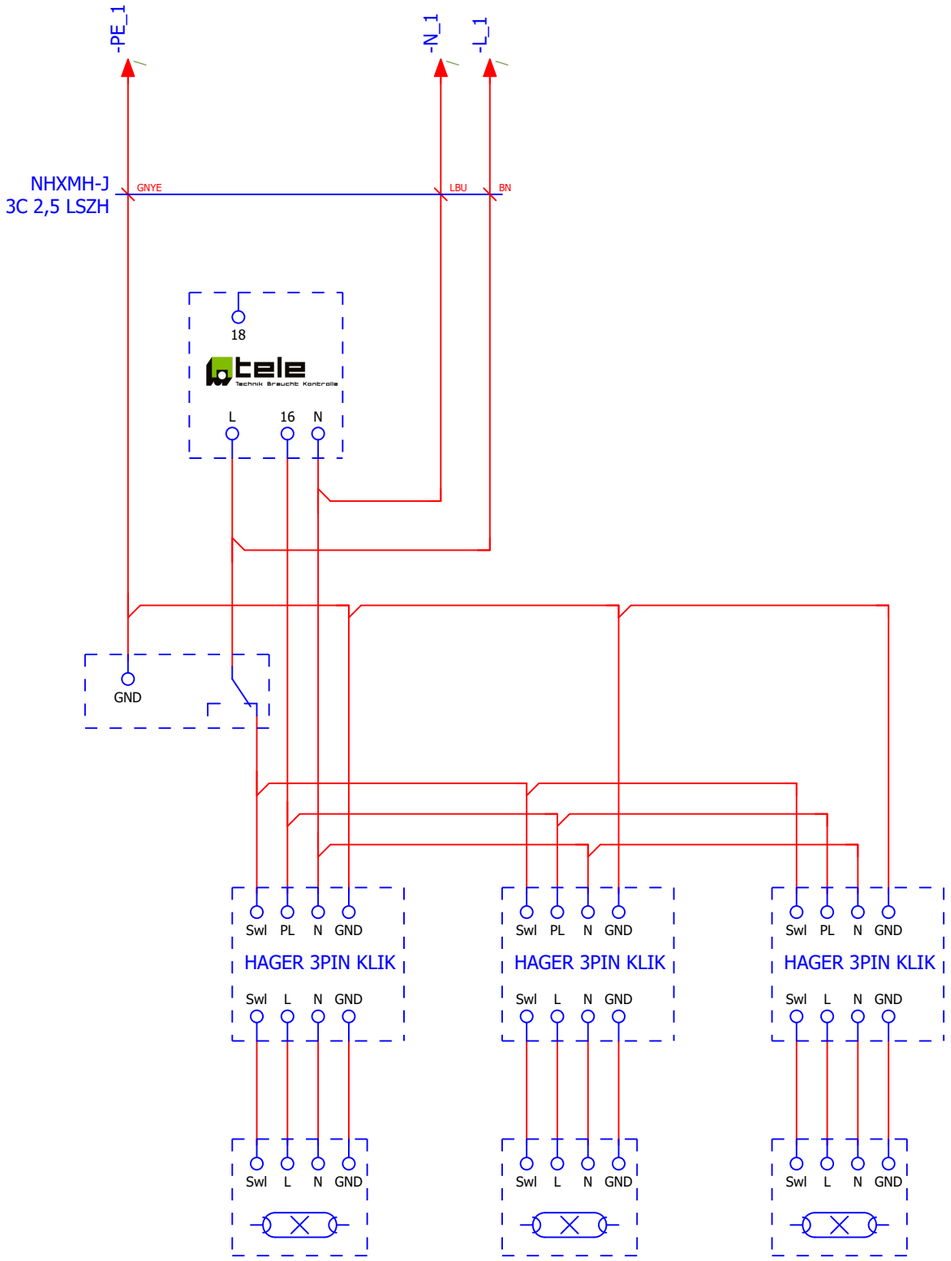


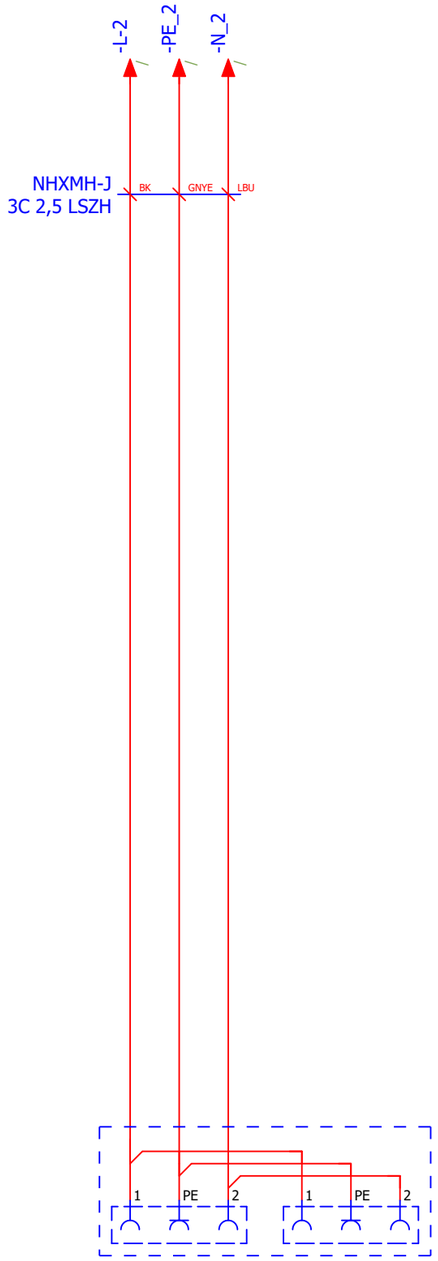
connector view PIII

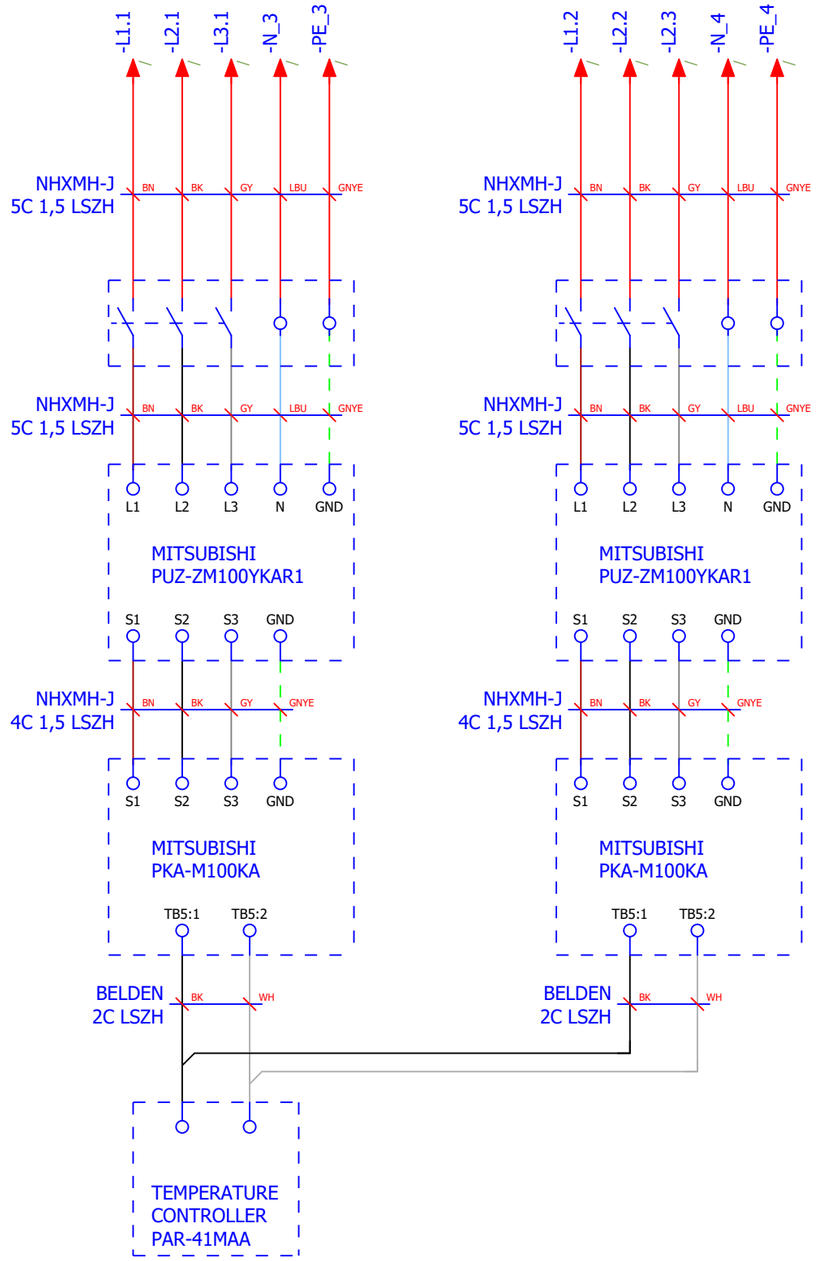
previous page: 442

next page: ++Container/190

Editor	Freqcon_JD			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 4	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	18.06.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 443
Date								+		total: 492







previous page:
++CT/443

next page:
&EPC++TRA/1

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18T1 &EFS/18.2	1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555	
-18W5 &EFS/18.3	1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153	

previous page:
&EFS++Container/190

next page:
++CONV/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-18Q1 &EFS++TRA/18.7	1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172	
-18Q1 &EFS++TRA/18.7	1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044	
-18Q1 &EFS++TRA/18.7	1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039	

previous page:
++TRA/1

next page:
+CON/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B2 &EFS++CT+/147.7	1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648	
-201Q1 &EFS+/201.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-201Q1 &EFS+/201.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-201Q1 &EFS+/201.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-201Q1 &EFS+/201.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-201Q1 &EFS+/201.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-201Q1 &EFS+/201.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-201Q1-C &EFS+/201.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-201Q1-C &EFS+/201.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-202Q1 &EFS+/202.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-202Q1 &EFS+/202.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-202Q1 &EFS+/202.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-202Q1 &EFS+/202.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-202Q1 &EFS+/202.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-202Q1 &EFS+/202.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-202Q1-C &EFS+/202.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-202Q1-C &EFS+/202.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

previous page:
+/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-202Q1-C &EFS+/202.6;&EFS+/202.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-202Q1-C &EFS+/202.6;&EFS+/202.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-203Q1 &EFS+/203.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-203Q1 &EFS+/203.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-203Q1 &EFS+/203.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-203Q1 &EFS+/203.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-203Q1 &EFS+/203.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-203Q1 &EFS+/203.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-203Q1-C &EFS+/203.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-203Q1-C &EFS+/203.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1 &EFS+/207.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-207Q1 &EFS+/207.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-207Q1 &EFS+/207.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-207Q1 &EFS+/207.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-207Q1 &EFS+/207.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-207Q1-C &EFS+/207.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-207Q1-C &EFS+/207.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-207Q1-C &EFS+/207.6;&EFS+/207.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-207Q1-C &EFS+/207.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1-U1 &EFS+/207.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-211Q1 &EFS+/211.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-211Q1 &EFS+/211.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-211Q1 &EFS+/211.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-211Q1 &EFS+/211.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-211Q1 &EFS+/211.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-211Q1-C &EFS+/211.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-211Q1-C &EFS+/211.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-211Q1-C &EFS+/211.6;&EFS+/211.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-211Q1-C &EFS+/211.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-211Q1-U1 &EFS+/211.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-217Q1 &EFS+/217.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-217Q1 &EFS+/217.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-217Q1 &EFS+/217.3	1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524	
-217Q1 &EFS+/217.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-217Q1 &EFS+/217.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-217Q1 &EFS+/217.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-217Q1-C &EFS+/217.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-217Q1-C &EFS+/217.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-217Q1-C &EFS+/217.6;&EFS+/217.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-217Q1-C &EFS+/217.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-217Q1-U1 &EFS+/217.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-260B1 &EFS+/260.3	1	Optical smoke detector 12V, with alarm relais	130-60-457	ABUS Security-Center GmbH & Co. KG	500713	X
-279M1 &EFS+/279.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M2 &EFS+/279.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M3 &EFS+/279.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M4 &EFS+/279.5	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M5 &EFS+/279.6	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-N &EFS+/99.5	2	Busbar holder for busbars 12x 5 (10)-30x 5 (10) and 6x 6 mm	8US1923-1AA01	Siemens	501271	X

previous page:
3

next page:
+IND/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-201L1 &EFS+/201.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-201L1 &EFS+/201.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-201U1 &EFS+/201.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-202L1 &EFS+/202.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-202L1 &EFS+/202.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-202U1 &EFS+/202.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-203L1 &EFS+/203.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-203L1 &EFS+/203.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-203U1 &EFS+/203.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-207L1 &EFS+/207.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-207L1 &EFS+/207.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-211L1 &EFS+/211.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-211L1 &EFS+/211.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-217L1 &EFS+/217.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-217L1 &EFS+/217.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X

previous page: +CON/4

next page: +CIR/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-80Q1 &EFS+/80.0	1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955	
-80Q1 &EFS+/80.1	1	Circuit breaker 3WL1112, 1250A, 42kA 690V, size 1, 3-pole, IEC, ETU15B, withdrawable	3WL1112-2BB36-1BJ2-ZA08+K07+M06+M21+R10	Siemens	501430	X
-83U1 &EFS+/83.2	1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918	
-83U1-C1 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C2 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C3 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C4 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C7 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C8 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C9 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C10 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C13 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C14 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C15 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C16 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-148B3 &EFS++CT+/148.5	1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649	
-227U1 &EFS+/227.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-227U1-C1 &EFS+/227.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-C7 &EFS+/227.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

previous page:
+IND/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-C13 &EFS+/227.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-F0 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F1 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F1 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F1 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F2 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F2 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F2 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F3 &EFS+/227.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F3 &EFS+/227.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F3 &EFS+/227.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-F4 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F4 &EFS+/227.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F5 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F5 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F5 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F6 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F6 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F6 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-F7 &EFS+/227.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F7 &EFS+/227.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F8 &EFS+/227.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F8 &EFS+/227.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F9 &EFS+/227.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F9 &EFS+/227.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F9 &EFS+/227.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F10 &EFS+/227.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F10 &EFS+/227.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F10 &EFS+/227.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F11 &EFS+/227.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F11 &EFS+/227.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F12 &EFS+/227.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-K1 &EFS+/227.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K2 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K3 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K7 &EFS+/227.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-K8 &EFS+/227.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-K9 &EFS+/227.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-227U1-U1 &EFS+/227.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-227U1-X3.1 &EFS+/227.a.0;&EFS+/227.a.9	0					
-227U1-X3.1 &EFS+/227.a.1...&EFS+/227.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-227U1-X3.1 &EFS+/227.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-227U1-X3.1 &EFS+/227.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-227U1-X3.1 &EFS+/227.a.2...&EFS+/227.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-227U1-X3.1 &EFS+/227.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-227U1-X3.2 &EFS+/227.a.0	0					
-227U1-X3.2 &EFS+/227.a.1...&EFS+/227.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-227U1-X3.2 &EFS+/227.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-231U1 &EFS+/231.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-231U1-C1 &EFS+/231.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-C7 &EFS+/231.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-C13 &EFS+/231.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-F0 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F1 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F1 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F1 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F2 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F2 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F2 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F3 &EFS+/231.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F3 &EFS+/231.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F3 &EFS+/231.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-F4 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F4 &EFS+/231.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F5 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F5 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F5 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F6 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F6 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F6 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-F7 &EFS+/231.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F7 &EFS+/231.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F8 &EFS+/231.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F8 &EFS+/231.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F9 &EFS+/231.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F9 &EFS+/231.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F9 &EFS+/231.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F10 &EFS+/231.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F10 &EFS+/231.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F10 &EFS+/231.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F11 &EFS+/231.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F11 &EFS+/231.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F12 &EFS+/231.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-K1 &EFS+/231.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K2 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K3 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K7 &EFS+/231.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

previous page: 5

next page: 7

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-K8 &EFS+/231.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-K9 &EFS+/231.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-231U1-U1 &EFS+/231.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-231U1-X3.1 &EFS+/231.a.0;&EFS+/231.a.9	0					
-231U1-X3.1 &EFS+/231.a.1...&EFS+/231.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-231U1-X3.1 &EFS+/231.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-231U1-X3.1 &EFS+/231.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-231U1-X3.1 &EFS+/231.a.2...&EFS+/231.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-231U1-X3.1 &EFS+/231.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-231U1-X3.2 &EFS+/231.a.0	0					
-231U1-X3.2 &EFS+/231.a.1...&EFS+/231.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-231U1-X3.2 &EFS+/231.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-237U1 &EFS+/237.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-237U1-C1 &EFS+/237.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-C7 &EFS+/237.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-C13 &EFS+/237.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-F0 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F1 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F1 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F1 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F2 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F2 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F2 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F3 &EFS+/237.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F3 &EFS+/237.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F3 &EFS+/237.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-F4 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F4 &EFS+/237.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F5 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F5 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F5 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F6 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F6 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F6 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-F7 &EFS+/237.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F7 &EFS+/237.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F8 &EFS+/237.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F8 &EFS+/237.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F9 &EFS+/237.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F9 &EFS+/237.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F9 &EFS+/237.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F10 &EFS+/237.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F10 &EFS+/237.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F10 &EFS+/237.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F11 &EFS+/237.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F11 &EFS+/237.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F12 &EFS+/237.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-K1 &EFS+/237.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K2 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K3 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K7 &EFS+/237.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-K8 &EFS+/237.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-K9 &EFS+/237.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	509201	X
-237U1-U1 &EFS+/237.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-237U1-X3.1 &EFS+/237.a.0;&EFS+/237.a.9	0					
-237U1-X3.1 &EFS+/237.a.1...&EFS+/237.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-237U1-X3.1 &EFS+/237.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-237U1-X3.1 &EFS+/237.a.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-237U1-X3.1 &EFS+/237.a.2...&EFS+/237.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-237U1-X3.1 &EFS+/237.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-237U1-X3.2 &EFS+/237.a.0	0					
-237U1-X3.2 &EFS+/237.a.1...&EFS+/237.a.7	13	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-237U1-X3.2 &EFS+/237.a.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-281M1 &EFS+/281.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M2 &EFS+/281.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M3 &EFS+/281.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-78F1 &EFS+/78.6	1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738	
-78F1 &EFS+/78.6	3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539	
-78F2 &EFS+/78.6	1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055	
-78F3 &EFS+/78.7;&EFS+/78.8	3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	
-78F3 &EFS+/78.7;&EFS+/78.8	3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545	
-78W1 &EFS+/78.3	1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W2 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W3 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W4 &EFS+/78.3	1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290	
-78W5 &EFS+/78.2	1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070	
-227W10 &EFS+/227.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W11 &EFS+/227.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W12 &EFS+/227.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W13 &EFS+/227.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W14 &EFS+/227.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W15 &EFS+/227.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-228F1 &EFS+/228.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F2 &EFS+/228.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F3 &EFS+/228.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231W10 &EFS+/231.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W11 &EFS+/231.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W12 &EFS+/231.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W13 &EFS+/231.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W14 &EFS+/231.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W15 &EFS+/231.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W10 &EFS+/237.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W11 &EFS+/237.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W12 &EFS+/237.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W13 &EFS+/237.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W14 &EFS+/237.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W15 &EFS+/237.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-238F1 &EFS+/238a.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F2 &EFS+/238a.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F3 &EFS+/238a.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F4 &EFS+/238b.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F5 &EFS+/238b.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F6 &EFS+/238b.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-X3.43	20	Multi-level terminal block	3208511	Phoenix Contact	500560	X

previous page:
1

next page:
++CT+/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113U5 &EFS/113c.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-XT1 &EFS/136.0...&EFS/136.8	20	Feed-through terminal block	3209510	Phoenix Contact	500583	
-XT1 &EFS/136.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT1 &EFS/136.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT1 &EFS/136.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
++CONV+AC_DC/2

next page:
+CTRL_1.1/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84Q1 &EFS+/84.0	1	EMERGENCY STOP SWITCH	3LD2203-1TP53	Siemens	500810	X
-84Q1 &EFS+/84.0	1	Auxiliary switch	3LD9200-5B	Siemens	504922	X
-112A1 &EFS+/112.2	1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475	
-126S1 &EFS+/126.1	1	PUSHBUTTON, BLACK, 1 NO	3SU1100-0AB10-3BA0	Siemens	10026	X
-126S1 &EFS+/126.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H1 &EFS+/140.1	1	Complete device, round, indicator light RED	3SU1102-6AA20-3AA0	Siemens	10019	X
-140H1 &EFS+/140.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H2 &EFS+/140.2	1	Complete device, round, indicator light YELLOW	3SU1102-6AA30-3AA0	Siemens	10021	X
-140H2 &EFS+/140.2	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H3 &EFS+/140.3	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H3 &EFS+/140.3	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H4 &EFS+/140.4	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H4 &EFS+/140.4	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-278M1 &EFS+/278.1	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
+/1

next page:
+.2/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-110U1 &EFS+/110.2	1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789	
-110U1 &EFS+/110.2	1	Connector RJ45, 4 Pol., Profinet, VS-PN-RJ45-5-Q/IP20	1658435	Phoenix Contact	500806	X
-114A1 &EFS+/114.2	1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505	
-114A1 &EFS+/114.2	1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944	
-185R1 &EFS+/185.7	1	SK Enclosure heater, 800/870 W, 230 V, 1~, 50/60 Hz, WHD: 103x200x103 mm	3105400	Rittal	500621	X

previous page:
+.1/1

next page:
+.3/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	23.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets	page: 1
Date								+ CTRL_1.2 Left side	total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84F1 &EFS+/84.6	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-84F2 &EFS+/84.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	X
-84F2 &EFS+/84.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-84K1 &EFS+/84.5	1	CONT.RELAY,3NO+1NC,DC24V,DIODE	3RH2131-2FB40	Siemens	501288	X
-101Q1 &EFS+/101.2	1	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	X
-101Q1 &EFS+/101.2	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	X
-101Q1 &EFS+/101.2	1	3-PHASE BUSBAR W. INFEED	3RV2917-1A	Siemens	500799	X
-101Q1 &EFS+/101.2	1	3-phase busbar including extension connector for 3 circuit breakers Size S00 and S0	3RV2917-4B	Siemens	504254	X
-101T1 &EFS+/101.2	1	Power supply unit	2866404	Phoenix Contact	502745	X
-102G1 &EFS+/102.2	1	Uninterruptible power supply	2320241	Phoenix Contact	501836	X
-102G2 &EFS+/102.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	X
-103F1 &EFS+/103.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F2 &EFS+/103.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F3 &EFS+/103.6	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F4 &EFS+/103.8	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F5 &EFS+/103.9	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-111A1 &EFS+/111.0	1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287	
-113T1 &EFS+/113a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T1 &EFS+/113a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	

previous page:
+.2/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113T2 &EFS+/113b.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T2 &EFS+/113b.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-113U1 &EFS+/113a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U2 &EFS+/113a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-113U3 &EFS+/113b.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-113U4 &EFS+/113b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-115A1 &EFS+/115.3	1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt	
-120A1 &EFS+/120.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	X
-134K1 &EFS+/134.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-134K1 &EFS+/134.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K1 &EFS+/135.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K1 &EFS+/135.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K2 &EFS+/135.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K2 &EFS+/135.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K3 &EFS+/135.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K3 &EFS+/135.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K4 &EFS+/135.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K4 &EFS+/135.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K5 &EFS+/135.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-135K5 &EFS+/135.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-136K7 &EFS+/136.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K8 &EFS+/136.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-136K9 &EFS+/136.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-137K1 &EFS+/137.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K1 &EFS+/137.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K2 &EFS+/137.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K2 &EFS+/137.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K3 &EFS+/137.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K3 &EFS+/137.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K4 &EFS+/137.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K4 &EFS+/137.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-138K1 &EFS+/138.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K1 &EFS+/138.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K2 &EFS+/138.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K2 &EFS+/138.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K3 &EFS+/138.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K3 &EFS+/138.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K4 &EFS+/138.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-138K4 &EFS+/138.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K5 &EFS+/138.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K5 &EFS+/138.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K6 &EFS+/138.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K6 &EFS+/138.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-138K7 &EFS+/138.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-138K7 &EFS+/138.7	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-139K1 &EFS+/139.1	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K2 &EFS+/139.2	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-139K3 &EFS+/139.3	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-150K1 &EFS+/150.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K1 &EFS+/150.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150K2 &EFS+/150.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K2 &EFS+/150.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150X1 &EFS+/150.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-150X1 &EFS+/150.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-150X1 &EFS+/150.2;&EFS+/150.4;&EFS+/151.1;&EFS+/151.4;&EFS+/151.6	5	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-151K1 &EFS+/151.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K1 &EFS+/151.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-151K2 &EFS+/151.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K2 &EFS+/151.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K3 &EFS+/151.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K3 &EFS+/151.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K4 &EFS+/151.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K4 &EFS+/151.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-171K3 &EFS+/171.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-171K3 &EFS+/171.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-173K3 &EFS+/173.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-173K3 &EFS+/173.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-181Q1 &EFS+/181.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-181Q1 &EFS+/181.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q1 &EFS+/181.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-181Q2 &EFS+/181.3	1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671	
-181Q2 &EFS+/181.3	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q2 &EFS+/181.3	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	
-182Q1 &EFS+/182.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-182Q1 &EFS+/182.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-182Q1 &EFS+/182.1	1	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-183F1 &EFS+/183.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	X
-183F1 &EFS+/183.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-183F1 &EFS+/183.1	1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364	X
-183F1 &EFS+/183.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	X
-183F2 &EFS+/183.3	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-183F2 &EFS+/183.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185B1 &EFS+/185.6	1	Thermostat NC contact, -10 to 50 °C	8MR2170-1CA	Siemens	500816	X
-185F1 &EFS+/185.1	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-185F1 &EFS+/185.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-185F2 &EFS+/185.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	X
-185F2 &EFS+/185.7	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-186B1 &EFS+/186.6	1	Thermostat NO contact, -10 to 50 °C	8MR2170-1CB	Siemens	501577	X
-186K1 &EFS+/186.6	1	CONTACTOR,AC3:3KW 1NO DC24V M. DIODE	3RT2015-2FB41	Siemens	501516	X
-187F1 &EFS+/187.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C13	5SY4113-7	Siemens	504323	X
-187F1 &EFS+/187.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-187F2 &EFS+/187.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-189K1 &EFS+/189.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-190F1 &EFS+/190.1	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F1 &EFS+/190.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-190F1 &EFS+/190.1	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F2 &EFS+/190.3	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F2 &EFS+/190.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F2 &EFS+/190.3	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190F3 &EFS+/190.5	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F3 &EFS+/190.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-190F3 &EFS+/190.5	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190X10 &EFS+/190.9	1	5TE6 REG Socket Outlets, 16 A	5TE6800	Siemens	503215	X
-190XT1 &EFS+/190.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X
-190XT1 &EFS+/190.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-190XT1 &EFS+/190.1;&EFS+/190.5	3	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-191F1 &EFS+/191.1	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F1 &EFS+/191.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191F2 &EFS+/191.3	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-191F2 &EFS+/191.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	X
-191XT1 &EFS+/191.1;&EFS+/191.3	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-191XT1 &EFS+/191.1	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-191XT1 &EFS+/191.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-191XT1 &EFS+/191.2;&EFS+/191.4	2	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-195K1 &EFS+/195.3	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K1 &EFS+/195.3	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K2 &EFS+/195.4	1	SIRIUS contactor relay	3RH2362-2BB40	Siemens	501287	X
-195K2 &EFS+/195.4	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K3 &EFS+/195.1	1	SIRIUS SAFETY RELAY STD RELAY 3NO+1NC	3SK1111-2AB30	Siemens	501260	X
-AI_01 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_01 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-AI_02 &EFS+/120.6	1	SIMATIC ET 200SP AI 8xRTD/TC 2-wire HF	6ES7134-6JF00-0CA1	Siemens	501550	X
-AI_02 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_03 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_03 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_04 &EFS+/120.7	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	X
-AI_04 &EFS+/120.7	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_01 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_01 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X

previous page: 7

next page: 9

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-DI_02 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_02 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_03 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_03 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_04 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_04 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_05 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_05 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_06 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens		X
-DI_06 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_01 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_01 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-DO_02 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	X
-DO_02 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_03 &EFS+/120.5	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_03 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_04 &EFS+/120.6	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_04 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-X1 &EFS+/181.0	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X1 &EFS+/181.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-X1 &EFS+/181.1;&EFS+/181.3;&EFS+/181.4;&EFS+/182.1;&EFS+/182.3;&EFS+/182.4	12	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-X1 &EFS+/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-X1 &EFS+/181.1;&EFS+/181.4;&EFS+/182.1;&EFS+/182.4	4	Ground terminal block	3209536	Phoenix Contact	500813	X
-X3 &EFS+/127.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3 &EFS+/127.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.10 &EFS+/129.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0;&EFS+/129.2;&EFS+/129.4;&EFS+/129.6;&EFS+/129.8;&EFS+/129.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.10 &EFS+/129.0;&EFS+/129.4;&EFS+/129.6;&EFS+/129.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.11 &EFS+/130.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.11 &EFS+/130.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.11 &EFS+/130.0;&EFS+/130.2;&EFS+/130.4;&EFS+/130.6;&EFS+/130.8;&EFS+/130.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.11 &EFS+/130.0;&EFS+/130.4;&EFS+/130.6;&EFS+/130.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.12 &EFS+/131.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X3.12 &EFS+/131.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.12 &EFS+/131.0;&EFS+/131.2;&EFS+/131.4;&EFS+/131.6;&EFS+/131.8;&EFS+/131.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.12 &EFS+/131.0;&EFS+/131.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.13 &EFS+/132.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X3.13 &EFS+/132.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.13 &EFS+/132.0;&EFS+/132.2;&EFS+/132.4;&EFS+/132.6;&EFS+/132.8;&EFS+/132.9	6	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3.13 &EFS+/132.0;&EFS+/132.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3	21	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-X3 &EFS+/127.1;&EFS+/127.5;&EFS+/128.3;&EFS+/188.1	5	Plug-in bridge FBS 2-3,5	3213014	Phoenix Contact	500802	X
-X5 &EFS+/145.0	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	X
-X5 &EFS+/145.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-X5.1 &EFS+/149.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0;&EFS+/149.2	2	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-X5.1 &EFS+/149.0	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-X5	15	Multi-level terminal block	3208511	Phoenix Contact	500560	X
-XDC1 &EFS+/103.1	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC1 &EFS+/103.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC1 &EFS+/103.2;&EFS+/103.3	7	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC1 &EFS+/103.2	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	X
-XDC1 &EFS+/103.3	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	X
-XDC1 &EFS+/103.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XDC2 &EFS+/103.3	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X

previous page: 10

next page: 12

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC2 &EFS+/103.3	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC2 &EFS+/103.4;&EFS+/103.5	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC2 &EFS+/103.4;&EFS+/103.5	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC3 &EFS+/103.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC3 &EFS+/103.5	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC3 &EFS+/103.6;&EFS+/103.7	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC3 &EFS+/103.6;&EFS+/103.7	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC4 &EFS+/103.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC4 &EFS+/103.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC4 &EFS+/103.8;&EFS+/103.9	4	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC4 &EFS+/103.8;&EFS+/103.9	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC5.1 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.1 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.1 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XDC5.2 &EFS+/103.8	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XDC5.2 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.2 &EFS+/103.9	1	Multi-level terminal block	3210583	Phoenix Contact	501385	X
-XE &EFS+/84.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	X
-XE &EFS+/84.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XE &EFS+/84.0;&EFS+/84.1	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XE &EFS+/84.0;&EFS+/84.1	3	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	X
-XE &EFS+/84.1;&EFS+/84.2	4	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-XE &EFS+/84.1	1	Plug-in bridge FBS 3-8	3030297	Phoenix Contact	501568	X
-XE &EFS+/84.2;&EFS+/84.3	3	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-XT &EFS+/183.0	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-XT &EFS+/183.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XT &EFS+/183.1;&EFS+/183.2;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2;&EFS+/187.4;&EFS+/187.5	8	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-XT &EFS+/183.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XT &EFS+/187.4	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XT &EFS+/183.1;&EFS+/183.4;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2	6	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XV &EFS+/171.8	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-XV &EFS+/171.8	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Base terminal for component connector	3210185	Phoenix Contact	500828	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Component plug terminal block	3036796	Phoenix Contact	500533	X
-XV &EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	8	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	X
-XV &EFS+/171.8	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XV &EFS+/134.5	1	Diode ZY12 - zener diode, DO-41, plastic, 12V, 2W	17060488	Distrelec Schuricht GmbH	500556	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-85U1 &EFS+/85.0	1	Power Bridge Rectifiers SKD 30/16A1, Vrrm = 1600V, Id = 30A	07122150	Semikron	501556	X
-85U10 &EFS+/85.0	1	EMI Filter X2 Y1 Version 2	505722	Freqcon GmbH	505722	X
-85U11 &EFS+/85.1	1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702	
-149U1 &EFS+/149.5	1	Interface module	2959609	Phoenix Contact	501595	X
-171F1 &EFS+/171.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-171F1 &EFS+/171.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-171K1 &EFS+/171.7	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171K2 &EFS+/171.8	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171R1 &EFS+/171.1	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-171R2 &EFS+/171.2	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-173F2 &EFS+/173.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F2 &EFS+/173.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-173F3 &EFS+/173.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F3 &EFS+/173.4	2	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-173K1 &EFS+/173.8	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173K2 &EFS+/173.9	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173R1 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R2 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R3 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X

previous page:
+.3/13

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R4 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-189X1 &EFS+/189.4	9	Measuring transformer disconnect terminal	3035696	Phoenix Contact	54498	X
-189X1 &EFS+/189.4	9	Test adapter - PAIS-4-FIX GY	3032791	Phoenix Contact	501482	X
-189X1 &EFS+/189.4	1	End cover D-DTME 6	3034426	Phoenix Contact	505468	X
-189X1 &EFS+/189.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-306K1 &EFS+/306.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K1 &EFS+/306.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K2 &EFS+/306.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K2 &EFS+/306.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K3 &EFS+/306.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K3 &EFS+/306.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K4 &EFS+/306.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K4 &EFS+/306.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K5 &EFS+/306.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K5 &EFS+/306.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K6 &EFS+/306.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K6 &EFS+/306.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K1 &EFS+/307.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K1 &EFS+/307.1	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-307K2 &EFS+/307.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K2 &EFS+/307.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K3 &EFS+/307.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K3 &EFS+/307.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K4 &EFS+/307.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K4 &EFS+/307.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K5 &EFS+/307.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K5 &EFS+/307.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-307K6 &EFS+/307.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-307K6 &EFS+/307.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K1 &EFS+/308.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K1 &EFS+/308.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K2 &EFS+/308.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K2 &EFS+/308.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K3 &EFS+/308.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K3 &EFS+/308.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K4 &EFS+/308.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K4 &EFS+/308.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K5 &EFS+/308.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-308K5 &EFS+/308.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-308K6 &EFS+/308.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-308K6 &EFS+/308.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K1 &EFS+/350.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K1 &EFS+/350.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K2 &EFS+/350.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K2 &EFS+/350.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350X1.21 &EFS+/350.1	1	End and partition plate for terminal block	3208579	Phoenix Contact	500504	
-350X1.21 &EFS+/350.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-350X1.21 &EFS+/350.1&EFS+/350.2&EFS+/350.4&EFS+/351.1&EFS+/351.3&EFS+/351.4&EFS+/352.1&EFS+/352.3&EFS+/353.1&EFS+/353.4&EFS+/352.4	9	Multi-level terminal block	3208511	Phoenix Contact	500560	
-350X1.21 &EFS+/352.1	0					
-351K1 &EFS+/351.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K1 &EFS+/351.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K2 &EFS+/351.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-351K2 &EFS+/351.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-351K3 &EFS+/351.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K3 &EFS+/351.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-351K4 &EFS+/351.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K4 &EFS+/351.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

previous page: 3

next page: 5

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-352K1 &EFS+/352.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K1 &EFS+/352.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-352K2 &EFS+/352.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K2 &EFS+/352.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K1 &EFS+/353.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K1 &EFS+/353.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K2 &EFS+/353.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K2 &EFS+/353.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K3 &EFS+/353.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K3 &EFS+/353.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K4 &EFS+/353.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K4 &EFS+/353.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-XE2 &EFS+/173.1	0					
-XE2 &EFS+/173.2...&EFS+/173.5	11	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Base terminal for component connector	3210185	Phoenix Contact	500828	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Component plug terminal block	3036796	Phoenix Contact	500533	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B1 &EFS+/147.5	1	Temperature sensor PT100, cable 1.5m, PVC	1101-6030-1211-110	S+S Regeltechnik GmbH	501787	X
-190H1 &EFS+/190.5	1	LED system light, Without socket, Length: 337 mm, Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500110	Rittal	10007	X
-190H1 &EFS+/190.5	1	Infeed, 2-pole (with socket, without connector), Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500420	Rittal	10009	X
-190H1 &EFS+/190.5	1	Door-Operated Switch, Input voltage: 230 V AC, 24 V DC, - 240 V, 1~, 50 Hz/60 Hz,	2500460	Rittal	500736	X

previous page:
+.4/5

next page:
+CTRL_1/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-20BG1 &EFS+/100.2	1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550	
-20BG1-X &EFS+/100.2	55	End bracket for terminal block	3022276	Phoenix Contact	500588	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-149X1 &EFS+/161.4...&EFS+/161.8	6	Feed-through terminal block Push-in PT 4	3211757	Phoenix Contact	500582	X
-149X1 &EFS+/161.4	1	End cover D-ST 4	3030420	Phoenix Contact	500502	
-149X1 &EFS+/161.4	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-149X1 &EFS+/161.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-160U1 &EFS+/160.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-161U1 &EFS+/161.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-162U1 &EFS+/162.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-163U1 &EFS+/163.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-164U1 &EFS+/164.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390	
-240U1 &EFS+/440.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-240U1 &EFS+/440.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-240U1 &EFS+/440.1	1	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-241U1 &EFS+/441.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-241U1 &EFS+/441.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-241U1 &EFS+/441.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-242U1 &EFS+/442.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-242U1 &EFS+/442.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-242U1 &EFS+/442.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-243U1 &EFS+/443.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-243U1 &EFS+/443.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-243U1 &EFS+/443.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-278M2 &EFS+/278.3	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
1

next page:
+CTRL.4/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R5 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R6 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R7 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	
-173R8 &EFS+/173.5	1	Power Resistor 100W 1% 10K J	160141	Widap AG	501614	

previous page:
+CTRL_2.1/2

next page:
++FAN+/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-52G1 &EFS++CT/181.0;&EFS++CT/181.7	0					
-52G1-148B1 &EFS++CT/148.1	1	Temperature sensor PT100, cable 3m, PVC	1101-6030-1231-110	S+S Regeltechnik GmbH	501575	X
-52G1-181M1 &EFS++CT/181.1	1	Pump CM10-2, 3x380V-415V, 50Hz, 1,27 kW, 2,85-2,9 A, 2.950 - 2.960 rpm / 440V-480V, 60Hz, 2,2 kW, 4,0-3,7A, 3.520-3.530 rpm	99080211	GRUNDFOS GmbH	501409	X
-52G1-181R1 &EFS++CT/181.3	1	Screw-in heater SEHK, 3kW, 400V	106066	Siekerkotte GmbH & Co. KG	500620	X
-52G1-181S1 &EFS++CT/181.7	0					
-52G1-181X1 &EFS++CT/181.0	0					
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.3;&EFS++CT/181.4;&EFS++CT/182.1	9	Feed-through terminal block	3209510	Phoenix Contact	500583	X
-52G1-181X1 &EFS++CT/181.3	1	End and partition plate for terminal block	3211003	Phoenix Contact	503382	X
-52G1-181X1 &EFS++CT/181.3	1	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X1 &EFS++CT/181.4	1	Feed-through terminal block	3209523	Phoenix Contact	500584	X
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.4;&EFS++CT/182.1	3	Ground terminal block	3209536	Phoenix Contact	500813	X
-52G1-181X3 &EFS++CT/148.1;&EFS++CT/181.7	2	Multi-level terminal block	3210567	Phoenix Contact	501386	X
-52G1-181X3 &EFS++CT/181.7	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	X
-52G1-181X3 &EFS++CT/181.7	2	End bracket for terminal block	3022276	Phoenix Contact	500588	X
-52G1-181X3 &EFS++CT/181.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-52G1-182M1 &EFS++CT/182.1	1	Heat exchanger 40kW cooling capacity, alluminium, 1,72kW, 3,86A, 400V	FR6555950001	Bondioli & Pavesi S.p.A.	500850	X

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153
1	TMC Transformer 3150kVA-6300V/620V-50Hz-AL-IP00		TMC Transformers	508555

Editor	Freqcon_DG			Statron	FREQCON	SUMMARIZED PARTS LIST	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EPA	Summarized part list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** BG connection rail 100x370 ***	50070	Freqcon GmbH	50070
9	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604
1	DC Adapter 3.3535 (EN-AW 5754) Alu	51524	Freqcon GmbH	51524
3	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867
3	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872
3	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882
1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918
1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955
3	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046
3	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053
1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190
1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290
3	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157
3	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426
3	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449
1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648
1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649
3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055
1	Auxiliary contacts S6000 SIZE 2	D5LAU01	Pronutec GmbH	503044
1	Direct handle S6000 SIZE 2	DS-LI21	Pronutec GmbH	503039
1	Switch-disconnector S6000, AC 600A at 690V AC (AC21B), size 2, 4-pole, to attach to the mounting plate	S6-08003NDO	Pronutec GmbH	10172
9	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130
3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545
1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738
3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779

previous page:
1

next page:
++CT/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** VX BG Steuerungseinheit IEC Standard-Batteriecontainer***	53550	Freqcon GmbH	53550
4	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890
1	RC-Brückengleichrichter	507702	Freqcon GmbH	507702
5	HVIO Modul V5.0;ISO N-DC, N-AC	500390	Freqcon GmbH	500390
1	WALL IE Industrial Ethernet Bridge and Firewall	700-860-WALL01	Helmholz	508505
1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10	ICP	508475
1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287
4	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805
2	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
2	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
38	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
41	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	5G Rundstrahlantenne mit Halterung (600-6000MHz)	B4BE-6-60-5SP	reichelt elektronik GmbH & Co. KG	507944
2	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
3	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845
2	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740
1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671

Summarized parts list

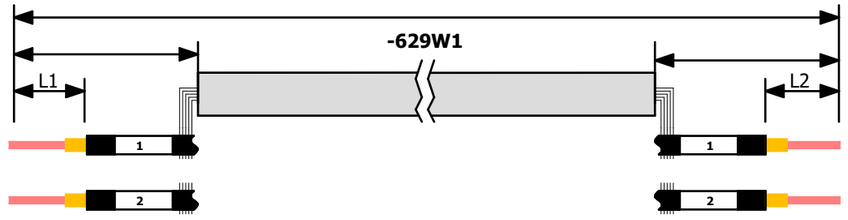
Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	CABLE CONNECTOR SIZE S00	3RV2917-5AA00	Siemens	500797
1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789
2	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
2	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
7	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804
1	Router Ewon Cosy 131, 4G + VPN router, supply 24 VDC UMTS router	WEC6133G	Wachendorff Prozesstechnik GmbH & Co. KG	506838alt
4	Power Resistor 100W 1% 10K J	160141	Widap AG	501614

0	1	2	3	4	5	6	7	8	9

Cable name =UNIT_01++TRA+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:29	Fuse 230V AC for Container Air Conditioning		
Control cabinet 1	++CT+CTRL_1.3-X3:18	Earthing switch in On Transformer 620V side		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Fuse 230V AC for Container Air Conditioning	++CONV-18Q1:13	
		Earthing switch in On Transformer 620V side	++CONV-18Q1:14	

FRQ_Kabelplan_04_groß_de_en

previous page:
&EPA++CT/2

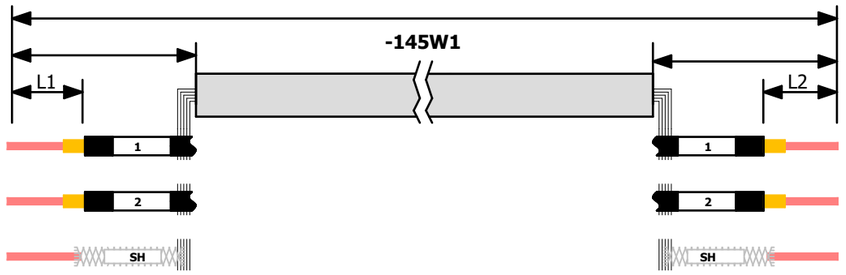
next page:
++CONV/1

Editor	Freqcon_DG			Statron		CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

page: 1
total: 492

Cable name =UNIT_01++CONV+-145W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

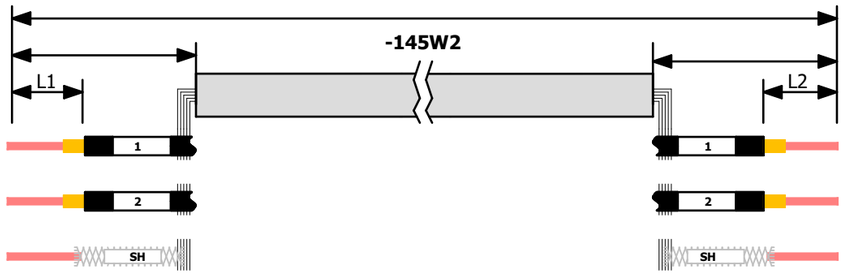


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-201L1:	INDUCTOR GRID PHASE L1 TEMPERATURE 1_1		
Inductor cabinet	+IND-201L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L1	++CT+CTRL_1.3-X5:1	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:2	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

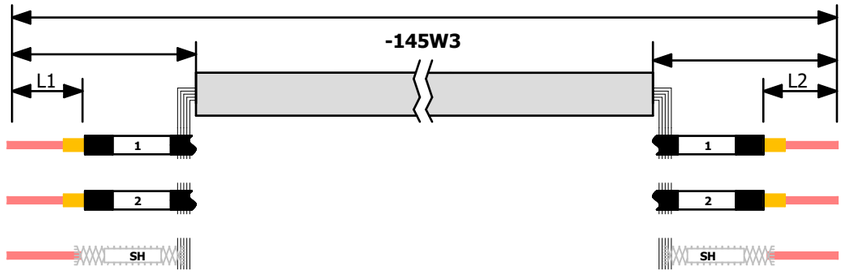


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-202L1:	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2		
Inductor cabinet	+IND-202L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L2	++CT+CTRL_1.3-X5:3	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:4	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

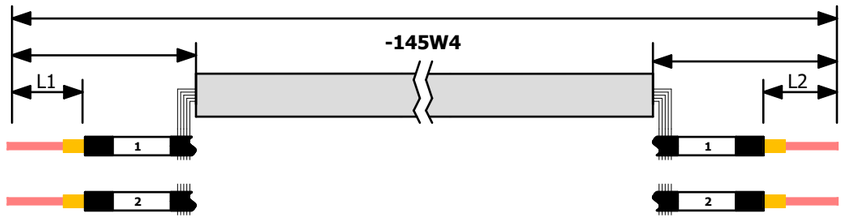


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-203L1:	INDUCTOR GRID PHASE L3 TEMPERATURE 1_3		
Inductor cabinet	+IND-203L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L3	++CT+CTRL_1.3-X5:5	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:6	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.1:	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		
Inductor cabinet	+IND-211L1.1	=		

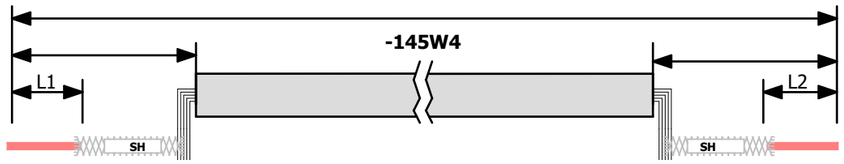
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1	++CT+CTRL_1.3-X5:7	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:8	*Control cabinet 1*

previous page: ++TRA/1
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

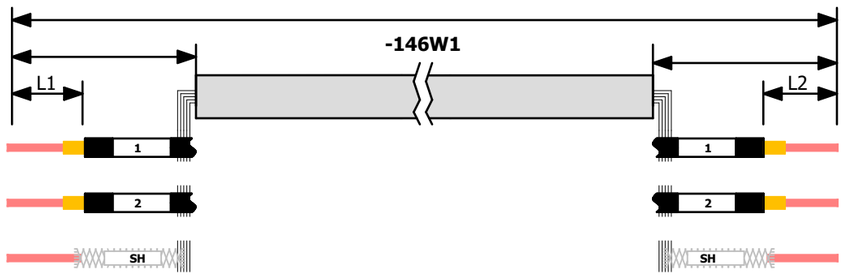


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1		

Cable name =UNIT_01++CONV+-146W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

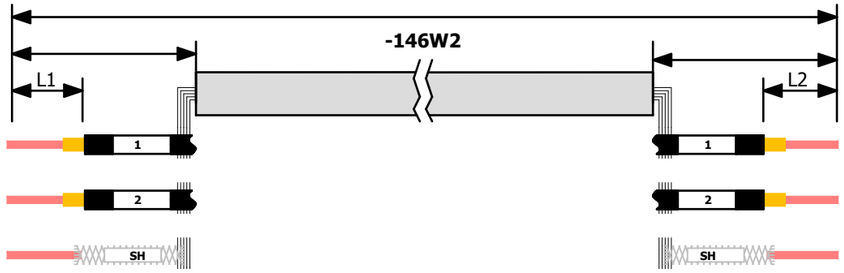


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.2	INDUCTOR DC SUB 2_2 TEMPERATURE 2_2		
Inductor cabinet	+IND-211L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_2	++CT+CTRL_1.3-X5:9	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:10	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3		
Inductor cabinet	+IND-211L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_3	++CT+CTRL_1.3-X5:11	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:12	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.1	INDUCTOR DC SUB 3_1 TEMPERATURE 3_1		
Inductor cabinet	+IND-207L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_1	++CT+CTRL_1.3-X5:13	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:14	***Control cabinet 1***
		=		

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-146W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

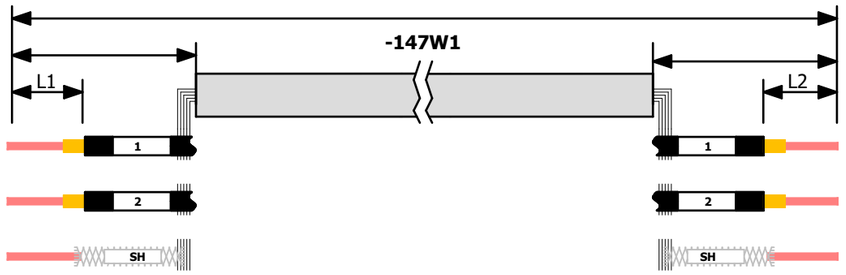


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.2	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2		
Inductor cabinet	+IND-207L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_2	++CT+CTRL_1.3-X5:15	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:16	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-147W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

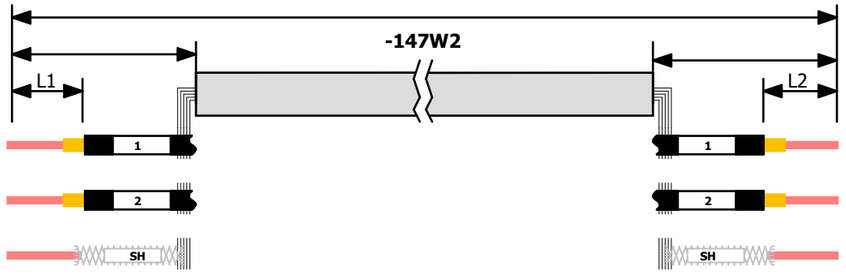


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.3:	INDUCTOR DC SUB 3_3 TEMPERATURE 3_3		
Inductor cabinet	+IND-207L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_3	++CT+CTRL_1.3-X5:17	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:18	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-147W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

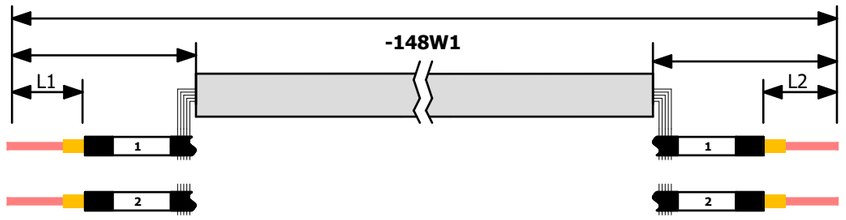


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.1:	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1		
Inductor cabinet	+IND-217L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_1	++CT+CTRL_1.3-X5:19	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:20	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.2:	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		
Inductor cabinet	+IND-217L1.2	=		

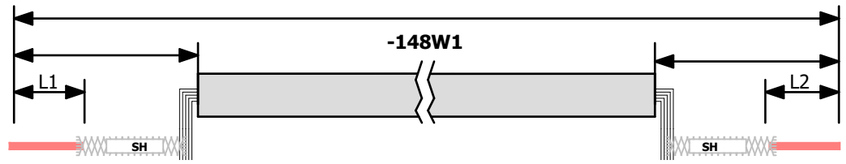
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2	++CT+CTRL_1.3-X5:25	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:26	*Control cabinet 1*

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2		

Cable name =UNIT_01++CONV+-148W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

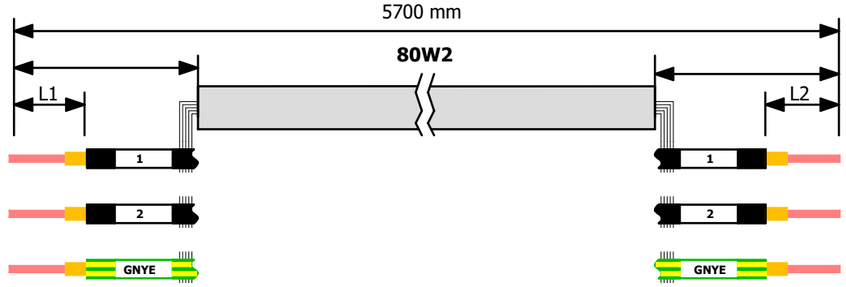


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.3:	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3		
Inductor cabinet	+IND-217L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_3	++CT+CTRL_1.3-X5:29	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:30	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-80W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

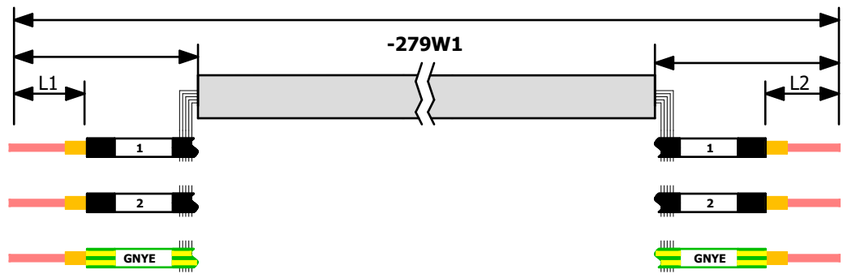


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:9	230V AC for Circuit Breaker 1	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:10	=	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	230V AC for Circuit Breaker 1	+CIR-80Q1:X5_2	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-80Q1:X5_1	***Circuit Breaker cabinet***
		=		

Cable name =UNIT_01++CONV+-279W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:1	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:2	=	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CON-279M1:L	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:N	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:PE	***Converter cabinet***

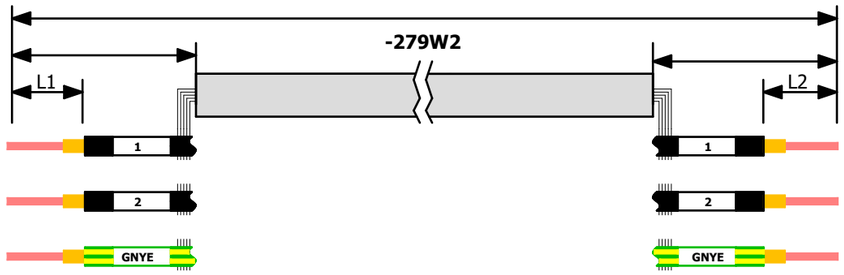
previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M1:L	FAN 1 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M1:N	=	stripped	8 mm
Converter cabinet	+CON-279M1:PE	=	stripped	8 mm

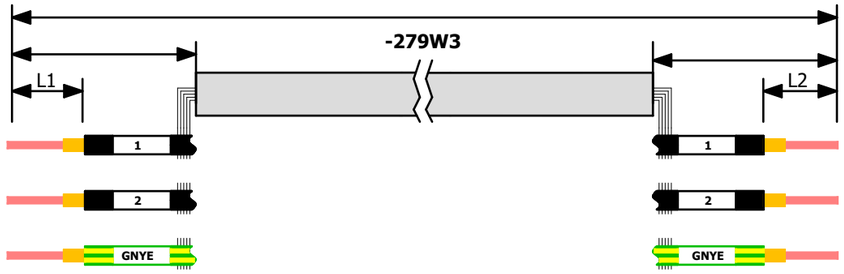


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CONVERTER	+CON-279M2:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M2:1	FAN 2 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M2:2	=	stripped	8 mm
Converter cabinet	+CON-279M2:PE	=	stripped	8 mm

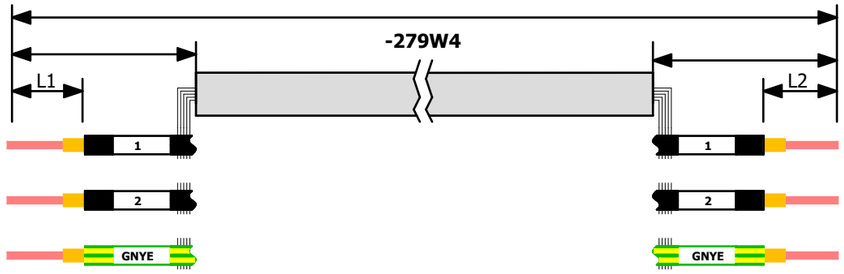


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CONVERTER	+CON-279M3:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W4
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M3:1	FAN 3 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M3:2	=	stripped	8 mm
Converter cabinet	+CON-279M3:PE	=	stripped	8 mm

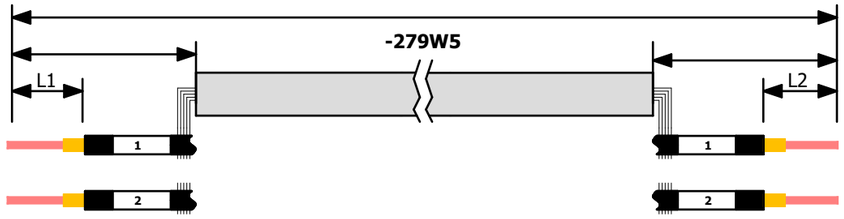


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 3 CONVERTER	+CON-279M4:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:1	FAN 4 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M4:2	=	stripped	8 mm



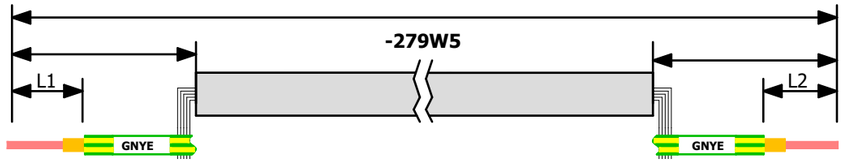
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M5:2	***Converter cabinet***

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

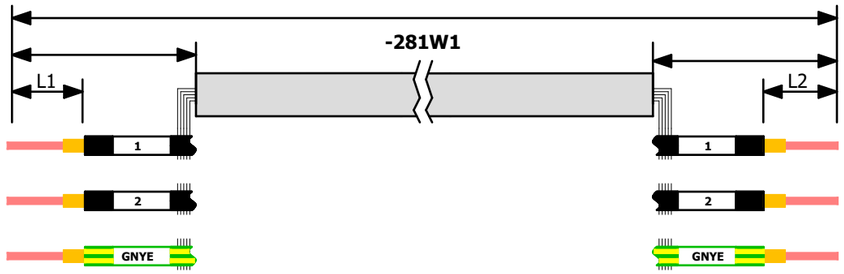


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:PE	FAN 4 CONVERTER	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:PE	*Converter cabinet*

Cable name =UNIT_01++CONV+-281W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:3	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:4	CIR Fans 1-3 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CIR-281M1:L	*Circuit Breaker cabinet*
8 mm	stripped	CIR Fans 1-3	+CIR-281M1:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M1:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

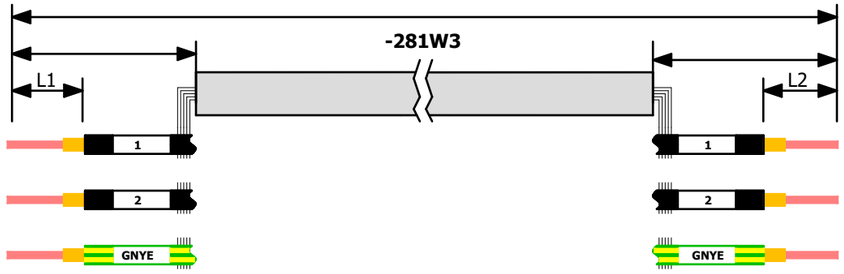


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M1:L	FAN 1 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CIRCUIT BREAKER CABINET	+CIR-281M2:L	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M2:L	FAN 2 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:PE	=	stripped	8 mm

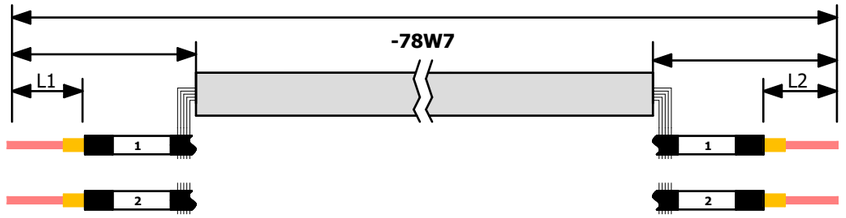
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CIRCUIT BREAKER CABINET	+CIR-281M3:1	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:2	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:PE	*Circuit Breaker cabinet*

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-78W7
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

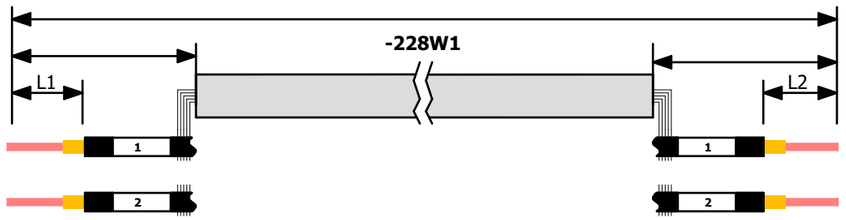


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:20			
AC and DC connection cabinet	+AC_DC-X3.43:19			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+AC_DC-78F1:13	AC and DC connection cabinet
			+AC_DC-78F1:14	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:7	SURGE ARRESTER DC SUBSYSTEM 3_1		
AC and DC connection cabinet	+AC_DC-X3.43:8	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_1	+AC_DC-228F1:11	AC and DC connection cabinet
		=	+AC_DC-228F1:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

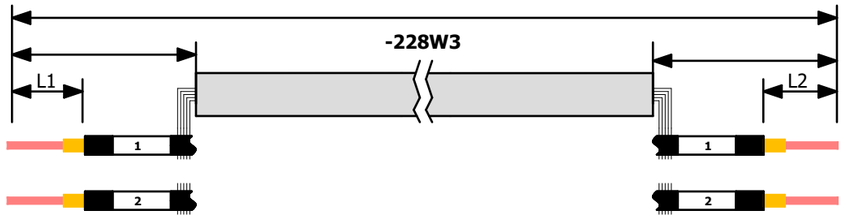


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:9	SURGE ARRESTER DC SUBSYSTEM 3_2		
AC and DC connection cabinet	+AC_DC-X3.43:10	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_2	+AC_DC-228F2:11	AC and DC connection cabinet
		=	+AC_DC-228F2:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:11	SURGE ARRESTER DC SUBSYSTEM 3_3		
AC and DC connection cabinet	+AC_DC-X3.43:12	=		

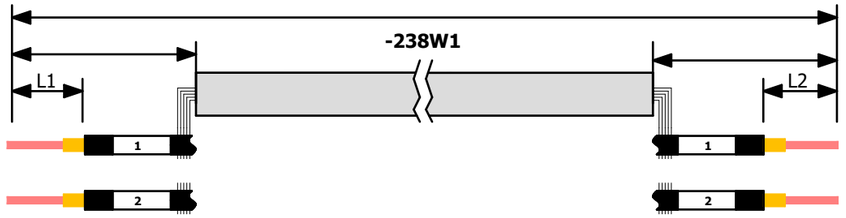
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_3	+AC_DC-228F3:11	AC and DC connection cabinet
		=	+AC_DC-228F3:12	AC and DC connection cabinet

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

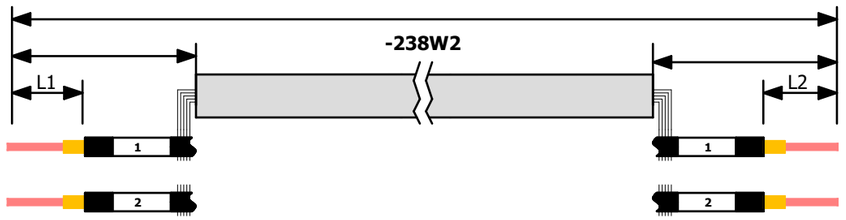


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1		
AC and DC connection cabinet	+AC_DC-X3.43:2	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_1	+AC_DC-238F1:11	***AC and DC connection cabinet***
		=	+AC_DC-238F1:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

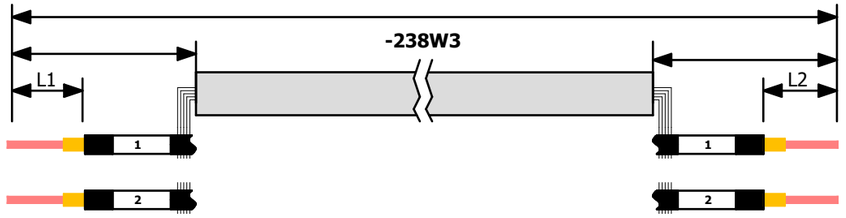


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:3	SURGE ARRESTER DC SUBSYSTEM 2_2		
AC and DC connection cabinet	+AC_DC-X3.43:4	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_2	+AC_DC-238F2:11	***AC and DC connection cabinet***
		=	+AC_DC-238F2:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

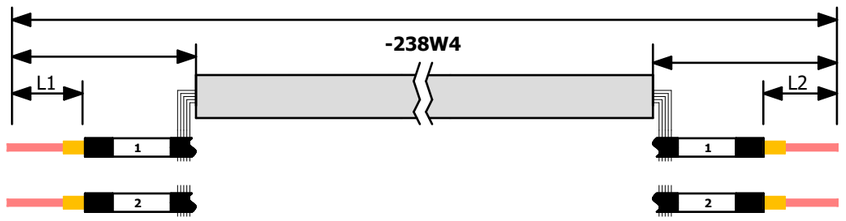


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:5	SURGE ARRESTER DC SUBSYSTEM 2_3		
AC and DC connection cabinet	+AC_DC-X3.43:6	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_3	+AC_DC-238F3:11	***AC and DC connection cabinet***
		=	+AC_DC-238F3:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W4
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:13	SURGE ARRESTER DC SUBSYSTEM 4_1		
AC and DC connection cabinet	+AC_DC-X3.43:14	=		

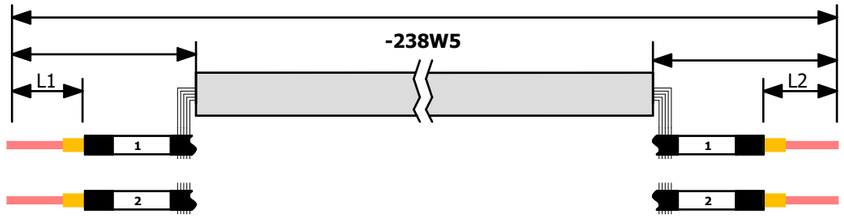
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_1	+AC_DC-238F4:11	***AC and DC connection cabinet***
		=	+AC_DC-238F4:12	***AC and DC connection cabinet***

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W5
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

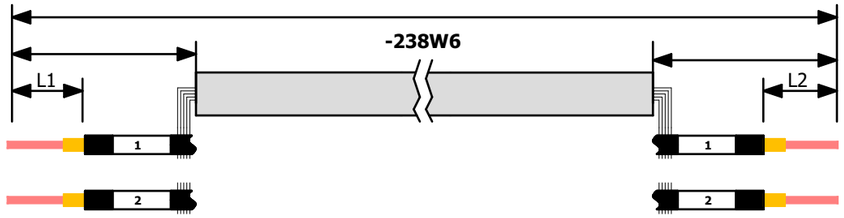


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:15	SURGE ARRESTER DC SUBSYSTEM 4_2		
AC and DC connection cabinet	+AC_DC-X3.43:16	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_2	+AC_DC-238F5:11	***AC and DC connection cabinet***
		=	+AC_DC-238F5:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W6
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

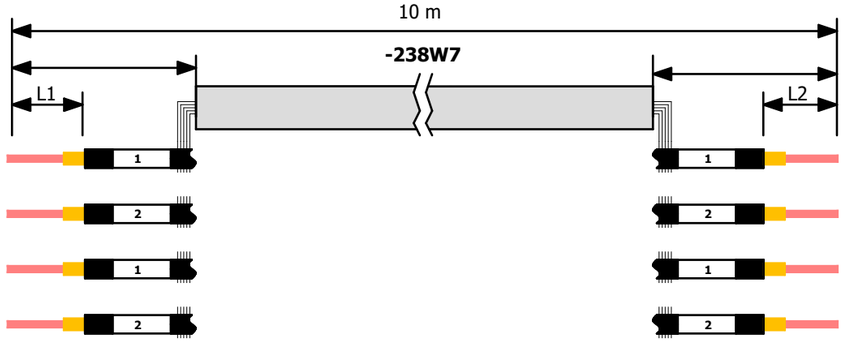


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:17	SURGE ARRESTER DC SUBSYSTEM 4_3		
AC and DC connection cabinet	+AC_DC-X3.43:18	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_3	+AC_DC-238F6:11	***AC and DC connection cabinet***
		=	+AC_DC-238F6:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W7
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030;10030

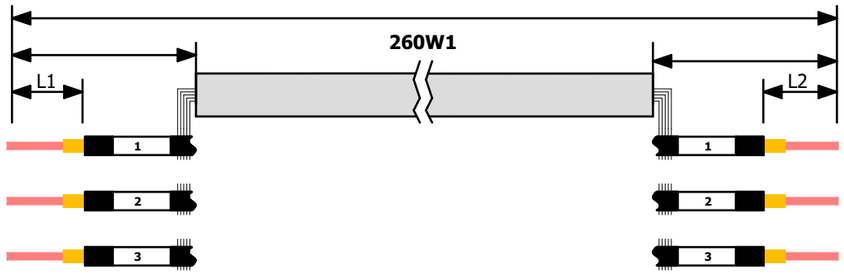


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1	stripped	7mm
AC and DC connection cabinet	+AC_DC-X3.43:20		stripped	7mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8mm	stripped	SURGE ARRESTER DC SUBSYSTEM 2_1	++CT+CTRL_1.3-X3:5	***Control cabinet 1***
8mm	stripped		++CT+CTRL_1.3-X3:6	***Control cabinet 1***

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors 3

Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:19	Smoke detector CON		
Control cabinet 1	++CT+CTRL_1.3-X3:20	=		
Control cabinet 1	++CT+CTRL_1.3-X3:21	=		

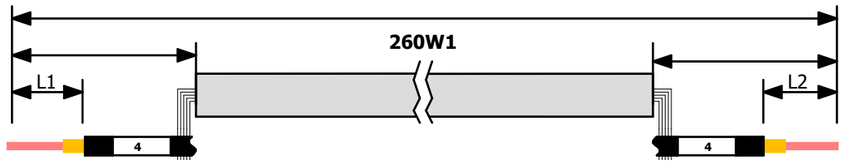
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Smoke detector CON	+CON-260B1:4	***Converter cabinet***
		=	+CON-260B1:2	***Converter cabinet***
		=	+CON-260B1:5	***Converter cabinet***

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors

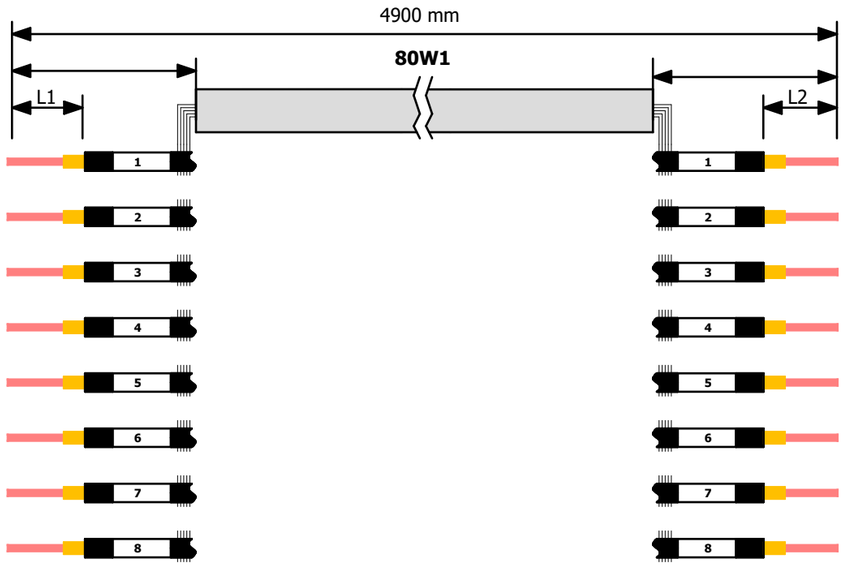
Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:22	Smoke detector CON					Smoke detector CON	+CON-260B1:6	*Converter cabinet*

Cable name =UNIT_01++CONV+-80W1
Cable type OZ-500 8x0,75 mm²
Free conductors

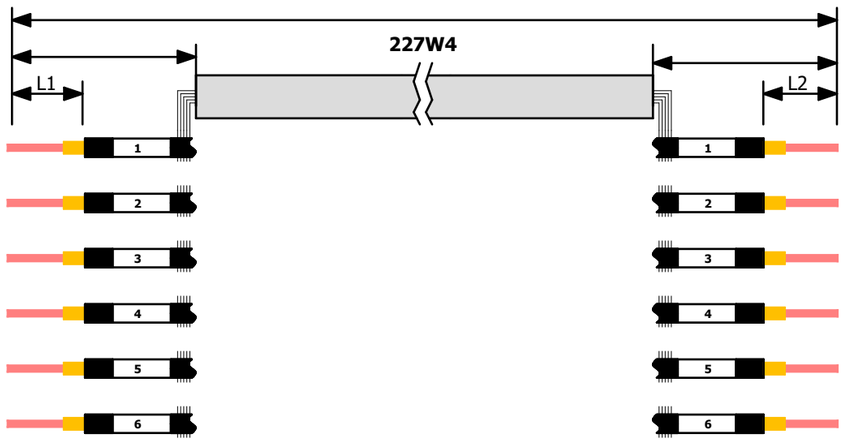
Cable parts HELU.10173
Order number 10173



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:1	CB 1 Tripped GRID	stripped	8 mm	8 mm	stripped	CB 1 Tripped GRID	+CIR-80Q1:X7_13	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:2	CB 1 OFF GRID	stripped	8 mm	8 mm	stripped	CB 1 OFF GRID	+CIR-80Q1:X6_9	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:3	CB 1 ON GRID	stripped	8 mm	8 mm	stripped	CB 1 ON GRID	+CIR-80Q1:X6_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:31	CB 1 GRID +24V	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_12	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:32	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:35	CB 2 ISLAND GRID +24V OPTIONAL	stripped	8 mm	8 mm	stripped	CB 2 ISLAND GRID	+CIR-80Q1:X6_7	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:36	CB 1 GRID	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_14	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:37	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_12	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



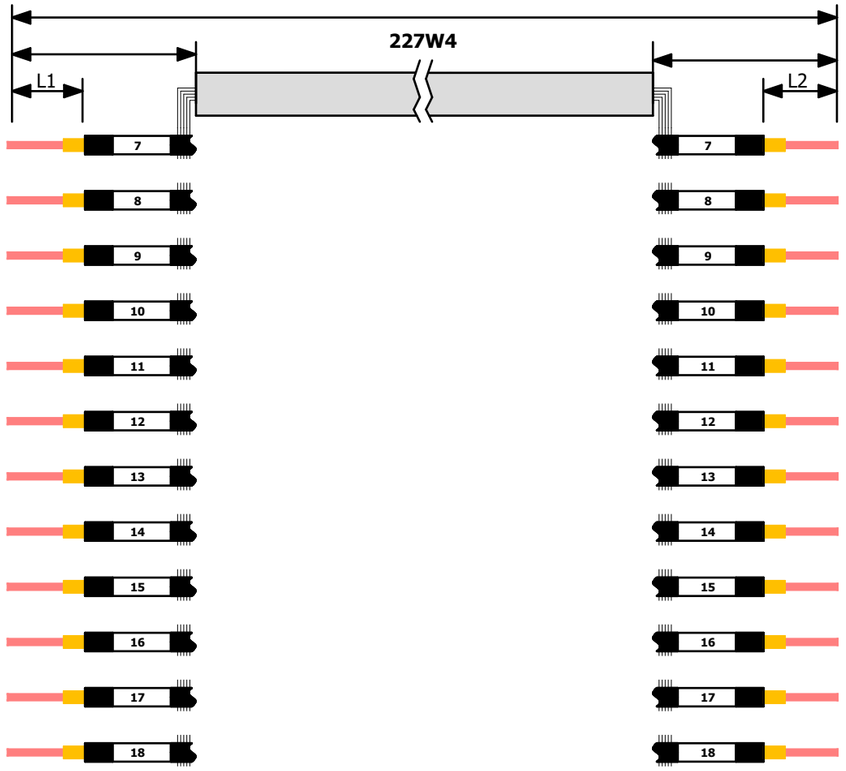
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:1	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:4	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:7	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:3	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:6	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:9	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EMB Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 10
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

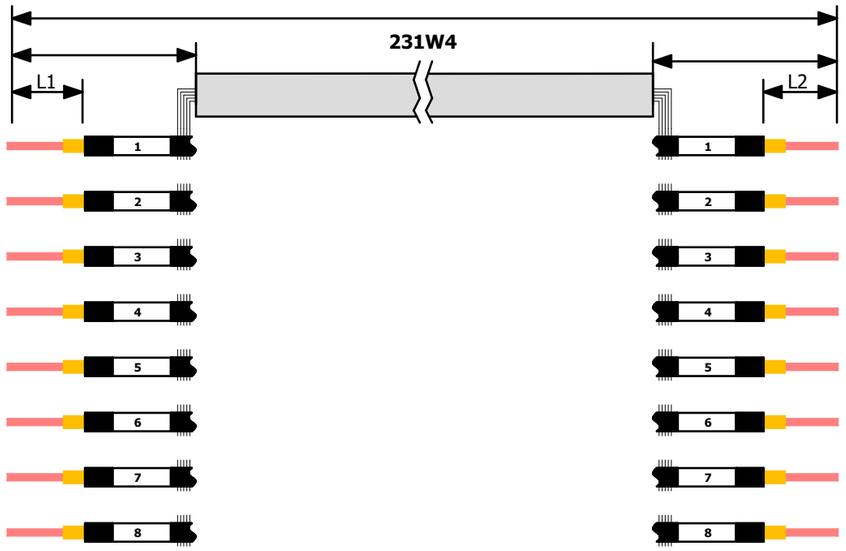
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K3:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

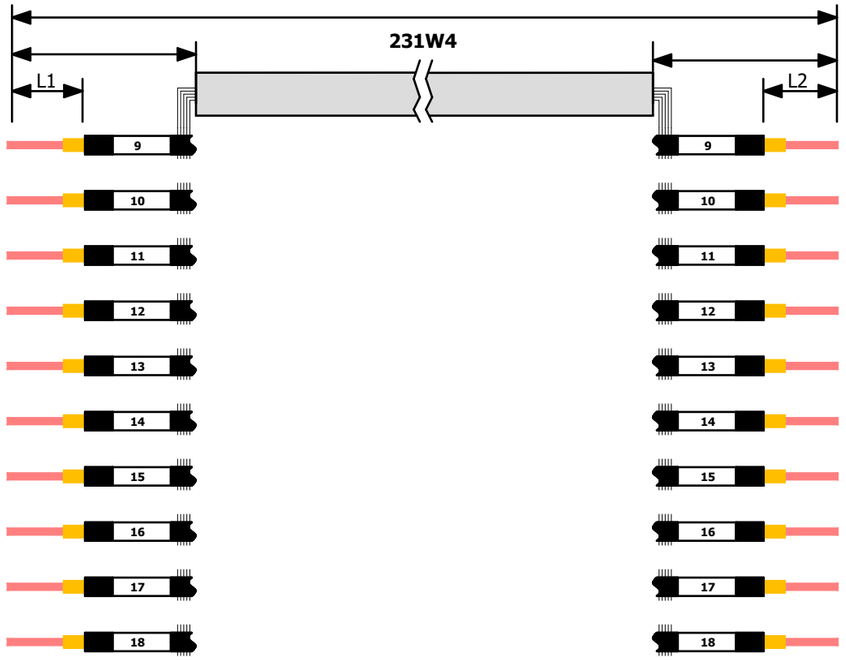


Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:4	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:7	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:3	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:6	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K3:A1	***Control cabinet 1***

previous page: 10
next page: 12

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

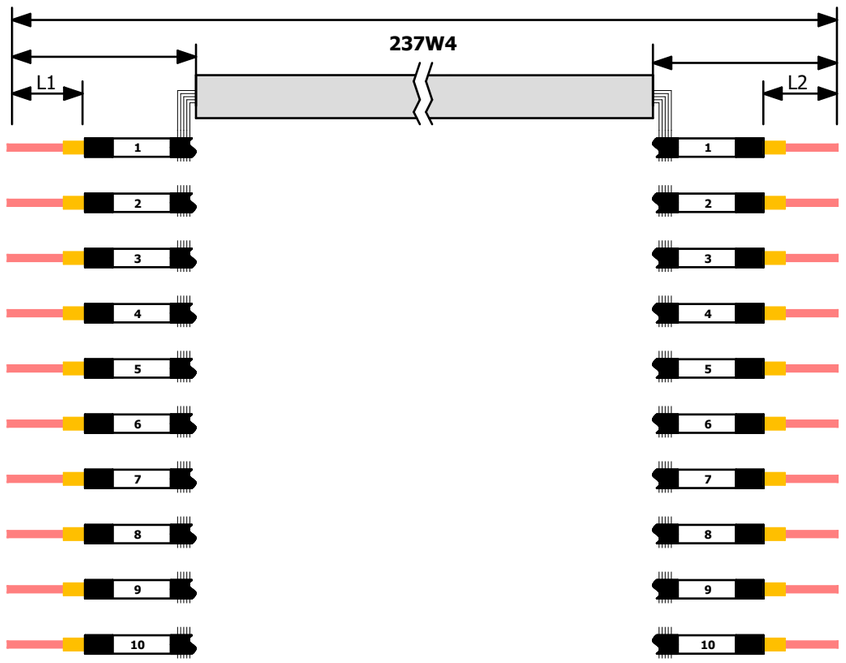
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



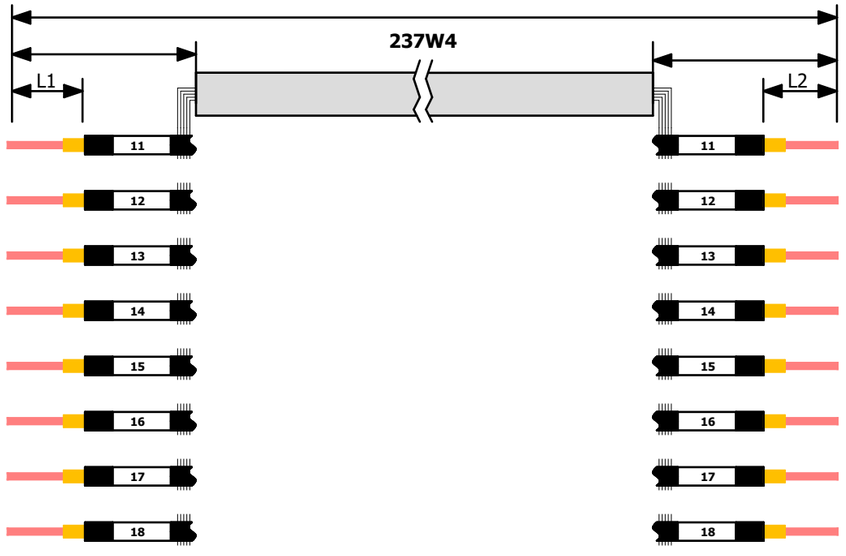
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-237U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:14	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:17	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:13	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:16	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:19	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K3:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-308K2:A1	***Control cabinet 1***

previous page: 11
next page: 13

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-X3.1:11		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:12		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:13		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:14		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:15		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:16		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:17		stripped	8 mm
			stripped	8 mm

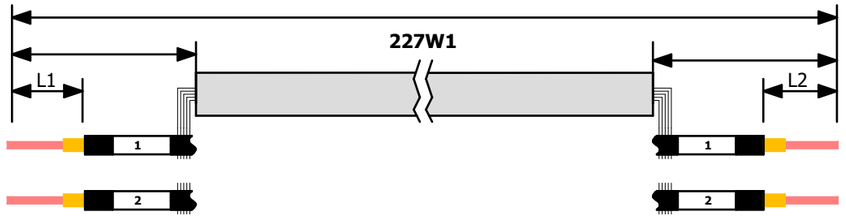


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped		++CT+CTRL_1.4-308K4:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-308K6:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:8	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:9	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:11	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:10	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-350X1.21:12	*Control cabinet 1*
8 mm	stripped			

Cable name =UNIT_01++CONV+-227W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F3:1			
Circuit Breaker cabinet	+CIR-227U1-F4:1			

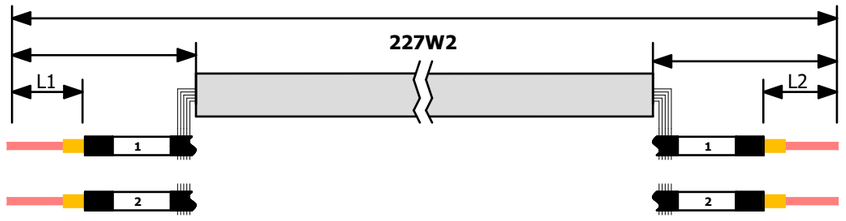


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:32	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-227W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F7:1			
Circuit Breaker cabinet	+CIR-227U1-F8:1			



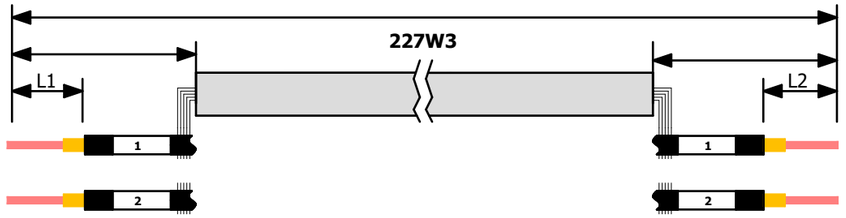
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:36	*Control cabinet 2*

previous page: 12
next page: 14

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-227W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

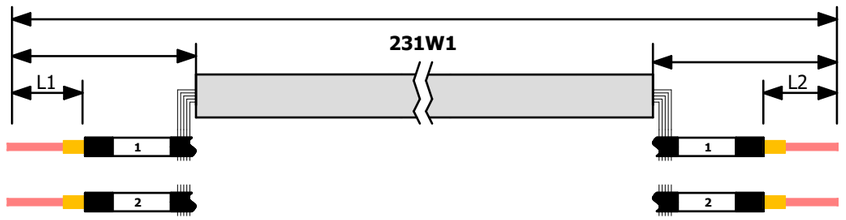


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F11:1			
Circuit Breaker cabinet	+CIR-227U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:40	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

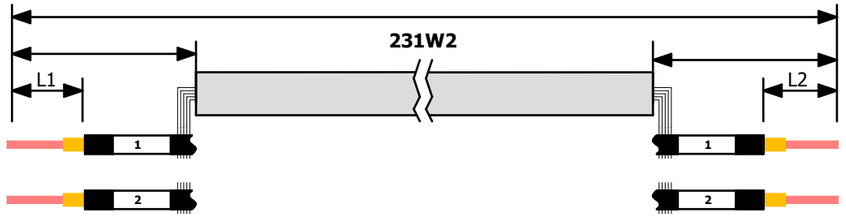


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F3:1			
Circuit Breaker cabinet	+CIR-231U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:19	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

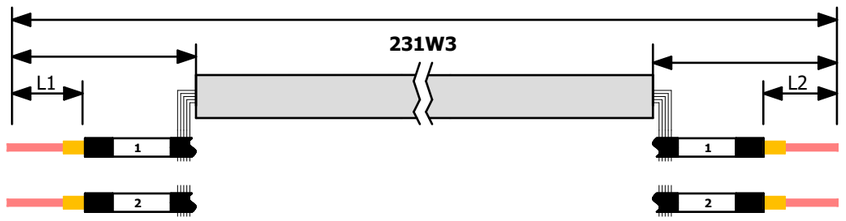


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F7:1			
Circuit Breaker cabinet	+CIR-231U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:23	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F11:1			
Circuit Breaker cabinet	+CIR-231U1-F12:1			

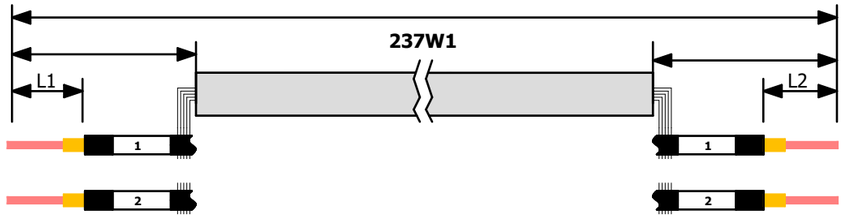
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:27	*Control cabinet 2*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 14
Date								+		total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-237W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

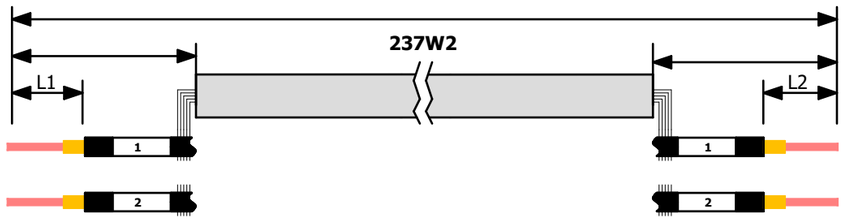


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F3:1			
Circuit Breaker cabinet	+CIR-237U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

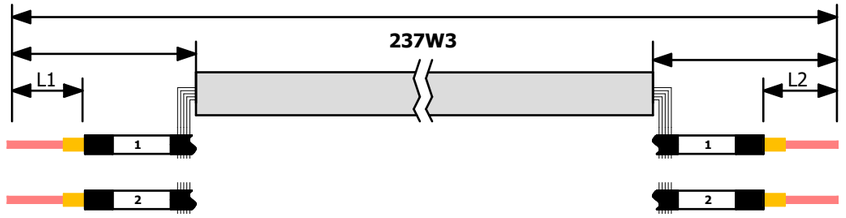


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F7:1			
Circuit Breaker cabinet	+CIR-237U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

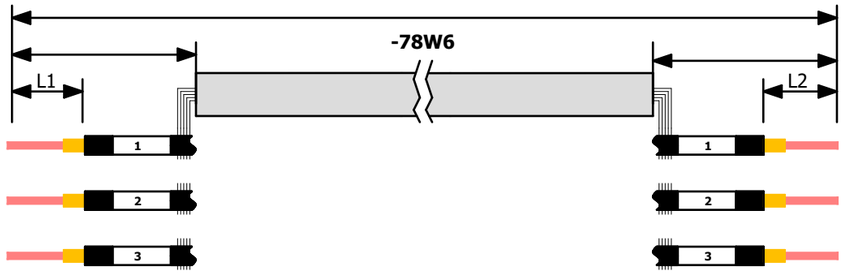


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F11:1			
Circuit Breaker cabinet	+CIR-237U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-78W6
Cable type OZ-600 3x2,5 mm²
Free conductors

Cable parts HELU.10691
Order number 10691



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-78F3:2			
AC and DC connection cabinet	+AC_DC-78F3:4			
AC and DC connection cabinet	+AC_DC-78F3:6			

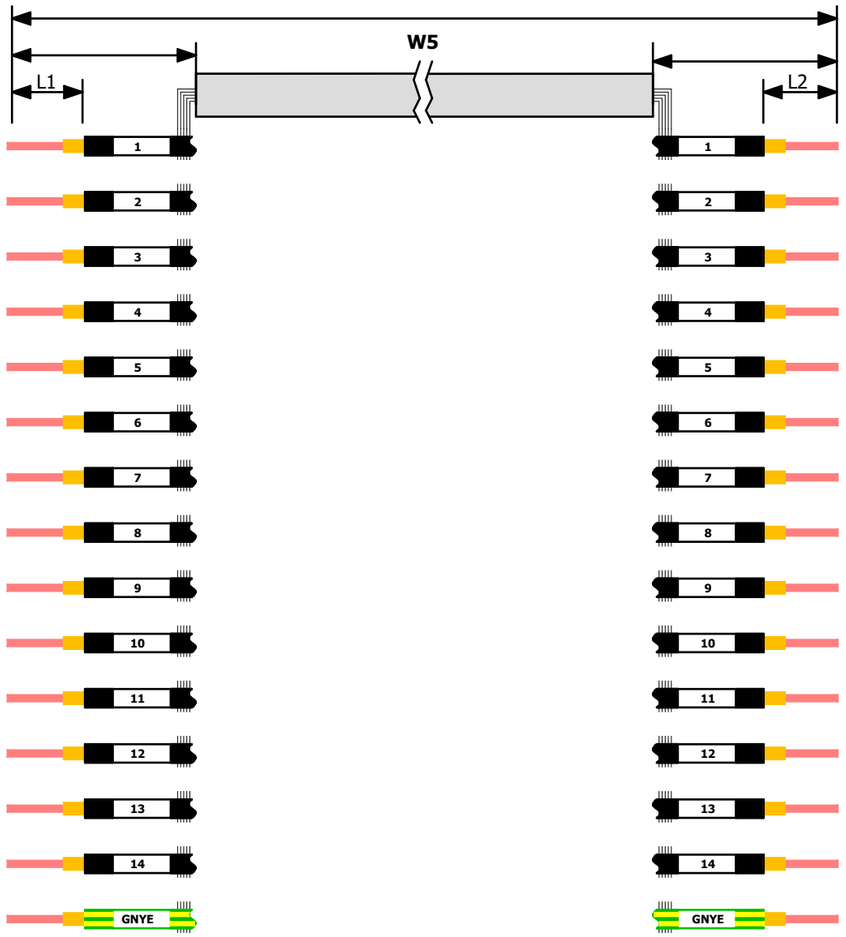
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_1.4-85U1:L1	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L2	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L3	*Control cabinet 1*

previous page: 14
next page: +CIR/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-227U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

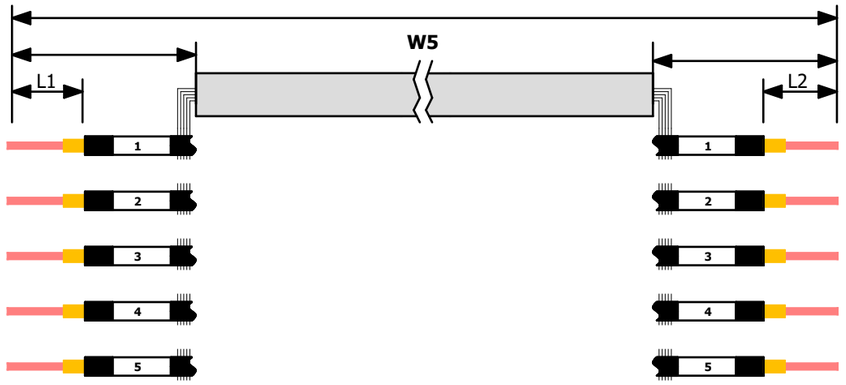
Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-227U1-X3.1:1							-227U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:2							-227U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:3							-227U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:4							-227U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:5							-227U1-X3.2:9	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:6							-227U1-X3.2:11	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:7							-227U1-X3.2:13	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:8							-227U1-X3.2:15	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:9							-227U1-X3.2:17	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:10							-227U1-X3.2:19	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:11							-227U1-X3.2:21	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:12							-227U1-X3.2:23	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:16							-227U1-X3.2:24	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:17							-227U1-X3.2:12	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:PE							-227U1-X3.2:PE	Circuit Breaker cabinet

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-231U1-X3.1:1							-231U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:2							-231U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:3							-231U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:4							-231U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:5							-231U1-X3.2:9	Circuit Breaker cabinet

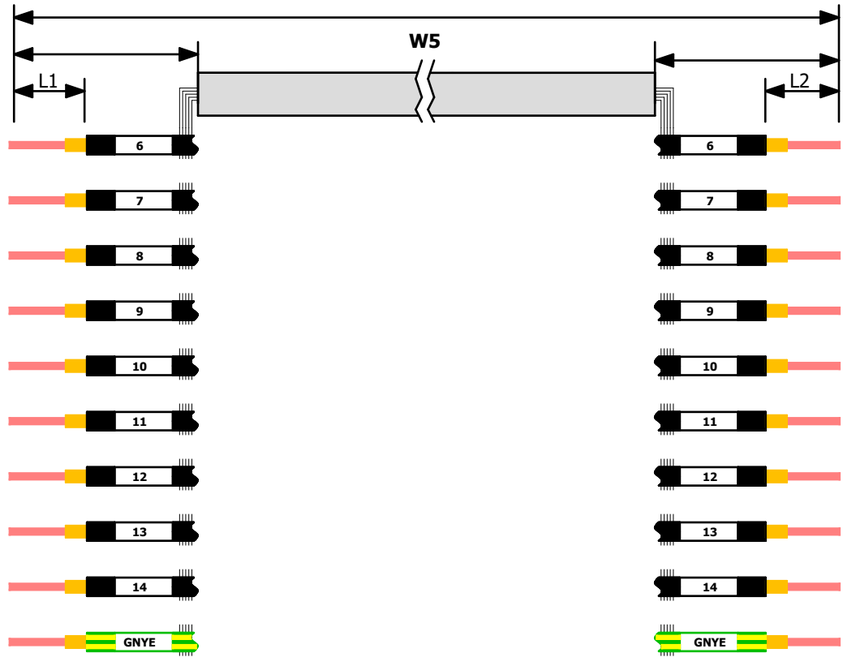
previous page: +/15
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-231U1-X3.1:6			
Circuit Breaker cabinet	-231U1-X3.1:7			
Circuit Breaker cabinet	-231U1-X3.1:8			
Circuit Breaker cabinet	-231U1-X3.1:9			
Circuit Breaker cabinet	-231U1-X3.1:10			
Circuit Breaker cabinet	-231U1-X3.1:11			
Circuit Breaker cabinet	-231U1-X3.1:12			
Circuit Breaker cabinet	-231U1-X3.1:16			
Circuit Breaker cabinet	-231U1-X3.1:17			
Circuit Breaker cabinet	-231U1-X3.1:PE			

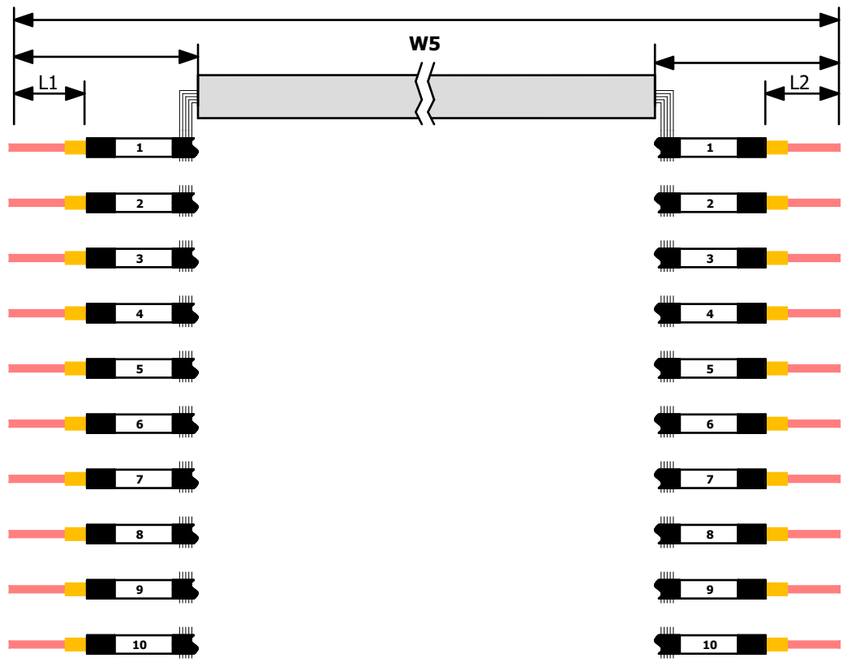


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-231U1-X3.2:11	*Circuit Breaker cabinet*
			-231U1-X3.2:13	*Circuit Breaker cabinet*
			-231U1-X3.2:15	*Circuit Breaker cabinet*
			-231U1-X3.2:17	*Circuit Breaker cabinet*
			-231U1-X3.2:19	*Circuit Breaker cabinet*
			-231U1-X3.2:21	*Circuit Breaker cabinet*
			-231U1-X3.2:23	*Circuit Breaker cabinet*
			-231U1-X3.2:24	*Circuit Breaker cabinet*
			-231U1-X3.2:12	*Circuit Breaker cabinet*
			-231U1-X3.2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:1			
Circuit Breaker cabinet	-237U1-X3.1:2			
Circuit Breaker cabinet	-237U1-X3.1:3			
Circuit Breaker cabinet	-237U1-X3.1:4			
Circuit Breaker cabinet	-237U1-X3.1:5			
Circuit Breaker cabinet	-237U1-X3.1:6			
Circuit Breaker cabinet	-237U1-X3.1:7			
Circuit Breaker cabinet	-237U1-X3.1:8			
Circuit Breaker cabinet	-237U1-X3.1:9			
Circuit Breaker cabinet	-237U1-X3.1:10			



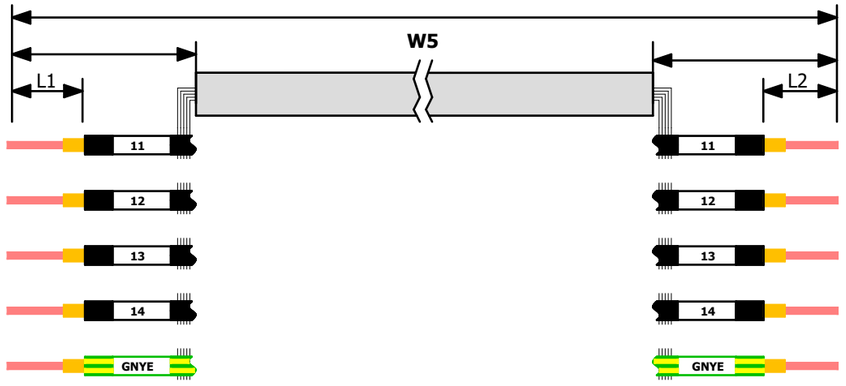
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:1	*Circuit Breaker cabinet*
			-237U1-X3.2:3	*Circuit Breaker cabinet*
			-237U1-X3.2:5	*Circuit Breaker cabinet*
			-237U1-X3.2:7	*Circuit Breaker cabinet*
			-237U1-X3.2:9	*Circuit Breaker cabinet*
			-237U1-X3.2:11	*Circuit Breaker cabinet*
			-237U1-X3.2:13	*Circuit Breaker cabinet*
			-237U1-X3.2:15	*Circuit Breaker cabinet*
			-237U1-X3.2:17	*Circuit Breaker cabinet*
			-237U1-X3.2:19	*Circuit Breaker cabinet*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



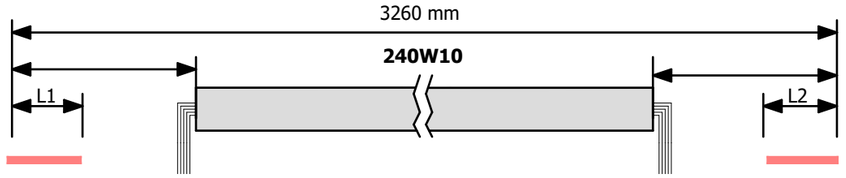
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:11			
Circuit Breaker cabinet	-237U1-X3.1:12			
Circuit Breaker cabinet	-237U1-X3.1:16			
Circuit Breaker cabinet	-237U1-X3.1:17			
Circuit Breaker cabinet	-237U1-X3.1:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:21	*Circuit Breaker cabinet*
			-237U1-X3.2:23	*Circuit Breaker cabinet*
			-237U1-X3.2:24	*Circuit Breaker cabinet*
			-237U1-X3.2:12	*Circuit Breaker cabinet*
			-237U1-X3.2:PE	*Circuit Breaker cabinet*

FRQ_Kabelplan_04_gro8_de_en

previous page: 2
next page: ++CT+/1

Cable name =UNIT_01++CT+-240W10
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

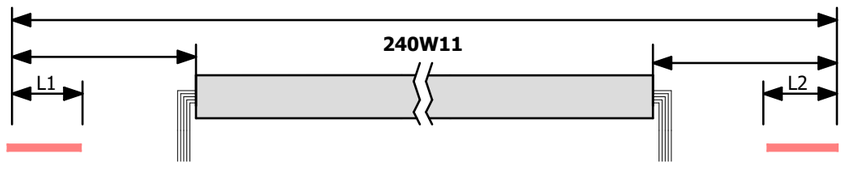


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

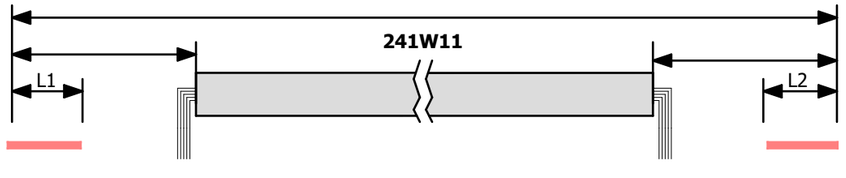


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-240U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

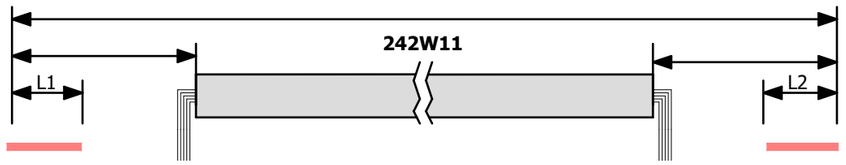


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-241U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

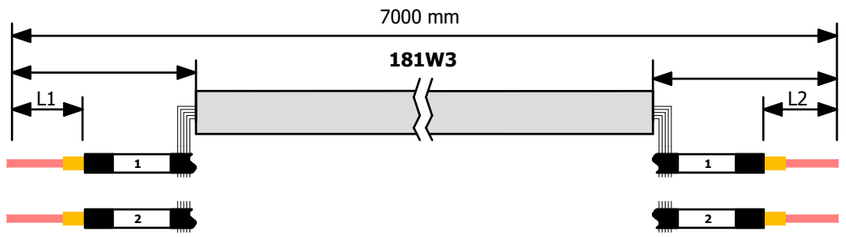


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-242U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2



Cable parts HELU.16563
Order number 16563

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:23	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X3:24	=	stripped	8 mm

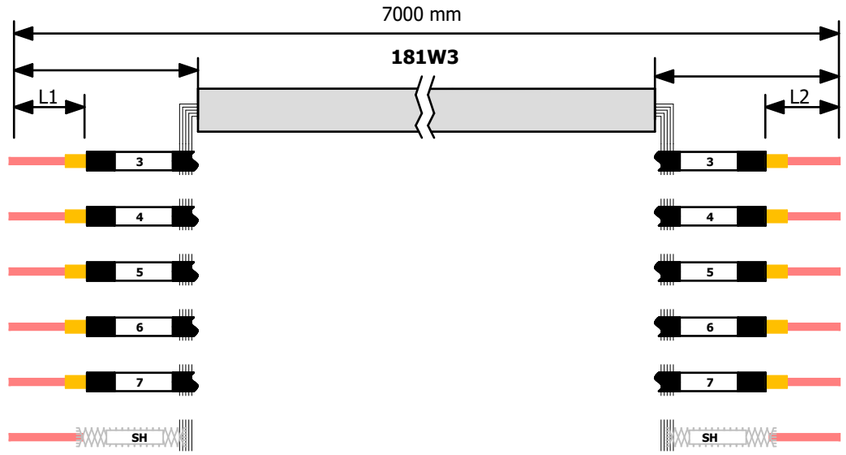
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:1	
	Flat connector	=	++FAN-52G1-181X3:3	

previous page: ++CONV+CIR/3
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2

Cable parts HELU.16563
Order number 16563

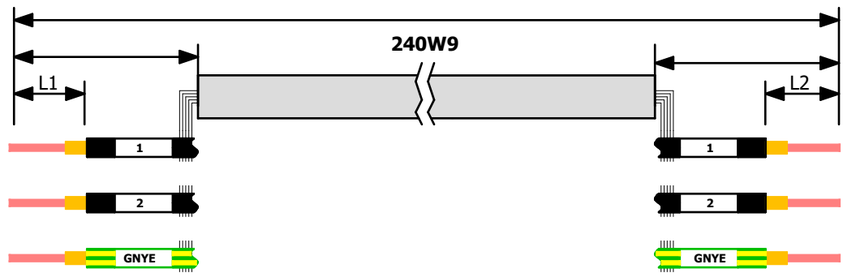


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:25	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X5:23	COOLING WATER TEMPERATURE	End splice	8 mm
Control cabinet 1	+CTRL_1.3-X5:24	=	End splice	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:2	
8 mm	stripped	COOLING WATER TEMPERATURE	++FAN-52G1-181X3:4	
8 mm	stripped	=	++FAN-52G1-181X3:5	

Cable name =UNIT_01++CT+-240W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031

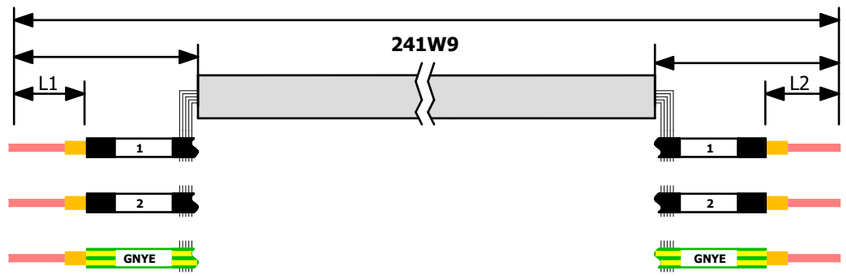


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC1:1	FUSE 24V DC CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:4	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	FUSE 24V DC CONTROL VOLTAGE	+CTRL_2.1-240U1:1	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-240U1:3	*Control cabinet 2*
	Connector	=	+CTRL_2.1-240U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:4	=	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

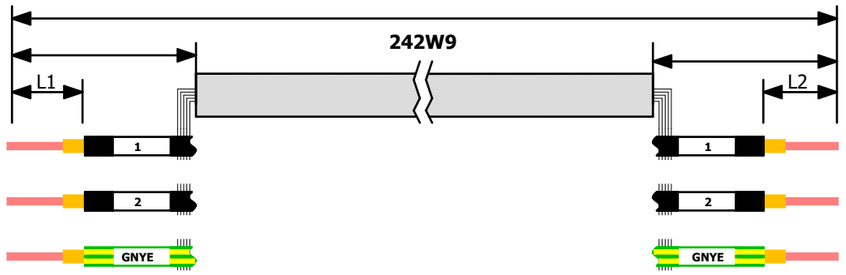
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-241U1:1	*Control cabinet 2*
	Connector	=	+CTRL_2.1-241U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-241U1:2	*Control cabinet 2*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

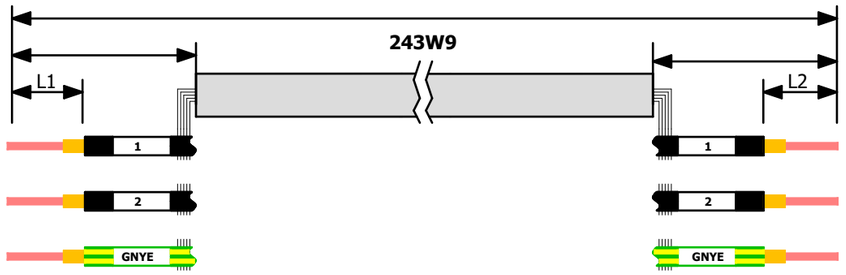


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-242U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

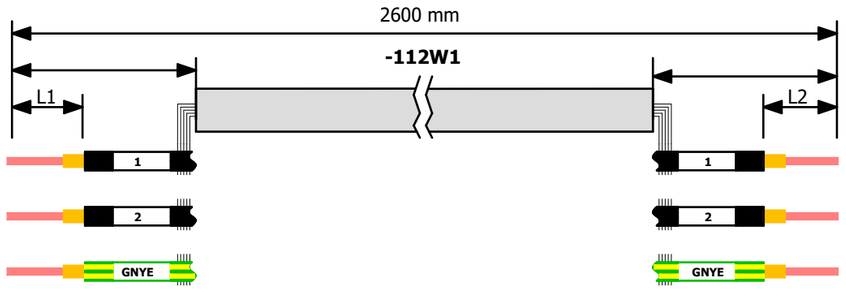


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-243U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-112W1
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

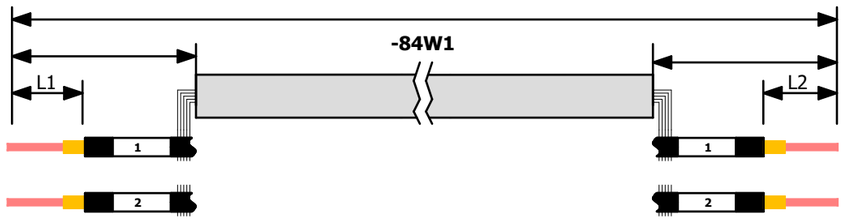


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE		
Control cabinet 1	+CTRL_1.3-XDC2:4	=		
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		BSU, SPARE CONTROL VOLTAGE	+CTRL_1.1-112A1:L+	*Control cabinet 1*
		=	+CTRL_1.1-112A1:M	*Control cabinet 1*
		Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_1.1-112A1:PE	*Control cabinet 1*

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors 1

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:2		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:4		stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	End splice		+CTRL_1.3-84F1:L1'	*Control cabinet 1*
8 mm	End splice		+CTRL_1.3-84F1:L2'	*Control cabinet 1*

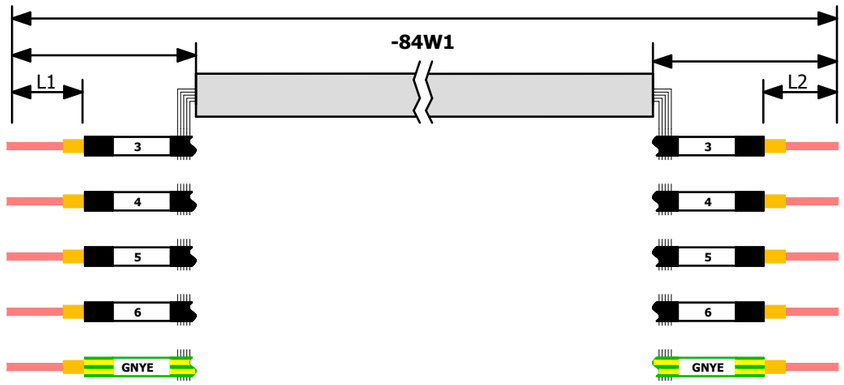
previous page: 2

next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors

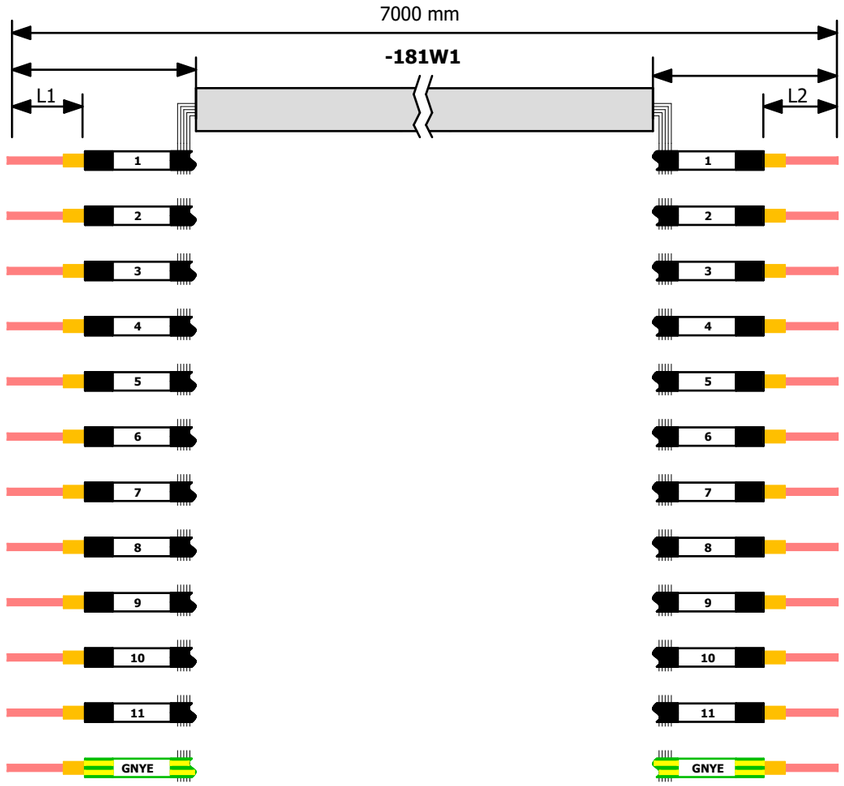
Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.1-84Q1:6		stripped	8 mm	8 mm	End splice		+CTRL_1.3-84F1:L3'	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:1		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F1:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:3		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F2:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:5		stripped	8 mm	8 mm	End splice		+CTRL_1.3-185F1:1	Control cabinet 1

Cable name =UNIT_01++CT+-181W1
Cable type JZ-600 12G1,5 mm²
Free conductors

Cable parts HELU.10670
Order number 10670



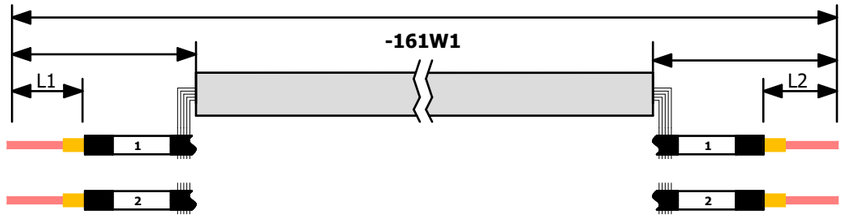
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.3-X1:1	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:1:1	
Control cabinet 1	+CTRL_1.3-X1:2	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:2:1	
Control cabinet 1	+CTRL_1.3-X1:3	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:3:1	
Control cabinet 1	+CTRL_1.3-X1:4	FUSE FOR PUMP	stripped	8 mm	8 mm	stripped	FUSE FOR PUMP	++FAN-52G1-181X1:4:1	
Control cabinet 1	+CTRL_1.3-X1:5	HEATER	stripped	8 mm	8 mm	stripped	HEATER	++FAN-52G1-181X1:5:1	
Control cabinet 1	+CTRL_1.3-X1:6	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:6:1	
Control cabinet 1	+CTRL_1.3-X1:7	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:7:1	
Control cabinet 1	+CTRL_1.3-X1:8	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	++FAN-52G1-181X1:8:1	
Control cabinet 1	+CTRL_1.3-X1:9	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:9:1	
Control cabinet 1	+CTRL_1.3-X1:10	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:10:1	
Control cabinet 1	+CTRL_1.3-X1:PE	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:PE:1	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-161W1
Cable type OZ-500 2x0,75 mm²
Free conductors 0

Cable parts HELU.10030
Order number 10030

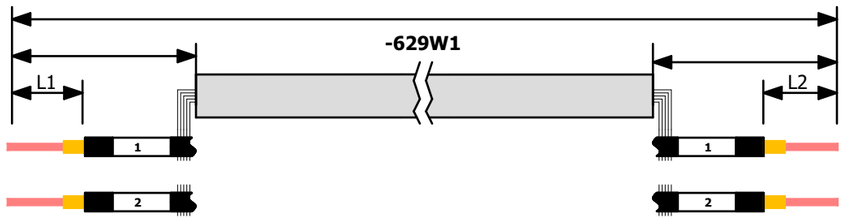


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:+			
Control cabinet 2	+CTRL_2.1-160U1:-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_2.1-161U1:+	Control cabinet 2
			+CTRL_2.1-161U1:-	Control cabinet 2

Cable name =UNIT_01++CT+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_01++CT+-195W1
Cable type OZ-500 4x0,75 mm²
Free conductors 0

Cable parts HELU.10034
Order number 10034

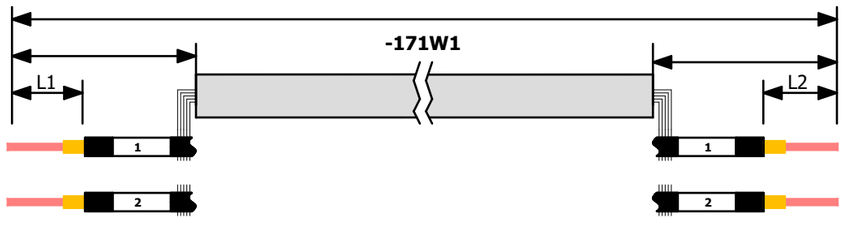


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:13	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:23			
Control cabinet 1	+CTRL_1.1-84Q1:14	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:24			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-195K3:T1	Control cabinet 1
			+CTRL_1.3-195K3:T2	Control cabinet 1
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-X3:41	Control cabinet 1
			+CTRL_1.3-X3:43	Control cabinet 1

Cable name =UNIT_01++CT+-171W1
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:1			
Control cabinet 1	+CTRL_1.4-171F1:3			

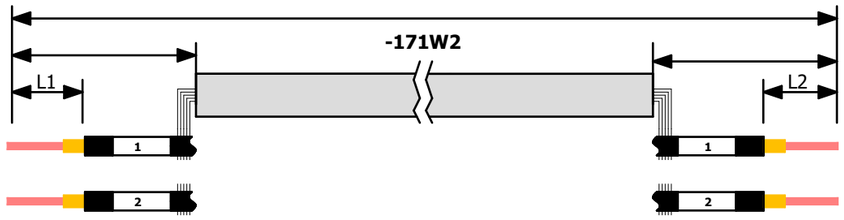
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-85U1:DC+	Control cabinet 1
			+CTRL_1.4-85U1:DC-	Control cabinet 1

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-171W2
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656

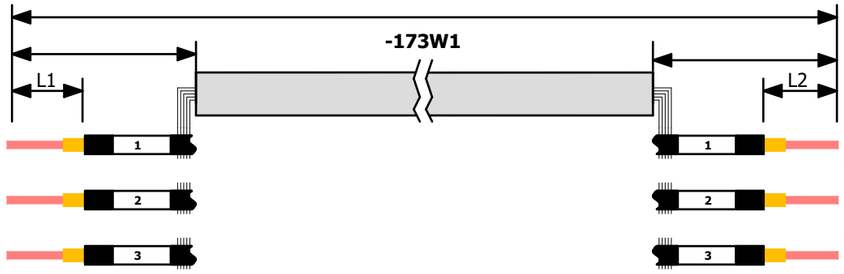


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:2			
Control cabinet 1	+CTRL_1.4-171F1:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-171K1:A1	*Control cabinet 1*
			+CTRL_1.4-171K2:A1	*Control cabinet 1*

Cable name =UNIT_01++CT+-173W1
Cable type OZ-600 3x2,5 mm²
Free conductors 3

Cable parts HELU.10691
Order number 10691

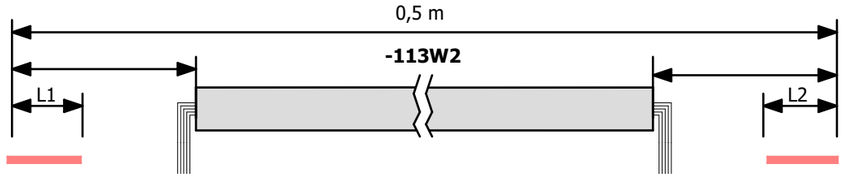


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-UDC+			
Converter cabinet	++CONV+CON-UDC-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-173F2:2	*Control cabinet 1*
			+CTRL_1.4-173F2:4	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

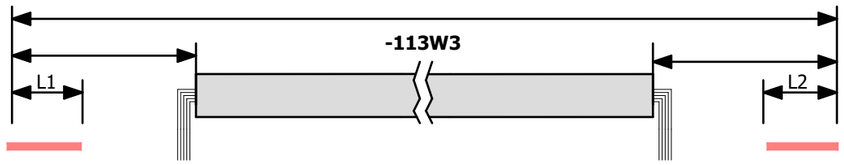


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U1:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U1:IN			

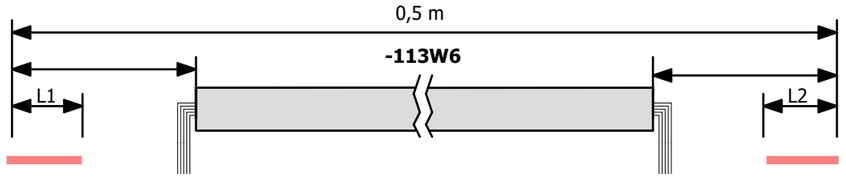
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U2:8	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 6
Date								+ total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-113W6
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

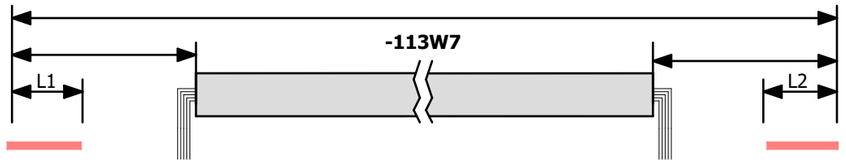


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T2:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U3:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W7
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

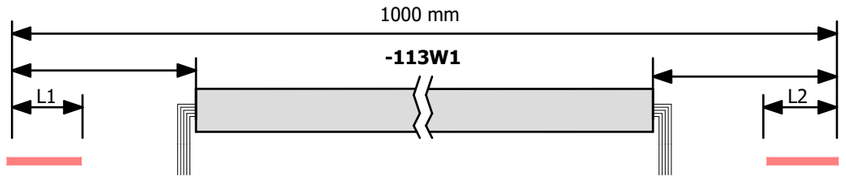


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U3:IN			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U4:8	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W1
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

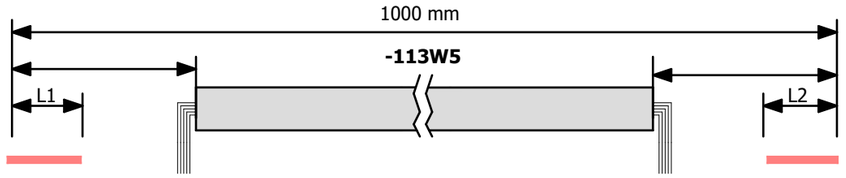


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X4:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T1:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W5
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

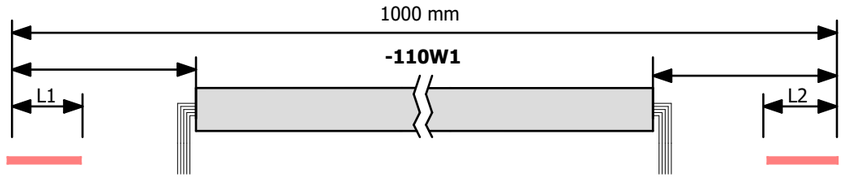


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X5:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T2:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-110W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



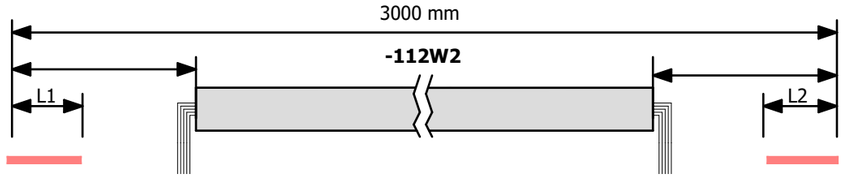
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X1:1-8	*Control cabinet 1*

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-112W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

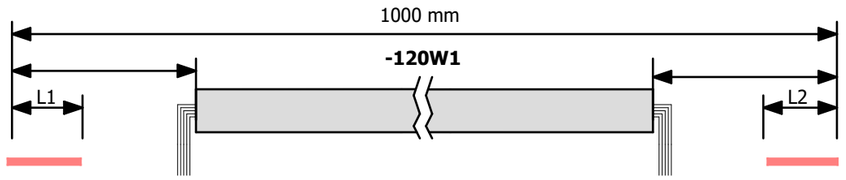


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-112A1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X2:1-8	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

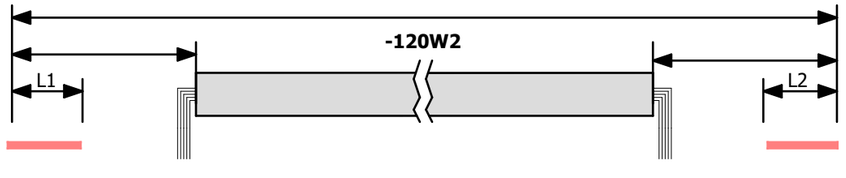


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P3		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-120A1:-X1:P1	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

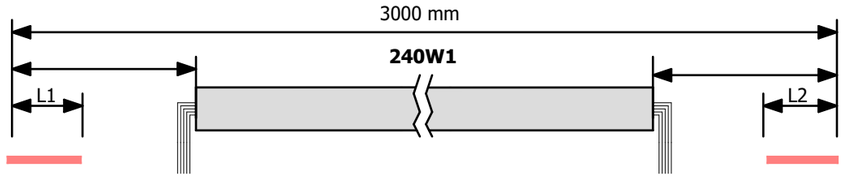


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-113U5:8			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-120A1:-X1:P2	*Control cabinet 1*

Cable name =UNIT_01++CT+-240W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

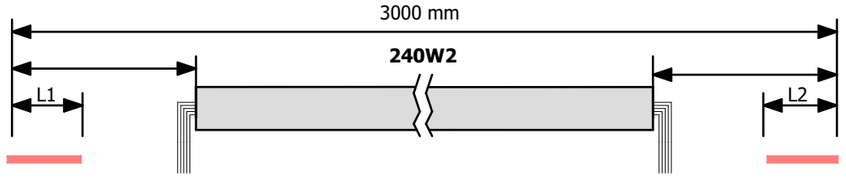


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-201Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

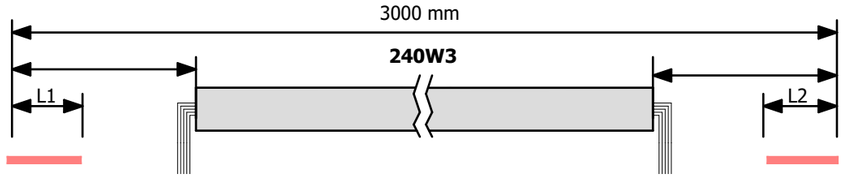
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-202Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X2	*Control cabinet 2*

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-240W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

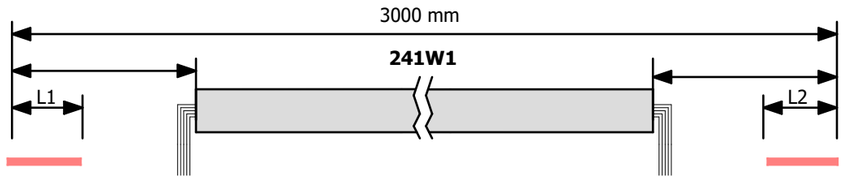


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-203Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

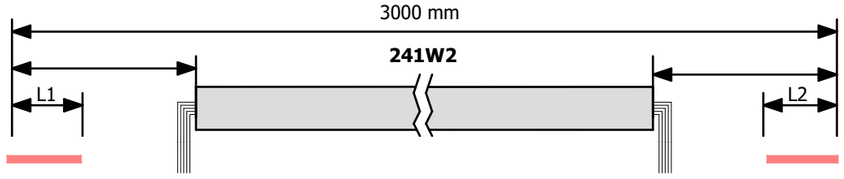


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

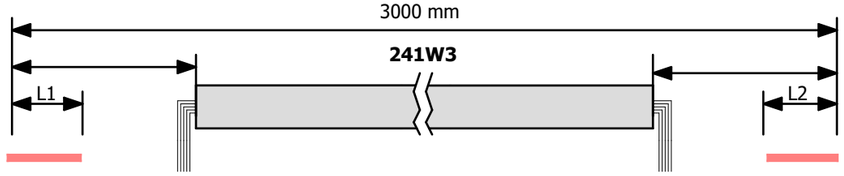


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

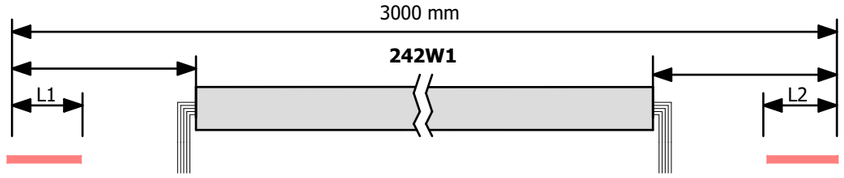


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X1		Connector	

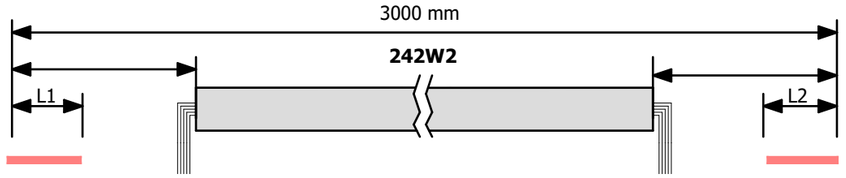
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X1	***Control cabinet 2***

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

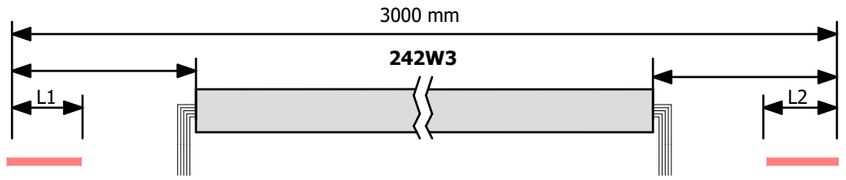


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

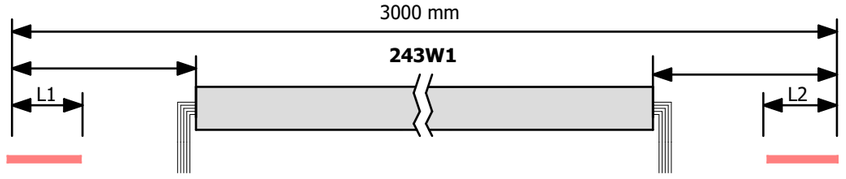


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

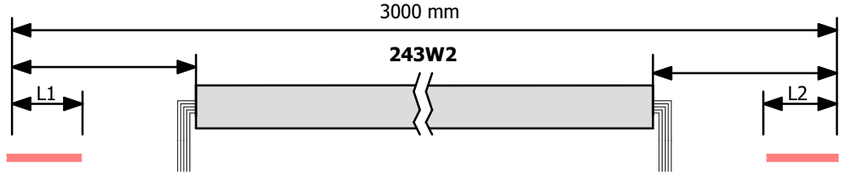


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

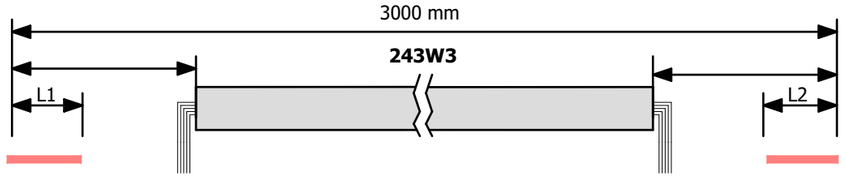


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X3		Connector	

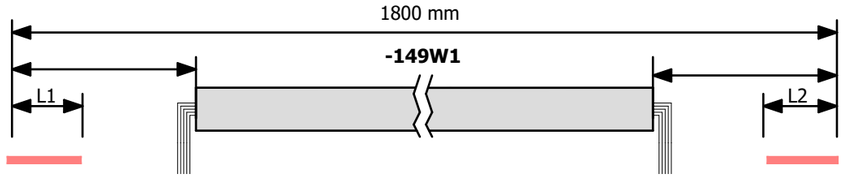
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X3	***Control cabinet 2***

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 10
Date							10354_23A2007	+		total: 492

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_01++CT+-149W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.671476
Order number

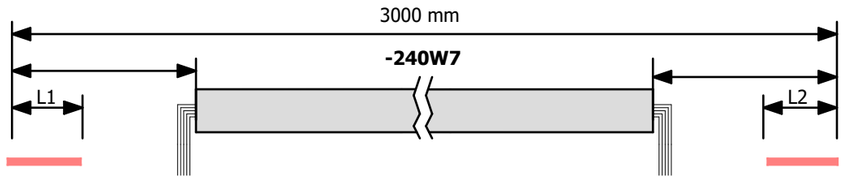


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-149U1:11X3		Connecor	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-162U1:11X3	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

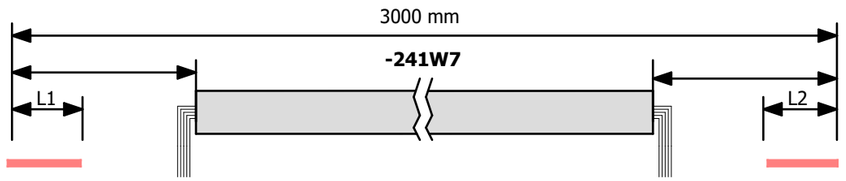


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

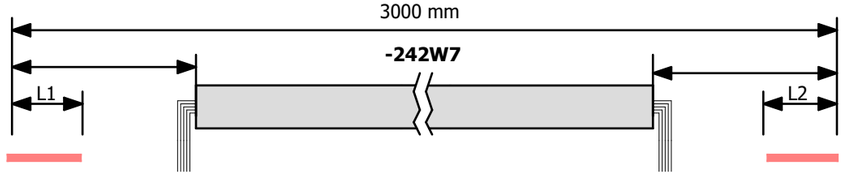


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-161U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

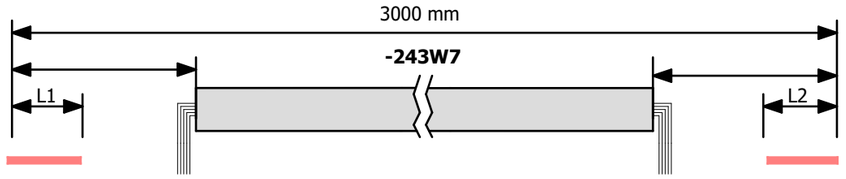


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-163U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-164U1:11X3		Connector	

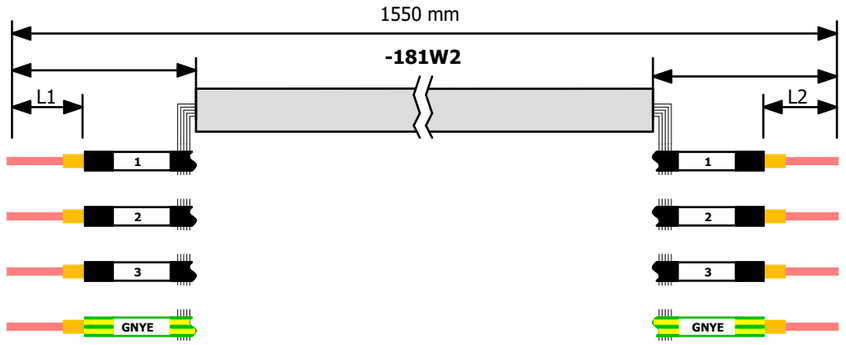
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:X7	*Control cabinet 2*

previous page: 10
next page: ++FAN/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++FAN+-52G1-181W2
Cable type JZ-600 4G1,5 mm²
Free conductors

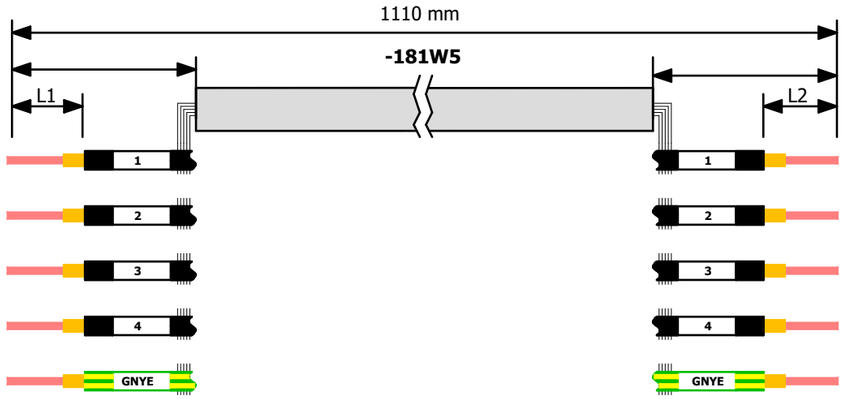
Cable parts HELU.10659
Order number 10659



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:1:2	PUMP	stripped	8 mm	5 mm	Ring cable lug M4	PUMP	-52G1-181M1:U1	
	-52G1-181X1:2:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:V1	
	-52G1-181X1:3:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:PE	

Cable name =UNIT_01++FAN+-52G1-181W5
Cable type JZ-600 5G1,5 mm²
Free conductors

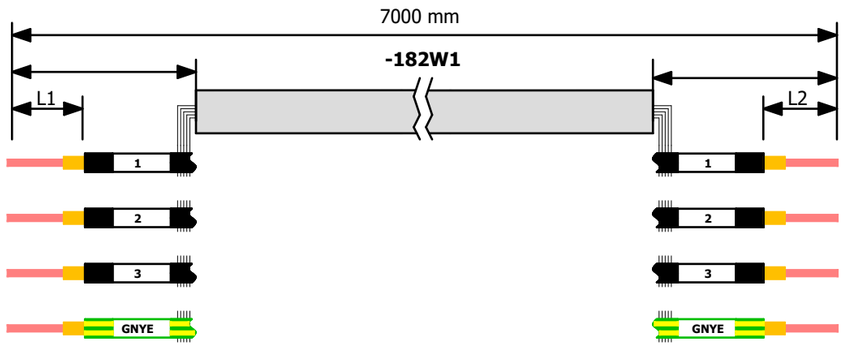
Cable parts HELU.10661
Order number 10661



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:4:2	FUSE FOR PUMP	stripped	8 mm	5 mm	Ring cable lug M4	FUSE FOR PUMP	-52G1-181R1:x1	
	-52G1-181X1:5:2	HEATER	stripped	8 mm	5 mm	Ring cable lug M4	HEATER	-52G1-181R1:x3	
	-52G1-181X1:6:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x5	
	-52G1-181X1:7:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x6	
	-52G1-181X1:PE:2	=					=	-52G1-181R1:PE	

Cable name =UNIT_01++FAN+-52G1-182W1
Cable type JZ-600 5G1,5 mm²
Free conductors

Cable parts HELU.10659
Order number 10659



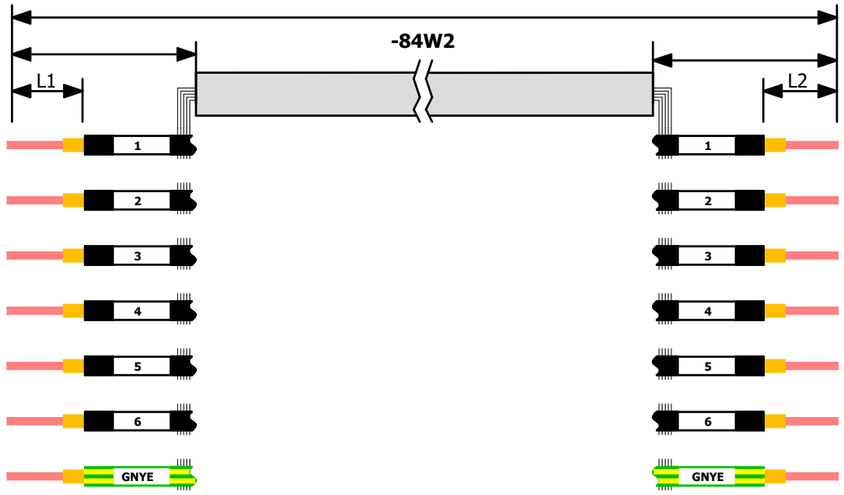
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:8:2	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	-52G1-182M1:U1	
	-52G1-181X1:9:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:V1	
	-52G1-181X1:10:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:PE	

previous page: ++CT/11
next page: ++EXTERN/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++EXTERN+-84W2
Cable type JZ-600 5G16 mm²
Free conductors 7

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page:
++FAN/1

next page:
&EMZ++CONV+IND/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-207L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2000
-207L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2001
-207L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2002
-211L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2003
-211L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2004
-211L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2005
-217L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2006
-217L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2007
-217L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2008

previous page:
&EMB++EXTERN+/1

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text			-146W3	Cable name	Strip =UNIT_01++CONV+IND-207L1.1						Cable name												Page / column
			F-CY-0Z (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1			1		++CT+CTRL_1.3-X5	13		,	-207L1.1	x2													&EFS++CT+/146.5
=			2		++CT+CTRL_1.3-X5	14		,	-207L1.1	x1													&EFS++CT+/146.5

Terminal diagram

Freqcon_F13_001_02

Function text			-146W4	Cable name	Strip =UNIT_01++CONV+IND-207L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2			1		++CT+CTRL_1.3-X5	15		,	-207L1.2	x2													&EFS++CT+/146.7
=			2		++CT+CTRL_1.3-X5	16		,	-207L1.2	x1													&EFS++CT+/146.7

Terminal diagram

Freqcon_F13_001_02

Function text			-147W1	Cable name	Strip =UNIT_01++CONV+IND-207L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3			1		++CT+CTRL_1.3-X5	17		,	-207L1.3	x2													&EFS++CT+/147.1
=			2		++CT+CTRL_1.3-X5	18		,	-207L1.3	x1													&EFS++CT+/147.1

Terminal diagram

Freqcon_F13_001_02

Function text			-145W4	Cable name	Strip =UNIT_01++CONV+IND-211L1.1						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1			1		++CT+CTRL_1.3-X5	7		,	-211L1.1	x2													&EFS++CT+/145.7
=			2		++CT+CTRL_1.3-X5	8		,	-211L1.1	x1													&EFS++CT+/145.7

Terminal diagram

Freqcon_F13_001_02

Function text			-146W1	Cable name	Strip =UNIT_01++CONV+IND-211L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2			1		++CT+CTRL_1.3-X5	9		,	-211L1.2	x2													&EFS++CT+/146.1
=			2		++CT+CTRL_1.3-X5	10		,	-211L1.2	x1													&EFS++CT+/146.1

Terminal diagram

Freqcon_F13_001_02

Function text			-146W2	Cable name	Strip =UNIT_01++CONV+IND-211L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3			1		++CT+CTRL_1.3-X5	11		,	-211L1.3	x2													&EFS++CT+/146.3
=			2		++CT+CTRL_1.3-X5	12		,	-211L1.3	x1													&EFS++CT+/146.3

Terminal diagram

Freqcon_F13_001_02

Function text			-147W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.1						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1			1		++CT+CTRL_1.3-X5	19		,	-217L1.1	x2													&EFS++CT+/147.3
=			2		++CT+CTRL_1.3-X5	20		,	-217L1.1	x1													&EFS++CT+/147.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W1	Cable name	Strip =UNIT_01++CONV+IND-217L1.2						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2			1		++CT+CTRL_1.3-X5	25		,	-217L1.2	x2													&EFS++CT+/148.3
=			2		++CT+CTRL_1.3-X5	26		,	-217L1.2	x1													&EFS++CT+/148.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.3						Cable name												Page / column
			F-CY-0Z (LIY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3			1		++CT+CTRL_1.3-X5	29		,	-217L1.3	x2													&EFS++CT+/148.7
=			2		++CT+CTRL_1.3-X5	30		,	-217L1.3	x1													&EFS++CT+/148.7

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-227U1-X3.1	DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2000
-227U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2001
-231U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2002
-231U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2003
-237U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2004
-237U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2005

previous page: +IND/2008

next page: 2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-227U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-227W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-227U1-W5	Page / column
			0Z-500	Cable type							Cable type	1Z-500	
			1		++CT+CTRL_1.4-350X1.21	1	1	,	-227U1-X3.2	1		1	&EFS+/227.a.1
			2		++CT+CTRL_1.4-350X1.21	4	2	,	-227U1-X3.2	3		2	&EFS+/227.a.2
			3		++CT+CTRL_1.4-350X1.21	7	3	,	-227U1-X3.2	5		3	&EFS+/227.a.2
			4		++CT+CTRL_1.4-350X1.21	3	4	,	-227U1-X3.2	7		4	&EFS+/227.a.3
			5		++CT+CTRL_1.4-350X1.21	6	5	,	-227U1-X3.2	9		5	&EFS+/227.a.4
			6		++CT+CTRL_1.4-350X1.21	9	6	,	-227U1-X3.2	11		6	&EFS+/227.a.5
			7		++CT+CTRL_1.4-307K1	A1	7	,	-227U1-X3.2	13		7	&EFS+/227.a.5
			8		++CT+CTRL_1.4-307K3	A1	8	,	-227U1-X3.2	15		8	&EFS+/227.a.6
			9		++CT+CTRL_1.4-307K5	A1	9	,	-227U1-X3.2	17		9	&EFS+/227.a.6
			10		++CT+CTRL_1.4-307K2	A1	10	,	-227U1-X3.2	19		10	&EFS+/227.a.6
			11		++CT+CTRL_1.4-307K4	A1	11	,	-227U1-X3.2	21		11	&EFS+/227.a.7
			12		++CT+CTRL_1.4-307K6	A1	12	,	-227U1-X3.2	23		12	&EFS+/227.a.7
			13		++CT+CTRL_1.3-X3.11	11	13	,	-227U1-F1	2			&EFS+/227.a.7
			14		++CT+CTRL_1.3-X3.12	9	14	,	-227U1-F5	2			&EFS+/227.a.8
			15		++CT+CTRL_1.3-X3.12	11	15	,	-227U1-F9	2			&EFS+/227.a.8
			16		++CT+CTRL_1.3-X3.12	10	16	,	-227U1-F2	1			&EFS+/227.a.9
									-227U1-X3.2	24		13	
			17		++CT+CTRL_1.4-350X1.21	2	17	,	-227U1-X3.2	12		14	&EFS+/227.a.9
							PE	,	-227U1-X3.2	PE		GNYE	&EFS+/227.a.9

previous page: 1000

next page: 2001

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-227U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-227U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-227U1-X3.1	1		1										&EFS+/227.a.1
							2															&EFS+/227.a.1
							3		-227U1-X3.1	2		2										&EFS+/227.a.2
							4															&EFS+/227.a.2
							5		-227U1-X3.1	3		3										&EFS+/227.a.2
							6															&EFS+/227.a.2
							7		-227U1-X3.1	4		4										&EFS+/227.a.3
							8															&EFS+/227.a.3
							9		-227U1-X3.1	5		5										&EFS+/227.a.4
							10															&EFS+/227.a.4
							11		-227U1-X3.1	6		6										&EFS+/227.a.5
							12		-227U1-X3.1	17		14										&EFS+/227.a.5
							13		-227U1-X3.1	7		7										&EFS+/227.a.5
							14															&EFS+/227.a.5
							15		-227U1-X3.1	8		8										&EFS+/227.a.6
							16															&EFS+/227.a.6
							17		-227U1-X3.1	9		9										&EFS+/227.a.6
							18															&EFS+/227.a.6
							19		-227U1-X3.1	10		10										&EFS+/227.a.6
							20															&EFS+/227.a.6
							21		-227U1-X3.1	11		11										&EFS+/227.a.7
							22															&EFS+/227.a.7
							23		-227U1-X3.1	12		12										&EFS+/227.a.7
							24		-227U1-X3.1	16		13										&EFS+/227.a.7
							PE															&EFS+/227.a.5
							PE		-227U1-X3.1	PE		GNYE										&EFS+/227.a.5

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2001
+	CIR	Circuit Breaker cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-231U1-W5	Page / column
			0Z-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.3-150X1	1	1	,	-231U1-X3.2	1		1	&EFS+/231.a.1
			2		++CT+CTRL_1.3-150X1	4	2	,	-231U1-X3.2	3		2	&EFS+/231.a.2
			3		++CT+CTRL_1.3-150X1	7	3	,	-231U1-X3.2	5		3	&EFS+/231.a.2
			4		++CT+CTRL_1.3-150X1	3	4	,	-231U1-X3.2	7		4	&EFS+/231.a.3
			5		++CT+CTRL_1.3-150X1	6	5	,	-231U1-X3.2	9		5	&EFS+/231.a.4
			6		++CT+CTRL_1.3-150X1	9	6	,	-231U1-X3.2	11		6	&EFS+/231.a.5
			7		++CT+CTRL_1.4-306K1	A1	7	,	-231U1-X3.2	13		7	&EFS+/231.a.5
			8		++CT+CTRL_1.4-306K3	A1	8	,	-231U1-X3.2	15		8	&EFS+/231.a.6
			9		++CT+CTRL_1.4-306K5	A1	9	,	-231U1-X3.2	17		9	&EFS+/231.a.6
			10		++CT+CTRL_1.4-306K2	A1	10	,	-231U1-X3.2	19		10	&EFS+/231.a.6
			11		++CT+CTRL_1.4-306K4	A1	11	,	-231U1-X3.2	21		11	&EFS+/231.a.7
			12		++CT+CTRL_1.4-306K6	A1	12	,	-231U1-X3.2	23		12	&EFS+/231.a.7
			13		++CT+CTRL_1.3-X3.10	9	13	,	-231U1-F1	2			&EFS+/231.a.7
			14		++CT+CTRL_1.3-X3.10	11	14	,	-231U1-F5	2			&EFS+/231.a.8
			15		++CT+CTRL_1.3-X3.11	9	15	,	-231U1-F9	2			&EFS+/231.a.8
			16		++CT+CTRL_1.3-X3.10	10	16	,	-231U1-F2	1			&EFS+/231.a.9
									-231U1-X3.2	24		13	
			17		++CT+CTRL_1.3-150X1	2	17	,	-231U1-X3.2	12		14	&EFS+/231.a.9
							PE	,	-231U1-X3.2	PE		GNYE	&EFS+/231.a.9

previous page: 2001

next page: 2003

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-231U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-231U1-X3.1	1		1										&EFS+/231.a.1
							2															&EFS+/231.a.1
							3		-231U1-X3.1	2		2										&EFS+/231.a.2
							4															&EFS+/231.a.2
							5		-231U1-X3.1	3		3										&EFS+/231.a.2
							6															&EFS+/231.a.2
							7		-231U1-X3.1	4		4										&EFS+/231.a.3
							8															&EFS+/231.a.3
							9		-231U1-X3.1	5		5										&EFS+/231.a.4
							10															&EFS+/231.a.4
							11		-231U1-X3.1	6		6										&EFS+/231.a.5
							12		-231U1-X3.1	17		14										&EFS+/231.a.5
							13		-231U1-X3.1	7		7										&EFS+/231.a.5
							14															&EFS+/231.a.5
							15		-231U1-X3.1	8		8										&EFS+/231.a.6
							16															&EFS+/231.a.6
							17		-231U1-X3.1	9		9										&EFS+/231.a.6
							18															&EFS+/231.a.6
							19		-231U1-X3.1	10		10										&EFS+/231.a.6
							20															&EFS+/231.a.6
							21		-231U1-X3.1	11		11										&EFS+/231.a.7
							22															&EFS+/231.a.7
							23		-231U1-X3.1	12		12										&EFS+/231.a.7
							24		-231U1-X3.1	16		13										&EFS+/231.a.7
							PE															&EFS+/231.a.5
							PE		-231U1-X3.1	PE		GNYE										&EFS+/231.a.5

previous page: 2002

next page: 2004

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-237W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-237U1-W5	Page / column
			QZ-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.4-350X1.21	11	1	,	-237U1-X3.2	1		1	&EFS+/237.a.1
			2		++CT+CTRL_1.4-350X1.21	14	2	,	-237U1-X3.2	3		2	&EFS+/237.a.2
			3		++CT+CTRL_1.4-350X1.21	17	3	,	-237U1-X3.2	5		3	&EFS+/237.a.2
			4		++CT+CTRL_1.4-350X1.21	13	4	,	-237U1-X3.2	7		4	&EFS+/237.a.3
			5		++CT+CTRL_1.4-350X1.21	16	5	,	-237U1-X3.2	9		5	&EFS+/237.a.4
			6		++CT+CTRL_1.4-350X1.21	19	6	,	-237U1-X3.2	11		6	&EFS+/237.a.5
			7		++CT+CTRL_1.4-308K1	A1	7	,	-237U1-X3.2	13		7	&EFS+/237.a.5
			8		++CT+CTRL_1.4-308K3	A1	8	,	-237U1-X3.2	15		8	&EFS+/237.a.6
			9		++CT+CTRL_1.4-308K5	A1	9	,	-237U1-X3.2	17		9	&EFS+/237.a.6
			10		++CT+CTRL_1.4-308K2	A1	10	,	-237U1-X3.2	19		10	&EFS+/237.a.6
			11		++CT+CTRL_1.4-308K4	A1	11	,	-237U1-X3.2	21		11	&EFS+/237.a.7
			12		++CT+CTRL_1.4-308K6	A1	12	,	-237U1-X3.2	23		12	&EFS+/237.a.7
			13		++CT+CTRL_1.3-X3.13	8	13	,	-237U1-F1	2			&EFS+/237.a.7
			14		++CT+CTRL_1.3-X3.13	9	14	,	-237U1-F5	2			&EFS+/237.a.8
			15		++CT+CTRL_1.3-X3.13	11	15	,	-237U1-F9	2			&EFS+/237.a.8
			16		++CT+CTRL_1.3-X3.13	10	16	,	-237U1-F2	1			&EFS+/237.a.9
									-237U1-X3.2	24		13	
			17		++CT+CTRL_1.4-350X1.21	12	17	,	-237U1-X3.2	12		14	&EFS+/237.a.9
							PE	,	-237U1-X3.2	PE		GNYE	&EFS+/237.a.9

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter page: 2004
Date								+ CIR Circuit Breaker cabinet total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-237U1-W5										Page / column
				Cable type							Cable type	JZ-500										
							1		-237U1-X3.1	1		1										&EFS+/237.a.1
							2															&EFS+/237.a.1
							3		-237U1-X3.1	2		2										&EFS+/237.a.2
							4															&EFS+/237.a.2
							5		-237U1-X3.1	3		3										&EFS+/237.a.2
							6															&EFS+/237.a.2
							7		-237U1-X3.1	4		4										&EFS+/237.a.3
							8															&EFS+/237.a.3
							9		-237U1-X3.1	5		5										&EFS+/237.a.4
							10															&EFS+/237.a.4
							11		-237U1-X3.1	6		6										&EFS+/237.a.5
							12		-237U1-X3.1	17		14										&EFS+/237.a.5
							13		-237U1-X3.1	7		7										&EFS+/237.a.5
							14															&EFS+/237.a.5
							15		-237U1-X3.1	8		8										&EFS+/237.a.6
							16															&EFS+/237.a.6
							17		-237U1-X3.1	9		9										&EFS+/237.a.6
							18															&EFS+/237.a.6
							19		-237U1-X3.1	10		10										&EFS+/237.a.6
							20															&EFS+/237.a.6
							21		-237U1-X3.1	11		11										&EFS+/237.a.7
							22															&EFS+/237.a.7
							23		-237U1-X3.1	12		12										&EFS+/237.a.7
							24		-237U1-X3.1	16		13										&EFS+/237.a.7
							PE															&EFS+/237.a.5
							PE		-237U1-X3.1	PE		GNYE										&EFS+/237.a.5

previous page:
2004

next page:
+AC_DC/1000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.2	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter	page: 2005
Date								+ CIR	Circuit Breaker cabinet	total: 492

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X3.43		1	20	0	0	40	=UNIT_01&EMZ++CONV+AC_DC/2000

previous page:
+CIR/2005

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text	-238W3 OZ-500	-238W2 OZ-500	-238W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-238W7 OZ-500	Page / column
SURGE ARRESTER DC SUBSYSTEM 2_1			1		-238F1	11	1	,	++CT+CTRL_1.3-X3	5		1	&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_1			2		-238F1	12	2	,	-X3.43	3			&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		1			-238F2	11	3	,	-X3.43	2			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		2			-238F2	12	4	,	-X3.43	5			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	1				-238F3	11	5	,	-X3.43	4			&EFS+/238a.9
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	2				-238F3	12	6	,	-X3.43	7			&EFS+/238a.9
SURGE ARRESTER DC SUBSYSTEM 2_3	2				-238F3	12	6	,	-X3.43	7			&EFS+/238a.9
								,					

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	20250805_V2.0
Date	21.01.2025					
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007
Date						

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2000
+	AC_DC	AC and DC connection cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	-228W3 OZ-500	-228W2 OZ-500	-228W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 3_1			1		-228F1	11	7	,	-X3.43	6		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_1			2		-228F1	12	8	,	-X3.43	9		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		1			-228F2	11	9	,	-X3.43	8		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		2			-228F2	12	10	,	-X3.43	11		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	1				-228F3	11	11	,	-X3.43	10		&EFS+/228.9
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	2				-228F3	12	12	,	-X3.43	13		&EFS+/228.9
								,				

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Function text	-238W6 OZ-500	-238W5 OZ-500	-238W4 OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 4_1			1		-238F4	11	13	,	-X3.43	12		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_1			2		-238F4	12	14	,	-X3.43	15		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		1			-238F5	11	15	,	-X3.43	14		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		2			-238F5	12	16	,	-X3.43	17		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	1				-238F6	11	17	,	-X3.43	16		&EFS+/238b.9
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	2				-238F6	12	18	,	-X3.43	19		&EFS+/238b.9
								,				

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV	Converter	page: 2002
+	AC_DC	AC and DC connection cabinet	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text			-78W7	Cable name	Strip =UNIT_01++CONV+AC_DC-X3.43						Cable name	-238W7										Page / column
			0Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	0Z-500										
			2		-78F1	14	19	,	-X3.43	18												&EFS+/78.8
								,														
			1		-78F1	13	20	,	++CT+CTRL_1.3-X3	6		2										&EFS+/78.8
								,														

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-XT1		1	20	0	0	20	=UNIT_01&EMZ++CT/2000

previous page:
++CONV+AC_DC/2003

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+-XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
Gas confirmed FGS							1	,	+CTRL_1.3-138K1	14			&EFS/136.0
=							2	,	+CTRL_1.3-138K1	11			&EFS/136.0
Smoke confirmed FGS							3	,	+CTRL_1.3-138K2	14			&EFS/136.1
=							4	,	+CTRL_1.3-138K2	11			&EFS/136.1
PLC fault status SIS							5	,	+CTRL_1.3-138K3	14			&EFS/136.2
=							6	,	+CTRL_1.3-138K3	11			&EFS/136.2
=							7	,	+CTRL_1.3-138K4	14			&EFS/136.2
Spare							8	,	+CTRL_1.3-138K4	11			&EFS/136.3
=							9	,	+CTRL_1.3-138K5	14			&EFS/136.3
=							10	,	+CTRL_1.3-138K5	11			&EFS/136.3
=							11	,	+CTRL_1.3-138K6	14			&EFS/136.4
=							12	,	+CTRL_1.3-138K6	11			&EFS/136.4
phase in sync							13	,	+CTRL_1.3-138K7	14			&EFS/136.5
=							14	,	+CTRL_1.3-138K7	11			&EFS/136.5
=							15	,	+CTRL_1.3-136K7	A2			&EFS/136.5
Shut-down to BESS							16	,	+CTRL_1.3-136K7	A1			&EFS/136.6
incoming CB is open							17	,	+CTRL_1.3-136K8	A2			&EFS/136.7
=							18	,	+CTRL_1.3-136K8	A1			&EFS/136.7
=							19	,	+CTRL_1.3-136K9	A2			&EFS/136.8
=							20	,	+CTRL_1.3-136K9	A1			&EFS/136.8

previous page: 1000

next page: +CTRL_1.3/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X1	Hauptsteuerstromkreis 400V/230V AC	1	PE	4	1	18	=UNIT_01&EMZ++CT+CTRL_1.3/2000
-X3	CONTROL VOLTAGE 24V DC	1	46	0	0	45	=UNIT_01&EMZ++CT+CTRL_1.3/2001
-X3.10	Rückmeldung DC Schütze Subsystem 1_4	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2003
-X3.11	=	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2004
-X3.12	=	1	12	0	0	14	=UNIT_01&EMZ++CT+CTRL_1.3/2005
-X3.13	Rückmeldung DC Schütze Subsystem 1_6	1	12	0	0	14	=UNIT_01&EMZ++CT+CTRL_1.3/2006
-X5	Kleinspannungssignale	1	30	0	0	30	=UNIT_01&EMZ++CT+CTRL_1.3/2007
-X5.1	DC Subsystem Spannungsmessung	1	2	0	0	4	=UNIT_01&EMZ++CT+CTRL_1.3/2009
-150X1	Subsysteme DC Schütz EIN	1	10	0	0	10	=UNIT_01&EMZ++CT+CTRL_1.3/2010
-XDC1	Steuerspannung 24VDC (USV) DC1	1	PE	2	0	16	=UNIT_01&EMZ++CT+CTRL_1.3/2011
-XDC2	Steuerspannung 24VDC (USV) DC2	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2013
-XDC3	Steuerspannung 24VDC (USV) DC3	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2016
-XDC4	Steuerspannung 24VDC (USV) DC4	1	4	0	0	8	=UNIT_01&EMZ++CT+CTRL_1.3/2017
-XDC5.1	Steuerspannung 24VDC (USV) DC5.1	1	1	0	0	2	=UNIT_01&EMZ++CT+CTRL_1.3/2018
-XDC5.2	Steuerspannung 24VDC (USV) DC5.2	1	1	0	0	2	=UNIT_01&EMZ++CT+CTRL_1.3/2019
-XE	Hauptstromversorgung 400V AC	1	6	3	4	14	=UNIT_01&EMZ++CT+CTRL_1.3/2020
-XT	Transfer Klemmenblock 24VDC/230VAC	1	16	6	0	22	=UNIT_01&EMZ++CT+CTRL_1.3/2021
-190XT1	230VAC Beleuchtung/Klimaanlage Container/Schrank	1	PE	4	4	16	=UNIT_01&EMZ++CT+CTRL_1.3/2023
-191XT1		1	PE	2	2	10	=UNIT_01&EMZ++CT+CTRL_1.3/2024
-XV	Suppression TVS Diode	1	4	0	0	27	=UNIT_01&EMZ++CT+CTRL_1.3/2025

previous page: +/2000

next page: 2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X1

Hauptsteuerstromkreis 400V/230V AC

Function text			-181W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
			1Z-600	Cable type							Cable type	
PUMP			1		++FAN-52G1-181X1	1:1	1	,	-139K2	2		&EFS+/181.1
=			2		++FAN-52G1-181X1	2:1	2	,	-139K2	4		&EFS+/181.1
=			3		++FAN-52G1-181X1	3:1	3	,	-139K2	6		&EFS+/181.1
=			GNYE		++FAN-52G1-181X1	PE:1	PE	,	+.2-110U1-PE			&EFS+/181.1
FUSE FOR PUMP			4		++FAN-52G1-181X1	4:1	4	,	-139K1	2		&EFS+/181.3
HEATER			5		++FAN-52G1-181X1	5:1	5	,	-139K1	4		&EFS+/181.4
=			6		++FAN-52G1-181X1	6:1	6	,	-139K1	6		&EFS+/181.4
=			7		++FAN-52G1-181X1	7:1	7	,	-XE	N:1		&EFS+/181.4
								,				
HEATER							PE	,				&EFS+/181.4
FAN 1 HEAT EXCHANGER			8		++FAN-52G1-181X1	8:1	8	,	-139K3	2		&EFS+/182.1
=			9		++FAN-52G1-181X1	9:1	9	,	-139K3	4		&EFS+/182.1
=			10		++FAN-52G1-181X1	10:1	10	,	-139K3	6		&EFS+/182.1
=							PE	,				&EFS+/182.1
FAN 2 HEAT EXCHANGER OPTIONAL							11	,				&EFS+/182.3
=							12	,				&EFS+/182.4
=							13	,				&EFS+/182.4
=							PE	,				&EFS+/182.4

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2000
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++CONV-80W1 OZ-500	-181W3 F-CY-OZ (LIY-CY)	++CONV-260W1 OZ-500	Cable name / Cable type	Strip =UNIT_01++CT+CTRL_1.3-X3 CONTROL VOLTAGE 24V DC — Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-80W1 OZ-500	++CONV-238W7 OZ-500	++TRA-629W1 OZ-500	++CONV-260W1 OZ-500	-181W3 F-CY-OZ (LIY-CY)	Page / column
CB 1 Tripped GRID					-DI_02	5	1		++CONV+CIR-80Q1	X7_13		1					&EFS+/127.1
CB 1 OFF GRID					-DI_02	4	2		++CONV+CIR-80Q1	X6_9		2					&EFS+/127.3
CB 1 ON GRID					-DI_02	3	3		++CONV+CIR-80Q1	X6_11		3					&EFS+/127.2
FUSE AND LIGHTNING PROTECTION							4		+.4-189X1	5							&EFS+/127.4
=					-XDC4	2	5		++CONV+AC_DC-X3.43	1			1				&EFS+/127.5
=					-DI_02	6	6		++CONV+AC_DC-X3.43	20			2				&EFS+/127.4
=					-X3	13	7		-134K1	11							&EFS+/127.5
CB 2 Tripped ISLAND GRID					-DI_04	12	8										&EFS+/128.1
CB 2 OFF ISLAND GRID					-DI_04	14	9										&EFS+/128.3
CB 2 ON ISLAND GRID					-DI_04	13	10										&EFS+/128.2
FUSE AND LIGHTNING PROTECTION 2							11										&EFS+/128.4
=					-DI_04	15	12										&EFS+/128.4
=					-X3	7	13										&EFS+/128.5
SPARE					-DI_04	1	14		+.2-18B1	4							&EFS+/133.1
SPARE					-DI_04	2	15		+.2-18B1	1							&EFS+/133.2
SPARE					-DI_04	3	16		+.2-18B1	4							&EFS+/133.3
Fuse 230V AC for Container Air Conditioning					-DI_04	11	17		-190F3	14							&EFS+/133.6
Earthing switch in On Transformer 620V side					-DI_04	5	18		++CONV-18Q1	14				2			&EFS+/133.9
Smoke detector CON					-DI_02	7	19		++CONV+CON-260B1	4					1		&EFS+/134.0
=			2		++CONV+CON-260B1	2	20		-XV	9							&EFS+/134.0
=			3		++CONV+CON-260B1	5	21		-XDC4	4							&EFS+/134.1
=			4		++CONV+CON-260B1	6	22		-134K1	11							&EFS+/134.1
PRESSURE SWITCH					-182Q1	13	23		++FAN-52G1-181X3	1						1	&EFS+/181.7
=		2			++FAN-52G1-181X3	3	24		-AI_04	3							&EFS+/181.7
=		3			++FAN-52G1-181X3	2	25		-XDC1	7							&EFS+/181.7
Fuse 230V AC for Container Air Conditioning					-XDC2	1	29		++CONV-18Q1	13				1			&EFS+/133.8
TRIP					-DI_04	4	30		+.2-18B1	7							&EFS+/133.4
CB 1 GRID +24V	4				++CONV+CIR-80Q1	X6_12	31		-XDC3	2							&EFS+/188.1
=	5				++CONV+CIR-80Q1	X5_11	32		-XDC3	3							&EFS+/188.1
CB 2 ISLAND GRID +24V OPTIONAL							33		-137K1	11							&EFS+/188.2
=							34										&EFS+/188.2
=	6				++CONV+CIR-80Q1	X6_7	35		-137K1	14							&EFS+/188.4
CB 1 GRID	7				++CONV+CIR-80Q1	X6_14	36		-137K2	12							&EFS+/188.5

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3

CONTROL VOLTAGE 24V DC

Function text			++CONV-80W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-195W1											Page / column
			OZ-500	Cable type							Cable type	OZ-500											
CB 1 GRID			8		++CONV+CIR-80Q1	X5_12	37	,	-189K1	22													&EFS+/188.6
=							38	,	-137K3	14													&EFS+/188.6
CB 2 ISLAND GRID OPTIONAL							39	,	-137K4	12													&EFS+/188.8
=							40	,	-189K1	21													&EFS+/188.8
SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS					-X3	42	41	,	+.1-84Q1	14		3											&EFS+/195.2
=					-195K3	IN1	42	,	-X3	41													&EFS+/195.2
=					-X3	44	43	,	+.1-84Q1	24		4											&EFS+/195.3
=					-195K3	IN2	44	,	-X3	43													&EFS+/195.3
=					-195K1	61	45	,	+.4-306K1	21													&EFS+/195.3
FAULT SIGNAL SAFETY RELAY					-195K3	IN	46	,	+.4-308K6	21													&EFS+/195.4
FAULT SIGNAL SAFETY RELAY					-195K3	IN	46	,	+.4-308K6	21													&EFS+/195.4

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 2002
Date							10354_23A2007	+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.10

Rückmeldung DC Schütze Subsystem 1_4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	OZ-500	++CONV-231W4	Page / column
SUBSYSTEM 2_1_DC + Contactor K1 is on			-DI_02	8	1		+.4-306K1	14					&EFS+/129.0
SUBSYSTEM 2_2_DC + Contactor K2 is on			+.4-306K3	14	2		-DI_02	10					&EFS+/129.2
SUBSYSTEM 2_1_DC -Contactor K7 is on			+.4-306K2	14	3		-DI_02	9					&EFS+/129.1
SUBSYSTEM 2_2_DC -Contactor K8 is on			+.4-306K4	14	4		-DI_02	11					&EFS+/129.3
SUBSYSTEM 2_3_DC + Contactor K3 is on			-DI_02	12	5		+.4-306K5	14					&EFS+/129.4
SUBSYSTEM 2_3_DC + SPARE			-DI_02	14	6								&EFS+/129.6
SUBSYSTEM 2_3_DC -Contactor K9 is on			-DI_02	13	7		+.4-306K6	14					&EFS+/129.5
SUBSYSTEM 2_DC -SPARE			-DI_02	15	8								&EFS+/129.7
SUBSYSTEM 2_1_DC FUSE OK			-DI_02	16	9		++CONV+CIR-231U1-X3.1	13		13			&EFS+/129.8
SUBSYSTEM 2_2_DC FUSE OK					10		++CONV+CIR-231U1-X3.1	16		16			&EFS+/129.9
=			-DI_03	1	11		++CONV+CIR-231U1-X3.1	14		14			&EFS+/129.9
=			-XDC4	1	12								&EFS+/129.9

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CT	Control cabinets	page: 2003
Date							10354_23A2007	+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.3-X3.11 Rückmeldung DC Schütze Subsystem 1_4					Cable name	++CONV-231W4	++CONV-227W4									Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	OZ-500	OZ-500									
SUBSYSTEM 3_1_DC + Contactor K1 is on					-DI_03	2	1		+.4-307K1	14												&EFS+/130.0
SUBSYSTEM 3_2_DC + Contactor K2 is on					+.4-307K3	14	2		-DI_03	4												&EFS+/130.2
SUBSYSTEM 3_1_DC -Contactor K7 is on					+.4-307K2	14	3		-DI_03	3												&EFS+/130.1
SUBSYSTEM 3_2_DC -Contactor K8 is on					+.4-307K4	14	4		-DI_03	5												&EFS+/130.3
SUBSYSTEM 3_3_DC + Contactor K3 is on					-DI_03	6	5		+.4-307K5	14												&EFS+/130.4
SUBSYSTEM 3_DC + SPARE					-DI_03	8	6															&EFS+/130.6
SUBSYSTEM 3_3_DC -Contactor K9 is on					-DI_03	7	7		+.4-307K6	14												&EFS+/130.5
SUBSYSTEM 3_DC -SPARE					-DI_03	9	8															&EFS+/130.7
SUBSYSTEM 2_DC FUSE OK					-DI_03	10	9		++CONV+CIR-231U1-X3.1	15		15										&EFS+/130.8
SUBSYSTEM 3_1_DC FUSE OK							10															&EFS+/130.9
=					-DI_03	11	11		++CONV+CIR-227U1-X3.1	13			13									&EFS+/130.9
=					-XDC4	2	12															&EFS+/130.9

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.12

Rückmeldung DC Schütze Subsystem 1_4

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-227W4										Page / column
				Cable type							Cable type	OZ-500										
SUBSYSTEM 4_1_DC + Contactor K1 is on					-DI_03	12	1		+.4-308K1	14												&EFS+/131.0
SUBSYSTEM 4_2_DC + Contactor K2 is on					+.4-308K3	14	2		-DI_03	14												&EFS+/131.2
SUBSYSTEM 4_1_DC -Contactor K7 is on					+.4-308K2	14	3		-DI_03	13												&EFS+/131.1
SUBSYSTEM 4_2_DC -Contactor K8 is on					+.4-308K4	14	4		-DI_03	15												&EFS+/131.3
SUBSYSTEM 4_3_DC + Contactor K3 is on					-DI_03	16	5		+.4-308K5	14												&EFS+/131.4
SUBSYSTEM 4_DC + SPARE					-DI_05	2	6															&EFS+/131.6
SUBSYSTEM 4_3_DC -Contactor K9 is on					-DI_05	1	7		+.4-308K6	14												&EFS+/131.5
SUBSYSTEM 4_DC -SPARE					-DI_05	3	8															&EFS+/131.7
SUBSYSTEM 3_2_DC FUSE OK					-DI_05	4	9		++CONV+CIR-227U1-X3.1	14		14										&EFS+/131.8
SUBSYSTEM 3_3_DC FUSE OK							10		++CONV+CIR-227U1-X3.1	16		16										&EFS+/131.9
=					-DI_05	5	11		++CONV+CIR-227U1-X3.1	15		15										&EFS+/131.9
=					-XDC4	2	12															&EFS+/131.9

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.13

Rückmeldung DC Schütze Subsystem 1_6

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	++CONV-237W4	OZ-500	Page / column
			-DI_05	6	1								&EFS+/132.0
					2		-DI_05	8					&EFS+/132.2
					3		-DI_05	7					&EFS+/132.1
					4		-DI_05	9					&EFS+/132.3
			-DI_05	10	5								&EFS+/132.4
			-DI_05	12	6								&EFS+/132.6
			-DI_05	11	7								&EFS+/132.5
SUBSYSTEM 4_1_DC FUSE OK			-DI_05	13	8		++CONV+CIR-237U1-X3.1	13			13		&EFS+/132.7
SUBSYSTEM 4_2_DC FUSE OK			-DI_05	14	9		++CONV+CIR-237U1-X3.1	14			14		&EFS+/132.8
SUBSYSTEM 4_3_DC FUSE OK					10		++CONV+CIR-237U1-X3.1	16			16		&EFS+/132.9
=			-DI_05	15	11		++CONV+CIR-237U1-X3.1	15			15		&EFS+/132.9
=			-XDC4	2	12								&EFS+/132.9

previous page: 2005

next page: 2007

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.13	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2006
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-145W1	++CONV-145W2	++CONV-145W3	++CONV-145W4	++CONV-146W1	++CONV-146W2	++CONV-146W3	++CONV-146W4	++CONV-147W1	++CONV-147W2	-181W3	Page / column
				Cable type							Cable type	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)	
INDUCTOR GRID PHASE L1 TEMPERATURE 1_1					-AI_01	1	1	,	++CONV+IND-201L1			1											&EFS+/145.1
=					-AI_01	9	2	,	++CONV+IND-201L1			2											&EFS+/145.1
INDUCTOR GRID PHASE L2 TEMPERATURE 1_2					-AI_01	2	3	,	++CONV+IND-202L1				1										&EFS+/145.3
=					-AI_01	10	4	,	++CONV+IND-202L1				2										&EFS+/145.3
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3					-AI_01	3	5	,	++CONV+IND-203L1					1									&EFS+/145.5
=					-AI_01	11	6	,	++CONV+IND-203L1					2									&EFS+/145.5
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1					-AI_01	4	7	,	++CONV+IND-211L1.1						1								&EFS+/145.7
=					-AI_01	12	8	,	++CONV+IND-211L1.1						2								&EFS+/145.7
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2					-AI_01	5	9	,	++CONV+IND-211L1.2							1							&EFS+/146.1
=					-AI_01	13	10	,	++CONV+IND-211L1.2							2							&EFS+/146.1
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3					-AI_01	6	11	,	++CONV+IND-211L1.3								1						&EFS+/146.3
=					-AI_01	14	12	,	++CONV+IND-211L1.3								2						&EFS+/146.3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1					-AI_01	7	13	,	++CONV+IND-207L1.1									1					&EFS+/146.5
=					-AI_01	15	14	,	++CONV+IND-207L1.1									2					&EFS+/146.5
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2					-AI_01	8	15	,	++CONV+IND-207L1.2										1				&EFS+/146.7
=					-AI_01	16	16	,	++CONV+IND-207L1.2										2				&EFS+/146.7
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3					-AI_02	1	17	,	++CONV+IND-207L1.3											1			&EFS+/147.1
=					-AI_02	9	18	,	++CONV+IND-207L1.3											2			&EFS+/147.1
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1					-AI_02	2	19	,	++CONV+IND-217L1.1												1		&EFS+/147.3
=					-AI_02	10	20	,	++CONV+IND-217L1.1												2		&EFS+/147.3
CONVERTER CABINET TEMPERATURE					-AI_02	4	21	,	++CONV+CON-147B2	+													&EFS+/147.7
=					-AI_02	12	22	,	++CONV+CON-147B2	-													&EFS+/147.7
COOLING WATER TEMPERATURE					-AI_02	5	23	,	++FAN-52G1-181X3	4												4	&EFS+/148.1
=					-AI_02	13	24	,	++FAN-52G1-181X3	5												5	&EFS+/148.1

previous page: 2006

next page: 2008

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-148W1	++CONV-148W2										Page / column
				Cable type							Cable type	F-CY-OZ (LIY-CY)	F-CY-OZ (LIY-CY)										
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2					-AI_02	6	25	,	++CONV+IND-217L1.2			1											&EFS+/148.3
=					-AI_02	14	26	,	++CONV+IND-217L1.2			2											&EFS+/148.3
CIR CABINET TEMPERATURE					-AI_02	7	27	,	++CONV+CIR-148B3	+													&EFS+/148.5
=					-AI_02	15	28	,	++CONV+CIR-148B3	-													&EFS+/148.5
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3					-AI_02	8	29	,	++CONV+IND-217L1.3				1										&EFS+/148.7
=					-AI_02	16	30	,	++CONV+IND-217L1.3				2										&EFS+/148.7

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5.1

DC Subsystem Spannungsmessung

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC_SUBSYSTEM 2_1.1 voltage			-AI_03	5	1		-AI_04	6			&EFS+/149.0
			-XDC1	6							
			-AI_03	6							
DC_SUBSYSTEM 2_3.1 voltage			-AI_03	7	2		+.4-149U1	14			&EFS+/149.2
			-AI_04	5							
			-AI_03	8							

previous page: 2008

next page: 2010

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_01++CT+CTRL_1.3-X5.1	20250805_V2.0	=	UNIT_01	Converter Container 1	
Date	21.01.2025							&	EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++	CT	Control cabinets	page: 2009
Date							10354_23A2007	+	CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-150X1

Subsysteme DC Schütz EIN

Function text			++CONV-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-231W4	Page / column
			OZ-500	Cable type							Cable type	OZ-500	
SUBSYSTEM 2_1 CONTACTOR DC+ ON			1		++CONV+CIR-231U1-X3.1	1	1	,	-150K1	14			&EFS+/150.2
=					-195K2	23	2	,	++CONV+CIR-231U1-X3.1	17		17	&EFS+/150.2
SUBSYSTEM 2_1 CONTACTOR DC-ON			4		++CONV+CIR-231U1-X3.1	4	3	,	-150K2	14			&EFS+/150.4
SUBSYSTEM 2_2 CONTACTOR DC+ ON			2		++CONV+CIR-231U1-X3.1	2	4	,	-151K1	14			&EFS+/151.1
=					-151K1	A2	5	,					&EFS+/151.1
SUBSYSTEM 2_3 CONTACTOR DC+ ON			5		++CONV+CIR-231U1-X3.1	5	6	,	-151K2	14			&EFS+/151.3
=			3		++CONV+CIR-231U1-X3.1	3	7	,	-151K3	14			&EFS+/151.4
=					-151K2	A2	8	,					&EFS+/151.4
SUBSYSTEM 2_3 CONTACTOR DC-ON			6		++CONV+CIR-231U1-X3.1	6	9	,	-151K4	14			&EFS+/151.6
=							10	,					&EFS+/151.6

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2010
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text	-112W1 / JZ-500	-242W9 / JZ-500	-240W9 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-243W9 / JZ-500	Page / column
FUSE 24V DC CONTROL VOLTAGE			1		+CTRL_2.1-240U1	1	1		-103F1	2			&EFS+/103.2
					+CTRL_2.1-160U1	+							
					+.2-18B1	40							
FUSE 24V DC CONTROL VOLTAGE					-DO_01	L+	2		-101Q1	13			&EFS+/103.2
					-AI_01	L+							
					+.1-126S1	13							
FUSE 24V DC CONTROL VOLTAGE					-136K7	11	3		-103F1	13			&EFS+/103.2
					-84F2	13							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			2		+CTRL_2.1-240U1	3	4		-102G1	OUTPUT DC 24 V:-			&EFS+/103.3
					-120A1	-X80:2							
					-DI_01	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-DO_01	M	5		+CTRL_2.1-160U1	-			&EFS+/103.3
					-AI_01	M							
					+.2-18B1	42							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-84K1	A2	6		-X5.1	1			&EFS+/103.3
					+.1-140H1	X2							
					+.2-110U1	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-AI_04	7	7						&EFS+/103.3
					-XDC2	3							
					-X3	25							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			GNYE		+CTRL_2.1-240U1	2	PE		-101T1	PE			&EFS+/103.4
					-XE	PE:1							
					-101T1	-"							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					+.2-18B1	41	PE		+CTRL_2.1-243U1	2		GNYE	&EFS+/103.4
		GNYE			+CTRL_2.1-242U1	2							
	GNYE				+.1-112A1	PE							

previous page: 2010

next page: 2012

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text			-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
			1Z-500	Cable type							Cable type	
			GNYE		+CTRL_2.1-241U1	2						

previous page: 2011

next page: 2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1
Date	21.01.2025					
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Date						

20250805_V2.0

10354_23A2007

=	UNIT_01	Converter Container 1		
&	EMZ	Terminals		
++	CT	Control cabinets	page:	2012
+	CTRL_1.3	Main mounting plate	total:	492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text	-241W9 / JZ-500	-242W9 / JZ-500	-243W9 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			1		+CTRL_2.1-243U1	1	1		-103F2	2		&EFS+/103.4
		1			+CTRL_2.1-242U1	1						
					-X3	29						
BSU, SPARE CONTROL VOLTAGE	1				+CTRL_2.1-241U1	1	2					&EFS+/103.5

previous page: 2012

next page: 2014

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2013
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text	-243W9 / JZ-500	-242W9 / JZ-500	-112W1 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
			1		+.1-112A1	L+						
BSU, SPARE CONTROL VOLTAGE					-186K1	A2	3		-XDC1	7		&EFS+/103.5
		2			+CTRL_2.1-242U1	3						
	2				+CTRL_2.1-243U1	3						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1		
&	EMZ	Terminals		
++	CT	Control cabinets	page:	2014
+	CTRL_1.3	Main mounting plate	total:	492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text		-112W1	-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
		1Z-500	1Z-500	Cable type							Cable type	
BSU, SPARE CONTROL VOLTAGE			2		+CTRL_2.1-241U1	3	4	⌟	-XDC3	3		&EFS+/103.5
					-138K1	A2						
		2			+.1-112A1	M						
								'				

previous page: 2014

next page: 2016

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2015
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC3

Steuerspannung 24VDC (USV) DC3

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
BSU, SPARE CONTROL VOLTAGE			-111A1	3	1		-103F3	2			&EFS+/103.6
			-173K3	21							
			+.2-114A1	2/L+							
BSU, SPARE CONTROL VOLTAGE			-X3	31	2		+.4-306K1	11			&EFS+/103.6
			-195K1	83							
			-115A1	V+							
PRECHARGE CONTROL VOLTAGE			-X3	32	3		-XDC2	4			&EFS+/103.7
			-111A1	4							
			+.2-114A1	1/M							
PRECHARGE CONTROL VOLTAGE			-195K1	43	4		-XDC4	3			&EFS+/103.7
			+.4-171K1	x2							
			-115A1	V-							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC4

Steuerspannung 24VDC (USV) DC4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
PRECHARGE CONTROL VOLTAGE			-195K1	33	1		-103F4	2			&EFS+/103.8
			-195K3	A1							
			-X3.10	12							
PRECHARGE CONTROL VOLTAGE			-X3.11	12	2		-X3.13	12			&EFS+/103.8
			-X3	5							
			-X3.12	12							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-139K2	A2	3		-XDC3	4			&EFS+/103.9
			-195K3	A2							
			-195K1	23							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-X3	21	4						&EFS+/103.9
			+.4-306K1	A2							
			+.4-306K1	A2							

previous page: 2016

next page: 2018

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.1

Steuerspannung 24VDC (USV) DC5.1

Function text				Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE						-186K1	1	1	,	-103F5	2			&EFS+/103.9
						-186K1	3							
									,					

previous page:
2017

next page:
2019

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2018
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.2

Steuerspannung 24VDC (USV) DC5.2

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			+.2-110U1	+24V	1	,	-186K1	2			&EFS+/103.9
			-120A1	-X80:1							
			-DI_01	L+							
						,					

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XE

Hauptstromversorgung 400V AC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
					1		-84F2	2			&EFS+/84.0
1-6					1						&EFA+++/2a.4
Supply Control Cabinet 3-phase 400V AC					N		-X1	7			&EFS+/84.1
=			-191XT1	4	N		-XT	2			&EFS+/84.1
=			-190F3	N	N		-191XT1	8			&EFS+/84.2
=			-190F2	N	N		-190F1	N			&EFS+/84.2
=					PE						&EFS+/84.2
=			-84F1	PE	PE		-XDC1	PE			&EFS+/84.2
=				PE	PE						&EFS+/84.3
			-101Q1	1	2		-190F2	1			&EFS+/84.0
					3		-84F2	4			&EFS+/84.0
Supply Control Cabinet 3-phase 400V AC			-101Q1	3	4		-190F3	1			&EFS+/84.1
=					5		-84F2	6			&EFS+/84.1
=			-101Q1	5	6		-190F1	1			&EFS+/84.1

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_01++CT+CTRL_1.3-XE	20250805_V2.0	=	UNIT_01	Converter Container 1	
Date	21.01.2025							&	EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++	CT	Control cabinets	page: 2020
Date							10354_23A2007	+	CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text	-278W1	++CONV-281W1	++CONV-279W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-279W1	++CONV-281W1	-278W1	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	1Z-500	1Z-500	1Z-500	
CON Fans 1-5 in door			1		++CONV+CON-279M1	L	1		-135K1	14					&EFS+/183.1
=			2		++CONV+CON-279M1	N	2		-XE	N:1					&EFS+/183.1
=							PE		++CONV+CON-279M1	PE		GNYE			&EFS+/183.1
=		1			++CONV+CIR-281M1	L	3		-135K3	14					&EFS+/183.3
CIR Fans 1-3 in door		2			++CONV+CIR-281M1	N	4								&EFS+/183.4
=							PE		++CONV+CIR-281M1	PE			GNYE		&EFS+/183.4
FAN 1 CONTROL CABINET	1				+.1-278M1	L	5		-135K2	14					&EFS+/185.1
=	2				+.1-278M1	N	6								&EFS+/185.1
=							PE		+.1-278M1	PE				GNYE	&EFS+/185.1

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2021
Date								+ CTRL_1.3 Main mounting plate — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text		++CONV-80W2	-185W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-185W1	++CONV-80W2										Page / column
		1Z-500	1Z-500	Cable type							Cable type	1Z-500	1Z-500										
HEATING CONTROL CABINET			1		+.2-185R1	1	7		-185B1	2													&EFS+/185.7
=			2		+.2-185R1	2	8																&EFS+/185.7
=							PE		+.2-185R1	PE		GNYE											&EFS+/185.7
230V AC for Circuit Breaker 1		1			++CONV+CIR-80Q1	X5_2	9		-187F1	2													&EFS+/187.1
=		2			++CONV+CIR-80Q1	X5_1	10																&EFS+/187.1
=							PE						GNYE										&EFS+/187.1
230V AC for Circuit Breaker Optional							11																&EFS+/187.2
=							12																&EFS+/187.2
=							PE																&EFS+/187.2
24V DC for Circuit Breaker 2 Optional							13		-187F2	2													&EFS+/187.4
=							14		-101T1	-													&EFS+/187.4
24V DC for Circuit Breaker Optional							15																&EFS+/187.5
=							16																&EFS+/187.5

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 2022
Date								+ CTRL_1.3 Main mounting plate total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-190XT1

230VAC Beleuchtung/Klimaanlage Container/Schrank

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
SPARE					1		-190F1	2			&EFS+/190.1
=					2		-190F1	N.			&EFS+/190.1
SPARE					PE						&EFS+/190.1
=					3		-190F2	2			&EFS+/190.3
=					4		-190F2	N.			&EFS+/190.3
SPARE					PE						&EFS+/190.3
Light Control cabinet		BN	+.5-190H1		5		-190F3	2			&EFS+/190.5
=					PE		-190X10	PE			&EFS+/190.5
=		LBU	+.5-190H1		6		-190F3	N.			&EFS+/190.5
230V AC for Container light, socket					7		-190X10	1			&EFS+/190.7
=					8		-190X10	2			&EFS+/190.7
230V AC for Container light, socket					PE						&EFS+/190.7

previous page: 2022

next page: 2024

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-190XT1	20250805_V2.0	= UNIT_01	Converter Container 1	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets	page: 2023
Date								+ CTRL_1.3	Main mounting plate	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.3-191XT1					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
400V AC for Container Air Conditioning 1							1	,	-191F1	2												&EFS+/191.1
=							2	,	-191F1	4												&EFS+/191.1
=							3	,	-191F1	6												&EFS+/191.1
=							4	,	-XE	N:2												&EFS+/191.2
=							PE	,														&EFS+/191.2
400V AC for Container Air Conditioning 2							5	,	-191F2	2												&EFS+/191.3
=							6	,	-191F2	4												&EFS+/191.3
=							7	,	-191F2	6												&EFS+/191.3
=							8	,	-XE	N:1												&EFS+/191.4
=							PE	,														&EFS+/191.4

previous page: 2023

next page: 2025

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XV

Suppression TVS Diode

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
Suppression TVS Diode bi-directional 47 V					1		-171K3	14			&EFS+/171.8
Suppression TVS Diode bi-directional 47 V					5						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					6						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					7						&EFS+/151.7
Suppression TVS Diode bi-directional 47 V					8						&EFS+/151.8
Suppression TVS Diode bi-directional 47 V					9						&EFS+/134.5
Suppression TVS Diode bi-directional 47 V					2		-173K3	14			&EFS+/173.9
Suppression TVS Diode bi-directional 47 V					3						&EFS+/150.7
Suppression TVS Diode bi-directional 47 V					4						&EFS+/150.7

previous page: 2024

next page: +.4/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-350X1.21	Subsysteme DC Schütz EIN	1	19	0	0	21	=UNIT_01&EMZ++CT+CTRL_1.4/2000
-XE2	Gleichstromversorgung 1000VDC	1	11	0	0	11	=UNIT_01&EMZ++CT+CTRL_1.4/2001
-XV.20		1	12	0	0	36	=UNIT_01&EMZ++CT+CTRL_1.4/2002

previous page:
+.3/2025

next page:
2000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.4-350X1.21 - =UNIT_01++CT+CTRL_1.4-XV.20	20250805_V2.0	= UNIT_01	Converter Container 1
Date	21.01.2025							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	Control cabinets
Date								+ CTRL_1.4	Right side

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-350X1.21

Subsysteme DC Schütz EIN

Function text		++CONV-237W4 OZ-500	++CONV-227W4 OZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-227W4 OZ-500	++CONV-237W4 OZ-500	Page / column
SUBSYSTEM 3_1 CONTACTOR DC+ ON			1		++CONV+CIR-227U1-X3.1	1	1	,	-350K1	14				&EFS+/350.2
=					-350K1	A2	2	,	++CONV+CIR-227U1-X3.1	17		17		&EFS+/350.2
SUBSYSTEM 3_1 CONTACTOR DC-ON			4		++CONV+CIR-227U1-X3.1	4	3	,	-350K2	14				&EFS+/350.4
			2		++CONV+CIR-227U1-X3.1	2	4	,	-351K1	14				&EFS+/351.1
					+.3-195K2	43	5	,						&EFS+/351.1
SUBSYSTEM 3_3 CONTACTOR DC+ ON			5		++CONV+CIR-227U1-X3.1	5	6	,	-351K2	14				&EFS+/351.3
=			3		++CONV+CIR-227U1-X3.1	3	7	,	-351K3	14				&EFS+/351.4
SUBSYSTEM 3_3 CONTACTOR DC-ON							8	,						&EFS+/351.5
=			6		++CONV+CIR-227U1-X3.1	6	9	,	-351K4	14				&EFS+/351.6
=							10	,						&EFS+/351.7
SUBSYSTEM 4_3 CONTACTOR DC-ON							10	,						&EFS+/353.6
SUBSYSTEM 4_1 CONTACTOR DC+ ON		1			++CONV+CIR-237U1-X3.1	1	11	,	-352K1	14				&EFS+/352.1
SUBSYSTEM 4_1 CONTACTOR DC-ON					-352K1	A2	12	,	++CONV+CIR-237U1-X3.1	17		17		&EFS+/352.2
=		4			++CONV+CIR-237U1-X3.1	4	13	,	-352K2	14				&EFS+/352.3
SUBSYSTEM 4_2 CONTACTOR DC+ ON		2			++CONV+CIR-237U1-X3.1	2	14	,	-353K1	14				&EFS+/353.1
=					-353K1	A2	15	,						&EFS+/353.1
SUBSYSTEM 4_3 CONTACTOR DC+ ON		5			++CONV+CIR-237U1-X3.1	5	16	,	-353K2	14				&EFS+/353.3
=		3			++CONV+CIR-237U1-X3.1	3	17	,	-353K3	14				&EFS+/353.4
=					-353K2	A2	18	,						&EFS+/353.4
SUBSYSTEM 4_3 CONTACTOR DC-ON		6			++CONV+CIR-237U1-X3.1	6	19	,	-353K4	14				&EFS+/353.6

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets — page: 2000
Date								+ CTRL_1.4 Right side — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-XE2

Gleichstromversorgung 1000VDC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
RESISTORS FOR DISCHARGING UDC+			-173R2		1		-173R1				&EFS+/173.2
RESISTORS FOR DISCHARGING UDC-			-173R4		2		-173R3				&EFS+/173.3
=			-173R4		3		+CTRL_2.1-160U1	15			&EFS+/173.3
=			-173R2		4		+CTRL_2.1-160U1	44			&EFS+/173.3
=			+CTRL_2.1-162U1	15	5		+CTRL_2.1-161U1	15			&EFS+/173.3
=			+CTRL_2.1-162U1	44	6		+CTRL_2.1-161U1	44			&EFS+/173.3
=			+CTRL_2.1-163U1	15	7		-189X1	4			&EFS+/173.4
=			+CTRL_2.1-163U1	44	8		+CTRL_2.1-164U1	44			&EFS+/173.4
=			+CTRL_2.1-164U1	15	9		++CONV+CON-N	N			&EFS+/173.4
=					10		+CTRL.4-173R6				&EFS+/173.5
=					11		+CTRL.4-173R8				&EFS+/173.5

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.4-XV.20					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Suppression TVS Diode bi-directional 47 V							1															&EFS+/350.7
Suppression TVS Diode bi-directional 47 V							2															&EFS+/350.7
Suppression TVS Diode bi-directional 47 V							3															&EFS+/351.7
Suppression TVS Diode bi-directional 47 V							4															&EFS+/351.7
Suppression TVS Diode bi-directional 47 V							5															&EFS+/351.8
Suppression TVS Diode bi-directional 47 V							6															&EFS+/351.8
Suppression TVS Diode bi-directional 47 V							7															&EFS+/352.7
Suppression TVS Diode bi-directional 47 V							8															&EFS+/352.7
Suppression TVS Diode bi-directional 47 V							9															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							10															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							11															&EFS+/353.7
Suppression TVS Diode bi-directional 47 V							12															&EFS+/353.8

previous page: 2001

next page: 2003

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_1.4-XV.20						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-149X1		1	6	0	0	6	=UNIT_01&EMZ++CT+CTRL_2.1/2000

previous page:
+CTRL_1.4/2003

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01++CT+CTRL_2.1-149X1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
					-161U1	19	1	,															&EFS+/161.4
					-161U1	23	2	,															&EFS+/161.5
					-161U1	27	3	,															&EFS+/161.5
					-161U1	32	4	,															&EFS+/161.6
					-161U1	36	5	,															&EFS+/161.7
					-161U1	40	6	,															&EFS+/161.8

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-52G1-181X1	400VAC Wassersystem	1	PE	3	1	14	=UNIT_01&EMZ++FAN/2000
-52G1-181X3		1	GND	0	0	6	=UNIT_01&EMZ++FAN/2001

previous page:
++CT+CTRL_2.1/2000

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++FAN+-52G1-181X1

400VAC Wassersystem

Function text	-52G1-182W1	-52G1-181W5	-52G1-181W2	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CT-181W1	Page / column
	1Z-600	1Z-600	1Z-600	Cable type							Cable type	1Z-600	
PUMP			1		-52G1-181M1	U1	1	,	++CT+CTRL_1.3-X1	1		1	&EFS++CT/181.1
=			2		-52G1-181M1	V1	2	,	++CT+CTRL_1.3-X1	2		2	&EFS++CT/181.1
=			3		-52G1-181M1	W1	3	,	++CT+CTRL_1.3-X1	3		3	&EFS++CT/181.1
FUSE FOR PUMP		1			-52G1-181R1	x1	4	,	++CT+CTRL_1.3-X1	4		4	&EFS++CT/181.3
HEATER		2			-52G1-181R1	x3	5	,	++CT+CTRL_1.3-X1	5		5	&EFS++CT/181.4
=		3			-52G1-181R1	x5	6	,	++CT+CTRL_1.3-X1	6		6	&EFS++CT/181.4
=		4			-52G1-181R1	x6	7	,	++CT+CTRL_1.3-X1	7		7	&EFS++CT/181.4
								,					
FAN 1 HEAT EXCHANGER	1				-52G1-182M1	U1	8	,	++CT+CTRL_1.3-X1	8		8	&EFS++CT/182.1
=	2				-52G1-182M1	V1	9	,	++CT+CTRL_1.3-X1	9		9	&EFS++CT/182.1
=	3				-52G1-182M1	W1	10	,	++CT+CTRL_1.3-X1	10		10	&EFS++CT/182.1
PUMP			GNYE		-52G1-181M1	PE	PE	,	++CT+CTRL_1.3-X1	PE		GNYE	&EFS++CT/181.1
HEATER		GNYE			-52G1-181R1	PE	PE	,					&EFS++CT/181.4
FAN 1 HEAT EXCHANGER	GNYE				-52G1-182M1	PE	PE	,					&EFS++CT/182.1

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++FAN+-52G1-181X1	20250805_V2.0	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN FAN page: 2000
Date								+ total: 492

Terminal diagram

Freqcon_F13_001_02

Function text			++CT-181W3	Cable name	Strip =UNIT_01++FAN+-52G1-181X3					Cable name	++CT-181W3										Page / column
			F-CY-0Z (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-0Z (LiY-CY)										
PRESSURE SWITCH			1		++CT+CTRL_1.3-X3	23	1	,	-52G1	1												&EFS++CT/181.7
=					-52G1	2	2	,	++CT+CTRL_1.3-X3	25		3										&EFS++CT/181.7
=					-52G1	3	3	,	++CT+CTRL_1.3-X3	24		2										&EFS++CT/181.7
COOLING WATER TEMPERATURE			4		++CT+CTRL_1.3-X5	23	4	,	-52G1-148B1	+												&EFS++CT/148.1
=			5		++CT+CTRL_1.3-X5	24	5	,	-52G1-148B1	-												&EFS++CT/148.1
PRESSURE SWITCH					-52G1	SH	GND	,														&EFS++CT/181.7

previous page: 2000

next page: =UNIT_02&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++FAN+-52G1-181X3	20250805_V2.0	= UNIT_01 Converter Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN FAN page: 2001
Date								+ total: 492

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

FREQCON

Customer:	Statron		
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Type:	BESS MSC-1000-620-8		
Product	BATTERY CONTAINER 1		
Circuit diagram No:	10354_23A2007	20250805_V2.0	
Producer (company):	Freqcon GmbH	53406 ASC	53409
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore		
Type:	BESS MSC-1000-620-8		
Project manager:	Freqcon_CP		

created on: 17.09.2019
edited on: 05.08.2025 edited by: Freqcon_DG total pages: 492

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	21.01.2025	Freqcon_DG
	3	INDEX	21.01.2025	Freqcon_DG
	4	INDEX	21.01.2025	Freqcon_DG
	5	INDEX	21.01.2025	Freqcon_DG
	6	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	05.11.2024	Freqcon_DG
	3a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
&ELU		Cabinet Overview		
	5a	Container overview	14.06.2024	Freqcon_JD
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	191	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	192	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	193	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	278	EARTHING CONTAINER	08.10.2024	Freqcon_DG
	290	BATTERY CABINETS 1-3	18.06.2024	Freqcon_JD
	291	BATTERY CABINETS 4+5	18.06.2024	Freqcon_JD
	292	BATTERY CABINETS 6-8	18.06.2024	Freqcon_JD
	293	BATTERY CABINETS 9-11	18.06.2024	Freqcon_JD
&EFS ++ASC		Circuit diagram auxillary cabinet		
	601	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	602	CONTROL VOLTAGE UPS	05.11.2024	Freqcon_DG
	603	CONTROL VOLTAGE FUSE	21.01.2025	Freqcon_DG
	611	ETHERNET SWITCH	18.06.2024	Freqcon_JD
	613a	ETHERNET / PROFINET ISOLATOR	25.11.2024	Freqcon_DG
	613b	PROFINET	25.11.2024	Freqcon_DG
	620	ET200 24V DC ASC	03.12.2024	Freqcon_DG
	621	ET200SP DIGITAL INPUTS DI_21 + DI_22	03.12.2024	Freqcon_DG
	623	ET200SP DIGITAL OUTPUTS DO_21	14.06.2024	Freqcon_JD
	624	ET200SP ANALOG INPUTS AI_21	14.06.2024	Freqcon_JD
	625	ET200SP ANALOG OUTPUTS AO_21	14.06.2024	Freqcon_JD
	636	OUTPUTS FIRE DAMPER	18.06.2024	Freqcon_JD
	669	SMOKE POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	670	GAS POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	678	DC BATTERY CABINETS	18.06.2024	Freqcon_JD
	680a	STATIONARY GAS DETECTOR BAT 1-4	14.06.2024	Freqcon_JD
	680b	STATIONARY GAS DETECTOR BAT 5-8	18.06.2024	Freqcon_JD
	680c	STATIONARY GAS DETECTOR BAT 9-11	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++ASC		Circuit diagram auxillary cabinet		
	681	EXTRACT FAN FIRE DAMPER	14.06.2024	Freqcon_JD
	684	AUXILIARY SUPPLY 400V AC	22.11.2024	Freqcon_DG
	685	AUXILIARY SUPPLY 400V AC	05.11.2024	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	29.10.2024	Freqcon_DG
	691	CONTAINER COOLING / LIGHTNING	05.11.2024	Freqcon_DG
&EPC ++Container		Parts List		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	21.01.2025	Freqcon_DG
	4	PARTS LIST	21.01.2025	Freqcon_DG
	5	PARTS LIST	21.01.2025	Freqcon_DG
	6	PARTS LIST	21.01.2025	Freqcon_DG
	7	PARTS LIST	21.01.2025	Freqcon_DG
&EPA ++Container		Summarized part list		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG

previous page: 2

next page: 4

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++Container		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	21.01.2025	Freqcon_DG
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_02++ASC+-X5.1 - =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_02++ASC+-X5.1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_02++ASC+-X5.2	21.01.2025	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2002	Klemmenplan =UNIT_02++ASC+-X5.3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_02++ASC+-X6	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_02++ASC+-XDC1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_02++ASC+-XDC2	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_02++ASC+-XES	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2009	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_02++ASC+-369XT	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2024	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2025	Klemmenplan =UNIT_02++ASC+-687XT1	05.11.2024	Freqcon_DG
	2026	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2027	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2028	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG

previous page: 4

next page: 6

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2029	Klemmenplan =UNIT_02++ASC+-687XT1	21.01.2025	Freqcon_DG
	2030	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2031	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2032	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG
	2033	Klemmenplan =UNIT_02++ASC+-690XT1	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/6

next page: 6a

SPECIFICATION of grounding

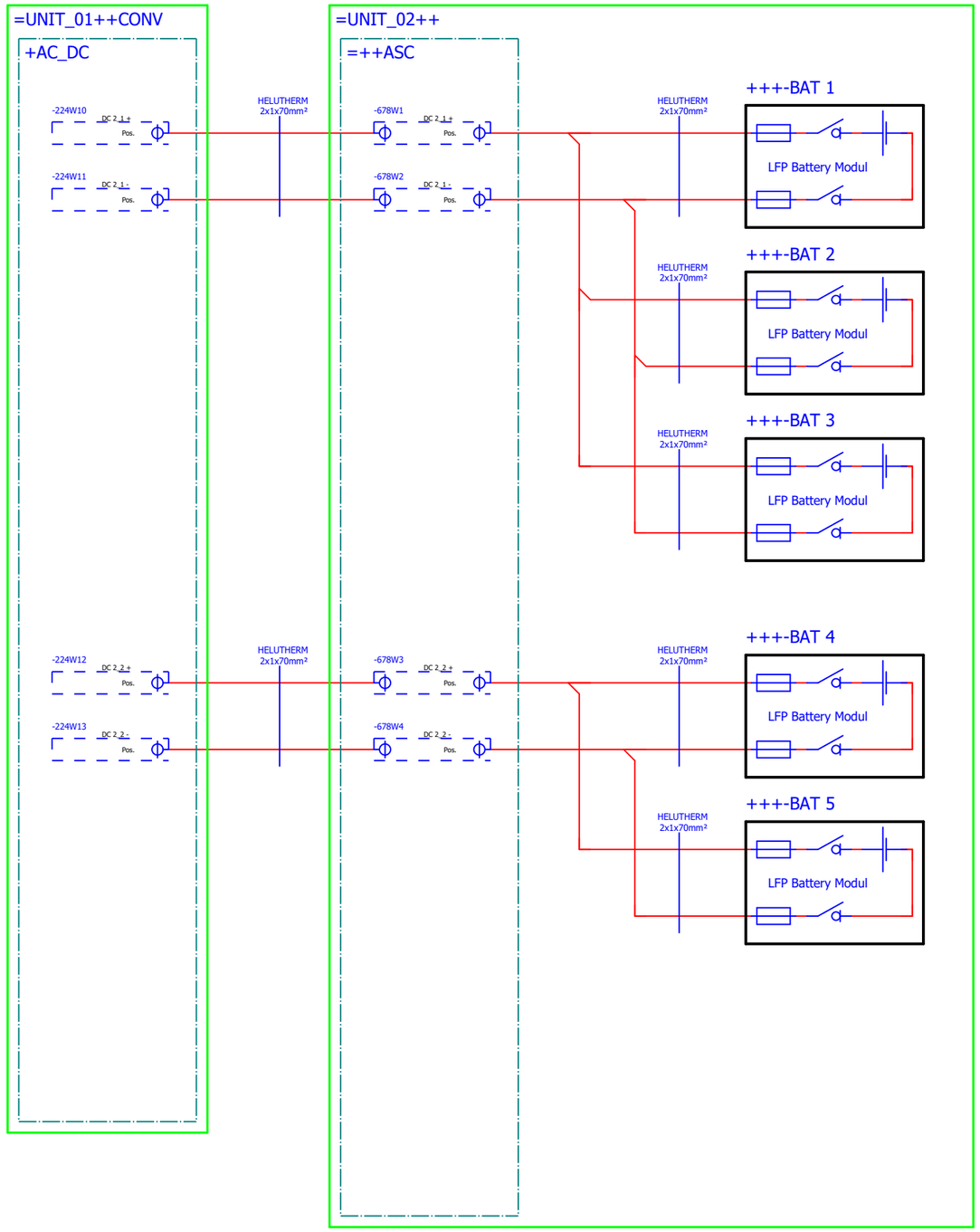
	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

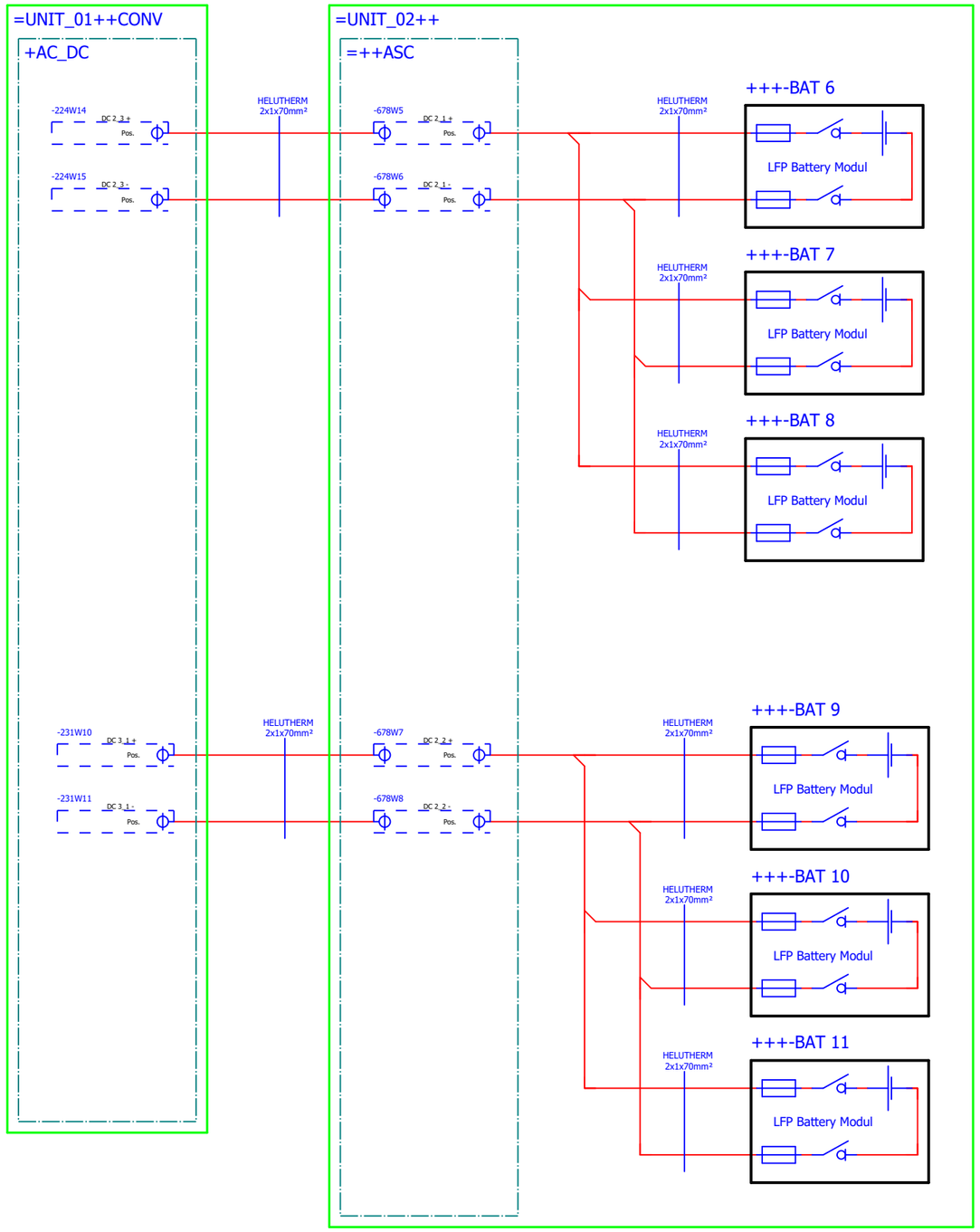
previous page: 1a

next page: &EFA/1a

Editor	Freqcon_JD			Statron	FREQCON	Specification Earthing	20250805_V2.0	= UNIT_02	Battery Container 1
Date	14.06.2024	Norm						& EAC	Explanatory documents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 6a
Date								+	total: 492

Single line diagram





previous page:
&EAC/6a

next page:
2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 1a
Date								+	total: 492

Single line diagram

Control circuit

++ASC

400V

-XES

-684F3 &EFS++ASC/684.2 C32A

-684F1 &EFS++ASC/684.0 C32A

-684F2 &EFS++ASC/684.5 TYP 1 + 2 SPD

-601F1 &EFS++ASC/601.1 TYP 1 + 2 SPD

-684F4 &EFS++ASC/685.0 C32A

-684F5 &EFS++ASC/685.5 TYP 1 + 2 SPD

-691F1 &EFS++ASC/691.1 C6A

-691F2 &EFS++ASC/691.3 C6A

-691F3 &EFS++ASC/691.4 C6A

-636K1 &EFS++ASC/636.1

-636K2 &EFS++ASC/636.2

-636K3 &EFS++ASC/636.4

M 1~

Exhaust Unit / shut-off flap Bat 1-4

Exhaust Unit / shut-off flap Bat 5-8

Exhaust Unit / shut-off flap Bat 9-11

Container Internal Lighting

-690F1 &EFS++ASC/690.1 16A

-690F3 &EFS++ASC/690.5 C6A

-690F4 &EFS++ASC/690.7 C6A

-690F5 &EFS++ASC/690.8 C6A

1/N/PE

crane 1

crane 2

crane 3

-691F4 &EFS++ASC/691.5 C16A

Cooling Units

-690F2 &EFS++ASC/690.3 16A

1/N/PE 1/N/PE

Container Sockets

-101Q1

20 A

Power Supply

-687F1 &EFS++ASC/687.1 C16A

-687F2 &EFS++ASC/687.3 C16A

-687F3 &EFS++ASC/687.4 C16A

-687F4 &EFS++ASC/687.5 C16A

-687F5 &EFS++ASC/687.7 C16A

Battery cabinet 1

Battery cabinet 2

Battery cabinet 3

Battery cabinet 4

Battery cabinet 5

-687F6 &EFS++ASC/687.8 C16A

-688F1 &EFS++ASC/688.1 C16A

-688F2 &EFS++ASC/688.2 C16A

-688F3 &EFS++ASC/688.4 C16A

-688F4 &EFS++ASC/688.5 C16A

-688F5 &EFS++ASC/688.7 C16A

Battery cabinet 6

Battery cabinet 7

Battery cabinet 8

Battery cabinet 9

Battery cabinet 10

Battery cabinet 11

previous page: 1a

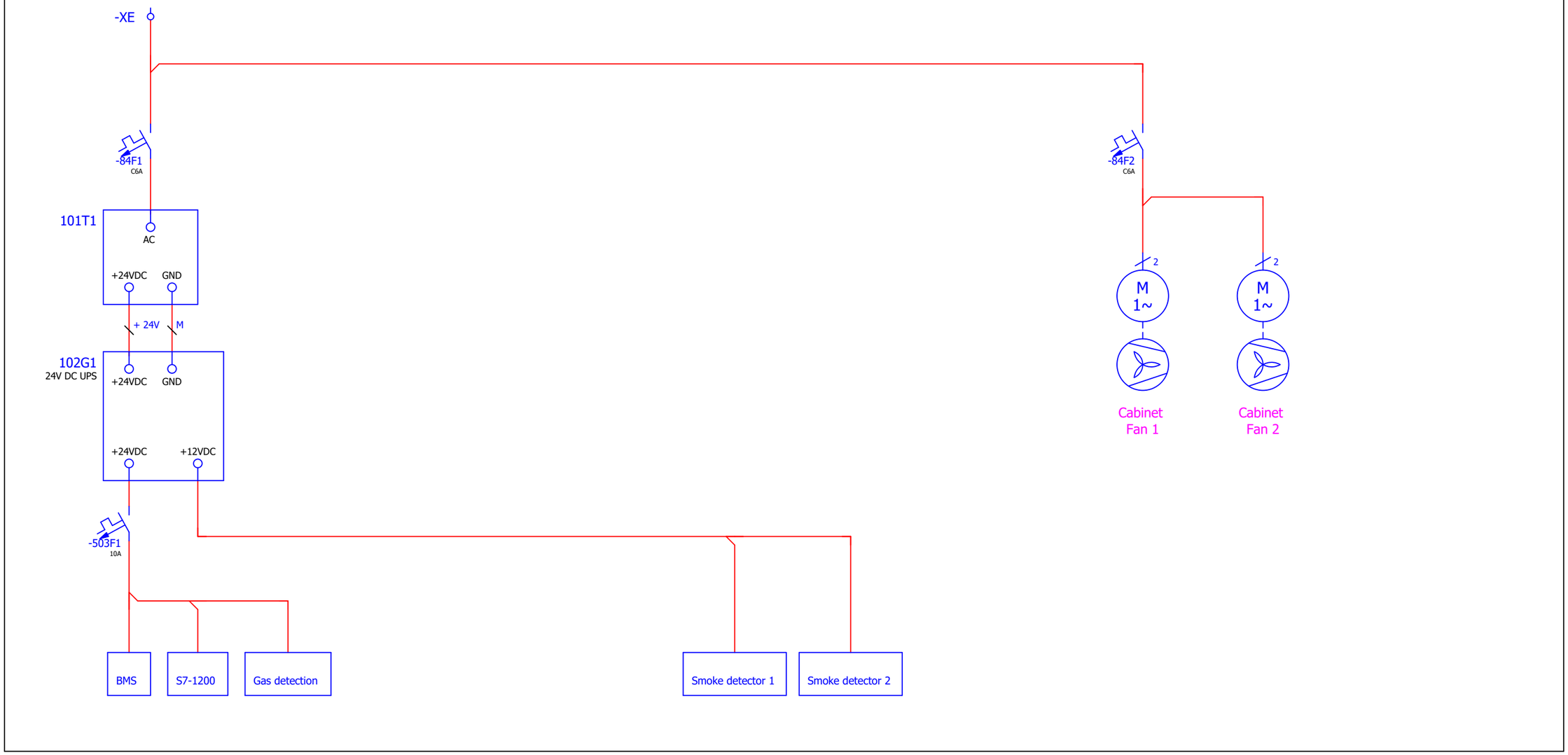
next page: 3a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2a
Date								+ total: 492

Single line diagram

Control circuit

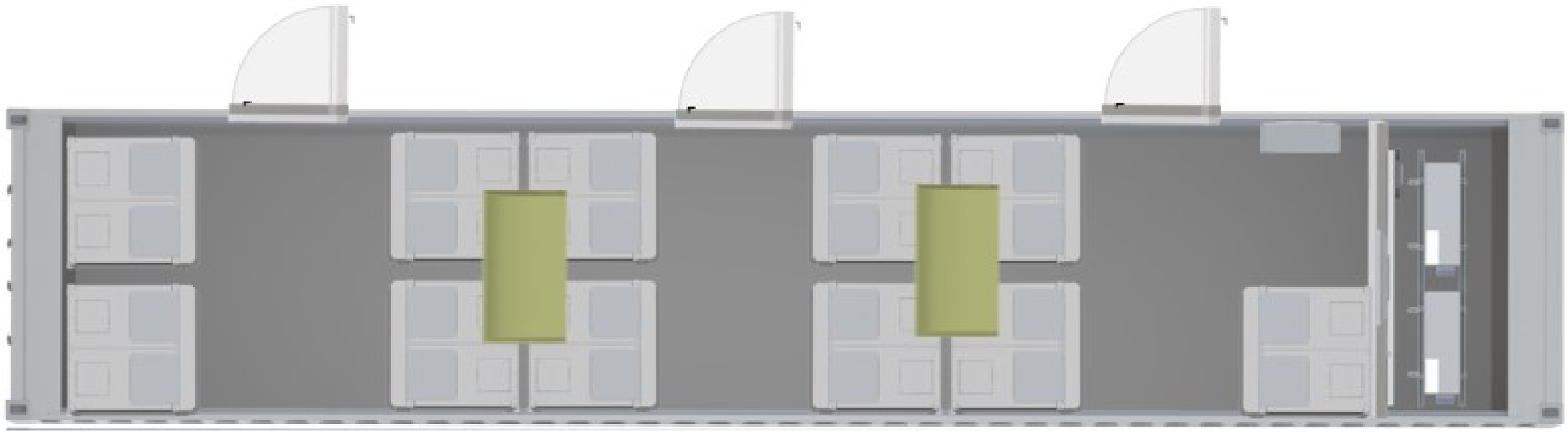
Battery Cabinet



previous page:
2a

next page:
&ELU/5a

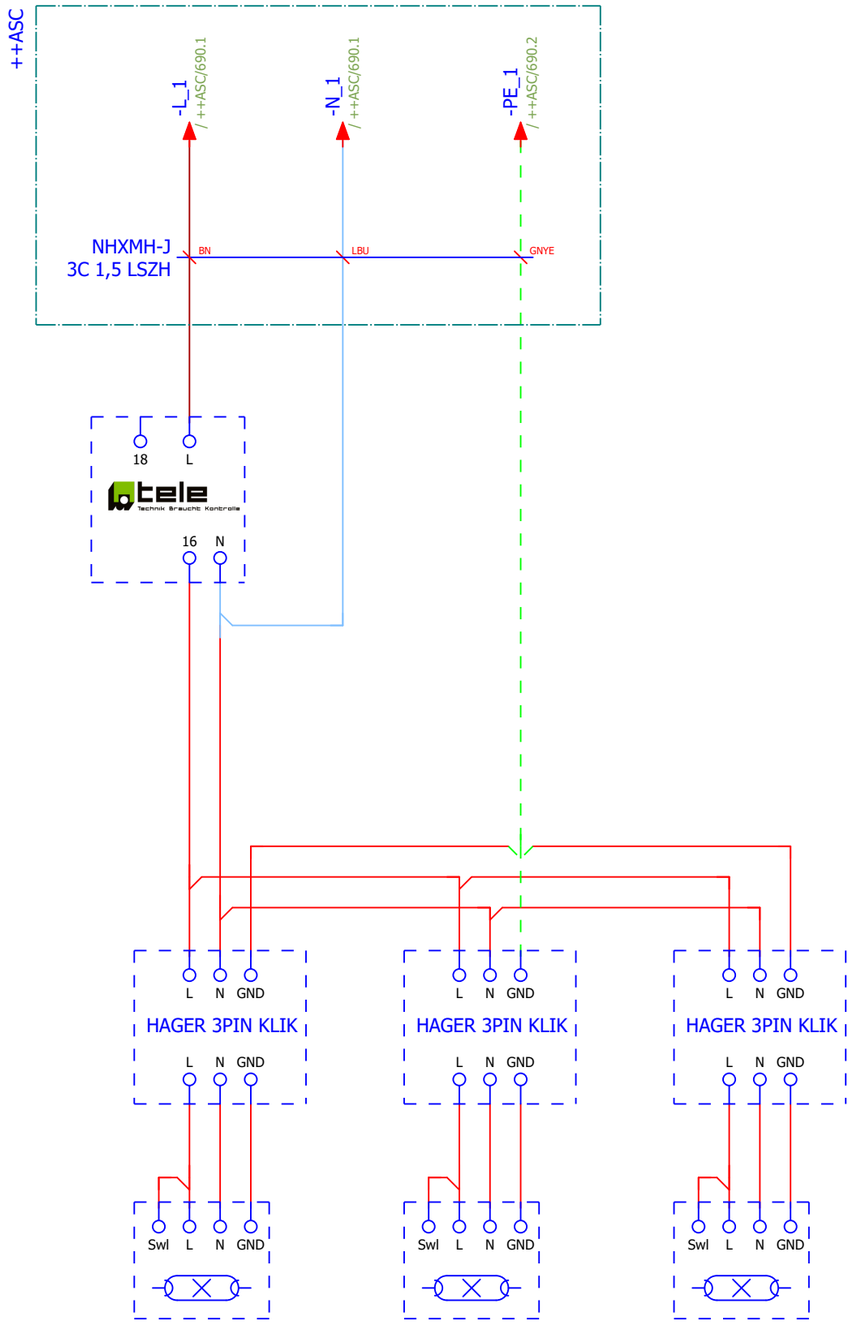
0	1	2	3	4	5	6	7	8	9



previous page:
&EFA/3a

next page:
&EFS++Container/190

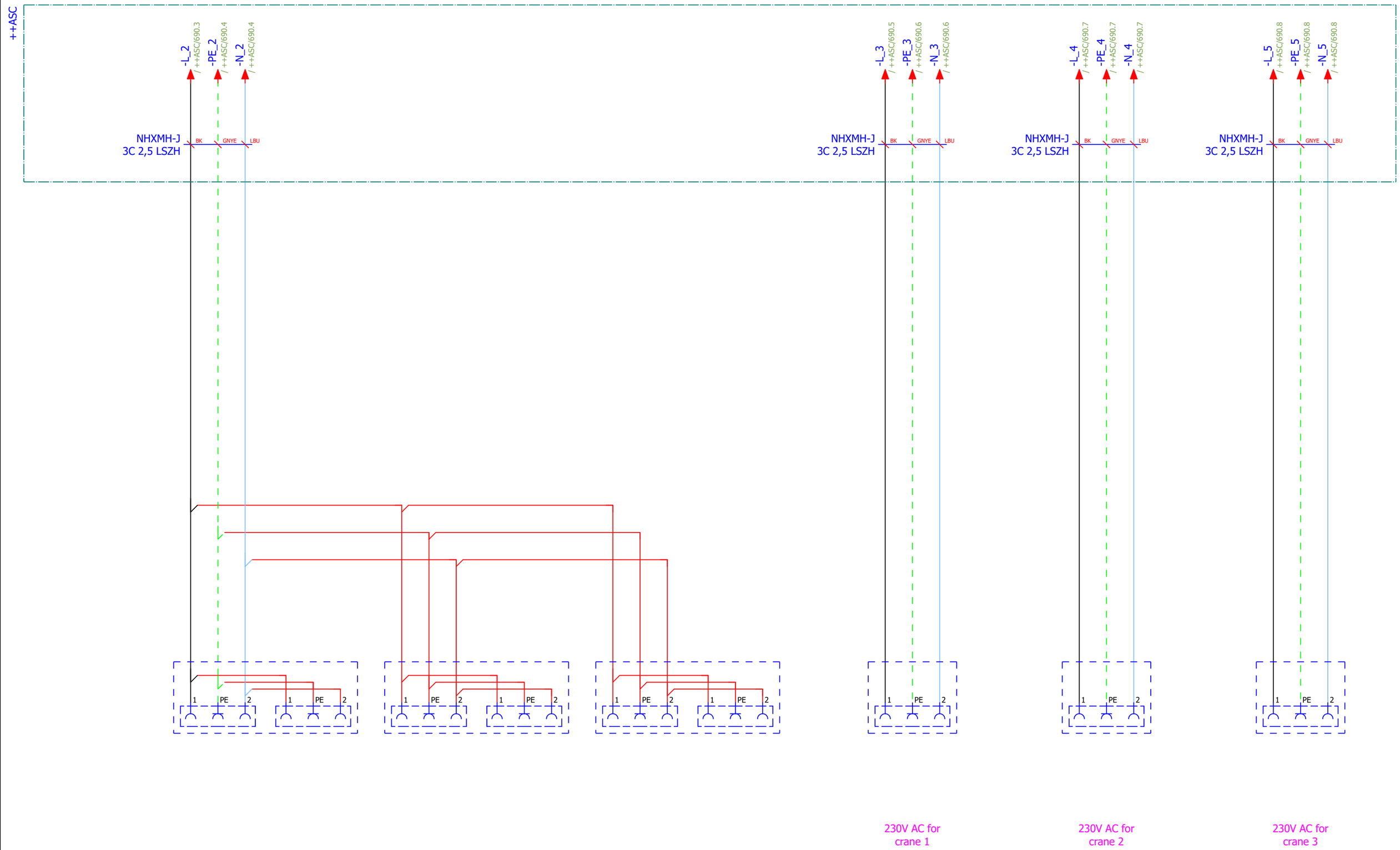
Editor	Freqcon_JD			Statron	FREQCON	Container overview	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024	Norm						& ELU Cabinet Overview	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
191

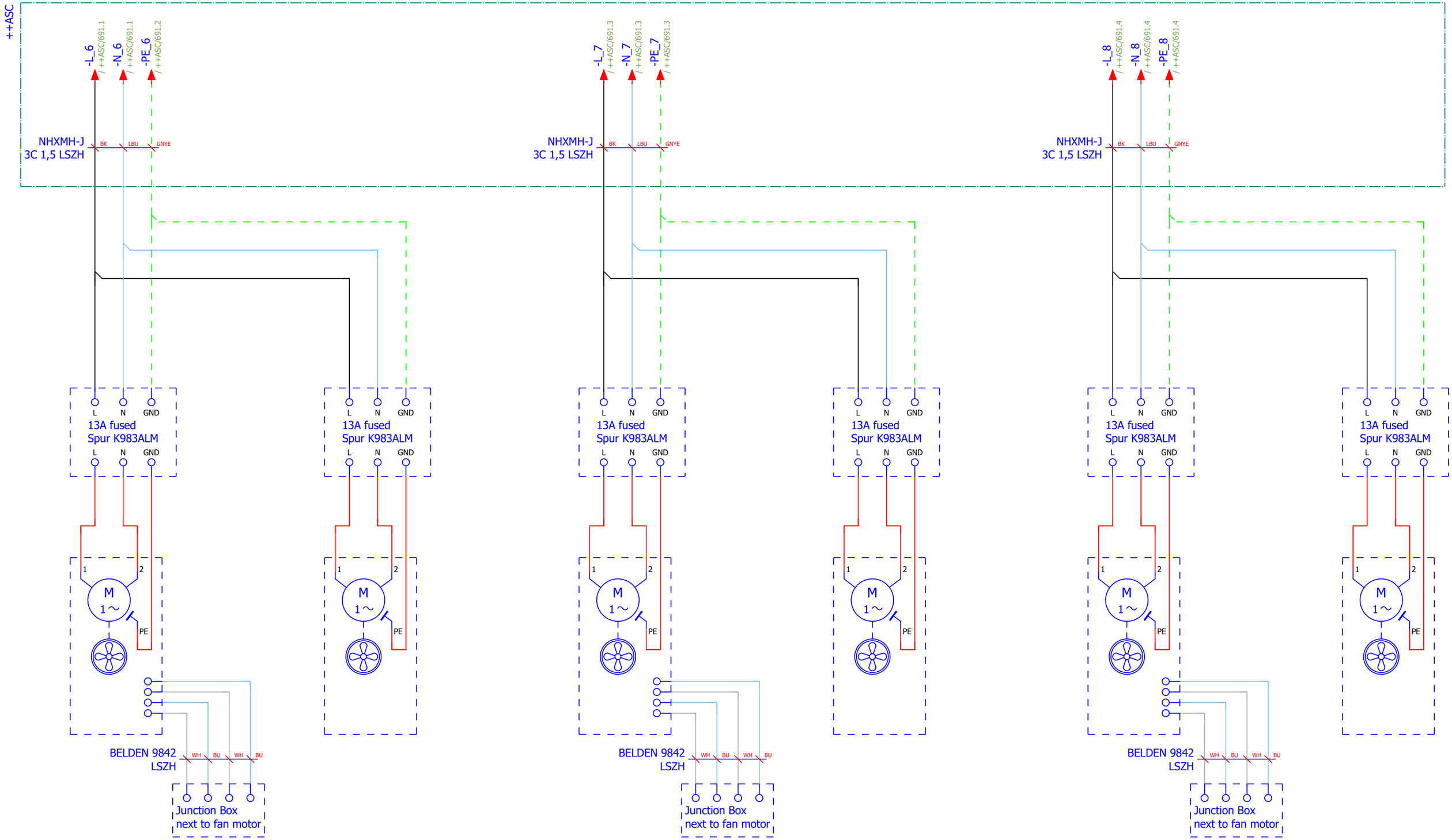
Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492



previous page: 190

next page: 192

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 191
Date								+	total: 492



230V AC for
Exhaust Unit
Battery cabinets 1-4

230V AC for
shut-off flap
Battery cabinets 1-4

230V AC for
Exhaust Unit
Battery cabinets 5-8

230V AC for
shut-off flap
Battery cabinets 5-8

230V AC for
Exhaust Unit
Battery cabinets 9-11

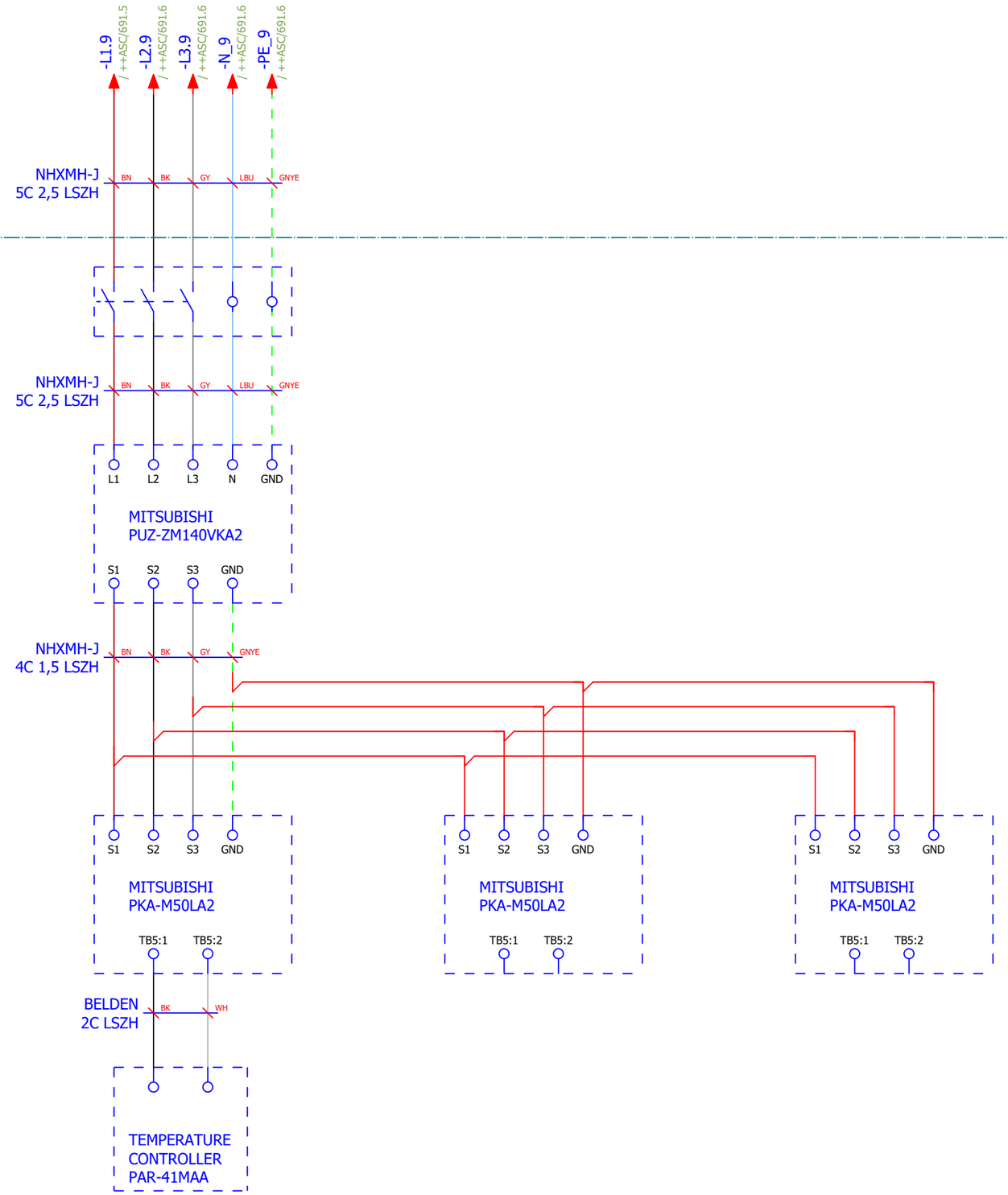
230V AC for
shut-off flap
Battery cabinets 9-11

previous page:
191

next page:
193

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 192
Date								+ total: 492

++ASC

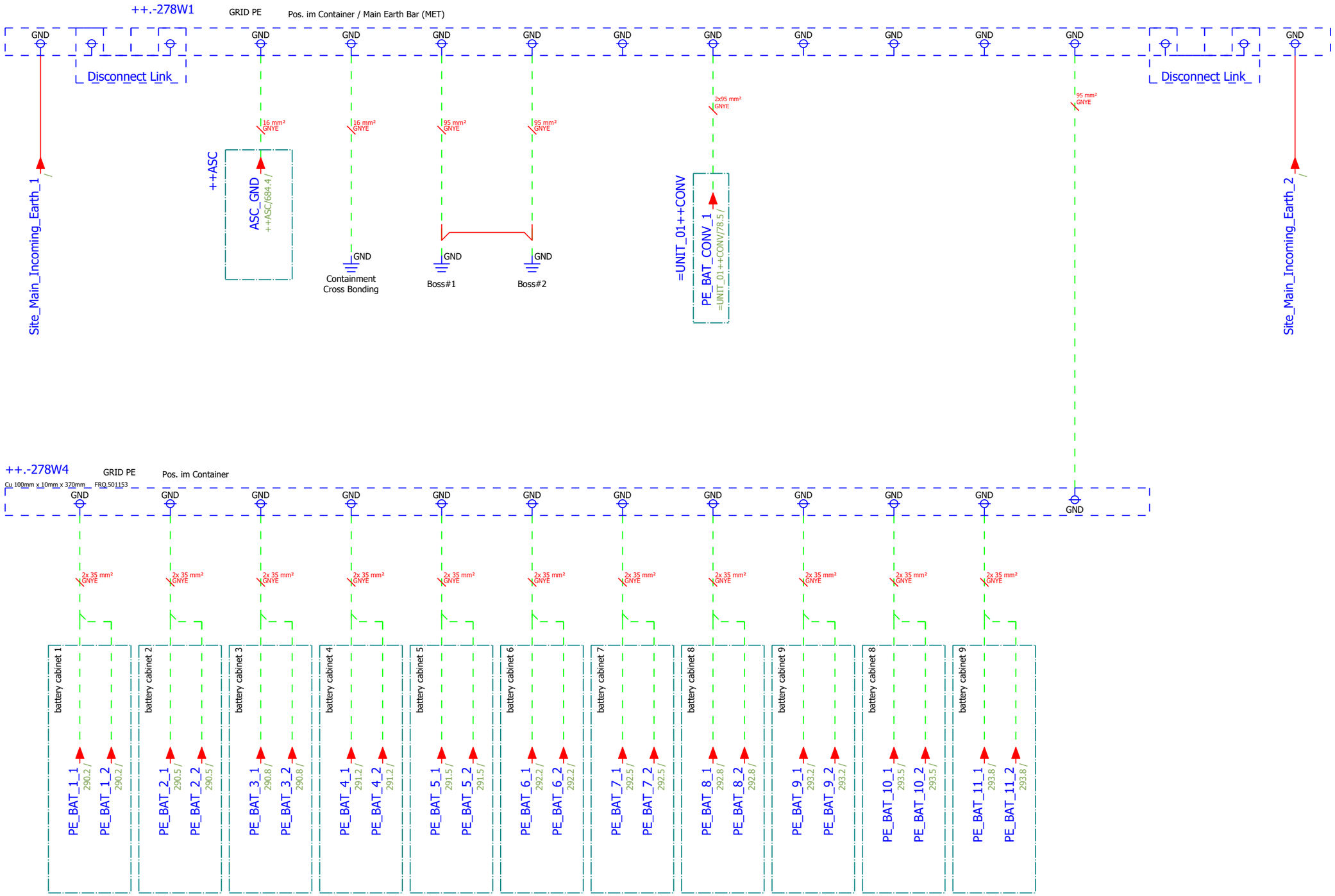


previous page:
192

next page:
278

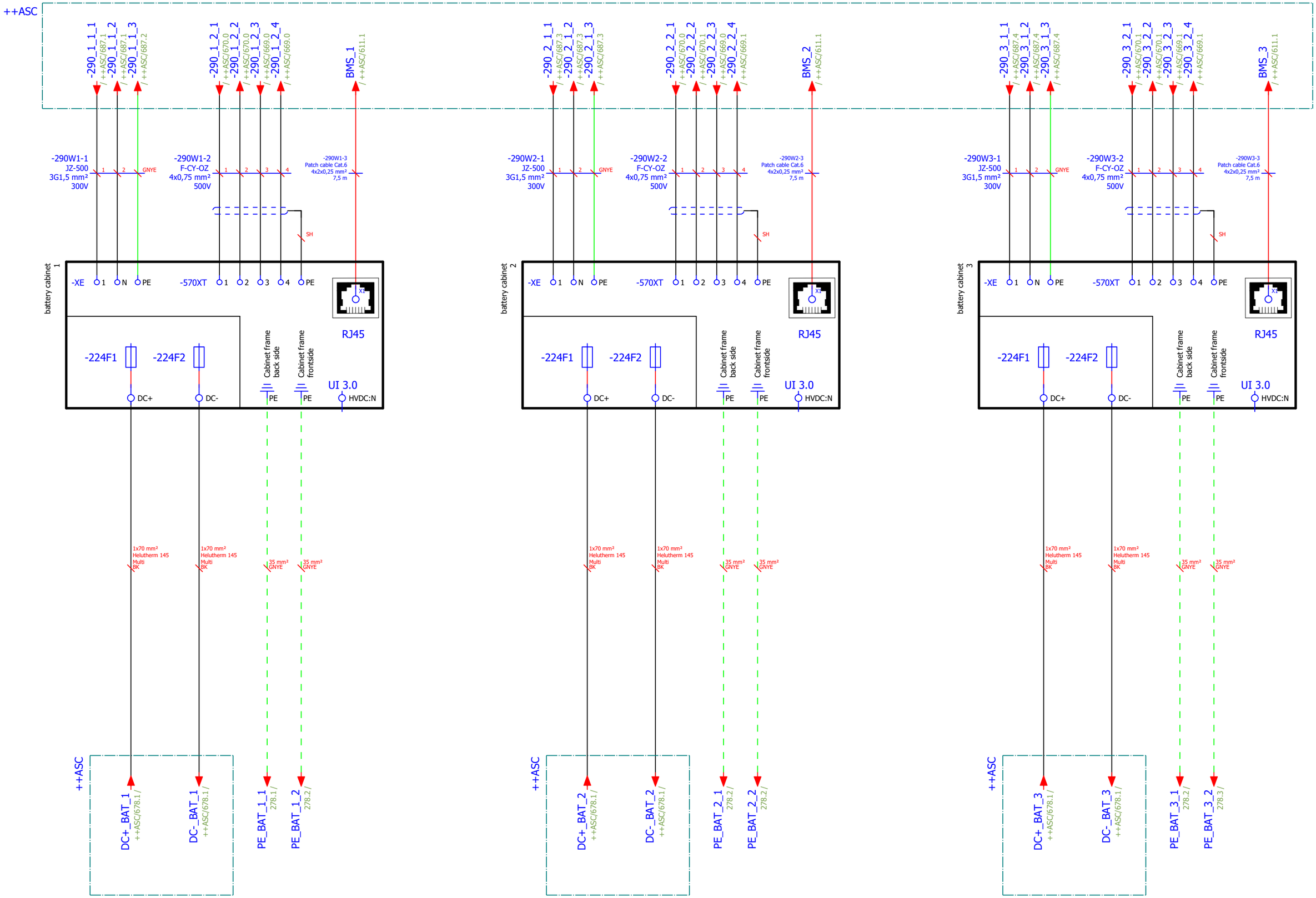
Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 193
Date								+	total: 492

Busbars PE



previous page: 193

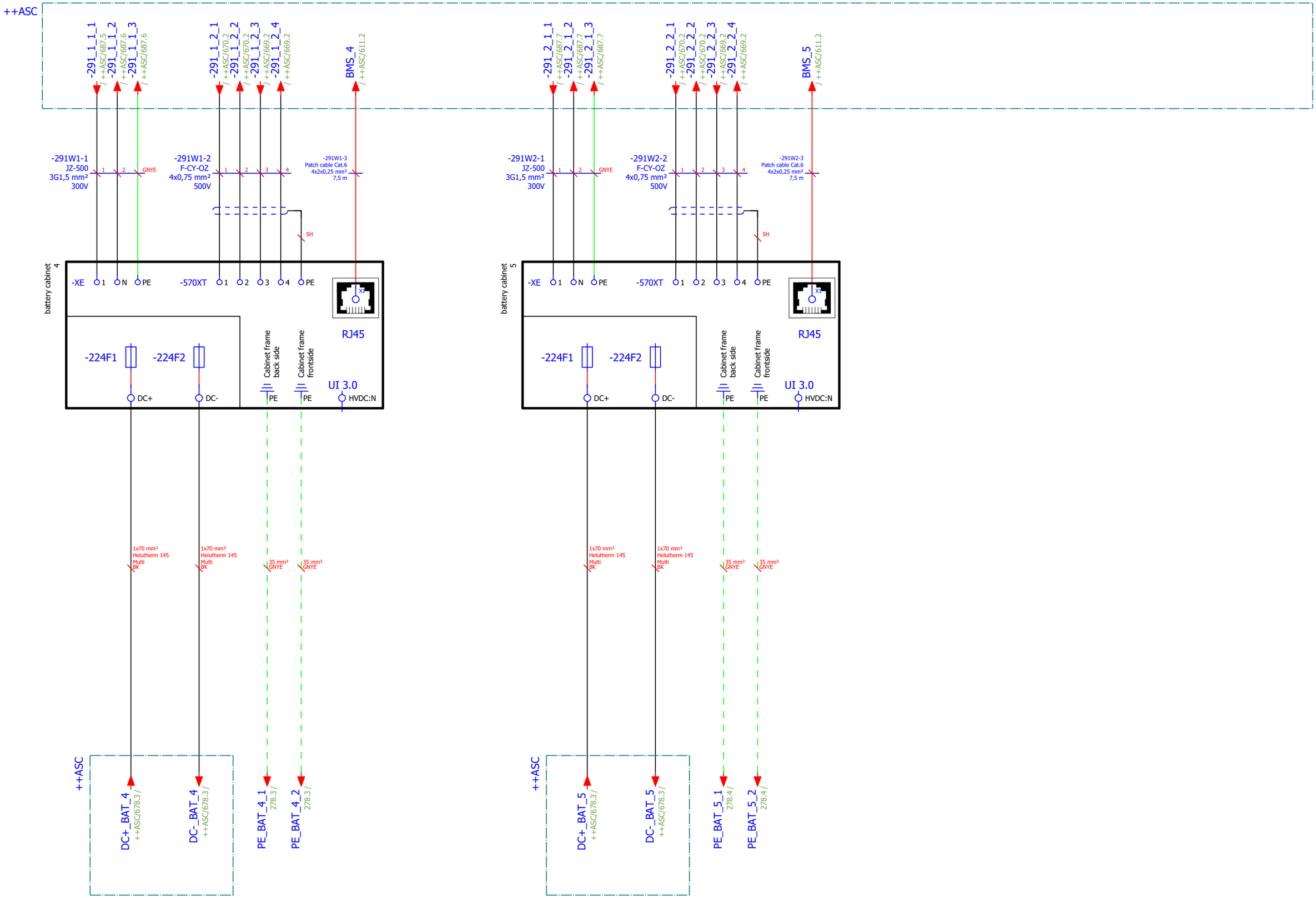
next page: 290



previous page: 278

next page: 291

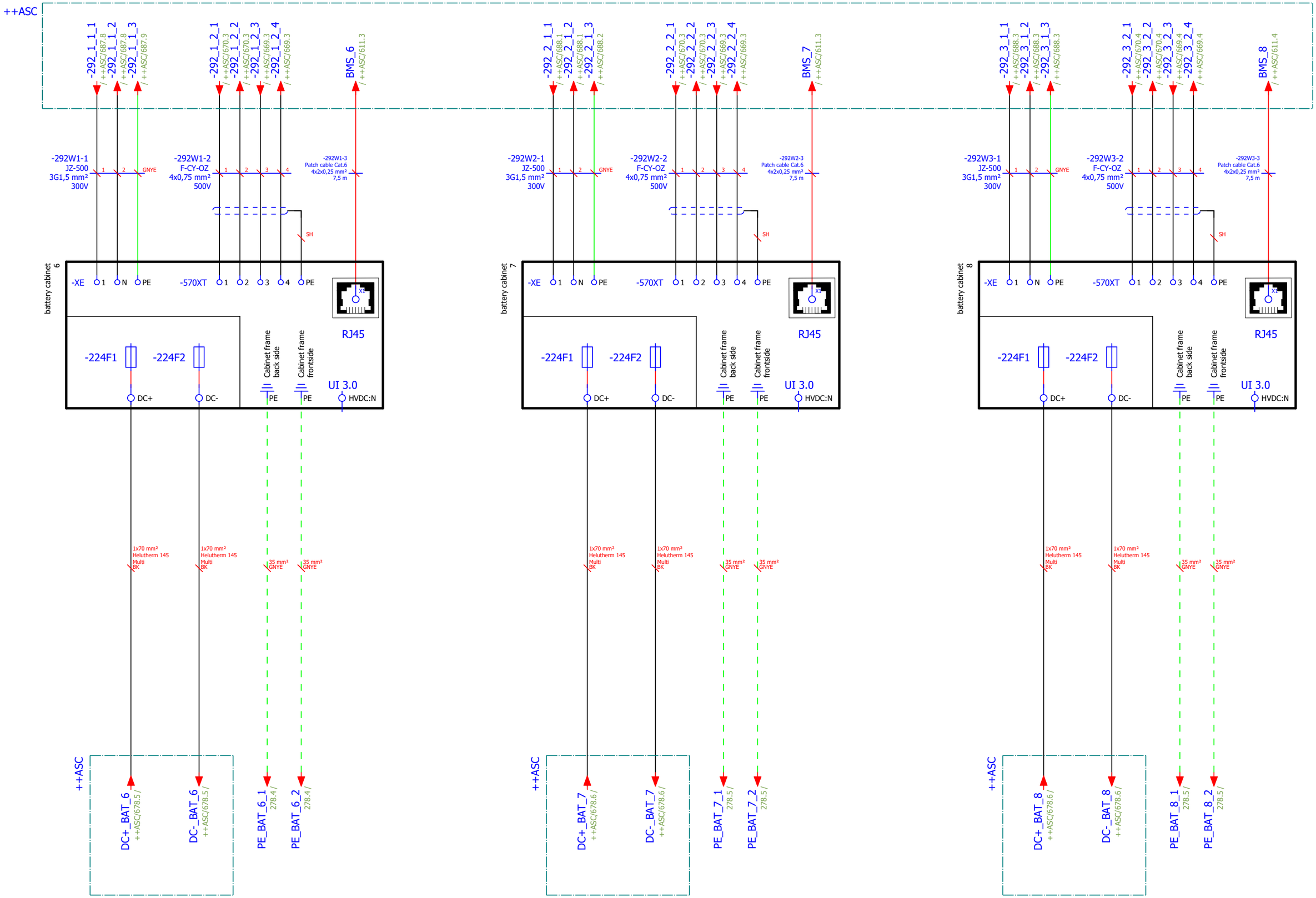
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 1-3	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 290
Date								+	total: 492



previous page: 290

next page: 292

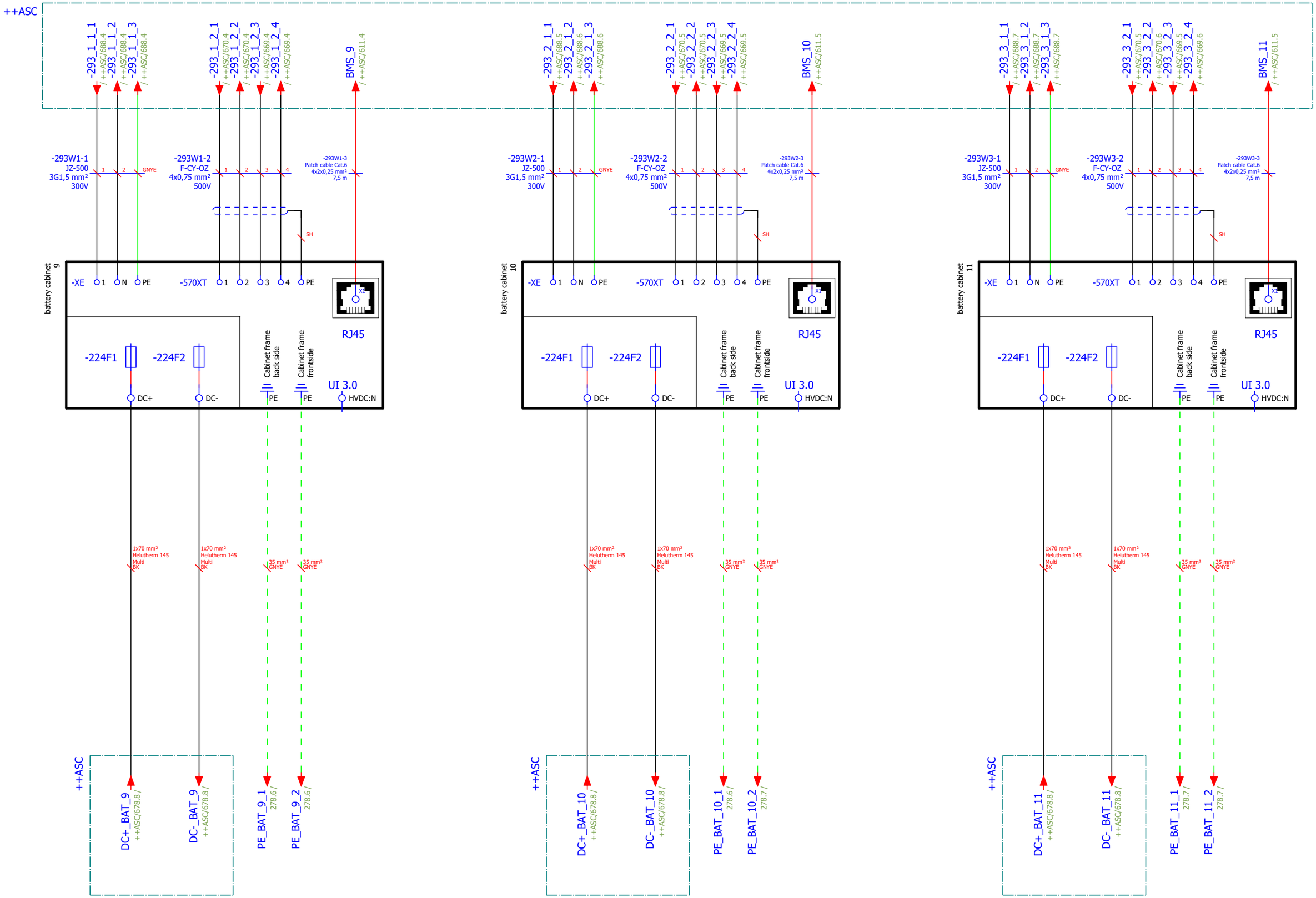
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 4+5	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 291
Date								+	total: 492



previous page: 291

next page: 293

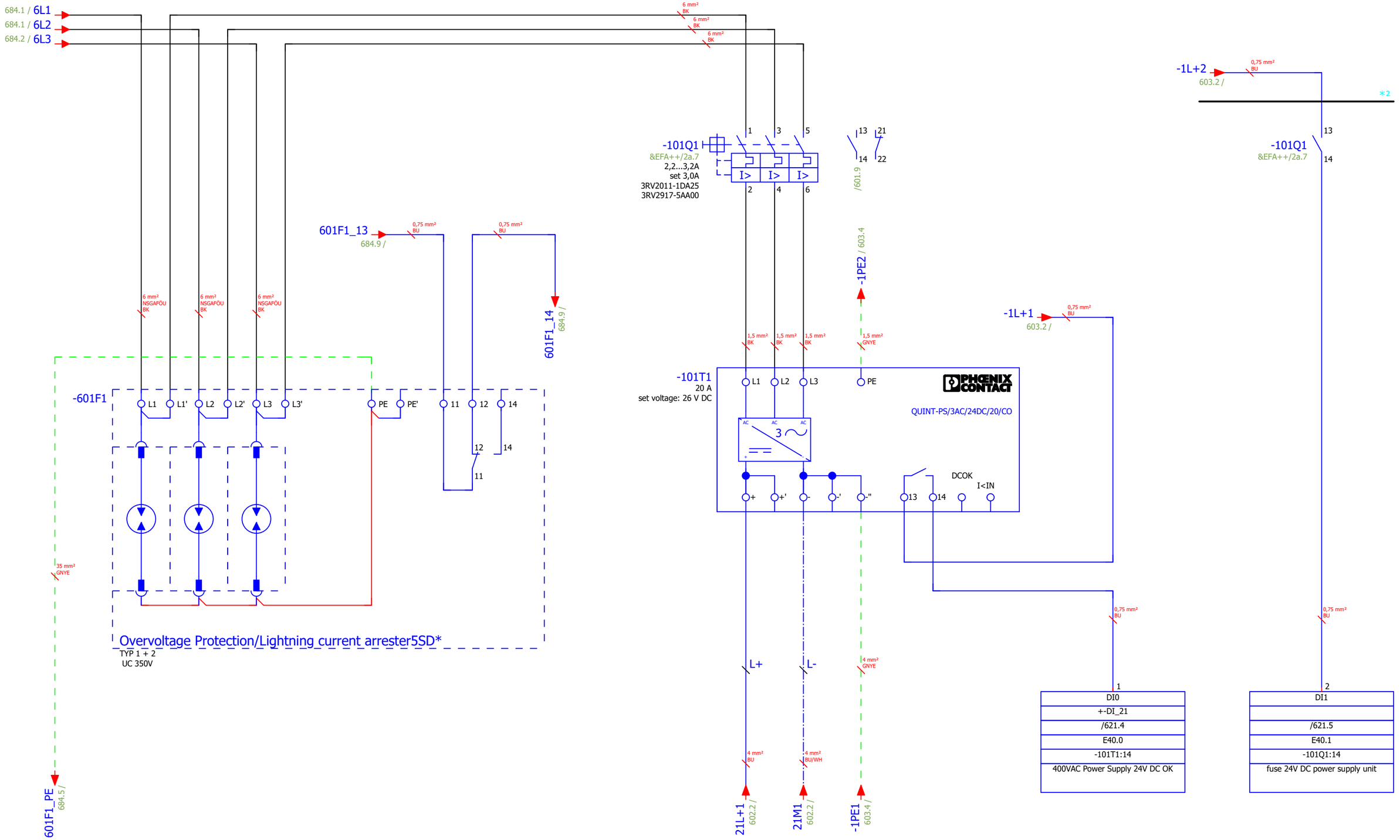
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 6-8	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 292
Date								+	total: 492



previous page: 292

next page: ++ASC/601

Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 9-11	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 293
Date								+	total: 492



previous page:
++Container/293

Power supply unit from 400V AC

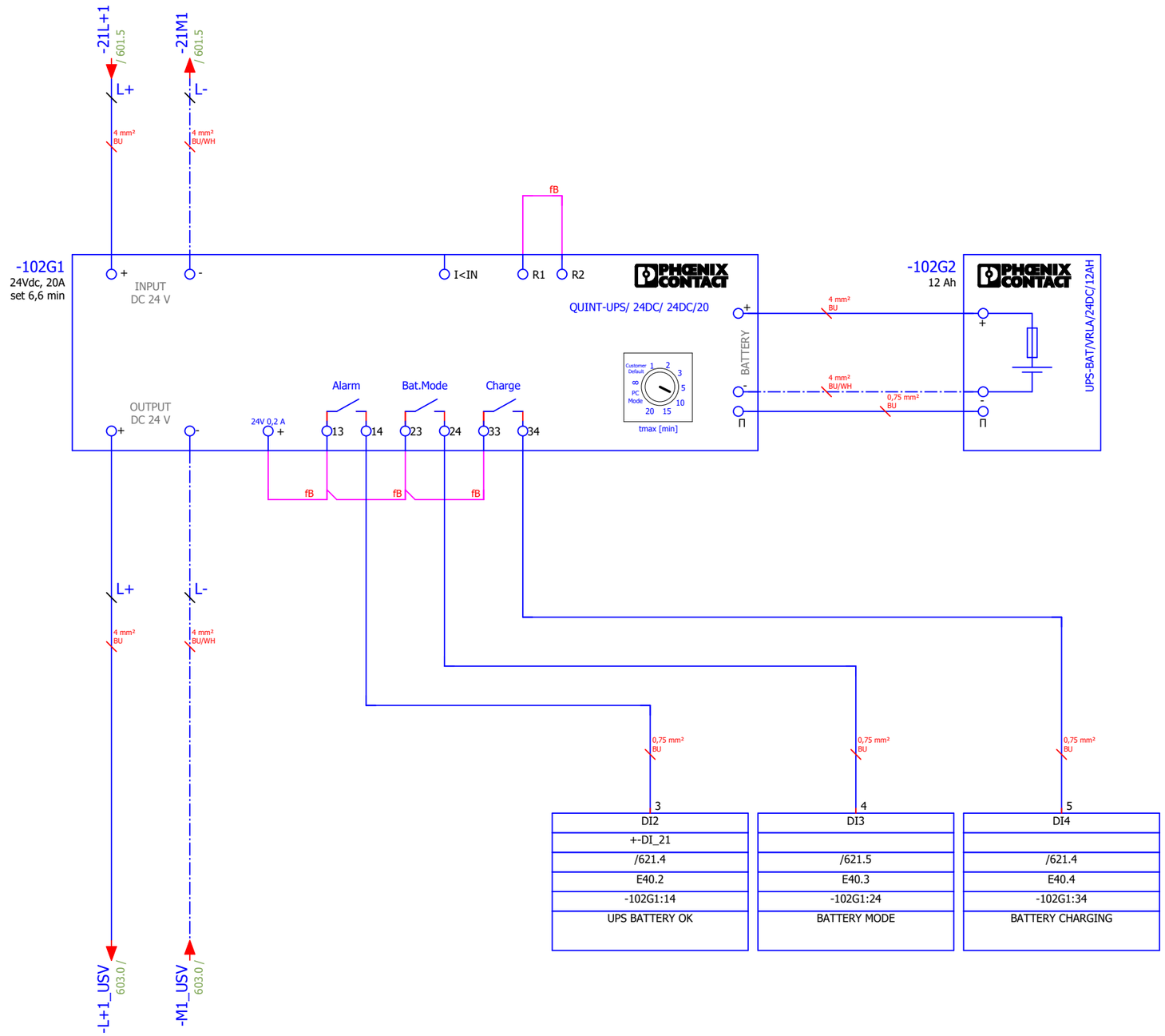
400VAC
Power Supply
24V DC OK

fuse
24V DC power supply unit

next page:
602

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

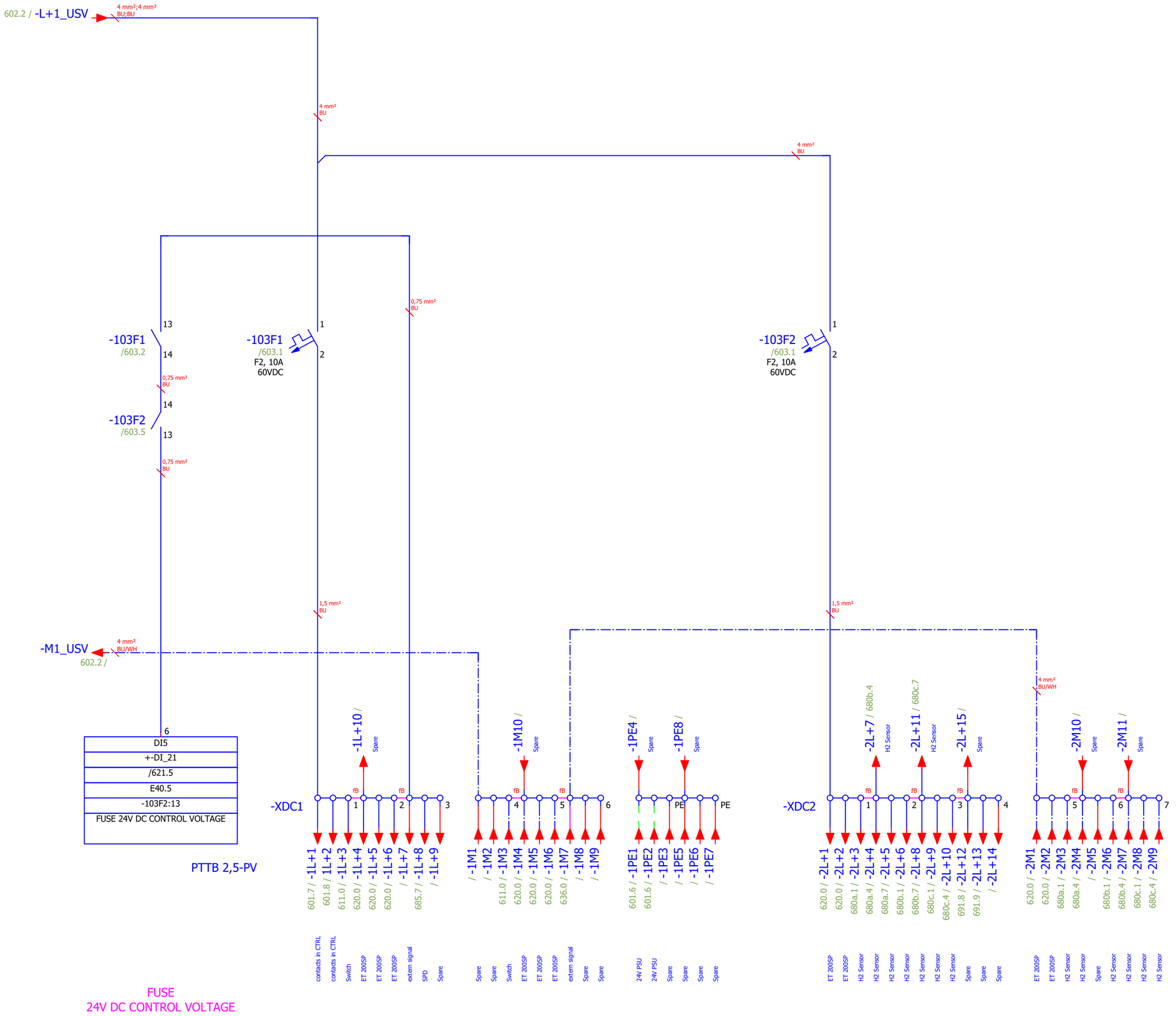
page: 601
total: 492



previous page:
601

next page:
603

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 602
Date								+ — total: 492

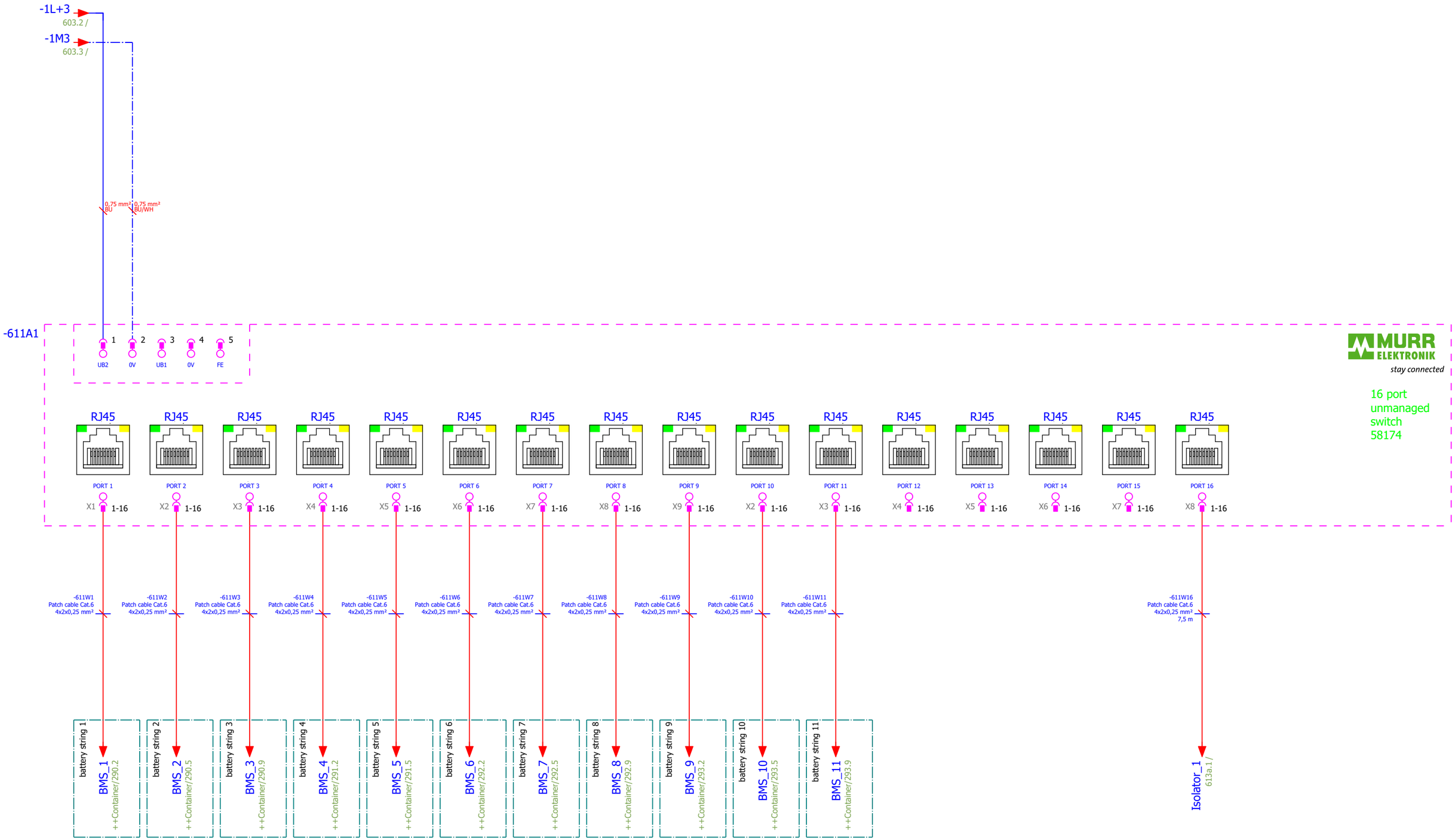


previous page:
602

next page:
611

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_02	Battery Container 1
Date	21.01.2025							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxiliary cabinet
Date								+	

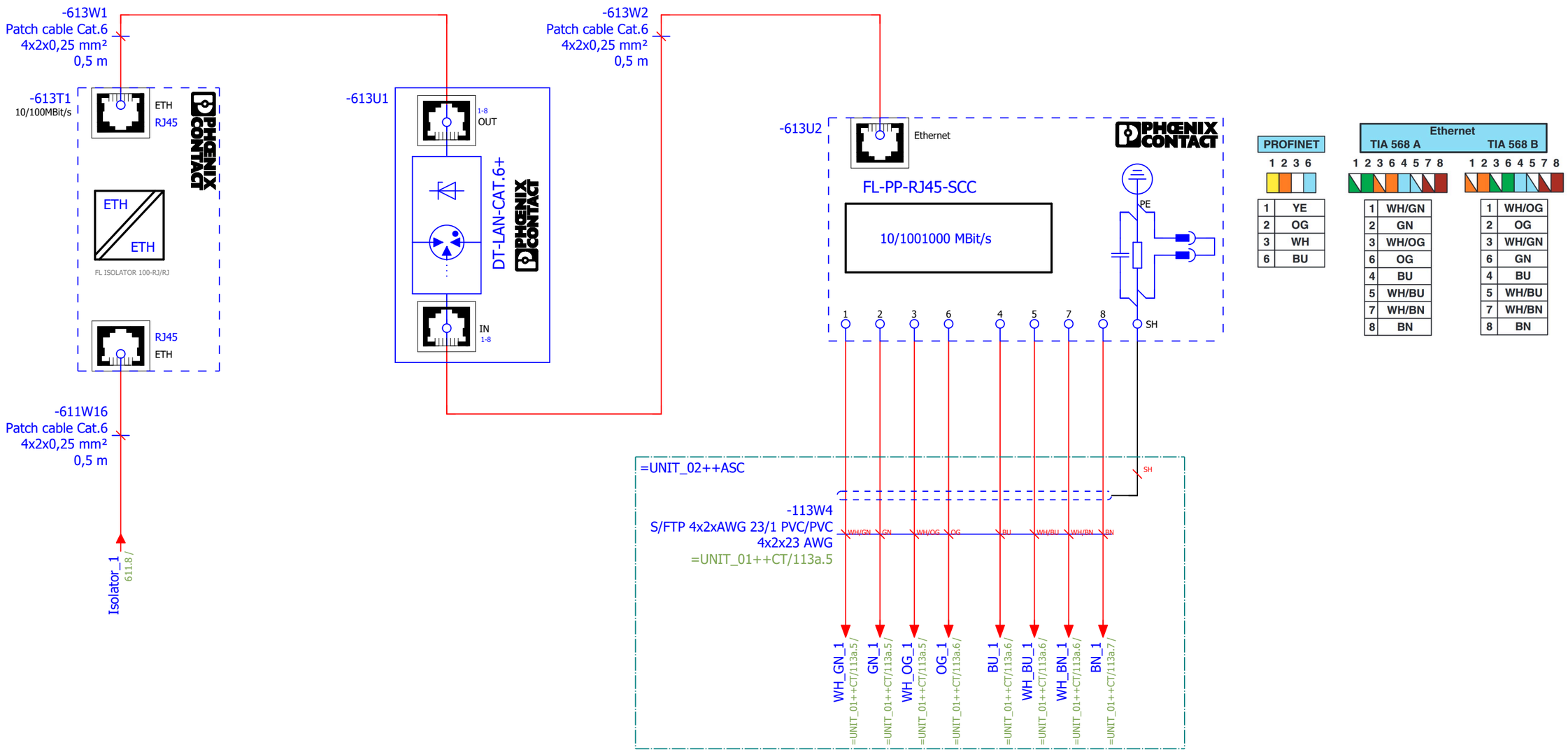
page: 603
total: 492



previous page: 603

next page: 613a

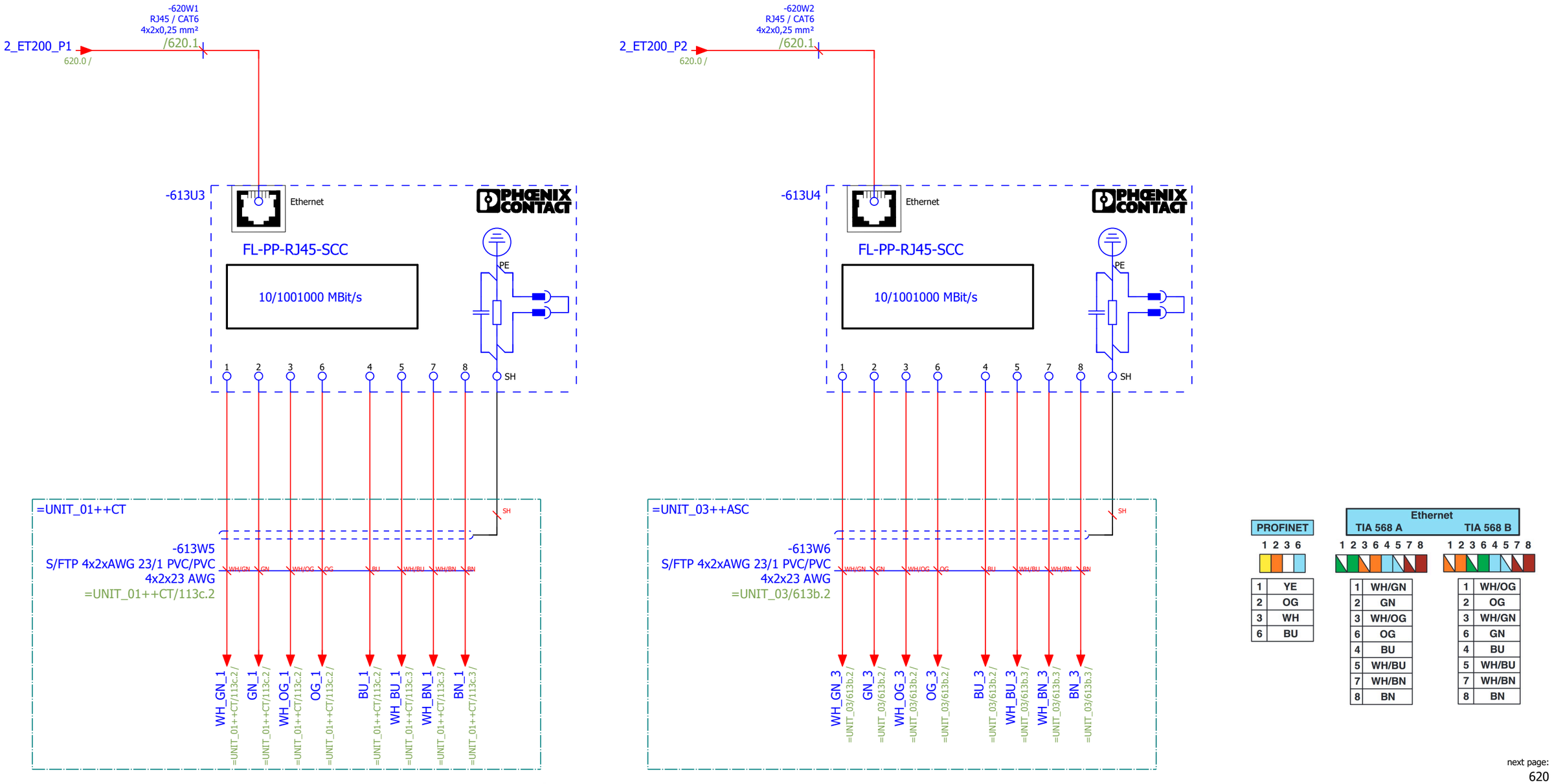
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 492



previous page:
611

next page:
613b

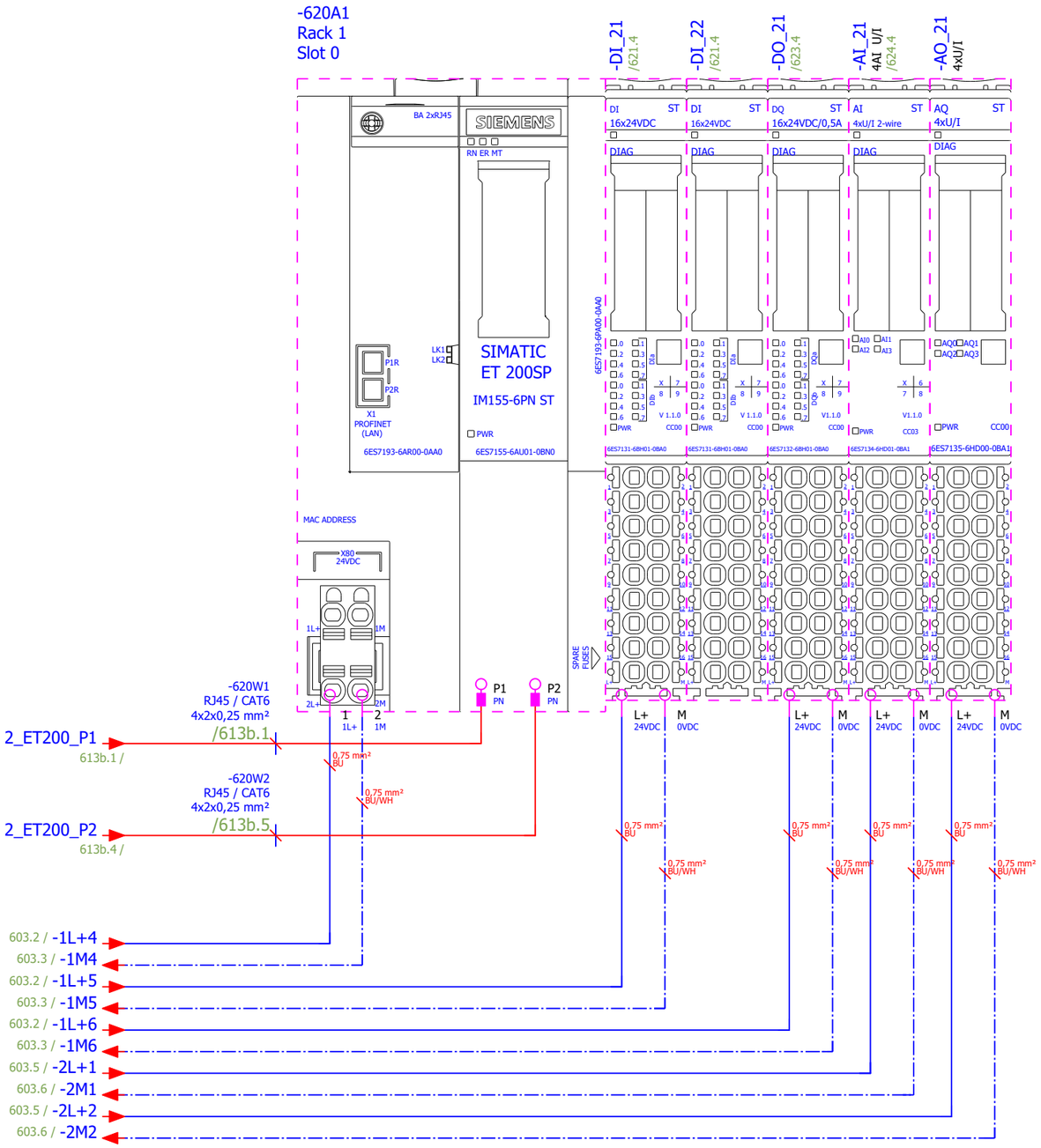
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	25.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 613a
Date								+	total: 492



previous page:
613a

next page:
620

Editor	Freqcon_DG			Statron	FREQCON	PROFINET	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613b
Date								+		total: 492



previous page:
613b

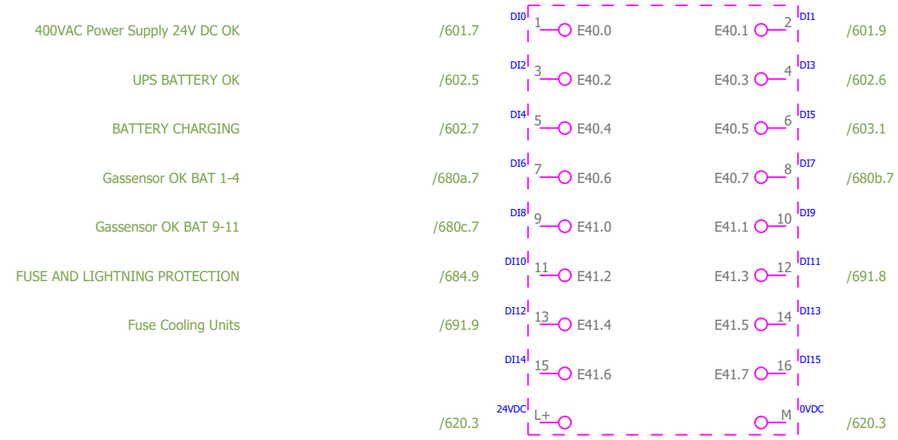
next page:
621

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC ASC	20250805_V2.0	= UNIT_02	Battery Container 1
Date	03.12.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 620
total: 492

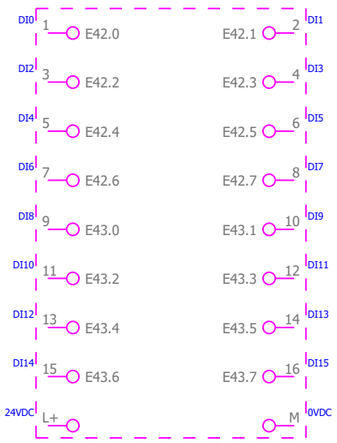
-DI_21

/620.3



-DI_22

/620.3



previous page: 620

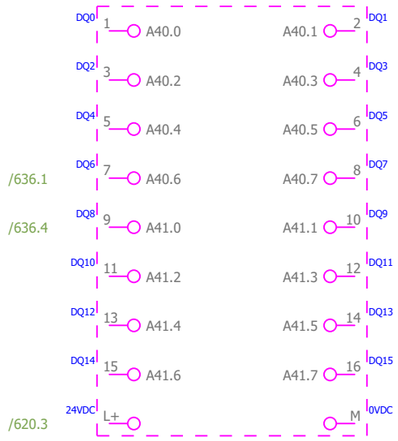
next page: 623

Editor	Freqcon_DG			Statron	FREQCON	ET200SP DIGITAL INPUTS DI_21 + DI_22	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	03.12.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 621
Date								+	total: 492

0	1	2	3	4	5	6	7	8	9

-DO_21

/620.3



230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4 /636.1

230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11 /636.4

/620.3

/636.2 230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8

/620.4

previous page: 621

next page: 624

Editor	Freqcon_JD			Statron	FREQCON	ET200SP DIGITAL OUTPUTS DO_21	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 623
Date								+	total: 492

-AI_21

/620.4



gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

/620.4

/680b.2 gas concentration BAT 5-8

/680b.2 gas concentration BAT 5-8

/620.4

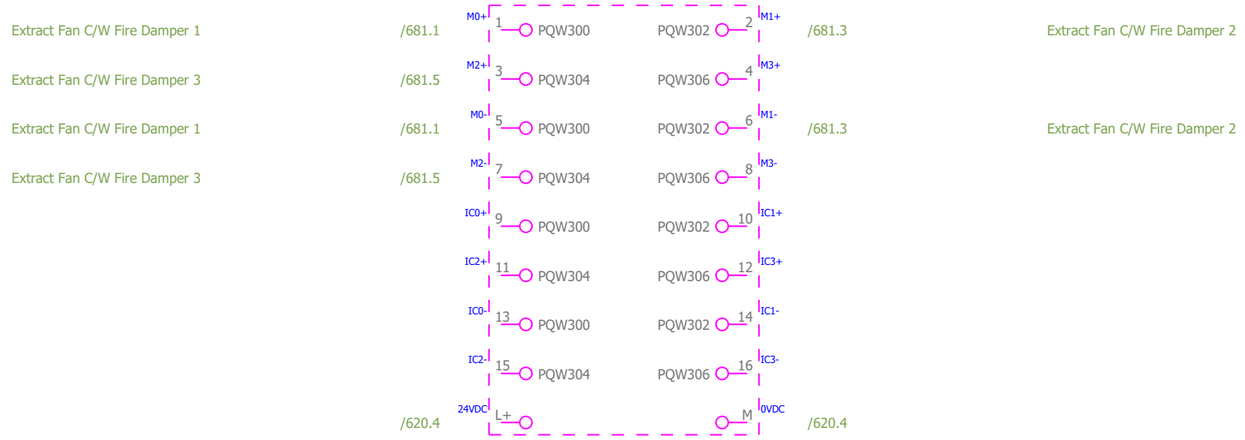
previous page: 623

next page: 625

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_21	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 624
Date								+	total: 492

-AO_21

/620.4



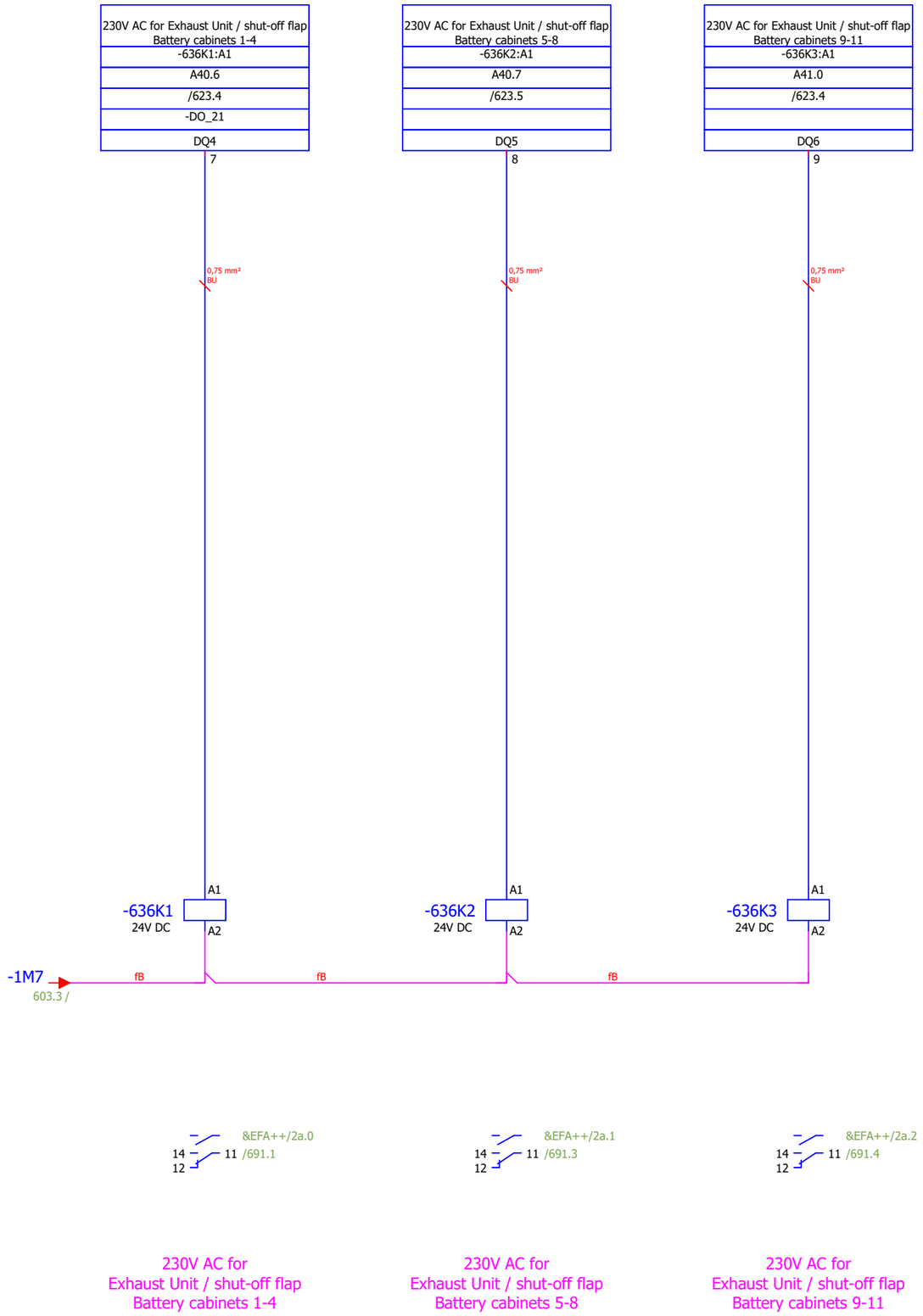
previous page: 624

next page: 636

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG OUTPUTS AO_21	20250805_V2.0	= UNIT_02	Battery Container 1
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 625

total: 492

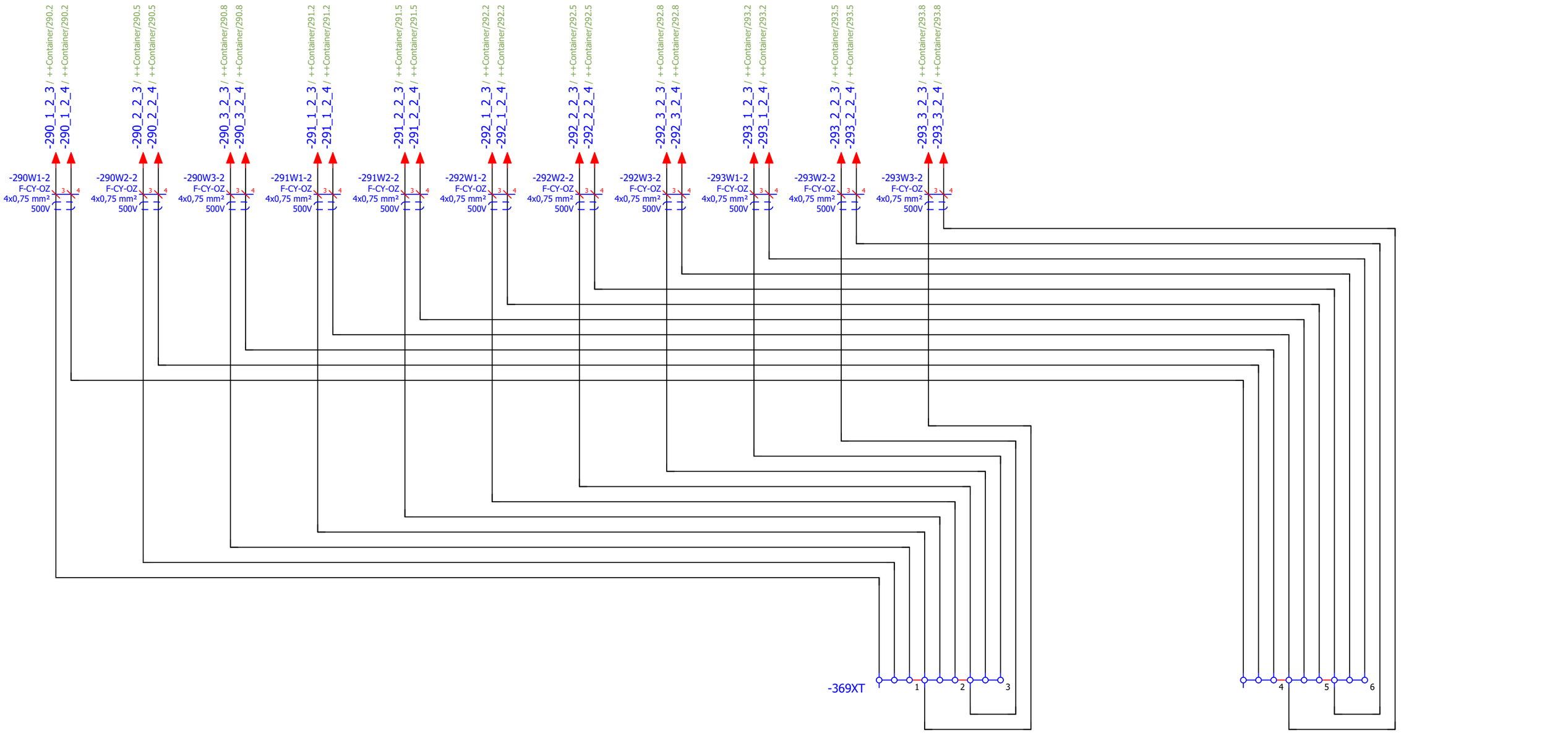


previous page: 625

next page: 669

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FIRE DAMPER	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 636
total: 492



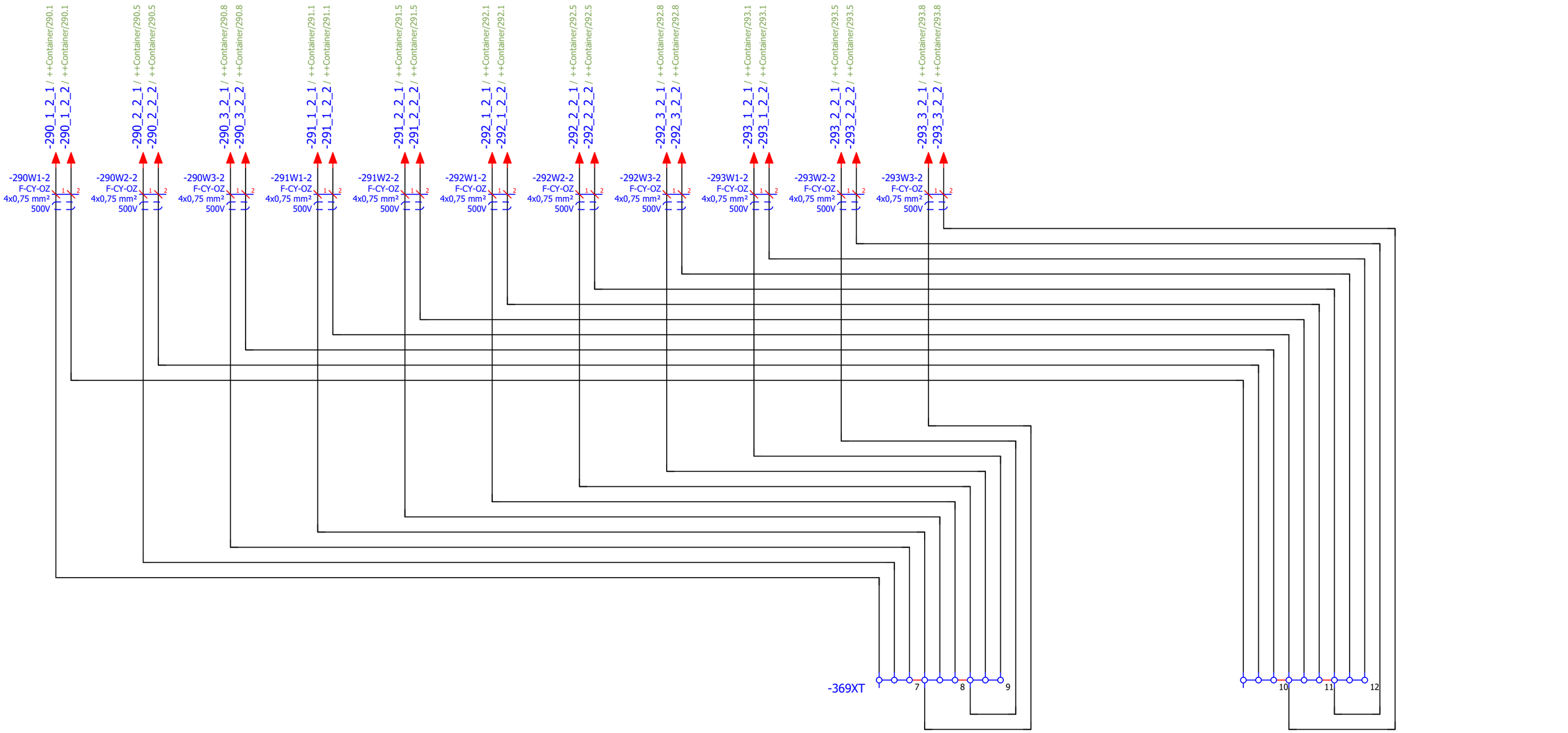
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page: 636

next page: 670

Editor	Freqcon_JD			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 492



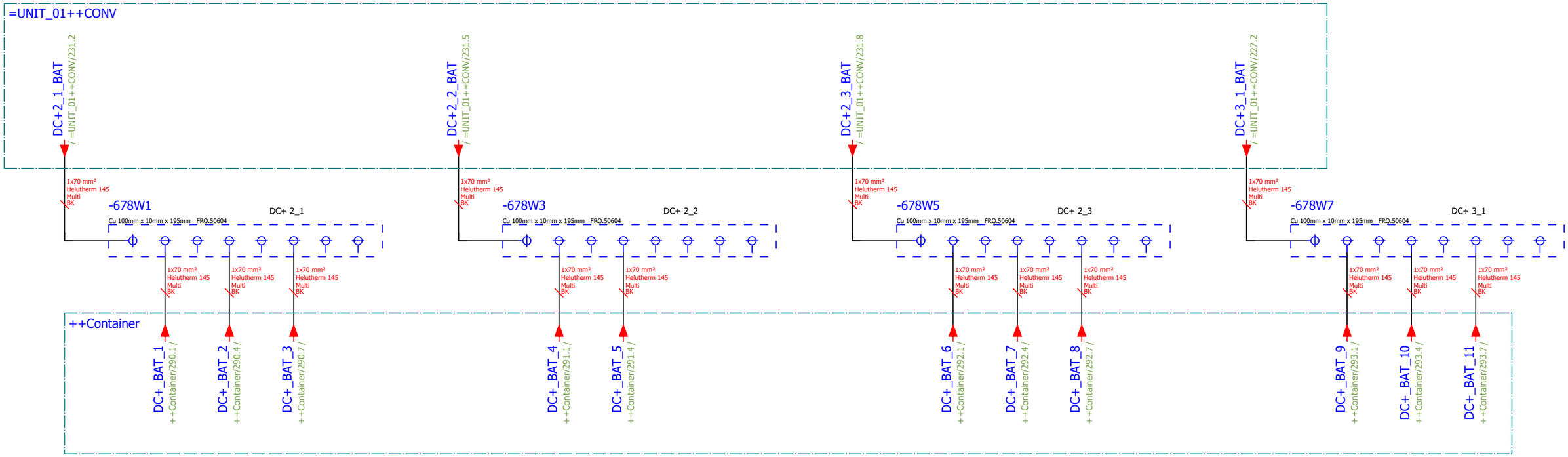
battery cabinet gas
potential-free contacts
customer

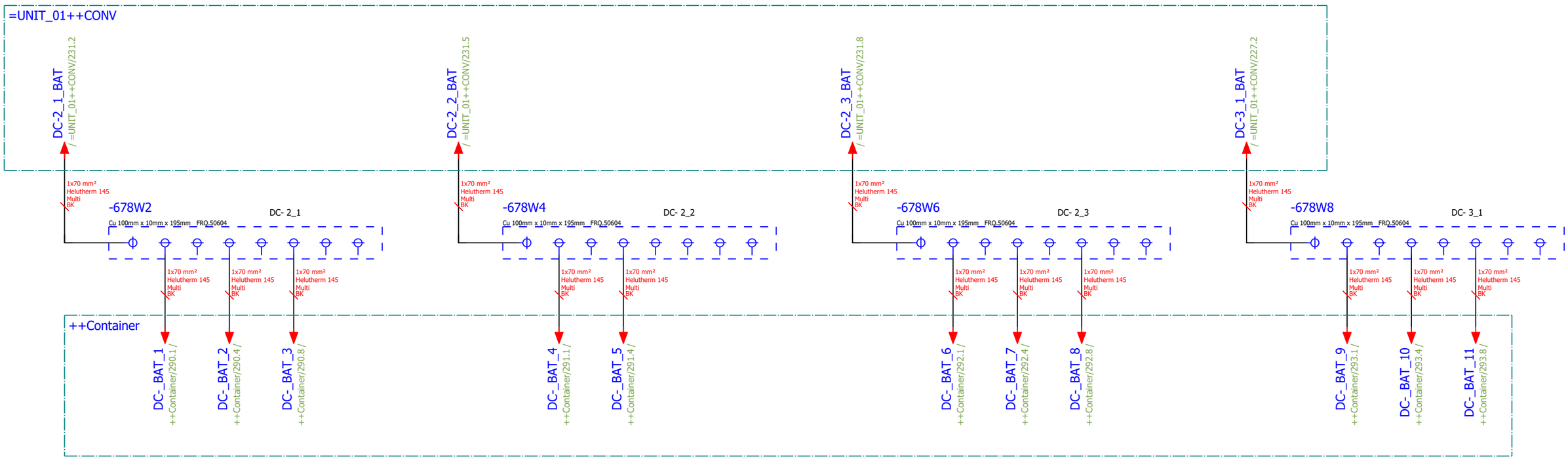
battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
678

Editor	Freqcon_JD			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 492





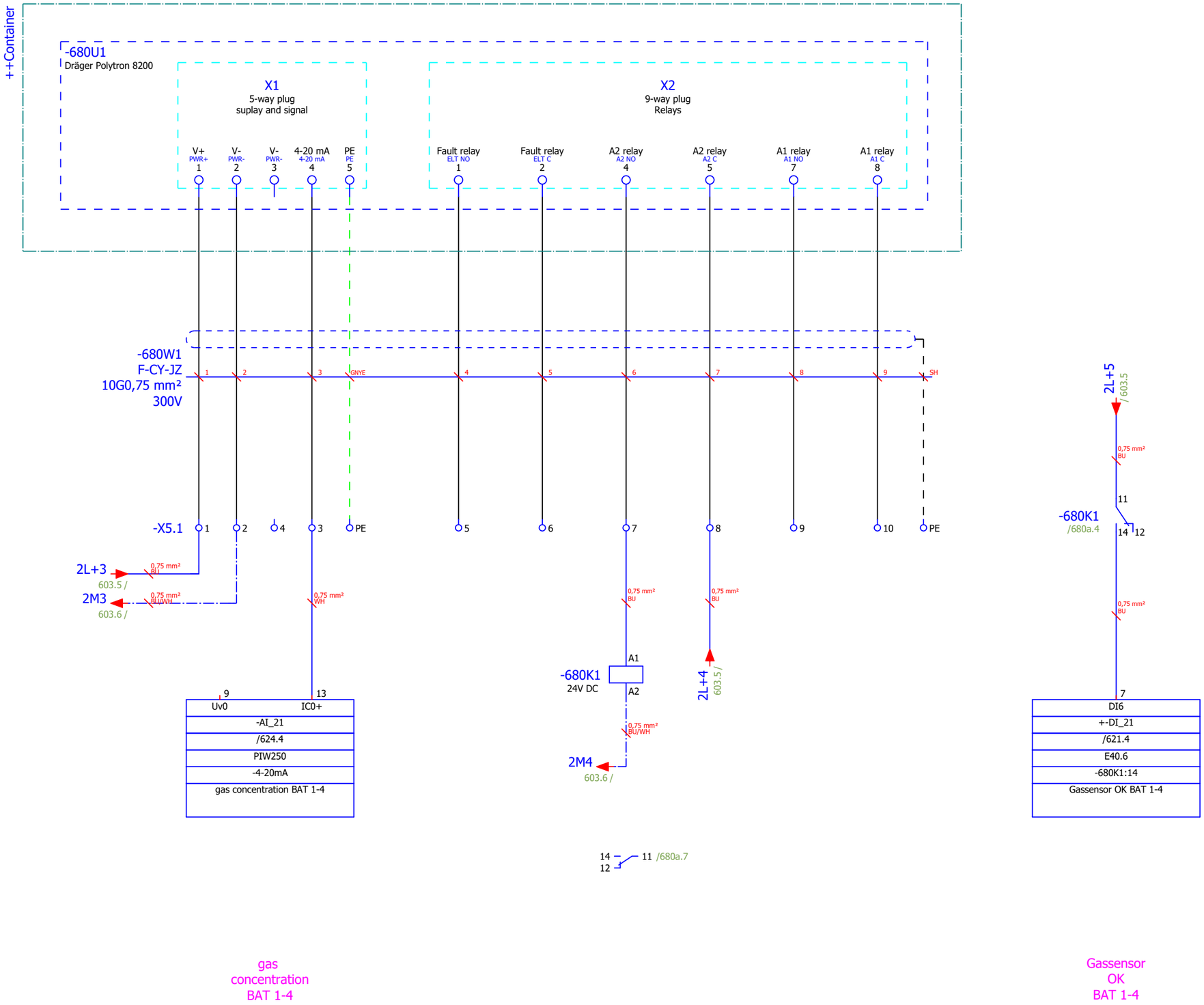
previous page: 670

next page: 680a

Editor	Freqcon_JD			Statron	FREQCON	DC BATTERY CABINETS	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 678

total: 492



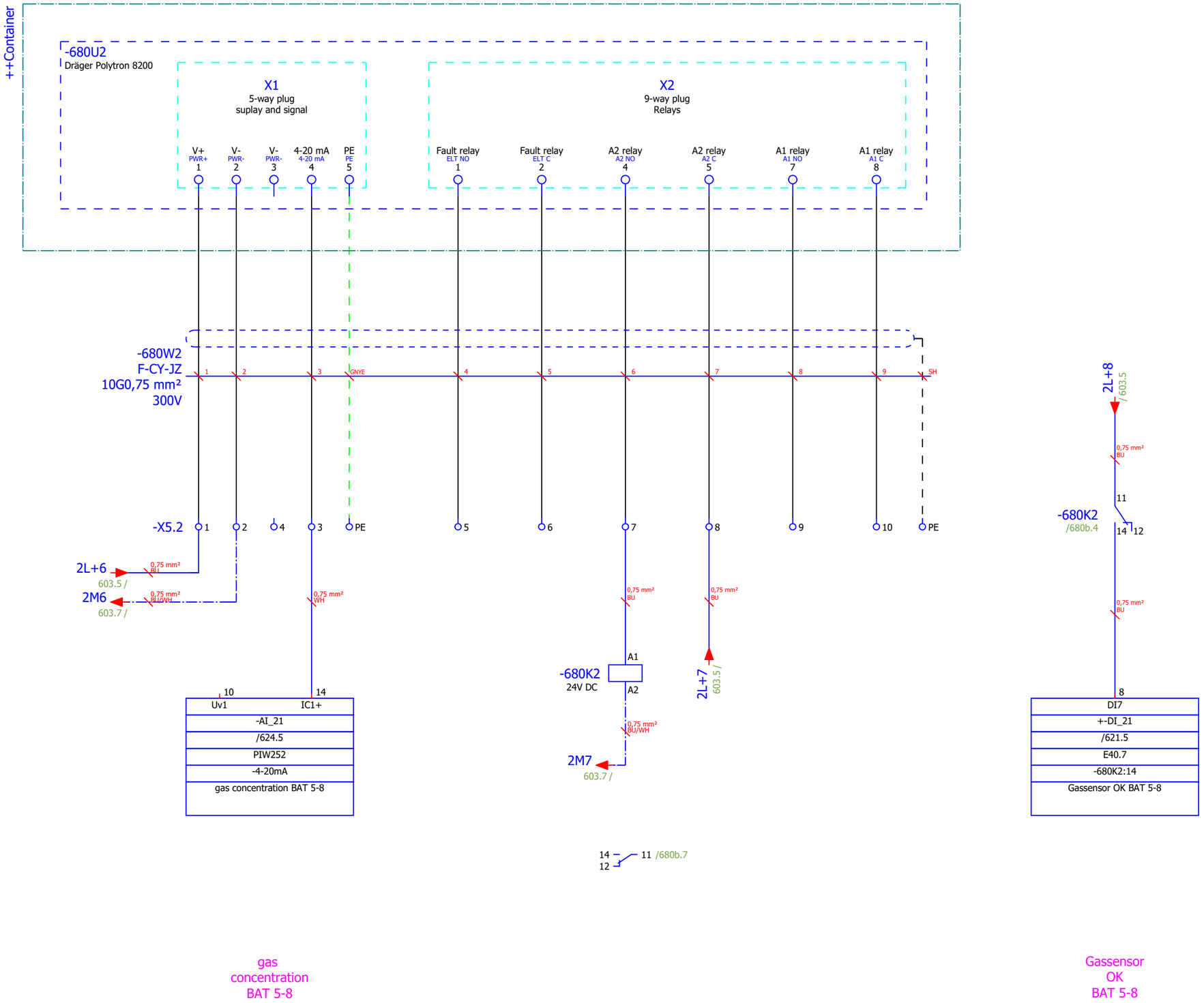
gas concentration BAT 1-4

Gassensor OK BAT 1-4

previous page: 678

next page: 680b

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 1-4	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680a
Date								+	total: 492



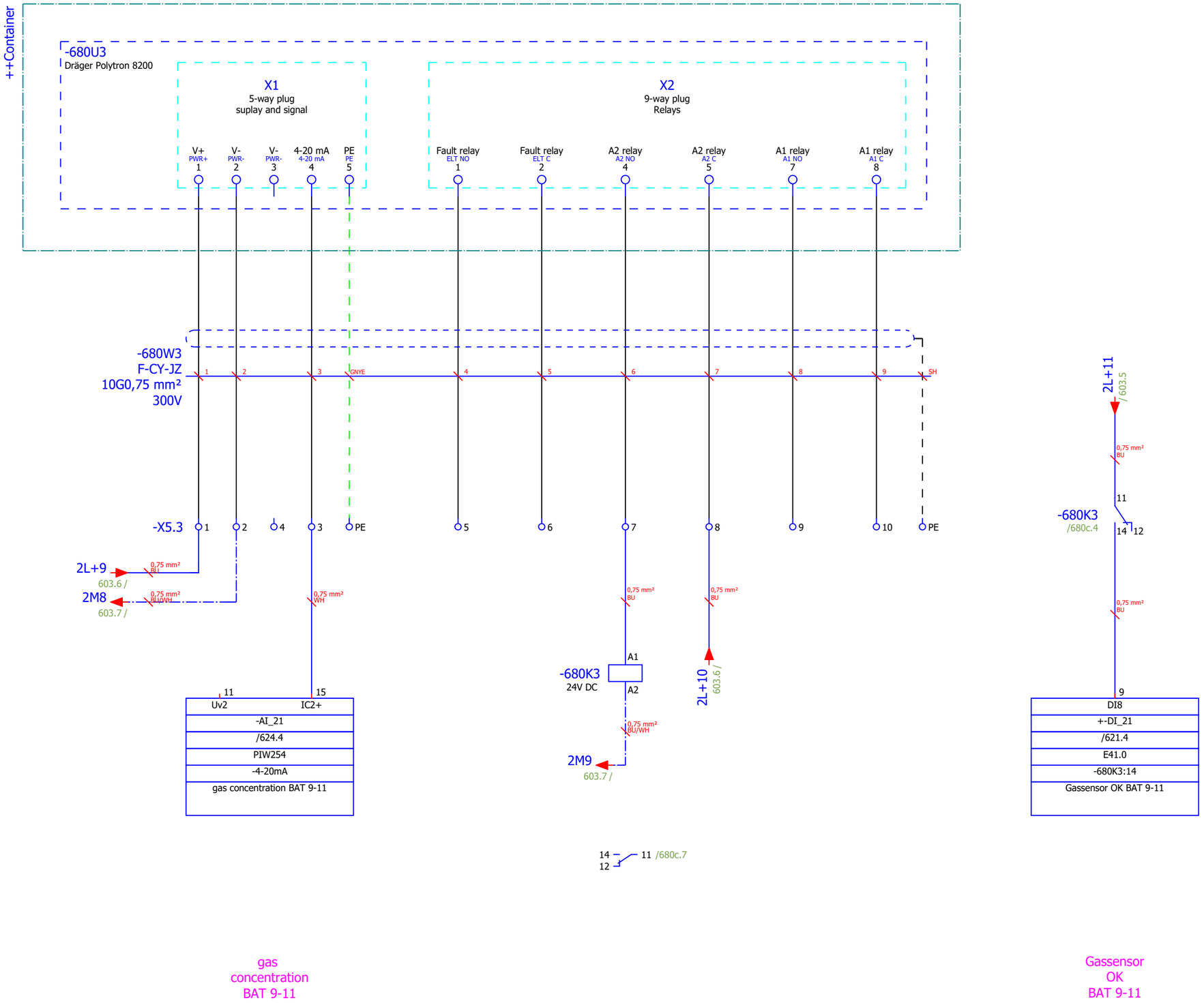
gas concentration BAT 5-8

Gassensor OK BAT 5-8

previous page: 680a

next page: 680c

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 5-8	20250805_V2.0	= UNIT_02 Battery Container 1
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 680b
Date								+ — total: 492



gas concentration BAT 9-11

Gassensor OK BAT 9-11

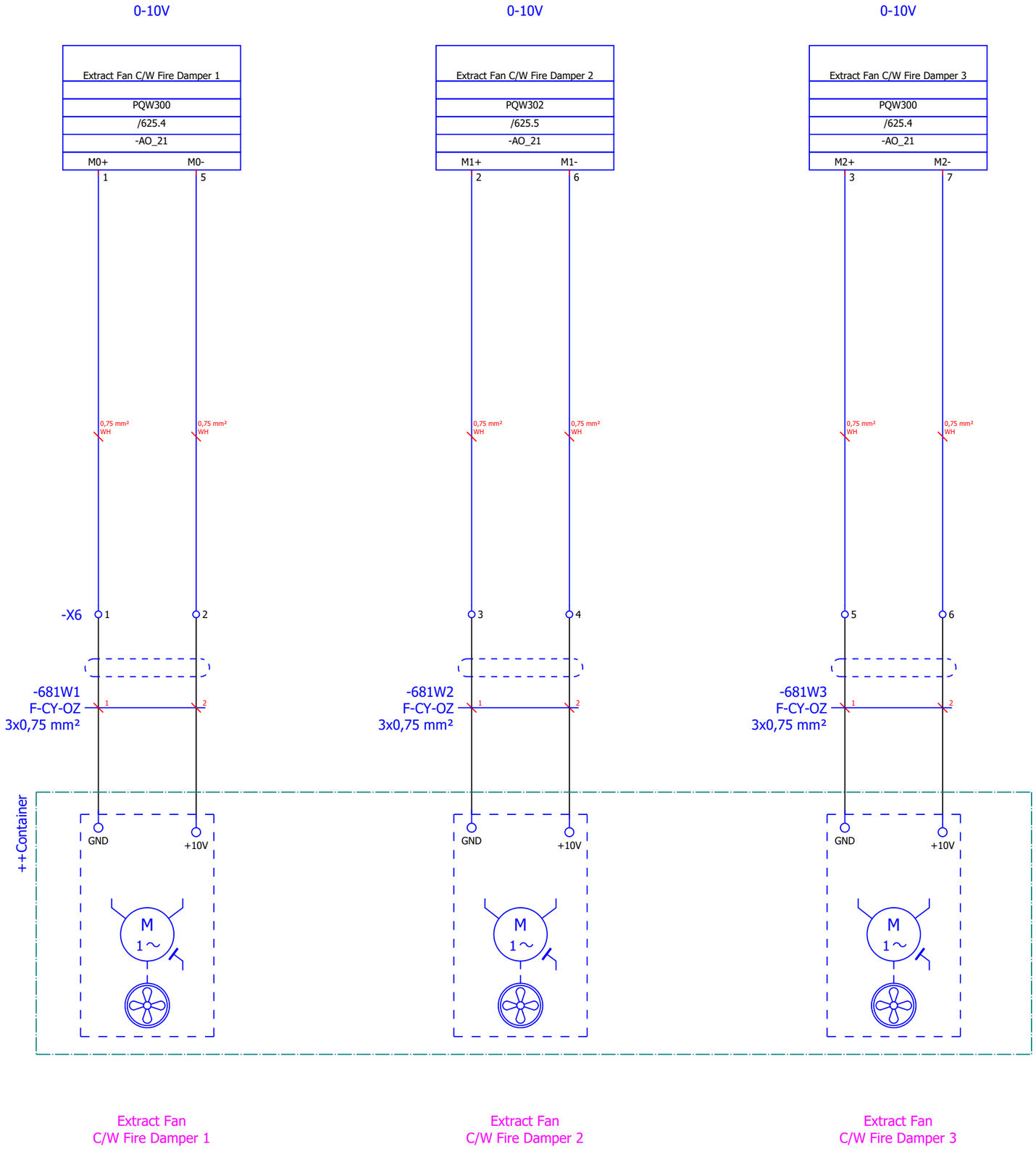
previous page: 680b

next page: 681

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 9-11	20250805_V2.0	= UNIT_02	Battery Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 680c

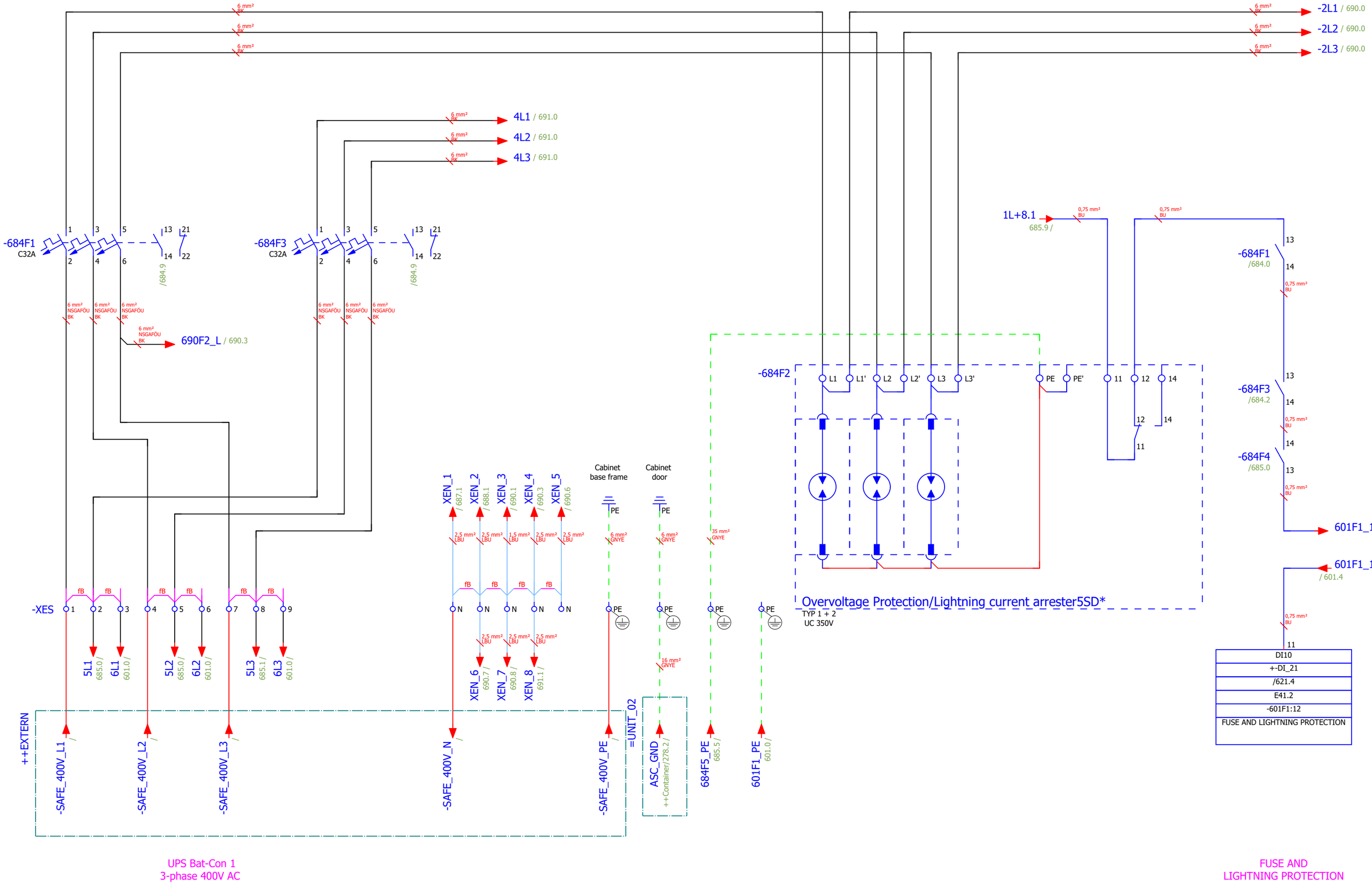
total: 492



previous page: 680c

next page: 684

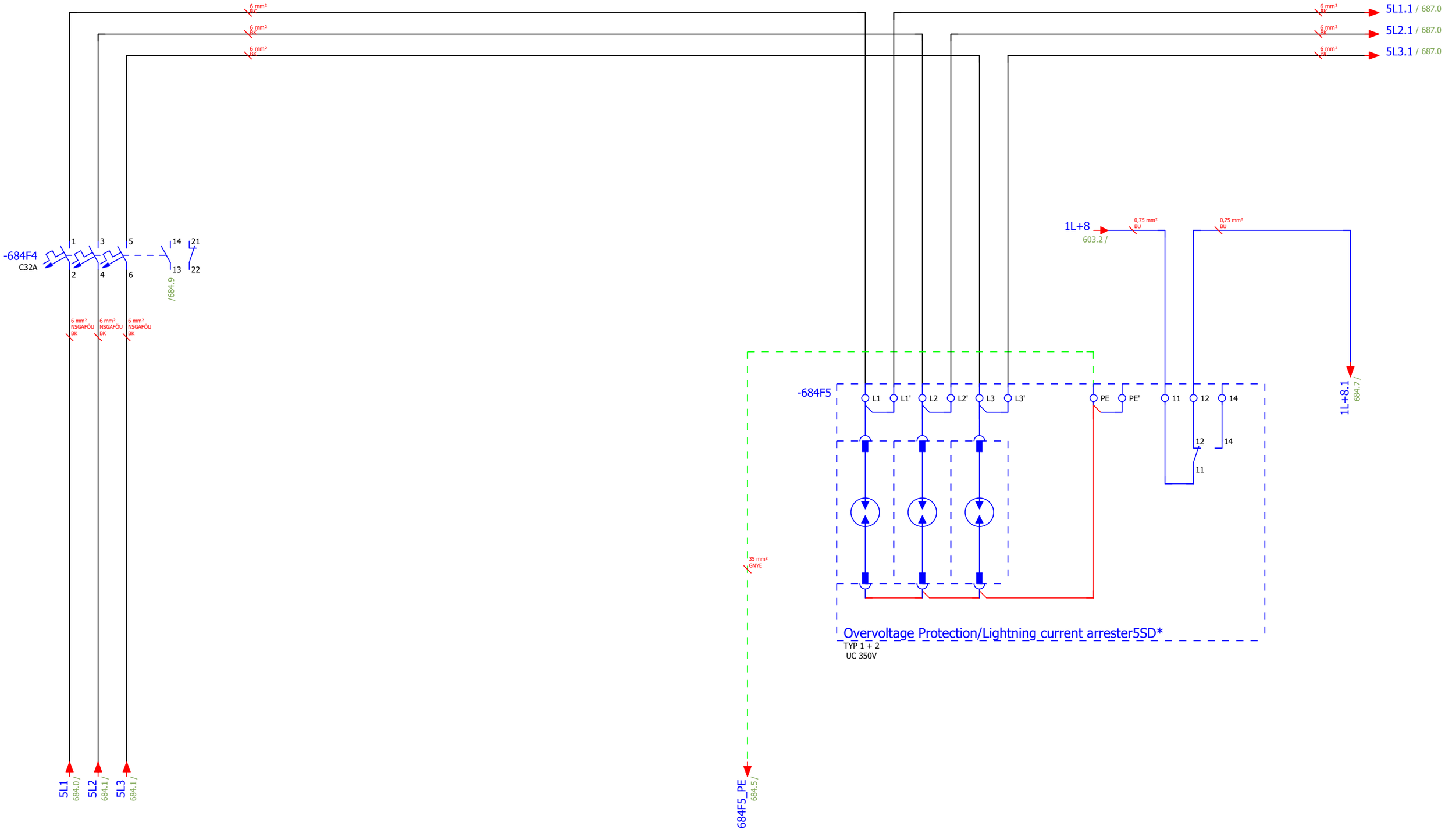
Editor	Freqcon_JD			Statron	FREQCON	EXTRACT FAN FIRE DAMPER	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 681
Date								+	total: 492



previous page: 681

next page: 685

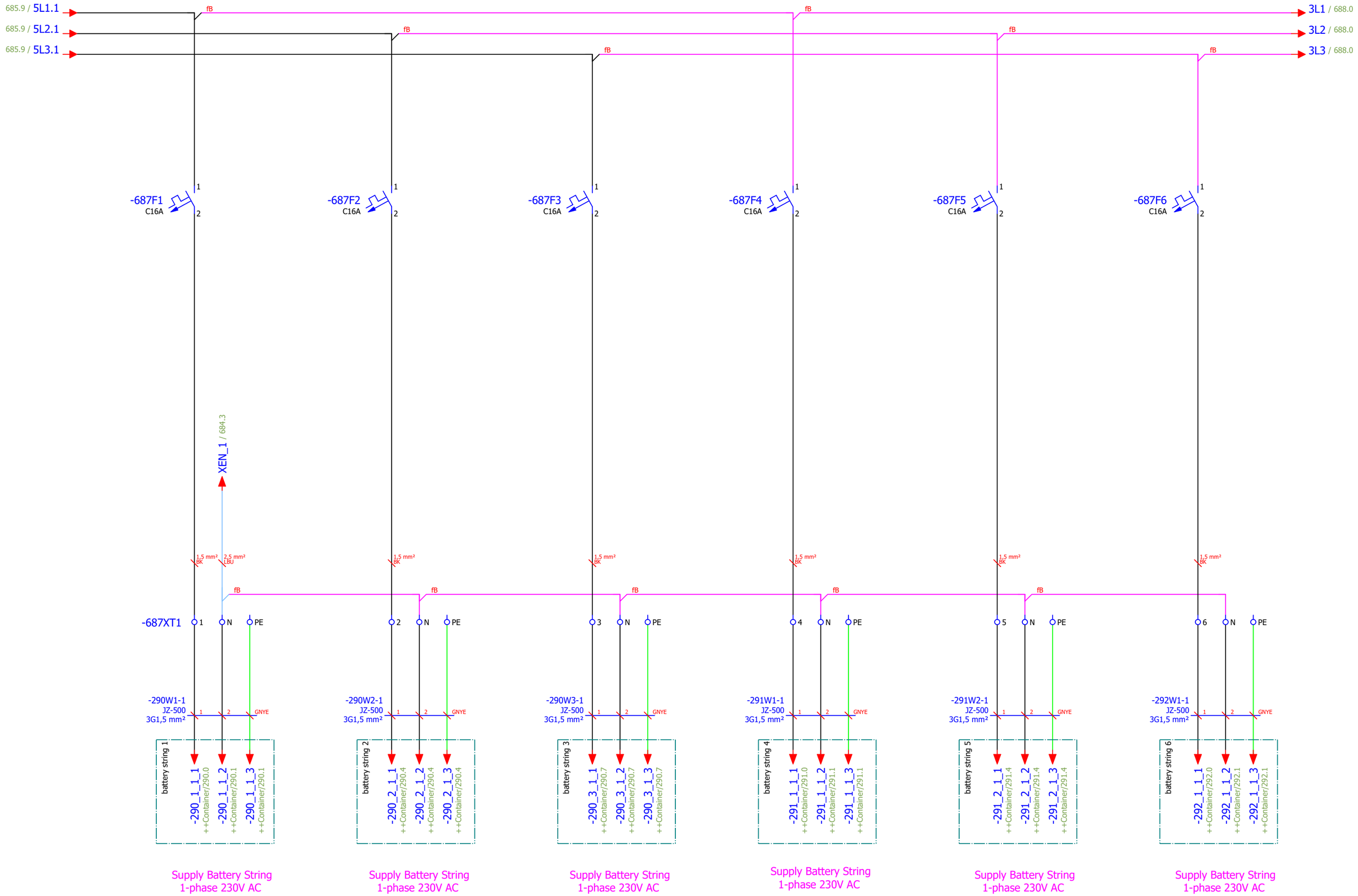
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	22.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 684
Date								+		total: 492



FUSE AND
LIGHTNING PROTECTION

previous page: 684
next page: 687

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	05.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 685
Date								+	total: 492



previous page: 685

next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 492

687.9 / 3L1
687.9 / 3L2
687.9 / 3L3

fB

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

XEN_2 / 684.3

1,5 mm² BK
2,5 mm² LBU

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

GNYE

battery string 7
-292_2_1_1 ++Container/292.4
-292_2_1_2 ++Container/292.4
-292_2_1_3 ++Container/292.4

battery string 8
-292_3_1_1 ++Container/292.7
-292_3_1_2 ++Container/292.7
-292_3_1_3 ++Container/292.7

battery string 9
-293_1_1_1 ++Container/293.0
-293_1_1_2 ++Container/293.1
-293_1_1_3 ++Container/293.1

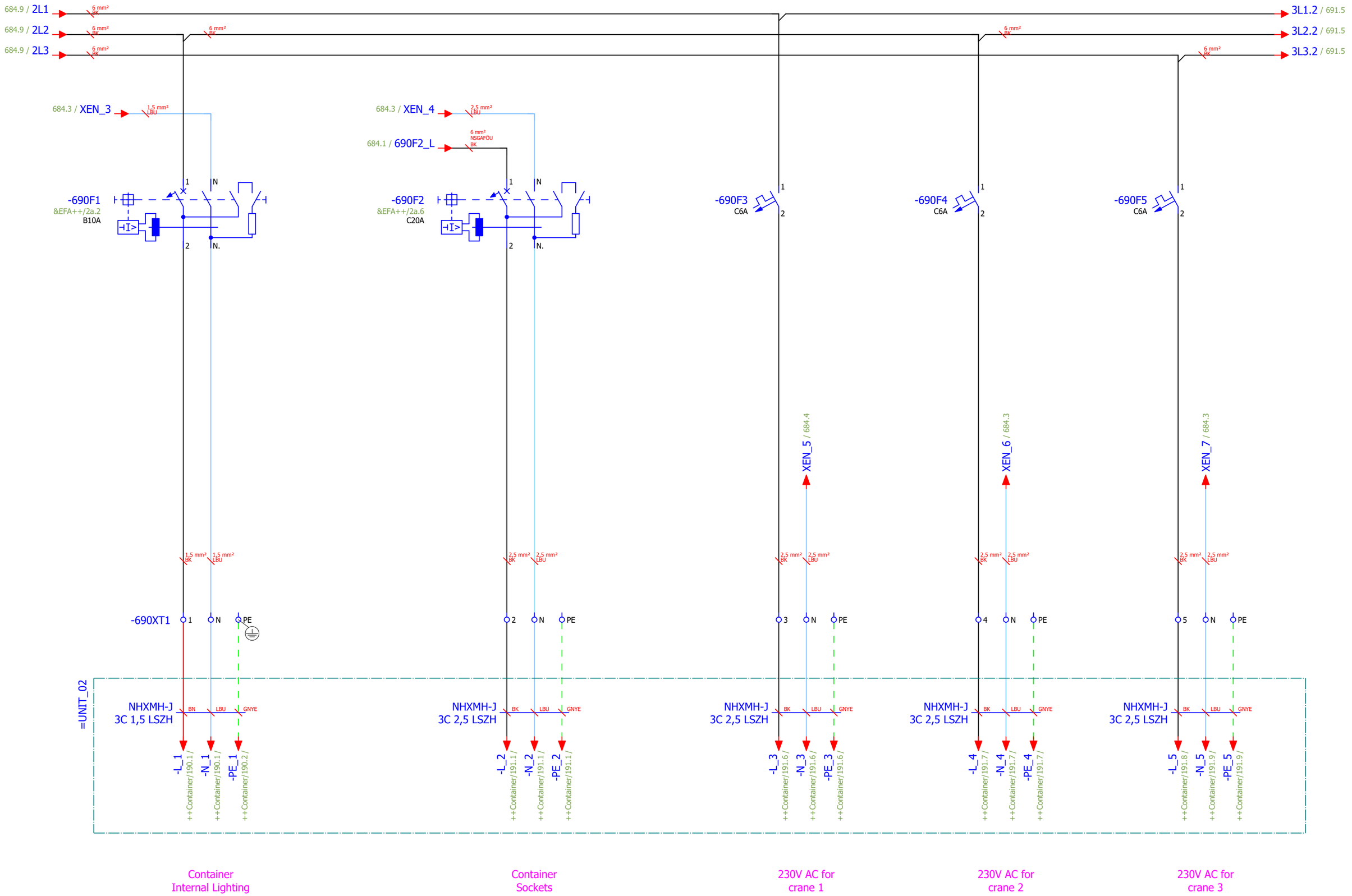
battery string 10
-293_2_1_1 ++Container/293.4
-293_2_1_2 ++Container/293.4
-293_2_1_3 ++Container/293.4

battery string 11
-293_3_1_1 ++Container/293.7
-293_3_1_2 ++Container/293.7
-293_3_1_3 ++Container/293.7

Supply Battery String 1-phase 230V AC

previous page: 687
next page: 690

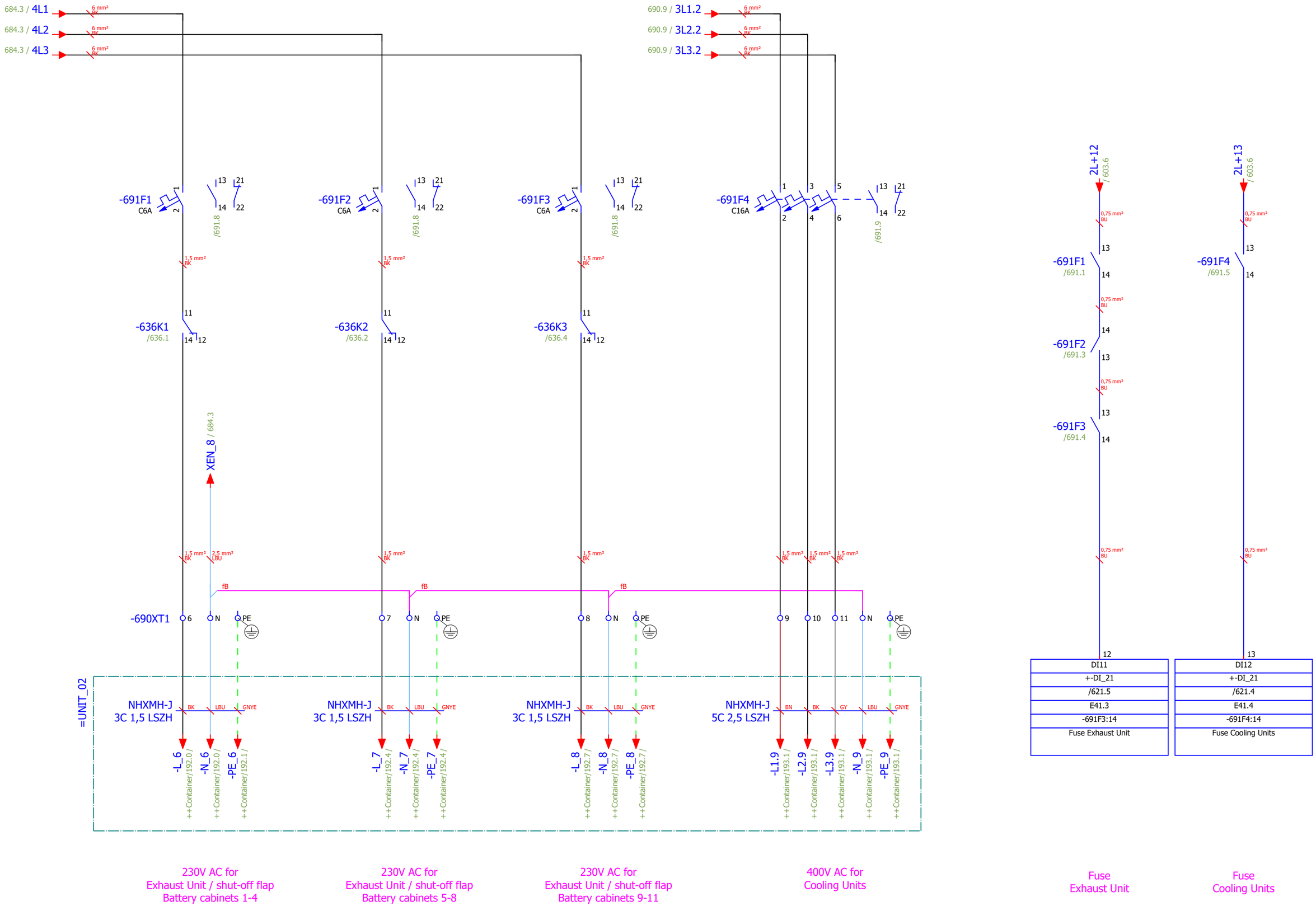
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_02 Battery Container 1	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 492



previous page: 688

next page: 691

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	29.10.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 690
Date								+		total: 492



previous page:
690

next page:
&EPC++Container/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 691
Date								+		total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U4 &EFS/613b.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.3...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.3...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.1;&EFS/687.3;&EFS/687.4;&EFS/687.6...&EFS/687.8;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.9;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	

previous page:
6

next page:
&EPA++Container/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/7

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
3	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
6	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
3	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

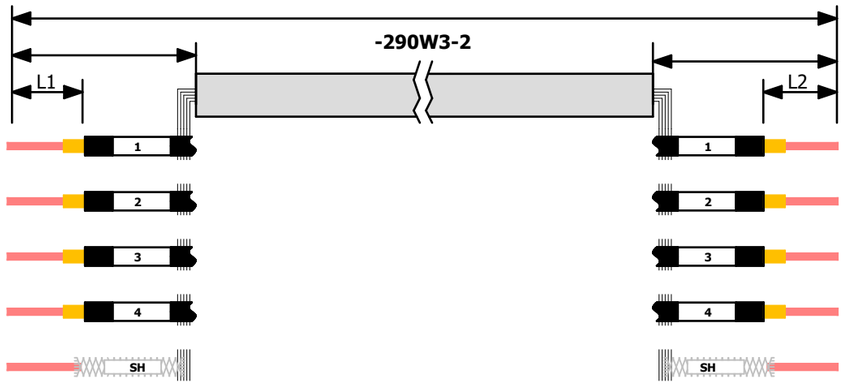
Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

Cable name =UNIT_02++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

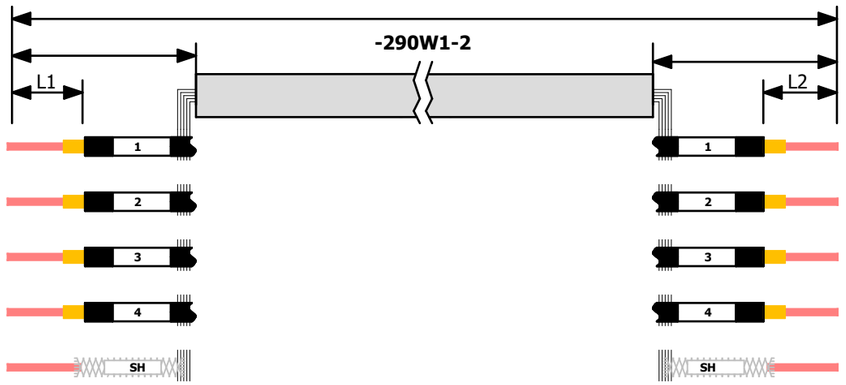


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

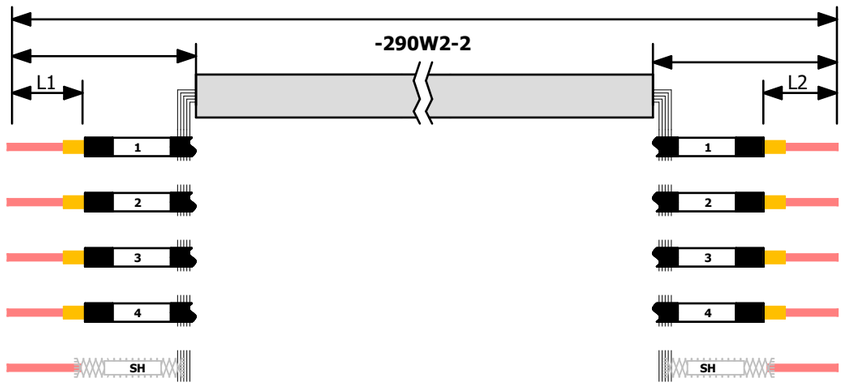


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

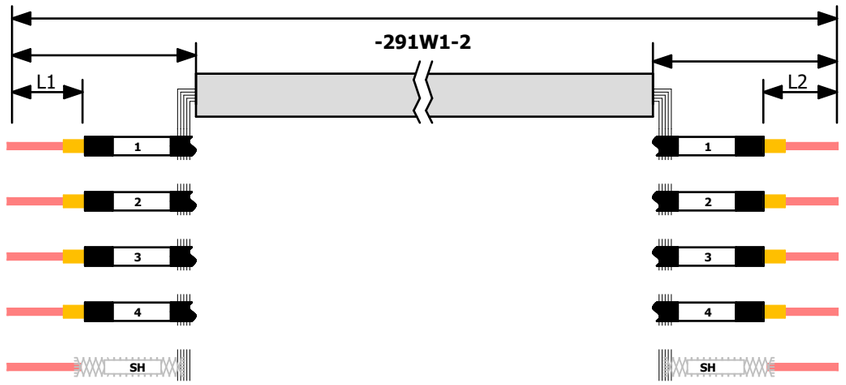
previous page:
&EPA++ASC/2

next page:
2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

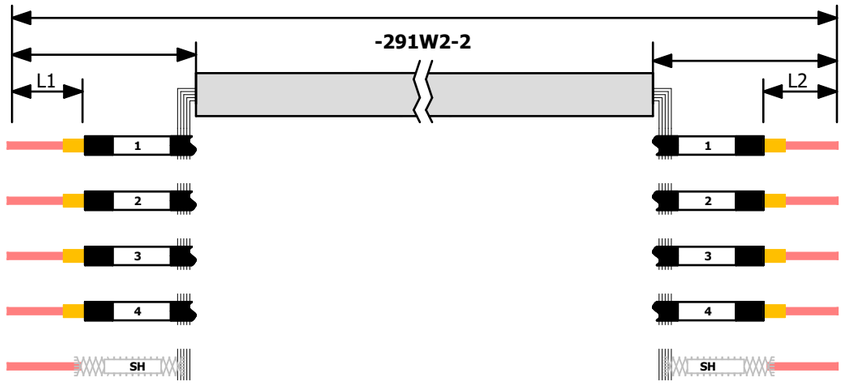


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

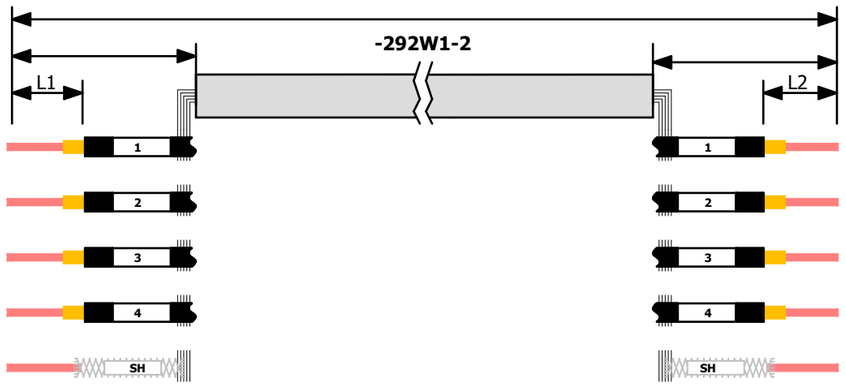


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

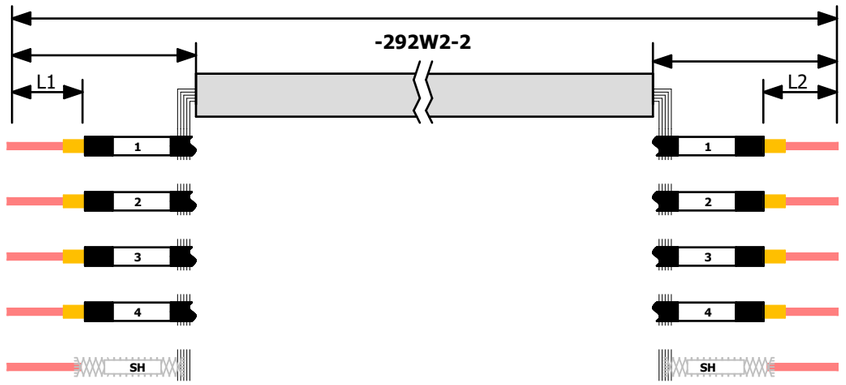
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

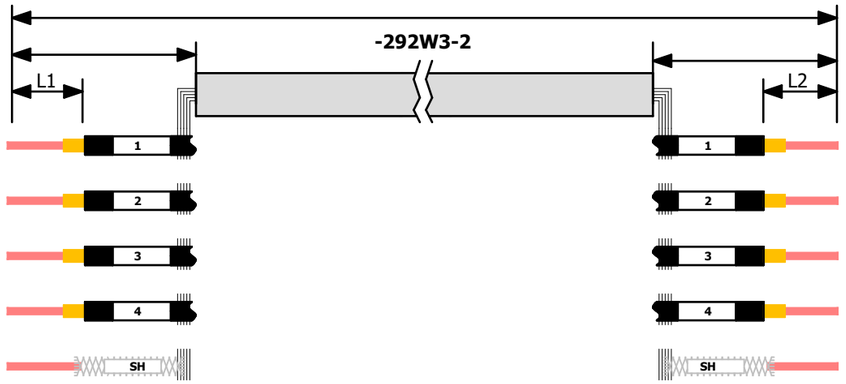


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

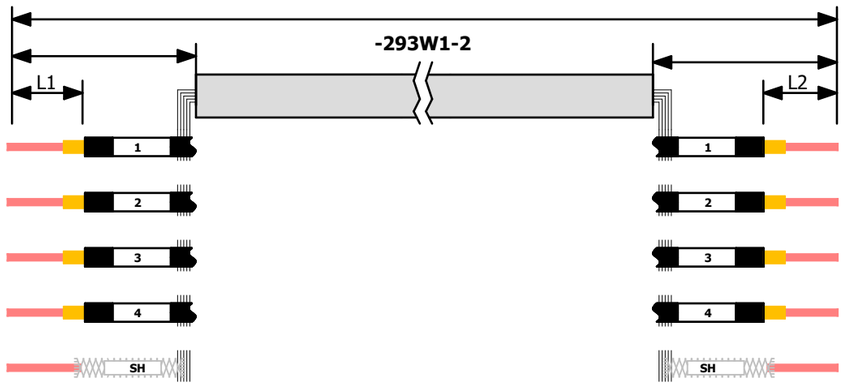


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

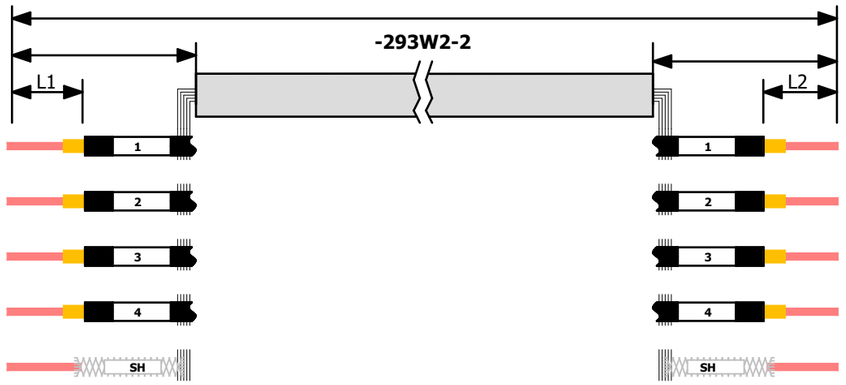
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

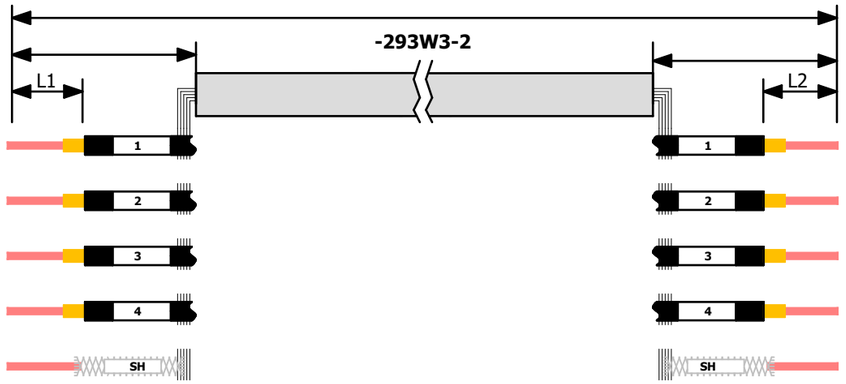


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

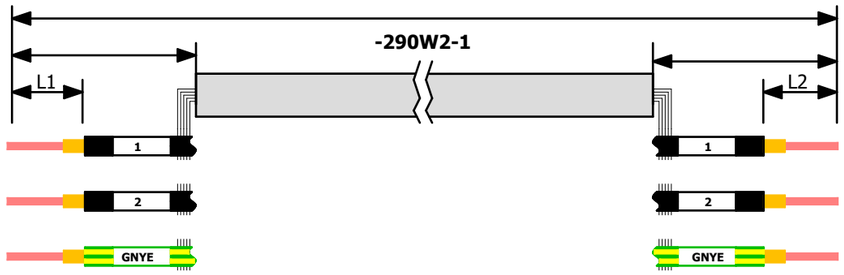
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

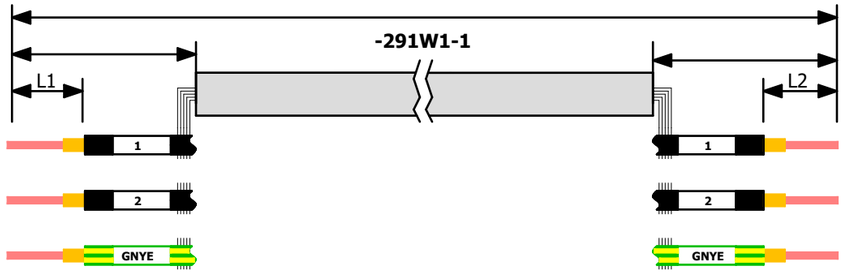


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

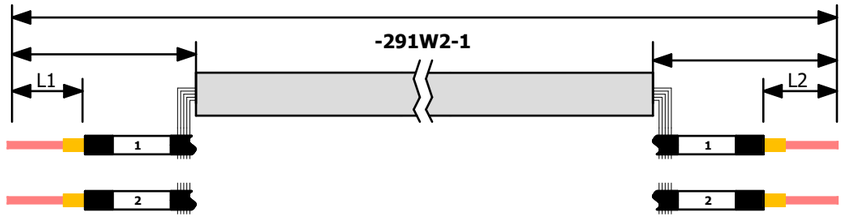


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

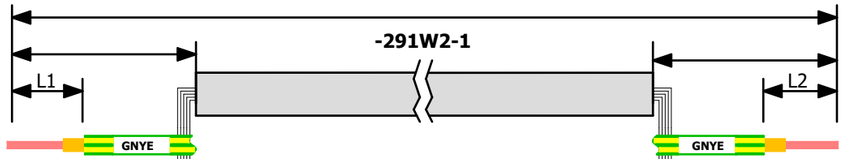
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

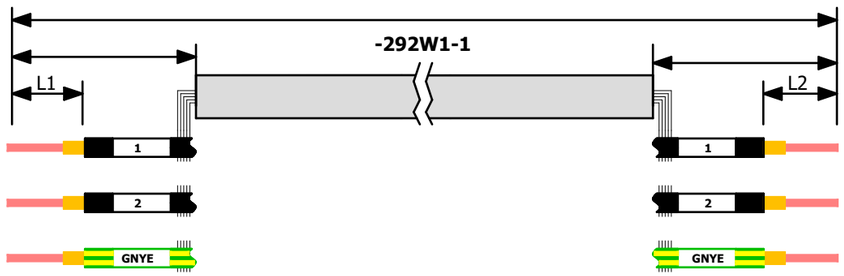


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

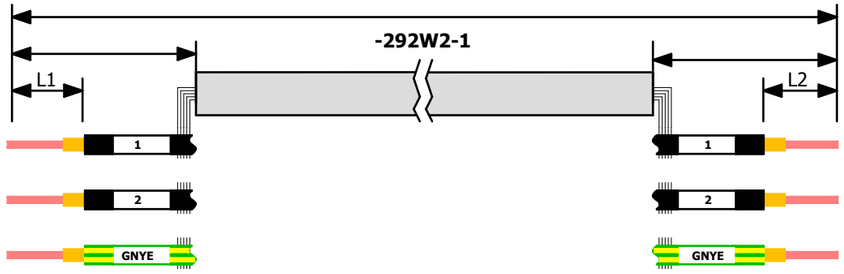


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

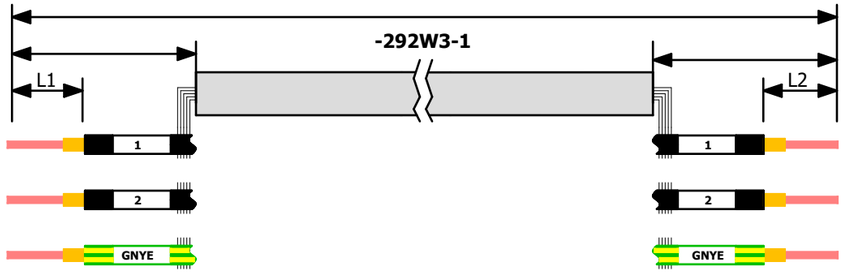


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

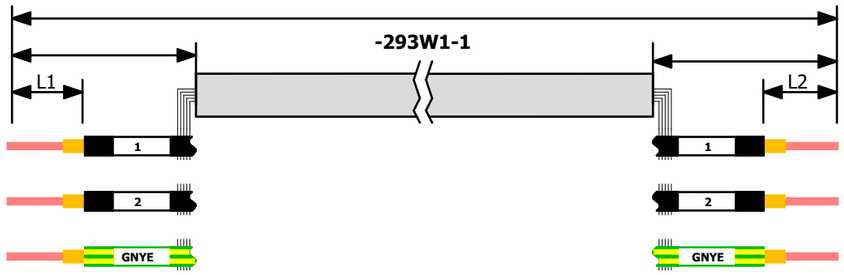
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

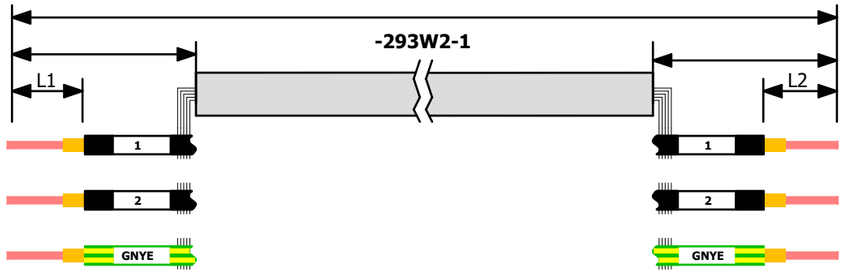


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

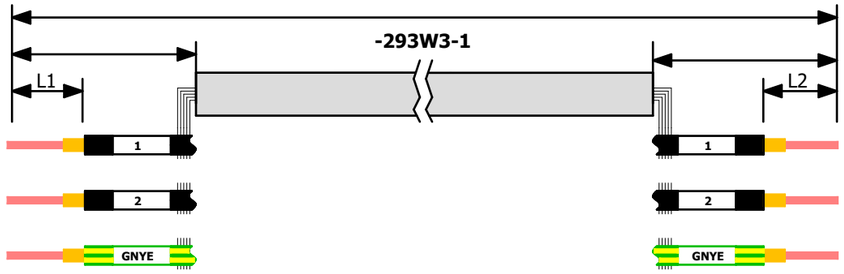


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

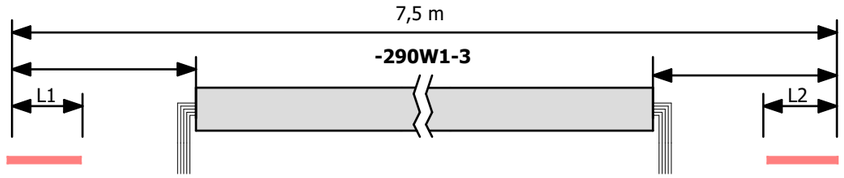


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

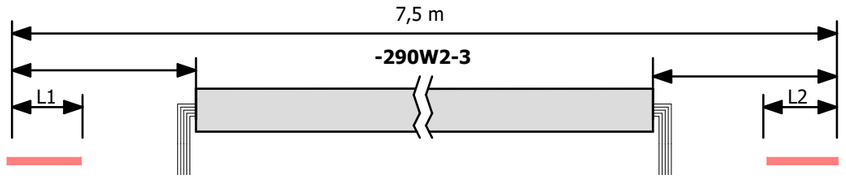
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 7
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

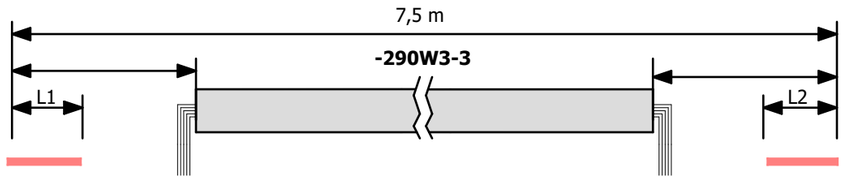


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

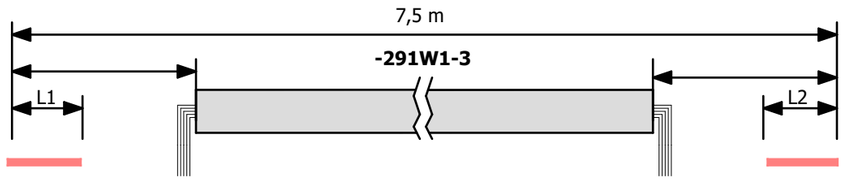


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_02++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

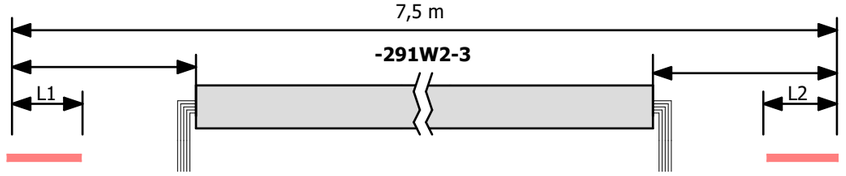


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

Cable name =UNIT_02++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

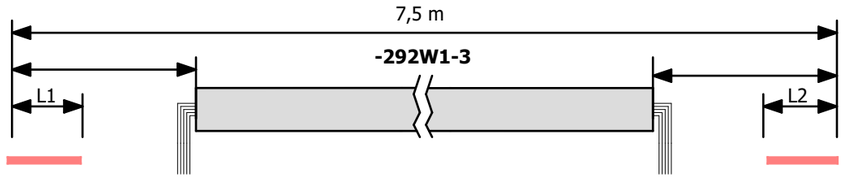


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_02++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



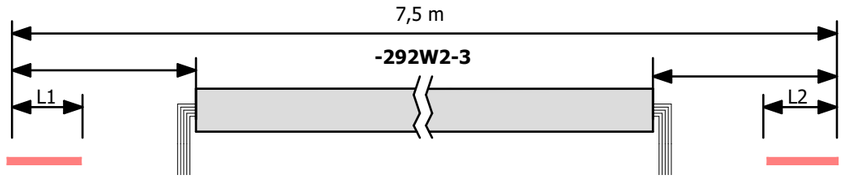
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

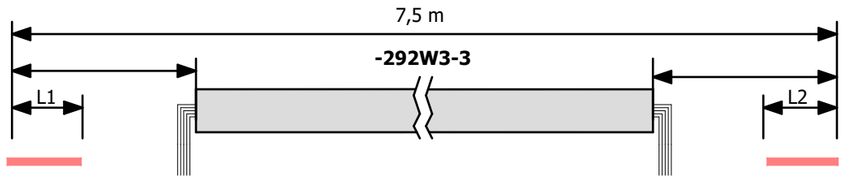


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X7:1-16	

Cable name =UNIT_02++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

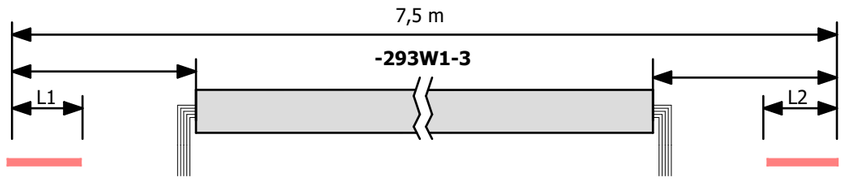


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X8:1-16	

Cable name =UNIT_02++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

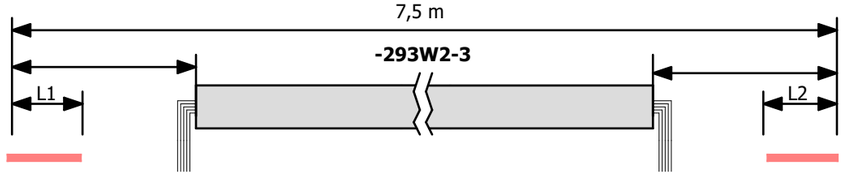


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X9:1-16	

Cable name =UNIT_02++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

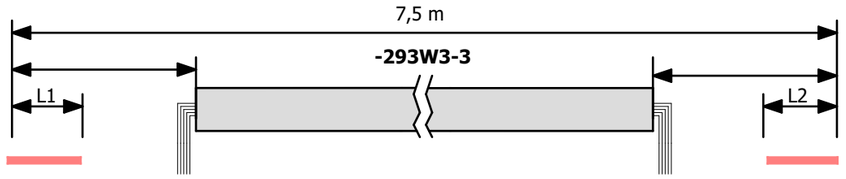


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

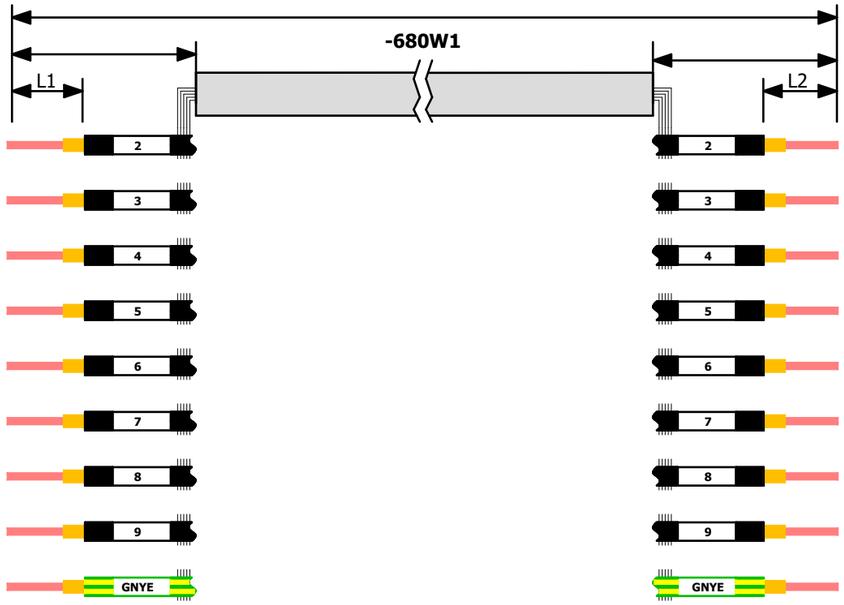
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

FRQ_Kabelplan_04_gro8_de_en

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 9
Date								+	total: 492

Cable name =UNIT_02++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

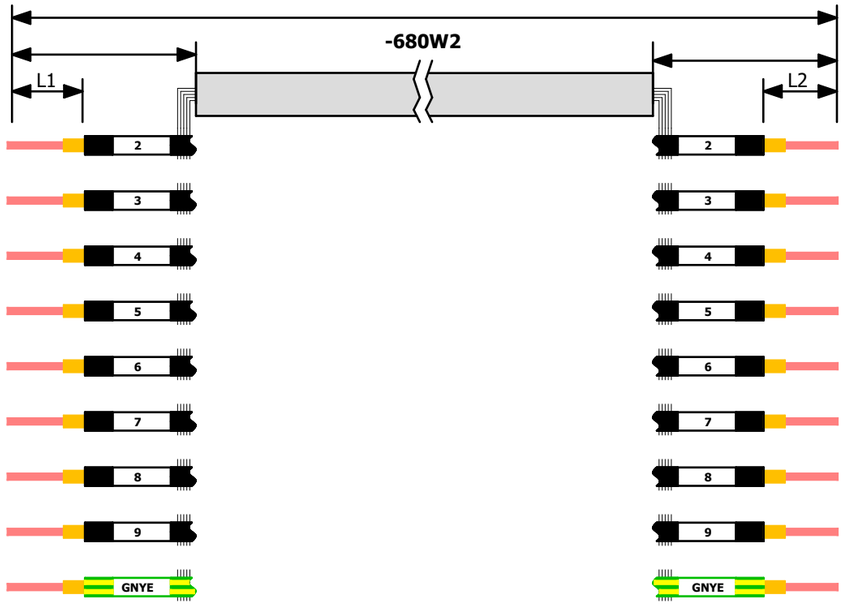


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_02++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

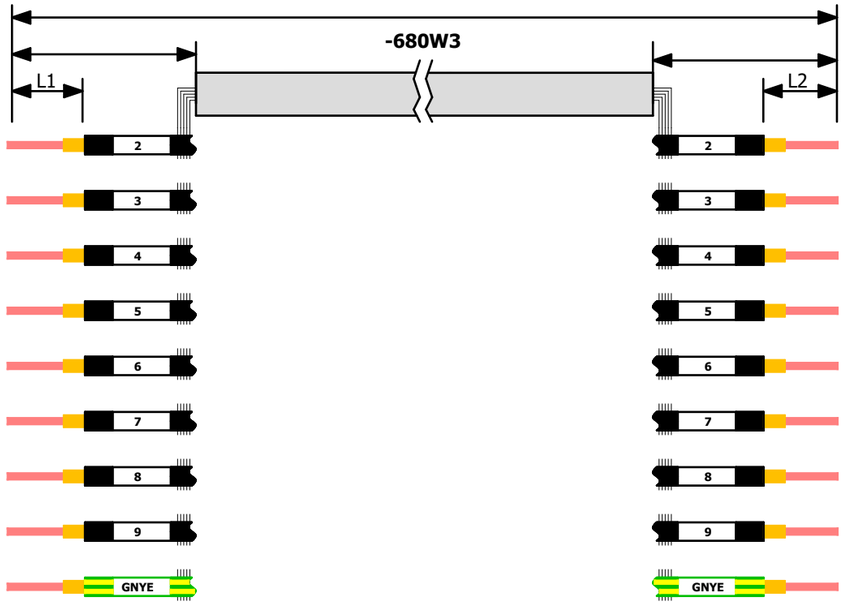
FRQ_Kabelplan_04_gro8_de_en

previous page: ++Container/9
next page: 2

Cable name =UNIT_02++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 9

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

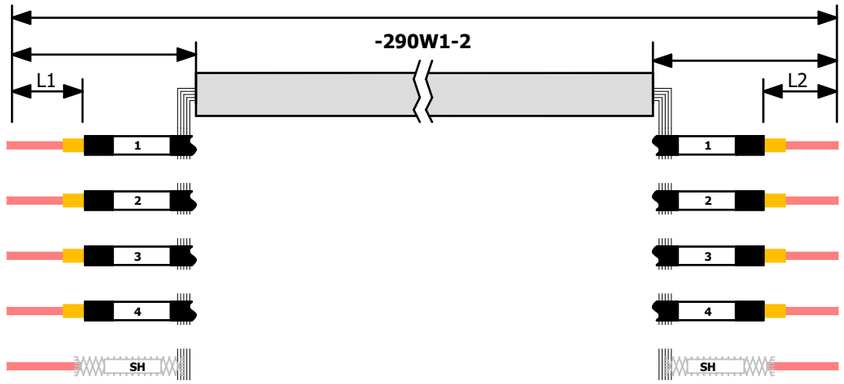


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_02++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

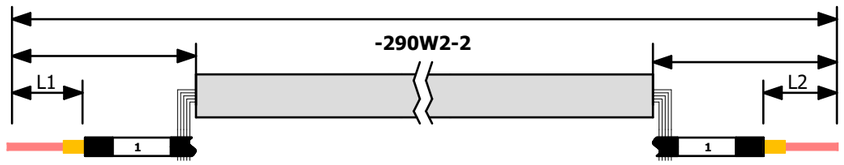


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

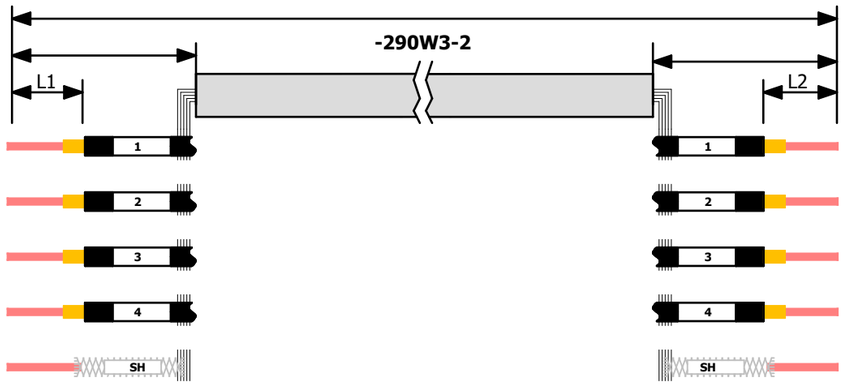


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

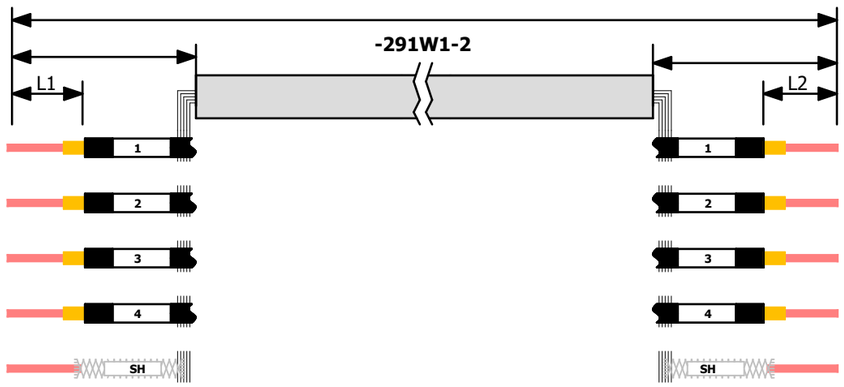


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

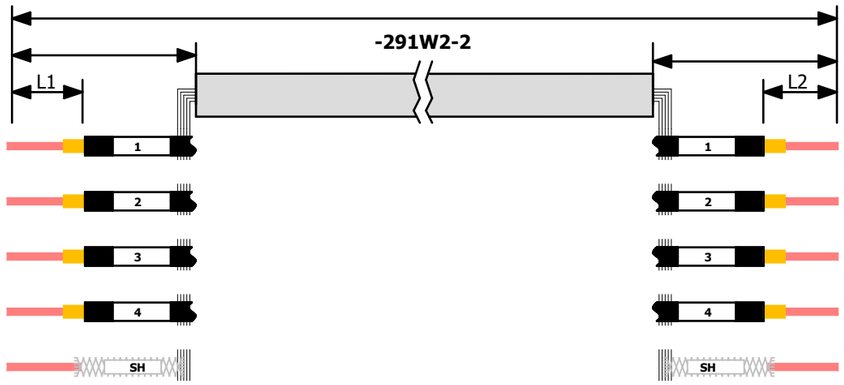
previous page: 2

next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

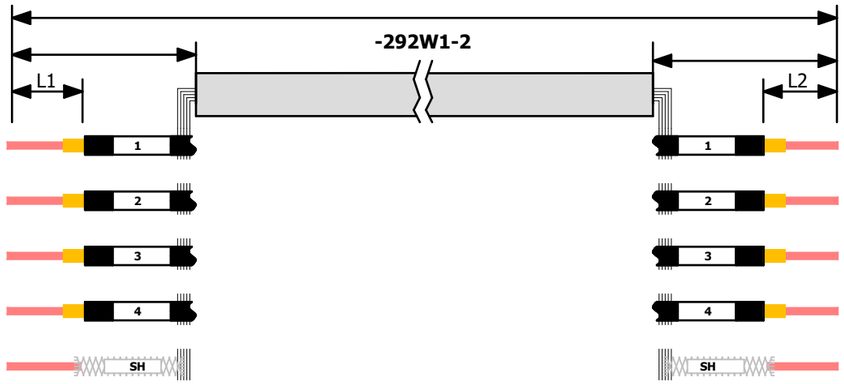


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

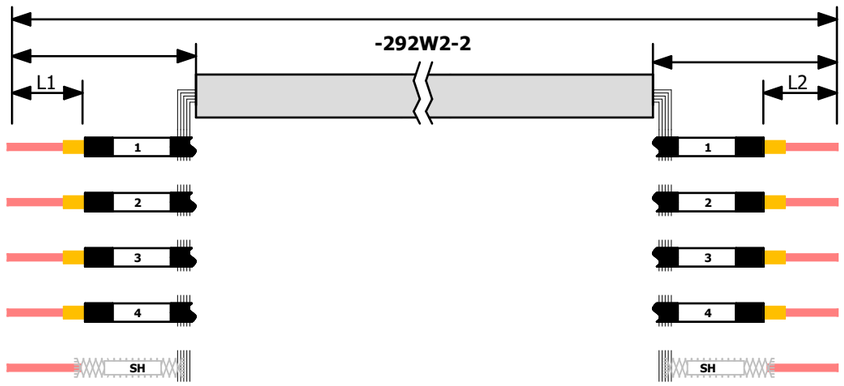


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

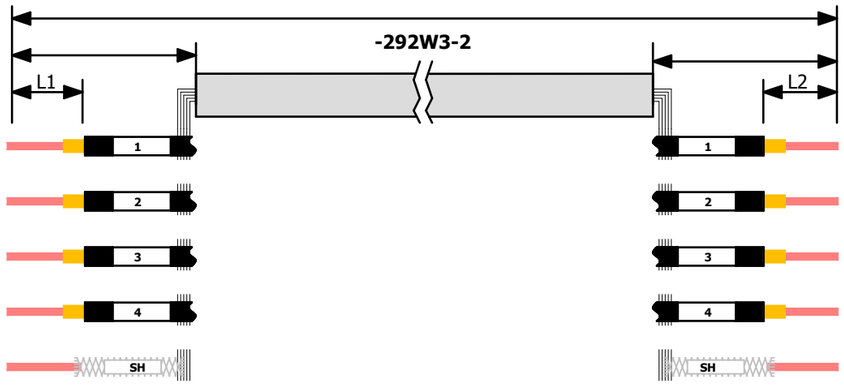
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

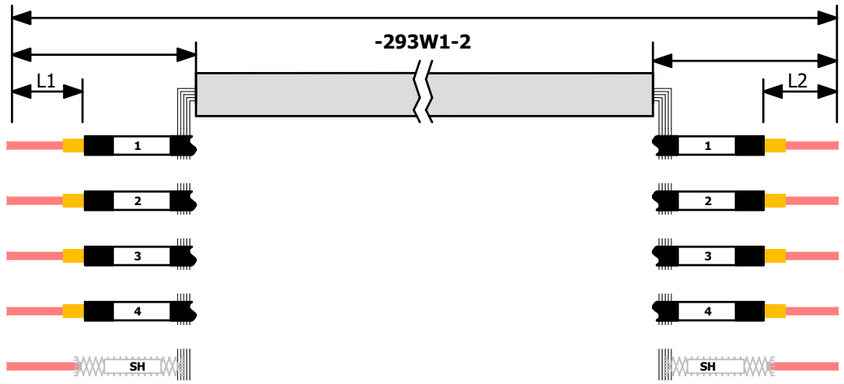


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

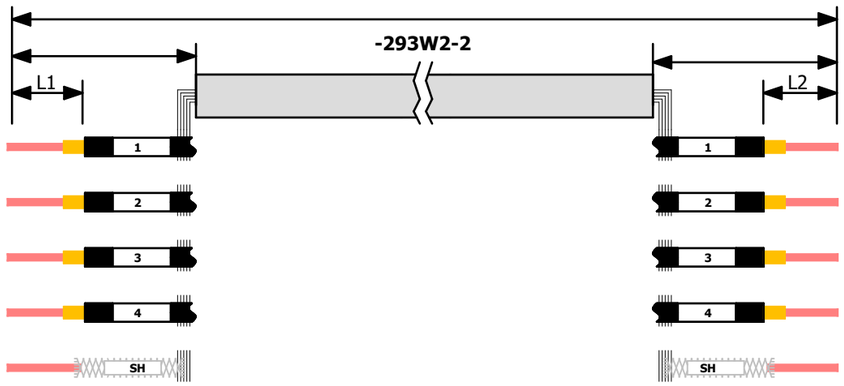


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

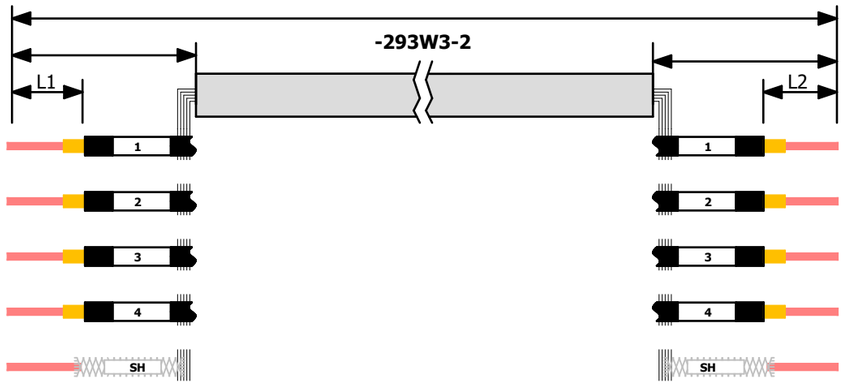
previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

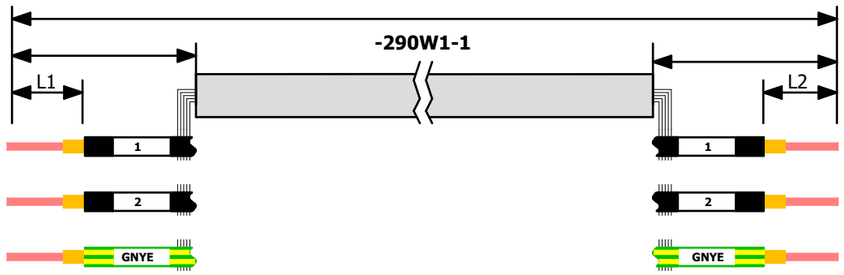


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

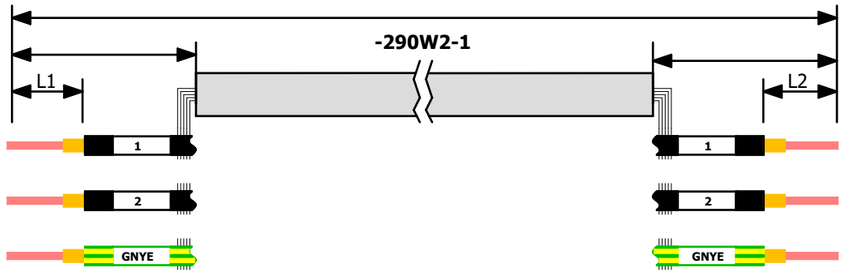


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

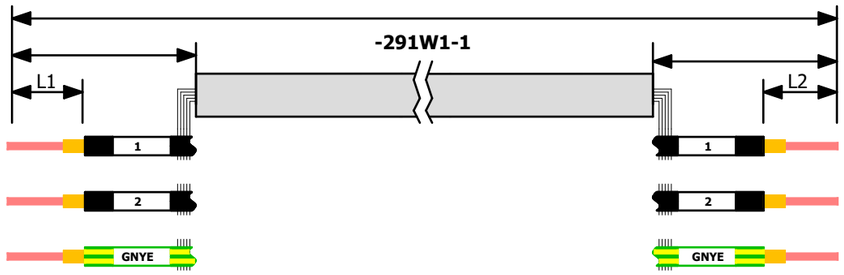


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

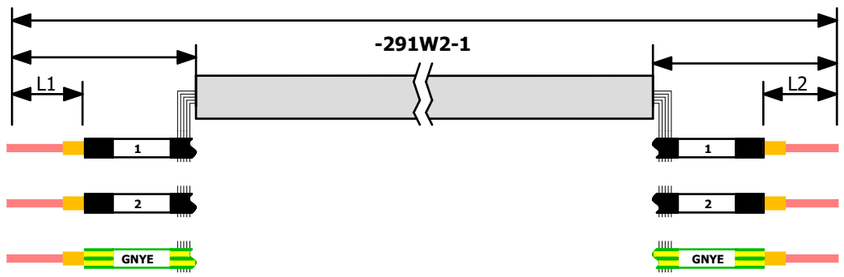


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

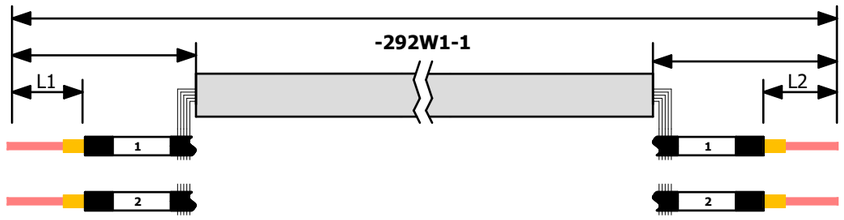


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

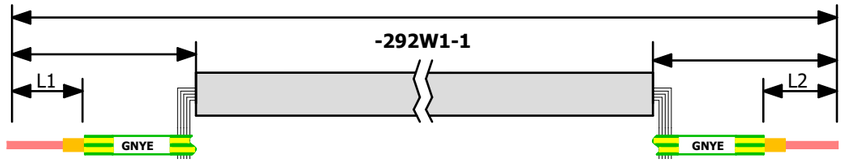
previous page: 6

next page: 8

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

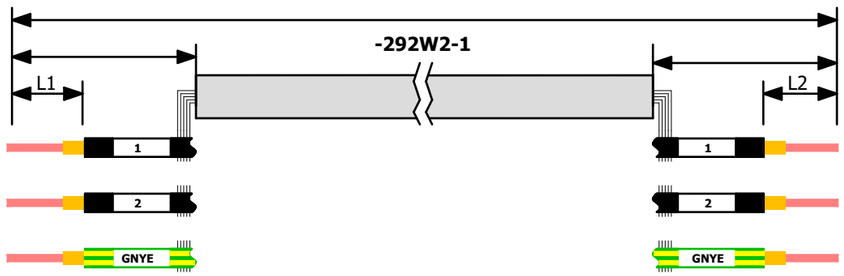


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

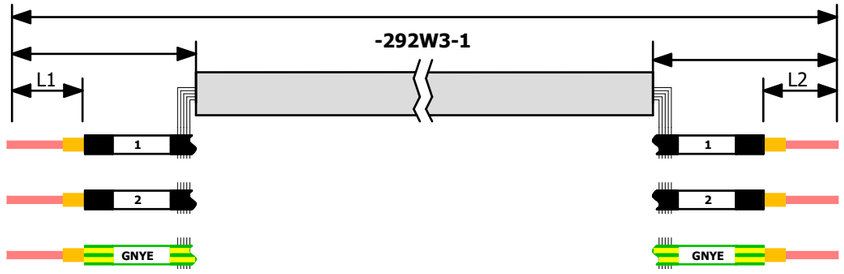


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

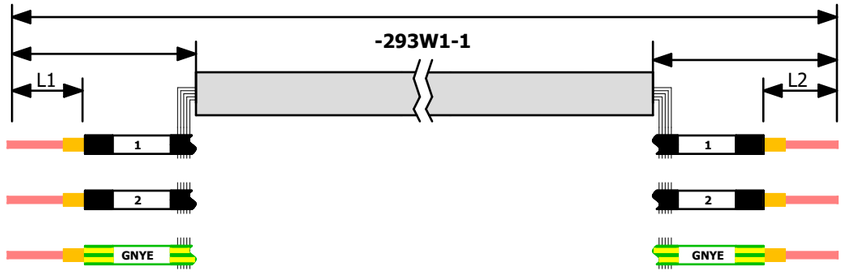


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

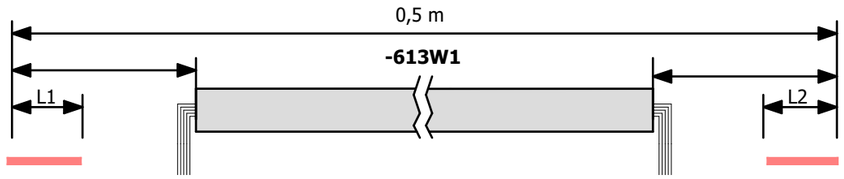


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

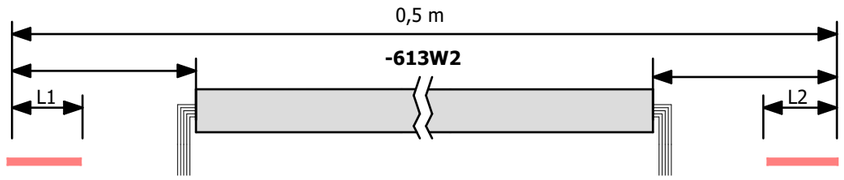


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_02++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			

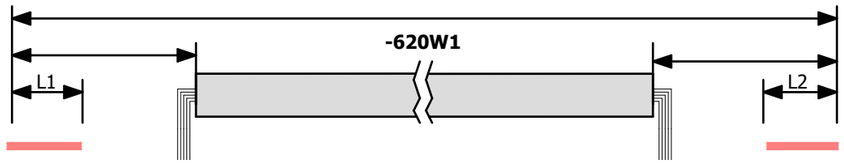
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_02	Battery Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 9
Date								+		total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_02++ASC+-620W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

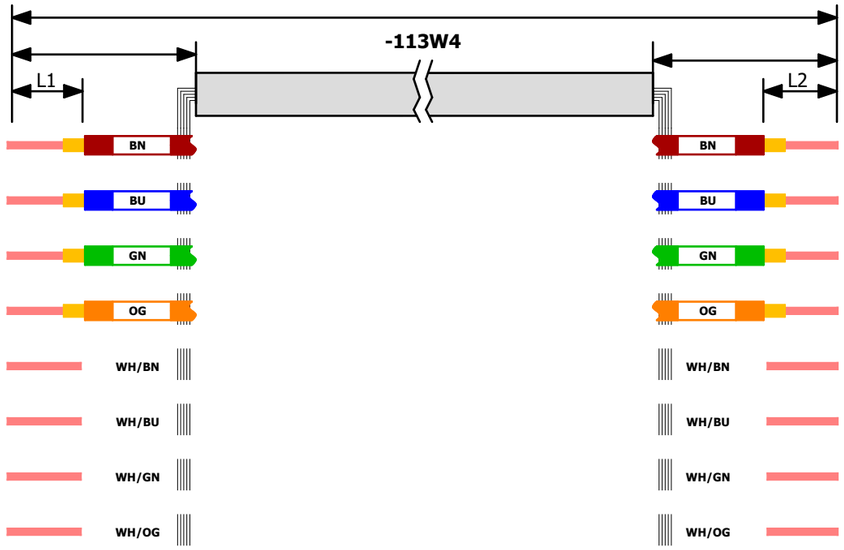
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U4:8							-620A1:-X1:P2	

Cable name =UNIT_02++ASC+-113W4
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:3							-613U2:3	

previous page: 9
next page: &EMZ/1000

FRQ_Kabelplan_04_groß_de_en

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X5.1		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2000
-X5.2		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2001
-X5.3		1	PE	2	0	12	=UNIT_02&EMZ++ASC/2002
-X6		1	6	0	0	6	=UNIT_02&EMZ++ASC/2003
-XDC1		1	PE	2	0	14	=UNIT_02&EMZ++ASC/2004
-XDC2		1	7	0	0	14	=UNIT_02&EMZ++ASC/2005
-XES		1	9	4	5	18	=UNIT_02&EMZ++ASC/2006
-369XT		1	12	0	0	24	=UNIT_02&EMZ++ASC/2007
-687XT1		1	PE	11	11	44	=UNIT_02&EMZ++ASC/2019
-690XT1		1	PE	40	4	119	=UNIT_02&EMZ++ASC/2030

previous page:
&EMB/10

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-X5.1

Function text				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-JZ	-680W1	Page / column
gas concentration BAT 1-4					-XDC2	1	1	,	++Container-680U1-X1	1				&EFS/680a.2
=					-XDC2	5	2	,	++Container-680U1-X1	2		2		&EFS/680a.2
=					-AI_21	13	3	,	++Container-680U1-X1	4		3		&EFS/680a.2
=							4	,						&EFS/680a.2
=							5	,	++Container-680U1-X2	1		4		&EFS/680a.3
=							6	,	++Container-680U1-X2	2		5		&EFS/680a.3
=					-680K1	A1	7	,	++Container-680U1-X2	4		6		&EFS/680a.4
=					-XDC2	2	8	,	++Container-680U1-X2	5		7		&EFS/680a.4
=							9	,	++Container-680U1-X2	7		8		&EFS/680a.5
=							10	,	++Container-680U1-X2	8		9		&EFS/680a.5
=							PE	,	++Container-680U1-X1	5		GNYE		&EFS/680a.2
=							PE	,	-480W1					&EFS/680a.6

previous page:
1000

next page:
2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X5.1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2000
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X5.2						Cable name	-680W2										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-JZ											
gas concentration BAT 5-8					-XDC2	2	1	,	++Container-680U2-X1	1													&EFS/680b.2
=					-XDC2	6	2	,	++Container-680U2-X1	2		2											&EFS/680b.2
=					-AI_21	14	3	,	++Container-680U2-X1	4		3											&EFS/680b.2
=							4	,															&EFS/680b.2
=							5	,	++Container-680U2-X2	1		4											&EFS/680b.3
=							6	,	++Container-680U2-X2	2		5											&EFS/680b.3
=					-680K2	A1	7	,	++Container-680U2-X2	4		6											&EFS/680b.4
=					-XDC2	2	8	,	++Container-680U2-X2	5		7											&EFS/680b.4
=							9	,	++Container-680U2-X2	7		8											&EFS/680b.5
=							10	,	++Container-680U2-X2	8		9											&EFS/680b.5
=							PE	,	++Container-680U2-X1	5		GNYE											&EFS/680b.2
=							PE	,	-480W1														&EFS/680b.6

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X5.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1
&	EMZ	Terminals
++	ASC	auxillary cabinet
+		

page: 2001
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X5.3					Cable name	-680W3										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z										
gas concentration BAT 9-11					-XDC2	3	1	,	++Container-680U3-X1	1												&EFS/680c.2
=					-XDC2	7	2	,	++Container-680U3-X1	2		2										&EFS/680c.2
=					-AI_21	15	3	,	++Container-680U3-X1	4		3										&EFS/680c.2
=							4	,														&EFS/680c.2
=							5	,	++Container-680U3-X2	1		4										&EFS/680c.3
=							6	,	++Container-680U3-X2	2		5										&EFS/680c.3
=					-680K3	A1	7	,	++Container-680U3-X2	4		6										&EFS/680c.4
=					-XDC2	3	8	,	++Container-680U3-X2	5		7										&EFS/680c.4
=							9	,	++Container-680U3-X2	7		8										&EFS/680c.5
=							10	,	++Container-680U3-X2	8		9										&EFS/680c.5
=							PE	,	++Container-680U3-X1	5		GNYE										&EFS/680c.2
=							PE	,	-480W1													&EFS/680c.6

previous page:
2001

next page:
2003

Editor	Freqcon_DG			Statron		FREQCON	Klemmenplan =UNIT_02++ASC+-X5.3	20250805_V2.0	=	UNIT_02	Battery Container 1		
Date	21.01.2025								&	EMZ	Terminals		
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				10354_23A2007	++	ASC	auxillary cabinet	page:	2002
Date									+			total:	492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-X6					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Extract Fan C/W Fire Damper 1						GND	1	,	-AO_21	1													&EFS/681.1
=						+10V	2	,	-AO_21	5													&EFS/681.1
Extract Fan C/W Fire Damper 2						GND	3	,	-AO_21	2													&EFS/681.3
=						+10V	4	,	-AO_21	6													&EFS/681.3
Extract Fan C/W Fire Damper 3						GND	5	,	-AO_21	3													&EFS/681.5
=						+10V	6	,	-AO_21	7													&EFS/681.5

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-X6	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2003

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-XDC1

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FUSE 24V DC CONTROL VOLTAGE			-101T1	13	1		-103F1	2			&EFS/603.2
			-101Q1	13							
			-611A1	1							
FUSE 24V DC CONTROL VOLTAGE			-620A1	-X80:1	2						&EFS/603.2
			-DI_21	L+							
			-DO_21	L+							
FUSE 24V DC CONTROL VOLTAGE			-684F5	11	3		-103F1	13			&EFS/603.2
FUSE 24V DC CONTROL VOLTAGE			-611A1	2	4		-102G1	OUTPUT DC 24 V:-			&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE			-620A1	-X80:2	5						&EFS/603.3
			-DI_21	M							
			-DO_21	M							
FUSE 24V DC CONTROL VOLTAGE			-636K1	A2	6		-XDC2	5			&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE			-101T1	-"	PE						&EFS/603.4
			-101T1	PE							
FUSE 24V DC CONTROL VOLTAGE					PE						&EFS/603.4

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XDC1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2004

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-XDC2						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
FUSE 24V DC CONTROL VOLTAGE					-AI_21	L+	1		-103F2	2													&EFS/603.5
					-AO_21	L+																	
					-X5.1	1																	
FUSE 24V DC CONTROL VOLTAGE					-X5.1	8	2		-X5.2	8													&EFS/603.5
					-680K1	11																	
					-X5.2	1																	
FUSE 24V DC CONTROL VOLTAGE					-680K2	11	3		-680K3	11													&EFS/603.5
					-X5.3	1																	
					-X5.3	8																	
FUSE 24V DC CONTROL VOLTAGE					-691F1	13	4																&EFS/603.6
					-691F4	13																	
					-691F4	13																	
FUSE 24V DC CONTROL VOLTAGE					-AI_21	M	5		-XDC1	6													&EFS/603.6
					-AO_21	M																	
					-X5.1	2																	
FUSE 24V DC CONTROL VOLTAGE					-680K1	A2	6																&EFS/603.6
					-X5.2	2																	
FUSE 24V DC CONTROL VOLTAGE					-680K2	A2	7																&EFS/603.7
					-X5.3	2																	
					-680K3	A2																	

previous page: 2004

next page: 2006

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XDC2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2005
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-XES					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
							1		-684F1	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC							N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-690F1	N													&EFS/684.3
=					-690XT1	N	N		-690F2	N													&EFS/684.3
=							N		-690XT1	N													&EFS/684.4
=							PE			PE													&EFS/684.4
=					++Container-278W1	GND	PE			PE													&EFS/684.4
=					-684F5	PE	PE		-684F2	PE													&EFS/684.5
=					-601F1	PE	PE																&EFS/684.5
					-684F4	2	2		-684F3	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC					-601F1	L1	3																&EFS/684.1
=							4		-684F1	4													&EFS/684.1
=					-684F4	4	5		-684F3	4													&EFS/684.1
=					-601F1	L2	6																&EFS/684.1
=							7		-684F1	6													&EFS/684.1
=					-684F4	6	8		-684F3	6													&EFS/684.1
=					-601F1	L3	9																&EFS/684.2

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-OZ	++Container-290W2-2 F-CY-OZ	++Container-290W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	1					&EFS/669.5
		3			++Container-570XT	3						
	3				++Container-570XT	3						

previous page: 2006

next page: 2008

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2007

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	2		++Container-570XT	3		3	&EFS/669.5
		3			++Container-570XT	3							
	3				++Container-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	3		++Container-570XT	3		3	&EFS/669.6
		3			++Container-570XT	3							
	3				++Container-570XT	3							

previous page: 2008

next page: 2010

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 2009
Date								+ — total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	4					&EFS/669.7
		4			++Container-570XT	4						
	4				++Container-570XT	4						

previous page:
2009

next page:
2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2010
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	5		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

previous page:
2010

next page:
2012

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2011
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	6		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

previous page: 2011

next page: 2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2012

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	7					&EFS/670.5
		1			++Container-570XT	1						
	1				++Container-570XT	1						

previous page: 2012

next page: 2014

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	8		++Container-570XT	1		1	&EFS/670.5
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	9		++Container-570XT	1		1	&EFS/670.6
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	10					&EFS/670.7
		2			++Container-570XT	2						
	2				++Container-570XT	2						

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	11		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	12		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

previous page: 2017

next page: 2019

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2018

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			++Container-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				++Container-XE	1	3	,	-687F3	2		&EFS/687.4

previous page:
2018

next page:
2020

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2019
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-1 JZ-500	++Container-291W2-1 JZ-500	++Container-291W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	4	,	-687F4	2		&EFS/687.5
=		1			++Container-XE	1	5	,	-687F5	2		&EFS/687.7
=	1				++Container-XE	1	6	,	-687F6	2		&EFS/687.8

previous page: 2019

next page: 2021

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025					& EMZ Terminals
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date						+

page: 2020

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-1	++Container-292W3-1	++Container-292W2-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	7	,	-688F1	2													&EFS/688.1
=		1			++Container-XE	1	8	,	-688F2	2													&EFS/688.3
=	1				++Container-XE	1	9	,	-688F3	2													&EFS/688.4

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W1-1 JZ-500	++Container-293W3-1 JZ-500	++Container-293W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	10	,	-688F4	2		&EFS/688.5
=		1			++Container-XE	1	11	,	-688F5	2		&EFS/688.7
=	2				++Container-XE	N	N	,	-XES	N		&EFS/687.1

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2022

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W1-1 JZ-500	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/687.6

previous page: 2022

next page: 2024

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2023

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W2-1 -XZ-500	++Container-292W1-1 -XZ-500	++Container-291W2-1 -XZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.7
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.8
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N		-XES	N		&EFS/688.1

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2024 of total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W2-1 -1Z-500	++Container-293W1-1 -1Z-500	++Container-292W3-1 -1Z-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/688.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/688.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/688.6

previous page: 2024

next page: 2026

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W2-1	++Container-290W1-1	++Container-293W3-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N																&EFS/688.7
Supply Battery String 1-phase 230V AC		GNYE			++Container-XE	PE	PE																&EFS/687.2
=	GNYE				++Container-XE	PE	PE																&EFS/687.3

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W2-1 -XZ-500	++Container-291W1-1 -XZ-500	++Container-290W3-1 -XZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,				&EFS/687.4
=		GNYE			++Container-XE	PE	PE	,				&EFS/687.6
=	GNYE				++Container-XE	PE	PE	,				&EFS/687.7

previous page: 2026

next page: 2028

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W3-1 / JZ-500	++Container-292W2-1 / JZ-500	++Container-292W1-1 / JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,				&EFS/687.9
=		GNYE			++Container-XE	PE	PE	,				&EFS/688.2
=	GNYE				++Container-XE	PE	PE	,				&EFS/688.3

previous page: 2027

next page: 2029

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20250805_V2.0	= UNIT_02	Battery Container 1
Date	21.01.2025					& EMZ	Terminals
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date						+	

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W3-1	++Container-293W2-1	++Container-293W1-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/688.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Container Internal Lighting						L	1	,	-690F1	2													&EFS/690.1
=						1	2	,	-690F2	2													&EFS/690.3
Container Sockets						1	3	,	-690F3	2													&EFS/690.5
230V AC for crane 2						1	4	,	-690F4	2													&EFS/690.7
230V AC for crane 3						1	5	,	-690F5	2													&EFS/690.8
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						L	6	,	-636K1	14													&EFS/691.1
						L																	
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						L	7	,	-636K2	14													&EFS/691.3
						L																	
								,															
								,															

previous page: 2029

next page: 2031

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,		

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
400V AC for Cooling Units							10	,	-691F4	4													&EFS/691.6
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,														

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
												Cable type	
230V AC for crane 2						PE	PE						&EFS/690.7
230V AC for crane 3						PE	PE						&EFS/690.8
Container Sockets						2	N		-690F2	N.			&EFS/690.4
230V AC for crane 1						2	N		-XES	N			&EFS/690.6
230V AC for crane 2						2	N		-XES	N			&EFS/690.7
230V AC for crane 3						2	N		-XES	N			&EFS/690.8
Container Internal Lighting						N	N		-690F1	N.			&EFS/690.1
=						GND	PE						&EFS/690.2
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						N	N		-XES	N			&EFS/691.1
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						GND	PE						&EFS/691.2
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						N	N						&EFS/691.3
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						GND	PE						&EFS/691.3
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						N	N						&EFS/691.4
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						GND	PE						&EFS/691.4
						GND							
400V AC for Cooling Units							N						&EFS/691.6
=							PE						&EFS/691.6

previous page: 2032

next page: =UNIT_03&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-690XT1	20250805_V2.0	= UNIT_02 Battery Container 1
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet page: 2033
Date								+ total: 492

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	BATTERY CONTAINER 2	
Circuit diagram No:	10354_23A2007	20250805_V2.0

Producer (company):	Freqcon GmbH	53412 ASC 53409
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Project manager:	Freqcon_CP	

created on: 17.09.2019
edited on: 05.08.2025 edited by: Freqcon_DG total pages: 492

previous page:
=UNIT_02&EMZ++ASC/2033

next page:
&EAB/1

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	05.11.2024	Freqcon_DG
&EAB		Contents		
	1	INDEX	23.01.2025	Freqcon_DG
	2	INDEX	21.01.2025	Freqcon_DG
	3	INDEX	21.01.2025	Freqcon_DG
	4	INDEX	21.01.2025	Freqcon_DG
	5	INDEX	21.01.2025	Freqcon_DG
	6	INDEX	21.01.2025	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	14.06.2024	Freqcon_JD
	6a	Specification Earthing	14.06.2024	Freqcon_JD
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
	2a	SYSTEMS OVERVIEW	05.11.2024	Freqcon_DG
	3a	SYSTEMS OVERVIEW	18.06.2024	Freqcon_JD
&ELU		Cabinet Overview		
	5a	Container overview	14.06.2024	Freqcon_JD
&EFS ++Container		Circuit diagram		
	190	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	191	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++Container		Circuit diagram		
	192	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	193	CONTAINER INSTALLATION	18.06.2024	Freqcon_JD
	278	EARTHING CONTAINER	18.06.2024	Freqcon_JD
	290	BATTERY CABINETS 1-3	18.06.2024	Freqcon_JD
	291	BATTERY CABINETS 4+5	18.06.2024	Freqcon_JD
	292	BATTERY CABINETS 6-8	18.06.2024	Freqcon_JD
	293	BATTERY CABINETS 9-11	18.06.2024	Freqcon_JD
&EFS ++ASC		Circuit diagram auxillary cabinet		
	601	CONTROL VOLTAGE POWER SUPPLY UNIT	05.11.2024	Freqcon_DG
	602	CONTROL VOLTAGE UPS	18.06.2024	Freqcon_JD
	603	CONTROL VOLTAGE FUSE	10.10.2024	Freqcon_DG
	611	ETHERNET SWITCH	18.06.2024	Freqcon_JD
	613a	ETHERNET / PROFINET ISOLATOR	25.11.2024	Freqcon_DG
	613b	PROFINET	25.11.2024	Freqcon_DG
	620	ET200 24V DC ASC	25.11.2024	Freqcon_DG
	621	ET200SP DIGITAL INPUTS DI_21 + DI_22	03.12.2024	Freqcon_DG
	623	ET200SP DIGITAL OUTPUTS DO_21	14.06.2024	Freqcon_JD
	624	ET200SP ANALOG INPUTS AI_21	14.06.2024	Freqcon_JD
	625	ET200SP ANALOG OUTPUTS AO_21	14.06.2024	Freqcon_JD
	635a	OUTPUTS COMMUNICATION	18.06.2024	Freqcon_JD
	635b	OUTPUTS COMMUNICATION	18.06.2024	Freqcon_JD
	636	OUTPUTS FIRE DAMPER	18.06.2024	Freqcon_JD
	669	SMOKE POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	670	GAS POTENTIAL-FREE CONTACTS	18.06.2024	Freqcon_JD
	678	DC BATTERY CABINETS	18.06.2024	Freqcon_JD
	680a	STATIONARY GAS DETECTOR BAT 1-4	18.06.2024	Freqcon_JD

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++ASC		Circuit diagram auxillary cabinet		
	680b	STATIONARY GAS DETECTOR BAT 5-8	18.06.2024	Freqcon_JD
	680c	STATIONARY GAS DETECTOR BAT 9-11	18.06.2024	Freqcon_JD
	681	EXTRACT FAN FIRE DAMPER	18.06.2024	Freqcon_JD
	684	AUXILIARY SUPPLY 400V AC	22.11.2024	Freqcon_DG
	685	AUXILIARY SUPPLY 400V AC	08.10.2024	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	08.10.2024	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	29.10.2024	Freqcon_DG
	691	CONTAINER COOLING / LIGHTNING	05.11.2024	Freqcon_DG
&EPC ++Container		Parts List		
	1	PARTS LIST	05.11.2024	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	21.01.2025	Freqcon_DG
	2	PARTS LIST	21.01.2025	Freqcon_DG
	3	PARTS LIST	21.01.2025	Freqcon_DG
	4	PARTS LIST	21.01.2025	Freqcon_DG
	5	PARTS LIST	21.01.2025	Freqcon_DG
	6	PARTS LIST	21.01.2025	Freqcon_DG
	7	PARTS LIST	21.01.2025	Freqcon_DG
	8	PARTS LIST	21.01.2025	Freqcon_DG
&EPA ++Container		Summarized part list		
	1	SUMMARIZED PARTS LIST	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
	2	SUMMARIZED PARTS LIST	21.01.2025	Freqcon_DG
&EMB ++Container		Cable list		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	05.11.2024	Freqcon_DG
	2	CABEL LIST	05.11.2024	Freqcon_DG
	3	CABEL LIST	05.11.2024	Freqcon_DG
	4	CABEL LIST	05.11.2024	Freqcon_DG
	5	CABEL LIST	05.11.2024	Freqcon_DG
	6	CABEL LIST	05.11.2024	Freqcon_DG
	7	CABEL LIST	05.11.2024	Freqcon_DG
	8	CABEL LIST	05.11.2024	Freqcon_DG
	9	CABEL LIST	05.11.2024	Freqcon_DG
	10	CABEL LIST	21.01.2025	Freqcon_DG

previous page: 3

next page: 5

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_03++ASC+-X5.1 - =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2000	Klemmenplan =UNIT_03++ASC+-X5.1	21.01.2025	Freqcon_DG
	2001	Klemmenplan =UNIT_03++ASC+-X5.2	21.01.2025	Freqcon_DG
	2002	Klemmenplan =UNIT_03++ASC+-X5.3	21.01.2025	Freqcon_DG
	2003	Klemmenplan =UNIT_03++ASC+-X6	21.01.2025	Freqcon_DG
	2004	Klemmenplan =UNIT_03++ASC+-XDC1	21.01.2025	Freqcon_DG
	2005	Klemmenplan =UNIT_03++ASC+-XDC2	21.01.2025	Freqcon_DG
	2006	Klemmenplan =UNIT_03++ASC+-XES	05.11.2024	Freqcon_DG
	2007	Klemmenplan =UNIT_03++ASC+-XT	21.01.2025	Freqcon_DG
	2008	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2009	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2010	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2011	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2012	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2013	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2014	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2015	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2016	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2017	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2018	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2019	Klemmenplan =UNIT_03++ASC+-369XT	21.01.2025	Freqcon_DG
	2020	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2021	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2022	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2023	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2024	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG
	2025	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2026	Klemmenplan =UNIT_03++ASC+-687XT1	05.11.2024	Freqcon_DG
	2027	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2028	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2029	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2030	Klemmenplan =UNIT_03++ASC+-687XT1	21.01.2025	Freqcon_DG
	2031	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2032	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2033	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG
	2034	Klemmenplan =UNIT_03++ASC+-690XT1	21.01.2025	Freqcon_DG

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/6

next page: 6a

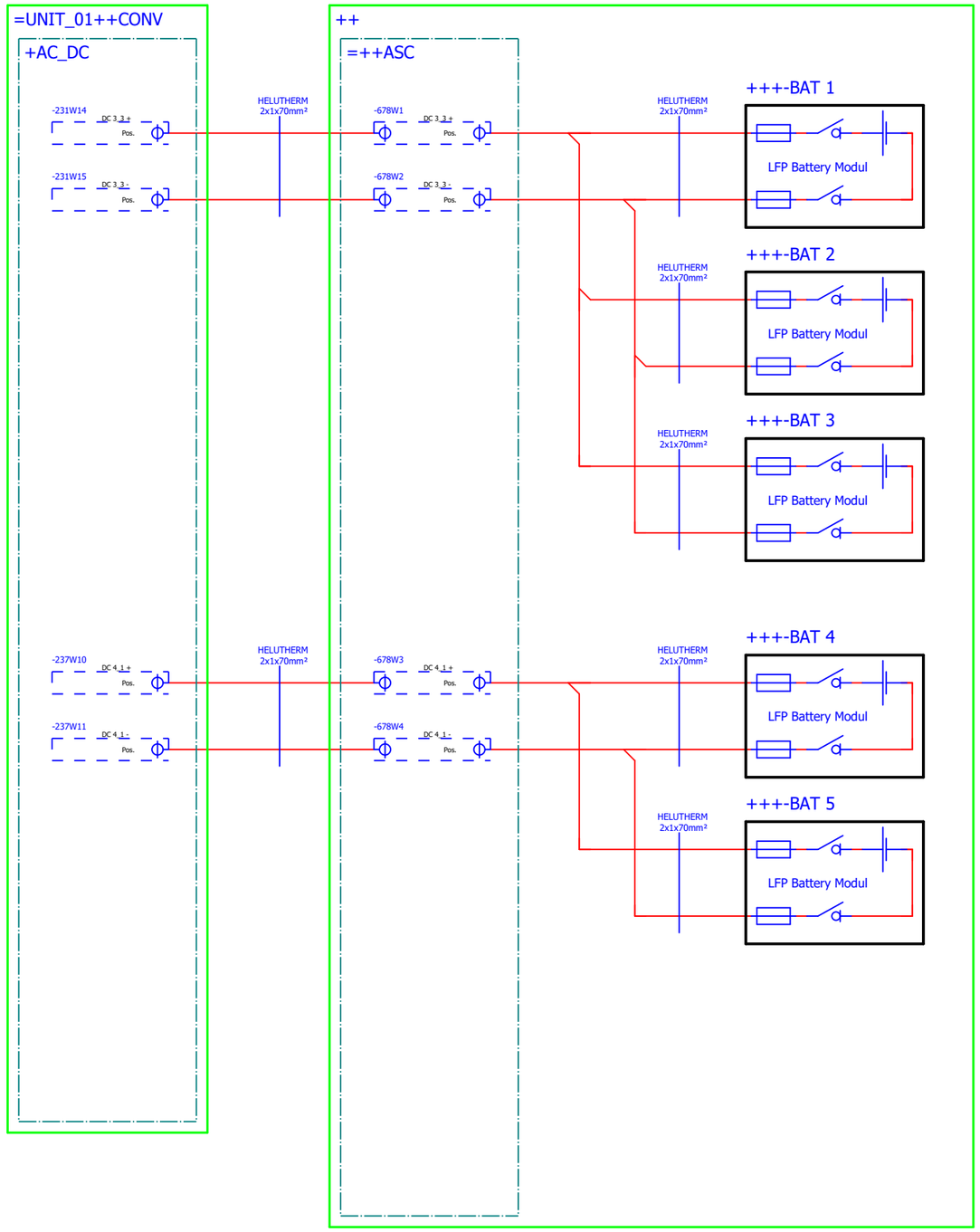
SPECIFICATION of grounding

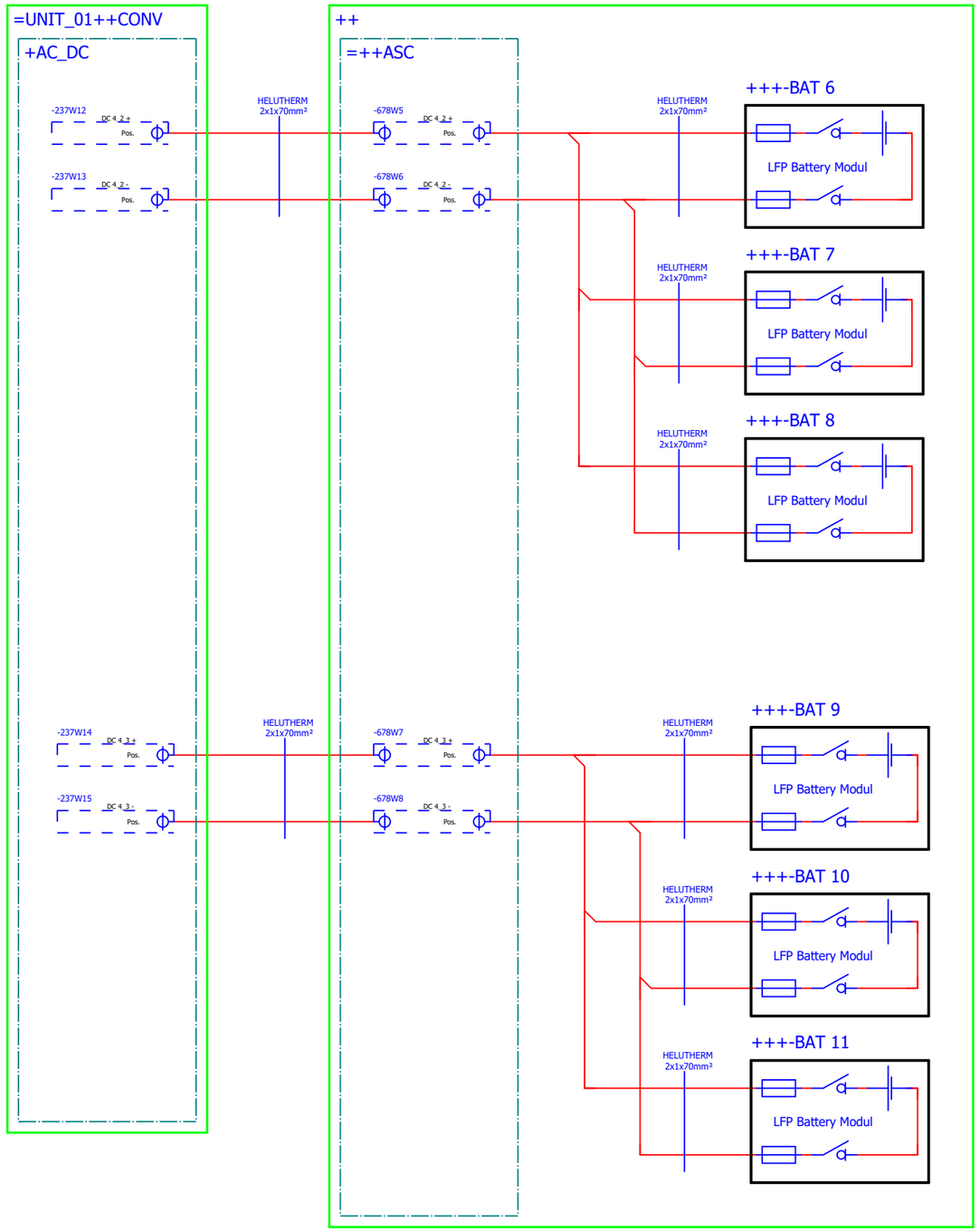
	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Single line diagram





previous page:
&EAC/6a

next page:
2a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 1a
Date								+ total: 492

Single line diagram

Control circuit

++ASC

400V

-XES

-684F3 &EFS++ASC/684.2 C32A

-684F1 &EFS++ASC/684.0 C32A

-684F2 &EFS++ASC/684.5 TYP 1 + 2 SPD

-601F1 &EFS++ASC/601.1 TYP 1 + 2 SPD

-684F4 &EFS++ASC/685.0 C32A

-684F5 &EFS++ASC/685.5 TYP 1 + 2 SPD

-691F1 &EFS++ASC/691.1 C6A

-691F2 &EFS++ASC/691.3 C6A

-691F3 &EFS++ASC/691.4 C6A

-690F1 &EFS++ASC/690.1 16A

-690F3 &EFS++ASC/690.5 C6A

-690F4 &EFS++ASC/690.7 C6A

-690F5 &EFS++ASC/690.8 C6A

-691F4 &EFS++ASC/691.5 C16A

-690F2 &EFS++ASC/690.3 16A

-101Q1

-687F1 &EFS++ASC/687.1 C16A

-687F2 &EFS++ASC/687.3 C16A

-687F3 &EFS++ASC/687.4 C16A

-687F4 &EFS++ASC/687.5 C16A

-687F5 &EFS++ASC/687.7 C16A

-636K1 &EFS++ASC/636.1

-636K2 &EFS++ASC/636.2

-636K3 &EFS++ASC/636.4

M 1~

1/N/PE

1/N/PE

1/N/PE

1/N/PE 1/N/PE

20 A

Battery cabinet 1

Battery cabinet 2

Battery cabinet 3

Battery cabinet 4

Battery cabinet 5

-687F6 &EFS++ASC/687.8 C16A

-688F1 &EFS++ASC/688.1 C16A

-688F2 &EFS++ASC/688.2 C16A

-688F3 &EFS++ASC/688.4 C16A

-688F4 &EFS++ASC/688.5 C16A

-688F5 &EFS++ASC/688.7 C16A

Battery cabinet 6

Battery cabinet 7

Battery cabinet 8

Battery cabinet 9

Battery cabinet 10

Battery cabinet 11

Exhaust Unit / shut-off flap Bat 1-4

Exhaust Unit / shut-off flap Bat 5-8

Exhaust Unit / shut-off flap Bat 9-11

Container Internal Lighting

crane 1

crane 2

crane 3

Cooling Units

Container Sockets

Power Supply

previous page: 1a

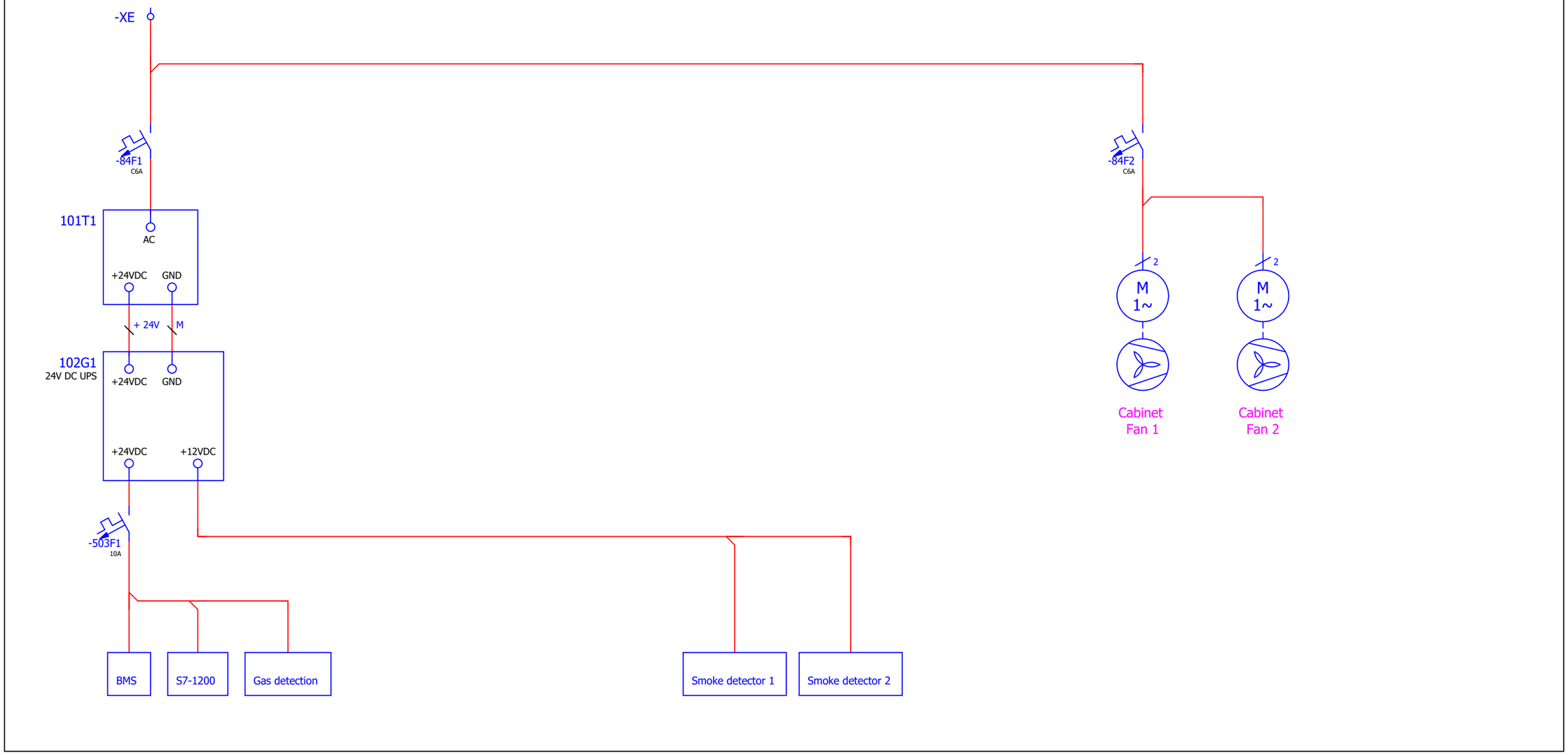
next page: 3a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2a
Date								+ total: 492

Single line diagram

Control circuit

Battery Cabinet

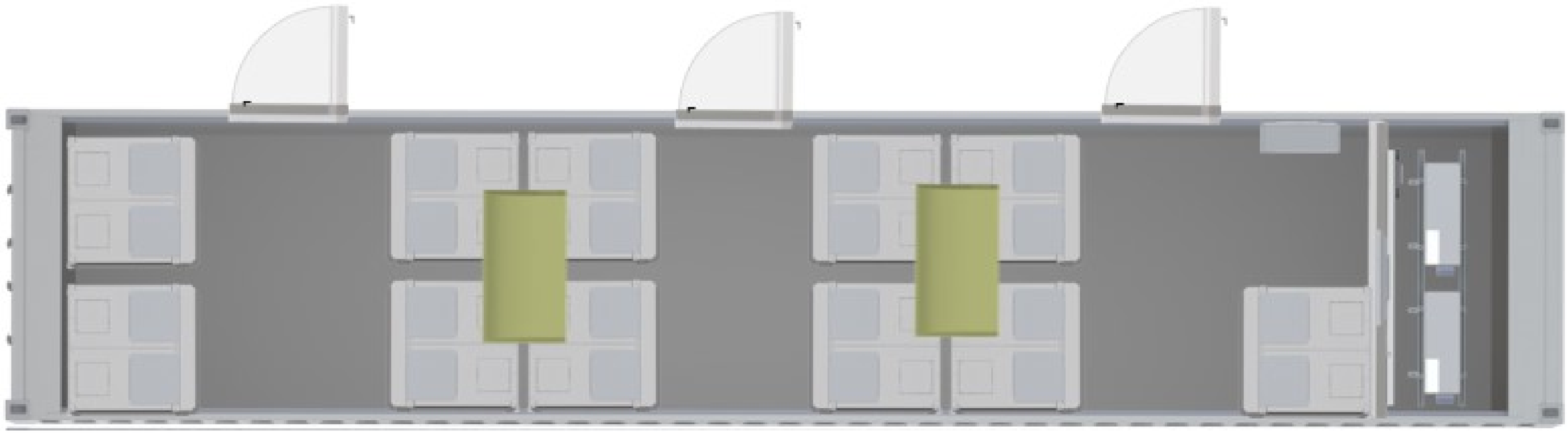


previous page:
2a

next page:
&ELU/5a

Editor	Freqcon_JD			Statron	FREQCON	SYSTEMS OVERVIEW	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 3a
Date								+	total: 492

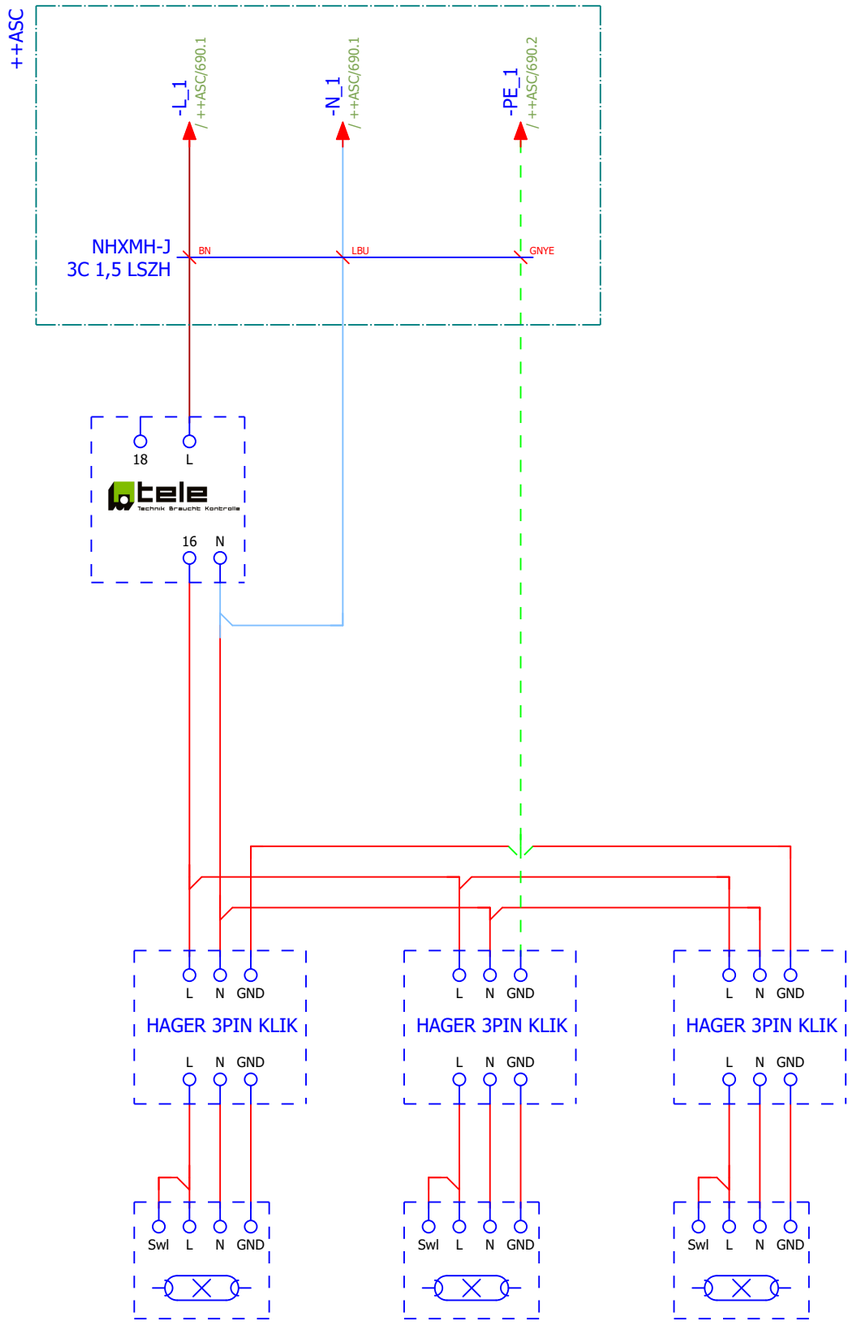
0	1	2	3	4	5	6	7	8	9



previous page:
&EFA/3a

next page:
&EFS++Container/190

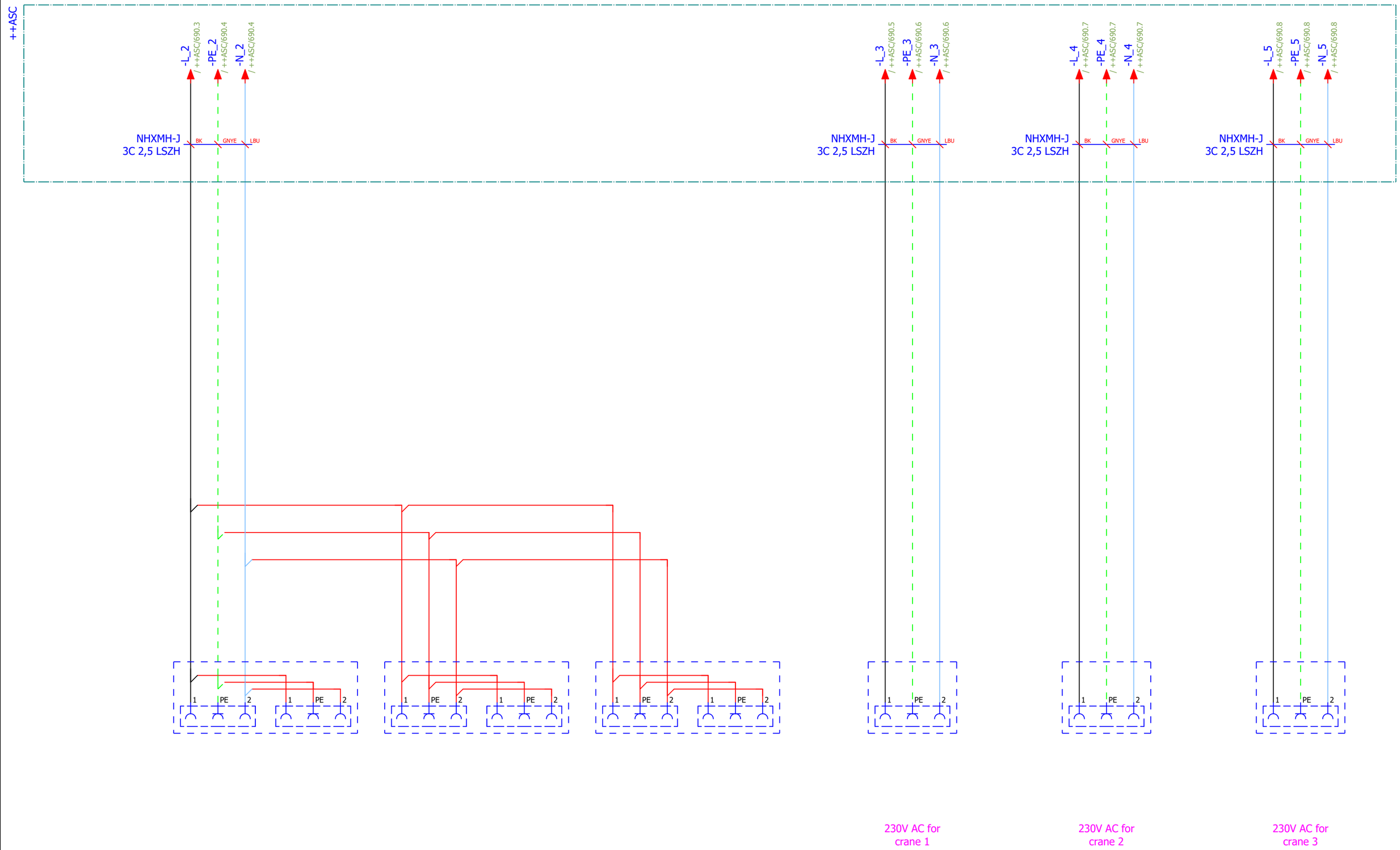
Editor	Freqcon_JD			Statron	FREQCON	Container overview	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	14.06.2024	Norm						& ELU Cabinet Overview	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 492



previous page:
&ELU++/5a

next page:
191

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 492



previous page: 190

next page: 192

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 191
Date								+	total: 492

++ASC

-L_6 / ++ASC/691.1
-N_6 / ++ASC/691.1
-PE_6 / ++ASC/691.2

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 1-4

-L_6 / ++ASC/691.1
-N_6 / ++ASC/691.1
-PE_6 / ++ASC/691.2

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

230V AC for
shut-off flap
Battery cabinets 1-4

-L_7 / ++ASC/691.3
-N_7 / ++ASC/691.3
-PE_7 / ++ASC/691.3

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 5-8

-L_7 / ++ASC/691.3
-N_7 / ++ASC/691.3
-PE_7 / ++ASC/691.3

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

230V AC for
shut-off flap
Battery cabinets 5-8

-L_8 / ++ASC/691.4
-N_8 / ++ASC/691.4
-PE_8 / ++ASC/691.4

NHXMH-J
3C 1,5 LSZH
BK LBU GNYE

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

BELDEN 9842
LSZH
WH BU WH BU

Junction Box
next to fan motor

230V AC for
Exhaust Unit
Battery cabinets 9-11

-L_8 / ++ASC/691.4
-N_8 / ++ASC/691.4
-PE_8 / ++ASC/691.4

L N GND
13A fused
Spur K983ALM
L N GND

1 2
M
1~
PE

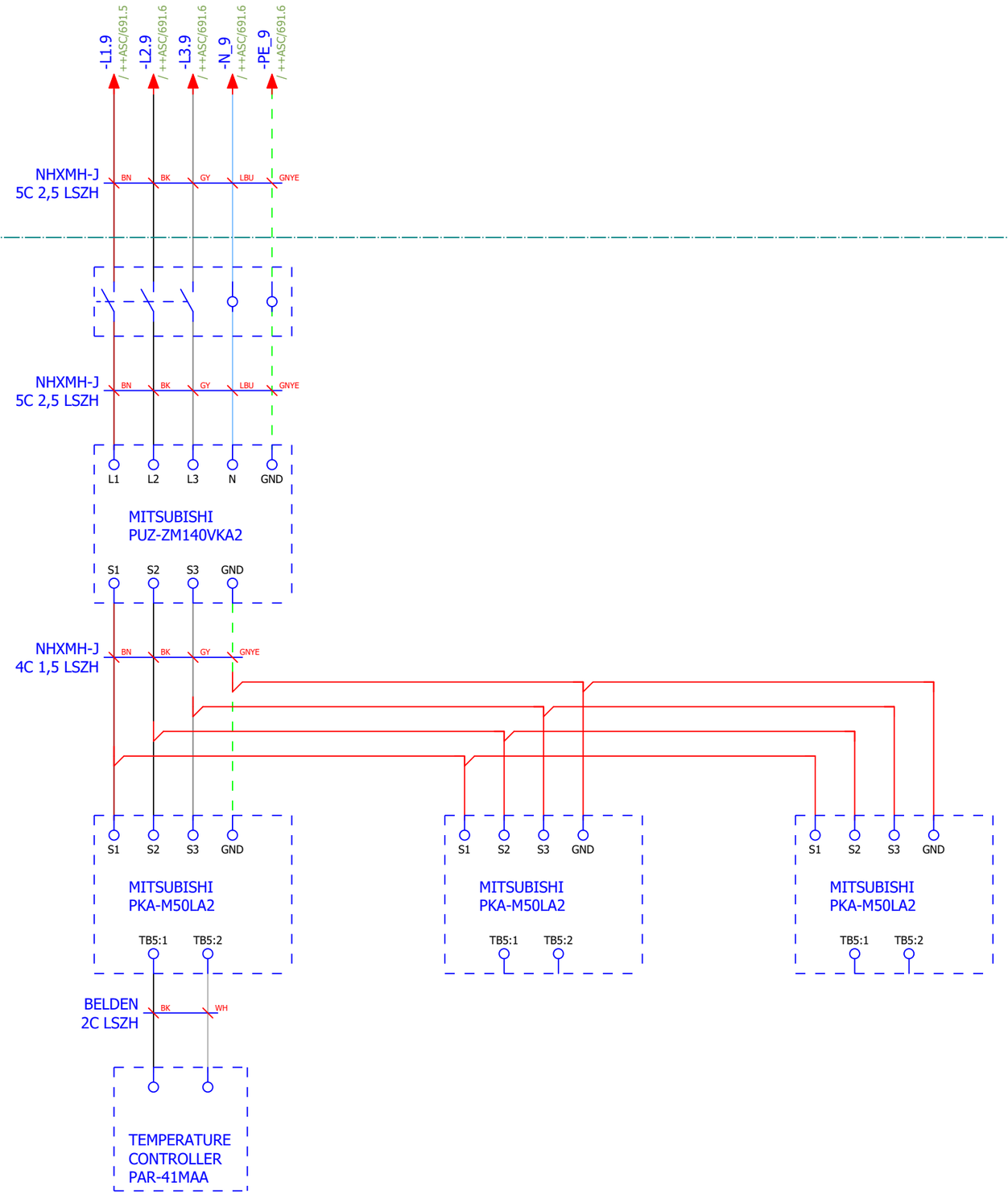
230V AC for
shut-off flap
Battery cabinets 9-11

previous page:
191

next page:
193

Editor	Freqcon_JD			Statron	FREQCON	CONTAINER INSTALLATION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 192
Date								+	total: 492

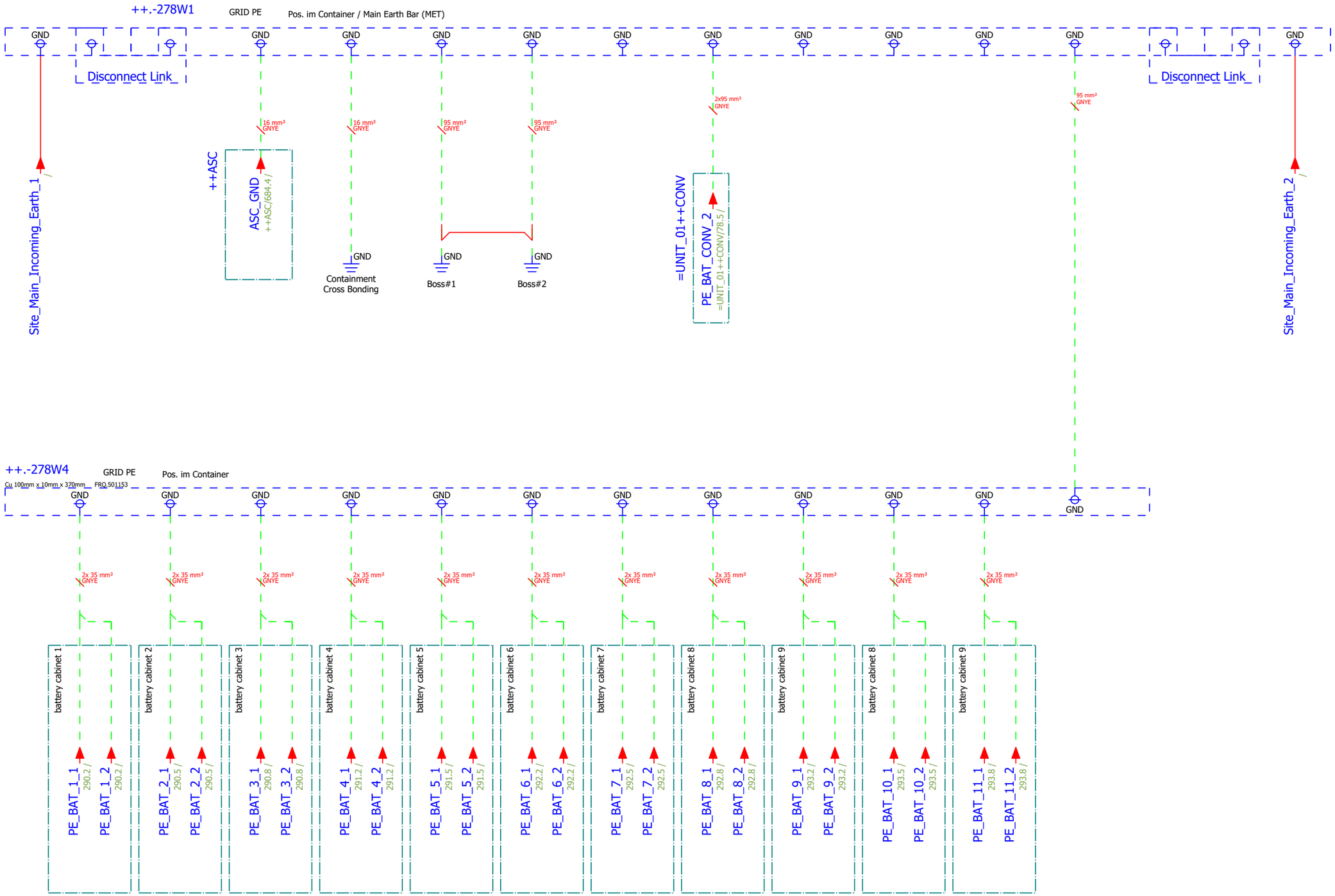
++ASC



previous page: 192

next page: 278

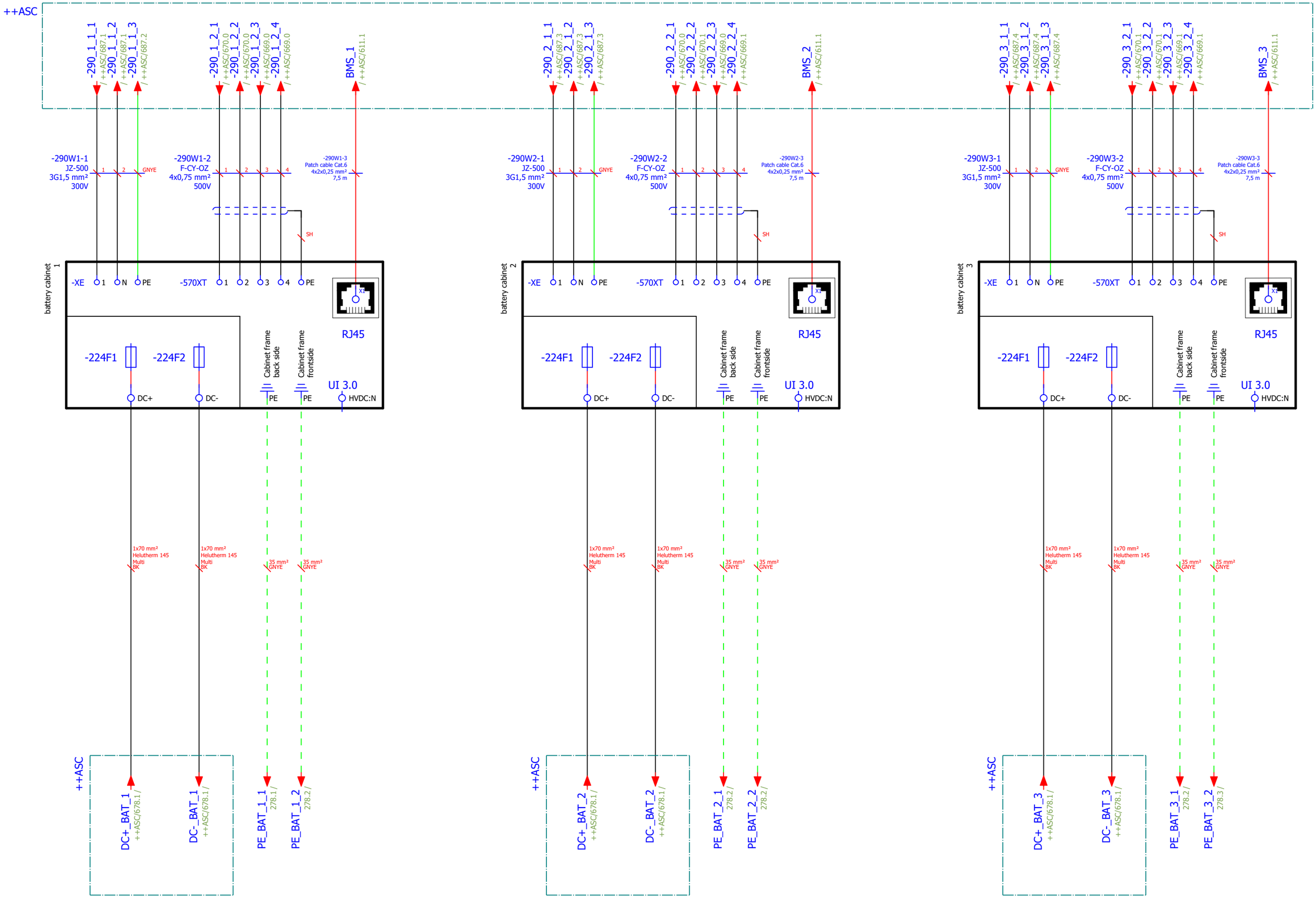
Busbars PE



previous page: 193

next page: 290

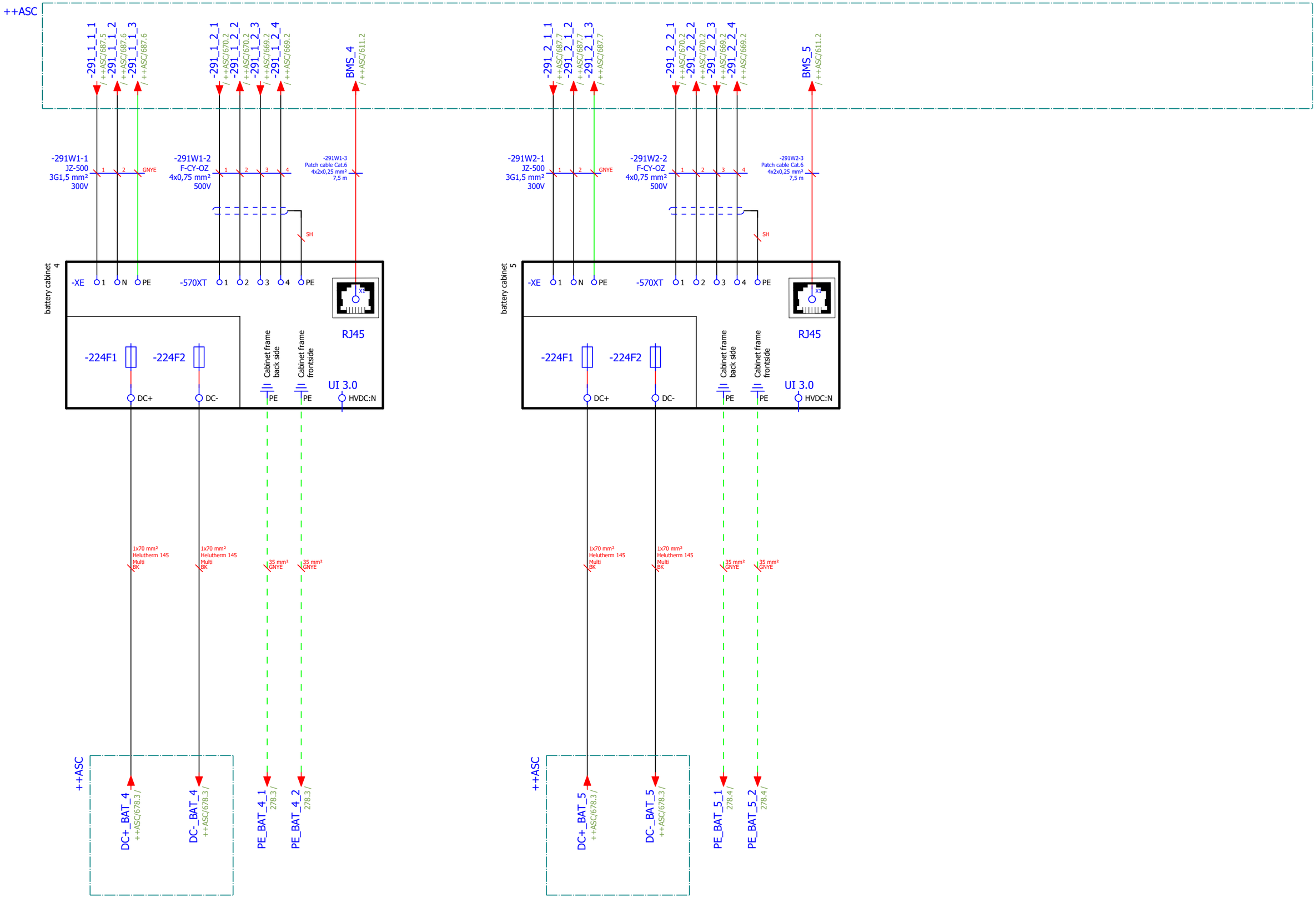
Editor	Freqcon_JD			Statron	FREQCON	EARTHING CONTAINER	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 278
Date								+	total: 492



previous page: 278

next page: 291

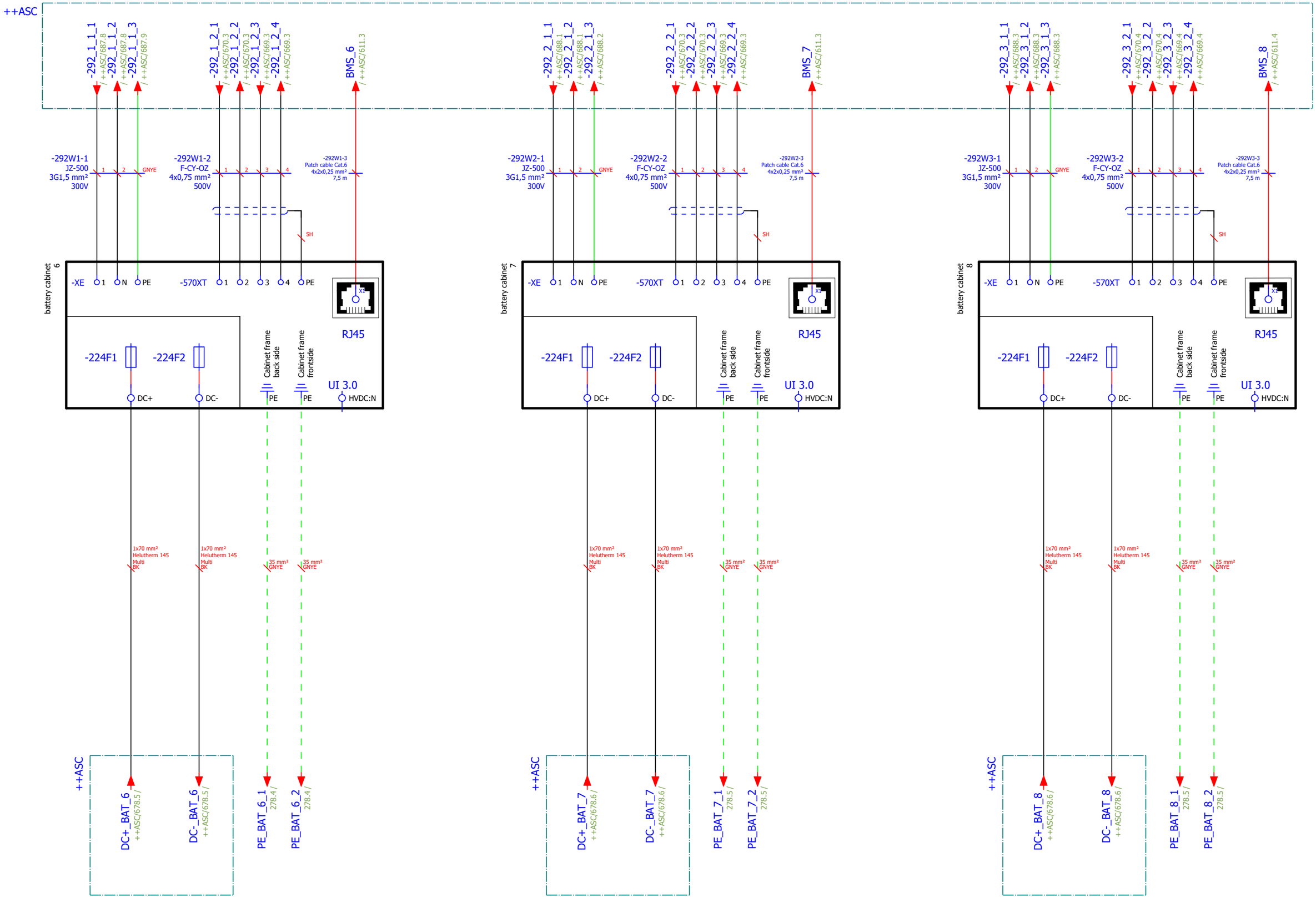
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 1-3	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 290
Date								+	total: 492



previous page: 290

next page: 292

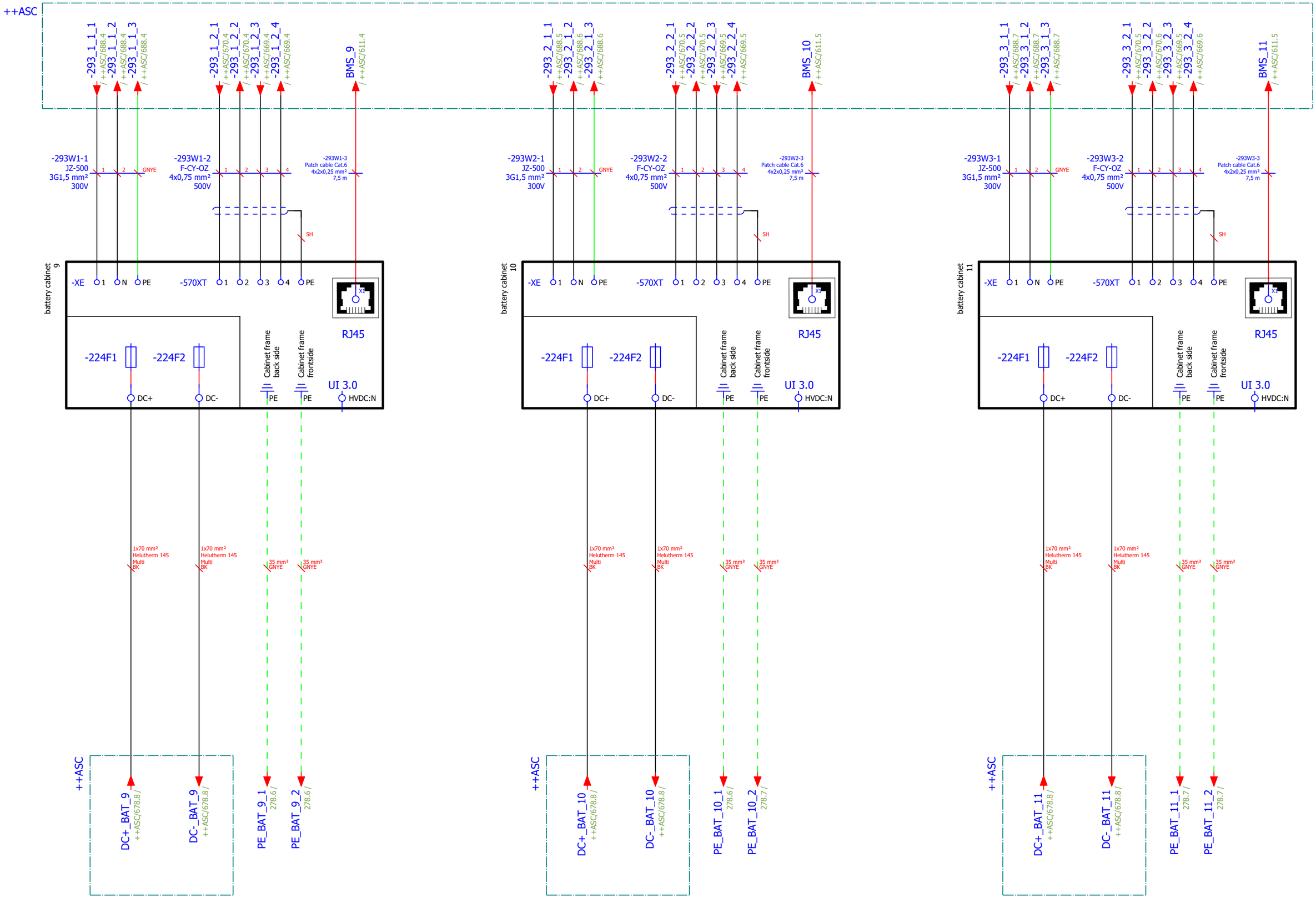
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 4+5	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 291
Date								+	total: 492



previous page: 291

next page: 293

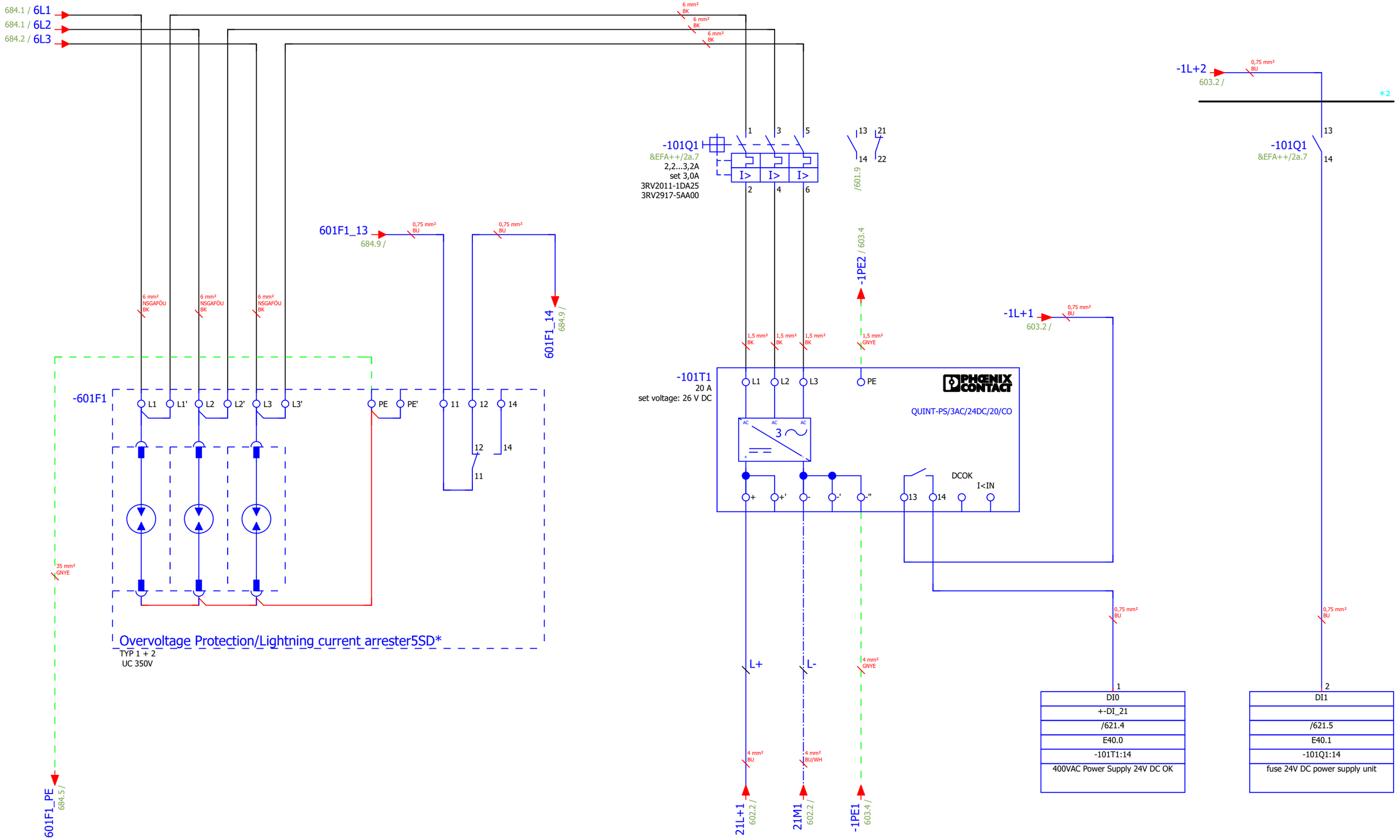
Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 6-8	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 292
Date								+ total: 492



previous page: 292

next page: ++ASC/601

Editor	Freqcon_JD			Statron	FREQCON	BATTERY CABINETS 9-11	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 293
Date								+ total: 492



previous page:
++Container/293

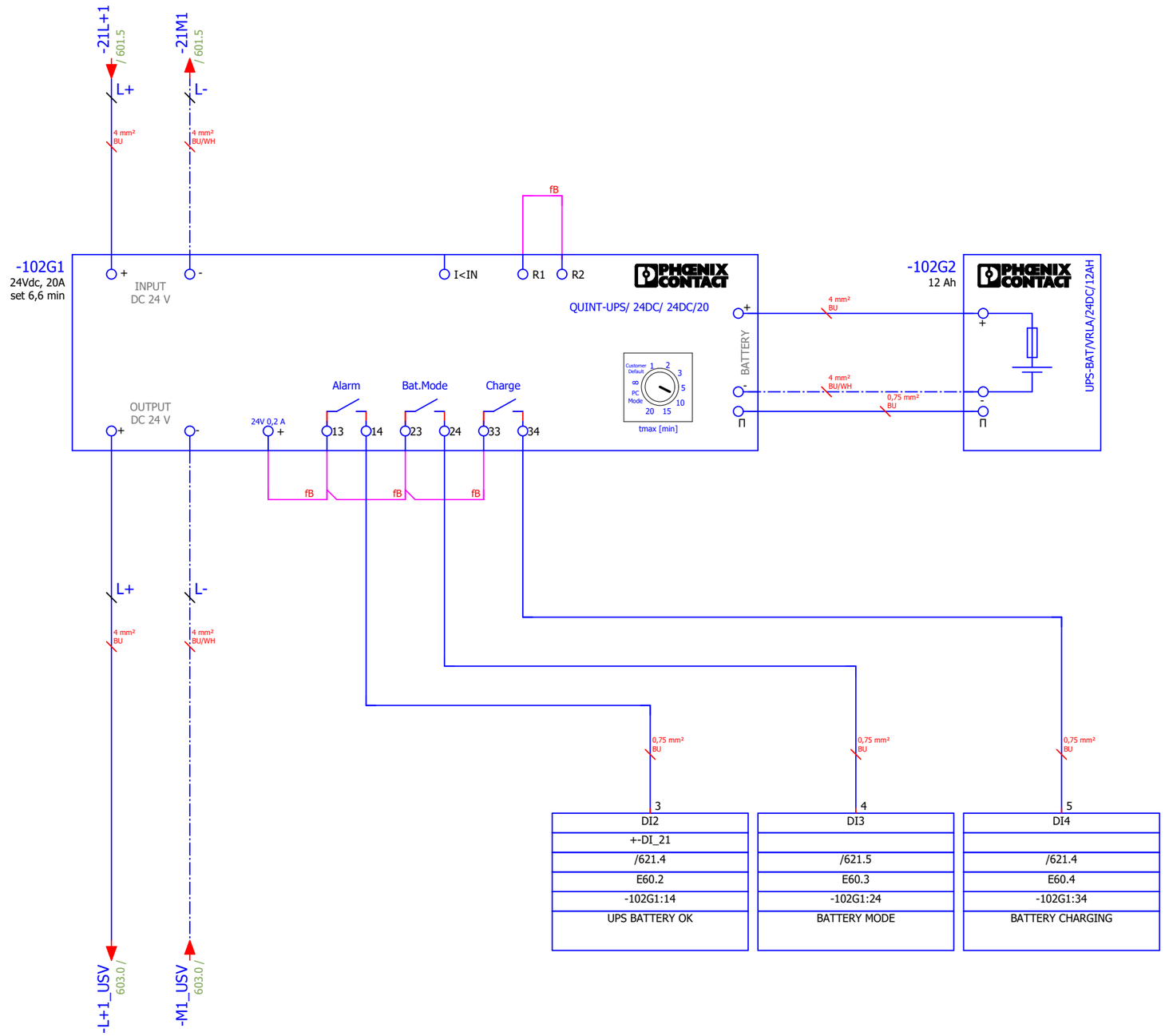
Power supply unit from 400V AC

400VAC
Power Supply
24V DC OK

fuse
24V DC power supply unit

next page:
602

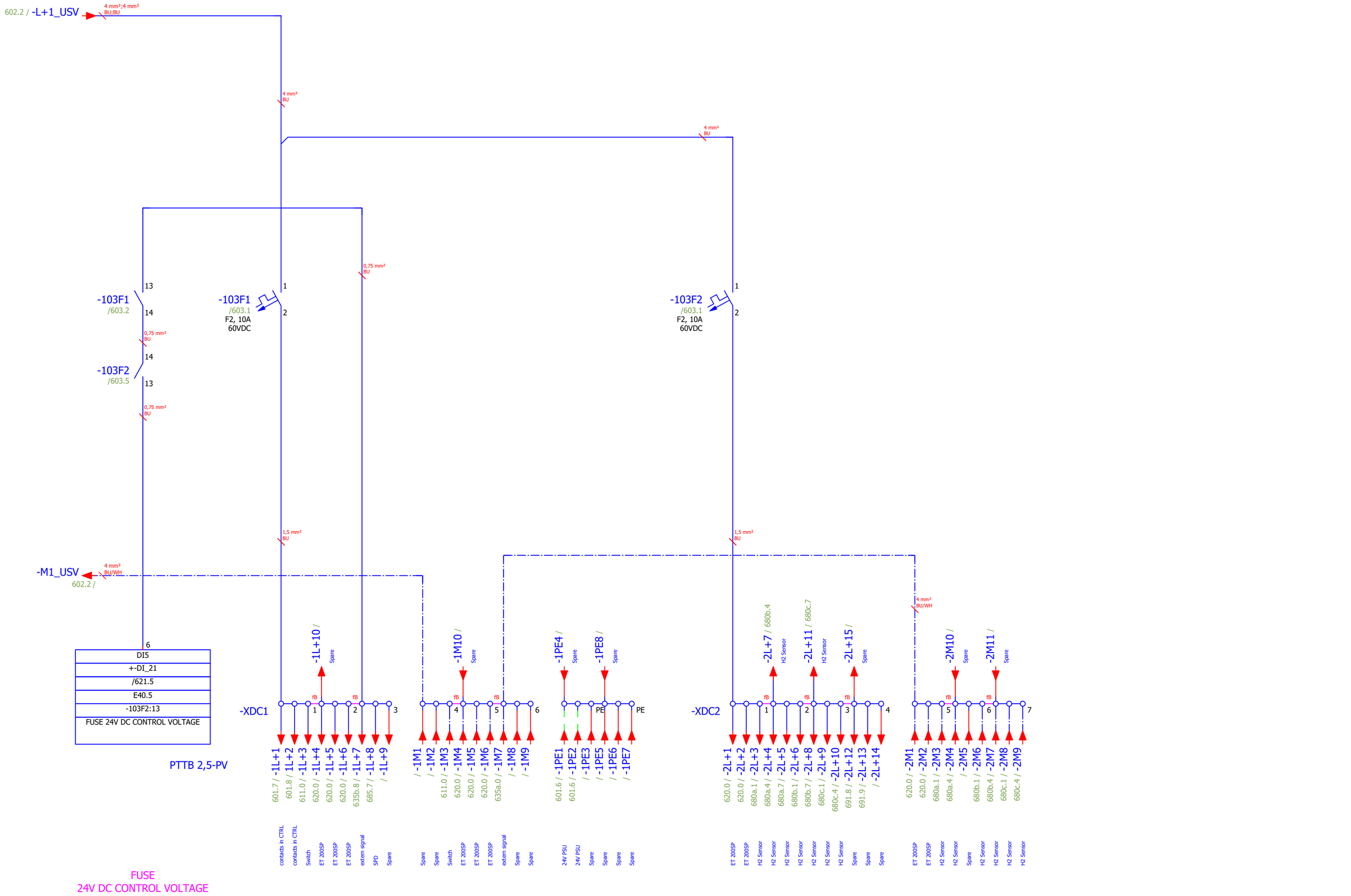
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20250805_V2.0	= UNIT_03	Battery Container 2
Date	05.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	page: 601 / total: 492



previous page:
601

next page:
603

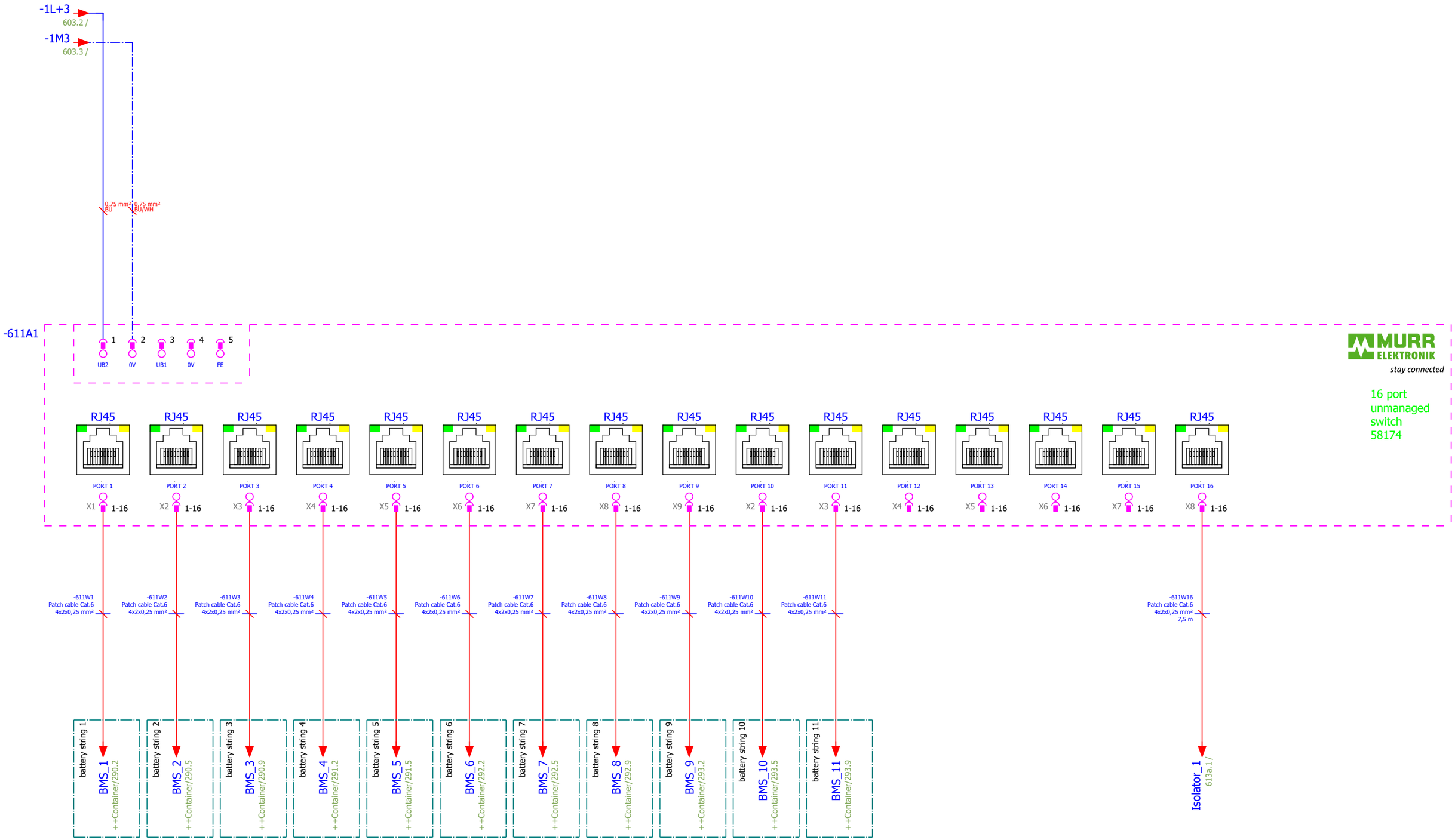
Editor	Freqcon_JD			Statron	FREQCON	CONTROL VOLTAGE UPS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 602
Date								+	total: 492



previous page:
602

next page:
611

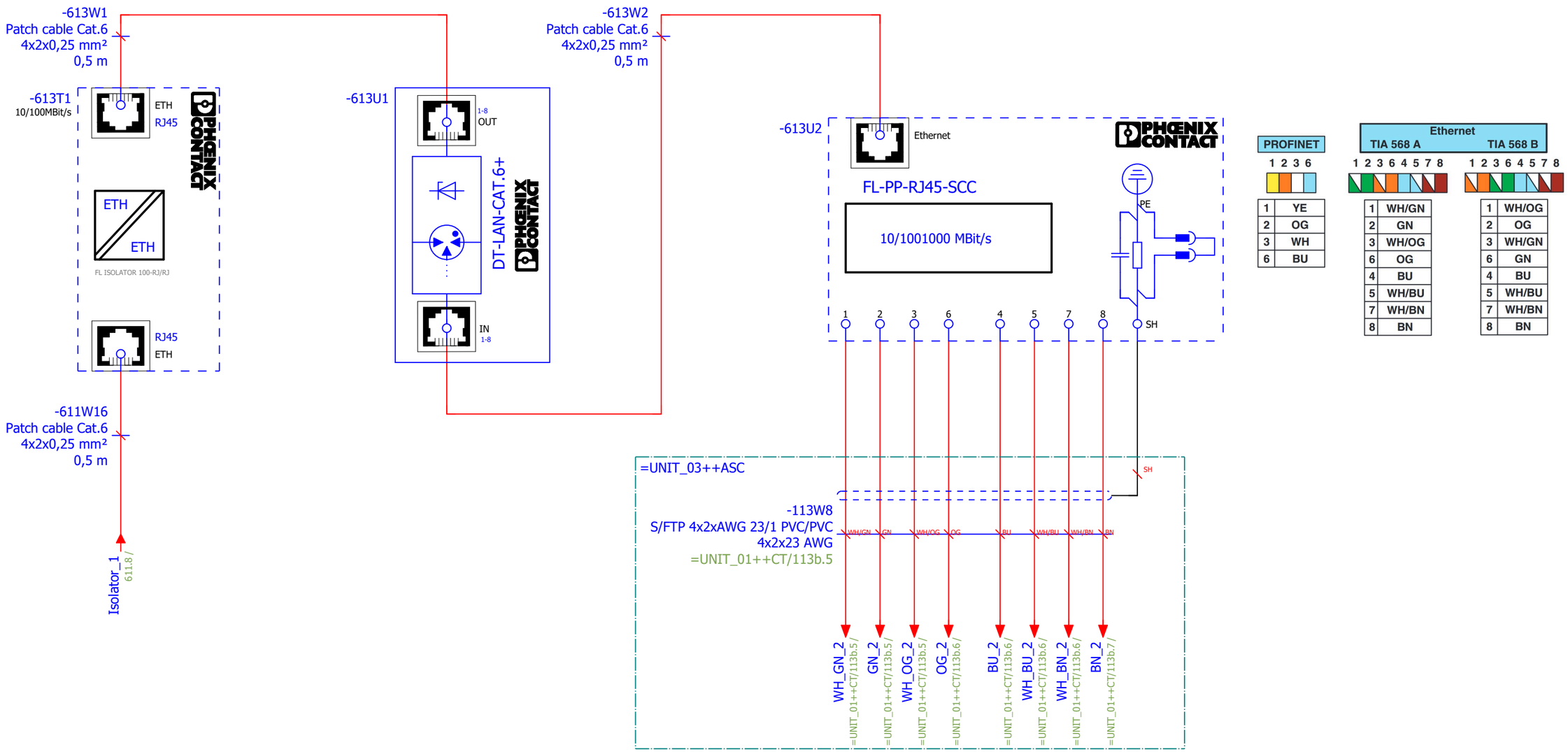
Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE FUSE	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	10.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxiliary cabinet	page: 603
Date								+	total: 492



previous page: 603

next page: 613a

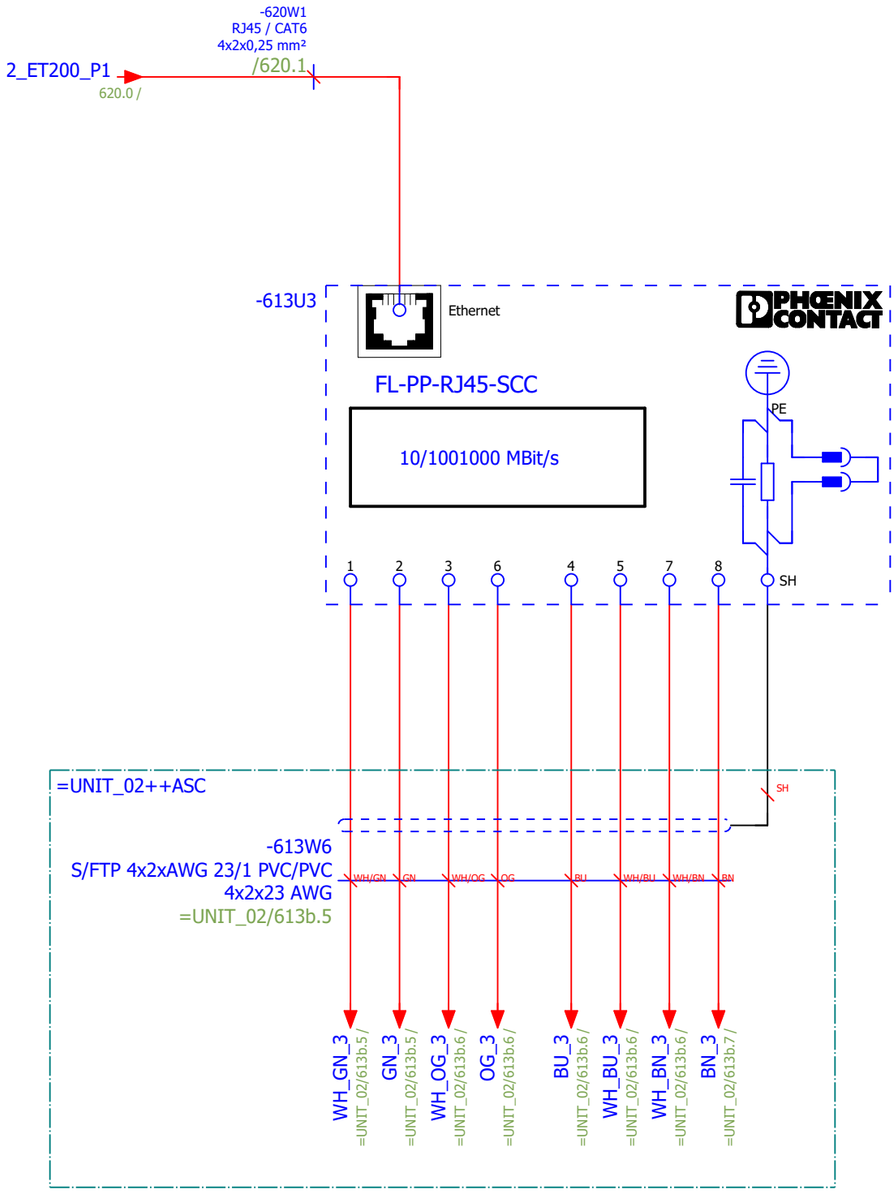
Editor	Freqcon_JD			Statron	FREQCON	ETHERNET SWITCH	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 492



previous page:
611

next page:
613b

Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	25.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 613a
Date								+	total: 492



PROFINET

1 2 3 6

1	YE
2	OG
3	WH
6	BU

Ethernet

TIA 568 A

1 2 3 6 4 5 7 8

1	WH/GN
2	GN
3	WH/OG
6	OG
4	BU
5	WH/BU
7	WH/BN
8	BN

TIA 568 B

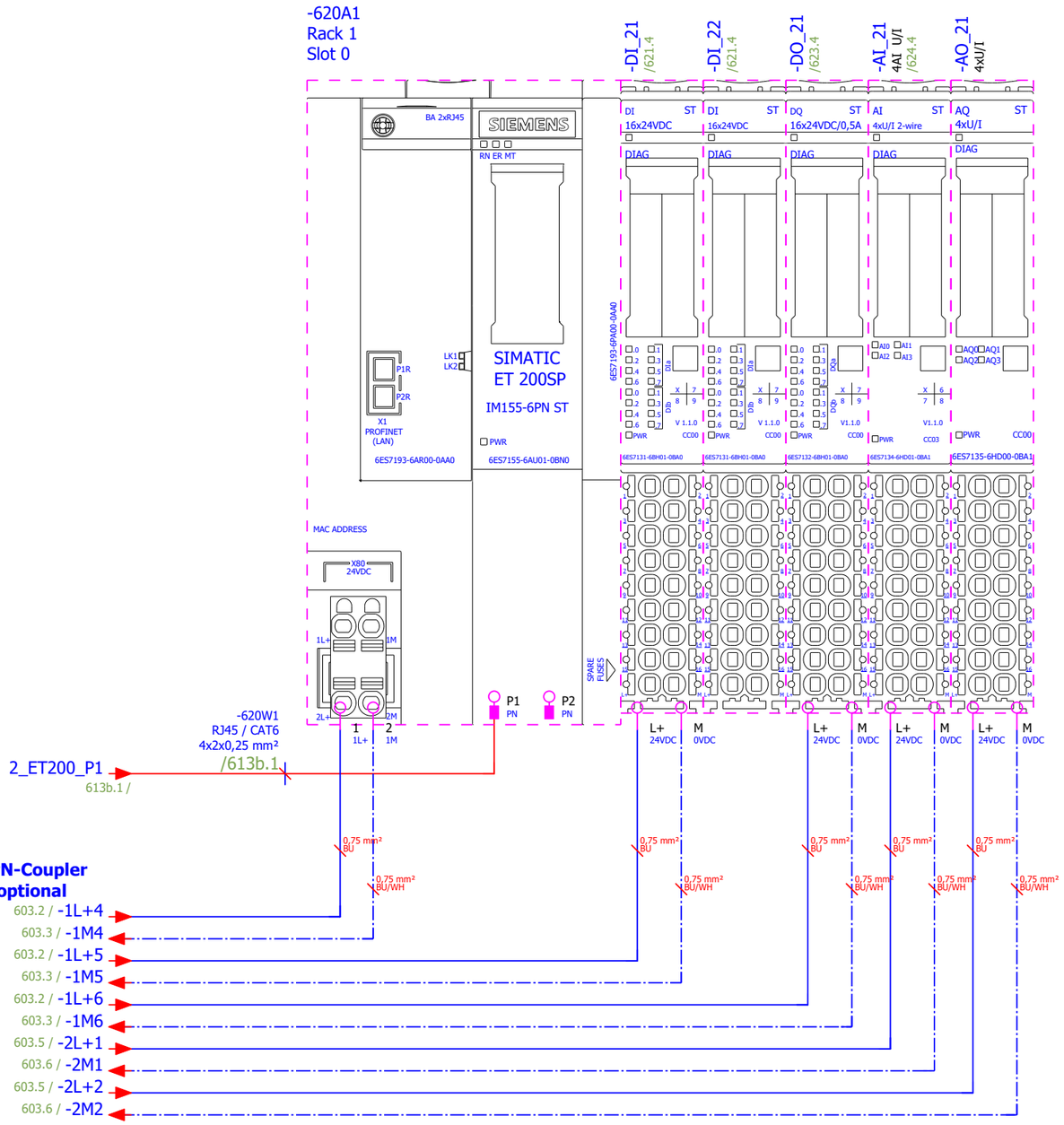
1 2 3 6 4 5 7 8

1	WH/OG
2	OG
3	WH/GN
6	GN
4	BU
5	WH/BU
7	WH/BN
8	BN

previous page:
613a

next page:
620

Editor	Freqcon_DG			Statron	FREQCON	PROFINET	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	25.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613b
Date								+		total: 492



previous page:
613b

next page:
621

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC ASC	20250805_V2.0	= UNIT_03	Battery Container 2
Date	25.11.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 620
total: 492

-DI_21

/620.3

400VAC Power Supply 24V DC OK	/601.7	DI0	1	E60.0	E60.1	2	DI1	/601.9	fuse 24V DC power supply unit
UPS BATTERY OK	/602.5	DI2	3	E60.2	E60.3	4	DI3	/602.6	BATTERY MODE
BATTERY CHARGING	/602.7	DI4	5	E60.4	E60.5	6	DI5	/603.1	FUSE 24V DC CONTROL VOLTAGE
Gassensor OK BAT 1-4	/680a.7	DI6	7	E60.6	E60.7	8	DI7	/680b.7	Gassensor OK BAT 5-8
Gassensor OK BAT 9-11	/680c.7	DI8	9	E61.0	E61.1	10	DI9	/635b.8	Shut-down to BESS
FUSE AND LIGHTNING PROTECTION	/684.9	DI10	11	E61.2	E61.3	12	DI11	/691.8	Fuse Exhaust Unit
Fuse Cooling Units	/691.9	DI12	13	E61.4	E61.5	14	DI13		
		DI14	15	E61.6	E61.7	16	DI15		
	/620.3	24VDC	L+			M	0VDC	/620.3	

-DI_22

/620.3

DI0	1	E62.0	E62.1	2	DI1
DI2	3	E62.2	E62.3	4	DI3
DI4	5	E62.4	E62.5	6	DI5
DI6	7	E62.6	E62.7	8	DI7
DI8	9	E63.0	E63.1	10	DI9
DI10	11	E63.2	E63.3	12	DI11
DI12	13	E63.4	E63.5	14	DI13
DI14	15	E63.6	E63.7	16	DI15
24VDC	L+			M	0VDC

previous page: 620

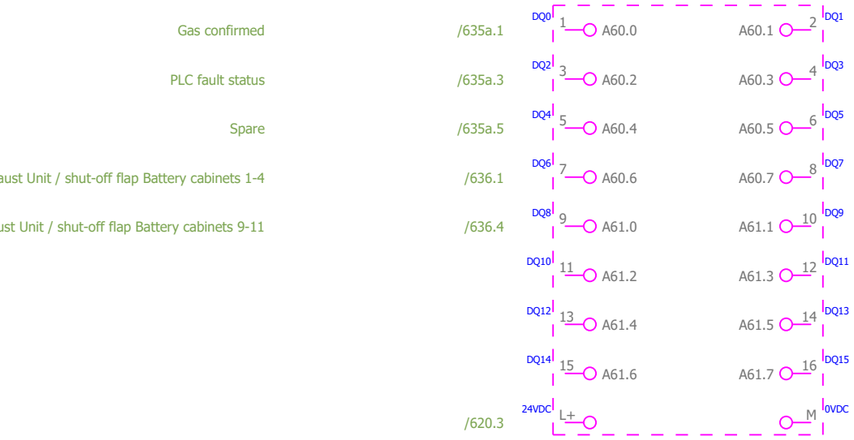
next page: 623

Editor	Freqcon_DG			Statron		ET200SP DIGITAL INPUTS DI_21 + DI_22	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	03.12.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 621
Date								+		total: 492

0	1	2	3	4	5	6	7	8	9

-DO_21

/620.3



Gas confirmed	/635a.1				/635a.2	Smoke confirmed
PLC fault status	/635a.3				/635a.4	Thermal runaway
Spare	/635a.5				/635a.6	Spare
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4	/636.1				/636.2	230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11	/636.4					
	/620.3				/620.4	

previous page: 621

next page: 624

Editor	Freqcon_JD			Statron		ET200SP DIGITAL OUTPUTS DO_21	20250805_V2.0	= UNIT_03	Battery Container 2
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

-AI_21

/620.4



gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

gas concentration BAT 1-4 /680a.2

gas concentration BAT 9-11 /680c.2

/620.4

/680b.2 gas concentration BAT 5-8

/680b.2 gas concentration BAT 5-8

/620.4

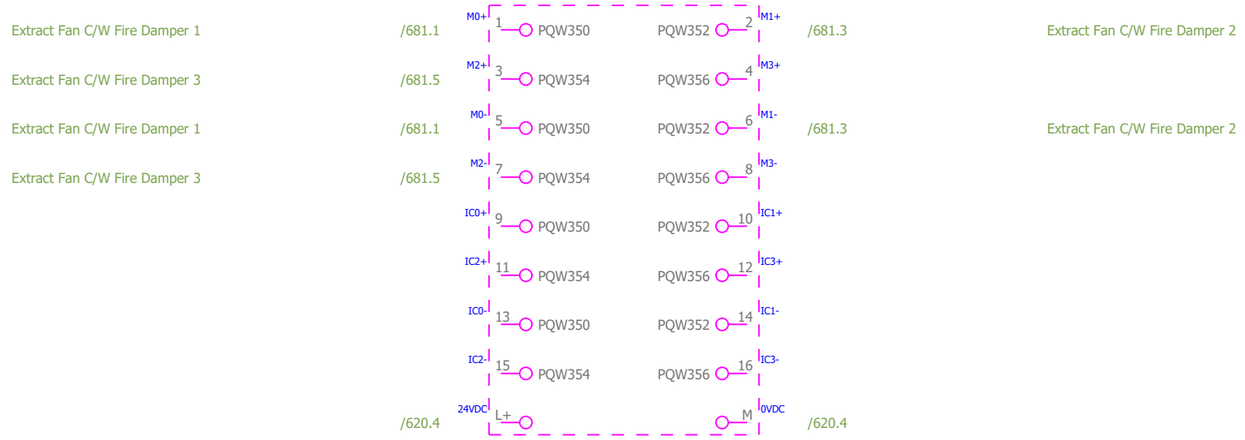
previous page: 623

next page: 625

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG INPUTS AI_21	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	14.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 624
Date								+	total: 492

-AO_21

/620.4



previous page: 624

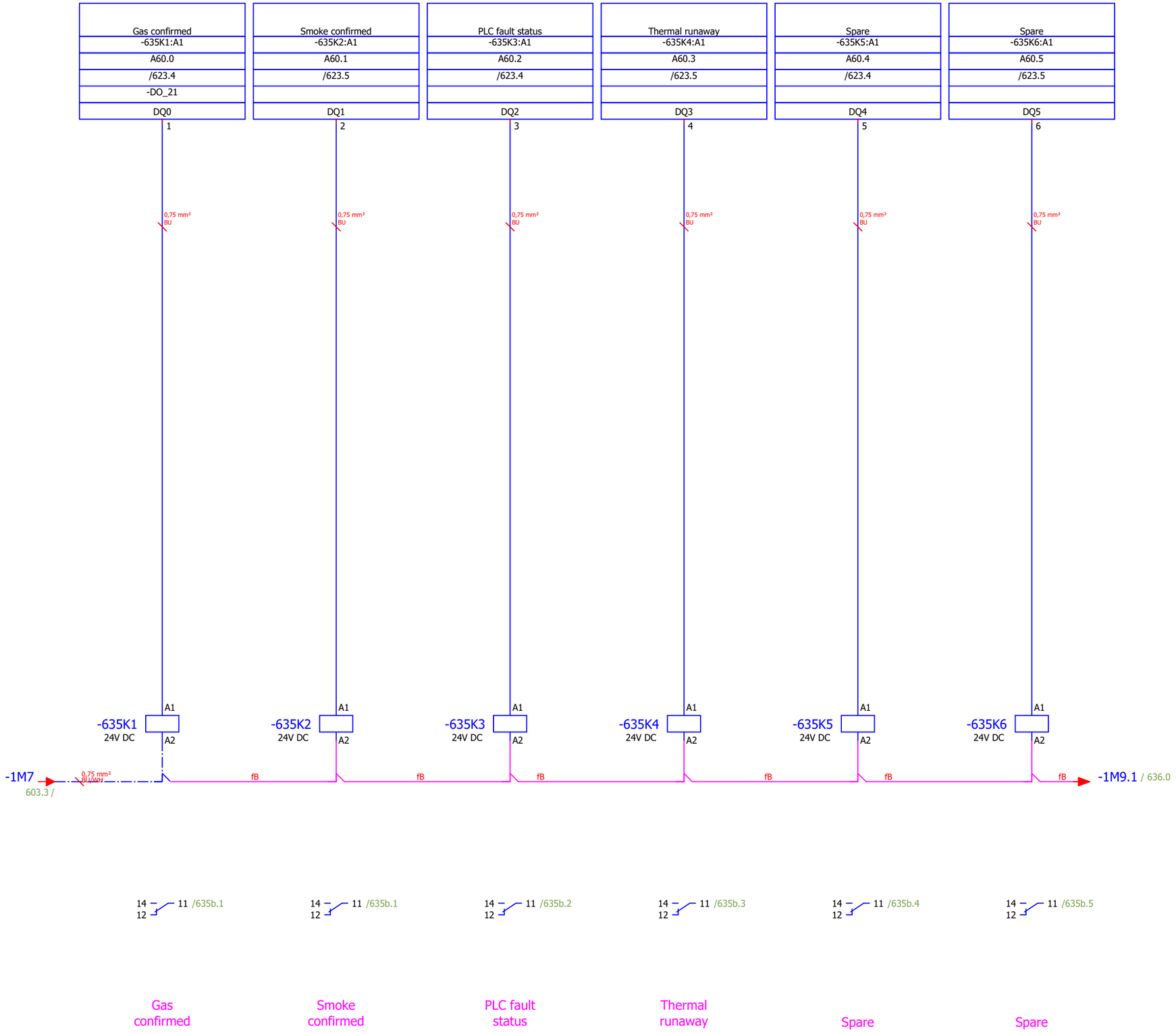
next page: 635a

Editor	Freqcon_JD			Statron	FREQCON	ET200SP ANALOG OUTPUTS AO_21	20250805_V2.0	= UNIT_03	Battery Container 2
Date	14.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 625

total: 492

0	1	2	3	4	5	6	7	8	9



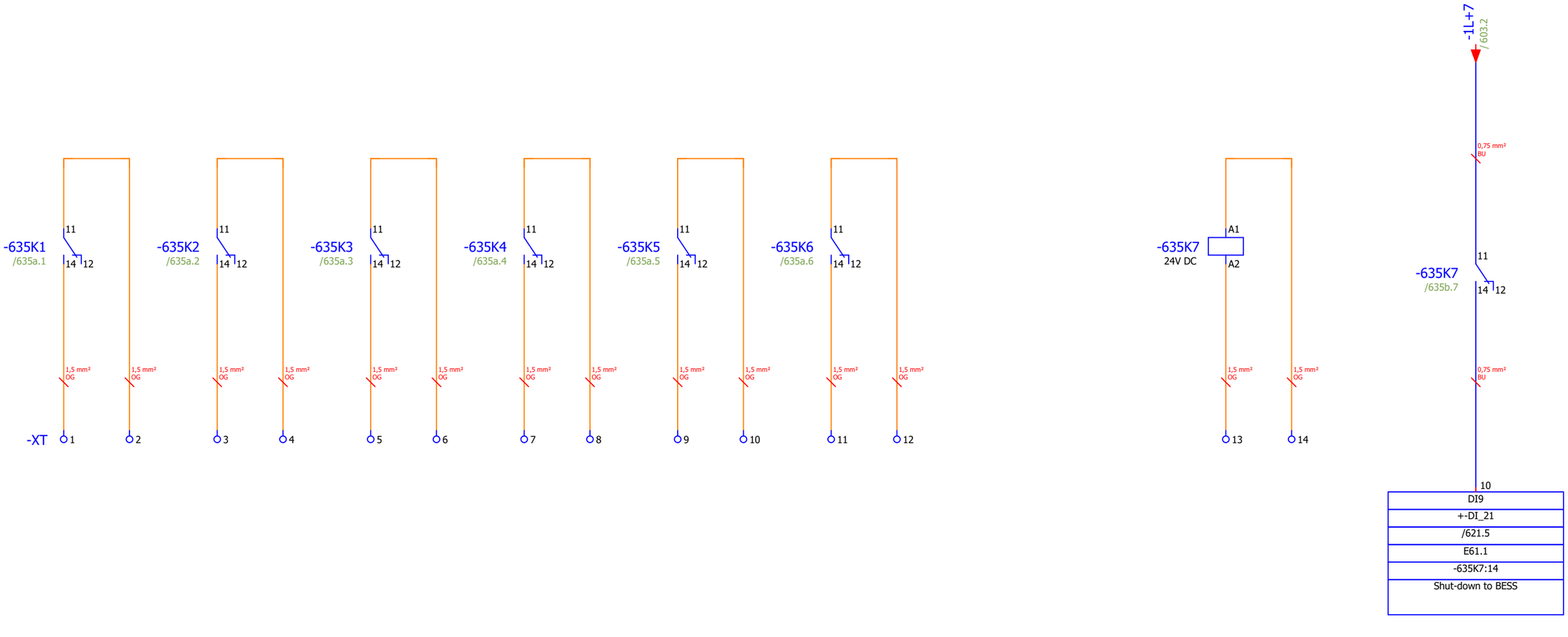
previous page: 625

next page: 635b

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 635a

total: 492



Gas confirmed FGS

Smoke confirmed FGS

PLC fault status SIS

Thermal runaway SIS

Spare

Spare

Shut-down to BESS

Shut-down to BESS

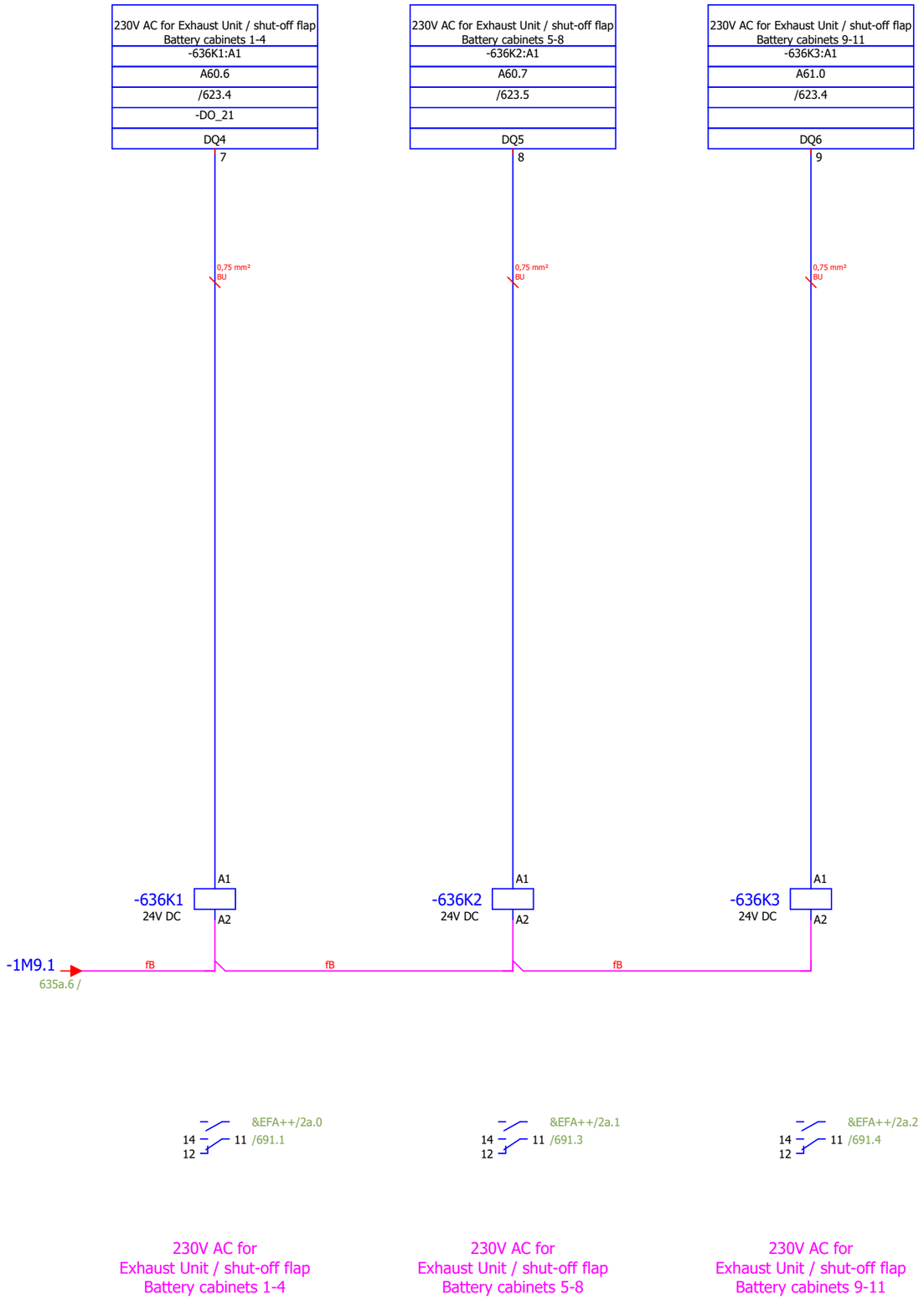
previous page: 635a

next page: 636

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS COMMUNICATION	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 635b

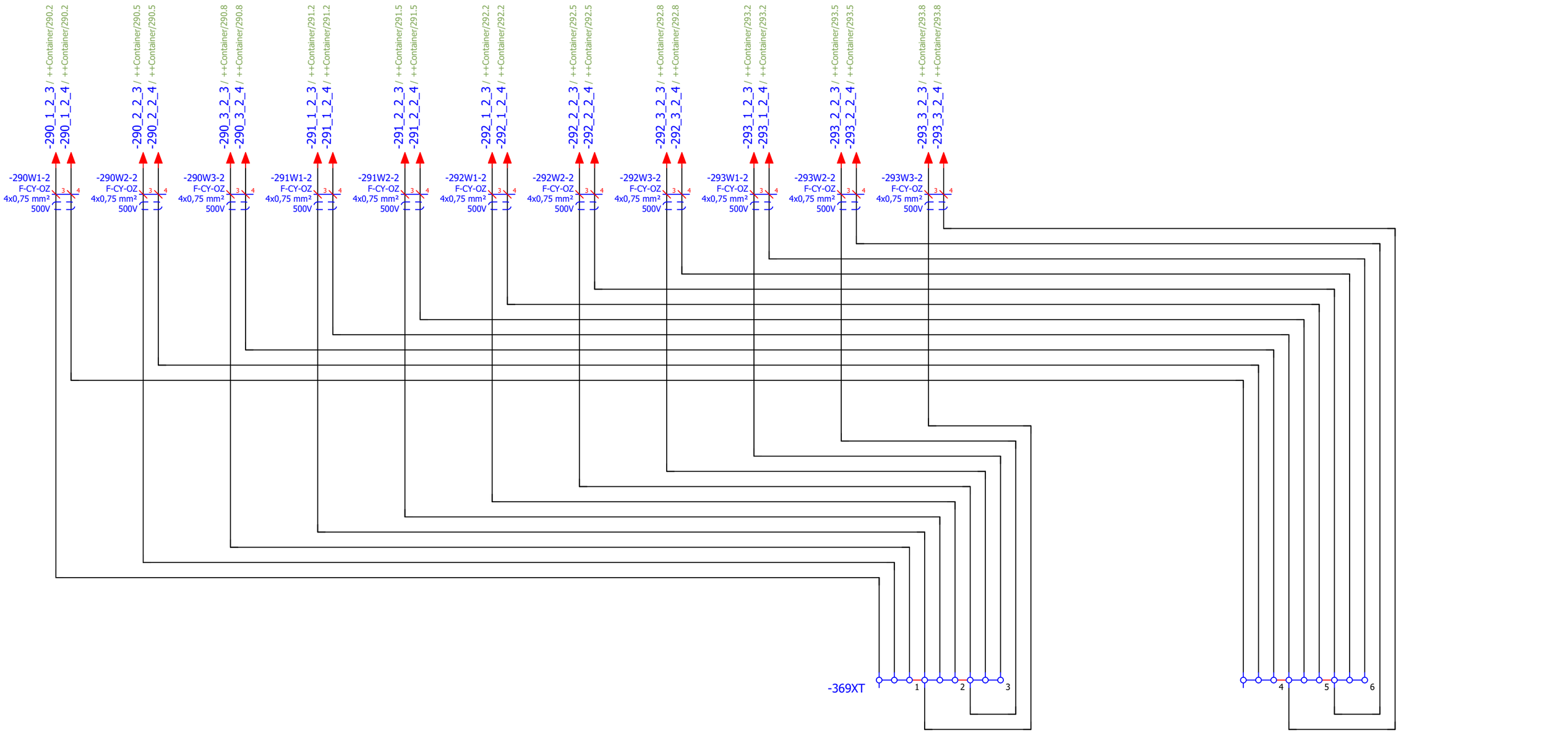
total: 492



previous page:
635b

next page:
669

Editor	Freqcon_JD			Statron	FREQCON	OUTPUTS FIRE DAMPER	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 636
Date								+	total: 492



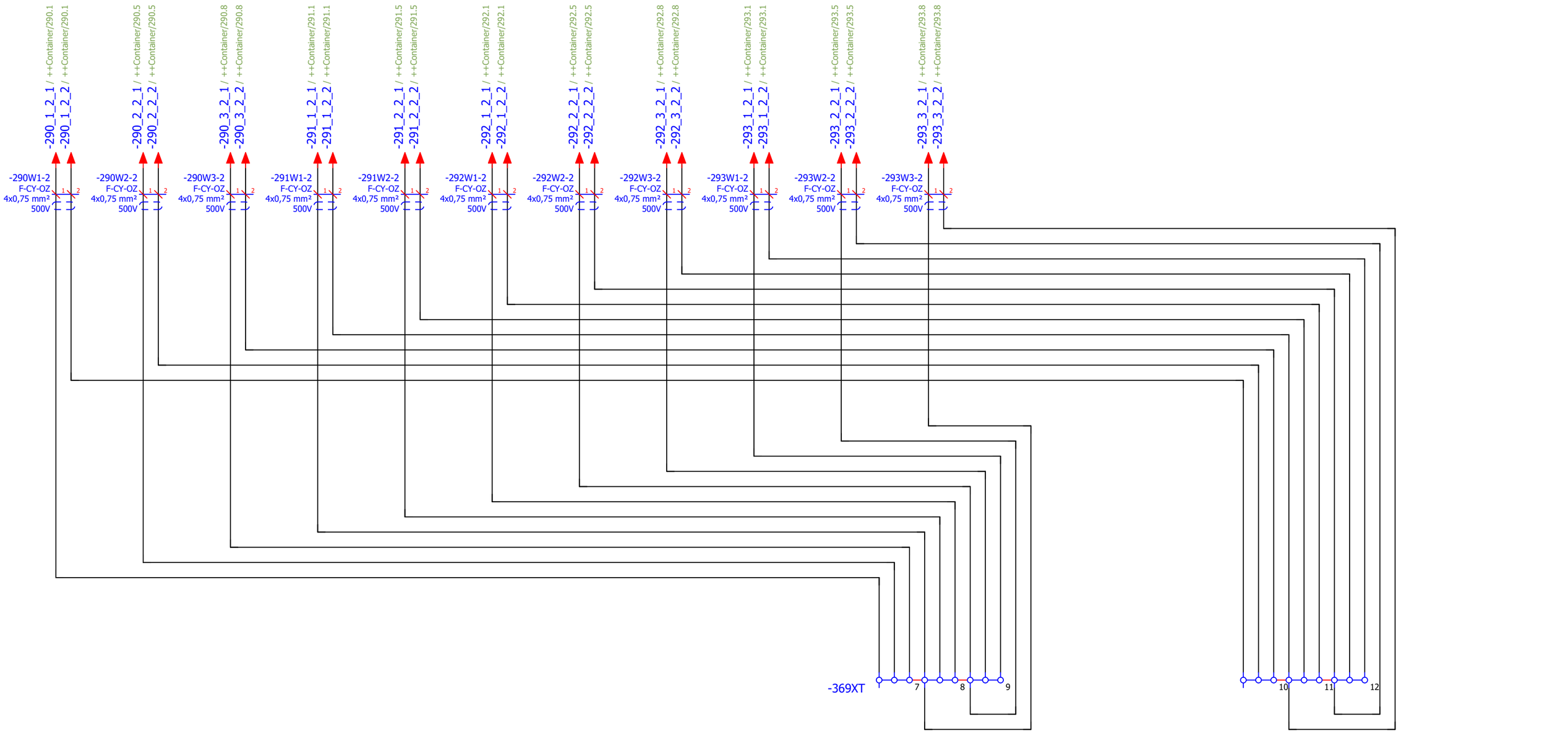
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page: 636

next page: 670

Editor	Freqcon_JD			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 492



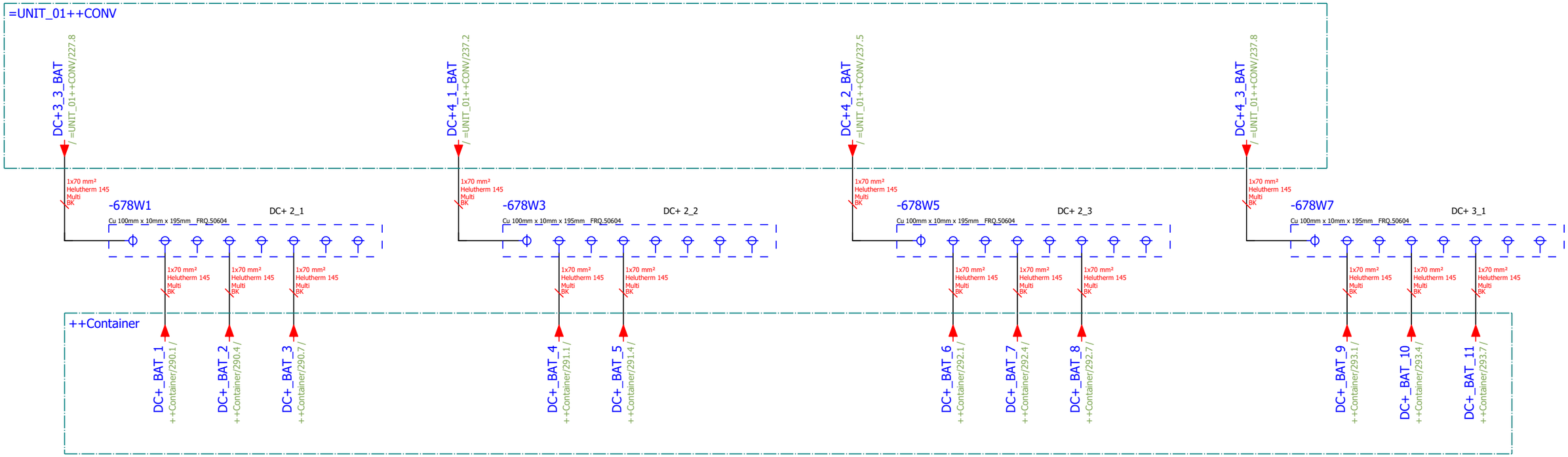
battery cabinet gas
potential-free contacts
customer

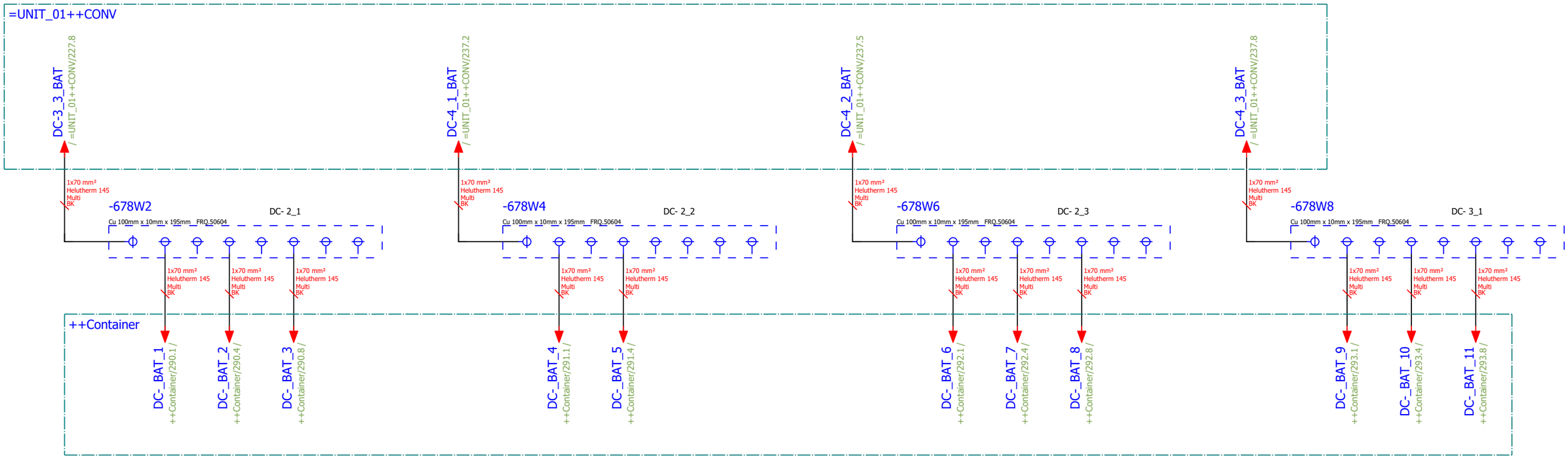
battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
678

Editor	Freqcon_JD			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 492





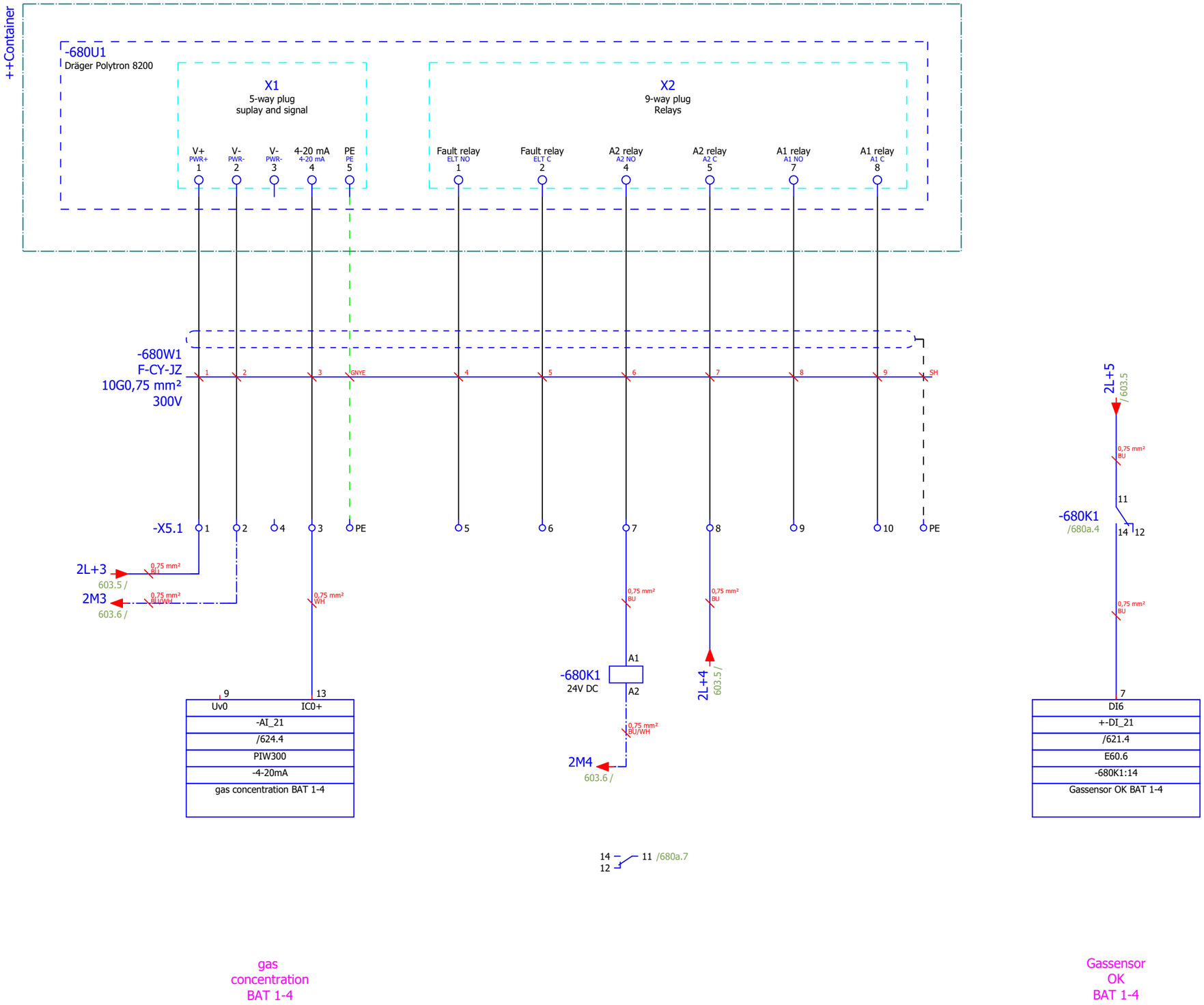
previous page: 670

next page: 680a

Editor	Freqcon_JD			Statron	FREQCON	DC BATTERY CABINETS	20250805_V2.0	= UNIT_03	Battery Container 2
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 678

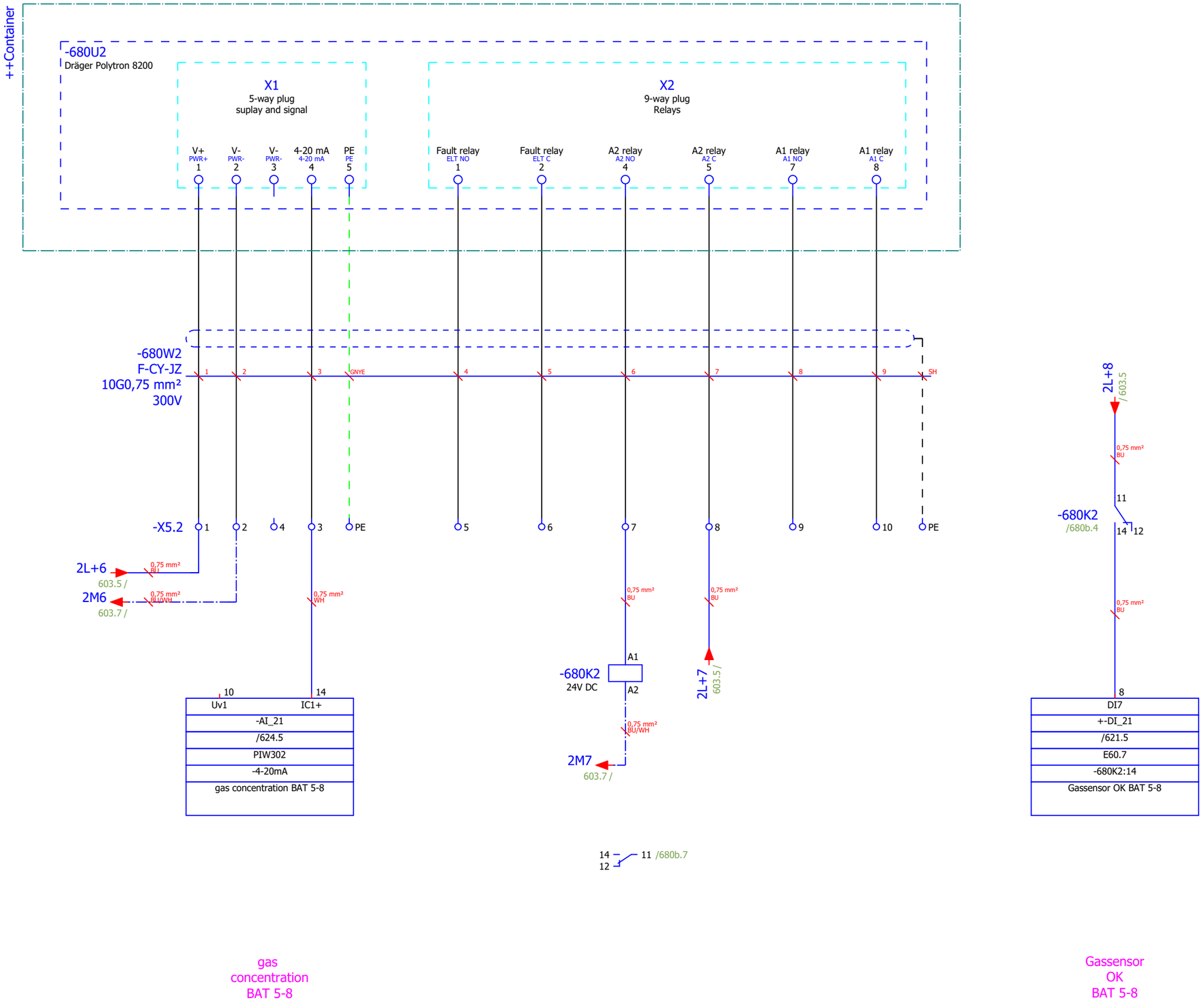
total: 492



previous page: 678

next page: 680b

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 1-4	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680a
Date								+	total: 492



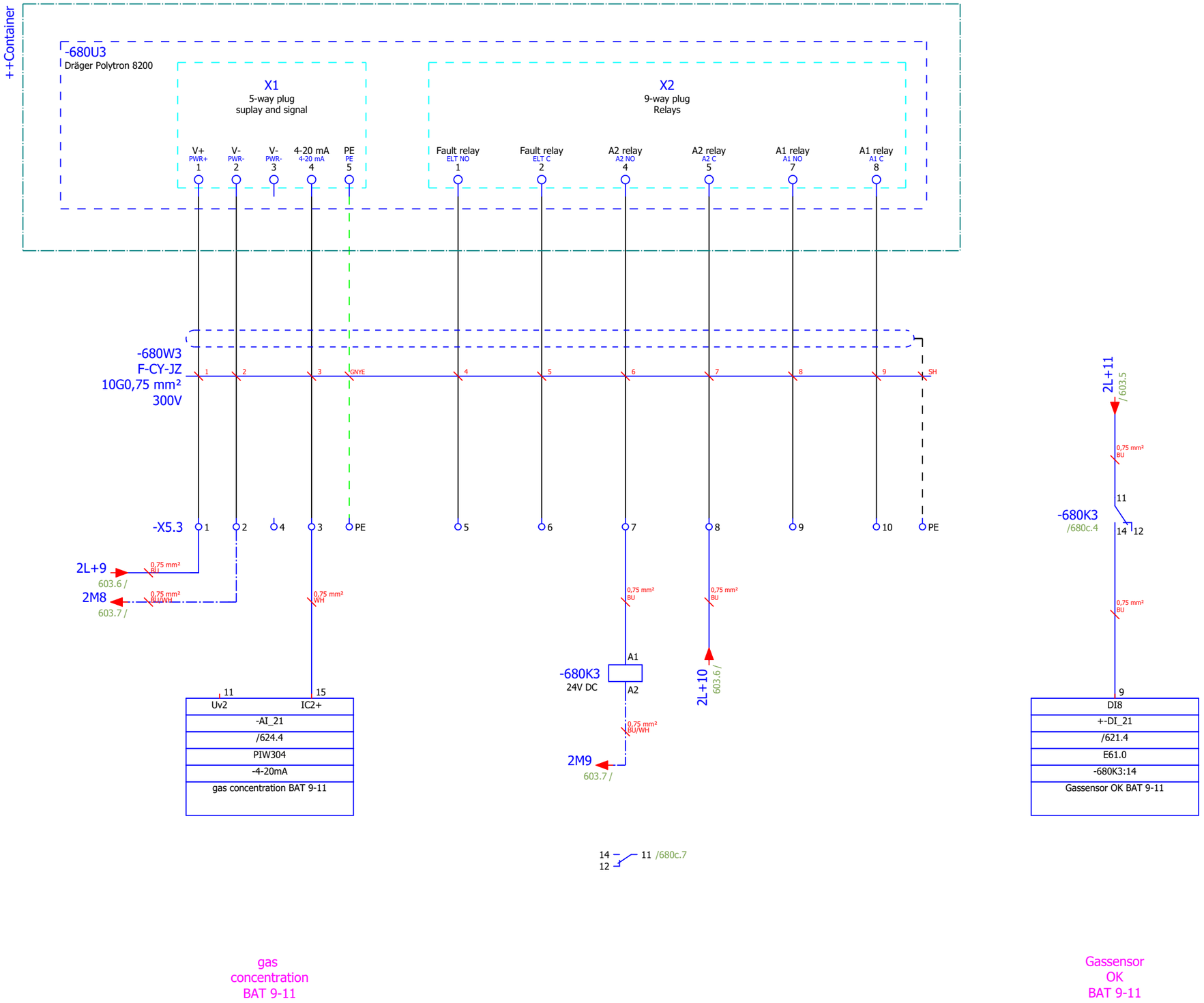
gas concentration BAT 5-8

Gassensor OK BAT 5-8

previous page: 680a

next page: 680c

Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 5-8	20250805_V2.0	= UNIT_03 Battery Container 2
Date	18.06.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 680b
Date								+ — total: 492



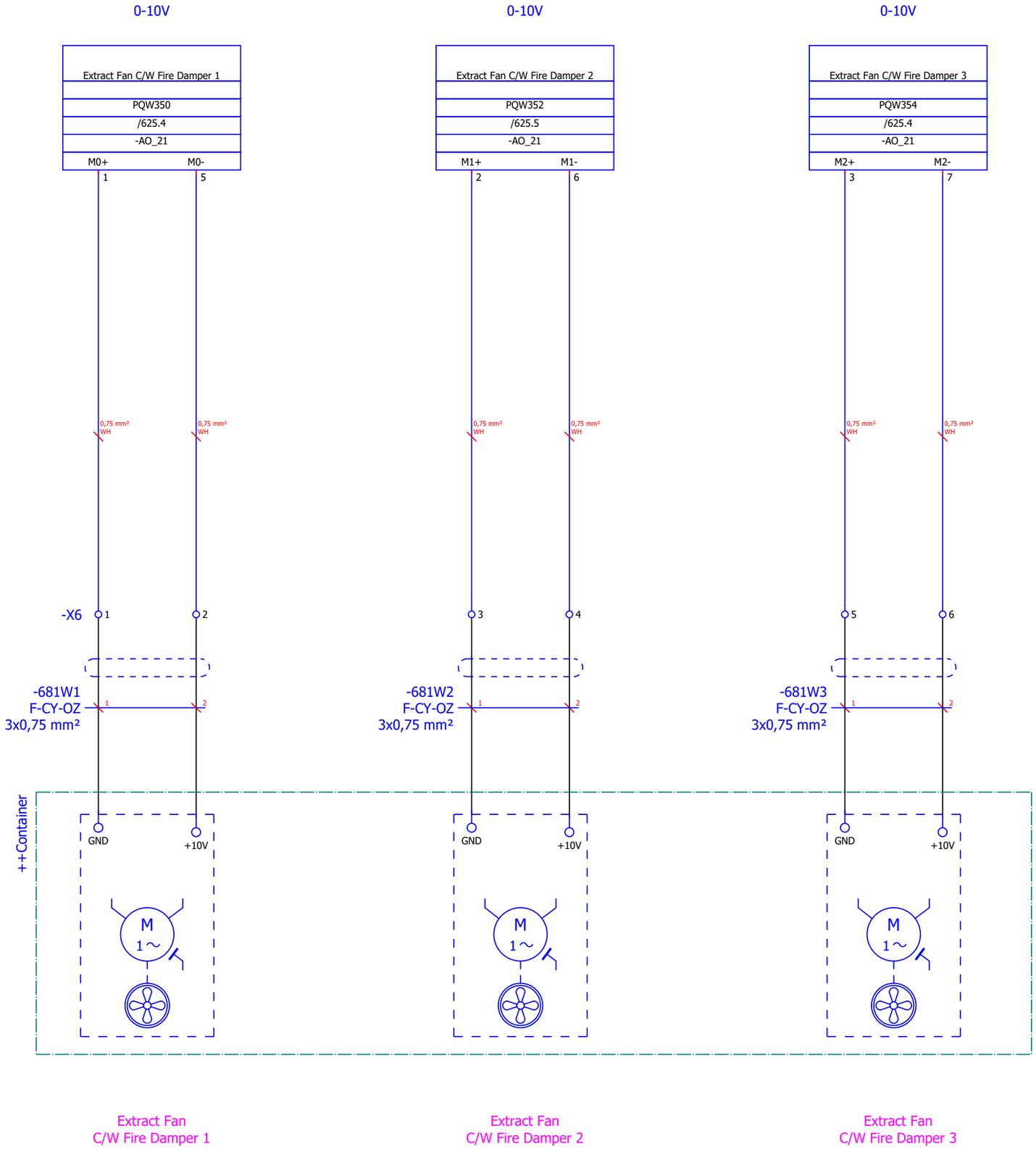
gas concentration BAT 9-11

Gassensor OK BAT 9-11

previous page: 680b

next page: 681

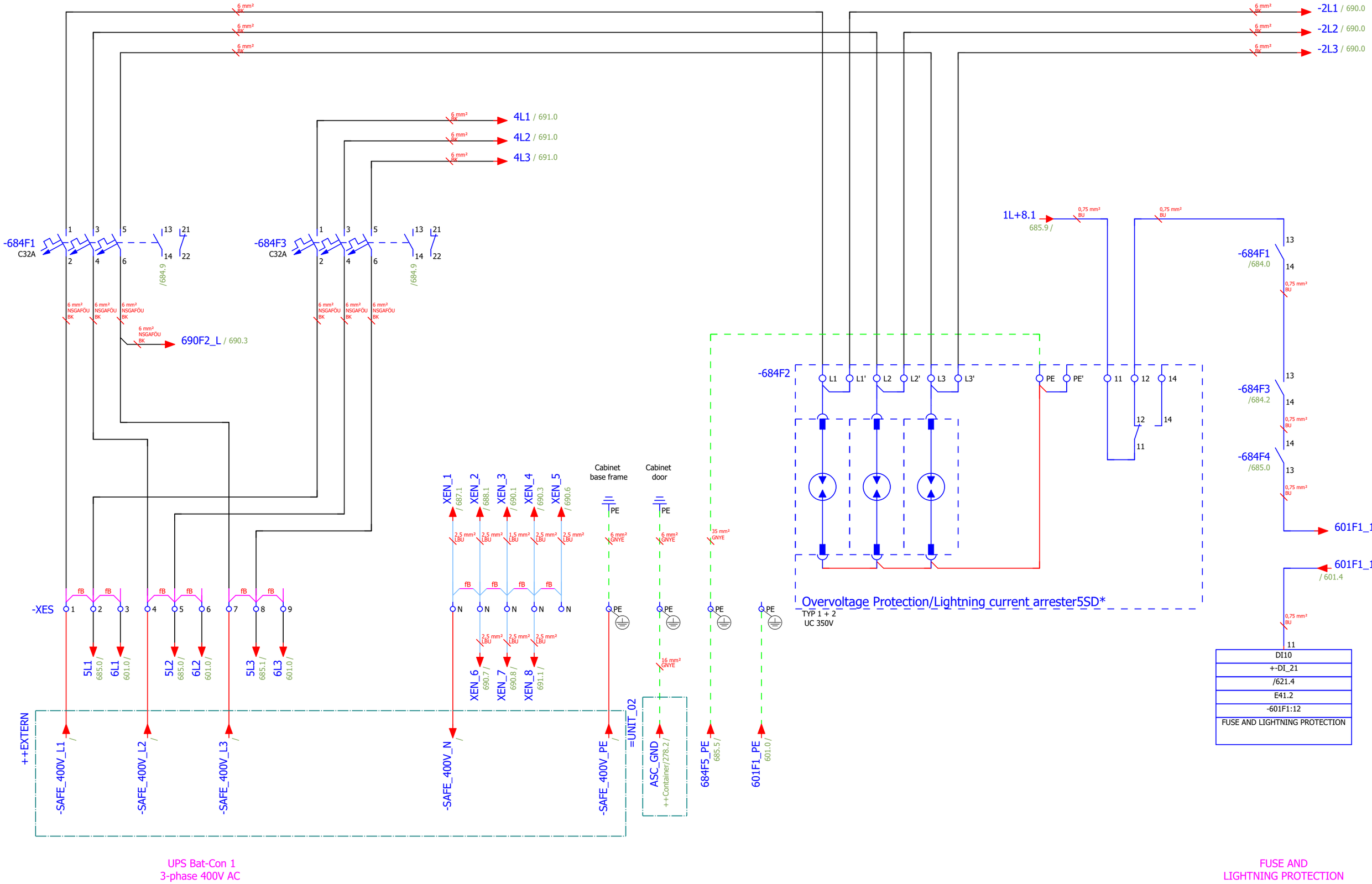
Editor	Freqcon_JD			Statron	FREQCON	STATIONARY GAS DETECTOR BAT 9-11	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 680c
Date								+	total: 492



previous page: 680c

next page: 684

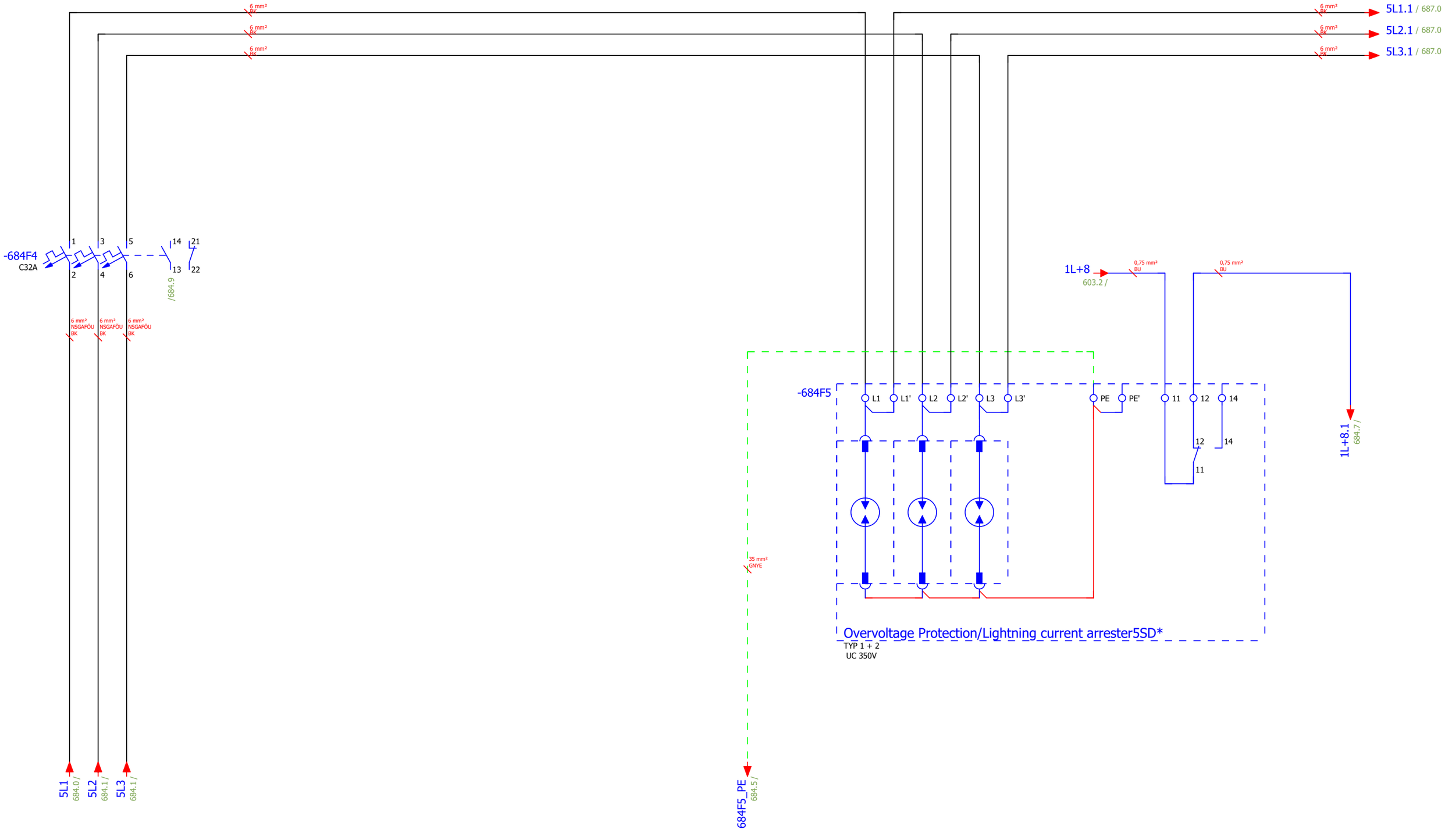
Editor	Freqcon_JD			Statron	FREQCON	EXTRACT FAN FIRE DAMPER	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 681
Date								+	total: 492



previous page: 681

next page: 685

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	22.11.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 684
Date								+	total: 492

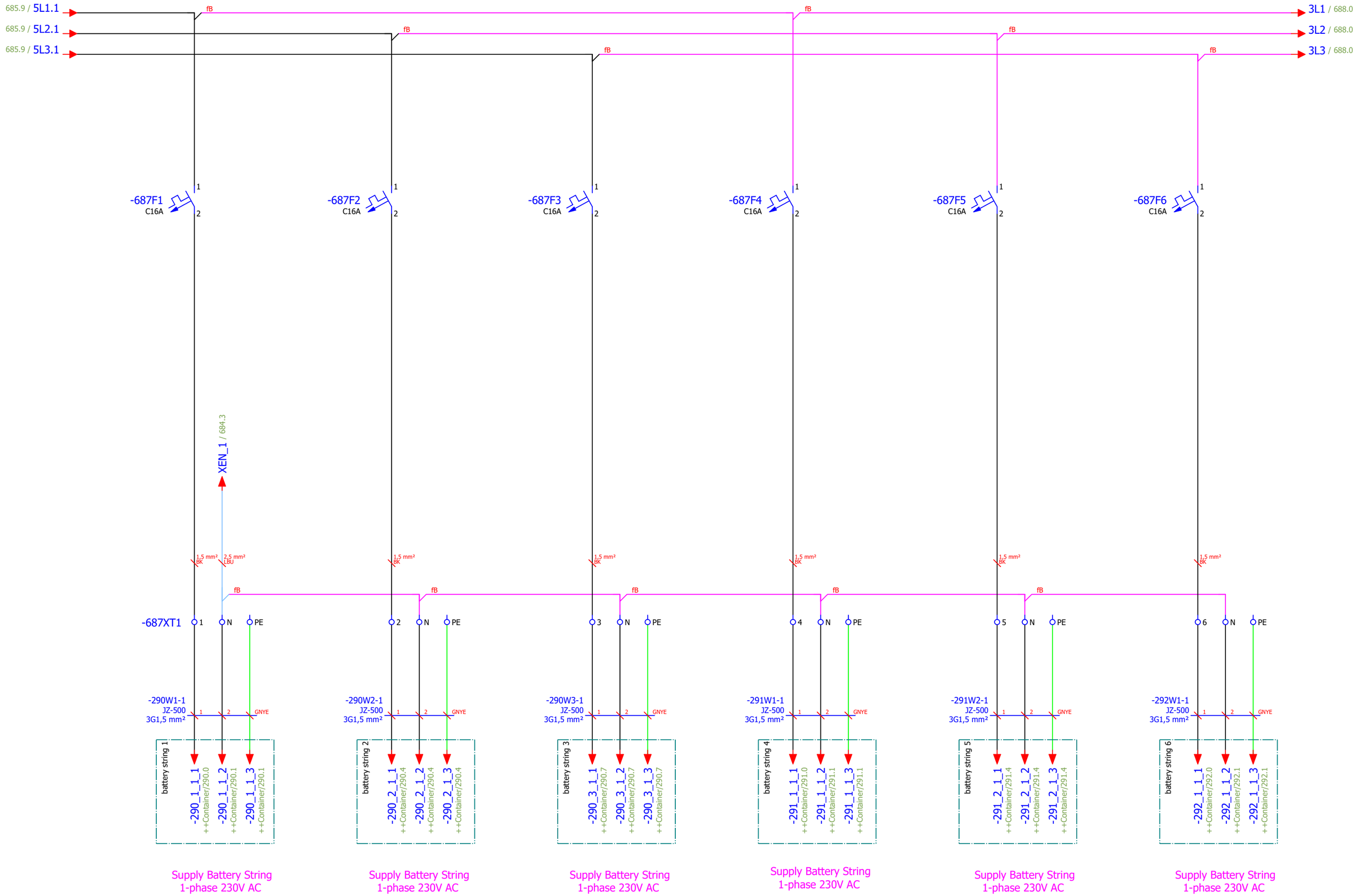


FUSE AND
LIGHTNING PROTECTION

previous page: 684

next page: 687

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 685
Date								+	total: 492



previous page: 685

next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 492

687.9 / 3L1
687.9 / 3L2
687.9 / 3L3

fB

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

XEN_2 / 684.3

1,5 mm² BK
2,5 mm² LBU

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

GNYE

battery string 7
-292_2_1_1 ++Container/292.4
-292_2_1_2 ++Container/292.4
-292_2_1_3 ++Container/292.4

battery string 8
-292_3_1_1 ++Container/292.7
-292_3_1_2 ++Container/292.7
-292_3_1_3 ++Container/292.7

battery string 9
-293_1_1_1 ++Container/293.0
-293_1_1_2 ++Container/293.1
-293_1_1_3 ++Container/293.1

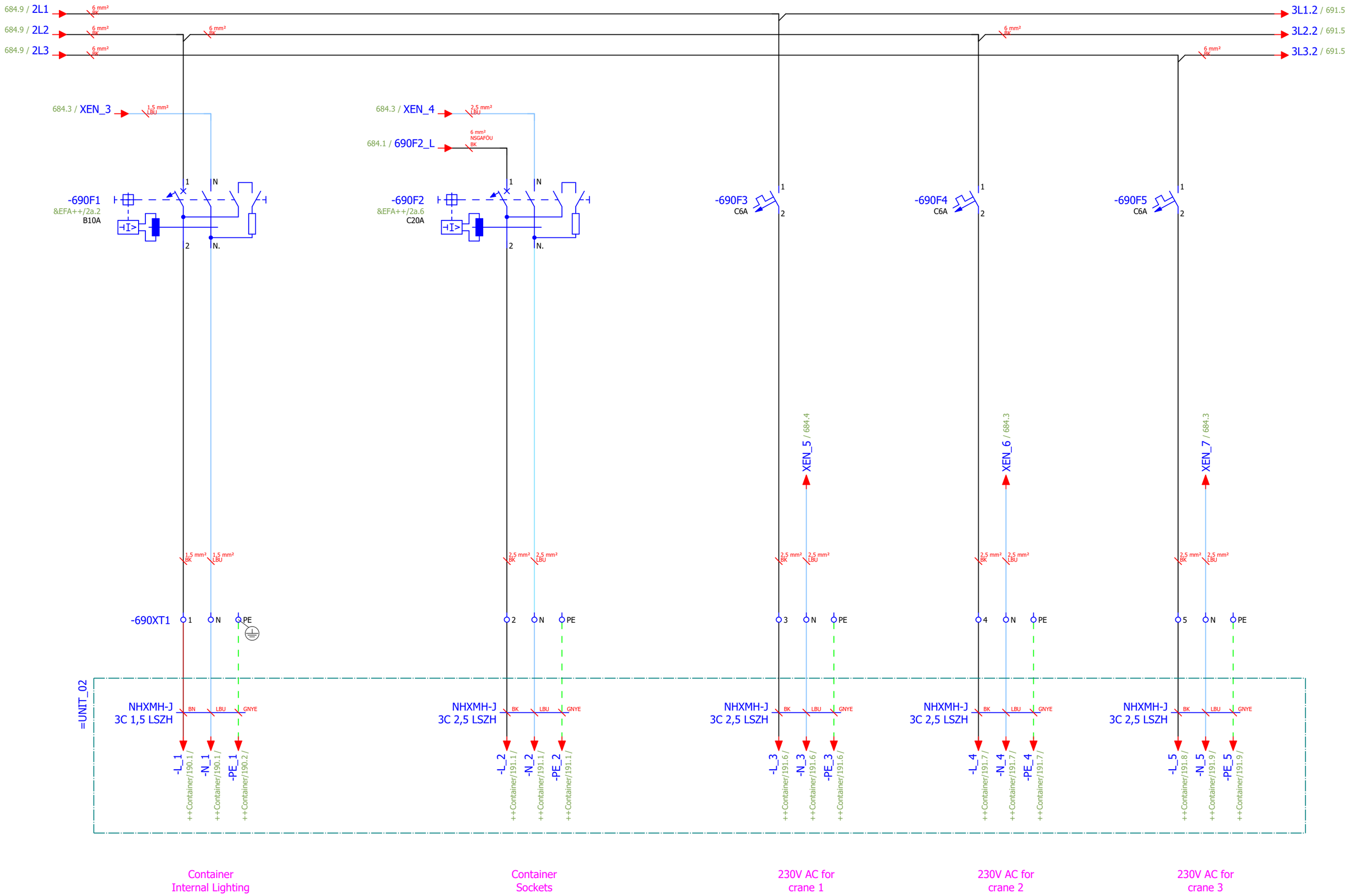
battery string 10
-293_2_1_1 ++Container/293.4
-293_2_1_2 ++Container/293.4
-293_2_1_3 ++Container/293.4

battery string 11
-293_3_1_1 ++Container/293.7
-293_3_1_2 ++Container/293.7
-293_3_1_3 ++Container/293.7

Supply Battery String 1-phase 230V AC

previous page: 687
next page: 690

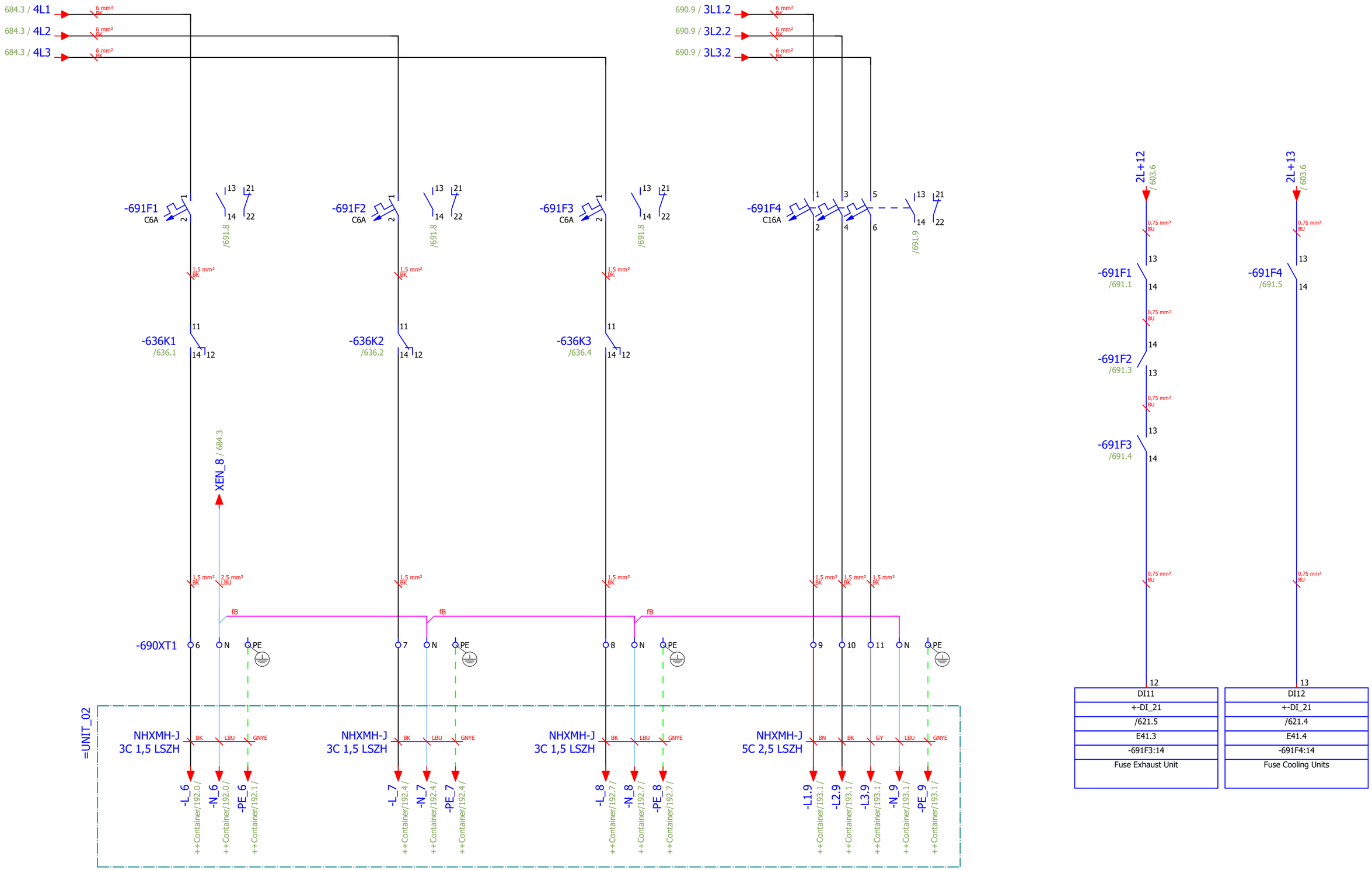
Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 492



previous page: 688

next page: 691

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	29.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 690
Date								+	total: 492



previous page:
690

next page:
&EPC++Container/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	05.11.2024							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 691
Date								+		total: 492

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680U1 &EFS++ASC/680a.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U2 &EFS++ASC/680b.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	
-680U3 &EFS++ASC/680c.1	1	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321	

previous page:
&EFS++ASC/691

next page:
++ASC/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-101Q1 &EFA++/2a.7;&EFS/601.5	2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432	
-101T1 &EFS/601.5	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	
-102G1 &EFS/602.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	
-102G2 &EFS/602.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	
-103F1 &EFS/603.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-103F2 &EFS/603.5	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Multi-level terminal block	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-601F1 &EFS/601.1	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613a.3	1	Surge protection device	2881007	Phoenix Contact	504791	
-613U2 &EFS/613a.5	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-613U3 &EFS/613b.1	1	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214	
-620A1 &EFS/620.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	
-635K1 &EFS/635a.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K1 &EFS/635a.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-635K2 &EFS/635a.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K2 &EFS/635a.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K3 &EFS/635a.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K3 &EFS/635a.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K4 &EFS/635a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K4 &EFS/635a.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K5 &EFS/635a.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K5 &EFS/635a.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K6 &EFS/635a.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-635K6 &EFS/635a.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-635K7 &EFS/635b.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K1 &EFS/636.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K2 &EFS/636.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K2 &EFS/636.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-636K3 &EFS/636.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-636K3 &EFS/636.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-680K1 &EFS/680a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-680K2 &EFS/680b.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-680K3 &EFS/680c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-684F1 &EFS/684.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F1 &EFS/684.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F2 &EFS/684.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-684F3 &EFS/684.2	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F3 &EFS/684.2	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F4 &EFS/685.0	1	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272	
-684F4 &EFS/685.0	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-684F5 &EFS/685.5	1	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1;&EFS/687.2...&EFS/687.5;&EFS/687.7;&EFS/687.8;&EFS/688.1;&EFS/688.2...&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209510	Phoenix Contact	500583	
-687XT1 &EFS/687.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	

previous page: 2

next page: 4

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687XT1 &EFS/687.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-687XT1 &EFS/687.2;&EFS/687.3;&EFS/687.4;&EFS/687.5...&EFS/687.8;&EFS/688;&EFS/688.1;&EFS/688.3;&EFS/688.4;&EFS/688.5;&EFS/688.7	11	Feed-through terminal block	3209523	Phoenix Contact	500584	
-687XT1 &EFS/687.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-687XT1 &EFS/688.1	1	Plug-in bridge FBS 5-5	3030190	Phoenix Contact	500545	
-687XT1 &EFS/687.2...&EFS/687.4;&EFS/687.6;&EFS/687.7;&EFS/687.8;&EFS/688.2...&EFS/688.4;&EFS/688.6;&EFS/688.7	11	Ground terminal block	3209536	Phoenix Contact	500813	
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440	
-690F2 &EFS/690.3	1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441	
-690F3 &EFS/690.5	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F4 &EFS/690.7	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690F5 &EFS/690.8	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Feed-through terminal block	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	35	Ground terminal block	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	7	End and partition plate for terminal block	3030417	Phoenix Contact	500506	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690XT1 &EFS/690.1;&EFS/691.1;&EFS/691.3...&EFS/691.6	14	End bracket for terminal block	3022276	Phoenix Contact	500588	
-691F1 &EFS/691.1	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F1 &EFS/691.1	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F2 &EFS/691.3	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F2 &EFS/691.3	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F3 &EFS/691.4	1	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682	
-691F3 &EFS/691.4	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-691F4 &EFS/691.5	1	CIRCUIT BREAKER 10KA 3POL C16	5SY4316-7	Siemens	503340	X
-691F4 &EFS/691.5	1	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737	
-AI_21 &EFS/620.4	1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-AO_21 &EFS/620.4	1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291	
-AO_21 &EFS/620.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_21 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	
-DI_22 &EFS/620.3	1	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_22 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-DO_21 &EFS/620.3	1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_21 &EFS/620.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X5.1 &EFS/680a.2...&EFS/680a.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.1 &EFS/680a.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.1 &EFS/680a.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.1 &EFS/680a.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.1 &EFS/680a.2;&EFS/680a.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.2 &EFS/680b.2...&EFS/680b.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.2 &EFS/680b.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.2 &EFS/680b.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.2 &EFS/680b.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.2 &EFS/680b.2;&EFS/680b.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X5.3 &EFS/680c.2...&EFS/680c.5	10	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X5.3 &EFS/680c.2	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X5.3 &EFS/680c.2	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X5.3 &EFS/680c.2	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	
-X5.3 &EFS/680c.2;&EFS/680c.6	2	Ground terminal block	3209536	Phoenix Contact	500813	
-X6 &EFS/681.1;&EFS/681.3;&EFS/681.5	6	Feed-through terminal block	3209510	Phoenix Contact	500583	
-X6 &EFS/681.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-X6 &EFS/681.1	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-X6 &EFS/681.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC1 &EFS/603.2;&EFS/603.3	6	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC1 &EFS/603.2;&EFS/603.3	2	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XDC1 &EFS/603.2	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC1 &EFS/603.2	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC1 &EFS/603.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	
-XDC2 &EFS/603.5...&EFS/603.7	7	Multi-level terminal block	3210583	Phoenix Contact	501385	
-XDC2 &EFS/603.5	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	
-XDC2 &EFS/603.5	1	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XDC2 &EFS/603.5	1	End and partition plate for terminal block	3211634	Phoenix Contact	500505	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	
-XDC2 &EFS/603.6	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	
-XES &EFS/684.0...&EFS/684.2	9	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	
-XES &EFS/684.0;&EFS/684.1	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XES &EFS/684.0	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XES &EFS/684.0	1	End and partition plate for terminal block PT 6	3212044	Phoenix Contact	500503	
-XES &EFS/684.3;&EFS/684.4	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XES &EFS/684.3	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XES &EFS/684.4;&EFS/684.5	4	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	
-XT &EFS/635b.1...&EFS/635b.5;&EFS/635b.7	14	Feed-through terminal block	3209510	Phoenix Contact	500583	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XT &EFS/635b.1	1	End and partition plate for terminal block	3030417	Phoenix Contact	500506	
-XT &EFS/635b.1	2	End bracket for terminal block	3022276	Phoenix Contact	500588	
-XT &EFS/635b.1	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	

previous page:
7

next page:
&EPA++Container/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	21.01.2025							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 8
Date								+	total: 492

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Polytron 8000 Series Customized 4-20/HART mit Relais	8344800	Dräger	509321

previous page:
&EPC++ASC/8

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598
1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229
1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573
1	Surge protection device	2881007	Phoenix Contact	504791
2	Patch panel, connection field: one RJ45 socket on 8 spring-cage connection terminals	2901642	Phoenix Contact	10214
13	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
9	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
2	CIRCUIT-BREAKER SPRING-L. CONN. 3.2A	3RV2011-1DA25	Siemens	501432
3	Combination arrester type 1+2, UC 350V AC, 3-pole, FM, for TNC systems	5SD7443-1	Siemens	504070
7	SENTRON Auxiliary current switch Mountable	5ST3010	Siemens	500737
1	PIN BUS BAR SHOCKHAZARD SAFETY, 16QMM 3 PHASE+HS	5ST3712	Siemens	10274
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, B-char, In: 10 A, Un AC: 230 V	5SU1354-6KK10	Siemens	10440
1	RCBO elm, 10 kA, 1P+N, type A, 30 mA, C-char, In: 20 A, Un AC: 230 V	5SU1354-7KK20	Siemens	10441
2	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086

Summarized parts list

Freqcon_ABAS_de_en

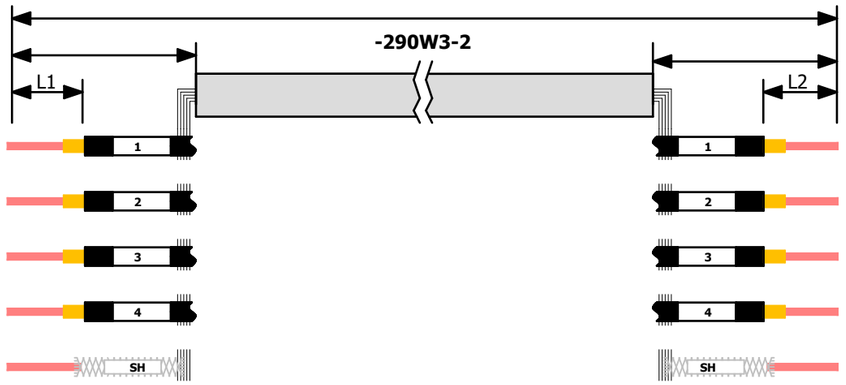
Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
6	SENTRON Miniature circuit breaker	5SY4106-7	Siemens	500682
11	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569
3	SENTRON Miniature circuit breaker	5SY4332-7	Siemens	505272
2	SIMATIC ET 200SP DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788
1	SIMATIC ET 200SP DQ 16x24 VDC/0.5 A ST	6ES7132-6BH01-0BA0	Siemens	504397
1	SIMATIC ET 200SP AI 4x U/I 2-wire	6ES7134-6HD01-0BA1	Siemens	505054
1	AQ 4XU/I ST	6ES7135-6HD00-0BA1	Siemens	504291
1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
4	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786

previous page: 1

next page: &EMB++Container/1

Cable name =UNIT_03++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

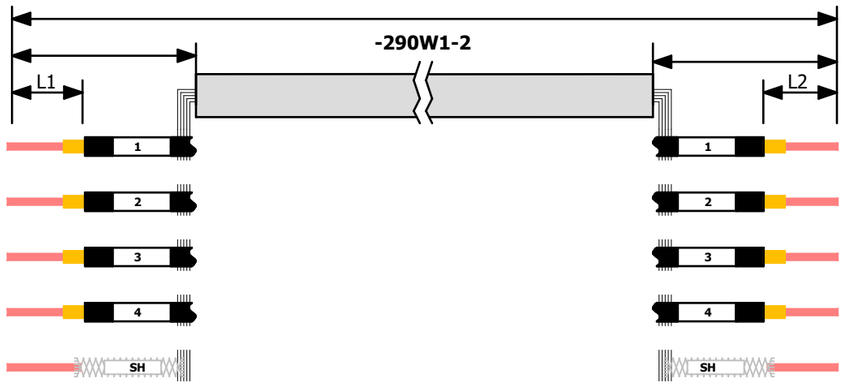


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

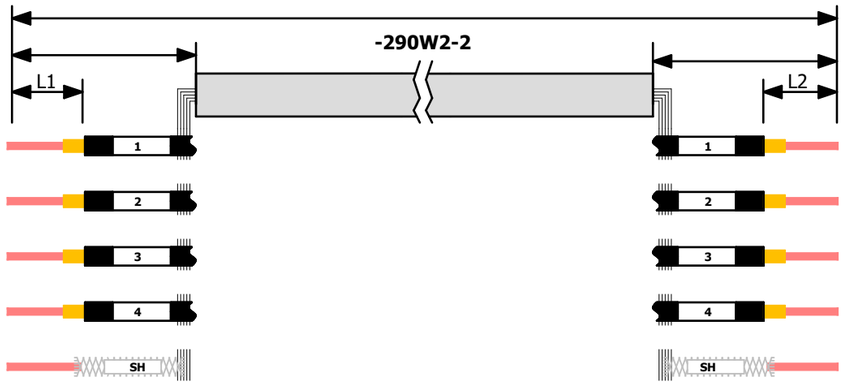


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

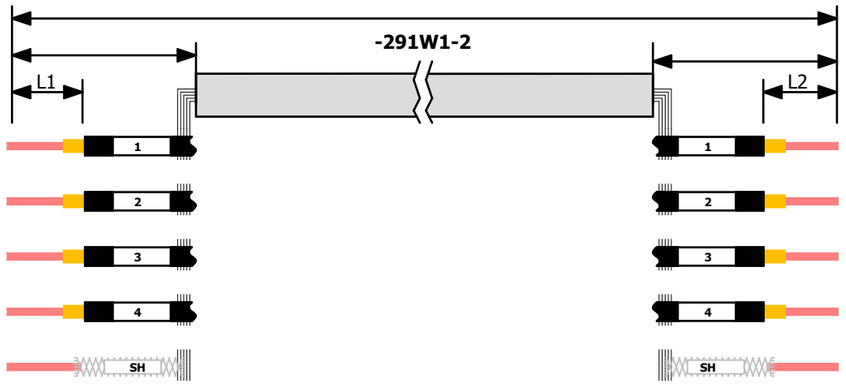
previous page:
&EPA++ASC/2

next page:
2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

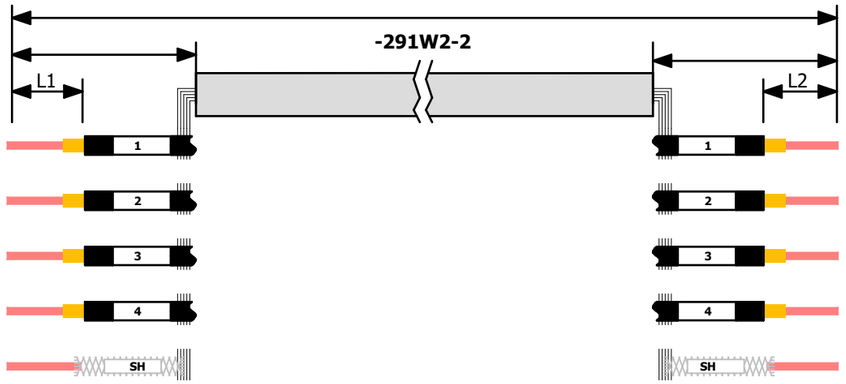


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

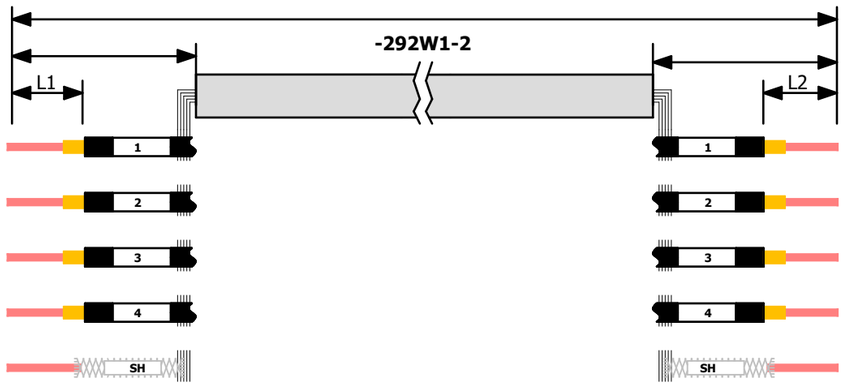


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

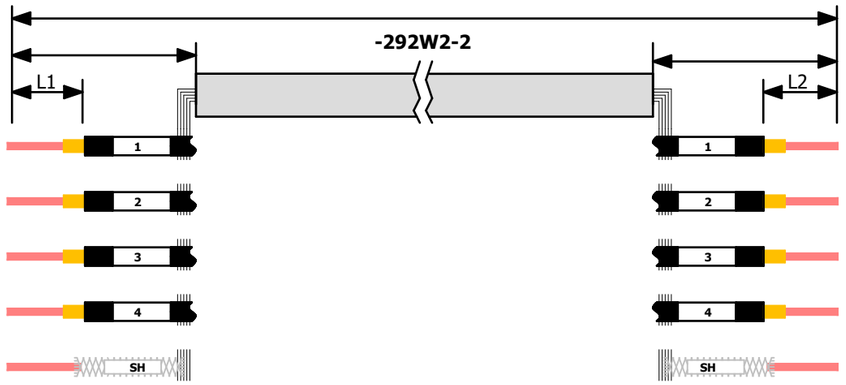
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

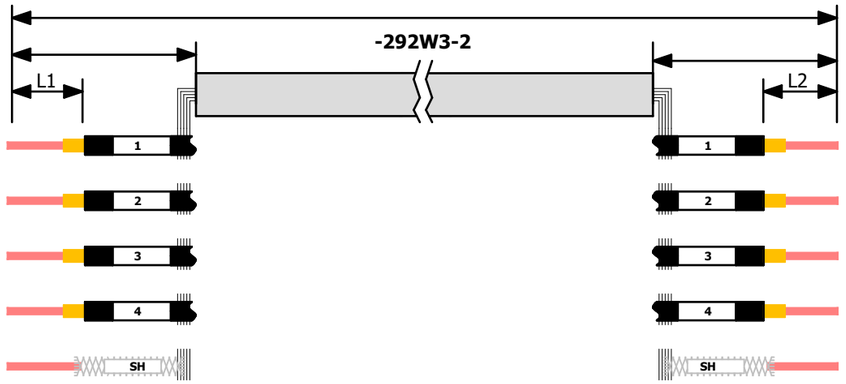


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

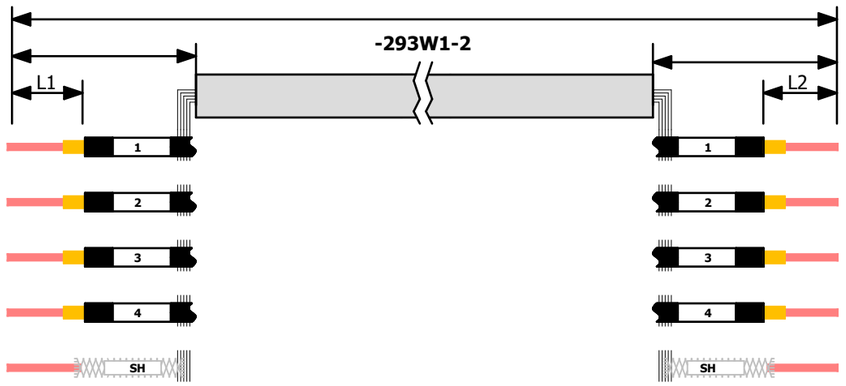


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

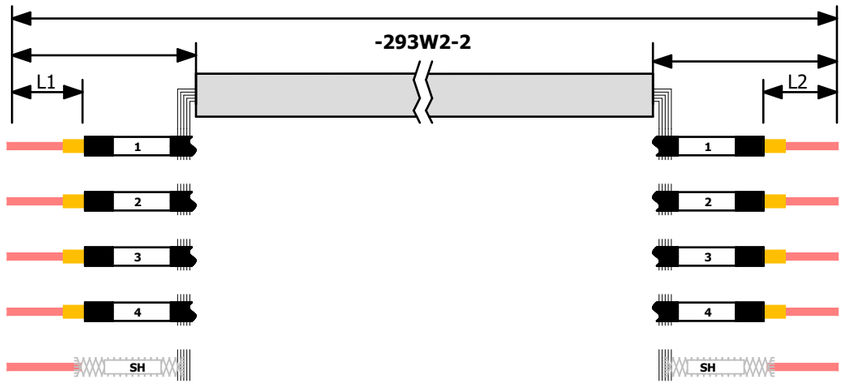
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

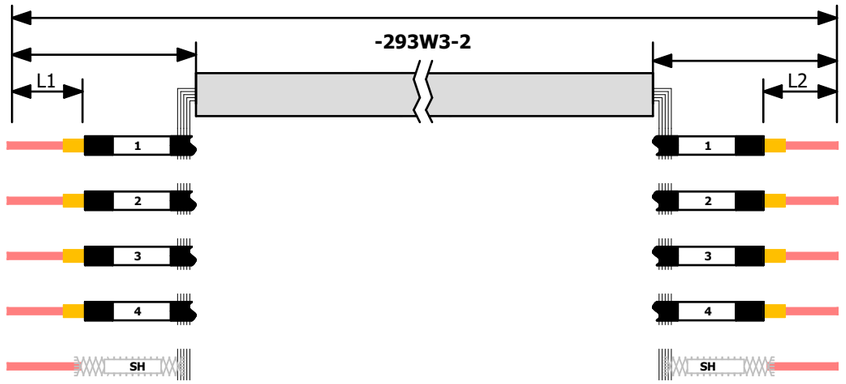


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250805_V2.0	= UNIT_03	Battery Container 2
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 4
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

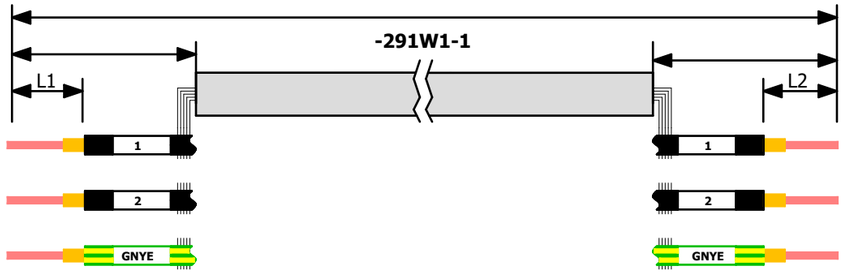


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

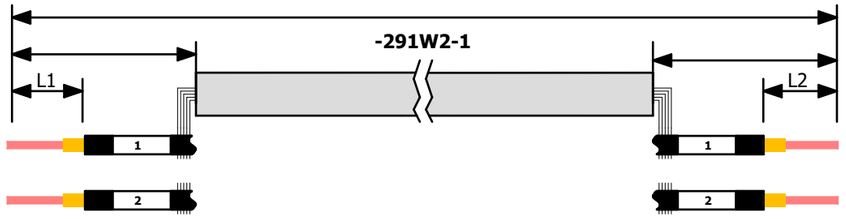


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

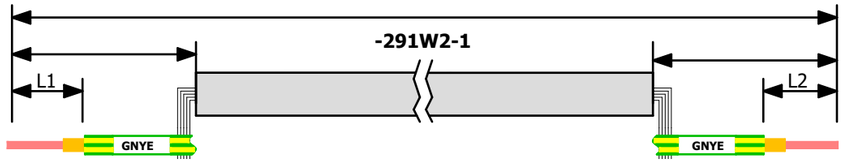
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

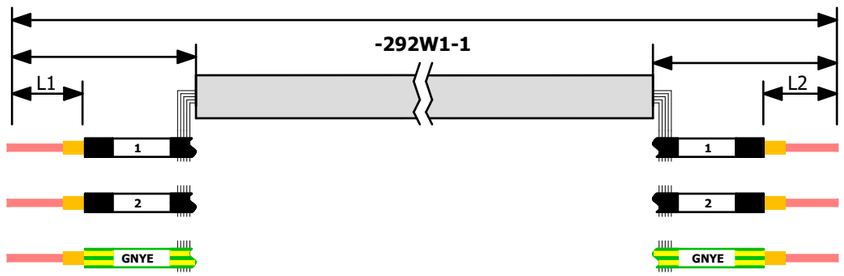


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

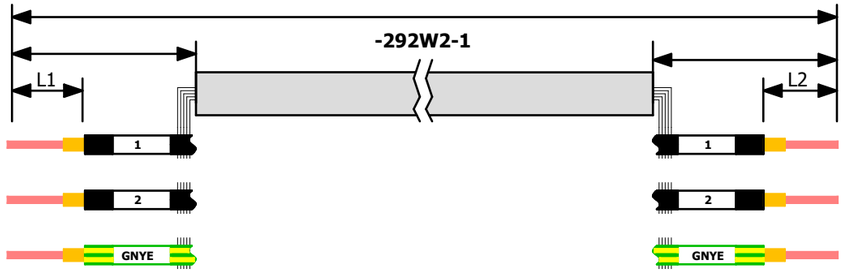


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

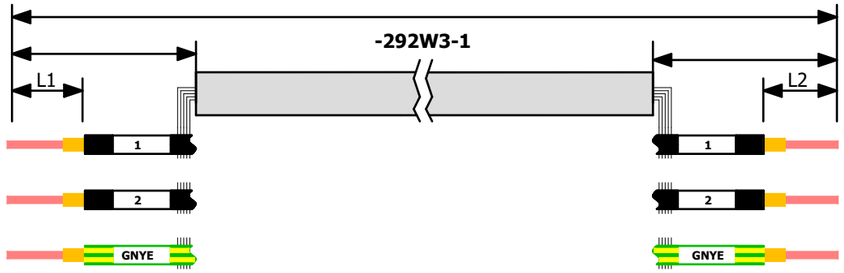


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

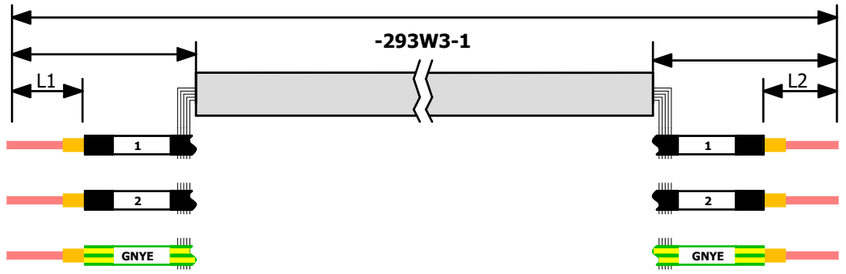


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

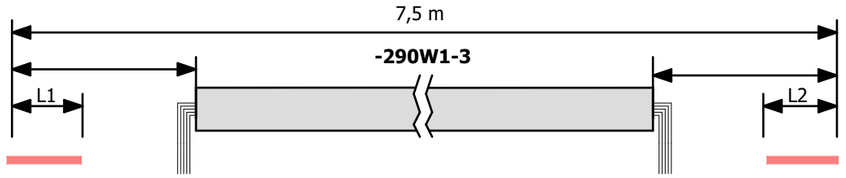


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

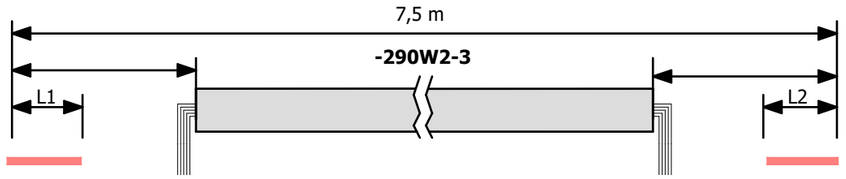


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Cable name =UNIT_03++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

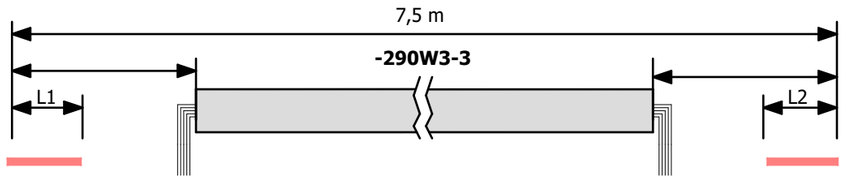


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

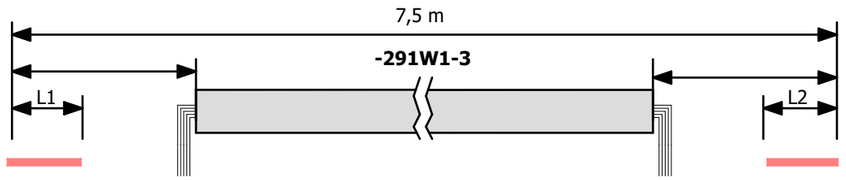


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_03++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

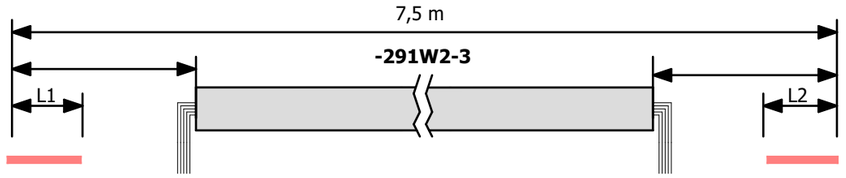


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

Cable name =UNIT_03++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

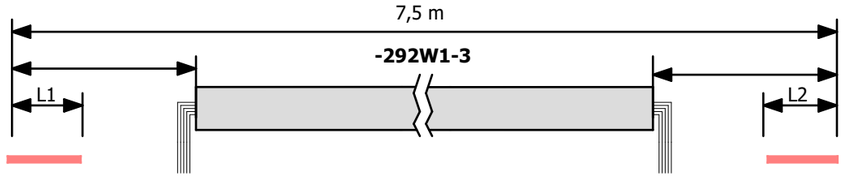


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_03++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



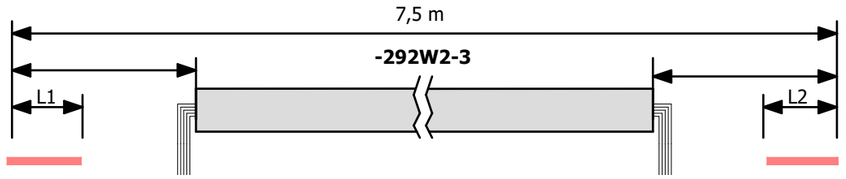
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

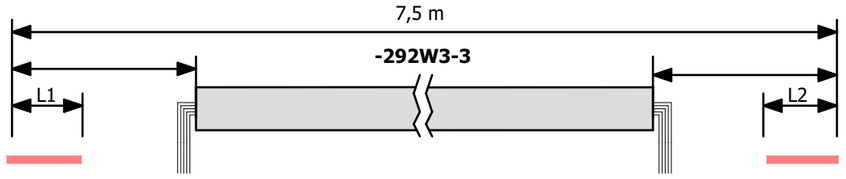
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X7:1-16	

Cable name =UNIT_03++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

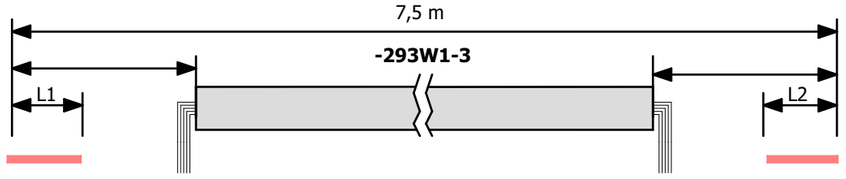
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X8:1-16	

Cable name =UNIT_03++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

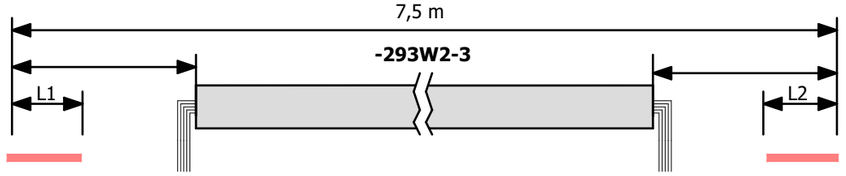
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X9:1-16	

Cable name =UNIT_03++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

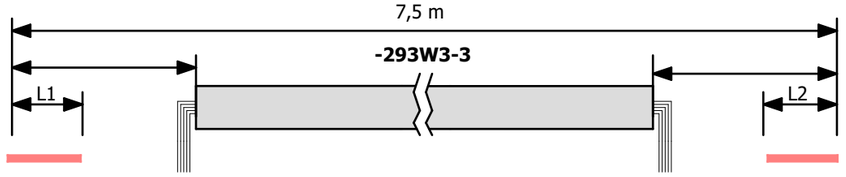
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



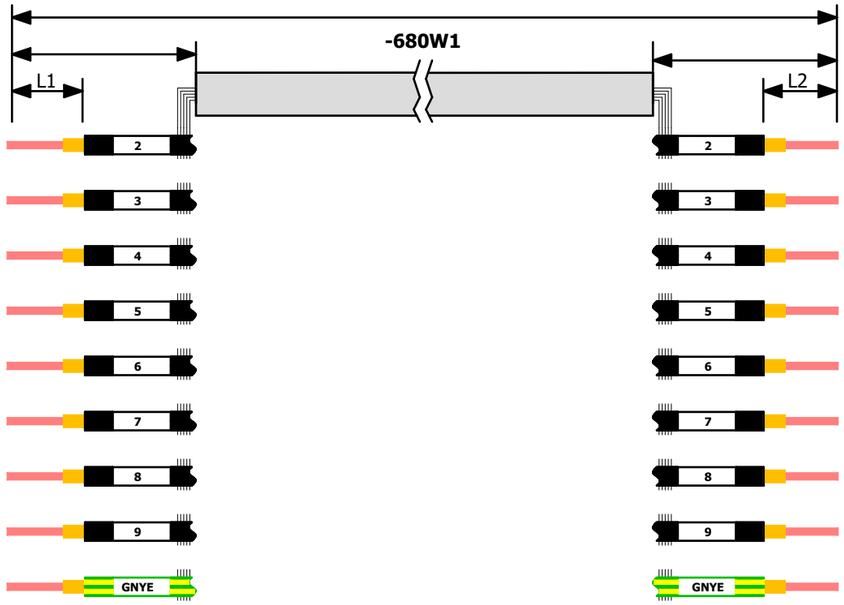
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X3:1-16	

previous page: 8
next page: ++ASC/1

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

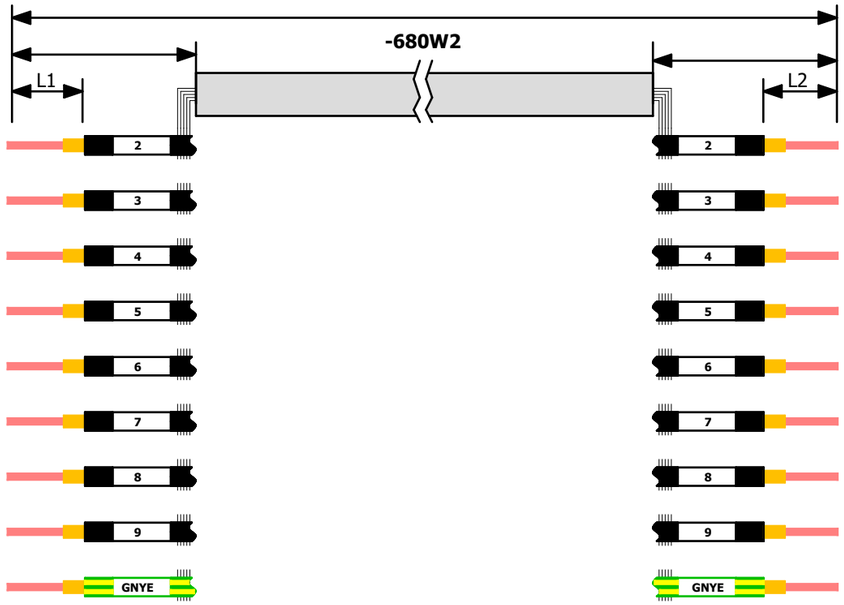


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_03++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

previous page:
++Container/9

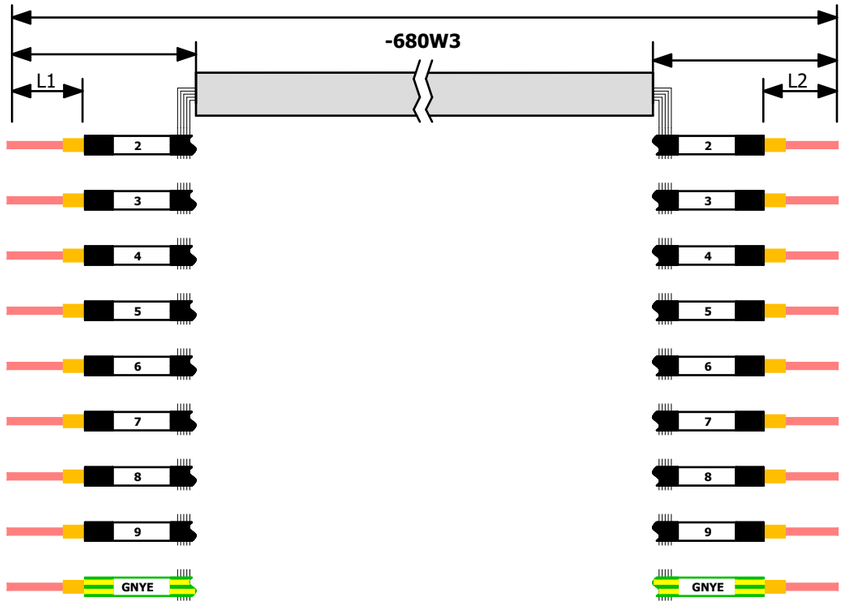
next page:
2

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 9

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

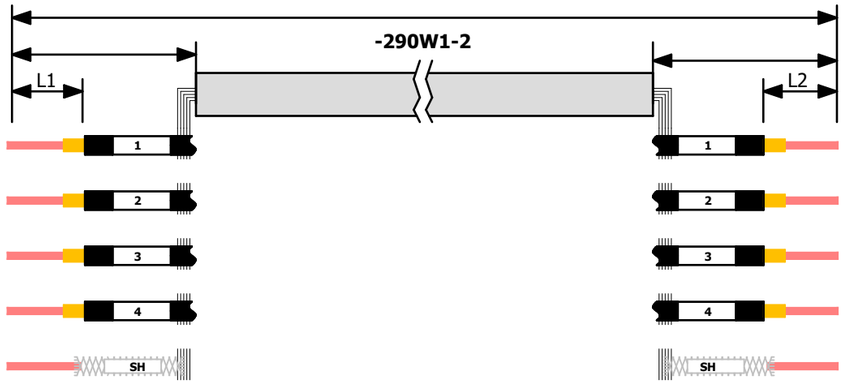


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_03++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

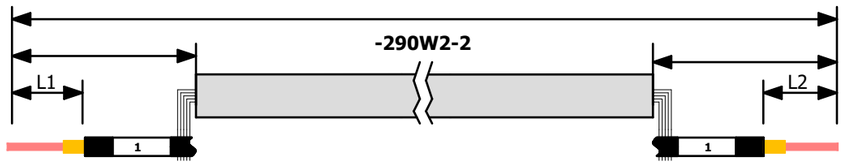


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

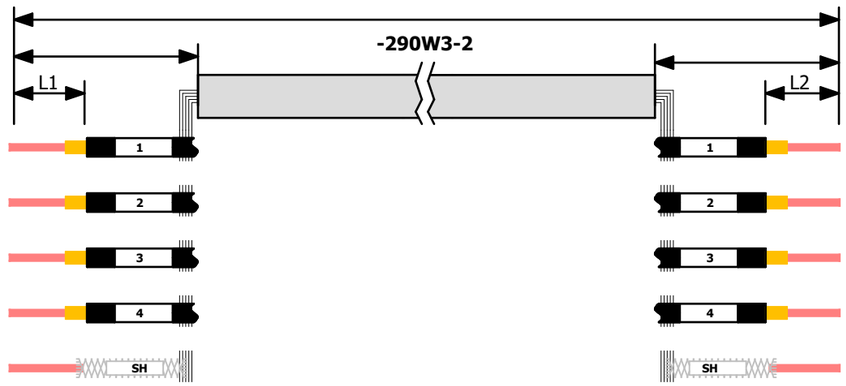


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

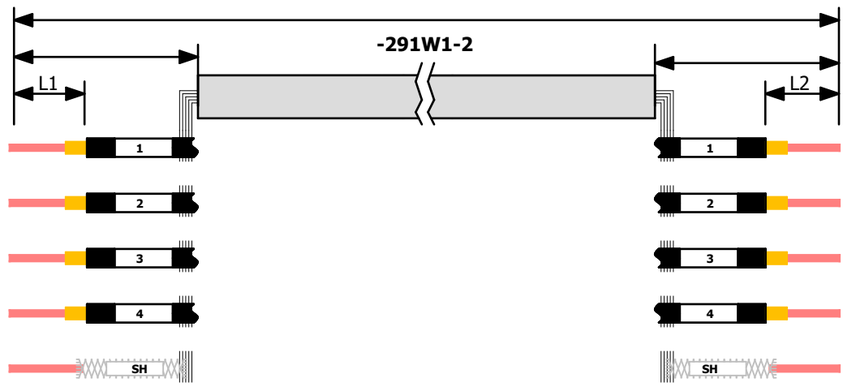


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 2

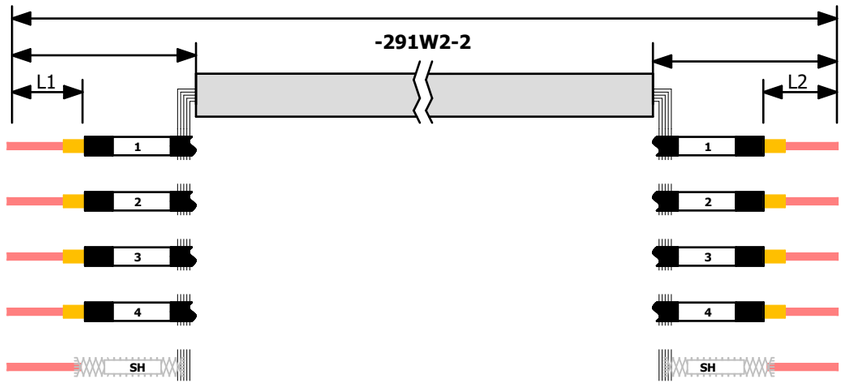
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

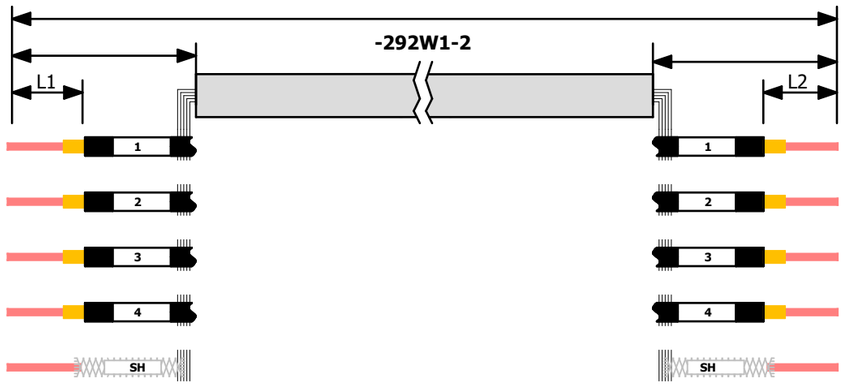


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

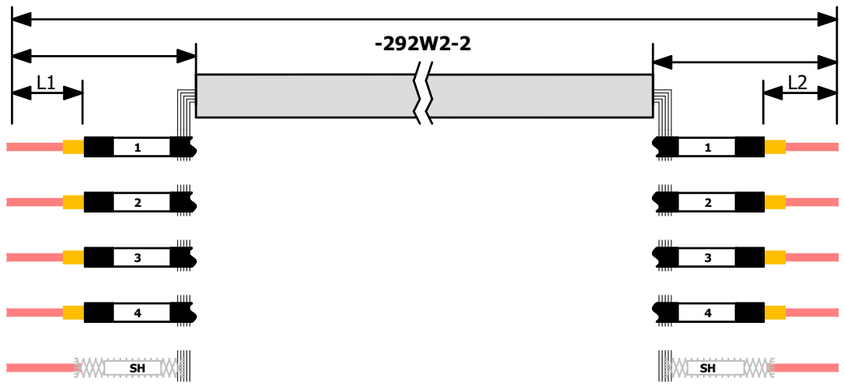


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



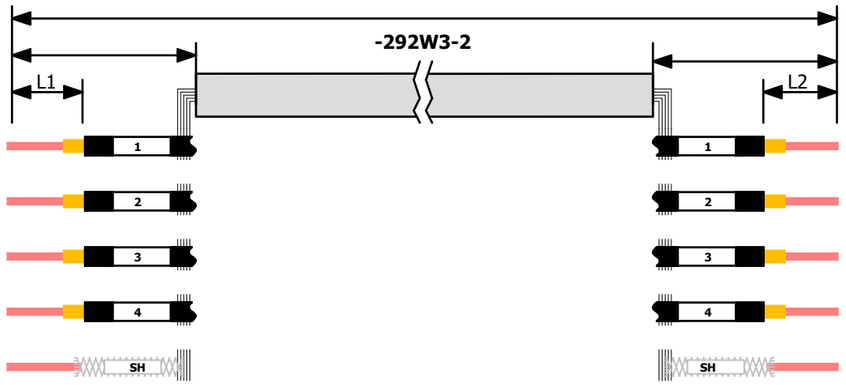
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

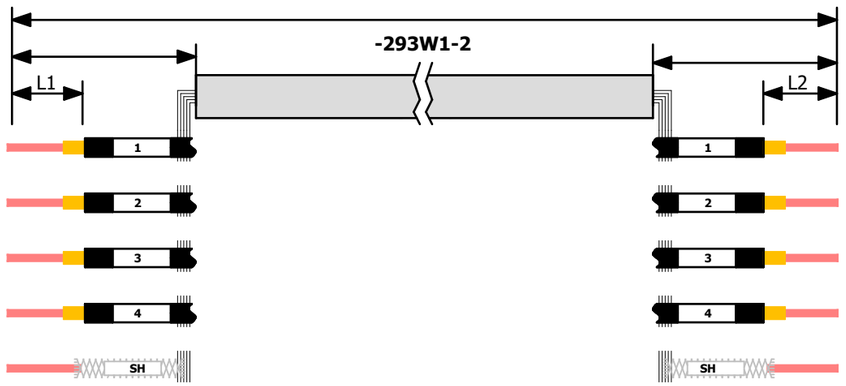
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

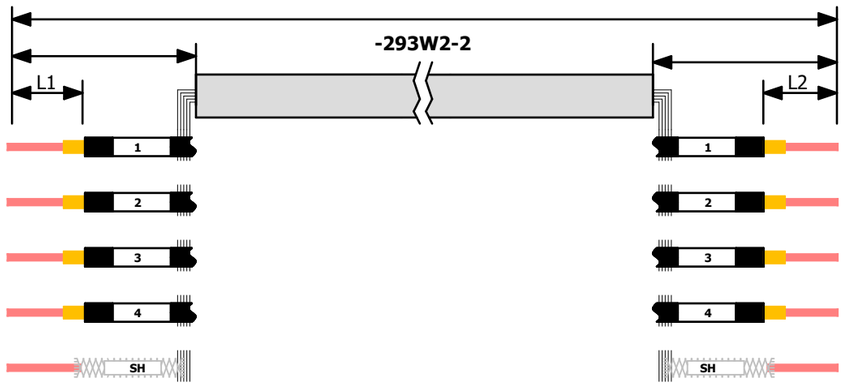
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



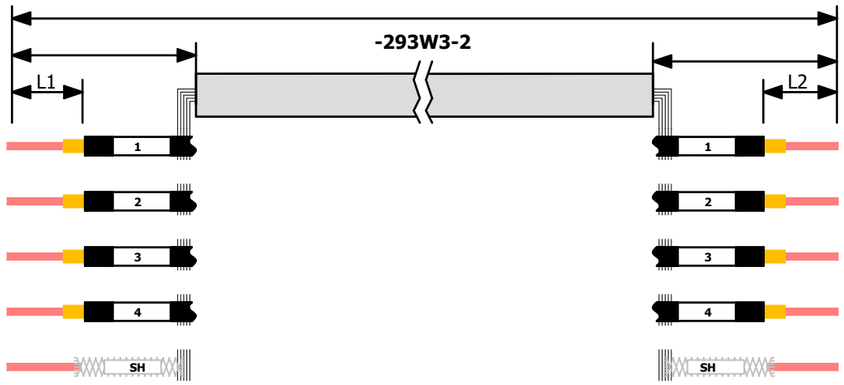
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

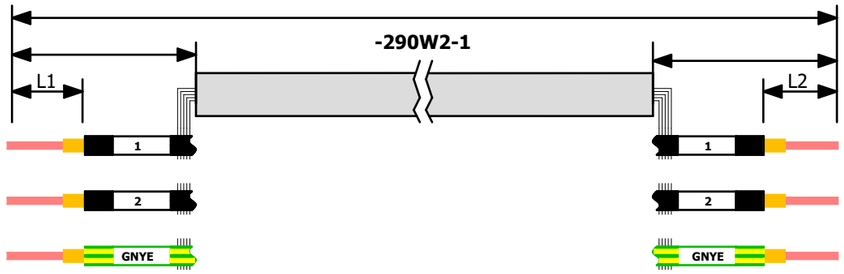


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

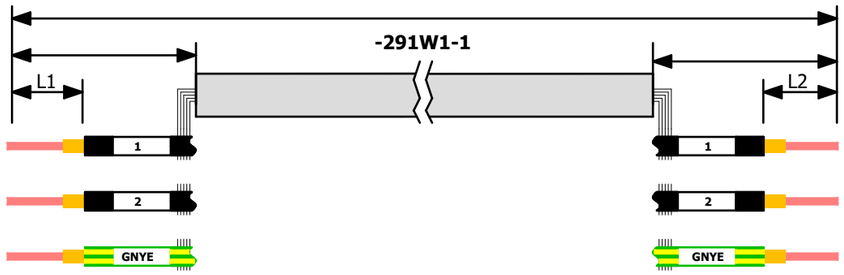


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

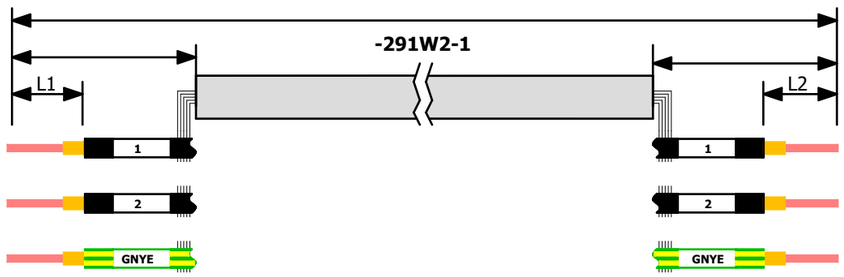


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

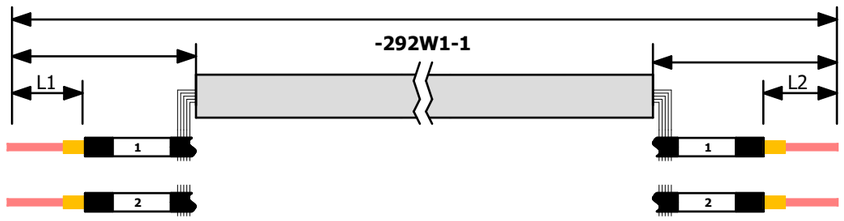


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

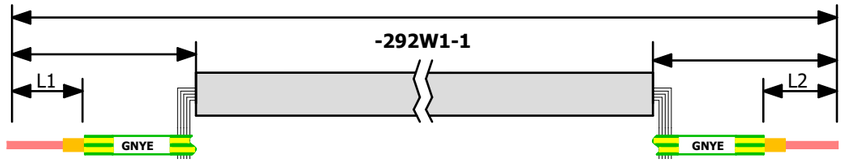
previous page: 6

next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

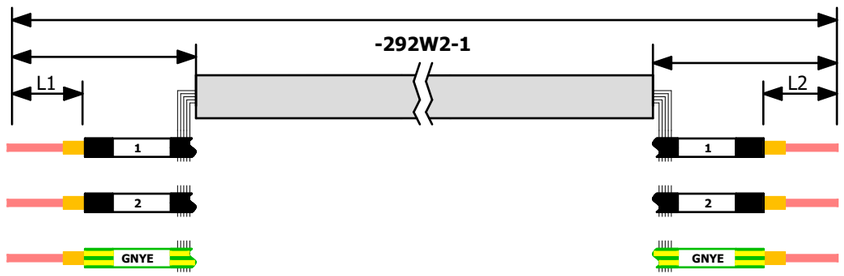


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

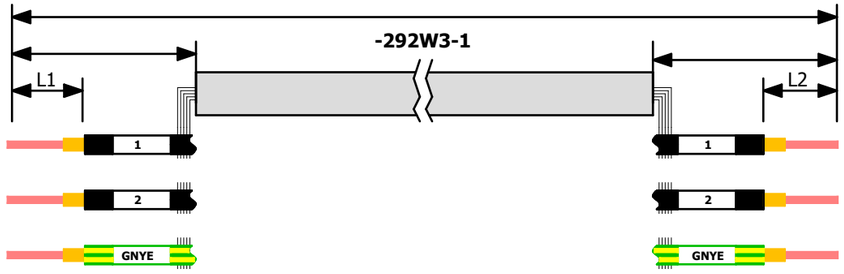


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

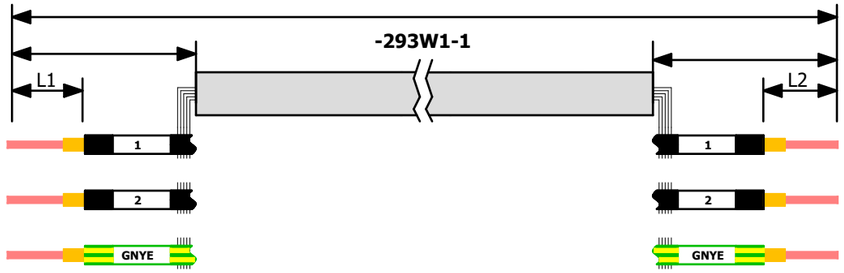


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

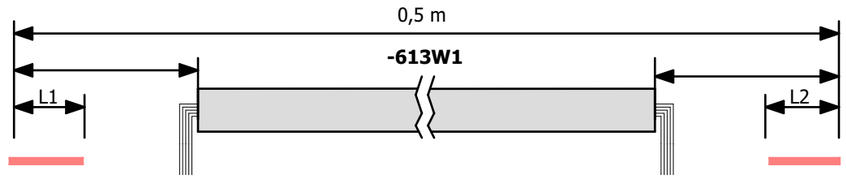


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

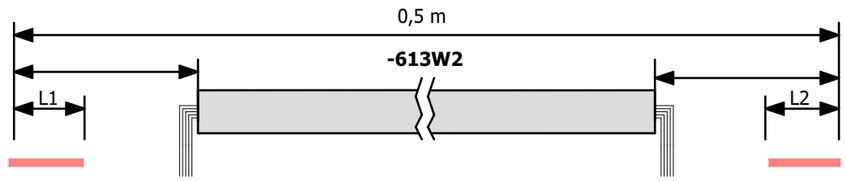


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_03++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			



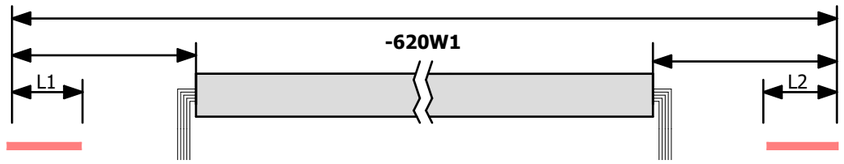
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

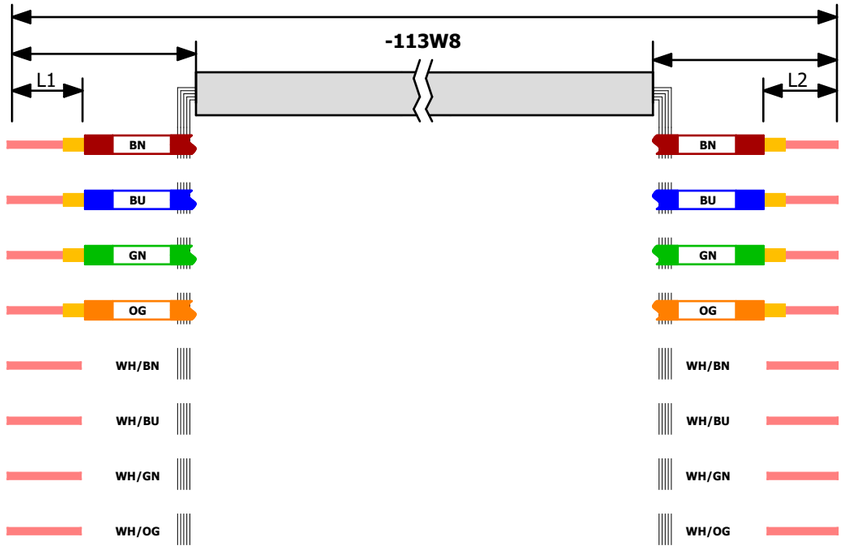
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_03++ASC+-113W8
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:3							-613U2:3	

previous page: 9

next page: &EMZ/1000

FRQ_Kabelplan_04_groß_de_en

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X5.1		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2000
-X5.2		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2001
-X5.3		1	PE	2	0	12	=UNIT_03&EMZ++ASC/2002
-X6		1	6	0	0	6	=UNIT_03&EMZ++ASC/2003
-XDC1		1	PE	2	0	14	=UNIT_03&EMZ++ASC/2004
-XDC2		1	7	0	0	14	=UNIT_03&EMZ++ASC/2005
-XES		1	9	4	5	18	=UNIT_03&EMZ++ASC/2006
-XT		1	14	0	0	14	=UNIT_03&EMZ++ASC/2007
-369XT		1	12	0	0	24	=UNIT_03&EMZ++ASC/2008
-687XT1		1	PE	11	11	44	=UNIT_03&EMZ++ASC/2020
-690XT1		1	PE	40	4	119	=UNIT_03&EMZ++ASC/2031

previous page:
&EMB/10

next page:
2000

Editor	Freqcon_DG			Statron		Klemmenleistenübersicht : =UNIT_03++ASC+-X5.1 - =UNIT_03++ASC+-690XT1	20250805_V2.0	= UNIT_03	Battery Container 2	
Date	21.01.2025							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 1000
Date								+		total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.1						Cable name	-680W1										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 1-4					-XDC2	1	1	,	++Container-680U1-X1	1													&EFS/680a.2
=					-XDC2	5	2	,	++Container-680U1-X1	2		2											&EFS/680a.2
=					-AI_21	13	3	,	++Container-680U1-X1	4		3											&EFS/680a.2
=							4	,															&EFS/680a.2
=							5	,	++Container-680U1-X2	1		4											&EFS/680a.3
=							6	,	++Container-680U1-X2	2		5											&EFS/680a.3
=					-680K1	A1	7	,	++Container-680U1-X2	4		6											&EFS/680a.4
=					-XDC2	2	8	,	++Container-680U1-X2	5		7											&EFS/680a.4
=							9	,	++Container-680U1-X2	7		8											&EFS/680a.5
=							10	,	++Container-680U1-X2	8		9											&EFS/680a.5
=							PE	,	++Container-680U1-X1	5		GNYE											&EFS/680a.2
=							PE	,	-480W1														&EFS/680a.6

previous page:
1000

next page:
2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-X5.1	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2000
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.2						Cable name	-680W2										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 5-8					-XDC2	2	1	,	++Container-680U2-X1	1													&EFS/680b.2
=					-XDC2	6	2	,	++Container-680U2-X1	2		2											&EFS/680b.2
=					-AI_21	14	3	,	++Container-680U2-X1	4		3											&EFS/680b.2
=							4	,															&EFS/680b.2
=							5	,	++Container-680U2-X2	1		4											&EFS/680b.3
=							6	,	++Container-680U2-X2	2		5											&EFS/680b.3
=					-680K2	A1	7	,	++Container-680U2-X2	4		6											&EFS/680b.4
=					-XDC2	2	8	,	++Container-680U2-X2	5		7											&EFS/680b.4
=							9	,	++Container-680U2-X2	7		8											&EFS/680b.5
=							10	,	++Container-680U2-X2	8		9											&EFS/680b.5
=							PE	,	++Container-680U2-X1	5		GNYE											&EFS/680b.2
=							PE	,	-480W1														&EFS/680b.6

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-X5.2	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2001
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X5.3						Cable name	-680W3										Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	F-CY-1Z											
gas concentration BAT 9-11					-XDC2	3	1	,	++Container-680U3-X1	1													&EFS/680c.2
=					-XDC2	7	2	,	++Container-680U3-X1	2		2											&EFS/680c.2
=					-AI_21	15	3	,	++Container-680U3-X1	4		3											&EFS/680c.2
=							4	,															&EFS/680c.2
=							5	,	++Container-680U3-X2	1		4											&EFS/680c.3
=							6	,	++Container-680U3-X2	2		5											&EFS/680c.3
=					-680K3	A1	7	,	++Container-680U3-X2	4		6											&EFS/680c.4
=					-XDC2	3	8	,	++Container-680U3-X2	5		7											&EFS/680c.4
=							9	,	++Container-680U3-X2	7		8											&EFS/680c.5
=							10	,	++Container-680U3-X2	8		9											&EFS/680c.5
=							PE	,	++Container-680U3-X1	5		GNYE											&EFS/680c.2
=							PE	,	-480W1														&EFS/680c.6

previous page:
2001

next page:
2003

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_03++ASC+-X5.3	20250805_V2.0
Date	21.01.2025						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2002
+			total: 492

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-X6					Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Extract Fan C/W Fire Damper 1						GND	1	,	-AO_21	1													&EFS/681.1
=						+10V	2	,	-AO_21	5													&EFS/681.1
Extract Fan C/W Fire Damper 2						GND	3	,	-AO_21	2													&EFS/681.3
=						+10V	4	,	-AO_21	6													&EFS/681.3
Extract Fan C/W Fire Damper 3						GND	5	,	-AO_21	3													&EFS/681.5
=						+10V	6	,	-AO_21	7													&EFS/681.5

previous page: 2002

next page: 2004

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XDC1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
FUSE 24V DC CONTROL VOLTAGE					-101T1	13	1		-103F1	2													&EFS/603.2
					-101Q1	13																	
					-611A1	1																	
FUSE 24V DC CONTROL VOLTAGE					-620A1	-X80:1	2																&EFS/603.2
					-DI_21	L+																	
					-DO_21	L+																	
FUSE 24V DC CONTROL VOLTAGE					-635K7	11	3		-103F1	13													&EFS/603.2
					-684F5	11																	
FUSE 24V DC CONTROL VOLTAGE					-611A1	2	4		-102G1	OUTPUT DC 24 V:-													&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE					-620A1	-X80:2	5																&EFS/603.3
					-DI_21	M																	
					-DO_21	M																	
FUSE 24V DC CONTROL VOLTAGE					-635K1	A2	6		-XDC2	5													&EFS/603.3
FUSE 24V DC CONTROL VOLTAGE					-101T1	-"	PE																&EFS/603.4
					-101T1	PE																	
FUSE 24V DC CONTROL VOLTAGE							PE																&EFS/603.4

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_03++ASC+-XDC1	20250805_V2.0	= UNIT_03	Battery Container 2
Date	21.01.2025							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 2004

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-XDC2

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FUSE 24V DC CONTROL VOLTAGE			-AI_21	L+	1		-103F2	2			&EFS/603.5
			-AO_21	L+							
			-X5.1	1							
FUSE 24V DC CONTROL VOLTAGE			-X5.1	8	2		-X5.2	8			&EFS/603.5
			-680K1	11							
			-X5.2	1							
FUSE 24V DC CONTROL VOLTAGE			-680K2	11	3		-680K3	11			&EFS/603.5
			-X5.3	1							
			-X5.3	8							
FUSE 24V DC CONTROL VOLTAGE			-691F1	13	4						&EFS/603.6
			-691F4	13							
			-691F4	13							
FUSE 24V DC CONTROL VOLTAGE			-AI_21	M	5		-XDC1	6			&EFS/603.6
			-AO_21	M							
			-X5.1	2							
FUSE 24V DC CONTROL VOLTAGE			-680K1	A2	6						&EFS/603.6
			-X5.2	2							
FUSE 24V DC CONTROL VOLTAGE			-680K2	A2	7						&EFS/603.7
			-X5.3	2							
			-680K3	A2							

previous page: 2004

next page: 2006

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XES						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
							1		-684F1	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC							N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-687XT1	N													&EFS/684.3
=					-690XT1	N	N		-690F1	N													&EFS/684.3
=					-690XT1	N	N		-690F2	N													&EFS/684.3
=							N		-690XT1	N													&EFS/684.4
=							PE			PE													&EFS/684.4
=					++Container-278W1	GND	PE			PE													&EFS/684.4
=					-684F5	PE	PE		-684F2	PE													&EFS/684.5
=					-601F1	PE	PE																&EFS/684.5
					-684F4	2	2		-684F3	2													&EFS/684.0
UPS Bat-Con 1 3-phase 400V AC					-601F1	L1	3																&EFS/684.1
=							4		-684F1	4													&EFS/684.1
=					-684F4	4	5		-684F3	4													&EFS/684.1
=					-601F1	L2	6																&EFS/684.1
=							7		-684F1	6													&EFS/684.1
=					-684F4	6	8		-684F3	6													&EFS/684.1
=					-601F1	L3	9																&EFS/684.2

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
Gas confirmed FGS							1	,	-635K1	14			&EFS/635b.1
=							2	,	-635K1	11			&EFS/635b.1
=							3	,	-635K2	14			&EFS/635b.1
Smoke confirmed FGS							4	,	-635K2	11			&EFS/635b.2
=							5	,	-635K3	14			&EFS/635b.2
Thermal runaway SIS							6	,	-635K3	11			&EFS/635b.3
=							7	,	-635K4	14			&EFS/635b.3
=							8	,	-635K4	11			&EFS/635b.3
Spare							9	,	-635K5	14			&EFS/635b.4
=							10	,	-635K5	11			&EFS/635b.4
=							11	,	-635K6	14			&EFS/635b.5
=							12	,	-635K6	11			&EFS/635b.5
Shut-down to BESS							13	,	-635K7	A2			&EFS/635b.7
=							14	,	-635K7	A1			&EFS/635b.7

previous page: 2006

next page: 2008

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-OZ	++Container-290W2-2 F-CY-OZ	++Container-290W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	1					&EFS/669.5
		3			++Container-570XT	3						
	3				++Container-570XT	3						

previous page: 2007

next page: 2009

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2008

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	2		++Container-570XT	3		3	&EFS/669.5
		3			++Container-570XT	3							
	3				++Container-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			3		++Container-570XT	3	3		++Container-570XT	3		3	&EFS/669.6
		3			++Container-570XT	3							
	3				++Container-570XT	3							

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2010

total: 492

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-369XT

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	4					&EFS/669.7
		4			++Container-570XT	4						
	4				++Container-570XT	4						

previous page:
2010

next page:
2012

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2011
total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	5		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet smoke detector potential-free contacts customer			4		++Container-570XT	4	6		++Container-570XT	4		4	&EFS/669.8
		4			++Container-570XT	4							
	4				++Container-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	7					&EFS/670.5
		1			++Container-570XT	1						
	1				++Container-570XT	1						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-OZ	++Container-291W2-2 F-CY-OZ	++Container-291W1-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	8		++Container-570XT	1		1	&EFS/670.5
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-0Z	++Container-292W3-2 F-CY-0Z	++Container-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		++Container-570XT	1	9		++Container-570XT	1		1	&EFS/670.6
		1			++Container-570XT	1							
	1				++Container-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-2 F-CY-0Z	++Container-290W2-2 F-CY-0Z	++Container-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	10					&EFS/670.7
		2			++Container-570XT	2						
	2				++Container-570XT	2						

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-2 F-CY-0Z	++Container-291W2-2 F-CY-0Z	++Container-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	11		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W1-2 F-CY-OZ	++Container-292W3-2 F-CY-OZ	++Container-292W2-2 F-CY-OZ	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++Container-293W2-2 F-CY-OZ	Page / column
battery cabinet gas potential-free contacts customer			2		++Container-570XT	2	12		++Container-570XT	2		2	&EFS/670.8
		2			++Container-570XT	2							
	2				++Container-570XT	2							

previous page: 2018

next page: 2020

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2019

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			++Container-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				++Container-XE	1	3	,	-687F3	2		&EFS/687.4

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2020 of total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W1-1 JZ-500	++Container-291W2-1 JZ-500	++Container-291W1-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	4	,	-687F4	2		&EFS/687.5
=		1			++Container-XE	1	5	,	-687F5	2		&EFS/687.7
=	1				++Container-XE	1	6	,	-687F6	2		&EFS/687.8

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-687XT1

Function text	++Container-293W1-1 JZ-500	++Container-292W3-1 JZ-500	++Container-292W2-1 JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	7	,	-688F1	2		&EFS/688.1
=		1			++Container-XE	1	8	,	-688F2	2		&EFS/688.3
=	1				++Container-XE	1	9	,	-688F3	2		&EFS/688.4

previous page: 2021

next page: 2023

Editor	Freqcon_DG	Statron	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2	
Date	21.01.2025				& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007	++ ASC auxillary cabinet	page: 2022
Date					+	total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W1-1	++Container-293W3-1	++Container-293W2-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		++Container-XE	1	10	,	-688F4	2													&EFS/688.5
=		1			++Container-XE	1	11	,	-688F5	2													&EFS/688.7
=	2				++Container-XE	N	N	,	-XES	N													&EFS/687.1
								,															

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W1-1 JZ-500	++Container-290W3-1 JZ-500	++Container-290W2-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/687.6

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2024

total: 492

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W2-1 -XZ-500	++Container-292W1-1 -XZ-500	++Container-291W2-1 -XZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/687.7
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/687.8
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N		-XES	N		&EFS/688.1

previous page: 2024

next page: 2026

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	05.11.2024							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W2-1 -1Z-500	++Container-293W1-1 -1Z-500	++Container-292W3-1 -1Z-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N					&EFS/688.3
Supply Battery String 1-phase 230V AC		2			++Container-XE	N	N					&EFS/688.4
Supply Battery String 1-phase 230V AC	2				++Container-XE	N	N					&EFS/688.6

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-290W2-1 JZ-500	++Container-290W1-1 JZ-500	++Container-293W3-1 JZ-500	Cable name / Cable type	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		++Container-XE	N	N	⌟				&EFS/688.7
								,				
Supply Battery String 1-phase 230V AC		GNYE			++Container-XE	PE	PE	,				&EFS/687.2
=	GNYE				++Container-XE	PE	PE	,				&EFS/687.3

previous page: 2026

next page: 2028

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-291W2-1	++Container-291W1-1	++Container-290W3-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/687.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/687.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/687.7

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-292W3-1	++Container-292W2-1	++Container-292W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/687.9
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.2
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.3

Terminal diagram

Freqcon_F13_001_02

Function text	++Container-293W3-1	++Container-293W2-1	++Container-293W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		++Container-XE	PE	PE	,															&EFS/688.4
=		GNYE			++Container-XE	PE	PE	,															&EFS/688.6
=	GNYE				++Container-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
				Cable type							Cable type	
Container Internal Lighting						L	1	,	-690F1	2		&EFS/690.1
=						1	2	,	-690F2	2		&EFS/690.3
Container Sockets						1	3	,	-690F3	2		&EFS/690.5
230V AC for crane 2						1	4	,	-690F4	2		&EFS/690.7
230V AC for crane 3						1	5	,	-690F5	2		&EFS/690.8
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						L	6	,	-636K1	14		&EFS/691.1
						L						
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
								,				
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						L	7	,	-636K2	14		&EFS/691.3
						L						
								,				
								,				

previous page: 2030

next page: 2032

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,		

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,															
400V AC for Cooling Units							10	,	-691F4	4													&EFS/691.6
								,															
								,															
								,															
								,															
								,															
								,															
								,															
								,														

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-690XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Cable type	Page / column
				Cable type							Cable type		
230V AC for crane 2						PE	PE						&EFS/690.7
230V AC for crane 3						PE	PE						&EFS/690.8
Container Sockets						2	N		-690F2	N.			&EFS/690.4
230V AC for crane 1						2	N		-XES	N			&EFS/690.6
230V AC for crane 2						2	N		-XES	N			&EFS/690.7
230V AC for crane 3						2	N		-XES	N			&EFS/690.8
Container Internal Lighting						N	N		-690F1	N.			&EFS/690.1
=						GND	PE						&EFS/690.2
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						N	N		-XES	N			&EFS/691.1
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 1-4						GND	PE						&EFS/691.2
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						N	N						&EFS/691.3
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 5-8						GND	PE						&EFS/691.3
						GND							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						N	N						&EFS/691.4
						N							
230V AC for Exhaust Unit / shut-off flap Battery cabinets 9-11						GND	PE						&EFS/691.4
						GND							
400V AC for Cooling Units							N						&EFS/691.6
=							PE						&EFS/691.6

previous page: 2033

next page:

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-690XT1	20250805_V2.0	= UNIT_03 Battery Container 2
Date	21.01.2025							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

STATRON
NON STOP POWER

Cable Schedule

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E13
Sequence Number: 001
Rev: 003
Document number: K559-2254-CWIWP4202201-E13-001
Document description: Cable Schedule

Revision	Date	Name	Description
001	20.02.2023	CPA / ADI	First Version
002	12.04.2023	CPA / ADI	Updated according to KBR comments
003	23.01.2025	MMÜ	Second revision

Cable Schedule
E13

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E13
Document name	Cable Schedule
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-28	C. Palenzuela	First version
2.0	2024-11-14	M. Müller	First revised version
3.0	2025-01-23	M. Müller	Second revision

Table 1: Version overview

	Date	Name
Editor	2023-03-28	C. Palenzuela
Checked by	2023-03-31	A. Fritz
Approved by	2023-03-31	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
January 2025

Doc Code
K559-2254-CWIWP4202201-E13-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Extract of BESS and PCS circuit diagram (Cable schedule PCS)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Cable Schedule PCS
Extract of BESS and PCS circuit diagram (Cable schedule Battery 1)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Cable Schedule Battery 1
Extract of BESS and PCS circuit diagram (Cable schedule Battery 2)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Cable Schedule Battery 2

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 2: Generic terms and abbreviations used

2 General

The cable schedules of the PCS and BESS containers are part of the circuit diagram of the complete system attached to this document (*see section 1.3 "Other Applicable Documents"*). The relevant pages are extracted into separate files as shown in the following table.

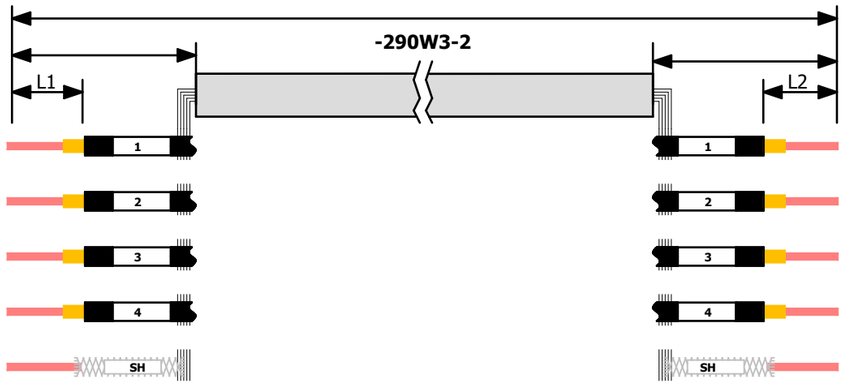
Container	Document Name
PCS	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Cable Schedule PCS
Battery 1	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Cable Schedule Battery 1
Battery 2	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Cable Schedule Battery 2

3 Appendix

1. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Cable Schedule PCS
2. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Cable Schedule Battery 1
3. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Cable Schedule Battery 2

Cable name =UNIT_02++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

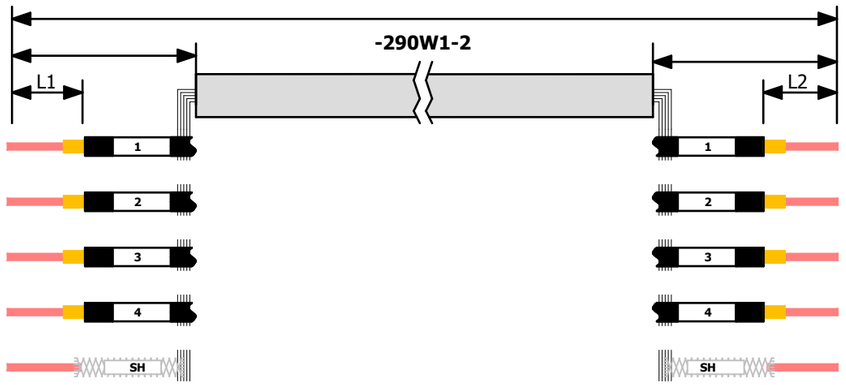


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

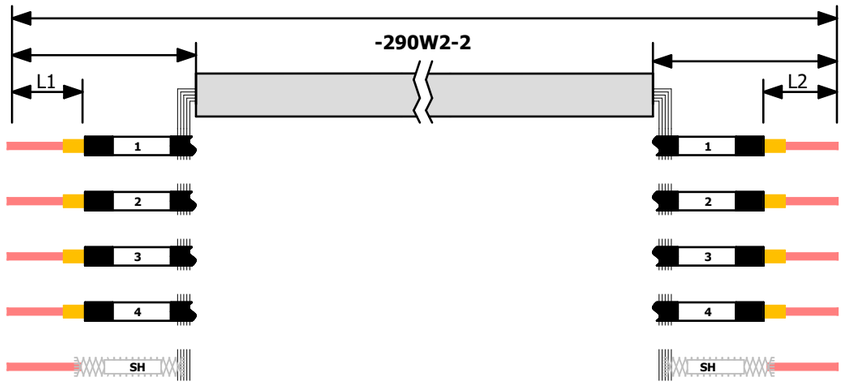


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

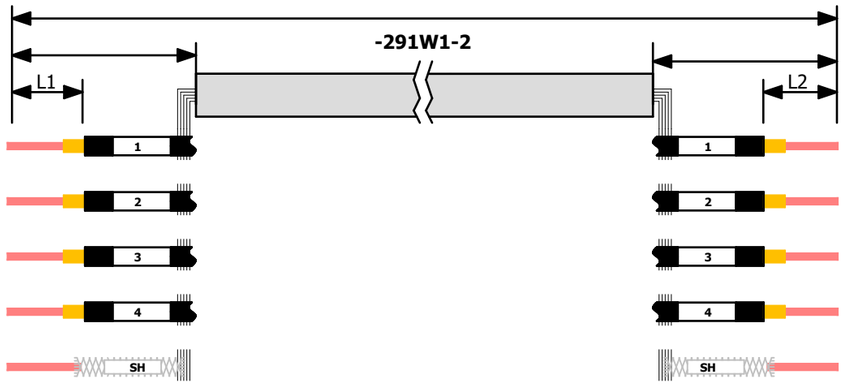
previous page:
&EPA++ASC/2

next page:
2

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

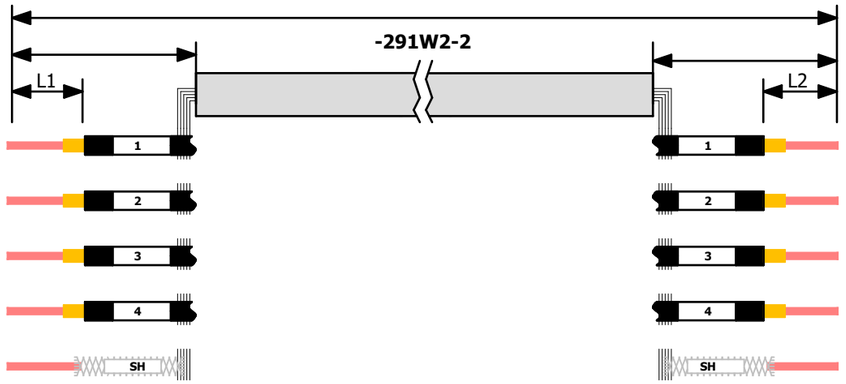


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

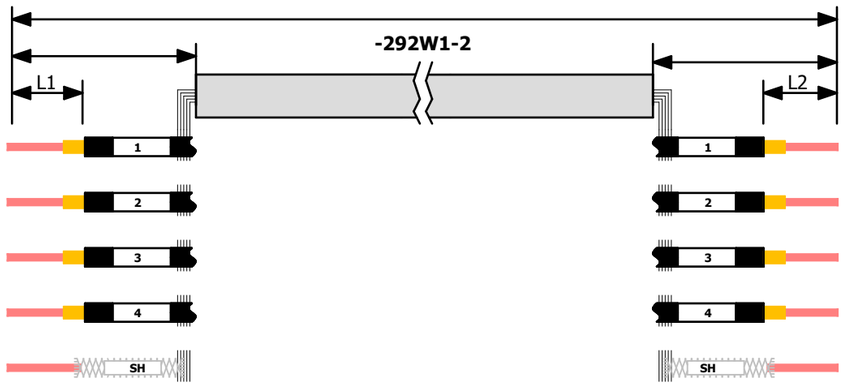


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

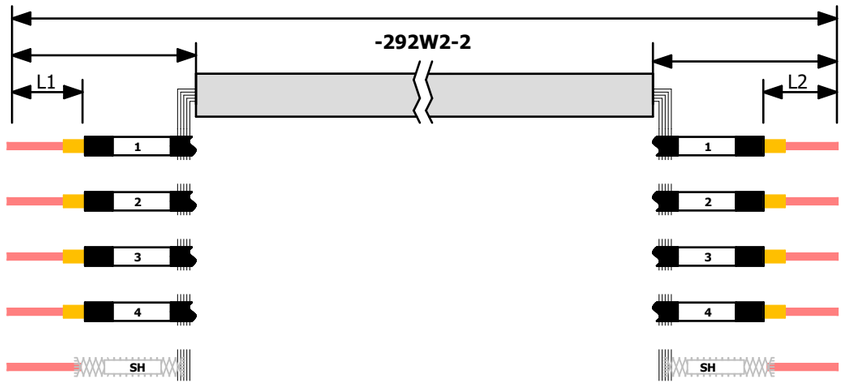
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

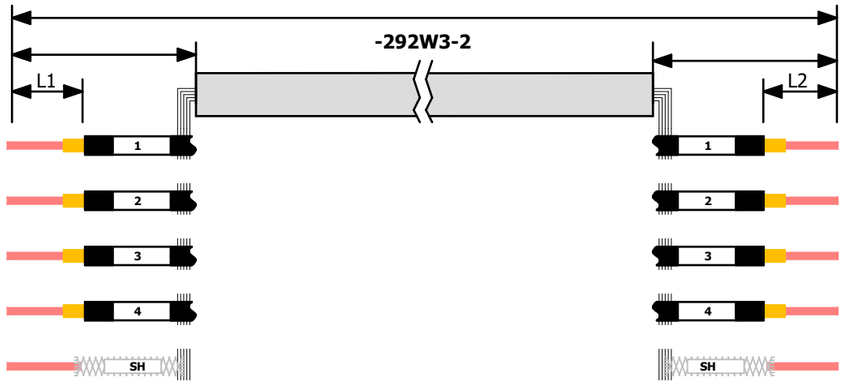


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

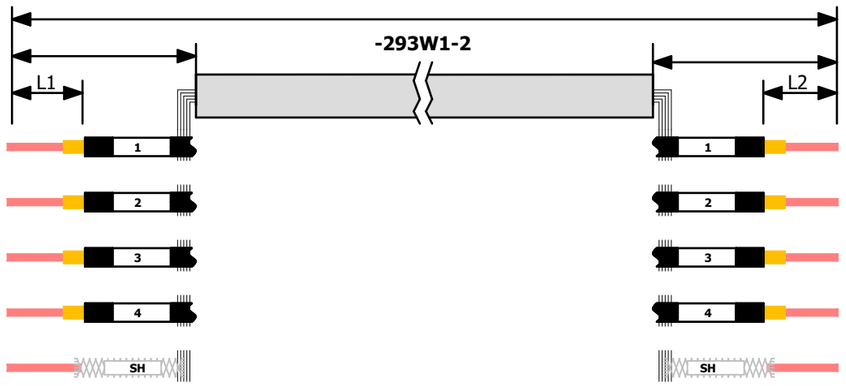


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

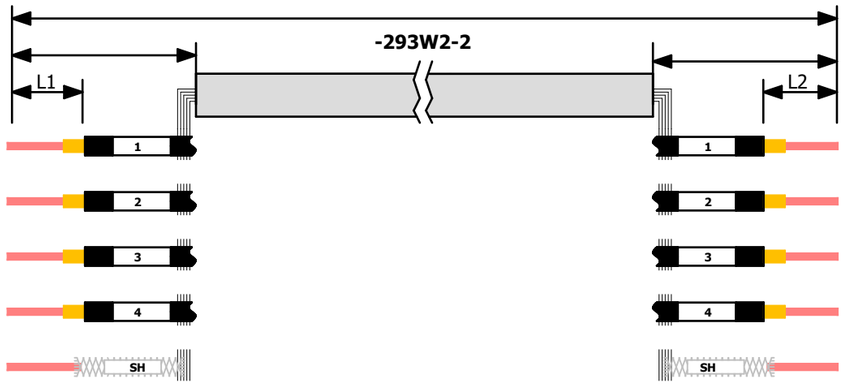
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

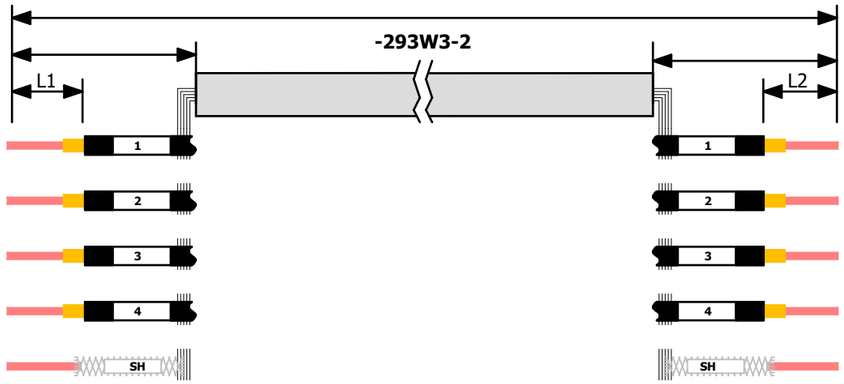


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

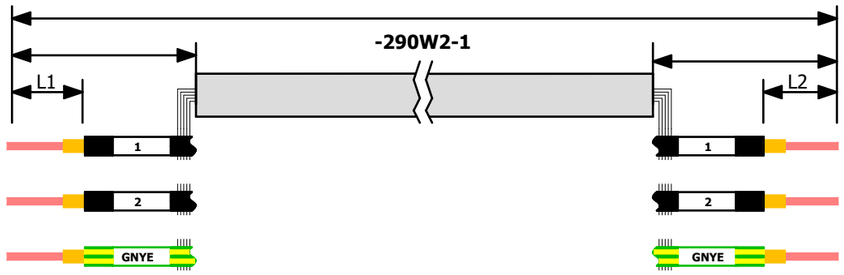
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

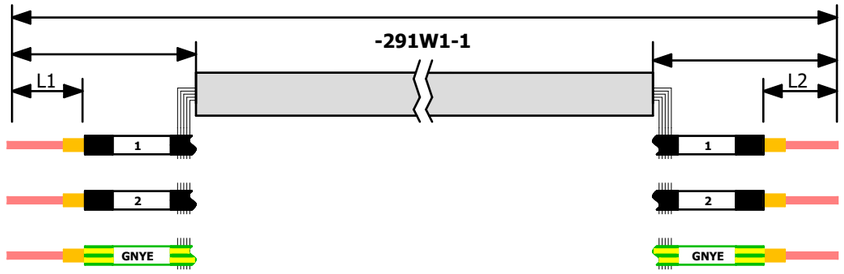


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

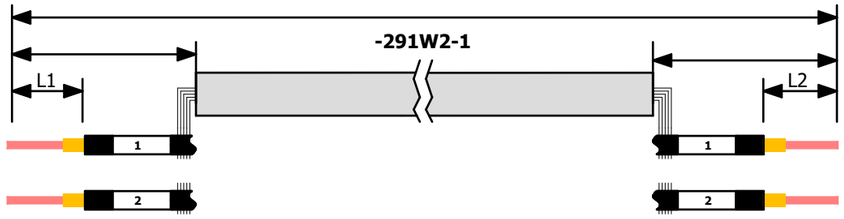


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

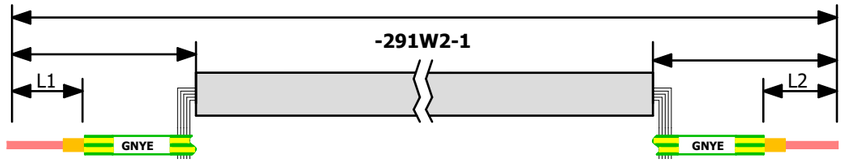
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

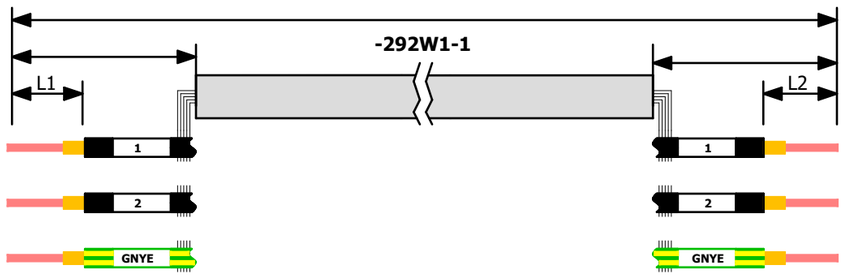


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

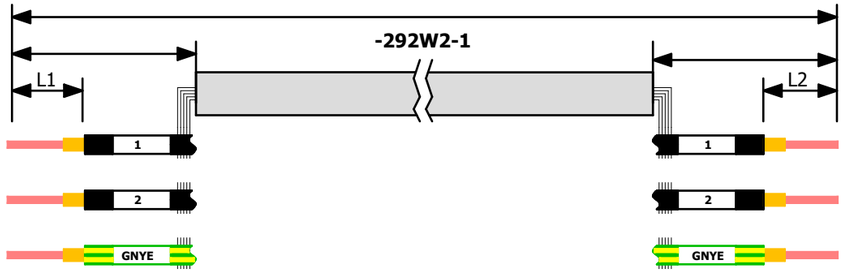


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

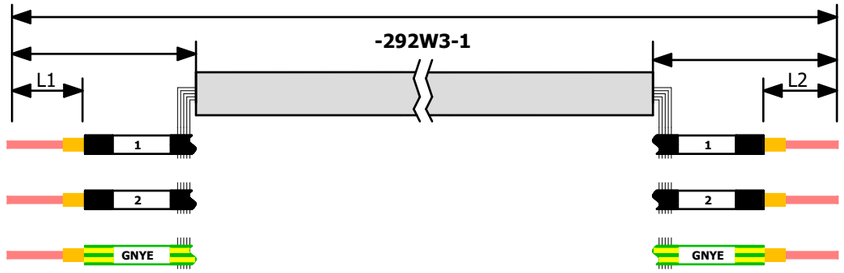


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

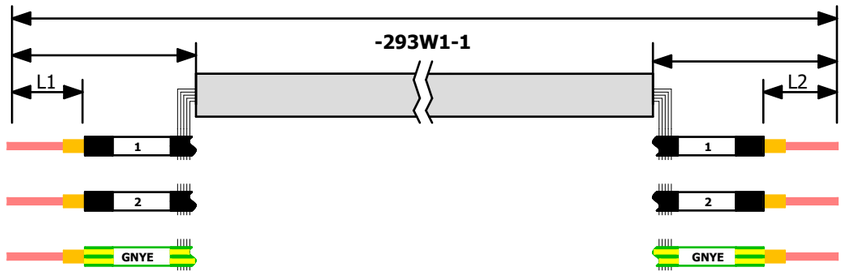
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

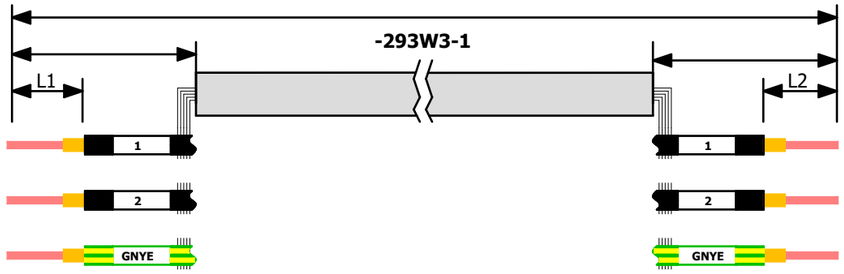


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

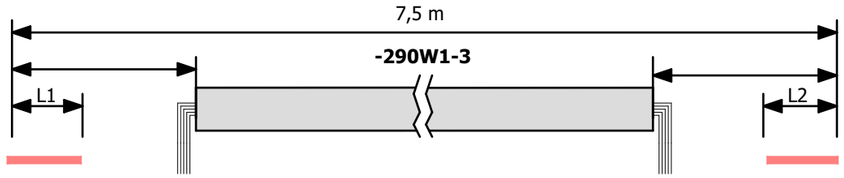


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

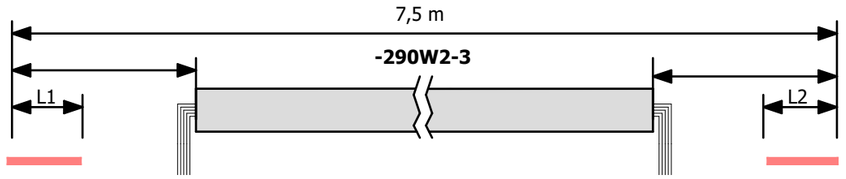
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_02 Battery Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 7
Date								+ total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

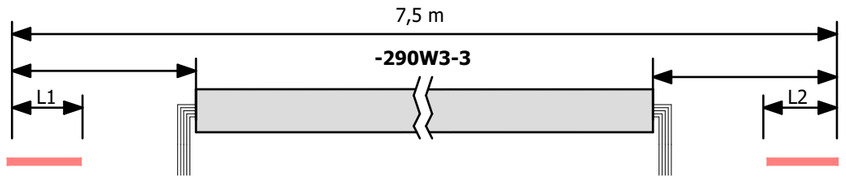


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

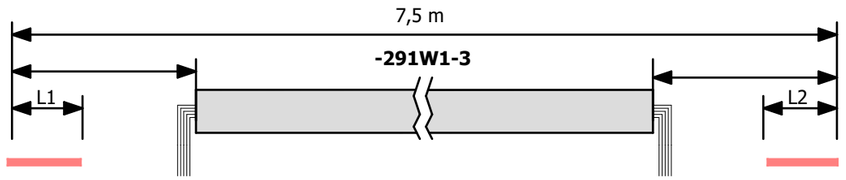


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_02++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

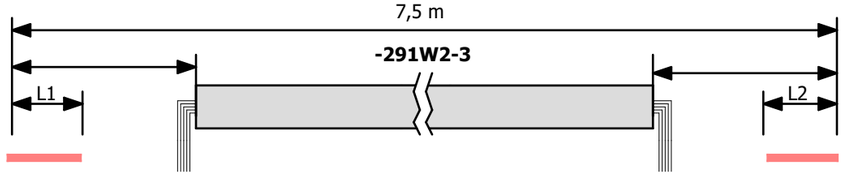


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

Cable name =UNIT_02++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

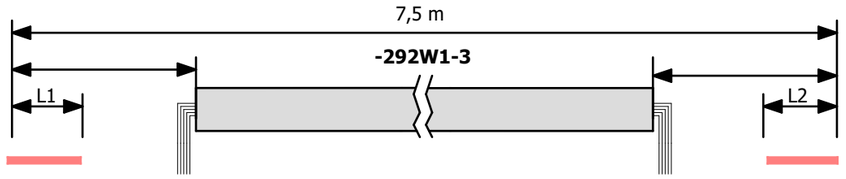


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_02++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



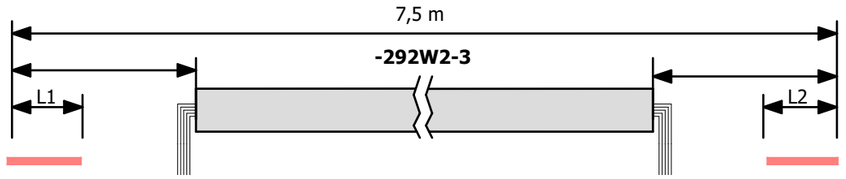
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

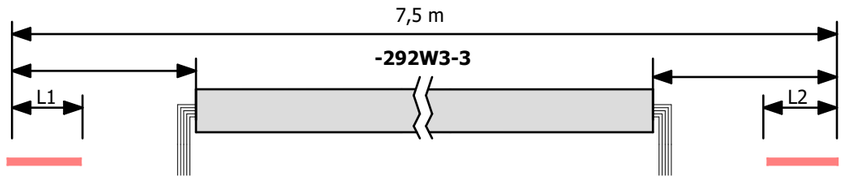


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X7:1-16	

Cable name =UNIT_02++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

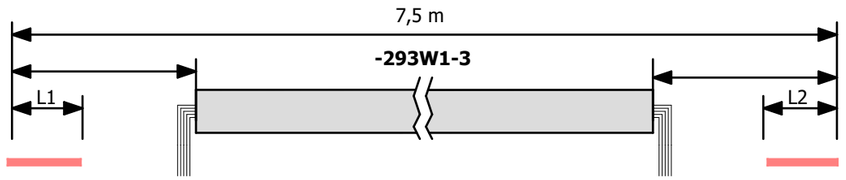


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X8:1-16	

Cable name =UNIT_02++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

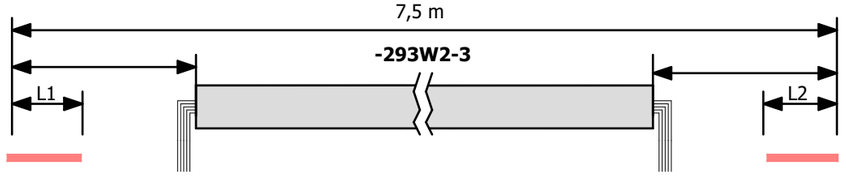


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X9:1-16	

Cable name =UNIT_02++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

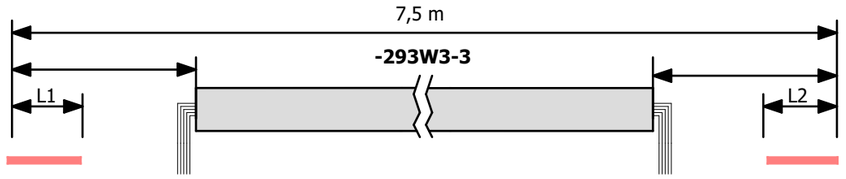


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

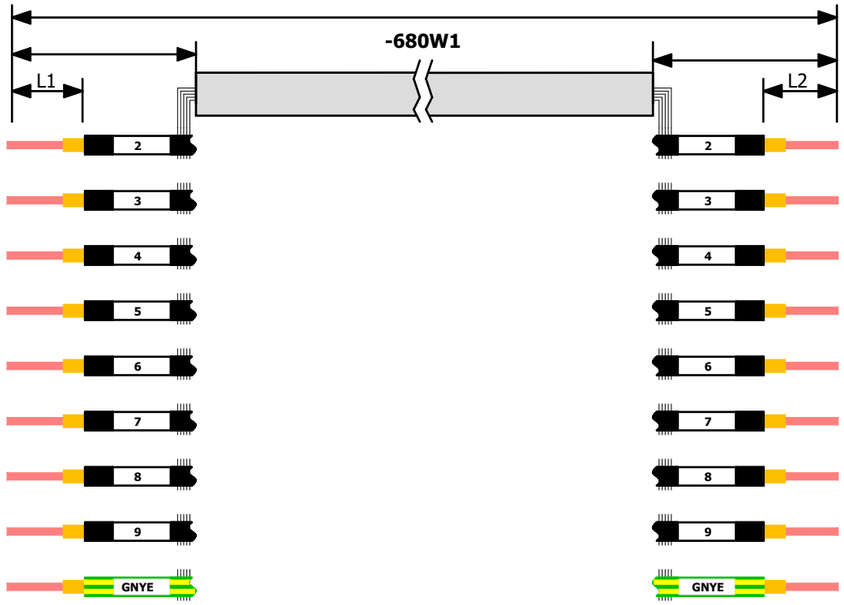
previous page: 8
next page: ++ASC/1

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

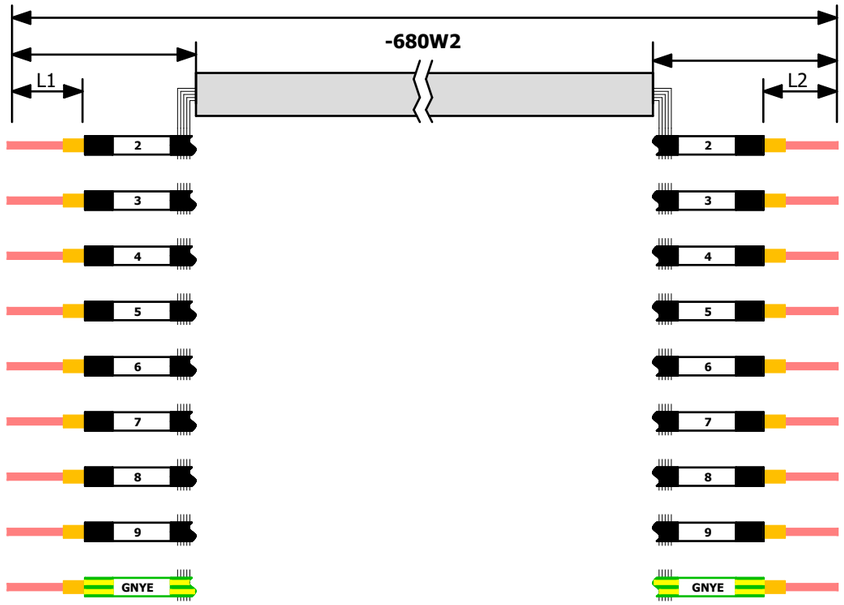


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_02++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		



L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

previous page:
++Container/9

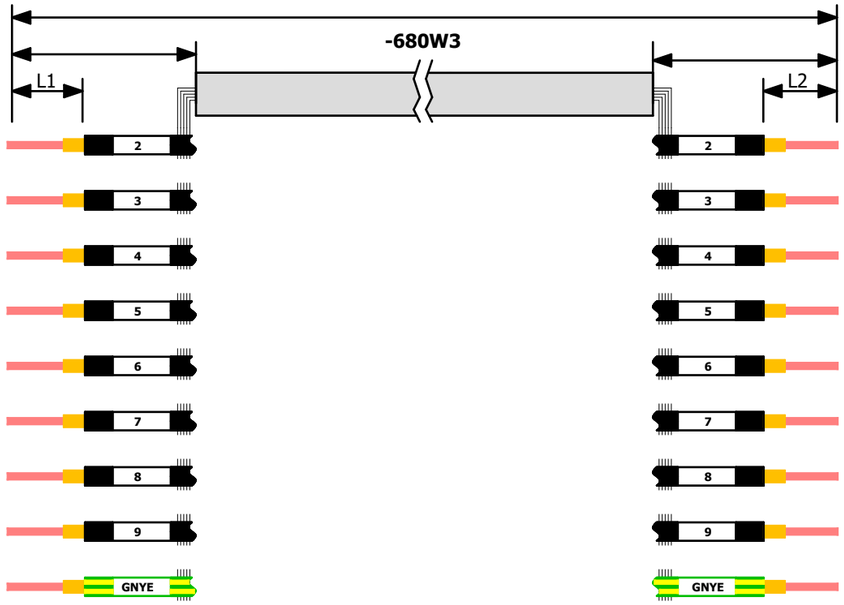
next page:
2

FRQ_Kabelplan_04_groß_de_en

0	1	2	3	4	5	6	7	8	9

Cable name =UNIT_02++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 0

Cable parts
Order number

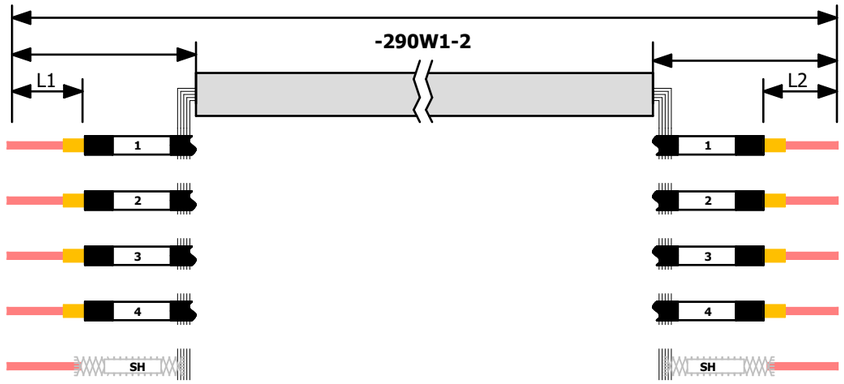


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_02++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

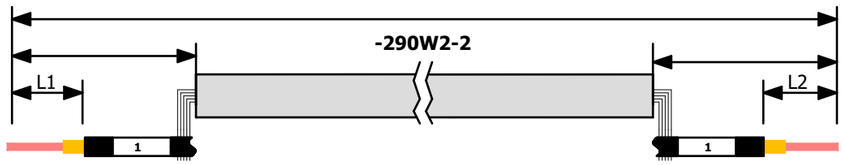


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

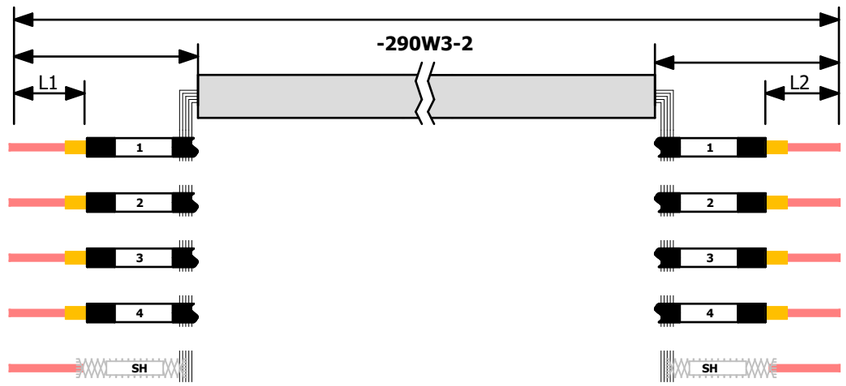


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

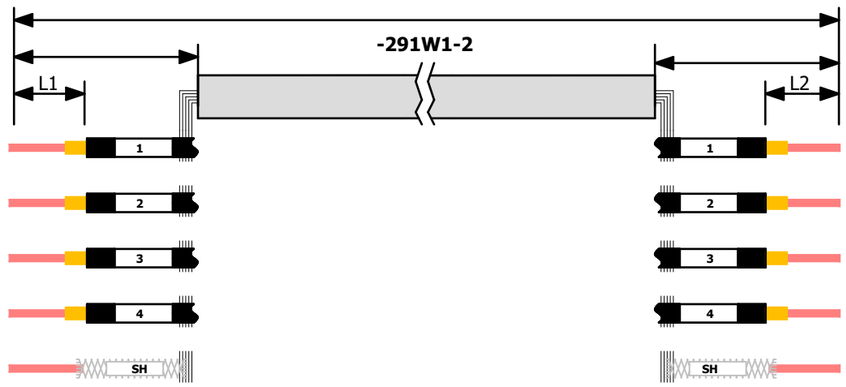


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



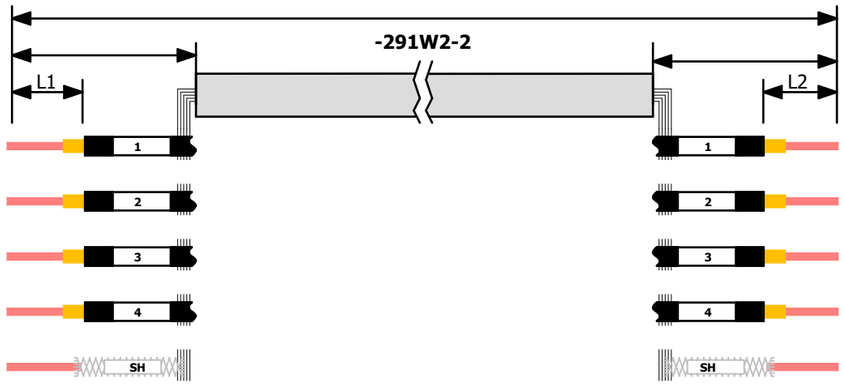
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

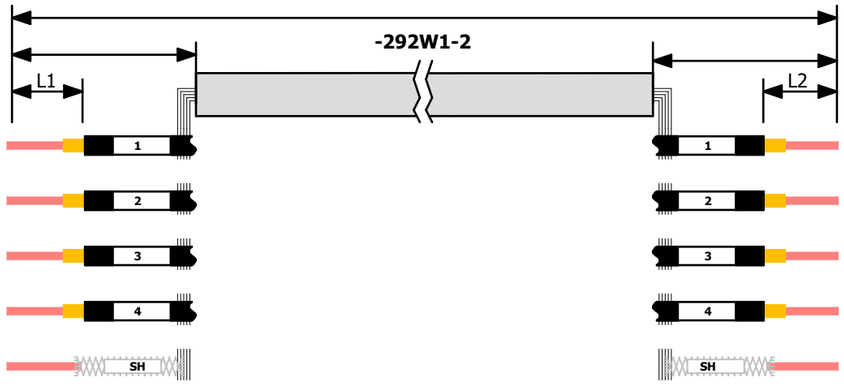


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

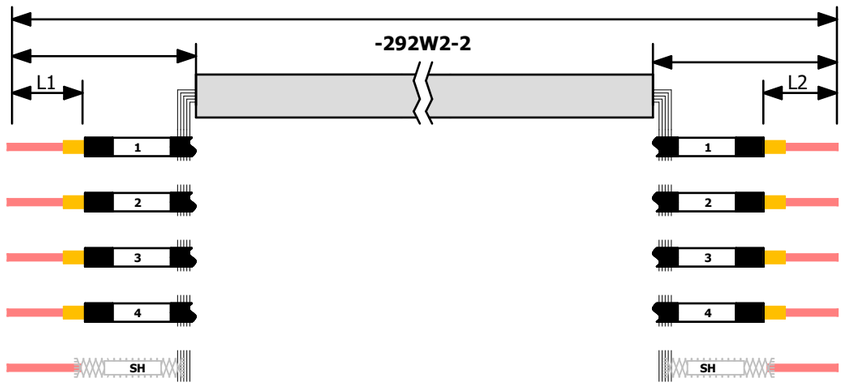


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

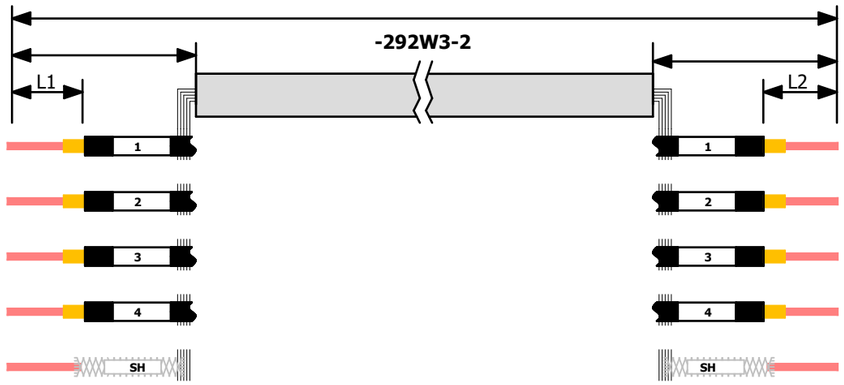
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

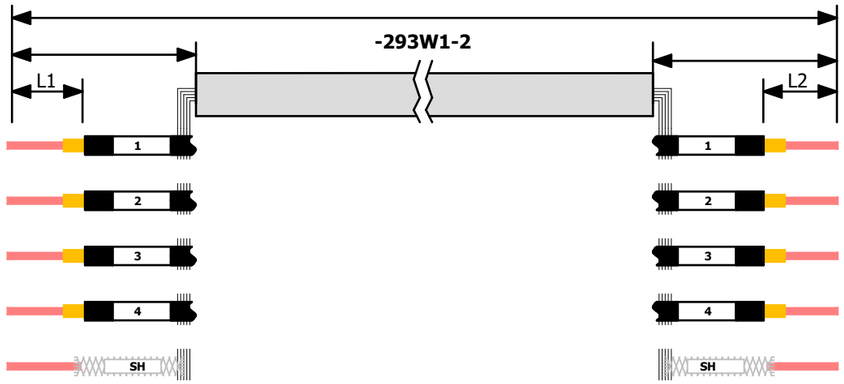


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

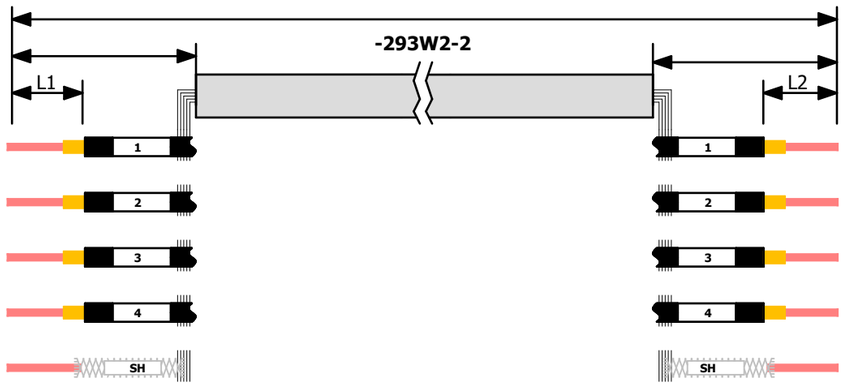


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

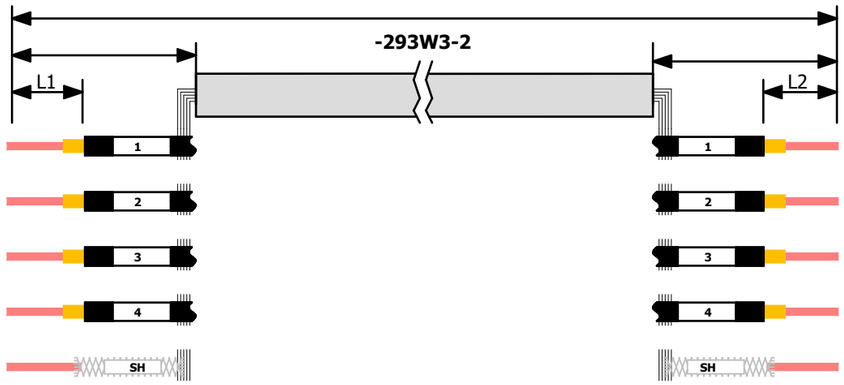
previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

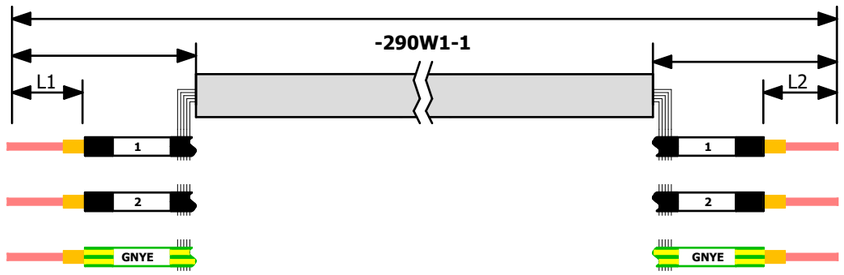


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

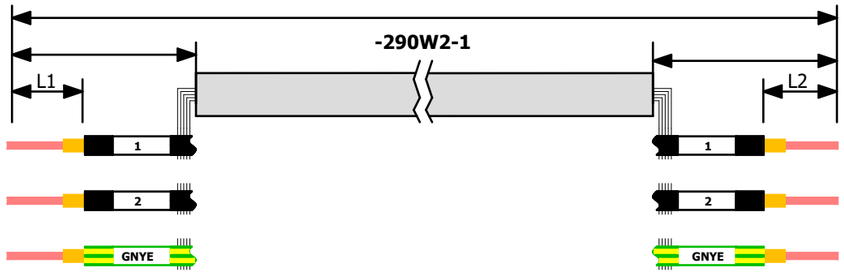


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

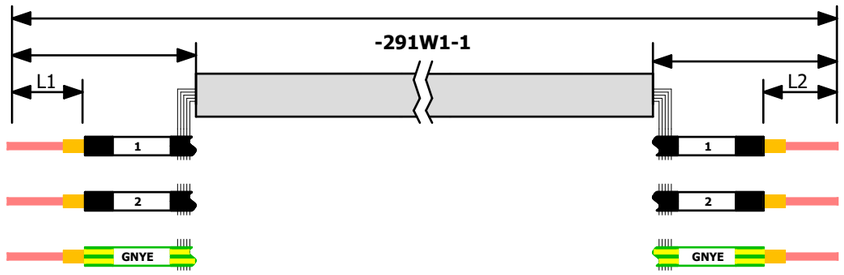


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

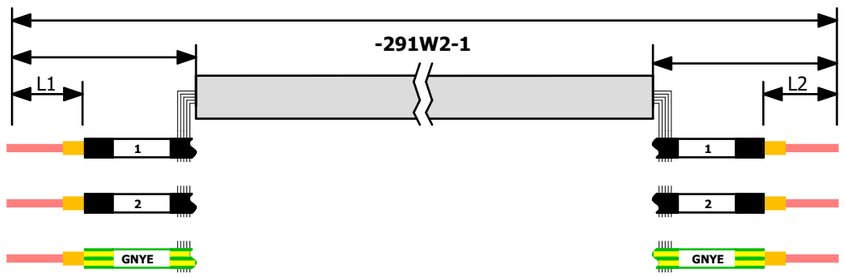


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

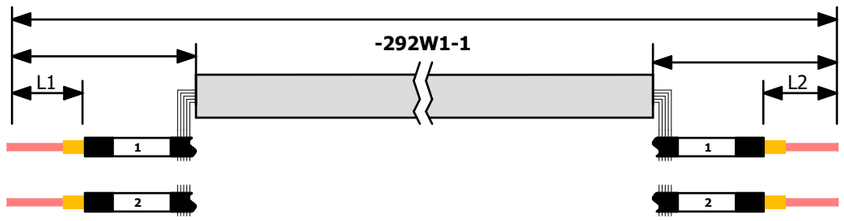


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

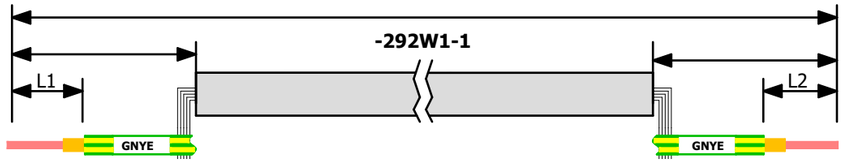
previous page: 6

next page: 8

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

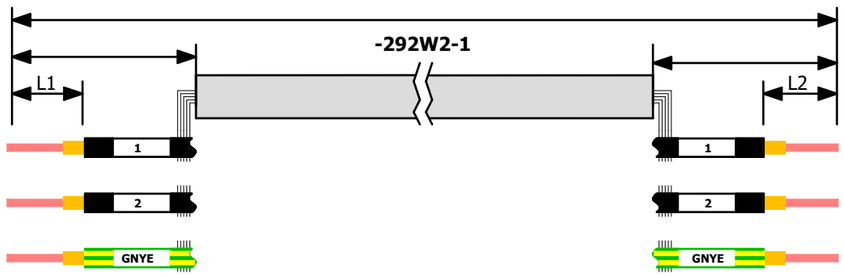


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

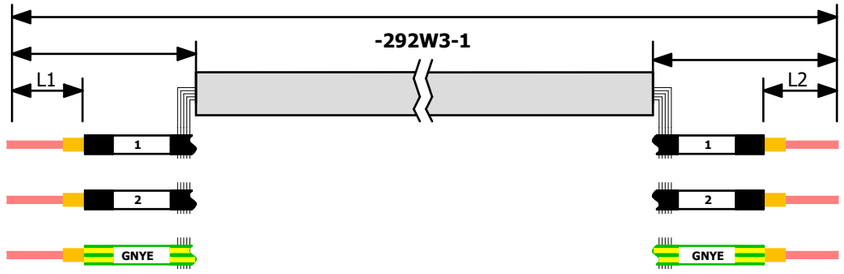


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

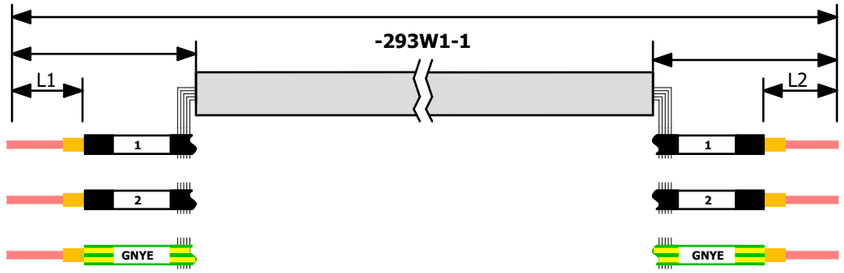


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_02++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

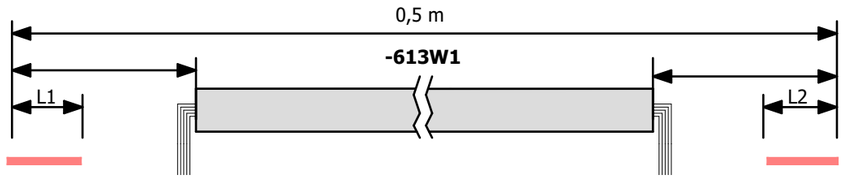


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

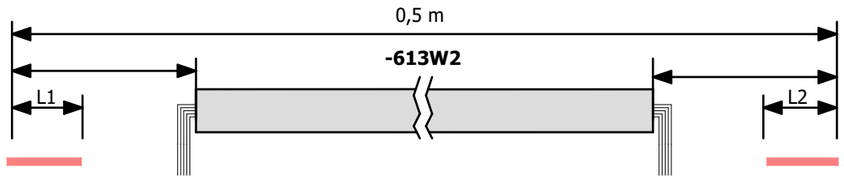


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_02++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			



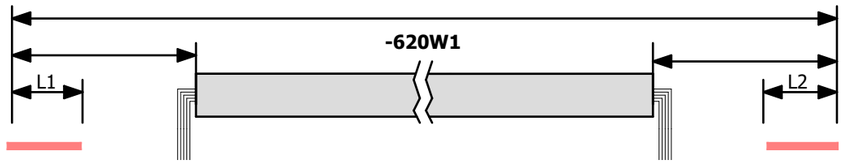
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

previous page: 8
next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_02++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_02++ASC+-620W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

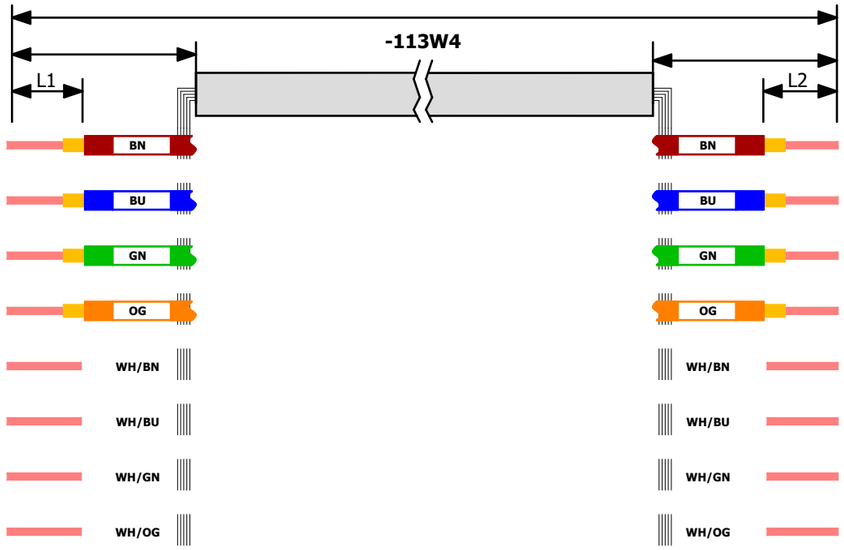
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U4:8							-620A1:-X1:P2	

Cable name =UNIT_02++ASC+-113W4
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U2:3							-613U2:3	

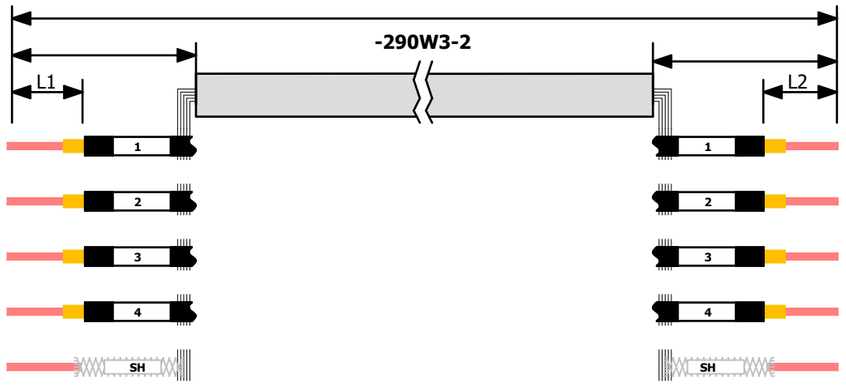
Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_02	Battery Container 1
Date	21.01.2025							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 10
total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

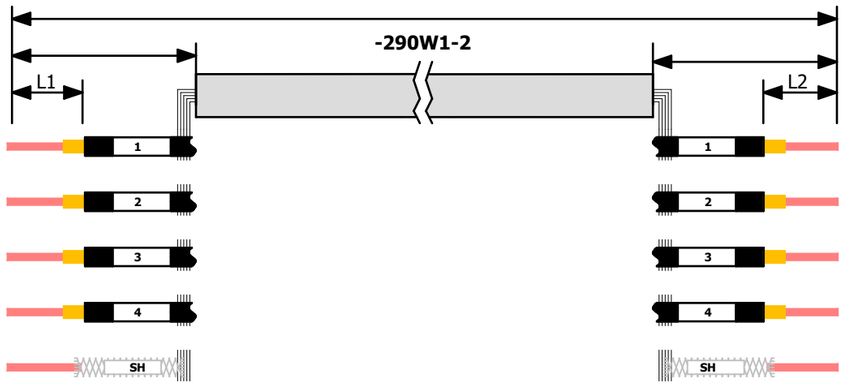


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

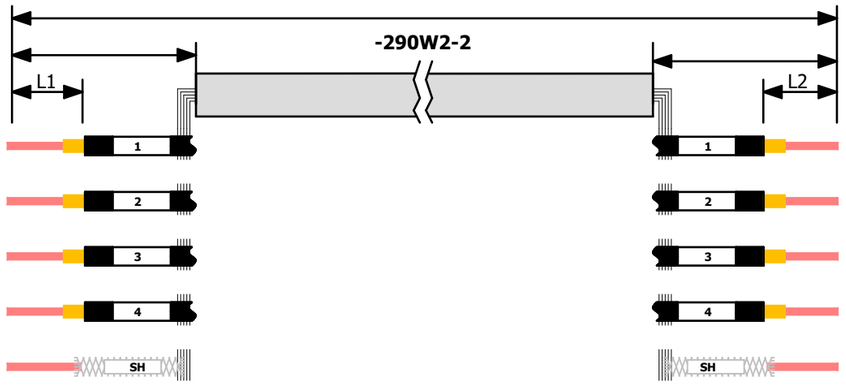


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03++Container+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

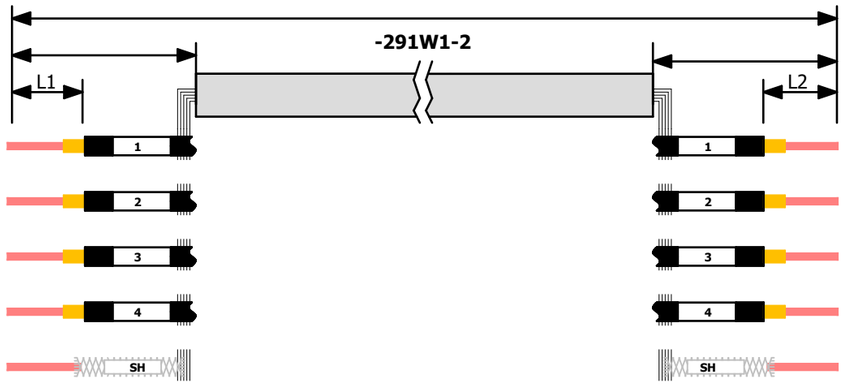
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

previous page: &EPA++ASC/2
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

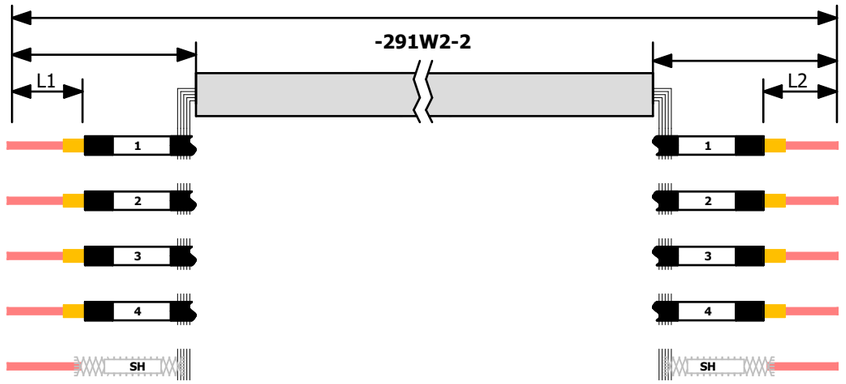


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

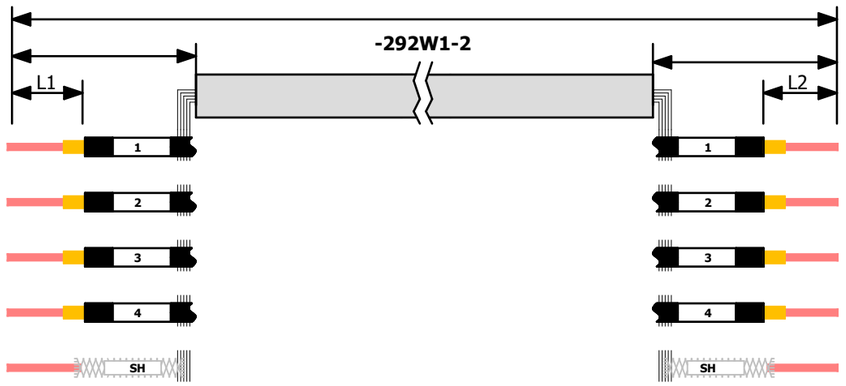


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

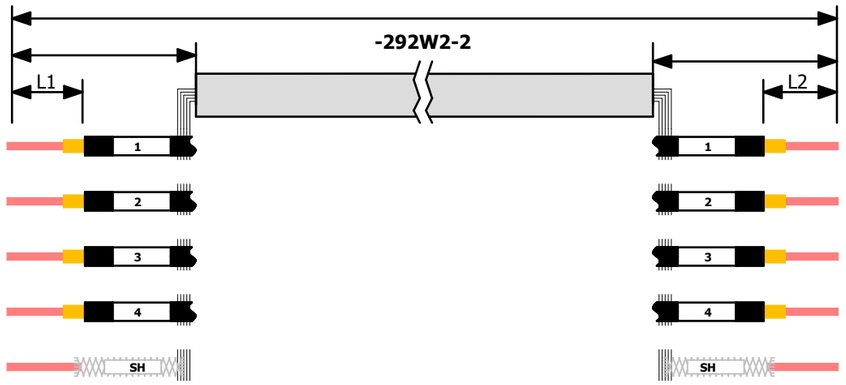
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

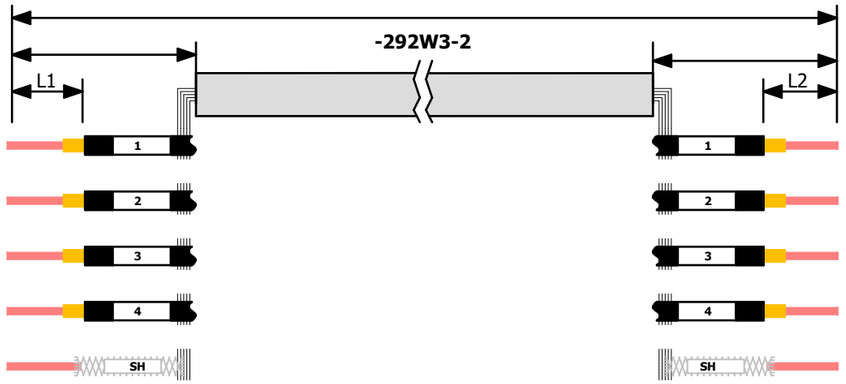


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

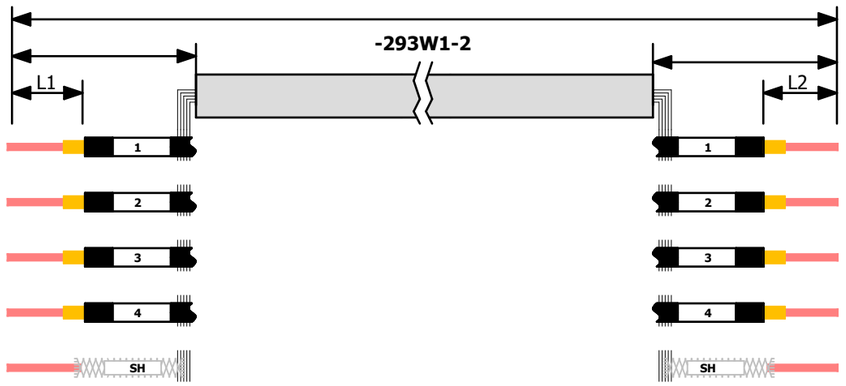


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

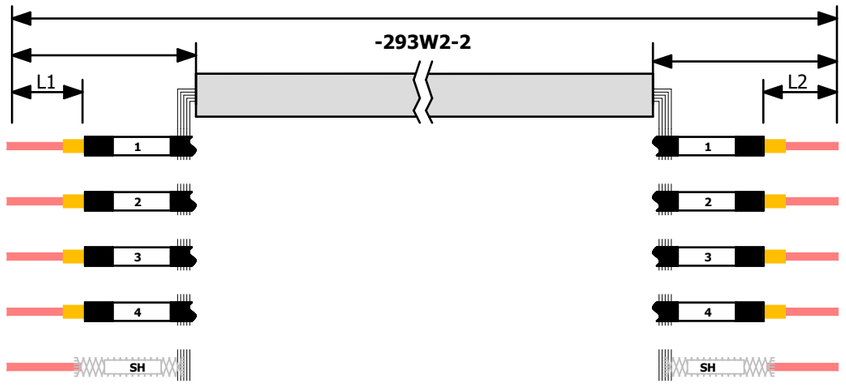
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

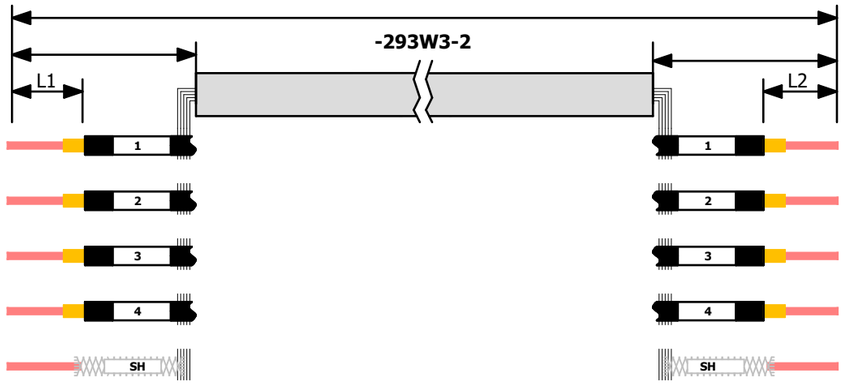


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03++Container+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03++Container+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

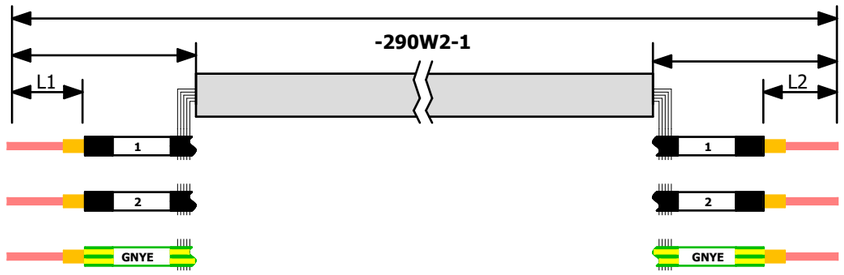
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:1	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_03 Battery Container 2	
Date	05.11.2024							& EMB Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 4
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:2	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

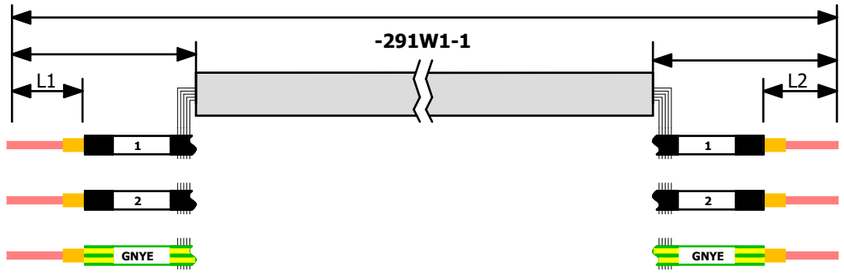


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:3	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

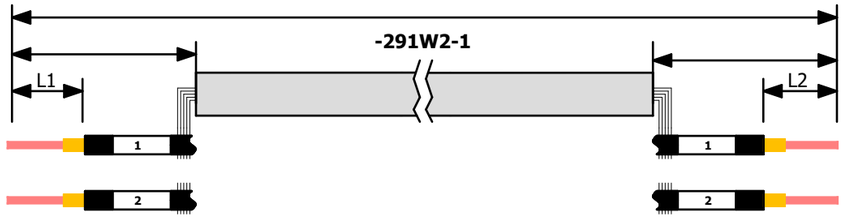


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:4	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			

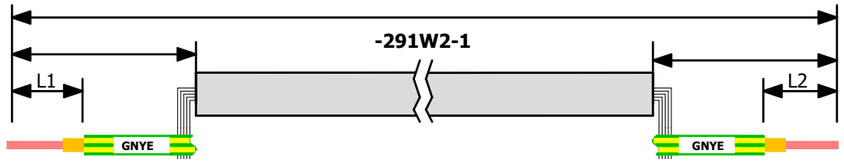
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

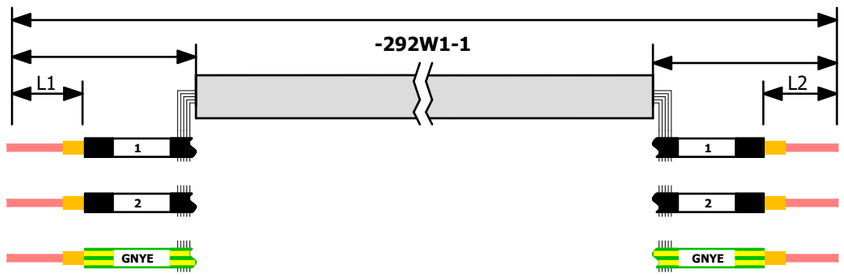


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

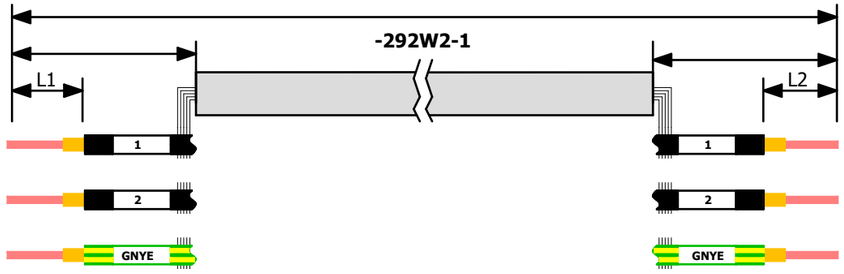


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

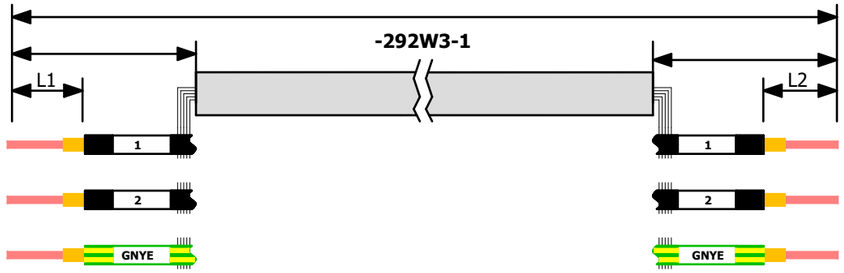


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

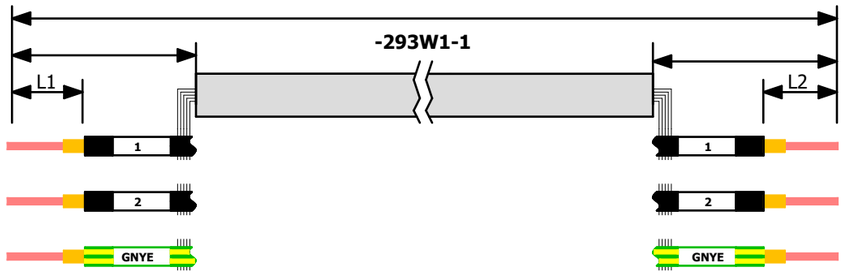
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:8	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++Container+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:9	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

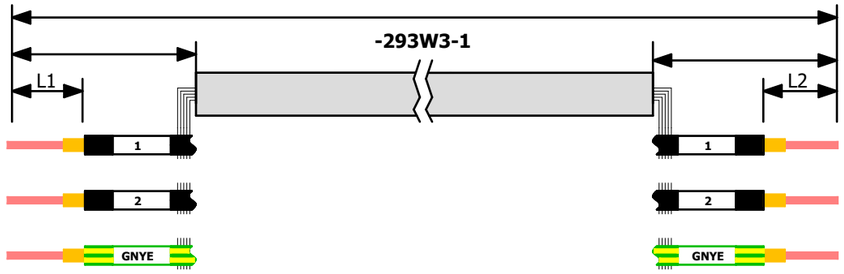


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:10	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

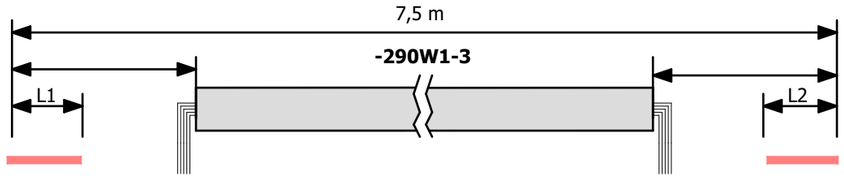


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:11	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03++Container+-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

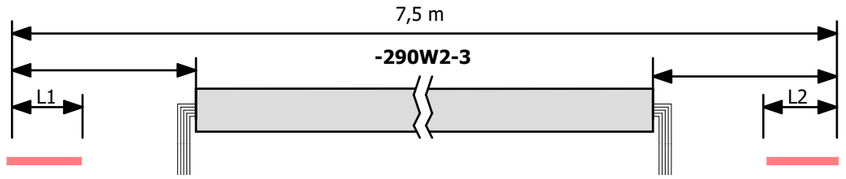


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Cable name =UNIT_03++Container+-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

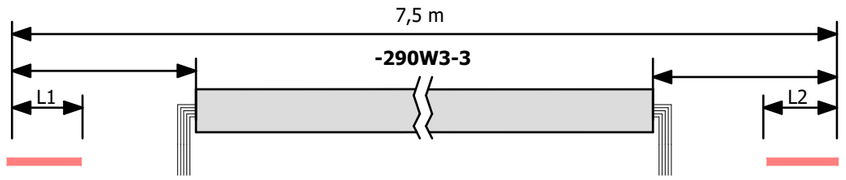
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

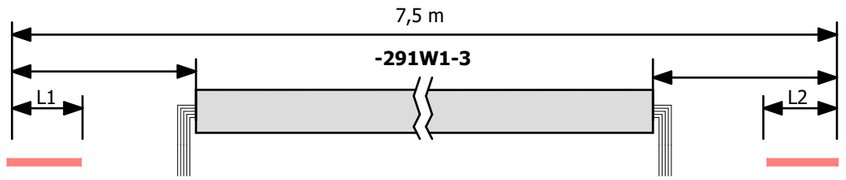
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X3:1-16	

Cable name =UNIT_03++Container+-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

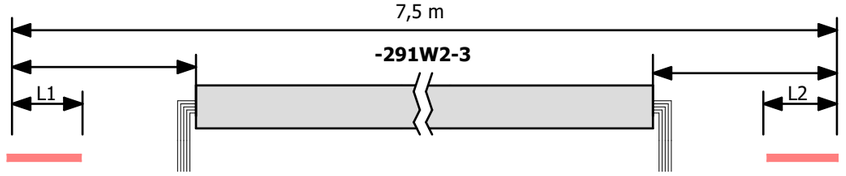
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X4:1-16	

Cable name =UNIT_03++Container+-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

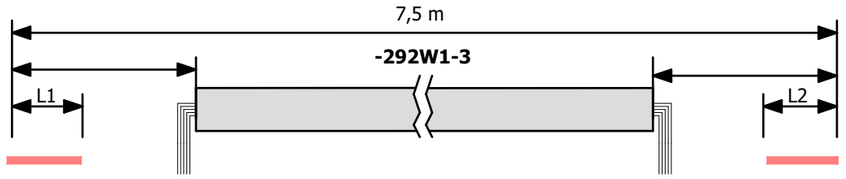
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X5:1-16	

Cable name =UNIT_03++Container+-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



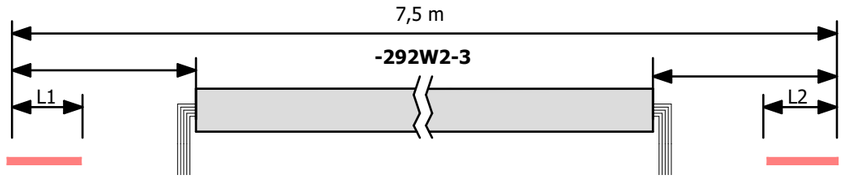
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X6:1-16	

previous page: 7
next page: 9

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++Container+-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

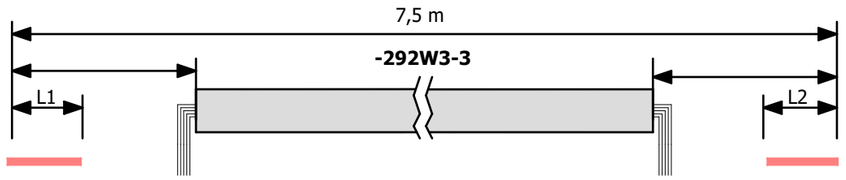


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X7:1-16	

Cable name =UNIT_03++Container+-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

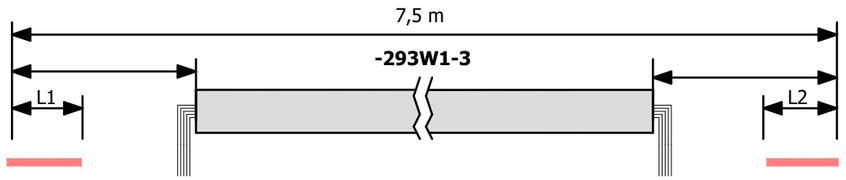


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X8:1-16	

Cable name =UNIT_03++Container+-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

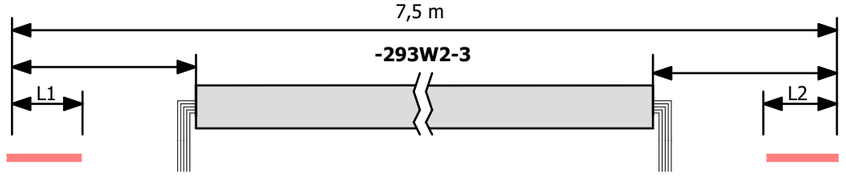


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X9:1-16	

Cable name =UNIT_03++Container+-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

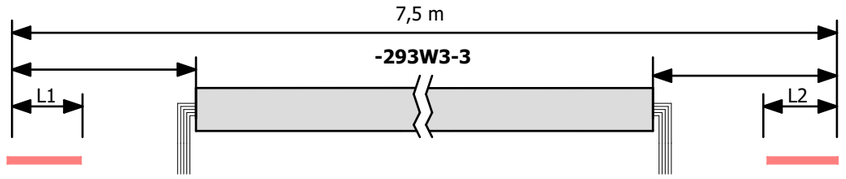


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_03++Container+-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

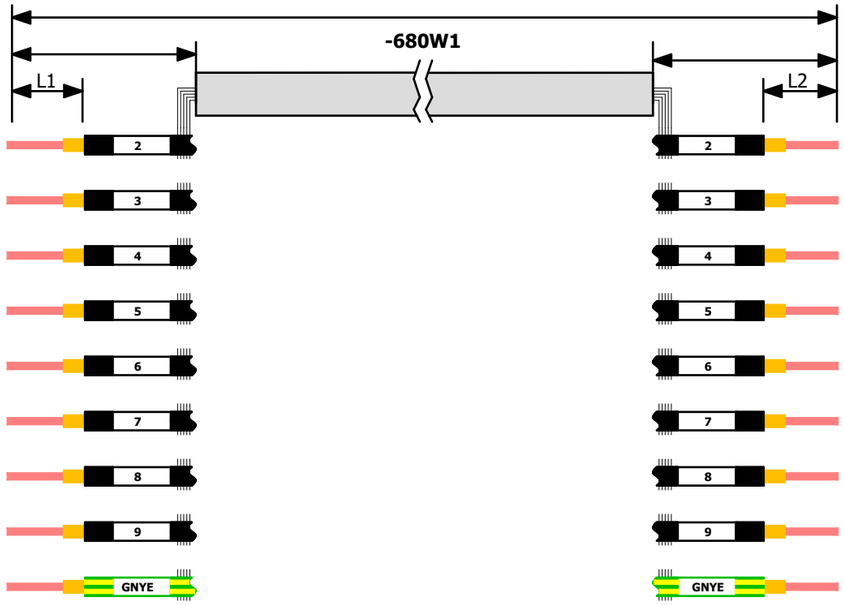
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_03	Battery Container 2
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 9
Date								+	total: 492

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-680W1
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number

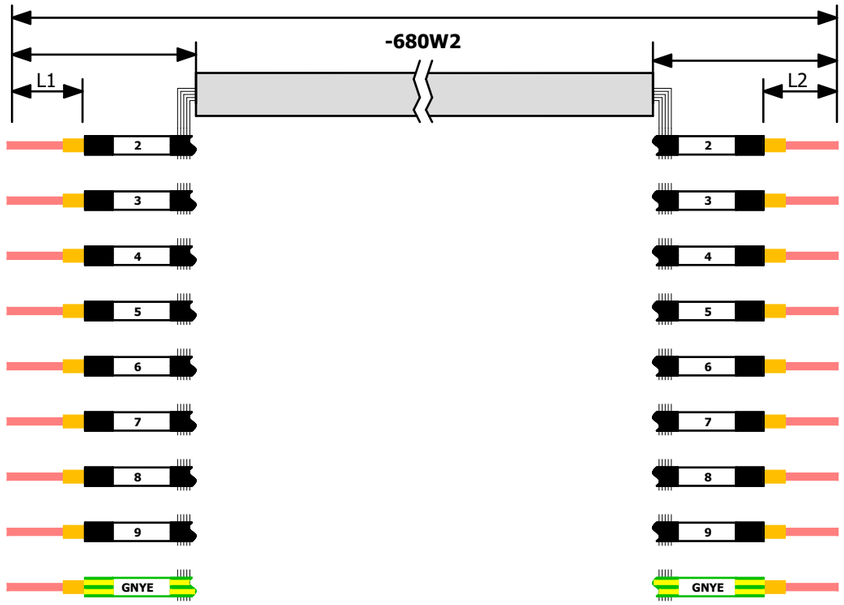


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.1:2	gas concentration BAT 1-4		
	-X5.1:3	=		
	-X5.1:5	=		
	-X5.1:6	=		
	-X5.1:7	=		
	-X5.1:8	=		
	-X5.1:9	=		
	-X5.1:10	=		
	-X5.1:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U1-X1:2	
		=	++Container-680U1-X1:4	
		=	++Container-680U1-X2:1	
		=	++Container-680U1-X2:2	
		=	++Container-680U1-X2:4	
		=	++Container-680U1-X2:5	
		=	++Container-680U1-X2:7	
		=	++Container-680U1-X2:8	
		=	++Container-680U1-X1:5	

Cable name =UNIT_03++ASC+-680W2
Cable type F-CY-JZ 10G0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.2:2	gas concentration BAT 5-8		
	-X5.2:3	=		
	-X5.2:5	=		
	-X5.2:6	=		
	-X5.2:7	=		
	-X5.2:8	=		
	-X5.2:9	=		
	-X5.2:10	=		
	-X5.2:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U2-X1:2	
		=	++Container-680U2-X1:4	
		=	++Container-680U2-X2:1	
		=	++Container-680U2-X2:2	
		=	++Container-680U2-X2:4	
		=	++Container-680U2-X2:5	
		=	++Container-680U2-X2:7	
		=	++Container-680U2-X2:8	
		=	++Container-680U2-X1:5	

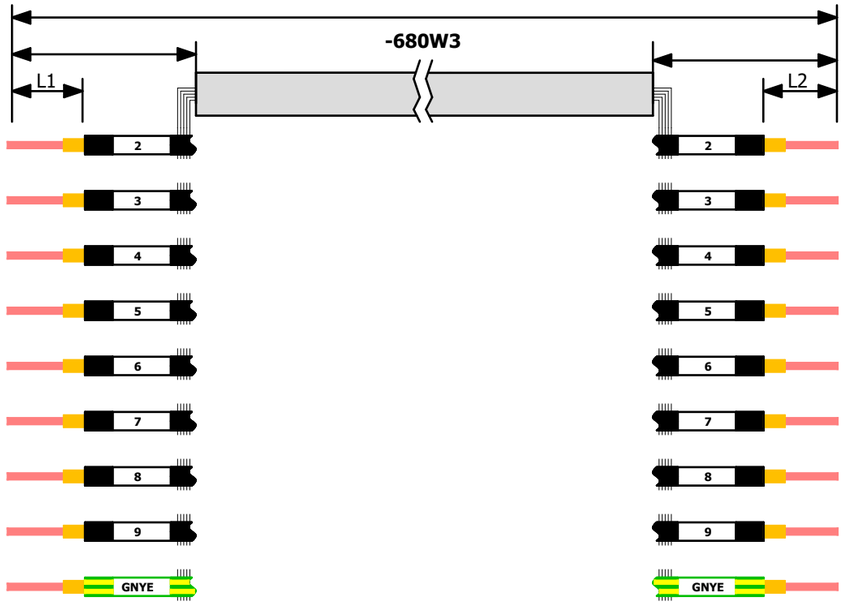
previous page: ++Container/9
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-680W3
Cable type F-CY-JZ 10G0,75 mm²
Free conductors 9

Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-X5.3:2	gas concentration BAT 9-11		
	-X5.3:3	=		
	-X5.3:5	=		
	-X5.3:6	=		
	-X5.3:7	=		
	-X5.3:8	=		
	-X5.3:9	=		
	-X5.3:10	=		
	-X5.3:PE	=		

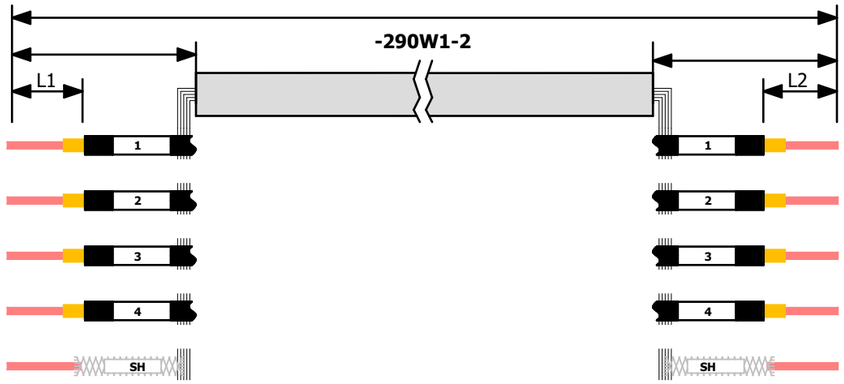


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		gas concentration	++Container-680U3-X1:2	
		=	++Container-680U3-X1:4	
		=	++Container-680U3-X2:1	
		=	++Container-680U3-X2:2	
		=	++Container-680U3-X2:4	
		=	++Container-680U3-X2:5	
		=	++Container-680U3-X2:7	
		=	++Container-680U3-X2:8	
		=	++Container-680U3-X1:5	

Cable name =UNIT_03++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

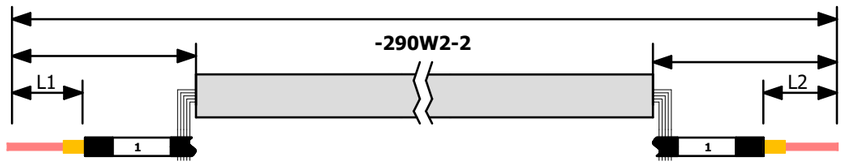


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

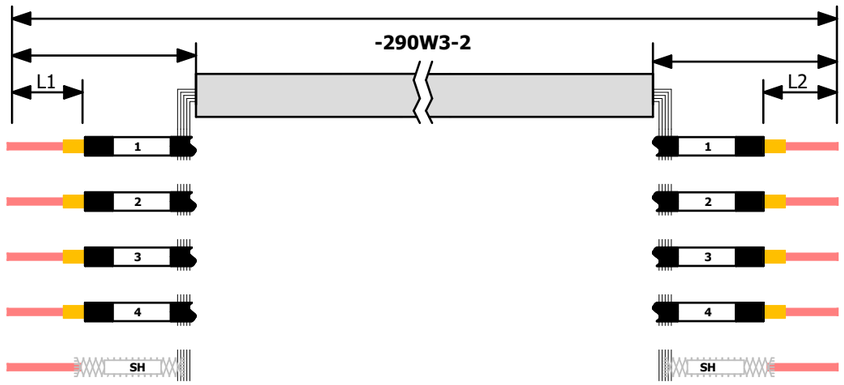


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

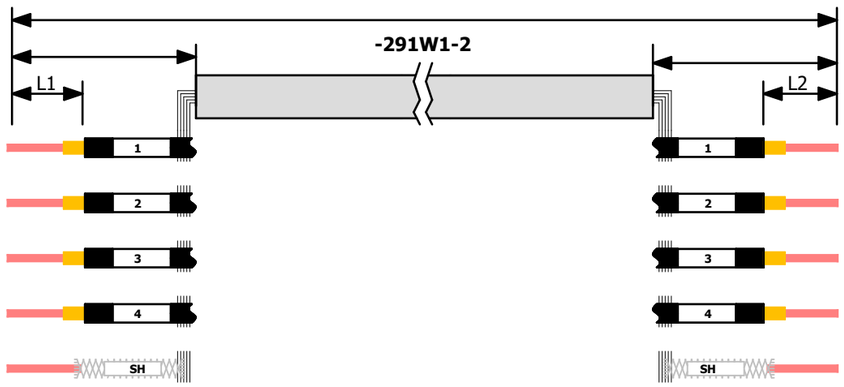


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

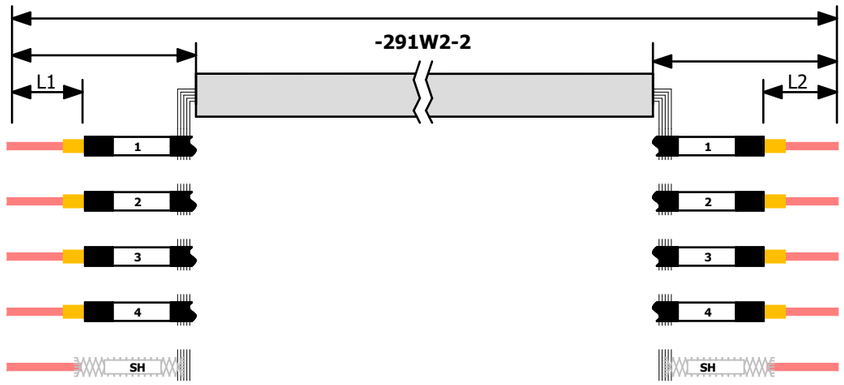
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

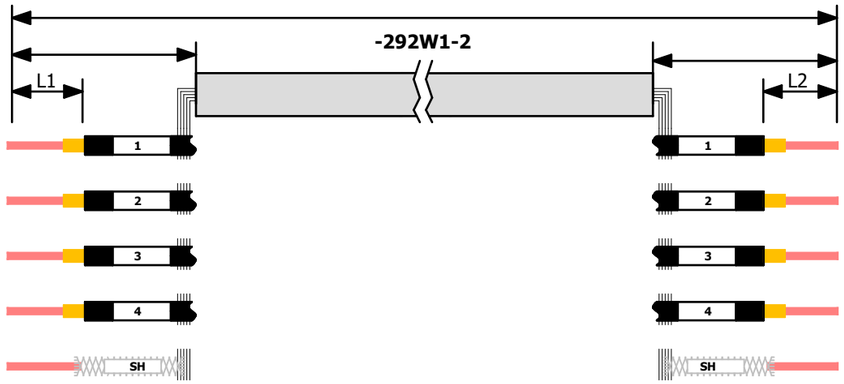


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

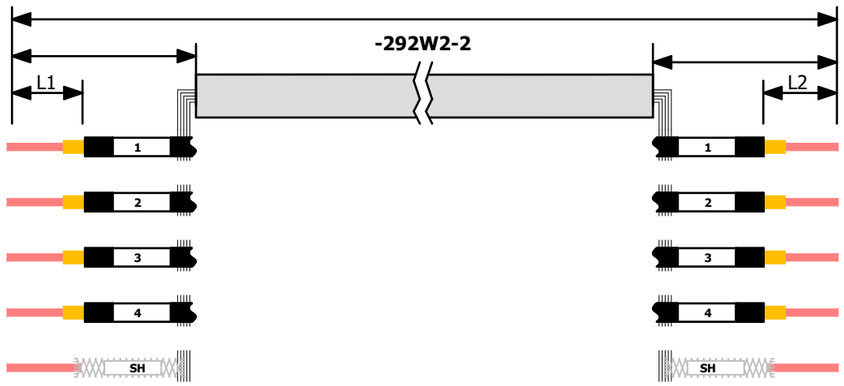


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

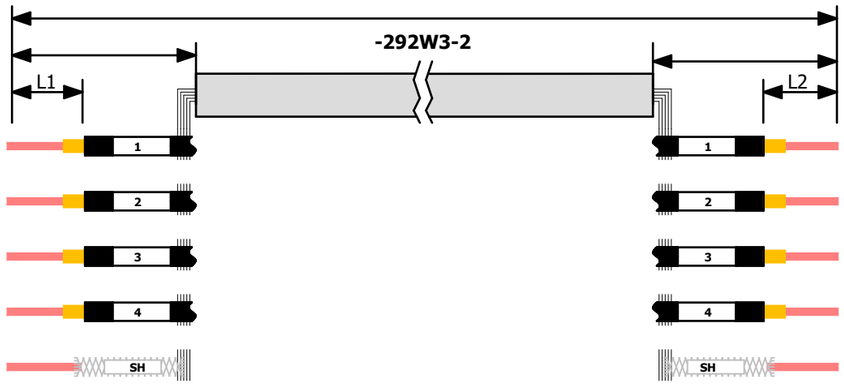
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

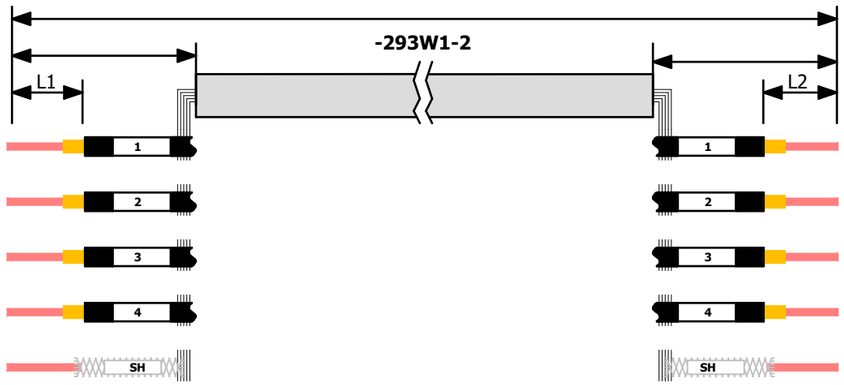


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

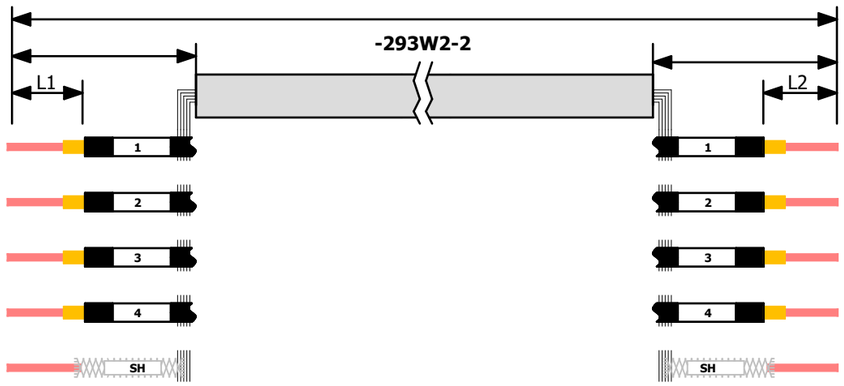


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

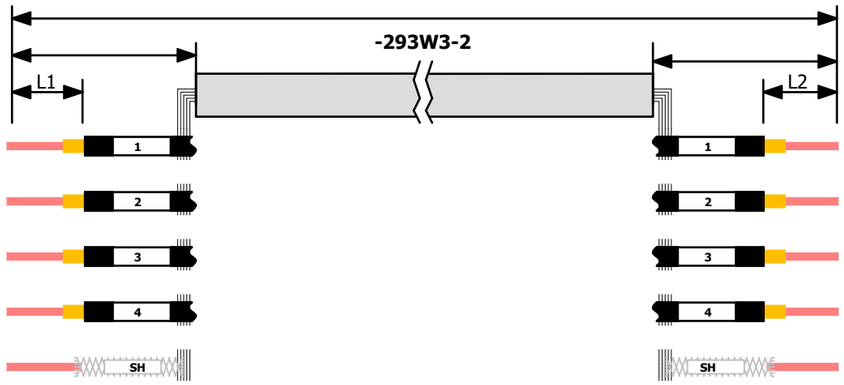
previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

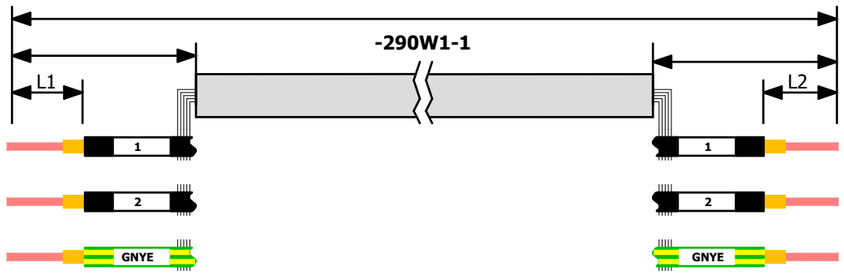


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

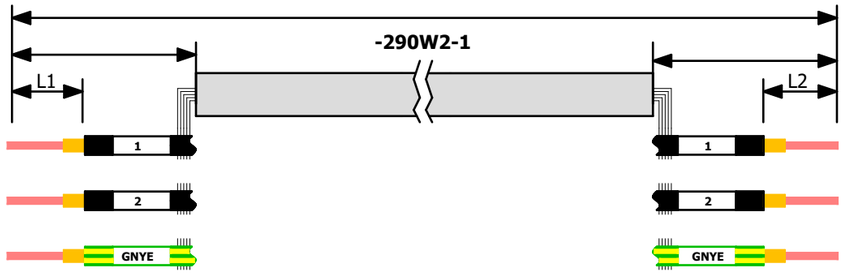


L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

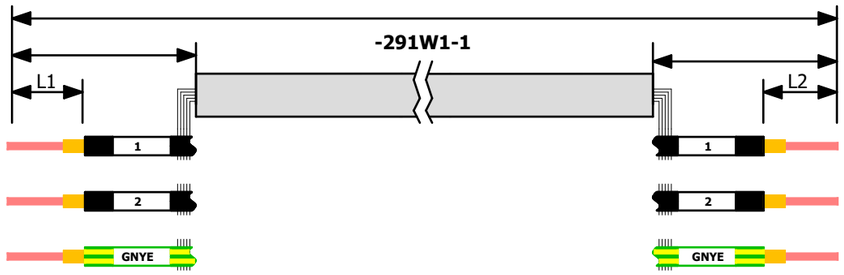


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

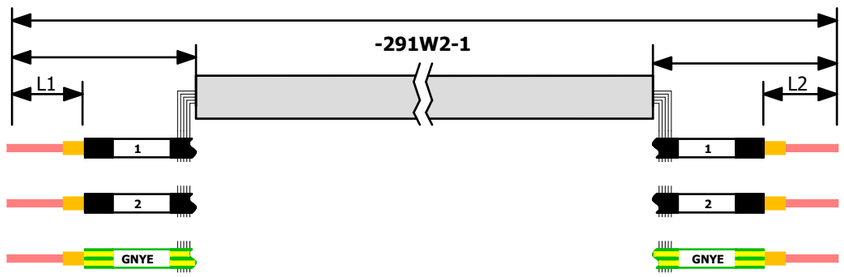


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091

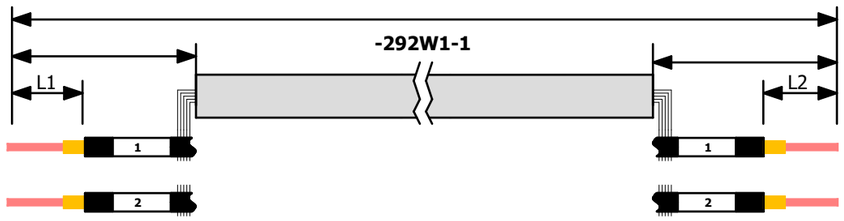


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

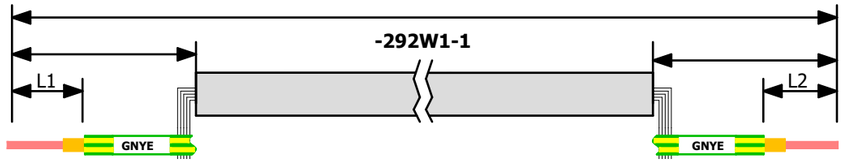
previous page: 6

next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

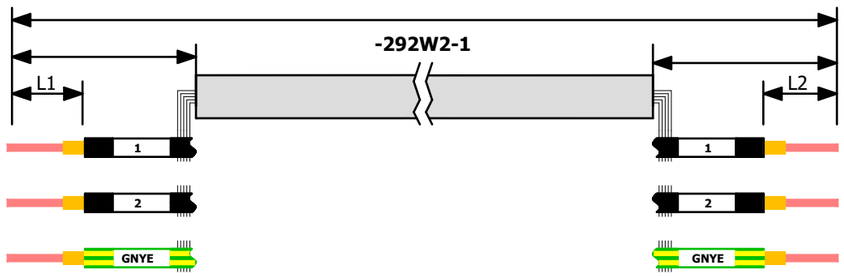


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

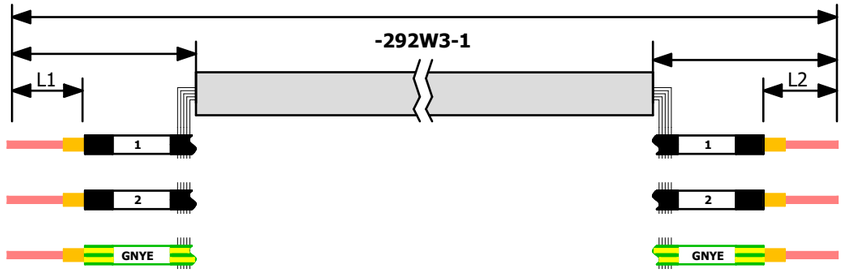


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091

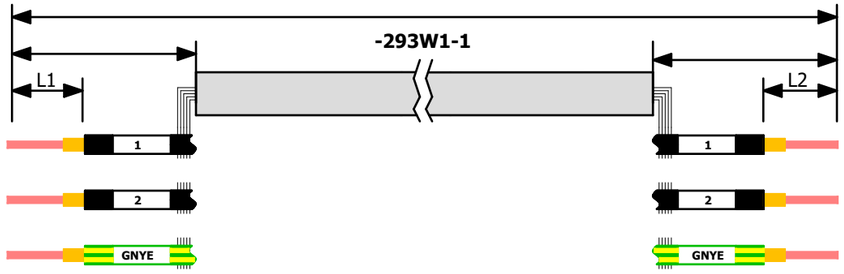


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 2

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_03++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

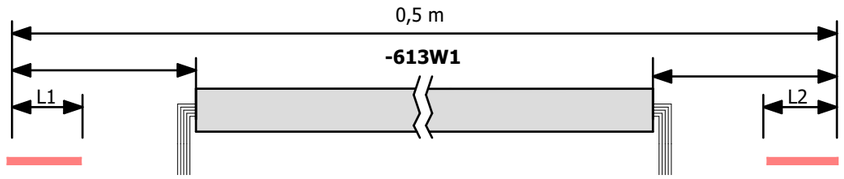


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

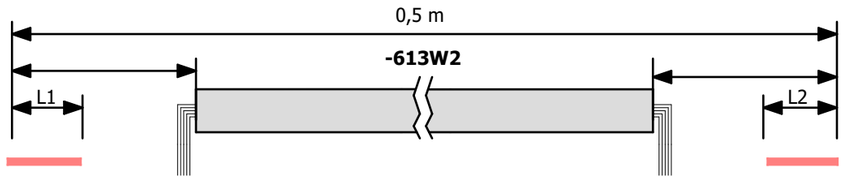


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

Cable name =UNIT_03++ASC+-613W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613U1:IN			

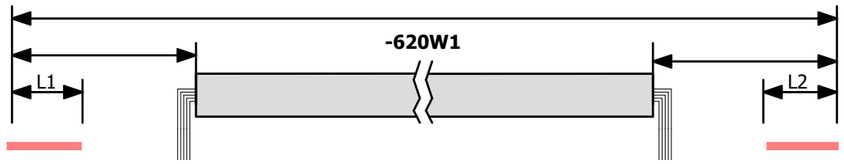
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U2:8	

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_03	Battery Container 2	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 9
Date								+		total: 492

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_03++ASC+-620W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

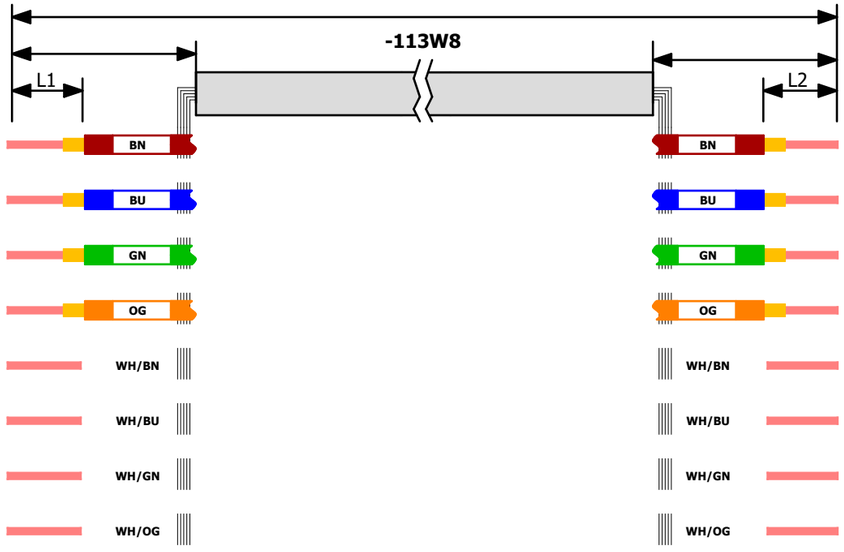
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-613U3:8							-620A1:-X1:P1	

Cable name =UNIT_03++ASC+-113W8
Cable type S/FTP 4x2xAWG 23/1 PVC/PVC 4x2x23 AWG
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:8							-613U2:8	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:4							-613U2:4	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:2							-613U2:2	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:6							-613U2:6	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:7							-613U2:7	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:5							-613U2:5	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:1							-613U2:1	
Control cabinet 1	=UNIT_01++CT+CTRL_1.3-113U4:3							-613U2:3	

previous page: 9

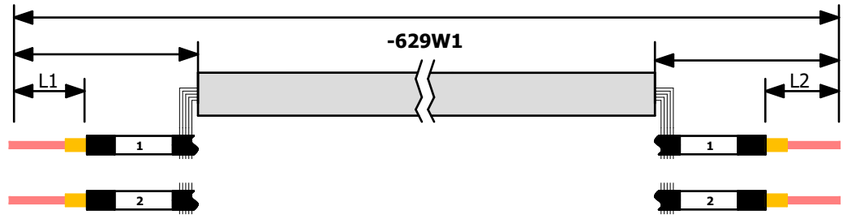
next page: &EMZ/1000

FRQ_Kabelplan_04_groß_de_en

0	1	2	3	4	5	6	7	8	9

Cable name =UNIT_01++TRA+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:29	Fuse 230V AC for Container Air Conditioning		
Control cabinet 1	++CT+CTRL_1.3-X3:18	Earthing switch in On Transformer 620V side		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Fuse 230V AC for Container Air Conditioning	++CONV-18Q1:13	
		Earthing switch in On Transformer 620V side	++CONV-18Q1:14	

FRQ_Kabelplan_04_groß_de_en

previous page:
&EPA++CT/2

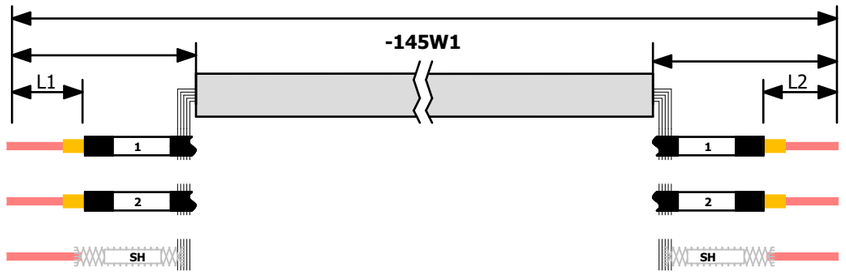
next page:
++CONV/1

Editor	Freqcon_DG			Statron		CABEL LIST	20250123_V1.3	= UNIT_01	Converter Container 1
Date	05.11.2024							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA	medium voltage transformer
Date								+	

page: 1
total: 492

Cable name =UNIT_01++CONV+-145W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

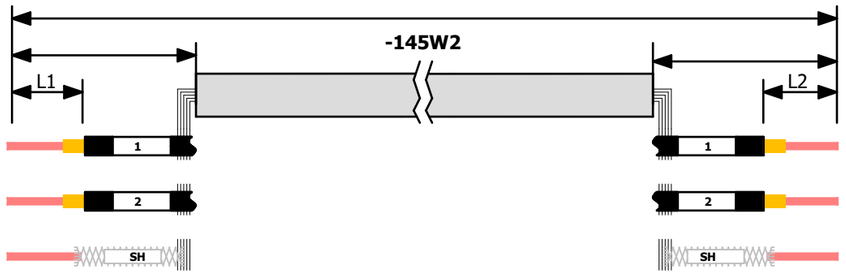


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-201L1:	INDUCTOR GRID PHASE L1 TEMPERATURE 1_1		
Inductor cabinet	+IND-201L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L1	++CT+CTRL_1.3-X5:1	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:2	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

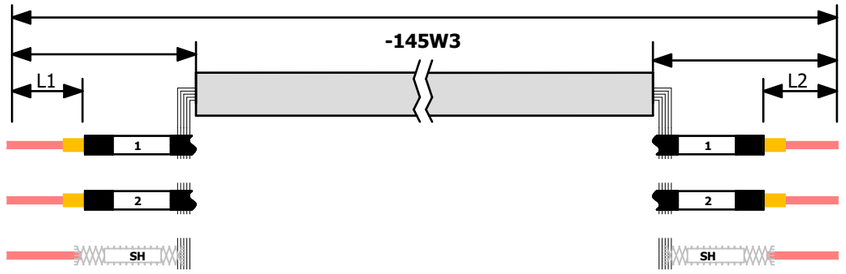


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-202L1:	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2		
Inductor cabinet	+IND-202L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L2	++CT+CTRL_1.3-X5:3	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:4	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

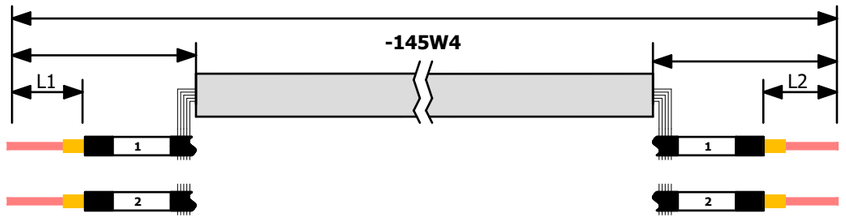


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-203L1:	INDUCTOR GRID PHASE L3 TEMPERATURE 1_3		
Inductor cabinet	+IND-203L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L3	++CT+CTRL_1.3-X5:5	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:6	*Control cabinet 1*
		=		

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.1:	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		
Inductor cabinet	+IND-211L1.1	=		

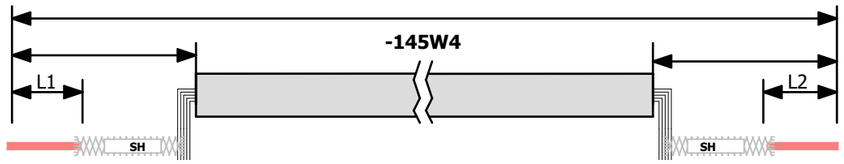
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1	++CT+CTRL_1.3-X5:7	*Control cabinet 1*
		=	++CT+CTRL_1.3-X5:8	*Control cabinet 1*

previous page: ++TRA/1
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

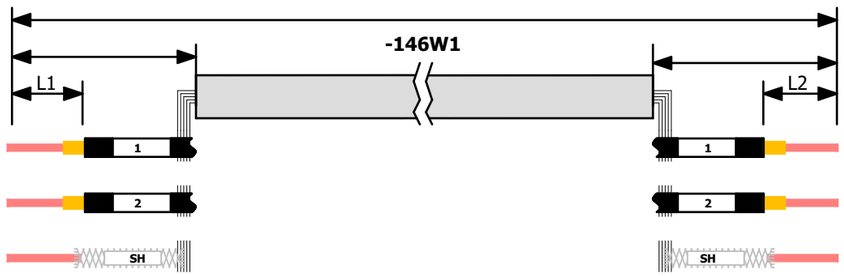


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1		

Cable name =UNIT_01++CONV+-146W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

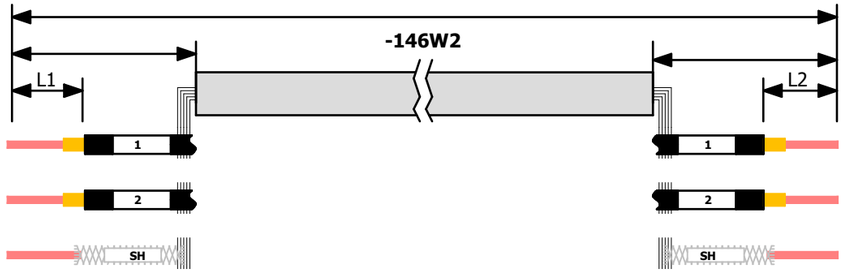


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.2	INDUCTOR DC SUB 2_2 TEMPERATURE 2_2		
Inductor cabinet	+IND-211L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_2	++CT+CTRL_1.3-X5:9	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:10	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3		
Inductor cabinet	+IND-211L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_3	++CT+CTRL_1.3-X5:11	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:12	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-146W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.1	INDUCTOR DC SUB 3_1 TEMPERATURE 3_1		
Inductor cabinet	+IND-207L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_1	++CT+CTRL_1.3-X5:13	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:14	***Control cabinet 1***
		=		

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-146W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

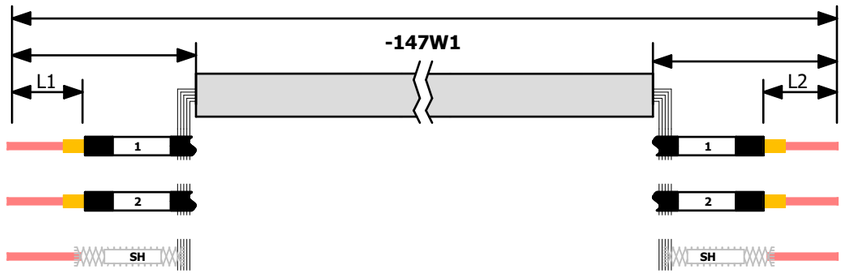


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.2	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2		
Inductor cabinet	+IND-207L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_2	++CT+CTRL_1.3-X5:15	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:16	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-147W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

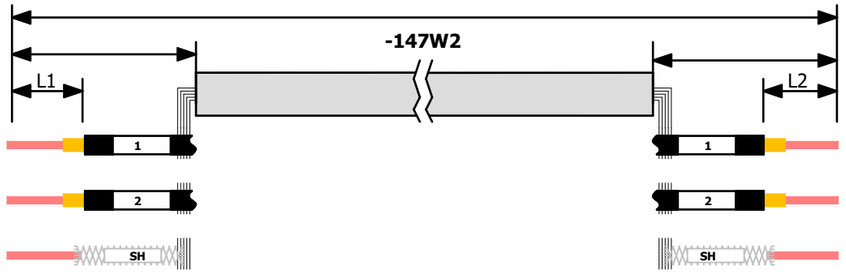


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.3:	INDUCTOR DC SUB 3_3 TEMPERATURE 3_3		
Inductor cabinet	+IND-207L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_3	++CT+CTRL_1.3-X5:17	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:18	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-147W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

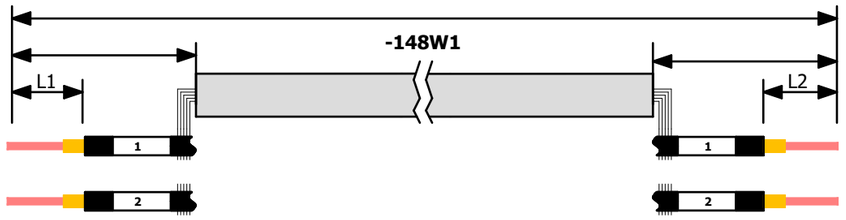


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.1:	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1		
Inductor cabinet	+IND-217L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_1	++CT+CTRL_1.3-X5:19	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:20	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.2:	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		
Inductor cabinet	+IND-217L1.2	=		

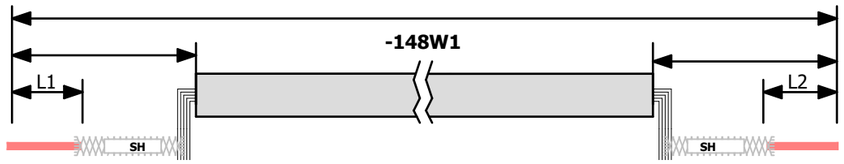
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2	++CT+CTRL_1.3-X5:25	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:26	***Control cabinet 1***

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

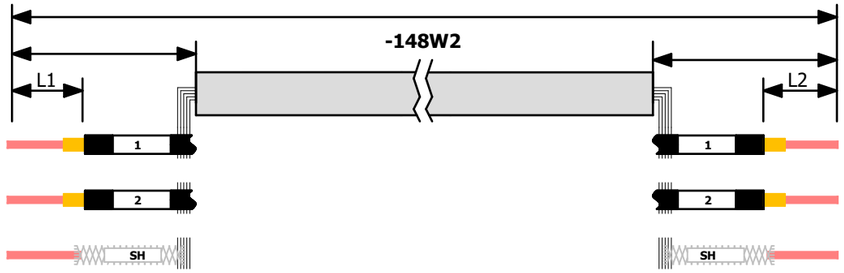


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2		

Cable name =UNIT_01++CONV+-148W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

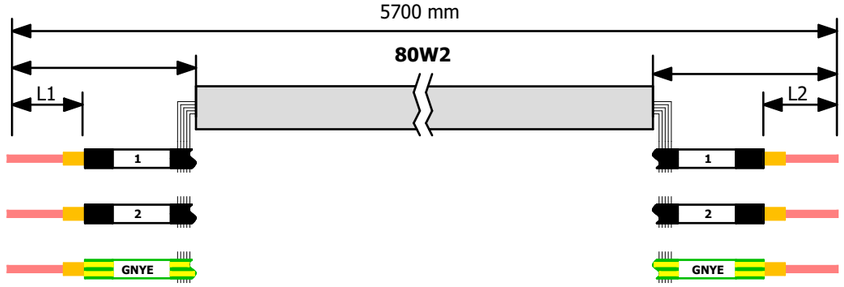


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.3:	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3		
Inductor cabinet	+IND-217L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_3	++CT+CTRL_1.3-X5:29	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:30	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-80W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

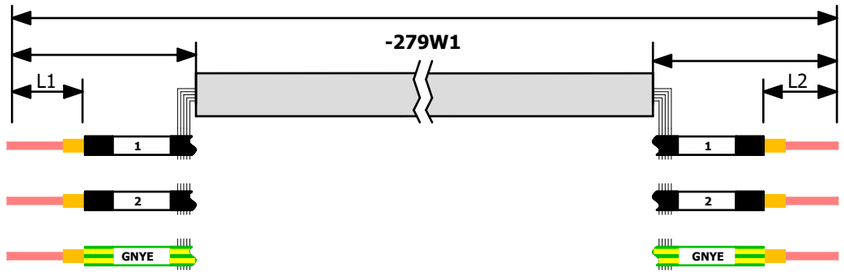


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:9	230V AC for Circuit Breaker 1	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:10	=	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	230V AC for Circuit Breaker 1	+CIR-80Q1:X5_2	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-80Q1:X5_1	***Circuit Breaker cabinet***
		=		

Cable name =UNIT_01++CONV+-279W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:1	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:2	=	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CON-279M1:L	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:N	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:PE	***Converter cabinet***

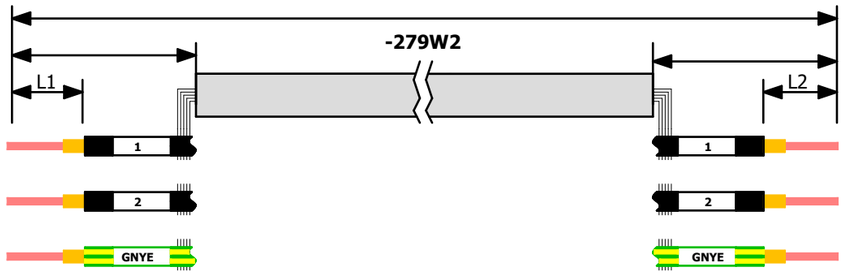
previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M1:L	FAN 1 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M1:N	=	stripped	8 mm
Converter cabinet	+CON-279M1:PE	=	stripped	8 mm

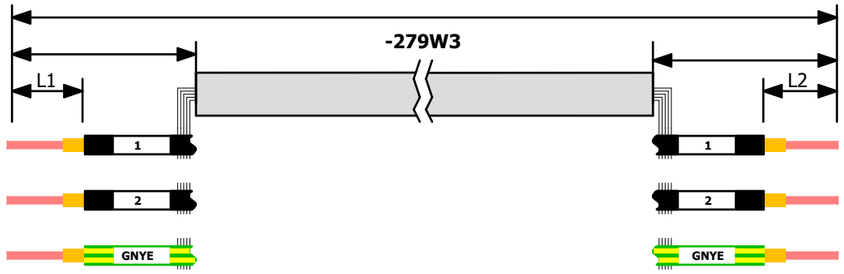


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CONVERTER	+CON-279M2:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M2:1	FAN 2 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M2:2	=	stripped	8 mm
Converter cabinet	+CON-279M2:PE	=	stripped	8 mm

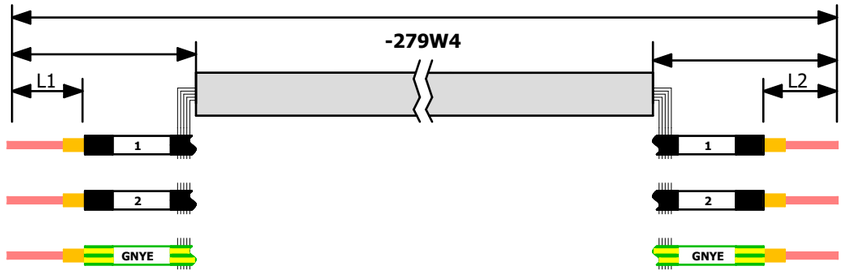


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CONVERTER	+CON-279M3:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W4
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M3:1	FAN 3 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M3:2	=	stripped	8 mm
Converter cabinet	+CON-279M3:PE	=	stripped	8 mm

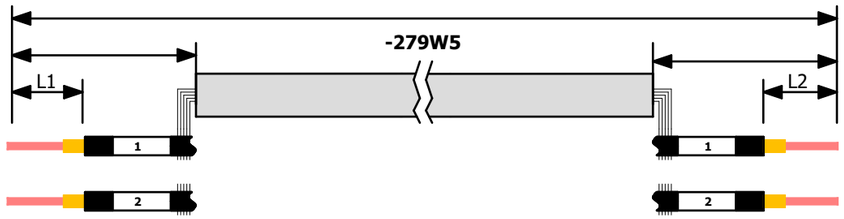


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 3 CONVERTER	+CON-279M4:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:1	FAN 4 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M4:2	=	stripped	8 mm



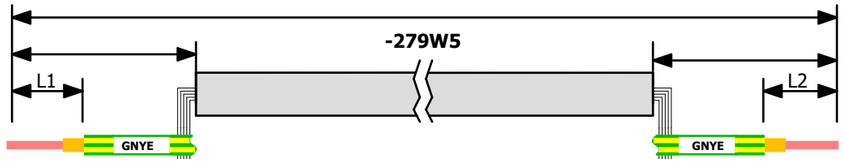
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M5:2	***Converter cabinet***

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

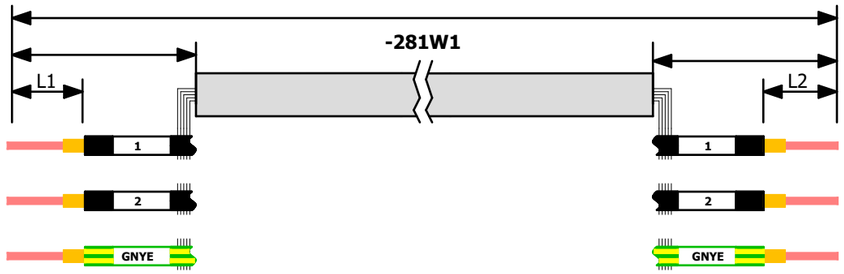


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:PE	FAN 4 CONVERTER	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:PE	*Converter cabinet*

Cable name =UNIT_01++CONV+-281W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:3	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:4	CIR Fans 1-3 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CIR-281M1:L	*Circuit Breaker cabinet*
8 mm	stripped	CIR Fans 1-3	+CIR-281M1:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M1:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

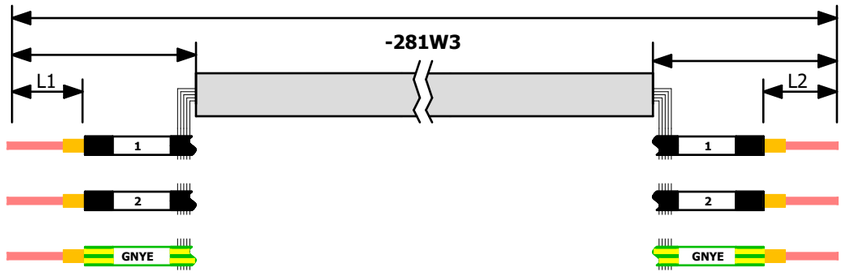


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M1:L	FAN 1 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CIRCUIT BREAKER CABINET	+CIR-281M2:L	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:N	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-281W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M2:L	FAN 2 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:PE	=	stripped	8 mm

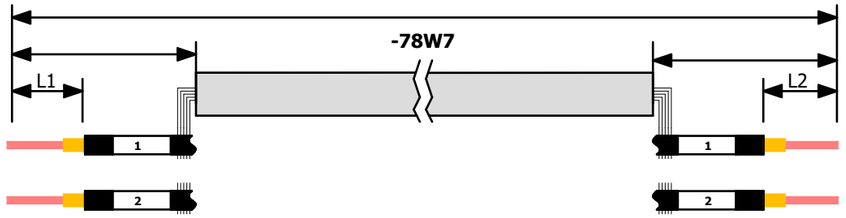
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CIRCUIT BREAKER CABINET	+CIR-281M3:1	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:2	*Circuit Breaker cabinet*
8 mm	stripped	=	+CIR-281M3:PE	*Circuit Breaker cabinet*

previous page: 5
next page: 7

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-78W7
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

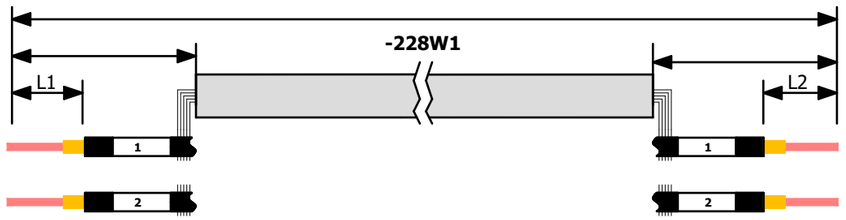


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:20			
AC and DC connection cabinet	+AC_DC-X3.43:19			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+AC_DC-78F1:13	AC and DC connection cabinet
			+AC_DC-78F1:14	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:7	SURGE ARRESTER DC SUBSYSTEM 3_1		
AC and DC connection cabinet	+AC_DC-X3.43:8	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_1	+AC_DC-228F1:11	AC and DC connection cabinet
		=	+AC_DC-228F1:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

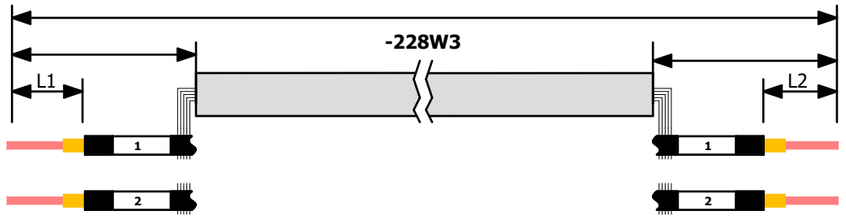


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:9	SURGE ARRESTER DC SUBSYSTEM 3_2		
AC and DC connection cabinet	+AC_DC-X3.43:10	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_2	+AC_DC-228F2:11	AC and DC connection cabinet
		=	+AC_DC-228F2:12	AC and DC connection cabinet

Cable name =UNIT_01++CONV+-228W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:11	SURGE ARRESTER DC SUBSYSTEM 3_3		
AC and DC connection cabinet	+AC_DC-X3.43:12	=		

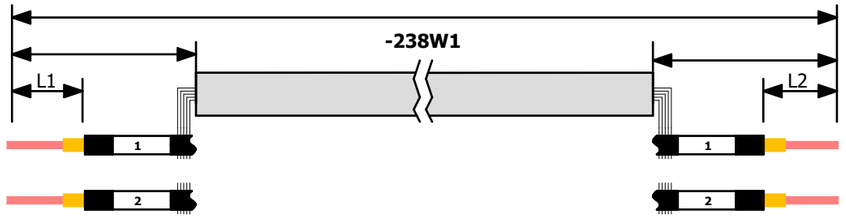
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_3	+AC_DC-228F3:11	AC and DC connection cabinet
		=	+AC_DC-228F3:12	AC and DC connection cabinet

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

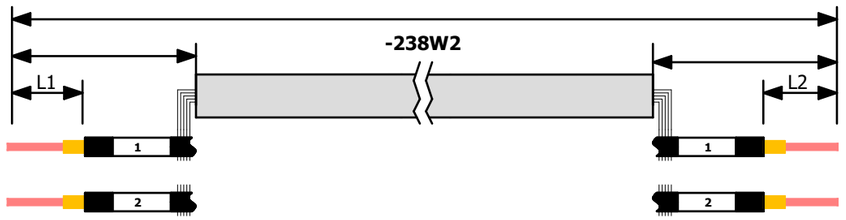


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1		
AC and DC connection cabinet	+AC_DC-X3.43:2	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_1	+AC_DC-238F1:11	***AC and DC connection cabinet***
		=	+AC_DC-238F1:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

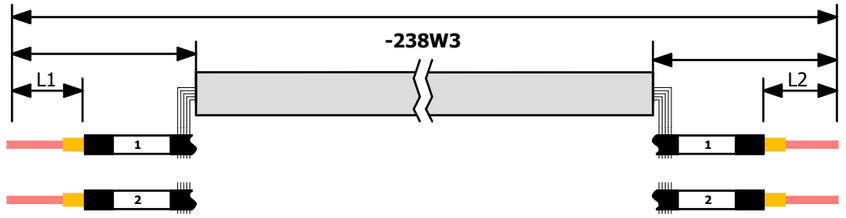


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:3	SURGE ARRESTER DC SUBSYSTEM 2_2		
AC and DC connection cabinet	+AC_DC-X3.43:4	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_2	+AC_DC-238F2:11	***AC and DC connection cabinet***
		=	+AC_DC-238F2:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

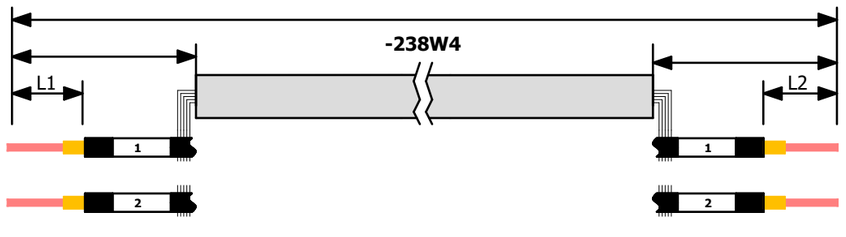


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:5	SURGE ARRESTER DC SUBSYSTEM 2_3		
AC and DC connection cabinet	+AC_DC-X3.43:6	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 2_3	+AC_DC-238F3:11	***AC and DC connection cabinet***
		=	+AC_DC-238F3:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W4
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:13	SURGE ARRESTER DC SUBSYSTEM 4_1		
AC and DC connection cabinet	+AC_DC-X3.43:14	=		

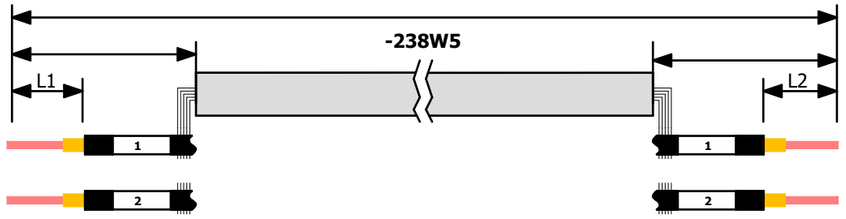
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_1	+AC_DC-238F4:11	***AC and DC connection cabinet***
		=	+AC_DC-238F4:12	***AC and DC connection cabinet***

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-238W5
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

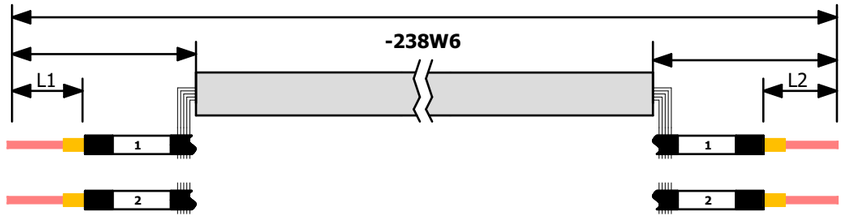


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:15	SURGE ARRESTER DC SUBSYSTEM 4_2		
AC and DC connection cabinet	+AC_DC-X3.43:16	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_2	+AC_DC-238F5:11	***AC and DC connection cabinet***
		=	+AC_DC-238F5:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W6
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

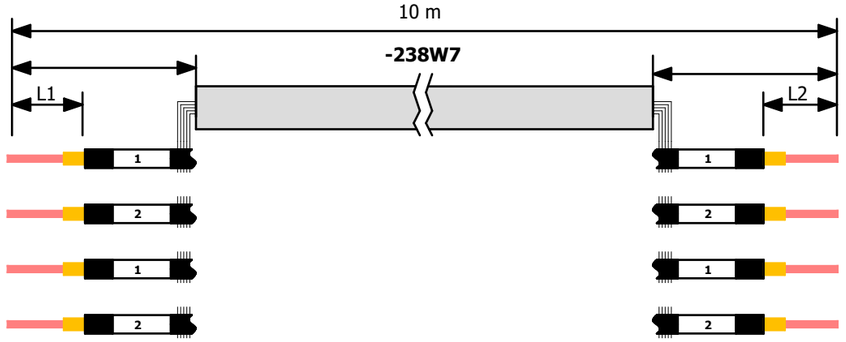


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:17	SURGE ARRESTER DC SUBSYSTEM 4_3		
AC and DC connection cabinet	+AC_DC-X3.43:18	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_3	+AC_DC-238F6:11	***AC and DC connection cabinet***
		=	+AC_DC-238F6:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W7
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030;10030

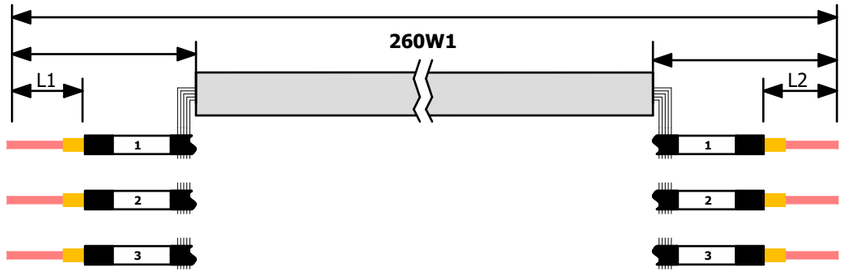


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1	stripped	7mm
AC and DC connection cabinet	+AC_DC-X3.43:20		stripped	7mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8mm	stripped	SURGE ARRESTER DC SUBSYSTEM 2_1	++CT+CTRL_1.3-X3:5	***Control cabinet 1***
8mm	stripped		++CT+CTRL_1.3-X3:6	***Control cabinet 1***

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors 3

Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:19	Smoke detector CON		
Control cabinet 1	++CT+CTRL_1.3-X3:20	=		
Control cabinet 1	++CT+CTRL_1.3-X3:21	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Smoke detector CON	+CON-260B1:4	***Converter cabinet***
		=	+CON-260B1:2	***Converter cabinet***
		=	+CON-260B1:5	***Converter cabinet***

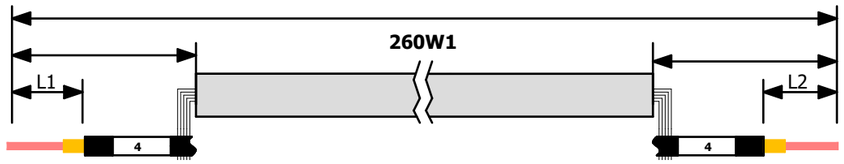
previous page: 8

next page: 10

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors

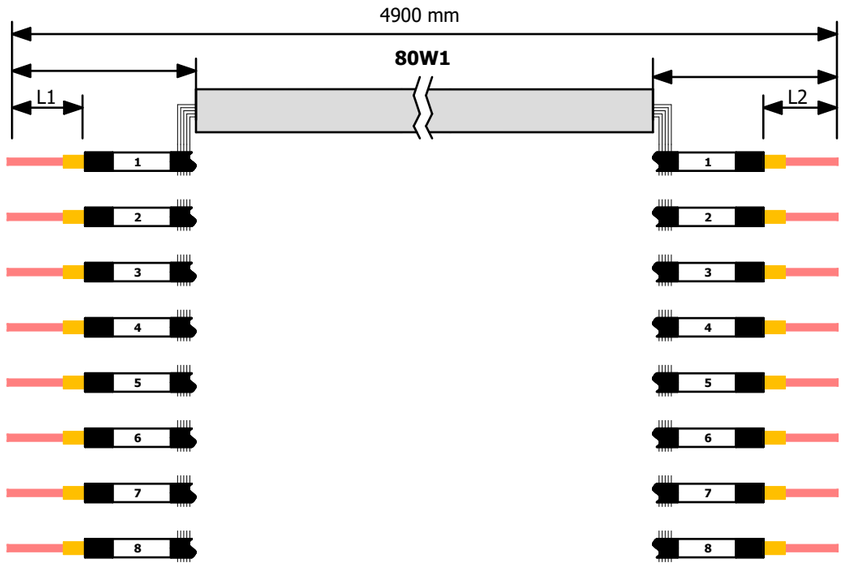
Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:22	Smoke detector CON					Smoke detector CON	+CON-260B1:6	*Converter cabinet*

Cable name =UNIT_01++CONV+-80W1
Cable type OZ-500 8x0,75 mm²
Free conductors

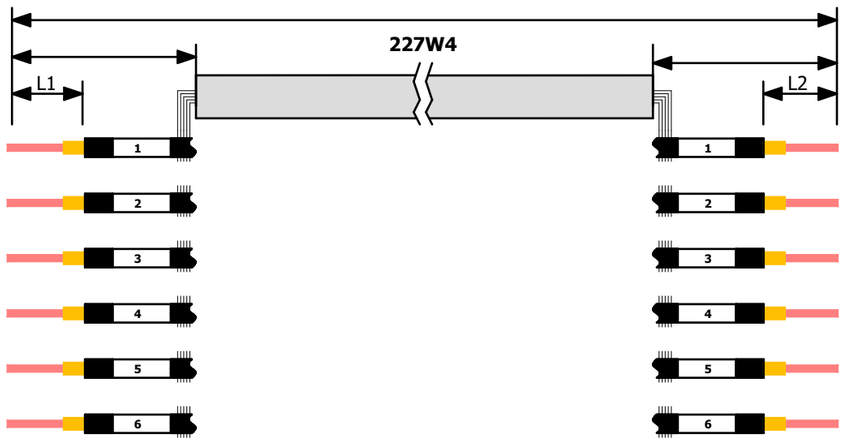
Cable parts HELU.10173
Order number 10173



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:1	CB 1 Tripped GRID	stripped	8 mm	8 mm	stripped	CB 1 Tripped GRID	+CIR-80Q1:X7_13	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:2	CB 1 OFF GRID	stripped	8 mm	8 mm	stripped	CB 1 OFF GRID	+CIR-80Q1:X6_9	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:3	CB 1 ON GRID	stripped	8 mm	8 mm	stripped	CB 1 ON GRID	+CIR-80Q1:X6_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:31	CB 1 GRID +24V	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_12	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:32	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_11	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:35	CB 2 ISLAND GRID +24V OPTIONAL	stripped	8 mm	8 mm	stripped	CB 2 ISLAND GRID	+CIR-80Q1:X6_7	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:36	CB 1 GRID	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_14	*Circuit Breaker cabinet*
Control cabinet 1	++CT+CTRL_1.3-X3:37	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_12	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



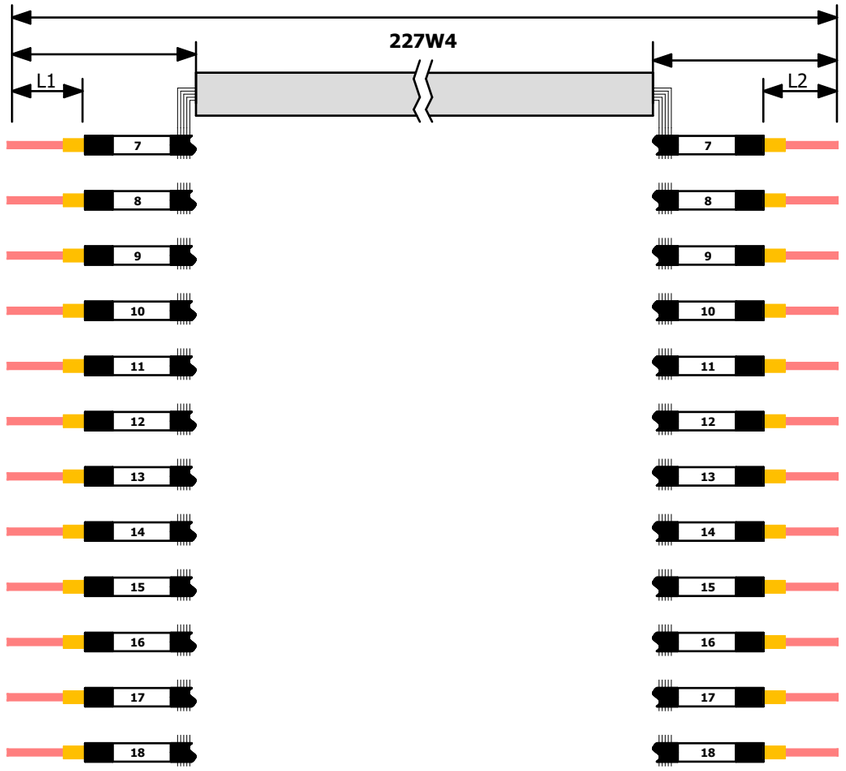
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:1	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:4	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:7	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:3	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:6	*Control cabinet 1*
Circuit Breaker cabinet	+CIR-227U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:9	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_01 Converter Container 1	
Date	05.11.2024							& EMB Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV Converter	page: 10
Date								+	total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

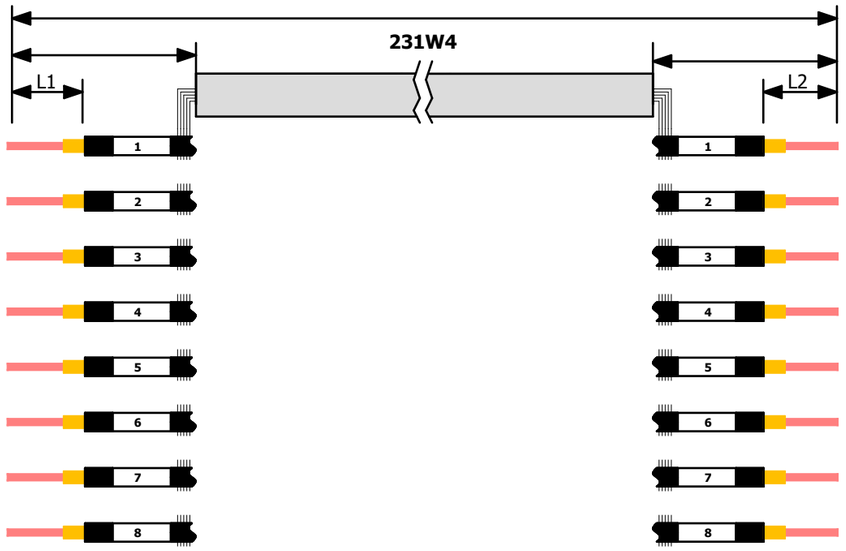
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K3:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-307K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



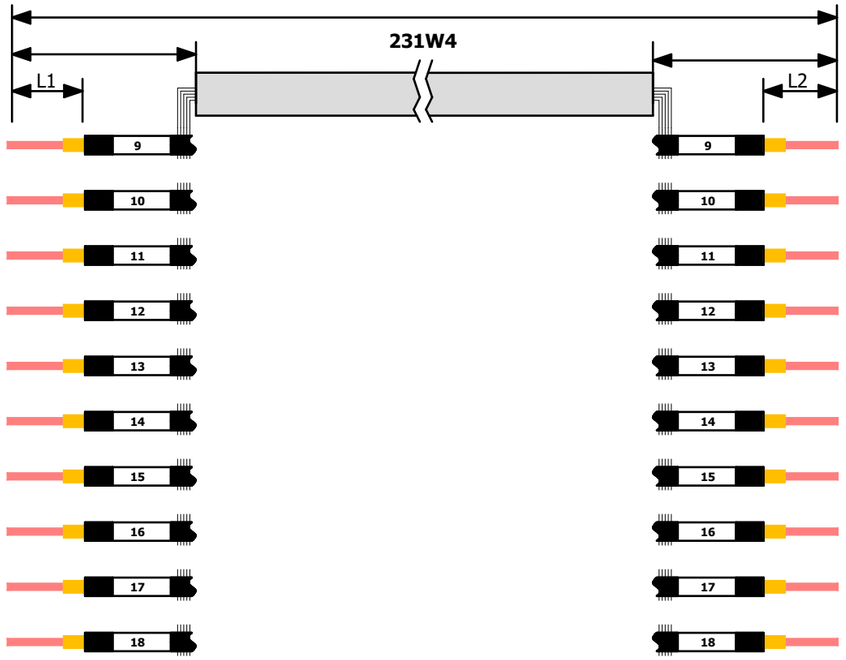
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:4	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:7	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:3	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:6	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K1:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K3:A1	***Control cabinet 1***

previous page: 10
next page: 12

0	1	2	3	4	5	6	7	8	9

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

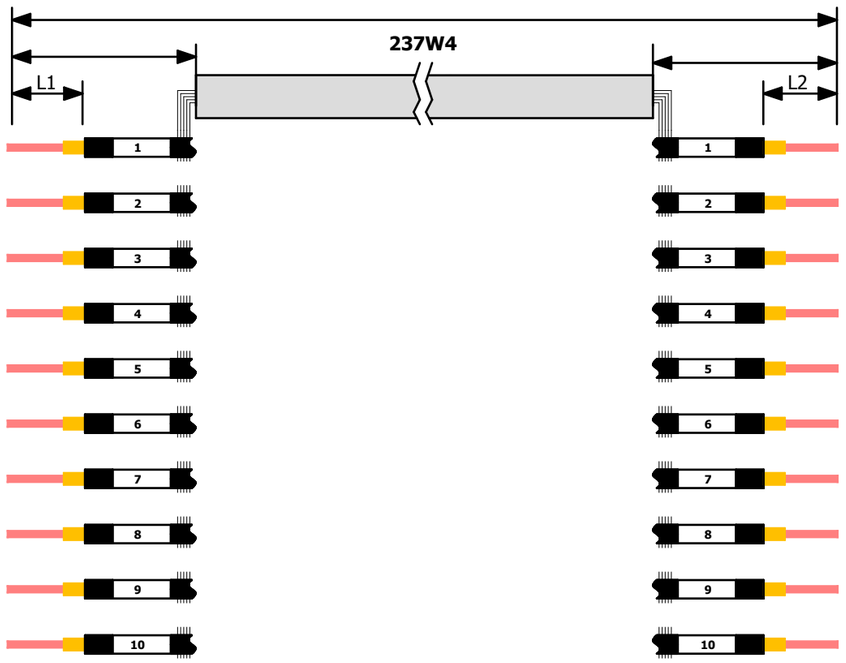


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-X3.1:9		stripped	8 mm
Circuit Breaker cabinet	+CIR-231U1-X3.1:10		stripped	8 mm
Circuit Breaker cabinet	+CIR-231U1-X3.1:11		stripped	8 mm
Circuit Breaker cabinet	+CIR-231U1-X3.1:12		stripped	8 mm
Circuit Breaker cabinet	+CIR-231U1-X3.1:13		stripped	8 mm
Circuit Breaker cabinet	+CIR-231U1-X3.1:14		stripped	8 mm
Circuit Breaker cabinet	+CIR-231U1-X3.1:15		stripped	8 mm
Circuit Breaker cabinet	+CIR-231U1-X3.1:16		stripped	8 mm
Circuit Breaker cabinet	+CIR-231U1-X3.1:17		stripped	8 mm
			stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped		++CT+CTRL_1.4-306K5:A1	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-306K2:A1	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-306K4:A1	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-306K6:A1	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.3-X3.10:9	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.3-X3.10:11	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.3-X3.11:9	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.3-X3.10:10	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.3-150X1:2	***Control cabinet 1***
8 mm	stripped			

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



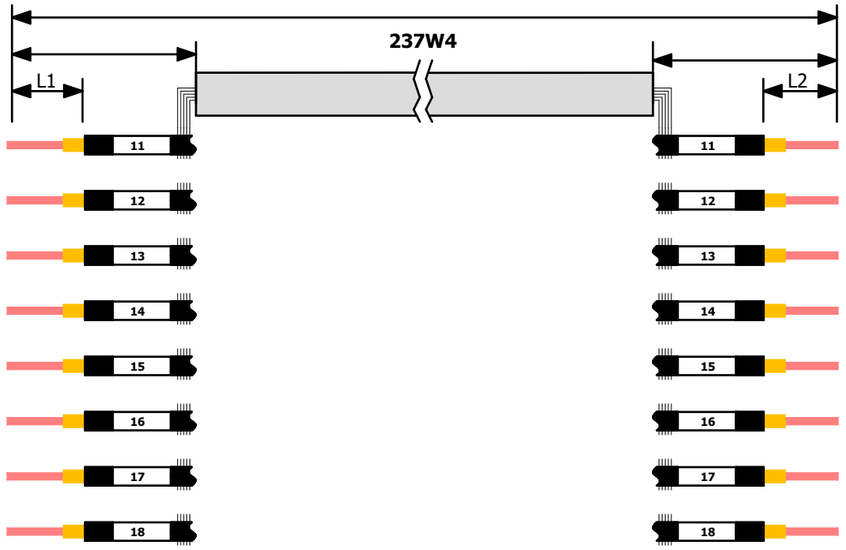
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-X3.1:1		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:2		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:3		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:4		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:5		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:6		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:7		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:8		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:9		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:10		stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped		++CT+CTRL_1.4-350X1.21:11	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-350X1.21:14	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-350X1.21:17	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-350X1.21:13	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-350X1.21:16	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-350X1.21:19	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-308K1:A1	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-308K3:A1	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-308K5:A1	***Control cabinet 1***
8 mm	stripped		++CT+CTRL_1.4-308K2:A1	***Control cabinet 1***

previous page: 11
next page: 13

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174

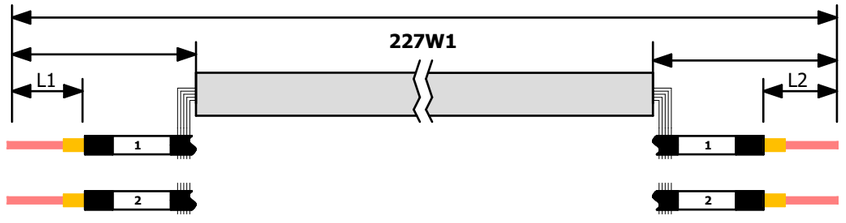


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-X3.1:11		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:12		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:13		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:14		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:15		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:16		stripped	8 mm
Circuit Breaker cabinet	+CIR-237U1-X3.1:17		stripped	8 mm
			stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped		++CT+CTRL_1.4-308K4:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-308K6:A1	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:8	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:9	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:11	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.3-X3.13:10	*Control cabinet 1*
8 mm	stripped		++CT+CTRL_1.4-350X1.21:12	*Control cabinet 1*
8 mm	stripped			

Cable name =UNIT_01++CONV+-227W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

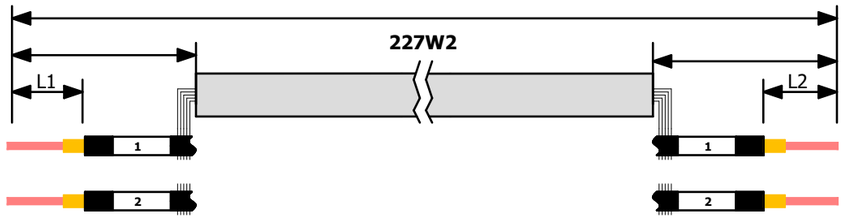


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F3:1			
Circuit Breaker cabinet	+CIR-227U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:32	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-227W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number



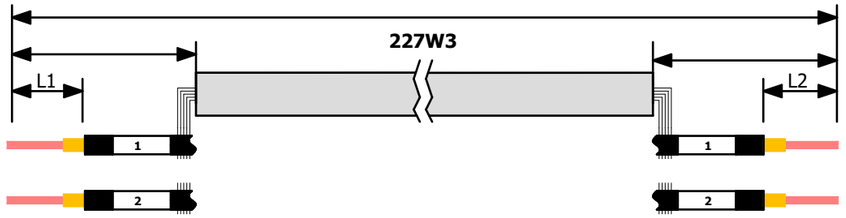
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F7:1			
Circuit Breaker cabinet	+CIR-227U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:36	*Control cabinet 2*

previous page: 12
next page: 14

Cable name =UNIT_01++CONV+-227W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

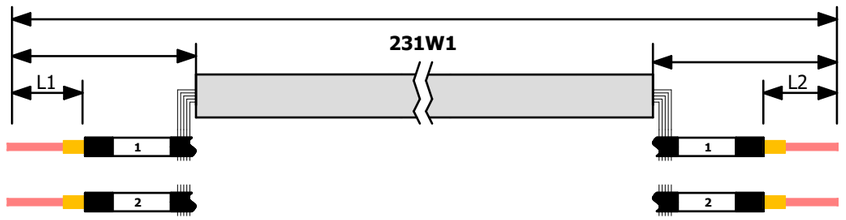


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F11:1			
Circuit Breaker cabinet	+CIR-227U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:40	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

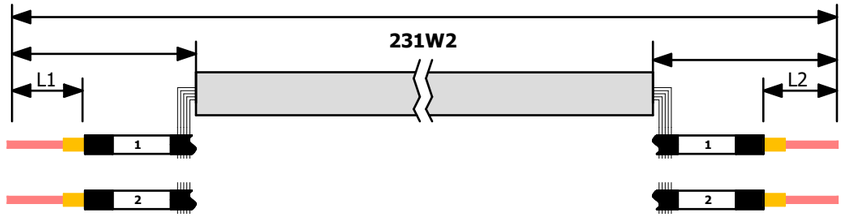


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F3:1			
Circuit Breaker cabinet	+CIR-231U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:19	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

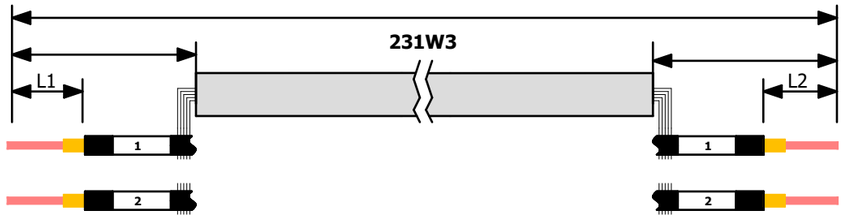


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F7:1			
Circuit Breaker cabinet	+CIR-231U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:23	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-231W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F11:1			
Circuit Breaker cabinet	+CIR-231U1-F12:1			

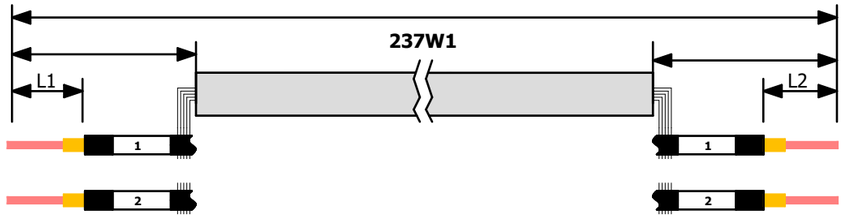
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-162U1:27	*Control cabinet 2*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_01	Converter Container 1	
Date	05.11.2024							& EMB	Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ CONV	Converter	page: 14
Date							10354_23A2007	+		total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+-237W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

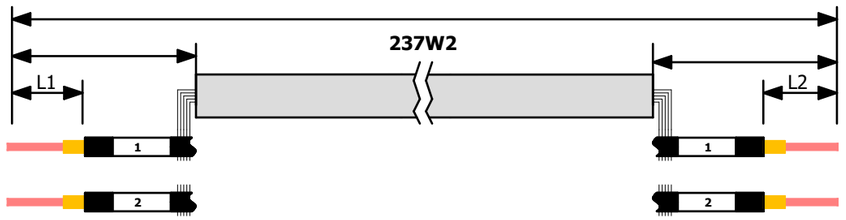


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F3:1			
Circuit Breaker cabinet	+CIR-237U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:19	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:23	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

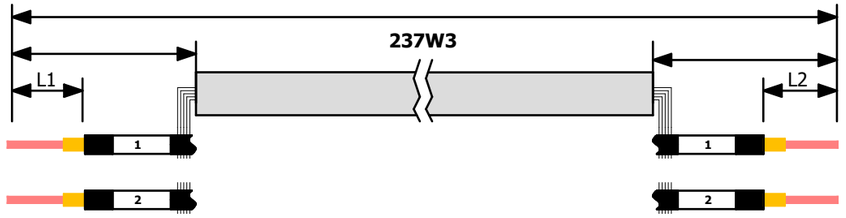


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F7:1			
Circuit Breaker cabinet	+CIR-237U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:27	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:32	*Control cabinet 2*

Cable name =UNIT_01++CONV+-237W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

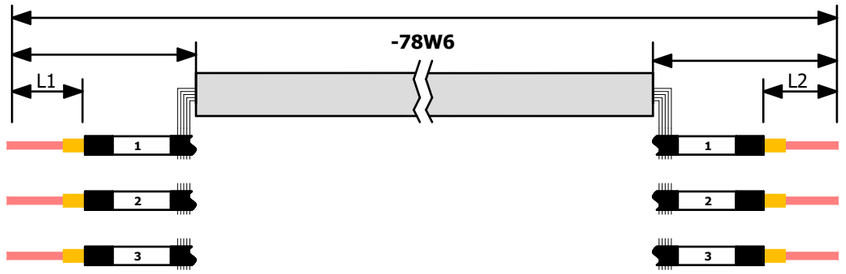


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F11:1			
Circuit Breaker cabinet	+CIR-237U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-164U1:36	*Control cabinet 2*
			++CT+CTRL_2.1-164U1:40	*Control cabinet 2*

Cable name =UNIT_01++CONV+-78W6
Cable type OZ-600 3x2,5 mm²
Free conductors

Cable parts HELU.10691
Order number 10691



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-78F3:2			
AC and DC connection cabinet	+AC_DC-78F3:4			
AC and DC connection cabinet	+AC_DC-78F3:6			

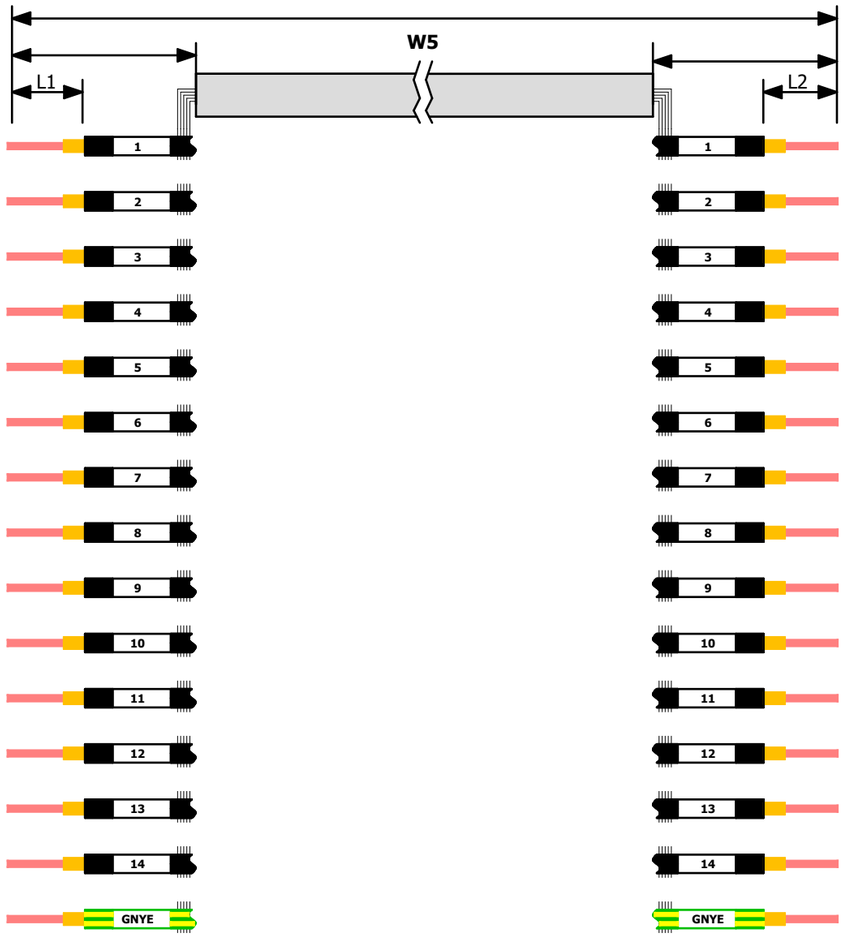
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_1.4-85U1:L1	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L2	*Control cabinet 1*
			++CT+CTRL_1.4-85U1:L3	*Control cabinet 1*

previous page: 14
next page: +CIR/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-227U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

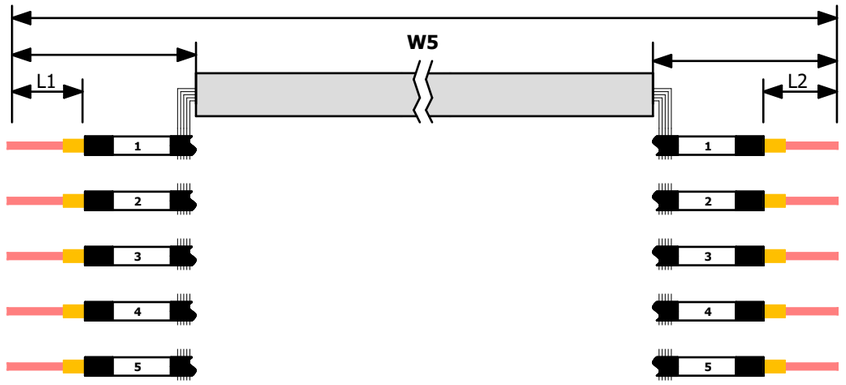
Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-227U1-X3.1:1							-227U1-X3.2:1	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:2							-227U1-X3.2:3	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:3							-227U1-X3.2:5	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:4							-227U1-X3.2:7	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:5							-227U1-X3.2:9	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:6							-227U1-X3.2:11	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:7							-227U1-X3.2:13	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:8							-227U1-X3.2:15	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:9							-227U1-X3.2:17	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:10							-227U1-X3.2:19	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:11							-227U1-X3.2:21	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:12							-227U1-X3.2:23	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:16							-227U1-X3.2:24	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:17							-227U1-X3.2:12	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-227U1-X3.1:PE							-227U1-X3.2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-231U1-X3.1:1							-231U1-X3.2:1	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-231U1-X3.1:2							-231U1-X3.2:3	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-231U1-X3.1:3							-231U1-X3.2:5	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-231U1-X3.1:4							-231U1-X3.2:7	*Circuit Breaker cabinet*
Circuit Breaker cabinet	-231U1-X3.1:5							-231U1-X3.2:9	*Circuit Breaker cabinet*

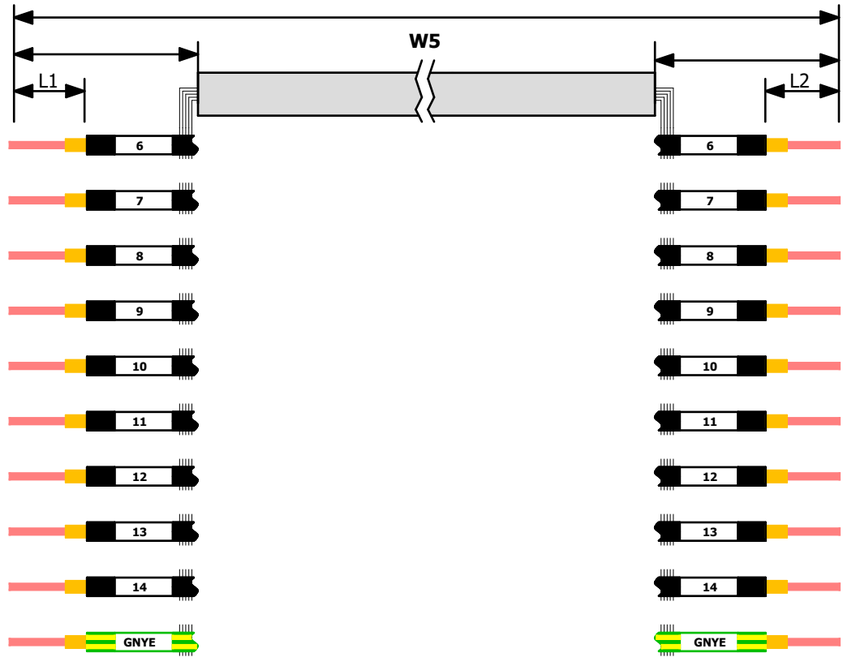
previous page: +/15
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-231U1-X3.1:6			
Circuit Breaker cabinet	-231U1-X3.1:7			
Circuit Breaker cabinet	-231U1-X3.1:8			
Circuit Breaker cabinet	-231U1-X3.1:9			
Circuit Breaker cabinet	-231U1-X3.1:10			
Circuit Breaker cabinet	-231U1-X3.1:11			
Circuit Breaker cabinet	-231U1-X3.1:12			
Circuit Breaker cabinet	-231U1-X3.1:16			
Circuit Breaker cabinet	-231U1-X3.1:17			
Circuit Breaker cabinet	-231U1-X3.1:PE			

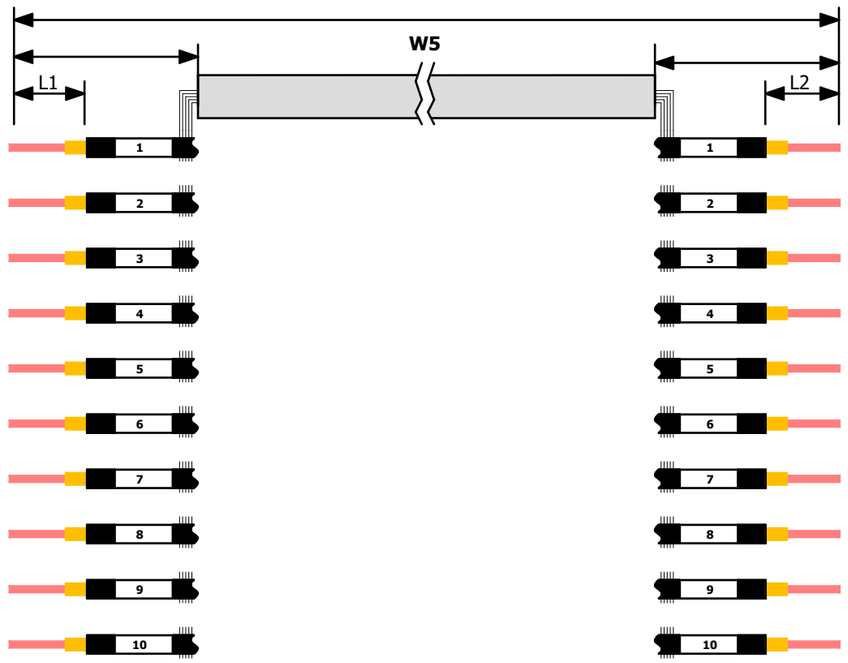


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-231U1-X3.2:11	*Circuit Breaker cabinet*
			-231U1-X3.2:13	*Circuit Breaker cabinet*
			-231U1-X3.2:15	*Circuit Breaker cabinet*
			-231U1-X3.2:17	*Circuit Breaker cabinet*
			-231U1-X3.2:19	*Circuit Breaker cabinet*
			-231U1-X3.2:21	*Circuit Breaker cabinet*
			-231U1-X3.2:23	*Circuit Breaker cabinet*
			-231U1-X3.2:24	*Circuit Breaker cabinet*
			-231U1-X3.2:12	*Circuit Breaker cabinet*
			-231U1-X3.2:PE	*Circuit Breaker cabinet*

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:1			
Circuit Breaker cabinet	-237U1-X3.1:2			
Circuit Breaker cabinet	-237U1-X3.1:3			
Circuit Breaker cabinet	-237U1-X3.1:4			
Circuit Breaker cabinet	-237U1-X3.1:5			
Circuit Breaker cabinet	-237U1-X3.1:6			
Circuit Breaker cabinet	-237U1-X3.1:7			
Circuit Breaker cabinet	-237U1-X3.1:8			
Circuit Breaker cabinet	-237U1-X3.1:9			
Circuit Breaker cabinet	-237U1-X3.1:10			



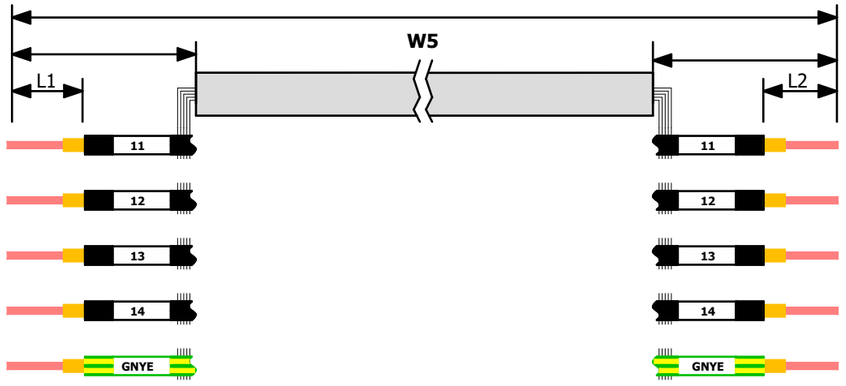
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:1	*Circuit Breaker cabinet*
			-237U1-X3.2:3	*Circuit Breaker cabinet*
			-237U1-X3.2:5	*Circuit Breaker cabinet*
			-237U1-X3.2:7	*Circuit Breaker cabinet*
			-237U1-X3.2:9	*Circuit Breaker cabinet*
			-237U1-X3.2:11	*Circuit Breaker cabinet*
			-237U1-X3.2:13	*Circuit Breaker cabinet*
			-237U1-X3.2:15	*Circuit Breaker cabinet*
			-237U1-X3.2:17	*Circuit Breaker cabinet*
			-237U1-X3.2:19	*Circuit Breaker cabinet*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



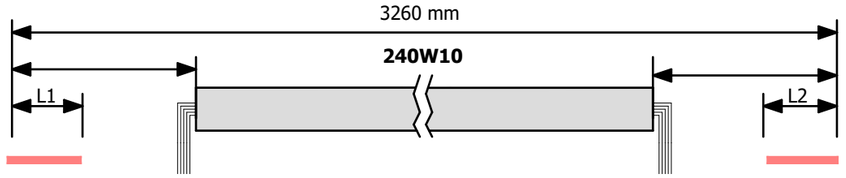
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:11			
Circuit Breaker cabinet	-237U1-X3.1:12			
Circuit Breaker cabinet	-237U1-X3.1:16			
Circuit Breaker cabinet	-237U1-X3.1:17			
Circuit Breaker cabinet	-237U1-X3.1:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:21	*Circuit Breaker cabinet*
			-237U1-X3.2:23	*Circuit Breaker cabinet*
			-237U1-X3.2:24	*Circuit Breaker cabinet*
			-237U1-X3.2:12	*Circuit Breaker cabinet*
			-237U1-X3.2:PE	*Circuit Breaker cabinet*

FRQ_Kabelplan_04_gro8_de_en

previous page: 2
next page: ++CT+/1

Cable name =UNIT_01++CT+-240W10
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

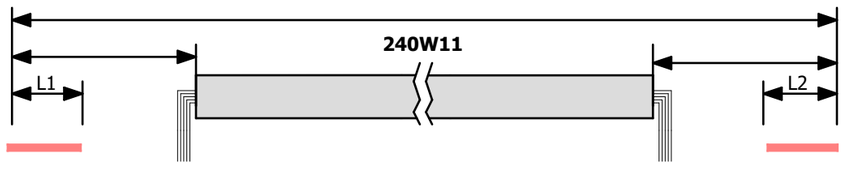


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

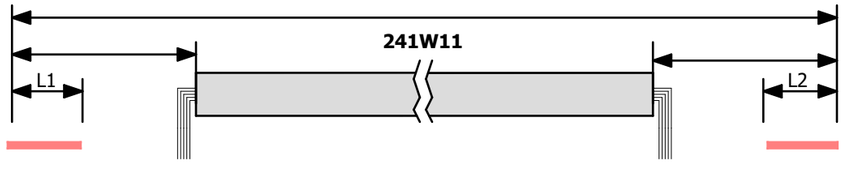


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-240U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

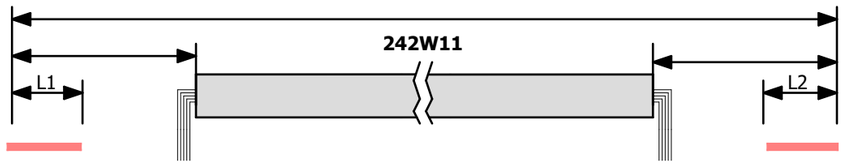


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-241U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors 2

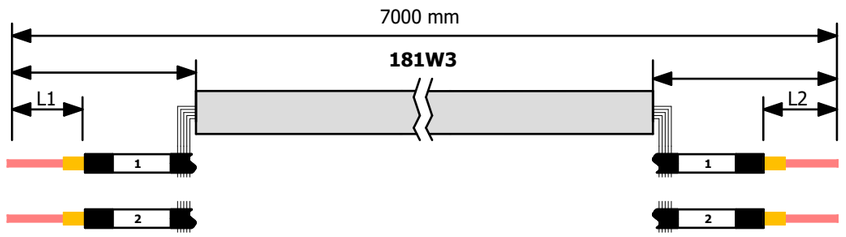


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-242U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:P1	*Control cabinet 2*

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2



Cable parts HELU.16563
Order number 16563

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:23	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X3:24	=	stripped	8 mm

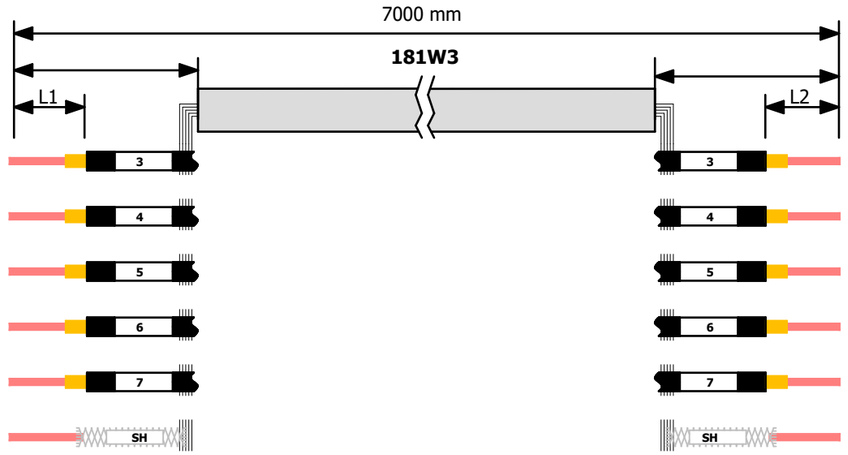
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:1	
	Flat connector	=	++FAN-52G1-181X3:3	

previous page: ++CONV+CIR/3
next page: 2

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-181W3
Cable type F-CY-OZ (LiY-CY) 7x0,75 mm²
Free conductors 2

Cable parts HELU.16563
Order number 16563

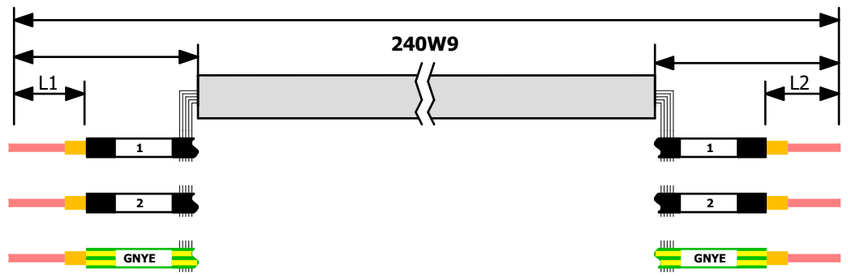


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X3:25	PRESSURE SWITCH	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X5:23	COOLING WATER TEMPERATURE	End splice	8 mm
Control cabinet 1	+CTRL_1.3-X5:24	=	End splice	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	++FAN-52G1-181X3:2	
8 mm	stripped	COOLING WATER TEMPERATURE	++FAN-52G1-181X3:4	
8 mm	stripped	=	++FAN-52G1-181X3:5	

Cable name =UNIT_01++CT+-240W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031

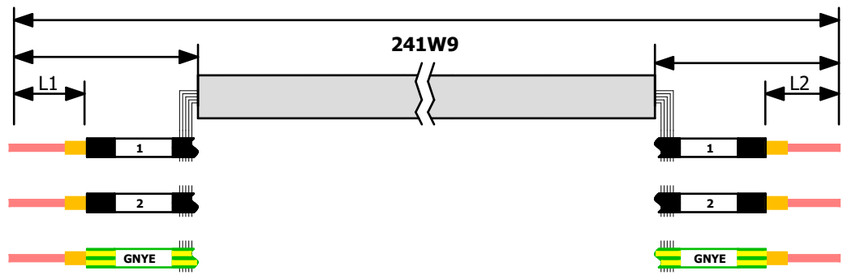


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC1:1	FUSE 24V DC CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:4	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	FUSE 24V DC CONTROL VOLTAGE	+CTRL_2.1-240U1:1	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-240U1:3	*Control cabinet 2*
	Connector	=	+CTRL_2.1-240U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W9
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:4	=	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

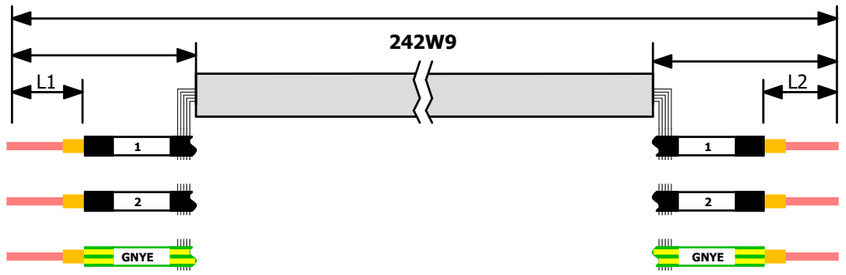
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-241U1:1	*Control cabinet 2*
	Connector	=	+CTRL_2.1-241U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-241U1:2	*Control cabinet 2*

previous page: 1
next page: 3

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

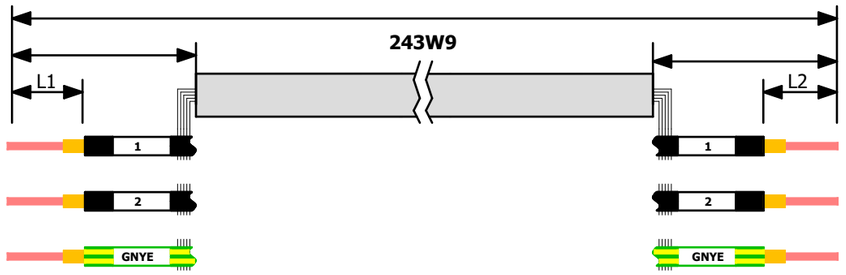


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-242U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W9
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

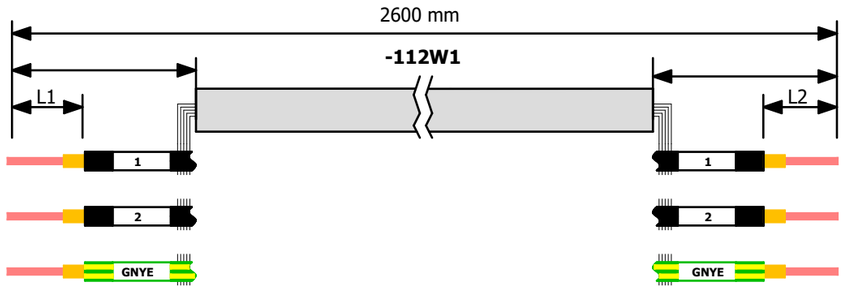


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:1	*Control cabinet 2*
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-243U1:3	*Control cabinet 2*
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:2	*Control cabinet 2*

Cable name =UNIT_01++CT+-112W1
Cable type JZ-500 3G0,75 mm²
Free conductors 0

Cable parts HELU.10031
Order number 10031

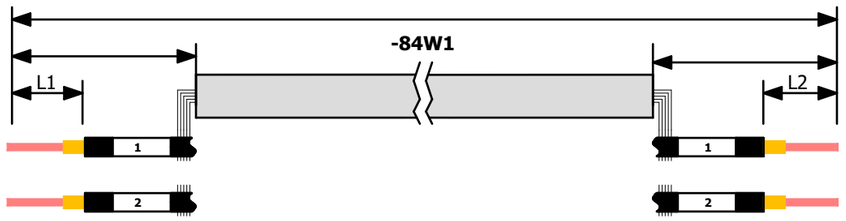


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE		
Control cabinet 1	+CTRL_1.3-XDC2:4	=		
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		BSU, SPARE CONTROL VOLTAGE	+CTRL_1.1-112A1:L+	*Control cabinet 1*
		=	+CTRL_1.1-112A1:M	*Control cabinet 1*
		Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_1.1-112A1:PE	*Control cabinet 1*

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors 1

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:2		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:4		stripped	8 mm

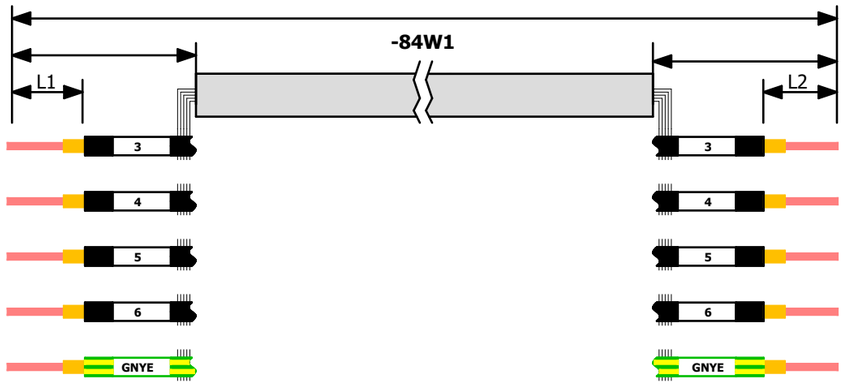
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	End splice		+CTRL_1.3-84F1:L1'	*Control cabinet 1*
8 mm	End splice		+CTRL_1.3-84F1:L2'	*Control cabinet 1*

previous page: 2
next page: 4

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors

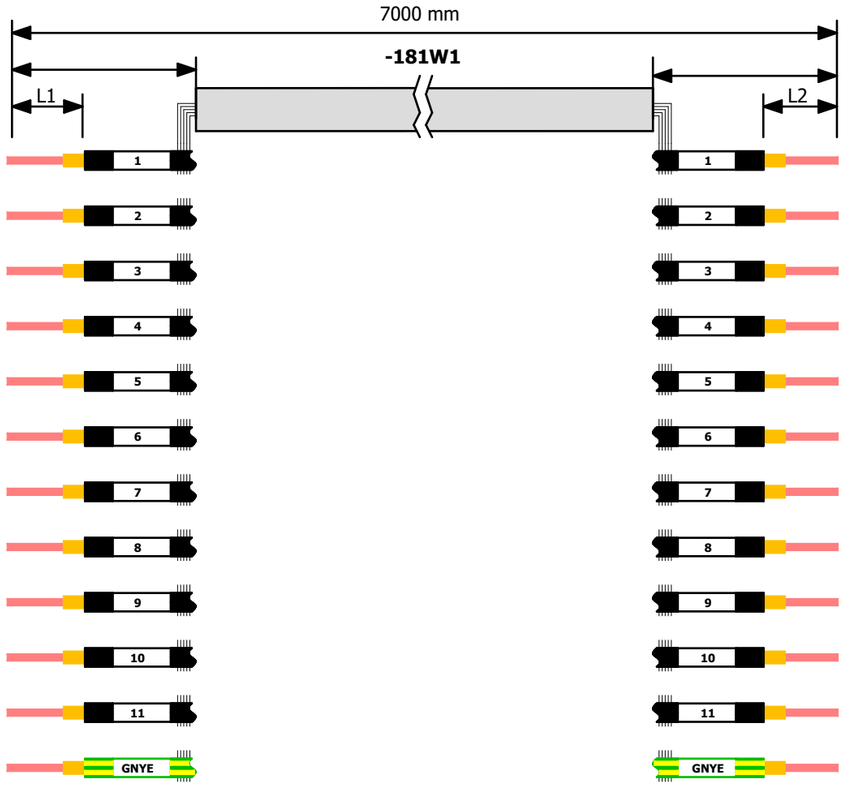
Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.1-84Q1:6		stripped	8 mm	8 mm	End splice		+CTRL_1.3-84F1:L3'	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:1		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F1:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:3		stripped	8 mm	8 mm	End splice		+CTRL_1.3-183F2:1	Control cabinet 1
Control cabinet 1	+CTRL_1.1-84Q1:5		stripped	8 mm	8 mm	End splice		+CTRL_1.3-185F1:1	Control cabinet 1

Cable name =UNIT_01++CT+-181W1
Cable type JZ-600 12G1,5 mm²
Free conductors

Cable parts HELU.10670
Order number 10670



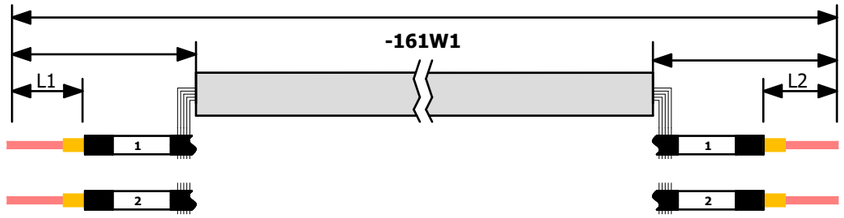
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.3-X1:1	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:1:1	
Control cabinet 1	+CTRL_1.3-X1:2	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:2:1	
Control cabinet 1	+CTRL_1.3-X1:3	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:3:1	
Control cabinet 1	+CTRL_1.3-X1:4	FUSE FOR PUMP	stripped	8 mm	8 mm	stripped	FUSE FOR PUMP	++FAN-52G1-181X1:4:1	
Control cabinet 1	+CTRL_1.3-X1:5	HEATER	stripped	8 mm	8 mm	stripped	HEATER	++FAN-52G1-181X1:5:1	
Control cabinet 1	+CTRL_1.3-X1:6	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:6:1	
Control cabinet 1	+CTRL_1.3-X1:7	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:7:1	
Control cabinet 1	+CTRL_1.3-X1:8	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	++FAN-52G1-181X1:8:1	
Control cabinet 1	+CTRL_1.3-X1:9	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:9:1	
Control cabinet 1	+CTRL_1.3-X1:10	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:10:1	
Control cabinet 1	+CTRL_1.3-X1:PE	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:PE:1	

previous page: 3
next page: 5

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-161W1
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030

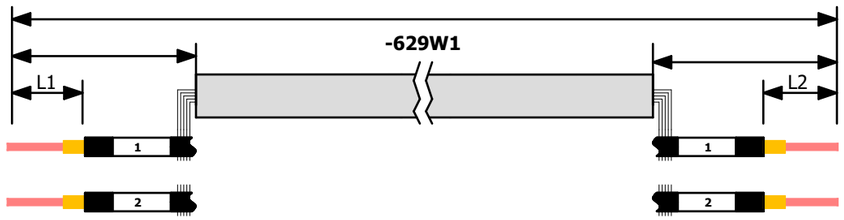


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:+			
Control cabinet 2	+CTRL_2.1-160U1:-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_2.1-161U1:+	*Control cabinet 2*
			+CTRL_2.1-161U1:-	*Control cabinet 2*

Cable name =UNIT_01++CT+-629W1
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_01++CT+-195W1
Cable type OZ-500 4x0,75 mm²
Free conductors 8

Cable parts HELU.10034
Order number 10034

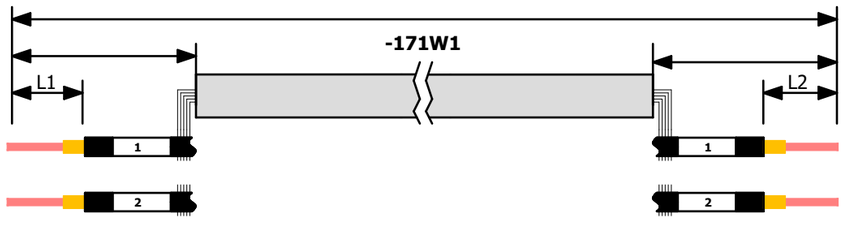


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:13	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:23			
Control cabinet 1	+CTRL_1.1-84Q1:14	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS		
Control cabinet 1	+CTRL_1.1-84Q1:24			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-195K3:T1	*Control cabinet 1*
			+CTRL_1.3-195K3:T2	*Control cabinet 1*
		SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-X3:41	*Control cabinet 1*
			+CTRL_1.3-X3:43	*Control cabinet 1*

Cable name =UNIT_01++CT+-171W1
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:1			
Control cabinet 1	+CTRL_1.4-171F1:3			

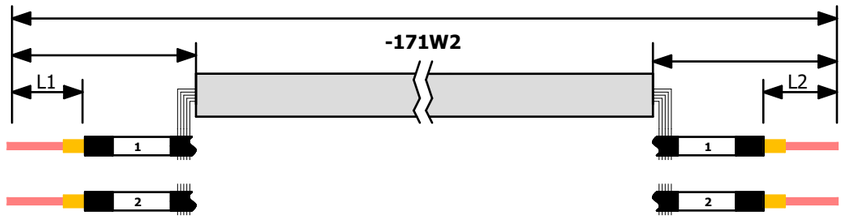
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-85U1:DC+	*Control cabinet 1*
			+CTRL_1.4-85U1:DC-	*Control cabinet 1*

previous page: 4
next page: 6

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-171W2
Cable type OZ-600 2x1,5 mm²
Free conductors 2

Cable parts HELU.10656
Order number 10656

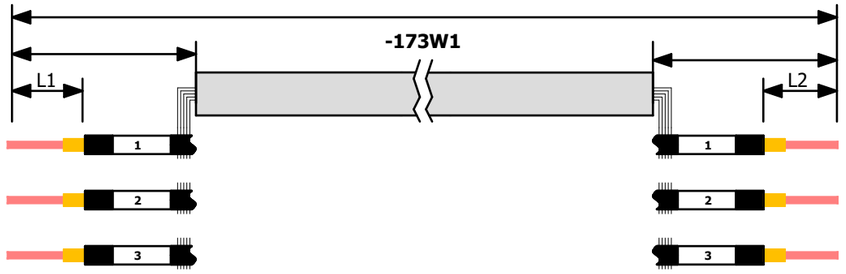


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:2			
Control cabinet 1	+CTRL_1.4-171F1:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-171K1:A1	*Control cabinet 1*
			+CTRL_1.4-171K2:A1	*Control cabinet 1*

Cable name =UNIT_01++CT+-173W1
Cable type OZ-600 3x2,5 mm²
Free conductors 3

Cable parts HELU.10691
Order number 10691

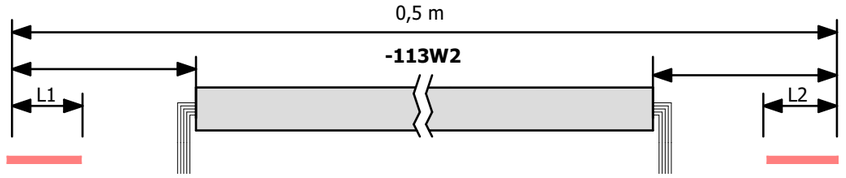


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-UDC+			
Converter cabinet	++CONV+CON-UDC-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-173F2:2	*Control cabinet 1*
			+CTRL_1.4-173F2:4	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

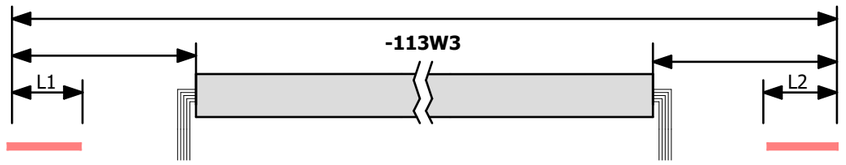


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U1:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 8

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U1:IN			

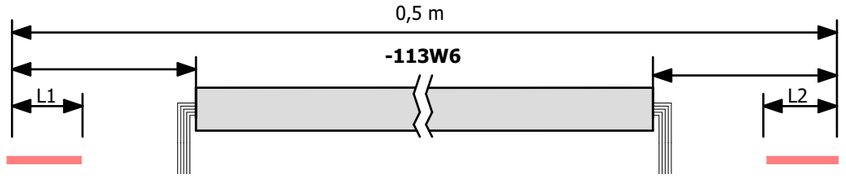
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U2:8	*Control cabinet 1*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 6
Date								+ total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-113W6
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN

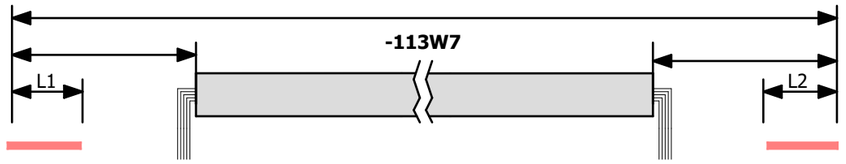


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T2:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U3:OUT	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W7
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

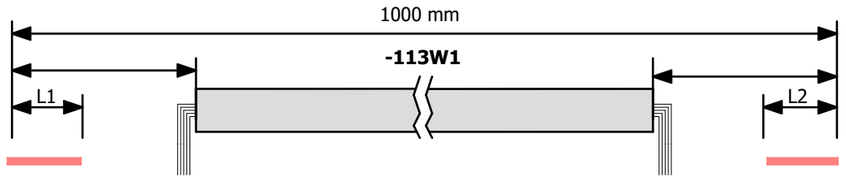


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U3:IN			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U4:8	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W1
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

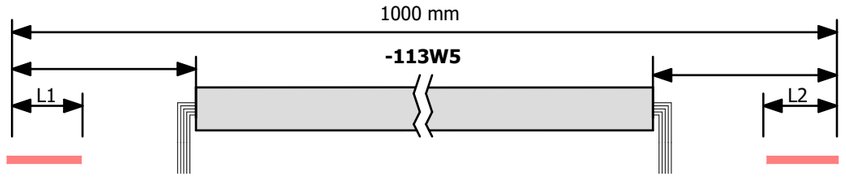


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X4:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T1:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-113W5
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

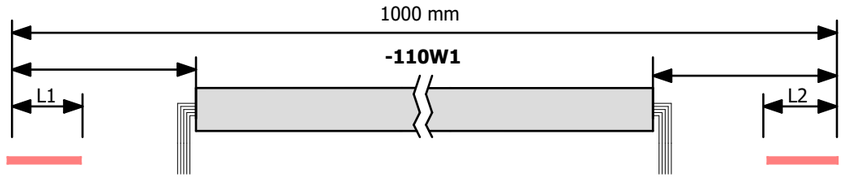


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X5:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T2:15	*Control cabinet 1*

Cable name =UNIT_01++CT+-110W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



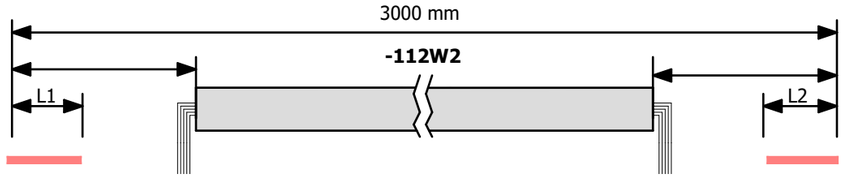
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X1:1-8	*Control cabinet 1*

previous page: 6
next page: 8

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-112W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

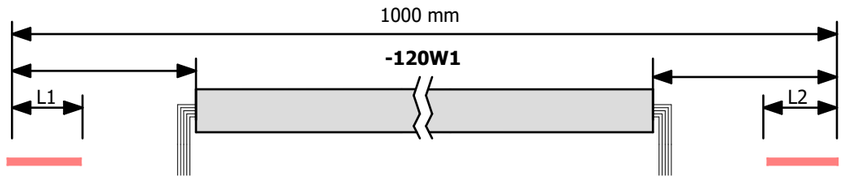


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-112A1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X2:1-8	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

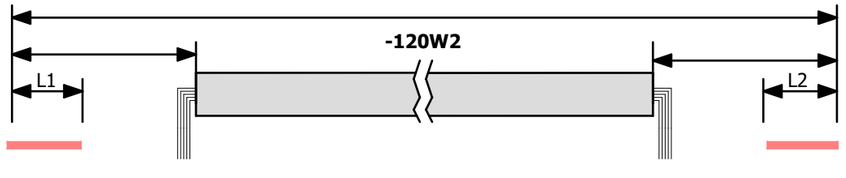


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P3		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-120A1:-X1:P1	*Control cabinet 1*

Cable name =UNIT_01++CT+-120W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

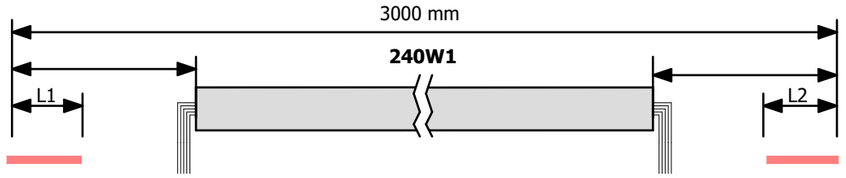


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-113U5:8			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-120A1:-X1:P2	*Control cabinet 1*

Cable name =UNIT_01++CT+-240W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

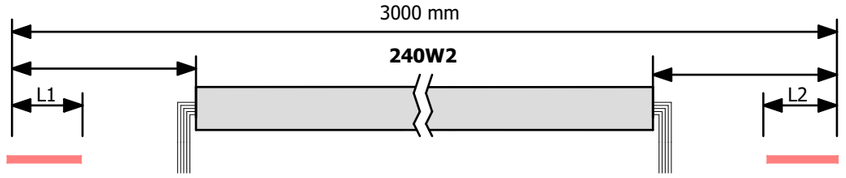


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-201Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X1	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

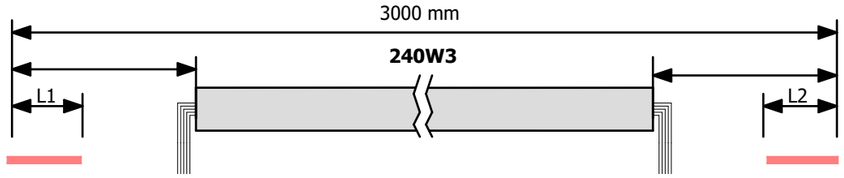
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-202Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X2	*Control cabinet 2*

previous page: 7
next page: 9

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-240W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

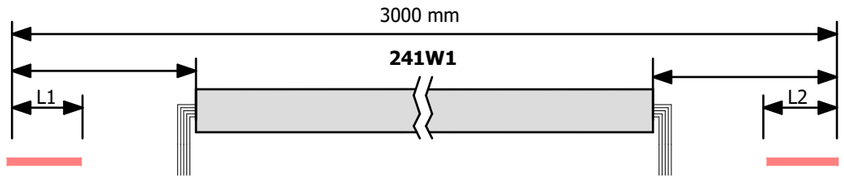


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-203Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

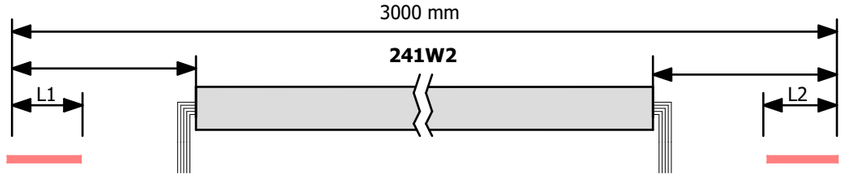


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

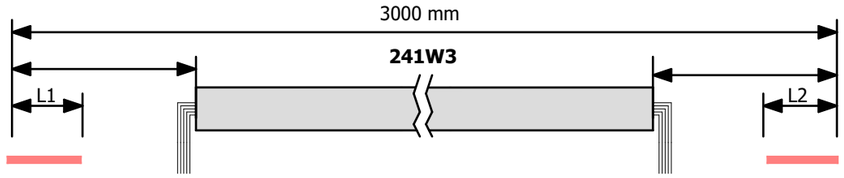


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

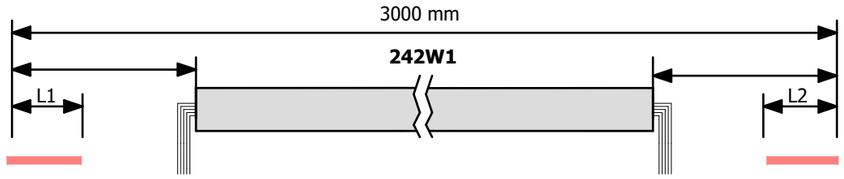


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

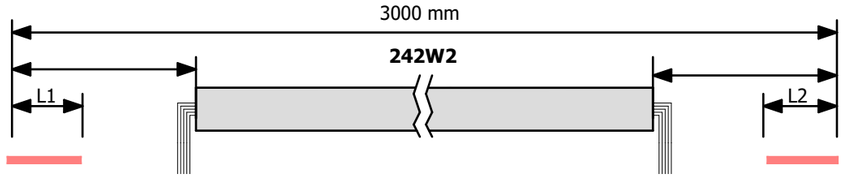
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X1	***Control cabinet 2***

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 9
Date								+ total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++CT+-242W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

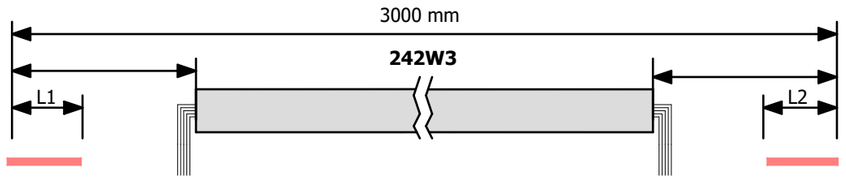


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

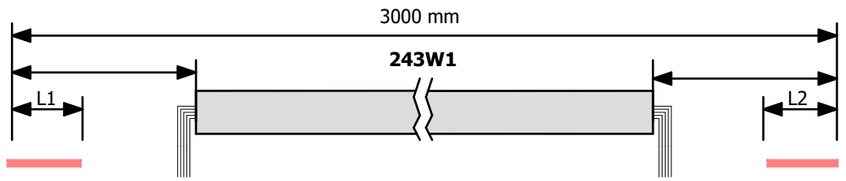


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

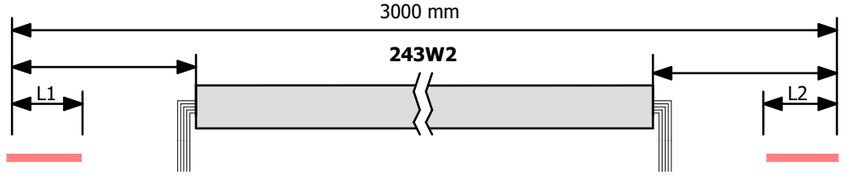


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

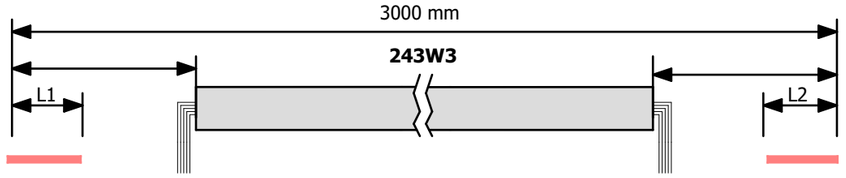


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-217Q1-U1:X3		Connector	

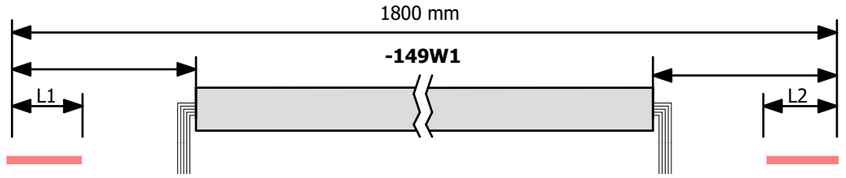
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-243U1:X3	***Control cabinet 2***

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 10
Date								+ total: 492

FRQ_Kabelplan_04_gro8_de_en

Cable name =UNIT_01++CT+-149W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.671476
Order number

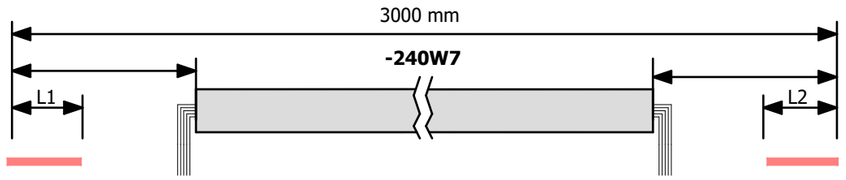


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-149U1:11X3		Connecor	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-162U1:11X3	*Control cabinet 2*

Cable name =UNIT_01++CT+-240W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

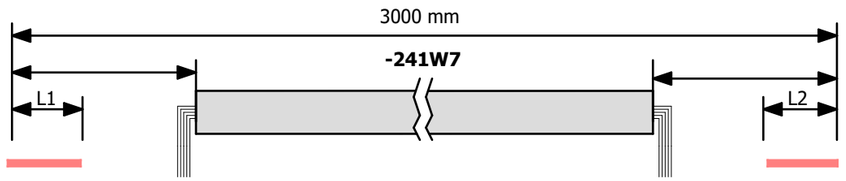


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-160U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-241W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

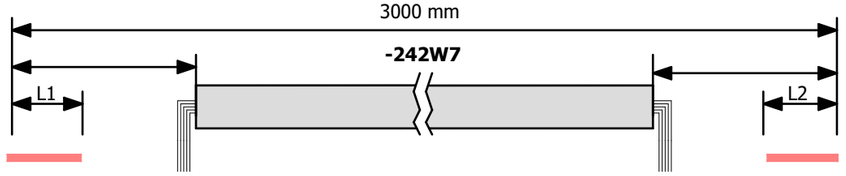


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-161U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-242W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097

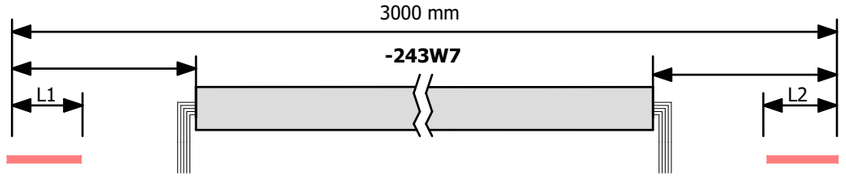


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-163U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:X7	*Control cabinet 2*

Cable name =UNIT_01++CT+-243W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts DIS.125-30-097
Order number 125-30-097



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-164U1:11X3		Connector	

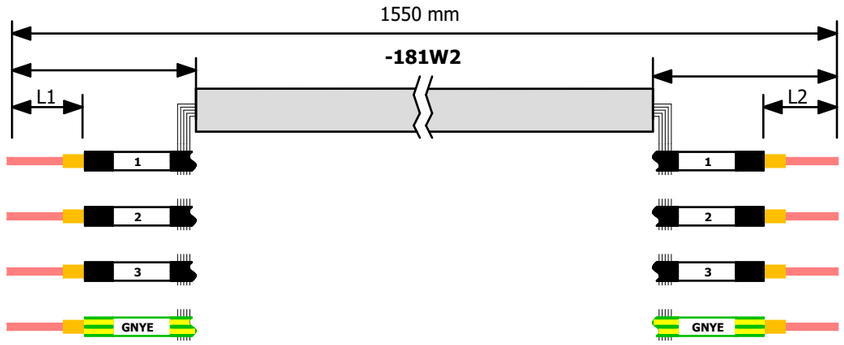
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:X7	*Control cabinet 2*

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT Control cabinets page: 11
Date								+ total: 492

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++FAN+-52G1-181W2
Cable type JZ-600 4G1,5 mm²
Free conductors

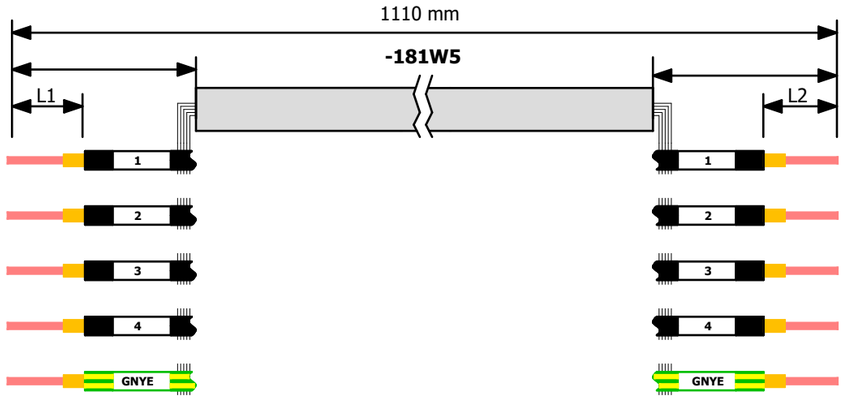
Cable parts HELU.10659
Order number 10659



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:1:2	PUMP	stripped	8 mm	5 mm	Ring cable lug M4	PUMP	-52G1-181M1:U1	
	-52G1-181X1:2:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:V1	
	-52G1-181X1:3:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:PE	

Cable name =UNIT_01++FAN+-52G1-181W5
Cable type JZ-600 5G1,5 mm²
Free conductors

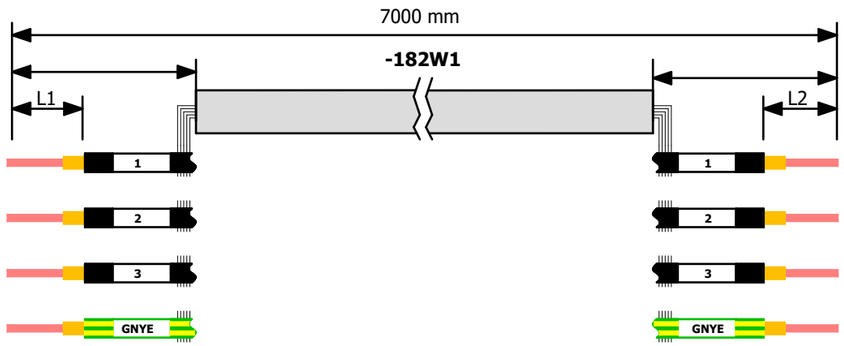
Cable parts HELU.10661
Order number 10661



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:4:2	FUSE FOR PUMP	stripped	8 mm	5 mm	Ring cable lug M4	FUSE FOR PUMP	-52G1-181R1:x1	
	-52G1-181X1:5:2	HEATER	stripped	8 mm	5 mm	Ring cable lug M4	HEATER	-52G1-181R1:x3	
	-52G1-181X1:6:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x5	
	-52G1-181X1:7:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x6	
	-52G1-181X1:PE:2	=					=	-52G1-181R1:PE	

Cable name =UNIT_01++FAN+-52G1-182W1
Cable type JZ-600 5G1,5 mm²
Free conductors

Cable parts HELU.10659
Order number 10659



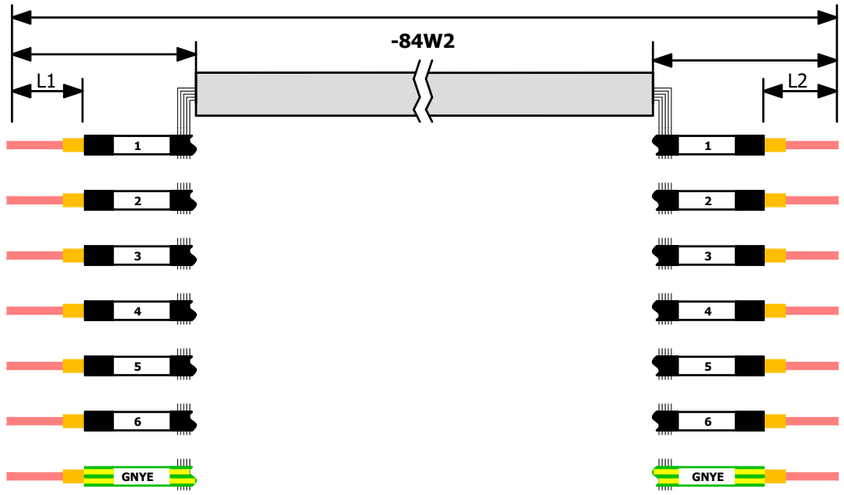
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:8:2	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	-52G1-182M1:U1	
	-52G1-181X1:9:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:V1	
	-52G1-181X1:10:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:PE	

previous page: ++CT/11
next page: ++EXTERN/1

FRQ_Kabelplan_04_groß_de_en

Cable name =UNIT_01++EXTERN+-84W2
Cable type JZ-600 5G16 mm²
Free conductors 7

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page:
++FAN/1

next page:
&EMZ++CONV+IND/1000

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20250123_V1.3	= UNIT_01 Converter Container 1
Date	05.11.2024							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ EXTERN page: 1
Date								+ total: 492

FRQ_Kabelplan_04_groß_de_en

STATRON
NON STOP POWER

Load List

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E14
Sequence Number: 001
Document number: K559-2254-CWIWP4202201-E14-001
Document description: Load List

KBR
ACCEPTANCE FOR ENGINEERING USE

THIS DOCUMENT IS:

ACCEPTED	(Code 1)	
ACCEPTED WITH COMMENTS	(Code 2)	X
NOT ACCEPTED	(Code 3)	
NOT REVIEWED	(Code 4)	

ACCEPTANCE DOES NOT RELIEVE SUPPLIER FROM FURNISHING MATERIAL IN CONFORMANCE WITH ORDER. REFER TO SDR-1 FOR FULL DEFINITION OF ACCEPTANCE CONDITIONS.

DISCIPLINE Electrical BY Ken Rose
DATE 17-Mar-2023

Revision			Description
001			First Version

KBR CROSSWIND FREQCON STATRON NON STOP POWER

Load List
E14

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E14
Document name	Load List
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-02-27	M. Maaz	First version

Table 1: Version overview

	Date	Name
Editor	2023-02-27	M. Maaz
Checked by	2023-02-27	A. Fritz
Approved by	2023-03-02	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7

1.1 About this Document 7

1.2 Display Elements 7

1.3 Other Applicable Documents 7

1.4 Generic Terms and Abbreviations Used 7

2 Main Auxiliary Loads 8

2.1 PCS Container 8

2.2 Battery Storage Container 8

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-E14-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document provides a brief list of main auxiliary loads in the BESS FQ system. A comprehensive list of auxiliary loads and the distribution of power supply shall be provided end of detailed engineering phase.

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 Main Auxiliary Loads

2.1 PCS Container

In the PCS container, the main auxiliary loads include (but not limited to):

- Control cabinet
- Water pump and distribution system
- Water heating element
- Water to air heat exchanger
- HVAC air cooling units for PCS (and transformer)
- Power supply inside container
- Several small components (e.g. fans for cabinets, lighting inside container, remote access router etc.)

2.2 Battery Storage Container

In the battery storage container(s), the main auxiliary loads include (but not limited to):

- BMS and communication ICs (including cabinet controller, CMC, measurements etc.)
- CO sensors, smoke sensors
- HVAC air cooling units
- External fire alarm (if required)
- External forced ventilation / exhaust fans (if required)
- Several small components (e.g. fans for cabinets, lighting inside container etc.)

1. Please provide Table based list (in excel) that shows each of the following in each column (as a minimum)
   1. DESRCIPTION
   2. TAG No.
   3. FUNCTION
   4. UTILITY FACTOR
   5. ABSORBED LOAD (kW)
   6. EQUIPMENT RATING POWER (kW)
   7. UTILISATION FACTOR (pu)
   8. EFFICIENCY - η (%)
   9. POWER FACTOR (Cos φ)
   10. LOAD FACTOR (pu)
   11. NOMINAL VOLATGE (V)
   12. CURRENT (A)
   13. START METHOD (DOL or VSD)

2. Can the load show actual power drawn from the system in each of the operating modes 1. Charging, 2. Discharging, 3. Standby, 4. Island, 5. Blackout

3. Load list to provide total power (Amps, kW) drawn form the system

STATRON
NON STOP POWER

Electrical Equipment List-01

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E99-001
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-E99-001
Document description: Electrical Equipment List

Revision	Date	Name	Description
001	31.03.2023	CPA / ADI	First Version

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Electrical Equipment List
E99-001

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E99-001
Document name	Electrical Equipment List
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-28	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-28	C. Palenzuela
Checked by	2023-03-31	A. Fritz
Approved by	2023-03-31	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-E99-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
BESS and PCS circuit diagram	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20230331_V0.01_B_W

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The electrical equipment lists of the PCS and BESS containers are part of the circuit diagram of the complete system attached to this document (*see section 1.3 "Other Applicable Documents"*).

File name:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20230331_V0.01_B_W.pdf

PCS equipment list:	PDF pages 112 to 158.
BESS 1 equipment list:	PDF pages 276 to 282
BESS 2 equipment list:	PDF pages 363 to 369

3 Appendix

1. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20230331_V0.01_B_W

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	CONVERTER CONTAINER	
Circuit diagram No:	10354_23A2007	ANL1_20230331_V0.01

Producer (company):	Freqcon GmbH	53396
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	CT_Ausbau 5XXXX CONV 53399
Type:	BESS MSC-1000-620-8	Container Ausbau 53043
Project manager:	Freqcon_CP	

created on:	17.09.2019			
edited on:	31.03.2023	edited by:	Freqcon_DG	total pages: 423

previous page:

next page: &EAB/1

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	30.03.2023	Freqcon_DG
&EAB		Contents		
	1	INDEX	31.03.2023	Freqcon_DG
	2	INDEX	31.03.2023	Freqcon_DG
	3	INDEX	31.03.2023	Freqcon_DG
	4	INDEX	31.03.2023	Freqcon_DG
	5	INDEX	31.03.2023	Freqcon_DG
	6	INDEX	30.03.2023	Freqcon_DG
	7	INDEX	30.03.2023	Freqcon_DG
	8	INDEX	30.03.2023	Freqcon_DG
	9	INDEX	30.03.2023	Freqcon_DG
	10	INDEX	31.03.2023	Freqcon_DG
	11	INDEX	31.03.2023	Freqcon_DG
	12	INDEX	31.03.2023	Freqcon_DG
	13	INDEX	31.03.2023	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	02.03.2023	Freqcon_DG
	6a	Specification Earthing	02.03.2023	Freqcon_DG
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	31.03.2023	Freqcon_DG
	2a	SYSTEMS OVERVIEW	31.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&ELU		Cabinet Overview		
	5a	CABINETS OVERVIEW	31.03.2023	Freqcon_DG
&EFS ++CONV		Circuit diagram		
	78	GRID CONNECTION	30.03.2023	Freqcon_DG
	80	BG CIRCUIT BREAKER 1000A AC GRID	30.03.2023	Freqcon_DG
	82	PI INDUCTORS GRID SIDE	29.03.2023	Freqcon_DG
	83	GRID AC FILTER 3* 600 µF + OVERVOLTAGE PROTECTOR	29.03.2023	Freqcon_DG
	99	BUSBARS N, PE	30.03.2023	Freqcon_DG
	200	POWER CIRCUITS COVER PAGE	29.03.2023	Freqcon_DG
	201	IGBT & INDUCTOR FOR GRID PHASE 1	29.03.2023	Freqcon_DG
	202	IGBT & INDUCTOR FOR GRID PHASE 2	29.03.2023	Freqcon_DG
	203	IGBT & INDUCTOR FOR GRID PHASE 3	29.03.2023	Freqcon_DG
	207	IGBT & INDUCTOR SUB 3_1 - 3_3	29.03.2023	Freqcon_DG
	211	IGBT & INDUCTOR SUB 2_1 -2_3	29.03.2023	Freqcon_DG
	217	IGBT & INDUCTOR SUB 4_1 -4_3	29.03.2023	Freqcon_DG
	227	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	30.03.2023	Freqcon_DG
	227.a	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	30.03.2023	Freqcon_DG
	228	DC SURGE ARRESTER 3_1 - 3_3	30.03.2023	Freqcon_DG
	231	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	30.03.2023	Freqcon_DG
	231.a	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	30.03.2023	Freqcon_DG
	237	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	30.03.2023	Freqcon_DG
	237.a	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	30.03.2023	Freqcon_DG
	238a	DC SURGE ARRESTER 2_1 - 2_3	30.03.2023	Freqcon_DG
	238b	DC SURGE ARRESTER 4_1 - 4_3	30.03.2023	Freqcon_DG
	260	SMOKE DETECTOR	29.03.2023	Freqcon_DG
	279	CONVERTER CABINET CLIMATE	29.03.2023	Freqcon_DG
	281	CIRCUIT BREAKER CABINET CLIMATE	29.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram		
	84	FEEDING CONTROL CABINET (CTRL)	29.03.2023	Freqcon_DG
	85	SUPPLY UDC	29.03.2023	Freqcon_DG
	100	CONTROL CABINET COVER PAGE	29.03.2023	Freqcon_DG
	101	CONTROL VOLTAGE POWER SUPPLY UNIT	29.03.2023	Freqcon_DG
	102	CONTROL VOLTAGE UPS	29.03.2023	Freqcon_DG
	103	CONTROL VOLTAGE FUSE	29.03.2023	Freqcon_DG
	110	MAIN PLC	29.03.2023	Freqcon_DG
	111	ETHERNET SWITCH	29.03.2023	Freqcon_DG
	112	PANEL PC HMI	29.03.2023	Freqcon_DG
	113a	ETHERNET / PROFINET ISOLATOR	29.03.2023	Freqcon_DG
	113b	ETHERNET / PROFINET ISOLATOR	29.03.2023	Freqcon_DG
	114	PN/ PN COUPLER	29.03.2023	Freqcon_DG
	115	UMTS ROUTER	29.03.2023	Freqcon_DG
	120	ET200 24V DC	29.03.2023	Freqcon_DG
	121	ET200SP DIGITAL INPUTS DI_01 - DI_03	29.03.2023	Freqcon_DG
	122	ET200SP DIGITAL INPUTS DI_04 + DI_05	29.03.2023	Freqcon_DG
	123	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	29.03.2023	Freqcon_DG
	124	ET200SP ANALOG INPUTS AI_01 - AI_03	29.03.2023	Freqcon_DG
	125	ET200SP ANALOG INPUTS AI_04	29.03.2023	Freqcon_DG
	126	INPUTS CONTROL ELEMENTS	29.03.2023	Freqcon_DG
	127	DIGITAL INPUTS CB 1	29.03.2023	Freqcon_DG
	128	DIGITAL INPUTS CB 2	29.03.2023	Freqcon_DG
	129	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	30.03.2023	Freqcon_DG
	130	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	30.03.2023	Freqcon_DG
	131	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	30.03.2023	Freqcon_DG
	132	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	30.03.2023	Freqcon_DG
	133	DIGITAL INPUTS SPARE	29.03.2023	Freqcon_DG

previous page: 2

next page: 4

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram		
	134	DIGITAL INPUTS SMOKE DETECTORS	29.03.2023	Freqcon_DG
	135	OUTPUTS FAN	29.03.2023	Freqcon_DG
	137	OUTPUTS CIRCUIT BREAKER	29.03.2023	Freqcon_DG
	139	OUTPUTS COOLING	29.03.2023	Freqcon_DG
	140	OUTPUTS CONTROL ELEMENTS	29.03.2023	Freqcon_DG
	145	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	29.03.2023	Freqcon_DG
	146	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	29.03.2023	Freqcon_DG
	147	ANALOG INPUTS CABINET TEMPERATURE	29.03.2023	Freqcon_DG
	148	ANALOG INPUTS COOLING WATER TEMPERATURE	29.03.2023	Freqcon_DG
	149	ANALOG INPUTS MEASURING VOLTAGE	29.03.2023	Freqcon_DG
	150	OUTPUTS DC CONTACTORS 2_1	30.03.2023	Freqcon_DG
	151	OUTPUTS DC CONTACTORS 2_2, 2_3	30.03.2023	Freqcon_DG
	160	INTERFACE HVIO 1	29.03.2023	Freqcon_DG
	161	INTERFACE HVIO 2	29.03.2023	Freqcon_DG
	163	INTERFACE HVIO 3	29.03.2023	Freqcon_DG
	164	INTERFACE HVIO 4	29.03.2023	Freqcon_DG
	171	PRE-CHARGING UDC	29.03.2023	Freqcon_DG
	173	DISCHARGE UDC	29.03.2023	Freqcon_DG
	181	WATER SYSTEM	29.03.2023	Freqcon_DG
	182	HEAT EXCHANGER	29.03.2023	Freqcon_DG
	183	Supply for cabinet fan	29.03.2023	Freqcon_DG
	185	FAN / HEATING CONTROL CABINET	29.03.2023	Freqcon_DG
	186	THERMOSTAT	29.03.2023	Freqcon_DG
	187	24V DC SUPPLY CB	29.03.2023	Freqcon_DG
	188	24V DC SUPPLY CON / CB GRID	29.03.2023	Freqcon_DG
	189	TEST TERMINAL BLOCK	29.03.2023	Freqcon_DG
	190	CONTAINER COOLING, LIGHT 230V SUPPLY	29.03.2023	Freqcon_DG

previous page: 3

next page: 5

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS ++CT		Circuit diagram		
	195	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	29.03.2023	Freqcon_DG
	278	CONTROL CABINET CLIMATE	29.03.2023	Freqcon_DG
	306.a	Feedback DC contactors 1_4 - 1_6	30.03.2023	Freqcon_DG
	306.b	Feedback DC contactors 2_1 - 2_3	30.03.2023	Freqcon_DG
	306.c	Feedback DC contactors 2_4 - 2_6	30.03.2023	Freqcon_DG
	350	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	30.03.2023	Freqcon_DG
	351	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	30.03.2023	Freqcon_DG
	352	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	30.03.2023	Freqcon_DG
	353	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	30.03.2023	Freqcon_DG
	440	PIII PROFINET IGBT IRT INTERFACE 1	29.03.2023	Freqcon_DG
	441	PIII PROFINET IGBT IRT INTERFACE 2	29.03.2023	Freqcon_DG
	442	PIII PROFINET IGBT IRT INTERFACE 3	29.03.2023	Freqcon_DG
	443	PIII PROFINET IGBT IRT INTERFACE 4	29.03.2023	Freqcon_DG
&EFS ++Container		Circuit diagram		
	190	CONTAINER COOLING, LIGHT 230V SUPPLY	29.03.2023	Freqcon_DG
&EPC ++CONV +CON		Parts List Converter cabinet		
	1	PARTS LIST	30.03.2023	Freqcon_DG
	2	PARTS LIST	30.03.2023	Freqcon_DG
	3	PARTS LIST	30.03.2023	Freqcon_DG
	4	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++CONV +IND		Parts List Inductor cabinet		
	1	PARTS LIST	30.03.2023	Freqcon_DG

previous page: 4

next page: 6

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CONV +CIR		Parts List Circuit Breaker cabinet		
	1	PARTS LIST	30.03.2023	Freqcon_DG
	2	PARTS LIST	30.03.2023	Freqcon_DG
	3	PARTS LIST	30.03.2023	Freqcon_DG
	4	PARTS LIST	30.03.2023	Freqcon_DG
	5	PARTS LIST	30.03.2023	Freqcon_DG
	6	PARTS LIST	30.03.2023	Freqcon_DG
	7	PARTS LIST	30.03.2023	Freqcon_DG
	8	PARTS LIST	30.03.2023	Freqcon_DG
	9	PARTS LIST	30.03.2023	Freqcon_DG
	10	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++CONV +AC_DC		Parts List AC and DC connection cabinet		
	1	PARTS LIST	30.03.2023	Freqcon_DG
	2	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++CT +CTRL_1.1		Parts List Control cabinet 1 Cabinet door		
	1	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++CT +CTRL_1.2		Parts List Control cabinet 1 Left side		
	1	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++CT +CTRL_1.3		Parts List Control cabinet 1 Main mounting plate		
	1	PARTS LIST	30.03.2023	Freqcon_DG
	2	PARTS LIST	30.03.2023	Freqcon_DG
	3	PARTS LIST	30.03.2023	Freqcon_DG
	4	PARTS LIST	30.03.2023	Freqcon_DG

previous page: 5

next page: 7

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL_1.3		Parts List Control cabinet 1 Main mounting plate		
	5	PARTS LIST	30.03.2023	Freqcon_DG
	6	PARTS LIST	30.03.2023	Freqcon_DG
	7	PARTS LIST	30.03.2023	Freqcon_DG
	8	PARTS LIST	30.03.2023	Freqcon_DG
	9	PARTS LIST	30.03.2023	Freqcon_DG
	10	PARTS LIST	30.03.2023	Freqcon_DG
	11	PARTS LIST	30.03.2023	Freqcon_DG
	12	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++CT +CTRL_1.4		Parts List Control cabinet 1 Right side		
	1	PARTS LIST	30.03.2023	Freqcon_DG
	2	PARTS LIST	30.03.2023	Freqcon_DG
	3	PARTS LIST	30.03.2023	Freqcon_DG
	4	PARTS LIST	30.03.2023	Freqcon_DG
	5	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++CT +CTRL_1.5		Parts List Control cabinet 1 above		
	1	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++CT +CTRL_1		Parts List Control cabinet 1		
	1	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++CT +CTRL_2.1		Parts List Control cabinet 2 Cabinet door		
	1	PARTS LIST	30.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPC ++CT +CTRL.1		Parts List		
	1	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++FAN		Parts List FAN		
	1	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++Container		Parts List		
	1	PARTS LIST	30.03.2023	Freqcon_DG
&EPA ++CONV		Summarized part list		
	1	SUMMARIZED PARTS LIST	30.03.2023	Freqcon_DG
	2	SUMMARIZED PARTS LIST	30.03.2023	Freqcon_DG
&EPA ++CT		Summarized part list		
	1	SUMMARIZED PARTS LIST	30.03.2023	Freqcon_DG
	2	SUMMARIZED PARTS LIST	30.03.2023	Freqcon_DG
&EPA ++Container		Summarized part list		
	1	SUMMARIZED PARTS LIST	30.03.2023	Freqcon_DG
&EMB		Cable list		
	1	CABEL LIST	30.03.2023	Freqcon_DG
&EMB ++CONV		Cable list		
	1	CABEL LIST	30.03.2023	Freqcon_DG
	2	CABEL LIST	30.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CONV		Cable list		
	3	CABEL LIST	30.03.2023	Freqcon_DG
	4	CABEL LIST	30.03.2023	Freqcon_DG
	5	CABEL LIST	30.03.2023	Freqcon_DG
	6	CABEL LIST	30.03.2023	Freqcon_DG
	7	CABEL LIST	30.03.2023	Freqcon_DG
	8	CABEL LIST	30.03.2023	Freqcon_DG
	9	CABEL LIST	30.03.2023	Freqcon_DG
	10	CABEL LIST	30.03.2023	Freqcon_DG
	11	CABEL LIST	30.03.2023	Freqcon_DG
	12	CABEL LIST	30.03.2023	Freqcon_DG
	13	CABEL LIST	30.03.2023	Freqcon_DG
	14	CABEL LIST	30.03.2023	Freqcon_DG
	15	CABEL LIST	30.03.2023	Freqcon_DG
	16	CABEL LIST	30.03.2023	Freqcon_DG
&EMB ++CONV +CIR		Cable list Circuit Breaker cabinet		
	1	CABEL LIST	30.03.2023	Freqcon_DG
	2	CABEL LIST	30.03.2023	Freqcon_DG
	3	CABEL LIST	30.03.2023	Freqcon_DG
&EMB ++CT		Cable list		
	1	CABEL LIST	30.03.2023	Freqcon_DG
	2	CABEL LIST	30.03.2023	Freqcon_DG
	3	CABEL LIST	30.03.2023	Freqcon_DG
	4	CABEL LIST	30.03.2023	Freqcon_DG
	5	CABEL LIST	30.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++CT		Cable list		
	6	CABEL LIST	30.03.2023	Freqcon_DG
	7	CABEL LIST	30.03.2023	Freqcon_DG
	8	CABEL LIST	30.03.2023	Freqcon_DG
	9	CABEL LIST	30.03.2023	Freqcon_DG
	10	CABEL LIST	30.03.2023	Freqcon_DG
&EMB ++FAN		Cable list FAN		
	1	CABEL LIST	30.03.2023	Freqcon_DG
	2	CABEL LIST	30.03.2023	Freqcon_DG
&EMB ++EXTERN		Cable list		
	1	CABEL LIST	30.03.2023	Freqcon_DG
&EMZ +CTRL.3		Terminals Main mounting plate		
	1000	Klemmenleistenübersicht : =UNIT_01+++CTRL.3-XE - =UNIT_01+++CTRL.3-XE	31.03.2023	Freqcon_DG
	2000	Klemmenplan =UNIT_01+++CTRL.3-XE	31.03.2023	Freqcon_DG
&EMZ ++CONV +IND		Terminals Inductor cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+IND-207L1.1 - =UNIT_01++CONV+IND-217L1.3	31.03.2023	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+IND-207L1.1	31.03.2023	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+IND-207L1.2	31.03.2023	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+IND-207L1.3	31.03.2023	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+IND-211L1.1	31.03.2023	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+IND-211L1.2	31.03.2023	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+IND-211L1.3	31.03.2023	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CONV+IND-217L1.1	31.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CONV +IND		Terminals Inductor cabinet		
	2007	Klemmenplan =UNIT_01++CONV+IND-217L1.2	31.03.2023	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CONV+IND-217L1.3	31.03.2023	Freqcon_DG
&EMZ ++CONV +CIR		Terminals Circuit Breaker cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+CIR-227U1-X3.1 - =UNIT_01++CONV+CIR-237U1-X3.2	31.03.2023	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.1	31.03.2023	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+CIR-227U1-X3.2	31.03.2023	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.1	31.03.2023	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.2	31.03.2023	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	31.03.2023	Freqcon_DG
	2005	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.2	31.03.2023	Freqcon_DG
&EMZ ++CONV +AC_DC		Terminals AC and DC connection cabinet		
	1000	Klemmenleistenübersicht : =UNIT_01++CONV+AC_DC-X3.43 - =UNIT_01++CONV+AC_DC-X3.43	31.03.2023	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	31.03.2023	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	31.03.2023	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	31.03.2023	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CONV+AC_DC-X3.43	31.03.2023	Freqcon_DG
&EMZ ++CT +CTRL_1.3		Terminals Control cabinet 1 Main mounting plate		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.3-X1 - =UNIT_01++CT+CTRL_1.3-XV	31.03.2023	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	31.03.2023	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	31.03.2023	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	31.03.2023	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	31.03.2023	Freqcon_DG
	2004	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.11	31.03.2023	Freqcon_DG

previous page: 10

next page: 12

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++CT +CTRL_1.3		Terminals Control cabinet 1 Main mounting plate		
	2005	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.12	31.03.2023	Freqcon_DG
	2006	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.13	31.03.2023	Freqcon_DG
	2007	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	31.03.2023	Freqcon_DG
	2008	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	31.03.2023	Freqcon_DG
	2009	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5.1	31.03.2023	Freqcon_DG
	2010	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	31.03.2023	Freqcon_DG
	2011	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	31.03.2023	Freqcon_DG
	2012	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	31.03.2023	Freqcon_DG
	2013	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	31.03.2023	Freqcon_DG
	2014	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	31.03.2023	Freqcon_DG
	2015	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	31.03.2023	Freqcon_DG
	2016	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC3	31.03.2023	Freqcon_DG
	2017	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC4	31.03.2023	Freqcon_DG
	2018	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.1	31.03.2023	Freqcon_DG
	2019	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.2	31.03.2023	Freqcon_DG
	2020	Klemmenplan =UNIT_01++CT+CTRL_1.3-XE	31.03.2023	Freqcon_DG
	2021	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	31.03.2023	Freqcon_DG
	2022	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	31.03.2023	Freqcon_DG
	2023	Klemmenplan =UNIT_01++CT+CTRL_1.3-190XT1	31.03.2023	Freqcon_DG
	2024	Klemmenplan =UNIT_01++CT+CTRL_1.3-XV	31.03.2023	Freqcon_DG
&EMZ ++CT +CTRL_1.4		Terminals Control cabinet 1 Right side		
	1000	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.4-350X1.21 - =UNIT_01++CT+CTRL_1.4-XV.20	31.03.2023	Freqcon_DG
	2000	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	31.03.2023	Freqcon_DG
	2001	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.22	31.03.2023	Freqcon_DG
	2002	Klemmenplan =UNIT_01++CT+CTRL_1.4-XE2	31.03.2023	Freqcon_DG
	2003	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	31.03.2023	Freqcon_DG

previous page: 11

next page: 13

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++FAN		Terminals FAN		
	1000	Klemmenleistenübersicht : =UNIT_01++FAN+-52G1-181X1 - =UNIT_01++FAN+-52G1-181X3	31.03.2023	Freqcon_DG
	2000	Klemmenplan =UNIT_01++FAN+-52G1-181X1	31.03.2023	Freqcon_DG
	2001	Klemmenplan =UNIT_01++FAN+-52G1-181X3	31.03.2023	Freqcon_DG

previous page: 12

next page: &EAC/1a

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/13

next page: 6a

SPECIFICATION of grounding

	from frame to			
1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Editor	Freqcon_DG			Statron	FREQCON	Specification Earthing	ANL1_20230331_V0.01	= UNIT_01 Converter Container 1
Date	02.03.2023	Norm						& EAC Explanatory documents
Proved by	FREQCON_HK			Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 6a
Date	19.06.2019							+ total: 423

Single line diagram

=UNIT_01++CONV

+AC_DC | +CIR | +IND | +CON | +IND | +CIR | +AC_DC

medium voltage transformer
-18T1
1MVA
6,6kV/0,62 kV AC
Gehäuse Erdung

V1_L1 V1_L2 V1_L3
-78W1 - 78W3
GRID L1 -L3
&EFS++CONV/78.3

NSGAFöu 3x4x70mm²

3WL1112-2BB36-1BJ2-Z
A08+K07+M06+M21+R10

-80Q1
max.
1250 A
&EFS++CONV/80.0

-83U1
Filter Caps 3*600µF
Overvoltage protect
&EFS++CONV/83.2

PT100
201L1 - 203L1
Inductor
1*1000A
0,2mH
&EFS++CONV/201.1

PIII 1_1 - PIII_1_3
201Q1 - 203Q1
1000A Stack x 3
AC
DC

V1_DC+ V1_DC-
UDC +
UDC N
UDC -

PIII 2_1 - PIII_2_3
-211Q1
3X250A Stack
DC DC DC DC DC DC

PT100
-211L1
&EFS++CONV/211.1
0,6mH
3*250A

-231U1
&EFS++CONV/231.0
DC Switch & Fuse 3*250A
Filter Caps 3*340µF
-K1 -K7 -K2 -K8 -K3 -K9
-F1 -F2 -F5 -F6 -F9 -F10
1500V 300A
1250V 400A
-C1 -C7 -C13 340µF

V2_L1 V2_L3 V2_L2
V2_DC+ V2_DC- V2_Ub

NSGAFöu 6x1x70mm²

-224W10 DC 1.4 + Pos.
-224W11 DC 1.4 - Pos.
-224W12 DC 1.5 + Pos.
-224W13 DC 1.5 - Pos.
-224W14 DC 1.6 + Pos.
-224W15 DC 1.6 - Pos.

HELUTHERM 2x1x70mm²

=UNIT_02++
BAT 1-3
BAT 4+5
BAT 6-8
LFP Battery Modul

PIII 3_1 - PIII_3_3
-207Q1
3X250A Stack

PT100
-207L1
&EFS++CONV/207.1
0,6mH
3*250A

-227U1
&EFS++CONV/227.0

V3_L1 V3_L3 V3_L2
V3_DC+ V3_DC- V3_Ub

NSGAFöu 6x2x70mm²

-231W10 DC 2.1 + Pos.
-231W11 DC 2.1 - Pos.
-231W12 DC 2.2 + Pos.
-231W13 DC 2.2 - Pos.
-231W14 DC 2.3 + Pos.
-231W15 DC 2.3 - Pos.

HELUTHERM 2x1x70mm²

=UNIT_03++
BAT 1-3
BAT 4+5
BAT 6-8
BAT 9-11
LFP Battery Modul

PIII 4_1 - PIII_4_3
-217Q1
3X250A Stack

PT100
-217L1
&EFS++CONV/217.1
0,6mH
3*250A

-237U1
&EFS++CONV/237.0

V4_L1 V4_L3 V4_L2
V4_DC+ V4_DC- V4_Ub

NSGAFöu 6x2x70mm²

-234W10 DC 2.4 + Pos.
-234W11 DC 2.4 - Pos.
-234W12 DC 2.5 + Pos.
-234W13 DC 2.5 - Pos.
-234W14 DC 2.6 + Pos.
-234W15 DC 2.6 - Pos.

HELUTHERM 2x1x70mm²

=UNIT_04++
BAT 1-3
BAT 4+5
BAT 6-8
BAT 9-11
LFP Battery Modul

N
78W4:N
&EFS++CONV/78.3
PEN
78W5:PE
&EFS++CONV/78.2

UDC_LINK_+ 2a.2 /
UDC_LINK_N 2a.5 /
UDC_LINK_- 2a.2 /

previous page: &EAC/6a
next page: 2a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	ANL1_20230331_V0.01	= UNIT_01	Converter Container 1
Date	31.03.2023	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 1a
Date								+	total: 423

Single line diagram

++CONV

Control circuit

CTRL /

UDC_LINK_+ /1a.4

UDC_LINK_- /1a.4

UDC_LINK_N /1a.4

+CTRL

+4

-173F2 10A

-173F3 1A

-173K2 1500V 30A DC

-173R3 500 Ohm 150 W

-173R4 500 Ohm 150 W

-173K1 1500V 30A DC

-173R1 500 Ohm 150 W

-173R2 500 Ohm 150 W

V1_DC-

V1_DC+

V1_L1 V1_L2 V1_L3

+4

-85U1 L1 L2 L3 DC+ DC-

-171F1 10A

-171K1 1500V 50A DC

-171K2 1500V 50A DC

-171R1 15 Ohm 300W

-171R2 15 Ohm 300W

Grid 400V
inc. overvotage fuse
& Fuse ??A(20A)

+3
Main mounting plate

1-6 -XE 1

-84F2

>+ CTRL.1 -84Q1

AC L1,L2,L3

101T1

24V DC supply unit

102G1

24V DC UPS

+24VDC GND

+ 24V DC 24V GND

-102G2

Battery

-103F1 - 103F4 F2, 10A 60VDC

+24V DC for Control Cabinet

-103F5 F2, 10A 60VDC

-186K1

-186B1

24V Supply Main PLC ET200SP

24V GND

Precharge Resistors

400V AC Control Cabinet

Thermostat for start PLC

previous page: 1a

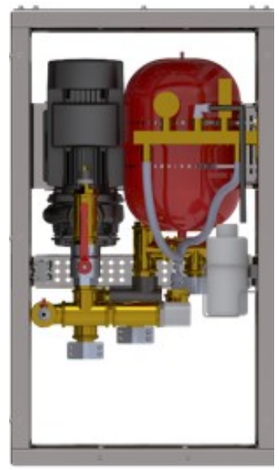
next page: &ELU/5a

Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	ANL1_20230331_V0.01	= UNIT_01	Converter Container 1
Date	31.03.2023	Norm						& EFA	Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 2a
Date								+	total: 423









+CTRL_1
Control cabinet 1

+CTRL_2
Control cabinet 2

++Steuerschränke

+CON
Converter cabinet

+IND
Inductor cabinet

+CTRL_1
Control cabinet 1

+AC_DC
AC and DC connection cabinet

++CONV

++FAN
FAN

previous page:
&EFA/2a

next page:
&EFS++CONV/78

Editor	Freqcon_DG			Statron	FREQCON	CABINETS OVERVIEW	ANL1_20230331_V0.01	= UNIT_01	Converter Container 1
Date	31.03.2023	Norm						& ELU	Cabinet Overview
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 423

Grid Busbars L1, L2, L3

+AC_DC-78W1 GRID L1 Pos. 5/ Links
Cu 100mm x 10mm x 370mm FRQ 52163
&EFA++/1a.0

+AC_DC-78W2 GRID L2 Pos. 5/ Mitte
Cu 100mm x 10mm x 370mm FRQ 52163

+AC_DC-78W3 GRID L3 Pos. 5/ Rechts
Cu 100mm x 10mm x 370mm FRQ 52163

4x70 mm² NSGAFöu BK → -L1CON1 / 80.0
4x70 mm² NSGAFöu BK → -L2CON1 / 80.0
4x70 mm² NSGAFöu BK → -L3CON1 / 80.0

25 mm² NSGAFöu BK

+AC_DC -78F1
690Vac
100A gL/gG
NH00
1 3 5 / 2 4 6
13 21 / 14 22
/78.8

-1F2 / ++CT/127.4
F3 / 238b.9

-238W7 OZ-500 2x0,75 mm² /238a.2
0,75 mm² BU
2

+AC_DC -X3.43
20 19

-78W7 OZ-500 2x0,75 mm²
1 2
13 14

+AC_DC -78F1 /78.6
0,75 mm² BU
11 12

Busbars N

+AC_DC-78W4 GRID N &ELU++/1a.1 Pos. unten Links
Cu 50mm x 10mm x 370mm FRQ 50622

2x70 mm² NSGAFöu BK → GRID_N / 99.5

16 mm² NSGA Föu BK
-AC_F_N.1 / 83.3
-AC_F_N.2 / 83.3
-AC_F_N.3 / 83.3

25 mm² BK
L1 L2 L3

+AC_DC -78F2
Typ 1 + Typ 2
400/690 V~
PE PE

35 mm² GNYE

+AC_DC -78F3
20A, aR
2 4 6

-78W6 OZ-600 3x2,5 mm² 0,6kV/1kV
1 2 3

-CHA_L1 / ++CT/85.1
-CHA_L2 / ++CT/85.1
-CHA_L3 / ++CT/85.1

Einspeisung_IEC_Seite 78
Einbauort_Sicherung in Connection cabinet

Busbars PE

+AC_DC-78W5 GRID PE &ELU++/1a.1 Pos. unten rechts
Cu 50mm x 10mm x 370mm FRQ 50622

PE

95 mm² GNYE
35 mm² GNYE

PE_2_1 / 238a.1
PE_2_2 / 238a.4
PE_2_3 / 238a.8
PE_3_1 / 228.1
PE_3_2 / 228.4
PE_3_3 / 228.8
PE_4_1 / 238b.1
PE_4_2 / 238b.4
PE_4_3 / 238b.8

=UNIT_02
PE_BAT_CONV_1 =UNIT_02++/278.1/
=UNIT_03
PE_BAT_CONV_2 =UNIT_03++/278.1/

400V TYP 1

L1 L2 L3 N PE

Grid connection xxxkVA, xxxV AC, max. xxx A

PE Container
PE Cabinet base frame front side
PE Cabinet base frame back side

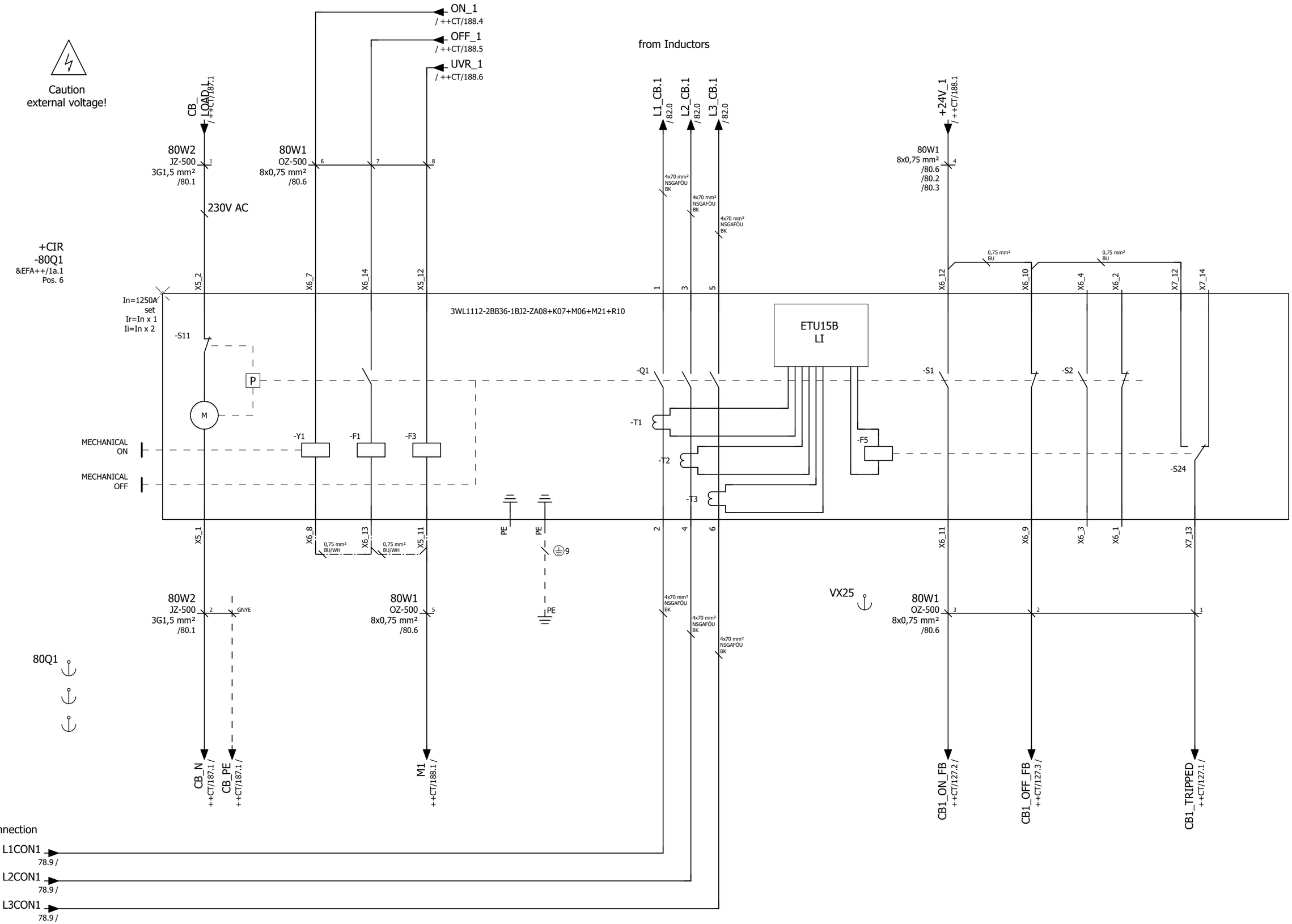
TN-C-S System
Generator/ Transformator
L1 L2 L3 N PE
PEN
Verbraucher
Betriebserder
Anlagenerder

IT-System
Generator oder Transformator
L1 L2 L3 N
Verbraucher PE

previous page: &ELU++/5a

next page: 80

Editor	Freqcon_DG			Statron	FREQCON	GRID CONNECTION	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 78
Date								+ total: 423



previous page: 78

next page: 82

Editor	Freqcon_DG			Statron	FREQCON	BG CIRCUIT BREAKER 1000A AC GRID	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 80
Date								+ total: 423

L1_CB.1
80.5 /

L2_CB.1
80.5 /

L3_CB.1
80.5 /

1000A

16 mm²;16 mm² NSGAFÖU BK -NF1.L1
/ 83.3

16 mm²;16 mm² NSGAFÖU BK -NF1.L2
/ 83.3

16 mm²;16 mm² NSGAFÖU BK -NF1.L3
/ 83.3

4x70 mm² NSGAFÖu BK L_IGBT 1
201.0 /

4x70 mm² NSGAFÖu BK L_IGBT 2
202.0 /

4x70 mm² NSGAFÖu BK L_IGBT 3
203.0 /

AWG	mm²
18	0,75
16	1
14	1,5
12	2,5
12 *	2,5 NSGAFÖu
10	4
6	10
6 *	10 NSGAFÖu
4	16
2	25
2 *	16 NSGAFÖu
1	35
250 kcmil	95 ALU
2x2	1x70 NSGAFÖu
2x4	2x70 NSGAFÖu
4x250 kcmil	4x70 NSGAFÖu
6x250 kcmil	6x70 NSGAFÖu

* cable into seperate UL protective tube

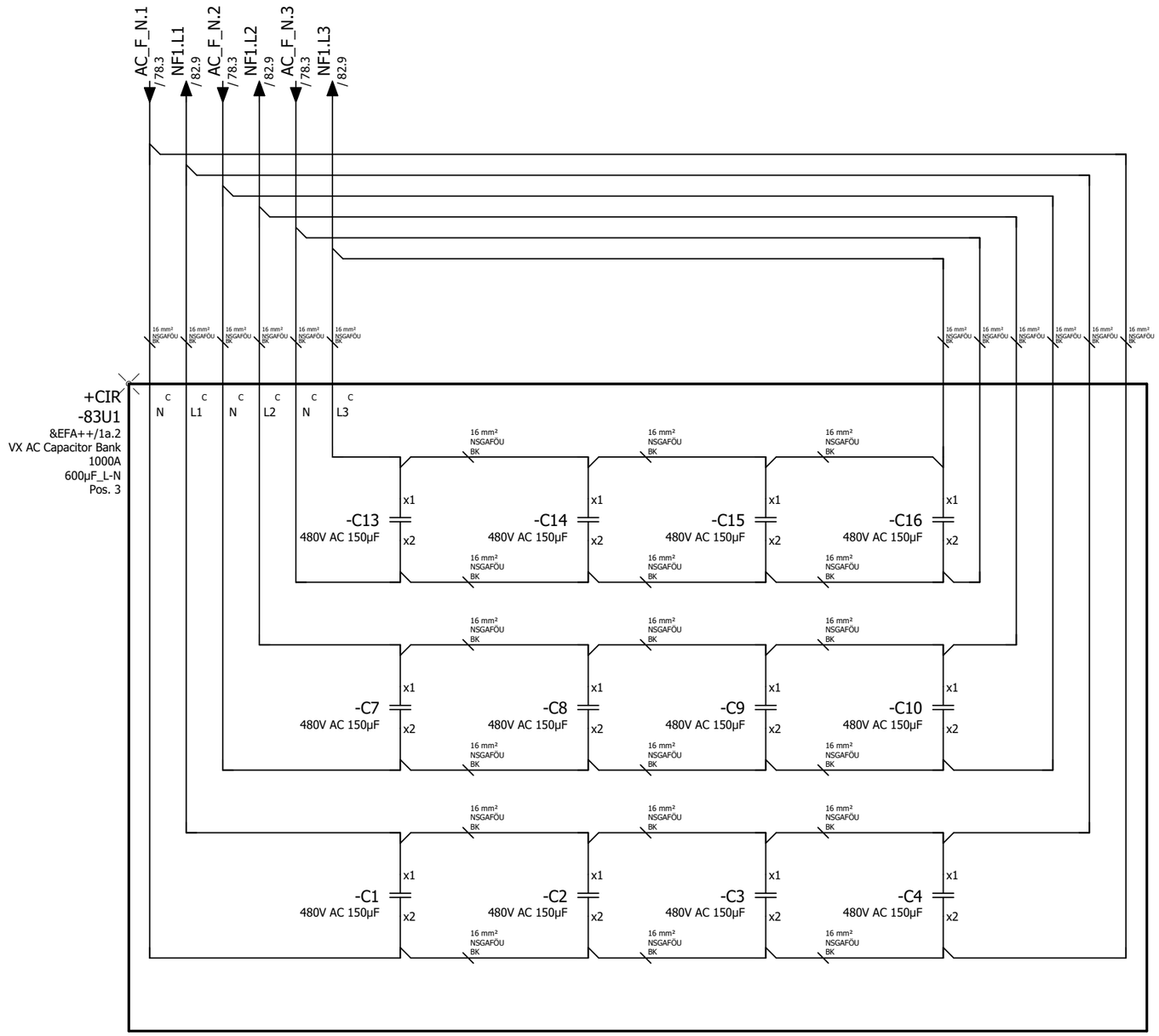
previous page:
80

next page:
83

Editor	Freqcon_DG			Statron	FREQCON	PI INDUCTORS GRID SIDE	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	page: 82
Date								+	total: 423

to polarity bar

behind main breaker



VX25

83U1

AWG	mm²
18	0,75
16	1
14	1,5
12	2,5
12 *	2,5 NSGAFöu
10	4
6	10
6 *	10 NSGAFöu
4	16
2	25
2 *	16 NSGAFöu
1	35
250 kcmil	95 ALU
2x2	1x70 NSGAFöu
2x4	2x70 NSGAFöu
4x250 kcmil	4x70 NSGAFöu
6x250 kcmil	6x70 NSGAFöu

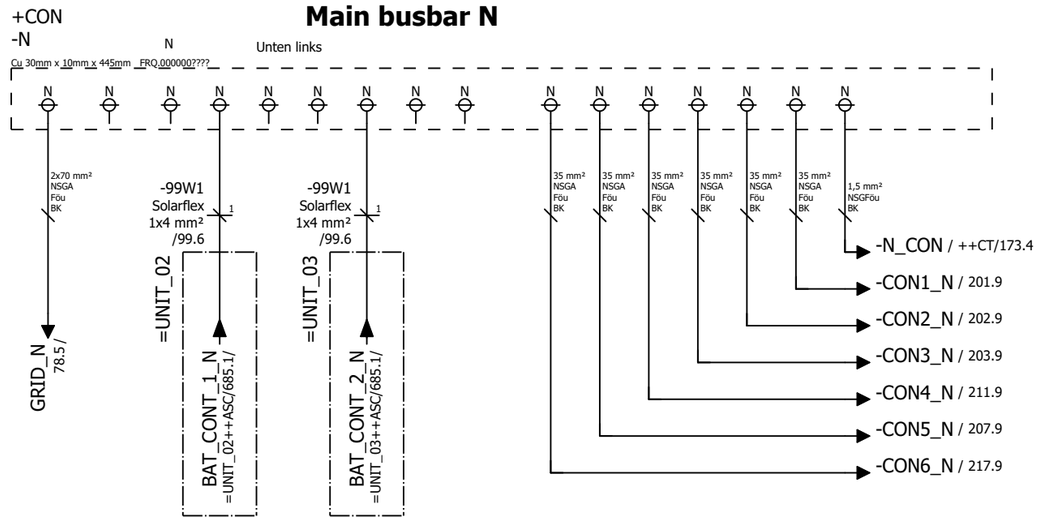
* cable into seperate UL protective tube

previous page: 82

next page: 99

Editor	Freqcon_DG			Statron	FREQCON	GRID AC FILTER 3* 600 µF + OVERVOLTAGE PROTECTOR	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 83
Date								+ total: 423

in converter cabinet



1000A

previous page: 83

next page: 200

Editor	Freqcon_DG			Statron	FREQCON	BUSBARS N, PE	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	page: 99
Date								+	total: 423

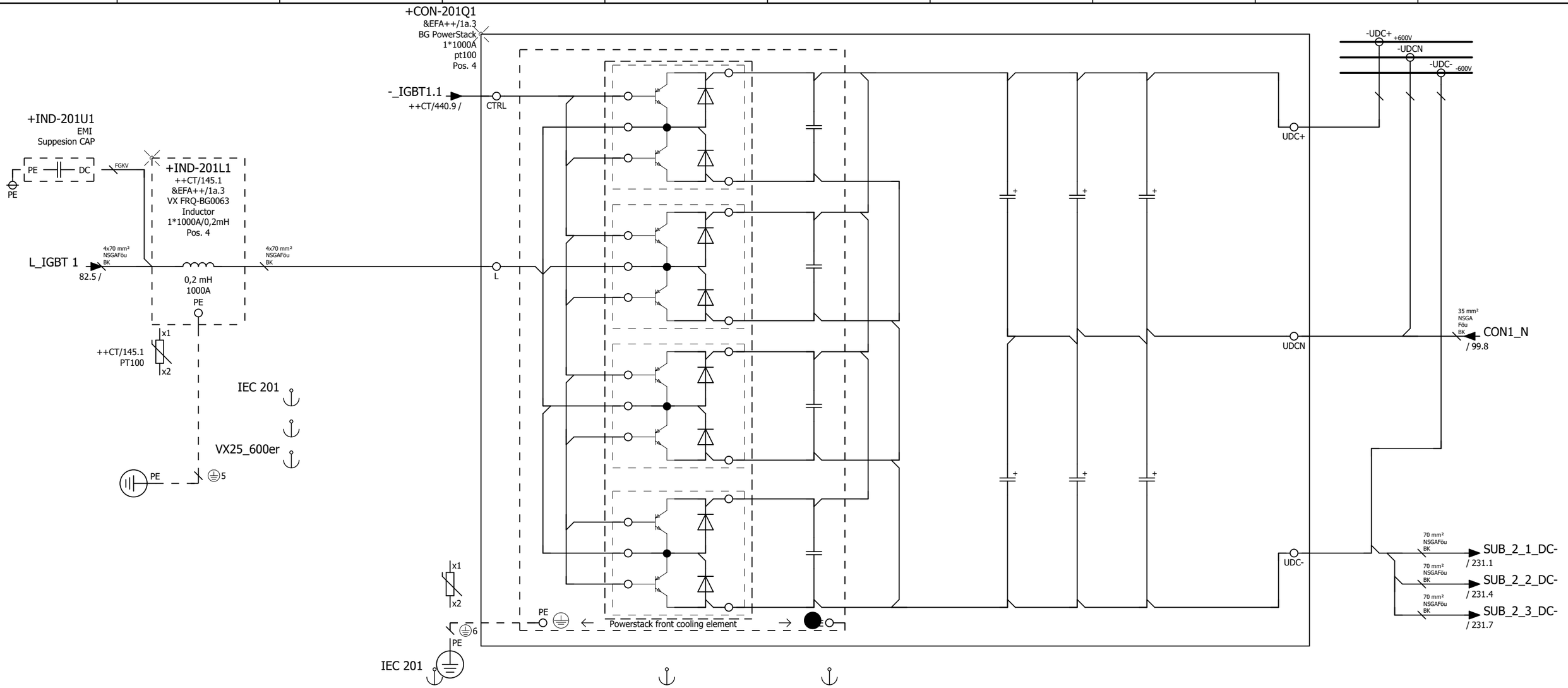
Power Circuits

Pages 200 - 299

- Converter cabinet
- Inductor cabinet
- Circuit Breaker cabinet

previous page: 99

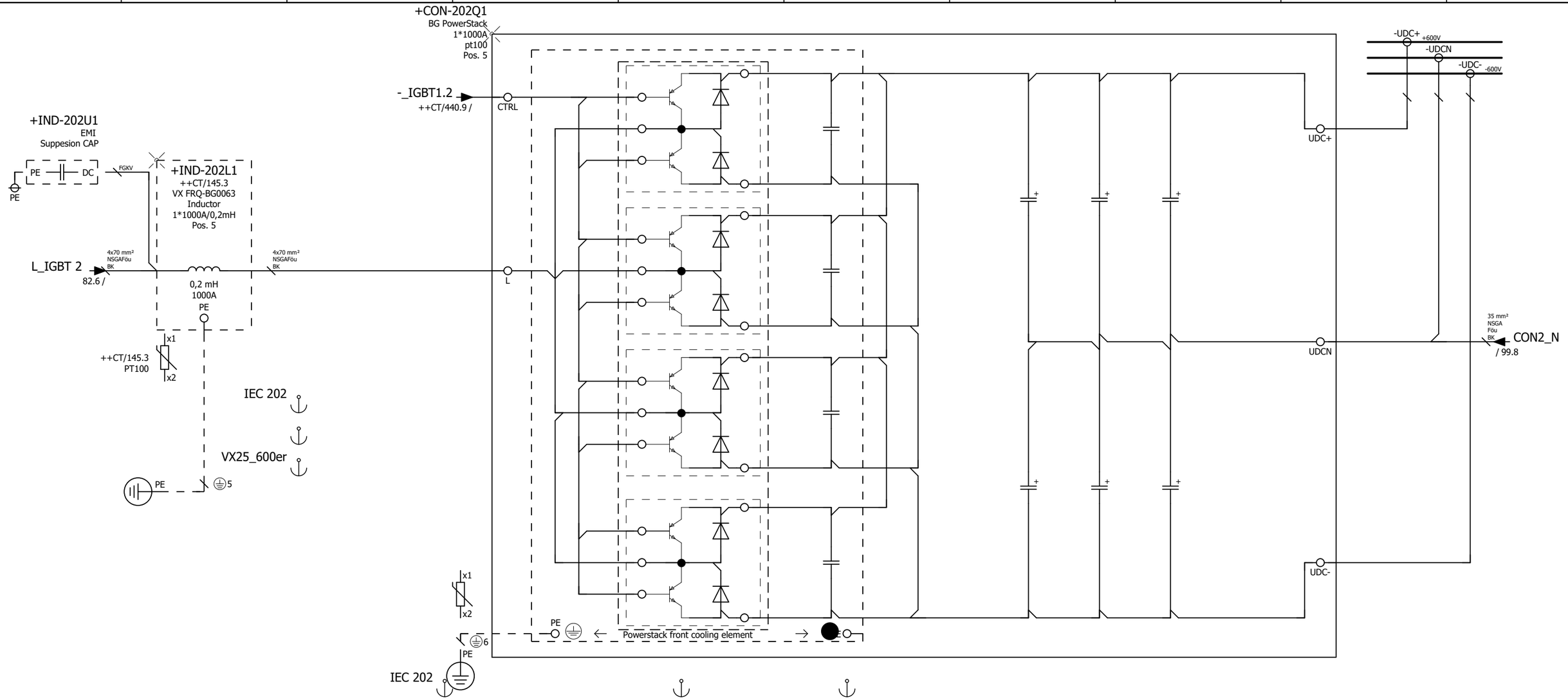
next page: 201



previous page: 200

next page: 202

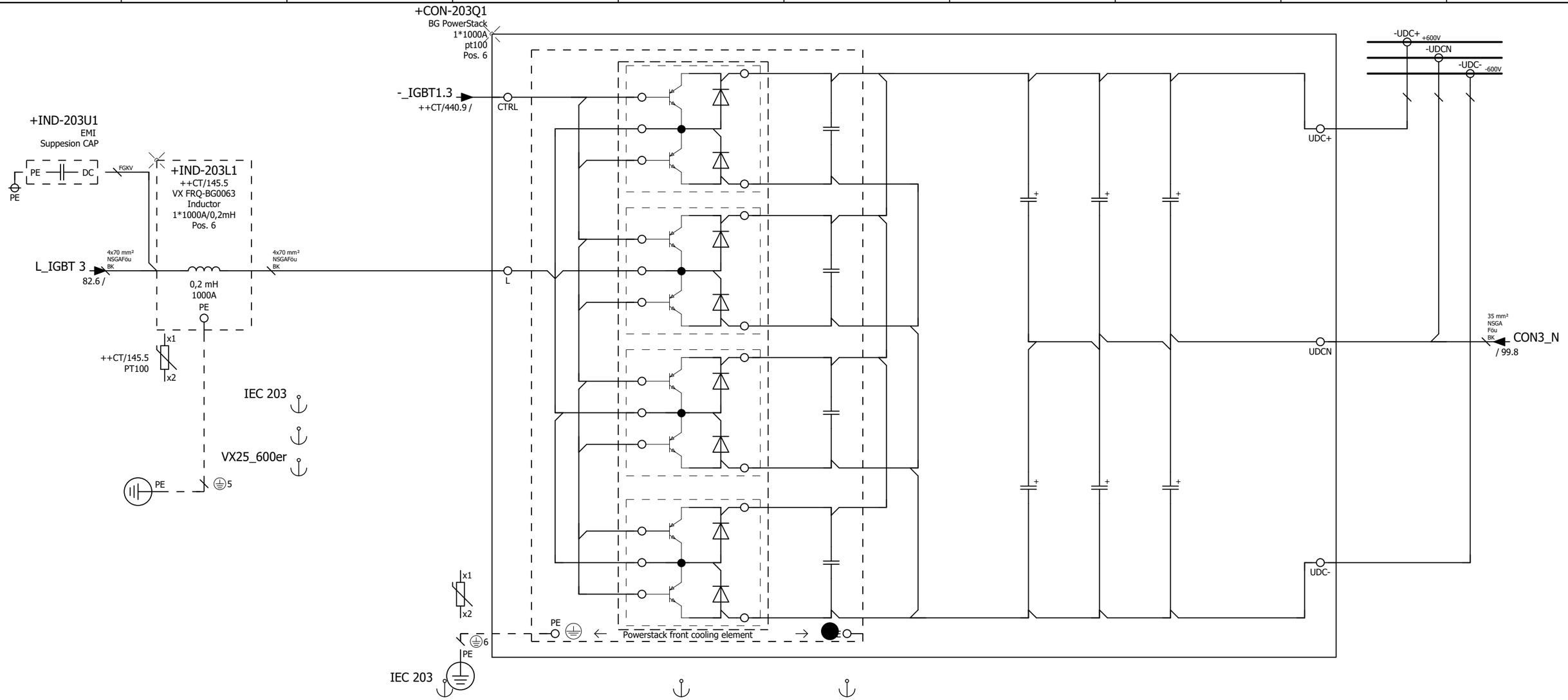
Editor	Freqcon_DG			Statron	FREQCON	IGBT & INDUCTOR FOR GRID PHASE 1	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	page: 201
Date								+	total: 423



previous page:
201

next page:
203

Editor	Freqcon_DG			Statron		IGBT & INDUCTOR FOR GRID PHASE 2	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	page: 202
Date								+	total: 423



previous page:
202

next page:
207

Editor	Freqcon_DG			Statron		IGBT & INDUCTOR FOR GRID PHASE 3	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	page: 203
Date								+	total: 423

+CON-207Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 1

-_IGBT3.1_2
207.9 /
CTRL

+IND-207L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 1

L_IGBT 3_1
227.0 /
70 mm² NSGAFöu BK
0,6mH
L:1

L_IGBT 3_2
227.3 /
70 mm² NSGAFöu BK
0,6mH
L:2

L_IGBT 3_3
227.6 /
70 mm² NSGAFöu BK
0,6mH
L:3

PE.1 PE.2 PE.3

IEC 204 DC

++CT/146.5
PT100
++CT/146.7
++CT/147.1
x1
x2

VX25

PE
5

x1
x2

6
PE

IEC 204

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON5_N
/ 99.8

+CON-207Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT3.1
++CT/442.9 /
X1
25-POL SUB-D SOCKET

-_IGBT3.2
++CT/442.9 /
X2
25-POL SUB-D SOCKET

-_IGBT3.3
++CT/442.9 /
X3
25-POL SUB-D SOCKET

SKiiP 3 Adapter

FRQ-M00080
FREQCON

Shield connect by a ring cable lug
SH

X4
26-POL Stiftleiste (für Flachband) SOCKET
-_IGBT3.1_2
/ 207.3

previous page: 203
next page: 211

Editor	Freqcon_DG			Statron	FREQCON	IGBT & INDUCTOR SUB 3_1 - 3_3	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 207
Date								+ total: 423

+CON-211Q1
&EFA++/1a.4
VX BG PowerStack
3*250A
Pos. 2

-_IGBT2.1_2
211.9 /
CTRL

+IND-211L1
&EFA++/1a.5
VX FRQ-BG0060
Inductor
3*250A/0,6mH
Pos. 2

L_IGBT 2_1
231.0 /
70 mm² NSGAFöu BK
0,6mH
L:1

L_IGBT 2_2
231.3 /
70 mm² NSGAFöu BK
0,6mH
L:2

L_IGBT 2_3
231.6 /
70 mm² NSGAFöu BK
0,6mH
L:3

PE.1 PE.2 PE.3

IEC 211 DC

++CT/145.7
PT100
x1 x2

++CT/146.1
x1 x2

++CT/146.3
x1 x2

VX25

PE 5

PE 5

PE 5

x1 x2

6 PE

IEC 211

-UDC+ +600V
-UDCN
-UDC- -600V

UDC+
UDCN
UDC-

35 mm² NSGA Föu BK
CON4_N
/ 99.8

+CON-211Q1-U1
FRQ-M00080-1
Pos. 1

-_IGBT2.1
++CT/441.9 /
X1
25-POL SUB-D SOCKET

-_IGBT2.2
++CT/441.9 /
X2
25-POL SUB-D SOCKET

-_IGBT2.3
++CT/441.9 /
X3
25-POL SUB-D SOCKET

SKiiP 3 Adapter

FRQ-M00080
FREQCON

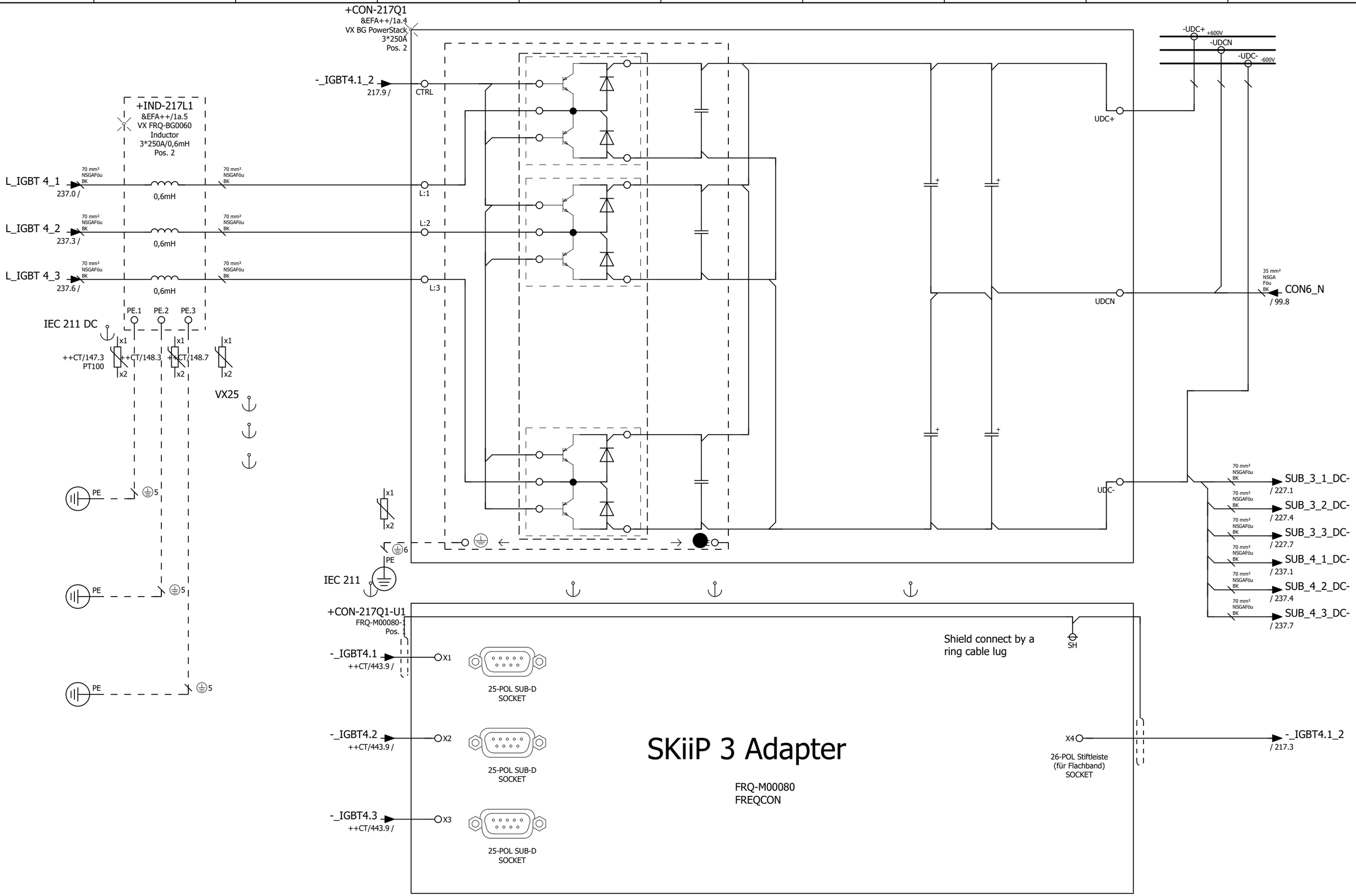
Shield connect by a ring cable lug
SH

X4
26-POL Stiftleiste (für Flachband) SOCKET
-_IGBT2.1_2
/ 211.3

previous page: 207

next page: 217

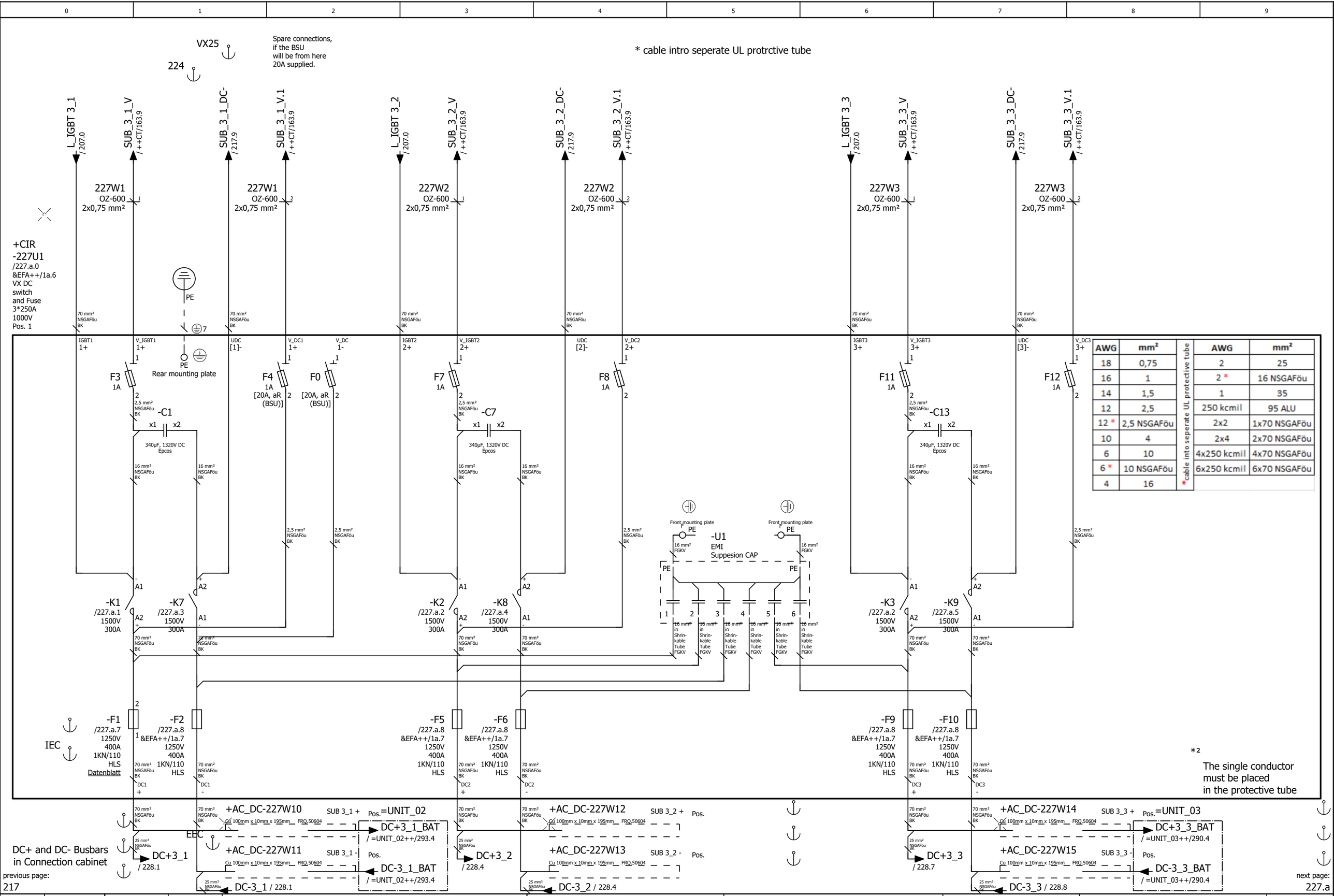
Editor	Freqcon_DG			Statron	FREQCON	IGBT & INDUCTOR SUB 2_1 -2_3	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 211
Date								+ total: 423



previous page: 211

next page: 227

Editor	Freqcon_DG			Statron	FREQCON	IGBT & INDUCTOR SUB 4_1 -4_3	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	page: 217
Date								+	total: 423



AWG	mm²	* cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

Editor	Freqcon_DG			Statron	
Date	30.03.2023				
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Date					

FREQCON

SUBSYSTEM 3_1 - 3_1
DC 3 x 250A

20230331_V0.01

10354_23A2007

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CONV	page:	227
+		total:	423

Adern 2, 5, 8, 11, 14 einseitig am switch and fuse anschließen. Im Steuerschrank abschrumpfen

224

-SUB_3_1_K_+ /++CT/350.2
-SUB_3_3_K_+ /++CT/351.4
-SUB_3_1_K_- /++CT/350.4
-SUB_3_3_K_- /++CT/351.6
SUB_3_1_+ /++CT/306.b.1
SUB_3_3_+ /++CT/306.b.7
SUB_3_1_- /++CT/306.b.2
SUB_3_3_- /++CT/306.b.8
SUB_3_1_F1_F2 /++CT/130.9
SUB_3_3_F1_F2 /++CT/131.8
-SUB_3_1_L+ /++CT/131.9
-SUB_3_1_K_M /++CT/350.2

227W4
OZ-500
18x1 mm²

+CIR
-227U1
/227.0
DC
switch
and fuse
3*250A
1000V
Pos. 1

X3.1 — W5
JZ-500
15G0,75 mm²
300V
/227.a.9

DC+ / DC-

X3.2 — -K1 -K2 -K3 -K7 -K8 -K9
24V DC
HX22
/227.a.1
24V
2A

PE

-F1 /227.1 — -F5 /227.3 &EFA++/1a.7 — -F9 /227.6 &EFA++/1a.7
-F2 /227.1 &EFA++/1a.7 — -F6 /227.3 &EFA++/1a.7 — -F10 /227.7 &EFA++/1a.7
0,75 mm² BU
*2

W5
JZ-500
15G0,75 mm²
300V
/227.a.1
13 14 GNYE

A2 A1 /227.1 — T1 T2 /227.a.5
A2 A1 /227.3 — T2 T1 — T1 T2 /227.a.6
A2 A1 /227.6 — T2 T1 — T1 T2 /227.a.6
A2 A1 /227.1 — T2 T1 — T1 T2 /227.a.6
A2 A1 /227.3 — T2 T1 — T1 T2 /227.a.7
A2 A1 /227.7 — T2 T1 — T1 T2 /227.a.7

AWG	mm²		AWG	mm²
18	0,75	cable into seperate UL protective tube	2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

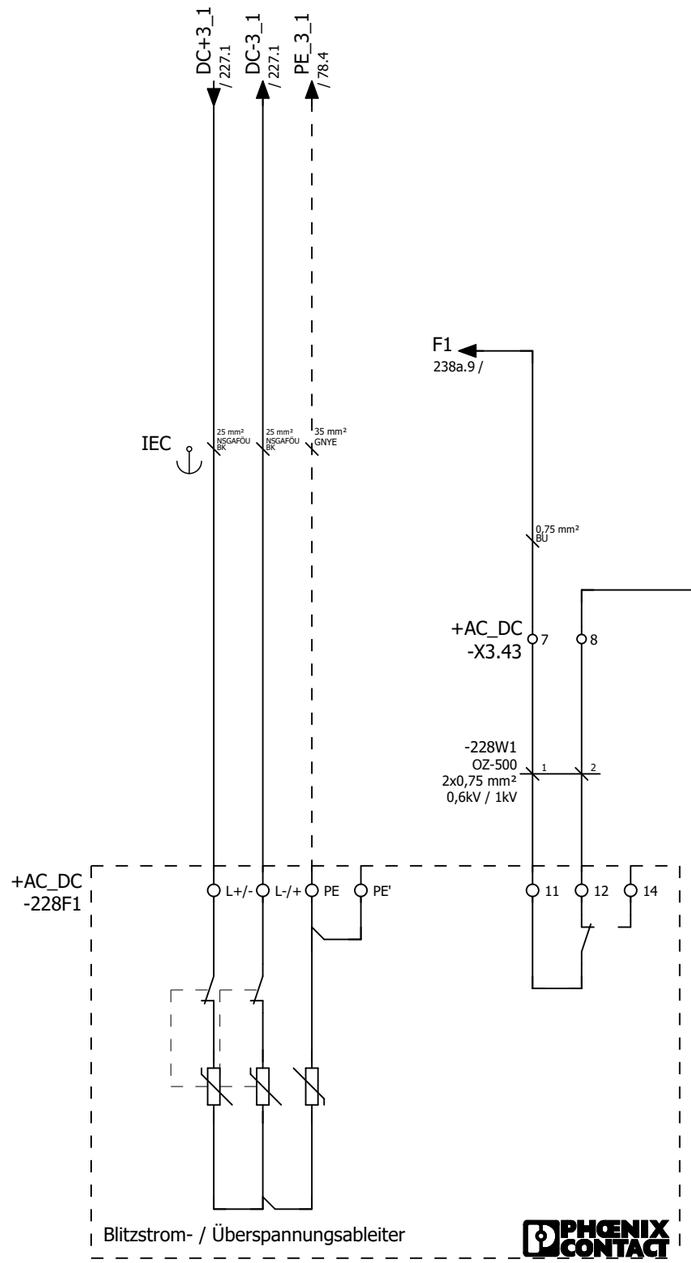
IEC

previous page: 227

next page: 228

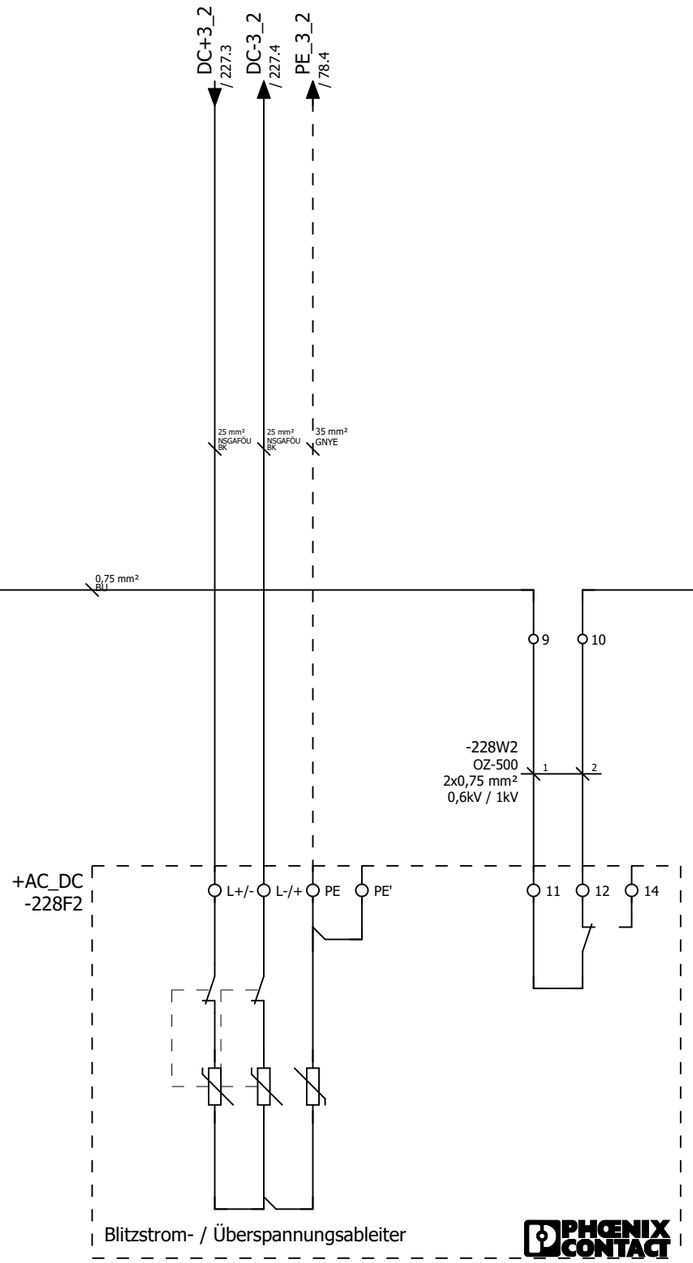
Editor	Freqcon_DG			Statron	FREQCON	SUBSYSTEM 3_1 - 3_1 DC 3 x 250A	20230331_V0.01
Date	30.03.2023						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV page: 227.a
							+ total: 423

DC+ and DC- Busbars



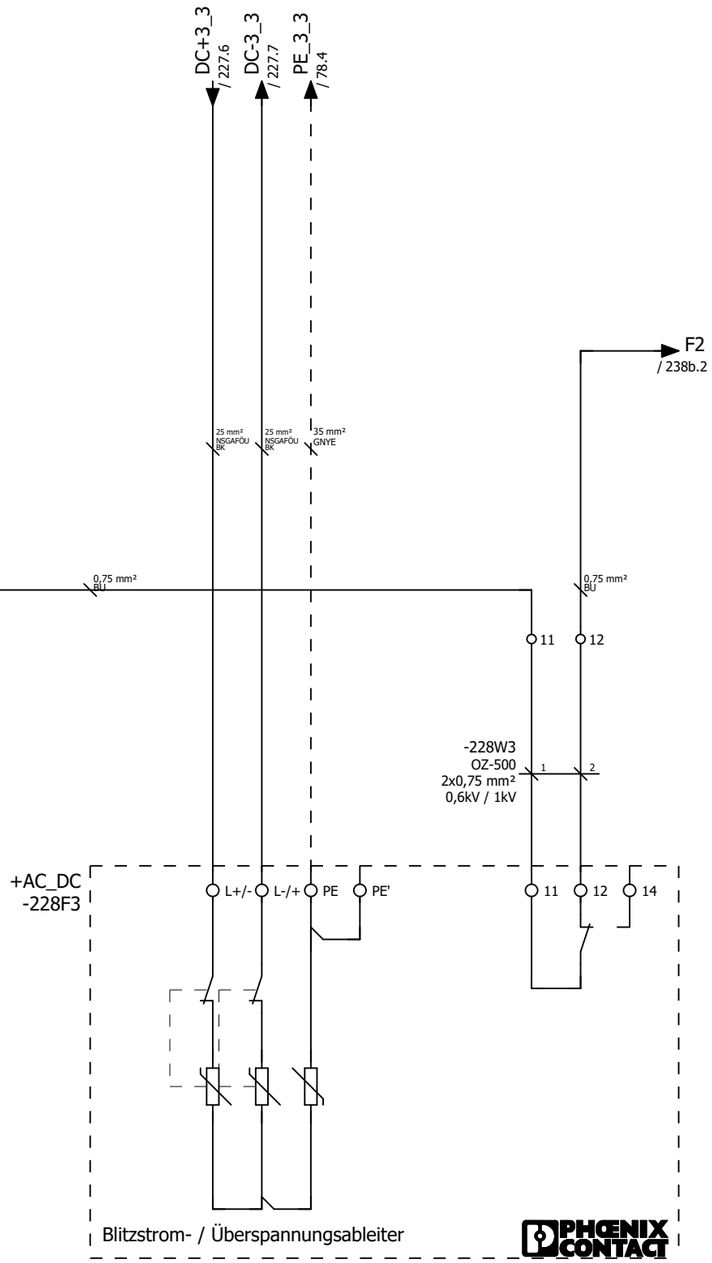
SURGE ARRESTER
DC SUBSYSTEM 3_1

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 3_2

DC+ and DC- Busbars



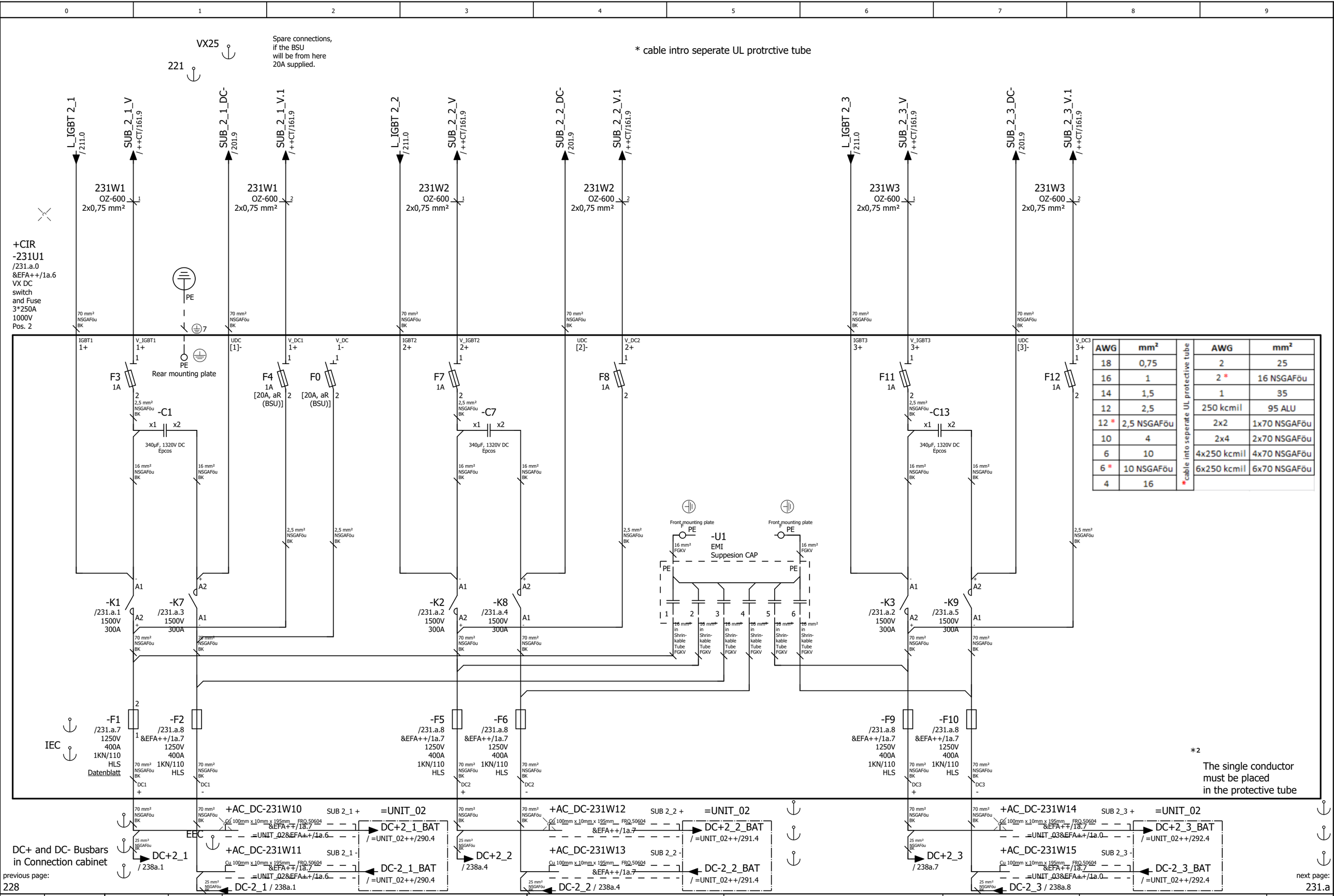
SURGE ARRESTER
DC SUBSYSTEM 3_3

in Connection cabinet

previous page:
227.a

next page:
231

Editor	Freqcon_DG			Statron	FREQCON	DC SURGE ARRESTER 3_1 - 3_3	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	page: 228
Date								+	total: 423



AWG	mm²	*cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

Editor	Freqcon_DG			Statron	
Date	30.03.2023				
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Date					

FREQCON

SUBSYSTEM 2_1 - 2_3
DC 3 x 250A

20230331_V0.01

10354_23A2007

=	UNIT_01	Converter Container 1
&	EFS	Circuit diagram
++	CONV	
+		

page: 231
total: 423

231

-SUB_2_1_K_.+ /++CT/150.2
-SUB_2_2_K_.+ /++CT/151.1
-SUB_2_3_K_.+ /++CT/151.4
-SUB_2_1_K_.- /++CT/150.4
-SUB_2_2_K_.- /++CT/151.3
-SUB_2_3_K_.- /++CT/151.6
SUB_2_1_+ /++CT/306.a.1
SUB_2_2_+ /++CT/306.a.4
SUB_2_3_+ /++CT/306.a.7
SUB_2_1_- /++CT/306.a.2
SUB_2_2_- /++CT/306.a.5
SUB_2_3_- /++CT/306.a.8
SUB_2_1_F1_F2 /++CT/129.8
SUB_2_2_F1_F2 /++CT/129.9
SUB_2_3_F1_F2 /++CT/130.8
-SUB_2_1_L+ /++CT/129.9
-SUB_2_1_K_.M /++CT/150.2

231W4
OZ-500
18x1 mm²

+CIR
-231U1
/231.0
DC
switch
and fuse
3*250A
1000V
Pos. 2

X3.1 W5
JZ-500
15G0,75 mm²
300V
/231.a.9

X3.2 -K1 -K2 -K3 -K7 -K8 -K9
/231.a.1 /231.a.2 /231.a.3 /231.a.4 /231.a.5
24V
2A

DC+
DC-

X3.2 -K1 -K2 -K3 -K7 -K8 -K9
24V DC HX22

PE

-F1 -F5 -F9
/231.1 /231.3 /231.6
&EFA++/1a.7

-F2 -F6 -F10
/231.1 /231.3 /231.7
&EFA++/1a.7

0,75 mm² BU

*2

W5
JZ-500
15G0,75 mm²
300V
/231.a.1

A2 A1 /231.1 T1 T2 /231.a.5
A2 A1 /231.3 T2 T1 T1 T2 /231.a.6
A2 A1 /231.6 T2 T1 T1 T2 /231.a.6
A2 A1 /231.1 T2 T1 T1 T2 /231.a.6
A2 A1 /231.3 T2 T1 T1 T2 /231.a.7
A2 A1 /231.7 T2 T1 T1 T2 /231.a.7

AWG	mm²	cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 231

next page: 237

Editor	Freqcon_DG			Statron	FREQCON	SUBSYSTEM 2_1 - 2_3 DC 3 x 250A	20230331_V0.01
Date	30.03.2023						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV page: 231.a
							+ total: 423

VX25

224

Spare connections, if the BSU will be from here 20A supplied.

* cable intro seperate UL protrctive tube

+CIR
-237U1
/237.a.0
&EFA++/1a.6
VX DC switch and Fuse
3*250A
1000V
Pos. 3

L_IGBT 4_1 /217.0
SUB_4_1_V /++CT/164.9
SUB_4_1_DC- /217.9
SUB_4_1_V.1 /++CT/164.9
L_IGBT 4_2 /217.0
SUB_4_2_V /++CT/164.9
SUB_4_2_DC- /217.9
SUB_4_2_V.1 /++CT/164.9
L_IGBT 4_3 /217.0
SUB_4_3_V /++CT/164.9
SUB_4_3_DC- /217.9
SUB_4_3_V.1 /++CT/164.9

237W1 OZ-600 2x0,75 mm²
237W2 OZ-600 2x0,75 mm²
237W3 OZ-600 2x0,75 mm²

PE
PE
Rear mounting plate

IGBT1 1+ / V_IGBT1 1+ / UDC [1]- / V_DC1 1+ / V_DC 1-
IGBT2 2+ / V_IGBT2 2+ / UDC [2]- / V_DC2 2+
IGBT3 3+ / V_IGBT3 3+ / UDC [3]- / V_DC3 3+

F3 1A
F4 1A [20A, aR (BSU)]
F0 [20A, aR (BSU)]
F7 1A
F8 1A
F11 1A
F12 1A

-C1 340µF, 1320V DC Epcos
-C7 340µF, 1320V DC Epcos
-C13 340µF, 1320V DC Epcos

Front mounting plate
-U1 EMI Suppesion CAP

-K1 /237.a.1 1500V 300A
-K7 /237.a.3 1500V 300A
-K2 /237.a.2 1500V 300A
-K8 /237.a.4 1500V 300A
-K3 /237.a.2 1500V 300A
-K9 /237.a.5 1500V 300A

-F1 /237.a.7 1250V 400A 1KN/110 HLS Datenblatt
-F2 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F5 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F6 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F9 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS
-F10 /237.a.8 &EFA++/1a.7 1250V 400A 1KN/110 HLS

IEC

*2 The single conductor must be placed in the protective tube

AWG	mm²	*cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

EEC

DC+ and DC- Busbars in Connection cabinet

+AC_DC-237W10 Cu 100mm x 10mm x 195mm FRQ.50604 → DC+4_1 / 238b.1
+AC_DC-237W11 Cu 100mm x 10mm x 195mm FRQ.50604 → DC-4_1 / 238b.1
+AC_DC-237W12 Cu 100mm x 10mm x 195mm FRQ.50604 → DC+4_2 / 238b.4
+AC_DC-237W13 Cu 100mm x 10mm x 195mm FRQ.50604 → DC-4_2 / 238b.4
+AC_DC-237W14 Cu 100mm x 10mm x 195mm FRQ.50604 → DC+4_3 / 238b.7
+AC_DC-237W15 Cu 100mm x 10mm x 195mm FRQ.50604 → DC-4_3 / 238b.8

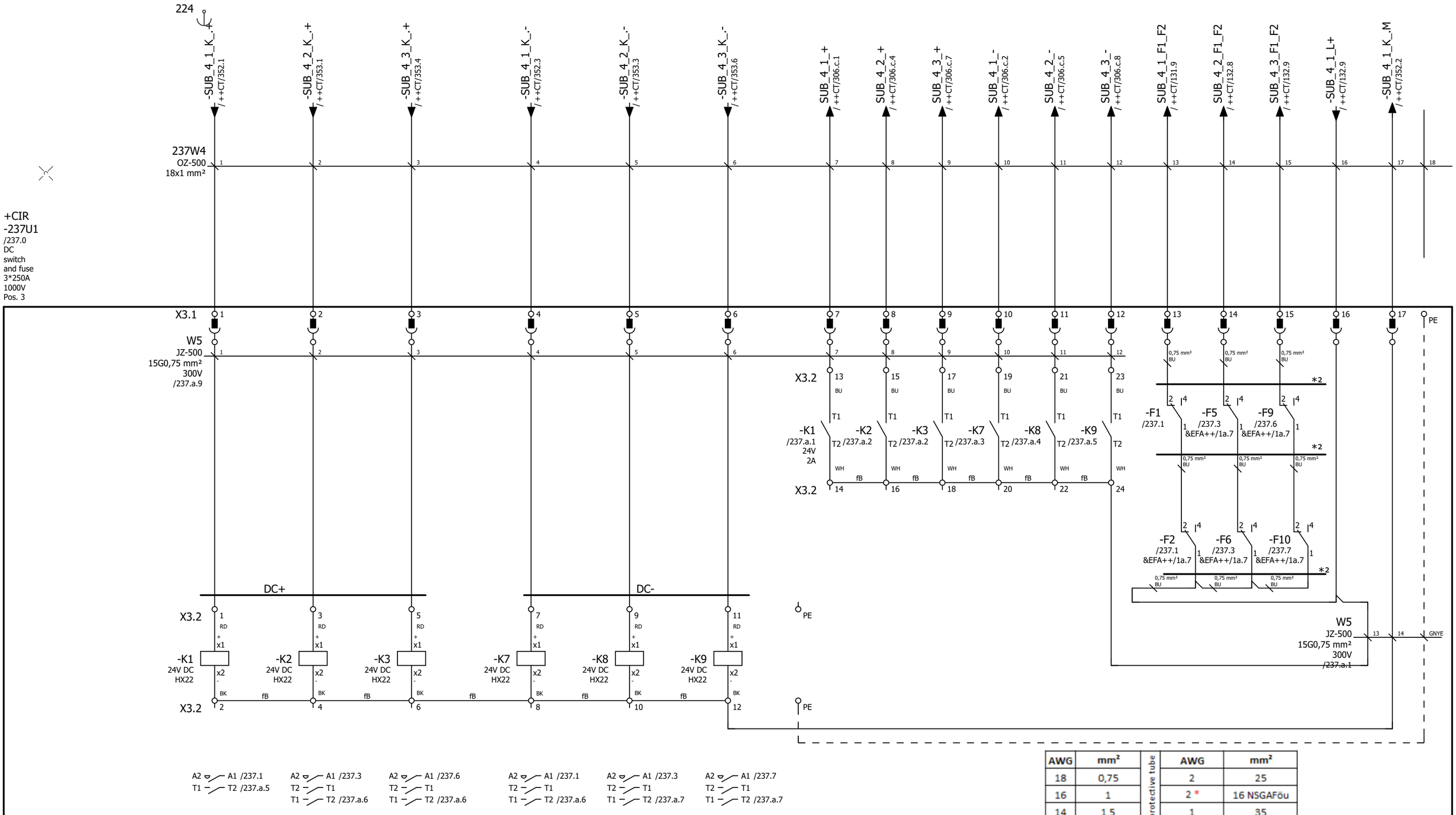
SUB 4_1 + Pos.=UNIT_03 → DC+4_1_BAT / =UNIT_03++/291.4
SUB 4_1 - Pos. → DC-4_1_BAT / =UNIT_03++/291.4
SUB 4_2 + Pos.=UNIT_03 → DC+4_2_BAT / =UNIT_03++/292.4
SUB 4_2 - Pos. → DC-4_2_BAT / =UNIT_03++/292.4
SUB 4_3 + Pos.=UNIT_03 → DC+4_3_BAT / =UNIT_03++/293.4
SUB 4_3 - Pos. → DC-4_3_BAT / =UNIT_03++/293.4

previous page: 231.a

next page: 237.a

Editor	Freqcon_DG			Statron	FREQCON
Date	30.03.2023			Shell Crosswind BESS FQ 1MW 5MWh Offshore	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A
Proved by					20230331_V0.01
Date					10354_23A2007

=	UNIT_01	Converter Container 1
&	EFS	Circuit diagram
++	CONV	page: 237
+		total: 423



AWG	mm²	cable into seperate UL protective tube	AWG	mm²
18	0,75		2	25
16	1		2 *	16 NSGAFöu
14	1,5		1	35
12	2,5		250 kcmil	95 ALU
12 *	2,5 NSGAFöu		2x2	1x70 NSGAFöu
10	4		2x4	2x70 NSGAFöu
6	10		4x250 kcmil	4x70 NSGAFöu
6 *	10 NSGAFöu		6x250 kcmil	6x70 NSGAFöu
4	16			

*2 The single conductor must be placed in the protective tube

IEC

previous page: 237
next page: 238a

Editor	Freqcon_DG			Statron	FREQCON	SUBSYSTEM 4_1 - 4_3 DC 3 x 250A	20230331_V0.01
Date	30.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

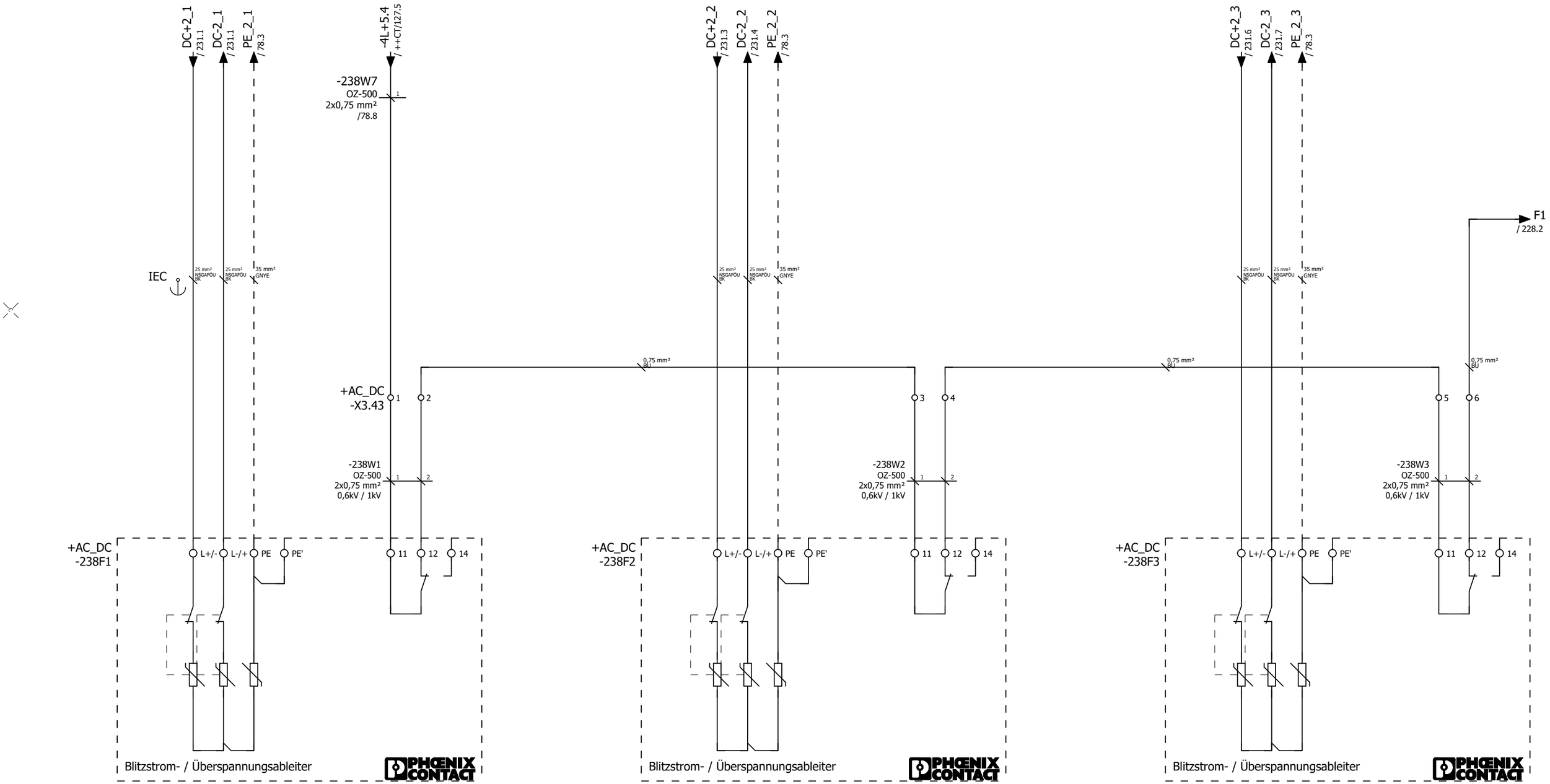
=	UNIT_01	Converter Container 1
&	EFS	Circuit diagram
++	CONV	
+		

page: 237.a
total: 423

DC+ and DC- Busbars

DC+ and DC- Busbars

DC+ and DC- Busbars



SURGE ARRESTER
DC SUBSYSTEM 2_1

SURGE ARRESTER
DC SUBSYSTEM 2_2

SURGE ARRESTER
DC SUBSYSTEM 2_3

in Connection cabinet

previous page:
237.a

next page:
238b

Editor	Freqcon_DG			Statron	FREQCON	DC SURGE ARRESTER 2_1 - 2_3	20230331_V0.01
Date	30.03.2023						= UNIT_01 Converter Container 1
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			& EFS Circuit diagram
Date						10354_23A2007	++ CONV page: 238a
							+ total: 423

DC+ and DC- Busbars

DC+4_1 / 237.1
DC-4_1 / 237.1
PE_4_1 / 78.4

IEC

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F2
228.9 /

0,75 mm² BU

0,75 mm² BU

+AC_DC
-X3.43
13 14

-238W4
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F4
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_1

DC+ and DC- Busbars

DC+4_2 / 237.3
DC-4_2 / 237.4
PE_4_2 / 78.4

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

0,75 mm² BU

15 16

-238W5
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F5
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

SURGE ARRESTER
DC SUBSYSTEM 4_2

DC+ and DC- Busbars

DC+4_3 / 237.6
DC-4_3 / 237.7
PE_4_3 / 78.5

25 mm² NSGAFÖU BK
25 mm² NSGAFÖU BK
35 mm² GNYE

F3
/ 78.9

0,75 mm² BU

0,75 mm² BU

17 18

-238W6
OZ-500
2x0,75 mm²
0,6kV / 1kV
1 2

+AC_DC
-238F6
L+/- L-/+ PE PE'
11 12 14

Blitzstrom- / Überspannungsableiter

PHOENIX CONTACT

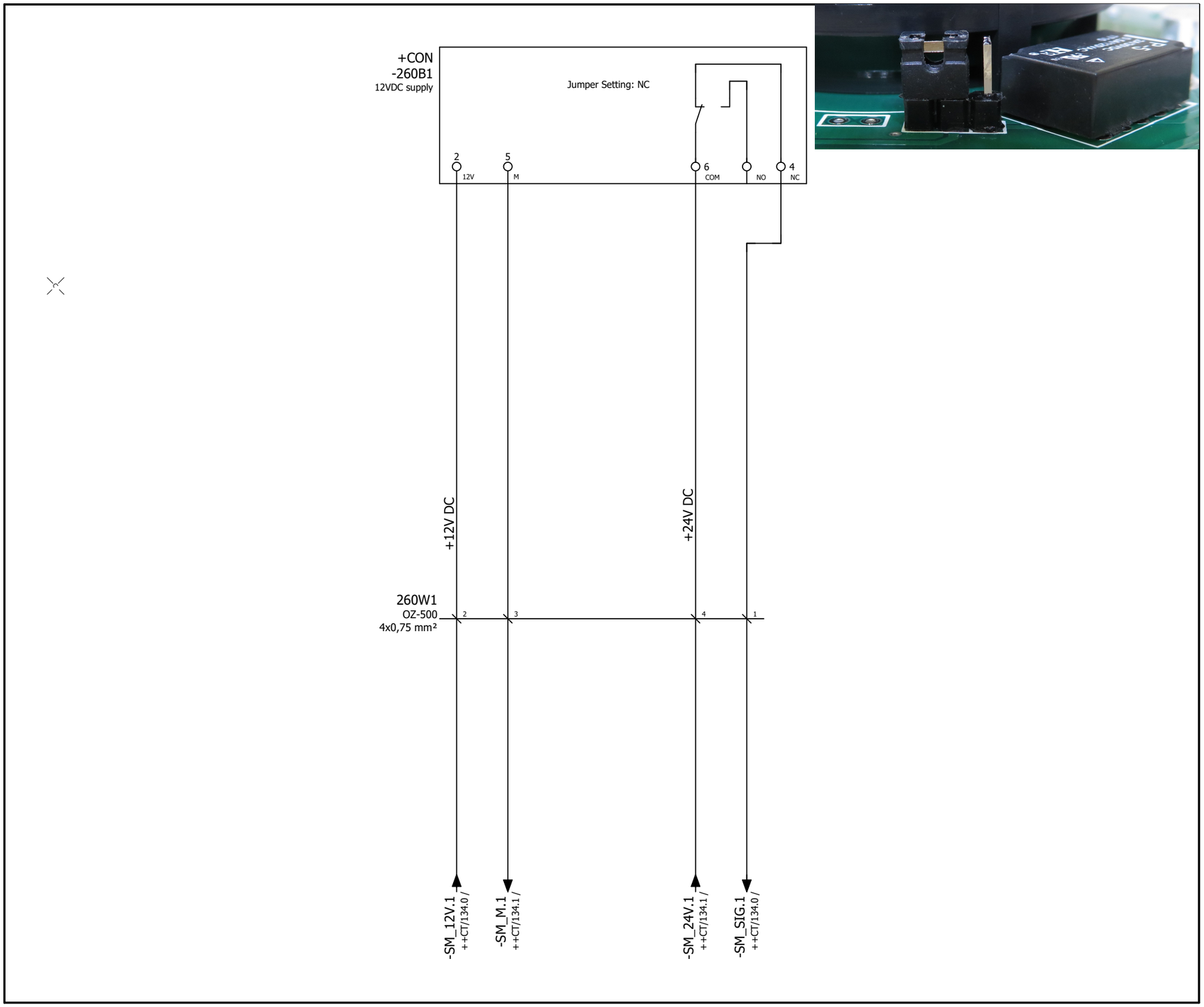
SURGE ARRESTER
DC SUBSYSTEM 4_3

in Connection cabinet

previous page: 238a

next page: 260

Editor	Freqcon_DG			Statron	FREQCON	DC SURGE ARRESTER 4_1 - 4_3	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 238b
Date								+ total: 423

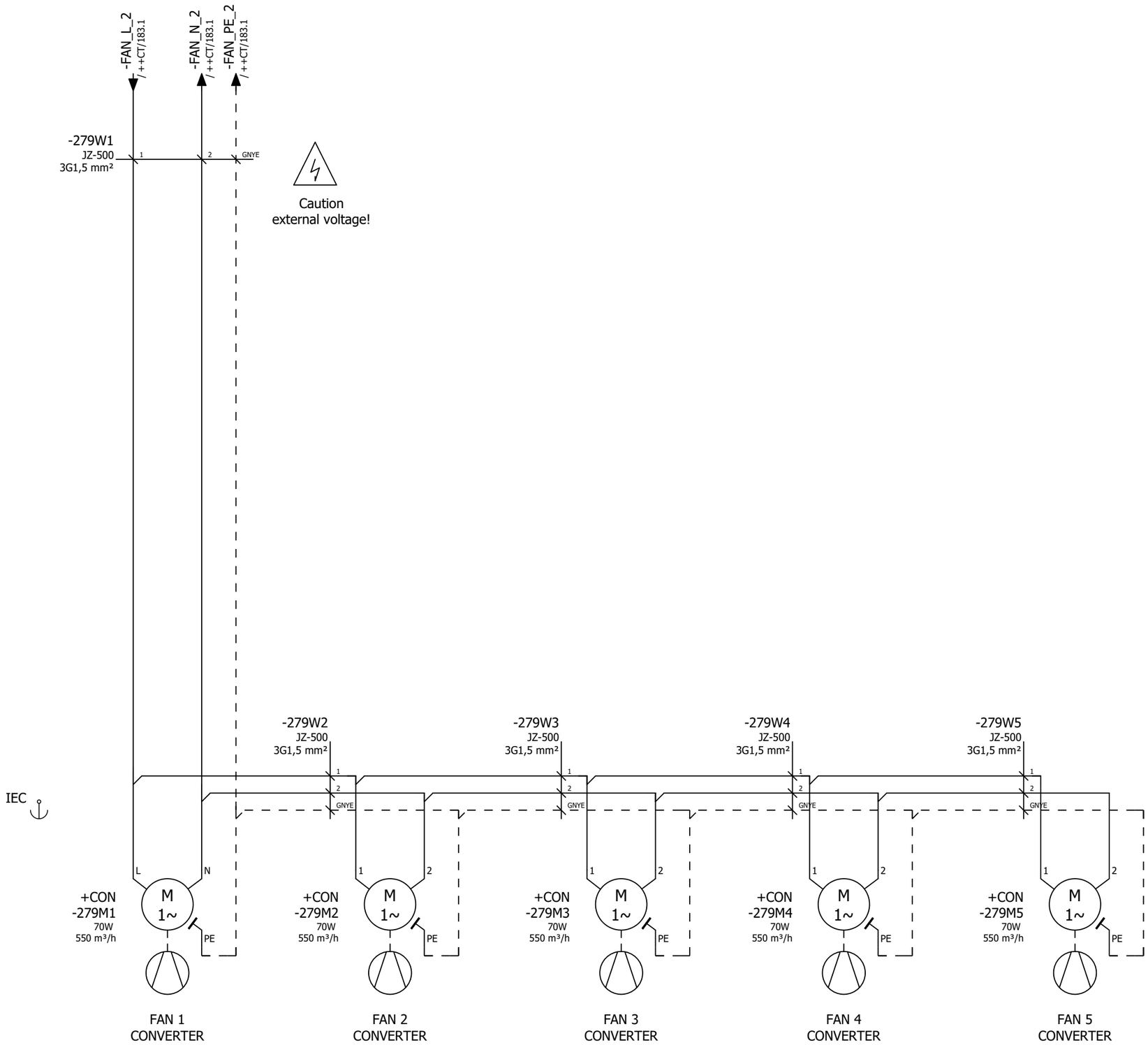


SMOKE DETECTOR
+CON CABINET

previous page:
238b

next page:
279

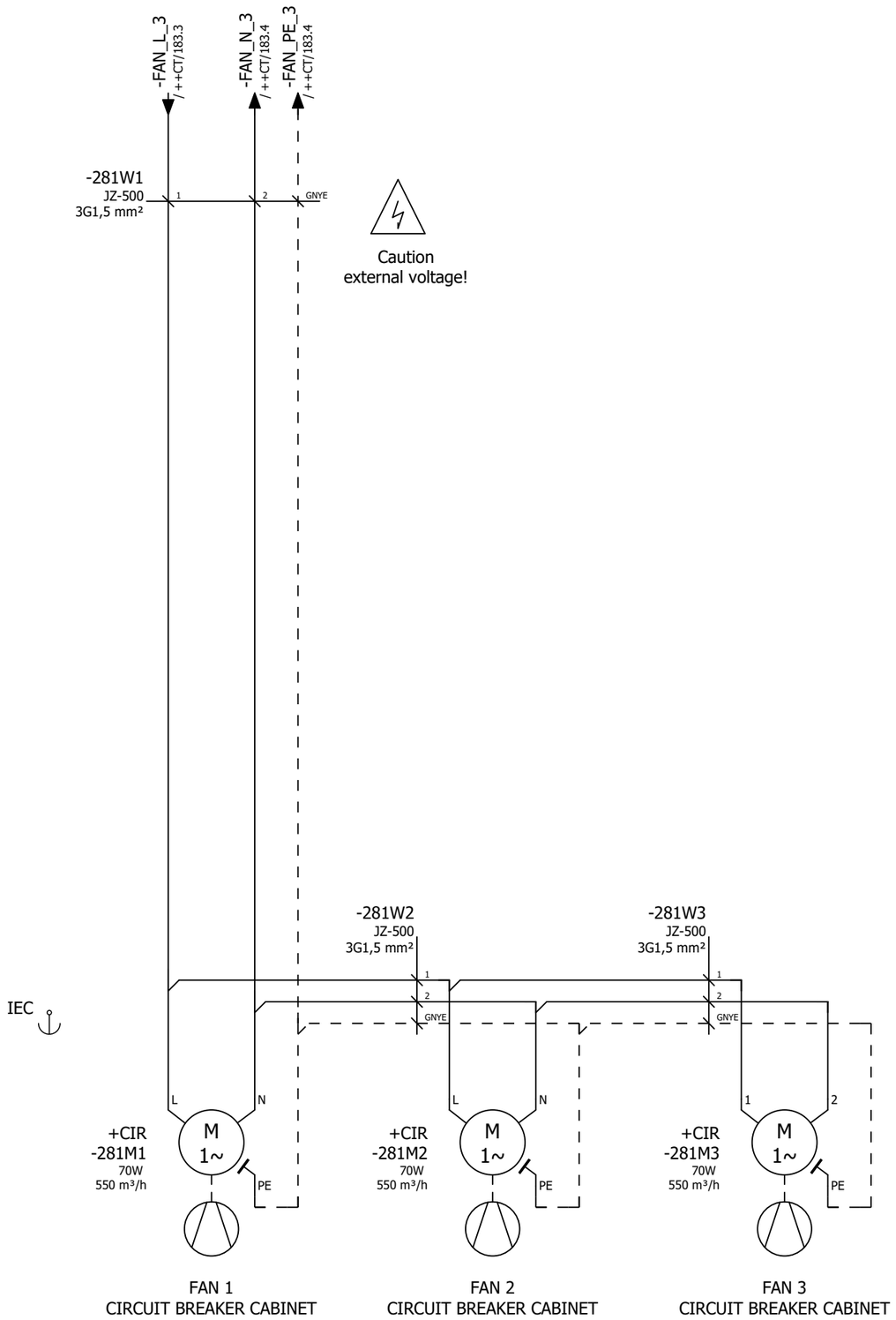
Editor	Freqcon_DG			Statron	FREQCON	SMOKE DETECTOR	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	page: 260
Date								+	total: 423



previous page:
260

next page:
281

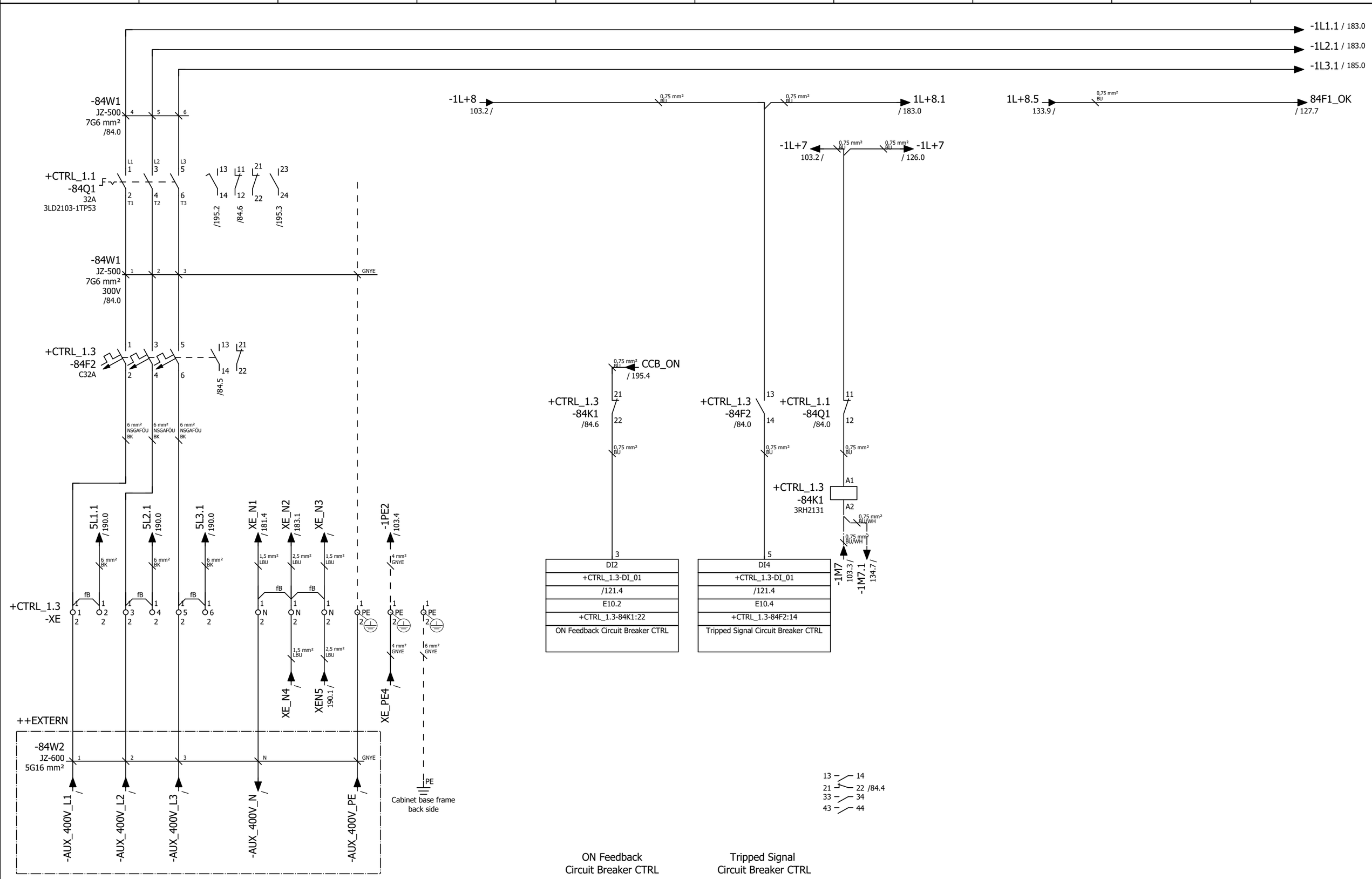
Editor	Freqcon_DG			Statron	FREQCON	CONVERTER CABINET CLIMATE	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	page: 279
Date								+	total: 423



previous page:
279

next page:
++CT/84

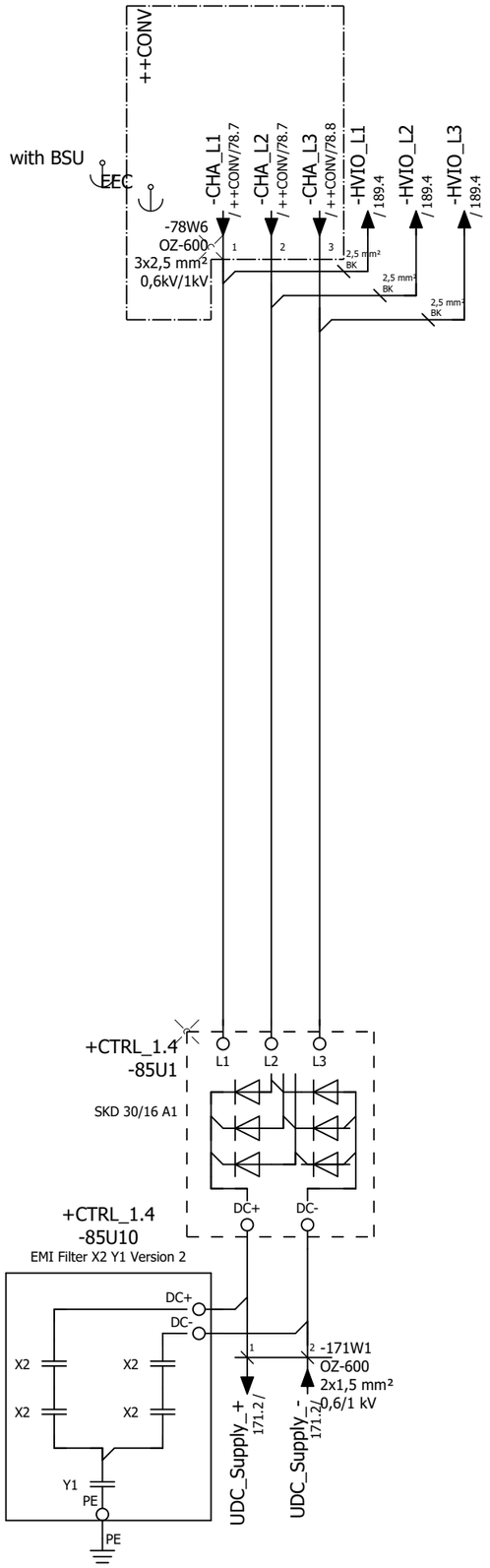
Editor	Freqcon_DG			Statron	FREQCON	CIRCUIT BREAKER CABINET CLIMATE	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 281
Date								+ total: 423



previous page:
++CONV/281

next page:
85

Editor	Freqcon_DG			Statron	FREQCON	FEEDING CONTROL CABINET (CTRL)	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 84
Date								+	total: 423



previous page: 84

earthing via cooling element

next page: 100

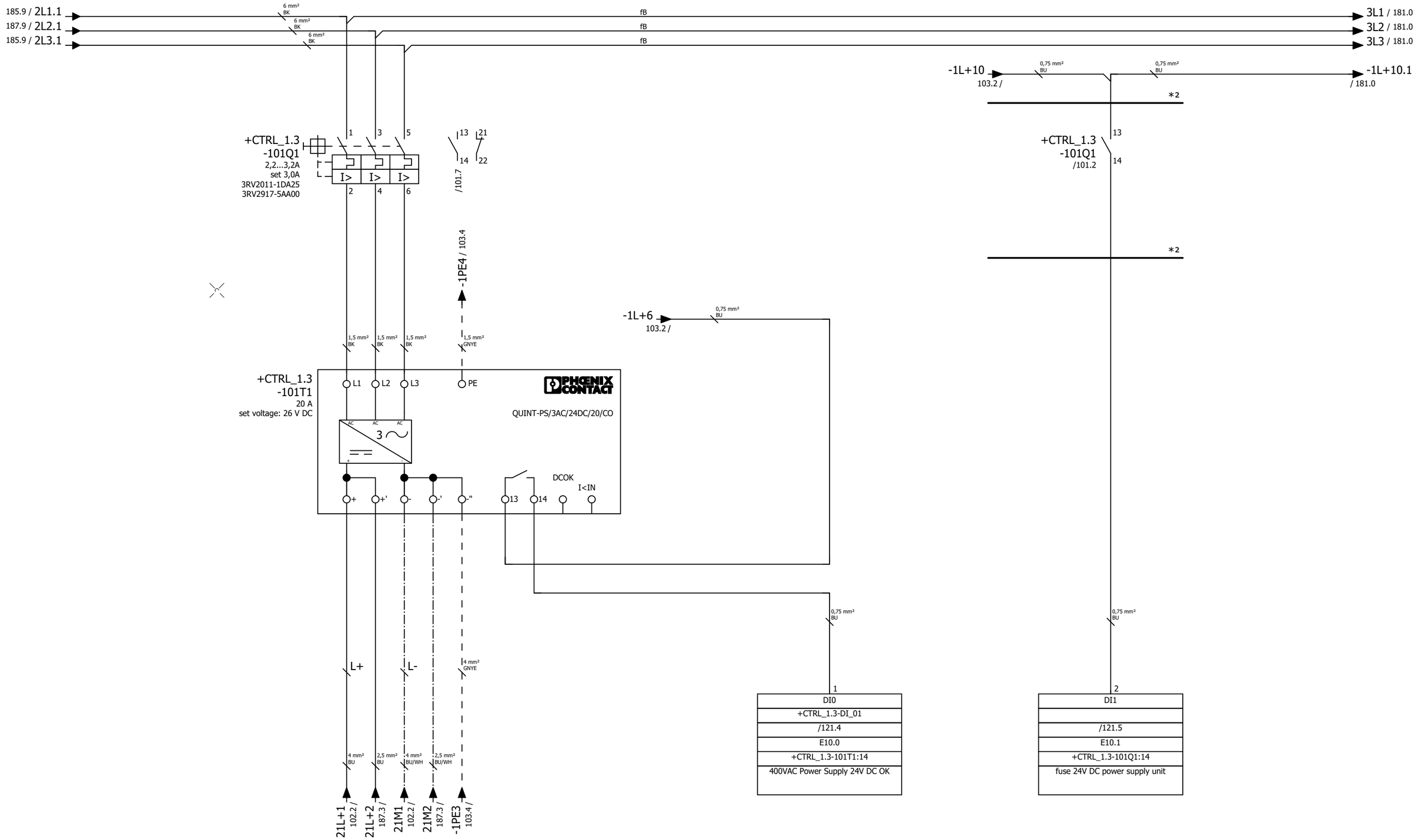
Editor	Freqcon_DG			Statron	FREQCON	SUPPLY UDC	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 85
Date								+	total: 423

Control Cabinet

Pages 100 - 199

previous page: 85

next page: 101



*2

The single conductor must be placed in the protective tube

400VAC Power Supply 24V DC OK

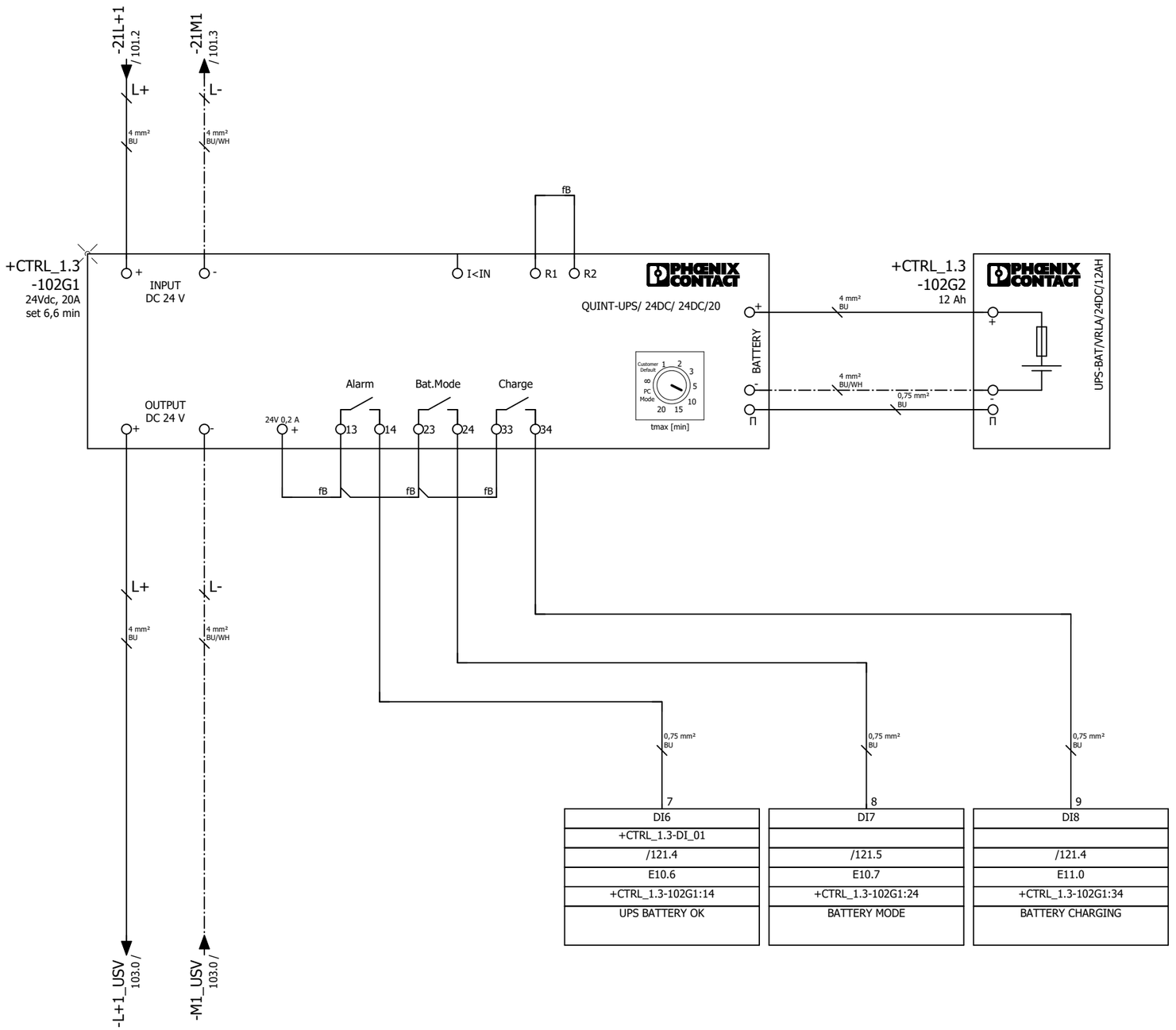
fuse 24V DC power supply unit

previous page: 100

Power supply unit from 400V AC

next page: 102

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE POWER SUPPLY UNIT	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 101
Date								+	total: 423



UPS BATTERY OK | BATTERY MODE | BATTERY CHARGING

previous page: 101

next page: 103

Editor	Freqcon_DG			Statron	FREQCON	CONTROL VOLTAGE UPS	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 102
Date								+ total: 423

102.2 / -L+1_USV — 4 mm²;4 mm² BU;BU

CABINET CONTROL VOLTAGE RESET
A11.0
/123.4
+CTRL_1.3-DO_01
DQ8
9

-M1_USV — 4 mm² BU/WH — 102.2 /

DI3
+CTRL_1.3-DI_01
/121.5
E10.3
+CTRL_1.3-103F5:14
FUSE 24V DC CONTROL VOLTAGE
4

PTTB 2,5-PV

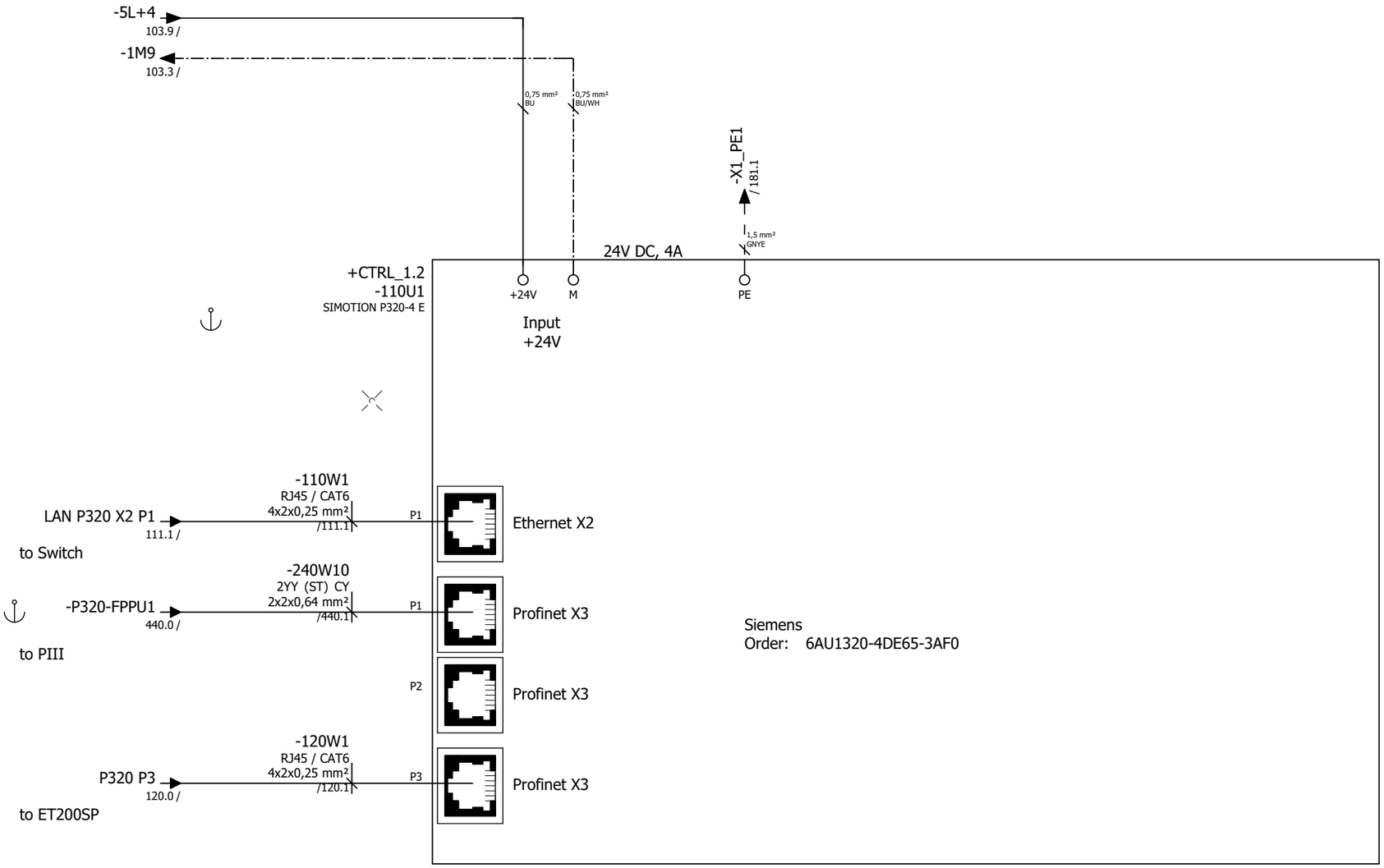
+CTRL_1.3 -103F1 /103.2 — 13/14
+CTRL_1.3 -103F2 /103.4 — 13/14
+CTRL_1.3 -103F3 /103.6 — 13/14
+CTRL_1.3 -103F4 /103.8 — 13/14
+CTRL_1.3 -103F5 /103.9 — 13/14
0,75 mm² BU

+CTRL_1.3 -103F1 /103.1 F2, 10A 60VDC — 1/2
+CTRL_1.3 -103F2 /103.1 F2, 10A 60VDC — 1/2
+CTRL_1.3 -103F3 /103.1 F2, 10A 60VDC — 1/2
+CTRL_1.3 -103F4 /103.1 F2, 10A 60VDC — 1/2
+CTRL_1.3 -103F5 /103.1 F2, 10A 60VDC — 1/2
4 mm² BU

+CTRL_1.3 -XDC1 — 0,75 mm² BU — fB 1–7
+CTRL_1.3 -XDC2 — 1,5 mm² BU — fB 1–7
+CTRL_1.3 -XDC3 — 1,5 mm² BU — fB 1–6
+CTRL_1.3-XDC4 — 1,5 mm² BU — fB 1–4

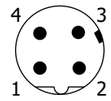
-1L+10 / 101.6 — ET 200 SP
-1M10 / 160.1 — HVIO 1
-1M11 / 149.0 — HVIO_AI
-1PE4 / 101.3 — Main_Line Transformer_Primary
-1PE8 / 443.0
-2L+7 / — SPARE
-3L+7 / 129.0 — SPARE
-4L+7 / 132.9 — DC Feedbacks
-4M7 / — SPARE

| | | |



Siemens
Order: 6AU1320-4DE65-3AF0

Plug with D-coded



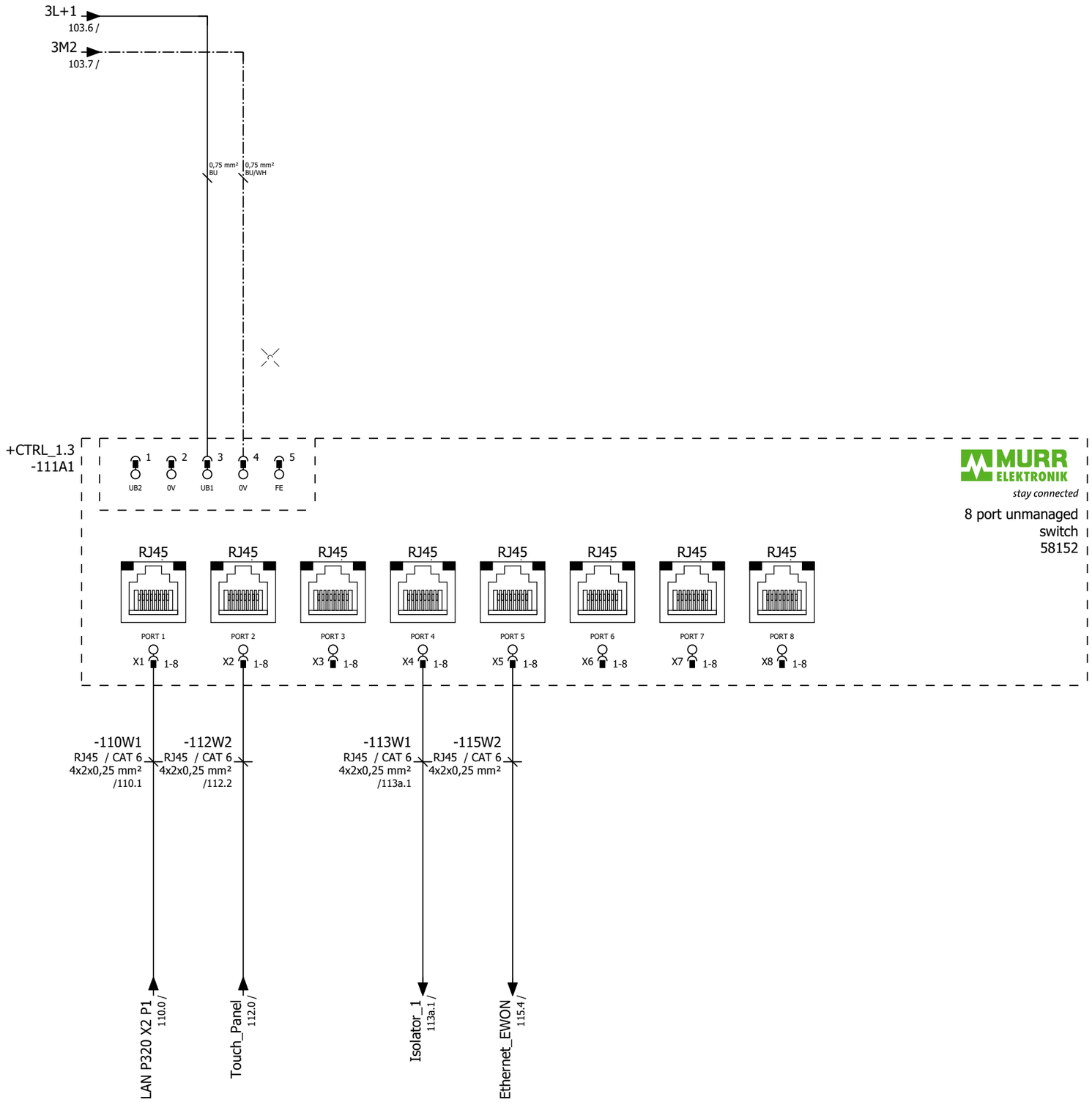
Top view of the pinheader

Signal	Colour	RJ45	M12 plug
TD+	yellow	1	1
TD-	orange	2	3
RD+	white	3	2
RD-	blue	6	4

Connection P320 -- PIII

previous page:
103

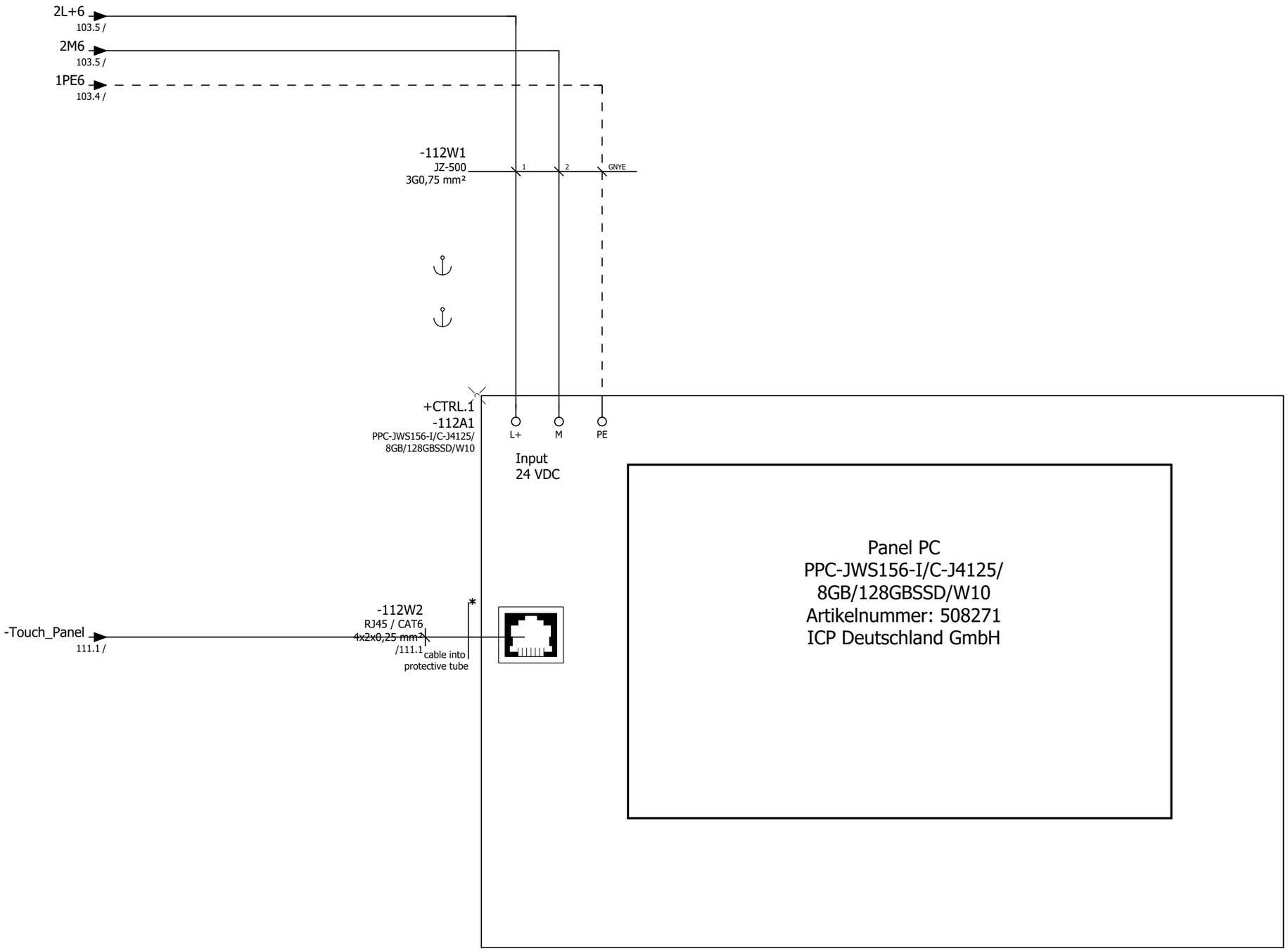
next page:
111



previous page:
110

next page:
112

Editor	Freqcon_DG			Statron	FREQCON	ETHERNET SWITCH	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 111
Date								+ total: 423

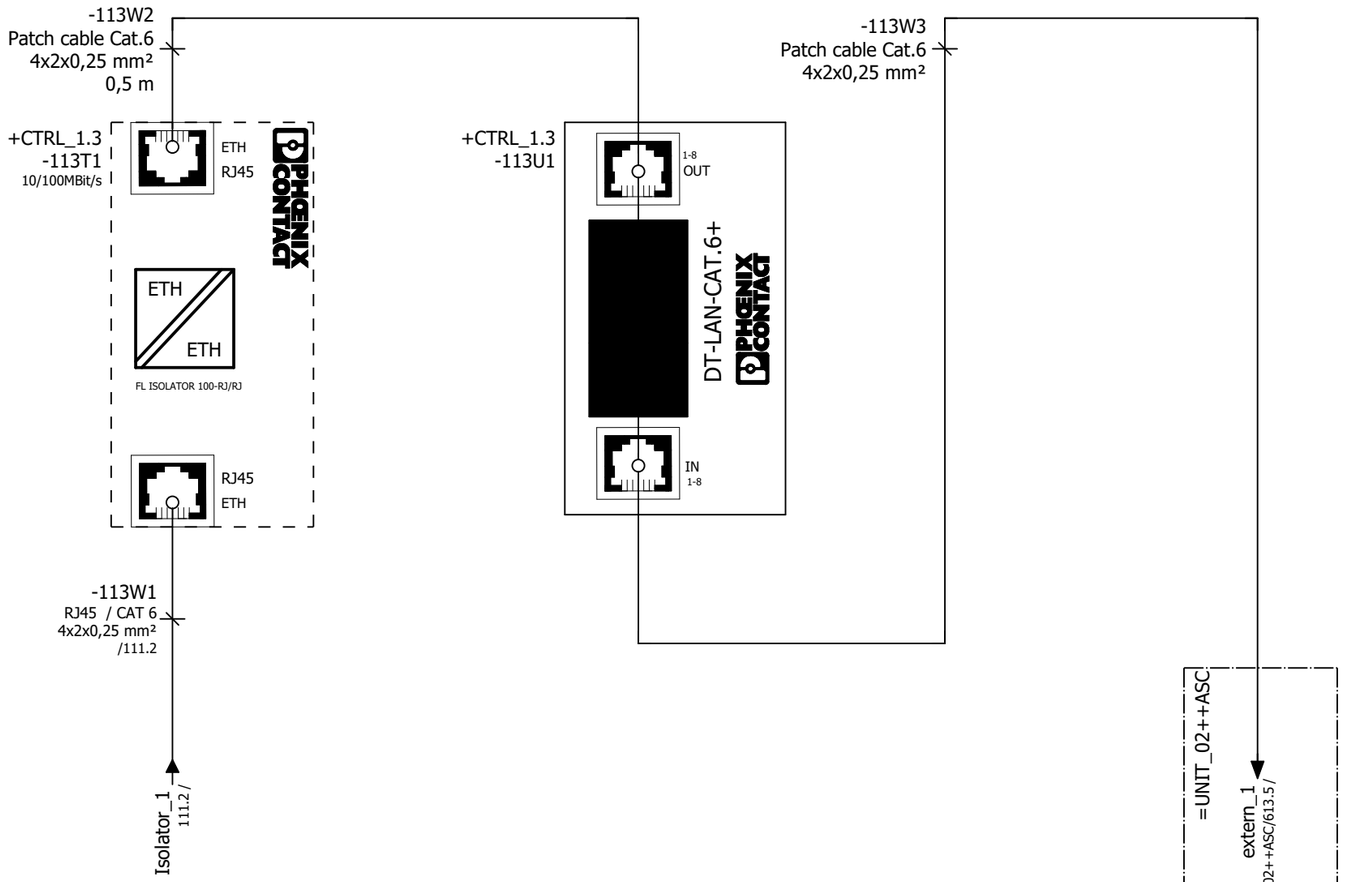


PANEL PC

previous page:
111

next page:
113a

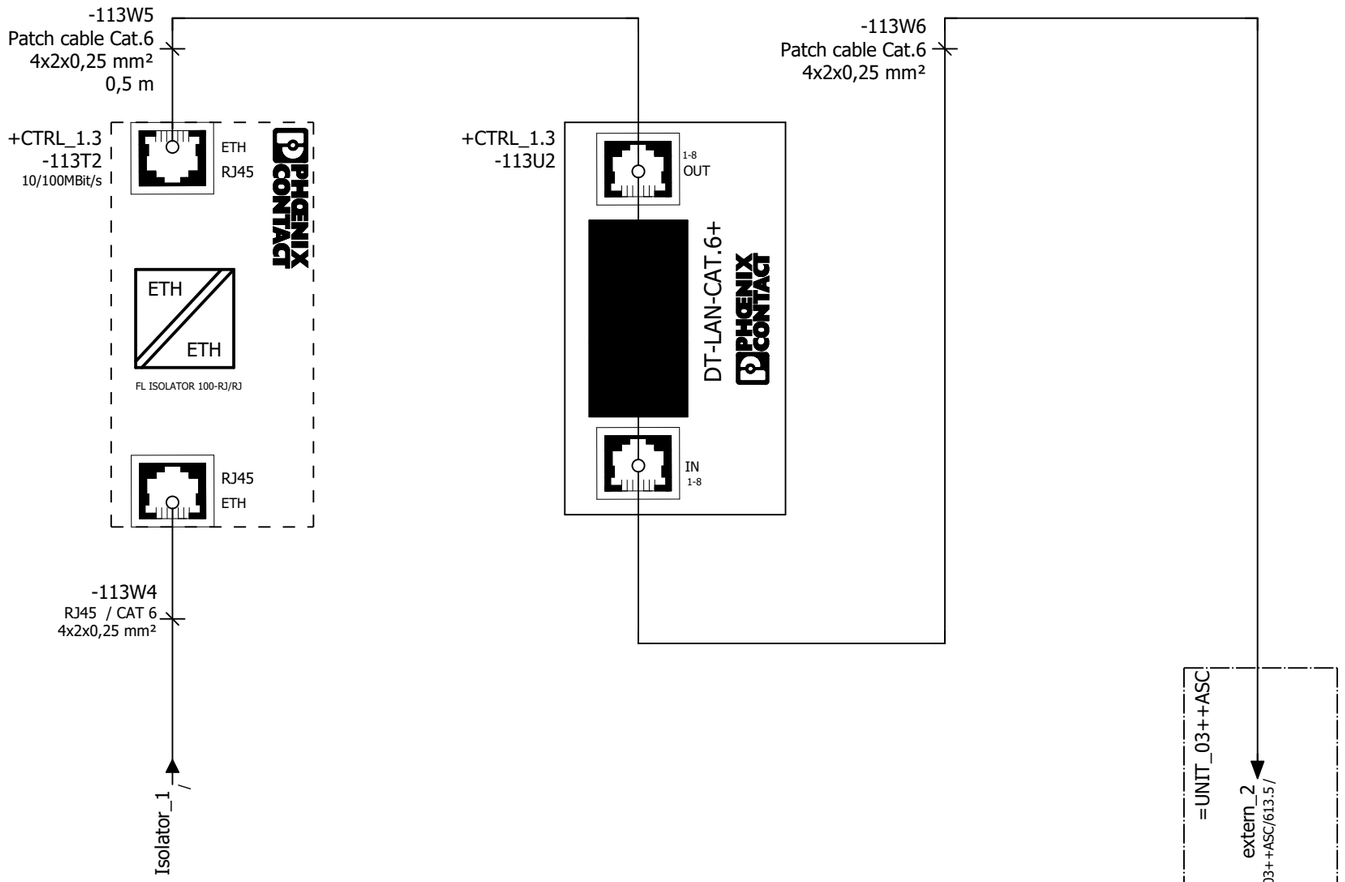
Editor	Freqcon_DG			Statron	FREQCON	PANEL PC HMI	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 112
Date								+ total: 423



previous page:
112

next page:
113b

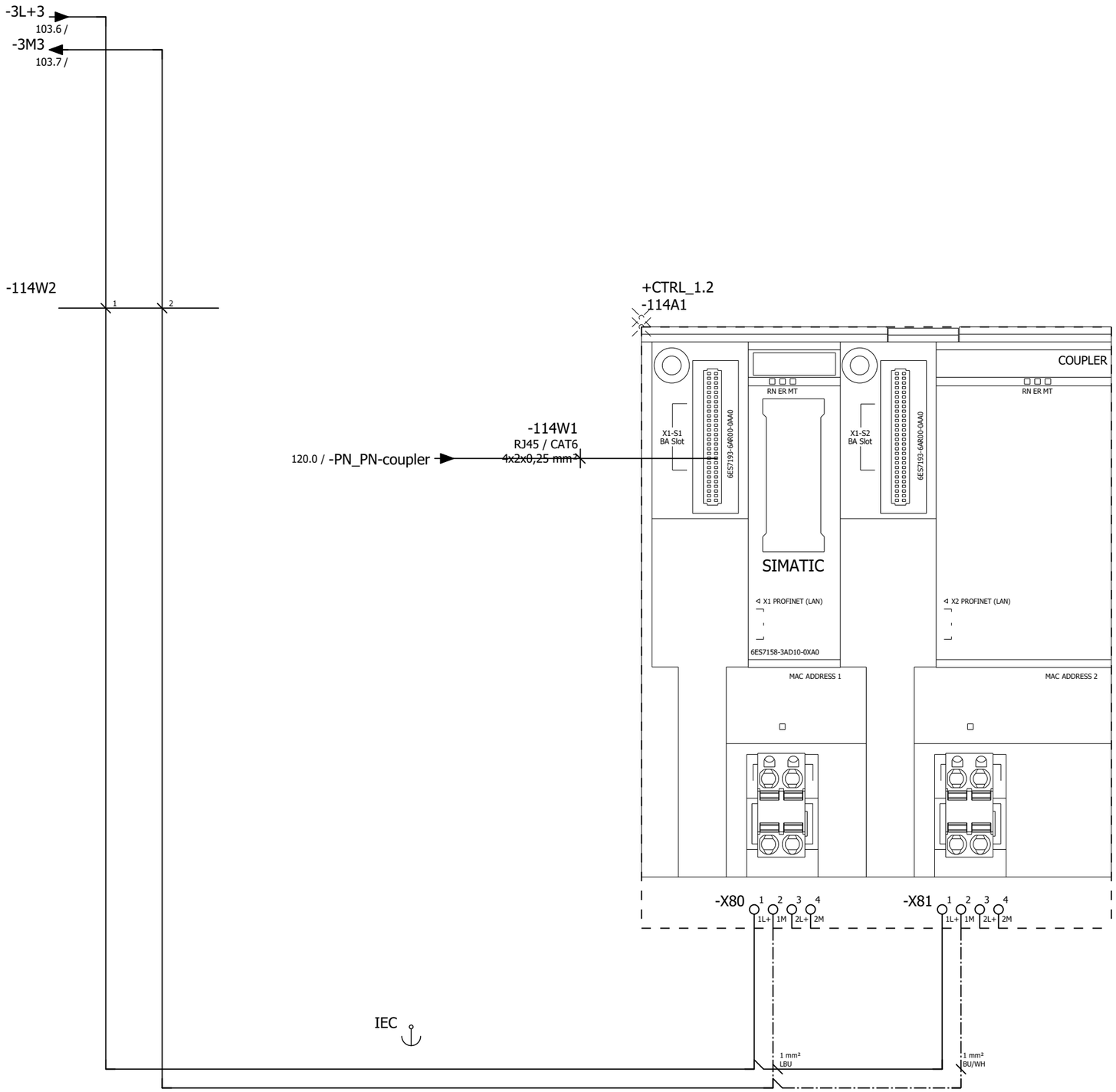
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 113a
Date								+	total: 423



previous page:
113a

next page:
114

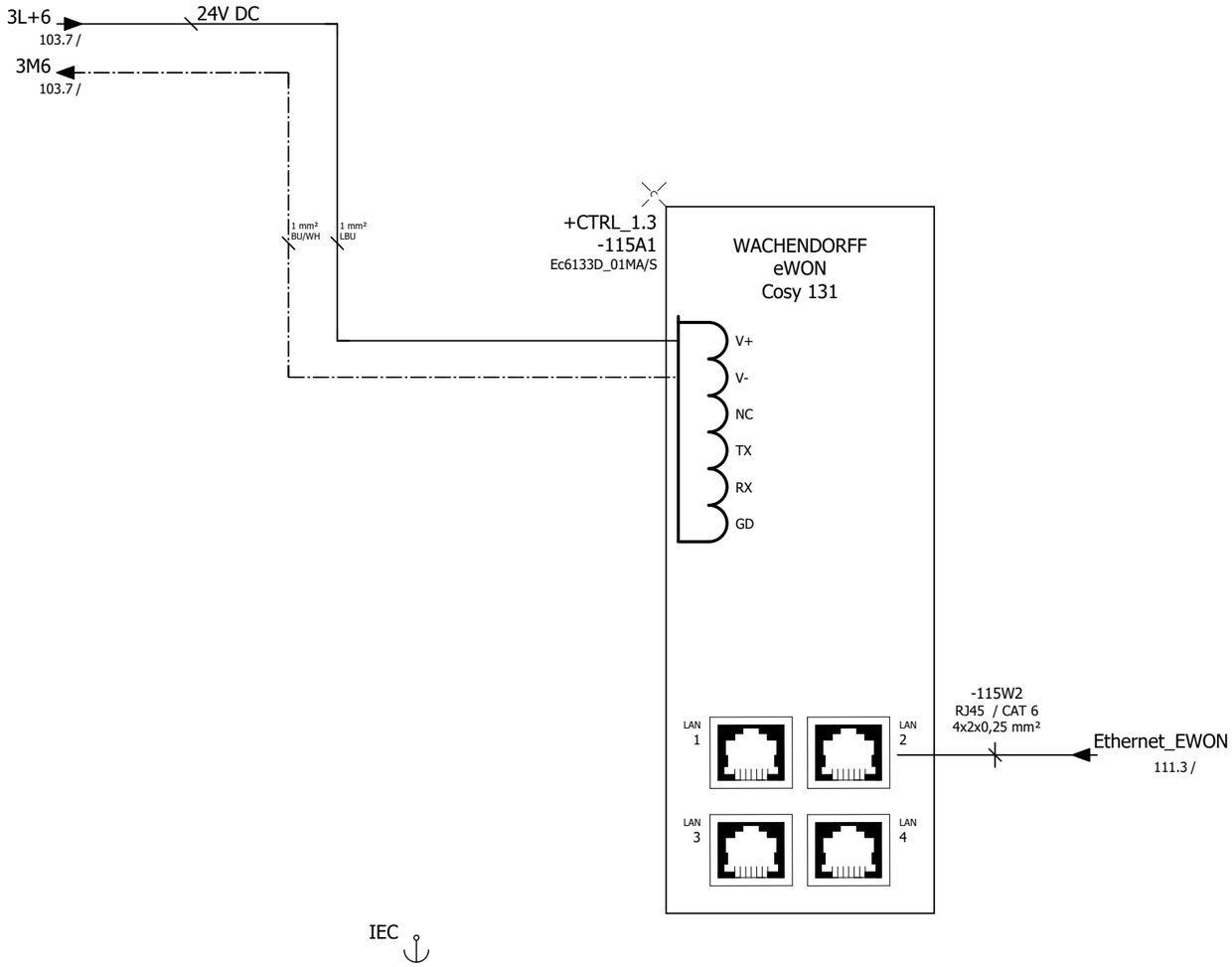
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 113b
Date								+	total: 423



previous page:
113b

next page:
115

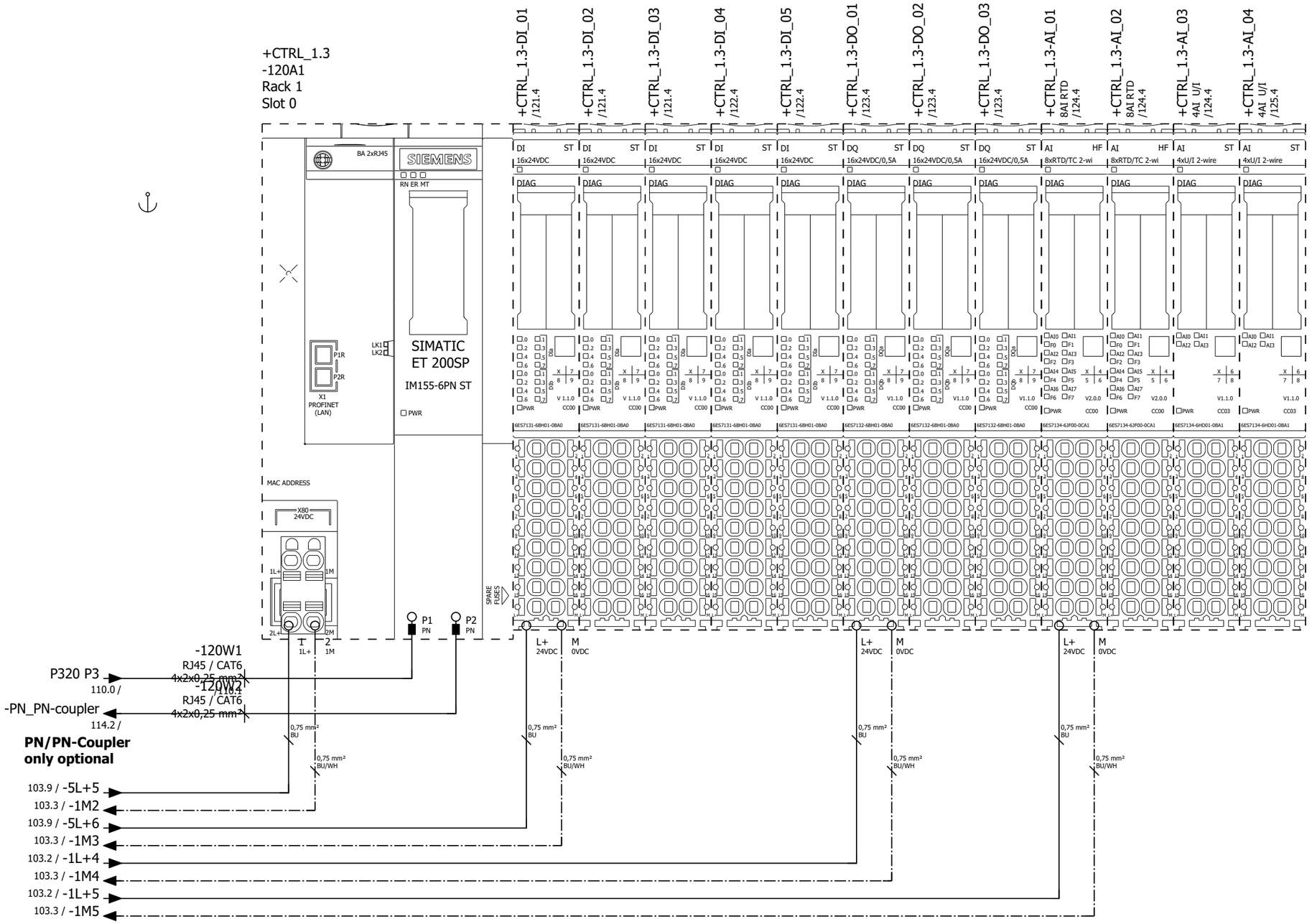
Editor	Freqcon_DG			Statron	FREQCON	PN/ PN COUPLER	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 114
Date								+	total: 423



previous page:
114

next page:
120

Editor	Freqcon_DG			Statron		UMTS ROUTER	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 115
Date								+	total: 423



previous page: 115

next page: 121

Editor	Freqcon_DG			Statron	FREQCON	ET200 24V DC	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 120
Date								+	total: 423

+CTRL_1.3-DI_01

/120.3

400VAC Power Supply 24V DC OK	/101.5	DI0 1	E10.0	E10.1 2 DI1	/101.7	fuse 24V DC power supply unit
ON Feedback Circuit Breaker CTRL	/84.4	DI2 3	E10.2	E10.3 4 DI3	/103.1	FUSE 24V DC CONTROL VOLTAGE
Tripped Signal Circuit Breaker CTRL	/84.5	DI4 5	E10.4	E10.5 6 DI5	/127.7	LIGHTNING PROTECTION in Control Cabinet OPTIONAL
UPS BATTERY OK	/102.5	DI6 7	E10.6	E10.7 8 DI7	/102.6	BATTERY MODE
BATTERY CHARGING	/102.7	DI8 9	E11.0	E11.1 10 DI9	/126.1	RESET -126S1
FUSE FOR PUMP	/181.2	DI10 11	E11.2	E11.3 12 DI11	/182.2	FAN 1 HEAT EXCHANGER
FUSE FOR HEATER	/181.5	DI12 13	E11.4	E11.5 14 DI13	/181.6	PRESSURE SWITCH
Fuse Fans CON, IND Cabinets	/183.6	DI14 15	E11.6	E11.7 16 DI15	/185.9	supply light, fan, heater, power unit in cabinet
	/120.3	24VDC L+		M 0VDC	/120.3	

+CTRL_1.3-DI_02

/120.3

FAULT SIGNAL SAFETY RELAY	/195.4	DI0 1	E12.0	E12.1 2 DI1	/187.6	FUSES SUPPLY FOR CIRCUIT BREAKER 1+2
CB 1 ON GRID	/127.2	DI2 3	E12.2	E12.3 4 DI3	/127.3	CB 1 OFF GRID
CB 1 Tripped GRID	/127.1	DI4 5	E12.4	E12.5 6 DI5	/127.4	FUSE AND LIGHTNING PROTECTION
Smoke detector CON	/134.0	DI6 7	E12.6	E12.7 8 DI7	/129.0	SUBSYSTEM 2_1_DC + Contactor K1 is on
SUBSYSTEM 2_1_DC + Contactor K2 is on	/129.1	DI8 9	E13.0	E13.1 10 DI9	/129.2	SUBSYSTEM 2_1_DC -Contactor K7 is on
SUBSYSTEM 2_1_DC -Contactor K8 is on	/129.3	DI10 11	E13.2	E13.3 12 DI11	/129.4	SUBSYSTEM 2_2_DC + Contactor K1 is on
SUBSYSTEM 2_2_DC + Contactor K2 is on	/129.5	DI12 13	E13.4	E13.5 14 DI13	/129.6	SUBSYSTEM 2_2_DC -Contactor K7 is on
SUBSYSTEM 2_2_DC -Contactor K8 is on	/129.7	DI14 15	E13.6	E13.7 16 DI15	/129.8	SUBSYSTEM 2_1_DC FUSE OK
		24VDC L+		M 0VDC		

+CTRL_1.3-DI_03

/120.3

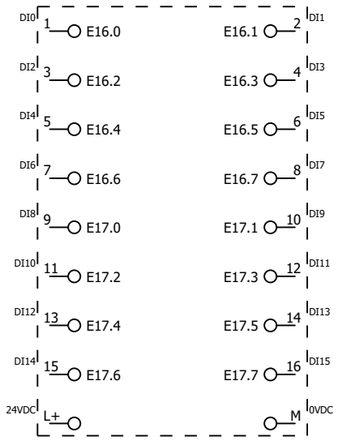
SUBSYSTEM 2_2_DC FUSE OK	/129.9	DI0 1	E14.0	E14.1 2 DI1	/130.0	SUBSYSTEM 2_3_DC + Contactor K1 is on
SUBSYSTEM 2_3_DC + Contactor K2 is on	/130.1	DI2 3	E14.2	E14.3 4 DI3	/130.2	SUBSYSTEM 2_3_DC -Contactor K7 is on
SUBSYSTEM 2_3_DC -Contactor K8 is on	/130.3	DI4 5	E14.4	E14.5 6 DI5	/130.4	SUBSYSTEM 3_1_DC + Contactor K1 is on
SUBSYSTEM 3_1_DC + Contactor K2 is on	/130.5	DI6 7	E14.6	E14.7 8 DI7	/130.6	SUBSYSTEM 3_1_DC -Contactor K7 is on
SUBSYSTEM 3_1_DC -Contactor K8 is on	/130.7	DI8 9	E15.0	E15.1 10 DI9	/130.8	SUBSYSTEM 2_3_DC FUSE OK
SUBSYSTEM 3_1_DC FUSE OK	/130.9	DI10 11	E15.2	E15.3 12 DI11	/131.0	SUBSYSTEM 3_3_DC + Contactor K1 is on
SUBSYSTEM 3_3_DC + Contactor K2 is on	/131.1	DI12 13	E15.4	E15.5 14 DI13	/131.2	SUBSYSTEM 3_3_DC -Contactor K7 is on
SUBSYSTEM 3_3_DC -Contactor K8 is on	/131.3	DI14 15	E15.6	E15.7 16 DI15	/131.4	SUBSYSTEM 4_1_DC + Contactor K1 is on
		24VDC L+		M 0VDC		

previous page: 120

next page: 122

+CTRL_1.3-DI_04

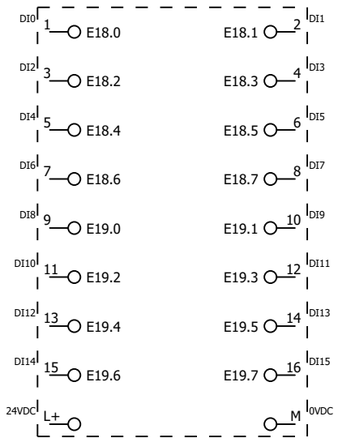
/120.4



				/133.0	SPARE
SPARE	/133.1			/133.2	SPARE
Fuse 230V AC for Container Air Conditioning	/133.3			/128.1	CB 2 Tripped ISLAND GRID
CB 2 ON ISLAND GRID	/128.2			/128.3	CB 2 OFF ISLAND GRID
FUSE AND LIGHTNING PROTECTION 2	/128.4			/182.5	FAN 2 HEAT EXCHANGER (OPTIONAL)

+CTRL_1.3-DI_05

/120.4



SUBSYSTEM 4_1_DC + Contactor K2 is on	/131.5			/131.6	SUBSYSTEM 4_1_DC -Contactor K7 is on
SUBSYSTEM 4_1_DC -Contactor K8 is on	/131.7			/131.8	SUBSYSTEM 3_3_DC FUSE OK
SUBSYSTEM 4_1_DC FUSE OK	/131.9			/132.0	SUBSYSTEM 4_2_DC + Contactor K1 is on
SUBSYSTEM 4_2_DC + Contactor K2 is on	/132.1			/132.2	SUBSYSTEM 4_2_DC -Contactor K7 is on
SUBSYSTEM 4_2_DC -Contactor K8 is on	/132.3			/132.4	SUBSYSTEM 4_3_DC + Contactor K1 is on
SUBSYSTEM 4_3_DC + Contactor K2 is on	/132.5			/132.6	SUBSYSTEM 4_3_DC -Contactor K7 is on
SUBSYSTEM 4_3_DC -Contactor K8 is on	/132.7			/132.8	SUBSYSTEM 4_2_DC FUSE OK
SUBSYSTEM 4_3_DC FUSE OK	/132.9				

previous page: 121

next page: 123

+CTRL_1.3-DO_01

/120.4

CON Fans 1-5 in door	/135.1	DQ0 1	A10.0	A10.1 2 DQ1	/135.2	FAN 1 Control cabinet
CIR Fans 1-3 in door	/135.3	DQ2 3	A10.2	A10.3 4 DQ3	/135.4	SPARE 230V
CB2 ON ISLAND GRID OPTIONAL	/137.3	DQ4 5	A10.4	A10.5 6 DQ5	/137.4	CB 2 OFF ISLAND GRID OPTIONAL
Precharging DC-Link Capacitors	/171.5	DQ6 7	A10.6	A10.7 8 DQ7	/173.6	Discharge CON
CABINET CONTROL VOLTAGE RESET	/103.1	DQ8 9	A11.0	A11.1 10 DQ9	/137.1	CB1 ON GRID
CB 1 OFF GRID	/137.2	DQ10 11	A11.2	A11.3 12 DQ11	/189.1	GRID FAULT
FAULT 140H1	/140.1	DQ12 13	A11.4	A11.5 14 DQ13	/140.2	PREHEATING 140H2
READY FOR OPERATION 140H3	/140.3	DQ14 15	A11.6	A11.7 16 DQ15	/140.4	OPERATING 140H4
	/120.4	24VDC L+		M 0VDC	/120.5	

+CTRL_1.3-DO_02

/120.5

SUBSYSTEM 2_1 CONTACTOR DC+ ON	/150.1	DQ0 1	A12.0	A12.1 2 DQ1	/150.3	SUBSYSTEM 2_1 CONTACTOR DC-ON
SUBSYSTEM 2_2 CONTACTOR DC+ ON	/151.0	DQ2 3	A12.2	A12.3 4 DQ3	/151.2	SUBSYSTEM 2_2 CONTACTOR DC-ON
SUBSYSTEM 2_3 CONTACTOR DC+ ON	/151.3	DQ4 5	A12.4	A12.5 6 DQ5	/151.5	SUBSYSTEM 2_3 CONTACTOR DC-ON
		DQ6 7	A12.6	A12.7 8 DQ7	/135.5	SPARE
		DQ8 9	A13.0	A13.1 10 DQ9		
		DQ10 11	A13.2	A13.3 12 DQ11	/139.4	Fan 2 Heat exchanger optional
Heater On converter coolingsystem	/139.1	DQ12 13	A13.4	A13.5 14 DQ13	/139.2	Pump converter coolingsystem
Fan 1 Heat exchanger	/139.3	DQ14 15	A13.6	A13.7 16 DQ15	/134.8	Reset the smoke detectors
		24VDC L+		M 0VDC		

+CTRL_1.3-DO_03

/120.5

SUBSYSTEM 3_1 CONTACTOR DC+ ON	/350.1	DQ0 1	A14.0	A14.1 2 DQ1	/350.3	SUBSYSTEM 3_1 CONTACTOR DC-ON
		DQ2 3	A14.2	A14.3 4 DQ3		
SUBSYSTEM 3_3 CONTACTOR DC+ ON	/351.4	DQ4 5	A14.4	A14.5 6 DQ5	/351.5	SUBSYSTEM 3_3 CONTACTOR DC-ON
SUBSYSTEM 4_1 CONTACTOR DC+ ON	/352.0	DQ6 7	A14.6	A14.7 8 DQ7	/352.2	SUBSYSTEM 4_1 CONTACTOR DC-ON
SUBSYSTEM 4_2 CONTACTOR DC+ ON	/353.0	DQ8 9	A15.0	A15.1 10 DQ9	/353.2	SUBSYSTEM 4_2 CONTACTOR DC-ON
SUBSYSTEM 4_3 CONTACTOR DC+ ON	/353.3	DQ10 11	A15.2	A15.3 12 DQ11	/353.5	SUBSYSTEM 4_3 CONTACTOR DC-ON
		DQ12 13	A15.4	A15.5 14 DQ13		
		DQ14 15	A15.6	A15.7 16 DQ15		
		24VDC L+		M 0VDC		

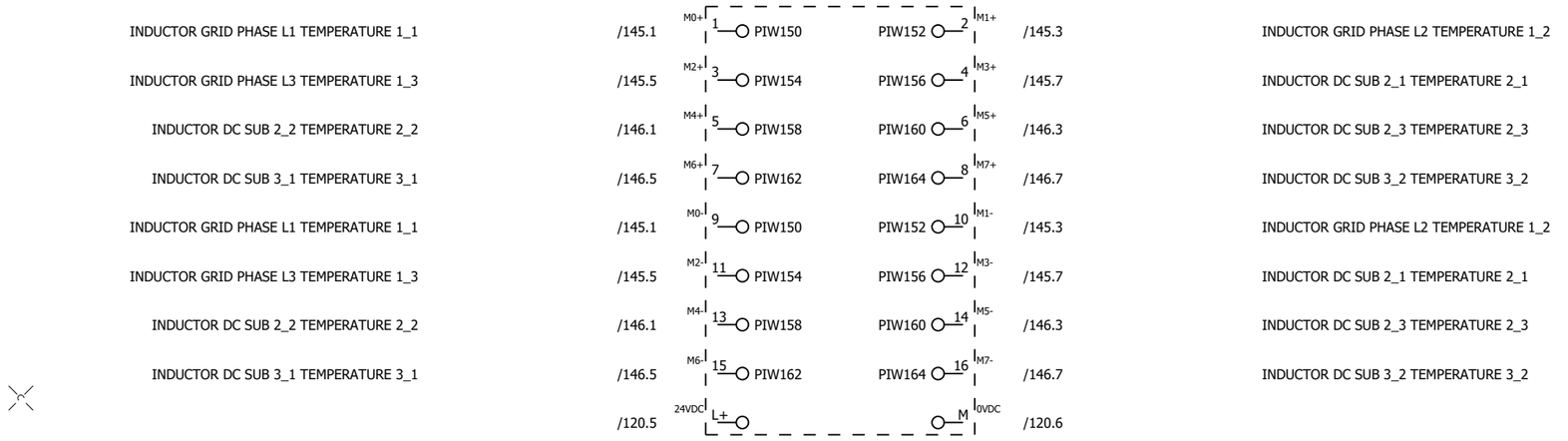
previous page: 122

next page: 124

Editor	Freqcon_DG			Statron	FREQCON	ET200SP DIGITAL OUTPUTS DO_01 - DO_03	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 123
Date								+ total: 423

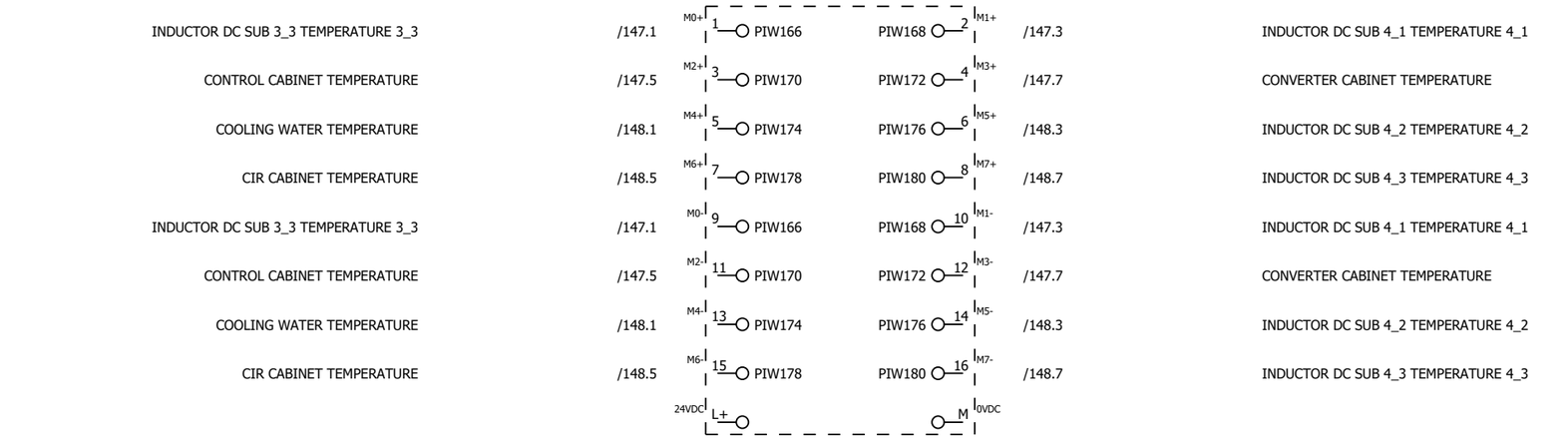
+CTRL_1.3-AI_01

/120.5



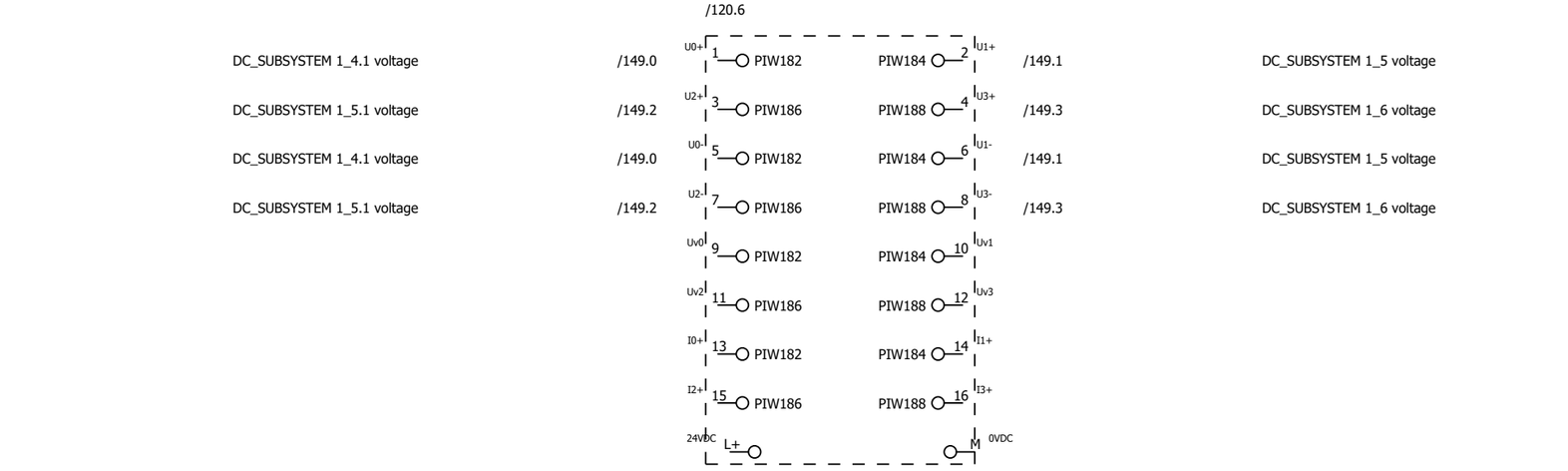
+CTRL_1.3-AI_02

/120.6



+CTRL_1.3-AI_03

/120.6



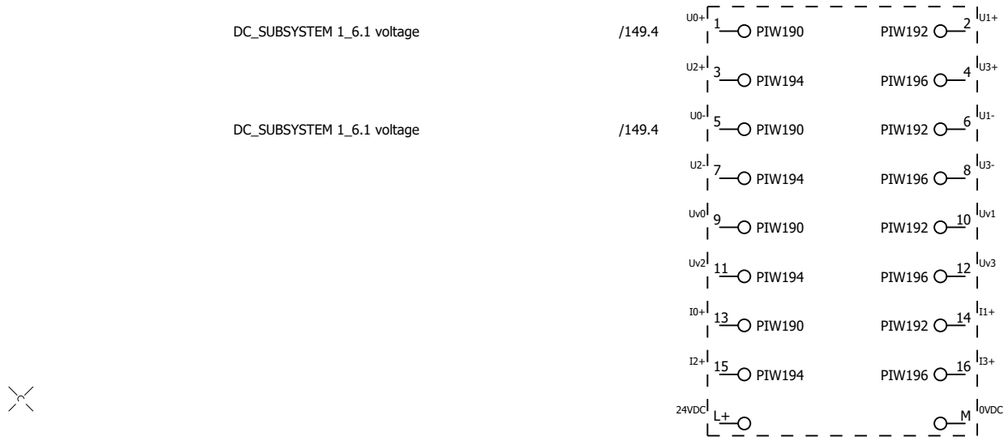
previous page: 123

next page: 125

Editor	Freqcon_DG			Statron	FREQCON	ET200SP ANALOG INPUTS AI_01 - AI_03	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 124
Date								+	total: 423

+CTRL_1.3-AI_04

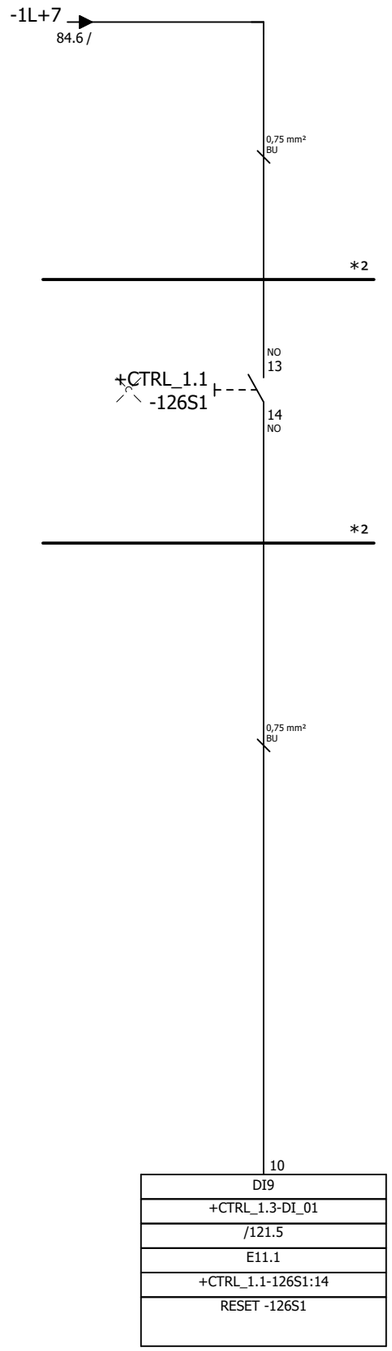
/120.6



previous page: 124

next page: 126

Editor	Freqcon_DG			Statron	FREQCON	ET200SP ANALOG INPUTS AI_04	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 125
Date								+	total: 423



RESET
-126S1

*2
The single conductor
must be placed
in the protective tube

previous page:
125

next page:
127

Editor	Freqcon_DG			Statron	FREQCON	INPUTS CONTROL ELEMENTS	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 126
Date								+	total: 423

EC

3WL

++CONV

-CB1_TRIPPED / ++CONV/80.8

-CB1_ON_FB / ++CONV/80.7

-CB1_OFF_FB / ++CONV/80.7

-1F2 / ++CONV/78.9

-4L+5.4 / ++CONV/238a.2

-80W1
OZ-500
8x0,75 mm²

-238W7
OZ-500
2x0,75 mm²

+CTRL_1.3
-X3

-24V_Signal / 189.5

-4L+5.3 / 134.0

84F1_OK / 84.9

0,75 mm² BU

fB

bridge

-4L+5 / 103.8

-4L+5.1 / 128.5

DI14	DI2	DI3	DI5
+CTRL_1.3-DI_02	+CTRL_1.3-DI_02		
/121.4	/121.4	/121.5	/121.5
E12.4	E12.2	E12.3	E12.5
++CONV+CIR-80Q1:X7_13	++CONV+CIR-80Q1:X6_11	++CONV+CIR-80Q1:X6_9	++CONV+AC_DC-78F1:13
CB 1 Tripped GRID	CB 1 ON GRID	CB 1 OFF GRID	FUSE AND LIGHTNING PROTECTION

DI5
+CTRL_1.3-DI_01
/121.5
E10.5
+CTRL_1.3-190F1:13
LIGHTNING PROTECTION in Control Cabinet OPTIONAL

Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 1 Tripped GRID

CB 1 ON GRID

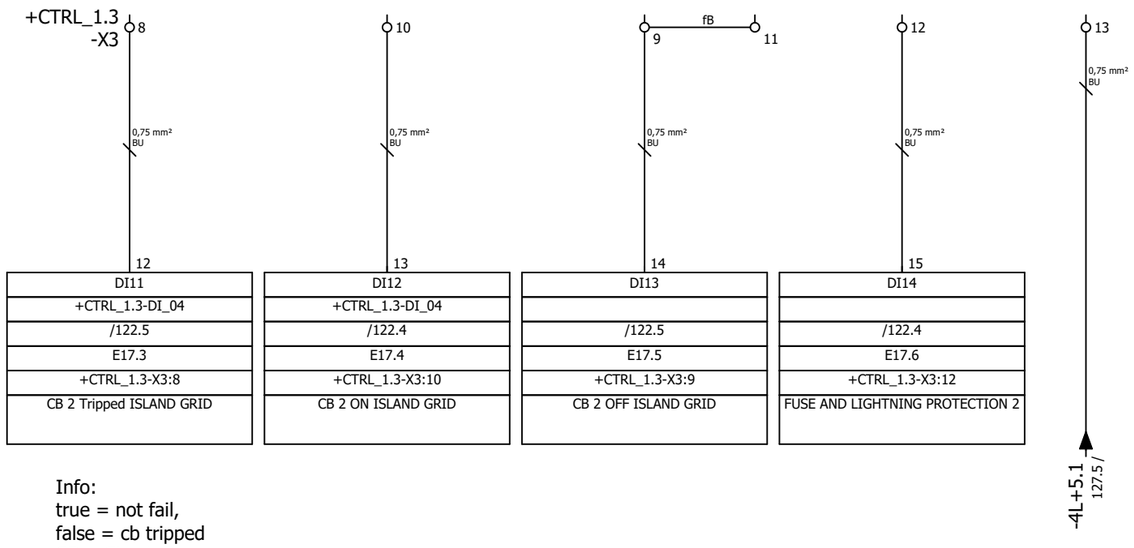
CB 1 OFF GRID

FUSE AND LIGHTNING PROTECTION

LIGHTNING PROTECTION in Control Cabinet OPTIONAL

previous page: 126

next page: 128



Info:
true = not fail,
false = cb tripped
CB = Circuit Breaker

CB 2 Tripped ISLAND GRID

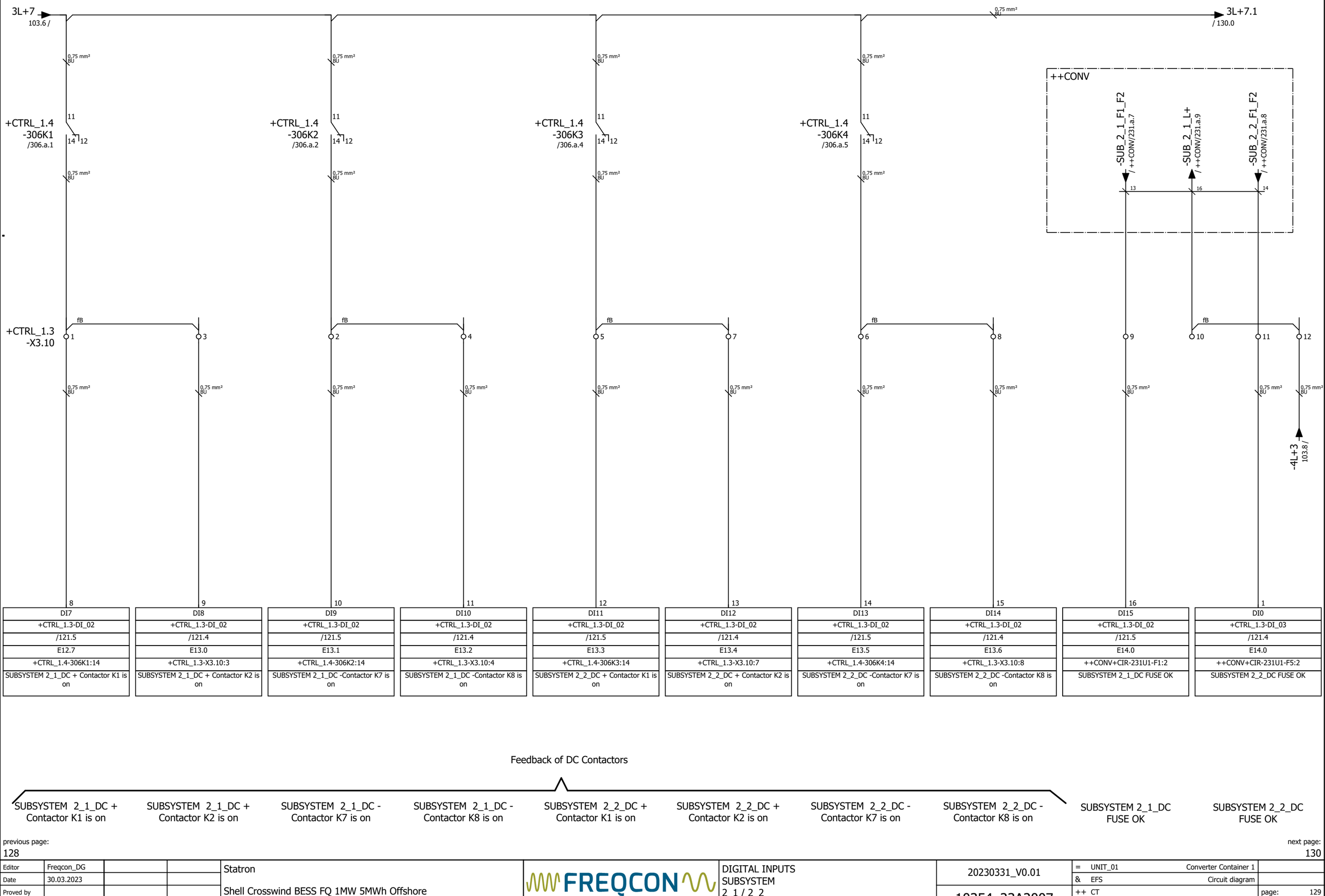
CB 2 ON ISLAND GRID

CB 2 OFF ISLAND GRID

FUSE AND LIGHTNING PROTECTION 2

previous page: 127

next page: 129



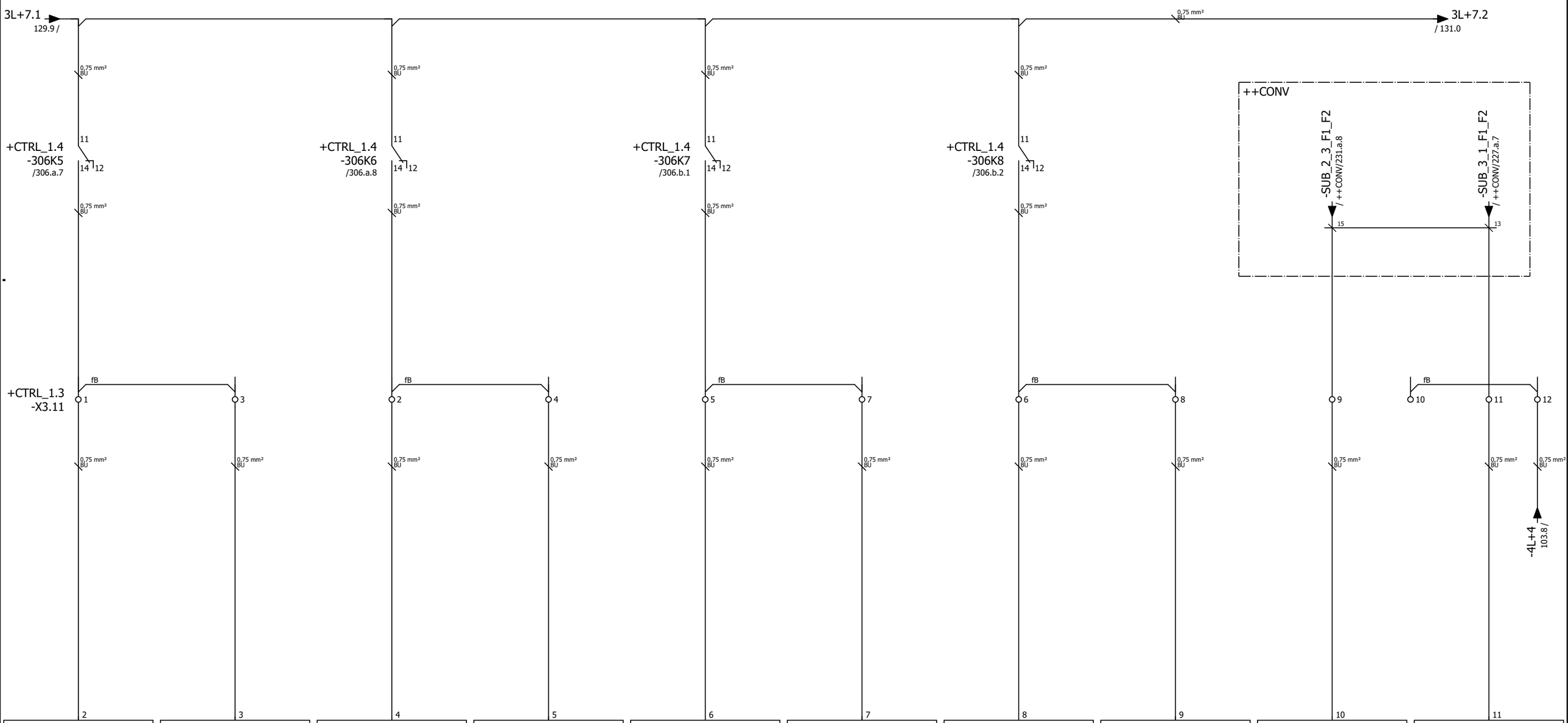
Feedback of DC Contactors

SUBSYSTEM 2_1_DC + Contactor K1 is on | SUBSYSTEM 2_1_DC + Contactor K2 is on | SUBSYSTEM 2_1_DC - Contactor K7 is on | SUBSYSTEM 2_1_DC - Contactor K8 is on | SUBSYSTEM 2_2_DC + Contactor K1 is on | SUBSYSTEM 2_2_DC + Contactor K2 is on | SUBSYSTEM 2_2_DC - Contactor K7 is on | SUBSYSTEM 2_2_DC - Contactor K8 is on | SUBSYSTEM 2_1_DC FUSE OK | SUBSYSTEM 2_2_DC FUSE OK

previous page: 128

next page: 130

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_1 / 2_2	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 129
Date								+ total: 423



2	3	4	5	6	7	8	9	10	11
DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	DI9	DI10
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03
/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4	/121.5	/121.4
E14.1	E14.2	E14.3	E14.4	E14.5	E14.6	E14.7	E15.0	E15.1	E15.2
+CTRL_1.4-306K5:14	+CTRL_1.3-X3.11:3	+CTRL_1.4-306K6:14	+CTRL_1.3-X3.11:4	+CTRL_1.4-306K7:14	+CTRL_1.3-X3.11:7	+CTRL_1.4-306K8:14	+CTRL_1.3-X3.11:8	++CONV+CIR-231U1-F9:2	++CONV+CIR-227U1-F1:2
SUBSYSTEM 2_3_DC + Contactor K1 is on	SUBSYSTEM 2_3_DC + Contactor K2 is on	SUBSYSTEM 2_3_DC -Contactor K7 is on	SUBSYSTEM 2_3_DC -Contactor K8 is on	SUBSYSTEM 3_1_DC + Contactor K1 is on	SUBSYSTEM 3_1_DC + Contactor K2 is on	SUBSYSTEM 3_1_DC -Contactor K7 is on	SUBSYSTEM 3_1_DC -Contactor K8 is on	SUBSYSTEM 2_3_DC FUSE OK	SUBSYSTEM 3_1_DC FUSE OK

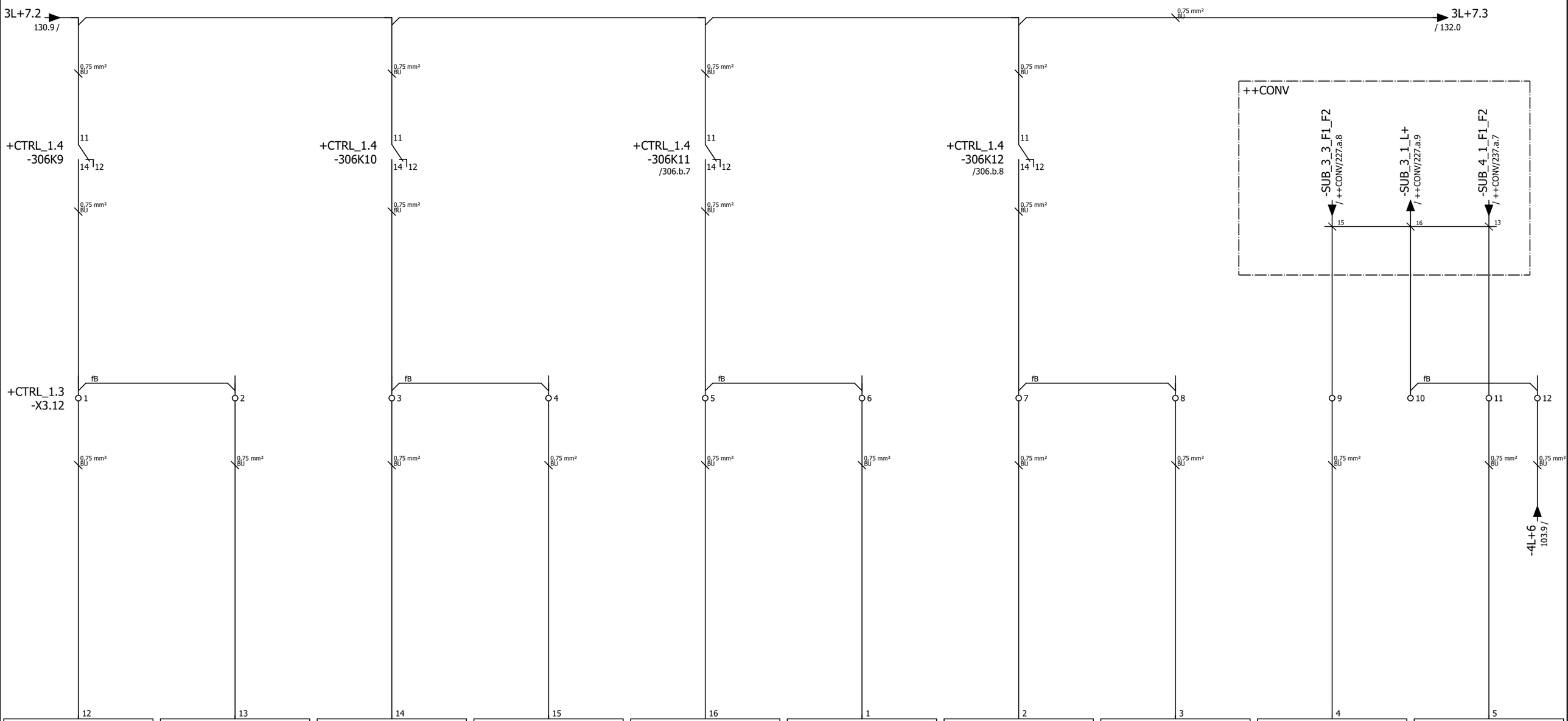
Feedback of DC Contactors

SUBSYSTEM 2_3_DC + Contactor K1 is on | SUBSYSTEM 2_3_DC + Contactor K2 is on | SUBSYSTEM 2_3_DC - Contactor K7 is on | SUBSYSTEM 2_3_DC - Contactor K8 is on | SUBSYSTEM 3_1_DC + Contactor K1 is on | SUBSYSTEM 3_1_DC + Contactor K2 is on | SUBSYSTEM 3_1_DC - Contactor K7 is on | SUBSYSTEM 3_1_DC - Contactor K8 is on | SUBSYSTEM 2_3_DC FUSE OK | SUBSYSTEM 3_1_DC FUSE OK

previous page: 129

next page: 131

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 2_3 / 3_1	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 130
Date								+ total: 423



12	13	14	15	16	1	2	3	4	5
DI11	DI12	DI13	DI14	DI15	DI0	DI1	DI2	DI3	DI4
+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_03	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05
/121.5	/121.4	/121.5	/121.4	/121.5	/122.4	/122.5	/122.4	/122.5	/122.4
E15.3	E15.4	E15.5	E13.6	E13.7	E18.0	E18.1	E18.2	E18.3	E18.4
+CTRL_1.4-306K9:14	+CTRL_1.3-X3.12:2	+CTRL_1.4-306K10:14	+CTRL_1.3-X3.12:4	+CTRL_1.4-306K11:14	+CTRL_1.3-X3.12:6	+CTRL_1.4-306K12:14	+CTRL_1.3-X3.12:8	++CONV+CIR-227U1-F9:2	++CONV+CIR-237U1-F1:2
SUBSYSTEM 3_3_DC + Contactor K1 is on	SUBSYSTEM 3_3_DC + Contactor K2 is on	SUBSYSTEM 3_3_DC -Contactor K7 is on	SUBSYSTEM 3_3_DC -Contactor K8 is on	SUBSYSTEM 4_1_DC + Contactor K1 is on	SUBSYSTEM 4_1_DC + Contactor K2 is on	SUBSYSTEM 4_1_DC -Contactor K7 is on	SUBSYSTEM 4_1_DC -Contactor K8 is on	SUBSYSTEM 3_3_DC FUSE OK	SUBSYSTEM 4_1_DC FUSE OK

Feedback of DC Contactors

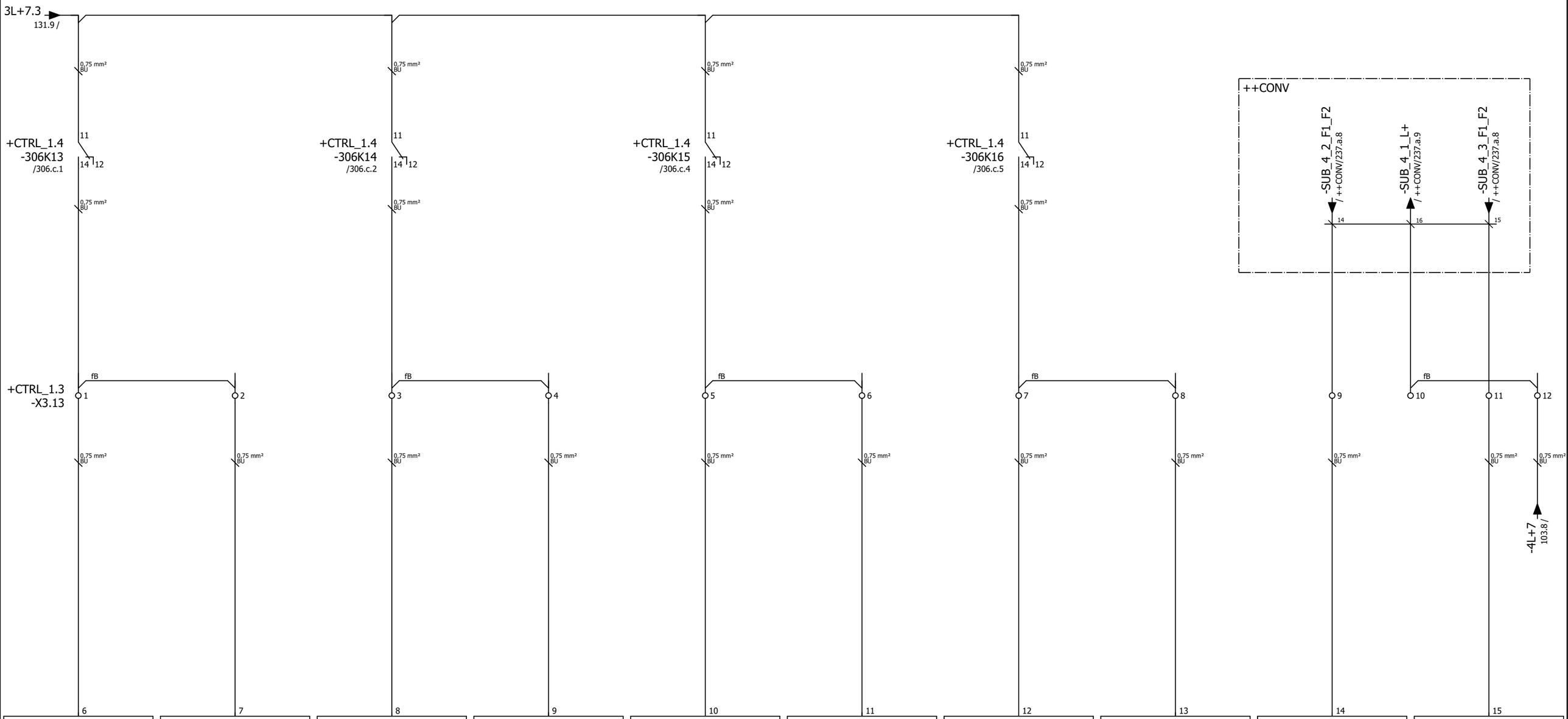
SUBSYSTEM 3_3_DC + Contactor K1 is on | SUBSYSTEM 3_3_DC + Contactor K2 is on | SUBSYSTEM 3_3_DC - Contactor K7 is on | SUBSYSTEM 3_3_DC - Contactor K8 is on | SUBSYSTEM 4_1_DC + Contactor K1 is on | SUBSYSTEM 4_1_DC + Contactor K2 is on | SUBSYSTEM 4_1_DC - Contactor K7 is on | SUBSYSTEM 4_1_DC - Contactor K8 is on | SUBSYSTEM 3_3_DC FUSE OK | SUBSYSTEM 4_1_DC FUSE OK

previous page: 130

next page: 132

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 3_3 / 4_1	20230331_V0.01
Date	30.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EFS	Circuit diagram	
++	CT	page:	131
+		total:	423



6	7	8	9	10	11	12	13	14	15
DI5	DI6	DI7	DI8	DI9	DI10	DI11	DI12	DI13	DI14
+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05	+CTRL_1.3-DI_05
/122.5	/122.4	/122.5	/122.4	/122.5	/122.4	/122.5	/122.4	/122.5	/122.4
E18.5	E18.6	E18.7	E19.0	E19.1	E19.2	E19.3	E19.4	E19.5	E19.6
+CTRL_1.4-306K13:14	+CTRL_1.3-X3.13:2	+CTRL_1.4-306K14:14	+CTRL_1.3-X3.13:4	+CTRL_1.4-306K15:14	+CTRL_1.3-X3.13:6	+CTRL_1.4-306K16:14	+CTRL_1.3-X3.13:8	++CONV+CIR-237U1-F5:2	++CONV+CIR-237U1-F9:2
SUBSYSTEM 4_2_DC + Contactor K1 is on	SUBSYSTEM 4_2_DC + Contactor K2 is on	SUBSYSTEM 4_2_DC -Contactor K7 is on	SUBSYSTEM 4_2_DC -Contactor K8 is on	SUBSYSTEM 4_3_DC + Contactor K1 is on	SUBSYSTEM 4_3_DC + Contactor K2 is on	SUBSYSTEM 4_3_DC -Contactor K7 is on	SUBSYSTEM 4_3_DC -Contactor K8 is on	SUBSYSTEM 4_2_DC FUSE OK	SUBSYSTEM 4_3_DC FUSE OK

Feedback of DC Contactors

SUBSYSTEM 4_2_DC + Contactor K1 is on	SUBSYSTEM 4_2_DC + Contactor K2 is on	SUBSYSTEM 4_2_DC - Contactor K7 is on	SUBSYSTEM 4_2_DC - Contactor K8 is on	SUBSYSTEM 4_3_DC + Contactor K1 is on	SUBSYSTEM 4_3_DC + Contactor K2 is on	SUBSYSTEM 4_3_DC - Contactor K7 is on	SUBSYSTEM 4_3_DC - Contactor K8 is on	SUBSYSTEM 4_2_DC FUSE OK	SUBSYSTEM 4_3_DC FUSE OK

previous page: 131

next page: 133

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SUBSYSTEM 4_2 / 4_3	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 132
Date								+ total: 423

1L+8.4
187.9 /

1L+8.5
/ 84.7

0,75 mm² BU

+CTRL_1.3
-190F1
/190.1

+CTRL_1.3
-190F2
/190.3

+CTRL_1.3
-190F3
/190.5

+CTRL_1.3
-X3

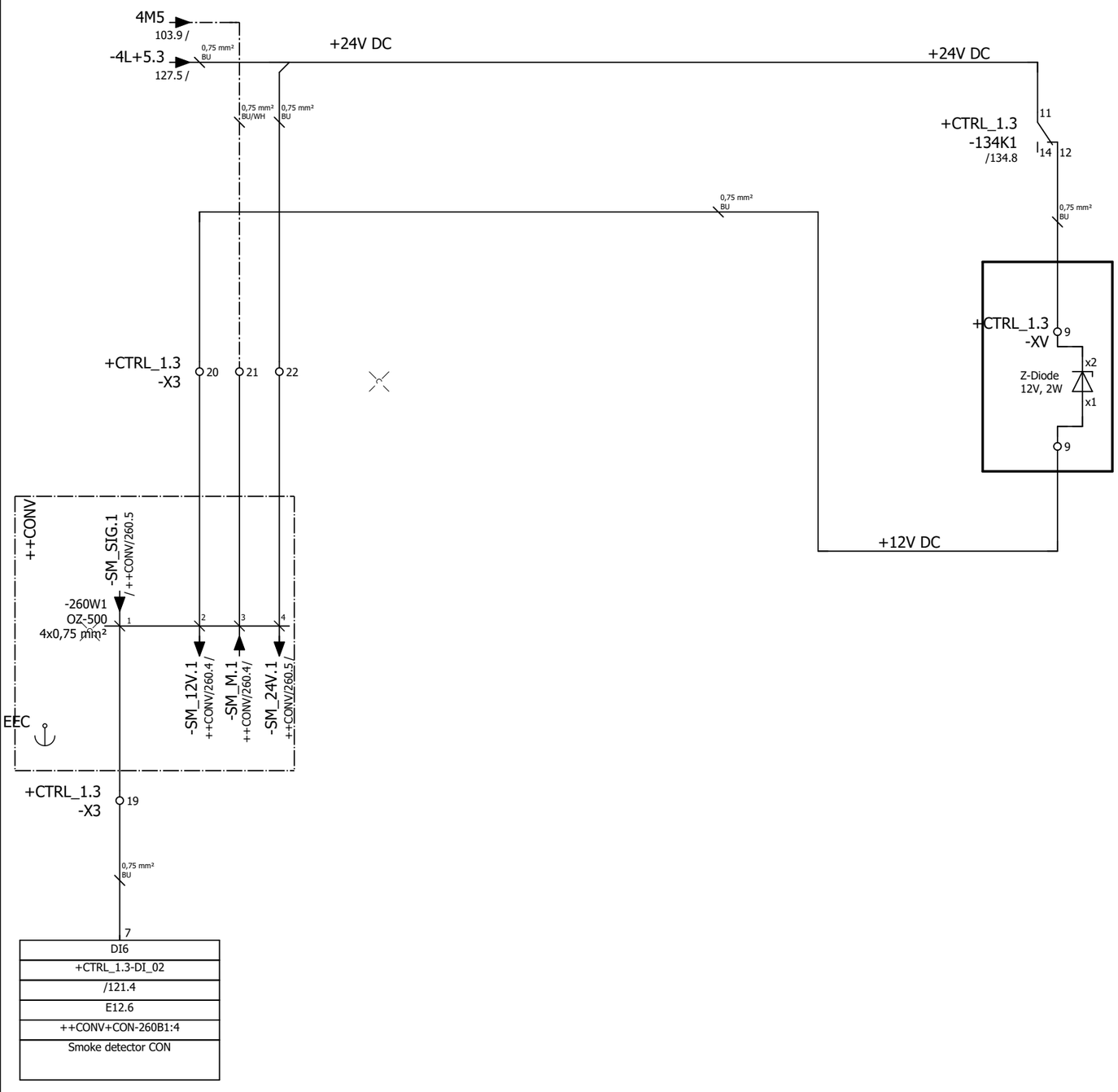
	8	9	10	11
	DI7	DI8	DI9	DI10
	+CTRL_1.3-DI_04	+CTRL_1.3-DI_04	+CTRL_1.3-DI_04	+CTRL_1.3-DI_04
	/122.5	/122.4	/122.5	/122.4
	E17.0	E17.1	E17.2	E17.2
	+CTRL_1.3-X3:14	+CTRL_1.3-X3:15	+CTRL_1.3-X3:16	+CTRL_1.3-190F3:14
	SPARE	SPARE	SPARE	Fuse 230V AC for Container Air Conditioning

SPARE | SPARE | SPARE | Fuse 230V AC for Container Air Conditioning | SPARE

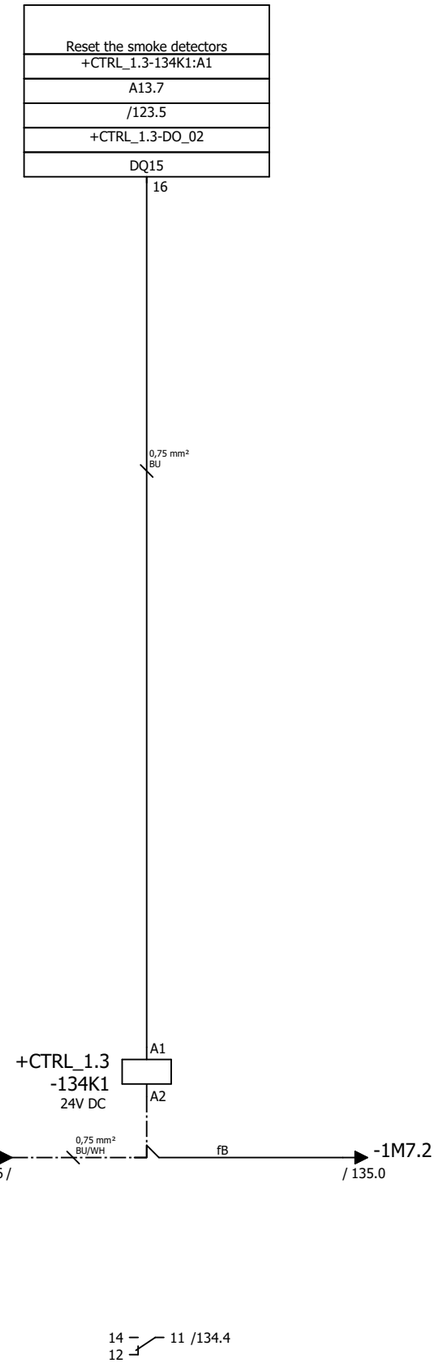
previous page: 132

next page: 134

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SPARE	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 133
Date								+ total: 423



Smoke detector
CON



Reset
the smoke detectors

previous page:
133

next page:
135

Editor	Freqcon_DG			Statron	FREQCON	DIGITAL INPUTS SMOKE DETECTORS	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 134
Date								+	total: 423

CON Fans 1-5 in door	FAN 1 Control cabinet	CIR Fans 1-3 in door	SPARE 230V	SPARE
+CTRL_1.3-135K1:A1	+CTRL_1.3-135K2:A1	+CTRL_1.3-135K3:A1	+CTRL_1.3-135K4:A1	+CTRL_1.3-135K5:A1
A10.0	A10.1	A10.2	A10.3	A12.7
/123.4	/123.5	/123.4	/123.5	/123.5
+CTRL_1.3-DO_01				+CTRL_1.3-DO_02
DQ0	DQ1	DQ2	DQ3	DQ7
1	2	3	4	8

0,75 mm² BU

+CTRL_1.3 -135K1 24V DC A1 A2
+CTRL_1.3 -135K2 24V DC A1 A2
+CTRL_1.3 -135K3 24V DC A1 A2
+CTRL_1.3 -135K4 24V DC A1 A2
+CTRL_1.3 -135K5 24V DC A1 A2

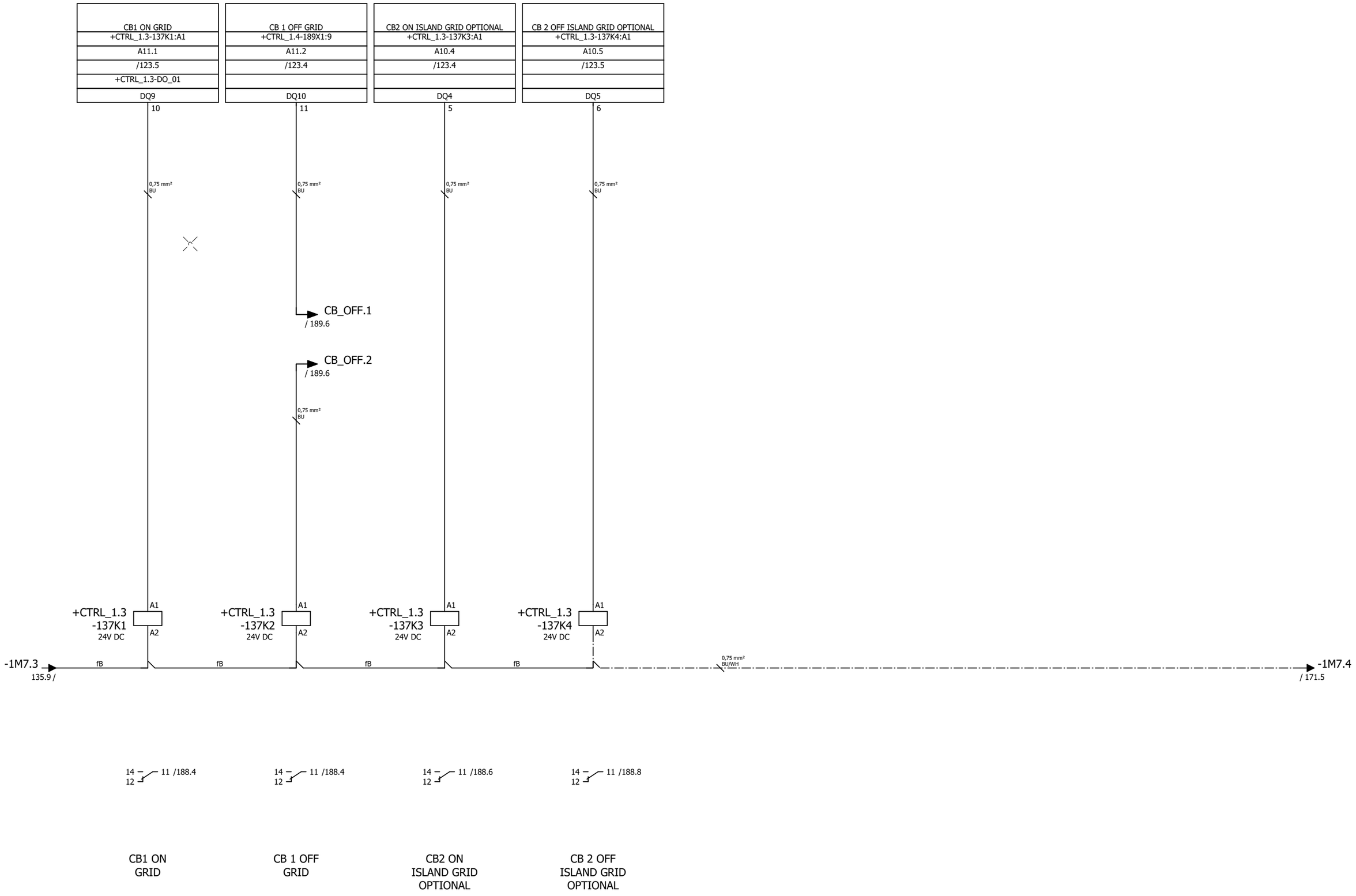
-1M7.2 134.9 / — fB — fB — fB — fB — fB — fB — -1M7.3 / 137.0

14 12 11 /183.1
14 12 11 /185.1
14 12 11 /183.3
14 12 11 /190.3

CON Fans 1-5 in door
FAN 1 Control cabinet
CIR Fans 1-3 in door
SPARE 230V
SPARE

previous page: 134
next page: 137

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS FAN	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 135
Date								+	total: 423

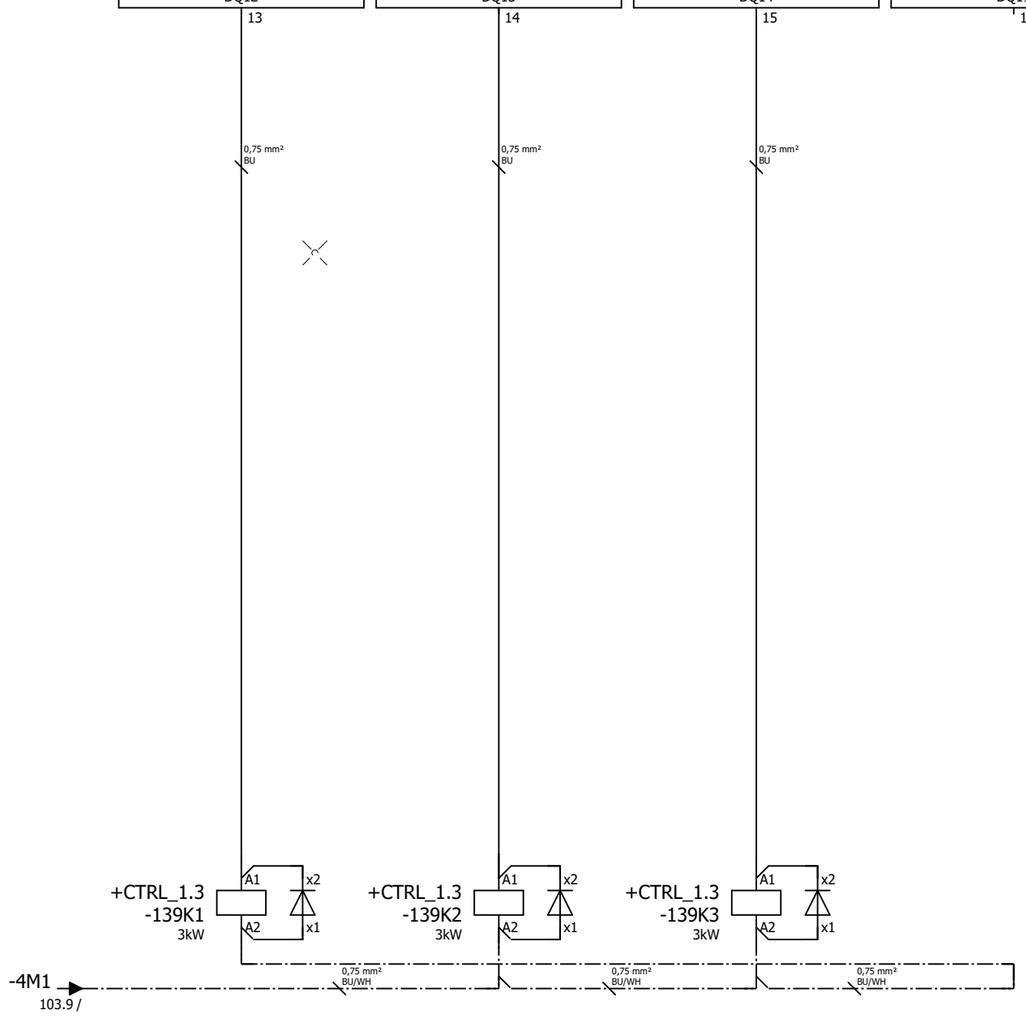


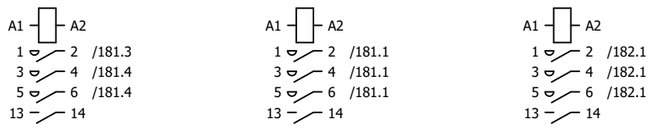
previous page: 135

next page: 139

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS CIRCUIT BREAKER	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 137
Date								+	total: 423

Heater On converter coolingsystem	Pump converter coolingsystem	Fan 1 Heat exchanger	Fan 2 Heat exchanger optional
+CTRL_1.3-139K1:A1	+CTRL_1.3-139K2:A1	+CTRL_1.3-139K3:A1	
A13.4	A13.5	A13.6	A13.3
/123.4	/123.5	/123.4	/123.5
+CTRL_1.3-DO_02			
DQ12	DQ13	DQ14	DQ11





Heater On converter coolingsystem

Pump converter coolingsystem

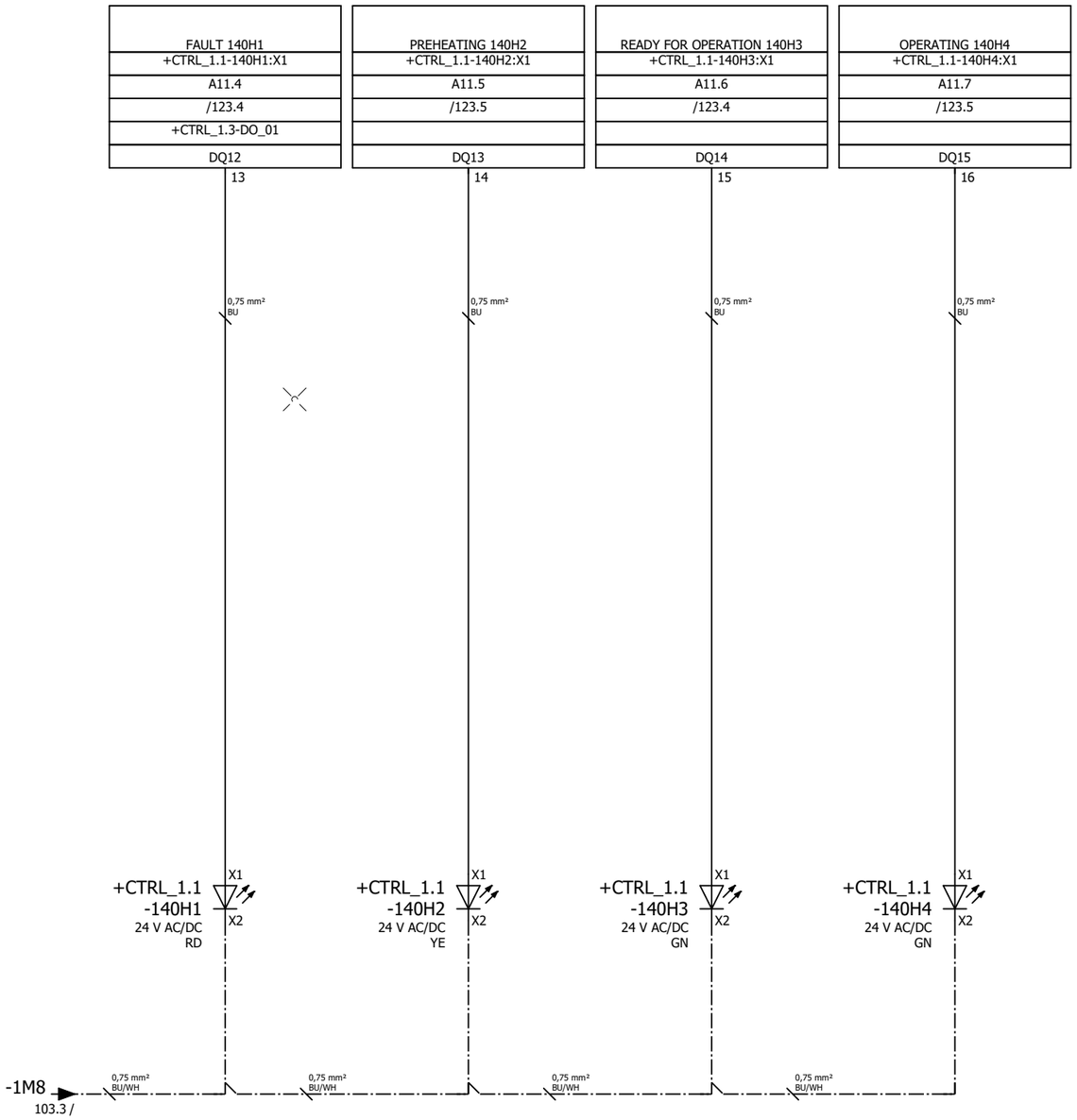
Fan 1 Heat exchanger

Fan 2 Heat exchanger optional

previous page: 137

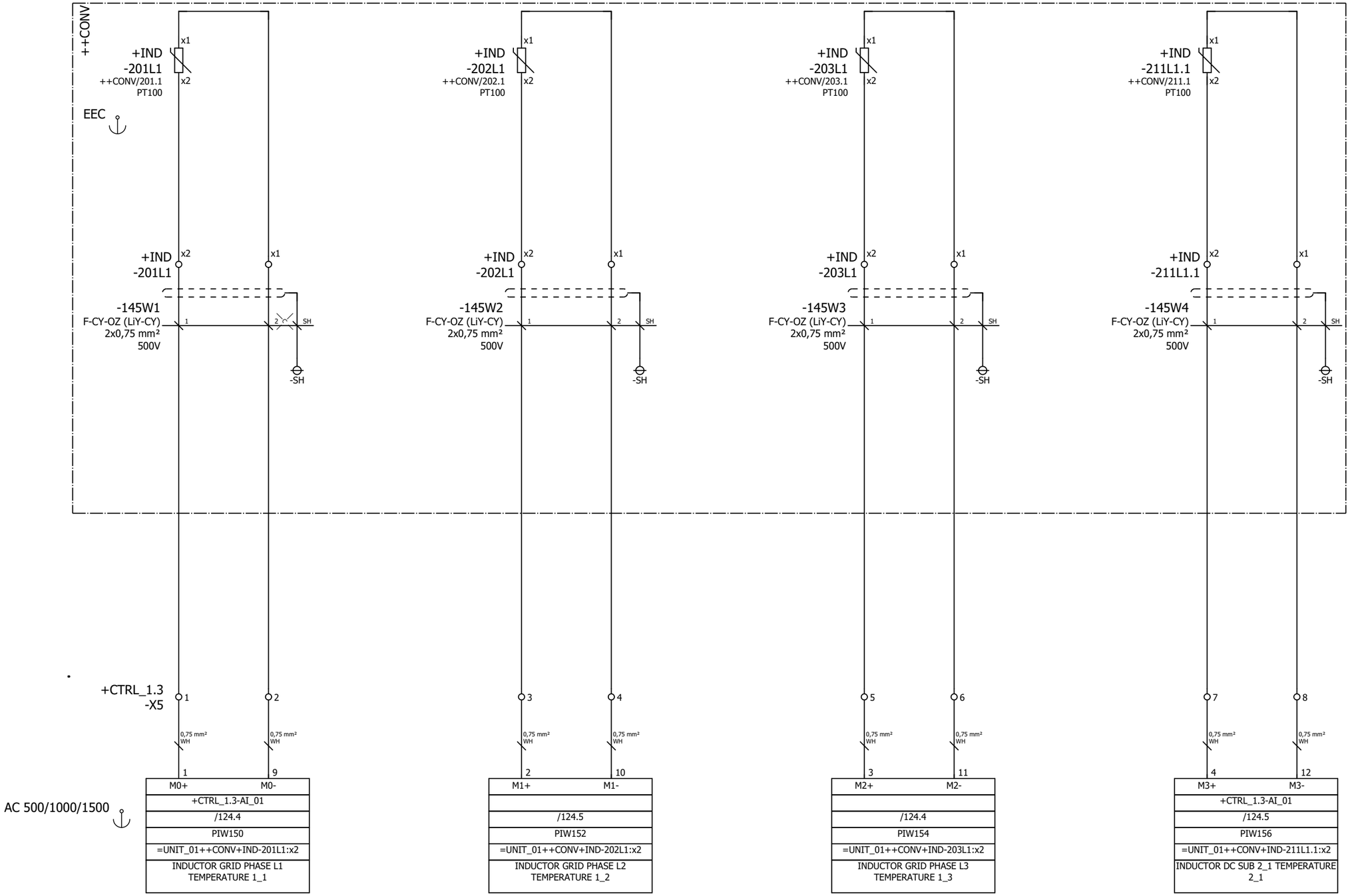
next page: 140

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS COOLING	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 139
Date								+ total: 423



previous page: 139

next page: 145



INDUCTOR
GRID PHASE L1
TEMPERATURE 1_1

INDUCTOR
GRID PHASE L2
TEMPERATURE 1_2

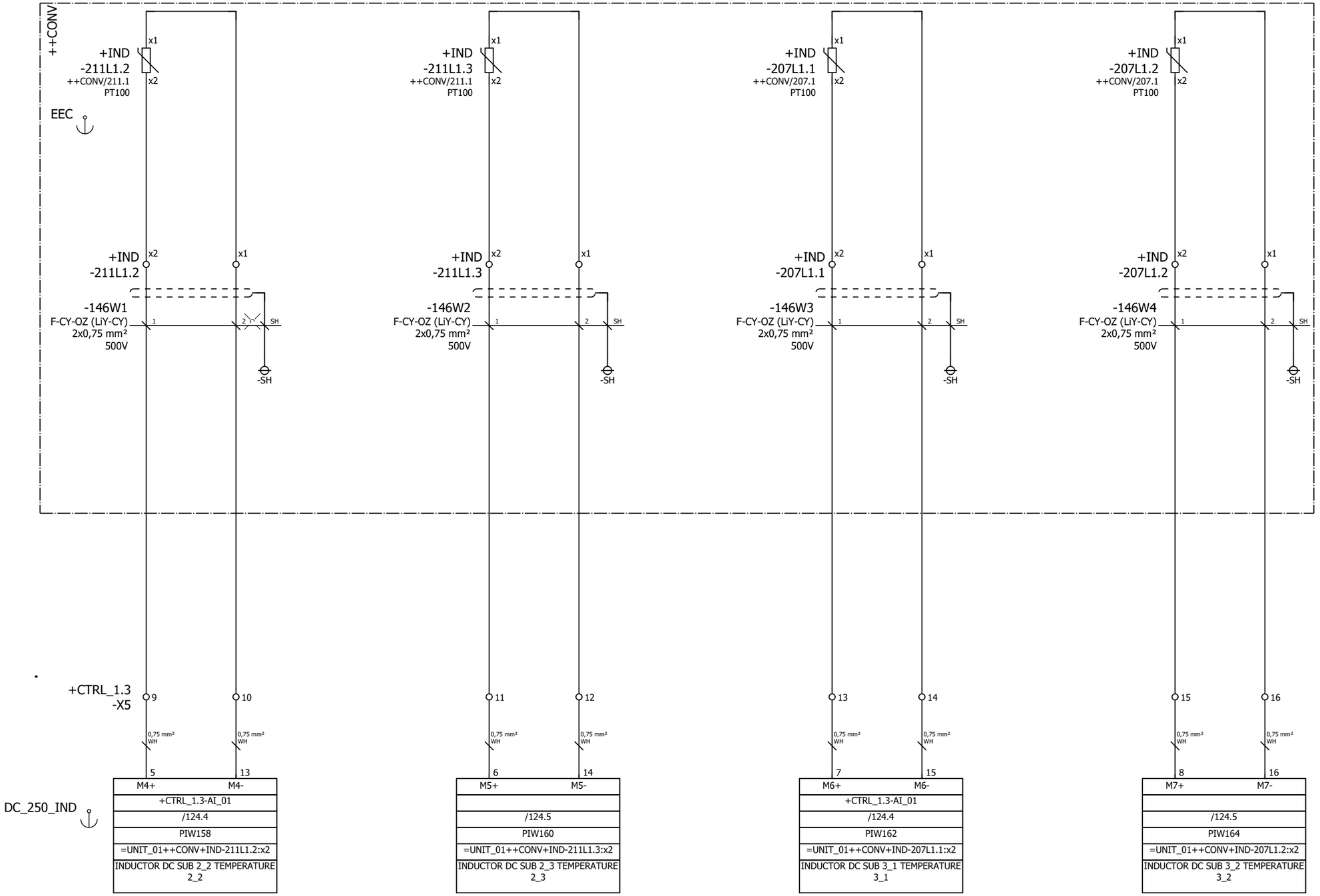
INDUCTOR
GRID PHASE L3
TEMPERATURE 1_3

INDUCTOR
DC SUB 2_1
TEMPERATURE 2_1

previous page: 140

next page: 146

Editor	Freqcon_DG			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_1 -1_3)	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 145
Date								+	total: 423



INDUCTOR DC SUB 2_2 TEMPERATURE 2_2

INDUCTOR DC SUB 2_3 TEMPERATURE 2_3

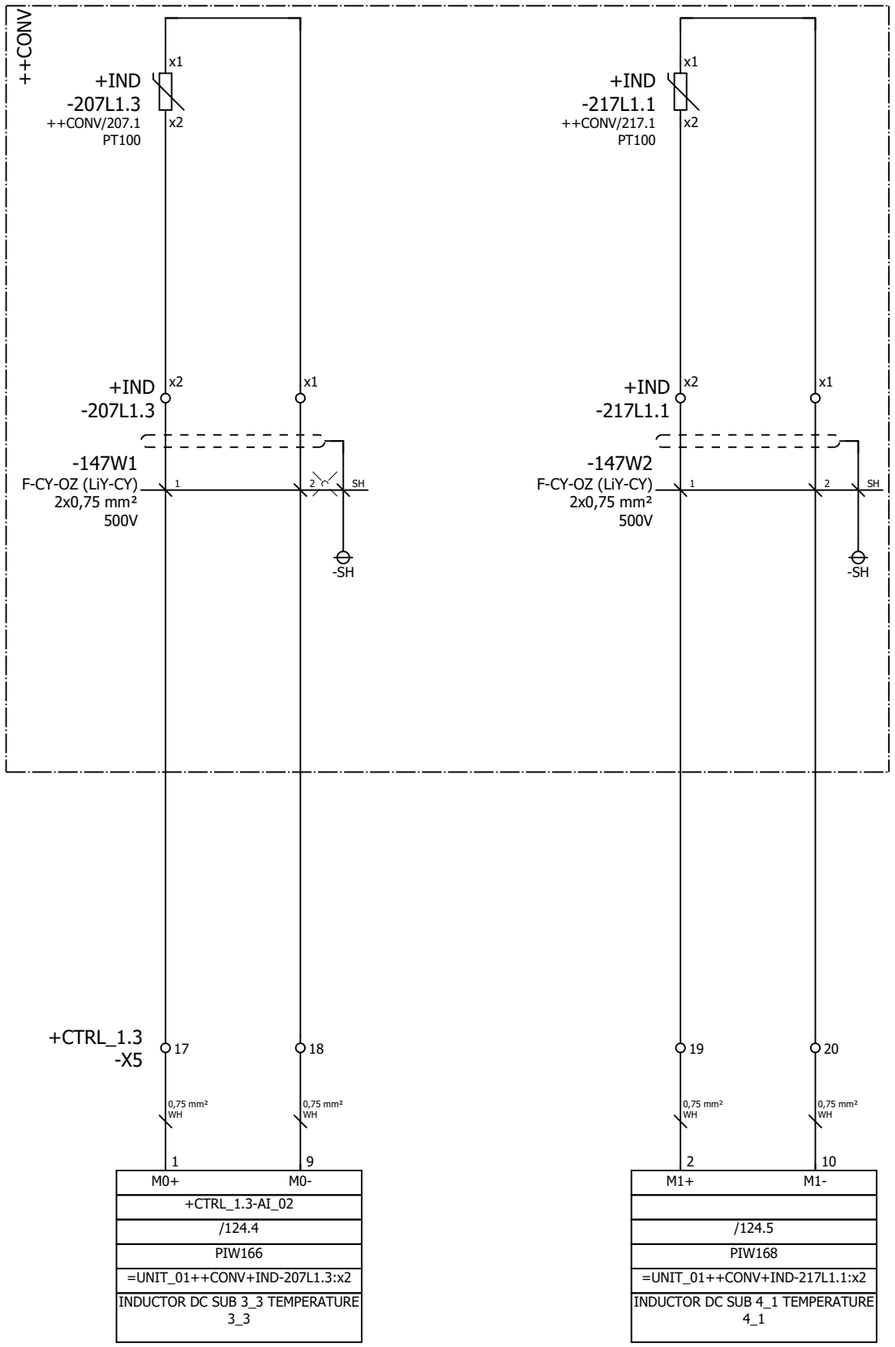
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1

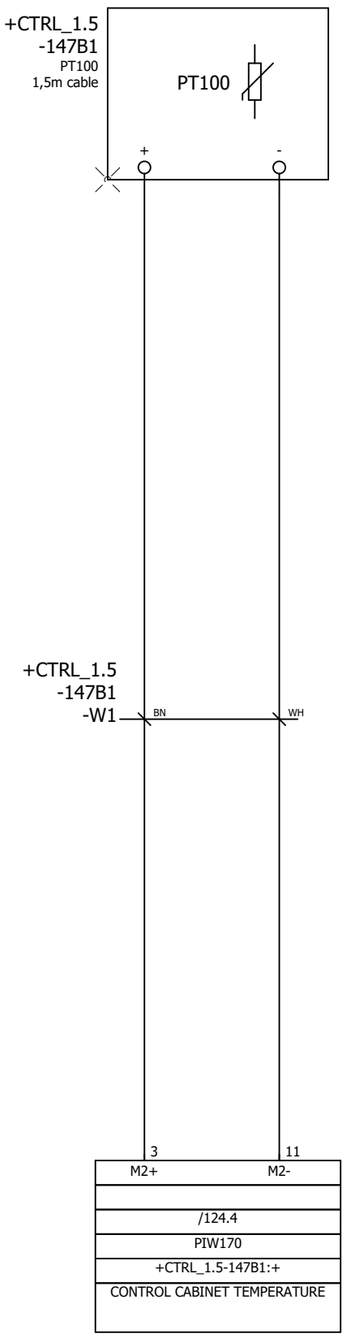
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2

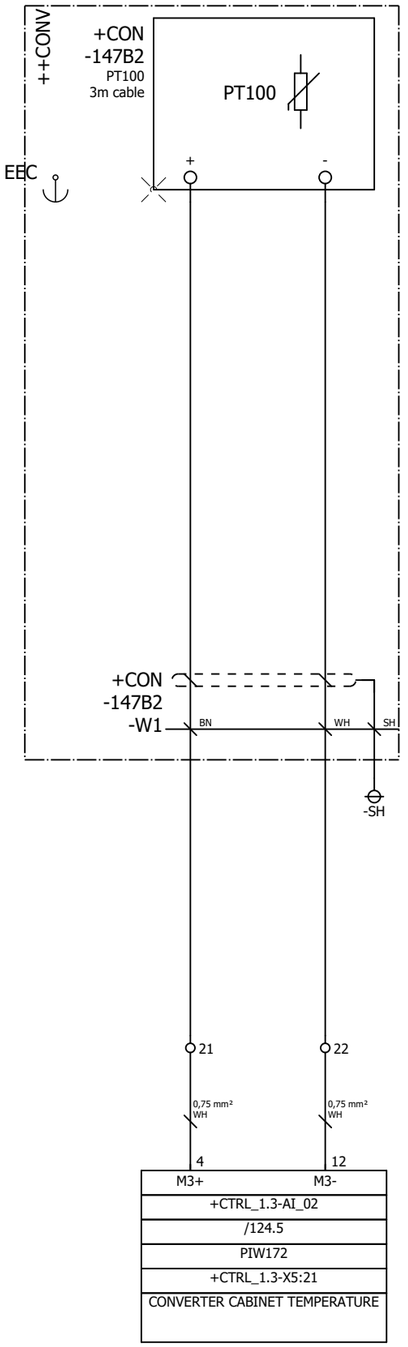
previous page: 145

next page: 147

Editor	Freqcon_DG			Statron	FREQCON	ANALOG INPUTS (TEMPERATURE SUBSYSTEM 1_4 -1_6)	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 146
Date								+ total: 423







INDUCTOR
DC SUB 3_3
TEMPERATURE 3_3

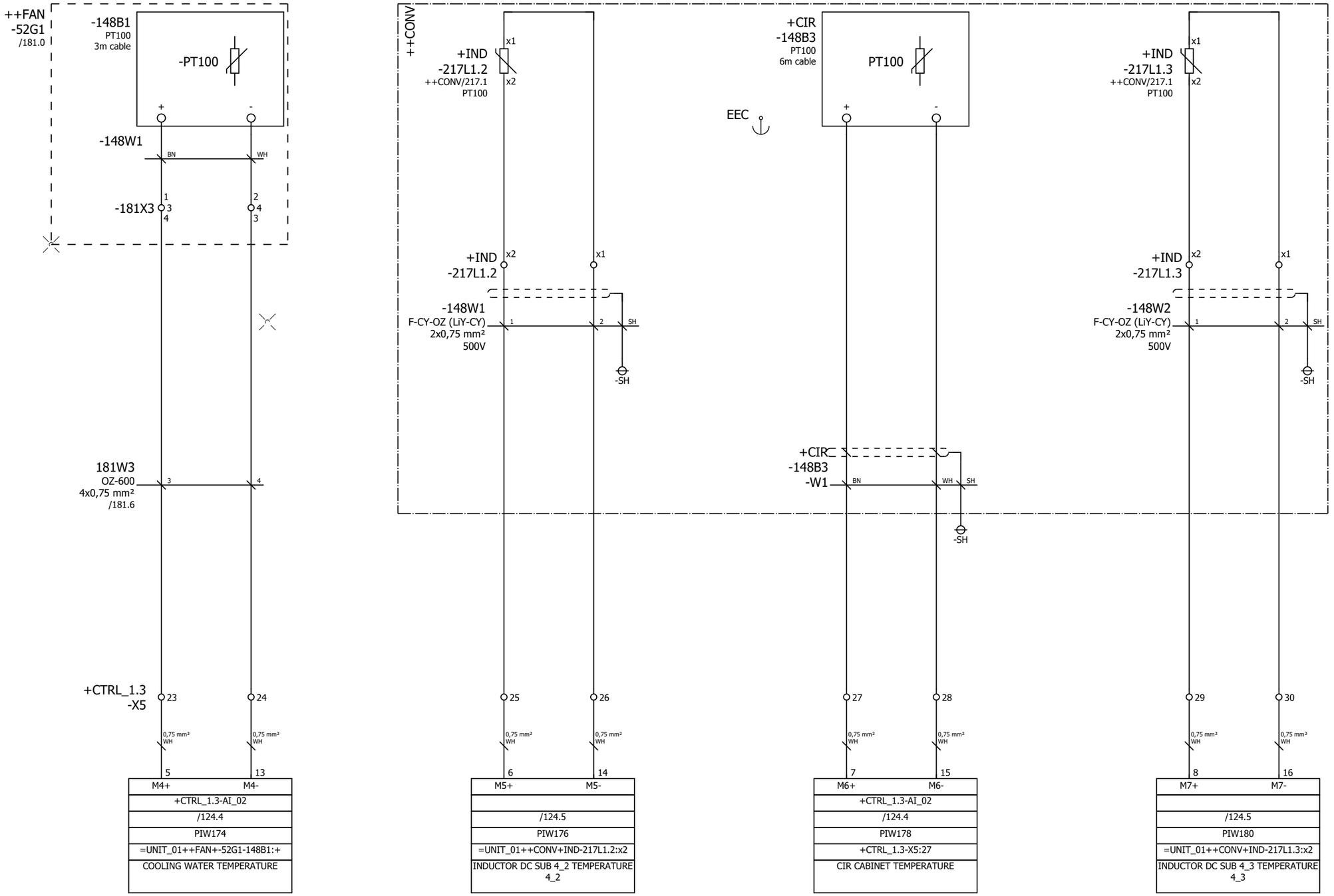
INDUCTOR
DC SUB 4_1
TEMPERATURE 4_1

CONTROL
CABINET
TEMPERATURE

CONVERTER
CABINET
TEMPERATURE

previous page:
146

next page:
148



COOLING WATER TEMPERATURE

INDUCTOR DC SUB 4_2 TEMPERATURE 4_2

CIR CABINET TEMPERATURE

INDUCTOR DC SUB 4_3 TEMPERATURE 4_3

previous page: 147

next page: 149

-1M11
103.3 /

0,75 mm²
BU/WH

fB

+CTRL_1.3
-X5.1

1

2

0,75 mm²
BU/WH

0,75 mm²
BU/WH

0,75 mm²
BU/WH

0,75 mm²
BU/WH

0,75 mm²
BU/WH

0,75 mm²
BU/WH

0,75 mm²
WH

0,75 mm²
WH

0,75 mm²
WH

0,75 mm²
WH

0,75 mm²
WH

0,75 mm²
WH

1	5	2	6	3	7	4	8	1	5	2	6
U0+	U0-	U1+	U1-	U2+	U2-	U3+	U3-	U0+	U0-	U1+	U1-
+CTRL_1.3-AI_03				+CTRL_1.3-AI_03				+CTRL_1.3-AI_04		+CTRL_1.3-AI_04	
/124.4		/124.5		/124.4		/124.5		/125.4		/125.5	
PIW182		PIW184		PIW186		PIW188		PIW190		PIW192	
+CTRL_1.4-149U1:15		+CTRL_1.4-149U1:16		+CTRL_1.4-149U1:17		+CTRL_1.4-149U1:20		+CTRL_1.4-149U1:19		+CTRL_1.4-149U1:18	
DC_SUBSYSTEM 1_4.1 voltage		DC_SUBSYSTEM 1_5 voltage		DC_SUBSYSTEM 1_5.1 voltage		DC_SUBSYSTEM 1_6 voltage		DC_SUBSYSTEM 1_6.1 voltage		SPARE SPARE voltage	

+CTRL_1.4
-149U1
PXC.2959609

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Adapter Sub-D 25 Pin Buchse
Terminalblock 27 Pin

25-POL SUB-D
SOCKET

11X3

-149W1
pre-assembled D-Sub cable 1:1

HVIO_AN
/

DC_SUBSYSTEM
1_4.1
voltage

DC_SUBSYSTEM
1_5
voltage

DC_SUBSYSTEM
1_5.1
voltage

DC_SUBSYSTEM
1_6
voltage

DC_SUBSYSTEM
1_6.1
voltage

SPARE
SPARE
voltage

Voltage measurement

previous page:
148

next page:
150

-4L+1
103.8 /

0,75 mm² BU

SUBSYSTEM 2_1 CONTACTOR DC+ ON
+CTRL_1.3-150K1:A1
A12.0
/123.4
+CTRL_1.3-DO_02
DQ0
1

SUBSYSTEM 2_1 CONTACTOR DC-ON
+CTRL_1.3-150K2:A1
A12.1
/123.5
DQ1
2

+CTRL_1.3
-195K1
/195.3
33
34

+CTRL_1.3
-195K2
/195.4
34
33

+CTRL_1.3
-150K1
/150.1
11
14
12

+CTRL_1.3
-150K2
/150.3
11
14
12

L+Safe
/ 151.0

-4M3
103.9 /

0,75 mm² BU/WH

+CTRL_1.3
-195K1
/195.3
23
24

+CTRL_1.3
-195K2
/195.4
24
23

PTTB 1,5/S

+CTRL_1.3
-150X1
1

-SUB_2_1_K_.M
/++CONV/231.a.9

++CONV

-231W4
OZ-500
18x1 mm²
1
17

EEC

-SUB_2_1_K_.+
/++CONV/231.a.1

+CTRL_1.3
-150X1
2

+CTRL_1.3
-150K1
24V DC
A1
A2

+CTRL_1.3
-150K2
24V DC
A1
A2

++CONV

-231W4
OZ-500
18x1 mm²
4

-SUB_2_1_K_.-
/++CONV/231.a.3

+CTRL_1.3
-XV
/150.7
Suppression
TVS Diode
bi-directional 47 V
150.7
3
4

M_Safe_XV.1
151.4 /

M_Safe_XV.2
/ 151.7

fB

M_Safe
/ 151.0

14 12 11 /150.2

SUBSYSTEM 2_1
CONTACTOR DC+
ON

14 12 11 /150.4

SUBSYSTEM 2_1
CONTACTOR DC-
ON

previous page:
149

next page:
151

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_1	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 150
Date								+ total: 423

-L+Safe
150.9 /

L+Safe.1
/ 350.0

SUBSYSTEM 2_2 CONTACTOR DC+ ON
+CTRL_1.3-151K1:A1
A12.2
/123.4
+CTRL_1.3-DO_02
DQ2

SUBSYSTEM 2_2 CONTACTOR DC-ON
+CTRL_1.3-151K2:A1
A12.3
/123.5
+CTRL_1.3-DO_02
DQ3

SUBSYSTEM 2_3 CONTACTOR DC+ ON
+CTRL_1.3-151K3:A1
A12.4
/123.4
+CTRL_1.3-DO_02
DQ4

SUBSYSTEM 2_3 CONTACTOR DC-ON
+CTRL_1.3-151K4:A1
A12.5
/123.5
DQ5

3 4 5 6

+CTRL_1.3 -151K1 /151.0
+CTRL_1.3 -151K2 /151.2
+CTRL_1.3 -151K3 /151.3
+CTRL_1.3 -151K4 /151.5

11 14 12

0,75 mm² BU

+CTRL_1.3 -150X1

++CONV
EEC
-231W4 OZ-500 18x1 mm²
-SUB_2_2_K_+ /231.a.2/ ++CONV
-SUB_2_2_K_- /231.a.4/ ++CONV
-SUB_2_3_K_+ /231.a.2/ ++CONV
-SUB_2_3_K_- /231.a.5/ ++CONV

+CTRL_1.3 -XV
M_Safe_XV.2
150.9 /
fB

+CTRL_1.3 -150X1 5
+CTRL_1.3 -151K1 24V DC
+CTRL_1.3 -151K2 24V DC
+CTRL_1.3 -151K3 24V DC
+CTRL_1.3 -151K4 24V DC
A1 A2

0,75 mm² BU/WH
M_Safe_XV.1
/ 150.7

10

-M_Safe
150.9 /
M_Safe.1
/ 350.0

14 12 11 /151.1
14 12 11 /151.3
14 12 11 /151.4
14 12 11 /151.6

SUBSYSTEM 2_2 CONTACTOR DC+ ON

SUBSYSTEM 2_2 CONTACTOR DC- ON

SUBSYSTEM 2_3 CONTACTOR DC+ ON

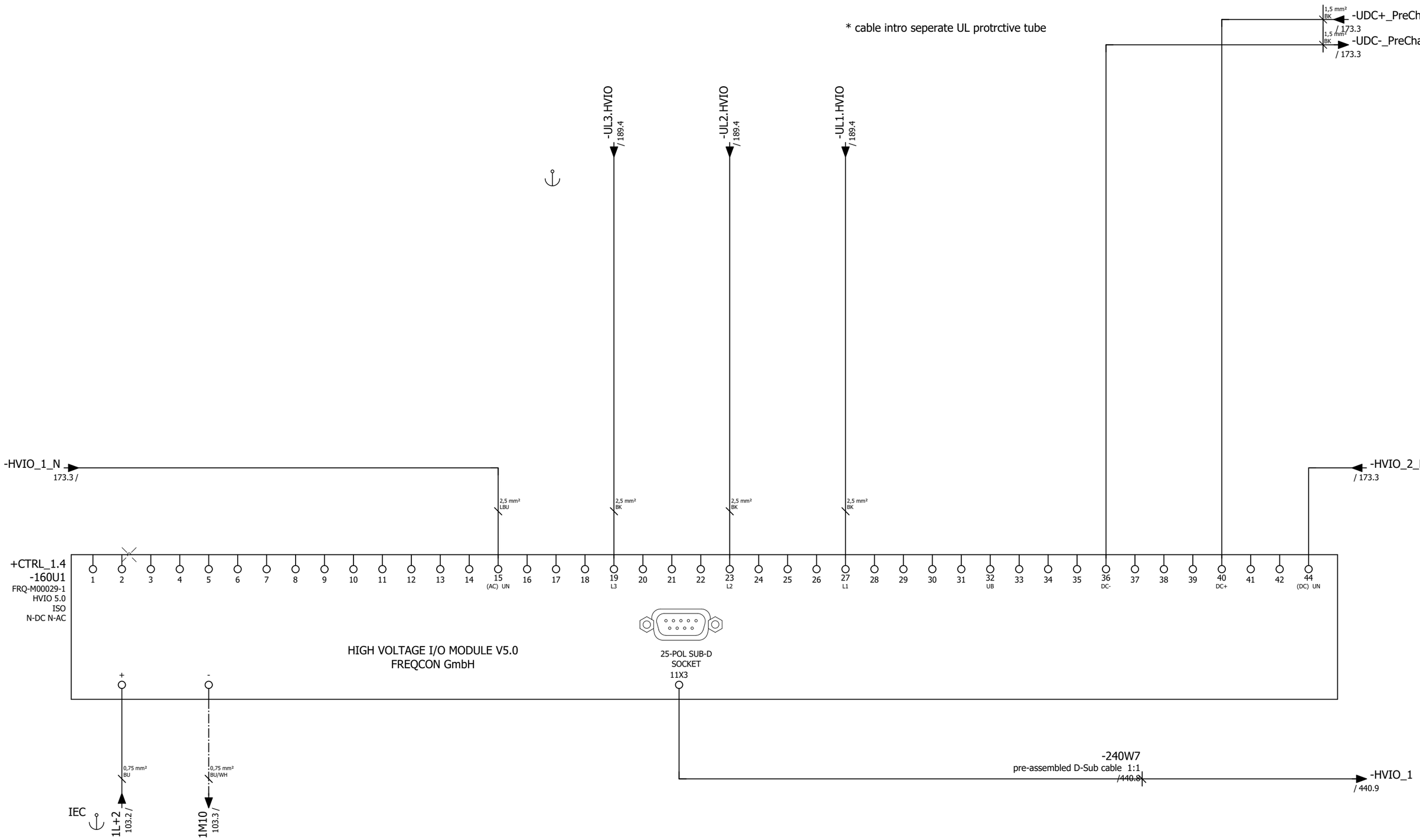
SUBSYSTEM 2_3 CONTACTOR DC- ON

previous page: 150

next page: 160

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS 2_2, 2_3	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 151
Date								+ total: 423

* cable intro seperate UL protrctive tube

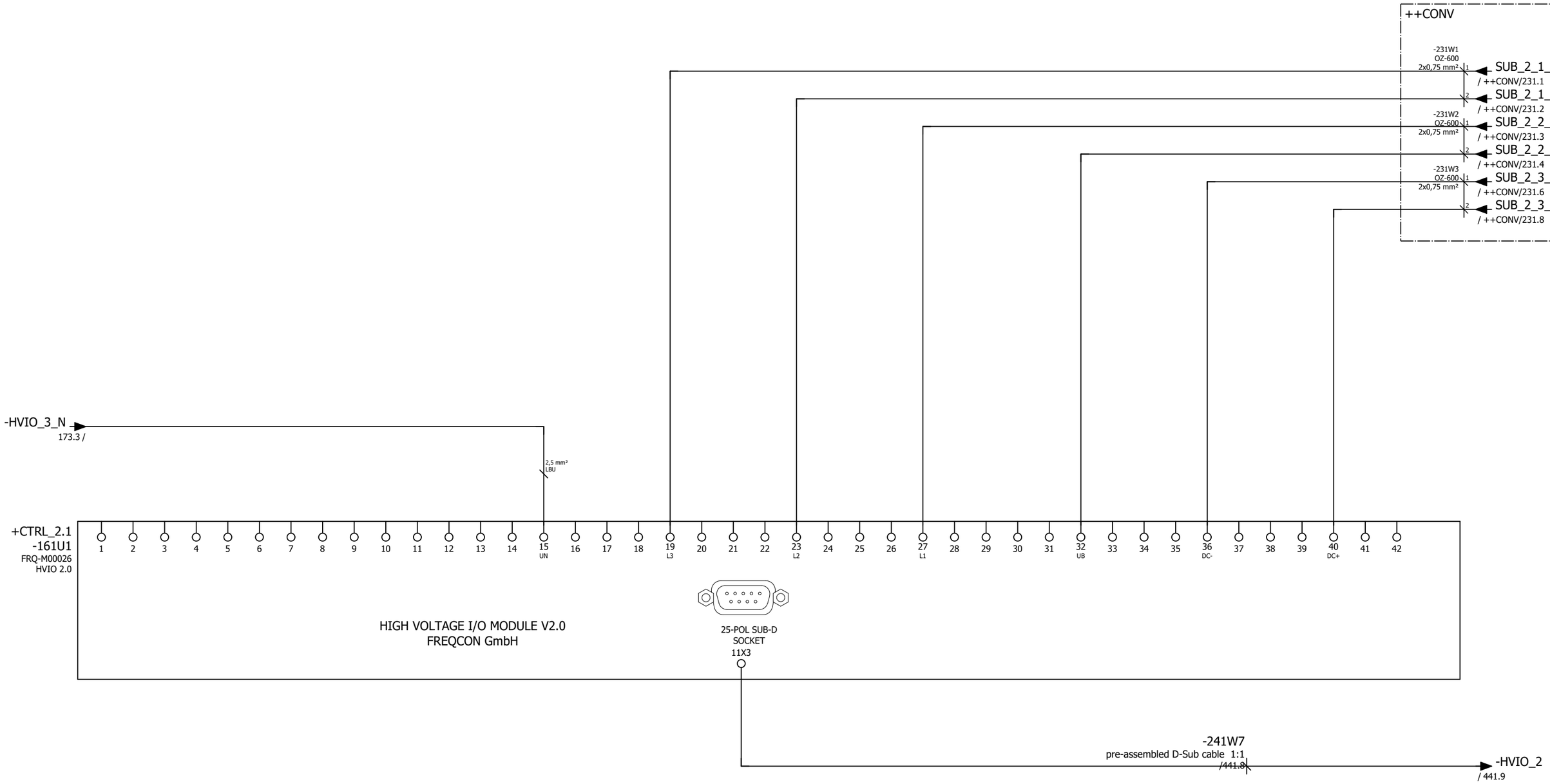


previous page:
151

Measuring: Grid side voltage / DC-Link

next page:
161

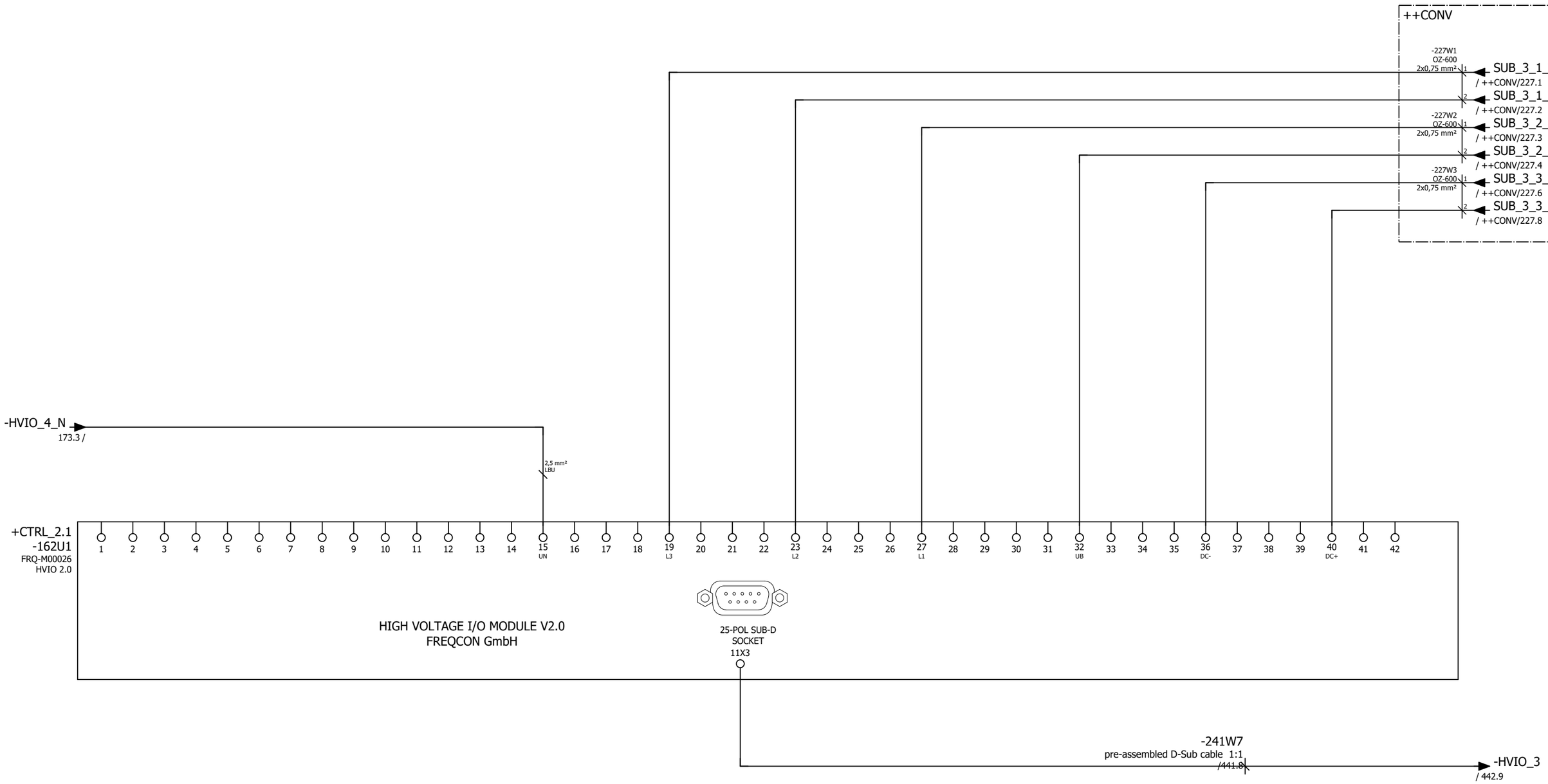
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 1	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 160
Date								+	total: 423



previous page:
160

next page:
163

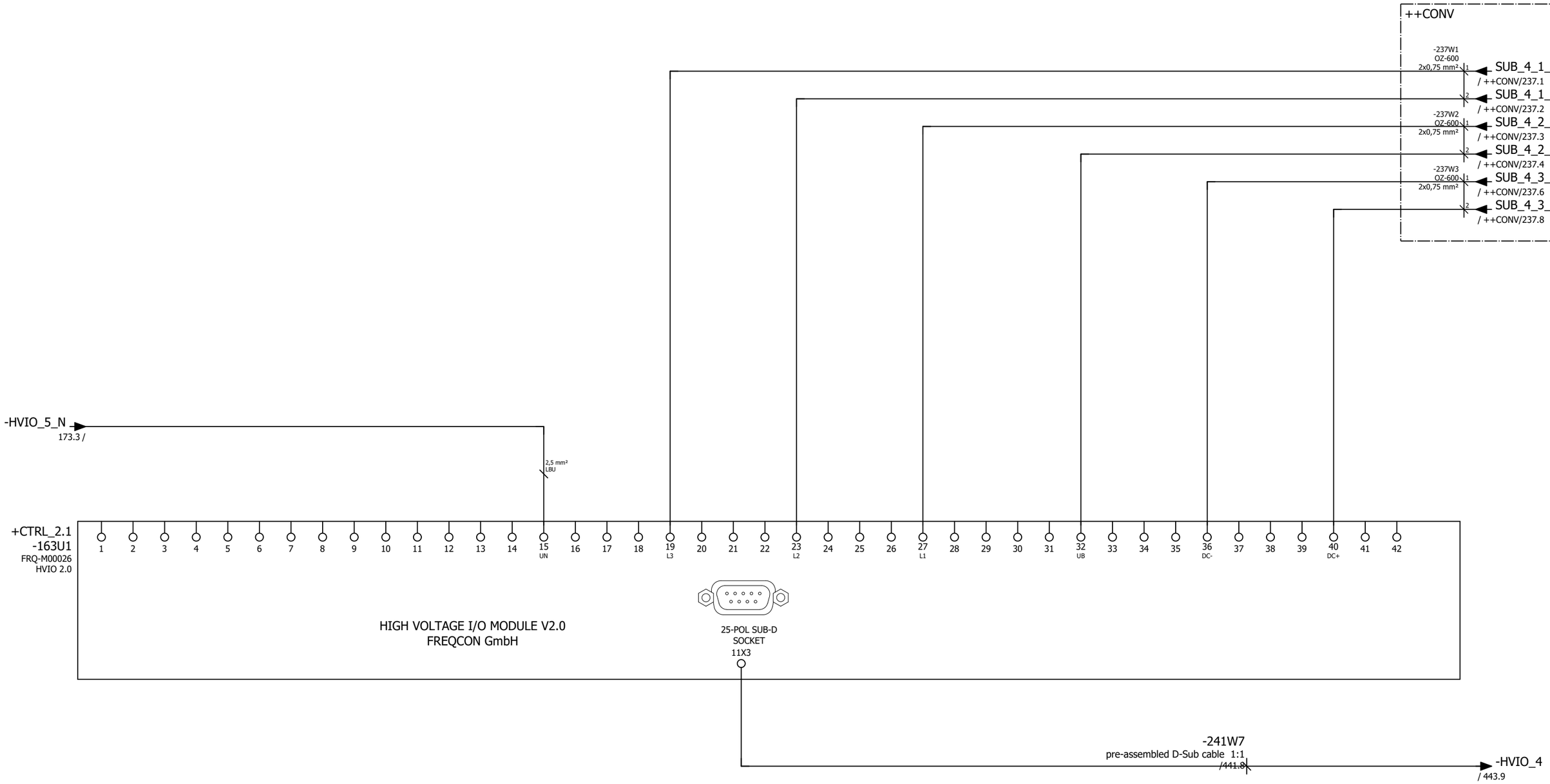
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 2	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 161
Date								+	total: 423



previous page:
161

next page:
164

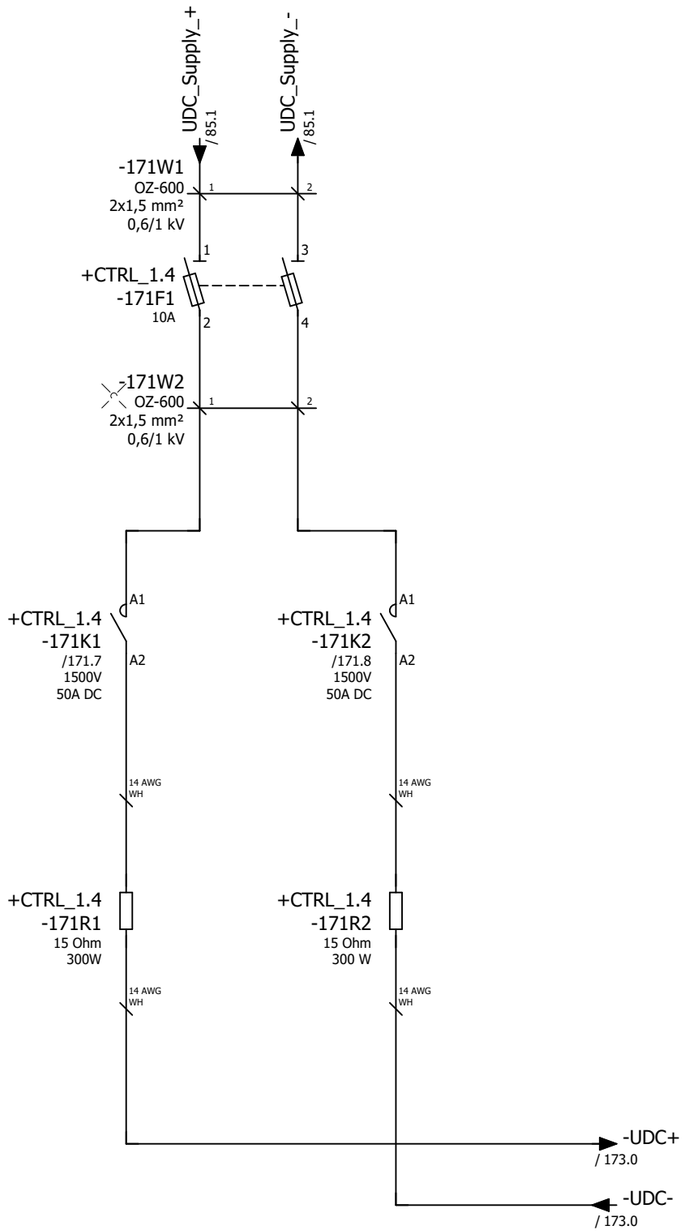
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 3	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 163
Date								+	total: 423



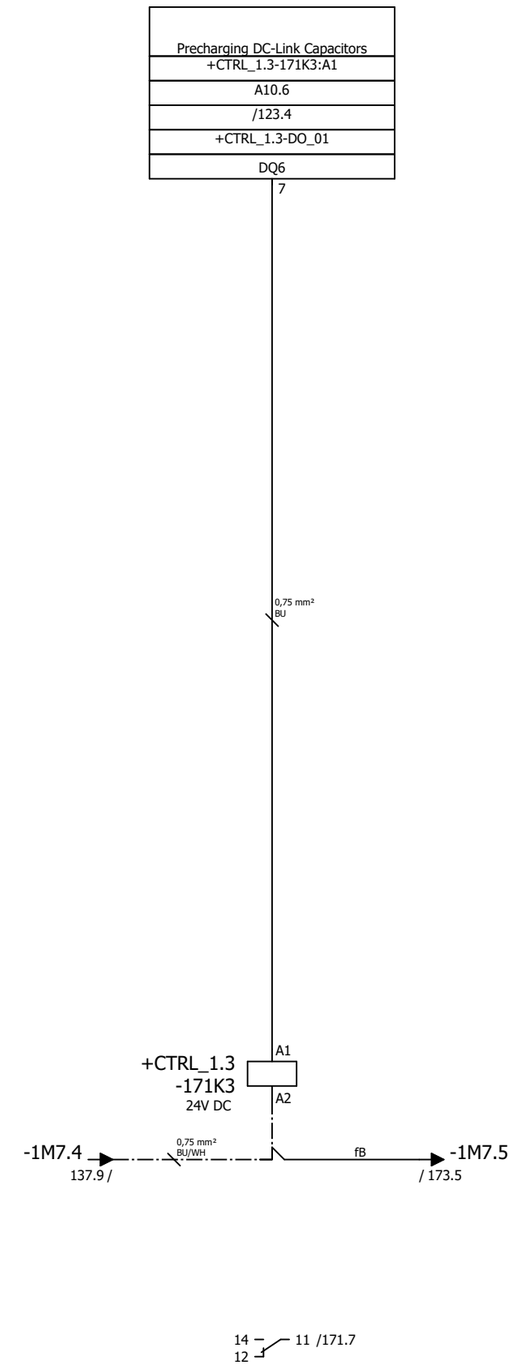
previous page:
163

next page:
171

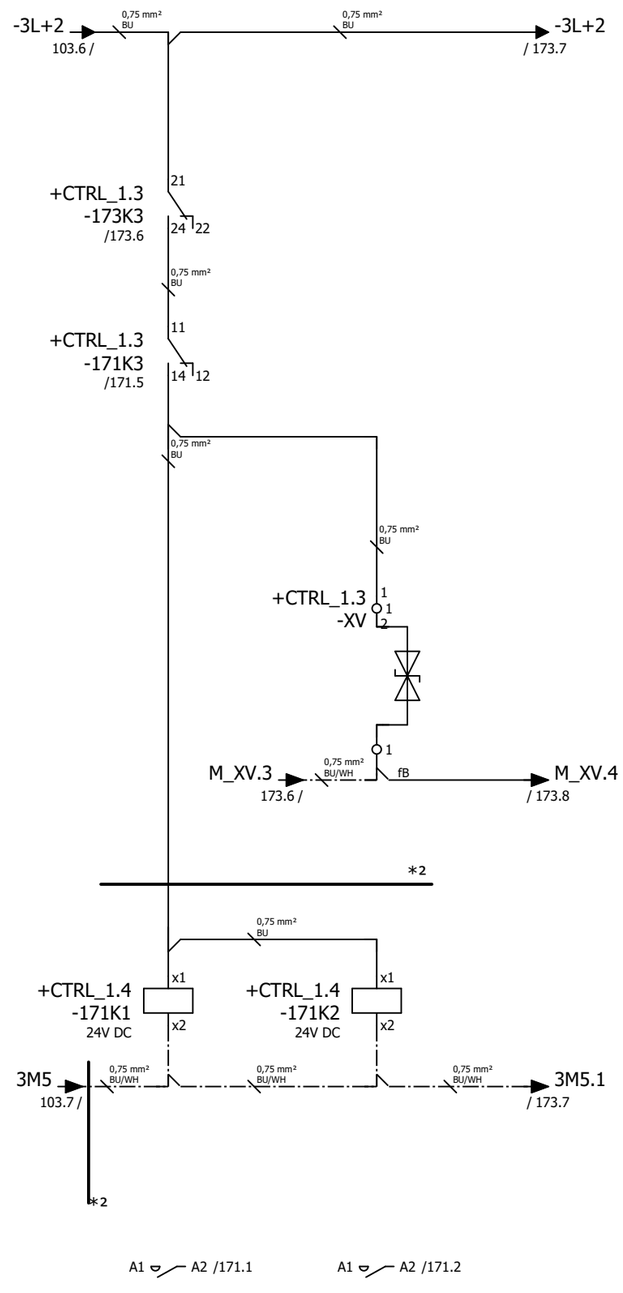
Editor	Freqcon_DG			Statron	FREQCON	INTERFACE HVIO 4	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 164
Date								+	total: 423



RESISTORS
FOR PRECHARGING
from Grid or Battery or DC-Link



Precharging
DC-Link Capacitors



*2

The single conductor
must be placed
in the protective tube

previous page:
164

next page:
173

Editor	Freqcon_DG			Statron	FREQCON	PRE-CHARGING UDC	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 171
Date								+	total: 423

++CONV
+CON_DC
UDC+ +400V
UDC_LINK_CON
UDC- -400V

-173W1
OZ-600
3x2,5 mm²
0,6kV

1,5 mm² NSGFöu BK
1,5 mm² NSGFöu BK

+CTRL_1.4
-173F2
10A

+CTRL_1.4
-173F3
1A

-UDC+_PreCharg
160.9 /
-UDC-_PreCharg
160.9 /

1,5 mm² BK

-UDC+
171.3 /
-UDC-
171.3 /
14 AWG WH

+CTRL_1.4
-173K1
/173.8
1500V
30A DC

+CTRL_1.4
-173K2
/173.9
1500V
30A DC

18 AWG WH

+CTRL_1.4
-173R1
500 Ohm
150 W

+CTRL_1.4
-XE2

+CTRL_1.4
-173R2
500 Ohm
150 W

+CTRL_1.4
-173R3
500 Ohm
150 W

+CTRL_1.4
-173R4
500 Ohm
150 W

-HVIO_1_N / 160.0
-HVIO_2_N / 160.9
-HVIO_3_N / 161.0
-UN.1 / 189.5
-N_CON / ++CONV/99.8
++CONV

2,5 mm² LBU
fB

-HVIO_4_N 163.0 /
-HVIO_5_N 164.0 /

RESISTORS FOR DISCHARGING UDC+

RESISTORS FOR DISCHARGING UDC-

Discharge CON
+CTRL_1.3-173K3:A1
A10.7
/123.5
+CTRL_1.3-DO_01
DQ7
8

0,75 mm² BU

+CTRL_1.3
-173K3
24V DC

0,75 mm² BU/WH
M_XV.3
-1M7.5
171.6 /
-1M7.6 171.8
/ 189.0

Discharge CON

14 11 /173.8
12
24 21 /171.7
22

-3L+2
171.9 /

+CTRL_1.3
-173K3
/173.6

+CTRL_1.3
-XV

M_XV.4
171.9 /

*2

+CTRL_1.4
-173K1
24V DC

+CTRL_1.4
-173K2
24V DC

3M5.1
171.9 /

DISCHARGING UDC+

A1 A2 /173.2
x1 x2

DISCHARGING UDC-

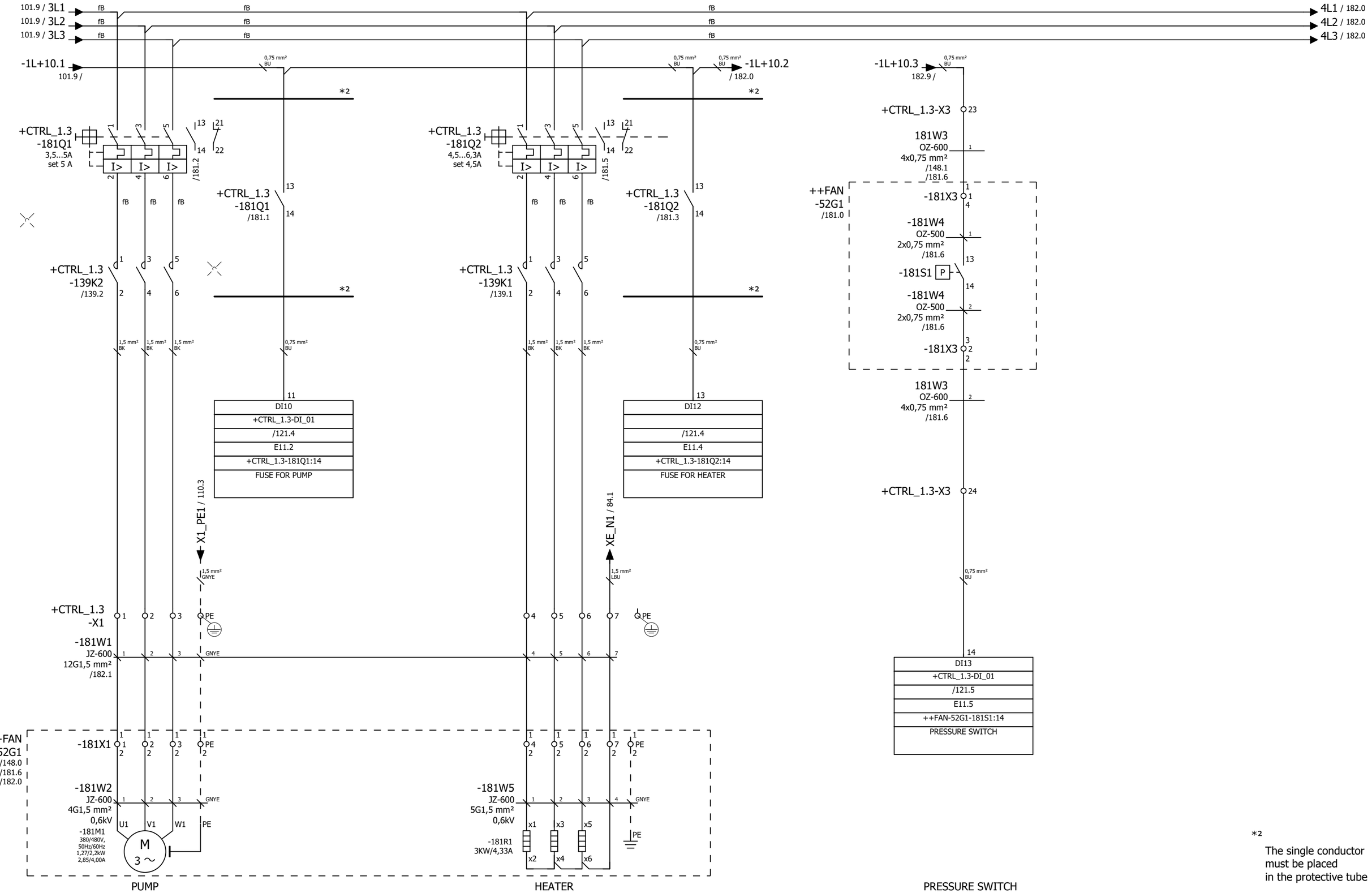
A1 A2 /173.3
x1 x2

*2
The single conductor must be placed in the protective tube

previous page: 171

next page: 181

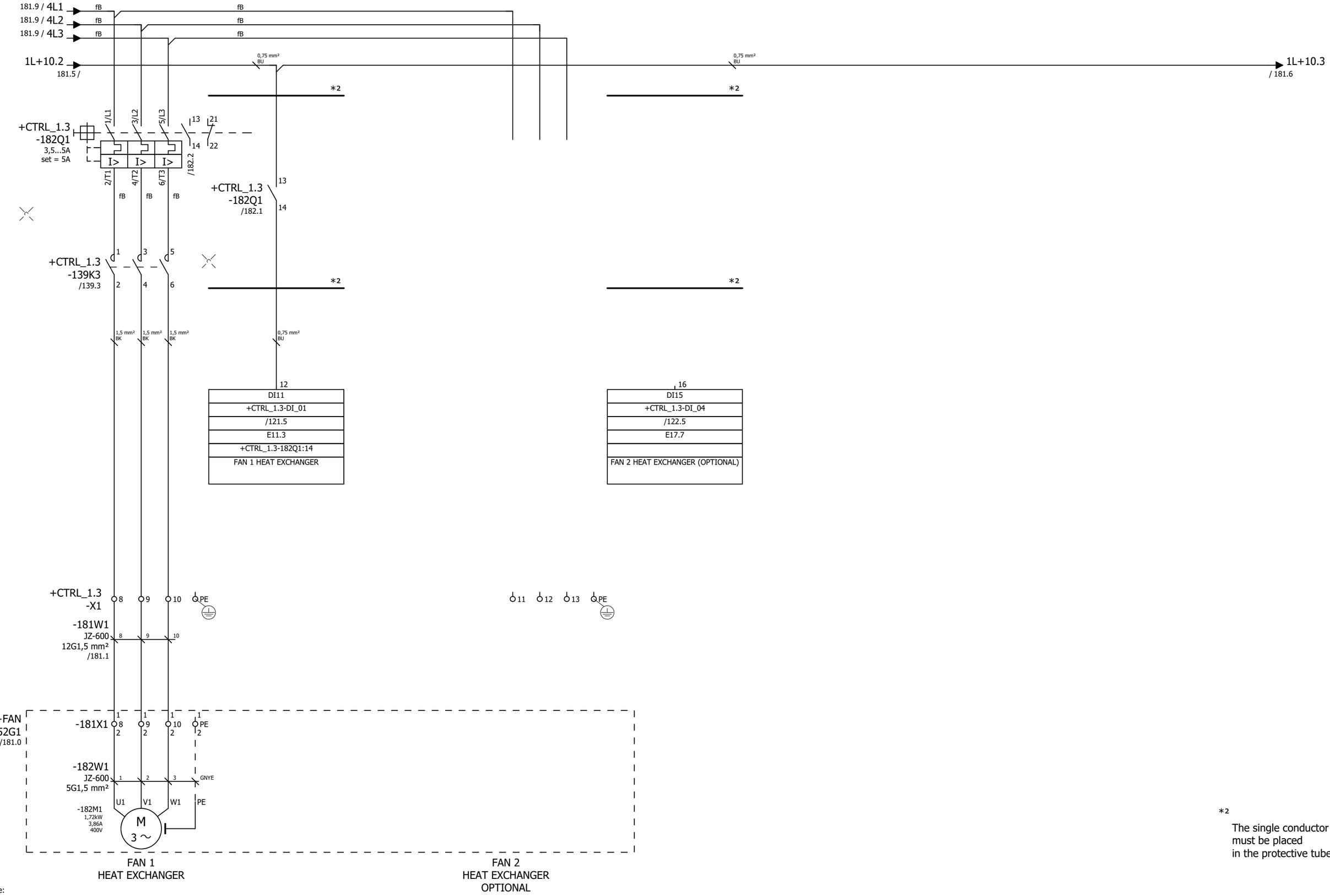
Editor	Freqcon_DG			Statron	FREQCON	DISCHARGE UDC	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 173
Date								+ total: 423



previous page: 173

next page: 182

Editor	Freqcon_DG			Statron	FREQCON	WATER SYSTEM	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 181
Date								+ total: 423



*2

The single conductor
must be placed
in the protective tube

previous page: 181

next page: 183

Editor	Freqcon_DG			Statron	FREQCON	HEAT EXCHANGER	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 182
Date								+	total: 423

84.9 / 1L1.1
84.9 / 1L2.1
fB
1L1.2 / 185.0
1L2.2 / 187.0

-1L+8.1
84.6 /
0,75 mm² BU
-1L+8.2
/ 185.8

+CTRL_1.3
-183F1
C16A
/183.6
+CTRL_1.3
-183F2
C10A
/183.6

*2
+CTRL_1.3
-183F1
/183.1
0,75 mm² BU
*2
+CTRL_1.3
-183F2
/183.3
0,75 mm² BU
*2

1,5 mm² BK
1,5 mm² BK

+CTRL_1.3
-135K1
/135.1
XE_N2 / 84.2
+CTRL_1.3
-135K3
/135.3

1,5 mm² BK
2,5 mm² LBU
1,5 mm² BK

fB
fB
FB_XT.4-6
/ 185.1

PT 2,5 +CTRL_1.3
-XT
PE
PE

15
DI14
+CTRL_1.3-DI_01
/121.4
E11.6
+CTRL_1.3-183F2:13
Fuse Fans CON, IND Cabinets

++CONV
-279W1
JZ-500
3G1,5 mm²
EEC
-FAN_L_2 ++CONV/279.1/
-FAN_N_2 ++CONV/279.1/
-FAN_PE_2 ++CONV/279.1/

++CONV
-281W1
JZ-500
3G1,5 mm²
EEC
-FAN_L_3 ++CONV/281.1/
-FAN_N_3 ++CONV/281.1/
-FAN_PE_3 ++CONV/281.1/

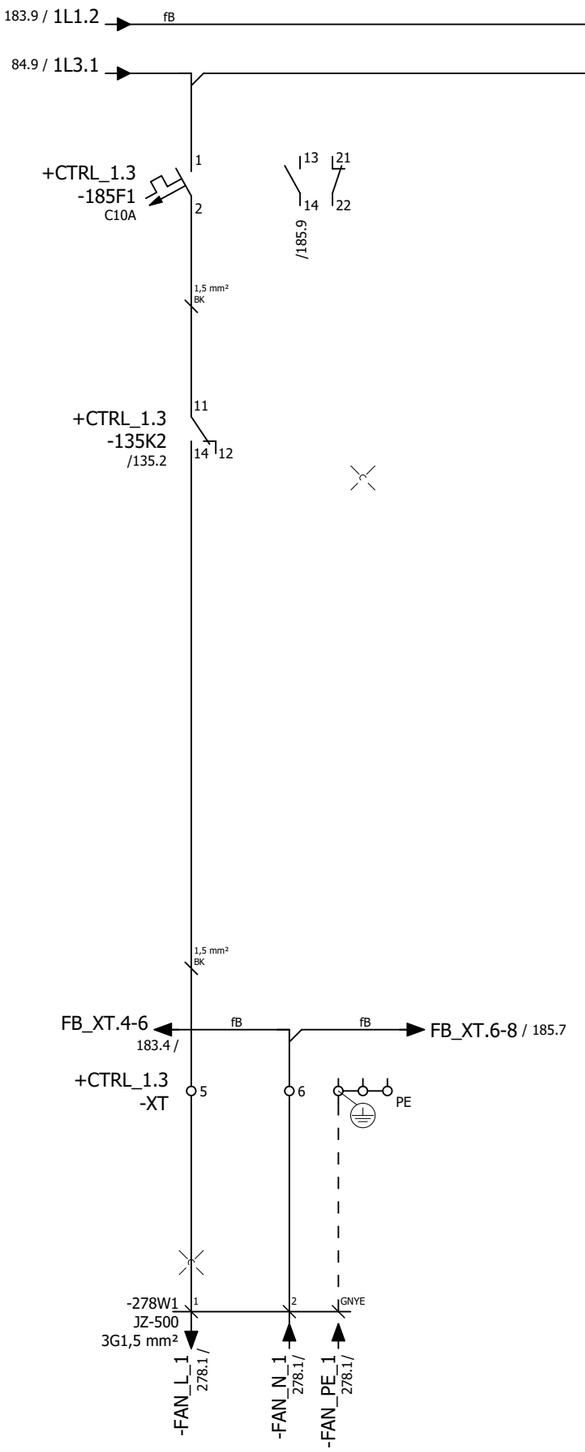
CON
Fans 1-5
in door

CIR
Fans 1-3
in door

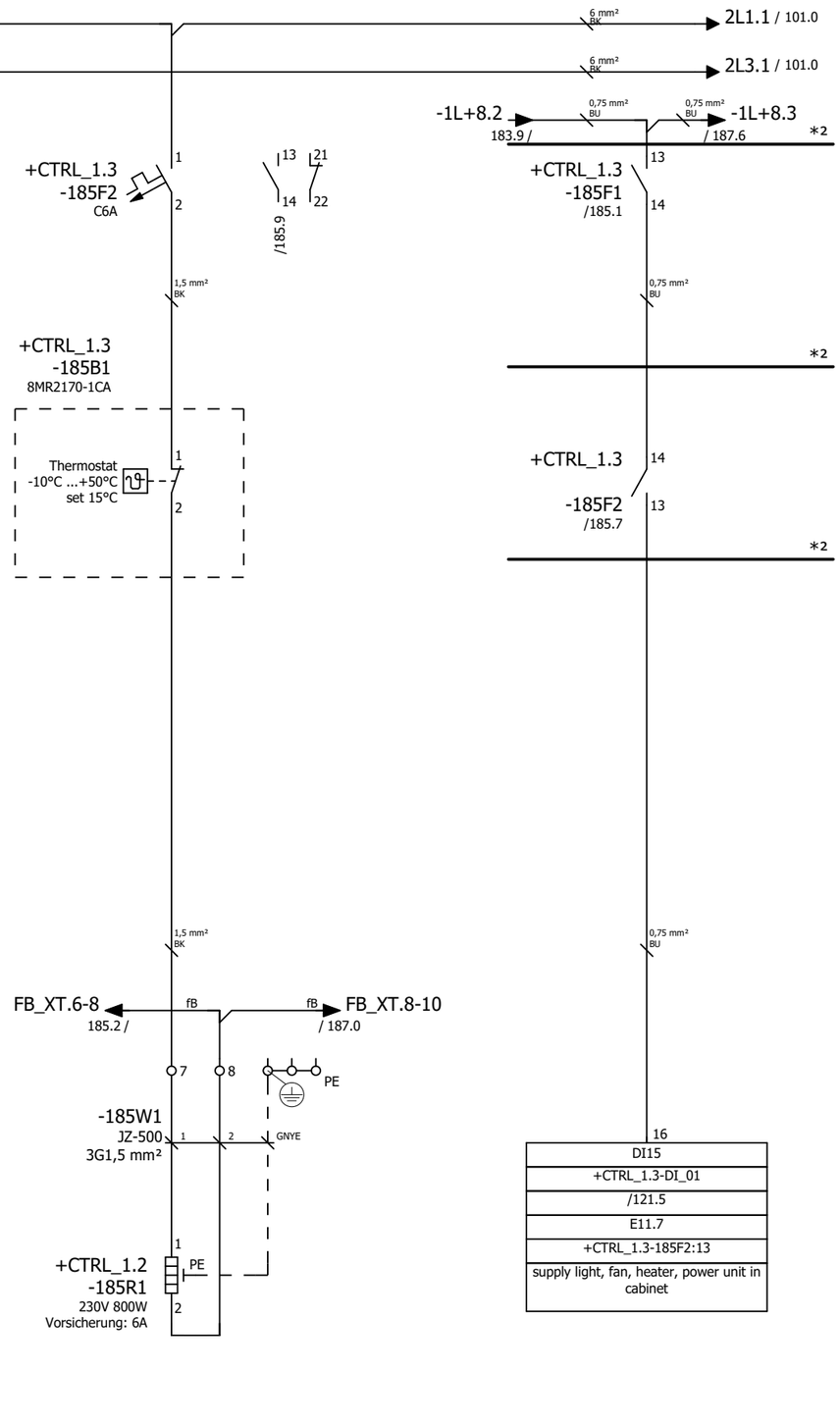
*2
The single conductor
must be placed
in the protective tube

previous page: 182
next page: 185

Editor	Freqcon_DG			Statron		Supply for cabinet fan	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 183
Date								+ total: 423



FAN 1
CONTROL CABINET



HEATING
CONTROL CABINET

*2

The single conductor
must be placed
in the protective tube
supply light, fan, heater, power unit
in cabinet

previous page:
183

next page:
186

Editor	Freqcon_DG			Statron	FREQCON	FAN / HEATING CONTROL CABINET	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 185
Date								+	total: 423

-5L+2
103.9 /

0,75 mm²
BU

0,75 mm²
BU

+CTRL_1.3
-186B1
8MR2170-1CB

Thermostat
-10°C ...+50°C
set 5°C

1
2

0,75 mm²
BU

+CTRL_1.3
-186K1
/186.6

3
4

0,75 mm²
BU

+CTRL_1.3
-186K1
3kW

A1
x2
A2
x1

-2M1
103.5 /

0,75 mm²
BU/WH

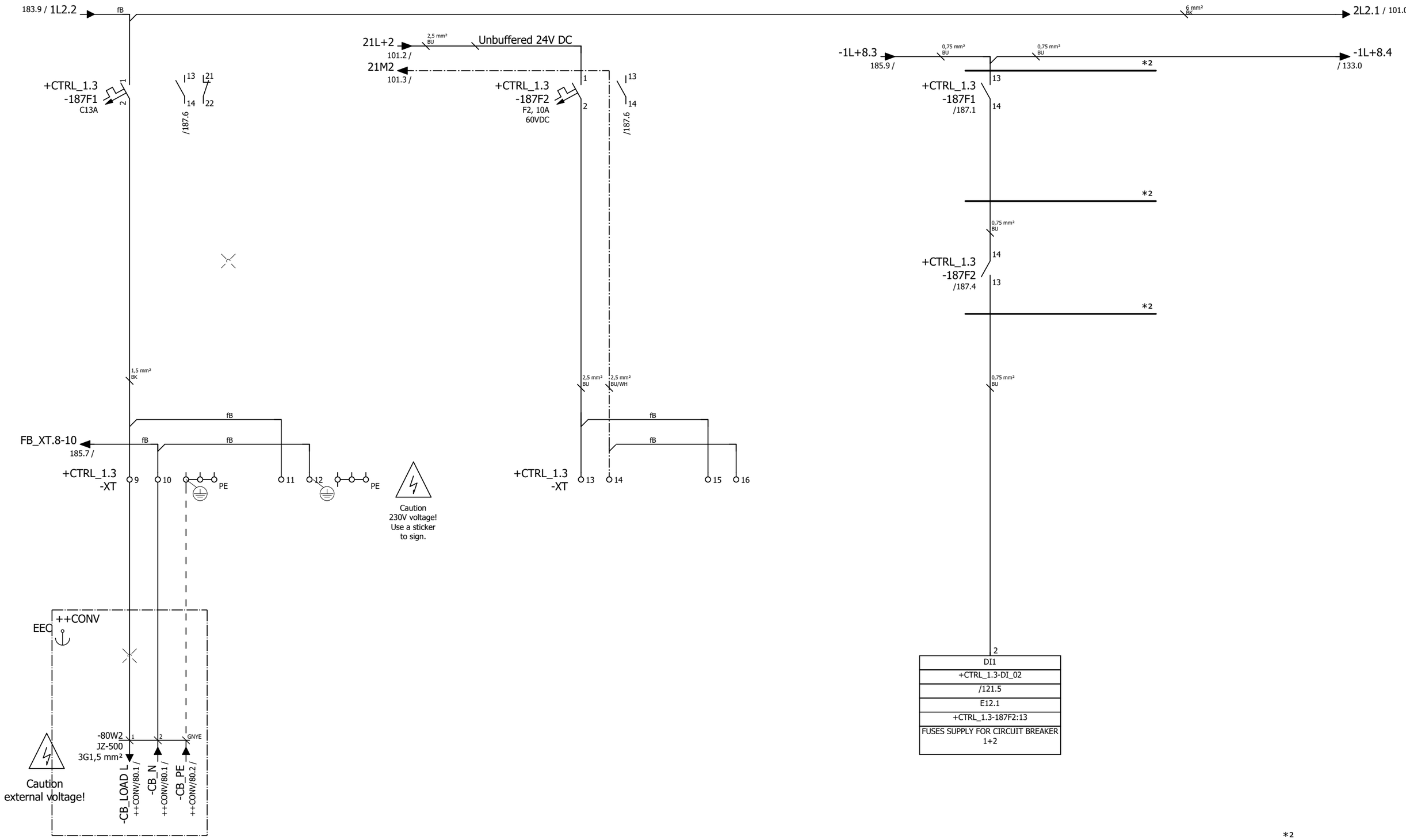
A1 A2
1 2 /103.9
3 4 /186.8
5 6
13 14

Thermostat
for start PLC

previous page:
185

next page:
187

Editor	Freqcon_DG			Statron	FREQCON	THERMOSTAT	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 186
Date								+	total: 423



230V AC
for Circuit Breaker 1

230V AC
for Circuit Breaker
Optional

24V DC
for Circuit Breaker 2
Optional

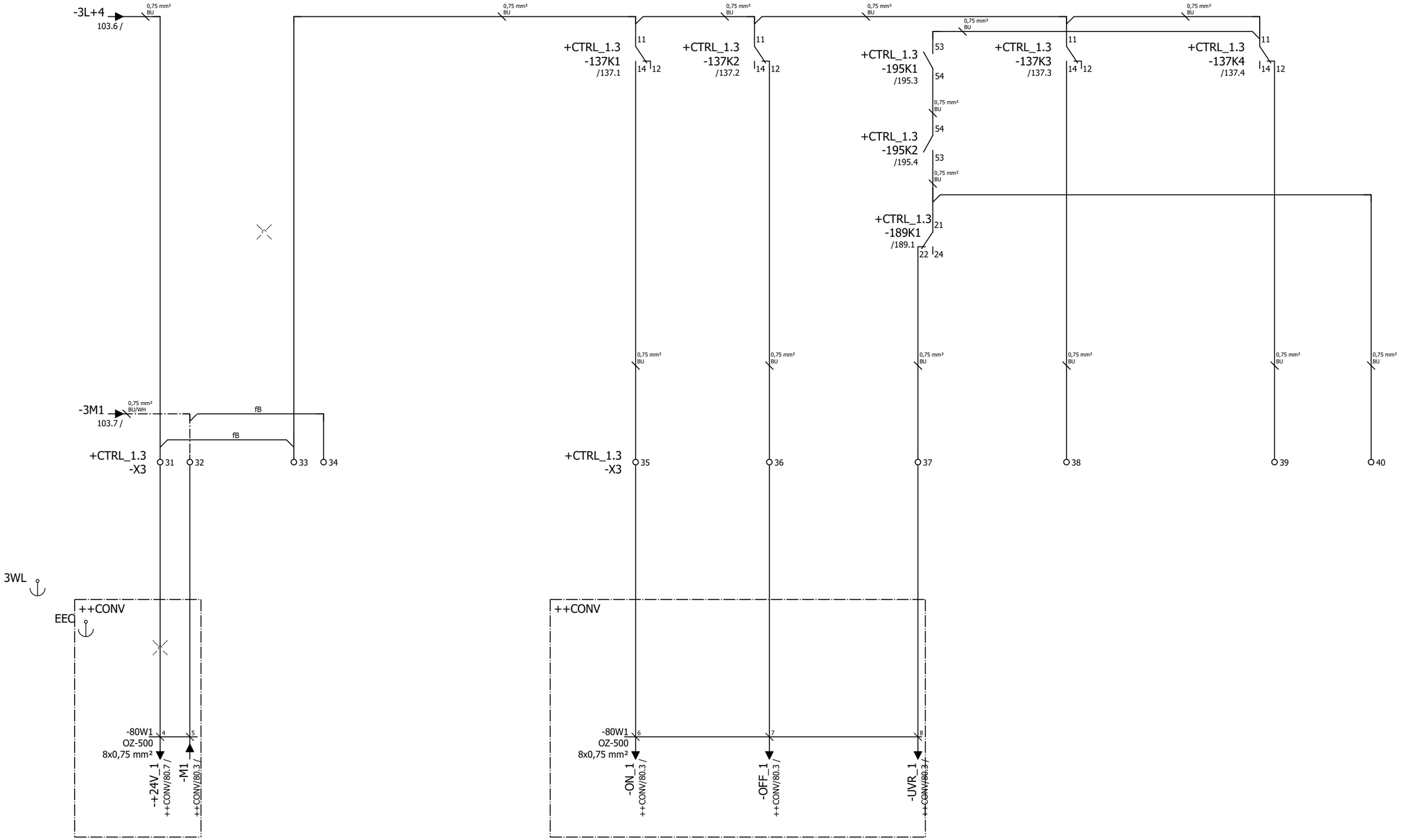
24V DC
for Circuit Breaker
Optional

FUSES
SUPPLY FOR
CIRCUIT BREAKER 1+2

previous page: 186

next page: 188

Editor	Freqcon_DG			Statron	FREQCON	24V DC SUPPLY CB	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 187
Date								+ total: 423



previous page: 187

next page: 189

Editor	Freqcon_DG			Statron	FREQCON	24V DC SUPPLY CON / CB GRID	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 188
Date								+	total: 423

GRID FAULT
+CTRL_1.3-189K1:A1
A11.3
/123.5
+CTRL_1.3-DO_01
DQ11

12

0,75 mm²
BU

+CTRL_1.3
-189K1
24V DC

A1

A2

-1M7.6
173.6 /

fB

0,75 mm²
BU/WH

-M_(GND)
/ 189.5

14
12
11 /189.6

24
22
21 /188.6

GRID FAULT

Voltage inputs
3 phases 620V AC

Grid Circuit Breaker:
if OFF then 24V;
if ON then 0V

Grid OK

-UL1.HVIO
/ 160.5
2,5 mm²
BK

-UL2.HVIO
/ 160.5
2,5 mm²
BK

-UL3.HVIO
/ 160.4
2,5 mm²
BK

-UN.1
/ 173.3
2,5 mm²
LBU

-24V_Signal
/ 127.4
0,75 mm²
BU

-M_(GND)
/ 189.1
0,75 mm²
BU/WH

+CTRL_1.3
-189K1
/189.1
11
12
14
0,75 mm²
BU

CB_OFF.1
/ 137.2
0,75 mm²
BU

+CTRL_1.4
-189X1
Test disconnect
terminal block
Phoenix Contact
UTME 6

1 2 3 4 5 6 7 8 9

1 2 3 4 5 6 7 8 9

2,5 mm²
BK

2,5 mm²
BK

2,5 mm²
BK

0,75 mm²
BU

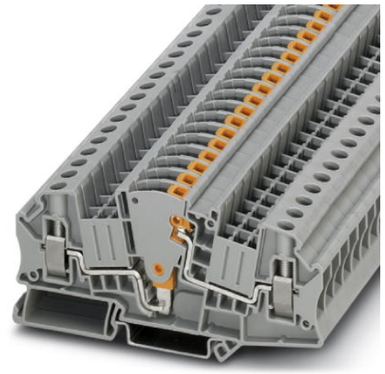
-HVIO_L1
85.1 /

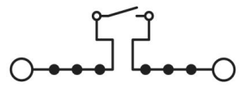
-HVIO_L2
85.1 /

-HVIO_L3
85.2 /

CB_OFF.2
137.2 /

Relais
Circuit Breaker
OFF





Test terminal block for protection tests

previous page:
188

next page:
190

Editor	Freqcon_DG			Statron	FREQCON	TEST TERMINAL BLOCK	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 189
Date								+ total: 423

84.0 / 5L1.1
84.1 / 5L2.1
84.1 / 5L3.1
6 mm² BK

+CTRL_1.3
-190F1
C16A
/133.3

+CTRL_1.3
-190F2
C16A
/133.3

+CTRL_1.3
-190F3
16A
/133.3

XEN5 / 84.2

1,5 mm² BK
2,5 mm² LBU
1,5 mm² BK
1,5 mm² LBU
fB

+CTRL_1.3
-190XT1

+CTRL_1.3
-135K4
/135.4

1,5 mm² BK
1,5 mm² LBU
fB

+CTRL_1.5
-190H1
-W1
2x1,5 mm²
BN
LBU

+CTRL_1.5
-190H1
7W
600lm

++
in Container
190W1
NYM-J
5x
NYM-J
BN
LBU
GNYE
-Container_L
++Container/190.3
-Container_N_
++Container/190.3
-Container_PE_
++Container/190.3

1,5 mm² BK
1,5 mm² GNYE
1,5 mm² LBU
+CTRL_1.3
-190X10
250 V AC, 16 A

230V AC for
Container Air Conditioning

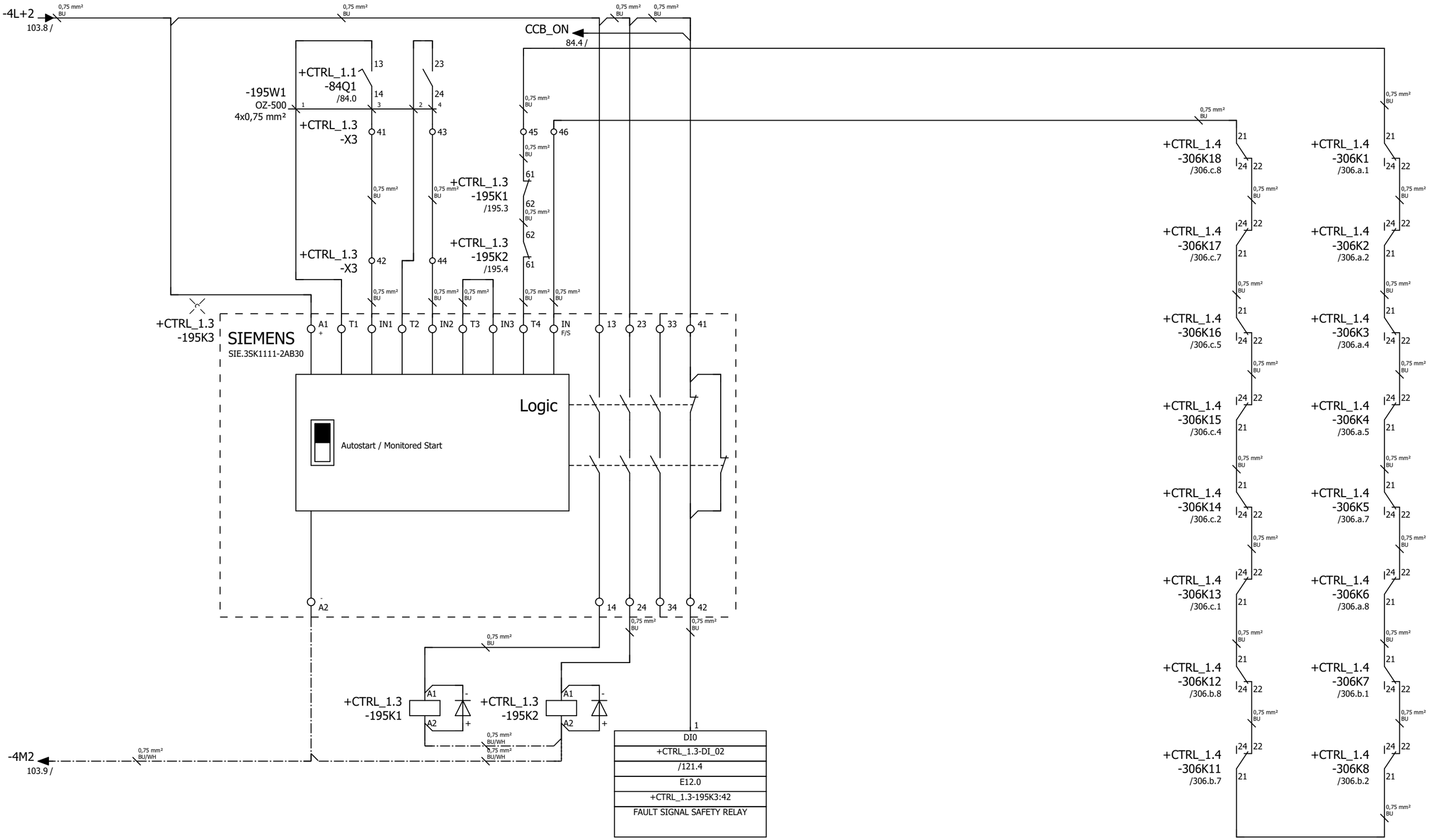
SPARE

Light
Control cabinet

230V AC for
Container light, socket

previous page: 189
next page: 195

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING, LIGHT 230V SUPPLY	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 190
Date								+	total: 423



SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS

A1 — A2
13 — 14
23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
71 — 72
83 — 84 /351.1

FAULT SIGNAL SAFETY RELAY

A1 — A2
13 — 14
23 — 24 /150.0
33 — 34 /150.2
43 — 44 /351.0
53 — 54 /188.6
61 — 62 /195.3
71 — 72
83 — 84 /351.1

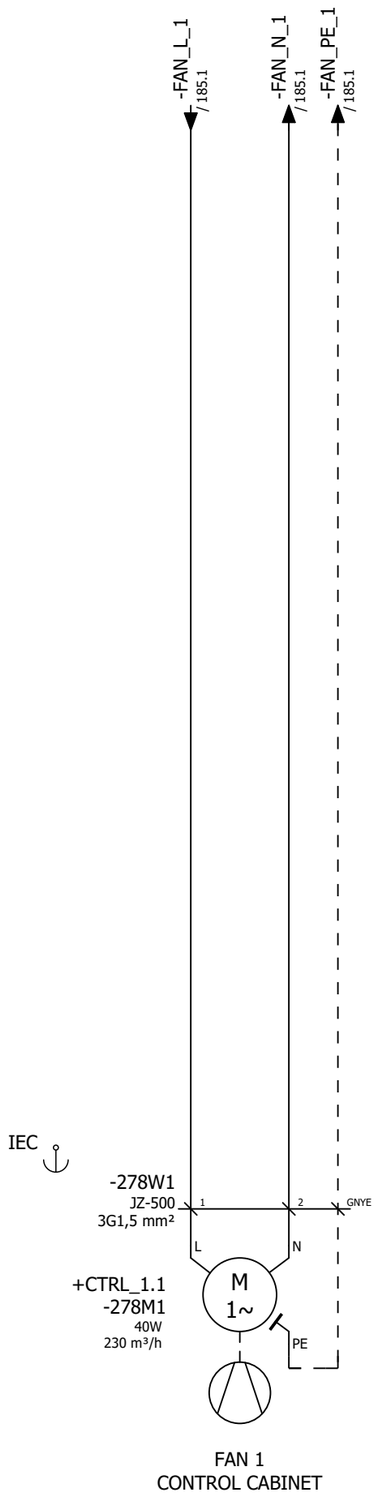
If the safety relais triggers or a failure is detected, then is the feedback "true".

Note:
The feedback circuit monitors the positions of the positive-guided NC contacts on the contactors 195K1 and 195K2. If one of their contacts latsches, then it is not possible to switch the contactors back on.

previous page: 190

next page: 278

Editor	Freqcon_DG			Statron	FREQCON	SHUTDOWN CIRCUIT BREAKERS, DC CONTACTORS	20230331_V0.01	= UNIT_01 Converter Container 1
Date	29.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 195
Date								+ total: 423

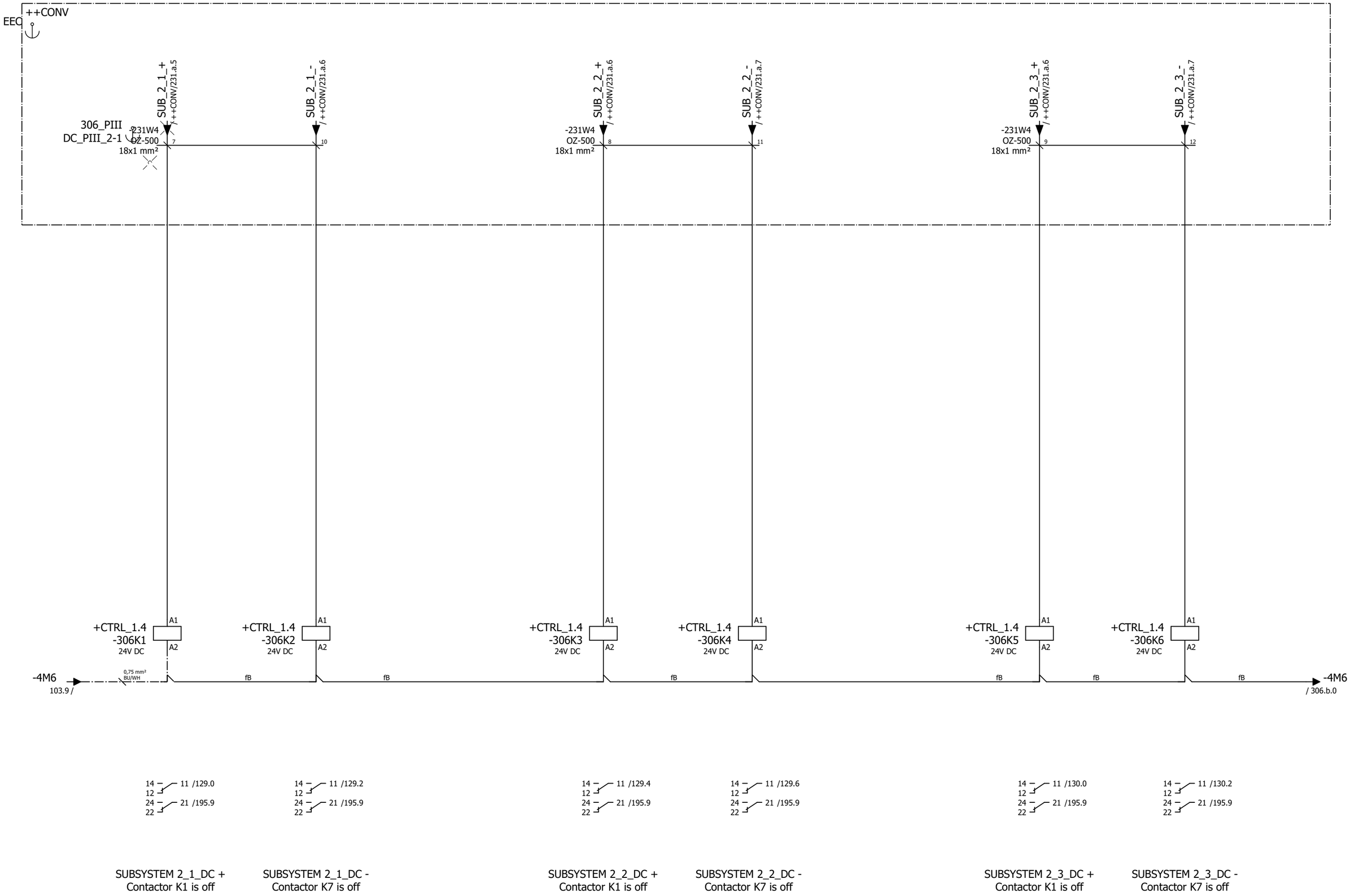


FAN 1
CONTROL CABINET

previous page:
195

next page:
306.a

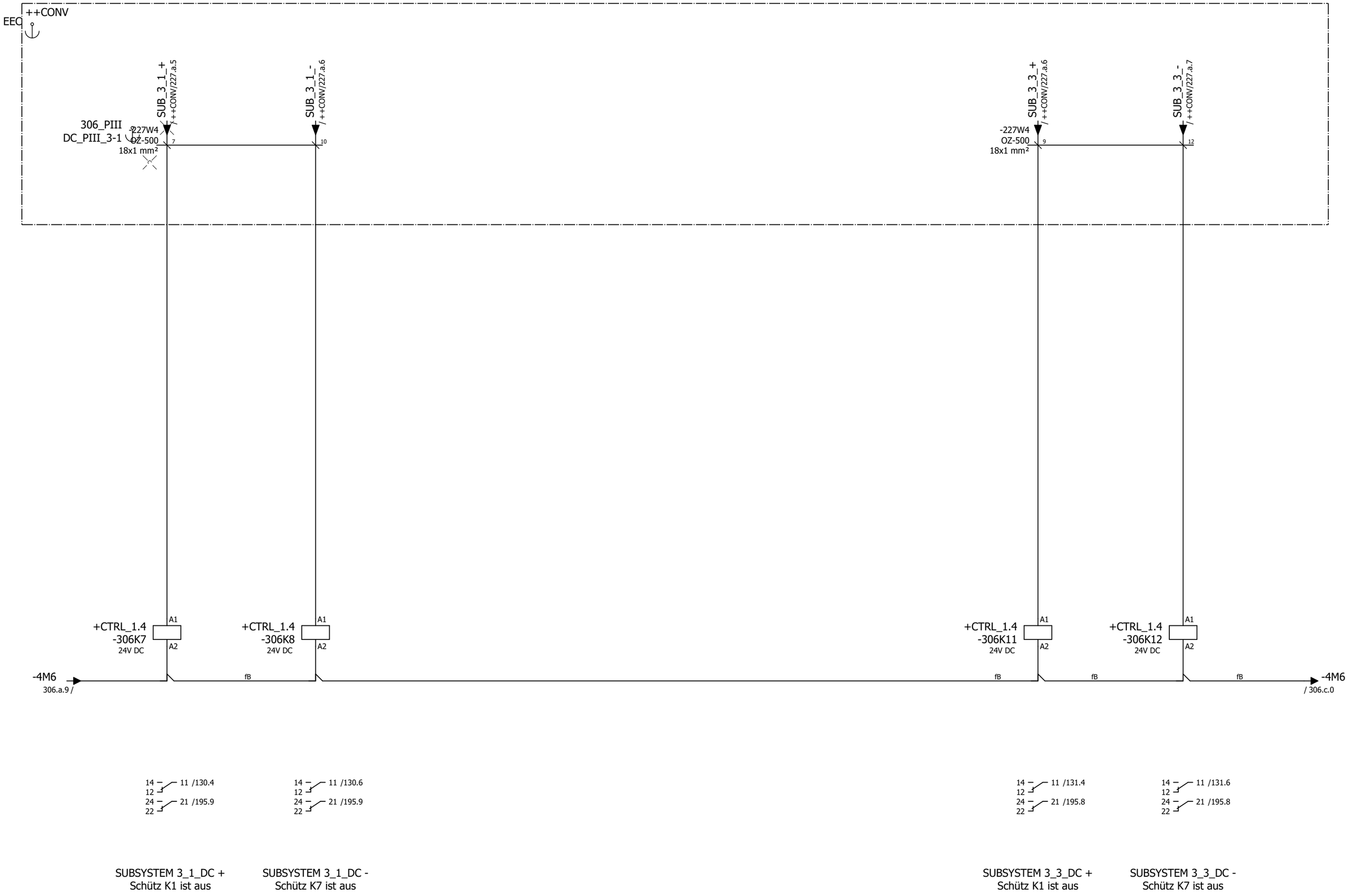
Editor	Freqcon_DG			Statron	FREQCON	CONTROL CABINET CLIMATE	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 278
Date								+	total: 423



previous page: 278

next page: 306.b

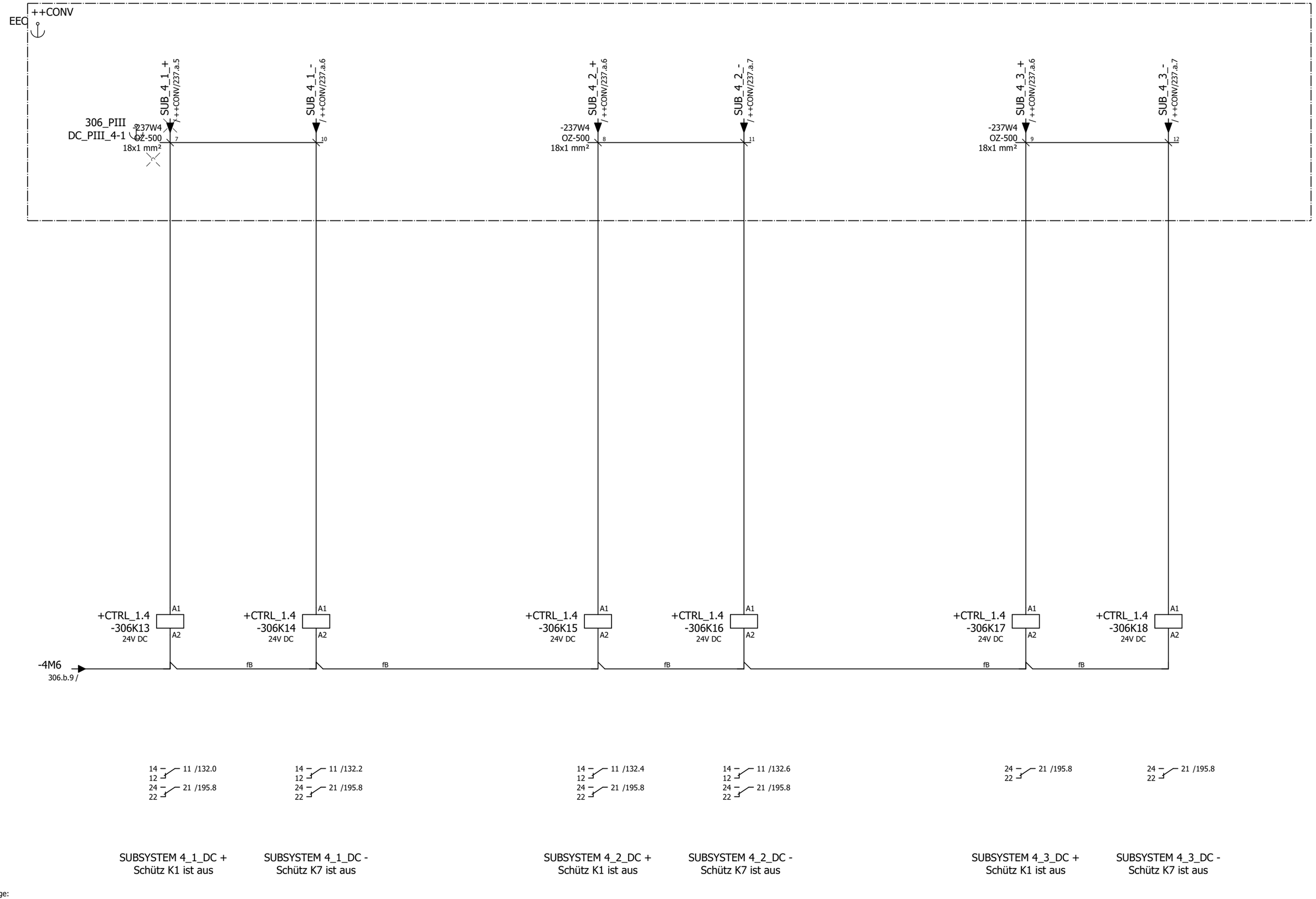
Editor	Freqcon_DG			Statron	FREQCON	Feedback DC contactors 1_4 - 1_6	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 306.a
Date								+ total: 423



previous page:
306.a

next page:
306.c

Editor	Freqcon_DG			Statron	FREQCON	Feedback DC contactors 2_1 - 2_3	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 306.b
Date								+ total: 423



SUBSYSTEM 4_1_DC +
Schütz K1 ist aus

SUBSYSTEM 4_1_DC -
Schütz K7 ist aus

SUBSYSTEM 4_2_DC +
Schütz K1 ist aus

SUBSYSTEM 4_2_DC -
Schütz K7 ist aus

SUBSYSTEM 4_3_DC +
Schütz K1 ist aus

SUBSYSTEM 4_3_DC -
Schütz K7 ist aus

previous page:
306.b

next page:
350

Editor	Freqcon_DG			Statron	FREQCON	Feedback DC contactors 2_4 - 2_6	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 306.c
Date								+ total: 423

-L+Safe.1
151.9 /

0.75 mm² BU

SUBSYSTEM 3_1 CONTACTOR DC+ ON
+CTRL_1.4-350K1:A1
A14.0
/123.4
+CTRL_1.3-DO_03
DQ0
1

SUBSYSTEM 3_1 CONTACTOR DC-ON
+CTRL_1.4-350K2:A1
A14.1
/123.5
+CTRL_1.3-DO_03
DQ1
2

0.75 mm² BU

+CTRL_1.4
-350K1
/350.1
11
14
12

+CTRL_1.4
-350K2
/350.3
11
14
12

0.75 mm² BU

PTTB 1,5/S

+CTRL_1.4
-350X1.21
1

-SUB_3_1_K_.M
/++CONV/227.a.9
17

++CONV
-227W4
OZ-500
18x1 mm²
1
4

-SUB_3_1_K_.+
++CONV/227.a.1/

-SUB_3_1_K_.-
++CONV/227.a.3/

+CTRL_1.4
-350X1.21
2

+CTRL_1.4
-350K1
24V DC
A1
A2

+CTRL_1.4
-350K2
24V DC
A1
A2

0.75 mm² BU/MH

-M_Safe.1
151.9 /
1.5 mm² BU/MH

fB

14
12
11 /350.2

14
12
11 /350.4

SUBSYSTEM 3_1
CONTACTOR DC+
ON

SUBSYSTEM 3_1
CONTACTOR DC-
ON

+CTRL_1.4
-XV.20
/350.7
Suppression
TVS Diode
bi-directional 47 V
1
2

M_Safe_XV.3
351.4 /
0.75 mm² BU/MH
fB
fB
M_Safe_XV.2
/ 351.7

previous page:
306.c

next page:
351

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_1	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 350
Date								+	total: 423

-3L+5
103.7 /

0,75 mm² BU

+CTRL_1.3
-195K1
/195.3

83
84

+CTRL_1.3
-195K2
/195.4

84
83

SUBSYSTEM 3_3 CONTACTOR DC+ ON
+CTRL_1.4-351K3:A1
A14.4
/123.4
+CTRL_1.3-DO_03
DQ4
5

SUBSYSTEM 3_3 CONTACTOR DC-ON
+CTRL_1.4-351K4:A1
A14.5
/123.5
DQ5
6

L+Safe.2
/ 352.0

+CTRL_1.4
-351K1

+CTRL_1.4
-351K2

+CTRL_1.4
-351K3
/351.4

+CTRL_1.4
-351K4
/351.5

11
14
12

-3M4
103.7 /

0,75 mm² BU/WH

+CTRL_1.3
-195K1
/195.3

43
44

+CTRL_1.3
-195K2
/195.4

44
43

+CTRL_1.4
-350X1.21

4
6
7
9
5
8
10

++CONV

-227W4
OZ-500
18x1 mm²

-SUB_3_3_K_+
++CONV/227.a.2/

-SUB_3_3_K_-
++CONV/227.a.5/

+CTRL_1.4
-XV.20
/351.7
Suppression
TVS Diode
bi-directional 47 V

M_Safe_XV.2
350.9 /

fB

M_Safe_XV.4
/ 352.7

+CTRL_1.4
-351K3
24V DC

+CTRL_1.4
-351K4
24V DC

A1
A2

M_Safe_XV.3
/ 350.7

M_Safe.2
/ 352.0

14 — 11 /351.4
12

14 — 11 /351.6
12

SUBSYSTEM 3_3
CONTACTOR DC+
ON

SUBSYSTEM 3_3
CONTACTOR DC-
ON

previous page:
350

next page:
352

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 3_2 - 3_3	20230331_V0.01	= UNIT_01	Converter Container 1
Date	30.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 351
Date								+	total: 423

-L+Safe.2
351.9 /

0,75 mm² BU

SUBSYSTEM 4_1 CONTACTOR DC+ ON
+CTRL_1.4-352K1:A1
A14.6
/123.4
+CTRL_1.3-DO_03
DQ6
7

SUBSYSTEM 4_1 CONTACTOR DC-ON
+CTRL_1.4-352K2:A1
A14.7
/123.5
DQ7
8

L+Safe.3
/ 353.0

+CTRL_1.4
-352K1
/352.0
11
14
12

+CTRL_1.4
-352K2
/352.2
11
14
12

+CTRL_1.4
-350X1.22
11
++CONV
-237W4
OZ-500
18x1 mm²
1
17
-SUB_4_1_K_.+
++CONV/237.a.1
-SUB_4_1_K_M
/++CONV/237.a.9

+CTRL_1.4
-350X1.22
13
++CONV
-237W4
OZ-500
18x1 mm²
4
16
-SUB_4_1_K_.-
++CONV/237.a.3

+CTRL_1.4
-350X1.22
12

+CTRL_1.4
-XV.20
/352.7
Suppression
TVS Diode
bi-directional 47 V
7
8

M_Safe_XV.4
351.9 /
fB
M_Safe_XV.5
/ 353.7

+CTRL_1.4
-352K1
24V DC
A1
A2

+CTRL_1.4
-352K2
24V DC
A1
A2

0,75 mm² BU/MH

-M_Safe.2
351.9 /
fB
M_Safe.3
/ 353.0

14 — 11 /352.1
12

14 — 11 /352.3
12

SUBSYSTEM 4_1
CONTACTOR DC+
ON

SUBSYSTEM 4_1
CONTACTOR DC-
ON

previous page:
351

next page:
353

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_1	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 352
Date								+ total: 423

-L+Safe.3
352.9 /

SUBSYSTEM 4_2 CONTACTOR DC+ ON
+CTRL_1.4-353K1:A1
A15.0
/123.4
+CTRL_1.3-DO_03
DQ8

SUBSYSTEM 4_2 CONTACTOR DC-ON
+CTRL_1.4-353K2:A1
A15.1
/123.5
+CTRL_1.3-DO_03
DQ9

SUBSYSTEM 4_3 CONTACTOR DC+ ON
+CTRL_1.4-353K3:A1
A15.2
/123.4
+CTRL_1.3-DO_03
DQ10

SUBSYSTEM 4_3 CONTACTOR DC-ON
+CTRL_1.4-353K4:A1
A15.3
/123.5
DQ11

9 10 11 12

0,75 mm² BU

+CTRL_1.4 -353K1 /353.0
+CTRL_1.4 -353K2 /353.2
+CTRL_1.4 -353K3 /353.3
+CTRL_1.4 -353K4 /353.5
11 14 12

+CTRL_1.4 -350X1.21
++CONV
-237W4 OZ-500 18x1 mm²
-SUB_4_2_K_+ ++CONV/237.a.2/
-SUB_4_3_K_+ ++CONV/237.a.2/
-SUB_4_3_K_- ++CONV/237.a.5/

+CTRL_1.4 -XV.20 /353.7
Suppression TVS Diode bi-directional 47 V
M_Safe_XV.5
352.9 /
fB

+CTRL_1.4 -350X1.21
5 8 10

+CTRL_1.4 -353K1 24V DC
+CTRL_1.4 -353K2 24V DC
+CTRL_1.4 -353K3 24V DC
+CTRL_1.4 -353K4 24V DC
A1 A2

-M_Safe.3
352.9 /

14 12 11 /353.1
14 12 11 /353.3
14 12 11 /353.4
14 12 11 /353.6

SUBSYSTEM 4_2 CONTACTOR DC+ ON
SUBSYSTEM 4_2 CONTACTOR DC- ON
SUBSYSTEM 4_3 CONTACTOR DC+ ON
SUBSYSTEM 4_3 CONTACTOR DC- ON

previous page: 352
next page: 440

Editor	Freqcon_DG			Statron	FREQCON	OUTPUTS DC CONTACTORS SUBSYSTEM 4_2 - 4_3	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 353
Date								+	total: 423

-1L+1
103.2 /
-1M1
103.3 /
-1PE1
103.4 /
240W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-240U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2

Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

240W10
2YY (ST) CY
2x2x0,64 mm²
/110.1
-P320-FPPU1
110.0 /
P1
(IN)

240W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU1-FPPU2
441.0 /
P2
(OUT)

M12 System-
steckverbinder

Arc Detect

M6 Bolzen
-PE

IEC

PE
19

Stecker A-Codiert

PIII_1

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8
X7
X6
X5

IGBT1
IGBT2
IGBT3
IGBT4
25-POL SUB-D SOCKET
X1
X2
X3
X4

240W1
pre-assembled D-Sub cable 1:1
240W2
pre-assembled D-Sub cable 1:1
240W3
pre-assembled D-Sub cable 1:1

++CONV
-_IGBT1.1
/ ++CONV/201.3
-_IGBT1.2
/ ++CONV/202.3
-_IGBT1.3
/ ++CONV/203.3

-240W7
pre-assembled D-Sub cable 1:1
/160.7
-HVIO_1
/ 160.9

PIII_1

PIII_Version
2_6_V_4

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

P2
LAN OUT
P1
LAN IN
Supply
24 V DC
IGBT6
IGBT4
IGBT2
HVIO
Arc Detect
Fuse
6A F
IGBT5
IGBT3
IGBT1
CHOPPER
25-POL SUB-D

connector view PIII

previous page: 353
next page: 441

Editor	Freqcon_DG			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 1	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 440
Date								+	total: 423

-2L+4
103.5 /
-2M4
103.5 /
-1PE7
103.4 /

241W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-241U1
PIII
IGBT IRT Interface
2.6 V4 cabinet

1 3 4 2

4 3
1 2

Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

240W11
2YY (ST) CY
2x2x0,64 mm²
/440.1
-FPPU1-FPPU2
440.0 /
P1
(IN)

241W11
2YY (ST) CY
2x2x0,64 mm²
/442.1
-FPPU2-FPPU3
442.0 /
P2
(OUT)

M12 System-
steckverbinder

Arc Detect

M6 Bolzen
-PE

PE
19

IEC

PIII_2

PIII_Version
2_6_V_4

Stecker A-Codiert

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_2

CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D SOCKET
X8
X7
X6
X5

IGBT1
IGBT2
IGBT3
IGBT4
25-POL SUB-D SOCKET
X1
X2
X3
X4

++CONV

241W1
pre-assembled D-Sub cable 1:1
-_IGBT2.1
/ ++CONV/211.3

241W2
pre-assembled D-Sub cable 1:1
-_IGBT2.2
/ ++CONV/211.3

241W3
pre-assembled D-Sub cable 1:1
-_IGBT2.3
/ ++CONV/211.3

-241W7
pre-assembled D-Sub cable 1:1
/161.7
/163.7
/164.7
-HVIO_2
/ 161.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

P2
LAN OUT
P1
LAN IN
Supply
24 V DC
IGBT6
IGBT4
IGBT2
HVIO
Arc Detect
Fuse
6A F
IGBT5
IGBT3
IGBT1
CHOPPER
25-POL SUB-D

connector view PIII

previous page: 440
next page: 442

Editor	Freqcon_DG			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 2	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 441
Date								+	total: 423

-2L+2
103.4 /
-2M2
103.5 /
-1PE5
103.4 /
242W9
JZ-500
3G0,75 mm²
GNYE
+CTRL_2.1
-242U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
Ansicht
Stiftleiste
24 VDC
M12 System-
steckverbinder
Stecker A-Codiert
PIII_3
241W11
2YY (ST) CY
2x2x0,64 mm²
/441.1
-FPPU2-FPPU3
441.0 /
P1
(IN)
Ansicht
Buchsenleiste
M12 System-
steckverbinder
242W11
2YY (ST) CY
2x2x0,64 mm²
/443.1
-FPPU3-FPPU4
443.0 /
P2
(OUT)
Arc Detect
M6 Bolzen
-PE
PE
19
IEC
PIII_3
PIII_Version
2_6_V_4

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

PIII_2
CHOPPER
HVIO
IGBT6
IGBT5
25-POL SUB-D
SOCKET
X8
X7
X6
X5

IGBT1
IGBT2
IGBT3
IGBT4
X1
X2
X3
X4
25-POL SUB-D
SOCKET

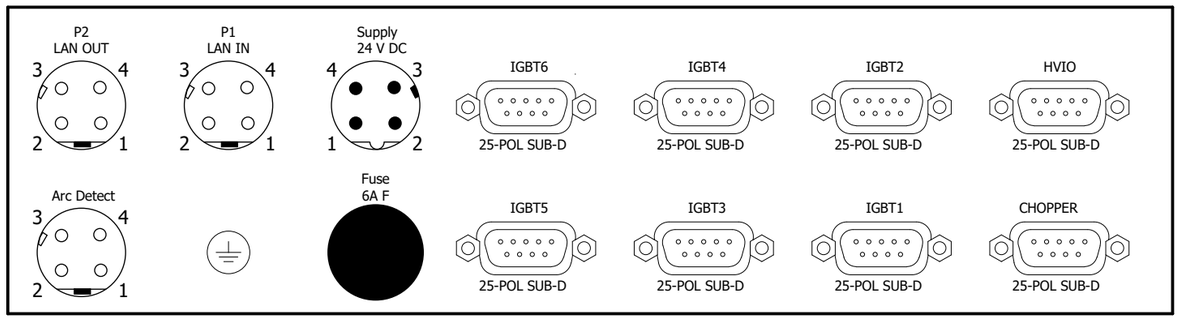
++CONV
242W1
pre-assembled D-Sub cable 1:1
-_IGBT3.1
/ ++CONV/207.3
242W2
pre-assembled D-Sub cable 1:1
-_IGBT3.2
/ ++CONV/207.3
242W3
pre-assembled D-Sub cable 1:1
-_IGBT3.3
/ ++CONV/207.3

-242W7
pre-assembled D-Sub cable 1:1
-HVIO_3
/ 163.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded



connector view PIII

previous page: 441
next page: 443

Editor	Freqcon_DG			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 3	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 442
Date								+	total: 423

-2L+3
103.4 /
-2M3
103.5 /
-1PE8
103.4 /
243W9
JZ-500
3G0,75 mm²
1 2 GNYE

+CTRL_2.1
-243U1
PIII
IGBT IRT Interface
2.6 V4 cabinet
1 3 4 2

Ansicht
Stiftleiste
24 VDC

M12 System-
steckverbinder

Ansicht
Buchsenleiste

242W11
2YY (ST) CY
2x2x0,64 mm²
/442.1
-FPPU3-FPPU4
442.0 /
P1 (IN)

M12 System-
steckverbinder

P2 (OUT)

Arc Detect

M6 Bolzen
-PE

PE 19

IEC

PIII_4

PIII_Version
2_6_V_4

Stecker A-Codiert

PIII_2

Converter Control Interface
Type: PIII IGBT IRT Interface 2.6 V4
FRQ 504890

CHOPPER X8
HVIO X7
IGBT6 X6
IGBT5 X5
25-POL SUB-D SOCKET

PIII_2

IGBT1 X1
IGBT2 X2
IGBT3 X3
IGBT4 X4
25-POL SUB-D SOCKET

++CONV

243W1
pre-assembled D-Sub cable 1:1
-_IGBT4.1
/ ++CONV/217.3

243W2
pre-assembled D-Sub cable 1:1
-_IGBT4.2
/ ++CONV/217.3

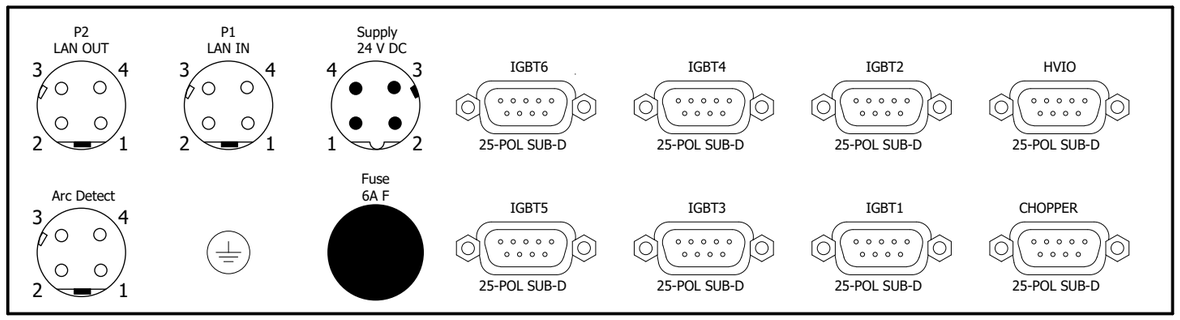
243W3
pre-assembled D-Sub cable 1:1
-_IGBT4.3
/ ++CONV/217.3

-243W7
pre-assembled D-Sub cable 1:1
-HVIO_4
/ 164.9

Signal	Colour	M12 Plug	M12 Plug
TD+	yellow	1	1
TD-	orange	3	3
RD+	white	2	2
RD-	blue	4	4

Connection PIII -- P320

Plug D-coded

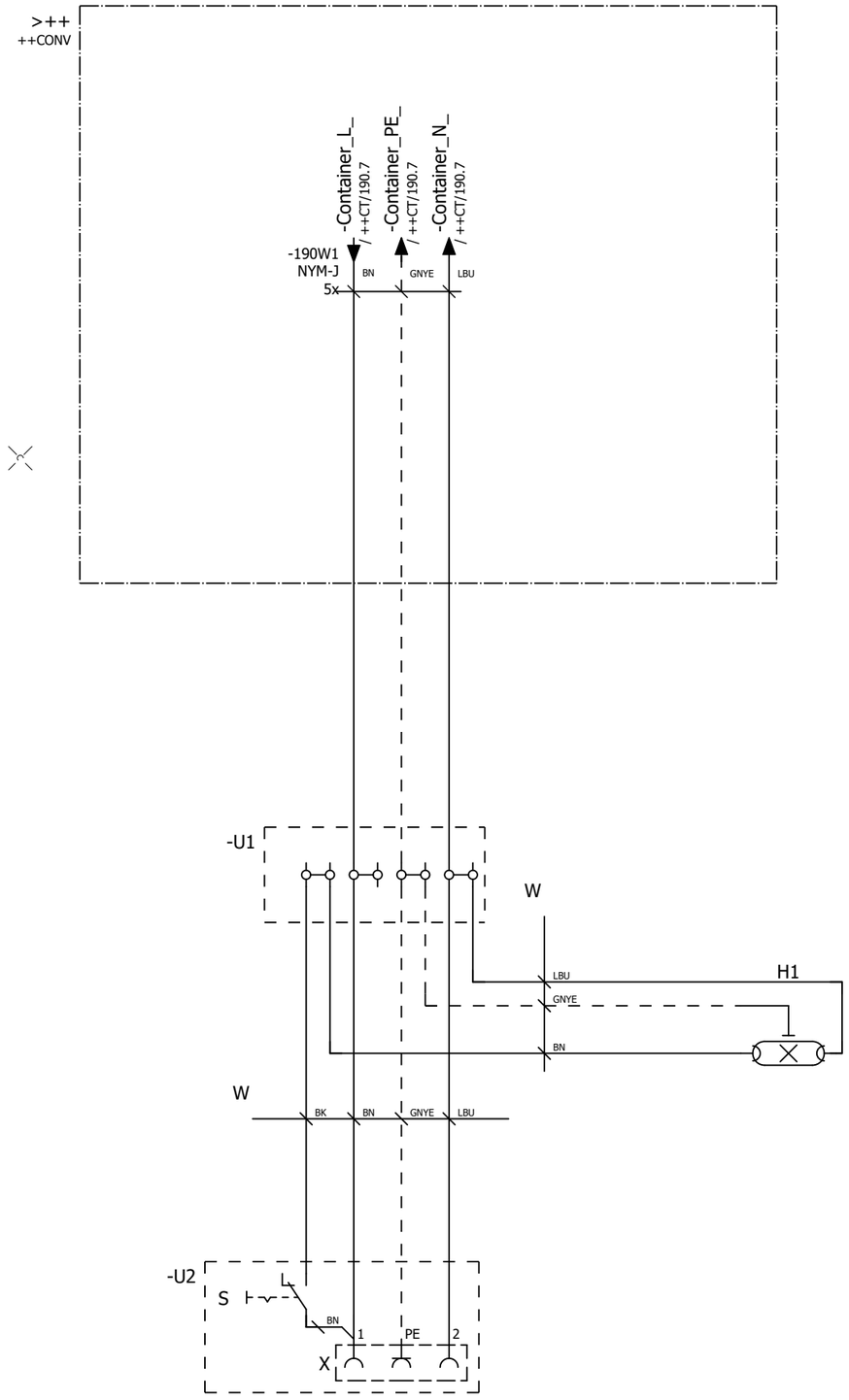


connector view PIII

previous page:
442

next page:
++Container/190

Editor	Freqcon_DG			Statron	FREQCON	PIII PROFINET IGBT IRT INTERFACE 4	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 443
Date								+	total: 423



230V AC for
Container light, socket

previous page:
++CT/443

next page:
&EPC++CONV+CON/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING, LIGHT 230V SUPPLY	20230331_V0.01	= UNIT_01	Converter Container 1
Date	29.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 190
Date								+	total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B2 &EFS++CT+/147.7	1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648	
-201Q1 &EFS+/201.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-201Q1 &EFS+/201.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-201Q1 &EFS+/201.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-201Q1 &EFS+/201.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-201Q1 &EFS+/201.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-201Q1 &EFS+/201.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-201Q1-C &EFS+/201.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-201Q1-C &EFS+/201.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-201Q1-C &EFS+/201.6;&EFS+/201.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-202Q1 &EFS+/202.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-202Q1 &EFS+/202.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-202Q1 &EFS+/202.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-202Q1 &EFS+/202.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-202Q1 &EFS+/202.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-202Q1 &EFS+/202.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-202Q1-C &EFS+/202.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-202Q1-C &EFS+/202.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 1
Date								+ CON Converter cabinet total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-202Q1-C &EFS+/202.6;&EFS+/202.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-202Q1-C &EFS+/202.6;&EFS+/202.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-203Q1 &EFS+/203.3	1	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872	
-203Q1 &EFS+/203.3	1	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157	
-203Q1 &EFS+/203.3	1	SKiiP 2414 GB17E4-4DUW, 1*1000 A	20603236	Semikron	501558	X
-203Q1 &EFS+/203.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-203Q1 &EFS+/203.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-203Q1 &EFS+/203.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-203Q1-C &EFS+/203.5	4	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-203Q1-C &EFS+/203.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	3	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-203Q1-C &EFS+/203.6;&EFS+/203.7	2	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1 &EFS+/207.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-207Q1 &EFS+/207.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-207Q1 &EFS+/207.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-207Q1 &EFS+/207.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-207Q1 &EFS+/207.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-207Q1-C &EFS+/207.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-207Q1-C &EFS+/207.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-207Q1-C &EFS+/207.6;&EFS+/207.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-207Q1-C &EFS+/207.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-207Q1-U1 &EFS+/207.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-211Q1 &EFS+/211.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-211Q1 &EFS+/211.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-211Q1 &EFS+/211.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-211Q1 &EFS+/211.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-211Q1 &EFS+/211.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-211Q1-C &EFS+/211.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X
-211Q1-C &EFS+/211.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-211Q1-C &EFS+/211.6;&EFS+/211.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-211Q1-C &EFS+/211.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-211Q1-U1 &EFS+/211.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-217Q1 &EFS+/217.3	1	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867	
-217Q1 &EFS+/217.3	1	SKiiP 603 GD172-3DK1470	20452470	Semikron	501559	X
-217Q1 &EFS+/217.3	2	Mini feed-through terminal block, Push in, MPT 1,5/S	3248100	Phoenix Contact	501024	X
-217Q1 &EFS+/217.3	2	End clamp CLIPFIX 15	3022263	Phoenix Contact	500935	X
-217Q1 &EFS+/217.3	1	End cover D-MPT 1,5/S	3248120	Phoenix Contact	500899	X
-217Q1-C &EFS+/217.5	3	Snubber capacitor 470nF 5% 1500V Version for SkiiP module (SL)	KPF-271 REV-01	Alcon Electronics Pvt. Ltd.	501406	X

previous page: 2

next page: 4

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-217Q1-C &EFS+/217.6	1	Film Capacitor 1500µF 700VDC, with PT100 temperature sensor	1025314-54097	FTCap GmbH	504740	X
-217Q1-C &EFS+/217.6;&EFS+/217.7	2	Film Capacitor 1500µF 700VDC	1025173-54097	FTCap GmbH	500662	X
-217Q1-C &EFS+/217.7	1	Film Capacitor 1500µF 700VDC EC1500µ700d116165KF6_1	1025170-54097	FTCap GmbH	500661	X
-217Q1-U1 &EFS+/217.3	1	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426	
-260B1 &EFS+/260.3	1	Optical smoke detector 12V, with alarm relais	130-60-457	ABUS Security-Center GmbH & Co. KG	500713	X
-279M1 &EFS+/279.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M2 &EFS+/279.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M3 &EFS+/279.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M4 &EFS+/279.5	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-279M5 &EFS+/279.6	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-N &EFS+/99.5	2	Busbar holder for busbars 12x 5 (10)-30x 5 (10) and 6x 6 mm	8US1923-1AA01	Siemens	501271	X

previous page:
3

next page:
+IND/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 4
Date								+ CON Converter cabinet total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-201L1 &EFS+/201.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-201L1 &EFS+/201.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-201U1 &EFS+/201.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-202L1 &EFS+/202.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-202L1 &EFS+/202.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-202U1 &EFS+/202.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-203L1 &EFS+/203.1	1	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053	
-203L1 &EFS+/203.1	1	Inductor, 1050A, 0.2mH, 690V, 50/60Hz, 1-phas, 1x PT100, water-cooled	36231	Trafotek Oy	500889	X
-203U1 &EFS+/203.0	1	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449	
-207L1 &EFS+/207.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-207L1 &EFS+/207.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-211L1 &EFS+/211.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-211L1 &EFS+/211.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X
-217L1 &EFS+/217.1	1	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046	
-217L1 &EFS+/217.1	1	3x Single phase line reactor, UN=690 V, 50/60 Hz, LN=0,6 mH, I=263,0 A	37106B	Trafotek Oy	501204	X

previous page:
+CON/4

next page:
+CIR/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-80Q1 &EFS+/80.0	1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955	
-80Q1 &EFS+/80.1	1	Circuit breaker 3WL1112, 1250A, 42kA 690V, size 1, 3-pole, IEC, ETU15B, withdrawable	3WL1112-2BB36-1BJ2-ZA08+K07+M06+M21+R10	Siemens	501430	X
-83U1 &EFS+/83.2	1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918	
-83U1-C1 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C2 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C3 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C4 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C7 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C8 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C9 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C10 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C13 &EFS+/83.4	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C14 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C15 &EFS+/83.5	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-83U1-C16 &EFS+/83.6	1	CAPACITORS MKP AC B32362 150µF 680V AC / 480V rms	B32362A4157J080	EPCOS AG	500663	X
-148B3 &EFS++CT+/148.5	1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649	
-227U1 &EFS+/227.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-227U1-C1 &EFS+/227.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-C7 &EFS+/227.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 1
Date								+ CIR Circuit Breaker cabinet total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-C13 &EFS+/227.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-227U1-F0 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F1 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F1 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F1 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F2 &EFS+/227.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F2 &EFS+/227.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F2 &EFS+/227.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F3 &EFS+/227.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F3 &EFS+/227.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F3 &EFS+/227.1	1	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-227U1-F4 &EFS+/227.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F4 &EFS+/227.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F5 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F5 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F5 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F6 &EFS+/227.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F6 &EFS+/227.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F6 &EFS+/227.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-F7 &EFS+/227.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F7 &EFS+/227.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F8 &EFS+/227.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F8 &EFS+/227.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F9 &EFS+/227.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F9 &EFS+/227.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F9 &EFS+/227.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F10 &EFS+/227.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-227U1-F10 &EFS+/227.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-227U1-F10 &EFS+/227.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-227U1-F11 &EFS+/227.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F11 &EFS+/227.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-227U1-F12 &EFS+/227.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-227U1-F12 &EFS+/227.8	1	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-227U1-K1 &EFS+/227.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-227U1-K2 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-227U1-K3 &EFS+/227.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-227U1-K7 &EFS+/227.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 3
Date								+ CIR Circuit Breaker cabinet total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-227U1-K8 &EFS+/227.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-227U1-K9 &EFS+/227.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-227U1-U1 &EFS+/227.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-227U1-X3.1 &EFS+/227.a.0;&EFS+/227.a.9	0					
-227U1-X3.1 &EFS+/227.a.1...&EFS+/227.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-227U1-X3.1 &EFS+/227.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-227U1-X3.1 &EFS+/227.a.1	1	End cover D-ST 2,5	3030417	Phoenix Contact	500506	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-227U1-X3.1 &EFS+/227.a.1;&EFS+/227.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-227U1-X3.1 &EFS+/227.a.2...&EFS+/227.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-227U1-X3.1 &EFS+/227.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-227U1-X3.2 &EFS+/227.a.0	0					
-227U1-X3.2 &EFS+/227.a.1...&EFS+/227.a.7	13	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-227U1-X3.2 &EFS+/227.a.1	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.7	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-227U1-X3.2 &EFS+/227.a.1;&EFS+/227.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-231U1 &EFS+/231.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-231U1-C1 &EFS+/231.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-C7 &EFS+/231.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-C13 &EFS+/231.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-231U1-F0 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F1 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F1 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F1 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F2 &EFS+/231.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F2 &EFS+/231.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F2 &EFS+/231.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F3 &EFS+/231.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F3 &EFS+/231.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F3 &EFS+/231.1	1	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-231U1-F4 &EFS+/231.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F4 &EFS+/231.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F5 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F5 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F5 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F6 &EFS+/231.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F6 &EFS+/231.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F6 &EFS+/231.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-F7 &EFS+/231.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F7 &EFS+/231.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F8 &EFS+/231.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F8 &EFS+/231.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F9 &EFS+/231.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F9 &EFS+/231.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F9 &EFS+/231.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F10 &EFS+/231.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-231U1-F10 &EFS+/231.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-231U1-F10 &EFS+/231.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-231U1-F11 &EFS+/231.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F11 &EFS+/231.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-231U1-F12 &EFS+/231.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-231U1-F12 &EFS+/231.8	1	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-231U1-K1 &EFS+/231.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-231U1-K2 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-231U1-K3 &EFS+/231.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-231U1-K7 &EFS+/231.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 6
Date								+ CIR Circuit Breaker cabinet total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231U1-K8 &EFS+/231.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-231U1-K9 &EFS+/231.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-231U1-U1 &EFS+/231.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-231U1-X3.1 &EFS+/231.a.0;&EFS+/231.a.9	0					
-231U1-X3.1 &EFS+/231.a.1...&EFS+/231.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-231U1-X3.1 &EFS+/231.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-231U1-X3.1 &EFS+/231.a.1	1	End cover D-ST 2,5	3030417	Phoenix Contact	500506	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-231U1-X3.1 &EFS+/231.a.1;&EFS+/231.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-231U1-X3.1 &EFS+/231.a.2...&EFS+/231.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-231U1-X3.1 &EFS+/231.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-231U1-X3.2 &EFS+/231.a.0	0					
-231U1-X3.2 &EFS+/231.a.1...&EFS+/231.a.7	13	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-231U1-X3.2 &EFS+/231.a.1	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.7	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-231U1-X3.2 &EFS+/231.a.1;&EFS+/231.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-237U1 &EFS+/237.0	1	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882	
-237U1-C1 &EFS+/237.1	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-C7 &EFS+/237.3	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-C13 &EFS+/237.7	1	CAPACITORS MKP DC B2562 340µF 1320V DC	B25620C1347K321	EPCOS AG	501405	X
-237U1-F0 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F1 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F1 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F1 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F2 &EFS+/237.1	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F2 &EFS+/237.1	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F2 &EFS+/237.1	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F3 &EFS+/237.1	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F3 &EFS+/237.1	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F3 &EFS+/237.1	1	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-237U1-F4 &EFS+/237.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F4 &EFS+/237.2	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F5 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F5 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F5 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F6 &EFS+/237.3	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F6 &EFS+/237.3	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F6 &EFS+/237.3	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-F7 &EFS+/237.3	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F7 &EFS+/237.3	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F8 &EFS+/237.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F8 &EFS+/237.4	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F9 &EFS+/237.6	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F9 &EFS+/237.6	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F9 &EFS+/237.6	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F10 &EFS+/237.7	1	HLS Fuse 1250V/400A Size 1KN/110	170M4243	Gemballa Electronics	501537	X
-237U1-F10 &EFS+/237.7	1	Fuse base Bussmann 1250A, 1400V, 110mm center distance, UR 43653	170H3006	Gemballa Electronics	501536	X
-237U1-F10 &EFS+/237.7	1	Microswitch 250V/2A Switch K1	170H0069	Gemballa Electronics	501455	X
-237U1-F11 &EFS+/237.6	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F11 &EFS+/237.6	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	X
-237U1-F12 &EFS+/237.8	1	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-237U1-F12 &EFS+/237.8	1	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-237U1-K1 &EFS+/237.a.1	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-237U1-K2 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-237U1-K3 &EFS+/237.a.2	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-237U1-K7 &EFS+/237.a.3	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-237U1-K8 &EFS+/237.a.4	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-237U1-K9 &EFS+/237.a.5	1	HX22 CAB 1500V, 300A, SPST-NO, 24Vdc	GIG/HX22CAB	GIGAVAC	501517	X
-237U1-U1 &EFS+/237.4	1	EMI Suppresion CAP L1-L3; N; DC + & -	FRQ-M00111	Freqcon GmbH	500450	X
-237U1-X3.1 &EFS+/237.a.0;&EFS+/237.a.9	0					
-237U1-X3.1 &EFS+/237.a.1...&EFS+/237.a.9	17	Feed-through terminal block Push-in PT 2,5/1P	3210033	Phoenix Contact	501390	X
-237U1-X3.1 &EFS+/237.a.1	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-L	3210062	Phoenix Contact	504126	X
-237U1-X3.1 &EFS+/237.a.1	1	End cover D-ST 2,5	3030417	Phoenix Contact	500506	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-237U1-X3.1 &EFS+/237.a.1;&EFS+/237.a.9	2	Latching PR	3040559	Phoenix Contact	504066	X
-237U1-X3.1 &EFS+/237.a.2...&EFS+/237.a.9	15	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-M	3210091	Phoenix Contact	504129	X
-237U1-X3.1 &EFS+/237.a.9	1	Plug Push-in, 1 Pol., 0,14 mm² - 4 mm², PP-H 2,5/1-R	3210127	Phoenix Contact	10044	X
-237U1-X3.2 &EFS+/237.a.0	0					
-237U1-X3.2 &EFS+/237.a.1...&EFS+/237.a.7	13	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-237U1-X3.2 &EFS+/237.a.1	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.7	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-237U1-X3.2 &EFS+/237.a.1;&EFS+/237.a.5	2	Plug-in bridge FBS 10-3,5	3213056	Phoenix Contact	501171	X
-281M1 &EFS+/281.1	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M2 &EFS+/281.2	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X
-281M3 &EFS+/281.3	1	SK TopTherm fan-and-filter unit, 550/600 m³/h, 230 V, 1~, 50/60 Hz, 70W	3243100	Rittal	500596	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-78F1 &EFS+/78.6	1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738	
-78F1 &EFS+/78.6	3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539	
-78F2 &EFS+/78.6	1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055	
-78F3 &EFS+/78.7;&EFS+/78.8	3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779	
-78F3 &EFS+/78.7;&EFS+/78.8	3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545	
-78W1 &EFS+/78.3	1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W2 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W3 &EFS+/78.3	0	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190	
-78W4 &EFS+/78.3	1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290	
-78W5 &EFS+/78.2	1	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290	
-227W10 &EFS+/227.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W11 &EFS+/227.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W12 &EFS+/227.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W13 &EFS+/227.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W14 &EFS+/227.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-227W15 &EFS+/227.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-228F1 &EFS+/228.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F2 &EFS+/228.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-228F3 &EFS+/228.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-231W10 &EFS+/231.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W11 &EFS+/231.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W12 &EFS+/231.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W13 &EFS+/231.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W14 &EFS+/231.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-231W15 &EFS+/231.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W10 &EFS+/237.1	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W11 &EFS+/237.1	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W12 &EFS+/237.4	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W13 &EFS+/237.4	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W14 &EFS+/237.7	1	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-237W15 &EFS+/237.7	0	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604	
-238F1 &EFS+/238a.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F2 &EFS+/238a.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F3 &EFS+/238a.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F4 &EFS+/238b.0	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F5 &EFS+/238b.4	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-238F6 &EFS+/238b.7	1	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130	
-X3.43	20	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X

previous page:
1

next page:
++CT+CTRL_1.1/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84Q1 &EFS+/84.0	1	EMERGENCY STOP SWITCH	3LD2203-1TP53	Siemens	500810	X
-84Q1 &EFS+/84.0	1	Auxiliary switch	3LD9200-5B	Siemens	504922	X
-126S1 &EFS+/126.1	1	PUSHBUTTON, BLACK, 1 NO	3SU1100-0AB10-3BA0	Siemens	10026	X
-126S1 &EFS+/126.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H1 &EFS+/140.1	1	Complete device, round, indicator light RED	3SU1102-6AA20-3AA0	Siemens	10019	X
-140H1 &EFS+/140.1	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H2 &EFS+/140.2	1	Complete device, round, indicator light YELLOW	3SU1102-6AA30-3AA0	Siemens	10021	X
-140H2 &EFS+/140.2	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H3 &EFS+/140.3	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H3 &EFS+/140.3	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-140H4 &EFS+/140.4	1	Complete device, round, indicator light GREEN	3SU1102-6AA40-3AA0	Siemens	10023	X
-140H4 &EFS+/140.4	1	Marker carriers - CARRIER-EMP 22 (27X12,5)	0827446	Phoenix Contact	500751	X
-278M1 &EFS+/278.1	1	SK TopTherm fan-and-filter unit, 230/250 m³/h, 230 V, 1~, 50/60 Hz, 40W	3241100	Rittal	500594	X

previous page:
++CONV+AC_DC/2

next page:
+.2/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-110U1 &EFS+/110.2	1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789	
-110U1 &EFS+/110.2	1	Connector RJ45, 4 Pol., Profinet, VS-PN-RJ45-5-Q/IP20	1658435	Phoenix Contact	500806	X
-114A1 &EFS+/114.3	1	SIMATIC PN/PN Coupler	6ES7158-3AD10-0XA0	Siemens	10138	
-114A1 &EFS+/114.3	2	BA 2XRJ45	6ES7193-6AR00-0AA0	Siemens	505628	
-185R1 &EFS+/185.7	1	SK Enclosure heater, 800/870 W, 230 V, 1~, 50/60 Hz, WHD: 103x200x103 mm	3105400	Rittal	500621	X

previous page:
+.1/1

next page:
+.3/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-84F2 &EFS+/84.0	1	CIRCUIT BREAKER 400V, 10KA, 3-POLE, C, 32A	5SY4332-7	Siemens	505272	X
-84F2 &EFS+/84.0	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	X
-84K1 &EFS+/84.6	1	CONTACTOR RELAY, 3NO+1NC DC 24V, mit Diode integriert	3RH2131-2FB40	Siemens	501288	X
-101Q1 &EFS+/101.2	1	MOTOR PROTECTION S00, A-release 2.2...3.2 A, N-release 42 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1DA25	Siemens	501432	X
-101Q1 &EFS+/101.2	1	Cable connector size S00 Spring-type terminal	3RV2917-5AA00	Siemens	500797	X
-101Q1 &EFS+/101.2	1	3-phase busbar with infeed left for 2 circuit breakers Size S00 and S0	3RV2917-1A	Siemens	500799	X
-101Q1 &EFS+/101.2	1	3-phase busbar including extension connector for 3 circuit breakers Size S00 and S0	3RV2917-4B	Siemens	504254	X
-101T1 &EFS+/101.2	1	Power supply QUINT-PS/3AC/24DC/20/CO, with protective coating	2320924	Phoenix Contact	501573	X
-102G1 &EFS+/102.2	1	Uninterruptible power supply QUINT-UPS/ 24DC/ 24DC/20	2320238	Phoenix Contact	501598	X
-102G2 &EFS+/102.6	1	Energy storage UPS-BAT/VRLA/24DC/12AH	2320322	Phoenix Contact	501229	X
-103F1 &EFS+/103.2	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F2 &EFS+/103.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F3 &EFS+/103.6	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F4 &EFS+/103.8	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-103F5 &EFS+/103.9	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-111A1 &EFS+/111.0	1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287	
-113T1 &EFS+/113a.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-113T1 &EFS+/113a.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-113T2 &EFS+/113b.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	

previous page:
+.2/1

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-113T2 &EFS+/113b.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-113U1 &EFS+/113a.3	1	Surge protection device DT-LAN-CAT.6+	2881007	Phoenix Contact	504791	
-113U2 &EFS+/113b.3	1	Surge protection device DT-LAN-CAT.6+	2881007	Phoenix Contact	504791	
-115A1 &EFS+/115.3	1	eWON Cosy 131, 3G+VPN Router, Versorgung 24 VDC UMTS Router	WEC6133D	Wachendorff Prozesstechnik GmbH & Co. KG	501809	
-120A1 &EFS+/120.1	1	SIMATIC ET 200SP, PROFINET Interface-Module, IM 155-6 PN ST, bundle of Server module + Busadapter	6ES7155-6AA01-0BN0	Siemens	501554	X
-134K1 &EFS+/134.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-134K1 &EFS+/134.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K1 &EFS+/135.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K1 &EFS+/135.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K2 &EFS+/135.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K2 &EFS+/135.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K3 &EFS+/135.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K3 &EFS+/135.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K4 &EFS+/135.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K4 &EFS+/135.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-135K5 &EFS+/135.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-135K5 &EFS+/135.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K1 &EFS+/137.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K1 &EFS+/137.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-137K2 &EFS+/137.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K2 &EFS+/137.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K3 &EFS+/137.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K3 &EFS+/137.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-137K4 &EFS+/137.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-137K4 &EFS+/137.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-139K1 &EFS+/139.1	1	AC Contactor 3RT2015, 7A, 3KW @AC-3, 400V, S00, 3-pole, 24VDC, 1NO, spring-type, integr.diode	3RT2015-2FB41	Siemens	501516	X
-139K2 &EFS+/139.2	1	AC Contactor 3RT2015, 7A, 3KW @AC-3, 400V, S00, 3-pole, 24VDC, 1NO, spring-type, integr.diode	3RT2015-2FB41	Siemens	501516	X
-139K3 &EFS+/139.3	1	AC Contactor 3RT2015, 7A, 3KW @AC-3, 400V, S00, 3-pole, 24VDC, 1NO, spring-type, integr.diode	3RT2015-2FB41	Siemens	501516	X
-150K1 &EFS+/150.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K1 &EFS+/150.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150K2 &EFS+/150.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-150K2 &EFS+/150.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-150X1 &EFS+/150.1	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-150X1 &EFS+/150.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-150X1 &EFS+/150.2;&EFS+/150.4;&EFS+/151.1;&EFS+/151.4;&EFS+/151.6	5	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-151K1 &EFS+/151.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K1 &EFS+/151.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K2 &EFS+/151.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-151K2 &EFS+/151.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K3 &EFS+/151.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K3 &EFS+/151.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-151K4 &EFS+/151.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-151K4 &EFS+/151.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-171K3 &EFS+/171.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-171K3 &EFS+/171.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-173K3 &EFS+/173.6	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-173K3 &EFS+/173.6	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	X
-181Q1 &EFS+/181.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-181Q1 &EFS+/181.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q1 &EFS+/181.1	1	Cable connector size S00 Spring-type terminal	3RV2917-5AA00	Siemens	500797	
-181Q2 &EFS+/181.3	1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671	
-181Q2 &EFS+/181.3	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-181Q2 &EFS+/181.3	1	Cable connector size S00 Spring-type terminal	3RV2917-5AA00	Siemens	500797	
-182Q1 &EFS+/182.1	1	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740	
-182Q1 &EFS+/182.1	1	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845	
-182Q1 &EFS+/182.1	1	Cable connector size S00 Spring-type terminal	3RV2917-5AA00	Siemens	500797	
-183F1 &EFS+/183.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	X

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_01	Converter Container 1
Date	30.03.2023							& EPC	Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 4
Date								+ CTRL_1.3	Main mounting plate total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-183F1 &EFS+/183.1	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	X
-183F1 &EFS+/183.1	1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364	X
-183F1 &EFS+/183.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	X
-183F2 &EFS+/183.3	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-183F2 &EFS+/183.3	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	X
-185B1 &EFS+/185.6	1	Thermostat NC contact, -10 to 50 °C	8MR2170-1CA	Siemens	500816	X
-185F1 &EFS+/185.1	1	CIRCUIT BREAKER 10KA 1POL C10	5SY4110-7	Siemens	500681	X
-185F1 &EFS+/185.1	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	X
-185F2 &EFS+/185.7	1	CIRCUIT BREAKER 10KA 1POL C6	5SY4106-7	Siemens	500682	X
-185F2 &EFS+/185.7	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	X
-186B1 &EFS+/186.6	1	Thermostat NO contact, -10 to 50 °C	8MR2170-1CB	Siemens	501577	X
-186K1 &EFS+/186.6	1	AC Contactor 3RT2015, 7A, 3KW @AC-3, 400V, S00, 3-pole, 24VDC, 1NO, spring-type, integr.diode	3RT2015-2FB41	Siemens	501516	X
-187F1 &EFS+/187.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C13	5SY4113-7	Siemens	504323	X
-187F1 &EFS+/187.1	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	X
-187F2 &EFS+/187.4	1	Device circuit breaker 230VAC / 60VDC, 3kA, 1-pole, AS, F2, 10A	5SY1710-4	Siemens	10086	X
-189K1 &EFS+/189.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	X
-190F1 &EFS+/190.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	X
-190F1 &EFS+/190.1	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	X
-190F2 &EFS+/190.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	X

previous page: 4

next page: 6

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-190F2 &EFS+/190.3	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	X
-190F3 &EFS+/190.5	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	X
-190F3 &EFS+/190.5	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	X
-190F3 &EFS+/190.5	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	X
-190X10 &EFS+/190.9	1	SCHUKO socket outlet 16 A according to DIN VDE 0620 for installation in distribution boards	5TE6800	Siemens	503215	X
-190XT1 &EFS+/190.0	1	End cover D-ST 2,5	3030417	Phoenix Contact	500506	X
-190XT1 &EFS+/190.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block Push-in PT 2,5	3209510	Phoenix Contact	500583	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Feed-through terminal block Push-in PT 2,5 BU	3209523	Phoenix Contact	500584	X
-190XT1 &EFS+/190.1;&EFS+/190.5	3	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-190XT1 &EFS+/190.1;&EFS+/190.3;&EFS+/190.5;&EFS+/190.7	4	Ground modular terminal block Push-in PT 2,5-PE	3209536	Phoenix Contact	500813	X
-195K1 &EFS+/195.3	1	Contactor relay 3RH2362, 24VDC, S00, 6NO, 2NC, spring-type, removable aux. switch	3RH2362-2BB40	Siemens	501287	X
-195K1 &EFS+/195.3	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K2 &EFS+/195.4	1	Contactor relay 3RH2362, 24VDC, S00, 6NO, 2NC, spring-type, removable aux. switch	3RH2362-2BB40	Siemens	501287	X
-195K2 &EFS+/195.4	1	SURGE SUPPRESSOR, DIODE COMBINATION, DC 12...250V, F. CONT. RELAYS A. MOTOR CONT. SZ S00	3RT29161EH00	Siemens	500534	X
-195K3 &EFS+/195.1	1	SIRIUS SAFETY RELAY STANDARD SERIES DEVICE	3SK1111-2AB30	Siemens	501260	X
-AI_01 &EFS+/120.5	1	ET 200SP, AI 8XRTD/TC 2-WIRE HF	6ES7134-6JF00-0CA1	Siemens	501550	
-AI_01 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-AI_02 &EFS+/120.6	1	ET 200SP, AI 8XRTD/TC 2-WIRE HF	6ES7134-6JF00-0CA1	Siemens	501550	

previous page: 5

next page: 7

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-AI_02 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_03 &EFS+/120.6	1	ET 200SP, AI 4XU/I 2-WIRE ST, PU 1	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_03 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-AI_04 &EFS+/120.6	1	ET 200SP, AI 4XU/I 2-WIRE ST, PU 1	6ES7134-6HD01-0BA1	Siemens	505054	
-AI_04 &EFS+/120.6	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_01 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_01 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-DI_02 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_02 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_03 &EFS+/120.3	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_03 &EFS+/120.3	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_04 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_04 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DI_05 &EFS+/120.4	1	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788	
-DI_05 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X
-DO_01 &EFS+/120.4	1	DQ 16X24V DC/0,5A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_01 &EFS+/120.4	1	BASEUNIT TYPE A0, BU15-P16+A0+2D	6ES7193-6BP00-0DA0	Siemens	500786	X
-DO_02 &EFS+/120.5	1	DQ 16X24V DC/0,5A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_02 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	X

previous page: 6

next page: 8

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-DO_03 &EFS+/120.5	1	DQ 16X24V DC/0,5A ST	6ES7132-6BH01-0BA0	Siemens	504397	
-DO_03 &EFS+/120.5	1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787	
-X1 &EFS+/181.0	1	End cover D-ST 2,5	3030417	Phoenix Contact	500506	X
-X1 &EFS+/181.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-X1 &EFS+/181.1;&EFS+/181.3;&EFS+/181.4;&EFS+/182.1;&EFS+/182.3;&EFS+/182.4	12	Feed-through terminal block Push-in PT 2,5	3209510	Phoenix Contact	500583	X
-X1 &EFS+/181.4	1	Feed-through terminal block Push-in PT 2,5 BU	3209523	Phoenix Contact	500584	X
-X1 &EFS+/181.1;&EFS+/181.4;&EFS+/182.1;&EFS+/182.4	4	Ground modular terminal block Push-in PT 2,5-PE	3209536	Phoenix Contact	500813	X
-X3 &EFS+/127.1	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-X3 &EFS+/127.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-X3.10 &EFS+/129.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.10 &EFS+/129.0;&EFS+/129.2;&EFS+/129.4;&EFS+/129.6;&EFS+/129.8;&EFS+/129.9	6	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-X3.10 &EFS+/129.0;&EFS+/129.4;&EFS+/129.6;&EFS+/129.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.11 &EFS+/130.0	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-X3.11 &EFS+/130.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.11 &EFS+/130.0;&EFS+/130.2;&EFS+/130.4;&EFS+/130.6;&EFS+/130.8;&EFS+/130.9	6	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-X3.11 &EFS+/130.0;&EFS+/130.4;&EFS+/130.6;&EFS+/130.9	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.12 &EFS+/131.0	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-X3.12 &EFS+/131.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X

previous page: 7

next page: 9

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-X3.12 &EFS+/131.0;&EFS+/131.2;&EFS+/131.4;&EFS+/131.6;&EFS+/131.8;&EFS+/131.9	6	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-X3.12 &EFS+/131.0;&EFS+/131.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3.13 &EFS+/132.0	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-X3.13 &EFS+/132.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X3.13 &EFS+/132.0;&EFS+/132.2;&EFS+/132.4;&EFS+/132.6;&EFS+/132.8;&EFS+/132.9	6	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-X3.13 &EFS+/132.0;&EFS+/132.6	4	Plug-in bridge FBS 3-3,5	3213027	Phoenix Contact	503102	X
-X3	20	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-X3 &EFS+/127.1;&EFS+/127.5;&EFS+/128.3;&EFS+/188.1	5	Plug-in bridge FBS 2-3,5	3213014	Phoenix Contact	500802	X
-X5 &EFS+/145.0	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	X
-X5 &EFS+/145.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0	1	End cover D-PTTB 2,5	3211634	Phoenix Contact	500505	X
-X5.1 &EFS+/149.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-X5.1 &EFS+/149.0;&EFS+/149.2	2	Double-level terminal block Push-in PTTB 2,5-PV	3210583	Phoenix Contact	501385	X
-X5.1 &EFS+/149.0	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-X5	15	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	X
-XDC1 &EFS+/103.1	1	End cover D-PTTB 2,5	3211634	Phoenix Contact	500505	X
-XDC1 &EFS+/103.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC1 &EFS+/103.2;&EFS+/103.3	7	Double-level terminal block Push-in PTTB 2,5-PV	3210583	Phoenix Contact	501385	X
-XDC1 &EFS+/103.2	1	Plug-in bridge FBS 3-5	3030174	Phoenix Contact	503103	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC1 &EFS+/103.3	1	Plug-in bridge FBS 4-5	3030187	Phoenix Contact	500801	X
-XDC1 &EFS+/103.4	2	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XDC2 &EFS+/103.3	1	End cover D-PTTB 2,5	3211634	Phoenix Contact	500505	X
-XDC2 &EFS+/103.3	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC2 &EFS+/103.4;&EFS+/103.5	4	Double-level terminal block Push-in PTTB 2,5-PV	3210583	Phoenix Contact	501385	X
-XDC2 &EFS+/103.4;&EFS+/103.5	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC3 &EFS+/103.5	1	End cover D-PTTB 2,5	3211634	Phoenix Contact	500505	X
-XDC3 &EFS+/103.5	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC3 &EFS+/103.6;&EFS+/103.7	4	Double-level terminal block Push-in PTTB 2,5-PV	3210583	Phoenix Contact	501385	X
-XDC3 &EFS+/103.6;&EFS+/103.7	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC4 &EFS+/103.7	1	End cover D-PTTB 2,5	3211634	Phoenix Contact	500505	X
-XDC4 &EFS+/103.7	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC4 &EFS+/103.8;&EFS+/103.9	4	Double-level terminal block Push-in PTTB 2,5-PV	3210583	Phoenix Contact	501385	X
-XDC4 &EFS+/103.8;&EFS+/103.9	2	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XDC5.1 &EFS+/103.8	1	End cover D-PTTB 2,5	3211634	Phoenix Contact	500505	X
-XDC5.1 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XDC5.1 &EFS+/103.9	1	Double-level terminal block Push-in PTTB 2,5-PV	3210583	Phoenix Contact	501385	X
-XDC5.2 &EFS+/103.8	1	End cover D-PTTB 2,5	3211634	Phoenix Contact	500505	X
-XDC5.2 &EFS+/103.8	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XDC5.2 &EFS+/103.9	1	Double-level terminal block Push-in PTTB 2,5-PV	3210583	Phoenix Contact	501385	X
-XE &EFS+/84.0	1	End cover D-PT 6	3212044	Phoenix Contact	500503	X
-XE &EFS+/84.0	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-XE &EFS+/84.0;&EFS+/84.1	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XE &EFS+/84.0;&EFS+/84.1	3	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	X
-XE &EFS+/84.1;&EFS+/84.2	3	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	X
-XE &EFS+/84.1	1	Plug-in bridge FBS 3-8	3030297	Phoenix Contact	501568	X
-XE &EFS+/84.2;&EFS+/84.3	3	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	X
-XT &EFS+/183.0	1	End cover D-PTTB 2,5	3211634	Phoenix Contact	500505	X
-XT &EFS+/183.0	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-XT &EFS+/183.1;&EFS+/183.3;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2;&EFS+/187.4;&EFS+/187.5	8	Double-level terminal block Push-in PTTB 2,5	3210567	Phoenix Contact	501386	X
-XT &EFS+/183.1	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XT &EFS+/187.4	1	Plug-in bridge FBS 2-5	3030161	Phoenix Contact	505211	X
-XT &EFS+/183.1;&EFS+/183.4;&EFS+/185.1;&EFS+/185.7;&EFS+/187.1;&EFS+/187.2	6	Protective conductor double-level terminal block Push-in PTTB 2,5-PE	3210596	Phoenix Contact	501389	X
-XV &EFS+/171.8	1	End cover D-PT 2,5-MT	3211003	Phoenix Contact	503382	X
-XV &EFS+/171.8	1	Terminal strip marker carrier KLM 3	0811969	Phoenix Contact	501402	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Disconnect terminal block Push-in PT 2,5-TG	3210185	Phoenix Contact	500828	X
-XV &EFS+/134.5;&EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	9	Component connector P-CO	3036796	Phoenix Contact	500533	X
-XV &EFS+/150.7;&EFS+/151.7;&EFS+/151.8;&EFS+/171.8;&EFS+/173.9	8	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	X

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 11
Date								+ CTRL_1.3 Main mounting plate total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XV &EFS+/171.8	1	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	X
-XV &EFS+/134.5	1	Diode ZY12 - zener diode, DO-41, plastic, 12V, 2W	17060488	Distrelec Schuricht GmbH	500556	X

previous page:
11

next page:
+.4/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-85U1 &EFS+/85.0	1	Power Bridge Rectifiers SKD 30/16A1, Vrrm = 1600V, Id = 30A	07122150	Semikron	501556	X
-85U10 &EFS+/85.0	1	EMI Filter X2 Y1 Version 2	505722	Freqcon GmbH	505722	X
-149U1 &EFS+/149.5	1	Interface module UM 25-D25SUB/B/FRONT/Q	2959609	Phoenix Contact	501595	X
-160U1 &EFS+/160.0	1	HVIO Modul V5.0;ISO N-DC, N-AC	FRQ-M00029-1	Freqcon GmbH	500390	
-171F1 &EFS+/171.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-171F1 &EFS+/171.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-171K1 &EFS+/171.7	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171K2 &EFS+/171.8	1	DC contactor P115, 50A, 1500V DC, 1-pole, 24Vdc, SPST-NO	GIG/P115CDA	GIGAVAC	501487	X
-171R1 &EFS+/171.1	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-171R2 &EFS+/171.2	1	Power Resistor 15R 10%(K) 300W, alu.-housing, VHPR/UL 300H	110072	Widap AG	501616	X
-173F2 &EFS+/173.2	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F2 &EFS+/173.2	2	Fuse link 1000V AC/DC, 10A, 10x38mm, gR, 30kA	5019906-10	Schukat	501540	X
-173F3 &EFS+/173.4	1	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 2-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7023-4	Siemens	500780	X
-173F3 &EFS+/173.4	2	Fuse link 1000V AC/DC, 1A, 10x38mm, gR, 30kA	5019906.1	Schukat	500774	X
-173K1 &EFS+/173.8	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173K2 &EFS+/173.9	1	DC contactor PNC113, 30A, 1500V DC, 1-pole, 24Vdc, SPST-NC	GIG/PNC113CDA	GIGAVAC	501488	X
-173R1 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R2 &EFS+/173.2	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-173R3 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X

previous page:
+.3/12

next page:
2

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-173R4 &EFS+/173.3	1	Power resistor 500R 10%(K) 150W, alu.-housing, VHPR/UL 200H	110073	Widap AG	501615	X
-189X1 &EFS+/189.4	9	Test disconnect terminal block UTME 6	3047400	Phoenix Contact	501387	X
-189X1 &EFS+/189.4	9	Test adapter - PAIS-4-FIX GY	3032791	Phoenix Contact	501482	X
-189X1 &EFS+/189.4	1	End cover D-UTME 6	3047426	Phoenix Contact	504250	X
-189X1 &EFS+/189.4	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-306K1 &EFS+/306.a.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K1 &EFS+/306.a.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K2 &EFS+/306.a.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K2 &EFS+/306.a.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K3 &EFS+/306.a.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K3 &EFS+/306.a.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K4 &EFS+/306.a.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K4 &EFS+/306.a.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K5 &EFS+/306.a.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K5 &EFS+/306.a.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K6 &EFS+/306.a.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K6 &EFS+/306.a.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K7 &EFS+/306.b.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K7 &EFS+/306.b.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-306K8 &EFS+/306.b.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K8 &EFS+/306.b.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K11 &EFS+/306.b.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K11 &EFS+/306.b.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K12 &EFS+/306.b.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K12 &EFS+/306.b.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K13 &EFS+/306.c.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K13 &EFS+/306.c.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K14 &EFS+/306.c.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K14 &EFS+/306.c.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K15 &EFS+/306.c.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K15 &EFS+/306.c.4	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K16 &EFS+/306.c.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K16 &EFS+/306.c.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K17 &EFS+/306.c.7	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K17 &EFS+/306.c.7	2	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-306K18 &EFS+/306.c.8	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-306K18 &EFS+/306.c.8	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K1 &EFS+/350.1	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-350K1 &EFS+/350.1	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350K2 &EFS+/350.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-350K2 &EFS+/350.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-350X1.21 &EFS+/350.1	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	
-350X1.21 &EFS+/350.1	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	
-350X1.21 &EFS+/350.2;&EFS+/350.4;&EFS+/351.1;&EFS+/351.4;&EFS+/351.6;&EFS+/353.1;&EFS+/353.4;&EFS+/353.6	8	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	
-350X1.22 &EFS+/352.1	0					
-350X1.22 &EFS+/352.3	1	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	
-351K3 &EFS+/351.4	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K3 &EFS+/351.4	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-351K4 &EFS+/351.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-351K4 &EFS+/351.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-352K1 &EFS+/352.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K1 &EFS+/352.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-352K2 &EFS+/352.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-352K2 &EFS+/352.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K1 &EFS+/353.0	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K1 &EFS+/353.0	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K2 &EFS+/353.2	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-353K2 &EFS+/353.2	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K3 &EFS+/353.3	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K3 &EFS+/353.3	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-353K4 &EFS+/353.5	1	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726	
-353K4 &EFS+/353.5	1	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803	
-XE2 &EFS+/173.1	0					
-XE2 &EFS+/173.2...&EFS+/173.4	7	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	X
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Disconnect terminal block Push-in PT 2,5-TG	3210185	Phoenix Contact	500828	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Component connector P-CO	3036796	Phoenix Contact	500533	
-XV.20 &EFS+/350.7;&EFS+/351.7;&EFS+/351.8;&EFS+/352.7;&EFS+/353.7;&EFS+/353.8	12	Suppression diode CB-417, 600W, 47V, -65...+175°C	P6KE47CA	reichelt elektronik GmbH & Co. KG	501574	

previous page:
4

next page:
+.5/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-147B1 &EFS+/147.5	1	Temperature sensor PT100, cable 1.5m, PVC	1101-6030-1211-110	S+S Regeltechnik GmbH	501787	X
-190H1 &EFS+/190.5	1	LED system light, Without socket, Length: 337 mm, Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500110	Rittal	10007	X
-190H1 &EFS+/190.5	1	Infeed, 2-pole (with socket, without connector), Input voltage: 100 V - 240 V, 1~, 50 Hz/60 Hz	2500420	Rittal	10009	X
-190H1 &EFS+/190.5	1	Door-Operated Switch, Input voltage: 230 V AC, 24 V DC, - 240 V, 1~, 50 Hz/60 Hz,	2500460	Rittal	500736	X

previous page:
+.4/5

next page:
+CTRL_1/1

Editor	Freqcon_DG			Statron		PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	30.03.2023							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 1
Date								+ CTRL_1.5 above	total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-20BG1 &EFS+/100.2	1	*** VX BG Steuerungseinheit IEC VX-25 ohne SPS***	51610	Freqcon GmbH	51610	
-20BG1-X &EFS+/100.2	55	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X

previous page:
+.5/1

next page:
+CTRL_2.1/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	30.03.2023							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 1
Date								+ CTRL_1 Control cabinet 1	total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-161U1 &EFS+/161.0	1	HVIO Modul V2.0;101 : 1	FRQ-M00026	Freqcon GmbH	500386	
-162U1 &EFS+/163.0	1	HVIO Modul V2.0;101 : 1	FRQ-M00026	Freqcon GmbH	500386	
-163U1 &EFS+/164.0	1	HVIO Modul V2.0;101 : 1	FRQ-M00026	Freqcon GmbH	500386	
-240U1 &EFS+/440.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-240U1 &EFS+/440.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-240U1 &EFS+/440.1	1	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-241U1 &EFS+/441.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-241U1 &EFS+/441.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-241U1 &EFS+/441.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-242U1 &EFS+/442.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-242U1 &EFS+/442.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-242U1 &EFS+/442.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	
-243U1 &EFS+/443.1	1	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890	
-243U1 &EFS+/443.1	1	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805	
-243U1 &EFS+/443.1	2	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804	

Editor	Freqcon_DG			Statron		PARTS LIST	20230331_V0.01	= UNIT_01	Converter Container 1
Date	30.03.2023							& EPC	Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 1
Date								+ CTRL_2.1	Cabinet door total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-112A1 &EFS+/112.2	1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10		508271	

previous page:
+CTRL_2.1/1

next page:
++FAN+/1

Editor	Freqcon_DG			Statron		PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	30.03.2023							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 1
Date								+ CTRL.1	total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-52G1 &EFS++CT/181.0	0					
-52G1-148B1 &EFS++CT/148.1	1	Temperature sensor PT100, cable 3m, PVC	1101-6030-1231-110	S+S Regeltechnik GmbH	501575	X
-52G1-181M1 &EFS++CT/181.1	1	Pump CM10-2, 3x380V-415V, 50Hz, 1,27 kW, 2,85-2,9 A, 2.950 - 2.960 rpm / 440V-480V, 60Hz, 2,2 kW, 4,0-3,7A, 3.520-3.530 rpm	99080211	GRUNDFOS GmbH	501409	X
-52G1-181R1 &EFS++CT/181.3	1	Screw-in heater SEHK, 3kW, 400V	106066	Siekerkotte GmbH & Co. KG	500620	X
-52G1-181S1 &EFS++CT/181.6	1	Pressure switch, water, 0.8 bar, EWFE MAN Micromat EC	138251028	OEG OEL- und Gasfeuergesellschaft	500570	X
-52G1-181X1 &EFS++CT/181.0	0					
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.3;&EFS++CT/181.4;&EFS++CT/182.1	9	Feed-through terminal block Push-in PT 2,5	3209510	Phoenix Contact	500583	X
-52G1-181X1 &EFS++CT/181.3	1	End cover D-PT 2,5-MT	3211003	Phoenix Contact	503382	X
-52G1-181X1 &EFS++CT/181.3	1	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-52G1-181X1 &EFS++CT/181.4	1	Feed-through terminal block Push-in PT 2,5 BU	3209523	Phoenix Contact	500584	X
-52G1-181X1 &EFS++CT/181.1;&EFS++CT/181.4;&EFS++CT/182.1	3	Ground modular terminal block Push-in PT 2,5-PE	3209536	Phoenix Contact	500813	X
-52G1-181X3 &EFS++CT/181.6	0					
-52G1-181X3 &EFS++CT/148.1;&EFS++CT/181.6	2	Double-level terminal block Push-in PTTB 2,5	3210567	Phoenix Contact	501386	X
-52G1-181X3 &EFS++CT/181.6	1	End cover D-PTTB 2,5	3211634	Phoenix Contact	500505	X
-52G1-181X3 &EFS++CT/181.6	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	X
-52G1-181X3 &EFS++CT/181.6	1	Terminal strip marker carrier KLM 3-L	0814788	Phoenix Contact	500652	X
-52G1-182M1 &EFS++CT/182.1	1	Heat exchanger 40kW cooling capacity, alluminium, 1,72kW, 3,86A, 400V	FR6555950001	Bondioli & Pavesi S.p.A.	500850	X

Editor	Freqcon_DG			Statron		PARTS LIST	20230331_V0.01	= UNIT_01	Converter Container 1
Date	30.03.2023							& EPC	Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN	FAN page: 1
Date								+	total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-H1 &EFS/190.4	1	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282	
-U1 &EFS/190.2	1	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434	
-U1 &EFS/190.2	1	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756	
-U2 &EFS/190.2	1	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149	

previous page:
++FAN/1

next page:
&EPA++CONV/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_01 Converter Container 1
Date	30.03.2023							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container page: 1
Date								+ total: 423

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
9	*** BG connection rail 100x195 ***	50604	Freqcon GmbH	50604
3	*** VX BG PowerStack 3*250A***	52867	Freqcon GmbH	52867
3	*** VX BG PowerStack 1*1000A*** with SkiiP 2414 GB12E4-4DUW	52872	Freqcon GmbH	52872
3	*** VX BG DC switch and Fuse 3*250A 1000V***	52882	Freqcon GmbH	52882
1	*** VX BG AC Capacitor Bank 3 * 600µF ***	52918	Freqcon GmbH	52918
1	*** VX BG Circuit Breaker IEC 1000 A ***	52955	Freqcon GmbH	52955
3	*** VX Trible phase line Inductor, I= 3x 250A LN= 0,6mH ***	53046	Freqcon GmbH	53046
3	*** VX Single phase line Inductor, I= 1x 1000 A LN= 0,2mH ***	53053	Freqcon GmbH	53053
1	*** BG connection rail 100x370 ***	53190	Freqcon GmbH	53190
2	*** VX BG PE + N busbar 50x380 - 600 MTS ***	53290	Freqcon GmbH	53290
3	D SUB ADAPTER, PLUG-RECEPTACLE, 25-POL, L-COM DG9025MF1	506157	Freqcon GmbH	506157
3	SKiiP 3 I Adapter	FRQ-M00080-1	Freqcon GmbH	500426
3	EMI Suppresion CAP DC	FRQ-M00110	Freqcon GmbH	500449
1	Temperature sensor PT100, cable 3m Silicon	H2-012030-SDS	Fühler Direkt	500648
1	Temperature sensor PT100, cable 6m Silicon	H2-012060-SDS	Fühler Direkt	500649
3	Fuse link 690V AC, 100A, NH00, gL/gG, UL recognized, Bussmann	100NHG00B-690	Gemballa Electronics	501539
1	SURGE ARRESTER [Typ 1 + Typ 2] PP BC TNC 50-400/690	374504	LEUTRON GmbH	10055
9	Lightning/surge arrester type 1/2 2P 1500VDC	2905640	Phoenix Contact	501130

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	SITOR cylindrical fuse link, 10 x 38 mm, 20 A, aR, Un AC: 600 V, Un DC: 700 V, DC according to UL	3NC1020	Siemens	501545
1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738
3	CYLINDRICAL FUSE-HOLDER 10X38 1000V 25A 1-POLE FOR PHOTOVOLTAIC-APPLICATION	3NW7013-4	Siemens	500779

previous page: 1

next page: ++CT/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	*** VX BG Steuerungseinheit IEC VX-25 ohne SPS***	51610	Freqcon GmbH	51610
4	PIII IGBT IRT Interface 2.6 V4 cabinet	504890	Freqcon GmbH	504890
3	HVIO Modul V2.0;101 : 1	FRQ-M00026	Freqcon GmbH	500386
1	HVIO Modul V5.0;ISO N-DC, N-AC	FRQ-M00029-1	Freqcon GmbH	500390
1	Panel PC 15,6" PPC-JWS156-J4125	PPC-JWS156-I/C-J4125/8GB/128GBSSD/W10		508271
1	Tree 8TX Metall - Unmanaged Switch - 8 Ports	58152	Murrelektronik	10287
4	Connector screw connection, 4 Pol., 4 mm² - 6 mm², SACC-M12FS-4CON-PG7	1681114	Phoenix Contact	500805
2	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
2	Surge protection device DT-LAN-CAT.6+	2881007	Phoenix Contact	504791
26	Relay Module RIF-1-RPT-LDP-24DC/2X21AU	2903330	Phoenix Contact	500726
31	Plug-in bridge FBS 2-6 BU	3036932	Phoenix Contact	500803
2	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
3	Link module spring-type Electrical and mechanical for 3RV2011 and 3RT201	3RA2911-2AA00	Siemens	500845
2	MOTOR PROTECTION S00, A-release 3.5...5 A, N-release 65 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1FA25	Siemens	500740
1	MOTOR PROTECTION S00, A-release 4.5...6.3 A, N-release 82 A, Spring-type terminal, auxiliary switches 1NO+1NC	3RV2011-1GA25	Siemens	500671
3	Cable connector size S00 Spring-type terminal	3RV2917-5AA00	Siemens	500797
1	SIMOTION P320-4 BOX WITH INTEL CORE I3 PROZESSOR; 2 X 1,6 GHZ	6AU1320-4DE65-3AF0	Siemens	500789
5	ET 200SP, DI 16x 24V DC ST, PU 1	6ES7131-6BH01-0BA0	Siemens	500788

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	DQ 16X24V DC/0,5A ST	6ES7132-6BH01-0BA0	Siemens	504397
2	ET 200SP, AI 4XU/I 2-WIRE ST, PU 1	6ES7134-6HD01-0BA1	Siemens	505054
2	ET 200SP, AI 8XRTD/TC 2-WIRE HF	6ES7134-6JF00-0CA1	Siemens	501550
1	SIMATIC PN/PN Coupler	6ES7158-3AD10-0XA0	Siemens	10138
2	BA 2XRJ45	6ES7193-6AR00-0AA0	Siemens	505628
1	BASEUNIT TYPE A0, BU15-P16+A0+2B, bridged to the left	6ES7193-6BP00-0BA0	Siemens	500787
7	Plug connector IE FC M12 PLUG PRO 2X2 M12	6GK1901-0DB20-6AA0	Siemens	500804
1	eWON Cosy 131, 3G+VPN Router, Versorgung 24 VDC UMTS Router	WEC6133D	Wachendorff Prozesstechnik GmbH & Co. KG	501809

Summarized parts list

Freqcon_ABAS_de_en

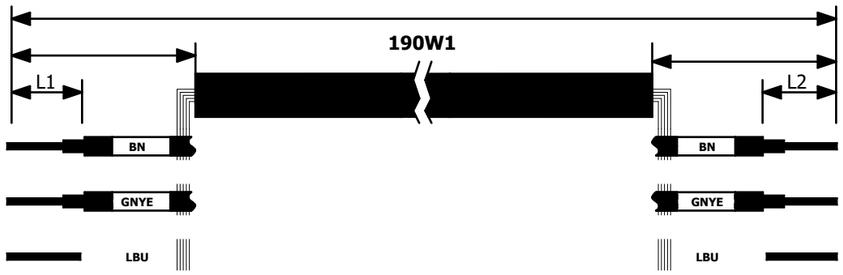
Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434
1	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149
1	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282
1	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756

previous page:
++CT/2

next page:
&EMB++/1

Cable name =UNIT_01+++-190W1
Cable type NYM-J 5x
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-190XT1:7	230V AC for Container light, socket		
Control cabinet 1	++CT+CTRL_1.3-190XT1:PE	=		
Control cabinet 1	++CT+CTRL_1.3-190XT1:8	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		230V AC for Container light, socket	++Container-U1	
		=	++Container-U1	
		=	++Container-U1	

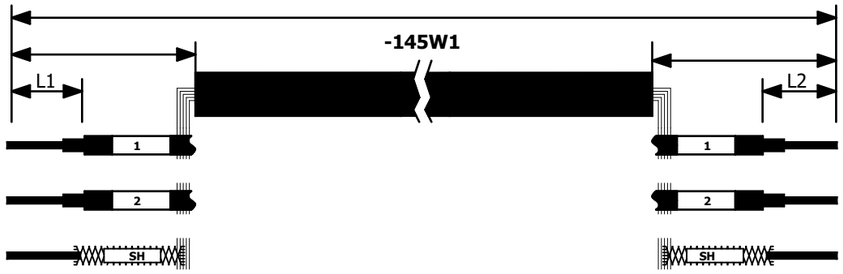
FRQ_kabelplan_04_gr0..de_en

previous page:
&EPA++Container/1

next page:
++CONV/1

Cable name =UNIT_01++CONV+-145W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

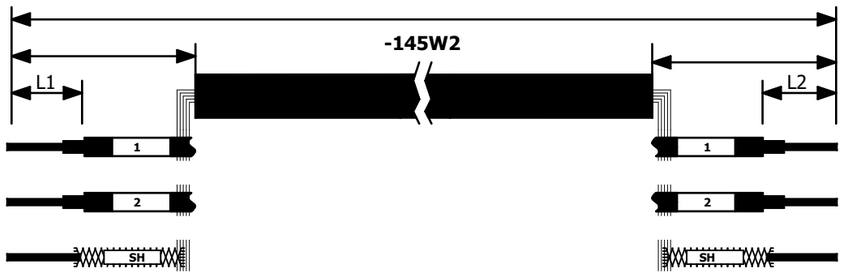


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-201L1:	INDUCTOR GRID PHASE L1 TEMPERATURE 1_1		
Inductor cabinet	+IND-201L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L1	++CT+CTRL_1.3-X5:1	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:2	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-145W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

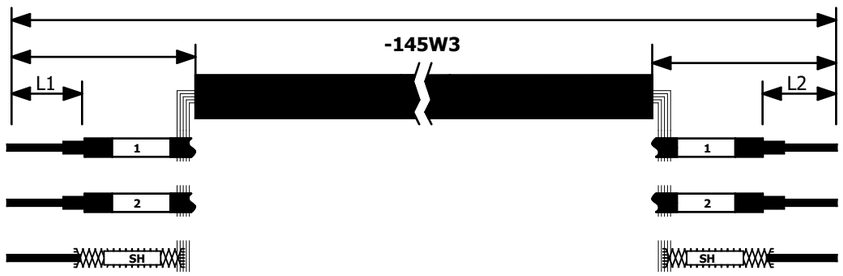


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-202L1:	INDUCTOR GRID PHASE L2 TEMPERATURE 1_2		
Inductor cabinet	+IND-202L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L2	++CT+CTRL_1.3-X5:3	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:4	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-145W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-203L1:	INDUCTOR GRID PHASE L3 TEMPERATURE 1_3		
Inductor cabinet	+IND-203L1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR GRID PHASE L3	++CT+CTRL_1.3-X5:5	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:6	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-211L1.1:	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1		
Inductor cabinet	+IND-211L1.1	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 2_1	++CT+CTRL_1.3-X5:7	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:8	***Control cabinet 1***

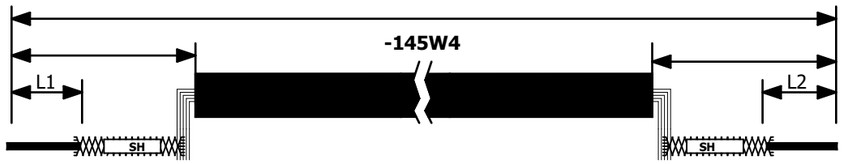
previous page:
++/1

next page:
2

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_01++CONV+-145W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

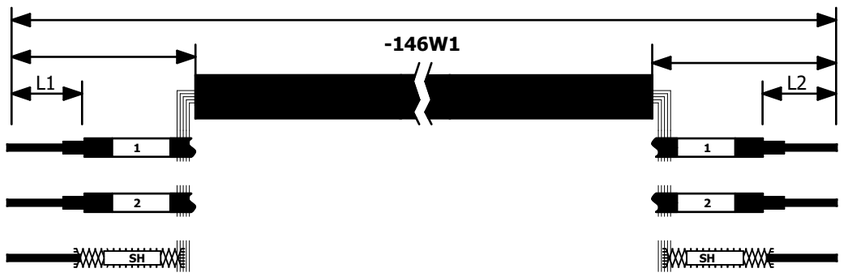
Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-SH	INDUCTOR DC SUB 2_1 TEMPERATURE 2_1					INDUCTOR DC SUB 2_1		

Cable name =UNIT_01++CONV+-146W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Inductor cabinet	+IND-211L1.2	INDUCTOR DC SUB 2_2 TEMPERATURE 2_2					INDUCTOR DC SUB 2_2	++CT+CTRL_1.3-X5:9	***Control cabinet 1***
Inductor cabinet	+IND-211L1.2	=					=	++CT+CTRL_1.3-X5:10	***Control cabinet 1***
	-SH	=					=		

Cable name =UNIT_01++CONV+-146W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Inductor cabinet	+IND-211L1.3	INDUCTOR DC SUB 2_3 TEMPERATURE 2_3					INDUCTOR DC SUB 2_3	++CT+CTRL_1.3-X5:11	***Control cabinet 1***
Inductor cabinet	+IND-211L1.3	=					=	++CT+CTRL_1.3-X5:12	***Control cabinet 1***
	-SH	=					=		

Cable name =UNIT_01++CONV+-146W3
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Inductor cabinet	+IND-207L1.1	INDUCTOR DC SUB 3_1 TEMPERATURE 3_1					INDUCTOR DC SUB 3_1	++CT+CTRL_1.3-X5:13	***Control cabinet 1***
Inductor cabinet	+IND-207L1.1	=					=	++CT+CTRL_1.3-X5:14	***Control cabinet 1***
	-SH	=					=		

previous page: 1
next page: 3

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CONV+-146W4
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

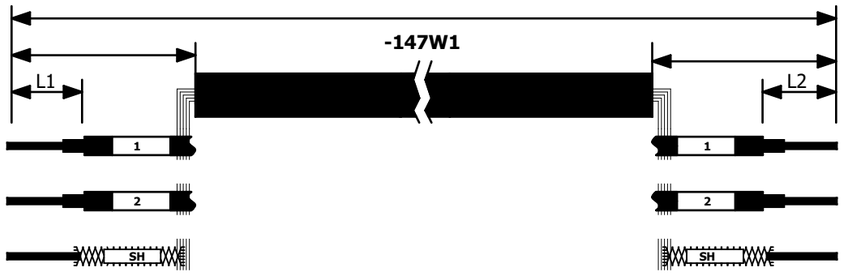


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.2	INDUCTOR DC SUB 3_2 TEMPERATURE 3_2		
Inductor cabinet	+IND-207L1.2	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_2	++CT+CTRL_1.3-X5:15	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:16	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-147W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

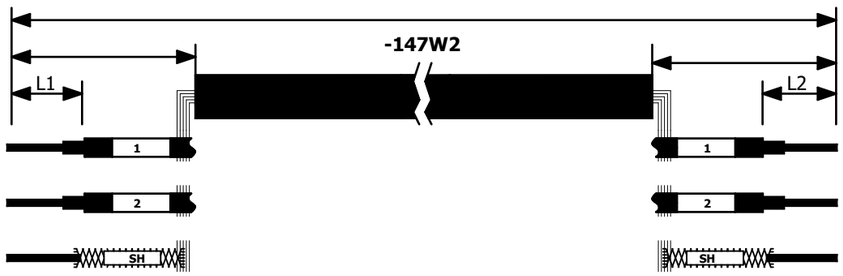


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-207L1.3:	INDUCTOR DC SUB 3_3 TEMPERATURE 3_3		
Inductor cabinet	+IND-207L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 3_3	++CT+CTRL_1.3-X5:17	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:18	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-147W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.1:	INDUCTOR DC SUB 4_1 TEMPERATURE 4_1		
Inductor cabinet	+IND-217L1.1	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_1	++CT+CTRL_1.3-X5:19	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:20	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.2:	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		
Inductor cabinet	+IND-217L1.2	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2	++CT+CTRL_1.3-X5:25	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:26	***Control cabinet 1***

previous page: 2
next page: 4

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CONV+-148W1
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-SH	INDUCTOR DC SUB 4_2 TEMPERATURE 4_2		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_2		

Cable name =UNIT_01++CONV+-148W2
Cable type F-CY-OZ (LiY-CY) 2x0,75 mm²
Free conductors

Cable parts HELU.16558
Order number 16558

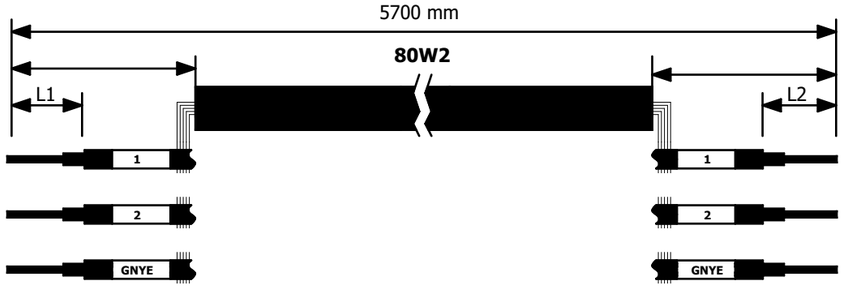


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Inductor cabinet	+IND-217L1.3:	INDUCTOR DC SUB 4_3 TEMPERATURE 4_3		
Inductor cabinet	+IND-217L1.3	=		
	-SH	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		INDUCTOR DC SUB 4_3	++CT+CTRL_1.3-X5:29	***Control cabinet 1***
		=	++CT+CTRL_1.3-X5:30	***Control cabinet 1***
		=		

Cable name =UNIT_01++CONV+-80W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

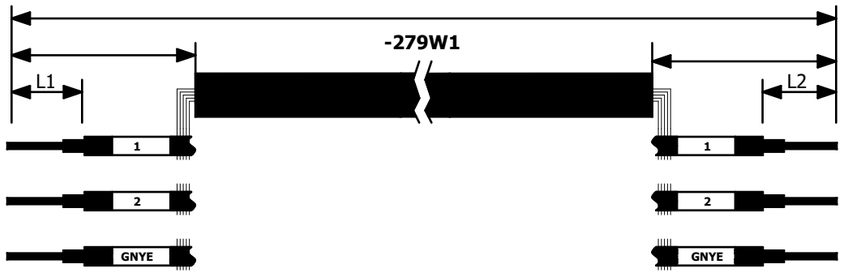


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:9	230V AC for Circuit Breaker 1	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:10	=	End splice	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	230V AC for Circuit Breaker 1	+CIR-80Q1:X5_2	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-80Q1:X5_1	***Circuit Breaker cabinet***
		=		

Cable name =UNIT_01++CONV+-279W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:1	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:2	=	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

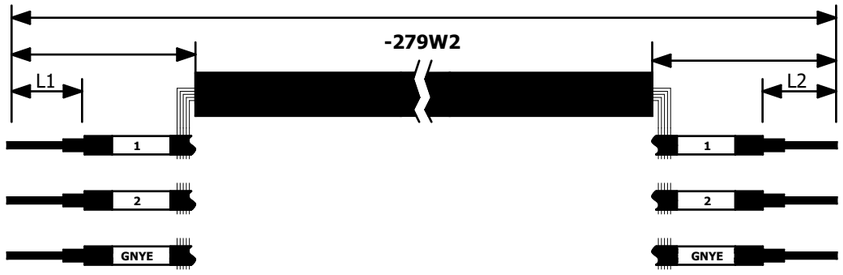
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CON-279M1:L	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:N	***Converter cabinet***
8 mm	stripped	=	+CON-279M1:PE	***Converter cabinet***

previous page: 3
next page: 5

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CONV+-279W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

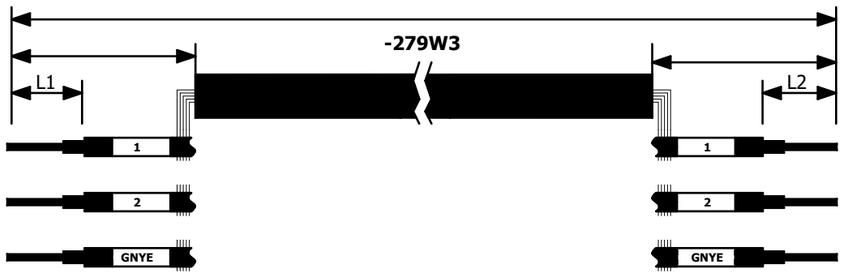


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M1:L	FAN 1 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M1:N	=	stripped	8 mm
Converter cabinet	+CON-279M1:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CONVERTER	+CON-279M2:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M2:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

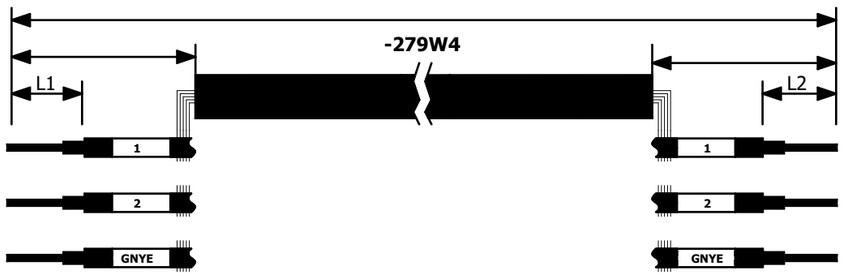


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M2:1	FAN 2 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M2:2	=	stripped	8 mm
Converter cabinet	+CON-279M2:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CONVERTER	+CON-279M3:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M3:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W4
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

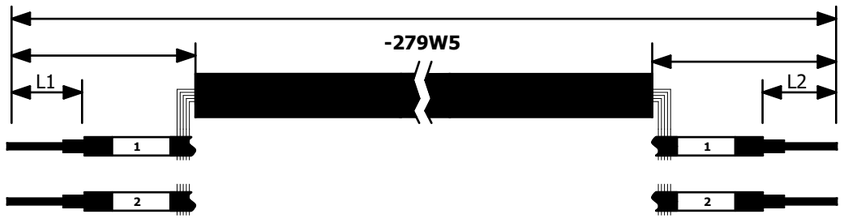


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M3:1	FAN 3 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M3:2	=	stripped	8 mm
Converter cabinet	+CON-279M3:PE	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 3 CONVERTER	+CON-279M4:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:2	***Converter cabinet***
8 mm	stripped	=	+CON-279M4:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:1	FAN 4 CONVERTER	stripped	8 mm
Converter cabinet	+CON-279M4:2	=	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:1	***Converter cabinet***
8 mm	stripped	=	+CON-279M5:2	***Converter cabinet***

previous page: 4
next page: 6

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CONV+-279W5
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	+CON-279M4:PE	FAN 4 CONVERTER	stripped	8 mm

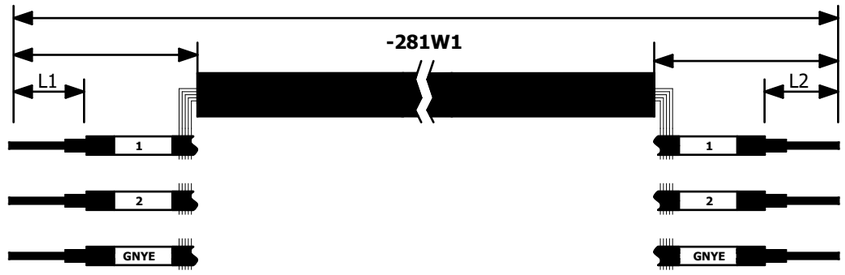


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 4 CONVERTER	+CON-279M5:PE	***Converter cabinet***

Cable name =UNIT_01++CONV+-281W1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-XT:3	CON Fans 1-5 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:4	CIR Fans 1-3 in door	stripped	8 mm
Control cabinet 1	++CT+CTRL_1.3-XT:PE	=	stripped	8 mm

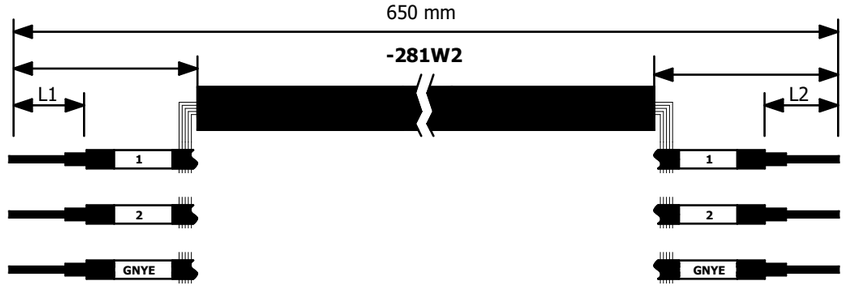


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	CON Fans 1-5	+CIR-281M1:L	***Circuit Breaker cabinet***
8 mm	stripped	CIR Fans 1-3	+CIR-281M1:N	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-281M1:PE	***Circuit Breaker cabinet***

Cable name =UNIT_01++CONV+-281W2
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M1:L	FAN 1 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M1:PE	=	stripped	8 mm



L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 1 CIRCUIT BREAKER CABINET	+CIR-281M2:L	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-281M2:N	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-281M2:PE	***Circuit Breaker cabinet***

Cable name =UNIT_01++CONV+-281W3
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-281M2:L	FAN 2 CIRCUIT BREAKER CABINET	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:N	=	stripped	8 mm
Circuit Breaker cabinet	+CIR-281M2:PE	=	stripped	8 mm



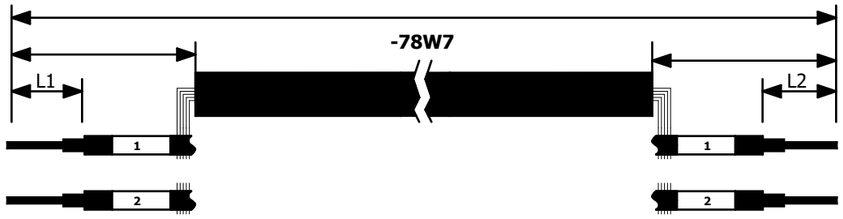
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	FAN 2 CIRCUIT BREAKER CABINET	+CIR-281M3:1	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-281M3:2	***Circuit Breaker cabinet***
8 mm	stripped	=	+CIR-281M3:PE	***Circuit Breaker cabinet***

previous page: 5
next page: 7

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CONV+-78W7
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

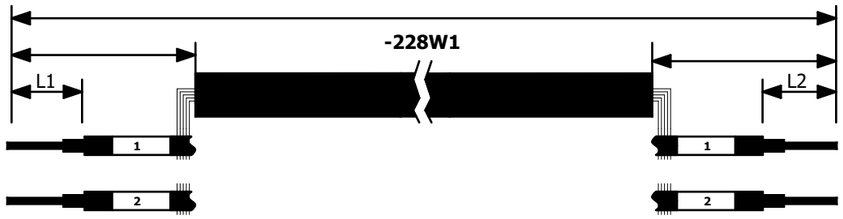


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:20			
AC and DC connection cabinet	+AC_DC-X3.43:19			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+AC_DC-78F1:13	***AC and DC connection cabinet***
			12	

Cable name =UNIT_01++CONV+-228W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030

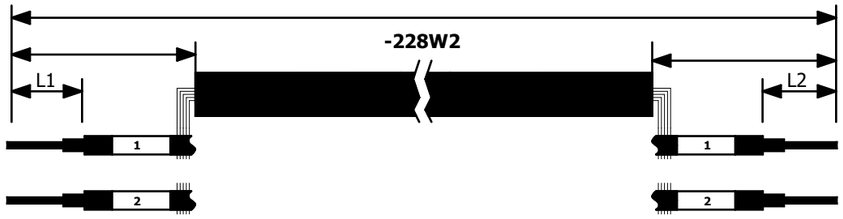


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:7	SURGE ARRESTER DC SUBSYSTEM 3_1		
AC and DC connection cabinet	+AC_DC-X3.43:8	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_1	+AC_DC-228F1:11	***AC and DC connection cabinet***
		=	+AC_DC-228F1:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-228W2
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:9	SURGE ARRESTER DC SUBSYSTEM 3_2		
AC and DC connection cabinet	+AC_DC-X3.43:10	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_2	+AC_DC-228F2:11	***AC and DC connection cabinet***
		=	+AC_DC-228F2:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-228W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:11	SURGE ARRESTER DC SUBSYSTEM 3_3		
AC and DC connection cabinet	+AC_DC-X3.43:12	=		

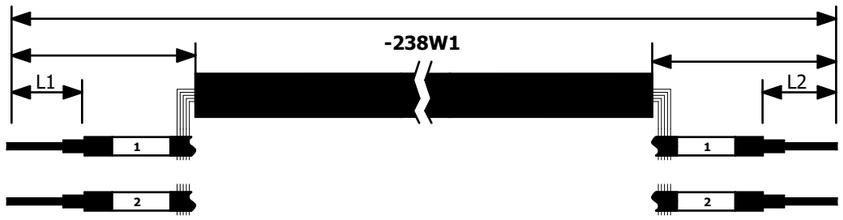
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 3_3	+AC_DC-228F3:11	***AC and DC connection cabinet***
		=	+AC_DC-228F3:12	***AC and DC connection cabinet***

previous page: 6
next page: 8

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CONV+-238W1
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1					SURGE ARRESTER DC SUBSYSTEM 2_1	+AC_DC-238F1:11	***AC and DC connection cabinet***
AC and DC connection cabinet	+AC_DC-X3.43:2	=					=	+AC_DC-238F1:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W2
Cable type OZ-500 2x0,75 mm²
Free conductors

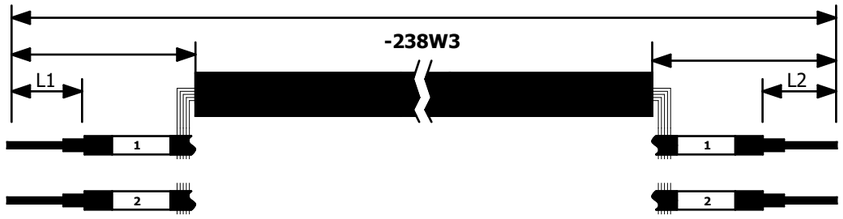
Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
AC and DC connection cabinet	+AC_DC-X3.43:3	SURGE ARRESTER DC SUBSYSTEM 2_2					SURGE ARRESTER DC SUBSYSTEM 2_2	+AC_DC-238F2:11	***AC and DC connection cabinet***
AC and DC connection cabinet	+AC_DC-X3.43:4	=					=	+AC_DC-238F2:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W3
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
AC and DC connection cabinet	+AC_DC-X3.43:5	SURGE ARRESTER DC SUBSYSTEM 2_3					SURGE ARRESTER DC SUBSYSTEM 2_3	+AC_DC-238F3:11	***AC and DC connection cabinet***
AC and DC connection cabinet	+AC_DC-X3.43:6	=					=	+AC_DC-238F3:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W4
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



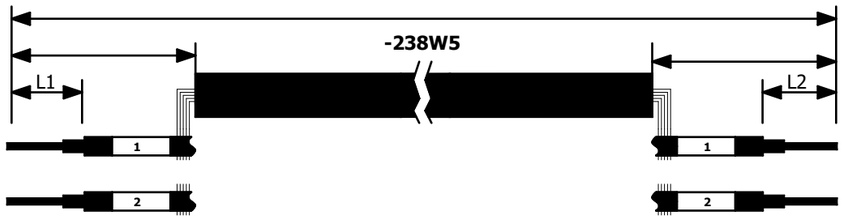
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
AC and DC connection cabinet	+AC_DC-X3.43:13	SURGE ARRESTER DC SUBSYSTEM 4_1					SURGE ARRESTER DC SUBSYSTEM 4_1	+AC_DC-238F4:11	***AC and DC connection cabinet***
AC and DC connection cabinet	+AC_DC-X3.43:14	=					=	+AC_DC-238F4:12	***AC and DC connection cabinet***

previous page: 7
next page: 9

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_01++CONV+-238W5
Cable type OZ-500 2x0,75 mm²
Free conductors 0

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:15	SURGE ARRESTER DC SUBSYSTEM 4_2		
AC and DC connection cabinet	+AC_DC-X3.43:16	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_2	+AC_DC-238F5:11	***AC and DC connection cabinet***
		=	+AC_DC-238F5:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W6
Cable type OZ-500 2x0,75 mm²
Free conductors 0

Cable parts HELU.10030
Order number 10030

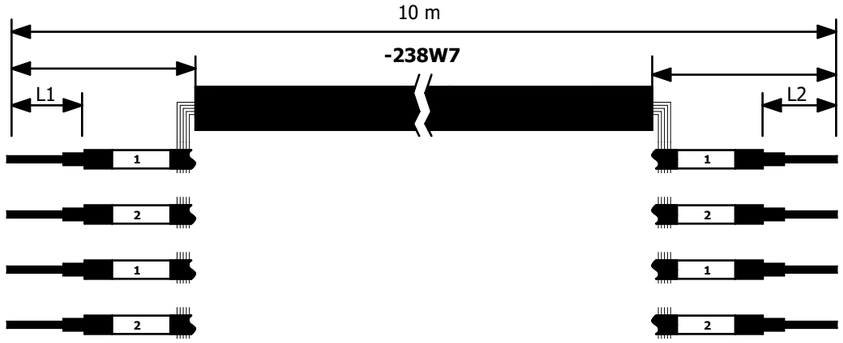


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:17	SURGE ARRESTER DC SUBSYSTEM 4_3		
AC and DC connection cabinet	+AC_DC-X3.43:18	=		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		SURGE ARRESTER DC SUBSYSTEM 4_3	+AC_DC-238F6:11	***AC and DC connection cabinet***
		=	+AC_DC-238F6:12	***AC and DC connection cabinet***

Cable name =UNIT_01++CONV+-238W7
Cable type OZ-500 2x0,75 mm²
Free conductors 2

Cable parts HELU.10030
Order number 10030;10030

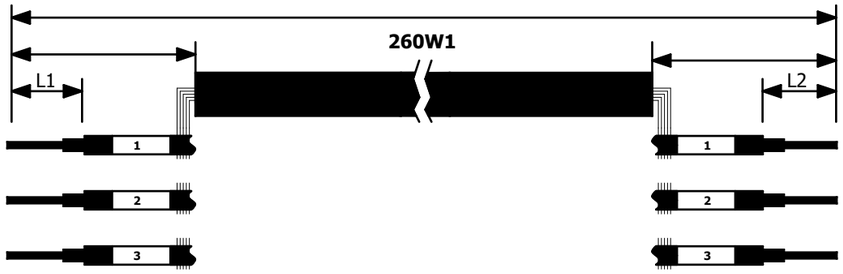


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-X3.43:1	SURGE ARRESTER DC SUBSYSTEM 2_1	stripped	7mm
AC and DC connection cabinet	+AC_DC-X3.43:20		stripped	7mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8mm	stripped	SURGE ARRESTER DC SUBSYSTEM 2_1	++CT+CTRL_1.3-X3:5	***Control cabinet 1***
8mm	stripped		++CT+CTRL_1.3-X3:6	***Control cabinet 1***

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors 0

Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	++CT+CTRL_1.3-X3:19	Smoke detector CON		
Control cabinet 1	++CT+CTRL_1.3-X3:20	=		
Control cabinet 1	++CT+CTRL_1.3-X3:21	=		

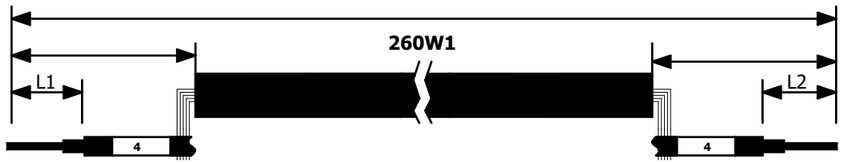
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Smoke detector CON	+CON-260B1:4	***Converter cabinet***
		=	+CON-260B1:2	***Converter cabinet***
		=	+CON-260B1:5	***Converter cabinet***

previous page: 8
next page: 10

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_01++CONV+-260W1
Cable type OZ-500 4x0,75 mm²
Free conductors

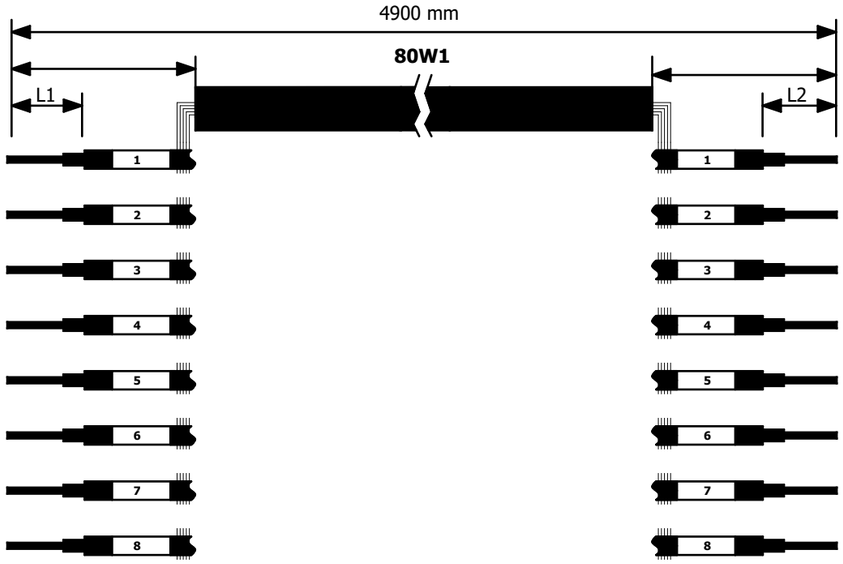
Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:22	Smoke detector CON					Smoke detector CON	+CON-260B1:6	***Converter cabinet***

Cable name =UNIT_01++CONV+-80W1
Cable type OZ-500 8x0,75 mm²
Free conductors

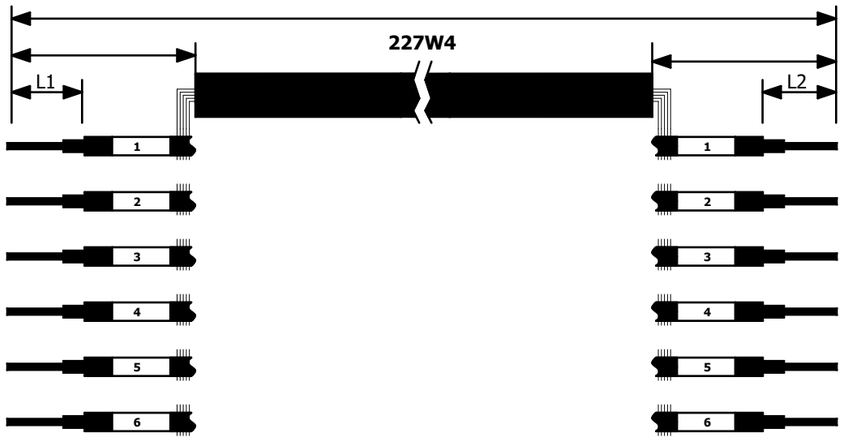
Cable parts HELU.10173
Order number 10173



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	++CT+CTRL_1.3-X3:1	CB 1 Tripped GRID	stripped	8 mm	8 mm	stripped	CB 1 Tripped GRID	+CIR-80Q1:X7_13	***Circuit Breaker cabinet***
Control cabinet 1	++CT+CTRL_1.3-X3:2	CB 1 OFF GRID	stripped	8 mm	8 mm	stripped	CB 1 OFF GRID	+CIR-80Q1:X6_9	***Circuit Breaker cabinet***
Control cabinet 1	++CT+CTRL_1.3-X3:3	CB 1 ON GRID	stripped	8 mm	8 mm	stripped	CB 1 ON GRID	+CIR-80Q1:X6_11	***Circuit Breaker cabinet***
Control cabinet 1	++CT+CTRL_1.3-X3:31	CB 1 GRID +24V	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_12	***Circuit Breaker cabinet***
Control cabinet 1	++CT+CTRL_1.3-X3:32	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_11	***Circuit Breaker cabinet***
Control cabinet 1	++CT+CTRL_1.3-X3:35	CB 2 ISLAND GRID +24V OPTIONAL	stripped	8 mm	8 mm	stripped	CB 2 ISLAND GRID	+CIR-80Q1:X6_7	***Circuit Breaker cabinet***
Control cabinet 1	++CT+CTRL_1.3-X3:36	CB 1 GRID	stripped	8 mm	8 mm	stripped	CB 1 GRID	+CIR-80Q1:X6_14	***Circuit Breaker cabinet***
Control cabinet 1	++CT+CTRL_1.3-X3:37	=	stripped	8 mm	8 mm	stripped	=	+CIR-80Q1:X5_12	***Circuit Breaker cabinet***

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



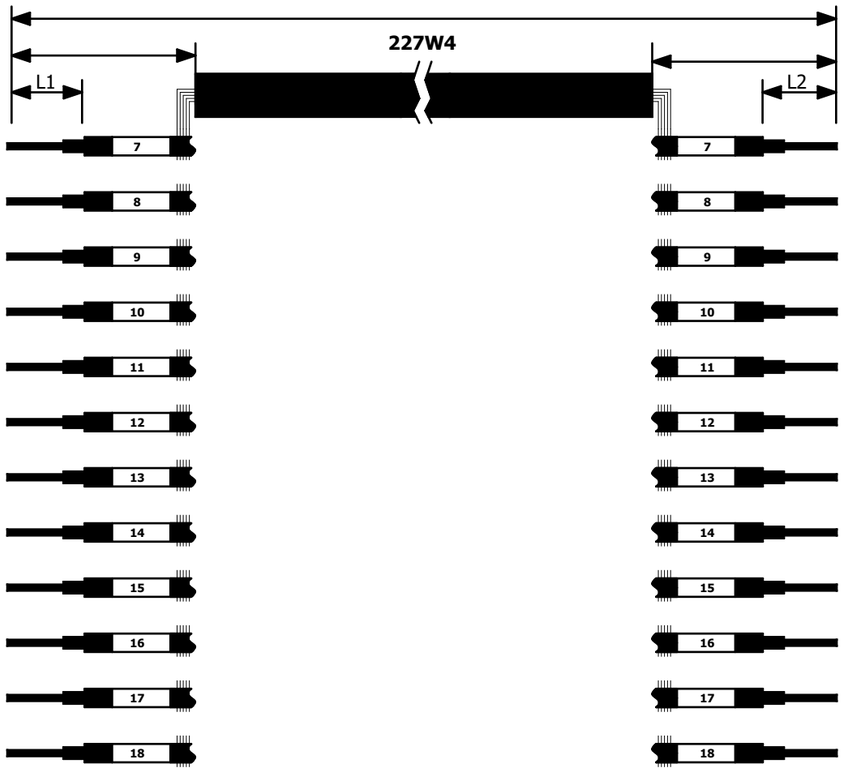
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:2		stripped	8 mm	8 mm	stripped			
Circuit Breaker cabinet	+CIR-227U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:7	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:3	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-227U1-X3.1:5		stripped	8 mm	8 mm	stripped			
Circuit Breaker cabinet	+CIR-227U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:9	***Control cabinet 1***

previous page: 9
next page: 11

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_01++CONV+-227W4
Cable type OZ-500 18x1 mm²
Free conductors

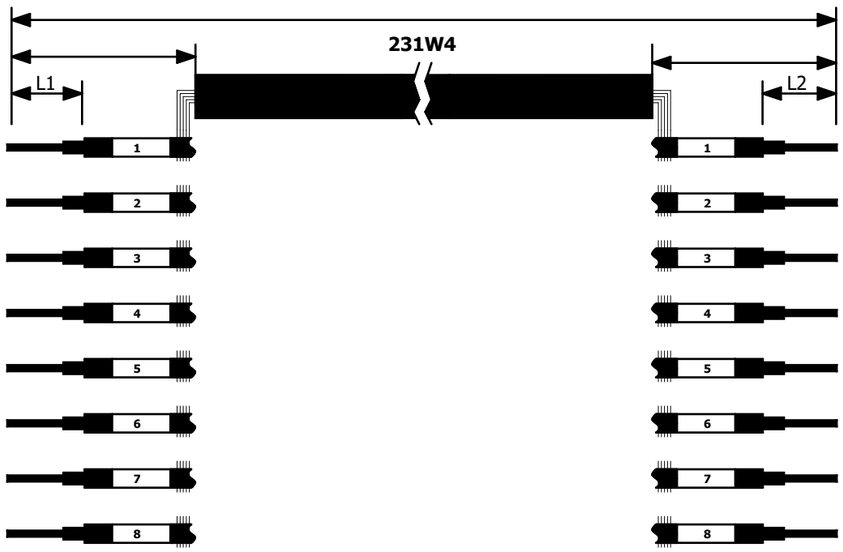
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K7:A1	Control cabinet 1
Circuit Breaker cabinet	+CIR-227U1-X3.1:8		stripped	8 mm	8 mm	stripped			
Circuit Breaker cabinet	+CIR-227U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K11:A1	Control cabinet 1
Circuit Breaker cabinet	+CIR-227U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K8:A1	Control cabinet 1
Circuit Breaker cabinet	+CIR-227U1-X3.1:11		stripped	8 mm	8 mm	stripped			
Circuit Breaker cabinet	+CIR-227U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K12:A1	Control cabinet 1
Circuit Breaker cabinet	+CIR-227U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:11	Control cabinet 1
Circuit Breaker cabinet	+CIR-227U1-X3.1:14		stripped	8 mm	8 mm	stripped			
Circuit Breaker cabinet	+CIR-227U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:9	Control cabinet 1
Circuit Breaker cabinet	+CIR-227U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:10	Control cabinet 1
Circuit Breaker cabinet	+CIR-227U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:2	Control cabinet 1
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:1	Control cabinet 1
Circuit Breaker cabinet	+CIR-231U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:4	Control cabinet 1
Circuit Breaker cabinet	+CIR-231U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:7	Control cabinet 1
Circuit Breaker cabinet	+CIR-231U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:3	Control cabinet 1
Circuit Breaker cabinet	+CIR-231U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:6	Control cabinet 1
Circuit Breaker cabinet	+CIR-231U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:9	Control cabinet 1
Circuit Breaker cabinet	+CIR-231U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K1:A1	Control cabinet 1
Circuit Breaker cabinet	+CIR-231U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K3:A1	Control cabinet 1

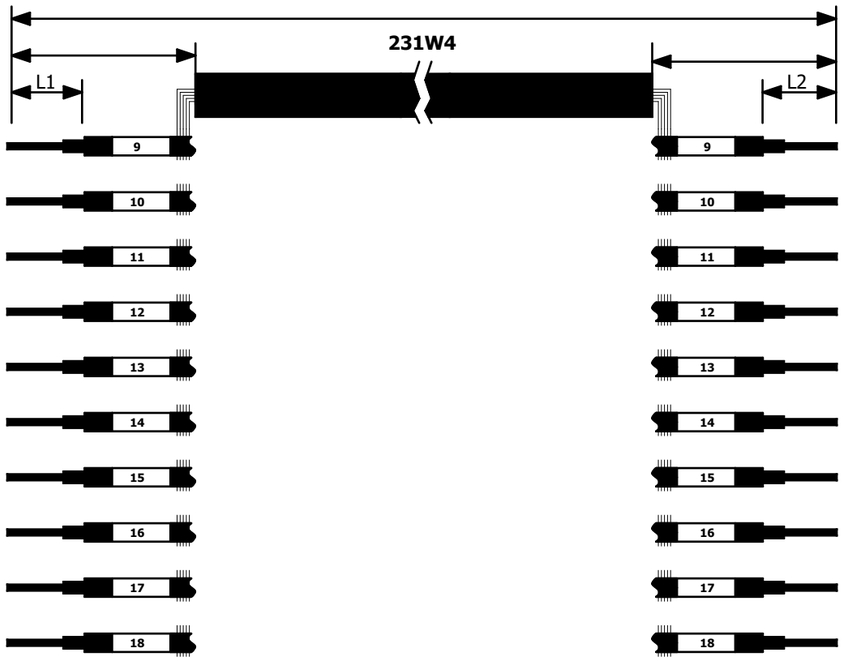
FRQ_kabelplan_04_gr0_de_en

previous page: 10
next page: 12

0	1	2	3	4	5	6	7	8	9

Cable name =UNIT_01++CONV+-231W4
Cable type OZ-500 18x1 mm²
Free conductors

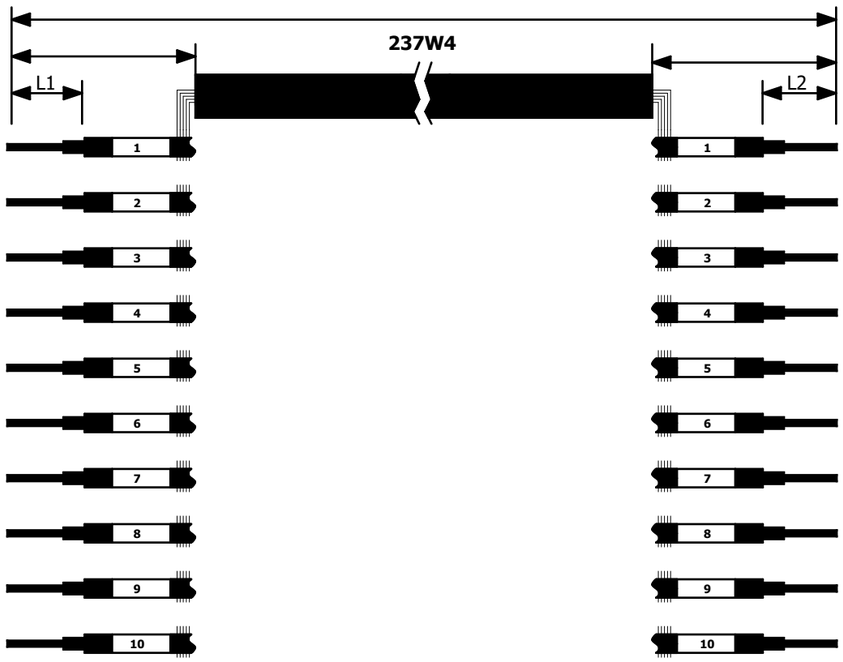
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-231U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K5:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K2:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K4:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K6:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.11:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.10:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-231U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-150X1:2	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

Cable parts HELU.10174
Order number 10174



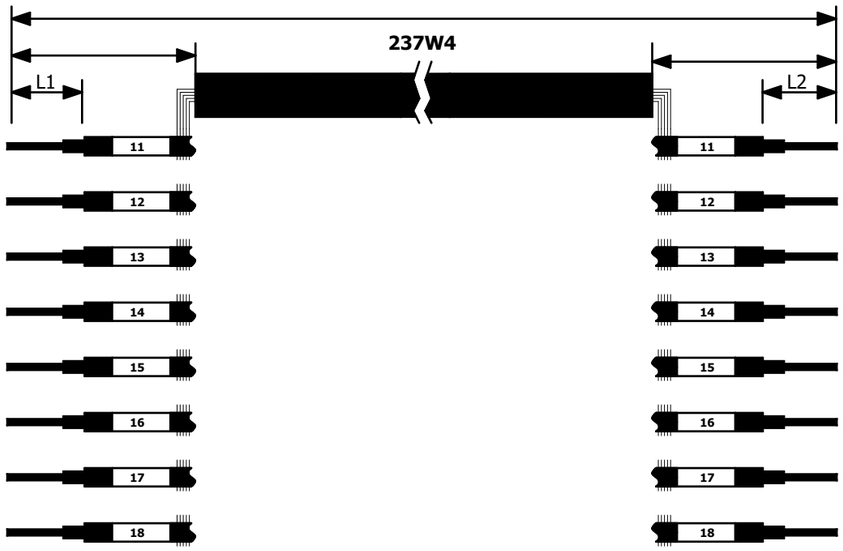
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-237U1-X3.1:1		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.22:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:2		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:4	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:3		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:7	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:4		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.22:13	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:5		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:6	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:6		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.21:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:7		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K13:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:8		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K15:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:9		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K17:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:10		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K14:A1	***Control cabinet 1***

FRQ_kabelplan_04_gr0..de_en

previous page: 11
next page: 13

Cable name =UNIT_01++CONV+-237W4
Cable type OZ-500 18x1 mm²
Free conductors

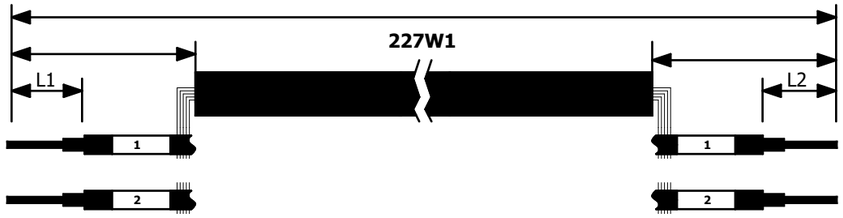
Cable parts HELU.10174
Order number 10174



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-237U1-X3.1:11		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K16:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:12		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-306K18:A1	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:13		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.12:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:14		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.13:9	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:15		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.13:11	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:16		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.3-X3.13:10	***Control cabinet 1***
Circuit Breaker cabinet	+CIR-237U1-X3.1:17		stripped	8 mm	8 mm	stripped		++CT+CTRL_1.4-350X1.22:12	***Control cabinet 1***
			stripped	8 mm	8 mm	stripped			

Cable name =UNIT_01++CONV+-227W1
Cable type OZ-600 2x0,75 mm²
Free conductors

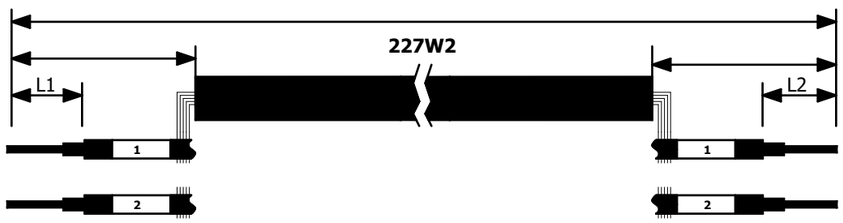
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-F3:1							++CT+CTRL_2.1-162U1:19	***Control cabinet 2***
Circuit Breaker cabinet	+CIR-227U1-F4:1							++CT+CTRL_2.1-162U1:23	***Control cabinet 2***

Cable name =UNIT_01++CONV+-227W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

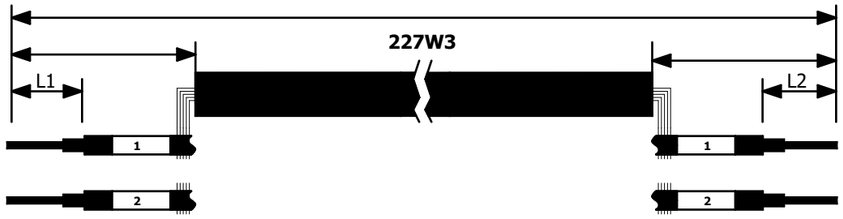


Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	+CIR-227U1-F7:1							++CT+CTRL_2.1-162U1:27	***Control cabinet 2***
Circuit Breaker cabinet	+CIR-227U1-F8:1							++CT+CTRL_2.1-162U1:32	***Control cabinet 2***

previous page: 12
next page: 14

Cable name =UNIT_01++CONV+-227W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

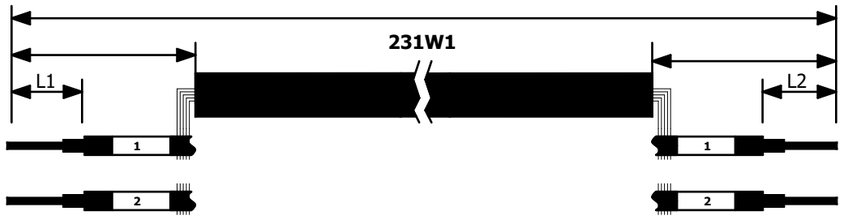


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-227U1-F11:1			
Circuit Breaker cabinet	+CIR-227U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-162U1:36	***Control cabinet 2***
			++CT+CTRL_2.1-162U1:40	***Control cabinet 2***

Cable name =UNIT_01++CONV+-231W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

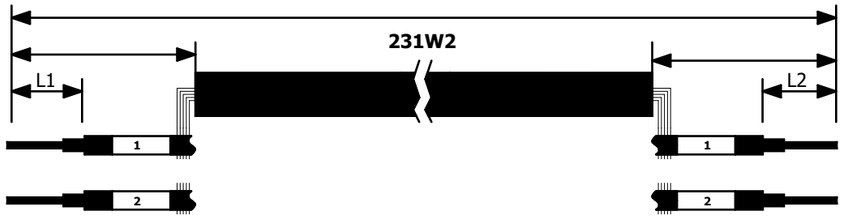


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F3:1			
Circuit Breaker cabinet	+CIR-231U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-161U1:19	***Control cabinet 2***
			++CT+CTRL_2.1-161U1:23	***Control cabinet 2***

Cable name =UNIT_01++CONV+-231W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

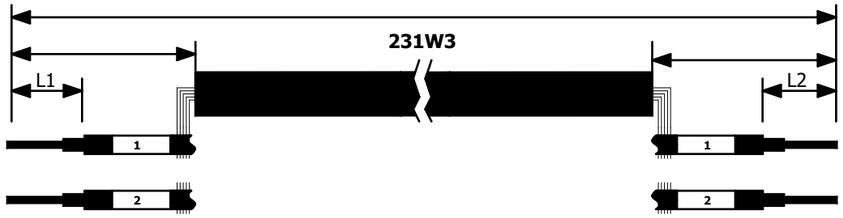


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F7:1			
Circuit Breaker cabinet	+CIR-231U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-161U1:27	***Control cabinet 2***
			++CT+CTRL_2.1-161U1:32	***Control cabinet 2***

Cable name =UNIT_01++CONV+-231W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-231U1-F11:1			
Circuit Breaker cabinet	+CIR-231U1-F12:1			

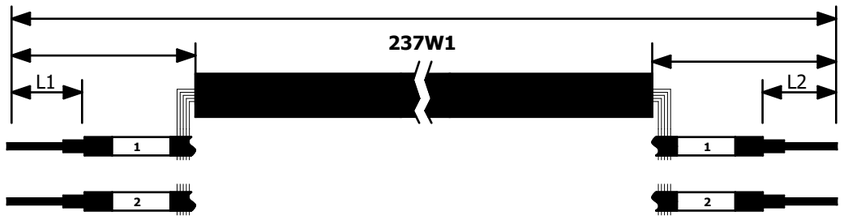
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-161U1:36	***Control cabinet 2***
			++CT+CTRL_2.1-161U1:40	***Control cabinet 2***

FRQ_kabelplan_04_gr0_de_en

previous page: 13
next page: 15

Cable name =UNIT_01++CONV+-237W1
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

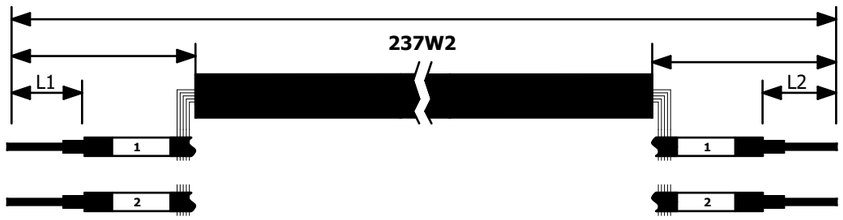


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F3:1			
Circuit Breaker cabinet	+CIR-237U1-F4:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:19	***Control cabinet 2***
			++CT+CTRL_2.1-163U1:23	***Control cabinet 2***

Cable name =UNIT_01++CONV+-237W2
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

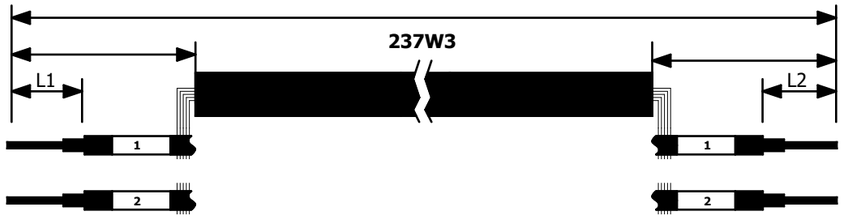


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F7:1			
Circuit Breaker cabinet	+CIR-237U1-F8:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:27	***Control cabinet 2***
			++CT+CTRL_2.1-163U1:32	***Control cabinet 2***

Cable name =UNIT_01++CONV+-237W3
Cable type OZ-600 2x0,75 mm²
Free conductors

Cable parts
Order number

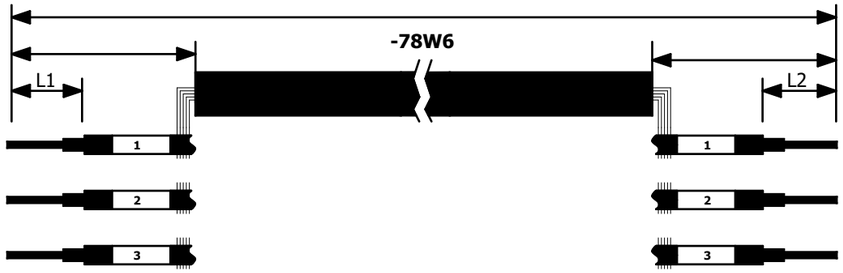


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	+CIR-237U1-F11:1			
Circuit Breaker cabinet	+CIR-237U1-F12:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_2.1-163U1:36	***Control cabinet 2***
			++CT+CTRL_2.1-163U1:40	***Control cabinet 2***

Cable name =UNIT_01++CONV+-78W6
Cable type OZ-600 3x2,5 mm²
Free conductors

Cable parts HELU.10691
Order number 10691



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
AC and DC connection cabinet	+AC_DC-78F3:2			
AC and DC connection cabinet	+AC_DC-78F3:4			
AC and DC connection cabinet	+AC_DC-78F3:6			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++CT+CTRL_1.4-85U1:L1	***Control cabinet 1***
			++CT+CTRL_1.4-85U1:L2	***Control cabinet 1***
			++CT+CTRL_1.4-85U1:L3	***Control cabinet 1***

previous page: 14
next page: 16

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CONV+-99W1
Cable type Solarflex 1x4 mm²
Free conductors

Cable parts
Order number



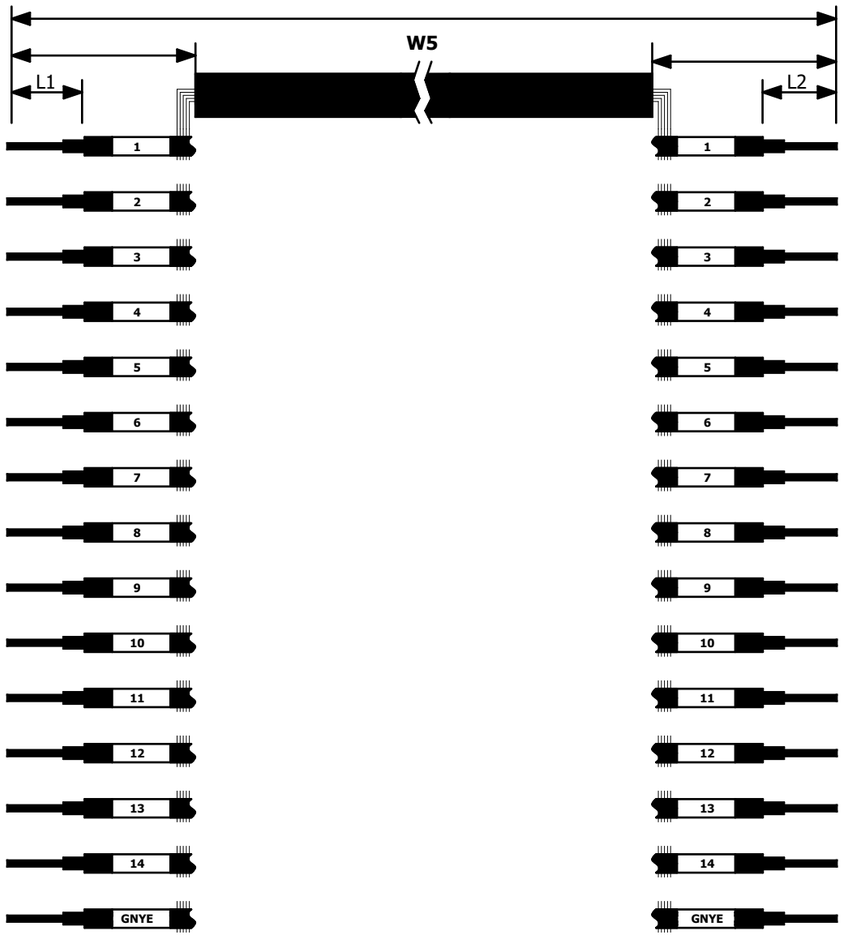
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	=UNIT_02++ASC-XN:1							+CON-N:N	***Converter cabinet***
	=UNIT_03++ASC-XN:1							+CON-N:N	***Converter cabinet***

FRQ_kabelplan_04_grid_de_en

previous page: 15
next page: +CIR/1

Cable name =UNIT_01++CONV+CIR-227U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

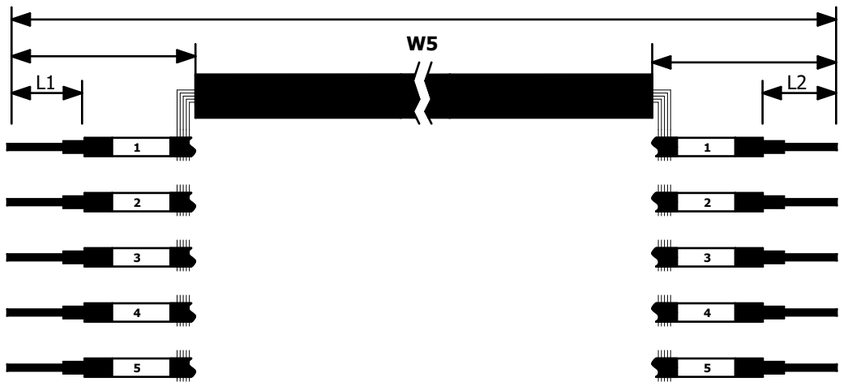
Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-227U1-X3.1:1							-227U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:2							-227U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:3							-227U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:4							-227U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:5							-227U1-X3.2:9	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:6							-227U1-X3.2:11	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:7							-227U1-X3.2:13	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:8							-227U1-X3.2:15	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:9							-227U1-X3.2:17	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:10							-227U1-X3.2:19	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:11							-227U1-X3.2:21	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:12							-227U1-X3.2:23	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:16							-227U1-X3.2:24	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:17							-227U1-X3.2:12	Circuit Breaker cabinet
Circuit Breaker cabinet	-227U1-X3.1:PE							-227U1-X3.2:PE	Circuit Breaker cabinet

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



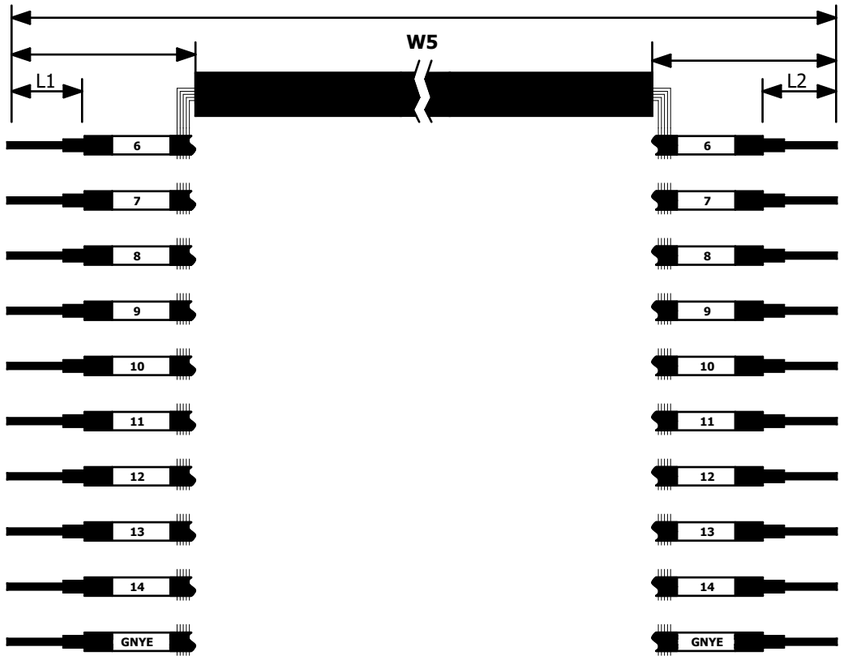
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-231U1-X3.1:1							-231U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:2							-231U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:3							-231U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:4							-231U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:5							-231U1-X3.2:9	Circuit Breaker cabinet

previous page: +/16
next page: 2

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CONV+CIR-231U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

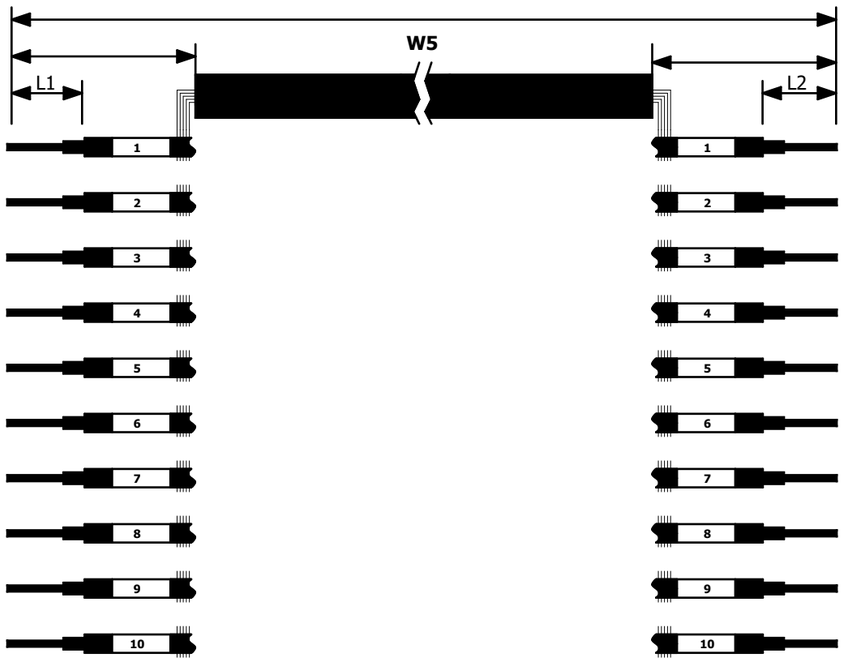
Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-231U1-X3.1:6							-231U1-X3.2:11	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:7							-231U1-X3.2:13	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:8							-231U1-X3.2:15	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:9							-231U1-X3.2:17	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:10							-231U1-X3.2:19	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:11							-231U1-X3.2:21	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:12							-231U1-X3.2:23	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:16							-231U1-X3.2:24	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:17							-231U1-X3.2:12	Circuit Breaker cabinet
Circuit Breaker cabinet	-231U1-X3.1:PE							-231U1-X3.2:PE	Circuit Breaker cabinet

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



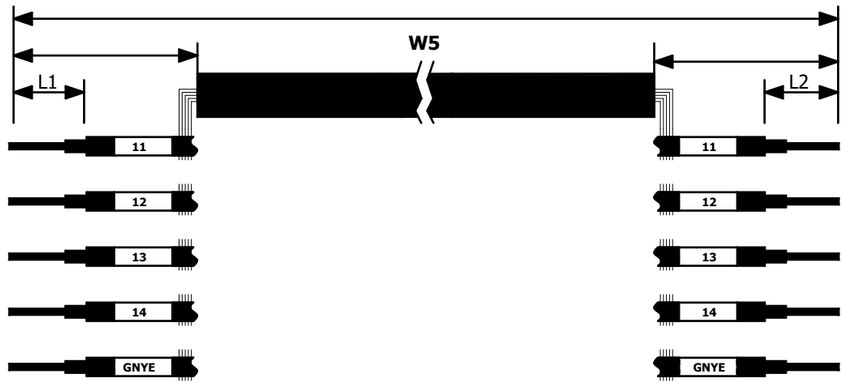
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Circuit Breaker cabinet	-237U1-X3.1:1							-237U1-X3.2:1	Circuit Breaker cabinet
Circuit Breaker cabinet	-237U1-X3.1:2							-237U1-X3.2:3	Circuit Breaker cabinet
Circuit Breaker cabinet	-237U1-X3.1:3							-237U1-X3.2:5	Circuit Breaker cabinet
Circuit Breaker cabinet	-237U1-X3.1:4							-237U1-X3.2:7	Circuit Breaker cabinet
Circuit Breaker cabinet	-237U1-X3.1:5							-237U1-X3.2:9	Circuit Breaker cabinet
Circuit Breaker cabinet	-237U1-X3.1:6							-237U1-X3.2:11	Circuit Breaker cabinet
Circuit Breaker cabinet	-237U1-X3.1:7							-237U1-X3.2:13	Circuit Breaker cabinet
Circuit Breaker cabinet	-237U1-X3.1:8							-237U1-X3.2:15	Circuit Breaker cabinet
Circuit Breaker cabinet	-237U1-X3.1:9							-237U1-X3.2:17	Circuit Breaker cabinet
Circuit Breaker cabinet	-237U1-X3.1:10							-237U1-X3.2:19	Circuit Breaker cabinet

FRQ_kabelplan_04_gr0..de_en

previous page: 1
next page: 3

Cable name =UNIT_01++CONV+CIR-237U1-W5
Cable type JZ-500 15G0,75 mm²
Free conductors

Cable parts HELU.10046
Order number 10046



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Circuit Breaker cabinet	-237U1-X3.1:11			
Circuit Breaker cabinet	-237U1-X3.1:12			
Circuit Breaker cabinet	-237U1-X3.1:16			
Circuit Breaker cabinet	-237U1-X3.1:17			
Circuit Breaker cabinet	-237U1-X3.1:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-237U1-X3.2:21	*Circuit Breaker cabinet*
			-237U1-X3.2:23	*Circuit Breaker cabinet*
			-237U1-X3.2:24	*Circuit Breaker cabinet*
			-237U1-X3.2:12	*Circuit Breaker cabinet*
			-237U1-X3.2:PE	*Circuit Breaker cabinet*

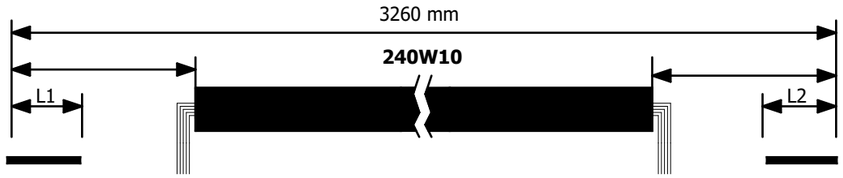
FRQ_kabelplan_04_gr0_de_en

previous page: 2
next page: ++CT+/1

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_01++CT+-240W10
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors

Cable parts
Order number

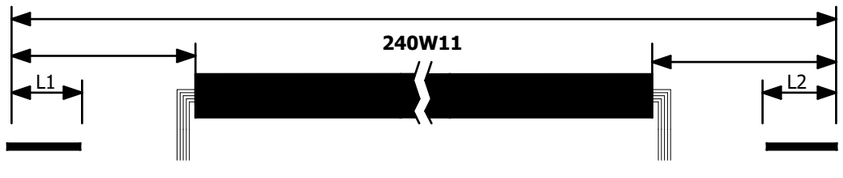


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:P1	***Control cabinet 2***

Cable name =UNIT_01++CT+-240W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors

Cable parts
Order number

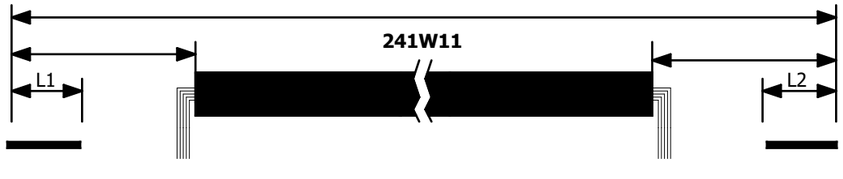


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-240U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:P1	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-241U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-242U1:P1	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W11
Cable type 2YY (ST) CY 2x2x0,64 mm²
Free conductors

Cable parts
Order number

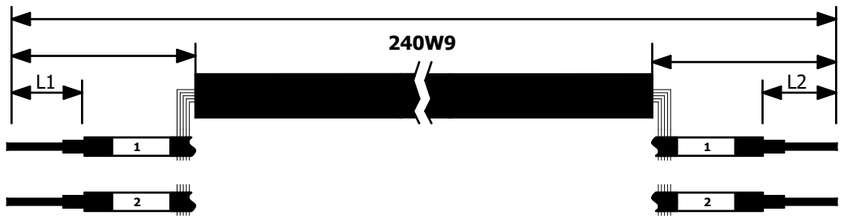


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-242U1:P2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-243U1:P1	***Control cabinet 2***

Cable name =UNIT_01++CT+-240W9
Cable type JZ-500 3G0,75 mm²
Free conductors

Cable parts HELU.10031
Order number 10031



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC1:1	FUSE 24V DC CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:4	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	FUSE 24V DC CONTROL VOLTAGE	+CTRL_2.1-240U1:1	***Control cabinet 2***
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-240U1:3	***Control cabinet 2***

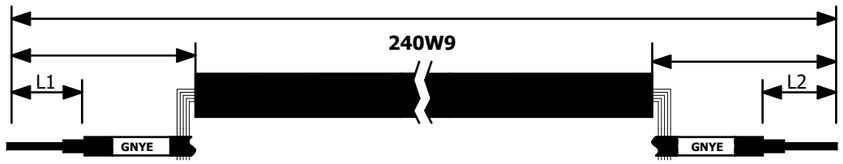
previous page:
++CONV+CIR/3

next page:
2

Cable name =UNIT_01++CT+-240W9
Cable type JZ-500 3G0,75 mm²
Free conductors

Cable parts HELU.10031
Order number 10031

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

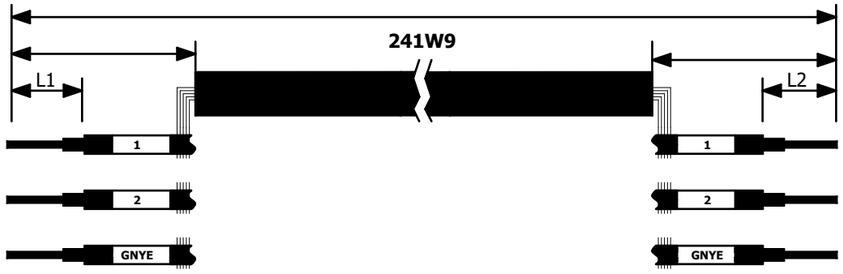


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-240U1:2	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W9
Cable type JZ-500 3G0,75 mm²
Free conductors

Cable parts HELU.10031
Order number 10031

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:4	=	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

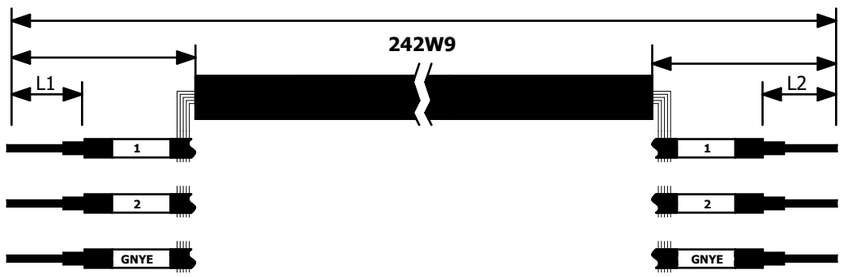


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-241U1:1	***Control cabinet 2***
	Connector	=	+CTRL_2.1-241U1:3	***Control cabinet 2***
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-241U1:2	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W9
Cable type JZ-500 3G0,75 mm²
Free conductors

Cable parts HELU.10031
Order number 10031

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm

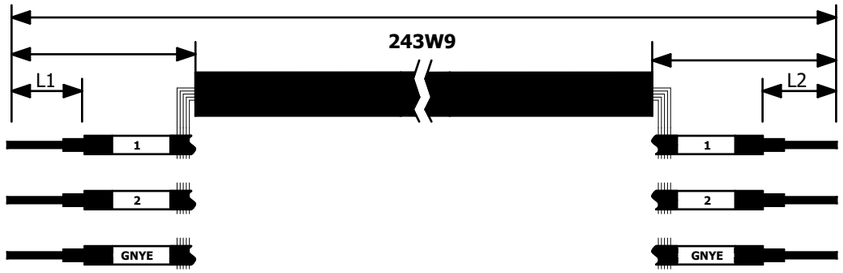


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:1	***Control cabinet 2***
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-242U1:3	***Control cabinet 2***
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-242U1:2	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W9
Cable type JZ-500 3G0,75 mm²
Free conductors

Cable parts HELU.10031
Order number 10031

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:1	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC2:3	BSU, SPARE CONTROL VOLTAGE	stripped	8 mm
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	stripped	8 mm



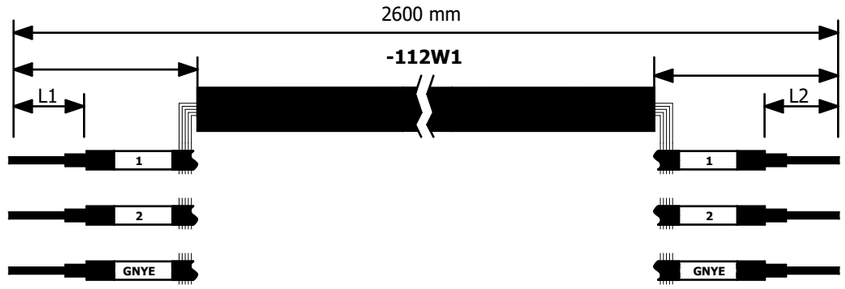
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:1	***Control cabinet 2***
	Connector	BSU, SPARE CONTROL VOLTAGE	+CTRL_2.1-243U1:3	***Control cabinet 2***
	Connector	Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL_2.1-243U1:2	***Control cabinet 2***

previous page: 1
next page: 3

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CT+-112W1
Cable type JZ-500 3G0,75 mm²
Free conductors 3

Cable parts HELU.10031
Order number 10031

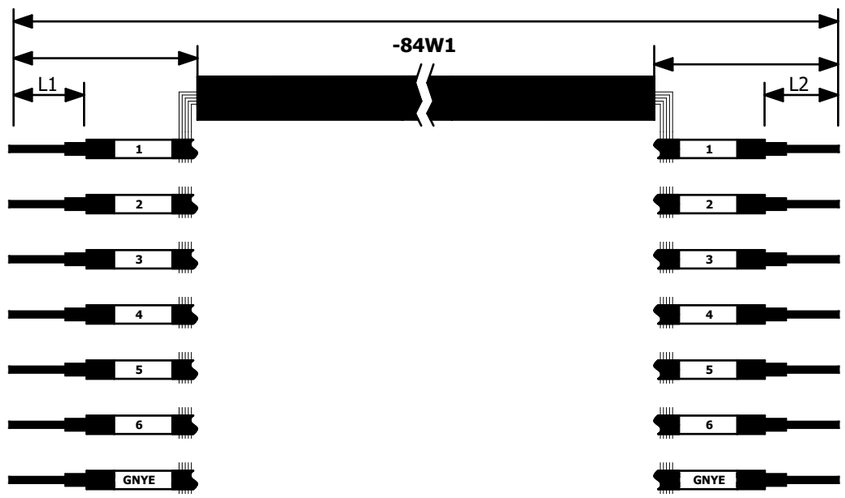


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-XDC2:2	BSU, SPARE CONTROL VOLTAGE		
Control cabinet 1	+CTRL_1.3-XDC2:4	=		
Control cabinet 1	+CTRL_1.3-XDC1:PE	Main PLC, SPS, 24V contacts CONTROL VOLTAGE		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		BSU, SPARE CONTROL VOLTAGE	+CTRL.1-112A1:L+	
		=	+CTRL.1-112A1:M	
		Main PLC, SPS, 24V contacts CONTROL VOLTAGE	+CTRL.1-112A1:PE	

Cable name =UNIT_01++CT+-84W1
Cable type JZ-500 7G6 mm²
Free conductors 7

Cable parts HELU.10150
Order number 10150

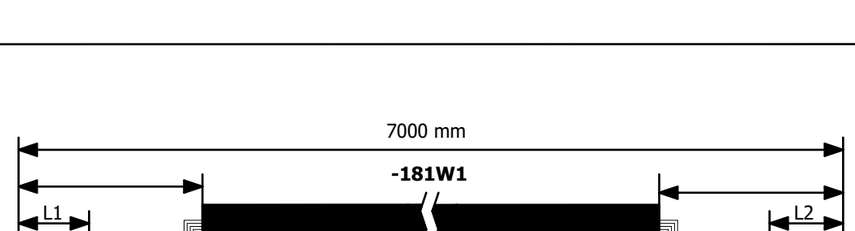


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.1-84Q1:2		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:4		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:6		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:1		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:3		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1:5		stripped	8 mm
Control cabinet 1	+CTRL_1.1-84Q1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	End splice		+CTRL_1.3-84F2:1	***Control cabinet 1***
8 mm	End splice		+CTRL_1.3-84F2:3	***Control cabinet 1***
8 mm	End splice		+CTRL_1.3-84F2:5	***Control cabinet 1***
8 mm	End splice		+CTRL_1.3-183F1:1	***Control cabinet 1***
8 mm	End splice		+CTRL_1.3-183F2:1	***Control cabinet 1***
8 mm	End splice		+CTRL_1.3-185F1:1	***Control cabinet 1***
			+CTRL_1.3-XE:PE:1	***Control cabinet 1***

Cable name =UNIT_01++CT+-181W1
Cable type JZ-600 12G1,5 mm²
Free conductors 5

Cable parts HELU.10670
Order number 10670



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-X1:1	PUMP	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X1:2	=	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X1:3	=	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X1:4	FUSE FOR PUMP	stripped	8 mm
Control cabinet 1	+CTRL_1.3-X1:5	HEATER	stripped	8 mm

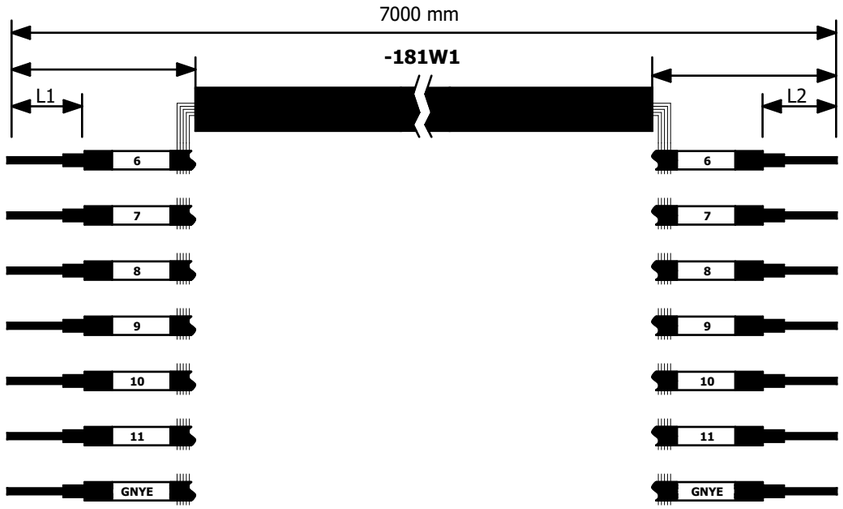
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
8 mm	stripped	PUMP	++FAN-52G1-181X1:1:1	
8 mm	stripped	=	++FAN-52G1-181X1:2:1	
8 mm	stripped	=	++FAN-52G1-181X1:3:1	
8 mm	stripped	FUSE FOR PUMP	++FAN-52G1-181X1:4:1	
8 mm	stripped	HEATER	++FAN-52G1-181X1:5:1	

previous page: 2
next page: 4

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CT+-181W1
Cable type JZ-600 12G1,5 mm²
Free conductors 1

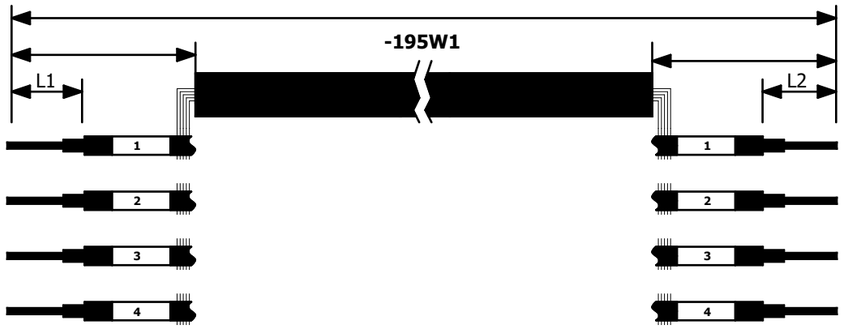
Cable parts HELU.10670
Order number 10670



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.3-X1:6	HEATER	stripped	8 mm	8 mm	stripped	HEATER	++FAN-52G1-181X1:6:1	
Control cabinet 1	+CTRL_1.3-X1:7	=	stripped	8 mm	8 mm	stripped	=	++FAN-52G1-181X1:7:1	
Control cabinet 1	+CTRL_1.3-X1:8	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	++FAN-52G1-181X1:8:1	
Control cabinet 1	+CTRL_1.3-X1:9	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:9:1	
Control cabinet 1	+CTRL_1.3-X1:10	=	stripped	8 mm	8 mm	End splice	=	++FAN-52G1-181X1:10:1	
Control cabinet 1	+CTRL_1.3-X1:PE	PUMP	stripped	8 mm	8 mm	stripped	PUMP	++FAN-52G1-181X1:PE:1	

Cable name =UNIT_01++CT+-195W1
Cable type OZ-500 4x0,75 mm²
Free conductors 8

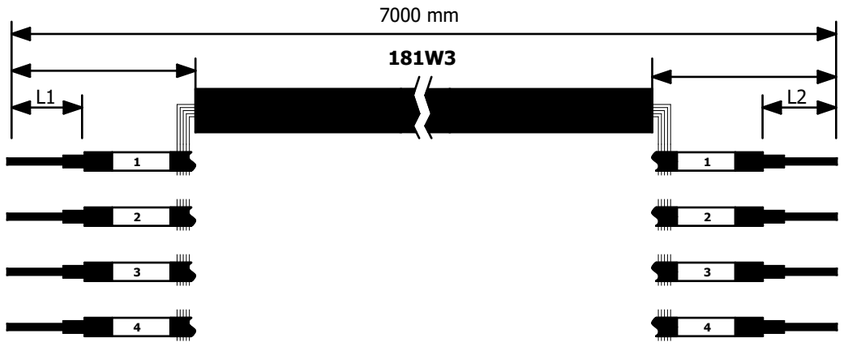
Cable parts HELU.10034
Order number 10034



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.1-84Q1:13	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS					SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-195K3:T1	***Control cabinet 1***
Control cabinet 1	+CTRL_1.1-84Q1:23							+CTRL_1.3-195K3:T2	***Control cabinet 1***
Control cabinet 1	+CTRL_1.1-84Q1:14	SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS					SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS	+CTRL_1.3-X3:41	***Control cabinet 1***
Control cabinet 1	+CTRL_1.1-84Q1:24							+CTRL_1.3-X3:43	***Control cabinet 1***

Cable name =UNIT_01++CT+-181W3
Cable type OZ-600 4x0,75 mm²
Free conductors 8

Cable parts HELU.10586
Order number 10586



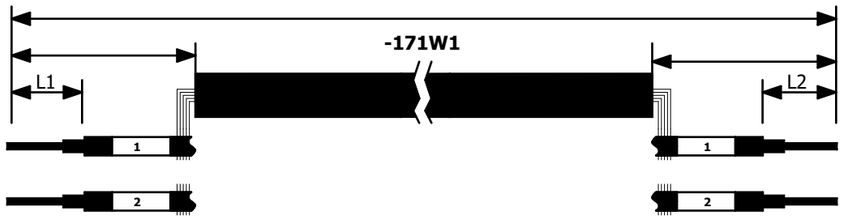
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Control cabinet 1	+CTRL_1.3-X3:23	PRESSURE SWITCH	End splice	8 mm	8 mm	stripped	PRESSURE SWITCH	++FAN-52G1-181X3:1:1	
Control cabinet 1	+CTRL_1.3-X3:24	=	End splice	8 mm	8 mm	stripped	=	++FAN-52G1-181X3:2:2	
Control cabinet 1	+CTRL_1.3-X5:23	COOLING WATER TEMPERATURE	End splice	8 mm	8 mm	stripped	COOLING WATER TEMPERATURE	++FAN-52G1-181X3:3:4	
Control cabinet 1	+CTRL_1.3-X5:24	=	End splice	8 mm	8 mm	stripped	=	++FAN-52G1-181X3:4:3	

previous page: 3
next page: 5

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_01++CT+-171W1
Cable type OZ-600 2x1,5 mm²
Free conductors 0

Cable parts HELU.10656
Order number 10656

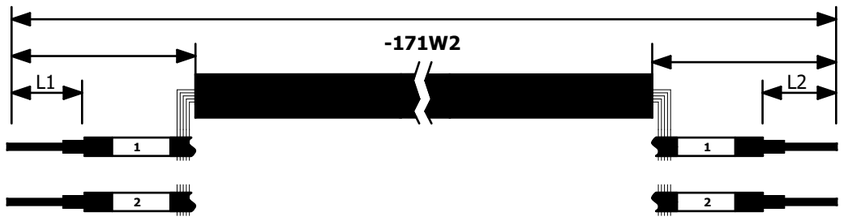


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:1			
Control cabinet 1	+CTRL_1.4-171F1:3			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-85U1:DC+	***Control cabinet 1***
			+CTRL_1.4-85U1:DC-	***Control cabinet 1***

Cable name =UNIT_01++CT+-171W2
Cable type OZ-600 2x1,5 mm²
Free conductors 0

Cable parts HELU.10656
Order number 10656

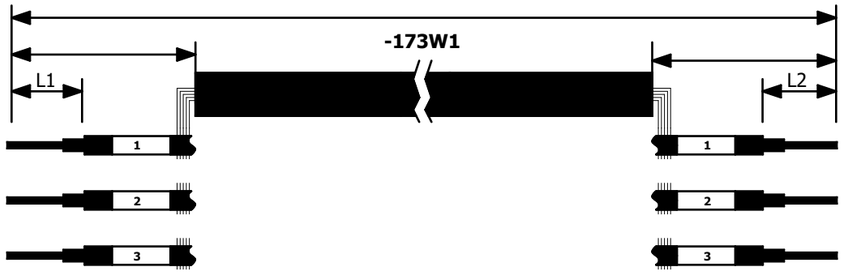


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-171F1:2			
Control cabinet 1	+CTRL_1.4-171F1:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-171K1:A1	***Control cabinet 1***
			+CTRL_1.4-171K2:A1	***Control cabinet 1***

Cable name =UNIT_01++CT+-173W1
Cable type OZ-600 3x2,5 mm²
Free conductors 1

Cable parts HELU.10691
Order number 10691



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet DC	++CONV+CON_DC-UDC+			
Converter cabinet DC	++CONV+CON_DC-UDC-			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.4-173F2:2	***Control cabinet 1***
			+CTRL_1.4-173F2:4	***Control cabinet 1***

Cable name =UNIT_01++CT+-113W2
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors 0

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T1:7			

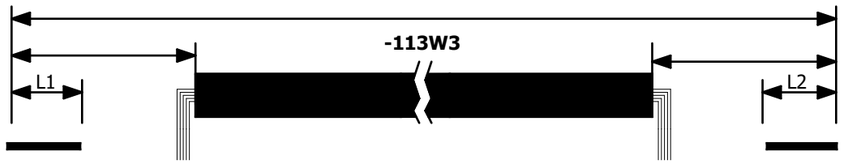
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U1:OUT	***Control cabinet 1***

previous page: 4
next page: 6

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++CT+-113W3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

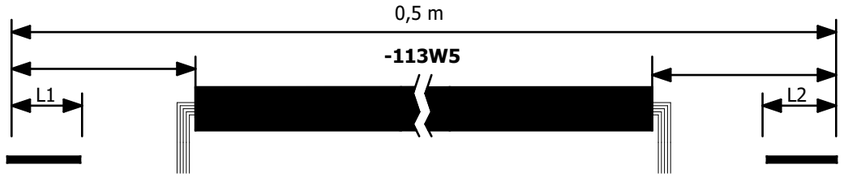


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U1:IN			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			=UNIT_02++ASC-613U1:IN	

Cable name =UNIT_01++CT+-113W5
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113T2:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			+CTRL_1.3-113U2:OUT	***Control cabinet 1***

Cable name =UNIT_01++CT+-113W6
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

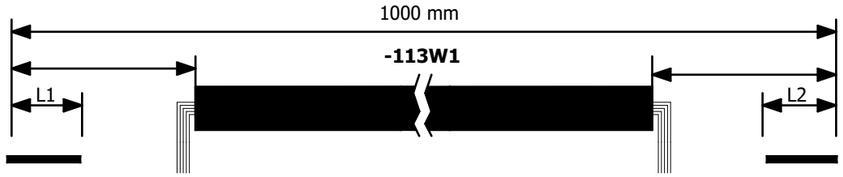


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-113U2:IN			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			=UNIT_03++ASC-613U1:IN	

Cable name =UNIT_01++CT+-113W1
Cable type RJ45 / CAT 6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

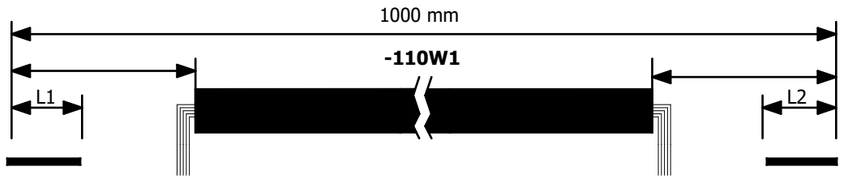


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X4:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-113T1:15	***Control cabinet 1***

Cable name =UNIT_01++CT+-110W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P1		RJ45 connector	

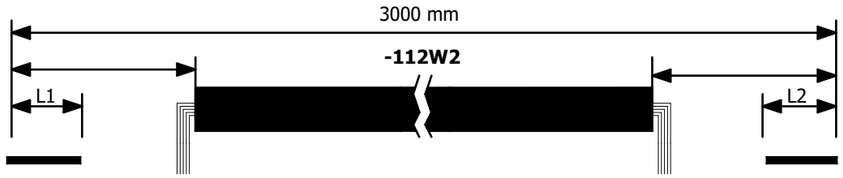
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-111A1:X1:1-8	***Control cabinet 1***

previous page: 5
next page: 7

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_01++CT+-112W2
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

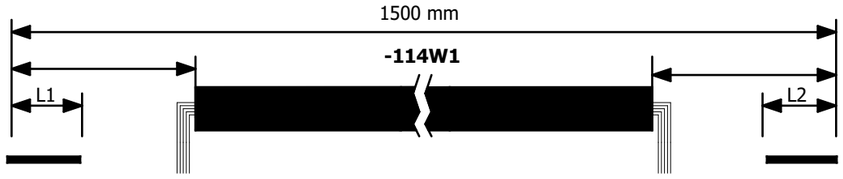


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.3-111A1:X2:1-8		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL.1-112A1	

Cable name =UNIT_01++CT+-114W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

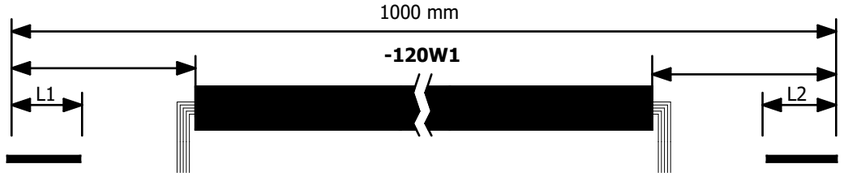


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-114A1		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-120A1:-X1:P2	***Control cabinet 1***

Cable name =UNIT_01++CT+-120W1
Cable type RJ45 / CAT6 4x2x0,25 mm²
Free conductors

Cable parts
Order number

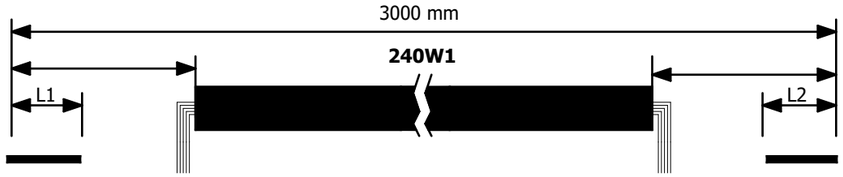


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.2-110U1:P3		RJ45 connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		+CTRL_1.3-120A1:-X1:P1	***Control cabinet 1***

Cable name =UNIT_01++CT+-240W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number

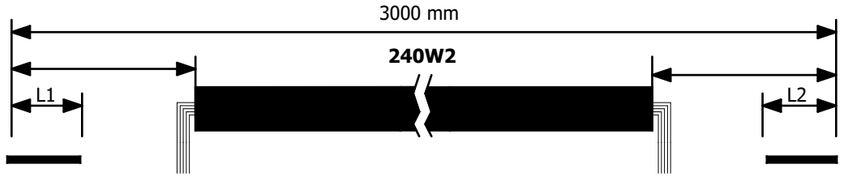


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-201Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-240W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-202Q1:CTRL		Connector	

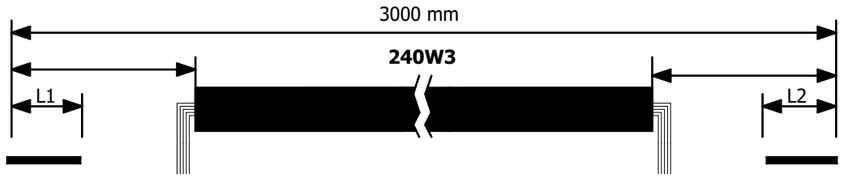
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X2	***Control cabinet 2***

previous page: 6
next page: 8

FRQ_kabelplan_04_grid_de_en

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_01++CT+-240W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

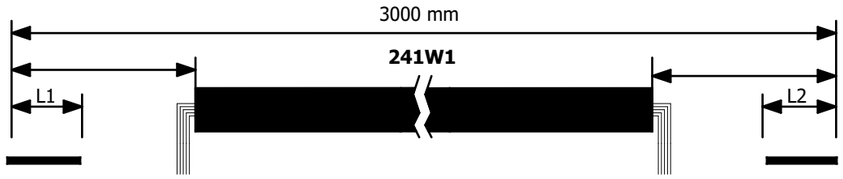


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-203Q1:CTRL		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-240U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors

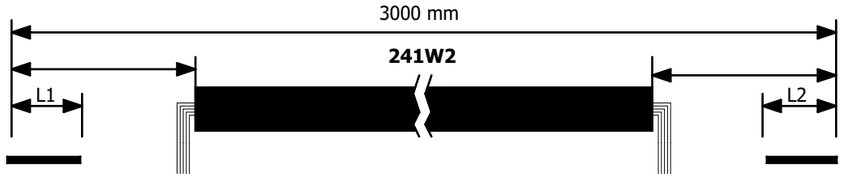


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X1	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors

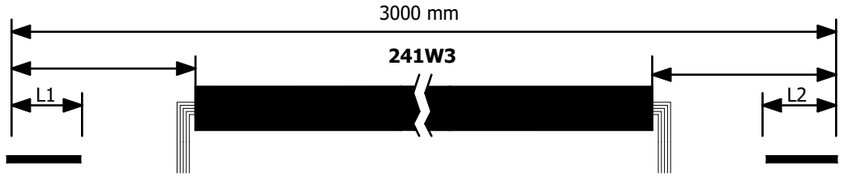


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X2		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors

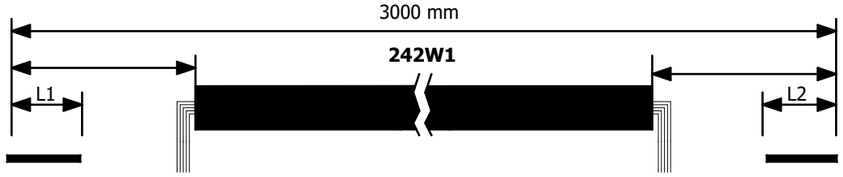


Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-211Q1-U1:X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-241U1:X3	***Control cabinet 2***

Cable name =UNIT_01++CT+-242W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

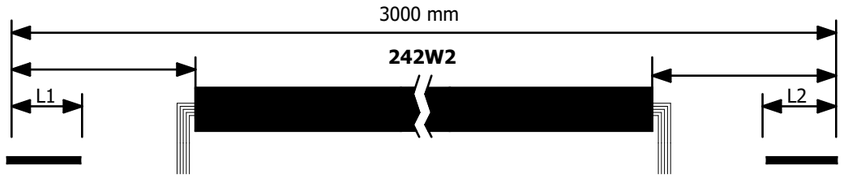
Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Converter cabinet	++CONV+CON-207Q1-U1:X1		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Female connector		+CTRL_2.1-242U1:X1	***Control cabinet 2***

previous page: 7
next page: 9

FRQ_kabelplan_04_grid_de_en

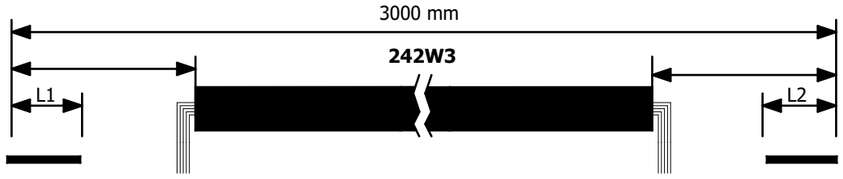
Cable name =UNIT_01++CT+-242W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Converter cabinet	++CONV+CON-207Q1-U1:X2		Connector			Female connector		+CTRL_2.1-242U1:X2	***Control cabinet 2***

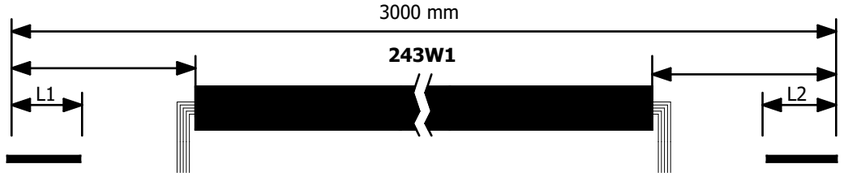
Cable name =UNIT_01++CT+-242W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Converter cabinet	++CONV+CON-207Q1-U1:X3		Connector			Female connector		+CTRL_2.1-242U1:X3	***Control cabinet 2***

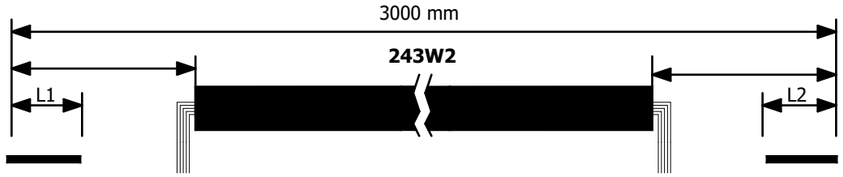
Cable name =UNIT_01++CT+-243W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Converter cabinet	++CONV+CON-217Q1-U1:X1		Connector			Female connector		+CTRL_2.1-243U1:X1	***Control cabinet 2***

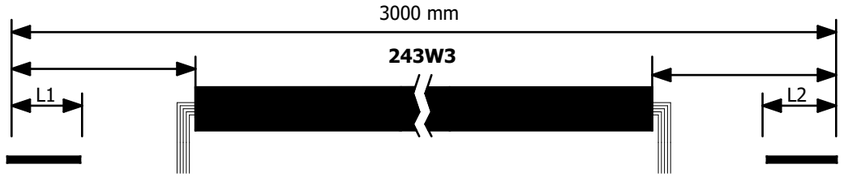
Cable name =UNIT_01++CT+-243W2
Cable type pre-assembled D-Sub cable 1:1
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Converter cabinet	++CONV+CON-217Q1-U1:X2		Connector			Female connector		+CTRL_2.1-243U1:X2	***Control cabinet 2***

Cable name =UNIT_01++CT+-243W3
Cable type pre-assembled D-Sub cable 1:1
Free conductors



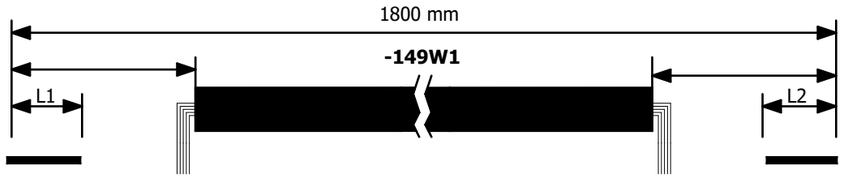
Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
Converter cabinet	++CONV+CON-217Q1-U1:X3		Connector			Female connector		+CTRL_2.1-243U1:X3	***Control cabinet 2***

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20230331_V0.01	= UNIT_01	Converter Container 1
Date	30.03.2023							& EMB	Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 9
Date								+	total: 423

Cable name =UNIT_01++CT+-149W1
Cable type pre-assembled D-Sub cable 1:1
Free conductors 1

Cable parts DIS.671476
Order number

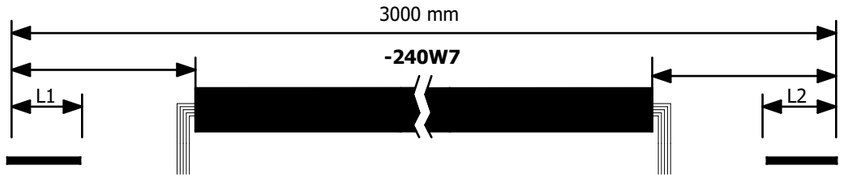


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_01++CT+-240W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors 2

Cable parts DIS.125-30-097
Order number 125-30-097

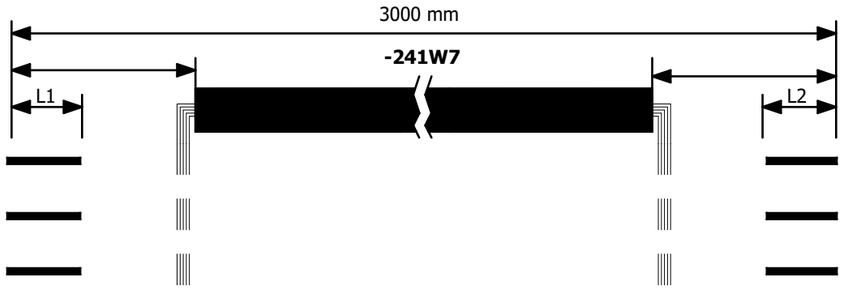


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 1	+CTRL_1.4-160U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-240U1:X7	***Control cabinet 2***

Cable name =UNIT_01++CT+-241W7
Cable type pre-assembled D-Sub cable 1:1
Free conductors 2

Cable parts DIS.125-30-097
Order number 125-30-097



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
Control cabinet 2	+CTRL_2.1-161U1:11X3		Connector	
Control cabinet 2	+CTRL_2.1-162U1:11X3		Connector	
Control cabinet 2	+CTRL_2.1-163U1:11X3		Connector	

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Connector		+CTRL_2.1-241U1:X7	***Control cabinet 2***
	Connector		+CTRL_2.1-242U1:X7	***Control cabinet 2***
	Connector		+CTRL_2.1-243U1:X7	***Control cabinet 2***

FRQ_kabelplan_04_grid_de_en

previous page: 9
next page: ++FAN/1

Cable name =UNIT_01++FAN+-52G1-181W2
Cable type JZ-600 4G1,5 mm²
Free conductors

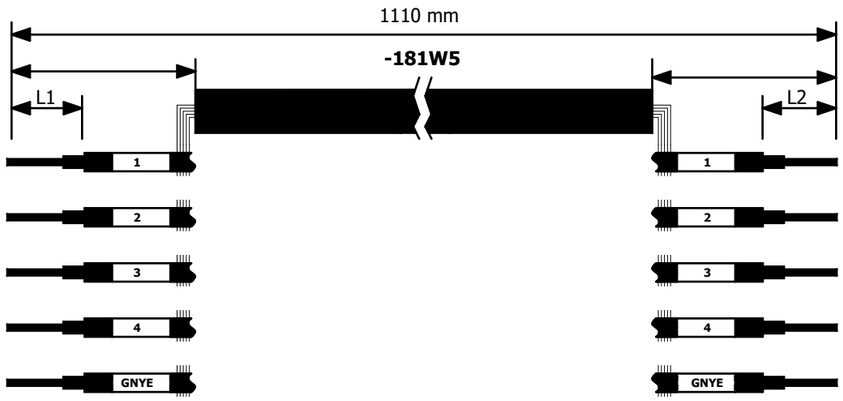
Cable parts HELU.10659
Order number 10659



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:1:2	PUMP	stripped	8 mm	5 mm	Ring cable lug M4	PUMP	-52G1-181M1:U1	
	-52G1-181X1:2:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:V1	
	-52G1-181X1:3:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181M1:PE	

Cable name =UNIT_01++FAN+-52G1-181W5
Cable type JZ-600 5G1,5 mm²
Free conductors

Cable parts HELU.10661
Order number 10661



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:4:2	FUSE FOR PUMP	stripped	8 mm	5 mm	Ring cable lug M4	FUSE FOR PUMP	-52G1-181R1:x1	
	-52G1-181X1:5:2	HEATER	stripped	8 mm	5 mm	Ring cable lug M4	HEATER	-52G1-181R1:x3	
	-52G1-181X1:6:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x5	
	-52G1-181X1:7:2	=	stripped	8 mm	5 mm	Ring cable lug M4	=	-52G1-181R1:x6	
	-52G1-181X1:PE:2	=					=	-52G1-181R1:PE	

Cable name =UNIT_01++FAN+-52G1-182W1
Cable type JZ-600 5G1,5 mm²
Free conductors

Cable parts HELU.10659
Order number 10659



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-52G1-181X1:8:2	FAN 1 HEAT EXCHANGER	stripped	8 mm	8 mm	End splice	FAN 1 HEAT EXCHANGER	-52G1-182M1:U1	
	-52G1-181X1:9:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:V1	
	-52G1-181X1:10:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:W1	
	-52G1-181X1:PE:2	=	stripped	8 mm	8 mm	End splice	=	-52G1-182M1:PE	

previous page:
++CT/10

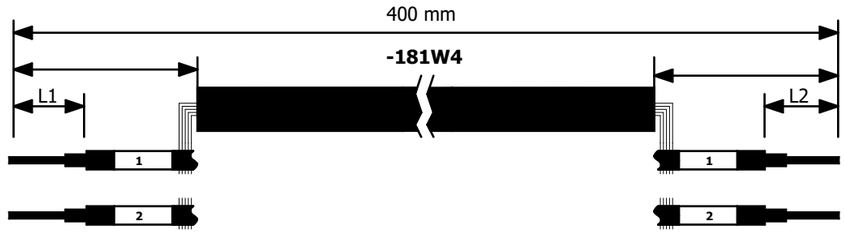
next page:
2

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	30.03.2023							& EMB Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ FAN FAN	page: 1
Date								+	total: 423

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_01++FAN+-52G1-181W4
Cable type OZ-500 2x0,75 mm²
Free conductors

Cable parts HELU.10030
Order number 10030



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-52G1-181X3:1:4	PRESSURE SWITCH	stripped	8 mm
	-52G1-181X3:2:3	=	stripped	8 mm

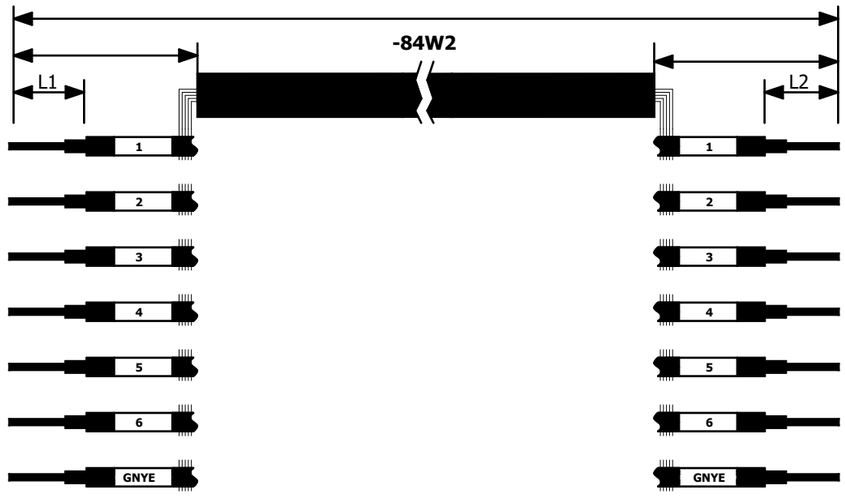
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	Flat connector	PRESSURE SWITCH	-52G1-181S1:13	
	Flat connector	=	-52G1-181S1:14	

FRQ_kabelplan_04_gr0_de_en

previous page: 1
next page: ++EXTERN/1

Cable name =UNIT_01++EXTERN+-84W2
Cable type JZ-600 5G16 mm²
Free conductors 7

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page:
++FAN/2

next page:
&EMZ+++CTRL.3/1000

FRQ_kabelplan_04_gr0_de_en

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-XE		1	1	0	0	1	=UNIT_01&EMZ+CTRL.3/2000

previous page:
&EMB++EXTERN+/1

next page:
2000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenleistenübersicht : =UNIT_01+++CTRL.3-XE - =UNIT_01+++CTRL.3-XE	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++			page: 1000
+	CTRL.3	Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_01+++CTRL.3-XE						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
1-6							1																&EFA+/2a.4

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-207L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2000
-207L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2001
-207L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2002
-211L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2003
-211L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2004
-211L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2005
-217L1.1				0	0	2	=UNIT_01&EMZ++CONV+IND/2006
-217L1.2				0	0	2	=UNIT_01&EMZ++CONV+IND/2007
-217L1.3				0	0	2	=UNIT_01&EMZ++CONV+IND/2008

previous page:
+++CTRL.3/2000

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text			-146W3	Cable name	Strip =UNIT_01++CONV+IND-207L1.1					Cable name												Page / column
			F-CY-OZ (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type											
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1			1		++CT+CTRL_1.3-X5	13		,	-207L1.1	x2												&EFS++CT+/146.5
=			2		++CT+CTRL_1.3-X5	14		,	-207L1.1	x1												&EFS++CT+/146.5

Terminal diagram

Freqcon_F13_001_02

Function text			-146W4	Cable name	Strip =UNIT_01++CONV+IND-207L1.2						Cable name												Page / column
			F-CY-OZ (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2			1		++CT+CTRL_1.3-X5	15		,	-207L1.2	x2													&EFS++CT+/146.7
=			2		++CT+CTRL_1.3-X5	16		,	-207L1.2	x1													&EFS++CT+/146.7

Terminal diagram

Freqcon_F13_001_02

Function text			-147W1	Cable name	Strip =UNIT_01++CONV+IND-207L1.3						Cable name												Page / column
			F-CY-OZ (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3			1		++CT+CTRL_1.3-X5	17		,	-207L1.3	x2													&EFS++CT+/147.1
=			2		++CT+CTRL_1.3-X5	18		,	-207L1.3	x1													&EFS++CT+/147.1

Terminal diagram

Freqcon_F13_001_02

Function text			-145W4	Cable name	Strip =UNIT_01++CONV+IND-211L1.1						Cable name												Page / column
			F-CY-OZ (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1			1		++CT+CTRL_1.3-X5	7		,	-211L1.1	x2													&EFS++CT+/145.7
=			2		++CT+CTRL_1.3-X5	8		,	-211L1.1	x1													&EFS++CT+/145.7

Terminal diagram

Freqcon_F13_001_02

Function text			-146W1	Cable name	Strip =UNIT_01++CONV+IND-211L1.2						Cable name												Page / column
			F-CY-OZ (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2			1		++CT+CTRL_1.3-X5	9		,	-211L1.2	x2													&EFS++CT+/146.1
=			2		++CT+CTRL_1.3-X5	10		,	-211L1.2	x1													&EFS++CT+/146.1

Terminal diagram

Freqcon_F13_001_02

Function text			-146W2	Cable name	Strip =UNIT_01++CONV+IND-211L1.3						Cable name												Page / column
			F-CY-OZ (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3			1		++CT+CTRL_1.3-X5	11		,	-211L1.3	x2													&EFS++CT+/146.3
=			2		++CT+CTRL_1.3-X5	12		,	-211L1.3	x1													&EFS++CT+/146.3

Terminal diagram

Freqcon_F13_001_02

Function text			-147W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.1						Cable name												Page / column
			F-CY-OZ (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1			1		++CT+CTRL_1.3-X5	19		,	-217L1.1	x2													&EFS++CT+/147.3
=			2		++CT+CTRL_1.3-X5	20		,	-217L1.1	x1													&EFS++CT+/147.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W1	Cable name	Strip =UNIT_01++CONV+IND-217L1.2					Cable name												Page / column
			F-CY-OZ (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type											
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2			1		++CT+CTRL_1.3-X5	25		,	-217L1.2	x2												&EFS++CT+/148.3
=			2		++CT+CTRL_1.3-X5	26		,	-217L1.2	x1												&EFS++CT+/148.3

Terminal diagram

Freqcon_F13_001_02

Function text			-148W2	Cable name	Strip =UNIT_01++CONV+IND-217L1.3						Cable name												Page / column
			F-CY-OZ (LiY-CY)	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3			1		++CT+CTRL_1.3-X5	29		,	-217L1.3	x2													&EFS++CT+/148.7
=			2		++CT+CTRL_1.3-X5	30		,	-217L1.3	x1													&EFS++CT+/148.7

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-227U1-X3.1	DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2000
-227U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2001
-231U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2002
-231U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2003
-237U1-X3.1	=	1	PE	1	0	18	=UNIT_01&EMZ++CONV+CIR/2004
-237U1-X3.2	=	1	PE	2	0	28	=UNIT_01&EMZ++CONV+CIR/2005

previous page: +IND/2008

next page: 2000

Terminal diagram

Freqcon_F13_001_02

Function text			-227W4	Cable name	Strip =UNIT_01++CONV+CIR-227U1-X3.1 DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen						Cable name	-227U1-W5										Page / column
			OZ-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	JZ-500											
			1		++CT+CTRL_1.4-350X1.21	1	1	,	-227U1-X3.2	1		1											&EFS+/227.a.1
			2				2	,	-227U1-X3.2	3		2											&EFS+/227.a.2
			3		++CT+CTRL_1.4-350X1.21	7	3	,	-227U1-X3.2	5		3											&EFS+/227.a.2
			4		++CT+CTRL_1.4-350X1.21	3	4	,	-227U1-X3.2	7		4											&EFS+/227.a.3
			5				5	,	-227U1-X3.2	9		5											&EFS+/227.a.4
			6		++CT+CTRL_1.4-350X1.21	9	6	,	-227U1-X3.2	11		6											&EFS+/227.a.5
			7		++CT+CTRL_1.4-306K7	A1	7	,	-227U1-X3.2	13		7											&EFS+/227.a.5
			8				8	,	-227U1-X3.2	15		8											&EFS+/227.a.6
			9		++CT+CTRL_1.4-306K11	A1	9	,	-227U1-X3.2	17		9											&EFS+/227.a.6
			10		++CT+CTRL_1.4-306K8	A1	10	,	-227U1-X3.2	19		10											&EFS+/227.a.6
			11				11	,	-227U1-X3.2	21		11											&EFS+/227.a.7
			12		++CT+CTRL_1.4-306K12	A1	12	,	-227U1-X3.2	23		12											&EFS+/227.a.7
			13		++CT+CTRL_1.3-X3.11	11	13	,	-227U1-F1	2													&EFS+/227.a.7
			14				14	,	-227U1-F5	2													&EFS+/227.a.8
			15		++CT+CTRL_1.3-X3.12	9	15	,	-227U1-F9	2													&EFS+/227.a.8
			16		++CT+CTRL_1.3-X3.12	10	16	,	-227U1-F2	1													&EFS+/227.a.9
									-227U1-X3.2	24		13											
			17		++CT+CTRL_1.4-350X1.21	2	17	,	-227U1-X3.2	12		14											&EFS+/227.a.9
							PE	,	-227U1-X3.2	PE		GNYE											&EFS+/227.a.9

previous page: 1000

next page: 2001

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-227U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name											Page / column
				Cable type								-227U1-W5											
												JZ-500											
							1		-227U1-X3.1	1		1											&EFS+/227.a.1
							2																&EFS+/227.a.1
							3		-227U1-X3.1	2		2											&EFS+/227.a.2
							4																&EFS+/227.a.2
							5		-227U1-X3.1	3		3											&EFS+/227.a.2
							6																&EFS+/227.a.2
							7		-227U1-X3.1	4		4											&EFS+/227.a.3
							8																&EFS+/227.a.3
							9		-227U1-X3.1	5		5											&EFS+/227.a.4
							10																&EFS+/227.a.4
							11		-227U1-X3.1	6		6											&EFS+/227.a.5
							12		-227U1-X3.1	17		14											&EFS+/227.a.5
							13		-227U1-X3.1	7		7											&EFS+/227.a.5
							14																&EFS+/227.a.5
							15		-227U1-X3.1	8		8											&EFS+/227.a.6
							16																&EFS+/227.a.6
							17		-227U1-X3.1	9		9											&EFS+/227.a.6
							18																&EFS+/227.a.6
							19		-227U1-X3.1	10		10											&EFS+/227.a.6
							20																&EFS+/227.a.6
							21		-227U1-X3.1	11		11											&EFS+/227.a.7
							22																&EFS+/227.a.7
							23		-227U1-X3.1	12		12											&EFS+/227.a.7
							24		-227U1-X3.1	16		13											&EFS+/227.a.7
							PE																&EFS+/227.a.5
							PE		-227U1-X3.1	PE		GNYE											&EFS+/227.a.5

previous page: 2000

next page: 2002

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-231U1-W5	Page / column
			OZ-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.3-150X1	1	1	,	-231U1-X3.2	1		1	&EFS+/231.a.1
			2		++CT+CTRL_1.3-150X1	4	2	,	-231U1-X3.2	3		2	&EFS+/231.a.2
			3		++CT+CTRL_1.3-150X1	7	3	,	-231U1-X3.2	5		3	&EFS+/231.a.2
			4		++CT+CTRL_1.3-150X1	3	4	,	-231U1-X3.2	7		4	&EFS+/231.a.3
			5		++CT+CTRL_1.3-150X1	6	5	,	-231U1-X3.2	9		5	&EFS+/231.a.4
			6		++CT+CTRL_1.3-150X1	9	6	,	-231U1-X3.2	11		6	&EFS+/231.a.5
			7		++CT+CTRL_1.4-306K1	A1	7	,	-231U1-X3.2	13		7	&EFS+/231.a.5
			8		++CT+CTRL_1.4-306K3	A1	8	,	-231U1-X3.2	15		8	&EFS+/231.a.6
			9		++CT+CTRL_1.4-306K5	A1	9	,	-231U1-X3.2	17		9	&EFS+/231.a.6
			10		++CT+CTRL_1.4-306K2	A1	10	,	-231U1-X3.2	19		10	&EFS+/231.a.6
			11		++CT+CTRL_1.4-306K4	A1	11	,	-231U1-X3.2	21		11	&EFS+/231.a.7
			12		++CT+CTRL_1.4-306K6	A1	12	,	-231U1-X3.2	23		12	&EFS+/231.a.7
			13		++CT+CTRL_1.3-X3.10	9	13	,	-231U1-F1	2			&EFS+/231.a.7
			14		++CT+CTRL_1.3-X3.10	11	14	,	-231U1-F5	2			&EFS+/231.a.8
			15		++CT+CTRL_1.3-X3.11	9	15	,	-231U1-F9	2			&EFS+/231.a.8
			16		++CT+CTRL_1.3-X3.10	10	16	,	-231U1-F2	1			&EFS+/231.a.9
									-231U1-X3.2	24		13	
			17		++CT+CTRL_1.3-150X1	2	17	,	-231U1-X3.2	12		14	&EFS+/231.a.9
							PE	,	-231U1-X3.2	PE		GNYE	&EFS+/231.a.9

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.1	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV page: 2002
Date								+ CIR Circuit Breaker cabinet total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-231U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name											Page / column
				Cable type								-231U1-W5											
												JZ-500											
							1		-231U1-X3.1	1		1											&EFS+/231.a.1
							2																&EFS+/231.a.1
							3		-231U1-X3.1	2		2											&EFS+/231.a.2
							4																&EFS+/231.a.2
							5		-231U1-X3.1	3		3											&EFS+/231.a.2
							6																&EFS+/231.a.2
							7		-231U1-X3.1	4		4											&EFS+/231.a.3
							8																&EFS+/231.a.3
							9		-231U1-X3.1	5		5											&EFS+/231.a.4
							10																&EFS+/231.a.4
							11		-231U1-X3.1	6		6											&EFS+/231.a.5
							12		-231U1-X3.1	17		14											&EFS+/231.a.5
							13		-231U1-X3.1	7		7											&EFS+/231.a.5
							14																&EFS+/231.a.5
							15		-231U1-X3.1	8		8											&EFS+/231.a.6
							16																&EFS+/231.a.6
							17		-231U1-X3.1	9		9											&EFS+/231.a.6
							18																&EFS+/231.a.6
							19		-231U1-X3.1	10		10											&EFS+/231.a.6
							20																&EFS+/231.a.6
							21		-231U1-X3.1	11		11											&EFS+/231.a.7
							22																&EFS+/231.a.7
							23		-231U1-X3.1	12		12											&EFS+/231.a.7
							24		-231U1-X3.1	16		13											&EFS+/231.a.7
							PE																&EFS+/231.a.5
							PE		-231U1-X3.1	PE		GNYE											&EFS+/231.a.5

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-231U1-X3.2	20230331_V0.01	= UNIT_01	Converter Container 1	
Date	31.03.2023							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV		page: 2003
Date								+ CIR	Circuit Breaker cabinet	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.1

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text			-237W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-237U1-W5	Page / column
			OZ-500	Cable type							Cable type	JZ-500	
			1		++CT+CTRL_1.4-350X1.22	11	1	,	-237U1-X3.2	1		1	&EFS+/237.a.1
			2		++CT+CTRL_1.4-350X1.21	4	2	,	-237U1-X3.2	3		2	&EFS+/237.a.2
			3		++CT+CTRL_1.4-350X1.21	7	3	,	-237U1-X3.2	5		3	&EFS+/237.a.2
			4		++CT+CTRL_1.4-350X1.22	13	4	,	-237U1-X3.2	7		4	&EFS+/237.a.3
			5		++CT+CTRL_1.4-350X1.21	6	5	,	-237U1-X3.2	9		5	&EFS+/237.a.4
			6		++CT+CTRL_1.4-350X1.21	9	6	,	-237U1-X3.2	11		6	&EFS+/237.a.5
			7		++CT+CTRL_1.4-306K13	A1	7	,	-237U1-X3.2	13		7	&EFS+/237.a.5
			8		++CT+CTRL_1.4-306K15	A1	8	,	-237U1-X3.2	15		8	&EFS+/237.a.6
			9		++CT+CTRL_1.4-306K17	A1	9	,	-237U1-X3.2	17		9	&EFS+/237.a.6
			10		++CT+CTRL_1.4-306K14	A1	10	,	-237U1-X3.2	19		10	&EFS+/237.a.6
			11		++CT+CTRL_1.4-306K16	A1	11	,	-237U1-X3.2	21		11	&EFS+/237.a.7
			12		++CT+CTRL_1.4-306K18	A1	12	,	-237U1-X3.2	23		12	&EFS+/237.a.7
			13		++CT+CTRL_1.3-X3.12	11	13	,	-237U1-F1	2			&EFS+/237.a.7
			14		++CT+CTRL_1.3-X3.13	9	14	,	-237U1-F5	2			&EFS+/237.a.8
			15		++CT+CTRL_1.3-X3.13	11	15	,	-237U1-F9	2			&EFS+/237.a.8
			16		++CT+CTRL_1.3-X3.13	10	16	,	-237U1-F2	1			&EFS+/237.a.9
									-237U1-X3.2	24		13	
			17		++CT+CTRL_1.4-350X1.22	12	17	,	-237U1-X3.2	12		14	&EFS+/237.a.9
							PE	,	-237U1-X3.2	PE		GNYE	&EFS+/237.a.9

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CONV+CIR-237U1-X3.1	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CONV		page: 2004
+	CIR	Circuit Breaker cabinet	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CONV+CIR-237U1-X3.2

DC Schalter + Sicherungen-Ansteuerungen und Rückmeldungen

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name											Page / column
				Cable type								-237U1-W5											
												JZ-500											
							1		-237U1-X3.1	1		1											&EFS+/237.a.1
							2																&EFS+/237.a.1
							3		-237U1-X3.1	2		2											&EFS+/237.a.2
							4																&EFS+/237.a.2
							5		-237U1-X3.1	3		3											&EFS+/237.a.2
							6																&EFS+/237.a.2
							7		-237U1-X3.1	4		4											&EFS+/237.a.3
							8																&EFS+/237.a.3
							9		-237U1-X3.1	5		5											&EFS+/237.a.4
							10																&EFS+/237.a.4
							11		-237U1-X3.1	6		6											&EFS+/237.a.5
							12		-237U1-X3.1	17		14											&EFS+/237.a.5
							13		-237U1-X3.1	7		7											&EFS+/237.a.5
							14																&EFS+/237.a.5
							15		-237U1-X3.1	8		8											&EFS+/237.a.6
							16																&EFS+/237.a.6
							17		-237U1-X3.1	9		9											&EFS+/237.a.6
							18																&EFS+/237.a.6
							19		-237U1-X3.1	10		10											&EFS+/237.a.6
							20																&EFS+/237.a.6
							21		-237U1-X3.1	11		11											&EFS+/237.a.7
							22																&EFS+/237.a.7
							23		-237U1-X3.1	12		12											&EFS+/237.a.7
							24		-237U1-X3.1	16		13											&EFS+/237.a.7
							PE																&EFS+/237.a.5
							PE		-237U1-X3.1	PE		GNYE											&EFS+/237.a.5

previous page: 2004

next page: +AC_DC/1000

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X3.43		1	20	0	0	40	=UNIT_01&EMZ++CONV+AC_DC/2000

previous page:
+CIR/2005

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Function text	-238W3 / OZ-500	-238W2 / OZ-500	-238W1 / OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-238W7 / OZ-500	Page / column
SURGE ARRESTER DC SUBSYSTEM 2_1			1		-238F1	11	1	,	++CT+CTRL_1.3-X3	5		1	&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_1			2		-238F1	12	2	,	-X3.43	3			&EFS+/238a.2
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		1			-238F2	11	3	,	-X3.43	2			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_2		2			-238F2	12	4	,	-X3.43	5			&EFS+/238a.5
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	1				-238F3	11	5	,	-X3.43	4			&EFS+/238a.9
								,					
SURGE ARRESTER DC SUBSYSTEM 2_3	2				-238F3	12	6	,	-X3.43	7			&EFS+/238a.9
								,					

Terminal diagram

Freqcon_F13_001_02

Function text	-228W3 / OZ-500	-228W2 / OZ-500	-228W1 / OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 3_1			1		-228F1	11	7	,	-X3.43	6		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_1			2		-228F1	12	8	,	-X3.43	9		&EFS+/228.2
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		1			-228F2	11	9	,	-X3.43	8		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_2		2			-228F2	12	10	,	-X3.43	11		&EFS+/228.5
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	1				-228F3	11	11	,	-X3.43	10		&EFS+/228.9
								,				
SURGE ARRESTER DC SUBSYSTEM 3_3	2				-228F3	12	12	,	-X3.43	13		&EFS+/228.9
								,				

Terminal diagram

Freqcon_F13_001_02

Function text	-238W6 / OZ-500	-238W5 / OZ-500	-238W4 / OZ-500	Cable name / Cable type	Strip =UNIT_01++CONV+AC_DC-X3.43 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
SURGE ARRESTER DC SUBSYSTEM 4_1			1		-238F4	11	13	,	-X3.43	12		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_1			2		-238F4	12	14	,	-X3.43	15		&EFS+/238b.2
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		1			-238F5	11	15	,	-X3.43	14		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_2		2			-238F5	12	16	,	-X3.43	17		&EFS+/238b.5
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	1				-238F6	11	17	,	-X3.43	16		&EFS+/238b.9
								,				
SURGE ARRESTER DC SUBSYSTEM 4_3	2				-238F6	12	18	,	-X3.43	19		&EFS+/238b.9
								,				

Terminal diagram

Freqcon_F13_001_02

Function text			-78W7	Cable name	Strip =UNIT_01++CONV+AC_DC-X3.43						Cable name	-238W7										Page / column
			OZ-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	OZ-500										
			2			12	19	,	-X3.43	18												&EFS+/78.8
								,														
			1		-78F1	13	20	,	++CT+CTRL_1.3-X3	6		2										&EFS+/78.8
								,														

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-X1	Hauptsteuerstromkreis 400V/230V AC	1	PE	4	1	17	=UNIT_01&EMZ++CT+CTRL_1.3/2000
-X3	CONTROL VOLTAGE 24V DC	1	46	0	0	40	=UNIT_01&EMZ++CT+CTRL_1.3/2001
-X3.10	Rückmeldung DC Schütze Subsystem 1_4	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2003
-X3.11	=	1	12	0	0	15	=UNIT_01&EMZ++CT+CTRL_1.3/2004
-X3.12	=	1	12	0	0	12	=UNIT_01&EMZ++CT+CTRL_1.3/2005
-X3.13	Rückmeldung DC Schütze Subsystem 1_6	1	12	0	0	12	=UNIT_01&EMZ++CT+CTRL_1.3/2006
-X5	Kleinspannungssignale	1	30	0	0	30	=UNIT_01&EMZ++CT+CTRL_1.3/2007
-X5.1	DC Subsystem Spannungsmessung	1	2	0	0	2	=UNIT_01&EMZ++CT+CTRL_1.3/2009
-150X1	Subsysteme DC Schütz EIN	1	10	0	0	10	=UNIT_01&EMZ++CT+CTRL_1.3/2010
-XDC1	Steuerspannung 24VDC (USV) DC1	1	PE	2	0	9	=UNIT_01&EMZ++CT+CTRL_1.3/2011
-XDC2	Steuerspannung 24VDC (USV) DC2	1	4	0	0	4	=UNIT_01&EMZ++CT+CTRL_1.3/2013
-XDC3	Steuerspannung 24VDC (USV) DC3	1	4	0	0	4	=UNIT_01&EMZ++CT+CTRL_1.3/2016
-XDC4	Steuerspannung 24VDC (USV) DC4	1	4	0	0	4	=UNIT_01&EMZ++CT+CTRL_1.3/2017
-XDC5.1	Steuerspannung 24VDC (USV) DC5.1	1	1	0	0	1	=UNIT_01&EMZ++CT+CTRL_1.3/2018
-XDC5.2	Steuerspannung 24VDC (USV) DC5.2	1	1	0	0	1	=UNIT_01&EMZ++CT+CTRL_1.3/2019
-XE	Hauptstromversorgung 400V AC	1	6	3	3	12	=UNIT_01&EMZ++CT+CTRL_1.3/2020
-XT	Transfer Klemmenblock 24VDC/230VAC	1	16	6	0	22	=UNIT_01&EMZ++CT+CTRL_1.3/2021
-190XT1	230VAC Beleuchtung/Klimaanlage Container/Schrank	1	PE	4	4	12	=UNIT_01&EMZ++CT+CTRL_1.3/2023
-XV	Suppression TVS Diode	1	4	0	0	9	=UNIT_01&EMZ++CT+CTRL_1.3/2024

previous page:
++CONV+AC_DC/2003

next page:
2000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenleistenübersicht : =UNIT_01++CT+CTRL_1.3-X1 - =UNIT_01++CT+CTRL_1.3-XV	20230331_V0.01	= UNIT_01	Converter Container 1	
Date	31.03.2023							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT		page: 1000
Date								+ CTRL_1.3	Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X1

Hauptsteuerstromkreis 400V/230V AC

Function text			-181W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
			1Z-600	Cable type									
PUMP			1		++FAN-52G1-181X1	1:1	1	,	-139K2	2			&EFS+/181.1
=			2		++FAN-52G1-181X1	2:1	2	,	-139K2	4			&EFS+/181.1
=			3		++FAN-52G1-181X1	3:1	3	,	-139K2	6			&EFS+/181.1
=			GNYE		++FAN-52G1-181X1	PE:1	PE	,	+.2-110U1-PE				&EFS+/181.1
FUSE FOR PUMP			4		++FAN-52G1-181X1	4:1	4	,	-139K1	2			&EFS+/181.3
HEATER			5		++FAN-52G1-181X1	5:1	5	,	-139K1	4			&EFS+/181.4
=			6		++FAN-52G1-181X1	6:1	6	,	-139K1	6			&EFS+/181.4
=			7		++FAN-52G1-181X1	7:1	7	,	-XE	N:1			&EFS+/181.4
=							PE	,					&EFS+/181.4
FAN 1 HEAT EXCHANGER			8		++FAN-52G1-181X1	8:1	8	,	-139K3	2			&EFS+/182.1
=			9		++FAN-52G1-181X1	9:1	9	,	-139K3	4			&EFS+/182.1
=			10		++FAN-52G1-181X1	10:1	10	,	-139K3	6			&EFS+/182.1
=							PE	,					&EFS+/182.1
FAN 2 HEAT EXCHANGER OPTIONAL							11	,					&EFS+/182.3
=							12	,					&EFS+/182.4
=							13	,					&EFS+/182.4
=							PE	,					&EFS+/182.4

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X1	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 2000
Date								+ CTRL_1.3 Main mounting plate total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3

CONTROL VOLTAGE 24V DC

Function text	++CONV-80W1 OZ-500	-181W3 OZ-600	++CONV-260W1 OZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-80W1 OZ-500	++CONV-238W7 OZ-500	++CONV-260W1 OZ-500	-195W1 OZ-500	Page / column
CB 1 Tripped GRID					-DI_02	5	1		++CONV+CIR-80Q1	X7_13		1				&EFS+/127.1
CB 1 OFF GRID					-DI_02	4	2		++CONV+CIR-80Q1	X6_9		2				&EFS+/127.3
CB 1 ON GRID					-DI_02	3	3		++CONV+CIR-80Q1	X6_11		3				&EFS+/127.2
FUSE AND LIGHTNING PROTECTION							4		+.4-189X1	5						&EFS+/127.4
=					-XDC4	2	5		++CONV+AC_DC-X3.43	1			1			&EFS+/127.5
=					-DI_02	6	6		++CONV+AC_DC-X3.43	20			2			&EFS+/127.4
=					-X3	13	7		-134K1	11						&EFS+/127.5
CB 2 Tripped ISLAND GRID					-DI_04	12	8									&EFS+/128.1
CB 2 OFF ISLAND GRID					-DI_04	14	9									&EFS+/128.3
CB 2 ON ISLAND GRID					-DI_04	13	10									&EFS+/128.2
FUSE AND LIGHTNING PROTECTION 2							11									&EFS+/128.4
=					-DI_04	15	12									&EFS+/128.4
=					-X3	7	13									&EFS+/128.5
SPARE					-DI_04	8	14									&EFS+/133.0
=					-DI_04	9	15									&EFS+/133.1
=					-DI_04	10	16									&EFS+/133.2
Fuse 230V AC for Container Air Conditioning					-DI_04	11	17		-190F3	14						&EFS+/133.3
SPARE							18									&EFS+/133.4
Smoke detector CON					-DI_02	7	19		++CONV+CON-260B1	4			1			&EFS+/134.0
=			2		++CONV+CON-260B1	2	20		-XV	9						&EFS+/134.0
=			3		++CONV+CON-260B1	5	21		-XDC4	4						&EFS+/134.1
=			4		++CONV+CON-260B1	6	22		-134K1	11						&EFS+/134.1
PRESSURE SWITCH		1			++FAN-52G1-181X3	1:1	23		-182Q1	13						&EFS+/181.6
=		2			++FAN-52G1-181X3	2:2	24		-DI_01	14						&EFS+/181.6
CB 1 GRID +24V	4				++CONV+CIR-80Q1	X6_12	31		-XDC3	2						&EFS+/188.1
=	5				++CONV+CIR-80Q1	X5_11	32		-XDC3	3						&EFS+/188.1
CB 2 ISLAND GRID +24V OPTIONAL							33		-137K1	11						&EFS+/188.2
=							34									&EFS+/188.2
=	6				++CONV+CIR-80Q1	X6_7	35		-137K1	14						&EFS+/188.4
CB 1 GRID	7				++CONV+CIR-80Q1	X6_14	36		-137K2	12						&EFS+/188.5
=	8				++CONV+CIR-80Q1	X5_12	37		-189K1	22						&EFS+/188.6
=							38		-137K3	14						&EFS+/188.6
CB 2 ISLAND GRID OPTIONAL							39		-137K4	12						&EFS+/188.8
=							40		-189K1	21						&EFS+/188.8
SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS					-X3	42	41		+.1-84Q1	14				3		&EFS+/195.2

previous page: 2000

next page: 2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CT		page: 2001
+	CTRL_1.3	Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3

CONTROL VOLTAGE 24V DC

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name: -195W1										Page / column
				Cable type								OZ-500										
SHUTDOWN CIRCUIT BREAKERS / DC CONTACTORS					-195K3	IN1	42	,	-X3	41												&EFS+/195.2
=					-X3	44	43	,	+.1-84Q1	24		4										&EFS+/195.3
=					-195K3	IN2	44	,	-X3	43												&EFS+/195.3
=					-195K1	61	45	,	+.4-306K1	21												&EFS+/195.3
FAULT SIGNAL SAFETY RELAY					-195K3	IN	46	,	+.4-306K18	21												&EFS+/195.4

previous page: 2001

next page: 2003

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 2002
Date								+ CTRL_1.3 Main mounting plate total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.10

Rückmeldung DC Schütze Subsystem 1_4

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-231W4										Page / column
				Cable type							Cable type	OZ-500										
SUBSYSTEM 2_1_DC + Contactor K1 is on					-DI_02	8	1		+.4-306K1	14												&EFS+/129.0
SUBSYSTEM 2_1_DC -Contactor K7 is on					+.4-306K2	14	2		-DI_02	10												&EFS+/129.2
SUBSYSTEM 2_1_DC + Contactor K2 is on							3		-DI_02	9												&EFS+/129.1
SUBSYSTEM 2_1_DC -Contactor K8 is on							4		-DI_02	11												&EFS+/129.3
SUBSYSTEM 2_2_DC + Contactor K1 is on					-DI_02	12	5		+.4-306K3	14												&EFS+/129.4
SUBSYSTEM 2_2_DC -Contactor K7 is on					-DI_02	14	6		+.4-306K4	14												&EFS+/129.6
SUBSYSTEM 2_2_DC + Contactor K2 is on					-DI_02	13	7															&EFS+/129.5
SUBSYSTEM 2_2_DC -Contactor K8 is on					-DI_02	15	8															&EFS+/129.7
SUBSYSTEM 2_1_DC FUSE OK					-DI_02	16	9		++CONV+CIR-231U1-X3.1	13		13											&EFS+/129.8
SUBSYSTEM 2_2_DC FUSE OK							10		++CONV+CIR-231U1-X3.1	16		16										&EFS+/129.9
=					-DI_03	1	11		++CONV+CIR-231U1-X3.1	14		14										&EFS+/129.9
=					-XDC4	1	12															&EFS+/129.9

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.10	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 2003
Date								+ CTRL_1.3 Main mounting plate total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.11

Rückmeldung DC Schütze Subsystem 1_4

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-231W4	++CONV-227W4										Page / column
				Cable type							Cable type	OZ-500	OZ-500										
SUBSYSTEM 2_3_DC + Contactor K1 is on					-DI_03	2	1		+.4-306K5	14													&EFS+/130.0
SUBSYSTEM 2_3_DC -Contactor K7 is on					+.4-306K6	14	2		-DI_03	4													&EFS+/130.2
SUBSYSTEM 2_3_DC + Contactor K2 is on							3		-DI_03	3													&EFS+/130.1
SUBSYSTEM 2_3_DC -Contactor K8 is on							4		-DI_03	5													&EFS+/130.3
SUBSYSTEM 3_1_DC + Contactor K1 is on					-DI_03	6	5		+.4-306K7	14													&EFS+/130.4
SUBSYSTEM 3_1_DC -Contactor K7 is on					-DI_03	8	6		+.4-306K8	14													&EFS+/130.6
SUBSYSTEM 3_1_DC + Contactor K2 is on					-DI_03	7	7																&EFS+/130.5
SUBSYSTEM 3_1_DC -Contactor K8 is on					-DI_03	9	8																&EFS+/130.7
SUBSYSTEM 2_3_DC FUSE OK					-DI_03	10	9		++CONV+CIR-231U1-X3.1	15		15											&EFS+/130.8
SUBSYSTEM 3_1_DC FUSE OK							10																&EFS+/130.9
=					-DI_03	11	11		++CONV+CIR-227U1-X3.1	13			13										&EFS+/130.9
=					-XDC4	2	12																&EFS+/130.9

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron		Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.11	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 2004
Date								+ CTRL_1.3 Main mounting plate total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.12

Rückmeldung DC Schütze Subsystem 1_4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	++CONV-227W4	++CONV-237W4	Page / column
											OZ-500	OZ-500	
SUBSYSTEM 3_3_DC + Contactor K1 is on			-DI_03	12	1		+.4-306K9	14					&EFS+/131.0
SUBSYSTEM 3_3_DC + Contactor K2 is on					2		-DI_03	13					&EFS+/131.1
SUBSYSTEM 3_3_DC -Contactor K7 is on			+.4-306K10	14	3		-DI_03	14					&EFS+/131.2
SUBSYSTEM 3_3_DC -Contactor K8 is on					4		-DI_03	15					&EFS+/131.3
SUBSYSTEM 4_1_DC + Contactor K1 is on			-DI_03	16	5		+.4-306K11	14					&EFS+/131.4
SUBSYSTEM 4_1_DC + Contactor K2 is on			-DI_05	1	6								&EFS+/131.5
SUBSYSTEM 4_1_DC -Contactor K7 is on			-DI_05	2	7		+.4-306K12	14					&EFS+/131.6
SUBSYSTEM 4_1_DC -Contactor K8 is on			-DI_05	3	8								&EFS+/131.7
SUBSYSTEM 3_3_DC FUSE OK			-DI_05	4	9		++CONV+CIR-227U1-X3.1	15			15		&EFS+/131.8
SUBSYSTEM 4_1_DC FUSE OK					10		++CONV+CIR-227U1-X3.1	16			16		&EFS+/131.9
=			-DI_05	5	11		++CONV+CIR-237U1-X3.1	13				13	&EFS+/131.9
=			-XDC4	2	12								&EFS+/131.9

previous page: 2004

next page: 2006

Editor	Freqcon_DG			Statron	Klemmenplan =UNIT_01++CT+CTRL_1.3-X3.12	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023						& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007	++ CT page: 2005
Date							+ CTRL_1.3 Main mounting plate total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X3.13

Rückmeldung DC Schütze Subsystem 1_6

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Cable type	Page / column
										++CONV-237W4	OZ-500	
SUBSYSTEM 4_2_DC + Contactor K1 is on			-DI_05	6	1		+.4-306K13	14				&EFS+/132.0
SUBSYSTEM 4_2_DC + Contactor K2 is on					2		-DI_05	7				&EFS+/132.1
SUBSYSTEM 4_2_DC -Contactor K7 is on			+.4-306K14	14	3		-DI_05	8				&EFS+/132.2
SUBSYSTEM 4_2_DC -Contactor K8 is on					4		-DI_05	9				&EFS+/132.3
SUBSYSTEM 4_3_DC + Contactor K1 is on			-DI_05	10	5		+.4-306K15	14				&EFS+/132.4
SUBSYSTEM 4_3_DC + Contactor K2 is on			-DI_05	11	6							&EFS+/132.5
SUBSYSTEM 4_3_DC -Contactor K7 is on			-DI_05	12	7		+.4-306K16	14				&EFS+/132.6
SUBSYSTEM 4_3_DC -Contactor K8 is on			-DI_05	13	8							&EFS+/132.7
SUBSYSTEM 4_2_DC FUSE OK			-DI_05	14	9		++CONV+CIR-237U1-X3.1	14		14		&EFS+/132.8
SUBSYSTEM 4_3_DC FUSE OK					10		++CONV+CIR-237U1-X3.1	16		16		&EFS+/132.9
=			-DI_05	15	11		++CONV+CIR-237U1-X3.1	15		15		&EFS+/132.9
=			-XDC4	2	12							&EFS+/132.9

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-145W1	++CONV-145W2	++CONV-145W3	++CONV-145W4	++CONV-146W1	++CONV-146W2	++CONV-146W3	++CONV-146W4	++CONV-147W1	++CONV-147W2	-181W3	Page / column
				Cable type							Cable type	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)	OZ-600	
INDUCTOR GRID PHASE L1 TEMPERATURE 1_1					-AI_01	1	1	,	++CONV+IND-201L1			1											&EFS+/145.1
=					-AI_01	9	2	,	++CONV+IND-201L1			2											&EFS+/145.1
INDUCTOR GRID PHASE L2 TEMPERATURE 1_2					-AI_01	2	3	,	++CONV+IND-202L1				1										&EFS+/145.3
=					-AI_01	10	4	,	++CONV+IND-202L1				2										&EFS+/145.3
INDUCTOR GRID PHASE L3 TEMPERATURE 1_3					-AI_01	3	5	,	++CONV+IND-203L1					1									&EFS+/145.5
=					-AI_01	11	6	,	++CONV+IND-203L1					2									&EFS+/145.5
INDUCTOR DC SUB 2_1 TEMPERATURE 2_1					-AI_01	4	7	,	++CONV+IND-211L1.1						1								&EFS+/145.7
=					-AI_01	12	8	,	++CONV+IND-211L1.1						2								&EFS+/145.7
INDUCTOR DC SUB 2_2 TEMPERATURE 2_2					-AI_01	5	9	,	++CONV+IND-211L1.2							1							&EFS+/146.1
=					-AI_01	13	10	,	++CONV+IND-211L1.2							2							&EFS+/146.1
INDUCTOR DC SUB 2_3 TEMPERATURE 2_3					-AI_01	6	11	,	++CONV+IND-211L1.3								1						&EFS+/146.3
=					-AI_01	14	12	,	++CONV+IND-211L1.3								2						&EFS+/146.3
INDUCTOR DC SUB 3_1 TEMPERATURE 3_1					-AI_01	7	13	,	++CONV+IND-207L1.1									1					&EFS+/146.5
=					-AI_01	15	14	,	++CONV+IND-207L1.1									2					&EFS+/146.5
INDUCTOR DC SUB 3_2 TEMPERATURE 3_2					-AI_01	8	15	,	++CONV+IND-207L1.2										1				&EFS+/146.7
=					-AI_01	16	16	,	++CONV+IND-207L1.2										2				&EFS+/146.7
INDUCTOR DC SUB 3_3 TEMPERATURE 3_3					-AI_02	1	17	,	++CONV+IND-207L1.3											1			&EFS+/147.1
=					-AI_02	9	18	,	++CONV+IND-207L1.3											2			&EFS+/147.1
INDUCTOR DC SUB 4_1 TEMPERATURE 4_1					-AI_02	2	19	,	++CONV+IND-217L1.1												1		&EFS+/147.3
=					-AI_02	10	20	,	++CONV+IND-217L1.1												2		&EFS+/147.3
CONVERTER CABINET TEMPERATURE					-AI_02	4	21	,	++CONV+CON-147B2	+													&EFS+/147.7
=					-AI_02	12	22	,	++CONV+CON-147B2	-													&EFS+/147.7
COOLING WATER TEMPERATURE					-AI_02	5	23	,	++FAN-52G1-181X3	3:4												3	&EFS+/148.1
=					-AI_02	13	24	,	++FAN-52G1-181X3	4:3												4	&EFS+/148.1

previous page:
2006

next page:
2008

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-X5	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CT		page: 2007
+	CTRL_1.3	Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5

Kleinspannungssignale

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-148W1	++CONV-148W2									Page / column
				Cable type							Cable type	F-CY-OZ (LiY-CY)	F-CY-OZ (LiY-CY)									
INDUCTOR DC SUB 4_2 TEMPERATURE 4_2					-AI_02	6	25	,	++CONV+IND-217L1.2			1										&EFS+/148.3
=					-AI_02	14	26	,	++CONV+IND-217L1.2			2										&EFS+/148.3
CIR CABINET TEMPERATURE					-AI_02	7	27	,	++CONV+CIR-148B3	+												&EFS+/148.5
=					-AI_02	15	28	,	++CONV+CIR-148B3	-												&EFS+/148.5
INDUCTOR DC SUB 4_3 TEMPERATURE 4_3					-AI_02	8	29	,	++CONV+IND-217L1.3				1									&EFS+/148.7
=					-AI_02	16	30	,	++CONV+IND-217L1.3				2									&EFS+/148.7

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-X5.1

DC Subsystem Spannungsmessung

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC_SUBSYSTEM 1_4.1 voltage			-AI_03	5	1		-AI_24	6			&EFS+/149.0
			-XDC1	6							
			-AI_03	6							
DC_SUBSYSTEM 1_5.1 voltage			-AI_03	7	2		+.4-149U1	14			&EFS+/149.2
			-AI_04	5							
			-AI_03	8							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-150X1

Subsysteme DC Schütz EIN

Function text			++CONV-231W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-231W4	Page / column
			OZ-500	Cable type								OZ-500	
SUBSYSTEM 2_1 CONTACTOR DC+ ON			1		++CONV+CIR-231U1-X3.1	1	1	,	-150K1	14			&EFS+/150.2
=					-195K2	23	2	,	++CONV+CIR-231U1-X3.1	17		17	&EFS+/150.2
SUBSYSTEM 2_1 CONTACTOR DC-ON			4		++CONV+CIR-231U1-X3.1	4	3	,	-150K2	14			&EFS+/150.4
SUBSYSTEM 2_2 CONTACTOR DC+ ON			2		++CONV+CIR-231U1-X3.1	2	4	,	-151K1	14			&EFS+/151.1
=					-151K1	A2	5	,					&EFS+/151.1
SUBSYSTEM 2_3 CONTACTOR DC+ ON			5		++CONV+CIR-231U1-X3.1	5	6	,	-151K2	14			&EFS+/151.3
=			3		++CONV+CIR-231U1-X3.1	3	7	,	-151K3	14			&EFS+/151.4
=					-151K2	A2	8	,					&EFS+/151.4
SUBSYSTEM 2_3 CONTACTOR DC-ON			6		++CONV+CIR-231U1-X3.1	6	9	,	-151K4	14			&EFS+/151.6
=							10	,					&EFS+/151.6

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-150X1	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 2010
Date								+ CTRL_1.3 Main mounting plate total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text	-112W1 / JZ-500	-242W9 / JZ-500	-240W9 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-243W9 / JZ-500	Page / column
FUSE 24V DC CONTROL VOLTAGE			1		+CTRL_2.1-240U1	1	1		-103F1	2			&EFS+/103.2
					+.4-160U1	+							
FUSE 24V DC CONTROL VOLTAGE					-DO_01	L+	2		-101Q1	13			&EFS+/103.2
					-AI_01	L+							
					-101T1	13							
FUSE 24V DC CONTROL VOLTAGE					+.1-84Q1	11	3		-103F1	13			&EFS+/103.2
					-84F2	13							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			2		+CTRL_2.1-240U1	3	4		-102G1	OUTPUT DC 24 V:-			&EFS+/103.3
					-120A1	-X80:2							
					-DI_01	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-DO_01	M	5		+.4-160U1	-			&EFS+/103.3
					-AI_01	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-84K1	A2	6		-X5.1	1			&EFS+/103.3
					+.1-140H1	X2							
					+.2-110U1	M							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE					-XDC2	3	7						&EFS+/103.3
=			GNYE		+CTRL_2.1-240U1	2	PE		-101T1	PE			&EFS+/103.4
					-XE	PE:1							
					-101T1	-"							
Main PLC, SPS, 24V contacts CONTROL VOLTAGE		GNYE			+CTRL_2.1-242U1	2	PE		+CTRL_2.1-243U1	2		GNYE	&EFS+/103.4
	GNYE				+CTRL.1-112A1	PE							

previous page: 2010

next page: 2012

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 2011
Date								+ CTRL_1.3 Main mounting plate total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC1

Steuerspannung 24VDC (USV) DC1

Function text	-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	Cable type							Cable type	
	GNYE		+CTRL_2.1-241U1	2						

previous page: 2011

next page: 2013

Editor	Freqcon_DG	Statron	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC1	20230331_V0.01	= UNIT_01	Converter Container 1	
Date	31.03.2023				& EMZ	Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007	++ CT	page:	2012
Date					+ CTRL_1.3	Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-241W9 1Z-500	-243W9 1Z-500	-242W9 1Z-500	Cable name Cable type	Strip =UNIT_01++CT+CTRL_1.3-XDC2 Steuerspannung 24VDC (USV) DC2 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name Cable type	Page / column
Main PLC, SPS, 24V contacts CONTROL VOLTAGE			1		+CTRL_2.1-242U1	1	1		-103F2	2		&EFS+/103.4
		1			+CTRL_2.1-243U1	1						
BSU, SPARE CONTROL VOLTAGE	1				+CTRL_2.1-241U1	1	2					&EFS+/103.5

previous page: 2012

next page: 2014

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	31.03.2023					& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 2013
Date						+ CTRL_1.3 Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text	-243W9	-242W9	-112W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	
			1		+CTRL.1-112A1	L+						
BSU, SPARE CONTROL VOLTAGE					-186K1	A2	3		-XDC1	7		&EFS+/103.5
		2			+CTRL_2.1-242U1	3						
	2				+CTRL_2.1-243U1	3						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC2	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CT		page: 2014
+	CTRL_1.3	Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC2

Steuerspannung 24VDC (USV) DC2

Function text		-112W1	-241W9	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
		JZ-500	JZ-500	Cable type							Cable type	
BSU, SPARE CONTROL VOLTAGE			2		+CTRL_2.1-241U1	3	4	⌟	-XDC3	3		&EFS+/103.5
		2			+CTRL.1-112A1	M						

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC3

Steuerspannung 24VDC (USV) DC3

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
BSU, SPARE CONTROL VOLTAGE			-111A1	3	1		-103F3	2			&EFS+/103.6
			-173K3	21							
			+.2-114A1	-X80:1							
BSU, SPARE CONTROL VOLTAGE			-X3	31	2		+.4-306K1	11			&EFS+/103.6
			-195K1	83							
			-115A1	V+							
PRECHARGE CONTROL VOLTAGE			-X3	32	3		-XDC2	4			&EFS+/103.7
			-111A1	4							
			+.2-114A1	-X80:2							
PRECHARGE CONTROL VOLTAGE			-195K1	43	4		-XDC4	3			&EFS+/103.7
			+.4-171K1	x2							
			-115A1	V-							

previous page: 2015

next page: 2017

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC3	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	31.03.2023					& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 2016
Date						+ CTRL_1.3 Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC4

Steuerspannung 24VDC (USV) DC4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
PRECHARGE CONTROL VOLTAGE			-195K1	33	1		-103F4	2			&EFS+/103.8
			-195K3	A1							
			-X3.10	12							
PRECHARGE CONTROL VOLTAGE			-X3.11	12	2		-X3.13	12			&EFS+/103.8
			-X3	5							
			-X3.12	12							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-139K2	A2	3		-XDC3	4			&EFS+/103.9
			-195K3	A2							
			-195K1	23							
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-X3	21	4						&EFS+/103.9
			+.4-306K1	A2							

previous page: 2016

next page: 2018

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.1

Steuerspannung 24VDC (USV) DC5.1

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			-186K1	1	1	,	-103F5	2			&EFS+/103.9
			-186K1	3							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XDC5.2

Steuerspannung 24VDC (USV) DC5.2

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
DC CONTACTORS, RELAYS, CONTROL VOLTAGE			+.2-110U1	+24V	1	,	-186K1	2			&EFS+/103.9
			-120A1	-X80:1							
			-DI_01	L+							

previous page: 2018

next page: 2020

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XDC5.2	20230331_V0.01	= UNIT_01 Converter Container 1	
Date	31.03.2023					& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page: 2019
Date						+ CTRL_1.3 Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XE

Hauptstromversorgung 400V AC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
					1		-84F2	2		-84W1	&EFS+/84.0
Supply Control Cabinet 3-phase 400V AC					N		-X1	7			&EFS+/84.1
=					N		-XT	2			&EFS+/84.2
=			-190XT1	2	N						&EFS+/84.2
=					PE		+.1-84Q1			GNYE	&EFS+/84.2
=					PE		-XDC1	PE			&EFS+/84.2
=				PE	PE						&EFS+/84.3
					2		-190F2	1			&EFS+/84.0
					3		-84F2	4			&EFS+/84.0
Supply Control Cabinet 3-phase 400V AC					4		-190F3	1			&EFS+/84.1
=					5		-84F2	6			&EFS+/84.1
=					6		-190F1	1			&EFS+/84.1

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text	-278W1 1Z-500	++CONV-281W1 1Z-500	++CONV-279W1 1Z-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	++CONV-279W1 1Z-500	++CONV-281W1 1Z-500	-278W1 1Z-500	Page / column
CON Fans 1-5 in door			1		++CONV+CON-279M1	L	1		-135K1	14					&EFS+/183.1
=			2		++CONV+CON-279M1	N	2		-XE	N:1					&EFS+/183.1
=							PE		++CONV+CON-279M1	PE		GNYE			&EFS+/183.1
=		1			++CONV+CIR-281M1	L	3		-135K3	14					&EFS+/183.3
CIR Fans 1-3 in door		2			++CONV+CIR-281M1	N	4								&EFS+/183.4
=							PE		++CONV+CIR-281M1	PE			GNYE		&EFS+/183.4
FAN 1 CONTROL CABINET	1				+.1-278M1	L	5		-135K2	14					&EFS+/185.1
=	2				+.1-278M1	N	6								&EFS+/185.1
=							PE		+.1-278M1	PE				GNYE	&EFS+/185.1

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023						& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007	++ CT page: 2021
Date							+ CTRL_1.3 Main mounting plate total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XT

Transfer Klemmenblock 24VDC/230VAC

Function text		++CONV-80W2	-185W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-185W1	++CONV-80W2	Page / column
		JZ-500	JZ-500	Cable type							Cable type	JZ-500	JZ-500	
HEATING CONTROL CABINET			1		+.2-185R1	1	7		-185B1	2				&EFS+/185.7
=			2		+.2-185R1	2	8							&EFS+/185.7
=							PE		+.2-185R1	PE		GNYE		&EFS+/185.7
230V AC for Circuit Breaker 1		1			++CONV+CIR-80Q1	X5_2	9		-187F1	2				&EFS+/187.1
=		2			++CONV+CIR-80Q1	X5_1	10							&EFS+/187.1
=							PE						GNYE	&EFS+/187.1
230V AC for Circuit Breaker Optional							11							&EFS+/187.2
=							12							&EFS+/187.2
=							PE							&EFS+/187.2
24V DC for Circuit Breaker 2 Optional							13		-187F2	2				&EFS+/187.4
=							14		-101T1	-'				&EFS+/187.4
24V DC for Circuit Breaker Optional							15							&EFS+/187.5
=							16							&EFS+/187.5

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XT	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CT		page: 2022
+	CTRL_1.3	Main mounting plate	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-190XT1

230VAC Beleuchtung/Klimaanlage Container/Schrank

Function text		-190W1	+.5-190H1-W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
		NYM-J		Cable type							Cable type	
230V AC for Container Air Conditioning							1	,	-190F1	2		&EFS+/190.1
=							2	●	-XE	N:2		&EFS+/190.1
=							PE	,				&EFS+/190.1
SPARE							3	,	-135K4	14		&EFS+/190.3
=							4	●	-190F3	N		&EFS+/190.3
=							PE	,				&EFS+/190.3
Light Control cabinet			BN		+.5-190H1		5	●	-190F3	2		&EFS+/190.5
=							PE	,	-190X10	PE		&EFS+/190.5
=			LBU		+.5-190H1		6	●	-190F3	N.		&EFS+/190.5
230V AC for Container light, socket		BN			++Container-U1		7	●	-190X10	1		&EFS+/190.7
=		LBU			++Container-U1		8	●	-190X10	2		&EFS+/190.7
=		GNYE			++Container-U1		PE	,				&EFS+/190.7

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.3-XV

Suppression TVS Diode

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
Suppression TVS Diode bi-directional 47 V					1		-171K3	14			&EFS+/171.8
=					5						&EFS+/151.7
=					6						&EFS+/151.7
=					7						&EFS+/151.7
=					8						&EFS+/151.8
=					9						&EFS+/134.5
=					2		-173K3	14			&EFS+/173.9
=					3						&EFS+/150.7
=					4						&EFS+/150.7

previous page: 2023

next page: +.4/1000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.3-XV	20230331_V0.01	= UNIT_01	Converter Container 1	
Date	31.03.2023							& EMZ	Terminals	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT	page:	2024
Date								+ CTRL_1.3	Main mounting plate	total: 423

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-350X1.21	Subsysteme DC Schütz EIN	1	10	0	0	20	=UNIT_01&EMZ++CT+CTRL_1.4/2000
-350X1.22		11	13	0	0	4	=UNIT_01&EMZ++CT+CTRL_1.4/2001
-XE2	Gleichstromversorgung 1000VDC	1	7	0	0	7	=UNIT_01&EMZ++CT+CTRL_1.4/2002
-XV.20		1	12	0	0	12	=UNIT_01&EMZ++CT+CTRL_1.4/2003

previous page:
+.3/2024

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-350X1.21

Subsysteme DC Schütz EIN

Function text		++CONV-237W4	++CONV-227W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-227W4	Page / column
		OZ-500	OZ-500	Cable type							Cable type	OZ-500	
SUBSYSTEM 3_1 CONTACTOR DC+ ON			1		++CONV+CIR-227U1-X3.1	1	1	,	-350K1	14			&EFS+/350.2
=					-350K1	A2	2	,	++CONV+CIR-227U1-X3.1	17		17	&EFS+/350.2
SUBSYSTEM 3_1 CONTACTOR DC-ON			4		++CONV+CIR-227U1-X3.1	4	3	,	-350K2	14			&EFS+/350.4
							4	,	-351K1	14			&EFS+/351.1
SUBSYSTEM 4_2 CONTACTOR DC+ ON		2			++CONV+CIR-237U1-X3.1	2	4	,	-353K1	14			&EFS+/353.1
					+.3-195K2	43	5	,					&EFS+/351.1
								,					
SUBSYSTEM 4_2 CONTACTOR DC+ ON					-353K1	A2	5	,					&EFS+/353.1
SUBSYSTEM 3_3 CONTACTOR DC+ ON							6	,	-351K2	14			&EFS+/351.3
SUBSYSTEM 4_3 CONTACTOR DC+ ON		5			++CONV+CIR-237U1-X3.1	5	6	,	-353K2	14			&EFS+/353.3
SUBSYSTEM 3_3 CONTACTOR DC+ ON			3		++CONV+CIR-227U1-X3.1	3	7	,	-351K3	14			&EFS+/351.4
								,					
SUBSYSTEM 4_3 CONTACTOR DC+ ON		3			++CONV+CIR-237U1-X3.1	3	7	,	-353K3	14			&EFS+/353.4
SUBSYSTEM 3_3 CONTACTOR DC-ON							8	,					&EFS+/351.5
SUBSYSTEM 4_3 CONTACTOR DC+ ON					-353K2	A2	8	,					&EFS+/353.4
SUBSYSTEM 3_3 CONTACTOR DC-ON			6		++CONV+CIR-227U1-X3.1	6	9	,	-351K4	14			&EFS+/351.6
								,					
SUBSYSTEM 4_3 CONTACTOR DC-ON		6			++CONV+CIR-237U1-X3.1	6	9	,	-353K4	14			&EFS+/353.6
SUBSYSTEM 3_3 CONTACTOR DC-ON							10	,					&EFS+/351.7
SUBSYSTEM 4_3 CONTACTOR DC-ON							10	,					&EFS+/353.6

previous page: 1000

next page: 2001

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.4-350X1.21	20230331_V0.01	= UNIT_01 Converter Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CT page: 2000
Date								+ CTRL_1.4 Right side total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-350X1.22

Function text			++CONV-237W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CONV-237W4	Page / column
			OZ-500	Cable type							Cable type	OZ-500	
SUBSYSTEM 4_1 CONTACTOR DC+ ON			1		++CONV+CIR-237U1-X3.1	1	11	,	-352K1	14			&EFS+/352.1
SUBSYSTEM 4_1 CONTACTOR DC-ON					-352K1	A2	12	,	++CONV+CIR-237U1-X3.1	17		17	&EFS+/352.2
=			4		++CONV+CIR-237U1-X3.1	4	13	,	-352K2	14			&EFS+/352.3
								,					

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-XE2

Gleichstromversorgung 1000VDC

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
RESISTORS FOR DISCHARGING UDC+			-173R2		1		-173R1				&EFS+/173.2
RESISTORS FOR DISCHARGING UDC-			-173R4		2		-173R3				&EFS+/173.3
=			-173R4		3		-160U1	15			&EFS+/173.3
=			-173R2		4		-160U1	44			&EFS+/173.3
=			+CTRL_2.1-162U1	15	5		+CTRL_2.1-161U1	15			&EFS+/173.3
=			+CTRL_2.1-163U1	15	6		-189X1	4			&EFS+/173.3
=					7		++CONV+CON-N	N			&EFS+/173.4

previous page: 2001

next page: 2003

| | | | | |

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++CT+CTRL_1.4-XV.20

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
Suppression TVS Diode bi-directional 47 V					1						&EFS+/350.7
=					2						&EFS+/350.7
=					3						&EFS+/351.7
=					4						&EFS+/351.7
=					5						&EFS+/351.8
=					6						&EFS+/351.8
=					7						&EFS+/352.7
=					8						&EFS+/352.7
=					9						&EFS+/353.7
=					10						&EFS+/353.7
=					11						&EFS+/353.7
=					12						&EFS+/353.8

previous page:
2002

next page:
++FAN+/1000

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++CT+CTRL_1.4-XV.20	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	CT		page: 2003
+	CTRL_1.4	Right side	total: 423

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-52G1-181X1	400VAC Wassersystem	1	PE	3	1	13	=UNIT_01&EMZ++FAN/2000
-52G1-181X3	Rückmeldung Druckschalter Wassersystem	1	4	0	0	4	=UNIT_01&EMZ++FAN/2001

previous page:
++CT+CTRL_1.4/2003

next page:
2000

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++FAN+-52G1-181X1

400VAC Wassersystem

Function text	-52G1-182W1	-52G1-181W5	-52G1-181W2	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CT-181W1	Page / column
	1Z-600	1Z-600	1Z-600	Cable type							Cable type	1Z-600	
PUMP			1		-52G1-181M1	U1	1	,	++CT+CTRL_1.3-X1	1		1	&EFS++CT/181.1
=			2		-52G1-181M1	V1	2	,	++CT+CTRL_1.3-X1	2		2	&EFS++CT/181.1
=			3		-52G1-181M1	W1	3	,	++CT+CTRL_1.3-X1	3		3	&EFS++CT/181.1
FUSE FOR PUMP		1			-52G1-181R1	x1	4	,	++CT+CTRL_1.3-X1	4		4	&EFS++CT/181.3
HEATER		2			-52G1-181R1	x3	5	,	++CT+CTRL_1.3-X1	5		5	&EFS++CT/181.4
=		3			-52G1-181R1	x5	6	,	++CT+CTRL_1.3-X1	6		6	&EFS++CT/181.4
=		4			-52G1-181R1	x6	7	,	++CT+CTRL_1.3-X1	7		7	&EFS++CT/181.4
FAN 1 HEAT EXCHANGER	1				-52G1-182M1	U1	8	,	++CT+CTRL_1.3-X1	8		8	&EFS++CT/182.1
=	2				-52G1-182M1	V1	9	,	++CT+CTRL_1.3-X1	9		9	&EFS++CT/182.1
=	3				-52G1-182M1	W1	10	,	++CT+CTRL_1.3-X1	10		10	&EFS++CT/182.1
PUMP			GNYE		-52G1-181M1	PE	PE	,	++CT+CTRL_1.3-X1	PE		GNYE	&EFS++CT/181.1
HEATER		GNYE			-52G1-181R1	PE	PE	,					&EFS++CT/181.4
FAN 1 HEAT EXCHANGER	GNYE				-52G1-182M1	PE	PE	,					&EFS++CT/182.1
FAN 1 HEAT EXCHANGER	GNYE				-52G1-182M1	PE	PE	,					&EFS++CT/182.1

previous page: 1000

next page: 2001

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_01++FAN+-52G1-181X3

Rückmeldung Druckschalter Wassersystem

Function text		++CT-181W3	-52G1-181W4	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	++CT-181W3	Page / column
		OZ-600	OZ-500	Cable type							Cable type	OZ-600	
PRESSURE SWITCH			1		-52G1-181S1	13	1	,	++CT+CTRL_1.3-X3	23		1	&EFS++CT/181.6
=			2		-52G1-181S1	14	2	,	++CT+CTRL_1.3-X3	24		2	&EFS++CT/181.6
COOLING WATER TEMPERATURE		3			++CT+CTRL_1.3-X5	23	3	,	-52G1-148B1	+			&EFS++CT/148.1
=		4			++CT+CTRL_1.3-X5	24	4	,	-52G1-148B1	-			&EFS++CT/148.1

previous page:
2000

next page:
=UNIT_02&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_01++FAN+-52G1-181X3	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_01	Converter Container 1	
&	EMZ	Terminals	
++	FAN	FAN	page: 2001
+			total: 423

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	BATTERY CONTAINER 1	
Circuit diagram No:	10354_23A2007	ANL2_20230331_V0.01

Producer (company):	Freqcon GmbH	53396
		ASC 5XXXX
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	Container Ausbau 53043
Type:	BESS MSC-1000-620-8	
Project manager:	Freqcon_CP	

created on:	17.09.2019		
edited on:	31.03.2023	edited by: Freqcon_DG	total pages: 423

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	30.03.2023	Freqcon_DG
&EAB		Contents		
	1	INDEX	31.03.2023	Freqcon_DG
	2	INDEX	31.03.2023	Freqcon_DG
	3	INDEX	31.03.2023	Freqcon_DG
	4	INDEX	31.03.2023	Freqcon_DG
	5	INDEX	31.03.2023	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	04.01.2023	Freqcon_WF
	6a	Specification Earthing	04.01.2023	Freqcon_WF
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	31.03.2023	Freqcon_DG
&ELU		Cabinet Overview		
	5a	Container overview	31.03.2023	Freqcon_DG
&EFS		Circuit diagram		
	190	CONTAINER COOLING, LIGHT 230V SUPPLY	30.03.2023	Freqcon_DG
	278	EARTHING CONTAINER	30.03.2023	Freqcon_DG
	290	BATTERY CABINETS 1-3	31.03.2023	Freqcon_DG
	291	BATTERY CABINETS 4-5	31.03.2023	Freqcon_DG
	292	BATTERY CABINETS 6-8	31.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS		Circuit diagram		
	293	BATTERY CABINETS 9-11	31.03.2023	Freqcon_DG
&EFS ++ASC		Circuit diagram auxillary cabinet		
	611	ETHERNET SWITCH	29.03.2023	Freqcon_DG
	613	ETHERNET / PROFINET ISOLATOR	29.03.2023	Freqcon_DG
	630	FUSES FEEDBACK	30.03.2023	Freqcon_DG
	669	SMOKE POTENTIAL-FREE CONTACTS	31.03.2023	Freqcon_DG
	670	GAS POTENTIAL-FREE CONTACTS	29.03.2023	Freqcon_DG
	684	AUXILIARY SUPPLY 400V AC	30.03.2023	Freqcon_DG
	685	BATTERY CABINETS MEASURE N	30.03.2023	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	30.03.2023	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	30.03.2023	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	30.03.2023	Freqcon_DG
&EPC		Parts List		
	1	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	30.03.2023	Freqcon_DG
	2	PARTS LIST	30.03.2023	Freqcon_DG
	3	PARTS LIST	30.03.2023	Freqcon_DG
	4	PARTS LIST	30.03.2023	Freqcon_DG
&EPA		Summarized part list		
	1	SUMMARIZED PARTS LIST	30.03.2023	Freqcon_DG

Editor	Freqcon_DG			Statron	FREQCON	INDEX	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023							& EAB Contents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2
Date								+ total: 423

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	30.03.2023	Freqcon_DG
&EMB		Cable list		
	1	CABEL LIST	30.03.2023	Freqcon_DG
	2	CABEL LIST	30.03.2023	Freqcon_DG
	3	CABEL LIST	30.03.2023	Freqcon_DG
	4	CABEL LIST	30.03.2023	Freqcon_DG
	5	CABEL LIST	30.03.2023	Freqcon_DG
	6	CABEL LIST	30.03.2023	Freqcon_DG
	7	CABEL LIST	31.03.2023	Freqcon_DG
	8	CABEL LIST	31.03.2023	Freqcon_DG
	9	CABEL LIST	31.03.2023	Freqcon_DG
	10	CABEL LIST	31.03.2023	Freqcon_DG
	11	CABEL LIST	31.03.2023	Freqcon_DG
	12	CABEL LIST	31.03.2023	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	31.03.2023	Freqcon_DG
	2	CABEL LIST	31.03.2023	Freqcon_DG
	3	CABEL LIST	31.03.2023	Freqcon_DG
	4	CABEL LIST	31.03.2023	Freqcon_DG
	5	CABEL LIST	31.03.2023	Freqcon_DG
	6	CABEL LIST	31.03.2023	Freqcon_DG
	7	CABEL LIST	31.03.2023	Freqcon_DG
	8	CABEL LIST	31.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++EXTERN		Cable list		
	1	CABEL LIST	30.03.2023	Freqcon_DG
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_02++ASC+-630X3 - =UNIT_02++ASC+-690XT1	31.03.2023	Freqcon_DG
	2000	Klemmenplan =UNIT_02++ASC+-630X3	31.03.2023	Freqcon_DG
	2001	Klemmenplan =UNIT_02++ASC+-XE	31.03.2023	Freqcon_DG
	2002	Klemmenplan =UNIT_02++ASC+-XF3.1	31.03.2023	Freqcon_DG
	2003	Klemmenplan =UNIT_02++ASC+-XF3.2	31.03.2023	Freqcon_DG
	2004	Klemmenplan =UNIT_02++ASC+-XF3.3	31.03.2023	Freqcon_DG
	2005	Klemmenplan =UNIT_02++ASC+-XF3.4	31.03.2023	Freqcon_DG
	2006	Klemmenplan =UNIT_02++ASC+-XN	31.03.2023	Freqcon_DG
	2007	Klemmenplan =UNIT_02++ASC+-XN	31.03.2023	Freqcon_DG
	2008	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2009	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2010	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2011	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2012	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2013	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2014	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2015	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2016	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2017	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2018	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2019	Klemmenplan =UNIT_02++ASC+-369XT	31.03.2023	Freqcon_DG
	2020	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2021	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2022	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2023	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2024	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2025	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2026	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2027	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2028	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2029	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2030	Klemmenplan =UNIT_02++ASC+-687XT1	31.03.2023	Freqcon_DG
	2031	Klemmenplan =UNIT_02++ASC+-690XT1	31.03.2023	Freqcon_DG

previous page: 4

next page: &EAC/1a

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/5

next page: 6a

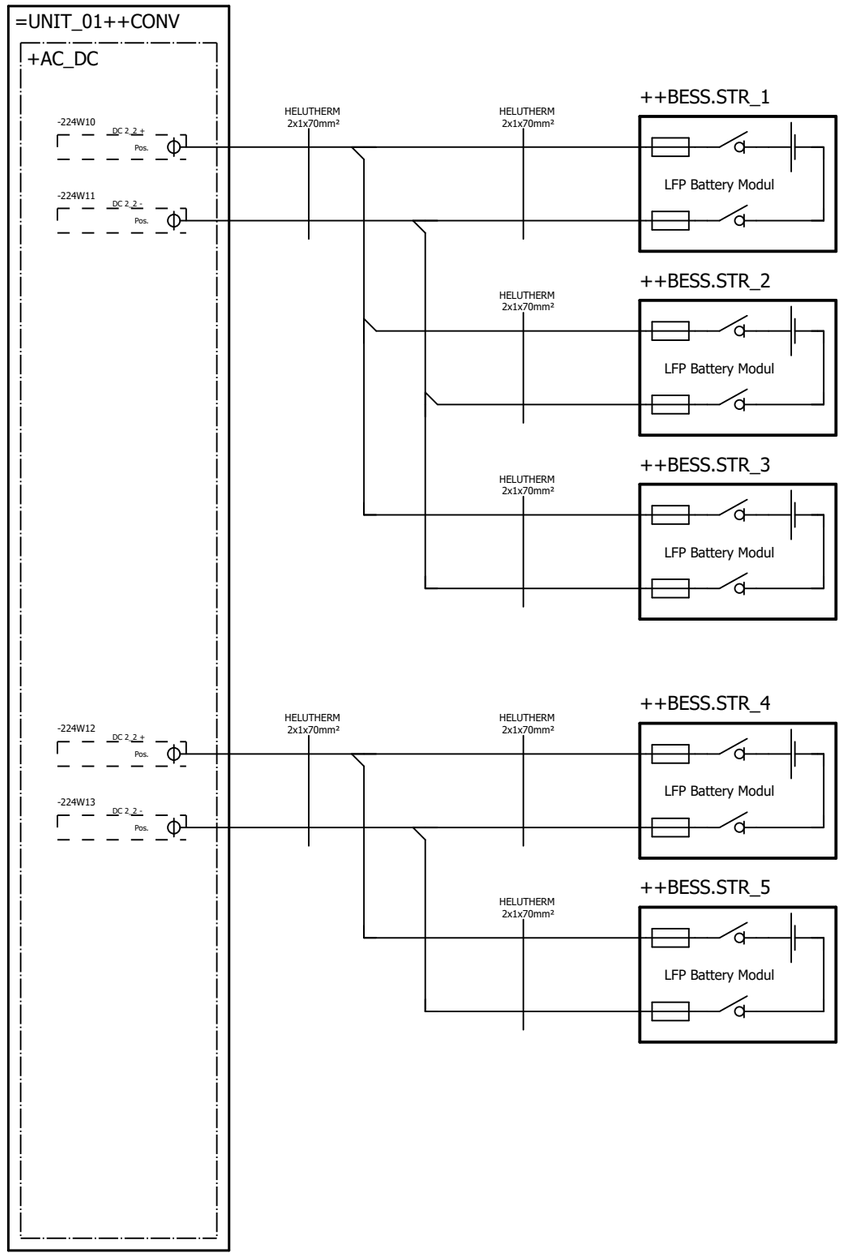
SPECIFICATION of grounding

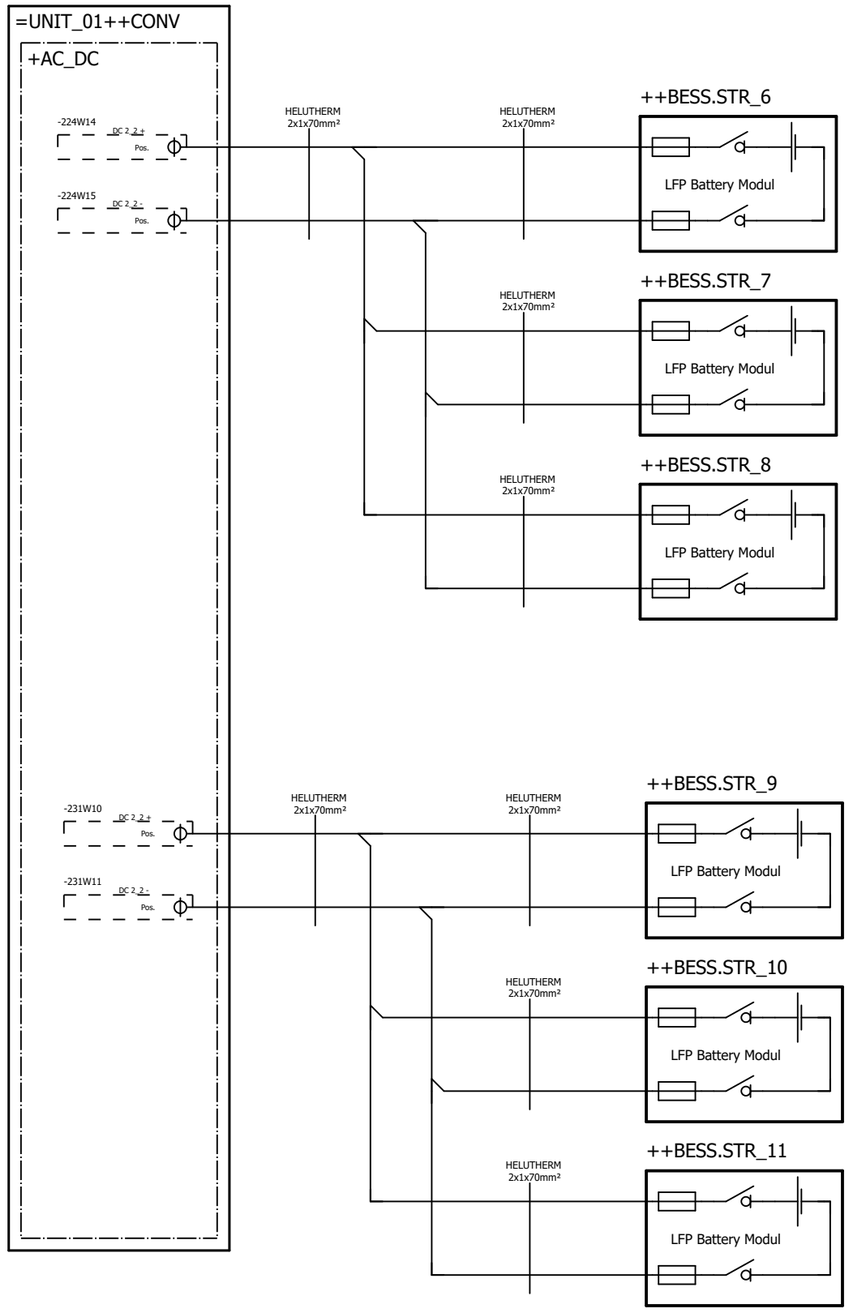
	from frame to			
⏚1	roof & side walls & doors	EVD_1	Flachband	2x25 mm²
⏚2	frame	EVD_2	Flachband	2x25 mm²
⏚3	base	EVD_3	Flachband	2x25 mm²
⏚4	Mounting plate & partitions	EVD_4	H07-V-K	2x25 mm²
⏚5	inductors	EVD_5	H07-V-k	2x25 mm²
⏚6	Powerstack	EVD_6	H07-V-K	2x25 mm²
⏚7	DC Switch & Fuse	EVD_7	H07-V-K	2x25 mm²
⏚8	AC Filter	EVD_8	H07-V-K	2x25 mm²
⏚9	circuit-breaker	EVD_9	H07-V-K	2x25 mm²
⏚10	Freqcon_Fast_Disconektor	EVD_10	H07-V-K	2x25 mm²
⏚11	Freqcon_Rectifier_Modul	EVD_11	H07-V-K	2x25 mm²
⏚12	capacitor banks	EVD_12	H07-V-K	2x25 mm²
⏚13	water distributor	EVD_13	H07-V-K	2x25 mm²
⏚14	SPARE	EVD_14	H07-V-K	2x25 mm²
⏚15	SPARE	EVD_15	H07-V-K	2x25 mm²
⏚16	SPARE	EVD_16	H07-V-K	2x25 mm²
⏚17	SPARE	EVD_17	H07-V-K	2x25 mm²
⏚18	SPARE	EVD_18	H07-V-K	2x25 mm²
	from door to			
⏚19	PROFINET IRT IGBT Interface	EVD_19	H07-V-K	1,5 mm²
⏚20	HMI	EVD_20	H07-V-K	1,5 mm²
⏚21	SPARE	EVD_21	H07-V-K	??? mm²
⏚22	SPARE	EVD_22	H07-V-K	??? mm²

previous page: 1a

next page: &EFA/1a

Single line diagram

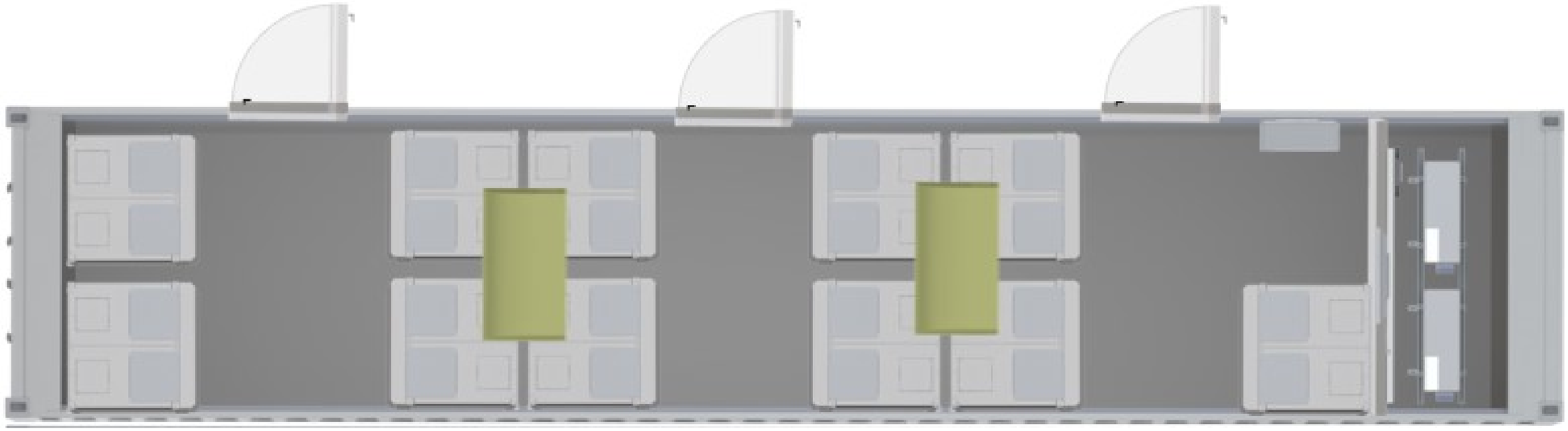




previous page:
&EAC/6a

next page:
&ELU/5a

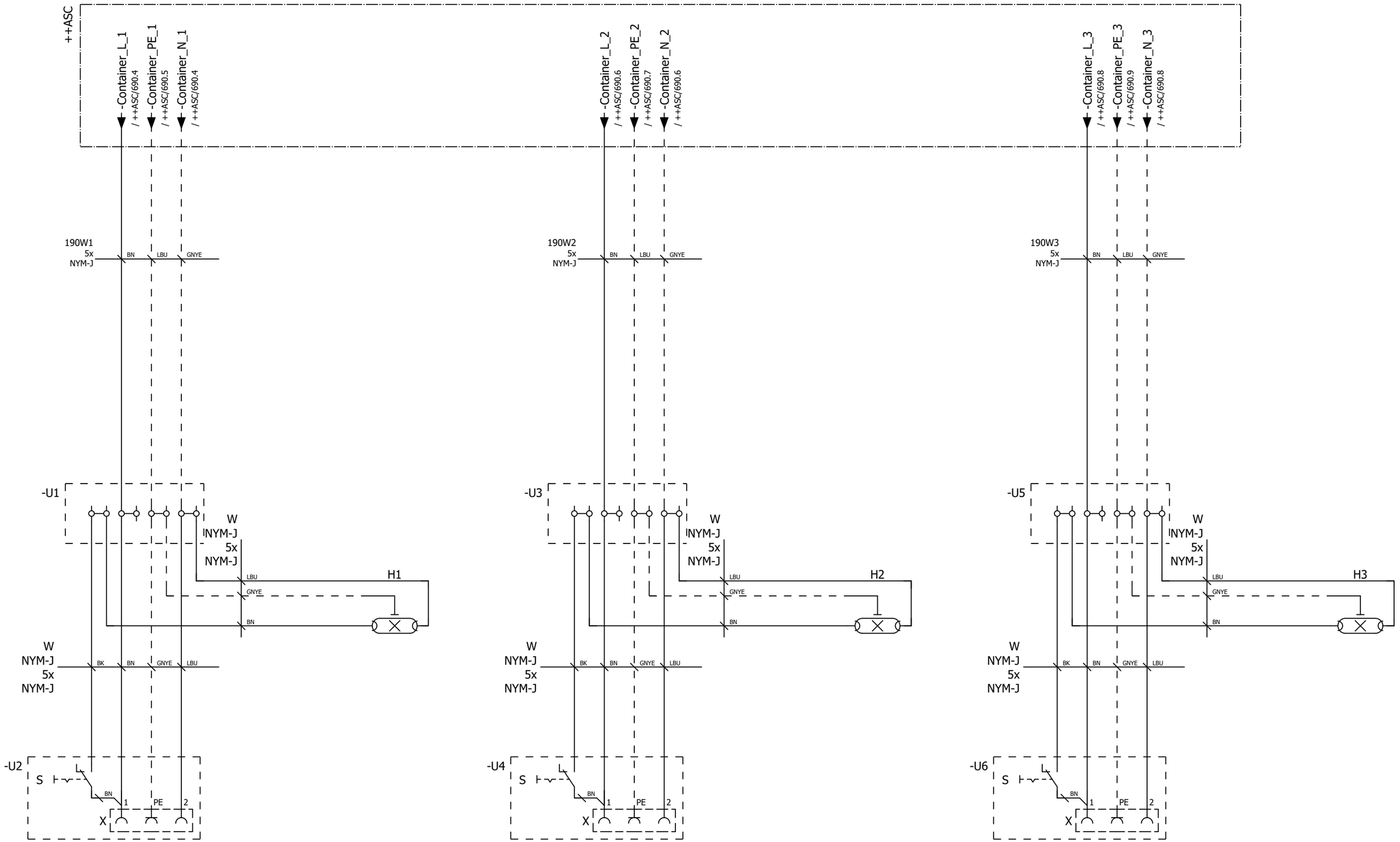
Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	ANL2_20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 1a
Date								+ total: 423



previous page:
&EFA/1a

next page:
&EFS/190

Editor	Freqcon_DG			Statron	FREQCON	Container overview	ANL2_20230331_V0.01	= UNIT_02	Battery Container 1
Date	31.03.2023	Norm						& ELU	Cabinet Overview
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 423



230V AC for
Container light, socket

230V AC for
Container light, socket

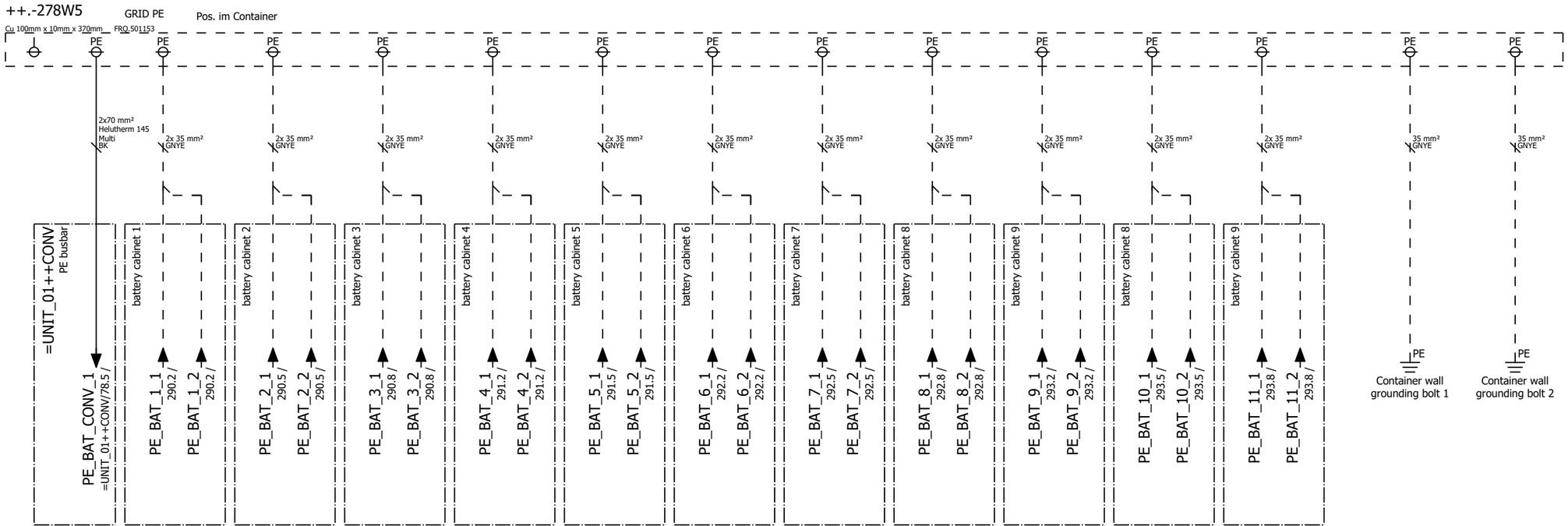
230V AC for
Container light, socket

previous page:
&ELU/5a

next page:
278

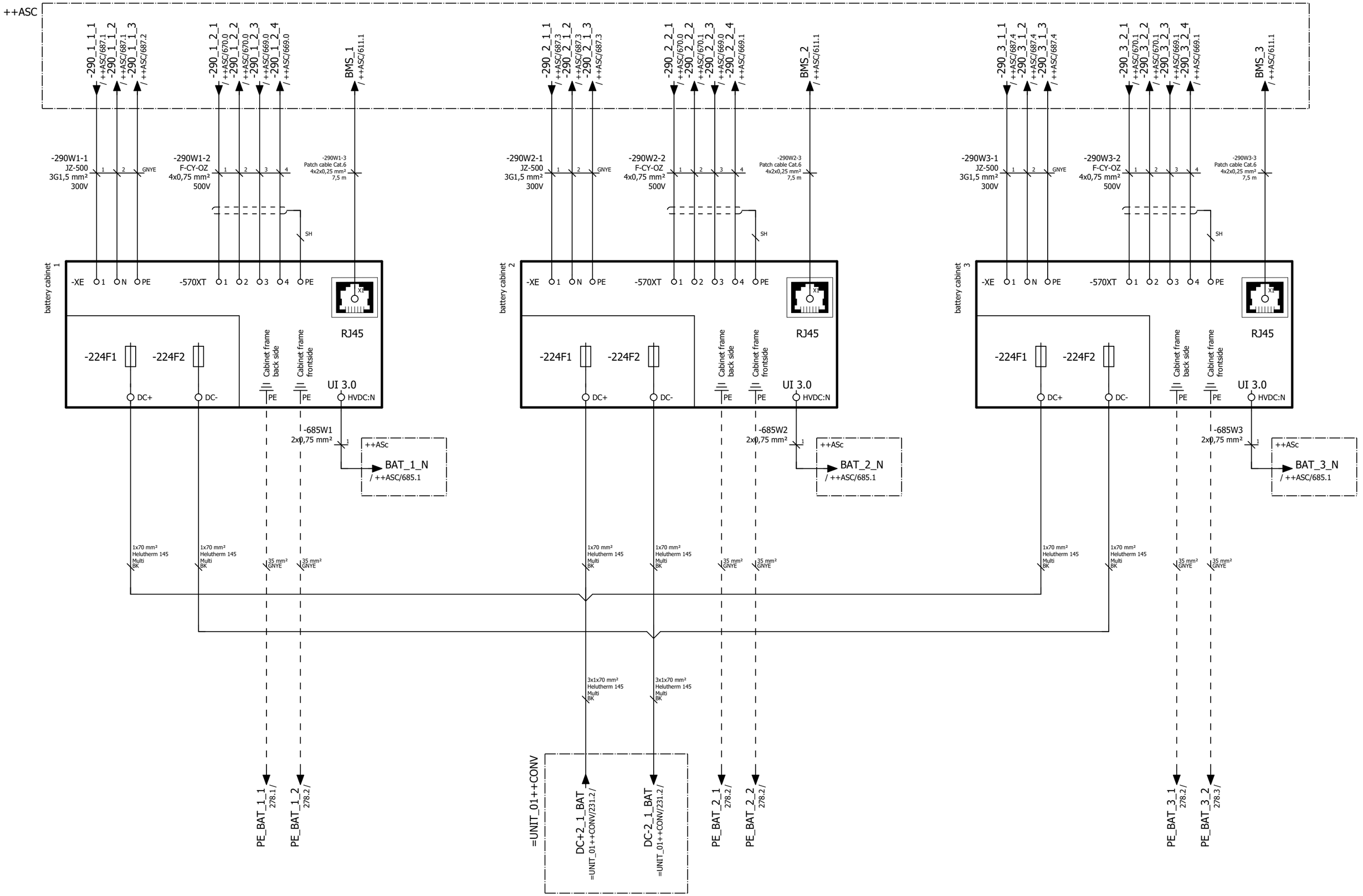
Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING, LIGHT 230V SUPPLY	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 190
Date								+	total: 423

Busbars PE



previous page: 190

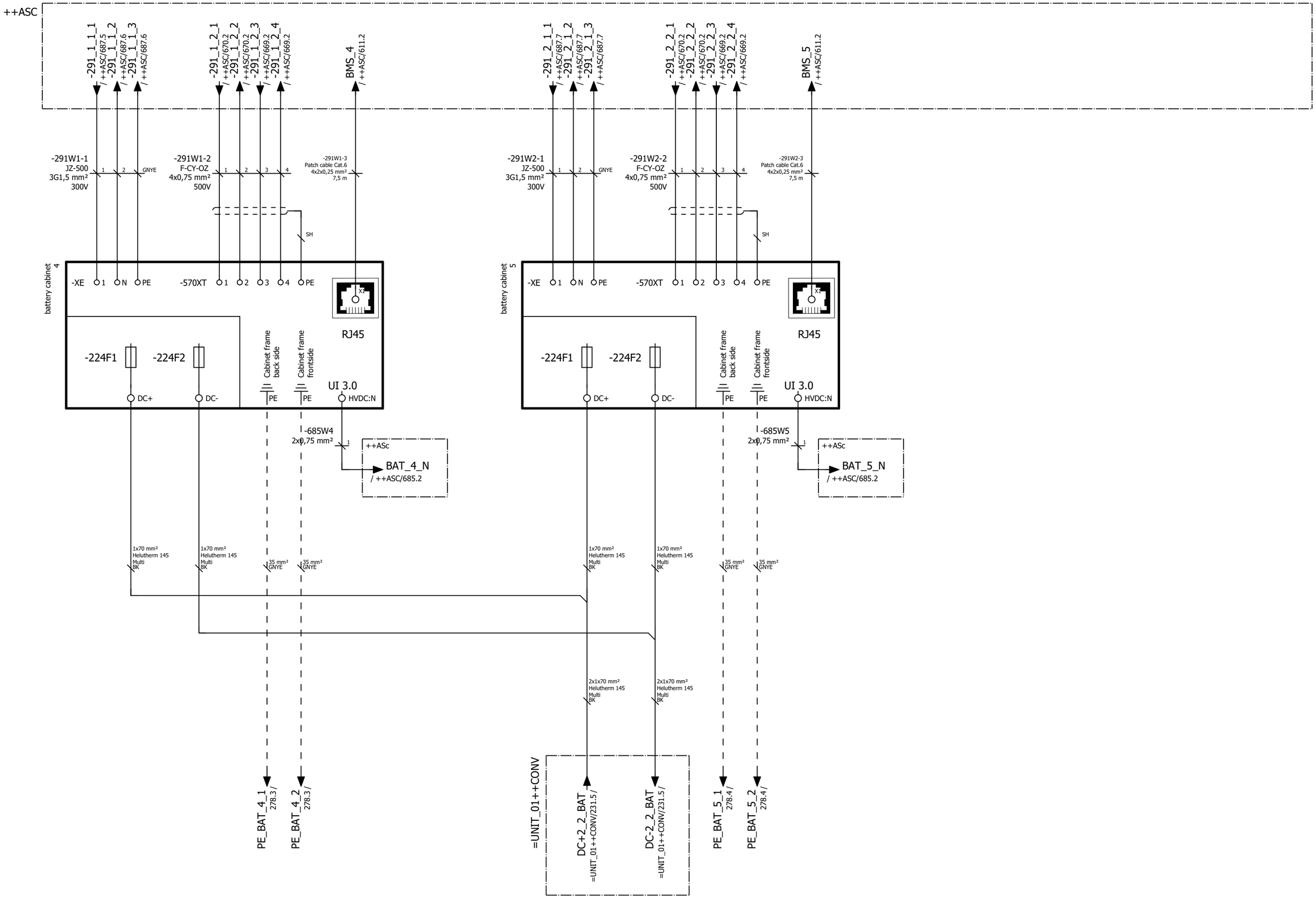
next page: 290



previous page: 278

next page: 291

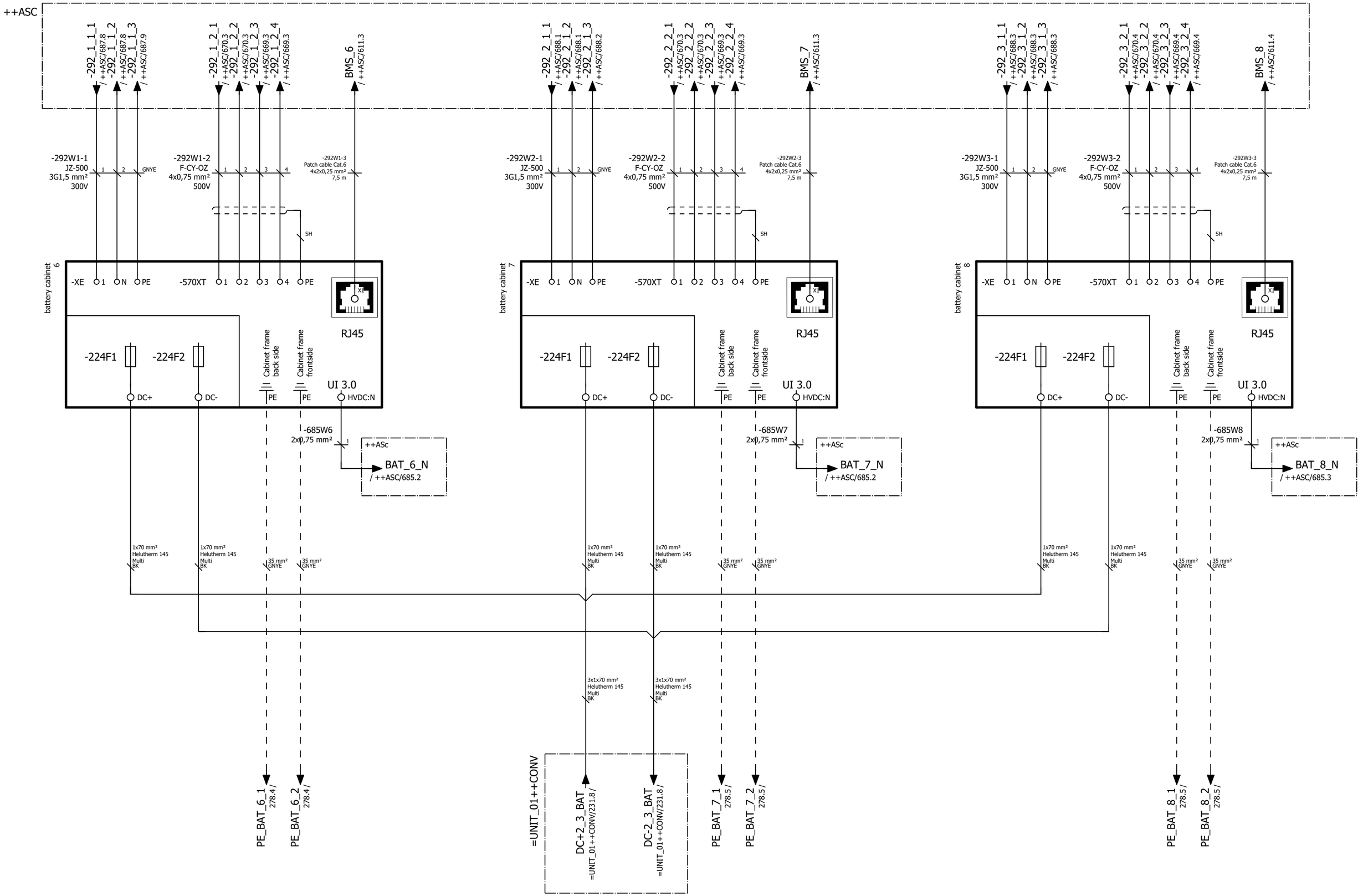
Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS 1-3	20230331_V0.01	= UNIT_02	Battery Container 1
Date	31.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 290
Date								+	total: 423



previous page: 290

next page: 292

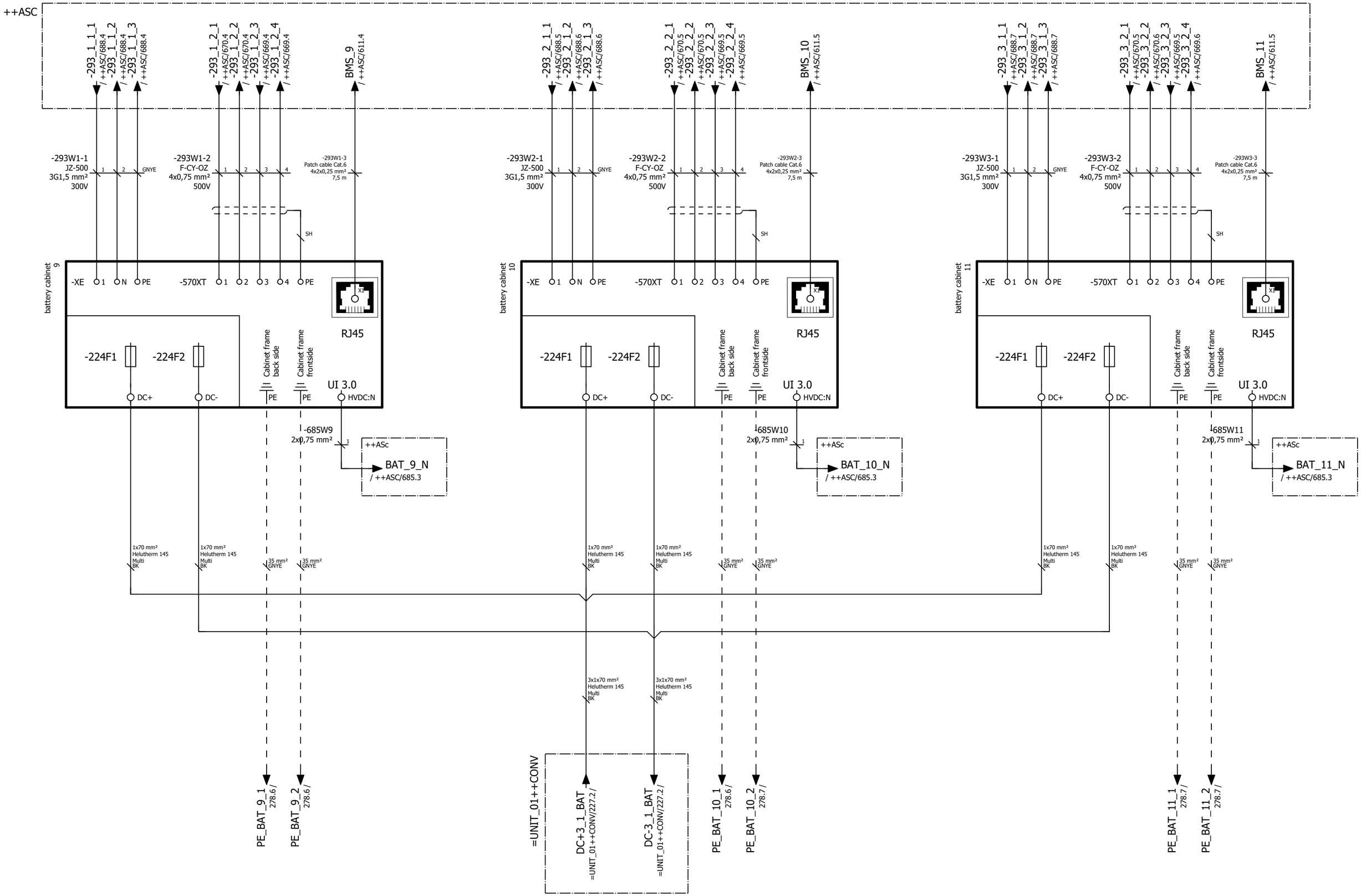
Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS 4-5	20230331_V0.01	= UNIT_02	Battery Container 1
Date	31.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 291
Date								+	total: 423



previous page: 291

next page: 293

Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS 6-8	20230331_V0.01	= UNIT_02	Battery Container 1
Date	31.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 292
Date								+	total: 423



previous page: 292

next page: ++ASC/611

Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS 9-11	20230331_V0.01	= UNIT_02	Battery Container 1
Date	31.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 293
Date								+	total: 423

-3L+1
630.1 /
-3M1
630.2 /

0,75 mm² BU
0,75 mm² BU/WH

-611A1

1 UB2
2 0V
3 UB1
4 0V
5 FE

MURR ELEKTRONIK
stay connected

16 port
unmanaged
switch
58174

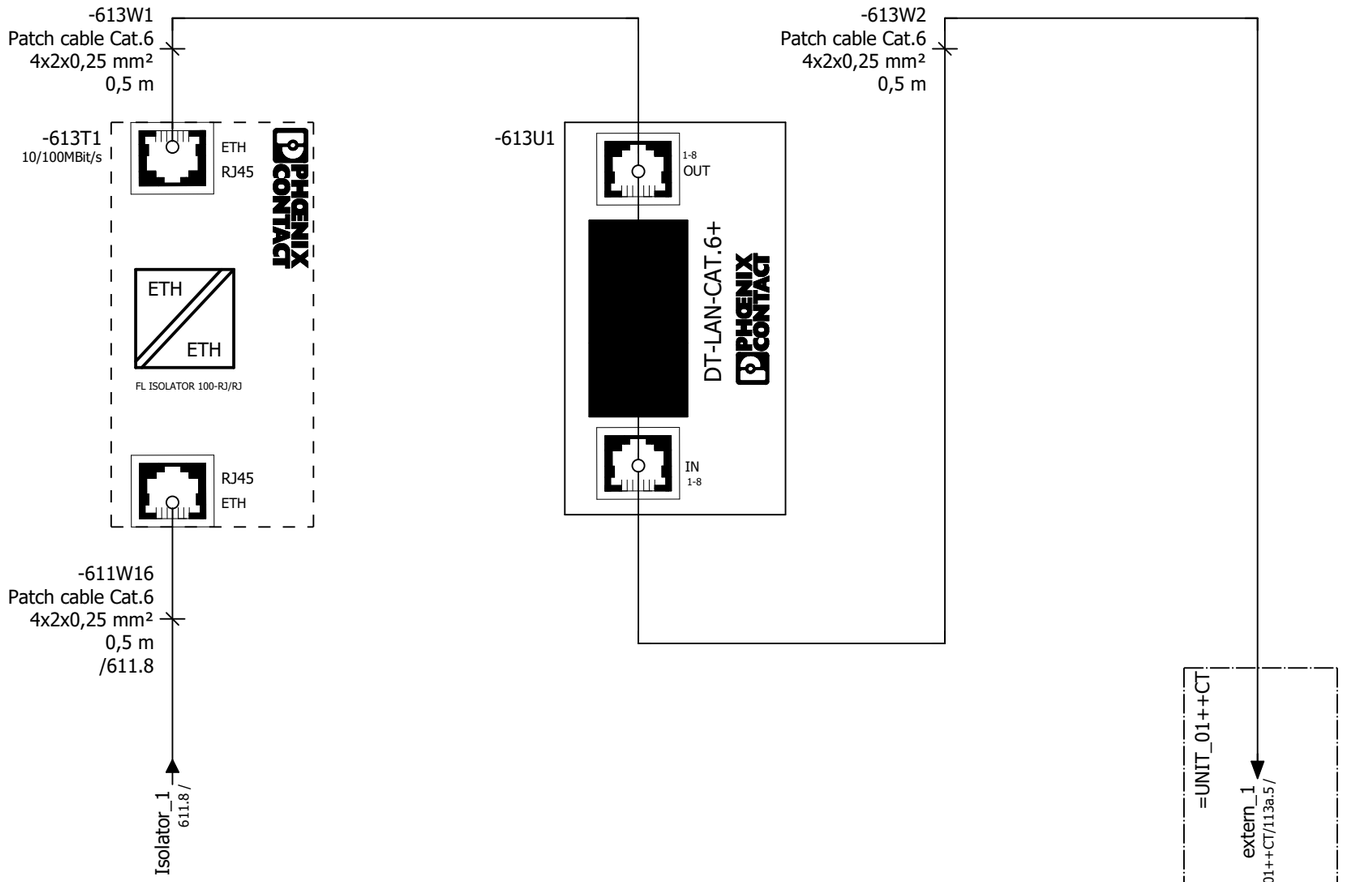
RJ45 PORT 1 X1 1-16
RJ45 PORT 2 X2 1-16
RJ45 PORT 3 X3 1-16
RJ45 PORT 4 X4 1-16
RJ45 PORT 5 X5 1-16
RJ45 PORT 6 X6 1-16
RJ45 PORT 7 X7 1-16
RJ45 PORT 8 X8 1-16
RJ45 PORT 9 X9 1-16
RJ45 PORT 10 X2 1-16
RJ45 PORT 11 X3 1-16
RJ45 PORT 12 X4 1-16
RJ45 PORT 13 X5 1-16
RJ45 PORT 14 X6 1-16
RJ45 PORT 15 X7 1-16
RJ45 PORT 16 X8 1-16

-611W1 Patch cable Cat.6 4x2x0,25 mm² → battery string 1 BMS_1 ++/290.2
-611W2 Patch cable Cat.6 4x2x0,25 mm² → battery string 2 BMS_2 ++/290.5
-611W3 Patch cable Cat.6 4x2x0,25 mm² → battery string 3 BMS_3 ++/290.9
-611W4 Patch cable Cat.6 4x2x0,25 mm² → battery string 4 BMS_4 ++/291.2
-611W5 Patch cable Cat.6 4x2x0,25 mm² → battery string 5 BMS_5 ++/291.5
-611W6 Patch cable Cat.6 4x2x0,25 mm² → battery string 6 BMS_6 ++/292.2
-611W7 Patch cable Cat.6 4x2x0,25 mm² → battery string 7 BMS_7 ++/292.5
-611W8 Patch cable Cat.6 4x2x0,25 mm² → battery string 8 BMS_8 ++/292.9
-611W9 Patch cable Cat.6 4x2x0,25 mm² → battery string 9 BMS_9 ++/293.2
-611W10 Patch cable Cat.6 4x2x0,25 mm² → battery string 10 BMS_10 ++/293.5
-611W11 Patch cable Cat.6 4x2x0,25 mm² → battery string 11 BMS_11 ++/293.9
-611W16 Patch cable Cat.6 4x2x0,25 mm² 7,5 m /613.1 → Isolator_1 613.1 /

previous page:
++/293

next page:
613

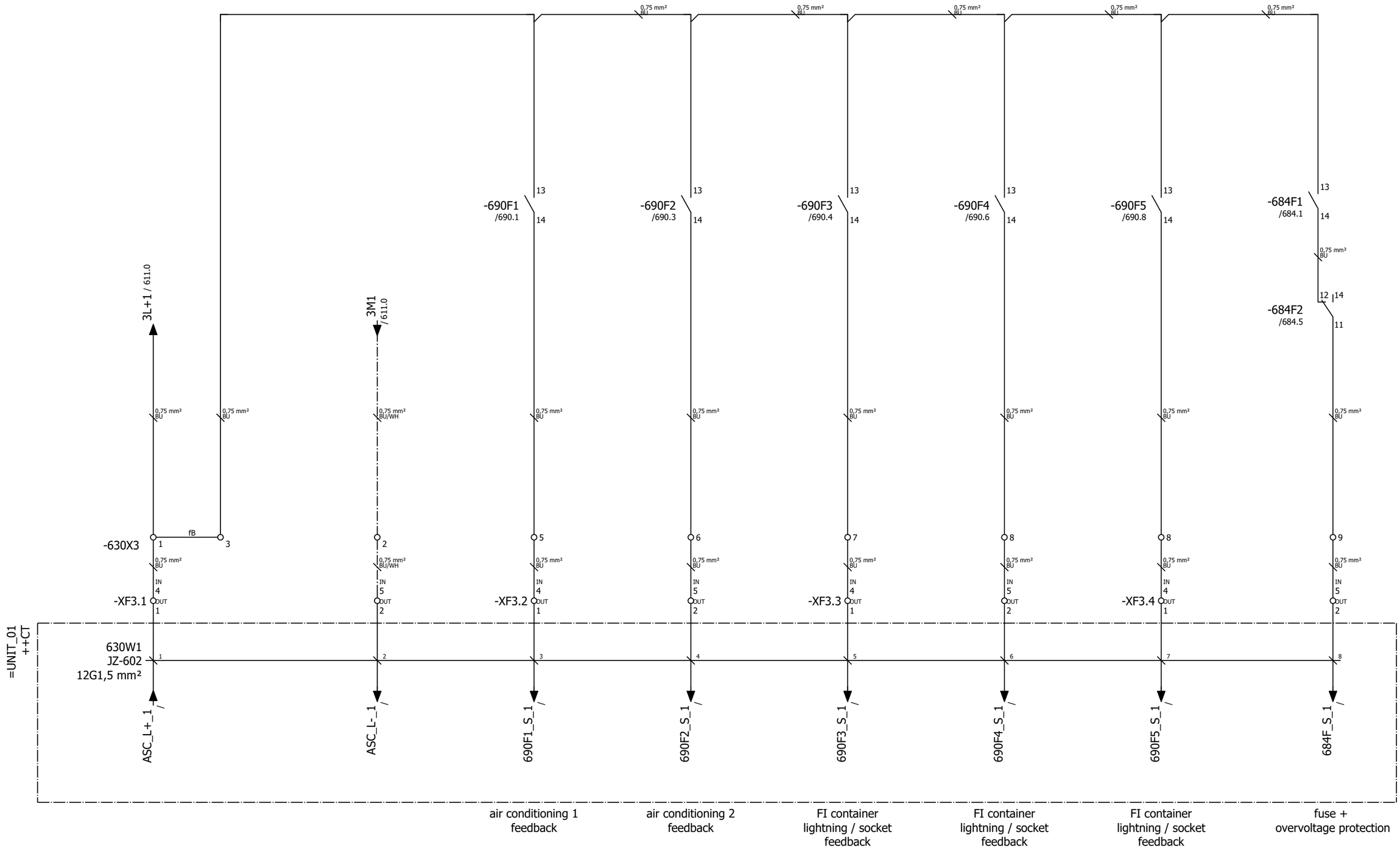
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET SWITCH	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 423



previous page: 611

next page: 630

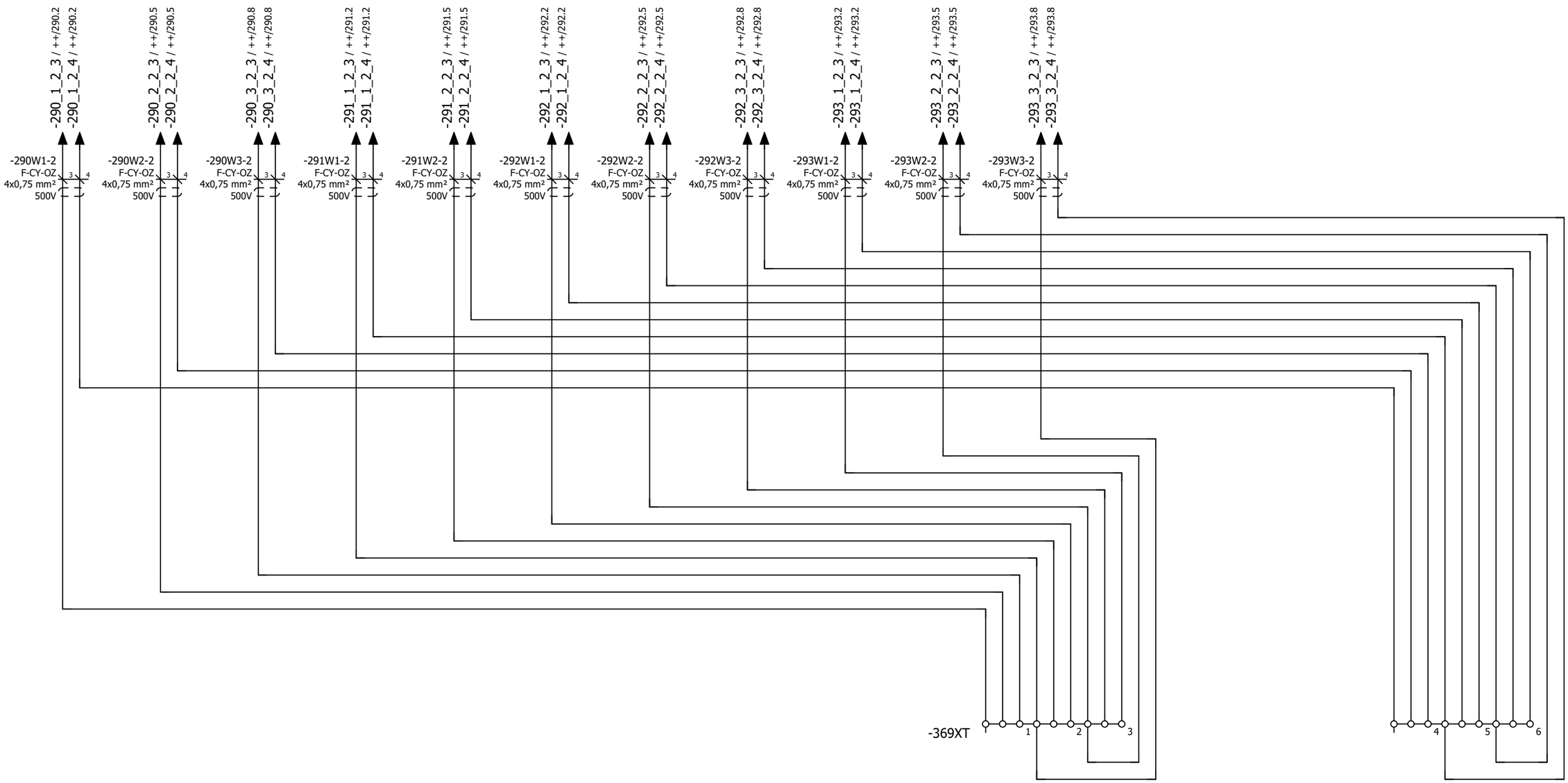
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20230331_V0.01	= UNIT_02	Battery Container 1	
Date	29.03.2023							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613
Date								+		total: 423



previous page: 613

next page: 669

Editor	Freqcon_DG			Statron	FREQCON	FUSES FEEDBACK	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 630
Date								+	total: 423



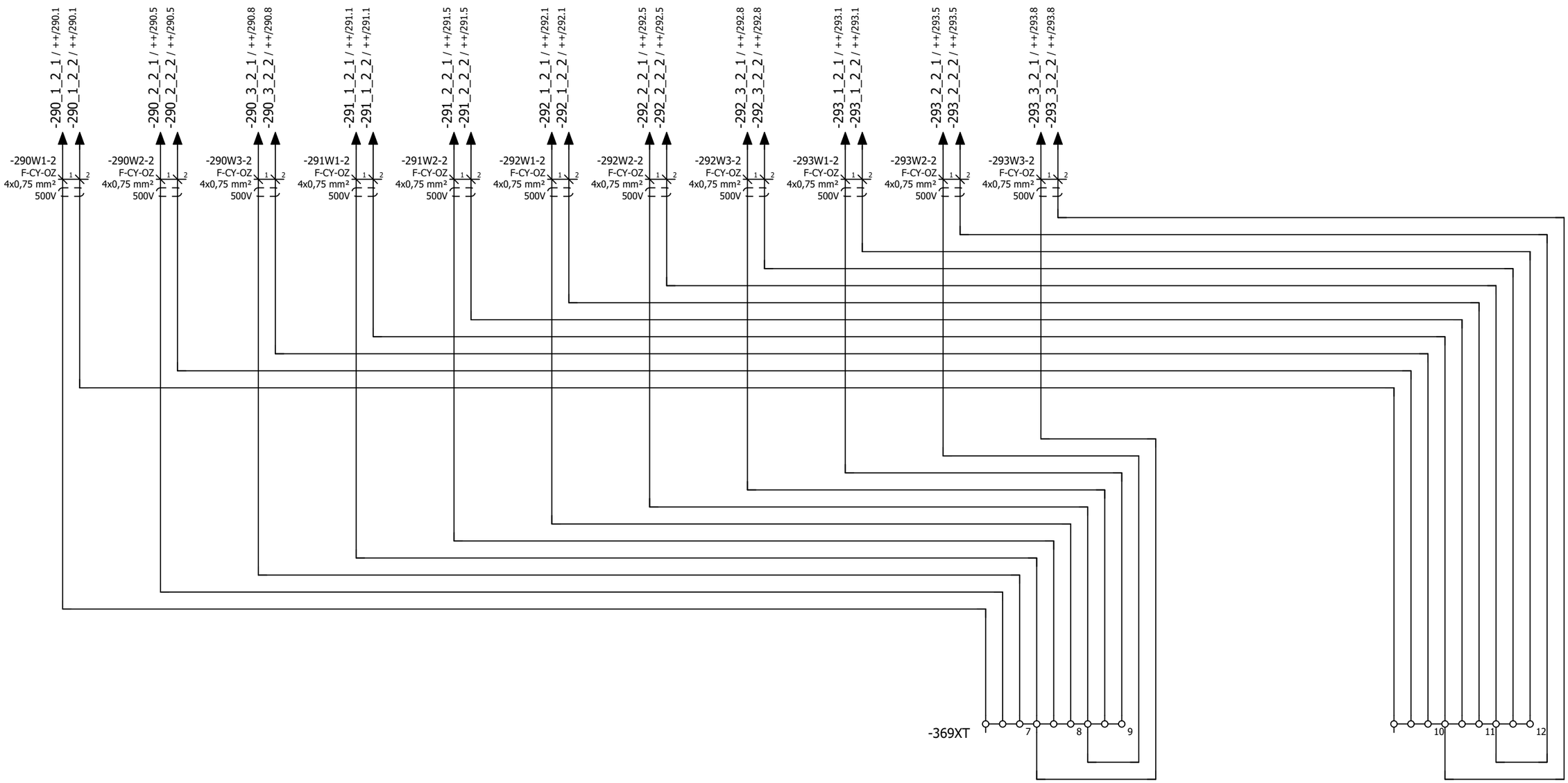
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page: 630

next page: 670

Editor	Freqcon_DG			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	31.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 423



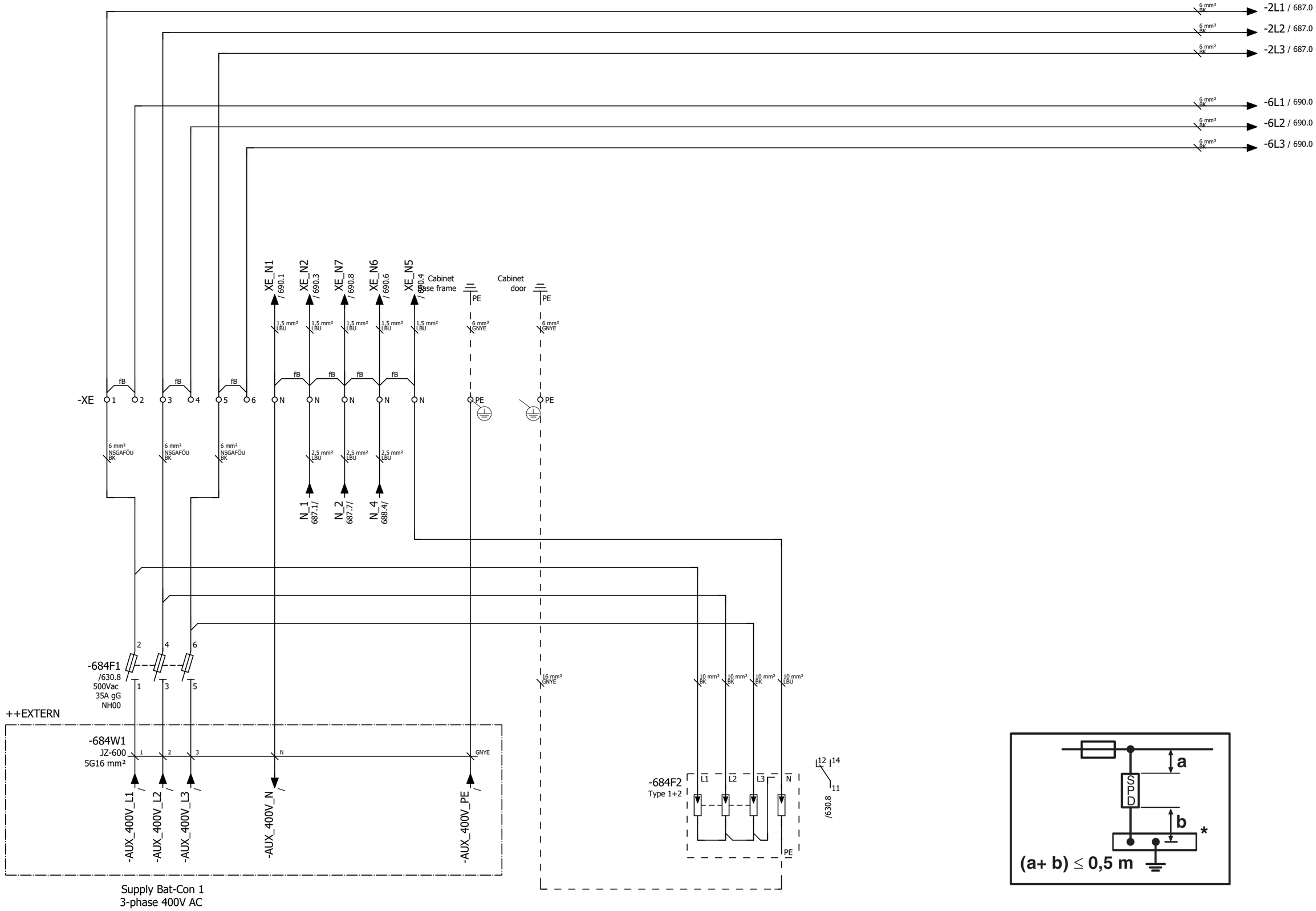
battery cabinet gas
potential-free contacts
customer

battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
684

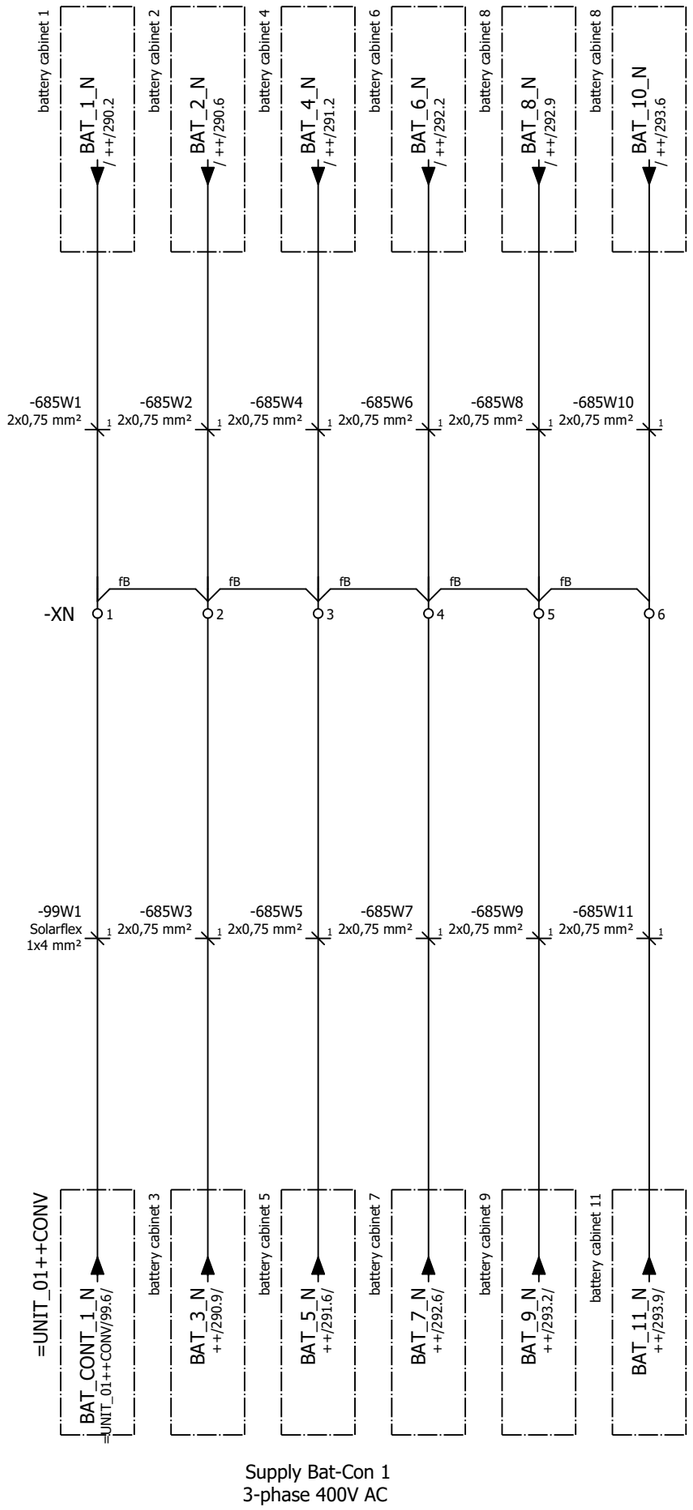
Editor	Freqcon_DG			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	29.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 423



previous page: 670

next page: 685

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 684
Date								+	total: 423



Supply Bat-Con 1
3-phase 400V AC

previous page: 684

next page: 687

Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS MEASURE N	20230331_V0.01	= UNIT_02	Battery Container 1	
Date	30.03.2023							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 685
Date								+		total: 423

684.9 / 2L1
684.9 / 2L2
684.9 / 2L3

3L1 / 688.0
3L2 / 688.0
3L3 / 688.0

fB

-687F1 C16A
-687F2 C16A
-687F3 C16A
-687F4 C16A
-687F5 C16A
-687F6 C16A

1
2

N_1 / 684.2
N_2 / 684.3
N_3 / 688.1

1,5 mm² BK
2,5 mm² LBU

-687XT1 1 N PE
-290W1-1 JZ-500 3G1,5 mm² 1 2 GNYE
-290W2-1 JZ-500 3G1,5 mm² 1 2 GNYE
-290W3-1 JZ-500 3G1,5 mm² 1 2 GNYE
-291W1-1 JZ-500 3G1,5 mm² 1 2 GNYE
-291W2-1 JZ-500 3G1,5 mm² 1 2 GNYE
-292W1-1 JZ-500 3G1,5 mm² 1 2 GNYE

2 N PE
3 N PE
4 N PE
5 N PE
6 N PE

battery string 1
-290_1_1_1 ++/290.0
-290_1_1_2 ++/290.1
-290_1_1_3 ++/290.1

battery string 2
-290_2_1_1 ++/290.4
-290_2_1_2 ++/290.4
-290_2_1_3 ++/290.4

battery string 3
-290_3_1_1 ++/290.7
-290_3_1_2 ++/290.7
-290_3_1_3 ++/290.7

battery string 4
-291_1_1_1 ++/291.0
-291_1_1_2 ++/291.1
-291_1_1_3 ++/291.1

battery string 5
-291_2_1_1 ++/291.4
-291_2_1_2 ++/291.4
-291_2_1_3 ++/291.4

battery string 6
-292_1_1_1 ++/292.0
-292_1_1_2 ++/292.1
-292_1_1_3 ++/292.1

Supply Battery String 1-phase 230V AC

previous page: 685
next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 423

687.9 / 3L1 fB
687.9 / 3L2 fB
687.9 / 3L3 fB
687.9 / N_3 fB
687.9 / N_4 / 684.3

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

1,5 mm² BK
2,5 mm² LBU

battery string 7
-292_2_1_1 ++/292.4
-292_2_1_2 ++/292.4
-292_2_1_3 ++/292.4

battery string 8
-292_3_1_1 ++/292.7
-292_3_1_2 ++/292.7
-292_3_1_3 ++/292.7

battery string 9
-293_1_1_1 ++/293.0
-293_1_1_2 ++/293.1
-293_1_1_3 ++/293.1

battery string 10
-293_2_1_1 ++/293.4
-293_2_1_2 ++/293.4
-293_2_1_3 ++/293.4

battery string 11
-293_3_1_1 ++/293.7
-293_3_1_2 ++/293.7
-293_3_1_3 ++/293.7

Supply Battery String
1-phase 230V AC

previous page: 687
next page: 690

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 423

684.9 / 6L1 — 6 mm² BK
684.9 / 6L2 — 6 mm² BK
684.9 / 6L3 — 6 mm² BK

684.3 / XE_N5 — 1,5 mm² LBU
684.3 / XE_N6 — 1,5 mm² LBU
684.3 / XE_N7 — 1,5 mm² LBU

-690F1 /630.3 C16A
-690F2 /630.4 C16A
-690F3 16A /630.5
-690F4 16A /630.6
-690F5 16A /630.7

XE_N1 / 684.2
XE_N2 / 684.2

1,5 mm² BK, 1,5 mm² LBU

-690XT1: 1 N PE; L N PE

230V AC for
Container Air Conditioning 1

230V AC for
Container Air Conditioning 2

190W1 NYM-J 5x NYM-J — BN LBU GNYE — 3 PE N
=UNIT_02
-Container_L_1 ++/190.1
-Container_N_1 ++/190.1
-Container_PE_1 ++/190.1

FI container
lightning / socket
feedback

190W2 NYM-J 5x NYM-J — BN LBU GNYE — 4 PE N
=UNIT_02
-Container_L_2 ++/190.4
-Container_N_2 ++/190.4
-Container_PE_2 ++/190.4

FI container
lightning / socket
feedback

190W3 NYM-J 5x NYM-J — BN LBU GNYE — 5 PE N
=UNIT_02
-Container_L_3 ++/190.7
-Container_N_3 ++/190.7
-Container_PE_3 ++/190.7

FI container
lightning / socket
feedback

previous page: 688
next page: &EPC++/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20230331_V0.01	= UNIT_02	Battery Container 1	
Date	30.03.2023							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 690
Date								+		total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-278W5 &EFS/278.1	1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153	
-H1 &EFS/190.3	1	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282	
-H2 &EFS/190.6	1	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282	
-H3 &EFS/190.9	1	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282	
-U1 &EFS/190.1	1	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434	
-U1 &EFS/190.1	1	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756	
-U2 &EFS/190.0	1	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149	
-U3 &EFS/190.4	1	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434	
-U3 &EFS/190.4	1	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756	
-U4 &EFS/190.3	1	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149	
-U5 &EFS/190.7	1	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434	
-U5 &EFS/190.7	1	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756	
-U6 &EFS/190.7	1	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149	

previous page:
&EFS++ASC/690

next page:
++ASC/1

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Double-level terminal block Push-in PTTB 2,5-PV	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613.3	1	Surge protection device DT-LAN-CAT.6+	2881007	Phoenix Contact	504791	
-630X3 &EFS/630.1;&EFS/630.3;&EFS/630.5	4	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	
-630X3 &EFS/630.1	2	Plug-in bridge FBS 2-3,5	3213014	Phoenix Contact	500802	
-630X3 &EFS/630.1	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	
-630X3 &EFS/630.1	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	
-684F1 &EFS/684.1	1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738	
-684F1 &EFS/684.1	3	LV HRC fuse element, NH00, In: 35 A, gG, Un AC: 500 V, Un DC: 250 V, Front indicator, live grip lugs	3NA3814-7	Siemens	502933	
-684F2 &EFS/684.5	1	Surge arrester, type 1 + 2, UC 335V AC, 4-pole, FM, for TN-S and TT systems	5SD7414-3	Siemens	10207	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_02 Battery Container 1
Date	30.03.2023							& EPC Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet page: 1
Date								+ total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1...&EFS/687.9;&EFS/688.1...&EFS/688.7	0					
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F2 &EFS/690.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F2 &EFS/690.3	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F3 &EFS/690.4	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	
-690F3 &EFS/690.4	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F3 &EFS/690.4	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	
-690F4 &EFS/690.6	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	
-690F4 &EFS/690.6	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F4 &EFS/690.6	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_02	Battery Container 1
Date	30.03.2023							& EPC	Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 2

total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690F5 &EFS/690.8	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	
-690F5 &EFS/690.8	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F5 &EFS/690.8	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	
-690XT1 &EFS/690.1	5	Feed-through terminal block Push-in PT 2,5	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1	5	Feed-through terminal block Push-in PT 2,5 BU	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1	5	Ground modular terminal block Push-in PT 2,5-PE	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1	1	End cover D-ST 2,5	3030417	Phoenix Contact	500506	
-690XT1 &EFS/690.1	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	
-XE &EFS/684.1;&EFS/684.2	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	
-XE &EFS/684.1;&EFS/684.2	3	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XE &EFS/684.1	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	
-XE &EFS/684.2;&EFS/684.3	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XE &EFS/684.2	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XE &EFS/684.4	2	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	
-XE &EFS/684.4	1	End cover D-PT 16 N	3212060	Phoenix Contact	503716	
-XF3.1 &EFS/630.1	1	Surge arrester, UC 24V DC, 2-pole, for 6A signal circuit TTC-6-2-HC-24DC-UT-I	2908439	Phoenix Contact	10162	
-XF3.2 &EFS/630.3	1	Surge arrester, UC 24V DC, 2-pole, for 6A signal circuit TTC-6-2-HC-24DC-UT-I	2908439	Phoenix Contact	10162	
-XF3.3 &EFS/630.5	1	Surge arrester, UC 24V DC, 2-pole, for 6A signal circuit TTC-6-2-HC-24DC-UT-I	2908439	Phoenix Contact	10162	
-XF3.4 &EFS/630.7	1	Surge arrester, UC 24V DC, 2-pole, for 6A signal circuit TTC-6-2-HC-24DC-UT-I	2908439	Phoenix Contact	10162	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XN &EFS/685.1...&EFS/685.3	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	
-XN &EFS/685.1...&EFS/685.3	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XN &EFS/685.1	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	

previous page:
3

next page:
&EPA++/1

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	30.03.2023							& EPC Parts List	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 4
Date								+	total: 423

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434
3	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149
3	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282
3	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756
1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153

previous page:
&EPC++ASC/4

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Surge protection device DT-LAN-CAT.6+	2881007	Phoenix Contact	504791
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
3	LV HRC fuse element, NH00, In: 35 A, gG, Un AC: 500 V, Un DC: 250 V, Front indicator, live grip lugs	3NA3814-7	Siemens	502933
1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738
1	Surge arrester, type 1 + 2, UC 335V AC, 4-pole, FM, for TN-S and TT systems	5SD7414-3	Siemens	10207
5	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737
1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
3	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608
3	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765
13	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569

Cable name =UNIT_02+++-685W1
Cable type 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-HVDC:N	

Cable name =UNIT_02+++-685W2
Cable type 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:2			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-HVDC:N	

Cable name =UNIT_02+++-685W3
Cable type 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:2			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-HVDC:N	

Cable name =UNIT_02+++-685W4
Cable type 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:3	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_02+++-685W5
Cable type 2x0,75 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:3	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

previous page:
&EPA++ASC/1

next page:
2

FRQ_kabelplan_04_grd_de_en

Cable name =UNIT_02+++-685W6
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:4	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_02+++-685W7
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:4	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_02+++-685W8
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:5	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_02+++-685W9
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:5	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_02+++-685W10
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:6	Supply Bat-Con 1 3-phase 400V AC		

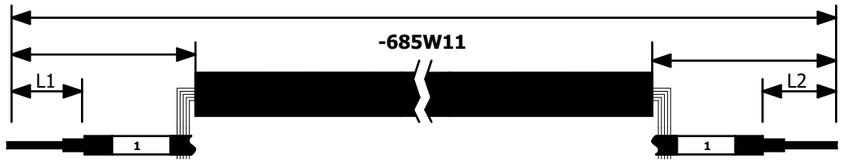
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

previous page: 1
next page: 3

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_02+++-685W11
Cable type 2x0,75 mm²
Free conductors

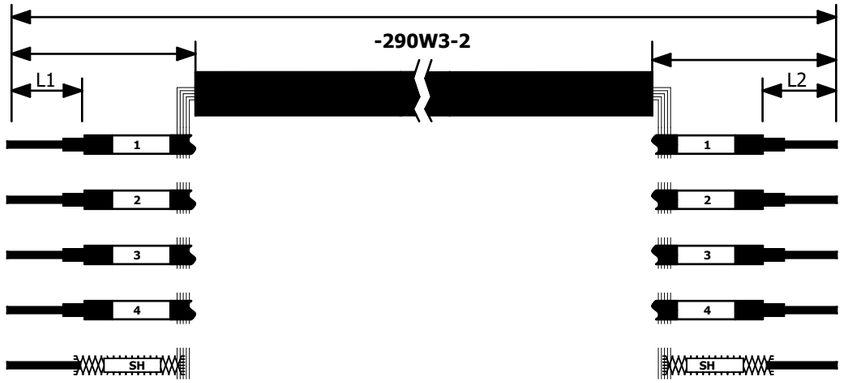
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	++ASC-XN:6	Supply Bat-Con 1 3-phase 400V AC					Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_02+++-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

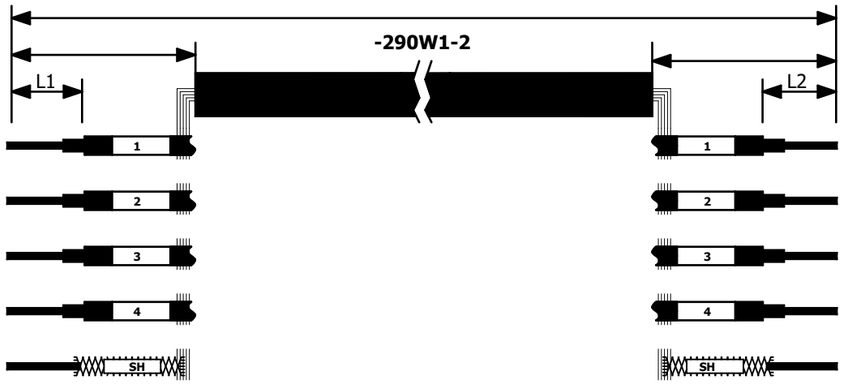
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-570XT:1							++ASC-369XT:7	
	-570XT:2							++ASC-369XT:10	
	-570XT:3							++ASC-369XT:1	
	-570XT:4							++ASC-369XT:4	

Cable name =UNIT_02+++-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



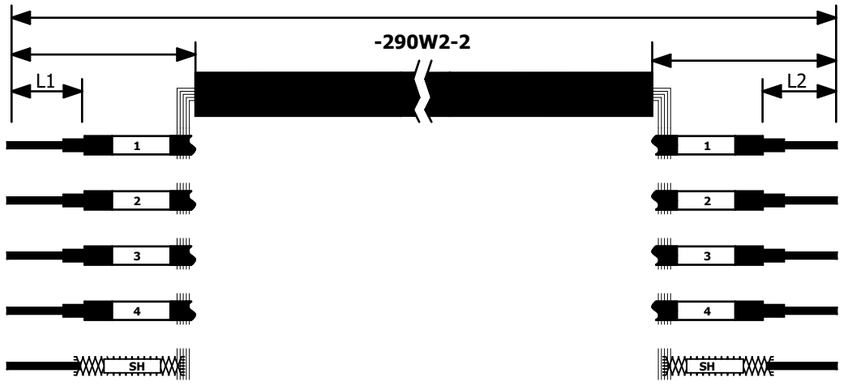
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-570XT:1							++ASC-369XT:7	
	-570XT:2							++ASC-369XT:10	
	-570XT:3							++ASC-369XT:1	
	-570XT:4							++ASC-369XT:4	

previous page: 2
next page: 4

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_02+++-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

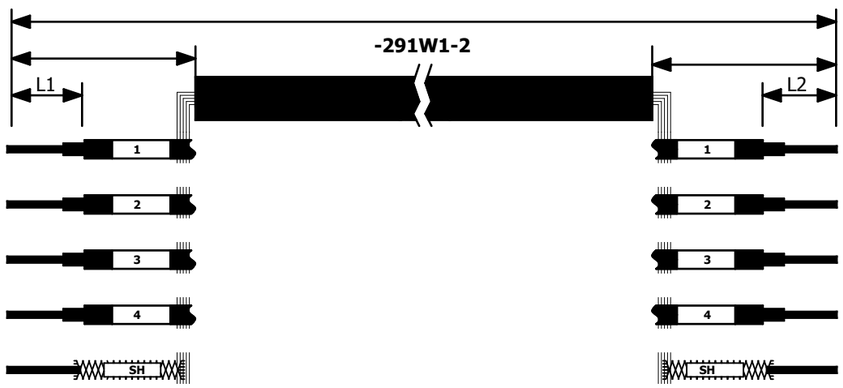


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_02+++-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

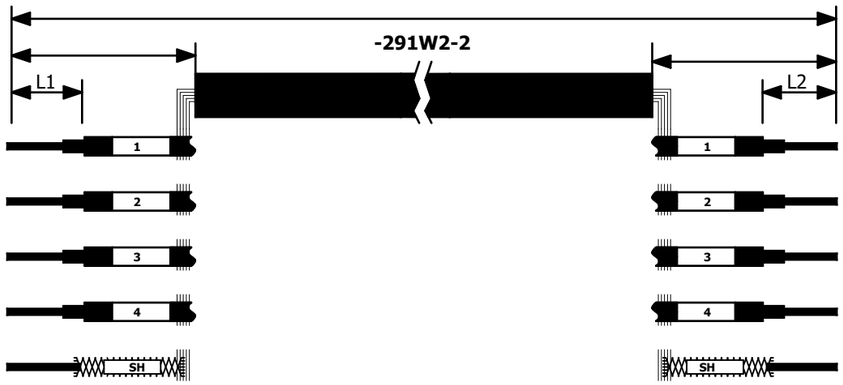


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02+++-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

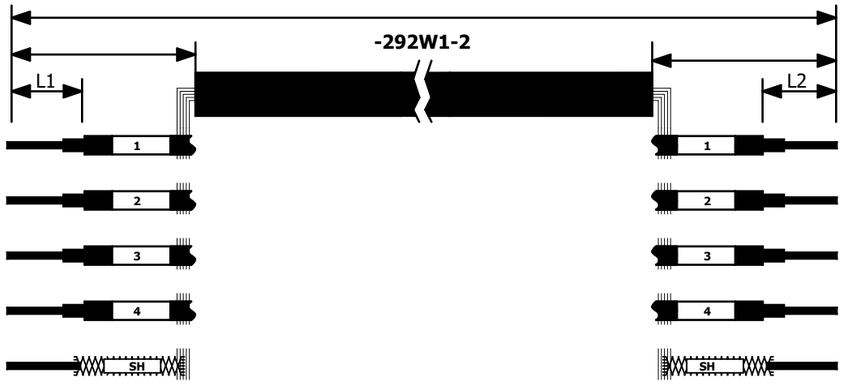
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 3
next page: 5

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_02+++-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

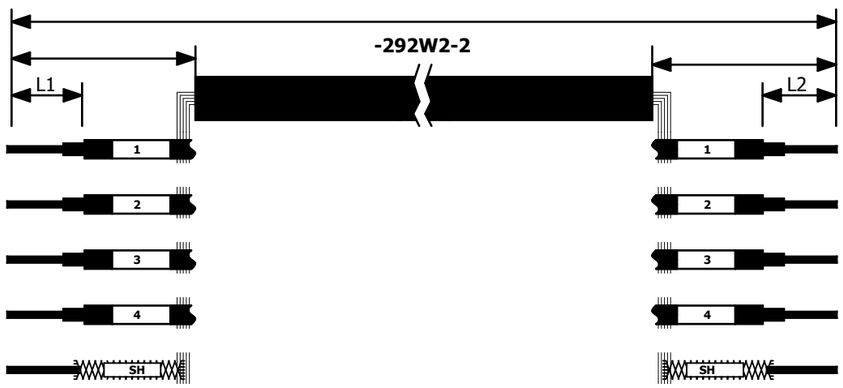


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_02+++-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

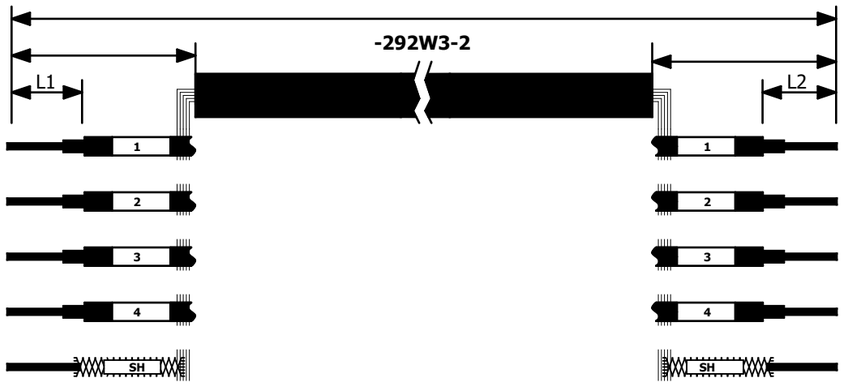


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02+++-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

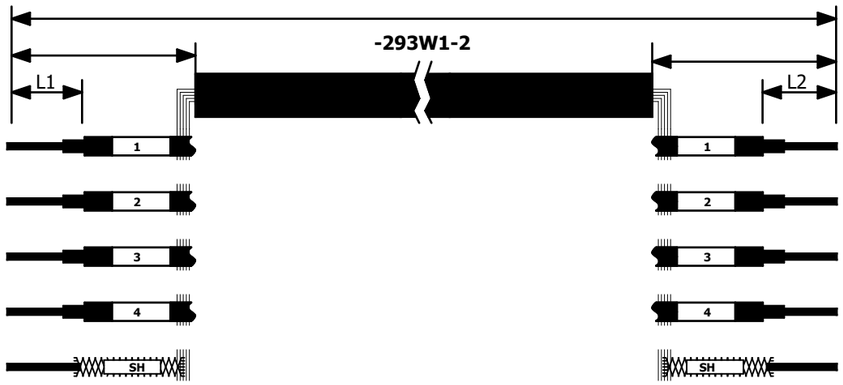
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

previous page: 4
next page: 6

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_02+++-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

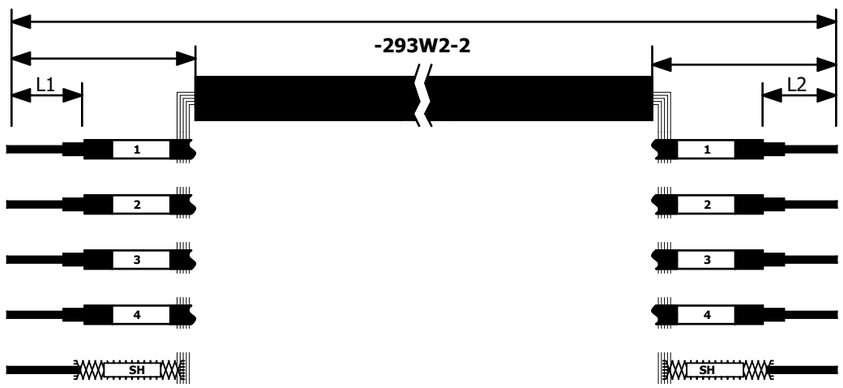


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02+++-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

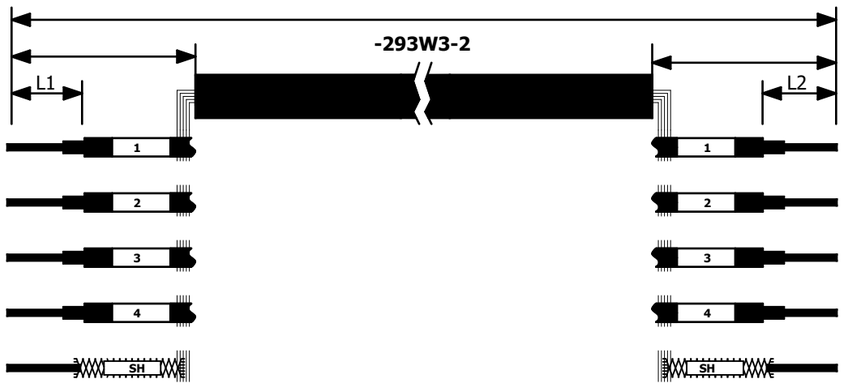


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_02+++-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

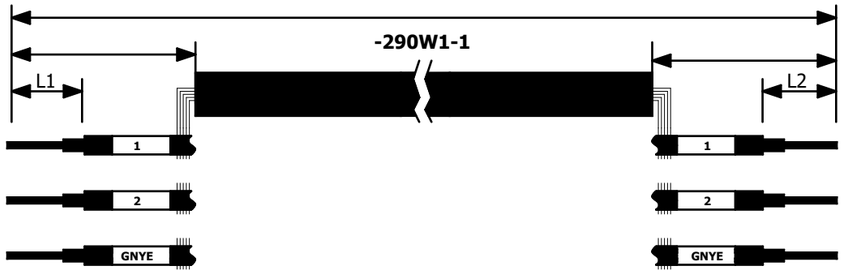
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 5
next page: 7

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_02+++-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

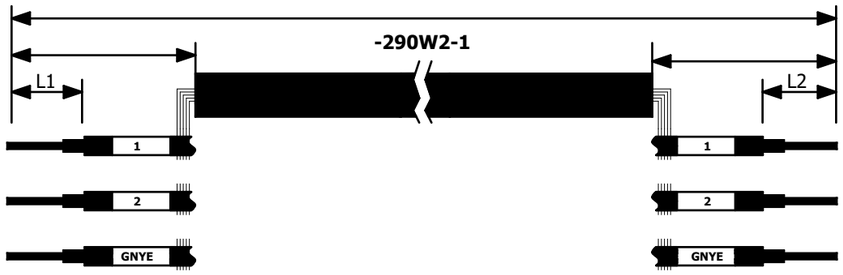
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:1	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_02+++-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

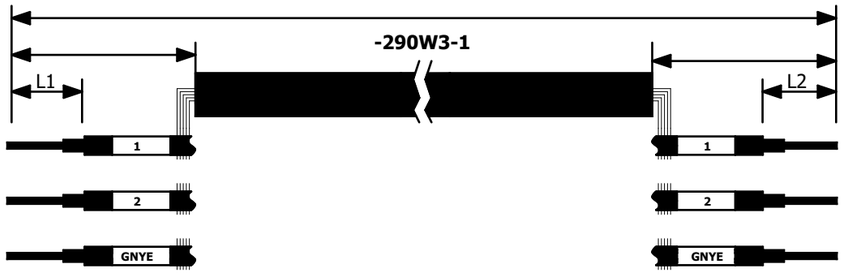
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:2	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_02+++-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:3	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_02+++-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:4	
	-XE:N							++ASC-687XT1:N	

previous page: 6
next page: 8

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_02+++-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

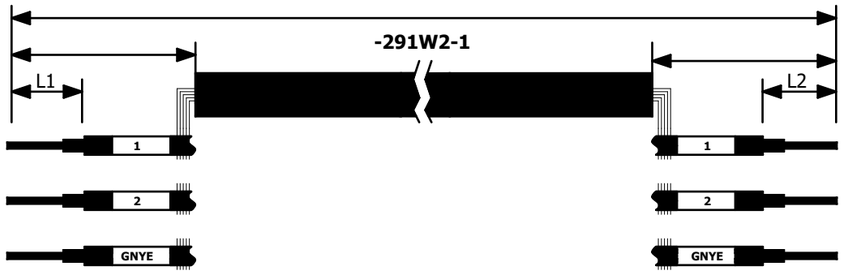


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_02+++-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

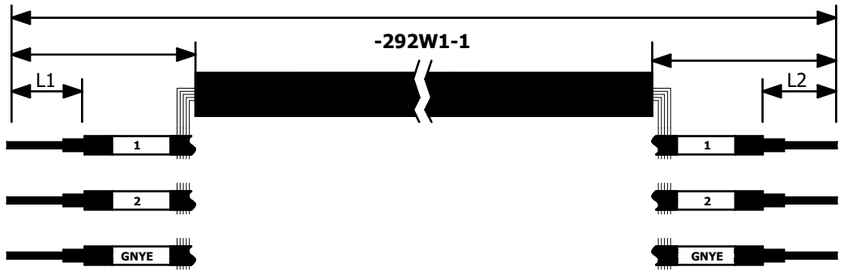


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02+++-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

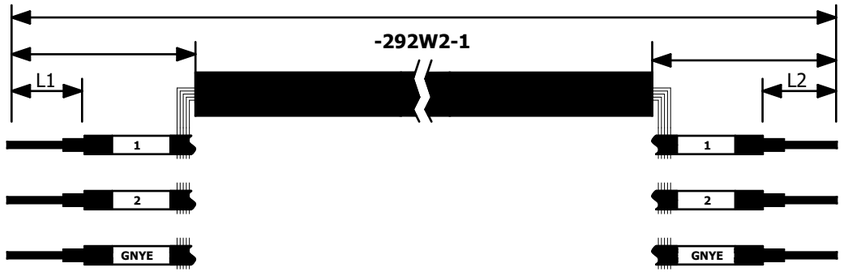


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_02+++-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

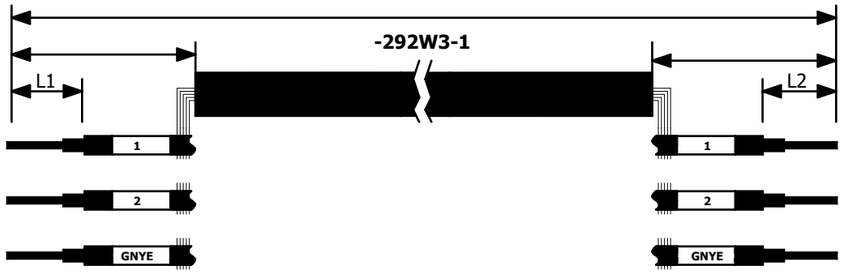
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 7
next page: 9

FRQ_kabelplan_04_grd_de_en

Cable name =UNIT_02+++-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

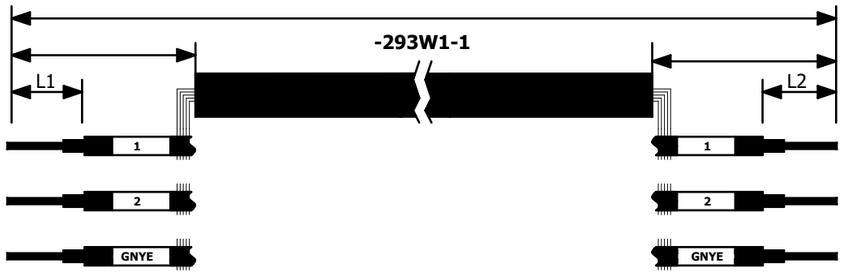
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:8	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_02+++-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:9	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_02+++-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

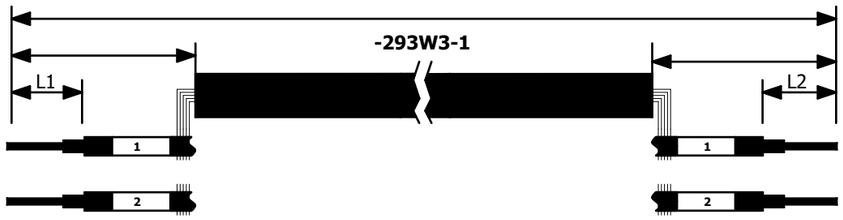
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:10	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_02+++-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



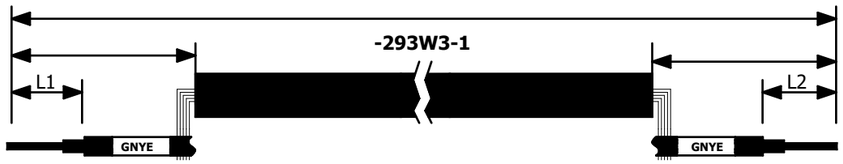
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:11	
	-XE:N							++ASC-687XT1:N	

previous page: 8
next page: 10

FRQ_kabelplan_04_grd_de_en

Cable name =UNIT_02+++-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

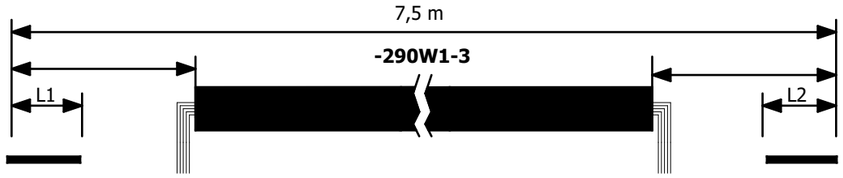


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_02+++-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

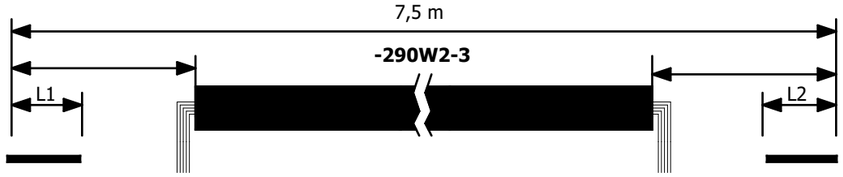


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Cable name =UNIT_02+++-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

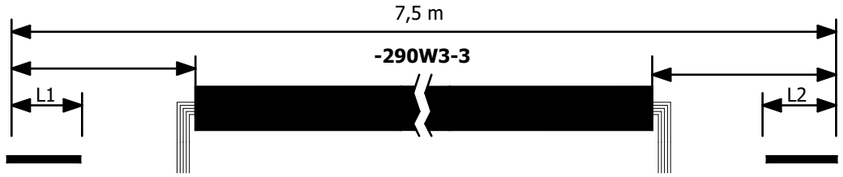


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02+++-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

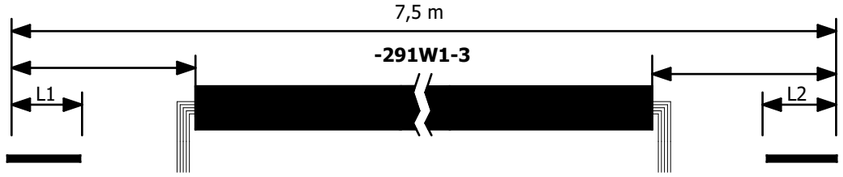


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_02+++-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

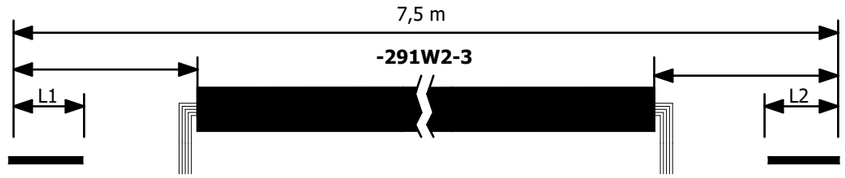
previous page: 9
next page: 11

FRQ_kabelplan_04_grd_de_en

Cable name =UNIT_02+++-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

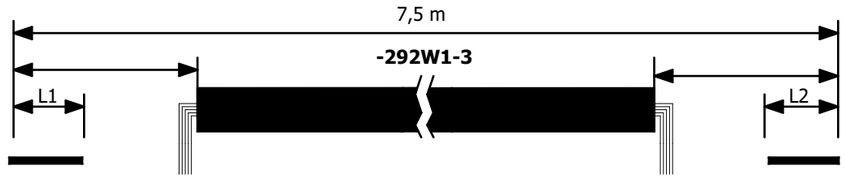


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X5:1-16	

Cable name =UNIT_02+++-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

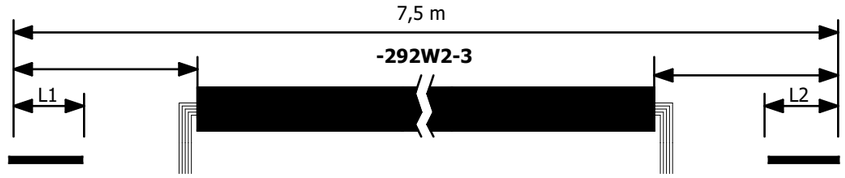


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X6:1-16	

Cable name =UNIT_02+++-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

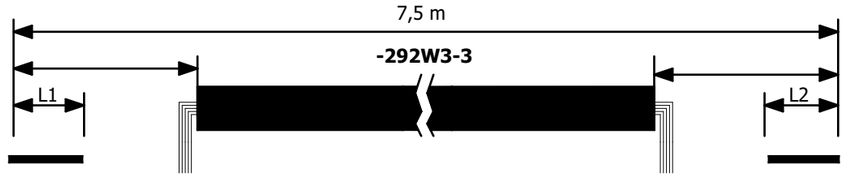


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X7:1-16	

Cable name =UNIT_02+++-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

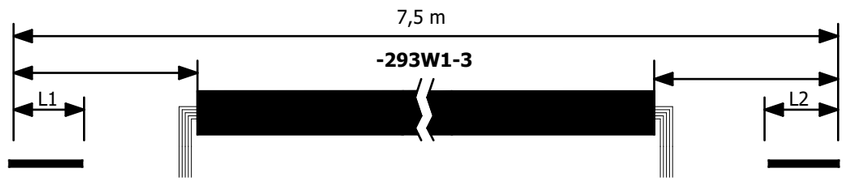


L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X8:1-16	

Cable name =UNIT_02+++-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

Mounting location:	Source	Function text source	wire end handling	L1 [mm]



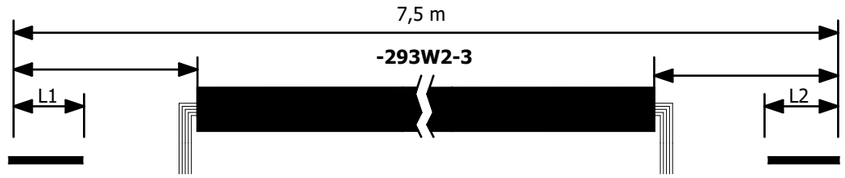
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X9:1-16	

previous page: 10
next page: 12

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_02+++-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

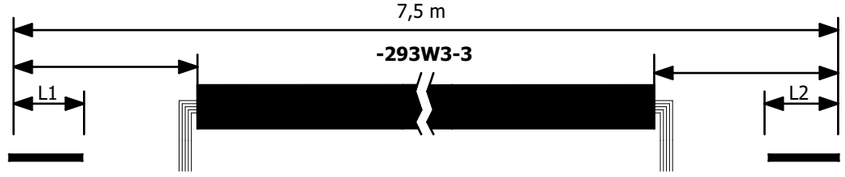


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_02+++-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

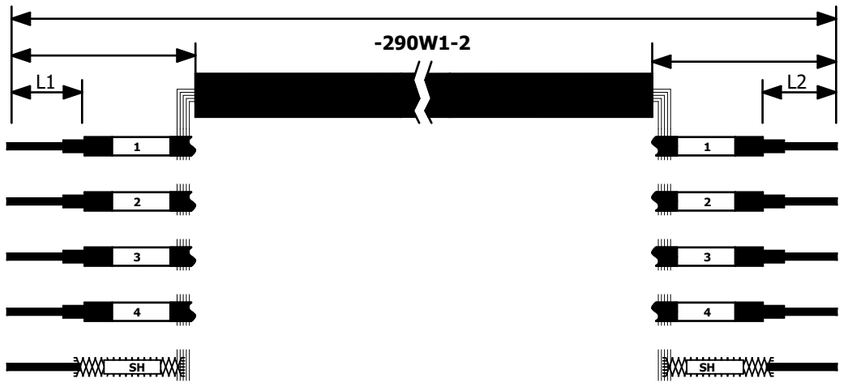
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

FRQ_kabelplan_04_grid_de_en

previous page: 11
next page: ++ASC/1

Cable name =UNIT_02++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

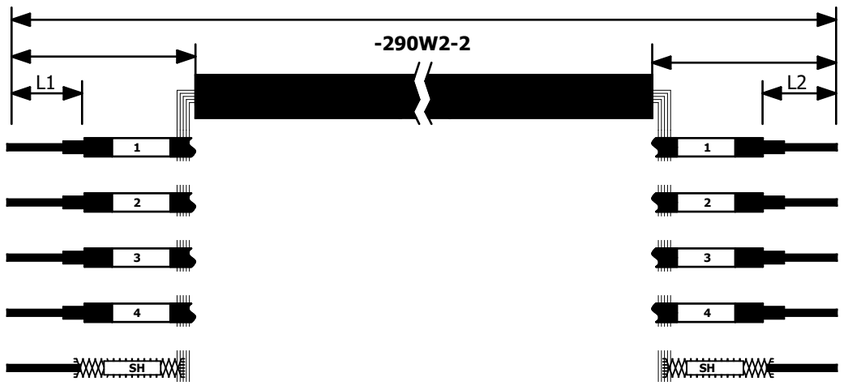


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

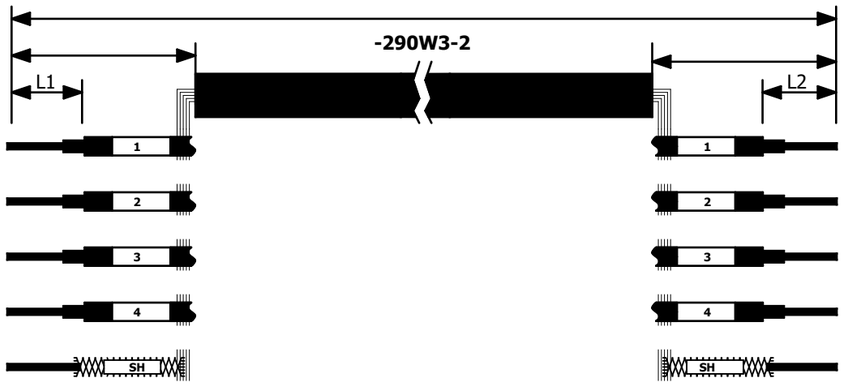


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

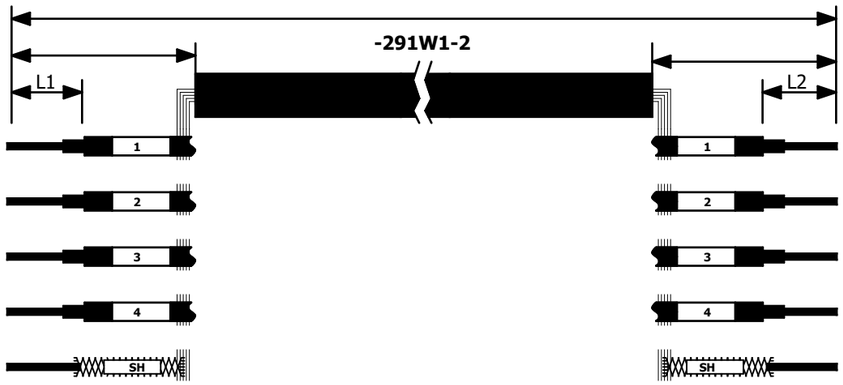
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: ++/12
next page: 2

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_02++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

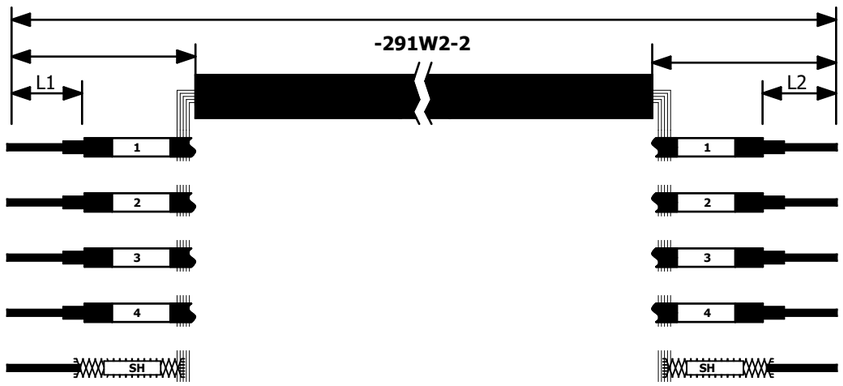


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

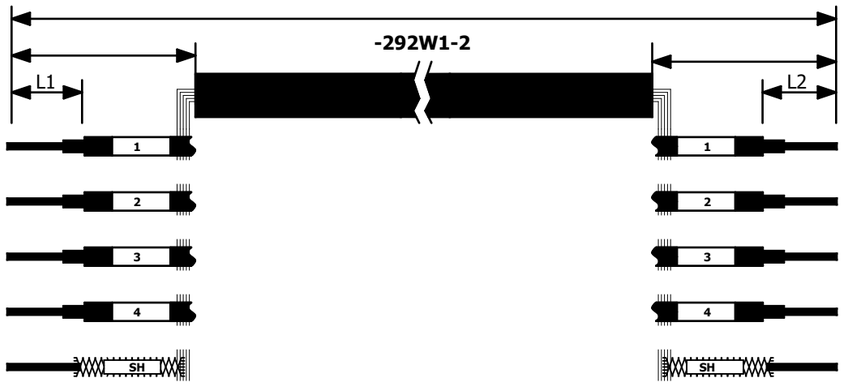


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

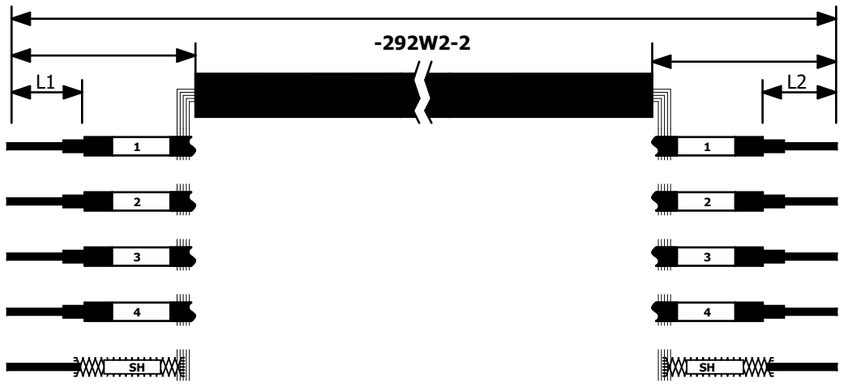
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_02++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

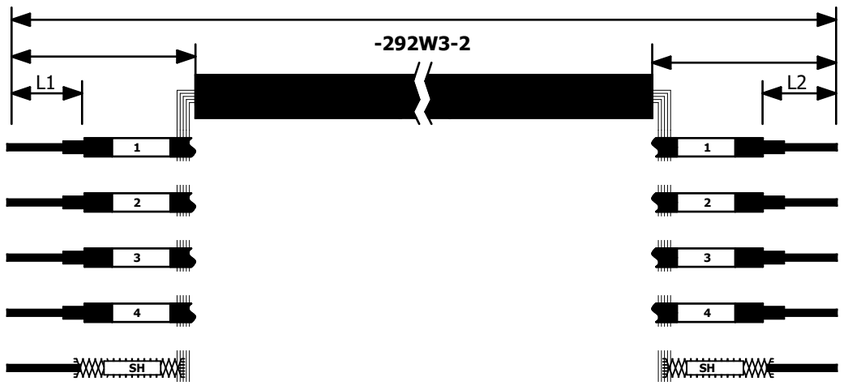


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

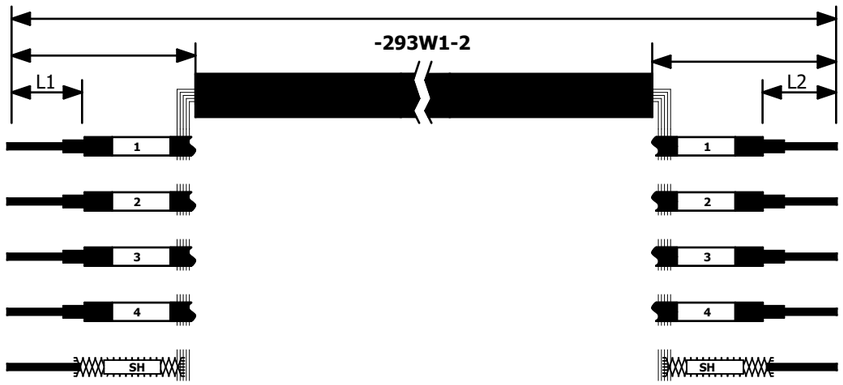


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



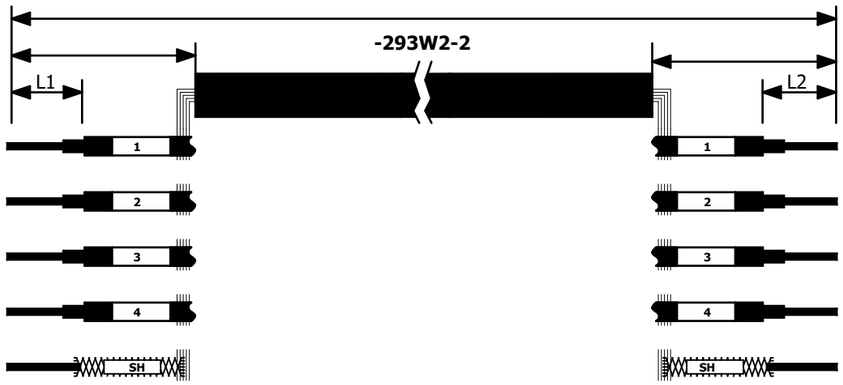
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 2
next page: 4

Cable name =UNIT_02++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

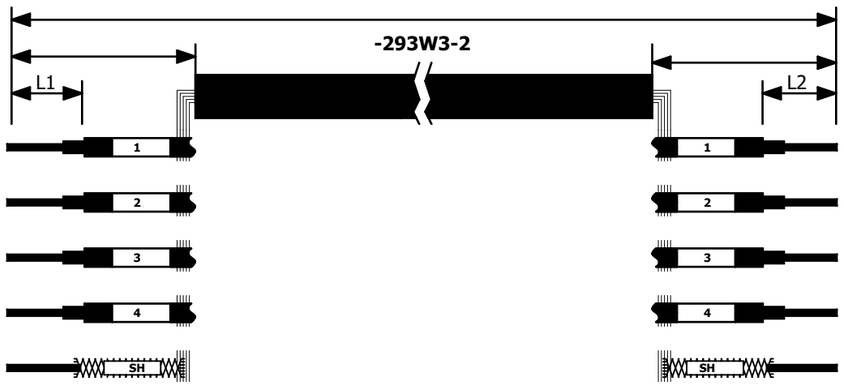


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

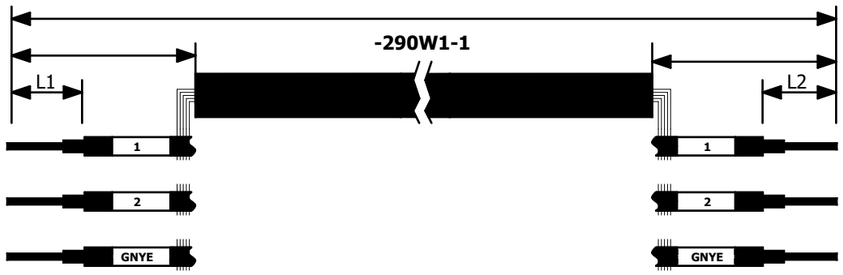


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

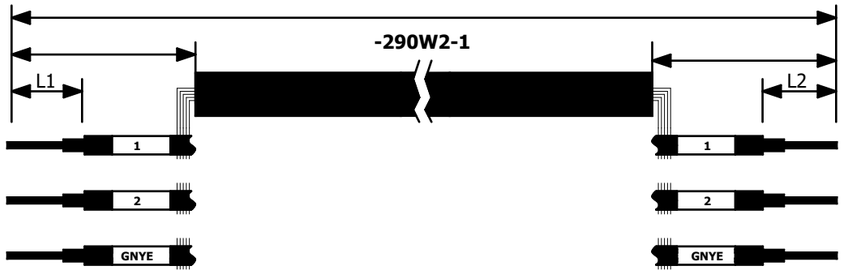
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_02++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

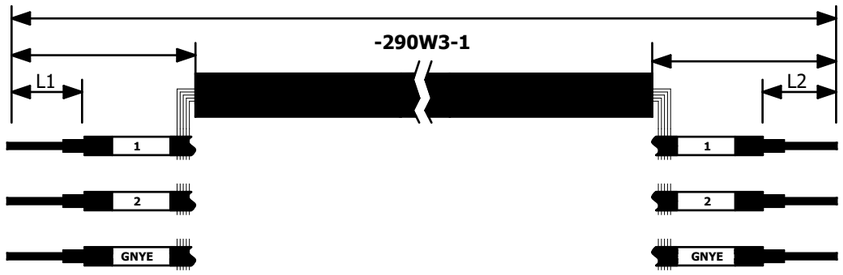


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

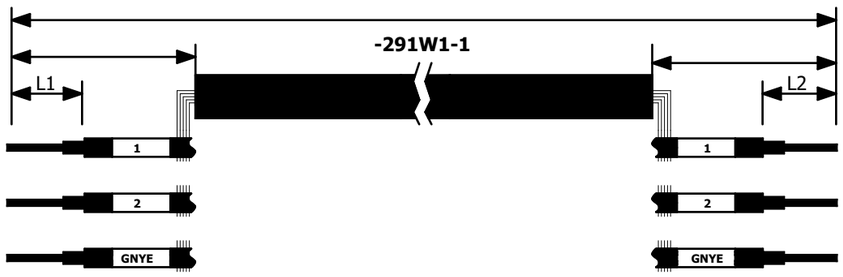


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 4
next page: 6

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_02++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

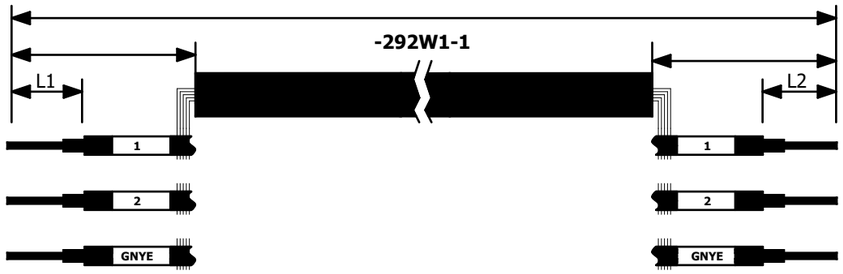
Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

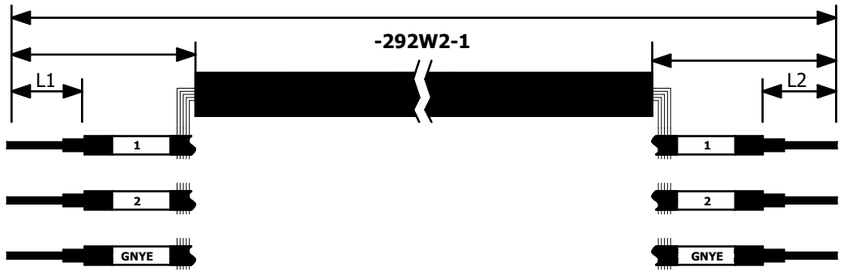
Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

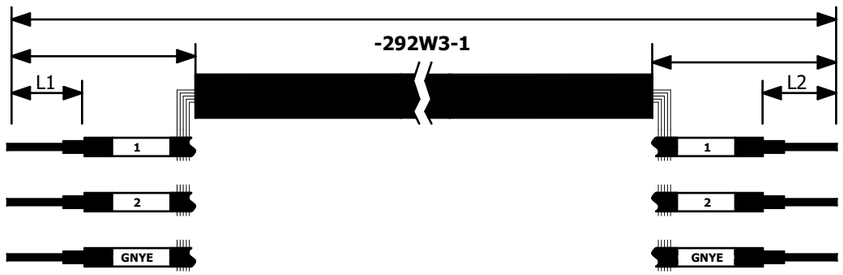
Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



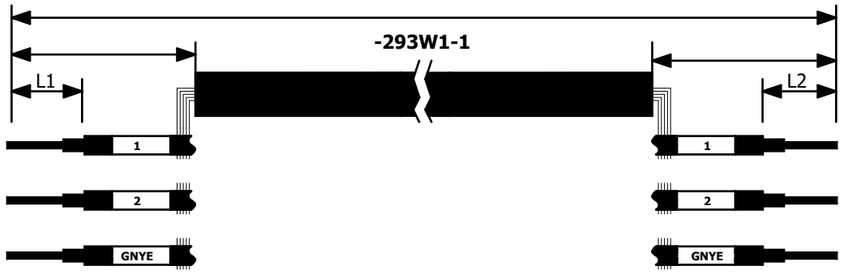
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_02++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

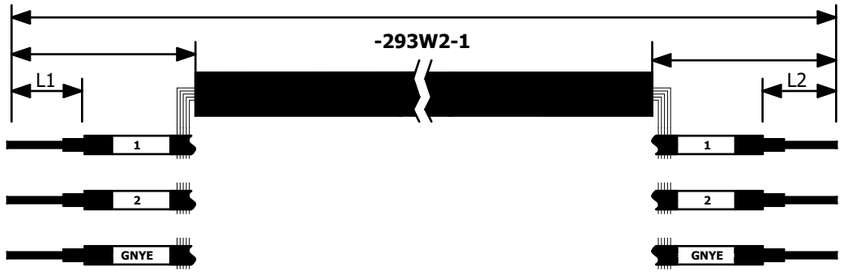


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

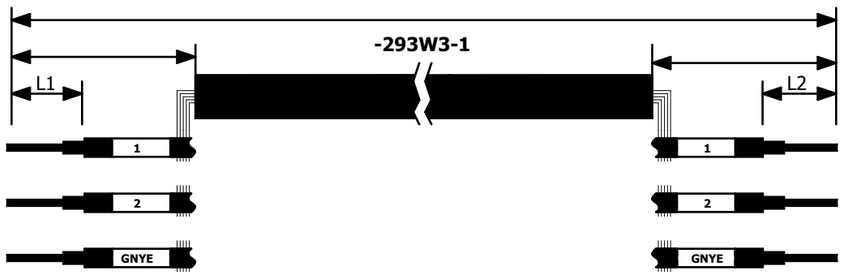


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

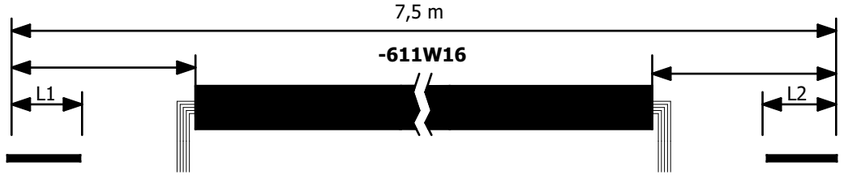


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_02++ASC+-611W16
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-611A1:X8:1-16		RJ45 connector	

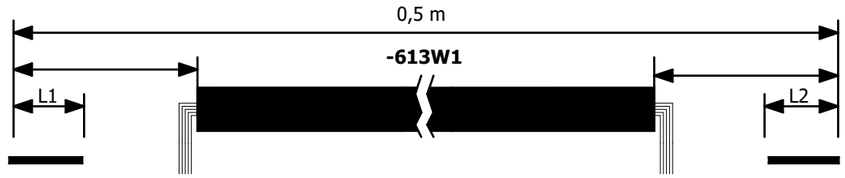
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		-613T1:15	

previous page: 6
next page: 8

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_02++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

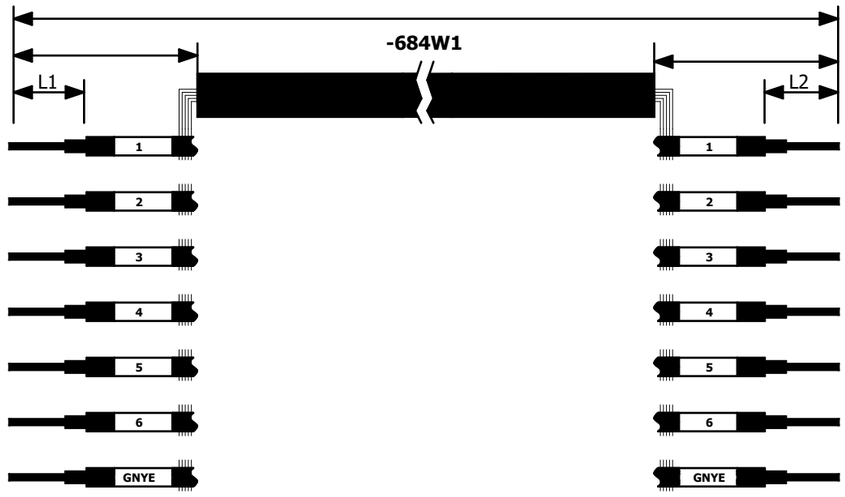
FRQ_kabelplan_04_gr0..de_en

previous page: 7

next page: ++EXTERN/1

Cable name =UNIT_02++EXTERN+-684W1
Cable type JZ-600 5G16 mm²
Free conductors 7

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

FRQ_kabelplan_04_gr0_de_en

previous page:
++ASC/8

next page:
&EMZ++ASC/1000

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	30.03.2023							& EMB Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ EXTERN	page: 1
Date								+	total: 423

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-630X3		1	9	0	0	12	=UNIT_02&EMZ++ASC/2000
-XE		1	6	2	5	13	=UNIT_02&EMZ++ASC/2001
-XF3.1		4/1	5/2	0	0	2	=UNIT_02&EMZ++ASC/2002
-XF3.2		4/1	5/2	0	0	2	=UNIT_02&EMZ++ASC/2003
-XF3.3		4/1	5/2	0	0	2	=UNIT_02&EMZ++ASC/2004
-XF3.4		4/1	5/2	0	0	2	=UNIT_02&EMZ++ASC/2005
-XN		1	6	0	0	6	=UNIT_02&EMZ++ASC/2006
-369XT		1	12	0	0	12	=UNIT_02&EMZ++ASC/2008
-687XT1		1	PE	11	11	33	=UNIT_02&EMZ++ASC/2020
-690XT1		1	PE	7	5	20	=UNIT_02&EMZ++ASC/2031

previous page:
&EMB++EXTERN/1

next page:
2000

Editor	Freqcon_DG			Statron		Klemmenleistenübersicht : =UNIT_02++ASC+-630X3 - =UNIT_02++ASC+-690XT1	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet page: 1000
Date								+ total: 423

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-630X3						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
					-XF3.1	4/1:4	1		-611A1	1													&EFS/630.1
					-XF3.1	5/2:5	2		-611A1	2													&EFS/630.2
							3		-690F1	13													&EFS/630.1
air conditioning 1 feedback					-690F1	14	5		-XF3.2	4/1:4													&EFS/630.3
air conditioning 2 feedback					-690F2	14	6		-XF3.2	5/2:5													&EFS/630.4
FI container lightning / socket feedback					-690F3	14	7		-XF3.3	4/1:4													&EFS/630.5
=					-XF3.3	5/2:5	8		-690F4	14													&EFS/630.6
=					-XF3.4	4/1:4	8		-690F5	14													&EFS/630.7
fuse + overvoltage protection					-XF3.4	5/2:5	9		-684F2	11													&EFS/630.8

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-XE

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
Supply Bat-Con 1 3-phase 400V AC			-684F1	2	1		-687F1	1			&EFS/684.1
=					N		-690XT1	N			&EFS/684.2
=			-687XT1	N	N		-690XT1	N			&EFS/684.2
=			-687XT1	N	N		-690F5	N			&EFS/684.3
=			-687XT1	N	N		-690F4	N			&EFS/684.3
=			-684F2	N	N		-690F3	N			&EFS/684.3
=					PE			PE			&EFS/684.4
=			-684F2	PE	PE			PE			&EFS/684.4
=					2		-690F1	1			&EFS/684.1
=			-684F1	4	3		-687F2	1			&EFS/684.1
=					4		-690F3	1			&EFS/684.2
=			-684F1	6	5		-687F3	1			&EFS/684.2
=					6		-690F2	1			&EFS/684.2
=					6		-690F2	1			&EFS/684.2

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XE	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2001
total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-XF3.1

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name												Page / column
				Cable type							Cable type												
							4/1	,	-630X3	1													&EFS/630.1
							5/2	,	-630X3	2													&EFS/630.2

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-XF3.2

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
				Cable type									
air conditioning 1 feedback							4/1	,	-630X3	5			&EFS/630.3
air conditioning 2 feedback							5/2	,	-630X3	6			&EFS/630.4

previous page: 2002

next page: 2004

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-XF3.2	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-XF3.3

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FI container lightning / socket feedback					4/1	,	-630X3	7			&EFS/630.5
=					5/2	,	-630X3	8			&EFS/630.6

previous page: 2003

next page: 2005

| | | | | |

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-XF3.4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FI container lightning / socket feedback					4/1	,	-630X3	8			&EFS/630.7
fuse + overvoltage protection					5/2	,	-630X3	9			&EFS/630.8

previous page: 2004

next page: 2006

| | | | | |

Terminal diagram

Freqcon_F13_001_02

Function text	-685W5	-685W3	=UNIT_01++CONV-99W1	Cable name	Strip =UNIT_02++ASC+-XN						Cable name	-685W1	-685W2	-685W4									Page / column
			Solarflex	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
			1		=UNIT_01++CONV+CON-N	N	1		-HVDC	N		1											&EFS/685.1
		1			-HVDC	N	2		-HVDC	N			1										&EFS/685.1
Supply Bat-Con 1 3-phase 400V AC	1				-HVDC	N	3		-HVDC	N				1									&EFS/685.2

Terminal diagram

Freqcon_F13_001_02

Function text	-685W11	-685W9	-685W7	Cable name	Strip =UNIT_02++ASC+-XN Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-685W6	-685W8	-685W10									Page / column
				Cable type							Cable type												
Supply Bat-Con 1 3-phase 400V AC			1		-HVDC	N	4		-HVDC	N		1											&EFS/685.2
=		1			-HVDC	N	5		-HVDC	N			1										&EFS/685.3
=	1				-HVDC	N	6		-HVDC	N				1									&EFS/685.3

Terminal diagram

Freqcon_F13_001_02

Function text	-290W3-2	-290W2-2	-290W1-2	Cable name	Strip =UNIT_02++ASC+-369XT						Cable name												Page / column
	F-CY-0Z	F-CY-0Z	F-CY-0Z	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
battery cabinet smoke detector potential-free contacts customer			3		-570XT	3	1																&EFS/669.5
		3			-570XT	3																	
	3				-570XT	3																	

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	-292W1-2 F-CY-0Z	-291W2-2 F-CY-0Z	-291W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W3-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			3		-570XT	3	2		-570XT	3		3	&EFS/669.5
		3			-570XT	3							
	3				-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	-293W1-2	-292W3-2	-292W2-2	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-293W2-2	Page / column
	F-CY-0Z	F-CY-0Z	F-CY-0Z	Cable type							Cable type	F-CY-0Z	
battery cabinet smoke detector potential-free contacts customer			3		-570XT	3	3		-570XT	3		3	&EFS/669.6
		3			-570XT	3							
	3				-570XT	3							

previous page: 2009

next page: 2011

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2010

total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-290W3-2	-290W2-2	-290W1-2	Cable name	Strip =UNIT_02++ASC+-369XT						Cable name												Page / column
	F-CY-0Z	F-CY-0Z	F-CY-0Z	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
battery cabinet smoke detector potential-free contacts customer			4		-570XT	4	4																&EFS/669.7
		4			-570XT	4																	
	4				-570XT	4																	

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	-292W1-2 F-CY-0Z	-291W2-2 F-CY-0Z	-291W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W3-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			4		-570XT	4	5		-570XT	4		4	&EFS/669.8
		4			-570XT	4							
	4				-570XT	4							

previous page:
2011

next page:
2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2012
+			total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-293W1-2 F-CY-0Z	-292W3-2 F-CY-0Z	-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W2-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			4		-570XT	4	6		-570XT	4		4	&EFS/669.8
		4			-570XT	4							
	4				-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	-290W3-2 F-CY-0Z	-290W2-2 F-CY-0Z	-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		-570XT	1	7					&EFS/670.5
		1			-570XT	1						
	1				-570XT	1						

previous page: 2013

next page: 2015

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2014
+			total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-292W1-2 F-CY-0Z	-291W2-2 F-CY-0Z	-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		-570XT	1	8		-570XT	1		1	&EFS/670.5
		1			-570XT	1							
	1				-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	-293W1-2 F-CY-0Z	-292W3-2 F-CY-0Z	-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		-570XT	1	9		-570XT	1		1	&EFS/670.6
		1			-570XT	1							
	1				-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	-290W3-2	-290W2-2	-290W1-2	Cable name	Strip =UNIT_02++ASC+-369XT						Cable name												Page / column
	F-CY-0Z	F-CY-0Z	F-CY-0Z	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
battery cabinet gas potential-free contacts customer			2		-570XT	2	10																&EFS/670.7
		2			-570XT	2																	
	2				-570XT	2																	

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-369XT

Function text	-292W1-2 F-CY-0Z	-291W2-2 F-CY-0Z	-291W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		-570XT	2	11		-570XT	2		2	&EFS/670.8
		2			-570XT	2							
	2				-570XT	2							

previous page:
2017

next page:
2019

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-369XT	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023					& EMZ Terminals
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date						+

page: 2018
total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-293W1-2 F-CY-0Z	-292W3-2 F-CY-0Z	-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_02++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		-570XT	2	12		-570XT	2		2	&EFS/670.8
		2			-570XT	2							
	2				-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-687XT1

Function text	-290W3-1	-290W2-1	-290W1-1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	
Supply Battery String 1-phase 230V AC			1		-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				-XE	1	3	,	-687F3	2		&EFS/687.4

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2020

total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-292W1-1	-291W2-1	-291W1-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		-XE	1	4	,	-687F4	2													&EFS/687.5
=		1			-XE	1	5	,	-687F5	2													&EFS/687.7
=	1				-XE	1	6	,	-687F6	2													&EFS/687.8

previous page: 2020

next page: 2022

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2021

total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-687XT1

Function text	-293W1-1	-292W3-1	-292W2-1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	
Supply Battery String 1-phase 230V AC			1		-XE	1	7	,	-688F1	2		&EFS/688.1
=		1			-XE	1	8	,	-688F2	2		&EFS/688.3
=	1				-XE	1	9	,	-688F3	2		&EFS/688.4

previous page: 2021

next page: 2023

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Function text	-290W1-1	-293W3-1	-293W2-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			1		-XE	1	10	,	-688F4	2													&EFS/688.5
=		1			-XE	1	11	,	-688F5	2													&EFS/688.7
=	2				-XE	N	N	⌐	-XE	N													&EFS/687.1

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-687XT1

Function text	-291W1-1	-290W3-1	-290W2-1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type								
Supply Battery String 1-phase 230V AC			2		-XE	N	N					&EFS/687.3
=		2			-XE	N	N					&EFS/687.4
=	2				-XE	N	N					&EFS/687.6

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_02	Battery Container 1	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2024
+			total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-687XT1

Function text	-292W2-1 / JZ-500	-292W1-1 / JZ-500	-291W2-1 / JZ-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		-XE	N	N		-XE	N		&EFS/687.7
=		2			-XE	N	N					&EFS/687.8
=	2				-XE	N	N					&EFS/688.1

previous page: 2024

next page: 2026

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-687XT1	20230331_V0.01	= UNIT_02 Battery Container 1	
Date	31.03.2023					& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 2025
Date						+	total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-293W2-1 / JZ-500	-293W1-1 / JZ-500	-292W3-1 / JZ-500	Cable name / Cable type	Strip =UNIT_02++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		-XE	N	N					&EFS/688.3
=		2			-XE	N	N		-XE	N		&EFS/688.4
=	2				-XE	N	N					&EFS/688.6

previous page: 2025

next page: 2027

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_02++ASC+-687XT1

Function text	-290W2-1	-290W1-1	-293W3-1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type									
Supply Battery String 1-phase 230V AC			2		-XE	N	N						&EFS/688.7
=		GNYE			-XE	PE	PE						&EFS/687.2
=	GNYE				-XE	PE	PE						&EFS/687.3

previous page: 2026

next page: 2028

Terminal diagram

Freqcon_F13_001_02

Function text	-291W2-1	-291W1-1	-290W3-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		-XE	PE	PE	,															&EFS/687.4
=		GNYE			-XE	PE	PE	,															&EFS/687.6
=	GNYE				-XE	PE	PE	,															&EFS/687.7

Terminal diagram

Freqcon_F13_001_02

Function text	-292W3-1	-292W2-1	-292W1-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		-XE	PE	PE	,															&EFS/687.9
=		GNYE			-XE	PE	PE	,															&EFS/688.2
=	GNYE				-XE	PE	PE	,															&EFS/688.3

Terminal diagram

Freqcon_F13_001_02

Function text	-293W3-1	-293W2-1	-293W1-1	Cable name	Strip =UNIT_02++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		-XE	PE	PE	,															&EFS/688.4
=		GNYE			-XE	PE	PE	,															&EFS/688.6
=	GNYE				-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_02++ASC+-690XT1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
230V AC for Container Air Conditioning 1							1	,	-690F1	2													&EFS/690.1
FI container lightning / socket feedback					-U1		3	,	-690F3	2													&EFS/690.4
=					-U3		4	,	-690F4	2													&EFS/690.6
=					-U5		5	,	-690F5	2													&EFS/690.8
								,															
FI container lightning / socket feedback					-U1		N	,															&EFS/690.5
=					-U3		N	,															&EFS/690.7
=					-U5		N	,															&EFS/690.9
								,															
								,															
FI container lightning / socket feedback					-U1		PE	,	-690F3	N.													&EFS/690.4
=					-U3		PE	,	-690F4	N.													&EFS/690.6
=					-U5		PE	,	-690F5	N.													&EFS/690.8
								,															
=					-U5		PE	,	-690F5	N.													&EFS/690.8
								,															
								,															
230V AC for Container Air Conditioning 2							2	,	-690F2	2													&EFS/690.3
230V AC for Container Air Conditioning 1							N	,	-XE	N													&EFS/690.1
=							PE	,															&EFS/690.2
230V AC for Container Air Conditioning 2							N	,	-XE	N													&EFS/690.3
=							PE	,															&EFS/690.3

previous page:
2030

next page:
=UNIT_03&EAA++/1

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_02++ASC+-690XT1	20230331_V0.01	= UNIT_02 Battery Container 1
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet page: 2031
Date								+ total: 423

Freqcon GmbH

Bürgerwiesenweg 5
D-27336 Rethem
+49 5165 291760-0
info@freqcon.com

Customer:	Statron	
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	
Type:	BESS MSC-1000-620-8	
Product	BATTERY CONTAINER 2	
Circuit diagram No:	10354_23A2007	ANL3_20230302_V0.01

Producer (company):	Freqcon GmbH	53396 ASC 5XXXX
Project:	Shell Crosswind BESS FQ 1MW 5MWh Offshore	Container Ausbau 53043
Type:	BESS MSC-1000-620-8	
Project manager:	Freqcon_CP	

created on:	17.09.2019			
edited on:	31.03.2023	edited by: Freqcon_DG	total pages:	423

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EAA		Cover sheet		
	1	Cover	30.03.2023	Freqcon_DG
&EAB		Contents		
	1	INDEX	31.03.2023	Freqcon_DG
	2	INDEX	31.03.2023	Freqcon_DG
	3	INDEX	31.03.2023	Freqcon_DG
	4	INDEX	31.03.2023	Freqcon_DG
	5	INDEX	31.03.2023	Freqcon_DG
&EAC		Explanatory documents		
	1a	Specification	31.03.2023	Freqcon_DG
	6a	Specification Earthing	31.03.2023	Freqcon_DG
&EFA		Single line diagram		
	1a	SYSTEMS OVERVIEW	31.03.2023	Freqcon_DG
&ELU		Cabinet Overview		
	5a	Container overview	31.03.2023	Freqcon_DG
&EFS		Circuit diagram		
	190	CONTAINER COOLING, LIGHT 230V SUPPLY	30.03.2023	Freqcon_DG
	278	EARTHING CONTAINER	30.03.2023	Freqcon_DG
	290	BATTERY CABINETS 1-3	31.03.2023	Freqcon_DG
	291	BATTERY CABINETS 4-5	31.03.2023	Freqcon_DG
	292	BATTERY CABINETS 6-8	31.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EFS		Circuit diagram		
	293	BATTERY CABINETS 9-11	31.03.2023	Freqcon_DG
&EFS ++ASC		Circuit diagram auxillary cabinet		
	611	ETHERNET SWITCH	30.03.2023	Freqcon_DG
	613	ETHERNET / PROFINET ISOLATOR	30.03.2023	Freqcon_DG
	630	FUSES FEEDBACK	30.03.2023	Freqcon_DG
	669	SMOKE POTENTIAL-FREE CONTACTS	30.03.2023	Freqcon_DG
	670	GAS POTENTIAL-FREE CONTACTS	31.03.2023	Freqcon_DG
	684	AUXILIARY SUPPLY 400V AC	30.03.2023	Freqcon_DG
	685	BATTERY CABINETS MEASURE N	30.03.2023	Freqcon_DG
	687	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	30.03.2023	Freqcon_DG
	688	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	30.03.2023	Freqcon_DG
	690	CONTAINER COOLING / LIGHTNING	30.03.2023	Freqcon_DG
&EPC		Parts List		
	1	PARTS LIST	30.03.2023	Freqcon_DG
&EPC ++ASC		Parts List auxillary cabinet		
	1	PARTS LIST	30.03.2023	Freqcon_DG
	2	PARTS LIST	30.03.2023	Freqcon_DG
	3	PARTS LIST	30.03.2023	Freqcon_DG
	4	PARTS LIST	30.03.2023	Freqcon_DG
&EPA		Summarized part list		
	1	SUMMARIZED PARTS LIST	30.03.2023	Freqcon_DG

Editor	Freqcon_DG			Statron	FREQCON	INDEX	20230331_V0.01	= UNIT_03 Battery Container 2
Date	31.03.2023							& EAB Contents
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 2
Date								+ total: 423

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EPA ++ASC		Summarized part list auxillary cabinet		
	1	SUMMARIZED PARTS LIST	30.03.2023	Freqcon_DG
&EMB		Cable list		
	1	CABEL LIST	30.03.2023	Freqcon_DG
	2	CABEL LIST	30.03.2023	Freqcon_DG
	3	CABEL LIST	30.03.2023	Freqcon_DG
	4	CABEL LIST	30.03.2023	Freqcon_DG
	5	CABEL LIST	30.03.2023	Freqcon_DG
	6	CABEL LIST	30.03.2023	Freqcon_DG
	7	CABEL LIST	31.03.2023	Freqcon_DG
	8	CABEL LIST	31.03.2023	Freqcon_DG
	9	CABEL LIST	31.03.2023	Freqcon_DG
	10	CABEL LIST	31.03.2023	Freqcon_DG
	11	CABEL LIST	31.03.2023	Freqcon_DG
	12	CABEL LIST	31.03.2023	Freqcon_DG
&EMB ++ASC		Cable list auxillary cabinet		
	1	CABEL LIST	31.03.2023	Freqcon_DG
	2	CABEL LIST	31.03.2023	Freqcon_DG
	3	CABEL LIST	31.03.2023	Freqcon_DG
	4	CABEL LIST	31.03.2023	Freqcon_DG
	5	CABEL LIST	31.03.2023	Freqcon_DG
	6	CABEL LIST	31.03.2023	Freqcon_DG
	7	CABEL LIST	31.03.2023	Freqcon_DG
	8	CABEL LIST	31.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMB ++EXTERN		Cable list		
	1	CABEL LIST	30.03.2023	Freqcon_DG
&EMZ ++ASC		Terminals auxillary cabinet		
	1000	Klemmenleistenübersicht : =UNIT_03++ASC+-630X3 - =UNIT_03++ASC+-690XT1	31.03.2023	Freqcon_DG
	2000	Klemmenplan =UNIT_03++ASC+-630X3	31.03.2023	Freqcon_DG
	2001	Klemmenplan =UNIT_03++ASC+-XE	31.03.2023	Freqcon_DG
	2002	Klemmenplan =UNIT_03++ASC+-XF3.1	31.03.2023	Freqcon_DG
	2003	Klemmenplan =UNIT_03++ASC+-XF3.2	31.03.2023	Freqcon_DG
	2004	Klemmenplan =UNIT_03++ASC+-XF3.3	31.03.2023	Freqcon_DG
	2005	Klemmenplan =UNIT_03++ASC+-XF3.4	31.03.2023	Freqcon_DG
	2006	Klemmenplan =UNIT_03++ASC+-XN	31.03.2023	Freqcon_DG
	2007	Klemmenplan =UNIT_03++ASC+-XN	31.03.2023	Freqcon_DG
	2008	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2009	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2010	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2011	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2012	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2013	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2014	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2015	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2016	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2017	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2018	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2019	Klemmenplan =UNIT_03++ASC+-369XT	31.03.2023	Freqcon_DG
	2020	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2021	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2022	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG

Table of contents

FREQCON_INHALT_04_de_en

Assignment	Page	Page description	Date	Edited by
&EMZ ++ASC		Terminals auxillary cabinet		
	2023	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2024	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2025	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2026	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2027	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2028	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2029	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2030	Klemmenplan =UNIT_03++ASC+-687XT1	31.03.2023	Freqcon_DG
	2031	Klemmenplan =UNIT_03++ASC+-690XT1	31.03.2023	Freqcon_DG

previous page: 4

next page: &EAC/1a

SPECIFICATION

TERMINAL STRIP

-XE1	MAIN POWER SUPPLY 600V AC
-XE2	DC POWER SUPPLY 1000V DC
-XE	MAIN POWER SUPPLY 400V AC
-X1	MAIN POWER 400V/230V AC
-X2	LIGHT CABINET 230V AC
-X3	CONTROL VOLTAGE 24V DC
-14X1	CONTROL VOLTAGE 24V DC (TO DC CONTACTORS)
-X5	LOW-VOLTAGE SIGNALS
-XDC0	24V DC POWER SUPPLY
-XDC1-4	CONTROL VOLTAGE 24V DC (UPS)
-XT	TRANSFER TERMINAL BLOCK 24V DC / 230V AC

WIRING COLOR

L1 / L2 / L3	=	BLACK
N	=	LIGHT BLUE (IEC) / GREY (UL)
PE	=	YELLOW-GREEN
EXTERNAL VOLTAGE	=	ORANGE
CONTROL VOLTAGE 24 V DC	=	DARK BLUE
ANALOG SIGNALS	=	WHITE

PLACE

+CTRL	=	Control cabinet
+CON	=	Converter cabinet
+IND	=	Inductor cabinet
+CIR	=	Circuit breaker cabinet
+COSY	=	Cooling System
+FAN	=	External fan

previous page: &EAB/5

next page: 6a

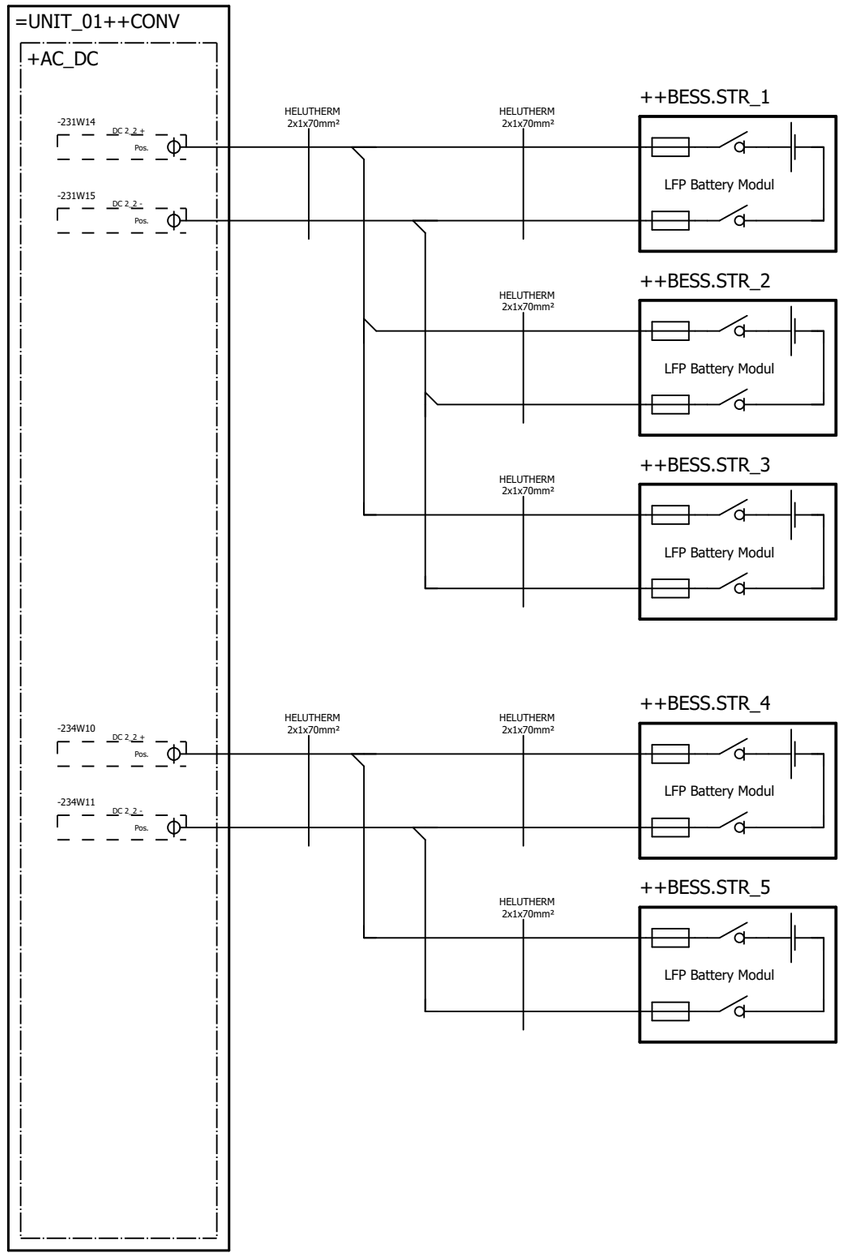
SPECIFICATION of grounding

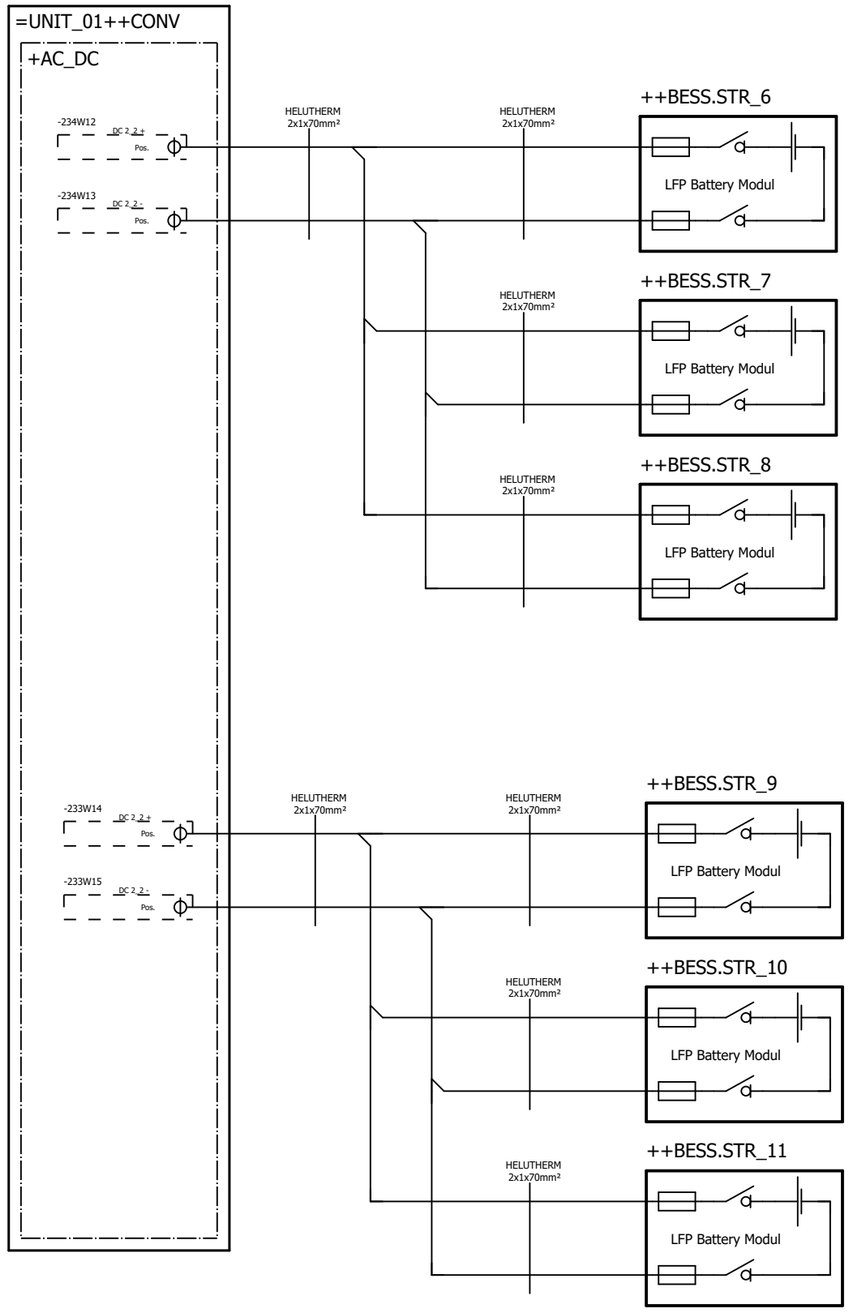
	from frame to			
⏚1	**roof & side walls & doors**	**EVD_1**	**Flachband**	**2x25 mm²**
⏚2	**frame**	**EVD_2**	**Flachband**	**2x25 mm²**
⏚3	**base**	**EVD_3**	**Flachband**	**2x25 mm²**
⏚4	**Mounting plate & partitions**	**EVD_4**	**H07-V-K**	**2x25 mm²**
⏚5	**inductors**	**EVD_5**	**H07-V-k**	**2x25 mm²**
⏚6	**Powerstack**	**EVD_6**	**H07-V-K**	**2x25 mm²**
⏚7	**DC Switch & Fuse**	**EVD_7**	**H07-V-K**	**2x25 mm²**
⏚8	**AC Filter**	**EVD_8**	**H07-V-K**	**2x25 mm²**
⏚9	**circuit-breaker**	**EVD_9**	**H07-V-K**	**2x25 mm²**
⏚10	**Freqcon_Fast_Disconektor**	**EVD_10**	**H07-V-K**	**2x25 mm²**
⏚11	**Freqcon_Rectifier_Modul**	**EVD_11**	**H07-V-K**	**2x25 mm²**
⏚12	**capacitor banks**	**EVD_12**	**H07-V-K**	**2x25 mm²**
⏚13	**water distributor**	**EVD_13**	**H07-V-K**	**2x25 mm²**
⏚14	**SPARE**	**EVD_14**	**H07-V-K**	**2x25 mm²**
⏚15	**SPARE**	**EVD_15**	**H07-V-K**	**2x25 mm²**
⏚16	**SPARE**	**EVD_16**	**H07-V-K**	**2x25 mm²**
⏚17	**SPARE**	**EVD_17**	**H07-V-K**	**2x25 mm²**
⏚18	**SPARE**	**EVD_18**	**H07-V-K**	**2x25 mm²**
	from door to			
⏚19	**PROFINET IRT IGBT Interface**	**EVD_19**	**H07-V-K**	**1,5 mm²**
⏚20	**HMI**	**EVD_20**	**H07-V-K**	**1,5 mm²**
⏚21	**SPARE**	**EVD_21**	**H07-V-K**	**??? mm²**
⏚22	**SPARE**	**EVD_22**	**H07-V-K**	**??? mm²**

previous page: 1a

next page: &EFA/1a

Single line diagram

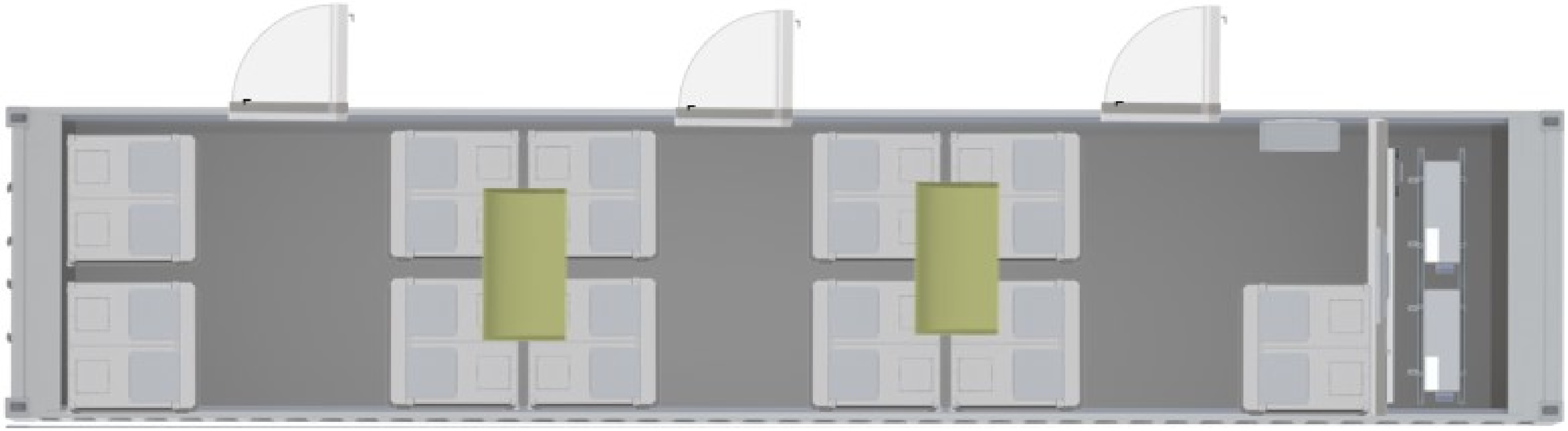




previous page:
&EAC/6a

next page:
&ELU/5a

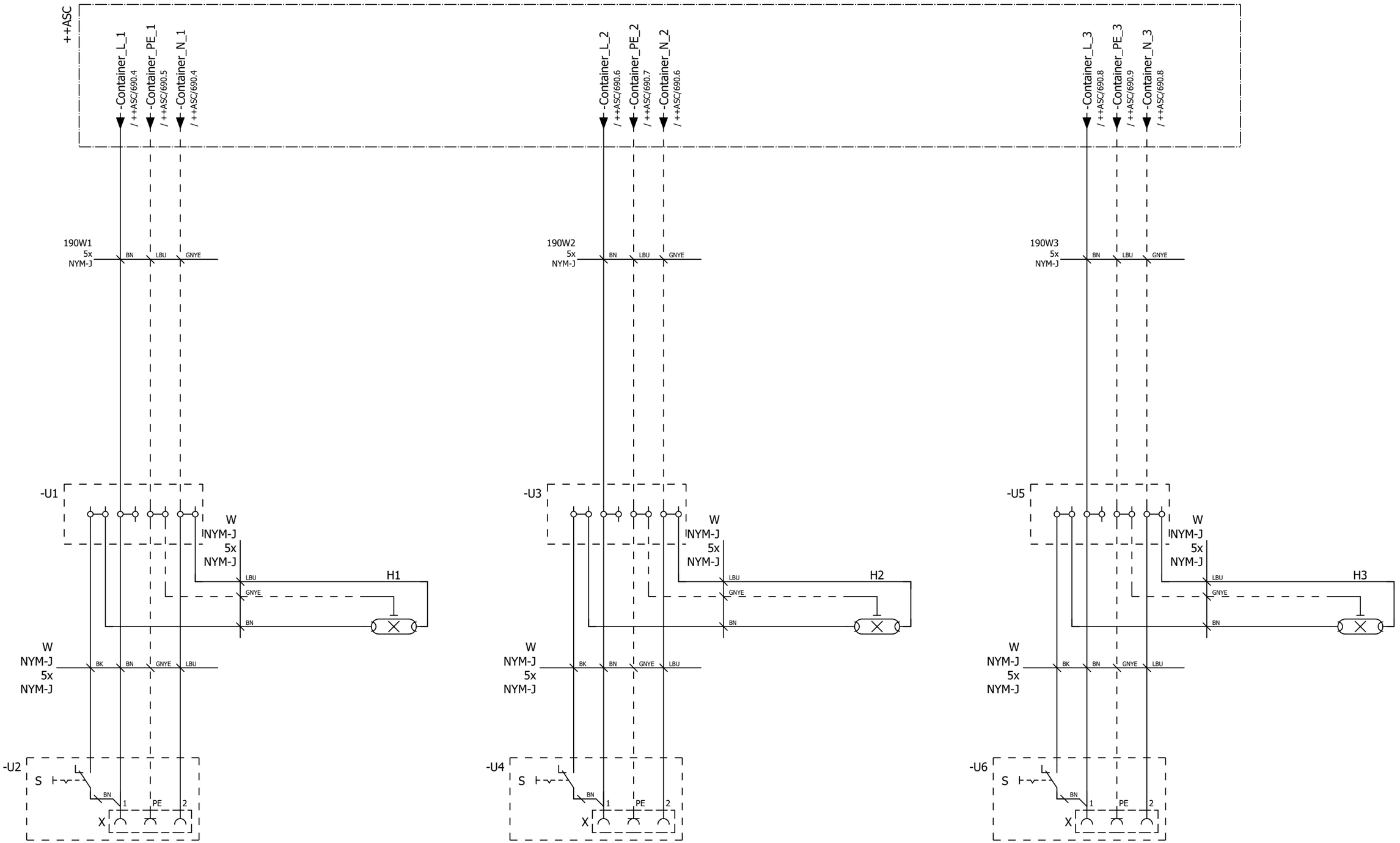
Editor	Freqcon_DG			Statron	FREQCON	SYSTEMS OVERVIEW	ANL2_20230331_V0.01	= UNIT_03 Battery Container 2
Date	31.03.2023	Norm						& EFA Single line diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 1a
Date								+ total: 423



previous page:
&EFA/1a

next page:
&EFS/190

Editor	Freqcon_DG			Statron	FREQCON	Container overview	ANL2_20230331_V0.01	= UNIT_03	Battery Container 2
Date	31.03.2023	Norm						& ELU	Cabinet Overview
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 5a
Date								+	total: 423



230V AC for
Container light, socket

230V AC for
Container light, socket

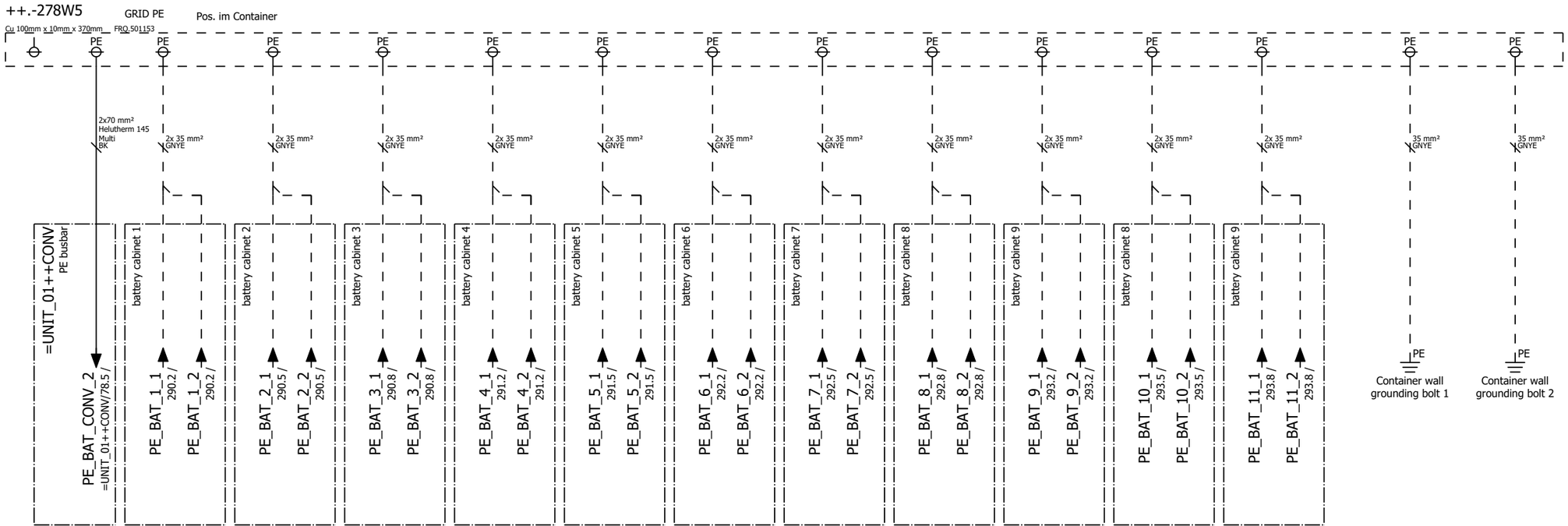
230V AC for
Container light, socket

previous page:
&ELU/5a

next page:
278

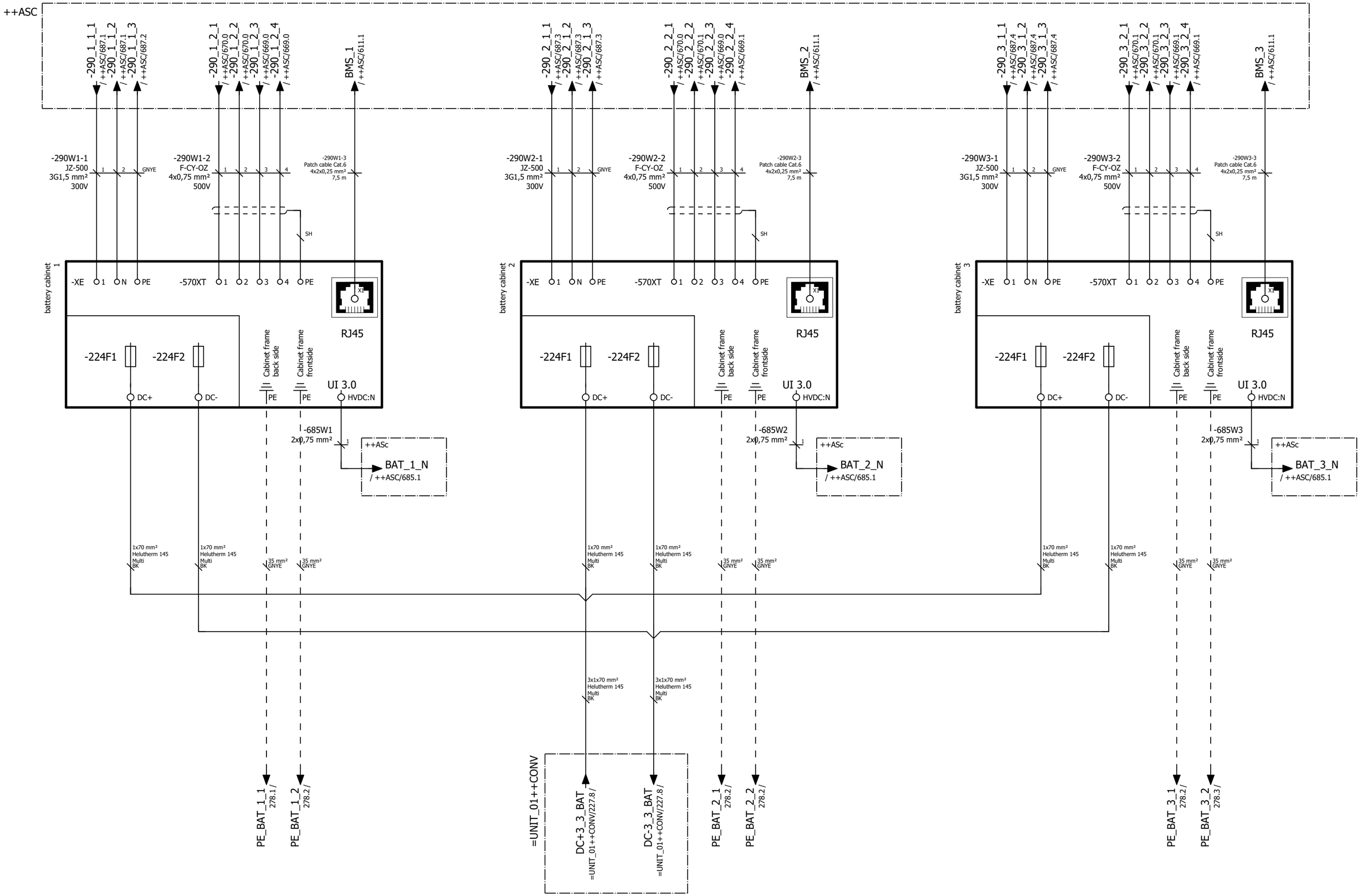
Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING, LIGHT 230V SUPPLY	20230331_V0.01	= UNIT_03 Battery Container 2
Date	30.03.2023							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ page: 190
Date								+ total: 423

Busbars PE



previous page: 190

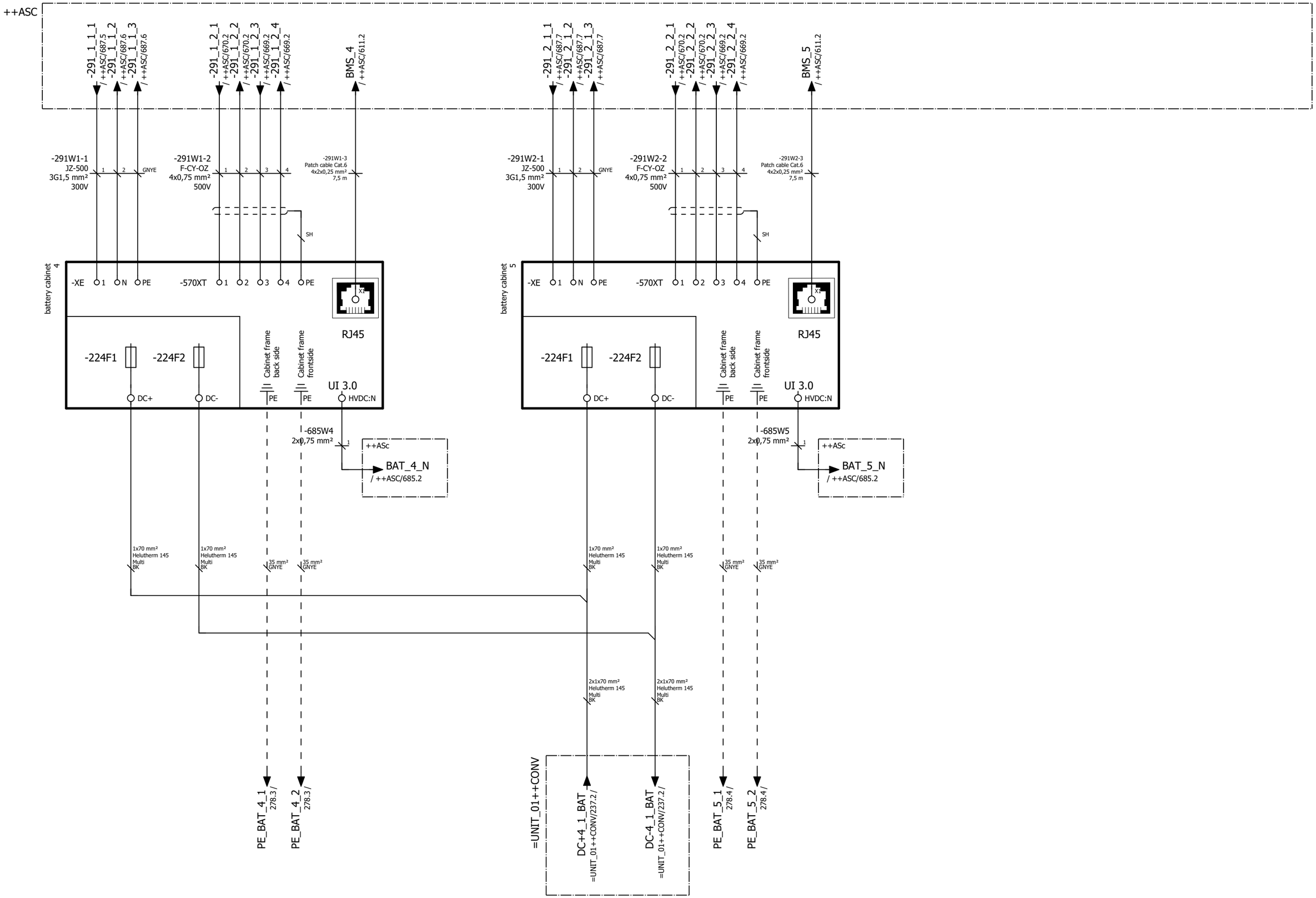
next page: 290



previous page: 278

next page: 291

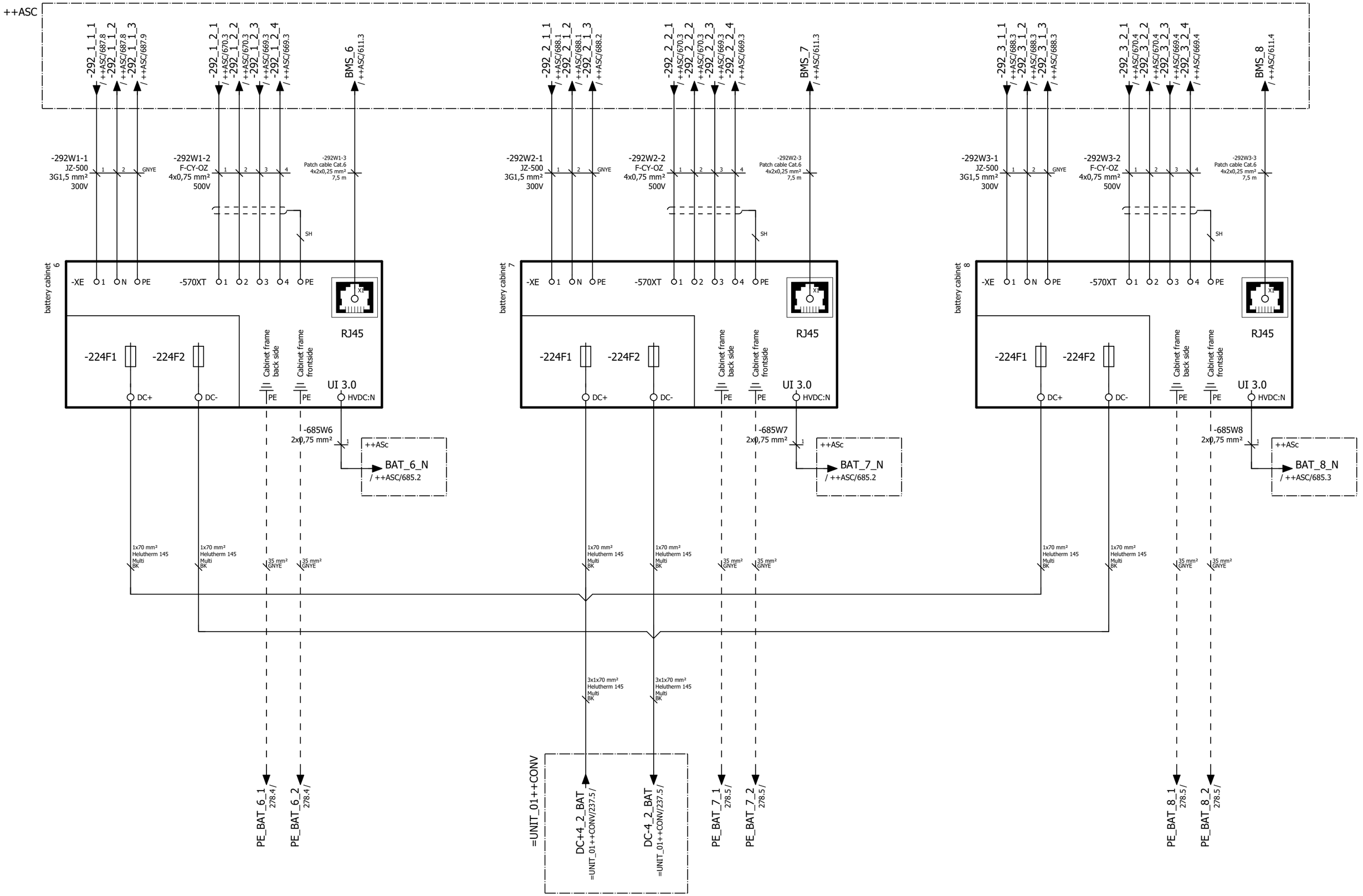
Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS 1-3	20230331_V0.01	= UNIT_03	Battery Container 2
Date	31.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 290
Date								+	total: 423



previous page: 290

next page: 292

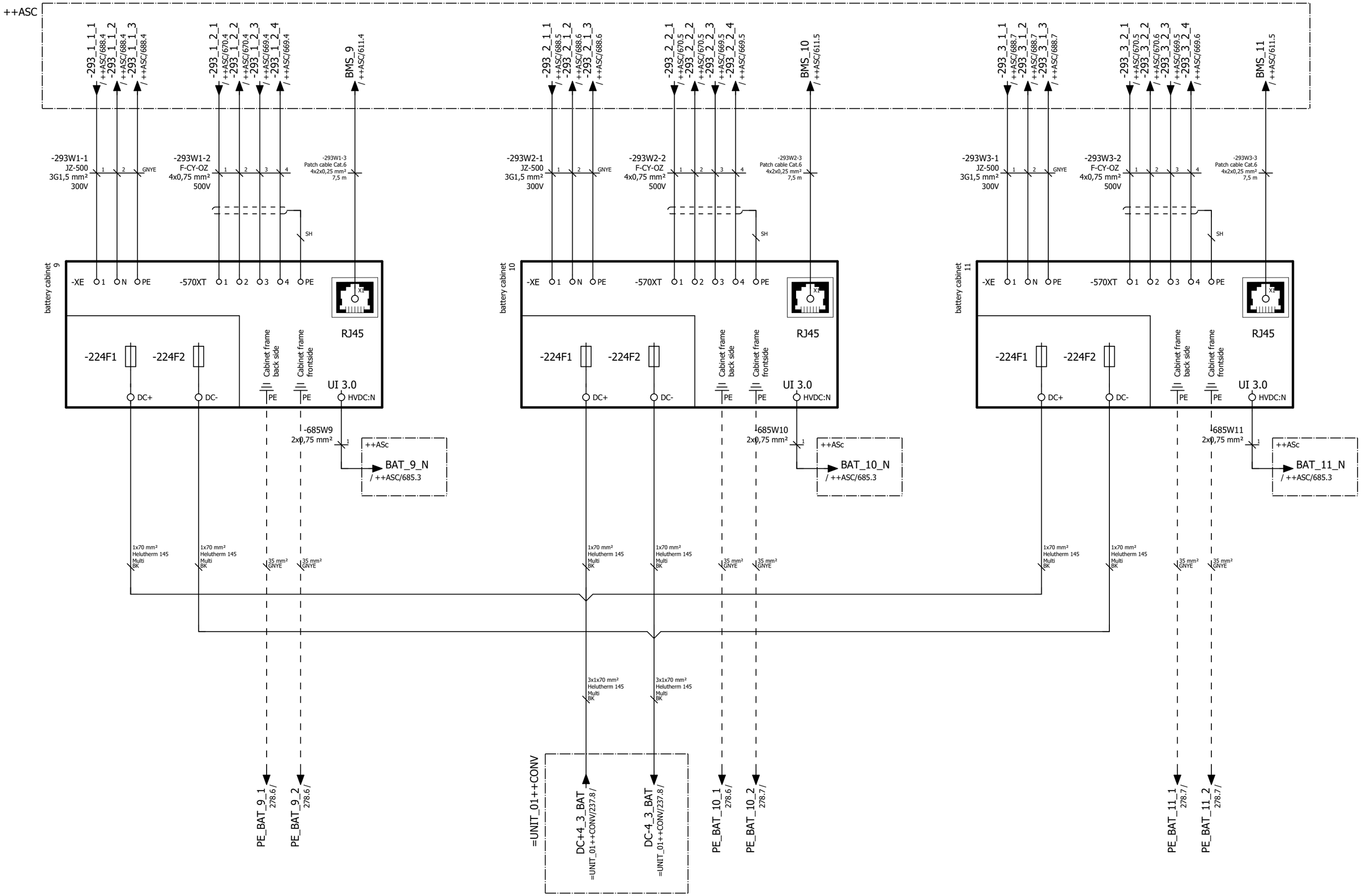
Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS 4-5	20230331_V0.01	= UNIT_03	Battery Container 2
Date	31.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 291
Date								+	total: 423



previous page: 291

next page: 293

Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS 6-8	20230331_V0.01	= UNIT_03	Battery Container 2
Date	31.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 292
Date								+	total: 423



previous page: 292

next page: ++ASC/611

Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS 9-11	20230331_V0.01	= UNIT_03	Battery Container 2
Date	31.03.2023							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++	page: 293
Date								+	total: 423

-3L+1
630.1 /
-3M1
630.2 /

0,75 mm² BU
0,75 mm² BU/WH

-611A1

1 UB2
2 0V
3 UB1
4 0V
5 FE

MURR ELEKTRONIK
stay connected

16 port
unmanaged
switch
58174

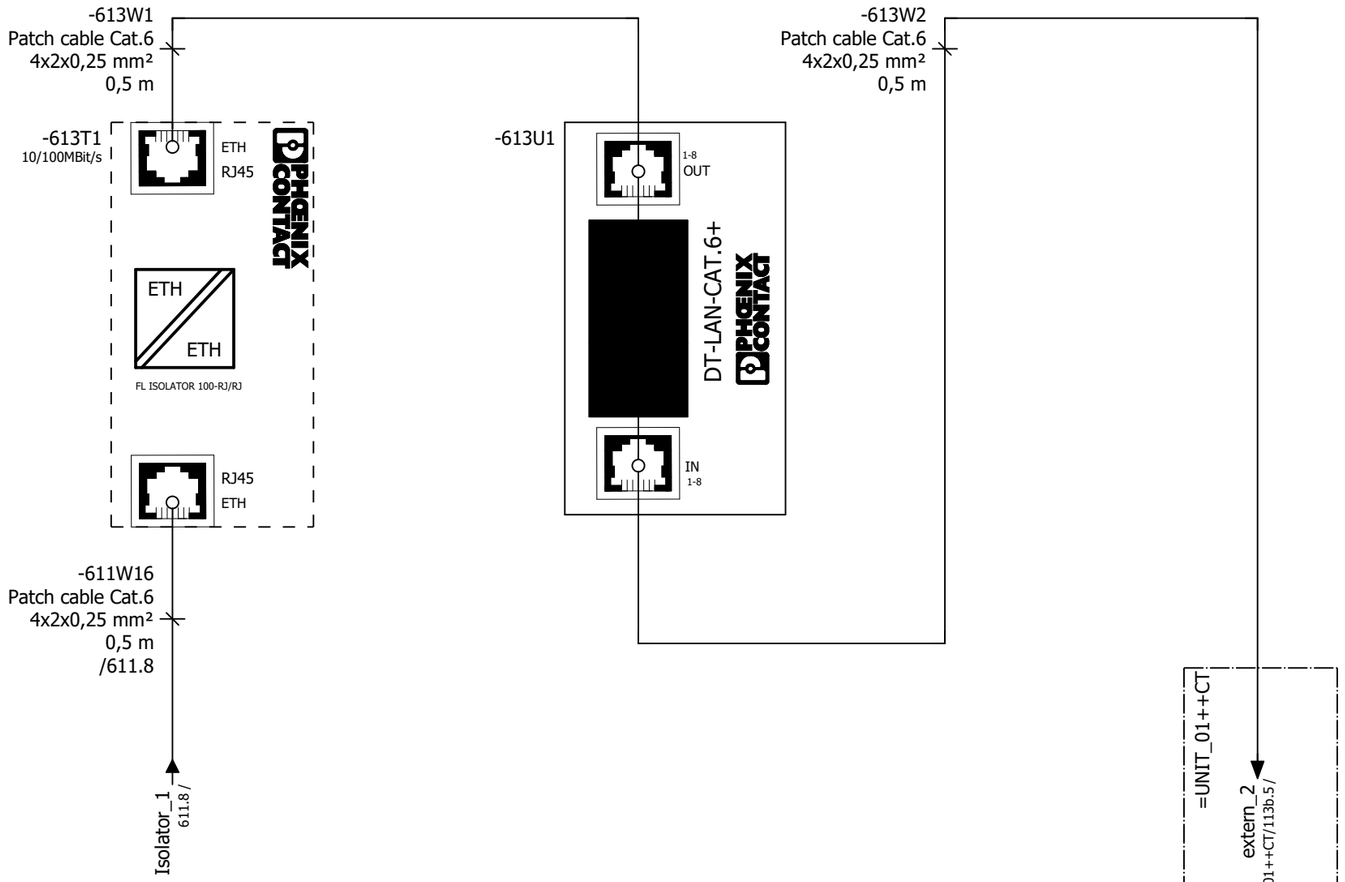
RJ45 PORT 1 X1 1-16
RJ45 PORT 2 X2 1-16
RJ45 PORT 3 X3 1-16
RJ45 PORT 4 X4 1-16
RJ45 PORT 5 X5 1-16
RJ45 PORT 6 X6 1-16
RJ45 PORT 7 X7 1-16
RJ45 PORT 8 X8 1-16
RJ45 PORT 9 X9 1-16
RJ45 PORT 10 X2 1-16
RJ45 PORT 11 X3 1-16
RJ45 PORT 12 X4 1-16
RJ45 PORT 13 X5 1-16
RJ45 PORT 14 X6 1-16
RJ45 PORT 15 X7 1-16
RJ45 PORT 16 X8 1-16

-611W1 Patch cable Cat.6 4x2x0,25 mm² → battery string 1 BMS_1 ++/290.2
-611W2 Patch cable Cat.6 4x2x0,25 mm² → battery string 2 BMS_2 ++/290.5
-611W3 Patch cable Cat.6 4x2x0,25 mm² → battery string 3 BMS_3 ++/290.9
-611W4 Patch cable Cat.6 4x2x0,25 mm² → battery string 4 BMS_4 ++/291.2
-611W5 Patch cable Cat.6 4x2x0,25 mm² → battery string 5 BMS_5 ++/291.5
-611W6 Patch cable Cat.6 4x2x0,25 mm² → battery string 6 BMS_6 ++/292.2
-611W7 Patch cable Cat.6 4x2x0,25 mm² → battery string 7 BMS_7 ++/292.5
-611W8 Patch cable Cat.6 4x2x0,25 mm² → battery string 8 BMS_8 ++/292.9
-611W9 Patch cable Cat.6 4x2x0,25 mm² → battery string 9 BMS_9 ++/293.2
-611W10 Patch cable Cat.6 4x2x0,25 mm² → battery string 10 BMS_10 ++/293.5
-611W11 Patch cable Cat.6 4x2x0,25 mm² → battery string 11 BMS_11 ++/293.9
-611W16 Patch cable Cat.6 4x2x0,25 mm² 7,5 m /613.1 → Isolator_1 613.1 /

previous page:
++/293

next page:
613

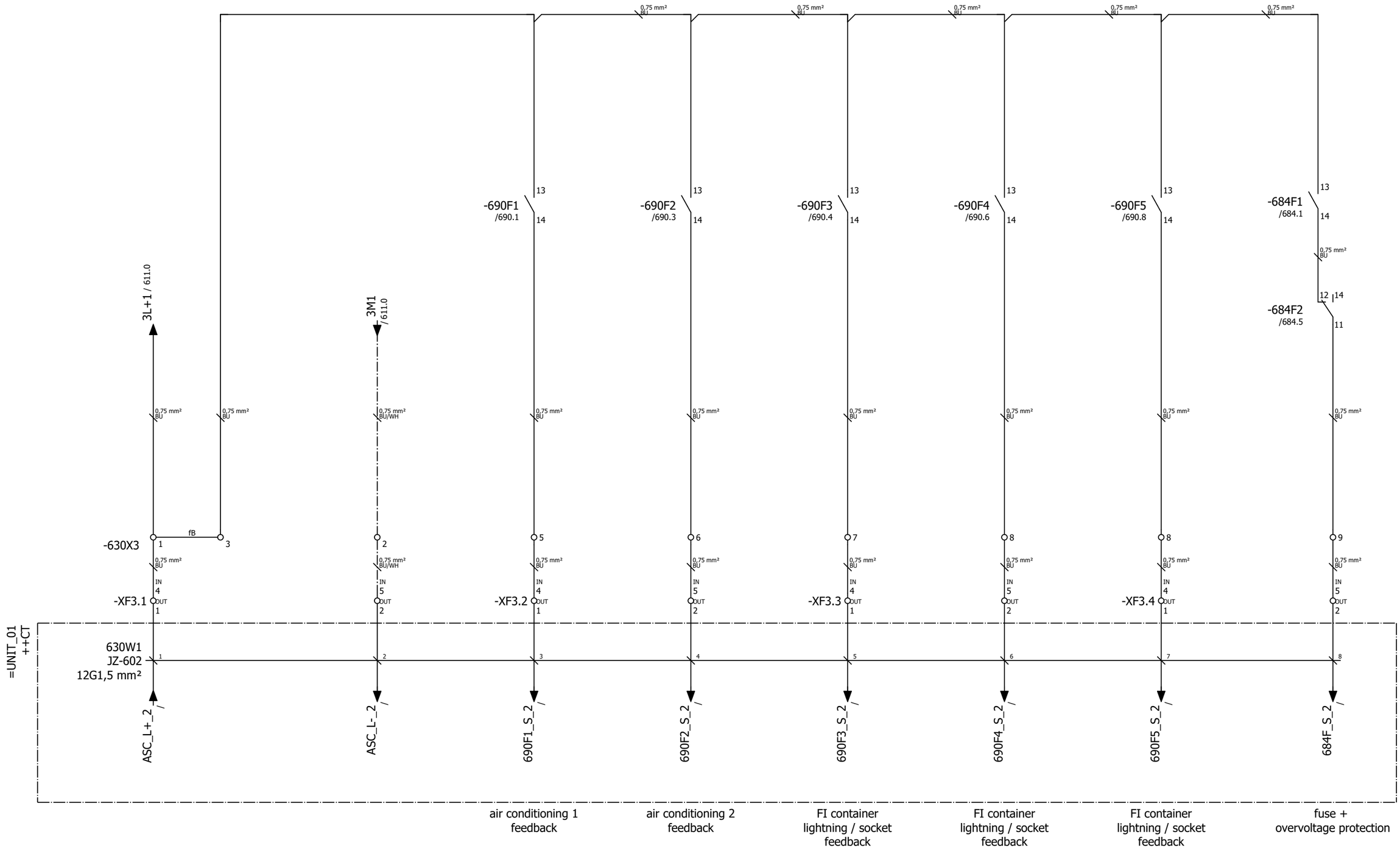
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET SWITCH	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 611
Date								+	total: 423



previous page: 611

next page: 630

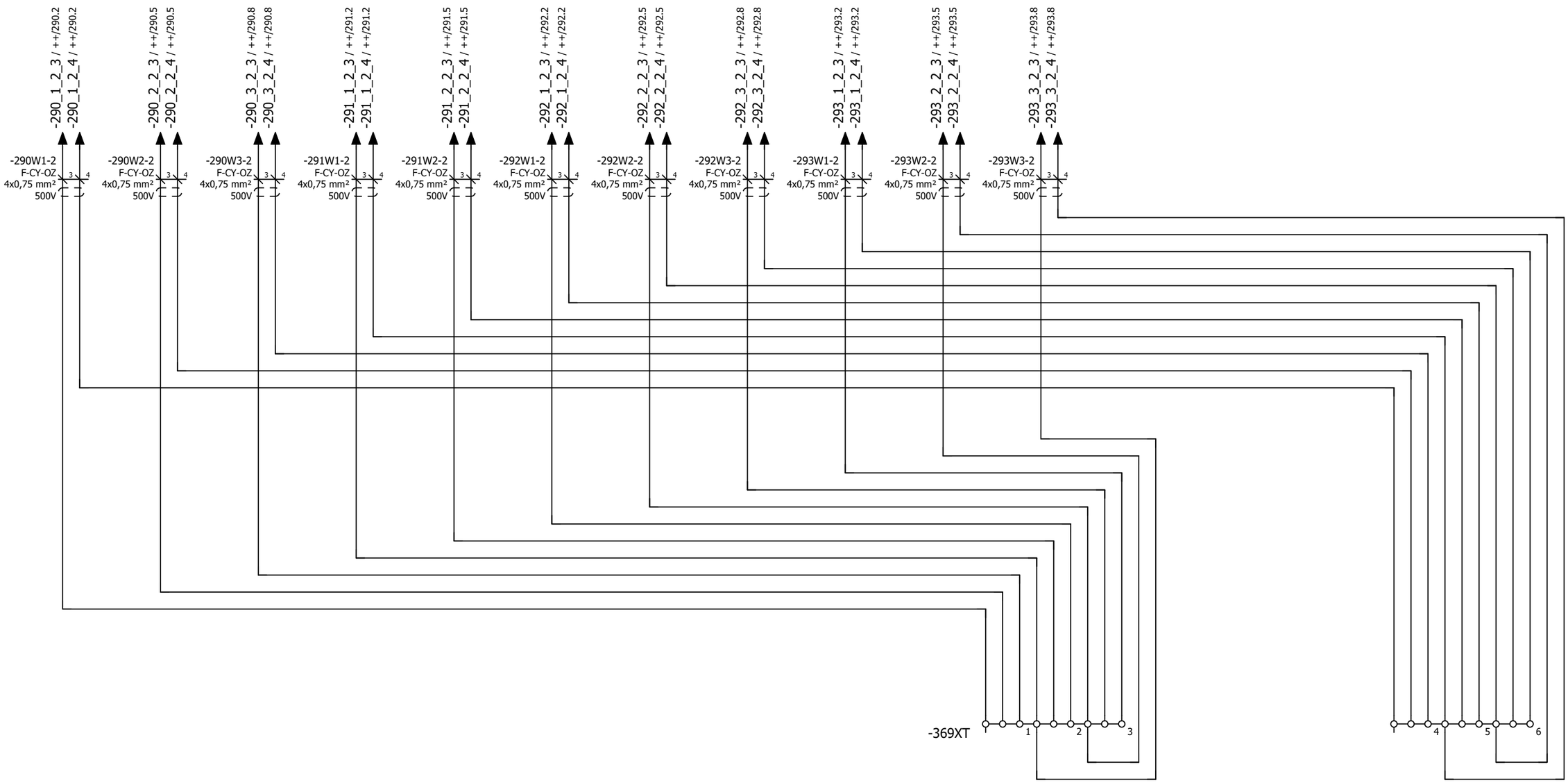
Editor	Freqcon_DG			Statron	FREQCON	ETHERNET / PROFINET ISOLATOR	20230331_V0.01	= UNIT_03	Battery Container 2	
Date	30.03.2023							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 613
Date								+		total: 423



previous page: 613

next page: 669

Editor	Freqcon_DG			Statron	FREQCON	FUSES FEEDBACK	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 630
Date								+	total: 423



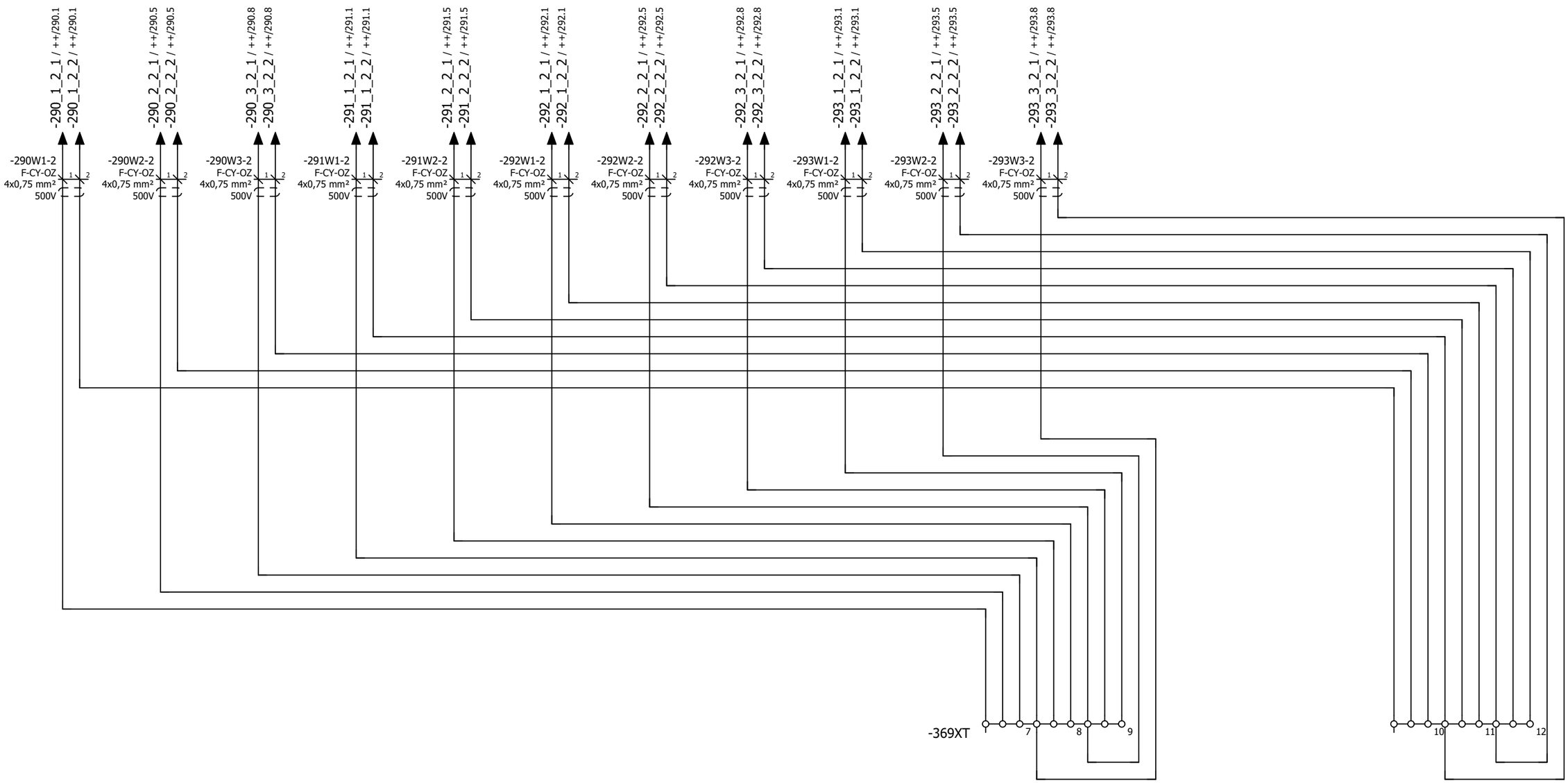
battery cabinet smoke detector
potential-free contacts
customer

battery cabinet smoke detector
potential-free contacts
customer

previous page:
630

next page:
670

Editor	Freqcon_DG			Statron	FREQCON	SMOKE POTENTIAL-FREE CONTACTS	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 669
Date								+	total: 423



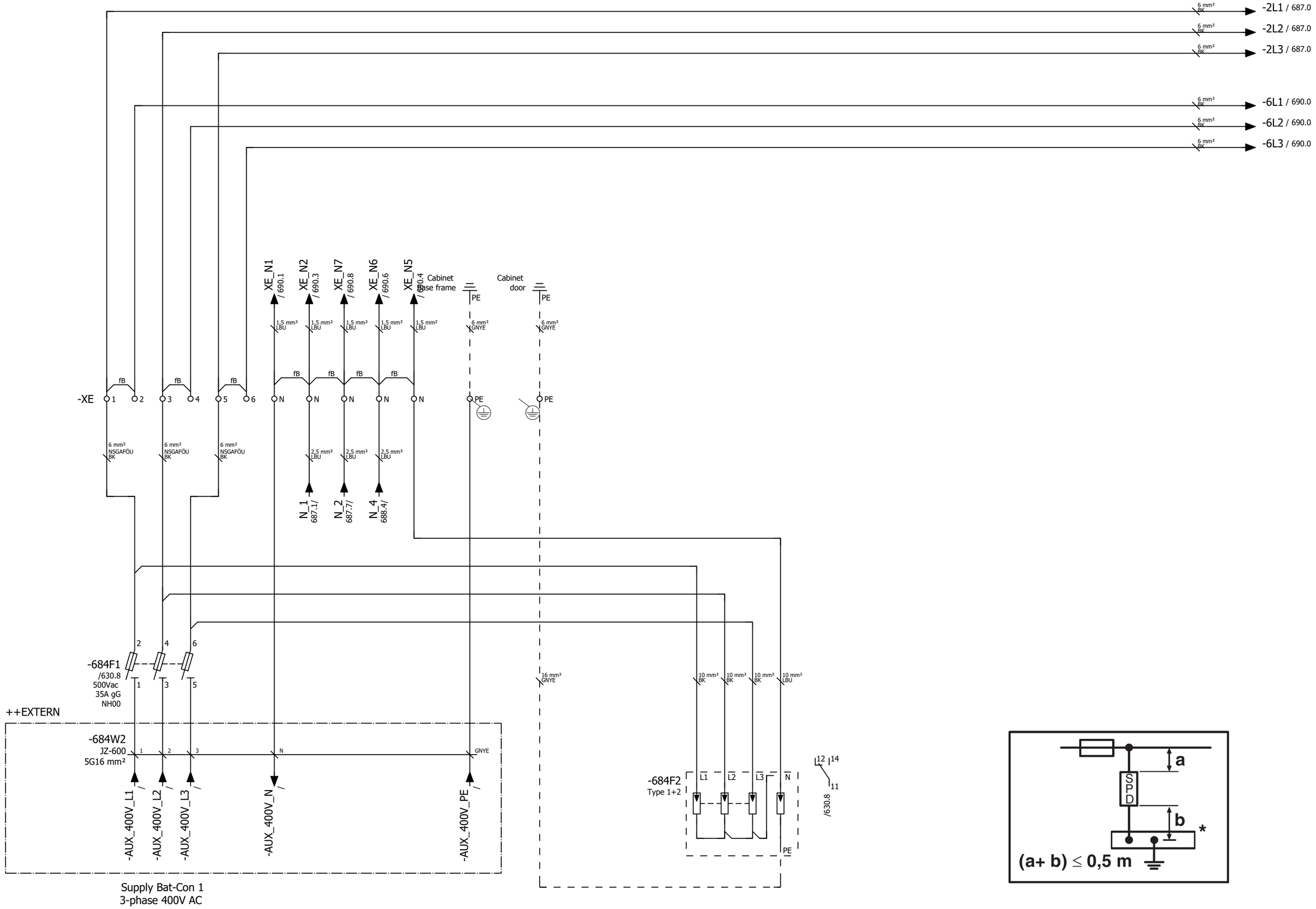
battery cabinet gas
potential-free contacts
customer

battery cabinet gas
potential-free contacts
customer

previous page:
669

next page:
684

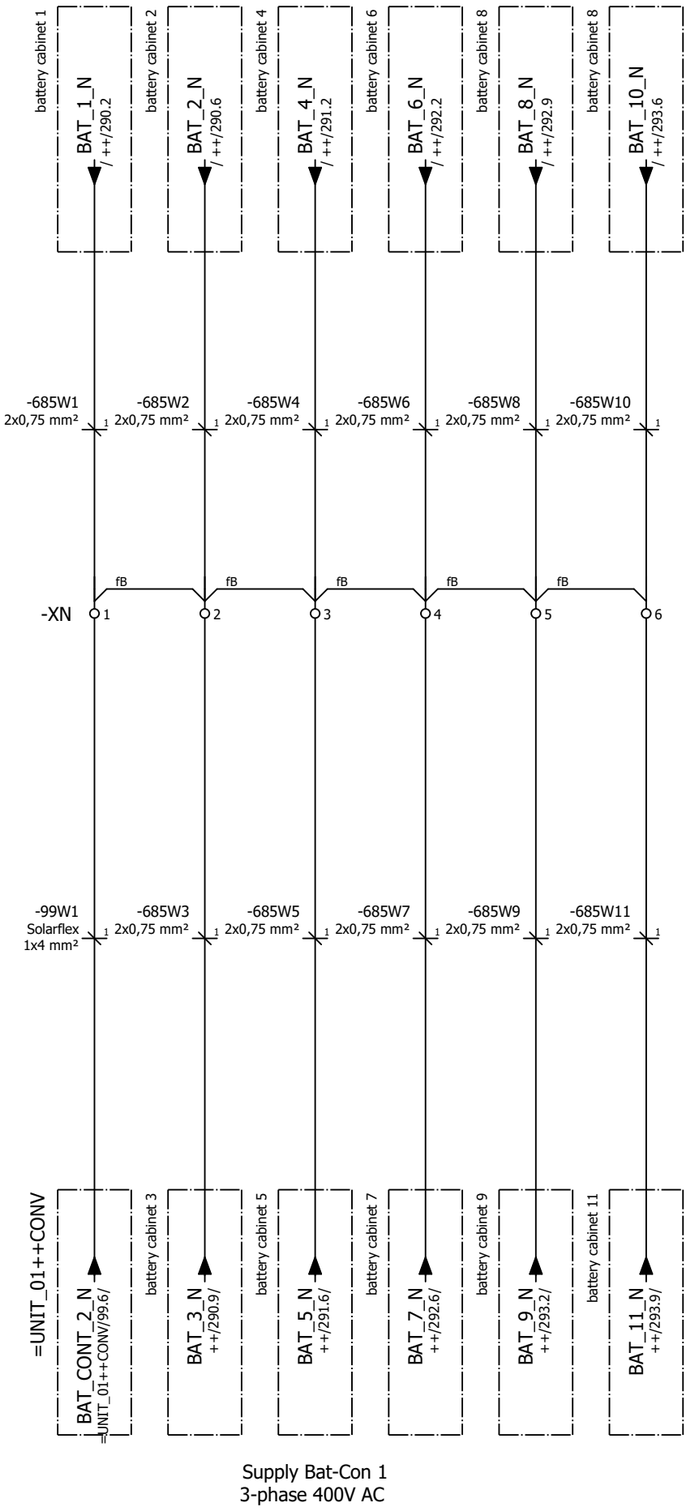
Editor	Freqcon_DG			Statron	FREQCON	GAS POTENTIAL-FREE CONTACTS	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	31.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 670
Date								+	total: 423



previous page: 670

next page: 685

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V AC	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 684
Date								+	total: 423



previous page: 684

next page: 687

Editor	Freqcon_DG			Statron	FREQCON	BATTERY CABINETS MEASURE N	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 685
Date								+	total: 423

684.9 / 2L1
684.9 / 2L2
684.9 / 2L3

3L1 / 688.0
3L2 / 688.0
3L3 / 688.0

fB

-687F1 C16A
-687F2 C16A
-687F3 C16A
-687F4 C16A
-687F5 C16A
-687F6 C16A

1
2

N_1 / 684.2
N_2 / 684.3

1,5 mm² BK
2,5 mm² LBU

-687XT1 1 N PE
-290W1-1 JZ-500 3G1,5 mm² 1 2 GNYE
-290W2-1 JZ-500 3G1,5 mm² 1 2 GNYE
-290W3-1 JZ-500 3G1,5 mm² 1 2 GNYE
-291W1-1 JZ-500 3G1,5 mm² 1 2 GNYE
-291W2-1 JZ-500 3G1,5 mm² 1 2 GNYE
-292W1-1 JZ-500 3G1,5 mm² 1 2 GNYE

2 N PE
3 N PE
4 N PE
5 N PE
6 N PE

N_3 / 688.1

battery string 1
-290_1_1_1 ++/290.0
-290_1_1_2 ++/290.1
-290_1_1_3 ++/290.1

battery string 2
-290_2_1_1 ++/290.4
-290_2_1_2 ++/290.4
-290_2_1_3 ++/290.4

battery string 3
-290_3_1_1 ++/290.7
-290_3_1_2 ++/290.7
-290_3_1_3 ++/290.7

battery string 4
-291_1_1_1 ++/291.0
-291_1_1_2 ++/291.1
-291_1_1_3 ++/291.1

battery string 5
-291_2_1_1 ++/291.4
-291_2_1_2 ++/291.4
-291_2_1_3 ++/291.4

battery string 6
-292_1_1_1 ++/292.0
-292_1_1_2 ++/292.1
-292_1_1_3 ++/292.1

Supply Battery String 1-phase 230V AC
Supply Battery String 1-phase 230V AC
Supply Battery String 1-phase 230V AC
Supply Battery String 1-phase 230V AC
Supply Battery String 1-phase 230V AC
Supply Battery String 1-phase 230V AC

previous page: 685
next page: 688

Editor	Freqcon_DG			Statron	FREQCON	AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 687
Date								+	total: 423

687.9 / 3L1 fB
687.9 / 3L2 fB
687.9 / 3L3 fB
687.9 / N_3 fB
687.9 / N_4 / 684.3

-688F1 C16A
-688F2 C16A
-688F3 C16A
-688F4 C16A
-688F5 C16A

-687XT1 7 N PE
-687XT1 8 N PE
-687XT1 9 N PE
-687XT1 10 N PE
-687XT1 11 N PE

-292W2-1 JZ-500 3G1,5 mm²
-292W3-1 JZ-500 3G1,5 mm²
-293W1-1 JZ-500 3G1,5 mm²
-293W2-1 JZ-500 3G1,5 mm²
-293W3-1 JZ-500 3G1,5 mm²

1,5 mm² BK
2,5 mm² LBU
GNYE

battery string 7
-292_2_1_1 ++/292.4
-292_2_1_2 ++/292.4
-292_2_1_3 ++/292.4

battery string 8
-292_3_1_1 ++/292.7
-292_3_1_2 ++/292.7
-292_3_1_3 ++/292.7

battery string 9
-293_1_1_1 ++/293.0
-293_1_1_2 ++/293.1
-293_1_1_3 ++/293.1

battery string 10
-293_2_1_1 ++/293.4
-293_2_1_2 ++/293.4
-293_2_1_3 ++/293.4

battery string 11
-293_3_1_1 ++/293.7
-293_3_1_2 ++/293.7
-293_3_1_3 ++/293.7

Supply Battery String
1-phase 230V AC

previous page: 687
next page: 690

Editor	Freqcon_DG			Statron		AUXILIARY SUPPLY 400V / 230V AC DISTRIBUTION	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	30.03.2023							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 688
Date								+	total: 423

684.9 / 6L1 — 6 mm² BK
684.9 / 6L2 — 6 mm² BK
684.9 / 6L3 — 6 mm² BK

-690F1 /630.3 C16A — 6 mm² BK
-690F2 /630.4 C16A — 6 mm² BK

684.3 / XE_N5 — 1,5 mm² LBU
-690F3 16A — /630.5
684.3 / XE_N6 — 1,5 mm² LBU
-690F4 16A — /630.6
684.3 / XE_N7 — 1,5 mm² LBU
-690F5 16A — /630.7

XE_N1 / 684.2
XE_N2 / 684.2

-690XT1

1,5 mm² BK, 1,5 mm² LBU

L N PE

230V AC for
Container Air Conditioning 1

230V AC for
Container Air Conditioning 2

190W1 NYM-J 5x NYM-J — BN LBU GNYE
=UNIT_02
-Container_L_1 ++/190.1
-Container_N_1 ++/190.1
-Container_PE_1 ++/190.1

FI container
lightning / socket
feedback

190W2 NYM-J 5x NYM-J — BN LBU GNYE
=UNIT_02
-Container_L_2 ++/190.4
-Container_N_2 ++/190.4
-Container_PE_2 ++/190.4

FI container
lightning / socket
feedback

190W3 NYM-J 5x NYM-J — BN LBU GNYE
=UNIT_02
-Container_L_3 ++/190.7
-Container_N_3 ++/190.7
-Container_PE_3 ++/190.7

FI container
lightning / socket
feedback

previous page: 688
next page: &EPC++/1

Editor	Freqcon_DG			Statron	FREQCON	CONTAINER COOLING / LIGHTNING	20230331_V0.01	= UNIT_03	Battery Container 2	
Date	30.03.2023							& EFS	Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet	page: 690
Date								+		total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-278W5 &EFS/278.1	1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153	
-H1 &EFS/190.3	1	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282	
-H2 &EFS/190.6	1	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282	
-H3 &EFS/190.9	1	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282	
-U1 &EFS/190.1	1	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434	
-U1 &EFS/190.1	1	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756	
-U2 &EFS/190.0	1	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149	
-U3 &EFS/190.4	1	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434	
-U3 &EFS/190.4	1	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756	
-U4 &EFS/190.3	1	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149	
-U5 &EFS/190.7	1	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434	
-U5 &EFS/190.7	1	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756	
-U6 &EFS/190.7	1	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-369XT &EFS/669.5...&EFS/669.8;&EFS/670.5...&EFS/670.8	12	Double-level terminal block Push-in PTTB 2,5-PV	3210583	Phoenix Contact	501385	
-369XT &EFS/669.5;&EFS/669.7;&EFS/670.5;&EFS/670.7	4	Plug-in bridge FBS 10-5	3030213	Phoenix Contact	500547	
-369XT &EFS/669.5	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	
-611A1 &EFS/611.0	1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286	
-613T1 &EFS/613.1	1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464	
-613T1 &EFS/613.1	1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395	
-613U1 &EFS/613.3	1	Surge protection device DT-LAN-CAT.6+	2881007	Phoenix Contact	504791	
-630X3 &EFS/630.1;&EFS/630.3;&EFS/630.5	4	Double-level terminal block Push-in PTTB 1,5/S	3208511	Phoenix Contact	500560	
-630X3 &EFS/630.1	2	Plug-in bridge FBS 2-3,5	3213014	Phoenix Contact	500802	
-630X3 &EFS/630.1	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	
-630X3 &EFS/630.1	1	End cover D-PTTB 1,5/S	3208579	Phoenix Contact	500504	
-684F1 &EFS/684.1	1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738	
-684F1 &EFS/684.1	3	LV HRC fuse element, NH00, In: 35 A, gG, Un AC: 500 V, Un DC: 250 V, Front indicator, live grip lugs	3NA3814-7	Siemens	502933	
-684F2 &EFS/684.5	1	Surge arrester, type 1 + 2, UC 335V AC, 4-pole, FM, for TN-S and TT systems	5SD7414-3	Siemens	10207	
-687F1 &EFS/687.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F1 &EFS/687.1	1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364	
-687F1 &EFS/687.1	2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570	
-687F2 &EFS/687.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F3 &EFS/687.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-687F4 &EFS/687.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F5 &EFS/687.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687F6 &EFS/687.8	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-687XT1 &EFS/687.1...&EFS/687.9;&EFS/688.1...&EFS/688.7	0					
-688F1 &EFS/688.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F2 &EFS/688.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F3 &EFS/688.4	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F4 &EFS/688.5	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-688F5 &EFS/688.7	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F1 &EFS/690.1	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F2 &EFS/690.3	1	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569	
-690F2 &EFS/690.3	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F3 &EFS/690.4	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	
-690F3 &EFS/690.4	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F3 &EFS/690.4	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	
-690F4 &EFS/690.6	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	
-690F4 &EFS/690.6	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F4 &EFS/690.6	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	

Editor	Freqcon_DG			Statron	FREQCON	PARTS LIST	20230331_V0.01	= UNIT_03	Battery Container 2
Date	30.03.2023							& EPC	Parts List
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	

page: 2

total: 423

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-690F5 &EFS/690.8	1	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765	
-690F5 &EFS/690.8	1	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737	
-690F5 &EFS/690.8	1	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608	
-690XT1 &EFS/690.1	5	Feed-through terminal block Push-in PT 2,5	3209510	Phoenix Contact	500583	
-690XT1 &EFS/690.1	5	Feed-through terminal block Push-in PT 2,5 BU	3209523	Phoenix Contact	500584	
-690XT1 &EFS/690.1	5	Ground modular terminal block Push-in PT 2,5-PE	3209536	Phoenix Contact	500813	
-690XT1 &EFS/690.1	1	End cover D-ST 2,5	3030417	Phoenix Contact	500506	
-690XT1 &EFS/690.1	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	
-XE &EFS/684.1;&EFS/684.2	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	
-XE &EFS/684.1;&EFS/684.2	3	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XE &EFS/684.1	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	
-XE &EFS/684.2;&EFS/684.3	5	Feed-through terminal block Push-in PT 6 BU	3211819	Phoenix Contact	500585	
-XE &EFS/684.2	1	Plug-in bridge FBS 5-8	3030310	Phoenix Contact	504375	
-XE &EFS/684.4	2	Ground modular terminal block Push-in PT 6-PE	3211822	Phoenix Contact	500725	
-XE &EFS/684.4	1	End cover D-PT 16 N	3212060	Phoenix Contact	503716	
-XF3.1 &EFS/630.1	1	Surge arrester, UC 24V DC, 2-pole, for 6A signal circuit TTC-6-2-HC-24DC-UT-I	2908439	Phoenix Contact	10162	
-XF3.2 &EFS/630.3	1	Surge arrester, UC 24V DC, 2-pole, for 6A signal circuit TTC-6-2-HC-24DC-UT-I	2908439	Phoenix Contact	10162	
-XF3.3 &EFS/630.5	1	Surge arrester, UC 24V DC, 2-pole, for 6A signal circuit TTC-6-2-HC-24DC-UT-I	2908439	Phoenix Contact	10162	
-XF3.4 &EFS/630.7	1	Surge arrester, UC 24V DC, 2-pole, for 6A signal circuit TTC-6-2-HC-24DC-UT-I	2908439	Phoenix Contact	10162	

Parts list

Freqcon-mit_FRQ-Nr_ABAS_de_en

Equipment identifier Schematic / position	Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.	subordinated part
-XN &EFS/685.1...&EFS/685.3	6	Feed-through terminal block Push-in PT 6	3211813	Phoenix Contact	501388	
-XN &EFS/685.1...&EFS/685.3	4	Plug-in bridge FBS 2-8	3030284	Phoenix Contact	502068	
-XN &EFS/685.1	2	End clamp CLIPFIX 35-5	3022276	Phoenix Contact	500588	

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
3	Junction box IP65 6qmm 110x110x67mm grKst	ABOX025-L	Famo GmbH+Co.KG	505434
3	Combination socket / switch on plaster gray / blue-green IP44 matt	2601/6/20EW-53	Famo GmbH+Co.KG	503149
3	LED-Waterproof luminaire 50W 4000K 5500lm Konv IP65 elektr Kst_klar II IK08	3117332	Famo GmbH+Co.KG	10282
3	Junction box IP65 10qmm 140x140x79mm grKst	ABOX100-L	Famo GmbH+Co.KG	502756
1	Anschlussschiene;100x370mm;Zeichnung 501153B	501153	Freqcon GmbH	501153

previous page:
&EPC++ASC/4

next page:
++ASC/1

Summarized parts list

Freqcon_ABAS_de_en

Amount	Designation	Order number	Manufacturer / Supplier	Freqcon ERP No.
1	TREE 16 TX Metall 2GE 14 FE - Unmanaged Gigabit Switch - 16 Ports/	58174	Murrelektronik	10286
1	Network isolators - FL ISOLATOR 100-RJ/RJ	2313931	Phoenix Contact	501464
1	Surge protection device DT-LAN-CAT.6+	2881007	Phoenix Contact	504791
1	0,5m Cat.6 PiMF-Patchcabel, green	PATCH-C6 05 GN	reichelt elektronik GmbH & Co. KG	504395
3	LV HRC fuse element, NH00, In: 35 A, gG, Un AC: 500 V, Un DC: 250 V, Front indicator, live grip lugs	3NA3814-7	Siemens	502933
1	Fuse switch disconnector 3NP1, 3-pole, NH00, 160 A, for mounting plate, flat terminal, Fuse monitoring: electromechanical	3NP11331CA11	Siemens	500738
1	Surge arrester, type 1 + 2, UC 335V AC, 4-pole, FM, for TN-S and TT systems	5SD7414-3	Siemens	10207
5	AUXILIARY SWITCH 1NO+1NC for 5SL, 5SY, 5SP	5ST3010	Siemens	500737
1	Pin busbar touch-safe, 16 mm2 3x 1-phase+AUX, 1016 mm long	5ST3714	Siemens	503364
2	End cap for pin busbars 2 - 3-phase	5ST3750	Siemens	503570
3	Handle coupler for residual current miniature circuit breaker D=70 mm	5ST3805-1	Siemens	500608
3	RCBO elm, TYP A, 230V, 10KA, 1 Pol.+N, 30mA, C, 16A	5SU1354-7KK16	Siemens	500765
13	CIRCUIT BREAKER 230/400V 10KA 1POL C16	5SY4116-7	Siemens	503569

Cable name =UNIT_03+++-685W1
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:1			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-HVDC:N	

Cable name =UNIT_03+++-685W2
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:2			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-HVDC:N	

Cable name =UNIT_03+++-685W3
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:2			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-HVDC:N	

Cable name =UNIT_03+++-685W4
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:3	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_03+++-685W5
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:3	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

previous page:
&EPA++ASC/1

next page:
2

FRQ_kabelplan_04_grd_de_en

Cable name =UNIT_03+++-685W6
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:4	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_03+++-685W7
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:4	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_03+++-685W8
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:5	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_03+++-685W9
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:5	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_03+++-685W10
Cable type 2x0,75 mm²
Free conductors



Cable parts
Order number

Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:6	Supply Bat-Con 1 3-phase 400V AC		

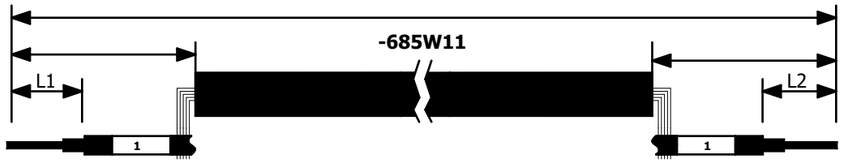
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

previous page: 1
next page: 3

FRQ_kabelplan_04_grd_de_en

Cable name =UNIT_03+++-685W11
Cable type 2x0,75 mm²
Free conductors

Cable parts
Order number

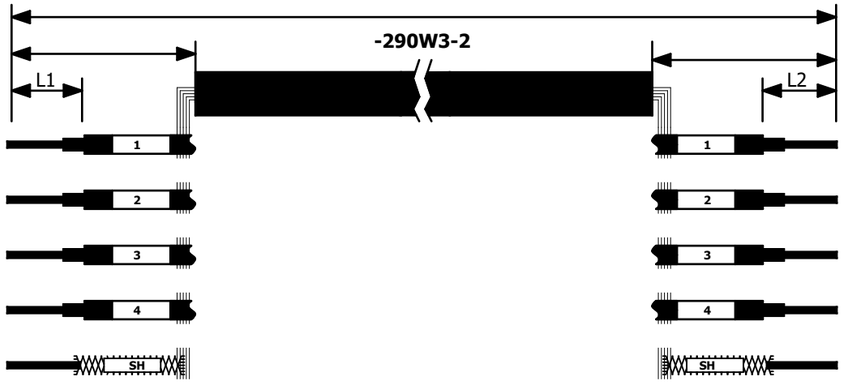


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	++ASC-XN:6	Supply Bat-Con 1 3-phase 400V AC		

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
		Supply Bat-Con 1 3-phase 400V AC	-HVDC:N	

Cable name =UNIT_03+++-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

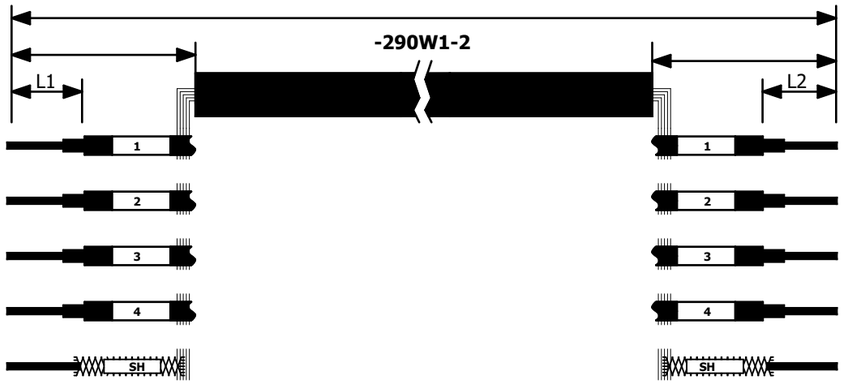


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03+++-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

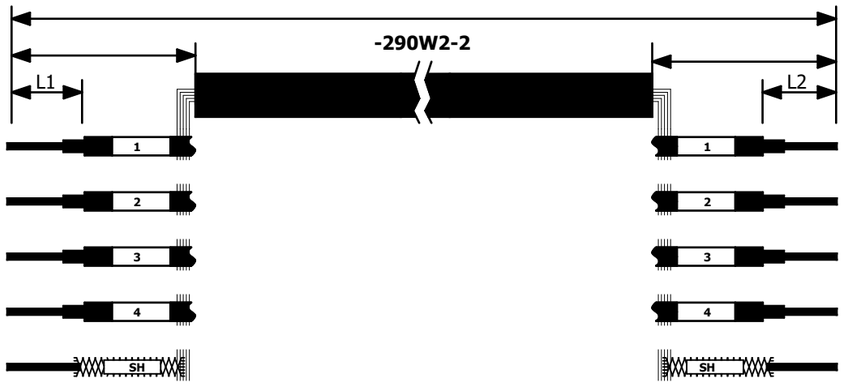
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

previous page: 2
next page: 4

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_03+++-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

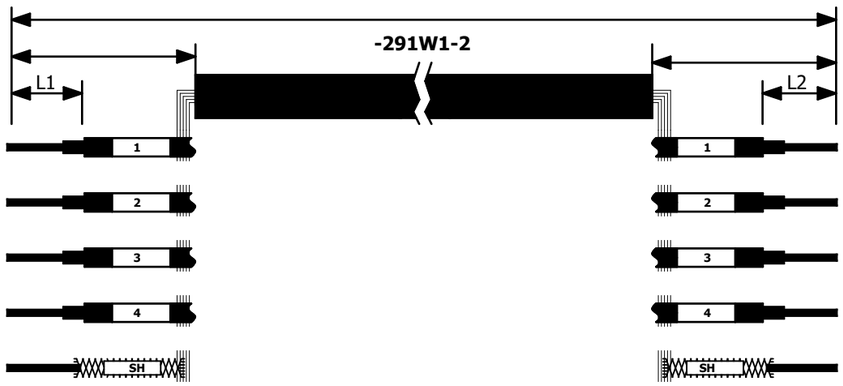


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:7	
			++ASC-369XT:10	
			++ASC-369XT:1	
			++ASC-369XT:4	

Cable name =UNIT_03+++-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

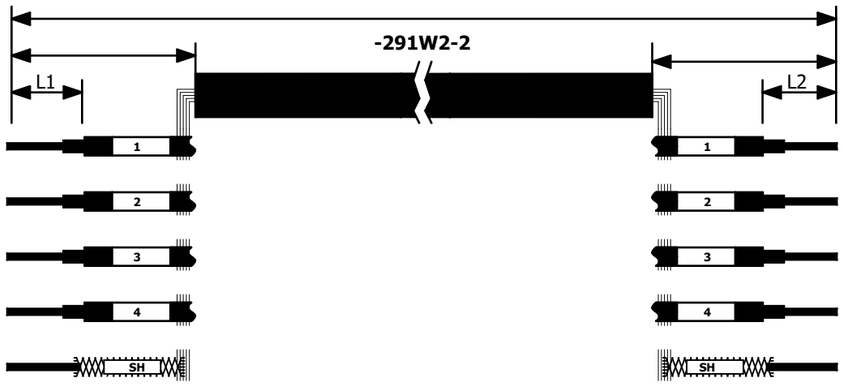


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

Cable name =UNIT_03+++-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

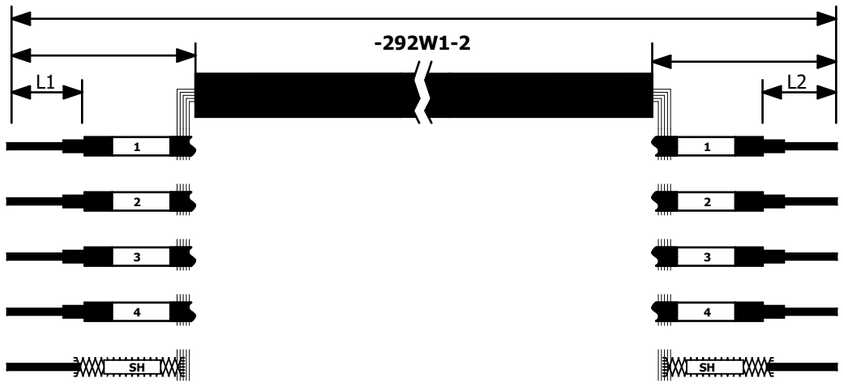
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 3
next page: 5

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_03+++-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

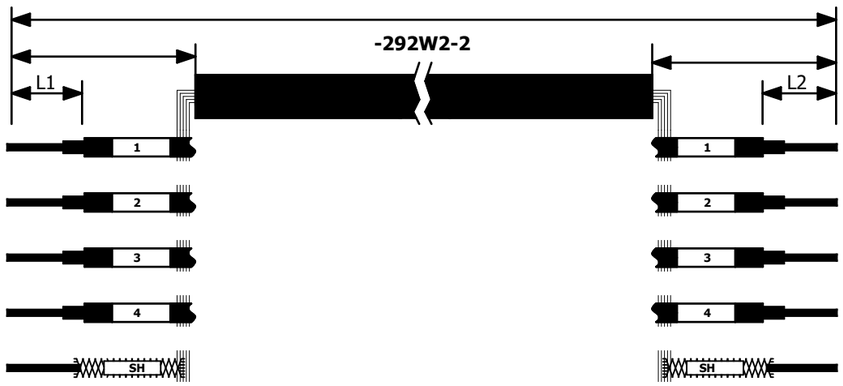
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-570XT:1							++ASC-369XT:8	
	-570XT:2							++ASC-369XT:11	
	-570XT:3							++ASC-369XT:2	
	-570XT:4							++ASC-369XT:5	

Cable name =UNIT_03+++-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

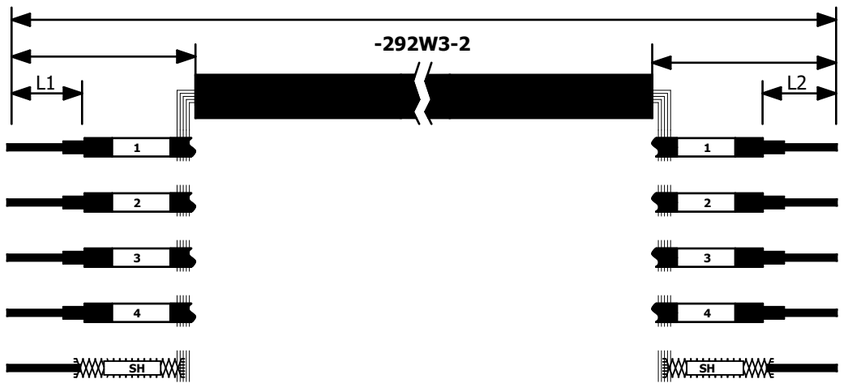
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-570XT:1							++ASC-369XT:9	
	-570XT:2							++ASC-369XT:12	
	-570XT:3							++ASC-369XT:3	
	-570XT:4							++ASC-369XT:6	

Cable name =UNIT_03+++-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



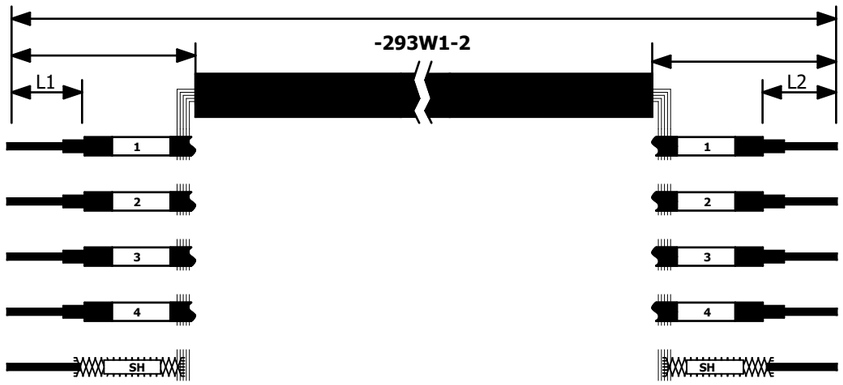
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-570XT:1							++ASC-369XT:9	
	-570XT:2							++ASC-369XT:12	
	-570XT:3							++ASC-369XT:3	
	-570XT:4							++ASC-369XT:6	

previous page: 4
next page: 6

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_03+++-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

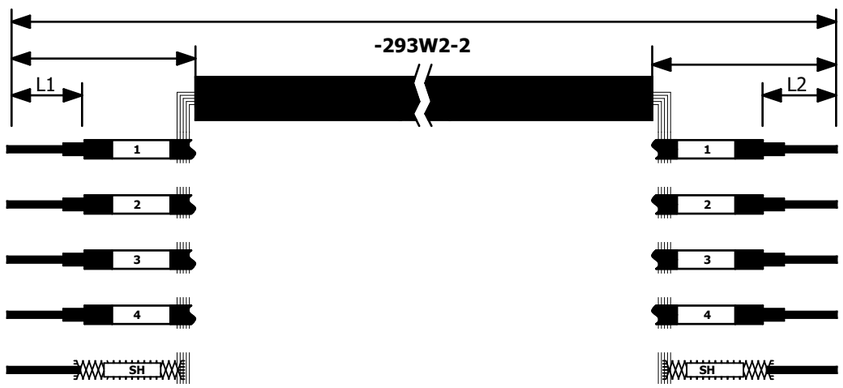


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03+++-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560

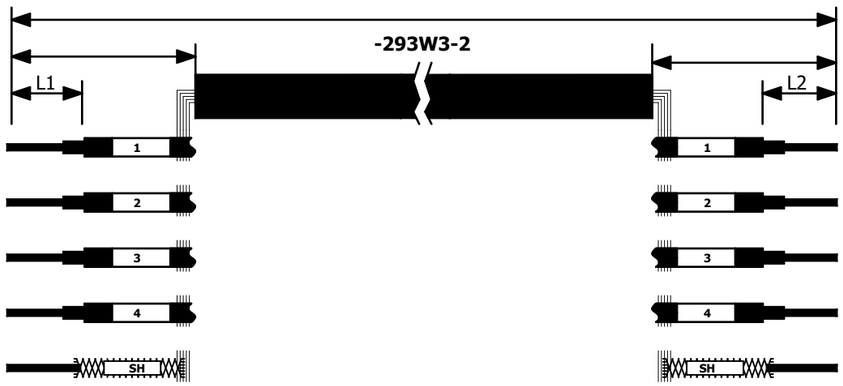


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:9	
			++ASC-369XT:12	
			++ASC-369XT:3	
			++ASC-369XT:6	

Cable name =UNIT_03+++-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-570XT:1			
	-570XT:2			
	-570XT:3			
	-570XT:4			

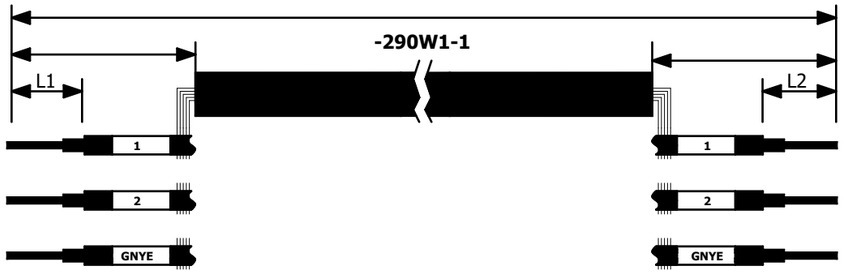
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-369XT:8	
			++ASC-369XT:11	
			++ASC-369XT:2	
			++ASC-369XT:5	

previous page: 5
next page: 7

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_03+++-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

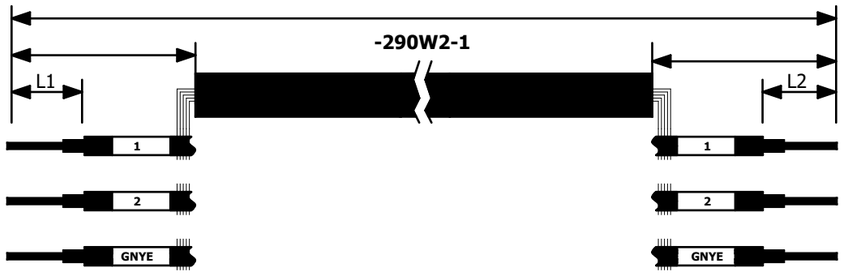
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:1	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_03+++-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

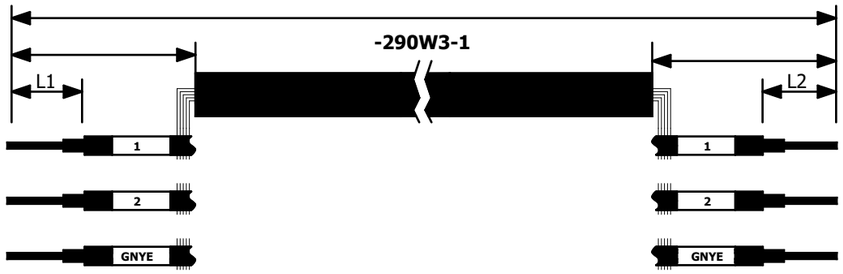
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:2	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_03+++-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:3	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_03+++-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:4	
	-XE:N							++ASC-687XT1:N	

previous page: 6
next page: 8

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_03+++-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

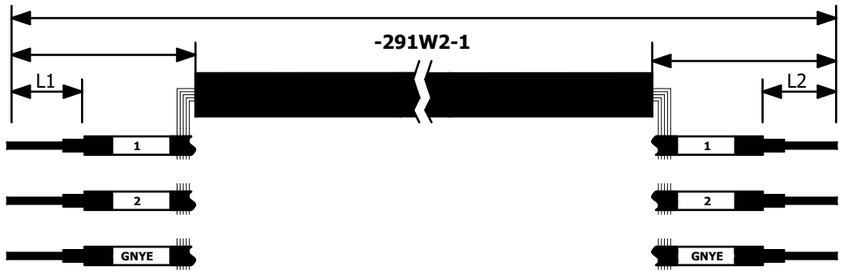


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_03+++-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

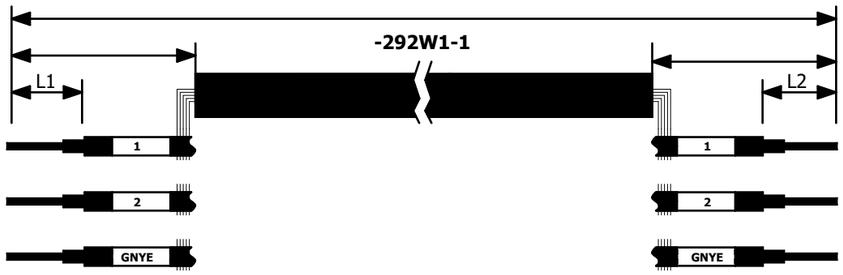


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:5	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03+++-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

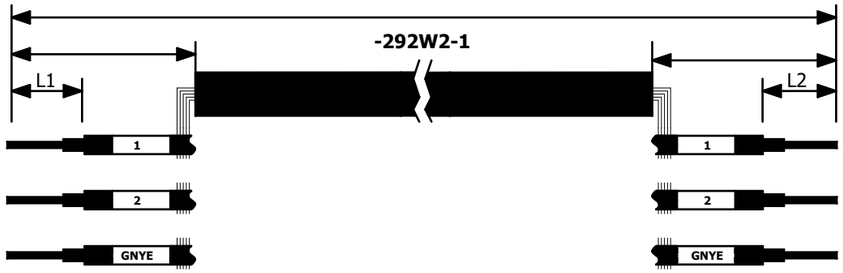


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:6	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

Cable name =UNIT_03+++-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:1			
	-XE:N			
	-XE:PE			

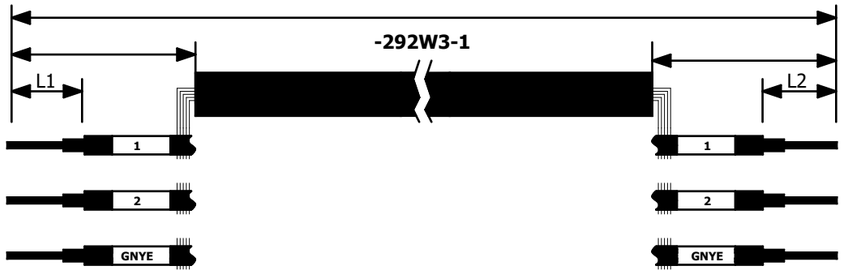
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:7	
			++ASC-687XT1:N	
			++ASC-687XT1:PE	

previous page: 7
next page: 9

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_03+++-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

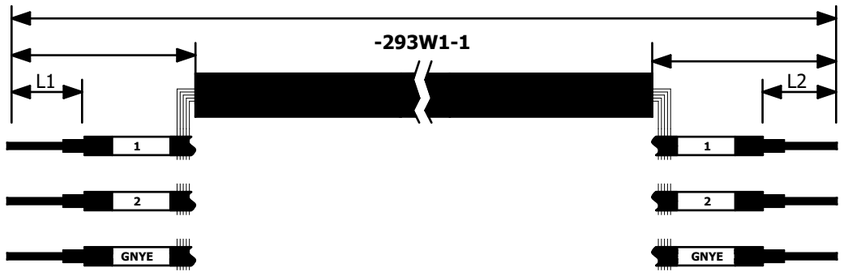
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:8	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_03+++-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:9	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_03+++-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

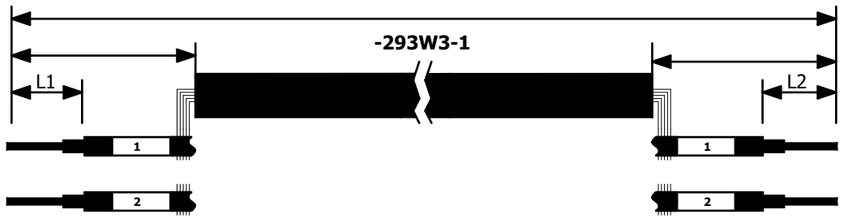
Cable parts
Order number



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:10	
	-XE:N							++ASC-687XT1:N	
	-XE:PE							++ASC-687XT1:PE	

Cable name =UNIT_03+++-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number



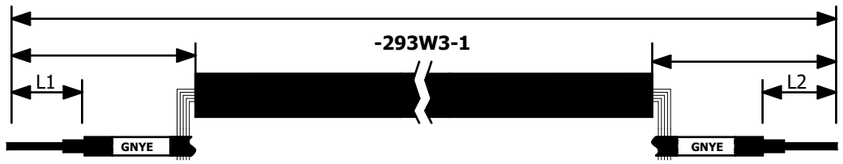
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	-XE:1							++ASC-687XT1:11	
	-XE:N							++ASC-687XT1:N	

previous page: 8
next page: 10

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_03+++-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts
Order number

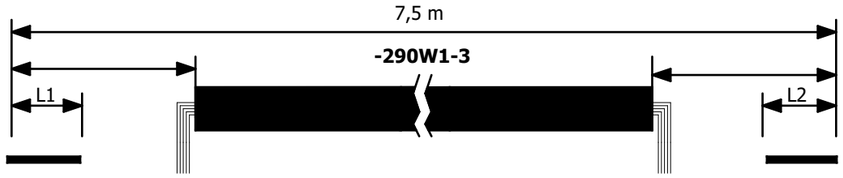


Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-XE:PE			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-687XT1:PE	

Cable name =UNIT_03+++-290W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

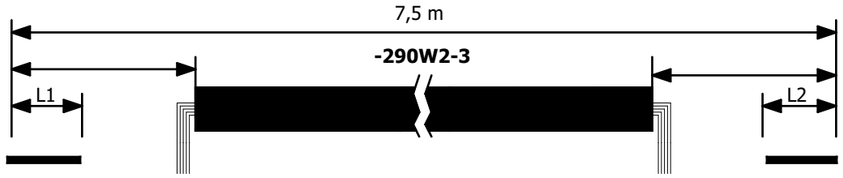


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X1:1-16	

Cable name =UNIT_03+++-290W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

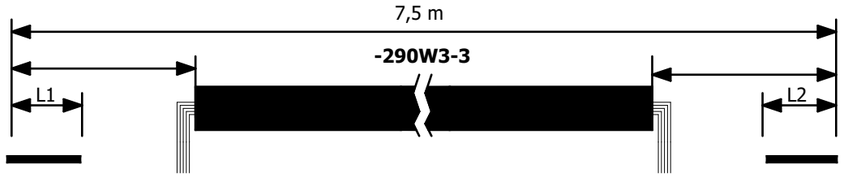


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_03+++-290W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

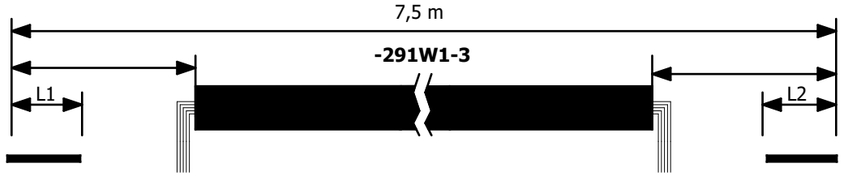


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

Cable name =UNIT_03+++-291W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



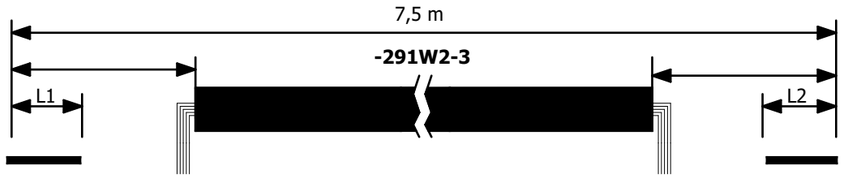
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X4:1-16	

previous page: 9
next page: 11

Cable name =UNIT_03+++-291W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

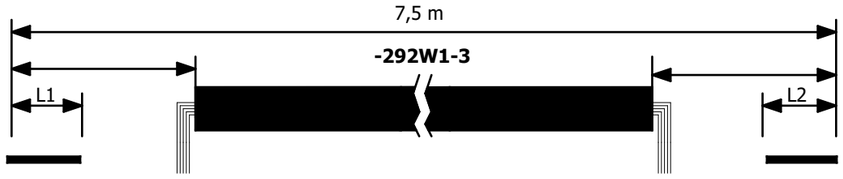
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X5:1-16	

Cable name =UNIT_03+++-292W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

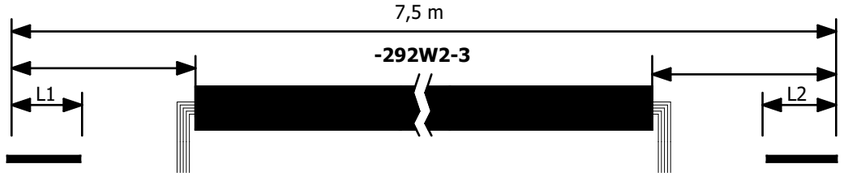
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X6:1-16	

Cable name =UNIT_03+++-292W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

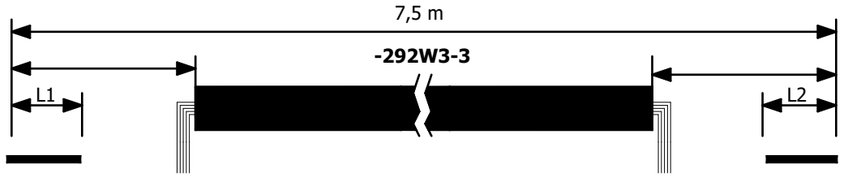
Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X7:1-16	

Cable name =UNIT_03+++-292W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X8:1-16	

Cable name =UNIT_03+++-293W1-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



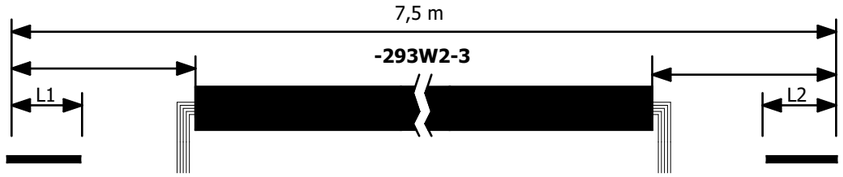
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:
								++ASC-611A1:X9:1-16	

previous page: 10
next page: 12

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_03+++-293W2-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN

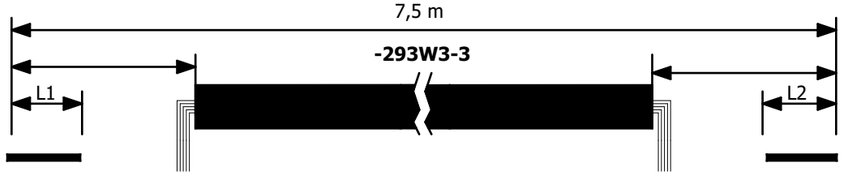


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X2:1-16	

Cable name =UNIT_03+++-293W3-3
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

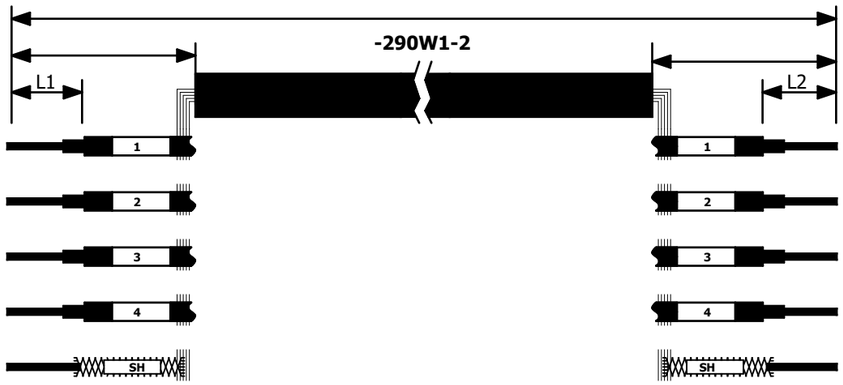
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			++ASC-611A1:X3:1-16	

FRQ_kabelplan_04_gr0_de_en

previous page: 11
next page: ++ASC/1

Cable name =UNIT_03++ASC+-290W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

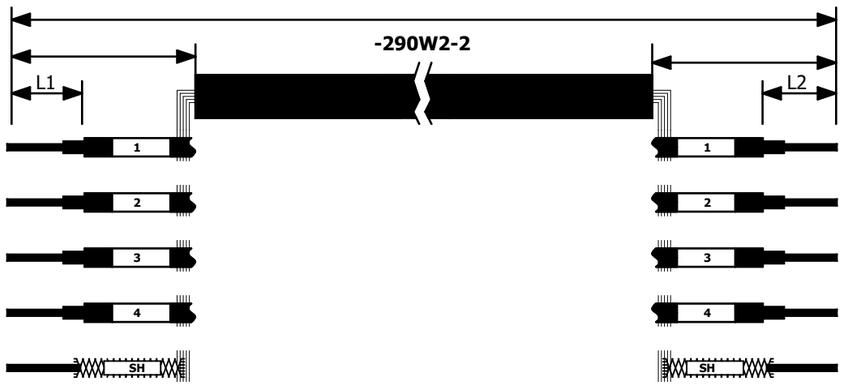


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

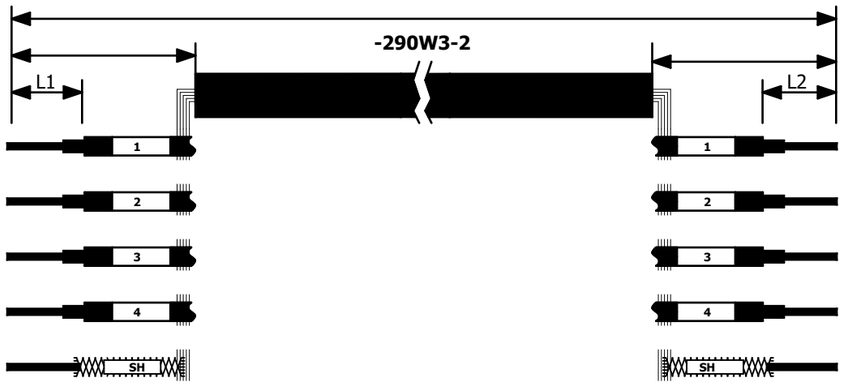


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

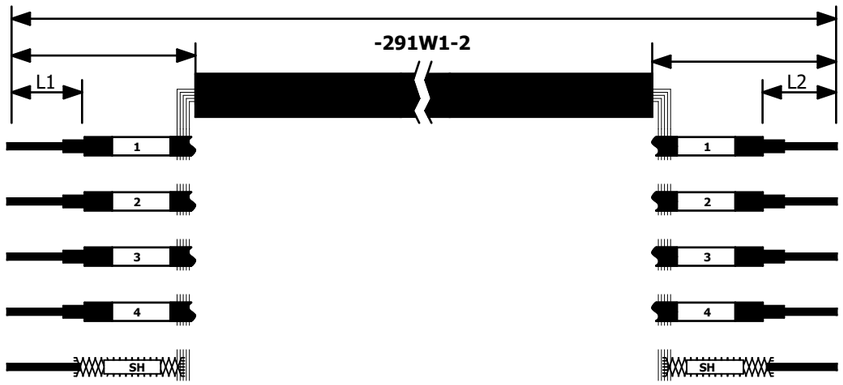
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: ++/12
next page: 2

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_03++ASC+-291W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

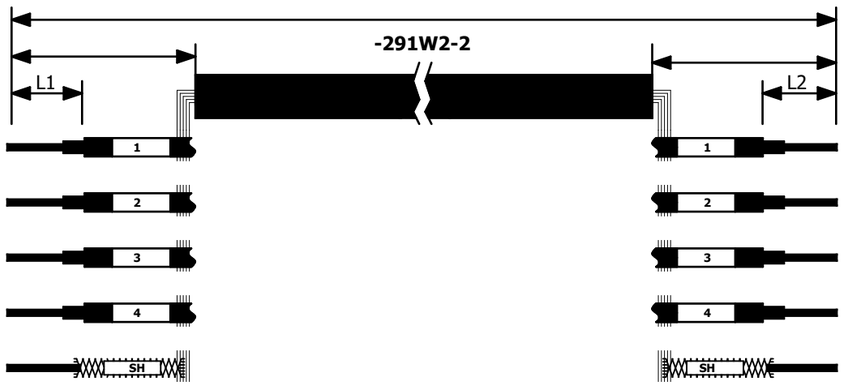
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

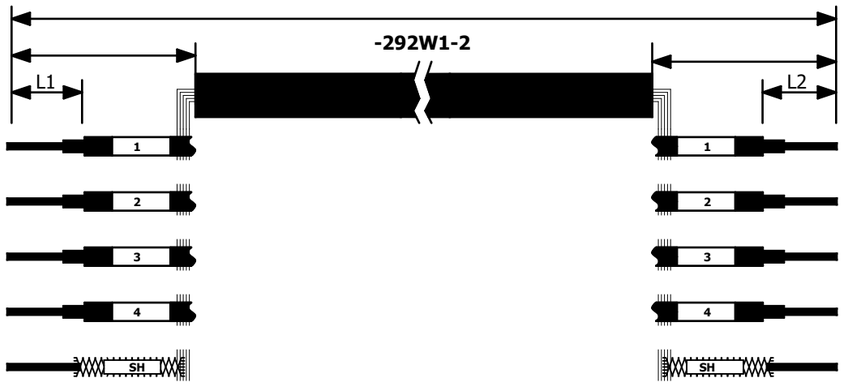
Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



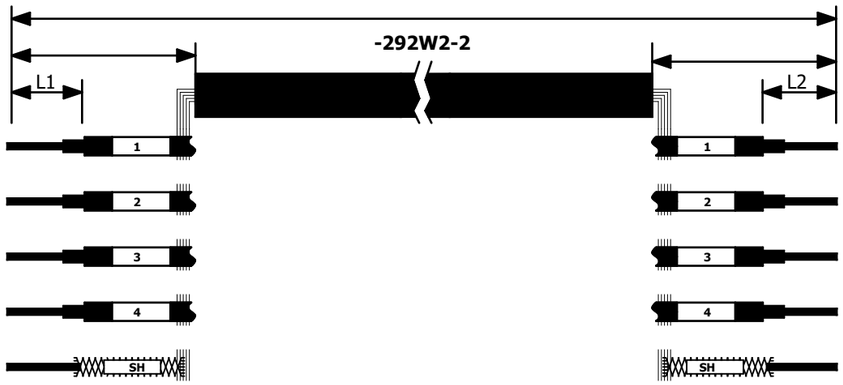
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 1
next page: 3

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_03++ASC+-292W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

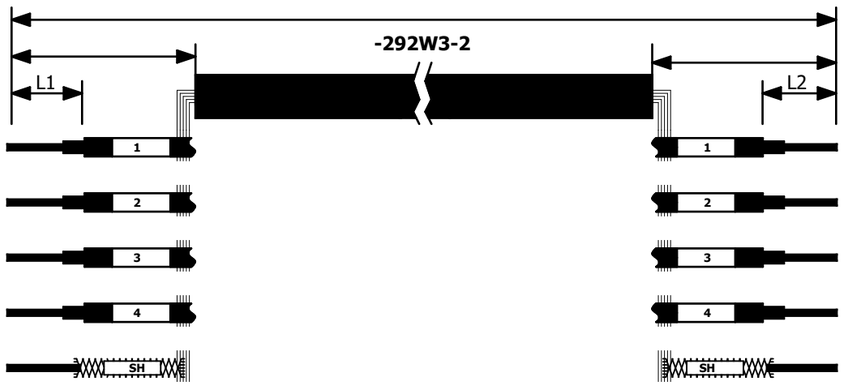


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560

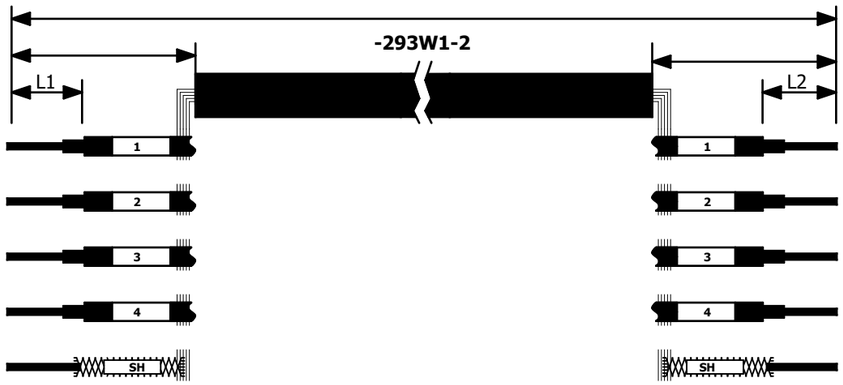


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W1-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



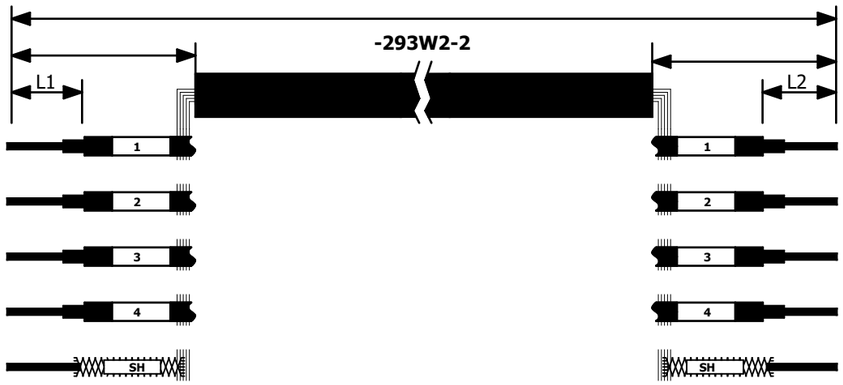
Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 2
next page: 4

Cable name =UNIT_03++ASC+-293W2-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

Cable parts HELU.16560
Order number 16560



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W3-2
Cable type F-CY-OZ 4x0,75 mm²
Free conductors 4

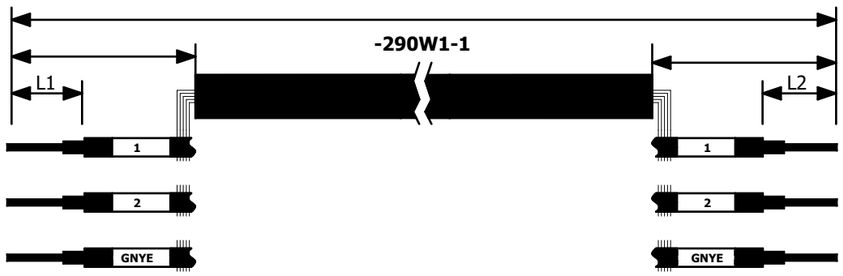
Cable parts HELU.16560
Order number 16560

Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors 3

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

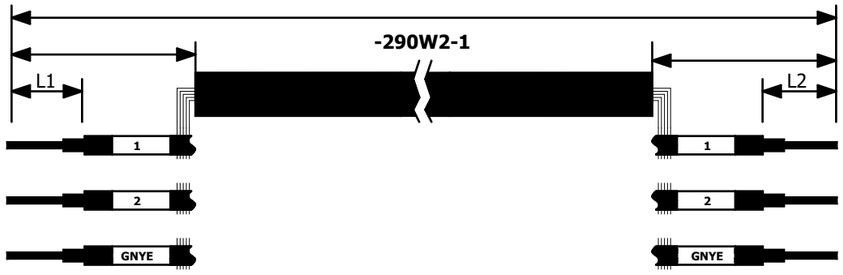
L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 3
next page: 5

FRQ_kabelplan_04_gr0_de_en

Cable name =UNIT_03++ASC+-290W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

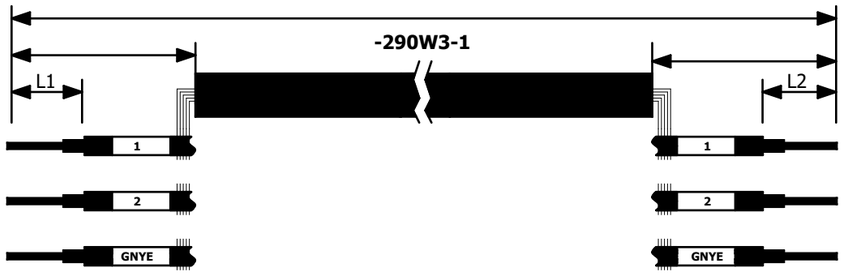


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-290W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

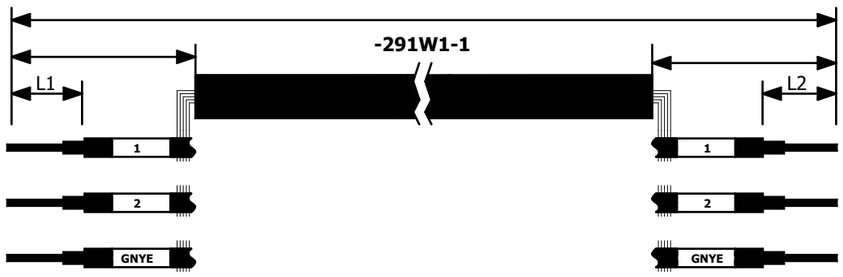


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 4
next page: 6

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_03++ASC+-291W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

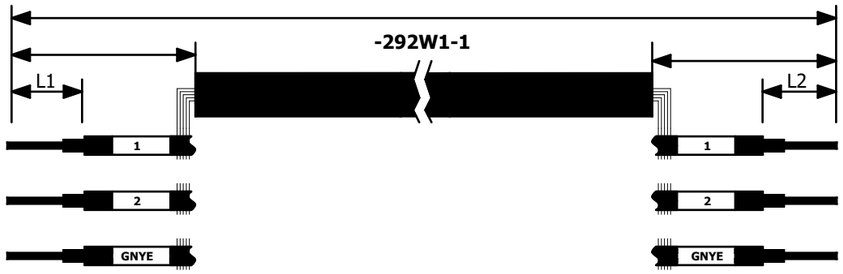
Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

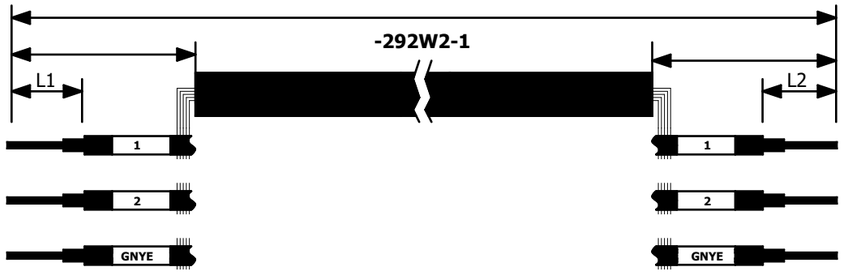
Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

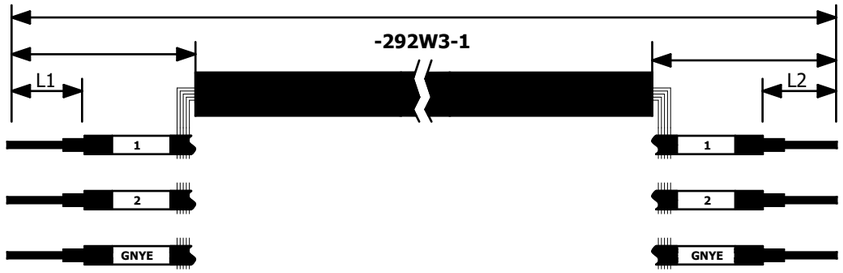
Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-292W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



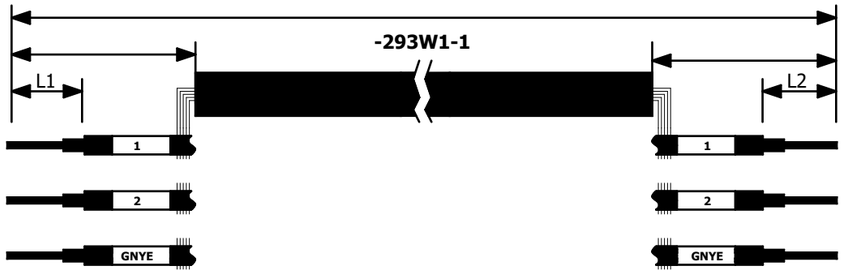
Mounting location:	Source	Function text source	wire end handling	L1 [mm]	L2 [mm]	wire end handling	Function text target	Target	Mounting location:

previous page: 5
next page: 7

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_03++ASC+-293W1-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

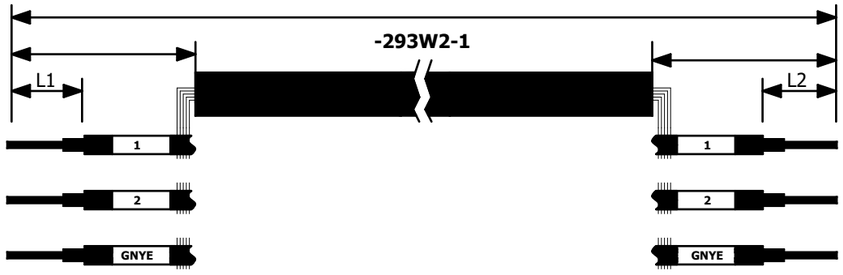


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W2-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-293W3-1
Cable type JZ-500 3G1,5 mm²
Free conductors

Cable parts HELU.10091
Order number 10091

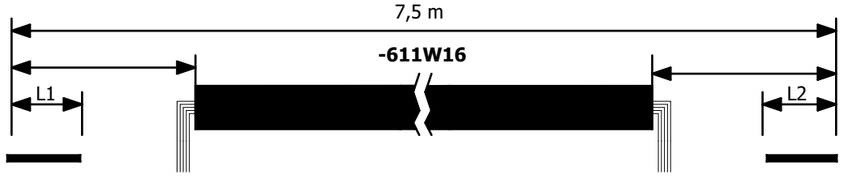


Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

Cable name =UNIT_03++ASC+-611W16
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 7,5 GN
Order number PATCH-C6 7,5 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-611A1:X8:1-16		RJ45 connector	

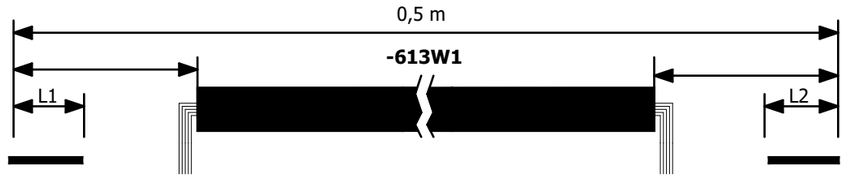
L2 [mm]	wire end handling	Function text target	Target	Mounting location:
	RJ45 connector		-613T1:15	

previous page: 6
next page: 8

FRQ_kabelplan_04_grid_de_en

Cable name =UNIT_03++ASC+-613W1
Cable type Patch cable Cat.6 4x2x0,25 mm²
Free conductors

Cable parts REI.PATCH-C6 05 GN
Order number PATCH-C6 05 GN



Mounting location:	Source	Function text source	wire end handling	L1 [mm]
	-613T1:7			

L2 [mm]	wire end handling	Function text target	Target	Mounting location:
			-613U1:OUT	

FRQ_kabelplan_04_gr06_de_en

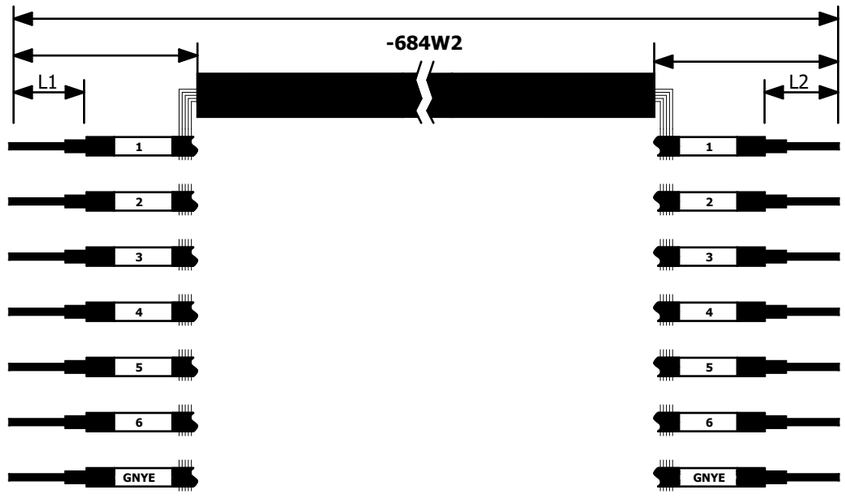
previous page: 7

next page: ++EXTERN/1

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	31.03.2023							& EMB Cable list	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 8
Date								+	total: 423

Cable name =UNIT_03++EXTERN+-684W2
Cable type JZ-600 5G16 mm²
Free conductors 7

Cable parts HELU.10150
Order number 10150



Mounting location:	Source	Function text source	wire end handling	L1 [mm]

L2 [mm]	wire end handling	Function text target	Target	Mounting location:

FRQ_kabelplan_04_gr0_de_en

previous page:
++ASC/8

next page:
&EMZ++ASC/1000

Editor	Freqcon_DG			Statron	FREQCON	CABEL LIST	20230331_V0.01	= UNIT_03 Battery Container 2
Date	30.03.2023							& EMB Cable list
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ EXTERN page: 1
Date								+ total: 423

Terminal-strip overview

F14_001

Terminal strip	Terminal strip definition text	Terminals					Graphical page of terminal diagrams
		first	last	Total PE	Total N	Total number	
-630X3		1	9	0	0	12	=UNIT_03&EMZ++ASC/2000
-XE		1	6	2	5	13	=UNIT_03&EMZ++ASC/2001
-XF3.1		4/1	5/2	0	0	2	=UNIT_03&EMZ++ASC/2002
-XF3.2		4/1	5/2	0	0	2	=UNIT_03&EMZ++ASC/2003
-XF3.3		4/1	5/2	0	0	2	=UNIT_03&EMZ++ASC/2004
-XF3.4		4/1	5/2	0	0	2	=UNIT_03&EMZ++ASC/2005
-XN		1	6	0	0	6	=UNIT_03&EMZ++ASC/2006
-369XT		1	12	0	0	12	=UNIT_03&EMZ++ASC/2008
-687XT1		1	PE	11	11	33	=UNIT_03&EMZ++ASC/2020
-690XT1		1	PE	7	5	20	=UNIT_03&EMZ++ASC/2031

previous page:
&EMB++EXTERN/1

next page:
2000

Editor	Freqcon_DG			Statron		Klemmenleistenübersicht : =UNIT_03++ASC+-630X3 - =UNIT_03++ASC+-690XT1	20230331_V0.01	= UNIT_03	Battery Container 2
Date	31.03.2023							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC	auxillary cabinet
Date								+	page: 1000 / total: 423

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-630X3						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
					-XF3.1	4/1:4	1		-611A1	1													&EFS/630.1
					-XF3.1	5/2:5	2		-611A1	2													&EFS/630.2
							3		-690F1	13													&EFS/630.1
air conditioning 1 feedback					-690F1	14	5		-XF3.2	4/1:4													&EFS/630.3
air conditioning 2 feedback					-690F2	14	6		-XF3.2	5/2:5													&EFS/630.4
FI container lightning / socket feedback					-690F3	14	7		-XF3.3	4/1:4													&EFS/630.5
=					-XF3.3	5/2:5	8		-690F4	14													&EFS/630.6
=					-XF3.4	4/1:4	8		-690F5	14													&EFS/630.7
fuse + overvoltage protection					-XF3.4	5/2:5	9		-684F2	11													&EFS/630.8

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-XE

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
Supply Bat-Con 1 3-phase 400V AC			-684F1	2	1		-687F1	1			&EFS/684.1
=					N		-690XT1	N			&EFS/684.2
=			-687XT1	N	N		-690XT1	N			&EFS/684.2
=			-687XT1	N	N		-690F5	N			&EFS/684.3
=			-687XT1	N	N		-690F4	N			&EFS/684.3
=			-684F2	N	N		-690F3	N			&EFS/684.3
=					PE			PE			&EFS/684.4
=			-684F2	PE	PE			PE			&EFS/684.4
=					2		-690F1	1			&EFS/684.1
=			-684F1	4	3		-687F2	1			&EFS/684.1
=					4		-690F3	1			&EFS/684.2
=			-684F1	6	5		-687F3	1			&EFS/684.2
=					6		-690F2	1			&EFS/684.2
=					6		-690F2	1			&EFS/684.2

previous page:
2000

next page:
2002

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-XE	20230331_V0.01	= UNIT_03 Battery Container 2
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

page: 2001
total: 423

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XF3.1						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
							4/1	,	-630X3	1													&EFS/630.1
							5/2	,	-630X3	2													&EFS/630.2

Terminal diagram

Freqcon_F13_001_02

Function text				Cable name	Strip =UNIT_03++ASC+-XF3.2						Cable name												Page / column
				Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
air conditioning 1 feedback							4/1	,	-630X3	5													&EFS/630.3
air conditioning 2 feedback							5/2	,	-630X3	6													&EFS/630.4

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-XF3.3

Function text				Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
				Cable type							Cable type	
FI container lightning / socket feedback							4/1	,	-630X3	7		&EFS/630.5
=							5/2	,	-630X3	8		&EFS/630.6

previous page: 2003

next page: 2005

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-XF3.3	20230331_V0.01	= UNIT_03 Battery Container 2
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet — page: 2004
Date								+ — total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-XF3.4

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
FI container lightning / socket feedback					4/1	,	-630X3	8			&EFS/630.7
fuse + overvoltage protection					5/2	,	-630X3	9			&EFS/630.8

previous page: 2004

next page: 2006

| | | | | |

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-XN

Function text	-685W5	-685W3	=UNIT_01++CONV-99W1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-685W1	-685W2	-685W4									Page / column
			Solarflex	Cable type							Cable type												
			1		=UNIT_01++CONV+CON-N	N	1		-HVDC	N		1											&EFS/685.1
		1			-HVDC	N	2		-HVDC	N			1										&EFS/685.1
Supply Bat-Con 1 3-phase 400V AC	1				-HVDC	N	3		-HVDC	N				1									&EFS/685.2

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-XN

Function text	-685W11	-685W9	-685W7	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	-685W6	-685W8	-685W10									Page / column
				Cable type							Cable type												
Supply Bat-Con 1 3-phase 400V AC			1		-HVDC	N	4		-HVDC	N		1											&EFS/685.2
=		1			-HVDC	N	5		-HVDC	N			1										&EFS/685.3
=	1				-HVDC	N	6		-HVDC	N				1									&EFS/685.3

Terminal diagram

Freqcon_F13_001_02

Function text	-290W3-2	-290W2-2	-290W1-2	Cable name	Strip =UNIT_03++ASC+-369XT					Cable name												Page / column
	F-CY-0Z	F-CY-0Z	F-CY-0Z	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type											
battery cabinet smoke detector potential-free contacts customer			3		-570XT	3	1															&EFS/669.5
		3			-570XT	3																
	3				-570XT	3																

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-369XT

Function text	-292W1-2 F-CY-0Z	-291W2-2 F-CY-0Z	-291W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W3-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			3		-570XT	3	2		-570XT	3		3	&EFS/669.5
		3			-570XT	3							
	3				-570XT	3							

previous page:
2008

next page:
2010

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2009
+			total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-293W1-2 F-CY-0Z	-292W3-2 F-CY-0Z	-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W2-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			3		-570XT	3	3		-570XT	3		3	&EFS/669.6
		3			-570XT	3							
	3				-570XT	3							

Terminal diagram

Freqcon_F13_001_02

Function text	-290W3-2 F-CY-0Z	-290W2-2 F-CY-0Z	-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet smoke detector potential-free contacts customer			4		-570XT	4	4					&EFS/669.7
		4			-570XT	4						
	4				-570XT	4						

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-369XT

Function text	-292W1-2 F-CY-0Z	-291W2-2 F-CY-0Z	-291W1-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W3-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			4		-570XT	4	5		-570XT	4		4	&EFS/669.8
		4			-570XT	4							
	4				-570XT	4							

previous page:
2011

next page:
2013

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2012
+			total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-293W1-2 F-CY-0Z	-292W3-2 F-CY-0Z	-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W2-2 F-CY-0Z	Page / column
battery cabinet smoke detector potential-free contacts customer			4		-570XT	4	6		-570XT	4		4	&EFS/669.8
		4			-570XT	4							
	4				-570XT	4							

Terminal diagram

Freqcon_F13_001_02

Function text	-290W3-2 F-CY-0Z	-290W2-2 F-CY-0Z	-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			1		-570XT	1	7					&EFS/670.5
		1			-570XT	1						
	1				-570XT	1						

Terminal diagram

Freqcon_F13_001_02

Function text	-292W1-2 F-CY-0Z	-291W2-2 F-CY-0Z	-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		-570XT	1	8		-570XT	1		1	&EFS/670.5
		1			-570XT	1							
	1				-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-369XT

Function text	-293W1-2 F-CY-0Z	-292W3-2 F-CY-0Z	-292W2-2 F-CY-0Z	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			1		-570XT	1	9		-570XT	1		1	&EFS/670.6
		1			-570XT	1							
	1				-570XT	1							

Terminal diagram

Freqcon_F13_001_02

Function text	-290W3-2 F-CY-0Z	-290W2-2 F-CY-0Z	-290W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT: Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
battery cabinet gas potential-free contacts customer			2		-570XT	2	10					&EFS/670.7
		2			-570XT	2						
	2				-570XT	2						

Terminal diagram

Freqcon_F13_001_02

Function text	-292W1-2 F-CY-0Z	-291W2-2 F-CY-0Z	-291W1-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W3-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		-570XT	2	11		-570XT	2		2	&EFS/670.8
		2			-570XT	2							
	2				-570XT	2							

previous page:
2017

next page:
2019

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-369XT	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2018
+			total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-293W1-2 F-CY-0Z	-292W3-2 F-CY-0Z	-292W2-2 F-CY-0Z	Cable name / Cable type	Strip =UNIT_03++ASC+-369XT Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	-293W2-2 F-CY-0Z	Page / column
battery cabinet gas potential-free contacts customer			2		-570XT	2	12		-570XT	2		2	&EFS/670.8
		2			-570XT	2							
	2				-570XT	2							

Terminal diagram

Freqcon_F13_001_02

Function text	-290W3-1	-290W2-1	-290W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	
Supply Battery String 1-phase 230V AC			1		-XE	1	1	,	-687F1	2		&EFS/687.1
=		1			-XE	1	2	,	-687F2	2		&EFS/687.3
=	1				-XE	1	3	,	-687F3	2		&EFS/687.4

previous page: 2019

next page: 2021

Editor	Freqcon_DG			Statron	Klemmenplan =UNIT_03++ASC+-687XT1	20230331_V0.01	= UNIT_03	Battery Container 2
Date	31.03.2023						& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007	++ ASC	auxillary cabinet
Date							+	

Terminal diagram

Freqcon_F13_001_02

Function text	-292W1-1	-291W2-1	-291W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1 Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	
Supply Battery String 1-phase 230V AC			1		-XE	1	4	,	-687F4	2		&EFS/687.5
=		1			-XE	1	5	,	-687F5	2		&EFS/687.7
=	1				-XE	1	6	,	-687F6	2		&EFS/687.8

previous page: 2020

next page: 2022

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	31.03.2023					& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 2021
Date						+	total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-687XT1

Function text	-293W1-1	-292W3-1	-292W2-1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	
Supply Battery String 1-phase 230V AC			1		-XE	1	7	,	-688F1	2		&EFS/688.1
=		1			-XE	1	8	,	-688F2	2		&EFS/688.3
=	1				-XE	1	9	,	-688F3	2		&EFS/688.4

previous page: 2021

next page: 2023

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-687XT1

Function text	-290W1-1	-293W3-1	-293W2-1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	
Supply Battery String 1-phase 230V AC			1		-XE	1	10	,	-688F4	2		&EFS/688.5
=		1			-XE	1	11	,	-688F5	2		&EFS/688.7
=	2				-XE	N	N	,┐	-XE	N		&EFS/687.1

previous page: 2022

next page: 2024

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20230331_V0.01	= UNIT_03 Battery Container 2
Date	31.03.2023							& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet
Date								+

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-687XT1

Function text	-291W1-1 1Z-500	-290W3-1 1Z-500	-290W2-1 1Z-500	Cable name / Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name / Cable type	Page / column
Supply Battery String 1-phase 230V AC			2		-XE	N	N					&EFS/687.3
=		2			-XE	N	N					&EFS/687.4
=	2				-XE	N	N					&EFS/687.6

previous page: 2023

next page: 2025

Editor	Freqcon_DG			Statron	Klemmenplan =UNIT_03++ASC+-687XT1	20230331_V0.01	= UNIT_03 Battery Container 2
Date	31.03.2023						& EMZ Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore		10354_23A2007	++ ASC auxillary cabinet — page: 2024
Date							+ — total: 423

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-687XT1

Function text	-292W2-1	-292W1-1	-291W2-1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	
Supply Battery String 1-phase 230V AC			2		-XE	N	N		-XE	N		&EFS/687.7
=		2			-XE	N	N					&EFS/687.8
=	2				-XE	N	N					&EFS/688.1

previous page: 2024

next page: 2026

Editor	Freqcon_DG	Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20230331_V0.01	= UNIT_03 Battery Container 2	
Date	31.03.2023					& EMZ Terminals	
Proved by		Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ ASC auxillary cabinet	page: 2025
Date						+	total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-293W2-1	-293W1-1	-292W3-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			2		-XE	N	N																&EFS/688.3
=		2			-XE	N	N		-XE	N													&EFS/688.4
=	2				-XE	N	N																&EFS/688.6

Terminal diagram

Freqcon_F13_001_02

Function text	-290W2-1	-290W1-1	-293W3-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			2		-XE	N	N																&EFS/688.7
=		GNYE			-XE	PE	PE																&EFS/687.2
=	GNYE				-XE	PE	PE																&EFS/687.3

Terminal diagram

Freqcon_F13_001_02

Function text	-291W2-1	-291W1-1	-290W3-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		-XE	PE	PE	,															&EFS/687.4
=		GNYE			-XE	PE	PE	,															&EFS/687.6
=	GNYE				-XE	PE	PE	,															&EFS/687.7

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-687XT1

Function text	-292W3-1	-292W2-1	-292W1-1	Cable name	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable name	Page / column
	1Z-500	1Z-500	1Z-500	Cable type							Cable type	
Supply Battery String 1-phase 230V AC			GNYE		-XE	PE	PE	,				&EFS/687.9
=		GNYE			-XE	PE	PE	,				&EFS/688.2
=	GNYE				-XE	PE	PE	,				&EFS/688.3

previous page: 2028

next page: 2030

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-687XT1	20230331_V0.01
Date	31.03.2023						
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007
Date							

=	UNIT_03	Battery Container 2	
&	EMZ	Terminals	
++	ASC	auxillary cabinet	page: 2029
+			total: 423

Terminal diagram

Freqcon_F13_001_02

Function text	-293W3-1	-293W2-1	-293W1-1	Cable name	Strip =UNIT_03++ASC+-687XT1						Cable name												Page / column
	1Z-500	1Z-500	1Z-500	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type												
Supply Battery String 1-phase 230V AC			GNYE		-XE	PE	PE	,															&EFS/688.4
=		GNYE			-XE	PE	PE	,															&EFS/688.6
=	GNYE				-XE	PE	PE	,															&EFS/688.7

Terminal diagram

Freqcon_F13_001_02

Strip

=UNIT_03++ASC+-690XT1

Function text	Cable name	Cable type	Target designation	Connection point	Terminal	Jumper	Target designation	Connection point	Cable type	Cable name	Page / column
230V AC for Container Air Conditioning 1					1	,	-690F1	2			&EFS/690.1
FI container lightning / socket feedback			-U1		3	,	-690F3	2			&EFS/690.4
=			-U3		4	,	-690F4	2			&EFS/690.6
=			-U5		5	,	-690F5	2			&EFS/690.8
						,					
FI container lightning / socket feedback			-U1		N	,					&EFS/690.5
=			-U3		N	,					&EFS/690.7
=			-U5		N	,					&EFS/690.9
						,					
						,					
FI container lightning / socket feedback			-U1		PE	,	-690F3	N.			&EFS/690.4
=			-U3		PE	,	-690F4	N.			&EFS/690.6
=			-U5		PE	,	-690F5	N.			&EFS/690.8
						,					
=			-U5		PE	,	-690F5	N.			&EFS/690.8
						,					
						,					
230V AC for Container Air Conditioning 2					2	,	-690F2	2			&EFS/690.3
230V AC for Container Air Conditioning 1					N	,	-XE	N			&EFS/690.1
=					PE	,					&EFS/690.2
230V AC for Container Air Conditioning 2					N	,	-XE	N			&EFS/690.3
=					PE	,					&EFS/690.3

previous page: 2030

next page:

Editor	Freqcon_DG			Statron	FREQCON	Klemmenplan =UNIT_03++ASC+-690XT1	20230331_V0.01	= UNIT_03	Battery Container 2
Date	31.03.2023							& EMZ	Terminals
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore				++ ASC	auxillary cabinet
Date							10354_23A2007	+	

Hazardous Area Layout-02

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E99-002
Sequence Number: 001
Rev: 005
Document number: K559-2254-CWIWP4202201-E99-002
Document description: Hazardous Area Layout

Revision	Date	Name	Description
001	20.02.2023	CPA / ADI	First Version
002	12.04.2023	CPA / ADI	Updated according to KBR comments
003	21.01.2025	MMÜ	Second revision

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Hazardous Area Layout
E99-002

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E99-002
Document name	Hazardous Area Layout
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-05-09	C. Palenzuela	First version
1.1	2023-05-25	C. Palenzuela	First revised version
1.2	2023-06-01	C. Palenzuela	Removed errors in section 4.4
1.3	2023-06-26	C. Palenzuela	Updated several pages
1.4	2025-01-22	M. Mueller	Second revision

Table 1: Version overview

	Date	Name
Editor	2023-06-26	C. Palenzuela
Checked by	2023-06-26	M. Maaz
Approved by	2023-06-26	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Other Applicable Documents 7
1.3 Generic Terms and Abbreviations Used 7
2 General 8
3 Container Access 9
3.1 PCS Container 9
3.2 BESS Containers 12
4 H2 Detection and Exhaust 14
4.1 Container Intake and Exhaust Fans 14
4.2 H2 Sensors 14
4.3 Explosive Atmosphere Potential 15
4.4 Hazardous Area Classification 16
4.5 Clearance Spaces BESS Containers 17
4.6 Clearance Spaces PCS Container 18

Identification

Product Version / Document Version

Product version
Prototype

Document release date
January 2025

Doc Code
K559-2254-CWIWP4202201-E99-002

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, later documents supersede the information provided in this document.

1.2 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
BESS and PCS circuit diagram	23A2007_230305_FRQCON_fire safety process_v1.3

Table 1: Other applicable documents

1.3 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
CCS	Central Control System (BLPH)
IGBT	Insulated-gate bipolar transistor
LeL	Lower explosive limit
LFP	Lithium ferro-phosphate
PCS	Power Conversion System

Table 2: Generic terms and abbreviations used

2 General

For installation of the PCS and BESS containers, sufficient clearance and safety distances must be observed in order to allow doors to fully open and to allow personnel to safely move throughout the electrical systems (see section 21. and 2.2).

Only trained, instructed personal with sufficient training is allowed to enter the PCS and BESS containers. It is not allowed to enter the BESS container during operation. The BESS must first be disconnected before entering for maintenance work. Disconnection of the BESS can be performed from the HMI inside the PCS Container or via customer CCS – BESS reconnection is not possible via remote during maintenance.

- Each container is secured with padlocks and safety doors (no micro-switches at container doors).
- There are no physical barriers present inside containers, blocking escape routes or hindering maintenance.

3 Container Access

The entrances to the containers are described in the following subsections.

- **BESS containers are not allowed to be entered during operation** – BESS must first be disconnected before entering for maintenance work. Disconnection can be performed from the HMI inside the PCS Container or via customer CCS – BESS reconnection is not possible via remote during maintenance.
- **PCS container can be entered by trained professionals during operation** – personnel is only allowed to operate the HMI and operating panel on the outside of the control cabinet. It is not allowed to open any switch cabinet doors during operation. This is indicated by safety signs on the switch cabinets (*see Figure 1*) and is also clearly emphasised in the operating instructions of the PCS.

  For safety reasons, personnel must keep a distance of 1m from any switch cabinet expect for the control cabinet (*see Figure 2*).



Figure 1: Safety sign 1



Figure 2: Safety sign 2

3.1 PCS Container

Main Entrance Door

The main entrance door of the PCS is located on the long side of the PCS container (*see Figure 3 and Figure 4,* ①). The door is used as the main entrance to the PCS container. The door is secured with a cylinder lock with key.

Door Specification:

Single Door Clear Opening 900 x 2200mm high

- 4 no. stainless steel 316 hinges per door leaf
- stainless steel 316 handles with escutcheons
- 3-point latch (SS316 external/SS304 internal components)
- seals
- door closer on active door leaf (aluminium with anti-corrosive coating)
- panic opening device SS304 (incl. push bar) on active door leaf
- cylinder lock with 3 keys
- windbreak SS304 on active door leaf

PCS Container

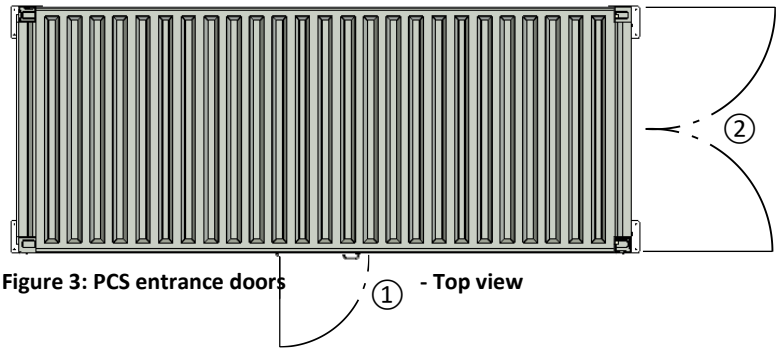


Figure 3: PCS entrance doors - Top view

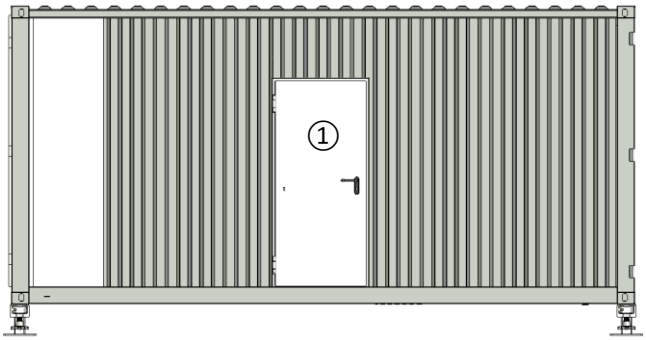


Figure 4: PCS entrance doors – side view

Transformer Room Entrance

The transformer room entrance door is only to be used during installation, commissioning and inspection work on the transformer. To enter the PCS container the main entrance door mentioned above is to be used. The transformer room entrance double-door is located on the front side of the PCS container (*see Figure 3,* ②). The double door is secured with a cylinder lock with keys.

Door Specification:

Double Door Clear Opening 2100 x 2200mm high

- 4 no. stainless steel 316 hinges per door leaf
- stainless steel 316 handles with escutcheons
- 3-point latch (SS316 external/SS304 internal components)
- seals
- door closer on active door leaf (aluminium with anti-corrosive coating)
- panic opening device SS304 (incl. push bar) on active door leaf
- cylinder lock with 3 keys
- windbreak SS304 on active door leaf

3.2 BESS Containers

Main Entrance Doors

The three (3) entrance doors of the BESS are located on the long side of the BESS containers (*see Figure* 5 *and Figure 6,* ①). These doors are used as the main entrances to the BESS containers. Each door is secured with a cylinder lock with key.

Door Specification:

Single Door Clear Opening 900 x 2200mm high

- 4 no. stainless steel 316 hinges per door leaf
- stainless steel 316 handles with escutcheons
- 3-point latch (SS316 external/SS304 internal components)
- seals
- door closer on active door leaf (aluminium with anti-corrosive coating)
- panic opening device SS304 (incl. push bar) on active door leaf
- cylinder lock with 3 keys
- windbreak SS304 on active door leaf

BESS Container 1

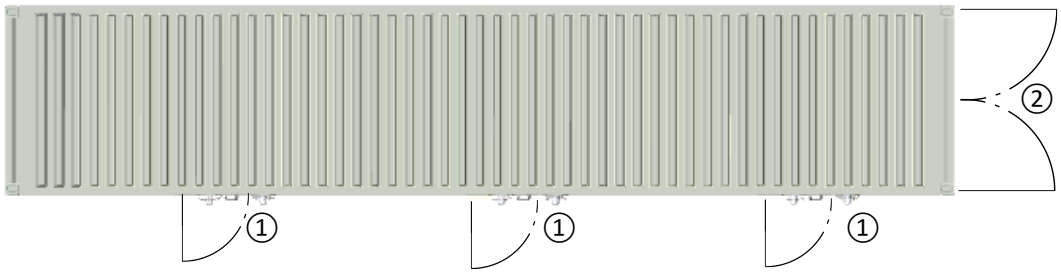


Figure 5: BESS entrance doors – top view

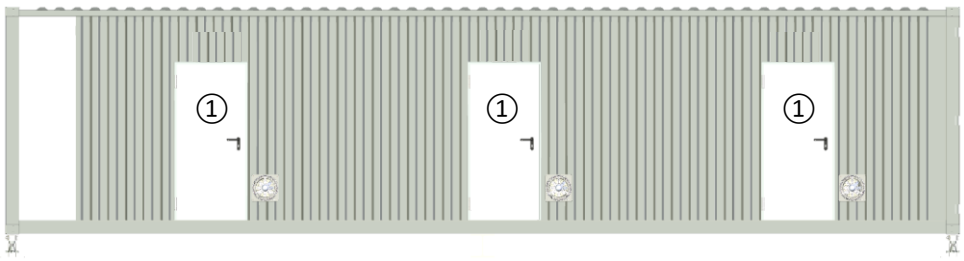


Figure 6: BESS entrance doors – side view

Cabinet Installation Door

The double door on the front side of the BESS containers (*see Figure 6,* ②) is only to be used during installation of the battery cabinets. After installation, only the entrance doors are to be used to enter the BESS containers (*see Figure 6,* ①). The double doors are secured with cylinder locks with keys.

Door Specification:

Double Door Clear Opening 2100 x 2200mm high

- 4 no. stainless steel 316 hinges per door leaf
- stainless steel 316 handles with escutcheons
- 3-point latch (SS316 external/SS304 internal components)
- seals
- door closer on active door leaf (aluminium with anti-corrosive coating)
- panic opening device SS304 (incl. push bar) on active door leaf
- cylinder lock with 3 keys
- windbreak SS304 on active door leaf

4 H2 Detection and Exhaust

4.1 Container Intake and Exhaust Fans

Each BESS container is equipped with three (3) fans in the lower part of their long side drawing air into the container in case of gas detection (*see Figure 8*). During normal operation, the intake and exhaust fans are sealed with dampers, which will only be activated during an H2 detection by the system.

4.2 H2 Sensors

There are three (3) H2 sensors installed in the ceiling of each BESS container to detect possible H2 gas inside the atmosphere of the BESS containers.

As soon as a H2 sensor measures a LeL of >4 % inside the container atmosphere, an error will be triggered by the PCS main controller and

- Battery cabinet fans are activated, exhausting the air from the inside of the cabinets to the container interior.
- Dampers on container intake and exhaust are opened and intake and exhaust fans activated, exhausting the air from inside the container to the outside.
- Each battery cabinet is set to “error and disconnected” state
    - Charging/discharging process stops
    - DC side of battery cabinets is disconnected via DC switches inside the cabinets
- IGBTs deactivated and de-energized
- Main AC main circuit breaker 80Q1 disconnects the 620 VAC AC side of the PCS

As soon as the measured LeL is <4 %, the main controller sets the BESS back to “ready for connections” state. In this state, a manual reset of the fault must be performed via CCS remote connection or at the operating panel inside the container.

The H2 sensors used are of the following type:
Dräger Polytron 8200 CAT

4.3 Explosive Atmosphere Potential

Since FREQCON is actively taking countermeasures to avoid high concentrations of potential off-gases through extensive ventilation of the container interior, thus avoiding risk of explosions, we see the container interior as a safe zone. Therefore, no ATEX rated devices are used in the containers.

Internal H2

Since the BESS is equipped with LFP batteries, FREQCON only expects gases to be present inside the container in the event of a thermal runaway of the batteries. As this scenario is highly unlikely due to the cell technology used and the safety measures provided (*detailed information described in document 23A2007_230305_FRQCON_fire safety process_v1.x*), FREQCON does not see a high enough potential for the generation of an explosive atmosphere inside the container to classify the interior of the BESS and PCS containers as a potentially hazardous area.

External H2

As the BESS is located on an offshore platform with H2 production and storage, the factor of H2 coming from outside the BESS containers was also considered during the design phase of the containers. The conclusion is that because the BESS is located on a platform below the H2 units, the chemical properties of H2 prevent it from entering the BESS (H2 lighter than air, therefore rises).

4.4 Hazardous Area Classification

The following figure shows the top view of both BESS containers standing back-to-back. Based on the previously described measures to prevent an explosive mixture, we define the whole system (BESS and PCS) as non-hazardous area.

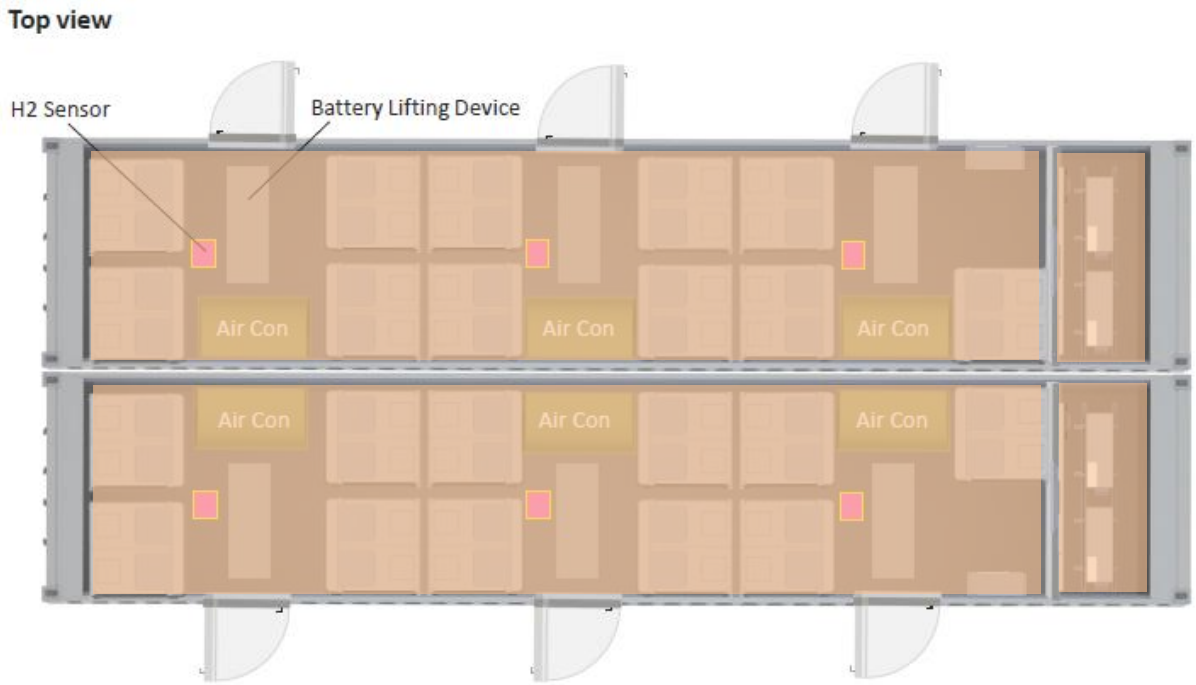


Figure 7: Container top view

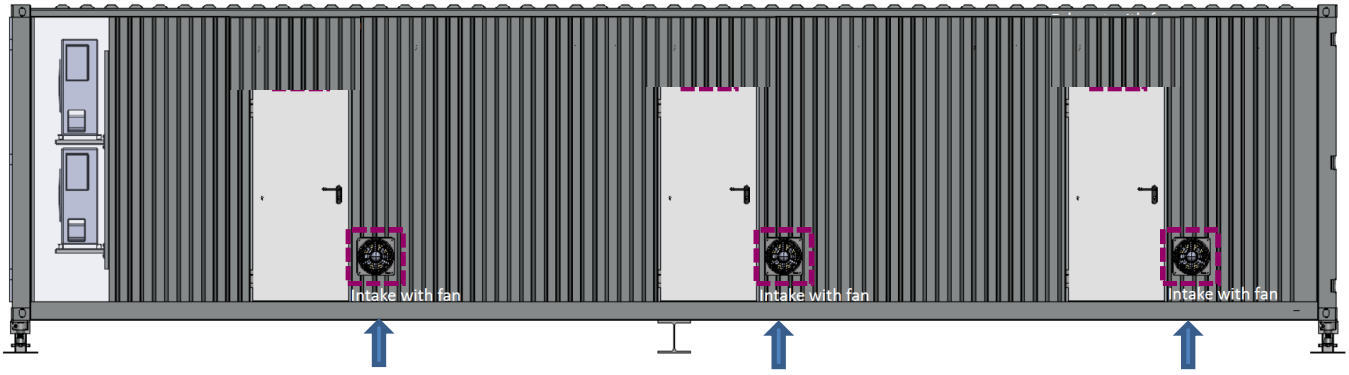
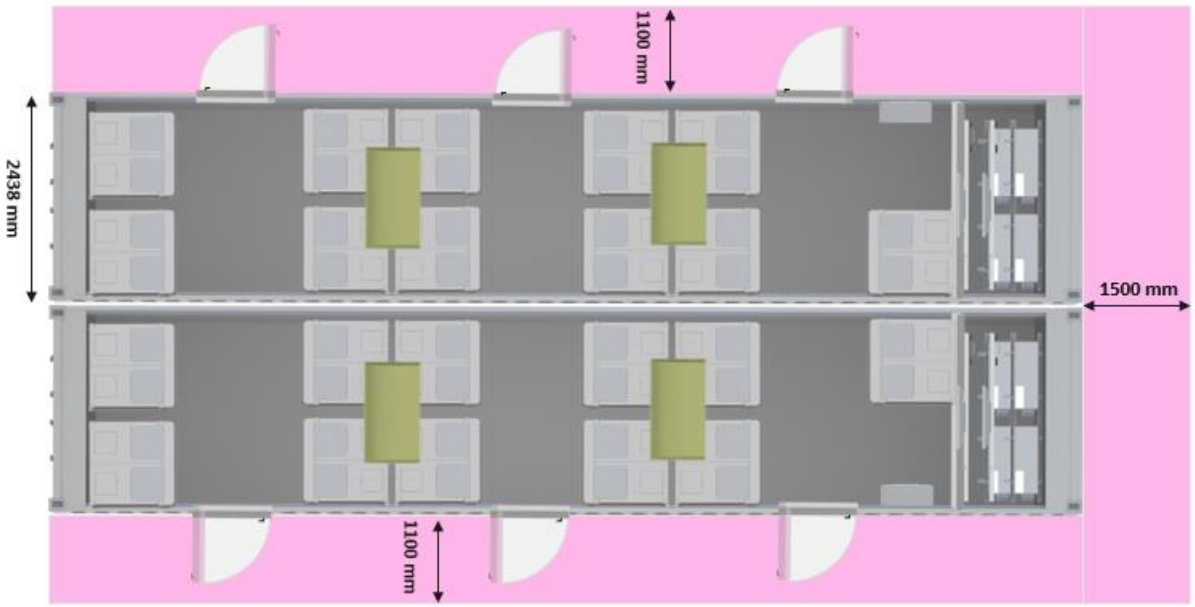


Figure 8: Exhaust system – side view

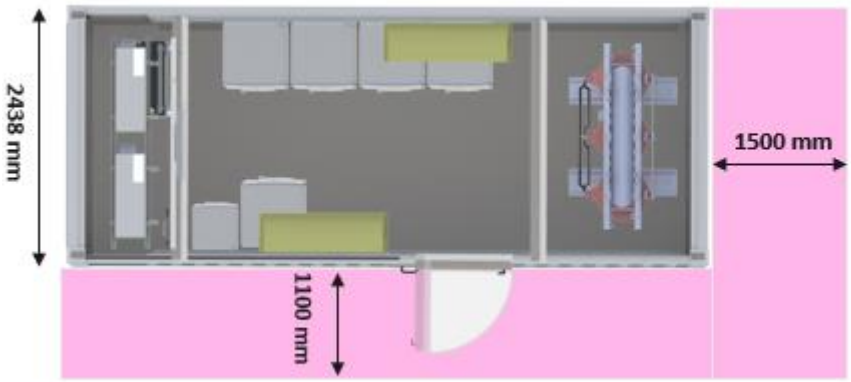
4.5 Clearance Spaces BESS Containers

The following safety distances must be observed for the installation of the BESS containers.



4.6 Clearance Spaces PCS Container

The following safety distances must be observed for installation of the PCS container.



Cable Transits Schedule-03

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E99-003
Sequence Number: 001
Rev: 004
Document number: K559-2254-CWIWP4202201-E99-003
Document description: Cable Transits Schedule

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Cable Transits Schedule
E99-003

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E99-003
Document name	Cable Transits Schedule
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-23	C. Palenzuela	First version
2.0	2025-01-23	M. Mueller	Second revised version
3.0	2025-01-29	M. Mueller	Updated figure 1
4.0	2025-02-04	C. Palenzuela	Updated section 3.1

Table 1: Version overview

	Date	Name
Editor	2023-03-23	C. Palenzuela
Checked by	2023-03-30	A. Fritz
Approved by	2023-03-30	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 Cable Outlets 8
2.1 Overall System 8
2.2 PCS Container 9
2.3 BESS 1 Container 9
2.4 BESS 2 Container 10
3 Cable Gland Description 11
3.1 PCS Container 11
3.2 BESS 1 14
3.3 BESS 2 16

Identification

Product Version / Document Version

Product version
Prototype

Document release date
February 2025

Doc Code
K559-2254-CWIWP4202201-E99-003

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 Cable Outlets

2.1 Overall System

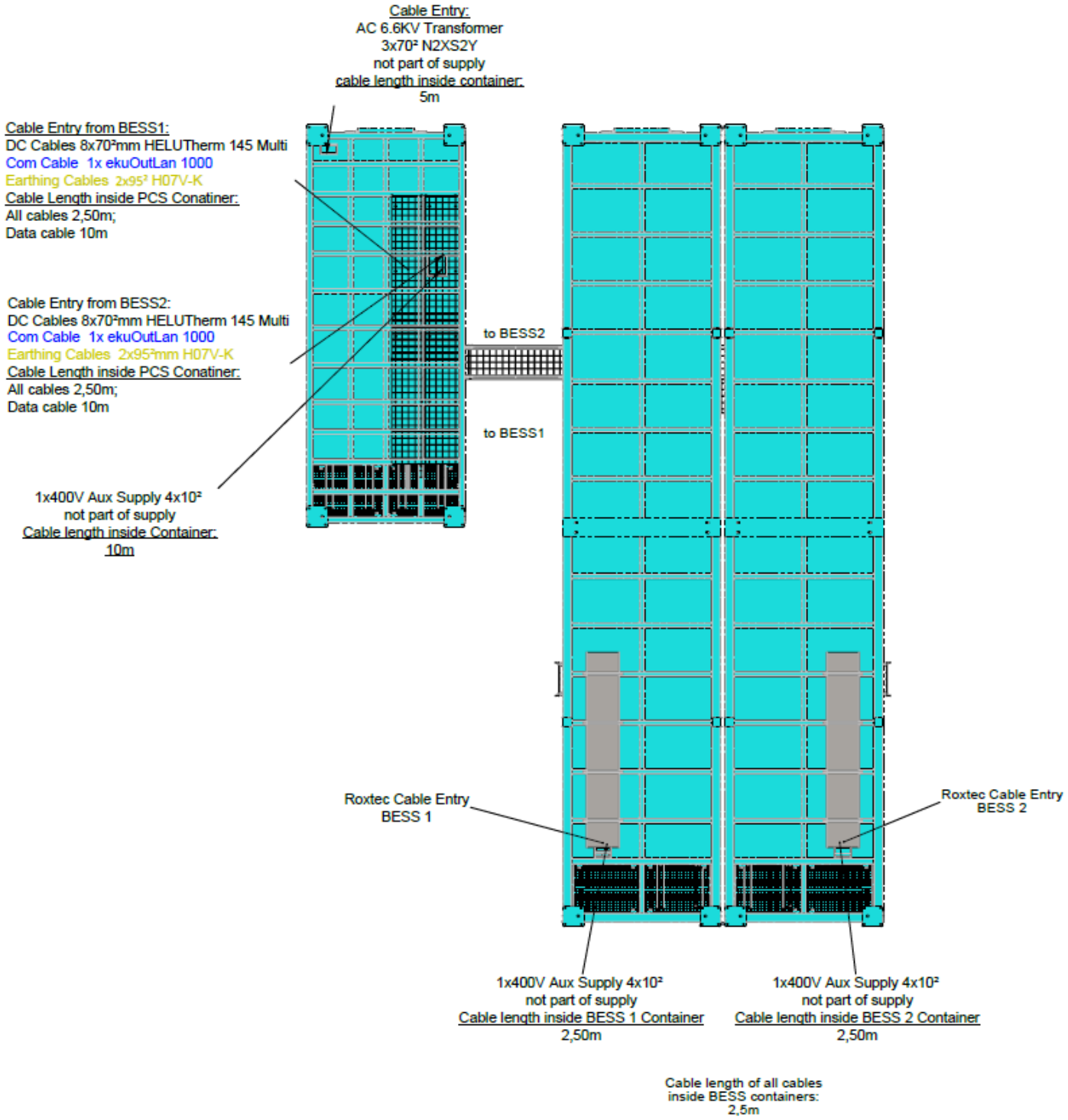
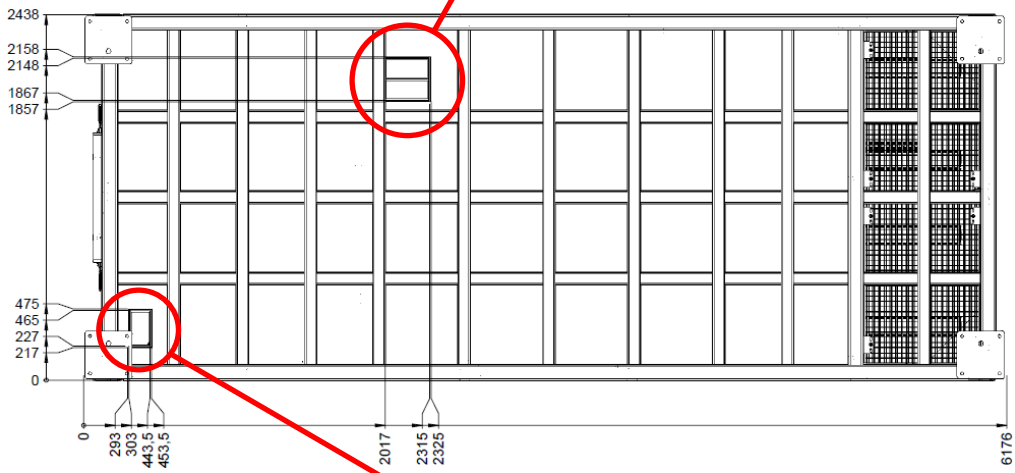


Figure 1: Cable outlets – Overall system (Bottom view)

2.2 PCS Container

Cable interface 1 (Roxtec cable gland)

- DC power cables
- Communication cables
- 400 V AC aux. cables



Cable interface 2 (Roxtec cable gland)

- 6.6 kV MV cables

Figure 2: Cable outlets – PCS (Bottom view)

2.3 BESS 1 Container

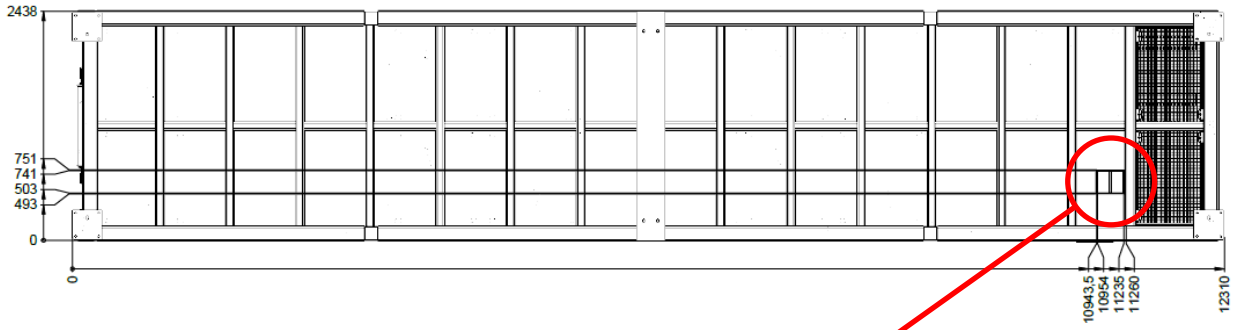


Figure 3: Cable outlets – BESS 1 (Bottom view)

Cable interface (Roxtec cable gland)

- DC power cables
- Communication cables
- 400 V AC aux. cables

2.4 BESS 2 Container

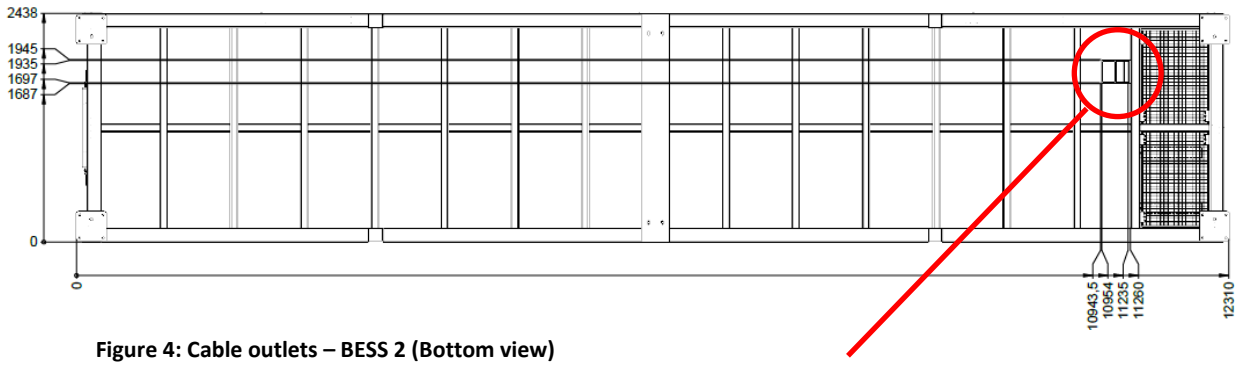


Figure 4: Cable outlets – BESS 2 (Bottom view)

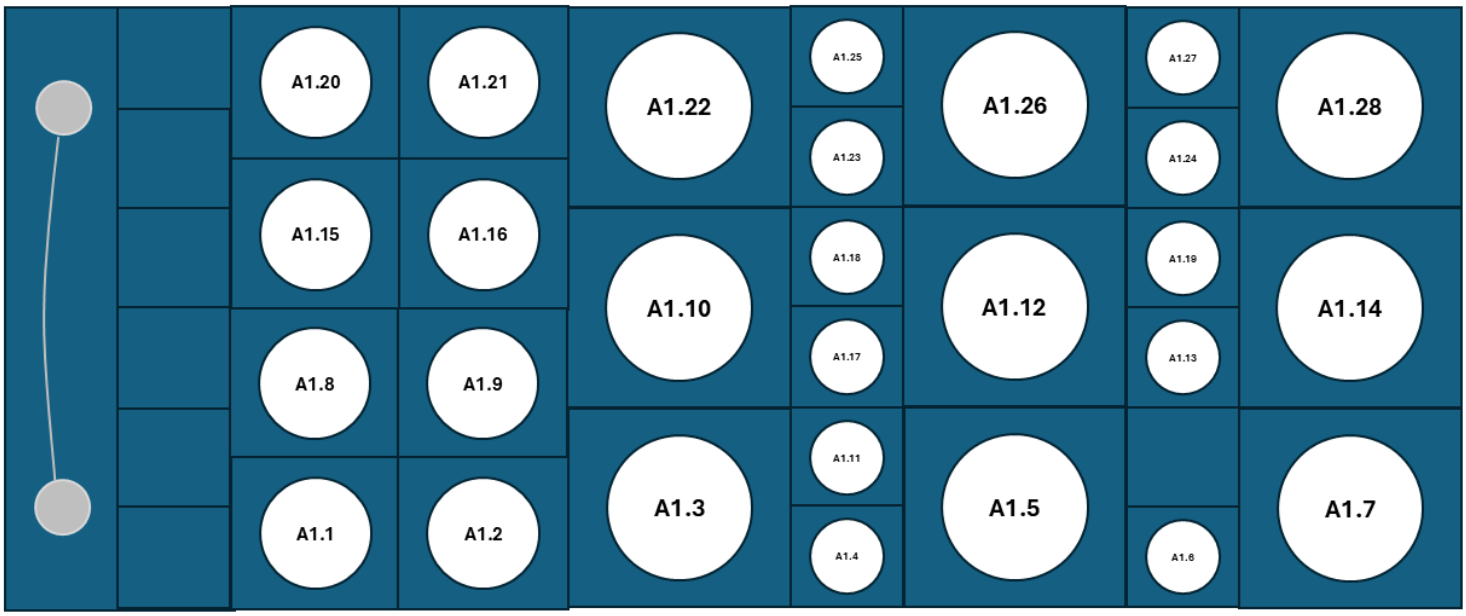
Cable interface (Roxtec cable gland)

- DC power cables
- Communication cables
- 400 V AC aux. cables

3 Cable Gland Description

3.1 PCS Container

Cable interface – PCS – Comm and Aux 1

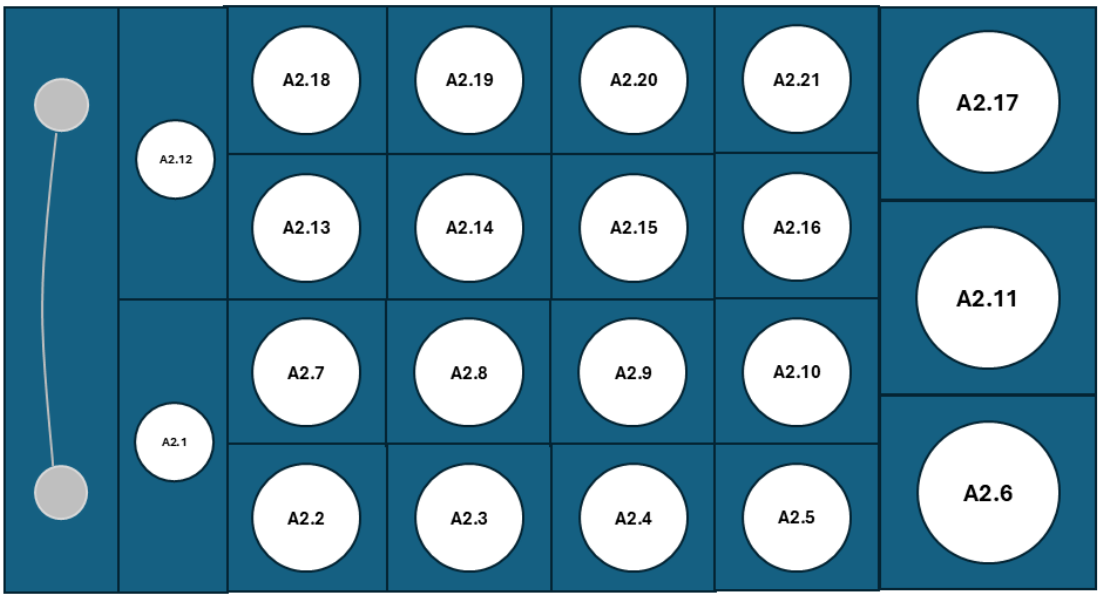


PCS – Comm and Aux 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:2		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:4	*	P320 PLC / B400-NET-001.01	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5		85002CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:9		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:11	*	P320 PLC / B400-NET-001.02	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		85001-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:15		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:16	**	P320 PLC / B400-FGS-002	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:18		C-85-XS-001 / B400-SIS-001	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:19	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:20		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:21	**	P320 PLC / B400-SIS-001	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:23	***	82006-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:24	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:25	***	82007-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:26		83011-CEL / 84W2	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

A1:27	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

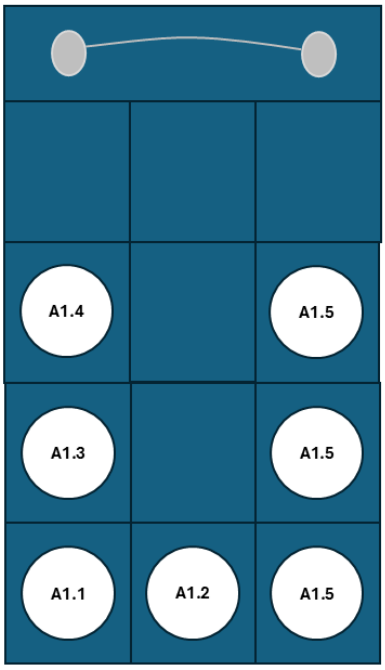
Cable interface – PCS – Comm and Aux 2



PCS – Comm and Aux 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:2	Solarflex-X 1x 70	DC Cable - DC+4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:3	Solarflex-X 1x 70	DC Cable - DC-4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:4	Solarflex-X 1x 70	DC Cable - DC+3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC-3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:7	Solarflex-X 1x 70	DC Cable - DC+4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:8	Solarflex-X 1x 70	DC Cable - DC-4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:9	Solarflex-X 1x 70	DC Cable - DC+2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:13	Solarflex-X 1x 70	DC Cable - DC+4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:14	Solarflex-X 1x 70	DC Cable - DC-4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC+2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC-2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:18	Solarflex-X 1x 70	DC Cable - DC+3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:19	Solarflex-X 1x 70	DC Cable - DC-3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:20	Solarflex-X 1x 70	DC Cable - DC+2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:21	Solarflex-X 1x 70	DC Cable - DC-2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 (MV Transformer)

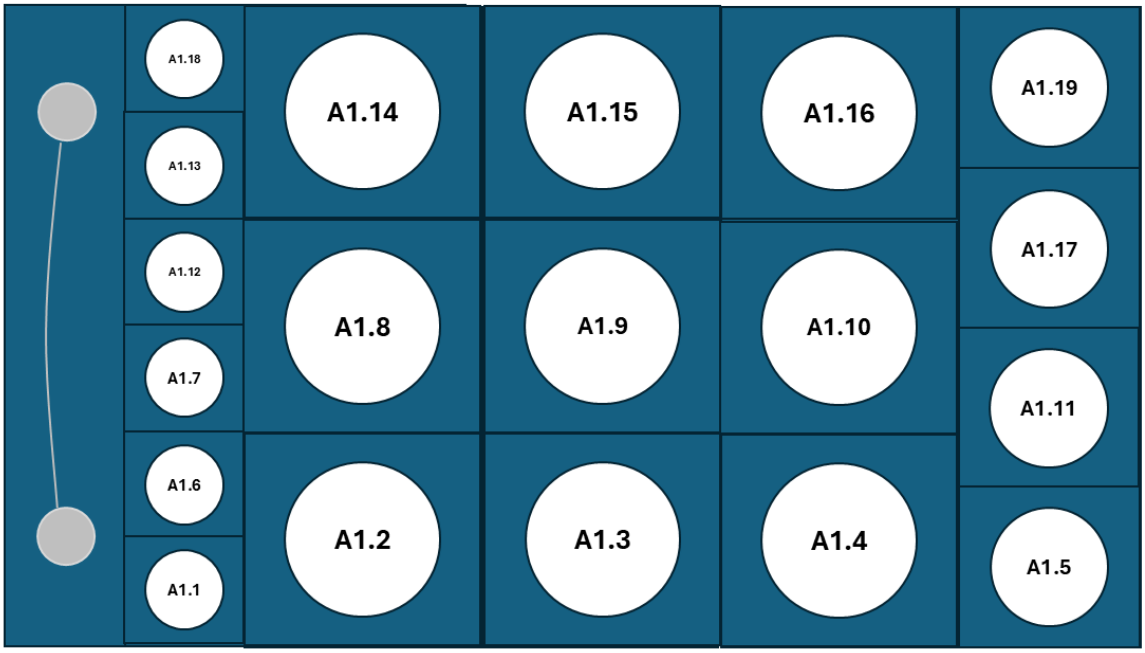


PCS – MV Transformer

Pos.	Cable ID	Name	Cable Category	OD (mm / [“])	Module Type
A1:1	1	82005 – L2	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:2	4	82005 – L3	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:3	5	82005 – L1	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

3.2 BESS 1

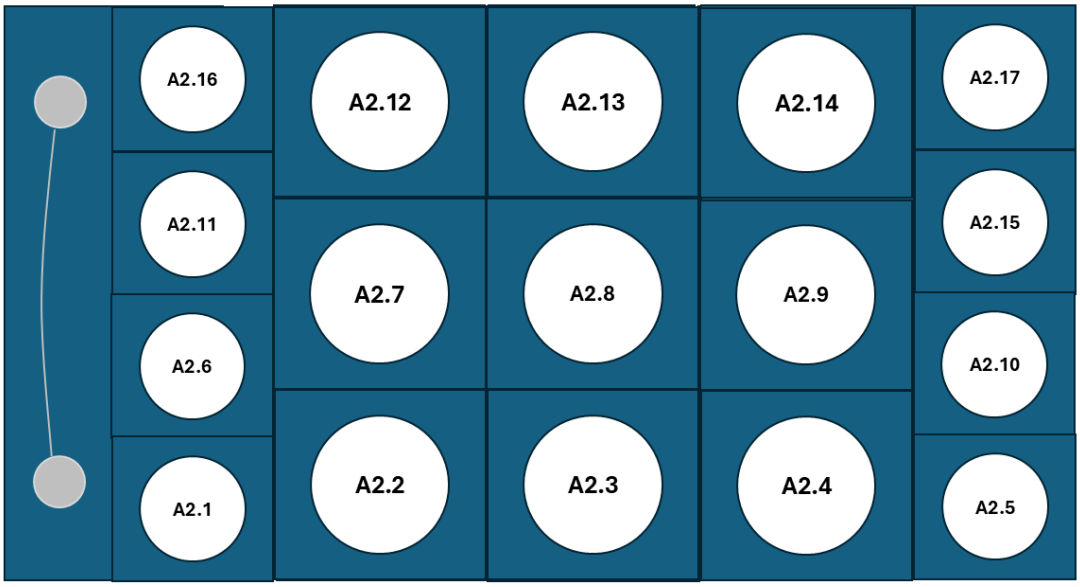
Cable interface 1 - BESS 1



BESS 1 - 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:1	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5	4x 10 mm²	400 V Aux Supply – 83015-CEL	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:6	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:7		COM Cable - ETH	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		COM Cable - UNIT_1 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13		COM Cable - UNIT_3 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 - BESS 1

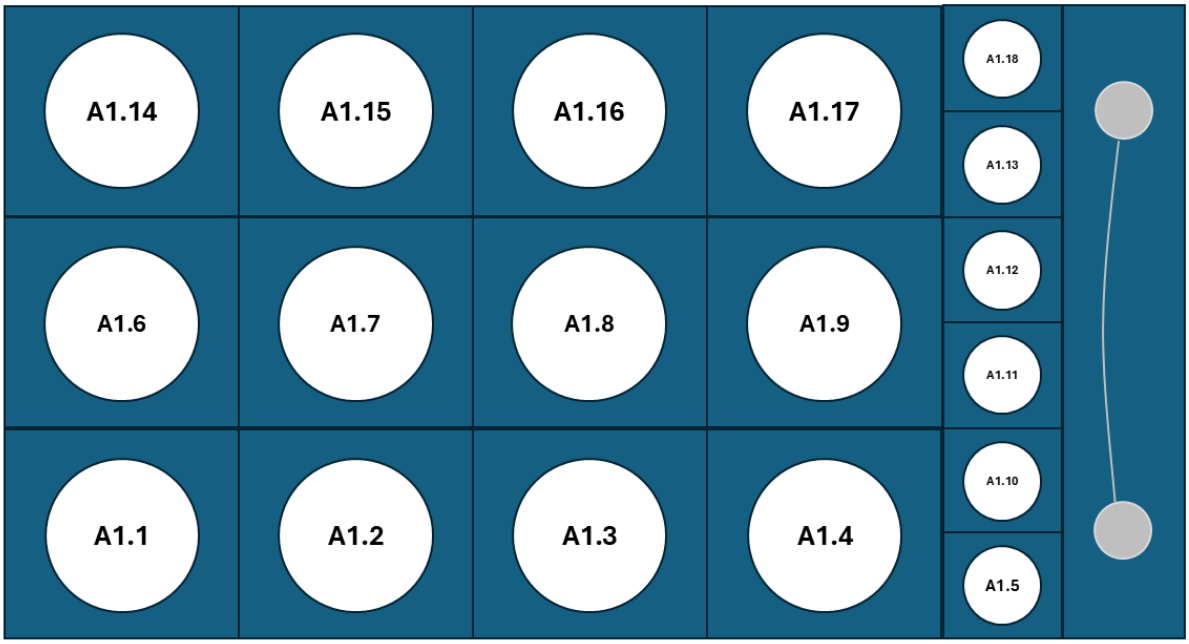


BESS 1 - 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:1	Solarflex-X 1x 70	DC Cable - DC-2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC+2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:6	Solarflex-X 1x 70	DC Cable - DC+2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:11	Solarflex-X 1x 70	DC Cable - DC-2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC-3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC+2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:17	Solarflex-X 1x 70	DC Cable - DC+3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

3.3 BESS 2

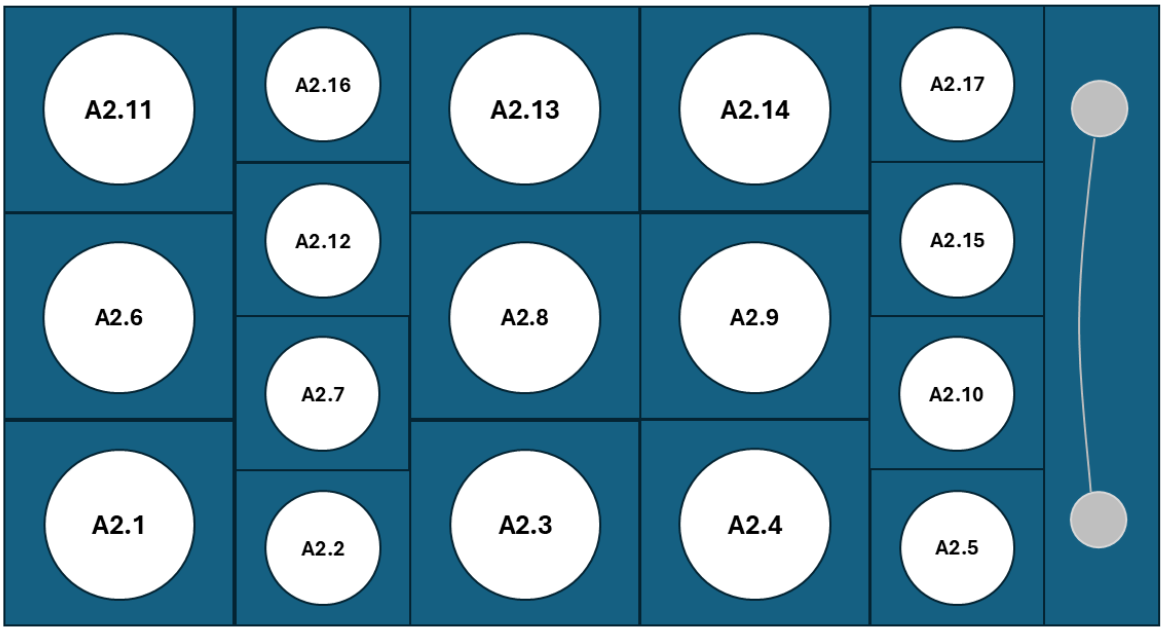
Cable interface 1 - BESS 2



BESS 2 - 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:1	4x 10 mm²	400 V Aux Supply – 83014-CEL	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:10	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		COM Cable - ETH	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13		COM Cable - UNIT_2 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:18		COM Cable – ET200 Unit_1 (not connected)	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 - BESS 2



BESS 2 - 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:2	Solarflex-X 1x 70	DC Cable - DC+4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC+3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:7	Solarflex-X 1x 70	DC Cable - DC-4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:12	Solarflex-X 1x 70	DC Cable - DC-4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC+4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC+4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:17	Solarflex-X 1x 70	DC Cable - DC-4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Earthing Layout-04

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E99-004
Sequence Number: 001
Rev: 002
Document number: K559-2254-CWIWP4202201-E99-004
Document description: Earthing Layout

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Earthing Layout
E99-004

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E99-004
Document name	Earthing Layout
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	C. Palenzuela	First version
2.0	2024-11-28	M. Müller	First revised version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	C. Palenzuela
Checked by	2023-03-14	A. Fritz
Approved by	2023-03-14	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
2.1 External Earthing Layout 8
2.2 Internal Earthing Layout 9
3 Appendix 10

Identification

Product Version / Document Version

Product version
Prototype

Document release date
November 2024

Doc Code
K559-2254-CWIWP4202201-E99-004

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of the documentation for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
BESS and PCS circuit diagram	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
Extract of BESS and PCS circuit diagram (Earthing layout PCS)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Eathing layout PCS
Extract of BESS and PCS circuit diagram (Earthing layout Battery 1)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Earthing layout Battery 1
Extract of BESS and PCS circuit diagram (Earthing layout Battery 2)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Earthing layout Battery 2

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 2: Generic terms and abbreviations used

2 General

The description of the earthing layout is divided into two sections:

- External earthing layout: Earthing connections between the central earthing point and the three FREQCON containers
- Internal earthing layout: Earthing connections inside the FREQCON containers

2.1 External Earthing Layout

The external earthing layout is shown in the following figure.

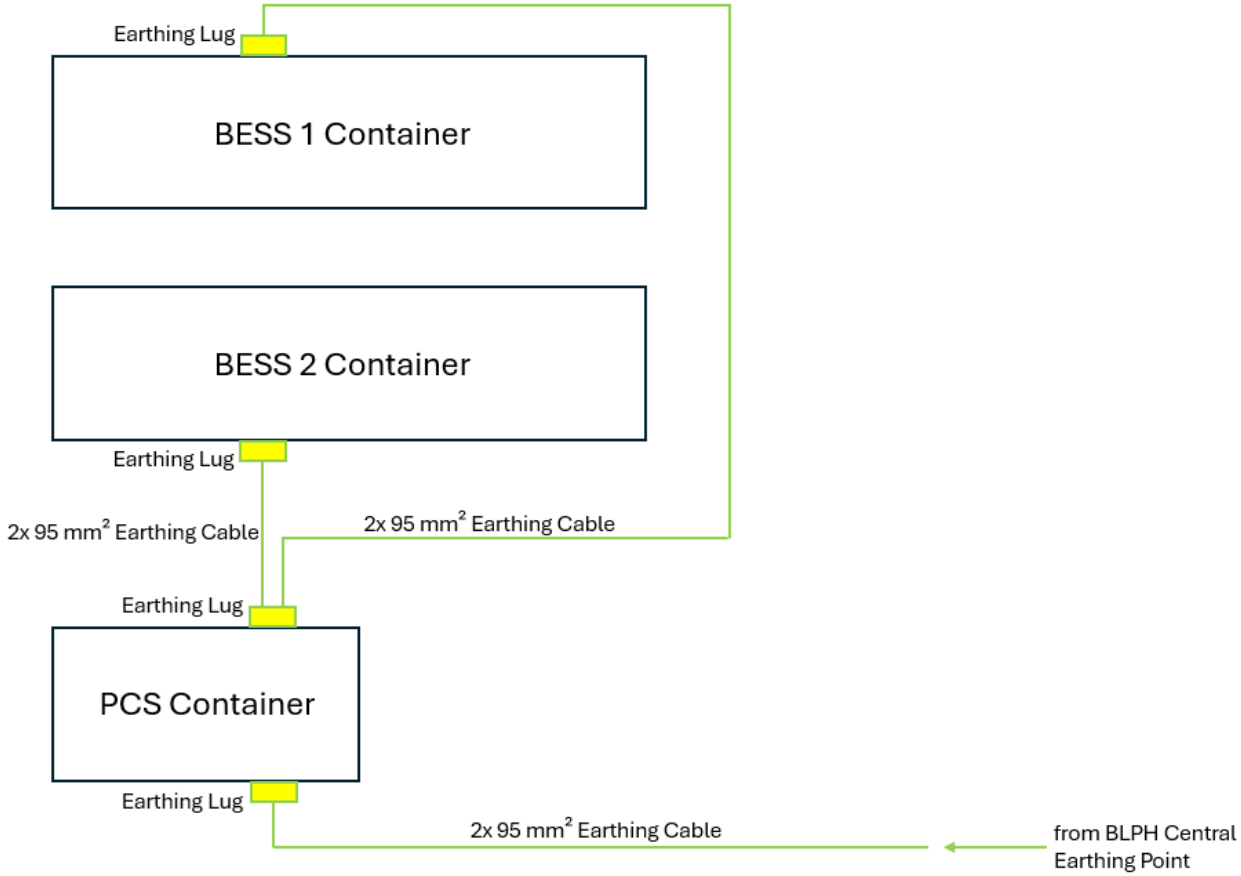


Figure 1: External earthing layout

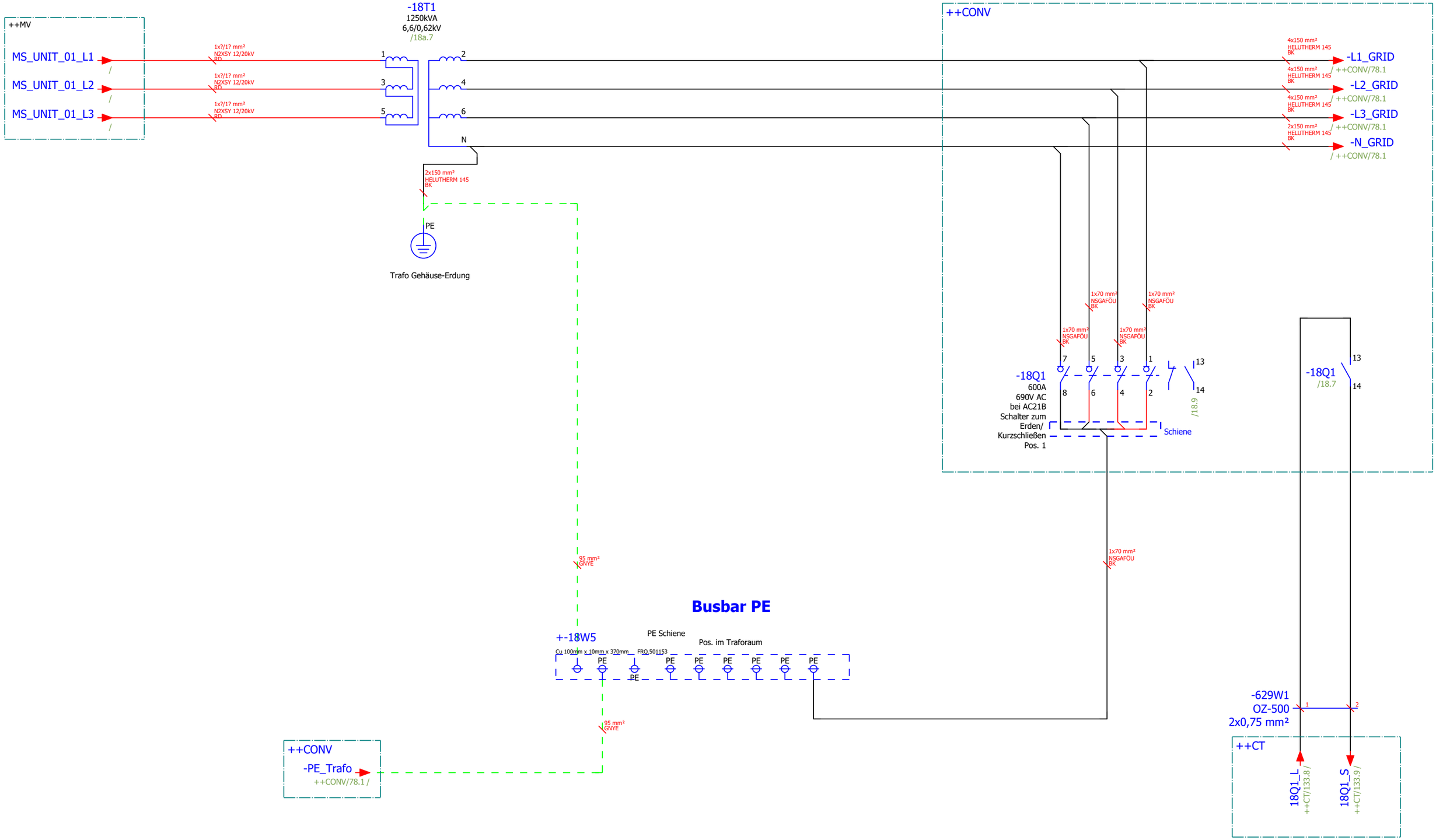
2.2 Internal Earthing Layout

The internal earthing layout of the PCS and BESS containers are part of the circuit diagram of the complete system attached to this document (*see section 1.3 "Other Applicable Documents"*). The relevant pages are extracted into separate files as shown in the following table.

Container	Document Name
PCS	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Earthing Layout PCS
Battery 1	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Earthing Layout Battery 1
Battery 2	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Earthing Layout Battery 2

3 Appendix

1. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
2. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Earthing Layout PCS
3. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Earthing Layout Battery 1
4. 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_Earthing Layout Battery 2



previous page:
&ELU++/5a

next page:
18a

Editor	Freqcon_DG			Statron	FREQCON	MV-TRANSFORMER UNIT_01+02	20241105_V1.2	= UNIT_01 Converter Container 1
Date	05.11.2024							& EFS Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ TRA medium voltage transformer page: 18
Date								+ total: 498

Grid Busbars L1, L2, L3

++TRA

-L1_GRID ++TRA/18.9 /
-L2_GRID ++TRA/18.9 /
-L3_GRID ++TRA/18.9 /

+AC_DC-78W1 GRID L1 Pos. 1/ Links
Cu 100mm x 10mm x 370mm FRQ.52163 &EFA++/1a.0
+AC_DC-78W2 GRID L2 Pos. 1/ Mitte
Cu 100mm x 10mm x 370mm FRQ.52163
+AC_DC-78W3 GRID L3 Pos. 1/ Rechts
Cu 100mm x 10mm x 370mm FRQ.52163

4x50 mm² NSGAFöu BK → -L1CON1 / 80.0
4x50 mm² NSGAFöu BK → -L2CON1 / 80.0
4x50 mm² NSGAFöu BK → -L3CON1 / 80.0

25 mm² NSGAFöu BK

+AC_DC -78F1 690Vac 100A gL/gG NH00 /78.8
1 3 5 13 21 / 2 4 6 14 22

-1F2 / ++CT/127.4
F3 / 238b.9

-238W7 OZ-500 2x0,75 mm² /238a.2
0,75 mm² BU
+AC_DC -X3.43 20 19
-78W7 OZ-500 2x0,75 mm²
+AC_DC -78F1 /78.6 13 14

+AC_DC -78F2 Typ 1 + Typ 2 400/690 V~ L1 L2 L3 PE PE
+AC_DC -78F3 20A, aR 1 3 5 / 2 4 6
-78W6 OZ-600 3x2,5 mm² 0,6kV/1kV 1 2 3

-CHA_L1 ++CT/85.1 /
-CHA_L2 ++CT/85.1 /
-CHA_L3 ++CT/85.1 /

35 mm² GNYE

Busbars N

-N_GRID ++TRA/18.9 /

+AC_DC-78W4 GRID N &EFA++/1a.1 Pos. unten Links
Cu 50mm x 10mm x 370mm FRQ.50622
2x50 mm² NSGAFöu BK → GRID_N / 99.5

16 mm² NSGA Föu BK
-AC_F_N.1 83.3 /
-AC_F_N.2 83.3 /
-AC_F_N.3 83.3 /

Busbars PE

Einspeisung_IEC_Seite 78
Einbauort_Sicherung in Connection cabinet

+AC_DC-78W5 GRID PE &EFA++/1a.1 Pos. unten rechts
Cu 100mm x 10mm x 370mm FRQ.50070

-PE_Trafo ++TRA/18.2 /

PE PE PE PE PE PE PE PE PE PE PE PE PE PE

95 mm² GNYE
35 mm² GNYE

PE_2_1 238a.1 /
PE_2_2 238a.4 /
PE_2_3 238a.8 /
PE_3_1 228.1 /
PE_3_2 228.4 /
PE_3_3 228.8 /
PE_4_1 238b.1 /
PE_4_2 238b.4 /
PE_4_3 238b.8 /

=UNIT_02 PE_BAT_CONV_1 =UNIT_02++Container/278.5 /
=UNIT_03 PE_BAT_CONV_2 =UNIT_03++Container/278.5 /

PE Container
PE Cabinet base frame front side
PE Cabinet base frame back side

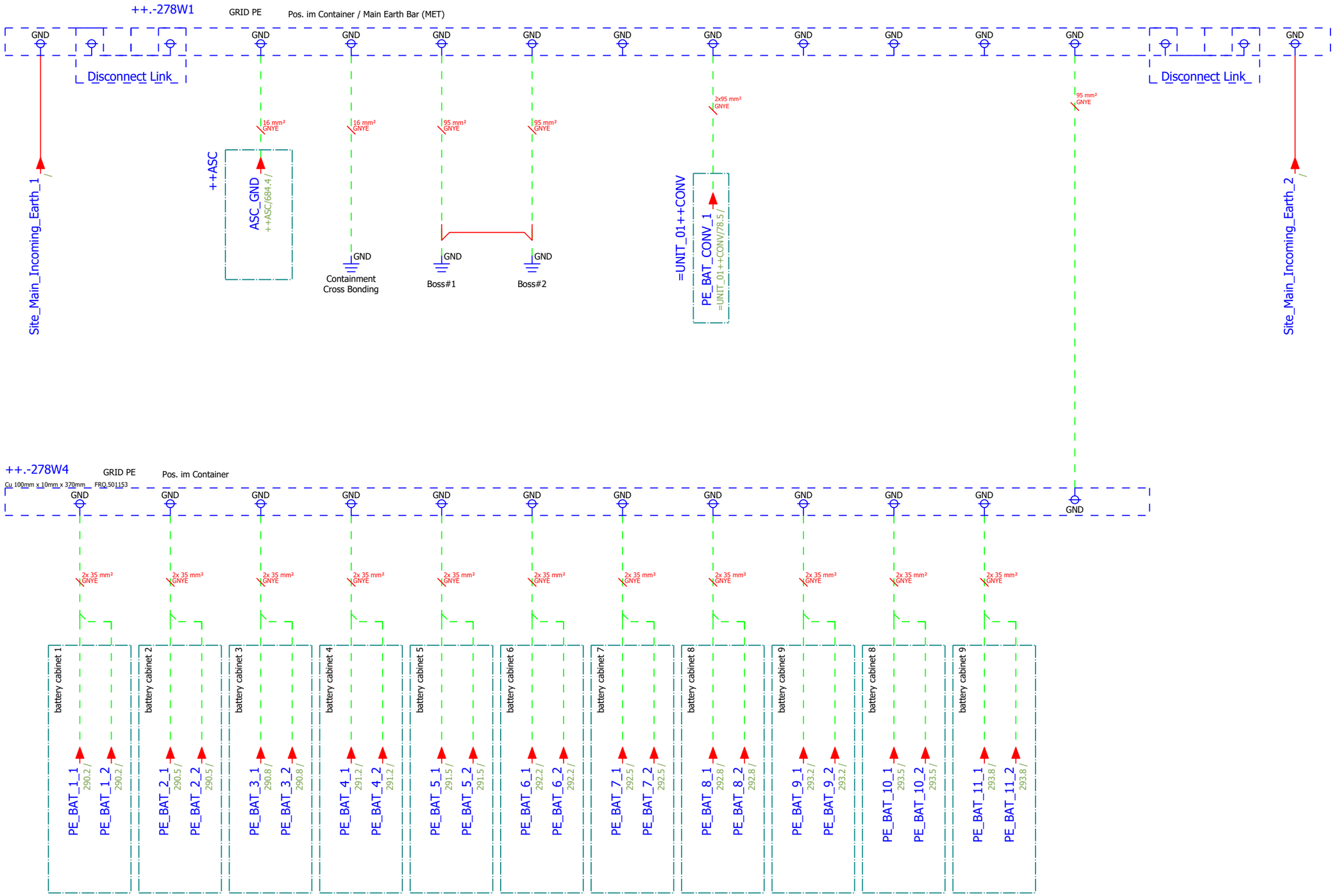
400V TYP 1

previous page: ++TRA/18a
next page: 80

Editor	Freqcon_JD			Statron	FREQCON	GRID CONNECTION	20241105_V1.2	= UNIT_01	Converter Container 1
Date	18.06.2024							& EFS	Circuit diagram
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ CONV	Converter
Date								+	

page: 78
total: 498

Busbars PE

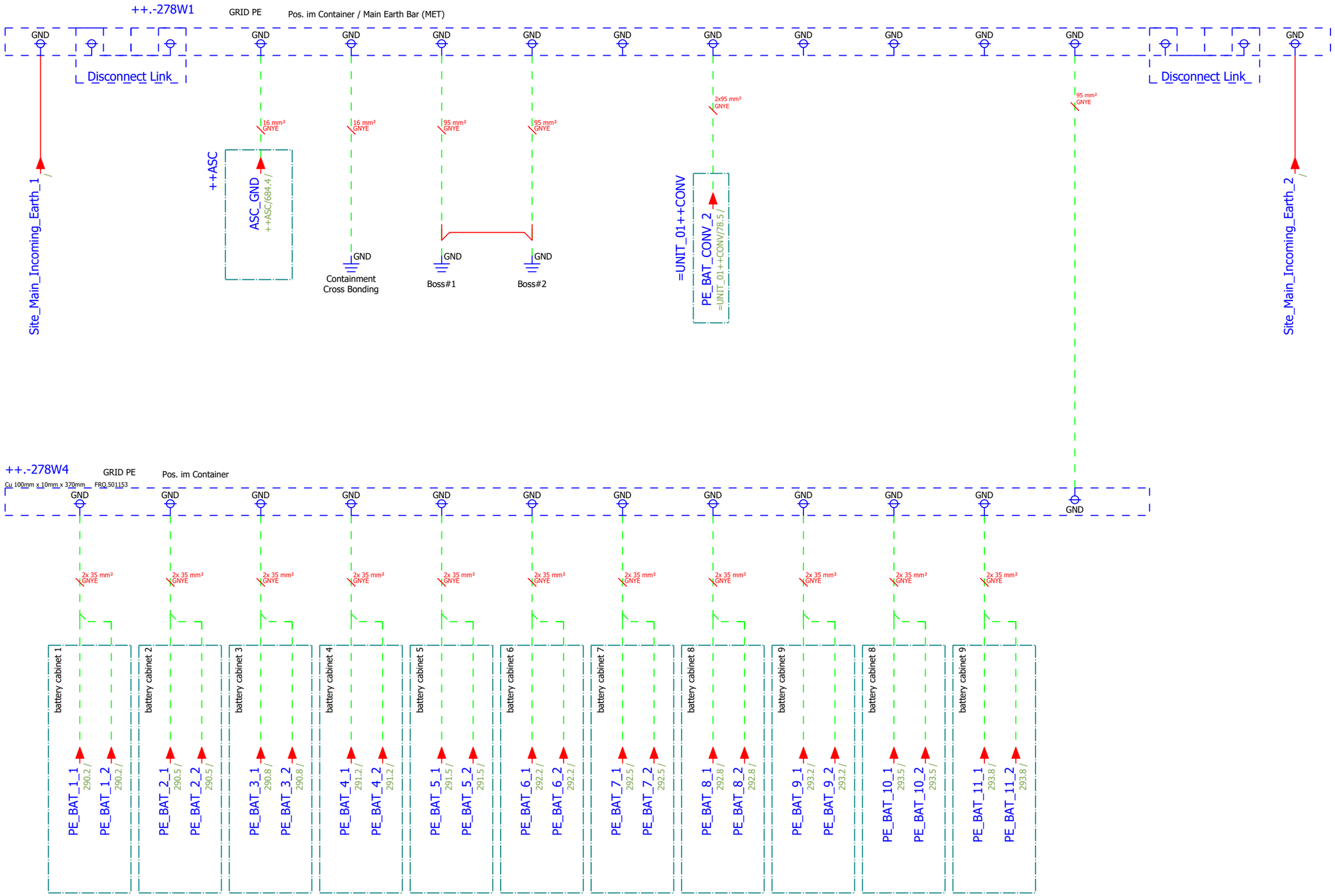


previous page: 193

next page: 290

Editor	Freqcon_DG			Statron	FREQCON	EARTHING CONTAINER	20241105_V1.2	= UNIT_02 Battery Container 1	
Date	08.10.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 278
Date								+	total: 498

Busbars PE



previous page: 193

next page: 290

Editor	Freqcon_JD			Statron	FREQCON	EARTHING CONTAINER	20241105_V1.2	= UNIT_03 Battery Container 2	
Date	18.06.2024							& EFS Circuit diagram	
Proved by				Shell Crosswind BESS FQ 1MW 5MWh Offshore			10354_23A2007	++ Container	page: 278
Date								+	total: 498

STATRON
NON STOP POWER

Harmonic Study Report-05

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E99
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-E99-005
Document description: Harmonic Study Report

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Harmonic Study Report
E99

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E99
Document name	Harmonic Study Report
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-15	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-15	C. Palenzuela
Checked by	2023-03-16	A. Fritz
Approved by	2023-03-16	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 10

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-E99-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Extract from Wind Guard certification test report: Part 1: Power Quality for MSC 1000 (PCS) according to TR3 directive	MG19134.06.01_Freqcon_MSC_TR3_Rev25_Auszug_Teil1

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

Harmonics and interharmonics of proposed converter system FREQCON MSC 1000 620 V were measured during the certification process according to FGW TR3 directive (FGW Technische Richtlinie Teil 3). The values were recorded from 0 to 100% active power output of the PCS.

The extract of the power quality test report is attached to this document (*see section 1.3 "Other Applicable Documents"*).

Oberschwingungsmessungen / *Harmonics*												
Wirkleistungsbin *Active power bin in %*	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max**
Ordnungszahl / *Order*	I_h/I_n (%)											
2	0,03	0,04	0,04	0,05	0,06	0,06	0,07	0,07	0,07	0,08	0,10	0,10
3	0,20	0,14	0,19	0,25	0,28	0,31	0,32	0,34	0,35	0,35	0,37	0,37
4	0,03	0,03	0,03	0,04	0,04	0,04	0,05	0,06	0,07	0,08	0,08	0,08
5	1,39	1,32	1,20	1,23	1,25	1,25	1,21	1,23	1,26	1,21	1,31	1,39
6	0,04	0,03	0,03	0,02	0,03	0,04	0,04	0,05	0,07	0,08	0,14	0,14
7	0,28	0,24	0,19	0,19	0,20	0,21	0,23	0,25	0,29	0,32	0,57	0,57
8	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,04	0,07	0,07
9	0,03	0,04	0,04	0,05	0,05	0,03	0,03	0,04	0,03	0,05	0,09	0,09
10	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,05	0,10	0,10
11	0,10	0,11	0,11	0,20	0,18	0,15	0,16	0,16	0,15	0,22	0,57	0,57
12	0,05	0,05	0,05	0,06	0,07	0,07	0,07	0,07	0,08	0,11	0,19	0,19
13	0,18	0,18	0,19	0,16	0,12	0,12	0,15	0,15	0,16	0,13	0,13	0,19
14	0,02	0,03	0,02	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,05	0,05
15	0,06	0,07	0,09	0,08	0,13	0,12	0,09	0,06	0,06	0,05	0,07	0,13
16	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05
17	0,05	0,05	0,06	0,06	0,07	0,07	0,07	0,08	0,07	0,07	0,09	0,09
18	0,06	0,10	0,08	0,08	0,08	0,08	0,09	0,09	0,08	0,08	0,10	0,10
19	0,05	0,05	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,06	0,09	0,09
20	0,03	0,04	0,04	0,04	0,04	0,05	0,05	0,05	0,04	0,05	0,05	0,05
21	0,03	0,04	0,04	0,04	0,05	0,05	0,05	0,05	0,04	0,04	0,05	0,05
22	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04
23	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,05	0,04	0,05	0,05
24	0,02	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04
25	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,05	0,04	0,05	0,05
26	0,03	0,03	0,04	0,03	0,04	0,04	0,04	0,06	0,04	0,04	0,04	0,06
27	0,03	0,03	0,03	0,04	0,04	0,05	0,04	0,05	0,05	0,05	0,05	0,05
28	0,03	0,03	0,04	0,04	0,04	0,05	0,05	0,06	0,05	0,05	0,04	0,06
29	0,03	0,03	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,05	0,06	0,06
30	0,03	0,04	0,04	0,05	0,05	0,05	0,06	0,07	0,06	0,06	0,05	0,07
31	0,04	0,04	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,06	0,06	0,07
32	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,08	0,06	0,07	0,05	0,08
33	0,04	0,04	0,05	0,05	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08
34	0,05	0,05	0,05	0,06	0,06	0,07	0,08	0,08	0,07	0,08	0,06	0,08
35	0,04	0,04	0,05	0,05	0,07	0,06	0,07	0,07	0,08	0,07	0,09	0,09
36	0,04	0,05	0,05	0,06	0,06	0,06	0,08	0,07	0,08	0,08	0,07	0,08
37	0,05	0,05	0,05	0,05	0,06	0,07	0,07	0,07	0,07	0,08	0,09	0,09
38	0,05	0,05	0,06	0,05	0,06	0,06	0,06	0,07	0,06	0,08	0,08	0,08
39	0,05	0,04	0,05	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,10	0,10
40	0,05	0,04	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,06	0,07	0,07
41	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,07	0,07
42	0,04	0,04	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,05	0,05
43	0,04	0,03	0,03	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,05	0,05
44	0,03	0,02	0,02	0,02	0,02	0,01	0,02	0,02	0,02	0,03	0,02	0,03
45	0,02	0,02	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,03	0,05	0,05
46	0,02	0,01	0,01	0,01	0,01	0,02	0,03	0,03	0,03	0,03	0,03	0,03
47	0,01	0,01	0,01	0,01	0,02	0,02	0,03	0,03	0,03	0,03	0,04	0,04
48	0,01	0,01	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,02	0,03	0,03
49	0,01	0,02	0,02	0,02	0,03	0,03	0,03	0,02	0,03	0,02	0,03	0,03
50	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
THC %	1,46	1,38	1,28	1,32	1,35	1,35	1,75	1,37	1,40	1,34	1,61	1,75

Bezugswert / *Reference value* $I_{n\ FGW\ TR\ 3}$ = 932 A

3 Appendix

1. MG19134.06.01_Freqcon_MSC_TR3_Rev25_Auszug_Teil1

WindGuard Certification GmbH
Akkreditiert nach DIN EN ISO/IEC 17025:2018
Accredited according to DIN EN ISO/IEC 17025:2018
Oldenburger Straße 65, 26316 Varel, Germany

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Angaben / *Data*			
Anlagenhersteller *Manufacturer*	FREQCON GmbH	**Herstellerangaben** *Manufacturer´s specifications*	Herstellerbescheinigung_TR3 Rev25_FREQCON_210608_signed.pdf
Anlagentyp *Installation type*	MSC Wechselrichter	**Anlagenart** *Generic type of installation*	Wechselrichter
		Nennleistung P_n *Rated power P_n*	1000 kW
Prüfbericht *Test report*	MG19134.03.01	**Messzeitraum** *Period of measurement*	26.10.2021 – 01.11.2021

Nenndaten / *Rated data*			
Nennscheinleistung S_n *Rated apparent power S_n*	1000 kVA [1]	**Nennstrom $I_{n\ FGW\ TR\ 3}$** *Rated current $I_{n\ FGW\ TR\ 3}$*	931,2 A [1]
Nennfrequenz f_n *Rated frequency f_n*	50 Hz	**Nennspannung U_n** *Rated voltage U_n*	620 V

[1] Berechnet bei cos ϕ = 1 nach /FGW TR3/ / *Calculated at cos ϕ = 1 according to /FGW TR3/*

Wirkleistungsspitzen / active power peaks [kW]		**Normierte Wirkleistungs-spitzen / Normalised active power peaks [p.u.]**		**Anzahl 10-Minuten-Datensätze / Number of 10-minute data sets**
P0,2	977,6	P0,2	0,978	8
P60	968,5	P60	0,969	
P600	965,6	P600	0,966	

Schalthandlungen / *Switching operations*				
Schaltvorgang *Case of switching operations*	**Einschalten bei $P_{verfügbar}$ <10% P_n** (Einschaltwindgeschwindigkeit) *Start-up at $P_{available}$* <10% P_n (cut-in wind speed)			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{10}	20			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{120}	240			
Netzimpedanzwinkel ψ_k *Grid impedance angle ψ_k*	**30°**	**50°**	**70°**	**85°**
Flickerformfaktor, $k_f(\psi_k)$ *Flicker step factor, $k_f(\psi_k)$*	0,058	0,134	0,206	0,236
Spannungsänderungsfaktor, $k_u(\psi_k)$ *Voltage change factor $k_u(\psi_k)$*	0,024	0,024	0,024	0,024

WindGuard Certification GmbH
Akkreditiert nach DIN EN ISO/IEC 17025:2018
Accredited according to DIN EN ISO/IEC 17025:2018
Oldenburger Straße 65, 26316 Varel, Germany

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. / *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Schalthandlungen / *Switching operations*				
Schaltvorgang *Case of switching operations*	**Einschalten bei $P_{verfügbar} = P_n$** (Nennwindgeschwindigkeit) *Start-up at $P_{available}$* = P_n (rated wind speed)			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{10}	20			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{120}	240			
Netzimpedanzwinkel ψ_k *Grid impedance angle ψ_k*	**30°**	**50°**	**70°**	**85°**
Flickerformfaktor $k_f(\psi k)$ *Flicker step factor, $k_f(\psi k)$*	0,073	0,150	0,225	0,256
Spannungsänderungsfaktor $k_u(\psi k)$ *Voltage change factor $k_u(\psi k)$*	1,508	1,127	0,660	0,446
Schaltvorgang *Case of switching operations*	**Serviceabschaltung bei Nennleistung P_n** / *Service cut-off at rated power P_n*			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{10}	1			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{120}	12			
Netzimpedanzwinkel ψ_k *Grid impedance angle ψ_k*	**30°**	**50°**	**70°**	**85°**
Flickerformfaktor $k_f(\psi k)$ *Flicker step factor, $k_f(\psi k)$*	0,043	0,058	0,069	0,072
Spannungsänderungsfaktor $k_u(\psi k)$ *Voltage change factor $k_u(\psi k)$*	1,514	1,131	0,616	0,180

Unsymmetrie / Unbalance												
P_n (%)	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max**
U_i (%)	---	1,22	0,72	0,62	0,55	0,52	0,52	0,51	0,50	0,51	0,48	1,22

Flicker												
P_{bin} [%]	0	10	20	30	40	50	60	70	80	90	100	Max
Netzimpedanzwinkel Ψ_k / Network Impedance phase angle Ψ_k	**Flickerbeiwert / Flicker coefficient, c (Ψ_k, P_{bin})**											
30°	0,51	0,50	0,58	0,63	0,66	0,73	0,89	0,92	1,02	0,99	0,92	1,02
50°	0,49	0,48	0,58	0,63	0,67	0,74	0,89	0,92	1,00	0,95	0,90	1,00
70°	0,42	0,42	0,52	0,57	0,61	0,66	0,80	0,83	0,88	0,84	0,81	0,88
85°	0,33	0,34	0,43	0,48	0,52	0,57	0,68	0,72	0,75	0,72	0,73	0,75

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Oberschwingungsmessungen / *Harmonics*

Wirkleistungsbin *Active power bin in %*	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max**
Ordnungszahl / *Order*	I_h/I_n (%)											
2	0,03	0,04	0,04	0,05	0,06	0,06	0,07	0,07	0,07	0,08	0,10	0,10
3	0,20	0,14	0,19	0,25	0,28	0,31	0,32	0,34	0,35	0,35	0,37	0,37
4	0,03	0,03	0,03	0,04	0,04	0,04	0,05	0,06	0,07	0,08	0,08	0,08
5	1,39	1,32	1,20	1,23	1,25	1,25	1,21	1,23	1,26	1,21	1,31	1,39
6	0,04	0,03	0,03	0,02	0,03	0,04	0,04	0,05	0,07	0,08	0,14	0,14
7	0,28	0,24	0,19	0,19	0,20	0,21	0,23	0,25	0,29	0,32	0,57	0,57
8	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,04	0,07	0,07
9	0,03	0,04	0,04	0,05	0,05	0,03	0,03	0,04	0,03	0,05	0,09	0,09
10	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,05	0,10	0,10
11	0,10	0,11	0,11	0,20	0,18	0,15	0,16	0,16	0,15	0,22	0,57	0,57
12	0,05	0,05	0,05	0,06	0,07	0,07	0,07	0,07	0,08	0,11	0,19	0,19
13	0,18	0,18	0,19	0,16	0,12	0,12	0,15	0,15	0,16	0,13	0,13	0,19
14	0,02	0,03	0,02	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,05	0,05
15	0,06	0,07	0,09	0,08	0,13	0,12	0,09	0,06	0,06	0,05	0,07	0,13
16	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05
17	0,05	0,05	0,06	0,06	0,07	0,07	0,07	0,08	0,07	0,07	0,09	0,09
18	0,06	0,10	0,08	0,08	0,08	0,08	0,09	0,09	0,08	0,08	0,10	0,10
19	0,05	0,05	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,06	0,09	0,09
20	0,03	0,04	0,04	0,04	0,04	0,05	0,05	0,05	0,04	0,05	0,05	0,05
21	0,03	0,04	0,04	0,04	0,05	0,05	0,05	0,05	0,04	0,04	0,05	0,05
22	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04
23	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,05	0,04	0,05	0,05
24	0,02	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04
25	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,05	0,04	0,05	0,05
26	0,03	0,03	0,04	0,03	0,04	0,04	0,04	0,06	0,04	0,04	0,04	0,06
27	0,03	0,03	0,03	0,04	0,04	0,05	0,04	0,05	0,05	0,05	0,05	0,05
28	0,03	0,03	0,04	0,04	0,04	0,05	0,05	0,06	0,05	0,05	0,04	0,06
29	0,03	0,03	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,05	0,06	0,06
30	0,03	0,04	0,04	0,05	0,05	0,05	0,06	0,07	0,06	0,06	0,05	0,07
31	0,04	0,04	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,06	0,06	0,07
32	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,08	0,06	0,07	0,05	0,08
33	0,04	0,04	0,05	0,05	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08
34	0,05	0,05	0,05	0,06	0,06	0,07	0,08	0,08	0,07	0,08	0,06	0,08
35	0,04	0,04	0,05	0,05	0,07	0,06	0,07	0,07	0,08	0,07	0,09	0,09
36	0,04	0,05	0,05	0,06	0,06	0,06	0,08	0,07	0,08	0,08	0,07	0,08
37	0,05	0,05	0,05	0,05	0,06	0,07	0,07	0,07	0,07	0,08	0,09	0,09
38	0,05	0,05	0,06	0,05	0,06	0,06	0,06	0,07	0,06	0,08	0,08	0,08
39	0,05	0,04	0,05	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,10	0,10
40	0,05	0,04	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,06	0,07	0,07
41	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,07	0,07
42	0,04	0,04	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,05	0,05
43	0,04	0,03	0,03	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,05	0,05
44	0,03	0,02	0,02	0,02	0,02	0,01	0,02	0,02	0,02	0,03	0,02	0,03
45	0,02	0,02	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,03	0,05	0,05
46	0,02	0,01	0,01	0,01	0,01	0,02	0,03	0,03	0,03	0,03	0,03	0,03
47	0,01	0,01	0,01	0,01	0,02	0,02	0,03	0,03	0,03	0,03	0,04	0,04
48	0,01	0,01	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,02	0,03	0,03
49	0,01	0,02	0,02	0,02	0,03	0,03	0,03	0,02	0,03	0,02	0,03	0,03
50	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
THC %	1,46	1,38	1,28	1,32	1,35	1,35	1,75	1,37	1,40	1,34	1,61	1,75

Bezugswert / *Reference value* $I_{n\ FGW\ TR\ 3}$ **= 932 A**

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Zwischenharmonische / *Interharmonics*

Wirkleistungsbin *Active power bin in %*	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max**
f in Hz	**I_h/I_n (%)**											
75	0,02	0,02	0,03	0,03	0,03	0,05	0,06	0,06	0,07	0,08	0,08	0,08
125	0,01	0,01	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,04	0,05	0,05
175	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,04
225	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,09	0,09
275	0,02	0,02	0,02	0,03	0,03	0,04	0,04	0,04	0,05	0,08	0,16	0,16
325	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,09	0,09
375	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,10	0,10
425	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,09	0,09
475	0,02	0,02	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,06	0,11	0,11
525	0,04	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,06	0,08	0,16	0,16
575	0,07	0,06	0,07	0,08	0,09	0,10	0,10	0,10	0,11	0,14	0,26	0,26
625	0,05	0,05	0,05	0,06	0,07	0,07	0,08	0,08	0,08	0,10	0,18	0,18
675	0,03	0,03	0,03	0,04	0,04	0,04	0,05	0,05	0,05	0,06	0,09	0,09
725	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,05	0,07	0,07
775	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,05	0,05	0,06	0,07	0,07
825	0,06	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08	0,08	0,09	0,09
875	0,09	0,10	0,10	0,11	0,11	0,11	0,13	0,13	0,13	0,13	0,16	0,16
925	0,08	0,09	0,09	0,10	0,10	0,10	0,12	0,12	0,13	0,11	0,13	0,13
975	0,05	0,06	0,07	0,07	0,07	0,08	0,09	0,09	0,08	0,09	0,11	0,11
1025	0,04	0,05	0,06	0,06	0,06	0,06	0,06	0,08	0,07	0,06	0,07	0,08
1075	0,04	0,04	0,05	0,06	0,05	0,06	0,07	0,07	0,06	0,07	0,09	0,09
1125	0,04	0,04	0,05	0,05	0,06	0,06	0,06	0,07	0,07	0,06	0,06	0,07
1175	0,03	0,04	0,05	0,06	0,06	0,06	0,07	0,06	0,07	0,07	0,08	0,08
1225	0,04	0,05	0,05	0,06	0,06	0,06	0,07	0,07	0,08	0,06	0,06	0,08
1275	0,04	0,04	0,06	0,06	0,06	0,07	0,08	0,08	0,07	0,07	0,08	0,08
1325	0,04	0,05	0,06	0,07	0,06	0,07	0,07	0,09	0,08	0,07	0,06	0,09
1375	0,04	0,05	0,06	0,07	0,07	0,08	0,09	0,09	0,08	0,09	0,10	0,10
1425	0,05	0,05	0,07	0,08	0,08	0,08	0,08	0,09	0,09	0,08	0,07	0,09
1475	0,04	0,06	0,07	0,08	0,08	0,08	0,11	0,10	0,11	0,10	0,10	0,11
1525	0,05	0,07	0,07	0,09	0,09	0,08	0,10	0,10	0,11	0,09	0,08	0,11
1575	0,05	0,07	0,08	0,08	0,09	0,10	0,11	0,12	0,11	0,12	0,11	0,12
1625	0,06	0,07	0,09	0,10	0,09	0,10	0,10	0,13	0,11	0,12	0,10	0,13
1675	0,06	0,07	0,09	0,10	0,09	0,11	0,13	0,12	0,12	0,15	0,13	0,15
1725	0,07	0,08	0,09	0,10	0,11	0,11	0,11	0,12	0,12	0,14	0,11	0,14
1775	0,06	0,08	0,09	0,10	0,10	0,10	0,13	0,12	0,14	0,13	0,13	0,14
1825	0,07	0,08	0,09	0,10	0,11	0,10	0,11	0,12	0,12	0,12	0,12	0,12
1875	0,07	0,08	0,10	0,10	0,10	0,11	0,12	0,12	0,12	0,13	0,14	0,14
1925	0,07	0,08	0,09	0,09	0,10	0,10	0,09	0,11	0,10	0,13	0,14	0,14
1975	0,06	0,08	0,09	0,09	0,08	0,09	0,10	0,10	0,10	0,12	0,13	0,13

Bezugswert / *Reference value* $I_{n\,FGW\,TR\,3}$ **= 932 A**

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Höhere Frequenzen/ *Higher frequencies components*

Wirkleistungsbin *Active power bin in %*	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max**
f in Hz	**I_h/I_n (%)**											
2100	0,14	0,15	0,15	0,15	0,15	0,14	0,14	0,14	0,16	0,18	0,24	0,24
2300	0,07	0,07	0,06	0,07	0,07	0,08	0,10	0,11	0,12	0,13	0,15	0,15
2500	0,06	0,07	0,09	0,09	0,10	0,10	0,09	0,09	0,09	0,09	0,10	0,10
2700	0,06	0,05	0,05	0,05	0,05	0,06	0,07	0,07	0,09	0,08	0,08	0,09
2900	0,04	0,05	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,07	0,07	0,07
3100	0,04	0,04	0,04	0,05	0,05	0,06	0,06	0,06	0,06	0,06	0,06	0,06
3300	0,03	0,04	0,05	0,05	0,04	0,05	0,05	0,05	0,05	0,05	0,05	0,05
3500	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,05	0,05
3700	0,03	0,03	0,04	0,04	0,04	0,03	0,04	0,04	0,04	0,05	0,05	0,05
3900	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04
4100	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,04	0,04	0,04
4300	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,03
4500	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,02	0,03	0,03
4700	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
4900	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
5100	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
5300	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
5500	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,03
5700	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03
5900	0,01	0,01	0,02	0,01	0,02	0,02	0,02	0,03	0,03	0,02	0,02	0,03
6100	0,01	0,02	0,01	0,02	0,02	0,02	0,02	0,03	0,02	0,01	0,01	0,03
6300	0,01	0,01	0,02	0,02	0,02	0,03	0,02	0,02	0,01	0,01	0,01	0,03
6500	0,02	0,02	0,01	0,02	0,03	0,02	0,02	0,01	0,01	0,01	0,01	0,03
6700	0,02	0,02	0,02	0,03	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,03
6900	0,02	0,03	0,03	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,03
7100	0,03	0,03	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,03
7300	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,02
7500	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
7700	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
7900	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8100	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8300	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8500	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8700	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8900	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01

Bezugswert / *Reference value* **$I_{n\ FGW\ TR\ 3}$ = 932 A**

WindGuard Certification GmbH
Akkreditiert nach DIN EN ISO/IEC 17025:2018
Accredited according to DIN EN ISO/IEC 17025:2018
Oldenburger Straße 65, 26316 Varel, Germany

WINDGUARD Certification

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. / *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter"
„Determination of the electrical properties of the FREQCON MSC Inverter"

„Technische Richtlinie Teil 3" Rev. /Version 25, FGW e.V.

Dieser Auszug aus dem Prüfbericht fasst die Ergebnisse des Prüfberichtes Nr. MG19134.03.01 zusammen.
This extract from the test report summarizes the results of the test report no. MG19134.03.01.
Gemessen durch / *measured by*: Damian Slowinski
Bearbeiter/*Editor*: Damian Slowinski, Florian Freytag

DAkkS Deutsche Akkreditierungsstelle D-PL-17195-01-00

Elektrische Eigenschaften TR 3 FGW 2021 Konformitätssiegel

WINDGUARD Certification
Oldenburger Straße 65 · 26316 Varel
Tel. +49 (0)4451 - 9515 - 213
Fax +49-(0)4451-9515-218
Email: info@windguard-certification.de

Varel, 24.11.2021

Florian Freytag
Bearbeiter/*Editor*

Damian Slowinski
Prüfer/*Approver*

*Die **WindGuard Certification GmbH** ist ein von der **Deutschen Akkreditierungsstelle (DAkkS)** nach DIN EN ISO/IEC 17025:2018 akkreditiertes Prüflaboratorium (DAkkS-Verfahrensnummer: D-PL-17195) in den Bereichen Messungen der elektrischen Eigenschaften von dezentralen Energieerzeugungseinheiten (EZE) und Energieerzeugungsanlagen (EZA).*
*Die **WindGuard Certification GmbH** führt das Konformitätssiegel der **Fördergesellschaft Windenergie und andere Dezentrale Energien e.V. (FGW)** für die Vermessung der Elektrischen Eigenschaften.*
Bearbeiter und **Prüfer** sind entsprechend der hausinternen Verfahren geschult und zugelassen.

***WindGuard Certification GmbH** is accredited by **Deutsche Akkreditierungsstelle (DAkkS)** as a testing laboratory, according to DIN EN ISO/IEC 17025:2018 (DAkkS registry-no: D-PL-17195), in the field of Measurements of electrical properties of decentralized power generating units (EZE) and power generating plants (EZA).*
***WindGuard Certification GmbH** is holder of the conformity seal of the **Fördergesellschaft Windenergie und andere Dezentrale Energien e.V. (FGW)** for the measurement of electrical characteristics of power generating units and systems.*
*The **Editor** and **Approver** are trained and certified according to the internal audit procedures.*

Dieser Auszug aus dem Prüfbericht enthält 6 Seiten. Der Vordruck ist urheberechtlich geschützt. Nachdruck und Vervielfältigung nur mit Zustimmung der Herausgeber.
This extract from the test report comprises 6 pages total. Copyright by the publisher. No part of this form may be reproduced in any form or by any means without permission of the publisher.

WindGuard Certification GmbH
Akkreditiert nach DIN EN ISO/IEC 17025:2018
Accredited according to DIN EN ISO/IEC 17025:2018
Oldenburger Straße 65, 26316 Varel, Germany

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Angaben / *Data*			
Anlagenhersteller *Manufacturer*	FREQCON GmbH	**Herstellerangaben** *Manufacturer´s specifications*	Herstellerbescheinigung_TR3 Rev25_FREQCON_210608_signed.pdf
Anlagentyp *Installation type*	MSC Wechselrichter	**Anlagenart** *Generic type of installation*	Wechselrichter
		Nennleistung P_n *Rated power P_n*	1000 kW
Prüfbericht *Test report*	MG19134.03.01	**Messzeitraum** *Period of measurement*	26.10.2021 – 01.11.2021

Nenndaten / *Rated data*			
Nennscheinleistung S_n *Rated apparent power S_n*	1000 kVA [1]	**Nennstrom $I_{n\ FGW\ TR\ 3}$** *Rated current $I_{n\ FGW\ TR\ 3}$*	931,2 A [1]
Nennfrequenz f_n *Rated frequency f_n*	50 Hz	**Nennspannung U_n** *Rated voltage U_n*	620 V

[1] Berechnet bei cos ϕ = 1 nach /FGW TR3/ / *Calculated at cos ϕ = 1 according to /FGW TR3/*

Wirkleistungsspitzen / active power peaks [kW]		**Normierte Wirkleistungs-spitzen / Normalised active power peaks [p.u.]**		**Anzahl 10-Minuten-Datensätze / Number of 10-minute data sets**
P0,2	977,6	P0,2	0,978	8
P60	968,5	P60	0,969	
P600	965,6	P600	0,966	

Schalthandlungen / *Switching operations*				
Schaltvorgang *Case of switching operations*	**Einschalten bei $P_{verfügbar}$ <10% P_n** (Einschaltwindgeschwindigkeit) *Start-up at $P_{available}$* <10% P_n (cut-in wind speed)			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{10}	20			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{120}	240			
Netzimpedanzwinkel ψ_k *Grid impedance angle ψ_k*	**30°**	**50°**	**70°**	**85°**
Flickerformfaktor, $k_f(\psi_k)$ *Flicker step factor, $k_f(\psi_k)$*	0,058	0,134	0,206	0,236
Spannungsänderungsfaktor, $k_u(\psi_k)$ *Voltage change factor $k_u(\psi_k)$*	0,024	0,024	0,024	0,024

WindGuard Certification GmbH
Akkreditiert nach DIN EN ISO/IEC 17025:2018
Accredited according to DIN EN ISO/IEC 17025:2018
Oldenburger Straße 65, 26316 Varel, Germany

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. / *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Schalthandlungen / *Switching operations*				
Schaltvorgang *Case of switching operations*	**Einschalten bei $P_{verfügbar} = P_n$** (Nennwindgeschwindigkeit) *Start-up at $P_{available}$* = P_n (rated wind speed)			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{10}	20			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{120}	240			
Netzimpedanzwinkel ψ_k *Grid impedance angle ψ_k*	**30°**	**50°**	**70°**	**85°**
Flickerformfaktor $k_f(\psi k)$ *Flicker step factor, $k_f(\psi k)$*	0,073	0,150	0,225	0,256
Spannungsänderungsfaktor $k_u(\psi k)$ *Voltage change factor $k_u(\psi k)$*	1,508	1,127	0,660	0,446
Schaltvorgang *Case of switching operations*	**Serviceabschaltung bei Nennleistung P_n** / *Service cut-off at rated power P_n*			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{10}	1			
Max. Anz. Schalthandlungen Max. no. of switching operations N_{120}	12			
Netzimpedanzwinkel ψ_k *Grid impedance angle ψ_k*	**30°**	**50°**	**70°**	**85°**
Flickerformfaktor $k_f(\psi k)$ *Flicker step factor, $k_f(\psi k)$*	0,043	0,058	0,069	0,072
Spannungsänderungsfaktor $k_u(\psi k)$ *Voltage change factor $k_u(\psi k)$*	1,514	1,131	0,616	0,180

Unsymmetrie / Unbalance												
P_n (%)	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max**
U_i (%)	---	1,22	0,72	0,62	0,55	0,52	0,52	0,51	0,50	0,51	0,48	1,22

Flicker												
P_{bin} [%]	0	10	20	30	40	50	60	70	80	90	100	Max
Netzimpedanzwinkel Ψ_k / Network Impedance phase angle Ψ_k	**Flickerbeiwert / Flicker coefficient, c (Ψ_k, P_{bin})**											
30°	0,51	0,50	0,58	0,63	0,66	0,73	0,89	0,92	1,02	0,99	0,92	1,02
50°	0,49	0,48	0,58	0,63	0,67	0,74	0,89	0,92	1,00	0,95	0,90	1,00
70°	0,42	0,42	0,52	0,57	0,61	0,66	0,80	0,83	0,88	0,84	0,81	0,88
85°	0,33	0,34	0,43	0,48	0,52	0,57	0,68	0,72	0,75	0,72	0,73	0,75

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Oberschwingungsmessungen / *Harmonics*

Wirkleistungsbin *Active power bin in %*	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max**
Ordnungszahl / *Order*	I_h/I_n (%)											
2	0,03	0,04	0,04	0,05	0,06	0,06	0,07	0,07	0,07	0,08	0,10	0,10
3	0,20	0,14	0,19	0,25	0,28	0,31	0,32	0,34	0,35	0,35	0,37	0,37
4	0,03	0,03	0,03	0,04	0,04	0,04	0,05	0,06	0,07	0,08	0,08	0,08
5	1,39	1,32	1,20	1,23	1,25	1,25	1,21	1,23	1,26	1,21	1,31	1,39
6	0,04	0,03	0,03	0,02	0,03	0,04	0,04	0,05	0,07	0,08	0,14	0,14
7	0,28	0,24	0,19	0,19	0,20	0,21	0,23	0,25	0,29	0,32	0,57	0,57
8	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,04	0,07	0,07
9	0,03	0,04	0,04	0,05	0,05	0,03	0,03	0,04	0,03	0,05	0,09	0,09
10	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,05	0,10	0,10
11	0,10	0,11	0,11	0,20	0,18	0,15	0,16	0,16	0,15	0,22	0,57	0,57
12	0,05	0,05	0,05	0,06	0,07	0,07	0,07	0,07	0,08	0,11	0,19	0,19
13	0,18	0,18	0,19	0,16	0,12	0,12	0,15	0,15	0,16	0,13	0,13	0,19
14	0,02	0,03	0,02	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,05	0,05
15	0,06	0,07	0,09	0,08	0,13	0,12	0,09	0,06	0,06	0,05	0,07	0,13
16	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05
17	0,05	0,05	0,06	0,06	0,07	0,07	0,07	0,08	0,07	0,07	0,09	0,09
18	0,06	0,10	0,08	0,08	0,08	0,08	0,09	0,09	0,08	0,08	0,10	0,10
19	0,05	0,05	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,06	0,09	0,09
20	0,03	0,04	0,04	0,04	0,04	0,05	0,05	0,05	0,04	0,05	0,05	0,05
21	0,03	0,04	0,04	0,04	0,05	0,05	0,05	0,05	0,04	0,04	0,05	0,05
22	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04
23	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,05	0,04	0,05	0,05
24	0,02	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04
25	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,05	0,04	0,05	0,05
26	0,03	0,03	0,04	0,03	0,04	0,04	0,04	0,06	0,04	0,04	0,04	0,06
27	0,03	0,03	0,03	0,04	0,04	0,05	0,04	0,05	0,05	0,05	0,05	0,05
28	0,03	0,03	0,04	0,04	0,04	0,05	0,05	0,06	0,05	0,05	0,04	0,06
29	0,03	0,03	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,05	0,06	0,06
30	0,03	0,04	0,04	0,05	0,05	0,05	0,06	0,07	0,06	0,06	0,05	0,07
31	0,04	0,04	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,06	0,06	0,07
32	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,08	0,06	0,07	0,05	0,08
33	0,04	0,04	0,05	0,05	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08
34	0,05	0,05	0,05	0,06	0,06	0,07	0,08	0,08	0,07	0,08	0,06	0,08
35	0,04	0,04	0,05	0,05	0,07	0,06	0,07	0,07	0,08	0,07	0,09	0,09
36	0,04	0,05	0,05	0,06	0,06	0,06	0,08	0,07	0,08	0,08	0,07	0,08
37	0,05	0,05	0,05	0,05	0,06	0,07	0,07	0,07	0,07	0,08	0,09	0,09
38	0,05	0,05	0,06	0,05	0,06	0,06	0,06	0,07	0,06	0,08	0,08	0,08
39	0,05	0,04	0,05	0,05	0,05	0,06	0,06	0,06	0,06	0,07	0,10	0,10
40	0,05	0,04	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,06	0,07	0,07
41	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,07	0,07
42	0,04	0,04	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,05	0,05
43	0,04	0,03	0,03	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,05	0,05
44	0,03	0,02	0,02	0,02	0,02	0,01	0,02	0,02	0,02	0,03	0,02	0,03
45	0,02	0,02	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,03	0,05	0,05
46	0,02	0,01	0,01	0,01	0,01	0,02	0,03	0,03	0,03	0,03	0,03	0,03
47	0,01	0,01	0,01	0,01	0,02	0,02	0,03	0,03	0,03	0,03	0,04	0,04
48	0,01	0,01	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,02	0,03	0,03
49	0,01	0,02	0,02	0,02	0,03	0,03	0,03	0,02	0,03	0,02	0,03	0,03
50	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
THC %	1,46	1,38	1,28	1,32	1,35	1,35	1,75	1,37	1,40	1,34	1,61	1,75

Bezugswert / *Reference value* $I_{n\ FGW\ TR\ 3}$ **= 932 A**

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Zwischenharmonische / *Interharmonics*

Wirkleistungsbin *Active power bin in %*	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max**
f in Hz	**I_h/I_n (%)**											
75	0,02	0,02	0,03	0,03	0,03	0,05	0,06	0,06	0,07	0,08	0,08	0,08
125	0,01	0,01	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,04	0,05	0,05
175	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,04
225	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,09	0,09
275	0,02	0,02	0,02	0,03	0,03	0,04	0,04	0,04	0,05	0,08	0,16	0,16
325	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,09	0,09
375	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,10	0,10
425	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,09	0,09
475	0,02	0,02	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,06	0,11	0,11
525	0,04	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,06	0,08	0,16	0,16
575	0,07	0,06	0,07	0,08	0,09	0,10	0,10	0,10	0,11	0,14	0,26	0,26
625	0,05	0,05	0,05	0,06	0,07	0,07	0,08	0,08	0,08	0,10	0,18	0,18
675	0,03	0,03	0,03	0,04	0,04	0,04	0,05	0,05	0,05	0,06	0,09	0,09
725	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04	0,04	0,05	0,07	0,07
775	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,05	0,05	0,06	0,07	0,07
825	0,06	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08	0,08	0,09	0,09
875	0,09	0,10	0,10	0,11	0,11	0,11	0,13	0,13	0,13	0,13	0,16	0,16
925	0,08	0,09	0,09	0,10	0,10	0,10	0,12	0,12	0,13	0,11	0,13	0,13
975	0,05	0,06	0,07	0,07	0,07	0,08	0,09	0,09	0,08	0,09	0,11	0,11
1025	0,04	0,05	0,06	0,06	0,06	0,06	0,06	0,08	0,07	0,06	0,07	0,08
1075	0,04	0,04	0,05	0,06	0,05	0,06	0,07	0,07	0,06	0,07	0,09	0,09
1125	0,04	0,04	0,05	0,05	0,06	0,06	0,06	0,07	0,07	0,06	0,06	0,07
1175	0,03	0,04	0,05	0,06	0,06	0,06	0,07	0,06	0,07	0,07	0,08	0,08
1225	0,04	0,05	0,05	0,06	0,06	0,06	0,07	0,07	0,08	0,06	0,06	0,08
1275	0,04	0,04	0,06	0,06	0,06	0,07	0,08	0,08	0,07	0,07	0,08	0,08
1325	0,04	0,05	0,06	0,07	0,06	0,07	0,07	0,09	0,08	0,07	0,06	0,09
1375	0,04	0,05	0,06	0,07	0,07	0,08	0,09	0,09	0,08	0,09	0,10	0,10
1425	0,05	0,05	0,07	0,08	0,08	0,08	0,08	0,09	0,09	0,08	0,07	0,09
1475	0,04	0,06	0,07	0,08	0,08	0,08	0,11	0,10	0,11	0,10	0,10	0,11
1525	0,05	0,07	0,07	0,09	0,09	0,08	0,10	0,10	0,11	0,09	0,08	0,11
1575	0,05	0,07	0,08	0,08	0,09	0,10	0,11	0,12	0,11	0,12	0,11	0,12
1625	0,06	0,07	0,09	0,10	0,09	0,10	0,10	0,13	0,11	0,12	0,10	0,13
1675	0,06	0,07	0,09	0,10	0,09	0,11	0,13	0,12	0,12	0,15	0,13	0,15
1725	0,07	0,08	0,09	0,10	0,11	0,11	0,11	0,12	0,12	0,14	0,11	0,14
1775	0,06	0,08	0,09	0,10	0,10	0,10	0,13	0,12	0,14	0,13	0,13	0,14
1825	0,07	0,08	0,09	0,10	0,11	0,10	0,11	0,12	0,12	0,12	0,12	0,12
1875	0,07	0,08	0,10	0,10	0,10	0,11	0,12	0,12	0,12	0,13	0,14	0,14
1925	0,07	0,08	0,09	0,09	0,10	0,10	0,09	0,11	0,10	0,13	0,14	0,14
1975	0,06	0,08	0,09	0,09	0,08	0,09	0,10	0,10	0,10	0,12	0,13	0,13

Bezugswert / *Reference value* $I_{n\,FGW\,TR\,3}$ **= 932 A**

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter“
„Determination of the electrical properties of the FREQCON MSC Inverter“

„Technische Richtlinie Teil 3“ Rev. /Version 25, FGW e.V.

Höhere Frequenzen/ *Higher frequencies components*

Wirkleistungsbin *Active power bin in %*	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**Max**
f in Hz	**I_h/I_n (%)**											
2100	0,14	0,15	0,15	0,15	0,15	0,14	0,14	0,14	0,16	0,18	0,24	0,24
2300	0,07	0,07	0,06	0,07	0,07	0,08	0,10	0,11	0,12	0,13	0,15	0,15
2500	0,06	0,07	0,09	0,09	0,10	0,10	0,09	0,09	0,09	0,09	0,10	0,10
2700	0,06	0,05	0,05	0,05	0,05	0,06	0,07	0,07	0,09	0,08	0,08	0,09
2900	0,04	0,05	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,07	0,07	0,07
3100	0,04	0,04	0,04	0,05	0,05	0,06	0,06	0,06	0,06	0,06	0,06	0,06
3300	0,03	0,04	0,05	0,05	0,04	0,05	0,05	0,05	0,05	0,05	0,05	0,05
3500	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,05	0,05
3700	0,03	0,03	0,04	0,04	0,04	0,03	0,04	0,04	0,04	0,05	0,05	0,05
3900	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04
4100	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,04	0,04	0,04
4300	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,03
4500	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,02	0,03	0,03
4700	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
4900	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
5100	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
5300	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
5500	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,03
5700	0,01	0,01	0,01	0,01	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03
5900	0,01	0,01	0,02	0,01	0,02	0,02	0,02	0,03	0,03	0,02	0,02	0,03
6100	0,01	0,02	0,01	0,02	0,02	0,02	0,02	0,03	0,02	0,01	0,01	0,03
6300	0,01	0,01	0,02	0,02	0,02	0,03	0,02	0,02	0,01	0,01	0,01	0,03
6500	0,02	0,02	0,01	0,02	0,03	0,02	0,02	0,01	0,01	0,01	0,01	0,03
6700	0,02	0,02	0,02	0,03	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,03
6900	0,02	0,03	0,03	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,03
7100	0,03	0,03	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,03
7300	0,02	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,02
7500	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
7700	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
7900	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8100	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8300	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8500	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8700	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
8900	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01

Bezugswert / *Reference value* **$I_{n\ FGW\ TR\ 3}$ = 932 A**

WindGuard Certification GmbH
Akkreditiert nach DIN EN ISO/IEC 17025:2018
Accredited according to DIN EN ISO/IEC 17025:2018
Oldenburger Straße 65, 26316 Varel, Germany

WINDGUARD Certification

Auszug aus dem Prüfbericht

Teil 1: Netzverträglichkeit

Extract from the test report: Part 1: Power Quality

Auszug Nr. / *Extract No:* **MG19134.06.01**

„Bestimmung der elektrischen Eigenschaften des FREQCON MSC Wechselrichter"
„Determination of the electrical properties of the FREQCON MSC Inverter"

„Technische Richtlinie Teil 3" Rev. /Version 25, FGW e.V.

Dieser Auszug aus dem Prüfbericht fasst die Ergebnisse des Prüfberichtes Nr. MG19134.03.01 zusammen.
This extract from the test report summarizes the results of the test report no. MG19134.03.01.
Gemessen durch / *measured by*: Damian Slowinski
Bearbeiter/*Editor*: Damian Slowinski, Florian Freytag

DAkkS Deutsche Akkreditierungsstelle D-PL-17195-01-00

Elektrische Eigenschaften TR 3 FGW 2021 Konformitätssiegel

WINDGUARD Certification
Oldenburger Straße 65 · 26316 Varel
Tel. +49 (0)4451 - 9515 - 213
Fax +49-(0)4451-9515-218
Email: info@windguard-certification.de

Varel, 24.11.2021

Florian Freytag
Bearbeiter/*Editor*

Damian Slowinski
Prüfer/*Approver*

*Die **WindGuard Certification GmbH** ist ein von der **Deutschen Akkreditierungsstelle (DAkkS)** nach DIN EN ISO/IEC 17025:2018 akkreditiertes Prüflaboratorium (DAkkS-Verfahrensnummer: D-PL-17195) in den Bereichen Messungen der elektrischen Eigenschaften von dezentralen Energieerzeugungseinheiten (EZE) und Energieerzeugungsanlagen (EZA).*
*Die **WindGuard Certification GmbH** führt das Konformitätssiegel der **Fördergesellschaft Windenergie und andere Dezentrale Energien e.V. (FGW)** für die Vermessung der Elektrischen Eigenschaften.*
Bearbeiter und **Prüfer** sind entsprechend der hausinternen Verfahren geschult und zugelassen.

***WindGuard Certification GmbH** is accredited by **Deutsche Akkreditierungsstelle (DAkkS)** as a testing laboratory, according to DIN EN ISO/IEC 17025:2018 (DAkkS registry-no: D-PL-17195), in the field of Measurements of electrical properties of decentralized power generating units (EZE) and power generating plants (EZA).*
***WindGuard Certification GmbH** is holder of the conformity seal of the **Fördergesellschaft Windenergie und andere Dezentrale Energien e.V. (FGW)** for the measurement of electrical characteristics of power generating units and systems.*
*The **Editor** and **Approver** are trained and certified according to the internal audit procedures.*

Dieser Auszug aus dem Prüfbericht enthält 6 Seiten. Der Vordruck ist urheberechtlich geschützt. Nachdruck und Vervielfältigung nur mit Zustimmung der Herausgeber.
This extract from the test report comprises 6 pages total. Copyright by the publisher. No part of this form may be reproduced in any form or by any means without permission of the publisher.

STATRON
NON STOP POWER

Overall Electrical Model-06

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: E99-06
Sequence Number: 006
Rev: 001
Document number: K559-2254-CWIWP4202201-E99-006
Document description: Overall Electrical Model

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Overall Electrical Model
E99-06

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	E99-06
Document name	Overall Electrical Model
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-15	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-15	C. Palenzuela
Checked by	2023-03-16	A. Fritz
Approved by	2023-03-16	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-E99-006

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Electric Model of MSC converter family as PowerFactory model	Freqcon_VDE_4110_4120_4130_rel_enc_v4
Documentation for MSC converter model in PowerFactory	Documentation_Freqcon_Inverter_Model_VDE_v4
MSC converter parameter lists	Parameters_Freqcon_MSC_Family

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The overall electric model of the proposed converter system as PowerFactory model, as well as the accompanying documentation and parameter lists are attached to this document (*see section 1.3 "Other Applicable Documents"*).

3 Appendix

1. Freqcon_VDE_4110_4120_4130_rel_enc_v4.pfd
2. Documentation_Freqcon_Inverter_Model_VDE_v4
3. Parameters_Freqcon_MSC_Family

Detail Drawings (all equipment items)

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: F01
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-F01-001
Document description: Detail Drawings

Revision	Date	Name	Description
001	31.03.2023	CPA / ADI	First Version

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Detail Drawings
F01

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	F01
Document name	Detail Drawings
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-30	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-30	C. Palenzuela
Checked by	2023-03-31	A. Fritz
Approved by	2023-03-31	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-F01-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Archive with PCS and BESS detail drawings	Detail_drawings.zip

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

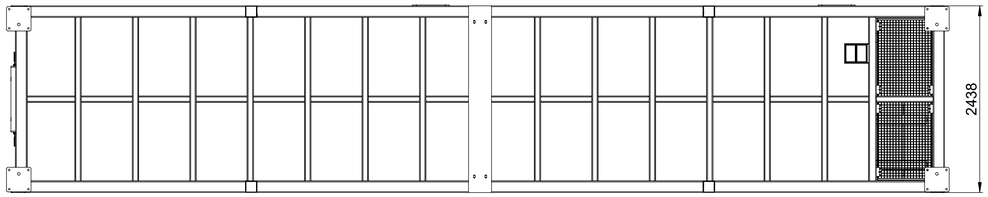
2 General

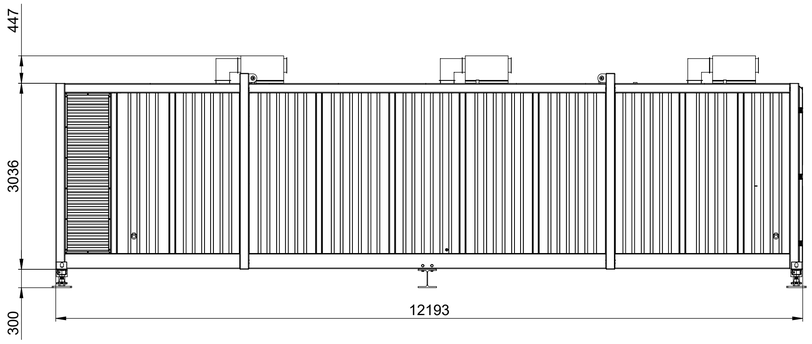
The 3D CAD models of the PCS and BESS containers as well as a drawing of the complete system as pdf are attached to this document (*see section 1.3 "Other Applicable Documents"*).

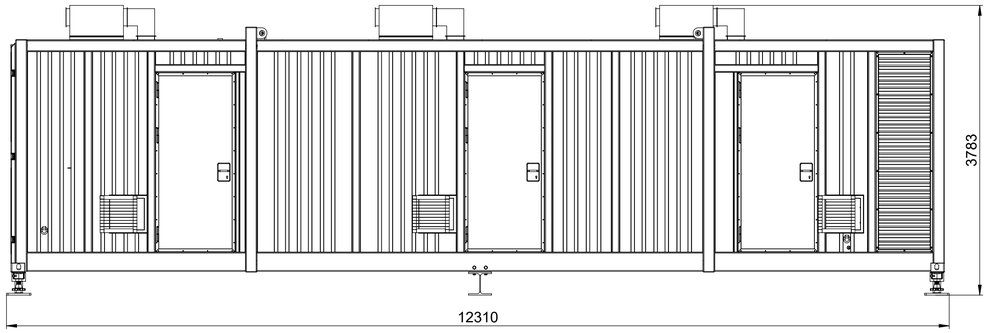
Archive name:	Datail_drawings.zip
PCS Container Step Model:	53396 PCS Container.step
BESS Container 1 Step Model:	53406 Battery Container 1.step
BESS Container 2 Step Model:	53412 Battery Container 2.step
Complete System PDF Drawing:	508261 BESS 1 MW 5.5 MWh 6.6 kV.pdf

3 Appendix

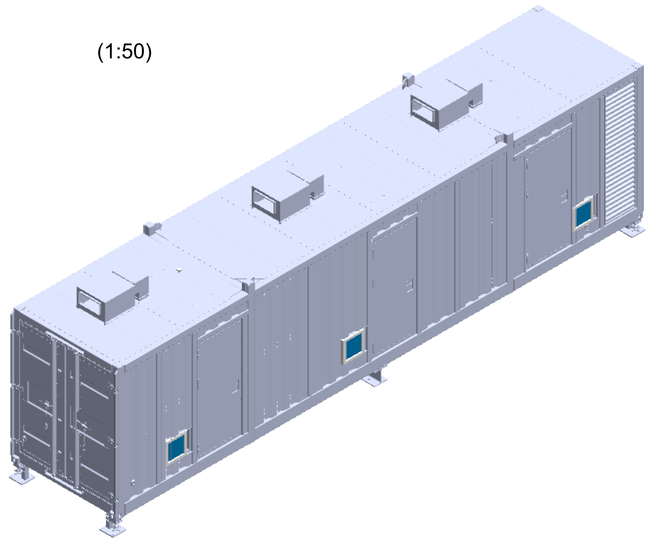
1. Detail_Drawings.zip

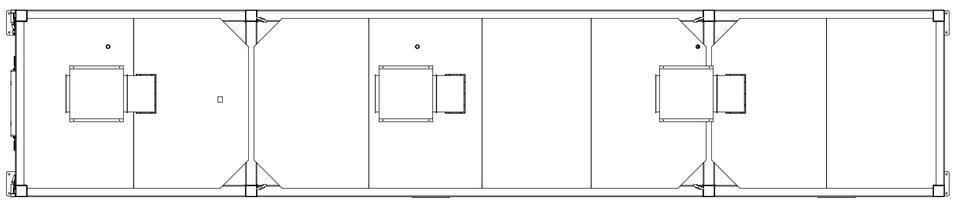




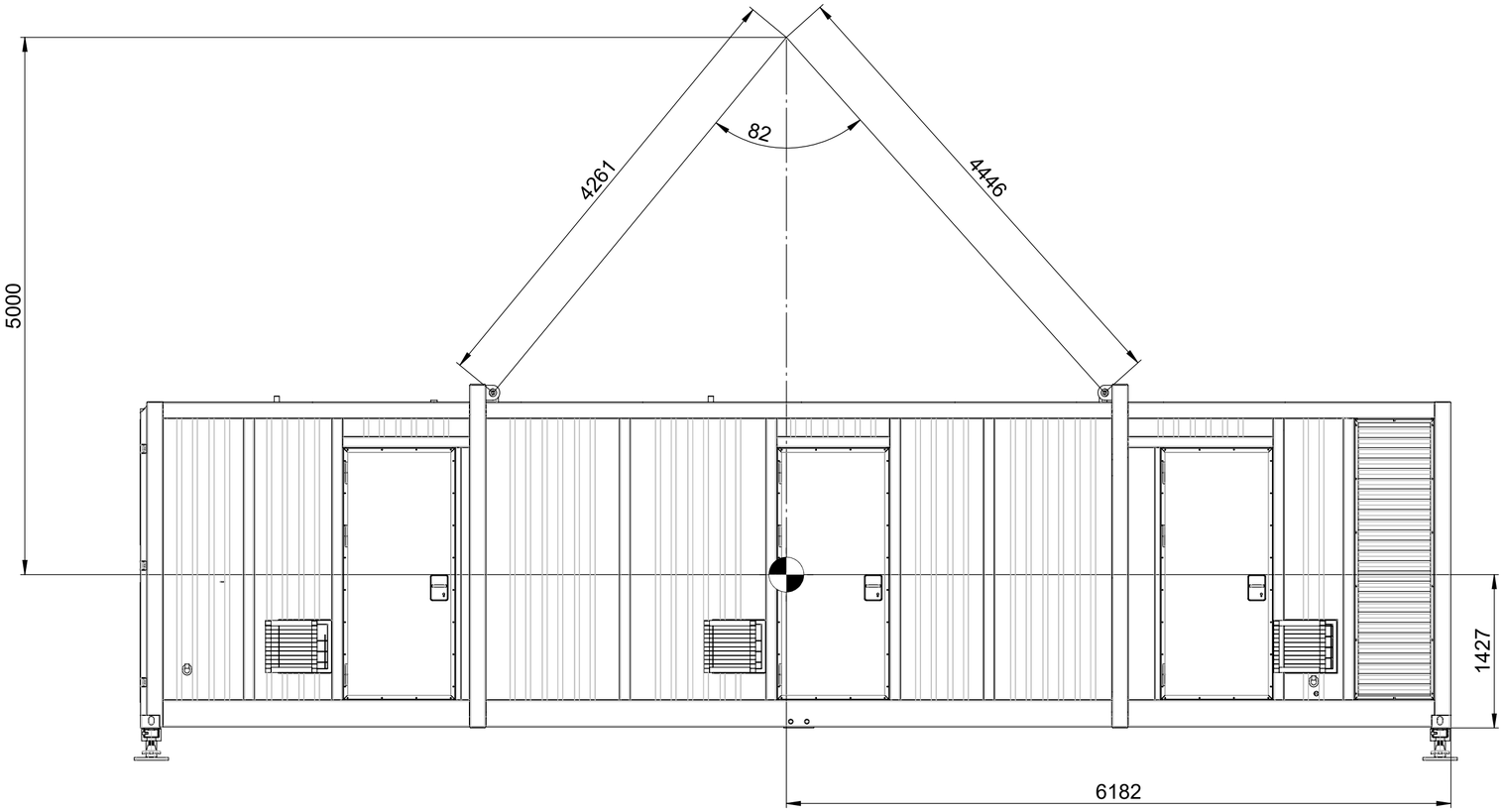


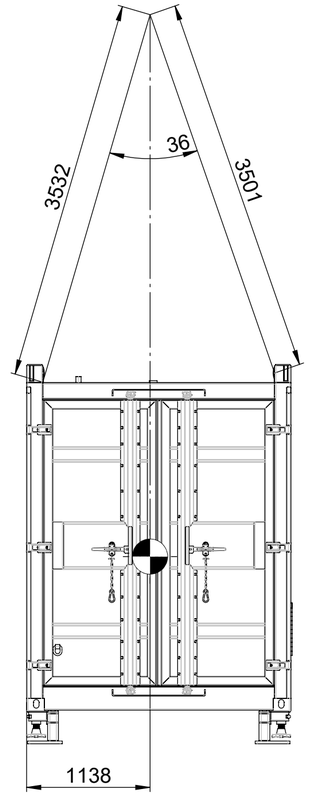
(1:50)





| | | |





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	17.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 14250.00 kg

Bezeichnung (description):

Batteriecontainer 2

Battery Container 2

Scale: 1:40

Sheet: 2 (A2)

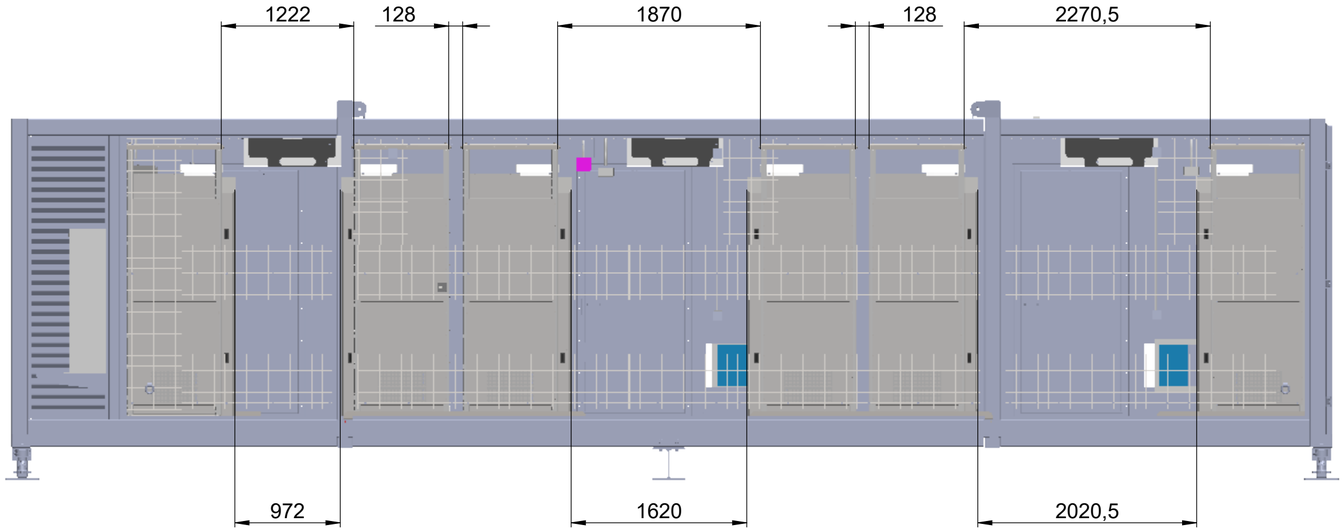
2 of: 5

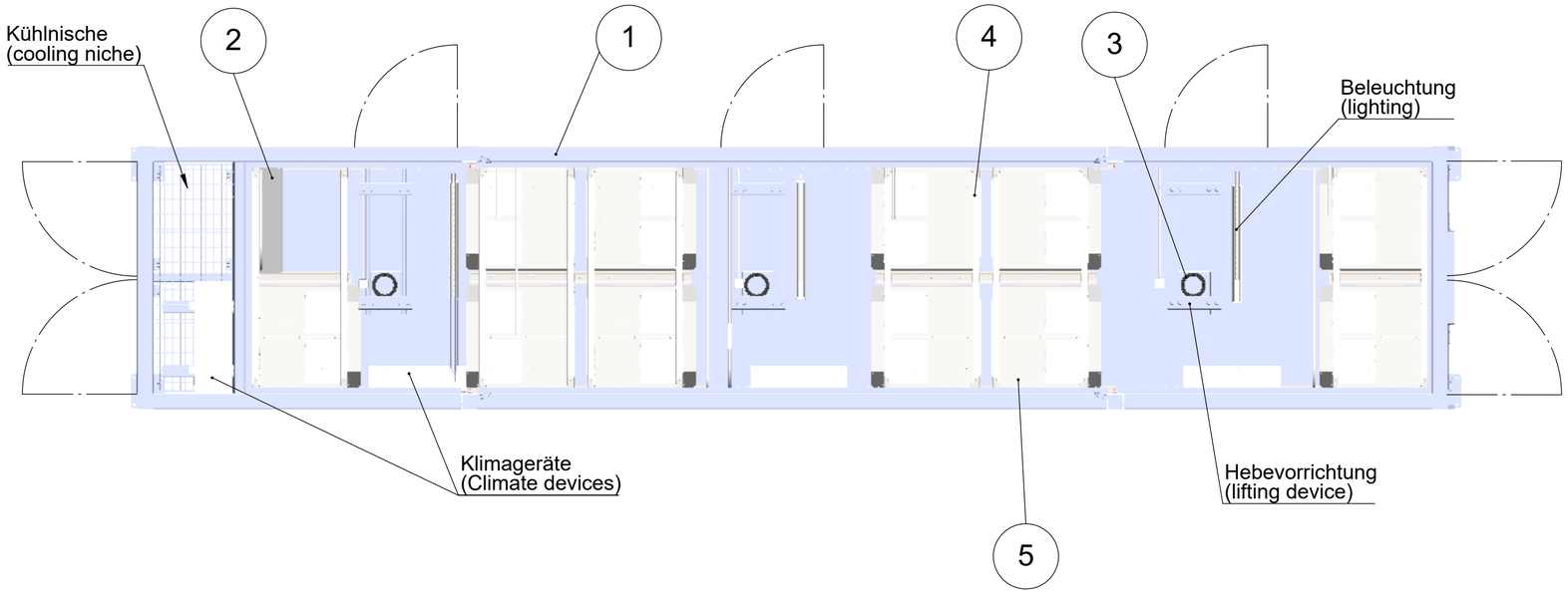
Artikel-Nr. (article number): 53412

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben





Pos. Nr.	Menge	**Bezeichnung**	engl. Bezeichnung	Art.-Nr.	**Lieferant**	**Lieferanten Nr.**
1	1	BESS Container 2 LHS	BESS container 2 LHS	507828	--	--
2	1	Hilfsversorgungsschrank 1	Distribution Cabinet 1	53409	--	--
3	3	Netzanschlussleitung/Verlängerungskabel 3m, Schwar	Mains connection cable/extension cable	54615	Famo	2810377
4	1	Einbaurahmen Verstärkt	Reinforced mounting frame	509198		
5	11	Schrank_verstärkt_mit Einsch._LF280K_28	Reinforced cabinet with slide in Units_28	54625	--	--

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	17.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 12214.44 kg

Bezeichnung (description):

Batteriecontainer 2

Battery Container 2

Scale: 1:40

Sheet: 3 (A2)

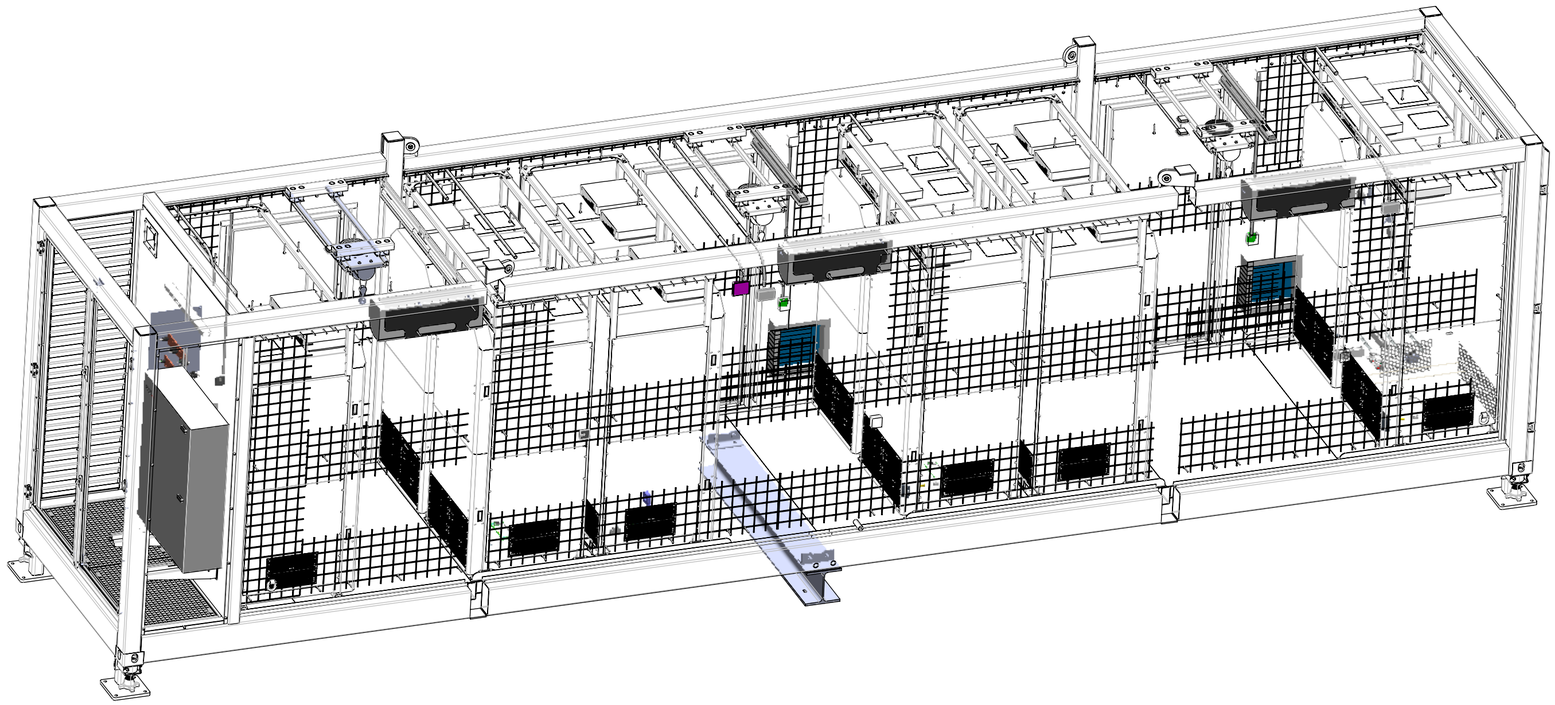
Artikel-Nr. (article number): 53412

3 of: 5

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK							
Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 12214.44 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	17.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Batteriecontainer 2

Battery Container 2

Scale: 1:35

Sheet: 4 (A2)

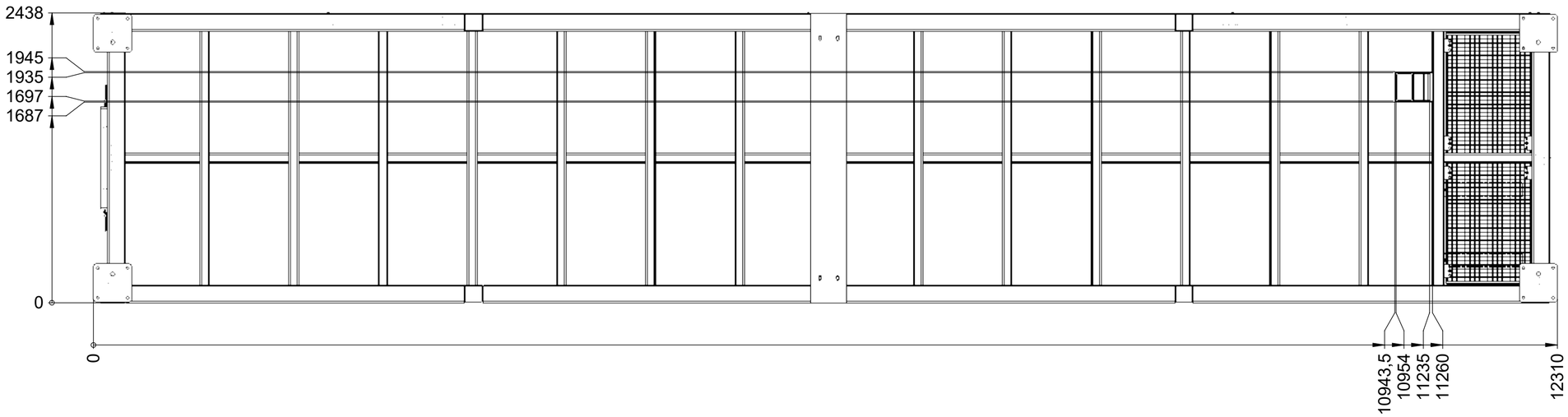
4 of: 5

Artikel-Nr. (article number): 53412

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material):

Gewicht (weight): 7339.14 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	17.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Batteriecontainer 2

Battery Container 2

Scale: 1:30

Sheet: 5 (A2)

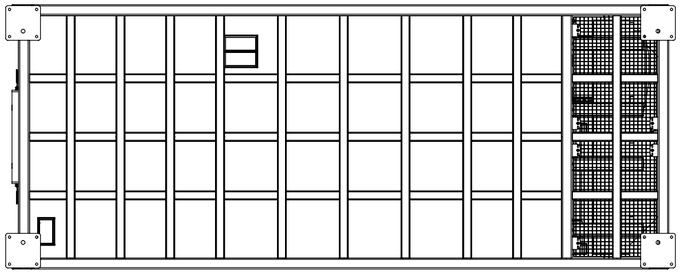
5 of: 5

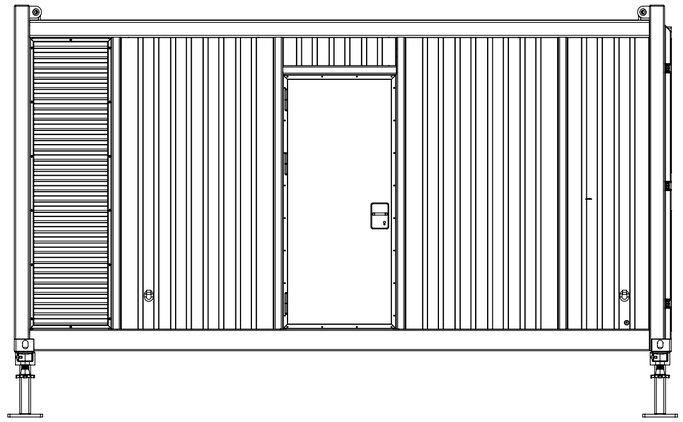
Artikel-Nr. (article number): 53412

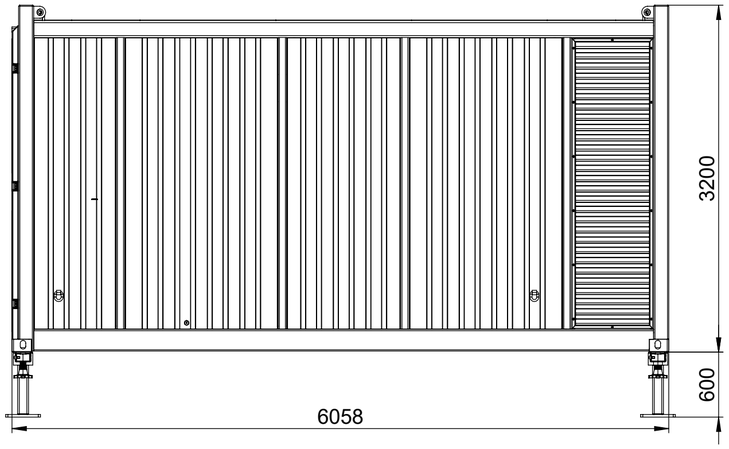
Revision:

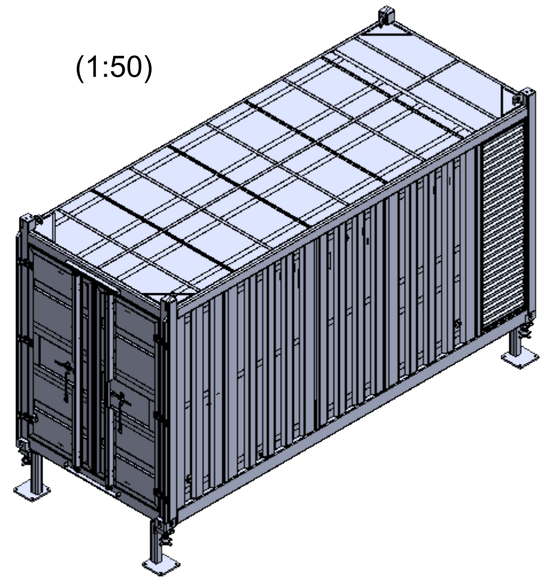
Projekt-Nr. & Kunde (project number & customer):

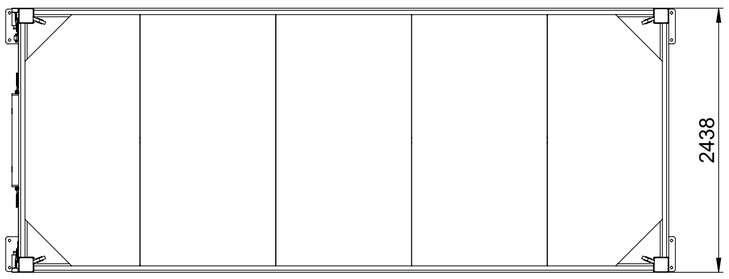
CAD System SolidWorks | Status: Freigegeben











Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: - (surface)

Werkstoff (material):

Gewicht (weight): 12199.00 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	21.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Umrichtercontainer

PCS (Converter) Container

Scale: 1:40

Sheet: 1 (A2)

1 of: 5

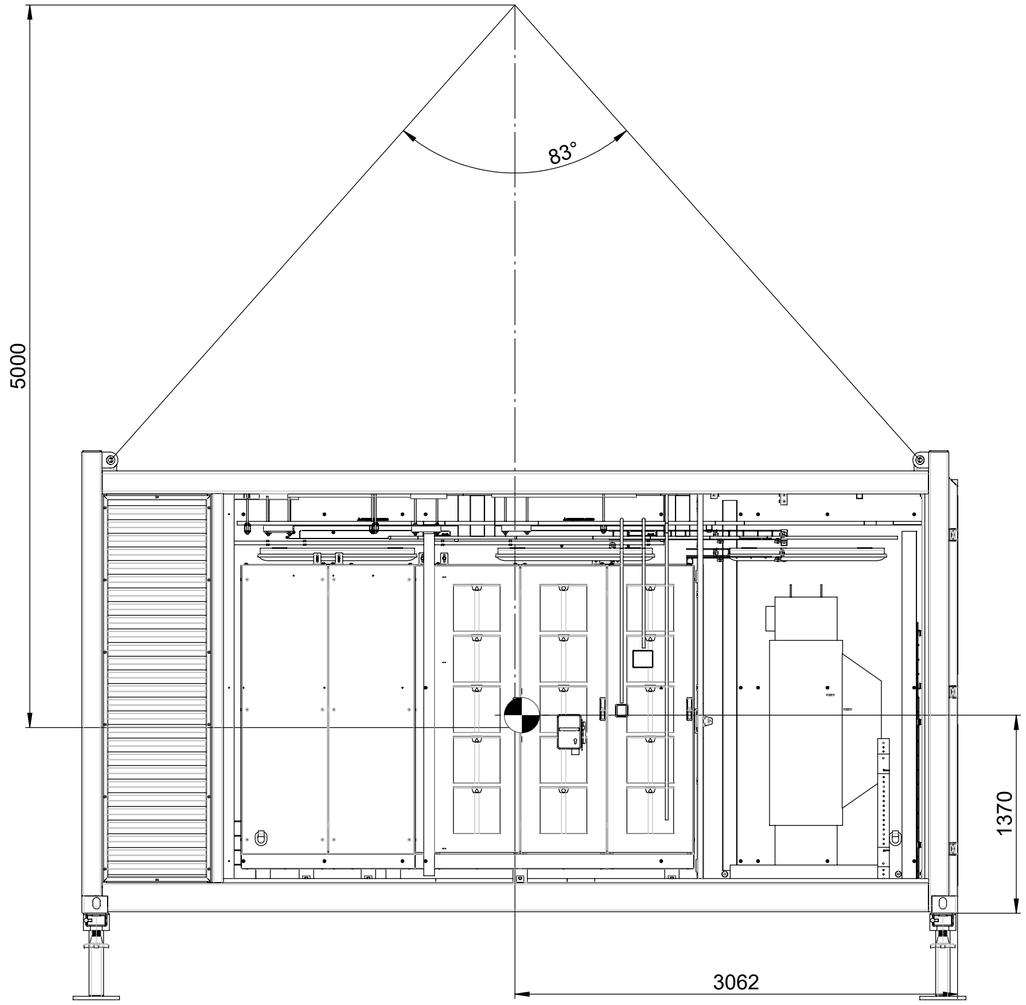
Artikel-Nr. (article number): 53396

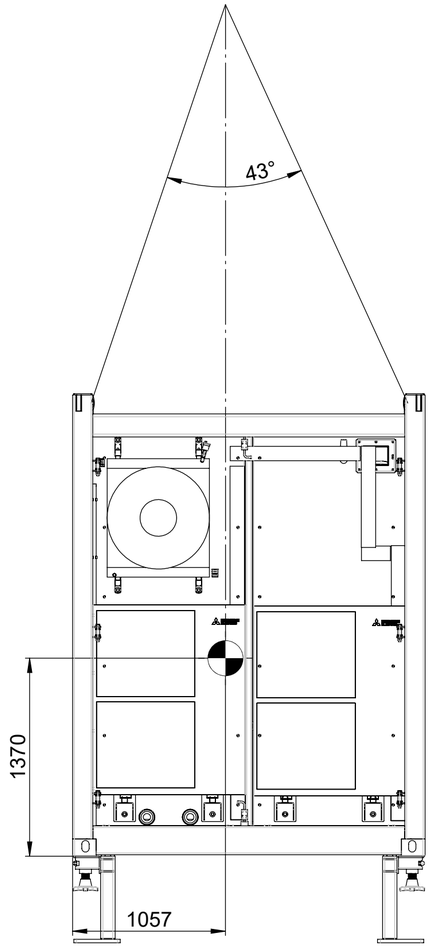
Revision:

alte Zeichnungs-Nr. (old drawing number):

CAD System SolidWorks

Status: Freigegeben





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK
Abmaße in mm für Nennmaßbereiche

Genauigkeitsgrad	0,5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	21.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.*

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

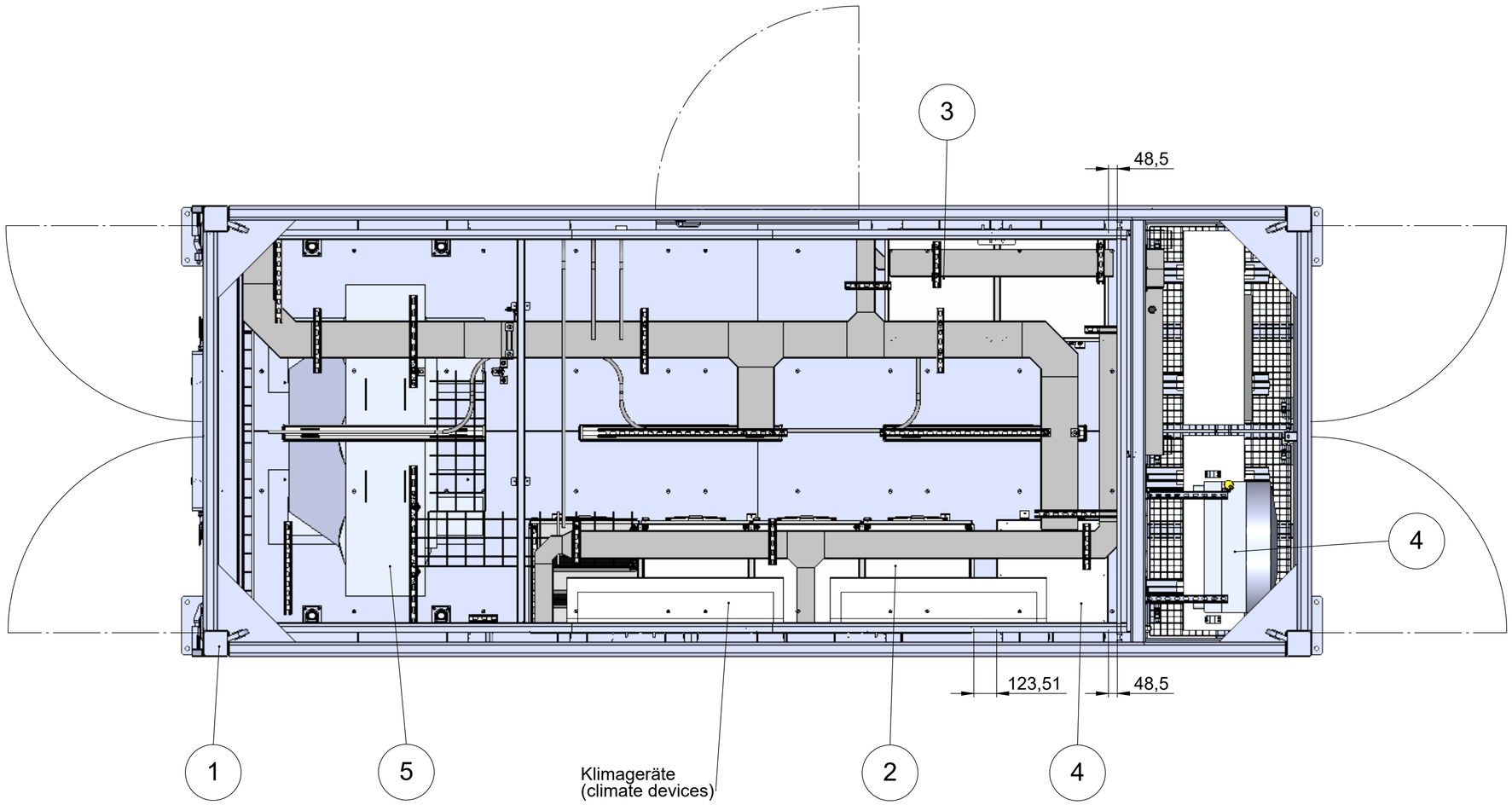
Oberfläche: (surface) -
Werkstoff (material): 12199.00 kg

Bezeichnung (description):
Umrichtercontainer
PCS (Converter) Container

Scale: 1:30
Sheet: 2 (A2)
2 of: 5
Revision:

Artikel-Nr. (article number): 53396
Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Pos. Nr.	Menge	**Bezeichnung**	engl. Bezeichnung	Art.-Nr.	**Lieferant**	**Lieferanten Nr.**
1	1	Umrichtercontainer_20ft	PCS Container 20ft	508727	--	--
2	1	Umrichter	Converter System	53399	Freqcon	--
3	1	Steuerschrank1&2	Control Cabinets 1&2	53763	--	--
4	1	Kühlsystem	Cooling System	53405	--	--
5	1	Gießharztransformator 1250kVA	transformer 1250kVA	508464	Powerfullstop	

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Abmaße in mm für Nennmaßbereiche

Genauigkeitsgrad	0,5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 15899.18 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	21.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Umrichtercontainer

PCS (Converter) Container

Scale: 1:20

Sheet: 3 (A2)

Artikel-Nr. (article number): 53396

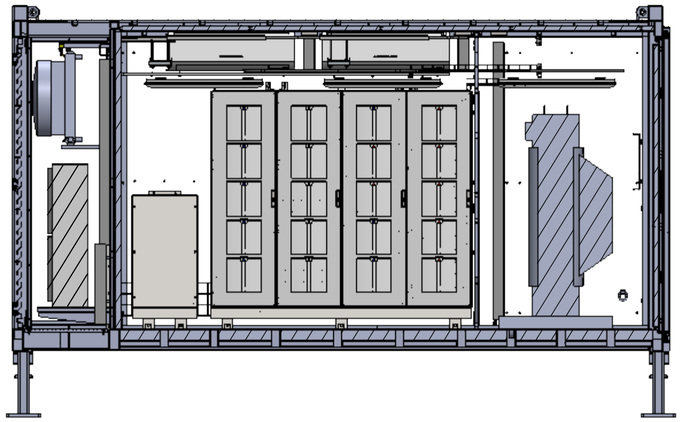
3 of: 5

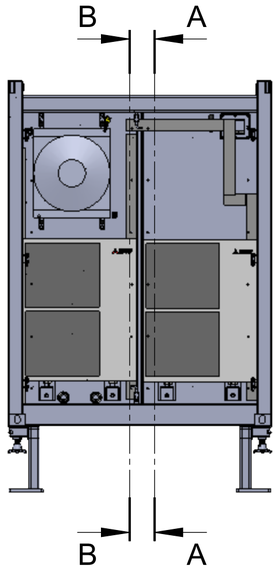
Revision:

Projekt-Nr. & Kunde (project number & customer):

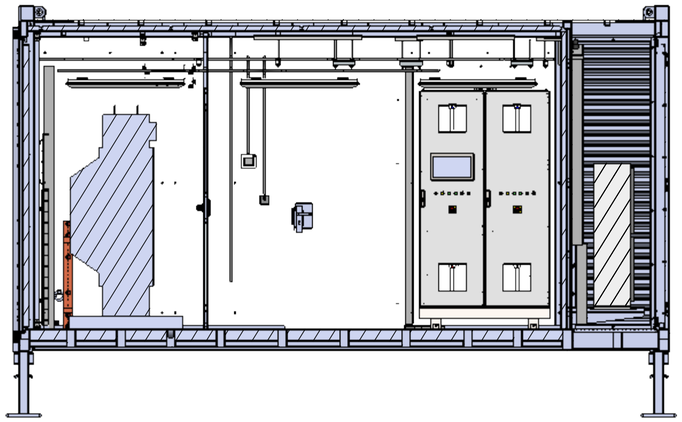
CAD System SolidWorks | Status: Freigegeben

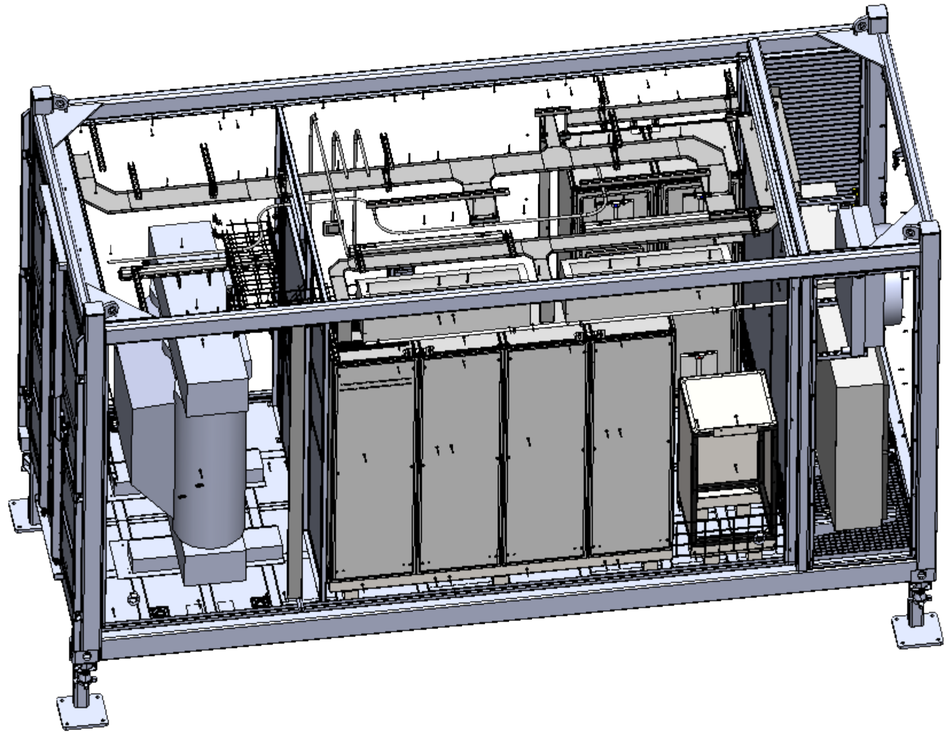
A-A





B-B





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material): 12199.00 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	21.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Bezeichnung (description):

Umrichtercontainer

PCS (Converter) Container

Scale: 1:40

Sheet: 4 (A2)

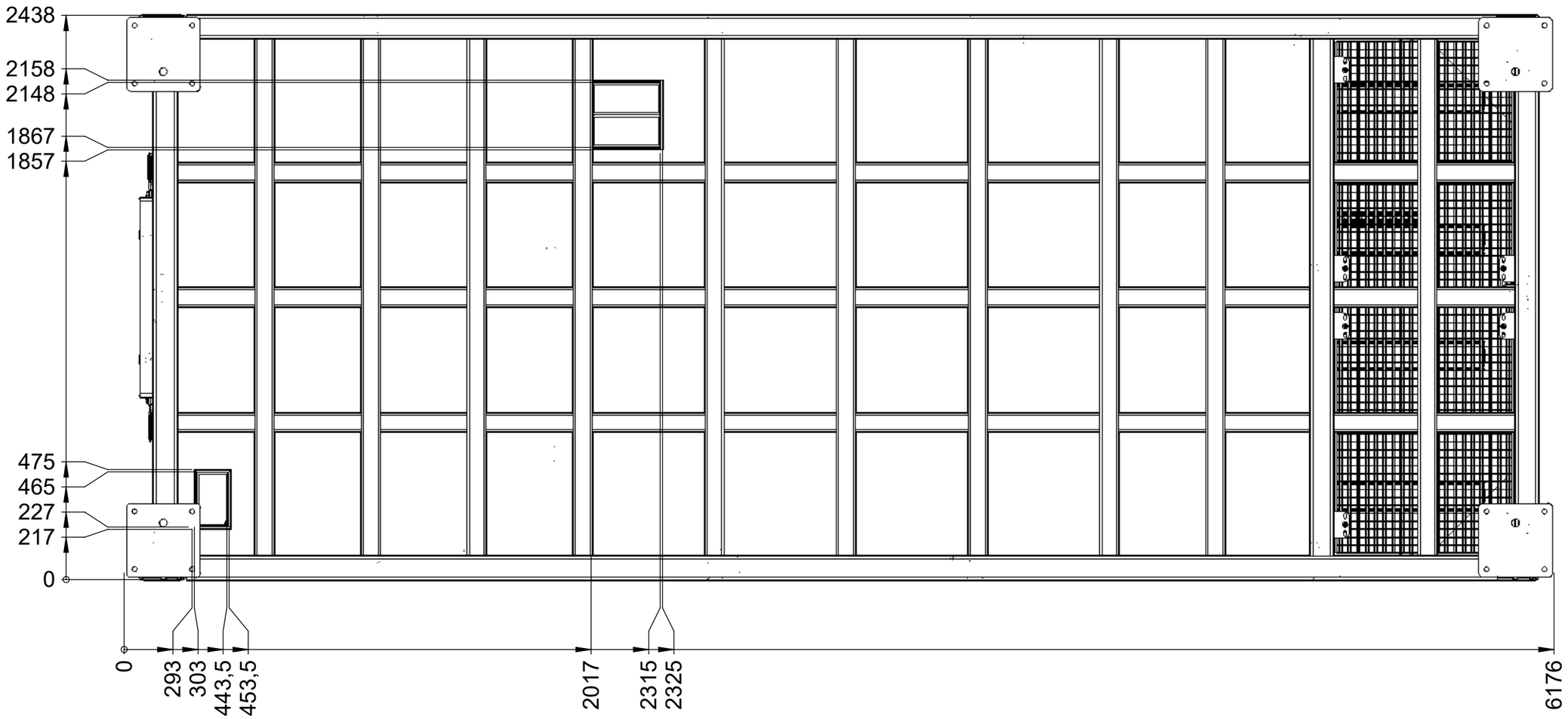
4 of: 5

Artikel-Nr. (article number): 53396

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK							
Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 .. 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

ISO 13715

	Datum (Date):	Name:
Drawn:	23.02.2023	i. Hirsch
Checked:	21.03.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material):

Gewicht (weight): 5562.00 kg

Bezeichnung (description):

Umrichtercontainer

PCS (Converter) Container

Scale: 1:20

Sheet: 5 (A3)

5 of: 5

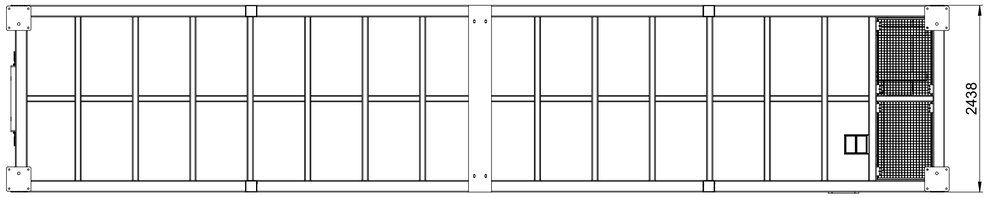
Artikel-Nr. (article number): 53396

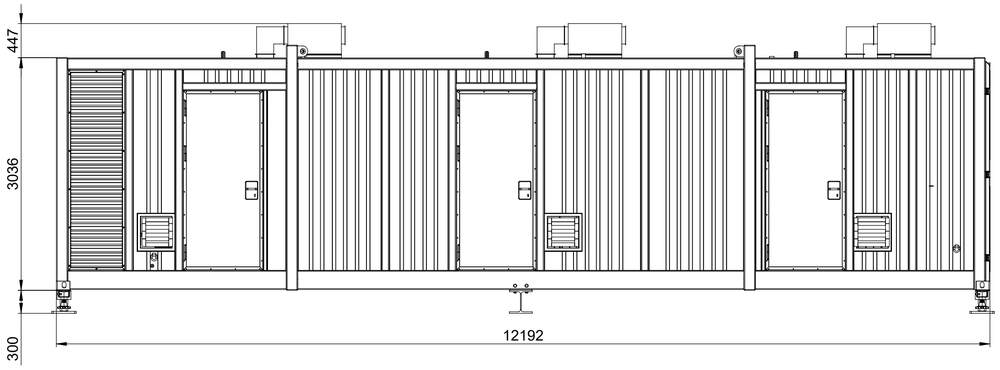
Revision:

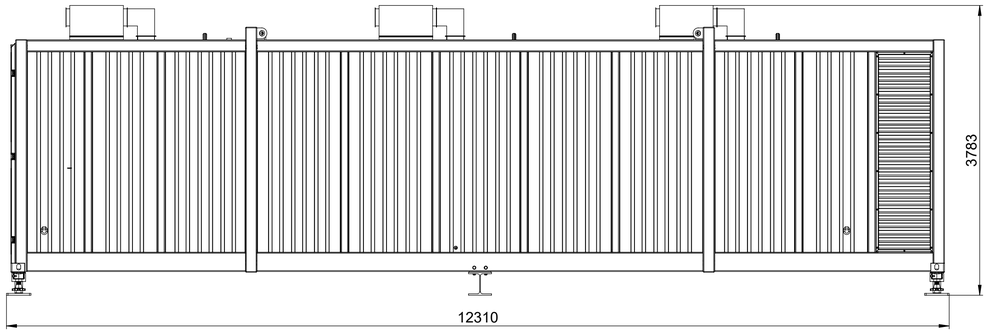
Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks

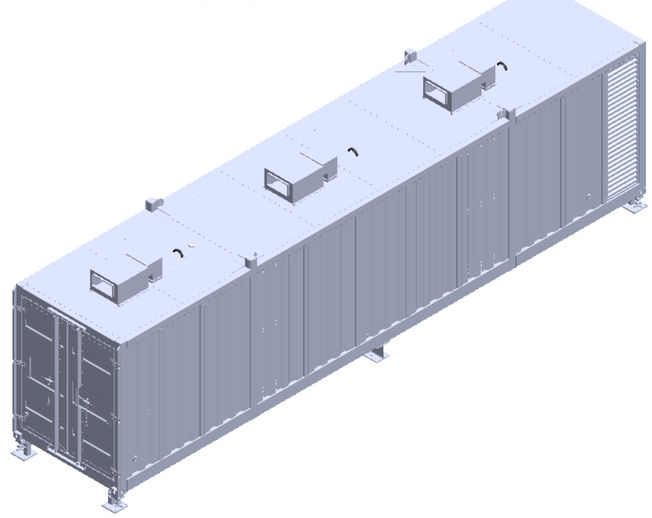
Status: Freigegeben

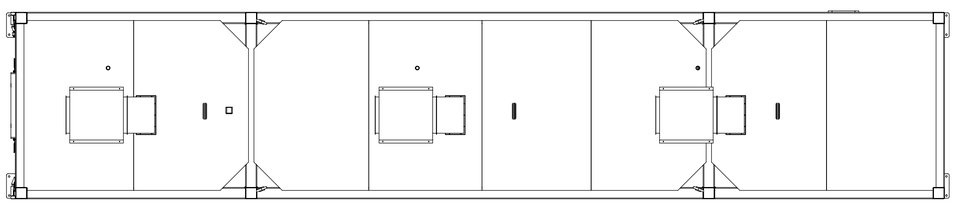




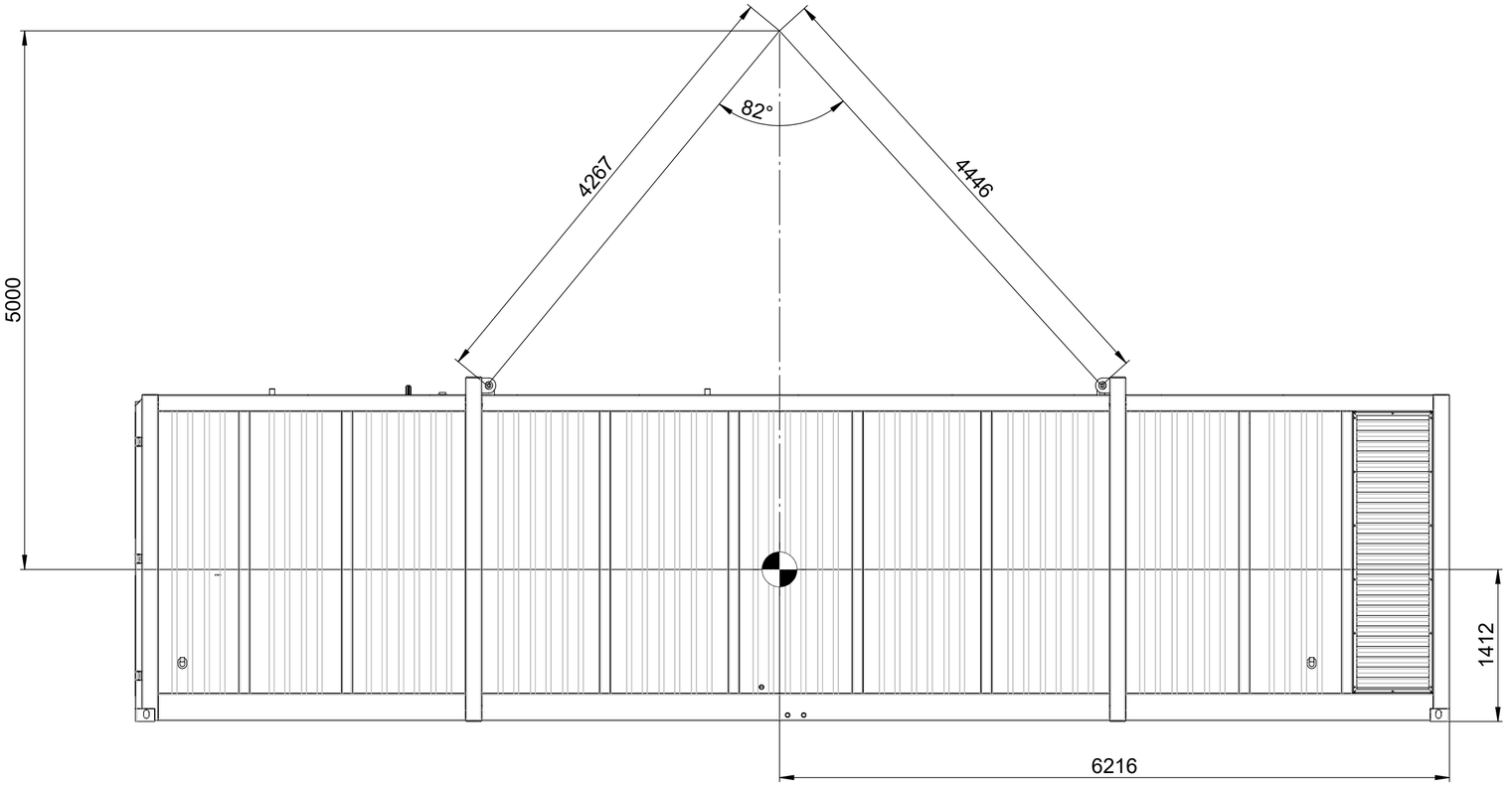


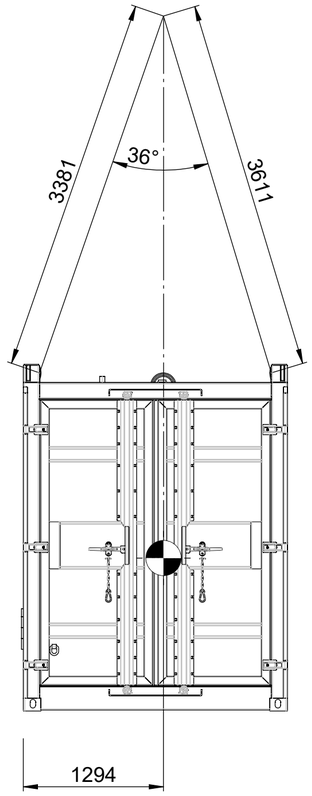
(1:50)





| | | |





Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK							
Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	22.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: - (surface)

Werkstoff (material): Gewicht (weight): 14250.00 kg

Bezeichnung (description):

Batteriecontainer 1

Battery Container 1

Scale: 1:40

Sheet: 2 (A2)

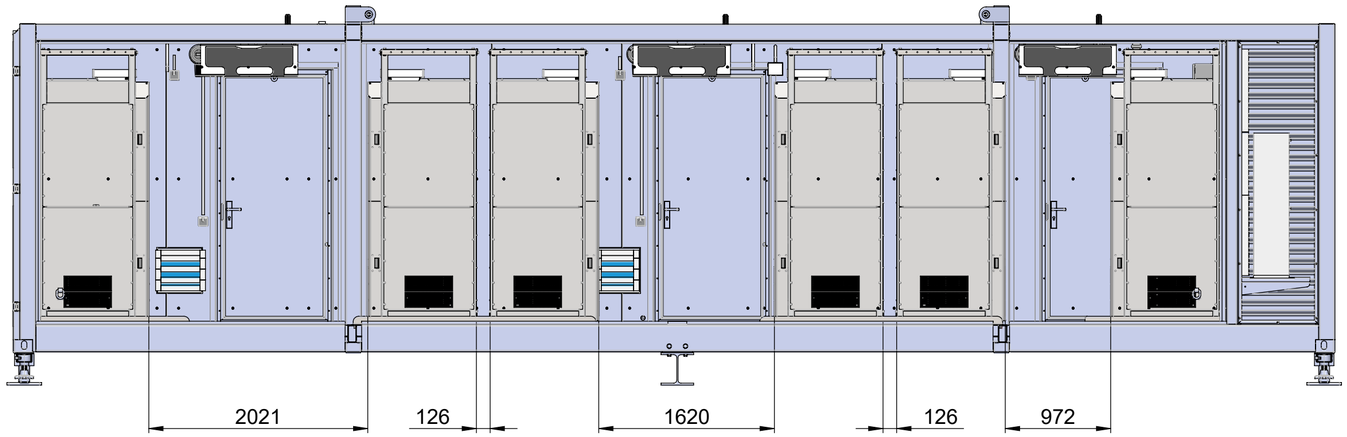
2 of: 5

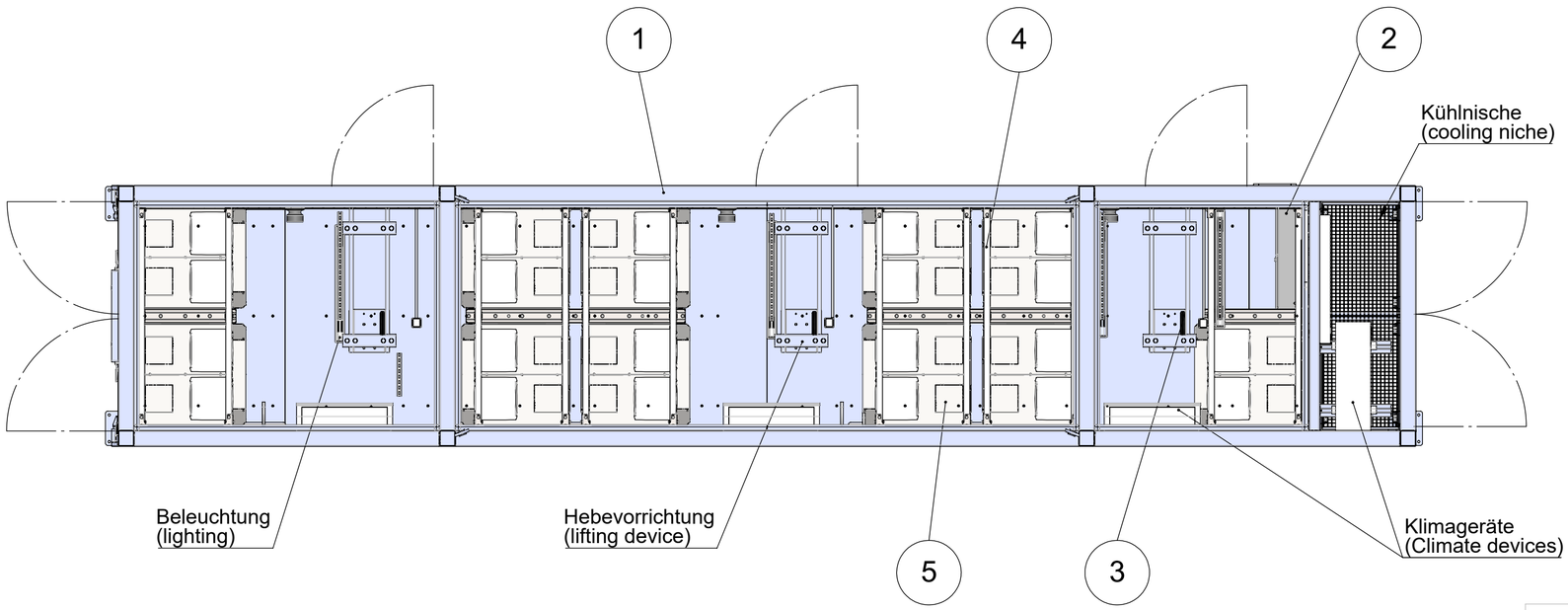
Artikel-Nr. (article number): 53406

Revision:

alte Zeichnungs-Nr. (old drawing number):

CAD System SolidWorks | Status: Freigegeben





Pos. Nr.	Menge	**Bezeichnung**	engl. Bezeichnung	Art.-Nr.	**Lieferant**	**Lieferanten Nr.**
1	1	BESS Container 1 RHS	BESS container 1 RHS	508728	--	--
2	1	Hilfsversorgungsschrank 1	Distribution Cabinet 1	53409	--	--
3	3	Netzanschlussleitung/Verlängerungskabel 3m, Schwar	Mains connection cable/extension cable	54615	Famo	2810377
4	1	Einbaurahmen Verstärkt	Reinforced mounting frame	509198		
5	11	Schrank_verstärkt_mit Einsch._LF280K_28	Reinforced cabinet with slide-in Units_28	54625	--	--

Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

+0,5 -0,5
ISO 13715

	Datum (Date):	Name:
Drawn:	22.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.'

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 14791.35 kg

Bezeichnung (description):

Batteriecontainer 1

Battery Container 1

Scale: 1:40

Sheet: 3 (A2)

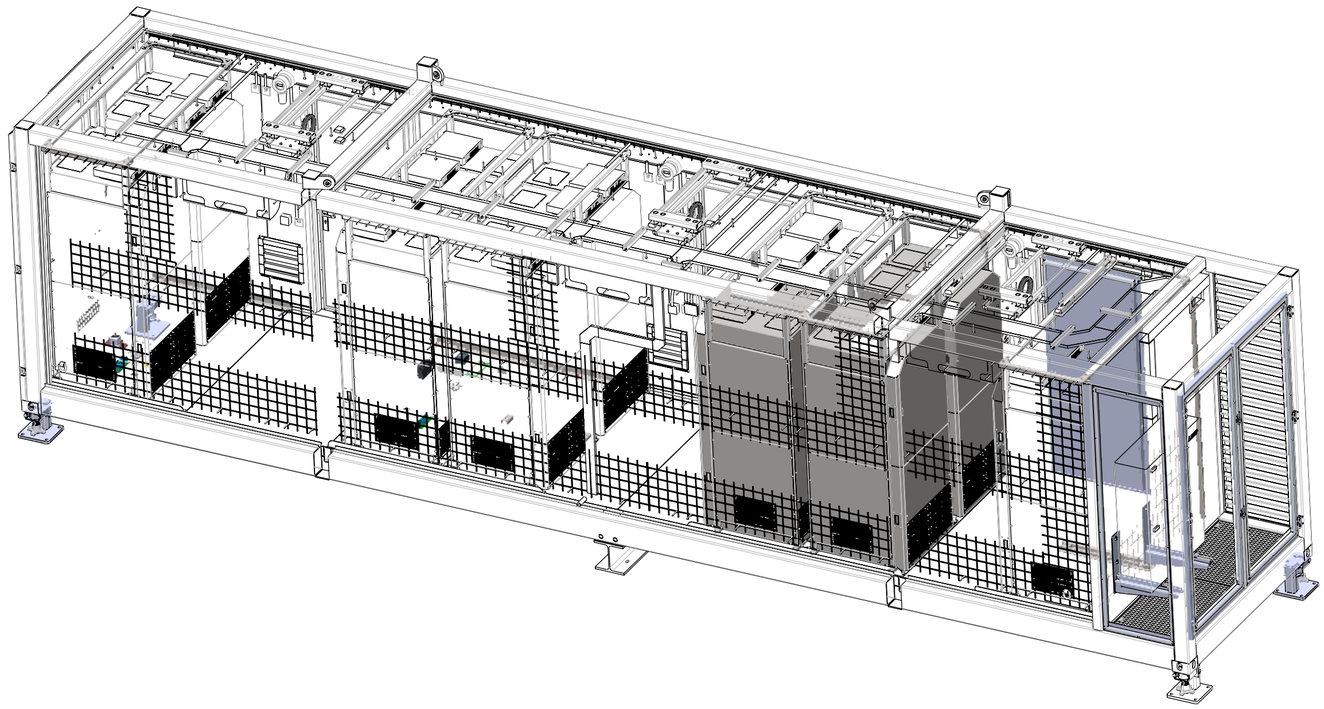
Artikel-Nr. (article number): 53406

3 of: 5

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

ISO 13715

	Datum (Date):	Name:
Drawn:	22.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten.

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

Oberfläche: (surface) -

Werkstoff (material): 35853.00 kg

Bezeichnung (description):

Batteriecontainer 1

Battery Container 1

Scale: 1:40

Sheet: 4 (A2)

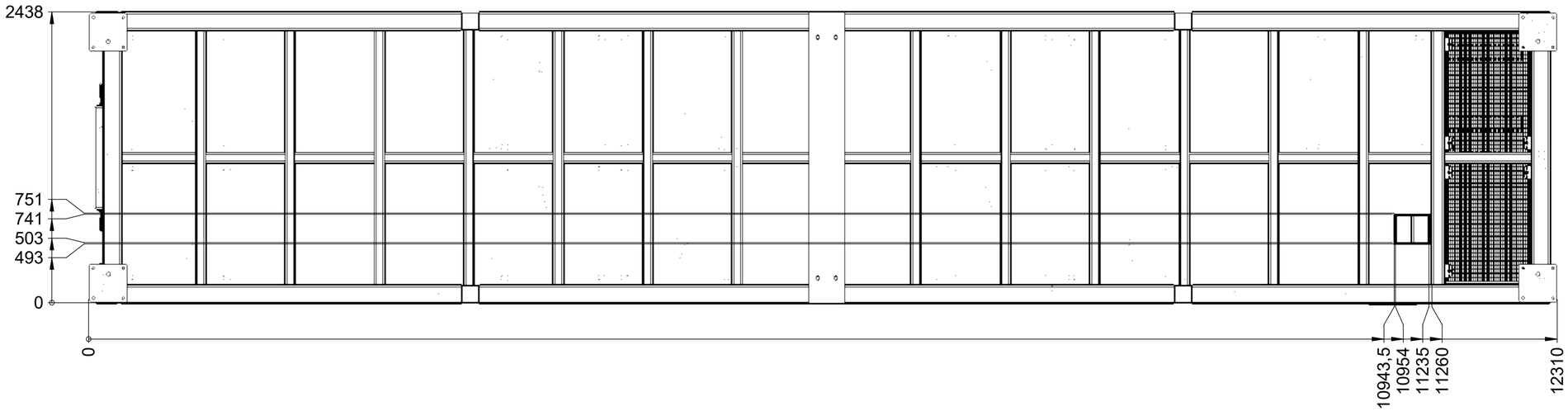
Artikel-Nr. (article number): 53406

4 of: 5

Revision:

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks | Status: Freigegeben



Rev.:	Änderung (changes):	Datum (Date):	Name:

Allgemeintoleranzen für Längenmaße DIN ISO 2768-mK

Genauigkeitsgrad	Abmaße in mm für Nennmaßbereiche						
	0.5 ... 3	> 3 ... 6	> 6 ... 30	> 30 ... 120	> 120 ... 400	> 400 ... 1000	> 1000 ... 2000
m (mittel)	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2

Oberfläche: (surface) -

Werkstoff (material):

Gewicht (weight): 35853.00 kg

+0,5 -0,5

ISO 13715

	Datum (Date):	Name:
Drawn:	22.02.2023	i. Hirsch
Checked:	30.05.2024	MvD

Bezeichnung (description):

Batteriecontainer 1

Battery Container 1

Scale: 1:30

Sheet: 5 (A2)

5 of: 5

Revision:

Artikel-Nr. (article number): 53406

Projekt-Nr. & Kunde (project number & customer):

CAD System SolidWorks

Status: Freigegeben

Schutzvermerk ISO 16016: Weitergabe sowie Vervielfältigung dieses Dokuments, Verwertung und Mitteilung seines Inhalts sind verboten, soweit nicht ausdrücklich gestattet. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patent-, Gebrauchsmuster- oder Geschmacksmustereintragung vorbehalten."

FREQCON
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem
+49 (0) 5165 291760-0

STATRON
NON STOP POWER

Pressure Vessel / Tanks Mechanical Calculations - Calc. for lifting brackets on containers

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: G01
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-G01-001
Document description: Pressure Vessel / Tanks Mechanical Calculations

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Pressure Vessel / Tanks Mechanical Calculations
G01

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	G01
Document name	Pressure Vessel / Tanks Mechanical Calculations
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	C. Palenzuela	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	C. Palenzuela
Checked by	2023-03-14	A. Fritz
Approved by	2023-03-14	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-G01-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Extract from DNVGL-ST-E271	Extracted pages from DNVGL-ST-E271 - JAN 2021

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

The lifting eyes of the 20” and 40” containers of the proposed system are in design phase and calculations cannot be provided at this stage. This will be done after the drawings were prepared by the container supplier and send to DNV for approval.

The lifting eye / padeye design will comply with DNV 2.7-1 as attached chapter 4.4.1. 4 padeyes per container (*see section 1.3 “Other Applicable Documents”*).

3 Appendix

1. Extracted pages from DNVGL-ST-E271 - JAN 2021

Guidance note:

Material thicknesses greater than the above may be necessary, depending on the materials specified, design configuration proposed and calculated stresses.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.3 Welding

4.3.1 Welding of pad eyes

All primary welds between pad eyes and the container shall be full penetration welds.

Guidance note:

Fillet welding of additional supporting welds on pad eyes and on pad eye supporting structure may be acceptable after special consideration. Proven pad eye configurations are recommended and these include, but are not limited to, slotted and base plate types. Other designs may be accepted after justification by the designer and special consideration by DNV GL.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.3.2 Welding of other primary structure

Essential and non-redundant primary structural members shall be joined using full penetration welds.

Fork pockets shall be connected to the bottom rails with full penetration welds. If, however, they pass through the bottom rail, fillet welds on both inner and outer faces of the rail may be used. Fillet welds may be permitted for other primary structure, after special consideration by DNV GL.

4.3.3 Welding of secondary structure

Secondary structures may be joined using fillet welds. Intermittent fillet welding of secondary structure is acceptable, but appropriate measures shall be taken to avoid water ingress and corrosion, for example at joints exposed to the external environment.

Welds between primary and secondary structures may be considered as welding of secondary structure. Due care should be taken not to introduce significant constraints or stress concentrations in primary structural members by the inappropriate location and welding of secondary structures or ancilliary components.

4.4 Design details

4.4.1 Pad eyes

Please also refer to App.C.

Pad eyes shall be positioned on the container to avoid, as far as practicable, the risk of lifting sets fouling against the container or its cargo during normal use. Pad eyes shall be designed to permit free movement of the shackle and sling termination without fouling the pad eye or adjacent structures. They should, as far as possible, be designed to avoid damage from other containers.

Pad eyes may protrude above the top of the container but shall not protrude horizontally outside the container. If slotted through the corners posts, the outside corners/edges shall be shaped or modified to eliminate snagging, see [4.1.3].

This copy of the document is intended for use by DNV GL employees only.

This copy of the document is intended for use by DNV GL employees only.

Guidance note 1:

Pad eyes that are placed vertically and aligned towards a central point can normally accommodate variations in sling angles, i.e. a lifting set with the legs 45° from vertical can be replaced with a longer lifting set, giving a smaller angle to the vertical without any adverse effect on the pad eyes or the container. Pad eyes positioned at an angle to the vertical cannot accommodate this variation, sling legs in this case shall always be the correct length to avoid out of plane loads on the pad eye.

Containers designed with a centre of gravity offset from the geometric centre may be fitted with asymmetric lifting sets, to ensure a horizontal lift. If the lifting set is asymmetric, the pad eyes must be aligned towards the centre of lift, to avoid out of plane loads.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

In order to prevent lateral bending moments, pad eyes shall be designed such that they align, with the lifting set legs, to the centre of lift. In the as-built condition, pad eyes shall have a maximum manufacturing tolerance of ±2.5°.

Any difference in the diagonal measurements between lifting point centres shall not exceed 0.2% of the nominal length of the diagonal, or 5 mm, whichever is the greater.

Pad eye hole diameter shall match the shackle used, with a clearance between the shackle pin and pad eye hole not exceeding 6% of the shackle pin diameter.

Guidance note 2:

Localised wear in pad eyes may occur during the lifetime of an offshore container. The 6% clearance defined above is considered the maximum design tolerance for all new offshore containers. Any wear experienced during the lifetime of a container could mean that this value is exceeded.

The pad eye hole diameter should be carefully selected to accommodate the necessary shackle pin diameter. For the purposes of strength and longevity, the difference in hole and pin, diameter should be as small as possible. At the same time, the shackle pin maximum diameter, including tolerance, and pad eye hole dimensional tolerance and coatings should be considered to ensure that the pin can be inserted into the pad eye without the use of tools.

The pad eye configuration should readily allow insertion of the proposed shackle and pin, with due consideration given to the space available and any clashes with primary structural members.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

The maximum concentrated hot spot stresses at the bolt hole, due to geometry effects and contact stress, shall not exceed twice the nominal material yield stress, i.e. $2R_e$, at the design load.

This copy of the document is intended for use by DNV GL employees only.

Guidance note 3:

Figure 4-1 shows a simplistic representation of a pad eye and the key dimensions to be defined.

The simplified method outlined below can be used to determine the minimum pad eye dimensions.

More refined methods may be used for calculating pad eye stresses and submitted as part of the approval process, if considered necessary, see [B.1] for guidance.

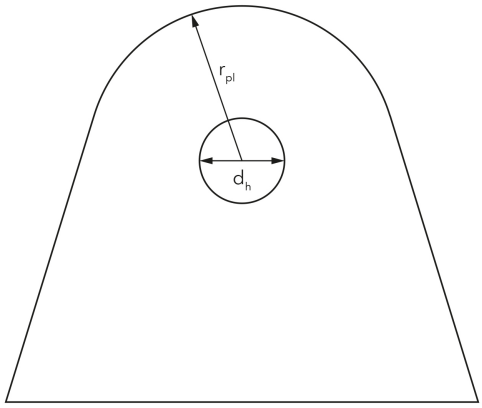


Figure 4-1 Pad eye

The following equations use these definitions:

R_e = nominal yield stress, at room temperature, in [MPa] or [N/mm^2]

RSL = resultant sling load, in [N]

r_{pl} = shortest distance from centre of pad eye hole to edge of pad eye, in [mm]

d_h = pad eye hole diameter, in [mm]

t_{pl} = pad eye thickness, in [mm]

t_c = cheek plate thickness, in [mm]

d_c = pad eye cheek plate diameter, in [mm]

a = pad eye cheek plate weld throat thickness, in [mm]

z = pad eye cheek plate weld leg length, in [mm].

1. TEAR-OUT STRESS

$$R_e \geq \frac{3RSL}{2r_{pl}t_{pl} - d_h t_{pl}} \qquad (4.13)$$

Tear-out stress confirms that the stress level at the edge of the bolt hole is acceptable, assuming a stress concentration factor of 3.

If fillet welded cheek plates are used to obtain the pad eye thickness required (clearance between pad eye and inside of shackle) these should not be taken into account in the tear-out stress calculation.

If a pad eye design incorporates a tube or boss through it, the wall thickness of the boss shall be excluded from the tear-out stress calculation, unless the weld between it and the pad eye plate is full penetration and the boss material is equivalent (i.e. grade and level of certification) to that of the pad eye plate.

2. CONTACT STRESS

$$R_e \geq 23.7 \times \sqrt{\frac{RSL}{d_h\left(t_{pl} + 2t_c\right)}} \qquad (4.14)$$

Contact stress estimates peak compressive stress at the contact line between two concentric cylinders, with a difference in diameter of 6%.

The contact stress criterion may be calculated using the total thickness of pad eye and cheek plates.

3. CHEEK PLATE WELD SHEAR STRESS

$$R_e \geq \frac{RSLt_c}{\left(t_{pl} + t_c\right) d_c \frac{z}{\sqrt{2}}} \qquad (4.15)$$

The above equation is based on the following assumptions:

- The cheek plate will be fillet welded all around the outer edge of the cheek plate.
- The cheek plate will be so stiff, in plane, that it is reasonable to assume that the majority of the weld will be active in transferring load.
- The fillet welds stress components will vary all around the weld. Pure shear on the weld throat has been assumed.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

The thickness of the pad eye plate at the hole shall not be less than 75% of the inside width (jaw) of the proposed shackle.

Guidance note 4:

If the pad eye plate thickness is below the 75% limit, it can be increased by welding cheek plates or by inserting a thick walled tube/pipe or boss through the pad eye.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Pad eyes shall be welded to the frame with full penetration welds. If the lifting force is transferred through the thickness of a plate (the z-direction), plates with specified through thickness properties shall be used. Please see [3.1.2.1].

4.4.2 Intermediate cargo decks

When intermediate cargo decks are fitted, they shall be designed for a uniformly distributed load of at least:

$$0.5P\phi g \qquad (4.16)$$

where Load factor:

$$\phi = 3.0$$

When intermediate cargo decks are designed only to be used for dedicated cargo with loading other than half the total payload, the design and test loads shall be modified accordingly. Please see [4.1.2], [4.6] and Sec.6.

4.4.3 Stacking and stacking fittings

If offshore containers are designed to be stacked on top of one another, either onshore or offshore, no more than two containers should be stacked. Waste skips with trapezium shaped sides may be designed for stacking of several units in empty condition.

Stacking guides on top rails or on the underside of a container shall be designed to prevent lateral movement and to prevent tipping of the upper container.

Offshore containers that are also certified to IMO CSC and/or ISO 1496 shall in addition be designed for stacking on container ships according to IMO CSC and/or ISO 1496.

See also [4.1.3] and App.G.

This copy of the document is intended for use by DNV GL employees only.

STATRON
NON STOP POWER

Process/Utility Calculations

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: G02
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-G02-001
Document description: Process/Utility Calculations

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version

Process/Utility Calculations
G02

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	G02
Document name	Process/Utility Calculations
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	M. Maaz	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	M. Maaz
Checked by	2023-03-15	C. Palenzuela
Approved by	2023-03-15	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 BESS Cooling 8
4 Appendix 10

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-G02-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

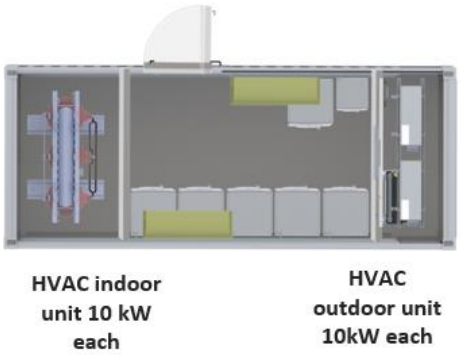
This document provides preliminary information about the expected load requirements for the HVAC units installed for BESS FQ. The calculated load values in this document are preliminary information based on HVAC units that Freqcon uses for on-shore BESS projects. Realistic load information can be provided at a later stage with selected off-shore HVAC units.

3 BESS Cooling

FREQCON PCS is primarily water cooled. The water pump and heat exchanger shown in the figure are part of the supply. To dissipate the waste heat from the IGBT power modules and inductors installed in the inverter system, these components are cooled down to the required operating temperature by an internal cooling system consisting of cooling hoses, coolant pump, water manifold and an air/water heat exchanger. The closed-loop water cooling system is capable of removing 80% of the waste heat. The remaining 20 % is removed by air cooling units.



The water-glycol circuit (WGK) is designed as a closed cooling circuit. The water-glycol mixture is passed through the heat sinks of the IGBT power modules to dissipate the heat generated in the modules.

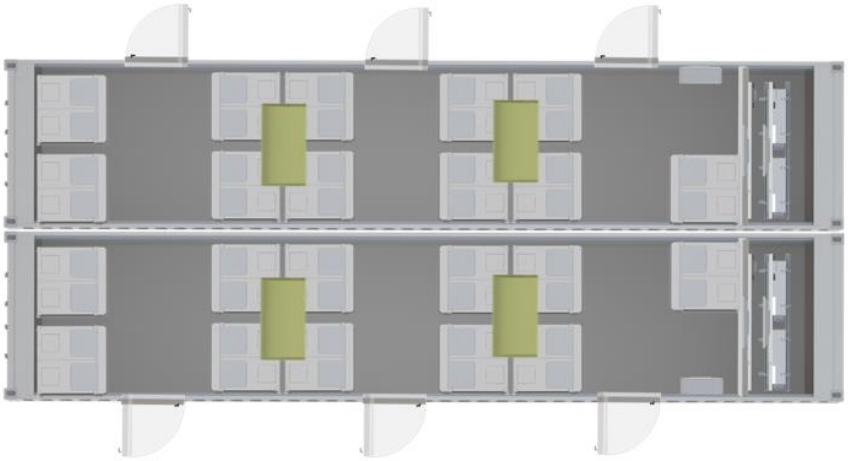


For proper operation of the IGBT power modules, it is also necessary to heat the modules to a certain minimum temperature. To heat the modules to this minimum temperature during a cold start, the cooling water in the cooling system is preheated by an electrical heating element mounted in the cooling water

manifold. The preheating process is carried out until the minimum cooling water temperature of 25°C is reached, which takes about 20 minutes. After the IGBT modules have reached the temperature of 25°C, the inverter is enabled for normal operation by the control system. Water-cooled systems are more reliable and have a longer service life.

Considering the expected losses of the PCS at nominal power and also the losses from the medium voltage transformer, Freqcon installs two HVAC units each with 10 kW cooling power. This cooling units are sized to provide ample cooling power for both the PCS and the transformer as well as provide redundancy.

The battery cabinets are air-cooled. Multiple HVAC units are installed inside the battery containers to actively cool the battery cabinets and maintain optimal temperatures for longevity of the BESS.



HVAC indoor unit
7kW each

HVAC outdoor unit
7kW each

The cooling load of the battery cabinets is calculated based on the resistance losses in the battery modules at nominal power. Additional heat losses are calculated for BMS system and other control elements in the battery container.

For each battery container, Freqcon installs two HVAC units each with 7 kW cooling power to provide redundant cooling power and uniform distribution within the battery container. At the low C-rate for the project, the heat losses from the battery modules is quite low. Estimated cooling load for 11 battery cabinets at BoL is 11.3 kW. The cooling units are over-dimensioned to ensure redundancy and also to account for increased losses as the batteries age.

Two fans are installed on top of each battery cabinet to ensure active air circulation within the battery cabinets. The fans pull the air from the battery cabinets upwards towards the HVAC units installed on the ceiling.

4 Appendix

STATRON
NON STOP POWER

Reliability and Availability

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: G11
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-G11-001
Document description: Reliability and Availability

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version



Reliability and Availability
G11

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	G11
Document name	Reliability and Availability
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	M. Maaz	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	M. Maaz
Checked by	2023-03-15	C. Palenzuela
Approved by	2023-03-15	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Reliability and Availability 8
3.1 Modular Design 8
3.2 Reliable Components 8
3.3 Availability 8
4 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-G11-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

This document provides information about the availability and reliability of the BESS FQ system.

3 Reliability and Availability

3.1 Modular Design

The BESS FQ system is designed with modular elements to ensure that the BESS is capable of remaining in operation during failures of one or more battery cabinets and even in case of failure of DC IGBT powerstack or inductor or switch & fuse.

Multiple DC/DC powerstacks are used to connect the battery cabinets to the PCS. In case there is failure in battery rack(s), the PCS shall disconnect these battery racks. This results in a maximum loss of available battery storage corresponding to number of battery racks disconnected. Each battery rack has 250 kWh installed capacity.

The failing battery rack(s) can be accessed without disrupting the functioning battery racks. This means any maintenance or repair can be performed without the system being significantly affected.

In case, the DC IGBT stacks encounter a failure event, the IGBT would be disconnected for repair and maintenance. The effect of the failure of DC IGBT stack would be disconnection of the battery racks connected to it.

3.2 Reliable Components

FREQCON uses components from leading and well-established manufacturers including Siemens, Phoenix Contact, Semikron etc. The MTBF for the individual components is extremely high (e.g. the combined MTBF for IGBT based powerstacks is >40 years). Freqcon calculates the MTBF for the entire system according to the ISO 13849-1:2008 standard section C.5 and D.1.

$$\mathrm{MTBF} = \frac{1}{\sum_{1}^{n} \frac{1}{MTBF_n}}$$

3.3 Availability

The expected availability of the BESS is 97% during the warranty period. This does not include downtime due to planned maintenance or downtime due to customer responsibilities.

Due to the modular design from FREQCON, faulty modules can be replaced using the spare parts package at site. This significantly reduces MTBR. It must be noted that any maintenance (planned or otherwise) must be performed under supervision of Freqcon personnel or personnel trained by Freqcon.

4 Appendix

STATRON
NON STOP POWER

General performance curves (round trip efficiencies)

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: H09
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-H09-001
Document description: General performance curves (round trip efficiencies)

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version

General performance curves (round trip efficiencies) H09

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	H09
Document name	General performance curves (round trip efficiencies)
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	M. Maaz	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	M. Maaz
Checked by	2023-03-15	C. Palenzuela
Approved by	2023-03-15	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Round Trip Efficiencies 8
3.1 Preamble 8
3.2 Expected Efficiencies 8
4 Appendix 9

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-H09-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

This document provides expected round-trip-efficiencies of the EVE LF280K cells.

3 Round Trip Efficiencies

3.1 Preamble

The following table shows the DC-DC round-trip-efficiency of LFP battery cell LF280K when connected in combination in a battery module. The efficiencies are calculated with average measured resistances of the battery cells connected to form battery modules.

The battery cells experience higher resistances in practice due to increased connections as well as increased temperatures during operation as well as process variations.

Furthermore, the resistances of the battery cells are expected to increase non-linearly during an operation life of 10 years. This is due to aging of the batteries and particularly degradation of the anode and cathode, as well as increased resistance due to older connections.

3.2 Expected Efficiencies

C-Rate	RTE (BoL)	RTE (EoL 10 years)
0.1	99.14%	98.45%
0.2	98.28%	96.92%
0.5	95.73%	92.39%

4 Appendix

Assembly certificate Battery modules (zip folder including all test reports)

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Test Result: PASS
Battery Type: 508972
PCB Serial No.: 64
Date and time: 2024-06-14 10:31:31

Communication Test: PASS
Cell 1 Voltage-Test: PASS (3383mV)
Cell 2 Voltage-Test: PASS (3376mV)
Cell 3 Voltage-Test: PASS (3386mV)
Cell 4 Voltage-Test: PASS (3373mV)
Cell 5 Voltage-Test: PASS (3375mV)
Cell 6 Voltage-Test: PASS (3373mV)
Cell 7 Voltage-Test: PASS (3376mV)
Cell 8 Voltage-Test: PASS (3377mV)
Cell 9 Voltage-Test: PASS (3370mV)
Cell 10 Voltage-Test: PASS (3391mV)
AMB Temperature-Test: PASS (19deg C)
TB Temperature-Test: PASS (19deg C)
ex.T1 Temperature-Test: PASS (19.0deg C)
ex.T2 Temperature-Test: PASS (19.0deg C)
ex.T3 Temperature-Test: PASS (19.0deg C)
ex.T4 Temperature-Test: PASS (19.0deg C)
ex.T5 Temperature-Test: PASS (20.0deg C)
ex.T6 Temperature-Test: PASS (19.0deg C)
ex.T7 Temperature-Test: PASS (19.0deg C)
ex.T8 Temperature-Test: PASS (19.0deg C)
ex.T9 Temperature-Test: PASS (19.0deg C)
ex.T10 Temperature-Test: PASS (19.0deg C)
ex.T11 Temperature-Test: PASS (19.0deg C)
ex.T12 Temperature-Test: PASS (19.0deg C)
Cell 1 ESR-Test: PASS (518 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

Cell 2 ESR-Test: PASS (527 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

Cell 3 ESR-Test: PASS (581 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

Cell 4 ESR-Test: PASS (527 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

Cell 5 ESR-Test: PASS (545 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

Cell 6 ESR-Test: PASS (563 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

Cell 7 ESR-Test: PASS (563 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

Cell 8 ESR-Test: PASS (572 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

Cell 9 ESR-Test: PASS (609 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

Cell 10 ESR-Test: PASS (745 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 227 ÂµOhm

PCB Serial No. valid: PASS

Test Result: PASS
Battery Type: 508972
PCB Serial No.: 93
Date and time: 2024-06-14 10:35:45

Communication Test: PASS
Cell 1 Voltage-Test: PASS (3380mV)
Cell 2 Voltage-Test: PASS (3372mV)
Cell 3 Voltage-Test: PASS (3375mV)
Cell 4 Voltage-Test: PASS (3378mV)
Cell 5 Voltage-Test: PASS (3368mV)
Cell 6 Voltage-Test: PASS (3372mV)
Cell 7 Voltage-Test: PASS (3369mV)
Cell 8 Voltage-Test: PASS (3369mV)
Cell 9 Voltage-Test: PASS (3367mV)
Cell 10 Voltage-Test: PASS (3376mV)
AMB Temperature-Test: PASS (20deg C)
TB Temperature-Test: PASS (19deg C)
ex.T1 Temperature-Test: PASS (19.0deg C)
ex.T2 Temperature-Test: PASS (19.0deg C)
ex.T3 Temperature-Test: PASS (19.0deg C)
ex.T4 Temperature-Test: PASS (19.0deg C)
ex.T5 Temperature-Test: PASS (20.0deg C)
ex.T6 Temperature-Test: PASS (19.0deg C)
ex.T7 Temperature-Test: PASS (19.0deg C)
ex.T8 Temperature-Test: PASS (19.0deg C)
ex.T9 Temperature-Test: PASS (19.0deg C)
ex.T10 Temperature-Test: PASS (19.0deg C)
ex.T11 Temperature-Test: PASS (20.0deg C)
ex.T12 Temperature-Test: PASS (20.0deg C)
Cell 1 ESR-Test: PASS (437 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

Cell 2 ESR-Test: PASS (510 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

Cell 3 ESR-Test: PASS (528 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

Cell 4 ESR-Test: PASS (537 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

Cell 5 ESR-Test: PASS (510 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

Cell 6 ESR-Test: PASS (546 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

Cell 7 ESR-Test: PASS (555 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

Cell 8 ESR-Test: PASS (555 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

Cell 9 ESR-Test: PASS (574 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

Cell 10 ESR-Test: PASS (528 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 137 ÂµOhm

PCB Serial No. valid: PASS

Test Result: PASS
Battery Type: 508972
PCB Serial No.: 35
Date and time: 2024-06-12 15:12:55

Communication Test: PASS
Cell 1 Voltage-Test: PASS (3385mV)
Cell 2 Voltage-Test: PASS (3377mV)
Cell 3 Voltage-Test: PASS (3377mV)
Cell 4 Voltage-Test: PASS (3374mV)
Cell 5 Voltage-Test: PASS (3376mV)
Cell 6 Voltage-Test: PASS (3382mV)
Cell 7 Voltage-Test: PASS (3372mV)
Cell 8 Voltage-Test: PASS (3380mV)
Cell 9 Voltage-Test: PASS (3377mV)
Cell 10 Voltage-Test: PASS (3383mV)
AMB Temperature-Test: PASS (19deg C)
TB Temperature-Test: PASS (19deg C)
ex.T1 Temperature-Test: PASS (19.0deg C)
ex.T2 Temperature-Test: PASS (19.0deg C)
ex.T3 Temperature-Test: PASS (19.0deg C)
ex.T4 Temperature-Test: PASS (19.0deg C)
ex.T5 Temperature-Test: PASS (19.0deg C)
ex.T6 Temperature-Test: PASS (19.0deg C)
ex.T7 Temperature-Test: PASS (19.0deg C)
ex.T8 Temperature-Test: PASS (19.0deg C)
ex.T9 Temperature-Test: PASS (19.0deg C)
ex.T10 Temperature-Test: PASS (19.0deg C)
ex.T11 Temperature-Test: PASS (20.0deg C)
ex.T12 Temperature-Test: PASS (19.0deg C)
Cell 1 ESR-Test: PASS (527 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

Cell 2 ESR-Test: PASS (518 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

Cell 3 ESR-Test: PASS (545 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

Cell 4 ESR-Test: PASS (554 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

Cell 5 ESR-Test: PASS (545 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

Cell 6 ESR-Test: PASS (545 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

Cell 7 ESR-Test: PASS (563 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

Cell 8 ESR-Test: PASS (581 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

Cell 9 ESR-Test: PASS (581 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

Cell 10 ESR-Test: PASS (709 ÂµOhm)
PASS - ESR deviation in String OK (< 400 ÂµOhm). Is 191 ÂµOhm

PCB Serial No. valid: PASS

Stress test reports

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Final Test Report of Battery Rack

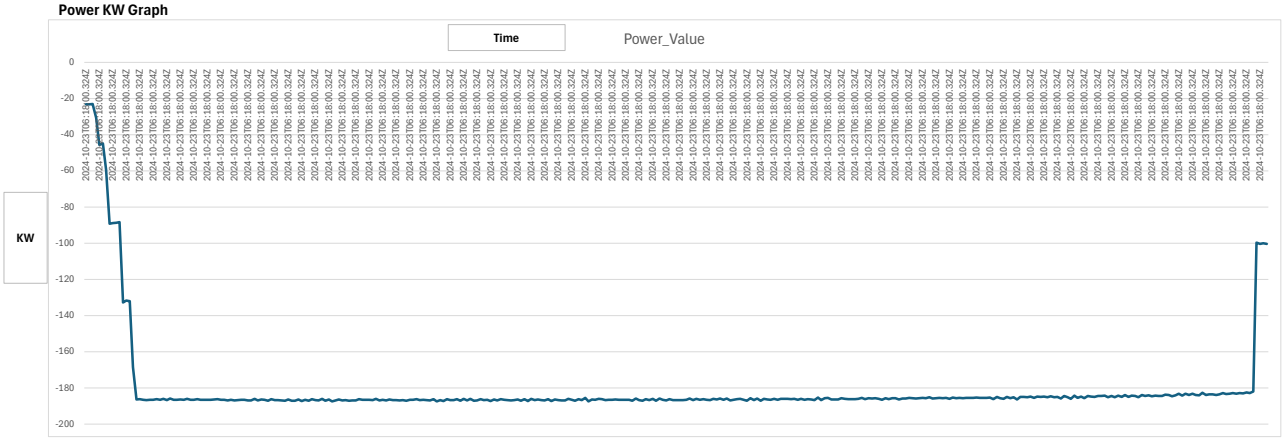
Customer	**Shell**	
Type of Test	Discharge - Battery Rack	
Date of Test	23-Oct-24	
Time -Start	08:16	**Uhr**
Time -Stop	09:27	**Uhr**
Duration of Test	01:11	**Stunde:Min**
Avg. Runing Current	-206.63	**A**
Avg. Runing Power	-180.32	**KW**
SOC Before Test	100.00	**%**
SOC After Test	6.55	**%**
Rack Capacity	280	**Kwh**
Generated Energy	-213.38	**Kwh**

Container 4.2 - Rack 03 -DCPort 02			Before Test Values.				After Test Values			
Module	Artikel	Module Serial No.	Module Voltage1	Max. Cell Voltage1	Min. Cell Voltage1	Max Temperature1	Module Voltage2	Max. Cell Voltage2	Min. Cell Voltage2	Max Temperature2
Serial No.	No.	No.	V	V	V	C°	V	V	V	C°
1	508972	FRQ-508972000308	3.4443	3.446	3.442	17	3.1085	3.120	3.090	40.0
2	509344	FRQ-509344000373	3.4523	3.455	3.442	18	3.0992	3.116	3.015	43.0
3	509344	FRQ-509344000379	3.4443	3.451	3.441	18	3.1029	3.123	3.009	40.0
4	509344	FRQ-509344000356	3.4501	3.452	3.445	18	3.09	3.110	3.025	41.0
5	509344	FRQ-509344000380	3.4466	3.455	3.439	18	3.092	3.113	3.012	40.0
6	509344	FRQ-509344000390	3.4424	3.45	3.434	17	3.1	3.115	3.022	40.0
7	509344	FRQ-509344000400	3.4441	3.454	3.441	19	3.0738	3.093	2.976	42.0
8	509344	FRQ-509344000401	3.4456	3.451	3.442	16	3.0842	3.105	2.994	39.0
9	508972	FRQ-508972001573	3.4421	3.445	3.439	17	3.1045	3.112	3.100	39.0
10	509344	FRQ-509344000381	3.4432	3.451	3.439	17	3.0923	3.116	2.977	38.0
11	509344	FRQ-509344000357	3.4513	3.454	3.446	16	3.0928	3.115	3.011	36.0
12	509344	FRQ-509344000378	3.4455	3.453	3.441	16	3.1071	3.124	3.046	37.0
13	509344	FRQ-509344000372	3.4524	3.457	3.446	16	3.1065	3.128	3.038	36.0
14	508972	FRQ-508972000576	3.4483	3.451	3.447	16	3.1222	3.131	3.103	39.0
15	509344	FRQ-509344000398	3.4432	3.448	3.439	16	3.0957	3.111	3.031	39.0
16	509344	FRQ-509344000374	3.4513	3.454	3.444	17	3.1017	3.115	3.041	40.0
17	509344	FRQ-509344000377	3.4487	3.452	3.44	18	3.1079	3.126	3.082	42.0
18	509344	FRQ-509344000358	3.4479	3.451	3.445	18	3.0981	3.115	3.044	41.0
19	509344	FRQ-509344000382	3.4424	3.454	3.437	19	3.1048	3.125	3.055	48.0
20	508972	FRQ-508972001574	3.4413	3.451	3.435	19	3.103	3.114	3.075	42.0
21	509344	FRQ-509344000402	3.4429	3.449	3.438	19	3.0796	3.103	3.013	41.0
22	508972	FRQ-508972001572	3.4375	3.448	3.433	18	3.0728	3.112	3.052	40.0
23	509344	FRQ-509344000347	3.4463	3.45	3.441	17	3.0771	3.099	2.989	40.0
24	509344	FRQ-509344000383	3.4424	3.449	3.438	17	3.0793	3.110	2.936	40.0
25	508972	FRQ-508972000050	3.4463	3.454	3.442	17	3.1189	3.128	3.085	40.0
26	509344	FRQ-509344000376	3.4483	3.451	3.442	18	3.1059	3.122	3.079	41.0
27	509344	FRQ-509344000391	3.4433	3.449	3.44	19	3.1099	3.124	3.054	46.0
28	508972	FRQ-508972001508	3.4444	3.454	3.439	18	3.1036	3.116	3.067	41.0

Database Results



Power KW Graph



Final Test Report of Battery Rack

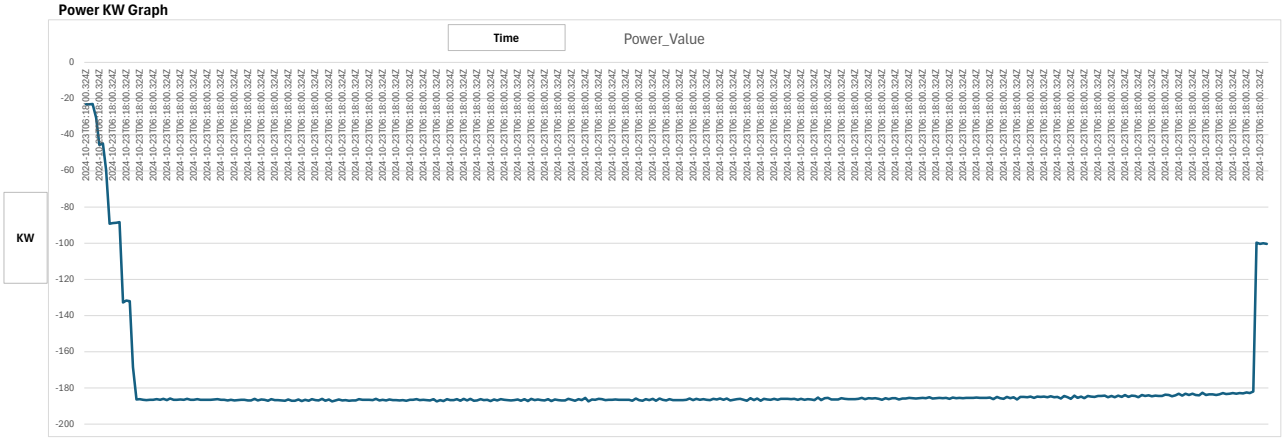
Customer	**Shell**	
Type of Test	Discharge - Battery Rack	
Date of Test	23-Oct-24	
Time -Start	08:16	**Uhr**
Time -Stop	09:27	**Uhr**
Duration of Test	01:11	**Stunde:Min**
Avg. Runing Current	-205.17	**A**
Avg. Runing Power	-180.32	**KW**
SOC Before Test	100.00	**%**
SOC After Test	5.87	**%**
Rack Capacity	280	**Kwh**
Generated Energy	-213.38	**Kwh**

Container 4.2 - Rack 03 -DCPort 02			Before Test Values.				After Test Values			
Module	Artikel	Module Serial No.	Module Voltage1	Max. Cell Voltage1	Min. Cell Voltage1	Max Temperature1	Module Voltage2	Max. Cell Voltage2	Min. Cell Voltage2	Max Temperature2
Serial No.	No.	No.	V	V	V	C°	V	V	V	C°
1	509344	FRQ-509344000514	3.4465	3.455	3.441	17	3.112	3.124	3.080	40.0
2	509344	FRQ-509344000526	3.452	3.455	3.448	17	3.114	3.123	3.087	39.0
3	509344	FRQ-509344000359	3.4521	3.455	3.444	17	3.112	3.123	3.075	40.0
4	509344	FRQ-509344000339	3.4485	3.452	3.445	17	3.111	3.122	3.078	39.0
5	509344	FRQ-509344000492	3.449	3.45	3.448	17	3.094	3.111	3.059	41.0
6	509344	FRQ-509344000531	3.4483	3.451	3.443	17	3.086	3.113	3.049	39.0
7	509344	FRQ-509344000535	3.4448	3.45	3.44	17	3.087	3.100	3.030	38.0
8	509344	FRQ-509344000534	3.4467	3.455	3.442	16	3.089	3.108	3.057	38.0
9	509344	FRQ-509344000538	3.4478	3.451	3.445	17	3.089	3.113	3.043	38.0
10	509344	FRQ-509344000491	3.4514	3.458	3.447	16	3.106	3.125	3.059	38.0
11	509344	FRQ-509344000360	3.4463	3.454	3.441	16	3.114	3.133	3.062	36.0
12	509344	FRQ-509344000363	3.447	3.451	3.442	16	3.116	3.126	3.073	37.0
13	509344	FRQ-509344000386	3.4428	3.449	3.439	16	3.111	3.123	3.063	37.0
14	509344	FRQ-509344000349	3.4492	3.452	3.447	16	3.103	3.115	3.058	39.0
15	509344	FRQ-509344000512	3.4442	3.45	3.441	17	3.104	3.113	3.066	38.0
16	509344	FRQ-509344000524	3.4447	3.449	3.441	17	3.109	3.115	3.083	39.0
17	509344	FRQ-509344000362	3.4464	3.451	3.44	17	3.109	3.117	3.081	40.0
18	509344	FRQ-509344000341	3.4485	3.453	3.445	18	3.107	3.128	3.069	41.0
19	509344	FRQ-509344000493	3.4476	3.449	3.446	18	3.087	3.112	3.037	40.0
20	509344	FRQ-509344000537	3.4446	3.449	3.44	18	3.090	3.102	3.037	40.0
21	509344	FRQ-509344000533	3.4437	3.452	3.438	17	3.089	3.106	3.069	39.0
22	509344	FRQ-509344000532	3.4433	3.45	3.437	18	3.072	3.092	3.035	39.0
23	509344	FRQ-509344000536	3.4413	3.449	3.436	16	3.086	3.106	3.019	39.0
24	509344	FRQ-509344000494	3.4462	3.45	3.442	17	3.080	3.106	3.027	40.0
25	509344	FRQ-509344000342	3.4438	3.452	3.44	17	3.096	3.116	2.990	40.0
26	509344	FRQ-509344000348	3.4471	3.449	3.445	18	3.096	3.113	3.038	41.0
27	509344	FRQ-509344000525	3.4445	3.448	3.44	17	3.103	3.112	3.061	40.0
28	509344	FRQ-509344000513	3.4435	3.451	3.439	17	3.100	3.112	3.038	40.0

Database Results



Power KW Graph

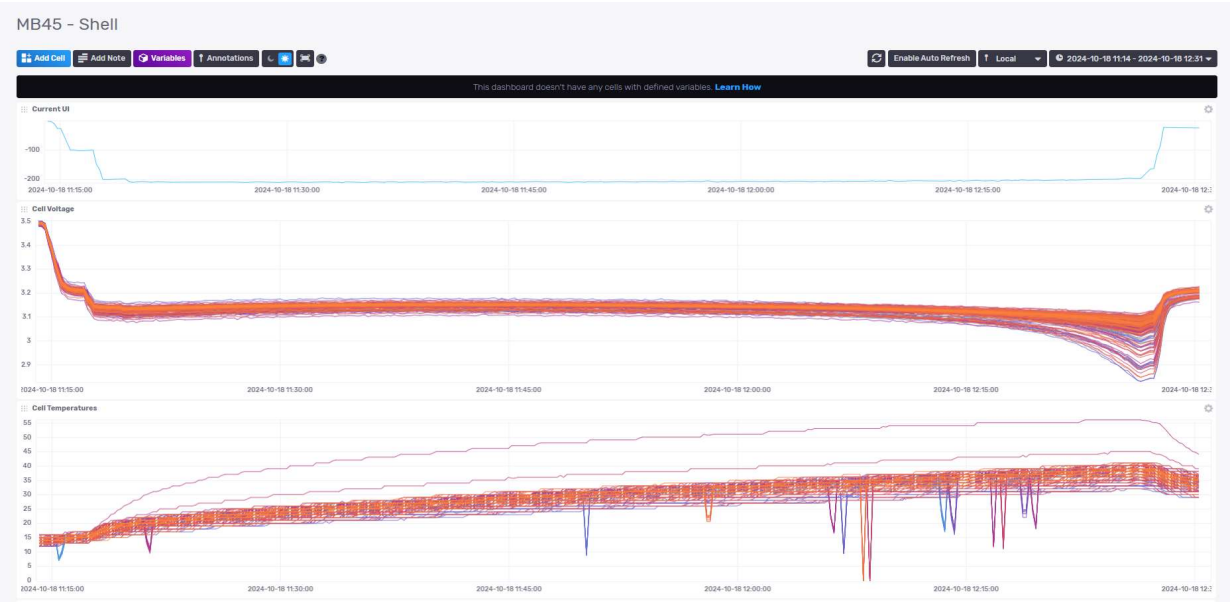


Final Test Report of Battery Rack

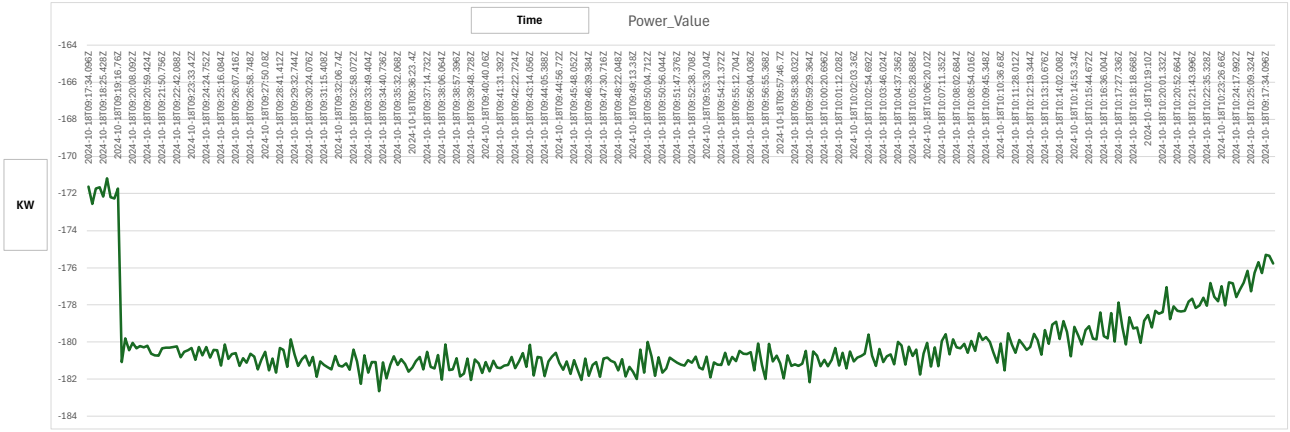
Customer	**Shell**	
Type of Test	Discharge - Battery Rack	
Date of Test	18-Oct-24	
Time -Start	11:14	**Uhr**
Time -Stop	12:31	**Uhr**
Duration of Test	01:17	**Stunde:Min**
Avg. Runing Current	-204.39	**A**
Avg. Runing Power	-180.14	**KW**
SOC Before Test	100.00	**%**
SOC After Test	12	**%**
Rack Capacity	280	**Kwh**
Generated Energy	-231.18	**Kwh**

Container 4.2 - Rack 05 -DCPort 03			Before Test Values.				After Test Values			
Module Serial No.	Artikel No.	Module Serial No.	Module Voltage1 V	Max. Cell Voltage1 V	Min. Cell Voltage1 V	Max Temperature1 C°	Module Voltage2 V	Max. Cell Voltage2 V	Min. Cell Voltage2 V	Max Temperature2 C°
1	509344	FRQ-509344000431	3.576	3.578	3.575	16.0	3.058	3.090	2.981	40.0
2	509344	FRQ-509344000432	3.571	3.572	3.569	15.0	3.068	3.092	2.967	39.0
3	509344	FRQ-509344000405	3.570	3.572	3.567	14.0	3.035	3.068	2.884	39.0
4	509344	FRQ-509344000407	3.571	3.572	3.569	15.0	3.039	3.081	2.891	40.0
5	509344	FRQ-509344000353	3.570	3.574	3.567	15.0	3.024	3.061	2.882	40.0
6	508972	FRQ-508972001539	3.571	3.572	3.569	15.0	3.095	3.107	3.076	39.0
7	509344	FRQ-509344000392	3.573	3.574	3.571	15.0	3.014	3.065	2.820	41.0
8	509344	FRQ-509344000393	3.573	3.576	3.571	14.0	3.025	3.072	2.812	39.0
9	509344	FRQ-509344000369	3.573	3.575	3.572	14.0	3.029	3.061	2.961	37.0
10	509344	FRQ-509344000354	3.574	3.575	3.573	14.0	3.029	3.066	2.880	37.0
11	509344	FRQ-509344000406	3.575	3.579	3.572	15.0	3.031	3.069	2.865	36.0
12	509344	FRQ-509344000409	3.574	3.575	3.572	15.0	3.062	3.075	3.032	38.0
13	509344	FRQ-509344000433	3.574	3.576	3.572	14.0	3.052	3.092	2.946	36.0
14	509344	FRQ-509344000430	3.577	3.579	3.576	15.0	3.048	3.079	2.863	39.0
15	509344	FRQ-509344000429	3.576	3.577	3.574	14.0	3.063	3.090	2.961	39.0
16	509344	FRQ-509344000435	3.577	3.578	3.575	15.0	3.046	3.082	2.920	40.0
17	509344	FRQ-509344000082	3.576	3.578	3.575	15.0	3.062	3.095	2.912	39.0
18	508972	FRQ-508972000274	3.577	3.578	3.575	14.0	3.110	3.123	3.089	39.0
19	509344	FRQ-509344000355	3.577	3.579	3.576	15.0	3.044	3.094	2.855	40.0
20	509344	FRQ-509344000371	3.576	3.579	3.574	16.0	3.033	3.083	2.894	40.0
21	509344	FRQ-509344000394	3.578	3.579	3.576	16.0	3.049	3.081	2.949	40.0
22	509344	FRQ-509344000395	3.578	3.580	3.576	16.0	3.038	3.085	2.869	40.0
23	509344	FRQ-509344000370	3.577	3.579	3.575	16.0	3.039	3.096	2.936	41.0
24	508972	FRQ-508972000459	3.578	3.581	3.576	16.0	3.109	3.123	3.072	39.0
25	509344	FRQ-509344000404	3.578	3.580	3.576	15.0	3.079	3.108	2.980	40.0
26	509344	FRQ-509344000411	3.577	3.579	3.575	16.0	3.056	3.091	2.893	40.0
27	509344	FRQ-509344000434	3.578	3.580	3.576	16.0	3.070	3.115	2.860	41.0
28	509344	FRQ-509344000428	3.577	3.580	3.575	15.0	3.067	3.097	2.951	40.0

Database Results



Power KW Graph



Final Test Report of Battery Rack

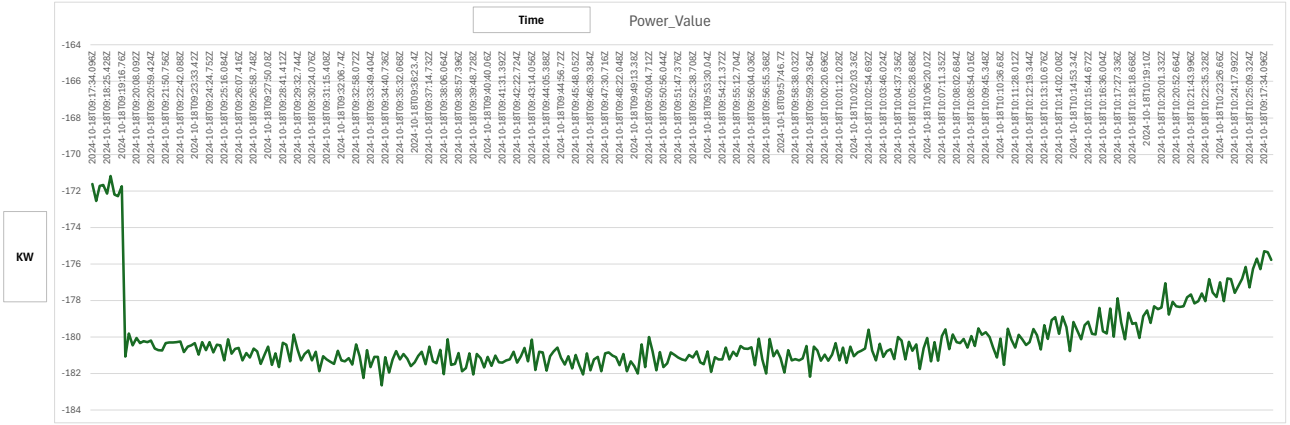
Customer	**Shell**	
Type of Test	Discharge - Battery Rack	
Date of Test	18-Oct-24	
Time -Start	11:14	**Uhr**
Time -Stop	12:31	**Uhr**
Duration of Test	01:17	**Stunde:Min**
Avg. Runing Current	-203.38	**A**
Avg. Runing Power	-180.14	**KW**
SOC Before Test	100.00	**%**
SOC After Test	12	**%**
Rack Capacity	280	**Kwh**
Generated Energy	-231.18	**Kwh**

Container 4.2 - Rack 06 - DCPort 03			Before Test Values.				After Test Values			
Module Serial No.	Artikel No.	Module Serial No.	Module Voltage1 V	Max. Cell Voltage1 V	Min. Cell Voltage1 V	Max Temperature1 C°	Module Voltage2 V	Max. Cell Voltage2 V	Min. Cell Voltage2 V	Max Temperature2 C°
1	509344	FRQ-509344000500	3.577	3.579	3.574	15.0	3.062	3.080	2.996	40.0
2	509344	FRQ-509344000499	3.578	3.579	3.574	15.0	3.058	3.078	3.001	40.0
3	509344	FRQ-509344000517	3.578	3.579	3.576	15.0	3.063	3.081	3.003	41.0
4	509344	FRQ-509344000487	3.578	3.580	3.575	15.0	3.043	3.070	2.988	41.0
5	509344	FRQ-509344000010	3.578	3.579	3.576	15.0	3.081	3.094	3.053	41.0
6	509344	FRQ-509344000495	3.577	3.580	3.576	14.0	3.016	3.052	2.967	40.0
7	509344	FRQ-509344000486	3.578	3.580	3.576	14.0	2.991	3.026	2.936	39.0
8	508972	FRQ-508972000379	3.579	3.581	3.577	13.0	3.072	3.084	3.028	40.0
9	509344	FRQ-509344000498	3.578	3.580	3.576	14.0	3.009	3.050	2.959	39.0
10	509344	FRQ-509344000527	3.578	3.581	3.576	14.0	3.055	3.089	3.004	39.0
11	509344	FRQ-509344000488	3.579	3.580	3.577	13.0	3.048	3.077	3.006	36.0
12	509344	FRQ-509344000518	3.577	3.579	3.574	14.0	3.067	3.080	3.009	37.0
13	509344	FRQ-509344000501	3.577	3.578	3.576	13.0	3.058	3.080	3.034	36.0
14	509344	FRQ-509344000504	3.576	3.578	3.569	14.0	3.062	3.085	2.969	39.0
15	509344	FRQ-509344000505	3.576	3.579	3.574	14.0	3.042	3.075	3.003	39.0
16	509344	FRQ-509344000502	3.577	3.579	3.576	14.0	3.076	3.095	3.056	41.0
17	509344	FRQ-509344000515	3.577	3.579	3.574	15.0	3.083	3.104	3.036	42.0
18	509344	FRQ-509344000489	3.576	3.577	3.575	15.0	3.071	3.102	3.019	41.0
19	509344	FRQ-509344000528	3.574	3.576	3.572	16.0	3.057	3.090	3.011	46.0
20	509344	FRQ-509344000497	3.573	3.575	3.572	15.0	3.033	3.081	2.971	41.0
21	509344	FRQ-509344000484	3.574	3.575	3.572	16.0	3.027	3.069	2.972	40.0
22	509344	FRQ-509344000483	3.574	3.576	3.573	15.0	3.013	3.054	2.975	41.0
23	509344	FRQ-509344000496	3.575	3.577	3.574	15.0	3.052	3.083	3.006	41.0
24	509344	FRQ-509344000529	3.576	3.579	3.574	15.0	3.071	3.093	3.035	40.0
25	509344	FRQ-509344000490	3.575	3.577	3.573	14.0	3.072	3.097	3.023	40.0
26	509344	FRQ-509344000516	3.576	3.577	3.574	15.0	3.090	3.099	3.068	41.0
27	508972	FRQ-508972001571	3.571	3.578	3.567	16.0	3.086	3.095	3.062	40.0
28	508972	FRQ-508972001492	3.576	3.578	3.575	16.0	3.084	3.092	3.072	40.0

Database Results



Power KW Graph



Final Test Report of Battery Rack

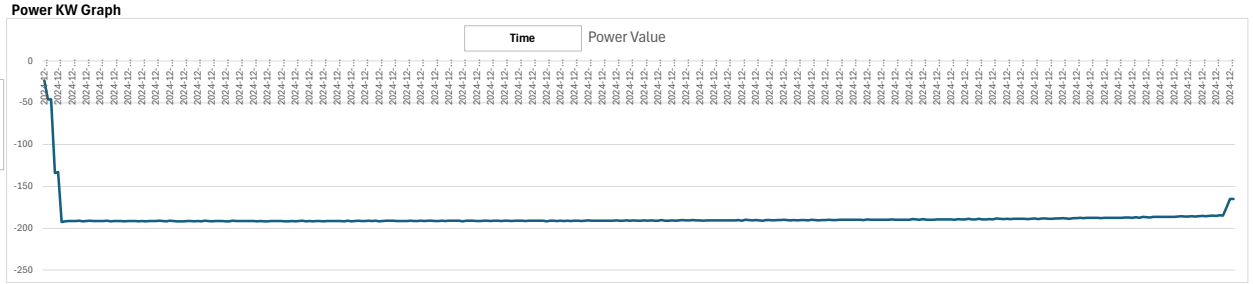
Customer	**Shell**	
Type of Test	Discharge - Battery Rack	
Date of Test	01-Dec-24	
Time -Start	10:45	**Uhr**
Time -Stop	12:01	**Uhr**
Duration of Test	01:16	**Stunde:Min**
Avg. Runing Current	-214.68	**A**
Avg. Runing Power	-188.32	**KW**
SOC Before Test	100.00	**%**
SOC After Test	3.33	**%**
Rack Capacity	280	**Kwh**
Generated Energy	-238.54	**Kwh**

Container 4.1 - Rack 07 - DCPort 04			Before Test Values.				After Test Values			
Module	Artikel	Module Serial No.	Module Voltage1	Max. Cell Voltage1	Min. Cell Voltage1	Max Temperature1	Module Voltage2	Max. Cell Voltage2	Min. Cell Voltage2	Max Temperature2
Serial No.	No.	No.	V	V	V	C°	V	V	V	C°
1	508972	FRQ-508972000280	3.554	3.562	3.544	21.0	3.081	3.088	3.067	46.0
2	509344	FRQ-509344000098	3.563	3.564	3.562	21.0	3.069	3.085	3.009	46.0
3	509344	FRQ-509344000194	3.563	3.564	3.562	21.0	3.084	3.090	3.065	46.0
4	509344	FRQ-509344000120	3.563	3.565	3.560	21.0	3.065	3.087	2.971	46.0
5	509344	FRQ-509344000195	3.563	3.564	3.562	20.0	3.085	3.091	3.066	45.0
6	509344	FRQ-509344000199	3.563	3.564	3.562	21.0	3.081	3.087	3.063	46.0
7	509344	FRQ-509344000203	3.563	3.564	3.561	21.0	3.073	3.083	3.043	46.0
8	509344	FRQ-509344000202	3.563	3.564	3.562	21.0	3.079	3.084	3.060	46.0
9	509344	FRQ-509344000198	3.563	3.564	3.562	20.0	3.076	3.088	3.014	45.0
10	509344	FRQ-509344000174	3.563	3.564	3.562	20.0	3.062	3.084	2.980	45.0
11	509344	FRQ-509344000119	3.563	3.564	3.562	19.0	3.068	3.092	2.993	39.0
12	509344	FRQ-509344000185	3.563	3.564	3.562	20.0	3.087	3.110	3.067	41.0
13	509344	FRQ-509344000100	3.564	3.564	3.563	20.0	3.062	3.085	2.962	41.0
14	509344	FRQ-509344000105	3.562	3.564	3.560	21.0	3.062	3.087	2.975	46.0
15	509344	FRQ-509344000110	3.563	3.564	3.562	20.0	3.063	3.100	2.968	45.0
16	509344	FRQ-509344000099	3.562	3.564	3.561	20.0	3.068	3.090	2.978	46.0
17	509344	FRQ-509344000184	3.562	3.564	3.561	21.0	3.083	3.091	3.059	46.0
18	509344	FRQ-509344000117	3.562	3.564	3.561	20.0	3.060	3.082	2.970	46.0
19	509344	FRQ-509344000196	3.562	3.564	3.561	21.0	3.080	3.085	3.062	47.0
20	508972	FRQ-508972000692	3.562	3.564	3.560	21.0	3.068	3.081	3.050	46.0
21	509344	FRQ-509344000204	3.563	3.564	3.561	21.0	3.075	3.085	3.054	47.0
22	509344	FRQ-509344000205	3.562	3.564	3.560	21.0	3.069	3.082	3.051	46.0
23	509344	FRQ-509344000201	3.563	3.565	3.561	21.0	3.074	3.083	3.061	46.0
24	509344	FRQ-509344000197	3.562	3.564	3.560	20.0	3.080	3.088	3.058	45.0
25	509344	FRQ-509344000118	3.562	3.564	3.560	20.0	3.055	3.082	2.948	45.0
26	509344	FRQ-509344000175	3.562	3.564	3.561	21.0	3.056	3.087	2.938	47.0
27	509344	FRQ-509344000097	3.563	3.564	3.561	21.0	3.054	3.078	2.951	46.0
28	509344	FRQ-509344000111	3.563	3.564	3.561	21.0	3.060	3.097	2.943	47.0

Database Results



Power KW Graph

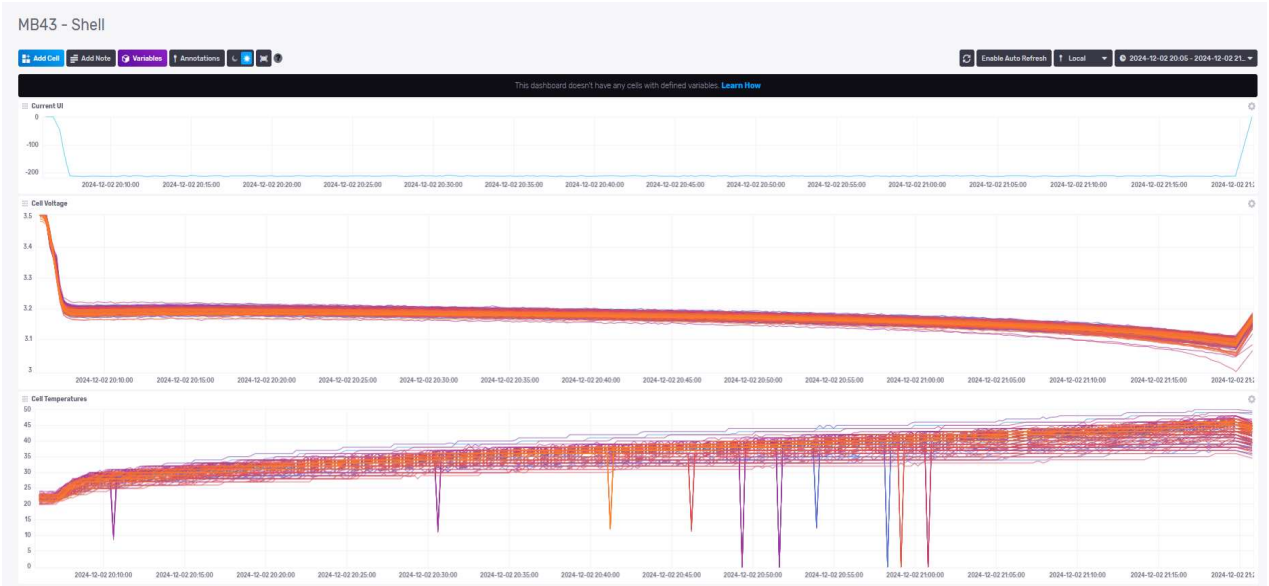


Final Test Report of Battery Rack

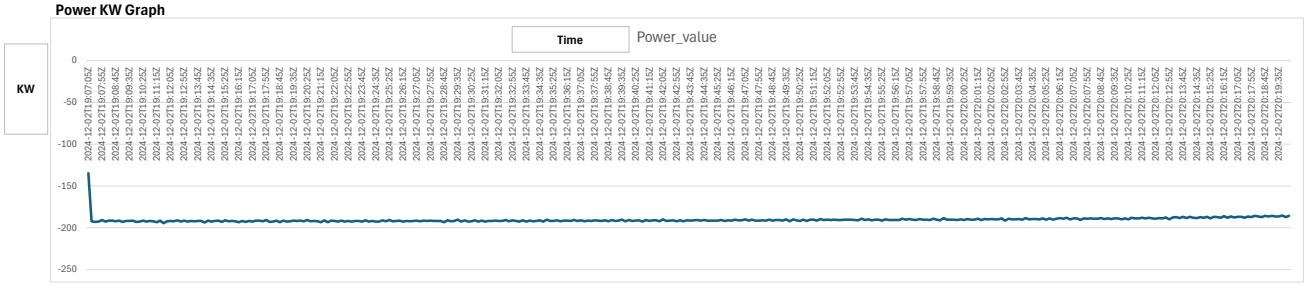
Customer	**Shell**	
Type of Test	Discharge - Battery Rack	
Date of Test	02-Dec-24	
Time -Start	20:07	**Uhr**
Time -Stop	21:20	**Uhr**
Duration of Test	01:13	**Stunde:Min**
Avg. Runing Current	-211.43	**A**
Avg. Runing Power	-190.43	**KW**
SOC Before Test	100.00	**%**
SOC After Test	7.23	**%**
Rack Capacity	280	**Kwh**
Generated Energy	-231.69	**Kwh**

Container 4.1 - Rack 03 - DCPort 02			Before Test Values.				After Test Values			
Module Serial No.	Artikel No.	Module Serial No.	Module Voltage1 V	Max. Cell Voltage1 V	Min. Cell Voltage1 V	Max Temperature1 C°	Module Voltage2 V	Max. Cell Voltage2 V	Min. Cell Voltage2 V	Max Temperature2 C°
1	508972	FRQ-508972000285	3.502	3.503	3.501	22.0	3.093	3.103	3.073	46.0
2	508972	FRQ-508972000302	3.502	3.503	3.501	23.0	3.093	3.098	3.079	46.0
3	508972	FRQ-508972000471	3.502	3.504	3.499	23.0	3.098	3.111	3.081	46.0
4	508972	FRQ-508972000410	3.502	3.503	3.501	22.0	3.093	3.101	3.075	46.0
5	508972	FRQ-508972000726	3.502	3.503	3.501	22.0	3.092	3.097	3.071	49.0
6	508972	FRQ-508972000469	3.503	3.503	3.502	22.0	3.089	3.095	3.074	46.0
7	508972	FRQ-508972000765	3.502	3.503	3.501	22.0	3.088	3.097	3.066	46.0
8	508972	FRQ-508972000314	3.502	3.503	3.501	22.0	3.089	3.097	3.067	46.0
9	508972	FRQ-508972000284	3.502	3.504	3.500	22.0	3.092	3.104	3.070	45.0
10	508972	FRQ-508972000303	3.502	3.503	3.501	22.0	3.095	3.107	3.082	45.0
11	508972	FRQ-508972000396	3.502	3.503	3.502	22.0	3.098	3.106	3.072	42.0
12	508972	FRQ-508972001027	3.502	3.503	3.501	22.0	3.092	3.106	3.070	42.0
13	508972	FRQ-508972000533	3.502	3.503	3.501	22.0	3.096	3.105	3.082	42.0
14	508972	FRQ-508972001445	3.502	3.503	3.501	22.0	3.085	3.094	3.052	45.0
15	509344	FRQ-509344000085	3.502	3.503	3.501	22.0	3.089	3.105	3.036	45.0
16	508972	FRQ-508972001450	3.503	3.506	3.502	22.0	3.090	3.098	3.062	48.0
17	508972	FRQ-508972000711	3.502	3.503	3.501	22.0	3.093	3.098	3.083	50.0
18	508972	FRQ-508972000319	3.502	3.503	3.502	22.0	3.093	3.102	3.083	46.0
19	508972	FRQ-508972000702	3.503	3.504	3.501	23.0	3.089	3.102	3.070	48.0
20	508972	FRQ-508972000035	3.503	3.503	3.502	23.0	3.071	3.099	2.961	48.0
21	508972	FRQ-508972000350	3.503	3.505	3.501	22.0	3.127	3.131	3.116	46.0
22	508972	FRQ-508972000545	3.502	3.503	3.501	23.0	3.132	3.142	3.121	46.0
23	508972	FRQ-508972000393	3.502	3.503	3.501	23.0	3.130	3.132	3.122	46.0
24	508972	FRQ-508972000529	3.502	3.503	3.501	23.0	3.134	3.142	3.119	46.0
25	508972	FRQ-508972000934	3.502	3.503	3.501	23.0	3.100	3.142	3.084	45.0
26	508972	FRQ-508972000723	3.502	3.503	3.501	23.0	3.167	3.170	3.161	46.0
27	508972	FRQ-508972000400	3.502	3.503	3.501	23.0	3.165	3.168	3.163	47.0
28	509344	FRQ-509344000530	3.497	3.503	3.483	24.0	3.156	3.160	3.146	47.0

Database Results



Power KW Graph



Final Test Report of Battery Rack

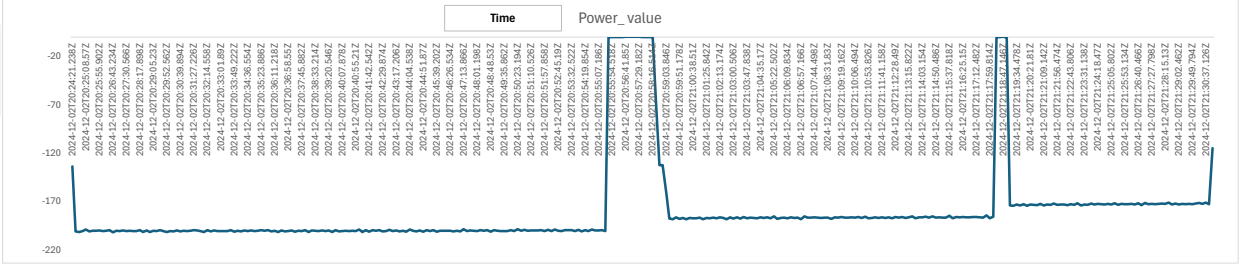
Customer	**Shell**	
Type of Test	Discharge - Battery Rack	
Date of Test	02-Dec-24	
Time -Start	21:25	**Uhr**
Time -Stop	22:33	**Uhr**
Duration of Test	01:08	**Stunde:Min**
Avg. Runing Current	-211.43	**A**
Avg. Runing Power	-183.93	**KW**
SOC Before Test	100.00	**%**
SOC After Test	19.88	**%**
Rack Capacity	280	**Kwh**
Generated Energy	-208.45	**Kwh**

Container 4.1 - Rack 05 - DCPort 03			Before Test Values.				After Test Values			
Module Serial No.	Artikel No.	Module Serial No.	Module Voltage1 V	Max. Cell Voltage1 V	Min. Cell Voltage1 V	Max Temperature1 C°	Module Voltage2 V	Max. Cell Voltage2 V	Min. Cell Voltage2 V	Max Temperature2 C°
1	509344	FRQ-509344000124	3.555	3.562	3.552	23.0	3.081	3.088	3.067	46.0
2	509344	FRQ-509344000191	3.559	3.563	3.556	23.0	3.069	3.085	3.009	46.0
3	509344	FRQ-509344000163	3.560	3.562	3.559	23.0	3.084	3.090	3.065	46.0
4	509344	FRQ-509344000149	3.556	3.559	3.554	23.0	3.065	3.087	2.971	46.0
5	509344	FRQ-509344000102	3.555	3.558	3.553	22.0	3.085	3.091	3.066	45.0
6	509344	FRQ-509344000193	3.554	3.557	3.551	22.0	3.081	3.087	3.063	46.0
7	509344	FRQ-509344000096	3.555	3.558	3.552	22.0	3.073	3.083	3.043	46.0
8	509344	FRQ-509344000095	3.556	3.560	3.554	21.0	3.079	3.084	3.060	46.0
9	509344	FRQ-509344000192	3.559	3.561	3.555	22.0	3.076	3.088	3.014	45.0
10	509344	FRQ-509344000101	3.554	3.559	3.551	22.0	3.062	3.084	2.980	45.0
11	509344	FRQ-509344000150	3.557	3.560	3.554	22.0	3.068	3.092	2.993	39.0
12	509344	FRQ-509344000352	3.546	3.551	3.543	22.0	3.087	3.110	3.067	41.0
13	509344	FRQ-509344000190	3.559	3.561	3.556	22.0	3.062	3.085	2.962	41.0
14	509344	FRQ-509344000125	3.556	3.559	3.553	22.0	3.062	3.087	2.975	46.0
15	509344	FRQ-509344000123	3.556	3.560	3.553	22.0	3.063	3.100	2.968	45.0
16	509344	FRQ-509344000189	3.559	3.561	3.557	22.0	3.068	3.090	2.978	46.0
17	509344	FRQ-509344000165	3.556	3.560	3.553	22.0	3.083	3.091	3.059	46.0
18	509344	FRQ-509344000151	3.557	3.561	3.554	22.0	3.060	3.082	2.970	46.0
19	509344	FRQ-509344000112	3.558	3.562	3.554	22.0	3.080	3.085	3.062	47.0
20	509344	FRQ-509344000187	3.560	3.562	3.558	19.0	3.068	3.081	3.050	46.0
21	509344	FRQ-509344000094	3.556	3.561	3.551	22.0	3.075	3.085	3.054	47.0
22	509344	FRQ-509344000093	3.554	3.559	3.552	23.0	3.069	3.082	3.051	46.0
23	509344	FRQ-509344000186	3.559	3.561	3.555	23.0	3.074	3.083	3.061	46.0
24	509344	FRQ-509344000113	3.555	3.559	3.552	23.0	3.080	3.088	3.058	45.0
25	508972	FRQ-508972001046	3.556	3.559	3.554	22.0	3.055	3.082	2.948	45.0
26	509344	FRQ-509344000166	3.553	3.555	3.545	23.0	3.056	3.087	2.938	47.0
27	509344	FRQ-509344000188	3.559	3.561	3.557	23.0	3.054	3.078	2.951	46.0
28	509344	FRQ-509344000122	3.555	3.561	3.551	23.0	3.060	3.097	2.943	47.0

Database Results



Power KW Graph



Final Test Report of Battery Rack

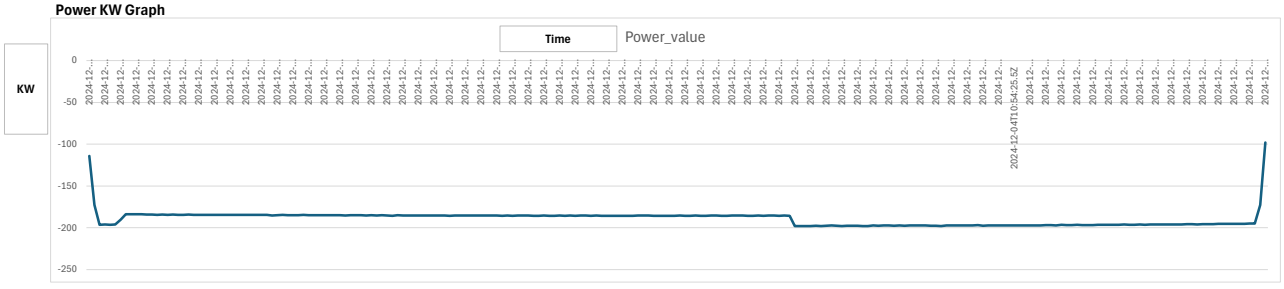
Customer	**Shell**	
Type of Test	Discharge - Battery Rack	
Date of Test	04-Dec-24	
Time -Start	11:05	**Uhr**
Time -Stop	12:07	**Uhr**
Duration of Test	01:02	**Stunde:Min**
Avg. Runing Current	-214.83	**A**
Avg. Runing Power	-189.06	**KW**
SOC Before Test	100.00	**%**
SOC After Test	19.46	**%**
Rack Capacity	280	**Kwh**
Generated Energy	-195.36	**Kwh**

Container 4.1 - Rack 07/Rack22 - DCPort 04			Before Test Values.				After Test Values			
Module Serial No.	Artikel No.	Module Serial No.	Module Voltage1 V	Max. Cell Voltage1 V	Min. Cell Voltage1 V	Max Temperature1 C°	Module Voltage2 V	Max. Cell Voltage2 V	Min. Cell Voltage2 V	Max Temperature2 C°
1	509344	FRQ-509344000542	3.576	3.577	3.572	21.0	3.119	3.126	3.088	43.0
2	509344	FRQ-509344000546	3.577	3.579	3.575	21.0	3.128	3.134	3.110	43.0
3	509344	FRQ-509344000550	3.576	3.578	3.574	21.0	3.132	3.140	3.116	43.0
4	509344	FRQ-509344000553	3.576	3.578	3.572	21.0	3.134	3.152	3.099	42.0
5	508972	FRQ-508972000772	3.571	3.572	3.569	8.0	3.083	3.097	3.062	40.0
6	509344	FRQ-509344000086	3.569	3.572	3.568	8.0	3.090	3.102	3.060	36.0
7	509344	FRQ-509344000040	3.572	3.574	3.570	7.0	3.083	3.095	3.071	34.0
8	509344	FRQ-509344000308	3.574	3.577	3.569	6.0	3.081	3.091	3.053	35.0
9	508972	FRQ-508972000054	3.571	3.573	3.569	8.0	3.085	3.094	3.056	37.0
10	509344	FRQ-509344000410	3.569	3.575	3.565	8.0	3.058	3.072	3.007	38.0
11	508972	FRQ-508972001017	3.572	3.575	3.561	10.0	3.078	3.085	3.052	44.0
12	509344	FRQ-509344000549	3.576	3.578	3.573	22.0	3.129	3.138	3.112	44.0
13	509344	FRQ-509344000545	3.575	3.578	3.574	22.0	3.123	3.149	3.078	44.0
14	509344	FRQ-509344000540	3.575	3.578	3.573	21.0	3.113	3.121	3.084	44.0
15	509344	FRQ-509344000541	3.577	3.579	3.575	21.0	3.105	3.114	3.080	44.0
16	509344	FRQ-509344000543	3.569	3.571	3.567	22.0	3.135	3.153	3.109	43.0
17	509344	FRQ-509344000547	3.575	3.578	3.573	22.0	3.135	3.142	3.115	43.0
18	509344	FRQ-509344000552	3.571	3.572	3.570	22.0	3.113	3.121	3.090	44.0
19	509344	FRQ-509344000078	3.573	3.575	3.570	9.0	3.106	3.115	3.061	39.0
20	509344	FRQ-509344000200	3.570	3.572	3.565	7.0	3.105	3.114	3.082	37.0
21	509344	FRQ-509344000351	3.568	3.574	3.566	8.0	2.993	3.024	2.924	37.0
22	509344	FRQ-509344000485	3.568	3.571	3.567	8.0	3.030	3.060	2.972	34.0
23	508972	FRQ-508972000182	3.571	3.573	3.567	9.0	3.087	3.098	3.052	38.0
24	508972	FRQ-508972000336	3.572	3.575	3.569	9.0	3.086	3.110	3.072	40.0
25	509344	FRQ-509344000551	3.575	3.576	3.573	21.0	3.132	3.153	3.108	44.0
26	509344	FRQ-509344000548	3.574	3.577	3.572	21.0	3.132	3.139	3.113	42.0
27	509344	FRQ-509344000544	3.575	3.577	3.573	21.0	3.122	3.133	3.090	43.0
28	509344	FRQ-509344000539	3.576	3.578	3.573	20.0	3.125	3.132	3.107	42.0

Database Results



Power KW Graph



STATRON
NON STOP POWER

Surface Preparation & Painting Specification

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

SDRL Code: J04
Sequence Number: 001
Rev: 001
Document number: K559-2254-CWIWP4202201-J04-001
Document description: Surface Preparation & Painting Specification

Revision	Date	Name	Description
001	17.03.2023	CPA / ADI	First Version

STATRON AG | Almuesenacherstrasse 1 | 5506 Mägenwil | Switzerland | T: +41 (0)62 88748 87 | statron@statron.com | www.statron.com

Surface Preparation & Painting Specification
J04

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	J04
Document name	Surface Preparation & Painting Specification
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2023-03-13	M. Maaz	First version

Table 1: Version overview

	Date	Name
Editor	2023-03-13	M. Maaz
Checked by	2023-03-15	C. Palenzuela
Approved by	2023-03-15	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 About this Document 7
1.2 Display Elements 7
1.3 Other Applicable Documents 7
1.4 Generic Terms and Abbreviations Used 7
2 General 8
3 Container Specifications 8
3.1 Module Overview 8
3.2 Module Construction Overview 9
3.3 Internal Cladding (Interior Finish) 9
3.4 Doors 10
3.4.1 Double Door Clear Opening 2100 x 2200mm high. 1 on each end of unit 10
3.4.2 Single Door Clear Opening 900 x 2200mm high 10
3.5 Miscellaneous 10
3.5.1 Earthing Boss 10
3.5.2 Customer Logo / Design 11
3.5.3 Battery container Forced Ventilation 11
3.5.4 External recess for AC condensers 11
3.5.5 External Paint Finish 11
3.5.6 Internal Paint Finish 11
4 Appendix 12

Identification

Product Version / Document Version

Product version
Prototype

Document release date
March 2023

Doc Code
K559-2254-CWIWP4202201-J04-001

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 About this Document

This document is part of project phase “Detailed Design Engineering” for the Base Load Power Hub (BLPH) Project (K559-2254). In case of any contradiction resulting by the information or specification given in this document, phase 2 or later documents supersede the information provided in this document.

1.2 Display Elements

Symbol	Meaning
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

Table 1: Display Elements

1.3 Other Applicable Documents

The following documents are applicable:

Document type	Document Name

Table 2: Other applicable documents

1.4 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 3: Generic terms and abbreviations used

2 General

This document provides information about the container specifications for the offered BESS.

3 Container Specifications

The BESS FQ system is comprised in 2x 40 ft. HC containers and 1x 20 ft. HC container.

3.1 Module Overview

Battery container external dimensions	12192mm (l) 2438mm (w) x 2895mm (h)
PCS & TX container external dimensions	6058mm (l) 2438mm (w) x 2895mm (h)
Design Temperature	-20°C - +45°C
Frame material	EN10219 / 10210 Box Section EN 10025 Plate and PFC
Overall Structure Design Criteria	DNV2.7-1

3.2 Module Construction Overview

Overall Design	Container to be constructed from a fully welded, carbon steel primary structure with corrugated wall and flat roof panel. Internally insulated with H120 insulation. The E-House is designed to be lifted from the top by 4 slings. Fitted with 4 x bottom ISO corners.
Walls	Hollow section primary structure and support beams. External Wall sheeting 4mm corrugated steel welded to structure.
Roof	Hollow section primary structure and support beams. External roof sheeting 4mm steel welded to structure.

3.3 Internal Cladding (Interior Finish)

Ceiling	Insulated internally with H120 Insulation. Internally cladded with 50mm thickness PIR metal faced sandwich panels. Internal face of panels 0.5mm steel, colour White Polyester.
Walls	Insulated internally with H120 Insulation. Internally cladded with 50mm thickness PIR metal faced sandwich panels. Internal face of panels 0.5mm steel, colour White Polyester.
Base	Insulated internally with H120 Insulation. 4mm Carbon steel plate on underside. 3mm carbon steel plate on upper.
Internal Partition (PCS & Tx)	Insulated internally with H120 Insulation. Internally cladded with 50mm thickness PIR metal faced sandwich panels. Internal face of panels 0.5mm steel, colour White Polyester.
Fire rating	Wall & ceiling H120 fire rating for integrity and insulation from inside to outside. Doors certified for H120 integrity only fire rating
Pressurisation	N/A.

3.4 Doors

3.4.1 Double Door Clear Opening 2100 x 2200mm high. 1 on each end of unit

Continuously hot-dipped galvanized 275 gr/m² – painted as follows:
- 130 µm primer Hempadur Mastic 45880 (high build epoxy)
- 130 µm intermediate layer Hempadur Mastic 45880 (high build epoxy)
- 60 µm Polyurethane gloss topcoat – Hempathane 55610

Total DFT approx. 320 mu
Internal and external door leaf/frame same RAL end colour.
Doors will be supplied with the following heavy duty hardware:
- 4 no. stainless steel 316 hinges per door leaf
- stainless steel 316 handles with escutcheons
- 3-point latch (SS316 external/SS304 internal components)
- seals
- door closer on active door leaf (aluminium with anti-corrosive coating)
- panic opening device SS304 (incl. push bar) on active door leaf
- cylinder lock with 3 keys
- windbreak SS304 on active door leaf

3.4.2 Single Door Clear Opening 900 x 2200mm high

Continuously hot-dipped galvanized 275 gr/m² – painted as follows:
- 130 µm primer Hempadur Mastic 45880 (high build epoxy)
- 130 µm intermediate layer Hempadur Mastic 45880 (high build epoxy)
- 60 µm Polyurethane gloss topcoat – Hempathane 55610

Total DFT approx. 320 mu
Internal and external door leaf/frame same RAL end colour.
Doors will be supplied with the following heavy duty hardware:
- 4 no. stainless steel 316 hinges per door leaf
- stainless steel 316 handles with escutcheons
- 3-point latch (SS316 external/SS304 internal components)
- seals
- door closer on active door leaf (aluminium with anti-corrosive coating)
- panic opening device SS304 (incl. push bar) on active door leaf
- cylinder lock with 3 keys
- windbreak SS304 on active door leaf

3.5 Miscellaneous

3.5.1 Earthing Boss

2No. 304 Stainless Steel M12 Through wall earthing bosses welded to the base rail of the Module at a location to be specified. Access opening cut in in internal floor plate above each earthing bosses.

3.5.2 Customer Logo / Design

No specific design included.

3.5.3 Battery container Forced Ventilation

3No. 500mm x 500mm extract fans c/w electric fire damper & external weather louver.
3No. 400mm x 400mm intake electric fire damper c/w G3 filter & external weather louver

3.5.4 External recess for AC condensers

1no. recess area to the rear of each container as per example below:



3.5.5 External Paint Finish

Black Carbon steel shot-blasted to SA2.5

3.5.6 Internal Paint Finish

Insulation panel self-colour white polyester (not painted) equivalent to C2

4 Appendix

Acceptance Test Procedure (FAT)

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

FREQCON

FAT Test Protocol

40FT BESS Container 2

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-03-21	S. Laudahn	First version
2.0	2024-07-06	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Creator	21.03.2024	S. Laudahn
Tested by		
Released by		

Table 2: Release overview

Imprint

Software development
Hardware development and production
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

Email:
info@freqcon.com

Contact information
For further information, please call us or send an e-mail to info@freqcon.com.
Visit our website http://www.freqcon.com for more information about our products and solutions.

Contents

1 About this document 6
2 Responsibilities 6
2.1 Responsibilities of FREQCON GmbH 6
2.2 Responsibilities of the customer 6
3 General Arrangement 7
4 Container Inspection 7
4.1 Prerequisites 7
4.2 Container Visual Inspection (Exterior) 8
4.3 Container Visual Inspection 9
5 Employees present 10
6 Examination and authorisation 11

Identification

Product and type designation

Container type
40FT BESS

Serial No.
FRQ-53412000001

Document number
23A2007_240706_FAT_40FT_BESS_Container_2_EN_v2.0

Name and address of the manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this document

This acceptance report is used to assess compliance with all design and customer requirements of the tested system.

The factory acceptance test (FAT) is carried out by specialised personnel before delivery of the system and the result is checked by the customer.

2 Responsibilities

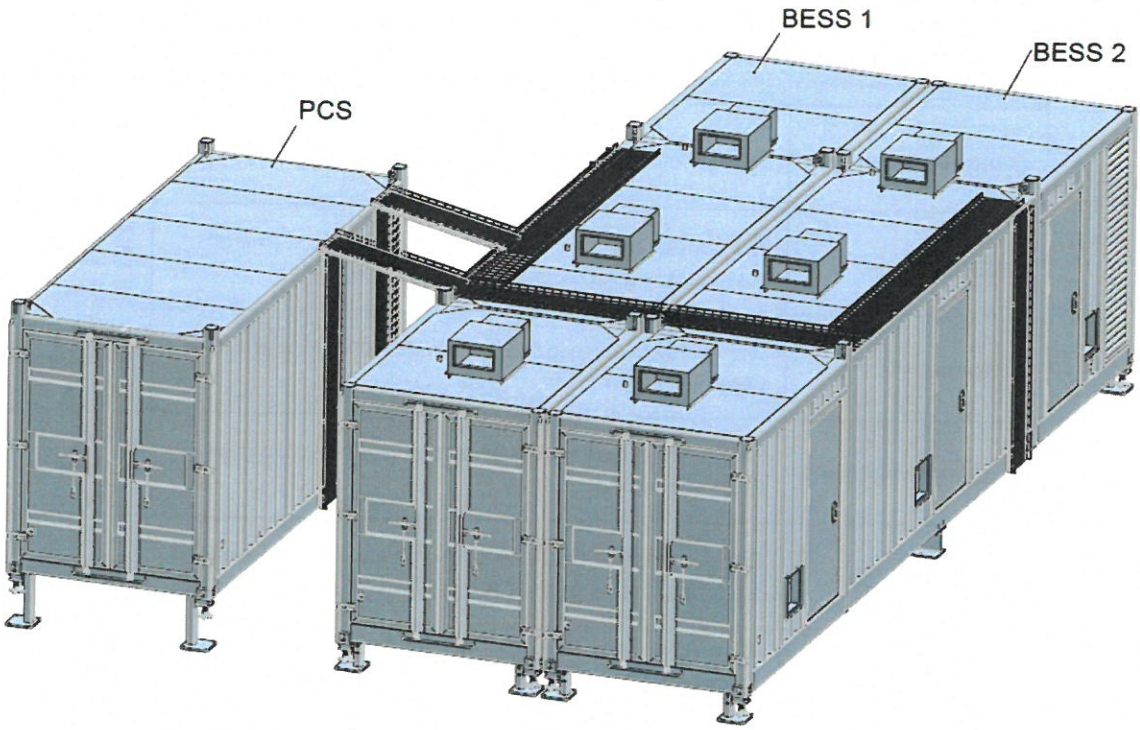
2.1 Responsibilities of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (FAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

2.2 Responsibilities of the customer

- Dispatch of specialised personnel to FREQCON GmbH, inspection of the acceptance results and documented data by the specialised personnel
- Confirmation of the factory acceptance report by specialised personnel

3 General Arrangement



4 Container Inspection

4.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. CAD of containers

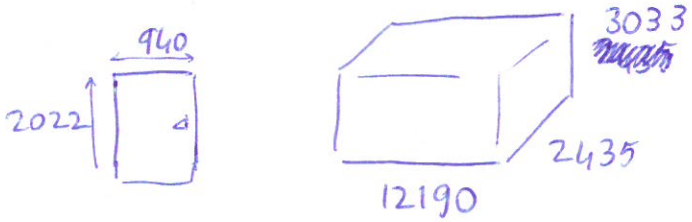
Remarks:

4.2 Container Visual Inspection (Exterior)

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Container colour	Required colour/RAL colour code: 7035 (Light Grey)	☒ OK ☐ Defects ☐ N/A
Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☒ OK ☐ Defects ☐ N/A
Performances	The bushings correspond in size and position to the underlying CAD	☒ OK ☐ Defects ☐ N/A
Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☐ OK ☒ Defects ☐ N/A
Doors/openings	Doors and other openings of the container correspond in size and position to the CAD on which they are based	☒ OK ☐ Defects ☐ N/A
Cooling niche	The cooling recess corresponds to the underlying CAD. The cooling units are in the correct position and can draw in sufficient fresh air.	☒ OK ☐ Defects ☐ N/A
Warnings	The required warning signs are located on the personnel doors	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
BESS 2 – FRQ-534060000 1 Earthing of cooling niche doors + spikes and sharp edges on grid + cable tray to be fixed



4.3 Container Visual Inspection

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☒ OK ☐ Defects ☐ N/A
Light/sockets	Sufficient lighting is available. There are service sockets (230 V) in the container interior. The sockets and lighting are usable and easily accessible.	☒ OK ☐ Defects ☐ N/A
Air conditioning	The air conditioning units are in the correct position and at least one control unit for the air conditioning units is present. The air conditioning units are functional and can cool the room to a satisfactory level.	☒ ☐ OK ☐ Defects ☐ N/A
Personal security	All steps in the container (if present) are marked in signal colours (yellow/black). There are no sharp edges in the container.	☐ OK ☒ Defects ☐ N/A
Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☒ OK ☐ Defects ☐ N/A
Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
Missing marking yellow/black on step Electrical cabinets = no ferrules on all cables no lables on cables & wires identification

5 Employees present

Identify each employee involved in the execution of this protocol. Document personal names, signature, name abbreviation and date in the following table:

Company Name	Employee Name	Signature	Abbreviation	Date
SHELL CROSSWIND	ALESSANDRO SUTTO			17/07/24
Fulltrum obo Crosswind	Ali Tahouazi			17.07.24
ABL	Dominik Mahl			17.07.2024
CROSSWIND	MARTIN TAYLOR			17/07/24

	Yes/No
All persons involved in the factory acceptance test were documented.	☐ Y ☐ N

Remarks and description in case of defects:
SEE ALSO CONSOLIDATED PUNCH LIST

6 Examination and authorisation

The test report becomes the factory acceptance report as soon as the individual test reports have been completed and labelled with a test date. The factory acceptance report is sent to the customer for confirmation and the results must be documented in the TR8 test report.

TR8	Examination and authorisation of execution
Checking the test results and original data. Final assessment for factory acceptance	
☒ PASSED	☐ NOT PASSED
If there are any deviations, please complete the following section.	
Evaluate whether or not the existing deviation has an influence on the final factory acceptance test.	
☐ YES	☒ NO

Remark:

SEE OVERALL PUNCHLIST

Carried out by:	CARLOS PALENZUELA	Date:	18.07.2024
	FREQCON GmbH		DD/MM/YYYY
Authorised by:		Date:	18-07-2024
	Customer		DD/MM/YYYY

FREQCON

FAT Test Protocol

Converter & BESS

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-02-29	S. Laudahn	First version
1.1	2024-05-14	C. Palenzuela J. Nitsch	Updated several sections
2.0	2024-07-08	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Editor	29.02.2024	S. Laudahn
Checked by		
Released by		

Table 2: Release overview

Imprint

Software development
Hardware development and production
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

Email:
info@freqcon.com

Contact information
For further information, please call us or send an e-mail to info@freqcon.com.
Visit our website http://www.freqcon.com for more information about our products and solutions.

Contents

1 About this document 6
2 Responsibilities 6
2.1 Responsibilities of FREQCON GmbH 6
2.2 Responsibilities of the customer 6
2.3 Single Line Diagram 7
2.4 General Arrangement 8
3 Converter (PCS) 9
3.1 Reference Documents Converter (PCS) 9
3.2 PCS Tests 10
3.2.1 Prerequisites 10
3.2.2 Visual Inspection of Control Cabinet 1 11
3.2.3 Visual Inspection of Control Cabinet 2 14
3.2.4 Visual inspection of Converter Cabinets 16
3.3 Visual inspection of Converter Cooling System 18
3.4 Function test 19
4 BESS 1 24
4.1 Reference Documents BESS 1 24
4.2 Battery Cabinets Tests 24
4.2.1 Prerequisites 24
4.2.2 Visual inspection of Battery Cabinets 25
5 BESS 2 28
5.1 Reference Documents BESS 2 28
5.2 Battery Cabinets Tests 28
5.2.1 Prerequisites 28
5.2.2 Visual inspection of Battery Cabinets 29
6 Employees Present 32
7 Examination and authorisation 33

Identification

Product and type designation

Device type
BESS 1 MW / 5MWh

Circuit diagram version
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62

Document number
23A2007_240708_FAT_BESS_Converter_EN_v2.0

Name and address of the manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this document

This acceptance report is used to assess compliance with all design and customer requirements of the tested system.

The factory acceptance test (FAT) is carried out by specialised personnel before delivery of the system and the result is checked by the customer.

2 Responsibilities

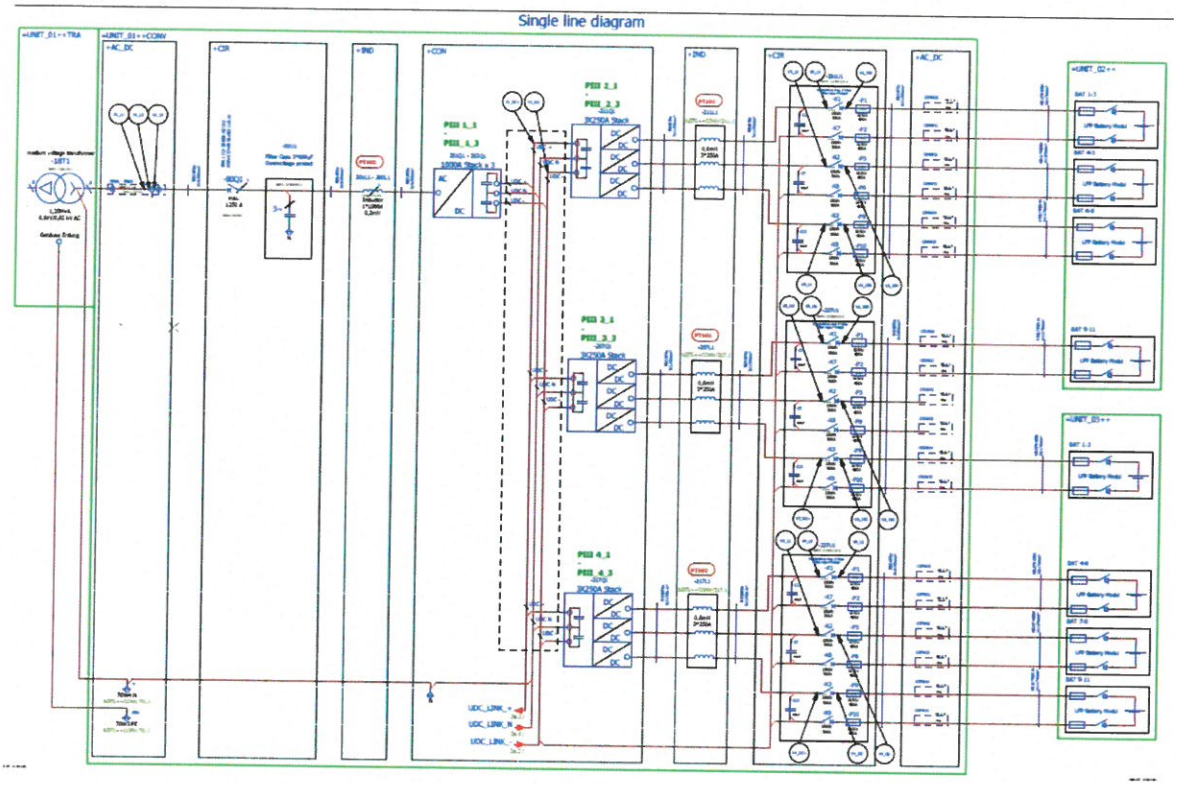
2.1 Responsibilities of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (FAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

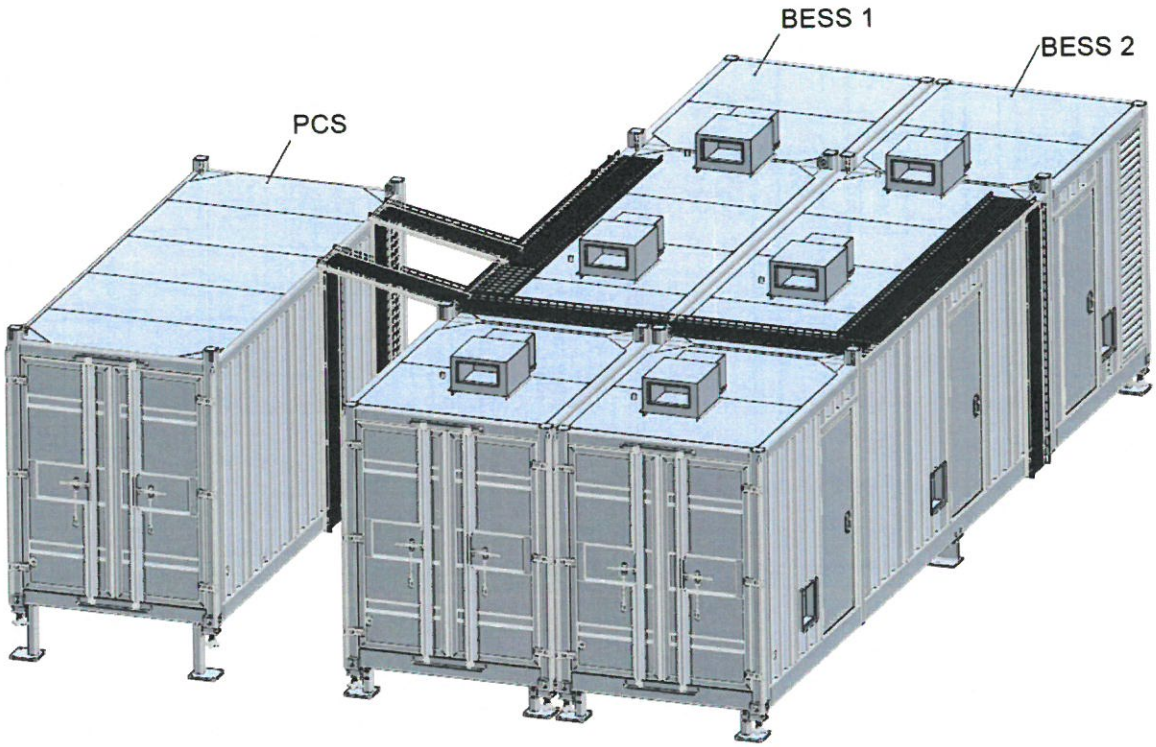
2.2 Responsibilities of the customer

- Dispatch of specialised personnel to FREQCON GmbH, inspection of the acceptance results and documented data by the specialised personnel
- Confirmation of the factory acceptance report by specialised personnel

2.3 Single Line Diagram



2.4 General Arrangement



3 Converter (PCS)

3.1 Reference Documents Converter (PCS)

Document Title	Document Name
Overall Schematics	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62

3.2 PCS Tests

3.2.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

Remarks:

3.2.2 Visual Inspection of Control Cabinet 1

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR01	Test		Result
1.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	
1.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No sharp edges or recognisable damage present.	
1.3	**Wires and cables** lids cover & tidy cables	**Test Layout:** Visually inspect cable connections and wires inside the control cabinet for perfect condition and loose parts.	☐ OK ☒ Defects ☐ N/A
		Pass Fail Criteria: Cable connections in perfect condition, no loose parts present.	
1.4	**Compliance with circuit diagram** I/O check report	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).	☐ OK ☒ Defects ☐ N/A
		Pass Fail Criteria: • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	
1.5	**Control elements labelling**	**Test Layout:** Check if the operating elements on the control cabinet door are labelled according to the circuit diagram.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The operating elements are labelled according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	

1.6	**Control elements description** Missing manual	**Test Layout:** Check if the operating elements are explained in the operating manual. **Pass Fail Criteria:** The operating elements are explained in the operating manual. **Reference document:** 10354_23A2007_YYMMDD_Operating_Manual_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	☐ OK ☒ Defects ☐ N/A
1.7	**Data interface** Not clear	**Test Layout:** Check if data interface complies with the schematic. **Pass Fail Criteria:** The data interface corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☐ Defects ☒ N/A
1.8	**Earthing**	**Test Layout:** Check if the control cabinet is properly earthed in accordance with the circuit diagram. **Pass Fail Criteria:** The control cabinet is properly earthed.	☒ OK ☐ Defects ☐ N/A
1.9	**Power supply**	**Test Layout:** Check the AC connection terminals of the control cabinet. Check if all three phases provide 230 V AC by using a Multimeter. **Pass Fail Criteria:** All three phases of the AC supply provide 230 V AC.	☒ OK ☐ Defects ☐ N/A
1.10	**UPS**	**Test Layout:** Check if the control cabinet is properly earthed in accordance with the circuit diagram. **Pass Fail Criteria:** The UPS complies with the specification. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A

1.11	**Warnings**	**Test Layout:** Check if the required warning signs are located on the cabinet doors. **Pass Fail Criteria:** The required warning signs are located on the cabinet doors. **Reference document:** FORM_QS002_Warnhinweise_20231013_Rev3-0	☒ OK ☐ Defects ☐ N/A

Remarks:
Change table on control cabinet to CTRL 1 & 2

3.2.3 Visual Inspection of Control Cabinet 2

Check all system components, including external ones, to ensure that they are in perfect condition.
Document the qualification results in the following table.

TR01	Test		Result
1.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust.	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	
1.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages.	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No sharp edges or recognisable damage present.	
1.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the control cabinet for perfect condition and loose parts.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Cable connections in perfect condition, no loose parts present.	
1.4	**Compliance with circuit diagram** • Add lable on 24V U1 • Lable on cables	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).	☐ OK ☒ Defects ☐ N/A
		Pass Fail Criteria: • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	
1.5	**Earthing**	**Test Layout:** Check if the control cabinet is properly earthed in accordance with the circuit diagram.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The control cabinet is properly earthed. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	
1.6	**Power supply**	**Test Layout:** Check the AC connection terminals of the control cabinet. Check if all three phases provide 230 V AC by using a Multimeter.	☒ OK ☐ Defects ☐ N/A

Is this works on 24V DC

		Pass Fail Criteria: All three phases of the AC supply provide 230 V AC.	
1.8	**Warnings**	**Test Layout:** Check if the required warning signs are located on the cabinet doors.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The required warning signs are located on the cabinet doors. **Reference document:** FORM_QS002_Warnhinweise_20231013_Rev3-0	

Remarks and description of defects:

3.2.4 Visual inspection of Converter Cabinets

Check all system components, including external ones, to ensure that they are in perfect condition.
Document the qualification results in the following table.

TR02	Test		Result
2.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	
2.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No sharp edges or recognisable damage present.	
2.3	**Wires and cables** lables on cables	**Test Layout:** Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts.	☐ OK ☒ Defects ☐ N/A
		Pass Fail Criteria: Cable connections are in perfect condition, no loose parts present.	
2.4	**Compliance with circuit diagram**	**Test Layout:** Visually inspect the following power components for compliance with the circuit diagram: • AC IGBTs • DC IGBTs • AC inductors • DC inductors • AC Filter	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The power components (IGBT, choke, filter) correspond to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	
2.5	**Protective elements** Closure covers are mounted before transport	**Test Layout:** Check correct installation of protective elements according to the circuit diagram.	☒ OK ☒ Defects ✓ ☐ N/A
		Pass Fail Criteria: The protective elements are installed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	

2.6	**Connection busbars**	Check if connection busbars are installed according to the circuit diagram. **Pass Fail Criteria:** The connection busbars are installed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
2.7	**Earthing**	**Test Layout:** Check control cabinet for proper earthing. Refer to circuit diagram. **Pass Fail Criteria:** The control cabinet is properly earthed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
2.8	**Smoke detectors**	**Test Layout:** Check if smoke detectors are installed in the IGBT cabinet according to the circuit diagram. **Pass Fail Criteria:** Smoke detectors are installed in the IGBT cabinet according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
2.9	**Smoke detector test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal triggers "301024: Supply: Smoke detector feedback tripped" alarm and is displayed on HMI/WebVisu. Hardware Trigger: Smoke FG1	☒ OK ☐ Defects ☐ N/A

Remarks and description of defects:
Smoke → 178k2 + XT1 3,4 80 Q1 ☒ OK

3.3 Visual inspection of Converter Cooling System

Check the correct installation and connection of the cooling system. Document the qualification results in the following table.

TR03	Test		Result
3.1	**Leakage and connections check**	**Test Layout:** Check the converter water cooling system for proper connection and leaks. Run cooling system and perform visual check of connections and check for leaks	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: All connections are properly connected and no leakage present.	
3.2	**Pressure check** 4,2 bar	**Test Layout:** Check whether the pressure of the cooling system is above 3 bar. Check on the manometer of the converter cooling system cabinet (COSY) and verify value on HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Manometer and HMI/WebVisu indicate a pressure of 3 bar.	
3.3	**Water drop check**	**Test Layout:** Check that no drops of water can be seen at the connection points of the coolant hoses.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No water on the connection points of coolant hoses.	

Remarks:

- Drain over pressure bottle collection
- Change coolant check coolant at yard

3.4 Function test

Check whether the electrical power and signal transmission meets the agreed requirements. Document the qualification results in the following table.

TR04	Test		Result
4.1	**Supply voltage control cabinet**	**Test Layout:** Switch on the control cabinet by applying the supply voltage or turning on the main switch. The control unit starts up properly.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Pass: - Simotion turns on - HMI turns on properly and WebVisualization (WebVisu) access is active - Access to Simotion WebVisu is established and "Run" state of Simotion can be confirmed	
4.2	**Feedback signals**	**Test Layout:** Exemplary control of system feedback and error evaluation, for example by manually triggering fuses. Errors are output correctly.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Random sampling: The status is correctly indicated by the red Error LED on the control cabinet 1 door. The error message can be reset by pressing the reset button on the control cabinet.	
4.3	**Smoke detectors**	**Test Layout:** Test the smoke detector in PCS CON-cabinet with test spray.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The smoke detectors trigger accordingly and an error (Error level 4) is generated.	

4.4	**Cabinet Fans**	**Test Layout:** Testing the cabinet fans by simulating increased temperature values of the cabinets or direct control of the fans by the control system. **Pass Fail Criteria:** Cabinet fans activate according to temperature threshold set in the control system.	☒ OK ☐ Defects ☐ N/A
4.5	**Converter liquid cooling system** check cooling water level	**Test Layout:** Converter liquid cooling system test: Switch on the cooling system. The cooling system heats the cooling water as required. Check the heat exchangers by simulating the cooling water temperature. **Pass Fail Criteria:** - Heat exchanger switches on and off correctly (Visual check) - **"Preheating"** status is correctly indicated by the **yellow "Preheating** LED" on the control cabinet. - Pump is running (visual check) - Heater is heating up the coolant (check coolant temperature on HMI/WebVisu)	☐ OK ☐ Defects ☐ N/A
4.6	**AC connection**	**Test Layout:** Apply the operating voltage (if not already applied). Check the measured voltages for plausibility with Multimeter at AC connection point. The HMI/WebVisu displays the mains voltage correctly. The measured Multimeter values correspond to the values displayed on the HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A
4.7	**Converter pre-charging**	**Test Layout:** Pre-charging of converter. **Pass Fail Criteria:** - Converter is pre-charged from the mains and the 3WL main circuit breaker (80Q1) switches-on. - **"Ready for Operation"** status is indicated by the **green "Ready for Operation"** LED on the control cabinet door.	☐ OK ☐ Defects ☐ N/A
4.8	**IGBTs**	**Test Layout:** IGBT activation **Pass Fail Criteria:** - IGBTs can be switched on without any problems. - DC link is regulated to the set voltage. - **"Operating"** status is indicated by the green **"Operating"** LED on the control cabinet door.	☐ OK ☐ Defects ☐ N/A
4.9	**Emergency stop**	**Test Layout:** Test of the emergency stop. Switching on the emergency stop or switching off the main switch when the inverter is in operation (DC-link control).	☐ OK ☐ Defects ☐ N/A

		Pass Fail Criteria: - Inverter immediately switches to OFF mode. - Red "Fault" LED starts glowing on control cabinet door. - AC main switch (80Q1) opens.	
4.10	**Back-to-Back Test**	**Duration: After reaching 1000 A duration test of 10 min.** **Test Layout:** Back-to-Back Test: At 400 V AC connection Increase the AC current setpoint value slowly to 1000 A output and keep this value for 10 minutes. - 10 A - 100 A - 200 A - ... - 1000 A ✓ Heat run: Check if temperatures of - IGBTs - Inductors - Coolant of converter cooling system are within the permissible ranges by verifying the temperature values displayed on the HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Back-to-Back Test: AC current output of 1000 A is displayed correctly on the HMI/WebVisu according to setpoint. Heat run: IGBT, inductor and converter cooling system coolant temperatures are below the temperature thresholds set in the control system. ✓	
4.10	**DC ports** only 160 A due to connection configuration	**Duration: After reaching 250 A test duration is 10 min.** **Test Layout:** DC-ports connection Increase the DC current setpoint slowly to 250 A and keep this value for 10 minutes. Heat run: Check if temperatures of - IGBTs - Inductors - Coolant of converter cooling system are within the permissible ranges by verifying the temperature values displayed on the HMI/WebVisu.	

Different mode of operation when in the yard
Test will be finally performed after battery modules are installed → SAT

		Pass Fail Criteria: Back-to-Back Test: DC current output of 250 A is displayed on the HMI/WebVisu according to setpoint. Heat run: IGBT, inductor and converter cooling system coolant temperatures are below the temperature thresholds set in the control system.	☒ ok
4.11	**Measurements**	**Test Layout:** Check if the measured values (temperatures, voltages and currents) are properly collected by the Simotion (PCS main controller) and verify by using a multimeter or current clamp at DC and AC side. **Pass Fail Criteria:** Values measured with multimeter are +/- 5% correspond to the values displayed on the HMI/WebVisu.	☐ OK ☐ Defects ☐ N/A
4.12	**Switching-off**	**Test Layout:** Switching off the inverter. The inverter is properly switched off by removing the control bits. **Pass Fail Criteria:** "OFF" state is indicated by the HMI/WebVisu.	☐ OK ☐ Defects ☐ N/A
4.13	**UPS** not perform.	**Test Layout:** Checking the UPS functionality. If the auxiliary supply fails (e.g. by activating the fuse of the AC power supply unit), the control cabinet continues to be supplied by the UPS. **Pass Fail Criteria:** After the defined time, the control cabinet is switched off completely. When the voltage returns, the control unit starts up again and the UPS battery is charged.	☐ OK ☐ Defects ☐ N/A
4.14	**WebVisu/HMI**	**Test Layout:** Check the Web Visualisation (WebVisu) running on the control cabinet HMI for proper functionality **Pass Fail Criteria:** Select each individual HMI (WebVisu) pages and check behaviour (lag during selection or scrolling, correct display of values and system components). The visualisation is functional.	☒ OK ☐ Defects ☐ N/A

Remarks:
Couldn't enter PCS = 0 no light check or physical measurement Test: 4,5; 4,7; 4,8; 4.9; 4.11; 4,12; 4,13

4 BESS 1

4.1 Reference Documents BESS 1

Document Title	Document name
Schematic	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62

4.2 Battery Cabinets Tests

4.2.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. Circuit diagram of battery cabinets
2. General arrangement overview
3. Interface documentation (if available)

Remarks:

4.2.2 Visual inspection of Battery Cabinets

Check system components of 3 battery cabinets (one cabinet in each container section) inside BESS 1 container, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR05	Test		Result
5.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust. **Pass Fail Criteria:** Covers and interior are clean, without dirt or rust.	☒ OK ☐ Defects ☐ N/A
5.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages **Pass Fail Criteria:** No sharp edges or recognisable damage present.	☒ OK ☐ Defects ☐ N/A
5.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the battery cabinets for perfect condition and no loose parts. **Pass Fail Criteria:** Cable connections are in perfect condition, no loose parts present.	☒ OK ☐ Defects ☐ N/A
5.4	**Protective elements**	**Test Layout:** Check correct installation of protective elements according to circuit diagram. **Pass Fail Criteria:** Protective elements are installed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
5.5	**Earthing** need to connect ⏚ to screens mΩ limit protocols & reading	**Test Layout:** Check battery cabinet for proper earthing. Refer to circuit diagram. **Pass Fail Criteria:** Battery cabinet is properly earthed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☒ Defects ☐ N/A
5.6	**Smoke detectors**	**Test Layout:** Check if smoke detectors are installed in battery cabinet according to circuit diagram.	

		Pass Fail Criteria: Smoke detectors are installed in battery cabinet according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
5.7	**Fire extinguishing system (Stat-X)** loose cable	**Test Layout:** Check if Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram. **Pass Fail Criteria:** Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
5.8	**Control plate** I/O check & QAQC doc	**Test Layout:** Check if control plate in the bottom section of the battery cabinet is installed according to circuit diagram. **Pass Fail Criteria:** Control plate is installed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☒ Defects ☐ N/A
5.9	**CO Sensor and Alarm Unit**	**Test Layout:** Check if CO Sensor and Alarm Unit are installed according to circuit diagram. **Pass Fail Criteria:** CO Sensor and Alarm Unit are installed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
5.10	**Smoke detector test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal will trigger "Thermal runaway" procedure and displayed on HMI.	☒ OK ☐ Defects ☐ N/A
5.11	**CO sensor test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal will trigger "Thermal runaway" procedure and displayed on HMI.	☒ OK ☐ Defects ☐ N/A

5.12	**H2 Sensor Test**	**Test Layout:** H2 Gas Alarm Test: Simulate trigger value in software from gas sensor and check if exhaust units and fire dampers operate properly. Check if gas alarm feedback is properly transmitted via hardwired signals.	☐ OK ☐ Defects ☒ N/A
		Pass Fail Criteria: After gas alarm the fire dampers open and the exhaust units start venting out the containers. Gas alarm feedback relay has opened. An error message is displayed on the HMI/WebVisu.	

Remarks:
Stat - x - loose cable also extra cable on cabinet control plate - ask from VO certificate we can't certify Cables are only MARKED not labled

5 BESS 2

5.1 Reference Documents BESS 2

Document Title	Document name
Schematic	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62

5.2 Battery Cabinets Tests

5.2.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

4. Circuit diagram of battery cabinets
5. General arrangement overview
6. Interface documentation (if available)

Remarks:

5.2.2 Visual inspection of Battery Cabinets

Check system components of 3 battery cabinets (one cabinet in each container section) inside BESS 1 container, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR05	Test		Result
6.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust. **Pass Fail Criteria:** Covers and interior are clean, without dirt or rust.	☑ OK ☐ Defects ☐ N/A
6.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages **Pass Fail Criteria:** No sharp edges or recognisable damage present.	☒ OK ☐ Defects ☐ N/A
6.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the battery cabinets for perfect condition and no loose parts. **Pass Fail Criteria:** Cable connections are in perfect condition, no loose parts present.	☐ OK ☐ Defects ☐ N/A
6.4	**Protective elements**	**Test Layout:** Check correct installation of protective elements according to circuit diagram. **Pass Fail Criteria:** Protective elements are installed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
6.5	**Earthing**	**Test Layout:** Check battery cabinet for proper earthing. Refer to circuit diagram. **Pass Fail Criteria:** Battery cabinet is properly earthed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☒ Defects ☐ N/A
6.6	**Smoke detectors**	**Test Layout:** Check if smoke detectors are installed in battery cabinet according to circuit diagram.	

		Pass Fail Criteria: Smoke detectors are installed in battery cabinet according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
6.7	**Fire extinguishing system (Stat-X)**	**Test Layout:** Check if Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram. **Pass Fail Criteria:** Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
6.8	**Control plate**	**Test Layout:** Check if control plate in the bottom section of the battery cabinet is installed according to circuit diagram. **Pass Fail Criteria:** Control plate is installed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☒ Defects ☐ N/A
6.9	**CO Sensor and Alarm Unit**	**Test Layout:** Check if CO Sensor and Alarm Unit are installed according to circuit diagram. **Pass Fail Criteria:** CO Sensor and Alarm Unit are installed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
6.10	**Smoke detector test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal will trigger "Thermal runaway" procedure and displayed on HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A
6.11	**CO sensor test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal will trigger "Thermal runaway" procedure and displayed on HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A

6.12	**H2 Sensor Test**	**Test Layout:** H2 Gas Alarm Test: Simulate trigger value in software from gas sensor and check if exhaust units and fire dampers operate properly. Check if gas alarm feedback is properly transmitted via hardwired signals.	☒ N/A
		Pass Fail Criteria: After gas alarm the fire dampers open and the exhaust units start venting out the containers. Gas alarm feedback relay has opened. An error message is displayed in the WebVisu.	

Remarks:

6 Employees Present

Identify each employee involved in the execution of this protocol. Document the person's name, signature, name abbreviation and date in the following table:

Company Name	Employee Name	Employee Signature	Abbreviation	Date
SHELL CLOSS WIND	ALESSANDRO SUTTO			18/7/24
MARTIN TAYLOR	CROSSWIND			18/07/24
ABL	Dominik Mähl			18.07.2024
FREQCON	C. PALENZUELA			18.07.2024

	Yes/No
All persons involved in the factory acceptance test were documented.	☐ Y ☐ N

Remarks:

7 Examination and authorisation

The test report becomes the factory acceptance report as soon as the individual test reports have been completed and labelled with a test date. The factory acceptance report is sent to the customer for confirmation and the results must be documented in the TR8 test report.

TR05	Examination and authorisation of execution
Check the test results and original data. Final assessment for factory acceptance.	
☒ PASSED	☐ NOT PASSED
If there are any deviations, please complete the following section.	
Evaluate whether or not the existing deviation has an influence on the final factory acceptance test.	
☐ YES	☒ NO

Remarks:
SEE OVERALL PUNCHLIST

Carried out by:	CARLOS PALENZUELA FREQCON GmbH	Date:	18.07.2024 DD/MM/YYYY
Authorised by:	FAT Customer	Date:	18.07.2024 DD/MM/YYYY

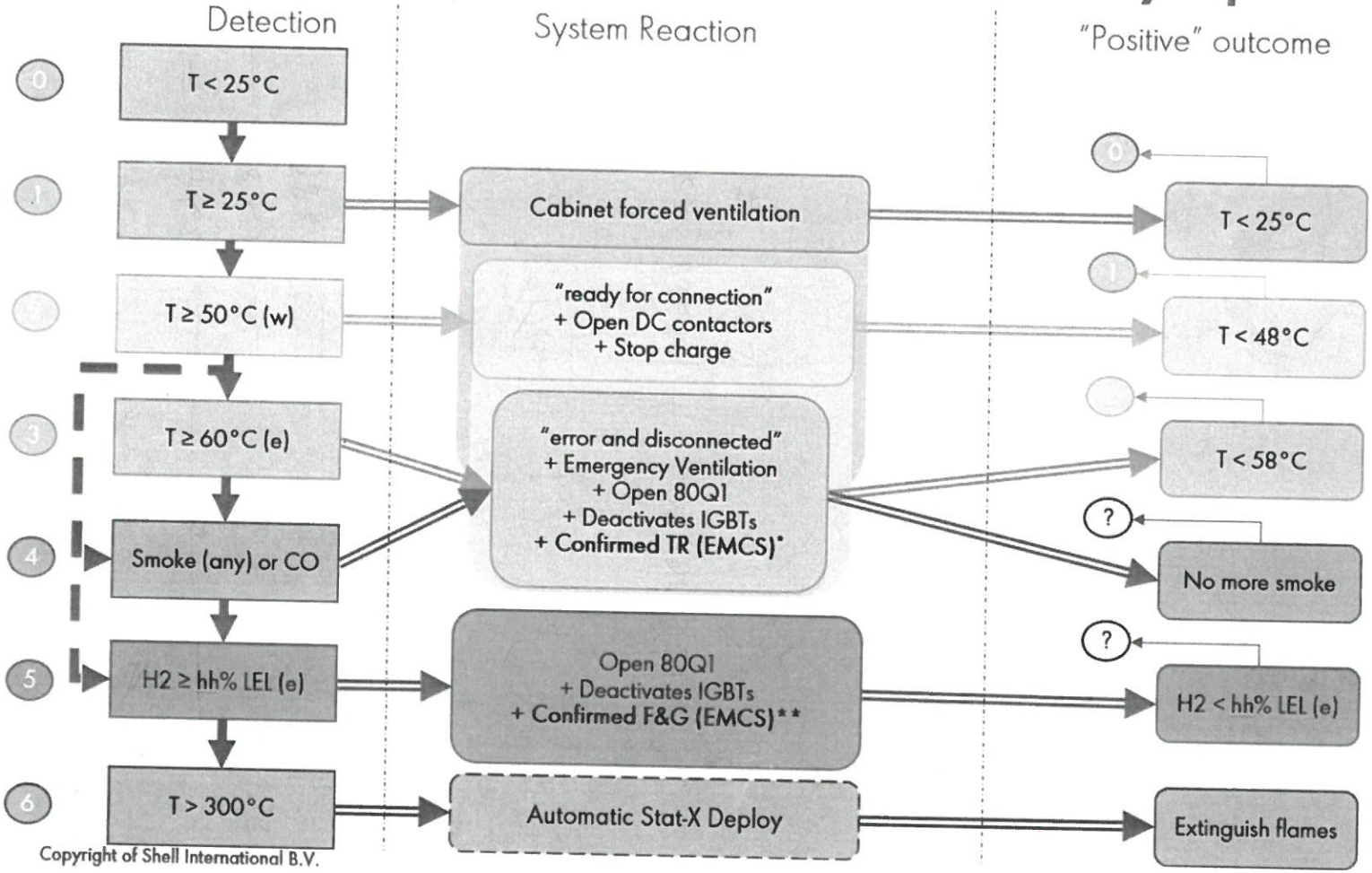
Appendix A - Measurement data for the performance test (if performed)

Insert prepared tables for performance values/times/temperatures/etc.

Smoke FG1 – Smoke PCS → ESD1D
Gas FG2 – H2 Sensor BESS 1&2 → ESD1D
Therm. rise TR – Triggered HH temp (760°C) or CO det or Smoke → ESD1

BMS - Confirmed new Process Fire Safety operations

*Aux still on
**Full platform shut down with H2 blowout



Automatic reset – no operator action needed
Once the temperature is back in the correct range, operation can continue normally. Point 2 will generate a warning log.

Remote reset – operator action needed

*These triggers will also send a message to the EMCS as "**fire alarm**" – Reset To be discussed with EMCS and BLPH*

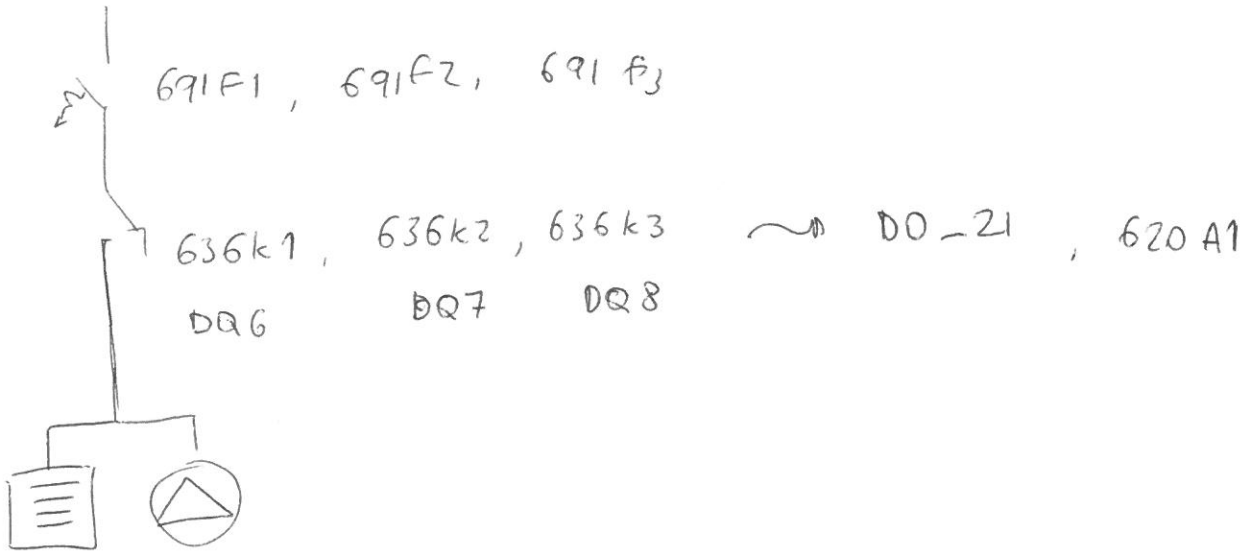
No reset

Copyright of Shell International B.V.

CTRL 1.3 - DO - 04 NO

DQ0 Gas alarm — 138k1 — XT1 1,2
DQ1 Smoke alarm — 138k2 — 3,4
DQ2 PLC fault — 138k3 — 5,6
DQ3 TR — 138k4 — 7,8

PANS



FREQCON

FAT Test Protocol

20FT PCS Container

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-03-21	S. Laudahn	First version
2.0	2024-07-06	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Creator	21.03.2024	S. Laudahn
Tested by		
Released by		

Table 2: Release overview

Imprint

Software development
Hardware development and production
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

Email:
info@freqcon.com

Contact information
For further information, please call us or send an e-mail to info@freqcon.com.
Visit our website http://www.freqcon.com for more information about our products and solutions.

Contents

1 About this document 6
2 Responsibilities 6
2.1 Responsibilities of FREQCON GmbH 6
2.2 Responsibilities of the customer 6
3 General Arrangement 7
4 Container Inspection 7
4.1 Prerequisites 7
4.2 Container Visual Inspection (Exterior) 8
4.3 Container Visual Inspection 9
5 Employees present 10
6 Examination and authorisation 11

Identification

Product and type designation

Container type
40FT BESS

Serial No.
FRQ-53396000001

Document number
23A2007_240706_FAT_20FT_PCS_Container_EN_v2.0

Name and address of the manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this document

This acceptance report is used to assess compliance with all design and customer requirements of the tested system.

The factory acceptance test (FAT) is carried out by specialised personnel before delivery of the system and the result is checked by the customer.

2 Responsibilities

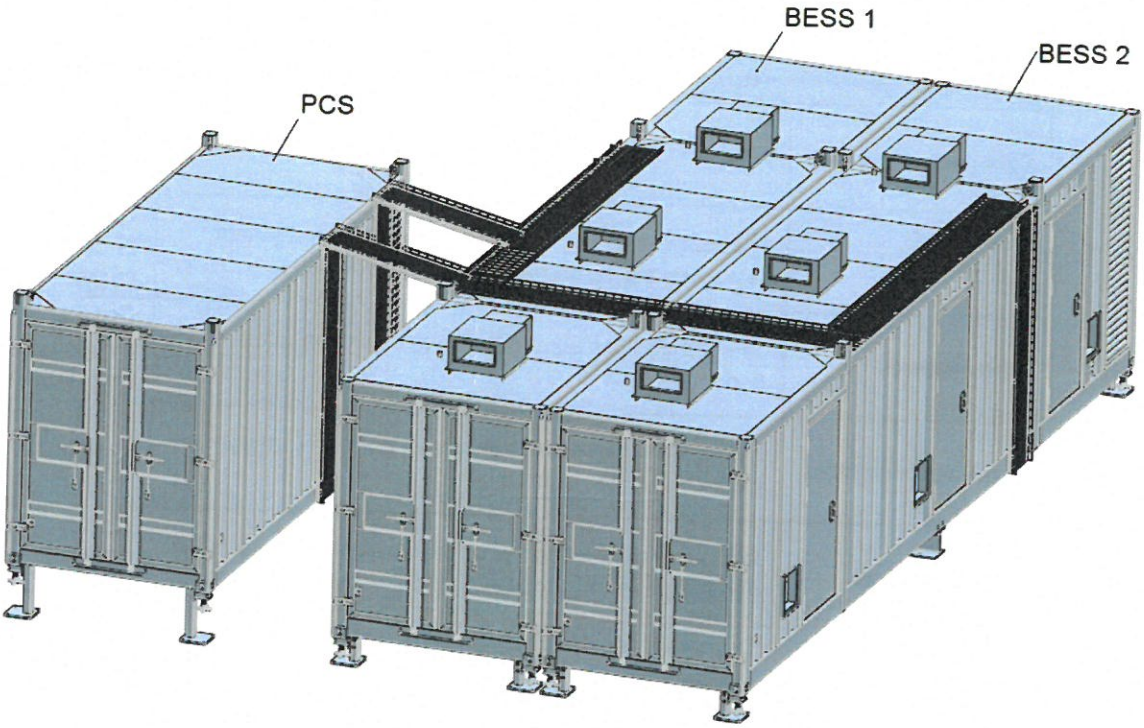
2.1 Responsibilities of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (FAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

2.2 Responsibilities of the customer

- Dispatch of specialised personnel to FREQCON GmbH, inspection of the acceptance results and documented data by the specialised personnel
- Confirmation of the factory acceptance report by specialised personnel

3 General Arrangement



4 Container Inspection

4.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. CAD of containers

Remarks:

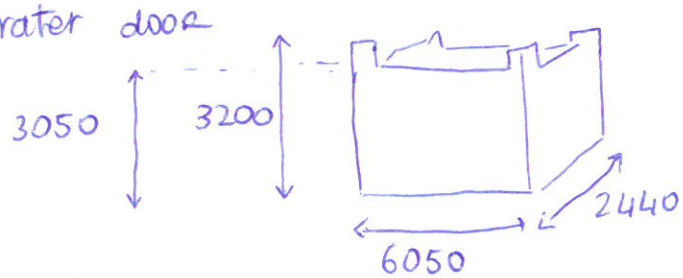
4.2 Container Visual Inspection (Exterior)

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Container colour	Required colour/RAL colour code: 7035 (Light Grey)	☒ OK ☐ Defects ☐ N/A
Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☒ OK ☐ Defects ☐ N/A
Performances	The bushings correspond in size and position to the underlying CAD	☒ OK ☐ Defects ☐ N/A
Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☐ OK ☒ Defects ☐ N/A
Doors/openings	Doors and other openings of the container correspond in size and position to the CAD on which they are based	☒ OK ☐ Defects ☐ N/A
Cooling niche	The cooling recess corresponds to the underlying CAD. The cooling units are in the correct position and can draw in sufficient fresh air.	☒ OK ☐ Defects ☐ N/A
Warnings	The required warning signs are located on the personnel doors	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:

PCS container = FRQ-5339600 0001
Minor rust spots around container feet
Earthing lugs painted
Blue ferrules on earthing cable on access door
~~Missing lock handle on door~~ closed
Missing grounding of cooling niche doors
"Push to open" inside operater door



4.3 Container Visual Inspection

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☒ OK ☐ Defects ☐ N/A
Light/sockets	Sufficient lighting is available. There are service sockets (230 V) in the container interior. The sockets and lighting are usable and easily accessible.	☒ OK ☐ Defects ☐ N/A
Air conditioning	The air conditioning units are in the correct position and at least one control unit for the air conditioning units is present. The air conditioning units are functional and can cool the room to a satisfactory level.	☒ ☐ OK ☐ Defects ☐ N/A
Personal security	All steps in the container (if present) are marked in signal colours (yellow/black). There are no sharp edges in the container.	☐ OK ☒ Defects ☐ N/A
Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☐ OK ☒ Defects ☐ N/A
Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
- Missing yellow/black marking on step entry door - Missing cable ladders on back door in transformer area for HV. AC side cables

5 Employees present

Identify each employee involved in the execution of this protocol. Document personal names, signature, name abbreviation and date in the following table:

Company Name	Employee Name	Signature	Abbreviation	Date
SHELL	ALESSANDRO IUTTO			17/07/24
CROSSWIND	MARTIN TAFLAN			17/07/24
ABL	Dominik Mähl			17.07.2024
FREQCON	CARLOS PALENZUELA			17.07.24
Fulcrum obo Crosswind	Ali Tahanwarf	Johan. Ki		17.07.24

	Yes/No
All persons involved in the factory acceptance test were documented.	☐ Y ☐ N

Remarks and description in case of defects:
SEE ALSO OVERALL PUNCH-LIST

6 Examination and authorisation

The test report becomes the factory acceptance report as soon as the individual test reports have been completed and labelled with a test date. The factory acceptance report is sent to the customer for confirmation and the results must be documented in the TR8 test report.

TR8	Examination and authorisation of execution
Checking the test results and original data. Final assessment for factory acceptance	
☒ PASSED	☐ NOT PASSED
If there are any deviations, please complete the following section.	
Evaluate whether or not the existing deviation has an influence on the final factory acceptance test.	
☐ YES	☒ NO

Remark:
SEE OVERALL PUNCH LIST

Carried out by:	C Palan FREQCON GmbH	Date:	18.07.2024 DD/MM/YYYY
Authorised by:	FAT Customer	Date:	18.07.2024 DD/MM/YYYY

FREQCON

FAT Test Protocol

40FT BESS Container 1

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-03-21	S. Laudahn	First version
2.0	2024-07-06	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Creator	21.03.2024	S. Laudahn
Tested by		
Released by		

Table 2: Release overview

FREQCON

FAT Test Protocol

40FT BESS Container 1

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-03-21	S. Laudahn	First version
2.0	2024-07-06	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Creator	21.03.2024	S. Laudahn
Tested by		
Released by		

Table 2: Release overview

Imprint

Software development

Hardware development and production

Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

Email:
info@freqcon.com

Contact information

For further information, please call us or send an e-mail to info@freqcon.com.
Visit our website http://www.freqcon.com for more information about our products and solutions.

Contents

1 About this document 6
2 Responsibilities 6
2.1 Responsibilities of FREQCON GmbH 6
2.2 Responsibilities of the customer 6
3 General Arrangement 7
4 Container Inspection 7
4.1 Prerequisites 7
4.2 Container Visual Inspection (Exterior) 8
4.3 Container Visual Inspection 9
5 Employees present 10
6 Examination and authorisation 11

Identification

Product and type designation

Container type
40FT BESS

Serial No.
FRQ-53406000001

Document number
23A2007_240706_FAT_40FT_BESS_Container_1_EN_v2.0

Name and address of the manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this document

This acceptance report is used to assess compliance with all design and customer requirements of the tested system.

The factory acceptance test (FAT) is carried out by specialised personnel before delivery of the system and the result is checked by the customer.

2 Responsibilities

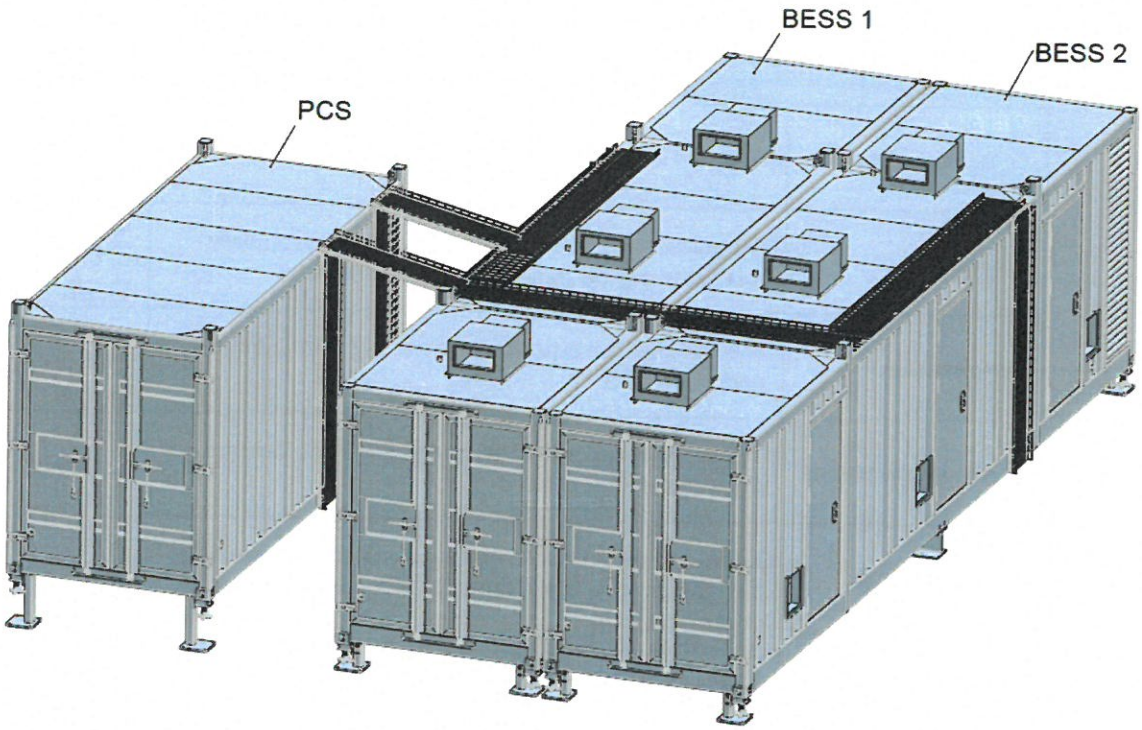
2.1 Responsibilities of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (FAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

2.2 Responsibilities of the customer

- Dispatch of specialised personnel to FREQCON GmbH, inspection of the acceptance results and documented data by the specialised personnel
- Confirmation of the factory acceptance report by specialised personnel

3 General Arrangement



4 Container Inspection

4.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. CAD of containers

Remarks:

4.2 Container Visual Inspection (Exterior)

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Container colour	Required colour/RAL colour code: 7035 (Light Grey)	☑ OK ☐ Defects ☐ N/A
Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☑ OK ☐ Defects ☐ N/A
Performances	The bushings correspond in size and position to the underlying CAD	☒ OK ☐ Defects ☐ N/A
Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☐ OK ☒ Defects ☐ N/A
Doors/openings	Doors and other openings of the container correspond in size and position to the CAD on which they are based	☒ OK ☐ Defects ☐ N/A
Cooling niche	The cooling recess corresponds to the underlying CAD. The cooling units are in the correct position and can draw in sufficient fresh air.	☒ OK ☐ Defects ☐ N/A
Warnings	The required warning signs are located on the personnel doors	☑ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
- BESS 1 = FRQ-5341200001 - COG should be marked & should be visible on all sides for lifting operations - finalize mounting cable tray cover on cooling niche - Earthing point on external is painted over - Earthing of cooling niche doors



4.3 Container Visual Inspection

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☒ OK ☐ Defects ☐ N/A
Light/sockets	Sufficient lighting is available. There are service sockets (230 V) in the container interior. The sockets and lighting are usable and easily accessible.	☒ OK ☐ Defects ☐ N/A
Air conditioning	The air conditioning units are in the correct position and at least one control unit for the air conditioning units is present. The air conditioning units are functional and can cool the room to a satisfactory level.	☒ ☐ OK ☐ Defects ☐ N/A
Personal security	All steps in the container (if present) are marked in signal colours (yellow/black). There are no sharp edges in the container.	☐ OK ☒ Defects ☐ N/A
Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☒ OK ☐ Defects ☐ N/A
Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
Gaskets on emergency doors → to be checked Sealing might be partial "push to open" sticker inside the access doors

5 Employees present

Identify each employee involved in the execution of this protocol. Document personal names, signature, name abbreviation and date in the following table:

Company Name	Employee Name	Signature	Abbreviation	Date
SHELL CROSSWIND	ALESSANDRO SUTTO			17/07/24
Fulkrum on behalf of crosswind	Mi Tahannazif	Tahan Jt		17.04.24
ABL	Dominik Mähl			17.07.2024
CROSSWIND	MARTIN TAYLOR			17/07/24
FREQCON	CARLOS PALENZUELA			17/07/24

	Yes/No
All persons involved in the factory acceptance test were documented.	☐ Y ☐ N

Remarks and description in case of defects:
SEE ALSO CONSOLIDATED PUNCH LIST

6 Examination and authorisation

The test report becomes the factory acceptance report as soon as the individual test reports have been completed and labelled with a test date. The factory acceptance report is sent to the customer for confirmation and the results must be documented in the TR8 test report.

TR8	Examination and authorisation of execution
Checking the test results and original data. Final assessment for factory acceptance	
☑ PASSED	☐ NOT PASSED
If there are any deviations, please complete the following section.	
Evaluate whether or not the existing deviation has an influence on the final factory acceptance test.	
☐ YES	☑ NO

Remark:

SEE OVERALL PUNCHLIST

Carried out by:	CARLOS PALENZUELA	Date:	18.07.2024
	FREQCON GmbH		DD/MM/YYYY
Authorised by:	[signature]	Date:	18.07.2024
	Customer		DD/MM/YYYY

STATRON
NON STOP POWER

Leak Testing Procedure

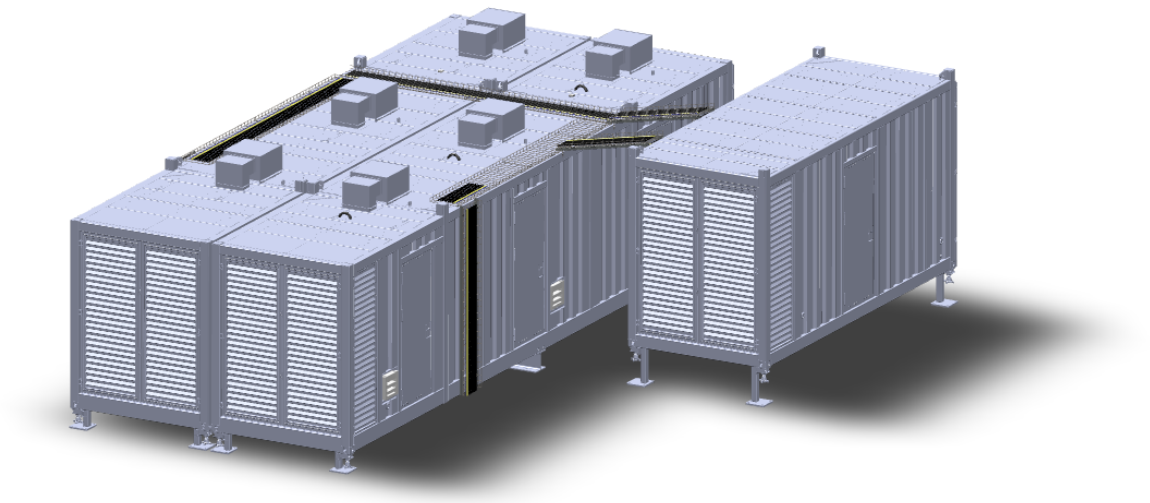
Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

FREQCON

Operating and Maintenance Manual
BESS PRO

1 MW/ 5 MWh
6.6 kV AC

Stationary Battery Energy Storage System (BESS)



Version	Date	Name	Description
v0.4	2024-08-22	M. Müller C. Palenzuela	First draft version
v1.0	2025-01-22	M. Müller C. Palenzuela	Final version
v1.1	2025-01-31	M. Müller	Updated version
v1.2	2025-02-05	C. Palenzuela	Updated section 11.2.3.1

Table 1: Version overview

	Date	Name
Editor:	2024-08-22	M. Müller C. Palenzuela
Checked by:	2024-08-24	M. Müller
Approved by:	2024-08-24	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware/Software Development and Production Centre

FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Deutschland

Phone: +49 (0) 5165 - 291 760 - 0

E-Mail:
info@freqcon.com

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.com**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Service

Service hotline for repair, complaints and maintenance from Monday to Thursday from 9:00 am - 4:00 pm and Friday from 9:00 am - 2:00 pm:

Phone: +49 (0) 5165 – 291 760 – 50

E-Mail:
service@freqcon.com

Content

1 About these Instructions 11
1.1 Disclaimer of Liability 12
1.2 Applicable Documents 12
1.3 Abbreviations 12
1.4 Warning Symbols 13
1.5 Information Symbols 14
1.6 Warning Levels / Signal Words 14
1.7 Target Groups 15
2 Safety Instructions 16
2.1 The Five Safety Rules 16
2.2 Basic Safety Information 16
2.3 Safety Instructions Battery Storage Unit 25
2.3.1 Safety Data Sheet 26
2.3.2 Personal Protection 26
2.3.3 Fire Fighting Measures 28
2.3.4 Disposal Considerations 31
2.3.5 Transport Information 31
2.4 Handling Electrostatic Sensitive Devices (ESD) 31
2.5 Warnings and Symbols on the Device 32
2.6 Qualification of Personnel 33
2.7 Personal Protection Equipment (PPE) 33
2.8 Changes of the Product 34
2.9 Proper Use 34
2.10 Misuse 35
2.11 Duties of the Operating Company 35
2.12 Duties of the User 36
3 Product Description 37
3.1 Working Principle 38
3.2 Control 38
3.3 PCS 38
3.4 Decoupling Protection 39
3.5 Auxiliary Power Supply of Protective Devices 39
3.6 Behavior in the event of a supply voltage failure 40
4 Design 41

4.1 AC Grid Connection 42
4.2 Data Interface 42
4.3 Safety Design 43
4.3.1 Safety Chain Battery Cell 43
4.3.2 Safety BMS Rack (S7) 43
4.3.3 Safety Converter Control 44
4.3.4 Overview of the Safety Concept 45
4.3.5 Fire Protection System and Suppression System 46
4.4 PCS Container 50
4.4.1 Container Overview 50
4.4.2 Cabinet Overview- Converter Cabinets 54
4.4.3 Internal Components – Converter Cabinets 55
4.4.4 Cabinet Overview - Control Cabinets 57
4.4.5 Internal Components – Control Cabinets (CTRL_1 and CTRL_2) 58
4.4.6 External Components – Control Cabinet 59
4.5 BESS 1 Container 60
4.5.1 Container Overview 60
4.5.2 Cabinet Overview- BESS 1 Battery Cabinets 64
4.5.3 Internal Components – Battery Cabinets 65
4.6 BESS 2 Container 66
4.6.1 Container Overview 66
4.6.2 Cabinet Overview- BESS 2 Battery Cabinets 70
4.6.3 Internal Components – Battery Cabinets 71
4.7 Battery Modules 72
4.7.1 Design 72
4.7.2 Technical Data 73
4.7.3 Connection Elements 74
4.7.4 Communication Scheme 74
4.7.5 Lifting Device and Mounting Table 75
4.7.6 Mobile Lifting Device 77
4.7.7 MV Transformer 78
4.8 Cooling System 79
4.8.1 BESS 1 / BESS 2 Container 79
4.8.2 PCS Container 80
5 Operating Interfaces 84

6 Control System 84
6.1 Main Control System 84
6.2 Battery Cabinet Control System 86
6.3 Network Structure 87
7 Converter Main States 90
7.1 Error Levels 90
7.2 Main States 91
8 Technical Data 93
9 Environmental Conditions 94
10 Transport, Storage and Commissioning 95
10.1 Unpacking 95
10.2 Transport 96
10.2.1 Container Lifting 98
10.2.2 Dimensions and Center of Gravity 101
10.3 Storage 102
10.3.1 Storage Condition 102
10.4 Assembly and Initial Commissioning 104
11 Mounting 105
11.1 General 105
11.1.1 Cable Routing 106
11.1.2 Coding 106
11.2 Installation location 107
11.2.1 Distances Between Containers 108
11.2.2 Cable Outlets 109
11.2.3 Cable Gland Description 112
11.2.4 AC Connection 119
11.2.5 Higher-Level Controller Connection 121
12 Pre-Commissioning 122
12.1 Activate Motor Contactors and Fuses 122
12.2 Check Power Cables 122
12.3 Check Communication Cables 123
12.4 Cooling System Preparations 123
13 Commissioning 123
14 Operation 123
14.1 Operating Panel 124

14.2 Indicator Lights ... 124
14.3 Control Elements ... 125
14.4 Switching on the BESS ... 126
14.5 Switching off the BESS ... 128
14.6 De-Energizing ... 130
14.7 Check Voltage-Free Status of DC Link ... 131
14.8 AC Circuit Breaker ... 132
14.8.1 Circuit Breaker Components ... 133
14.8.2 Positions of CB in the Guide Frame ... 134
14.8.3 Protect the CB Against Unintentional Reclosing ... 135
14.9 DC Fuse Switch Disconnectors ... 137
14.9.1 Fuse Disconnector Components ... 138
14.9.2 Locking Device ... 139
14.9.3 Protect the DC Disconnector Against Unintentional Reclosing ... 140
15 Monitoring ... 141
16 Data transfer with higher-level controller ... 142
17 Maintenance ... 142
17.1 Preparations Prior Maintenance ... 144
17.2 Maintenance Schedule ... 145
17.3 UPS ... 146
17.3.1 UPS Functionality Check ... 146
17.3.2 Removing the UPS battery ... 147
17.4 Changing the Intake Fan Filters ... 150
17.5 Visual Inspection ... 151
17.6 AC Circuit Breaker(s) ... 152
17.6.1 Inspection work ... 152
17.7 Replace PLC Buffer Battery ... 153
17.7.1 Preventive maintenance ... 153
17.7.2 Replacing Backup Battery ... 153
17.8 Exchanging the Cooling Liquid ... 154
17.8.2 Filling the Cooling System ... 157
17.9 Check pressure of expansion tank ... 160
17.10 Pump ... 162
17.11 Exhaust Units ... 163
17.12 Fire Dampers ... 163

17.13 H2 Sensors 163
18 Container Repair 164
18.1 Process Instructions (New Application) 164
18.2 Process instructions (Repair - damage down to the steel) 165
18.3 Process instructions (Repair - damage only within the topcoat) 167
19 Settable Devices 168
20 IP Addresses 168
21 PLC 169
21.1 Indicator Lights 169
21.2 Connection Elements 171
21.3 PLC Connection 172
21.4 Compiled Project Update 173
22 WebVisu 176
22.1 WebVisu remote connection 177
22.2 Navigation 178
22.2.1 Home Button 178
22.2.2 Page Menu Button 179
22.3 WebVisu User Interface 179
22.4 WebVisu Pages 180
22.4.1 Overview 180
22.4.2 Overview DC-DC 181
22.4.3 AC-DC Converter 182
22.4.4 DC Link 183
22.4.5 DC-DC Converter 184
22.4.6 Converter Control 185
22.4.7 Cooling 186
22.4.8 Battery Overview 187
22.4.9 Grid Protection Settings 188
22.4.10 Init List 189
22.4.11 Error List 190
22.4.12 Action List 191
23 Troubleshooting 192
24 Dismantling and Disposal 192
24.1 Safety 192
24.2 Dismantling 192

24.3 Disposal of Packaging Material 192
24.4 BESS Disposal 193

Identification

Product and Type Designation

Type
BESS 1 MW / 5 MWh / 6.6 kV / 620 V AC

Serial number

PCS	FRQ-53396000001
BESS 1	FRQ-53406000001
BESS 2	FRQ-53412000001

Product family
BESS Energy Storage System

Product Version / Document Version

Product version
Prototype

Document release date
February 2025

Doc Code
10354_23A2007_250205_Operating_Manual_BESS_1MW_5MWh_6.6kV_EN_v1.2

Name and Address of Manufacturer and Supplier

FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Deutschland

Legal Information

This work is protected by copyright. This work is protected by copyright. This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About these Instructions

This manual is part of the product and applies exclusively to the system described in this document.

This operating manual contains the necessary information for the proper use of the described system. The operating manual is supplied together with the product and is considered as an important part of the product.

Please read this manual carefully, as it contains important information on the installation and operation of the product.
Please pay particular attention to the notes regarding the safe use of the system.
The manufacturer accepts no liability for any damage caused by failure to observe these instructions.

Keep this manual and provide it to the new owner in case of a change of the operating company.
All personnel who have any relation of handling or operating the product must always have direct access to this manual.

All personnel who have any relation of operating the unit are obligated to read all related manuals regarding the system described in this document. The employed personnel must declare that they have fully read and understood all contents of the manuals and agree to follow all instructions, especially issues regarding safety and accident prevention.

Additional Documents

The instructions of this operating manual must be supplemented with the necessary, customary local and current accident prevention regulations, environmental protection rules and laws.

Location of the Manual

Always keep this manual within direct reach when operating or handling the unit. The operator must have direct access to the manual. The operator must have direct access to the manual.

Display Elements

Symbol	Significance
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

1.1 Disclaimer of Liability

The contents of this publication have been reviewed to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, any necessary corrections are included in subsequent editions.

1.2 Applicable Documents

The delivery scope of the product includes the following documents:

Document	Document Name
Circuit diagram BESS 1 MW / 5 MWh (FREQCON)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20250123_V1.3
Data interface description (FREQCON)	23A2007_250116_Modbus_Register BESS_V1_0_0_1
Maintenance schedule – BESS (FREQCON)	EED_0000_20_Maintenance_Schedule_BESS_LFP_v1.3_EN
Operating and Maintenance Manual -AC circuit breaker 3WL (Siemens)	3ZX1812-0WL00-0AN4_online_201806140915326928
Operating Manual -DC circuit breaker 3NP1 (Siemens)	System_Manual_3NP1_3ZX1012-0NP10-1AC1_en-US
Operating, commissioning and maintenance instructions PLC Simotion P320-4 (Siemens)	P320_4_commissioning_en-US P320_4_operating_en-US
MSDS Battery Cells LF280 (EVE)	LF280K MSDS
Aerosol Safety Data Sheet (Stat-X)	Stat-X Aerosol Safety Sheet 19010.3_SDSR_Stat-X_1
Stat-X operating instructions (Stat-X)	19001 1.2.5 Owners Manual Electric DE
Operating and Maintenance Manual – exhaust units (Puma)	TFE_Direct_Driven_Unit_Run_&_Standby_O_&_M_1030
Operating and Maintenance Manual – fire dampers (Puma)	Air_Make_Up_Dampers_O&M_1032
Operating and Maintenance Manual – H2 sensors (Dräger)	Dräger Polytron 8200 manual 9033302_01_2011_enus
Operating Instructions – cable hoist	manual_2255140

Table 3: Applicable documents

1.3 Abbreviations

The following list provides descriptions about the generic terms and abbreviations used in this document:

Generic Term and Abbreviation	Significance
AC	Alternating current
Identifier	Equipment labeling
BESS	Battery Energy Storage System
BMS	Battery management system
BSU	Blackstart unit
DC	Direct current
DC-link	Direct current link
EMC	Electromagnetic compatibility
EMF	Electromagnetic fields
EMS	Energy management system
FRQ	FRFEQCON GmbH
HMI	Human-Machine Interface
HV	High voltage

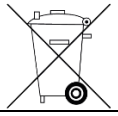
HVIO	High Voltage I/O Module
MB	Modbus
RTU	Remote Terminal Unit
TCP	Transmission control protocol
MSC	Multi-Source Converter
MV	Medium voltage
LFP	Lithium iron phosphate
LV	Low voltage
PCS	Power conversion system
PLC	Programmable Logic Controller
PPE	Personal safety equipment
IGBT	Insulated-Gate Bipolar Transistor
IEC	International Electrotechnical Commission
I/O	Input/output
IP	Internet protocol
SoC	State of charge
TR	Thermal runway
UPS	Uninterruptable power supply

Table 4: List of Abbreviations

1.4 Warning Symbols

Observe the warning symbols in this document and those attached on the device. The warning symbols have the following meaning:

Symbols	Significance
	Hazard (general)
	Hazard by voltage
	Hazard by high temperature
	Hazard by batteries
	Hazard by fire
	Maintenance lockout tagout, do not switch!
	Acute toxicity (oral, dermal, inhalation) (hazard. category 4)
	Respiratory sensitization (hazard category 1, 1A and 1B)
	Prohibition for people with pacemakers

	Hazard by heavy load
	Do not dispose in household waste. (See section 24 “Dismantling and Disposal”)

1.5 Information Symbols

Symbol	Significance
	Important technical information for this product

1.6 Warning Levels / Signal Words

DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE	Indicates that property damage can result, if proper precautions are not taken.

1.7 Target Groups

⚠ DANGER	
	**Danger from and for unauthorized persons** Unauthorized persons are not aware of the dangers in the work area and may endanger themselves and third parties. ➜ Keep unauthorized persons away from the work area. ➜ If in doubt, speak to persons and direct them away from the work area. ➜ Interrupt the work as long as unauthorized persons are in the work area. ➜ Always keep the entrance door(s) locked when not performing work on the system to prevent unauthorized persons from entering the container.

Group	Significance
Operator	• Uses the product himself for commercial or economic purposes or lets a third-party use/apply it. • During operation, bears legal product responsibility for the protection of the user, personnel and third parties. • May not open control cabinets and/or perform maintenance.
Trained person	• Has been demonstrably trained and instructed by the operator about the assigned tasks and possible dangers in case of improper behavior. • Is authorized to operate the plant. • May not open control cabinets and/or perform maintenance.
Service Personnel	• FREQCON GmbH service personnel • Personnel trained and authorized by FREQCON and authorized specialist personnel. • Carries out all other work on the plant, e. g. commissioning, maintenance work, transport, and troubleshooting.
Manufacturer	• Person who was/is involved in the development of the energy storage system and has detailed knowledge of the structure and function of the modules or the entire system - in accordance with the relevant specialist area.

Table 5: Target groups

2 Safety Instructions

2.1 The Five Safety Rules

For your own personal safety and to prevent material damage when carrying out any work, always observe the safety-relevant instructions and the following five safety rules according to EN 50110-1 "Working in a voltage-free state".



2.2 Basic Safety Information

Do not operate!	**Lock and tag power switches and controller devices**
	Follow national laws regarding occupational safety and health. ➜ Identify the energy source(s). ➜ Isolate the energy source(s). ➜ Determine voltage-free status. ➜ Ground device or equipment to protect from short circuiting and from shocks. ➜ Lock and Tag the energy source(s). ➜ Prove that the equipment isolation is effective. ➜ When required, apply lock-out device or clamp and secure with padlock(s).

Important!	
	➜ Read the instructions of this manual thoroughly before use! ➜ Keep manual within reach. ➜ All personnel who have to perform any task on the BESS (on-site or remotely) with respect to operation of the unit are obligated to read all related manuals regarding the BESS. By proceeding with work on the BESS, the personnel declare that they have fully read and understood all contents of the manuals and agree to follow all instructions, especially issues regarding safety and accident prevention.

⚠ DANGER	
	**Hazard by voltage** Always respect all the safety instructions and, in particular: ➜ Always use protective devices suitable and approved for each type of activity. ➜ The instructions in this manual must be strictly followed. ➜ Use of the equipment must comply with all national and local regulations. ➜ Access to internal components is only allowed after the converter has been de-energized and disconnected from all power supplies.

⚠ DANGER	
	**Hazard by voltage** ➜ Electric shock hazard. ➜ Only electricians may perform work on electrical components. ➜ Do not touch live components! ➜ Disconnect the device from all power supplies, before performing work on the device. ➜ Do not short circuit any conductive parts that are not de-energized before. (Take care with jewellery, tools, instruments, etc. which can cause short circuits accidentally.)

⚠ DANGER	
	**Hazard by voltage** ➜ Before opening the cabinet doors de-energize the converter. ➜ Even if the main circuit breaker is switched off, the cabinets are not completely voltage-free.

⚠ DANGER	
	**Risk of burns on hot surfaces** ➜ Avoid contact with hot surfaces or wear protective clothing (e.g. protective gloves).

⚠ DANGER	
	**General risk of injury due to improper handling** ➜ Only perform work on the device if you have expert knowledge of the respective activity. ➜ Follow the operating instructions and warnings stated in this manual.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 “Protect the CB Against Unintentional Reclosing”. ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

⚠ DANGER	
	**Danger to life through electric arcs** Danger by electric arcs could occur by: • Exceedance of the maximum input current • Faulty design of circuit breakers or transformers • Faulty or not connected cables • Excessive contamination Electric arcs may lead to death, severe injuries or material damage. ➜ Make sure the system is properly designed and all power cables are connected correctly. The maximum permissible input current is provided in the table "Technical Data". ➜ Excessive contamination must be removed.

⚠ DANGER	
	**General risk of injury due to improper handling.** Always respect all the safety instructions and, in particular: ➜ Always use protective devices suitable and approved for each type of activity. ➜ The instructions in this manual must be strictly followed. ➜ Use of the equipment must comply with all national and local regulations. ➜ Access to internal components is only allowed after the converter has been de-energized and disconnected from all power supplies. ➜ It is not allowed to perform work on a live converter. ➜ The converter and all connected systems/components must be electrical grounded properly. ➜ All installation work and maintenance on the BESS must be carried out by qualified personnel. ➜ Improper use or handling of the BESS during transportation, installation or during operation may result in damage to the equipment or cause severe, even fatal injury. ➜ Maintenance work on the converter unit must be performed with reasonable care. ➜ Non-compliance with the present instructions may cause damage to the product and could lead to serious injuries of the personnel.

⚠ DANGER	
	**Danger to life when live parts are touched on damaged devices** Improper handling of devices can cause damage. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components. If touched, this can result in death or severe injury. ➜ Ensure compliance with the limit values specified in the technical data during transport, storage and operation. ➜ Do not use any damaged devices.

⚠ DANGER	
	**Danger to life through electric shock due to unconnected cable shields** Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields. ➜ As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.

⚠ DANGER	
	**Danger to life due to electric shock when not grounded** If the protective conductor connection is missing or incorrect, high voltages can occur at open, exposed parts when using devices of protection class I. Touching these parts can result in death or serious injury. ➜ Ground the device in compliance with the applicable regulations.

⚠ DANGER	
	**Danger to life due to electric shock when opening plug connections in operation** When opening plug connections in operation, arcs can result in death or severe injuries. ➜ Only open plug connections when the equipment is de-energized, unless it has been explicitly stated that they can be opened in operation.

⚠ DANGER	
	**Danger to life through electric shock due to the residual charge of the power component capacitors** Due to the use of capacitors, a dangerous voltage is present even up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury. ➜ Wait for 5 minutes and then check the de-energized state of the system. Only then should you start working on the device.

⚠ DANGER	
	**Danger to life from electromagnetic fields** Electromagnetic fields (EMF) are generated by the operation of electrical power equipment, such as transformers, converters, or motors. People with pacemakers or implants are at particular risk in the immediate vicinity of this equipment. ➜ If you have a heart pacemaker or implant, maintain a minimum distance of 2 m from electrical power equipment.

⚠ DANGER	
	**Danger to life when safety functions are inactive** Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death. ➜ Observe the information in the appropriate product documentation before commissioning. ➜ Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components. ➜ Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing. ➜ Perform a function test. ➜ Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

⚠ DANGER	
	**Danger to life due to fire if overheating occurs because of insufficient ventilation clearances** Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems. ➜ Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

⚠ DANGER	
	**Danger of an accident occurring due to missing or illegible warning labels** Missing or illegible warning labels can result in accidents involving death or serious injury. Check that the warning labels are complete based on the documentation. ➜ Attach any missing warning labels to the components, in the national language if necessary. ➜ Replace illegible warning labels.

⚠ WARNING	
	**Hazard by hot surfaces of components** During operation, some components may heat up significantly, e.g. heat sinks and inductors. These components can still be very hot for some time after operation. In case of contact, severe bodily injuries, such as skin burns, may result. ➜ Do not touch hot surfaces even after shutdown of the converter system.

⚠ WARNING	
	**Danger to life or malfunctions of the BESS as a result of incorrect or changed parameterization** As a result of incorrect or changed parameterization, the system can malfunction, which in turn can lead to injuries or death. ➜ Protect the parameterization (parameter assignments) against unauthorized access. ➜ Respond to possible malfunctions by applying suitable measures (e.g. EMERGENCY STOP or EMERGENCY OFF).

⚠ WARNING	
 	**Hazard by cooling liquid** The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed. ➜ Avoid oral ingestion of the coolant since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention. ➜ Avoid skin contact with the coolant. ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

⚠ CAUTION	
	**Hazard by sharp edges on packaging** Improper handling during unpacking can cause injuries. ➜ Use appropriate safety gloves to protect your hands from possible cuts.

NOTICE	
	**Material damage due to loose power connections** Insufficient tightening torques or vibrations can result in loose electrical connections. This can result in damage due to fire, device defects or malfunctions. ➜ Tighten all power connections with the specified tightening torques, e.g. grid supply connection. ➜ Check all power connections at regular intervals. This applies in particular after transport.

NOTICE	
	**Device damage caused by incorrect voltage/insulation tests** Incorrect voltage/insulation tests can damage the device. ➜ Before performing voltage/insulation tests on the equipment, disconnect all equipment as high voltage tests have been performed on inverters and motors by their manufacturers. Therefore, it is not necessary to perform a retest on the system.

NOTICE

Material damage due to overloading of DC devices and connecting cables

The DC paths and the connection cables are not protected against overload by the BESS.

Select external components according to the specified nominal and maximum currents of the BESS.

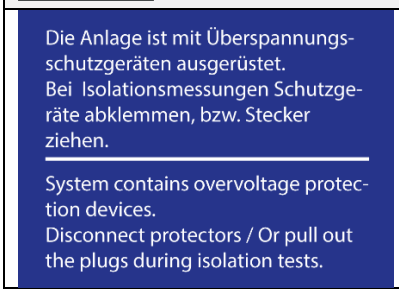
➜ If necessary, use appropriate protective equipment for the external components.

NOTICE

Material damage due to improper use of the transformer

For your safety, carefully read the delivered operating instructions of the transformer and observe the instructions. Technical specifications of the transformer which are provided on its´ type plate like rated current, rated power etc. must be strictly observed when commissioning and feeding power to the grid. All electrical connection work must be carried out onsite and by trained, qualified personnel, provided with the required safety devices in accordance with the national occupational safety regulations. Please pay attention to the proper protection of the transformer during unloading, installation at the place of operation, feeding and operation The transgression of the voltage or power and the presence of external factors (such as condensation, solar radiation, plants and animals) can affect the proper functioning of the transformer).

NOTICE



General risk of damage

During isolation tests disconnect overvoltage protection devices or pull out the plugs otherwise they will be activated or destroyed.

2.3 Safety Instructions Battery Storage Unit

⚠ DANGER	
	**Hazard by electrolyte** Work on the battery storage system is only allowed to be performed by FREQCON service personnel or qualified personnel trained and authorized by FREQCON. It is not allowed to modify or manipulate the battery storage unit and its components. ➜ Do not open, disassemble or puncture the battery storage cabinets or battery modules. ➜ Do not short circuit the battery storage unit. ➜ Do not expose the battery storage system to vibrations or shock. ➜ Do not a use defective or damaged battery storage system or battery modules. ➜ Do not touch defective or damaged batteries with bare hands. Defective or damaged batteries must only be handled by FREQCON personnel.

⚠ DANGER	
	**Hazard by electrolyte** The material/media required for intended operation of the battery storage system are procured and provided by the manufacturer. ➜ The proper handling of these materials/media and the associated risks underly the sole responsibility of the manufacturer. ➜ Hazard and disposal information must be provided by the manufacturer. ➜ The safety data sheets of the material and media manufacturers are to be observed.

⚠ WARNING	
	**Health hazards due to negligent use of personal protective equipment** Serious injuries can occur when working without personal protective equipment. ➜ Wear personal protective equipment (PPE) when working on the BESS. Refer to section 2.7 "Personal Protection Equipment (PPE)" for information regarding the required PPE.

⚠ WARNING	
	**Possible danger to life due to electric shock when extinguishing fire or due to flooding!** If the following instructions are not observed, this can lead to damage to property and personal injury, for which FREQCON GmbH accepts no liability whatsoever. ➜ In the event of a fire, switch off the battery storage system if safe to do so. ➜ Immediately alert the fire department. ➜ Immediately remove yourself and other persons from the danger zone. ➜ Inform the fire department about the presence of lithium iron phosphate batteries.

⚠ CAUTION	
	**Danger due to fire breaking out** During operation, fire may break out, e.g. due to sparks or heated surfaces. ➜ Observe the relevant safety regulations (5 safety rules). ➜ Note the risk of arcing when operating the NH isolators installed inside the battery storage cabinets. ➜ Never install or operate a potentially defective or obviously defective battery storage unit.

⚠ CAUTION	
	**Hazard by burns (electric arcs)** When working on the electrical equipment, you may come into direct contact with faulty or overloaded parts which can cause burns. ➜ Always observe the relevant country-specific safety regulations. ➜ Note the risk of arcing when operating the NH isolators installed inside the battery storage cabinets. ➜ Note the risk of arcing when operating the NH isolators installed inside the battery storage cabinets.

2.3.1 Safety Data Sheet

Observe the information provided in the Material Safety Data Sheet (MSDS) of the battery cells (*see section 1.2 "Applicable Documents"*).

2.3.2 Personal Protection

This chapter describes the personal protection for FREQCON battery converter systems in the event of fire or the occurrence of a toxic gas concentration.

Basic safety measures

- No person may remain inside the container or in the safety area of the container while the system is in operation.
- All container doors must be locked while the system is in operation.
- Maintenance and repair work may only be carried out when the system is switched off and all energy sources are disconnected from the system.

Critical situation regarding personal safety

A person enters the container for maintenance/repair work in which there is a fire (risk of deflagration when opening the container door) or a toxic concentration of carbon monoxide due to outgassing batteries.

Definition of the protection objective

Under all circumstances, a person must be prevented from entering the container if the critical situation mentioned before exists.

Technical measures to achieve the protection objective

- Reliable detection of a fire or toxic gas concentration using suitable sensors (smoke detectors, CO sensors, temperature sensors).
- The sensors are redundant. Smoke detectors, CO sensors and temperature sensors are installed in each battery room.
- One H2 sensor is installed inside each battery room of the BESS containers.
- If the system is shut down by emergency shutdown, no person may enter the container.
- If a hazardous situation exists, an infrared thermometer must first be used to check whether there is a fire in the container. A temperature above 60 °C is a sure sign of a fire inside the container. If this is the case, the container doors must not be opened (risk of deflagration) and the fire brigade must be alerted.
- If a fire can be ruled out as the cause of the emergency shutdown, a toxic gas concentration could be present. Entering the container is not permitted in this situation. Active ventilation (exhaust units in the BESS container roof) reduces the gas concentration in the container.

2.3.3 Fire Fighting Measures

1) Fire protection / early fire detection
   a. Spatial conditions:
      Primarily through the structural measure; Space between modules, air conditioning and ventilation reduces the risk of thermal stress to a minimum
   b. It must be ensured that there is no additional fire load in the battery rooms. Unauthorized access must be strictly prevented.
   c. Sensors for detecting smoke, heat and CO gas are redundantly built into the alarm system.
   d. At 300 °C automatic fire suppression using an aerosol mist triggers itself.

Important: Extinguishing an internal cell fire is not possible. Due to the chemical release of bound oxygen in the cathodes, the fire inside the cell sustains itself. The aerosol extinguishing system is intended to prevent the flames from spreading to the outer surroundings of the battery module!

2) Behavior in case of fire
   a. Upon detecting a fire in the battery room, the battery container is immediately and automatically disconnected from the grid. The circuit breaker opens its contacts to prevent any further external energy supply.
   b. Toxic and hazardous substances are released by the battery in the event of a fire.
      Harmful gases include:
      Hydrogen (H_2) 48%
      Carbon dioxide (CO_2) 27%
      Carbon monoxide (CO) 11%
   c. Remove all persons from the danger area.
   d. Clear affected area and secure from entry.
   e. Disconnect all supply voltages of the BESS at the disconnection points of the external voltage sources.
   f. Only start active measures in the event of visible flame development outside the energy storage unit.
   g. Do not enter any electrolyte cloud that may form in the external area (near the floor).
   h. Wait at least 48 hours before starting firefighting measures inside the container. First open the access door and wait another 2 h.

⚠ DANGER	
	**Poisoning and chemical burns hazard** Escaping electrolyte gases contain chemicals which are harmful to humans. ➜ Keep away from electrolyte mist clouds. ➜ Approach electrolyte mist clouds only under full protection. ➜ Observe the instructions in the Material Safety Data Sheet of the battery cells *(see applicable documents)*. ➜ Follow the following instructions

3) Recommendation for rescue units

   Firefighting should be conducted according to regional standards and guidelines.
   (EN 15182-1:2019-11).
   The distance for the fire hose nozzle must be maintained.

Ensure full protective gear according to DGUV Information 205-014 (e.g. DIN EN 469 ; Protective clothing for the fire brigade - performance requirements for protective clothing for fire brigade activities) and recirculating air independent respirator is worn.
For firefighting protective equipment, thermal risk is given more priority than chemical hazard.

4) Instructions after fire extinction

Once the fire brigade has cleared the fire site and the fire has been extinguished, an electrically trained specialist must immediately ensure and verify the absence of voltage (measure all poles) and secure against re-energization.
5 safety rules!
Attention: Batteries continue to maintain voltage even after disconnection!
In addition, ventilate the rooms adequately to eliminate any remaining hazardous fire gases.
According to the technical data sheet, the battery modules must be stored/disposed.

Rules of Conduct for the Fire Brigade

The following notice board must be kept outside the container or handed over to the local fire department. A laminated copy is included in the scope of delivery.

Rules of conduct for the fire brigade



Attention electrical voltage!

Batteries are still live after disconnection!!!

Batteries can outgas when heated

CO = carbon monoxide
H2 = Hydrogen







Unauthorized access is strictly prohibited.

Keep doors closed in case of fire

The use of respiratory protection is strongly recommended





Battery fire cannot be extinguished!

Container cooling from outside

Extinguishing agents: water

2.3.4 Disposal Considerations

Lithium-ion cell batteries are labeled in compliance with the EU Battery Directive 2006/66/EC.

For instructions regarding the disposal of the battery storage system and its battery storage modules, refer to section 24 ”Dismantling and Disposal”.

2.3.5 Transport Information

For information regarding the transport of the battery storage system and its battery storage modules, refer to section 10.2 "Transport”.

2.4 Handling Electrostatic Sensitive Devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE



Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- ➜ Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g. conductive foam rubber of aluminum foil.
- ➜ Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- ➜ Place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam. ESD packaging, ESD transport container).

⚠ DANGER



Danger to life as a result of unsafe operating states resulting from software manipulation

Software manipulations (e.g. viruses, trojans, malware or worms) can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- ➜ Keep the software up to date.
- ➜ Incorporate all installed products, especially the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation.
- ➜ Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

2.5 Warnings and Symbols on the Device



2.6 Qualification of Personnel

Installation, service and operating personnel must be sufficiently trained before installing, operating and handling the equipment.

2.7 Personal Protection Equipment (PPE)

Always wear safety equipment when working on the product.

When carrying out maintenance and service work, secure controllers, devices and units of designated area against accidental activation.

Symbol	Meaning and Application
	Gloves made of nitrile rubber against chemicals and microorganisms (at least protection index 2 according to EN 374-1) • for removal of electrolyte or hydrofluoric acid (only by FREQCON service) • Gloves according to EN 60903 - up to 1000 V AC for live working activities
	Safety shoes (toe protection, non-slip, ESD) • Operation • Cleaning Safety shoes (acid resistant) or rubber boots • for removal of electrolyte or hydrofluoric acid (only by FREQCON service)
	Tightly fitting safety goggles/basket goggles/face shield • for removal of electrolyte and hydrofluoric acid (only by FREQCON service)
	Chemical protective suit • for removal of electrolyte and hydrofluoric acid (only by FREQCON service) • for fire fighting
	Ambient air-independent breathing apparatus • for firefighting in case of smoke formation inside or outside the building (by rescue forces)

Table 6: Personal Protection Equipment (PPE)

2.8 Changes of the Product

Modifications to the product and/or mounting of parts from other manufacturers can endanger the operating safety of the product. This especially applies to tampering with safety-relevant parts.

Any modification carried out without prior written approval by the manufacturer will result in the manufacturer's declaration of conformity becoming void. The responsibility for damage and accidents caused by modifications of this kind shall be borne solely by the user.

2.9 Proper Use

The Battery Energy Storage System (BESS) described in this document is intended to feed into or draw power out of a connected electric grid by means of a power conversion system connected between both. The system specifications are listed in section 3 of this document.

The system is properly constructed, installed and commissioned by FREQCON service personnel according to manufacturer specifications. The operator ensures that the required environmental conditions are met (*see section 8 and 9*).

Modification of the device by the operator or integrator is not permitted. Only use the device in accordance with the specifications in this manual and the locally applicable standards and directives. Use contrary to the specifications and specified operating limits as well as any modification of the energy storage unit by the user is not permitted and will void the warranty!

Deviations from this manual are not permitted or require the separate written approval of FREQCON GmbH.

The system is intended for stationary use as a fixed installation. Any other or additional use is considered improper and increases the risk of personal injury and property damage when handling the energy storage system. The manufacturer rejects any liability and warranty claims for damage caused by improper use.

Access to the container is only permitted for instructed personnel. The access doors of the container must be locked if no instructed personnel are on site. The access doors of the container must be locked if no instructed personnel is on site.

Proper use also includes the following measures:

- ➜ Observe the operating manual.
- ➜ Comply with technical data.
- ➜ Comply with maintenance conditions.
- ➜ Immediately eliminate faults which hamper safety.
- ➜ Operate the unit only when it is in technically flawless condition.

2.10 Misuse

Any use which goes beyond the proper use is considered to be misuse. It can result in serious injuries or damage and is therefore prohibited.

The responsibility for damage resulting from misuse shall be borne solely by the operating company of the product.

2.11 Duties of the Operating Company

To ensure safe, smooth operation of the unit, you as the operator must comply with the following:

Personnel

- ➜ Only allow personnel with corresponding knowledge to operate and clean the product.
- ➜ Only allow a trained electrician or person with electro technical instruction to work on the electrical system. The regulations given in section 1.7 “Target Groups” must be observed.
- ➜ Clearly and bindingly specify the responsibilities for operation, service and maintenance work.

Operating Manual

- ➜ Always keep this operating manual available near the device.
- ➜ Make sure that the personnel have read and understood this operating manual before working on the device.

Safety

- ➜ Monitor the compliance with the generally valid legal and other binding safety and accident prevention regulations.
- ➜ Make sure that the users of the product wear the necessary, personal safety equipment in accordance with their job.
- ➜ Ensure that all safety and danger warnings on the product and in the installation room are kept complete and in legible condition.

Inspection and Maintenance

- ➜ Observe the adherence of the inspection and maintenance intervals in section 16 „Maintenance“.
- ➜ Operate the product only if it is flawless.

2.12 Duties of the User

The following are referred to as users:

- Persons, who install and configure the product.
- Persons, who operate the product and eliminate errors during the process.
- Persons, who carry out checking, maintenance and inspection activities.

Follow the instructions below in the interest of your own safety and for fault-free operation of the product:

➜ Read this operating manual before using the product. If you have questions, contact your superior or the safety officer.
➜ Always carry out activities based on the complete operating manual. Missing information due to an incomplete operating manual can result in serious or fatal injuries and in damage.
➜ Familiarize yourself with the safety devices of the product. Do not make any modifications to it.
➜ Do not operate the product until you have received a complete user training course for this product from an authorized person.
➜ Report any fault in the product to your superior if you cannot and may not eliminate it yourself.

3 Product Description

The battery energy storage system described in this document (BESS) is designed as a battery-to-grid system.

The BESS system is generally capable to provide the following functions, but the specific functions depend on the contractually agreed specifications:



Figure 1: BESS Functions Overview

The BESS consisting of a battery storage system with battery modules, battery control system and air conditioning systems are integrated in two (2) 40" HC containers with an active fire suppression system (*see section 4, "Design"*).

The PCS hardware and software control system as well as the converter technology incl. water cooling system with heat exchangers and air conditioning systems for the interior temperature are integrated in one (1) separate 20" container with a passive fire suppression system. The BESS is connected to the AC grid via busbars at the HV side of a 6.6 kV /620 V AC MV transformer inside the PCS container. The cable entries into the containers are located in the container floors.

It is not permitted to use the BESS system for purposes other than those specified in this manual.

Only sufficiently trained personnel are permitted to run, handle, and operate the unit (*see section 1.7* "*Target* Groups").

3.1 Working Principle

The BESS consists of a converter system with a total output of 1 MW and a battery storage system with a usable storage capacity of 5 MWh (5.5 MWh installed).

The BESS is passively charged by the energy taken from the AC grid via contactors and resistors from the DC link of the PCS as soon as the voltage level of the battery storage system falls below a value predefined in the PCS controller.

3.2 Control

A Programmable Logic Controller (PLC) is used as system controller. After commissioning and parameterization, the BESS operates automatically. The control system provides remote monitoring and access to the converter functions and set point adjustment via IT network. For detailed information regarding the control system, refer to section 6 “Control System”.

3.3 PCS

The BESS system is equipped with an integrated power conversion system (PCS), the FREQCON MSC converter system.

The key component of the converter system is a DC link converter with a control unit, generating a controlled DC voltage from the AC infeed, the so-called DC link voltage. The DC link voltage is kept to a constant level independently from the grid voltage (also in case of power feedback into the grid). It is required that the specified DC voltage setpoint is within a defined operational range.

3.4 Decoupling Protection

The decoupling protection of the converter system consists of the main controller, which evaluates the signals and controls the coupling switch (circuit breaker). In addition, peripherals for measuring the grid voltage are installed. The periphery consists of a HVIO that divides the grid voltage to a lower voltage and a PIII converter interface that digitizes the measured voltage and provides it to the main controller.

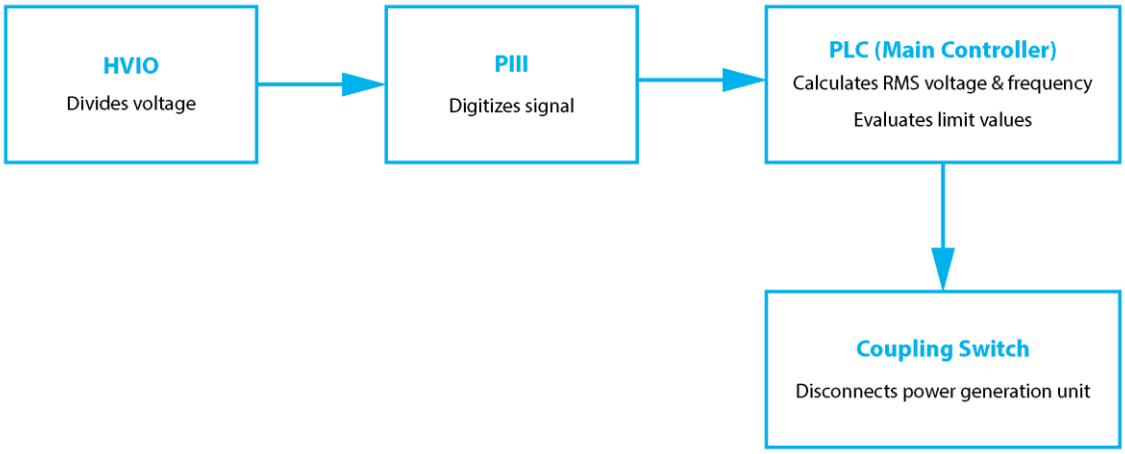


Figure 2: Decoupling protection scheme

The grid phases are measured by an HVIO board that is connected to a PIII. The voltages evaluated are phase-neutral voltages.

The measured instantaneous voltages are used to determine the RMS value, the phase angle and the frequency in the main controller. The currents are recorded directly at IGBT half bridges and also digitized via the PIII. RMS currents are calculated in the main controller.

RMS voltages, RMS currents and frequency are monitored for limit values in the main controller and the coupling switch is switched off if these are exceeded.

3.5 Auxiliary Power Supply of Protective Devices

The entire control system is buffered via a UPS. This is set so that the control and protection system is supplied with energy for at least 15 minutes.

In the event of a faulty UPS and a grid failure, the main controller fails, the grid switch opens, and the converter disconnects from the grid.

3.6 Behavior in the event of a supply voltage failure

If the supply voltage of the converter system fails, the following steps are carried out:

1. The failure of the supply voltage is immediately detected by the main controller.
2. A level 4 error is triggered. This means:
   a. All IGBTs (both DC and AC side) are switched off (500 µs after the fault occurs).
   b. The switches to the energy sources are opened (30 ms after the fault occurs), which disconnects the converter system from all AC and DC networks.
   c. The DC link of the converter system is discharged.
   d. The cooling system of the converter system is switched off (30 ms after the error occurs). This is possible because there are no more heat losses.
3. The UPS supplies the converter control system for another 15 minutes. A backup copy of the init files and parameters is created in the non-volatile memory.
   a. When the power supply is restored, this data is automatically reloaded. It is neither possible nor necessary for the customer to access the data.
   b. Important operating data of the converter system at the time of the power failure (voltages, currents, temperatures, etc.) are logged in a buffer file as long as the UPS is running. Which data is logged in detail depends on the converter type.
   c. The buffer file can be displayed via the FREQCON buffer analysis tool (subject to license) as soon as the supply voltage is available again.
4. If a battery storage system is present, the battery control is switched off immediately so that the battery storage is transferred to a safe state. No operating data of the battery system is saved.
5. Before the switch cabinet doors are opened for a visual inspection after the supply voltage has failed, it is essential to wait for the DC link to discharge.

⚠ DANGER	
	**Risk of injury due to electric shock** Discharging the DC link takes several minutes. The "Ready for Operation" signal light is not an indicator of a fully discharged DC link. Do not carry out any work on the converter before the DC link has been completely discharged. ➜ Wait until the DC link is completely discharged and check that it is de-energized as described in section 14.7 "Check Voltage-Free Status of DC Link ".

4 Design

For better handling and to increase system flexibility, all components of the BESS system are housed in containers.

BESS main components:

- BESS with installed battery modules, control systems and integrated fire protection and suppression system
- Integrated climate control system
- Integrated emergency fan system
- Several sensor systems (H2, CO; temperature and smoke)

PCS main components

- Converter system consisting of AC/DC battery converter, control system and converter cooling system
- Integrated water-air cooling system
- Integrated climate control system
- Several sensor systems (temperature and smoke)

Both the PCS and the BESS are controlled and monitored by the same main control system, which is installed in the control cabinet (CTRL) of the PCS container.

The waste heat in the interior of the containers is conducted via internal air conditioning (AC) units from the interior to external AC units at the front side of the container (*see section 4.8 "Cooling System"*).

The BESS containers are equipped with recesses on its underside for the passage of cables (*see section 11.2.2 "Cable Outlets"*). Furthermore, the PCS container is also provided with cutouts on the bottom side to connect the external AC and DC line cables to the converter system.

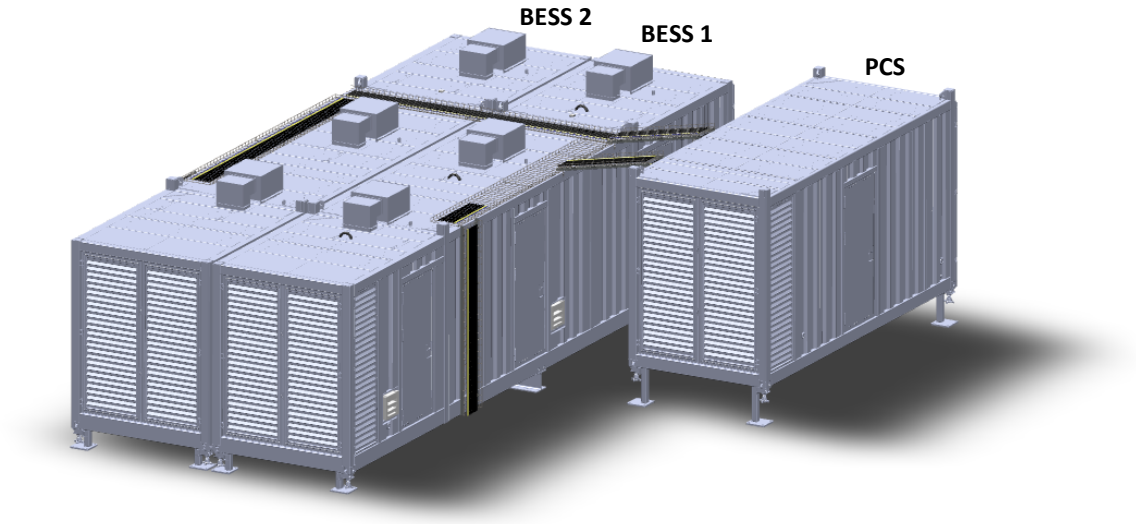


Figure 3: Design

4.1 AC Grid Connection

The BESS is equipped with AC busbars for connection of a 620 V AC grid. The AC busbars are located inside the AC_DC cabinet (*see section 4.4.3*) of the converter system.

Cutouts for inserting the AC power cables into the container are located in the container floor (*see section 11.2.2 "Cable Outlets"*). Through these cutouts, the AC power cables can be fed directly from below into the converter cabinets and connected to the corresponding AC connection busbars inside the cabinets of the converter system.

Further information and a description of the connection of the AC mains supply cables to the converter system are provided in section 11.2.4 "AC Connection".

Note:
The electrical connection must only be performed by personnel trained by FREQCON or by FREQCON service personnel.

4.2 Data Interface

The BESS system can be connected to an electronic higher-level control unit (control room) via a PROFINET interface. The required parameters (current, voltages, frequency, power) are provided by the BESS main control system and transmitted via PROFINET protocol.

The higher-level control unit is connected to the main control unit via a network isolator (114A1) in the CTRL_1 control cabinet (*see section 11.2.5 "Higher-Level Controller Connection"*).

For external control and monitoring of the converter, it is necessary that the customer has access to selected control and status variables stored in the BESS main control system, which can be read and overwritten by the customer's higher-level control. For this purpose, predefined control profiles with the relevant control variables and status profiles with all relevant status variables are stored for the data transfer between the customer's higher-level controller and the converter system.

For a detailed description of the individual data profiles, see the applicable document "23A2007_250116_Modbus_Register BESS_Vx_x_x_x".

4.3 Safety Design

4.3.1 Safety Chain Battery Cell

The battery monitoring system, BMS interface UI and BMS interface RS485, signal error messages via potential-free contacts. See also the documentation for the "BMS interface UI" and "BMS inter-face RS485" hardware modules.

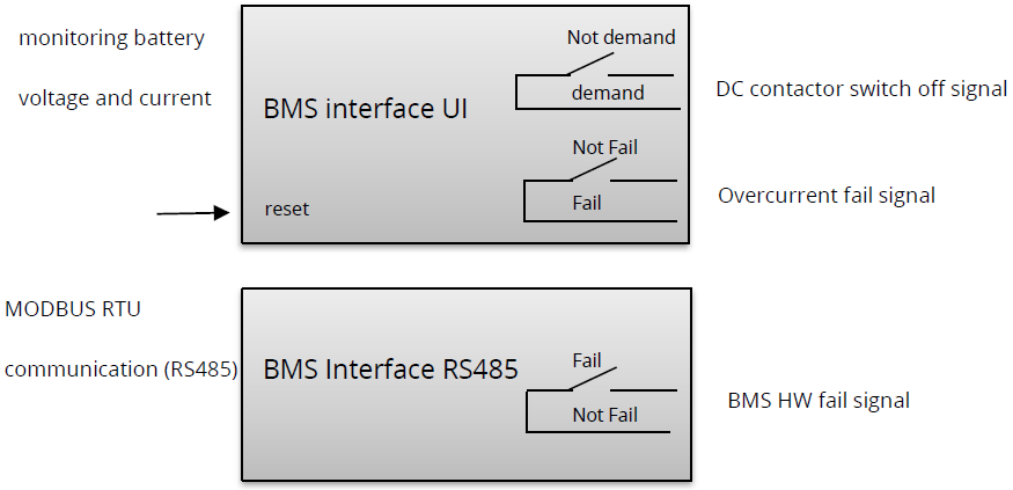


Figure 4: Safety chain battery cell

4.3.1.1 BMS Interface UI

The BMS interface UI monitors the total voltage of a battery rack and the current of the rack.
The BMS interface UI independently monitors the global battery voltage and the battery current. There is a potential-free contact for both errors which opens the contact in the event of an error.
The BMS interface UI has its own digital input for resetting an error message. If an error has been signaled and acknowledged manually via the visualization or MODBUS TCP, this digital input is set briefly.

4.3.1.2 BMS Module

The signals of the BMS interface are monitored in FB_battery_monitoring.
BMS interface RS485 HW error signal. The BMS monitors the battery cells for overvoltage, undervoltage and overtemperature.
If an error is detected locally by a BMS board, the safety chain is opened and an error is signaled.

4.3.2 Safety BMS Rack (S7)

The BMS rack monitors the following states:

- Modbus RTU communication error: The MODBUS RTU master cyclically queries the data of all BMS battery modules (MODBUS RTU slaves).
  If a MODBUS RTU slave [nmodule] is not reached or supplies faulty data, this is evaluated as a communication error. There is a communication error counter for each battery module. While a communication error increments the counter reading, successful communication re-sets the counter to 0.

- Battery voltage monitoring (cmp): The measured battery voltage is cyclically compared with the sum of the individual battery module voltages. If the absolute value of the difference be-tween the two voltages exceeds the 16 V limit value for more than 30 s, an error signal is is-sued.
- Battery monitoring cell voltage: Monitoring of all cell voltages to the maximum value of the measured voltages.
- Battery monitoring current: Monitoring of the battery current.
- Battery monitoring cell temperature: The maximum battery cell temperature is determined cyclically, approximately every 2.5 s, from all battery module cell temperatures recorded. A peak filter suppresses temperature jumps greater than 5 °C for a maximum of 8 cycles. If the average cell temperature is already close to the switch-off limit, incorrect measurements (jump) would result in a warning or error signal.
- Battery monitoring Balancer Temperature and ambient temperature Balancer
- Monitoring the battery pack connections + and - for overtemperature
- Smoke detector
- Gas sensor
- Line protection (fuses) of the auxiliary systems
- Main fuse (battery current)
- Modbus-TCP communication error: An error is triggered in the event of a communication timeout with the charging system (inverter control).
- Contactor feedback: Monitoring whether the status of the contactors matches the target status

If a fault is detected, the DC contactors open after 0.5 seconds.
In addition to errors, warnings can also be generated for cell voltages and cell currents.

4.3.3 Safety Converter Control

The converter system constantly communicates with the connected battery racks and continuously checks the following statuses:

- Modbus-TCP communication: In the event of a communication timeout with the battery racks, a corresponding rack is switched off or an error is triggered at converter level.
- Fault conditions: All faults at BMS rack level are signaled to the converter and the current is briefly set to zero to enable the DC contactors in the racks to be switched without current. Every fault reported by a rack prompts the converter system to disconnect the corresponding rack. Some error states also trigger a switch-off of the converter. The following error messages trigger a switch-off of the converter:
  - Error with the DC contactors in a rack
  - Tripping of a DC fuse in a rack
  - Triggering a smoke detector in a rack
  - Triggering a gas alarm in a rack
- Overvoltage (cell voltage): In the event of a cell overvoltage, the current setpoint value is also set to zero independently of the lookup tables.
- Undervoltage (cell voltage): If a cell is undervoltage, the batteries are charged with a low current to prevent deep discharge. If the cell voltage drops further, the corresponding rack is dis-connected.
- Warning messages: If a warning message is generated by a rack, the charging system re-quests a disconnection of the corresponding rack. As soon as the warning is no longer pre-sent, an attempt is made to reconnect the rack.

- Charge control system: To protect the cells from fault conditions, the following limits are available for charging and discharging the system. The respective limit values can be stored via lookup tables and thus set graduated limit values for the charging and discharging current. All limits are analyzed separately and the lowest limit is selected for the current limit. The limits are parameterized so that the charging or discharging current can be reduced to 0 A.
  - Maximum cell voltage
  - Maximum cell temperature
  - Maximum balance temperature
  - SOC (real)
  - Customer SOC (adjusted to capacity sold)

4.3.4 Overview of the Safety Concept

The safety aspects described in chapters 4.3.1 to 4.3.3 result in a three-stage safety concept:

1. Module level:
   - Detection of cell voltages and temperatures and opening of the safety chain in the event of a limit value violation.
2. Rack level:
   - Evaluation the safety chain and open the DC contactors if necessary.
   - In-house evaluation of cell voltages, cell currents, cell temperatures, smoke sensors, gas sensors and communication with the modules and the charging system. If required, fault generation and opening of the DC contactors.
   - Option to disconnect the rack independently if the safety chain is triggered or a self-detected fault condition occurs.
3. Converter level:
   - Evaluation of the cell voltages, currents and temperatures as well as the error states of a rack. Triggering of a converter error for selected error states of individual racks.
   - Reduction of the charging and discharging currents according to lookup tables depending on the cell voltage and temperatures.
   - Request to switch off the rack or the inverter in the event of a rack fault.

4.3.5 Fire Protection System and Suppression System

FREQCON uses highly safe lithium-ion battery cell technology: Lithium iron phosphate (LiFePO4) cells are, among other things, highly temperature resistant and significantly safer compared to cells based on other lithium-ion technologies. The use of these technologies significantly reduces the probability of a thermal runaway, as they do not catch fire even in the event of a short circuit or overcharging.

Furthermore, in addition to controlling and monitoring the state of charge at cell and system level, the FREQCON BMS (Battery Management System) also handles temperature management during charging and discharging. Every second, the temperature, state of charge and all other important operating parameters of each individual battery cell, as well as of the battery modules, are collected and analyzed by the FREQCON BMS.

This means that a potential problem of the cells is already detected at approx. 60 °C, and thus much earlier than the actual fire development the battery storage is brought back into a safe operating condition by segmental or complete shutdown.

In addition to CO sensors and smoke detectors, there are a total of 339 temperature sensors in one battery cabinet alone. This ensures that the cells are always kept within the defined and safe operating range and that, in addition to achieving high efficiency and low degradation, the probability of overloading is also excluded.

The fire protection system meets the thermal runaway propagation containment requirements of IEC 62619 as well as requirements of the EN 54 Fire detection and fire alarm systems standard.

4.3.5.1 Detection and Response

The fire protection system aims to detect malfunction as early as possible and suppress the problem before it results in a fire hazard. The system is divided into two parts. One part is primarily designed for plant protection and the other part has the aim of personal safety. For both purposes the BESS containers are equipped with several automatic detectors:

Personal safety:

- 3x H2 sensor per BESS container
- 3x emergency exhaust unit per BESS container

Plant protection:

- 1x CO sensor per battery cabinet
- 2x smoke detectors per battery cabinet
- Temperature sensors (in cells)

The carbon monoxide (CO) sensors for the battery cabinets are an extra measure to detect malfunctioning even before smoke detection (VESDA). Its primary objective is to detect outgassing from battery cells. With the cell chemistry known, the specific reactions that occur during outgassing are well understood. The relative proportions of these gases can be predicted based on the known reactions. For the used battery cells up to 169.7 liters of gas mixture of a single battery cell are released in the unlikely event of outgassing. The main components of this gas mixture being approximately:

- Carbon monoxide (CO): 11 %
- Carbon dioxide (CO2): 27 %
- Hydrogen (H2): 48 %

The CO sensors trigger an alarm based on the measured CO concentration as specified in DIN EN 50291-1:

Co concentration	No alarm within	Alarm not later than
30 ppm	120 min	-
50 ppm	60 min	90 min
100 ppm	10 min	40 min
300 ppm	-	3 min

As the complete outgassing of a single battery cell results in about 500 ppm CO in the battery room the CO sensor will be triggered in such an event based on the thresholds in table given above. The CO sensor alarm will reset when the CO concentration falls below approximately 50 ppm.

The alarm level of the analog CO sensor is set to 1000 ppm which is equivalent to a H_2 concentration of about 10 % LEL (lower explosive limit).

The smoke detector has an optical work principle and is getting triggered by (smoke) particles. It is getting also triggered from the aerosol which is released during the outgassing of a battery cell, being thereby independent of the gas concentration.

Personal safety - If an incident should occur and one sensor of the security chain for personal safety is triggered the system responds as follows:

- The complete system (BESS and PCS) is switched off and disconnected from the mains via a control system. The AC connection of the converter is disconnected, the DC connection to the battery storage system is cut off, and if existing, the MV switchgear with the transformer and low voltage distribution are disconnected from the mains.
- H2 concentration > 4000 ppm of analog H2 sensor (equivalent to about 4 % LEL H_2):
  - Battery cabinets are switched off
  - Stop charging/discharging
  - Ventilation starting (Exhaust units)
  - Error message (Error level 4)

Plant protection - Depending on which sensors are triggered the system responds as follows:

- Temperature >55 °C:
  - Battery cabinet is switched off
  - Stop charging/discharging
  - Warning message
- Temperature >56 °C:
  - Same as temperature >55 °C
  - Error message
- 1x CO sensor in the battery cabinets is triggered:
  - Battery cabinet is switched off

  - Stop charging/discharging
  - Warning message
- 2x smoke detectors are triggered:
  - Disconnects battery DC connection (contactors)
  - Deactivate converter IGBTs
  - Disconnect converter from AC connection
  - Error message
- Temperature > 300 °C:
  - StatX fire suppression triggers itself
- CO concentration > 300 ppm of analog CO sensor:
  - Battery cabinet is switched off
  - Stop charging/discharging
  - Error message

The active emergency exhaust system of the container ensures the gas concentration decreases over time. Based on the assumption of a slight overpressure of 1 Pa which is reasonable in the event of an outgassing battery cell, the estimated time for a complete air exchange in the battery room is less than an hour.

4.3.5.2 Active Fire Suppression inside Battery Cabinets

The fire protection system actively fights the fire only in the affected area (battery cabinet). This is achieved by using condensed aerosol, a compact and effective solution compared to CO2 or halocarbons. The aerosol is contained in Stat-X 60 E cartridges, which are triggered by a 12 VDC signal from the control system or self-triggered due to rupture of a temperature sensitive seal, releasing ultrafine cloud of condensed aerosol to chemically extinguish the fire. These cartridges are non-pressurized, leave minimal residue after discharge, and approved for halon and hydrofluorocarbons (HFCs). The cartridges meet the standards dictated by NFPA 2010 and UL 2775.

Each battery cabinet contains two (2) Stat-X aerosol cartridges and two (2) smoke detectors *(see figure below*). Furthermore, the battery cabinets are also equipped with temperature sensors and CO detectors. As soon as a temperature of >300°C has been reached inside the affected cabinet, the aerosol fire suppression cartridges are self-activated and the affected battery cabinet is filled with an aerosol cloud, extinguishing the fire. Aerosol is not released in other cabinets where the sensors have not been triggered, thereby eliminating the fault at the source, and preventing it from spreading to other parts of the system. The aerosol remaining in the air provides additional extended protection for a finite time against re-flash of any fire in case of lithium-ion batteries. The aerosol remains in the cabinet until it is certain that the fire hazard has been eliminated.



① Aerosol cartridge
② Smoke detector

For safety reasons, the container may not be entered for 48 hours after the extinguishing system has been triggered. The defective battery module must then be replaced by the manufacturer and the entire system is put back into operation.

The Stat-X aerosol cartridges are easily replaceable and are connected to the fire protection system again for future events.

Fire detectors will have to be cleaned and tested after a Stat-X discharge event.

After discharge there may be some minimal residue in the immediate vicinity of the generator or underneath it. This should clean up easily with water or detergent as any residue is water soluble. The Stat-X agent does not require hazmat procedures after discharge for cleanup and there are no hazardous materials in the generators themselves

Figure 5: Battery cabinet (1000 mm wide) with Stat-X fire extinguishing cartridges (front view)

4.4 PCS Container

4.4.1 Container Overview

Side view

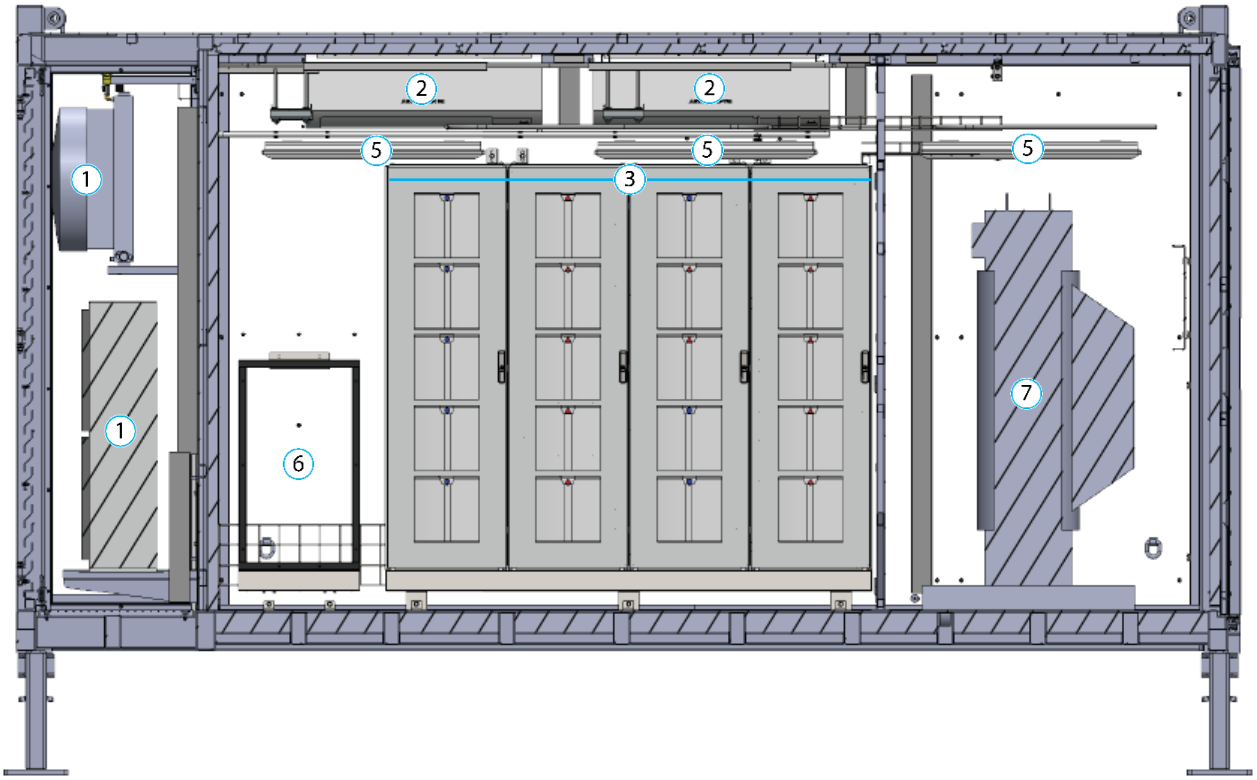


Figure 6: Container overview – side view

Position	Component
①	External cooling system components (*for details see section 4.8 "Cooling System"*)
②	Internal cooling system components (*for details see section 4.8 "Cooling System"*)
③	Converter cabinets (CONV)
④	Control cabinets (CTRL_1 & CTRL_2)
⑤	Container lights
⑥	Cooling system cabinet (COSY)
⑦	MV Transformer

Table 7: Container overview – components

Top View

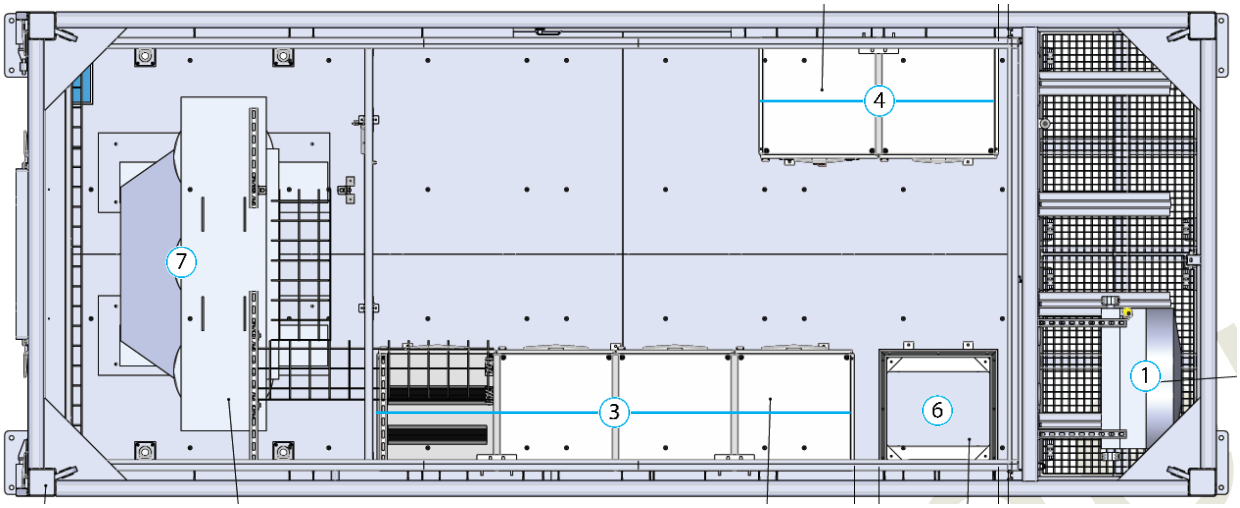


Figure 7: Container overview – side view

Perspective view

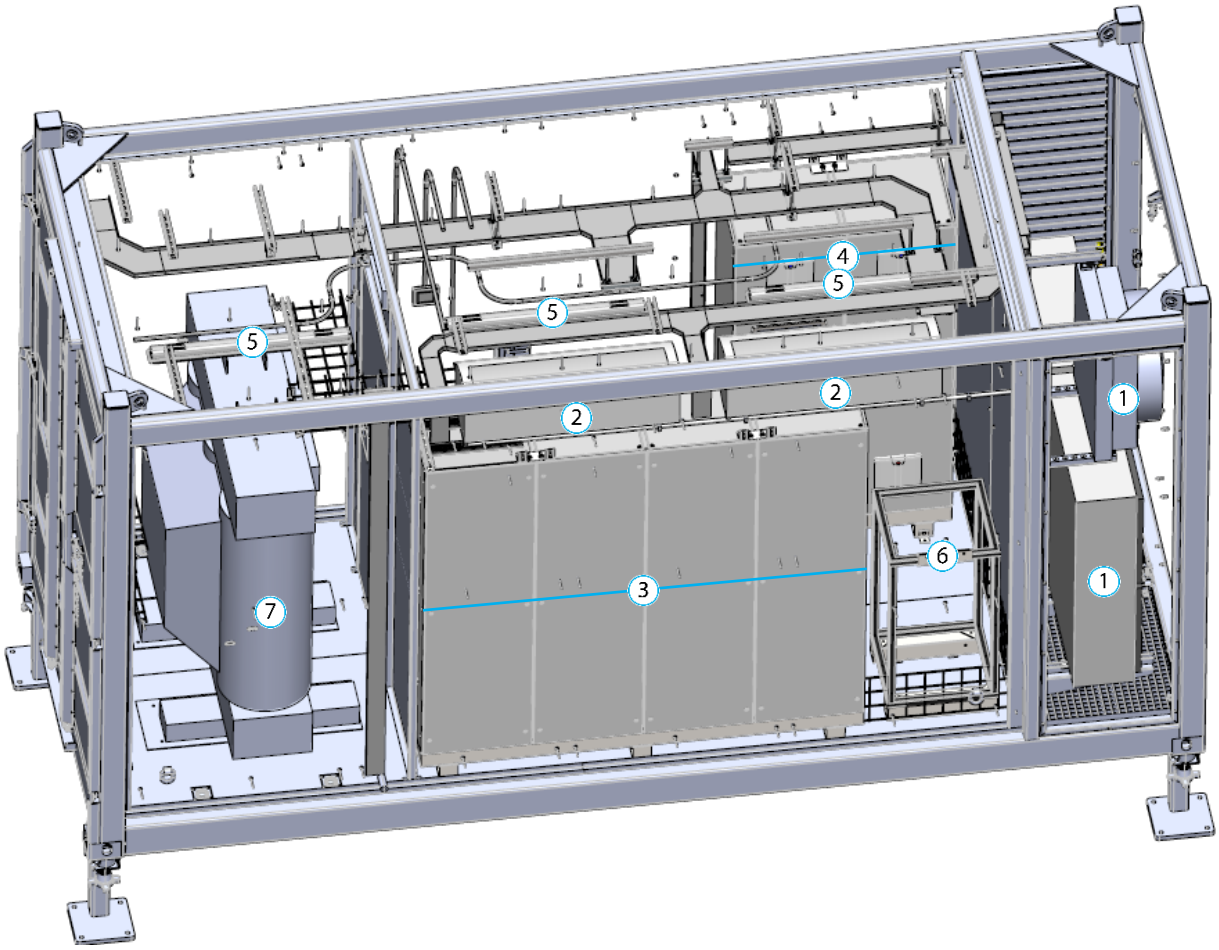


Figure 8: Container overview- perspective view

Side View Left

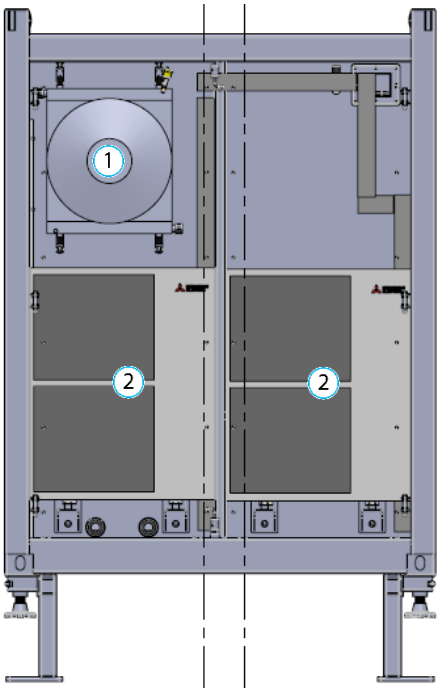


Figure 9: Container overview – side view left

Position	Component
①	Heat exchanger
②	External AC unit

Side View Right

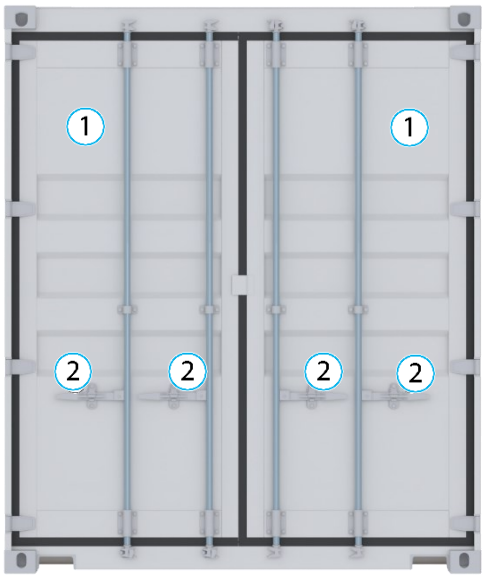


Figure 10: Container overview – side view right

Position	Component
①	Container doors
②	Door lock

Table 8: Container overview – side view left

4.4.2 Cabinet Overview- Converter Cabinets



Figure 11: Cabinet overview – converter unit

Position	Cabinet Designation	Abbreviation
①	Converter cabinet	CON
②	Inductor cabinet	IND
③	Circuit breaker cabinet	CIR
④	AC and DC connection cabinet	AC_DC

Table 9: Cabinet Overview – converter unit

4.4.3 Internal Components – Converter Cabinets

The following internal components are installed in the control cabinets of the AC/DC converter unit:

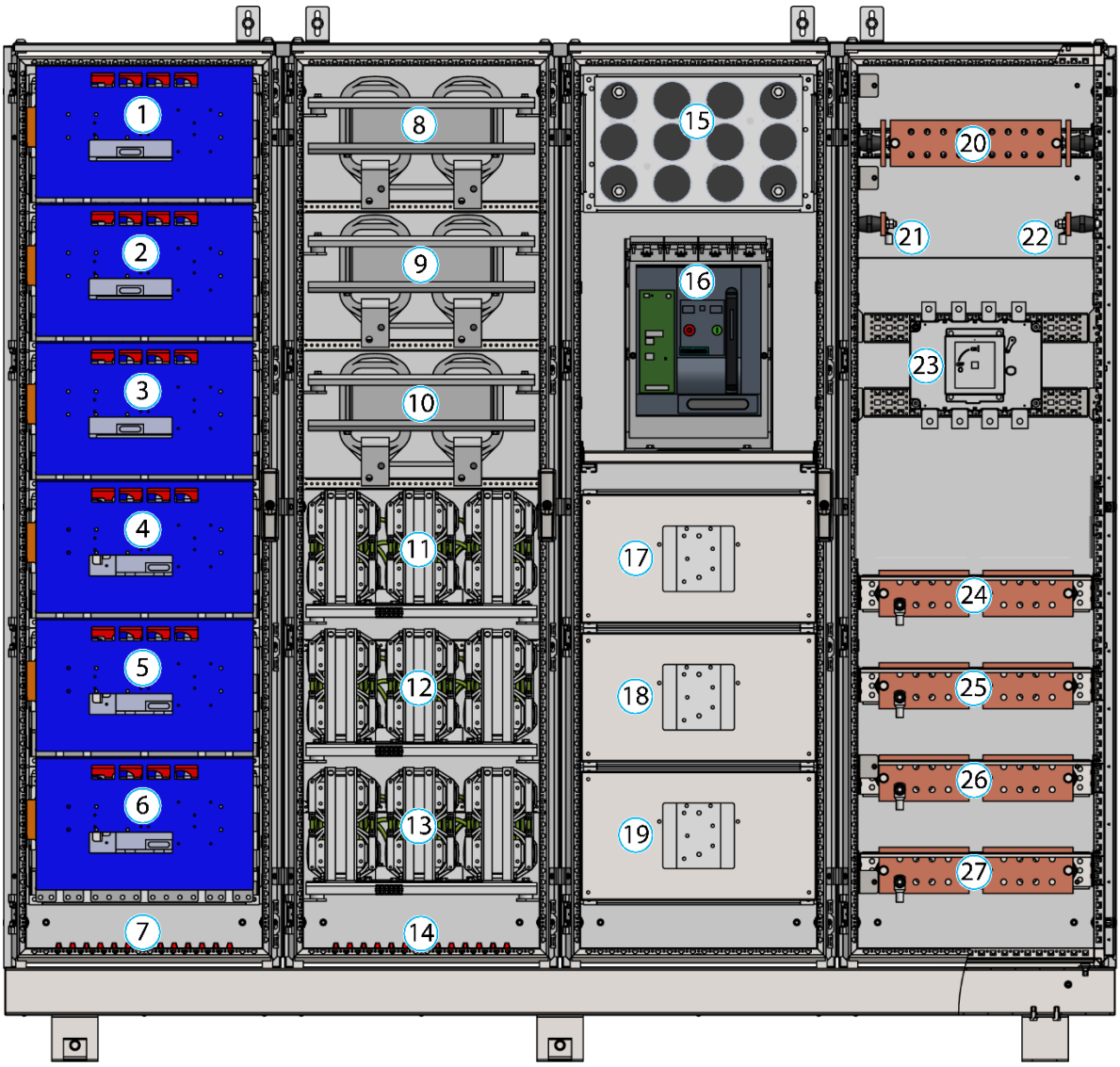


Figure 12: Internal components – converter unit

Pos.	Component	Part number	Identifier
1	AC IGBT Power Stack 1* 1000 A	52872	201Q1
2	AC IGBT Power Stack 1* 1000 A	52872	202Q1
3	AC IGBT Power Stack 1* 1000 A	52872	203Q1
4	DC IGBT Power Stack 3* 250 A	52867	207Q1
5	DC IGBT Power Stack 3* 250 A	52867	211Q1

6	DC IGBT Power Stack 3* 250 A	52867	217Q1
7	Coolant dispenser	--	--
8	AC Single phase line inductor 1000 A / 0.2 mH	53053	201L1
9	AC Single phase line inductor 1000 A / 0.2 mH	53053	202L1
10	AC Single phase line inductor 1000 A / 0.2 mH	53053	203L1
11	DC Single phase line inductor 3x 250 A / 0.6 mH	53046	207L1
12	DC Single phase line inductor 3x 250 A / 0.6 mH	53046	211L1
13	DC Single phase line inductor 3x 250 A / 0.6 mH	53046	217L1
14	Coolant dispenser	--	--
15	AC Filter 1000 A / 3*600 µF	52918	83U1
16	AC Main circuit breaker IEC 1000 A	52955	80Q1
17	DC Switch & Fuse 3* 250 A / 1000 V	52882	227U1
18	DC Switch & Fuse 3* 250 A / 1000 V	52882	231U1
19	DC Switch & Fuse 3* 250 A / 1000 V	52882	237U1
20	AC Grid connection busbars L1/L2/L3	--	78W1 - 78W3
21	N - Connection busbar	--	78W4
22	PE - Connection busbar	--	78W5
23	Switch for earthing and short-circuiting 600 A / 690 V	10172	18Q1
24	DC connection busbars + / - BESS 1 string 1 - 8	--	227W10 – 227W15
25	DC connection busbars + / - BESS 1 string 9 - 11	--	231W10 – 231W11
26	DC connection busbars + / - BESS 2 string 1 – 3 DC connection busbars + / - BESS 2 string 4 - 6	--	231W14 / 231W15 237W10 / 237W11
27	DC connection busbars + / - BESS 2 string 7 - 11	--	237W12 – 237W15

Table 10: Internal components – converter unit

4.4.4 Cabinet Overview - Control Cabinets

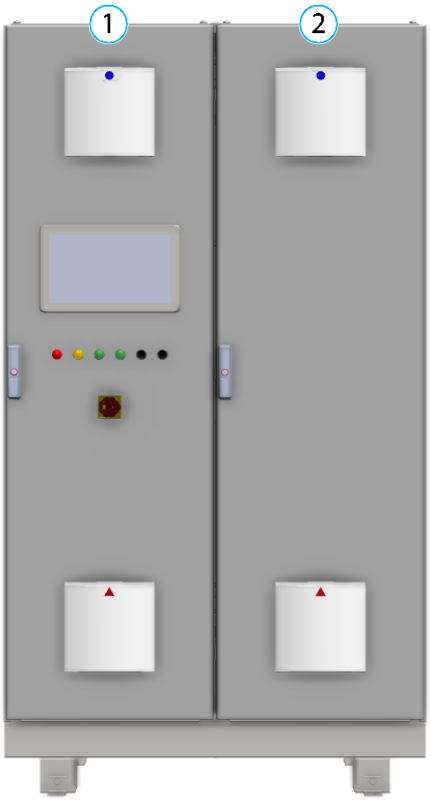


Figure 13: Cabinet overview – control cabinets

Position	Cabinet Designation	Abbreviation
①	Control cabinet 1	CTRL_1
②	Control cabinet 2	CTRL_2

Table 11: Cabinet Overview – control cabinets

4.4.5 Internal Components – Control Cabinets (CTRL_1 and CTRL_2)

The following internal components are contained within the control cabinets (CTRL_1 and CTRL_2).

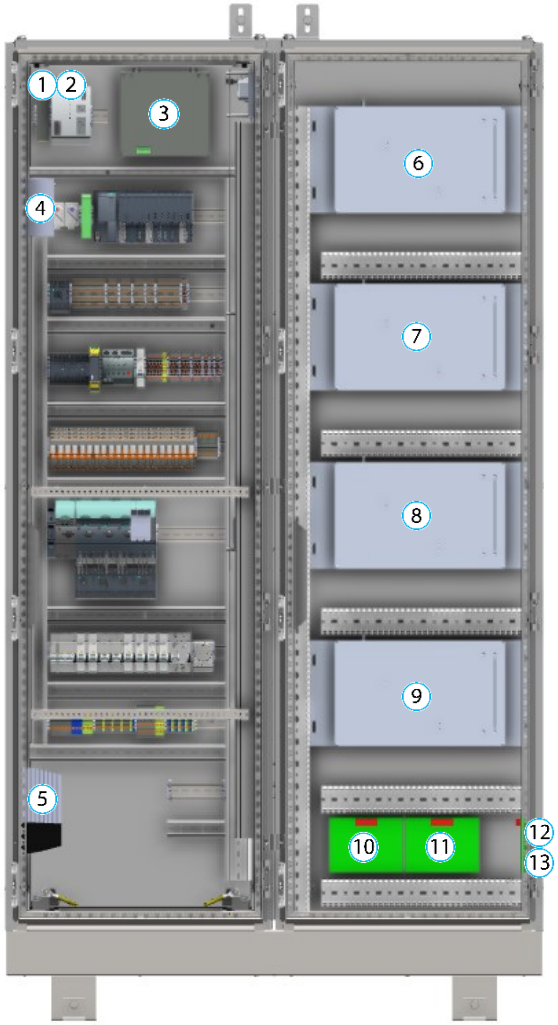


Figure 14: Internal components – control cabinets (CTRL_1 and CTRL_2)

Pos.	Component	Part number	Identifier
1	UPS unit 24 V DC	501836	102G1
2	24 V DC power supply for UPS unit	502745	101T1
3	Energy storage 24 V DC / 12 Ah for UPS unit	501229	102G2
4	Main controller PLC SIMOTION P320-4	500789	110U1
5	Cabinet heater 800 W	500621	185R1
6	PIII IGBT IRT Interface 2.6 V4	504890	240U1
7	PIII IGBT IRT Interface 2.6 V4	504890	241U1
8	PIII IGBT IRT Interface 2.6 V4	504890	242U1
9	PIII IGBT IRT Interface 2.6 V4	504890	243U1

10	HVIO Modul V5.0	500390	161U1
11	HVIO Modul V5.0	500390	162U1
12	HVIO Modul V5.0	500390	163U1
13	HVIO Modul V5.0	500390	164U1

4.4.6 External Components – Control Cabinet

The following internal components are contained within the control cabinet 1 (CTRL_1).

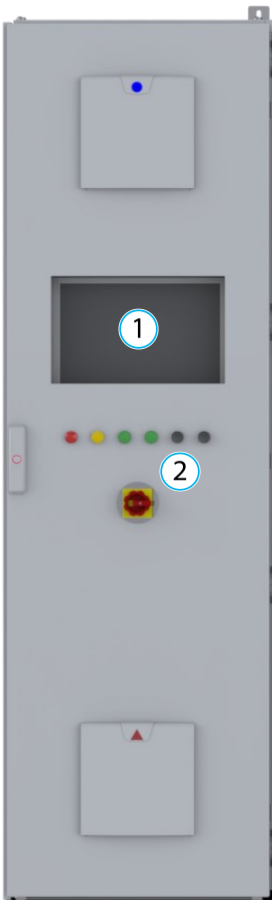


Figure 15: Internal components - control cabinet 1

Pos.	Component
1	HMI panel
2	Operating panel *(see 14.1 "Operating* Panel*")*

Table 12: Internal components - control cabinet

4.5 BESS 1 Container

4.5.1 Container Overview

Side view

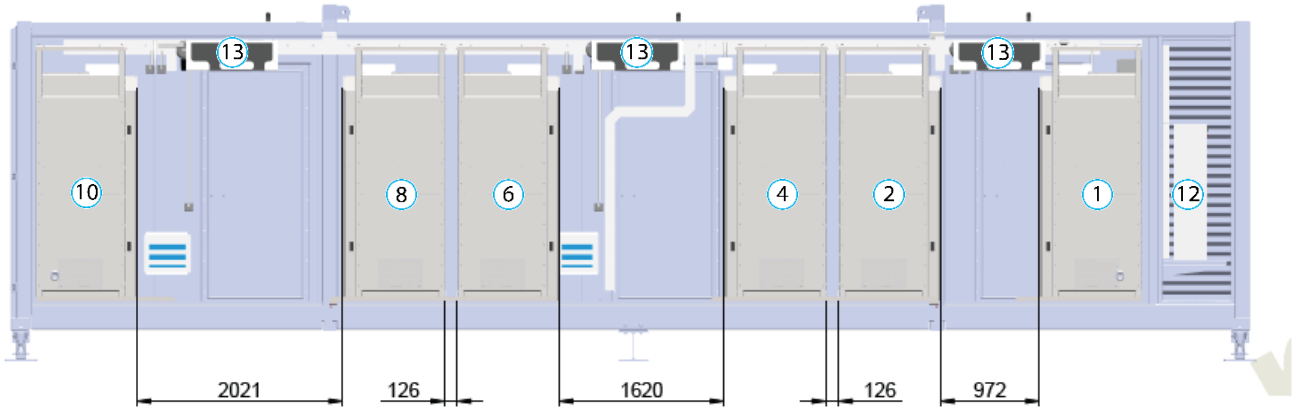


Figure 16: Container overview – side view

Position	Component
①	Battery storage cabinet (BESS 1 string 1)
②	Battery storage cabinet (BESS 1 string 2)
③	Battery storage cabinet (BESS 1 string 3)
④	Battery storage cabinet (BESS 1 string 4)
⑤	Battery storage cabinet (BESS 1 string 5)
⑥	Battery storage cabinet (BESS 1 string 6)
⑦	Battery storage cabinet (BESS 1 string 7)
⑧	Battery storage cabinet (BESS 1 string 8)
⑨	Battery storage cabinet (BESS 1 string 9)
⑩	Battery storage cabinet (BESS 1 string 10)
⑪	Battery storage cabinet (BESS 1 string 11)
⑫	External cooling system component (*for details see section 4.8 "Cooling System"*)
⑬	Internal cooling system component (*for details see section 4.8 "Cooling System"*)
⑭	Container lights
⑮	Lifting device (*for details see section 4.7.5 "Lifting Device"*)

Table 13: Container overview – components

Top View

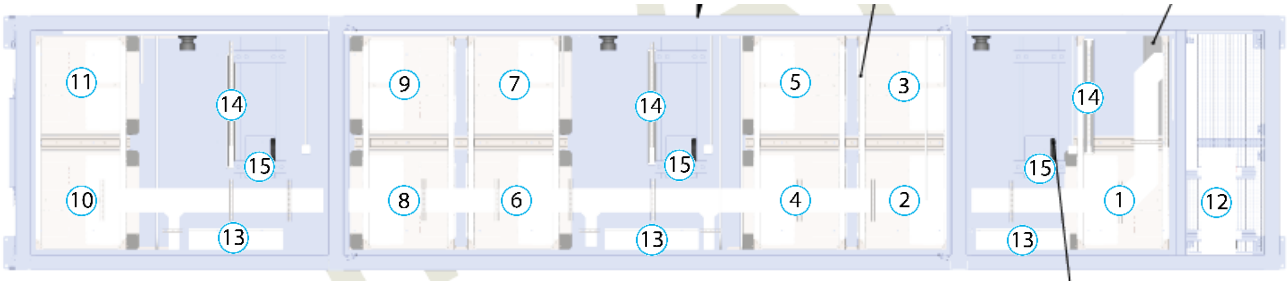


Figure 17: Container overview – top view

Perspective view

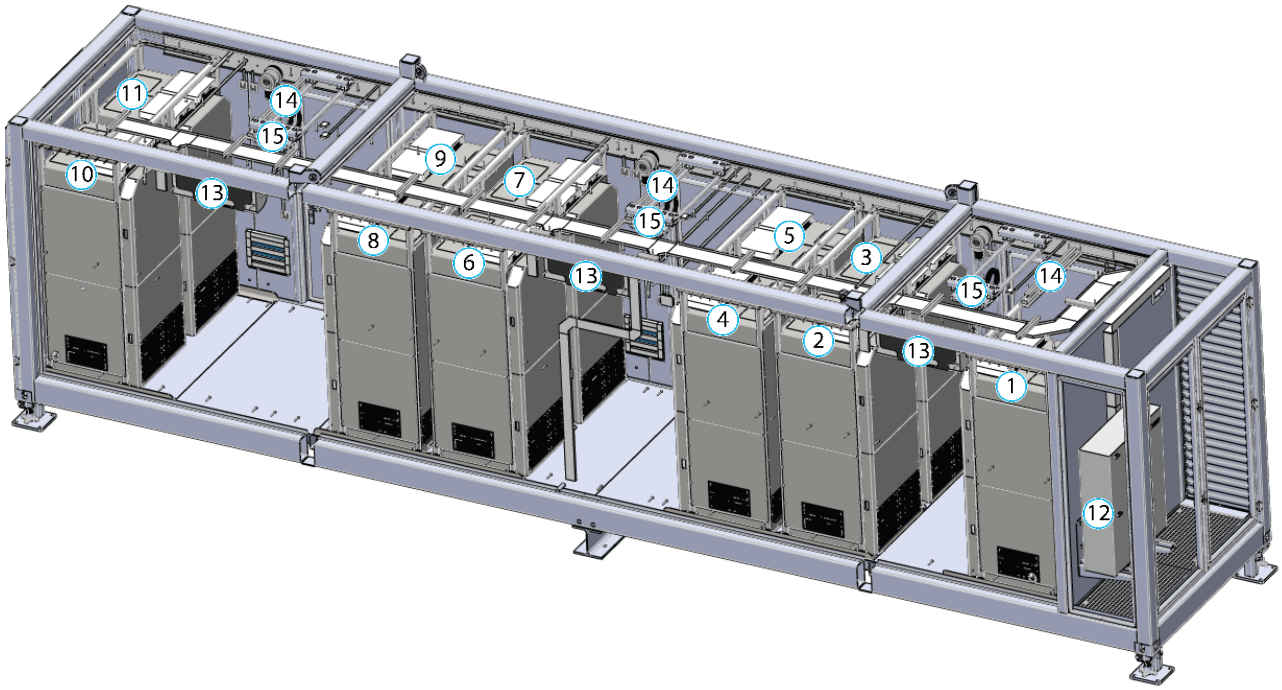


Figure 18: Container overview- perspective view

Side View Left

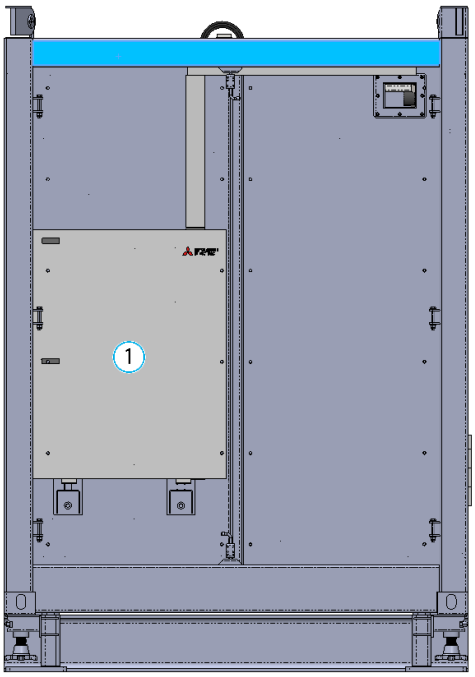


Figure 19: Container overview – side view left

Position	Component
①	External AC unit

Table 14: Container overview – side view left

Side View Right

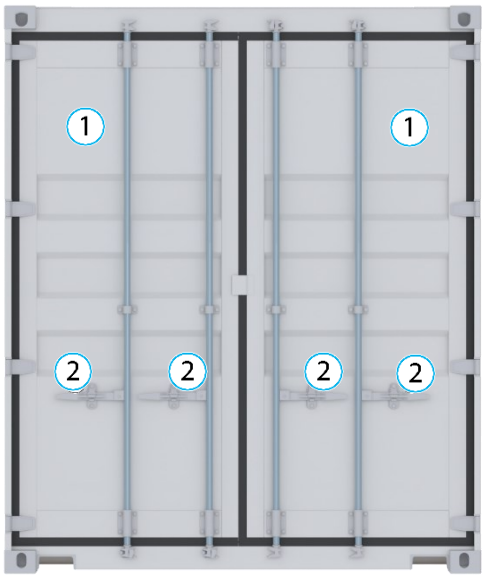


Figure 20: Container overview – side view right

Position	Component
①	Container doors
②	Door lock

Table 15: Container overview – side view left

4.5.2 Cabinet Overview- BESS 1 Battery Cabinets

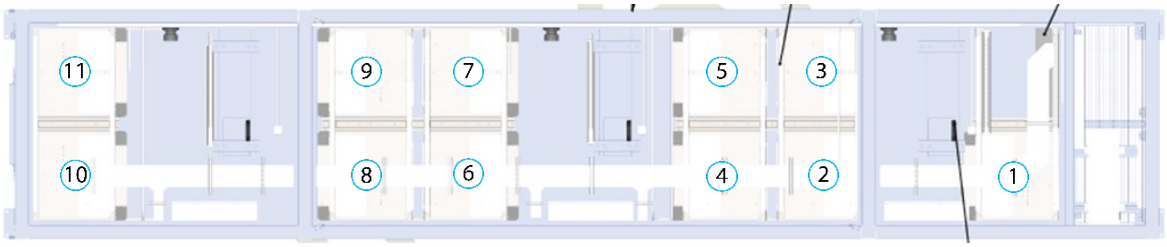


Figure 21: Cabinet overview – BESS 1 battery cabinets (Container top view)

Position	Cabinet Designation	Abbreviation
①	Battery cabinet 1	BESS.STR_1
②	Battery cabinet 2	BESS.STR_2
③	Battery cabinet 3	BESS.STR_3
④	Battery cabinet 4	BESS.STR_4
⑤	Battery cabinet 5	BESS.STR_5
⑥	Battery cabinet 6	BESS.STR_6
⑦	Battery cabinet 7	BESS.STR_7
⑧	Battery cabinet 8	BESS.STR_8
⑨	Battery cabinet 9	BESS.STR_9
⑩	Battery cabinet 10	BESS.STR_10
⑪	Battery cabinet 11	BESS.STR_11

Table 16: Cabinet Overview – BESS 1 battery cabinets

4.5.3 Internal Components – Battery Cabinets

The following internal components are contained within the battery cabinets:



Figure 22: Internal components – battery storage cabinets

Pos.	Component	Part number
①	Cabinet fan	505587
②	Battery module LF 280	508972
③	Aerosol cartridge of fire extinguishing unit Aero-X Stat-X 60E	506501
④	Optical smoke detector 12 V	500713
⑤	DC fuse switch disconnector 3NP1, 3-pole, NH2, 400 A	10226
⑥	Mounting plate with cabinet control system, DC, contactors etc.	52422

Table 17: Internal components – battery storage cabinets

4.6 BESS 2 Container

4.6.1 Container Overview

Side view

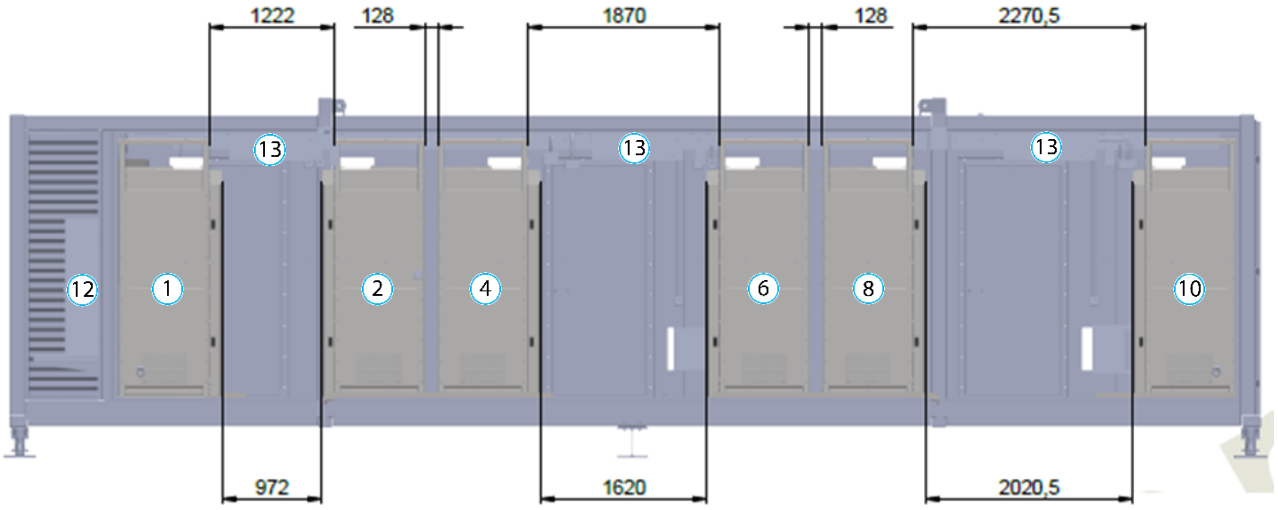


Figure 23: Container overview – side view

Position	Component
①	Battery storage cabinet (BESS 2 string 1)
②	Battery storage cabinet (BESS 2 string 2)
③	Battery storage cabinet (BESS 2 string 3)
④	Battery storage cabinet (BESS 2 string 4)
⑤	Battery storage cabinet (BESS 2 string 5)
⑥	Battery storage cabinet (BESS 2 string 6)
⑦	Battery storage cabinet (BESS 2 string 7)
⑧	Battery storage cabinet (BESS 2 string 8)
⑨	Battery storage cabinet (BESS 2 string 9)
⑩	Battery storage cabinet (BESS 2 string 10)
⑪	Battery storage cabinet (BESS 2 string 11)
⑫	External cooling system component (*for details see section 4.8 "Cooling System"*)
⑬	Internal cooling system component (*for details see section 4.8 "Cooling System"*)
⑭	Container lights
⑮	Lifting device (*for details see section 4.7.5 "Lifting Device"*)

Table 18: Container overview – components

Top View

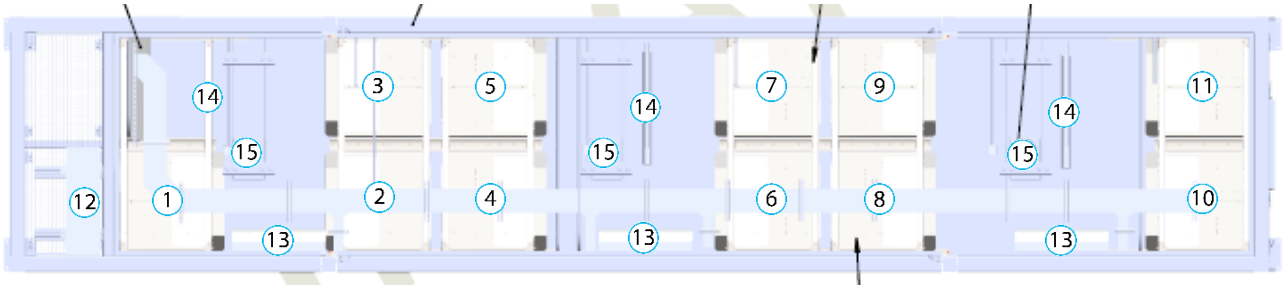


Figure 24: Container overview – top view

Perspective view

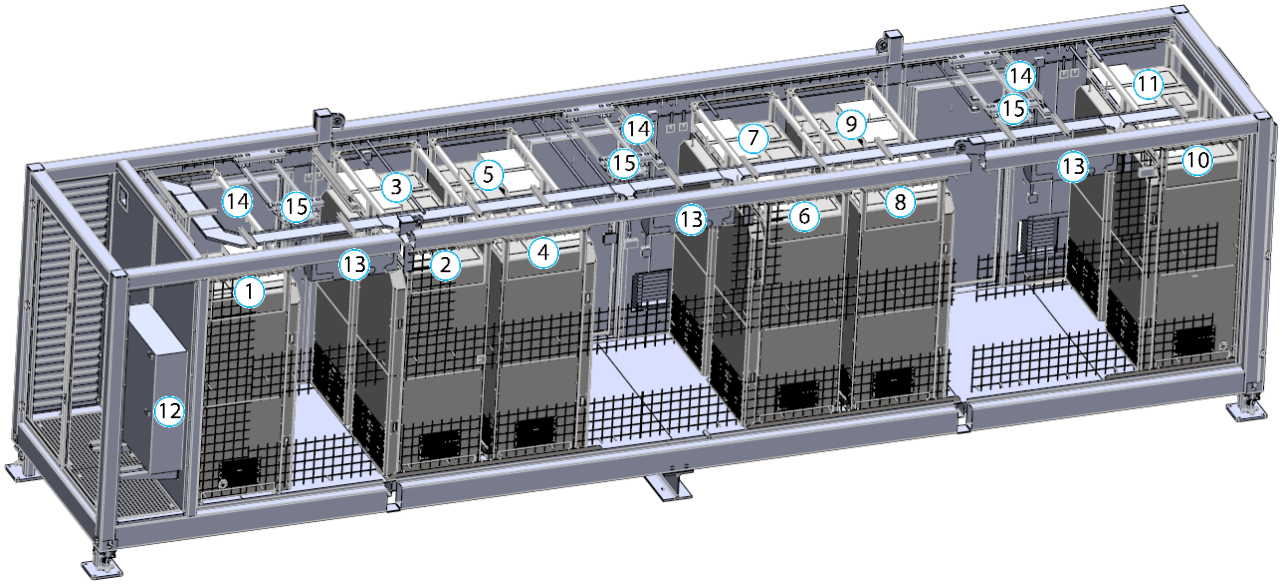


Figure 25: Container overview- perspective view

Side View Left

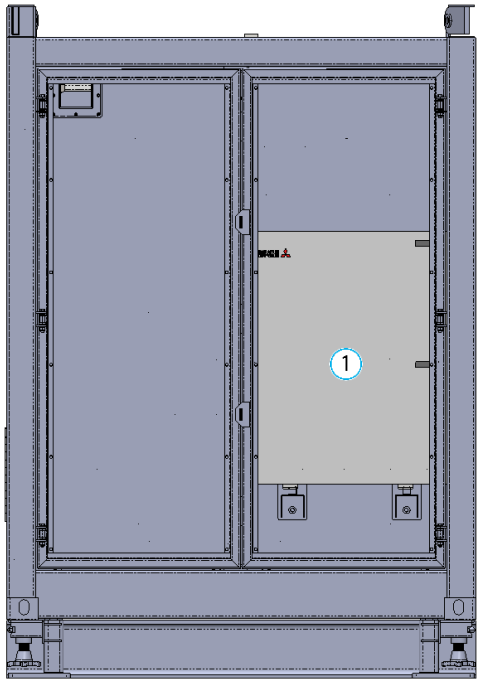


Figure 26: Container overview – side view left

Position	Component
①	External AC unit

Table 19: Container overview – side view left

Side View Right

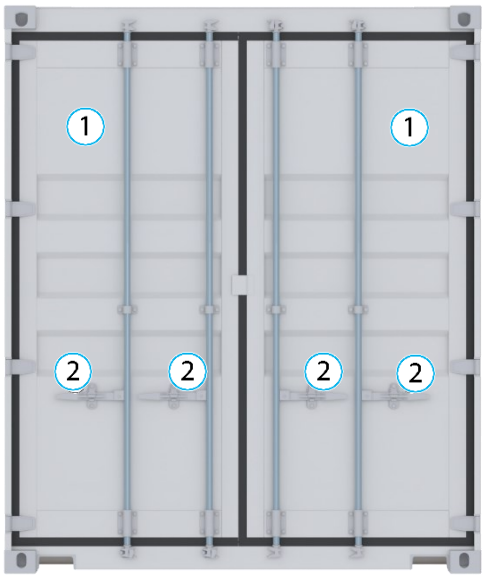


Figure 27: Container overview – side view right

Position	Component
①	Container doors
②	Door lock

Table 20: Container overview – side view left

4.6.2 Cabinet Overview- BESS 2 Battery Cabinets

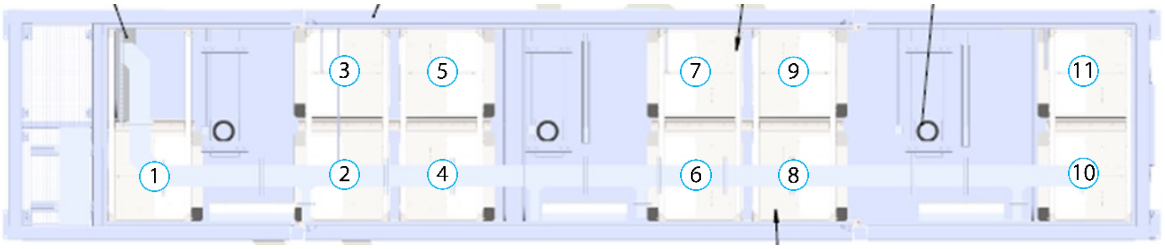


Figure 28: Cabinet overview – BESS 2 battery cabinets (Container top view)

Position	Cabinet Designation	Abbreviation
①	Battery cabinet 1	BESS.STR_1
②	Battery cabinet 2	BESS.STR_2
③	Battery cabinet 3	BESS.STR_3
④	Battery cabinet 4	BESS.STR_4
⑤	Battery cabinet 5	BESS.STR_5
⑥	Battery cabinet 6	BESS.STR_6
⑦	Battery cabinet 7	BESS.STR_7
⑧	Battery cabinet 8	BESS.STR_8
⑨	Battery cabinet 9	BESS.STR_9
⑩	Battery cabinet 10	BESS.STR_10
⑪	Battery cabinet 11	BESS.STR_11

Table 21: Cabinet Overview – BESS 2 battery cabinets

4.6.3 Internal Components – Battery Cabinets

The following internal components are contained within the battery cabinets:



Figure 29: Internal components – battery storage cabinets

Pos.	Component	Part number
①	Cabinet fan	505587
②	Battery module LF 280	508972
③	Aerosol cartridge of fire extinguishing unit Aero-X Stat-X 60E	506501
④	Optical smoke detector 12 V	500713
⑤	DC fuse switch disconnector 3NP1, 3-pole, NH2, 400 A	10226
⑥	Mounting plate with cabinet control system, DC, contactors etc.	52422

Table 22: Internal components – battery storage cabinets

4.7 Battery Modules



Figure 30: Battery module LF 280

4.7.1 Design

The lithium iron phosphate cells (LiFePO4) inside the LF 280 battery modules are connected in series and provide a total energy content of 8.96 kWh per module.

Each module is equipped with a monitoring PCB, providing the following functions:

- Voltage monitoring of single cells for charging and discharging
- Battery temperature monitoring
- Selective cell balancing
- Data exchange with central BESS controller
- Local insulation measurement
- Robust industrial design for transport, assembly und operation



Figure 31: Battery module design

No.	Component
①	Battery module LF280
②	Boreholes for lifting device (M6)
③	DC positive (+) socket
④	DC negative (-) socket
⑤	COM-Connection RJ45 and 24 V DC power supply
⑥	Boreholes for transport handle mounting
⑦	Label with safety and warning instructions

Table 23: Battery module design

4.7.2 Technical Data

Technical Data Battery Module LF 280	
Part number	508972
Rated Voltage	32 V DC
Total capacity	280 Ah
Number of cells per battery module	10
Stored Energy	8960 Wh
Maximum voltage	36 V DC
Max. current	280 A
Max. charge and discharge rate	1 C
Temperature range storage	-20 °C … +45 °C (long-term storage at 0…35°C)
Temperature range operation	0 °C … +55 °C
Connections for DC+ / DC-	Surlock Plus
Communication connections	RJ 45
Protection class	IP 20
Weight	65.3 kg
Dimensions (WxHxD)	188 mm x 239 mm x 908 mm
Cell Data (Single Cell)	
Type	Prismatic cells
Capacity (typ.)	280 Ah
Voltage (typ.)	3.2 V
Voltage (max.)	3.65 V
Voltage (min.)	2.5 V
Battery life	>3500 cycles (80% remaining capacity)
Impedance (AC)	<0.25 mΩ
BMS Pack Universal	
Power supply (external)	24 V DC (rated), <0.5 W
Power supply (internal)	36 V DC (max.), < 0.2 W
Communication	EIA-485, Modbus RTU
Baud rate (max.)	19200 Bit/s
Bus participants (max.)	32
Balancer design	Load resistor
Balancer current @3.5 V	1.06 A
Voltage measurement	10 measurements per 14-bit resolution
Temperature measurements	8x NTC 10 kΩ (up to 14 bit analogue/digital converter) 1x PT100 (12 bit analogue/digital converter)
Isolation measurement	Earth fault monitoring

Table 24: Technical data - Battery module LF280

4.7.3 Connection Elements



Figure 32:Connection elements

Pos.	Terminal	Description	Connection type	Cable
①	X1	DC + Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
②	X2	DC – Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
④	X3	Communication (input)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7
⑤	X4	Communication (Output)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7
⑤	X5	24 V DC power supply	2-pole male terminal	Pay attention to cable routing in cabinet

Table 25: Connection elements

4.7.4 Communication Scheme

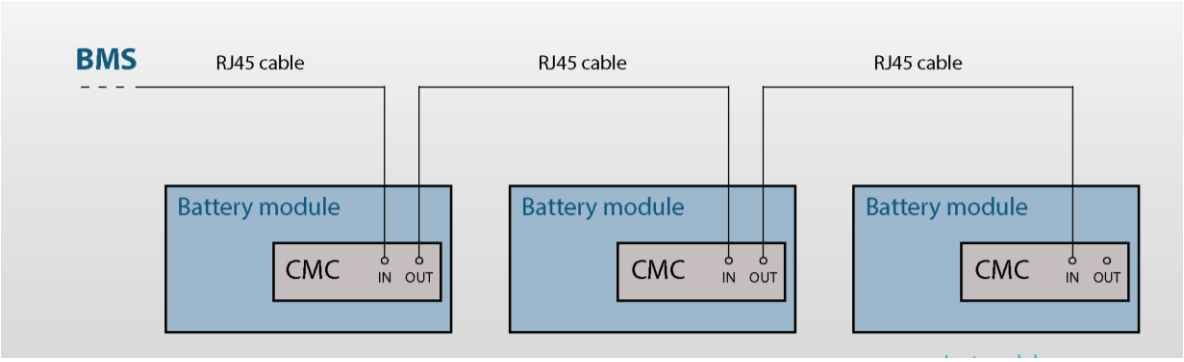


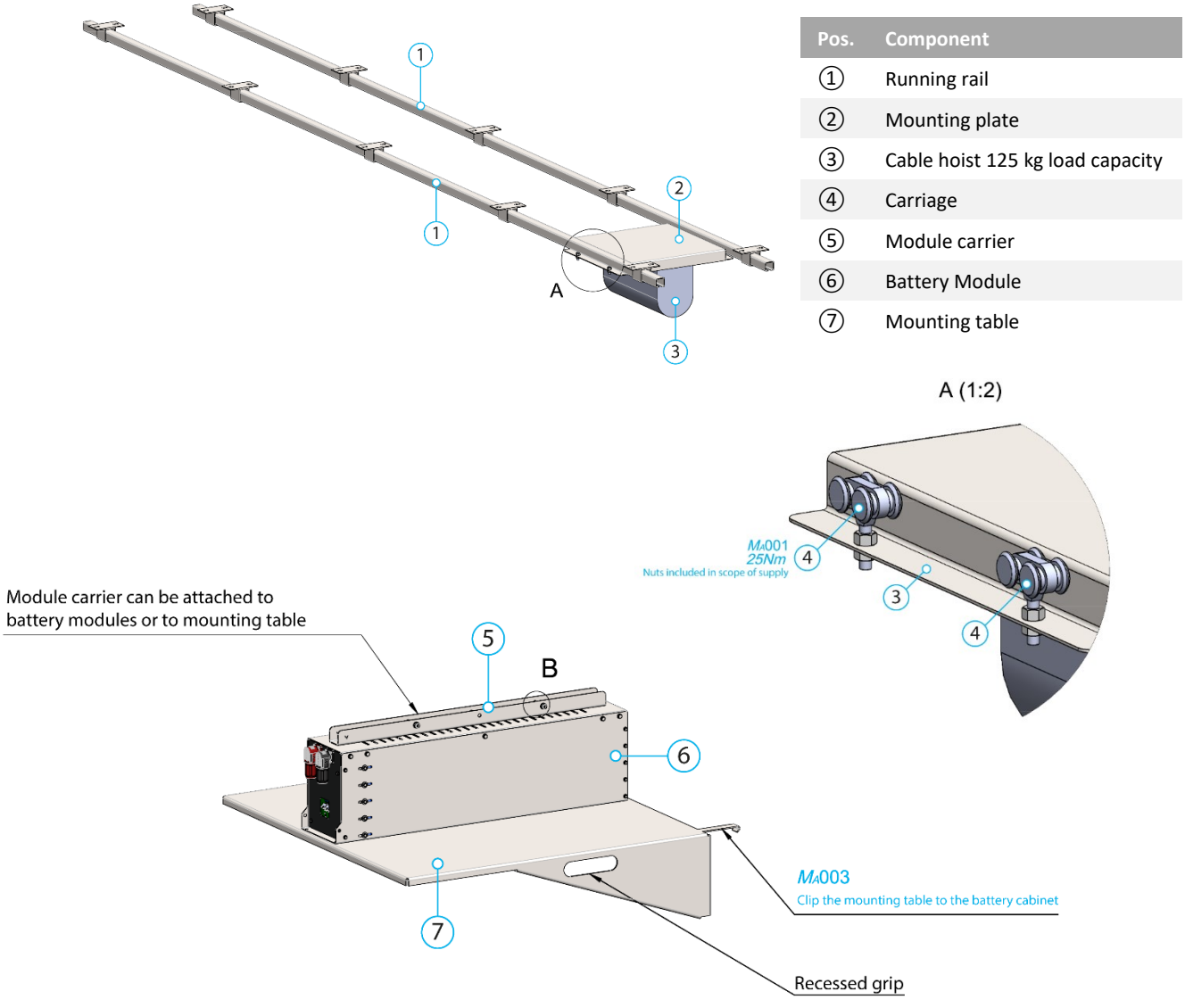
Figure 33: BMS communication scheme

4.7.5 Lifting Device and Mounting Table

For the lifting of battery modules, a lifting device is installed at the container ceiling, allowing safe handling and installation of the battery modules.

The lifting device mainly consist of a cable hoist which is mounted to a mounting plate with carriers, allowing to move the cable hoist through running rails to each end of the container. The cable hoist is operated via cable remote control.
For better handling of the battery modules when inserting them to the battery storage cabinet, a mounting table is provided, that can be attached to the battery storage cabinets.

For detailed information and operating instructions regarding the cable hoist, please refer to the original cable hoist manufacturer's original operating manual (*see section 1.2 "Applicable Documents"*).



Pos.	Component
①	Running rail
②	Mounting plate
③	Cable hoist 125 kg load capacity
④	Carriage
⑤	Module carrier
⑥	Battery Module
⑦	Mounting table

Figure 34: Lifting device and mounting table

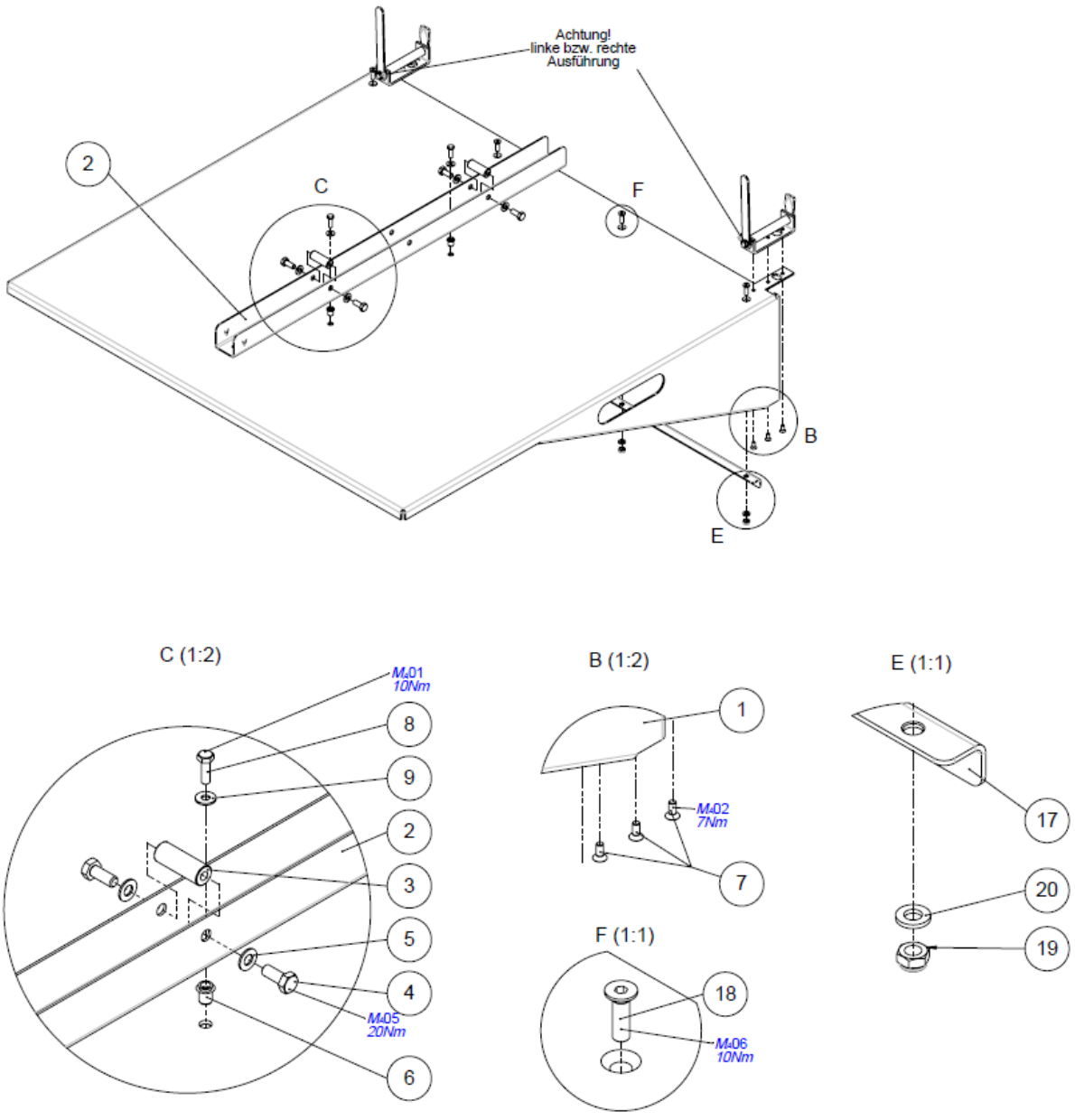


Figure 35: Mounting table

4.7.6 Mobile Lifting Device

A mobile lifting device for moving battery modules inside the BESS containers can be used. The mobile lifting device “Material-Lift GUIL ELC-725” or other models are suitable to lift and mount battery modules inside FREQCON BESS containers.

One (1) battery module can be placed onto the table of the mobile lifting device at once. The module needs to be pushed from the pallet of the forklift truck in front of the BESS container door onto the table of the mobile lifting device.

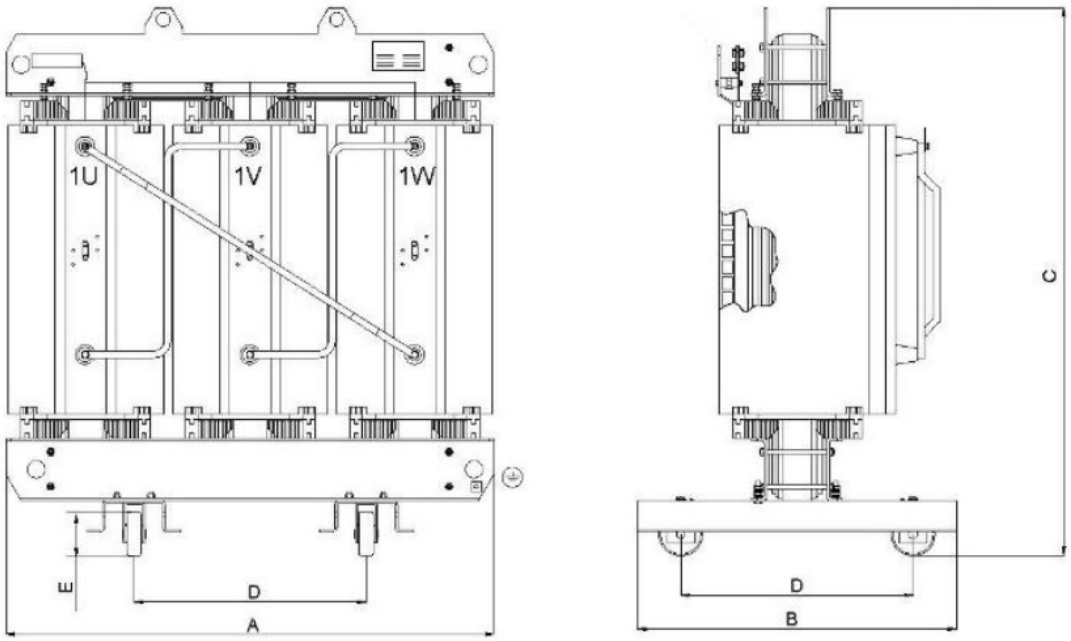
The mobile lifting device can then be moved to the battery cabinet where the battery module needs to be installed.



Figure 36: Mobile lifting device “Material-Lift GUIL ELC-725”

Technical details	
Dimensions L x W x H	400 mm x 550 mm x 1320 mm
Type of construction	Material lift
Overall height	1320 mm
Dead weight	51 kg
Lifting function	Cable winch
Lifting height	4000 mm
Platform dimensions L x W	550 x 500 mm
Table height max.	3940 mm
Table height min.	1320 mm
Load capacity:	125 kg

4.7.7 MV Transformer



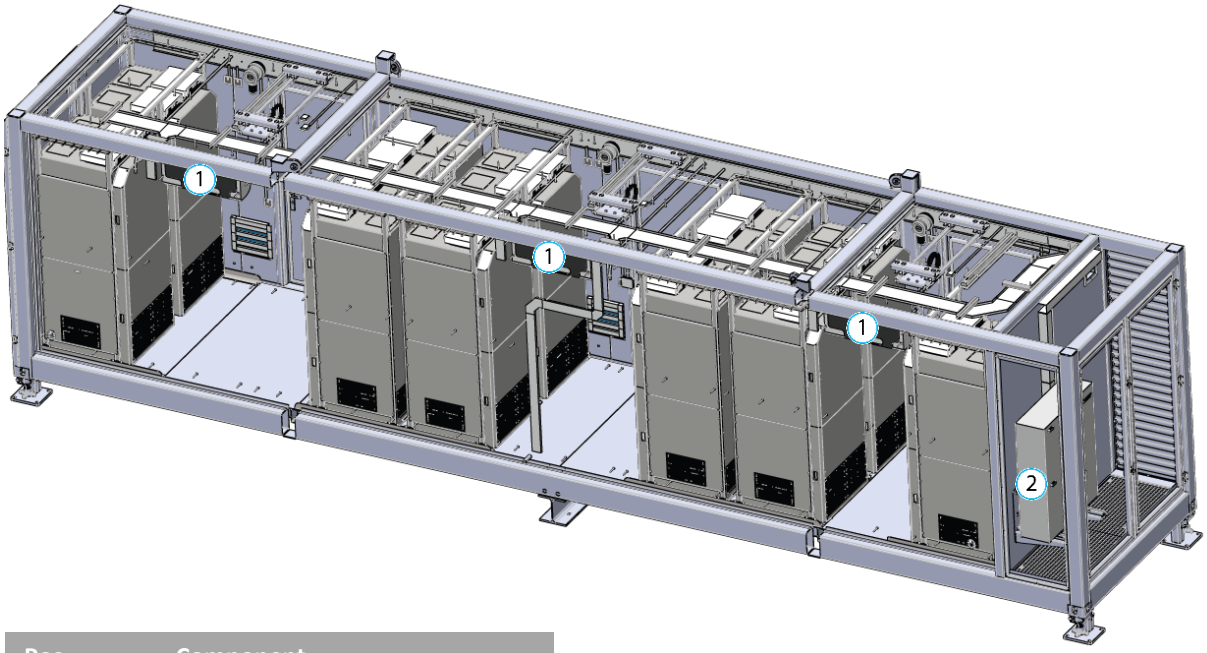
Position	1			
Reference Standards	IEC 60076-1,IEC 60076-11, EU 548/2014,EN 50588-1			
Type	TPZ3K7.2.1250	**Application**	Converter	6 Pulse
Rated Power – AN	1250 kVA	**Duty Class**	I	
Type of Cooling	AN	**Frequency**	50 Hz	
Degree of Protection	IP00			

CHARACTERISTICS

	HV	**LV**
Voltage	7 kV	0,62 kV
Insulation Class	7.2/20/60 kV	1,1/3/- kV
Tapping	±2x2,5%	-
Material	Aluminium	Aluminium
Insulation class	F	F
Temperature rise	100 K	100 K
Connections location	Top	Top
Vector Group	Dyn5	
Level of losses	EcoDesign TIER II	
No-Load Losses (Po)	1620 W	
On-Load Losses 120°C (Pcc)	11000 W	
Tolerance on the losses	0%	
Impedance 120°C (Uk%)	6%	
Power Noise (Lwa)	≤ 66 dB(A)	
Pressure Noise (Lpa)	≤ 52 dB(A)	
Ambient Temperature	-25°C ; + 40°C	
Installation	≤ 1.000 m	
Fire (F), Environmental (E), Climatic (C) Classes	F1/E2/C2	
HV/LV earth screen	YES	
Dimensions IP00 (AxBxC)	1680x1050x1990 mm	**Wheel Base (D)** 820 mm
Wheels Dimensions (E)	160 mm	**Total Weight IP00** 3600 Kg

4.8 Cooling System

4.8.1 BESS 1 / BESS 2 Container



Pos	Component
①	Internal AC unit
②	External AC unit

Table 26: BESS 1 / BESS 2: Cooling system components

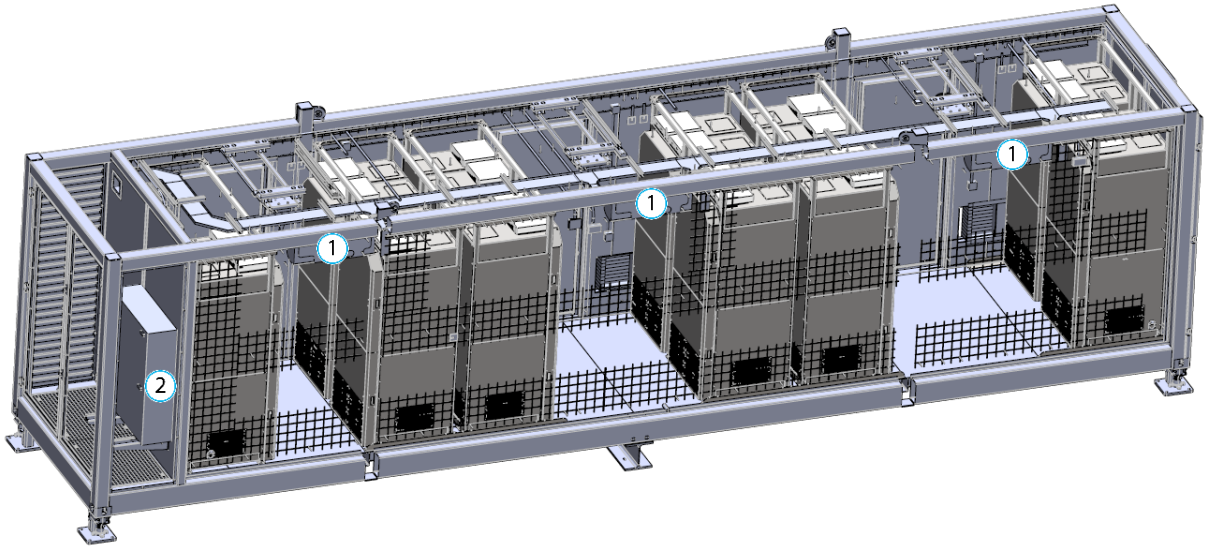


Figure 37: BESS 1 (above) / BESS 2 (below): Cooling system components

4.8.1.1 Battery Cabinets Cooling

The waste heat inside the battery cabinets is actively dissipated by two fans in the roof of each battery cabinet. The heated air is pushed out of the cabinet to the inside of the BESS container.

4.8.1.2 Container Cooling

The waste heat in the interior of the container is conducted via the three internal air conditioning (AC) units (*see Figure 37*) from the interior to the external air conditioning units of the container.

The container is equipped with several temperature sensors for monitoring the internal container temperature.

4.8.2 PCS Container

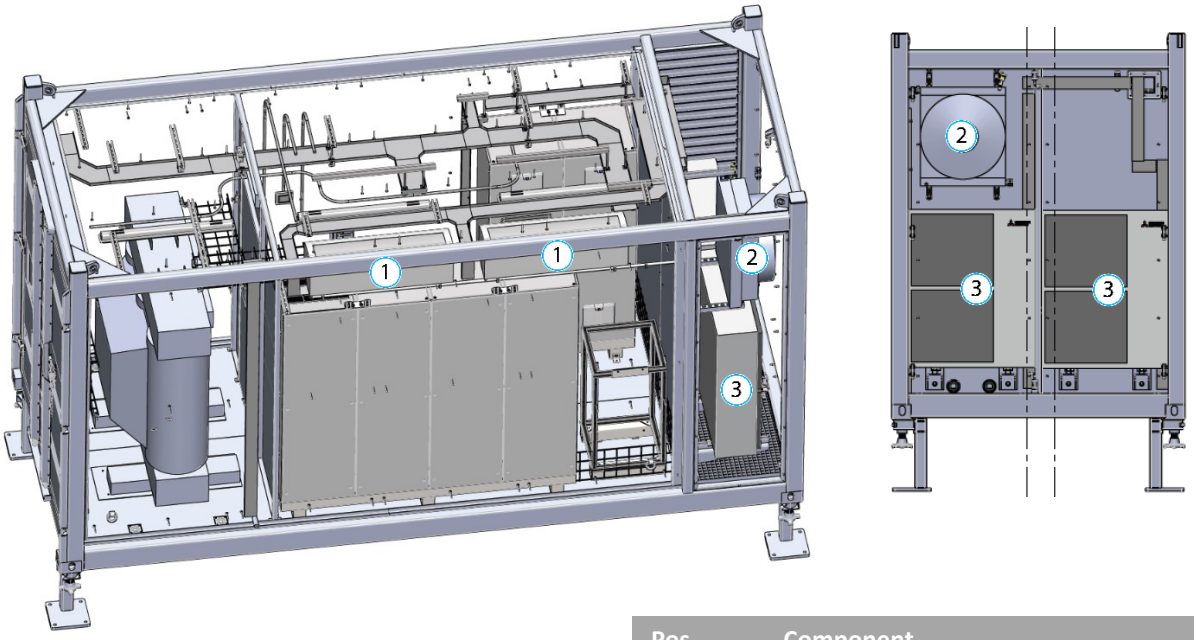


Figure 38: PCS: Cooling system components

Pos	Component
①	Internal AC unit
②	Heat exchanger
③	External AC unit

Table 27: PCS: Cooling system components

4.8.2.1 Container Cooling

The waste heat in the interior of the container is conducted via the three internal air conditioning (AC) units (*see Figure 38*) from the interior to the external air conditioning units of the container.

The container is equipped with several temperature sensors for monitoring the internal container temperature.

4.8.2.2 Converter Cooling System

To dissipate the waste heat from the IGBT power modules and inductors installed in the converter, these components are cooled down to the required operating temperature by an internal cooling system consisting of cooling hoses, coolant pumps, water distributors and four air/water heat exchangers.

The water-glycol-circulation (WGC) is designed as a closed cooling circuit. A water-glycol mix flows through the cooling modules of the converter and dissipates the heat produced by the IGBT modules. Additionally, the IGBT modules need a minimum temperature to operate properly. To heat up the IGBT modules from a cold start, the water-cooling system is pre-heated by an electrical heating element which is flange-mounted to the coolant manifold. The pre-heating process is performed to achieve an operational temperature of 25 °C, which takes about 20 minutes. After the IGBT modules have reached the temperature of about 25 °C, the converter is permitted to begin its normal operation.

The electrical pre-heater will be switched off automatically by a control unit at a temperature of > 28 °C of the coolant temperature sensor. The heating element is switched off at least 2 minutes before the pump is switched off. This procedure avoids overheating of the heating element since there must be a permanent flow around the heating element during heating.

A 3/2 directional mixing valve at the WGC unit controls the inlet temperature to the converter by mixing the water-glycol mixture of the heat exchanger and a bypass circuit. The 3/2 directional mixing valve opens at 36°C (mechanically set at mixing valve) and leads the cooling water to the heat exchanger.

Pre-heater on-off temperature hysteresis (sensor measures the inlet temperature to the converter)	
Coolant temperature > 28 °C	Heaters will be turned off
Coolant temperature < 25 °C	Heater will be turned back on

Table 28: Pre-heater on-off temperature hysteresis

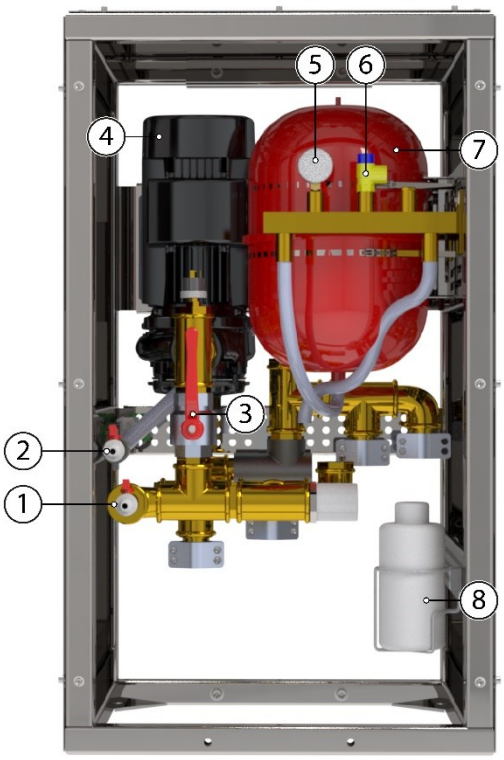


Figure 39: Cooling system cabinet (COSY) components

Position	Component
①	¾“ inlet flow connection with valve
②	"¾“ return flow connection with valve
③	Stop cock
④	Coolant pump
⑤	Manometer
⑥	Overpressure valve
⑦	Expansion vessel
⑧	Overflow vessel

Table 29: Cooling system enclosure (COSY) components

4.8.2.3 IGBT modules cooling

The cooling system dissipates the heat generated during normal operation of the converter.
The IGBT modules are mounted on heat sinks through which coolant flows. Tubing connectors provide the connection to the inlet and outlet of coolant.

4.8.2.4 Coolant Specifications

Coolant		
	Manufacturer	**Description**
Allowed Coolants	NALCO AG	Varidos FSK
	BASF AG	Glysantin G30
	Clariant	Antifrogen N
	Clariant	Antifrogen L
	DOW	Dowcal 20
Coolant concentration mixed with water	> 40 % to 60 % (depending on manufacturer recommendation)	
Coolant change interval	Every 5 years	

Table 30: Coolant specifications

5 Operating Interfaces

The BESS is operated and controlled either via

- The control panel on the control cabinet CTRL of the converter (*see section 14.1)*
  - Push-buttons
    - RESET (restart emergency stop circuit)
  - Indication lights:
    - Fault (red; controller error is active)
    - Preheating (yellow; preheating of coolant)
    - Ready for Operation (green; converter is ready for operation)
    - Operating (green; converter is active)
  - Other control elements:
    - Main switch
    - Emergency-stop push button
- interface to the customer's higher-level control system (*see section 6*).

6 Control System

6.1 Main Control System

The system is controlled and monitored by a main control system installed on the P320 PLC inside the control cabinet (CTRL). Both the converter and the BESS control system are installed on the same PLC.

Data exchange between the individual cabinet control systems and BESS main control system is performed via MODBUS TCP protocol.

BESS Main Control System Overview

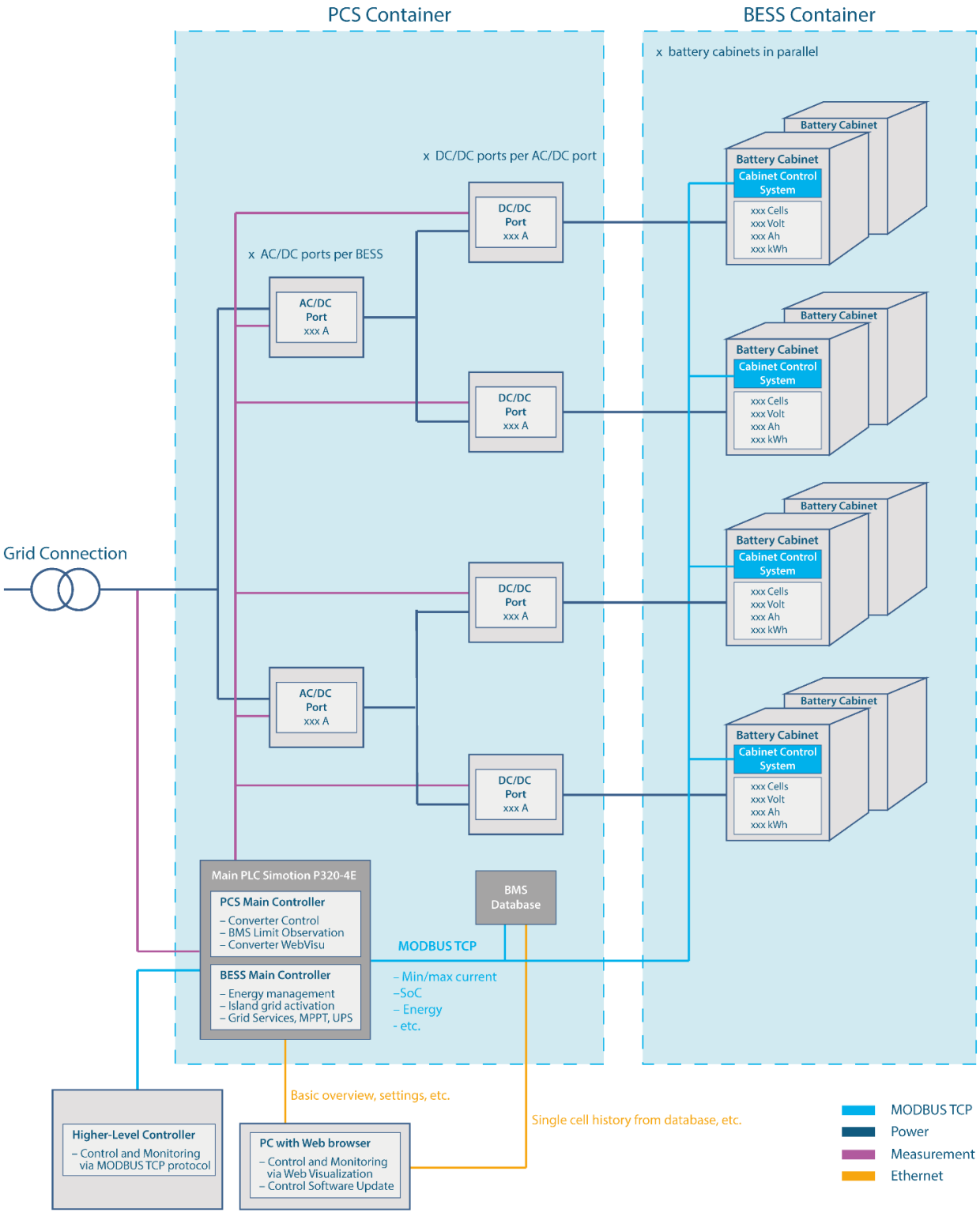


Figure 40: Main control system overview

6.2 Battery Cabinet Control System

Each battery cabinet is equipped with its own control system (Siemens S7) collecting the relevant data from the individual battery modules and providing these to the main control system (*see section 6.1*).

The tasks and features of the cabinet control system are the following:

- Monitoring of battery cell voltages and temperatures
- Monitoring of the battery charging and discharging current
- Control of DC switches
- Monitoring of line protection and smoke detectors
- MODBUS RTU Master for communication with BMS system (battery monitoring system)
- MODBUS TCP Server provides the communication interface to other systems. For example, for the external charger or the consumers

Cabinet Control System Overview

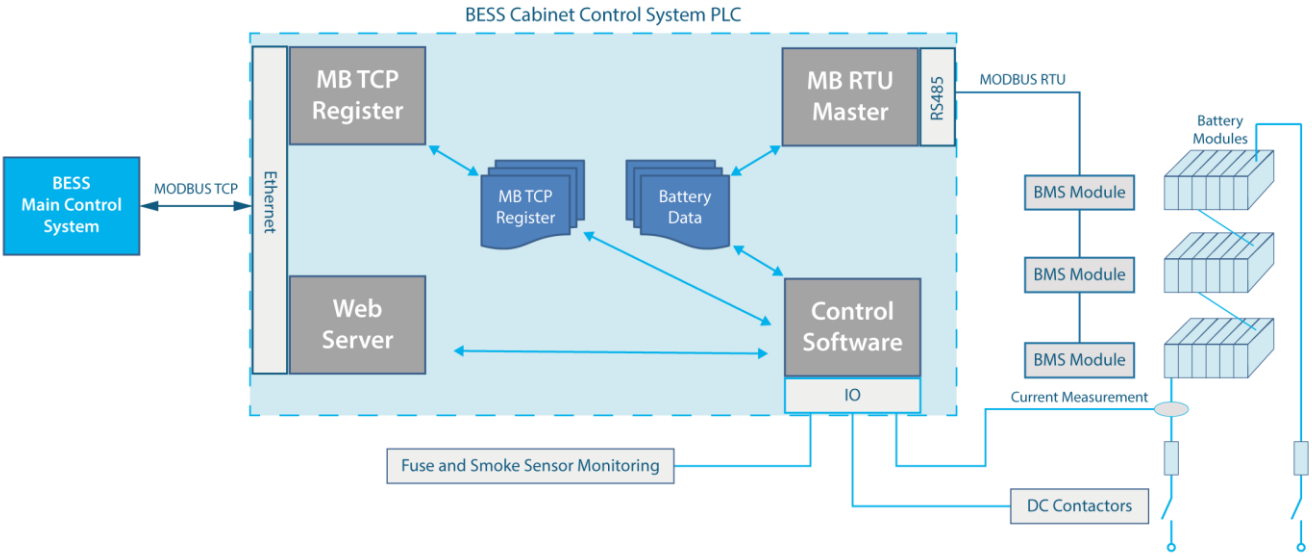


Figure 41: BESS cabinet control system overview

Data exchange between the cabinet control system and the individual battery modules is performed via MODBUS RTU protocol. Therefore, each battery cabinet is provided with several MODBUS RTU interfaces for Modbus connection of the battery modules.

6.3 Network Structure

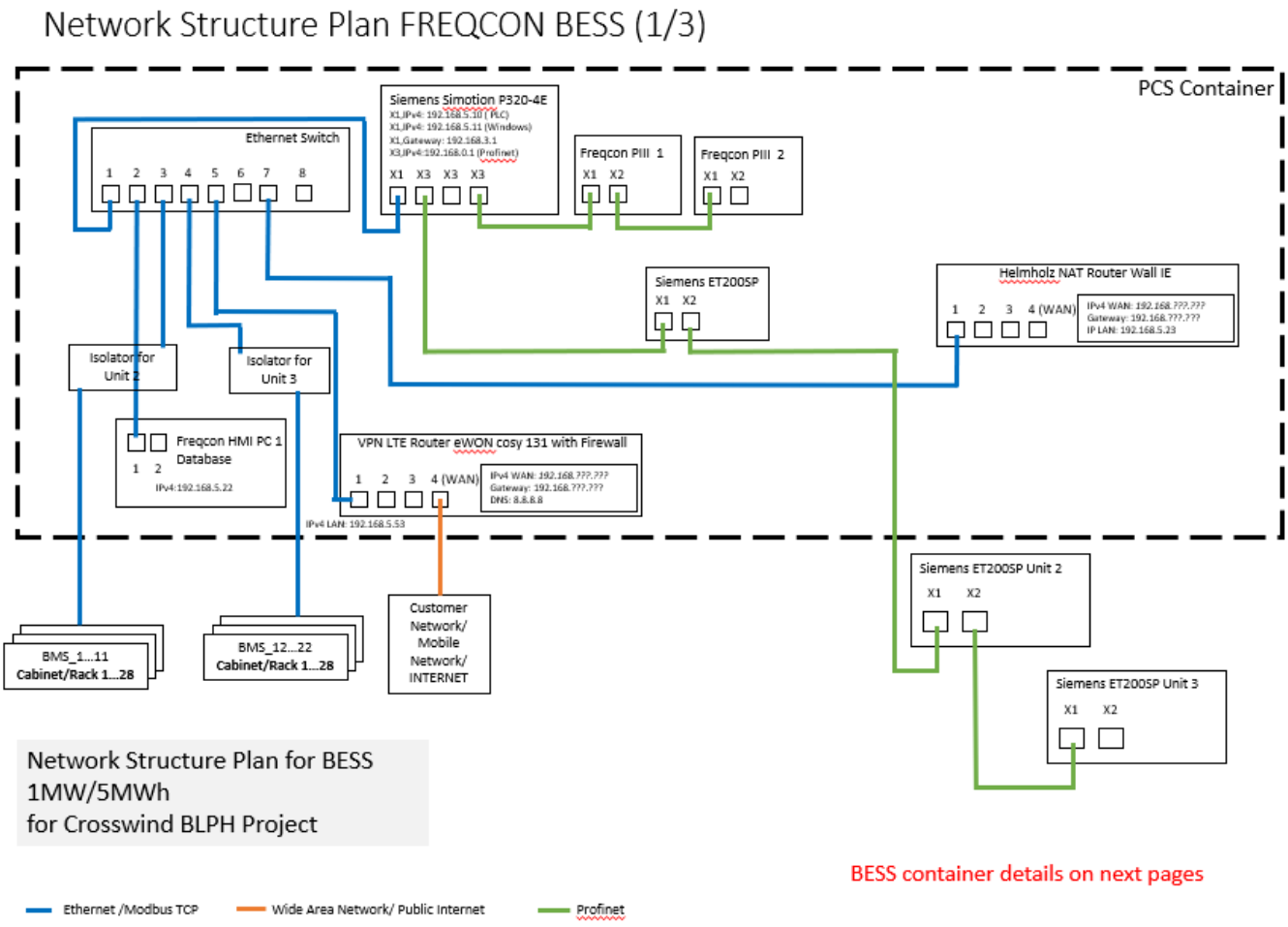


Figure 42: MSC network structure (1/3)

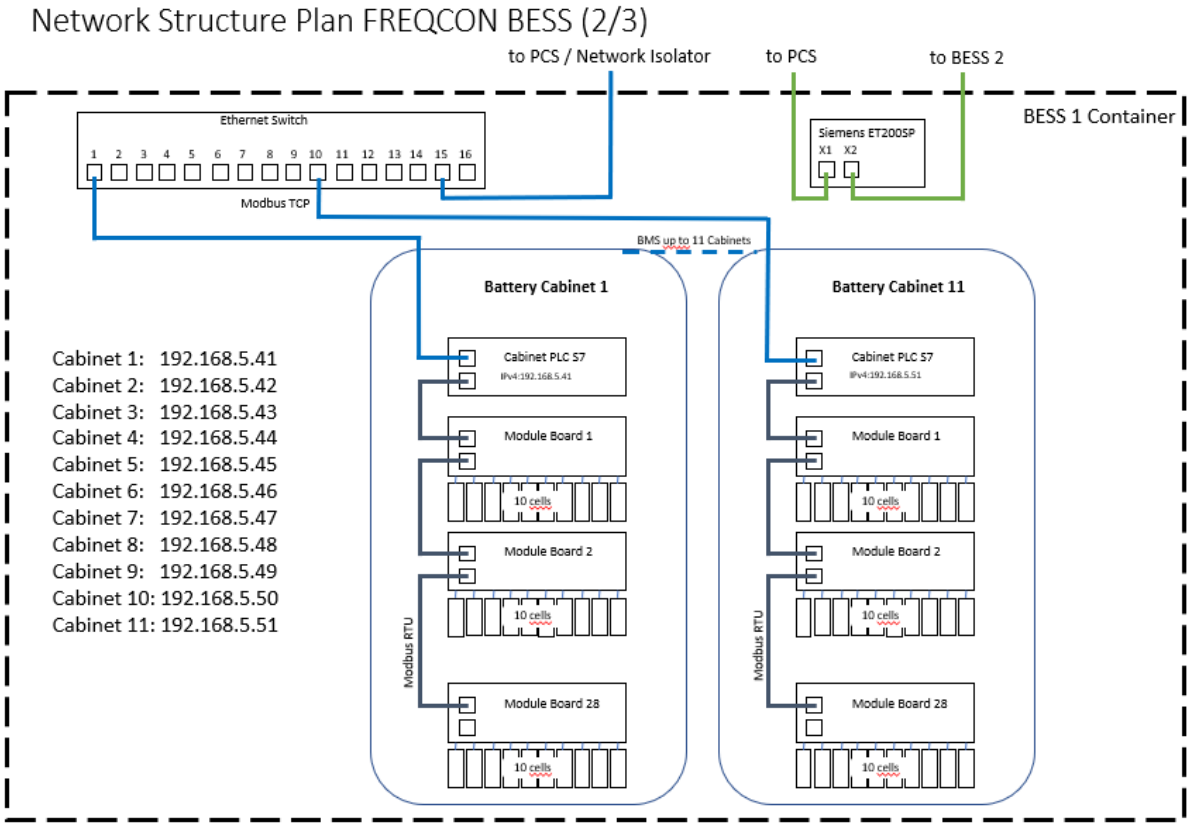


Figure 43: BESS network structure (2/3)

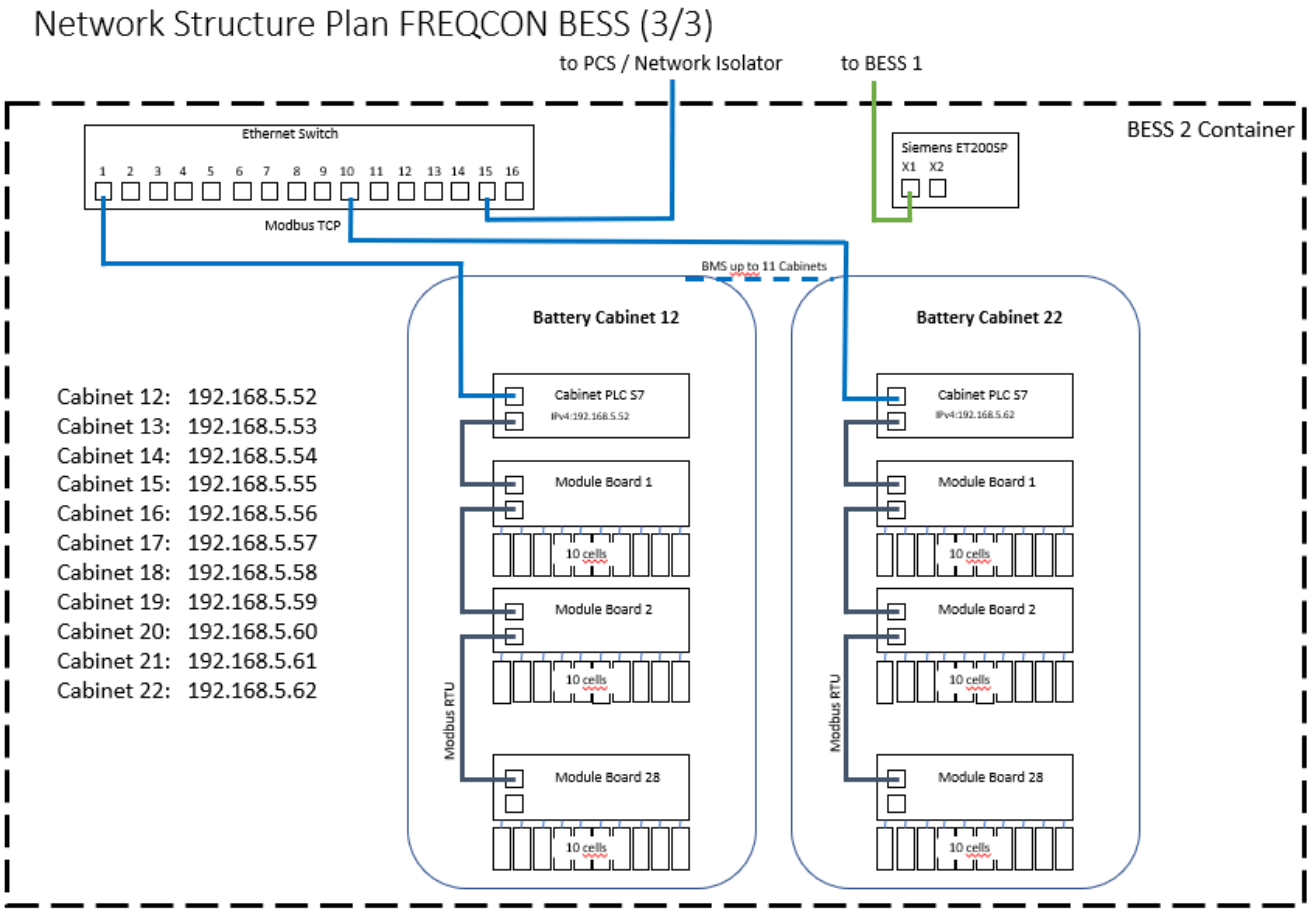


Figure 44: BESS network structure (3/3)

7 Converter Main States

The individual converter main states are depicted in the flow diagram below and described in section 7.2.

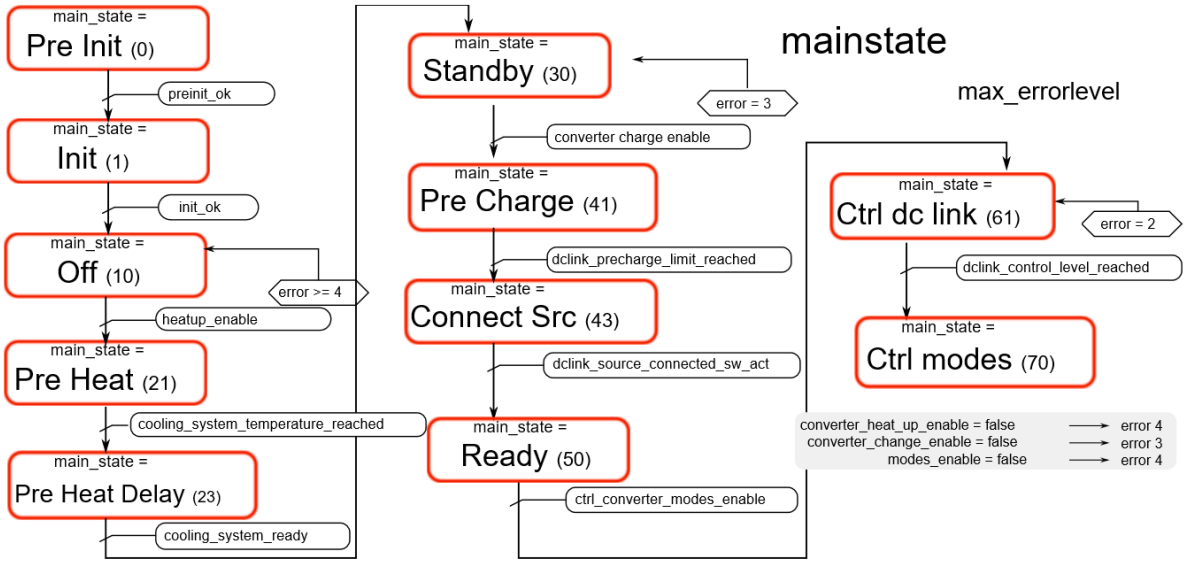


Figure 45: Converter main states

7.1 Error Levels

Error Level	Description
0	No error, logging information
1	Warning category, a warning limit is reached
2	Error category, stop subsystems
3	Error category, stop system and discharge DC-link, cooling system enable
4	Error category, stop system and also the cooling system

Table 31: Error levels

7.2 Main States

INIT

The system was turned on and the stored initialization parameters are read. Cooling and converter system are stopped.

OFF

DC link is discharged. The converter and cooling system are not in operation.

Pre-Heat

The converter is switched-off and is preparing for operation. The cooling system regulates to the optimum temperature of the cooling water, IGBT, capacitors and inductors.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Heat-Delay

The converter is preparing for operation. The operation temperatures of the components are reached and maintained for a defined time span.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

STANDBY

Standby mode – converter is off, but the cooling system is in operation.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Pre-Charge

The converter´s main DC-link is pre-charged to a defined voltage level.

An error level 3, such as detection of wrong grid conditions, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Connect SW

Source contactor is closed.

An error level 3, such as switching error of the source contactor, is leading to a change to main state "STANDBY" (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

READY

Converter is ready for operation. Cooling system is operating, the DC link is charged and source is connected.

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

DC link Ctrl

The converter power module that is set to "DC link control" mode is activated.

An error level 2, such as derating, DC link errors or over temperature, are leading to a change to main state READY (converter is off, cooling system is in operation).

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Ctrl Mode

The remaining converter power modules that are enabled are activated. The converter is operating.

An error level 1, such as power module over temperature, over-current or over-voltage, is leading to a stop of the respective power module.

An error level 2, such as derating, DC link errors or over temperature, are leading to a change to main state READY (converter is off, cooling system is in operation).

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

8 Technical Data

Container	
Container type	PCS: Customer-specific container BESS: Customer-specific container
Transport weight	PCS: approx. 13.7 t BESS: approx. 15 t (Batteries not installed)
Total weight	BESS: approx. 35 t (Batteries installed)
Container dimensions (L x W x H)	PCS: 6058 mm x 2438 mm x 3200 mm BESS: 12310 mm x 2438 mm x 3783 mm

PCS	
Type	MSC-1000-620-8
Manufacturer	FREQCON GmbH
Nominal AC voltage	620 VAC + 10% - 20%
AC power frequency (nominal)	50 Hz ± 5 Hz
Nominal apparent power	1000 kVA
Nominal active power	1000 kW
Nominal AC current	931 A
Maximum AC current	1050 A
Power factor at rated power / adjustable	1 / 0.03 overexcited to 0.0 underexcited
IGBT switching frequency	2 to 4 kHz
DC link voltage	1175 VDC
Number of DC outputs	8
Current per DC output	250 ADC
DC voltage range	700 VDC to 1022 VDC
HVAC system	included

BESS	
Battery Module	1C LFP Battery 280Ah
Cell manufacturer	EVE
Battery cells per cabinet	28
Battery capacity per cabinet	250.88 kWh
Number of battery cabinets	22
BESS capacity (installed)	5500 kWh
BESS capacity (usable at 0.2 C operation)	5000 kWh
Storage temperature range battery storage (> 1 month)	0 °C to 35 °C (30% to 50% SoC)
Ambient temperature range	-20 °C to +40 °C
Battery management system	FREQCON BMS

Controller	
Main control system	Siemens Simotion P320-4
Control software	FREQCON Framework
Internal communication	Profinet IRT
External communication interfaces	Ethernet, RS485, RS232, MODBUS TCP, Profibus, Profinet
Maximum total harmonic distortion	< 3% at nominal power

Converter Cooling System	
Cooling principle	Liquid and air cooled, air heat exchanger
Maximum cooling water inlet temperature	65°C
Operating pressure range cooling system	2.5 … 3.5 bar
Nominal cooling system pressure	3 bar
Coolant capacity (without hoses)	Approx. 80 l
Heat exchanger weight (without cooling liquid)	Approx. 75 kg

Protective Devices and Standards	
Battery (DC)	Fuse and DC load break switch
AC side disconnection point	Air circuit breaker
DC overvoltage protection	Surge arrester, type I
AC overvoltage protection	Surge arrester, class I
Ground fault monitoring	Yes
Insulation monitoring	Yes
Fire protection (converter)	Smoke and arc detection
Fire protection (batteries)	Active Fire Protection System
Maximum permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month/year) / 0% to 95%
Inverter Life (rated conditions)	20 years

Table 32: Technical data

9 Environmental Conditions

	Stationary Operation	Storage packaging with protected layers	Transportation packaging with protected layers
Relative Humidity	Max. 95% No condensation; Relative Humidity <60% under corrosive atmosphere	Max. 95%	Max. 95%
Pollution level IEC60721-3-3 IEC60721-3-2 IEC60721-3-1	No conductive dust		
	3S2 coated PCB: Chemical Air: 3C2 Solid Particulate: 3S2	1S3 coated PCB: Chemical Air: 1C2 Solid Particulate: 1S3	2S2 coated PCB: Chemical Air: 2C2 Solid Particulate: 2S2
Atmospheric pressure	70 … 106 kPa	70 … 106 kPa	70 … 106 kPa
Vibration amplitude	Max 1 mm (5 … 13.2 Hz)	Max 1 mm (5 … 13.2 Hz)	Max. 3.5 mm (5 … 13.2 Hz)
IEC60068-2	Max. 7 m/s^2 (13.2 … 100 Hz) sinusoidal	Max. 7m/s^2 (13.2 … 100 Hz) sinusoidal	Max. 15 m/s^2 (9 … 200 Hz) sinusoidal
Impact IEC60068-2-29	Impermissible	Max. 100 m/s^2, 11 ms	Max. 100 m/s2, 11 ms
Free-fall	Impermissible	Impermissible	Impermissible

Table 33: Environmental conditions

10 Transport, Storage and Commissioning



Please observe the instructions for transport in section 10.2 and for storage and professional handling in section 10.3.

10.1 Unpacking

⚠ CAUTION



Hazard by sharp edges on packaging
Improper handling during unpacking can cause injuries.
➜ Use appropriate safety gloves to protect your hands from possible cuts.

The packaging of the system consists of cardboard, plastic and corrugated board. After usage the packaging must be disposed according to the local regulations for the disposal of paper products (e.g. recycling). After delivery, the delivered units and components must be checked for completeness and damage. If any damage on the delivered units and components have been found, contact the delivery service or FREQCON GmbH immediately.

10.2 Transport

Regarding the transport of the battery modules, refer to the battery module manual.

⚠ DANGER	
	**Hazard by electrolyte release due to mechanical damage to battery modules** Severe burns, long-term physical damage, and environmental damage due to electrolyte. ➜ The device must be disconnected before maintenance work. Work under voltage is not permitted. ➜ Observe the safety data sheet of the battery module and keep it accessible at all times. ➜ Never open battery modules by force. ➜ Avoid contact with escaping electrolyte at all costs, leave the danger area immediately. ➜ In case of ingestion, immediately alert the emergency services! ➜ In case of eye contact: Rinse cautiously with water for several minutes. Remove any contact lenses and continue rinsing. Call poison information center or doctor! ➜ In case of skin contact: Remove contaminated clothing immediately. Wash/shower skin with plenty of water. Call poison control center or doctor! ➜ Prevent release of electrolyte into the environment at all costs. ➜ Wear suitable protective equipment when disposing of electrolyte *(see section* 2.7 "Personal Protection Equipment (PPE)").

⚠ DANGER	
	**Fire due to short circuits in the event of mechanical damage to the battery modules.** Severe burns or death due to short circuits that may result in fire. The electrolyte used is highly flammable as a liquid or vapor. ➜ Avoid mechanical damage. ➜ Never open battery modules by force. ➜ Protect the system against vandalism. ➜ Fire loads or sources of fire near the installation site are not permitted. ➜ In the event of damage, press the emergency OFF button immediately. ➜ In case of fire, leave the danger area immediately and alert the fire department!

NOTICE
Inadequate transportation of the device and all of its components may cause damage to the installed components. ➜ Vibrations and jolts must be avoided during transportation. ➜ The container must be transported in a horizontal position (lying down). ➜ Make sure to observe the specific national safety precautions for transport by truck, train or ship´.

NOTICE
Do not transport the containers with installed batteries ➜ Lifting or Moving of the Container is not allowed if battery modules are inside the container ➜ Remove every battery module from the container before lifting or mowing the container

The container must be transported to the installation site by instructed personnel.

The container weight is specified in section 8, "Technical Data" on page 93. Make sure that the components can be placed at ground level.

For information regarding the dimensions and center of gravity of the container, see section 10.2.2. The container weight is specified in section 8, "Technical Data". Make sure that the components can be placed at ground level.
Vibrations and jolts must be avoided during transportation. If the system was damaged during transport, you must immediately inform the responsible transport company.

The cabinet must be transported in a horizontal position (lying down). It is not permitted to tip over the container during transportation or in any other scenario.
Applied assemblies (if existing) must be protected against damage by external influences during transportation and storage.



All persons involved in the transport of lithium batteries must be trained and certified according to regulations.

The information provided below is for informational purposes only.

10.2.1 Container Lifting

⚠ DANGER	
	**Heavy load** **Improper lifting can result in death, serious injury or property damage.** Never lift the container above people. Use only lifting and personal protective equipment approved by OSHA or other national institutions.

NOTICE
Only use an appropriate crane to lift the container, capable to withstand the loads specified as follows: Total weight of cabinet combination *see section 8, „Technical Data“ page 93.*

NOTICE
Observe the container´s center of gravity during lifting: Observe the container´s center of gravity during lifting with crane, shown in section 10.2.2.

To lift the containers with a crane, use the four transport lugs on the top corners of the container (*see following illustration*).

PCS

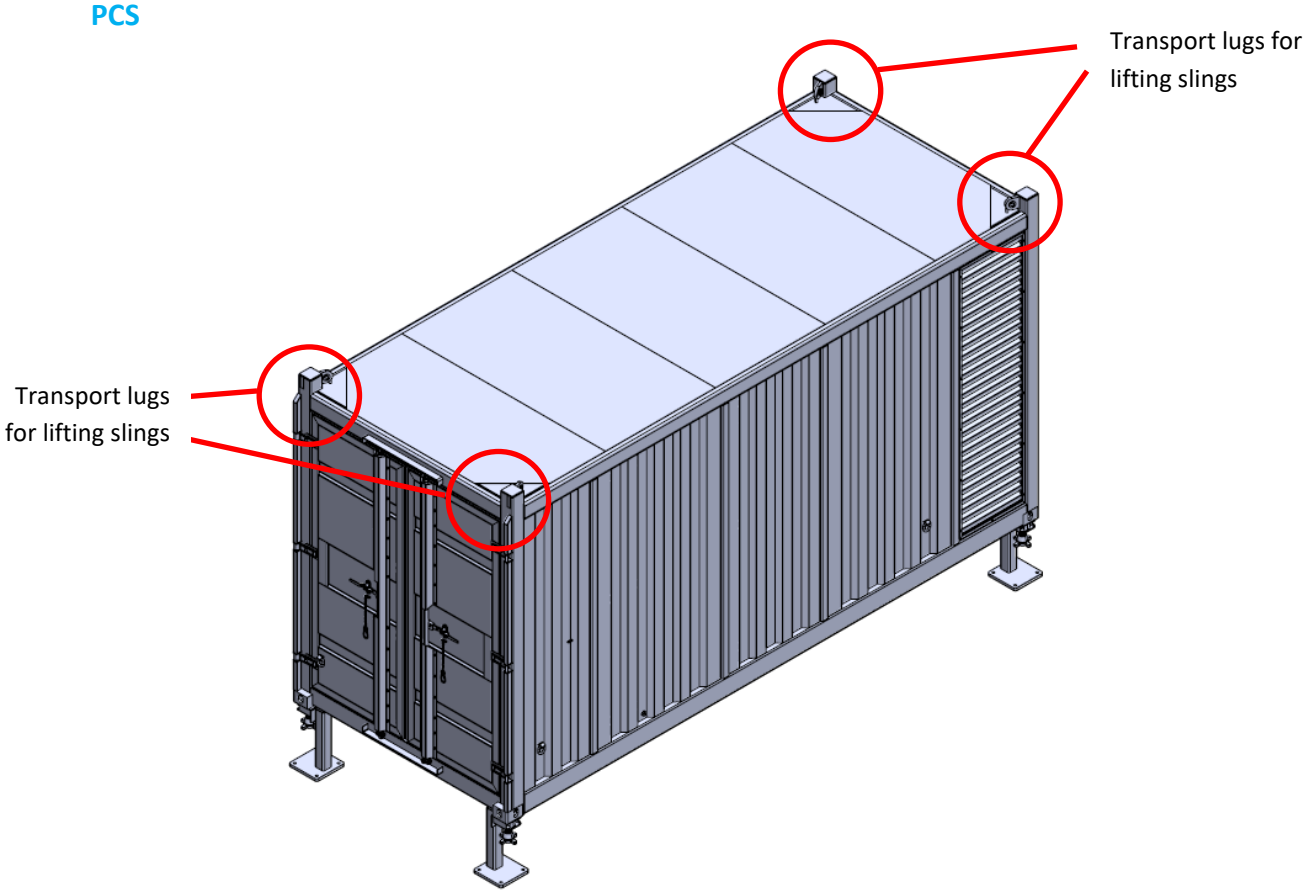


Figure 46: PCS container transport lugs

BESS 1

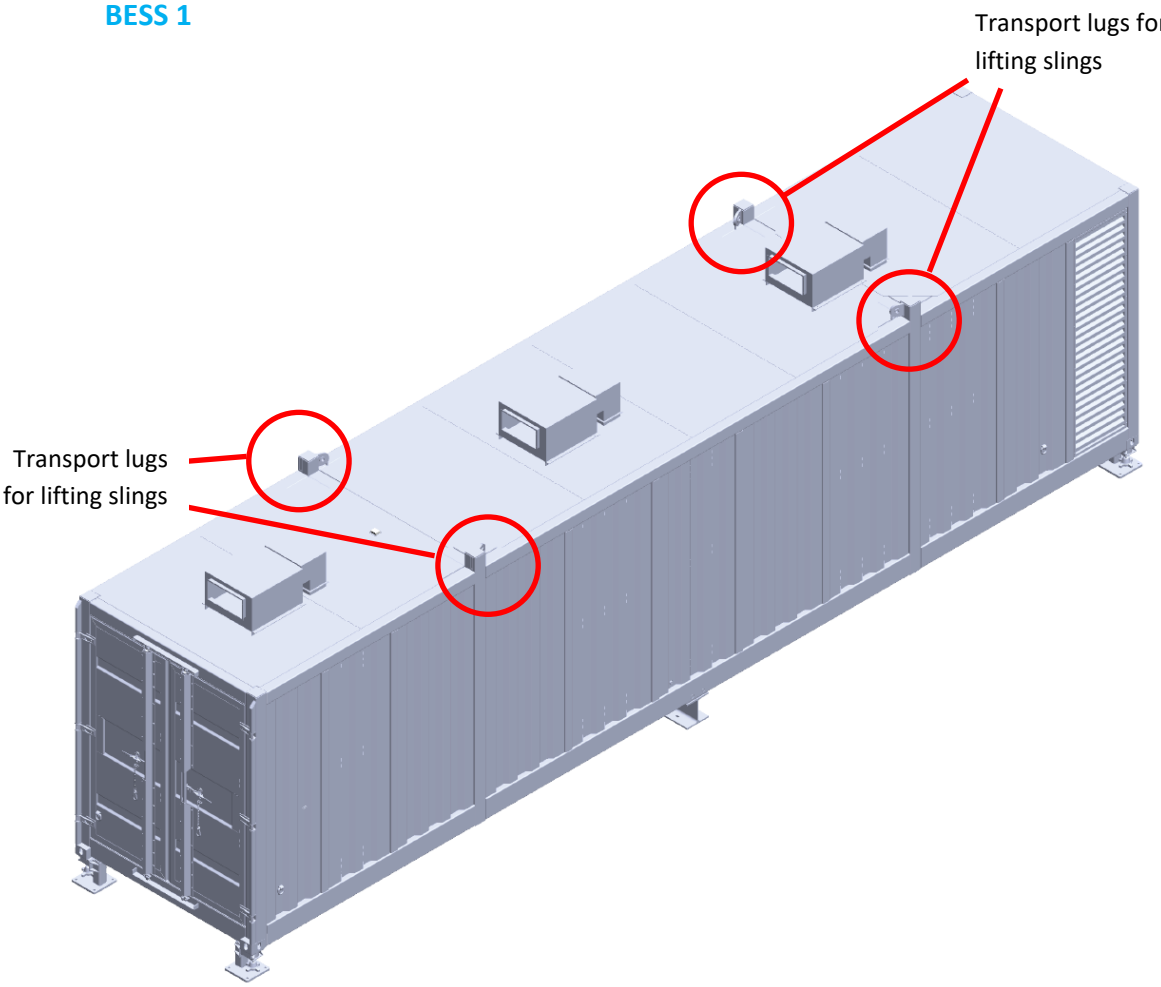


Figure 47: BESS 1 container transport lugs

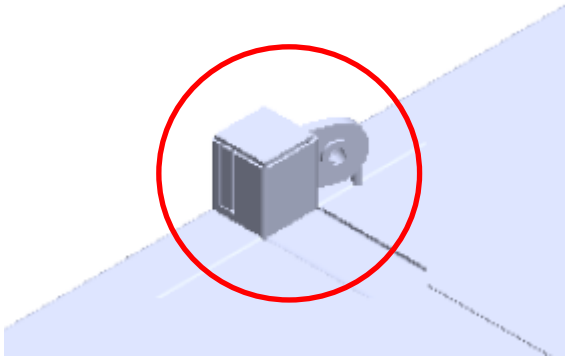


Figure 48: Transport lug

BESS 2

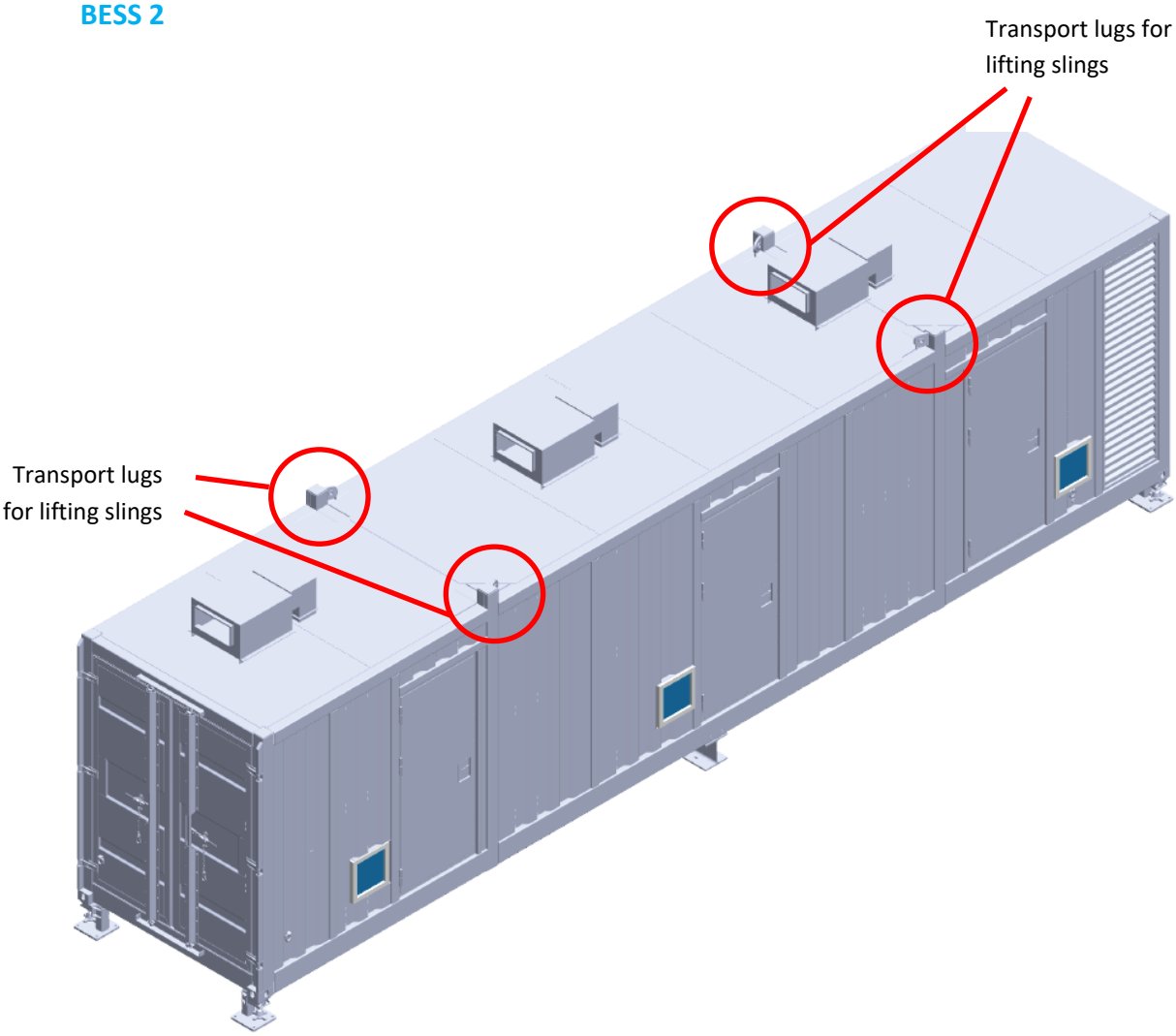


Figure 49: BESS 2 container transport lugs

10.2.2 Dimensions and Center of Gravity

10.2.2.1 PCS Container

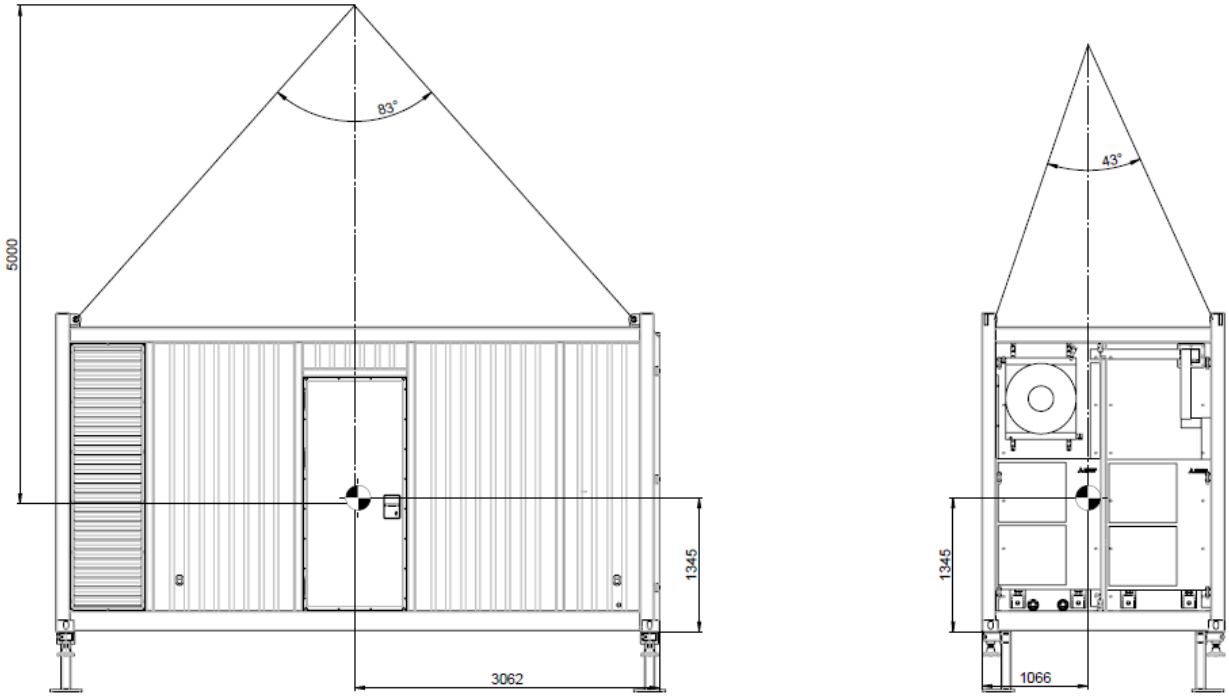
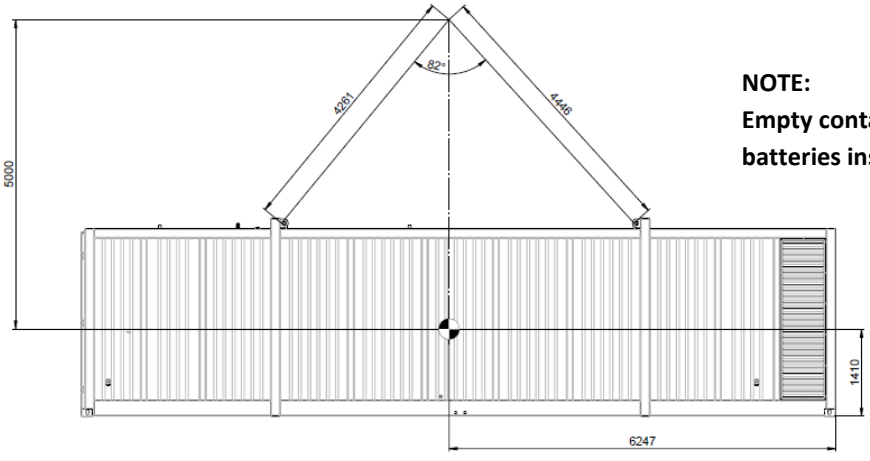


Figure 50: PCS Container – dimensions and center of gravity

10.2.2.2 BESS 1 Container



NOTE:
Empty container, no batteries installed

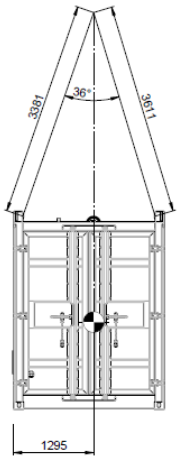
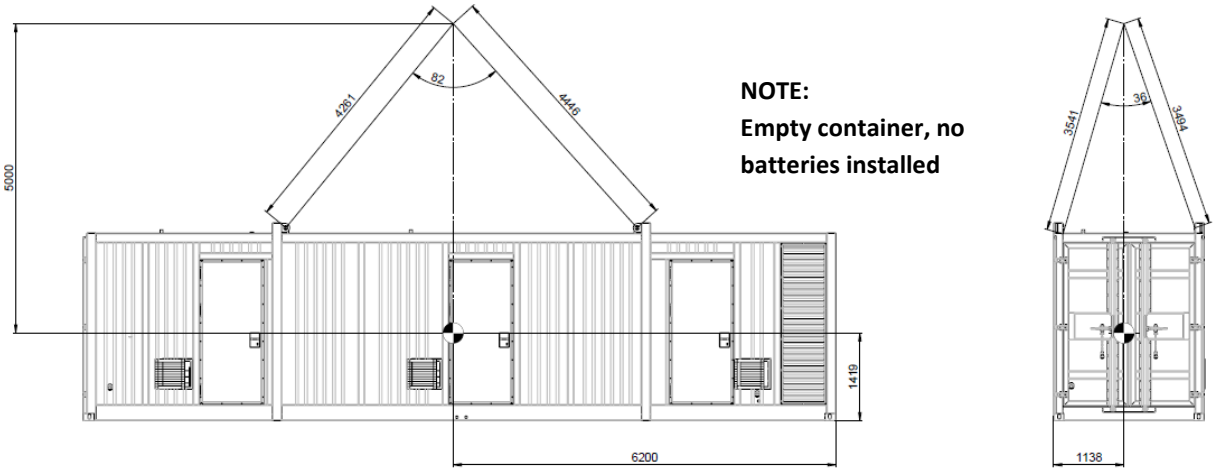


Figure 51: BESS 1 Container – dimensions and center of gravity

10.2.2.3 BESS 2 Container



NOTE:
Empty container, no batteries installed

Figure 52: BESS 2 Container – dimensions and center of gravity

10.3 Storage

10.3.1 Storage Condition

NOTICE	
	Damage to components in the event of improper storage. The storage conditions of the energy storage device are only maintained when the climate control of the container is active. ➜ Keep air conditioning activated/enabled even in case of storage. ➜ Supply energy storage with power even if it is out of operation. ➜ Only deactivate air conditioning if storage conditions are maintained by other measures. ➜ Condensing must be avoided.

NOTICE
The cooling liquid inside the cooling system must be removed at least once every five years. ➜ Check the pressure on the expansion tank every time the cooling liquid is exchanged. The cooling system must be completely drained during a pressure test of the expansion vessel *(see section 17.8.1.3 "Draining the cooling* system*")*.

NOTICE
➜ The BESS container must not be exposed to strong vibrations. ➜ Condensing must be avoided.

NOTICE
The battery of the UPS unit of the converter system must be removed from the battery module at storage temperatures of <0°C. ➜ The removal of the UPS battery is described at 17.3.2.

Store the components of the energy storage system under the following conditions:

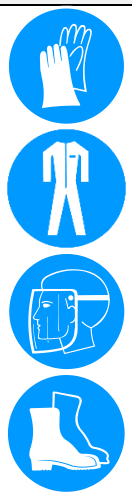
➜ Store the components of the energy storage device according to pollution degree 2 (no conductive pollution).
➜ Do not expose components of the energy storage device to aggressive media.

Storage Condition	Value
Storage temperature	*see technical data in section 8*
Max. relative humidity	*see technical data in section 8*
Positioning of the product during storage	laying down, horizontal

Table 34: Storage conditions

10.4 Assembly and Initial Commissioning

⚠ DANGER	
	**Electric shock due to low voltage and arcing on loose wires.** Severe irreparable damage to the nervous system, burns and death. ➜ Access to control cabinets and string cabinets only by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel. ➜ Plant control units may also be opened by instructed persons with the qualification of a qualified electrician. ➜ Work on electrical and electronic components as well as cables of the battery system may only be carried out by FREQCON service personnel!

⚠ DANGER	
	**Electric shock due to low voltage and arcing on loose wires.** Severe irreparable damage to the nervous system, burns and death. ➜ Access to control cabinets and string cabinets only by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel. ➜ Work on electrical and electronic components as well as cables of the battery system may only be carried out by FREQCON service personnel! ➜ Wear personal protection equipment (Electrician's gloves, protective visor, safety shoes, hearing protection)

The energy storage system may only be installed and commissioned by trained service personnel or by FREQCON instructed and authorized maintenance personnel.

11 Mounting

11.1 General

The BESS container must be set up and positioned safely at the installation site and may only be installed by instructed FREQCON service personnel.

Service personnel must at least have the following tools in reach before starting the installation:

Pos.	Installation Tools	Amount
	Basic Tools	
1.	Flashlight	1
2.	Pliers set	1
3.	Ratchet set	1
4.	Torque wrench (1 - 100 Nm)	1
5.	Socket wrench set (with sockets 7 – 19 mm)	1
6.	Wrench set	1
7.	Cross-section screw drivers set	1
8.	Flat-section screw drivers set	1
9.	Allen key / Hex socket key set	1
10.	Cutter	1
11.	First-aid kit	1
12.	Multi-meter instrument	1
13.	Two-pole voltage tester	

Table 35: Installation tools

⚠ DANGER	
	**Electric shock due to low voltage and arcing on loose wires.** Severe irreparable damage to the nervous system, burns and death. ➜ Access to control cabinets and string cabinets only by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel. ➜ Plant control units may also be opened by instructed persons with the qualification of a qualified electrician. ➜ Work on electrical and electronic components as well as cables of the battery system may only be carried out by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel.

⚠ DANGER
Make sure that the energy source is locked and tagged and ensure that the isolation is effective before conducting work on the system. After switching-off the voltage supply, some components might still carry a charge. Check all poles using a suitable device.

⚠ WARNING
The electrical connection must be carried out in accordance with the local regulations of the utility company and /or VDE (in Germany).

Do not operate!	Lock and tag power switches and controller devices
	Observe national laws regarding Occupational Safety and Health, as well as Industrial Standards. ➢ DIN VDE 0105-100; VDE 0105-100:2009-10 Operation of electrical installations - General requirements.

11.1.1 Cable Routing

It is recommended that the power cables and the control cables are installed in separate trays. Avoid long parallel runs of power cables with other cables in order to decrease electromagnetic interference.
Where control cables must cross power cables, make sure they are arranged at an angle as near to 90 degrees as possible.
The cable trays must have good electrical connection to each other and to the grounding/earthing.

11.1.2 Coding

11.1.2.1 Coding Terminal Strip

Terminal designation	Description
-XE1	Main power supply 600 V AC
-XE2	DC power supply 1000 V DC
-XE	Main power supply 400 V AC
-X1	Main power 400 V / 230 VAC
-X2	Light cabinet 230 V AC
-X3	Control voltage 24 V DC
-14X1	Control voltage 24 V DC (to DC contactors)
-X5	Low-voltage signals
-XDC0	24 V DC power supply
-XDC1-4	Control voltage 24 VDC (UPS)
-XT	Transfer terminal block 24 V DC / 230 V AC

11.1.2.2 Coding Wiring colors

Cable	Color
L1/L2/L3	Black
N	Light blue
PE	Yellow-green
External voltage	Orange
Control voltage 24 VDC	Dark blue
Analog signals	White

11.1.2.3 Coding Power Supply

Terminal	Phase
U1	L1
V1	L2
W1	L3

11.2 Installation location

⚠ DANGER

Danger to life due to electric shock!
The DC paths and the connection cables are not protected against overload by the BESS.
Select external components according to the specified nominal and maximum currents of the BESS.
➜ If necessary, use appropriate protective equipment for the external components.

⚠ DANGER

Danger from and for unauthorized persons
Unauthorized persons are not aware of the dangers in the work area and may endanger themselves and third parties danger.
➜ Keep unauthorized persons away from the work area.
➜ If in doubt, speak to persons and direct them away from the work area.
➜ Interrupt the work as long as unauthorized persons are in the work area.
➜ Always keep the entrance door(s) locked when not performing work on the system to prevent unauthorized persons from entering the container.

⚠ WARNING

Danger to life due to unsuitable lifting material
While lifting the battery modules use only suitable lifting equipment and lifting tackle
➜ Make sure that all the material and equipment is designed for the weight and all required inspections have been done.
➜ Make sure that no person is under the battery module during lifting.

⚠ CAUTION

Danger to life due to unsuitable lifting material
While lifting the container and/or battery modules use only suitable lifting equipment and lifting tackle
➜ Make sure that all the material and equipment is designed for the weight and all required inspections have been done.
➜ Make sure that no person is under the container or battery module during lifting.

NOTICE

Equipment damage due to intruding animals
Prevent animals from entering the interior of the container from below through the cable glands or recesses.
➜ Secure the container from the outside with suitable protection against the entry of animals.

The BESS containers are designed for outdoor installation, on a flat and ground level surface. Make sure that the environmental conditions meet the values of section 8 „Technical Data“ and section 9 “Environmental Conditions”.

The entrances to the containers must be accessible from every side to allow for visual inspections or maintenance and repair work, if necessary

Air inlets and outlets of the containers, as well as on the cabinets inside the container, must always be kept free and cleaned of dirt in order to ensure the required air flow of the installed fans.

11.2.1 Distances Between Containers

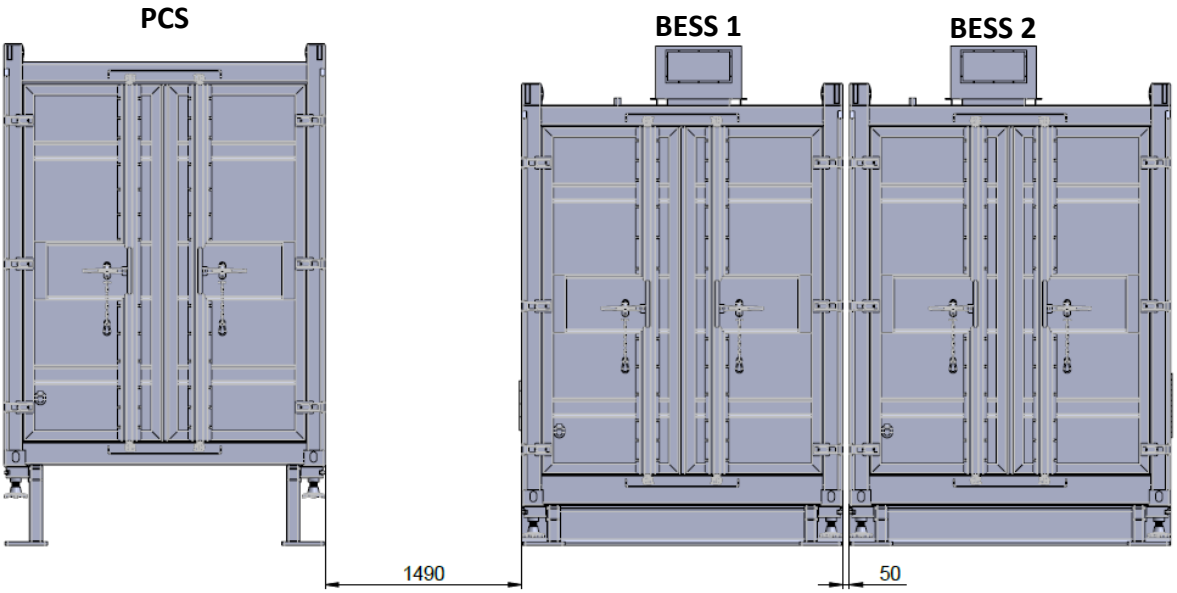


Figure 53: Distances between containers

11.2.2 Cable Outlets

Overall System

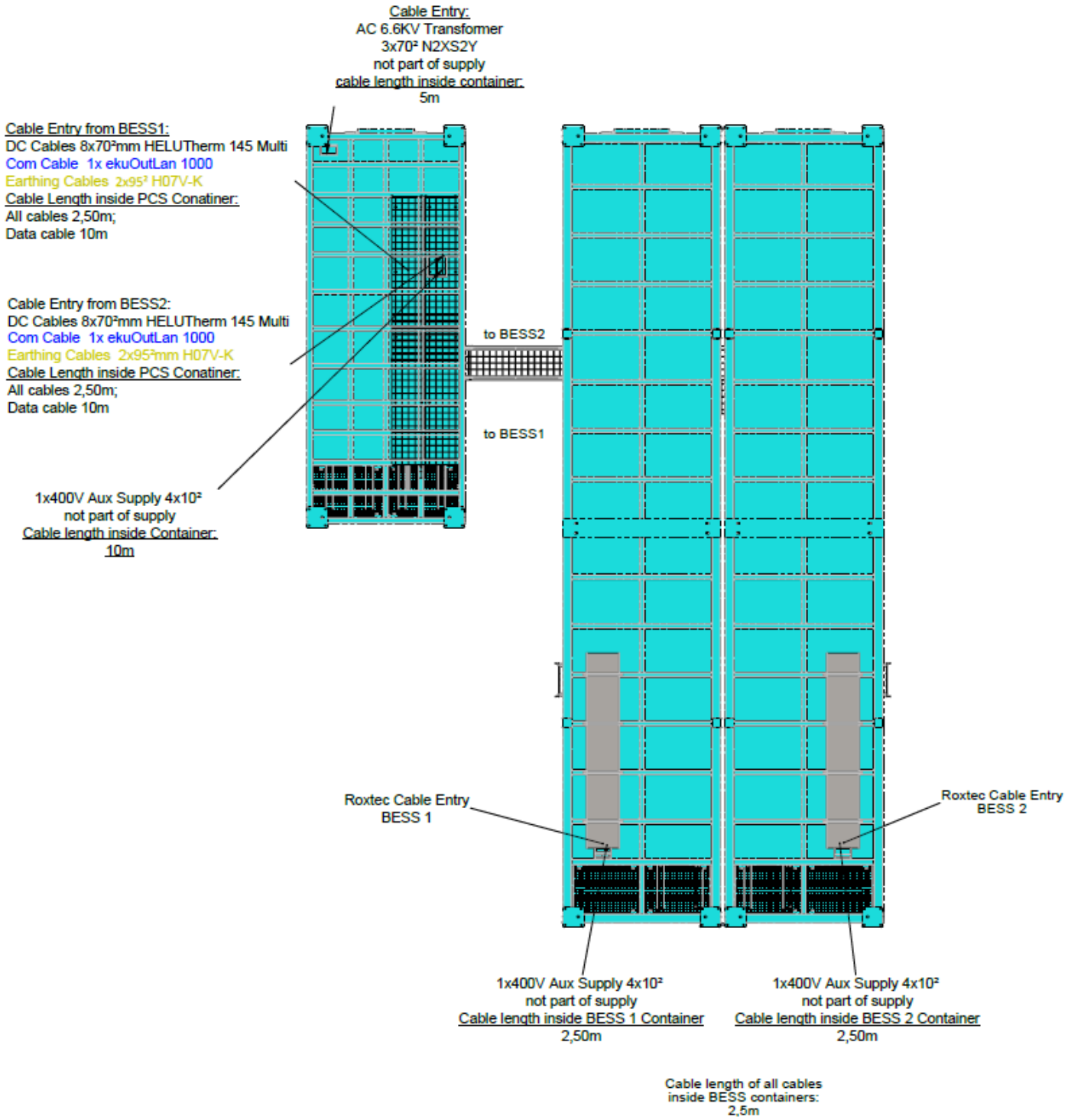


Figure 54: Cable outlets – Overall system (Bottom view)

11.2.2.1 PCS Container

Cable interface 1 (Roxtec cable gland)
- DC power cables
- Communication cables
- 400 V AC aux. cables

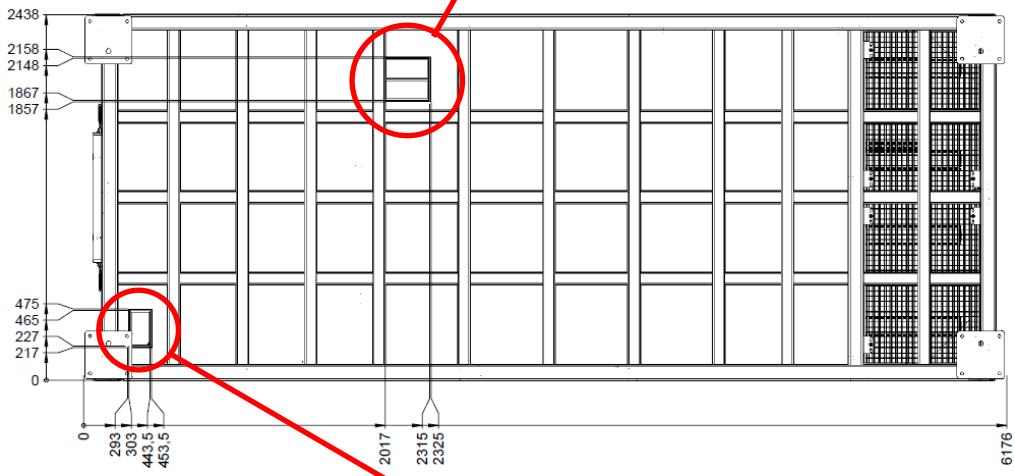


Figure 55: Cable outlets – PCS (Bottom view)

Cable interface 2 (Roxtec cable gland)
- 6.6 kV MV cables

11.2.2.2 BESS 1 Container

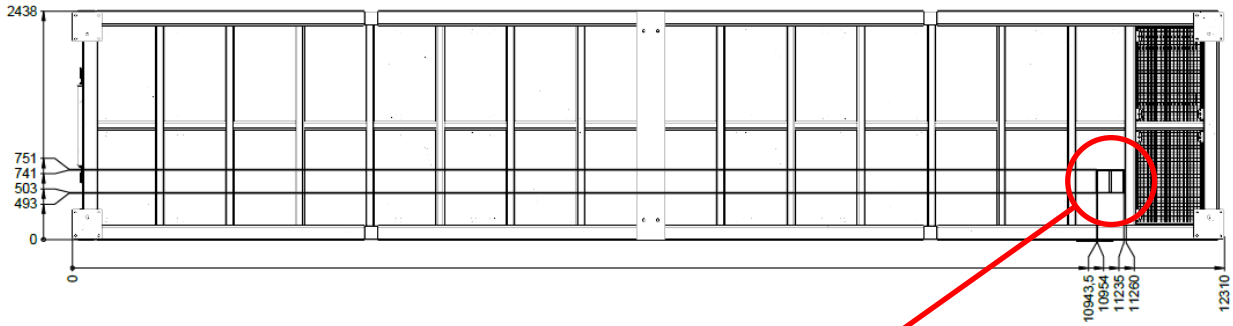


Figure 56: Cable outlets – BESS 1 (Bottom view)

Cable interface (Roxtec cable gland)
- DC power cables
- Communication cables
- 400 V AC aux. cables

11.2.2.3 BESS 2 Container

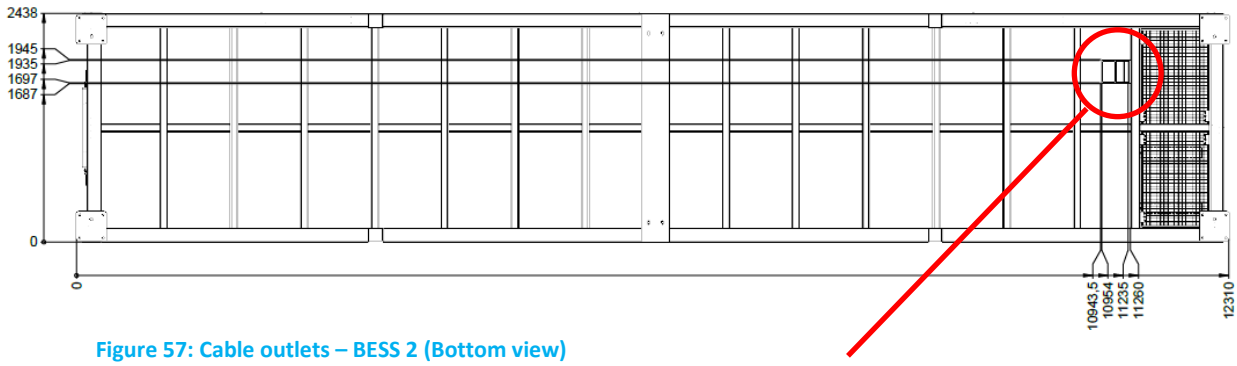


Figure 57: Cable outlets – BESS 2 (Bottom view)

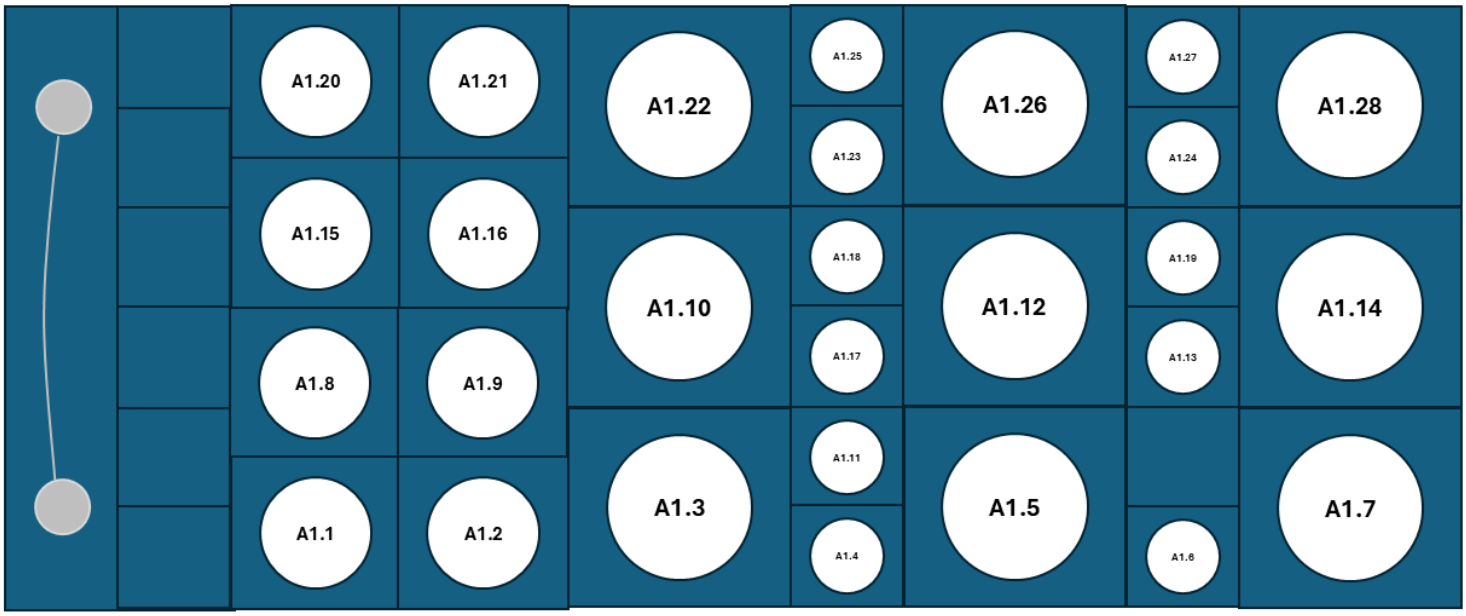
Cable interface (Roxtec cable gland)

- DC power cables
- Communication cables
- 400 V AC aux. cables

11.2.3 Cable Gland Description

11.2.3.1 PCS Container

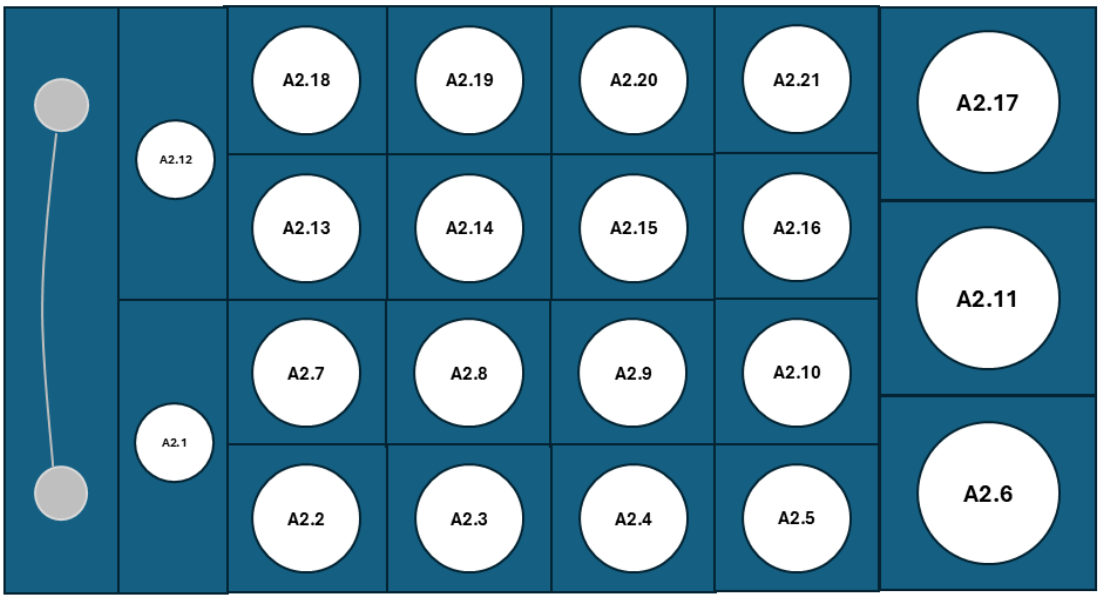
Cable interface – PCS – Comm and Aux 1



PCS – Comm and Aux 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:2		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:4	*	P320 PLC / B400-NET-001.01	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5		85002CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:9		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:11	*	P320 PLC / B400-NET-001.02	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		85001-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:15		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:16	**	P320 PLC / B400-FGS-002	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:18		C-85-XS-001 / B400-SIS-001	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:19	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:20		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:21	**	P320 PLC / B400-SIS-001	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:23	***	82006-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:24	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:25	***	82007-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:26		83011-CEL / 84W2	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:27	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

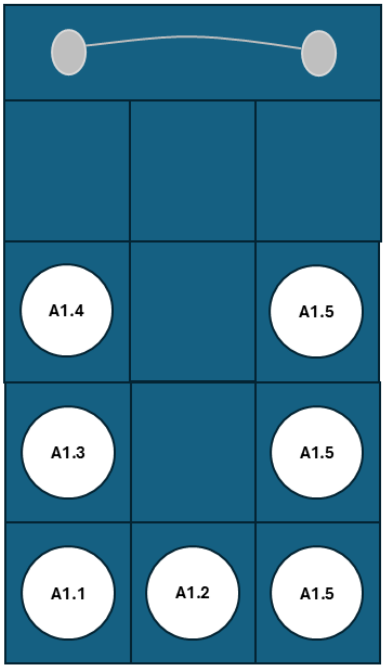
Cable interface – PCS – Comm and Aux 2



PCS – Comm and Aux 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:2	Solarflex-X 1x 70	DC Cable - DC+4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:3	Solarflex-X 1x 70	DC Cable - DC-4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:4	Solarflex-X 1x 70	DC Cable - DC+3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC-3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:7	Solarflex-X 1x 70	DC Cable - DC+4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:8	Solarflex-X 1x 70	DC Cable - DC-4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:9	Solarflex-X 1x 70	DC Cable - DC+2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:13	Solarflex-X 1x 70	DC Cable - DC+4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:14	Solarflex-X 1x 70	DC Cable - DC-4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC+2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC-2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:18	Solarflex-X 1x 70	DC Cable - DC+3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:19	Solarflex-X 1x 70	DC Cable - DC-3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:20	Solarflex-X 1x 70	DC Cable - DC+2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:21	Solarflex-X 1x 70	DC Cable - DC-2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 (MV Transformer)

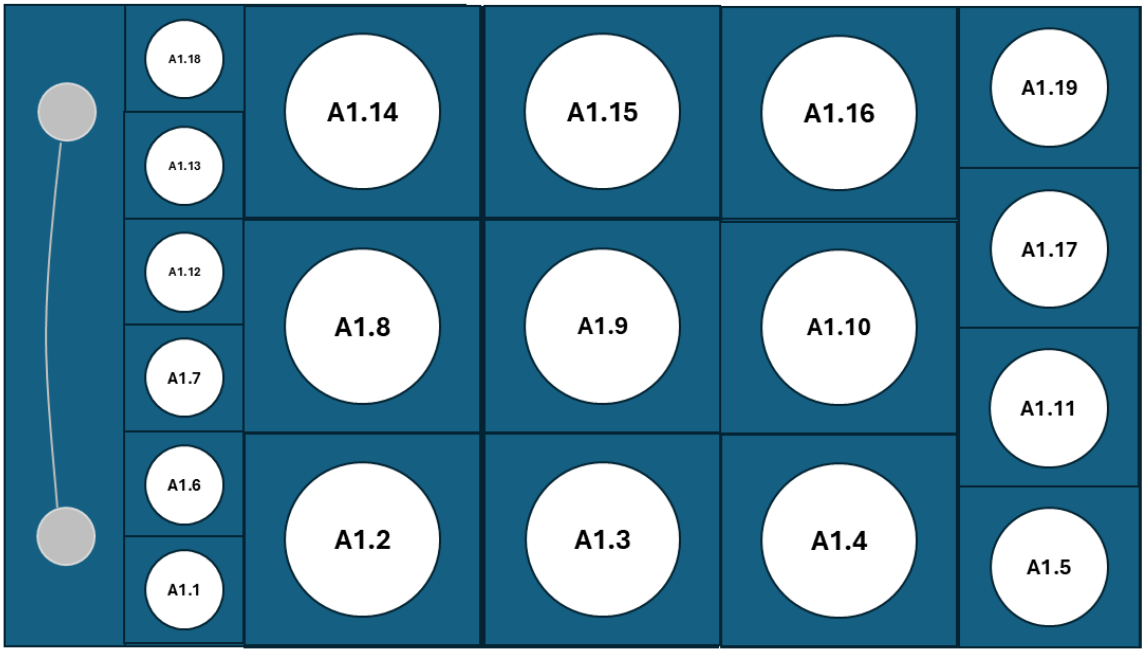


PCS – MV Transformer

Pos.	Cable ID	Name	Cable Category	OD (mm / [“])	Module Type
A1:1	1	82005 – L2	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:2	4	82005 – L3	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:3	5	82005 – L1	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

11.2.3.2 BESS 1

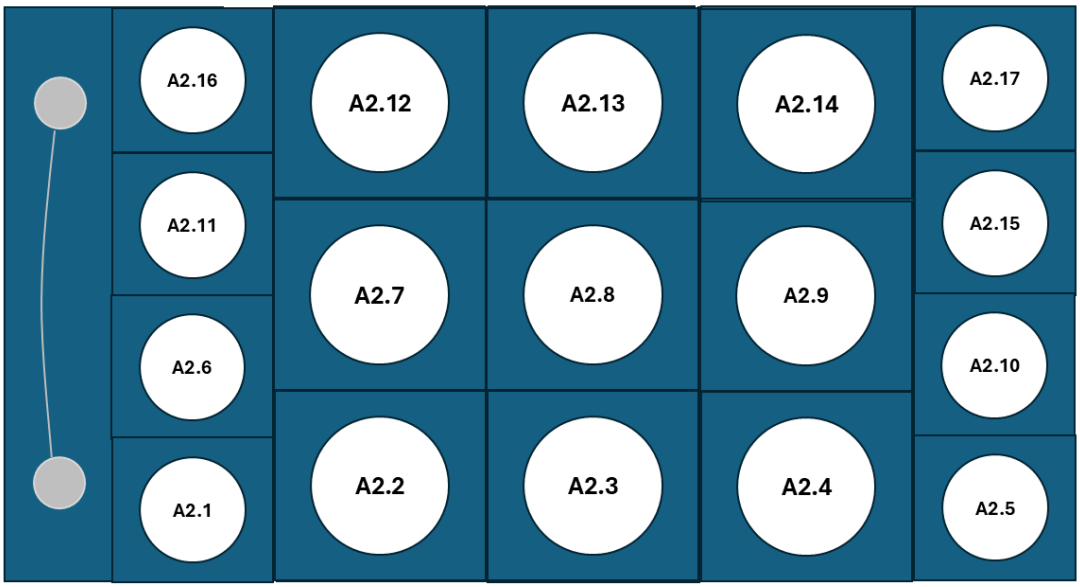
Cable interface 1 - BESS 1



BESS 1 - 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:1	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5	4x 10 mm²	400 V Aux Supply – 83015-CEL	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:6	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:7		COM Cable - ETH	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		COM Cable - UNIT_1 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13		COM Cable - UNIT_3 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 - BESS 1

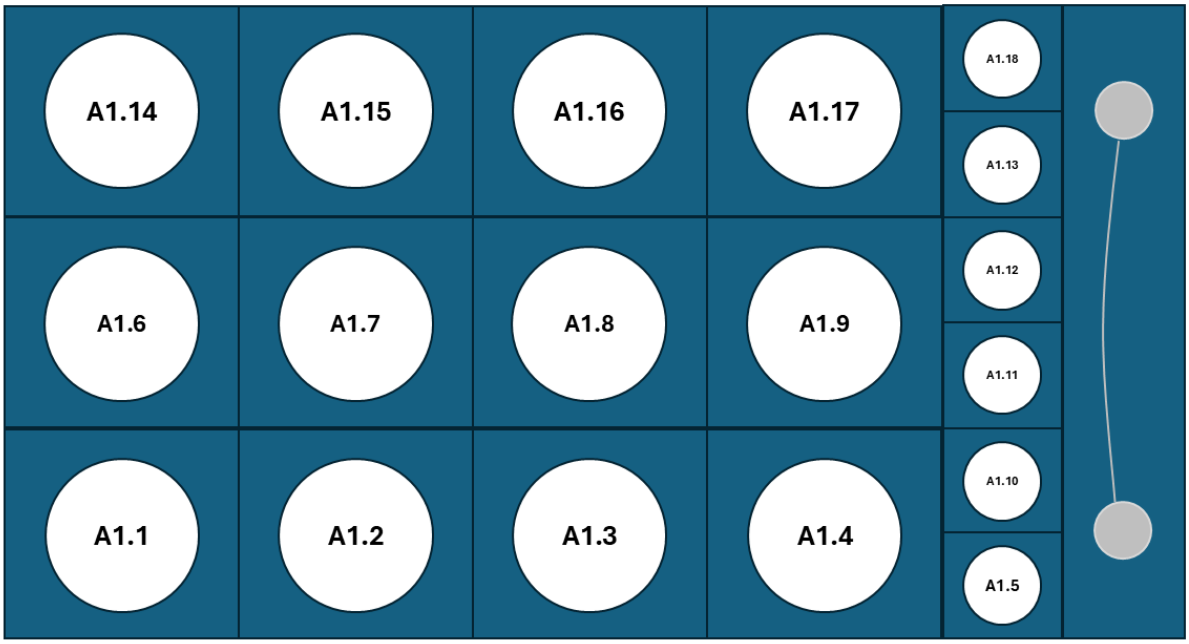


BESS 1 - 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:1	Solarflex-X 1x 70	DC Cable - DC-2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC+2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:6	Solarflex-X 1x 70	DC Cable - DC+2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:11	Solarflex-X 1x 70	DC Cable - DC-2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC-3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC+2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:17	Solarflex-X 1x 70	DC Cable - DC+3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

11.2.3.3 BESS 2

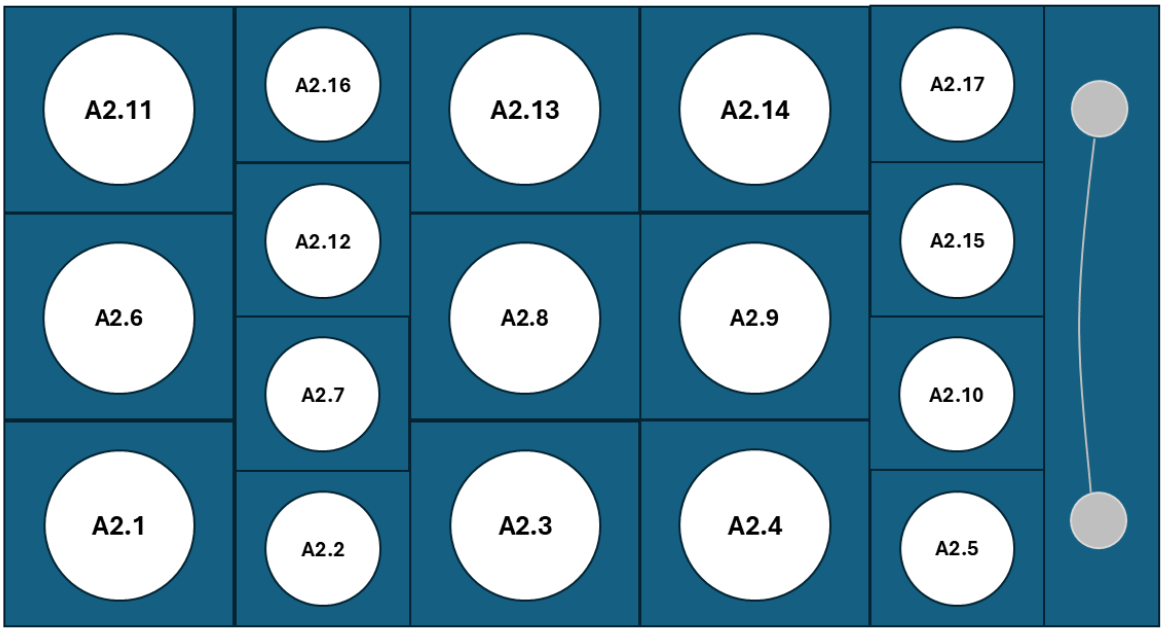
Cable interface 1 - BESS 2



BESS 2 - 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:1	4x 10 mm²	400 V Aux Supply – 83014-CEL	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:10	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		COM Cable - ETH	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13		COM Cable - UNIT_2 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:18		COM Cable – ET200 Unit_1 (not connected)	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 - BESS 2



BESS 2 - 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:2	Solarflex-X 1x 70	DC Cable - DC+4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC+3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:7	Solarflex-X 1x 70	DC Cable - DC-4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:12	Solarflex-X 1x 70	DC Cable - DC-4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC+4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC+4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:17	Solarflex-X 1x 70	DC Cable - DC-4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

11.2.4 AC Connection

⚠ DANGER

Before performing work on the BESS, make sure the system is disconnected from all power supplies, the feed-in disconnectors are open and secured against unintentional reclosing.

NOTICE

- ➜ Comply with the minimum cable cross-sections indicated in the wiring diagram provided.
- ➜ Always secure AC power cables with adequate strain relief in order to prevent the removal of the power cables from the AC connections after installation.

To connect the 620 V AC network, the system provides AC, PE and N connection busbars within the **AC_DC cabinet** *(see circuit diagram and following figure, ① to ⑤)*.

Also refer to the provided circuit diagram (*see section 1.2 "Applicable Documents"*) when connecting the BESS to the AC grid.

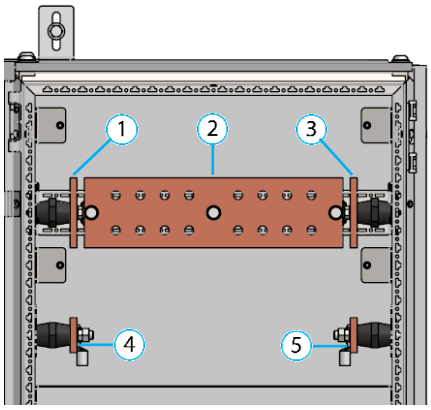


Figure 58: AC grid connection busbars inside AC_DC cabinet

Pos.	Description	Identifier
①	AC grid connection busbar L1	78W1
②	AC grid connection busbar L2	78W2
③	AC grid connection busbar L3	78W3
④	AC grid connection busbar N	78W5
⑤	AC grid connection busbar PE	78W4

Table 36: AC grid connection busbars inside AC_DC cabinet

Task 1: **Connect the AC grid supply cables to the designated AC grid connection busbars inside the AC_DC cabinet *(see wiring diagram and illustration below)*.**

Step 1 : Lead the customer-side AC grid supply cables through the recess provided in the container floor from below into the container interior.

Step 2 : Lead AC grid supply cables through the recess provided in the cabinet floor of the AC_DC cabinet from below to the inside of the cabinet.

Step 3 : Locate the 78W1, 78W2 and 78W3 AC connection and the PE and N busbars inside the AC_DC cabinet (*see illustration above,* ① - ⑤).

Step 4 : Screw the three grid phase cables L1, L2, L3 and the PE and N cable to the corresponding connection busbars inside the AC_DC cabinet (*see illustration and table above,* ① - ⑤) using appropriate cable lugs, screws, nuts and washers.

Step 5 : Apply the torque specified by the screw connection manufacturer to the connection.

Step 6 : Check connections for tightness.

✓ **The AC grid supply cables were successfully connected to the corresponding AC grid connection busbars in the AC_DC cabinet.**

11.2.5 Higher-Level Controller Connection

⚠ DANGER

Before performing work on the BESS, make sure the system is disconnected from all power supplies, the feed-in disconnectors are open and secured against unintentional reclosing.

The converter system is mainly controlled and monitored via the customers´ higher-level controller. The higher-level controller is connected to the BESS main controller via a PROFINET interface. Therefore, a network isolator (114A1) is provided inside the control cabinet 1 (CTRL_1) of the converter system, to which the higher-level controller can be connected via an Ethernet line.

To connect the higher-level controller to the converter controller via Ethernet line, proceed as follows:

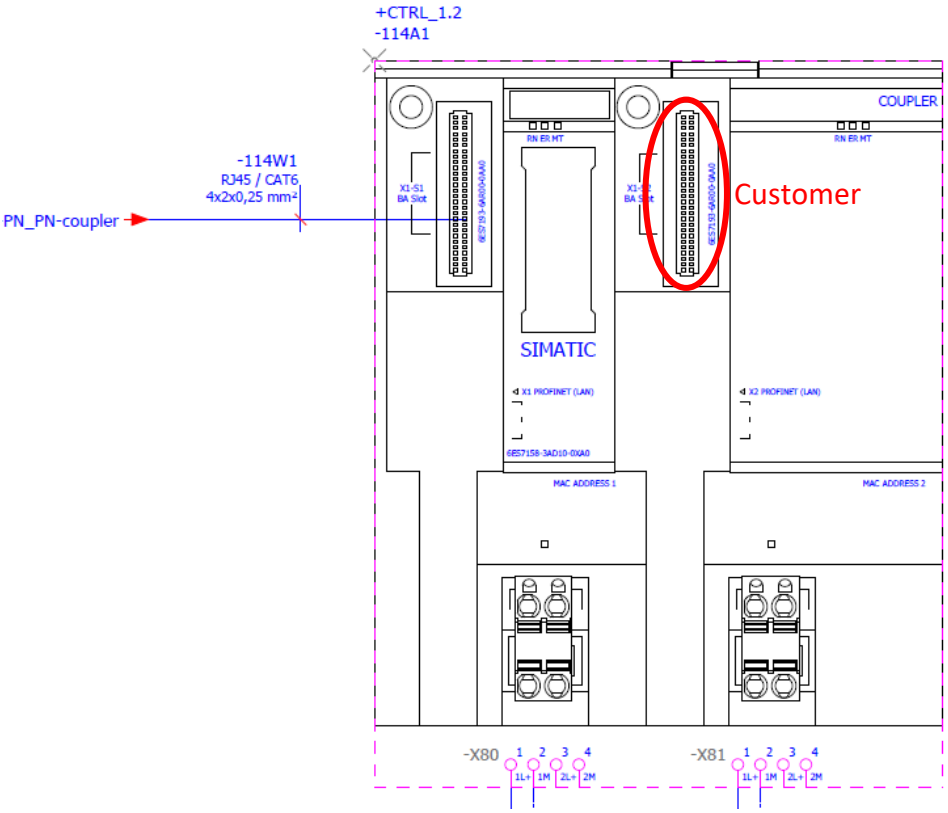


Figure 59: Network isolator 114A1 inside CTRL_1 cabinet

Task 1: **Connect the customer-side higher-level controller to the BESS main controller cabinet (*see circuit diagram and illustration above*).**

Step 1 : Lead the Ethernet cable coming from the external, higher-level controller through the recess in the bottom of the control cabinet 1 (CTRL_1) into the cabinet interior.

Step 2 : Locate the network isolator (114A1) inside the control cabinet.

Step 3 : Connect the external Ethernet cable to the free port of the network isolator.

✓ **The higher-level controller has been successfully connected to the BESS main controller via Ethernet cable.**

12 Pre-Commissioning

Follow the steps below for preparations prior to commissioning of the converter:

Do not operate!	Lock and tag power switches and controller devices
⚠ DANGER 	Disconnect power and block operation controller devices. Follow national laws regarding Occupational Safety and Health. 1. Identify the energy source(s). 2. Isolate the energy source(s). 3. Determine voltage-free status. 4. Ground device or equipment to protect from short circuiting and from shocks. 5. Lock and Tag the energy source(s). 6. Prove that the equipment isolation is effective. 7. When required, apply lock-out device or clamp and secure with padlock(s).

12.1 Activate Motor Contactors and Fuses

Task 1: Activate motor contactors and test auxiliary voltages

Set the main switch on the control cabinet door to ON position. ☐

Activate the motor contactors inside the converters system cabinets. ☐

Check the 400 V AC power supply using the corresponding terminals inside CTRL cabinet. ☐

Task 2: Switch on fuses

Switch on all 24/230/400V AC/DC fuses inside the cabinets. ☐

Install the fuses for the UPS supply. ☐

Check, whether the 24 V DC voltage has the correct polarity and magnitude. ☐

Switch on all the 24 V DC fuses (130F1) if not already activated (green indicator lights indicate activated fuse). ☐

After this action all the control devices indicator lights in the control cabinet including the main PLC Siemens SIMOTION P320 should glow green, indicating that these parts are activated and working.

12.2 Check Power Cables

Inspect wiring for proper installation and connection. See wiring diagram for detailed information about the wiring. ☐

12.3 Check Communication Cables

Inspect wiring for proper installation and connection. See wiring diagram for detailed information about the wiring. ☐

Communication between main PLC and converter is established. ☐

12.4 Cooling System Preparations

The cooling system is set under 3 bar air pressure for at least 1 hour. The system pressure must not decrease within that time. ☐

The system is filled with coolant under working pressure of 3 bar and checked for leakage for at least an hour. ☐

13 Commissioning

Follow the steps below for commissioning of the BESS:

Task 1: **Converter Commissioning**

Step 1 : Make sure that the customer-side mains is switched off and decoupled from the converter system.

Step 2 : Make sure that all the work and action instructions listed in section 11 "Mounting" have been carried out.

Step 3 : Follow all instructions listed in section 14.4.

✓ **The BESS is now ready for operation.**

14 Operation

⚠ DANGER	
	Do not enter the container if the warning light is on (red light) ➜ It is only allowed to enter the container if the warning light indicated that it is safe to enter the container (green light) ➜ If the warning light is completely off (no green or red light) consider that it is not safe to enter the container. Before entering the container, make sure that there is no fire inside and no harmful atmosphere

NOTICE	
	• Staying in the container during operation is not permitted, except to turn-off the system in case of emergency • Use the remote interface to start the converter • Do always switch off the converter if you go inside the container

14.1 Operating Panel

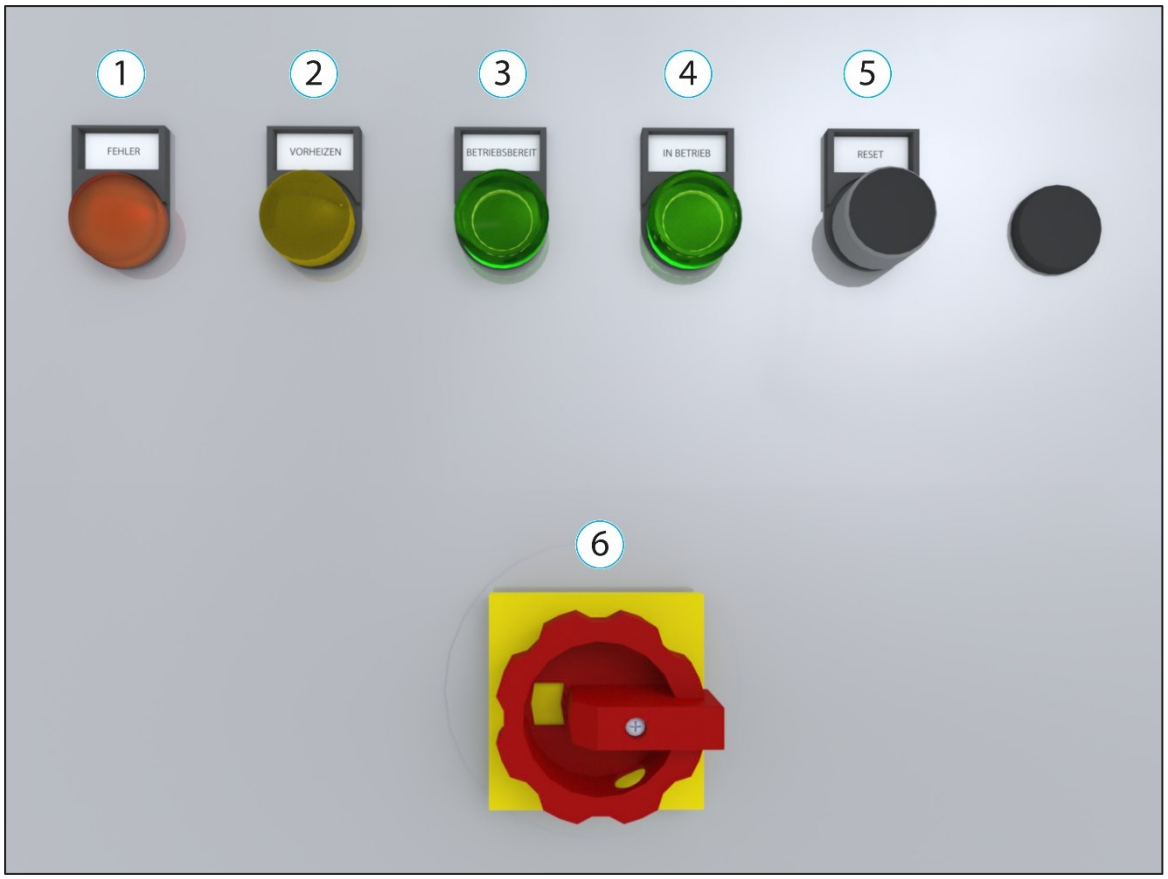


Figure 60: Operating panel

14.2 Indicator Lights

Pos.	Indicator Light	Description
①	**Fault**	**Flashing light** A warning of the converter main controller is present. The converter remains in operation. Constantly glowing: A fault has been detected by the converter main controller. The BESS does not function correctly.
②	**Preheating**	**Flashing light** The cooling liquid is preheated until the set cooling liquid temperature has been reached. Constantly glowing: The coolant temperature has reached the set temperature and is maintained for a set time span (defined in controller). **Light off:** The cooling liquid temperature was maintained for the time span defined in the controller. The preheating process is finished.
③	**Ready for Operation**	**Flashing light** The DC-link of the converter is pre-charging until the set voltage has been reached. **Constantly glowing:**

		The DC-link is precharged to the set voltage and the power switches are closed.
④	**Operating**	**Constantly glowing:** The converter´s IGBTs are enabled. The converter is operating.

Table 37: Indicator lights

14.3 Control Elements

Pos.	Control Element	Description
⑤	**Reset** *Push button*	Resets an existing fault of the main controller and the emergency stop relay.
⑥	**Main switch** *Rotary Switch*	Main switch 480 V power supply for converter control electronics.

Table 38: Control Elements

14.4 Switching on the BESS

Carry out the following steps to switch on the BESS:

Task 1: **Switch on the BESS**
Step 1 : Make sure that the external emergency stop button (customer side, if present) is not activated.
Step 2 : Switch the main switch (*see figure 60,* ⑥) to the "ON" position.

Note 1: If the temperature inside the control cabinet falls below 15°C, the internal control cabinet heating is automatically switched on. The main control is only enabled after the temperature limit value of >5°C has been reached.
Note 2: Once the BESS control system has started up, the function commands transmitted by the higher-level control system are executed.
Note 3: If the BESS control unit detects an error, the red "Fault" indicator (①) lights up.

Step 3 : Check the BESS control system for error messages via the higher-level control system (customer side using WebVisu or communication interface).
Step 4 : Resolve the error(s) if possible.
Step 5 : After successful troubleshooting, acknowledge the error by sending a "Reset" command via the higher-level control system (customer side via WebVisu or communication interface) or the reset button on the CTRL cabinet (⑤*)*.

	For detailed information on the control commands, such as the reset command, which are transmitted to the BESS control system via the customer's higher-level control system, please refer to the document "Description of data profiles" (*see section 1.2 "Applicable Documents"*).

	The control bits described below can be set simultaneously and are automatically processed by the control system in the correct sequence.

Step 6 : Set the **converter_heatup_enable** bit to **TRUE** via the communication interface of the external control room or via the WebVisu. The signal initiates the preheating process of the cooling system. This process normally takes 20 minutes. The "Preheating" indication light illuminates (*see figure 60,* ②).
Step 7 : As soon as all temperatures are within the permissible range, the "Preheating" indication light goes off.
Step 8 : Set the **converter_charge_enable** bit to **TRUE** via the communication interface of the external control room or via the WebVisu. The signal initiates precharging of the DC link and the "Ready for operation" indication light (③) starts to flash. As soon as the DC link is pre-charged, the main switch responsible for the DC link control is switched on and the "Ready for operation" indication light (③) starts to light up constantly.
Step 9 : Set the **converter_modes_enable** bit to **TRUE** via the communication interface of the external control room or via the WebVisu. The signal activates the pulse enable of the grid IGBT´s.
Step 10 : If no errors have occurred, the BESS starts normal operation and the "Operation" indication light (④) lights up constantly.

Step 11 : The detailed procedure for switching on the converter system must be carried out in accordance with the document "Description of data profiles" (*see section 1.2 "Applicable Documents")*. The sequence of the individual steps is shown on the "Flow Chart" tab.

✓ **The BESS is now switched on and in operation.**

14.5 Switching off the BESS

Follow the steps below in order to switch-off the converter:

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 “Protect the CB Against Unintentional Reclosing”. ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

Task 1: **Switch off the BESS.**

Step 1 : To switch off the converter, carry out the steps in reverse order according to the document "Description of the data profiles" in the "Flow chart" tab (*see section 1.2 “Applicable Documents”*).

Step 2 : Set the **converter_modes_enable** bit to **FALSE** via the communication interface of the external control room or via the WebVisu. The signal deactivates the pulse enable of the grid IGBT´s.

Step 3 : Set the **converter_charge_enable** bit to **FALSE** via the communication interface of the external control room or via the WebVisu. The signal opens the main switch and initiates the discharge of the DC link. As soon as the main switch is open, the "Ready for operation" indication light goes off (*see figure 60,* ③).

⚠ DANGER	
	**Risk of injury due to electric shock!** **Discharging the DC link takes several minutes. The "Ready for operation" indication light is not an indicator of a fully discharged DC link. Do not carry out any work on BESS before the DC link has been completely discharged.** ➜ Wait until the DC link is completely discharged and check that it is de-energized as described in section 14.7 "Check Voltage-Free Status of DC Link ".

Step 4 : Set the **converter_heatup_enable** bit to **FALSE** via the communication interface of the external control room or via the WebVisu. The signal switches off the water cooling of the converter after a run-on time of 2 minutes.

Step 5 : Switch the main switch on the converter control cabinet (*see figure 60,* ⑥) to the "OFF" position.

✓ **The BESS is now switched off.**



The UPS can be switched off by pulling the blade type fuse of the UPS unit.

14.6 De-Energizing

Carry out the following steps to de-energize the BESS system:

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 "Protect the CB Against Unintentional Reclosing". ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

Task 1: **De-energize the BESS**

Step 1 : Switch-off the converter system like explained in section 14.4.

Step 2 : Secure the AC circuit breaker(s) from unintentional reclosure, like explained in section 14.9.3.

Step 3 : Decouple the customer AC connection from the converter system using a suitable disconnection device.

Step 4 : Wait for 30 minutes until the converters´ DC link is discharged and check the voltage-free status of the DC-link by using a suitable 2-pole voltage tester.

✓ **The BESS is now switched off and de-energized.**

14.7 Check Voltage-Free Status of DC Link



The DC link voltage can be up to 1300 VDC. Make sure that the measuring device for testing the absence of voltage in the DC link is suitable for this voltage range.



For converter systems with more than one DC link, the following steps must be carried out to check the absence of DC link voltage on each DC link.

The following steps must be followed to check that the DC link is de-energized:

Step 1 : After switching off the system, check the DC link voltage on the WebVisu or via the communication interface of the external control room.

Step 2 : Check that the DC link is de-energized at the HVIO measuring fuse 173F2 between connections 2 and 4 in the CTRL cabinet.

Step 3 : In addition, check that the DC link is de-energized at the HVIO measuring fuse 173F2 by measuring between connection 2 and N (or PE) in the CTRL cabinet.

Step 4 : In addition, check that the DC link is de-energized at the HVIO measuring fuse 173F2 by measuring between connection 4 and N (or PE) in the CTRL cabinet.

Step 5 : Check that there is no voltage on the DC link between a DC- connection (*see figure below*, ①) and DC+ connection (②) of the PowerStack.

➜ For switch cabinets with more than one installed PowerStack, access to the DC link connections is at the bottom stack.
➜ The DC+ connections are positioned slightly to the rear compared to the DC connections.

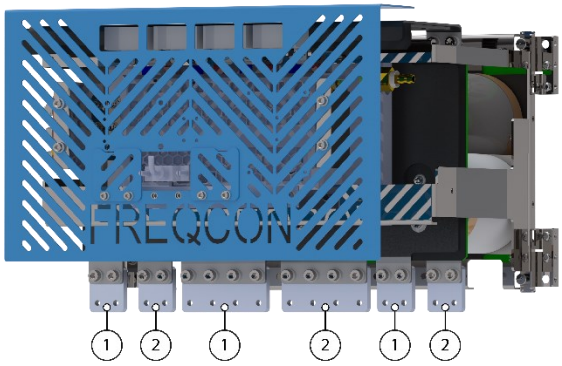


Figure 61: DC- connections ① and DC+ connections ② on the PowerStack (figure may differ from the actual design)

14.8 AC Circuit Breaker

NOTICE

The AC main circuit breaker(s) must not be switched manually!
Do not switch the AC main circuit breaker manually under any circumstances, as this could damage the breaker and the equipment.

The converter system is equipped with an individual 3WL circuit breaker, in order to disconnect the connected grid from the BESS systems electric circuit.

The main circuit-breaker(s) is/are located in the CIR cabinet (*see section 4.4.3 "Internal Components"*).

To protect the circuit breaker against unauthorized switching and to protect the maintenance and operator personnel, the circuit breakers contain a number of locking devices.

For instructions on how to secure the circuit-breaker(s) against reclosing, see section 14.8.3.

Detailed information can be found in the manufacturer's documentation for the circuit-breaker (*see also section 1.2 "Applicable documents"*):

Document type	Document Name	File Name
Operating instructions AC circuit breaker	3ZX1812-0WL00-0AN4	3ZX1812-0WL00-0AN4_online_201806140915326928

14.8.1 Circuit Breaker Components

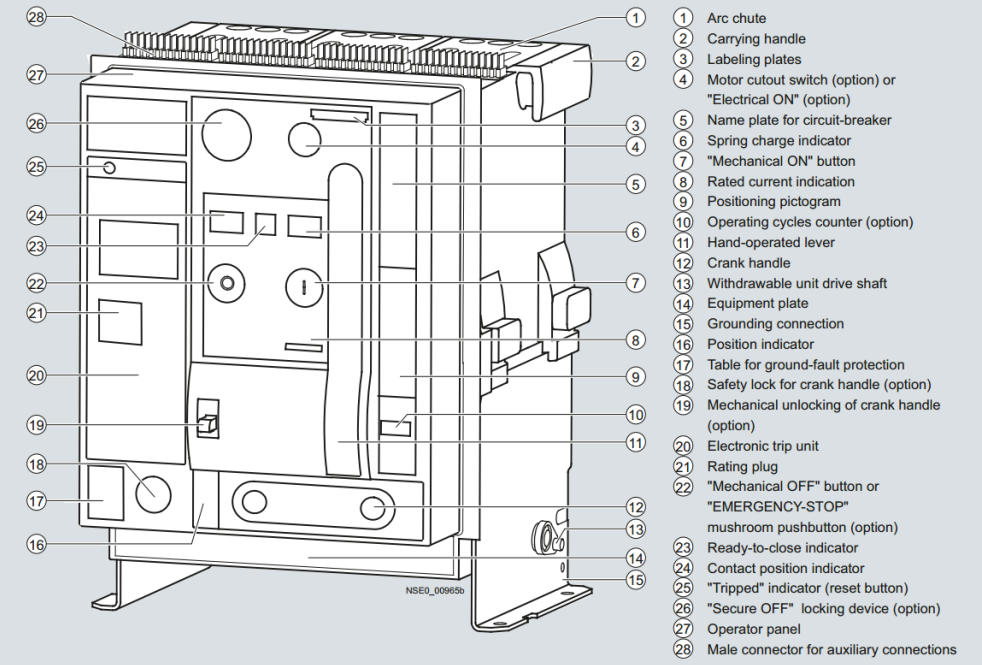
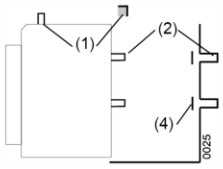
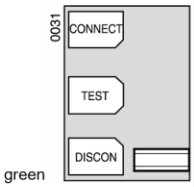
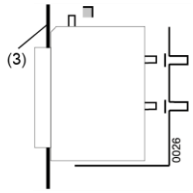
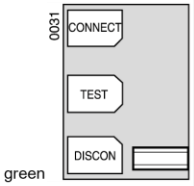
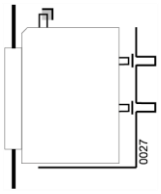
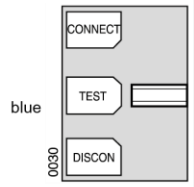
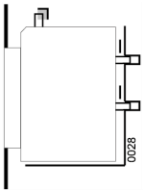
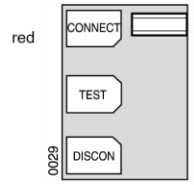


Figure 62: Circuit breaker components

14.8.2 Positions of CB in the Guide Frame

	Diagram	Positon indicator	Power circuit	Auxiliary circuit	Cubicle door	Shutter
Maintenance position			disconnected	disconnected	open	closed
Disconnected position			disconnected	disconnected	closed	closed
Test position			disconnected	connected	closed	closed
Connected position			connected	connected	closed	open

(1) Auxiliary circuit
(2) Primary circuit
(3) Cubicle door
(4) Shutter

Figure 63: Circuit breaker positions

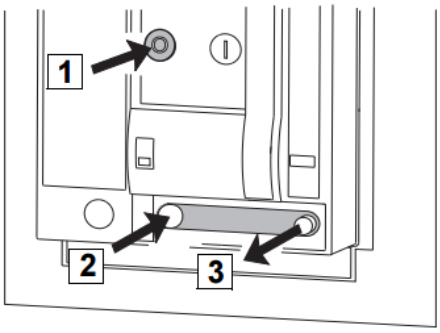
14.8.3 Protect the CB Against Unintentional Reclosing

Drawing out of the racking handle can be prevented by fitting a maximum of three padlocks. The circuit breaker is then locked against moving.

Task 1: **Unlocking the racking handle/ Withdrawing racking handle.**

Step 1 : OPEN circuit breaker.

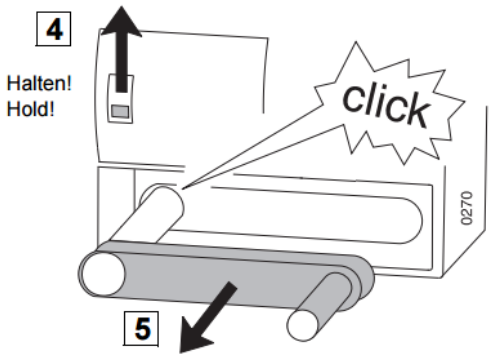
Step 2 : Push the crank.



Step 3 : Pull out handle.

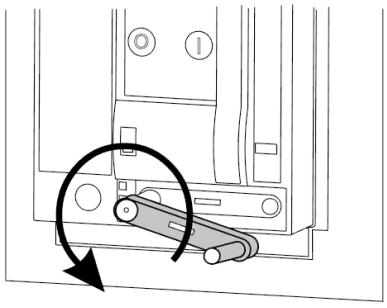
Step 4 : Lift and hold the control lever.

Step 5 : Pull out the crank.

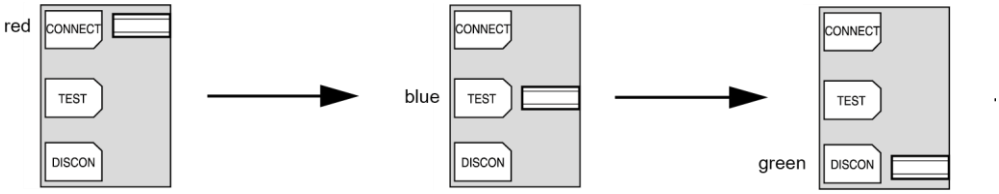


Task 2: Racking circuit breaker into the disconnected position.

Step 1 : Rack the handle until the disconnected position is indicated by the position indicator (green).



Position indicatior

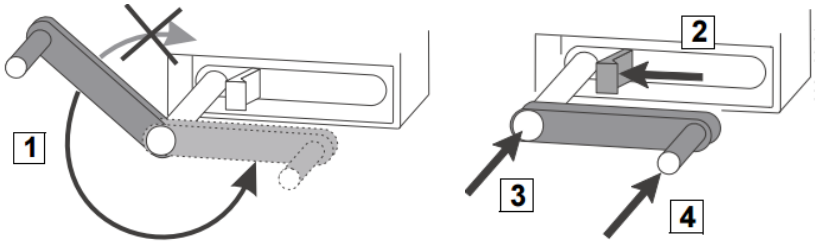


Task 3: Push in the racking handle.

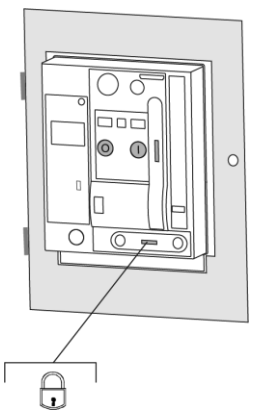
Step 1 : Bring the racking handle to the position indicated in the illustration below.

Step 2 : Push in the crank.

Step 3 : Push in the handle.



Task 4: Lock the racking handle with one or more padlocks.



14.9 DC Fuse Switch Disconnectors

NOTICE	
	**The DC fuse switch disconnectors must not be switched manually!** Do not switch the DC fuse switch disconnectors manually under any circumstances, as this could damage the breaker and the equipment.

Each of the battery storage cabinets is equipped with a DC fuse switch disconnector, in order to disconnect the corresponding battery cabinet from the electric circuit of the BESS.

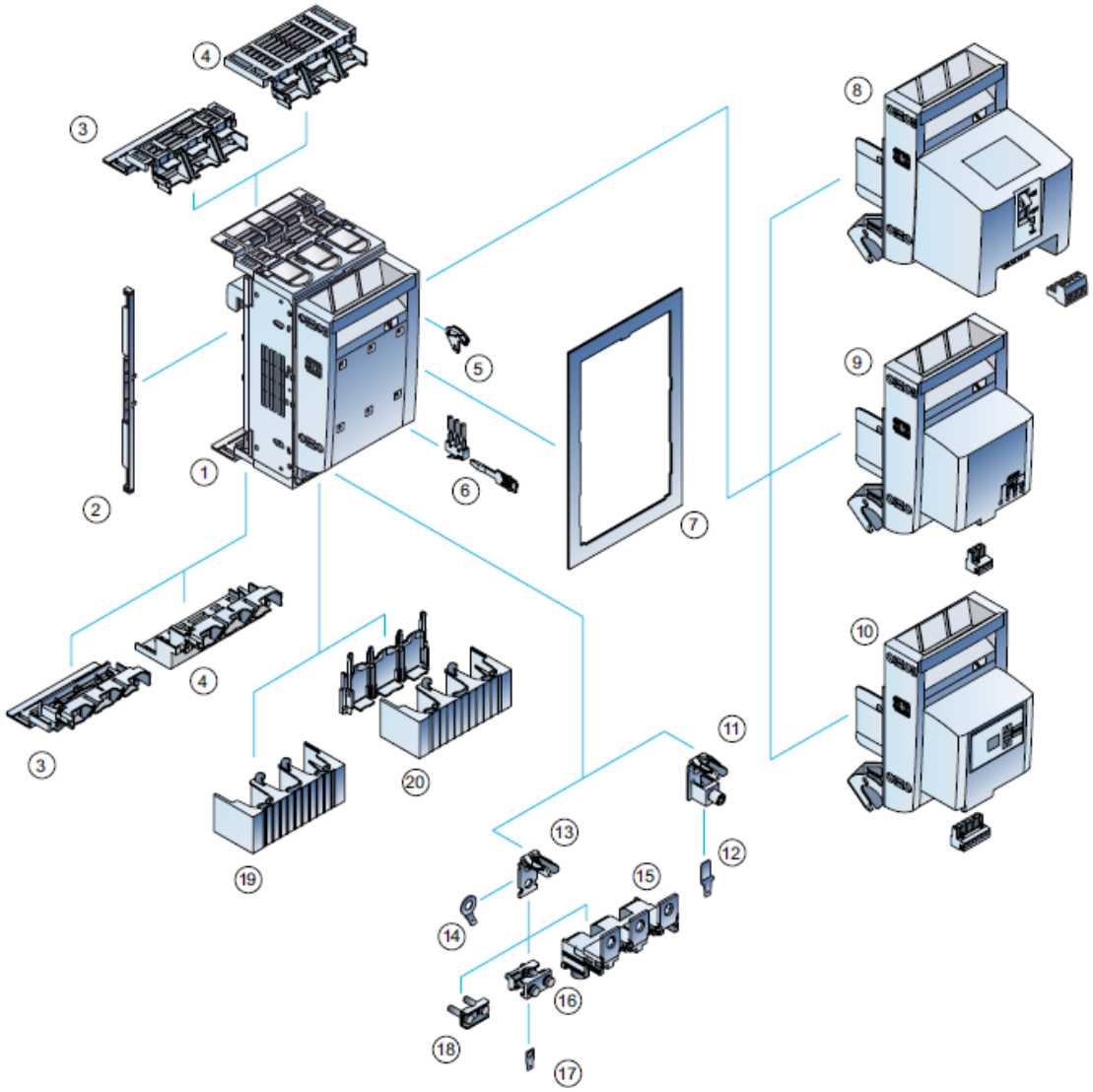
A DC fuse switch-disconnector is located on the mounting plate at the bottom of each battery cabinet.

To protect the DC fuse switch disconnector against unauthorized switching and to protect the maintenance personnel, the disconnector is provided with locking devices.

For instructions on how to prevent unintentional reclosing of the DC fuse switch disconnector, *see section 14.9.3, "Protect the DC Disconnector Against Unintentional Reclosing"*.

For detailed information regarding the DC fuse switch disconnector, refer to the original manufacturer manual (*see section 1.2 "Applicable Documents"*).

14.9.1 Fuse Disconnector Components



① SENTRON 3NP1 fuse switch disconnector
② Cover support
③ Reach-round protection for mounting onto Siemens busbar system
④ Reach-round protection for mounting onto Rittal busbar system
⑤ Locking device
⑥ Auxiliary switch with actuator
⑦ Molded plastic cover
⑧ Handle unit with mechanical fuse monitoring (MFM)
⑨ Handle unit with electronic fuse monitoring (EFM 10)
⑩ Handle unit with electronic fuse monitoring (EFM 20/25)
⑪ Box terminal
⑫ Auxiliary conductor terminal for box terminal
⑬ Blade terminal
⑭ Auxiliary conductor terminal for blade terminal
⑮ Deep-drawn terminal module
⑯ Prism terminal
⑰ Auxiliary conductor terminal for prism terminal
⑱ Saddle terminal
⑲ Terminal cover
⑳ Terminal cover with reach-round protection on the back

Figure 64: Circuit breaker components

14.9.2 Locking Device

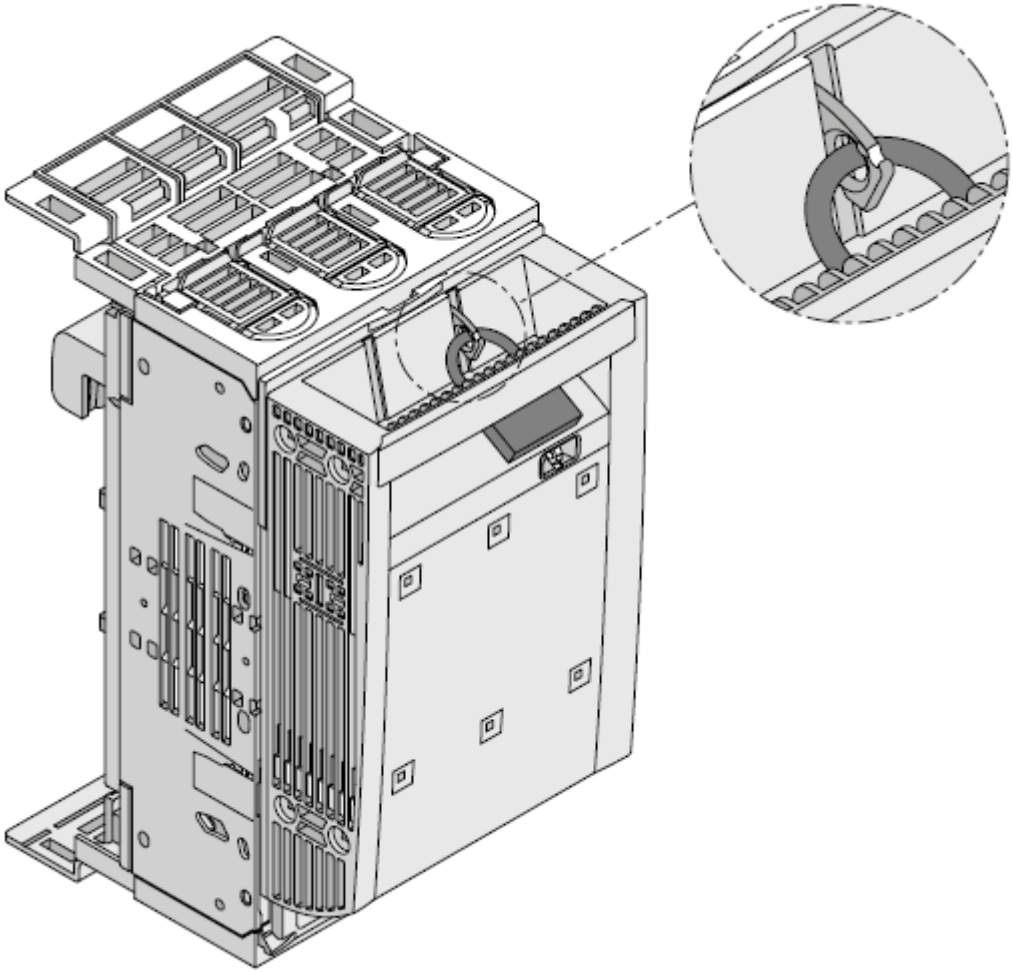


Figure 65: Locking device

14.9.3 Protect the DC Disconnector Against Unintentional Reclosing

You can lock the 3NP1 fuse switch disconnector to protect it against unauthorized actuation.
Either an eye (optional accessory, see below) and a padlock (shackle diameter: 6 mm) or two padlocks (shackle diameter: 2x 3 mm) are required for this purpose. The padlocks are not supplied with the fuse switch disconnector.

NOTICE
You can open the handle unit of a fuse switch disconnector that has been locked with an eye and one padlock by force in order to trip an emergency stop (rupture point on the eye).

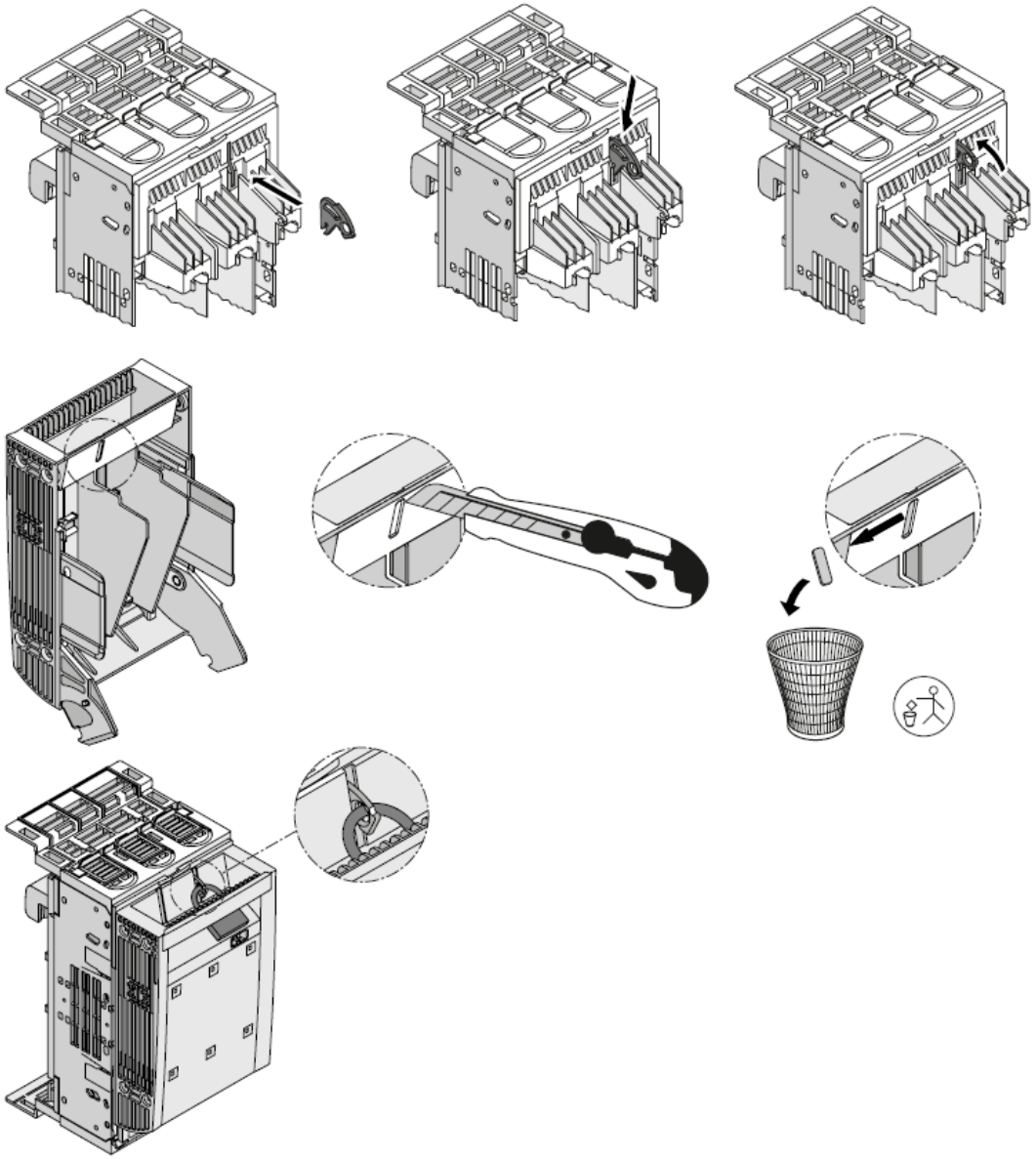


Figure 66: Secure fuse switch-disconnector against unintentional reclosing

15 Monitoring

PIII Converter Control Module

The converter system is equipped with two converter control interfaces.

PIII Indicator Lights

LED	Color	Label	Description
1	red	**UDC max**	DC-link voltage exceeded maximum value
2	red	**Imod max**	Current of one or more IGBT´s exceeded maximum value
3	red	**Error IGBT 1**	Error detected on IGBT 1
4	red	**Error IGBT 2**	Error detected on IGBT 2
5	red	**Error IGBT 3**	Error detected on IGBT 3
6	red	**Error IGBT 4**	Error detected on IGBT 4
7	red	**Error IGBT 5**	Error detected on IGBT 5
8	red	**Error IGBT 6**	Error detected on IGBT 6
9	red	**Error IGBT 7**	Error detected on IGBT 7
10	green	**PWM Mode**	IGBT 1, IGBT 2 and IGBT 3 are working in PWM mode
11	green	**Enable**	IGBT 1 - 6 ready for operation
12	green	**Top 1**	Top 1 active
13	green	**Bot 1**	Bot 1 active
14	green	**Top 2**	Top 2 active
15	green	**Bot 2**	Bot 2 active
16	green	**Top 3**	Top 3 active
17	green	**Bot 3**	Bot 3 active
18	green	**Top 4**	Top 4 active
19	green	**Bot 4**	Bot 4 active
20	green	**Top 5**	Top 5 active
21	green	**Bot 5**	Bot 5 active
22	green	**Top 6**	Top 6 active
23	green	**Bot 6**	Bot 6 active
24	green	**Chopper Active**	Brake chopper is active
25	green	**Blinki**	Profinet communication between main PLC and PIII is established
26	green	**24 V Supply**	24V supply connected
27	green	**UL 1**	L1 voltage apparent
28	green	**UL 2**	L2 voltage apparent
29	green	**UL 3**	L3 voltage apparent
30	green	**Urec**	Booster voltage is apparent on rectifier
31	green	**UDC +**	DC link voltage is apparent
32	green	**Arc Detect**	Arc detection has tripped

Table 39: PIII indicator lights

16 Data transfer with higher-level controller

As described in section 4.2 "Data Interface", the BESS is controlled and monitored via the transfer of data with the customer's higher-level control system. Data transfer between BESS and the higher-level control system is performed via PROFINET protocol.

For external control and monitoring of the converter, it is necessary for the customer to have access to selected control and status variables stored in the converter controller, which can be read and overwritten by the customer's higher-level controller. For this purpose, predefined control profiles with the relevant control variables and status profiles with all relevant status variables are stored for the data transfer from BESS to the customer's higher-level controller.

For a detailed description of the individual data profiles, see Description of data profiles (*see section 1.2 "Applicable Documents"*).

17 Maintenance

The following describes the maintenance work that is necessary for trouble-free operation of the converter system (PCS) and Battery Energy Storage System (BESS). Maintenance intervals must be observed (*see section 17.2 "Maintenance* Schedule*"*).

If increased wear of individual components or functional groups is determined during regular inspections, the operator has to reduce the required maintenance intervals on the basis of the actual signs of wear. Changes compared to the normal operation (increased power consumption, temperatures, vibrations, noises, etc. or respond of monitoring systems) might indicate the functionality of the device is impaired. These then have to be subjected to an inspection by qualified personnel.

For information regarding maintenance of the BESS battery cabinets refer to document „20_Maintenance_Schedule“ (*see section 1.2 "Applicable Documents"*). Maintenance intervals provided in the maintenance schedule must be adhered.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 “Protect the CB Against Unintentional Reclosing”. ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

⚠ WARNING	
 	**Hazard by cooling liquid** The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed. ➜ Avoid oral ingestion of the coolant, since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention. ➜ Avoid skin contact with the coolant. ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

NOTICE
Service and maintenance work on the BESS and cooling system must only be carried out by qualified and authorized personnel.

17.1 Preparations Prior Maintenance

The following safety precautions must be carried out before commencing service and maintenance work.

Non-observation of these safety instructions can cause injury to persons, damage to objects or malfunction or damage to the device itself.

Do not operate!	**Lock and tag power switches and controller devices**
⚠ DANGER 	Disconnect power and block operation controller devices. Follow national laws regarding Occupational Safety and Health. 1. Identify the energy source(s). 2. Isolate the energy source(s). 3. Determine voltage-free status. 4. Ground device or equipment to protect from short circuiting and from shocks. 5. Lock and Tag the energy source(s). 6. Prove that the equipment isolation is effective. 7. When required, apply lock-out device or clamp and secure with padlock(s).

17.2 Maintenance Schedule

Location	Component	Maintenance Work	Maintenance Interval	Description in
PCS Container CTRL cabinet	UPS battery	Functionality check	Once every 6 months	Section 17.3.1
PCS Container CTRL cabinet	UPS battery	Remove battery from battery unit	At storage temperatures below 0°C	Section 17.3.2
PCS Container All switch cabinets	Intake fan filters	Check the fan filters for contamination and replace if necessary	Once every 6 months	Section 17.4
All containers	Complete BESS system	Visual inspection	Once every 6 months / in case of a fault	Section 17.5
PCS Container CIR cabinet	Circuit breaker 3WL	Inspection	Once every 12 months	Section 17.6.1
		Replace arc-chute covers	After no more than three short-circuit interruptions	
		Replace arc chutes and contact system	Depending upon their condition	
		Replace operating system	Depending upon their condition	
PCS Container CTRL cabinet	PLC	Replace backup battery of Simotion PLC	Once every 4 years	Section 17.7
PCS Container COSY	Coolant	Exchange cooling liquid	Once every 5 years	Section 17.6
PCS Container COSY	Expansion vessel	Check pressure	Once every 5 years / When exchanging the cooling liquid / When error "pressure low" is apparent	Section 17.9
BESS Containers	Exhaust units	Inspection	Once every 6 months / in accordance with existing maintenance schedule	Section 17.11
BESS Containers	Fire dampers	Inspection	Once every 6 months / in accordance with existing maintenance schedule	Section 17.12
BESS Containers	H2 Sensors	Inspection	Once every 6 months	Section 17.13

Table 40: PCS Maintenance Schedule

17.3 UPS

17.3.1 UPS Functionality Check

(once every 6 months)

In order to check the functionality of the UPS device, the following steps must be performed:

Task 1: **Perform functionality check of the UPS device**

Step 1 : Set the main switch on the door of the control cabinet (*see figure 60,* ⑥) to the "OFF" position.

Step 2 : Locate the UPS module 102G1 inside the control cabinet (*see section 4.4.3*).
The yellow LED (*see figure below,* ④) on the front of the UPS module should glow, indicating that battery mode is active and the battery is discharging because the power supply is not available.

Step 3 : Wait for the buffer time set on the potentiometer on the front of the UPS module (②, default value: 6.6 min.).
During this time, check if the SoC bar graph (①) is displaying the current state of charge (SoC).

Note 4: During and after the test, the red LED (③) displaying an UPS alarm should not start glowing, since this would indicate an faulty or almost empty battery. In this case, the UPS battery must be replaced as described in the original manufacturer documentation.

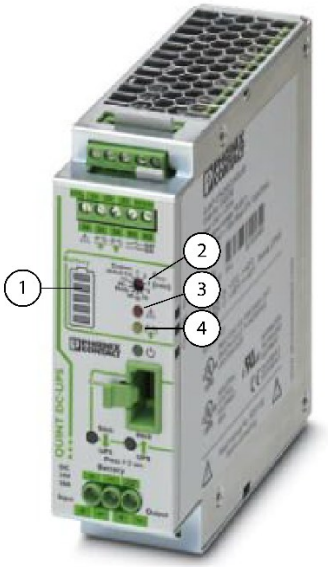


Figure 67: UPS module

Pos.	Description
①	Bar graph for displaying the current charging state of the power storage device
②	Buffer time setting: default: 6.6 min.
③	Red LED: alarm
④	Yellow LED: battery mode

Icon	Meaning of LEDs
⚠	Red LED on: UPS alarm due to one of the reasons: • battery almost empty • battery not detected • battery replacement required LED off: No UPS alarm, power supply available, normal operation.
🔋	Yellow LED on: Battery mode is ON, battery is discharging because power supply failed. LED off: Battery mode is OFF, i.e. mains available.
⏻	Green LED on: Mains is ON. LED off: Mains is OFF.

17.3.2 Removing the UPS battery

(At storage temperatures below 0°C)

NOTICE
The battery of the UPS unit must be removed at temperatures below 0°C.

In order to remove the battery from the energy storage device UPS-BAT/VRLA/24DC/12AH, the service mode of the UPS device must be activated.

Task 1: Activate service mode

The corresponding activation rights have to be granted for service mode activation and deactivation.

The service mode cannot be activated, while the QUINT-UPS runs in battery mode. The power supply must be available.

Step 1 : Depending on the granted activation rights, the service mode can be activated in three different ways:

1. By holding down both push buttons on the QUINT-UPS named "Stick -> UPS" and "UPS -> Stick" for at least 6 seconds.

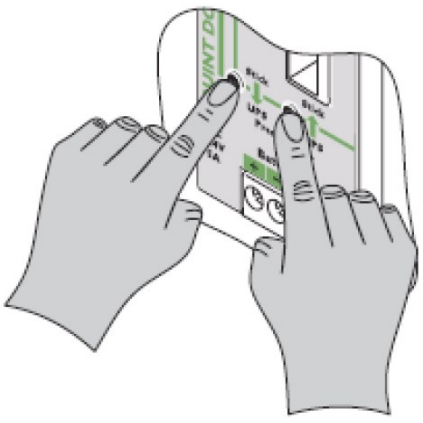


Figure 68: UPS control elements

2. By connecting a service stick (*see manufacturer manual*) to the Data port of the UPS.
3. By using the UPS-CONF (*see manufacturer manual*) software as follows:
   In the "Settings" group, select the "Service" item, and click the "On / Off" button near the "Activate service mode" text.

While the service mode is active

- the alarm status is activated,
- the charging current is interrupted,
- the status LED "Service mode active" in the UPS-CONF software ("Settings" group /"Service" item) is green

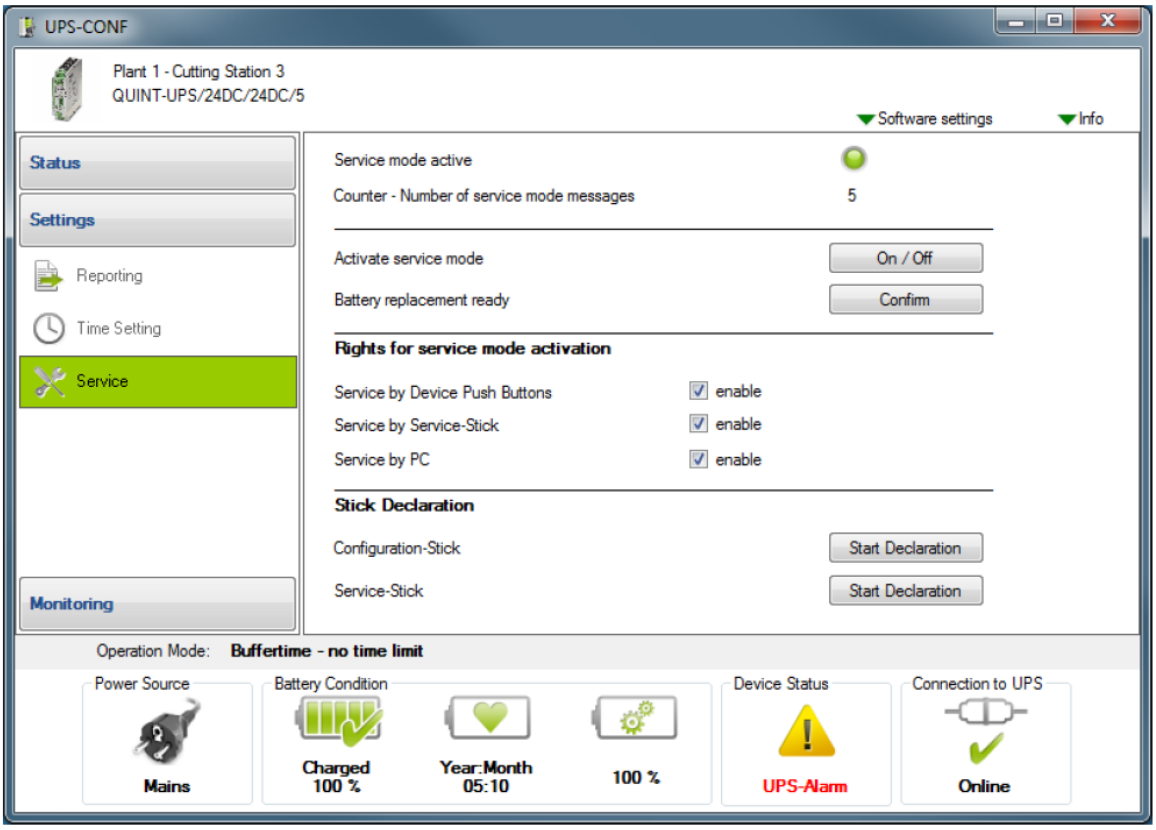


Figure 69: UPS CONF software

Task 2: Remove battery

⚠ DANGER
Before activating the service mode, read and obey carefully the safety instructions in the topic “Important safety notes” of the manufacturer manual.

⚠ DANGER
Watch polarity when connecting cables!

Step 1 : Activate the service mode by one of the ways described in Task 1.
Step 2 : Open battery module housing.
Step 3 : Remove fuses *(see illustration below)*.

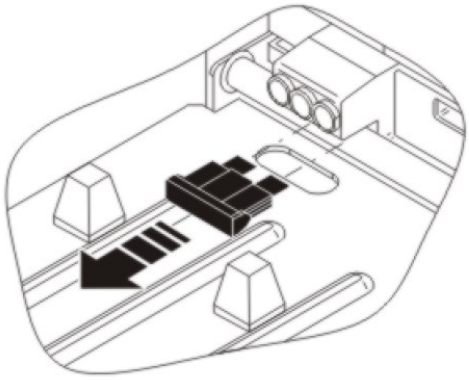


Figure 70: Remove UPS battery fuses

Step 4 : Remove cabling.
Step 5 : Remove battery.
Step 6 : Fix cabling inside housing.
Step 7 : Store the battery module together with the fuses.
Step 8 : Close battery module housing.

NOTICE
The battery and the fuses of the UPS unit must be reassembled before commissioning, recommissioning and operation of the MSC converter unit.

17.4 Changing the Intake Fan Filters

Check every 6 months, replace depending on degree of soiling)

The fan-and-filter unit and outlet filter are supplied as standard with a standard filter mat for the pre-filtering of dry, coarse dust and lint. In order to increase the protection category, and in the case of dust with a grain size of < 10 µm, we recommend the use of fine filter mats (optionally available).
The filter must be checked in regular intervals in accordance to the level of dust exposure and replaced as necessary.

⚠ DANGER

➜ Only change the filter mat while the fan rotor is stationary.
➜ Never insert your fingers into the fan rotor.

⚠ DANGER

The unit is live. Switch off the power supply before opening, and take suitable precautions against it being accidently switched back on.

NOTICE

Use only original Rittal filters which bear the Rittal logo in order to safeguard the designated protection category, air throughout and operating approvals.

To insert or replace the filter, proceed as follows (direction of airflow: drawing from outside and blowing into the enclosure):

Task 1: **Replace intake filter**
Step 1 : First press the catch of the louvred grill (Rittal logo) up slightly with one finger.
Step 2 : Once it is released, the louvred grill can be dropped open by approx. 70° or 90°.
Step 3 : If necessary, first place the fine filter mat into the housing.
Step 4 : Ensure that the open (roughened) side faces towards the louvred grill.
Step 5 : Insert the enclosed standard filter mat.
Step 6 : Ensure that the open side (without Rittal logo) faces towards the louvred grill.
Step 7 : Push the louvred grill back onto the enclosure until it snaps audibly into position.

17.5 Visual Inspection

(once every 12 months/in case of a fault)

Check the fan filters for contamination. Replace filters if necessary (*see section 17.4*).

Visually inspect the BESS cabinets for:

- Corrosion
- Damage
- Contamination

Electrical connections
Electrical connections must be checked for proper connection in order to ensure safe operation of the system and to prevent personnel from injuries due to electrical shock.

Corrosion
Corroded electrical connections must be replaced in order to maintain safe operation of the system and to prevent personnel from injuries due to electrical shock.

Damage
Damaged wires and clamps must be replaced immediately in order to maintain safe operation of the converter system and to prevent personnel from injuries due to electrical shock.

Contamination
Check the interior of the converter unit for contamination and dirt in order to prevent the internal components from short-circuiting and damage.

NOTICE
Do not use solvents for cleaning – especially on polycarbonate plastics. Use a vacuum cleaner to remove dirt or dust.

17.6 AC Circuit Breaker(s)

17.6.1 Inspection work

(once every 12 months)

The arc chutes and contact system of the circuit breaker(s) must be inspected according to these operation instructions. If a fault condition opens the circuit breaker(s), the circuit breaker(s) should be inspected before it is put back into service. Contact assemblies need to be changed according to their condition.

The switchgear operator has to determine inspection intervals depending on the breaker application conditions:

- min. 1 x per annum
- after interruption of heavy loads

During the inspection the following items must be examined:

- arc chutes and contact systems
- electrical and mechanical functionality of the breaker
- mechanical on- / off-functionality
- main and auxiliary circuits, function and connecting quality
- plausibility control of trip unit settings and correction, if necessary

Draw-Out guide frames with arc-chute covers installed, have to be replaced after no more than three short-circuit interruptions of the circuit breaker. If the breaker endurance is exhausted, then the breaker and old spare parts need to be disposed off, according to the effective legal regulations.
The arc chutes and the contact system must be replaced depending upon their condition.

Depending on the circuit breaker stress it may also be necessary to replace the operating system.

For detailed regarding the maintenance of the circuit breaker, refer to original manufacturers´ documentation (*see section 1.2 "Applicable Documents"*):

Document type	Document Name	File Name
Operating instructions	3ZX1812-0WL00-0AN4	3ZX1812-0WL00-0AN4_online_201806140915326928

17.7 Replace PLC Buffer Battery

17.7.1 Preventive maintenance

(every 4 years)

To maintain the high system availability, the manufacturer recommends the preventive replacement of the CMOS buffer battery, which is installed in the system PLC.

Component	Replacement interval
CMOS buffer battery	4 years

17.7.2 Replacing Backup Battery

NOTICE

The service life of the backup battery is approx. 5 - 8 years, depending on the ambient conditions.

Detailed information on maintenance can be found in the manufacturer's documentation for the Simotion P320-4 PLC *(see also section "Other applicable documents")*:

Document type	Document Name	File Name
Operating instructions	P320- 4 Commissioning and installation manual	P320_4_commissioning_en-EN

17.8 Exchanging the Cooling Liquid

(Every 5 years)

The cooling liquid inside the converter cooling system is to be exchanged as described in the following sections.

Like described in section 0, the converter cooling system is split up into two independent cooling systems for each converter system, allowing Converter System 1 and 2 independently from one another.

Therefore, each of the following steps must be performed for each cooling system separately.

NOTICE

- The cooling liquid inside the cooling system must be removed at least once every five years.
- Check the pressure on the expansion tank every time the cooling liquid is exchanged. The cooling system must be completely drained in order to perform a pressure check of the expansion tank (*see section17.9*).

NOTICE

The pump must not run dry as it might damage the pump.

17.8.1.1 Required Tools

The following table provides you with information regarding the tools required to perform maintenance work on the cooling system:

Amount	Tool	Description	Preferred Type	Manufacturer
3	Hose ½"	Length: 2 m, max. 50 bar	Variolux Silverline	Gardena
1	Filling pump	For glycol use, min. 2 bar pressure	Unistar 2000 A	ZUWA
1	Cooling liquid vessel	Min. 55 l capacity		
1	Inlet pressure gauge	For expansion tanks, digital	Art. No.: 512240122	OEG
1	Tank filler 400 ml	For increasing and testing the pressure in expansion tanks	Art. No.: 311779100	OEG
1	Adapter for tank filler	Adapter for screwing on the tank filler can	Art. No.: 512240126	OEG

Table 41: Required tools for cooling system maintenance

17.8.1.2 Allowed Coolants

The following table lists the suitable coolants for using in the cooling system. When exchanging the cooling liquid of the cooling system, only use a coolant listed in the table.

Please observe the manufacture's information regarding the cooling range of the designated cooling liquid.

Manufacturer	Type
NALCO AG	Varidos FSK
BASF AG	Glysantin G30
Clariant	Antifrogen N
Clariant	Antifrogen L
DOW	Dowcal 20
Zitrec	M-25 C

Table 42: Allowed coolants

17.8.1.3 Draining the cooling system

NOTICE

Check the pressure on the expansion tank every time the cooling liquid is exchanged. The cooling system must be empty in order to perform a pressure check of the expansion tank (*see section 17.9*).

⚠ WARNING



Hazard by cooling liquid

The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed.

- ➜ Avoid oral ingestion of the coolant, since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention.
- ➜ Avoid skin contact with the coolant.
- ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

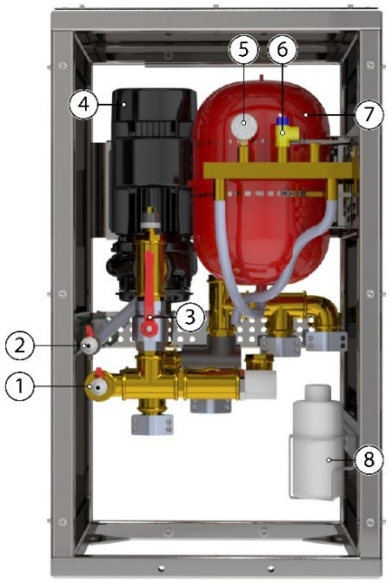


Figure 71: Cooling system components inside cooling system cabinet (COSY)

Pos.	Cooling system components
①	¾“ inlet flow connection with valve
②	"¾“ return flow connection with valve
③	Stop cock
④	Coolant pump
⑤	Manometer
⑥	Overpressure valve
⑦	Expansion vessel
⑧	Overflow vessel

Table 43: Cooling system components

Task 1: **Draining the cooling system**

Step 1 : Connect a pressure hose to the return flow connection of the cooling system inside the COSY cabinet (*see figure 71,* ②) and lead the end of the hose inside a suitable vessel.

Step 2 : Open the return flow valve (②).

Step 3 : The cooling liquid drains through the hose inside the vessel.

Step 4 : Wait until the cooling system is completely drained and then check it for any liquid remaining in the system.

17.8.2 Filling the Cooling System

⚠ WARNING	
	**Hazard by cooling liquid** The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed. ➜ Avoid oral ingestion of the coolant, since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention. ➜ Avoid skin contact with the coolant. ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

Task 1: **Prepare Coolant**

Step 1 : The expansion tank must be pre-charged to 1 bar at approx. 20 °C on the gas side.

Step 2 : Use a suitable container to prepare approx. 55 liters of coolant with a ratio of 60% water and 40% glycol (with Antifrogen N). The actual amount needed depends on the length of the hoses used to connect the heat exchanger.

Step 3 : Open the cooling liquid container (e.g. Antifrogen N) and place it in close proximity to the converter cooling system.

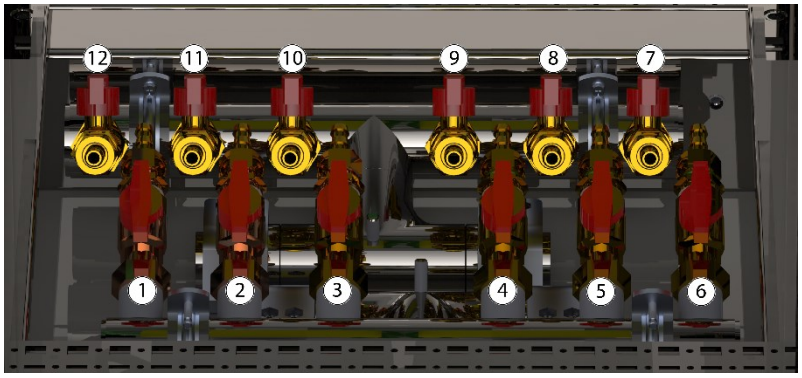


Figure 72: Water distributor, connections and valves in CON Cabinet

Pos.	Cooling System Component
①	Sub circuit with valve 1 - inlet flow
②	Sub circuit with valve 2 - inlet flow
③	Sub circuit with valve 3 - inlet flow
④	Sub circuit with valve 4 - inlet flow
⑤	Sub circuit with valve 5 - inlet flow

⑥	Sub circuit with valve 6 - inlet flow
⑦	Sub circuit with valve 6 - return flow
⑧	Sub circuit with valve 5 - return flow
⑨	Sub circuit with valve 4 - return flow
⑩	Sub circuit with valve 3 - return flow
⑪	Sub circuit with valve 2 - return flow
⑫	Sub circuit with valve 1 - return flow

Table 44: Cooling system – Coolant dispenser connections and valves inside CON cabinet

Task 2: Fill cooling system

NOTICE

Make sure that the pressure and suction hoses are completely immersed in the cooling liquid inside the cooling liquid container throughout the whole filling process, to avoid suction of air into the cooling circuit.

Step 1 : Connect the external filling pump and the cooling liquid canister using a suction hose.

Step 2 : Connect the external filling pump to the inlet flow connection *(see figure 71, ①)* with a pressure hose.

Step 3 : Open the valve on the top of the heat exchanger - if there are several heat exchangers, the valve of each heat exchanger must be opened *(see illustration below)*.

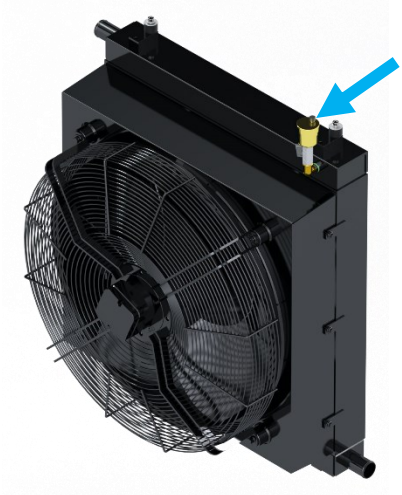


Figure 73: Valve on heat exchanger

Step 4 : Connect the return flow connection (*see figure 71,* ②) and the coolant canister with a pressure hose.

Step 5 : Close ALL valves of the sub-circuits on the water distributor of the CON cabinet (*see figure 72* ① - ⑥, ⑦ - ⑫).

Step 6 : Open the stop cock of the converter cooling system (*see figure 71,* ③).

Step 7 : Open the valves on the inlet flow connection and on the return flow connection.

Step 8 : Switch on the external filling pump and make sure that the intake hose is completely immersed in the cooling liquid inside the cooling liquid canister, so no air is sucked into the cooling circuit.

Step 9 : The main cooling circuit will be filled with coolant and the air will be removed from the circuit during this time. Wait until no more air bubbles are inside the cooling liquid canister.

Step 10 : Open the inlet flow and return flow valves of sub-circuit 1 (*see figure 72,* ① *and* ⑫).

Step 11 : Wait for 3 minutes. The sub cooling circuit will be filled with coolant and the air will be removed from the circuit during this time.

Step 12 : Shut off the inlet and return flow valve of sub circuit 1.

Step 13 : Proceed the same way for the remaining IGBT cooling circuits inside the CON cabinet.

Step 14 : Proceed the same way for the cooling circuits inside the IND cabinet.

Step 15 : Close the stopcock (*see figure 71,*③).

Step 16 : Open the valves of all connected sub-circuits.

Step 17 : Close the valve of the return flow connection (*see figure 71,* ②).

Step 18 : Wait until a pressure of 3 bar is indicated by the cooling systems´ manometer (*see figure 71,* ⑤). As soon as 3 bar have been reached, immediately shut off the inlet flow valve (*see figure 71,* ①).

Step 19 : Shut-off the external filling pump, but make sure the suction and pressure hose are still immersed in the cooling liquid inside the cooling liquid container.

Step 20 : Activate the coolant pump of the cooling system by switching on the motor protection circuit breaker 181Q1 inside the control cabinet and activate the contactor 139K2 inside the control cabinet using a suitable insulated tool.

Step 21 : Let the coolant pump run for 120 min.

Step 22 : Close the valve on the top of the heat exchanger(s) (*see figure 73*).

Step 23 : Deactivate the coolant pump of the cooling system by removing the insulated tool.

Step 24 : Check if the pressure on the cooling system manometer is indicated with 3 bar.

Step 25 : If the pressure indicated by the manometer is below 3 bar, switch the external filling pump back on an open the inlet flow valve.

Step 26 : As soon as a pressure of 3 bar has been reached, immediately shut-off the inlet flow valve and switch off the external filling pump.

Task 3: Perform a visual check of the entire cooling circuit for leaks.

17.9 Check pressure of expansion tank

Once every 5 years / When exchanging the cooling liquid / When error "pressure low" is apparent

NOTICE

The cooling system must be empty in order to perform a pressure check of the expansion tank (*see section 17.9*).

➜ Check the pressure on the expansion tank every time the cooling liquid is exchanged.

⚠ WARNING

Before performing maintenance work, make sure the system is off, cooled and not pressurized, all the electric parts are not energized, and the vessel is completely empty.

Maintenance of the expansion tank is to be performed according to the manual of the manufacturer.
ZILMET: manual_expansion_tank_537L_zilmet

Perform a pressure check of the expansion, checking that the pre-charge is at 1.5 bar.

- At least once every 5 years
- whenever the coolant of the water-cooling system is exchanged
- when converter controller reports the error message “pressure low”

The cooling system must be reduced to 0 bar in order to perform a pressure check of the expansion tank. **The necessary gas pressure is 1.5 bar**. If necessary, refill gas to 1.5 bar with compressed nitrogen. Exceptionally, the expansion tank can be filled up with compressed air. At the next maintenance the gas pre-charge pressure must be corrected with nitrogen.
The filling valve is similar to a filling valve of a car tire. Check the pressure with a tire gauge. Avoid unnecessary gas losses during testing.
See instructions below on how to perform a pressure check of the expansion tank and how to refill gas if necessary.

Task 1: **Check pressure of expansion tank**
In order to check the pressure of the expansion tank, the coolant inside the cooling systems´ circuits must be drained, until the manometer of the water-cooling system indicates a pressure of **0 bar**.

Step 1 : Drain the converter´s water cooling system like explained in section 17.8.1.3 until the manometer of the cooling system indicates a system pressure of 0 bar.

Step 2 : Connect the supplied tank filler with manometer and adapter (*see figure 75*) to the filling valve connection of the expansion vessel (*see figure 74*) and check if the nominal pressure of 1.5 bar is apparent.



Figure 74: Filling valve connection on expansion tank



Figure 75: Tank filler with manometer and adapter

NOTE: If the pressure indicated by the pressure gauge is below 1.5 bar, refill the expansion tank with gas, as described in the following:

Task 2: **Refill gas of expansion tank to 1.5 bar**

Step 1 : Connect the supplied tank filler with manometer and adapter to the filling valve connection of the expansion tank.

> **⚠ WARNING**
>
> Hold the tank filler bottle in upright position during the filling process. Don´t hold the bottle horizontally or tip the bottle during the filling process, since it could lead to injuries due to bursting material.

Step 2 : Refill gas until the connected pressure gauge is indicating a pressure of 1.5 bar.

Task 3: **Refill converter cooling system with coolant**

Step 1 : Refill the converter water-cooling system with cooling liquid like described in section 17.8.2 until the manometer of the water-cooling system indicates a pressure of 3 bar.

Step 2 : Let the coolant pump run for at least 1 hour.

Step 3 : Turn off- the internal coolant pump and check if the pressure indicated by the cooling system manometer is 3 bar.

Note: If the pressure is below 3 bar, refill cooling liquid until a pressure of 3 bar is indicated by the manometer of the water-cooling system.

17.10 Pump

⚠ WARNING

Make sure that escaping cooling water does not cause injury to persons or damage to the equipment.

- The internal pump parts are maintenance-free.
- It is important to keep the motor clean in order to ensure adequate cooling of the motor.
- If the pump is installed in dusty environments, it must be cleaned and checked regularly.
- Take the enclosure class of the motor into account when cleaning.
- The motor has maintenance-free, greased-for-life bearings.
- Pump bearings and shaft seal are maintenance free.

Maintenance of the pump is to be performed according to the manual of the manufacturer

Manufacturer:	Grundfos
Type:	CM10-2 A-R-A-E-AQQE
Manufacturer article no.:	99080211

Frost Protection

NOTICE

Before start-up after a period of inactivity, the pump and the suction pipe should be completely filled with liquid.

Pumps which are not being used during periods of frost should be drained to avoid damage.
Remove the filling and drain plugs from the pump (*see illustration below).*

Do not refit the plugs until the pump is taken into operation again.

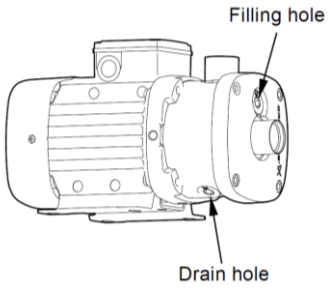


Figure 76: Position of filling hole and drain hole

17.11 Exhaust Units

Once every 6 months / fit in with existing service and maintenance plan

Periodically the extract unit must be electrically tested to ensure that the supply to the unit is continuous and that mechanically the FSD and motor open and close effectively.

It is recommended that this test be carried out twice yearly or to fit in with existing service and maintenance contracts.

The air flow failure switch should be checked for free movement and electrical conductance.

Refer to Puma technical sales leaflet for further information regarding dimensions, weights and unit performance and fan curves.

17.12 Fire Dampers

Once every 6 months / fit in with existing service and maintenance plan

The damper and motor require no service as such, but a periodic mechanical and electrical test of the working mechanisms should be carried out at least twice yearly, or to coincide with existing service and maintenance contracts.

See appropriate certified drawing of units for further information re: sizes etc.

17.13 H2 Sensors

Once every 6 months

The inspection must be carried out by trained service personnel.

The inspection intervals must be established in each individual case and shortened if necessary, depending on technical safety considerations, engineering conditions and the technical requirements of the equipment.

Contact Dräger service if you wish to take out a service contract and have any repairs carried out.

18 Container Repair

In case the container surface is damaged, repair the damaged surface as described in the following, to maintain the surface protection of the container.

18.1 Process Instructions (New Application)

Surface preparation according to DIN EN ISO 12944-4 sandblasting to surface preparation standard SA 2.5 (40 µm minimum roughness depth, medium roughness grade (G), angular blasting grit).

Primer:
REESA 2K-HS-Filling-Primer ZP
Material Nr.: 3D061
Color: ca. RAL 7035
Dry film thickness (DFT): 80 - 100 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

- Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

Topcoat:
REESA 2K-HS-PUR-OneCoat-Paint
Material Nr.: 6D062
Color: n. a.
Dry film thickness: 60 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

- Furthermore, a forced drying period of 60 minutes at a temperature of +60 °C is possible. Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C. The complete reaction period of the topcoat is 7 days.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

18.2 Process instructions (Repair - damage down to the steel)

Surface preparation according to DIN EN ISO 12944-4 surface preparation standard PSt2:

- Removal of loose and labile coating particles.
- Removal of rust using a wire brush or sandpaper (grain size 180).
- Surface grinding of the damaged and uneven areas, as well as edge areas, using sandpaper (grain size 180) until even.
- Removal of all foreign and separating substances.

Primer:
REESA 2K-HS-Filling-Primer ZP
Material nr.: 30061
Color: ca. RAL 7035
Dry film thickness: 80 - 100 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

Application process: brush application
Up to 3 coats may be required to achieve the DFT.
Intermediate drying time of the individual coats: 30 min.
Drying time between primer and topcoat: 2 hours.

- Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

Topcoat:
REESA 2K-HS-PUR-One-Coat-Paint
Material Nr.: 60062
Color: n. a.
Dry film thickness: 60 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

Application process: brush application
Up to two coats may be required to achieve the DFT.
Intermediate drying time of the individual coats: 30 min.

- Furthermore, a forced drying period of 60 minutes at a temperature of +60 °C is possible. Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C. The complete reaction period of the topcoat is 7 days.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

18.3 Process instructions (Repair - damage only within the topcoat)

Surface preparation according to DIN EN ISO 12944-4 surface preparation standard PSt2:

- Removal of loose and labile coating particles.
- Surface grinding of the damaged and uneven areas, as well as edge areas, using sandpaper (grain size 180) until even.
- Removal of all foreign and separating substances.

Topcoat:
REESA 2K-HS-PUR-One-Coat-Paint
Material Nr.: 60062
Color: n. a.
Dry film thickness: 60 - 80 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

- Furthermore, a forced drying period of 60 minutes at a temperature of 60 °C is possible. Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C. The complete reaction period of the topcoat is 7 days.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

19 Settable Devices

The following table provides the manufacturer settings of the components listed in the table.

Location	Identifier	Settable Device	Setting
CIR	80Q1	AC circuit breaker 3WL I_N=1250 A / 690 V	$I_R = I_N \times 1.0$ $I_i = I_N \times 2.0$
CTRL_1	101Q1	Circuit-breaker for motor protection, 2.2 ... 3.2 A	3 A
CTRL_1	181Q1	Circuit-breaker for motor protection, 3.5 ... 5 A	5 A
CTRL_1	181Q2	Circuit-breaker for motor protection, 4.5 ... 6.3 A	4.5 A
CTRL_1	182Q1	Circuit-breaker for motor protection, 3.5 ... 5 A	5 A
CTRL_1	185B1	Thermostat -10°C … +50°C	15°C
CTRL_1	186B1	Thermostat -10°C … +50°C	5°C
CTRL_1	102G1	USV QUINT 24 V DC / 20 A	6.6 min
CTRL_1	101T1	TRIO-PS/3AC/24DC/40	26 V DC
BESS_1	101T1	TRIO-PS/3AC/24DC/40	26 V DC
BESS_1	101Q1	Circuit-breaker for motor protection, 2.2 ... 3.2 A	3 A
BESS_1	102G1	USV QUINT 24 V DC / 20 A	6.6 min
BESS_2	101T1	TRIO-PS/3AC/24DC/40	26 V DC
BESS_2	101Q1	Circuit-breaker for motor protection, 2.2 ... 3.2 A	3 A
BESS_2	102G1	USV QUINT 24 V DC / 20 A	6.6 min

Table 45: Settable devices

20 IP Addresses

The following table provides the IP-addresses set at delivery state of the listed components.

Component	IP Address
Main controller P320	192.168.5.10

Table 46: IP addresses of components

21 PLC

The following sections provide you with a description of the connection elements and the indicator lights of the PLC and gives you information regarding the handling of the unit.

For further information regarding the PLC, see device manual SIMOTION_P320-4 of the manufacturer.

21.1 Indicator Lights

The following table describes the indicator lights at the front panel of the P320 PLC.

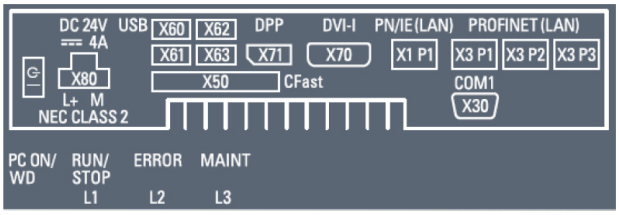


Figure 77: P320 PLC indicator lights

LED	Significance	State	Description
PC ON/ WD	Power supply	Green	BIOS ready to boot. Indicates the correct supply voltage of 3.3 V, 5 V and 12 V from the integrated power unit.
		OFF	Not relevant.
		Green/yellow flashing (1 Hz)	BIOS in POST, power switch on.
		Yellow	Idle state
RUN/STOP or L1	RUN STOP	Off	SIMOTION P Runtime is not running.
		Green	SIMOTION P320-4 in RUN.
		Yellow	SIMOTION P320-4 in STOP.
		Green/yellow: Flashes quickly (2 Hz)	DCP flashing
		Yellow: Flashes quickly (5 Hz)	FAULT state (only in combination with L2 and L3)
ERROR or L2 (SF PROFINET LED)	-	Off	SIMOTION P320-4 is working error-free.
	Error	Red: Continuous light	Bus error at the PROFINET interface.
		Red: Flashes quickly (2 Hz)	Erroneous configuration.

		Red: Flashes quickly (5 Hz)	FAULT state (only in combination with L1 and L3)
	INIT	Red: Flashes slowly (0.5 Hz)	During the INIT process, the SF PROFINET LED is con- trolled by the boot loader. The precise flashing behavior therefore cannot be determined and displayed. In the INIT state, 0.5 Hz flashing is displayed in the SI- MOTION P State. If no project has yet been loaded, 0.5 Hz flashing is also displayed for the INIT, which, in this case, is also retained in the Running state.
MAINT or L3 (SF LED)	-	Off	SIMOTION P320-4 is working error-free.
	Error	Red	An event has occurred which needs to be acknowledged (alarm, message, notification). (See Diagnostics Guide)
		Red: Flashes slowly (0.5 Hz)	License missing for licensed technology objects. Carry out the licensing to correct the error. Further information on the licensing can be found in the SIMOTION P320-4 E / SIMOTION P320-4 S Commissioning and Hardware Installation Manual.
		Red: Flashes quickly (5 Hz)	FAULT state (only in combination with L1 and L2) A fault has occurred to which the user program cannot respond. The following actions may be required to rectify the fault: ● Power OFF/ON ● Recommissioning

Table 47: P320 Indicator lights

21.2 Connection Elements

The following table describes the connection elements at the back side of the P320 PLC.

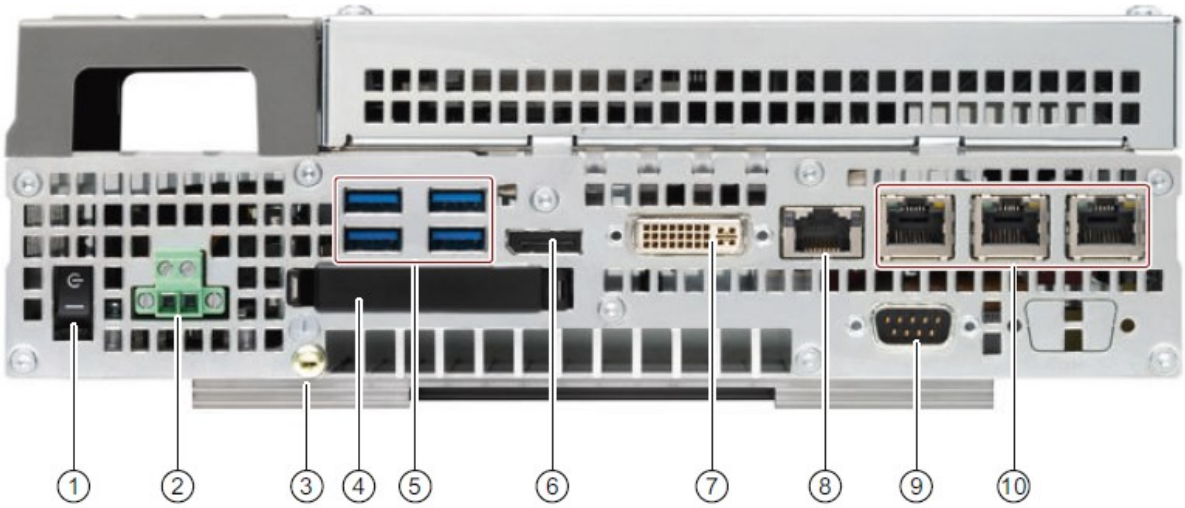


Figure 78: PLC connection elements

Pos.	Description	Description
①	On/off switch	Position OFF is the delivery state. The on/off switch does not isolate the device from the power supply.
②	24 VDC	24 VDC power supply connection
③	Protective conductor	Protective conductor terminal
④	Memory card slot	Cover for the CFast card
⑤	4 × USB 3.0	USB 3.0 high current, backward compatible with USB 2.0/1.1
⑥	Display port	Display port connection for digital monitor
⑦	DVI-I	DVI connector for CRT or LCD monitor with DVI interface
⑧	Ethernet	RJ45 Ethernet connection for 10/100/1000 Mbps
⑨	COM1	Serial interface
⑩	3 × PROFINET	PROFINET ports with three RJ45 sockets

Table 48: Table 38: PLC connection elements

21.3 PLC Connection

Follow the following steps to connect to the main PLC via PC or laptop.

Task 1: **Establish a connection to the PLC via PC or Laptop.**

Step 1 : Connect a PC or laptop via Ethernet cable to port X5 of Ethernet Switch 111A1 inside the CTRL cabinet (*see illustration below*).

Note 1: The connected PC or laptop and the converter PLC must be set to the same IP range.

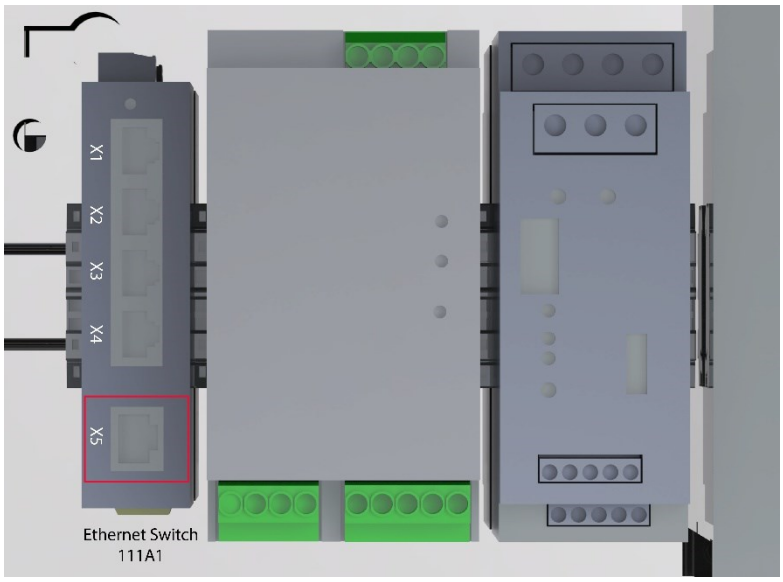


Figure 79: Ethernet Switch 111A1 - Port X5

21.4 Compiled Project Update

In case the PLC control software is not up to date at the time of commissioning, the control software must be updated.

Follow the following steps to perform a compiled project update of the main PLC.

Task 1: **Access the PLC user interface**
Step 1 : Connect to the PLC like described in section 21.3 “PLC“.
Step 2 : Open a web browser of your choice on the connected PLC or laptop
Step 3 : Type in the IP address of the PLC in the address field of your PC´s or laptop´s browser, followed by **/index.mwsl**.

Beispiel 1: 192.168.5.10/index.mwsl

The main controllers´ IP address set at delivery state is provided in Table 46.

Step 4 : The Simotion page “Home” will be displayed in the web browser of the connected PC or laptop.
✓ **The PLC user interface has been successfully accessed.**

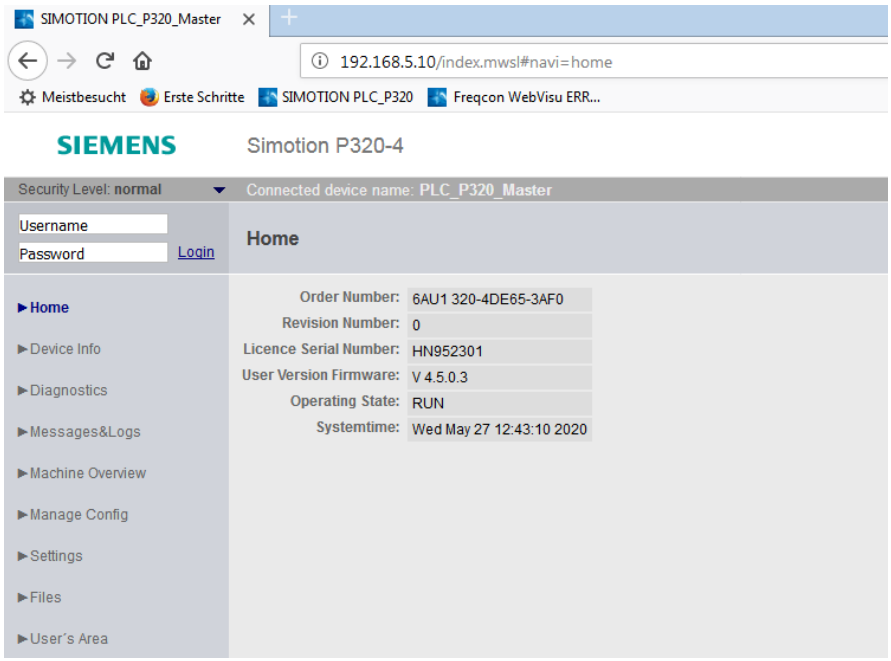


Figure 80: Connecting to the PLC user interface

Task 2: **Stop SIMOTION P320 operation.**

Step 1 : Connect to the PLC like described in section 21.3 “PLC“.

Step 2 : Select the "Settings" tab on the left-hand side of the visualization page (*see figure below,* ①).

Step 3 : In the new window, enter the following user data in the fields provided (case-sensitive):

Username: simotion

Password: simotion

Step 4 : Stop the PLC from running by clicking on the "STOP" button (②).

✓ **The PLC has been successfully stopped from operation.**

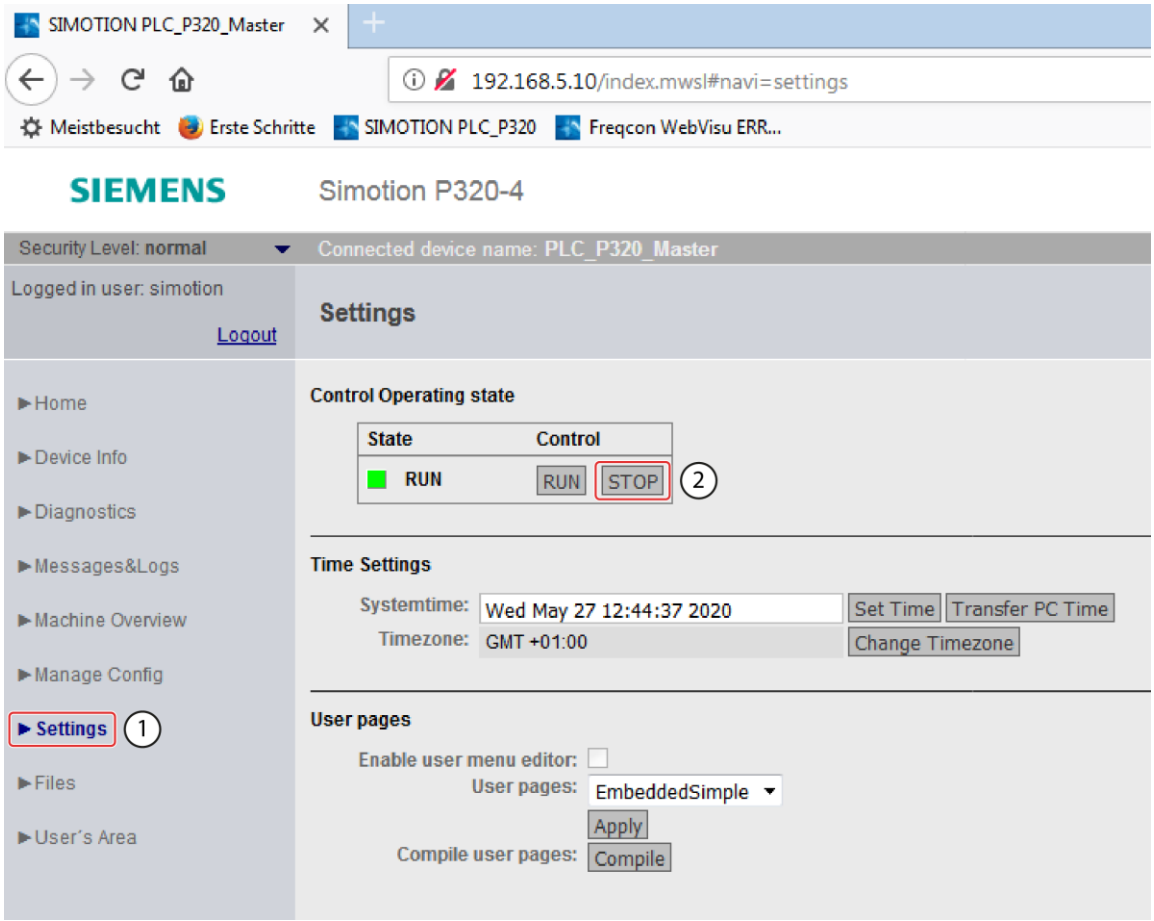


Figure 81: „Settings“ page

Task 3: **Load the compiled project ZIP archive to the SIMOTION P320 PLC**

Step 1 : Select “Manage Config” on the left site of the page (see *figure* below , ③).

Step 2 : Load the compiled project to the system by selecting the folder symbol (④).

Step 3 : Transfer the compiled project to the PLC by selecting the "Send update data" button (⑤).

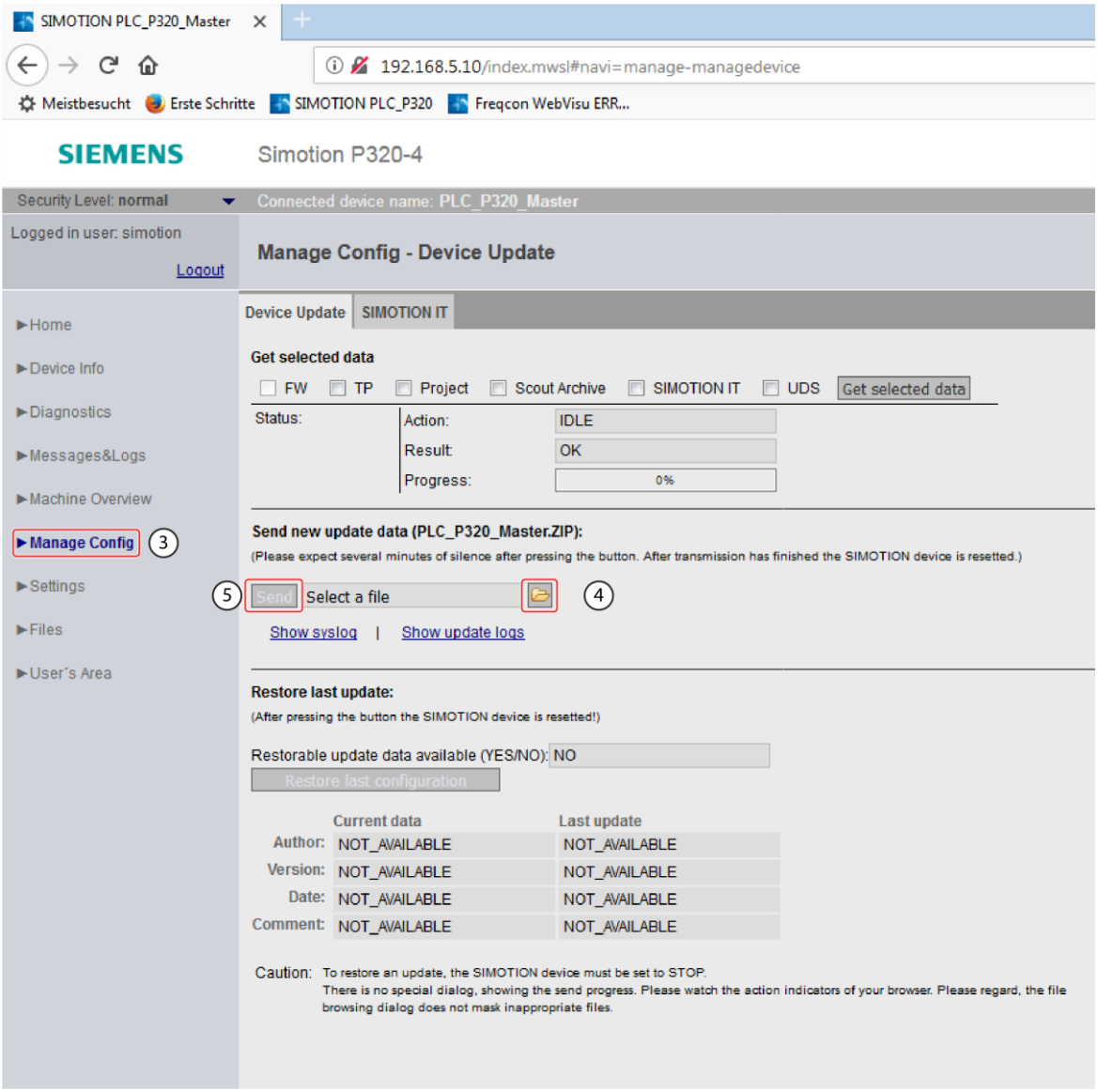


Figure 82: "Manage Config" page

Step 4 : Wait until the confirmation screen appears. The PLC reboots.

Step 5 : Wait for 5-7 minutes until the PLC has completed the reboot process.

Step 6 : Select the "Settings" tab.

Step 7 : Start the PLC by selecting the "RUN" button.

✓ **The PLC software has been successfully updated.**

22 WebVisu

FREQCON Web Visualization (WebVisu) provides granular control, real-time monitoring and visualization of key BESS functions. The WebVisu can be accessed either via the HMI touch panel on the control cabinet of the BESS or via a remote connection using a PC or laptop *(see section 22.1 "WebVisu remote connection")*.

The following sections provide you with information on handling and functionality and offer information on the individual WebVisu pages:

- Overview
- Overview DC-DC
- AC-DC Converter
- DC Link
- DC-DC Converter
- Converter Control
- Cooling
- Battery Overview
- Grid Protection Settings
- Init List
- Error List
- Action List

The individual pages can be selected by using the corresponding navigation buttons on the left side of every WebVisu page.

Note:

- Fields highlighted in grey can be adjusted by entering values inside the fields. Adjusted values are accepted by pressing the "Enter" key.
- Values must be entered in the fields without a unit.
- Fields with a white background indicate actual values.
- The selection of individual WebVisu pages depends on the user rights of the currently logged in user profile.

22.1 WebVisu remote connection

To connect to the WebVisu of the BESS via remote connection, carry out the following steps:

Task 1: **Establish a remote connection to the WebVisu of BESS**

Step 1 : Establish a connection to the PLC (main controller) in the control cabinet of the BESS by connecting a PC or laptop to the RJ45 socket of the network isolator (113T1) using an Ethernet cable.

Note 1: The connected PC or laptop and the PLC must be in the same IP range.

Step 2 : Open a web browser of your choice on the connected PLC or laptop.

Step 3 : Enter the IP address of the PLC in the address field of your PC´s or laptop´s browser.

Example: http://192.168.5.30

Note 2: The IP address of the main controller set at delivery is specified in Table 46.

Step 4 : The WebVisu page "Overview" is displayed in the web browser of the connected PC or laptop.

✓ **The remote connection to the WebVisu of BESS has been successfully established.**

22.2 Navigation

22.2.1 Home Button

The WebVisu "Overview" page can be displayed by selecting the "Home" button that appears on the left side of each WebVisu page *(see figure below)*.

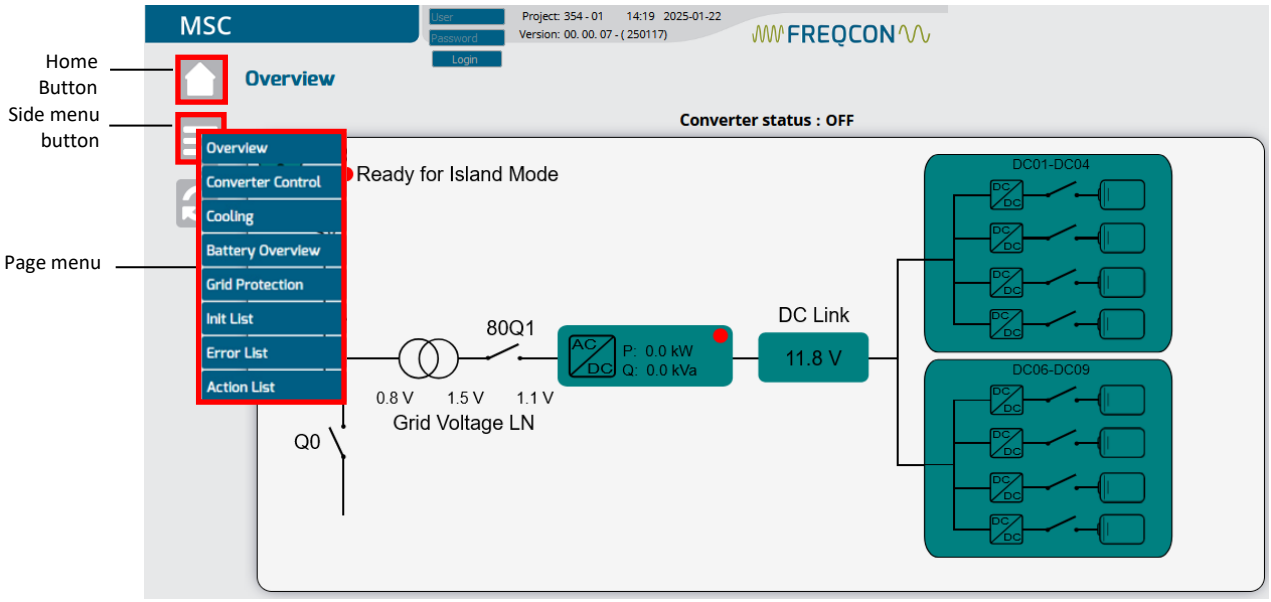


Figure 83: Navigation

22.2.2 Page Menu Button

The Page Menu is displayed via the Page Menu button that appears on every WebVisu page (*see figure 83*).

After selecting the Page Menu button, the Page Menu appears, where all WebVisu pages that can be selected with the respective user profile.

22.3 WebVisu User Interface

At the top of each WebVisu page, a user interface appears for each user (*see figure below*):

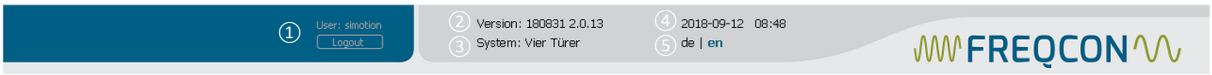


Figure 84: WebVisu user interface

The user interface provides the following information:

	Notification/Function	Description
①	User login	Type in the user profile name and password here. Press "Enter" to log in with a user profile. If a user profile is logged in, the current user profile is displayed here.
②	Version	Software version currently installed in the main control of the BESS
③	System	BESS-Identification number
④	Time/Date	Current time and date
⑤	Language selection	Choice between German and English display language

22.4 WebVisu Pages

22.4.1 Overview

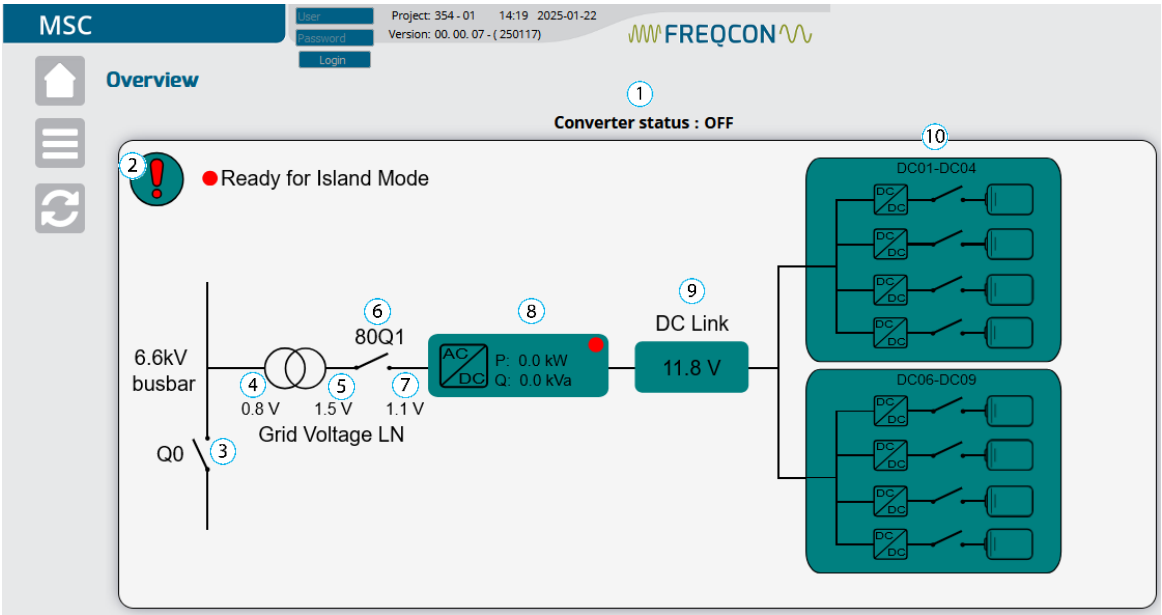


Figure 85: WebVisu page "Overview"

The "Overview" WebVisu page (*see figure above*) provides the user with a graphical overview of the main components of the BESS system and displays the following actual values:

	Description	Value
1	Converter status; for more detailed description see page “Converter control”	--
2	Green: no errors, red: errors; Clicking on the symbol takes you to the page "Error list"	--
3	MV Switch status	Open / closed
4	Voltage at the high-voltage side of the MV transformer	V
5	Voltage at the low-voltage side of the MV transformer	V
6	AC Circuit breaker 80Q1 (Switching state)	Open / closed
7	Voltage at the AC output of the converter	V
8	AC/DC Converter: active power and reactive power; Red: off, green: operation; Clicking on the symbol takes you to the page "AC-DC converter"	kW / kVA
9	DC Link voltage; Clicking on the symbol takes you to the page “DC Link”	V
10	DC/DC Converter; Clicking on the symbol takes you to the page "Overview DC-DC" of the DC Subsystems DC01-DC04 respectively DC06-DC09	--

22.4.2 Overview DC-DC

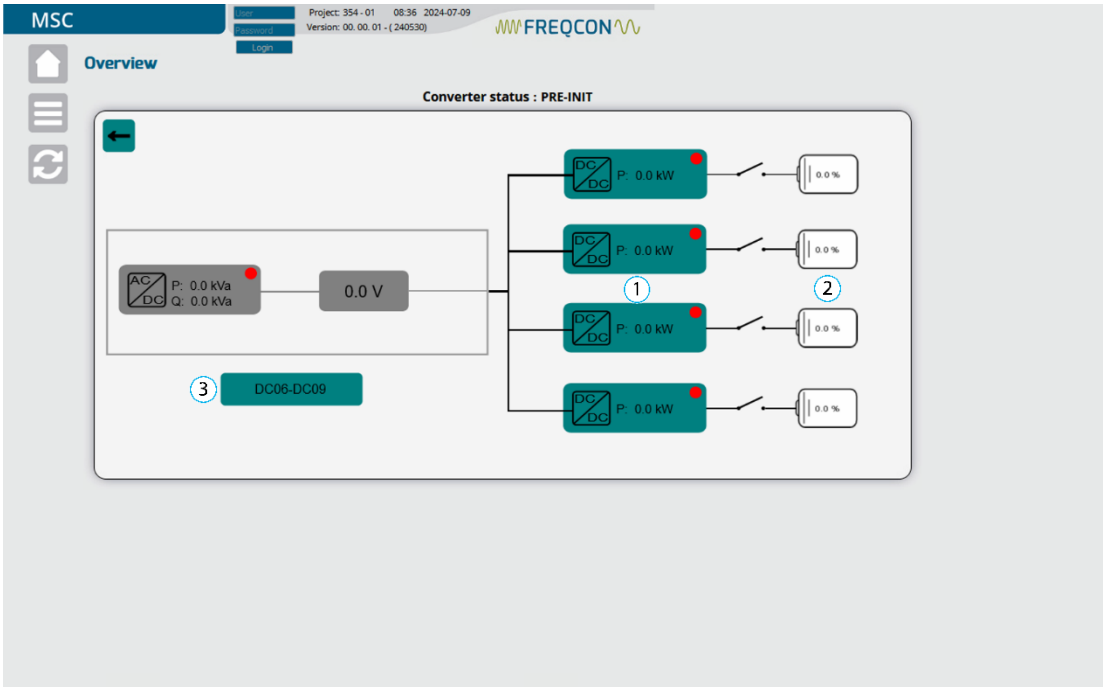


Figure 86: WebVisu page "Overview DC-DC"

The "Overview DC-DC" WebVisu page (*see figure above*) provides the user with a graphical overview of the main components of the BESS system and displays the following actual values:

	Description	Value
1	DC/DC Converter: active power (positive value: battery is charging, negative value: battery is discharging) Red: off; green: operation; Clicking on the symbol takes you to the page "DC-DC Converter" of the respective battery string	kW
2	State of charge	%
3	Switch to the page “Overview DC-DC” of the other DC Subsystem	--

22.4.3 AC-DC Converter

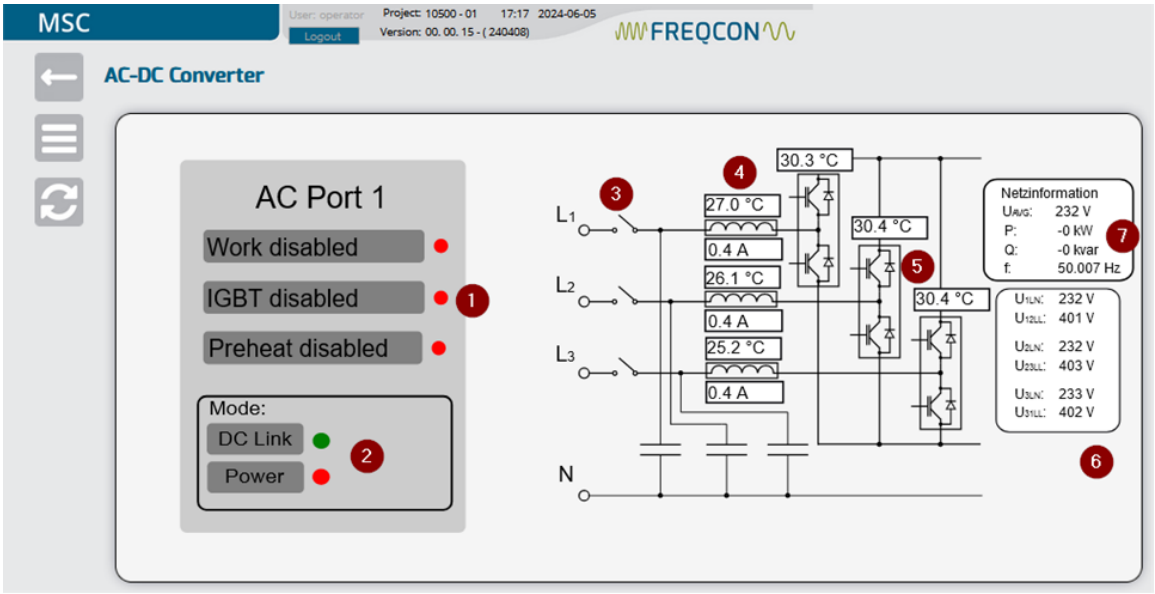


Figure 87: WebVisu page “AC-DC Converter"

	Description	Value
1	Working mode, not changeable	--
2	Control mode, not changeable	--
3	AC Circuit breaker	Open / closed
4	Inductor temperatures and phase currents through the IGBT and inductors	°C / A
5	IGBT temperatures	°C
6	String voltages and phase voltages at grid connection point	V
7	Grid information: Average voltage, active power, reactive power, grid frequency	V / kW / kvar / Hz

22.4.4 DC Link

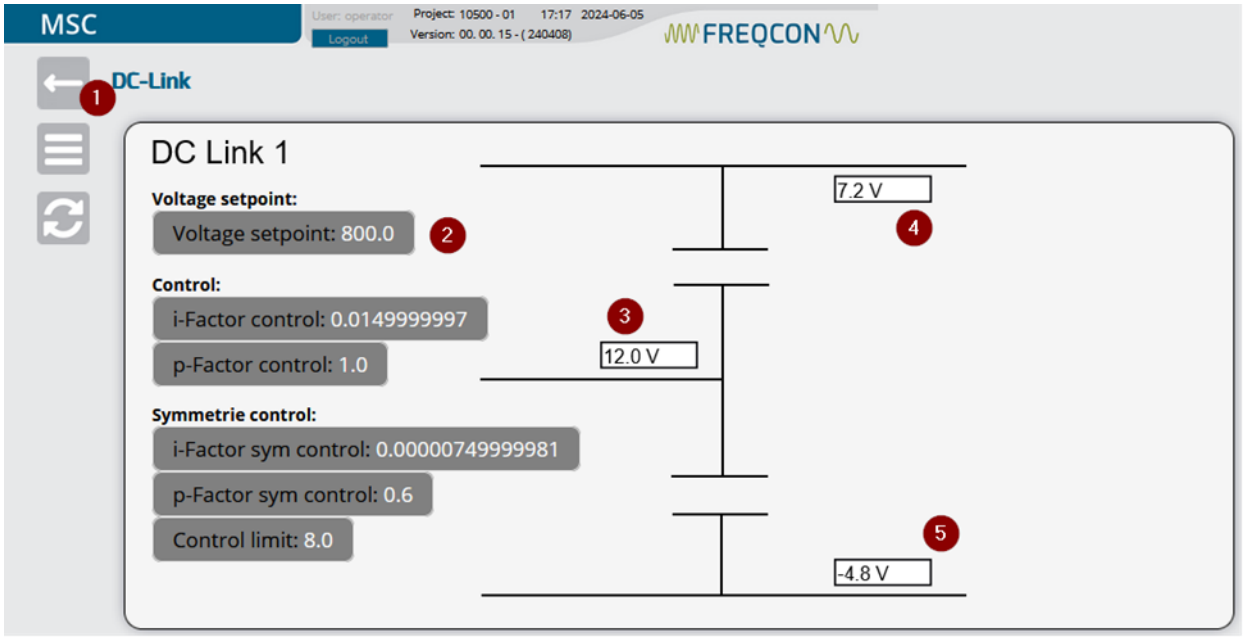


Figure 88: WebVisu page “DC Link"

	Description	Value
1	Back to “Overview”	--
2	DC link voltage setpoint, fixed value	V
3	Total DC link voltage	V
4	Positive DC link voltage	V
5	Negative DC link voltage	V

22.4.5 DC-DC Converter

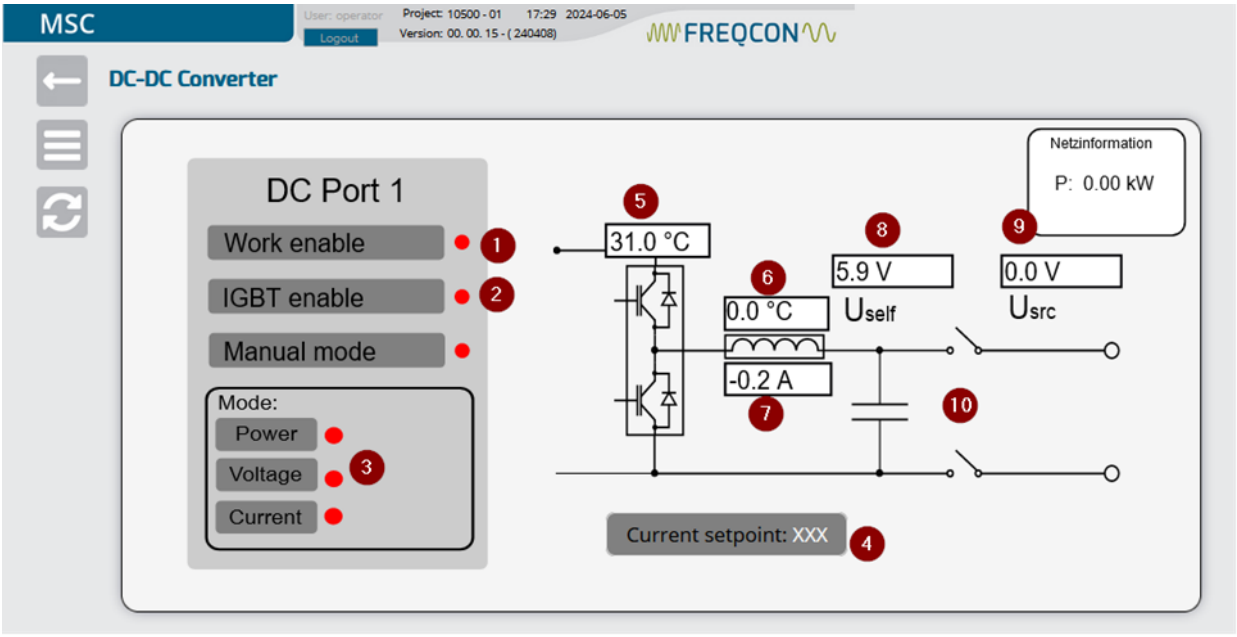


Figure 89: WebVisu page “DC-DC Converter"

	Description	Value
1	Status, not manually changeable	--
2	IGBT enabled	--
3	Control mode, not manually changeable	--
4	Manual setpoint, not available here	--
5	IGBT temperature	°C
6	Inductor temperature	°C
7	Current, filtered	A
8	Voltage at the filter capacitor	V
9	Voltage at the source	V
10	DC contactor (positive and negative)	Open / closed

22.4.6 Converter Control

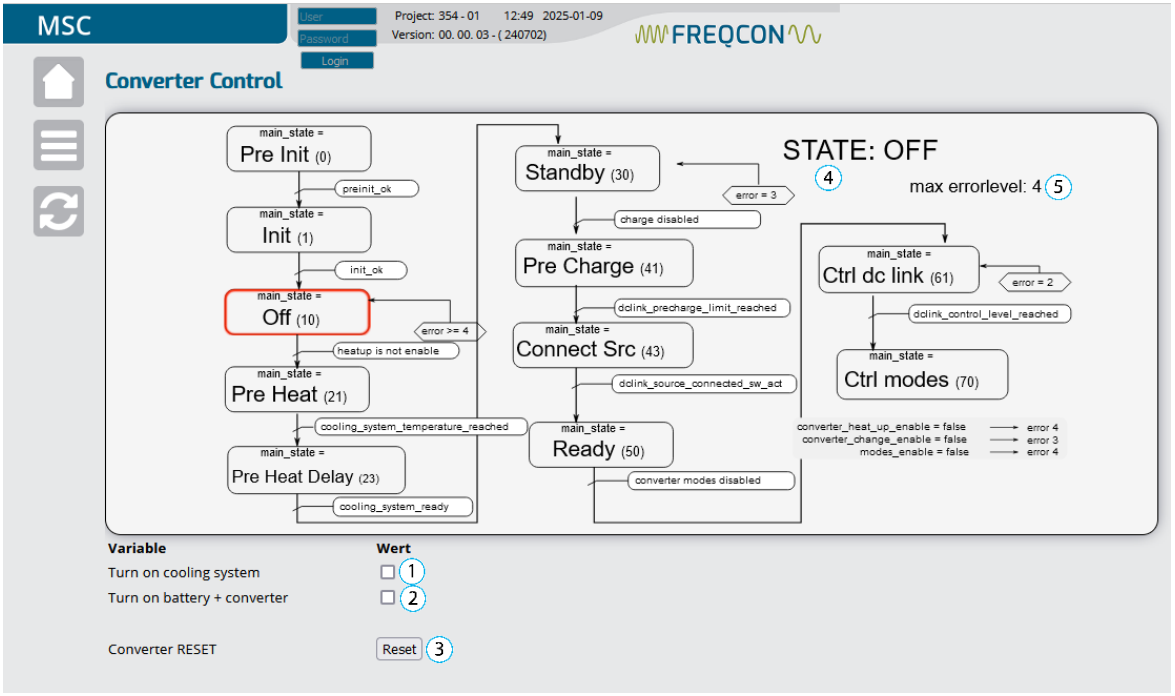


Figure 90: WebVisu page "Converter Control"

	Description	Value
1	Switch on cooling system, converter starts up to standby	--
2	Switch on converter and connect battery system	--
3	Reset converter error	--
4	The converter follows a step chain when it is switched on: Preinit: After switching on the PLC Init: Loading the initialization parameters from the memory card OFF: Converter is off Preheat: Coolant is heated to minimum temperature Preheat Delay: Temperature is held for a few minutes to reduce humidity caused by condensation on the components Standby: Cooling system is ready for use PreCharge: Charging of the DC link via resistors Connect Source: Switching on the mains switch S1 Ready: DC link is pre-charged and converter is connected to the mains, but IGBT is still off Ctrl DC Link: Switch on IGBT and regulate DC link voltage to nominal value Ctrl Modes: Normal operation	--
5	Error level 0 ... 1: Messages, warnings Error level 2: Shutdown of subsystems, e.g. a DC port Error level 3: Shutdown to standby, e.g. in the event of current or voltage overshoots, overtemperatures, etc.	--

22.4.7 Cooling

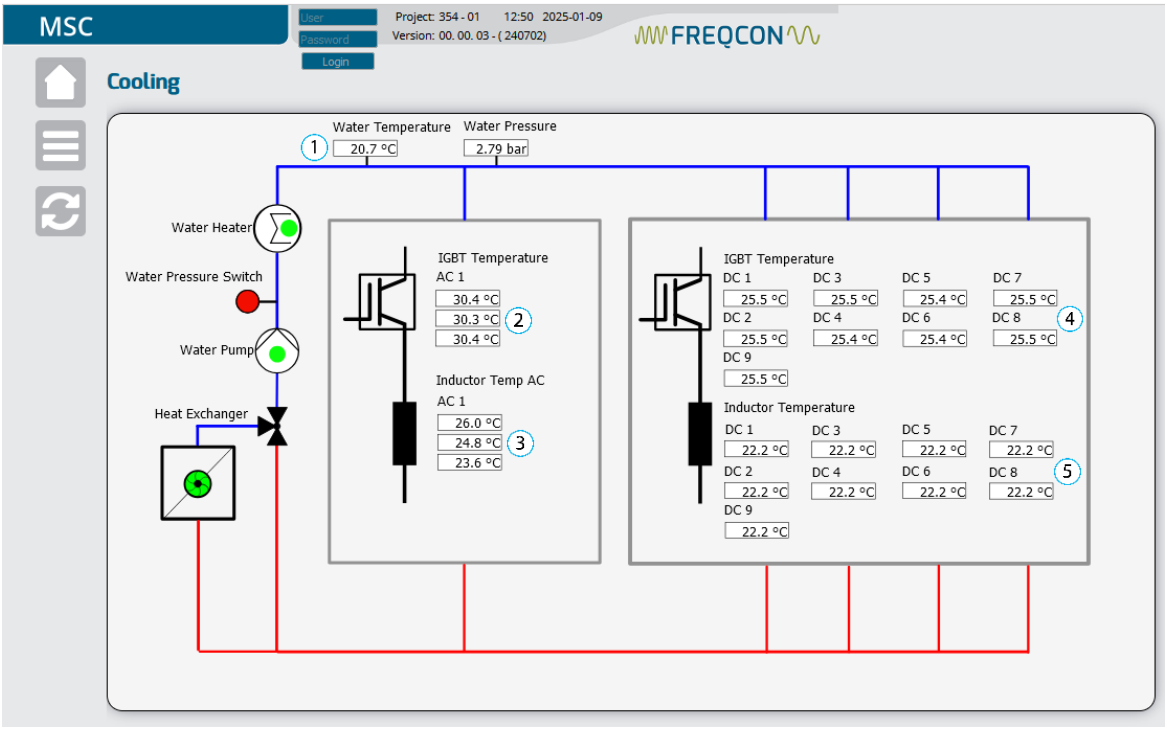


Figure 91: WebVisu page "Cooling"

The "Cooling" WebVisu pages provide the user with a graphical overview of the main components of the BESS cooling system:

- Cooling water heating element (water heater)
- Pressure switch
- Cooling water pump (water pump)
- Heat exchanger

The following actual values are displayed on the "Cooling" WebVisu page:

	Description	Value
1	Cooling water temperature inside the cooling system	°C
2	Temperatures of the AC IGBTs 1/2/3	°C
3	Temperatures of AC inductors 1/2/3	°C
4	IGBT temperatures of DC ports 1 - 8	°C
5	Inductor temperatures of DC ports 1 - 8	°C

22.4.8 Battery Overview

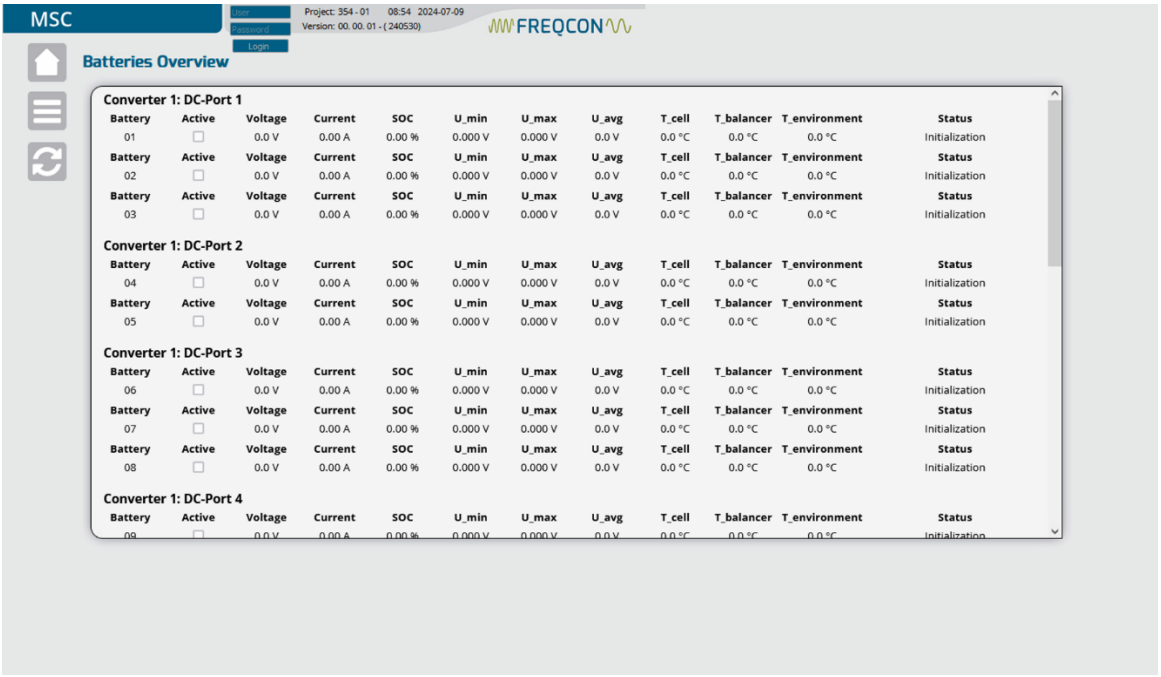


Figure 92: WebVisu page “Battery Overview"

The data is transmitted by the BMS as soon as the respective battery string is connected. If the string is disconnected from the converter system, the value "0" is displayed for current, voltage and SOC.

22.4.9 Grid Protection Settings

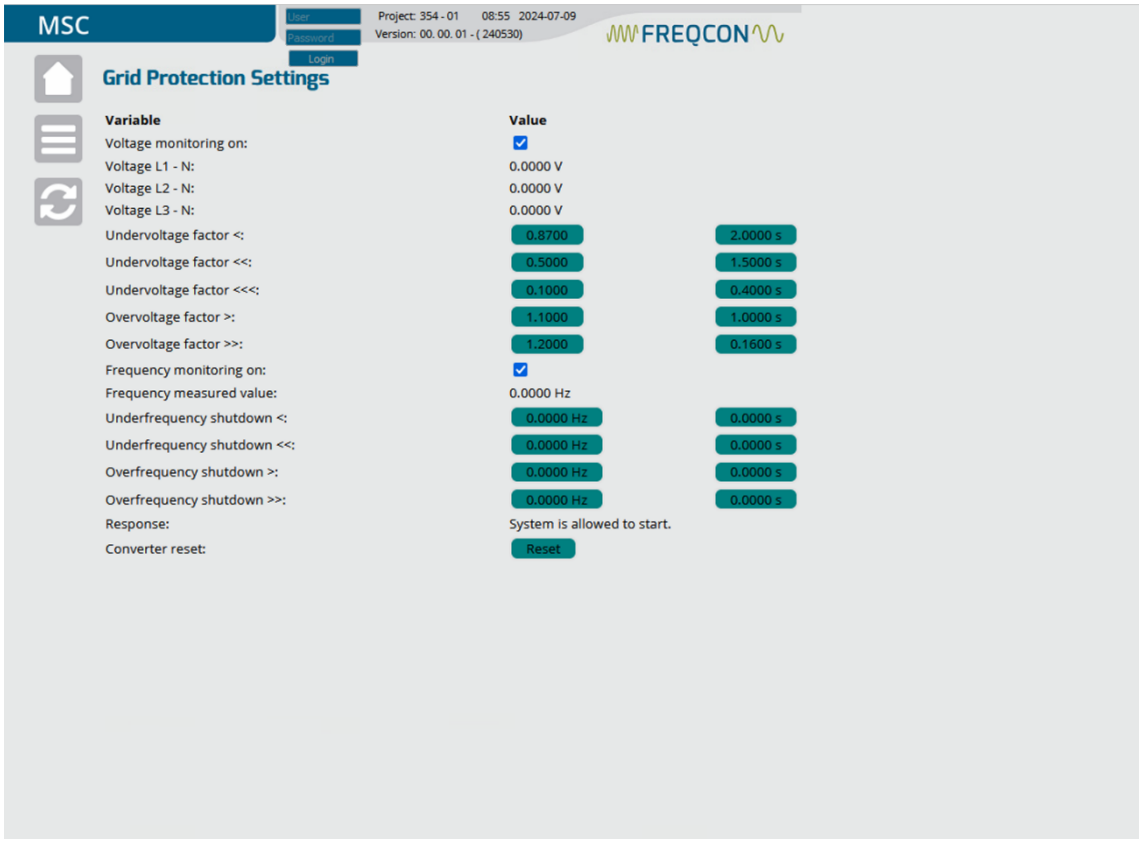


Figure 93: WebVisu page "Grid Protection Settings"

Changing the settings requires a logged in user "operator".

22.4.10 Init List

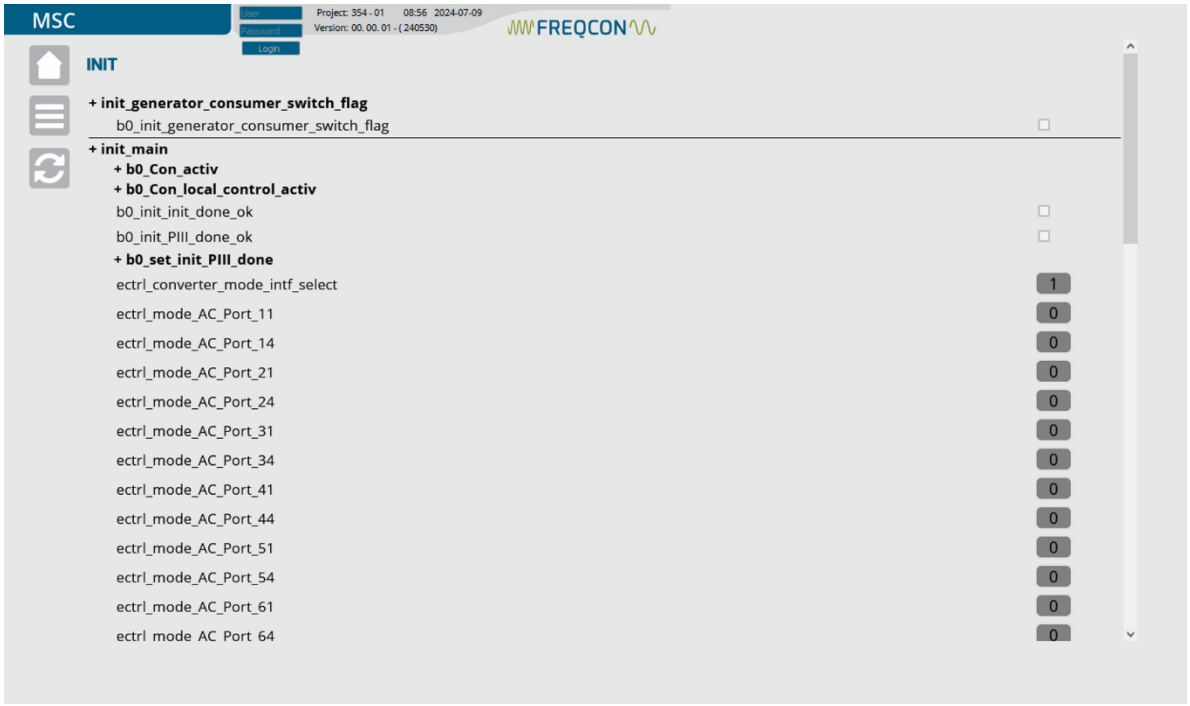


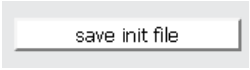
Figure 94: WebVisu page "Init List"

The WebVisu page "Init List" provides the user with an overview of all initialization values (Init values) stored in the BESS main controller.

The "Operator" user profile, as well as users who are not logged in with a profile, can only **check** the set Init values.
Only the **"Service"** and **"Factory"** user profiles can **adjust init values by** changing the value of the corresponding variable in the value field.

- ➜ To expand the parameter overview, click on the "+" sign in front of the corresponding init value.
- ➜ Fixed Init values are displayed on the right side of the corresponding Init parameter.
- ➜ To change the value, change the value inside the box and press „Enter“ on the keyboard of your PC or Laptop.
- ➜ The new value is set, but will be reset after a reboot of the controller.

Note:
To **permanently** adjust the init value, press "Enter" on your PC or laptop keyboard and then select the "Save init file" button at the bottom of the "Init" page. The selected value now remains saved even if the controller is restarted



22.4.11 Error List

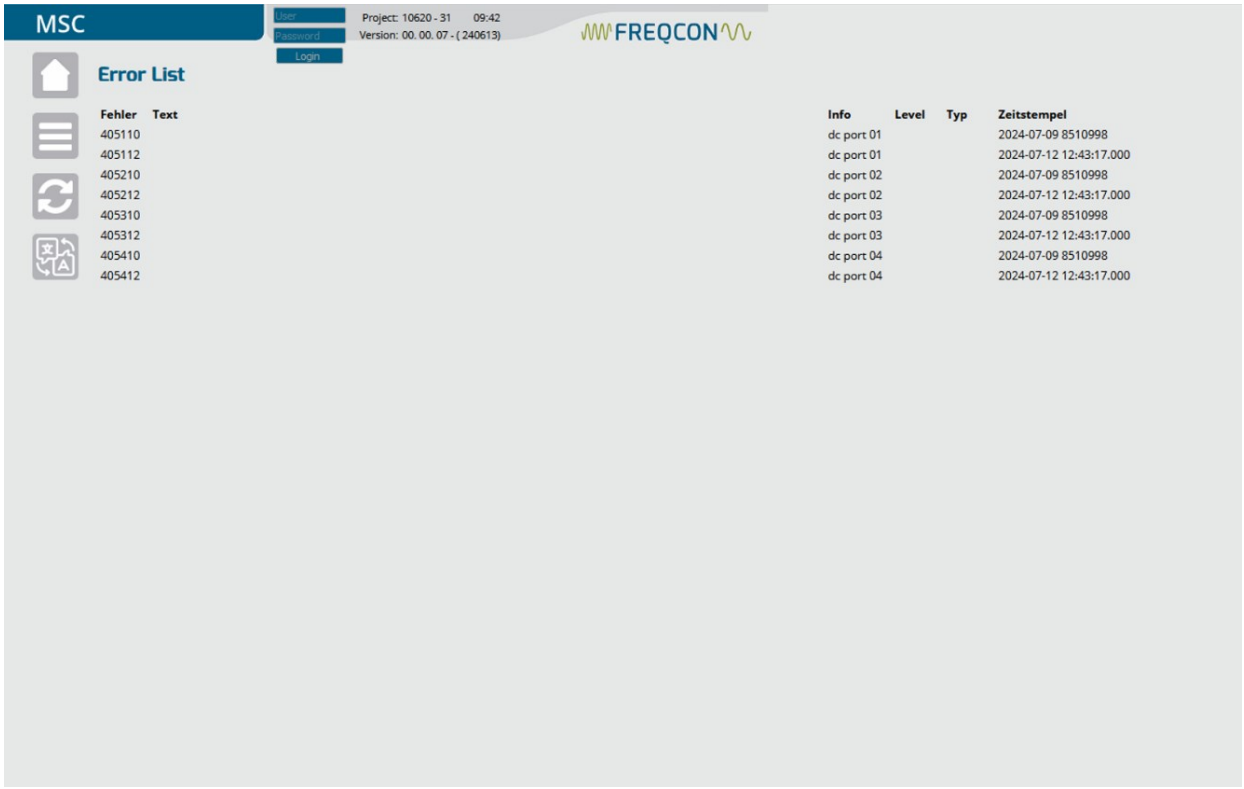


Figure 95: WebVisu page "Error list"

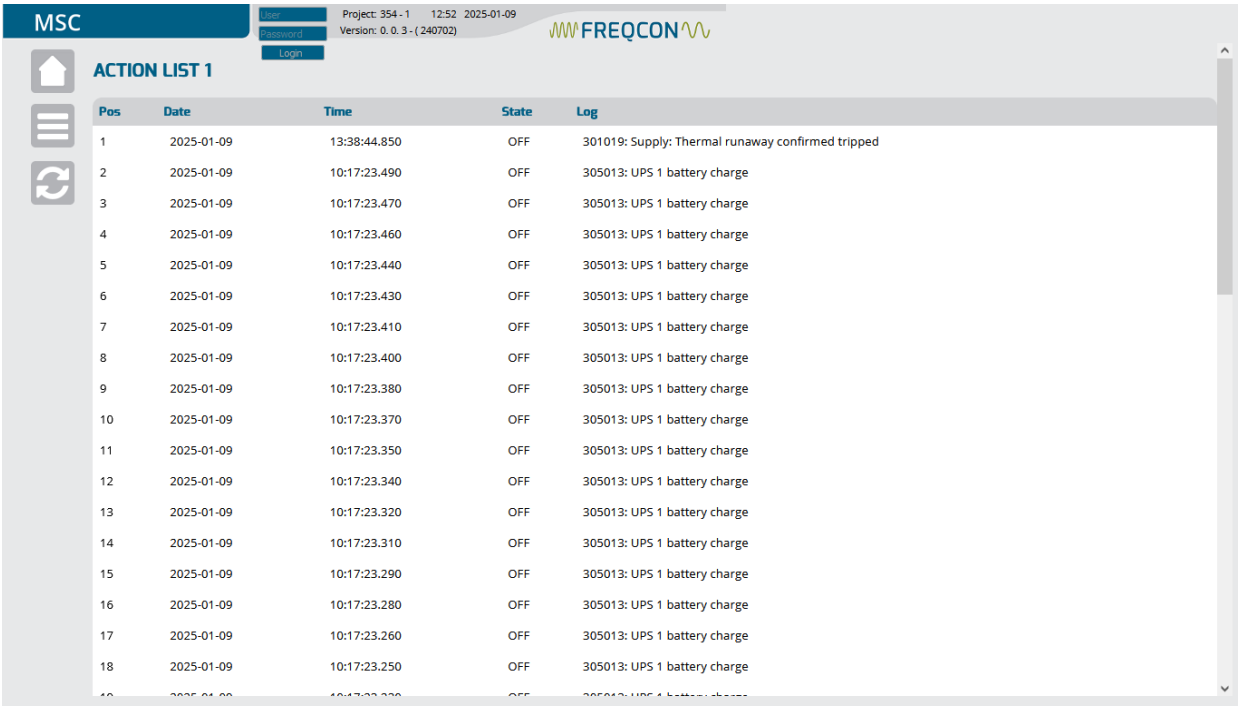
The WebVisu "Error List" page provides the user with a list of current system messages, warnings and errors.

The Error List shows only **current** system messages, warnings and errors. After a reset of a warning or error, these warning and error messages will not be any more displayed in the error list, if the warning or error is not anymore apparent.

The following information are provided inside the error list.

Name	Description
Error	Code of the individual message, warning or error.
Text	Description text for the individual message, warning or error.
Info	Additional information regarding the individual message, warning or error.
Level	Level of message, warning or error. **Note:** Level 1 to 4 are error levels and lead to a stop of the BESS system. For additional information regarding individual error messages, *see section 7.1* "Error Levels": Levels 0 and below are reporting and warning levels and do not cause the BESS system to stop.
Type	Indicates the message type of the individual message. Possible message types are: message, warning or error.
Time stamp	Indicates the time, at when the message, warning or error was detected by the controller.

22.4.12 Action List



Pos	Date	Time	State	Log
1	2025-01-09	13:38:44.850	OFF	301019: Supply: Thermal runaway confirmed tripped
2	2025-01-09	10:17:23.490	OFF	305013: UPS 1 battery charge
3	2025-01-09	10:17:23.470	OFF	305013: UPS 1 battery charge
4	2025-01-09	10:17:23.460	OFF	305013: UPS 1 battery charge
5	2025-01-09	10:17:23.440	OFF	305013: UPS 1 battery charge
6	2025-01-09	10:17:23.430	OFF	305013: UPS 1 battery charge
7	2025-01-09	10:17:23.410	OFF	305013: UPS 1 battery charge
8	2025-01-09	10:17:23.400	OFF	305013: UPS 1 battery charge
9	2025-01-09	10:17:23.380	OFF	305013: UPS 1 battery charge
10	2025-01-09	10:17:23.370	OFF	305013: UPS 1 battery charge
11	2025-01-09	10:17:23.350	OFF	305013: UPS 1 battery charge
12	2025-01-09	10:17:23.340	OFF	305013: UPS 1 battery charge
13	2025-01-09	10:17:23.320	OFF	305013: UPS 1 battery charge
14	2025-01-09	10:17:23.310	OFF	305013: UPS 1 battery charge
15	2025-01-09	10:17:23.290	OFF	305013: UPS 1 battery charge
16	2025-01-09	10:17:23.280	OFF	305013: UPS 1 battery charge
17	2025-01-09	10:17:23.260	OFF	305013: UPS 1 battery charge
18	2025-01-09	10:17:23.250	OFF	305013: UPS 1 battery charge

Figure 96: WebVisu page "Action list"

The WebVisu page "Action list" provides the user with an overview of the system events stored by the BESS controller.

The event list records the most important events and information of the BESS system, such as

- Plant operation
- Error messages
- Event messages
- Status messages

23 Troubleshooting

⚠ DANGER	
	**Electric shock due to low voltage** Severe irreparable damage to the nervous system, severe burns and death. ➜ In the event of faults, contact customer support. ➜ Have work on the energy storage device performed by service personnel only.

24 Dismantling and Disposal

24.1 Safety

For all work on the BESS observe the „Safety Instructions“ in section 2.

24.2 Dismantling

The end user is responsible for dismantling the energy storage device.

24.3 Disposal of Packaging Material

The proper disposal of packing materials is subject to national regulations and laws. If there are any doubts regarding the proper disposal of the packaging materials, ask a local disposal specialist or consult the local authorities.

The packaging my consist of the following materials:

- wooden frames
- pallets
- polyethylene foil
- plywood
- plastics
- silica gel

24.4 BESS Disposal

Always adhere the national regulations and laws regarding disposal or recycling.

⚠ WARNING	
	**Danger to life due to improper dismantling** In the case of improper dismantling, materials can slip, tip or shift, which can result in death, severe personal injury or material damage. ➜ Only qualified personal is allowed to dismantle and dispose, wearing suitable protective clothing. ➜ Before starting to dismantle, deenergize and ground the device. ➜ Also refer to section 10.1 "Unpacking" and section 10.2 “Transport”.

⚠ WARNING	
	Do not dispose the refrigerant of the external cooling unit in the atmosphere. It should be disposed of by companies dealing with special waste collection and recovery.

The batteries installed in the FREQCON BESS Container are subject to EU Directive 2006/66/EC on batteries and accumulators as well as spent batteries and accumulators.
They must be disposed of separately.
For this purpose, the batteries categorized as industrial batteries are not to be returned to the common take-back system but directly to the manufacturer FREQCON GmbH or a third-party company, qualified for this service.

Please note that the existing regulations for the transport of hazardous materials must be observed. The transport is the responsibility of the end user.

The end user is responsible for the following when disposing of batteries:

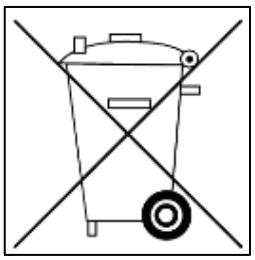
- Packaging
- Labeling
- Return transport to the manufacturer

After transport, the battery storage system must be disposed according to local regulations.
The energy storage device also contains electrical and electronic components that must be disposed of separately from other waste in accordance with local regulations and laws.

Pay particular care for the disposal or recycling of the following components:

- Batteries
- Circuit boards
- Electrical components
- Refrigerants

NOTE:
The transport of the battery modules installed inside the battery storage system underly strict regulations (UN 3480) and are only allowed to be transported by companies, qualified for this purpose.



The energy storage device also contains electrical and electronic components that must be disposed of separately from other waste in accordance with local regulations and laws.

Site Acceptance Test (SAT) Procedure

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

FREQCON

SAT Protocol

Converter & BESS

(Site Acceptance Test)

Version	date	Name	Description of the
Draft	2024-03-26	J. Nitsch C. Palenzuela	First, preliminary version
1.0	2024-10-08	J. Nitsch C. Palenzuela	First, final version
1.1	2024-10-21	J. Nitsch C. Palenzuela	Updated tables
2.0	2024-10-30	M. Jahns C. Palenzuela	Updated document structure
2.1	2024-11-01	C. Palenzuela	Comments implementation and corrections
2.2	2024-11-21		Comments implementation and corrections

Table 1Version overview

	Date	Name
Created by	2024-03-26	J. Nitsch C. Palenzuela
Checked by	2024-03-26	J. Nitsch
Approved by	2024-03-26	C. Palenzuela

Table 2Authorisation overview

Imprint

Hardware development and production centre

Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

E-mail:
info@freqcon.de
hardware@freqcon.de

Contact details

For further information, please contact us by phone or send us an e-mail to info@freqcon.com
You can also visit our website **at http://www.freqcon.com for** more information on our products and solutions.

Contents

1 About this Document 6
2 Responsibility 6
2.1 Responsibility of FREQCON GmbH 6
2.2 Responsibility of the customer 6
3 Device Description 7
3.1 Single Line Diagram 7
3.2 General Arrangement 8
4 PCS (Converter System) 9
4.1 Reference Documents 9
4.2 PCS Prerequisites 10
4.3 Visual inspection of Control Cabinet 1 11
4.4 Visual inspection of Control Cabinet 2 13
4.5 Visual inspection of Converter Cabinets 15
4.6 Visual Inspection of Converter Cooling System and Heat Exchanger 17
4.7 Power On 18
4.8 Software and Function Tests 21
5 BESS 1 and 2 24
5.1 Reference Documents 24
5.2 BESS Prerequisites 25
5.3 Container Visual Inspection BESS 1 26
5.4 Container Visual Inspection BESS 2 27
5.5 Power On BESS 1 28
5.6 Power On BESS 2 31
5.7 Function and Safety Critical Tests BESS 1, BESS 2 and PCS 34
6 Battery Modules 38
6.1 Reference Documents 38
6.2 Prerequisites 39
6.3 Installation Report 40
7 System Tests 41
7.1 Reference Documents 41
7.2 Prerequisites 42
7.1 Software and Function Tests 43
8 Employees Present 48
9 Check and Approval 50

Identification

Product and type designation

Device type
BESS 1 MW / 5MWh

Document number
23A2007_241030_SAT_BESS_EN_v2.0

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this Document

The test report for site acceptance test (SAT) is intended to qualify whether the system fulfils the design requirements and the customer's requirements.

The site acceptance test (SAT) is carried out by specialised personnel after delivery of the system at customer site and the result is checked by the customer.

2 Responsibility

2.1 Responsibility of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (SAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

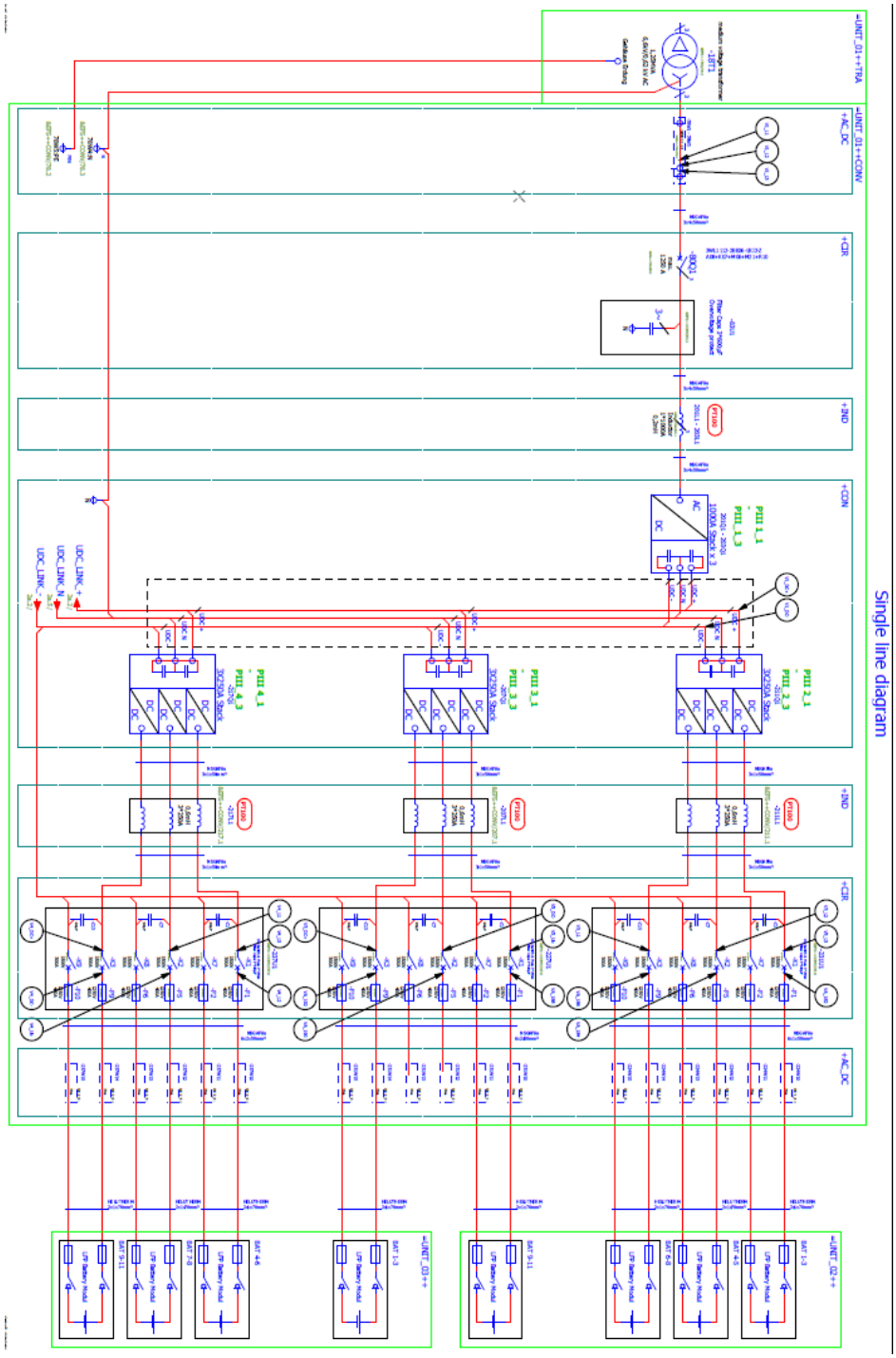
2.2 Responsibility of the customer

- Sending personnel to site, checking the test result and the data
- Approve the SAT protocol

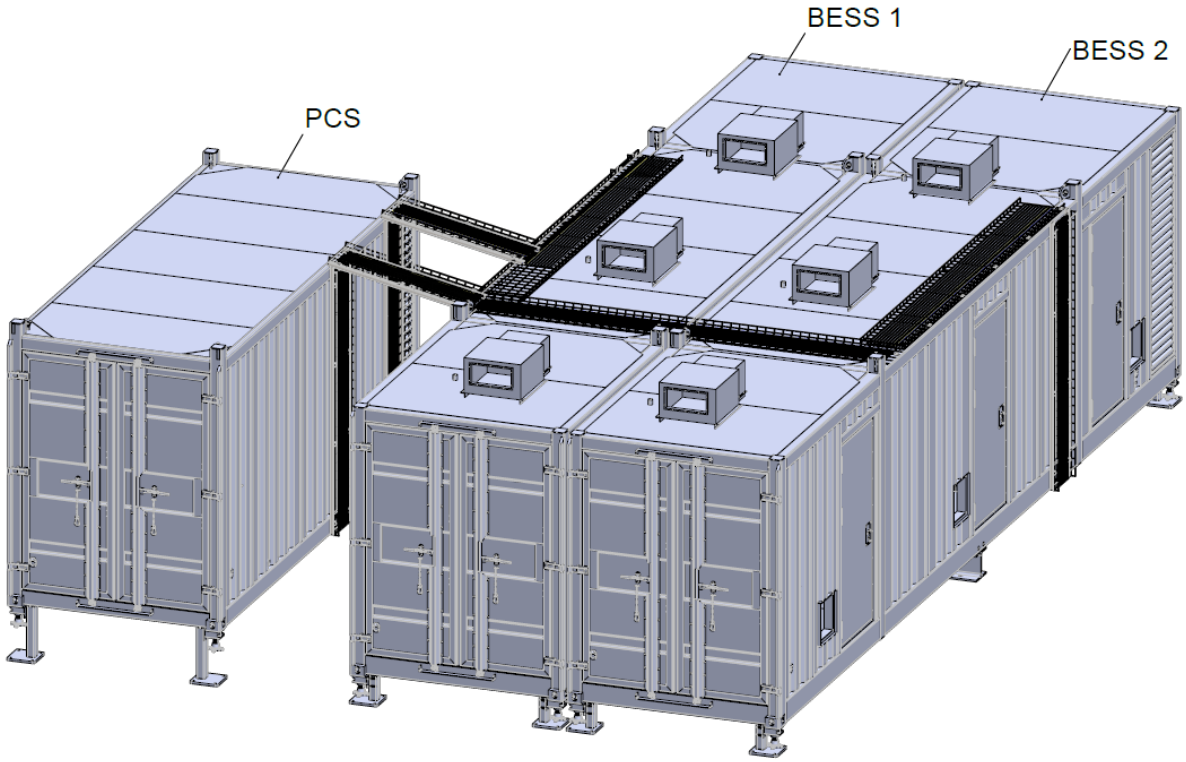
3 Device Description

3.1 Single Line Diagram

Extract from overall schematics “10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2”



3.2 General Arrangement



4 PCS (Converter System)

4.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3
FAT punchlist tracker	20240828 - punchlist - FRQ comments v2.4

4.2 PCS Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR01 test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding.

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400VAC aux PCS – *auxiliary load BESS B-200 <> 84W2*

Remarks:

4.3 Visual inspection of Control Cabinet 1

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR01	Test		Result
4.3.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust. **Pass Fail Criteria:** Covers and interior are clean, without dirt or rust.	☐ OK ☐ Defects ☐ N/A
4.3.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages **Pass Fail Criteria:** No sharp edges or recognisable damage present.	☐ OK ☐ Defects ☐ N/A
4.3.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts. **Pass Fail Criteria:** Cable connections are in perfect condition, no loose parts present.	☐ OK ☐ Defects ☐ N/A
4.3.4	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components). **Pass Fail Criteria:** • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_YYMMDD_Operating_Manual_ Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	☐ OK ☐ Defects ☐ N/A
4.3.5	**Touch panel**	**Test Layout:** Check if touch panel of HMI user interface is clean and without damage **Pass Fail Criteria:** The user interface of the touch panel is clean without damage	☐ OK ☐ Defects ☐ N/A
4.3.6	**Punch List Items Closed**	**Test Layout:** Review and confirm no category A open punch list items are outstanding. **Pass Fail Criteria:** No category A open punch list items are outstanding.	☐ OK ☐ Defects ☐ N/A
4.3.7	**LOTO**	**Apply LOTO as required.**	☐ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
Remarks:		

4.4 Visual inspection of Control Cabinet 2

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR02	Test		Result
4.4.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust. **Pass Fail Criteria:** Covers and interior are clean, without dirt or rust.	☐ OK ☐ Defects ☐ N/A
4.4.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages **Pass Fail Criteria:** No sharp edges or recognisable damage present.	☐ OK ☐ Defects ☐ N/A
4.4.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts. **Pass Fail Criteria:** Cable connections are in perfect condition, no loose parts present.	☐ OK ☐ Defects ☐ N/A
4.4.4	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components). **Pass Fail Criteria:** • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_YYMMDD_Operating_Manual_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	☐ OK ☐ Defects ☐ N/A
4.4.5	**Punch List Items Closed**	**Test Layout:** Review and confirm no category A open punch list items are outstanding. **Pass Fail Criteria:** No category A open punch list items are outstanding.	☐ OK ☐ Defects ☐ N/A
4.4.6	**LOTO**	**Apply LOTO as required.**	☐ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
Remarks:		

4.5 Visual inspection of Converter Cabinets

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR03	Test		Result
4.5.1	Cleanliness	**Test Layout:** **Check covers and cabinet interior for cleanliness and rust.** **Pass Fail Criteria:** **Covers and interior are clean, without dirt or rust.**	**☐ OK** **☐ Defects** **☐ N/A**
4.5.2	Metal sheets	**Test Layout:** **Check metal sheets for sharp edges and damages** **Pass Fail Criteria:** **No sharp edges or recognisable damage present.**	☐ OK ☐ Defects ☐ N/A
4.5.3	Wires and cables	**Test Layout:** **Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts.** **Pass Fail Criteria:** **Cable connections are in perfect condition, no loose parts present.**	☐ OK ☐ Defects ☐ N/A
4.5.4	Control elements description	**Test Layout:** **Check if the operating elements are explained in the operating manual.** **Pass Fail Criteria:** **The operating elements are explained in the operating manual.** **Reference document:** **10354_23A2007_YYMMDD_Operating_Manual_ Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x**	☐ OK ☐ Defects ☐ N/A
4.5.5	Punch List Items Closed	**Test Layout:** **Review and confirm no category A open punch list items are outstanding.** **Pass Fail Criteria:** **No category A open punch list items are outstanding.**	☐ OK ☐ Defects ☐ N/A
4.5.6	LOTO	**Apply LOTO as required.**	☐ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
Remarks:		

4.6 Visual Inspection of Converter Cooling System and Heat Exchanger

Check the correct installation and connection of the cooling system. Document the qualification results in the following table.

TR04	Test		Result
4.6.1	**Water drop check**	**Test Layout:** Check that no drops of water can be seen at the connection points of the coolant hoses. **Pass Fail Criteria:** No water on the connection points of coolant hoses.	☐ OK ☐ Defects ☐ N/A
4.6.2	**Heat exchanger visual inspection**	**Test Layout:** Check the external heat exchanger for proper connection and mechanical stability. **Pass Fail Criteria:** Heat exchanger is properly mechanically installed	☐ OK ☐ Defects ☐ N/A
4.6.3	**I/O check**	**Test Layout:** Check the electrical connection to the Heat exchanger unit **Pass Fail Criteria:** Heat exchanger is properly connected	☐ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
Remarks:		

4.7 Power On

Sequentially power on all the subsystems. Document the qualification results in the following table.

Please refer to the SLD on page 1a and 2a of the overall schematics for PCS:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Note:
Prior to carrying out any work, the commissioning engineer to check the current version of the reference document is available.

TR05	Test		Result
4.7.1	**Check LOTO of subsystem**	**Test Layout:** Check that all breakers feeding subsystems are turned to OFF position and LOTO **Pass Fail Criteria:** LOTO confirmed	☐ OK ☐ Defects ☐ N/A
4.7.2	**Remove LOTO from main feeding source (RM board)**	**Test Layout:** Remove LOTO from main feeding source and measure voltage across incoming cable. **Pass Fail Criteria:** Voltage is read at incoming feeding terminals.	☐ OK ☐ Defects ☐ N/A
4.7.3	**Supply voltage control cabinet**	**Test Layout:** Switch on 190F3 **Pass Fail Criteria:** Cabinet lights and socket power up	☐ OK ☐ Defects ☐ N/A
4.7.4	**Supply voltage control cabinet**	**Test Layout:** Switch on 191F1 **Pass Fail Criteria:** Clima 1 power up	☐ OK ☐ Defects ☐ N/A
4.7.5	**Supply voltage control cabinet**	**Test Layout:** Switch on 191F2 **Pass Fail Criteria:** Clima 2 power up	☐ OK ☐ Defects ☐ N/A
4.7.6	**Supply voltage control cabinet**	**Test Layout:** Switch on 101Q1. The control unit starts up properly. **Pass Fail Criteria:** Pass: - Simotion turns on - HMI turns on properly and WebVisualization (WebVisu) access is active Access to Simotion WebVisu is established and “Run” state of Simotion can be confirmed	☐ OK ☐ Defects ☐ N/A
4.7.7	**Supply voltage control cabinet**	**Test Layout:** Remove LOTO and switch on 84F2 **Pass Fail Criteria:** Voltage read at feeding terminals	☐ OK ☐ Defects ☐ N/A
4.7.8	**Supply voltage control cabinet**	**Test Layout:** Switch on 183F1	

TR05	Test		Result
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A
4.7.9	**Supply voltage control cabinet**	**Test Layout:** Switch on 183F2 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A
4.7.10	**Supply voltage control cabinet**	**Test Layout:** Switch on 185F1 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A
4.7.11	**Supply voltage control cabinet**	**Test Layout:** switch on 185F2 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A
4.7.12	**Supply voltage control cabinet**	**Test Layout:** Switch on 187F1 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A
4.7.13	**Supply voltage control cabinet**	**Test Layout:** Switch on 181Q1 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A
4.7.14	**Supply voltage control cabinet**	**Test Layout:** Switch on 181Q2 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A
4.7.15	**Supply voltage control cabinet**	**Test Layout:** Switch on 182Q1 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
Remarks:		

4.8 Software and Function Tests

Check the following software functions. Document the qualification results in the following table.

TR06	Test		Result	Completed by	Witnessed by	Date
4.8.1	**Leakage and connections check**	**Test Layout:** Check the converter water cooling system for proper connection and leaks. Run cooling system and perform visual check of connections and check for leaks **Pass Fail Criteria:** All connections are properly connected and no leakage present.	☐ OK ☐ Defects ☐ N/A			
4.8.2	**Pressure check**	**Test Layout:** Check whether the pressure of the cooling system is above 3 bar. Check on the manometer of the converter cooling system cabinet (COSY) and verify value on HMI/WebVisu. **Pass Fail Criteria:** Manometer and HMI/WebVisu indicate a pressure of 3 bar.	☐ OK ☐ Defects ☐ N/A			
4.8.3	**Check pre-heating** **4.5 FAT**	**Test Layout:** Connecting the converter via interface: • Check the pre-heating of the converter for proper functionality • Check the pre-charge and DC link control for proper functionality **Pass Fail Criteria:** - Heat exchanger switches on and off correctly (visual check) - Preheating status is correctly indicated by the HMI/WebVisu. - Pump is running (visual check) - Heater is heating up the coolant (check coolant temperature on HMI/WebVisu)	☐ OK ☐ Defects ☐ N/A			
4.8.4	**UPS** **4.13 FAT**	**Test Layout:** Checking the UPS functionality. If the auxiliary supply fails (e.g. by activating the fuse of the AC power supply unit), the control cabinet continues to be supplied by the UPS. **Pass Fail Criteria:** After the defined time, the control cabinet is switched off completely. When the voltage returns, the control unit starts up again and the UPS battery is charged.	☐ OK ☐ Defects ☐ N/A			
4.8.5	**Smoke detectors**	**Test Layout:** Test the smoke detector in PCS CON-cabinet with test spray.				

TR06	Test		Result	Completed by	Witnessed by	Date
		Pass Fail Criteria: The smoke detectors trigger accordingly and an error (Error level 4) is generated.	☐ OK ☐ Defects ☐ N/A			
4.8.6	**Communication test interface signals FREQCON->Customers**	**Test Layout:** Connecting communication interface to customer higher level controller. Transferring status signals to customer via comm interface. Check all signals listed in the comm interface list. **Reference document:** 23A2007_240628_PROFINET_Register BESS_V1_0_0_3	☐ OK ☐ Defects ☐ N/A			
		Pass Fail Criteria: The transmitted signals received via Profinet interface is plausible and correct.				
4.8.7	**Communication test interface signals Customer->Freqcon**	**Test Layout:** Connecting Profinet interface to customer higher level controller. Transferring control signals from customer higher level controller to BESS main controller via Profinet interface. Check all signals listed in the comm interface list. **Reference document:** 23A2007_240628_PROFINET_Register BESS_V1_0_0_3	☐ OK ☐ Defects ☐ N/A			
		Pass Fail Criteria: The transmitted signals received via Profinet interface are plausible and lead to foreseen behaviour.				

Remarks:

5 BESS 1 and 2

5.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3
FAT punchlist tracker	20240828 - punchlist - FRQ comments v2.4

5.2 BESS Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR0x test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding. Any re-work on the electrical installation is completed.

- LOTO equipment
- Gas test spray equipment

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400 VAC Aux BESS – auxiliary load BESS B-200 <> 84W2
- Temporary 230 V AC Multiple socket outlet (e.g. to supply Laptop, temporary lights etc.)

Remarks:

5.3 Container Visual Inspection BESS 1

Check all system parts, including external and internal parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR07	Examination		Result
5.3.1	**Damage**	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☐ OK ☐ Defects ☐ N/A
5.3.2	**Earthing connections**	The earthing lugs are in the correct position (compare CAD) and are not painted	☐ OK ☐ Defects ☐ N/A
5.3.3	**Warnings**	The required warning signs are located on the personnel doors	☐ OK ☐ Defects ☐ N/A
5.3.4	**Accessibility**	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☐ OK ☐ Defects ☐ N/A
5.3.5	**Installation of components and cables in the container**	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☐ OK ☐ Defects ☐ N/A
5.3.6	**Cable bushings**	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☐ OK ☐ Defects ☐ N/A
5.3.7	**LOTO**	**Apply LOTO as required.**	☐ OK ☐ Defects ☐ N/A

5.4 Container Visual Inspection BESS 2

Check all system parts, including external and internal parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR08	Examination		Result
5.4.1	**Damage**	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☐ OK ☐ Defects ☐ N/A
5.4.2	**Earthing connections**	The earthing lugs are in the correct position (compare CAD) and are not painted	☐ OK ☐ Defects ☐ N/A
5.4.3	**Warnings**	The required warning signs are located on the personnel doors	☐ OK ☐ Defects ☐ N/A
5.4.4	**Accessibility**	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☐ OK ☐ Defects ☐ N/A
5.4.5	**Installation of components and cables in the container**	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☐ OK ☐ Defects ☐ N/A
5.4.6	**Cable bushings**	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☐ OK ☐ Defects ☐ N/A
5.4.7	**LOTO**	Apply LOTO as required.	☐ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
Remarks:		

5.5 Power On BESS 1

Sequentially power on all the subsystems. Document the qualification results in the following table.

Please refer to the SLD on page 1a and 2a of the overall schematics for battery container 1:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Note:
Prior to carrying out any works, the commissioning engineer to check the current version of the reference document is available.

TR09	Test		Result
5.5.1	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components). **Pass Fail Criteria:** • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2	☐ OK ☐ Defects ☐ N/A
5.5.2	**Check LOTO of subsystem**	**Test Layout:** Check that all breakers feeding subsystems are turned to OFF position and LOTO **Pass Fail Criteria:** LOTO confirmed	☐ OK ☐ Defects ☐ N/A
5.5.3	**Remove LOTO from main feeding source (RM Board)**	**Test Layout:** Remove LOTO from main feeding source and measure voltage across incoming cable. **Pass Fail Criteria:** Voltage is read at incoming feeding terminals.	☐ OK ☐ Defects ☐ N/A
5.5.4	**Remove LOTO from main feeding source**	**Test Layout:** Remove LOTO and switch on 684F1. **Pass Fail Criteria:** Voltage read at downstream feeding terminals.	☐ OK ☐ Defects ☐ N/A
5.5.5	**Supply voltage**	**Test Layout:** Switch on 690F1 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (container lights)	☐ OK ☐ Defects ☐ N/A
5.5.6	**Supply voltage**	**Test Layout:** Switch on 690F2	

TR09	Test		Result
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (sockets)	☐ OK ☐ Defects ☐ N/A
5.5.7	**Supply voltage**	**Test Layout:** Switch on 690F3, 690F4, 690F5 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (cranes)	☐ OK ☐ Defects ☐ N/A
5.5.8	**Supply voltage**	**Test Layout:** Switch on 101Q1. The control unit starts up properly. **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (DC power supply)	☐ OK ☐ Defects ☐ N/A
5.5.9	**Supply voltage**	**Test Layout:** Switch on 691F4 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (cooling units)	☐ OK ☐ Defects ☐ N/A
5.5.10	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F3 **Pass Fail Criteria:** Voltage read at downstream feeding terminals	☐ OK ☐ Defects ☐ N/A
5.5.11	**Supply voltage**	**Test Layout:** Switch on 691F1, 691F2, 691F3 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (emergency ventilation and louvers)	☐ OK ☐ Defects ☐ N/A
5.5.12	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F4 **Pass Fail Criteria:** Voltage read at downstream feeding terminals	☐ OK ☐ Defects ☐ N/A
5.5.13	**Supply voltage**	**Test Layout:** Sequentially switch on 687F1, 687F2, 687F3, 687F4, 687F5, 687F6, 688F1, 688F2, 688F3, 688F4, 688F5 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
Remarks:		

5.6 Power On BESS 2

Sequentially power on all the subsystem. Document the qualification results in the following table.

Please refer to the SLD on page 1a and 2a of the overall schematics for Battery Container 2:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Note:
Prior to carrying out any works, the commissioning engineer to check the current version of the reference document is available.

TR10	Test		Result
5.6.1	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components). **Pass Fail Criteria:** • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2	☐ OK ☐ Defects ☐ N/A
5.6.2	**Check LOTO of subsystem**	**Test Layout:** Check that all breakers feeding subsystems are turned to OFF position and LOTO **Pass Fail Criteria:** LOTO confirmed	☐ OK ☐ Defects ☐ N/A
5.6.3	**Remove LOTO from main feeding source (RM Board)**	**Test Layout:** Remove LOTO from main feeding source and measure voltage across incoming cable. **Pass Fail Criteria:** Voltage is read at incoming feeding terminals.	☐ OK ☐ Defects ☐ N/A
5.6.4	**Remove LOTO from main feeding source**	**Test Layout:** Remove LOTO and switch on 684F1. **Pass Fail Criteria:** Voltage read at downstream feeding terminals.	☐ OK ☐ Defects ☐ N/A
5.6.5	**Supply voltage**	**Test Layout:** Switch on 690F1 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (container lights)	☐ OK ☐ Defects ☐ N/A
5.6.6	**Supply voltage**	**Test Layout:** Switch on 690F2	

TR10	Test		Result
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (sockets)	☐ OK ☐ Defects ☐ N/A
5.6.7	**Supply voltage**	**Test Layout:** Switch on 690F3, 690F4, 690F5 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (cranes)	☐ OK ☐ Defects ☐ N/A
5.6.8	**Supply voltage**	**Test Layout:** Switch on 101Q1. The control unit starts up properly. **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (DC power supply)	☐ OK ☐ Defects ☐ N/A
5.6.9	**Supply voltage**	**Test Layout:** Switch on 691F4 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (cooling units)	☐ OK ☐ Defects ☐ N/A
5.6.10	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F3 **Pass Fail Criteria:** Voltage read at downstream feeding terminals	☐ OK ☐ Defects ☐ N/A
5.6.11	**Supply voltage**	**Test Layout:** Switch on 691F1, 691F2, 691F3 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (emergency ventilation and louvers)	☐ OK ☐ Defects ☐ N/A
5.6.12	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F4 **Pass Fail Criteria:** Voltage read at downstream feeding terminals	☐ OK ☐ Defects ☐ N/A
5.6.13	**Supply voltage**	**Test Layout:** Sequentially switch on 687F1, 687F2, 687F3, 687F4, 687F5, 687F6, 688F1, 688F2, 688F3, 688F4, 688F5 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up	☐ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
Remarks:		

5.7 Function and Safety Critical Tests BESS 1, BESS 2 and PCS

Check system components of all battery cabinets (one cabinet in each container section) inside BESS 1 and 2 container and the following software functions. Document the qualification results in the following table.

Please refer to Appendix for the cause and effect description for the different detectors/sensors.

TR11	Test		Result	Completed by	Witnessed by	Date
5.7.1	**Check smoke detectors BESS 1**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☐ OK ☐ Defects ☐ N/A			
5.7.2	**Check CO detectors BESS 1**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☐ OK ☐ Defects ☐ N/A			
5.7.3	**Check H2 BESS 1**	**Test Layout:** Check the correct functionality of the H2 exhaust system (detection and gas removal) in case of TR/gas event. Sample gas trigger. Check correct behaviour of the BESS: - All battery cabinets decouple from PCS DC side - 80Q1 (Main AC breaker) opens - Air dampers are working - All exhaust system units in container roofs are operating - Fire&Gas is transmitted to higher level controller via hard wired signal	☐ OK ☐ Defects ☐ N/A			

TR11	Test		Result	Completed by	Witnessed by	Date
		Pass Fail Criteria: TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - F&G successfully transmitted to higher level controller via hard wired signal				
5.7.4	**Check smoke detectors BESS 2**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☐ OK ☐ Defects ☐ N/A			
5.7.5	**Check CO detectors BESS 2**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☐ OK ☐ Defects ☐ N/A			

TR11	Test		Result	Completed by	Witnessed by	Date
5.7.6	**Check H2 BESS 2**	**Test Layout:** Check the correct functionality of the H2 exhaust system (detection and gas removal) in case of TR/gas event. Sample gas trigger. Check correct behaviour of the BESS: - All battery cabinets decouple from PCS DC side - 80Q1 (Main AC breaker) opens - Air dampers are working - All exhaust system units in container roofs are operating - Fire&Gas is transmitted to higher level controller via hard wired signal	☐ OK ☐ Defects ☐ N/A			
		Pass Fail Criteria: TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - F&G successfully transmitted to higher level controller via hard wired signal				

6 Battery Modules

6.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3

6.2 Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR12 test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding. Any re-work on the electrical installation is completed.

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400 VAC aux BESS – *auxiliary load BESS B-200 <> 84W2*

Note – the battery modules have been tested after assembly for quality assessment (reports available) and have been tested for functionality and capacity prior to shipping (reports available).

Remarks:

6.3 Installation Report

Check the correct installation and connection of the battery modules in the BESS 1 and BESS 2 containers. Document the qualification results in the following table.

TR12	Test		Result	Completed by	Witnessed by	Date
6.3.1	**Installation report for cabinets**	**Test Layout:** Report issued for the following racks: BESS 1 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 BESS 2 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 **Pass Fail Criteria:** All cabinets have been checked and report is available	☐ OK ☐ Defects ☐ N/A			
6.3.2	**LOTO**	Check DC fused are disconnected.	☐ OK ☐ Defects ☐ N/A			

7 System Tests

7.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3

7.2 Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR0x test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding. Any re-work on the electrical installation is completed.

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400VAC aux BESS – *auxiliary load BESS B-200 <> 84W2*
- 6.6 kV AC
- (FREQCON) power meter needs to be connected to AC busbars for voltage measurement before energization

Remarks:

7.1 Software and Function Tests

Check the following software functions. Document the qualification results in the following table.

Note – in the event that BLPH control system connections are not available at this time, consideration must be given to implement temporary safety measures e.g. use of local temporary pushbutton in lieu of no trip signal from BLPH control system. To be fully risk assessed at site prior to any implementation.

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.1	**LOTO main connection and electro mechanical lock in place**	**Test Layout:** Confirm BESS AC connection is LOTO and captive key to earth the transformer is available before energizing the system. Confirm all system mains (80Q1) is open. **Pass Fail Criteria:** Transformer connections are correct. Captive key is retrieved, transformer is grounded. 80Q1 open.	☐ OK ☐ Defects ☐ N/A			
7.1.2	**Transformer inspection**	**Test Layout:** MV and LV connections are completed and according to as built electrical drawings. After visual inspection, lock the door and extract the captive key for energization. **Pass Fail Criteria:** Transformer connections are correct. Key is available for energization	☐ OK ☐ Defects ☐ N/A			
7.1.3	**Energize AC connection**	**Test Layout:** Energize main AC connection. - Transformer is energized - Turn on mains (80Q1). **Pass Fail Criteria:** Inverter units energized, no unexpected trips.	☐ OK ☐ Defects ☐ N/A			
7.1.4	**Check pre-charging and DC link control** **4.7 FAT**	**Test Layout:** Connecting the converter via interface: • Check the pre-charge and DC link control for proper functionality **Pass Fail Criteria:** **Precharge:** - Precharging process is indicated by HMI/WebVisu. - After precharging process is done, the green “Ready for Operation” is indicated by HMI/WebVisu. **DC Link Control:** - Verify correct DC-link voltage level was successfully reached and held via HMI/WebVisu.	☐ OK ☐ Defects ☐ N/A			

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.5	Check IGBTs	**Test Layout:** Check IGBT activation. **Pass Fail Criteria:** - IGBTs can be switched without any problems - Operating status is indicated by by HMI/WebVisu.	☐ OK ☐ Defects ☐ N/A			
7.1.6	Check DC ports	**Duration: After reaching 250 A test duration is 10 min.** **Test Layout:** **<u>DC ports:</u>** Connection to customer AC mains is performed in order to work AC power. Each port will be charged with 250 kW which corresponds to a current of 250 A. DC ports connection Increase the DC current setpoint slowly to 250 A and keep this value for 10 minutes. **<u>Heat run:</u>** Check if temperatures of - IGBTs - Inductors - Coolant of converter cooling system are within the permissible ranges by verifying the temperature values displayed on the HMI/WebVisu. **Pass Fail Criteria:** **<u>DC Ports:</u>** DC current output of 250 A is displayed on the HMI/WebVisu according to setpoint. **<u>Heat Run:</u>** IGBT, inductor and converter cooling system coolant temperatures are below the temperature thresholds set in the control system.	☐ OK ☐ Defects ☐ N/A			

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.7	**Check DC port current/offset control**	**Test Layout:** Check the DC port current control / offset control and check for oscillations.	☐ OK ☐ Defects ☐ N/A			
		Pass Fail Criteria: Oscillations are within the permissible range of +/- 10% of 250A.				
7.1.8	**Check temperature values**	**Test Layout:** Check all temperature values displayed on the HMI/WebVisu for plausibility.	☐ OK ☐ Defects ☐ N/A			
		Pass Fail Criteria: The temperature values indicated on the HMI/WebVisu are plausible. IGBTs: 30 … 65 °C Inductors: 30 … 120°C Cooling water: 27 … 55 °C				
7.1.9	**Measurements** **4.11 FAT**	**Test Layout:** Check if the measured values (voltages and currents) are properly collected by the Simotion (PCS main controller) and verify by using a multimeter or current clamp at DC and AC side.	☐ OK ☐ Defects ☐ N/A			
		Pass Fail Criteria: Values measured with multimeter correspond +/-5% to the values displayed on the HMI/WebVisu.				
7.1.10	**Check temperature derating functionality**	**Test Layout:** Check the temperature derating for proper functionality. For this purpose, lower the temperature setpoints.	☐ OK ☐ Defects ☐ N/A			
		Pass Fail Criteria: PCS lowers power according to the set derating thresholds.				
7.1.11	**Switching-off** **4.12 FAT**	**Test Layout:** Switching off the inverter. The inverter is properly switched off by removing the control bits.	☐ OK ☐ Defects ☐ N/A			
		Pass Fail Criteria: “OFF” state is indicated by the HMI/WebVisu.				

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.12	**Battery capacity test**	**Test Layout:** Capacity test / load test as required. Check the temperature behavior of the converter system during the test. Make sure plots include: - Power AC - Power DC - Voltage DC - Cell voltage max and min - Cell temp max and min - Room temperatures - Filter temperature - SOC **Pass Fail Criteria:** Capacity was successfully reached without power derating and all temperatures in acceptable ranges.	☐ OK ☐ Defects ☐ N/A			
7.1.13	**Performance Test** **AC output**	**Test Layout:** **Duration: After reaching 1000 A duration test of 10 min.** **Test Layout:** Increase the AC current setpoint value slowly to 1000 A output and keep this value for 10 minutes. **Pass Fail Criteria:** AC current output of 1000 A is displayed correctly on the HMI/WebVisu according to setpoint.	☐ OK ☐ Defects ☐ N/A			

8 Employees Present

Identify each employee involved in the execution of this protocol. Document the employee 's name, signature, name abbreviation and date in the following table:

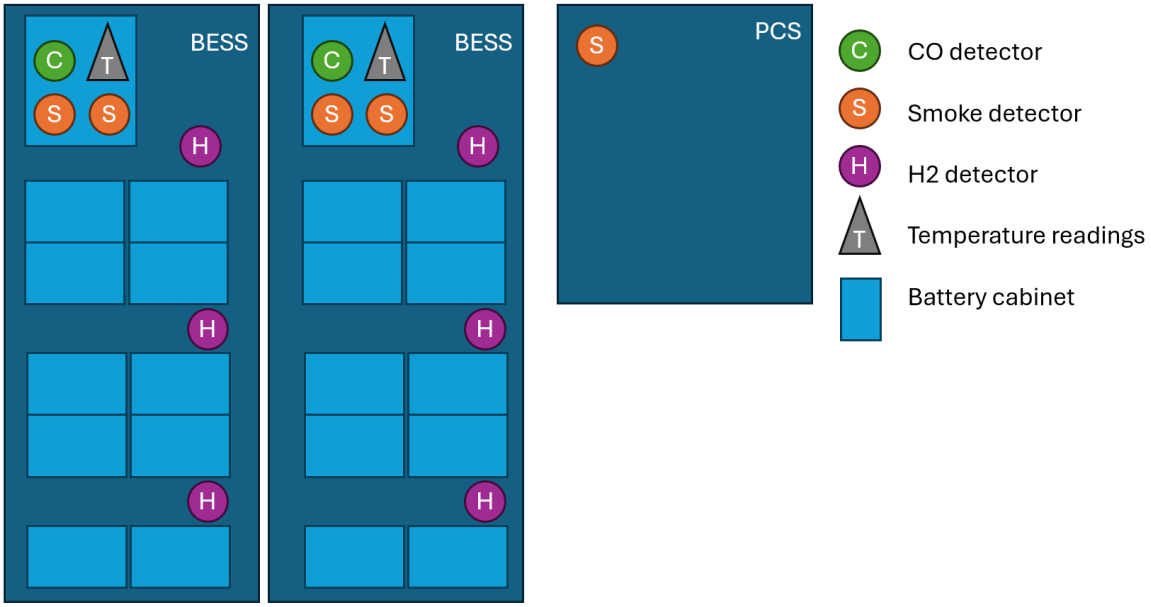
Company Name	Employee Name	Employee Signature	Abbreviation	Date

	Yes/No
All persons involved in the SAT were documented.	☐ Y ☐ N

Remarks:

9 Appendix

9.1 Fire and Gas Cause and Effect



Simplified representation of the location of different components within the BESS system.

9.1.1 PCS container

1x smoke detector – trigger 1-out-of-1 – it can be reset remotely.
Once triggered it sends 85-XA-002 (confirmed smoke) hardwired signal to EMCS.
PCS Control Cabinet XT1-3&4

9.1.2 BESS container

3x H2 detectors – trigger is 2-out-of-3.
It generates 85-XA-001 (confirmed gas) hardwired signal to EMCS.
PCS Control Cabinet XT1-1&2

9.1.3 BESS cabinets (1 to 11 in each container) - independent reaction

1x CO detector – trigger is 1-out-of-1
2x Smoke detectors – trigger is 2-out-of-2
Module Temperature reading (from BMS) – trigger is > 60°C
They generate 85-XA-004 (Confirmed Thermal Runaway) hardwired signal to EMCS
Note: each detector type works independently. The first one to reach the triggers conditions will activate the HW signal to EMCS.

10 Check and Approval

The SAT protocol becomes the SAT report when it has been completed as the individual test reports have been completed and labelled with a test date. The SAT report is submitted to the customer for confirmation and the results must be documented in TR14.

TR14	**Examination and authorisation of execution**
Check the test results and the original data. Final assessment for SAT	
□ PASS	□ NOT PASSED
If there are any unresolved discrepancies, please fill in the following “remarks” table.	
Specify whether or not these unresolved discrepancies may affect the completion of the SAT.	
□ YES	□ NO

Remarks:

Carried out by:		Date:	
	FREQCON GmbH		YYYY/MM/DD
Authorised by:		Date:	
	Customer		YYYY/MM/DD

STATRON
NON STOP POWER

Certificate for Safe Transport Goods - BESS Battery

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Material Safety Data Sheet

Section 1 – IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product Name: Li-ion Battery

Battery type: Li-ion Battery

Model	Voltage	Capacity（Ah）			Energy（Wh）
		Typical	Min	MAX	
LF280K	3.2V	280	/	/	896

Product Use: Energy Storage System

MSDS Date of Preparation: April 6th, 2021 ； Updated：/

Company Identification:

Name： EVE POWER Co., Ltd.

Address: No.68, Jingnan Avenue, Jingmen Hi-teck Zone, 448000 Jingmen City, Hubei Province

Post Code: 448000

Tel: +86-724-6079630

Fax:+86-724-6079688

Section 2 - Hazards Identification

- **Health Hazards (Acute and Chronic)**

These chemicals are contained in a sealed Al foil. Risk of exposure occurs only if the battery is mechanically or electrically abused. Contact of electrolyte with skin and eyes should be avoided.

- **Sign/Symptoms of Exposure**

A shorted battery can cause thermal and chemical burns upon contact with the skin. Maybe a reproductive hazard.

These products are classified as Articles under REACH and are not subject to the requirements for Information in the Supply Chain (Safety Data Sheets and Labels). While batteries may release hazardous substances if damaged, this is not an intended release as defined under REACH. Batteries are not classified as hazardous under the CLP.

The following information is provided to assist in the safe use of our products.

CAUTION: Battery can explode or leak if heated, disassembled, shorted, recharged, exposed to fire or high temperature or inserted incorrectly. Keep in original package until ready to use. Do not carry batteries

loose in your pocket or purse. Keep batteries away from children. If swallowed, consult a physician at once.

Under certain misuse conditions and by abusively opening the battery, exposed lithium can react with water or moisture in the air causing potential thermal burns or fire.

Section 3 – Composition/Information on Ingredient

Material or ingredient	Chemical Formula	CAS No.	Wt %

Lithium iron phosphate	$LiFePO_4$	/	37.0
Phosphate(1-),hexafluoro,lithium	$LiPF_6$	(CAS-No.)21324-40-3 (EC-No.)244-334-7	3.2
Graphite	C	(CAS-No.)7782-42-5 (EC-No.)231-955-3	19.1
Aluminum	Al	(CAS-No.)7429-90-5 (EC-No.)231-072-3 (EC Index-No.)013-002-00-1	4.6
Copper	Cu	(CAS-No.)7440-50-8 (EC-No.)231-159-6	7.5
Polypropylene	PP	(CAS-No.) 9003-07-0 (EC-No.)618-352-4	4.8

Section 4 - First Aid Measures

- **General Advice**

  The chemicals in this product are contained in a sealed package. Exposure to the contents will not occur unless the battery leaks, is exposed to high temperatures or is mechanically, physically, or electrically abused.

- **Eye**

  Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

- **Skin**

  Remove contaminated clothes and rinse skin with plenty of water or shower for 15 minutes. Get medical aid.

- **Inhalation**

  Remove from exposure and move to fresh air immediately. Use oxygen if available.

- **Ingestion**

  Give at least 2 glasses of milk or water. Induce vomiting unless patient is unconscious. Call a physician.

- **Note to Physician**

  Published reports recommend removal from the esophagus be done endoscopically (under direct visualization). Batteries beyond the esophagus need not be retrieved unless there are signs of injury to the GI tract or a large diameter battery fails to pass the pylorus. If asymptomatic, follow up x rays are necessary only to confirm the passage of larger batteries. Confirmation by stool inspection is preferable under most circumstances. Potential leakage of less than 50 milligrams of dimethoxyethane and propylene carbonate. Dimethoxyethane rapidly evaporates. Do not give ipecac.

Section 5 - Fire Fighting Measures

- **Fire and Explosion Hazards**: Batteries may burst and release hazardous decomposition products when exposed to a fire situation.
- **Extinguishing Media**

  CO_2.

- **Special Fire-Fighting Procedures**

  Self-contained breathing apparatus.
- **Unusual Fire and Explosion Hazards**

  Cell may vent when subjected to excessive heat-exposing battery contents.
- **Hazardous Combustion Products**

  Carbon monoxide, carbon dioxide, lithium oxide fumes.

Section 6 - Accidental Release Measures

- **Steps to be Taken in case Material is Released or Spilled**

  If the battery material is released, remove personnel from area until fumes dissipate. Provide maximum ventilation to clear out hazardous gases. Wipe it up with a cloth, and dispose of it in a plastic bag and put into a steel can. The preferred response is to leave the area and allow the battery to cool and vapors to dissipate. Provide maximum ventilation. Avoid skin and eye contact or inhalation of vapors. Remove spilled liquid with absorbent and incinerate.
- **Waste Disposal Method**

  It is recommended to discharge the battery to the end, handing in the abandoned batteries to related department unified, dispose of the batteries in accordance with approved local, state, and federal requirements. Consult state environmental protection agency and/or federal EPA.

Section 7 - Handling and Storage

The battery should not be opened, destroyed or incinerate, since they may leak or rupture and release to the environment the ingredients that they contain in the hermetically sealed container.

Do not short circuit terminals, or over charge the battery, forced over-discharge, throw to fire. Do not crush or puncture the battery, or immerse in liquids.

- **Precautions to be taken in Handling and Storing**

  Avoid mechanical or electrical abuse. Storage preferably in cool, dry and ventilated area, which is subject to little temperature change. Storage at high temperatures should be avoided.

  Do not place the battery near heating equipment, nor expose to direct sunlight for long periods.
- **Other Precautions**

  The battery may explode or cause burns, if disassembled, crushed or exposed to fire or high temperatures.

  Do not short or install with incorrect polarity.
- **Storage**

  Store batteries in a dry place at normal room temperature.

Section 8 - Exposure Controls, Personal Protection

- **Exposure Limits**: No exposure to the battery components should occur during normal use.
- **Ventilation:** Not necessary under conditions of normal use.
- **Respiratory Protection**

  In case of battery venting, provide as much ventilation as possible. Avoid confined areas with venting cell cores. Respiratory Protection is not necessary under conditions of normal use.
- **Skin Protection:** None required for normal use. Use butyl rubber gloves when handling leaking

batteries..

- **Eye Protection:** None required for normal use. Wear safety goggles when handling leaking batteries.
- **Protective Gloves**

  Not need
- **Other Protective Clothing or Equipment**

  Not necessary under conditions of normal use.

  Personal Protection is recommended for venting battery: Respiratory protection, Protective gloves, protective clothing and safety glass with side shields.

Section 9 - Physical and Chemical Properties

Appearance and Odor: prismatic cell, no odor.

Water Solubility: Insoluble

Flash Point: Not Applicable

Section 10 - Stability and Reactivity

- **Stability**

  Stable
- **Conditions to Avoid**

  Heating, mechanical abuse and electrical abuse.
- **Hazardous Decomposition Products**

  N/A.
- **Hazardous Polymerization**

  N/A.

Section 11 - Toxicological Information

- **Potential Health Effects**: The chemicals in this product are contained in a sealed package. Exposure to the contents will not occur unless the battery leaks, is exposed to high temperatures or is mechanically, physically, or electrically abused.
- **Eye Contact**: Contact with battery contents may cause irritation.
- **Skin Contact**: Contact with battery contents may cause irritation.
- **Inhalation**: Inhalation of vapors or fumes released due to heat or a large number of leaking batteries may cause respiratory and eye irritation.
- **Ingestion**: Seek immediate medical advice. Batteries lodged in the esophagus should be removed immediately since leakage, caustic burns and perforation package occur as soon as two hours after ingestion. Irritation to the internal/external mouth areas, may occur following exposure to a leaking battery.

Section 12 - Ecological Information

When promptly used or disposed the battery does not present environmental hazard. When disposed, keep away from water, rain and snow.

Section 13 - Disposal Considerations

- **APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION**

  If batteries are still fully charged or only partially discharged, they can be considered a reactive hazardous waste because of significant amount of not reaction or unconsumed lithium remaining in the spent battery. The battery must be neutralized through an approved secondary treatment facility prior to disposal as a hazardous waste. Recycling of battery can be done in authorized facility, through licensed waste carrier.

  lithium ion cell batteries are labeled in compliance with the EU Battery Directive 2006/66/EC.

Section 14 - Transport Information

Emergency Phone Number:

CHEMTREC 24 Hour Emergency Response Hotline （+86-752-2606966）

Persons who prepare or offer lithium batteries for transport are required by regulation to be trained and certified.

The information provided below is for informational purposes only.

Lithium Ion Batteries
UN No.：UN3480
EmS No.:F-A,S-I
Marine pollutant:No
Proper shipping name:Lithium ion battery（Including lithium ion ploymer batteries）
Hazard classification: The goods shall be complied with the requirements of section IA of Packing Instructions 965 of 61 th DGR Manual of IATA（2020）Edition and special provision 188 of IMDG CODE（Amdt.39-18）Edition,including the passing of the UN38.3 test.

The products meet all the requirements of the IATA DGR 61th edition, under special provisions including UN 38.3 test . If the package exceeds the table 965 - the - standard, so it belongs to the ninth category of dangerous goods. Only cargo transport. According to the packing instructions 965 Part IA IATA 61th version of the DGR requirements.

Lithium ion cells and batteries must be offered for transport at a state of charge (SoC) not exceeding 30% of their rated design capacity from 1 April 2016.

Shipping packages containing rechargeable lithium batteries must be labeled, regardless of size or number of batteries, with a lithium battery handling label.

More information concerning shipping, testing, marking and packaging can be obtained from Label master at http://www.labelmaster.com.

Separate battery when shipping to prevent short-circuiting. They should be packed in strong packaging for support during transport. Take in a cargo of them without falling, dropping, and breakage. Prevent

collapse of cargo piles and wet by rain.

Section 15 - Regulatory Information

- **Law Information**

  《Dangerous Goods Regulation》

  《Recommendations on the Transport of Dangerous Goods Model Regulations》

  《International Maritime Dangerous Goods》

  《Technical Instructions for the Safe Transport of Dangerous Goods》

  《Classification and code of dangerous goods》

  《Occupational Safety and Health Act》(OSHA)

  《Toxic Substances Control Act》(TSCA)

  《Consumer Product Safety Act》(CPSA)

  《Federal Environmental Pollution Control Act》(FEPCA)

  《The Oil Pollution Act》(OPA)

  《Superfund Amendments and Reauthorization Act Title III (302/311/312/313)》(SARA)

  《Resource Conservation and Recovery Act》(RCRA)

  《Safety Drinking Water Act》(CWA)

  《California Proposition 65》

  《Code of Federal Regulations》(CFR)

EU BATTERY DIRECTIVE: These batteries comply with the Directive substance limits and labeling requirements.

EU REACH REGISTRATION: These products are manufactured articles and not subject to REACH registration requirements.

EU Labeling: lithium ion cell batteries are labeled in compliance with the EU Battery Directive 2006/66/EC.

Section 16 – Other Information

EVE Hazard Rating: Health: 0 Fire: 0 Reactivity: 0

==========

Data supplied is for use only in connection with occupational safety and health.

DISCLAIMER: This MSDS is intended to provide a brief summary of our knowledge and guidance regarding the use of this material. The information contained here has been compiled from sources considered by EVE to be dependable and is accurate to the best of the Company's knowledge. It is not meant to be an all inclusive document on worldwide hazard communication regulations.

STATRON
NON STOP POWER

Material Safety Data Sheet - BESS Battery

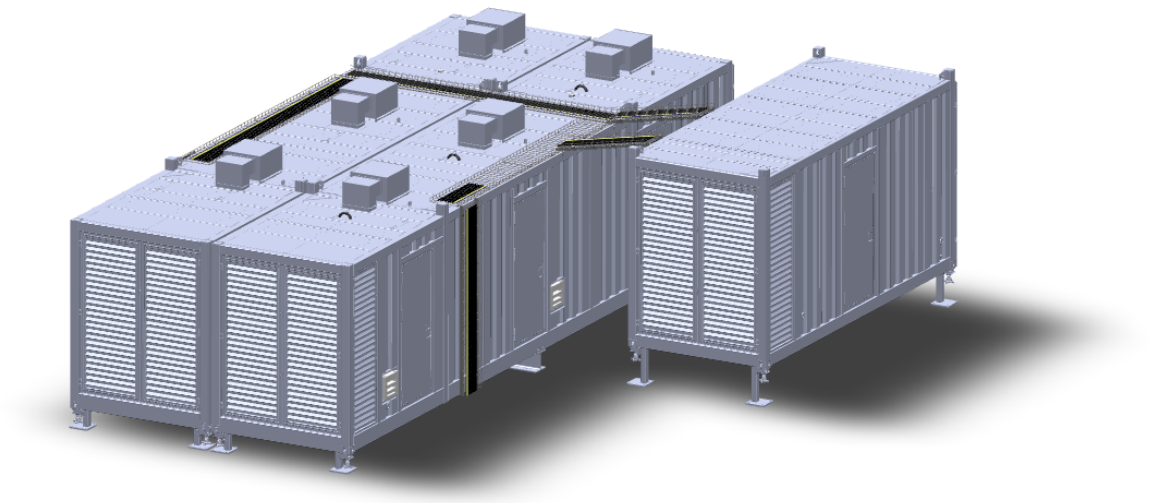
Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

FREQCON

Operating and Maintenance Manual
BESS PRO

1 MW/ 5 MWh
6.6 kV AC

Stationary Battery Energy Storage System (BESS)



Version	Date	Name	Description
v0.4	2024-08-22	M. Müller C. Palenzuela	First draft version
v1.0	2025-01-22	M. Müller C. Palenzuela	Final version
v1.1	2025-01-31	M. Müller	Updated version
v1.2	2025-02-05	C. Palenzuela	Updated section 11.2.3.1

Table 1: Version overview

	Date	Name
Editor:	2024-08-22	M. Müller C. Palenzuela
Checked by:	2024-08-24	M. Müller
Approved by:	2024-08-24	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware/Software Development and Production Centre

FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Deutschland

Phone: +49 (0) 5165 - 291 760 - 0

E-Mail:
info@freqcon.com

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.com**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Service

Service hotline for repair, complaints and maintenance from Monday to Thursday from 9:00 am - 4:00 pm and Friday from 9:00 am - 2:00 pm:

Phone: +49 (0) 5165 – 291 760 – 50

E-Mail:
service@freqcon.com

Content

1 About these Instructions 11
1.1 Disclaimer of Liability 12
1.2 Applicable Documents 12
1.3 Abbreviations 12
1.4 Warning Symbols 13
1.5 Information Symbols 14
1.6 Warning Levels / Signal Words 14
1.7 Target Groups 15
2 Safety Instructions 16
2.1 The Five Safety Rules 16
2.2 Basic Safety Information 16
2.3 Safety Instructions Battery Storage Unit 25
2.3.1 Safety Data Sheet 26
2.3.2 Personal Protection 26
2.3.3 Fire Fighting Measures 28
2.3.4 Disposal Considerations 31
2.3.5 Transport Information 31
2.4 Handling Electrostatic Sensitive Devices (ESD) 31
2.5 Warnings and Symbols on the Device 32
2.6 Qualification of Personnel 33
2.7 Personal Protection Equipment (PPE) 33
2.8 Changes of the Product 34
2.9 Proper Use 34
2.10 Misuse 35
2.11 Duties of the Operating Company 35
2.12 Duties of the User 36
3 Product Description 37
3.1 Working Principle 38
3.2 Control 38
3.3 PCS 38
3.4 Decoupling Protection 39
3.5 Auxiliary Power Supply of Protective Devices 39
3.6 Behavior in the event of a supply voltage failure 40
4 Design 41

4.1 AC Grid Connection 42
4.2 Data Interface 42
4.3 Safety Design 43
4.3.1 Safety Chain Battery Cell 43
4.3.2 Safety BMS Rack (S7) 43
4.3.3 Safety Converter Control 44
4.3.4 Overview of the Safety Concept 45
4.3.5 Fire Protection System and Suppression System 46
4.4 PCS Container 50
4.4.1 Container Overview 50
4.4.2 Cabinet Overview- Converter Cabinets 54
4.4.3 Internal Components – Converter Cabinets 55
4.4.4 Cabinet Overview - Control Cabinets 57
4.4.5 Internal Components – Control Cabinets (CTRL_1 and CTRL_2) 58
4.4.6 External Components – Control Cabinet 59
4.5 BESS 1 Container 60
4.5.1 Container Overview 60
4.5.2 Cabinet Overview- BESS 1 Battery Cabinets 64
4.5.3 Internal Components – Battery Cabinets 65
4.6 BESS 2 Container 66
4.6.1 Container Overview 66
4.6.2 Cabinet Overview- BESS 2 Battery Cabinets 70
4.6.3 Internal Components – Battery Cabinets 71
4.7 Battery Modules 72
4.7.1 Design 72
4.7.2 Technical Data 73
4.7.3 Connection Elements 74
4.7.4 Communication Scheme 74
4.7.5 Lifting Device and Mounting Table 75
4.7.6 Mobile Lifting Device 77
4.7.7 MV Transformer 78
4.8 Cooling System 79
4.8.1 BESS 1 / BESS 2 Container 79
4.8.2 PCS Container 80
5 Operating Interfaces 84

6 Control System 84
6.1 Main Control System 84
6.2 Battery Cabinet Control System 86
6.3 Network Structure 87
7 Converter Main States 90
7.1 Error Levels 90
7.2 Main States 91
8 Technical Data 93
9 Environmental Conditions 94
10 Transport, Storage and Commissioning 95
10.1 Unpacking 95
10.2 Transport 96
10.2.1 Container Lifting 98
10.2.2 Dimensions and Center of Gravity 101
10.3 Storage 102
10.3.1 Storage Condition 102
10.4 Assembly and Initial Commissioning 104
11 Mounting 105
11.1 General 105
11.1.1 Cable Routing 106
11.1.2 Coding 106
11.2 Installation location 107
11.2.1 Distances Between Containers 108
11.2.2 Cable Outlets 109
11.2.3 Cable Gland Description 112
11.2.4 AC Connection 119
11.2.5 Higher-Level Controller Connection 121
12 Pre-Commissioning 122
12.1 Activate Motor Contactors and Fuses 122
12.2 Check Power Cables 122
12.3 Check Communication Cables 123
12.4 Cooling System Preparations 123
13 Commissioning 123
14 Operation 123
14.1 Operating Panel 124

14.2 Indicator Lights ... 124
14.3 Control Elements ... 125
14.4 Switching on the BESS ... 126
14.5 Switching off the BESS ... 128
14.6 De-Energizing ... 130
14.7 Check Voltage-Free Status of DC Link ... 131
14.8 AC Circuit Breaker ... 132
14.8.1 Circuit Breaker Components ... 133
14.8.2 Positions of CB in the Guide Frame ... 134
14.8.3 Protect the CB Against Unintentional Reclosing ... 135
14.9 DC Fuse Switch Disconnectors ... 137
14.9.1 Fuse Disconnector Components ... 138
14.9.2 Locking Device ... 139
14.9.3 Protect the DC Disconnector Against Unintentional Reclosing ... 140
15 Monitoring ... 141
16 Data transfer with higher-level controller ... 142
17 Maintenance ... 142
17.1 Preparations Prior Maintenance ... 144
17.2 Maintenance Schedule ... 145
17.3 UPS ... 146
17.3.1 UPS Functionality Check ... 146
17.3.2 Removing the UPS battery ... 147
17.4 Changing the Intake Fan Filters ... 150
17.5 Visual Inspection ... 151
17.6 AC Circuit Breaker(s) ... 152
17.6.1 Inspection work ... 152
17.7 Replace PLC Buffer Battery ... 153
17.7.1 Preventive maintenance ... 153
17.7.2 Replacing Backup Battery ... 153
17.8 Exchanging the Cooling Liquid ... 154
17.8.2 Filling the Cooling System ... 157
17.9 Check pressure of expansion tank ... 160
17.10 Pump ... 162
17.11 Exhaust Units ... 163
17.12 Fire Dampers ... 163

17.13 H2 Sensors 163
18 Container Repair 164
18.1 Process Instructions (New Application) 164
18.2 Process instructions (Repair - damage down to the steel) 165
18.3 Process instructions (Repair - damage only within the topcoat) 167
19 Settable Devices 168
20 IP Addresses 168
21 PLC 169
21.1 Indicator Lights 169
21.2 Connection Elements 171
21.3 PLC Connection 172
21.4 Compiled Project Update 173
22 WebVisu 176
22.1 WebVisu remote connection 177
22.2 Navigation 178
22.2.1 Home Button 178
22.2.2 Page Menu Button 179
22.3 WebVisu User Interface 179
22.4 WebVisu Pages 180
22.4.1 Overview 180
22.4.2 Overview DC-DC 181
22.4.3 AC-DC Converter 182
22.4.4 DC Link 183
22.4.5 DC-DC Converter 184
22.4.6 Converter Control 185
22.4.7 Cooling 186
22.4.8 Battery Overview 187
22.4.9 Grid Protection Settings 188
22.4.10 Init List 189
22.4.11 Error List 190
22.4.12 Action List 191
23 Troubleshooting 192
24 Dismantling and Disposal 192
24.1 Safety 192
24.2 Dismantling 192

24.3 Disposal of Packaging Material 192
24.4 BESS Disposal 193

Identification

Product and Type Designation

Type
BESS 1 MW / 5 MWh / 6.6 kV / 620 V AC

Serial number

PCS	FRQ-53396000001
BESS 1	FRQ-53406000001
BESS 2	FRQ-53412000001

Product family
BESS Energy Storage System

Product Version / Document Version

Product version
Prototype

Document release date
February 2025

Doc Code
10354_23A2007_250205_Operating_Manual_BESS_1MW_5MWh_6.6kV_EN_v1.2

Name and Address of Manufacturer and Supplier

FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Deutschland

Legal Information

This work is protected by copyright. This work is protected by copyright. This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About these Instructions

This manual is part of the product and applies exclusively to the system described in this document.

This operating manual contains the necessary information for the proper use of the described system. The operating manual is supplied together with the product and is considered as an important part of the product.

Please read this manual carefully, as it contains important information on the installation and operation of the product.
Please pay particular attention to the notes regarding the safe use of the system.
The manufacturer accepts no liability for any damage caused by failure to observe these instructions.

Keep this manual and provide it to the new owner in case of a change of the operating company.
All personnel who have any relation of handling or operating the product must always have direct access to this manual.

All personnel who have any relation of operating the unit are obligated to read all related manuals regarding the system described in this document. The employed personnel must declare that they have fully read and understood all contents of the manuals and agree to follow all instructions, especially issues regarding safety and accident prevention.

Additional Documents

The instructions of this operating manual must be supplemented with the necessary, customary local and current accident prevention regulations, environmental protection rules and laws.

Location of the Manual

Always keep this manual within direct reach when operating or handling the unit. The operator must have direct access to the manual. The operator must have direct access to the manual.

Display Elements

Symbol	Significance
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

1.1 Disclaimer of Liability

The contents of this publication have been reviewed to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, any necessary corrections are included in subsequent editions.

1.2 Applicable Documents

The delivery scope of the product includes the following documents:

Document	Document Name
Circuit diagram BESS 1 MW / 5 MWh (FREQCON)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20250123_V1.3
Data interface description (FREQCON)	23A2007_250116_Modbus_Register BESS_V1_0_0_1
Maintenance schedule – BESS (FREQCON)	EED_0000_20_Maintenance_Schedule_BESS_LFP_v1.3_EN
Operating and Maintenance Manual -AC circuit breaker 3WL (Siemens)	3ZX1812-0WL00-0AN4_online_201806140915326928
Operating Manual -DC circuit breaker 3NP1 (Siemens)	System_Manual_3NP1_3ZX1012-0NP10-1AC1_en-US
Operating, commissioning and maintenance instructions PLC Simotion P320-4 (Siemens)	P320_4_commissioning_en-US P320_4_operating_en-US
MSDS Battery Cells LF280 (EVE)	LF280K MSDS
Aerosol Safety Data Sheet (Stat-X)	Stat-X Aerosol Safety Sheet 19010.3_SDSR_Stat-X_1
Stat-X operating instructions (Stat-X)	19001 1.2.5 Owners Manual Electric DE
Operating and Maintenance Manual – exhaust units (Puma)	TFE_Direct_Driven_Unit_Run_&_Standby_O_&_M_1030
Operating and Maintenance Manual – fire dampers (Puma)	Air_Make_Up_Dampers_O&M_1032
Operating and Maintenance Manual – H2 sensors (Dräger)	Dräger Polytron 8200 manual 9033302_01_2011_enus
Operating Instructions – cable hoist	manual_2255140

Table 3: Applicable documents

1.3 Abbreviations

The following list provides descriptions about the generic terms and abbreviations used in this document:

Generic Term and Abbreviation	Significance
AC	Alternating current
Identifier	Equipment labeling
BESS	Battery Energy Storage System
BMS	Battery management system
BSU	Blackstart unit
DC	Direct current
DC-link	Direct current link
EMC	Electromagnetic compatibility
EMF	Electromagnetic fields
EMS	Energy management system
FRQ	FRFEQCON GmbH
HMI	Human-Machine Interface
HV	High voltage

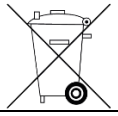
HVIO	High Voltage I/O Module
MB	Modbus
RTU	Remote Terminal Unit
TCP	Transmission control protocol
MSC	Multi-Source Converter
MV	Medium voltage
LFP	Lithium iron phosphate
LV	Low voltage
PCS	Power conversion system
PLC	Programmable Logic Controller
PPE	Personal safety equipment
IGBT	Insulated-Gate Bipolar Transistor
IEC	International Electrotechnical Commission
I/O	Input/output
IP	Internet protocol
SoC	State of charge
TR	Thermal runway
UPS	Uninterruptable power supply

Table 4: List of Abbreviations

1.4 Warning Symbols

Observe the warning symbols in this document and those attached on the device. The warning symbols have the following meaning:

Symbols	Significance
	Hazard (general)
	Hazard by voltage
	Hazard by high temperature
	Hazard by batteries
	Hazard by fire
	Maintenance lockout tagout, do not switch!
	Acute toxicity (oral, dermal, inhalation) (hazard. category 4)
	Respiratory sensitization (hazard category 1, 1A and 1B)
	Prohibition for people with pacemakers

	Hazard by heavy load
	Do not dispose in household waste. (See section 24 “Dismantling and Disposal”)

1.5 Information Symbols

Symbol	Significance
	Important technical information for this product

1.6 Warning Levels / Signal Words

DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE	Indicates that property damage can result, if proper precautions are not taken.

1.7 Target Groups

⚠ DANGER	
	**Danger from and for unauthorized persons** Unauthorized persons are not aware of the dangers in the work area and may endanger themselves and third parties. ➜ Keep unauthorized persons away from the work area. ➜ If in doubt, speak to persons and direct them away from the work area. ➜ Interrupt the work as long as unauthorized persons are in the work area. ➜ Always keep the entrance door(s) locked when not performing work on the system to prevent unauthorized persons from entering the container.

Group	Significance
Operator	• Uses the product himself for commercial or economic purposes or lets a third-party use/apply it. • During operation, bears legal product responsibility for the protection of the user, personnel and third parties. • May not open control cabinets and/or perform maintenance.
Trained person	• Has been demonstrably trained and instructed by the operator about the assigned tasks and possible dangers in case of improper behavior. • Is authorized to operate the plant. • May not open control cabinets and/or perform maintenance.
Service Personnel	• FREQCON GmbH service personnel • Personnel trained and authorized by FREQCON and authorized specialist personnel. • Carries out all other work on the plant, e. g. commissioning, maintenance work, transport, and troubleshooting.
Manufacturer	• Person who was/is involved in the development of the energy storage system and has detailed knowledge of the structure and function of the modules or the entire system - in accordance with the relevant specialist area.

Table 5: Target groups

2 Safety Instructions

2.1 The Five Safety Rules

For your own personal safety and to prevent material damage when carrying out any work, always observe the safety-relevant instructions and the following five safety rules according to EN 50110-1 "Working in a voltage-free state".



2.2 Basic Safety Information

Do not operate!	**Lock and tag power switches and controller devices**
	Follow national laws regarding occupational safety and health. ➜ Identify the energy source(s). ➜ Isolate the energy source(s). ➜ Determine voltage-free status. ➜ Ground device or equipment to protect from short circuiting and from shocks. ➜ Lock and Tag the energy source(s). ➜ Prove that the equipment isolation is effective. ➜ When required, apply lock-out device or clamp and secure with padlock(s).

Important!	
	➜ Read the instructions of this manual thoroughly before use! ➜ Keep manual within reach. ➜ All personnel who have to perform any task on the BESS (on-site or remotely) with respect to operation of the unit are obligated to read all related manuals regarding the BESS. By proceeding with work on the BESS, the personnel declare that they have fully read and understood all contents of the manuals and agree to follow all instructions, especially issues regarding safety and accident prevention.

⚠ DANGER	
	**Hazard by voltage** Always respect all the safety instructions and, in particular: ➜ Always use protective devices suitable and approved for each type of activity. ➜ The instructions in this manual must be strictly followed. ➜ Use of the equipment must comply with all national and local regulations. ➜ Access to internal components is only allowed after the converter has been de-energized and disconnected from all power supplies.

⚠ DANGER	
	**Hazard by voltage** ➜ Electric shock hazard. ➜ Only electricians may perform work on electrical components. ➜ Do not touch live components! ➜ Disconnect the device from all power supplies, before performing work on the device. ➜ Do not short circuit any conductive parts that are not de-energized before. (Take care with jewellery, tools, instruments, etc. which can cause short circuits accidentally.)

⚠ DANGER	
	**Hazard by voltage** ➜ Before opening the cabinet doors de-energize the converter. ➜ Even if the main circuit breaker is switched off, the cabinets are not completely voltage-free.

⚠ DANGER	
	**Risk of burns on hot surfaces** ➜ Avoid contact with hot surfaces or wear protective clothing (e.g. protective gloves).

⚠ DANGER	
	**General risk of injury due to improper handling** ➜ Only perform work on the device if you have expert knowledge of the respective activity. ➜ Follow the operating instructions and warnings stated in this manual.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 “Protect the CB Against Unintentional Reclosing”. ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

⚠ DANGER	
	**Danger to life through electric arcs** Danger by electric arcs could occur by: • Exceedance of the maximum input current • Faulty design of circuit breakers or transformers • Faulty or not connected cables • Excessive contamination Electric arcs may lead to death, severe injuries or material damage. ➜ Make sure the system is properly designed and all power cables are connected correctly. The maximum permissible input current is provided in the table "Technical Data". ➜ Excessive contamination must be removed.

⚠ DANGER	
	**General risk of injury due to improper handling.** Always respect all the safety instructions and, in particular: ➜ Always use protective devices suitable and approved for each type of activity. ➜ The instructions in this manual must be strictly followed. ➜ Use of the equipment must comply with all national and local regulations. ➜ Access to internal components is only allowed after the converter has been de-energized and disconnected from all power supplies. ➜ It is not allowed to perform work on a live converter. ➜ The converter and all connected systems/components must be electrical grounded properly. ➜ All installation work and maintenance on the BESS must be carried out by qualified personnel. ➜ Improper use or handling of the BESS during transportation, installation or during operation may result in damage to the equipment or cause severe, even fatal injury. ➜ Maintenance work on the converter unit must be performed with reasonable care. ➜ Non-compliance with the present instructions may cause damage to the product and could lead to serious injuries of the personnel.

⚠ DANGER	
	**Danger to life when live parts are touched on damaged devices** Improper handling of devices can cause damage. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components. If touched, this can result in death or severe injury. ➜ Ensure compliance with the limit values specified in the technical data during transport, storage and operation. ➜ Do not use any damaged devices.

⚠ DANGER	
	**Danger to life through electric shock due to unconnected cable shields** Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields. ➜ As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.

⚠ DANGER	
	**Danger to life due to electric shock when not grounded** If the protective conductor connection is missing or incorrect, high voltages can occur at open, exposed parts when using devices of protection class I. Touching these parts can result in death or serious injury. ➜ Ground the device in compliance with the applicable regulations.

⚠ DANGER	
	**Danger to life due to electric shock when opening plug connections in operation** When opening plug connections in operation, arcs can result in death or severe injuries. ➜ Only open plug connections when the equipment is de-energized, unless it has been explicitly stated that they can be opened in operation.

⚠ DANGER	
	**Danger to life through electric shock due to the residual charge of the power component capacitors** Due to the use of capacitors, a dangerous voltage is present even up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury. ➜ Wait for 5 minutes and then check the de-energized state of the system. Only then should you start working on the device.

⚠ DANGER	
	**Danger to life from electromagnetic fields** Electromagnetic fields (EMF) are generated by the operation of electrical power equipment, such as transformers, converters, or motors. People with pacemakers or implants are at particular risk in the immediate vicinity of this equipment. ➜ If you have a heart pacemaker or implant, maintain a minimum distance of 2 m from electrical power equipment.

⚠ DANGER	
	**Danger to life when safety functions are inactive** Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death. ➜ Observe the information in the appropriate product documentation before commissioning. ➜ Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components. ➜ Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing. ➜ Perform a function test. ➜ Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

⚠ DANGER	
	**Danger to life due to fire if overheating occurs because of insufficient ventilation clearances** Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems. ➜ Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

⚠ DANGER	
	**Danger of an accident occurring due to missing or illegible warning labels** Missing or illegible warning labels can result in accidents involving death or serious injury. Check that the warning labels are complete based on the documentation. ➜ Attach any missing warning labels to the components, in the national language if necessary. ➜ Replace illegible warning labels.

⚠ WARNING	
	**Hazard by hot surfaces of components** During operation, some components may heat up significantly, e.g. heat sinks and inductors. These components can still be very hot for some time after operation. In case of contact, severe bodily injuries, such as skin burns, may result. ➜ Do not touch hot surfaces even after shutdown of the converter system.

⚠ WARNING	
	**Danger to life or malfunctions of the BESS as a result of incorrect or changed parameterization** As a result of incorrect or changed parameterization, the system can malfunction, which in turn can lead to injuries or death. ➜ Protect the parameterization (parameter assignments) against unauthorized access. ➜ Respond to possible malfunctions by applying suitable measures (e.g. EMERGENCY STOP or EMERGENCY OFF).

⚠ WARNING	
 	**Hazard by cooling liquid** The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed. ➜ Avoid oral ingestion of the coolant since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention. ➜ Avoid skin contact with the coolant. ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

⚠ CAUTION	
	**Hazard by sharp edges on packaging** Improper handling during unpacking can cause injuries. ➜ Use appropriate safety gloves to protect your hands from possible cuts.

NOTICE	
	**Material damage due to loose power connections** Insufficient tightening torques or vibrations can result in loose electrical connections. This can result in damage due to fire, device defects or malfunctions. ➜ Tighten all power connections with the specified tightening torques, e.g. grid supply connection. ➜ Check all power connections at regular intervals. This applies in particular after transport.

NOTICE	
	**Device damage caused by incorrect voltage/insulation tests** Incorrect voltage/insulation tests can damage the device. ➜ Before performing voltage/insulation tests on the equipment, disconnect all equipment as high voltage tests have been performed on inverters and motors by their manufacturers. Therefore, it is not necessary to perform a retest on the system.

NOTICE

Material damage due to overloading of DC devices and connecting cables

The DC paths and the connection cables are not protected against overload by the BESS.

Select external components according to the specified nominal and maximum currents of the BESS.

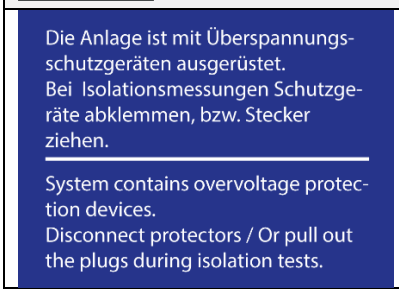
➜ If necessary, use appropriate protective equipment for the external components.

NOTICE

Material damage due to improper use of the transformer

For your safety, carefully read the delivered operating instructions of the transformer and observe the instructions. Technical specifications of the transformer which are provided on its´ type plate like rated current, rated power etc. must be strictly observed when commissioning and feeding power to the grid. All electrical connection work must be carried out onsite and by trained, qualified personnel, provided with the required safety devices in accordance with the national occupational safety regulations. Please pay attention to the proper protection of the transformer during unloading, installation at the place of operation, feeding and operation The transgression of the voltage or power and the presence of external factors (such as condensation, solar radiation, plants and animals) can affect the proper functioning of the transformer).

NOTICE



General risk of damage

During isolation tests disconnect overvoltage protection devices or pull out the plugs otherwise they will be activated or destroyed.

2.3 Safety Instructions Battery Storage Unit

⚠ DANGER	
	**Hazard by electrolyte** Work on the battery storage system is only allowed to be performed by FREQCON service personnel or qualified personnel trained and authorized by FREQCON. It is not allowed to modify or manipulate the battery storage unit and its components. ➜ Do not open, disassemble or puncture the battery storage cabinets or battery modules. ➜ Do not short circuit the battery storage unit. ➜ Do not expose the battery storage system to vibrations or shock. ➜ Do not a use defective or damaged battery storage system or battery modules. ➜ Do not touch defective or damaged batteries with bare hands. Defective or damaged batteries must only be handled by FREQCON personnel.

⚠ DANGER	
	**Hazard by electrolyte** The material/media required for intended operation of the battery storage system are procured and provided by the manufacturer. ➜ The proper handling of these materials/media and the associated risks underly the sole responsibility of the manufacturer. ➜ Hazard and disposal information must be provided by the manufacturer. ➜ The safety data sheets of the material and media manufacturers are to be observed.

⚠ WARNING	
	**Health hazards due to negligent use of personal protective equipment** Serious injuries can occur when working without personal protective equipment. ➜ Wear personal protective equipment (PPE) when working on the BESS. Refer to section 2.7 "Personal Protection Equipment (PPE)" for information regarding the required PPE.

⚠ WARNING	
	**Possible danger to life due to electric shock when extinguishing fire or due to flooding!** If the following instructions are not observed, this can lead to damage to property and personal injury, for which FREQCON GmbH accepts no liability whatsoever. ➜ In the event of a fire, switch off the battery storage system if safe to do so. ➜ Immediately alert the fire department. ➜ Immediately remove yourself and other persons from the danger zone. ➜ Inform the fire department about the presence of lithium iron phosphate batteries.

⚠ CAUTION	
	**Danger due to fire breaking out** During operation, fire may break out, e.g. due to sparks or heated surfaces. ➜ Observe the relevant safety regulations (5 safety rules). ➜ Note the risk of arcing when operating the NH isolators installed inside the battery storage cabinets. ➜ Never install or operate a potentially defective or obviously defective battery storage unit.

⚠ CAUTION	
	**Hazard by burns (electric arcs)** When working on the electrical equipment, you may come into direct contact with faulty or overloaded parts which can cause burns. ➜ Always observe the relevant country-specific safety regulations. ➜ Note the risk of arcing when operating the NH isolators installed inside the battery storage cabinets. ➜ Note the risk of arcing when operating the NH isolators installed inside the battery storage cabinets.

2.3.1 Safety Data Sheet

Observe the information provided in the Material Safety Data Sheet (MSDS) of the battery cells (*see section 1.2 "Applicable Documents"*).

2.3.2 Personal Protection

This chapter describes the personal protection for FREQCON battery converter systems in the event of fire or the occurrence of a toxic gas concentration.

Basic safety measures

- No person may remain inside the container or in the safety area of the container while the system is in operation.
- All container doors must be locked while the system is in operation.
- Maintenance and repair work may only be carried out when the system is switched off and all energy sources are disconnected from the system.

Critical situation regarding personal safety

A person enters the container for maintenance/repair work in which there is a fire (risk of deflagration when opening the container door) or a toxic concentration of carbon monoxide due to outgassing batteries.

Definition of the protection objective

Under all circumstances, a person must be prevented from entering the container if the critical situation mentioned before exists.

Technical measures to achieve the protection objective

- Reliable detection of a fire or toxic gas concentration using suitable sensors (smoke detectors, CO sensors, temperature sensors).
- The sensors are redundant. Smoke detectors, CO sensors and temperature sensors are installed in each battery room.
- One H2 sensor is installed inside each battery room of the BESS containers.
- If the system is shut down by emergency shutdown, no person may enter the container.
- If a hazardous situation exists, an infrared thermometer must first be used to check whether there is a fire in the container. A temperature above 60 °C is a sure sign of a fire inside the container. If this is the case, the container doors must not be opened (risk of deflagration) and the fire brigade must be alerted.
- If a fire can be ruled out as the cause of the emergency shutdown, a toxic gas concentration could be present. Entering the container is not permitted in this situation. Active ventilation (exhaust units in the BESS container roof) reduces the gas concentration in the container.

2.3.3 Fire Fighting Measures

1) Fire protection / early fire detection
   a. Spatial conditions:
      Primarily through the structural measure; Space between modules, air conditioning and ventilation reduces the risk of thermal stress to a minimum
   b. It must be ensured that there is no additional fire load in the battery rooms. Unauthorized access must be strictly prevented.
   c. Sensors for detecting smoke, heat and CO gas are redundantly built into the alarm system.
   d. At 300 °C automatic fire suppression using an aerosol mist triggers itself.

Important: Extinguishing an internal cell fire is not possible. Due to the chemical release of bound oxygen in the cathodes, the fire inside the cell sustains itself. The aerosol extinguishing system is intended to prevent the flames from spreading to the outer surroundings of the battery module!

2) Behavior in case of fire
   a. Upon detecting a fire in the battery room, the battery container is immediately and automatically disconnected from the grid. The circuit breaker opens its contacts to prevent any further external energy supply.
   b. Toxic and hazardous substances are released by the battery in the event of a fire.
      Harmful gases include:
      Hydrogen (H_2) 48%
      Carbon dioxide (CO_2) 27%
      Carbon monoxide (CO) 11%
   c. Remove all persons from the danger area.
   d. Clear affected area and secure from entry.
   e. Disconnect all supply voltages of the BESS at the disconnection points of the external voltage sources.
   f. Only start active measures in the event of visible flame development outside the energy storage unit.
   g. Do not enter any electrolyte cloud that may form in the external area (near the floor).
   h. Wait at least 48 hours before starting firefighting measures inside the container. First open the access door and wait another 2 h.

⚠ DANGER	
	**Poisoning and chemical burns hazard** Escaping electrolyte gases contain chemicals which are harmful to humans. ➜ Keep away from electrolyte mist clouds. ➜ Approach electrolyte mist clouds only under full protection. ➜ Observe the instructions in the Material Safety Data Sheet of the battery cells *(see applicable documents)*. ➜ Follow the following instructions

3) Recommendation for rescue units

   Firefighting should be conducted according to regional standards and guidelines.
   (EN 15182-1:2019-11).
   The distance for the fire hose nozzle must be maintained.

Ensure full protective gear according to DGUV Information 205-014 (e.g. DIN EN 469 ; Protective clothing for the fire brigade - performance requirements for protective clothing for fire brigade activities) and recirculating air independent respirator is worn.
For firefighting protective equipment, thermal risk is given more priority than chemical hazard.

4) Instructions after fire extinction

Once the fire brigade has cleared the fire site and the fire has been extinguished, an electrically trained specialist must immediately ensure and verify the absence of voltage (measure all poles) and secure against re-energization.
5 safety rules!
Attention: Batteries continue to maintain voltage even after disconnection!
In addition, ventilate the rooms adequately to eliminate any remaining hazardous fire gases.
According to the technical data sheet, the battery modules must be stored/disposed.

Rules of Conduct for the Fire Brigade

The following notice board must be kept outside the container or handed over to the local fire department. A laminated copy is included in the scope of delivery.

Rules of conduct for the fire brigade



Attention electrical voltage!

Batteries are still live after disconnection!!!

Batteries can outgas when heated

CO = carbon monoxide
H2 = Hydrogen







Unauthorized access is strictly prohibited.

Keep doors closed in case of fire

The use of respiratory protection is strongly recommended





Battery fire cannot be extinguished!

Container cooling from outside

Extinguishing agents: water

2.3.4 Disposal Considerations

Lithium-ion cell batteries are labeled in compliance with the EU Battery Directive 2006/66/EC.

For instructions regarding the disposal of the battery storage system and its battery storage modules, refer to section 24 ”Dismantling and Disposal”.

2.3.5 Transport Information

For information regarding the transport of the battery storage system and its battery storage modules, refer to section 10.2 "Transport”.

2.4 Handling Electrostatic Sensitive Devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE



Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- ➜ Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g. conductive foam rubber of aluminum foil.
- ➜ Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- ➜ Place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam. ESD packaging, ESD transport container).

⚠ DANGER



Danger to life as a result of unsafe operating states resulting from software manipulation

Software manipulations (e.g. viruses, trojans, malware or worms) can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- ➜ Keep the software up to date.
- ➜ Incorporate all installed products, especially the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation.
- ➜ Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

2.5 Warnings and Symbols on the Device



2.6 Qualification of Personnel

Installation, service and operating personnel must be sufficiently trained before installing, operating and handling the equipment.

2.7 Personal Protection Equipment (PPE)

Always wear safety equipment when working on the product.

When carrying out maintenance and service work, secure controllers, devices and units of designated area against accidental activation.

Symbol	Meaning and Application
	Gloves made of nitrile rubber against chemicals and microorganisms (at least protection index 2 according to EN 374-1) • for removal of electrolyte or hydrofluoric acid (only by FREQCON service) • Gloves according to EN 60903 - up to 1000 V AC for live working activities
	Safety shoes (toe protection, non-slip, ESD) • Operation • Cleaning Safety shoes (acid resistant) or rubber boots • for removal of electrolyte or hydrofluoric acid (only by FREQCON service)
	Tightly fitting safety goggles/basket goggles/face shield • for removal of electrolyte and hydrofluoric acid (only by FREQCON service)
	Chemical protective suit • for removal of electrolyte and hydrofluoric acid (only by FREQCON service) • for fire fighting
	Ambient air-independent breathing apparatus • for firefighting in case of smoke formation inside or outside the building (by rescue forces)

Table 6: Personal Protection Equipment (PPE)

2.8 Changes of the Product

Modifications to the product and/or mounting of parts from other manufacturers can endanger the operating safety of the product. This especially applies to tampering with safety-relevant parts.

Any modification carried out without prior written approval by the manufacturer will result in the manufacturer's declaration of conformity becoming void. The responsibility for damage and accidents caused by modifications of this kind shall be borne solely by the user.

2.9 Proper Use

The Battery Energy Storage System (BESS) described in this document is intended to feed into or draw power out of a connected electric grid by means of a power conversion system connected between both. The system specifications are listed in section 3 of this document.

The system is properly constructed, installed and commissioned by FREQCON service personnel according to manufacturer specifications. The operator ensures that the required environmental conditions are met (*see section 8 and 9*).

Modification of the device by the operator or integrator is not permitted. Only use the device in accordance with the specifications in this manual and the locally applicable standards and directives. Use contrary to the specifications and specified operating limits as well as any modification of the energy storage unit by the user is not permitted and will void the warranty!

Deviations from this manual are not permitted or require the separate written approval of FREQCON GmbH.

The system is intended for stationary use as a fixed installation. Any other or additional use is considered improper and increases the risk of personal injury and property damage when handling the energy storage system. The manufacturer rejects any liability and warranty claims for damage caused by improper use.

Access to the container is only permitted for instructed personnel. The access doors of the container must be locked if no instructed personnel are on site. The access doors of the container must be locked if no instructed personnel is on site.

Proper use also includes the following measures:

- ➜ Observe the operating manual.
- ➜ Comply with technical data.
- ➜ Comply with maintenance conditions.
- ➜ Immediately eliminate faults which hamper safety.
- ➜ Operate the unit only when it is in technically flawless condition.

2.10 Misuse

Any use which goes beyond the proper use is considered to be misuse. It can result in serious injuries or damage and is therefore prohibited.

The responsibility for damage resulting from misuse shall be borne solely by the operating company of the product.

2.11 Duties of the Operating Company

To ensure safe, smooth operation of the unit, you as the operator must comply with the following:

Personnel

- ➜ Only allow personnel with corresponding knowledge to operate and clean the product.
- ➜ Only allow a trained electrician or person with electro technical instruction to work on the electrical system. The regulations given in section 1.7 “Target Groups” must be observed.
- ➜ Clearly and bindingly specify the responsibilities for operation, service and maintenance work.

Operating Manual

- ➜ Always keep this operating manual available near the device.
- ➜ Make sure that the personnel have read and understood this operating manual before working on the device.

Safety

- ➜ Monitor the compliance with the generally valid legal and other binding safety and accident prevention regulations.
- ➜ Make sure that the users of the product wear the necessary, personal safety equipment in accordance with their job.
- ➜ Ensure that all safety and danger warnings on the product and in the installation room are kept complete and in legible condition.

Inspection and Maintenance

- ➜ Observe the adherence of the inspection and maintenance intervals in section 16 „Maintenance“.
- ➜ Operate the product only if it is flawless.

2.12 Duties of the User

The following are referred to as users:

- Persons, who install and configure the product.
- Persons, who operate the product and eliminate errors during the process.
- Persons, who carry out checking, maintenance and inspection activities.

Follow the instructions below in the interest of your own safety and for fault-free operation of the product:

➜ Read this operating manual before using the product. If you have questions, contact your superior or the safety officer.
➜ Always carry out activities based on the complete operating manual. Missing information due to an incomplete operating manual can result in serious or fatal injuries and in damage.
➜ Familiarize yourself with the safety devices of the product. Do not make any modifications to it.
➜ Do not operate the product until you have received a complete user training course for this product from an authorized person.
➜ Report any fault in the product to your superior if you cannot and may not eliminate it yourself.

3 Product Description

The battery energy storage system described in this document (BESS) is designed as a battery-to-grid system.

The BESS system is generally capable to provide the following functions, but the specific functions depend on the contractually agreed specifications:



Figure 1: BESS Functions Overview

The BESS consisting of a battery storage system with battery modules, battery control system and air conditioning systems are integrated in two (2) 40" HC containers with an active fire suppression system (*see section 4, "Design"*).

The PCS hardware and software control system as well as the converter technology incl. water cooling system with heat exchangers and air conditioning systems for the interior temperature are integrated in one (1) separate 20" container with a passive fire suppression system. The BESS is connected to the AC grid via busbars at the HV side of a 6.6 kV /620 V AC MV transformer inside the PCS container. The cable entries into the containers are located in the container floors.

It is not permitted to use the BESS system for purposes other than those specified in this manual.

Only sufficiently trained personnel are permitted to run, handle, and operate the unit (*see section 1.7* "*Target* Groups").

3.1 Working Principle

The BESS consists of a converter system with a total output of 1 MW and a battery storage system with a usable storage capacity of 5 MWh (5.5 MWh installed).

The BESS is passively charged by the energy taken from the AC grid via contactors and resistors from the DC link of the PCS as soon as the voltage level of the battery storage system falls below a value predefined in the PCS controller.

3.2 Control

A Programmable Logic Controller (PLC) is used as system controller. After commissioning and parameterization, the BESS operates automatically. The control system provides remote monitoring and access to the converter functions and set point adjustment via IT network. For detailed information regarding the control system, refer to section 6 “Control System”.

3.3 PCS

The BESS system is equipped with an integrated power conversion system (PCS), the FREQCON MSC converter system.

The key component of the converter system is a DC link converter with a control unit, generating a controlled DC voltage from the AC infeed, the so-called DC link voltage. The DC link voltage is kept to a constant level independently from the grid voltage (also in case of power feedback into the grid). It is required that the specified DC voltage setpoint is within a defined operational range.

3.4 Decoupling Protection

The decoupling protection of the converter system consists of the main controller, which evaluates the signals and controls the coupling switch (circuit breaker). In addition, peripherals for measuring the grid voltage are installed. The periphery consists of a HVIO that divides the grid voltage to a lower voltage and a PIII converter interface that digitizes the measured voltage and provides it to the main controller.

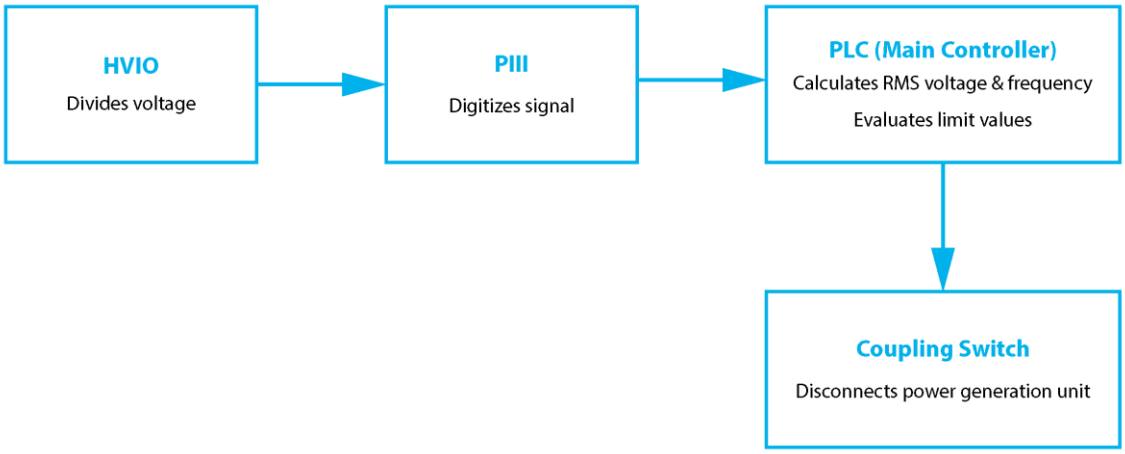


Figure 2: Decoupling protection scheme

The grid phases are measured by an HVIO board that is connected to a PIII. The voltages evaluated are phase-neutral voltages.

The measured instantaneous voltages are used to determine the RMS value, the phase angle and the frequency in the main controller. The currents are recorded directly at IGBT half bridges and also digitized via the PIII. RMS currents are calculated in the main controller.

RMS voltages, RMS currents and frequency are monitored for limit values in the main controller and the coupling switch is switched off if these are exceeded.

3.5 Auxiliary Power Supply of Protective Devices

The entire control system is buffered via a UPS. This is set so that the control and protection system is supplied with energy for at least 15 minutes.

In the event of a faulty UPS and a grid failure, the main controller fails, the grid switch opens, and the converter disconnects from the grid.

3.6 Behavior in the event of a supply voltage failure

If the supply voltage of the converter system fails, the following steps are carried out:

1. The failure of the supply voltage is immediately detected by the main controller.
2. A level 4 error is triggered. This means:
   a. All IGBTs (both DC and AC side) are switched off (500 µs after the fault occurs).
   b. The switches to the energy sources are opened (30 ms after the fault occurs), which disconnects the converter system from all AC and DC networks.
   c. The DC link of the converter system is discharged.
   d. The cooling system of the converter system is switched off (30 ms after the error occurs). This is possible because there are no more heat losses.
3. The UPS supplies the converter control system for another 15 minutes. A backup copy of the init files and parameters is created in the non-volatile memory.
   a. When the power supply is restored, this data is automatically reloaded. It is neither possible nor necessary for the customer to access the data.
   b. Important operating data of the converter system at the time of the power failure (voltages, currents, temperatures, etc.) are logged in a buffer file as long as the UPS is running. Which data is logged in detail depends on the converter type.
   c. The buffer file can be displayed via the FREQCON buffer analysis tool (subject to license) as soon as the supply voltage is available again.
4. If a battery storage system is present, the battery control is switched off immediately so that the battery storage is transferred to a safe state. No operating data of the battery system is saved.
5. Before the switch cabinet doors are opened for a visual inspection after the supply voltage has failed, it is essential to wait for the DC link to discharge.

⚠ DANGER	
	**Risk of injury due to electric shock** Discharging the DC link takes several minutes. The "Ready for Operation" signal light is not an indicator of a fully discharged DC link. Do not carry out any work on the converter before the DC link has been completely discharged. ➜ Wait until the DC link is completely discharged and check that it is de-energized as described in section 14.7 "Check Voltage-Free Status of DC Link ".

4 Design

For better handling and to increase system flexibility, all components of the BESS system are housed in containers.

BESS main components:

- BESS with installed battery modules, control systems and integrated fire protection and suppression system
- Integrated climate control system
- Integrated emergency fan system
- Several sensor systems (H2, CO; temperature and smoke)

PCS main components

- Converter system consisting of AC/DC battery converter, control system and converter cooling system
- Integrated water-air cooling system
- Integrated climate control system
- Several sensor systems (temperature and smoke)

Both the PCS and the BESS are controlled and monitored by the same main control system, which is installed in the control cabinet (CTRL) of the PCS container.

The waste heat in the interior of the containers is conducted via internal air conditioning (AC) units from the interior to external AC units at the front side of the container (*see section 4.8 "Cooling System"*).

The BESS containers are equipped with recesses on its underside for the passage of cables (*see section 11.2.2 "Cable Outlets"*). Furthermore, the PCS container is also provided with cutouts on the bottom side to connect the external AC and DC line cables to the converter system.

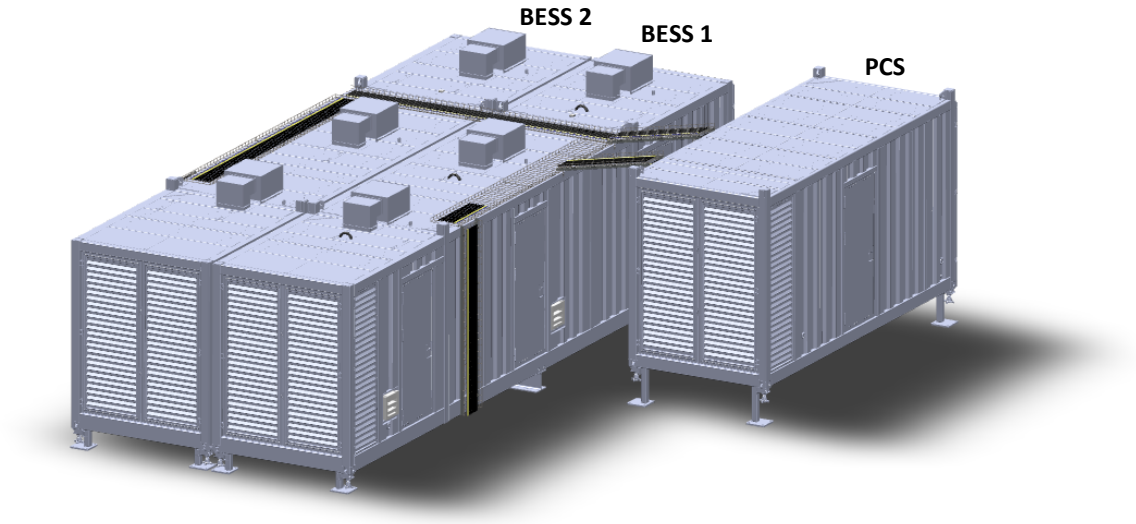


Figure 3: Design

4.1 AC Grid Connection

The BESS is equipped with AC busbars for connection of a 620 V AC grid. The AC busbars are located inside the AC_DC cabinet (*see section 4.4.3*) of the converter system.

Cutouts for inserting the AC power cables into the container are located in the container floor (*see section 11.2.2 "Cable Outlets"*). Through these cutouts, the AC power cables can be fed directly from below into the converter cabinets and connected to the corresponding AC connection busbars inside the cabinets of the converter system.

Further information and a description of the connection of the AC mains supply cables to the converter system are provided in section 11.2.4 "AC Connection".

Note:
The electrical connection must only be performed by personnel trained by FREQCON or by FREQCON service personnel.

4.2 Data Interface

The BESS system can be connected to an electronic higher-level control unit (control room) via a PROFINET interface. The required parameters (current, voltages, frequency, power) are provided by the BESS main control system and transmitted via PROFINET protocol.

The higher-level control unit is connected to the main control unit via a network isolator (114A1) in the CTRL_1 control cabinet (*see section 11.2.5 "Higher-Level Controller Connection"*).

For external control and monitoring of the converter, it is necessary that the customer has access to selected control and status variables stored in the BESS main control system, which can be read and overwritten by the customer's higher-level control. For this purpose, predefined control profiles with the relevant control variables and status profiles with all relevant status variables are stored for the data transfer between the customer's higher-level controller and the converter system.

For a detailed description of the individual data profiles, see the applicable document "23A2007_250116_Modbus_Register BESS_Vx_x_x_x".

4.3 Safety Design

4.3.1 Safety Chain Battery Cell

The battery monitoring system, BMS interface UI and BMS interface RS485, signal error messages via potential-free contacts. See also the documentation for the "BMS interface UI" and "BMS inter-face RS485" hardware modules.

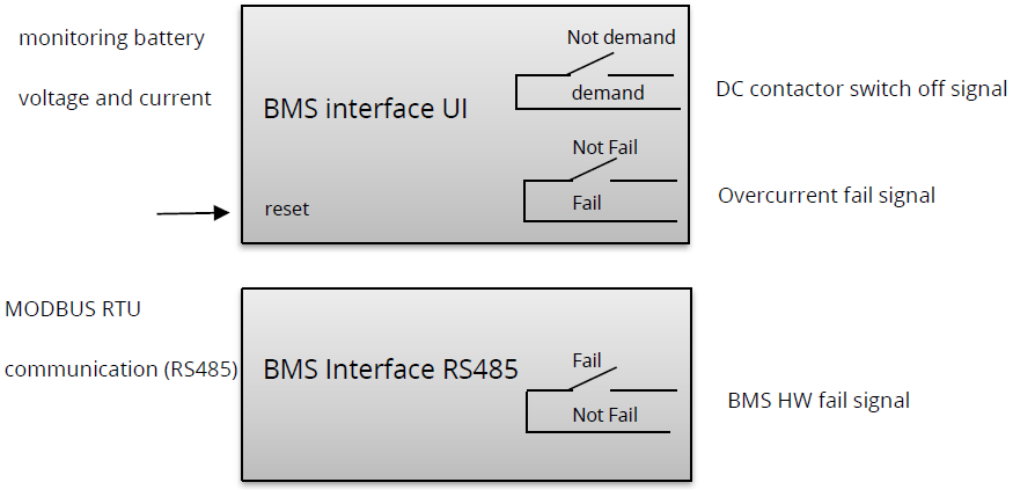


Figure 4: Safety chain battery cell

4.3.1.1 BMS Interface UI

The BMS interface UI monitors the total voltage of a battery rack and the current of the rack.
The BMS interface UI independently monitors the global battery voltage and the battery current. There is a potential-free contact for both errors which opens the contact in the event of an error.
The BMS interface UI has its own digital input for resetting an error message. If an error has been signaled and acknowledged manually via the visualization or MODBUS TCP, this digital input is set briefly.

4.3.1.2 BMS Module

The signals of the BMS interface are monitored in FB_battery_monitoring.
BMS interface RS485 HW error signal. The BMS monitors the battery cells for overvoltage, undervoltage and overtemperature.
If an error is detected locally by a BMS board, the safety chain is opened and an error is signaled.

4.3.2 Safety BMS Rack (S7)

The BMS rack monitors the following states:

- Modbus RTU communication error: The MODBUS RTU master cyclically queries the data of all BMS battery modules (MODBUS RTU slaves).
  If a MODBUS RTU slave [nmodule] is not reached or supplies faulty data, this is evaluated as a communication error. There is a communication error counter for each battery module. While a communication error increments the counter reading, successful communication re-sets the counter to 0.

- Battery voltage monitoring (cmp): The measured battery voltage is cyclically compared with the sum of the individual battery module voltages. If the absolute value of the difference be-tween the two voltages exceeds the 16 V limit value for more than 30 s, an error signal is is-sued.
- Battery monitoring cell voltage: Monitoring of all cell voltages to the maximum value of the measured voltages.
- Battery monitoring current: Monitoring of the battery current.
- Battery monitoring cell temperature: The maximum battery cell temperature is determined cyclically, approximately every 2.5 s, from all battery module cell temperatures recorded. A peak filter suppresses temperature jumps greater than 5 °C for a maximum of 8 cycles. If the average cell temperature is already close to the switch-off limit, incorrect measurements (jump) would result in a warning or error signal.
- Battery monitoring Balancer Temperature and ambient temperature Balancer
- Monitoring the battery pack connections + and - for overtemperature
- Smoke detector
- Gas sensor
- Line protection (fuses) of the auxiliary systems
- Main fuse (battery current)
- Modbus-TCP communication error: An error is triggered in the event of a communication timeout with the charging system (inverter control).
- Contactor feedback: Monitoring whether the status of the contactors matches the target status

If a fault is detected, the DC contactors open after 0.5 seconds.
In addition to errors, warnings can also be generated for cell voltages and cell currents.

4.3.3 Safety Converter Control

The converter system constantly communicates with the connected battery racks and continuously checks the following statuses:

- Modbus-TCP communication: In the event of a communication timeout with the battery racks, a corresponding rack is switched off or an error is triggered at converter level.
- Fault conditions: All faults at BMS rack level are signaled to the converter and the current is briefly set to zero to enable the DC contactors in the racks to be switched without current. Every fault reported by a rack prompts the converter system to disconnect the corresponding rack. Some error states also trigger a switch-off of the converter. The following error messages trigger a switch-off of the converter:
  - Error with the DC contactors in a rack
  - Tripping of a DC fuse in a rack
  - Triggering a smoke detector in a rack
  - Triggering a gas alarm in a rack
- Overvoltage (cell voltage): In the event of a cell overvoltage, the current setpoint value is also set to zero independently of the lookup tables.
- Undervoltage (cell voltage): If a cell is undervoltage, the batteries are charged with a low current to prevent deep discharge. If the cell voltage drops further, the corresponding rack is dis-connected.
- Warning messages: If a warning message is generated by a rack, the charging system re-quests a disconnection of the corresponding rack. As soon as the warning is no longer pre-sent, an attempt is made to reconnect the rack.

- Charge control system: To protect the cells from fault conditions, the following limits are available for charging and discharging the system. The respective limit values can be stored via lookup tables and thus set graduated limit values for the charging and discharging current. All limits are analyzed separately and the lowest limit is selected for the current limit. The limits are parameterized so that the charging or discharging current can be reduced to 0 A.
  - Maximum cell voltage
  - Maximum cell temperature
  - Maximum balance temperature
  - SOC (real)
  - Customer SOC (adjusted to capacity sold)

4.3.4 Overview of the Safety Concept

The safety aspects described in chapters 4.3.1 to 4.3.3 result in a three-stage safety concept:

1. Module level:
   - Detection of cell voltages and temperatures and opening of the safety chain in the event of a limit value violation.
2. Rack level:
   - Evaluation the safety chain and open the DC contactors if necessary.
   - In-house evaluation of cell voltages, cell currents, cell temperatures, smoke sensors, gas sensors and communication with the modules and the charging system. If required, fault generation and opening of the DC contactors.
   - Option to disconnect the rack independently if the safety chain is triggered or a self-detected fault condition occurs.
3. Converter level:
   - Evaluation of the cell voltages, currents and temperatures as well as the error states of a rack. Triggering of a converter error for selected error states of individual racks.
   - Reduction of the charging and discharging currents according to lookup tables depending on the cell voltage and temperatures.
   - Request to switch off the rack or the inverter in the event of a rack fault.

4.3.5 Fire Protection System and Suppression System

FREQCON uses highly safe lithium-ion battery cell technology: Lithium iron phosphate (LiFePO4) cells are, among other things, highly temperature resistant and significantly safer compared to cells based on other lithium-ion technologies. The use of these technologies significantly reduces the probability of a thermal runaway, as they do not catch fire even in the event of a short circuit or overcharging.

Furthermore, in addition to controlling and monitoring the state of charge at cell and system level, the FREQCON BMS (Battery Management System) also handles temperature management during charging and discharging. Every second, the temperature, state of charge and all other important operating parameters of each individual battery cell, as well as of the battery modules, are collected and analyzed by the FREQCON BMS.

This means that a potential problem of the cells is already detected at approx. 60 °C, and thus much earlier than the actual fire development the battery storage is brought back into a safe operating condition by segmental or complete shutdown.

In addition to CO sensors and smoke detectors, there are a total of 339 temperature sensors in one battery cabinet alone. This ensures that the cells are always kept within the defined and safe operating range and that, in addition to achieving high efficiency and low degradation, the probability of overloading is also excluded.

The fire protection system meets the thermal runaway propagation containment requirements of IEC 62619 as well as requirements of the EN 54 Fire detection and fire alarm systems standard.

4.3.5.1 Detection and Response

The fire protection system aims to detect malfunction as early as possible and suppress the problem before it results in a fire hazard. The system is divided into two parts. One part is primarily designed for plant protection and the other part has the aim of personal safety. For both purposes the BESS containers are equipped with several automatic detectors:

Personal safety:

- 3x H2 sensor per BESS container
- 3x emergency exhaust unit per BESS container

Plant protection:

- 1x CO sensor per battery cabinet
- 2x smoke detectors per battery cabinet
- Temperature sensors (in cells)

The carbon monoxide (CO) sensors for the battery cabinets are an extra measure to detect malfunctioning even before smoke detection (VESDA). Its primary objective is to detect outgassing from battery cells. With the cell chemistry known, the specific reactions that occur during outgassing are well understood. The relative proportions of these gases can be predicted based on the known reactions. For the used battery cells up to 169.7 liters of gas mixture of a single battery cell are released in the unlikely event of outgassing. The main components of this gas mixture being approximately:

- Carbon monoxide (CO): 11 %
- Carbon dioxide (CO2): 27 %
- Hydrogen (H2): 48 %

The CO sensors trigger an alarm based on the measured CO concentration as specified in DIN EN 50291-1:

Co concentration	No alarm within	Alarm not later than
30 ppm	120 min	-
50 ppm	60 min	90 min
100 ppm	10 min	40 min
300 ppm	-	3 min

As the complete outgassing of a single battery cell results in about 500 ppm CO in the battery room the CO sensor will be triggered in such an event based on the thresholds in table given above. The CO sensor alarm will reset when the CO concentration falls below approximately 50 ppm.

The alarm level of the analog CO sensor is set to 1000 ppm which is equivalent to a H_2 concentration of about 10 % LEL (lower explosive limit).

The smoke detector has an optical work principle and is getting triggered by (smoke) particles. It is getting also triggered from the aerosol which is released during the outgassing of a battery cell, being thereby independent of the gas concentration.

Personal safety - If an incident should occur and one sensor of the security chain for personal safety is triggered the system responds as follows:

- The complete system (BESS and PCS) is switched off and disconnected from the mains via a control system. The AC connection of the converter is disconnected, the DC connection to the battery storage system is cut off, and if existing, the MV switchgear with the transformer and low voltage distribution are disconnected from the mains.
- H2 concentration > 4000 ppm of analog H2 sensor (equivalent to about 4 % LEL H_2):
  - Battery cabinets are switched off
  - Stop charging/discharging
  - Ventilation starting (Exhaust units)
  - Error message (Error level 4)

Plant protection - Depending on which sensors are triggered the system responds as follows:

- Temperature >55 °C:
  - Battery cabinet is switched off
  - Stop charging/discharging
  - Warning message
- Temperature >56 °C:
  - Same as temperature >55 °C
  - Error message
- 1x CO sensor in the battery cabinets is triggered:
  - Battery cabinet is switched off

  - Stop charging/discharging
  - Warning message
- 2x smoke detectors are triggered:
  - Disconnects battery DC connection (contactors)
  - Deactivate converter IGBTs
  - Disconnect converter from AC connection
  - Error message
- Temperature > 300 °C:
  - StatX fire suppression triggers itself
- CO concentration > 300 ppm of analog CO sensor:
  - Battery cabinet is switched off
  - Stop charging/discharging
  - Error message

The active emergency exhaust system of the container ensures the gas concentration decreases over time. Based on the assumption of a slight overpressure of 1 Pa which is reasonable in the event of an outgassing battery cell, the estimated time for a complete air exchange in the battery room is less than an hour.

4.3.5.2 Active Fire Suppression inside Battery Cabinets

The fire protection system actively fights the fire only in the affected area (battery cabinet). This is achieved by using condensed aerosol, a compact and effective solution compared to CO2 or halocarbons. The aerosol is contained in Stat-X 60 E cartridges, which are triggered by a 12 VDC signal from the control system or self-triggered due to rupture of a temperature sensitive seal, releasing ultrafine cloud of condensed aerosol to chemically extinguish the fire. These cartridges are non-pressurized, leave minimal residue after discharge, and approved for halon and hydrofluorocarbons (HFCs). The cartridges meet the standards dictated by NFPA 2010 and UL 2775.

Each battery cabinet contains two (2) Stat-X aerosol cartridges and two (2) smoke detectors *(see figure below*). Furthermore, the battery cabinets are also equipped with temperature sensors and CO detectors. As soon as a temperature of >300°C has been reached inside the affected cabinet, the aerosol fire suppression cartridges are self-activated and the affected battery cabinet is filled with an aerosol cloud, extinguishing the fire. Aerosol is not released in other cabinets where the sensors have not been triggered, thereby eliminating the fault at the source, and preventing it from spreading to other parts of the system. The aerosol remaining in the air provides additional extended protection for a finite time against re-flash of any fire in case of lithium-ion batteries. The aerosol remains in the cabinet until it is certain that the fire hazard has been eliminated.



① Aerosol cartridge
② Smoke detector

For safety reasons, the container may not be entered for 48 hours after the extinguishing system has been triggered. The defective battery module must then be replaced by the manufacturer and the entire system is put back into operation.

The Stat-X aerosol cartridges are easily replaceable and are connected to the fire protection system again for future events.

Fire detectors will have to be cleaned and tested after a Stat-X discharge event.

After discharge there may be some minimal residue in the immediate vicinity of the generator or underneath it. This should clean up easily with water or detergent as any residue is water soluble. The Stat-X agent does not require hazmat procedures after discharge for cleanup and there are no hazardous materials in the generators themselves

Figure 5: Battery cabinet (1000 mm wide) with Stat-X fire extinguishing cartridges (front view)

4.4 PCS Container

4.4.1 Container Overview

Side view

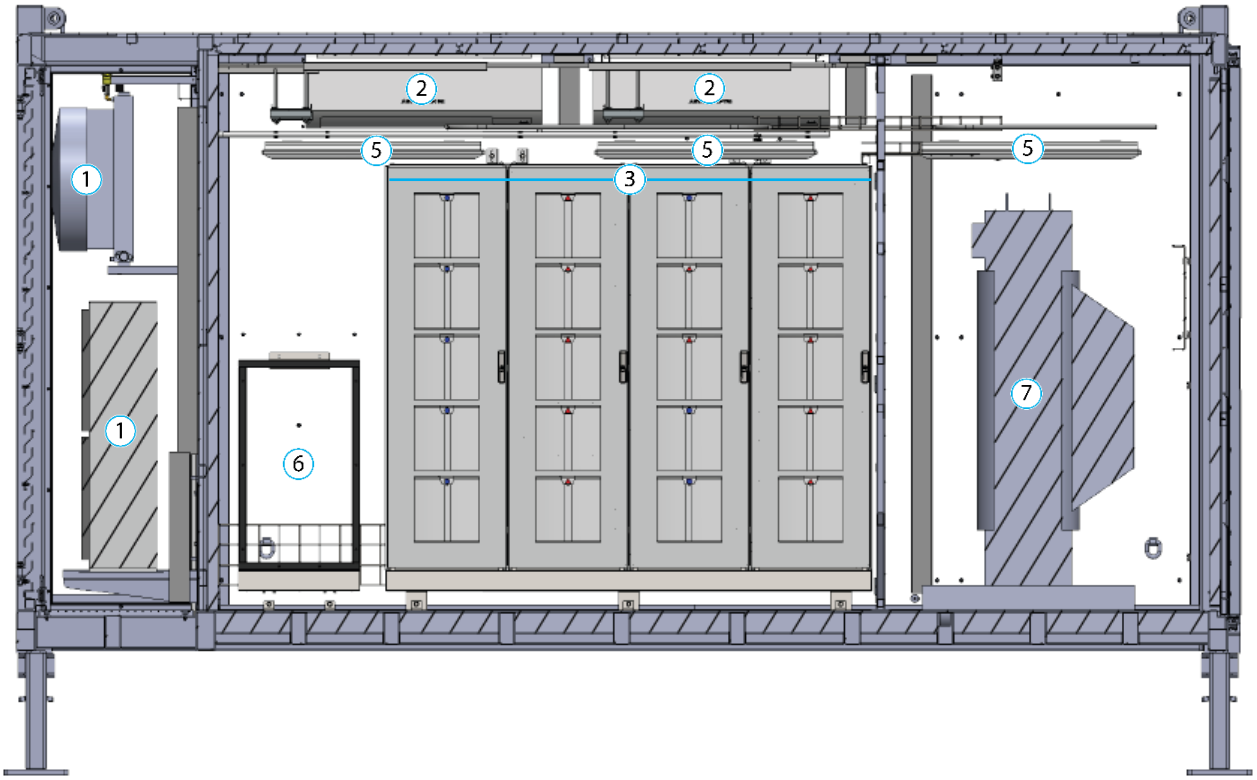


Figure 6: Container overview – side view

Position	Component
①	External cooling system components (*for details see section 4.8 "Cooling System"*)
②	Internal cooling system components (*for details see section 4.8 "Cooling System"*)
③	Converter cabinets (CONV)
④	Control cabinets (CTRL_1 & CTRL_2)
⑤	Container lights
⑥	Cooling system cabinet (COSY)
⑦	MV Transformer

Table 7: Container overview – components

Top View

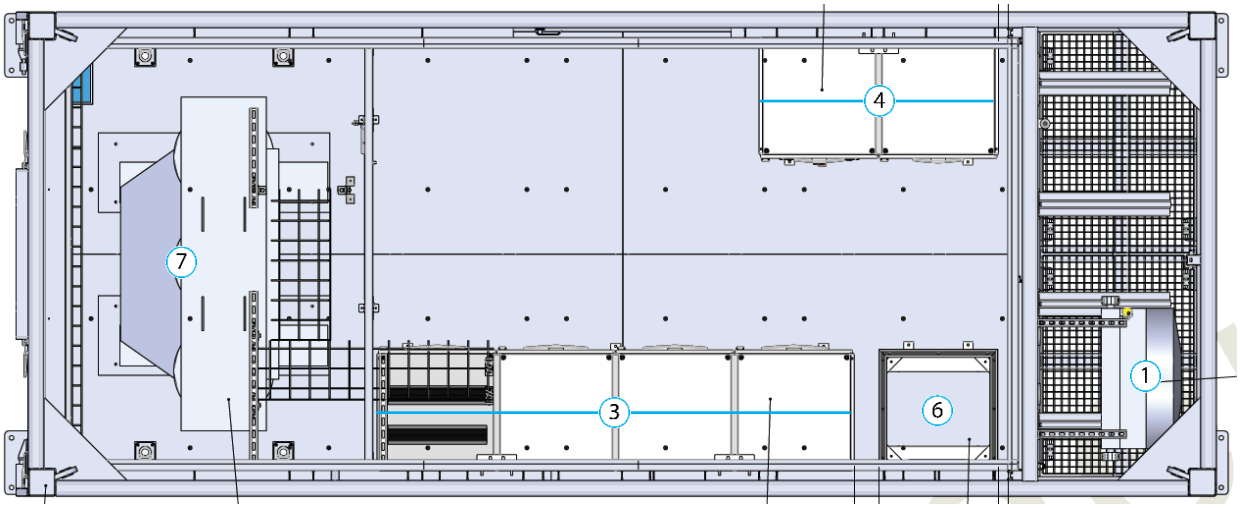


Figure 7: Container overview – side view

Perspective view

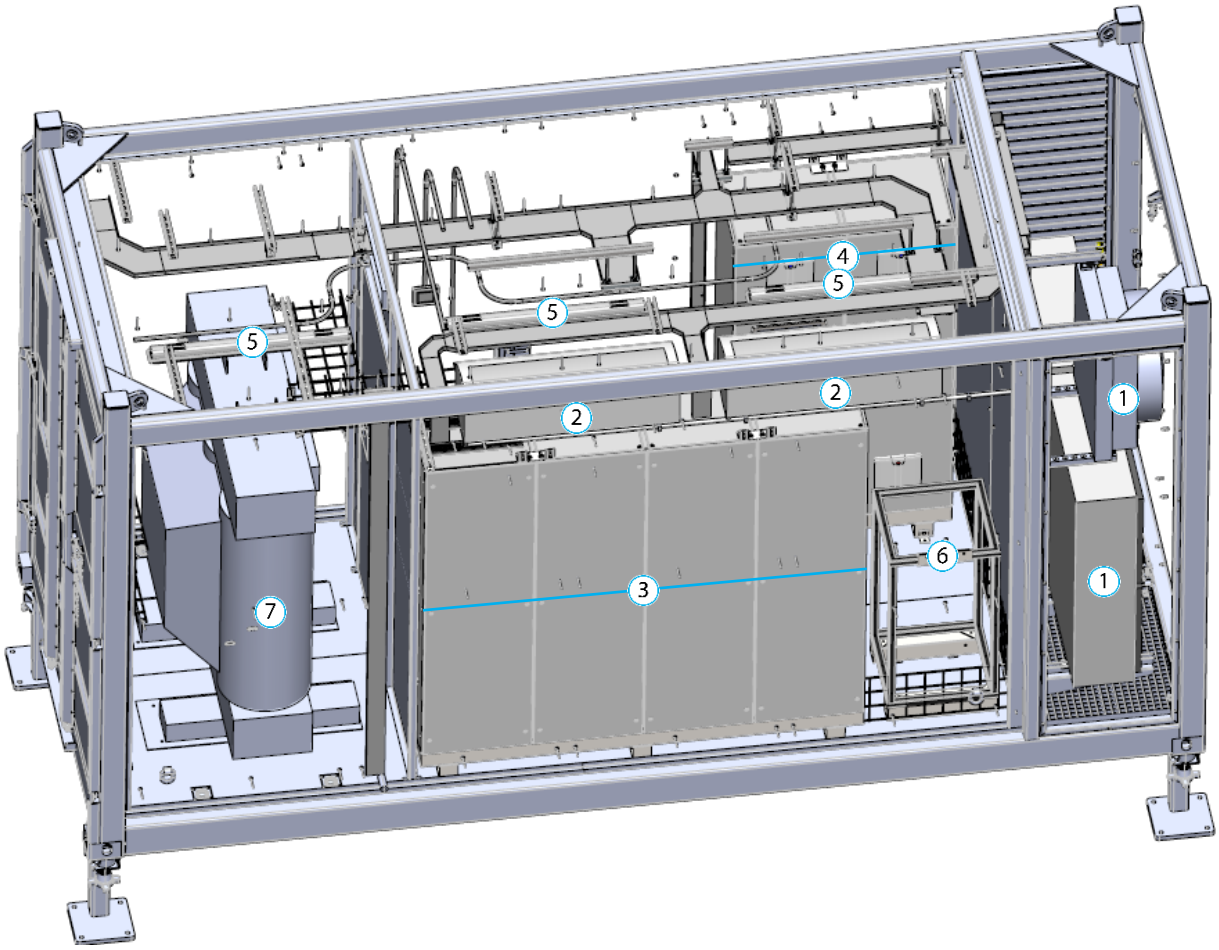


Figure 8: Container overview- perspective view

Side View Left

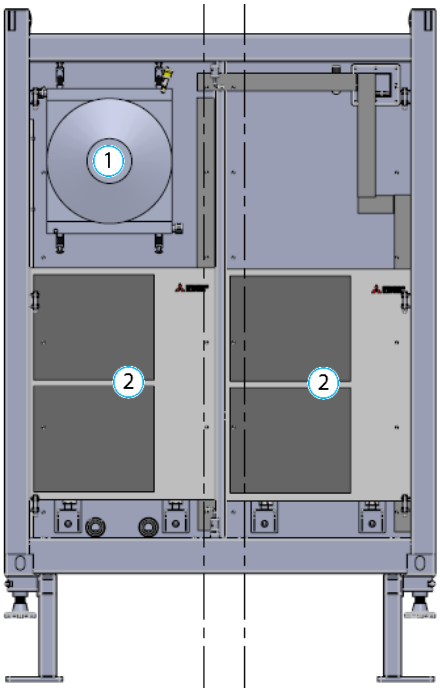


Figure 9: Container overview – side view left

Position	Component
①	Heat exchanger
②	External AC unit

Side View Right

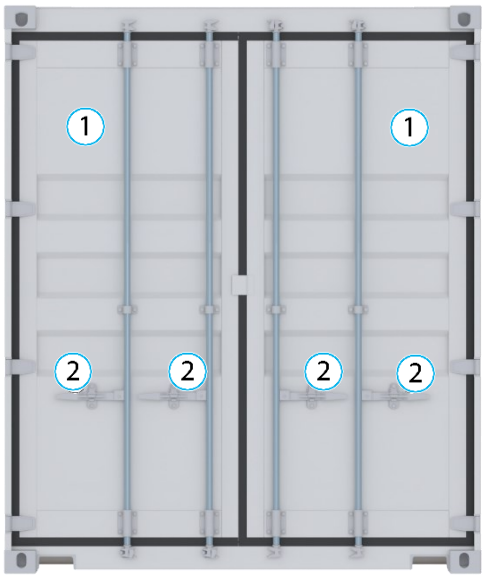


Figure 10: Container overview – side view right

Position	Component
①	Container doors
②	Door lock

Table 8: Container overview – side view left

4.4.2 Cabinet Overview- Converter Cabinets



Figure 11: Cabinet overview – converter unit

Position	Cabinet Designation	Abbreviation
①	Converter cabinet	CON
②	Inductor cabinet	IND
③	Circuit breaker cabinet	CIR
④	AC and DC connection cabinet	AC_DC

Table 9: Cabinet Overview – converter unit

4.4.3 Internal Components – Converter Cabinets

The following internal components are installed in the control cabinets of the AC/DC converter unit:

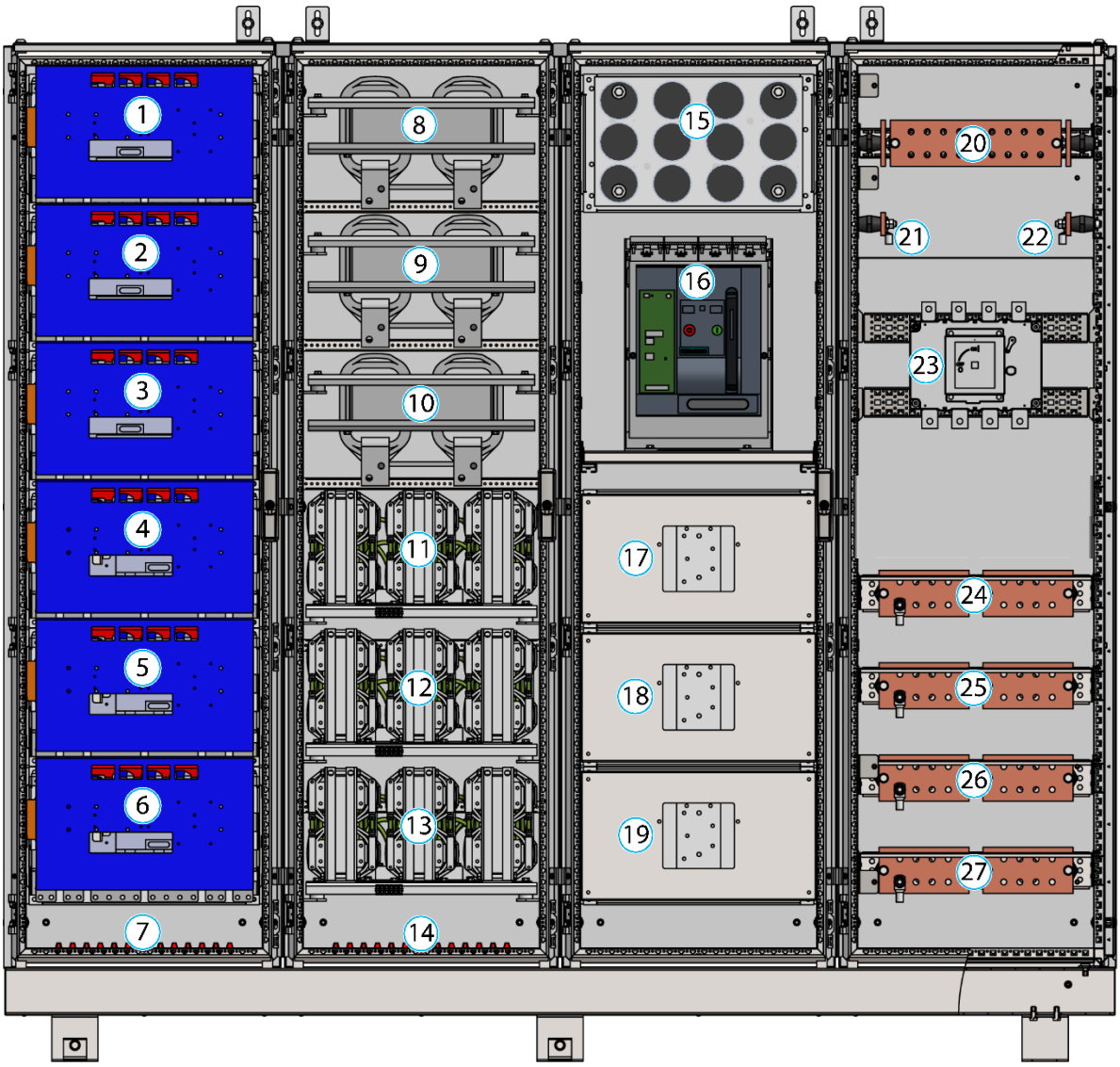


Figure 12: Internal components – converter unit

Pos.	Component	Part number	Identifier
1	AC IGBT Power Stack 1* 1000 A	52872	201Q1
2	AC IGBT Power Stack 1* 1000 A	52872	202Q1
3	AC IGBT Power Stack 1* 1000 A	52872	203Q1
4	DC IGBT Power Stack 3* 250 A	52867	207Q1
5	DC IGBT Power Stack 3* 250 A	52867	211Q1

6	DC IGBT Power Stack 3* 250 A	52867	217Q1
7	Coolant dispenser	--	--
8	AC Single phase line inductor 1000 A / 0.2 mH	53053	201L1
9	AC Single phase line inductor 1000 A / 0.2 mH	53053	202L1
10	AC Single phase line inductor 1000 A / 0.2 mH	53053	203L1
11	DC Single phase line inductor 3x 250 A / 0.6 mH	53046	207L1
12	DC Single phase line inductor 3x 250 A / 0.6 mH	53046	211L1
13	DC Single phase line inductor 3x 250 A / 0.6 mH	53046	217L1
14	Coolant dispenser	--	--
15	AC Filter 1000 A / 3*600 µF	52918	83U1
16	AC Main circuit breaker IEC 1000 A	52955	80Q1
17	DC Switch & Fuse 3* 250 A / 1000 V	52882	227U1
18	DC Switch & Fuse 3* 250 A / 1000 V	52882	231U1
19	DC Switch & Fuse 3* 250 A / 1000 V	52882	237U1
20	AC Grid connection busbars L1/L2/L3	--	78W1 - 78W3
21	N - Connection busbar	--	78W4
22	PE - Connection busbar	--	78W5
23	Switch for earthing and short-circuiting 600 A / 690 V	10172	18Q1
24	DC connection busbars + / - BESS 1 string 1 - 8	--	227W10 – 227W15
25	DC connection busbars + / - BESS 1 string 9 - 11	--	231W10 – 231W11
26	DC connection busbars + / - BESS 2 string 1 – 3 DC connection busbars + / - BESS 2 string 4 - 6	--	231W14 / 231W15 237W10 / 237W11
27	DC connection busbars + / - BESS 2 string 7 - 11	--	237W12 – 237W15

Table 10: Internal components – converter unit

4.4.4 Cabinet Overview - Control Cabinets

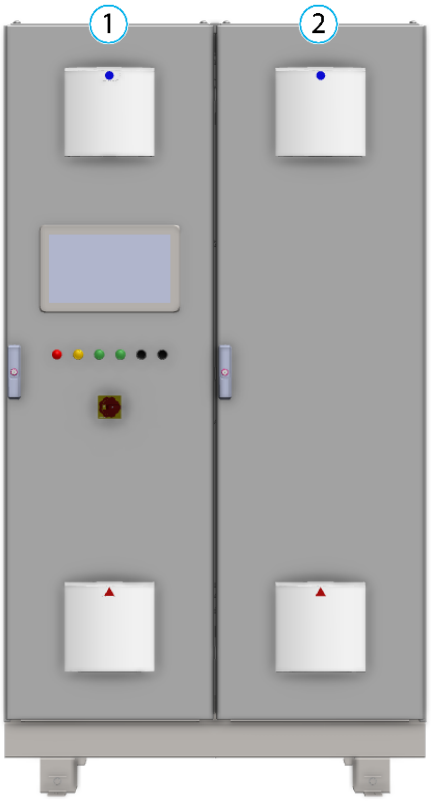


Figure 13: Cabinet overview – control cabinets

Position	Cabinet Designation	Abbreviation
①	Control cabinet 1	CTRL_1
②	Control cabinet 2	CTRL_2

Table 11: Cabinet Overview – control cabinets

4.4.5 Internal Components – Control Cabinets (CTRL_1 and CTRL_2)

The following internal components are contained within the control cabinets (CTRL_1 and CTRL_2).

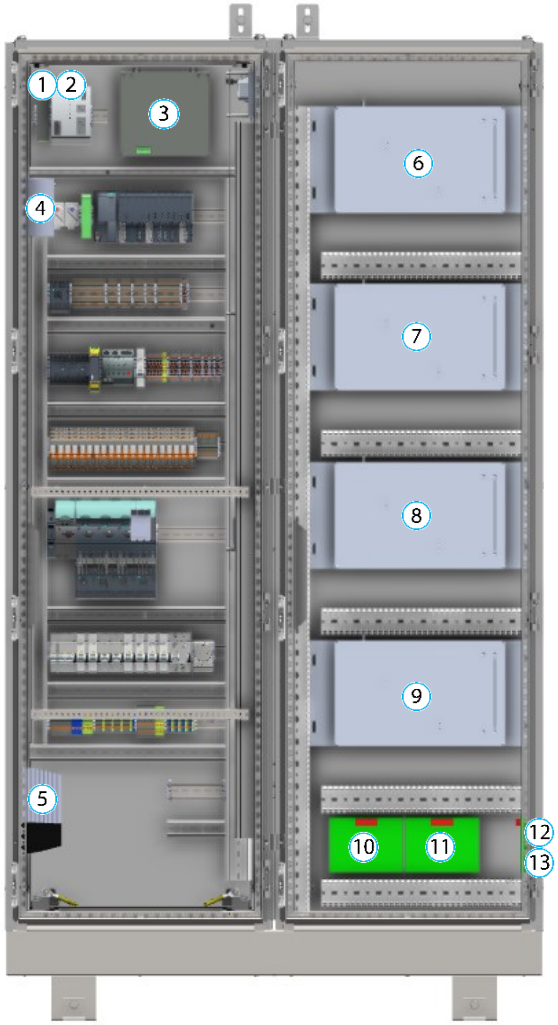


Figure 14: Internal components – control cabinets (CTRL_1 and CTRL_2)

Pos.	Component	Part number	Identifier
1	UPS unit 24 V DC	501836	102G1
2	24 V DC power supply for UPS unit	502745	101T1
3	Energy storage 24 V DC / 12 Ah for UPS unit	501229	102G2
4	Main controller PLC SIMOTION P320-4	500789	110U1
5	Cabinet heater 800 W	500621	185R1
6	PIII IGBT IRT Interface 2.6 V4	504890	240U1
7	PIII IGBT IRT Interface 2.6 V4	504890	241U1
8	PIII IGBT IRT Interface 2.6 V4	504890	242U1
9	PIII IGBT IRT Interface 2.6 V4	504890	243U1

10	HVIO Modul V5.0	500390	161U1
11	HVIO Modul V5.0	500390	162U1
12	HVIO Modul V5.0	500390	163U1
13	HVIO Modul V5.0	500390	164U1

4.4.6 External Components – Control Cabinet

The following internal components are contained within the control cabinet 1 (CTRL_1).

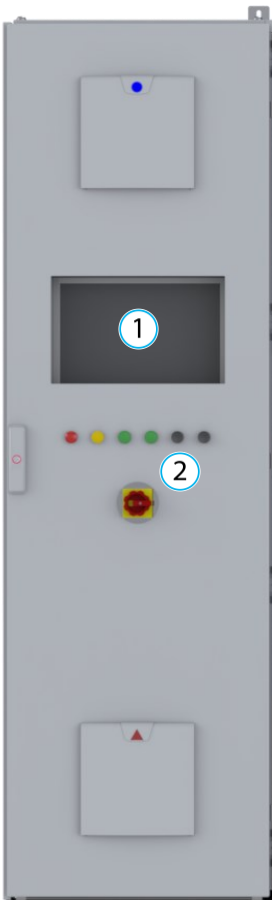


Figure 15: Internal components - control cabinet 1

Pos.	Component
1	HMI panel
2	Operating panel *(see 14.1 "Operating* Panel*")*

Table 12: Internal components - control cabinet

4.5 BESS 1 Container

4.5.1 Container Overview

Side view

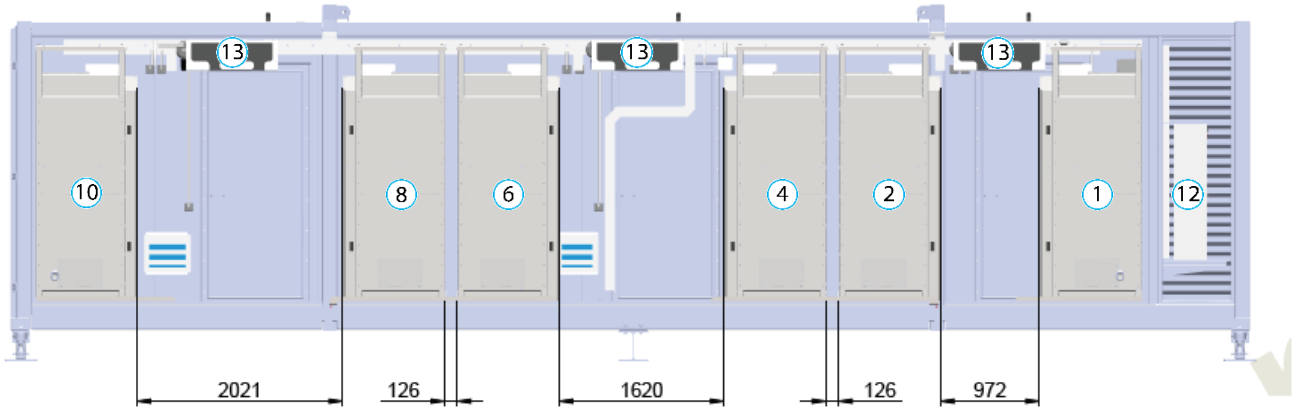


Figure 16: Container overview – side view

Position	Component
①	Battery storage cabinet (BESS 1 string 1)
②	Battery storage cabinet (BESS 1 string 2)
③	Battery storage cabinet (BESS 1 string 3)
④	Battery storage cabinet (BESS 1 string 4)
⑤	Battery storage cabinet (BESS 1 string 5)
⑥	Battery storage cabinet (BESS 1 string 6)
⑦	Battery storage cabinet (BESS 1 string 7)
⑧	Battery storage cabinet (BESS 1 string 8)
⑨	Battery storage cabinet (BESS 1 string 9)
⑩	Battery storage cabinet (BESS 1 string 10)
⑪	Battery storage cabinet (BESS 1 string 11)
⑫	External cooling system component (*for details see section 4.8 "Cooling System"*)
⑬	Internal cooling system component (*for details see section 4.8 "Cooling System"*)
⑭	Container lights
⑮	Lifting device (*for details see section 4.7.5 "Lifting Device"*)

Table 13: Container overview – components

Top View

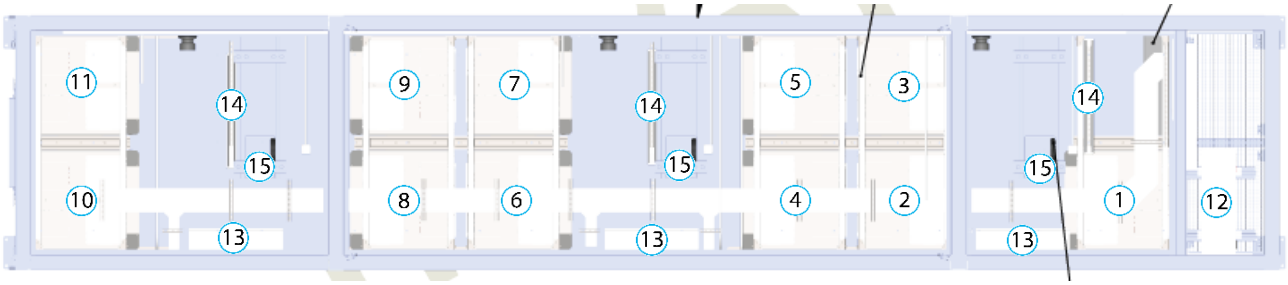


Figure 17: Container overview – top view

Perspective view

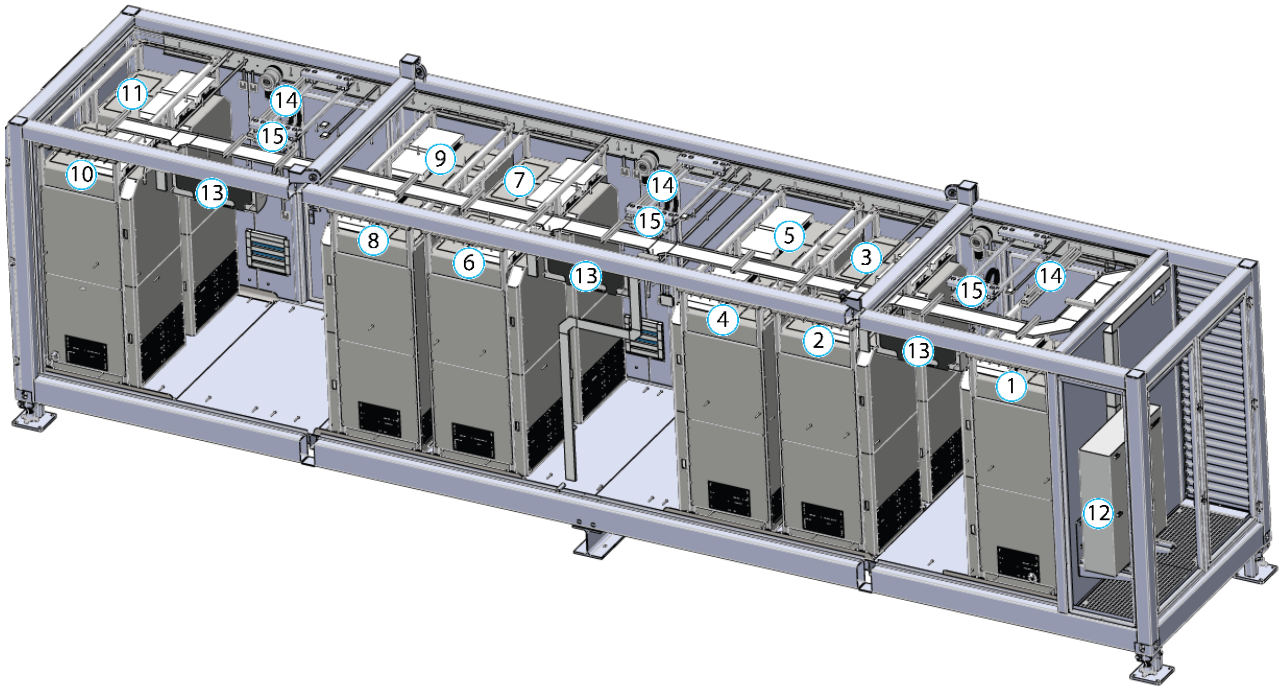


Figure 18: Container overview- perspective view

Side View Left

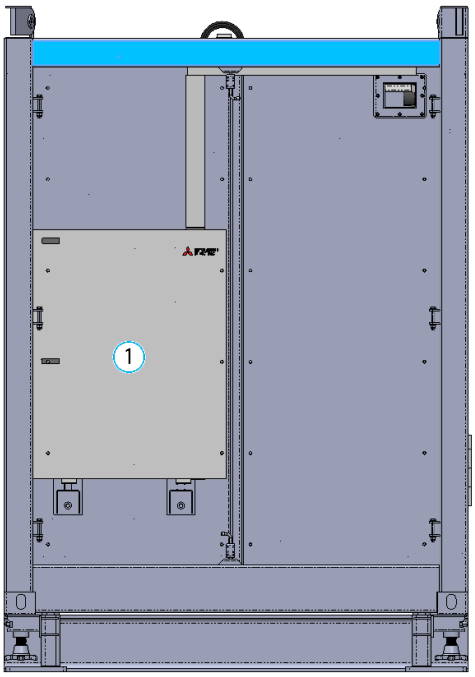


Figure 19: Container overview – side view left

Position	Component
①	External AC unit

Table 14: Container overview – side view left

Side View Right

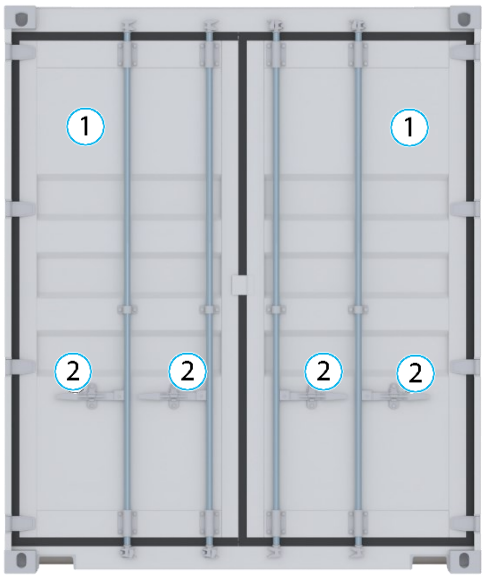


Figure 20: Container overview – side view right

Position	Component
①	Container doors
②	Door lock

Table 15: Container overview – side view left

4.5.2 Cabinet Overview- BESS 1 Battery Cabinets

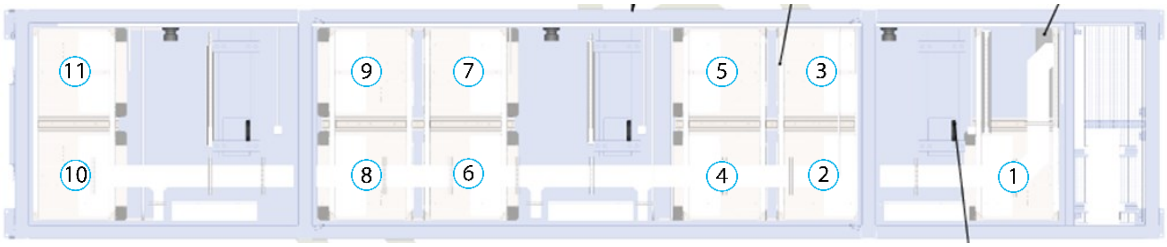


Figure 21: Cabinet overview – BESS 1 battery cabinets (Container top view)

Position	Cabinet Designation	Abbreviation
①	Battery cabinet 1	BESS.STR_1
②	Battery cabinet 2	BESS.STR_2
③	Battery cabinet 3	BESS.STR_3
④	Battery cabinet 4	BESS.STR_4
⑤	Battery cabinet 5	BESS.STR_5
⑥	Battery cabinet 6	BESS.STR_6
⑦	Battery cabinet 7	BESS.STR_7
⑧	Battery cabinet 8	BESS.STR_8
⑨	Battery cabinet 9	BESS.STR_9
⑩	Battery cabinet 10	BESS.STR_10
⑪	Battery cabinet 11	BESS.STR_11

Table 16: Cabinet Overview – BESS 1 battery cabinets

4.5.3 Internal Components – Battery Cabinets

The following internal components are contained within the battery cabinets:



Figure 22: Internal components – battery storage cabinets

Pos.	Component	Part number
①	Cabinet fan	505587
②	Battery module LF 280	508972
③	Aerosol cartridge of fire extinguishing unit Aero-X Stat-X 60E	506501
④	Optical smoke detector 12 V	500713
⑤	DC fuse switch disconnector 3NP1, 3-pole, NH2, 400 A	10226
⑥	Mounting plate with cabinet control system, DC, contactors etc.	52422

Table 17: Internal components – battery storage cabinets

4.6 BESS 2 Container

4.6.1 Container Overview

Side view

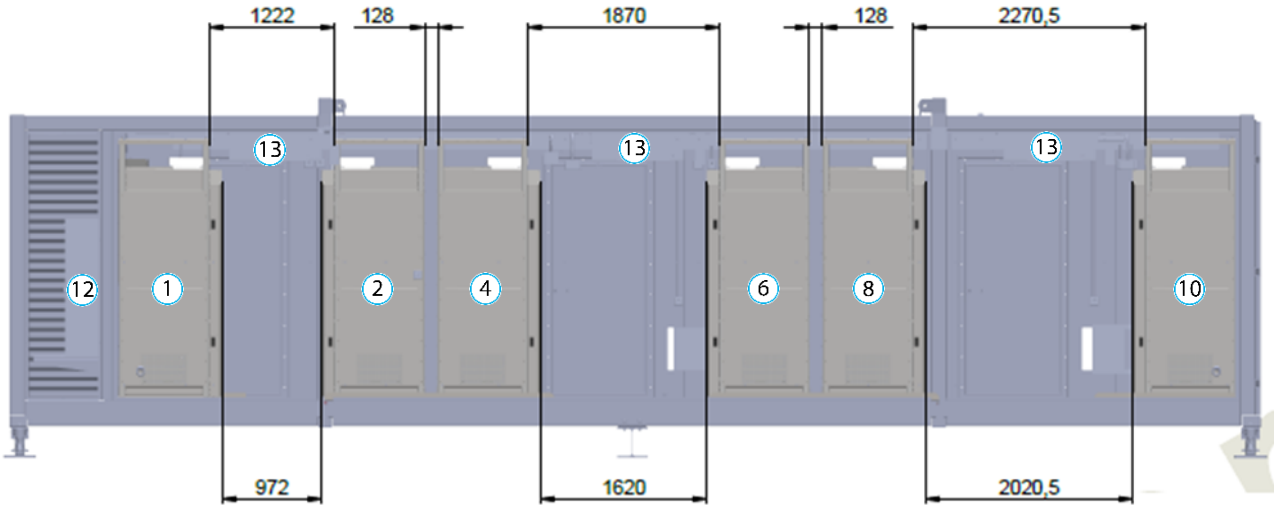


Figure 23: Container overview – side view

Position	Component
①	Battery storage cabinet (BESS 2 string 1)
②	Battery storage cabinet (BESS 2 string 2)
③	Battery storage cabinet (BESS 2 string 3)
④	Battery storage cabinet (BESS 2 string 4)
⑤	Battery storage cabinet (BESS 2 string 5)
⑥	Battery storage cabinet (BESS 2 string 6)
⑦	Battery storage cabinet (BESS 2 string 7)
⑧	Battery storage cabinet (BESS 2 string 8)
⑨	Battery storage cabinet (BESS 2 string 9)
⑩	Battery storage cabinet (BESS 2 string 10)
⑪	Battery storage cabinet (BESS 2 string 11)
⑫	External cooling system component (*for details see section 4.8 "Cooling System"*)
⑬	Internal cooling system component (*for details see section 4.8 "Cooling System"*)
⑭	Container lights
⑮	Lifting device (*for details see section 4.7.5 "Lifting Device"*)

Table 18: Container overview – components

Top View

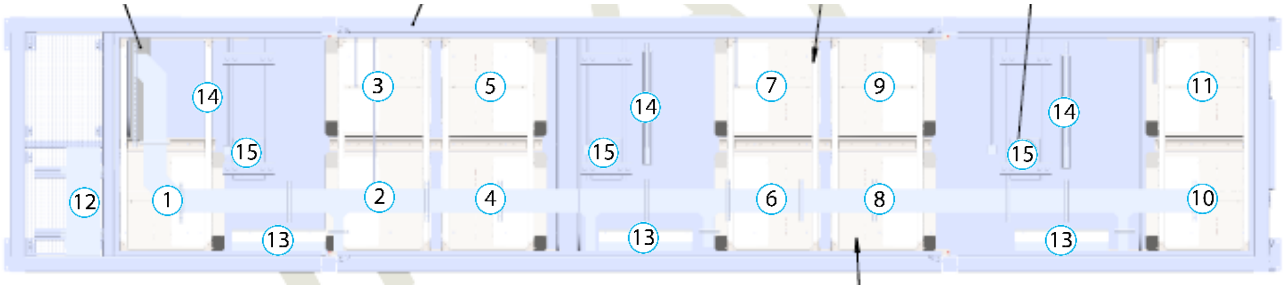


Figure 24: Container overview – top view

Perspective view

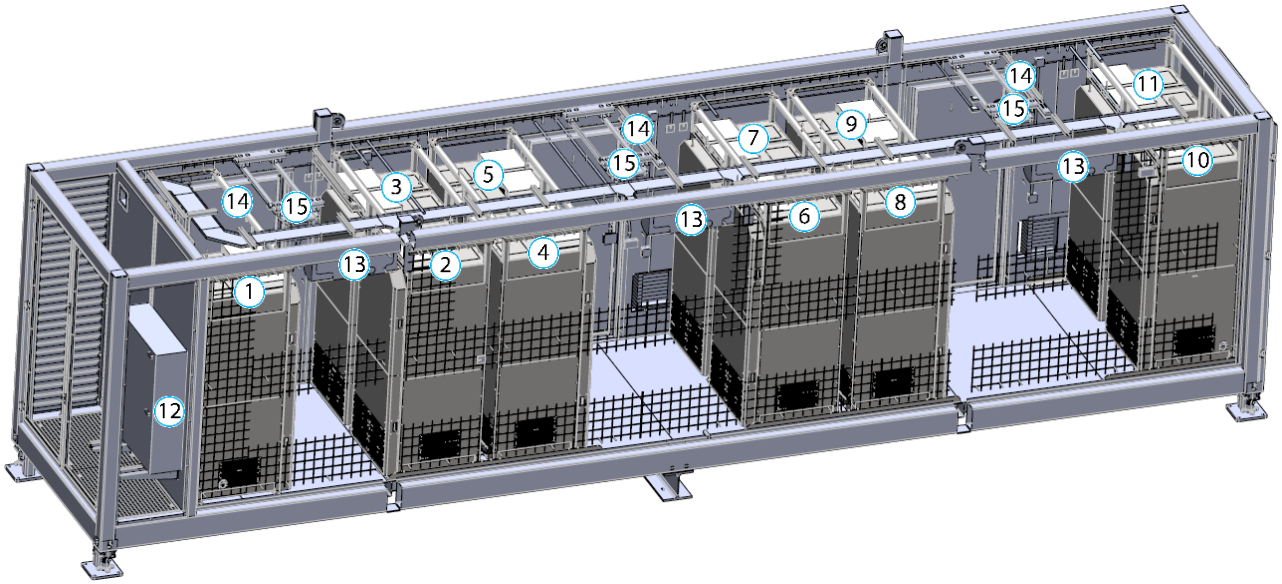


Figure 25: Container overview- perspective view

Side View Left

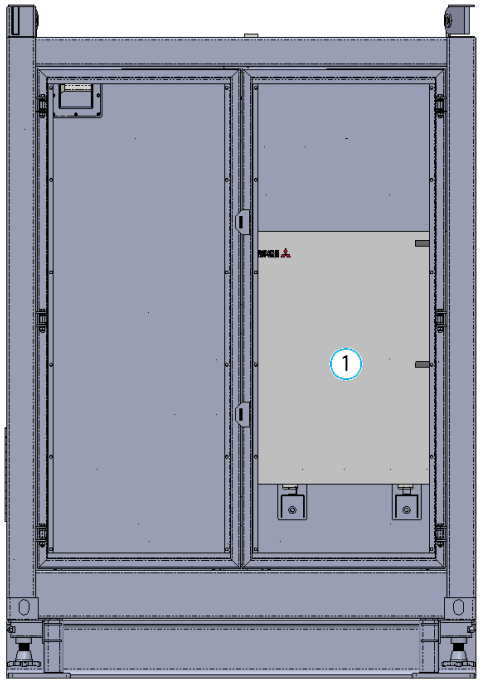


Figure 26: Container overview – side view left

Position	Component
①	External AC unit

Table 19: Container overview – side view left

Side View Right

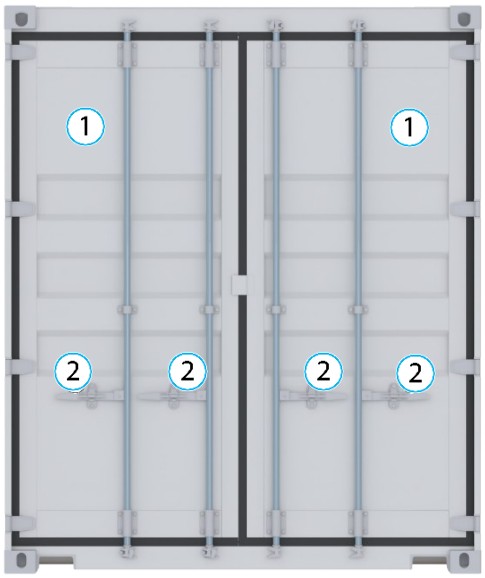


Figure 27: Container overview – side view right

Position	Component
①	Container doors
②	Door lock

Table 20: Container overview – side view left

4.6.2 Cabinet Overview- BESS 2 Battery Cabinets

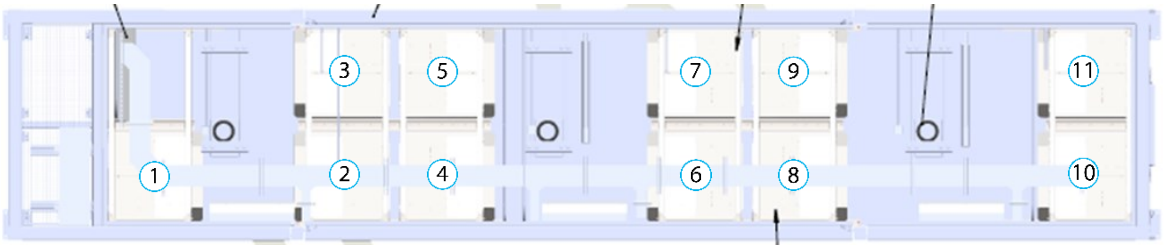


Figure 28: Cabinet overview – BESS 2 battery cabinets (Container top view)

Position	Cabinet Designation	Abbreviation
①	Battery cabinet 1	BESS.STR_1
②	Battery cabinet 2	BESS.STR_2
③	Battery cabinet 3	BESS.STR_3
④	Battery cabinet 4	BESS.STR_4
⑤	Battery cabinet 5	BESS.STR_5
⑥	Battery cabinet 6	BESS.STR_6
⑦	Battery cabinet 7	BESS.STR_7
⑧	Battery cabinet 8	BESS.STR_8
⑨	Battery cabinet 9	BESS.STR_9
⑩	Battery cabinet 10	BESS.STR_10
⑪	Battery cabinet 11	BESS.STR_11

Table 21: Cabinet Overview – BESS 2 battery cabinets

4.6.3 Internal Components – Battery Cabinets

The following internal components are contained within the battery cabinets:



Figure 29: Internal components – battery storage cabinets

Pos.	Component	Part number
①	Cabinet fan	505587
②	Battery module LF 280	508972
③	Aerosol cartridge of fire extinguishing unit Aero-X Stat-X 60E	506501
④	Optical smoke detector 12 V	500713
⑤	DC fuse switch disconnector 3NP1, 3-pole, NH2, 400 A	10226
⑥	Mounting plate with cabinet control system, DC, contactors etc.	52422

Table 22: Internal components – battery storage cabinets

4.7 Battery Modules



Figure 30: Battery module LF 280

4.7.1 Design

The lithium iron phosphate cells (LiFePO4) inside the LF 280 battery modules are connected in series and provide a total energy content of 8.96 kWh per module.

Each module is equipped with a monitoring PCB, providing the following functions:

- Voltage monitoring of single cells for charging and discharging
- Battery temperature monitoring
- Selective cell balancing
- Data exchange with central BESS controller
- Local insulation measurement
- Robust industrial design for transport, assembly und operation



Figure 31: Battery module design

No.	Component
①	Battery module LF280
②	Boreholes for lifting device (M6)
③	DC positive (+) socket
④	DC negative (-) socket
⑤	COM-Connection RJ45 and 24 V DC power supply
⑥	Boreholes for transport handle mounting
⑦	Label with safety and warning instructions

Table 23: Battery module design

4.7.2 Technical Data

Technical Data Battery Module LF 280	
Part number	508972
Rated Voltage	32 V DC
Total capacity	280 Ah
Number of cells per battery module	10
Stored Energy	8960 Wh
Maximum voltage	36 V DC
Max. current	280 A
Max. charge and discharge rate	1 C
Temperature range storage	-20 °C … +45 °C (long-term storage at 0…35°C)
Temperature range operation	0 °C … +55 °C
Connections for DC+ / DC-	Surlock Plus
Communication connections	RJ 45
Protection class	IP 20
Weight	65.3 kg
Dimensions (WxHxD)	188 mm x 239 mm x 908 mm
Cell Data (Single Cell)	
Type	Prismatic cells
Capacity (typ.)	280 Ah
Voltage (typ.)	3.2 V
Voltage (max.)	3.65 V
Voltage (min.)	2.5 V
Battery life	>3500 cycles (80% remaining capacity)
Impedance (AC)	<0.25 mΩ
BMS Pack Universal	
Power supply (external)	24 V DC (rated), <0.5 W
Power supply (internal)	36 V DC (max.), < 0.2 W
Communication	EIA-485, Modbus RTU
Baud rate (max.)	19200 Bit/s
Bus participants (max.)	32
Balancer design	Load resistor
Balancer current @3.5 V	1.06 A
Voltage measurement	10 measurements per 14-bit resolution
Temperature measurements	8x NTC 10 kΩ (up to 14 bit analogue/digital converter) 1x PT100 (12 bit analogue/digital converter)
Isolation measurement	Earth fault monitoring

Table 24: Technical data - Battery module LF280

4.7.3 Connection Elements



Figure 32:Connection elements

Pos.	Terminal	Description	Connection type	Cable
①	X1	DC + Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
②	X2	DC – Battery module	10.3 mm Surlock Plus	Pay attention to cable routing in cabinet
④	X3	Communication (input)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7
⑤	X4	Communication (Output)	RJ45, 45°	PiMF, 4x2 min. AWG 27/7
⑤	X5	24 V DC power supply	2-pole male terminal	Pay attention to cable routing in cabinet

Table 25: Connection elements

4.7.4 Communication Scheme

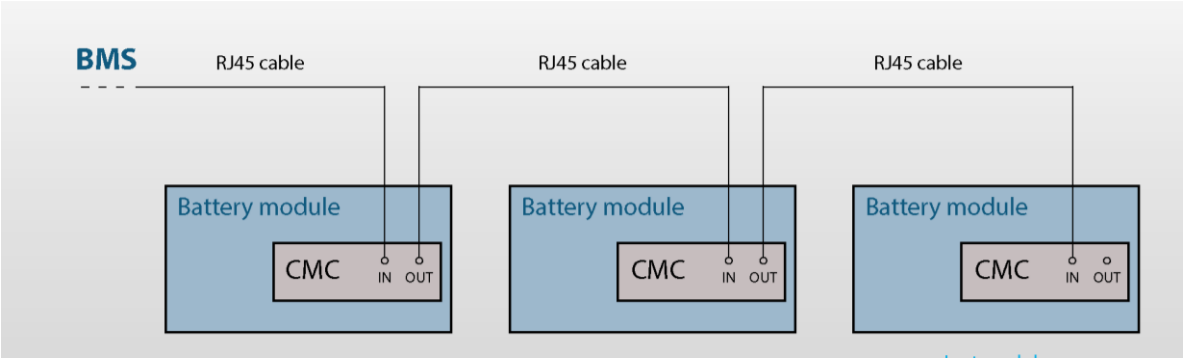


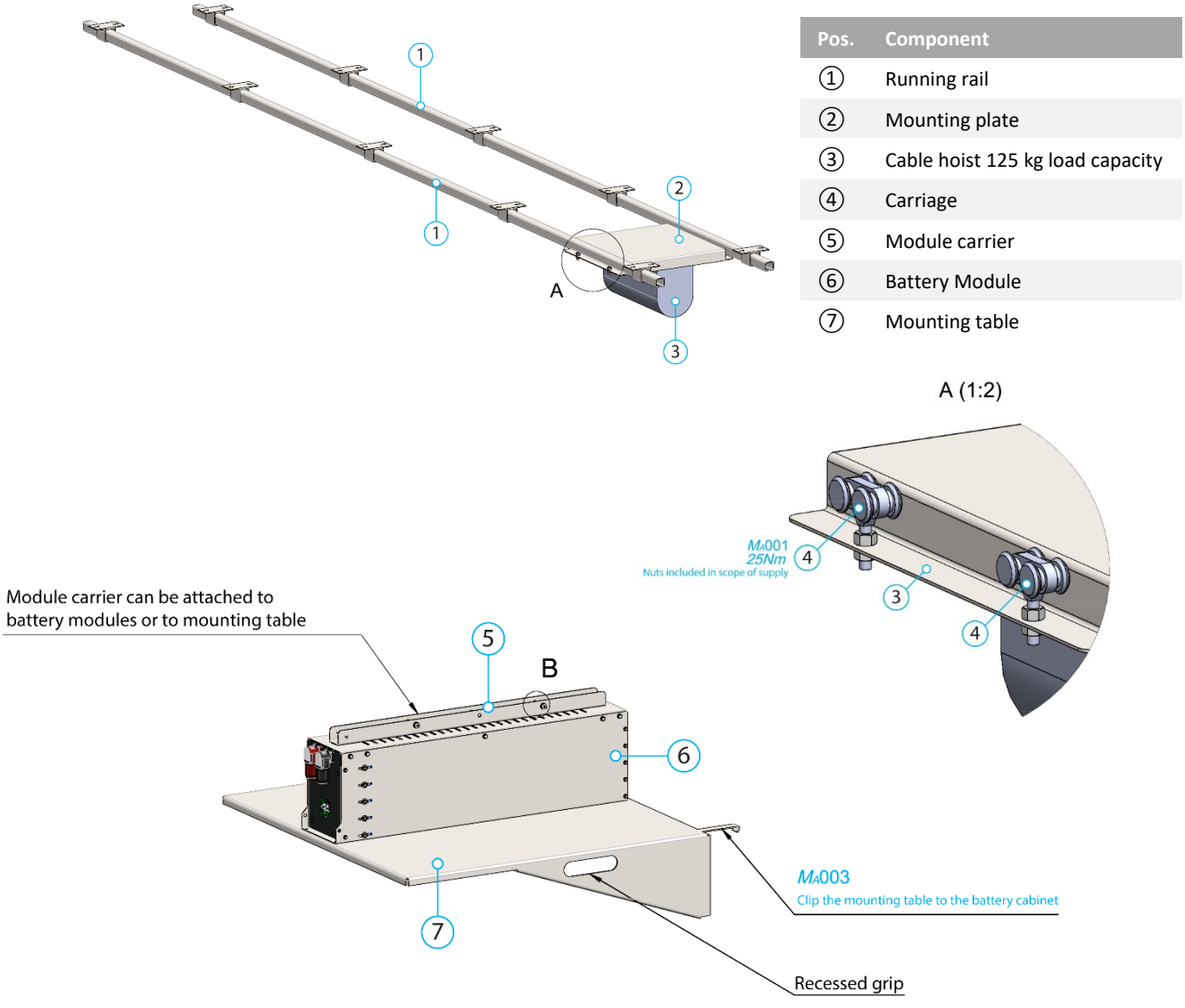
Figure 33: BMS communication scheme

4.7.5 Lifting Device and Mounting Table

For the lifting of battery modules, a lifting device is installed at the container ceiling, allowing safe handling and installation of the battery modules.

The lifting device mainly consist of a cable hoist which is mounted to a mounting plate with carriers, allowing to move the cable hoist through running rails to each end of the container. The cable hoist is operated via cable remote control.
For better handling of the battery modules when inserting them to the battery storage cabinet, a mounting table is provided, that can be attached to the battery storage cabinets.

For detailed information and operating instructions regarding the cable hoist, please refer to the original cable hoist manufacturer's original operating manual (*see section 1.2 "Applicable Documents"*).



Pos.	Component
①	Running rail
②	Mounting plate
③	Cable hoist 125 kg load capacity
④	Carriage
⑤	Module carrier
⑥	Battery Module
⑦	Mounting table

Figure 34: Lifting device and mounting table

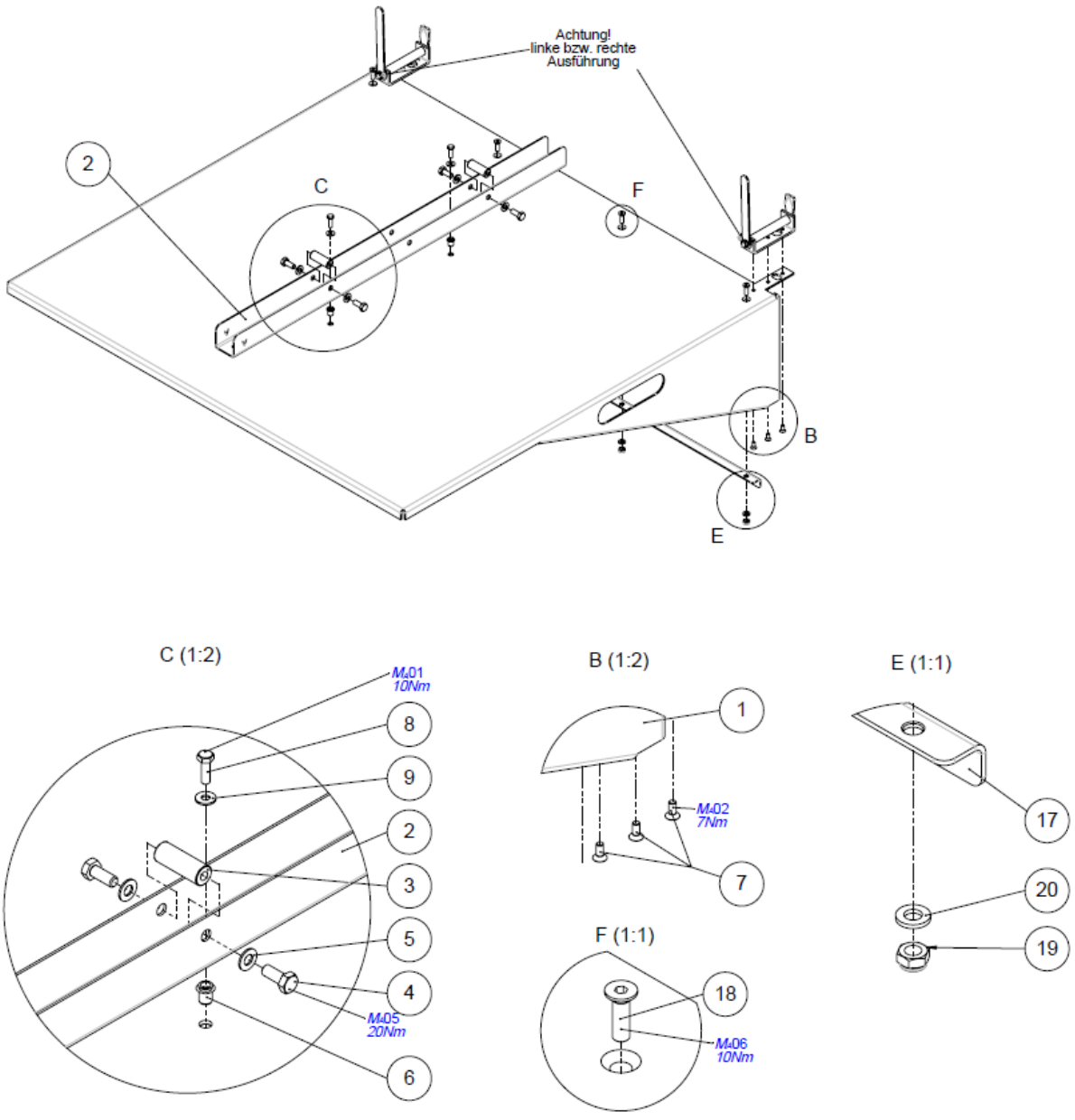


Figure 35: Mounting table

4.7.6 Mobile Lifting Device

A mobile lifting device for moving battery modules inside the BESS containers can be used. The mobile lifting device “Material-Lift GUIL ELC-725” or other models are suitable to lift and mount battery modules inside FREQCON BESS containers.

One (1) battery module can be placed onto the table of the mobile lifting device at once. The module needs to be pushed from the pallet of the forklift truck in front of the BESS container door onto the table of the mobile lifting device.

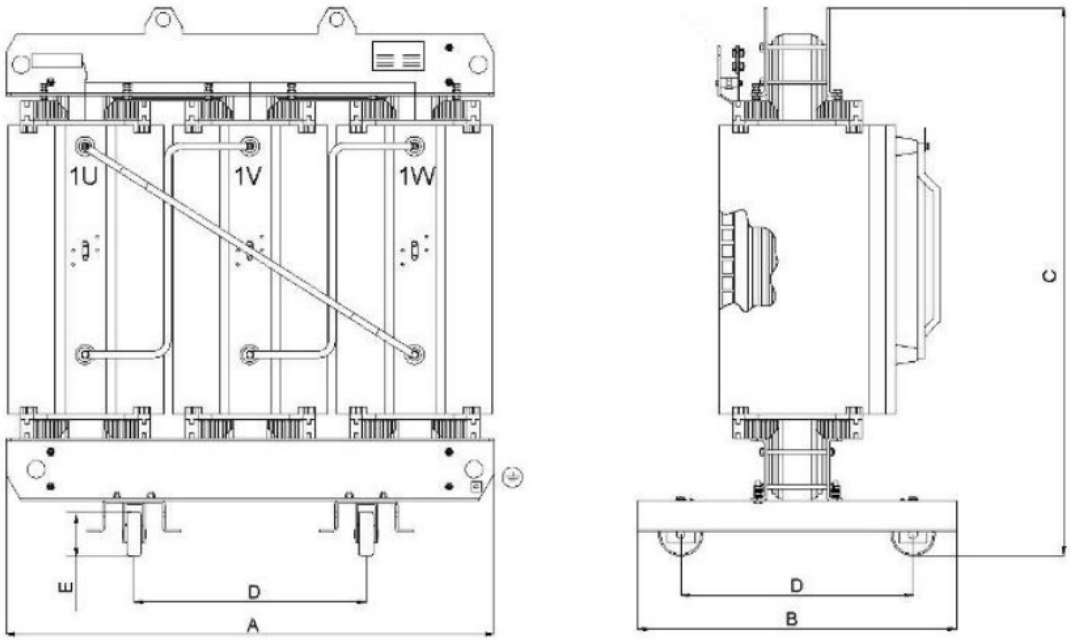
The mobile lifting device can then be moved to the battery cabinet where the battery module needs to be installed.



Figure 36: Mobile lifting device “Material-Lift GUIL ELC-725”

Technical details	
Dimensions L x W x H	400 mm x 550 mm x 1320 mm
Type of construction	Material lift
Overall height	1320 mm
Dead weight	51 kg
Lifting function	Cable winch
Lifting height	4000 mm
Platform dimensions L x W	550 x 500 mm
Table height max.	3940 mm
Table height min.	1320 mm
Load capacity:	125 kg

4.7.7 MV Transformer



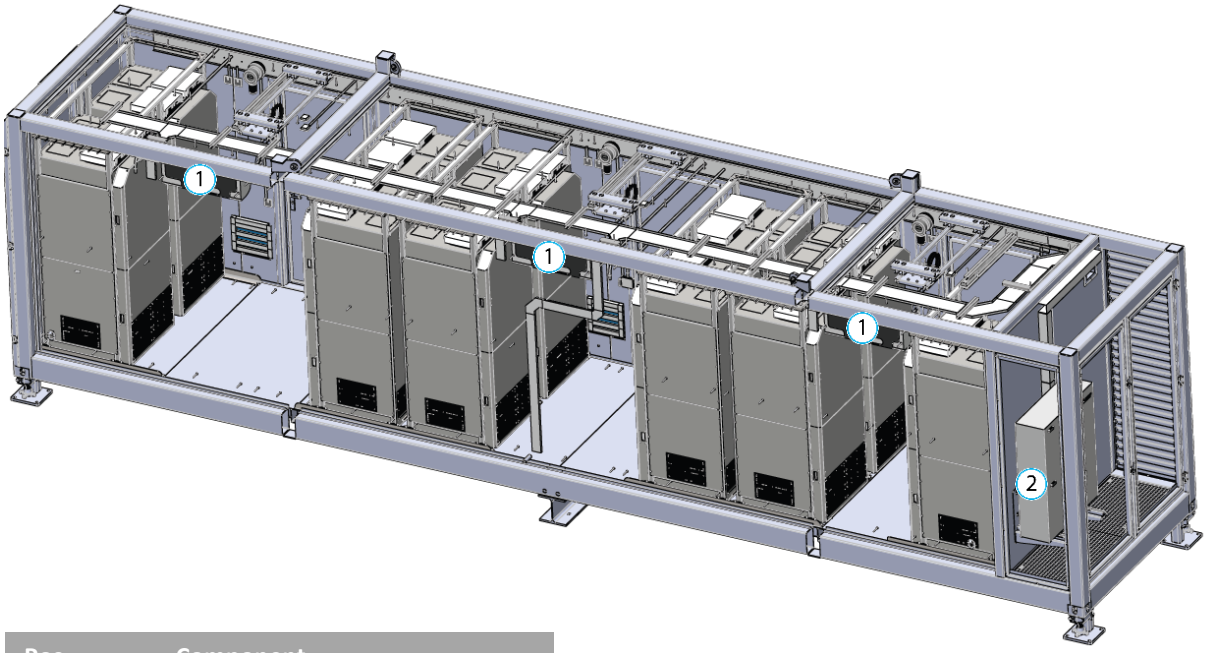
Position	1			
Reference Standards	IEC 60076-1,IEC 60076-11, EU 548/2014,EN 50588-1			
Type	TPZ3K7.2.1250	**Application**	Converter	6 Pulse
Rated Power – AN	1250 kVA	**Duty Class**	I	
Type of Cooling	AN	**Frequency**	50 Hz	
Degree of Protection	IP00			

CHARACTERISTICS

	HV	**LV**
Voltage	7 kV	0,62 kV
Insulation Class	7.2/20/60 kV	1,1/3/- kV
Tapping	±2x2,5%	-
Material	Aluminium	Aluminium
Insulation class	F	F
Temperature rise	100 K	100 K
Connections location	Top	Top
Vector Group	Dyn5	
Level of losses	EcoDesign TIER II	
No-Load Losses (Po)	1620 W	
On-Load Losses 120°C (Pcc)	11000 W	
Tolerance on the losses	0%	
Impedance 120°C (Uk%)	6%	
Power Noise (Lwa)	≤ 66 dB(A)	
Pressure Noise (Lpa)	≤ 52 dB(A)	
Ambient Temperature	-25°C ; + 40°C	
Installation	≤ 1.000 m	
Fire (F), Environmental (E), Climatic (C) Classes	F1/E2/C2	
HV/LV earth screen	YES	
Dimensions IP00 (AxBxC)	1680x1050x1990 mm	**Wheel Base (D)** 820 mm
Wheels Dimensions (E)	160 mm	**Total Weight IP00** 3600 Kg

4.8 Cooling System

4.8.1 BESS 1 / BESS 2 Container



Pos	Component
①	Internal AC unit
②	External AC unit

Table 26: BESS 1 / BESS 2: Cooling system components

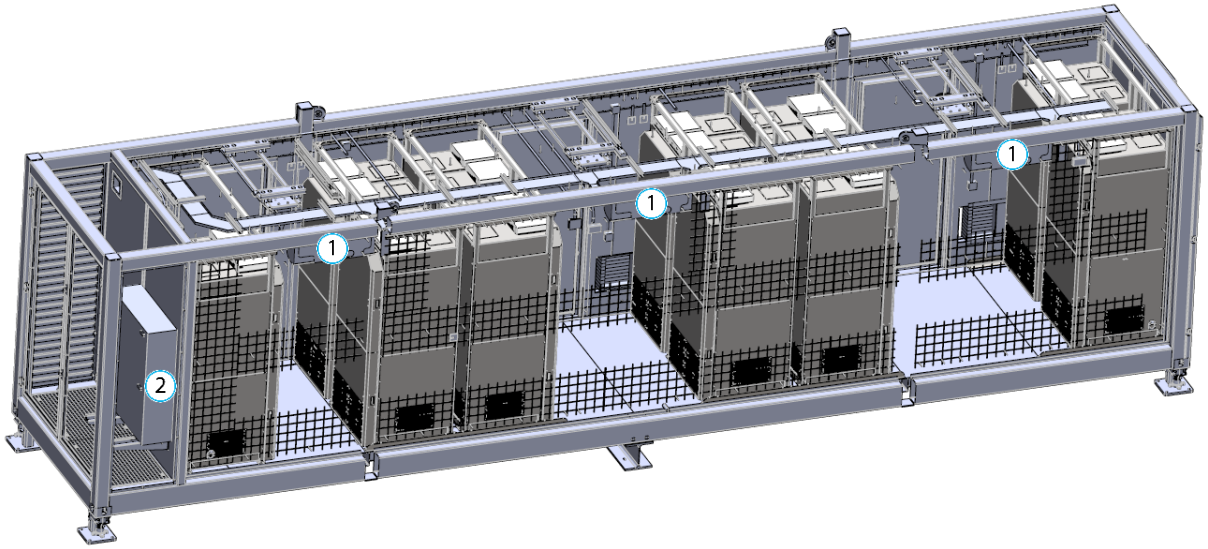


Figure 37: BESS 1 (above) / BESS 2 (below): Cooling system components

4.8.1.1 Battery Cabinets Cooling

The waste heat inside the battery cabinets is actively dissipated by two fans in the roof of each battery cabinet. The heated air is pushed out of the cabinet to the inside of the BESS container.

4.8.1.2 Container Cooling

The waste heat in the interior of the container is conducted via the three internal air conditioning (AC) units (*see Figure 37*) from the interior to the external air conditioning units of the container.

The container is equipped with several temperature sensors for monitoring the internal container temperature.

4.8.2 PCS Container

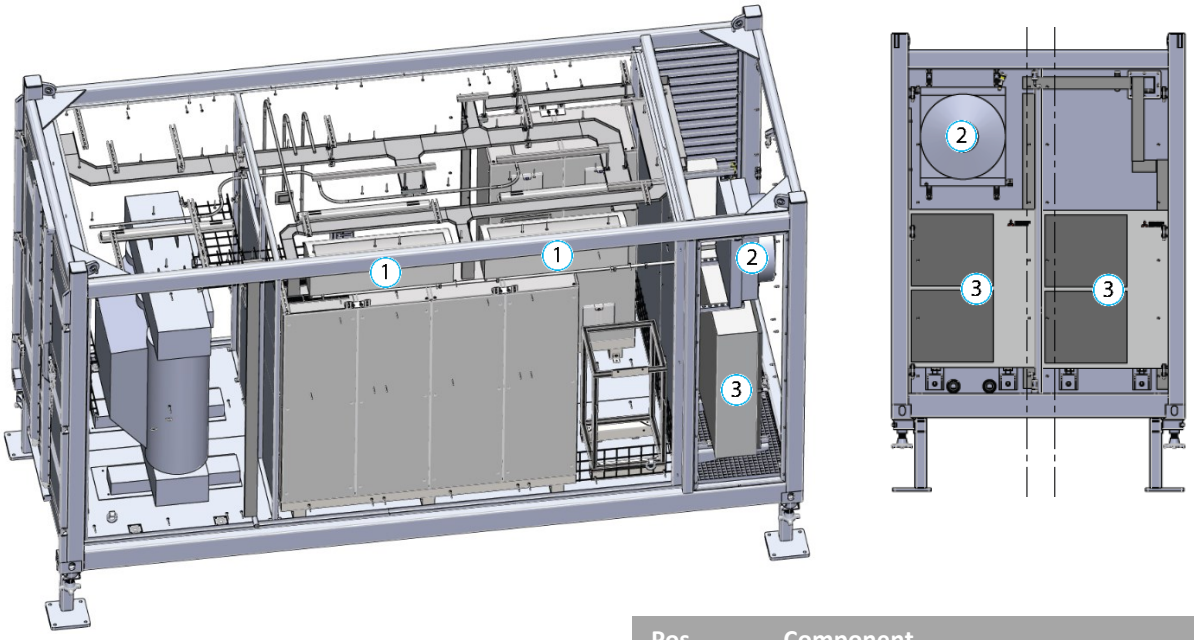


Figure 38: PCS: Cooling system components

Pos	Component
①	Internal AC unit
②	Heat exchanger
③	External AC unit

Table 27: PCS: Cooling system components

4.8.2.1 Container Cooling

The waste heat in the interior of the container is conducted via the three internal air conditioning (AC) units (*see Figure 38*) from the interior to the external air conditioning units of the container.

The container is equipped with several temperature sensors for monitoring the internal container temperature.

4.8.2.2 Converter Cooling System

To dissipate the waste heat from the IGBT power modules and inductors installed in the converter, these components are cooled down to the required operating temperature by an internal cooling system consisting of cooling hoses, coolant pumps, water distributors and four air/water heat exchangers.

The water-glycol-circulation (WGC) is designed as a closed cooling circuit. A water-glycol mix flows through the cooling modules of the converter and dissipates the heat produced by the IGBT modules. Additionally, the IGBT modules need a minimum temperature to operate properly. To heat up the IGBT modules from a cold start, the water-cooling system is pre-heated by an electrical heating element which is flange-mounted to the coolant manifold. The pre-heating process is performed to achieve an operational temperature of 25 °C, which takes about 20 minutes. After the IGBT modules have reached the temperature of about 25 °C, the converter is permitted to begin its normal operation.

The electrical pre-heater will be switched off automatically by a control unit at a temperature of > 28 °C of the coolant temperature sensor. The heating element is switched off at least 2 minutes before the pump is switched off. This procedure avoids overheating of the heating element since there must be a permanent flow around the heating element during heating.

A 3/2 directional mixing valve at the WGC unit controls the inlet temperature to the converter by mixing the water-glycol mixture of the heat exchanger and a bypass circuit. The 3/2 directional mixing valve opens at 36°C (mechanically set at mixing valve) and leads the cooling water to the heat exchanger.

Pre-heater on-off temperature hysteresis (sensor measures the inlet temperature to the converter)	
Coolant temperature > 28 °C	Heaters will be turned off
Coolant temperature < 25 °C	Heater will be turned back on

Table 28: Pre-heater on-off temperature hysteresis

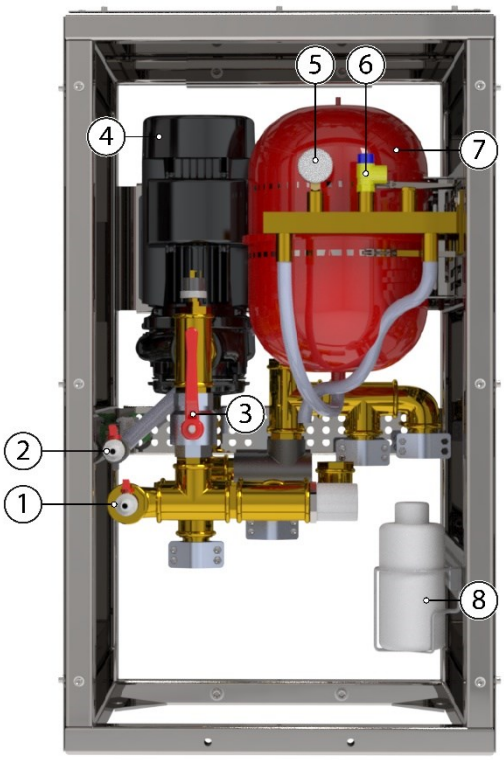


Figure 39: Cooling system cabinet (COSY) components

Position	Component
①	¾“ inlet flow connection with valve
②	"¾“ return flow connection with valve
③	Stop cock
④	Coolant pump
⑤	Manometer
⑥	Overpressure valve
⑦	Expansion vessel
⑧	Overflow vessel

Table 29: Cooling system enclosure (COSY) components

4.8.2.3 IGBT modules cooling

The cooling system dissipates the heat generated during normal operation of the converter.
The IGBT modules are mounted on heat sinks through which coolant flows. Tubing connectors provide the connection to the inlet and outlet of coolant.

4.8.2.4 Coolant Specifications

Coolant		
	Manufacturer	**Description**
Allowed Coolants	NALCO AG	Varidos FSK
	BASF AG	Glysantin G30
	Clariant	Antifrogen N
	Clariant	Antifrogen L
	DOW	Dowcal 20
Coolant concentration mixed with water	> 40 % to 60 % (depending on manufacturer recommendation)	
Coolant change interval	Every 5 years	

Table 30: Coolant specifications

5 Operating Interfaces

The BESS is operated and controlled either via

- The control panel on the control cabinet CTRL of the converter (*see section 14.1)*
  - Push-buttons
    - RESET (restart emergency stop circuit)
  - Indication lights:
    - Fault (red; controller error is active)
    - Preheating (yellow; preheating of coolant)
    - Ready for Operation (green; converter is ready for operation)
    - Operating (green; converter is active)
  - Other control elements:
    - Main switch
    - Emergency-stop push button
- interface to the customer's higher-level control system (*see section 6*).

6 Control System

6.1 Main Control System

The system is controlled and monitored by a main control system installed on the P320 PLC inside the control cabinet (CTRL). Both the converter and the BESS control system are installed on the same PLC.

Data exchange between the individual cabinet control systems and BESS main control system is performed via MODBUS TCP protocol.

BESS Main Control System Overview

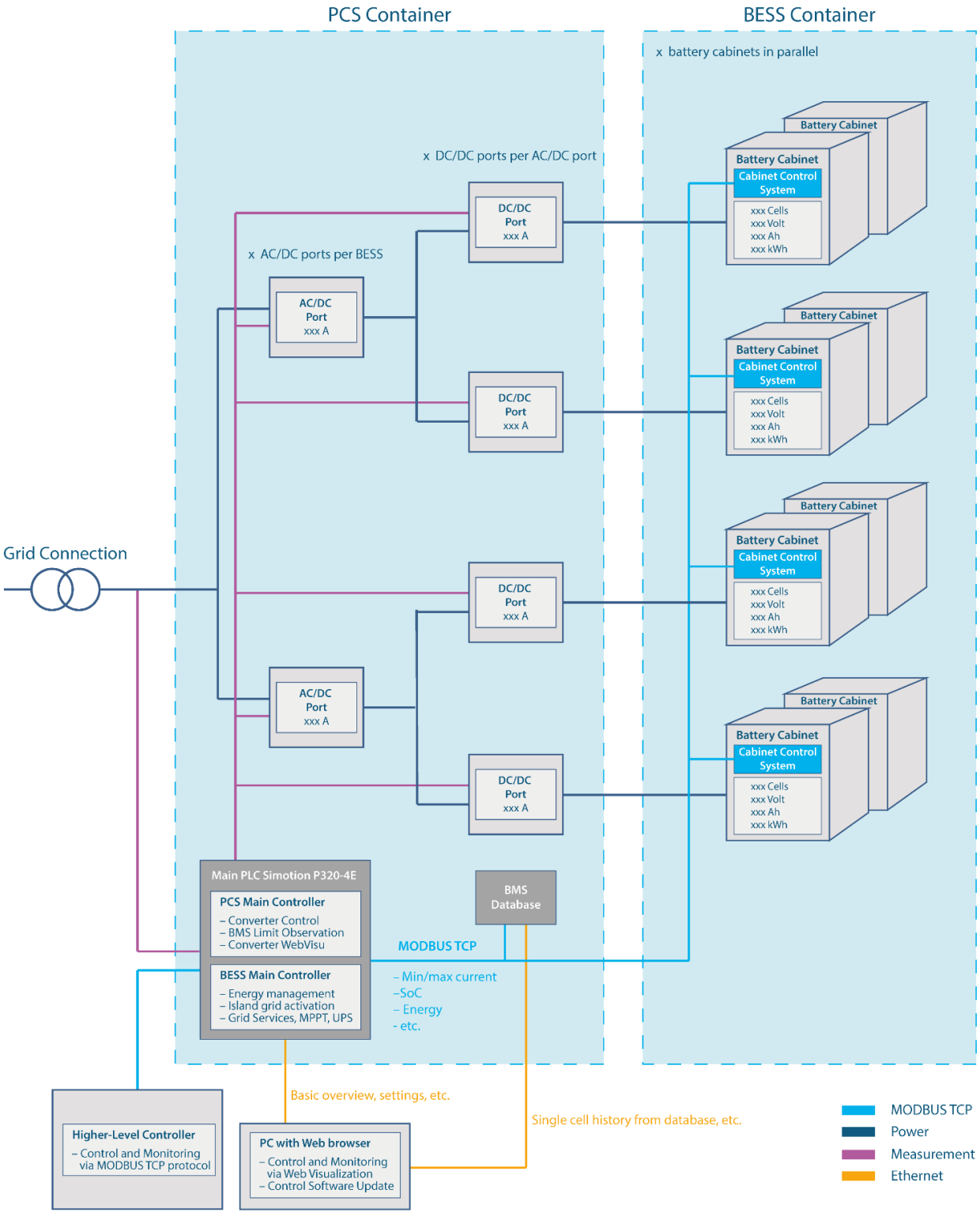


Figure 40: Main control system overview

6.2 Battery Cabinet Control System

Each battery cabinet is equipped with its own control system (Siemens S7) collecting the relevant data from the individual battery modules and providing these to the main control system (*see section 6.1*).

The tasks and features of the cabinet control system are the following:

- Monitoring of battery cell voltages and temperatures
- Monitoring of the battery charging and discharging current
- Control of DC switches
- Monitoring of line protection and smoke detectors
- MODBUS RTU Master for communication with BMS system (battery monitoring system)
- MODBUS TCP Server provides the communication interface to other systems. For example, for the external charger or the consumers

Cabinet Control System Overview

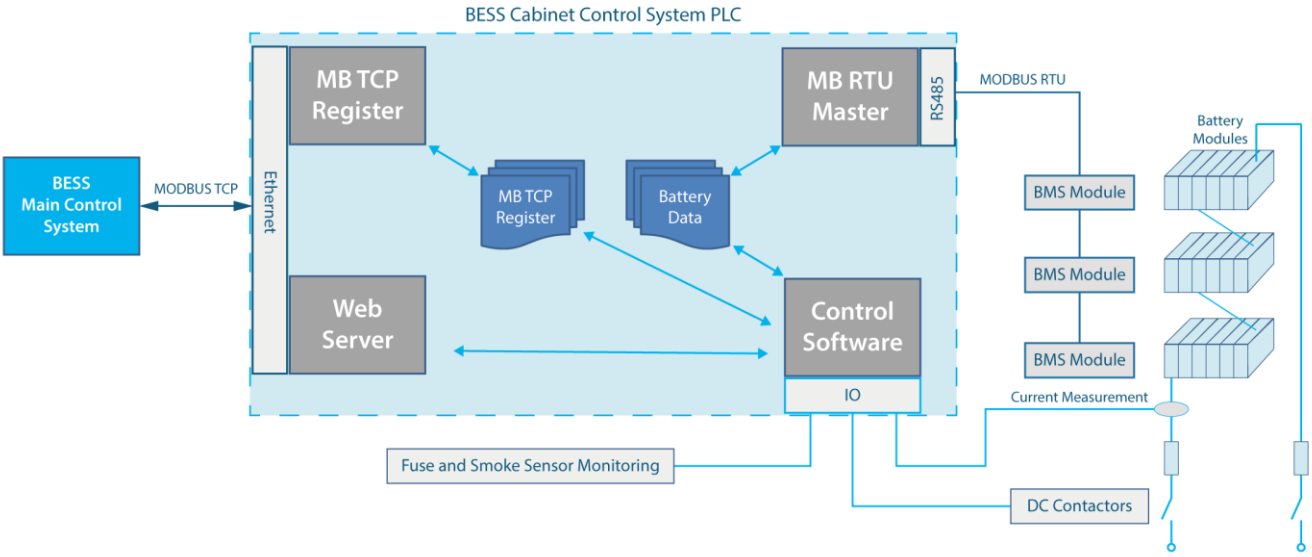


Figure 41: BESS cabinet control system overview

Data exchange between the cabinet control system and the individual battery modules is performed via MODBUS RTU protocol. Therefore, each battery cabinet is provided with several MODBUS RTU interfaces for Modbus connection of the battery modules.

6.3 Network Structure

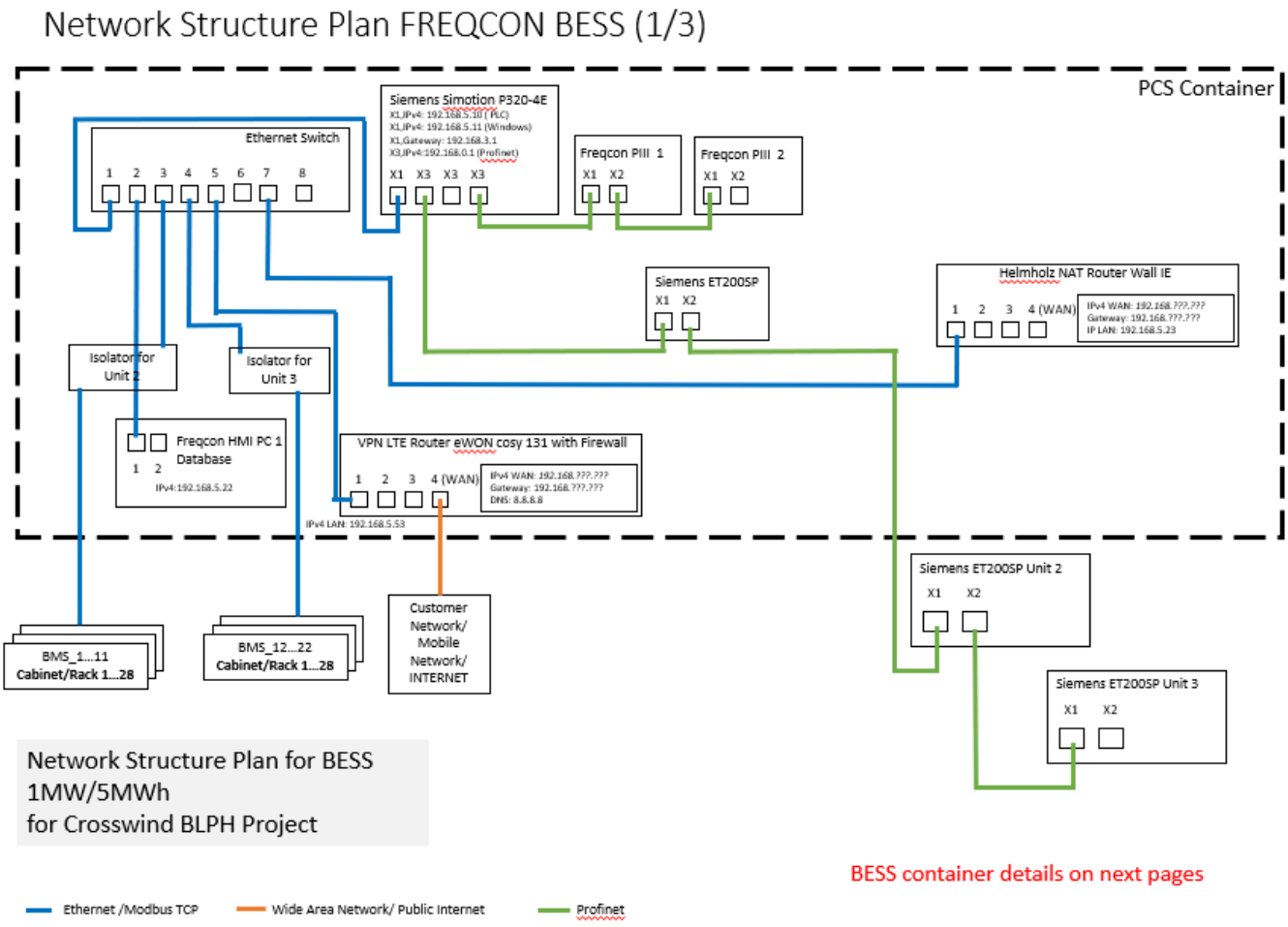


Figure 42: MSC network structure (1/3)

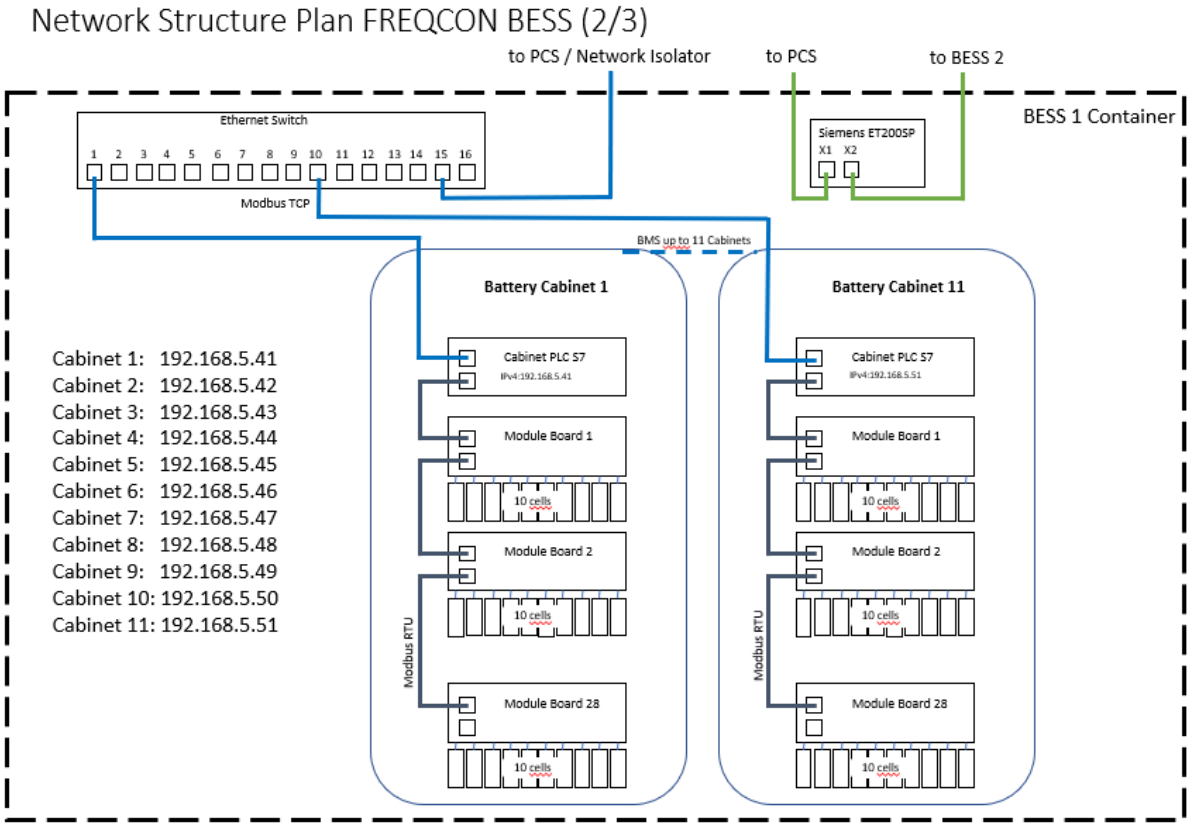


Figure 43: BESS network structure (2/3)

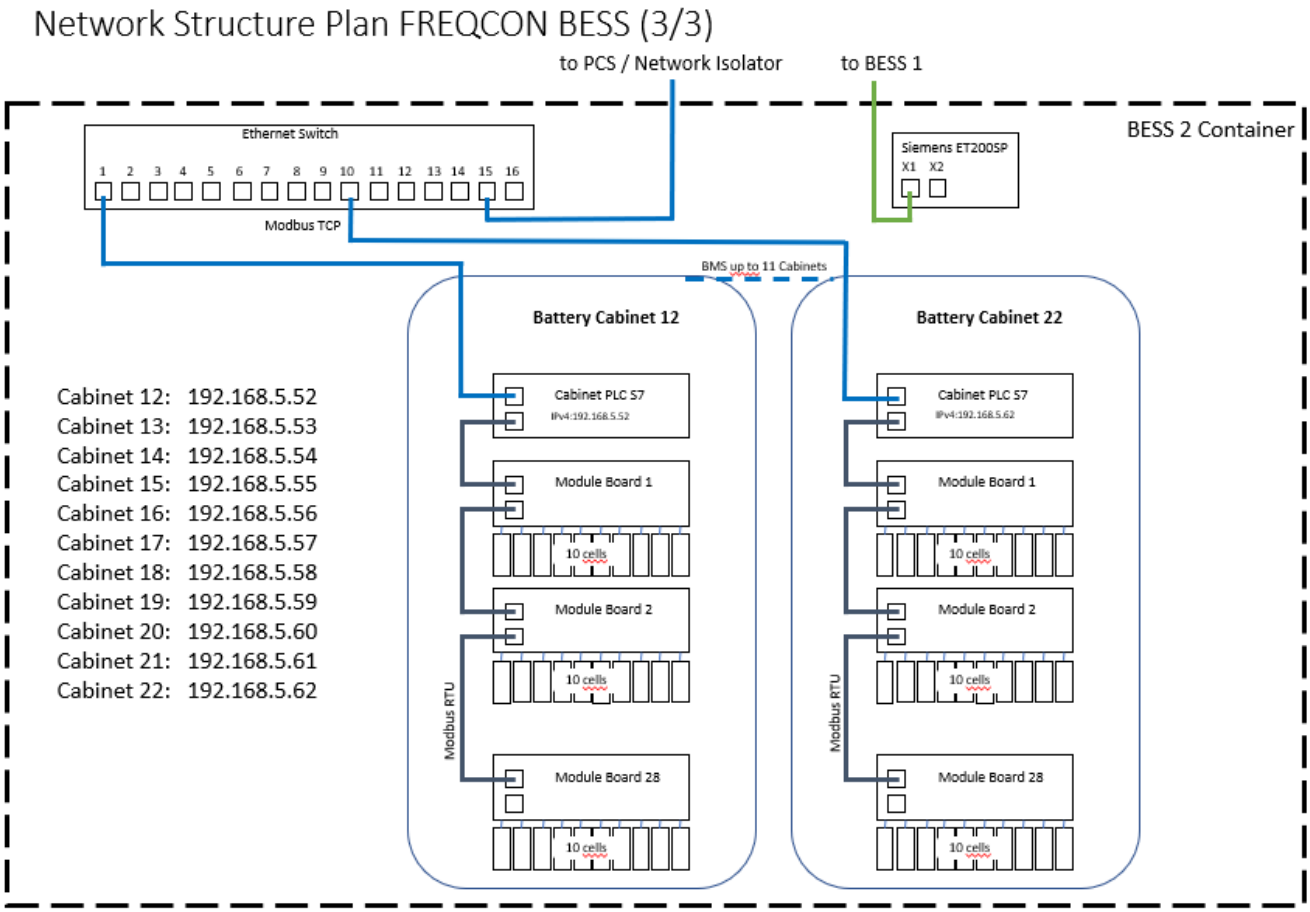


Figure 44: BESS network structure (3/3)

7 Converter Main States

The individual converter main states are depicted in the flow diagram below and described in section 7.2.

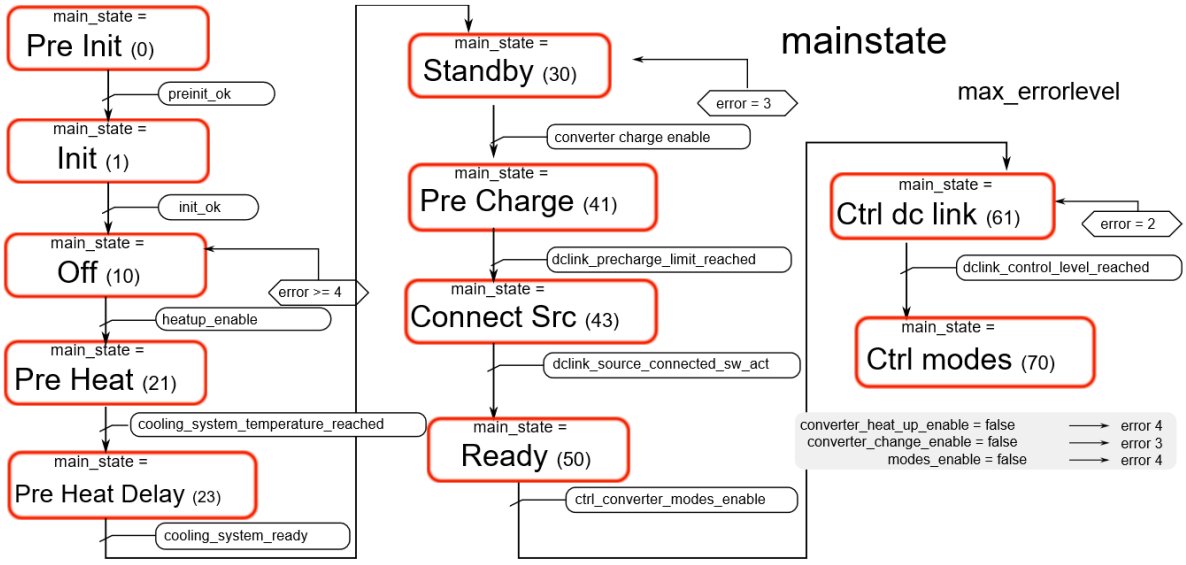


Figure 45: Converter main states

7.1 Error Levels

Error Level	Description
0	No error, logging information
1	Warning category, a warning limit is reached
2	Error category, stop subsystems
3	Error category, stop system and discharge DC-link, cooling system enable
4	Error category, stop system and also the cooling system

Table 31: Error levels

7.2 Main States

INIT

The system was turned on and the stored initialization parameters are read. Cooling and converter system are stopped.

OFF

DC link is discharged. The converter and cooling system are not in operation.

Pre-Heat

The converter is switched-off and is preparing for operation. The cooling system regulates to the optimum temperature of the cooling water, IGBT, capacitors and inductors.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Heat-Delay

The converter is preparing for operation. The operation temperatures of the components are reached and maintained for a defined time span.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

STANDBY

Standby mode – converter is off, but the cooling system is in operation.

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Pre-Charge

The converter´s main DC-link is pre-charged to a defined voltage level.

An error level 3, such as detection of wrong grid conditions, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Connect SW

Source contactor is closed.

An error level 3, such as switching error of the source contactor, is leading to a change to main state "STANDBY" (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

READY

Converter is ready for operation. Cooling system is operating, the DC link is charged and source is connected.

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

DC link Ctrl

The converter power module that is set to "DC link control" mode is activated.

An error level 2, such as derating, DC link errors or over temperature, are leading to a change to main state READY (converter is off, cooling system is in operation).

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

Ctrl Mode

The remaining converter power modules that are enabled are activated. The converter is operating.

An error level 1, such as power module over temperature, over-current or over-voltage, is leading to a stop of the respective power module.

An error level 2, such as derating, DC link errors or over temperature, are leading to a change to main state READY (converter is off, cooling system is in operation).

An error level 3, such as grid faults, is leading to a change to main state STANDBY (converter is off, cooling system is in operation).

An error level 4, such as a cooling system leak, leads to a change to main state "OFF" (stop cooling system and converter).

8 Technical Data

Container	
Container type	PCS: Customer-specific container BESS: Customer-specific container
Transport weight	PCS: approx. 13.7 t BESS: approx. 15 t (Batteries not installed)
Total weight	BESS: approx. 35 t (Batteries installed)
Container dimensions (L x W x H)	PCS: 6058 mm x 2438 mm x 3200 mm BESS: 12310 mm x 2438 mm x 3783 mm

PCS	
Type	MSC-1000-620-8
Manufacturer	FREQCON GmbH
Nominal AC voltage	620 VAC + 10% - 20%
AC power frequency (nominal)	50 Hz ± 5 Hz
Nominal apparent power	1000 kVA
Nominal active power	1000 kW
Nominal AC current	931 A
Maximum AC current	1050 A
Power factor at rated power / adjustable	1 / 0.03 overexcited to 0.0 underexcited
IGBT switching frequency	2 to 4 kHz
DC link voltage	1175 VDC
Number of DC outputs	8
Current per DC output	250 ADC
DC voltage range	700 VDC to 1022 VDC
HVAC system	included

BESS	
Battery Module	1C LFP Battery 280Ah
Cell manufacturer	EVE
Battery cells per cabinet	28
Battery capacity per cabinet	250.88 kWh
Number of battery cabinets	22
BESS capacity (installed)	5500 kWh
BESS capacity (usable at 0.2 C operation)	5000 kWh
Storage temperature range battery storage (> 1 month)	0 °C to 35 °C (30% to 50% SoC)
Ambient temperature range	-20 °C to +40 °C
Battery management system	FREQCON BMS

Controller	
Main control system	Siemens Simotion P320-4
Control software	FREQCON Framework
Internal communication	Profinet IRT
External communication interfaces	Ethernet, RS485, RS232, MODBUS TCP, Profibus, Profinet
Maximum total harmonic distortion	< 3% at nominal power

Converter Cooling System	
Cooling principle	Liquid and air cooled, air heat exchanger
Maximum cooling water inlet temperature	65°C
Operating pressure range cooling system	2.5 … 3.5 bar
Nominal cooling system pressure	3 bar
Coolant capacity (without hoses)	Approx. 80 l
Heat exchanger weight (without cooling liquid)	Approx. 75 kg

Protective Devices and Standards	
Battery (DC)	Fuse and DC load break switch
AC side disconnection point	Air circuit breaker
DC overvoltage protection	Surge arrester, type I
AC overvoltage protection	Surge arrester, class I
Ground fault monitoring	Yes
Insulation monitoring	Yes
Fire protection (converter)	Smoke and arc detection
Fire protection (batteries)	Active Fire Protection System
Maximum permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month/year) / 0% to 95%
Inverter Life (rated conditions)	20 years

Table 32: Technical data

9 Environmental Conditions

	Stationary Operation	Storage packaging with protected layers	Transportation packaging with protected layers
Relative Humidity	Max. 95% No condensation; Relative Humidity <60% under corrosive atmosphere	Max. 95%	Max. 95%
Pollution level IEC60721-3-3 IEC60721-3-2 IEC60721-3-1	No conductive dust		
	3S2 coated PCB: Chemical Air: 3C2 Solid Particulate: 3S2	1S3 coated PCB: Chemical Air: 1C2 Solid Particulate: 1S3	2S2 coated PCB: Chemical Air: 2C2 Solid Particulate: 2S2
Atmospheric pressure	70 … 106 kPa	70 … 106 kPa	70 … 106 kPa
Vibration amplitude	Max 1 mm (5 … 13.2 Hz)	Max 1 mm (5 … 13.2 Hz)	Max. 3.5 mm (5 … 13.2 Hz)
IEC60068-2	Max. 7 m/s^2 (13.2 … 100 Hz) sinusoidal	Max. 7m/s^2 (13.2 … 100 Hz) sinusoidal	Max. 15 m/s^2 (9 … 200 Hz) sinusoidal
Impact IEC60068-2-29	Impermissible	Max. 100 m/s^2, 11 ms	Max. 100 m/s2, 11 ms
Free-fall	Impermissible	Impermissible	Impermissible

Table 33: Environmental conditions

10 Transport, Storage and Commissioning



Please observe the instructions for transport in section 10.2 and for storage and professional handling in section 10.3.

10.1 Unpacking

⚠ CAUTION



Hazard by sharp edges on packaging
Improper handling during unpacking can cause injuries.
➜ Use appropriate safety gloves to protect your hands from possible cuts.

The packaging of the system consists of cardboard, plastic and corrugated board. After usage the packaging must be disposed according to the local regulations for the disposal of paper products (e.g. recycling). After delivery, the delivered units and components must be checked for completeness and damage. If any damage on the delivered units and components have been found, contact the delivery service or FREQCON GmbH immediately.

10.2 Transport

Regarding the transport of the battery modules, refer to the battery module manual.

⚠ DANGER	
	**Hazard by electrolyte release due to mechanical damage to battery modules** Severe burns, long-term physical damage, and environmental damage due to electrolyte. ➜ The device must be disconnected before maintenance work. Work under voltage is not permitted. ➜ Observe the safety data sheet of the battery module and keep it accessible at all times. ➜ Never open battery modules by force. ➜ Avoid contact with escaping electrolyte at all costs, leave the danger area immediately. ➜ In case of ingestion, immediately alert the emergency services! ➜ In case of eye contact: Rinse cautiously with water for several minutes. Remove any contact lenses and continue rinsing. Call poison information center or doctor! ➜ In case of skin contact: Remove contaminated clothing immediately. Wash/shower skin with plenty of water. Call poison control center or doctor! ➜ Prevent release of electrolyte into the environment at all costs. ➜ Wear suitable protective equipment when disposing of electrolyte *(see section* 2.7 "Personal Protection Equipment (PPE)").

⚠ DANGER	
	**Fire due to short circuits in the event of mechanical damage to the battery modules.** Severe burns or death due to short circuits that may result in fire. The electrolyte used is highly flammable as a liquid or vapor. ➜ Avoid mechanical damage. ➜ Never open battery modules by force. ➜ Protect the system against vandalism. ➜ Fire loads or sources of fire near the installation site are not permitted. ➜ In the event of damage, press the emergency OFF button immediately. ➜ In case of fire, leave the danger area immediately and alert the fire department!

NOTICE
Inadequate transportation of the device and all of its components may cause damage to the installed components. ➜ Vibrations and jolts must be avoided during transportation. ➜ The container must be transported in a horizontal position (lying down). ➜ Make sure to observe the specific national safety precautions for transport by truck, train or ship´.

NOTICE
Do not transport the containers with installed batteries ➜ Lifting or Moving of the Container is not allowed if battery modules are inside the container ➜ Remove every battery module from the container before lifting or mowing the container

The container must be transported to the installation site by instructed personnel.

The container weight is specified in section 8, "Technical Data" on page 93. Make sure that the components can be placed at ground level.

For information regarding the dimensions and center of gravity of the container, see section 10.2.2. The container weight is specified in section 8, "Technical Data". Make sure that the components can be placed at ground level.
Vibrations and jolts must be avoided during transportation. If the system was damaged during transport, you must immediately inform the responsible transport company.

The cabinet must be transported in a horizontal position (lying down). It is not permitted to tip over the container during transportation or in any other scenario.
Applied assemblies (if existing) must be protected against damage by external influences during transportation and storage.



All persons involved in the transport of lithium batteries must be trained and certified according to regulations.

The information provided below is for informational purposes only.

10.2.1 Container Lifting

⚠ DANGER	
	**Heavy load** **Improper lifting can result in death, serious injury or property damage.** Never lift the container above people. Use only lifting and personal protective equipment approved by OSHA or other national institutions.

NOTICE
Only use an appropriate crane to lift the container, capable to withstand the loads specified as follows: Total weight of cabinet combination *see section 8, „Technical Data“ page 93.*

NOTICE
Observe the container´s center of gravity during lifting: Observe the container´s center of gravity during lifting with crane, shown in section 10.2.2.

To lift the containers with a crane, use the four transport lugs on the top corners of the container (*see following illustration*).

PCS

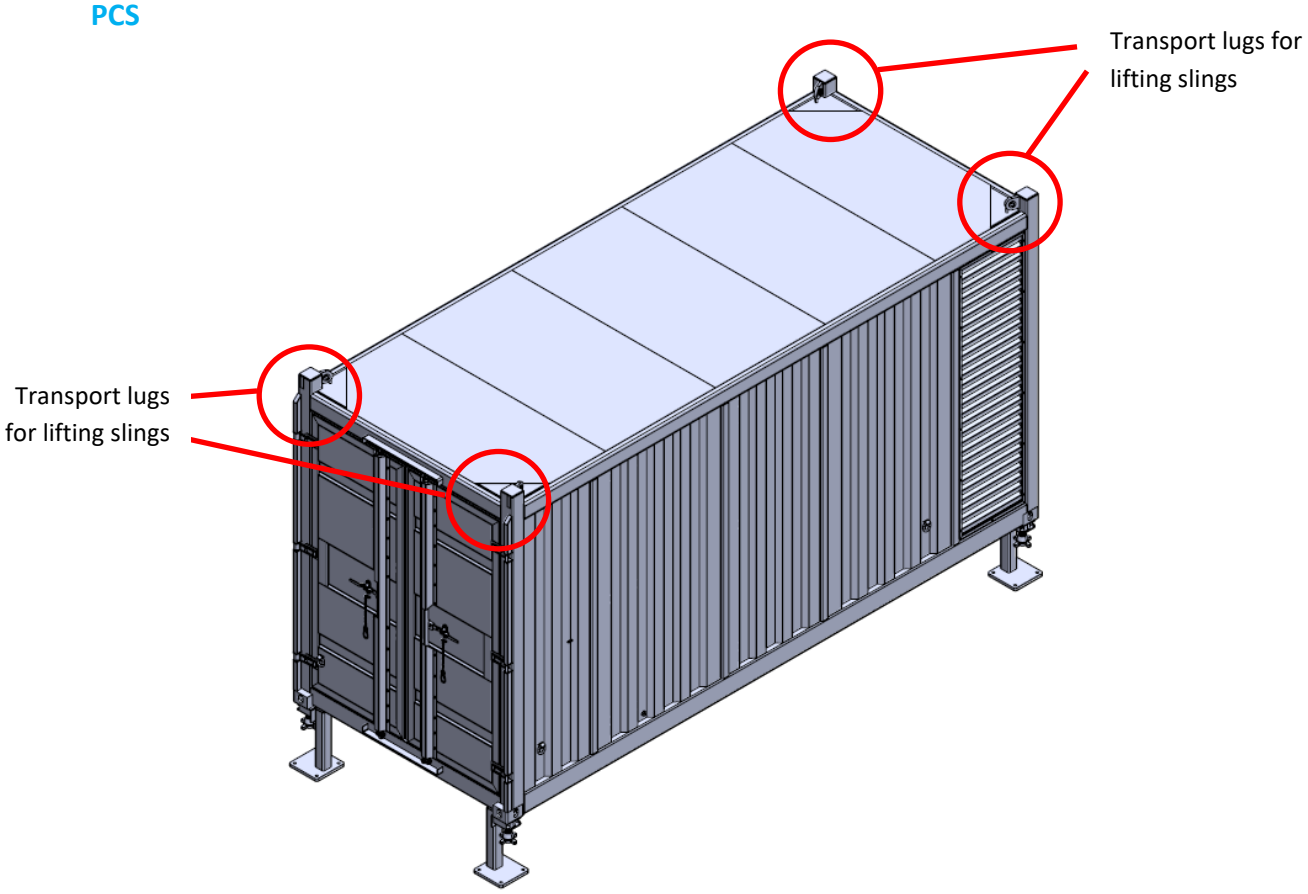


Figure 46: PCS container transport lugs

BESS 1

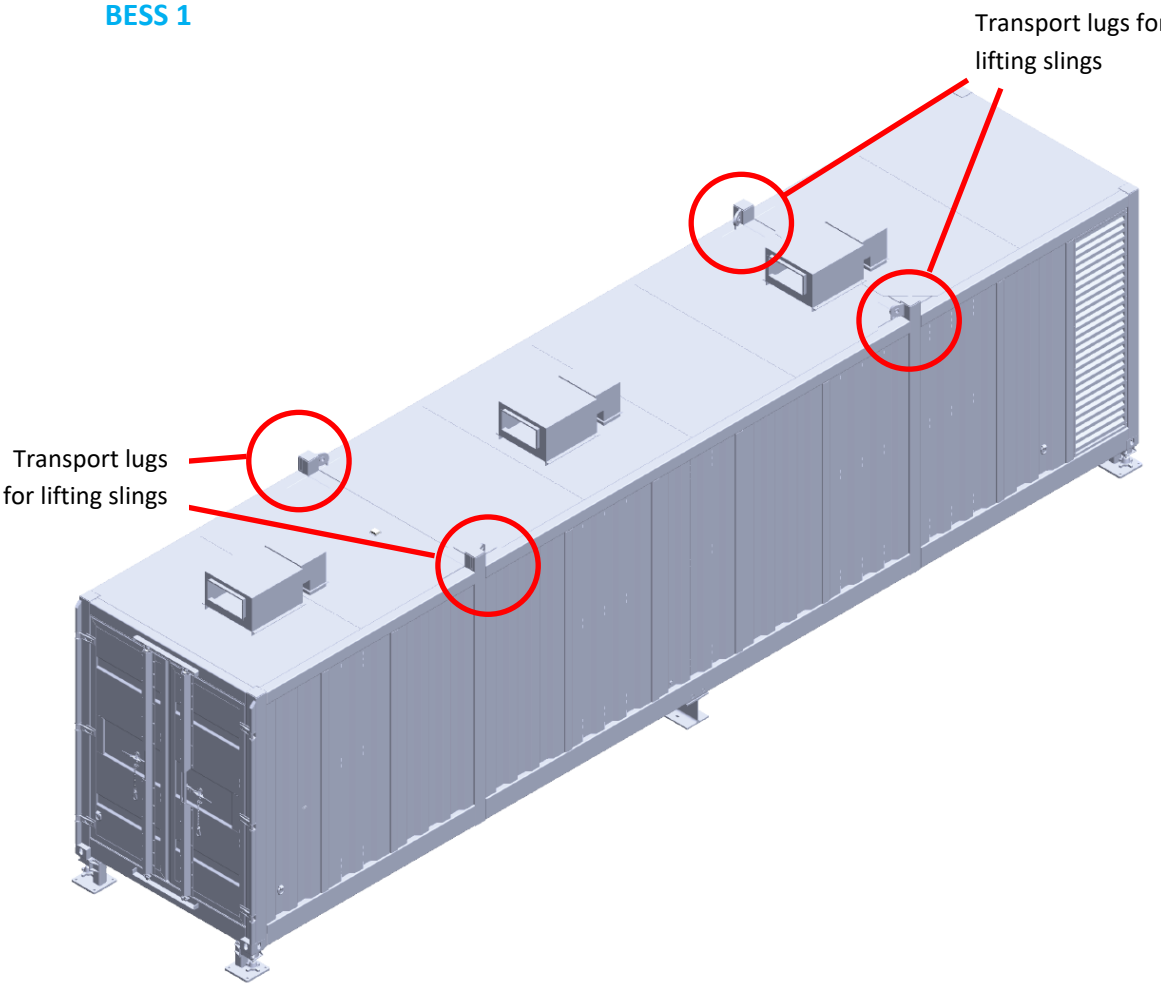


Figure 47: BESS 1 container transport lugs

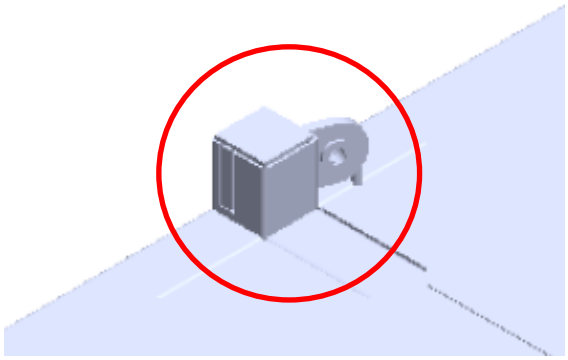


Figure 48: Transport lug

BESS 2

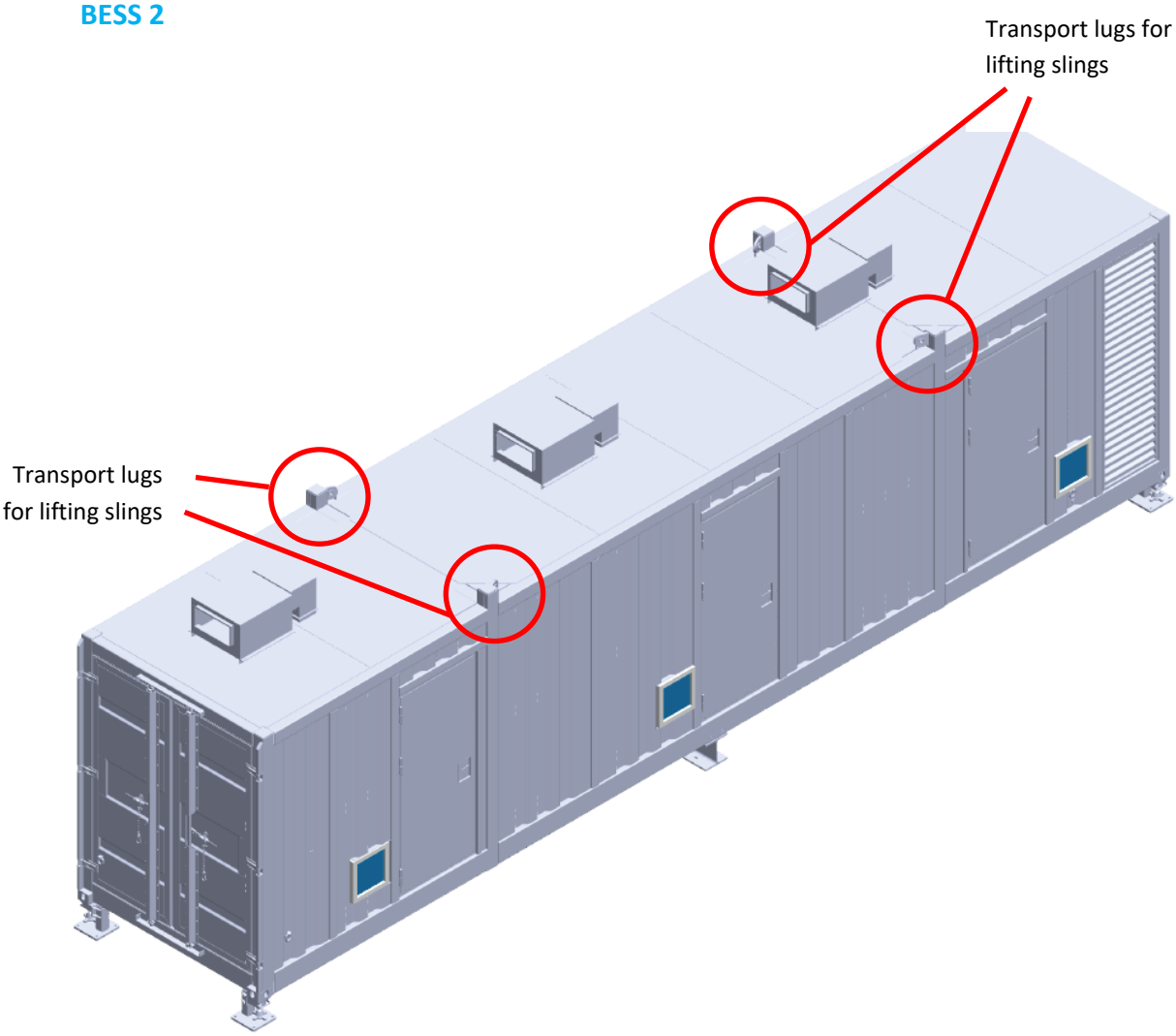


Figure 49: BESS 2 container transport lugs

10.2.2 Dimensions and Center of Gravity

10.2.2.1 PCS Container

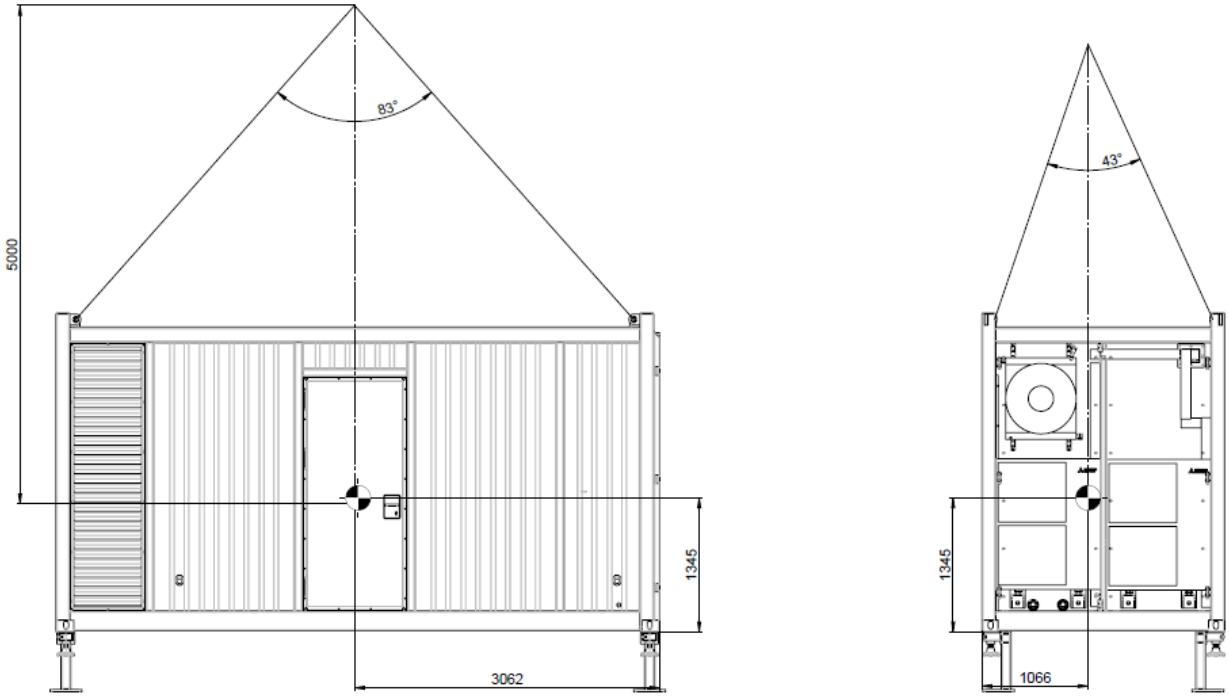
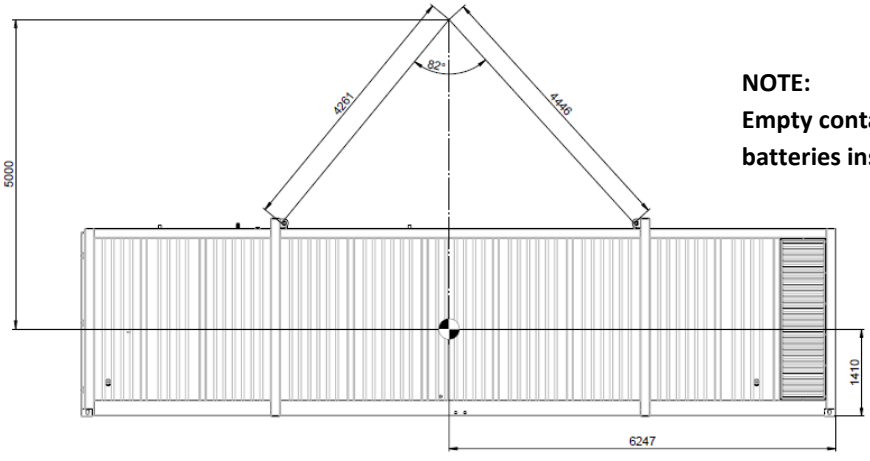


Figure 50: PCS Container – dimensions and center of gravity

10.2.2.2 BESS 1 Container



NOTE:
Empty container, no batteries installed

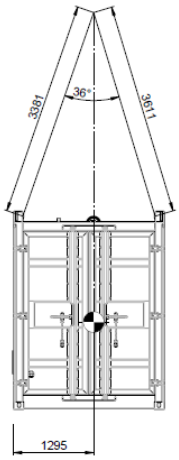
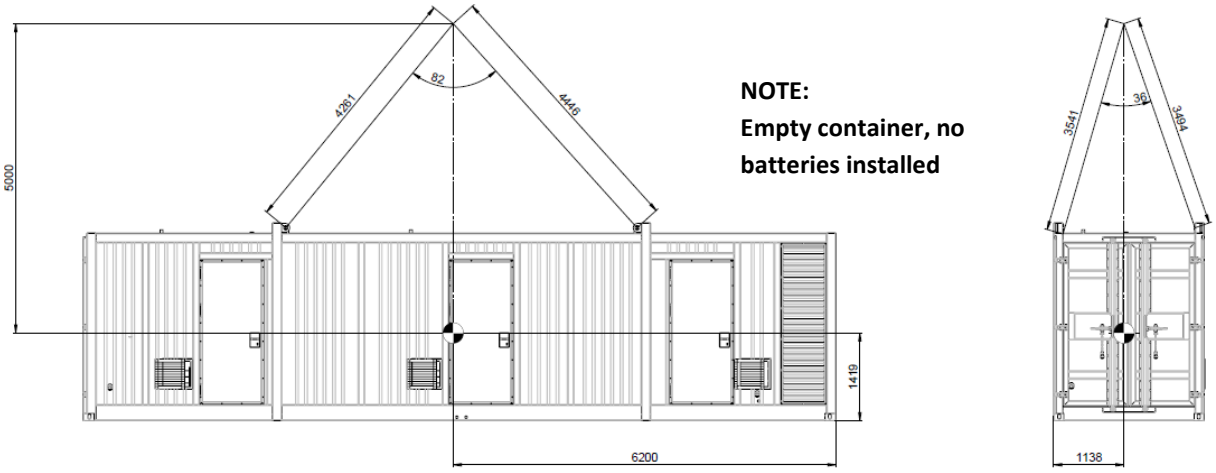


Figure 51: BESS 1 Container – dimensions and center of gravity

10.2.2.3 BESS 2 Container



NOTE:
Empty container, no batteries installed

Figure 52: BESS 2 Container – dimensions and center of gravity

10.3 Storage

10.3.1 Storage Condition

NOTICE	
	Damage to components in the event of improper storage. The storage conditions of the energy storage device are only maintained when the climate control of the container is active. ➜ Keep air conditioning activated/enabled even in case of storage. ➜ Supply energy storage with power even if it is out of operation. ➜ Only deactivate air conditioning if storage conditions are maintained by other measures. ➜ Condensing must be avoided.

NOTICE
The cooling liquid inside the cooling system must be removed at least once every five years. ➜ Check the pressure on the expansion tank every time the cooling liquid is exchanged. The cooling system must be completely drained during a pressure test of the expansion vessel *(see section 17.8.1.3 "Draining the cooling* system*")*.

NOTICE
➜ The BESS container must not be exposed to strong vibrations. ➜ Condensing must be avoided.

NOTICE
The battery of the UPS unit of the converter system must be removed from the battery module at storage temperatures of <0°C. ➜ The removal of the UPS battery is described at 17.3.2.

Store the components of the energy storage system under the following conditions:

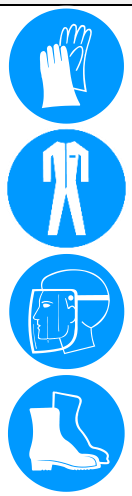
➜ Store the components of the energy storage device according to pollution degree 2 (no conductive pollution).
➜ Do not expose components of the energy storage device to aggressive media.

Storage Condition	Value
Storage temperature	*see technical data in section 8*
Max. relative humidity	*see technical data in section 8*
Positioning of the product during storage	laying down, horizontal

Table 34: Storage conditions

10.4 Assembly and Initial Commissioning

⚠ DANGER	
	**Electric shock due to low voltage and arcing on loose wires.** Severe irreparable damage to the nervous system, burns and death. ➜ Access to control cabinets and string cabinets only by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel. ➜ Plant control units may also be opened by instructed persons with the qualification of a qualified electrician. ➜ Work on electrical and electronic components as well as cables of the battery system may only be carried out by FREQCON service personnel!

⚠ DANGER	
	**Electric shock due to low voltage and arcing on loose wires.** Severe irreparable damage to the nervous system, burns and death. ➜ Access to control cabinets and string cabinets only by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel. ➜ Work on electrical and electronic components as well as cables of the battery system may only be carried out by FREQCON service personnel! ➜ Wear personal protection equipment (Electrician's gloves, protective visor, safety shoes, hearing protection)

The energy storage system may only be installed and commissioned by trained service personnel or by FREQCON instructed and authorized maintenance personnel.

11 Mounting

11.1 General

The BESS container must be set up and positioned safely at the installation site and may only be installed by instructed FREQCON service personnel.

Service personnel must at least have the following tools in reach before starting the installation:

Pos.	Installation Tools	Amount
	Basic Tools	
1.	Flashlight	1
2.	Pliers set	1
3.	Ratchet set	1
4.	Torque wrench (1 - 100 Nm)	1
5.	Socket wrench set (with sockets 7 – 19 mm)	1
6.	Wrench set	1
7.	Cross-section screw drivers set	1
8.	Flat-section screw drivers set	1
9.	Allen key / Hex socket key set	1
10.	Cutter	1
11.	First-aid kit	1
12.	Multi-meter instrument	1
13.	Two-pole voltage tester	

Table 35: Installation tools

⚠ DANGER	
	**Electric shock due to low voltage and arcing on loose wires.** Severe irreparable damage to the nervous system, burns and death. ➜ Access to control cabinets and string cabinets only by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel. ➜ Plant control units may also be opened by instructed persons with the qualification of a qualified electrician. ➜ Work on electrical and electronic components as well as cables of the battery system may only be carried out by FREQCON service personnel or by FREQCON instructed and authorized maintenance personnel.

⚠ DANGER
Make sure that the energy source is locked and tagged and ensure that the isolation is effective before conducting work on the system. After switching-off the voltage supply, some components might still carry a charge. Check all poles using a suitable device.

⚠ WARNING
The electrical connection must be carried out in accordance with the local regulations of the utility company and /or VDE (in Germany).

Do not operate!	Lock and tag power switches and controller devices
	Observe national laws regarding Occupational Safety and Health, as well as Industrial Standards. ➢ DIN VDE 0105-100; VDE 0105-100:2009-10 Operation of electrical installations - General requirements.

11.1.1 Cable Routing

It is recommended that the power cables and the control cables are installed in separate trays. Avoid long parallel runs of power cables with other cables in order to decrease electromagnetic interference.
Where control cables must cross power cables, make sure they are arranged at an angle as near to 90 degrees as possible.
The cable trays must have good electrical connection to each other and to the grounding/earthing.

11.1.2 Coding

11.1.2.1 Coding Terminal Strip

Terminal designation	Description
-XE1	Main power supply 600 V AC
-XE2	DC power supply 1000 V DC
-XE	Main power supply 400 V AC
-X1	Main power 400 V / 230 VAC
-X2	Light cabinet 230 V AC
-X3	Control voltage 24 V DC
-14X1	Control voltage 24 V DC (to DC contactors)
-X5	Low-voltage signals
-XDC0	24 V DC power supply
-XDC1-4	Control voltage 24 VDC (UPS)
-XT	Transfer terminal block 24 V DC / 230 V AC

11.1.2.2 Coding Wiring colors

Cable	Color
L1/L2/L3	Black
N	Light blue
PE	Yellow-green
External voltage	Orange
Control voltage 24 VDC	Dark blue
Analog signals	White

11.1.2.3 Coding Power Supply

Terminal	Phase
U1	L1
V1	L2
W1	L3

11.2 Installation location

⚠ DANGER

Danger to life due to electric shock!
The DC paths and the connection cables are not protected against overload by the BESS.
Select external components according to the specified nominal and maximum currents of the BESS.
➜ If necessary, use appropriate protective equipment for the external components.

⚠ DANGER

Danger from and for unauthorized persons
Unauthorized persons are not aware of the dangers in the work area and may endanger themselves and third parties danger.
➜ Keep unauthorized persons away from the work area.
➜ If in doubt, speak to persons and direct them away from the work area.
➜ Interrupt the work as long as unauthorized persons are in the work area.
➜ Always keep the entrance door(s) locked when not performing work on the system to prevent unauthorized persons from entering the container.

⚠ WARNING

Danger to life due to unsuitable lifting material
While lifting the battery modules use only suitable lifting equipment and lifting tackle
➜ Make sure that all the material and equipment is designed for the weight and all required inspections have been done.
➜ Make sure that no person is under the battery module during lifting.

⚠ CAUTION

Danger to life due to unsuitable lifting material
While lifting the container and/or battery modules use only suitable lifting equipment and lifting tackle
➜ Make sure that all the material and equipment is designed for the weight and all required inspections have been done.
➜ Make sure that no person is under the container or battery module during lifting.

NOTICE

Equipment damage due to intruding animals
Prevent animals from entering the interior of the container from below through the cable glands or recesses.
➜ Secure the container from the outside with suitable protection against the entry of animals.

The BESS containers are designed for outdoor installation, on a flat and ground level surface. Make sure that the environmental conditions meet the values of section 8 „Technical Data“ and section 9 “Environmental Conditions”.

The entrances to the containers must be accessible from every side to allow for visual inspections or maintenance and repair work, if necessary

Air inlets and outlets of the containers, as well as on the cabinets inside the container, must always be kept free and cleaned of dirt in order to ensure the required air flow of the installed fans.

11.2.1 Distances Between Containers

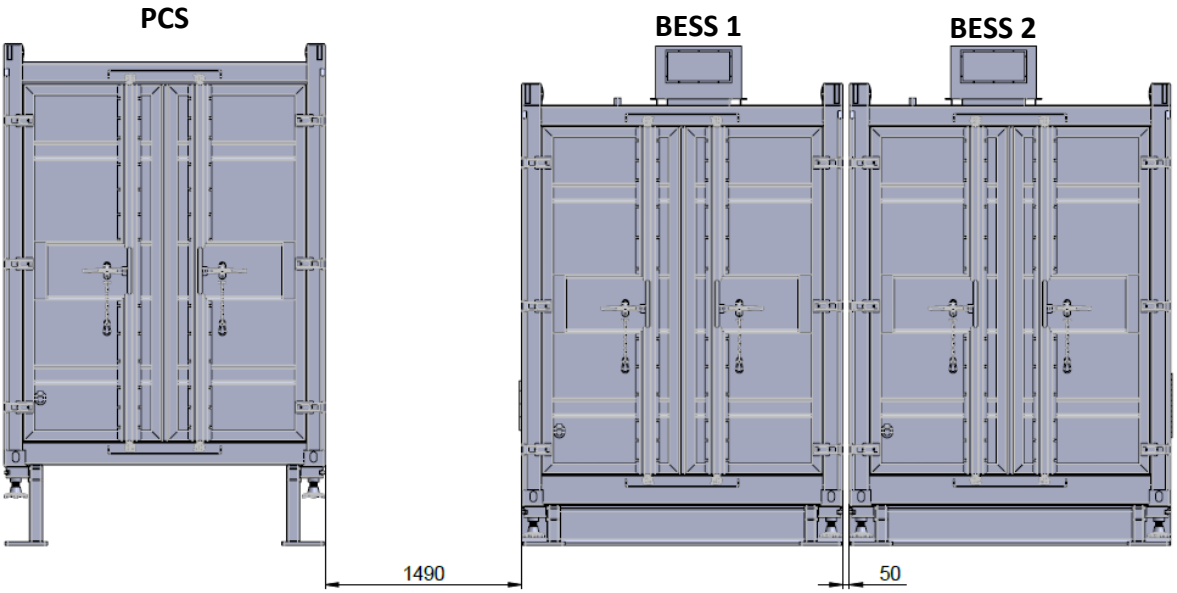


Figure 53: Distances between containers

11.2.2 Cable Outlets

Overall System

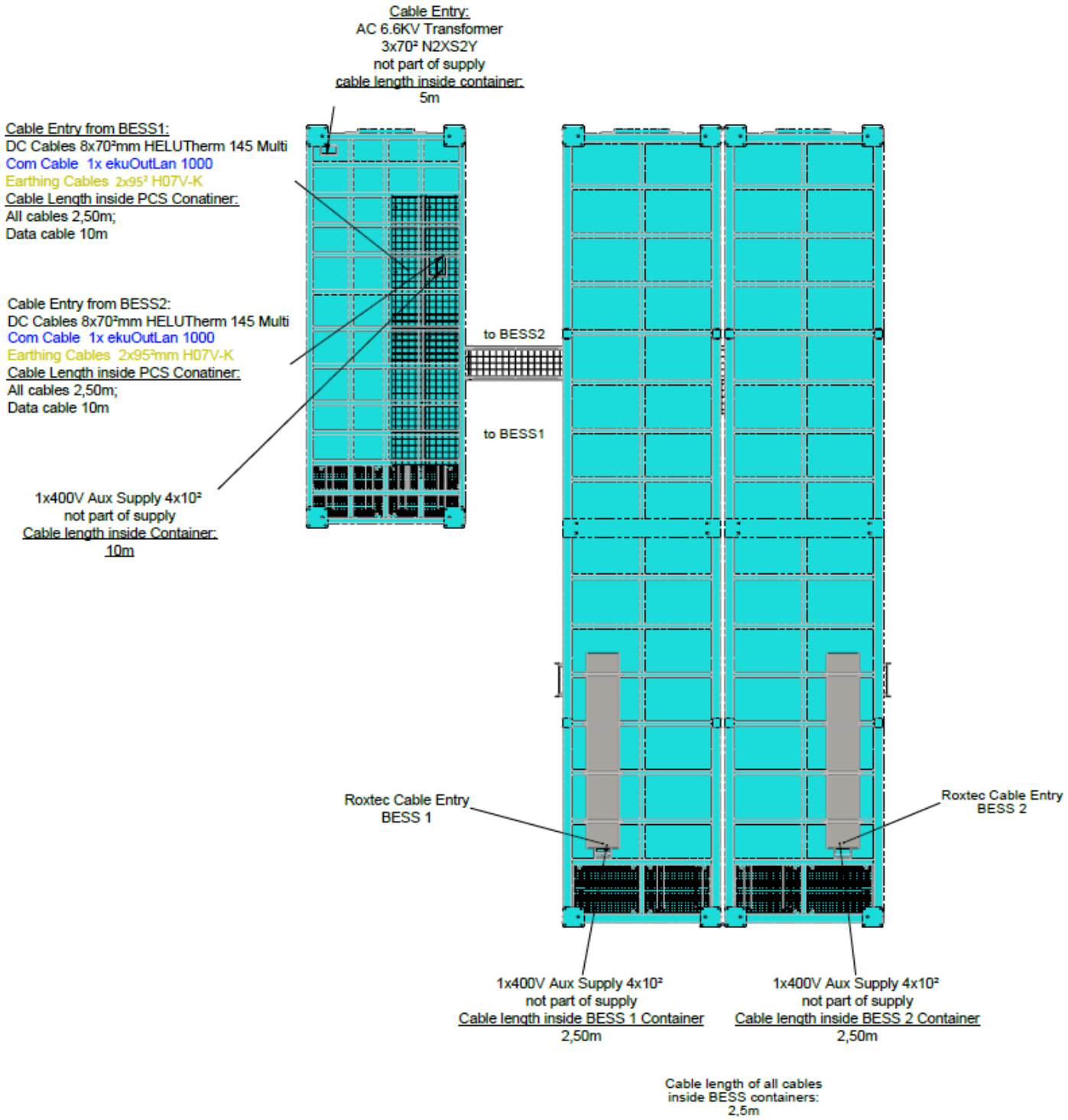


Figure 54: Cable outlets – Overall system (Bottom view)

11.2.2.1 PCS Container

Cable interface 1 (Roxtec cable gland)
- DC power cables
- Communication cables
- 400 V AC aux. cables

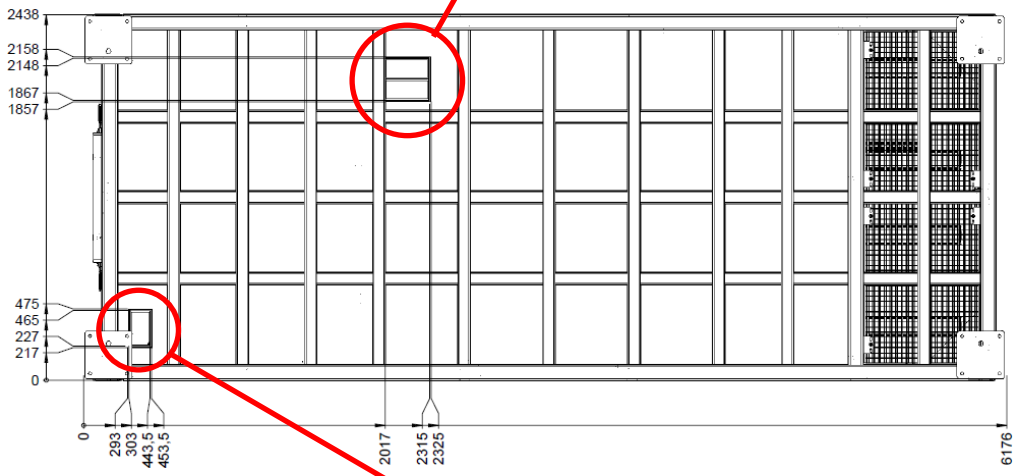


Figure 55: Cable outlets – PCS (Bottom view)

Cable interface 2 (Roxtec cable gland)
- 6.6 kV MV cables

11.2.2.2 BESS 1 Container

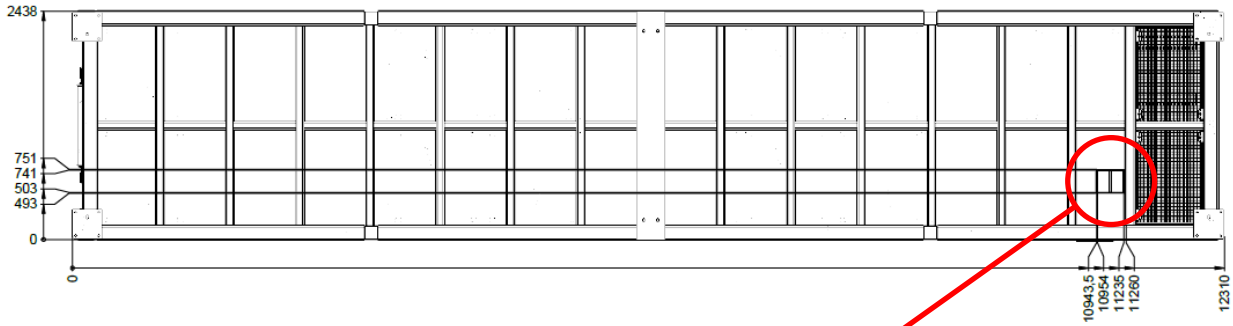


Figure 56: Cable outlets – BESS 1 (Bottom view)

Cable interface (Roxtec cable gland)
- DC power cables
- Communication cables
- 400 V AC aux. cables

11.2.2.3 BESS 2 Container

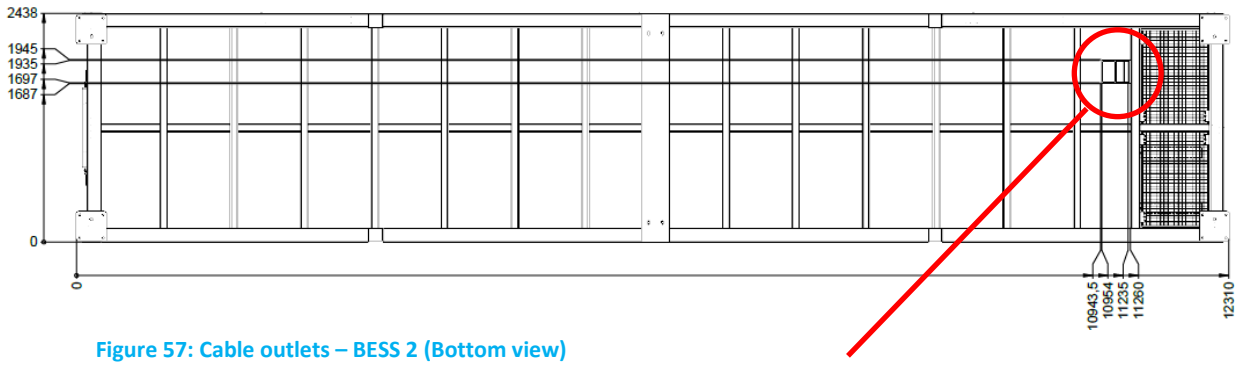


Figure 57: Cable outlets – BESS 2 (Bottom view)

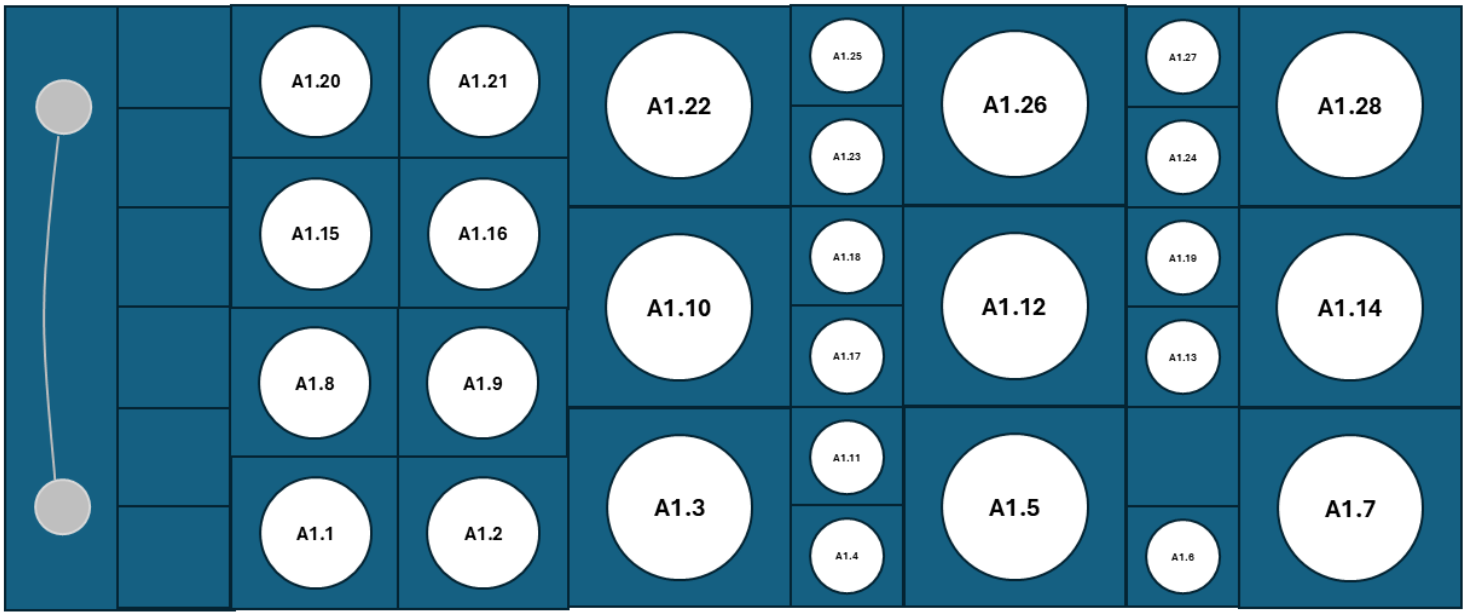
Cable interface (Roxtec cable gland)

- DC power cables
- Communication cables
- 400 V AC aux. cables

11.2.3 Cable Gland Description

11.2.3.1 PCS Container

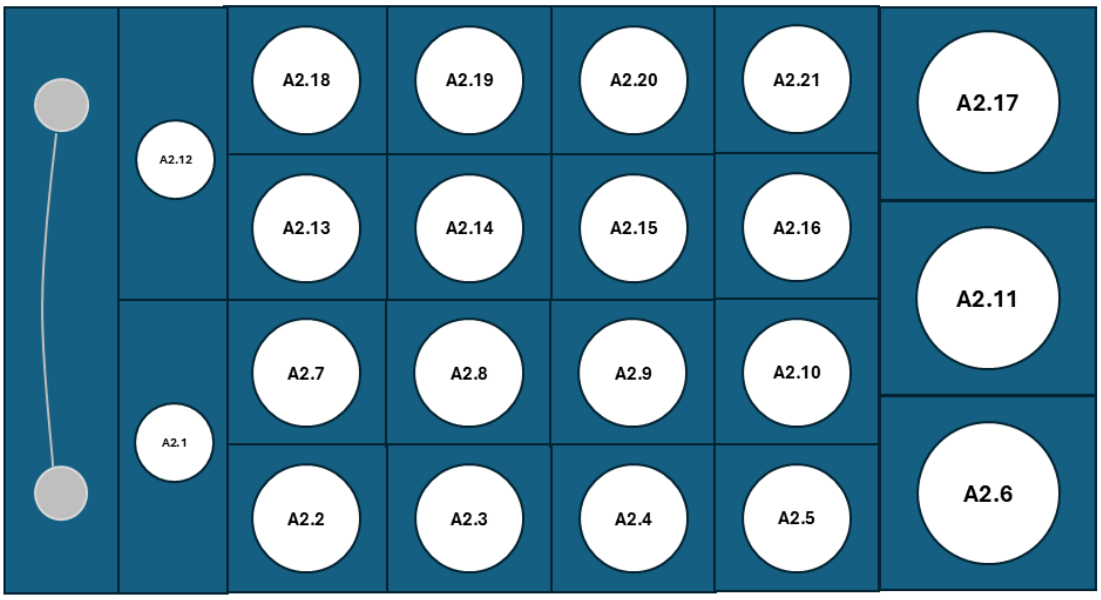
Cable interface – PCS – Comm and Aux 1



PCS – Comm and Aux 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:2		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:4	*	P320 PLC / B400-NET-001.01	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5		85002CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:9		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:11	*	P320 PLC / B400-NET-001.02	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		85001-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:15		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:16	**	P320 PLC / B400-FGS-002	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:18		C-85-XS-001 / B400-SIS-001	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:19	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:20		COM Cable Ethernet	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:21	**	P320 PLC / B400-SIS-001	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:23	***	82006-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:24	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:25	***	82007-CEC	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:26		83011-CEL / 84W2	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:27	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

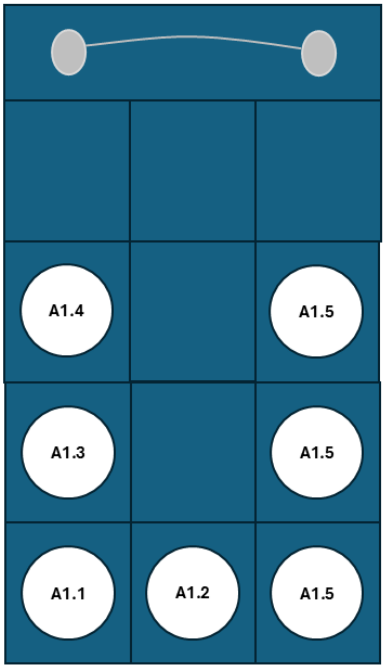
Cable interface – PCS – Comm and Aux 2



PCS – Comm and Aux 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:2	Solarflex-X 1x 70	DC Cable - DC+4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:3	Solarflex-X 1x 70	DC Cable - DC-4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:4	Solarflex-X 1x 70	DC Cable - DC+3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC-3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:7	Solarflex-X 1x 70	DC Cable - DC+4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:8	Solarflex-X 1x 70	DC Cable - DC-4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:9	Solarflex-X 1x 70	DC Cable - DC+2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:13	Solarflex-X 1x 70	DC Cable - DC+4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:14	Solarflex-X 1x 70	DC Cable - DC-4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC+2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC-2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:18	Solarflex-X 1x 70	DC Cable - DC+3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:19	Solarflex-X 1x 70	DC Cable - DC-3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:20	Solarflex-X 1x 70	DC Cable - DC+2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:21	Solarflex-X 1x 70	DC Cable - DC-2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 (MV Transformer)

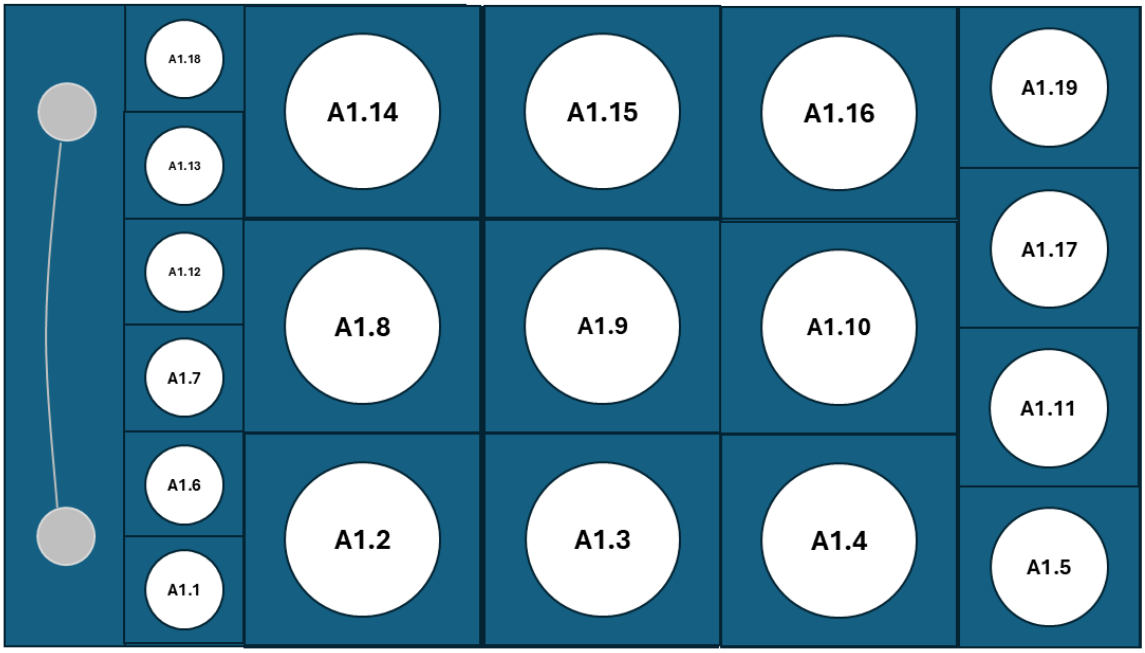


PCS – MV Transformer

Pos.	Cable ID	Name	Cable Category	OD (mm / [“])	Module Type
A1:1	1	82005 – L2	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:2	4	82005 – L3	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:3	5	82005 – L1	AC 6.6 kV Transformer	10 [0.394“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

11.2.3.2 BESS 1

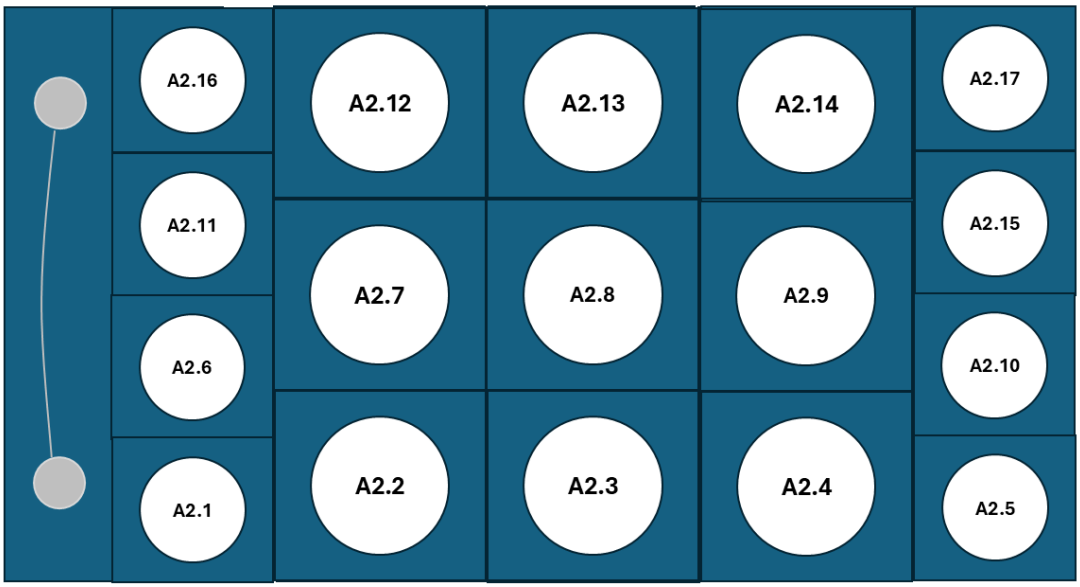
Cable interface 1 - BESS 1



BESS 1 - 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:1	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5	4x 10 mm²	400 V Aux Supply – 83015-CEL	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:6	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:7		COM Cable - ETH	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		COM Cable - UNIT_1 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13		COM Cable - UNIT_3 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 - BESS 1

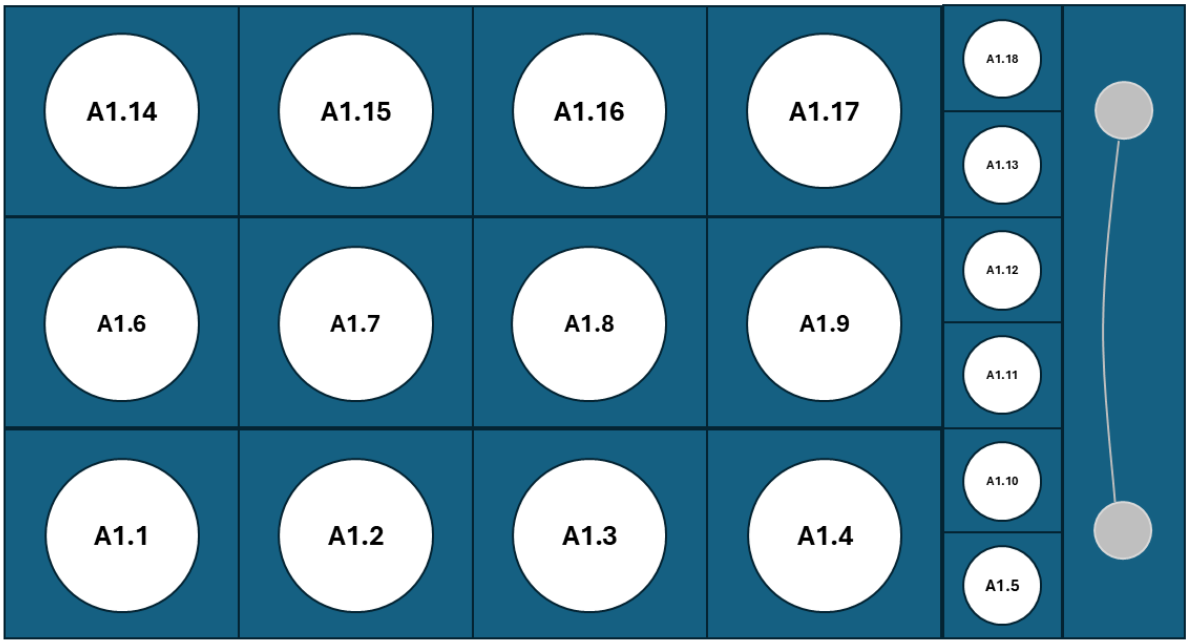


BESS 1 - 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:1	Solarflex-X 1x 70	DC Cable - DC-2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC+2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:6	Solarflex-X 1x 70	DC Cable - DC+2_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-2_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:11	Solarflex-X 1x 70	DC Cable - DC-2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC-3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC+2_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:17	Solarflex-X 1x 70	DC Cable - DC+3_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

11.2.3.3 BESS 2

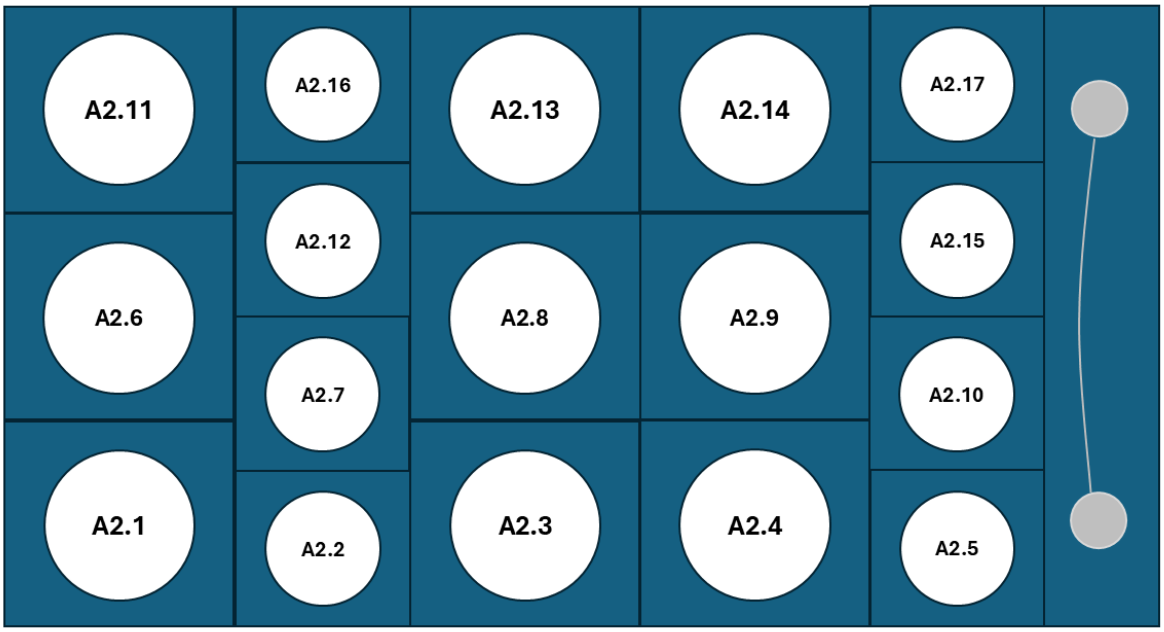
Cable interface 1 - BESS 2



BESS 2 - 1

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A1:1	4x 10 mm²	400 V Aux Supply – 83014-CEL	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:5	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:10	H07V-K 1x 95 mm²	Earthing Cable	11 [0.433“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:12		COM Cable - ETH	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:13		COM Cable - UNIT_2 PROFINET	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A1:18		COM Cable – ET200 Unit_1 (not connected)	4 [0.157“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

Cable interface 2 - BESS 2



BESS 2 - 2

Pos.	Cable Type	Cable Category	OD (mm / [“])	Module Type
A2:2	Solarflex-X 1x 70	DC Cable - DC+4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:5	Solarflex-X 1x 70	DC Cable - DC+3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:7	Solarflex-X 1x 70	DC Cable - DC-4_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:10	Solarflex-X 1x 70	DC Cable - DC-3_3 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:12	Solarflex-X 1x 70	DC Cable - DC-4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:15	Solarflex-X 1x 70	DC Cable - DC+4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:16	Solarflex-X 1x 70	DC Cable - DC+4_2 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]
A2:17	Solarflex-X 1x 70	DC Cable - DC-4_1 BAT	9.5 [0.374“]	RM 20W40 3.5-16.5 [0.138“-0.650“]

11.2.4 AC Connection

⚠ DANGER

Before performing work on the BESS, make sure the system is disconnected from all power supplies, the feed-in disconnectors are open and secured against unintentional reclosing.

NOTICE

- ➜ Comply with the minimum cable cross-sections indicated in the wiring diagram provided.
- ➜ Always secure AC power cables with adequate strain relief in order to prevent the removal of the power cables from the AC connections after installation.

To connect the 620 V AC network, the system provides AC, PE and N connection busbars within the **AC_DC cabinet** *(see circuit diagram and following figure, ① to ⑤)*.

Also refer to the provided circuit diagram (*see section 1.2 "Applicable Documents"*) when connecting the BESS to the AC grid.

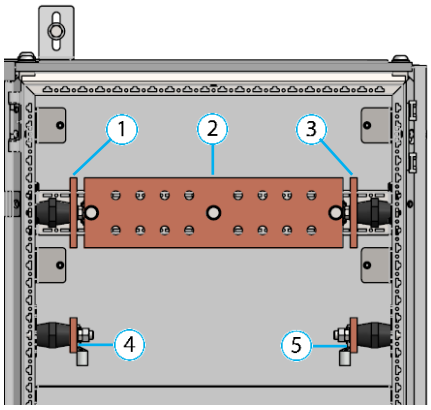


Figure 58: AC grid connection busbars inside AC_DC cabinet

Pos.	Description	Identifier
①	AC grid connection busbar L1	78W1
②	AC grid connection busbar L2	78W2
③	AC grid connection busbar L3	78W3
④	AC grid connection busbar N	78W5
⑤	AC grid connection busbar PE	78W4

Table 36: AC grid connection busbars inside AC_DC cabinet

Task 1: **Connect the AC grid supply cables to the designated AC grid connection busbars inside the AC_DC cabinet *(see wiring diagram and illustration below)*.**

Step 1 : Lead the customer-side AC grid supply cables through the recess provided in the container floor from below into the container interior.

Step 2 : Lead AC grid supply cables through the recess provided in the cabinet floor of the AC_DC cabinet from below to the inside of the cabinet.

Step 3 : Locate the 78W1, 78W2 and 78W3 AC connection and the PE and N busbars inside the AC_DC cabinet (*see illustration above,* ① - ⑤).

Step 4 : Screw the three grid phase cables L1, L2, L3 and the PE and N cable to the corresponding connection busbars inside the AC_DC cabinet (*see illustration and table above,* ① - ⑤) using appropriate cable lugs, screws, nuts and washers.

Step 5 : Apply the torque specified by the screw connection manufacturer to the connection.

Step 6 : Check connections for tightness.

✓ **The AC grid supply cables were successfully connected to the corresponding AC grid connection busbars in the AC_DC cabinet.**

11.2.5 Higher-Level Controller Connection

⚠ DANGER

Before performing work on the BESS, make sure the system is disconnected from all power supplies, the feed-in disconnectors are open and secured against unintentional reclosing.

The converter system is mainly controlled and monitored via the customers´ higher-level controller. The higher-level controller is connected to the BESS main controller via a PROFINET interface. Therefore, a network isolator (114A1) is provided inside the control cabinet 1 (CTRL_1) of the converter system, to which the higher-level controller can be connected via an Ethernet line.

To connect the higher-level controller to the converter controller via Ethernet line, proceed as follows:

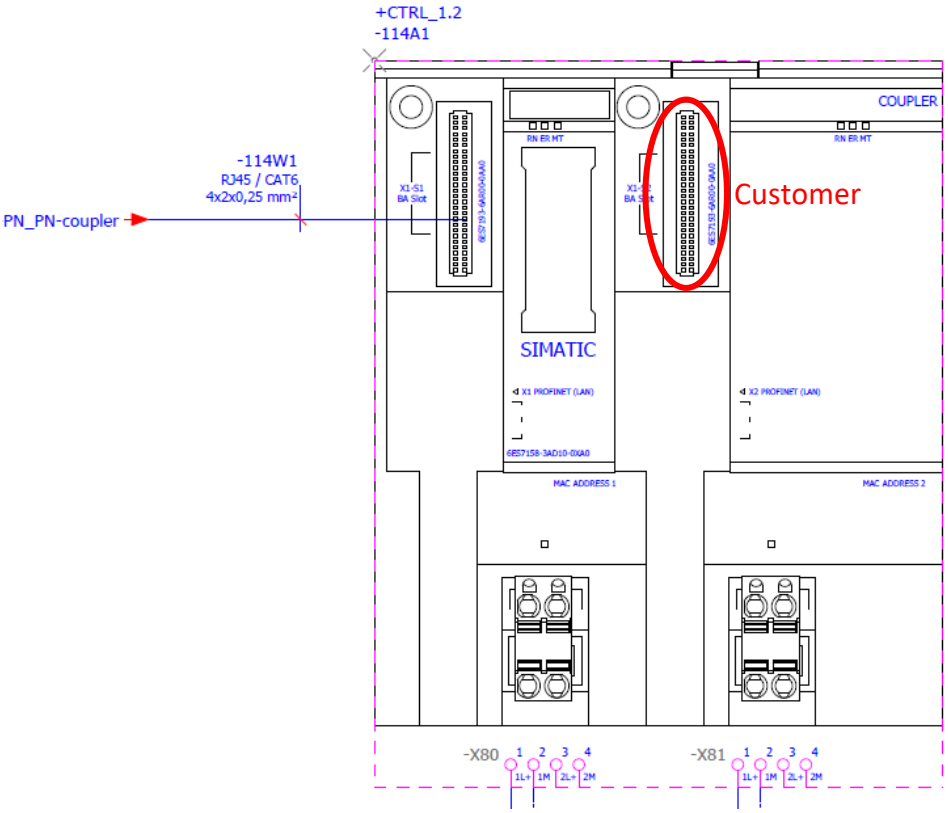


Figure 59: Network isolator 114A1 inside CTRL_1 cabinet

Task 1: **Connect the customer-side higher-level controller to the BESS main controller cabinet (*see circuit diagram and illustration above*).**

Step 1 : Lead the Ethernet cable coming from the external, higher-level controller through the recess in the bottom of the control cabinet 1 (CTRL_1) into the cabinet interior.

Step 2 : Locate the network isolator (114A1) inside the control cabinet.

Step 3 : Connect the external Ethernet cable to the free port of the network isolator.

✓ **The higher-level controller has been successfully connected to the BESS main controller via Ethernet cable.**

12 Pre-Commissioning

Follow the steps below for preparations prior to commissioning of the converter:

Do not operate!	Lock and tag power switches and controller devices
⚠ DANGER 	Disconnect power and block operation controller devices. Follow national laws regarding Occupational Safety and Health. 1. Identify the energy source(s). 2. Isolate the energy source(s). 3. Determine voltage-free status. 4. Ground device or equipment to protect from short circuiting and from shocks. 5. Lock and Tag the energy source(s). 6. Prove that the equipment isolation is effective. 7. When required, apply lock-out device or clamp and secure with padlock(s).

12.1 Activate Motor Contactors and Fuses

Task 1: Activate motor contactors and test auxiliary voltages

Set the main switch on the control cabinet door to ON position. ☐

Activate the motor contactors inside the converters system cabinets. ☐

Check the 400 V AC power supply using the corresponding terminals inside CTRL cabinet. ☐

Task 2: Switch on fuses

Switch on all 24/230/400V AC/DC fuses inside the cabinets. ☐

Install the fuses for the UPS supply. ☐

Check, whether the 24 V DC voltage has the correct polarity and magnitude. ☐

Switch on all the 24 V DC fuses (130F1) if not already activated (green indicator lights indicate activated fuse). ☐

After this action all the control devices indicator lights in the control cabinet including the main PLC Siemens SIMOTION P320 should glow green, indicating that these parts are activated and working.

12.2 Check Power Cables

Inspect wiring for proper installation and connection. See wiring diagram for detailed information about the wiring. ☐

12.3 Check Communication Cables

Inspect wiring for proper installation and connection. See wiring diagram for detailed information about the wiring. ☐

Communication between main PLC and converter is established. ☐

12.4 Cooling System Preparations

The cooling system is set under 3 bar air pressure for at least 1 hour. The system pressure must not decrease within that time. ☐

The system is filled with coolant under working pressure of 3 bar and checked for leakage for at least an hour. ☐

13 Commissioning

Follow the steps below for commissioning of the BESS:

Task 1: **Converter Commissioning**

Step 1 : Make sure that the customer-side mains is switched off and decoupled from the converter system.

Step 2 : Make sure that all the work and action instructions listed in section 11 "Mounting" have been carried out.

Step 3 : Follow all instructions listed in section 14.4.

✓ **The BESS is now ready for operation.**

14 Operation

⚠ DANGER	
	Do not enter the container if the warning light is on (red light) ➜ It is only allowed to enter the container if the warning light indicated that it is safe to enter the container (green light) ➜ If the warning light is completely off (no green or red light) consider that it is not safe to enter the container. Before entering the container, make sure that there is no fire inside and no harmful atmosphere

NOTICE	
	• Staying in the container during operation is not permitted, except to turn-off the system in case of emergency • Use the remote interface to start the converter • Do always switch off the converter if you go inside the container

14.1 Operating Panel

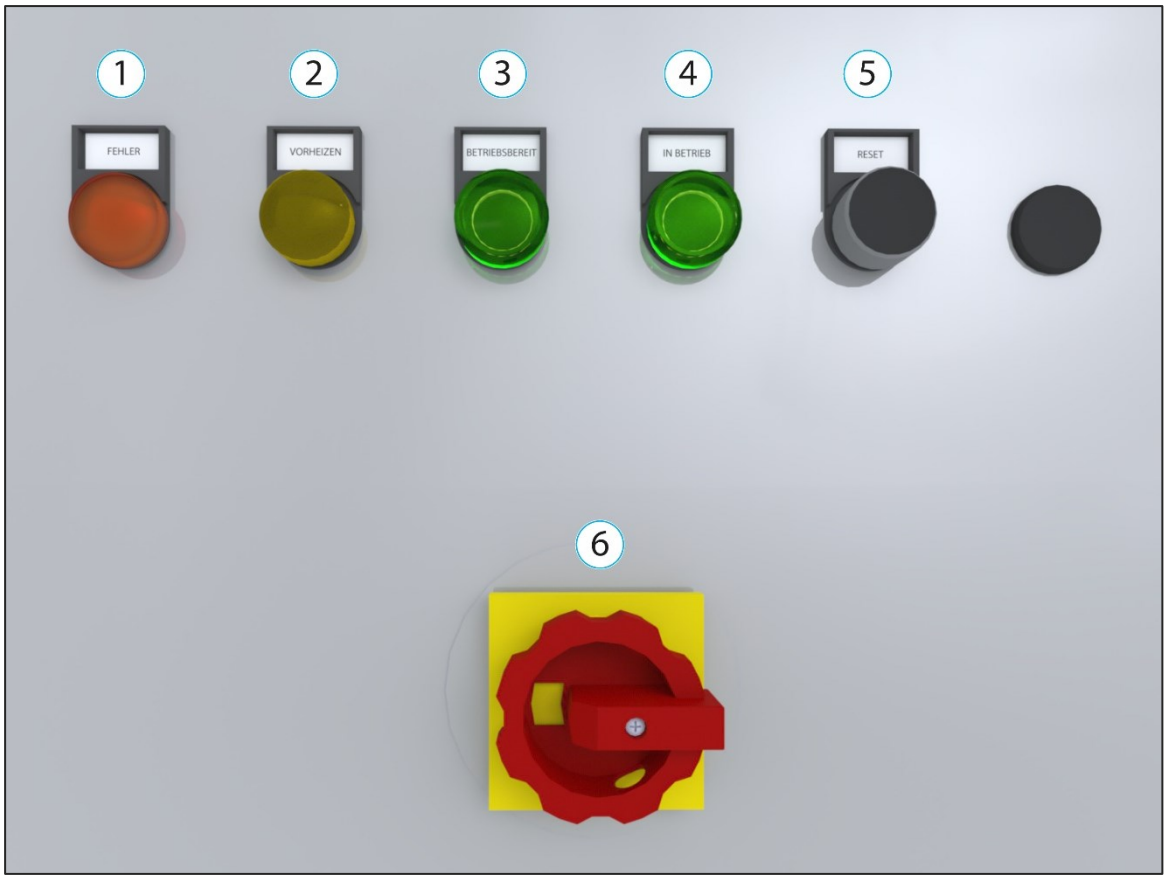


Figure 60: Operating panel

14.2 Indicator Lights

Pos.	Indicator Light	Description
①	**Fault**	**Flashing light** A warning of the converter main controller is present. The converter remains in operation. Constantly glowing: A fault has been detected by the converter main controller. The BESS does not function correctly.
②	**Preheating**	**Flashing light** The cooling liquid is preheated until the set cooling liquid temperature has been reached. Constantly glowing: The coolant temperature has reached the set temperature and is maintained for a set time span (defined in controller). **Light off:** The cooling liquid temperature was maintained for the time span defined in the controller. The preheating process is finished.
③	**Ready for Operation**	**Flashing light** The DC-link of the converter is pre-charging until the set voltage has been reached. **Constantly glowing:**

		The DC-link is precharged to the set voltage and the power switches are closed.
④	**Operating**	**Constantly glowing:** The converter´s IGBTs are enabled. The converter is operating.

Table 37: Indicator lights

14.3 Control Elements

Pos.	Control Element	Description
⑤	**Reset** *Push button*	Resets an existing fault of the main controller and the emergency stop relay.
⑥	**Main switch** *Rotary Switch*	Main switch 480 V power supply for converter control electronics.

Table 38: Control Elements

14.4 Switching on the BESS

Carry out the following steps to switch on the BESS:

Task 1: **Switch on the BESS**
Step 1 : Make sure that the external emergency stop button (customer side, if present) is not activated.
Step 2 : Switch the main switch (*see figure 60,* ⑥) to the "ON" position.

Note 1: If the temperature inside the control cabinet falls below 15°C, the internal control cabinet heating is automatically switched on. The main control is only enabled after the temperature limit value of >5°C has been reached.
Note 2: Once the BESS control system has started up, the function commands transmitted by the higher-level control system are executed.
Note 3: If the BESS control unit detects an error, the red "Fault" indicator (①) lights up.

Step 3 : Check the BESS control system for error messages via the higher-level control system (customer side using WebVisu or communication interface).
Step 4 : Resolve the error(s) if possible.
Step 5 : After successful troubleshooting, acknowledge the error by sending a "Reset" command via the higher-level control system (customer side via WebVisu or communication interface) or the reset button on the CTRL cabinet (⑤*)*.

	For detailed information on the control commands, such as the reset command, which are transmitted to the BESS control system via the customer's higher-level control system, please refer to the document "Description of data profiles" (*see section 1.2 "Applicable Documents"*).

	The control bits described below can be set simultaneously and are automatically processed by the control system in the correct sequence.

Step 6 : Set the **converter_heatup_enable** bit to **TRUE** via the communication interface of the external control room or via the WebVisu. The signal initiates the preheating process of the cooling system. This process normally takes 20 minutes. The "Preheating" indication light illuminates (*see figure 60,* ②).
Step 7 : As soon as all temperatures are within the permissible range, the "Preheating" indication light goes off.
Step 8 : Set the **converter_charge_enable** bit to **TRUE** via the communication interface of the external control room or via the WebVisu. The signal initiates precharging of the DC link and the "Ready for operation" indication light (③) starts to flash. As soon as the DC link is pre-charged, the main switch responsible for the DC link control is switched on and the "Ready for operation" indication light (③) starts to light up constantly.
Step 9 : Set the **converter_modes_enable** bit to **TRUE** via the communication interface of the external control room or via the WebVisu. The signal activates the pulse enable of the grid IGBT´s.
Step 10 : If no errors have occurred, the BESS starts normal operation and the "Operation" indication light (④) lights up constantly.

Step 11 : The detailed procedure for switching on the converter system must be carried out in accordance with the document "Description of data profiles" (*see section 1.2 "Applicable Documents")*. The sequence of the individual steps is shown on the "Flow Chart" tab.

✓ **The BESS is now switched on and in operation.**

14.5 Switching off the BESS

Follow the steps below in order to switch-off the converter:

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 “Protect the CB Against Unintentional Reclosing”. ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

Task 1: **Switch off the BESS.**

Step 1 : To switch off the converter, carry out the steps in reverse order according to the document "Description of the data profiles" in the "Flow chart" tab (*see section 1.2 “Applicable Documents”*).

Step 2 : Set the **converter_modes_enable** bit to **FALSE** via the communication interface of the external control room or via the WebVisu. The signal deactivates the pulse enable of the grid IGBT´s.

Step 3 : Set the **converter_charge_enable** bit to **FALSE** via the communication interface of the external control room or via the WebVisu. The signal opens the main switch and initiates the discharge of the DC link. As soon as the main switch is open, the "Ready for operation" indication light goes off (*see figure 60,* ③).

⚠ DANGER	
	**Risk of injury due to electric shock!** **Discharging the DC link takes several minutes. The "Ready for operation" indication light is not an indicator of a fully discharged DC link. Do not carry out any work on BESS before the DC link has been completely discharged.** ➜ Wait until the DC link is completely discharged and check that it is de-energized as described in section 14.7 "Check Voltage-Free Status of DC Link ".

Step 4 : Set the **converter_heatup_enable** bit to **FALSE** via the communication interface of the external control room or via the WebVisu. The signal switches off the water cooling of the converter after a run-on time of 2 minutes.

Step 5 : Switch the main switch on the converter control cabinet (*see figure 60,* ⑥) to the "OFF" position.

✓ **The BESS is now switched off.**



The UPS can be switched off by pulling the blade type fuse of the UPS unit.

14.6 De-Energizing

Carry out the following steps to de-energize the BESS system:

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 "Protect the CB Against Unintentional Reclosing". ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

Task 1: **De-energize the BESS**

Step 1 : Switch-off the converter system like explained in section 14.4.

Step 2 : Secure the AC circuit breaker(s) from unintentional reclosure, like explained in section 14.9.3.

Step 3 : Decouple the customer AC connection from the converter system using a suitable disconnection device.

Step 4 : Wait for 30 minutes until the converters´ DC link is discharged and check the voltage-free status of the DC-link by using a suitable 2-pole voltage tester.

✓ **The BESS is now switched off and de-energized.**

14.7 Check Voltage-Free Status of DC Link



The DC link voltage can be up to 1300 VDC. Make sure that the measuring device for testing the absence of voltage in the DC link is suitable for this voltage range.



For converter systems with more than one DC link, the following steps must be carried out to check the absence of DC link voltage on each DC link.

The following steps must be followed to check that the DC link is de-energized:

Step 1 : After switching off the system, check the DC link voltage on the WebVisu or via the communication interface of the external control room.

Step 2 : Check that the DC link is de-energized at the HVIO measuring fuse 173F2 between connections 2 and 4 in the CTRL cabinet.

Step 3 : In addition, check that the DC link is de-energized at the HVIO measuring fuse 173F2 by measuring between connection 2 and N (or PE) in the CTRL cabinet.

Step 4 : In addition, check that the DC link is de-energized at the HVIO measuring fuse 173F2 by measuring between connection 4 and N (or PE) in the CTRL cabinet.

Step 5 : Check that there is no voltage on the DC link between a DC- connection (*see figure below*, ①) and DC+ connection (②) of the PowerStack.

➜ For switch cabinets with more than one installed PowerStack, access to the DC link connections is at the bottom stack.
➜ The DC+ connections are positioned slightly to the rear compared to the DC connections.

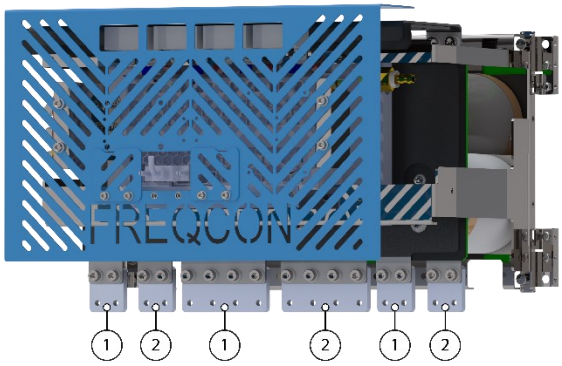


Figure 61: DC- connections ① and DC+ connections ② on the PowerStack (figure may differ from the actual design)

14.8 AC Circuit Breaker

NOTICE

The AC main circuit breaker(s) must not be switched manually!
Do not switch the AC main circuit breaker manually under any circumstances, as this could damage the breaker and the equipment.

The converter system is equipped with an individual 3WL circuit breaker, in order to disconnect the connected grid from the BESS systems electric circuit.

The main circuit-breaker(s) is/are located in the CIR cabinet (*see section 4.4.3 "Internal Components"*).

To protect the circuit breaker against unauthorized switching and to protect the maintenance and operator personnel, the circuit breakers contain a number of locking devices.

For instructions on how to secure the circuit-breaker(s) against reclosing, see section 14.8.3.

Detailed information can be found in the manufacturer's documentation for the circuit-breaker (*see also section 1.2 "Applicable documents"*):

Document type	Document Name	File Name
Operating instructions AC circuit breaker	3ZX1812-0WL00-0AN4	3ZX1812-0WL00-0AN4_online_201806140915326928

14.8.1 Circuit Breaker Components

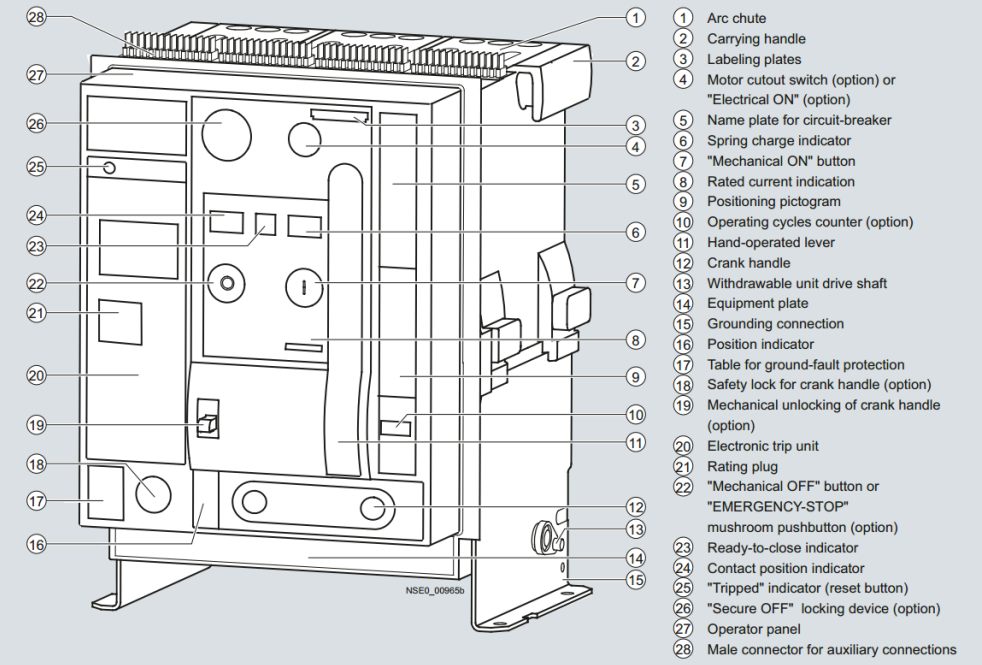
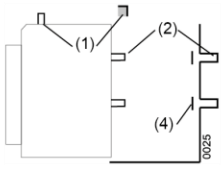
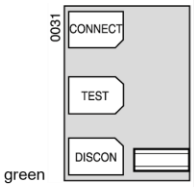
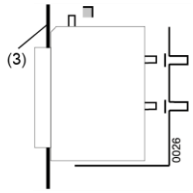
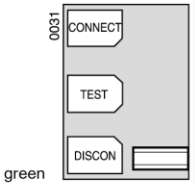
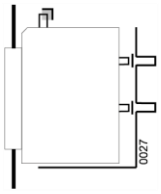
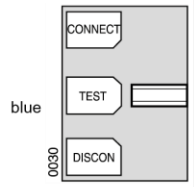
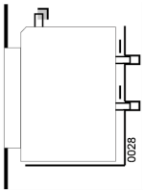
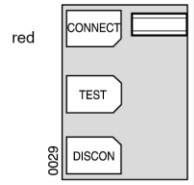


Figure 62: Circuit breaker components

14.8.2 Positions of CB in the Guide Frame

	Diagram	Positon indicator	Power circuit	Auxiliary circuit	Cubicle door	Shutter
Maintenance position			disconnected	disconnected	open	closed
Disconnected position			disconnected	disconnected	closed	closed
Test position			disconnected	connected	closed	closed
Connected position			connected	connected	closed	open

(1) Auxiliary circuit
(2) Primary circuit
(3) Cubicle door
(4) Shutter

Figure 63: Circuit breaker positions

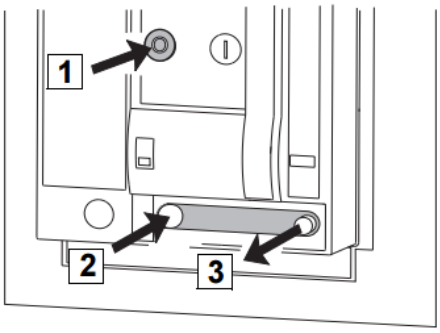
14.8.3 Protect the CB Against Unintentional Reclosing

Drawing out of the racking handle can be prevented by fitting a maximum of three padlocks. The circuit breaker is then locked against moving.

Task 1: **Unlocking the racking handle/ Withdrawing racking handle.**

Step 1 : OPEN circuit breaker.

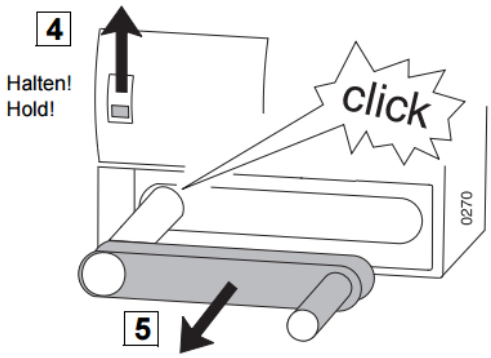
Step 2 : Push the crank.



Step 3 : Pull out handle.

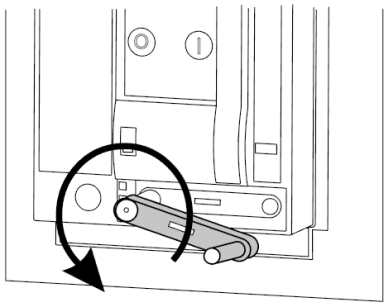
Step 4 : Lift and hold the control lever.

Step 5 : Pull out the crank.

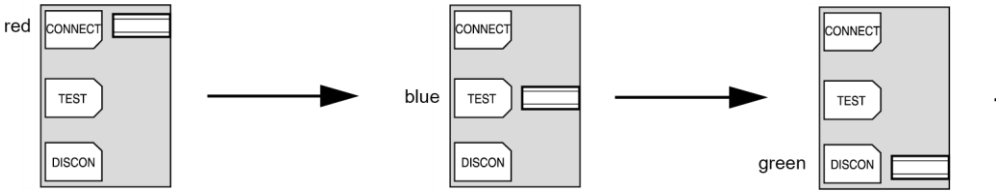


Task 2: Racking circuit breaker into the disconnected position.

Step 1 : Rack the handle until the disconnected position is indicated by the position indicator (green).



Position indicatior

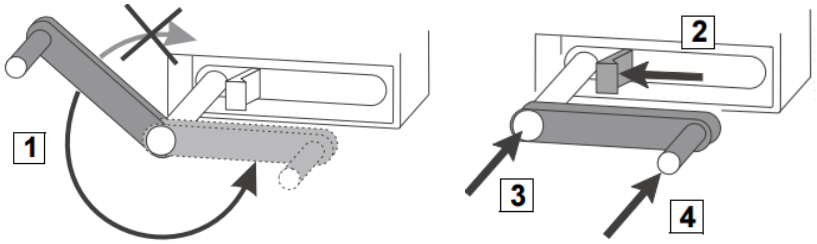


Task 3: Push in the racking handle.

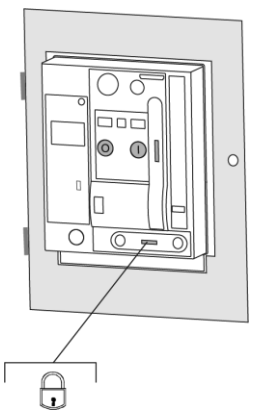
Step 1 : Bring the racking handle to the position indicated in the illustration below.

Step 2 : Push in the crank.

Step 3 : Push in the handle.



Task 4: Lock the racking handle with one or more padlocks.



14.9 DC Fuse Switch Disconnectors

NOTICE	
	**The DC fuse switch disconnectors must not be switched manually!** Do not switch the DC fuse switch disconnectors manually under any circumstances, as this could damage the breaker and the equipment.

Each of the battery storage cabinets is equipped with a DC fuse switch disconnector, in order to disconnect the corresponding battery cabinet from the electric circuit of the BESS.

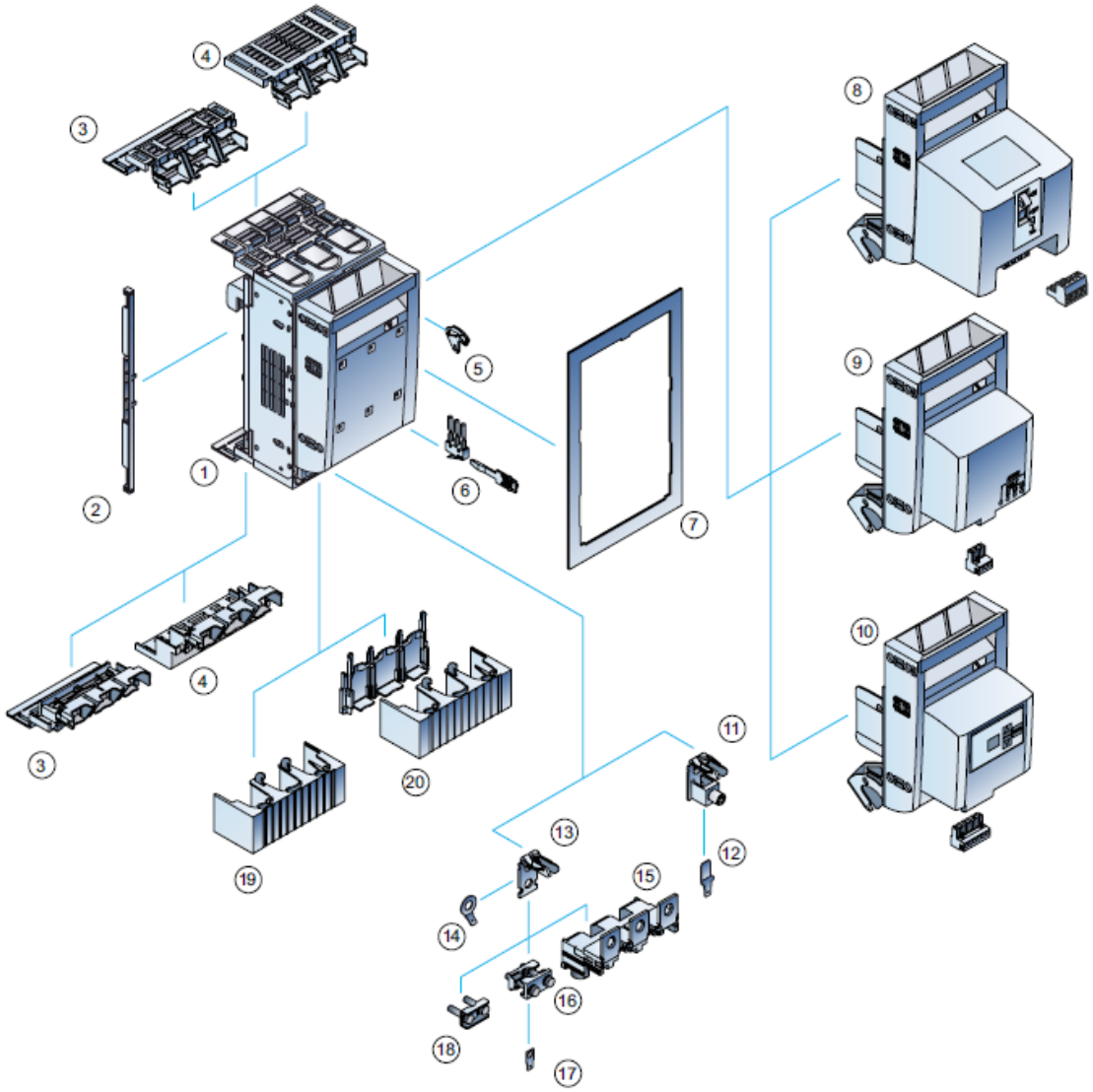
A DC fuse switch-disconnector is located on the mounting plate at the bottom of each battery cabinet.

To protect the DC fuse switch disconnector against unauthorized switching and to protect the maintenance personnel, the disconnector is provided with locking devices.

For instructions on how to prevent unintentional reclosing of the DC fuse switch disconnector, *see section 14.9.3, "Protect the DC Disconnector Against Unintentional Reclosing"*.

For detailed information regarding the DC fuse switch disconnector, refer to the original manufacturer manual (*see section 1.2 "Applicable Documents"*).

14.9.1 Fuse Disconnector Components



① SENTRON 3NP1 fuse switch disconnector
② Cover support
③ Reach-round protection for mounting onto Siemens busbar system
④ Reach-round protection for mounting onto Rittal busbar system
⑤ Locking device
⑥ Auxiliary switch with actuator
⑦ Molded plastic cover
⑧ Handle unit with mechanical fuse monitoring (MFM)
⑨ Handle unit with electronic fuse monitoring (EFM 10)
⑩ Handle unit with electronic fuse monitoring (EFM 20/25)
⑪ Box terminal
⑫ Auxiliary conductor terminal for box terminal
⑬ Blade terminal
⑭ Auxiliary conductor terminal for blade terminal
⑮ Deep-drawn terminal module
⑯ Prism terminal
⑰ Auxiliary conductor terminal for prism terminal
⑱ Saddle terminal
⑲ Terminal cover
⑳ Terminal cover with reach-round protection on the back

Figure 64: Circuit breaker components

14.9.2 Locking Device

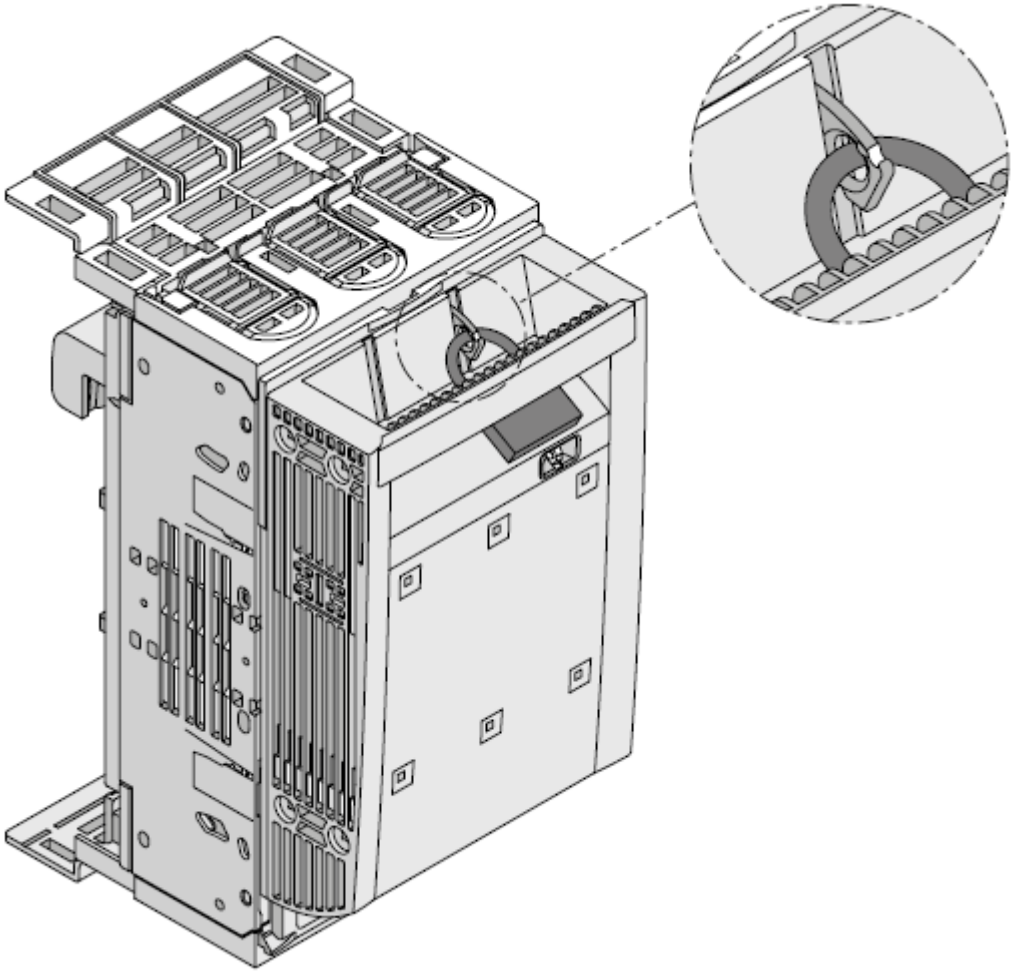


Figure 65: Locking device

14.9.3 Protect the DC Disconnector Against Unintentional Reclosing

You can lock the 3NP1 fuse switch disconnector to protect it against unauthorized actuation.
Either an eye (optional accessory, see below) and a padlock (shackle diameter: 6 mm) or two padlocks (shackle diameter: 2x 3 mm) are required for this purpose. The padlocks are not supplied with the fuse switch disconnector.

NOTICE
You can open the handle unit of a fuse switch disconnector that has been locked with an eye and one padlock by force in order to trip an emergency stop (rupture point on the eye).

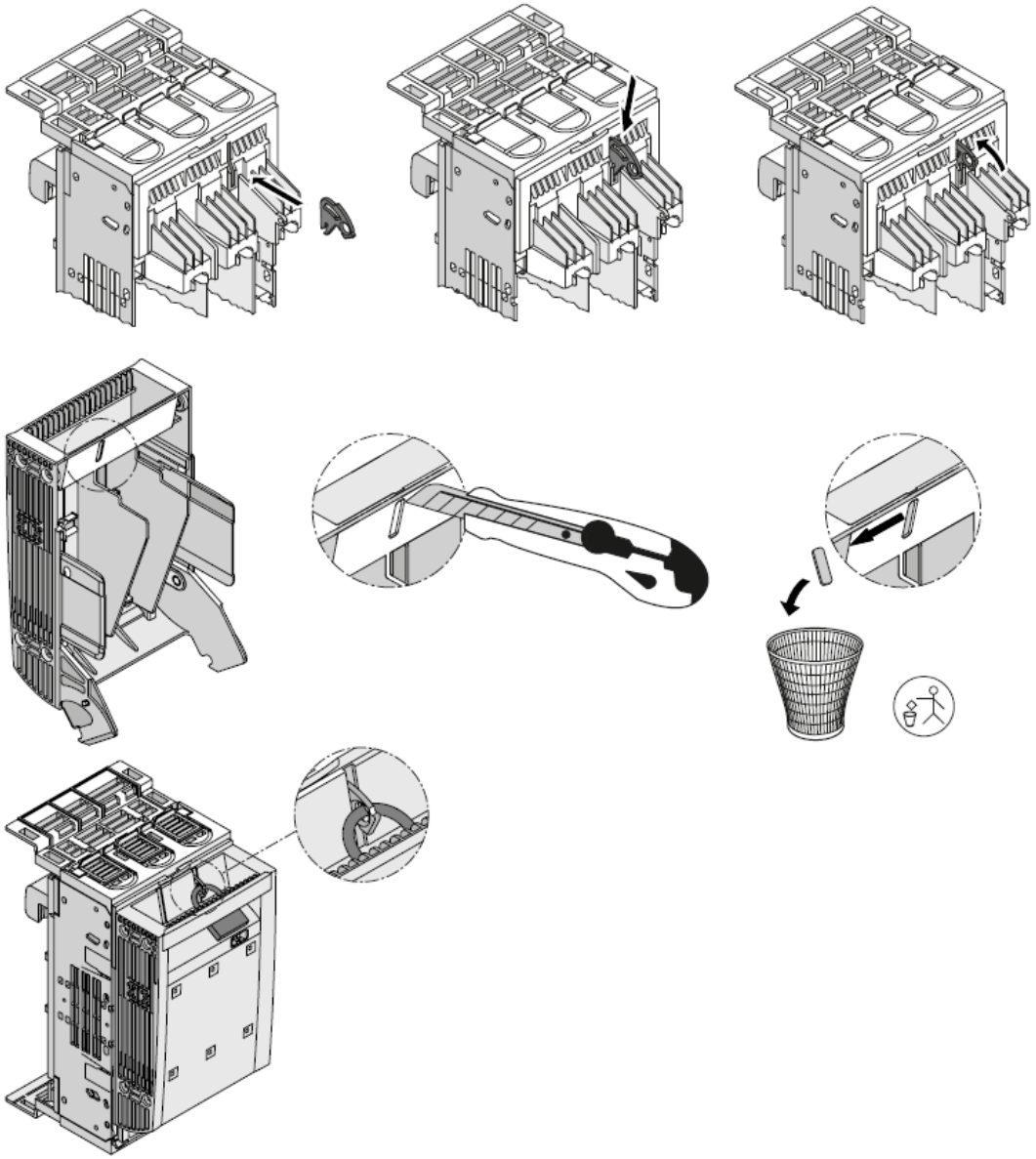


Figure 66: Secure fuse switch-disconnector against unintentional reclosing

15 Monitoring

PIII Converter Control Module

The converter system is equipped with two converter control interfaces.

PIII Indicator Lights

LED	Color	Label	Description
1	red	**UDC max**	DC-link voltage exceeded maximum value
2	red	**Imod max**	Current of one or more IGBT´s exceeded maximum value
3	red	**Error IGBT 1**	Error detected on IGBT 1
4	red	**Error IGBT 2**	Error detected on IGBT 2
5	red	**Error IGBT 3**	Error detected on IGBT 3
6	red	**Error IGBT 4**	Error detected on IGBT 4
7	red	**Error IGBT 5**	Error detected on IGBT 5
8	red	**Error IGBT 6**	Error detected on IGBT 6
9	red	**Error IGBT 7**	Error detected on IGBT 7
10	green	**PWM Mode**	IGBT 1, IGBT 2 and IGBT 3 are working in PWM mode
11	green	**Enable**	IGBT 1 - 6 ready for operation
12	green	**Top 1**	Top 1 active
13	green	**Bot 1**	Bot 1 active
14	green	**Top 2**	Top 2 active
15	green	**Bot 2**	Bot 2 active
16	green	**Top 3**	Top 3 active
17	green	**Bot 3**	Bot 3 active
18	green	**Top 4**	Top 4 active
19	green	**Bot 4**	Bot 4 active
20	green	**Top 5**	Top 5 active
21	green	**Bot 5**	Bot 5 active
22	green	**Top 6**	Top 6 active
23	green	**Bot 6**	Bot 6 active
24	green	**Chopper Active**	Brake chopper is active
25	green	**Blinki**	Profinet communication between main PLC and PIII is established
26	green	**24 V Supply**	24V supply connected
27	green	**UL 1**	L1 voltage apparent
28	green	**UL 2**	L2 voltage apparent
29	green	**UL 3**	L3 voltage apparent
30	green	**Urec**	Booster voltage is apparent on rectifier
31	green	**UDC +**	DC link voltage is apparent
32	green	**Arc Detect**	Arc detection has tripped

Table 39: PIII indicator lights

16 Data transfer with higher-level controller

As described in section 4.2 "Data Interface", the BESS is controlled and monitored via the transfer of data with the customer's higher-level control system. Data transfer between BESS and the higher-level control system is performed via PROFINET protocol.

For external control and monitoring of the converter, it is necessary for the customer to have access to selected control and status variables stored in the converter controller, which can be read and overwritten by the customer's higher-level controller. For this purpose, predefined control profiles with the relevant control variables and status profiles with all relevant status variables are stored for the data transfer from BESS to the customer's higher-level controller.

For a detailed description of the individual data profiles, see Description of data profiles (*see section 1.2 "Applicable Documents"*).

17 Maintenance

The following describes the maintenance work that is necessary for trouble-free operation of the converter system (PCS) and Battery Energy Storage System (BESS). Maintenance intervals must be observed (*see section 17.2 "Maintenance* Schedule*"*).

If increased wear of individual components or functional groups is determined during regular inspections, the operator has to reduce the required maintenance intervals on the basis of the actual signs of wear. Changes compared to the normal operation (increased power consumption, temperatures, vibrations, noises, etc. or respond of monitoring systems) might indicate the functionality of the device is impaired. These then have to be subjected to an inspection by qualified personnel.

For information regarding maintenance of the BESS battery cabinets refer to document „20_Maintenance_Schedule“ (*see section 1.2 "Applicable Documents"*). Maintenance intervals provided in the maintenance schedule must be adhered.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on a live system.** After switching off the converter, the DC-link of the converter still carries dangerous voltages, which may cause death or severe injuries if touched or short circuit. ➜ Before performing work on the converter, deenergize the converter, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ It is not allowed to open the cabinet doors before the converter system has been de-energized and the capacitors are discharged. ➜ It is not allowed to perform any work on the converter before the system has been de-energized.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform maintenance work on the converter system, before the converter system has been disconnected from all power sources.** After switching off the converter, the connected DC power cables of the battery strings, the DC connection busbars in the AC_DC cabinet and the DC switch & fuse units continue to carry dangerous voltages that can cause death or serious injury if touched or short-circuited. ➜ Before starting work inside the converter cabinets, de-energize the converter system as described in section 14.6 “De-Energizing”, wait for 30 minutes until the installed capacitors are discharged and check the voltage-free status of the DC-link by using a 2-pole voltage tester. ➜ Disconnect the DC power cables from the converter system using suitable DC disconnecting devices before carrying out any work in the cabinets of the converter system. ➜ Before disconnecting the DC power cables from the DC connection busbars, always check for voltage-free status of the DC power cables, since dangerous electric arcs may lead to severe injuries or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any work on the MV switchgear and the MV transformer before the PLC container has been disconnected from all voltage sources.** After switching off the converter, the connected MV transformer, the MV switchgear, its connecting cables and terminals continue to carry dangerous voltages which, if touched or short-circuited, can cause death or serious injury. ➜ Before working on the medium voltage components of the converter container, de-energize the converter system as described in section 14.6 “De-Energizing”. ➜ Disconnect the AC mains connection by opening the MV switchgear. ➜ Before disconnecting the AC power cables from the AC connection busbars, always check the voltage-free status of the AC power cables, otherwise dangerous arcs can cause serious injury or death when disconnecting the power cables.

⚠ DANGER	
	**Electric shock hazard!** **Do not perform any maintenance work on the converter system before the AC circuit breaker and MV switchgear have been switched off and protected against unintentional reclosure.** ➜ Before starting work inside the converter cabinets, the AC circuit breaker 80Q1 must be switched off and protected against unintentional reclosure as described in section 14.8.3 “Protect the CB Against Unintentional Reclosing”. ➜ Before you start working inside the control cabinets, the medium-voltage switchgear must be switched off and protected against unintentional reclosure.

⚠ WARNING	
 	**Hazard by cooling liquid** The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed. ➜ Avoid oral ingestion of the coolant, since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention. ➜ Avoid skin contact with the coolant. ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

NOTICE
Service and maintenance work on the BESS and cooling system must only be carried out by qualified and authorized personnel.

17.1 Preparations Prior Maintenance

The following safety precautions must be carried out before commencing service and maintenance work.

Non-observation of these safety instructions can cause injury to persons, damage to objects or malfunction or damage to the device itself.

Do not operate!	**Lock and tag power switches and controller devices**
⚠ DANGER 	Disconnect power and block operation controller devices. Follow national laws regarding Occupational Safety and Health. 1. Identify the energy source(s). 2. Isolate the energy source(s). 3. Determine voltage-free status. 4. Ground device or equipment to protect from short circuiting and from shocks. 5. Lock and Tag the energy source(s). 6. Prove that the equipment isolation is effective. 7. When required, apply lock-out device or clamp and secure with padlock(s).

17.2 Maintenance Schedule

Location	Component	Maintenance Work	Maintenance Interval	Description in
PCS Container CTRL cabinet	UPS battery	Functionality check	Once every 6 months	Section 17.3.1
PCS Container CTRL cabinet	UPS battery	Remove battery from battery unit	At storage temperatures below 0°C	Section 17.3.2
PCS Container All switch cabinets	Intake fan filters	Check the fan filters for contamination and replace if necessary	Once every 6 months	Section 17.4
All containers	Complete BESS system	Visual inspection	Once every 6 months / in case of a fault	Section 17.5
PCS Container CIR cabinet	Circuit breaker 3WL	Inspection	Once every 12 months	Section 17.6.1
		Replace arc-chute covers	After no more than three short-circuit interruptions	
		Replace arc chutes and contact system	Depending upon their condition	
		Replace operating system	Depending upon their condition	
PCS Container CTRL cabinet	PLC	Replace backup battery of Simotion PLC	Once every 4 years	Section 17.7
PCS Container COSY	Coolant	Exchange cooling liquid	Once every 5 years	Section 17.6
PCS Container COSY	Expansion vessel	Check pressure	Once every 5 years / When exchanging the cooling liquid / When error "pressure low" is apparent	Section 17.9
BESS Containers	Exhaust units	Inspection	Once every 6 months / in accordance with existing maintenance schedule	Section 17.11
BESS Containers	Fire dampers	Inspection	Once every 6 months / in accordance with existing maintenance schedule	Section 17.12
BESS Containers	H2 Sensors	Inspection	Once every 6 months	Section 17.13

Table 40: PCS Maintenance Schedule

17.3 UPS

17.3.1 UPS Functionality Check

(once every 6 months)

In order to check the functionality of the UPS device, the following steps must be performed:

Task 1: **Perform functionality check of the UPS device**

Step 1 : Set the main switch on the door of the control cabinet (*see figure 60,* ⑥) to the "OFF" position.

Step 2 : Locate the UPS module 102G1 inside the control cabinet (*see section 4.4.3*).
The yellow LED (*see figure below,* ④) on the front of the UPS module should glow, indicating that battery mode is active and the battery is discharging because the power supply is not available.

Step 3 : Wait for the buffer time set on the potentiometer on the front of the UPS module (②, default value: 6.6 min.).
During this time, check if the SoC bar graph (①) is displaying the current state of charge (SoC).

Note 4: During and after the test, the red LED (③) displaying an UPS alarm should not start glowing, since this would indicate an faulty or almost empty battery. In this case, the UPS battery must be replaced as described in the original manufacturer documentation.

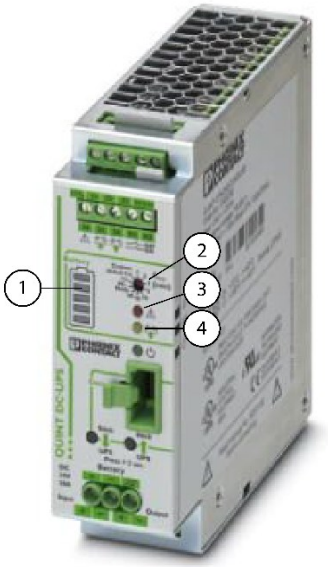


Figure 67: UPS module

Pos.	Description
①	Bar graph for displaying the current charging state of the power storage device
②	Buffer time setting: default: 6.6 min.
③	Red LED: alarm
④	Yellow LED: battery mode

Icon	Meaning of LEDs
⚠	Red LED on: UPS alarm due to one of the reasons: • battery almost empty • battery not detected • battery replacement required LED off: No UPS alarm, power supply available, normal operation.
🔋	Yellow LED on: Battery mode is ON, battery is discharging because power supply failed. LED off: Battery mode is OFF, i.e. mains available.
⏻	Green LED on: Mains is ON. LED off: Mains is OFF.

17.3.2 Removing the UPS battery

(At storage temperatures below 0°C)

NOTICE
The battery of the UPS unit must be removed at temperatures below 0°C.

In order to remove the battery from the energy storage device UPS-BAT/VRLA/24DC/12AH, the service mode of the UPS device must be activated.

Task 1: Activate service mode

The corresponding activation rights have to be granted for service mode activation and deactivation.

The service mode cannot be activated, while the QUINT-UPS runs in battery mode. The power supply must be available.

Step 1 : Depending on the granted activation rights, the service mode can be activated in three different ways:

1. By holding down both push buttons on the QUINT-UPS named "Stick -> UPS" and "UPS -> Stick" for at least 6 seconds.

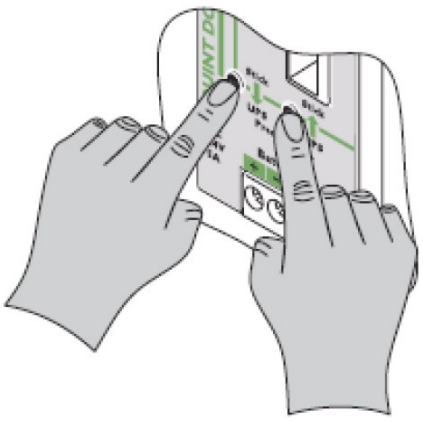


Figure 68: UPS control elements

2. By connecting a service stick (*see manufacturer manual*) to the Data port of the UPS.
3. By using the UPS-CONF (*see manufacturer manual*) software as follows:
   In the "Settings" group, select the "Service" item, and click the "On / Off" button near the "Activate service mode" text.

While the service mode is active

- the alarm status is activated,
- the charging current is interrupted,
- the status LED "Service mode active" in the UPS-CONF software ("Settings" group /"Service" item) is green

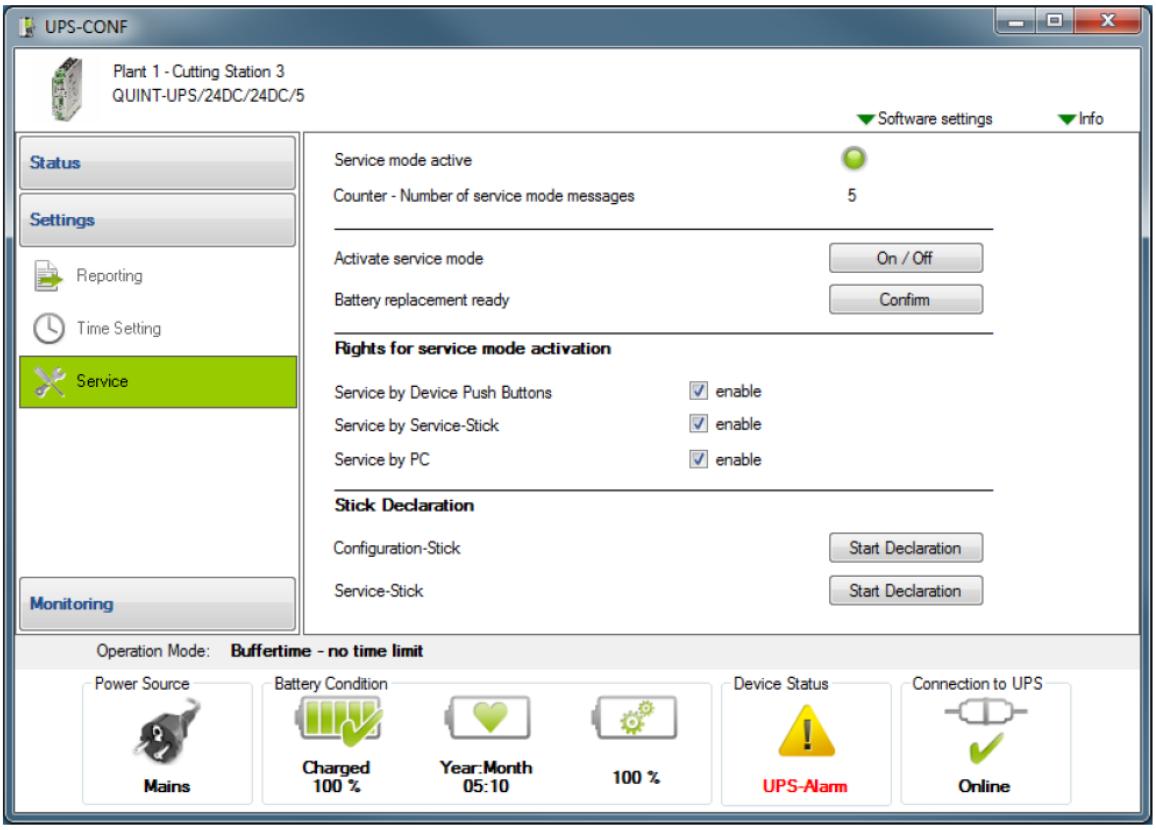


Figure 69: UPS CONF software

Task 2: Remove battery

⚠ DANGER
Before activating the service mode, read and obey carefully the safety instructions in the topic “Important safety notes” of the manufacturer manual.

⚠ DANGER
Watch polarity when connecting cables!

Step 1 : Activate the service mode by one of the ways described in Task 1.
Step 2 : Open battery module housing.
Step 3 : Remove fuses *(see illustration below)*.

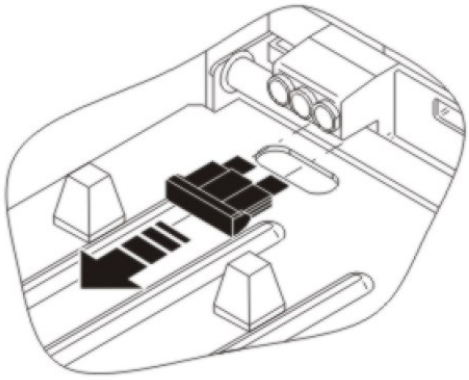


Figure 70: Remove UPS battery fuses

Step 4 : Remove cabling.
Step 5 : Remove battery.
Step 6 : Fix cabling inside housing.
Step 7 : Store the battery module together with the fuses.
Step 8 : Close battery module housing.

NOTICE
The battery and the fuses of the UPS unit must be reassembled before commissioning, recommissioning and operation of the MSC converter unit.

17.4 Changing the Intake Fan Filters

Check every 6 months, replace depending on degree of soiling)

The fan-and-filter unit and outlet filter are supplied as standard with a standard filter mat for the pre-filtering of dry, coarse dust and lint. In order to increase the protection category, and in the case of dust with a grain size of < 10 µm, we recommend the use of fine filter mats (optionally available).
The filter must be checked in regular intervals in accordance to the level of dust exposure and replaced as necessary.

⚠ DANGER

➜ Only change the filter mat while the fan rotor is stationary.
➜ Never insert your fingers into the fan rotor.

⚠ DANGER

The unit is live. Switch off the power supply before opening, and take suitable precautions against it being accidently switched back on.

NOTICE

Use only original Rittal filters which bear the Rittal logo in order to safeguard the designated protection category, air throughout and operating approvals.

To insert or replace the filter, proceed as follows (direction of airflow: drawing from outside and blowing into the enclosure):

Task 1: **Replace intake filter**
Step 1 : First press the catch of the louvred grill (Rittal logo) up slightly with one finger.
Step 2 : Once it is released, the louvred grill can be dropped open by approx. 70° or 90°.
Step 3 : If necessary, first place the fine filter mat into the housing.
Step 4 : Ensure that the open (roughened) side faces towards the louvred grill.
Step 5 : Insert the enclosed standard filter mat.
Step 6 : Ensure that the open side (without Rittal logo) faces towards the louvred grill.
Step 7 : Push the louvred grill back onto the enclosure until it snaps audibly into position.

17.5 Visual Inspection

(once every 12 months/in case of a fault)

Check the fan filters for contamination. Replace filters if necessary (*see section 17.4*).

Visually inspect the BESS cabinets for:

- Corrosion
- Damage
- Contamination

Electrical connections
Electrical connections must be checked for proper connection in order to ensure safe operation of the system and to prevent personnel from injuries due to electrical shock.

Corrosion
Corroded electrical connections must be replaced in order to maintain safe operation of the system and to prevent personnel from injuries due to electrical shock.

Damage
Damaged wires and clamps must be replaced immediately in order to maintain safe operation of the converter system and to prevent personnel from injuries due to electrical shock.

Contamination
Check the interior of the converter unit for contamination and dirt in order to prevent the internal components from short-circuiting and damage.

NOTICE
Do not use solvents for cleaning – especially on polycarbonate plastics. Use a vacuum cleaner to remove dirt or dust.

17.6 AC Circuit Breaker(s)

17.6.1 Inspection work

(once every 12 months)

The arc chutes and contact system of the circuit breaker(s) must be inspected according to these operation instructions. If a fault condition opens the circuit breaker(s), the circuit breaker(s) should be inspected before it is put back into service. Contact assemblies need to be changed according to their condition.

The switchgear operator has to determine inspection intervals depending on the breaker application conditions:

- min. 1 x per annum
- after interruption of heavy loads

During the inspection the following items must be examined:

- arc chutes and contact systems
- electrical and mechanical functionality of the breaker
- mechanical on- / off-functionality
- main and auxiliary circuits, function and connecting quality
- plausibility control of trip unit settings and correction, if necessary

Draw-Out guide frames with arc-chute covers installed, have to be replaced after no more than three short-circuit interruptions of the circuit breaker. If the breaker endurance is exhausted, then the breaker and old spare parts need to be disposed off, according to the effective legal regulations.
The arc chutes and the contact system must be replaced depending upon their condition.

Depending on the circuit breaker stress it may also be necessary to replace the operating system.

For detailed regarding the maintenance of the circuit breaker, refer to original manufacturers´ documentation (*see section 1.2 "Applicable Documents"*):

Document type	Document Name	File Name
Operating instructions	3ZX1812-0WL00-0AN4	3ZX1812-0WL00-0AN4_online_201806140915326928

17.7 Replace PLC Buffer Battery

17.7.1 Preventive maintenance

(every 4 years)

To maintain the high system availability, the manufacturer recommends the preventive replacement of the CMOS buffer battery, which is installed in the system PLC.

Component	Replacement interval
CMOS buffer battery	4 years

17.7.2 Replacing Backup Battery

NOTICE

The service life of the backup battery is approx. 5 - 8 years, depending on the ambient conditions.

Detailed information on maintenance can be found in the manufacturer's documentation for the Simotion P320-4 PLC *(see also section "Other applicable documents")*:

Document type	Document Name	File Name
Operating instructions	P320- 4 Commissioning and installation manual	P320_4_commissioning_en-EN

17.8 Exchanging the Cooling Liquid

(Every 5 years)

The cooling liquid inside the converter cooling system is to be exchanged as described in the following sections.

Like described in section 0, the converter cooling system is split up into two independent cooling systems for each converter system, allowing Converter System 1 and 2 independently from one another.

Therefore, each of the following steps must be performed for each cooling system separately.

NOTICE

- The cooling liquid inside the cooling system must be removed at least once every five years.
- Check the pressure on the expansion tank every time the cooling liquid is exchanged. The cooling system must be completely drained in order to perform a pressure check of the expansion tank (*see section17.9*).

NOTICE

The pump must not run dry as it might damage the pump.

17.8.1.1 Required Tools

The following table provides you with information regarding the tools required to perform maintenance work on the cooling system:

Amount	Tool	Description	Preferred Type	Manufacturer
3	Hose ½"	Length: 2 m, max. 50 bar	Variolux Silverline	Gardena
1	Filling pump	For glycol use, min. 2 bar pressure	Unistar 2000 A	ZUWA
1	Cooling liquid vessel	Min. 55 l capacity		
1	Inlet pressure gauge	For expansion tanks, digital	Art. No.: 512240122	OEG
1	Tank filler 400 ml	For increasing and testing the pressure in expansion tanks	Art. No.: 311779100	OEG
1	Adapter for tank filler	Adapter for screwing on the tank filler can	Art. No.: 512240126	OEG

Table 41: Required tools for cooling system maintenance

17.8.1.2 Allowed Coolants

The following table lists the suitable coolants for using in the cooling system. When exchanging the cooling liquid of the cooling system, only use a coolant listed in the table.

Please observe the manufacture's information regarding the cooling range of the designated cooling liquid.

Manufacturer	Type
NALCO AG	Varidos FSK
BASF AG	Glysantin G30
Clariant	Antifrogen N
Clariant	Antifrogen L
DOW	Dowcal 20
Zitrec	M-25 C

Table 42: Allowed coolants

17.8.1.3 Draining the cooling system

NOTICE

Check the pressure on the expansion tank every time the cooling liquid is exchanged. The cooling system must be empty in order to perform a pressure check of the expansion tank (*see section 17.9*).

⚠ WARNING



Hazard by cooling liquid

The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed.

- ➜ Avoid oral ingestion of the coolant, since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention.
- ➜ Avoid skin contact with the coolant.
- ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

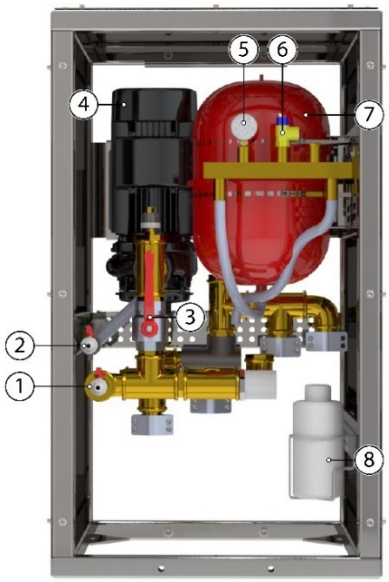


Figure 71: Cooling system components inside cooling system cabinet (COSY)

Pos.	Cooling system components
①	¾“ inlet flow connection with valve
②	"¾“ return flow connection with valve
③	Stop cock
④	Coolant pump
⑤	Manometer
⑥	Overpressure valve
⑦	Expansion vessel
⑧	Overflow vessel

Table 43: Cooling system components

Task 1: **Draining the cooling system**

Step 1 : Connect a pressure hose to the return flow connection of the cooling system inside the COSY cabinet (*see figure 71,* ②) and lead the end of the hose inside a suitable vessel.

Step 2 : Open the return flow valve (②).

Step 3 : The cooling liquid drains through the hose inside the vessel.

Step 4 : Wait until the cooling system is completely drained and then check it for any liquid remaining in the system.

17.8.2 Filling the Cooling System

⚠ WARNING	
	**Hazard by cooling liquid** The coolant used in the internal cooling system of the converter is harmful to human or animal health when touched or swallowed. ➜ Avoid oral ingestion of the coolant, since it can lead to harm to human or animal health. In case of accidental ingestion or eye contact with the coolant, seek immediate medical attention. ➜ Avoid skin contact with the coolant. ➜ Use appropriate eye protectors and protective gloves when working on the cooling system and during filling and draining of the cooling liquid.

Task 1: **Prepare Coolant**

Step 1 : The expansion tank must be pre-charged to 1 bar at approx. 20 °C on the gas side.

Step 2 : Use a suitable container to prepare approx. 55 liters of coolant with a ratio of 60% water and 40% glycol (with Antifrogen N). The actual amount needed depends on the length of the hoses used to connect the heat exchanger.

Step 3 : Open the cooling liquid container (e.g. Antifrogen N) and place it in close proximity to the converter cooling system.

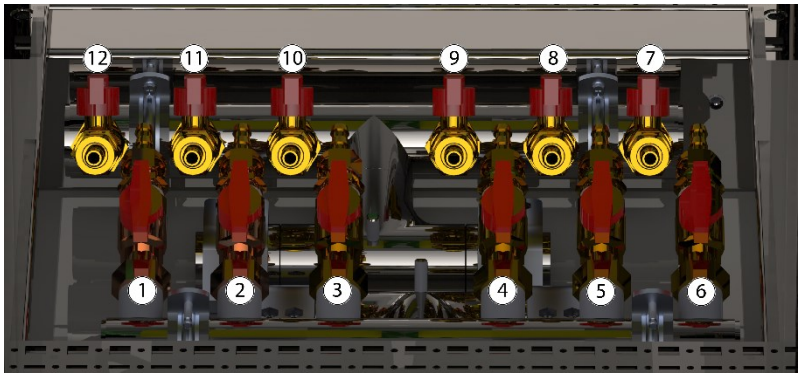


Figure 72: Water distributor, connections and valves in CON Cabinet

Pos.	Cooling System Component
①	Sub circuit with valve 1 - inlet flow
②	Sub circuit with valve 2 - inlet flow
③	Sub circuit with valve 3 - inlet flow
④	Sub circuit with valve 4 - inlet flow
⑤	Sub circuit with valve 5 - inlet flow

⑥	Sub circuit with valve 6 - inlet flow
⑦	Sub circuit with valve 6 - return flow
⑧	Sub circuit with valve 5 - return flow
⑨	Sub circuit with valve 4 - return flow
⑩	Sub circuit with valve 3 - return flow
⑪	Sub circuit with valve 2 - return flow
⑫	Sub circuit with valve 1 - return flow

Table 44: Cooling system – Coolant dispenser connections and valves inside CON cabinet

Task 2: Fill cooling system

NOTICE

Make sure that the pressure and suction hoses are completely immersed in the cooling liquid inside the cooling liquid container throughout the whole filling process, to avoid suction of air into the cooling circuit.

Step 1 : Connect the external filling pump and the cooling liquid canister using a suction hose.

Step 2 : Connect the external filling pump to the inlet flow connection *(see figure 71, ①)* with a pressure hose.

Step 3 : Open the valve on the top of the heat exchanger - if there are several heat exchangers, the valve of each heat exchanger must be opened *(see illustration below)*.

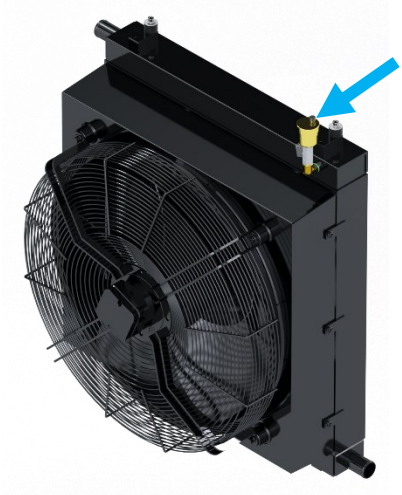


Figure 73: Valve on heat exchanger

Step 4 : Connect the return flow connection (*see figure 71,* ②) and the coolant canister with a pressure hose.

Step 5 : Close ALL valves of the sub-circuits on the water distributor of the CON cabinet (*see figure 72* ① - ⑥, ⑦ - ⑫).

Step 6 : Open the stop cock of the converter cooling system (*see figure 71,* ③).

Step 7 : Open the valves on the inlet flow connection and on the return flow connection.

Step 8 : Switch on the external filling pump and make sure that the intake hose is completely immersed in the cooling liquid inside the cooling liquid canister, so no air is sucked into the cooling circuit.

Step 9 : The main cooling circuit will be filled with coolant and the air will be removed from the circuit during this time. Wait until no more air bubbles are inside the cooling liquid canister.

Step 10 : Open the inlet flow and return flow valves of sub-circuit 1 (*see figure 72,* ① *and* ⑫).

Step 11 : Wait for 3 minutes. The sub cooling circuit will be filled with coolant and the air will be removed from the circuit during this time.

Step 12 : Shut off the inlet and return flow valve of sub circuit 1.

Step 13 : Proceed the same way for the remaining IGBT cooling circuits inside the CON cabinet.

Step 14 : Proceed the same way for the cooling circuits inside the IND cabinet.

Step 15 : Close the stopcock (*see figure 71,*③).

Step 16 : Open the valves of all connected sub-circuits.

Step 17 : Close the valve of the return flow connection (*see figure 71,* ②).

Step 18 : Wait until a pressure of 3 bar is indicated by the cooling systems´ manometer (*see figure 71,* ⑤). As soon as 3 bar have been reached, immediately shut off the inlet flow valve (*see figure 71,* ①).

Step 19 : Shut-off the external filling pump, but make sure the suction and pressure hose are still immersed in the cooling liquid inside the cooling liquid container.

Step 20 : Activate the coolant pump of the cooling system by switching on the motor protection circuit breaker 181Q1 inside the control cabinet and activate the contactor 139K2 inside the control cabinet using a suitable insulated tool.

Step 21 : Let the coolant pump run for 120 min.

Step 22 : Close the valve on the top of the heat exchanger(s) (*see figure 73*).

Step 23 : Deactivate the coolant pump of the cooling system by removing the insulated tool.

Step 24 : Check if the pressure on the cooling system manometer is indicated with 3 bar.

Step 25 : If the pressure indicated by the manometer is below 3 bar, switch the external filling pump back on an open the inlet flow valve.

Step 26 : As soon as a pressure of 3 bar has been reached, immediately shut-off the inlet flow valve and switch off the external filling pump.

Task 3: Perform a visual check of the entire cooling circuit for leaks.

17.9 Check pressure of expansion tank

Once every 5 years / When exchanging the cooling liquid / When error "pressure low" is apparent

NOTICE

The cooling system must be empty in order to perform a pressure check of the expansion tank (*see section 17.9*).

➜ Check the pressure on the expansion tank every time the cooling liquid is exchanged.

⚠ WARNING

Before performing maintenance work, make sure the system is off, cooled and not pressurized, all the electric parts are not energized, and the vessel is completely empty.

Maintenance of the expansion tank is to be performed according to the manual of the manufacturer.
ZILMET: manual_expansion_tank_537L_zilmet

Perform a pressure check of the expansion, checking that the pre-charge is at 1.5 bar.

- At least once every 5 years
- whenever the coolant of the water-cooling system is exchanged
- when converter controller reports the error message “pressure low”

The cooling system must be reduced to 0 bar in order to perform a pressure check of the expansion tank. **The necessary gas pressure is 1.5 bar**. If necessary, refill gas to 1.5 bar with compressed nitrogen. Exceptionally, the expansion tank can be filled up with compressed air. At the next maintenance the gas pre-charge pressure must be corrected with nitrogen.
The filling valve is similar to a filling valve of a car tire. Check the pressure with a tire gauge. Avoid unnecessary gas losses during testing.
See instructions below on how to perform a pressure check of the expansion tank and how to refill gas if necessary.

Task 1: **Check pressure of expansion tank**
In order to check the pressure of the expansion tank, the coolant inside the cooling systems´ circuits must be drained, until the manometer of the water-cooling system indicates a pressure of **0 bar**.

Step 1 : Drain the converter´s water cooling system like explained in section 17.8.1.3 until the manometer of the cooling system indicates a system pressure of 0 bar.

Step 2 : Connect the supplied tank filler with manometer and adapter (*see figure 75*) to the filling valve connection of the expansion vessel (*see figure 74*) and check if the nominal pressure of 1.5 bar is apparent.



Figure 74: Filling valve connection on expansion tank



Figure 75: Tank filler with manometer and adapter

NOTE: If the pressure indicated by the pressure gauge is below 1.5 bar, refill the expansion tank with gas, as described in the following:

Task 2: **Refill gas of expansion tank to 1.5 bar**

Step 1 : Connect the supplied tank filler with manometer and adapter to the filling valve connection of the expansion tank.

> **⚠ WARNING**
>
> Hold the tank filler bottle in upright position during the filling process. Don´t hold the bottle horizontally or tip the bottle during the filling process, since it could lead to injuries due to bursting material.

Step 2 : Refill gas until the connected pressure gauge is indicating a pressure of 1.5 bar.

Task 3: **Refill converter cooling system with coolant**

Step 1 : Refill the converter water-cooling system with cooling liquid like described in section 17.8.2 until the manometer of the water-cooling system indicates a pressure of 3 bar.

Step 2 : Let the coolant pump run for at least 1 hour.

Step 3 : Turn off- the internal coolant pump and check if the pressure indicated by the cooling system manometer is 3 bar.

Note: If the pressure is below 3 bar, refill cooling liquid until a pressure of 3 bar is indicated by the manometer of the water-cooling system.

17.10 Pump

⚠ WARNING

Make sure that escaping cooling water does not cause injury to persons or damage to the equipment.

- The internal pump parts are maintenance-free.
- It is important to keep the motor clean in order to ensure adequate cooling of the motor.
- If the pump is installed in dusty environments, it must be cleaned and checked regularly.
- Take the enclosure class of the motor into account when cleaning.
- The motor has maintenance-free, greased-for-life bearings.
- Pump bearings and shaft seal are maintenance free.

Maintenance of the pump is to be performed according to the manual of the manufacturer

Manufacturer:	Grundfos
Type:	CM10-2 A-R-A-E-AQQE
Manufacturer article no.:	99080211

Frost Protection

NOTICE

Before start-up after a period of inactivity, the pump and the suction pipe should be completely filled with liquid.

Pumps which are not being used during periods of frost should be drained to avoid damage.
Remove the filling and drain plugs from the pump (*see illustration below).*

Do not refit the plugs until the pump is taken into operation again.

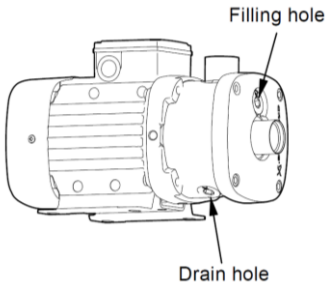


Figure 76: Position of filling hole and drain hole

17.11 Exhaust Units

Once every 6 months / fit in with existing service and maintenance plan

Periodically the extract unit must be electrically tested to ensure that the supply to the unit is continuous and that mechanically the FSD and motor open and close effectively.

It is recommended that this test be carried out twice yearly or to fit in with existing service and maintenance contracts.

The air flow failure switch should be checked for free movement and electrical conductance.

Refer to Puma technical sales leaflet for further information regarding dimensions, weights and unit performance and fan curves.

17.12 Fire Dampers

Once every 6 months / fit in with existing service and maintenance plan

The damper and motor require no service as such, but a periodic mechanical and electrical test of the working mechanisms should be carried out at least twice yearly, or to coincide with existing service and maintenance contracts.

See appropriate certified drawing of units for further information re: sizes etc.

17.13 H2 Sensors

Once every 6 months

The inspection must be carried out by trained service personnel.

The inspection intervals must be established in each individual case and shortened if necessary, depending on technical safety considerations, engineering conditions and the technical requirements of the equipment.

Contact Dräger service if you wish to take out a service contract and have any repairs carried out.

18 Container Repair

In case the container surface is damaged, repair the damaged surface as described in the following, to maintain the surface protection of the container.

18.1 Process Instructions (New Application)

Surface preparation according to DIN EN ISO 12944-4 sandblasting to surface preparation standard SA 2.5 (40 µm minimum roughness depth, medium roughness grade (G), angular blasting grit).

Primer:
REESA 2K-HS-Filling-Primer ZP
Material Nr.: 3D061
Color: ca. RAL 7035
Dry film thickness (DFT): 80 - 100 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

- Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

Topcoat:
REESA 2K-HS-PUR-OneCoat-Paint
Material Nr.: 6D062
Color: n. a.
Dry film thickness: 60 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

- Furthermore, a forced drying period of 60 minutes at a temperature of +60 °C is possible. Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C. The complete reaction period of the topcoat is 7 days.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

18.2 Process instructions (Repair - damage down to the steel)

Surface preparation according to DIN EN ISO 12944-4 surface preparation standard PSt2:

- Removal of loose and labile coating particles.
- Removal of rust using a wire brush or sandpaper (grain size 180).
- Surface grinding of the damaged and uneven areas, as well as edge areas, using sandpaper (grain size 180) until even.
- Removal of all foreign and separating substances.

Primer:
REESA 2K-HS-Filling-Primer ZP
Material nr.: 30061
Color: ca. RAL 7035
Dry film thickness: 80 - 100 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

Application process: brush application
Up to 3 coats may be required to achieve the DFT.
Intermediate drying time of the individual coats: 30 min.
Drying time between primer and topcoat: 2 hours.

- Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

Topcoat:
REESA 2K-HS-PUR-One-Coat-Paint
Material Nr.: 60062
Color: n. a.
Dry film thickness: 60 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

Application process: brush application
Up to two coats may be required to achieve the DFT.
Intermediate drying time of the individual coats: 30 min.

- Furthermore, a forced drying period of 60 minutes at a temperature of +60 °C is possible. Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C. The complete reaction period of the topcoat is 7 days.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

18.3 Process instructions (Repair - damage only within the topcoat)

Surface preparation according to DIN EN ISO 12944-4 surface preparation standard PSt2:

- Removal of loose and labile coating particles.
- Surface grinding of the damaged and uneven areas, as well as edge areas, using sandpaper (grain size 180) until even.
- Removal of all foreign and separating substances.

Topcoat:
REESA 2K-HS-PUR-One-Coat-Paint
Material Nr.: 60062
Color: n. a.
Dry film thickness: 60 - 80 µm

Application process: spray application
Compressed air spraying, airless-spraying or electrostatic spraying according to technical data sheet.

- Furthermore, a forced drying period of 60 minutes at a temperature of 60 °C is possible. Processing is possible above ä minimum temperature of +8 °C. The critical dew point temperature must be exceeded by 3 °C. The complete reaction period of the topcoat is 7 days.
- The mixing process of the 2K material must be carried out according to the enclosed technical data sheet.
- After a period of seven hours the mixed material must no longer be used and has to be disposed of, according to the legal regulations.

19 Settable Devices

The following table provides the manufacturer settings of the components listed in the table.

Location	Identifier	Settable Device	Setting
CIR	80Q1	AC circuit breaker 3WL I_N=1250 A / 690 V	$I_R = I_N \times 1.0$ $I_i = I_N \times 2.0$
CTRL_1	101Q1	Circuit-breaker for motor protection, 2.2 ... 3.2 A	3 A
CTRL_1	181Q1	Circuit-breaker for motor protection, 3.5 ... 5 A	5 A
CTRL_1	181Q2	Circuit-breaker for motor protection, 4.5 ... 6.3 A	4.5 A
CTRL_1	182Q1	Circuit-breaker for motor protection, 3.5 ... 5 A	5 A
CTRL_1	185B1	Thermostat -10°C … +50°C	15°C
CTRL_1	186B1	Thermostat -10°C … +50°C	5°C
CTRL_1	102G1	USV QUINT 24 V DC / 20 A	6.6 min
CTRL_1	101T1	TRIO-PS/3AC/24DC/40	26 V DC
BESS_1	101T1	TRIO-PS/3AC/24DC/40	26 V DC
BESS_1	101Q1	Circuit-breaker for motor protection, 2.2 ... 3.2 A	3 A
BESS_1	102G1	USV QUINT 24 V DC / 20 A	6.6 min
BESS_2	101T1	TRIO-PS/3AC/24DC/40	26 V DC
BESS_2	101Q1	Circuit-breaker for motor protection, 2.2 ... 3.2 A	3 A
BESS_2	102G1	USV QUINT 24 V DC / 20 A	6.6 min

Table 45: Settable devices

20 IP Addresses

The following table provides the IP-addresses set at delivery state of the listed components.

Component	IP Address
Main controller P320	192.168.5.10

Table 46: IP addresses of components

21 PLC

The following sections provide you with a description of the connection elements and the indicator lights of the PLC and gives you information regarding the handling of the unit.

For further information regarding the PLC, see device manual SIMOTION_P320-4 of the manufacturer.

21.1 Indicator Lights

The following table describes the indicator lights at the front panel of the P320 PLC.

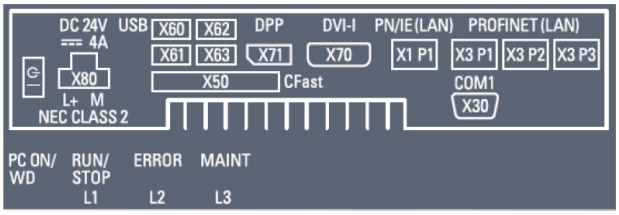


Figure 77: P320 PLC indicator lights

LED	Significance	State	Description
PC ON/ WD	Power supply	Green	BIOS ready to boot. Indicates the correct supply voltage of 3.3 V, 5 V and 12 V from the integrated power unit.
		OFF	Not relevant.
		Green/yellow flashing (1 Hz)	BIOS in POST, power switch on.
		Yellow	Idle state
RUN/STOP or L1	RUN STOP	Off	SIMOTION P Runtime is not running.
		Green	SIMOTION P320-4 in RUN.
		Yellow	SIMOTION P320-4 in STOP.
		Green/yellow: Flashes quickly (2 Hz)	DCP flashing
		Yellow: Flashes quickly (5 Hz)	FAULT state (only in combination with L2 and L3)
ERROR or L2 (SF PROFINET LED)	-	Off	SIMOTION P320-4 is working error-free.
	Error	Red: Continuous light	Bus error at the PROFINET interface.
		Red: Flashes quickly (2 Hz)	Erroneous configuration.

		Red: Flashes quickly (5 Hz)	FAULT state (only in combination with L1 and L3)
	INIT	Red: Flashes slowly (0.5 Hz)	During the INIT process, the SF PROFINET LED is con- trolled by the boot loader. The precise flashing behavior therefore cannot be determined and displayed. In the INIT state, 0.5 Hz flashing is displayed in the SI- MOTION P State. If no project has yet been loaded, 0.5 Hz flashing is also displayed for the INIT, which, in this case, is also retained in the Running state.
MAINT or L3 (SF LED)	-	Off	SIMOTION P320-4 is working error-free.
	Error	Red	An event has occurred which needs to be acknowledged (alarm, message, notification). (See Diagnostics Guide)
		Red: Flashes slowly (0.5 Hz)	License missing for licensed technology objects. Carry out the licensing to correct the error. Further information on the licensing can be found in the SIMOTION P320-4 E / SIMOTION P320-4 S Commissioning and Hardware Installation Manual.
		Red: Flashes quickly (5 Hz)	FAULT state (only in combination with L1 and L2) A fault has occurred to which the user program cannot respond. The following actions may be required to rectify the fault: ● Power OFF/ON ● Recommissioning

Table 47: P320 Indicator lights

21.2 Connection Elements

The following table describes the connection elements at the back side of the P320 PLC.

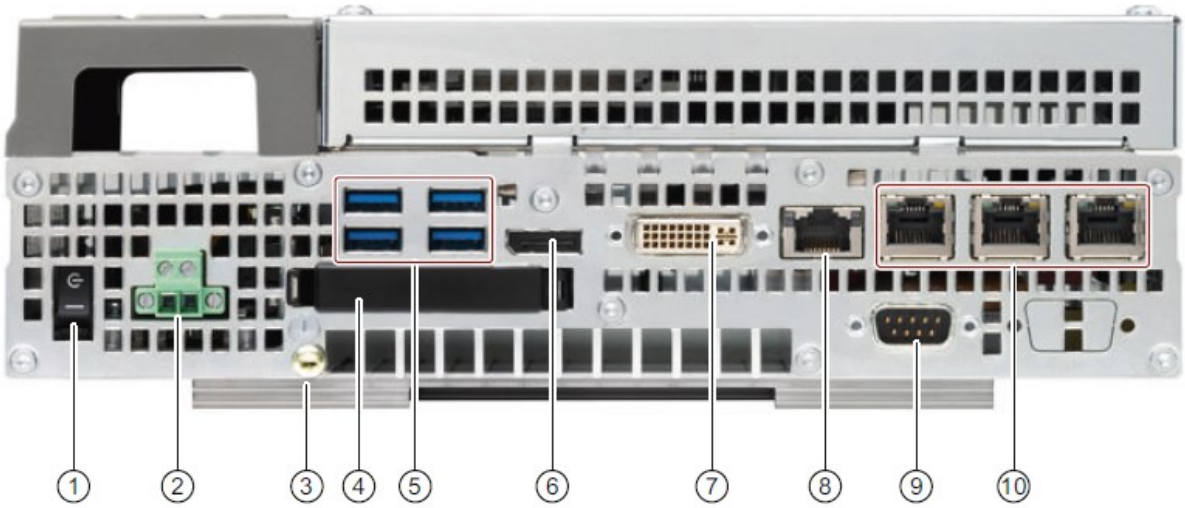


Figure 78: PLC connection elements

Pos.	Description	Description
①	On/off switch	Position OFF is the delivery state. The on/off switch does not isolate the device from the power supply.
②	24 VDC	24 VDC power supply connection
③	Protective conductor	Protective conductor terminal
④	Memory card slot	Cover for the CFast card
⑤	4 × USB 3.0	USB 3.0 high current, backward compatible with USB 2.0/1.1
⑥	Display port	Display port connection for digital monitor
⑦	DVI-I	DVI connector for CRT or LCD monitor with DVI interface
⑧	Ethernet	RJ45 Ethernet connection for 10/100/1000 Mbps
⑨	COM1	Serial interface
⑩	3 × PROFINET	PROFINET ports with three RJ45 sockets

Table 48: Table 38: PLC connection elements

21.3 PLC Connection

Follow the following steps to connect to the main PLC via PC or laptop.

Task 1: **Establish a connection to the PLC via PC or Laptop.**

Step 1 : Connect a PC or laptop via Ethernet cable to port X5 of Ethernet Switch 111A1 inside the CTRL cabinet (*see illustration below*).

Note 1: The connected PC or laptop and the converter PLC must be set to the same IP range.

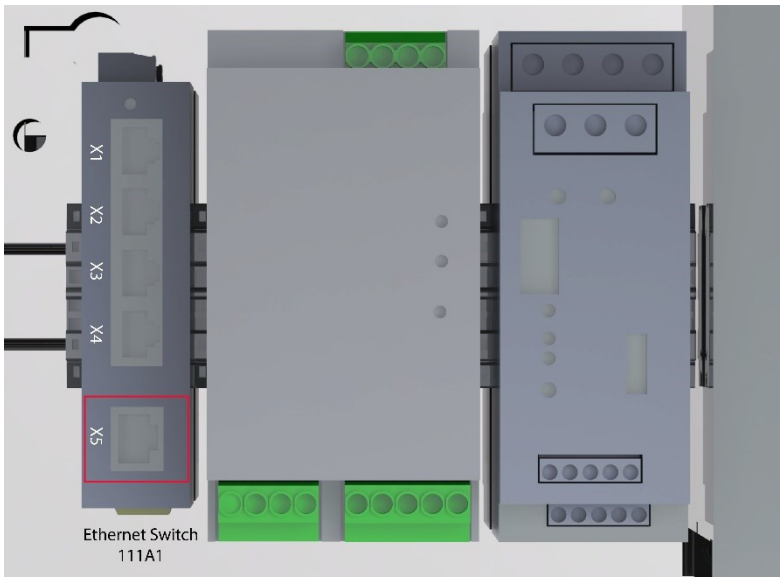


Figure 79: Ethernet Switch 111A1 - Port X5

21.4 Compiled Project Update

In case the PLC control software is not up to date at the time of commissioning, the control software must be updated.

Follow the following steps to perform a compiled project update of the main PLC.

Task 1: **Access the PLC user interface**
Step 1 : Connect to the PLC like described in section 21.3 “PLC“.
Step 2 : Open a web browser of your choice on the connected PLC or laptop
Step 3 : Type in the IP address of the PLC in the address field of your PC´s or laptop´s browser, followed by **/index.mwsl**.

Beispiel 1: 192.168.5.10/index.mwsl

The main controllers´ IP address set at delivery state is provided in Table 46.

Step 4 : The Simotion page “Home” will be displayed in the web browser of the connected PC or laptop.
✓ **The PLC user interface has been successfully accessed.**

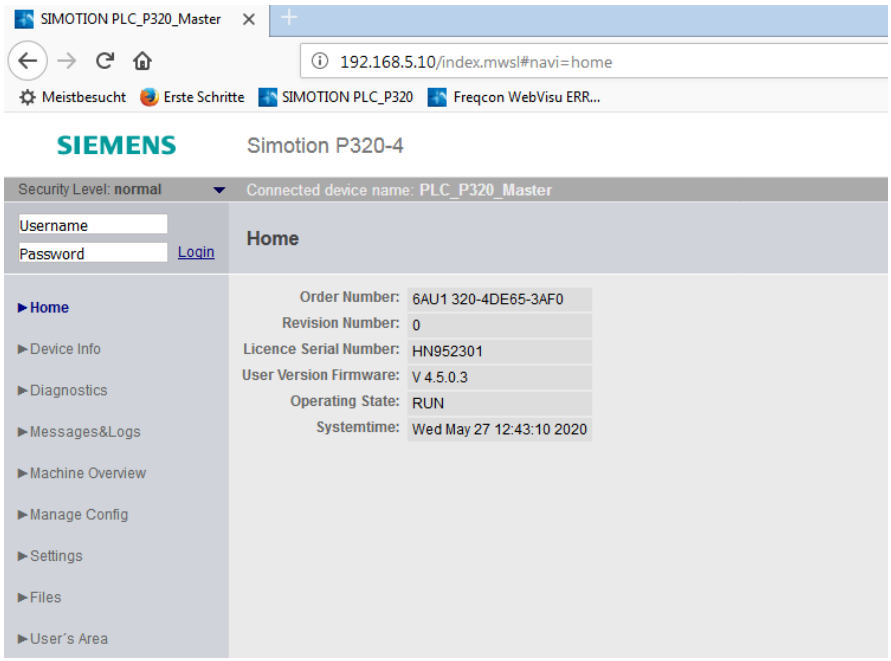


Figure 80: Connecting to the PLC user interface

Task 2: **Stop SIMOTION P320 operation.**

Step 1 : Connect to the PLC like described in section 21.3 “PLC“.

Step 2 : Select the "Settings" tab on the left-hand side of the visualization page (*see figure below,* ①).

Step 3 : In the new window, enter the following user data in the fields provided (case-sensitive):

Username: simotion

Password: simotion

Step 4 : Stop the PLC from running by clicking on the "STOP" button (②).

✓ **The PLC has been successfully stopped from operation.**

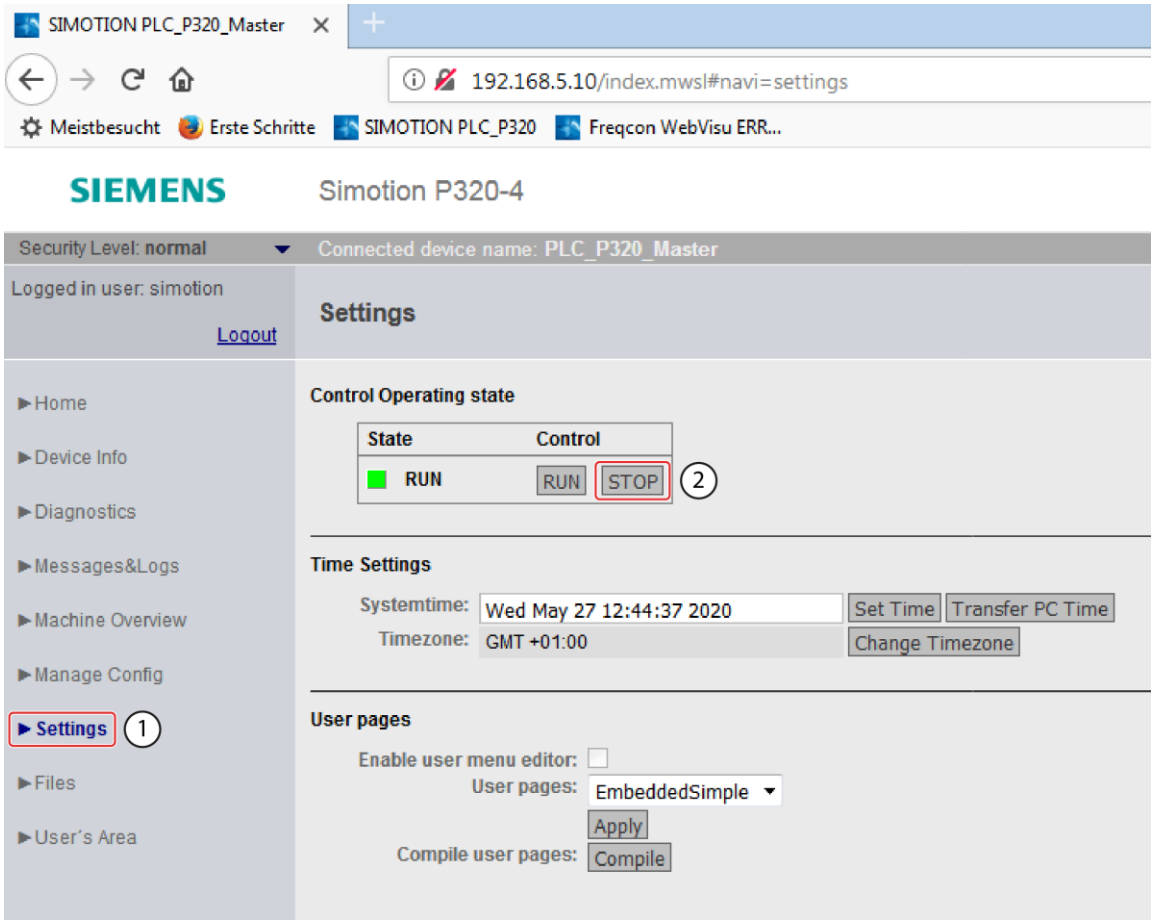


Figure 81: „Settings“ page

Task 3: **Load the compiled project ZIP archive to the SIMOTION P320 PLC**

Step 1 : Select “Manage Config” on the left site of the page (see *figure* below , ③).

Step 2 : Load the compiled project to the system by selecting the folder symbol (④).

Step 3 : Transfer the compiled project to the PLC by selecting the "Send update data" button (⑤).

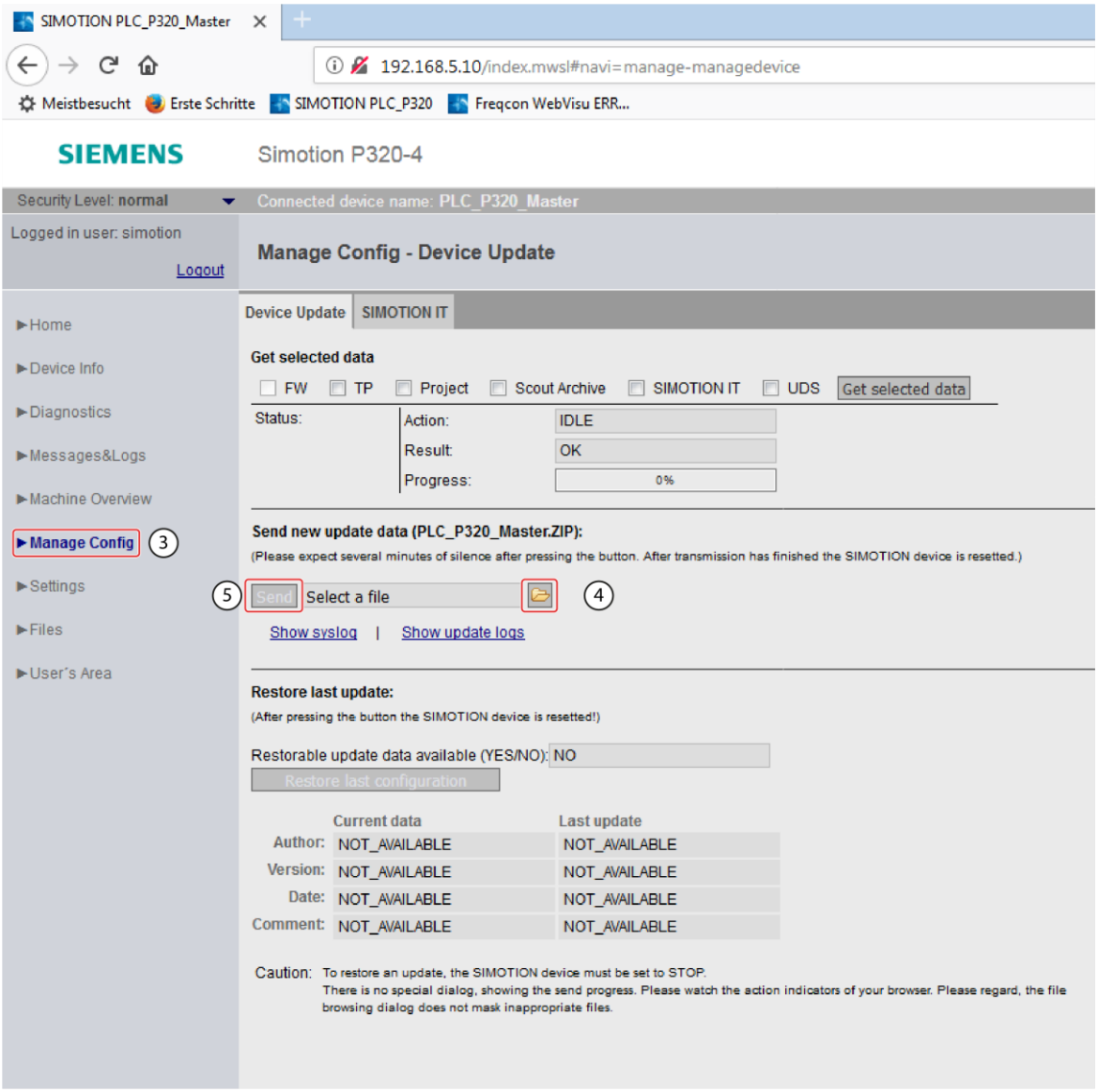


Figure 82: "Manage Config" page

Step 4 : Wait until the confirmation screen appears. The PLC reboots.

Step 5 : Wait for 5-7 minutes until the PLC has completed the reboot process.

Step 6 : Select the "Settings" tab.

Step 7 : Start the PLC by selecting the "RUN" button.

✓ **The PLC software has been successfully updated.**

22 WebVisu

FREQCON Web Visualization (WebVisu) provides granular control, real-time monitoring and visualization of key BESS functions. The WebVisu can be accessed either via the HMI touch panel on the control cabinet of the BESS or via a remote connection using a PC or laptop *(see section 22.1 "WebVisu remote connection")*.

The following sections provide you with information on handling and functionality and offer information on the individual WebVisu pages:

- Overview
- Overview DC-DC
- AC-DC Converter
- DC Link
- DC-DC Converter
- Converter Control
- Cooling
- Battery Overview
- Grid Protection Settings
- Init List
- Error List
- Action List

The individual pages can be selected by using the corresponding navigation buttons on the left side of every WebVisu page.

Note:

- Fields highlighted in grey can be adjusted by entering values inside the fields. Adjusted values are accepted by pressing the "Enter" key.
- Values must be entered in the fields without a unit.
- Fields with a white background indicate actual values.
- The selection of individual WebVisu pages depends on the user rights of the currently logged in user profile.

22.1 WebVisu remote connection

To connect to the WebVisu of the BESS via remote connection, carry out the following steps:

Task 1: **Establish a remote connection to the WebVisu of BESS**

Step 1 : Establish a connection to the PLC (main controller) in the control cabinet of the BESS by connecting a PC or laptop to the RJ45 socket of the network isolator (113T1) using an Ethernet cable.

Note 1: The connected PC or laptop and the PLC must be in the same IP range.

Step 2 : Open a web browser of your choice on the connected PLC or laptop.

Step 3 : Enter the IP address of the PLC in the address field of your PC´s or laptop´s browser.

Example: http://192.168.5.30

Note 2: The IP address of the main controller set at delivery is specified in Table 46.

Step 4 : The WebVisu page "Overview" is displayed in the web browser of the connected PC or laptop.

✓ **The remote connection to the WebVisu of BESS has been successfully established.**

22.2 Navigation

22.2.1 Home Button

The WebVisu "Overview" page can be displayed by selecting the "Home" button that appears on the left side of each WebVisu page *(see figure below)*.

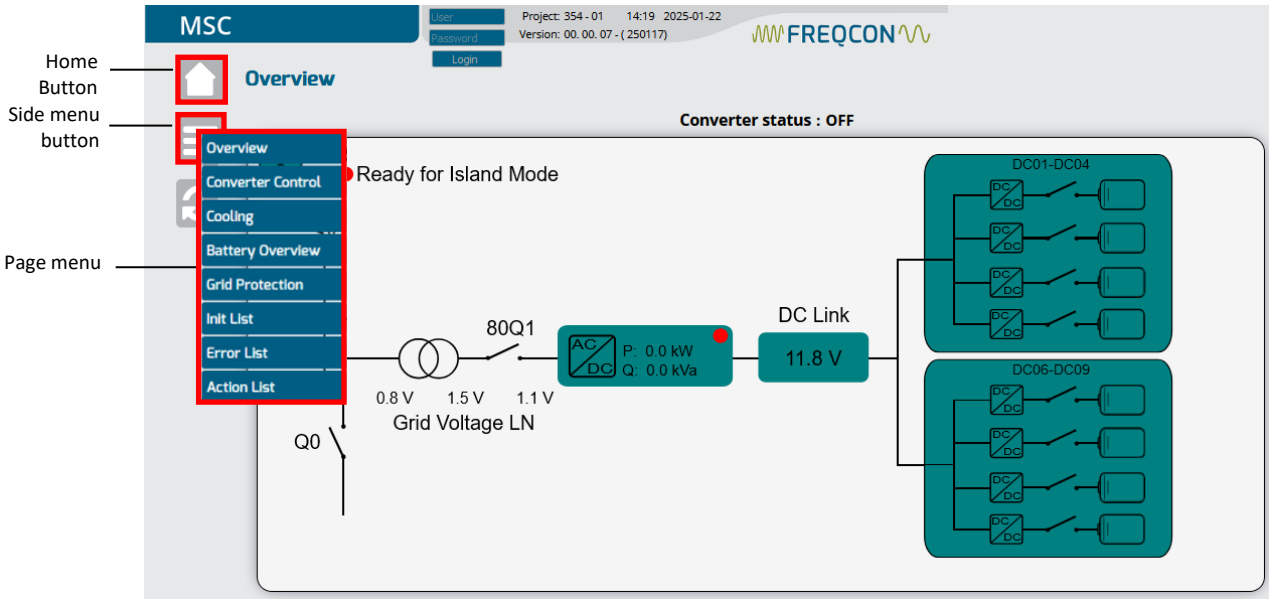


Figure 83: Navigation

22.2.2 Page Menu Button

The Page Menu is displayed via the Page Menu button that appears on every WebVisu page (*see figure 83*).

After selecting the Page Menu button, the Page Menu appears, where all WebVisu pages that can be selected with the respective user profile.

22.3 WebVisu User Interface

At the top of each WebVisu page, a user interface appears for each user (*see figure below*):

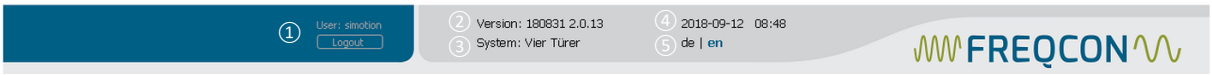


Figure 84: WebVisu user interface

The user interface provides the following information:

	Notification/Function	Description
①	User login	Type in the user profile name and password here. Press "Enter" to log in with a user profile. If a user profile is logged in, the current user profile is displayed here.
②	Version	Software version currently installed in the main control of the BESS
③	System	BESS-Identification number
④	Time/Date	Current time and date
⑤	Language selection	Choice between German and English display language

22.4 WebVisu Pages

22.4.1 Overview

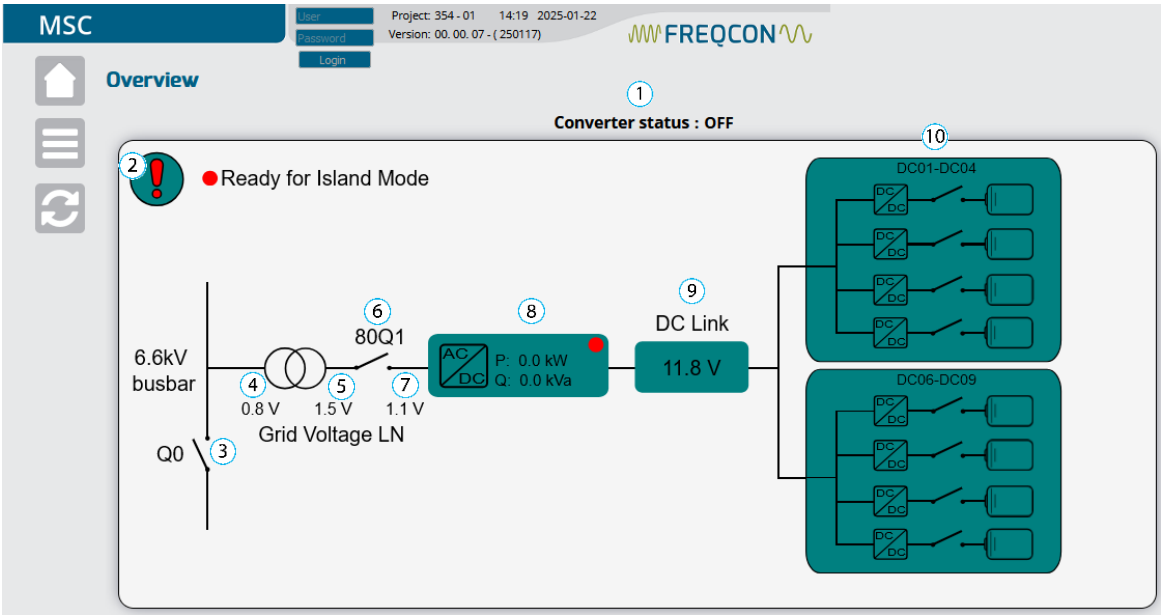


Figure 85: WebVisu page "Overview"

The "Overview" WebVisu page (*see figure above*) provides the user with a graphical overview of the main components of the BESS system and displays the following actual values:

	Description	Value
1	Converter status; for more detailed description see page “Converter control”	--
2	Green: no errors, red: errors; Clicking on the symbol takes you to the page "Error list"	--
3	MV Switch status	Open / closed
4	Voltage at the high-voltage side of the MV transformer	V
5	Voltage at the low-voltage side of the MV transformer	V
6	AC Circuit breaker 80Q1 (Switching state)	Open / closed
7	Voltage at the AC output of the converter	V
8	AC/DC Converter: active power and reactive power; Red: off, green: operation; Clicking on the symbol takes you to the page "AC-DC converter"	kW / kVA
9	DC Link voltage; Clicking on the symbol takes you to the page “DC Link”	V
10	DC/DC Converter; Clicking on the symbol takes you to the page "Overview DC-DC" of the DC Subsystems DC01-DC04 respectively DC06-DC09	--

22.4.2 Overview DC-DC

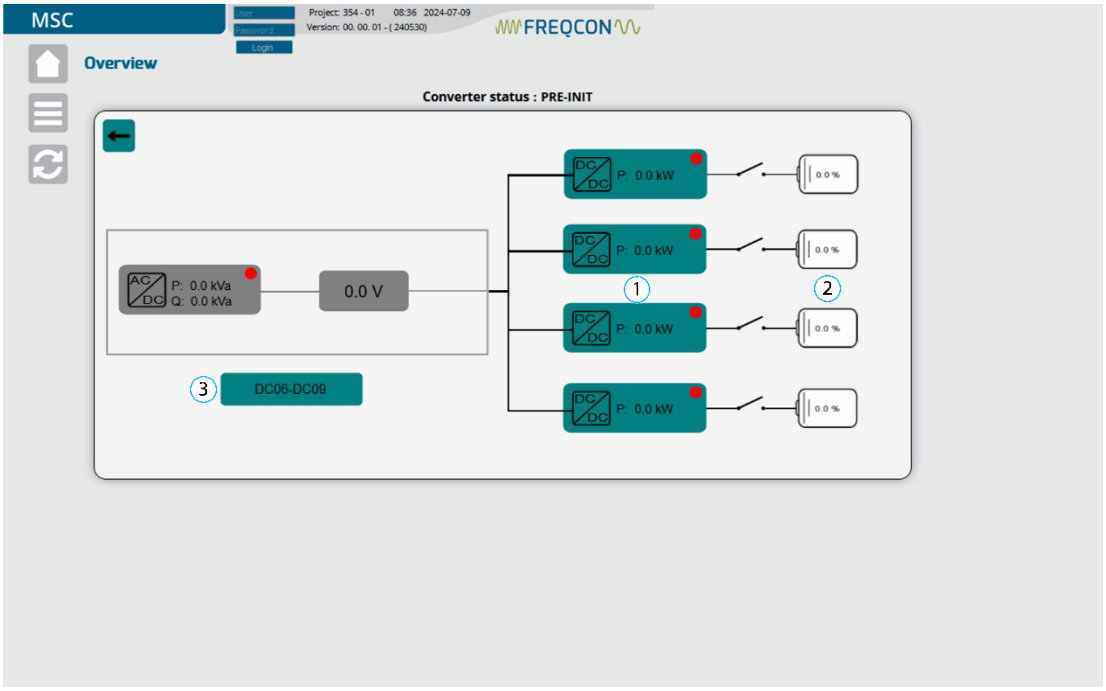


Figure 86: WebVisu page "Overview DC-DC"

The "Overview DC-DC" WebVisu page (*see figure above*) provides the user with a graphical overview of the main components of the BESS system and displays the following actual values:

	Description	Value
1	DC/DC Converter: active power (positive value: battery is charging, negative value: battery is discharging) Red: off; green: operation; Clicking on the symbol takes you to the page "DC-DC Converter" of the respective battery string	kW
2	State of charge	%
3	Switch to the page “Overview DC-DC” of the other DC Subsystem	--

22.4.3 AC-DC Converter

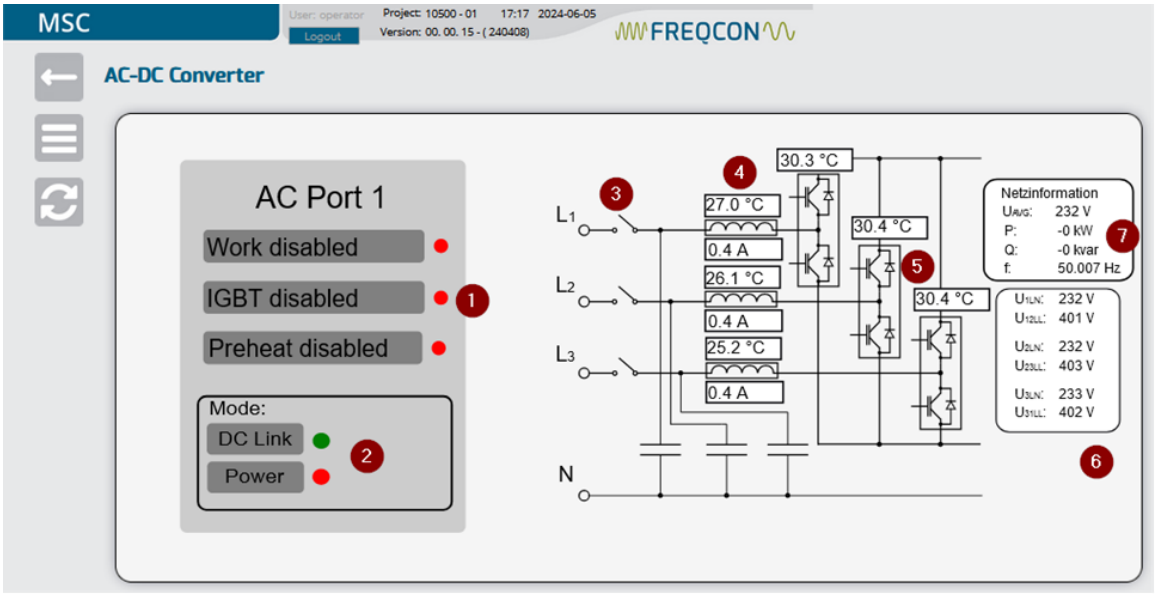


Figure 87: WebVisu page “AC-DC Converter"

	Description	Value
1	Working mode, not changeable	--
2	Control mode, not changeable	--
3	AC Circuit breaker	Open / closed
4	Inductor temperatures and phase currents through the IGBT and inductors	°C / A
5	IGBT temperatures	°C
6	String voltages and phase voltages at grid connection point	V
7	Grid information: Average voltage, active power, reactive power, grid frequency	V / kW / kvar / Hz

22.4.4 DC Link

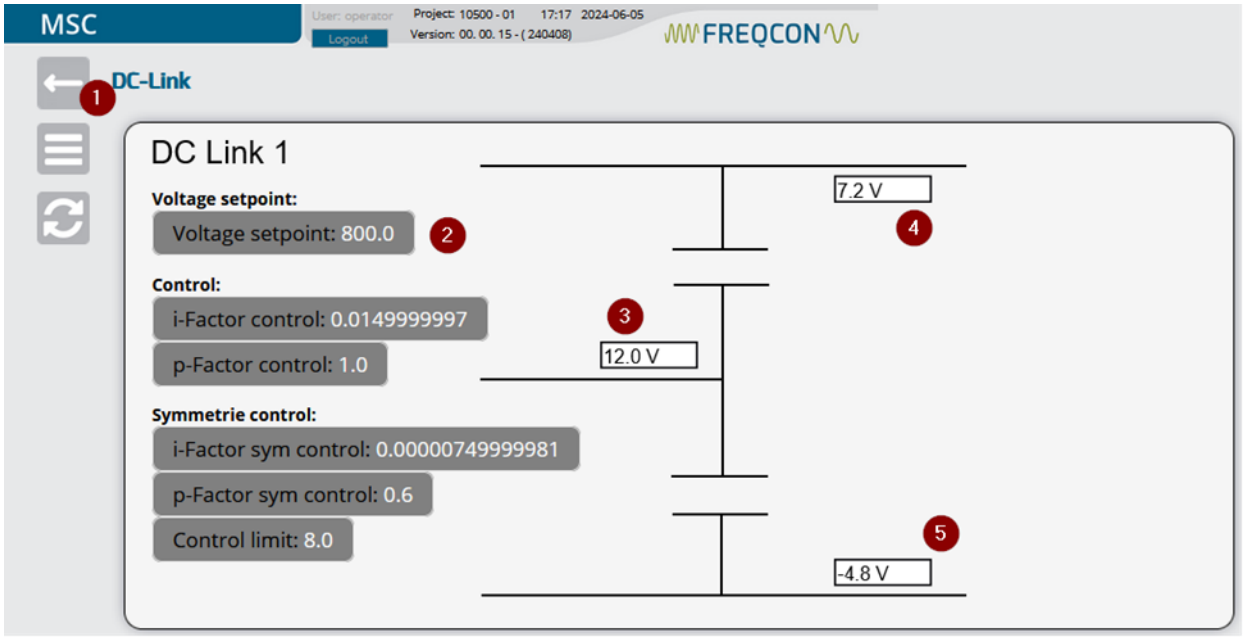


Figure 88: WebVisu page “DC Link"

	Description	Value
1	Back to “Overview”	--
2	DC link voltage setpoint, fixed value	V
3	Total DC link voltage	V
4	Positive DC link voltage	V
5	Negative DC link voltage	V

22.4.5 DC-DC Converter

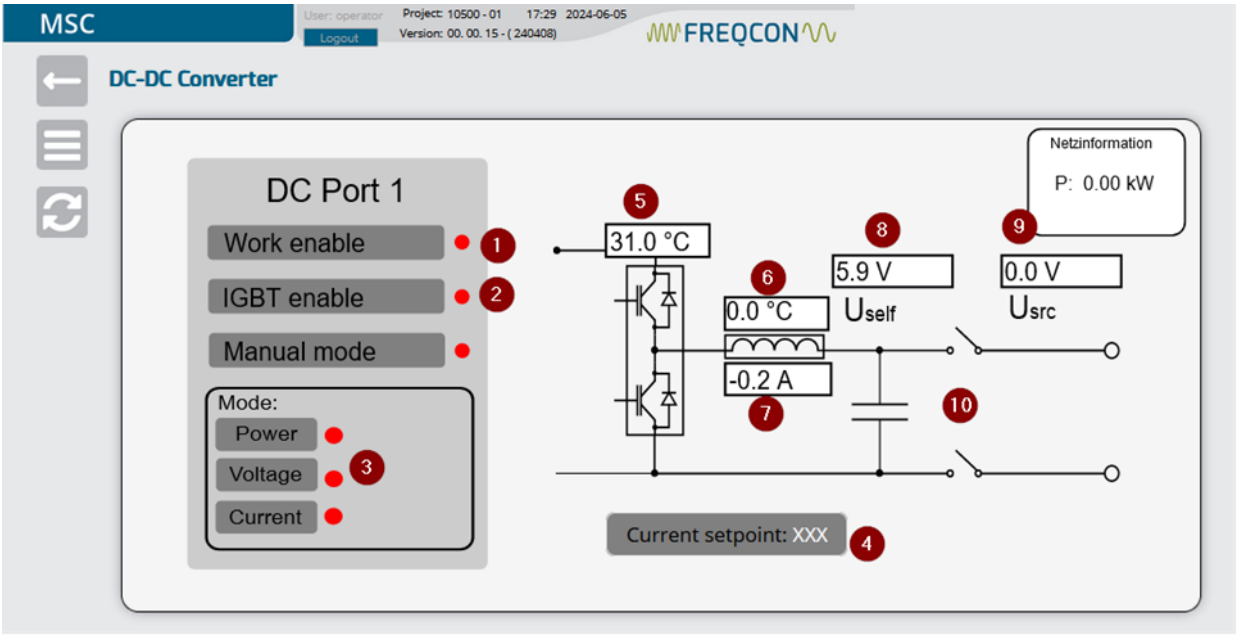


Figure 89: WebVisu page “DC-DC Converter"

	Description	Value
1	Status, not manually changeable	--
2	IGBT enabled	--
3	Control mode, not manually changeable	--
4	Manual setpoint, not available here	--
5	IGBT temperature	°C
6	Inductor temperature	°C
7	Current, filtered	A
8	Voltage at the filter capacitor	V
9	Voltage at the source	V
10	DC contactor (positive and negative)	Open / closed

22.4.6 Converter Control

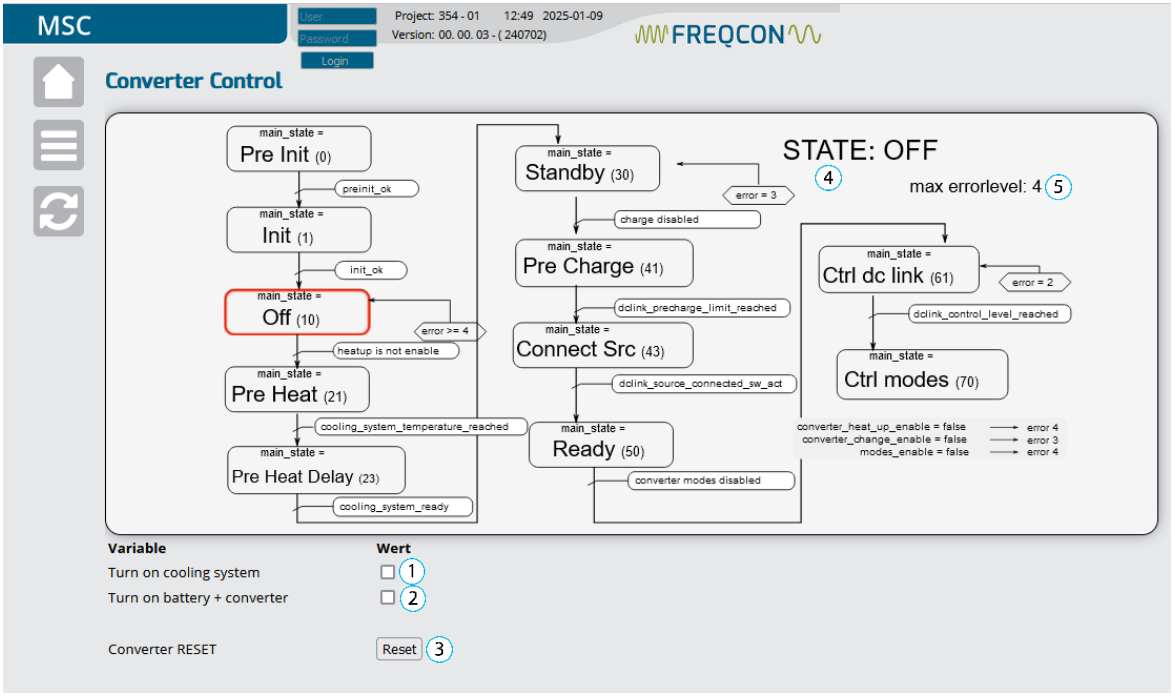


Figure 90: WebVisu page "Converter Control"

	Description	Value
1	Switch on cooling system, converter starts up to standby	--
2	Switch on converter and connect battery system	--
3	Reset converter error	--
4	The converter follows a step chain when it is switched on: Preinit: After switching on the PLC Init: Loading the initialization parameters from the memory card OFF: Converter is off Preheat: Coolant is heated to minimum temperature Preheat Delay: Temperature is held for a few minutes to reduce humidity caused by condensation on the components Standby: Cooling system is ready for use PreCharge: Charging of the DC link via resistors Connect Source: Switching on the mains switch S1 Ready: DC link is pre-charged and converter is connected to the mains, but IGBT is still off Ctrl DC Link: Switch on IGBT and regulate DC link voltage to nominal value Ctrl Modes: Normal operation	--
5	Error level 0 ... 1: Messages, warnings Error level 2: Shutdown of subsystems, e.g. a DC port Error level 3: Shutdown to standby, e.g. in the event of current or voltage overshoots, overtemperatures, etc.	--

22.4.7 Cooling

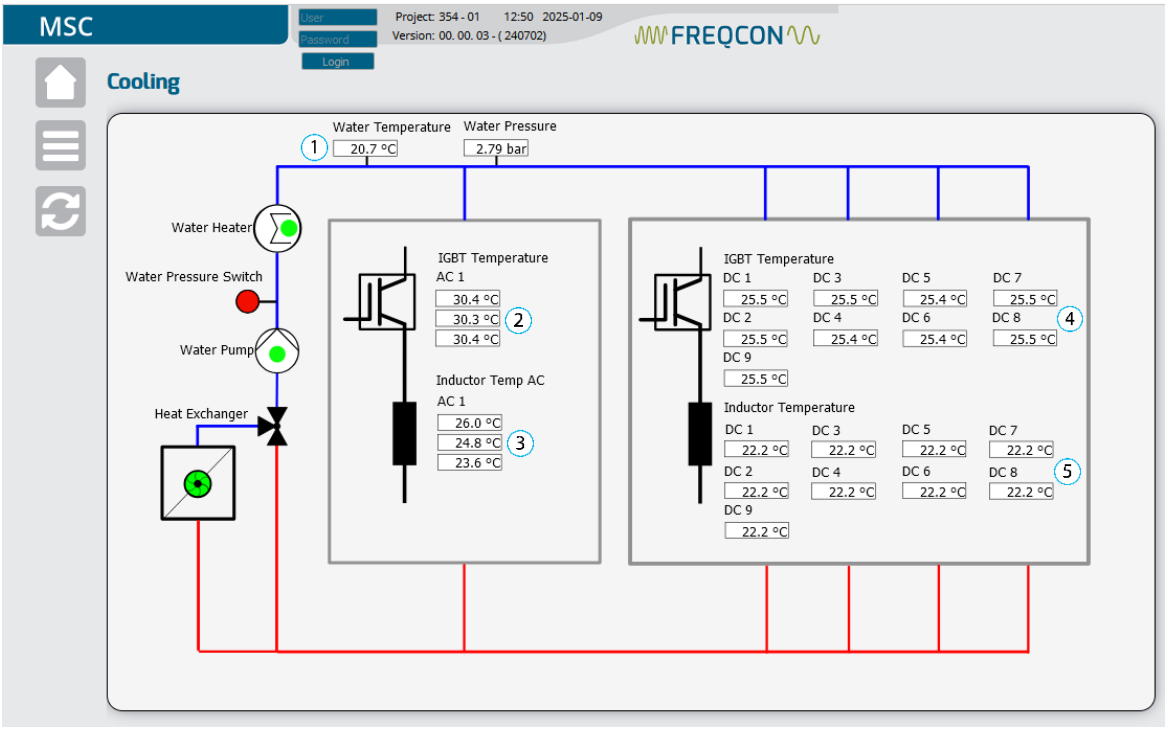


Figure 91: WebVisu page "Cooling"

The "Cooling" WebVisu pages provide the user with a graphical overview of the main components of the BESS cooling system:

- Cooling water heating element (water heater)
- Pressure switch
- Cooling water pump (water pump)
- Heat exchanger

The following actual values are displayed on the "Cooling" WebVisu page:

	Description	Value
1	Cooling water temperature inside the cooling system	°C
2	Temperatures of the AC IGBTs 1/2/3	°C
3	Temperatures of AC inductors 1/2/3	°C
4	IGBT temperatures of DC ports 1 - 8	°C
5	Inductor temperatures of DC ports 1 - 8	°C

22.4.8 Battery Overview

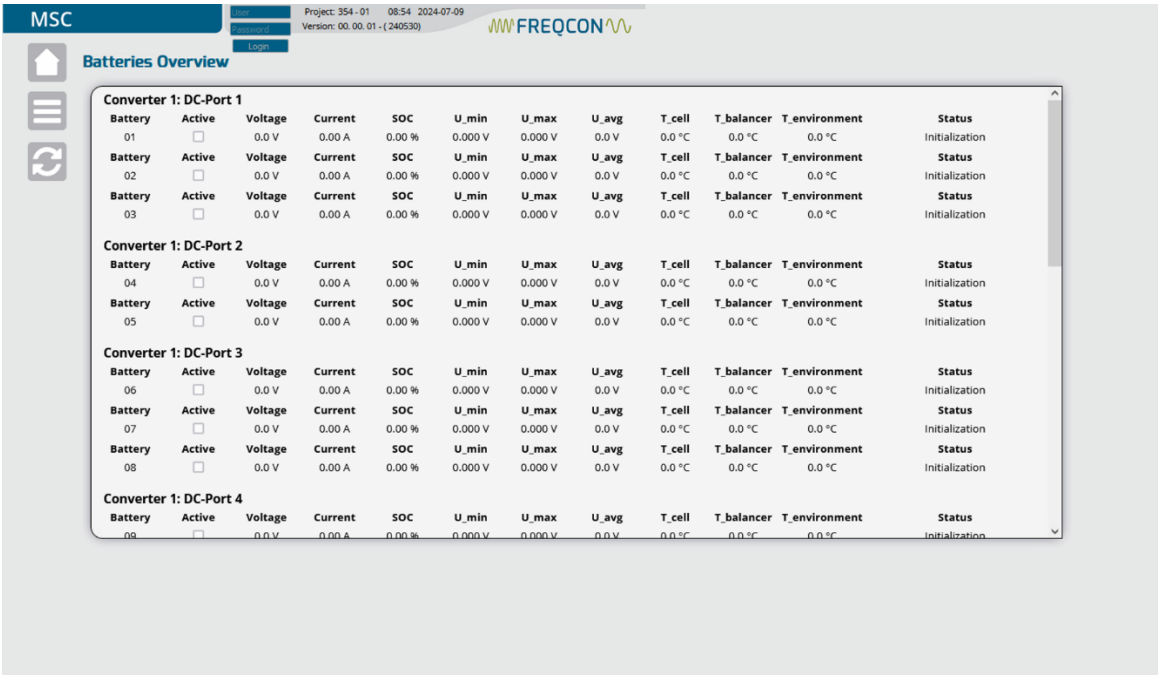


Figure 92: WebVisu page “Battery Overview"

The data is transmitted by the BMS as soon as the respective battery string is connected. If the string is disconnected from the converter system, the value "0" is displayed for current, voltage and SOC.

22.4.9 Grid Protection Settings

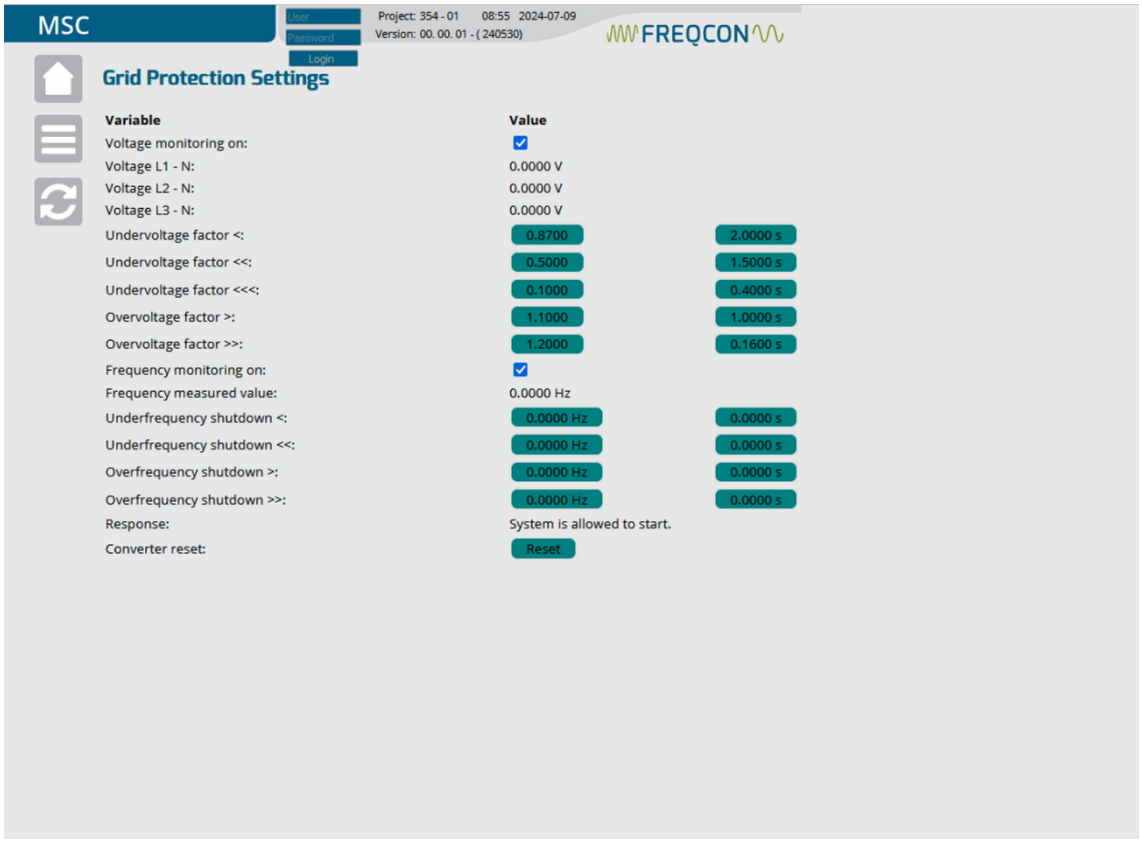


Figure 93: WebVisu page "Grid Protection Settings"

Changing the settings requires a logged in user "operator".

22.4.10 Init List

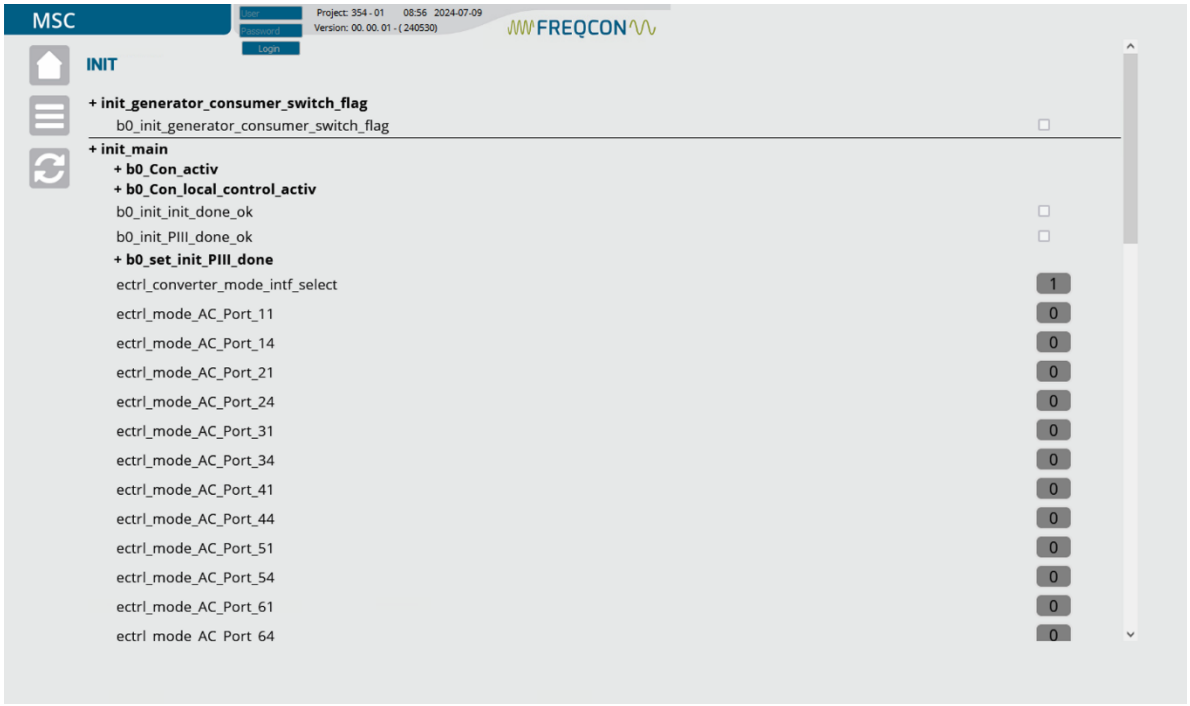


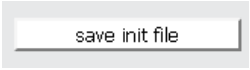
Figure 94: WebVisu page "Init List"

The WebVisu page "Init List" provides the user with an overview of all initialization values (Init values) stored in the BESS main controller.

The "Operator" user profile, as well as users who are not logged in with a profile, can only **check** the set Init values.
Only the **"Service"** and **"Factory"** user profiles can **adjust init values by** changing the value of the corresponding variable in the value field.

- ➜ To expand the parameter overview, click on the "+" sign in front of the corresponding init value.
- ➜ Fixed Init values are displayed on the right side of the corresponding Init parameter.
- ➜ To change the value, change the value inside the box and press „Enter“ on the keyboard of your PC or Laptop.
- ➜ The new value is set, but will be reset after a reboot of the controller.

Note:
To **permanently** adjust the init value, press "Enter" on your PC or laptop keyboard and then select the "Save init file" button at the bottom of the "Init" page. The selected value now remains saved even if the controller is restarted



22.4.11 Error List

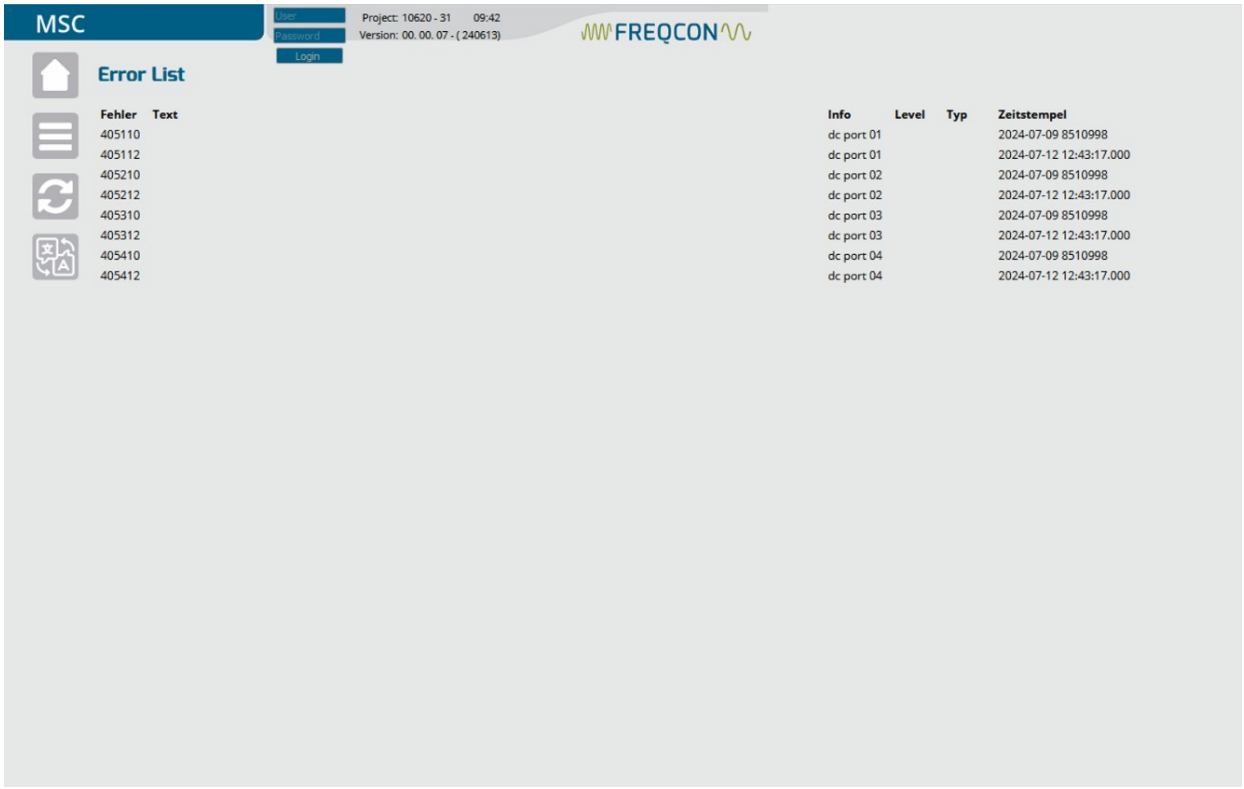


Figure 95: WebVisu page "Error list"

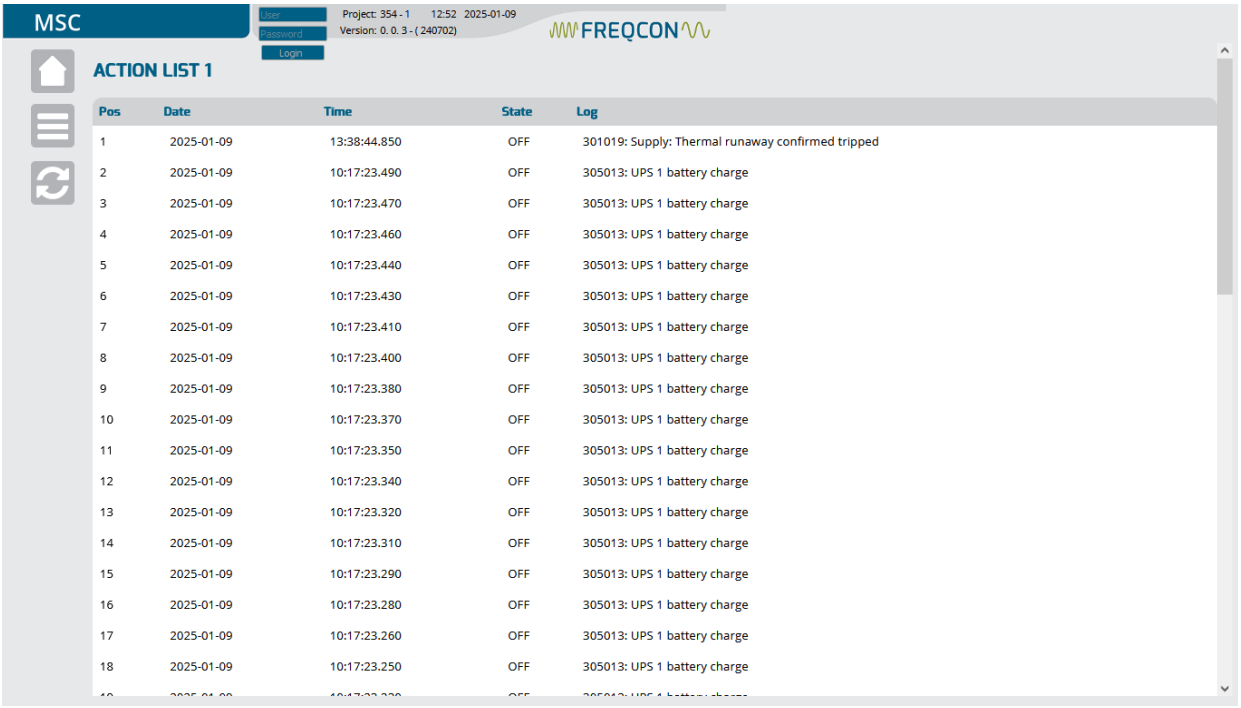
The WebVisu "Error List" page provides the user with a list of current system messages, warnings and errors.

The Error List shows only **current** system messages, warnings and errors. After a reset of a warning or error, these warning and error messages will not be any more displayed in the error list, if the warning or error is not anymore apparent.

The following information are provided inside the error list.

Name	Description
Error	Code of the individual message, warning or error.
Text	Description text for the individual message, warning or error.
Info	Additional information regarding the individual message, warning or error.
Level	Level of message, warning or error. **Note:** Level 1 to 4 are error levels and lead to a stop of the BESS system. For additional information regarding individual error messages, *see section 7.1* "Error Levels": Levels 0 and below are reporting and warning levels and do not cause the BESS system to stop.
Type	Indicates the message type of the individual message. Possible message types are: message, warning or error.
Time stamp	Indicates the time, at when the message, warning or error was detected by the controller.

22.4.12 Action List



Pos	Date	Time	State	Log
1	2025-01-09	13:38:44.850	OFF	301019: Supply: Thermal runaway confirmed tripped
2	2025-01-09	10:17:23.490	OFF	305013: UPS 1 battery charge
3	2025-01-09	10:17:23.470	OFF	305013: UPS 1 battery charge
4	2025-01-09	10:17:23.460	OFF	305013: UPS 1 battery charge
5	2025-01-09	10:17:23.440	OFF	305013: UPS 1 battery charge
6	2025-01-09	10:17:23.430	OFF	305013: UPS 1 battery charge
7	2025-01-09	10:17:23.410	OFF	305013: UPS 1 battery charge
8	2025-01-09	10:17:23.400	OFF	305013: UPS 1 battery charge
9	2025-01-09	10:17:23.380	OFF	305013: UPS 1 battery charge
10	2025-01-09	10:17:23.370	OFF	305013: UPS 1 battery charge
11	2025-01-09	10:17:23.350	OFF	305013: UPS 1 battery charge
12	2025-01-09	10:17:23.340	OFF	305013: UPS 1 battery charge
13	2025-01-09	10:17:23.320	OFF	305013: UPS 1 battery charge
14	2025-01-09	10:17:23.310	OFF	305013: UPS 1 battery charge
15	2025-01-09	10:17:23.290	OFF	305013: UPS 1 battery charge
16	2025-01-09	10:17:23.280	OFF	305013: UPS 1 battery charge
17	2025-01-09	10:17:23.260	OFF	305013: UPS 1 battery charge
18	2025-01-09	10:17:23.250	OFF	305013: UPS 1 battery charge

Figure 96: WebVisu page "Action list"

The WebVisu page "Action list" provides the user with an overview of the system events stored by the BESS controller.

The event list records the most important events and information of the BESS system, such as

- Plant operation
- Error messages
- Event messages
- Status messages

23 Troubleshooting

⚠ DANGER	
	**Electric shock due to low voltage** Severe irreparable damage to the nervous system, severe burns and death. ➜ In the event of faults, contact customer support. ➜ Have work on the energy storage device performed by service personnel only.

24 Dismantling and Disposal

24.1 Safety

For all work on the BESS observe the „Safety Instructions“ in section 2.

24.2 Dismantling

The end user is responsible for dismantling the energy storage device.

24.3 Disposal of Packaging Material

The proper disposal of packing materials is subject to national regulations and laws. If there are any doubts regarding the proper disposal of the packaging materials, ask a local disposal specialist or consult the local authorities.

The packaging my consist of the following materials:

- wooden frames
- pallets
- polyethylene foil
- plywood
- plastics
- silica gel

24.4 BESS Disposal

Always adhere the national regulations and laws regarding disposal or recycling.

⚠ WARNING	
	**Danger to life due to improper dismantling** In the case of improper dismantling, materials can slip, tip or shift, which can result in death, severe personal injury or material damage. ➜ Only qualified personal is allowed to dismantle and dispose, wearing suitable protective clothing. ➜ Before starting to dismantle, deenergize and ground the device. ➜ Also refer to section 10.1 "Unpacking" and section 10.2 “Transport”.

⚠ WARNING	
	Do not dispose the refrigerant of the external cooling unit in the atmosphere. It should be disposed of by companies dealing with special waste collection and recovery.

The batteries installed in the FREQCON BESS Container are subject to EU Directive 2006/66/EC on batteries and accumulators as well as spent batteries and accumulators.
They must be disposed of separately.
For this purpose, the batteries categorized as industrial batteries are not to be returned to the common take-back system but directly to the manufacturer FREQCON GmbH or a third-party company, qualified for this service.

Please note that the existing regulations for the transport of hazardous materials must be observed. The transport is the responsibility of the end user.

The end user is responsible for the following when disposing of batteries:

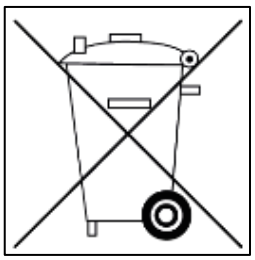
- Packaging
- Labeling
- Return transport to the manufacturer

After transport, the battery storage system must be disposed according to local regulations.
The energy storage device also contains electrical and electronic components that must be disposed of separately from other waste in accordance with local regulations and laws.

Pay particular care for the disposal or recycling of the following components:

- Batteries
- Circuit boards
- Electrical components
- Refrigerants

NOTE:
The transport of the battery modules installed inside the battery storage system underly strict regulations (UN 3480) and are only allowed to be transported by companies, qualified for this purpose.



The energy storage device also contains electrical and electronic components that must be disposed of separately from other waste in accordance with local regulations and laws.

Drawing of LF280K plus holder

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

RD-S216-C-005A-LF

公差等级	基本尺寸分段（mm）（GB108-2000）						
	0.5-3	>3-6	>6-30	>30-120	>120-400	>400-1000	>1000-2000
紧密f	±0.05	±0.05	±0.1	±0.15	±0.2	±0.3	±0.5
中等m	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2
粗糙c	±0.2	±0.3	±0.5	±0.8	±1.2	±2.0	±3.0

标记	处数	日期	变更内容描述	担当
		2021.6.23	初版发行	/
1				

分发部门
品管部：☑
工程部：☑
PMC部：☑
生产部：☑
采购部：☑
项目部：☐
技术部：☑
销售部：☐
中试部：☐

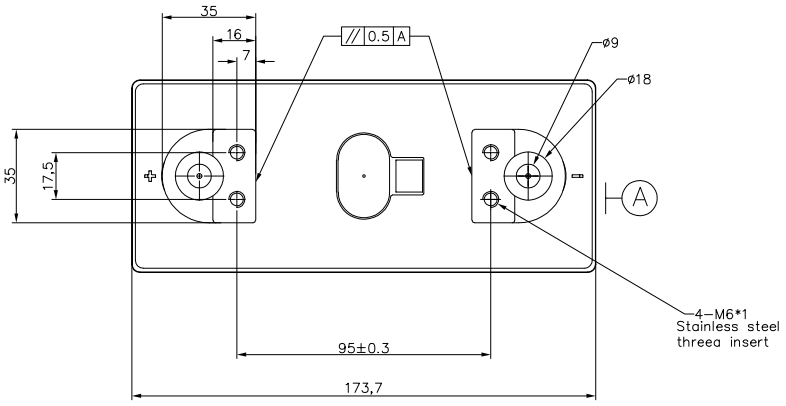
名　　称
借用产品或部件

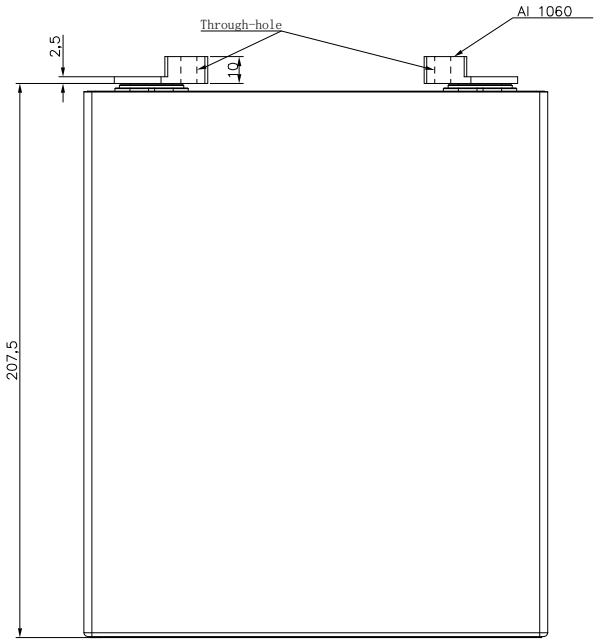
所属装配号

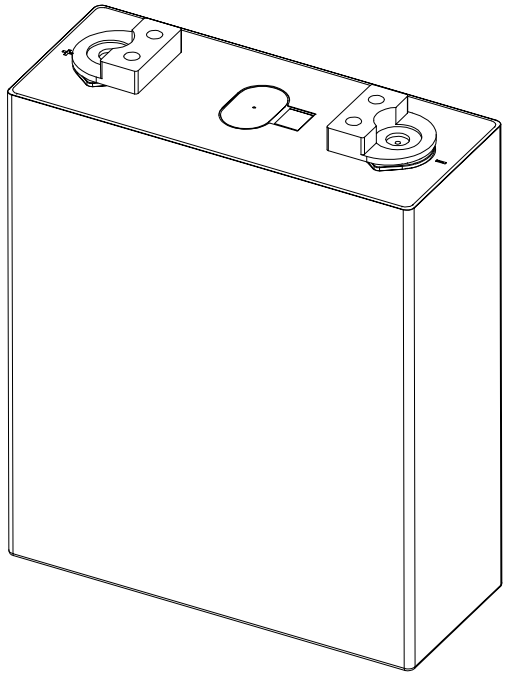
媒体编号

旧底图登记号

底图登记号







湖北亿纬动力有限公司
未经亿纬公司书面允许，禁止复印，否则追究法律责任！

设 计		工 艺	
制 图		质 量	
审 核		批 准	
标准化		发行日期	2021-6-23

机型号	/			零件名称	LF 280K 焊接支架		
图 号	/			料号	91022715		
材 料	/			版本	A	视图方向	
阶段标记	F	C	Z	S	P		
日 期						单位	mm
第1张/共1张		重量	/	比例	/	尺寸	A3

STATRON
NON STOP POWER

SAT Protocol

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

FREQCON

SAT Protocol

Converter & BESS

(Site Acceptance Test)

Version	date	Name	Description of the
Draft	2024-03-26	J. Nitsch C. Palenzuela	First, preliminary version
1.0	2024-10-08	J. Nitsch C. Palenzuela	First, final version
1.1	2024-10-21	J. Nitsch C. Palenzuela	Updated tables
2.0	2024-10-30	M. Jahns C. Palenzuela	Updated document structure
2.1	2024-11-01	C. Palenzuela	Comments implementation and corrections
2.2	2024-11-21		Comments implementation and corrections

Table 1Version overview

	Date	Name
Created by	2024-03-26	J. Nitsch C. Palenzuela
Checked by	2024-03-26	J. Nitsch
Approved by	2024-03-26	C. Palenzuela

Table 2Authorisation overview

Imprint

Hardware development and production centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

E-mail:
info@freqcon.de
hardware@freqcon.de

Contact details

For further information, please contact us by phone or send us an e-mail to info@freqcon.com
You can also visit our website **at http://www.freqcon.com for** more information on our products and solutions.

Contents

1 About this Document 6
2 Responsibility 6
2.1 Responsibility of FREQCON GmbH 6
2.2 Responsibility of the customer 6
3 Device Description 7
3.1 Single Line Diagram 7
3.2 General Arrangement 8
4 PCS (Converter System) 9
4.1 Reference Documents 9
4.2 PCS Prerequisites 10
4.3 Visual inspection of Control Cabinet 1 11
4.4 Visual inspection of Control Cabinet 2 13
4.5 Visual inspection of Converter Cabinets 15
4.6 Visual Inspection of Converter Cooling System and Heat Exchanger 17
4.7 Power On 18
4.8 Software and Function Tests 21
5 BESS 1 and 2 24
5.1 Reference Documents 24
5.2 BESS Prerequisites 25
5.3 Container Visual Inspection BESS 1 26
5.4 Container Visual Inspection BESS 2 27
5.5 Power On BESS 1 28
5.6 Power On BESS 2 31
5.7 Function and Safety Critical Tests BESS 1, BESS 2 and PCS 34
6 Battery Modules 38
6.1 Reference Documents 38
6.2 Prerequisites 39
6.3 Installation Report 40
7 System Tests 41
7.1 Reference Documents 41
7.2 Prerequisites 42
7.1 Software and Function Tests 43
8 Employees Present 48
9 Check and Approval 50

Identification

Product and type designation

Device type
BESS 1 MW / 5MWh

Document number
23A2007_241030_SAT_BESS_EN_v2.0

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this Document

The test report for site acceptance test (SAT) is intended to qualify whether the system fulfils the design requirements and the customer's requirements.

The site acceptance test (SAT) is carried out by specialised personnel after delivery of the system at customer site and the result is checked by the customer.

2 Responsibility

2.1 Responsibility of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (SAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

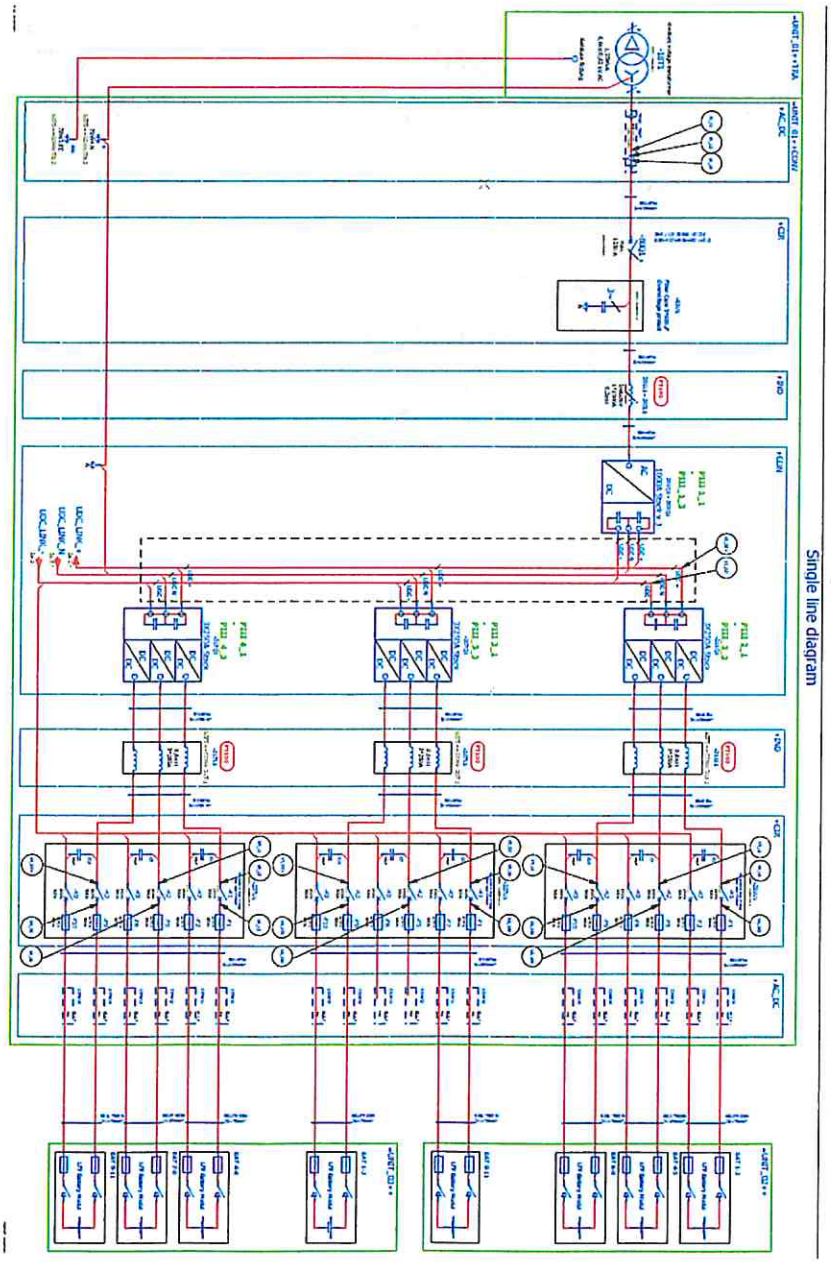
2.2 Responsibility of the customer

- Sending personnel to site, checking the test result and the data
- Approve the SAT protocol

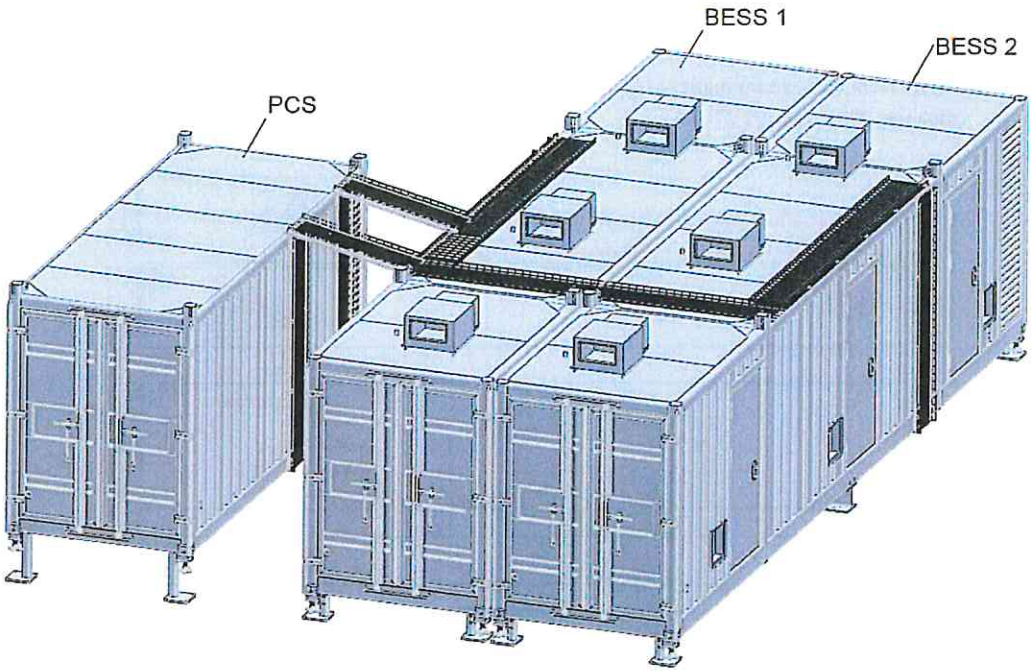
3 Device Description

3.1 Single Line Diagram

Extract from overall schematics "10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2"



3.2 General Arrangement



4 PCS (Converter System)

4.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3
FAT punchlist tracker	20240828 - punchlist - FRQ comments v2.4

4.2 PCS Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR01 test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding.

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400VAC aux PCS – *auxiliary load BESS B-200 <> 84W2*

Remarks:

4.3 Visual inspection of Control Cabinet 1

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR01	Test		Result
4.3.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust. **Pass Fail Criteria:** Covers and interior are clean, without dirt or rust.	☒ OK ☐ Defects ☐ N/A
4.3.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages **Pass Fail Criteria:** No sharp edges or recognisable damage present.	☒ OK ☐ Defects ☐ N/A
4.3.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts. **Pass Fail Criteria:** Cable connections are in perfect condition, no loose parts present.	☒ OK ☐ Defects ☐ N/A
4.3.4	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components). **Pass Fail Criteria:** • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_YYMMDD_Operating_Manual_ Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	☒ OK ☐ Defects ☐ N/A
4.3.5	**Touch panel**	**Test Layout:** Check if touch panel of HMI user interface is clean and without damage **Pass Fail Criteria:** The user interface of the touch panel is clean without damage	☒ OK ☐ Defects ☐ N/A
4.3.6	**Punch List Items Closed**	**Test Layout:** Review and confirm no category A open punch list items are outstanding. **Pass Fail Criteria:** No category A open punch list items are outstanding.	☒ OK ☐ Defects ☐ N/A
4.3.7	**LOTO**	**Apply LOTO as required.**	☒ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
ALESSANDRO SUTTO GERRY MCCAN FREDERIC HEIN	CARLOS PALENZUELA	23-11-2024

Remarks:

Missing lables on interface cable

13.03.25 - lables added

4.4 Visual inspection of Control Cabinet 2

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR02	Test		Result
4.4.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	
4.4.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No sharp edges or recognisable damage present.	
4.4.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Cable connections are in perfect condition, no loose parts present.	
4.4.4	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_YYMMDD_Operating_Manual_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	
4.4.5	**Punch List Items Closed**	**Test Layout:** Review and confirm no category A open punch list items are outstanding.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No category A open punch list items are outstanding.	
4.4.6	**LOTO**	**Apply LOTO as required.**	☐ OK ☐ Defects ☒ N/A

Completed by	Witnessed by	Date
ALESSANDRO SUTO GERRY MCCAN FREDERIC KEIN	CARLOS PALENTUELA	28-11-2024

Remarks:

Naming labels on interface cables

13.03.25 – cables added

4.5 Visual inspection of Converter Cabinets

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR03	Test		Result
4.5.1	Cleanliness	Test Layout: Check covers and cabinet interior for cleanliness and rust. Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	☒ OK ☐ Defects ☐ N/A
4.5.2	Metal sheets	Test Layout: Check metal sheets for sharp edges and damages Pass Fail Criteria: No sharp edges or recognisable damage present.	☒ OK ☐ Defects ☐ N/A
4.5.3	Wires and cables	Test Layout: Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts. Pass Fail Criteria: Cable connections are in perfect condition, no loose parts present.	☒ OK ☐ Defects ☐ N/A
4.5.4	Control elements description	Test Layout: Check if the operating elements are explained in the operating manual. Pass Fail Criteria: The operating elements are explained in the operating manual. Reference document: 10354_23A2007_YYMMDD_Operating_Manual_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	☒ OK ☐ Defects ☐ N/A
4.5.5	Punch List Items Closed	Test Layout: Review and confirm no category A open punch list items are outstanding. Pass Fail Criteria: No category A open punch list items are outstanding.	☒ OK ☐ Defects ☐ N/A
4.5.6	LOTO	Apply LOTO as required.	☒ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
ALESSANDRO SUTTO GERRY MCCAN FREDERIC HEIN	CARLOS PALENUELA	28-11-2024
Remarks:		

4.6 Visual Inspection of Converter Cooling System and Heat Exchanger

Check the correct installation and connection of the cooling system. Document the qualification results in the following table.

TR04	Test		Result
4.6.1	**Water drop check**	**Test Layout:** Check that no drops of water can be seen at the connection points of the coolant hoses.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No water on the connection points of coolant hoses.	
4.6.2	**Heat exchanger visual inspection**	**Test Layout:** Check the external heat exchanger for proper connection and mechanical stability.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Heat exchanger is properly mechanically installed	
4.6.3	**I/O check**	**Test Layout:** Check the electrical connection to the Heat exchanger unit	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Heat exchanger is properly connected	

Completed by	Witnessed by	Date
~~ALEF~~ ADNAN AKCAM	ALESSANDRO TUTTO	14.3.2025
Remarks:		

4.7 Power On

Sequentially power on all the subsystems. Document the qualification results in the following table.

Please refer to the SLD on page 1a and 2a of the overall schematics for PCS:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Note:
Prior to carrying out any work, the commissioning engineer to check the current version of the reference document is available.

TR05	Test		Result
4.7.1	**Check LOTO of subsystem**	**Test Layout:** Check that all breakers feeding subsystems are turned to OFF position and LOTO **Pass Fail Criteria:** LOTO confirmed	☑ OK ☐ Defects ☐ N/A
4.7.2	**Remove LOTO from main feeding source (RM board)**	**Test Layout:** Remove LOTO from main feeding source and measure voltage across incoming cable. **Pass Fail Criteria:** Voltage is read at incoming feeding terminals.	☒ OK ☐ Defects ☐ N/A
4.7.3	**Supply voltage control cabinet**	**Test Layout:** Switch on 190F3 **Pass Fail Criteria:** Cabinet lights and socket power up	☒ OK ☐ Defects ☐ N/A
4.7.4	**Supply voltage control cabinet**	**Test Layout:** Switch on 191F1 **Pass Fail Criteria:** Clima 1 power up	☒ OK ☐ Defects ☐ N/A
4.7.5	**Supply voltage control cabinet**	**Test Layout:** Switch on 191F2 **Pass Fail Criteria:** Clima 2 power up	☒ OK ☐ Defects ☐ N/A
4.7.6	**Supply voltage control cabinet**	**Test Layout:** Switch on 101Q1. The control unit starts up properly. **Pass Fail Criteria:** Pass: - Simotion turns on - HMI turns on properly and WebVisualization (WebVisu) access is active Access to Simotion WebVisu is established and "Run" state of Simotion can be confirmed	☒ OK ☐ Defects ☐ N/A
4.7.7	**Supply voltage control cabinet**	**Test Layout:** Remove LOTO and switch on 84F2 **Pass Fail Criteria:** Voltage read at feeding terminals	☒ OK ☐ Defects ☐ N/A
4.7.8	**Supply voltage control cabinet**	**Test Layout:** Switch on 183F1	

TR05	Test		Result
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	☑ OK ☐ Defects ☐ N/A
4.7.9	**Supply voltage control cabinet**	**Test Layout:** Switch on 183F2	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.10	**Supply voltage control cabinet**	**Test Layout:** Switch on 185F1	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.11	**Supply voltage control cabinet**	**Test Layout:** switch on 185F2	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.12	**Supply voltage control cabinet**	**Test Layout:** Switch on 187F1	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.13	**Supply voltage control cabinet**	**Test Layout:** Switch on 181Q1	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.14	**Supply voltage control cabinet**	**Test Layout:** Switch on 181Q2	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.15	**Supply voltage control cabinet**	**Test Layout:** Switch on 182Q1	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	

Completed by	Witnessed by	Date
GERRY MCCAN FREDERIC HEIN		21-11-2024
Remarks:		

4.8 Software and Function Tests

Check the following software functions. Document the qualification results in the following table.

TR06	Test		Result	Completed by	Witnessed by	Date
4.8.1	Leakage and connections check	**Test Layout:** Check the converter water cooling system for proper connection and leaks. Run cooling system and perform visual check of connections and check for leaks **Pass Fail Criteria:** All connections are properly connected and no leakage present.	☑ OK ☐ Defects ☐ N/A	A. SUTO A. AKCAM		14.3.25
4.8.2	Pressure check	**Test Layout:** Check whether the pressure of the cooling system is above 3 bar. Check on the manometer of the converter cooling system cabinet (COSY) and verify value on HMI/WebVisu. **Pass Fail Criteria:** Manometer and HMI/WebVisu indicate a pressure of 3 bar.	☑ OK ☐ Defects ☐ N/A	A. SUTO A. AKCAM		14.3.25
4.8.3	Check pre-heating 4.5 FAT	**Test Layout:** Connecting the converter via interface: • Check the pre-heating of the converter for proper functionality • Check the pre-charge and DC link control for proper functionality **Pass Fail Criteria:** - Heat exchanger switches on and off correctly (visual check) - Preheating status is correctly indicated by the HMI/WebVisu. - Pump is running (visual check) - Heater is heating up the coolant (check coolant temperature on HMI/WebVisu)	☑ OK ☐ Defects ☐ N/A	A. SUTO A. AKCAM		14.3.25
4.8.4	UPS 4.13 FAT	**Test Layout:** Checking the UPS functionality. If the auxiliary supply fails (e.g. by activating the fuse of the AC power supply unit), the control cabinet continues to be supplied by the UPS. **Pass Fail Criteria:** After the defined time, the control cabinet is switched off completely. When the voltage returns, the control unit starts up again and the UPS battery is charged.	☑ OK ☐ Defects ☐ N/A	A. SUTO A. AKCAM		14.3.25
4.8.5	Smoke detectors	**Test Layout:** Test the smoke detector in PCS CON-cabinet with test spray.				

TR06	Test		Result	Completed by	Witnessed by	Date
		Pass Fail Criteria: The smoke detectors trigger accordingly and an error (Error level 4) is generated.	☑ OK ☐ Defects ☐ N/A	A SUTTO A AKRAM		14.3.25
4.8.6	**Communication test interface signals FREQCON->Customers**	**Test Layout:** Connecting communication interface to customer higher level controller. Transferring status signals to customer via comm interface. Check all signals listed in the comm interface list. **Reference document:** 23A2007_240628_PROFINET_Register BESS_V1_0_0_3 **Pass Fail Criteria:** The transmitted signals received via Profinet interface is plausible and correct.	☑ OK ☐ Defects ☐ N/A	ALESSANDRO SUTTO ADNAN AKRAM	FABIO SIEGEN	14.3.25
4.8.7	**Communication test interface signals Customer->Freqcon** MODBUS	**Test Layout:** MODBUS Connecting ~~Profinet~~ interface to customer higher level controller. Transferring control signals from customer higher level controller to BESS main controller via ~~Profinet~~ MODBUS interface. Check all signals listed in the comm interface list. **Reference document:** 23A2007_240628_PROFINET_Register BESS_V1_0_0_3 **Pass Fail Criteria:** The transmitted signals received via ~~Profinet~~ interface are plausible and lead to foreseen behaviour.	☑ OK ☐ Defects ☐ N/A	A. SUTTO ADNAN AKRAM	FABIO SIEGEN	14.3.25

Remarks:

5 BESS 1 and 2

5.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3
FAT punchlist tracker	20240828 - punchlist - FRQ comments v2.4

5.2 BESS Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR0x test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding. Any re-work on the electrical installation is completed.

- LOTO equipment
- Gas test spray equipment

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400 VAC Aux BESS – auxiliary load BESS B-200 <> 84W2
- Temporary 230 V AC Multiple socket outlet (e.g. to supply Laptop, temporary lights etc.)

Remarks:

5.3 Container Visual Inspection BESS 1

Check all system parts, including external and internal parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR07	Examination		Result
5.3.1	Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☑ OK ☐ Defects ☐ N/A
5.3.2	Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☑ OK ☐ Defects ☐ N/A
5.3.3	Warnings	The required warning signs are located on the personnel doors	☑ OK ☐ Defects ☐ N/A
5.3.4	Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☑ OK ☐ Defects ☐ N/A
5.3.5	Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☑ OK ☐ Defects ☐ N/A
5.3.6	Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☑ OK ☐ Defects ☐ N/A
5.3.7	LOTO	Apply LOTO as required.	☑ OK ☐ Defects ☐ N/A

5.4 Container Visual Inspection BESS 2

Check all system parts, including external and internal parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR08	Examination		Result
5.4.1	Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☒ OK ☐ Defects ☐ N/A
5.4.2	Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☒ OK ☐ Defects ☐ N/A
5.4.3	Warnings	The required warning signs are located on the personnel doors	☒ OK ☐ Defects ☐ N/A
5.4.4	Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☒ OK ☐ Defects ☐ N/A
5.4.5	Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☒ OK ☐ Defects ☐ N/A
5.4.6	Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☒ OK ☐ Defects ☐ N/A
5.4.7	LOTO	Apply LOTO as required.	☒ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
ALESSANDRO SUTO GENY MCLAN EDGENIC MEIN	CARLOS PALENUELA	28-11-2024
Remarks:		

5.5 Power On BESS 1

Sequentially power on all the subsystems. Document the qualification results in the following table.

Please refer to the SLD on page 1a and 2a of the overall schematics for battery container 1:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Note:
Prior to carrying out any works, the commissioning engineer to check the current version of the reference document is available.

TR09	Test		Result
5.5.1	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components). **Pass Fail Criteria:** • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2	☐ OK ☒ Defects ☐ N/A
5.5.2	**Check LOTO of subsystem**	**Test Layout:** Check that all breakers feeding subsystems are turned to OFF position and LOTO **Pass Fail Criteria:** LOTO confirmed	☒ OK ☐ Defects ☐ N/A
5.5.3	**Remove LOTO from main feeding source (RM Board)**	**Test Layout:** Remove LOTO from main feeding source and measure voltage across incoming cable. **Pass Fail Criteria:** Voltage is read at incoming feeding terminals.	☒ OK ☐ Defects ☐ N/A
5.5.4	**Remove LOTO from main feeding source**	**Test Layout:** Remove LOTO and switch on 684F1. **Pass Fail Criteria:** Voltage read at downstream feeding terminals.	☒ OK ☐ Defects ☐ N/A
5.5.5	**Supply voltage**	**Test Layout:** Switch on 690F1 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (container lights)	☒ OK ☐ Defects ☐ N/A
5.5.6	**Supply voltage**	**Test Layout:** Switch on 690F2	

TR09	Test		Result
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (sockets)	☒ OK ☐ Defects ☐ N/A
5.5.7	**Supply voltage**	**Test Layout:** Switch on 690F3, 690F4, 690F5	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (cranes)	
5.5.8	**Supply voltage**	**Test Layout:** Switch on 101Q1. The control unit starts up properly.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (DC power supply)	
5.5.9	**Supply voltage**	**Test Layout:** Switch on 691F4	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (cooling units)	
5.5.10	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F3	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals	
5.5.11	**Supply voltage**	**Test Layout:** Switch on 691F1, 691F2, 691F3	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (emergency ventilation and louvers)	
5.5.12	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F4	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals	
5.5.13	**Supply voltage**	**Test Layout:** Sequentially switch on 687F1, 687F2, 687F3, 687F4, 687F5, 687F6, 688F1, 688F2, 688F3, 688F4, 688F5	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	

Completed by	Witnessed by	Date
A SUTTO	F. HEIN	06-12-24

Remarks:

Panel needs further rework to bring it to AS-BUILT.
Planned work

13.03.25 – Rework completed - panel AS-BUILT

5.6 Power On BESS 2

Sequentially power on all the subsystem. Document the qualification results in the following table.

Please refer to the SLD on page 1a and 2a of the overall schematics for Battery Container 2:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Note:
Prior to carrying out any works, the commissioning engineer to check the current version of the reference document is available.

TR10	Test		Result
5.6.1	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).	☐ OK ☒ Defects ☐ N/A LABELS E panels
		Pass Fail Criteria: • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2	
5.6.2	**Check LOTO of subsystem**	**Test Layout:** Check that all breakers feeding subsystems are turned to OFF position and LOTO	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: LOTO confirmed	
5.6.3	**Remove LOTO from main feeding source (RM Board)**	**Test Layout:** Remove LOTO from main feeding source and measure voltage across incoming cable.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage is read at incoming feeding terminals.	
5.6.4	**Remove LOTO from main feeding source**	**Test Layout:** Remove LOTO and switch on 684F1.	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals.	
5.6.5	**Supply voltage**	**Test Layout:** Switch on 690F1	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (container lights)	
5.6.6	**Supply voltage**	**Test Layout:** Switch on 690F2	

TR10	Test		Result
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (sockets)	☒ OK ☐ Defects ☐ N/A
5.6.7	**Supply voltage**	**Test Layout:** Switch on 690F3, 690F4, 690F5	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (cranes)	
5.6.8	**Supply voltage**	**Test Layout:** Switch on 101Q1. The control unit starts up properly.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (DC power supply)	
5.6.9	**Supply voltage**	**Test Layout:** Switch on 691F4	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (cooling units)	
5.6.10	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F3	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals	
5.6.11	**Supply voltage**	**Test Layout:** Switch on 691F1, 691F2, 691F3	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (emergency ventilation and louvers)	
5.6.12	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F4	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals	
5.6.13	**Supply voltage**	**Test Layout:** Sequentially switch on 687F1, 687F2, 687F3, 687F4, 687F5, 687F6, 688F1, 688F2, 688F3, 688F4, 688F5	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	

Completed by	Witnessed by	Date
ALESSANDRO SUTO FABIAN HEIN	MARKUS JAHNS	02-12-2024

Remarks:

13.03.25 - All punches Solved

5.7 Function and Safety Critical Tests BESS 1, BESS 2 and PCS

Check system components of all battery cabinets (one cabinet in each container section) inside BESS 1 and 2 container and the following software functions. Document the qualification results in the following table.

TR11	Test		Result	Completed by	Witnessed by	Date
5.7.1	**Check smoke detectors BESS 1**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and (-) All battery cabinets decoupled from PCS (-) 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A SUTTO	M JAHNS F HEIN	06. 12. 24
5.7.2	**Check CO detectors BESS 1**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and (-) All battery cabinets decoupled from PCS (-) 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A SUTTO	M JAHNS F HEIN	06 12 24
5.7.3	**Check H2 BESS 1**	**Test Layout:** Check the correct functionality of the H2 exhaust system (detection and gas removal) in case of TR/gas event. Sample gas trigger. Check correct behaviour of the BESS: (-) All battery cabinets decouple from PCS DC side (-) 80Q1 (Main AC breaker) opens - ~~Air dampers are working~~ - ~~All exhaust system units in container roofs are operating~~ - Fire&Gas is transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A SUTTO	M JAHNS G. del MISSIER	06-12-24

TR11	Test		Result	Completed by	Witnessed by	Date
		Pass Fail Criteria: TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - ~~Air dampers are working~~ - ~~All exhaust system units in container roofs are operating~~ - F&G successfully transmitted to higher level controller via hard wired signal				
5.7.4	**Check smoke detectors BESS 2**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A. SUTTO	M. JAHNS G. del MISSIER	21.11.24
5.7.5	**Check CO detectors BESS 2**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A SUTTO	M JAHNS G del MISSIER	21.11.24

TR11	Test		Result	Completed by	Witnessed by	Date
5.7.6	**Check H2 BESS 2**	**Test Layout:** Check the correct functionality of the H2 exhaust system (detection and gas removal) in case of TR/gas event. Sample gas trigger. Check correct behaviour of the BESS: - All battery cabinets decouple from PCS DC side - 80Q1 (Main AC breaker) opens - ~~Air dampers are working~~ - ~~All exhaust system units in container roofs are operating~~ - Fire&Gas is transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	AUTO	MJAHNS G.del MISSIER	21-11-25
		Pass Fail Criteria: TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - ~~Air dampers are working~~ - ~~All exhaust system units in container roofs are operating~~ - F&G successfully transmitted to higher level controller via hard wired signal				

NOTE: Check RE-SET mechanism of Smoke triggered alarms 2002

13.03.25 - Reset logic changed to 2002

6 Battery Modules

6.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3

6.2 Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR12 test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding. Any re-work on the electrical installation is completed.

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400 VAC aux BESS – *auxiliary load BESS B-200 <> 84W2*

Note – the battery modules have been tested after assembly for quality assessment (reports available) and have been tested for functionality and capacity prior to shipping (reports available).

Remarks:

6.3 Installation Report

Check the correct installation and connection of the battery modules in the BESS 1 and BESS 2 containers. Document the qualification results in the following table.

TR12	Test		Result	Completed by	Witnessed by	Date
6.3.1	**Installation report for cabinets**	**Test Layout:** Report issued for the following racks: BESS 1 ☑ 1 ☑ 2 ☑ 3 ☑ 4 ☑ 5 ☑ 6 ☑ 7 ☑ 8 ☑ 9 ☑ 10 ☑ 11 BESS 2 ☑ 1 ☑ 2 ☑ 3 ☑ 4 ☑ 5 ☑ 6 ☑ 7 ☑ 8 ☑ 9 ☑ 10 ☑ 11	☑ OK ☐ Defects ☐ N/A	A. SUTO, ADNAN AKYOL		11.3.25
		Pass Fail Criteria: All cabinets have been checked and report is available				
6.3.2	**LOTO**	Check DC fused are disconnected.	☑ OK ☐ Defects ☐ N/A			

7 System Tests

7.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3

7.2 Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR0x test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding. Any re-work on the electrical installation is completed.

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400VAC aux BESS – *auxiliary load BESS B-200 <> 84W2*
- 6.6 kV AC
- (FREQCON) power meter needs to be connected to AC busbars for voltage measurement before energization

Remarks:

7.1 Software and Function Tests

Check the following software functions. Document the qualification results in the following table.

Note – in the event that BLPH control system connections are not available at this time, consideration must be given to implement temporary safety measures e.g. use of local temporary pushbutton in lieu of no trip signal from BLPH control system. To be fully risk assessed at site prior to any implementation.

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.1	**LOTO main connection and electro mechanical lock in place**	**Test Layout:** Confirm BESS AC connection is LOTO and captive key to earth the transformer is available before energizing the system. Confirm all system mains (80Q1) is open. **Pass Fail Criteria:** Transformer connections are correct. Captive key is retrieved, transformer is grounded. 80Q1 open.	☑ OK ☐ Defects ☐ N/A	A. AKRAM	A. SUTO	14.3.25
7.1.2	**Transformer inspection**	**Test Layout:** MV and LV connections are completed and according to as built electrical drawings. After visual inspection, lock the door and extract the captive key for energization. **Pass Fail Criteria:** Transformer connections are correct. Key is available for energization	☑ OK ☐ Defects ☐ N/A	A. AKRAM	A. SUTO	14.3.25
7.1.3	**Energize AC connection**	**Test Layout:** Energize main AC connection. - Transformer is energized - Turn on mains (80Q1). **Pass Fail Criteria:** Inverter units energized, no unexpected trips.	☑ OK ☐ Defects ☐ N/A	A. AKRAM	A. SUTO	14.3.25
7.1.4	**Check pre-charging and DC link control** 4.7 FAT	**Test Layout:** Connecting the converter via interface: • Check the pre-charge and DC link control for proper functionality **Pass Fail Criteria:** **Precharge:** - Precharging process is indicated by HMI/WebVisu. - After precharging process is done, the green "Ready for Operation" is indicated by HMI/WebVisu. **DC Link Control:** - Verify correct DC-link voltage level was successfully reached and held via HMI/WebVisu.	☑ OK ☐ Defects ☐ N/A	A. AKRAM	A. SUTO	14.3.25

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.5	Check IGBTs	**Test Layout:** Check IGBT activation. **Pass Fail Criteria:** - IGBTs can be switched without any problems - Operating status is indicated by by HMI/WebVisu.	☑ OK ☐ Defects ☐ N/A	A AKKAM	A. SUTO	24.3.25
7.1.6	Check DC ports	**Duration: After reaching 250 A test duration is 10 min.** **Test Layout:** **<u>DC ports:</u>** Connection to customer AC mains is performed in order to work AC power. Each port will be charged with 250 kW which corresponds to a current of 250 A. DC ports connection Increase the DC current setpoint slowly to 250 A and keep this value for 10 minutes. **<u>Heat run:</u>** Check if temperatures of - IGBTs - Inductors - Coolant of converter cooling system are within the permissible ranges by verifying the temperature values displayed on the HMI/WebVisu. **Pass Fail Criteria:** **<u>DC Ports:</u>** DC current output of 250 A is displayed on the HMI/WebVisu according to setpoint. **<u>Heat Run:</u>** IGBT, inductor and converter cooling system coolant temperatures are below the temperature thresholds set in the control system.	☑ OK ☐ Defects ☐ N/A	A. AKKAM	A. SUTO	24.3.25

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.7	**Check DC port current/offset control**	**Test Layout:** Check the DC port current control / offset control and check for oscillations. **Pass Fail Criteria:** Oscillations are within the permissible range of +/- 10% of 250A.	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	14.3.25
7.1.8	**Check temperature values**	**Test Layout:** Check all temperature values displayed on the HMI/WebVisu for plausibility. **Pass Fail Criteria:** The temperature values indicated on the HMI/WebVisu are plausible. IGBTs: 30 ... 65 °C Inductors: 30 ... 120°C Cooling water: 27 ... 55 °C	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	14.3.25
7.1.9	**Measurements** 4.11 FAT	**Test Layout:** Check if the measured values (voltages and currents) are properly collected by the Simotion (PCS main controller) and verify by using a multimeter or current clamp at DC and AC side. **Pass Fail Criteria:** Values measured with multimeter correspond +/-5% to the values displayed on the HMI/WebVisu.	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	14.3.25
7.1.10	**Check temperature derating functionality**	**Test Layout:** Check the temperature derating for proper functionality. For this purpose, lower the temperature setpoints. **Pass Fail Criteria:** PCS lowers power according to the set derating thresholds.	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	08.04.25
7.1.11	**Switching-off** 4.12 FAT	**Test Layout:** Switching off the inverter. The inverter is properly switched off by removing the control bits. **Pass Fail Criteria:** "OFF" state is indicated by the HMI/WebVisu.	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	08.04.25

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.12	Battery capacity test	**Test Layout:** Capacity test / load test as required. Check the temperature behavior of the converter system during the test. Make sure plots include: - Power AC - Power DC - Voltage DC - Cell voltage max and min - Cell temp max and min - Room temperatures - Filter temperature - SOC **Pass Fail Criteria:** Capacity was successfully reached without power derating and all temperatures in acceptable ranges.	☐ OK ☐ Defects ☒ N/A			
7.1.13	Performance Test AC output	**Test Layout:** **Duration: After reaching 1000 A duration test of 10 min.** **Test Layout:** Increase the AC current setpoint value slowly to 1000 A output and keep this value for 10 minutes. **Pass Fail Criteria:** AC current output of 1000 A is displayed correctly on the HMI/WebVisu according to setpoint.	☒ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	08.06.25

REMARK
7.1.12 test will be completed after installation at final location. It is not considered necessary currently as part of SAT

8 Employees Present

Identify each employee involved in the execution of this protocol. Document the employee 's name, signature, name abbreviation and date in the following table:

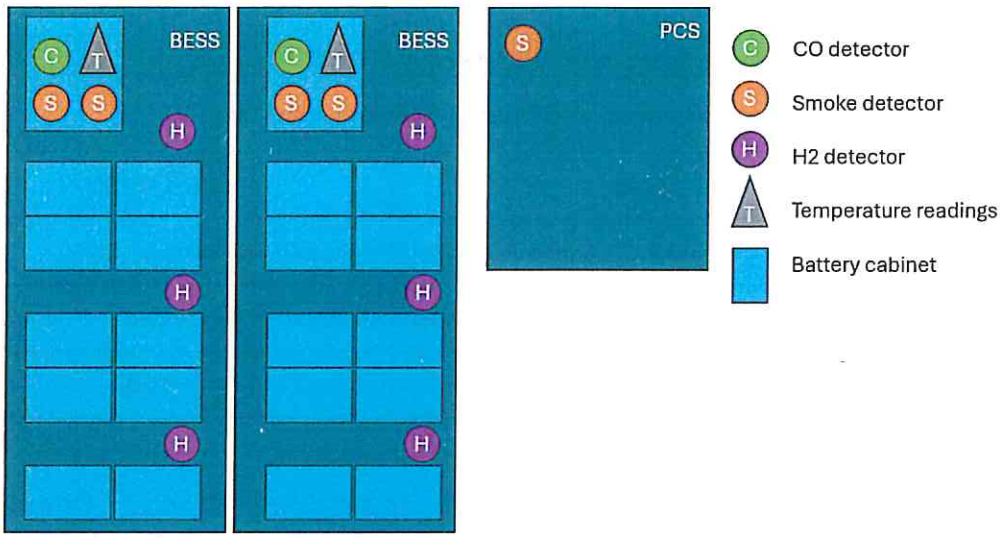
Company Name	Employee Name	Employee Signature	Abbreviation	Date
FREQCON	Md. Adnan Akram		MAA	08.04.25
CROSSWIND	ALESSANDRO SUTTO		ASU	08.04.25
CROSSWIND	JOHN MACKILLOP		JM	08.04.25
CROSSWIND	DAVE MUSGROVE		DM	08/04/2025

	Yes/No
All persons involved in the SAT were documented.	☒ Y ☐ N

Remarks:
B Punches C30000871, C30000874 remain open (Door handle on BESS 2 door & identifyer stickers for containers) to BE adressed

9 Appendix

9.1 Fire and Gas Cause and Effect



Simplified representation of the location of different components within the BESS system.

9.1.1 PCS container

1x smoke detector – trigger 1-out-of-1 – it can be reset remotely.
Once triggered it sends 85-XA-002 (confirmed smoke) hardwired signal to EMCS.
PCS Control Cabinet XT1-3&4

9.1.2 BESS container

3x H2 detectors – trigger is 2-out-of-3.
It generates 85-XA-001 (confirmed gas) hardwired signal to EMCS.
PCS Control Cabinet XT1-1&2

9.1.3 BESS cabinets (1 to 11 in each container) - independent reaction

1x CO detector – trigger is 1-out-of-1
2x Smoke detectors – trigger is 2-out-of-2
Module Temperature reading (from BMS) – trigger is > 60°C
They generate 85-XA-004 (Confirmed Thermal Runaway) hardwired signal to EMCS
Note: each detector type works independently. The first one to reach the triggers conditions will activate the HW signal to EMCS.

10 Check and Approval

The SAT protocol becomes the SAT report when it has been completed as the individual test reports have been completed and labelled with a test date. The SAT report is submitted to the customer for confirmation and the results must be documented in TR14.

TR14	Examination and authorisation of execution
Check the test results and the original data. Final assessment for SAT	
☒ PASS	☐ NOT PASSED
If there are any unresolved discrepancies, please fill in the following "remarks" table.	
Specify whether or not these unresolved discrepancies may affect the completion of the SAT.	
☐ YES	☒ NO

Remarks:
8 Punches C30000871, C30000874 remain Open
(Door handle on BESS2 & identifyer Sticker for BESS1&2)
to be adressed - not affecting completion of SAT

Carried out by:	M. Adnan Akram	Date:	2025 · 04 · 08
	FREQCON GmbH		YYYY/MM/DD
Authorised by:	ALESSANDRO SUTTO	Date:	2025 · 04 · 08
	Customer		YYYY/MM/DD

STATRON
NON STOP POWER

Arc Flash Calculation

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

STATRON
NON STOP POWER

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

Document number:
23A2007_241105_FREQCON_BESS_Arc_Flash_Study_v2.0

Document description: Arc Flash Study

Revision	Date	Name	Description
001	21.10.2024	CPA	First Version
002	02.11.2024	CPA	First Revised Version

Arc Flash Study
BESS

for Base Load Power Hub (BLPH) Project

Classification: confidential

Document no.	23A2007_241105_FREQCON_BESS_Arc_Flash_Study_v2.0
Document name	Arc Flash Study
Component / System	BESS
Project code	K559-2254

Version	Date	Name	Description
1.0	2024-09-30	D. Grochotzky C. Palenzuela	First version
2.0	2024-11-05	D. Grochotzky C. Palenzuela	First revised version

Table 1: Version overview

	Date	Name
Editor	2024-10-21	S. Laudahn C. Palenzuela
Checked by	2024-09-30	S. Laudahn
Approved by	2024-09-30	C. Palenzuela

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 Other Applicable Documents 7
1.2 Generic Terms and Abbreviations Used 7
2 Arc Flash Study 8
2.1 Reference Point 8
2.2 Variables 9
2.3 Results 10

Identification

Product Version / Document Version

Product version
Prototype

Document release date
November 2024

Doc Code
23A2007_241105_FREQCON_BESS_Arc_Flash_Study_v2.0

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
BESS Overall Electrical Schematics	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241017_V1.0

Table 1: Other applicable documents

1.2 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 2: Generic terms and abbreviations used

2 Arc Flash Study

2.1 Reference Point

Reference point for the calculation are the AC busbars of AC mains circuit breaker 80Q1 inside PCS container (see following SLD extract):

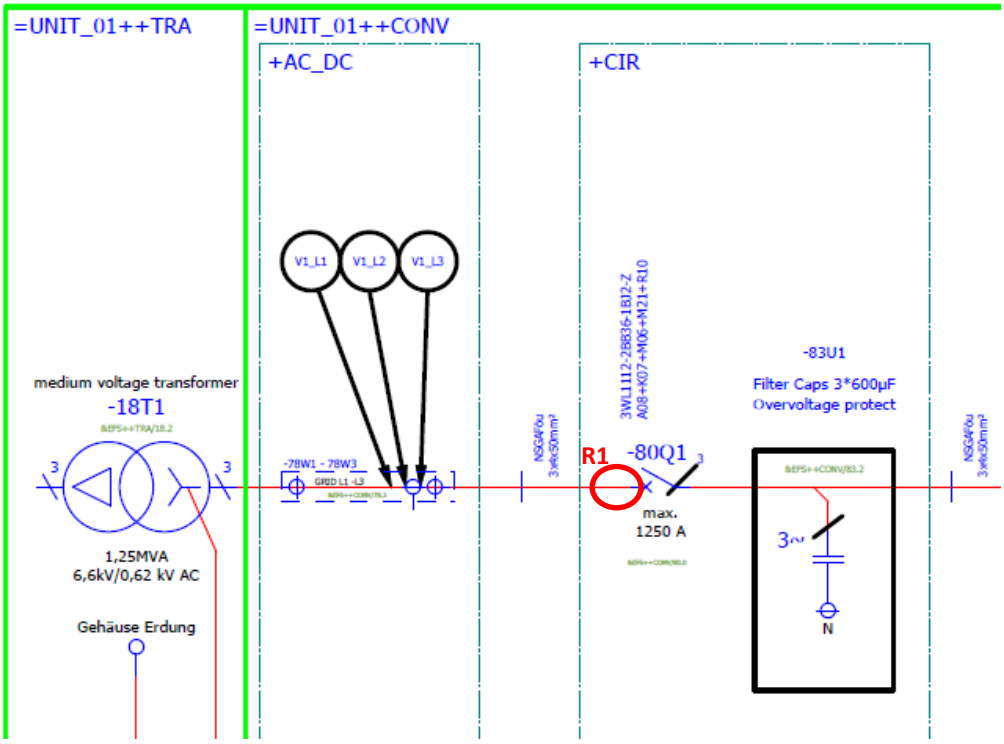


Figure 1: SLD extract showing reference point (10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241017_V1.0)

2.2 Variables

For calculating the arc flash study “Online Arc Flash Calculator IEEE 1584 (2002 and 2018)” was used. (https://www.jcalc.net/arc-flash-calculator-ieee)

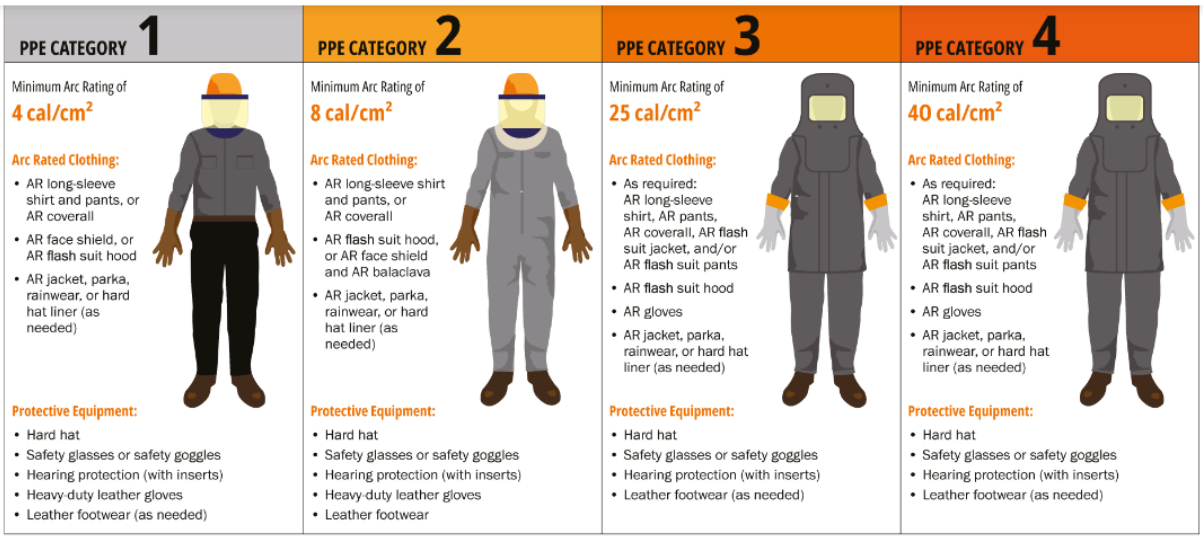
Variables used for arc flash study calculation:

Standard	IEEE 1584-2018			
Unit of measure	Metric			
Voltage	620	Vac		
Fault current	33,6	kA		
Arcing time for I_{arc}	100	ms		
Arcing time for I_{arc_min}	200	ms		
Equipment type	Switchgear			
Working distance	610	mm		
Enclosure width	508	mm		
Enclosure height	1245	mm		
Enclosure depth	508	mm		
Electrode configuration	Vertical in Box -VCB			
Conductor gap	32	mm		
Reset				
Calculate				

2.3 Results

Results of arc flash study calculation:

Normal Arcing Current		Reduced Arcing Current	
Arcing current I_{arc}	26.06 kA	Arcing current I_{arc_min}	23.04 kA
Incident energy	3.45 cal/cm^2	Incident energy	**6.13 cal/cm^2**
Arc flash boundary	1,181 mm	Arc flash boundary	**1,692 mm**
PPE Category	1	PPE Category	**2**
Size correction factor	1.2602		



STATRON
NON STOP POWER

Transformer Data Sheets

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Power FULL STOP
... nothing else

TECHNICAL DATA THREE-PHASE CAST RESIN TRANSFORMER

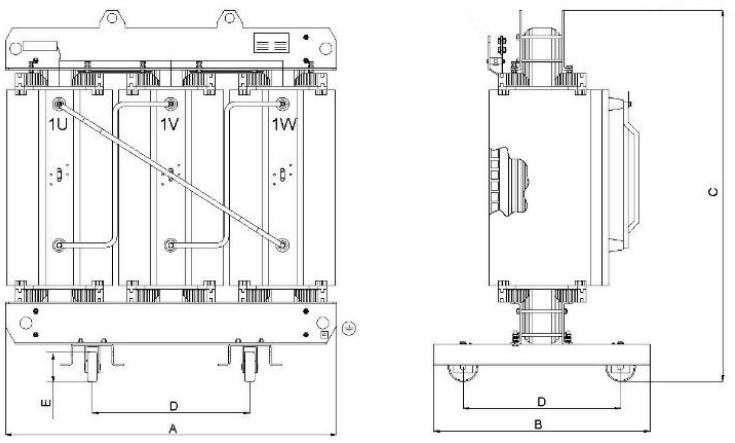
Position	1			
Reference Standards	IEC 60076-1,IEC 60076-11, EU 548/2014,EN 50588-1			
Type	TPZ3K7.2.1250	**Application**	Converter	6 Pulse
Rated Power – AN	1250 kVA	**Duty Class**	I	
Type of Cooling	AN	**Frequency**	50 Hz	
Degree of Protection	IP00			

CHARACTERISTICS

	HV	**LV**		
Voltage	7 kV	0,62 kV		
Insulation Class	7.2/20/60 kV	1,1/3/- kV		
Tapping	±2x2,5%	-		
Material	Aluminium	Aluminium		
Insulation class	F	F		
Temperature rise	100 K	100 K		
Connections location	Top	Top		
Vector Group	Dyn5			
Level of losses	EcoDesign TIER II			
No-Load Losses (Po)	1620 W			
On-Load Losses 120°C (Pcc)	11000 W			
Tolerance on the losses	0%			
Impedance 120°C (Uk%)	6%			
Power Noise (Lwa)	≤ 66 dB(A)			
Pressure Noise (Lpa)	≤ 52 dB(A)			
Ambient Temperature	-25°C ; + 40°C			
Installation	≤ 1.000 m			
Fire (F), Environmental (E), Climatic (C) Classes	F1/E2/C2			
HV/LV earth screen	YES			
Dimensions IP00 (AxBxC)	1680x1050x1990 mm	**Wheel Base (D)**	820 mm	
Wheels Dimensions (E)	160 mm	**Total Weight IP00**	3600 Kg	

STANDARD ACCESSORIES

Earthing terminal
Primary voltage tapping
MV output insulators
Output bars from LV windings
4 orthogonal revolving wheels
Name plate IEC 60076
Eyesbolts for Horizontal and Vertical movements
3 thermal sensors PT100 for temperature control
Routine tests report according to IEC 60076



„Power." Sp. z o.o.
ul. Chemiczna 14
41-100 Siemianowice Śląskie, Poland
Tel.: +48 32 7240531
Fax: +48 32 7882271
NIP: PL 646-280-34-52
email: office@powerfullstop.com

PN-EN ISO 9001 ISOCERT CERTYFIKAT
PN-EN ISO 14001 ISOCERT CERTYFIKAT

STATRON
NON STOP POWER

Transformer Certificate of Compliance

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

CE

Power FULL STOP ... nothing else

PN-EN ISO 9001 ISOCERT CERTYFIKAT PN-EN ISO 14001 ISOCERT CERTYFIKAT

DEKLARACJA ZGODNOŚCI / DECLARATION OF CONFORMITY

Producent / Manufacturer

Power. Sp. z o.o.
ul. Chemiczna 14
41-100 Siemianowice Śląskie / Poland
tel. +48 32 724 05 31 fax +48 32 607 15 31
deklaruje z pełną odpowiedzialnością, że produkt/y oznakowany/e:
declare under their sole responsibility that the product/s marked:

NAZWA PRODUKTU PRODUCT NAME	RODZAJ PRODUKTU PRODUCT TYPE	NUMER FABRYCZNY SERIAL NUMBER	MOC POWER
CAST RESIN TRANSFORMER	TPZ3K07.1250	2305062	1250kVA

jest / są zgodny/e z następującymi dyrektywami EC, łącznie ze wszystkimi późniejszymi zmianami:
is/are in conformity with the following EC directive, including all following applicable amendments:

Nr. / No.	Tytuł / Title
Dyrektywa 2014/30/EC Directive 2014/30/EC	Kompatybilność elektromagnetyczna Electromagnetic Compatibility
Rozporządzenie Komisji UE Nr. 548/2014 Commission Regulation EU Nr. 548/2014	Rozporządzenie Komisji UE Nr. 548/2014 w sprawie wykonania dyrektywy 2009/125/EC Commission regulation EU Nr 548/2014 on implementing Directive 2009/125/EC

i potwierdza, że wymienione produkty zostały wykonane zgodnie z następującymi standartami i /o specyfikacjami technicznymi:
and confirms, that the mentioned products have been produced according the following standards and technical specifications:

Nr./No.	Edycja/Issue	Tytuł / Title
IEC 60076-11	Ed. 2019-01	Transformatory – Transformatory suche Power Transformers - Dry Type Transformers
IEC 60076-1	Ed. III 2011-04	Power Transformers – General Transformatory – Wymagania ogólne
IEC 60076-2	Ed. III 2011-02	Transformatory – Przyrosty temperatury Power Transformers - Temperature Rise
IEC 60076-3	Ed. III 2013-07	Transformatory – Poziomy izolacji; próby wytrzymałości elektrycznej i zewnętrzne odstępy izolacyjne w powietrzu Power Transformers - Insulation levels, dielectric test and external clearances in air
IEC 60076-4	Ed. I 2002-06	Transformatory– Przewodnik wykonywania prób udarem piorunowym i udarem łączeniowym -- Transformatory i dławiki Power Transformers - Guide to lightning impulse and switching impulse testing – Power transformers and reactors
IEC 60076-5	Ed. IV 2006-02	Transformatory – Wytrzymałość zwarciowa Power Transformers - Ability to withstand short circuit
IEC 60076-10	Ed. II 2016-03	Transformatory – Wyznaczanie poziomów dźwięku Power Transformers - Determination of sound levels
IEC 61378-1	Ed. II 2011-07	Transformatory przekształtnikowe – Część 1 : Transformatory do zastosowań przemysłowych Converter transformers - Part 1: Transformers for industrial applications
IEC 61378-2	Ed. II 2011-07	Transformatory przekształtnikowe – Część 2 : Transformatory do układów wysokiego napięcia prąd stałego (HVDC) Converter transformers - Part 2: Transformers for HVDC Application

STAMP

(Place, Date, Signature)

Siemianowice Śląskie; 05/02/2024

STATRON
NON STOP POWER

FAT reports for PCS, BESS1, BESS2, BESS Converter Containers

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

FREQCON

FAT Test Protocol

Converter & BESS

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-02-29	S. Laudahn	First version
1.1	2024-05-14	C. Palenzuela J. Nitsch	Updated several sections
2.0	2024-07-08	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Editor	29.02.2024	S. Laudahn
Checked by		
Released by		

Table 2: Release overview

Imprint

Software development
Hardware development and production
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

Email:
info@freqcon.com

Contact information
For further information, please call us or send an e-mail to info@freqcon.com.
Visit our website http://www.freqcon.com for more information about our products and solutions.

Contents

1 About this document 6
2 Responsibilities 6
2.1 Responsibilities of FREQCON GmbH 6
2.2 Responsibilities of the customer 6
2.3 Single Line Diagram 7
2.4 General Arrangement 8
3 Converter (PCS) 9
3.1 Reference Documents Converter (PCS) 9
3.2 PCS Tests 10
3.2.1 Prerequisites 10
3.2.2 Visual Inspection of Control Cabinet 1 11
3.2.3 Visual Inspection of Control Cabinet 2 14
3.2.4 Visual inspection of Converter Cabinets 16
3.3 Visual inspection of Converter Cooling System 18
3.4 Function test 19
4 BESS 1 24
4.1 Reference Documents BESS 1 24
4.2 Battery Cabinets Tests 24
4.2.1 Prerequisites 24
4.2.2 Visual inspection of Battery Cabinets 25
5 BESS 2 28
5.1 Reference Documents BESS 2 28
5.2 Battery Cabinets Tests 28
5.2.1 Prerequisites 28
5.2.2 Visual inspection of Battery Cabinets 29
6 Employees Present 32
7 Examination and authorisation 33

Identification

Product and type designation

Device type
BESS 1 MW / 5MWh

Circuit diagram version
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62

Document number
23A2007_240708_FAT_BESS_Converter_EN_v2.0

Name and address of the manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this document

This acceptance report is used to assess compliance with all design and customer requirements of the tested system.

The factory acceptance test (FAT) is carried out by specialised personnel before delivery of the system and the result is checked by the customer.

2 Responsibilities

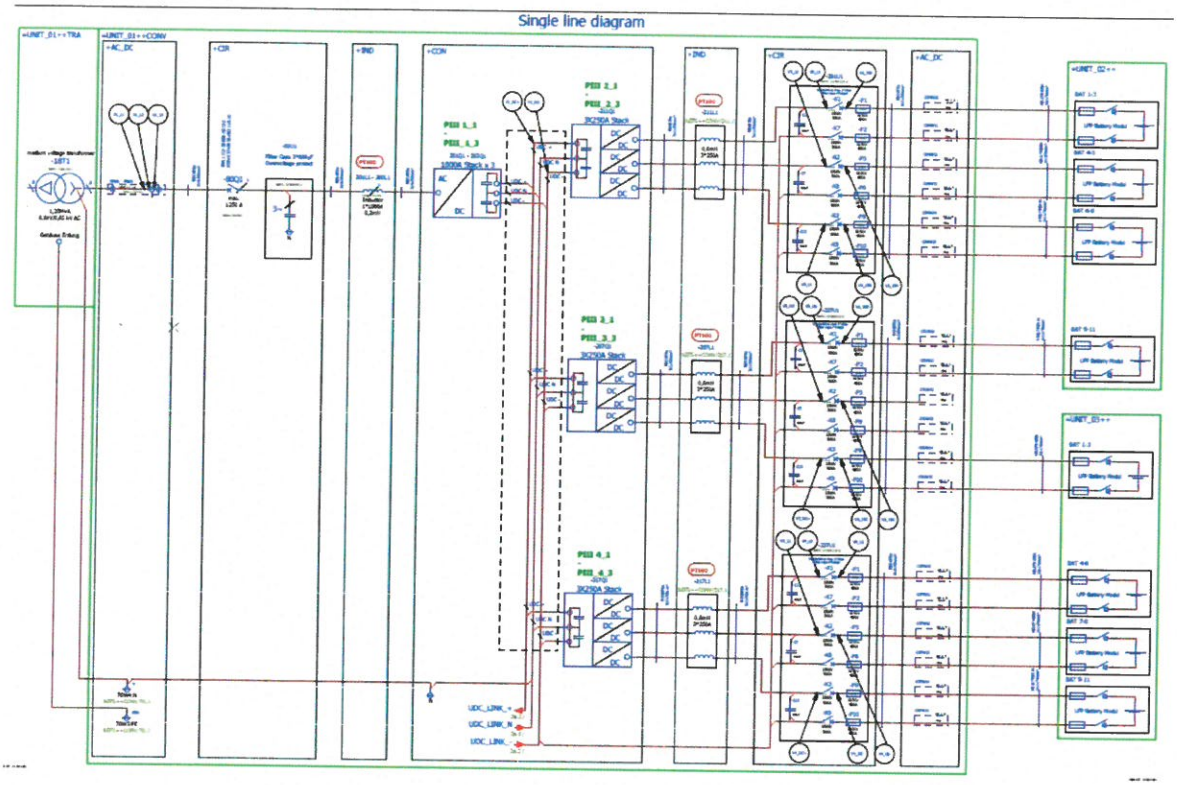
2.1 Responsibilities of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (FAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

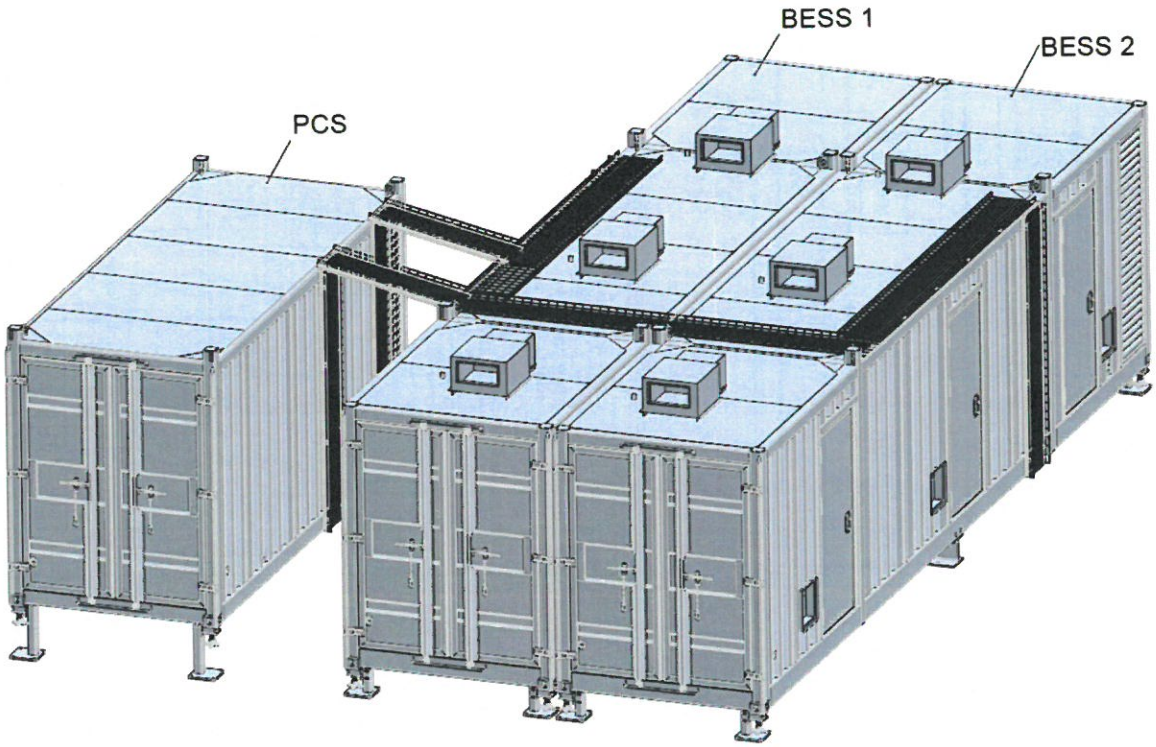
2.2 Responsibilities of the customer

- Dispatch of specialised personnel to FREQCON GmbH, inspection of the acceptance results and documented data by the specialised personnel
- Confirmation of the factory acceptance report by specialised personnel

2.3 Single Line Diagram



2.4 General Arrangement



3 Converter (PCS)

3.1 Reference Documents Converter (PCS)

Document Title	Document Name
Overall Schematics	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62

3.2 PCS Tests

3.2.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

Remarks:

3.2.2 Visual Inspection of Control Cabinet 1

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR01	Test		Result
1.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	
1.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No sharp edges or recognisable damage present.	
1.3	**Wires and cables** lids cover & tidy cables	**Test Layout:** Visually inspect cable connections and wires inside the control cabinet for perfect condition and loose parts.	☐ OK ☒ Defects ☐ N/A
		Pass Fail Criteria: Cable connections in perfect condition, no loose parts present.	
1.4	**Compliance with circuit diagram** I/O check report	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).	☐ OK ☒ Defects ☐ N/A
		Pass Fail Criteria: • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	
1.5	**Control elements labelling**	**Test Layout:** Check if the operating elements on the control cabinet door are labelled according to the circuit diagram.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The operating elements are labelled according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	

1.6	**Control elements description** Missing manual	**Test Layout:** Check if the operating elements are explained in the operating manual. **Pass Fail Criteria:** The operating elements are explained in the operating manual. **Reference document:** 10354_23A2007_YYMMDD_Operating_Manual_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	☐ OK ☒ Defects ☐ N/A
1.7	**Data interface** Not clear	**Test Layout:** Check if data interface complies with the schematic. **Pass Fail Criteria:** The data interface corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☐ Defects ☒ N/A
1.8	**Earthing**	**Test Layout:** Check if the control cabinet is properly earthed in accordance with the circuit diagram. **Pass Fail Criteria:** The control cabinet is properly earthed.	☒ OK ☐ Defects ☐ N/A
1.9	**Power supply**	**Test Layout:** Check the AC connection terminals of the control cabinet. Check if all three phases provide 230 V AC by using a Multimeter. **Pass Fail Criteria:** All three phases of the AC supply provide 230 V AC.	☒ OK ☐ Defects ☐ N/A
1.10	**UPS**	**Test Layout:** Check if the control cabinet is properly earthed in accordance with the circuit diagram. **Pass Fail Criteria:** The UPS complies with the specification. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A

1.11	**Warnings**	**Test Layout:** Check if the required warning signs are located on the cabinet doors. **Pass Fail Criteria:** The required warning signs are located on the cabinet doors. **Reference document:** FORM_QS002_Warnhinweise_20231013_Rev3-0	☒ OK ☐ Defects ☐ N/A

Remarks:
Change table on control cabinet to CTRL 1 & 2

3.2.3 Visual Inspection of Control Cabinet 2

Check all system components, including external ones, to ensure that they are in perfect condition.
Document the qualification results in the following table.

TR01	Test		Result
1.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust.	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	
1.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages.	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No sharp edges or recognisable damage present.	
1.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the control cabinet for perfect condition and loose parts.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Cable connections in perfect condition, no loose parts present.	
1.4	**Compliance with circuit diagram** • Add lable on 24V U1 • Lable on cables	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).	☐ OK ☒ Defects ☐ N/A
		Pass Fail Criteria: • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	
1.5	**Earthing**	**Test Layout:** Check if the control cabinet is properly earthed in accordance with the circuit diagram.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The control cabinet is properly earthed. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	
1.6	**Power supply**	**Test Layout:** Check the AC connection terminals of the control cabinet. Check if all three phases provide 230 V AC by using a Multimeter.	☒ OK ☐ Defects ☐ N/A

Is this works on 24V DC

		Pass Fail Criteria: All three phases of the AC supply provide 230 V AC.	
1.8	**Warnings**	**Test Layout:** Check if the required warning signs are located on the cabinet doors.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The required warning signs are located on the cabinet doors. **Reference document:** FORM_QS002_Warnhinweise_20231013_Rev3-0	

Remarks and description of defects:

3.2.4 Visual inspection of Converter Cabinets

Check all system components, including external ones, to ensure that they are in perfect condition.
Document the qualification results in the following table.

TR02	Test		Result
2.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	
2.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No sharp edges or recognisable damage present.	
2.3	**Wires and cables** lables on cables	**Test Layout:** Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts.	☐ OK ☒ Defects ☐ N/A
		Pass Fail Criteria: Cable connections are in perfect condition, no loose parts present.	
2.4	**Compliance with circuit diagram**	**Test Layout:** Visually inspect the following power components for compliance with the circuit diagram: • AC IGBTs • DC IGBTs • AC inductors • DC inductors • AC Filter	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The power components (IGBT, choke, filter) correspond to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	
2.5	**Protective elements** Closure covers are mounted before transport	**Test Layout:** Check correct installation of protective elements according to the circuit diagram.	☒ OK ☒ Defects ✓ ☐ N/A
		Pass Fail Criteria: The protective elements are installed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	

2.6	**Connection busbars**	Check if connection busbars are installed according to the circuit diagram. **Pass Fail Criteria:** The connection busbars are installed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
2.7	**Earthing**	**Test Layout:** Check control cabinet for proper earthing. Refer to circuit diagram. **Pass Fail Criteria:** The control cabinet is properly earthed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
2.8	**Smoke detectors**	**Test Layout:** Check if smoke detectors are installed in the IGBT cabinet according to the circuit diagram. **Pass Fail Criteria:** Smoke detectors are installed in the IGBT cabinet according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
2.9	**Smoke detector test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal triggers "301024: Supply: Smoke detector feedback tripped" alarm and is displayed on HMI/WebVisu. Hardware Trigger: Smoke FG1	☒ OK ☐ Defects ☐ N/A

Remarks and description of defects:
Smoke → 178k2 + XT1 3,4 80 Q1 ☒ OK

3.3 Visual inspection of Converter Cooling System

Check the correct installation and connection of the cooling system. Document the qualification results in the following table.

TR03	Test		Result
3.1	**Leakage and connections check**	**Test Layout:** Check the converter water cooling system for proper connection and leaks. Run cooling system and perform visual check of connections and check for leaks	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: All connections are properly connected and no leakage present.	
3.2	**Pressure check** 4,2 bar	**Test Layout:** Check whether the pressure of the cooling system is above 3 bar. Check on the manometer of the converter cooling system cabinet (COSY) and verify value on HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Manometer and HMI/WebVisu indicate a pressure of 3 bar.	
3.3	**Water drop check**	**Test Layout:** Check that no drops of water can be seen at the connection points of the coolant hoses.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No water on the connection points of coolant hoses.	

Remarks:

- Drain over pressure bottle collection
- Change & check coolant at yard

3.4 Function test

Check whether the electrical power and signal transmission meets the agreed requirements. Document the qualification results in the following table.

TR04	Test		Result
4.1	**Supply voltage control cabinet**	**Test Layout:** Switch on the control cabinet by applying the supply voltage or turning on the main switch. The control unit starts up properly.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Pass: - Simotion turns on - HMI turns on properly and WebVisualization (WebVisu) access is active - Access to Simotion WebVisu is established and "Run" state of Simotion can be confirmed	
4.2	**Feedback signals**	**Test Layout:** Exemplary control of system feedback and error evaluation, for example by manually triggering fuses. Errors are output correctly.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Random sampling: The status is correctly indicated by the red Error LED on the control cabinet 1 door. The error message can be reset by pressing the reset button on the control cabinet.	
4.3	**Smoke detectors**	**Test Layout:** Test the smoke detector in PCS CON-cabinet with test spray.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: The smoke detectors trigger accordingly and an error (Error level 4) is generated.	

4.4	**Cabinet Fans**	**Test Layout:** Testing the cabinet fans by simulating increased temperature values of the cabinets or direct control of the fans by the control system. **Pass Fail Criteria:** Cabinet fans activate according to temperature threshold set in the control system.	☒ OK ☐ Defects ☐ N/A
4.5	**Converter liquid cooling system** check cooling water level	**Test Layout:** Converter liquid cooling system test: Switch on the cooling system. The cooling system heats the cooling water as required. Check the heat exchangers by simulating the cooling water temperature. **Pass Fail Criteria:** - Heat exchanger switches on and off correctly (Visual check) - **"Preheating"** status is correctly indicated by the **yellow "Preheating** LED" on the control cabinet. - Pump is running (visual check) - Heater is heating up the coolant (check coolant temperature on HMI/WebVisu)	☐ OK ☐ Defects ☐ N/A
4.6	**AC connection**	**Test Layout:** Apply the operating voltage (if not already applied). Check the measured voltages for plausibility with Multimeter at AC connection point. The HMI/WebVisu displays the mains voltage correctly. The measured Multimeter values correspond to the values displayed on the HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A
4.7	**Converter pre-charging**	**Test Layout:** Pre-charging of converter. **Pass Fail Criteria:** - Converter is pre-charged from the mains and the 3WL main circuit breaker (80Q1) switches-on. - **"Ready for Operation"** status is indicated by the **green "Ready for Operation"** LED on the control cabinet door.	☐ OK ☐ Defects ☐ N/A
4.8	**IGBTs**	**Test Layout:** IGBT activation **Pass Fail Criteria:** - IGBTs can be switched on without any problems. - DC link is regulated to the set voltage. - **"Operating"** status is indicated by the green **"Operating"** LED on the control cabinet door.	☐ OK ☐ Defects ☐ N/A
4.9	**Emergency stop**	**Test Layout:** Test of the emergency stop. Switching on the emergency stop or switching off the main switch when the inverter is in operation (DC-link control).	☐ OK ☐ Defects ☐ N/A

		Pass Fail Criteria: - Inverter immediately switches to OFF mode. - Red "Fault" LED starts glowing on control cabinet door. - AC main switch (80Q1) opens.	
4.10	**Back-to-Back Test**	**Duration: After reaching 1000 A duration test of 10 min.** **Test Layout:** Back-to-Back Test: At 400 V AC connection Increase the AC current setpoint value slowly to 1000 A output and keep this value for 10 minutes. - 10 A - 100 A - 200 A - ... - 1000 A ✓ Heat run: Check if temperatures of - IGBTs - Inductors - Coolant of converter cooling system are within the permissible ranges by verifying the temperature values displayed on the HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Back-to-Back Test: AC current output of 1000 A is displayed correctly on the HMI/WebVisu according to setpoint. Heat run: IGBT, inductor and converter cooling system coolant temperatures are below the temperature thresholds set in the control system. ✓	
4.10	**DC ports** only 160 A due to connection configuration	**Duration: After reaching 250 A test duration is 10 min.** **Test Layout:** DC-ports connection Increase the DC current setpoint slowly to 250 A and keep this value for 10 minutes. Heat run: Check if temperatures of - IGBTs - Inductors - Coolant of converter cooling system are within the permissible ranges by verifying the temperature values displayed on the HMI/WebVisu.	

Different mode of operation when in the yard
Test will be finally performed after battery modules are installed → SAT

		Pass Fail Criteria: Back-to-Back Test: DC current output of 250 A is displayed on the HMI/WebVisu according to setpoint. Heat run: IGBT, inductor and converter cooling system coolant temperatures are below the temperature thresholds set in the control system.	☒ ok
4.11	**Measurements**	**Test Layout:** Check if the measured values (temperatures, voltages and currents) are properly collected by the Simotion (PCS main controller) and verify by using a multimeter or current clamp at DC and AC side. **Pass Fail Criteria:** Values measured with multimeter are +/- 5% correspond to the values displayed on the HMI/WebVisu.	☐ OK ☐ Defects ☐ N/A
4.12	**Switching-off**	**Test Layout:** Switching off the inverter. The inverter is properly switched off by removing the control bits. **Pass Fail Criteria:** "OFF" state is indicated by the HMI/WebVisu.	☐ OK ☐ Defects ☐ N/A
4.13	**UPS** not perform.	**Test Layout:** Checking the UPS functionality. If the auxiliary supply fails (e.g. by activating the fuse of the AC power supply unit), the control cabinet continues to be supplied by the UPS. **Pass Fail Criteria:** After the defined time, the control cabinet is switched off completely. When the voltage returns, the control unit starts up again and the UPS battery is charged.	☐ OK ☐ Defects ☐ N/A
4.14	**WebVisu/HMI**	**Test Layout:** Check the Web Visualisation (WebVisu) running on the control cabinet HMI for proper functionality **Pass Fail Criteria:** Select each individual HMI (WebVisu) pages and check behaviour (lag during selection or scrolling, correct display of values and system components). The visualisation is functional.	☒ OK ☐ Defects ☐ N/A

Remarks:
Couldn't enter PCS = 0 no light check or physical measurement Test: 4,5; 4,7; 4,8; 4.9; 4.11; 4,12; 4,13

4 BESS 1

4.1 Reference Documents BESS 1

Document Title	Document name
Schematic	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62

4.2 Battery Cabinets Tests

4.2.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. Circuit diagram of battery cabinets
2. General arrangement overview
3. Interface documentation (if available)

Remarks:

4.2.2 Visual inspection of Battery Cabinets

Check system components of 3 battery cabinets (one cabinet in each container section) inside BESS 1 container, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR05	Test		Result
5.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust. **Pass Fail Criteria:** Covers and interior are clean, without dirt or rust.	☒ OK ☐ Defects ☐ N/A
5.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages **Pass Fail Criteria:** No sharp edges or recognisable damage present.	☒ OK ☐ Defects ☐ N/A
5.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the battery cabinets for perfect condition and no loose parts. **Pass Fail Criteria:** Cable connections are in perfect condition, no loose parts present.	☒ OK ☐ Defects ☐ N/A
5.4	**Protective elements**	**Test Layout:** Check correct installation of protective elements according to circuit diagram. **Pass Fail Criteria:** Protective elements are installed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
5.5	**Earthing** need to connect ⏚ to screens mΩ limit protocols & reading	**Test Layout:** Check battery cabinet for proper earthing. Refer to circuit diagram. **Pass Fail Criteria:** Battery cabinet is properly earthed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☒ Defects ☐ N/A
5.6	**Smoke detectors**	**Test Layout:** Check if smoke detectors are installed in battery cabinet according to circuit diagram.	

		Pass Fail Criteria: Smoke detectors are installed in battery cabinet according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
5.7	**Fire extinguishing system (Stat-X)** loose cable	**Test Layout:** Check if Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram. **Pass Fail Criteria:** Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
5.8	**Control plate** I/O check & QAQC doc	**Test Layout:** Check if control plate in the bottom section of the battery cabinet is installed according to circuit diagram. **Pass Fail Criteria:** Control plate is installed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☒ Defects ☐ N/A
5.9	**CO Sensor and Alarm Unit**	**Test Layout:** Check if CO Sensor and Alarm Unit are installed according to circuit diagram. **Pass Fail Criteria:** CO Sensor and Alarm Unit are installed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
5.10	**Smoke detector test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal will trigger "Thermal runaway" procedure and displayed on HMI.	☒ OK ☐ Defects ☐ N/A
5.11	**CO sensor test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal will trigger "Thermal runaway" procedure and displayed on HMI.	☒ OK ☐ Defects ☐ N/A

5.12	**H2 Sensor Test**	**Test Layout:** H2 Gas Alarm Test: Simulate trigger value in software from gas sensor and check if exhaust units and fire dampers operate properly. Check if gas alarm feedback is properly transmitted via hardwired signals.	☐ OK ☐ Defects ☒ N/A
		Pass Fail Criteria: After gas alarm the fire dampers open and the exhaust units start venting out the containers. Gas alarm feedback relay has opened. An error message is displayed on the HMI/WebVisu.	

Remarks:
Stat - x - loose cable also extra cable on cabinet control plate - ask from VO certificate we can't certify Cables are only MARKED not labled

5 BESS 2

5.1 Reference Documents BESS 2

Document Title	Document name
Schematic	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62

5.2 Battery Cabinets Tests

5.2.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

4. Circuit diagram of battery cabinets
5. General arrangement overview
6. Interface documentation (if available)

Remarks:

5.2.2 Visual inspection of Battery Cabinets

Check system components of 3 battery cabinets (one cabinet in each container section) inside BESS 1 container, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR05	Test		Result
6.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust. **Pass Fail Criteria:** Covers and interior are clean, without dirt or rust.	☑ OK ☐ Defects ☐ N/A
6.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages **Pass Fail Criteria:** No sharp edges or recognisable damage present.	☒ OK ☐ Defects ☐ N/A
6.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the battery cabinets for perfect condition and no loose parts. **Pass Fail Criteria:** Cable connections are in perfect condition, no loose parts present.	☐ OK ☐ Defects ☐ N/A
6.4	**Protective elements**	**Test Layout:** Check correct installation of protective elements according to circuit diagram. **Pass Fail Criteria:** Protective elements are installed according to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
6.5	**Earthing**	**Test Layout:** Check battery cabinet for proper earthing. Refer to circuit diagram. **Pass Fail Criteria:** Battery cabinet is properly earthed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☒ Defects ☐ N/A
6.6	**Smoke detectors**	**Test Layout:** Check if smoke detectors are installed in battery cabinet according to circuit diagram.	

		Pass Fail Criteria: Smoke detectors are installed in battery cabinet according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
6.7	**Fire extinguishing system (Stat-X)**	**Test Layout:** Check if Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram. **Pass Fail Criteria:** Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
6.8	**Control plate**	**Test Layout:** Check if control plate in the bottom section of the battery cabinet is installed according to circuit diagram. **Pass Fail Criteria:** Control plate is installed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☐ OK ☒ Defects ☐ N/A
6.9	**CO Sensor and Alarm Unit**	**Test Layout:** Check if CO Sensor and Alarm Unit are installed according to circuit diagram. **Pass Fail Criteria:** CO Sensor and Alarm Unit are installed according to circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62	☒ OK ☐ Defects ☐ N/A
6.10	**Smoke detector test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal will trigger "Thermal runaway" procedure and displayed on HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A
6.11	**CO sensor test**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** Alarm signal will trigger "Thermal runaway" procedure and displayed on HMI/WebVisu.	☒ OK ☐ Defects ☐ N/A

6.12	**H2 Sensor Test**	**Test Layout:** H2 Gas Alarm Test: Simulate trigger value in software from gas sensor and check if exhaust units and fire dampers operate properly. Check if gas alarm feedback is properly transmitted via hardwired signals.	☒ N/A
		Pass Fail Criteria: After gas alarm the fire dampers open and the exhaust units start venting out the containers. Gas alarm feedback relay has opened. An error message is displayed in the WebVisu.	

Remarks:

6 Employees Present

Identify each employee involved in the execution of this protocol. Document the person's name, signature, name abbreviation and date in the following table:

Company Name	Employee Name	Employee Signature	Abbreviation	Date
SHELL CLOSS WIND	ALESSANDRO SUTTO			18/7/24
MARTIN TAYLOR	CROSSWIND			18/07/24
ABL	Dominik Mähl			18.07.2024
FREQCON	C. PALENZUELA			18.07.2024

	Yes/No
All persons involved in the factory acceptance test were documented.	☐ Y ☐ N

Remarks:

7 Examination and authorisation

The test report becomes the factory acceptance report as soon as the individual test reports have been completed and labelled with a test date. The factory acceptance report is sent to the customer for confirmation and the results must be documented in the TR8 test report.

TR05	Examination and authorisation of execution
Check the test results and original data. Final assessment for factory acceptance.	
☒ PASSED	☐ NOT PASSED
If there are any deviations, please complete the following section.	
Evaluate whether or not the existing deviation has an influence on the final factory acceptance test.	
☐ YES	☒ NO

Remarks:
SEE OVERALL PUNCHLIST

Carried out by:	CARLOS PALENZUELA FREQCON GmbH	Date:	18.07.2024 DD/MM/YYYY
Authorised by:	FAT Customer	Date:	18.07.2024 DD/MM/YYYY

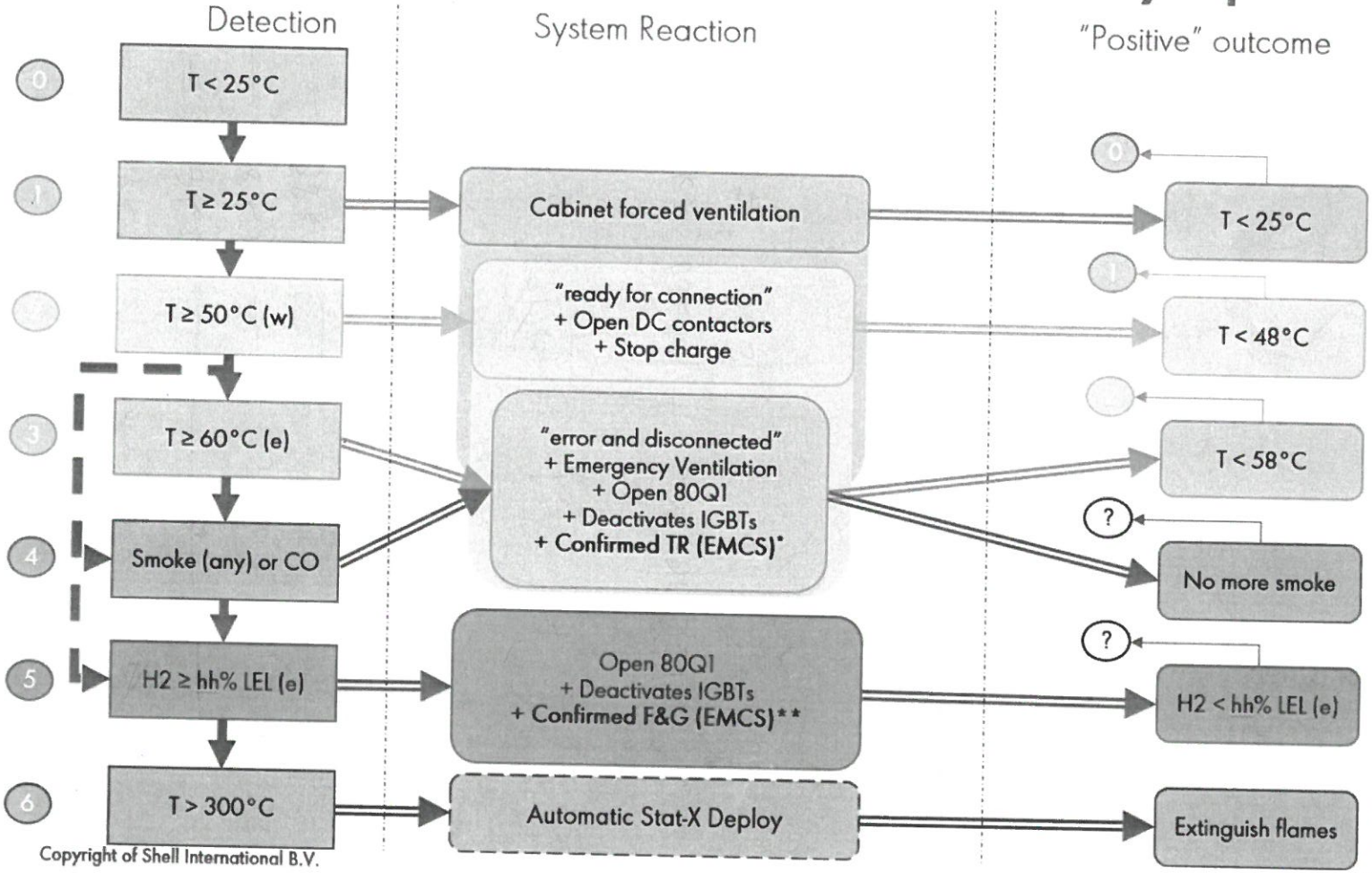
Appendix A - Measurement data for the performance test (if performed)

Insert prepared tables for performance values/times/temperatures/etc.

Smoke FG1 – Smoke PCS → ESD1D
Gas FG2 – H2 Sensor BESS 1&2 → ESD1D
Therm. rise TR – Triggered HH temp (760°C) or CO det or Smoke → ESD1

BMS - Confirmed new Process Fire Safety operations

*Aux still on
**Full platform shut down with H2 blowout



Automatic reset – no operator action needed
Once the temperature is back in the correct range, operation can continue normally. Point 2 will generate a warning log.

Remote reset – operator action needed

*These triggers will also send a message to the EMCS as "**fire alarm**" – Reset To be discussed with EMCS and BLPH*

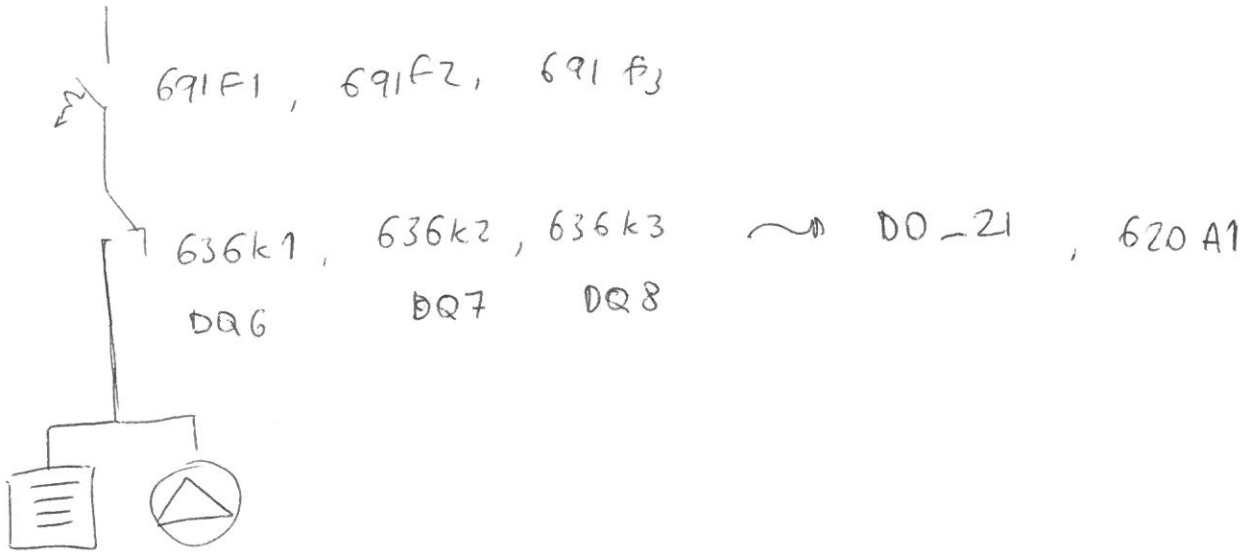
No reset

Copyright of Shell International B.V.

CTRL 1.3 - DO - 04 NO

DQ0 Gas alarm — 138k1 — XT1 1,2
DQ1 Smoke alarm — 138k2 — 3,4
DQ2 PLC fault — 138k3 — 5,6
DQ3 TR — 138k4 — 7,8

PANS



FREQCON

FAT Test Protocol

20FT PCS Container

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-03-21	S. Laudahn	First version
2.0	2024-07-06	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Creator	21.03.2024	S. Laudahn
Tested by		
Released by		

Table 2: Release overview

Imprint

Software development
Hardware development and production
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

Email:
info@freqcon.com

Contact information
For further information, please call us or send an e-mail to info@freqcon.com.
Visit our website http://www.freqcon.com for more information about our products and solutions.

Contents

1 About this document 6
2 Responsibilities 6
2.1 Responsibilities of FREQCON GmbH 6
2.2 Responsibilities of the customer 6
3 General Arrangement 7
4 Container Inspection 7
4.1 Prerequisites 7
4.2 Container Visual Inspection (Exterior) 8
4.3 Container Visual Inspection 9
5 Employees present 10
6 Examination and authorisation 11

Identification

Product and type designation

Container type
40FT BESS

Serial No.
FRQ-53396000001

Document number
23A2007_240706_FAT_20FT_PCS_Container_EN_v2.0

Name and address of the manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this document

This acceptance report is used to assess compliance with all design and customer requirements of the tested system.

The factory acceptance test (FAT) is carried out by specialised personnel before delivery of the system and the result is checked by the customer.

2 Responsibilities

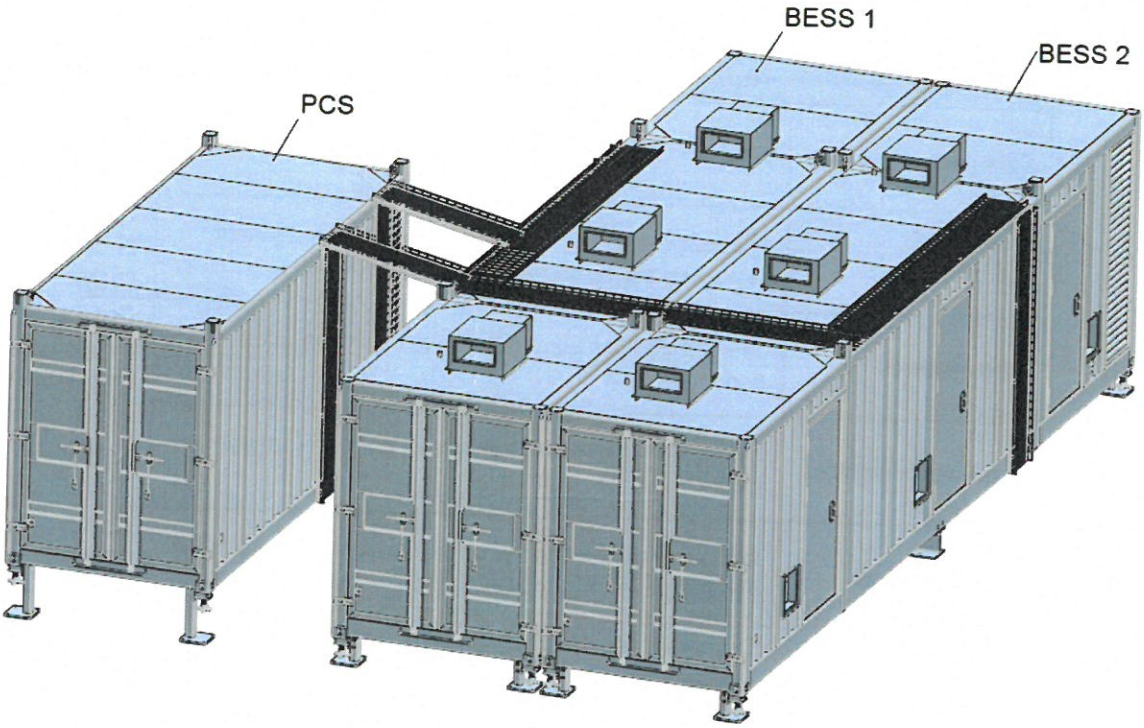
2.1 Responsibilities of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (FAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

2.2 Responsibilities of the customer

- Dispatch of specialised personnel to FREQCON GmbH, inspection of the acceptance results and documented data by the specialised personnel
- Confirmation of the factory acceptance report by specialised personnel

3 General Arrangement



4 Container Inspection

4.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. CAD of containers

Remarks:

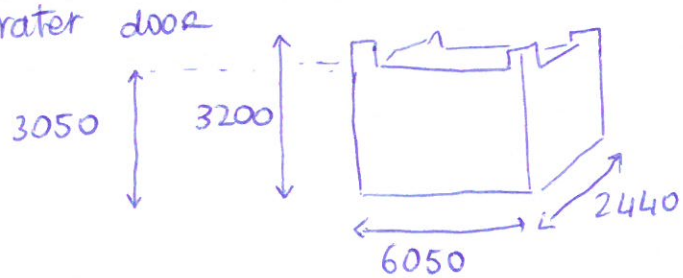
4.2 Container Visual Inspection (Exterior)

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Container colour	Required colour/RAL colour code: 7035 (Light Grey)	☒ OK ☐ Defects ☐ N/A
Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☒ OK ☐ Defects ☐ N/A
Performances	The bushings correspond in size and position to the underlying CAD	☒ OK ☐ Defects ☐ N/A
Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☐ OK ☒ Defects ☐ N/A
Doors/openings	Doors and other openings of the container correspond in size and position to the CAD on which they are based	☒ OK ☐ Defects ☐ N/A
Cooling niche	The cooling recess corresponds to the underlying CAD. The cooling units are in the correct position and can draw in sufficient fresh air.	☒ OK ☐ Defects ☐ N/A
Warnings	The required warning signs are located on the personnel doors	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:

PCS container = FRQ-5339600 0001
Minor rust spots around container feet
Earthing lugs painted
Blue ferrules on earthing cable on access door
~~Missing lock handle on door~~ closed
Missing grounding of cooling niche doors
"Push to open" inside operater door



4.3 Container Visual Inspection

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☒ OK ☐ Defects ☐ N/A
Light/sockets	Sufficient lighting is available. There are service sockets (230 V) in the container interior. The sockets and lighting are usable and easily accessible.	☒ OK ☐ Defects ☐ N/A
Air conditioning	The air conditioning units are in the correct position and at least one control unit for the air conditioning units is present. The air conditioning units are functional and can cool the room to a satisfactory level.	☒ ☐ OK ☐ Defects ☐ N/A
Personal security	All steps in the container (if present) are marked in signal colours (yellow/black). There are no sharp edges in the container.	☐ OK ☒ Defects ☐ N/A
Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☐ OK ☒ Defects ☐ N/A
Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
- Missing yellow/black marking on step entry door - Missing cable ladders on back door in transformer area for HV. AC side cables

5 Employees present

Identify each employee involved in the execution of this protocol. Document personal names, signature, name abbreviation and date in the following table:

Company Name	Employee Name	Signature	Abbreviation	Date
SHELL	ALESSANDRO IUTTO			17/07/24
CROSSWIND	MARTIN TAFLAN			17/07/24
ABL	Dominik Mähl			17.07.2024
FREQCON	CARLOS PALENZUELA			17.07.24
Fulcrum obo Crosswind	Ali Tahanwarf	Johan. Ki		17.07.24

	Yes/No
All persons involved in the factory acceptance test were documented.	☐ Y ☐ N

Remarks and description in case of defects:
SEE ALSO OVERALL PUNCH-LIST

6 Examination and authorisation

The test report becomes the factory acceptance report as soon as the individual test reports have been completed and labelled with a test date. The factory acceptance report is sent to the customer for confirmation and the results must be documented in the TR8 test report.

TR8	Examination and authorisation of execution
Checking the test results and original data. Final assessment for factory acceptance	
☒ PASSED	☐ NOT PASSED
If there are any deviations, please complete the following section.	
Evaluate whether or not the existing deviation has an influence on the final factory acceptance test.	
☐ YES	☒ NO

Remark:
SEE OVERALL PUNCH LIST

Carried out by:	C Palan FREQCON GmbH	Date:	18.07.2024 DD/MM/YYYY
Authorised by:	FAT Customer	Date:	18.07.2024 DD/MM/YYYY

FREQCON

FAT Test Protocol

40FT BESS Container 1

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-03-21	S. Laudahn	First version
2.0	2024-07-06	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Creator	21.03.2024	S. Laudahn
Tested by		
Released by		

Table 2: Release overview

FREQCON

FAT Test Protocol

40FT BESS Container 1

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-03-21	S. Laudahn	First version
2.0	2024-07-06	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Creator	21.03.2024	S. Laudahn
Tested by		
Released by		

Table 2: Release overview

Imprint

Software development

Hardware development and production

Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

Email:
info@freqcon.com

Contact information

For further information, please call us or send an e-mail to info@freqcon.com.
Visit our website http://www.freqcon.com for more information about our products and solutions.

Contents

1 About this document 6
2 Responsibilities 6
2.1 Responsibilities of FREQCON GmbH 6
2.2 Responsibilities of the customer 6
3 General Arrangement 7
4 Container Inspection 7
4.1 Prerequisites 7
4.2 Container Visual Inspection (Exterior) 8
4.3 Container Visual Inspection 9
5 Employees present 10
6 Examination and authorisation 11

Identification

Product and type designation

Container type
40FT BESS

Serial No.
FRQ-53406000001

Document number
23A2007_240706_FAT_40FT_BESS_Container_1_EN_v2.0

Name and address of the manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this document

This acceptance report is used to assess compliance with all design and customer requirements of the tested system.

The factory acceptance test (FAT) is carried out by specialised personnel before delivery of the system and the result is checked by the customer.

2 Responsibilities

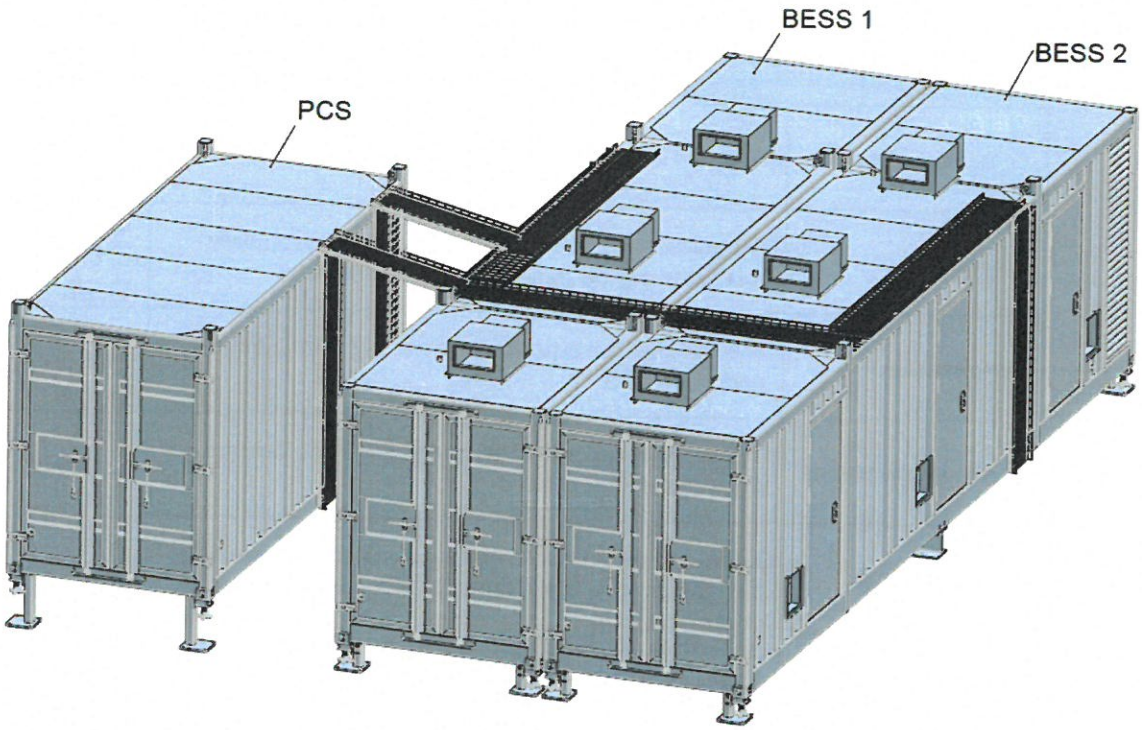
2.1 Responsibilities of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (FAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

2.2 Responsibilities of the customer

- Dispatch of specialised personnel to FREQCON GmbH, inspection of the acceptance results and documented data by the specialised personnel
- Confirmation of the factory acceptance report by specialised personnel

3 General Arrangement



4 Container Inspection

4.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. CAD of containers

Remarks:

4.2 Container Visual Inspection (Exterior)

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Container colour	Required colour/RAL colour code: 7035 (Light Grey)	☑ OK ☐ Defects ☐ N/A
Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☑ OK ☐ Defects ☐ N/A
Performances	The bushings correspond in size and position to the underlying CAD	☒ OK ☐ Defects ☐ N/A
Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☐ OK ☒ Defects ☐ N/A
Doors/openings	Doors and other openings of the container correspond in size and position to the CAD on which they are based	☒ OK ☐ Defects ☐ N/A
Cooling niche	The cooling recess corresponds to the underlying CAD. The cooling units are in the correct position and can draw in sufficient fresh air.	☒ OK ☐ Defects ☐ N/A
Warnings	The required warning signs are located on the personnel doors	☑ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
- BESS 1 = FRQ-5341200001 - COG should be marked & should be visible on all sides for lifting operations - finalize mounting cable tray cover on cooling niche - Earthing point on external is painted over - Earthing of cooling niche doors



4.3 Container Visual Inspection

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☒ OK ☐ Defects ☐ N/A
Light/sockets	Sufficient lighting is available. There are service sockets (230 V) in the container interior. The sockets and lighting are usable and easily accessible.	☒ OK ☐ Defects ☐ N/A
Air conditioning	The air conditioning units are in the correct position and at least one control unit for the air conditioning units is present. The air conditioning units are functional and can cool the room to a satisfactory level.	☒ ☐ OK ☐ Defects ☐ N/A
Personal security	All steps in the container (if present) are marked in signal colours (yellow/black). There are no sharp edges in the container.	☐ OK ☒ Defects ☐ N/A
Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☒ OK ☐ Defects ☐ N/A
Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
Gaskets on emergency doors → to be checked Sealing might be partial "push to open" sticker inside the access doors

5 Employees present

Identify each employee involved in the execution of this protocol. Document personal names, signature, name abbreviation and date in the following table:

Company Name	Employee Name	Signature	Abbreviation	Date
SHELL CROSSWIND	ALESSANDRO SUTTO			17/07/24
Fulkrum on behalf of crosswind	Mi Tahannazif	Tahan Jt		17.04.24
ABL	Dominik Mähl			17.07.2024
CROSSWIND	MARTIN TAYLOR			17/07/24
FREQCON	CARLOS PALENZUELA			17/07/24

	Yes/No
All persons involved in the factory acceptance test were documented.	☐ Y ☐ N

Remarks and description in case of defects:
SEE ALSO CONSOLIDATED PUNCH LIST

6 Examination and authorisation

The test report becomes the factory acceptance report as soon as the individual test reports have been completed and labelled with a test date. The factory acceptance report is sent to the customer for confirmation and the results must be documented in the TR8 test report.

TR8	Examination and authorisation of execution
Checking the test results and original data. Final assessment for factory acceptance	
☑ PASSED	☐ NOT PASSED
If there are any deviations, please complete the following section.	
Evaluate whether or not the existing deviation has an influence on the final factory acceptance test.	
☐ YES	☑ NO

Remark:

SEE OVERALL PUNCHLIST

Carried out by:	CARLOS PALENZUELA	Date:	18.07.2024
	FREQCON GmbH		DD/MM/YYYY
Authorised by:	[signature]	Date:	18.07.2024
	Customer		DD/MM/YYYY

FREQCON

FAT Test Protocol

40FT BESS Container 2

(Factory Acceptance Test)

Version	Date	Name	Description
1.0	2024-03-21	S. Laudahn	First version
2.0	2024-07-06	C. Palenzuela	Updated several sections

Table 1: Version overview

	Date	Name
Creator	21.03.2024	S. Laudahn
Tested by		
Released by		

Table 2: Release overview

Imprint

Software development
Hardware development and production
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

Email:
info@freqcon.com

Contact information
For further information, please call us or send an e-mail to info@freqcon.com.
Visit our website http://www.freqcon.com for more information about our products and solutions.

Contents

1 About this document 6
2 Responsibilities 6
2.1 Responsibilities of FREQCON GmbH 6
2.2 Responsibilities of the customer 6
3 General Arrangement 7
4 Container Inspection 7
4.1 Prerequisites 7
4.2 Container Visual Inspection (Exterior) 8
4.3 Container Visual Inspection 9
5 Employees present 10
6 Examination and authorisation 11

Identification

Product and type designation

Container type
40FT BESS

Serial No.
FRQ-53412000001

Document number
23A2007_240706_FAT_40FT_BESS_Container_2_EN_v2.0

Name and address of the manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this document

This acceptance report is used to assess compliance with all design and customer requirements of the tested system.

The factory acceptance test (FAT) is carried out by specialised personnel before delivery of the system and the result is checked by the customer.

2 Responsibilities

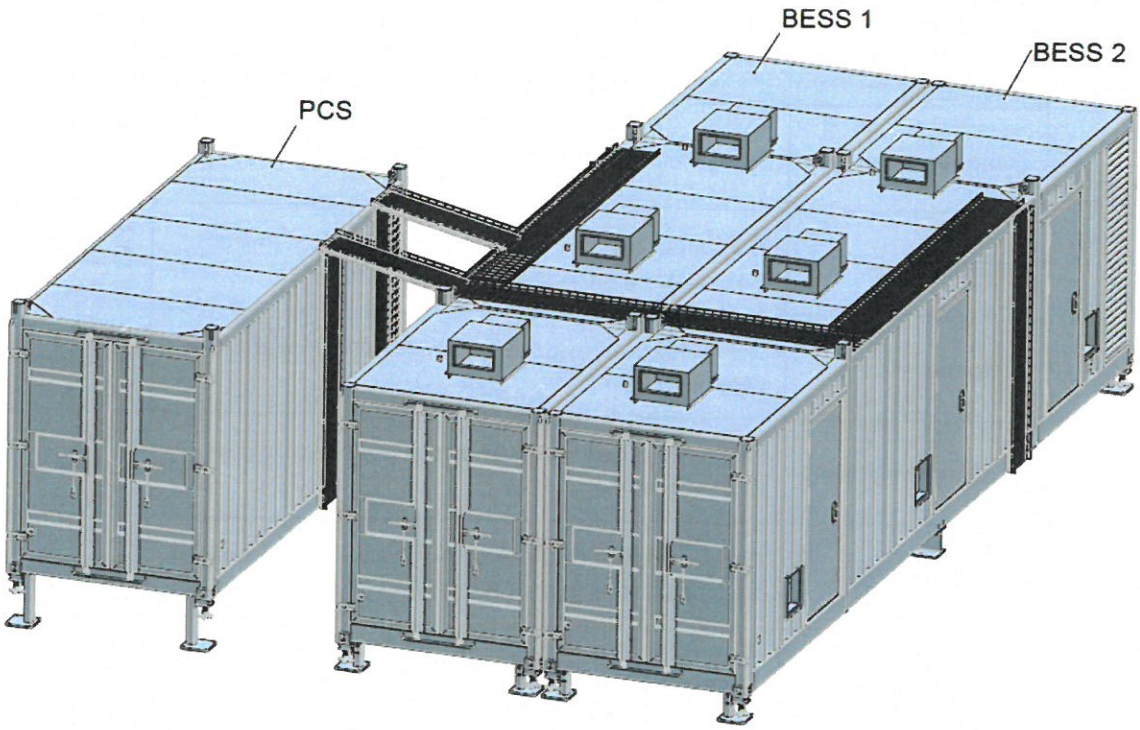
2.1 Responsibilities of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (FAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

2.2 Responsibilities of the customer

- Dispatch of specialised personnel to FREQCON GmbH, inspection of the acceptance results and documented data by the specialised personnel
- Confirmation of the factory acceptance report by specialised personnel

3 General Arrangement



4 Container Inspection

4.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. CAD of containers

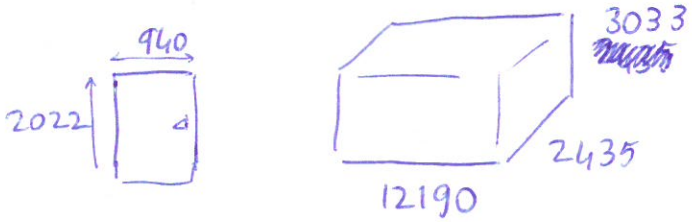
Remarks:

4.2 Container Visual Inspection (Exterior)

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Container colour	Required colour/RAL colour code: 7035 (Light Grey)	☒ OK ☐ Defects ☐ N/A
Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☒ OK ☐ Defects ☐ N/A
Performances	The bushings correspond in size and position to the underlying CAD	☒ OK ☐ Defects ☐ N/A
Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☐ OK ☒ Defects ☐ N/A
Doors/openings	Doors and other openings of the container correspond in size and position to the CAD on which they are based	☒ OK ☐ Defects ☐ N/A
Cooling niche	The cooling recess corresponds to the underlying CAD. The cooling units are in the correct position and can draw in sufficient fresh air.	☒ OK ☐ Defects ☐ N/A
Warnings	The required warning signs are located on the personnel doors	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
BESS 2 – FRQ-534060000 1 Earthing of cooling niche doors + spikes and sharp edges on grid + cable tray to be fixed



4.3 Container Visual Inspection

Check all system parts, including external parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

Examination		Result
Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☒ OK ☐ Defects ☐ N/A
Light/sockets	Sufficient lighting is available. There are service sockets (230 V) in the container interior. The sockets and lighting are usable and easily accessible.	☒ OK ☐ Defects ☐ N/A
Air conditioning	The air conditioning units are in the correct position and at least one control unit for the air conditioning units is present. The air conditioning units are functional and can cool the room to a satisfactory level.	☒ ☐ OK ☐ Defects ☐ N/A
Personal security	All steps in the container (if present) are marked in signal colours (yellow/black). There are no sharp edges in the container.	☐ OK ☒ Defects ☐ N/A
Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☒ OK ☐ Defects ☐ N/A
Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☒ OK ☐ Defects ☐ N/A

Remarks and description in case of defects:
Missing marking yellow/black on step Electrical cabinets = no ferrules on all cables no lables on cables & wires identification

5 Employees present

Identify each employee involved in the execution of this protocol. Document personal names, signature, name abbreviation and date in the following table:

Company Name	Employee Name	Signature	Abbreviation	Date
SHELL CROSSWIND	ALESSANDRO SUTTO			17/07/24
Fulltrum obo Crosswind	Ali Tahouazi			17.07.24
ABL	Dominik Mahl			17.07.2024
CROSSWIND	MARTIN TAYLOR			17/07/24

	Yes/No
All persons involved in the factory acceptance test were documented.	☐ Y ☐ N

Remarks and description in case of defects:
SEE ALSO CONSOLIDATED PUNCH LIST

6 Examination and authorisation

The test report becomes the factory acceptance report as soon as the individual test reports have been completed and labelled with a test date. The factory acceptance report is sent to the customer for confirmation and the results must be documented in the TR8 test report.

TR8	Examination and authorisation of execution
Checking the test results and original data. Final assessment for factory acceptance	
☒ PASSED	☐ NOT PASSED
If there are any deviations, please complete the following section.	
Evaluate whether or not the existing deviation has an influence on the final factory acceptance test.	
☐ YES	☒ NO

Remark:

SEE OVERALL PUNCHLIST

Carried out by:	CARLOS PALENZUELA	Date:	18.07.2024
	FREQCON GmbH		DD/MM/YYYY
Authorised by:		Date:	18-07-2024
	Customer		DD/MM/YYYY

STATRON
NON STOP POWER

Signed SAT report

FREQCON

SAT Protocol

Converter & BESS

(Site Acceptance Test)

Version	date	Name	Description of the
Draft	2024-03-26	J. Nitsch C. Palenzuela	First, preliminary version
1.0	2024-10-08	J. Nitsch C. Palenzuela	First, final version
1.1	2024-10-21	J. Nitsch C. Palenzuela	Updated tables
2.0	2024-10-30	M. Jahns C. Palenzuela	Updated document structure
2.1	2024-11-01	C. Palenzuela	Comments implementation and corrections
2.2	2024-11-21		Comments implementation and corrections

Table 1Version overview

	Date	Name
Created by	2024-03-26	J. Nitsch C. Palenzuela
Checked by	2024-03-26	J. Nitsch
Approved by	2024-03-26	C. Palenzuela

Table 2Authorisation overview

Imprint

Hardware development and production centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

E-mail:
info@freqcon.de
hardware@freqcon.de

Contact details

For further information, please contact us by phone or send us an e-mail to info@freqcon.com
You can also visit our website **at http://www.freqcon.com for** more information on our products and solutions.

Contents

1 About this Document 6
2 Responsibility 6
2.1 Responsibility of FREQCON GmbH 6
2.2 Responsibility of the customer 6
3 Device Description 7
3.1 Single Line Diagram 7
3.2 General Arrangement 8
4 PCS (Converter System) 9
4.1 Reference Documents 9
4.2 PCS Prerequisites 10
4.3 Visual inspection of Control Cabinet 1 11
4.4 Visual inspection of Control Cabinet 2 13
4.5 Visual inspection of Converter Cabinets 15
4.6 Visual Inspection of Converter Cooling System and Heat Exchanger 17
4.7 Power On 18
4.8 Software and Function Tests 21
5 BESS 1 and 2 24
5.1 Reference Documents 24
5.2 BESS Prerequisites 25
5.3 Container Visual Inspection BESS 1 26
5.4 Container Visual Inspection BESS 2 27
5.5 Power On BESS 1 28
5.6 Power On BESS 2 31
5.7 Function and Safety Critical Tests BESS 1, BESS 2 and PCS 34
6 Battery Modules 38
6.1 Reference Documents 38
6.2 Prerequisites 39
6.3 Installation Report 40
7 System Tests 41
7.1 Reference Documents 41
7.2 Prerequisites 42
7.1 Software and Function Tests 43
8 Employees Present 48
9 Check and Approval 50

Identification

Product and type designation

Device type
BESS 1 MW / 5MWh

Document number
23A2007_241030_SAT_BESS_EN_v2.0

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal information

This manual is protected by copyright. All rights are reserved by FREQCON GmbH. Reproduction of this document in whole or in part is only permitted within the legal provisions of copyright law. Any modification, censorship or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks in this document are the property of their respective owners.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 About this Document

The test report for site acceptance test (SAT) is intended to qualify whether the system fulfils the design requirements and the customer's requirements.

The site acceptance test (SAT) is carried out by specialised personnel after delivery of the system at customer site and the result is checked by the customer.

2 Responsibility

2.1 Responsibility of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (SAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

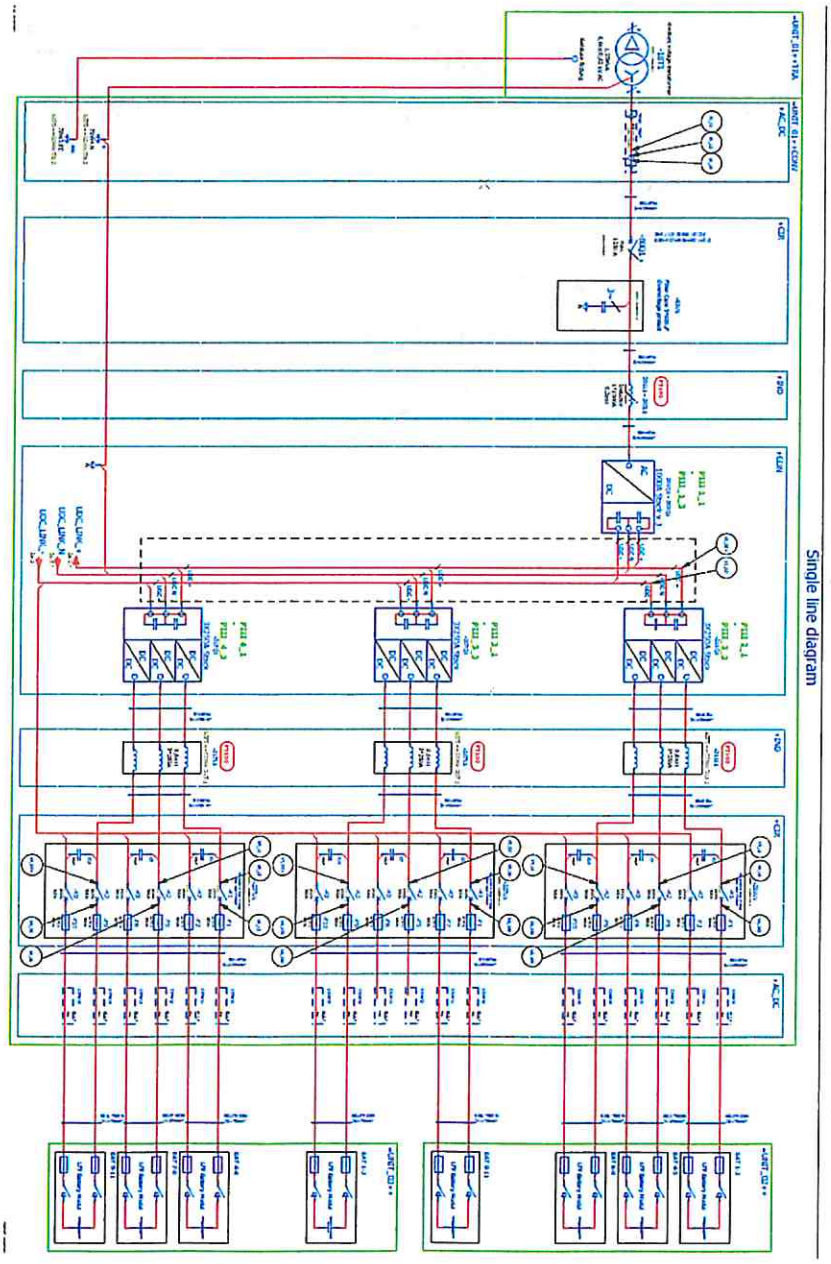
2.2 Responsibility of the customer

- Sending personnel to site, checking the test result and the data
- Approve the SAT protocol

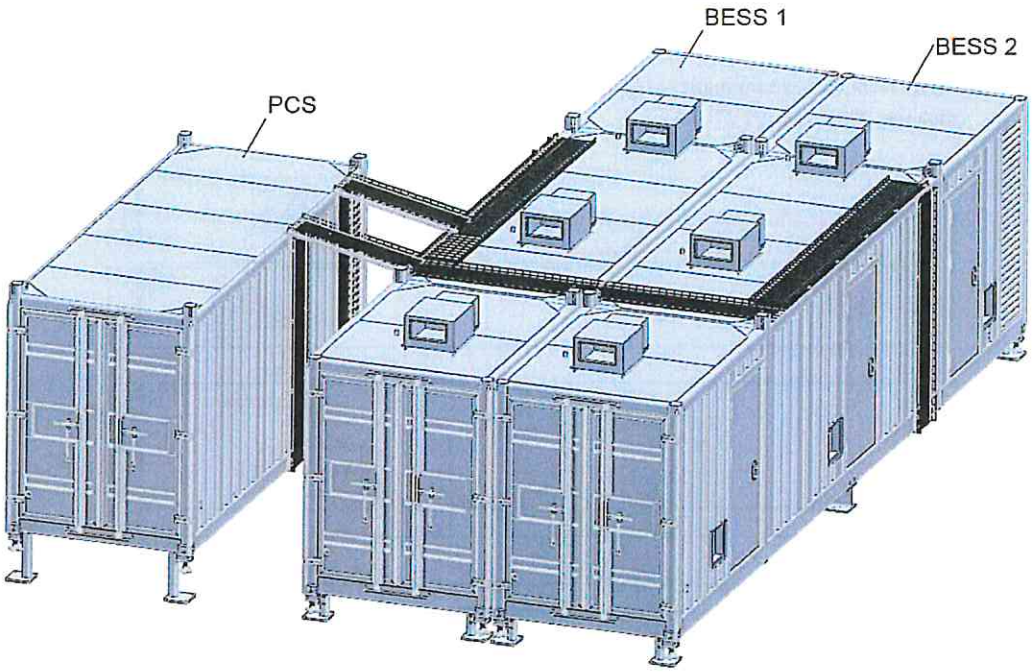
3 Device Description

3.1 Single Line Diagram

Extract from overall schematics "10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2"



3.2 General Arrangement



4 PCS (Converter System)

4.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3
FAT punchlist tracker	20240828 - punchlist - FRQ comments v2.4

4.2 PCS Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR01 test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding.

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400VAC aux PCS – *auxiliary load BESS B-200 <> 84W2*

Remarks:

4.3 Visual inspection of Control Cabinet 1

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR01	Test		Result
4.3.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust. **Pass Fail Criteria:** Covers and interior are clean, without dirt or rust.	☒ OK ☐ Defects ☐ N/A
4.3.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages **Pass Fail Criteria:** No sharp edges or recognisable damage present.	☒ OK ☐ Defects ☐ N/A
4.3.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts. **Pass Fail Criteria:** Cable connections are in perfect condition, no loose parts present.	☒ OK ☐ Defects ☐ N/A
4.3.4	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components). **Pass Fail Criteria:** • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_YYMMDD_Operating_Manual_ Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	☒ OK ☐ Defects ☐ N/A
4.3.5	**Touch panel**	**Test Layout:** Check if touch panel of HMI user interface is clean and without damage **Pass Fail Criteria:** The user interface of the touch panel is clean without damage	☒ OK ☐ Defects ☐ N/A
4.3.6	**Punch List Items Closed**	**Test Layout:** Review and confirm no category A open punch list items are outstanding. **Pass Fail Criteria:** No category A open punch list items are outstanding.	☒ OK ☐ Defects ☐ N/A
4.3.7	**LOTO**	**Apply LOTO as required.**	☒ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
ALESSANDRO SUTTO GERRY MCCAN FREDERIC HEIN	CARLOS PALENZUELA	23-11-2024

Remarks:

Missing labels on interface cable

13.03.25 - Labels added

4.4 Visual inspection of Control Cabinet 2

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR02	Test		Result
4.4.1	**Cleanliness**	**Test Layout:** Check covers and cabinet interior for cleanliness and rust.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	
4.4.2	**Metal sheets**	**Test Layout:** Check metal sheets for sharp edges and damages	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No sharp edges or recognisable damage present.	
4.4.3	**Wires and cables**	**Test Layout:** Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Cable connections are in perfect condition, no loose parts present.	
4.4.4	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. • Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_YYMMDD_Operating_Manual_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	
4.4.5	**Punch List Items Closed**	**Test Layout:** Review and confirm no category A open punch list items are outstanding.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No category A open punch list items are outstanding.	
4.4.6	**LOTO**	**Apply LOTO as required.**	☐ OK ☐ Defects ☒ N/A

Completed by	Witnessed by	Date
ALESSANDRO SUTO GERRY MCCAN FREDERIC KEIN	CARLOS PALENTUELA	28-11-2024

Remarks:

Naming labels on interface cables

13.03.25 – cables added

4.5 Visual inspection of Converter Cabinets

Check all system components, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR03	Test		Result
4.5.1	Cleanliness	Test Layout: Check covers and cabinet interior for cleanliness and rust. Pass Fail Criteria: Covers and interior are clean, without dirt or rust.	☒ OK ☐ Defects ☐ N/A
4.5.2	Metal sheets	Test Layout: Check metal sheets for sharp edges and damages Pass Fail Criteria: No sharp edges or recognisable damage present.	☒ OK ☐ Defects ☐ N/A
4.5.3	Wires and cables	Test Layout: Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts. Pass Fail Criteria: Cable connections are in perfect condition, no loose parts present.	☒ OK ☐ Defects ☐ N/A
4.5.4	Control elements description	Test Layout: Check if the operating elements are explained in the operating manual. Pass Fail Criteria: The operating elements are explained in the operating manual. Reference document: 10354_23A2007_YYMMDD_Operating_Manual_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x	☒ OK ☐ Defects ☐ N/A
4.5.5	Punch List Items Closed	Test Layout: Review and confirm no category A open punch list items are outstanding. Pass Fail Criteria: No category A open punch list items are outstanding.	☒ OK ☐ Defects ☐ N/A
4.5.6	LOTO	Apply LOTO as required.	☒ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
ALESSANDRO SUTTO GERRY MCCAN FREDERIC HEIN	CARLOS PALENUELA	28-11-2024
Remarks:		

4.6 Visual Inspection of Converter Cooling System and Heat Exchanger

Check the correct installation and connection of the cooling system. Document the qualification results in the following table.

TR04	Test		Result
4.6.1	**Water drop check**	**Test Layout:** Check that no drops of water can be seen at the connection points of the coolant hoses.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No water on the connection points of coolant hoses.	
4.6.2	**Heat exchanger visual inspection**	**Test Layout:** Check the external heat exchanger for proper connection and mechanical stability.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Heat exchanger is properly mechanically installed	
4.6.3	**I/O check**	**Test Layout:** Check the electrical connection to the Heat exchanger unit	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Heat exchanger is properly connected	

Completed by	Witnessed by	Date
~~ALEF~~ ADNAN AKCAM	ALESSANDRO TUTTO	14.3.2025
Remarks:		

4.7 Power On

Sequentially power on all the subsystems. Document the qualification results in the following table.

Please refer to the SLD on page 1a and 2a of the overall schematics for PCS:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Note:
Prior to carrying out any work, the commissioning engineer to check the current version of the reference document is available.

TR05	Test		Result
4.7.1	**Check LOTO of subsystem**	**Test Layout:** Check that all breakers feeding subsystems are turned to OFF position and LOTO **Pass Fail Criteria:** LOTO confirmed	☑ OK ☐ Defects ☐ N/A
4.7.2	**Remove LOTO from main feeding source (RM board)**	**Test Layout:** Remove LOTO from main feeding source and measure voltage across incoming cable. **Pass Fail Criteria:** Voltage is read at incoming feeding terminals.	☒ OK ☐ Defects ☐ N/A
4.7.3	**Supply voltage control cabinet**	**Test Layout:** Switch on 190F3 **Pass Fail Criteria:** Cabinet lights and socket power up	☒ OK ☐ Defects ☐ N/A
4.7.4	**Supply voltage control cabinet**	**Test Layout:** Switch on 191F1 **Pass Fail Criteria:** Clima 1 power up	☒ OK ☐ Defects ☐ N/A
4.7.5	**Supply voltage control cabinet**	**Test Layout:** Switch on 191F2 **Pass Fail Criteria:** Clima 2 power up	☒ OK ☐ Defects ☐ N/A
4.7.6	**Supply voltage control cabinet**	**Test Layout:** Switch on 101Q1. The control unit starts up properly. **Pass Fail Criteria:** Pass: - Simotion turns on - HMI turns on properly and WebVisualization (WebVisu) access is active Access to Simotion WebVisu is established and "Run" state of Simotion can be confirmed	☒ OK ☐ Defects ☐ N/A
4.7.7	**Supply voltage control cabinet**	**Test Layout:** Remove LOTO and switch on 84F2 **Pass Fail Criteria:** Voltage read at feeding terminals	☒ OK ☐ Defects ☐ N/A
4.7.8	**Supply voltage control cabinet**	**Test Layout:** Switch on 183F1	

TR05	Test		Result
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	☑ OK ☐ Defects ☐ N/A
4.7.9	**Supply voltage control cabinet**	**Test Layout:** Switch on 183F2	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.10	**Supply voltage control cabinet**	**Test Layout:** Switch on 185F1	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.11	**Supply voltage control cabinet**	**Test Layout:** switch on 185F2	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.12	**Supply voltage control cabinet**	**Test Layout:** Switch on 187F1	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.13	**Supply voltage control cabinet**	**Test Layout:** Switch on 181Q1	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.14	**Supply voltage control cabinet**	**Test Layout:** Switch on 181Q2	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	
4.7.15	**Supply voltage control cabinet**	**Test Layout:** Switch on 182Q1	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	

Completed by	Witnessed by	Date
GERRY MCCAN FREDERIC HEIN		21-11-2024
Remarks:		

4.8 Software and Function Tests

Check the following software functions. Document the qualification results in the following table.

TR06	Test		Result	Completed by	Witnessed by	Date
4.8.1	Leakage and connections check	**Test Layout:** Check the converter water cooling system for proper connection and leaks. Run cooling system and perform visual check of connections and check for leaks **Pass Fail Criteria:** All connections are properly connected and no leakage present.	☑ OK ☐ Defects ☐ N/A	A. SUTO A. AKCAM		14.3.25
4.8.2	Pressure check	**Test Layout:** Check whether the pressure of the cooling system is above 3 bar. Check on the manometer of the converter cooling system cabinet (COSY) and verify value on HMI/WebVisu. **Pass Fail Criteria:** Manometer and HMI/WebVisu indicate a pressure of 3 bar.	☑ OK ☐ Defects ☐ N/A	A. SUTO A. AKCAM		14.3.25
4.8.3	Check pre-heating 4.5 FAT	**Test Layout:** Connecting the converter via interface: • Check the pre-heating of the converter for proper functionality • Check the pre-charge and DC link control for proper functionality **Pass Fail Criteria:** - Heat exchanger switches on and off correctly (visual check) - Preheating status is correctly indicated by the HMI/WebVisu. - Pump is running (visual check) - Heater is heating up the coolant (check coolant temperature on HMI/WebVisu)	☑ OK ☐ Defects ☐ N/A	A. SUTO A. AKCAM		14.3.25
4.8.4	UPS 4.13 FAT	**Test Layout:** Checking the UPS functionality. If the auxiliary supply fails (e.g. by activating the fuse of the AC power supply unit), the control cabinet continues to be supplied by the UPS. **Pass Fail Criteria:** After the defined time, the control cabinet is switched off completely. When the voltage returns, the control unit starts up again and the UPS battery is charged.	☑ OK ☐ Defects ☐ N/A	A. SUTO A. AKCAM		14.3.25
4.8.5	Smoke detectors	**Test Layout:** Test the smoke detector in PCS CON-cabinet with test spray.				

TR06	Test		Result	Completed by	Witnessed by	Date
		Pass Fail Criteria: The smoke detectors trigger accordingly and an error (Error level 4) is generated.	☑ OK ☐ Defects ☐ N/A	A SUTTO A AKRAM		14.3.25
4.8.6	**Communication test interface signals FREQCON->Customers**	**Test Layout:** Connecting communication interface to customer higher level controller. Transferring status signals to customer via comm interface. Check all signals listed in the comm interface list. **Reference document:** 23A2007_240628_PROFINET_Register BESS_V1_0_0_3 **Pass Fail Criteria:** The transmitted signals received via Profinet interface is plausible and correct.	☑ OK ☐ Defects ☐ N/A	ALESSANDRO SUTTO ADNAN AKRAM	FABIO SIEGEN	14.3.25
4.8.7	**Communication test interface signals Customer->Freqcon** MODBUS	**Test Layout:** MODBUS Connecting ~~Profinet~~ interface to customer higher level controller. Transferring control signals from customer higher level controller to BESS main controller via ~~Profinet~~ MODBUS interface. Check all signals listed in the comm interface list. **Reference document:** 23A2007_240628_PROFINET_Register BESS_V1_0_0_3 **Pass Fail Criteria:** The transmitted signals received via ~~Profinet~~ interface are plausible and lead to foreseen behaviour.	☑ OK ☐ Defects ☐ N/A	A. SUTTO ADNAN AKRAM	FABIO SIEGEN	14.3.25

Remarks:

5 BESS 1 and 2

5.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3
FAT punchlist tracker	20240828 - punchlist - FRQ comments v2.4

5.2 BESS Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR0x test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding. Any re-work on the electrical installation is completed.

- LOTO equipment
- Gas test spray equipment

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400 VAC Aux BESS – auxiliary load BESS B-200 <> 84W2
- Temporary 230 V AC Multiple socket outlet (e.g. to supply Laptop, temporary lights etc.)

Remarks:

5.3 Container Visual Inspection BESS 1

Check all system parts, including external and internal parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR07	Examination		Result
5.3.1	Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☑ OK ☐ Defects ☐ N/A
5.3.2	Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☑ OK ☐ Defects ☐ N/A
5.3.3	Warnings	The required warning signs are located on the personnel doors	☑ OK ☐ Defects ☐ N/A
5.3.4	Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☑ OK ☐ Defects ☐ N/A
5.3.5	Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☑ OK ☐ Defects ☐ N/A
5.3.6	Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☑ OK ☐ Defects ☐ N/A
5.3.7	LOTO	Apply LOTO as required.	☑ OK ☐ Defects ☐ N/A

5.4 Container Visual Inspection BESS 2

Check all system parts, including external and internal parts, to ensure that they are in perfect condition. Document the qualification results in the following table.

TR08	Examination		Result
5.4.1	Damage	The container is free of dents and unusual rust (minor rust spots, e.g. on crane eyes, are unavoidable)	☒ OK ☐ Defects ☐ N/A
5.4.2	Earthing connections	The earthing lugs are in the correct position (compare CAD) and are not painted	☒ OK ☐ Defects ☐ N/A
5.4.3	Warnings	The required warning signs are located on the personnel doors	☒ OK ☐ Defects ☐ N/A
5.4.4	Accessibility	The clearances in the container correspond to the CAD. All enclosure doors are in the correct position and accessible	☒ OK ☐ Defects ☐ N/A
5.4.5	Installation of components and cables in the container	All components such as switch cabinets, cable trays, air conditioning units, etc. are properly installed and cannot fall or tip over.	☒ OK ☐ Defects ☐ N/A
5.4.6	Cable bushings	All cable ducts are present (possibly not fitted) and comply with the client's specification. Covers, cable bushings or similar are available for all openings in the container	☒ OK ☐ Defects ☐ N/A
5.4.7	LOTO	Apply LOTO as required.	☒ OK ☐ Defects ☐ N/A

Completed by	Witnessed by	Date
ALESSANDRO SUTO GENY MCLAN EDGENIC MEIN	CARLOS PALENUELA	28-11-2024
Remarks:		

5.5 Power On BESS 1

Sequentially power on all the subsystems. Document the qualification results in the following table.

Please refer to the SLD on page 1a and 2a of the overall schematics for battery container 1:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Note:
Prior to carrying out any works, the commissioning engineer to check the current version of the reference document is available.

TR09	Test		Result
5.5.1	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components). **Pass Fail Criteria:** • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2	☐ OK ☒ Defects ☐ N/A
5.5.2	**Check LOTO of subsystem**	**Test Layout:** Check that all breakers feeding subsystems are turned to OFF position and LOTO **Pass Fail Criteria:** LOTO confirmed	☒ OK ☐ Defects ☐ N/A
5.5.3	**Remove LOTO from main feeding source (RM Board)**	**Test Layout:** Remove LOTO from main feeding source and measure voltage across incoming cable. **Pass Fail Criteria:** Voltage is read at incoming feeding terminals.	☒ OK ☐ Defects ☐ N/A
5.5.4	**Remove LOTO from main feeding source**	**Test Layout:** Remove LOTO and switch on 684F1. **Pass Fail Criteria:** Voltage read at downstream feeding terminals.	☒ OK ☐ Defects ☐ N/A
5.5.5	**Supply voltage**	**Test Layout:** Switch on 690F1 **Pass Fail Criteria:** No breaker trip or issue and Relative circuit power up (container lights)	☒ OK ☐ Defects ☐ N/A
5.5.6	**Supply voltage**	**Test Layout:** Switch on 690F2	

TR09	Test		Result
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (sockets)	☒ OK ☐ Defects ☐ N/A
5.5.7	**Supply voltage**	**Test Layout:** Switch on 690F3, 690F4, 690F5	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (cranes)	
5.5.8	**Supply voltage**	**Test Layout:** Switch on 101Q1. The control unit starts up properly.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (DC power supply)	
5.5.9	**Supply voltage**	**Test Layout:** Switch on 691F4	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (cooling units)	
5.5.10	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F3	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals	
5.5.11	**Supply voltage**	**Test Layout:** Switch on 691F1, 691F2, 691F3	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (emergency ventilation and louvers)	
5.5.12	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F4	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals	
5.5.13	**Supply voltage**	**Test Layout:** Sequentially switch on 687F1, 687F2, 687F3, 687F4, 687F5, 687F6, 688F1, 688F2, 688F3, 688F4, 688F5	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	

Completed by	Witnessed by	Date
A SUTTO	F. HEIN	06-12-24

Remarks:

Panel needs further rework to bring it to AS-BUILT.
Planned work

13.03.25 – Rework completed - panel AS-BUILT

5.6 Power On BESS 2

Sequentially power on all the subsystem. Document the qualification results in the following table.

Please refer to the SLD on page 1a and 2a of the overall schematics for Battery Container 2:
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2

Note:
Prior to carrying out any works, the commissioning engineer to check the current version of the reference document is available.

TR10	Test		Result
5.6.1	**Compliance with circuit diagram**	**Test Layout:** • Check if main components of the control cabinet are installed in accordance with the circuit diagram. Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).	☐ OK ☒ Defects ☐ N/A LABELS E panels
		Pass Fail Criteria: • Essential parts of the control cabinet are available in accordance with the circuit diagram. • Labelling of the components in the control cabinet corresponds to the circuit diagram. **Reference document:** 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2	
5.6.2	**Check LOTO of subsystem**	**Test Layout:** Check that all breakers feeding subsystems are turned to OFF position and LOTO	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: LOTO confirmed	
5.6.3	**Remove LOTO from main feeding source (RM Board)**	**Test Layout:** Remove LOTO from main feeding source and measure voltage across incoming cable.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage is read at incoming feeding terminals.	
5.6.4	**Remove LOTO from main feeding source**	**Test Layout:** Remove LOTO and switch on 684F1.	☑ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals.	
5.6.5	**Supply voltage**	**Test Layout:** Switch on 690F1	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (container lights)	
5.6.6	**Supply voltage**	**Test Layout:** Switch on 690F2	

TR10	Test		Result
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (sockets)	☒ OK ☐ Defects ☐ N/A
5.6.7	**Supply voltage**	**Test Layout:** Switch on 690F3, 690F4, 690F5	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (cranes)	
5.6.8	**Supply voltage**	**Test Layout:** Switch on 101Q1. The control unit starts up properly.	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (DC power supply)	
5.6.9	**Supply voltage**	**Test Layout:** Switch on 691F4	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (cooling units)	
5.6.10	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F3	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals	
5.6.11	**Supply voltage**	**Test Layout:** Switch on 691F1, 691F2, 691F3	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up (emergency ventilation and louvers)	
5.6.12	**Supply voltage**	**Test Layout:** Remove LOTO and switch on 684F4	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: Voltage read at downstream feeding terminals	
5.6.13	**Supply voltage**	**Test Layout:** Sequentially switch on 687F1, 687F2, 687F3, 687F4, 687F5, 687F6, 688F1, 688F2, 688F3, 688F4, 688F5	☒ OK ☐ Defects ☐ N/A
		Pass Fail Criteria: No breaker trip or issue and Relative circuit power up	

Completed by	Witnessed by	Date
ALESSANDRO SUTO FABIAN HEIN	MARKUS JAHNS	02-12-2024

Remarks:

13.03.25 - All punches Solved

5.7 Function and Safety Critical Tests BESS 1, BESS 2 and PCS

Check system components of all battery cabinets (one cabinet in each container section) inside BESS 1 and 2 container and the following software functions. Document the qualification results in the following table.

TR11	Test		Result	Completed by	Witnessed by	Date
5.7.1	**Check smoke detectors BESS 1**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and (-) All battery cabinets decoupled from PCS (-) 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A SUTTO	M JAHNS F HEIN	06. 12. 24
5.7.2	**Check CO detectors BESS 1**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and (-) All battery cabinets decoupled from PCS (-) 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A SUTTO	M JAHNS F HEIN	06 12 24
5.7.3	**Check H2 BESS 1**	**Test Layout:** Check the correct functionality of the H2 exhaust system (detection and gas removal) in case of TR/gas event. Sample gas trigger. Check correct behaviour of the BESS: (-) All battery cabinets decouple from PCS DC side (-) 80Q1 (Main AC breaker) opens - ~~Air dampers are working~~ - ~~All exhaust system units in container roofs are operating~~ - Fire&Gas is transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A SUTTO	M JAHNS G. del MISSIER	06-12-24

TR11	Test		Result	Completed by	Witnessed by	Date
		Pass Fail Criteria: TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - ~~Air dampers are working~~ - ~~All exhaust system units in container roofs are operating~~ - F&G successfully transmitted to higher level controller via hard wired signal				
5.7.4	**Check smoke detectors BESS 2**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A. SUTTO	M. JAHNS G. del MISSIER	21.11.24
5.7.5	**Check CO detectors BESS 2**	**Test Layout:** Use test spray to trigger the sensor. **Pass Fail Criteria:** TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - Air dampers are working - All exhaust system units in container roofs are operating - TR successfully transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	A SUTTO	M JAHNS G del MISSIER	21.11.24

TR11	Test		Result	Completed by	Witnessed by	Date
5.7.6	**Check H2 BESS 2**	**Test Layout:** Check the correct functionality of the H2 exhaust system (detection and gas removal) in case of TR/gas event. Sample gas trigger. Check correct behaviour of the BESS: - All battery cabinets decouple from PCS DC side - 80Q1 (Main AC breaker) opens - ~~Air dampers are working~~ - ~~All exhaust system units in container roofs are operating~~ - Fire&Gas is transmitted to higher level controller via hard wired signal	☒ OK ☐ Defects ☐ N/A	AUTO	MJAHNS G.del MISSIER	21-11-25
		Pass Fail Criteria: TR/gas event was simulated and - All battery cabinets decoupled from PCS - 80Q1 (Main AC breaker) opened - ~~Air dampers are working~~ - ~~All exhaust system units in container roofs are operating~~ - F&G successfully transmitted to higher level controller via hard wired signal				

NOTE: Check RE-SET mechanism of Smoke triggered alarms 2002

13.03.25 - Reset logic changed to 2002

6 Battery Modules

6.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3

6.2 Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR12 test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding. Any re-work on the electrical installation is completed.

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400 VAC aux BESS – *auxiliary load BESS B-200 <> 84W2*

Note – the battery modules have been tested after assembly for quality assessment (reports available) and have been tested for functionality and capacity prior to shipping (reports available).

Remarks:

6.3 Installation Report

Check the correct installation and connection of the battery modules in the BESS 1 and BESS 2 containers. Document the qualification results in the following table.

TR12	Test		Result	Completed by	Witnessed by	Date
6.3.1	**Installation report for cabinets**	**Test Layout:** Report issued for the following racks: BESS 1 ☑ 1 ☑ 2 ☑ 3 ☑ 4 ☑ 5 ☑ 6 ☑ 7 ☑ 8 ☑ 9 ☑ 10 ☑ 11 BESS 2 ☑ 1 ☑ 2 ☑ 3 ☑ 4 ☑ 5 ☑ 6 ☑ 7 ☑ 8 ☑ 9 ☑ 10 ☑ 11	☑ OK ☐ Defects ☐ N/A	A. SUTO, ADNAN AKYOL		11.3.25
		Pass Fail Criteria: All cabinets have been checked and report is available				
6.3.2	**LOTO**	Check DC fused are disconnected.	☑ OK ☐ Defects ☐ N/A			

7 System Tests

7.1 Reference Documents

These documents are not physically included in this report but are externally available.

Document Title	Document Name
Overall Schematics (print out)	10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20241105_V1.2
GA drawing as build (print out)	23A2007 BLPH BESS complete system
Operating and maintenance manual (print out)	10354_23A2007_240911_Operating_Manual_BESS_1MW_5 MWh_6.6kV_EN_v0.87
FAT report (external)	23A2007_240708_FAT_BESS_Converter_EN_v2.0_Signed
Profinet interface list	23A2007_240628_PROFINET_Register BESS_V1_0_0_3

7.2 Prerequisites

Carefully qualify that this SAT protocol has been approved and the equipment has been inspected by the quality control department. Ensure that all requirements for the SAT are met. And then record the qualification results in the TR0x test report.

The following documents must be available in electronic form or as a printout for the SAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

No category A open punch list items are outstanding. Any re-work on the electrical installation is completed.

The following power sources are required to perform the activities listed in the following paragraphs. Please ensure the main power source is LOTO before starting operation and follow the correct procedures to power up any circuit.

- 400VAC aux BESS – *auxiliary load BESS B-200 <> 84W2*
- 6.6 kV AC
- (FREQCON) power meter needs to be connected to AC busbars for voltage measurement before energization

Remarks:

7.1 Software and Function Tests

Check the following software functions. Document the qualification results in the following table.

Note – in the event that BLPH control system connections are not available at this time, consideration must be given to implement temporary safety measures e.g. use of local temporary pushbutton in lieu of no trip signal from BLPH control system. To be fully risk assessed at site prior to any implementation.

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.1	**LOTO main connection and electro mechanical lock in place**	**Test Layout:** Confirm BESS AC connection is LOTO and captive key to earth the transformer is available before energizing the system. Confirm all system mains (80Q1) is open. **Pass Fail Criteria:** Transformer connections are correct. Captive key is retrieved, transformer is grounded. 80Q1 open.	☑ OK ☐ Defects ☐ N/A	A. AKRAM	A. SUTO	14.3.25
7.1.2	**Transformer inspection**	**Test Layout:** MV and LV connections are completed and according to as built electrical drawings. After visual inspection, lock the door and extract the captive key for energization. **Pass Fail Criteria:** Transformer connections are correct. Key is available for energization	☑ OK ☐ Defects ☐ N/A	A. AKRAM	A. SUTO	14.3.25
7.1.3	**Energize AC connection**	**Test Layout:** Energize main AC connection. - Transformer is energized - Turn on mains (80Q1). **Pass Fail Criteria:** Inverter units energized, no unexpected trips.	☑ OK ☐ Defects ☐ N/A	A. AKRAM	A. SUTO	14.3.25
7.1.4	**Check pre-charging and DC link control** 4.7 FAT	**Test Layout:** Connecting the converter via interface: • Check the pre-charge and DC link control for proper functionality **Pass Fail Criteria:** **Precharge:** - Precharging process is indicated by HMI/WebVisu. - After precharging process is done, the green "Ready for Operation" is indicated by HMI/WebVisu. **DC Link Control:** - Verify correct DC-link voltage level was successfully reached and held via HMI/WebVisu.	☑ OK ☐ Defects ☐ N/A	A. AKRAM	A. SUTO	14.3.25

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.5	Check IGBTs	**Test Layout:** Check IGBT activation. **Pass Fail Criteria:** - IGBTs can be switched without any problems - Operating status is indicated by by HMI/WebVisu.	☑ OK ☐ Defects ☐ N/A	A AKKAM	A. SUTO	24.3.25
7.1.6	Check DC ports	**Duration: After reaching 250 A test duration is 10 min.** **Test Layout:** **<u>DC ports:</u>** Connection to customer AC mains is performed in order to work AC power. Each port will be charged with 250 kW which corresponds to a current of 250 A. DC ports connection Increase the DC current setpoint slowly to 250 A and keep this value for 10 minutes. **<u>Heat run:</u>** Check if temperatures of - IGBTs - Inductors - Coolant of converter cooling system are within the permissible ranges by verifying the temperature values displayed on the HMI/WebVisu. **Pass Fail Criteria:** **<u>DC Ports:</u>** DC current output of 250 A is displayed on the HMI/WebVisu according to setpoint. **<u>Heat Run:</u>** IGBT, inductor and converter cooling system coolant temperatures are below the temperature thresholds set in the control system.	☑ OK ☐ Defects ☐ N/A	A. AKKAM	A. SUTO	24.3.25

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.7	**Check DC port current/offset control**	**Test Layout:** Check the DC port current control / offset control and check for oscillations. **Pass Fail Criteria:** Oscillations are within the permissible range of +/- 10% of 250A.	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	14.3.25
7.1.8	**Check temperature values**	**Test Layout:** Check all temperature values displayed on the HMI/WebVisu for plausibility. **Pass Fail Criteria:** The temperature values indicated on the HMI/WebVisu are plausible. IGBTs: 30 ... 65 °C Inductors: 30 ... 120°C Cooling water: 27 ... 55 °C	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	14.3.25
7.1.9	**Measurements** 4.11 FAT	**Test Layout:** Check if the measured values (voltages and currents) are properly collected by the Simotion (PCS main controller) and verify by using a multimeter or current clamp at DC and AC side. **Pass Fail Criteria:** Values measured with multimeter correspond +/-5% to the values displayed on the HMI/WebVisu.	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	14.3.25
7.1.10	**Check temperature derating functionality**	**Test Layout:** Check the temperature derating for proper functionality. For this purpose, lower the temperature setpoints. **Pass Fail Criteria:** PCS lowers power according to the set derating thresholds.	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	08.04.25
7.1.11	**Switching-off** 4.12 FAT	**Test Layout:** Switching off the inverter. The inverter is properly switched off by removing the control bits. **Pass Fail Criteria:** "OFF" state is indicated by the HMI/WebVisu.	☑ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	08.04.25

TR13	Test		Result	Completed by	Witnessed by	Date
7.1.12	Battery capacity test	**Test Layout:** Capacity test / load test as required. Check the temperature behavior of the converter system during the test. Make sure plots include: - Power AC - Power DC - Voltage DC - Cell voltage max and min - Cell temp max and min - Room temperatures - Filter temperature - SOC **Pass Fail Criteria:** Capacity was successfully reached without power derating and all temperatures in acceptable ranges.	☐ OK ☐ Defects ☒ N/A			
7.1.13	Performance Test AC output	**Test Layout:** **Duration: After reaching 1000 A duration test of 10 min.** **Test Layout:** Increase the AC current setpoint value slowly to 1000 A output and keep this value for 10 minutes. **Pass Fail Criteria:** AC current output of 1000 A is displayed correctly on the HMI/WebVisu according to setpoint.	☒ OK ☐ Defects ☐ N/A	A. AKCAM	A. SUTO	08.06.25

REMARK
7.1.12 test will be completed after installation at final location. It is not considered necessary currently as part of SAT

8 Employees Present

Identify each employee involved in the execution of this protocol. Document the employee 's name, signature, name abbreviation and date in the following table:

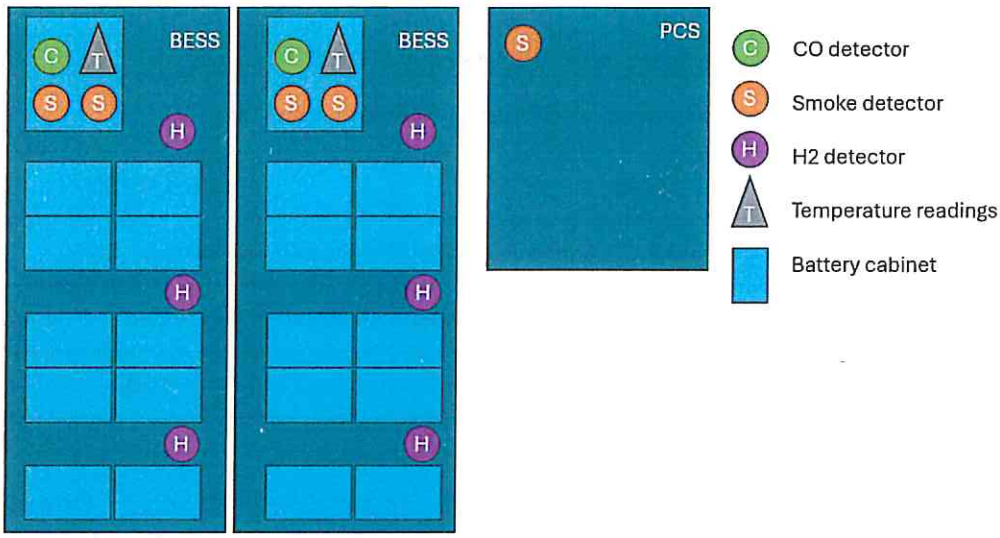
Company Name	Employee Name	Employee Signature	Abbreviation	Date
FREQCON	Md. Adnan Akram		MAA	08.04.25
CROSSWIND	ALESSANDRO SUTTO		ASU	08.04.25
CROSSWIND	JOHN MACKILLOP		JM	08.04.25
CROSSWIND	DAVE MUSGROVE		DM	08/04/2025

	Yes/No
All persons involved in the SAT were documented.	☒ Y ☐ N

Remarks:
B Punches C30000871, C30000874 remain open (Door handle on BESS 2 door & identifyer stickers for containers) to BE adressed

9 Appendix

9.1 Fire and Gas Cause and Effect



Simplified representation of the location of different components within the BESS system.

9.1.1 PCS container

1x smoke detector – trigger 1-out-of-1 – it can be reset remotely.
Once triggered it sends 85-XA-002 (confirmed smoke) hardwired signal to EMCS.
PCS Control Cabinet XT1-3&4

9.1.2 BESS container

3x H2 detectors – trigger is 2-out-of-3.
It generates 85-XA-001 (confirmed gas) hardwired signal to EMCS.
PCS Control Cabinet XT1-1&2

9.1.3 BESS cabinets (1 to 11 in each container) - independent reaction

1x CO detector – trigger is 1-out-of-1
2x Smoke detectors – trigger is 2-out-of-2
Module Temperature reading (from BMS) – trigger is > 60°C
They generate 85-XA-004 (Confirmed Thermal Runaway) hardwired signal to EMCS
Note: each detector type works independently. The first one to reach the triggers conditions will activate the HW signal to EMCS.

10 Check and Approval

The SAT protocol becomes the SAT report when it has been completed as the individual test reports have been completed and labelled with a test date. The SAT report is submitted to the customer for confirmation and the results must be documented in TR14.

TR14	Examination and authorisation of execution
Check the test results and the original data. Final assessment for SAT	
☒ PASS	☐ NOT PASSED
If there are any unresolved discrepancies, please fill in the following "remarks" table.	
Specify whether or not these unresolved discrepancies may affect the completion of the SAT.	
☐ YES	☒ NO

Remarks:
8 Punches C30000871, C30000874 remain Open
(Door handle on BESS2 & identifyer Sticker for BESS1&2)
to be adressed - not affecting completion of SAT

Carried out by:	M. Adnan Akram	Date:	2025 · 04 · 08
	FREQCON GmbH		YYYY/MM/DD
Authorised by:	ALESSANDRO SUTTO	Date:	2025 · 04 · 08
	Customer		YYYY/MM/DD

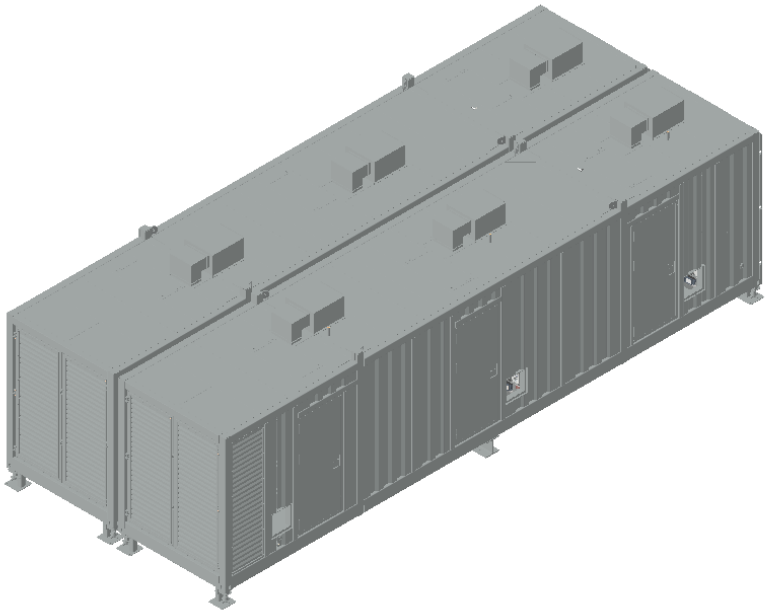
STATRON
NON STOP POWER

Structural analysis of battery racks in containers

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Beschreibung

Die nachfolgende Berechnung bezieht sich auf die eingebauten Batterieschränke der Containeranlage und deren Befestigung



Projekt

A24004_Batteriecontainer_Freqcon

Kunde

FREQCON

FREQCON GmbH
Bürgerwiesenweg 5
27336 Rethem
Deutschland

Ingenieur-Dienstleistungen

GIESSELMANN INGENIEURE
Dipl.-Ing. (FH) Lutz Giesselmann
Lüneburger Heerstr. 6
29223 Celle
Deutschland
Tel: +49 5141 / 4409 - 820
info@giesselmann-ingenieure.de
www.giesselmann-ingenieure.de



Celle, 04.04.2024
Dipl.-Ing. (FH) Lutz Giesselmann

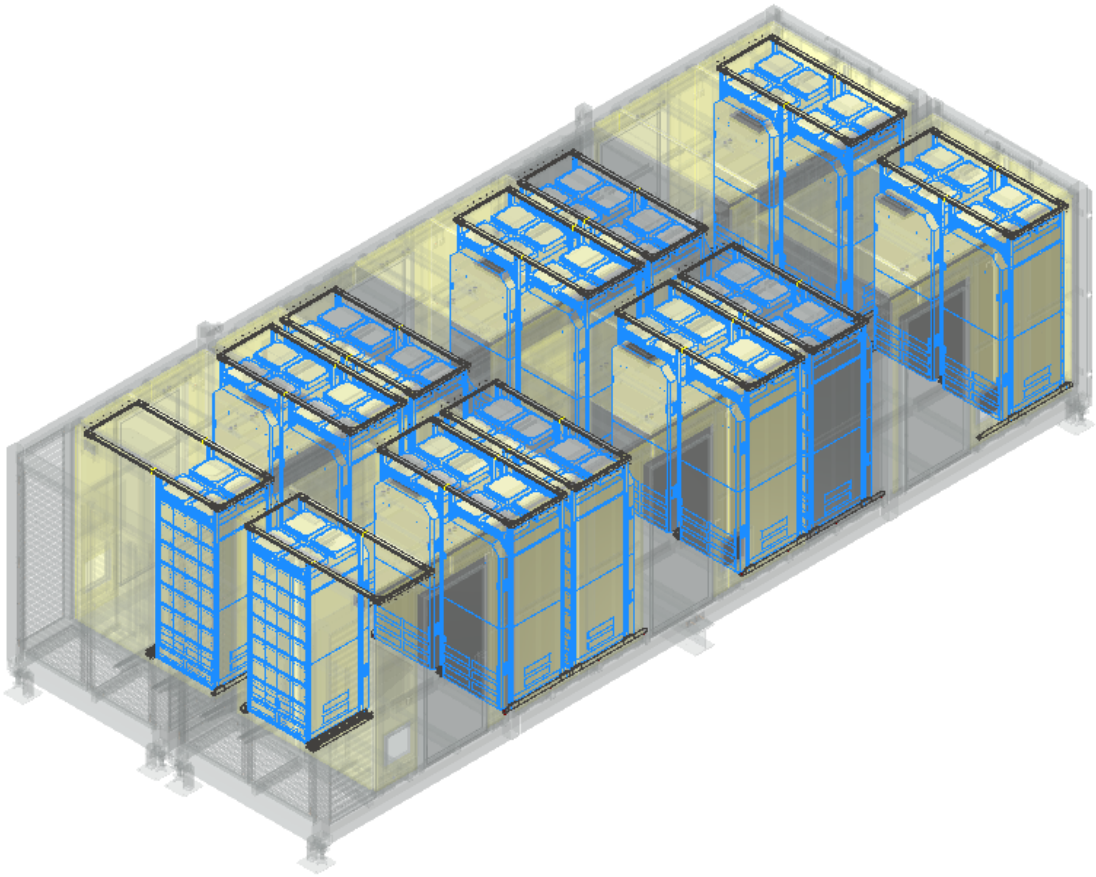
INHALTSVERZEICHNIS

Beschreibung 1
Projekt 1
Kunde 1
Ingenieur-Dienstleistungen 1
1 Kurzbeschreibung 3
1.1 Gesamtmodell 3
1.2 Batterieschrank 4
2 Berechnung 6
2.1 Beschleunigung Schiffstransport 6
2.2 Batterieschrank Masse & Volumen 6
3 Ergebnisse 7
3.1 Spannung und Verformung bei seitlicher Belastung des Containers 7
3.2 Spannung und Verformung bei längs- Belastung des Containers 8
4 Fazit 9
5 Belastungsanalyse - Querkräfte Transport 10
5.1 Statikanalyse:2 10
5.2 iProperties 10
5.3 Material(ien) 11
5.4 Betriebsbedingungen 12
5.5 Ergebnisse 15
6 Belastungsanalyse - Längskräfte Transport 17
6.1 Statikanalyse:1 17
6.2 iProperties 17
6.3 Material(ien) 18
6.4 Betriebsbedingungen 19
6.5 Ergebnisse 22

1 Kurzbeschreibung

Diese Containeranlage besteht aus zwei Batteriecontainern, welche jeweils 11 Batterieschränke enthalten. Die Batterieschränke sollen mit eingebauten Batterien zum Aufstellort transportiert werden. In dieser Berechnung wird die Befestigung der Batterieschränke im Container, sowie die Stabilität der Schrankrahmen nachgewiesen.

1.1 Gesamtmodell

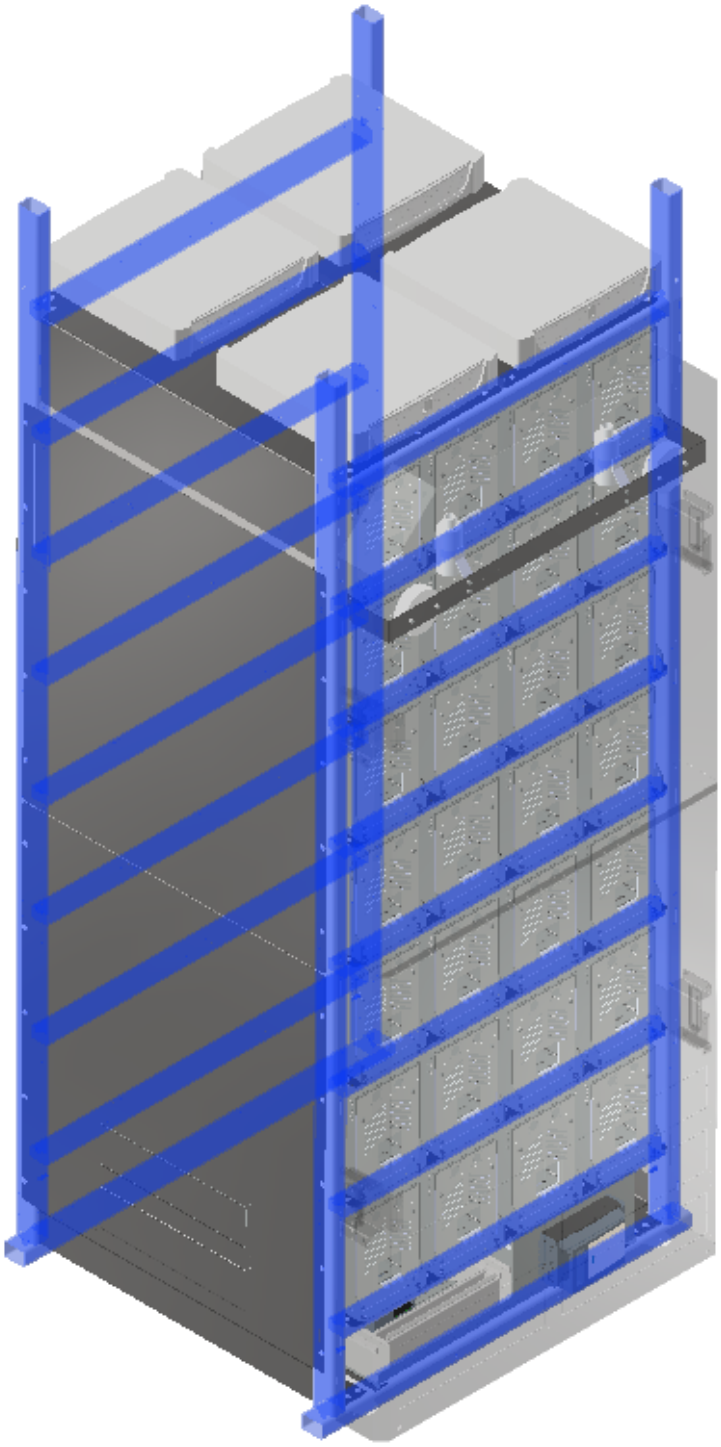


In den Containern befinden sich je 11 Batterieschränke, diese sind auf dem Fußboden mit Klemmschienen befestigt, welche die Gewichtskraft gleichmäßig auf die Rahmenstruktur des Containerbodens verteilen. Oben sind die Batterieschränke durch einen zusätzlichen Rahmen an der Containerstruktur fixiert.

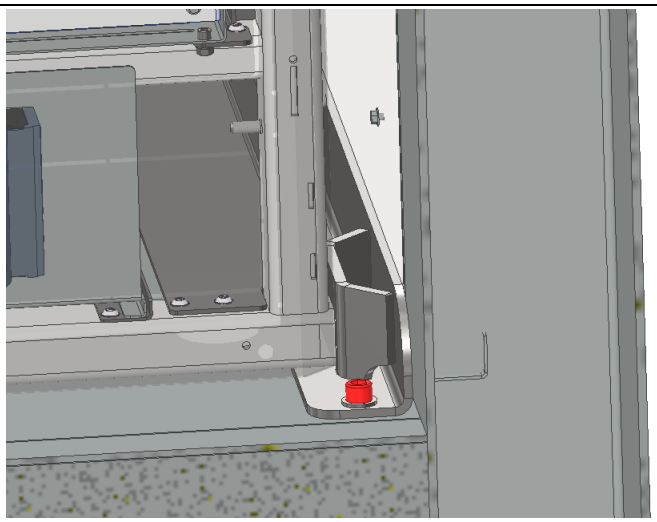
1.2 Batterieschrank

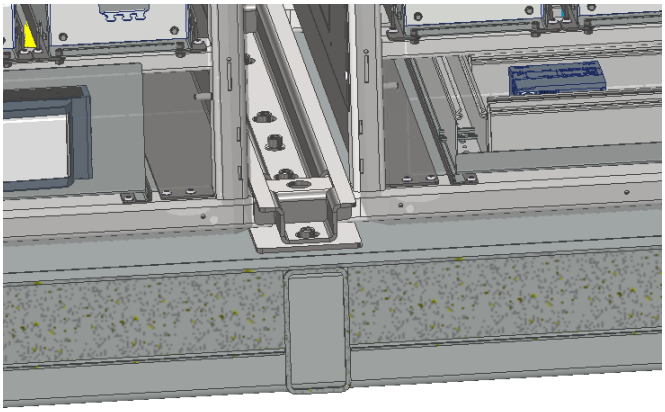
Der Batterieschrank besteht aus 2 baugleichen Rahmen aus Rechteckrohren. Der Schrank hat 7 Ebenen, in denen je 4 Batterien enthalten sind. Eine Batterie hat ein Gewicht von 66kg. Daraus ergibt sich ein Gesamtgewicht pro Batterieschrank von 1848kg.

Die Bauteile, welche nicht fest angeschraubt sind, wie die Frontabdeckungen, die Einschubhilfe und der Löschpatronenträger werden für den Transport entnommen und gesondert transportiert.



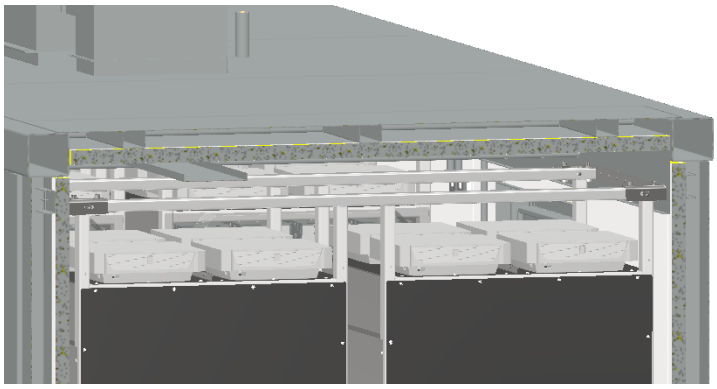
Die Befestigung der Batterieschränke erfolgt auf der Außenseite des Containers lediglich durch das Einschieben in Laschen, welche auf einem gekanteten Blechwinkel angeschweißt sind. Die Blechwinkel sind mit M12x40 Innensechskantschrauben der Festigkeitsklasse 8.8 durch den Blechboden an die Tragstruktur des Containers geschraubt.





Auf der Innenseite werden jeweils zwei nebeneinander und zwei hintereinanderstehende Batterieschränke zusammen auf den Boden geklemmt. Dafür wird ein Blech an das Mittelprofil des Containers geschraubt, auf das dann eine Klemmschiene geschraubt wird. Die Verschraubung des unteren Bleches erfolgt mit 10 x M12x40 Innensechskantschrauben der Festigkeitsklasse 8.8, die Klemmschiene wird mit 4 dieser Schrauben angeschraubt.

Oben werden die Batterieschränke durch in das senkrechte Rahmenprofil gesteckte Rechteckrohre in Position gehalten. Diese sind an Quertraversen angeschweißt, von denen immer zwei Stück mit einem Halteblech pro Seite an die Containerwand geschraubt ist. Die Verschraubung der Haltebleche erfolgt auf beiden Seiten mit je 8 Schneidschrauben 6,3 x 80 der Festigkeitsklasse 8.8. Die Haltebleche sind an den Ecken verschweißt, da diese am meisten beansprucht werden.



2 Berechnung

Zur Berechnung wurden die Beschleunigungswerte für den Schiffstransport aus dem beigestellten Dokument von Firma Freqcon verwendet. Die Containerstruktur sollte als starr angenommen werden.

2.1 Beschleunigung Schiffstransport

Option 1 Orientation specific transportation criteria			
	X (Roll)	**Y (Pitch)**	Z (incl. gravity)
Lower deck - roll	**+ / - 0.60 G**		**1G + / - 0.30 G**
Loadcase 1	-0.60 G in X		1.3 G Vertical
Loadcase 2	-0 .60 G in X		0.7 G vertical
Loadcase 3	+0.60 G in X		1.3 G Vertical
Loadcase 4	+0.60 G in X		0.7 G vertical

Aus: Crosswind – Technical Query Hollandse Kust Noord

2.2 Batterieschrank Masse & Volumen

Der Batterieschrank soll mit 28 Batterien befüllt werden.

Gewichtskraft einer Batterie = 660 N

Batterie- Gewichtskraft in einem Batterieschrank = 28 x 660N = 18480N

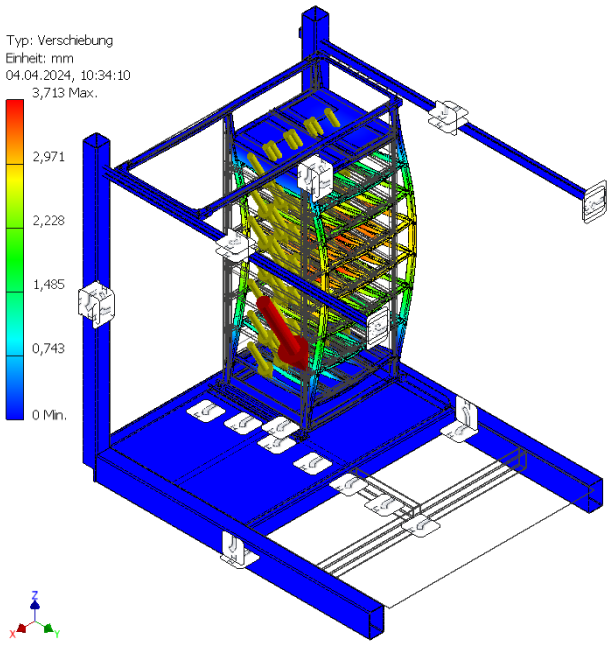
Weiterhin wurde die Belastung durch das Eigengewicht des Schranks durch das Ansetzen der Gravitationskräfte aus der Tabelle in die Berechnung einbezogen.

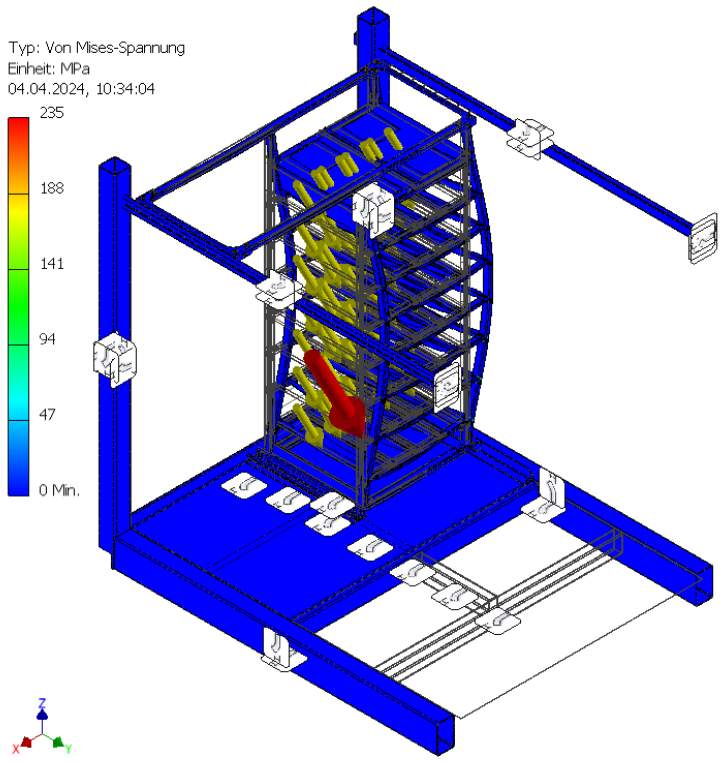
3 Ergebnisse

Folgende Berechnungsergebnisse wurden bei den Berechnungen der Querkräfte und Längskräfte während des Transportes ermittelt.

3.1 Spannung und Verformung bei seitlicher Belastung des Containers

Eine Spannungsspitze von 360 MPa tritt in einem sehr kleinen Bereich im Auflageprofil auf, in den angrenzenden Bereichen ist die Spannung deutlich niedriger. Außerdem wird der Bereich in der Realität nicht so stark belastet wie in der Berechnung, da die Batteriemodule in sich stabil sind und es zu keiner Durchbiegung der Auflageprofile kommt.

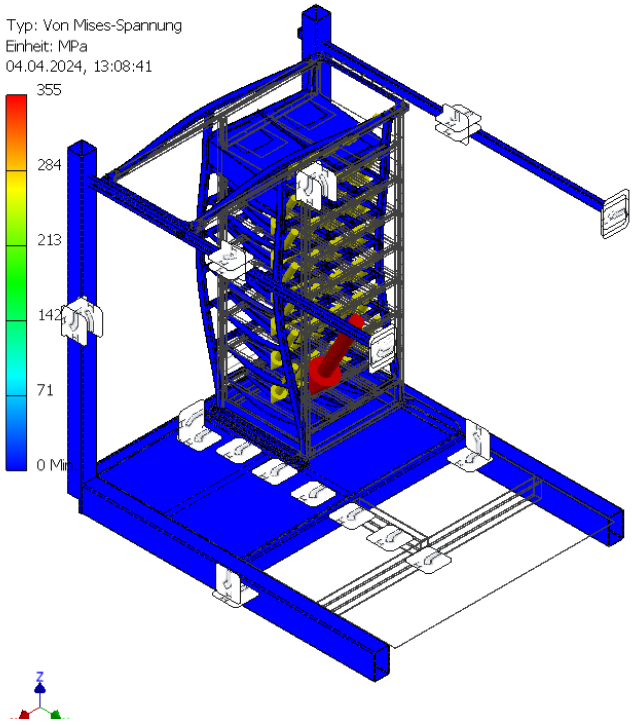


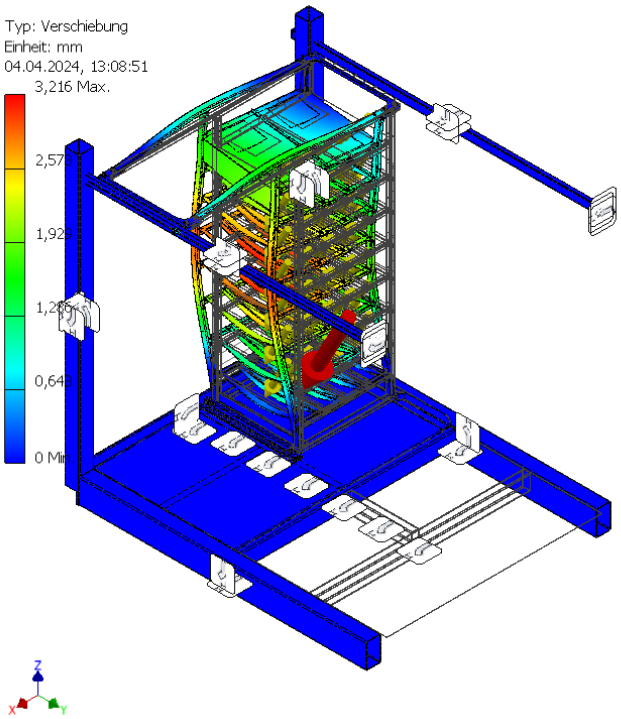


Die maximale Verschiebung von 3,7mm tritt ebenfalls in den Auflageprofilen auf, wenn man den Anteil der Durchbiegung der Auflageschienen abzieht, kommt man noch auf ca. 2,8mm die sich der Rahmen im schlimmsten Fall beim Transport verformt.

3.2 Spannung und Verformung bei längs- Belastung des Containers

Die Spannungsspitze tritt in einem sehr kleinen Bereich im Befestigungsblech der oberen Querbleche auf, in den angrenzenden Bereichen ist die Spannung deutlich niedriger. Das wird auch dadurch ersichtlich, dass die benachbarten Bereiche weit unter dem zulässigen Bereich von 355 MPa liegen.





Auch hier tritt die maximale Verschiebung von 3,7mm in den Auflageprofilen auf, wenn man den Anteil der Durchbiegung der Auflageschienen abzieht, kommt man noch auf ca. 2,7mm die sich der Rahmen im schlimmsten Fall beim Transport verformt.

4 Fazit

Die Befestigung der Batterieschränke an Boden und Decke hält den Belastungen des Schiffstransportes, auf dem unteren Deck, Stand. Der Rahmen des Batterieschrankes hält den Belastungen ebenfalls Stand, auch ohne die Berücksichtigung der aussteifenden Wirkung der Seitenbleche und des Rückblechs. Allerdings müssen für den Transport alle losen Bauteile, wie die Frontabdeckungen, die Einschubhilfe und der Löschpatronenträger entnommen und gesondert transportiert werden. Die Batterien sind am hinteren Ende gegen Verrutschen und Abheben gesichert und am vorderen Ende durch eine Verschraubung.

5 Belastungsanalyse - Querkräfte Transport

Analysierte Datei:	MG_Berechnung.iam
Autodesk Inventor-Version:	2023.4 (Build 274418000, 418)
Erstellungsdatum:	04.04.2024, 10:34
Studienautor:	EC

5.1 Statikanalyse:2

Allgemeines Ziel und Einstellungen:

Konstruktionsziel	Einzelner Punkt
Studientyp	Statische Analyse
Letztes Änderungsdatum	04.04.2024, 10:24
Modellzustand	[Primär]
Benutzerdefinierte Ansicht	Standard
Position	[Primär]
Modi für starres Bauteil suchen und entfernen	Nein
Belastungen über Kontaktflächen hinweg separieren	Nein
Analyse der Bewegungslasten	Nein

5.2 iProperties

Übersicht

Autor	EC

Projekt

Bauteilnummer	MG_Berechnung
Revisionsnummer	A
Projekt	A24004_Batteriecontainer_Freqcon
Konstrukteur	EC
Erstellungsdatum	13.03.2024

Benutzerdefiniert

Masse	1143,82

Physische Eigenschaften

Masse	1143,82 kg
Schwerpunkt	x=415,321 mm y=-12,6046 mm z=498,069 mm

Anmerkung: Physikalische Werte können sich von den weiter unten berichteten, von FEM verwendeten physikalischen Werten unterscheiden.

Netzeinstellungen:

Durchschnittl. Elementgröße (als Teil des Modelldurchmessers)	0,1
Min. Elementgröße (als Teil der durchschn. Größe)	0,2
Einteilungsfaktor	1,5
Max. Drehwinkel	60 grd
Kurvenförmige Netzelemente erstellen	Nein
Bauteilbasierte Messung für Baugruppennetz verwenden	Ja

5.3 Material(ien)

Name	1.0037 / S235JR	
Allgemein	Massendichte	7,85 g/cm^3
	Streckgrenze	235 MPa
	Zugfestigkeit	360 MPa
Spannung	Elastizitätsmodul	210 GPa
	Poissonsche Zahl	0,28 oE
	Schubmodul	82,0313 GPa
Bauteilname(n)	PL_Kopf.ipt PL_Sockel.ipt KA_Schweißbolzen_M8x20_VA.ipt PL_Auflage.ipt PL_Ständer.ipt PL_Abstützung_oben.ipt KA_Schweißmutter_DIN929_M12.ipt PL_Deckenstrebe.ipt DU_Berechnungsausschnitt_Container.ipt	

Name	1.0976 / S355MC	
Allgemein	Massendichte	7,85 g/cm^3
	Streckgrenze	355 MPa
	Zugfestigkeit	510 MPa
Spannung	Elastizitätsmodul	210 GPa
	Poissonsche Zahl	0,29 oE
	Schubmodul	81,3953 GPa
Bauteilname(n)	BL_Einschubschiene.ipt BL_Mittelblech_unten.ipt BL_Befestigungsblech_1.ipt BL_Einschublasche.ipt BL_Klemmblech_1.ipt BL_Klemmblech_2.ipt BL_Deckenträger.ipt BL_Aussteifung.ipt BL_Aussteifung_oben.ipt	

Name	8.8 A2F	
Allgemein	Massendichte	7,85 g/cm^3
	Streckgrenze	235 MPa
	Zugfestigkeit	360 MPa
Spannung	Elastizitätsmodul	210 GPa

	Poissonsche Zahl	0,28 oE
	Schubmodul	82,0313 GPa
Bauteilname(n)	DIN 125-1 A A 13 KA_Reyher_DIN7504.014_6,3x80.ipt DIN EN ISO 4762 M12 x 80 DIN EN ISO 4762 M12 x 60	

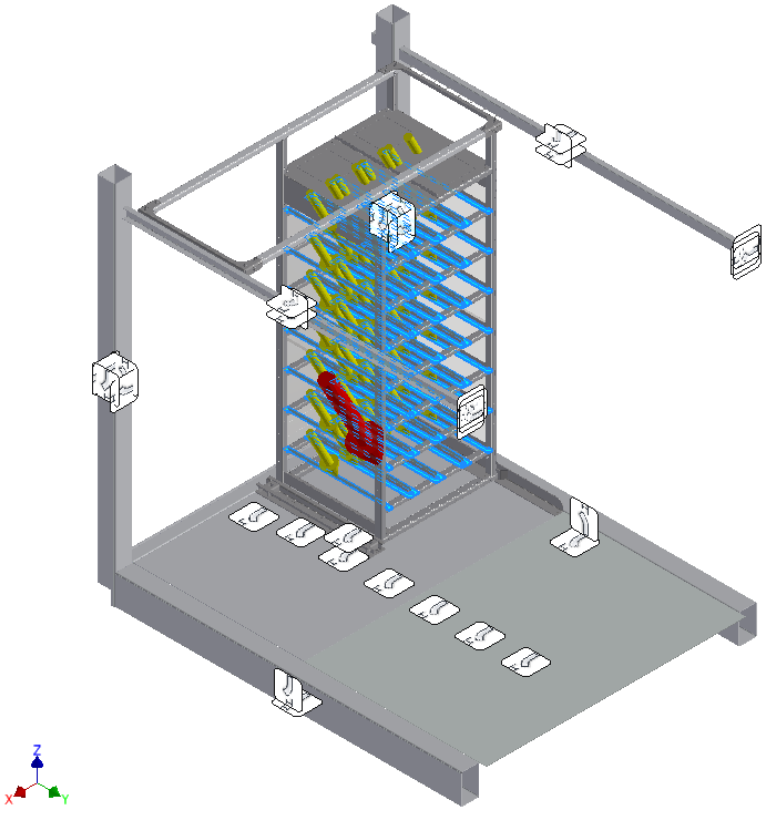
5.4 Betriebsbedingungen

Kraft:1

Diese Kraft ergibt sich aus der Gewichtskraft der Batterien multipliziert mit dem entsprechenden Richtungsfaktor aus der Beschleunigungstabelle für den Schiffstransport (Kap. 2.1)

Belastungstyp	Kraft
Größe	27285,393 N
Vektor X	-12936,000 N
Vektor Y	0,000 N
Vektor Z	-24024,000 N

Ausgewählte Fläche(n)

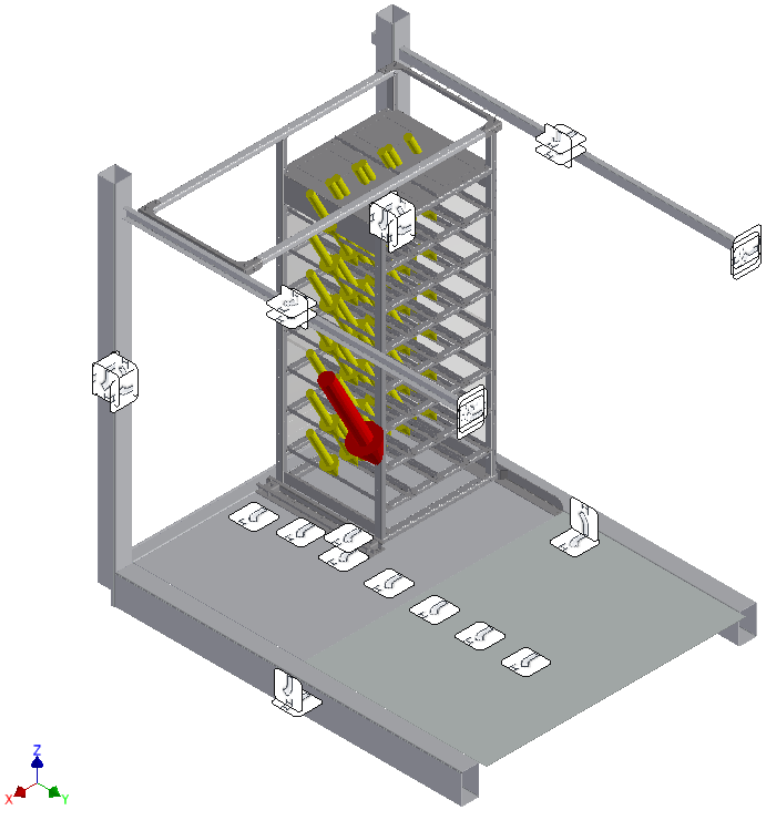


Schwerkraft

Diese Kraft ergibt sich aus der Schwerkraft des Batterieschranks selbst, multipliziert mit dem entsprechenden Richtungsfaktor aus der Beschleunigungstabelle für den Schiffstransport (Kap. 2.1)

Belastungstyp	Schwerkraft
Größe	14484,291 mm/s^2
Vektor X	-6867,000 mm/s^2
Vektor Y	0,000 mm/s^2
Vektor Z	-12753,000 mm/s^2

Ausgewählte Fläche(n)

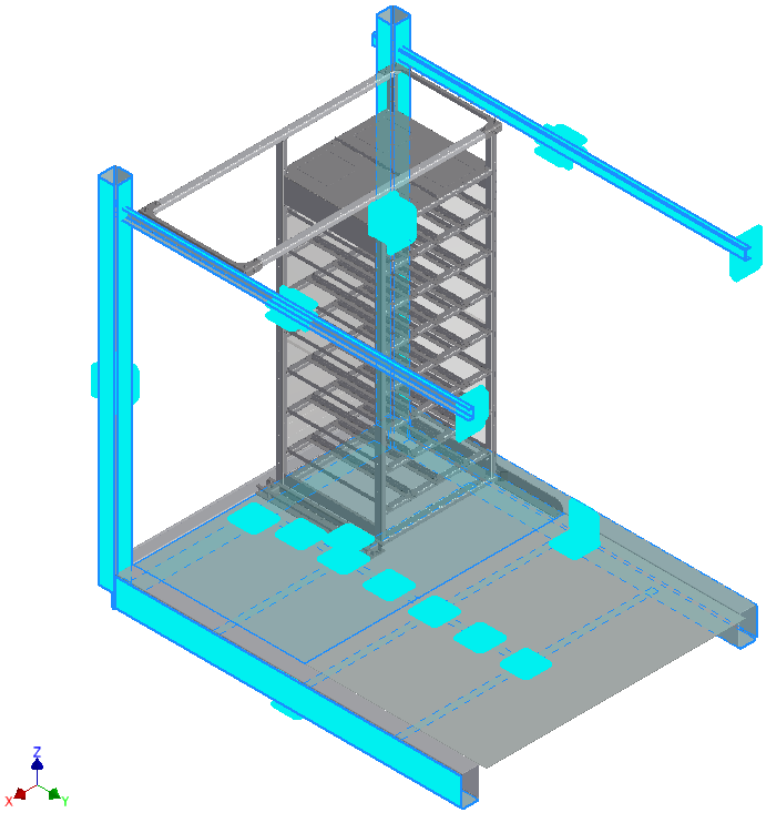


Festgelegte Abhängigkeit:1

Abhängigkeitstyp	Festgelegte Abhängigkeit

Die gesamte Containerstruktur aus dem Ausschnitt wird als starr angenommen. Die Kontaktflächen sind so mit Kontakten definiert, dass die realistischen Bedingungen möglichst genau abgebildet werden. Wo Flächen dich nur gegeneinander anlehnen, wie oben bei den eingesteckten Profilen, oder unten bei den eingeschobenen Füßen wurde mit dem Kontakt „Gleitend /nicht getrennt“ gearbeitet, sodass sich die Profile verschieben können, bis sie anliegen. Bei den Schraubverbindungen sind nur die Bohrungsflächen fest miteinander verbunden, die Anlageflächen können ebenfalls aufeinander gleiten.

Ausgewählte Fläche(n)

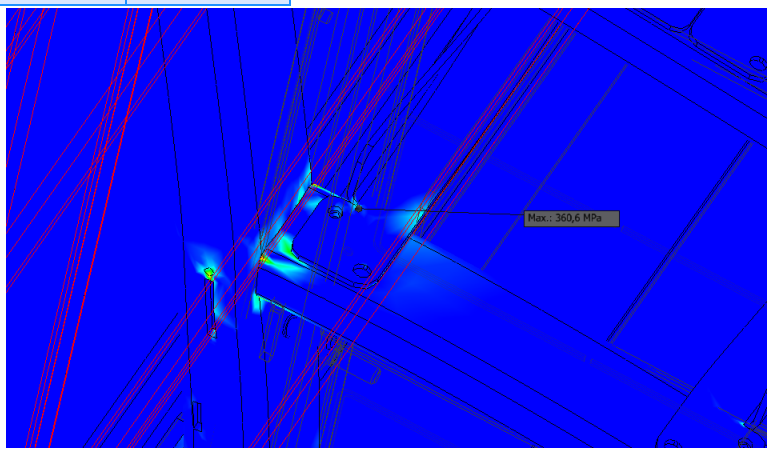


5.5 Ergebnisse

Ergebniszusammenfassung

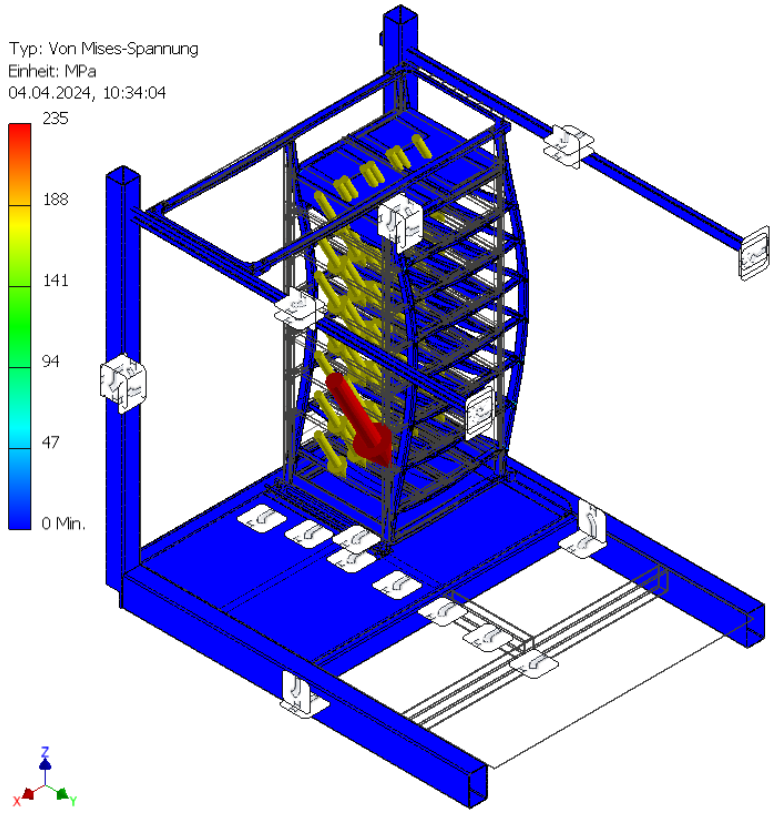
Name	Minimum	Maximum
Volumen	118508000 mm^3	
Masse	930,285 kg	
Von Mises-Spannung	0,000000000577284 MPa	360,597 MPa
Verschiebung	0 mm	3,71315 mm
Sicherheitsfaktor	0,842606 oE	15 oE

Die Spannungsspitze von 360 MPa tritt in sehr kleinen Bereichen im Auflageprofil auf, in den angrenzenden Bereichen ist die Spannung deutlich niedriger. Außerdem wird der Bereich in der Realität nicht so stark belastet wie in der Berechnung, da die Batteriemodule in sich stabil sind und es zu keiner Durchbiegung der Auflageprofile kommt.

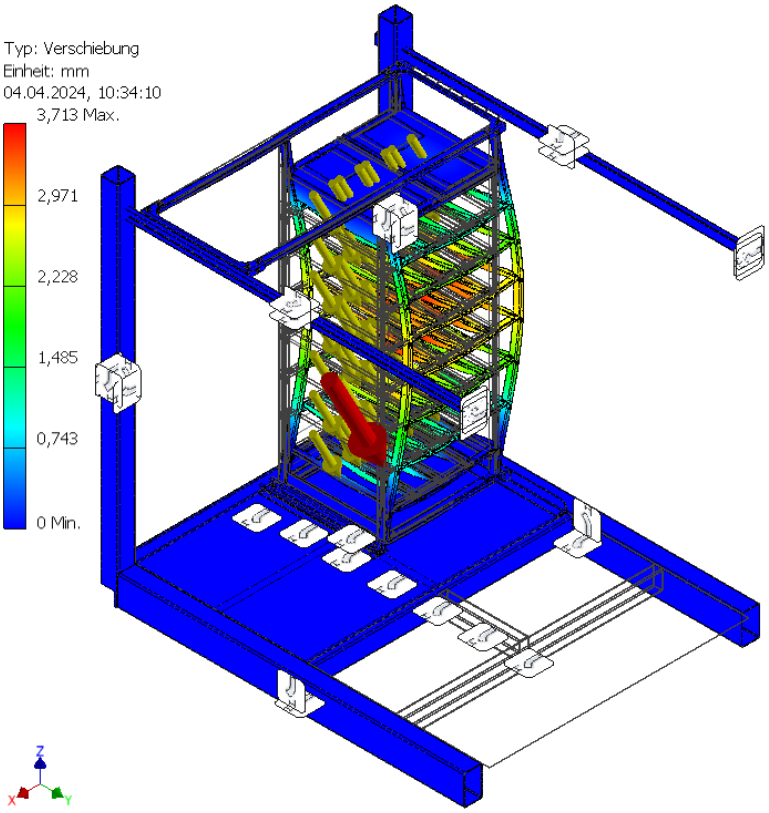


Zahlen

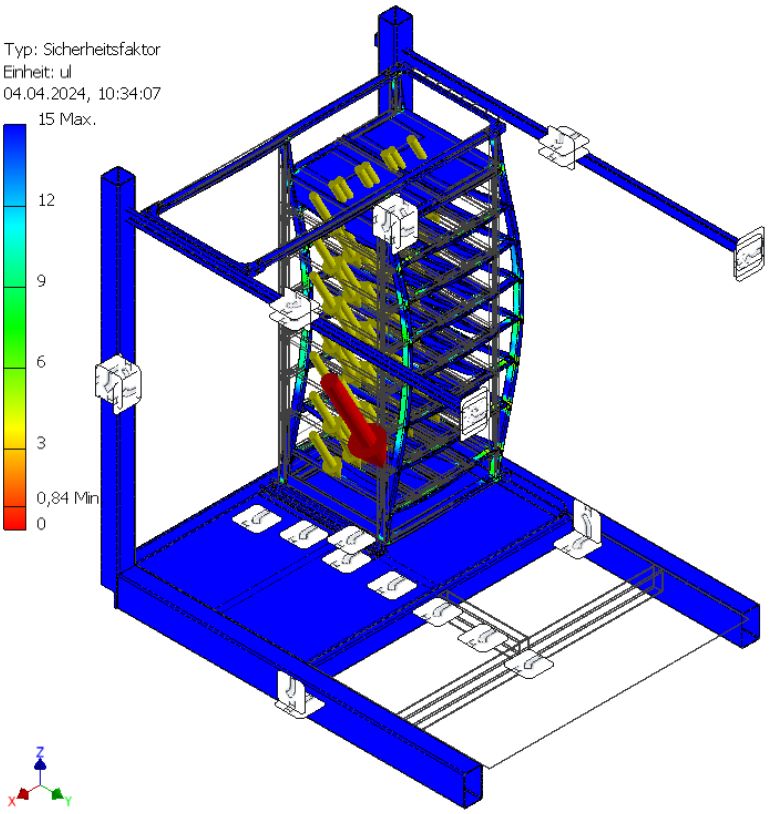
Von Mises-Spannung



Verschiebung



Sicherheitsfaktor



6 Belastungsanalyse - Längskräfte Transport

Analysierte Datei:	MG_Berechnung.iam
Autodesk Inventor-Version:	2023.4 (Build 274418000, 418)
Erstellungsdatum:	04.04.2024, 13:08
Studienautor:	EC

6.1 Statikanalyse:1

Allgemeines Ziel und Einstellungen:

Konstruktionsziel	Einzelner Punkt
Studientyp	Statische Analyse
Letztes Änderungsdatum	04.04.2024, 11:21
Modellzustand	[Primär]
Benutzerdefinierte Ansicht	Standard
Position	[Primär]
Modi für starres Bauteil suchen und entfernen	Nein
Belastungen über Kontaktflächen hinweg separieren	Nein
Analyse der Bewegungslasten	Nein

6.2 iProperties

Übersicht

Autor	EC

Projekt

Bauteilnummer	MG_Berechnung
Revisionsnummer	A
Projekt	A24004_Batteriecontainer_Freqcon
Konstrukteur	EC
Erstellungsdatum	13.03.2024

Status

Konstruktionsstatus	InBearbeitung

Benutzerdefiniert

Masse	1143,82

Physische Eigenschaften

Masse	1143,82 kg

Anmerkung: Physikalische Werte können sich von den weiter unten berichteten, von FEM verwendeten physikalischen Werten unterscheiden.

Netzeinstellungen:

Durchschnittl. Elementgröße (als Teil des Modelldurchmessers)	0,1
Min. Elementgröße (als Teil der durchschn. Größe)	0,2
Einteilungsfaktor	1,5
Max. Drehwinkel	60 grd
Kurvenförmige Netzelemente erstellen	Nein
Bauteilbasierte Messung für Baugruppennetz verwenden	Ja

6.3 Material(ien)

Name	1.0037 / S235JR	
Allgemein	Massendichte	7,85 g/cm^3
	Streckgrenze	235 MPa
	Zugfestigkeit	360 MPa
Spannung	Elastizitätsmodul	210 GPa
	Poissonsche Zahl	0,28 oE
	Schubmodul	82,0313 GPa
Bauteilname(n)	PL_Kopf.ipt PL_Sockel.ipt KA_Schweißbolzen_M8x20_VA.ipt PL_Auflage.ipt PL_Ständer.ipt PL_Abstützung_oben.ipt KA_Schweißmutter_DIN929_M12.ipt PL_Deckenstrebe.ipt DU_Berechnungsausschnitt_Container.ipt	

Name	1.0976 / S355MC	
Allgemein	Massendichte	7,85 g/cm^3
	Streckgrenze	355 MPa
	Zugfestigkeit	510 MPa
Spannung	Elastizitätsmodul	210 GPa
	Poissonsche Zahl	0,29 oE
	Schubmodul	81,3953 GPa
Bauteilname(n)	BL_Einschubschiene.ipt BL_Mittelblech_unten.ipt BL_Befestigungsblech_1.ipt BL_Einschublasche.ipt BL_Klemmblech_1.ipt BL_Klemmblech_2.ipt BL_Deckenträger.ipt BL_Aussteifung.ipt BL_Aussteifung_oben.ipt	

Name	8.8 A2F	
Allgemein	Massendichte	7,85 g/cm^3
	Streckgrenze	235 MPa
	Zugfestigkeit	360 MPa
Spannung	Elastizitätsmodul	210 GPa

	Poissonsche Zahl	0,28 oE
	Schubmodul	82,0313 GPa
Bauteilname(n)	DIN 125-1 A A 13 KA_Reyher_DIN7504.014_6,3x80.ipt DIN EN ISO 4762 M12 x 80 DIN EN ISO 4762 M12 x 60	

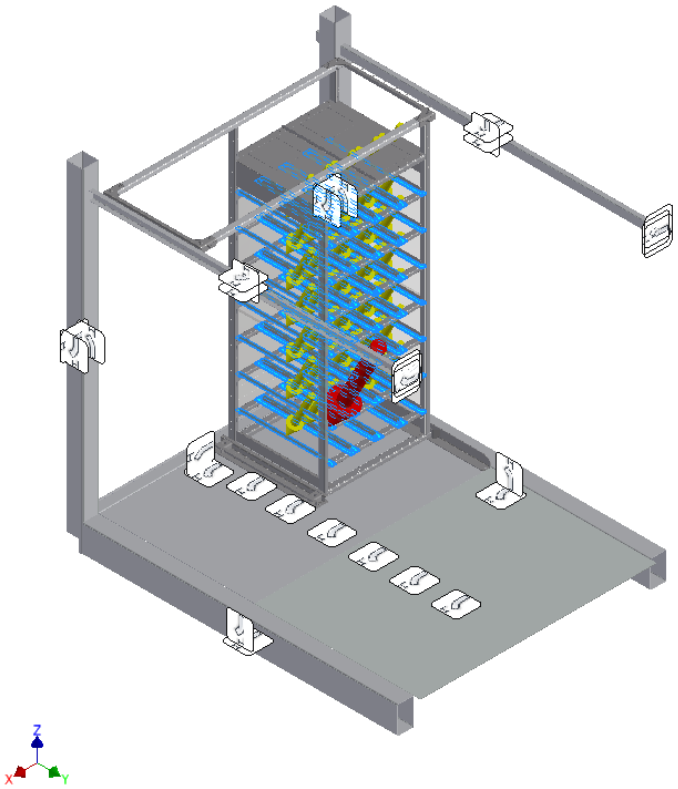
6.4 Betriebsbedingungen

Diese Kraft ergibt sich aus der Gewichtskraft der Batterien multipliziert mit dem entsprechenden Richtungsfaktor aus der Beschleunigungstabelle für den Schiffstransport (Kap. 2.1)

Kraft:1

Belastungstyp	Kraft
Größe	27285,393 N
Vektor X	0,000 N
Vektor Y	-12936,000 N
Vektor Z	-24024,000 N

Ausgewählte Fläche(n)

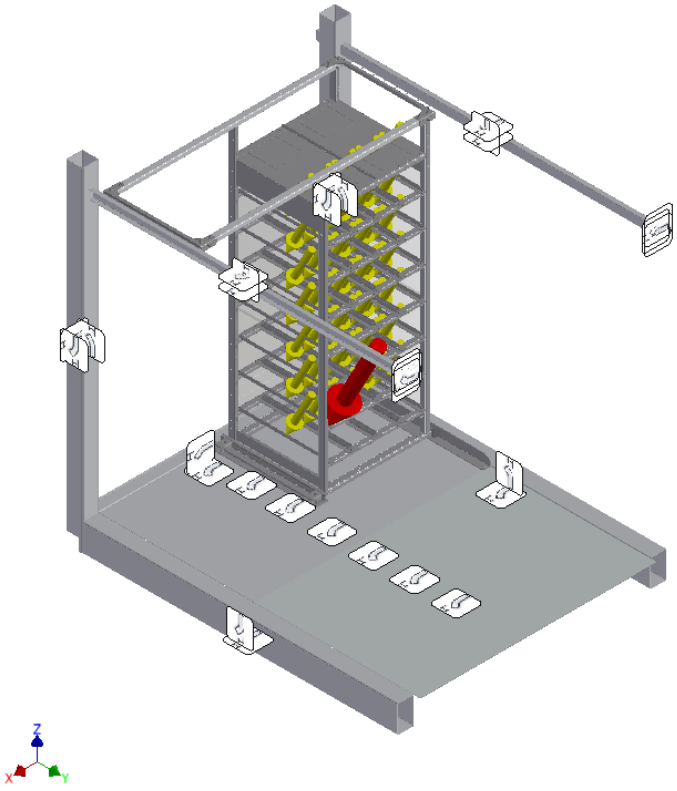


Schwerkraft

Diese Kraft ergibt sich aus der Schwerkraft des Batterieschranks selbst, multipliziert mit dem entsprechenden Richtungsfaktor aus der Beschleunigungstabelle für den Schiffstransport (Kap. 2.1)

Belastungstyp	Schwerkraft
Größe	14484,291 mm/s^2
Vektor X	0,000 mm/s^2
Vektor Y	-6867,000 mm/s^2
Vektor Z	-12753,000 mm/s^2

Ausgewählte Fläche(n)

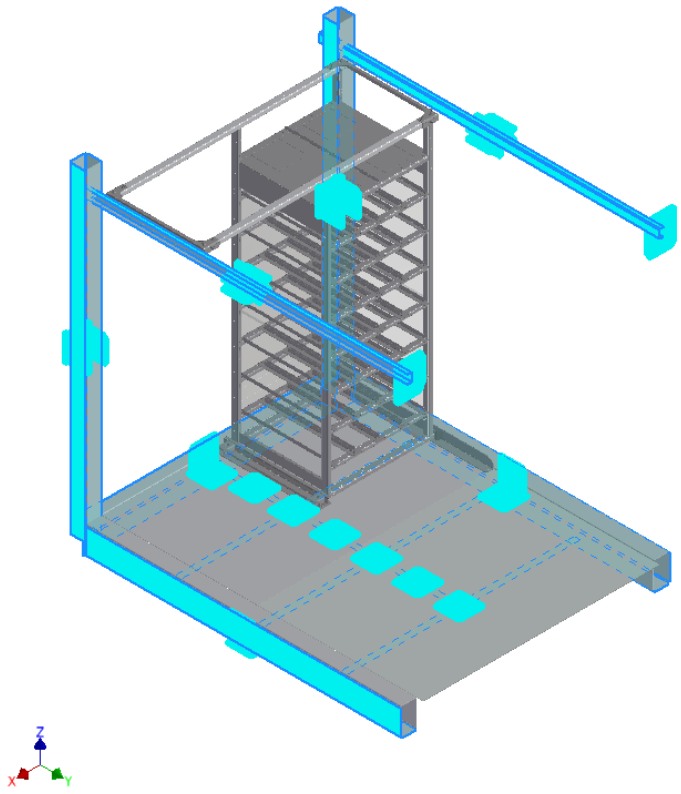


Festgelegte Abhängigkeit:1

Abhängigkeitstyp	Festgelegte Abhängigkeit

Die gesamte Containerstruktur aus dem Ausschnitt wird als starr angenommen. Die Kontaktflächen sind so mit Kontakten definiert, dass die realistischen Bedingungen möglichst genau abgebildet werden. Wo Flächen dich nur gegeneinander anlehnen, wie oben bei den eingesteckten Profilen, oder unten bei den eingeschobenen Füßen wurde mit dem Kontakt „Gleitend /nicht getrennt“ gearbeitet, sodass sich die Profile verschieben können, bis sie anliegen. Bei den Schraubverbindungen sind nur die Bohrungsflächen fest miteinander verbunden, die Anlageflächen können ebenfalls aufeinander gleiten.

Ausgewählte Fläche(n)

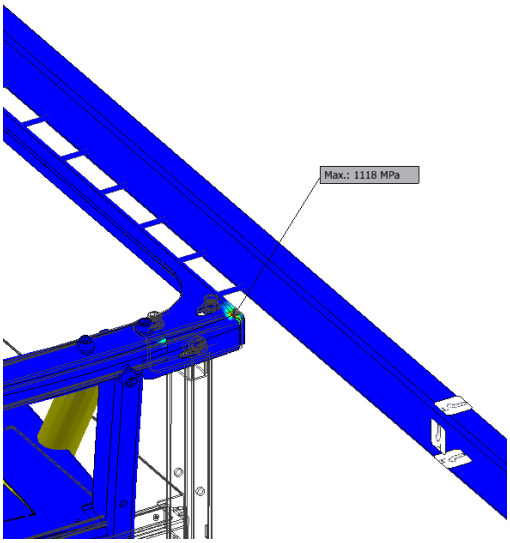


6.5 Ergebnisse

Ergebniszusammenfassung

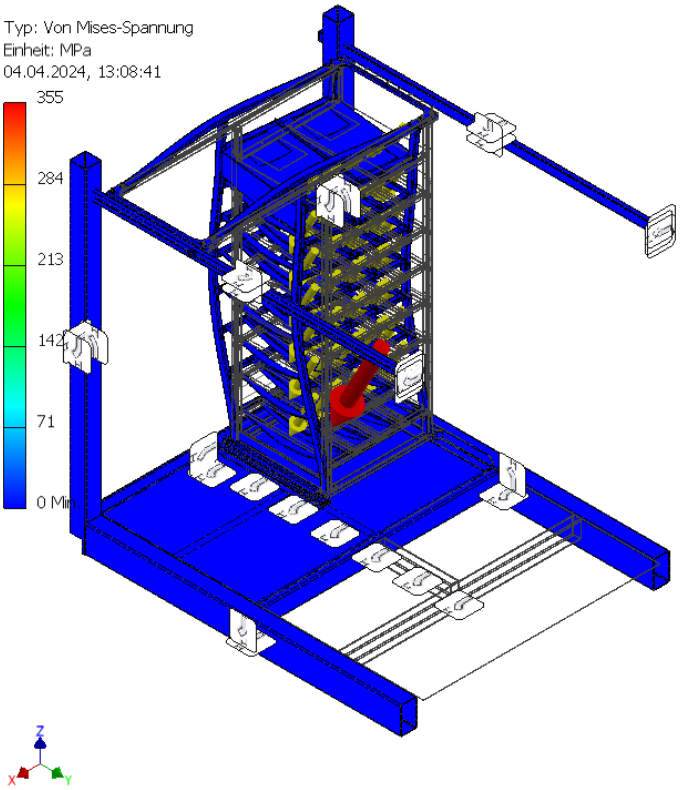
Name	Minimum	Maximum
Volumen	118508000 mm^3	
Masse	930,285 kg	
Von Mises-Spannung	0,00000000050376 MPa	1117,89 MPa
Verschiebung	0 mm	3,21571 mm
Sicherheitsfaktor	0,317564 oE	15 oE

Die Spannungsspitze von 1118 MPa tritt in einem sehr kleinen Bereich im Befestigungsblech der oberen Querbleche auf, in den angrenzenden Bereichen ist die Spannung deutlich niedriger. Das wird auch dadurch ersichtlich, dass die benachbarten Bereiche weit unter dem zulässigen Bereich von 355 MPa liegen.

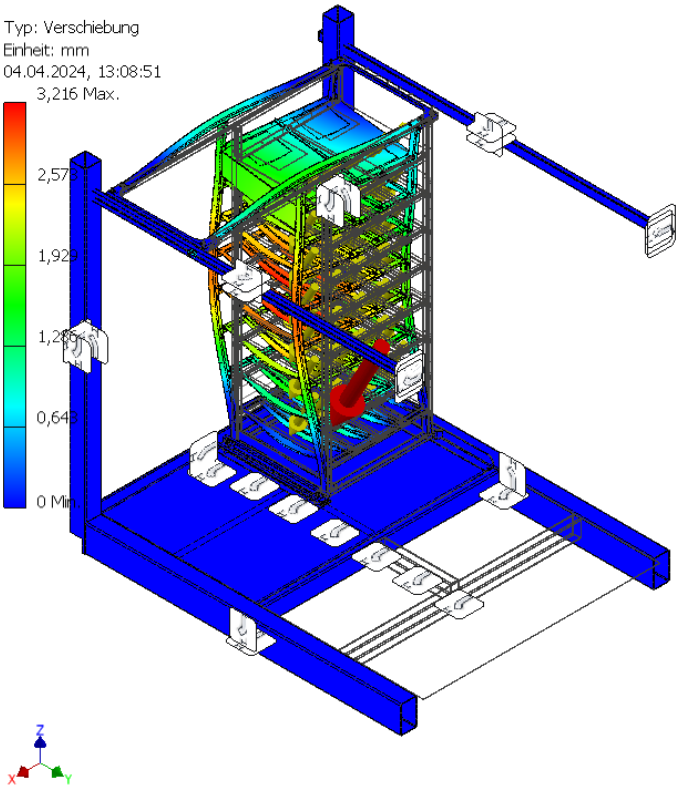


Zahlen

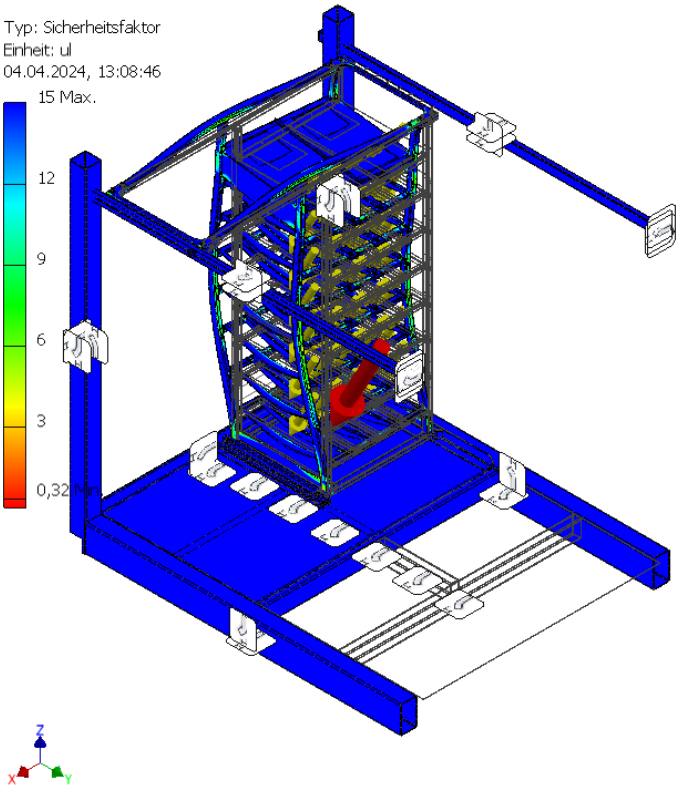
Von Mises-Spannung



Verschiebung



Sicherheitsfaktor



STATRON
NON STOP POWER

Battery Modules Sea Fastening Calculations

Statron AG I Almuesenacherstrasse 1 I 5506 Mägenwil I Switzerland I T: +41 62 88748 87 I statron@statron.com I www.statron.com

Battery Energy Storage System (BESS)
BASE LOAD POWER HUB

Statron ref. 331497

Project Code: K559-2254
Purchase Order Number: CW-I-WP4-2022-01

Document number:
23A2007_20032025_Battery_Modules_Sea_Fastening_Calcs_v1.0

Document description:
Battery Modules Sea Fastening Calculations

Battery Modules Sea Fastening Calculations

for FREQCON LF280 Battery Modules used in BESS for Base Load Power Hub (BLPH) Project.

Version	Date	Name	Description
1.0			First version

Table 1: Version overview

	Date	Name
Editor		
Checked by		
Approved by		

Table 2: Approval overview

Imprint

Hardware Development and Production Centre
Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 – 291 760 – 0

Email:
info@freqcon.de
hardware@freqcon.de
Phone: +49 (0) 571 – 388 478 – 10

Email:
info@freqcon.de
Software@freqcon.de

Contact details

For further information please contact us by phone or send us a mail to **info@freqcon.de**.
You can also visit us on our website **http://www.freqcon.com** to find more information about our products and solutions.

Content

1 Introduction 7
1.1 Other Applicable Documents 7
1.2 Generic Terms and Abbreviations Used 7
2 Issue with Hold-Down Clamps 8
3 Calculation of Bolt Strength 10

Identification

Document Version

Product version
Prototype

Document release date
March 2025

Doc Code
23A2007_20032025_Battery_Modules_Sea_Fastening_Calcs_v1.0

Name and Address of Manufacturer

Manufacturer of the product
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Legal Information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for FREQCON GmbH. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law. Any modification, expurgation or translation of this document is prohibited without the express written permission of FREQCON GmbH.
The trademarks stated in this document are the property of their respective owner.
© FREQCON GmbH. All rights reserved.

Original document

This document is an original document of FREQCON GmbH.

1 Introduction

1.1 Other Applicable Documents

The following documents are applicable:

Document type	Document Name
Statischer Nachweis Batterieregale in Container / *Static Proof of Battery Racks in Containers*	A24004_Batteriecontainer_Statischer_Nachweis_RevA

Table 1: Other applicable documents

1.2 Generic Terms and Abbreviations Used

This following list should help you understand some of the abbreviations used in this document.

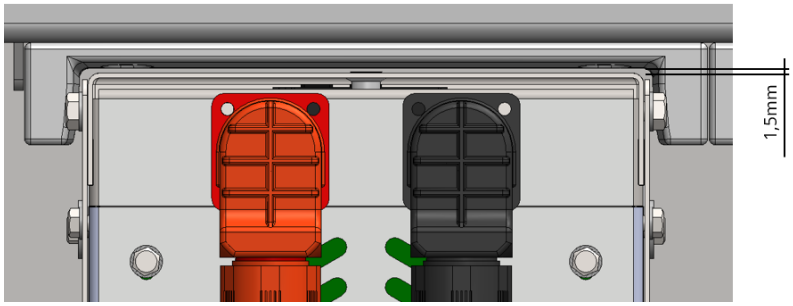
Generic Term and Abbreviation	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
PCS	Power Conversion System

Table 2: Generic terms and abbreviations used

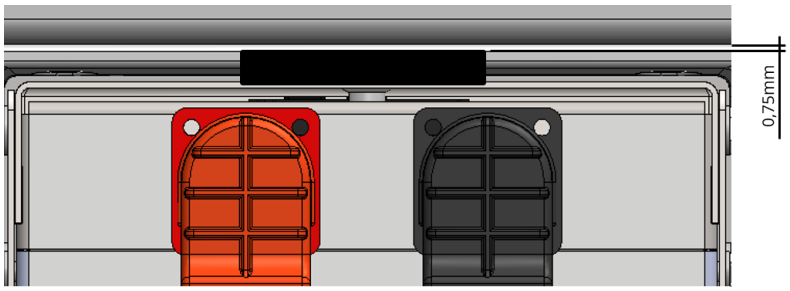
2 Hold-Down Clamps

The hold-down clamps used in the calculation from the document "Statischen Nachweis Batterieregale in Container (*Static Proof of Battery Racks in Containers*)" will be replaced with improved values in the new design. While the modules in the original calculation had a vertical clearance of 1.5 mm, the new design reduces this clearance to only 0.75 mm.

Original design as in "Statischen Nachweis Batterieregale in Container (*Static Proof of Battery Racks in Containers*)":

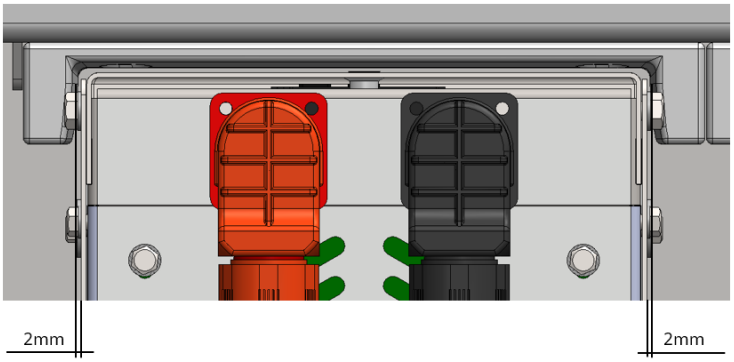


New design:

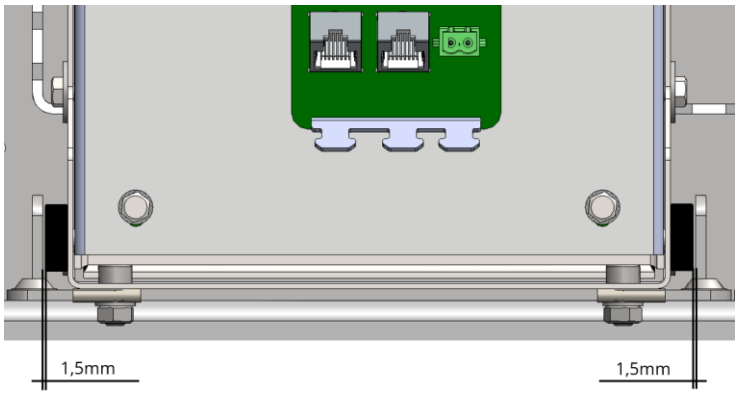


Additionally, the modules had a horizontal clearance of 4 mm in the aforementioned static proof. In the new design, we have reduced the clearance to 3 mm, thereby improving the values accordingly.

Original design as in "Statischen Nachweis Batterieregale in Container (*Static Proof of Battery Racks in Containers*)":



New design:



3 Fixing Bolts

Calculation of Bolt Strength

1. Calculation with M6 8.8 Cylinder Head Screws / Steel

The calculation from the document " Statischen Nachweis Batterieregale in Container " and confirmation of sea transport capability was carried out with M6 8.8 cylinder head screws.

It is assumed that the weight force of a battery is F=660N (refer to page 6 in document " Statischen Nachweis Batterieregale in Container").
The value F= 660N in the referred document is based on an acceleration of 1G. Therefore, the following values and proofs are also calculated with 1G.

The cross-sectional area S of an M6 screw (for shear at the shaft) is calculated as follows:

$$S = \pi * \left(\frac{d}{2}\right)^2 = \pi * \left(\frac{6mm}{2}\right)^2 = \pi * 9mm^2 = 28{,}27mm^2$$

Calculation of shear stress τ:

$$\tau = \frac{F}{S} = \frac{660N}{28{,}27mm^2} = 23{,}35N/mm^2$$

An M6 8.8 cylinder head screw made of steel has the following yield strength:

$$Re = 8 * 8 * 10N/mm^2 = 640\ N/mm^2$$

The shear stress of 23.35 N/mm² acting on the M6 8.8 screw is well below the shear strength or yield strength of 640 N/mm². Therefore, the screw can easily withstand the shear forces. It is significantly stronger than necessary to bear this load. Additionally, the module is fixed with two such screws, which means even less load acts on a single screw. The screws will not fail under these shear forces.

2. Values for M6 Cylinder Head Screws Made of PA6.6 GF 30% Glass Fiber Reinforced

It is also assumed that the weight force of a battery is F=660N (refer to page 6 in document " Statischen Nachweis Batterieregale in Container"). Additionally, the acting shear stress τ=23.35N/mm² from calculation 1 is to be used. The glass fiber reinforced M6 screw has a yield strength of 100-130 MPa. The weakest value is used for the calculation:

3. Conclusion

The M6 cylinder head screw made of PA6.6 GF 30% glass fiber reinforced can withstand the weight force of the battery module F=660N. With this weight force, a shear stress of τ=23.35N/mm² is assumed, while the screw can withstand 100N/mm² without deforming or breaking. Additionally, two such screws are used to fix the module.

Therefore, the change from steel screws to GFRP screws does not make a difference for sea transport. The calculation/document "Static Proof of Battery Racks in Containers" is not negatively affected and can continue to be used.